# **SECTION 2**

# Wiring



#### **General Guidelines**

- Provide circuit protection (fuses) for all wiring. The fuse rating should not exceed either the rated wiring current capacity or the total current requirements for all the add-on components on the circuit. Install fuses as close to the point of tapped power as possible.
- Document all revisions to the electrical system and place with the vehicle owner guide. Color code and/or label all revisions or additions to wiring.
- Provide protective covering in all areas that could be damaged during normal equipment installations.
- Disconnect the negative battery cable of vehicles stored on site to reduce the possibility of draining the battery by lights or other equipment.
- Do not allow control panels attached to the instrument panel to protrude into the driver and passenger air bag deployment zones. For additional information, refer to Section 4: Installation Considerations in this guide.
- Do not install switches and gauges in the driver or passenger knee impact areas.
- Inspect all Ford gauges, lights, and switches for correct operation after instrument panel work is performed.
- Properly secure all wiring relocated or removed while working behind the instrument panel to prevent chafing, squeaks and rattles.
- Provide adequate retention for wiring harnesses so that they are clear of bolts, corners, edges, etc., which could abrade the wires during normal vehicle operation.
- Anticipate misrouted wiring situations and protect all wiring from penetration by screws and raw edges.
- Weather-seal all electrical connectors exposed to the elements.
- Do not use quick splice connectors or wire nuts.
- Install the fuse panel so fuses are readily accessible.
- Make sure that connections are easily accessible for assembly and service.
- Make sure submersible connectors do not lose their seals under extreme assembly conditions, such as bending wires 90 degrees immediately after the connector.
- Whenever using connectors, use a socket (female) connector on the electrical source side and a plug (male) connector on the electrical load side to reduce the possibility of a short circuit when disconnected.
- Air bag restraint systems must remain intact as received from Ford Motor Company. Before modifications are done to the vehicle, the system must be disarmed by following the instructions provided in the current Crown Victoria Workshop Manual.
- Adherence to the above guidelines is not to be construed as approval by Ford Motor Company of any specific revisions or additions to the vehicle's original electrical system.

#### **Isolate The Systems**

When installing multiple police equipment components, it is advisable to use separate electrical systems to minimize confusion and ease troubleshooting. The front accessory connector has 4 fuses and 1 relay (located in the underhood power distribution box), the rear powerpoint has 3 fuses (located in the underhood power distribution box) , and the optional front power distribution box (located in the glove box compartment) has 6 fuses available for the addition of police equipment. Distribute loads among these circuits appropriately to help avoid an imbalanced system.

#### **Keep-alive Power**

The electronic engine and transmission control modules require battery power to be supplied at all times to maintain the keep-alive memory. Keep this in mind when installing load disconnect switches or solenoids.

#### **Equipment Grounding Guidelines**

- Do not ground the body to the transmission or transmission crossmember. Ground accessories to the chassis or the vehicle battery.
- Splicing into circuitry relating to the electronic engine and/or transmission control systems is not acceptable because of the adverse effect on the electronic system operation.
- Adequately protect electrical connections exposed to the elements.

#### Wire Insulation

- Polyvinyl Chloride (PVC) rated at 90°C (194°F) is the standard wire insulation that is acceptable for inside body use but is not acceptable for underhood/underbody wiring.
- Hypalon insulation should be used on links only (Ford Specification ESB-M1L54-A).
- Cross-linked Polyethylene (XPLPE or SXL) rated at 135°C (275°F) is the required insulation for underhood/underbody applications (Ford Specification ESB-M1L123-A).
- GXL can be used as an alternate wire (Ford Specification ESB-M7L85B) as long as the concentricity specifications are met. To provide a water-resistant seal in conjunction with crimp connectors, a Duraseal crimp connector is recommended since it is designed to account for outside wire diameter that is smaller than the present SXL wire.

### **Terminals and Connectors**

#### Connector Types

- Submersible (Sealed) A connector that is capable of being immersed in water.
- Weather-resistant A connector that will retain its sealing and connection qualities while being exposed to adverse weather conditions.
- Duraseal crimp A supplier trade name for a sealed wiring repair or splice.

When a connection is not defined (typical situation - harness to harness connectors), the following suggestions should be implemented:

- Determine the connector type. If it will be located in a hostile environment, use a sealed connector; if not, use an open connector. A hostile environment is defined as being exposed to water and/or salt accumulation and/or high temperatures (i.e., underhood, exterior panels and footwells). Use in-line connectors with secondary locks to prevent the terminal from being pushed out.
  - Do not use single wires smaller than 14-gauge in a 2-way or larger weather resistant connector (the very large style), since the wire may break during disengagement.
  - Use Hypalon, XLPE or Elexar insulation in submersible connectors to maintain sealing integrity. PVC is not acceptable because it cold flows and allows setting in a deformed pattern, therefore compromising the integrity of the seal.
- Determine the terminal type. Base your decision on wire gauge, current carrying capacity, connector type and insulation type.
  - Use non-detent low insertion force terminals whenever possible.
  - Do not use low insertion force female terminals in weather resistant connectors.
  - Analyze circuit requirements (signal levels, current, voltage, etc.) to determine the proper plating material (such as gold). Use of non-plated terminals is not recommended.
  - Do not use plugs to seal holes in micropin connector grommets. It is very easy to forget to
    insert them during manufacturing and ruin the seal. Use a grommet with only the necessary
    number of holes or use dummy wires at least 600 mm (24 inches) long.
  - Fully align connectors prior to terminal connection -- terminal cavities should have minimum tolerance to prevent terminals from floating, bending or pin push-out during mating/engagement.
  - Make sure connectors of similar type and color are identifiable to the operator to eliminate crossed connections and minimize assembly time. Avoid using similar types and colors of connectors close together.
  - Be sure that connectors have positive locking devices that allow easy installation with a low insertion force and easy removal. The connector snap should be easily felt and heard.
  - Eliminate the use of edgeboard, tang-type, and molded-over connectors. The use of blade-type weather resistant connectors is restricted to high current applications which cannot be handled by submersible connectors.

### **Circuit Protection and Electrical Load**

- Modification to existing vehicle wiring should be done only with caution and careful consideration of effects on the completed vehicle's electrical system. Anticipated circuitry should be studied to determine the required circuit protection and to avoid feedback loops.
- Added circuitry must be protected either by a base vehicle fuse or circuit breaker, or by a similar device supplied by the modifier.

- When adding loads to a base vehicle-protected circuit, make sure that the total electrical load through the base vehicle fuse or circuit breaker is less than the device's load rating.
- Use 80 percent of the fuse rating to determine maximum steady state load to reduce nuisance fuse failures.
- Use 135 percent of the fuse rating when sizing wiring to protect the circuit in the event of an overload. Fuses will last for 1 hour at 135 percent of their rating.
  - Total current draw is the sum of the base vehicle's circuit current requirement (measured with an ammeter) and the anticipated add-on component current requirements.
  - Never increase the rating of a factory installed fuse or circuit breaker.
  - If the total electrical load including additional electrical components, on any circuit, is less than the fuse protection rating or the capacity of some limiting component (switch, relay, etc.), the items to be added can be connected directly to that circuit. The headlamp switch circuits should never have additional lighting or electrical components directly connected.
  - Added devices that exceed the current capabilities of the factory-installed system are best controlled through the use of a relay or separate switch. The coil of the relay can be fed from the circuit in the factory harness (now acting as a signal circuit) with added wiring providing feeds to the added electrical device. The relay selection is important and depends on current requirements, number of cycles expected in the relay lifetime, whether the relay is to be operated intermittently or for long periods of time, and whether the relay is exposed to weather conditions or is installed in a protected area. When the current requirements of a circuit exceed the capacity of an available relay, the load should be reduced or divided through the use of additional relays.
  - Added wire feeds to the switch or relay power contacts should not be tapped into the basic vehicle wiring. Use the standard Auxiliary Power Distribution Box, or draw power as close to the battery as possible.

#### **Grommets and Sealing Requirements**

Any additional wiring routed through sheet metal must pass through a grommet that both seals the opening and locates the wire(s). Two-piece grommets (rubber with plastic inserts) are recommended to facilitate installation and retention.

- Locate grommets so they are accessible for proper seating (achieved by pulling) in sheet metal holes.
- Ramp grommets at the insertion end to facilitate installation and sealing.
- Be sure that the direction of the hole punch is in the direction of grommet seating and the hole is burr-free.
- Make sure the grommet molding compound will adhere to the harness to prevent slippage.
- Make sure the grommet will withstand the environment (temperature, splash, etc.).

- Be sure that holes are large enough to allow the installation of the harness without causing circuit damage.
- Use adhesive tape on main trunks or branches with at least a 50 percent overlap to prevent wicking through grommets. Be certain to diaper-wrap the takeouts.

### Wire Routing

 $\checkmark$  WARNING: Do not place electrical component attachments or ground screws adjacent to vehicle fuel tanks, fuel filler pipes, fuel lines, fuel vapor lines or carbon canisters. Failure to follow these instructions may result in personal injury.

Wire harness routing should conform to the following:

• Protect wires routed through holes in sheet metal or castings with a grommet whether or not conduit is used (see figure below).



#### A0073515

Route wires to avoid metal edges, screws, trim fasteners and abrasive surfaces. When such
routing is not possible, use protective devices (shields, caps, etc.) to protect the wires. Cover
metal edges with a protective shield and fasten the wiring within 3 inches on each side of the
edge (see figure below).



- Route wires to provide at least 3 inches of clearance to moving parts in their extreme movement location, unless positively fastened and protected by a conduit.
- Avoid wire routing without conduit in areas where temperatures exceed 82°C (180°F). Minimum clearance of 6 inches should be maintained from exhaust system components. Heat insulation and heat shields must be used on the wires routed in high temperature areas.
- Make certain that all underhood or underbody wiring is cross-linked polyethylene high temperature insulation wire 135°C (275°F) (minimum rating) consistent with SAE specification J1128 Type SXL wire. Normal PVC wire must not be used in underhood or underbody applications.
- Make sure all ground locations are readily accessible for installation, service and verification.
- Do not place ground attachments in high-splash areas.
- Do not route underbody wiring over the exhaust system.
- Underhood/underbody wiring must be routed in conduit for protection. Minimum conduit rating is 177°C (350°F).

#### Wire Retention and Routing

Use the following criteria to determine the location of retainers:

- Size and weight of wire bundle.
- Holes with poor accessibility that prevent installation of locators.
- Movement of wires that can result in abrasion, squeaks and rattles.
- When wiring is routed between two members where relative motion can occur, the wiring should be secured to each member with enough wire slack to allow flexing without damaging the wire.
- Wiring exposed to weather must provide a drip loop to prevent moisture from being conducted into the device through the wire connection (see figure below).



A0073517

#### Wiring

### Section 2: Wiring

- Avoid routing wires into areas exposed to wheel splash. When such routing cannot be avoided, adequate clipping and/or protective shields are required to protect the wires from stone and ice damage. Allow adequate slack in wiring between the engine and stationary components to compensate for engine roll.
- Avoid routing wires under the frame side members or at points lower than the bottom frame flange.
- Use plastic "zip" straps for "bundling" only (securing to other wires).
- The wire retainers and grommets installed by the assembly plant are usually designed to accommodate only the Ford-installed wires. Additional wiring or tubing should be retained by additional clips. When added wires or tubes are routed through sheet metal panels, new holes with proper wire protection and sealing must be used (see figures below).



#### A0074038

For retainer screws, the following guidelines apply:

- Avoid using fasteners that are too long for the application or are in an area which might damage vehicle components, including wiring, brake lines, fuel tank and lines, powertrain components, exhaust system, and suspension.
- Do not use pointed screws for attachments. Also check that screws used in the vicinity of the wiring are blunt-ended.
- To minimize the potential for wiring shorts do not use drill point screws. Trim components (including wiring shields) should use pin-type attachments instead of screws.

- Always check areas that screws protrude into for verification that an interference condition to other components does not exist.
- Make sure that retainers used are capable of withstanding the environment over the vehicle's life expectancy.

### **Splices and Repairs**

For quality splicing and to reduce potential problems, the following guidelines are recommended:

- Stagger the splices within a harness to reduce increased harness diameter. Splice only on straight areas as installed, not on bends.
- Strip wire ends making sure that individual conductor strands are not damaged.
- When soldering, make sure an adequate mechanical joint exists before applying solder. Use only resin-core solder. Acid-core solder should not be used since it may result in corrosion.
- For crimp joints, use butt-type metal barrel fasteners and the proper tool at the appropriate setting for the wire size (such as Motorcraft crimp tool S-9796) specifically designed for this type of work.
- Make sure splice joints are adequately sealed and insulated. In an outside environment, use Duraseal butt connectors or equivalent. A durable substitute splice joint can be achieved by using a bare metal barrel, crimping, flow-soldering and covering with shrink tubing (see figure). Quality electrical tape can be used inside the vehicle but is not recommended for an outside environment.
- Be sure that the new wire is not a lesser gauge than its original mating wire.



1. Disconnect the battery.

2. Strip wires to appropriate length.





- 3. Install heat shrink tubing.
- 4. Twist the wires together.

Note: Use resin-core mildly-activated (RMA) solder. Do not use acid-core solder.

5. Solder wires together.



A0075762

Note: Wait for solder to cool before moving wires.

6. Bend wire 1 back in a straight line.



A0075763

- Note: Overlap tubing on both wires.
- 7. Evenly position heat shrink tubing over wire repair.



A0075764

8. Use a heat gun to heat the repaired area until adhesive flows out of both ends of heat shrink tubing.

9. Reconnect the battery.



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### Sealed Connectors

Ford Part Number	Part Name	Class
E6FZ-14488-A	Butt Connector Gauge: 18-22, Color: Red	C
E6FZ-14488-B	Butt Connector Gauge: 14-16, Color: Blue	C
E6FZ-14488-C	Butt Connector Gauge: 10-12, Color: Yellow	C

Heat Shrinkable Tubing (Heat Shrink) (Ford Specification ESB-M99D56-A2)

Heat shrinkable tubing is available in various diameters for different splice sizes and configurations. When shrunk, it forms a small, flexible hermetic seal.

Other methods (tape, PVC mold, etc.) do not provide a hermetic seal and are not recommended. Splice balancing is critical with heat shrink insulation. If the splice is extremely unbalanced (more circuits on one side than the other), heat shrink insulation will not provide a proper seal. Evaluate the use of double terminals instead of splices where practical in these situations.

#### **Wire Protection Requirements**

General Notes:

- Anticipate problems and design accordingly. Try to anticipate what could go wrong and modify your designs to address any adverse impact.
- Review all connector applications and electrical systems to determine the need for solder, grease, weather-resistant or sealed connectors. Make sure components and wire insulation are compatible with greased connectors (important for long term durability).
- Make sure that drip loops or other means are provided to prevent water leakage into the vehicle through wiring assemblies that pass through the dash panel.

- Use greased or sealed connectors in floor pan troughs which are subject to moisture coming through the carpeting.
- Use XLPE insulation for uncovered runs that exceed 305 mm (12 inches).

### **Electrical Protection**

- Properly route wires away from noise-generating wires or components. However, if routing near noisy wires or plugging into noisy components is unavoidable, additional protection must be designed into the harness.
- Shielding Electro Magnetic Interference (EMI) Consider shielding if you must route close to high-current or noisy circuits. Use shielded wire and ground one side. Seal all splices in wire assemblies that use bare coaxial shielding (braid or tape) for EMI suppression, and insulate or tape over all shielding ends that terminate near any open connectors. This prevents splice and terminal shorts to the shielding. Minimize the length of conductors which extend beyond the shield. Failure to do this reduces the effectiveness of the shield.
- Spike suppression, in general, is accomplished by connecting a diode or resistor-diode combination across the terminals of the noisy component. The diode should be sufficiently close to the component (both electrically and physically) so that inductive spikes are clamped off. Make sure the diode is connected with the proper polarity.

Proper routing and retention will reduce the likelihood of chafing, pinching, etc. When this ideal routing is unattainable, the following additional protection is needed:

#### **Mechanical/Environmental Protection**

- Tape Tape is the most basic means of protection. It contains the wires in a loose bundle and provides limited environmental protection. It does not protect against chafing and pinching.
  - Kendall Polyken Fiberglass Base Tape (Ford Specification ESB-M3G38-A) is used for engine compartment applications. This durable tape provides against cut-through and abrasion commonly found in underhood applications.
  - Polyken 267 is a substitute tape that may be used in lower temperature areas of the engine compartment (apron area).
- Convolute Use convolute for all underhood/underbody applications or when increased temperature, abrasion or pinch resistance is required. Convoluted tubing comes in different diameters and materials to accommodate different temperature ranges and harness sizes.
  - Use polyethylene convolute when abrasion is the only consideration; this convolute is adequate up to 96°C (205°F) maximum. Use nylon convolute when underhood/underbody or abrasion and temperature are considerations; nylon convolute is adequate up to 177°C (350°F) maximum.
  - On all engine-mounted wiring or bend points. Use vinyl tape on the outside of the convolute to prevent wiring from looping out. This tape must be able to withstand high temperatures 135°C (275°F) or over.
  - Tape convolute junctions with abrasion-resistant tape (Polyken 267, fiberglass, etc.).

- Scroll Similar to convolute, but without the ridges. Scroll is used where harness rigidity is required, especially for maintaining critical locator dimensions. Use scroll for short lengths only, as it is quite inflexible.
- Note: This is not meant to be an all-inclusive list of methods for physically protecting the wires. There are other means of protection available that are not listed.

### Available Power Sources

### Front Power Access Point (C275)

The front power access point is a connector (C275) located below the glove compartment. This connector contains various power feeds and inputs available for the addition of police accessories. See the following illustrations and table for connector and circuit details. A mating connector with blunt cut wire leads (part # 14C194) is available as part of kit #14A032.



N0009543



N0012067

Cavity #	Circuit #	Gauge	Color	Function
1	-	-	-	Empty
2	679	16	GY/BK	Vehicle speed signal
3	705	16	LG/OG	Battery saver feed
4	726	10	LG	Battery feed from battery junction box fuse #117 (50A)
5	-	-	-	Empty
6	792	10	TN/YE	Battery feed from battery junction box fuse #111 (50A)
7	401	10	РК	Run/Accessory feed from battery junction box fuse #112 (40A), via the Run/Accessory Relay
8	-	-	-	Empty
9	3010	10	TN	Battery feed from battery junction box fuse #116 (50A)
10	-	-	-	Empty
11	1504	10	RD/WH	Battery feed from battery junction box fuse #114 (50A)
12	-	-	-	Empty

### Front (Optional) Auxiliary Power Distribution Box

The Auxiliary Power Distribution Box contains the following:

- Two 50A fused circuits connected to the battery through battery junction box fuse 111 and fuse 114.
- Two 20A fused circuits which operate with the ignition switch in the RUN or ACC position through battery junction box fuse 22 and fuse 23.
- Three 15A fuses connected to the battery through battery junction box fuse 117.
- Three 2A fuses providing battery saver feed, hazard in, and hazard out signals.
- One 5A fused circuit which operates with the ignition switch in the START position through central junction box fuse 10.
- Four ground circuits.



N0009544

#### **Rear Power Access Point**

The rear power access point is a battery access port for Police auxiliary equipment mounted in the trunk. It is capable of supplying 80 amps of battery voltage. Voltage to the positive terminal of the rear power access point is supplied through 2 50A fused circuits crimped together, connected to the battery through battery junction box (BJB) fuse 115 and fuse 118. Battery access is provided by 2 studs contained in an enclosure, mounted in the trunk behind the carpet, on the right side fender support. The terminal with the red wire is the battery positive, and the terminal with the black wire is the ground. Remove both fuses in the BJB before removing the cover to the rear power point. Make sure load devices can be turned off, and are switched off when reinserting the fuses.

WARNING: Under no circumstance should the rear power access point cover be removed without first removing the BJB fuse 115 and fuse 118. Removing the cover without removing the fuses could result in an electrical hazard. Turn off load devices before inserting the fuses. Failure to follow these instructions may result in personal injury.



### **Trunk Light Bar Connector**

In the right hand side of the trunk, there is an available power source (connector C421 [Except Police Prep Packages] or connector C438 [Police Prep Packages]).



N0012136

ltem	Description
1	Trunk Light Bar Connector (C421 [Except Police Prep Packages])
2	Trunk Light Bar Connector (C438 [Police Prep Packages])

The trunk light bar connector (C421 [Except Police Prep Packages]) is a 4 pin connector and has 1 power and 2 ground circuits available. See the following chart for connector information:



N0012068

Cavity #	Circuit #	Gauge	Color	Function
1	3258	10	RD/YE	Battery feed from battery junction box fuse #113 (50A)
2	57	10	BK	Ground
3	-	-	-	Empty
4	57	10	BK	Ground

The trunk light bar connector (C438 [Police Prep Packages]) is an 8 pin connector and has 3 power circuits and 3 ground circuits available. See the following chart for connector information:



#### N0012104

Cavity #	Circuit #	Gauge	Color	Function
1	3258	10	RD/YE	Battery feed from battery junction box fuse #113 (50A)
2	-	-	-	Empty
3	57	10	BK	Ground
4	57	10	BK	Ground
(Continued)				

Cavity #	Circuit #	Gauge	Color	Function
5	2301	10	RD/WH	Battery feed from battery junction box fuse #118 (50A)
6	2300	10	RD	Battery feed from battery junction box fuse #115 (50A)
7	-	-	-	Empty
8	57	10	BK	Ground

### **Police Prep Packages (Optional)**

Vehicles equipped with one of the optional Police Prep or Visibility Packages (options 65A, 68P, 65W, 65N, and 65U) include a different Auxiliary Power Distribution Box that is located in the glove compartment or trunk. By checking the area of the glove compartment or trunk, it can be easily determined if a vehicle is equipped with a Police Prep and Visibility Package. The standard Front Auxiliary Power Distribution Box normally mounted below the glove compartment is deleted and the Police Prep and Visibility Package Power Distribution Box is installed inside the glove compartment or trunk. For additional information, refer to the Ford Police Interceptor Preparation Packages Owner's Manual that is included with the vehicle.



#### Wiring

### Section 2: Wiring



### How To Change Option Content

#### Luggage Compartment Lid Release Switch

The luggage compartment lid release system may be configured to operate either when the ignition key is in the RUN/ACC position or at all times (without requiring a key). Configuration of the luggage compartment lid release switch is accomplished by connecting one of the two available connectors located behind the dash trim panel. One is wired for power at all times and the other is wired for power only when the ignition key is in the RUN/ACC position.



Use the following steps to change this option:

- Remove the dash trim panel by gently pulling to release the 9 push-type retainers.
- Disconnect luggage compartment lid release switch electrical connector.
- Locate and connect the alternate luggage compartment lid release switch electrical connector.



#### A0074046

- Note: The connectors can be identified by the wire colors. The connector with the (VT/YE) and (BK/WH) wires has power at all times. The connector with the (VT/YE) and (YE/GN) wires has power in the run position.
- Reinstall the dash trim panel.

#### Courtesy Lamp Disable (Dark Mode)

This option offers deletion of the illuminated entry function. Upon vehicle power-up, the lighting control module (LCM) will not provide interior lighting during entry or exit of the vehicle. The interior lighting will, however, still operate on demand whenever the dome lamp switch is active. If the dark car feature is necessary, the assembly plant enables this feature through the LCM. The vehicle can be reconfigured by entering diagnostics, enabling/disabling the courtesy lamps, and then exiting diagnostics.

Use the following steps to disable the courtesy lamps:

- 1. Connect the NGS diagnostic tool with vehicle communication module (VCM) to the data link connector (DLC).
- 2. Select vehicle 2006 Crown Victoria 4.6L.
- 3. Select Diagnostic Data Link.

- 4. Select Lighting Control Module (LCM).
- 5. Select Module Configuration.
- 6. Select Customer Preference Item.
- 7. Select Dark Car.
- 8. Select Enable or Disable.
- 9. Select Done.

### **Rear Power Window Disable**



#### A0092209

The rear window control switches of the Crown Victoria Police Interceptor can be disabled by disconnecting the rear window power supply connector (C340). This connector is located behind the LH B-pillar trim panel, adjacent to the seat belt retractor. Disconnect the connector to disable the rear window control switches. While they are disabled, the master window control switch can still control the rear windows. Refer to Crown Victoria Wiring Diagram Manual for additional power window wiring information.