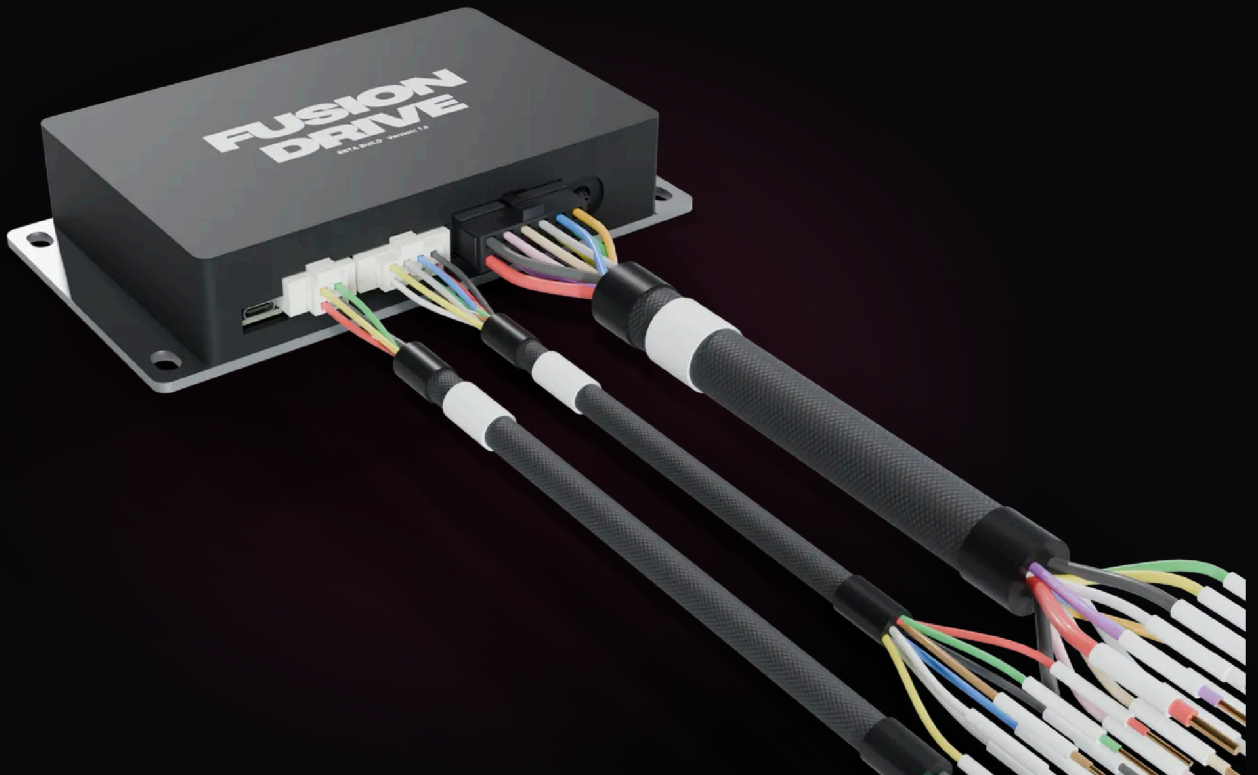




— 08 / REPLACE YOUR GAUGES

# Direct sensor connections

Direct sensors, hidden controllers and the electronics that still matter.



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## 1

## — SENSORS / REPLACE

# Choose what you are replacing

FD can replace the display and logging role of a compatible gauge by receiving the underlying measurement. Whether it can also replace the electronics depends on the sender. Pressure transducers with documented linear voltage outputs are different from wideband oxygen sensors, bare thermistors and thermocouples.

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| Existing arrangement                          | FD migration                                        | Required retained or added hardware            |
|-----------------------------------------------|-----------------------------------------------------|------------------------------------------------|
| Linear 0-5 V pressure sender and simple gauge | Dedicated sender to FD after identifying exact part | Correct excitation, wiring and calibration     |
| Wideband gauge with LSU sensor                | Remove visible display only if a controller remains | Matched wideband controller / sensor / harness |
| Resistive temperature gauge                   | Condition temperature to a defined linear voltage   | Proper excitation and nonlinear conversion     |
| Thermocouple EGT                              | Use a compatible amplifier or published CAN module  | Cold-junction compensation and fault handling  |
| Flex-fuel or pulse-flow sensor                | Use frequency-to-voltage or decoded CAN interface   | Qualified pulse conditioner/module             |
| Proprietary gauge network                     | Keep network or install independent measurement     | Public supported output or new sender          |

**INSTALLATION NOTE**

Replacing a gauge does not preserve its warning automatically. Recreate the required warning, validity handling and local behaviour explicitly, and retain an independent indication if the installation relies on it when no phone is present.

## 1.1 What this library does not infer

FD has no universal gauge protocol, wideband heater driver, thermocouple amplifier or direct pulse input on IN1-IN6. A two-wire sensor is not necessarily a switch. An apparent 0-5 V signal is not necessarily a safe tee point.

## 2

## — SENSORS / REPLACE

# Dedicated AEM pressure sensor

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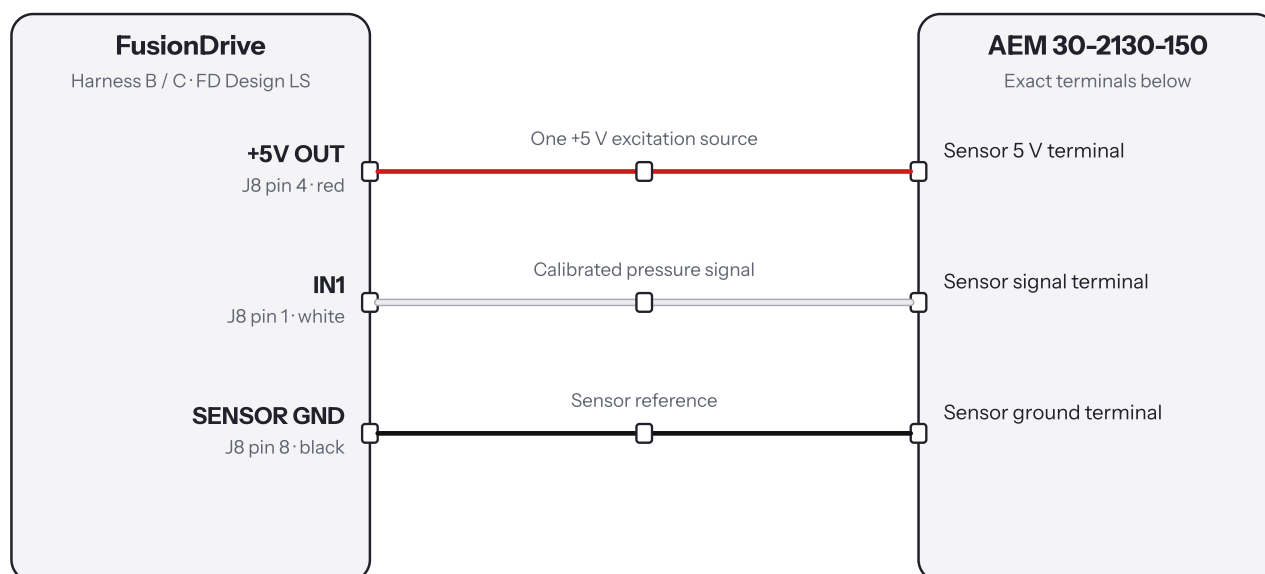
Exact worked model: AEM stainless 30-2130-150, manual 10-2130 Rev C and model-specific sensor sheet. This sender uses 5 V excitation, signal ground and a linear output: 0.5 V = 0 psi gauge, 4.5 V = 150 psi gauge. The manufacturer connector view looks into the sensor: with the illustrated key orientation, upper-left is ground, upper-right 5 V, lower terminal signal. Confirm using the actual connector view before building the mating harness; do not invent cavity letters from a generic Packard connector.

Sources: AEM 10-2130 Rev C pp1-2; 30-2130-150 sensor data, p1.

<https://documents.aemelectronics.com/aed016c791759036e1b92adbbb7ef6d3286dd279.pdf>

<https://documents.aemelectronics.com/195b5983d19ffac49170b8a1340fd16dcd6d3266.pdf>

## S-07 | Dedicated 30-2130-150 sender



Wire colours: FD loom at left; documented accessory wire at right. Small sleeve = insulated splice.

Connector positions here are logical; use the mating-face drawings to locate FD cavities.

Sensor-facing pin identification is in OEM 10-2130 Rev C p1. Do not infer cavity letters or wire colours.

## 2.1 Install and configure

**Current app workflow:** Configure this installation from its function in Settings. Controls provides live actions and the Dashboard provides glance controls; use a card's edit menu to return to setup. A configured output remains visible even when disabled. Enabled rules operate their assigned enabled outputs automatically; there is no extra output mode to select. Live Off, On or duty takes over a generic output until you choose Resume automation. Setup keeps the electrical limits, calibration and response settings. Assigned boost, WMI and nitrous outputs use their controller-specific actions, preserving sensor protections and any paired fuel/stage logic. Nitrous Arm allows its configured activation conditions to operate; it is not an unconditional spray command.

**Setup and vehicle data:** Starting presets remain editable; Add Sensor includes calibration and fine tuning before Create. Use dedicated IGN, fresh running-engine OBD evidence, or both for vehicle activity; a dedicated IGN wire is optional when valid OBD evidence is available. If the pressure hose is unused, explicitly select OBD pressure in setup. A valid atmospheric sensor reading cannot identify a disconnected hose. These app choices do not change the product-specific electrical compatibility or limitations described below.

- 1 Match the full sensor part number and pressure/fluid rating. Do not substitute the brass 30-2131 or a different full-scale sensor using this calibration. A 150 psi sender is not a nitrous bottle-pressure sender.
- 2 Choose a mechanically appropriate measurement point, hose/fitting and sealant. Isolate and depressurise the system before work. Pressure-sender electrical compatibility does not establish chemical, vibration or overpressure suitability.
- 3 For a dedicated sender, connect sensor power to J8 pin 4, signal to IN1/J8 pin 1, ground to J8 pin 8. Verify the FD 5 V rail remains within the sender requirement with all installed sensors. Do not join an ECU/gauge 5 V supply to FD.
- 4 Sensors > unused IN1 > Create Analog. Name the physical measurement, then Edit. Set Unit psi, Additional voltage scale 1, Voltage Range 0.5 to 4.5 and Value Range 0 to 150. Save and refresh.
- 5 At zero gauge pressure expect approximately 0.5 V; at a calibrated midpoint expect 2.5 V and 75 psi. Compare several reference pressures, including the operating window. Record tolerance rather than merely checking the display moves.
- 6 Test unplugged sender, open ground and loss of excitation using a controlled test fixture. A falling voltage must not be misinterpreted as safe pressure in a rule. Bind protections only after this failure behaviour is established.

## 2.2 Unit and reference check

The model sheet's psi column is gauge pressure while its kPa column includes a 100 kPa offset. For an FD gauge-pressure channel use the psi curve above and convert consistently; do not copy a mixed-reference kPa endpoint and label it gauge pressure. An absolute MAP sensor requires a separate absolute-to-gauge reference strategy, not an arbitrary relabel to boost.

## — SENSORS / REPLACE

3

# Wideband without a visible gauge

Retain a dedicated wideband controller that is compatible with the installed oxygen sensor and harness. FD receives its interpreted analog/CAN output. It cannot drive the LSU heater or calculate lambda directly from raw cell wires.

## 3.1 Worked controller: AEM 30-2310 Inline

Scope: 10-2310 Rev 02, 2011. White is analog output positive, brown signal reference, red switched fused supply and black power ground. White to the chosen FD IN; brown to sensor ground. The useful analog curve is 0.5 V = 8.5 AFR to 4.5 V = 18 AFR, in gasoline-equivalent AFR. Grey is RS-232, not CAN. The specified sensor is AEM 30-2001; do not assume interchangeability with the newer Bosch/FAE X-Series harness.

Source: AEM 10-2310 Rev 02 pp1-2,4-5. [https://documents.aemelectronics.com/techlibrary\\_30-2310\\_inline\\_wideband\\_uego\\_controller.pdf](https://documents.aemelectronics.com/techlibrary_30-2310_inline_wideband_uego_controller.pdf)

## 3.2 Migration procedure

- 1 Record the original gauge and sensor identity, output transfer, ECU connections and alarms. If the gauge contains the wideband controller, do not simply unplug it and reuse the raw sensor on FD.
- 2 Install the matching standalone wideband controller according to its own sensor, power and calibration instructions. Keep it accessible for status/calibration. A hidden module still needs suitable heat, moisture and strain protection.
- 3 Allocate an unused FD input. Use the Analog workflow in Book 07; enter the exact output endpoints and unit. Preserve any separate output the ECU needs. If there is no spare channel, use a qualified buffer or an alternative with enough outputs.
- 4 Reproduce required warning/permission behaviour from the original gauge using measured signals and explicit validity, plus an independent visible alarm if needed without the phone.
- 5 Validate sensor warm-up, readiness, full-lean, disconnected sensor, controller power loss and output fault values. Compare FD to a trusted reference throughout the actual operating range.
- 6 Log the new controller identity and calibration in the vehicle setup record. Old sessions and new sessions may need unit/transfer context for comparison. Do not relabel AFR as lambda: the measured-mixture selector requires the source to have the matching quantity and does not automatically convert it. Qualify ready/error voltages separately from analog Input Valid; endpoint clamping can conceal a not-ready value.

## 3.3 Other retained controllers

An existing Innovate LC-2 can already operate without a visible display; follow its chapter in Book 07. For AEM X-Series, MTX-L PLUS and AutoMeter gauges, retaining a powered hidden gauge/controller may preserve measurement, but mounting, visibility of faults and service access require an installation-specific decision. This edition does not authorise dismantling their electronics into an improvised enclosure.

## 4

## — SENSORS / REPLACE

# Temperature, flow and special senders

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## 4.1 Bare thermistor or resistive sender

FD's two-point calibration is linear; a thermistor curve is nonlinear. Use a conditioner with correct excitation and a documented linear temperature output, or a supported CAN module. Two matching temperatures do not prove a full-range calibration. Retain the gauge if it provides the required conversion.

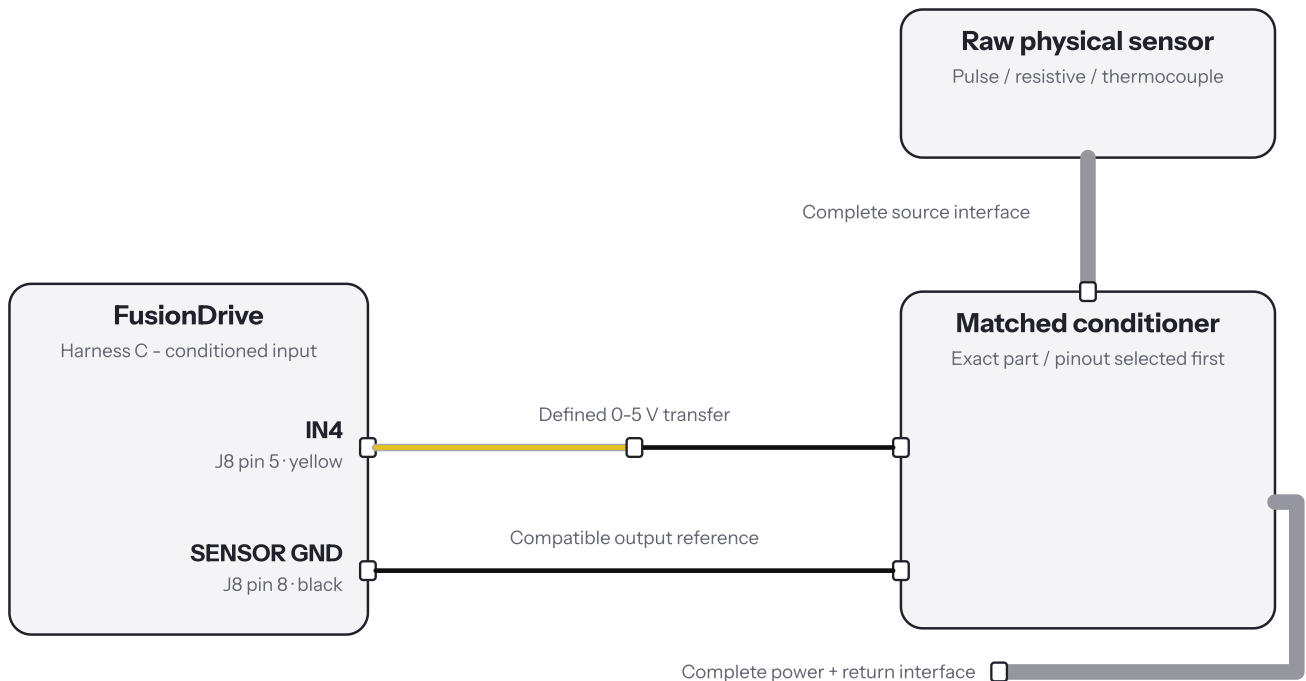
## 4.2 Thermocouple / EGT

A thermocouple needs the correct amplifier, connector materials and cold-junction compensation. Connect the amplifier output, not raw millivolt leads. Record its temperature endpoints and failure indication. Test open thermocouple and reversed polarity before relying on an EGT limit.

## 4.3 Frequency / pulse flow / ethanol content

FD's ADC channels do not count pulses. Use a compatible frequency-to-voltage or CAN interface with known scaling, latency and fault behaviour. An averaged trend signal may be too slow for rapid fuel/flow protection.

## S-08 | Condition a non-analog sender



Grey bands = complete specified multiwire interfaces, including required excitation and returns.

The conditioner must provide a documented linear transfer, fault behaviour, isolation and supply rating.

### 4.4 Conditioned sensor setup

- 1 Match conditioner input to the actual source: passive contact, open collector, push-pull, inductive pickup or other type. Supply it from a correctly fused, rated source.
- 2 Connect its documented output/reference to the selected IN and J8 ground. A 4-20 mA source needs a designed receiver with overrange/open-circuit handling; this guide does not prescribe a universal resistor.
- 3 Create an Analog sensor. Enter the conditioner's linear endpoints and units, save and read back. Record any filter delay.
- 4 Stimulate low, middle, high and fault states at the original source and verify FD's response. Voltage injected directly into FD tests only its mapping, not the complete sensor chain.
- 5 Before control use, measure end-to-end response and prove missing-source behaviour against the installation's requirement.

## 5

## — SENSORS / REPLACE

# Level switches and safety contacts

An FD switch input must remain within 0-5 V and have a defined high and low state. A bare normally-open or normally-closed switch does not create a voltage by itself. Use a qualified pull-up/pull-down/contact interface whose open-wire behaviour is deliberately defined. Do not assume a controller's ground-switched failsafe output can directly replace a dry contact.

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## 5.1 Build a meaningful state

- 1 Document what the physical contact means: tank sufficiently full, pressure switch healthy, arm request or fluid-level alarm. Name the FD channel for that meaning, not just IN2.
- 2 Create Type Digital (On/Off). Edit the threshold, hysteresis and reverse logic so the healthy state is unambiguous. Confirm each physical state using a meter and the live FD value.
- 3 Disconnect the sensor and one conductor at a time in the test fixture. An open wire must remove the intended permission rather than look healthy. If the circuit cannot distinguish those conditions, document the limitation or add supervised hardware.
- 4 Add the source to the relevant WMI, boost or nitrous protection selector only if that selector supports the quantity and the failure state. Otherwise use a qualified generic interlock path, retaining the controller's own protection.
- 5 Do not claim a level switch proves nozzle flow. A full reservoir can coexist with an empty line, blocked nozzle, failed pump or closed valve.

## 5.2 Independent alarms

If the original gauge sounded an alarm without a phone, preserve an independent indication or install a compatible alarm driven by a qualified output/driver. A notification on an absent phone is not equivalent. Allocate the alarm output before using all channels for controllers.

## 6

## — SENSORS / REPLACE

# Replace a complete gauge cluster carefully

## 6.1 Plan the whole vehicle before unplugging anything

Create a source inventory: physical measurement, sender/controller model, existing receiver, output protocol, unit/reference, full-scale range, latency, fault code and required warning. Separate display-only channels from those used for local control.

- 1 Reserve the six IN channels for signals that need direct analog acquisition. Use documented CAN2 broadcasts for suitable additional signals; use the car's supported OBD values where rate/meaning are adequate.
- 2 Keep safety-critical measurements local to the ESP via wired sensors or qualified vehicle/accessory CAN. Do not make an essential permission depend on a phone-only value.
- 3 For each removed gauge, list what is lost: sensor excitation, signal processing, alarm, peak memory, physical switch, independent display or backup indication. Assign a replacement or retain that function.
- 4 Label every source and signal origin in FD. Avoid duplicate Fuel pressure entries that refer to different physical ports or pressure references.
- 5 Save every configuration to the ESP and read it back. Create a vehicle setup record with pin assignments, calibration, output ownership and source freshness before enabling any actuator.
- 6 Test with the phone disconnected. The configured local controller/rules should behave as designed; FD does not retain phone log samples it never received or provide a visible gauge on an absent display.

## 6.2 Example allocation - measurement capacity, not a universal harness

| FD resource | Possible use                            | Qualification needed                 |
|-------------|-----------------------------------------|--------------------------------------|
| IN1         | Fuel rail pressure                      | Gauge vs differential reference      |
| IN2         | WMI line pressure                       | Fluid rating and dynamic response    |
| IN3         | Tank healthy status                     | Defined open-wire state              |
| IN4         | Bottle pressure                         | Correct high-pressure sensor range   |
| IN5         | Conditioned actual flow                 | Flow calibration and transient delay |
| IN6         | Driver arm request                      | Safe 0-5 V interface                 |
| CAN2        | Published wideband and accessory status | IDs, scaling, validity and freshness |
| CAN1        | Supported RPM, TPS, temperatures        | Rate, delay, ECU support and units   |

## 7

## — SENSORS / REPLACE

# Commissioning and review record

These are steps to be performed on the finished installation. The preparation of this manual did not execute them or establish a validated replacement product.

## 7.1 Measurement acceptance

- Photograph the sender labels, connector views and final labelled harness. Record every pin and reference ground.
- Verify supply voltage and source loading with all combinations of module power on/off. Confirm original receivers remain correct when retained.
- Use a traceable stimulus for low/mid/high values; record error, noise and lag. Verify fault and disconnected conditions separately from nominal range.
- Confirm required sensors remain fresh under simultaneous CAN traffic, logging and actuator switching. Test the worst expected electrical disturbance on a controlled fixture.
- Reload saved configuration after restart. Verify a renamed source or changed unit has not silently left an automation bound to the wrong measurement.

## 7.2 Control acceptance after a gauge migration

First use dummy loads. Exercise valid signal, threshold crossing, sensor fault, stale CAN, missing accessory power, FD restart, OTA and physical disarm. Record each action and release time. A logged commanded duty is not proof that a valve opened or fluid was delivered. Final pressure, flow, electrical and dyno validation remain installation-specific.

## 7.3 Review fields

| Record                                    | Installer entry |
|-------------------------------------------|-----------------|
| Vehicle and FD serial / board revision    | _____           |
| FD firmware / iOS build                   | _____           |
| Source model / hardware / manual revision | _____           |
| Calibration and source-reference files    | _____           |
| Fault and latency acceptance evidence     | _____           |
| Unmapped original functions               | _____           |
| Approver, date and release decision       | _____           |

FD sources: docs/V1\_LS\_HARDWARE\_LIMITATIONS.md; ios/FusionDrive/Models/HardwareMap.swift; Features/Sensors/SensorsView.swift; Features/OBD/CANDecodeEditorView.swift. This is a review edition, not a substitute for the actual vehicle's installation record.



# Questions?

**Documentation** · [fusiondrive.io/docs](https://fusiondrive.io/docs)

**Support** · in the app: [More](#) → [Settings](#) → [Device & firmware](#) → [Report an Issue](#)

**Review copy** · [Local FD V3 installation library](#)

FusionDrive switches real current to real loads and can control boost, water/methanol injection and nitrous. Fuse every feed and every load, respect the ratings in the specifications, and set failsafes before you drive. Configure and tune with the vehicle stationary. The installer is responsible for compliance with local vehicle regulations. Local review draft. These accessory installations have not received physical compatibility sign-off or manufacturer approval. Follow the exact-model qualification and commissioning steps in this guide before use. Match the exact model, generation, connector and manual revision. Terminal labels identify electrical connections, not connector mating-face or cavity order. Follow cavity markings and the official harness view; do not wire by colour alone. Manufacturer names identify equipment only. These independent FD instructions do not replace the manufacturer's manual.