Gunson

FAULT CODE READER

Vauxhall/Opel

PART NO G4153

HANDBOOK

Fault Code Reader

Vauxhall/Opel
Vehicles with the following engine management systems:
Motronic 4.1/2.7/2.5/1.5.4/1/5.2.8/1.5.2
Ecotronic
Multec/Multec M/S
Simtec 56/56.5
E1 Plus

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1. SAFETY FIRST

General safety guidelines to follow when working on vehicles

- **Always operate the vehicle in a well ventilated area.**
- **Do not inhale exhaust gases - they are very poisonous.**
- **Always make sure the vehicle is in park (Automatic transmission) or neutral (manual transmission) and that the parking brake is firmly set. Block the drive wheels.**
- **Always keep yourself, tools and test equipment away from all moving or hot engine parts. Treat high tension ignition components with respect, remembering that electrical shocks can cause involuntary movement which may result in secondary injury.**
- **Wear approved eye protection.**
- **Never wear loose clothing that can catch in moving engine parts and always tie-up or cover long hair.**
- **Never lay tools on a vehicle battery. You may short the terminals together causing harm to yourself, the tools or the battery.**
- **When carrying out tests on a motor vehicle, remember NEVER run the engine with the car battery disconnected (either + or -) since the alternator would then run at a damaging over-voltage.**
- **Never smoke or have open flames near vehicle. Vapours from gasoline and charging battery are highly flammable and explosive. Always keep a suitable fire extinguisher handy.**
- **Never leave vehicle unattended while running tests.**
- **Keep children and animals out of the area.**
- **Always turn ignition key OFF when connecting or disconnecting electrical components, unless otherwise instructed.**
- **Always follow vehicle manufacturer's warnings, cautions and service procedures.**

CAUTION

Some vehicles are equipped with safety air bags. You must follow vehicle service manual cautions when working around the air bag components or wiring. If the cautions are not followed, the air bag may open up unexpectedly, resulting in personal injury. Note:The air bag may still open up several minutes after the ignition key is off (or even if the vehicle battery is disconnected) because of a special energy reserve module.

Precautions to be followed when using the Fault Code Reader

- **Before connecting the leads, ensure that the correct connector of the car has been identified.**

- **Using this product may cause vehicle systems to self test, items such as coolant fans to suddenly start with no warning, and engine speed to suddenly increase.**

- **Using this product can involve working on a car while the engine is running. This is a potential hazard and the user should take every precaution to avoid any possibility of damage or injury.**

2. HOW FAULT CODES MAKE IT EASY

Modern vehicles have electronic control units that are able to identify and remember faults which occur in the vehicle's equipment. This system was introduced on the higher specification electronic fuel injection vehicles around 1986 and was applied to other types of ECU a little later(ABS and Ignition) Its application is now virtually universal to all petrol engine vehicles. This is a great benefit to service and maintenance personnel as it can considerably simplify vehicle repair. The vehicle faults are stored in the vehicle's Electronic Control Unit (ECU) as "Fault Codes".

The system is so simple that retrieving vehicle fault codes does not require particular skill. However, in order to read these fault codes some equipment is necessary. (E.g. a Fault Code Reader), which is used to instruct the vehicle's ECU to download fault codes and/or present them to the user on a display. By far the most common system is to present the code as a "blink code". The Fault Code Reader will activate that part of the OBD programme which identifies the defective component and cause a code to be displayed, usually by a light on the Fault Code Reader or by an instrument panel "Check Engine" light. These provide a series of pulses to simply count a code number. Systems with an instrument panel "Check engine" light are able to illuminate this when the engine is running to warn of faults, other systems are more secretive and need to be interrogated.

The Fault Code Reader is an economical but very effective product. It is available for a wide range of vehicles and enables the user to instruct the vehicle to download stored fault codes. Having obtained the fault codes, the user then identifies the nature of faults by referring to a list of code numbers. Comprehensive lists of code numbers are included in this handbook.

NB Car manufacturers have in the past used a connector type unique to

their own cars. Many manufacturers have used different types of connector at various times. Only recently have there been moves to standardise to a 16 pin socket.

Makes and models of car also vary in the degree of testing and fault diagnosis that is possible. In general, the ECU will identify faults that exist at the time of the test, but the ECU may also have a memory that remembers faults that have occurred in the recent past, and these can also be read out from memory using the Fault Code Reader. For instance, in some vehicles, the readout consists of the faults that are present at that time, followed after a "separator" code, by the codes that are held in memory from some previous time.

In most vehicles, tests are carried out with the engine off (but ignition on). Occasionally additional tests may be carried out with the engine running (this depends on the sophistication of the ECU and is not available on all makes of vehicle).

Having identified the fault codes, and eliminated the faults, the user may then wish to erase the faults from the ECU's memory. With some cars this is possible using a special sequence of operations, or a sequence of switch operations on the Fault Code Reader. With other vehicles this is not possible and it may be necessary to erase the memory by disconnecting the battery (-) connection (with engine not running), this has the disadvantage that codes for radio/ security system and also some ECU memory settings are temporarily lost. Fault codes generally disappear anyway after the fault has not been present for a certain number of engine start cycles, but deletion of the codes followed by a short drive has the advantage that it allows the operator to check if the fault has truly been rectified. This is confirmed if the code does not re-occur.

Before using this product (or indeed carrying out any vehicle maintenance), the user is recommended to read the precautions presented in later sections of this manual. In particular, note that during the use of this product the vehicle's On Board Diagnostic programme (OBD) takes control of the vehicle, and may activate various vehicle systems (such as turning on the cooling fan), this can constitute a safety hazard and the user should keep fingers clear during tests.

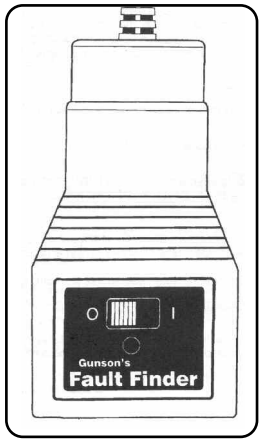
3. THE FAULT CODE READER

Fault Code Reader is complete with the connections for the vehicle listed on the packaging. It is not suitable for use on any other vehicle

INSTRUCTIONS FOR USE please read carefully and it will help you to use the product and interpret the information it can provide

TEST SWITCH. Labelled "0" and "I". Moving from "0" to "I" starts a test or changes the way the vehicle's Electronic Control Unit (ECU) functions.

LED CODE INDICATOR. (If fitted), will transmit pulses which represent the fault codes. On models where this is not fitted the pulses will generally be seen on the engine check light on the vehicle instrument panel.



4. HOW TO USE YOUR FAULT CODE READER

NUMBER / CODE IDENTIFICATION

Identifying fault codes is in fact very easy and simple, though it may seem complicated at a first reading, the user will soon get accustomed to the technique.

Basically, the ECU communicates with the "Code Reader" in a series of pulses, and the user simply counts these pulses to identify particular numbers. For example, the number 6 would be transmitted as 6 pulses in rapid succession. If we use the symbol ☼ to indicate a pulse, then the number 6 will be transmitted as:

☼ ☼ ☼ ☼ ☼ ☼ **= 6**

If the number is a 2 digit number, then each digit is transmitted separately. For example, the number 25 would be represented as 2 pulses, followed by a brief pause, and then 5 more pulses.

☼ ☼ ☼ ☼ ☼ ☼ ☼

2 5 = 25

In practice, the "Fault Code Reader" code will be output as a series of numbers one after the other, and the user has to recognise individual numbers, and recognise the gaps between numbers. This is made easy by the fact that the pause between two numbers is much greater than the pause between the individual digits of a number.

Similarly, there is an even greater pause between one series of code numbers

(egg representing current faults), and another series of code numbers (e.g. representing faults stored in memory.

To make matters even easier, the ECU, in most instances, repeats a series of code numbers, so that the user has the opportunity to check the reading.

Each code has a particular meaning, which is identified by reference to the tables of Fault Codes which follow.

GENERAL NOTES

Before connecting "the Fault Code Reader" to the car, the user should ensure that the TEST SWITCH is set to "O" and the diagnostic socket has been correctly identified. Check that the car ignition is off, the car is out of gear, and that the handbrake is applied.

When a fault code appears, it does not necessarily mean that the component indicated is faulty. It could mean that the ECU has received a signal from the component or it's wiring, which is outside specification.
Therefore before tests are performed, (using the Test Procedure Notes later in this Manual), it is important
all of the connections and wiring associated with the indicated component are checked.

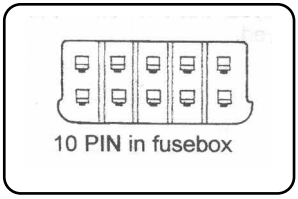
When multiple faults are indicated, it is possible that the fault on one component is causing incorrect readings from other components, but all the components will have to be checked to eliminate the true cause.

5. Where to Connect the Fault Code Reader

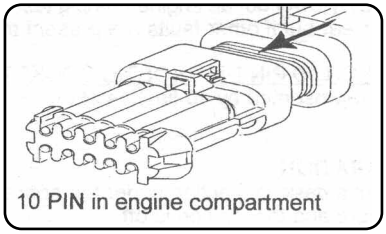
Diagnostic Sockets

10-Pin Socket

The 10-pin diagnostic socket is usually located in the fuse box or in the engine compartment wiring loom
No adaptor is required. Connect the Fault Code Reader to the appropriate diagnostic socket
Picture of 10pin socket in fuse box and 10 pin socket in engine compartment
Codes will be either 2 or 3 digits for vehicles fitted with the 10 pin socket



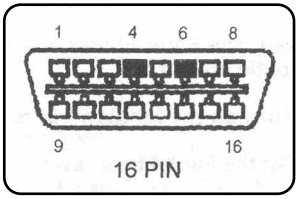
The Code 11111 is continuously transmitted to indicate test complete.
Code 12 will be the first code displayed. If this is the only code displayed then


10 PIN in engine compartment

the system is clear of any faults. NB: If fault code 31 is displayed, only applicable on some systems, it means there is no RPM signal. Only carry out an engine running test if this code is displayed. Start the engine and this code should clear. If other codes are present these will be displayed

16-Pin Socket

The 16-pin diagnostic socket is usually located in the fuse box or near the handbrake



Adapt the rectangular plug on the Fault code Reader lead by attaching the adaptor to the two pins in the plug; connect the other end of the adaptor to the 16 pin diagnostic socket. Connect the flat blade to No 4 and No 6 port hole.

Codes will be 4 digits for vehicles fitted with the 16 pin socket.

Zero is represented by 10 flashes of the engine check light.

Fault indication and display type

It is normal for Vauxhall/Opel vehicles to have an engine check light fitted to the instrument panel. The check light is orange when lit and has a small engine silhouette with at transistor symbol on it or the word CHECK. It should illuminate with the ignition on and engine not running to check the bulb and wiring.

If a significant continuous fault is present, this light should be illuminated while the engine is running. An intermittent fault may cause a fault code to be recorded without switching on the engine check light.

However, intermittent faults will result in a code being stored in the memory. After a number of repeat vehicle journeys without a fault, the code may be automatically deleted. It is advisable to test regularly or soon after an intermittent fault is experienced.

6. How to display codes

PREPARATION

Carry out a basic inspection under the bonnet before proceeding, ensure all leads and connectors are secure and the ignition is switched off.

TEST PROCEDURE

1). **Set switch on the Fault Code Reader to the "O" position and connect to the diagnostic socket. (Fig 1.)**
2). **Turn on the ignition but do not start the engine.**
3). **Set the switch in the "I" position for a period of approximately three seconds then return it to the "0" position.**
4). **After about five seconds the Test Start code will be transmitted as a series of pulses reading code 12, (PULSE - PAUSE - PULSE PULSE).**
5). **After a further five seconds the LED will extinguish.**
6). **Set the switch into the "I" position again for three seconds and then return to the "0" position.**
7). **The LED will now come on. After about five seconds the next code will be transmitted.**
8). **If the code is code 11, (PULSE PAUSE PULSE) then this denotes the end of the test sequence as no faults have been registered, proceed to (6).**
9). **If any other code is transmitted, this is a fault code. Continue as (5) below**
10). **Wait for five seconds and the "Code Scanner" LED will extinguish, if a fault code was transmitted, set the switch into the "I" position again for three seconds and then return to the "0" position. After about five seconds a further fault code may be transmitted.**

This switch sequence must be repeated until code 11, end of test, is transmitted.
The test can be repeated in order to confirm any codes or terminated by switching off the ignition and disconnecting the "Fault Code Reader".
Reference should be made to the Fault Code Table to identify any codes and to assist in repair procedures.

CLEARING CODES (AFTER CORRECTING ANY VEHICLE FAULTS)

When the end of the test procedure is indicated by the end of code 11, there will be a pause of about five seconds and the LED will extinguish.

1). **Put the switch into the "I" position for about ten seconds. Then put the switch into the "0" position, and switch off the ignition.**
2). **Perform the test procedure again to ensure that the fault codes have been deleted.**
3). **Drive the vehicle sufficient to warm the engine fully and then operate it under a variety of part and full load conditions.**
4). **Perform the test procedure again to ensure that the fault codes have not been reset.**

7. The Vehicle Application Tables

Ref	CORSA NOVA TIGRA	KADET-E ASTRA-E BELMONT	ASTRA-F	CALIBRA CAVALIER	VECTRA	CARLTON OMEGA	SENATOR-B	FRONTERA MONTEREY	Management System
1		20SEH/R (20NE					C30LE		MOTRONIC ML 4.1
2				C20LET					MOTRONIC M2.7
3		20XEJ C20XE							MOTRONIC M2.5
4						X20SE		X20SE X22XE	MOTRONIC M1.5.4
5	X10XE C16SE 1	20NE 20SEH 20SER C20NE		20NE 20SEH C20NE		20SE C20NEJ C25NE C20NE C26NE C30NE C30SE C30SEJ C30XEI	C26NE C20NE C30SE	C20NE C24NE	MOTRONIC M1.5
6			C20XE	C20XE X25XE	X25XE	X25XE X30XE			MOTRONIC M2.8
7			C20NE	C20NE					MOTRONIC M1.5.2
8						E18NVR			ECOTRONIC
9	12NE X12NZ X12SZ C14NZ X14SZ	C14NZ C16NZ C16NZ C18NZ	C14NZ X14NZ C16NZ X14NZ X16SZ/R	18NZ E16NZ C16NZ2 X16SZ C18NZ	X16SZR X16XEL				MULTEC
10	C14SE C16SE		C14SE C16SE						MULTEC M
11	X14XE C16XE X16XE		X14XE X16XEL C18XEL		X16XE				MULTEC S
12			C18X X20XEV	X18XE X20XEV	X18XE X20XEV	X20XEV			SIMTEC 56
13			C18XE X20XEV	X20XEV	X20XEV	X20XEV			SIMTEC 56.5
14	E16SE	E16SE/SV		16SV/18SV		18SV			E1 PLUS

8. Fault Codes

CODE	CODE REFERENCE FOR ECOTRONIC ENGINES (8)	ACTION
14	Coolant temperature- voltage low	Refer to TPN 2
15	Coolant temperature – voltage high	Refer to TPN 2
19	Not a valid code	
21	Throttle position sensor – voltage high	Refer to TPN 5
22	Throttle position sensor – voltage low	Refer to TPN 5
36	RON coding circuit	
42	Primary ignition current too high	Battery voltage likely too high or alternator fault
48	Battery – voltage low	Check battery voltage. Has been less than 8 volts
49	Battery – voltage high	Check battery voltage – Has been more than 16 volts
53	Throttle valve reg. pot – voltage low	Throttle valve adjuster pot – shorted to earth
54	Throttle valve reg. pot – voltage high	Throttle valve adjuster pot – at 5 volts
55	ECU faulty	
56	Pre-throttle – current high	
57	Pre-throttle – current low	
58	CO coding – voltage low	
59	Throttle valve reg. – Extension too low	
61	Throttle valve reg. – Close time too long	
62	Throttle valve reg. – Ventilation time too low	
63	Throttle valve reg. Evacuation time too low	
64	Primary ignition current – too low	Dwell too large. Excessive primary resistance
75	Torque control – voltage low	
76	Continuous torque control	

CODE	CODE REFERENCE FOR EI PLUS ENGINES (14)	ACTION
31	No engine RPM signal	Engine off
33	MAP sensor – voltage high	Refer to TPN 6
34	MAP sensor = voltage low	Refer to TPN 6
36	RON coding circuit	
42	No electronic spark timing signal	
46	Engine oil temperature – voltage low	Refer to TPN 2
47	Engine oil temperature – voltage high	Refer to TPN 2
48	Battery – voltage low	Check battery voltage. Has been less than 8 volts
49	Battery – voltage high	Check battery voltage – Has been more than 16 volts
55	IECU faulty	
56	Idle control valve – voltage high	
57	Idle control valve – voltage low	
67	Idle position switch – voltage low	Refer to TPN 4
68	Idle position switch – voltage high	Refer to TPN 4
72	Full position switch – voltage low	Refer to TPN 4
75	Torque control – voltage low	76
76	Continuous torque control	
95	Engine load signal input – voltage low	Dwell angle too small
98	PTC output – voltage low	
99	PTC output – voltage high	

CODE	CODE REFERENCE FOR MOTRONIC SYSTEMS (1-7)	L4.1 (1)	2.7 (2)	2.5 (3)	1.5 1.5.4 (4&5)	2.8 (6)	1.5.2 (7)	ACTION
13	Oxygen sensor – open circuit	X	X	X	X	X	X	Refer to TPN 9
14	Coolant temperature – voltage low	X	X	X	X	X	X	Refer to TPN 2
15	Coolant temperature – voltage high	X	X	X	X	X	X	Refer to TPN 2
16	Knock signal circuit	X		X	X	X		
17	Knock signal circuit 2	X				X		
18	Knock control module (ECU)	X		X	X			
19	Incorrect RPM signal	X	X	X	X	X	X	
21	Throttle position sensor – voltage high	X	X		X	X		Refer to TPN 5
22	Throttle position sensor – voltage low	X	X		X	X		Refer to TPN 6
23	Knock sensor – out of range	X			X			
25	Injector 1 - voltage high	X	X	X	X	X		Injector short – batt. volts
26	Injector 2 - voltage high	X		X	X	X		Injector short – batt. Volts
27	Injector 3 – voltage high			X	X	X		Injector short – batt. volts
28	Injector 4 – voltage high			X	X	X		Injector short – batt. volts
29	Injector 5 – voltage high					X		Injector short – batt. Volts
31	No engine RPM signal	X	X	X	X	X		Engine not running
32	Fuel pump relay – volts high					X		
38	Oxygen circuit – voltage low	X	X		X	X		Refer to TPN 9
39	Oxygen circuit – voltage high (rich)	X			X	X		Refer to TPN 9
41	1 speed ident. Switch voltage low				X			
42	1 speed ident... Switch voltage high				X			
44	Oxygen circuit – voltage low (weak)			X			X	Refer to TPN 9
48	Battery voltage low	X	X	X		X	X	Check batt. Volts has been less than 10v after engine start
49	Battery voltage high	X	X	X		X	X	Check batt. Volts has been more than 16v
51	ECU faulty			X			X	Refer to TPN 9
52	Check engine light – voltage high	X	X			X		Refer to TPN 2
53	Fuel pump relay – voltage low	X	X	X		X		Refer to TPN 2
54	Fuel pump relay – voltage high	X	X	X		X		
55	ECU faulty	X	X	X		X	X	
56	Idle air control – voltage low	X	X	X	X	X	X	
57	Idle air control – voltage high	X	X	X	X	X	X	

CODE	CODE REFERENCE FOR MOTRONIC SYSTEMS (1-7)	L4.1 (1)	2.7 (2)	2.5 (3)	1.5 1.5.4 (4&5)	2.8 (6)	1.5.2 (7)	ACTION
61	Fuel tank vent valve – volts low	X	X	X	X	X		
62	Fuel tank vent valve – volts high	X	X	X	X	X		
65	Idle CO potentiometer – volts low	X		X			X	
66	Idle CO potentiometer volts high	X		X			X	
67	Idle position switch – voltage low			X			X	
69	Intake air temperature – volts low	X	X				X	
71	Intake air temperature – volts high	X				X	X	
72	Full position switch – voltage high			X			X	
73	Air flow sensor – voltage low	X	X	X	X	X	X	Refer to TPN 1
74	Air flow sensor – voltage high	X	X	X	X	X	X	Refer to TPN 1
75	Torque control – voltage high	X	X	X	X	X	X	
79	Full load inhibitor – voltage low					X	X	
81	Injector valve 1 – voltage low	X	X	X	X	X	X	Injector short to ground or lead open circuit
82	Injector valve 2 – voltage low	X	X	X	X	X	X	Injector short to ground or lead open circuit
83	Injector valve 3 – voltage low	X	X	X	X	X	X	Injector short to ground or lead open circuit
84	Injector valve 4 – voltage low	X	X	X	X	X	X	Injector short to ground or lead open circuit
85	Injector valve 5 – voltage low	X	X	X	X	X	X	Injector short to ground or lead open circuit
86	Injector valve 6 – voltage low	X	X	X	X	X	X	Injector short to ground or lead open circuit
87	A/C cut off relay – voltage low				X	X		
88	A/C cut off relay – voltage high				X	X		
93	Half sensor – voltage low	X		X	X	X	X	Refer to TPN 6
94	Hall sensor – voltage high	X		X	X	X	X	Refer to TPN 6
95	Hot start valve – voltage low				X			
96	Hot start valve – voltage high				X			
97	Ignition/injection cut off voltage high					X	X	
113	Boost control out of range				X			
114	Boost pressure idle above upper limit				X			
115	Boost pressure full below lower limit				X			
116	Boost pressure full below upper limit				X			
117	Wastegate valve – voltage low				X			
118	Wastegate valve – voltage high				X			

CODE	CODE REFERENCE FOR MULTEC SYSTEMS	(9)	M (10)	S (11)	ACTION
13	Oxygen sensor – open circuit	X	X	X	Refer to TPN 9
14	Coolant temperature – voltage low	X	X	X	Refer to TPN 2
15	Coolant temperature – voltage high	X	X	X	Refer to TPN 2
16	Knock signal circuit	X		X	
18	Knock control module (ECU)			X	
19	Incorrect RPM signal	X	X	X	Crankshaft sensor signal faulty
21	Throttle position sensor – voltage high	X	X	X	Refer to TPN 5
22	Throttle position sensor – voltage low	X	X	X	Refer to TPN 5
24	No vehicle speed signal	X	X	X	
25	Injector valve- voltage low	X	X	X	
28	Fuel pump relay contact problem	X	X	X	
29	Fuel pump relay – voltage low			X	
32	Fuel pump relay – volts high	X	X	X	
33	MAP sensor – voltage high	X	X		Refer to TPN 6
34	MAP sensor – voltage low	X	X		Refer to TPN 6
35	Idle air control	X	X	X	
41	Primary signal to coil 2 & 3 – voltage high	X			DIS only
42	Primary signal to coil 2 & 3 – voltage low	X			DIS only
43	Primary signal – voltage high	X	X		
44	Oxygen sensor circuit – voltage low (weak)	X	X	X	Refer to TPN 9
45	Oxygen sensor circuit – voltage high	X	X	X	Refer to TPN 9
46	Primary signal – voltage high			X	
47	Linear EGR position	X			DIS only
49	Battery voltage high	X	X	X	Check battery – has been more than 17.2 volts
51	ECU faulty	X	X	X	
54	Idle CO potentiometer	X			
55	ECU faulty	X			
63	Primary signal to coil 2 & 3 – volts low	X			DIS only
64	Primary signal to coil 1 & 4 – volts low	X		X	DIS only
67	Mass air flow sensor – range fault			X	Refer to TPN 7
68	Mass air flow sensor – frequency fault			X	Refer to TPN 7
72	Mass air flow sensor – frequency fault			X	
75	Torque control – voltage low	X			
76	Continuous torque control	X			
81	Injector valve – voltage high	X	X	X	
93	Quad driver module (QDM)	X		X	

CODE	CODE REFERENCE FOR SIMTEC 56 SYSTEMS (12)	ACTION
13	Oxygen sensor – open circuit	Refer to TPN 9
14	Coolant temperature – voltage low	Refer to TPN 2
15	Coolant temperature – voltage high	Refer to TPN 2
16	Knock signal circuit	
19	Incorrect RPM signal	
21	Throttle position sensor – voltage high	Refer to TPN 5
22	Throttle position sensor – voltage low	Refer to TPN 5
23	Knock signal – out of range	
24	No vehicle speed signal	Injectors short circuited to battery voltage or injection signal not present
25	Injector valve 1 - voltage high	Injectors short circuited to battery voltage or injection signal not present
26	Injector valve 2 – voltage high	Injectors short circuited to battery voltage or injection signal not present
27	Injector valve 3 - voltage high	Injectors short circuited to battery voltage or injection signal not present
28	Injector valve 4 – voltage high	
37	Check light – voltage low	Refer to TPN 9
38	Oxygen sensor circuit – voltage high	Refer to TPN 9
39	Oxygen sensor circuit – voltage low	Refer to TPN 9
44	Oxygen sensor – lean exhaust	Refer to TPN 9
45	Oxygen sensor – rich exhaust	Check battery voltage has been less than 9v
48	Battery – voltage low	Check battery – has been more than 16 volts
49	Battery voltage high	
52	Check light – voltage high	
53	Fuel pump relay – voltage low	
54	Fuel pump relay – voltage high	
55	ECU faulty	
56	Idle air control – voltage high	
57	Idle air control – voltage low	
61	Fuel tank vent valve – voltage low	
62	Fuel tank vent valve – voltage high	
69	Intake air temperature – voltage low	
71	Intake air temperature – voltage high	
73	Mass air flow temperature – voltage low	Refer to TPN 7
74	Mass air flow temperature – voltage high	Refer to TPN 7
75	Torque control – voltage low	
76	Continuous torque control	
81	Injector valve 1– voltage low	Injector short circuit to ground
82	Injector valve 2 – voltage low	Injector short circuit to ground
83	Injector valve 3 – voltage low	Injector short circuit to ground
84	Injector valve 4 – voltage low	Injector short circuit to ground
87	A/C cut-off relay – voltage low	
88	A/C cut-off relay – voltage high	
91	Oxygen heating – voltage high	
92	Camshaft sensor – incorrect signal	
92	Oxygen sensor heating – voltage low	

CODE	CODE REFERENCE FOR SIMTEC 56.5 SYSTEMS (13)	ACTION
0100	MAF sensor	Refer to TPN 7
0105	Intake manifold pressure sensor	Refer to TPN 6
0110	Intake ATS	Refer to TPN 3
0115	CTS	Refer to TPN 2
0120	TPS	Refer to TPN 5
0130	HEGO	Refer to TPN 9
0135	HEGO heater	Refer to TPN 9
0150	HEGO	Refer to TPN 9
0173	HEGO	Refer to TPN 9
0200	Injector 1	
0202	Injector 2	
0203	Injector 3	
0204	Injector 4	
0205	Injector 5	
0206	Injector 6	
0230	Fuel Pump	
0325	Knock sensor	
0330	Knock sensor 2	
0335	Crank sensor	
0340	Camshaft sensor	
0351	Ignition coil 1 + 4	
0352	Ignition coil 2 + 3	
0400	Exhaust Gas Recirculation valve	Ref to TPN 10
0403	EGR valve	Ref to TPN 10
0410	Secondary air pump	
0412	Secondary solenoid valve	
0443	Tank vent valve	
0500	Odometer frequency sensor	

CODE	CODE REFERENCE FOR SIMTEC 56.5 SYSTEMS (13)	ACTION
0505	MAF sensor	
1110	Intake manifold pressure sensor	
1112	Intake ATS	
1113	CTS	
1120	TPS	Ref to TPN 4 or 5
1229	Power supply relay	
1231	Fuel pump relay	
1320	Knock control cyl. 1	
1327	Knock control cyl. 2	
1328	Knock control cyl. 3	
1329	Knock control cyl. 4	
1405	EGR valve	Ref to TPN 10
1410	Secondary air pump relay	
1411	Secondary air pump	
1501	Immobiliser control unit	
1502	Immobiliser control unit	
1503	Immobiliser control unit	
1530	Air flow relay	
1600	Internal control module	
1601	ECU too hot	
1602	Knock control module	
1604	Knock control unit	Ref to TPN 10
1605	Knock control unit	Ref to TPN 10
1606	Knock control unit	
1640	Knock control unit or Quad drive module	
1690	MIL/Engine tail /Malfunction indicator lamp)	
1740	Torque control unit	

9. TEST PROCEDURE NOTES (TPN)

1. VANE AIR FLOW METER

This is positioned in the airstream and is opened by the flow of the air intake. The greater the airflow, the more the flap/plate opens. The flap/plate is connected to a potentiometer that will produce a voltage reading proportional to the position of the flap/plate.

To test a Vane Air Flow Meter, probe the airflow meter connector with a voltage meter until the sensor output is identified. The output will be a voltage of 0.5v to 4.5v, or 4.5v to 9v. The reading changes as the air flow is varied. The airflow can be varied by varying the engine speed.

Test the output of the airflow meter with the ignition on, at idle, at 1500 RPM, at 3000 RPM, and during a rapid acceleration, and compare to typical values given below:

Ignition on	**0.25v-0.5v**	**3.5v**
Idle	**0.5v-1.5v**	**4.5v-5.0v**
1500 RPM	**0.7v-2v**	**5.0v-5.5v**
3000 RPM	**1.1v-3v**	**6-7v**
Rapid Acceleration	**3v-4.5v**	**>8v**

Typical Air Flow sensor output

Most systems give an increase in voltage with air flow rate, but some systems give a fall in voltage.

Gradually increase engine speed from idle to 3000 RPM, observing the voltage change. If the voltage becomes 0v or 5v at any point, repeat the test. If the same result is obtained, the resistive track of the airflow meter is damaged. If the voltage stays at a value as the engine speed changes it indicates a sticking flap/plate.

A sensor simulator that can simulate a varying voltage, can be used to provide a voltage to the ECU to simulate the output of the airflow sensor and positively diagnose a faulty airflow meter.

2. COOLANT TEMPERATURE SENSOR:

This should be tested by an ohms meter when the engine is cold, and also when warm (with any connections to the sensor disconnected). The results

should be checked against manufacturer's specifications, or typical values as given overleaf:

Typical Coolant Temperature Sensor Resistance

Most systems		Exception KE Jetronic, EEC1V.	
Cold	3-5 K Ω	50 K Ω	@ 15∞C
Warm	300-400 Ω	3.5 K Ω	@ 80∞C

A sensor simulator that can simulate resistance can be used to simulate the resistance value of the sensor and positively identify a defective sensor.

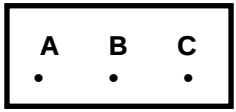
3 AIR TEMPERATURE SENSOR:
This may be tested by connecting an ohms meter across the sensor and checking against the typical values given below:

Typical Air Temperature Sensor Resistance

Most systems		Exceptions*	
Cold	5 K Ω	500 Ω	@ 0∞C
Warm	2.5 K Ω	200 Ω	@ 20∞C

***Exceptions - KE,L,LE2 and LE3 Jetronic Lucas P Digital**
The sensor is intended for fine-tuning the petrol/air mixture. Therefore dynamic tests while observing the injection duration are inconclusive. The use of a Sensor Simulator to simulate extreme temperature variations is useful to show the injection duration can be affected by air temperature and therefore that the circuit is fully operational.

4.THROTTLE SWITCH:
This is a switch which connects two terminals at idle (or closed throttle), and connect two other terminals when the throttle is open.



At idle **A+B connected**

Open throttle B+C connected

Typical throttle position switch

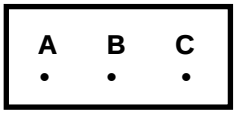
Therefore to test a throttle switch, connect an ohms meter across A + B. If the throttle is closed then there should be 0 ohms across A+B. With the throttle open, the reading should be open circuit or infinity. Connect the ohms meter across B + C. Vary the throttle positions and the opposite should be true.

Typical throttle switch resistance

Throttle closed	A to B = 0 Ω (closed circuit)
Throttle open	A to B = infinity (open circuit)
Throttle closed	B to C = infinity (open circuit)
Throttle open	B to C = 0 Ω (closed circuit)

5. THROTTLE POTENTIOMETER.

This is variable resistor with a reference voltage supplied to the resistor. As the throttle position changes the voltage on the output of the potentiometer varies. This voltage informs the ECU of the exact position of the throttle. In some cases the ECU measures the rate of change of throttle position, and so a "clean" potentiometer track can be very important.



A = Variable Voltage : 0.5 to 4.5v
B+C = Resistor - fixed : 3K Ω - 10K Ω

Typical throttle potentiometer

To test the throttle potentiometer disconnect the connector to the sensor and connect an ohms meter to terminals B and C. This is usually the fixed resistance of the potentiometer. A resistance of between 3k-10k should be observed. Re-connect the ohms meter to terminals A and B. A resistance of 0_-1k to 5k-10k should be observed between throttle closed and throttle open. From throttle closed, slowly open the throttle, observing the steady change in resistance. A rapid change in resistance or an open/ closed circuit reading indicates a faulty sensor.

To further test the sensor, reconnect the connector to the sensor and start the engine. Connect a voltage meter between terminal A and earth. Observe the voltage at idle. Slowly open the throttle observing the change in voltage. The

voltage is typically O.5v to 4.5v. A rapid change in the voltage, or a loss of the voltage, indicates a faulty sensor.
If the sensor is not producing a producing a voltage, or the tests are inconclusive, the use of a sensor simulator (to simulate the sensor output), should be used to provide a voltage to the ECU. If symptoms persist while using a Sensor Simulator, then the fault is not with the Throttle Position sensor. If the system works correctly while the sensor is being simulated (replaced) the sensor is positively identified as faulty.

6 MANIFOLD ABSOLUTE PRESSURE SENSOR:
This produces a voltage of 0.5 to 4.5v dependant upon the pressure/vacuum in the inlet manifold.
The connector usually has three terminals. Use a voltage meter to identify the 5 volt supply, the ground, and the output voltage of the sensor.
Test the response of the sensor output relative to engine speed as for (1). If there is little or no response, disconnect the vacuum pipe from the sensor and apply a vacuum directly to the sensor. If the voltage now varies, check the vacuum pipe for leaks or blockages. If the voltage does not vary with a direct vacuum, it is likely that the sensor is defective.
To positively identify the MAP sensor as faulty, use a Sensor Simulator to simulate the output of the sensor.

7. MASS AIR FLOW SENSOR:
This is a hot wire positioned in the air stream. The air flow through the air intake has a cooling effect on the hot wire, and the greater the flow, the greater the cooling effect. A control unit which regulates the temperature of the hot wire provides a voltage signal to the ECU relative to the air flow.

To test a mass air flow sensor, probe the airflow meter connector with a voltage meter until the sensor output is identified. The output will be a voltage of 0.5v to 4.5v, or 4.5v to 9v. This voltage changes as the air flow is varied. The airflow can be varied by varying the engine speed.
Test the output of the airflow meter with the ignition on, at idle, at 1500 RPM, at 3000 RPM and during a rapid acceleration and compare to the typical values below:

Ignition on	**0.25v-0.5v**
Idle	**0.5v-1.5v**
1500 RPM	**0.7v-2v**
3000 RPM	**1.1v-3v**
Rapid Acceleration	**3v-4.5v**

Typical Air Flow sensor output
Some systems produce a fall in the output voltage relative to an increase in air

flow. A sensor simulator can be used to provide a voltage to the ECU to simulate the output of the airflow sensor and positively diagnose a faulty airflow meter.

8.PETROL TEMPERATURE SENSOR:
This measures the fuel temperature in the fuel manifold/pipe. If the temperature exceeds 90∞C the ECU will enrich the mixture by increasing the injection duration, as fuel evaporation is likely above 90∞C.

9.LAMBDA OR OXYGEN SENSOR:
This sensor is positioned in the exhaust system. It provides a voltage signal to the ECU which is used to vary the injection duration to maintain an air/fuel ratio of 14 parts air to 1 part of fuel.
A Lambda sensor tester is required to test the operation of this sensor. On vehicles with a catalytic converter the Lambda sensor is essential as the sensor enables the ECU to maintain an oxygen content of about 2% in the exhaust. The catalytic converter requires the 2% of oxygen to perform its function.

10. VALVES:
The ECU uses valves in the fuel system to pass or restrict fuel or gases according to engine load conditions. Use the relay test to ensure that the ECU is actuating the valve. Valves are mechanical devices which can be sticking or jammed, therefore, removal and testing when removed from the vehicle may be required.

10. COMMON TERMS

Many abbreviated terms are peculiar to a particular manufacturer and are explained in the relevant text. Some more common or universal ones appear below.

COMPUTER SYSTEMS

ECU **ELECTRONIC CONTROL UNIT** These units may control a separate function, for example fuel injection, ignition, ABS. Modern systems tend to be more multi- function as this saves cost, wiring complications and ensures greater resistance to interference and more control over emitted interference.

OBD **ON BOARD DIAGNOSTICS** The facility provided by modern ECU's to self diagnose and report faults in the ECU, sensors, wiring connections etc. Fault codes are used to differentiate faults.

KAM **KEEP ALIVE MEMORY** A system for maintaining a record of faults encountered to be accessed later. These may be intermittent or recorded only under particular conditions and therefore not accessible during no load testing.

IGNITION

DIS **DISTRIBUTOR LESS IGNITION SYSTEM.** These use one coil per cylinder or an arrangement which provides one coil per two cylinders and sparks every rotation of the engine instead of every two rotations (wasted spark). The net result is that H.T. voltages do not have to be mechanically distributed. Together with ignition advance "mapping" in the ECU this provides a high reliability and performance.

EDIS **ELECTRONIC DISTRIBUTOR LESS IGNITION SYSTEM**

CID **CYLINDER IDENTIFICATION (SIGNAL)** Determines which cylinder is not only receiving a spark but is also on the compression stroke.

RON Defines the **OCTANE NUMBER** of petrol. Multiple position plug/socket arrangements allow ignition requirements to be changed for different rated fuels. e.g. "octane multiplug"

INJECTION/FUEL

LAMBDA SENSOR See EGO and HEGO sensors.

EGO EXHAUST GAS OXYGEN (SENSOR) Sensitive to low concentrations of oxygen in hot exhaust gas. Essential for accurate "feedback" control of injection.

HEGO HEATED EGO (SENSOR)

MAP MANIFOLD ABSOLUTE PRESSURE (SENSOR) Manifold pressure sensor measures differential pressure with vacuum sealed capsule (not atmospheric pressure).

MAF MANIFOLD AIR FLOW (SENSOR) "Vane" or "hot wire" flow sensor.

SENSORS GENERAL

PTC TEMPERATURE SENSOR of POSITIVE TEMPERATURE COEFFICIENT type. Low resistance when cold. NTC (NEGATIVE TEMPERATURE COEFFICIENT)is low resistance hot.

ATS, FTS, CTS, TTS TEMPERATURE SENSORS Air, Fuel, Coolant, Transmission.

10. WARRANTY

This warranty is in addition to the statutory rights of the purchaser.
The Tool Connection has made every effort to ensure that this product is of the highest quality and value to the customer. However, The Tool Connection can accept no responsibility for consequential damage howsoever caused arising from the use of this product.
All technical enquiries regarding this product should be made to:

The Tool Connection Technical Service Department: ++44 (0) 1926 818181

Please note that The Tool Connection cannot provide technical information or advice or service data on particular motor vehicles.
If this product should require service or repair, it should be returned to:

The Tool Connection Technical Service Department,
Kineton Road,
Southam,
Warwickshire,
CV47 0DR,
England.

Please give full details of faults requiring attention when sending goods for service or repair