

Jeep XJ 4.0L — OBD-I / SBEC Wiring Diagnostic Quick Reference

1991–1995 "High-Output" MPI • SBEC (Single Board Engine Controller) • OBD-I: 2-digit flash codes on the MIL, no generic P-codes. Document 2 of 3 (companions: 1987–1990 Renix and 1996–2001 OBD-II references). Verified colors below are largely from the 1993–1995 4.0L SBEC harness; confirm against your year's FSM 8W.

1. System Overview

Item	Detail
Controller	SBEC, on firewall (passenger side). Single 60-pin connector (pins embossed on the wire side)
Diagnostics	OBD-I. 2-digit fault codes read by key-dance flash on the MIL (or Chrysler DRB scan tool). No OBD-II port / generic P-codes.
Ignition	Single canister coil + distributor (CMP sync inside distributor). Coil driver = SBEC pin 19.
Idle control	AIS / IAC stepper motor (4-wire) on throttle body (SBEC pins 39, 40, 59, 60)
CKP	3-wire Hall-effect on bellhousing — 8V supply (vs 5V on 1996+ OBD-II)
O2 sensor	Single upstream, heated (no downstream sensor — that arrives with OBD-II in 1996)
Sensor supplies	Both a 5V (pin 6) and an 8V (pin 7) reference are present
Main power relay	ASD relay — on SBEC the fuel pump and ASD relay share one control wire (pin 51)
Charging	SBEC-controlled alternator field (pin 20); battery-voltage sense on pin 57
Network	CCD bus (pins 26/46) + datalink (pins 25/45) for the DRB scan tool — pre-PCI

Year variations within this range: early **1991** builds can still be Renix — verify your controller. **CKP connector** is a round plug on 1991–1992 and a flat plug on 1993+. EVAP/purge solenoid control (pin 52) appears only on **1995**; a maintenance-indicator output (pin 56) appears only on **1993**; battery-power pin 3 changed wire color from PNK/BLK (1993) to RED (1994–1995).

Golden rule: read the 2-digit codes first, but a code identifies the **circuit** with a fault, not the failed part. Verify power, ground, and signal at the component before replacing it.

2. Reading OBD-I Codes (key dance)

With the engine OFF: turn the key **ON–OFF–ON–OFF–ON** within 5 seconds and leave it ON. The MIL (check-engine light) flashes each stored code as two digit-groups: e.g. code 12 = *flash · pause · flash-flash*. **Code 55 = end**. Repeat the sequence as needed. No scanner required (a Chrysler DRB gives live data).

3. Sensor Specs & Expected Readings

Crankshaft Position (CKP) — 3-wire Hall

Type	Hall-effect (digital)
SBEC pin	24 signal (RED/LT GRN)
Supply	8.0V (pin 7 WHT/BLK)
Ground	Sensor ground (pin 4 BLK/LT BLU)
Signal	0–5V square wave cranking
Connector	Round 1991–1992; flat 1993+
Test	No ohm test (Hall) — crank by hand, watch DC volts toggle
Fail / code	Thermal (hot no-start); sets code 11

TPS & MAP

TPS pin	22 signal (ORG/DK BLU); 5V supply pin 6; gnd pin 4
TPS closed	~0.5–0.8V WOT ~4.5V (smooth)
TPS code	24 (out of range)
MAP pin	1 signal (RED/WHT); 5V supply pin 6; gnd pin 4
MAP KOEO	~4.0–5.0V (atmos)
MAP idle	~1.1–2.1V (17-20" vac)
MAP codes	13 (no change start → run), 14 (V hi/lo)

Camshaft Position (CMP) — in distributor

SBEC pin	44 signal (GRY/BLK), shared supply/gnd
Note	CKP + CMP both needed to fire; loss sets code 11

Coolant (ECT) & Intake Air (IAT) — NTC thermistor (same curve)

Temp	-40°F	32°F	70°F	100°F	160°F	200°F	212°F
Resistance	~100kΩ	~7,500Ω	~3,400Ω	~1,600Ω	~450Ω	~250Ω	~185Ω
Approx volts	~4.9V	~3.5V	~2.8V	~2.0V	~1.0V	~0.6V	~0.5V

ECT = SBEC pin 2 (TAN/BLK), code 22 / 44. **IAT** = SBEC pin 21 (BLK/RED), code 23. **Open** → reads -40°F, rich. **Short** → reads hot, lean. Gauge sender is separate.

Oxygen Sensor (single upstream, heated)

SBEC pin	41 signal (BLK/ORG)
Heater resist.	5–7 Ω (infinite = replace)
Rich	>0.6V (up to ~0.9V)
Lean	<0.3V (down to ~0.1V)
Switching	Toggles ~every 2s at hot idle
Codes	21 (no switch / V high)

Injectors & Ignition Coil

Inj. feed	12V from ASD relay
Inj. ground	SBEC switches ground to fire each
Inj. SBEC pins	16 c1, 15 c2, 14 c3, 13 c4, 38 c5, 58 c6
Inj. code	27 (driver no response)
Coil type	Single canister coil + distributor (lower front, passenger side of block)
Coil primary	0.95–1.20 Ω
Coil secondary	11,300–15,300 Ω
Coil feed	White = 12V; Green = SBEC signal (driver pin 19 GRY/WHT)

Spark test: pull coil wire from distributor, insert a spare plug, ground it, crank — strong blue spark = coil + trigger OK. A failed single coil = no spark to **all** cylinders. **Injector test:** unplug, ohm across terminals; all 6 within ~1 Ω ; OL/0 Ω = replace.

4. SBEC 60-Pin Connector — Pinout (1993–1995 4.0L)

Single 60-pin connector on the firewall (passenger side). Active pins shown; unlisted pins are not used. Verified from 1993–1995 4.0L SBEC service data (Grand Cherokee harness; XJ uses the same SBEC family — confirm colors against your FSM).

Pin	Wire	Function
1	RED/WHT	MAP signal
2	TAN/BLK	ECT sensor
3	PNK/BLK(93) RED(94-95)	Battery power
4	BLK/LT BLU	Sensor ground
5	BLK/TAN	Ground
6	VIO/WHT	5V sensor supply
7	WHT/BLK	8V sensor supply (CKP)
9	LT BLU/RED	Ignition voltage
11	BLK/TAN	Chassis ground
12	BLK/TAN	Chassis ground
13	LT BLU/BRN	Injector #4 driver
14	YEL/WHT	Injector #3 driver
15	TAN	Injector #2 driver
16	WHT/DK BLU	Injector #1 driver
19	GRY/WHT	Ignition coil driver
20	DK GRN	Gen field driver (V-reg)
21	BLK/RED	IAT sensor
22	ORG/DK BLU	TPS signal
24	RED/LT GRN	Crank (CKP) signal
25	BLK	Datalink transmit
26	VIO/BRN	CCD bus (+)
27	DK BLU/ORG	A/C low-pressure switch
28	LT GRN	A/C select input
29	BRN	Brake switch input
30	BLK/WHT	Park/Neutral (A/T)

Pin	Wire	Function
32	BLK/PNK	Check engine light (MIL)
33	TAN/RED	Cruise control (vacuum)
34	DK BLU/RED	A/C compressor relay gnd
38	GRY	Injector #5 driver
39	YEL/BLK	IAC motor 4
40	BRN/WHT	IAC motor 2
41	BLK/ORG	Oxygen sensor signal
43	GRY/LT BLU	Tachometer output
44	GRY/BLK	Camshaft (CMP) signal
45	BLK/YEL	Datalink receive
46	WHT/GRY	CCD bus (-)
47	WHT/ORG	Vehicle speed sensor
48	BRN/RED	Cruise (SET/COAST)
49	YEL/RED	Cruise (ON/OFF)
50	WHT/LT GRN	Cruise (RESUME/ACCEL)
51	PNK	Fuel pump + ASD relay ctrl
52	PNK/BLK	EVAP/purge (1995 only)
53	LT GRN/RED	Cruise (vent)
54	ORG/BLK	Upshift indicator (M/T)
56	GRY/PNK	Maint. indicator (1993 only)
57	DK GRN/BLK	Battery V sense (ASD)
58	BRN/YEL	Injector #6 driver
59	GRY/RED	IAC motor 1
60	VIO/BLK	IAC motor 3

If your colors don't match this chart, do not use it. That's the clearest sign these aren't the right pin-outs for your exact vehicle/year — identify the terminal by connector position instead. Never probe the connector front; back-probe or use a wire-piercing probe a few inches from the connector, and disconnect the battery negative before unplugging the SBEC.

5. OBD-I 2-Digit Fault Codes (1991–1995)

* = MIL may not illuminate while this code is present. Code **55** = end of codes. The 4.0L is single-bank (one O2 / one coil).

Code	Meaning / first checks
11*	No crank/cam reference during cranking — CKP/CMP, distributor, connector
12*	Battery/PCM disconnected within 50 starts (common, benign)
13	No MAP change start → run (vacuum line, MAP)
14	MAP signal V too high / too low
15	No vehicle speed sensor signal
17*	Engine stays cold too long (thermostat / ECT)
21	O2 not switching / signal V high
22	ECT signal out of range
23	IAT signal out of range
24	TPS signal out of range
25	AIS/IAC idle motor driver shorted
27*	Injector output driver no response
33*	A/C clutch relay open/short (always set if no A/C)
34*	Speed-control solenoid open/short
35*	Cooling fan relay open/short (XJ only)

Code	Meaning / first checks
37	TCC / part-throttle unlock / P-N switch (auto)
41	Alternator field control open/short
42*	ASD / fuel pump relay circuit, or fuel-gauge sender circuit
43	Misfire (cyl 1–6) / peak primary current not reached
44*	ECT circuit, or PCM battery-temp voltage problem
46	Battery voltage too high during charging
47	Battery voltage too low during charging
51	O2 indicates lean (abnormal correction factor)
52	O2 indicates rich (abnormal correction factor)
53*	PCM internal problem
55	End of code transmission
62	EMR/SRI mileage not stored in EEPROM
63*	PCM cannot write to EEPROM
64	Catalytic converter efficiency failure
65	Power steering switch failure

Note: code 51 = lean and 52 = rich follow the standard Chrysler OBD-I convention (some web copies list both as "rich" — that is a transcription error). Source list compiled from the Chrysler FSM via FixJeeps; verify edge cases against the FSM.

6. Relays & Charging

Item	Detail
ASD + Fuel Pump relay	On SBEC these share one control wire (pin 51 PNK). The relay feeds the coil, injectors, and O2 heater; SBEC grounds it when it sees a crank reference. Loss/fault sets code 42.
Battery-voltage sense	Pin 57 (DK GRN/BLK) — SBEC monitors charging through the ASD relay output.
Alternator field	SBEC drives field via pin 20 (DK GRN). Field fault = code 41; over/under charge = codes 46/47.

Relay bench test: coil 85–86 = 50–120Ω (OL=open, 0=short). 12V to 85/86 → click → 30–87 ~0Ω. **In-circuit:** key ON, relay out — power on exactly 2 of 4 pins (30 always hot, 85 switched); backprobe the control pin for a momentary ground during the 2-3s prime.

7. Troubleshooting Decision Trees

Crank—No-Start (OBD-I / SBEC)

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ENGINE CRANKS BUT WON'T START (1991-1995 SBEC)
├─ Read 2-digit codes first (key dance, count MIL flashes; 55 = end)
│   └─ Code 11? → no crank/cam reference → go to CKP/CMP
├─ ASD + fuel pump prime at key-ON? (shared relay, SBEC pin 51)
│   ├── YES → spark at coil wire? (white=12V feed, green=signal pulse)
│   │   ├── No spark to ALL cylinders → single coil, coil driver (pin 19), or ASD feed
│   │   ├── Spark some cylinders → distributor cap/rotor, plug wires
│   │   └── Spark OK → check injector pulse, fuel pressure
│   └── NO → check ASD relay, SBEC pin 51 control, SBEC power/grounds
└─ CKP: 3-wire Hall, 8V supply (pin 7) – crank by hand, watch signal toggle 0–5V
    (round plug 1991-1992, flat plug 1993+). CKP thermal failure = hot no-start.
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Rough Idle

ENGINE IDLES ROUGH

└ Vacuum leak (spray test)?

└ Found → repair hose / intake / TB

└ None found

└ Clean / check AIS-IAC motor (code 25?)

└ TPS volts at idle (code 24?)

└ MAP at idle (~1.1-2.1V; codes 13/14)

└ Fouled injector (resistance compare)

└ ECT reading (codes 22/44)

└ Cap/rotor, plug wires

└ O2 activity (codes 21/51/52)

Charging / Sensor Circuit

CHARGING (SBEC)

└ Running V at battery = 13.8-14.4V?

└ Low → field driver pin 20, field wiring; codes 41 / 47

└ High >15V → codes 46 (field stuck)

SENSOR READING SUSPICIOUS

└ 5V (pin 6) / 8V (pin 7) ref present?

└ 0V → open wire / SBEC fault

└ OK → continue

└ Sensor ground (pin 4) <0.5Ω to batt neg?

└ Signal: stuck hi=open, 0V=short, erratic=intermittent (wiggle test)

8. Procedures & Wire Color Code Legend

Key DMM procedures

- **Voltage:** DC 20V; black to good ground, red to pin; backprobe live circuits.
- **Resistance:** power OFF, disconnected. OL=open, 0Ω=short. (Hall CKP/CMP can't be ohm-tested.)
- **Continuity:** good wire beeps, ≤0.3Ω.
- **Voltage drop (ground):** red to ground point, black to batt neg, load circuit. <0.1V good; >0.2V = repair.
- **Backprobe** from the wire side; never probe the connector front. Disconnect battery neg before unplugging the SBEC.

Wire color codes

Code	Color	Code	Color
BLK/BK	Black	ORG/OR	Orange
BRN/BR	Brown	PNK/PK	Pink
DK BLU	Dark Blue	RED/RD	Red
DK GRN	Dark Green	TAN/TN	Tan
GRY/GY	Gray	VIO/VT	Violet
LT BLU	Lt Blue	WHT/WT	White
LT GRN	Lt Green	YEL/YL	Yellow

WHT/DK BLU = base/stripe. Note 1991–1995 charts often spell colors out (GRY, DK BLU) where later docs abbreviate (GY, DB).

OBD-I / SBEC (1991–1995) quick reference, Document 2 of 3. 60-pin pinout and colors from 1993–1995 4.0L SBEC service data (Grand Cherokee harness; XJ uses the same SBEC family) — verify against your year's FSM 8W. Sources: Chrysler/Jeep FSM 8W, TroubleshootMyVehicle (1993–1995 PCM pinout), FixJeeps (OBD-I code list, coil & CPS testing), Cherokee Forum / NAXJA. For diagnostic guidance only.