

Instruments

PART 15-3

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DESCRIPTION AND OPERATION

INSTRUMENT CLUSTER - LOW SERIES

The low series clusters are provided with speedometer, tachometer, fuel gauge and temperature gauge. A Liquid Crystal Display (LCD) located at the base of the cluster, provides odometer, tripmeter, Cruise Set/Cruise On (if fitted), 'lights on' warning, economy mode and distance to empty readouts. The LCD illumination is controlled by the light on/off switch, and can be switched to two levels of dimming. Within the instrument cluster are several warning jewels and the reset shaft. LPG and V8 vehicles do have a low coolant warning jewel. The dial illumination is back lit and also has two stage dimming controlled by the on/off switch.

INSTRUMENT CLUSTER - HIGH SERIES

The high series clusters (XR and higher), in addition to the features of the low series cluster, have an oil pressure gauge, a battery voltage gauge, an LCD gear position indicator (Fairmont, Fairmont Ghia, Fairlane, LTD only) and a car outline with door open (boot - Fairmont, Fairmont Ghia, only) warning jewels. The XR model has two stage LCD dimming. Higher models have variable adjustment as dictated by the Body Electronics Module (BEM). The backlighting of the gauges is controlled by the light on/off switch.

FUNCTIONAL DESCRIPTION

Fuel Gauge

The fuel sender unit provides a variable resistance to the instrument cluster. The gauge position is damped by cluster microprocessor software. Maximum rate of movement is 15 minutes for full scale change. After ignition is switched on, the tank level is read and compared to the level just before ignition off. If the difference is sufficient (approx. 12 litres), the gauge will be set to the new level. The gauge uses air core magnetic movement, driven by signals generated from the instrument cluster microprocessor.

Tachometer

The tachometer signal comes from the Electronic Engine Control (EEC) Module, which provides a buffered PIP signal. The gauge will indicate up to 7,000 revolutions per minute. The gauge uses a stepper motor, driven by signals generated from the instrument cluster microprocessor.

Engine Temperature Gauge

The engine temperature data comes (via serial communications) from the EEC Module. The instrument cluster microprocessor translates this data to a gauge position. The gauge uses air core magnetic movement, driven by signals generated from the instrument cluster microprocessor.

Oil Pressure Gauge

The gauge position is damped by cluster microprocessor software. The gauge uses air core magnetic movement, driven by signals generated from the instrument cluster microprocessor.

Voltage Gauge

The voltage gauge indicates ignition voltage supplied to the instrument cluster. The gauge uses air core magnetic movement, driven by signals generated from the instrument cluster microprocessor.

Seat Belt Warning Lamp

The seat belt warning lamp will display for 8 seconds after ignition voltage is switched on.

Left/Right Turn and High Beam Indicator Lamps

The senders for these indicators are active high (switch to ignition).

Park Brake Indicator, Brake Fail, Air Bag, Check ABS Warning Lamps

The senders for these indicators are active low (switch to ground).

Low Fuel Warning

Activated when the fuel level drops such that the sender resistance is below 23 ohms (represented by the fuel gauge pointer falling into the orange low fuel chaplet). There is an accompanying warning buzzer: 3 beeps then pause, repeating 4 times or until the reset shaft is pressed.

Lights On Warning Lamp

Warning is made when the instrument cluster determines that the ignition has been switched off while the park or head lights are on. Buzzer: 3 tones rising, then pause, repeating.

Demister Indicator Lamp

Sender is active high (switch to ignition).

Low Oil Pressure Warning Lamp

For low series models, the warning lamp is active low indication (switch to ground).

For high series models, the sender is a switch. The warning is made when the oil gauge pointer position has been in the red zone for more than 30 seconds, with the engine running. Buzzer: 5 high beeps.

Alternator Warning Lamp

The sender is active low (switch to ground).

The alternator fail lamp has a parallel resistor to maintain current to the alternator.

Low Coolant Warning Lamp (where fitted)

The sender is a switched resistance, the warning is made when the sender resistance is approx. 1380 Ω for more than 25 seconds. Refer to gauge and sender calibration Table 1.

Low Washer Water Warning

(Fairmont, Fairmont Ghia, Fairlane, LTD and XR).

Sender is active low (switch to ground). The warning jewel in the LCD will display if the sender is low for 15 seconds continuously.

Odometer - Displayed Key Off

The odometer reading is up to 999,999 km, and is stored in a non-volatile electronic memory. This information is stored for up to 10 years minimum, even when the battery is disconnected. The setting of the odometer in case of replacement of the instrument can only be performed with the appropriate equipment, by authorised dealers and agents. Software checks are made to determine if there have been unauthorised attempts to modify the odometer.

Trip Meter

The trip meter can read up to 999.9 Km and is stored in a non-volatile electronic memory. The meter can be reset by pushing the reset shaft. (For low series, the reset shaft must be pressed for 2 seconds or greater when in trip mode to reset the trip meter.) This information is stored for up to 10 years minimum, even when the battery is disconnected.

Reset Shaft

This shaft can be used to reset the tripmeter and toggle between tripmeter and 'Distance to Empty' (DTE) modes (Forte/S/Futura/XR).

Distance To Empty (DTE)

(Forte/S/Futura/XR)

The LCD screen includes a Distance to Empty feature, which displays the estimated distance before the car runs out of fuel. This estimate is based on the fuel tank sender, fuel usage information from the EEC and fuel consumption according to recent driving style. To toggle between the tripmeter and DTE display modes, press and hold the tripmeter reset shaft for more than 0.25 sec but less than 2 secs. If the ignition is cycled, the display resumes in the same mode as when the ignition was turned off, except when the DTE is less than 80 km, at which time the DTE will display warning before reverting to the previous mode.

When the DTE value reaches the threshold values of 80, 40 or 20 km, or if the vehicle ignition is turned to ON when DTE is equal to or less than 80 km, the instrument cluster will issue a series of warning beeps and flash both the DTE jewel and DTE value, regardless of whether DTE or trip meter was the selected mode. The beeping will continue for 10 seconds. The display will then return to its previous mode.

LPG vehicles: The feature operates as above when operating on petrol. When LPG is selected the DTE display indicates the distance to empty on LPG.

Economy & Cruise Indications

Senders are active low (switch to ground). The ECON and cruise indication is generated by the EEC V module when the transmission control switch is switched to the Economy position. The CRUISE indication is generated by the EEC V module when the cruise control system is turned on. The SET indication is generated by the cruise control module when the cruise control system is activated to control the vehicle speed.

The indications are displayed on the LCD and the update time is 1/2 second.

High Temperature Warning Lamp

This lamp is activated when the temperature is above 118.5°C, and the temperature gauge falls on or above the red chaplet, when the engine is running. An audible warning consisting of 5 beeps is activated when the lamp is first illuminated.

Night Time Illumination

For low series and XR models, illumination is provided by resistance wiring in the harness and is switched into the illumination circuits via the headlights on/off switch.

For high series models (except XR), the dimming is governed by the BEM (Body Electric Module).

Door Ajar Warning System

If a door is open at engine start the door ajar warning segment/segments will flash and the door ajar warning buzzer will sound. This lasts for three warning tones/flashes. The door ajar warning system consists of 4 micro switches, one mounted in each door, which when activated cause door symbols on the car outlined system to be displayed open or closed.

Low Series and XR Clusters:

A single segment door ajar warning is situated in the dial for the Base cluster and LCD for the XR cluster. If a door is open then the whole segment jewel will be lit. Maximum LCD update time is 1/2 second.

High Series Clusters:

A five segment door ajar warning is situated in the LCD. This warning indicates visually which door is open. Maximum LCD update time is 1/2 second.

Boot Lid

The boot lid warning system consists of a microswitch mounted in the boot. A symbol in the car outlined system is displayed on or off. Sender is active low (switch to ground). A cluster can be programmed in wagon or non-wagon mode. In non-wagon mode, no boot ajar warning (visual or audible) will be given except for a boot ajar symbol on the high series cluster only.

Gear Shift Indicator

Gear indicator data comes from the EEC V module. The instrument cluster microprocessor interprets this data for display.

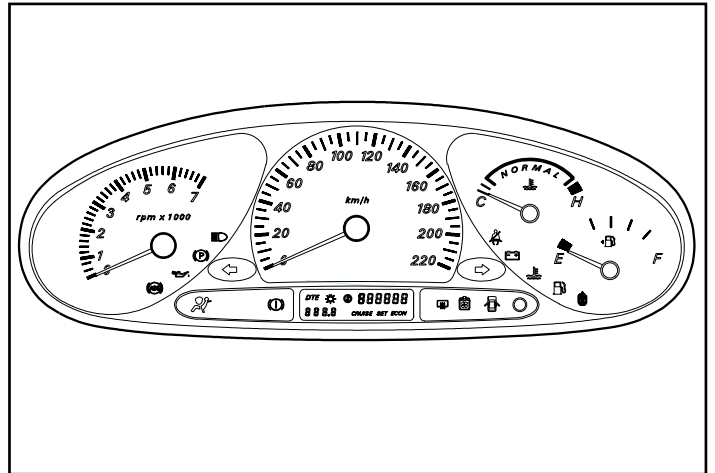


FIG. 1. - Low Series Instrument Cluster

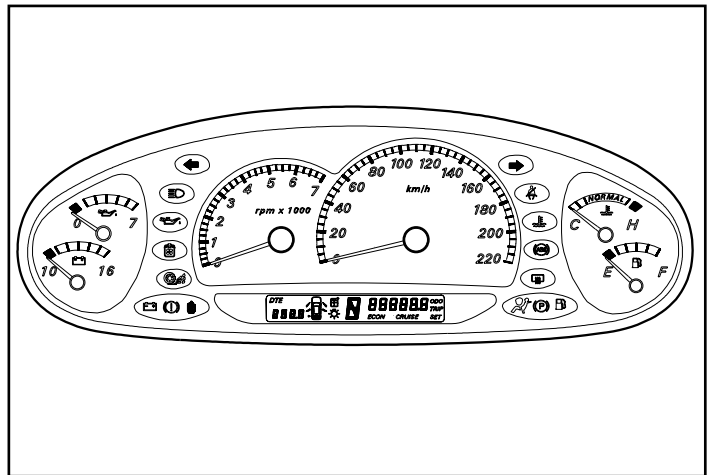


FIG. 2. - High Series Instrument Cluster

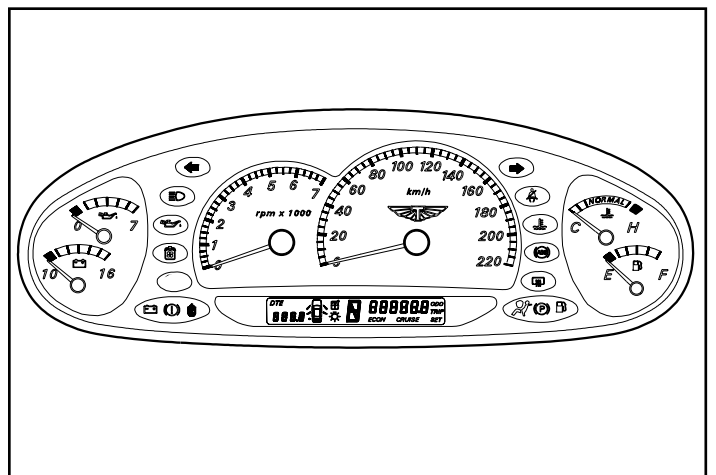


FIG. 3. - XR Series Instrument Cluster

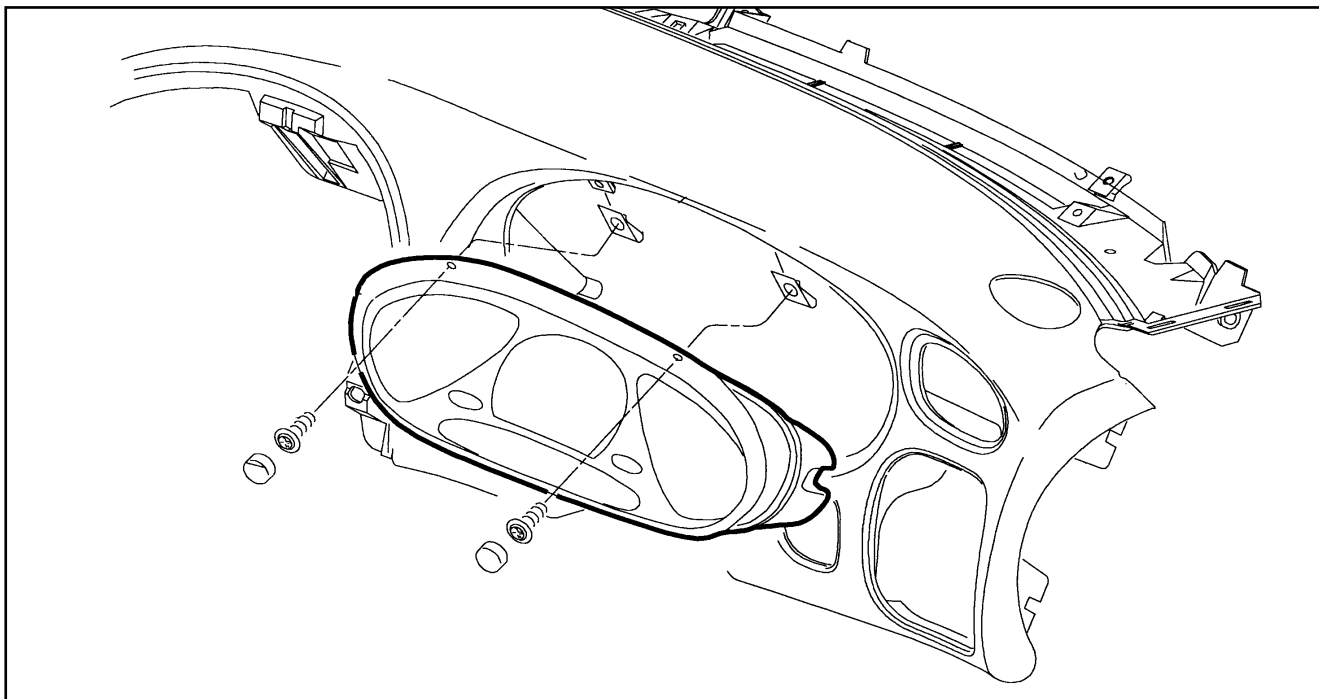
REMOVAL AND INSTALLATION

To remove the instrument cluster first remove the "one time only use" caps covering the two screws located at the top of the cluster. Remove the two screws using a phillips head screwdriver.

Once the screws are removed the cluster is only retained by a tight fit. Care must be taken to remove the cluster

evenly (square to the instrument panel) to avoid damage to the instrument panel vinyl.

For installation press the cluster fully home into the instrument panel and secure using the two phillips head screws. Fit new screw caps.



Cluster Installation

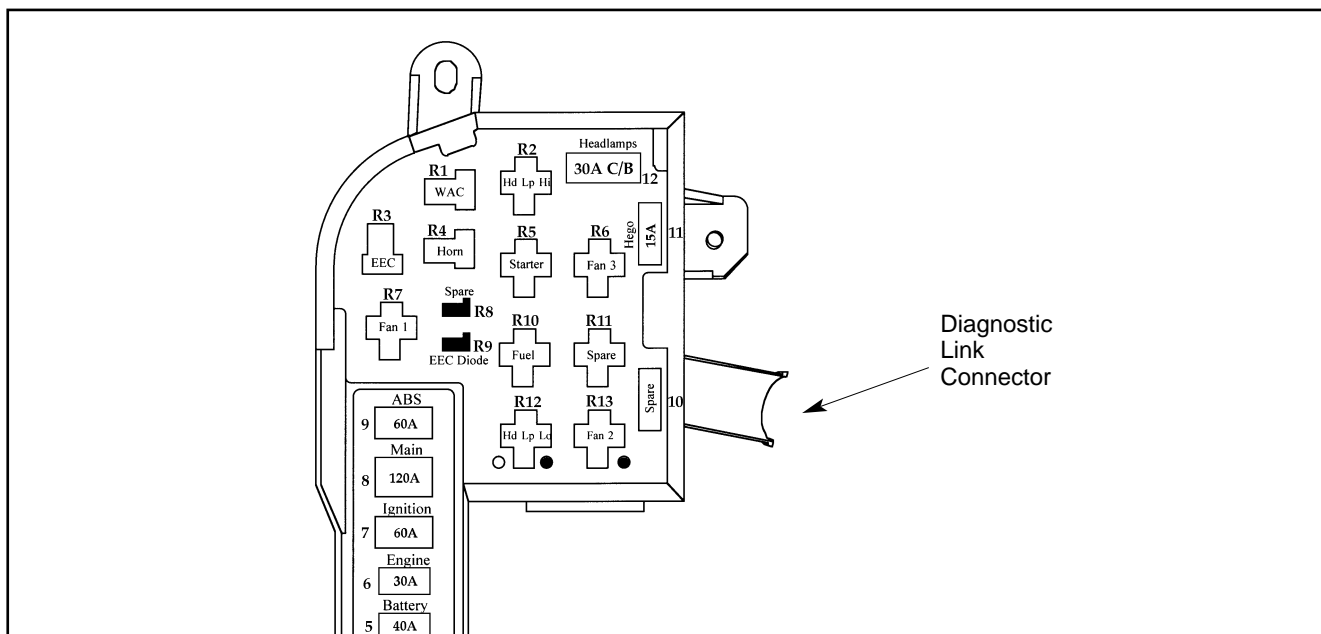
DIAGNOSIS AND TESTING

Diagnostics are available by connecting the Ford New Generation Star (NGS or WDS) tester to the diagnostics link connector located in the right hand side of the fuse box. Follow instructions provided with the NGS tester.

Diagnosis is performed by following the flowcharts provided and selecting Parameter Identification (PIDs) and Active Commands.

Prior to any diagnosis, general system checks should include:

- Instrument illumination fuse (Fuse 1).
- Instrument cluster fuse (Fuse 20).
- Battery voltage.
- Power supply to cluster, circuit 38, cluster connector J2 pin 20.
- Ignition power supply to cluster, circuit 16, cluster connector J2 pin 4.
- Connectors for correct fitment, signs of corrosion and damaged pins.



Location of Diagnostic Link Connector

DIAGNOSTIC TROUBLE CODES - (DTC's)**THE AUII ICM INCORPORATES:**

Function	NGS Display	Activation	Low Series	High Series
Petrol sender fail	B1201	Set if the petrol sender fail has been instigated due to a high reading on the input continuously for more than 10 seconds.	✓	✓
LPG sender fail	B2676	Set if the LPG sender fail has been instigated due to the LPG EEC data being 255 for more than 10 seconds.	✓	
Coolant temperature sender fail	C1781	Set if the coolant temperature sender fail has been instigated due to the ECT fail flag being set continuously for more than 10 seconds or no valid EEC message having been received for more than 10 seconds.	✓	✓
Coolant Temperature warning activated	B1238	Set if the coolant temperature warning has been activated due to coolant level being more than 119 degrees C°.	✓	✓
Low oil pressure warning activated	B2677	Set if the low oil pressure warning has been activated due to a short circuited oil pressure input for more than 30 seconds with the tachometer input more than 400 RPM.	✓	✓
Low coolant sender fail	B2678	Set if the low coolant input is short circuited or open circuit for more than 25 seconds.	✓	✓
PRNDL sender fail	B2678	Set if the gear fail flag from the EEC has been set.	✓	✓
EEC sender fail	B2682	Set if there is no correct EEC message with valid checksum for 10 seconds.	✓	✓
Overspeed '-' button stuck	B2683	Set if the '-' button has been pressed continually for 1 minute.	✓	
Overspeed '+' button stuck	B2684	Set if the '+' button has been pressed continually for 1 minute.	✓	
Overspeed 'Seek' button stuck	B2685	Set if the 'Seek' button has been pressed continually for 1 minute.	✓	
Trip reset button stuck	B2675	Set if trip reset button has been pressed continually for 1 minute	✓	✓

INSTRUMENT CLUSTER MODULE (ICM)
PIDS AVAILABLE USING NGS DIAGNOSTIC CARD

PID	DESCRIPTION	DISPLAY	Low Series	High Series
ABCHIME	Airbag Audible chime	ON/OFF	✓	✓
CCNT	Count of DTCS in ICM	NUMBER	✓	✓
COOLANT	Coolant Level	OK/LOW	✓	✓
D-AJAR	Door Ajar	CLOSED/OPEN	✓	(XR)
D-DR-SW	Drivers Door Ajar Switch	AJAR/CLOSED		✓
DECKLID	Boot Catch Switch	AJAR/CLOSED		✓
ECON_SW	Economy Mode status	ON/OFF	✓ (auto)	✓ (auto)
ECT	Engine Coolant Temperature (Note: Only valid for temperatures over 30 degrees Celsius)	DEGREES CELSIUS	✓	✓
EEC_SIG	Valid EEC data present	PRESNT/ NOT PRE	✓	✓
ENGINE	Engine type	16/V8	✓	✓
FUEL	LPG/Petrol Mode Status	PETROL/LPG	✓	✓
FUELLVL	Fuel tank level	% READING	✓	✓
LRDR-SW	Left Rear Door Ajar Switch	AJAR/CLOSED		✓
OVRSPD	Overspeed Select Switch	INACTIVE/ACTIVE	✓	(XR)
OIL_LVL	Oil Level	OK/NOT OK	✓	✓
P-DR-SW	Passenger Door Ajar Switch	AJAR/CLOSED		✓
PARK_SW	Park and Headlamp switch	ON/OFF	✓	✓
RESETSW	Message Display Centre reset switch	ON/OFF		✓
RRDR-SW	Right Rear Door Ajar Switch	AJAR/CLOSED		✓
RPM	Tachometer signal	RPM	✓	✓
SC-ON	Speed Control on Switch	NOT ACTIVE/ACTIVE	✓	✓
SET/ACC	Set/Accel Switch	INACTIVE/ACTIVE	✓	✓
SW-+	Overspeed +	INACTIVE/ACTIVE	✓	(XR)
SW-⁻	Overspeed –	INACTIVE/ACTIVE	✓	(XR)
TRANSGR	Automatic transmission gear lever position	PRK REV NTRL DRIVE DRIVE 3 DRIVE 2 DRIVE 1		✓ (auto)
TRIP_SW	Instrument cluster trip reset switch	ON/OFF	✓	✓
VBAT#1	Battery Voltage	VB ⁺	✓	✓
VSS1	Vehicle Speed Signal	KPH	✓	✓
WFLUID	Windscreen washer fluid	OK/LOW		✓

**INSTRUMENT CLUSTER MODULE (ICM)
ACTIVE COMMANDS AVAILABLE USING NGS DIAGNOSTIC CARD**

COMMAND	DESCRIPTION	Low Series	High Series
WARNING LAMPS AND CHIME	Operate all instrument cluster warning lamps and warning chime	✓	✓
SPEEDOMETER CONTROL	Operates speedo gauge using scroll dial	✓	✓
FUEL GAUGE CONTROL	Operates fuel gauge using scroll dial	✓	✓
ENGINE COOLANT GAUGE CONTROL	Operates temperature gauge using scroll dial	✓	✓
TACHOMETER CONTROL	Operates tacho gauge using scroll dial	✓	✓
BATTERY VOLTAGE GAUGE CONTROL	Operates battery gauge using scroll dial		✓
SEND REQUEST TO MODULE 1	Sends signal from cluster to BEM indicating door ajar (Note: sends signal to BEM & interior lights should illuminate. Does NOT display door open on instrument cluster)		✓
OIL PRESSURE GAUGE CONTROL	Operates oil pressure gauge using scroll dial		✓

INSTRUMENT CLUSTER MODULE (ICM) MODULE CONFIGURATION USING NGS SERVICE CARD

MODULE CONFIGURE	Instrument Cluster Module must be configured for the vehicle body type (ie WAGON or SEDAN) which it is fitted.	LOW	HIGH
		✓	✓

INSTRUMENT CLUSTER MODULE (ICM) ODOMETER RESETTING USING NGS SERVICE CARD

ODO RESET	Where the instrument cluster has to be replaced, the new cluster must be set to the previous cluster's odometer reading. Warning: The odometer may only be reset once on a new cluster	LOW	HIGH
		✓	✓

INSTRUMENT CLUSTER MODULE (ICM) DIAGNOSTIC FLOWCHARTS

DTC	SYMPTOM	TEST	Low Series	High Series
	LCD Variable Dimming does not function correctly	A		✓
	High beam indicator lamp not functioning correctly	B	✓	✓
	Turn signal indicator lamp not functioning correctly	C	✓	✓
B1201 B2676	Fuel gauge not functioning correctly	D	✓	✓
	Battery voltage gauge not functioning correctly	E		✓
C1781	Temperature gauge not functioning correctly	F	✓	✓
	Tachometer gauge not functioning correctly	G	✓	✓
N/A	Speedometer gauge not functioning correctly	H	✓	✓
B2677	Low oil pressure warning	I	✓	✓
	Gauge illumination does not function correctly	J	✓	✓
B2675	Trip Meter always reads zero	K	✓	✓
	Odometer and Trip meter do not update (frozen)	L	✓	✓
	Door, boot, display not functioning correctly	M	✓	✓
	Chime not functioning correctly	N	✓	✓
	Lights on warning not functioning correctly	O	✓	✓
B2681	PRNDL indicator not functioning correctly	P		✓(auto)
B2682	EEC Communication	Q	✓	✓
B2683 B2684 B2685	Overspeed control buttons	R	✓	
	DTE (Distance To Empty)/Range function	S	✓	✓

Note that Prior Approval from the Ford Technical Hotline is required before a Falcon Instrument Cluster, Fuel Pump or Fuel Sender is replaced.

TEST A - LCD Variable Dimming does not function correctly (High Series Only)

TEST STEP		RESULT	ACTION
A1	With the headlights switched on, operate the headlight variable dimming switch.		
	<ul style="list-style-type: none"> Does the instrument cluster LCD dim and increase in intensity ? 	Yes No	No Fault Go to A2
A2	Connect NGS, select Instrument Cluster and select Active Command: DIMMING CONTROL Using the NGS scroll dial adjust the LCD illumination.		
	<ul style="list-style-type: none"> Does the instrument cluster LCD dim and increase in intensity ? 	Yes No	Cluster OK Go to A3 Go to A4
A3	Connect NGS, select Body Electronics Module and select PID: PWM OUTPUT CONTROL 2 Operate the headlight variable dimming switch and using the NGS monitor the switch's operation.		
	<ul style="list-style-type: none"> Does the switch operate correctly ? 	Yes No	Check wiring between BEM and cluster, check for correct BEM operation refer Chapter 15.8 Repair/replace switch or switch wiring as required.
A4	Replace LCD globes. Connect NGS, select Instrument Cluster and select Active Command: DIMMING CONTROL Using the NGS scroll dial adjust the LCD illumination.		
	<ul style="list-style-type: none"> Does the instrument cluster LCD dim and increase in intensity ? 	Yes No	Fault fixed *

* Call the Ford Technical Hotline for a Prior Approval Number.

TEST B - High beam indicator lamp on cluster not functioning correctly

TEST STEP		RESULT	ACTION
B1	Check operation of high beam exterior lamps on vehicle		
	<ul style="list-style-type: none"> Is the operation of the high beam lamps as per normal? 	Yes	Go to B3
		No	Go to B2
B2	Check operation of high beam relay		
	<ul style="list-style-type: none"> Does the relay operate correctly ? 	Yes	Check switch/circuit wiring. Repair as required
		No	Replace relay as required
B3	Remove instrument cluster & replace high beam indicator globe, refit cluster and re-test.		
	<ul style="list-style-type: none"> Does the instrument cluster high beam indicator operate correctly ? 	Yes	Fault fixed, no further action required
		No	Go to B4
B4	Check the high beam input at instrument cluster connection (refer wiring schematics)		
	<ul style="list-style-type: none"> Does the input vary appropriately with the operation of the high beam signal combination switch ? 	Yes	*
		No	Check wiring between switch & instrument cluster (refer wiring schematics)

* Call the Ford Technical Hotline for a Prior Approval Number.

TEST C – Turn signal indicator lamp(s) on cluster not functioning correctly

TEST STEP		RESULT	ACTION
C1	Check operation of turn signal exterior lamps on vehicle.		
	<ul style="list-style-type: none"> Is the operation of turn signal lamps as per normal ? 	Yes	Go to C3
		No	Go to C2
C2	Check operation of turn signal indicator flasher relay.		
	<ul style="list-style-type: none"> Does the relay operate correctly ? 	Yes	Check switch/circuit wiring. Repair as required
		No	Replace relay as required
C3	Remove instrument cluster & replace turn signal indicator globes, refit cluster and re-test.		
	<ul style="list-style-type: none"> Does the instrument cluster turn signal indicators operate correctly ? 	Yes	Fault fixed, no further action required
		No	Go to C4
C4	Check the turn signal input at instrument cluster connection (refer wiring schematics) .		
	<ul style="list-style-type: none"> Do inputs vary appropriately with the operation of the turn signal combination switch ? 	Yes	*
		No	Check wiring between switch & instrument cluster (refer wiring schematics)

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TEST D- Fuel gauge not functioning correctly

TEST STEP		RESULT	ACTION
D1	Switch the ignition from the off to the on position	Yes No	Go to D4
	• Does the fuel gauge go to the full position & then to the empty position ?		Go to D2
D2	Connect NGS, select instrument cluster module and select Active Command: FUEL GAUGE CONTROL Using the NGS scroll dial adjust the gauge reading	Yes No	Go to D3
	• Does the fuel gauge respond correctly ? NOTE: percentage reading between NGS & gauge display may vary by +/- 5%		*
D3	Exit the NGS active command menu and select PID: FUELLVL	Yes No	Go to D4
	• Does the PID reading & the fuel gauge correlate (within +/- 5%) ?		*
D4	Check resistance reading at the fuel sender using a digital multimeter. Compare this measurement (using the sender calibration table) to the petrol level in the fuel tank. Check that the fuel sender float is free to move.	Yes No	Go to D5
	• Is the fuel sender operating correctly ?		*
D5	Check wiring between sender and gauge for continuity and shorts to ground.	Yes No	*
	• Is wiring OK ?		Repair wiring as required and retest

* Call the Ford Technical Hotline for a Prior Approval Number.

TEST E - Battery voltage gauge not functioning correctly

TEST STEP		RESULT	ACTION
E1	Check voltage at battery terminals using a digital multimeter.	Yes	Cluster operation OK., abnormal voltages could be due to faulty battery, alternator or regulator
	<ul style="list-style-type: none"> Does this reading correlate with the battery voltage gauge ? 		
		No	Go to E2
E2	Connect NGS, select instrument cluster module & select Active Command: BATTERY VOLTAGE INDICATOR CONTROL Using the NGS scroll dial adjust the gauge reading.	Yes	Go to E3
	<ul style="list-style-type: none"> Does the battery voltage gauge respond correctly ? 		
	NOTE: percentage reading between NGS and gauge display may vary between +/- 5%	No	*
E3	Exit the NGS active command menu & select PID: IGN_V	Yes	Go to E4
	<ul style="list-style-type: none"> Does the PID reading & the battery voltage gauge reading correlate to within +/- 5% ? 		
		No	*
E4	Check voltage reading at the battery terminals using a digital multimeter.	Yes	No fault found
	<ul style="list-style-type: none"> Does the PID reading (obtained in E3) & the measured battery voltage correlate ? 		
		No	Check wiring between battery and instrument cluster (refer wiring schematics)

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TEST F - Engine coolant temp. gauge not functioning correctly

Note: ECT signal is transmitted directly to the EEC, coolant temperature is then communicated serially via the DOL line (circuit 914) to the instrument cluster module.

TEST STEP		RESULT	ACTION
F1	Connect NGS, select instrument cluster and select Active command: ENGINE COOLANT GAUGE CONTROL Using the NGS scroll dial adjust the gauge reading		
	<ul style="list-style-type: none"> • Does the engine coolant temperature gauge respond correctly ? NOTE: percentage reading between NGS & gauge display may vary by +/- 5%	Yes	Go to F2
		No	*
F2	Exit the NGS active command menu and select PID: ECT- record ECT value Exit the instrument cluster NGS menu & select PCM PID: CHT- record CHT value.		
	<ul style="list-style-type: none"> • Do the PCM and the instrument cluster ECT/ CHT PID readings correlate ? NOTE: engine coolant temperature must be greater than 40 degrees celsius for the PIDS to correlate.	Yes	Cluster OK, check for correct operation of CHT sensor and wiring between sensor and PCM, refer chapter 10 Engine Management .
		No	If PCM PID ECT is above 40 degrees celsius and cluster PID ECT does not equate them check DOL line (circuit 914) for continuity.

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TEST G - Tachometer gauge not functioning correctly

NOTE: cluster tacho signal is supplied from the EEC to the cluster as a 10 volt square wave on circuit 648

TEST STEP		RESULT	ACTION
G1	Connect NGS, select instrument cluster and select Active command: TACHOMETER CONTROL Using the NGS scroll dial adjust the gauge readings.		
	<ul style="list-style-type: none"> Does the tachometer gauge respond correctly ? NOTE: percentage reading between NGS and gauge display may vary by +/- 5%	Yes	Go to G2
		No	*
G2	Start the vehicle & with the engine idling exit the NGS active command menu & select PID: RPM- record RPM value Exit the instrument cluster menu, select PCM and select PID: RPM - record RPM value		
	<ul style="list-style-type: none"> Do the PCM and the instrument cluster engine RPM readings correlate ? NOTE: engine idle RPM may vary slightly due to engine temp, air con, etc.	Yes	Cluster OK, check PCM for diagnostic trouble codes. Refer to chapter 10 Engine Management.
		No	Check circuit 648 for continuity, check tacho signal with digital multi meter at PCM pin 45 & cluster connector J2 pin 16

* Call the Ford Technical Hotline for a Prior Approval Number.

TEST H - Speedometer gauge not functioning correctly

NOTE: Vehicle speed signal is transmitted from the vehicle speed (hall) sensor to the instrument cluster module (circuit 999-W to cluster connector J2 pin 17). The signal is then sent from the cluster (via circuit 999 LB-W connector J2 pin 18) to the EEC (pin 58). The vehicle speed signal is also transmitted from the EEC to the BEM and the MDC via the DOL line(circuit 914). If the EEC does not receive a valid speed signal due to a fault in either the sensor, cluster or wiring then automatic transmission vehicles will default to a limp home mode as auto transmission shift patterns require a speed input.

TEST STEP		RESULT	ACTION
H1	Connect NGS, select instrument cluster and select PID: VSS1		
	<ul style="list-style-type: none"> Does the vehicle speed signal PID respond according to vehicle speed ? Note : vehicle speed PID test must be performed using 2 people , 1 to drive and other to perform diagnosis.	Yes No	Go to H2 Using a digital multimeter test frequency output of the speed (hall) sensor, compare this with gauge calibration tables.
H2	Exit the NGS PID menu and select Active Command: SPEEDOMETER CONTROL Using the NGS scroll dial adjust the gauge readings		
	<ul style="list-style-type: none"> Does the speedometer gauge respond correctly ? NOTE: percentage reading between NGS and gauge display may vary by +/-5%.	Yes No	Cluster OK *

* Call the Ford Technical Hotline for a Prior Approval Number.

TEST I - Low Oil Pressure Warning

TEST I WARNING NOTE - Only applicable XR, Fairmont, UP			
I1	Connect NGS, Select ICM and select PID: OIL_LVL		
	<ul style="list-style-type: none"> Does the PID status display 'OK' (KOER) + 'OK' (KOEO)? 	Yes No	* Go to I2
I2	Utilise multimeter and inspect oil pressure sender unit.		
	<ul style="list-style-type: none"> Is resistance <5ohms engine off and open circuit engine run? 	Yes No	Go to I3 Go to I4
I3	Utilise multimeter and inspect continuity of wire between sender and cluster.		
	<ul style="list-style-type: none"> Utilise wiring diagrams 		
I4	Remove sender and install oil pressure guage.		
	<ul style="list-style-type: none"> Is oil pressure correct? 	Yes No	Replace sender Repair engine

TEST J - Gauge illumination not functioning correctly

TEST STEP		RESULT	ACTION
J1	Remove instrument cluster , remove cluster globes and refit new globes. Recheck gauge illumination.		
	<ul style="list-style-type: none"> Do the gauges illuminate ? 	Yes No	Concern rectified Check for correct operation of park lamp switch and cluster dial illumination wiring.

TEST K - Trip meter always reads zero

TEST STEP		RESULT	ACTION
K1	Check reset shaft for sticking / binding condition. Free up if possible.		
	<ul style="list-style-type: none"> Does trip meter still constantly remain on zero ? Check DTC after 1 min. 	Yes No	* Concern rectified

TEST L - Trip meter and odometer do not update

TEST STEP		RESULT	ACTION
L1			
	<ul style="list-style-type: none"> Does the speedometer function ? 	Yes No	* Refer speedometer not functioning correctly - TestH.

* Call the Ford Technical Hotline for a Prior Approval Number.

TEST M - Door, boot display not functioning correctly

Note: Vehicles with low series clusters receive have the cluster and BEM in parallel with the door ajar switches (circuit 53). On vehicles with high series clusters the individual door ajar, boot and fuel flap signals are sent to the instrument cluster which in turn sends one door ajar signal (via circuit 631) to the BEM.

TEST STEP		RESULT	ACTION
M1	Connect NGS, select instrument cluster and select Active command: ALL WARNING LAMPS AND CHIME Select ALL LAMPS ON	Yes No	Go to M2 *
Do the door ajar lamps illuminate ?			
M2	With the NGS select ALL LAMPS OFF and exit Active Command menu.	High Low	Go to M4 Go to M3
Is the vehicle fitted with a high or low series cluster ?			
M3	Using NGS exit the instrument cluster menu and select BEM PID: DOORAJR Open and close each door in turn.	Yes No	Check wiring between BEM and cluster (circuit 53) Go to M4
Does the PID align with the operation of each door ?			
M4	Check operation of all door / boot / fuel flap courtesy lamp switches. Check circuit for power, earth , continuity with switch closed, shorts to ground etc. Refer wiring schematics.		

TEST N - Chime not functioning correctly

TEST STEP		RESULT	ACTION
N1	Connect NGS, select instrument cluster and select Active command: ALL WARNING LAMPS AND CHIME Select CHIME ON	Yes	Check functions associated with chime feature eg: Headlamp warning , Door ajar, DTE etc.
Does the chime sound ?			
		No	Go to N2 -
N2	Check voltage at battery and cluster power supply (connector J2 pin 20)	Yes	* Check the battery with the midtronics handheld battery tester.
Is the voltage above 12 volts ?			
		No	

* Call the Ford Technical Hotline for a Prior Approval Number.

TEST O - Lights on warning not working correctly

TEST STEP		RESULT	ACTION
O1	With the vehicle engine running switch the lights on, then turn ignition to the off position.	Yes No	Go to O3 Go to O2
	• Is the lights on warning displayed ?		
O2		Yes No	Go to O3 Turn auto headlamp off and retest.
	• Is the vehicle fitted with auto headlamp feature, and if so is this feature off ?		
O3	Connect NGS, select instrument cluster and select Active command: ALL WARNING LAMPS AND CHIME Select ALL LAMPS ON	Yes No	Cluster OK, check headlamp switch and wiring *
	• Does the lights on warning illuminate ?		

TEST P - PRNDL LCD indicator not functioning correctly

TEST STEP		RESULT	ACTION
P1	Connect NGS, select instrument cluster and select Active command: ALL WARNING LAMPS AND CHIME Select ALL LAMPS ON	Yes No	Go to P3 Go to P2
	• Does the PRNDL LCD display "PRND321" ?		
P2	Remove cluster and check LCD illumination globe.	Yes No	* Replace globe and retest
	• Is the LCD illumination globe OK ?		
P3	Using NGS exit the active command menu and select PID: TRANSGR note operation Exit the instrument cluster NGS menu & select PCM PID: GEAR note operation-	Yes No	Cluster OK, check for correct operation of Transmission Range Sensor and wiring between sensor and PCM, refer chapter 10 Engine management Check DOL line (circuit 914) for continuity.
	• Do the PCM GEAR and the instrument cluster TRANSGR PID readings correlate ?		

* Call the Ford Technical Hotline for a Prior Approval Number.

TEST Q - EEC Communication

TEST STEP		RESULT	ACTION
Q1	Connect NGS, Select ICM and select PID: EEC-SIG	Present Not Present	* GO to Q2
	• Does the PID display present or not present		
Q2	Select PCM and conduct retrieve/clear cont DTC's	Yes No	Go to Q3 GO to Q4
	• Were DOL codes displayed?		
Q3	Clear codes and retest	Yes No	Replace PCM GO to Q4
	• Were DOL codes still displayed?		
Q4	Check continuity of DOL wire between cluster and EECV PCM	Yes No	* Repair DOL wire
	• Is the wire <5ohms?		

TEST R - Overspeed Control Buttons - Low Series Only

B2683, B2684, B2685 relate to the overspeed control buttons, follow the procedure below for diagnosing any of the three DTC's

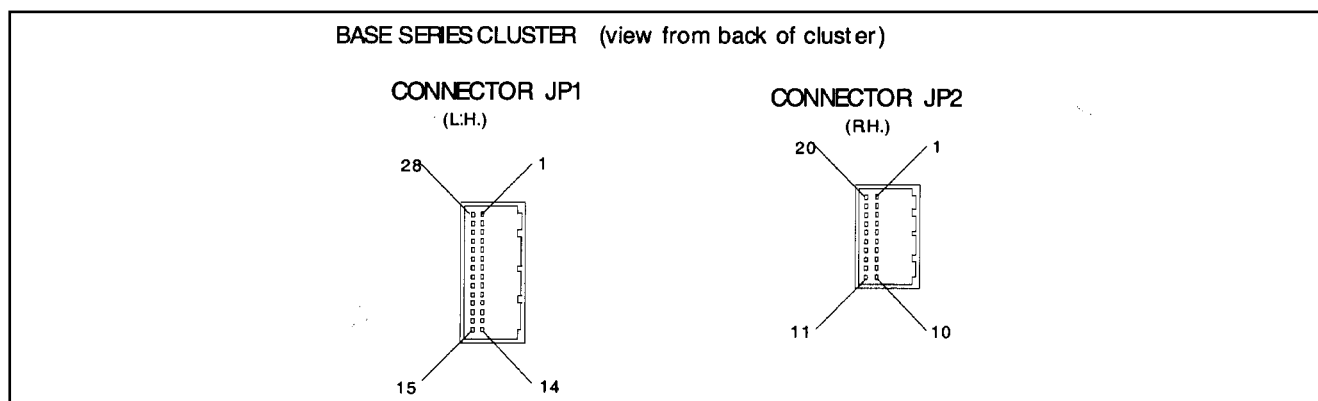
TEST STEP		RESULT	ACTION
R1	Connect NCS, select ICM and select PID: OVRSPD for B2685 : SW-+ for B2684 : SW- for B2683	Yes No	Go to R2 Go to R3
	• Does the PID indicate not active	Yes No	* Go to R3
R2	Check buttons for operation - depress button, • Does PID status change to 'Active'		
R3	Check switch and wiring integrity		
	• Utilise multimeter to test circuit and switch continuity - Refer to wiring diagrams		

TEST S - DTE (Distance To Empty)/Range function

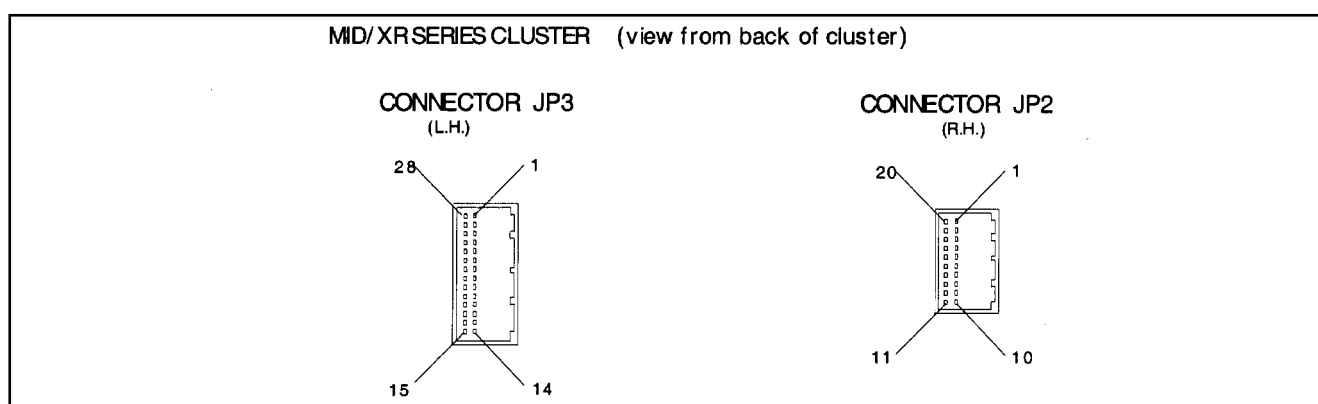
TEST STEP		RESULT	ACTION
	Does the DTE/Range function appear to be inaccurate, wrong or erratic	Yes	Call the Ford Technical Hotline for assistance.

* Call the Ford Technical Hotline for a Prior Approval Number.

Electrical Connection Details



Connector Pin Allocations



Low Current Connector J1 (Base only) –

Pin	FUNCTION	ACTIVATION	MAX. CONTINUOUS CURRENT
1	Not Used		
2	Not Used		
3	Not Used		
4	Not Used		
5	Not Used		
6	Not Used		
7	Door ajar	Switch to Gnd, or O/C	30mA
8	ABS Check	Open Collector	30mA
9	Rear Demist(heated backlite)	Switch to Ignition	20mA
10	Alternator Fail	Open Collector	30mA
11	LH Blinker	Switch to Ignition	200mA
12	High Beam	Switch to Ignition	200mA
13	Park Lamp (Dial Illum+)	Switch to Ignition	1.5A
14	Brake Fail	Switch to Ground	30mA
15	Security LED	Switch to Ground	30mA
16	Oil Level Sender	Resistance	
17	Seatbelt	Switch to Ground	30mA
18	Park Brake	Switch to Ground	30mA
19	RH Blinker	Switch to Ignition	200mA
20	Radio Output #1	Output to radio (pin 20 at radio)	10mA
21	Dial Illum neg	- 2 stage dim sw to ground	1.5A
22	Air Bag	Open Collector	30mA
23	Not Used		
24	Not Used		
25	Not Used		
26	Not Used		
27	Not Used		
28	Not Used		

Low Current Connector J2 (B/X/M):

Pin	FUNCTION	ACTIVATION	MAX. CONTINUOUS CURRENT
1	Power Ground	Ground	2A
2	Signal Ground	Ground	100mA
3	Low Coolant	Resistive Switch 180 to 1380	50mA
4	Ignition	13.5 V DC	3A
5	Low Oil - B Oil Pressure Sender - X/M	- Switch to Ground - Resistance	50mA 50mA
6	Drivers door ajar - B/X FR Door ajar - M	Switch to ground	20mA
7	Fuel Sender	Resistance	50mA
8	Radio Output #2	Output to radio (pin 18 at radio)	10mA
9	Overspeed Input	Resistance	10mA
10	Spare - B Low Wash Input -X/M	Switch to Ground	10mA
11	Spare - B Traction - X/M	Switch to Gnd, or O/C	30mA
12	Airbag Audible	Open Collector	10mA
13	Serial Data (EEC)	Open Collector	10mA
14	Diagnostic (ISO) Serial I/O	O/C and pullup to Battery	10mA
15	LCD Dim in - B - X/M	- switch to grnd (2 stage dim) - O/C (pwm from BEM)	10mA
16	Tacho Input	Pulses 0 to 13.5V	10mA
17	Speed Input	Pulses (open collector)	10mA
18	Speed Output	Pulses 0 to 13.5 V	20mA
19	Speed Supply	8.2V	120mA
20	Battery	13.5 V DC	2A

Low Current Connector J3 (X/M):

Pin	FUNCTION	ACTIVATION	MAX. CONTINUOUS CURRENT
1	Autolamp off Override - M	Special ADC input	10mA
2	Park Lamp (Dial Illum+)	Switch to Ignition	1.5A
3	Dial Illum neg	PWM from BEM	1.5A
4	MDC Rx - M	Open collector	10mA
5	RR Door Sw - M	Switch to Ground	20mA
6	FL Door Sw - M	Switch to Ground	20mA
7	Door ajar -X RL Door Sw - M	Switch to Ground	20mA
8	Boot Lid - M	Switch to Ground	20mA
9	Rear Demist (heated backlite)	Switch to Ignition	20mA
10	Alternator Fail	Open Collector	30mA
11	LH Blinker	Switch to Ignition	200mA
12	High Beam	Switch to Ignition	200mA
13	Spare LED #2	Sw Ign, Sw Gnd, or O/C	30mA
14	Brake Fail	Switch to Ground	30mA
15	Security LED	Switch to Ground	30mA
16	Oil Level Sender	Resistance	
17	Door Ajar Output -M	Open Collector	50mA
18	Park Brake	Switch to Ground	30mA
19	Spare LED #5	Sw Gnd, or O/C	30mA
20	Radio Output #1	Output to radio (pin 20 at radio)	10mA
21	Spare LED #3	Sw Ign, Sw Gnd, or O/C	30mA
22	Air Bag	Open Collector	30mA
23	ABS Check	Open Collector	30mA
24	Seatbelt	Switch to Ground	30mA
25	MDC Tx -M	Output to MDC	10mA
26	RH Blinker	Switch to Ignition	200mA
27	Spare	Spare	Spare
28	Spare	Spare	Spare

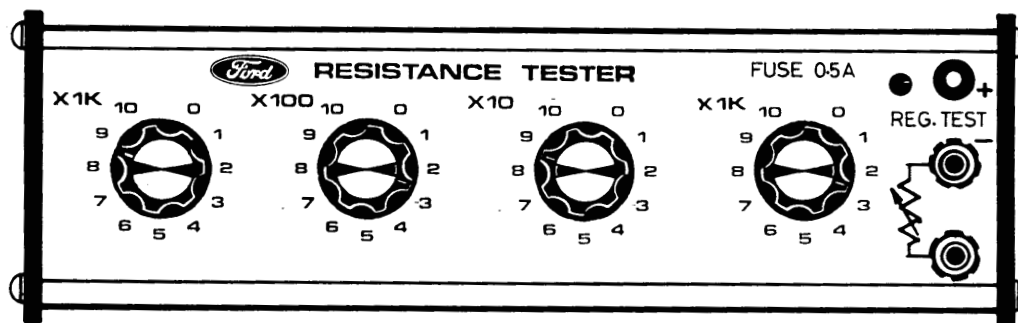
GAUGE AND SENDER UNIT TESTING

Gauges and sender units which read varying resistances may be tested using a variable resistance tester (such as tool No. 3385).

1. Disconnect the wiring harness from the sender unit.

NOTE: Accuracy of resistance tester values must be checked before each test using a digital multimeter.

2. With the ignition switch in the ON position, apply various resistances across the wiring harness terminals in accordance with the gauge calibration tables in this section.
3. Check that the expected gauge reading is achieved. If the gauge operates correctly, the problem exists with the sender unit. If not, the problem exists with the gauge or wiring harness.



Variable Resistance Tester

GAUGE AND SENDER CALIBRATION TABLES**TABLE 1: LOW COOLANT WARNING**

Condition	Sender Resistance	Lamp Indication
Short circuit	0 Ω	Flashing ON/OFF 1 Hz*
Close switch	180 Ω	OFF
Open switch	1380 Ω	ON
Open circuit	∞	Flashing at 1 Hz

*Short circuit detection only on XR and high series V8 clusters.

TABLE 2: FUEL SENDER

Indication	Sender Resistance (Ω)
Empty	0-2
Warning lamp illuminates	23
1/4	40.5
Half full	66
3/4	95
Full	149
Upper stop (88 degrees)	176

TABLE 3: TEMPERATURE GAUGE

Indication	Engine Temp. ($^{\circ}\text{C}$)
Low stop	40 \pm 3
mid range stop	75
high stop (warning Lamp illuminates)	118
low side of H grad.	123
high side of H grad.	130 \pm 3

TABLE 4: LOW SPEEDOMETER (except Police)

Frequency (Hz)	Speed (km/h)	Speed Tolerance (km/h)
104.167	60	+4
173.61	100	+4
190.97	110	+4
260.4	150	+4

If the speedometer gauge is inoperative check the supply connections to the sender, which should be greater than 8.1 volts. Refer to Circuit Diagram.

TABLE 5: LOW TACHOMETER

Frequency (V8) (Hz)	Frequency (I6) (Hz)	True RPM	Tolerance
66.67	50	1000	-50/+100
200	150	3000	-0/+200
333.33	250	5000	-0/+200