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2013 FORD Focus ST 5 Doors OEM Service and Repair Workshop Manual

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Item	Description
1	TCM (transmission control module)
2	PCM (powertrain control module)
3	PSCM (power steering control module)
4	ABS (anti-lock brake system) module
5	TCU (telematic control unit module)
6	BCM (body control module)
7	GWM (gateway module A)
8	TRM (trailer module)
9	IPMA (image processing module A)
10	Analog signal 8 inch display
11	Digital signal (coaxial cable 12 inch display)
12	APIM (SYNC module)
13	Audio system display
14	Rear parking aid camera

Network Message Chart

BCM (body control module) Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Camera setting request	APIM (SYNC module)	Commands the zoom level on and off based on driver inputs through the audio system display.

ABS (anti-lock brake system) Module Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Steering angle	PSCM (power steering control module)	The ABS (anti-lock brake system) module uses the steering angle sensor data to generate the steering wheel angle message that is sent to the BCM (body control module) to support the active guideline feature.

Image Display

The analog rear parking aid camera image is displayed by the audio system display when reverse (R) is selected. To determine the transmission gear position and enable the camera display, the PCM (powertrain control module) or TCM (transmission control module) sends the gear position message to the GWM (gateway module A) over the FD-CAN (Flexible Data Rate Controller Area Network) . The GWM (gateway module A) then send the message to the BCM (body control module) via the HS-CAN1 (high-speed controller area network 1) .

The analog rear parking aid camera is on any time it receives voltage (when the ignition is on), but a video signal is only generated under certain conditions. When reverse (R) is selected, the camera continuously generates a video signal. When any gear except reverse (R) is selected, the camera turns the video signal off when the vehicle speed reaches 16 km/h (10 mph), and turns the video signal on when vehicle speed falls below 8 km/h (5 mph). If the camera is not configured properly, some features may be inoperative. The camera sends the video signal on shielded twisted pair of wires to the APIM (SYNC module) , which displays the image on the audio system display.

The digital rear parking aid camera image is displayed by the audio system display when reverse (R) is selected. To determine the transmission gear position and enable the camera display, the PCM (powertrain control module) or TCM (transmission control module) sends the gear position message to the the IPMA (image processing module A) via the FD-CAN (Flexible Data Rate Controller Area Network) .

The digital rear parking aid camera is on any time it receives voltage (when the ignition is on), but a video signal is only generated under certain conditions. When reverse (R) is selected, the camera continuously generates a video signal. When any gear except reverse (R) is selected, the camera turns the video signal off when the vehicle speed reaches 16 km/h (10 mph), and turns the video signal on when vehicle speed falls below 8 km/h (5 mph). If the camera is not configured properly, some features may be inoperative. The camera sends the video signal on a coaxial cable to the IPMA (image processing module A) then the IPMA (image processing module A) sents the signal over a shielded twisted pair of wires for an 8 inch display or a coaxial cable for a 12 inch display to the APIM (SYNC module) , which displays the image on the audio system display.

The tailgate must be fully closed for correct operation of the rear parking aid camera system.

- Camera status
- Display zoom status
- Camera part number data
- Guideline status

Visual Park Aid Alert

The visual park aid alert feature displays a visual highlight in the zone where an object has been detected by the rear parking aid system. This feature utilizes the parking aid sensor data from the IPMA (image processing module A) to generate the visual highlights on the video image. When reverse (R) is selected and an object is detected by a rear parking aid sensor, the parking aid sensor data message from the IPMA (image processing module A) is used by the APIM (SYNC module) to generate the alert.

If the visual park aid alert feature is enabled, the feature is still operational even if the rear parking aid system has been disabled by the driver.

The on-screen alert transitions may not match changes in the audible parking aid alert tone frequency.

Fixed Guidelines

The rear parking aid camera fixed guidelines feature displays guidelines on top of the video image to assist the driver with alignment of the vehicle. A dashed line on the displayed image represents the center of the vehicle and 3 color-coded lines identify different zones between the rear of the vehicle and objects. The rear parking aid camera generates the fixed guidelines over the video image.

The guidelines are not shown when reverse (R) is not selected (video delay active).

Fixed guidelines are not shown when the tailgate is open.

The color-coded lines cannot indicate accurate or consistent distances between the rear of the vehicle and objects shown in the video image. This normal condition is due to variances in vehicle ride height including, but not limited to vehicle loading.

Active Guidelines (with Digital Rear Parking Aid Camera)

The active guidelines feature displays dynamic guidelines that correspond to the projected path of vehicle travel, based on the current steering angle. Several modules are involved in generating the steering angle data used to support the active guidelines. The PSCM (power steering control module) monitors the steering angle sensor and sends the steering wheel angle sensor data to the ABS (anti-lock brake system) module via the FD-CAN (Flexible Data Rate Controller Area Network) . The ABS (anti-lock brake system) module uses this message from the PSCM (power steering control module) to generate the steering angle message that is sent to the IPMA (image processing module A) over the FD-CAN (Flexible Data Rate Controller Area Network) . The IPMA (image processing module A) sends the steering angle data to the rear parking aid camera via the LVDS (low voltage differential signaling) . The rear parking aid camera uses this data to generate the active guidelines over the video image.

hardwired to the APIM (SYNC module) . The APIM (SYNC module) sends the driver generated commands over the HS-CAN3 (high-speed controller area network 3) to the GWM (gateway module A) . The GWM (gateway module A) then sends the commands to the IPMA (image processing module A) on the FD-CAN (Flexible Data Rate Controller Area Network) . The IPMA (image processing module A) sends the zoom command to the rear parking aid camera via the LVDS (low voltage differential signaling) . The zoom is generated by the rear parking aid camera.

Manual Zoom (with Analog Rear Parking Aid Camera)

The manual zoom feature is generated by the rear parking aid camera and has one level of zoom. If the manual zoom feature is on and the vehicle is shifted out of reverse (R), the manual zoom feature is disabled and must be re-enabled the next time reverse (R) is selected.

To turn the manual zoom feature on and off, the driver uses an on-screen button located on the audio system display while in reverse (R). The driver generated commands originate at the audio system display, which is hardwired to the APIM (SYNC module) . The APIM (SYNC module) sends the driver generated commands over the HS-CAN3 (high-speed controller area network 3) to the GWM (gateway module A) . The GWM (gateway module A) then sends the commands to the BCM (body control module) on the HS-CAN1 (high-speed controller area network 1) . The BCM (body control module) sends the zoom command to the rear parking aid camera via the LIN (local interconnect network) circuit. The zoom is generated by the rear parking aid camera.

Video Delay

When the video delay is turned on the APIM (SYNC module) keeps the rear video display enabled after the transmission is shifted out of reverse (R) into any gear other than park (P), until the vehicle speed reaches 8 km/h (5 mph). With the delay off (default) the image displays until the transmission is shifted out of reverse (R).

360 Degree View Camera

System Diagram

6	Front parking aid camera
7	RH (right-hand) side parking aid camera
8	LH (left-hand) side parking aid camera
9	TCU (telematic control unit module)
10	BCM (body control module)
11	GWM (gateway module A)
12	IPMA (image processing module A)
13	TRM (trailer module)
14	APIM (SYNC module)
15	Audio system display
16	Camera selection switch
17	Trailer parking aid camera
18	CHMSL parking aid camera

Network Message Chart

IPMA (image processing module A) Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Camera commands	APIM (SYNC module)	Commands the visual park aid alert and zoom level on and off based on driver inputs through the audio system display.
Driver door ajar status	BCM (body control module)	Generates the door ajar icon on the image when the LH (left-hand) front door is ajar.

	module)	IPMA (image processing module A) to support the active guideline feature.

APIM (SYNC module) Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Camera front display status	IPMA (image processing module A)	Enables the video display when the camera selection switch is pressed.
Camera view status	IPMA (image processing module A)	Indicates the active view that has been selected.
Camera zoom status	IPMA (image processing module A)	Indicates the zoom view that has been selected.
Gear lever position	PCM (powertrain control module) / TCM (transmission control module) (diesel)	Enables and disables the video display based on the current gear selection.
Parking aid sensor data	IPMA (image processing module A)	Generates the visual highlights in the zone where an object is detected by the rear audible parking aid system.
Rear camera on demand request	HVAC (heating, ventilation and air conditioning) module	Used by the APIM (SYNC module) to command the audio system display on when the rear camera on demand is requested.
Vehicle speed	PCM (powertrain control module)	When the video delay feature is turned on, this message is used to turn the rear camera display off after the vehicle speed exceeds a preset threshold.

Image Display

The 360 degree view camera system is capable of generating several different views using the front, rear, LH (left-hand) side, RH (right-hand) side, CHMSL, and trailer cameras (if equipped), and the IPMA (image processing module A) . The IPMA (image processing module A) processes the video signals from the cameras and generates the appropriate views that are displayed on the audio system display. The views that are displayed are determined by the transmission gear selector position.

(transmission control module) on vehicles with a diesel engine, sends the gear position and vehicle speed messages through the FD-CAN (Flexible Data Rate Controller Area Network) to the IPMA (image processing module A) . The camera selection switch is integral to the instrument panel center stack left switch and the switch is hardwired to the IPMA (image processing module A) .

All camera views are generated by the IPMA (image processing module A) , using the video signals from one or more of the cameras. The video signals are sent from the cameras to the IPMA (image processing module A) through coaxial cables. The IPMA (image processing module A) processes the image(s) from the cameras and sends a single image with the desired view to the APIM (SYNC module) . The IPMA (image processing module A) creates the final video images seen at the display and applies video adjustments such as brightness and sharpness color.

360 Degree Image Composition

To generate the 360 degree view, raw video is sent to the IPMA (image processing module A) in serialized data format, and the IPMA (image processing module A) combines and aligns the images from all 4 cameras to produce a single overhead view that is displayed on the audio system display along with a front or rear camera view.

When a camera or any body component that a camera is attached to is removed or adjusted, the 360 degree view camera alignment must be performed to create a 360 degree image.

Refer to: 360 Degree View Camera Alignment

(413-13B Parking Aid - Vehicles With: Parking Aid Camera, General Procedures).

When any gear except reverse (R) is selected, the IPMA (image processing module A) sends a disable request message to the cameras to turn the video signal off when the vehicle speed reaches 16 km/h (10 mph), and sends an enable request message to turn the video signal on when vehicle speed falls below 8 km/h (5 mph). If the IPMA (image processing module A) is not configured properly, some features and views may be inoperative.

The LH (left-hand) and RH (right-hand) side cameras are on and generating a video signal any time they receive voltage from the IPMA (image processing module A) . The IPMA (image processing module A) sends an enable request message through coaxial cables via LVDS (low voltage differential signaling) to the LH (left-hand) and RH (right-hand) side cameras when reverse (R) is selected and the vehicle speed is below 8 km/h (5 mph) or the camera selection switch is pressed.

Camera Features

The following features are driver selectable:

- Visual park aid alert — allows the driver to see the objects causing the parking aid system to sound.
- Manual zoom — allows the driver to manually zoom the image.
- Video delay — allows the driver to see the image behind the vehicle after the vehicle is shifted out of reverse (R) into any gear other than park (P).

The following features are not driver selectable:

- Fixed guidelines — displays guidelines to assist the driver with aligning the vehicle with an object.
- Active guidelines — displays the intended path of the vehicle based upon steering wheel input.

The system supports visual park aid alert on 360 + Normal and Normal views. Front and rear split view do not include visual park aid alert. For views that include the 360 degree overhead image, the visual park aid alert is generated by the IPMA (image processing module A) . For views that do not include the 360 degree overhead image, the visual park aid alert feature is generated by the APIM (SYNC module) .

To turn the manual zoom on and off, the driver generated commands originate at the audio system display, which is physically connected to the APIM (SYNC module) . The commands are sent by the APIM (SYNC module) to the IPMA (image processing module A) via the HS-CAN3 (high-speed controller area network 3) , GWM (gateway module A) and FD-CAN (Flexible Data Rate Controller Area Network) . The IPMA (image processing module A) then sends the zoom command to the rear camera via a coaxial cable. The image is then zoomed in or out by the rear camera.

The video delay feature is controlled within the APIM (SYNC module) .

The fixed and active guidelines are generated by the IPMA (image processing module A) and are not selectable by the driver.

LIN (local interconnect network) Communication

and 3 color-coded lines identify different zones between the rear of the vehicle and objects. The IPMA (image processing module A) generates the fixed guidelines over the video image.

Fixed guidelines are not shown when the tailgate is open.

The color-coded lines cannot indicate accurate or consistent distances between the rear of the vehicle and objects shown in the video image. This normal condition is due to variances in vehicle ride height including, but not limited to, vehicle loading.

Active Guidelines

Active guidelines are only displayed on the rear camera image in Rear 360 + Normal and Rear Normal views.

The active guidelines feature displays dynamic guidelines that correspond to the projected path of vehicle travel, based on the current steering angle. Several modules are involved in generating the steering angle data used to support the active guidelines. The PSCM (power steering control module) monitors the steering angle sensor and sends the steering wheel angle sensor data to the ABS (anti-lock brake system) module via the FD-CAN (Flexible Data Rate Controller Area Network) . The ABS (anti-lock brake system) module uses this message from the PSCM (power steering control module) to generate the steering angle message that is sent to the IPMA (image processing module A) through the FD-CAN (Flexible Data Rate Controller Area Network) . The IPMA (image processing module A) uses this data to generate the active guidelines over the video image.

When the steering wheel is in the straight-ahead position the active guidelines are not shown.

Active guidelines are not shown when the tailgate is open.

If the battery has been disconnected or discharged, or a module is disconnected or replaced, the active guidelines may be inoperative until the vehicle is driven on a flat and smooth road at 32 km/h (20 mph) or more, with hands placed loosely on the steering wheel and minimal steering correction for approximately 30 seconds. If the guidelines remain inoperative, it may be necessary to disconnect the battery for 5 minutes with the driver's door open, then drive the vehicle for 8 kilometers (5 miles) in normal city driving before performing the procedure described above.

Manual Zoom

The manual zoom is only supported by the rear camera. The manual zoom is only available for Rear 360 + Normal and Rear Normal views.

The manual zoom feature has one level of zoom. If the manual zoom feature is on and the vehicle is shifted out of reverse (R), the manual zoom feature is disabled. The manual zoom feature must be re-enabled the next time reverse (R) is selected. When the driver turns the zoom on or off at the audio system display, the command is sent from the APIM (SYNC module) via the HS-CAN3 (high-speed controller area network 3) to the GWM (gateway module A) . The GWM (gateway module A) then sends the message to the IPMA (image processing module A) through the FD-CAN (Flexible Data Rate Controller Area Network) . The IPMA (image processing module A) sends the manual zoom request message to the rear parking aid camera via the coaxial cable to turn the zoom on or off.