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T-Harness for a Telematics Device

Abstract

A T-harness for use in vehicles is provided. The T-harness has a main harness portion and a removable harness portion. The main harness portion has a vehicle OBD harness connector, a splitter, a telematics device harness connector, a telematics device harness segment connecting the vehicle OBD connector to the telematics device harness connector, a receptacle connector, and an auxiliary harness segment connecting the vehicle OBD connector to the receptacle connector. The removable harness portion has an auxiliary OBD harness connector, a plug connector configured for mating with the receptacle connector, and a multi-wire cable connecting the plug connector to the auxiliary OBD harness connector. A method of installing the T-harness in the vehicle is also provided.

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Background/Summary

RELATED APPLICATIONS [0001] This application claims priority from U.S. provisional application 63/552,342 filed on Feb. 12, 2024, the contents of which are herein incorporated by reference.

FIELD
[0002] The present disclosure generally relates to vehicle telematics, and more specifically to a T-Harness for a telematics device.
BACKGROUND
[0003] A telematics system may gather asset data using a telematics device. The telematics device may be integrated into or located onboard the asset. The asset may be a vehicle (“vehicular asset”) or some other stationary equipment. The telematics device may collect the asset data from the asset through a data connection with the asset. In the case of a vehicular asset, the telematics device gathers the asset data via an interface port, such as an onboard diagnostic port (OBD). Additionally, the telematics device may gather sensor data pertaining to the asset via sensors on the telematics device. Furthermore, the telematics device may gather location data pertaining to the asset from a location module on the telematics device. When the telematics device is coupled to the asset, the gathered sensor data and location data pertain to the asset. The gathered asset data, sensor data and location data may be received and recorded by a technical infrastructure of the telematics system, such as a telematics server, and used in the provision of fleet management tools, for telematics services, or for further data analysis.
SUMMARY
[0004] In one aspect of the present disclosure, there is provided a T-harness for use in vehicles having an On-Board Diagnostic (OBD) port. The T-harness comprises a main harness portion and a removable harness portion. The main harness portion includes a vehicle OBD harness connector, a splitter, a telematics device harness connector, a telematics device harness segment connecting the vehicle OBD harness connector to the telematics device harness connector, a first multi-signal connector, and an auxiliary harness segment connecting the vehicle OBD harness connector to the first multi-signal connector. The removable harness portion includes an auxiliary OBD harness connector, a second multi-signal connector configured for mating with the first multi-signal connector, and a multi-wire cable connecting the second multi-signal connector to the auxiliary OBD harness connector.
[0005] The first multi-signal connector may comprise a multi-signal receptacle connector and the second multi-signal connector may comprise a multi-signal plug connector.
[0006] The first multi-signal connector may comprise a multi-signal plug connector and the second multi-signal connector may comprise a multi-signal receptacle connector.
[0007] The auxiliary OBD harness connector may comprise an auxiliary OBD harness connector front portion and an auxiliary OBD harness connector rear portion.
[0008] The auxiliary OBD harness connector front portion may be trapezoidal in shape thus preventing connecting a device connector to the auxiliary OBD harness connector except in one correct orientation.
[0009] The auxiliary OBD harness connector rear portion may have a smaller width than a width of the auxiliary OBD harness connector front portion thus permitting insertion of the auxiliary OBD harness connector rear portion in a vehicle mount aperture.

[0010] The splitter may split signals of the vehicle OBD harness connector into a first plurality of signal lines routed to the telematics device harness connector via the telematics device harness segment and a second plurality of signal lines routed to the first multi-signal connector via the auxiliary harness segment.
[0011] The T-harness may further comprise a third multi-signal connector connected to a first plurality of signal lines in the vehicle OBD harness connector and a fourth multi-signal connector suitable for mating with the third multi-signal connector the second multi-signal connector connected to a second plurality of signal lines in the telematics device harness segment.
[0012] The first plurality of signal lines in the vehicle OBD harness connector may correspond to networking signal lines.
[0013] The third multi-signal connector may comprise a multi-signal plug connector and the fourth multi-signal connector may comprise a multi-signal receptacle connector.
[0014] The third multi-signal connector comprises a multi-signal receptacle connector and the fourth multi-signal connector comprises a multi-signal plug connector.
[0015] The splitter may be an integral part of the vehicle OBD harness connector.
[0016] In another aspect of the present disclosure, there is provided a method of installing a T-harness in a vehicle having an OBD port including a vehicle OBD connector connected to a vehicle mount. The method comprises disconnecting the vehicle OBD connector from the vehicle mount, connecting a mounting adapter to an auxiliary OBD harness connector of the T-harness at an auxiliary OBD harness connector rear portion, connecting the auxiliary OBD harness connector to the vehicle mount at the auxiliary OBD harness connector rear portion, connecting a removable harness portion of the T-harness to a main harness portion of the T-harness, and connecting the vehicle OBD connector to a vehicle OBD harness connector of the T-harness.
[0017] Connecting the mounting adapter to the auxiliary OBD harness connector at the auxiliary OBD harness connector rear portion may comprise sliding the mounting adapter over the auxiliary OBD harness connector until at least one locking member of the auxiliary OBD harness connector mates with at least one locking structure of the mounting adapter.
[0018] The at least one locking member may comprise at least one snap formed on at least one sidewall of the auxiliary OBD harness connector and the at least one locking structure of the mounting adapter may comprise at least one cutout on at least one sidewall of the mounting adapter, the at least one cutout sized and shaped for receiving the at least one snap in a locking arrangement.
[0019] Connecting the removable harness portion to the main harness portion may comprise connecting a first multi-signal connector of the main harness portion to a second multi-signal connector of the removable harness portion.
[0020] The first multi-signal connector may comprise a multi-signal plug connector and the second multi-signal connector may comprise a multi-signal receptacle connector.
[0021] The second multi-signal connector may comprise a multi-signal plug connector and the first multi-signal connector may comprise a multi-signal receptacle connector.
[0022] The method may further comprise disconnecting a third multi-signal connector connected to a telematics device harness segment of the T-harness from a fourth multi-signal connector connected to the vehicle OBD harness connector of the T-harness.
[0023] The method may further comprise connecting a telematics device to a telematics device harness connector of the T-harness.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0024] Exemplary non-limiting embodiments of the present invention are described with reference

to the accompanying drawings in which:
[0025] FIG. **1** is a schematic diagram of an exemplary telematics system including a plurality of telematics devices coupled to a plurality of vehicular assets;
[0026] FIG. **2** is a block diagram showing a telematics device coupled to an asset's communications bus via an interface port;
[0027] FIG. **3** depicts the pinout of a J1962 connector, also known as an On Board Diagnostics (OBD) connector;
[0028] FIG. **4** depicts a telematics device and a diagnostic tool both connected to an asset's communications bus via a T-Harness;
[0029] FIG. **5** is a perspective view of an exemplary T-Harness;
[0030] FIG. **6**A depicts a first step of installing the T-Harness of FIG. **5** wherein a vehicle OBD connector is removed from the vehicle mount;
[0031] FIG. **6**B depicts the second step of installing the T-Harness of FIG. **5** wherein a vehicle-side connector of the T-Harness is connected to the vehicle connector;
[0032] FIG. **6**C depicts the third step of installing the T-Harness of FIG. **5** wherein a telematics device is connected to the telematics device connector of the T-Harness;
[0033] FIG. **6**D depicts the fourth step of installing the T-Harness of FIG. **5** wherein a vehicle-specific adapter is connected to the auxiliary OBD port connector of the T-Harness;
[0034] FIG. **6**E depicts the fifth step of installing the T-Harness of FIG. **5** wherein the vehicle-specific adapter of FIG. **6**D is held in place by metal clips;
[0035] FIG. **6**F depicts the sixth step of installing the T-Harness of FIG. **5** wherein a cover plate is slid onto the vehicle-specific adapter of FIG. **6**D;
[0036] FIG. **6**G depicts the seventh step of installing the T-Harness of FIG. **5** wherein the auxiliary OBD port connector is installed in the vehicle mount to replace the vehicle OBD connector;
[0037] FIG. **7** depicts the T-Harness of FIG. **5** connected to the vehicle OBD connector, the vehicle mount, and the telematics device;
[0038] FIG. **8** depicts a trapezoidal OBD connector for use as the auxiliary OBD port connector of the T-Harness, in accordance with embodiments of the present disclosure;
[0039] FIG. **9** depicts an attempt to fit the trapezoidal OBD connector of FIG. **8** into a vehicle mount from the front side thereof;
[0040] FIG. **10** depicts a vehicle T-Harness for using in vehicles, the T-harness having a removable harness portion including a an auxiliary OBD port connector, in accordance with embodiments of the present disclosure;
[0041] FIG. **11** depicts a vehicle T-Harness similar to the T-harness of FIG. **10** but having a splitter which is separate from the vehicle OBD harness connector, in accordance with embodiments of the present disclosure;
[0042] FIGS. **12**A-**12**F depict different views of the auxiliary OBD connector of the T-Harness of FIG. **10**;
[0043] FIG. **13**A is a top, front, right side perspective view of a flange mount adapter, typically used by domestic (Ford™, GM™, Chrysler™) vehicles, for coupling to the auxiliary OBD connector of FIGS. **12**A-**12**H;
[0044] FIG. **13**B is a bottom, rear, left perspective view of the adapter of FIG. **13**A;
[0045] FIG. **13**C is a top front left perspective view of the adapter of FIG. **13**A-**13**H coupled to the auxiliary OBD connector of FIGS. **12**A-**12**H;
[0046] FIG. **14**A depicts the insertion of the adapter of FIGS. **13**A-**13**H onto the removable harness portion from FIG. **10** towards the auxiliary OBD connector of FIGS. **12**A-**12**H;
[0047] FIG. **14**B depicts the removable harness portion with the adapter of FIGS. **13**A-**13**H connected to the auxiliary OBD connector of FIGS. **12**A-**12**H;
[0048] FIG. **14**C depicts the removable harness portion with auxiliary OBD connector inserted into a vehicle mount;

[0049] FIG. **14**D depicts the connection of the removable harness portion to the T-Harness via the ribbon connectors;
[0050] FIG. **14**E depicts the connection of the vehicle OBD harness connector to the vehicle OBD connector; and
[0051] FIG. **15** depicts the T-Harness in a fully assembled mode and having a telematics device connected thereto.

DETAILED DESCRIPTION

Telematics System

[0052] FIG. **1** shows a high-level block diagram of a telematics system **101**. The telematics system **101** includes a telematics server **130**, (N) telematics devices shown as telematics device **200_1**, telematics device **200_2** . . . through telematics device **200**_N ("telematics device **200**"), a network **50**, administration terminal **140**, and operator terminals **150_1**, **150_2** . . . through **150**_N ("the operator terminals **150**"). FIG. **1** also shows a plurality of (N) assets named as asset **100_1**, asset **100_2** . . . asset **100**_N ("asset **100**") coupled to the telematics device **200_1**, telematics device **200_2** . . . telematics device **200**_N, respectively. Additionally, FIG. **1** shows a plurality of satellites **170_1**, **170_2** and **170_3** ("the satellites **170**") in communication with the telematics devices **200** for facilitating navigation.
[0053] The assets **100** shown are in the form of vehicles. For example, the asset **100_1** is shown as a truck, which may be part of a fleet that delivers goods or provides services. The asset **100_2** is shown as a passenger car. The asset **100_3** is shown as an electric vehicle (EV). Other types of vehicles, which are not shown, are also contemplated in the various embodiments of the present disclosure, including but not limited to, farming vehicles, construction vehicles, military vehicles, and the like.
[0054] While the assets shown in FIG. **1** are all land vehicles, this is not always the case. In some implementations, the asset is a marine vehicle or an airborne vehicle employing an ICE, an electric motor, or any other engine such as a jet engine, a rocket propulsion engine, and so on. In some cases, the asset is a piece of equipment such as a generator, a concrete mixer, a compressor, and the like.
[0055] The telematics devices **200** are coupled to assets **100**. For example, in FIG. **1** the telematics device **200_1** is coupled to the asset **100_1**. Similarly, the telematics device **200_2** is coupled to the asset **100_2** and the telematics device **200_3** is coupled to the asset **100_3**.
[0056] The network **50** may be a single network or a combination of networks such as a data cellular network, the Internet, and other network technologies. The network **50** provides connectivity between the different components of the system, such as between the telematics devices **200** and the telematics server **130**, between the administration terminal **140** and the telematics server **130**, and between the operator terminals **150** and the telematics server **130**.
[0057] In some implementations of the telematics system **101**, the network **50** is a cellular network utilizing cellular technology. In some implementations of the telematics system **101**, the network **50** comprises a Wide Area Network (WAN) using non-cellular WAN technologies. In some implementations, the network **50** is a combination of cellular and non-cellular technologies.
[0058] The telematics server **130** is an electronic device executing machine-executable programming instructions which enable the telematics server **130** to store and analyze telematics data **212**. The telematics server **130** may be a single computer system or a cluster of computers.
[0059] The satellites **170** are part of a global navigation satellite system (GNSS) which is a satellite-based navigation system that provides positioning, navigation, and timing services worldwide. The location information may be processed by a location module on the telematics device **200** to provide location data indicating the location of the telematics device **200** (and hence the location of the asset **100** coupled thereto).
[0060] The administration terminal **140** is an electronic device capable of connecting to the telematics server **130**, over the network **50**. The administration terminal **140** can be configured to

retrieve data and analytics related to one or more assets **100**; to receive alerts from the telematics server **130** in respect of one or more conditions on the telematics device **200**; and/or to issue commands to one or more telematics device **200** via the telematics server **130**. In some implementations, an administrator **11** communicates with the telematics server **130** using the administration terminal **140**. In addition to retrieving data and analytics, the administration terminal **140** allows the administrator **11** to set alerts and geofences for keeping track of the assets **100**, receiving notifications of deliveries, receiving notifications of vehicle conditions, and receiving alerts pertaining to driver behavior.

[0061] The operator terminals **150** are electronic devices, similar to the administration terminals **140**. The operator terminals **150** are shown as smartphones, however, this is not necessarily the case. An administration terminal is any one of: a desktop computer, an industrial human-machine interface (HMI), a touch screen panel, a table, a smartphone, an Augmented Reality (AR) headset, and a Network Operations Center (NOC). The operator terminals **150** are used by operators **10** (for example, vehicle drivers) of the assets **100** to both track and configure the usage of the assets **100**. For example, as shown in FIG. **1**, the operator **10_1** has the operator terminal **150_1**, the operator **10_2** has the operator terminal **150_2**, and the operator **10**_N has the operator terminal **150**_N. Assuming the operators **10** all belong to a fleet of vehicles, each of the operators **10** may operate any of the assets **100**. For example, FIG. **1** shows that the operator **10_1** is associated with the asset **100_1**, the operator **10_2** is associated with the asset **100_2**, and the operator **10**_N is associated with the asset **100**_N. However, any operator **10** may operate any asset **100** within a particular group of assets, such as a fleet. The operator terminals **150** are in communication with the telematics server **130** over the network **50**.

[0062] In operation, a telematics device **200** is coupled to an asset **100** to capture asset data. In some implementations, the asset data is combined with location data obtained by the telematics device **200** from a location module in communication with the satellites **170** and/or sensor data gathered from sensors in the telematics device **200** or another device coupled to the telematics device **200**. The combined asset data, location data, and sensor data are termed “telematics data.” The telematics device **200** sends the telematics data to the telematics server **130** over the network **50**. The telematics server **130** processes, aggregates, and/or analyzes the telematics data **212** to generate asset information pertaining to the assets **100** or to a fleet of assets. In some implementations, the telematics server **130** stores the telematics data and/or the generated asset information in the telematics database **132**. In some implementations, the administration terminal **140** connects to the telematics server **130**, over the network **50**, to access the generated asset information. In other implementations, the telematics server **130** pushes the generated asset information to the administration terminal **140**. In some implementations, the operators **10** use the operator terminals **150** to indicate to the telematics server **130** which assets **100** they are associated with. In response, the telematics server **130** updates the telematics database **132** to associate an operator **10** with an asset **100**. In some implementations, the telematics server **130** provides additional analytics related to the operators **10** including work time, location, and operating parameters. For example, for vehicle assets, the telematics data may include turning, speeding, and braking information. The telematics server **130** can correlate the telematics data **212** to the vehicle's driver by querying the telematics database **132** for a particular vehicle and retrieving the associated driver information. In some implementations, an administrator **11** uses the administration terminal **140** to set alerts for certain activities pertaining to the assets **100**. When criteria for an alert is met, the telematics server **130** sends a message to the administration terminal **140** to notify an administrator **11**. In some implementations, the telematics server **130** sends alerts to the operator terminal **150** to notify an operator **10** of the alert. In some implementations, the telematics server **130** sends alerts to the telematics device **200** to generate an alert to the driver such as a beep, a displayed message, or an audio message.

[0063] The asset **100** may have a plurality of electronic control units (ECUs) of the abovementioned types. A vehicle may, for example, have around seventy ECUs. For simplicity, only a few of the ECUs **110** are depicted in FIG. **2**. For example, in the depicted embodiment the asset **100** has three ECUs shown as the ECU **110**A, the ECU **110**B, and the ECU **110**C ("the ECUs **110**"). The ECU **110**A, the ECU **110**B, and the ECU **110**C are shown to be interconnected via an asset communications bus.

[0064] The most commonly used type of asset communications bus is the Controller Area Network (CAN) bus. CAN is a robust and standardized communication protocol designed for real-time control applications. The CAN bus is a physical bus used to connect various ECUs and sensors, allowing them to exchange data and commands. CAN ensures that different vehicle systems can work together seamlessly. ECUs are connected to the CAN bus using dedicated CAN transceivers and connectors.

[0065] For example, in FIG. **2** the ECUs **110** are interconnected using the CAN bus **104**. The ECUs **110** send and receive information to one another in CAN data frames by placing the information on the CAN bus **104**. When an ECU **110** places information on the CAN bus **104**, other ECUs **110** receive the information and may or may not consume or use that information.

[0066] Different protocols may be used to exchange information between the ECUs over a CAN bus. For example, ECUs **110** in trucks and heavy vehicles use the Society of Automotive Engineering (SAE) J1939 protocol to exchange information over a CAN bus **104**. J1939 is based on CAN and is used for diagnostic and communication purposes. Most passenger vehicles use the SAE J1979 protocol, which is commonly known as On-Board Diagnostic II (OBD-II) protocol to exchange information between ECUs **110** on their CAN bus **104**. OBD-II is a standardized diagnostic protocol used in most vehicles manufactured since the late 1990s. OBD-II provides a common interface for diagnostic tools to communicate with a wide range of ECUs in the vehicle, including the engine control module (ECM), transmission control module (TCM), and more. OBD-II allows for reading diagnostic trouble codes (DTCs), live data, and performing various diagnostic tests.

[0067] An asset **100** may allow access to information exchanged over the CAN bus **104** via an interface port **102**. For example, if the asset **100** is a passenger car, then the interface port **102** is most likely an OBD-II port. Data accessible through the interface port **102** is termed the asset data **112**. In some implementations, the interface port **102** includes a power interface for providing electric power to a telematics device **200** connected thereto.

Telematics Device

[0068] Further details relating to the telematics device **200** and how it interfaces with an asset **100** are shown with reference to FIG. **2**. FIG. **2** depicts an asset **100** and a telematics device **200** coupled thereto. Selected relevant components of each of the asset **100** and the telematics device **200** are shown.

[0069] The telematics device **200** includes a controller **230** coupled to a memory **240**, an asset interface **202** and a network interface **220**. The telematics device **200** also includes one or more sensors **204** and a location module **206**. In some implementations, the telematics device **200** contains an inertial measurement unit, shown as the IMU **290**. The telematics device **200** may also contain some optional components, shown in dashed lines in FIG. **2**. For example, the telematics device **200** may contain one or more of: a near-field communications (NFC) module such as NFC module **260**, a short-range wireless communications module **270**, and a wired communications module such as a serial communications module **280**. In some embodiments (not shown), the telematics device **200** may have a dedicated power source or a battery. In other embodiments, the telematics device **200** may receive power directly from the asset **100**, via the interface port **102**. The telematics device **200** shown is an example. Some of the components shown in solid lines may also be optional and may be implemented in separate modules. For example, some telematics devices (not shown) may not have a location module **206** and may rely on an external location module for obtaining the location data. Some telematics devices may not have any sensors **204** and may rely on external sensors for obtaining sensor data.

Interface Port

[0070] FIG. **3** depicts the pinout of a vehicle J1962 16-pin connector, also referred to as an OBD connector **300**. As shown in FIG. **3**, the OBD connector **300** has different signal lines which may be used by different protocols. Signal line **1** is known as the SAE J1850 bus+ (“J1850+) signal line and signal line **2** is known as the SAE J1850 bus− (“J1850−) signal. The J1850+/J1850− signal lines are used by the Variable Pulse Width (VPW) protocol and the Pulse Width Modulation (PWM) protocol. Signal line **7** is known as the ISO9141 K-line (“K-line”) signal line while signal line **15** is known as the ISO9141 L-line (“L-line’) signal line. The K-line and L-line are used by the ISO9141 protocol and the ISO14230 protocol. Signal line **6** is the ISO 15765-4 CAN High (“CANH”) signal line while signal line **14** is the ISO 15765-4 CAN Low (“CANL”) signal line. The CANH and CANL signal lines are used by the CAN protocol.

[0071] A vehicle asset may be connected to a diagnostic tool, such as an OBD-II reader or an emissions testing device, in addition to having a telematics device **200** connected therewith. FIG. **4** depicts the asset **100** of FIG. **2** shown connected to both a telematics device **200** and a diagnostic tool **600** via a splitter harness, commonly referred to as a T-harness **400**.

[0072] In this disclosure a “diagnostic tool” is an electronic device that may be used to read asset data **112** for the purpose of diagnosing problems, for the purpose of conducting performance testing such as emission testing, or for the purpose of ECU programming and/or firmware update. A diagnostic tool may also clear some engine error codes, typically known as Diagnostic Trouble Codes (DTCs). A diagnostic tool may also be referred to as a “scan tool” or a “testing tool”. In the depicted embodiment of FIG. **4**, the diagnostic tool **600** may be an OBD-II reader or any other diagnostic tool for use with a vehicle asset. The diagnostic tool **600** may be a stationary diagnostic tool installed in a workshop, or a portable diagnostic tool. The diagnostic tool **600** can obtain asset information by listening for broadcast data frames sent by the ECUs **110** over the CAN bus **104**, or by sending request frames to at least some of the ECUs **110** of the asset **100** requesting certain information.

[0073] A wire harness is a specially designed system that keeps numerous wires organized. In this disclosure, a “splitter harness” refers to a harness device that splits a group of signals into multiple groups of signals. As a non-limiting embodiment, a “T-harness” splits a group of signals into two groups of signals thus allowing two electrical devices to connect to the same interface. In the context of a vehicle a T-harness can be used to connect multiple devices to the interface port **102** of a vehicle. Logically, a splitter harness consists of a splitter connector and a plurality of cables or harness segments each ending in a connector for interfacing to a device. The splitter connector depicted in FIG. **4** comprises a T-connector **450**, a first harness segment **410**, a second harness segment **420**, and a third harness segment **440**. The T-connector **450** splits the group of signals provided by the interface port **102** over the first harness segment **410**, such as the signals of the OBD connector **300**, into two groups of signals sent over the second harness segment **420** and the third harness segment **440**. For example, a telematics device **200** may connect to the second harness segment **420** and a diagnostic tool **600** may connect to the third harness segment **440**. Accordingly, both the telematics device **200** and the diagnostic tool **600** have access to the interface port **102** and the CAN bus **104**.

[0074] FIG. **5** depicts a T-harness **500**. The T-harness **500** has a vehicle OBD harness connector **510**, a telematics device harness segment **520**, a telematics device harness connector **530**, an auxiliary OBD harness segment **540**, and an auxiliary OBD harness connector **550**. The vehicle OBD harness connector **510** connects the T-harness **500** to the vehicle's own OBD connector. The vehicle OBD harness connector **510** also serves as a splitter connector which splits the group of signals of the OBD connector into two identical groups of signals. A first group of signals goes into the telematics device harness segment **520**, and a second group of signals goes into the auxiliary OBD harness segment **540**. In other words, every signal of the OBD port is replicated in each of the telematics device harness segment **520** and the auxiliary OBD harness segment **540**. The telematics device harness connector **530** is shaped for receiving a telematics device **200** having a mating OBD connector. The auxiliary OBD harness connector **550** is intended to replace the vehicle's OBD connector as will be described below as we discuss installation of T-harnesses.

[0075] Many regulatory bodies, such as the California Air Resources Board (CARB) require that a vehicle's OBD port not be moved from its original location. As such, a harness such as the T-harness **500** has to be installed such that the auxiliary OBD harness connector **550** is installed in the exact same position as the vehicle's OBD connector. The installation steps of the T-harness **500** in a vehicle are explained with reference to FIG. **6**A to FIG. **6**F.

[0076] In FIG. **6**A, the vehicle OBD connector **610** is removed from the vehicle mount **620**. In FIG. **6**B, the vehicle OBD harness connector **510** is connected to the vehicle OBD connector **610**. In FIG. **6**C, the telematics device **200** is connected to the telematics device harness connector **530**.

[0077] In order to connect the auxiliary OBD harness connector **550** to the vehicle mount **620** so that it replaces the vehicle OBD connector **610**, a special adapter needs to be coupled to the auxiliary OBD harness connector **550**. This is because different vehicles have diverse types of vehicle mount **620**. Different adapters exist for different car manufacturers and/or vehicle types. The various adapters are shown in the figures and described further below. In FIG. **6**D an exemplary adapter in the form of a flange mount adapter **700** for North American vehicles is to be coupled to the auxiliary OBD harness connector **550** for allowing the auxiliary OBD harness connector **550** to fit in the vehicle mount **620** of some North American vehicles. As shown in FIG. **6**D, the flange mount adapter **700** is slid onto the auxiliary OBD harness connector front portion **552**. In FIG. **6**E, two metal clips **720** are inserted on both sides of the auxiliary OBD harness connector front portion **552** for retaining the flange mount adapter **700** in place thereon. In FIG. **6**F a connector cover **730** is slid onto the auxiliary OBD harness connector front portion **552**. In FIG. **6**G, the auxiliary OBD harness connector **550** is inserted into the vehicle mount aperture **622**. Additionally, the flange mount adapter **700** is fastened to the vehicle mount **620**, for example by a couple of screws **740** as shown. It is to be noted that other types of mounting adapters other than the flange mount adapter **700** may have different installation procedures.

[0078] FIG. **7** shows the T-harness **500** connected to the vehicle OBD connector **610**, a telematics device **200**, and a vehicle mount **620** of a vehicle. A diagnostic tool can connect to the auxiliary OBD harness connector **550**.

[0079] A problem arises from the shape of the auxiliary OBD harness connector **550**. A connector of a diagnostic tool or other similar tool may, albeit with difficulty, connect to the auxiliary OBD harness connector **550** in the wrong orientation. This is owing to the shape of the auxiliary OBD harness connector front portion **552** being substantially rectangular in shape. In some jurisdictions, an OBD connector must not be allowed to be used in a vehicle if there is even a remote chance that a diagnostic tool or similar tool may be connected backwards. In order to overcome this problem, the inventors have designed an auxiliary OBD harness connector **1050** that has an auxiliary OBD harness connector front portion **1056** that is trapezoidal in shape, as shown in FIG. **8**. The trapezoidal shape of the auxiliary OBD harness connector front portion **1056** prevents the insertion of a mating OBD connector (e.g., of a diagnostic tool) in the wrong orientation and only allows connecting a device connector to the auxiliary OBD harness connector **1050** in one correct orientation.

[0080] While the trapezoidal shape of the auxiliary OBD harness connector front portion **1056** prevents the insertion of a mating connector therein in the wrong orientation, the trapezoidal shape makes the auxiliary OBD harness connector front portion **1056** larger. In many cases, the auxiliary OBD harness connector **1050** cannot fit in the vehicle mount aperture **622** of the vehicle mount **620**, as illustrated in FIG. **9**.

[0081] The inventors have invented a modified T-harness design and an auxiliary OBD harness connector **1050** which does not allow the insertion of a corresponding connector in the wrong orientation but also fits in the vehicle mount aperture **622** of the vehicle mount **620**. The modified T-harness **1000**, for use in vehicles having an OBD port, is depicted in FIG. **10**.

[0082] With reference to FIG. **10**, the modified T-harness is comprised of a main harness portion **1000**A, and a removable harness portion **1000**B.

[0083] The main harness portion **1000**A comprises a vehicle OBD harness connector **1010**, a telematics device harness connector **1030**, a telematics device harness segment **1020**, an auxiliary harness segment **1040**, and a multi-signal receptacle connector **1070**. The main harness portion **1000**A optionally also has a two-wire receptacle connector **1080** and a two-wire plug connector **1085** on two of the signal lines leaving the vehicle OBD harness connector **1010** and going into the telematics device harness segment **1020**.

[0084] The vehicle OBD harness connector **1010** is similar to the vehicle OBD harness connector **510** and is configured to connect to a vehicle OBD connector **610**. The vehicle OBD harness connector **1010** also contains a splitter for splitting the signals of the vehicle OBD connector **610** into two groups of signals. A first group of signals is routed via the telematics device harness segment **1020** to the telematics device harness connector **1030**. A second group of signals is routed via the auxiliary harness segment **1040** to the multi-signal receptacle connector **1070**.

[0085] The telematics device harness segment **1020** is generally similar to the telematics device harness segment **520**.

[0086] The telematics device harness connector **1030** is similar to the telematics device harness connector **530**, and is configured for connecting a telematics device **200** thereto.

[0087] The auxiliary harness segment **1040** is a multi-wire cable which connects the vehicle OBD harness connector **1010** to the multi-signal receptacle connector **1070**. Specifically, the auxiliary harness segment **1040** routes the second group of signals of the two groups of signals provided by the splitter of the vehicle OBD harness connector **1010** to the multi-signal receptacle connector **1070**. In the depicted embodiment, the auxiliary harness segment **1040** is a multi-wire cable that is comprised of 16 signal lines.

[0088] The multi-signal receptacle connector **1070** is an off-the-shelf receptacle connector, such as the **206461** series made by Molex™. In the depicted embodiment, the multi-signal receptacle connector **1070** can accommodate 16 signal lines, similar to the 206461-16000 receptacle made by Molex™.

[0089] For some vehicles that have a network connection, such as an Ethernet connection, two of the signals on the vehicle OBD harness connector **1010** are dedicated to the network connection. Such signals need to be routed to the auxiliary OBD harness connector **1050** for use by a proprietary tool or device that may wish to connect to the vehicle via the network. Routing of such network signals to the auxiliary OBD harness connector **1050** may take place when the removable harness portion **1000**B is connected to the main harness portion **1000**A as will be described below. However, such networking signals should not be routed to a telematics device to prevent signal RF (radio frequency) leakage and/or the potential of shorting the network signal lines to other signal lines in the telematics device that may have different functionality. In such a case, the network connection signals may be prevented from being routed to the auxiliary OBD harness connector **1050** by disconnecting the two-wire plug connector **1085** from the two-wire receptacle connector **1080**.

[0090] In some embodiments, the networking signals comprise more than two wires. In such cases, the two-wire plug connector **1085** can be replaced by a multi-wire plug connector. Similarly, the two-wire receptacle connector **1080** is replaced with a multi-wire receptacle connector. The two-wire receptacle connector **1080** and the two-wire plug connector **1085** could also have the inverse gender. The two-wire plug connector **1085** could be connected in place of the two-wire receptacle connector **1080** and vice versa.

[0091] The removable harness portion **1000**B comprises a multi-signal plug connector **1075** configured to mate with the multi-signal receptacle connector **1070**, a multi-wire cable **1090**, and an auxiliary OBD harness connector **1050**.

[0092] The multi-signal plug connector **1075** is an off-the-shelf plug connector of the opposite gender of and is sized to fit with the multi-signal receptacle connector **1070**. When the multi-signal plug connector **1075** of the removable harness portion **1000**B is connected to the multi-signal receptacle connector **1070**, this connects the removable harness portion **1000**B to the main harness portion **1000**A to form the T-harness. In this case, signals routed to the multi-signal receptacle connector **1070** travel through the multi-signal plug connector **1075**, the multi-wire cable **1090**, and to the auxiliary OBD harness connector **1050**.

[0093] It should be noted that the multi-signal plug connector **1075** and the multi-signal receptacle connector **1070** could be swapped with the main harness portion **1000**A having the multi-signal plug connector **1075** and the removable harness portion having the multi-signal receptacle connector **1070**. Thus, the main harness portion can be thought of as having a first multi-signal connector and the removable harness portion having a second multi-signal connector configured to mate with the first multi-signal connector. The two-wire plug connector **1085** and the two-wire receptacle connector **1080** could also be multi-wire connectors instead of two-wire connectors. The two-wire plug connector **1085** could be connected to the telematics device harness segment **1020** and the two-wire receptacle connector could be connected to the vehicle OBD harness connector **1010**. Hence the main harness portion **1000**A can be thought of as having a third multi-wire connector and a fourth multi-wire connector.

[0094] The auxiliary harness connector **1050** has been described above with reference to FIG. **8**.

[0095] In the T-harness **1000** of FIG. **10**, the vehicle OBD harness connector **1010** has a built-in for splitting the signals of the vehicle OBD connector **610** into two groups of signals. In another embodiment of the T-harness **1000**, shown in FIG. **11**, the main harness portion **1000**A uses a vehicle OBD harness connector **1011** which does not contain a splitter. Instead, the main harness portion **1000**A uses a splitter **1012** coupled to the vehicle OBD harness connector **1011**. The splitter **1012** splits the signals output from the vehicle OBD harness connector **1011** into two groups of signals. A first group of signals is routed via the telematics device harness segment **1020** to the telematics device harness connector **1030**. A second group of signals is routed via the auxiliary harness segment **1040** to the multi-signal receptacle connector **1070**. As shown, the splitter **1012** is connected to an output side of the vehicle OBD harness connector **1011** via a multi-signal wire **1019**. In another implementation (not shown), the splitter may be configured to connect directly to the vehicle OBD harness connector **1011**. The telematics device harness segment **1020** carries the first group of signals from an output side of the splitter **1012** to the telematics device harness connector **1030**. The auxiliary harness segment **1040** carries the second group of signals from the output side of the splitter **1012** to the multi-signal receptacle connector **1070**. While the two-wire receptacle connector **1080** and the two-wire plug connector **1085** are not included in FIG. **11**, they may also be used in the implementation of FIG. **11** in which case the two-wire receptacle connector **1080** would be connected to a wire on the output side of the splitter **1012**.

[0096] FIGS. **12**A-**12**H depict different views of the auxiliary OBD harness connector **1050**. The auxiliary OBD harness connector **1050** has at least one locking member for mating with a matching locking structure on a vehicle mounting adapter. In the depicted embodiment, the at least one locking member is in the form of the auxiliary OBD harness connector snaps **1052** formed on opposite sides of the auxiliary OBD harness connector rear portion **1054**. The auxiliary OBD harness connector snaps **1052** are angled relative to the sidewall of the auxiliary OBD harness connector rear portion **1054** and are sized for fitting in a compatible cutout on a vehicle mounting adapter for locking the vehicle mounting adapter to the auxiliary OBD harness connector **1050**. The auxiliary OBD harness connector snaps **1052** are angled such that a vehicle mounting adapter can slide onto the auxiliary OBD harness connector **1050** from a rear side thereof **1054**. The auxiliary OBD harness connector snaps **1052** are configured to flex inwards towards the sidewall of the auxiliary OBD harness connector rear portion **1054** as a structure, such as a rib, of the mounting adapter applies pressure thereon. This facilitates the insertion of the auxiliary OBD harness connector snaps **1052** into matching cutouts on the vehicle mounting adapter.

[0097] As an example of a vehicle mounting adapter, we will first consider a flange mount adapter for North American vehicles, depicted in FIGS. **13**A-**131**. FIGS. **13**A-**13**H depict a flange mount adapter **1300** for use with Ford™, GM™, and Chrysler™ vehicles. The flange mount adapter **1300** has two rectangular cutouts **1320** configured for receiving the auxiliary OBD harness connector snaps **1052**. FIG. **131** depicts the flange mount adapter **1300** coupled to the auxiliary OBD harness connector **1050**. In FIG. **131**, the auxiliary OBD harness connector snaps **1052** are shown to have snapped into place within the two rectangular cutouts **1320** of the flange mount adapter **1300** in a locking arrangement. The steps for coupling the flange mount adapter **1300** to the auxiliary OBD connector are discussed below with reference to FIGS. **14**A-**14**B. Other cutout shapes are also contemplated as long as they can receive the auxiliary OBD harness connector snaps **1052**.

[0098] The design of the T-harness **1000** overcomes the problems described above in relation to fitting the various vehicle adapters to the auxiliary OBD harness connector **1050**. Specifically, the trapezoidal shape of the front of the auxiliary OBD harness connector **1050** prevents the insertion of the various vehicle adapters to the auxiliary OBD harness connector as shown in FIG. **9**. The split design of the T-harness **1000** permits the insertion of the vehicle adapters from the direction of the auxiliary OBD harness connector rear portion **1054**. This is demonstrated with reference to FIGS. **14**A to **14**E which depict the steps of installing the T-harness **1000** in a vehicle.

[0099] The first step of installing the T-harness **1000** in a vehicle involves the removal of the vehicle OBD connector **610** from the vehicle mount **620** as shown earlier in FIG. **6**A.

[0100] The second step is shown in FIG. **14**A. A mounting adapter suitable for the vehicle in which the T-harness **1000** is to be installed is then slipped over the removable harness portion **1000**B from the multi-signal plug connector **1075** side, over the multi-wire cable **1090**, and towards the auxiliary OBD harness connector **1050** from the direction of the auxiliary OBD harness connector rear portion **1054**. In FIGS. **14**A-**14**D, the flange mount adapter **1300** of FIGS. **13**A-**13**I is used. However, any other mounting adapter could be used as appropriate to the vehicle.

[0101] FIG. **14**B shows the auxiliary OBD harness connector **1050** with the flange mount adapter **1300** locked in place over the auxiliary OBD harness connector rear portion **1054**, as described above with reference to FIG. **13**I. Specifically the auxiliary OBD harness connector snaps **1052** have snapped into place within the rectangular cutout **1320** of the flange mount adapter **1300** thus locking the flange mount adapter **1300** to the auxiliary OBD harness connector **1050**.

[0102] The next step is to connect the removable harness portion **1000**B to the vehicle mount **620**. As discussed above with reference to FIG. **9**, the auxiliary OBD harness connector front portion **1056** is too large to fit in the vehicle mount aperture **622** of the vehicle mount **620**. However, as best seen in FIG. **12**C and FIG. **12**D, the auxiliary OBD harness connector **1050** has an auxiliary OBD harness connector rear portion **1054** that has a smaller width than the width of the auxiliary OBD harness connector front portion **1056** thereof. The auxiliary OBD harness connector rear portion **1054** is sized to pass through the vehicle mount aperture **622**. As such, to connect the removable harness portion **1000**B to the vehicle mount **620**, the multi-signal plug connector **1075** is passed through the vehicle mount aperture **622**, and the multi-wire cable **1090** is also threaded through the vehicle mount aperture **622**. Then the auxiliary OBD harness connector rear portion **1054** and the vehicle mounting adapter connected thereto are fitted in the vehicle mount aperture **622**. At this point, the vehicle mount adapter is connected to the vehicle mount **620** by whatever means the vehicle mount and the vehicle mount adapter are designed to use. FIG. **14**C depicts the removable harness portion **1000**B connected to the vehicle mount **620** at the auxiliary OBD harness connector **1050** and having a slide and lock mount adapter **1700** fitted thereon.

[0103] The next step is to connect the main harness portion **1000**A to the removable harness portion **1000**B, as shown in FIG. **14**D. Connecting the main harness portion **1000**A to the removable harness portion **1000**B comprises connecting the multi-signal plug connector **1075** to

the multi-signal receptacle connector **1070**.
[0104] The last step is to connect the vehicle OBD harness connector **1010** to the vehicle OBD connector **610**, as shown in FIG. **14**E.
[0105] FIG. **15** shows the T-harness **1000** with a telematics device **200** connected to the telematics device harness connector **1030**. The main harness portion **1000**A and the removable harness portion **1000**B are connected to one another, and the auxiliary OBD harness connector **1050** has a flange mounting adapter **1300** that allows the auxiliary OBD harness connector to be mounted to a vehicle mount **620**.
[0106] Advantageously, the T-harness **1000** replaces the vehicle OBD connector **610** with the auxiliary OBD harness connector **1050** which does not permit any connection thereto in an incorrect orientation. This is owing to the trapezoidal shape of the auxiliary OBD harness connector front portion **1056**. Additionally, the removable harness portion **1000**B allows for fitting the auxiliary OBD harness connector **1050** and any mounting adapter fitted thereto, to the vehicle mount from the direction of the auxiliary OBD harness connector rear portion **1054** and thus fit in the vehicle mount aperture **622**. Furthermore, the installation is made simple as the removable harness portion **1000**B is easy to handle due to its small size. As a result, installing the removable harness portion **1000**B to the vehicle mount **620** before connecting the main harness portion **1000**A makes the installation simple.
[0107] For vehicles which have network signal lines, the T-harness **1000** includes the two-wire receptacle connector **1080** and the two-wire plug connector **1085** on some signal lines routed from the vehicle OBD harness connector **1010** to the telematics device harness segment **1020**. Accordingly, such network signal lines can be disconnected and not routed to a telematics device connected to the telematics device harness connector **1030**. Advantageously, potential for RF leakage or an accidental shorting of such signal lines are averted.
[0108] Embodiments have been described where the techniques are implemented in circuitry and/or computer-executable instructions. It should be appreciated that some embodiments may be in the form of a method or process, of which at least one example has been provided. The acts performed as part of the method or process may be ordered in any suitable way. Accordingly, embodiments may be constructed in which acts are performed in an order different than illustrated, which may include performing some acts simultaneously, even though shown as sequential acts in illustrative embodiments. Various aspects of the embodiments described above may be used alone, in combination, or in a variety of arrangements not specifically discussed in the embodiments described in the foregoing and is therefore not limited in its application to the details and arrangement of components set forth in the foregoing description or illustrated in the drawings. For example, aspects described in one embodiment may be combined in any manner with aspects described in other embodiments.

Claims

1. A T-harness for use in vehicles having an On-Board Diagnostic (OBD) port, the T-harness comprising: a main harness portion including: a vehicle OBD harness connector; splitter connected with an output side of the vehicle OBD harness connector; a telematics device harness connector; a telematics device harness segment connecting an output of the splitter to the telematics device harness connector; a first multi-signal connector; an auxiliary harness segment connecting the output of the splitter to the first multi-signal connector; a removable harness portion including: an auxiliary OBD harness connector; a second multi-signal connector configured for mating with the first multi-signal connector; and a multi-wire cable connecting the second multi-signal connector to the auxiliary OBD harness connector.
2. The T-harness of claim 1, wherein the first multi-signal connector comprises a multi-signal receptacle connector and the second multi-signal connector comprises a multi-signal plug

connector.

3. The T-harness of claim 1, wherein the first multi-signal connector comprises a multi-signal plug connector and the second multi-signal connector comprises a multi-signal receptacle connector.

4. The T-harness of claim 1, wherein the auxiliary OBD harness connector comprises an auxiliary OBD harness connector front portion and an auxiliary OBD harness connector rear portion.

5. The T-harness of claim 4, wherein the auxiliary OBD harness connector front portion is trapezoidal in shape thus preventing connecting a device connector to the auxiliary OBD harness connector except in one correct orientation.

6. The T-harness of claim 4, wherein the auxiliary OBD harness connector rear portion has a smaller width than a width of the auxiliary OBD harness connector front portion thus permitting insertion of the auxiliary OBD harness connector rear portion in a vehicle mount aperture.

7. The T-harness of claim 1, wherein the splitter splits signals of the vehicle OBD harness connector into: a first plurality of signal lines routed to the telematics device harness connector via the telematics device harness segment; and a second plurality of signal lines routed to the first multi-signal connector via the auxiliary harness segment.

8. The T-harness of claim 1, further comprising: a third multi-signal connector connected to a first plurality of signal lines in the vehicle OBD harness connector; and a fourth multi-signal connector, suitable for mating with the third multi-signal connector, the second multi-signal connector connected to a second plurality of signal lines in the telematics device harness segment.

9. The T-harness of claim 8, wherein the first plurality of signal lines in the vehicle OBD harness connector correspond to networking signal lines.

10. The T-harness of claim 8, wherein the third multi-signal connector comprises a multi-signal plug connector and the fourth multi-signal connector comprises a multi-signal receptacle connector.

11. The T-harness of claim 8, wherein the third multi-signal connector comprises a multi-signal receptacle connector and the fourth multi-signal connector comprises a multi-signal plug connector.

12. The T-harness of claim 1, wherein the splitter is an integral part of the vehicle OBD harness connector.

13. A method of installing a T-harness in a vehicle having an OBD port including a vehicle OBD connector connected to a vehicle mount, the method comprising: disconnecting the vehicle OBD connector from the vehicle mount; connecting a mounting adapter to an auxiliary OBD harness connector of the T-harness at an auxiliary OBD harness connector rear portion; connecting the auxiliary OBD harness connector to the vehicle mount at the auxiliary OBD harness connector rear portion; connecting a removable harness portion of the T-harness to a main harness portion of the T-harness; and connecting the vehicle OBD connector to a vehicle OBD harness connector of the T-harness.

14. The method of claim 13, wherein connecting the mounting adapter to the auxiliary OBD harness connector at the auxiliary OBD harness connector rear portion comprises sliding the mounting adapter over the auxiliary OBD harness connector until at least one locking member of the auxiliary OBD harness connector mates with at least one locking structure of the mounting adapter.

15. The method of claim 14, wherein: the at least one locking member comprises at least one snap formed on at least one sidewall of the auxiliary OBD harness connector; and the at least one locking structure of the mounting adapter comprises at least one cutout on at least one sidewall of the mounting adapter, the at least one cutout sized and shaped for receiving the at least one snap in a locking arrangement.

16. The method of claim 13, wherein connecting the removable harness portion to the main harness portion comprises connecting a first multi-signal connector of the main harness portion to a second multi-signal connector of the removable harness portion.

17. The method of claim 16, wherein the first multi-signal connector comprises a multi-signal plug connector and the second multi-signal connector comprises a multi-signal receptacle connector.

18. The method of claim 16, wherein the second multi-signal connector comprises a multi-signal plug connector and the first multi-signal connector comprises a multi-signal receptacle connector.
19. The method of claim 13, further comprising disconnecting a third multi-signal connector connected to a telematics device harness segment of the T-harness from a fourth multi-signal connector connected to the vehicle OBD harness connector of the T-harness.
20. The method of claim 13, further comprising connecting a telematics device to a telematics device harness connector of the T-harness.