GM	**WORLDWIDE ENGINEERING STANDARDS**	**General Specification**	**INACTIVE GMW8781**

Platform to Powertrain Electrical Interface Specification Vehicle Speed and Rough Road Sensing Subsytem

This document is inactive with no replacement.

1 Scope

This standard is inactive with no replacement.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

None

3 Release and Revisions

This standard was originated in June 2003. It was first approved by the Global PPEI Core Team in December 2003. It was first published in February 2004.

Issue	Publication Date	Description (Organization)
1	FEB 2004	Initial publication.
2	AUG 2004	Global PPEI Version 3.5 Release.
3	JUL 2005	Global PPEI Version 3.6 Release.
4	MAR 2006	Global PPEI Version 3.7 Release.
5	AUG 2010	Global PPEI Version 3.8 Release. (Global PPEI Core Team)
6	SEP 2011	This standard is inactive with no replacement. (Powertrain Interface)

GM	WORLDWIDE ENGINEERING STANDARDS	General Specification Electrical/Electronic	GMW8781

Platform to Powertrain Electrical Interface Specification Vehicle Speed and Rough Road Sensing Subsystem

1 Introduction

Note: Nothing in this standard supersedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Scope. This standard defines the electrical interface between Platform and Powertrain for the Vehicle Speed and Rough Road Sensing Subsystem.

1.2 Mission/Theme. Not applicable.

1.3 Classification. This specification applies to all vehicles.

1.4 Applicability. The **GMW8762** Platform to Powertrain Electrical Interface (PPEI) Standard Specification includes: General Information, On-Board Diagnostics and Electrical Requirements and GM Local Area Network (GMLAN) Serial Data Signal Definitions and Framing for the following 19 PPEI subsystems standard specifications:

- **GMW8763** Power and Ground
- **GMW8764** Four Wheel Drive/All Wheel Drive Controls
- **GMW8765** Displays and Gauges
- **GMW8766** Engine Power Management
- **GMW8767** Starter Control
- **GMW8768** Vehicle Theft Deterrent
- **GMW8769** Cruise Control
- **GMW8770** Cooling Fan Control
- **GMW8771** Air Conditioning Compressor Control
- **GMW8772** Serial Data Architecture
- **GMW8773** Brakes and Traction Control
- **GMW8774** Enhanced Evaporative Emissions and Fuel
- **GMW8775** Exhaust After-Treatment
- **GMW8776** Suspension Control
- **GMW8777** Transmission
- **GMW8778** Generator Control
- **GMW8779** Post Collision Operation
- **GMW8780** Power Take-Off and Fast Idle Control
- **GMW8781** Vehicle Speed and Rough Road Sensing

Each of the 19 PPEI subsystem standard specifications contains the hardware, serial data, algorithms and calibrations for the named subsystem.

The master PPEI document and all 19 PPEI subsystem standard specifications are required to define the complete set of PPEI requirements.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW3001	GMW8771
GMW3059	GMW8772
GMW8762	GMW8773
GMW8763	GMW8774
GMW8764	GMW8775
GMW8765	GMW8776
GMW8766	GMW8777
GMW8767	GMW8778
GMW8768	GMW8779
GMW8769	GMW8780
GMW8770	

2.3 Additional References.

Global A Electrical Architecture Vehicle Odometer Sense & Display

GM Powertrain (GMPT) Cruise Control Subsystem Technical Specification (SSTS)

3 Subsystem Requirements

3.1 Functional Overview. Vehicle speed information is provided by Powertrain for various Platform functions. This information is available via serial data.

a. A distance rolling count serial data message provided by Powertrain is required for display and navigation purposes. All On-Board Diagnostic (OBD) modules or devices that support legislated Parameter Identifiers (PIDs) $21 and/or $31 shall use the distance rolling count serial data message for calculating distance traveled.

b. The counter shall be a function of at most two independent sources of data. The data sources available may be any of the following:
   1. Platform-supplied Wheel Rotational Status signals.
   2. Powertrain hardwired transmission output speed sensor.

c. When Wheel Rotational Status data is used to compute the distance rolling counter, Powertrain shall average the appropriate sources to compute the distance rolling counter. This means that if one of the sources is invalid, Powertrain shall not use that value in the average.

d. If both sources are failed, all distance rolling computations shall cease and the outgoing validity flag shall indicate “Invalid”. If either source subsequently repairs itself, distance rolling computations shall resume, even during the same ignition cycle.

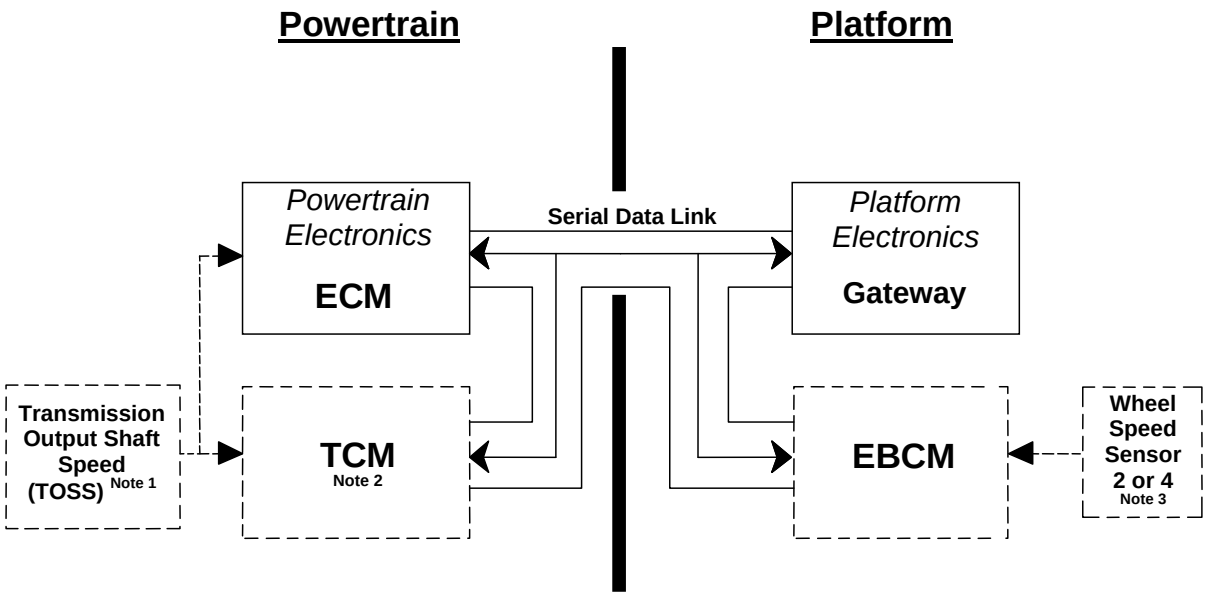
Tire size and axle ratio information shall reside in the Powertrain electronics since it is required for vehicle speed and distance rolling count calculation.

Rough road information is required for Powertrain diagnostics in some vehicles. For applications that require rough road sensing, the rough road parameter shall be calculated in the Engine Control Module (ECM). The calculation shall be based on wheel speed sensor data available via serial data.

3.2 Hardware Overview. Powertrain shall calculate vehicle speed and distance rolling count based any of the following pieces of source data: Transmission Output Shaft Sensor or Wheel Rotational Status signals transmitted by the Electronic Brake Control Module (EBCM) via the GMLAN high speed serial data link.

Vehicle speed and distance information shall be transmitted by Powertrain to Platform via the GMLAN high-speed serial data link.

3.2.1 Block Diagram. Figure 1 depicts a typical mechanization for the Platform-Powertrain electrical interface. This interface is the only standard defined.



Note 1: Vehicles with automatic transmissions are equipped with both an ECM and a TCM. TOSS is required on such applications and shall connect to the TCM. On vehicles without a TCM, the TOSS may connect to the ECM.
Note 2: Vehicles with manual transmissions are not equipped with a TCM. TOSS is mandatory on such applications in the OBD II market and, if available, shall connect to the ECM.
Note 3: Platform shall provide a hardwired 4000 pulse/mile signal if required for platform functions.

Figure 1: Vehicle Speed and Rough Road Sensing Block Diagram

3.3 Interface Description.

3.3.1 Serial Data Link. Vehicles equipped with a four-channel Anti-Lock Brake System (ABS) shall provide Powertrain four high-resolution pulse accumulation/timestamp signal sets, one associated with each wheel. Vehicles equipped with a three channel ABS system shall provide Powertrain two high resolution pulse accumulation/timestamp signal sets, one associated with the left non-driven wheel and one associated with the right non-driven wheel. Reference GMW8762, PPEI GMLAN Serial Data Signal Definitions and Framing Requirements for definitions of signals listed below in Table 1.

Table 1: Vehicle Speed and Rough Road Sensing Serial Data Signals

Signal Name	Transmitter	Notes
Antilock Brake System Active	Platform	Required with Anti-Lock Brake System (ABS)
Distance Rolling Count Average Driven	Powertrain	Required
Distance Rolling Count Average Driven Reset Occurred	Powertrain	Required
Distance Rolling Count Average Driven Source	Powertrain	Required
Distance Rolling Count Average Driven Validity	Powertrain	Required
Distance Rolling Count Average Non-Driven	Powertrain	Required
Distance Rolling Count Average Non-Driven Reset Occurred	Powertrain	Required
Distance Rolling Count Average Non-Driven Validity	Powertrain	Required
Driveline Final Axle Ratio	Powertrain	Platform Optional
Traction Control System Active	Platform	Required with Traction Control
Vehicle Speed Average Driven	Powertrain	Required
Vehicle Speed Average Driven Source	Powertrain	Required
Vehicle Speed Average Driven Validity	Powertrain	Required
Vehicle Speed Average Non-Driven	Powertrain	Required
Vehicle Speed Average Non-Driven Validity	Powertrain	Required
Vehicle Stability Enhancement System Active	Platform	Required with Vehicle Stability Enhancement System (VSES)
Wheel Distance Per Revolution Driven	Powertrain	Platform Optional
Wheel Distance Per Revolution Non-Driven	Powertrain	Platform Optional
Wheel Rotational Status Left Driven	Platform	Required with ABS
Wheel Rotational Status Left Non-Driven	Platform	Required with ABS
Wheel Rotational Status Right Driven	Platform	Required with ABS
Wheel Rotational Status Right Non-Driven	Platform	Required with ABS
Wheel Speed Sensing Legislated Diagnostic Status	Platform	Required with Wheel Sensor Rough Road Magnitude Signal

3.3.2 Calibrations. Table 2 contains calibrations that cross the Platform to Powertrain Electrical Interface (i.e., are located in devices on one side of the interface but controlled by the other side of the interface or driven by variation in the other side of the interface). Refer to Section 4 for details.

3.3.3 Vehicle Speed Signal Processing Tolerance Limit. In order to meet California and Hawaii State laws for odometer accuracy, the total odometer system accuracy shall be within ± 4%. Measurement errors due to target wheel tooth spacing, sensor construction and mounting, and ECM processing shall not exceed ± 2.5%. ECM processing error shall not exceed ± 0.5%. See Figure 2.

3.4 Failure Modes and Diagnostics. Refer to GMW8772, Serial Data Architecture for serial data failure modes and diagnostic information.

3.5 Electrical Characteristics. Not applicable.

Table 2: Vehicle Speed and Rough Road Sensing Calibrations Table

Calibration Name	Location	Owner
K_DrivenWheelPulsesPerRevolution	Powertrain	Platform
K_DrivenWheelsDescription	Powertrain	Platform
K_FinalAxleRatio	Powertrain	Platform
K_NonDrivenWheelPulsesPerRevolution	Powertrain	Platform
K_WheelDistancePerRevolutionDriven	Powertrain	Platform
K_WheelDistancePerRevolutionNonDriven	Powertrain	Platform
K_WheelRotationalStatusNominalSamplePeriod	Powertrain	Platform
K_WheelRotationalStatusTimestampResolution	Powertrain	Platform
K_WheelSpeedSensorsPresent	Powertrain	Platform

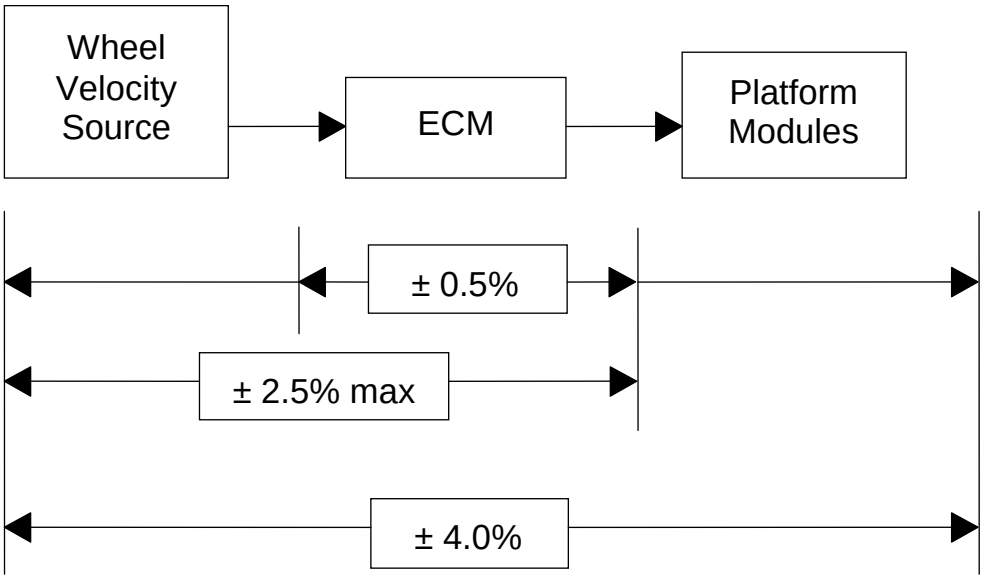


Figure 2: Tolerance Limits for Odometer/Vehicle Speed Accuracy

4 Algorithm

4.1 Vehicle Speed and Rough Road Sensing Calibrations Requirements.

4.1.1 General Overview. Vehicle Speed and Rough Road Sensing Calibration requirements contain only calibrations values that are owned by Platform and are located in Powertrain.

Vehicle Speed and Rough Road Sensing Algorithm is owned by Powertrain and is not defined in this calibration requirements section. For information on documentation for the rough road detection algorithm, refer to Section 3.

4.1.2 Vehicle Speed and Rough Road Sensing Algorithm Interface. Not applicable.

4.1.2.1 Context Diagram. Not applicable.

4.1.2.2 Requirements. Not applicable.

4.1.3 Execution/Activation Requirements. Not applicable.

4.1.4 Powertrain System State Transition Requirements. Not applicable.

4.1.5 Diagnostic Action Requirements. Not applicable.

4.1.6 Off-Vehicle Communications/Serial Data Interaction Requirements. Not applicable.

4.1.7 Data Dictionary.

4.1.7.1 Calibrations.

4.1.7.1.1 K_DrivenWheelsDescription. This calibration identifies whether the front wheels or the rear wheels are the driven wheels. It is used by a receiver of the Wheel Rotational Status GMLAN signals to determine which signals are associated with the driven wheels. The Wheel Rotational Status GMLAN signals are identified as driven or non-driven and require this calibration to identify the relationship between front and rear. When the calibration is set to “Front” then the front wheel signals are associated with the driven wheels. When the calibration is set to “Rear” then the rear wheel signals are associated with the driven wheels. Powertrain may use the Wheel Rotational Status signals for determination of cornering, left vs. right driven wheel slip, driven vs. non-driven wheel slip, vehicle reference speed (average non-driven wheel speed), and detection of non-normal driving stress on differentials and transfer cases.

Minimum Range:	Front/Rear
Minimum Resolution:	Not applicable
Typical Values:	Not applicable
Emissions Related:	No
Cal value owner:	Platform
Location:	Powertrain

4.1.7.1.2 K_DrivenWheelPulsesPerRevolution. Calibration that defines the driven wheel pulses per wheel revolution. This calibration is used by a receiver of the Wheel Rotational Status GMLAN signal to calculate vehicle distance traveled, speed and acceleration.

Minimum Range:	See note below regarding pulses per revolution and distance per revolution.
Minimum Resolution:	1
Typical Values:	Not applicable
Emissions Related:	Yes
Cal value owner:	Platform
Location:	Powertrain

Note: Calibration note regarding pulses per revolution and distance per revolution. For each axle (driven and non-driven) the terms pulses per revolution and distance per revolution shall be calibrated as a system. That is, the combination of the two calibrations results in a “ground distance per pulse” value. Distance per revolution ÷ pulses per revolution yields “ground distance per pulse”. Ground distance per pulse shall range between 15 and 63 mm as defined in GMW8762.

4.1.7.1.3 K_FinalAxleRatio. Calibration that defines the Final Axle Ratio = Axle Differential Input Speed (or Drive Shaft Speed)/Axle Differential Output Speed (or Wheel Axle Speed). This calibration is used by a receiver of the Wheel Rotational Status GMLAN signal in conjunction with

K_WheelDistancePerRevolutionDriven on TOSS (TOSS is mandatory on all automatic and manual transmissions in the OBDII market) equipped Vehicles to calculate vehicle distance traveled and speed.

Minimum Range:	2 to 6
Minimum Resolution:	0.01
Typical Values:	Not applicable
Emissions Related:	Yes
Cal value owner:	Platform
Location:	Powertrain

Note: Calibration note regarding pulses per revolution and distance per revolution. For each axle (driven and non-driven) the terms pulses per revolution and distance per revolution shall be calibrated as a system. That is, the combination of the two calibrations results in a “ground distance per pulse” value. Distance per revolution ÷ pulses per revolution yields “ground distance per pulse”. Ground distance per pulse shall range between 15 and 63 mm as defined in GMW8762.

4.1.7.1.4 K_NonDrivenWheelPulsesPerRevolution. Calibration that defines the non-driven wheel pulses per wheel revolution. This calibration is used by a receiver of the Wheel Rotational Status GMLAN signal to calculate vehicle distance traveled, speed and acceleration.

Minimum Range:	See note below regarding pulses per revolution and distance per revolution.
Minimum Resolution:	1
Typical Values:	Not applicable
Emissions Related:	Yes
Cal value owner:	Platform
Location:	Powertrain

Note: Calibration note regarding pulses per revolution and distance per revolution. For each axle (driven and non-driven) the terms pulses per revolution and distance per revolution shall be calibrated as a system. That is, the combination of the two calibrations results in a “ground distance per pulse” value. Distance per revolution ÷ pulses per revolution yields “ground distance per pulse”. Ground distance per pulse shall range between 15 and 63 mm as defined in GMW8762.

4.1.7.1.5 K_WheelDistancePerRevolutionDriven. Calibration that defines the driven wheel circumferential distance per revolution. This is commonly derived from the specified number of tire revolutions per kilometer. This calibration is used by a receiver of the Wheel Rotational Status GMLAN signal to calculate vehicle distance, speed and acceleration.

Minimum Range:	See note below regarding pulses per revolution and distance per revolution.
Minimum Resolution:	3 mm
Typical Values:	Not applicable
Emissions Related:	Yes
Cal value owner:	Platform
Location:	Powertrain

Note: Calibration note regarding pulses per revolution and distance per revolution. For each axle (driven and non-driven) the terms pulses per revolution and distance per revolution shall be calibrated as a system. That is, the combination of the two calibrations results in a “ground distance per pulse” value. Distance per revolution ÷ pulses per revolution yields “ground distance per pulse”. Ground distance per pulse shall range between 15 and 63 mm as defined in GMW8762.

4.1.7.1.6 K_WheelDistancePerRevolutionNonDriven. Calibration that defines the non-driven wheel circumferential distance per revolution. This is commonly derived from the specified number of tire revolutions per kilometer. This calibration is used by a receiver of the Wheel Rotational Status GMLAN signal to calculate vehicle distance, speed and acceleration.

Minimum Range:	See note below regarding pulses per revolution and distance per revolution
Minimum Resolution:	3 mm
Typical Values:	Not applicable
Emissions Related:	Yes

Cal value owner: Platform

Location: Powertrain

Note: Calibration note regarding pulses per revolution and distance per revolution. For each axle (driven and non-driven) the terms pulses per revolution and distance per revolution shall be calibrated as a system. That is, the combination of the two calibrations results in a “ground distance per pulse” value. Distance per revolution ÷ pulses per revolution yields “ground distance per pulse”. Ground distance per pulse shall range between 15 and 63 mm as defined in GMW8762.

4.1.7.1.7 K_WheelRotationalStatusNominalSamplePeriod. This calibration defines the nominal time interval between periodic calculations and transmissions of the wheel speed pulse and timestamp data contained in the Wheel Rotational Status GMLAN signals. This calibration may be used as a parameter in filtering or processing data derived from the received Wheel Rotational Status GMLAN signals.

Minimum Range: 10 to 15 ms

Minimum Resolution: 0.10 ms

Typical Values: Not applicable

Emissions Related: No

Cal value owner: Platform

Location: Powertrain

4.1.7.1.8 K_WheelRotationalStatusTimestampResolution. Calibration that defines the timebase associated with the Wheel Distance Timestamp subsignal in the GMLAN signals Wheel Rotational Status Left Driven and Wheel Rotational Status Right Driven. This calibration is used by a receiver of the Wheel Rotational Status signal to calculate vehicle distance, speed and acceleration. Refer to the signal definitions of these signals for further information.

Maximum Range: 0.000 to 4.000 µs

Note: This calibration shall be limited to a maximum value of 4.000 µs

Minimum Resolution: 0.002 ms

Typical Values: Not applicable.

Emissions Related: Yes

Cal value owner: Platform

Location: Powertrain

4.1.7.1.9 K_WheelSpeedSensorsPresent. Calibration that determines the wheel speed sensors present on the vehicle. When the calibration is set to “Driven and Non-Driven” then four wheel speed sensors are present on the vehicle. When the calibration is set to “Driven” then only the Driven wheel speed sensors are present on the vehicle. When the calibration is set to “Non-Driven” then only the non-driven wheel speed sensors are present on the vehicle. This calibration is used to determine which of the wheel rotational status signals contain data.

Minimum Range: Driven, Non-Driven, Driven and Non-Driven

Minimum Resolution: Not applicable

Typical Values: Not applicable

Emissions Related: No

Cal value owner: Platform

Location: Powertrain

4.1.7.2 Variables. Not applicable.

5 Provisions for Shipping

Not applicable.

6 Notes

6.1 Glossary. Not applicable.

6.2 Acronyms, Abbreviations, and Symbols.

Refer to GMW8762, Appendix A.3

7 Additional Paragraphs

7.1 All materials supplied to this specification must comply with the requirements of GMW3001, Rules and Regulations for Materials Specifications.

7.2 All parts or systems supplied to this standard must comply with the requirements of GMW3059, **Restricted and Reportable Substances for Parts.**

8 Coding System

This standard shall be referenced in other documents, drawings, etc., as follows:

GMW8781

9 Release and Revisions

This standard was originated in June 2003. It was first approved by The Global PPEI Core Team in December 2003. It was first published in February 2004.

Issue	Publication Date	Description (Organization)
1	FEB 2004	Initial publication.
2	AUG 2004	Global PPEI Version 3.5 Release.
3	JUL 2005	Global PPEI Version 3.6 Release.
4	MAR 2006	Global PPEI Version 3.7 Release.
5	AUG 2010	Global PPEI Version 3.8 Release. (Global PPEI Core Team)

Appendix A

The following are approved Change Requests (CRs) for the Global PPEI Version 3.8 Release that impacted the GMW8781 Vehicle Speed and Rough Road Sensing Subsystem.

Sections Changed	Description of Changes	Rationale/ Authorization
2.3	Add Global A Electrical Architecture Vehicle Odometer Sense & Display.	CR244
3.2.1 4.1.7.1	Figure 1; note 2 updated to reflect that TOSS is mandatory on such applications in the OBD II market. Added Toss is mandatory on all automatic and manual transmissions in the OBD II market.	CR 2677
4.1.7.1	Revise **K_DrivenWheelPulsesPerRevolution**, **K_NonDrivenWheelPulsesPerRevolution**, **K_WheelDistancePerRevolutionDriven** and **K_WheelDistancePerRevolutionNonDriven** to add revise the minimum range to specify a calibration note. Add calibration note.	CR1709
3.1	Add to first paragraph: “All On-Board Diagnostic (OBD) modules or devices that support legislated Parameter Identifiers (PIDs) $21 and/or $31 shall use the distance rolling count serial data message for calculating distance traveled.”	CR10545

Deviations

Not applicable.