

2022 CHEVROLET CORVETTE SERVICE MANUAL

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OnStar Description and Operation

This OnStar[®] system consists of the following components:

- Telematics Communication Module
- OnStar[®] three button assembly
- Microphones
- Cellular antenna
- Navigation antenna
- Back up battery
- WiFi Support
- TTY (Teletypewriter)

This system also interfaces with the factory installed vehicle audio system.

Telematics Communication Module

The OnStar Telecommunications Platform (TCP) system communicates with various infotainment components via Ethernet. The OnStar TCP uses Global System for Mobile Communication (GSM) to communicate data and voice signals over the national cellular network. The Telematics Communication Module supports entertainment WiFi hotspots by providing a connection to the cellular network for internet access. The module is capable of up to 4G LTE speeds and houses 2 technology systems, one to process Global Positioning System (GPS) data, and another for cellular information. The module sends and receives all cellular communications over two cellular antennas and cellular antenna coax cables.

The OnStar TCP system has two antenna inputs, a primary cellular signal and a combined GPS/secondary cellular signal. OnStar can receive signals from multiple global navigation satellite systems, including the United States developed Global Positioning System (GPS) and Russian developed Global Navigation Satellite System (GLONASS).

The module also has the capability of activating certain features such as, the horn, remote engine starting, initiating door lock/unlock, or activating the exterior lamps using the serial data circuits. These functions can be commanded by the OnStar[®] Call Center per a customer request or mobile device app depending on vehicle and customer subscription.

Dedicated circuits are used to connect the Telematics Communication Module to a microphone, the button assembly, and radio. When equipped, the Telematics Communication Module may contain a back up battery (BUB) which is internal to the control module and replaceable through an access cover. The Telematics Communication Module communicates with the rest of the vehicle over the serial data bus and Ethernet.

Power is provided by a dedicated, fused B+ circuit. Ground is provided through the vehicle wiring harness attached to the module. The power mode state is determined by the Telematics Communication Module through serial data messaging.

OnStar[®] Three Button Assembly

- The OnStar[®] button assembly may be part of the rearview mirror, or a separate, stand alone unit. The button assembly is comprised of 3 buttons or 3 capacitive touch buttons and status LED[™]s or an error indicator. The buttons are defined as follows:
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 - The answer/end button, which is black with a white phone icon or a white driver figure seated with voice signals near its face, allows the user to answer and end calls or initiate speech recognition.
 - The blue OnStar[®] call center button, which displays the OnStar[®] logo, allows the user to connect to the OnStar[®] call center.

- The emergency button, which displays white letters SOS with red background, sends a high priority emergency call to the OnStar® call center when pressed.

If the LED does not illuminate, this may indicate that the customer's OnStar® subscription is not active or has expired. Push the blue OnStar button to connect to an advisor who can then verify the account status.

The Telematics Communication Module supplies 10 volts to the OnStar® button assembly on the keypad supply voltage circuit. When pressed, each button completes a circuit across a resistor allowing a specific voltage to be returned to the Telematics Communication Module on the keypad signal circuit. Depending upon the voltage range returned the Telematics Communication Module is able to identify which button has been pressed.

The OnStar® status LED or error indicator is located near the buttons. The LED is green when the system is ON and operating normally. When any indicator is illuminated and flashing, it is an indication that a call is in progress. When the LED is red, this indicates a system malfunction is present. In the event there is a system malfunction and the OnStar® system is still able to make a call, the LED will flash red during the call.

Each LED or error indicator is controlled by either the Telematics Communication Module over dedicated LED signal circuits or by low speed GM LAN serial data depending on the inside rearview mirror option. Ground for the LED is provided by the wiring harness attached to the button assembly.

Secondary OnStar® Controls

Some vehicles may have an additional button that when pushed can engage the OnStar® system. The button may be a symbol of a face with sound waves, or may say MUTE, or be a symbol of a radio speaker with a slash through it.

By engaging the OnStar® system with this feature, the user can interact with the system by use of voice commands. A complete list of these commands is supplied in the information provided to the customer. If the information is not available for reference, at any command prompt the user can say "HELP" and the Telematics Communication Module will return an audible list of available commands.

Microphones

This system utilizes two hands free audio microphones, the primary microphone on the driver side and a secondary/reference microphone for the front passenger side. The primary microphone is connected directly to the Telematics Communication Module. It is also connected by an analog pass-through circuit to the radio from the Telematics Communication Module. The secondary microphone is connected directly to the radio.

The primary microphone is used for emergency and OnStar calls. During normal operating conditions it also provides Bluetooth calls and speech recognition to the radio. The secondary microphone is used as a reference for the primary microphone for passenger interference cancellation during speech recognition and also to enhance the driver side hands free calls. For MY18 and beyond the secondary microphone can also be used for front passenger hands free phone calls.

The front passenger secondary microphone is never used as a direct source for an OnStar call. The second microphone input modifies the primary microphone input to reduce background noise and other interference. An OnStar call requires the microphone to be directly connected to the Telematics Communication Module. During a normal (non-emergency) OnStar call the Telematics Communication Module receives an audio signal from the primary microphone and sends the signal to the radio via the Ethernet connection. The radio processes the OnStar call audio and sends it back to the Telematics Communication Module via the Ethernet connection. During an emergency button call the Telematics Communication Module contacts the OnStar call center directly and does not send the signal to the radio.

Cellular and GPS Antennas

The combination antenna will have any of the following antenna elements when equipped with OnStar:

- Primary cellular element
- Secondary cellular element
- GPS element
- Digital radio element
- AM/FM element

The OnStar® TCP system uses 2 cellular antenna elements to send and receive cellular data, the primary cellular element and the secondary cellular element. The primary cellular signal is carried by a coax cable that connects the antenna directly to the Telematics Communication Module. Details of the secondary cellular signal are further described below.

The GPS antenna element is used to collect the signals of the orbiting GPS satellites. GPS signals are output from the Telematics Communication Module on Ethernet. Other modules on Ethernet may use the GPS latitude, longitude and satellite time data broadcast by the Telematics Communication Module. Using positioning information from the vehicle Ethernet avoids the use of a coaxial signal splitter to pass the analog GPS signal to other modules. Within the antenna is housed a low noise amplifier that allows for a more broad and precise reception of this data. Also

housed within the antenna is circuitry to combine the GPS signal and the secondary cellular signal. The combination GPS/secondary cellular signal is carried by a coax cable that connects directly to the Telematics Communication Module. The cable also provides a path for DC current for powering the antenna.

Compass Heading

The Telematics Communication Module has a compass feature to calculate vehicle direction which is displayed via the instrument panel cluster or designated display. The compass heading is determined by dead reckoning until the GPS 3d fix is established. The dead reckoning is accomplished by using the yaw rate sensors and wheel ticks to determine heading changes from a GPS known heading. The GPS 3d fix heading is determined by the deferential of two locations.

Bluetooth[®]

With the OnStar TCP system Bluetooth[®] resides in the radio. Refer to Radio/Audio System Description and Operation for further details.

Phantom Phone Calls

A customer may report that the OnStar[®] system is attempting and/or completing phone calls which the operator of the vehicle did not initiate.

It is important to know which type of reported phantom phone call the operator is reporting. Some phone calls of this nature are considered normal and cannot be addressed other than through education, while others may require some remedial action to resolve. When attempting resolve, it is very important to determine under which circumstances the reported Phantom Phone call resulted.

The following are different scenarios:

- The vehicle may receive an incoming call just like any other phone. Typically the customer will hear the phone ringing in the vehicle. This scenario also includes incoming Bluetooth calls.
- Because the button assembly and associated wiring feeds voltage back to the OnStar[®] system based on the amount of voltage drop through each of the buttons, should the return line be partially shorted to voltage the system could interpret this voltage as a key press. If one of the buttons voltage is simulated, such as the Blue button. The system will make a phone call just as if the button had been pressed by the operator of the vehicle. Refer to the OnStar Button Malfunction document for diagnostics.
- Internal module fault. Some customers may report a condition where Phone Unavailable message is heard after the vehicle door is opened or key is cycled. The technician may find a DTC stored in the Telematics module (example: U1500 or B1000). Refer to diagnostics for the DTC making sure to follow any applicable Bulletins or PIs.
- Unwanted Hands free calling activation. A customer may report that the Ready! or OnStar[®] Ready! message is heard while driving. The customer may also advise that this seems to happen mostly while making a turn. In some cases it has been found that the customer is inadvertently pressing the push to talk button on the steering wheel controls. On rare occasions, other issues in the steering column or Steering Wheel Control system may induce this event.

The majority of reported Phantom Phone Calls can be attributed to accidental button presses or customer induced concern. In some cases an incoming call may be mistaken as a phantom call concern. It is important to verify all aspects of the customer concern in order to properly duplicate and diagnose the condition. If the concern points to normal operation and customer induced concern, please communicate to the customer this condition is a normal operating characteristic of their vehicle.

Back-up Battery

In some vehicles, the OnStar system is equipped with a Back-Up Battery (BUB) installed inside the Telematics Communication Module. This battery is a two-cell lithium-ion rechargeable battery assembly, connected with a short electrical harness, to the circuit board in the module. Contained within this two-cell battery package are a temperature-sensing thermistor, automatic-resetting circuit-overload protection, and a low-pressure vent valve. Nominal voltage of the battery pack is 7.3 Volts.

The BUB is only switched into service when the OnStar system is in normal On condition, vehicle power mode of either Run or On, and main vehicle battery power (B+) at the Telematics Communication Module suddenly becomes near-zero. At this time BUB power is connected to the main circuit board power using solid-state power switching circuits. After initiating BUB for module power, the CAN bus is monitored for a message confirming a collision-event, or near-collision event, has occurred. If a confirmation message is received, the Telematics Communication Module continues to use BUB as the power supply until it is depleted. If a confirmation message is not received within 10 seconds, the BUB power circuits are internally disconnected, preventing inadvertent dis-charge of the battery.

Charging circuitry within the Telematics Communication Module maintains the state of charge of the BUB. BUB charging occurs as determined by the module software, primarily based on temperature and state of charge. Battery state of charge is measured by the Telematics Communication Module circuitry, and remaining energy capacity calculated by the module software. On-board diagnostic tests check for circuit faults, over-temperature conditions, and low-energy capacity. Current DTCs will set for each of these conditions. No component checks are required, and are not recommended, for BUB diagnosis.

WiFi Support

The Telematics Communication Module supports entertainment WiFi hotspots by providing a connection to the cellular network for internet access. The radio acts as the central WiFi router and connects hardwire Ethernet to the Telematics Communication Module. The Telematics Communication Module completes the connection to the internet through the cellular network. It has the ability to connect up to 7 devices at one time.

Audio System Interface

When the OnStar[®] requires audio output, a serial data message is sent to the audio system to mute all radio functions and transmit OnStar[®] originated audio. The OnStar[®] audio is transmitted to the vehicle audio system by the Ethernet and circuits.

The audio system will mute and an audible ring will be heard through the speakers if the vehicle receives a call with the radio ON.

On some vehicles, the HVAC blower speed may be reduced when the OnStar[®] system is active to aid in reducing interior noise. When the system is no longer active, the blower speed will return to its previous setting.

OnStar[®] Sleep Cycle

The OnStar[®] system uses a unique sleep cycle to allow the system to receive cellular calls while the ignition is in the OFF position and retained accessory power mode has ended. This cycle enables the Telematics Communication Module to perform remote functions, such as door unlock, as commanded over the air by the OnStar[®] Call Center, and to continue to maintain an acceptable level of battery electrical drain.

The OnStar[®] system uses 4 states of readiness, depending upon the type of cellular market the vehicle is in when the ignition is put into the OFF state:

- High power
- Low power
- Sleep
- Digital standby

The high power state is in effect whenever the ignition is in the ON or RUN position, or retained accessory power is enabled, and the OnStar[®] system is sending or receiving calls or when the system is performing a remote function.

The low power state is in effect when the OnStar[®] system is idle with the ignition in the ON or RUN position, or with retained accessory power enabled.

The digital standby power state is entered after the vehicle has been shut off and the retained accessory power has timed out while in a digital cellular area. When in digital standby mode, the OnStar[®] module is able to perform all remote functions as commanded by an OnStar[®] advisor at any time, for a continuous 120 hours. After 120 hours, the Telematics Communication Module will go into sleep mode until a wake up signal from the vehicle is seen by the Telematics Communication Module. If the Telematics Communication Module loses the digital cellular signal it will revert to analog mode and follow the standard sleep state (9 minutes OFF, 1 minute standby) based on the time of the GPS signals, this will continue until a digital cellular signal is again received.

If the OnStar[®] system loses battery power while the system is in a standby or sleep mode, the system will remain OFF until battery power is restored and the ignition is turned to the ON or RUN position.

Features

OnStar[®] Personal Calling

The hands free, OnStar[®] personal calling cellular phone feature is an additional feature of the OnStar[®] system. This feature is embedded within the Telematics Communication Module; however it must be activated by an OnStar[®] advisor. OnStar[®] personal calling operates similar to most hand held cellular phones in that the availability for its usage is based on minutes or units. The customer must have a current OnStar[®] subscription, as this feature cannot be utilized without it. To use OnStar[®] personal calling, the customer must also purchase units (minutes) as outlined in the owners guide provided with the OnStar[®] system. Units begin to deplete, 1 unit is equal to 1 minute, as the customer makes outbound phone calls, answers inbound phone calls, or while connected to the OnStar[®] virtual advisor. In addition, units may also have an expiration date, depending upon the type of units purchased.

Turn by Turn Navigation (if equipped)

Turn by Turn Navigation allows the driver to contact OnStar[®] to obtain directions for driving from a current location to a desired location. The Turn by Turn Navigation system stores your planned route and continually checks your position along that route, when you deviate from the planned route, the system will recognize this and prompt the driver with verbal prompts for how to proceed. .

Teletypewriter (TTY) Users

OnStar has the ability to communicate to deaf, hard-of-hearing, or speech-impaired customers while in the vehicle. The available dealer-installed TTY system can provide in-vehicle access to all of the OnStar services, except Virtual Advisor and OnStar Turn-by-Turn Navigation.

Deactivated OnStar Accounts

In the event a customer has not renewed their OnStar account after expiration or the account was never activated, OnStar will make a discrete cellular call to the vehicle to deactivate the OnStar system. Before taking this action, customers are notified that the OnStar system in their vehicle will be deactivated unless they elect to renew the account. After the OnStar account has been deactivated, customers will experience the following:

- The OnStar status LED will not illuminate.
- The OnStar system will NOT attempt to connect to the OnStar Call Center in the event of a collision or if the vehicle's front air bags deploy for any other reason.
- An emergency button press will play a demo message indicating the service has been deactivated.
- An OnStar Call Center button press will connect the customer with a dedicated sales team who can sell an OnStar subscription and reactivate the vehicle. Depending on the type of OnStar hardware in the vehicle, the customer may first hear a demonstration message stating there is no current OnStar subscription for the vehicle, and directing the customer what to do to activate services.
- OnStar personal calling will not be available, as this feature requires the customer to have a current OnStar account. Attempts to use this feature may result in cellular connection failure messages and the inability to connect to the number dialed.

Certain vehicles that have never had an active OnStar account, or that have been deactivated, may be unable to establish a connection with the OnStar Call Center. When normal published diagnostic procedures do not indicate a possible cause for the no connect concern, the vehicle may have been deactivated. For deactivated vehicles, a no connect response should be considered normal operation. Further diagnosis and subsequent repair is only necessary should the customer elect to become an active OnStar subscriber or renew the account subscription.

OnStar Cellular, GPS, and Diagnostic Limitations

The proper operation of the OnStar System is dependent on several elements outside the components integrated into the vehicle. These include the National Cellular Network Infrastructure, the cellular telephone carriers within the network, and the GPS.

The cellular operation of the OnStar system may be inhibited by factors such as the users range from an analog or digital cellular tower, the state of the cellular carrier's equipment, and the location where the call is placed. Making an OnStar key press in areas that lack sufficient cellular coverage or have a temporary equipment failure will result in either the inability of a call to complete with a data transfer or the complete inability to connect to the OnStar Call Center. The OnStar system may also experience connection issues if the identification numbers for the module, station identification number, electronic serial number or manufacturers electronic ID, are not recognized by the cellular carriers local signal receiving towers.

The satellites that orbit earth providing the OnStar system with GPS data have almost no failures associated with them. In the event of a no GPS concern, the failure will likely lie with the inability of the system to gain GPS signals because of its location, i.e. in a parking structure, hardware failure, or being mistaken with an OnStar call which has reached the Call Center without vehicle data.

During diagnostic testing of the OnStar system, the technician should ensure the vehicle is located in an area that has a clear unobstructed view of the open sky, and preferably, an area where analog or digital cellular calls have been successfully placed. These areas can be found by successfully making an OnStar keypress in a known good OnStar equipped vehicle and confirming success with the OnStar Call Center advisor. Such places can be used as a permanent reference for future OnStar testing.

Mobile Identification Number and Mobile Directory Number

The Telematics Communication Module utilizes 2 numbers for cellular device identification, call routing and connection, a mobile identification number and a mobile directory number. The mobile identification number represents the number used by the cellular carrier for call routing purposes while the mobile directory number represents the number dialed to reach the cellular device.