



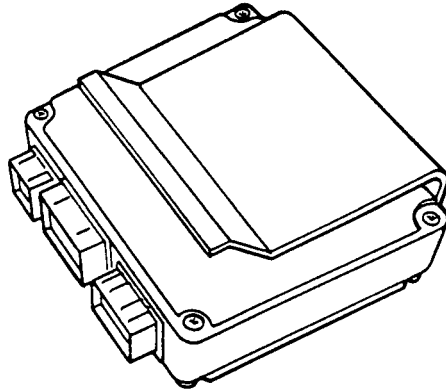
### GENERIC ENGINE MANAGEMENT SYSTEM (GEMS)

Land Rover moves into the next level of sophistication in engine management with the Generic Engine Management System (GEMS). GEMS incorporates the function of the distributor into the ECM to provide a computer-controlled Distributorless Ignition System (DIS).

GEMS also provides more precise fuel delivery through the use of adaptive operating software and Sequential Multiport Fuel Injection. More sophisticated OBD II diagnostic capabilities are also included as part of the package.

New default strategies have been incorporated into the GEMS to allow the vehicle to continue running in the event of sensor failure - sometimes without any apparent symptoms other than an illuminated MIL. When this is occurring, however, there is a reduction in vehicle performance, economy, or emissions system operation.

## ELECTRONIC CONTROL MODULE (ECM)



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***GEMS Electronic Control Module***

### **System Inputs**

The ECM is mounted in the engine compartment. The expanded list of ECM inputs is as follows:

- Crankshaft Position (CKP) Sensor
- Ignition Signal (Key on signal)
- Camshaft Position (CMP) Sensor
- Knock Sensor (KS)
- Intake Air Temperature Sensor
- Engine Coolant Temperature (ECT) Sensor
- Engine Fuel Temperature (EFT) Sensor
- Throttle Position Sensor (TPS)
- Mass Air Flow Sensor (MAFS)
- Park/Neutral Position Switch (PNPS)
- Heated Oxygen Sensors (4)
- Fuel Level Sensor
- Heated Front Screen
- Road speed (Range Rover)
- Air Conditioning request
- Battery Voltage
- Cooling fan request
- Security link
- ABS link

Several of these inputs (road speed, A/C request) originate in the ABS Module and are received via the Body Control Module.



## System Outputs

System outputs are as follows:

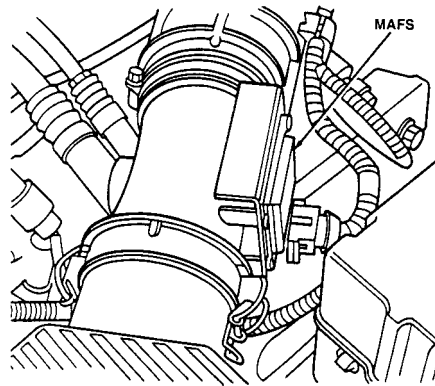
- A/C Compressor Clutch
- Fan Control
- Fuel Injectors
- Idle Air Control
- Purge Valve
- Malfunction Indicator Lamp (MIL)
- Fuel Pump Relay
- Main Relay
- Coil Driver

## *NEW COMPONENTS*

Many system inputs and outputs remain similar previous models. There are, however, several important exceptions:

## *Mass Air Flow Sensor (MAFS)*

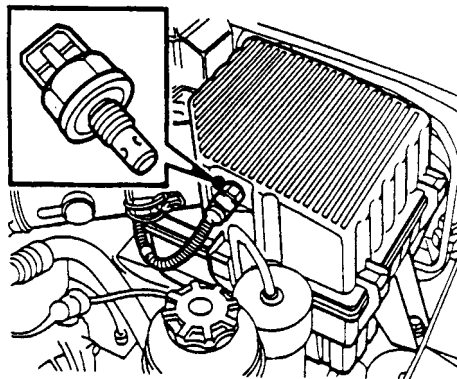
GEMS controlled vehicles use a MAFS with somewhat less responsibility than the sensor used on previous models. The MAFS sensor contains a single heated wire that is used, as on previous models, to measure air flow. The second wire, used to determine intake air temperature, is remotely mounted on GEMS vehicles and is no longer a part of the MAFS function.



**Mass Air Flow Sensor**

## *Intake Air Temperature Sensor*

A dedicated sensor, mounted on the air cleaner housing, measures intake air temperature.

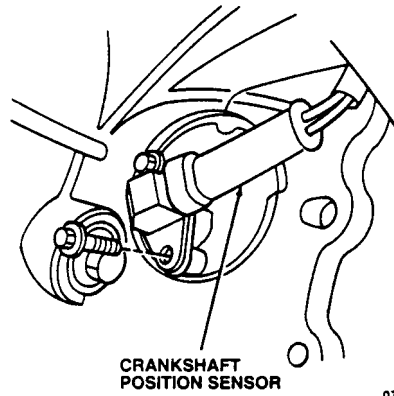


**Intake Air Temperature Sensor**

## *Crankshaft Position (CKP) Sensor*

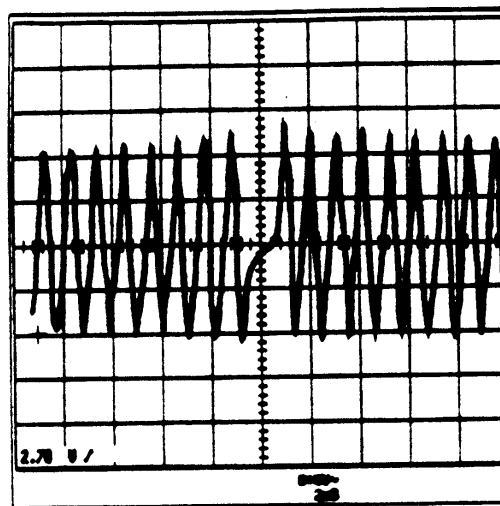
Basic engine timing is controlled by the ECM using input from the crankshaft position sensor. The sensor's signal is also used by the ECM in its engine knock and cylinder misfire operating strategies. There are no back-up strategies for the Crankshaft Position Sensor. The engine will not start or continue to run in the event of a Crankshaft Position Sensor failure.

The sensor is mounted on the flywheel housing.



***Crankshaft Position Sensor***

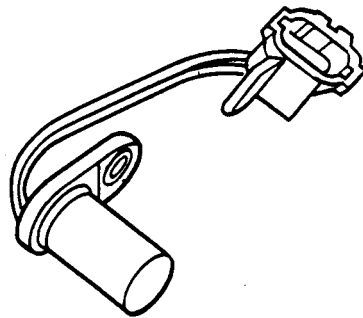
A detailed description of the Crankshaft Position Sensor's signal is provided in the Ignition System section of this book.



***Crankshaft Position Sensor Scope Pattern***

### *Camshaft Position (CMP) Sensor*

Camshaft position input is provided to the GEMS by a Hall Effect sensor located on the engine's front cover. Electronic pulses are produced as lobes on the cam chain wheel pass the sensor tip. Four pulses are produced for every two engine revolutions.

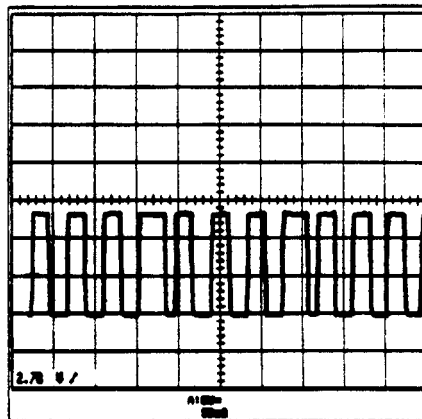


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***Camshaft Position Sensor***

The camshaft position signal is used by the ECM to precisely time fuel injector operation. This is especially important with SFI. The signal is also used, along with the crankshaft position sensor, as part of the engine knock control strategy.

A camshaft position sensor was not used on pre-GEMS systems.

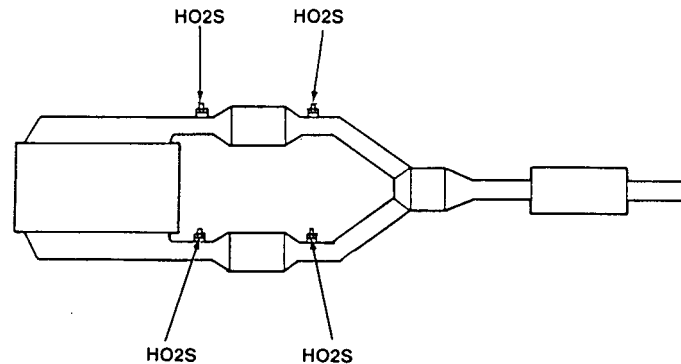


***Camshaft Position Sensor Scope Pattern***

***Rear HO2S Sensors***

Additional oxygen sensors are mounted in the exhaust system, downstream from each of the vehicle's catalytic converters. Data from these new sensors is compared with the signal produced by the front sensor on each bank. This information is used by the GEMS to monitor performance of the Three-Way Catalyst (TWC).

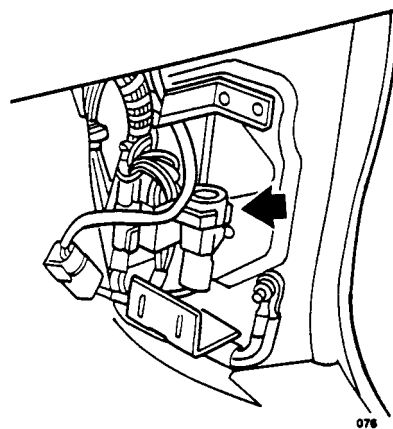
The rear sensors are also part of the ECM's fuel system back-up strategy. Should the signal from the front HO2S fail, the signal from the corresponding rear sensor will be used so that the vehicle can remain in closed-loop operation.



## ***Oxygen Sensor Circuit***

### ***Inertia Switch***

The inertia switch on GEMS equipped vehicles has been relocated to the passenger compartment, behind a trim panel on the right side footwell. Operation is identical to that of previous models.



## ***Inertia Switch***

### ***Ignition Coils***

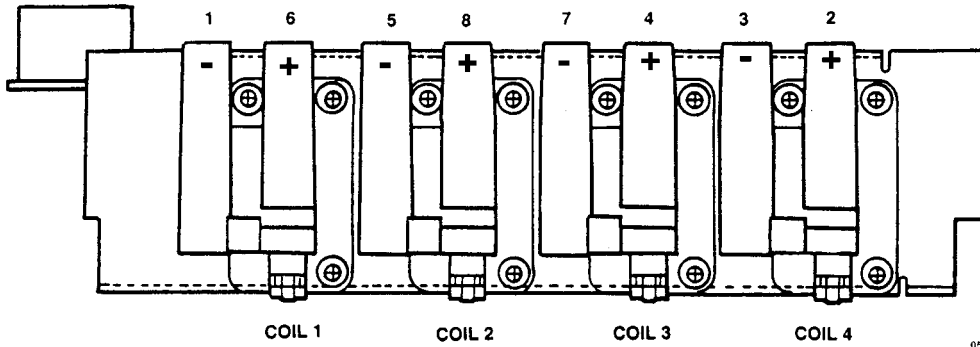
New ignition coils are used as part of the GEMS controlled Distributorless Ignition System (DIS). Four double-ended coils are mounted on a bracket at the rear of the engine compartment.

The circuit for each coil is completed by switching within the ECM. This produces sparks in two cylinders simultaneously, one cylinder on the compression stroke and one on the exhaust stroke. The spark on the exhaust stroke is the "wasted" spark described in the Ignition section of this book.



## GENERIC ENGINE MANAGEMENT SYSTEM (GEMS)

The ECM provides precise coil operation and ignition timing based on inputs including cam and crank position, coolant temperature, engine knock and load.



**Range Rover SE Ignition Coils**

### Relays

The GEMS engine management system uses four relays:

- Main Relay
- Ignition Relay
- Starter Motor Relay
- Fuel Pump Relay

Each of these relays is located in a fuse box mounted in the engine compartment.

The main relay supplies power to the ECM, fuel injectors, mass air flow meter and purge valve. Failure of this relay will prevent the engine from starting.

The ignition relay supplies power to the coils, fuel pump relay and heated oxygen sensors. This relay is immediately de-energized when the ignition key is turned to the OFF position.

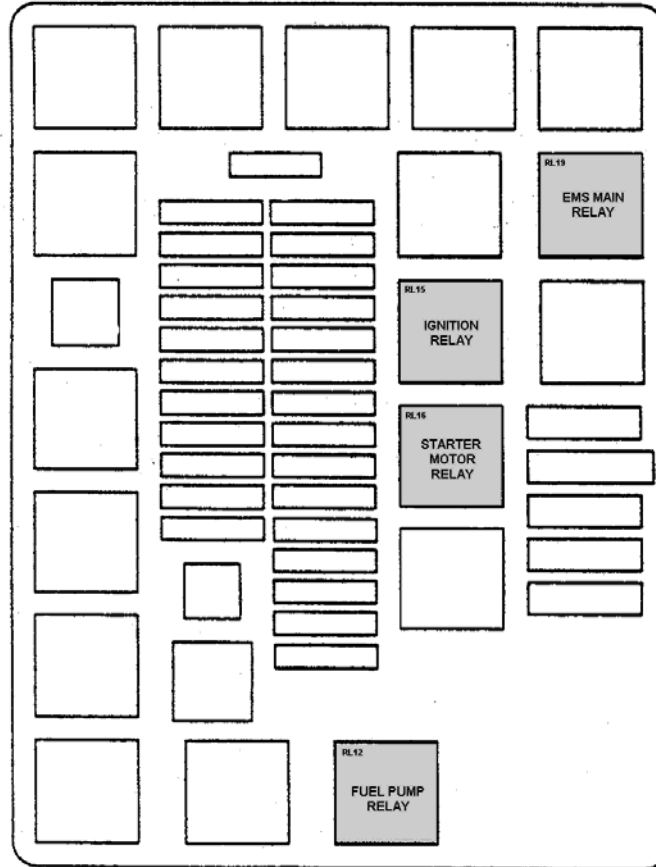
The starter relay provides the power feed to the starter motor. Operation of this relay is controlled by the ignition key.



# GENERIC ENGINE MANAGEMENT SYSTEM (GEMS)



The fuel pump relay is powered through the ignition relay and controlled by the ECM. The relay is first activated briefly with the key in the ON position to prime the fuel system. The relay remains activated during cranking and while the engine is running.



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***Relay Location in Fuse Box***



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## GENERIC ENGINE MANAGEMENT SYSTEM (GEMS)

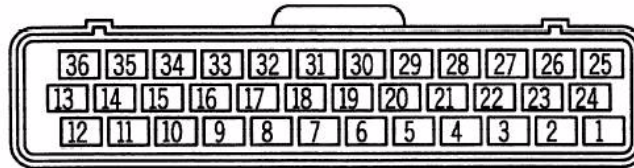
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# GEMS CONNECTOR PINOUTS



## GEMS CONNECTOR PINOUTS

Range Rover 4.0/4.6  
C505 (36way-Black)



PIN	WIRE COLOR	FUNCTION	PIN	WIRE COLOR	FUNCTION
1	BG	A/C Clutch Control via HEVAC ECU	19	SY	Purge Control Valve Control
2	GU	Fuel Consumption output to computer	20	-	
3	P	Cooling Fan Relay	21	WO	HO2S Upstream Heater Control
4	-		22	BY	MIL control via BeCM
5	-		23	S	Engine speed output to BeCM
6	-		24	UP	Fuel Pump Relay Control
7	-		25	-	
8	-		26	-	
9	-		27	YO	Throttle Angle Output to TCU
10	-		28	WU	HO2S Downstream Heater Control
11	YB	Cylinder #3 Injector Control	29	SP	Engine Torque Output to TCU
12	-		30	YN	Cylinder #4 Injector Control
13	YU	Cylinder #1 Injector Control	31	-	
14	-		32	YR	Cylinder #7 Injector Control
15	US	IACV-D	33	YG	Cylinder #5 Injector Control
16	RG	IACV-B	34	GW	IACV-C
17	YS	Cylinder #6 Injector Control	35	OR	IACV-A
18	YK	Cylinder #8 Injector Control	36	YW	Cylinder #2 Injector Control



## GEMS CONNECTOR PINOUTS

Range Rover 4.0/4.6  
C507 (36way-Red)

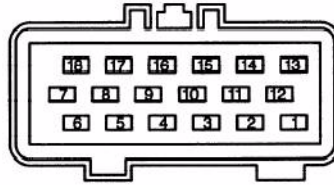


PIN	WIRE COLOR	FUNCTION	PIN	WIRE COLOR	FUNCTION
1	YK	ABS Rough Road input (96MY)	19	-	
2	SU	Cam Position Sensor	20	-	Data Link (non-NAS)
3	-		21	PG	Heated Front Screen input
4	ULG	T-Box Low Range input (96MY)	22	-	
5	-		23	KR	Data Link (NAS)
6	-		24	-	
7	GB	Fuel Level Input	25	-	
8	G	Right Downstream HO2S input	26	B	BeCM Engine Immobilization input
9	-		27	Y	Road speed input from ABS ECU
10	RB	Knock Sensor Common (0 volt)	28	BS	A/C Request from HEVAC input
11	KW	LH Knock Sensor input	29	YB	Cooling Fan Request input
12	KB	RH Knock Sensor input	30	-	
13	SLG	Air Temperature input	31	SR	Auto Gearbox Ignition retard
14	G	Coolant Temperature Sensor input	32	RB	HO2S Common
15	YLG	Throttle Position Sensor input	33	U	Right Upstream HO2S input
16	UG	Mass Air Flow Sensor input	34	O	Left Upstream HO2S input
17	Y	Left Downstream HO2S input	35	SW	Fuel Temperature Sensor input
18	BO	Park/Neutral Switch input	36	RB	Sensor common

# GEMS CONNECTOR PINOUTS



Range Rover 4.0/4.6  
C509 (18way-Black)



PIN	WIRE COLOR	FUNCTION	PIN	WIRE COLOR	FUNCTION
1	WK	Coil Driver Cylinders 5 & 8	10	B	Earth E529
2	-		11	BY	Crank Sensor Negative
3	-		12	KB	Crank Sensor Positive
4	R	TPS 5 volt supply	13	WU	Coil Drivers Cylinders 2&3
5	B	Earth E529	14	WB	Coil Drivers Cylinders 1&6
6	-		15	WY	Coil Drivers Cylinders 4&7
7	NO	Power Supply from Main Relay	16	B	Earth E529
8	W	"ON" input from Ignition Relay	17	UR	Main Relay Control - Low output
9	B	Earth E 529	18	-	

## Heated Oxygen Sensors (HO2S)

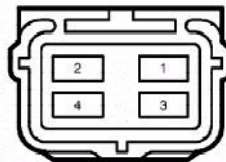
C521 Left Upstream

C526 Right Upstream

C535 Left Downstream

C536 Right Downstream

(4-way, Black)



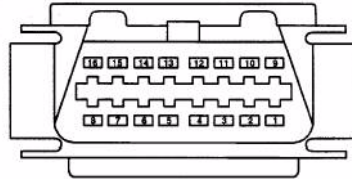
PIN	Wire Color				Description
	C521 Left Up- stream	C526 Right Up- stream	C535 Left Downstream	C536 Right Downstream	
1	O	U	Y	G	HO2S 5 Volt Reference
2	RB	RB	RB	RB	HO2S Signal Ground



## GEMS CONNECTOR PINOUTS

3	W	W	W	W	Heater Power supply
4	WO	WO	WU	WU	Heater Control

*Data Link Connector (X-318)*  
C231 (16-way, Black)

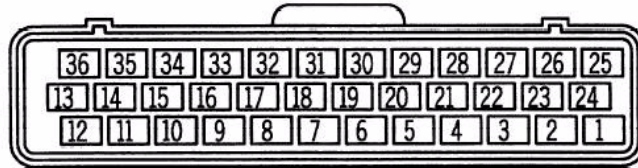


PIN	WIRE COLOR	FUNCTION	PIN	WIRE COLOR	FUNCTION
1	SR	Air Suspension Reset	9	-	
2	-		10	-	
3	-		11	WLG	"K"-Air Suspension
4	B	Battery Negative	12	WK	"L"-Air Suspension
5	BP	Chassis Negative	13	YK	"K"-SRS
6	-		14	YG	"L"-SRS
7	KR	"K"-GEMS,BeCM,HVAC,ABS	15	LGR	"L"-GEMS,BeCM,HVAC,ABS
8	-		16	N	Battery Positive(F33-Underhood)

# GEMS CONNECTOR PINOUTS



Discovery without EVAPS [pre 97MY]  
C1032 (36way-Black)



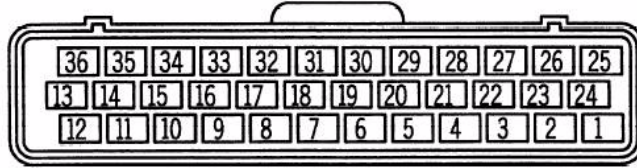
PIN	WIRE COLOR	FUNCTION	PIN	WIRE COLOR	FUNCTION
1	BS	A/C Clutch Relay Control	19	SY	Purge Control Valve Control
2	-		20	-	
3	GW	Cooling Fan Relay Control	21	WO	HO2S Upstream Heater Control
4	-		22	RS	MIL control
5	-		23	-	
6	-		24	UP	Fuel Pump Relay Control
7	-		25	-	
8	-		26	-	
9	-		27	-	
10	-		28	WU	HO2S Downstream Heater Control
11	YB	Cylinder #3 Injector Control	29	-	
12	-		30	YN	Cylinder #4 Injector Control
13	YU	Cylinder #1 Injector Control	31	-	
14	-		32	YR	Cylinder #7 Injector Control
15	US	IACV-D	33	YG	Cylinder #5 Injector Control
16	RG	IACV-B	34	GW	IACV-C
17	YS	Cylinder #6 Injector Control	35	OR	IACV-A
18	YK	Cylinder #8 Injector Control	36	YW	Cylinder #2 Injector Control



## GEMS CONNECTOR PINOUTS

Discovery without EVAPS [pre-97MY]

C1017 (36way-Red)



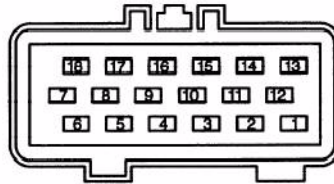
PIN	WIRE COLOR	FUNCTION	PIN	WIRE COLOR	FUNCTION
1	YK	ABS Rough Road input (96MY)	19	-	
2	SU	Cam Position Sensor	20	WK	Data Link (non-NAS)
3	-		21	-	
4	-		22	-	
5	-		23	WLG	Data Link (NAS)
6	-		24	-	
7	GB	Fuel Level Input	25	-	
8	R	Right Downstream HO2S input	26	B	10AS Engine Immobilization input
9	-		27	YK	Road speed input from ABS ECU
10	RB	Knock Sensor Common (0 volt)	28	YB	A/C Request input
11	O	LH Knock Sensor input	29	PB	Cooling Fan Request input
12	Y	RH Knock Sensor input	30	-	
13	SLG	Air Temperature input	31	-	
14	G	Coolant Temperature Sensor input	32	RB	HO2S Common
15	YLG	Throttle Position Sensor input	33	OG	Right Upstream HO2S input
16	UG	Mass Air Flow Sensor input	34	GR	Left Upstream HO2S input
17	GW	Left Downstream HO2S input	35	SW	Fuel Temperature Sensor input
18	OB	Park/Neutral Switch input	36	RB	Sensor common



# GEMS CONNECTOR PINOUTS



Discovery without EVAPS [pre-97MY]  
C1033 (18way-Black)



PIN	WIRE COLOR	FUNCTION	PIN	WIRE COLOR	FUNCTION
1	WK	Coil Driver Cylinders 5 & 8	10	B	Earth E529
2	-		11	G	Crank Sensor Negative
3	-		12	N	Crank Sensor Positive
4	R	TPS 5 volt supply	13	WU	Coil Drivers Cylinders 2&3
5	B	Earth E529	14	WB	Coil Drivers Cylinders 1&6
6	-		15	WY	Coil Drivers Cylinders 4&7
7	NO	Power Supply from Main Relay	16	B	Earth E529
8	G	"ON" input from Ignition Relay	17	UR	Main Relay Control - Low output
9	B	Earth E 529	18	-	

Heated Oxygen Sensors (HO2S)

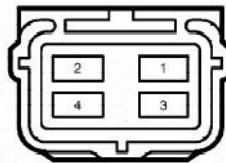
C112 Left Upstream

C113 Right Upstream

C1019 Left Downstream

C1020 Right Downstream

(4-way, Black)



PIN	Wire Color				Description
	C112 Left Upstream	C113 Right Upstream	C1019 Left Downstream	C1020 Right Downstream	
1	UY/GR	OG	GW	R	HO2S 5 Volt Reference
2	UW/NU	YB	NW	U	HO2S Signal Ground
3	B/WG	WG	WG	WG	Heater Power supply

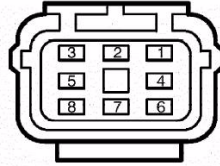


## GEMS CONNECTOR PINOUTS

4	NU/WO	WO	WU	WU	Heater Control
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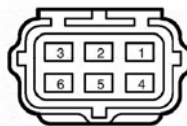
### MULTI-FUNCTION RELAY UNIT CONNECTORS

Discovery (without EVAPS) C1029 (8way-Black)



PIN	WIRE COLOR	FUNCTION
1	-	
2	-	
3	NO	Load Relay power out to ECM, Injectors, CANPV, MAFS, CMP
4	WP	Fuel Pump Power out
5	-	
6	NLG	Battery power to Load relay from Fuse F7
7	PW	Battery power to Fuel Pump Relay Fuse F6
8	NO	Load Relay power out common with pin 3

Discovery (without EVAPS) C1030 (6way-Black)

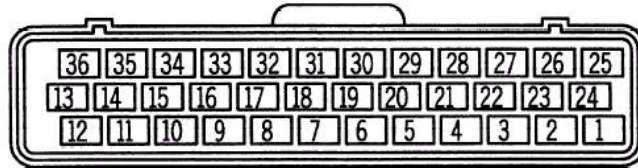


PIN	WIRE COLOR	FUNCTION
1	UP	Fuel Pump Relay control from ECM
2	WG	Key on power Fuel Pump Relay control from Fuse F3
3	UR	Main Relay control from ECM
4	-	
5	-	
6	-	

# GEMS CONNECTOR PINOUTS



**Discovery with EVAPS [97-99½ MY]**  
C1032 (36way-Black)



PIN	WIRE COLOR	FUNCTION	PIN	WIRE COLOR	FUNCTION
1	BS	A/C Clutch Relay Control	19	SY	Purge Control Valve Control
2	-		20	-	
3	GW	Cooling Fan Relay Control	21	WO	HO2S Upstream Heater Control
4	-		22	RS	MIL control
5	-		23	-	
6	NR	Canister Vent Seal Valve control	24	UP	Fuel Pump Relay Control
7	-		25	-	
8	-		26	-	
9	-		27	-	
10	-		28	WU	HO2S Downstream Heater Control
11	YB	Cylinder #3 Injector Control	29	-	
12	-		30	YN	Cylinder #4 Injector Control
13	YU	Cylinder #1 Injector Control	31	-	
14	-		32	YR	Cylinder #7 Injector Control
15	US	IACV-D	33	YG	Cylinder #5 Injector Control
16	RG	IACV-B	34	GW	IACV-C
17	YS	Cylinder #6 Injector Control	35	OR	IACV-A
18	YK	Cylinder #8 Injector Control	36	YW	Cylinder #2 Injector Control



## GEMS CONNECTOR PINOUTS

Discovery with EVAPS [97-99½ MY]  
C1017 (36way-Red)

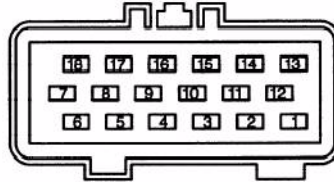


PIN	WIRE COLOR	FUNCTION	PIN	WIRE COLOR	FUNCTION
1	YK	ABS Rough Road input (96MY)	19	-	
2	SU	Cam Position Sensor	20	WK	Data Link (non-NAS)
3	-		21	-	
4	-		22	-	
5	-		23	WLG	Data Link (NAS)
6	-		24	-	
7	GB	Fuel Level Input	25	-	
8	R	Right Downstream HO2S input	26	B	10AS Engine Immobilization input
9	-		27	YK	Road speed input from ABS ECU
10	RB	Knock Sensor Common (0 volt)	28	YB	A/C Request input
11	O	LH Knock Sensor input	29	PB	Cooling Fan Request input
12	Y	RH Knock Sensor input	30	GK	Fuel Tank Pressure input
13	SLG	Air Temperature input	31	-	
14	G	Coolant Temperature Sensor input	32	RB	HO2S Common
15	YLG	Throttle Position Sensor input	33	OG	Right Upstream HO2S input
16	UG	Mass Air Flow Sensor input	34	GR	Left Upstream HO2S input
17	GW	Left Downstream HO2S input	35	SW	Fuel Temperature Sensor input
18	OB	Park/Neutral Switch input	36	RB	Sensor common

# GEMS CONNECTOR PINOUTS



Discovery with EVAPS [97-99½ MY]  
C1033 (18way-Black)



PIN	WIRE COLOR	FUNCTION	PIN	WIRE COLOR	FUNCTION
1	WK	Coil Driver Cylinders 5 & 8	10	B	Earth E529
2	-		11	G	Crank Sensor Negative
3	-		12	N	Crank Sensor Positive
4	R	TPS 5 volt supply	13	WU	Coil Drivers Cylinders 2&3
5	B	Earth E529	14	WB	Coil Drivers Cylinders 1&6
6	-		15	WY	Coil Drivers Cylinders 4&7
7	NO	Power Supply from Main Relay	16	B	Earth E529
8	G	“ON” input from Ignition Relay	17	UR	Main Relay Control - Low output
9	B	Earth E 529	18	-	

*Heated Oxygen Sensors (HO2S)*

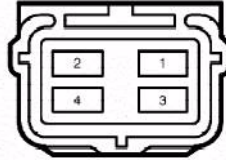
C112 Left Upstream

C113 Right Upstream



## GEMS CONNECTOR PINOUTS

C1019 Left Downstream  
 C1020 Right Downstream  
 (4-way, Black)

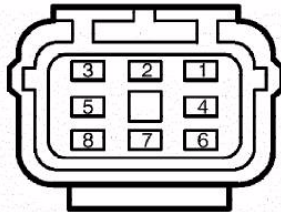


PIN	Wire Color				Description
	C112 Left Up- stream	C113 Right Upstream	C1019 Left Downstream	C1020 Right Downstream	
1	UY/GR	OG	GW	R	HO2S 5 Volt Reference
2	UW/NU	YB	NW	U	HO2S Signal Ground
3	B/WG	WG	WG	WG	Heater Power supply
4	NU/WO	WO	WU	WU	Heater Control

### MULTI-FUNCTION RELAY UNIT CONNECTORS

Discovery (with EVAPS)[97-99½ MY]

C1029 (8way-Black)



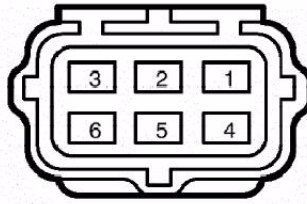
PIN	WIRE COLOR	FUNCTION
1	-	
2	-	
3	NO	Load Relay power out to ECM, Injectors, CANPV, MAFS, CMP
4	WP	Fuel Pump Power out
5	-	
6	NLG	Battery power to Load relay from Fuse F7
7	PW	Battery power to Fuel Pump Relay Fuse F6
8	NO	Load Relay power out common with pin 3

Discovery (with EVAPS)[97-99½ MY]

# GEMS CONNECTOR PINOUTS



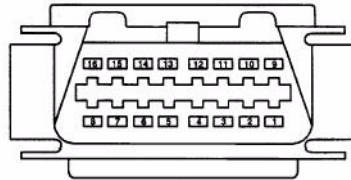
C1030 (6way-Black)



PIN	WIRE COLOR	FUNCTION
1	UP	Fuel Pump Relay control from ECM
2	WG	Key on power Fuel Pump Relay control from Fuse F3
3	UR	Main Relay control from ECM
4	-	
5	-	
6	-	

*Data Link Connector (X-318)*

Discovery (All with GEMS) C2083 (16-way, Black)



PIN	WIRE COLOR	FUNCTION	PIN	WIRE COLOR	FUNCTION
1	-		9	-	
2	-		10	-	
3	-		11	-	
4	B	Battery Negative	12	-	
5	B	Chassis Negative	13	YK	"K"-SRS
6	-		14		
7	WLG	"K"-GEMS,,ABS	15	WK	"L"-GEMS, ABS
8	KB	"K"-10AS	16	WR	Battery Positive (F3-Satellite Box2)



## GEMS CONNECTOR PINOUTS

**1997 Defender 90**  
C634 (36way-Black)



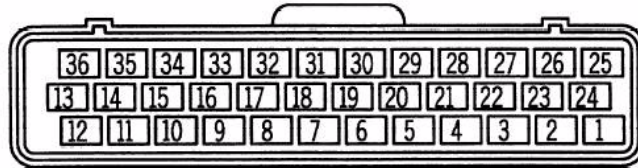
PIN	WIRE COLOR	FUNCTION	PIN	WIRE COLOR	FUNCTION
1	BS	A/C Clutch Relay enable (-)	19	SY	Purge Control Valve enable (-)
2	-		20	-	
3	GW	Cooling Fan Relay enable (-)	21	WO	HO2S Upstream Heater Control
4	-		22	RS	MIL bulb and Immob. ECU (Output)
5	-		23	-	
6	-		24	UP	Fuel Pump Relay Control (+)
7	-		25	-	
8	-		26	-	
9	-		27	-	
10	-		28	WU	HO2S Downstream Heater Control
11	YB	Cylinder #3 Injector Control	29	-	
12	-		30	YN	Cylinder #4 Injector Control
13	YU	Cylinder #1 Injector Control	31	-	
14	-		32	YR	Cylinder #7 Injector Control
15	US	IACV-D	33	YG	Cylinder #5 Injector Control
16	RG	IACV-B	34	GW	IACV-C
17	YS	Cylinder #6 Injector Control	35	OR	IACV-A
18	YK	Cylinder #8 Injector Control	36	YW	Cylinder #2 Injector Control



# GEMS CONNECTOR PINOUTS



1997 Defender 90  
C636 (36way-Red)



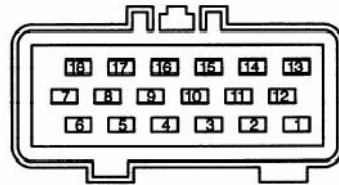
PIN	WIRE COLOR	FUNCTION	PIN	WIRE COLOR	FUNCTION
1	YR	ROUGH ROAD DET. ECU	19		
2	SU	CMP SENSOR INPUT	20	WK	ROUGH ROAD DET. ECU
3			21		
4			22		
5			23	WLG	ROUGH ROAD DET. ECU
6			24		
7	GB	FUEL LEVEL INPUT	25		
8	R	R.R. O2 SENSOR INPUT	26	B	Immobilization Unit Input
9			27	YK	
10	RB	KNOCK SENSOR GROUND	28	YB	A.C. COMPRESSOR REQUEST (TRINARY SWITCH -HIGH/LOW PRESS.)
11	O	L. KNOCK SENSOR	29	PB	A.C. CONDSEY FAN REQUEST (A.C. TRINARY SWITCH -MED. PRESS.)
12	Y	R. KNOCK SENSOR INPUT	30		
13	SLG	AIR TEMP SENSOR INPUT	31		
14	G	ECT SENSOR INPUT	32	RB	O2 SENSOR GROUND
15	YLG	TP SENSOR INPUT	33	OG	R.F. O2 SENSOR INPUT
16	UG	MAF SENSOR INPUT	34	GR	L.F. O2 SENSOR INPUT
17	GW	L.R. O2 SENSOR INPUT	35	SW	FUEL TEMP SENSOR INPUT
18	OB	STARTER RELAY GROUND	36	RB	MULT.* SENSOR GROUND

\* Multiple Sensor Ground= TP, ECT, MAF, CMP, Fuel Temp., Air Temp.



## GEMS CONNECTOR PINOUTS

1997 Defender 90  
C635 (18way-Black)



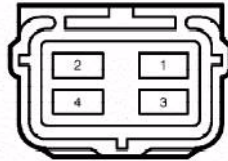
PIN	WIRE COLOR	FUNCTION	PIN	WIRE COLOR	FUNCTION
1	WK	Coil Driver Cylinders 5 & 8	10	B	Earth C560
2	-		11	G	Crank Sensor Negative
3	-		12	N	Crank Sensor Positive
4	R	TPS 5 volt supply	13	WU	Coil Drivers Cylinders 2&3
5	B	Earth C560	14	WB	Coil Drivers Cylinders 1&6
6	-		15	WY	Coil Drivers Cylinders 4&7
7	NO	Power Supply from Main Relay	16	B	Earth C560
8	WG	Fuel Pump Relay enable (-)	17	UR	Main Relay Control - enable (-)
9	B	Earth C560	18	-	

*Heated Oxygen Sensors (HO2S)*  
C644 Left Upstream  
C645 Right Upstream

# GEMS CONNECTOR PINOUTS

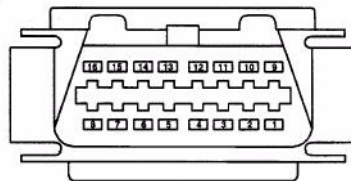


C643 Left Downstream  
 C642 Right Downstream  
 (4-way, Black)



PIN	Wire Color				Description
	C644 Left Up- stream	C645 Right Up- stream	C643 Left Downstream	C642 Right Downstream	
1	O	U	Y	G	HO2S 5 Volt Reference
2	RB	RB	RB	RB	HO2S Signal Ground
3	W	W	W	W	Heater Power supply
4	WO	WO	WU	WU	Heater Control

*Data Link Connector (X-318)*  
 C040 (16-way, Black)



PIN	WIRE COLOR	FUNCTION	PIN	WIRE COLOR	FUNCTION
1	-		9	-	
2	-		10	-	
3	-		11	-	
4	B	Chassis Negative (Header C286, C550)	12	-	
5	B	Chassis Negative (Header C286, C550)	13	-	
6	-		14	-	
7	WLG	"K"-GEMS, Rough Road Det. ECU	15	WK	"L"-GEMS, Rough Road Det. ECU
8	OLG		16	P	Battery Positive(Fuse 3-Passenger Compartment)



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## GEMS CONNECTOR PINOUTS

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# GEMS ECM TUNE SUMMARY



## GEMS ECM TUNE SUMMARY

**NOTE:** Any of the following tune levels may be valid for the year/model listed. ECM tunes should only be changed according to published service documentation or at the direction of the Technical Help desk, and only due to verified complaint or symptoms. Should a replacement be necessary, only 'Final Service Fix' PROM's should be used unless otherwise directed by Techline.

Model	Tune #	Description
95MY RR	9612	Production Tune, POE installed.
	9613	Production Tune, Line Build.
	9638	"Final" Service fix
96MY RR	9618	Original Production Tune
	9622	Service Fix for ABS/T-box Link Faults (P1317/1703)
	9636	"Final" Service fix
97MY RR	9635	POE fix for Oxy period fix on 4.6L
	9639	"Final" Service fix
98MY RR	9648	Original Production Tune (Contains all RR final service fixes)
99MY RR	9648	Original Production Tune (same as 98 MY)
99MY Calloway	9659	Available only with complete ECM
96MY Discovery	9621	Original Production Tune - phase 1
	9623	Original Production Tune - phase 2
	9631	Service Fix for ABS Link P1317 and Warm up timer P0125 (both phase 1&2)
	9637	"Final" Service fix - Auto trans
	9630	"Final" Service fix - Man trans
97MY Discovery	9624	Original Production Tune - Auto trans
	9629	Original Production Tune - Man trans
	9662	"Final" Service fix - Auto trans
	9644	"Final" Service fix - Man trans
97.5MY Discovery w/ EVAP Leak Detection	9633	Original Production Tune - Auto trans
	9634	Original Production Tune - Man trans
	9640	Running change, fix for Idle Surge and Fuel Level Fault P0461
	9641	Running change, fix for Idle Surge and Fuel Level Fault P0461
	9652	"Final" Service fix - Auto trans
	9653	"Final" Service fix - Man trans
98MY Discovery	9652	Original Production Tune - Auto trans (Contains all 97 Discovery final service fixes)
	9655	"Final" Service fix - Auto trans
99MYDisco	9655	Original Production Tune - Auto trans (same as 98 MY)
97MY Def 90	9632	Original Production Tune
	9661	"Final" Service fix
Range Rover "Final" Service fix tunes will include: Oxy period resolution to driver induced faults, Idle speed improvement preventing cold hesitation, and Engine Speed Fault (Gbox 21). Improved torque map to prevent Torque Reduction Fault (Gbox 23).		
Discovery "Final" Service fix tunes will include: Oxy period resolution to driver induced faults, Trailing Throttle Misfire, Idle speed improvement preventing cold hesitation, Idle speed fluctuation on decel, Fuel Level Fault P0461.		



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## GEMS ECM TUNE SUMMARY

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### Interim Service Tunes

The following is a list of unreleased tunes that were sent out by the GEMS Helpline on a case by case basis to correct individual problems.

Each one contains elements of the final service fix, but does not provide the full benefit of a final service fix tune.

Model	Tune #	Description
95 MY RR	4000	Increased Idle speed, Oxy Period fix (P0130/0150)
96 MY RR	4001	Increased Idle speed, Oxy Period fix (P0130/0150)
97 MY RR	4002	Increased Idle speed, Oxy Period fix (P0130/0150)
96 MY Discovery	8173	Increased Idle speed.
96 MY Discovery	568_563	Misfire trailing throttle and Oxy period fix (P0130/0150)

### Other Tunes

The following is a list of tunes that may be encountered in a vehicle, but are not appropriate for the year/model listed.

Model	Tune #	Description
95MY RR	9601	Original Production Tune - never sold
97MY RR	9626	Original Production Tune (All reworked to 9635)
98MY Discovery	9653	Original Production Tune - Man trans (no NAS Man trans built)