

V4

48-way Molex pin map, power latch, wiring, TunerStudio, and first start.
Columns A–H then J–M (letter I skipped). A1 is pin 48, top left, CAN High. M4
is pin 1, bottom right, 12 V from the main relay.

- Typical functions are TunerStudio-assignable examples unless marked hardware-tied.
- Auxiliary reuse pins are analog inputs.
- High-Z injectors only. Logic coils only. GPO 5 / 6 are signal, not injector power.

Contents

00	Molex map	48 cavities, A1–M4. Tap a pin.
01	Power & relay	L4 wakes, E4 latches, M4 feeds.
02	Sensors	CLT, IAT, TPS, MAP, analog.
03	Crank & cam	VR pair, Hall, flex, VSS.
04	Injectors	4 seq · 6 three-ch matched · 8 two-channel.
05	Ignition	Logic coils, 6-cyl wasted spark on Ign 1–3.
06	Drive-by-wire	H-bridge, pedal, ETB.
07	VVT, pump, fan	Low-sides and half-bridges.
08	CAN & dash	A1 / A2, Core EFI protocol.
09	Firmware	DFU, TunerStudio, pin assign.
10	First start	Garage checklist. Fuel last.
11	Faults	No RPM, no fuel, no spark.

00 Molex map

Looking into the ECU, polarising key at the top. Row 1 is the key row. Column A is the left / CAN end. Column M is the right / power end. TunerStudio still numbers 1–48; the letters are the cavity IDs on the housing.

KEY AT TOP · A1 TOP LEFT · M4 BOTTOM RIGHT

	A	B	C	D	E	F	G	H	J	K	L	M
1	A1	B1	C1	D1	E1	F1	G1	H1	J1	K1	L1	M1
	48	44	40	36	32	28	24	20	16	12	8	4

2	A2	B2	C2	D2	E2	F2	G2	H2	J2	K2	L2	M2
	47	43	39	35	31	27	23	19	15	11	7	3
3	A3	B3	C3	D3	E3	F3	G3	H3	J3	K3	L3	M3
	46	42	38	34	30	26	22	18	14	10	6	2
4	A4	B4	C4	D4	E4	F4	G4	H4	J4	K4	L4	M4
	45	41	37	33	29	25	21	17	13	9	5	1

Injector Ignition Low-side Half-bridge GP high DBW Main relay 12 V 5 V Power GND Sensor GND Thermistor

Analog 0–5 V VR / crank Hall CAN USB

I/O

Function	Count	Molex
Injector (high-Z)	4	C4 C3 B4 B3
Ignition (5 V logic)	4	K4 K3 K2 K1
GP high (push-pull)	2	J4 J3
Low-side	2	L2 M2
Half-bridge	4	D4 D3 D2 B2
ETB H-bridge	1	M1 L1
Main relay	1	E4
12 V in	2	M4 L4
Power ground	2	M3 L3
Sensor ground	2	H4 G4
5 V rail	2	C2 B1
Thermistor	4	H3 G2 G3 G1
Analog 0–5 V	10	H2 H1 F3 F2 F1 E3 E2 E1 D1 C1
VR crank	1 pair	A4 A3
Hall	3	F4 G3 G1
CAN	1	A1 A2
USB	1	J2 J1

Cylinder examples

Starting points. Assign firing order, injection mode and spare pins in TunerStudio to match the engine.

Cyl	Fuel	Spark
4	Sequential on Inj 1–4 (C4 C3 B4 B3)	Logic coils Ign 1–4 (K4–K1). Cam on F4 for COP.

Cyl Fuel		Spark
6	3-channel matched on external driver: Ign 4, GPO 5, GPO 6 (K1 J3 J4)	Wasted spark on Ign 1–3 (K4 K3 K2). Three coils, two cylinders each.
8	2-channel batch: GPO 6 / 5 (J4 J3) into an external driver	Wasted spark Ign 1–4. Pair cylinders 360° apart.

High-impedance injectors

Saturated injectors, >8 Ω. Low-Z needs a ballast. Dumb coils do not belong on K4–K1. GPO 5 / 6 trigger an external driver — they do not fire injectors or dumb coils themselves.

48-pin table

Sorted TunerStudio 1–48. Molex ID is the cavity on the housing.

Molex	n	Name	Typical	Notes	Wiring
M4	1	12 V from main relay Battery Sense	12 V from main relay output. See also E4 (pin 29). Do not forget L4 (pin 5).	Must be fed from relay 87. Do not feed this from key-on alone.	Main relay 87 → M4. Fuse 5–10 A close to the battery.
M3	2	Power ground gnd	Power GND	Star-ground with L3 to the engine block or chassis ground boss.	Heavy gauge (2.0–2.5 mm ²) to a clean engine-block earth.
M2	3	Low-side 2 3 - Lowside 2	VVT / idle	Do not use as an injector.	Load to switched +12 V from the main relay; ECU switches ground.
M1	4	ETB+ etb	ETB motor +	Pairs with L1. One electronic throttle. Cable-throttle cars leave this empty.	ETB motor +. Shield the pair. Keep away from ignition leads.
L4	5	Key-on 12 V 12v	12 V from key. Primary on/off supply.	Do not skip L4. Without it the unit will not boot even if M4 is live.	Fused ignition-switched 12 V. 5 A is enough.
L3	6	Power ground gnd	Power GND	Always land both M3 and L3.	Same earth boss as M3. Do not daisy-chain through body panels.
L2	7	Low-side 1 7 - Lowside 1	VVT / idle	Second dedicated low-side alongside M2.	Load to switched +12 V; ECU switches ground.
L1	8	ETB– etb	ETB motor –	If the blade drives the wrong way, swap M1 and L1 or invert in TunerStudio.	ETB motor –.
K4	9	Ignition 1 9 - Ignition 1	Coil 1	Will not fire a dumb coil. Cylinder assignment is in TunerStudio.	Coil / igniter signal. Coil +12 V from main relay, coil ground to the head.
K3	10	Ignition 2 10 - Ignition 2	Coil 2	Firing order is set in software.	Same as K4.
K2	11	Ignition 3 11 - Ignition 3	Coil 3	Wasted-spark pairs are assigned in ignition mode, not by doubling wires on one pin.	Same as K4.
K1	12	Ignition 4 12 - Ignition 4	Coil 4 · 6-cyl injector-driver channel 1	On a 6-cylinder this pin plus J3 (GPO 5) and J4 (GPO 6) trigger a 3-channel matched injector driver. Not a dumb-coil power stage.	4-cyl: smart coil 4. 6-cyl: external injector-driver input 1.
J4	13	GP Out 6 13 - GP Out 6	Tach / 6-cyl injector-driver 3 / 8-cyl injector-driver A	Confirm the 5 V / 12 V jumper. 6-cyl fuel: K1 + J3 + J4 into a 3-channel matched injector driver. 8-cyl fuel: injector-driver A with J3.	Signal only. Not a high-current injector low-side.
J3	14	GP Out 5 14 - GP Out 5	Tach / 6-cyl injector-driver 2 / 8-cyl injector-driver B	Same family as J4. 6-cyl fuel: channel 2 of the 3-channel matched driver. 8-cyl fuel: injector-driver B.	Signal only. Not a high-current injector low-side.

Molex	n	Name	Typical	Notes	Wiring
J2	15	USB D- usb	USB white wire	Shielded USB all the way to the connector.	Laptop USB white. One ground only, inside the USB cable.
J1	16	USB D+ usb	USB green wire	Internal micro-USB is still present. Use one path, not both.	Laptop USB green.
H4	17	Sensor ground agnd	Signal GND	Never bond sensor ground to chassis except at the ECU.	CLT, IAT, TPS, MAP, 0–5 V sensor grounds.
H3	18	CLT 18 - AN temp 1	CLT	On-board pull-up. Two-wire sensor: signal here, other side to H4 / G4.	CLT signal. Calibrate the curve in TunerStudio.
H2	19	AN volt 4 19 - AN volt 4	Spare 0–5 V	Analog input on V4.	0–5 V sensor signal to sensor ground.
H1	20	TPS 1 20 - AN volt 5	TPS (cable) or throttle-body TPS 1 (DBW)	Must read smoothly ~0.4–4.6 V.	TPS wiper. 5 V from B1, ground to H4 / G4.
G4	21	Sensor ground agnd	Signal GND	Use both H4 and G4 on a busy harness.	Same analog-ground star as H4.
G3	22	AN temp 4 / Hall / Flex 22 - AN temp 4 or Hall Input or Flex	Oil temp / cam 2 / VSS / flex	Software assigns the role.	Two-wire temp to sensor ground, or Hall / flex signal.
G2	23	IAT 23 - AN temp 2	IAT	Place the sensor in the intake tract after the turbo on boosted engines.	IAT signal, other side to sensor ground.
G1	24	AN temp 3 / Hall / Flex 24 - AN temp 3 or Hall Input or Flex	Spare temp / VSS / flex / analog pressure	Third of the three Hall-capable pins (F4, G3, G1).	Temp, Hall, or 0–5 V per firmware assignment.
F4	25	Hall cam 25 - Hall Cam	Cam (sequential) or wheel speed (batch)	Not a VR input. Sequential COP needs a cam here. Batch / wasted spark can run on crank only.	Hall signal. Shielded. 5 V from B1 or C2 if the sensor is 5 V.
F3	26	AN volt 2 26 - AN volt 2	TPS 2 (DBW) / oil pressure	Required as throttle TPS 2 if ETB is enabled.	0–5 V signal to sensor ground.
F2	27	AN volt 1 27 - AN volt 1	MAP	External 3-bar or 4-bar sensor.	MAP signal. 5 V from C2. Short, dedicated vacuum hose.
F1	28	AN volt 10 28 - AN volt 10, Aux Reuse	Fuel pressure / spare analog	Analog input on V4. Aux-reuse output is not used.	0–5 V signal to sensor ground.
E4	29	Main relay control Main Relay	Main relay	The ECU holds the relay until shutdown writes finish.	Relay coil: 86 to key-on 12 V, 85 to E4.
E3	30	AN volt 7 30 - AN volt 7	PPS 2 (DBW) / O2 / spare	Leave empty on a cable throttle if unused.	0–5 V signal to sensor ground.

Molex	n	Name	Typical	Notes	Wiring
E2	31	AN volt 3 31 - AN volt 3	PPS 1 (DBW) / O2 / spare	Primary pedal if ETB is enabled.	0–5 V signal to sensor ground.
E1	32	AN volt 6 32 - AN volt 6, Aux Reuse	Wideband analog / spare	Analog input on V4. Aux-reuse output is not used.	Wideband analog out → E1, analog ground → H4 / G4.
D4	33	GP Out 3 33 - GP Out 3	Spare / boost / stepper	Not an injector channel. Fuel is the four primary injector pins, or an external driver on J4 / J3.	Low-side: load to main-relay 12 V.
D3	34	GP Out 2 34 - GP Out 2	Fan relay	Relay coil only — not the fan motor.	Fan relay coil to switched 12 V, ECU grounds this pin.
D2	35	GP Out 1 35 - GP Out 1	Fuel pump relay	Prime is firmware-controlled. Do not hard-wire the pump to key-on.	Fuel-pump relay coil. Pump power from a 15–20 A fused feed through that relay.
D1	36	AN volt 8 36 - AN volt 8, Aux Reuse	Spare analog	Analog input on V4. Aux-reuse output is not used.	0–5 V signal to sensor ground.
C4	37	Injector 1 37 - Injector 1	Injector 1 (4-cyl sequential)	High-impedance (>8 Ω) only. 6-cyl 3-channel and 8-cyl two-channel batch do not use this pin — those jobs are the external driver on K1 / J3 / J4 or J4 / J3.	Injector –. Injector + from main-relay 87.
C3	38	Injector 2 38 - Injector 2	Injector 2 (4-cyl sequential)	Same rules as C4.	Injector –.
C2	39	MAP 5 V 5v	MAP sensor supply	Short this to ground and you lose MAP and anything sharing the rail.	MAP, Hall, 0–5 V sensors. 0.5 mm².
C1	40	AN volt 9 40 - AN volt 9, Aux Reuse	Spare analog	Analog input on V4. Aux-reuse output is not used.	0–5 V signal to sensor ground.
B4	41	Injector 3 41 - Injector 3	Injector 3 (4-cyl sequential)	Same rules as C4.	Injector –.
B3	42	Injector 4 42 - Injector 4	Injector 4 (4-cyl sequential)	Same rules as C4.	Injector –.
B2	43	GP Out 4 43 - GP Out 4	Spare / boost / second pump relay	Not an injector channel.	Low-side or push-pull per firmware.
B1	44	TPS 5 V 5v	TPS sensor supply	Independent from C2. A shorted TPS should not kill MAP.	TPS and PPS 5 V.
A4	45	Crank VR+ / Hall 45 - VR/Hall Crank	Crank VR+ / Hall	Primary RPM input. No RPM here = no fuel, no spark.	VR: A4 = VR+, A3 = VR–, twisted pair. Hall: signal on A4, leave A3 open.
A3	46	Crank VR– vr	Crank VR– (do not connect if Hall)	Leave open if the crank sensor is Hall.	VR–. Swap A4 / A3 if RPM reads during cranking but sync is noisy or 180° out.
A2	47	CAN Low can	CAN bus Low	Twisted pair with A1. 120 Ω terminator at each end of the bus.	Dash CAN L, and any other Core EFI CAN device.

Molex	n	Name	Typical	Notes	Wiring
A1	48	CAN High can	CAN bus High	1 Mbit/s typical. Do not mix with a 500 kbit OEM bus without a gateway.	Dash CAN H.

01 Power, grounds & main relay

The V4 will not run from key-on voltage alone. L4 (pin 5) wakes it, E4 (pin 29) latches the main relay, M4 (pin 1) is the resulting 12 V feed.

L4 is not optional

Key-on 12 V on L4 is the primary wake-up. M4 is the post-relay supply and battery-sense. Skip L4 and the ECU stays dead even if the relay is jumping 12 V onto M4.

How the latch works

On key-on the ECU grounds E4, the relay closes, M4 comes alive, and firmware holds the relay until it has finished writing to flash on shutdown. E4 is not a TunerStudio-assignable output.

Pins: L4 · 5 · Key-on 12 V E4 · 29 · Main relay control M4 · 1 · 12 V from main relay
M3 · 2 · Power ground L3 · 6 · Power ground

Relay pinout (standard 5-pin automotive)

- 30 — constant battery 12 V, fused 25–30 A close to the battery.
- 87 — switched 12 V out to M4, injectors, coils, VVT, idle, sensor 12 V if used.
- 86 — relay coil to ignition-switched 12 V (same feed as L4 is fine).
- 85 — relay coil to ECU E4 (low-side).
- 87a — unused.

Grounds

M3 and L3 are power ground. Run both, 2.0 mm² or thicker, to a sanded boss on the block or heads — not a painted seat-belt bolt. H4 and G4 are analog ground. Sensor grounds stay in that star and only meet chassis inside the ECU.

Two 5 V rails

C2 feeds MAP / extras. B1 feeds TPS / pedal. They are independent so a shorted throttle pot does not take the MAP with it. Never use either rail to power coils or a wideband heater.

Minimum fuse map

- Battery → relay 30: 25–30 A.
- Key-on → L4 and relay 86: 5 A.
- Relay 87 → injectors / injector driver: 10 A (4-cyl) to 20 A (8-cyl batch).
- Relay 87 → coil +12 V: 10–15 A.
- Fuel pump (via D2 relay): 15–20 A on the pump side, 5 A on the coil side.

02 Analog sensors

Four thermistor inputs with pull-ups, ten 0–5 V analog channels, two independent 5 V supplies, two analog grounds. Auxiliary reuse pins are analog inputs. Sensor roles are assignable in TunerStudio.

Temperature

H3 (CLT) and G2 (IAT) are the usual pair. G3 and G1 are extra thermistor / Hall / flex pins — oil temp, flex fuel, VSS, or a spare sender. On-board pull-ups. Two-wire NTC: one side to the analog pin, the other to sensor ground (H4 or G4).

Pins:

H3 · 18 · CLT

G2 · 23 · IAT

G3 · 22 · AN temp 4 / Hall / Flex

G1 · 24 · AN temp 3 / Hall / Flex

H4 · 17 · Sensor ground

G4 · 21 · Sensor ground

TPS and pedal

Cable throttle: H1 is TPS, 5 V from B1, ground on H4 / G4. Closed ~0.4–0.8 V, WOT 3.8–4.7 V, monotonic. Drive-by-wire adds throttle TPS 2 on F3 and pedal PPS 1 / PPS 2 on E2 and E3.

Pins:

H1 · 20 · TPS 1

F3 · 26 · AN volt 2

E2 · 31 · AN volt 3

E3 · 30 · AN volt 7

B1 · 44 · TPS 5 V

MAP and 0–5 V

F2 is the default MAP input. 5 V from C2. Remaining analog pins — H2, F1, E1, D1, C1 — take oil pressure, fuel pressure, wideband analog, or whatever the tune assigns. All aux-reuse pins on V4 are analog inputs.

Pins:

F2 · 27 · AN volt 1

C2 · 39 · MAP 5 V

H2 · 19 · AN volt 4

F1 · 28 · AN volt 10

E1 · 32 · AN volt 6

D1 · 36 · AN volt 8

C1 · 40 · AN volt 9

03 Crank, cam, flex & VSS

One VR crank pair, one dedicated Hall input, two multi-use Hall / flex / temp pins. No RPM on A4 means the engine will not fuel or spark.

VR crank

Most OEM crank sensors on 36-1, 60-2 and 12-1 wheels are VR. VR+ to A4, VR– to A3, twisted pair, shield earthed at the ECU analog ground only. If you see RPM while cranking but the engine will not sync, swap A4 and A3 before touching the trigger-type setting.

Pins:

A4 · 45 · Crank VR+ / Hall	A3 · 46 · Crank VR–
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Hall crank

Three-wire Hall: 5 V or 12 V supply, signal to A4, ground to sensor ground. Leave A3 unconnected.

Cam, VSS, flex

F4 is the primary Hall input (cam by default). G3 and G1 can be Hall, flex-fuel frequency, VSS, or thermistors. Sequential 4-cylinder COP needs a cam. 6- and 8-cylinder batch / wasted spark run on crank only — F4 is then free for wheel speed.

Pins:

F4 · 25 · Hall cam	G3 · 22 · AN temp 4 / Hall / Flex	G1 · 24 · AN temp 3 / Hall / Flex
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Trigger setup in TunerStudio

Start with the OEM pattern (60-2, 36-1, 36-2-2-2, 4G63, Toyota 1UZ, etc.). Confirm RPM is stable on a timing light before adding fuel. Nissan 360° optical CAS is not supported as a primary trigger.

04 Injectors · 4 / 6 / 8 cyl

Four primary high-Z injector drivers. Cylinder count is assignable: 4-cyl sequential on those four, 6-cyl 3-channel matched through an external driver on K1 / J3 / J4, 8-cyl two-channel batch through J4 / J3.

High-impedance only

Saturated injectors, $>8\ \Omega$. Low-Z ($2\text{--}4\ \Omega$) needs a ballast per injector or a different ECU. Ign 4, GP Out 5 and GP Out 6 are 5 V / 12 V logic — they trigger an external driver, they do not fire injectors themselves.

The four primary outputs

C4, C3, B4, B3 are Injector 1–4. The ECU switches ground. Injector 12 V comes from main-relay 87. Cylinder order is a TunerStudio table.

Pins:

C4 · 37 · Injector 1

C3 · 38 · Injector 2

B4 · 41 · Injector 3

B3 · 42 · Injector 4

4-cylinder — sequential

One injector per primary output. Sequential with a cam on F4, or batch/semi-sequential on crank only.

6-cylinder — 3-channel matched

Three matched batch channels through an external injector driver. Trigger that box from K1 (Ignition 4), J3 (GPO 5) and J4 (GPO 6). Two injectors per channel. Primary Inj 1–4 stay unused for fuel. Confirm 5 V vs 12 V jumper on GPO 5 / 6, and that Ign 4 is set as a fuel output — not a coil — in TunerStudio.

Pins:

K1 · 12 · Ignition 4

J3 · 14 · GP Out 5

J4 · 13 · GP Out 6

8-cylinder — two-channel batch

Two injector channels: J4 (GP Out 6, Injectors A) and J3 (GP Out 5, Injectors B) into an external driver. Four injectors per channel. Primary Inj 1–4 stay unused for fuel. Confirm 5 V vs 12 V jumper on GPO 5 / 6.

Pins:

J4 · 13 · GP Out 6

J3 · 14 · GP Out 5

05 Ignition · 4 / 6 / 8 cyl

Four 5 V logic-level coil triggers plus two GP highs. Cylinder count is assignable. Dumb coils need an igniter — these pins will not drive them.

Logic-level only

K4–K1, J3 and J4 are 5 V (or jumper-selected 12 V on the GP highs). Smart coils or an igniter pack — yes. A dumb coil without a module — no.

Pins:

K4 · 9 · Ignition 1

K3 · 10 · Ignition 2

K2 · 11 · Ignition 3

K1 · 12 · Ignition 4

J3 · 14 · GP Out 5

J4 · 13 · GP Out 6

4-cylinder

Smart coils on K4–K1 (Ignition 1–4). Wasted spark with two coils, or sequential COP with four coils plus a cam on F4. Coil +12 V from main-relay 87. Coil power ground to the head, not analog ground.

6-cylinder — wasted spark

Three logic coils on K4, K3, K2 (Ignition 1–3). Two cylinders per coil. Ignition 4 (K1) is taken by the 6-cyl 3-channel injector driver — do not also put a coil on it.

8-cylinder — wasted spark

Four logic outputs on K4–K1, wasted spark (two cylinders per coil). Pair cylinders 360° apart. Example 1UZ-FE order 1-8-4-3-6-5-7-2 pairs as 1&6, 8&5, 4&7, 3&2 — assign whatever firing order the engine actually has. GPO 5 / 6 are then free for the two-channel injector driver.

Lock timing to a fixed 10° and confirm with a light on cylinder 1 before you add load. If the light is 180° out, add 360° to the offset or swap wasted-spark pairs — do not guess with fuel in the hole.

06 Drive-by-wire

One H-bridge on M1 and L1, throttle TPS 1/2, pedal PPS 1/2. Cable-throttle cars leave the H-bridge empty.

Pins:

M1 · 4 · ETB+	L1 · 8 · ETB-	H1 · 20 · TPS 1	F3 · 26 · AN volt 2
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E2 · 31 · AN volt 3	E3 · 30 · AN volt 7
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Motor

ETB+ M1, ETB- L1. If the blade drives closed on a positive test, swap the two wires or invert the output in firmware.

Sensors

Throttle-body TPS 1 on H1, TPS 2 on F3. Pedal PPS 1 on E2, PPS 2 on E3. Each needs 5 V (B1) and sensor ground. Two independent wipers, not a Y-splice of one signal.

Safety

A miswired pedal is a wide-open throttle. Before the engine cranks: key-on, TunerStudio ETB test, confirm the blade follows the pedal and springs shut when USB is pulled.

07 VVT, pump, fan & spare

Two dedicated high-current low-sides plus four half-bridges. Roles are assignable — fuel pump, fan, boost, VVT, stepper.

Dedicated low-sides

L2 is Low-side 1, M2 is Low-side 2. Typical: VVT and idle, or dual VVT. Solenoid 12 V from the main relay.

Pins:

L2	·	7	·	Low-side 1
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M2	·	3	·	Low-side 2
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D2	·	35	·	GP Out 1
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D3	·	34	·	GP Out 2
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D4	·	33	·	GP Out 3
----	---	----	---	----------

B2	·	43	·	GP Out 4
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Fuel pump and fan

Typical assignment is GP Out 1 (D2) for the fuel-pump relay and GP Out 2 (D3) for the fan relay. Relay coils only. Pump power on its own 15–20 A fused feed. Firmware primes on key-on.

GPO 5 and GPO 6

J3 and J4 are push-pull logic. On a 4-cylinder they are free for tach, shift light or an extra coil. On a 6-cylinder they share the 3-channel matched injector driver with K1. On an 8-cylinder they trigger the two-channel injector driver. Do not double-assign them.

Stepper idle

Bipolar stepper idle valves can use the four half-bridges (D4, D3, D2, B2) as two coils. Unipolar (5-wire / 6-wire) steppers are not supported. DBW cars should not also run a stepper.

08 CAN & Core EFI dash

A1 / A2 are the CAN pair. The Core EFI 7-inch dash speaks the Core EFI protocol on this bus. 120 Ω at each end.

Pins:

A1 · 48 · CAN High	A2 · 47 · CAN Low
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Physical layer

Twisted pair, CAN H A1, CAN L A2. 1 Mbit/s is the Core EFI default. A 120 Ω terminator belongs at each end of the bus — inside the dash and inside the ECU, or as a plug-in resistor on the last device.

Core EFI 7-inch dash

The Race Shop 7-inch dash listed as ‘Core EFI Protocol’ is the matching unit (the non-Core protocol dash is for Haltech / ECUMaster / Link / AEM). Power the dash from a fused ignition feed, ground it to chassis, CAN H/L to A1 / A2. Enable the dash broadcast in TunerStudio.

Do not splice an OEM 500 kbit bus

OEM body buses are 500 kbit and already terminated. Hang the V4 on that bus and you will lose clusters, ABS or the ECU. Use a dedicated pair to the Core EFI dash, or a CAN gateway.

USB for tuning

TunerStudio talks USB, not CAN. J2 (D–, white) and J1 (D+, green), or the internal micro-USB. Shielded cable, one ground between laptop and ECU — the USB ground.

Pins:

J2 · 15 · USB D–	J1 · 16 · USB D+
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09 Firmware & TunerStudio

Core EFI loader for firmware, TunerStudio for the tune. Loaders and ini files live on the Race Shop support drive. Cylinder count, injection mode and pin functions are assignable in the project.

What runs on the box

V4 runs Core EFI firmware, tuned in TunerStudio. Use the Core EFI V4 loader from the Race Shop support page — not a binary from another Core EFI product.

Downloads

Core EFI firmware, versions and loaders: Race Shop → Support. TunerStudio MS (paid) is strongly preferred over the lite build.

Update via Auto DFU

01 Talk USB first

Windows Device Manager should show 'STMicroelectronics Virtual COM Port'. If it does not, install the ST VCP driver before you try DFU.

02 Auto DFU from the console

Open the Core EFI console, pick the COM port, Update Firmware. The activity LED stops, the VCP disappears, 'STM Device in DFU Mode' appears, then erase + download.

03 Power cycle

When the console reports Upgrade successful / Verify successful, key-off, wait 10 seconds, key-on. Confirm the new version string.

TunerStudio project

New project → load the Core EFI V4 ini that shipped with that firmware.

Set cylinder count, injection mode (sequential / batch) and ignition mode (COP / wasted spark) to match the engine. 6-cyl fuel is 3-channel matched on Ign 4 / GPO 5 / GPO 6 — assign those as injector-driver outputs, not coils.

Assign spare analog and GP pins to the sensors and relays actually fitted.

Calibrate TPS, CLT, IAT, MAP, AFR before you crank.

Save the .msq off the laptop.

10 First start

Garage checklist. Fuel last. Work the list in order.

On the bench, key-on, engine off

- ☐ **TunerStudio connects**
VCP enumerates. Firmware version matches the ini. Save a blank .msq.
- ☐ **Battery voltage reads 12–14 V**
Sensed on M4 after the main relay clicks. If TunerStudio shows 0 V, M4 or the relay is wrong.
- ☐ **Main relay latches on key-on**
L4 wakes the ECU, E4 grounds the coil, M4 goes live. Relay stays on until key-off plus a short write delay.
- ☐ **Both 5 V rails are 4.9–5.1 V**
C2 (MAP) and B1 (TPS) to sensor ground. A shorted rail is a sensor or a crushed wire.
- ☐ **CLT, IAT, TPS, MAP look sane**
CLT $\approx$ ambient, IAT $\approx$ ambient, TPS closed 0.4–0.8 V, MAP $\approx$ baro with the hose off.
- ☐ **Output test: injectors, coils, pump, fan**
4-cyl: C4–B3 and K4–K1. 6-cyl: K1 / J3 / J4 into the 3-channel injector driver, coils on K4–K2. 8-cyl: J4 / J3 into the injector driver, K4–K1 coils. Pump on D2.
- ☐ **If DBW: pedal moves the blade, spring-shut works**
USB unplug must drop the throttle closed. Skip this on a cable throttle.

Cranking, fuel disabled

- ☐ **RPM 150–300 while cranking**
No RPM = trigger, not tune. Composite logger before anything else. Swap VR polarity on A4 / A3 once.
- ☐ **Full sync (cam if sequential)**
Batch / wasted spark run on crank only. Sequential COP needs F4 as cam, not VSS.
- ☐ **Timing light at a locked 10° on cyl 1**
Set fixed timing. If the light is 180° off, fix offset — do not add fuel.

First fire

- ☐ **Re-enable injectors, prime the rail**
Pump primes on key-on. Crack a union if the rail is dry. No start spray down the intake.
- ☐ **It catches, AFR is 11–14, oil pressure is up**
If it fires and dies, add cranking fuel, not running VE. Kill it if oil pressure is zero after 3 seconds.
- ☐ **Cooling fan comes on**
Set a low on-temp for the first run.
- ☐ **Save a log and the .msq**
First idle log plus the project file. This is the only baseline you will ever have.

11 Faults

Most first-start failures are power, crank signal, or a driver fighting a short. Work the list in order — do not retune a dead trigger.

Dead ECU / no USB

L4 has key-on 12 V to ECU ground.

M3 and L3 are on a real engine earth.

E4 is grounding the relay coil; M4 then shows 12 V.

USB: J2 white, J1 green, shielded cable, ST VCP driver installed.

No RPM while cranking

VR: A4 / A3, twisted, swap polarity once.

Hall: A4 only, A3 open, sensor actually powered.

Trigger type and tooth count match the wheel.

Look at the composite logger in the Core EFI console before you touch fueling.

RPM yes, no fuel

4-cyl: C4, C3, B4, B3 actually clicking on the output test.

6-cyl: K1, J3, J4 toggling into the 3-channel injector driver, and that box has 12 V.

8-cyl: J4 / J3 toggling into the external driver, and that box has 12 V.

Injector +12 V from main-relay 87.

Fuel-pump relay on D2 clicks.

No spark

4-cyl / 8-cyl wasted spark: smart coil or igniter on K4–K1.

6-cyl: smart coils on K4, K3, K2. K1 is the injector driver, not a coil.

Coil +12 V present while cranking (relay 87).

Fixed-timing test at 10° with a light on cylinder 1.

Sync loss under load

Shield the crank pair. Cross it away from injector and coil looms.

Power ground on the block, not a painted chassis hole.

VR gap too large, or a cracked reluctor.

