Au Truck/Bus FMS Simulator
User Manual

Rev. C

Au Group Electronics

December 2018
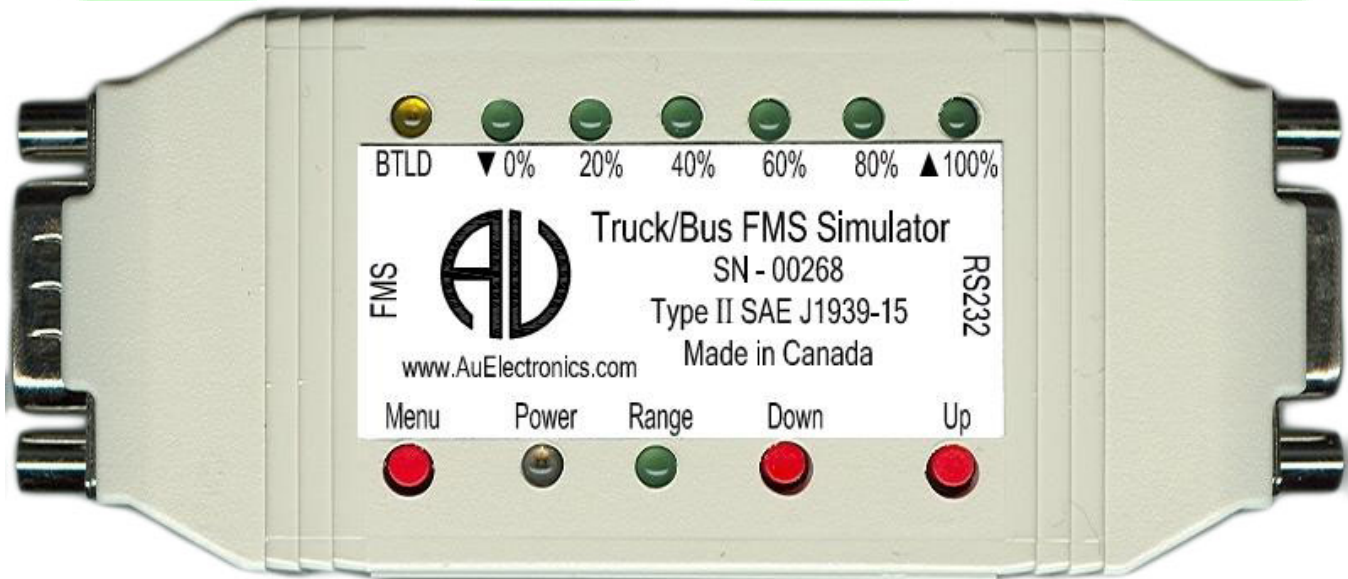
Table of Contents

Chapter 1 Introduction 3
1.1 FMS CAN Network Topology with Au FMS Simulator.........................3
1.2 Eight Editions of Au FMS Simulators..4
1.3 Major Hardware Features..4
1.4 Major Features 5
1.5 License /Software Code Upgrade and Support Service 6
Chapter 2 Supported FMS Parameters 7
2.1 Common FMS Parameters (47 SPNs + 68 TBIS) 7
2.2 Truck FMS Only Parameters (8 SPNs) 9
2.3 Bus FMS Only Parameters (51 SPNs) 9
Chapter 3 Operating Instructions 10
3.1. Power On / Network Connection 10
3.2. Operating Modes (Static/Dynamic)..10
3.3. Push Button Functions 10
3.4. LED Indicator Status 11
Chapter 4 Remote Terminal GUI 14
4.1 Display Panel – Common Parameters (47 SPNs)............................14
4.2 Display Panel –Truck FMS only Parameters (8 SPNs) 15
4.3 Display Panel – Bus FMS only Parameters (51 SPNs) 16
4.4 Step 1: Connect FMS Simulator to PC and FMS network.................16
4.4.1 CAN Baud Rate Configuration (Optional)..17
4.4.2 Change VIN Style 18
4.5 Step 2: Remote Control the FMS Simulator 19
Chapter 5 Data Configuration 21
5.1 Data for Common parameters:...23
5.2 Data for Truck FMS only Parameter:..25
5.3 Data for Bus FMS only Parameters..26
5.4 PGN List 26
5.5 Detail Data from step 0 to 100%..28
Appendex A - Remote Terminal Installation Guide...............................39
Appendex B - License Management..41
B-1 What's needed to upgrade Au FMS Simulator License?...................41
B-2 Step by Step License Upgrading Procedure 41
Appendex C - Au PIC Serial Bootloader Application Note....................43
C-1 What's needed Before Install Au PIC Bootloader?...........................43
C-2 How to Install Au PIC Bootloader? 43
C-3 How to Use Au PIC Bootloader? 45

Chapter 1 Introduction

Au Truck/Bus Fleet Management System (FMS) Simulators (Figure 1-1), a family of well designed devices, are capable of simulating majority of CAN (Control Area Network) signals on a vehicle FMS network. They can be connected to FMS CAN Network at the DB9 male connector marked as "FMS".

Pin out of the "FMS" side, DB9 male interface is illustrated in figure 1-2a.

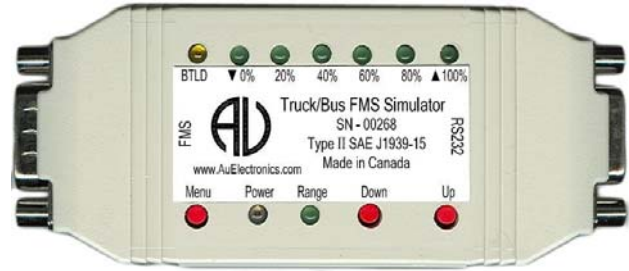Pin-out of the "RS232" side, DB9 female interface is illustrated in Figure 1-2b.

Figure 1-1 Au Truck/Bus FMS Simulator

The "RS232" side is designed as a DCE device (Data circuit terminating Equipment), which indicates: 2 = TXD, pin 3 = RXD, Pin 5=GND.   The RS232 connector can be connected to a DTE (Device Terminal equipment) device (e.g. a PC) with a straight wired cable. If the end user's device is a also a DCE device, a cross-over null modem connection, in the form of either an adapter or a cable must be used.

Pin 1: GND   Pin 6: CAN-L
Pin 5: +12V DC   Pin 7: CAN-H

Figure 1-2a Pin-out for FMS side DB9 male connector

Pin 2: To PC RXD   Pin 3: from PC TXD
Pin 5: GND

Figure 1- 2b Pin-out for RS232 side DB9 female connector

1.1   FMS CAN Network Topology with Au FMS Simulator

A typical FMS CAN network topology with Au Truck/Bus FMS Simulator is illustrated in Figure 1-3, PC remote terminal is optional. (Note: A 120 Ohm terminal resistor is included in this J1939-15 type II device.)
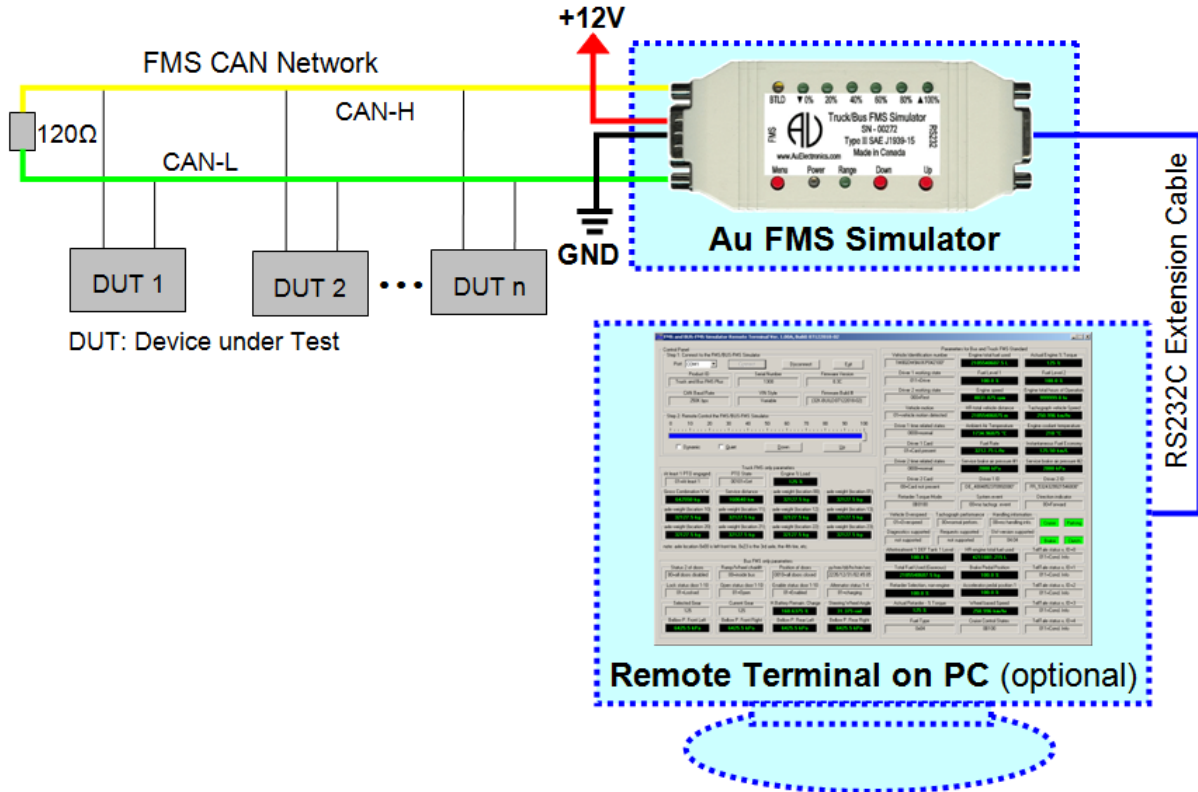
Figure 1-3 Typical FMS CAN Network topology with Au FMS Simulator (a SAE J1939-15 type II device)

1.2   Eight Editions of Au FMS Simulators

For variable user's applications, Au FMS Simulator is offered in different tiers: Value package FMS Simulator, Truck FMS Simulator, Bus FMS Simulator, or Truck and Bus FMS Simulator.

Basic Functions of Each Edition

- Au **Value Package** **FMS Simulator** can "statically" or "dynamically" generates **common** parameters shared by **Bus** FMS-Standard **and Truck** FMS-Standard defined in "*FMS-Standard Version 04* " dated on October 13, 2017.
- Au **Truck** **FMS Simulator** can "statically" or "dynamically" generate all parameters for **Truck** FMS-Standard, defined in "*FMS-Standard Version 04* " dated on October 13, 2017.
- Au **Bus** **FMS Simulator** can "statically" or "dynamically" generate all parameters for **Bus** FMS-Standard, defined in "*FMS-Standard Version 04* " dated on October 13, 2017.
- Au **Truck and Bus** **FMS Simulator** can "statically" or "dynamically" generate **all** parameters for both **Truck** FMS-Standard, and **Bus** FMS-Standard, defined in "*FMS-Standard Version 04* " dated on October 13, 2017.

As an option of added easy of use, PC software "**Remote Terminal**", is available to control and display simulated FMS signals from a personal computer (PC) through RS232 interface for all **Plus** edition FMS Simulator.

The **plus** editions have all the functions of **non-plus** editions, plus a **PC Remote Terminal program** (detail information is available in chapter 4.)

Plus Edition = Non-plus Edition + PC Remote Terminal Program

This document will introduce major hardware features, important parameters, operating instruction, remote terminal program and data configuration for all 8 editions of Au Truck/Bus FMS Simulators.

With the built-in serial bootloading feature, future released firmware can be in-filed updated in a very short time through RS232 interface.

The part # for 8 editions of Au Truck/Bus FMS Simulator and required accessories are listed in Table 1-1

Table 1-1 Part # for Au Truck/Bus FMS Simulator and necessary accessories

Au SAE Truck/Bus FMS, Accessories, and Service		Part #
Non-Plus Edition	Au Value Package FMS Simulator **non-plus** Edition	SIM-FMS-007
	Au Truck FMS Simulator **non-plus** Edition	SIM-FMS-001
	Au Bus FMS Simulator n**on-plus** Edition	SIM-FMS-002
	Au Truck and Bus FMS Simulator **non-plus** Edition	SIM-FMS-003
Plus Edition	Au Value Package FMS Simulator **Plus** Edition	SIM-FMS-008
	Au Truck FMS Simulator **Plus** Edition	SIM-FMS-004
	Au Bus FMS Simulator **Plus** Edition.	SIM-FMS-005
	Au Truck and Bus FMS Simulator **Plus** Edition	SIM-FMS-006
Accessories	USB to RS232 Serial Converter Cable	CBL-USB-232
	Cable for connection of power supply, CAN network and Power jacket	CBL-CAN-01M
	Wall Mount AC/DC Power Supply, positive center	PWR-912V-CP
	Cable for connection of power supply and CAN network	CBL-CAN-01
	RS232 Serial Extension Cable	CBL-RS232-01
Service	1 year support and minor upgrades for Au Truck/Bus FMS Simulator	SVS-SIM-FMS

1.3   Major Hardware Features

Major hardware features of Au SAE Truck/Bus FMS Simulator are listed below:

- **SAE J1939-15 Type II Device:** contains an internal 120 ohm terminal resistor for easy network setup
- **TVS (Transient Voltage Suppressor)** protection on CAN bus
- **Compact size:** 4-1/8" L X 1-3/4"W X 7/8"H (10.5 X 4.2 X 2 cm)
- **Enclosure color**: Black or PC white
- **Operating temperature:** -4 ˚F to 185 ˚F (-20 ˚C to 85 ˚C)
- **Power supply:** Nominal voltage: +12VDC or +24VDC, operating range: +10V~+32V DC, 250mA max
- **Nine LED indicators:** Power, Range, BTLD, ▼0%, 20%, 40%, 60%, 80%,▲100%. LEDs indicate the control step value and reflect push button operations.
- **Three push buttons:** Simulated FMS signals can be adjusted by push buttons: Menu, Down, Up
- **One buzzer:** Buzzer sound also reflects push button inputs, and it can be enabled/disabled
- **One DB9 Male "FMS" Interface** (Figure 1-2)**:**

A cable (Au Part#: CBL-CAN-01M or CBL-CAN-01, order separately) can be used for power supply and FMS CAN network

connection. One end of the cable (CBL-CAN-01M) is a DB9 female connector which will mate with the "FMS" DB9 male connector on the simulator. The other end of the cable consists of pigtail wires which can connect to power supply and CAN network. The color definition of each wire of the cable is illustrated in Table 1-2. CBL-CAN-01M also has a positive center power jacket, which can connect directly with the Power supply (Au Part#: PWR-912V-CP, order separately).

Table 1-2 Color definition of the CAN cable (CBL-CAN-01, CBL-CAN-01M)

Color	Signal
Red	Power supply +
White or Yellow	CAN-H
Green	CAN-L
Black	Power supply -

- **One 2500V rms isolated RS232 interface:** It is used for in-field firmware update, license management, and computer remote control for Plus editions. Au Truck/Bus FMS Simulator Plus editions can be connected to the RS232 (serial) port of a PC, either through a RS232 serial extension cable (Part#: CBL-RS232-01), as shown in Figure 1-4; or through a USB to RS232 Serial Adapter (Part#: CBL-USB-232), as shown in Figure 1-5. With the 2500V rms isolation feature, the ground loop issue can be prevent from happening between devices using different power supply. Please refer chapter 4 for detail information on Remote Terminal Program.
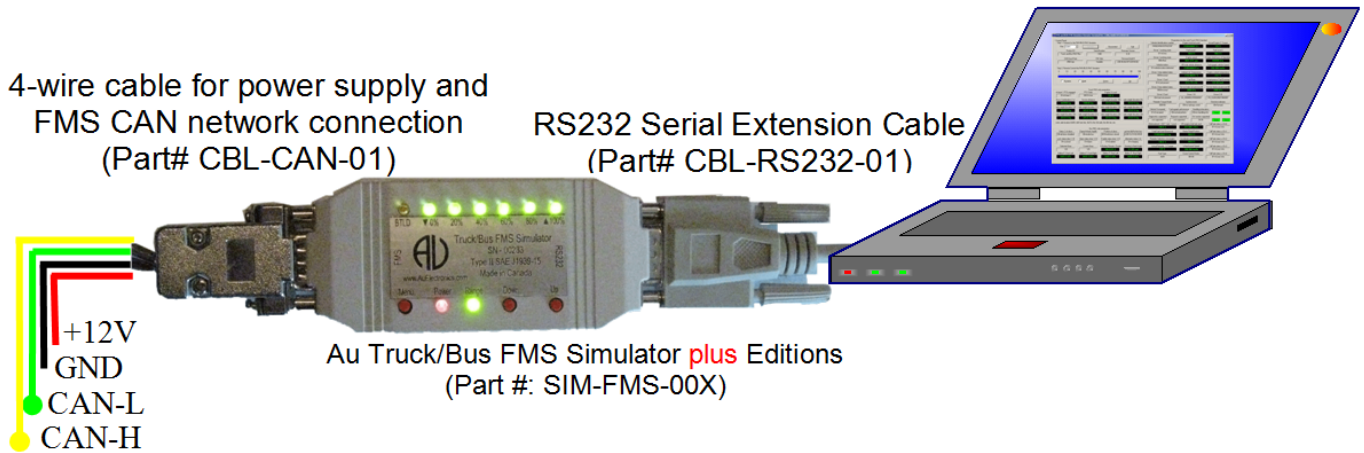

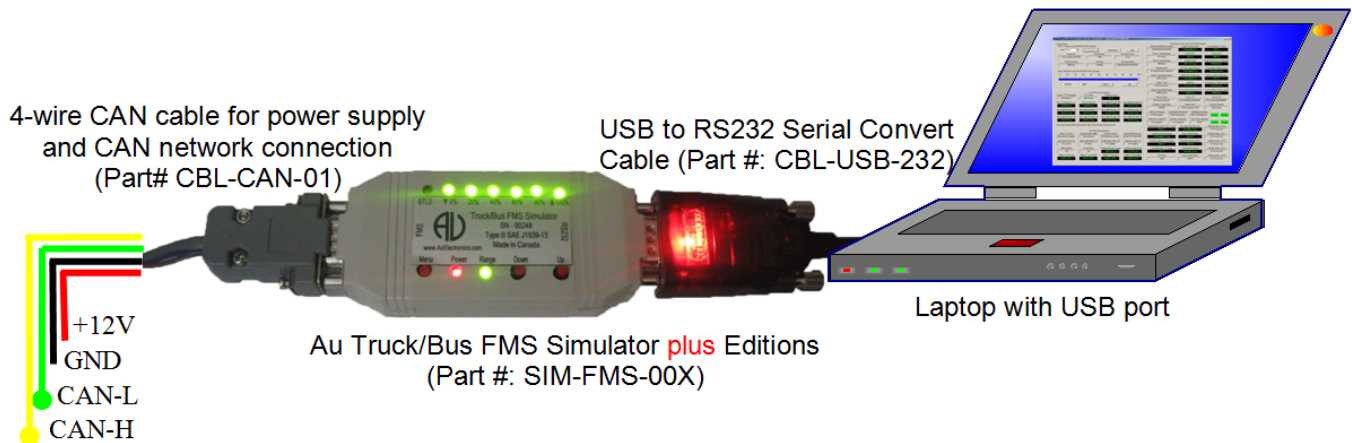Figure 1-4 Connection of Au FMS Simulator plus editions to PC with RS232 port

Figure 1-5 Connection of Au FMS Simulator plus editions to PC with USB port

1.4   Major Features

- **Smart features:** Recall last operating mode at power-on, capable of generating dynamic data, etc.
- **Ease of use:** No software setup experience or CAN protocol configuration skill is required. After a network is physically connected, it will dynamically generate J1939 data when it enters dynamic mode.
- **Static mode and dynamic mode:**
  - Static mode output static FMS signals. In this mode, signal can only be changed manually. Push buttons (**Up & Down**) or PC remote terminal software ("Plus" editions only) are used in "static mode" to adjust data outputs

- o In "dynamic mode", data cycles automatically in its protocol defined range.
- o Two modes can be switched easily.
- **"Remote Terminal"** software available for "Plus" editions: Display simulated FMS signals on a computer screen. All push button control functions are available on PC "Remote Terminal" software
- In field configurable **Multiple CAN baud rate** is supported: 250K, 500K, 1M, 125K, 62.5K Baud rate.
- **Two VIN styles can be field configurable**: "Fixed style" or "variable style", suite multiple test requirement.
- **Easy in-field license upgrade feature** with Au License Management Tool. Value package FMS simulator can be in-field upgraded to upper edition; "Truck FMS Simulator" or "Bus FMS Simulator" can be in-field upgraded to "Truck and Bus FMS Simulator"; non-plus edition can be in-field upgraded to Plus edition
- **In-field firmware update capability** for minor upgrades (SVS-SIM-FMS)
- **Annual support and minor upgrade services** are available (SVS-SIM-FMS)
- **Custom design is available upon request**. It provides a economy way to add customized parameters into current design.

1.5 License /Software Code Upgrade and Support Service

Lower edition of the Au FMS simulator can be in-field upgraded to higher edition by using the built in License management Toolset.
- Au Truck FMS simulator can be upgrade to Au Truck & Bus FMS simulator (part #: LIC-FMS-001)
- Au Bus FMS simulator can be upgrade to Au Truck & Bus FMS simulator (part #: LIC-FMS-002)
- non-plus edition can be upgraded to plus edition(part #: LIC-FMS-003)
- Au Value Package FMS simulator can be upgrade to Au Truck FMS simulator (part #: LIC-FMS-004)
- Au Value Package FMS simulator can be upgrade to Au Bus FMS simulator (part #: LIC-FMS-005)
- One year support and minor upgrade service is available (SVS-SIM-FMS).

License upgrading for the 8 editions of Au FMS Simulator are summarized in Figure 1-6.
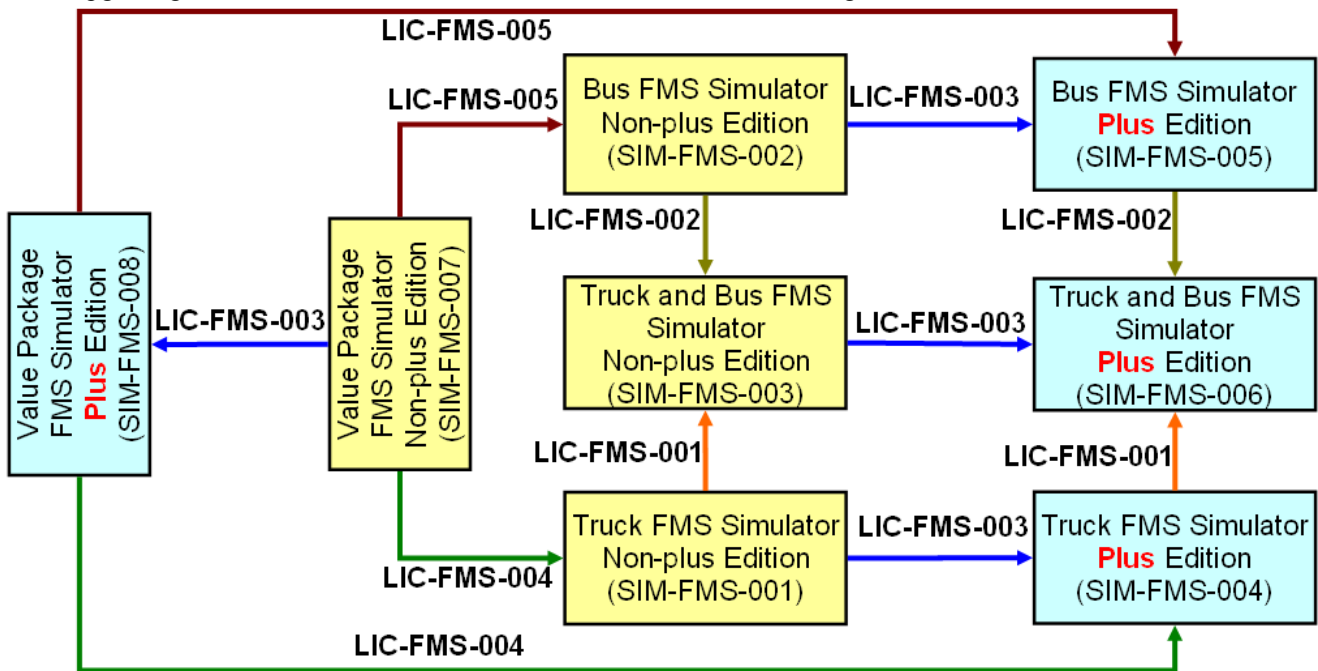

Figure 1-6 License upgrade for Au Truck/Bus FMS Simulator

Software code (firmware) can be in-field updated with Au PIC Bootloader, for instance, updated firmware code or custom-made codes can be re-programmed to gain new or special features.

Chapter 2 Supported FMS Parameters

Au FMS Simulator, supports the parameters defined in FMS-Standard Description Version 04 dated on October 13, 2017. The supported FMS parameters are grouped in 3 categories:

1. **Common parameters**: all parameters for **Bus and Truck** FMS-Standard that defined in chapter 1.1 of "FMS-Standard Description" Version 04 dated on October 13, 2017 .
2. **Truck FMS only parameters**: Parameters for **Truck** FMS-Standard defined in chapter 1.2 of "FMS-Standard Description" Version 04 dated on October 13, 2017 .
3. **Bus FMS only parameters**: Parameters for **Bus** FMS-Standard defined in chapter 1.3 of "FMS-Standard Description" Version 04 dated on October 13, 2017 .

The relationship of each group of parameters and FMS editions are illustrated in figure 2-1 and table 2 – 1.
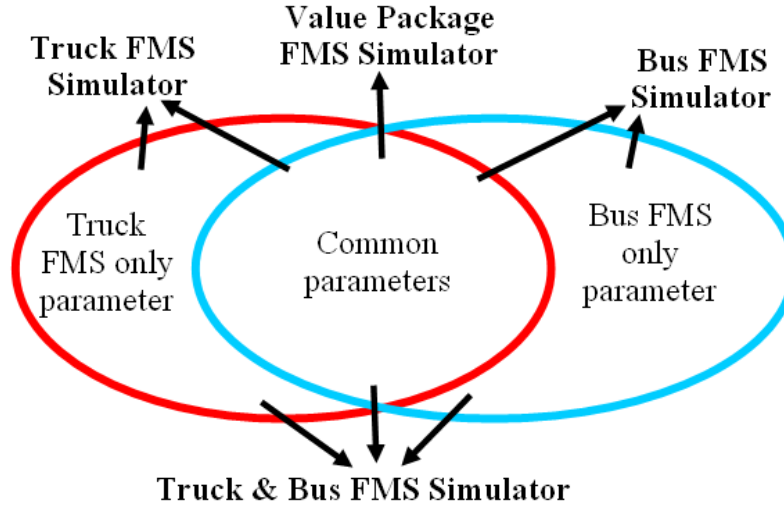

Figure 2 -1Parameters for FMS Edition

Table 2 – 1 Parameters Vs FMS Edition

Edition	Common Parameters	Truck FMS Only Parameters	Bus FMS only Parameters
Value Package FMS Simulator	√	×	×
Truck FMS Simulator	√	√	×
Bus FMS Simulator	√	×	√
Truck & FMS Simulator	√	√	√

2.1   Common FMS Parameters (47 SPNs + 68 TBIS)

- Engine Total fuel used (250)
- Fuel Level 1 (96)
- Fuel Level 2 (38)
- Actual Engine – Percent Torque (513)
- Engine Speed (190)
- Engine Total Hours of Operation (247)
- Vehicle identification number (237)
- Diagnostics supported (2804)
- Requests supported (2805)
- SW-version supported (2806)
- High Resolution Total vehicle distance (917)
- Vehicle motion (1611)
- Driver 1 working state (1612)
- Driver 2 working state (1613)
- Vehicle Overspeed (1614)
- Driver 1 card (1615)
- Driver 2 card (1616)
- Driver 1 time related states (1617)
- Driver 2 time related states (1618)
- Direction indicator (1619)
- Tachograph performance (1620)
- Handling information (1621)
- System event (1622)
- Tachograph vehicle speed (1624)
- Engine Coolant temperature (110)
- Ambient Air Temperature (171)
- Driver 1 identification (1625)
- Driver 2 identification (1626)
- Fuel Rate (183)
- Instantaneous Fuel Economy (184)
- Service Brake Air Pressure Circuit #1 (1087)
- Service Brake Air Pressure Circuit #2 (1088)

- High resolution engine total fuel used (5054)
- Aftertreatment 1 Diesel Exhaust Fluid Tank 1 level (1761)
- Telltale Block ID 0-4 * (SPN N/A)
- Telltale Status 1-15 * (SPN N/A)
- Brake Pedal Position (521)
- Fuel Type (5837)
- Total Fuel Used (Gaseous) (1040)
- Retarder Torque Mode (900)
- Actual Retarder - Percent Torque (520)
- Retarder selection, on-engine (1716)
- Parking Brake Switch (70)
- Wheel Based Speed (84)
- Cruise control status (527)
- Cruise control active (595)
- Brake Switch (597)
- Clutch Switch (598)
- Accelerator pedal position (91)
- TP.CM.BAM + TP.DT (SPN N/A)

*Telltale block ID and status (TBIS) (5x15 matrix) are listed in table 2-2:

Table 2-2 Telltale block ID and status table

Block ID	Telltale Status	Name	Block ID	Telltale Status	Name
0	1	Cooling air conditioning	2	9	Pram request
0	2	High beam, main beam	2	10	Bus stop brake
0	3	Low beam, dipped beam	2	11	Ad blue level
0	4	Turn signals	2	12	Raising
0	5	Hazard warning	2	13	Lowering
0	6	Provision for the disabled or handicapped persons	2	14	Kneeling
0	7	Parking Brake	2	15	Engine compartment temperature
0	8	Brake failure / brake system malfunction	3	1	Auxillary air pressure
0	9	Hatch open	3	2	Air filter clogged
0	10	Fuel level	3	3	Fuel filter differential pressure
0	11	Engine coolant temperature	3	4	Seat belt
0	12	Battery charging condition	3	5	EBS
0	13	Engine oil	3	6	Lane departure indication
0	14	Position lights, side lights	3	7	Advanced emergency braking system
0	15	Front fog light	3	8	ACC
1	1	Rear fog light	3	9	Trailer connected
1	2	Park Heating	3	10	ABS Trailer 1,2
1	3	Engine	3	11	Airbag
1	4	Service, call for maintenance	3	12	EBS Trailer 1,2
1	5	Transmission fluid temperature	3	13	Tachograph indication
1	6	Transmission failure / malfunction	3	14	ESC switched off
1	7	Anti-lock brake system failure	3	15	Lane departure warning switched off
1	8	Worn brake linings	4	1	Engine emission filter (Soot Filter)
1	9	Windscreen/ windshield washer fluid	4	2	Electric motor failures
1	10	Tire failure / malfunction	4	3	AdBlue tampering
1	11	Malfunction / general failure	4	4	Multiplex System
1	12	Engine oil temperature	4	5	Reserved for FMS-Standard
1	13	Engine oil level	4	6	Reserved for FMS-Standard
1	14	Engine coolant level	4	7	Reserved for FMS-Standard
1	15	Steering fluid level	4	8	Reserved for FMS-Standard
2	1	Steering failure	4	9	Reserved for FMS-Standard
2	2	Height Control (Leveling)	4	10	Reserved for FMS-Standard
2	3	Retarder	4	11	Reserved for FMS-Standard
2	4	Engine Emission system failure	4	12	Reserved for FMS-Standard
2	5	ESP indication	4	13	Reserved for FMS-Standard
2	6	Brake lights	4	14	Reserved for FMS-Standard
2	7	Articulation	4	15	Reserved for FMS-Standard
2	8	Stop Request			

2.2 Truck FMS Only Parameters (8 SPNs)

- PTO state (976)
- Engine Percent Load at Current Speed (92)
- Axle weight (582)
- Axle Location (928)
- Tire Location (928)
- Service distance (914)
- At least one PTO engaged (3948)
- Gross Combination Vehicle Weight (1760)

2.3 Bus FMS Only Parameters (51 SPNs)

- Ramp/Wheel chair life (1820)
- Position of Doors (1821)
- Status 2 of doors (3411)
- Lock Status Door 1 (3412)
- Open Status Door 1 (3413)
- Enable Status Door 1 (3414)
- Lock Status Door 2 (3415)
- Open Status Door 2 (3416)
- Enable Status Door 2 (3417)
- Lock Status Door 3 (3418)
- Open Status Door 3 (3419)
- Enable Status Door 3 (3420)
- Lock Status Door 4 (3421)
- Open Status Door 4 (3422)
- Enable Status Door 4 (3423)
- Lock Status Door 5 (3424)
- Open Status Door 5 (3425)
- Enable Status Door 5 (3426)
- Lock Status Door 6 (3427)
- Open Status Door 6 (3428)
- Enable Status Door 6 (3429)
- Lock Status Door 7 (3430)
- Open Status Door 7 (3431)
- Enable Status Door 7 (3432)
- Lock Status Door 8 (3433)
- Open Status Door 8 (3434)
- Enable Status Door 8 (3435)
- Lock Status Door 9 (3436)
- Open Status Door 9 (3437)
- Enable Status Door 9 (3438)
- Lock Status Door 10 (3439)
- Open Status Door 10 (3440)
- Enable Status Door 10 (3441)
- Seconds (959)
- Minutes (960)
- Hours (961)
- Day (962)
- Month (963)
- Year (964)
- Alternator Status 1 (3353)
- Alternator Status 2 (3354)
- Alternator Status 3 (3355)
- Alternator Status 4 (3356)
- Current Gear (523)
- Selected Gear (524)
- Bellow Pressure Front Axle Left (1725)
- Bellow Pressure Front Axle Right (1726)
- Bellow Pressure Rear Axle Left (1727)
- Bellow Pressure Rear Axle Right (1728)
- Hybrid Battery Pack Remaining Charge (5464)
- Steering Wheel Angle (1807)

Chapter 3 Operating Instructions

Au FMS Simulator can run all functions independently without a PC. It can be operated by just controlling 3 push buttons to generate FMS signals for product developers, testers, operators and manufacturers.

3.1. Power On / Network Connection

A cable (e.g. Au Part#: CBL-CAN-01M or CBL-CAN-01) can be used to provide Power and Network connection to the Au Truck/Bus FMS Simulator DB9 male connector (on **FMS** side). When the CBL-CAN-01M cable is used, connect the **Red** wire to "power supply +", **Black** wire to " power supply -"; the power supply must be within the range of +10VDC ~ +32VDC. The **Power** LED on simulator will light up, and simulator will resume the last saved operating mode (static mode or dynamic mode). For CAN network connection, please connect **White** / **Yellow** wire to CAN-H, **Green** wire to CAN-L.

Note: the cable (CBL-CAN-01M, CBL-CAN-01) is color coded (see Table 1-2, Chapter 1) and can be ordered separately.

3.2. Operating Modes (Static/Dynamic)

After power on, Au Truck/Bus FMS Simulator will work in either **static** mode or **dynamic** mode.

- **Static mode**: Au Truck/Bus FMS Simulator generates steady FMS signals. In this mode, two push buttons (**Up** and **Down**) can be used to change the data outputs. When no button is pushed, all data will stay at the last value.

- **Dynamic mode**: The value of all data will change automatically in FMS defined range.

- Switch between dynamic mode and static mode: press and hold both **Menu** and **Up** buttons until a long beep is heard if buzzer is enabled; or both the "▼0% LED" and the "▲100% LED" flip their status (from on to off or vice versa)

There are 3 push buttons (**Menu**, **Down**, **Up**) and 9 LEDs (Figure 3-1). Each LED is named after its function.
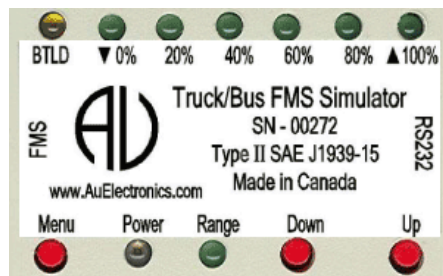

Figure 3-1 Position of push buttons and LEDs

3.3. Push Button Functions

3.3.1. Press **Down** button:

    a. Down button is used to decrease the values of all FMS signals. A single press will decrease all data one step from previous values until they reach the minimum values; the ▼0% LED will be triggered on or off.

    b. If ▼0% LED is on, press Down button one time, ▼0% LED will be off.

    c. If ▼0% LED is off, press Down button one time, ▼0% LED will be on.

    d. 80% LED blinks when control step value equals to 80%,

    e. 60% LED blinks when control step value equals to 60%,

    f. 40% LED blinks when control step value equals to 40%,

    g. 20% LED blinks when control step value equals to 20%,

    h. ▼0% LED blinks when control step equals to 0%,

    i. If buzzer is enabled, a short beep will be heard upon a press on Down button.

3.3.2. Press **Up** button:

    a. Up button is used to increase the values of all FMS signals. A single press will increase all simulated data one step to next data level until they reach the maximum values; the ▲100% LED will be triggered on or off.

    b. If ▲100% LED is on, press Up button one time, ▲100% LED will be off.

    c. If ▲100% LED is off, press Up button one time, ▲100% LED will be on.

    d. 20% LED blinks when control step value equals to 20%,

    e. 40% LED blinks when control step value equals to 40%,

    f. 60% LED blinks when control step value equals to 60%,

g.　80% LED blinks when control step value equals to 80%,

h.　▲100% LED blinks when control step value equals to the highest value, 100%.

i.　If buzzer is enabled, a short beep will be heard upon a press on Up button.

3.3.3. Press and hold both **Down + Up** button for more than 1 second:

a.　Down + Up buttons are used to turn buzzer on/off.

b.　If buzzer is on, press and hold Down + Up for more than 1 second will silent buzzer thereafter.

c.　If buzzer is mute, press and hold Down + Up for more than 1 second will enable the buzzer thereafter.

d.　Both ▲100% and ▼0% LED will flip their on/off status as a visual indication of this dual-button input.

e.　If buzzer is enabled, a long beep will be heard to reflect the input of Down + Up button.

3.3.4. Press and hold both **Menu + Up** button for more than 1 second:

a.　Menu + Up buttons are used to switch between static and dynamic mode.

b.　Both ▲100% LED and ▼0% LED will flip their status as a visual indication of this dual-button input.

c.　If buzzer is enabled, a long beep will be heard to reflect the input of Menu + Up button.

The push button functions are summarized in Table 3-1.

Table 3-1 Summary of push button functions

Push Button Operation	Function
Press **Down** button	Decrease all simulated data until they reach the lowest value
Press **Up** button	Increase all simulated data until they reach the highest value
Press **Menu** button	Not used
Press and hold **Menu** button when power on	Simulator will enter **Bootloader** mode, if no communication is detected from a PC Bootloader program within 10 seconds, it'll resume normal modes
Press and hold both **Down** + **Up** button	Buzzer ON/OFF control
Press and hold both **Menu** + **Up** button	Switch between Static/Dynamic mode
Press and hold both **Menu** + **Down** button	Not used

3.4. LED Indicator Status

Note: Red LEDs and Green LEDs are used in this document for illustration purpose; actual product might have different LED colors. Same applies to the push buttons. Au Group Electronics reserve the right of changing the color on each LEDs and push buttons without further notification.

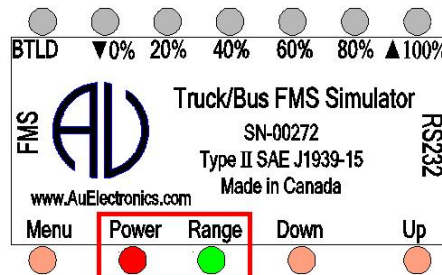- When power on, both **Power** LED and **Range** LED lit, as shown in Figure 3-2.

Figure 3-2 Power on, both Power and Range LED lit

All FMS data can be changed within the protocol defined range from 0 to 100 control steps (named 0% to 100% control step value from now on), 6 LEDs are used to identify the control step value in the range of 0%, 20%, 40%, 60%, 80%, and 100%.

- **▲100%** LED will be triggered on or off with a press on the **Up** button, accompany with the increasing brightness of **Range** LED. A press on the **Up** button will also increase the control step value and all simulated data.

o　When control step value equals to 0%, the ▼0% LED blinks.

o   When control step value equals to 20%, 20% LED blinks.
o   If keep pressing **Up** button, the control step value will keep increasing. The 20% LED will then be always on, as shown in Figure 3-3. This indicates a data range from 21- 39%.
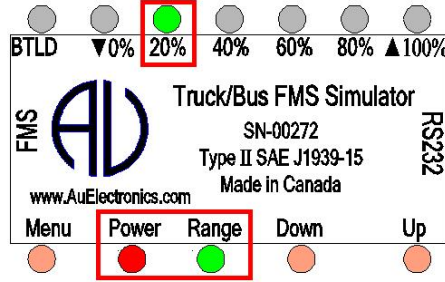

Figure 3-3 Power, Range, 20% LED on, indicating data range is from 21% to 39%

o   When control step value equals to 40%, 40% LED blinks.
o   If keep pressing **Up** button, the control step value will keep increasing. The 20% and 40% LED will be always on, as shown in Figure 3-4. It indicates the data range from 41% to 59%.
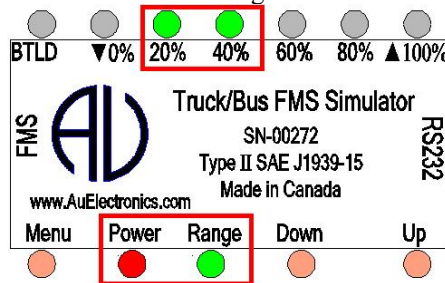

Figure 3-4 Power, Range, 20%, 40% LED on, indicating data range is from 41% to 59%

o   When control step value equals to 60%, 60% LED blinks
o   If keep pressing **Up** button, the control step value will keep increasing. The 20%, 40%, and 60% LED will be on, as shown in Figure 3-5. It indicates the data range from 61% to 79%.

Figure 3-5 Power, Range, 20%, 40%, 60% LED on, indicating data range is from 61% to 79%

o   When control step value equals to 80%, 80% LED blinks.
o   If keep pressing **Up** button, the control step value will keep increasing. The 20%, 40%, 60%, and 80% LED will be on, as shown in Figure 3-6. It indicates the data range from 81% to 99%.
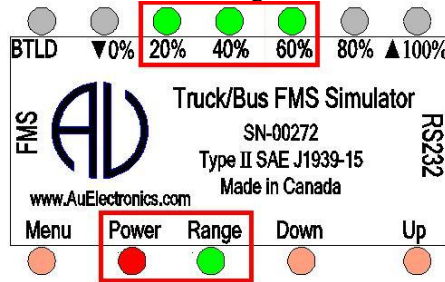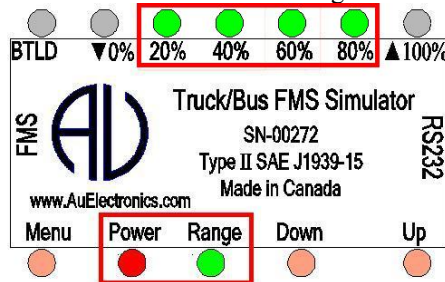

Figure 3-6 Power, Range, 20%, 40%, 60%, 80% LED on, indicating data range is from 81% to 99%

o   When control step value equals to 100%, the 20%, 40%, 60%, and 80% LED will be constant on. ▲100% LED blinks, as shown in Figure 3-7.
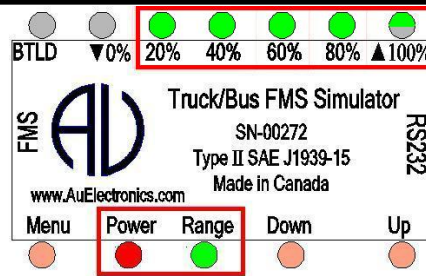
Figure 3-7 Power, Range, 20%, 40%, 60%, 80% are constant on, "▲100%" LED blinks, indicating data reaches 100%

- **▼0%** LED will be triggered on or off when pressing **Down** button, accompany with the decreasing brightness of Range LED. A press on the **Down** button will also decrease the control step value and all simulated data. When the control step value equals to 0%, ▼0% LED blinks.

The control step value vs. LED indicator status is summarized in Table 3-2.

Table 3-2 Control step value vs. LED indicator status (in Static Mode)

Step	Operation	LED Status
1	Connect **+10~+32 V DC** power supply	**Power, Range** LED on, other LEDs recall the last saved status at Static mode
2	Press **Down** button	**▼0%** LED on/off
3	Continue press **Down** button until control step value = 0%	**▼0%** LED blink
4	Press **Up** button	**▲100%** LED on/off
5	Continue press **Up** button for control step value 1 to 19%	**Power, Range** LED constant on
6	Continue press **Up** button for control step value 20%	**Power, Range** LED on, **20%** LED Blink
7	Continue press **Up** button for control step value 21 to 39%	**Power, Range** LED on, **20%** LED on
8	Continue press **Up** button for control step value 40%	**Power, Range, 20%** LED ON, **40%** LED Blink
9	Continue press **Up** button for control step value 41 to 59%	**Power, Range, 20%, 40%** LED on
10	Continue press **Up** button for control step value 60%	**Power, Range, 20%, 40%** LED on, **60%** LED blink
11	Continue press **Up** button for control step value 61 to 79%	**Power, Range, 20%, 40%, 60%** LED on
12	Continue press **Up** button for control step value 80%	**Power, Range, 20%,40%, 60%** LED on, **80%** LED blink
13	Continue press **Up** button for control step value 81 to 99%	**Power, Range, 20%, 40%, 60%, 80%** LED on
14	Continue press **Up** button for control step value 100%	**Power, Range, 20%, 40%, 60%, 80%** LED on, **▲100%** blink

Chapter 4 Remote Terminal GUI

As an option of added ease of use, PC software "Remote Terminal" is available to control and display simulated FMS signals from a personal computer (PC) through RS232 interface for all **Plus** editions FMS Simulator.

The Remote Terminal GUI (Graphic User Interface) includes 4 panels (a control panel and 3 display panels):

1.   Control Panel for Serial connection and production information;
2.   Display Panel for Common FMS parameters;
3.   Display Panel for Truck FMS only parameters;
4.   Display Panel for Bus FMS only parameters

On Remote Terminal GUI for Au **Truck & Bu**s FMS Simulator plus edition, all three display panels will be active (Figure 4 -1).
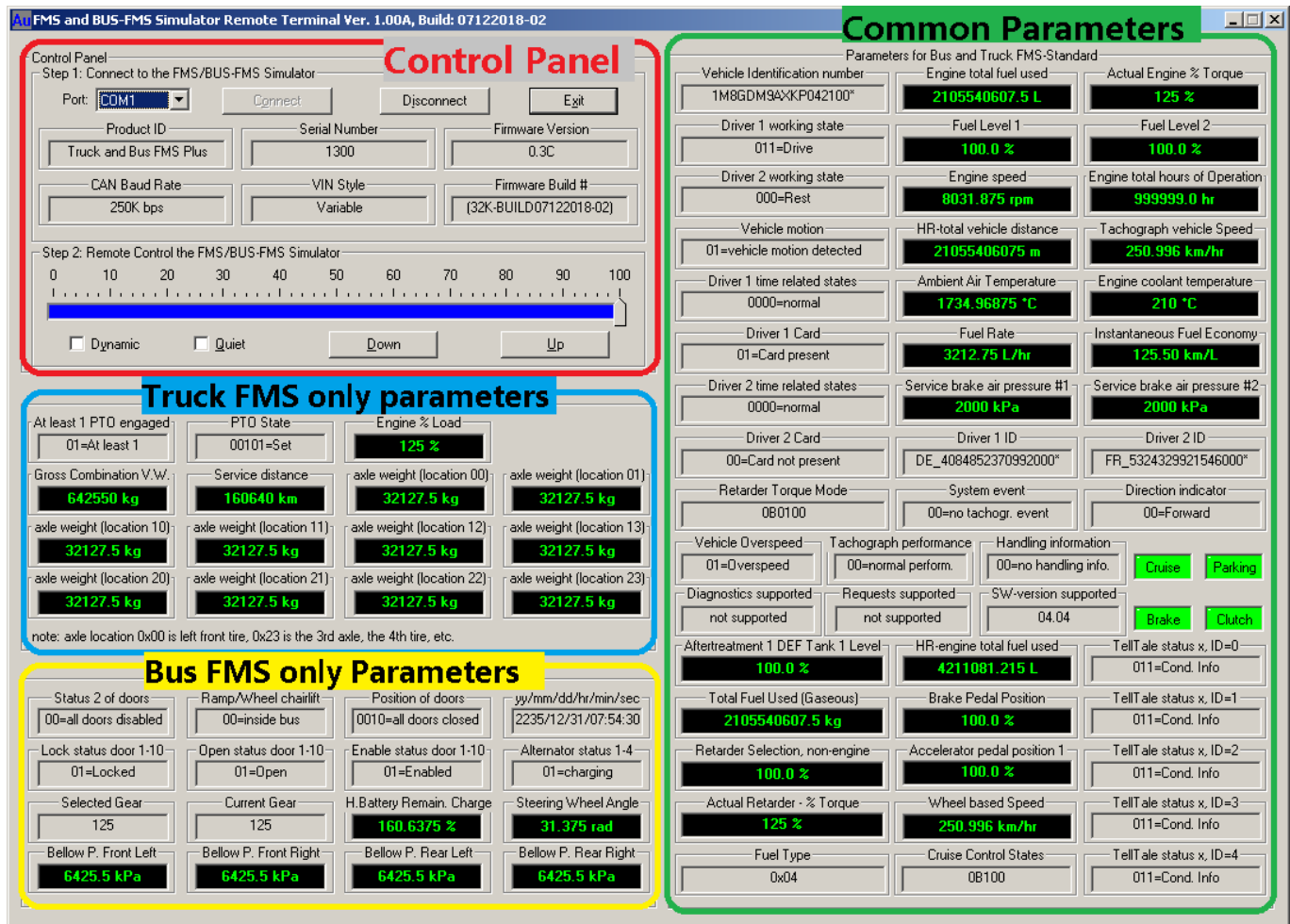
Figure 4–1 PC Remote Terminal for *Truck & Bus FMS Simulator Plus Edition*

4.1 Display Panel – Common Parameters (47 SPNs)

On the Remote Terminal GUI for **Value Package** FMS Simulator plus edition, only the display panel for **Common** parameters will be active.

The common parameters display panel is located on the right hand side (figure 4- 1). It displays the 52 common FMS parameters. Detail data of the Common Parameters from 1% to 100% can be found in Chapter 5 Data Configuration.
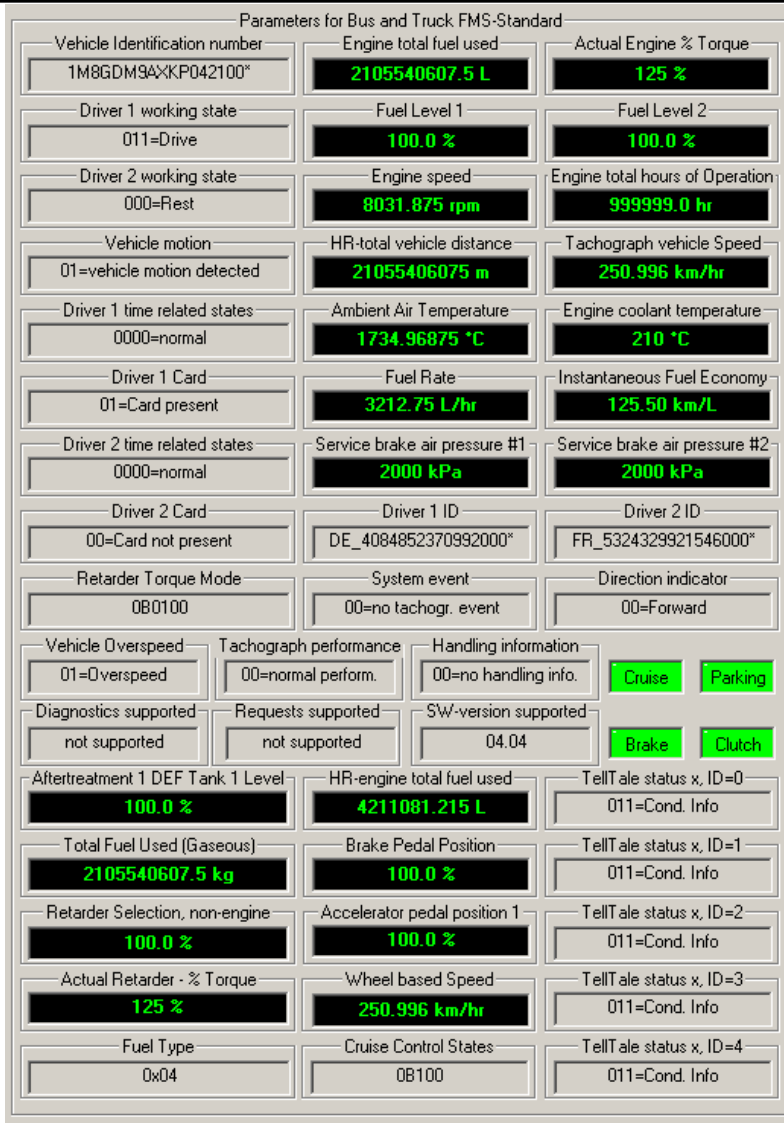
Figure 4-1 Panel for displaying parameters for Bus and Truck FMS-Standard (Common Parameters)

4.2 Display Panel –Truck FMS only Parameters (8 SPNs)

On Remote Terminal GUI for Au **Truck** FMS Simulator plus edition, the display panels for **common** parameters and **Truck FMS only** parameters will be active.

The Truck FMS only parameters display panel is located on the middle left side, as the name indicated, it display the FMS parameters that only applicable to Truck FMS, as shown in Figure 4-2.

Figure 4-2 Display Panel for Truck FMS only Parameters

4.3 Display Panel – Bus FMS only Parameters (51 SPNs)

On Remote Terminal GUI for Au **Bus** FMS Simulator plus edition, the display panels for **common** parameters and **Bus FMS only** parameters will be active.

The Bus FMS only parameters display panel is located on the bottom left side, it display the FMS parameters that only applicable to Bus FMS, as shown in Figure 4-3.
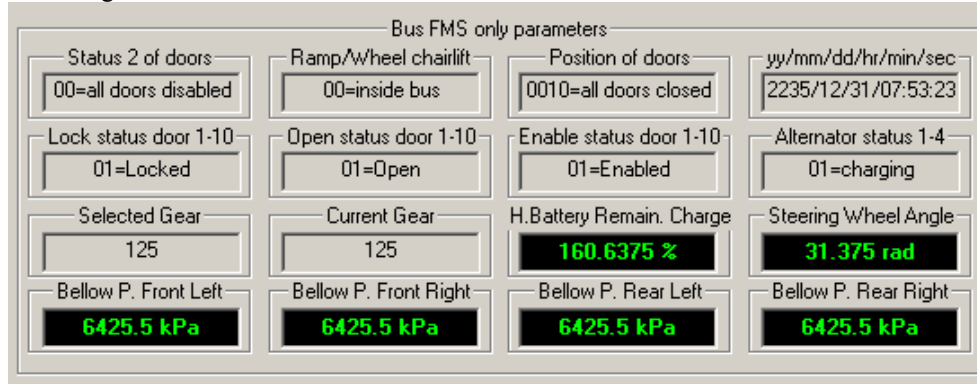
Figure 4-3Display Panel for Bus FMS only Parameters

Following paragraphs will explain how to use the Remote Terminal GUI to remote control the FMS **Plus** editions.

4.4 Step 1: Connect FMS Simulator to PC and FMS network

Follow the steps below to connect FMS simulator to PC and FMS network. A typical FMS Simulator in FMS network is illustrated in Chapter 1, Figure 1-3.

1. Connect FMS simulator **FMS side** to power supply and a FMS CAN network
2. Connect FMS simulator **RS232 side** to a PC (either using RS232 serial extension cable for RS232 port on PC or using USB to RS232 serial convert cable for USB port on PC).
3. On the Remote Terminal GUI, select serial port # from the "Port" drop down list.
4. Click "Connect" button

Product information of the connected FMS simulator device will display (Product ID, Serial Number, Firmware Version, CAN Baud Rate, VIN Style and Firmware Build#), as shown in Figure 4-5.
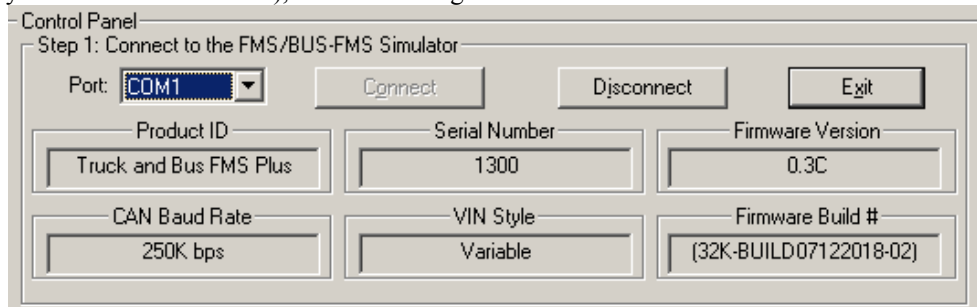
Figure 4-5 FMS simulator remote terminal control panel step 1

Note: The control panel step 1 can always be used to display Product ID, Serial Number, Firmware Version, CAN Baud Rate, VIN Style and Firmware Build#, for all Au FMS simulator Editions (both plus edition and non-plus edition).

After connecting Au FMS simulator to a PC serial port, click Au logo at the top left corner, from the drop down menu select the "About FMSSimulatoRemoteTerminal..." as shown in Figure 4-6.
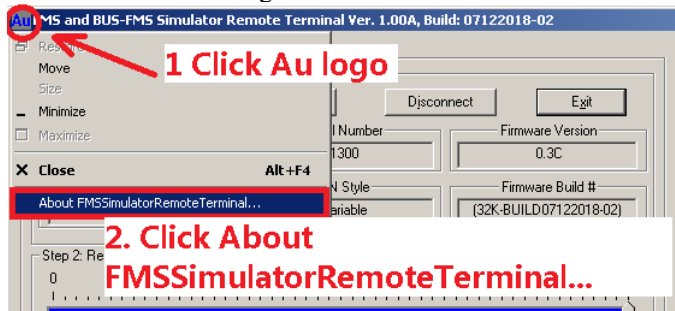
Figure 4-6 Access the About FMS Simulator Remote Terminal

The "FMSSimulatorRemoteTerminal" About window (Figure 4-7) can be used to view the product information, configure CAN Baud Rate, change VIN Style, and perform license upgrading if needed.
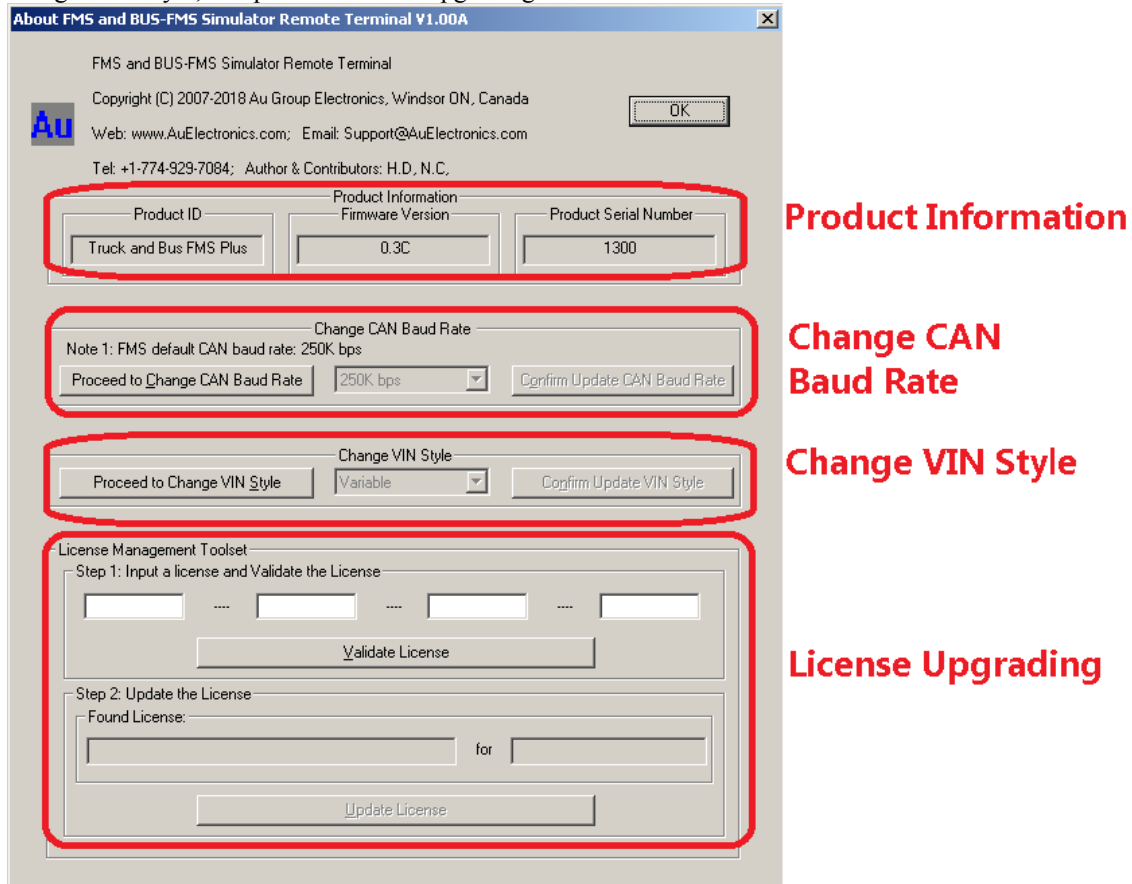
Figure 4-7 Major Functions of Au FMSSimulatorRemoteTerminal About Window

4.4.1 CAN Baud Rate Configuration (Optional)

The default CAN baud rate for FMS is 250K bps. All Au FMS simulator CAN baud rate is set at the default value (250K bps), it is NOT necessary to configure the CAN baud rate.

1.   In the case you do need to configure the FMS CAN baud rate, click "Process to change CAN Baud Rate" button first, as shown in figure 4-8
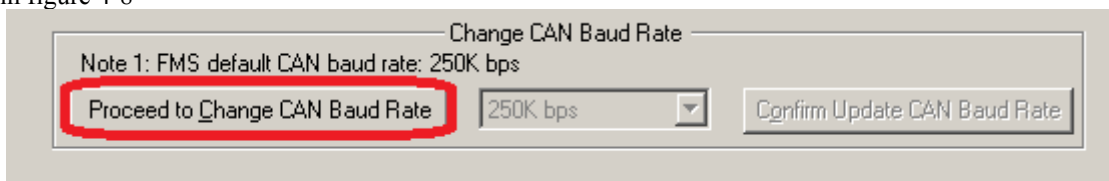
Figure 4 - 8

2.   Select the desired CAN baud rate from the drop down list, there are 5 optional CAN baud rate selections available (62.5K, 125K, 250K, 500K, and 1M bps), 500K bps was selected in this example.
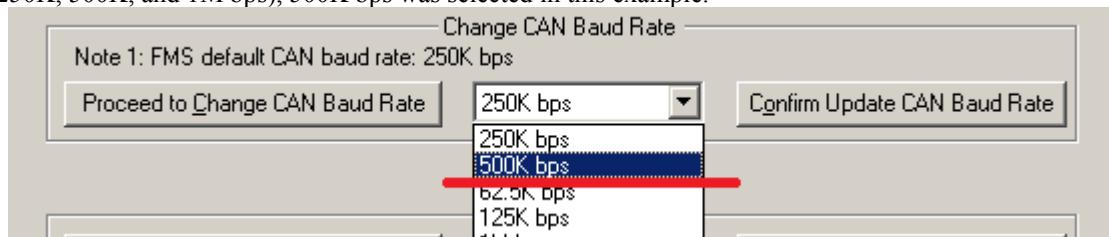
Figure 4 - 9

3.   Click "Confirm Update CAN Baud Rate" button to confirm the change.
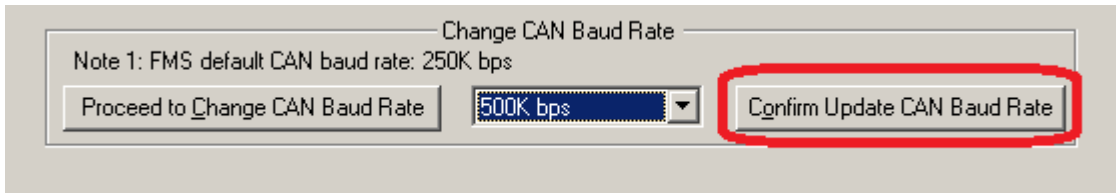
Figure 4 - 10

A long beep will be heard, and the CAN Baud Rate display in the Control Panel of FMS Simulator Remote Terminal GUI will reflect the change, as shown in Figure 4 - 11.
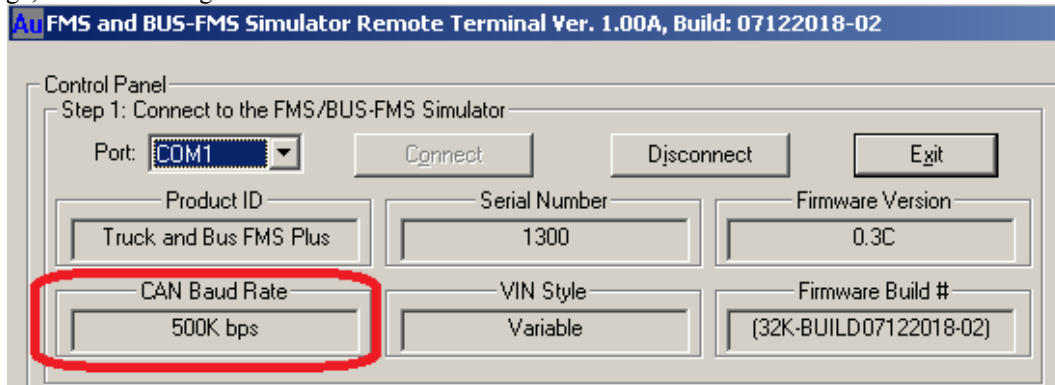
Figure 4 - 11

4.4.2 Change VIN Style

There are 2 styles of VIN available for all FMS Simulators: Variable VIN and Fixed VIN.

If the VIN style is set as "Variable", the VIN will be different in value and length at each simulation step. Note 1: the last 3 digit will be change with the step value.

If the VIN style is set as "Fixed", the VIN will always be 17 digits and the last 6 digits match with the SN of the device.

Table 4-1 Controlled Steps vs. VIN

Step Value	VIN Style	
	Fixed	**Variable**
0%		*
1%		1*
2%		02*
3%		003*
4%	1M8GDM9AXKPnnnnnn*	2004*
5%		42005*
6%		042006*
7%		P042007*
8 - 100%		1M8GDM9AXKP042008* (note 1)

The "FMSSimulatorRemoteTerminal" About window can be used to change VIN Style.
1.   Click "Proceed to Change VIN Style"
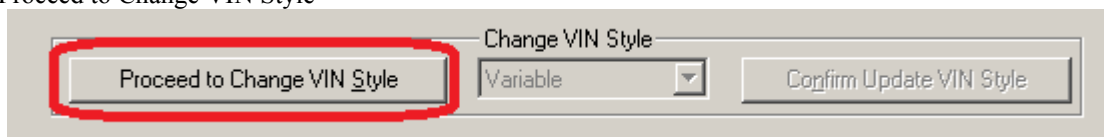
Figure 4 - 12

2.   Select "Fixed" from the drop down list
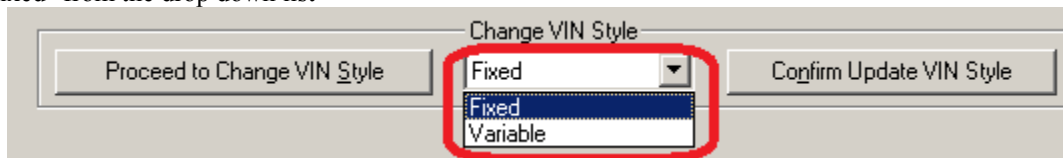
Figure 4 - 13

3.　Click "Confirm Update VIN Style" button.
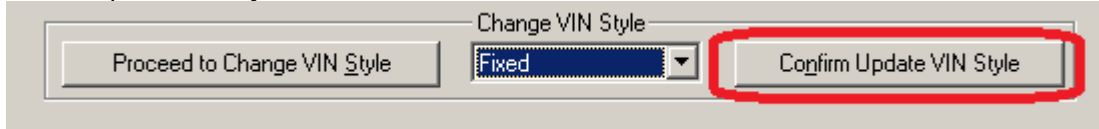
Figure 4 - 17

Now the VIN style has been changed from Variable to Fixed, as shown in Figure 4 -15.
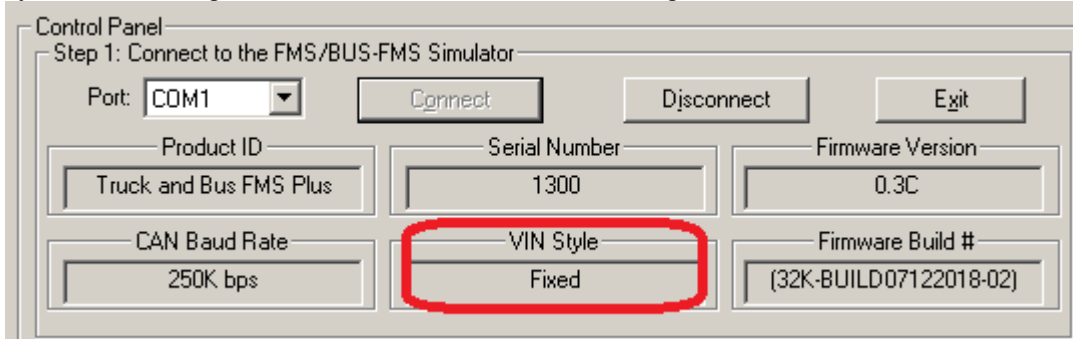
Figure 4 - 15

VIN can be viewed on the display panel for common parameters for all plus edition of FMS simulator.

The function of step 1 control items is summarized in Table 4-1.

Table 4-1　Function summary of step 1 control items

Items	Function
Port	Serial port can be selected from drop down list (COM1 to COM50)
Connect	Click "Connect" button to connect FMS Simulator with selected PC serial port.
Disconnect	Click "Disconnect" button to release the selected PC serial port.
Exit	Click "Exit" button to close the FMS Simulator Remote Terminal program
Product ID	Display the current edition of Au FMS Simulator that's hooked up with the serial port. (*Truck and Bus FMS Simulator Plus Edition* is demonstrated in Figure 4-2)
Serial Number	Display the serial number of FMS simulator that's connected to the serial port. (The serial number of FMS Simulator demonstrated in Figure 4-2 is 4688967288)
Firmware Version	Display the current firmware version of FMS Simulator that's hooked up with the serial port. (The version of FMS Simulator demonstrated in Figure 4-2 is 0.3C)
CAN Baud Rate	The CAN Bus Baud Rate of the FMS simulator, default value is 250K bps, and can be configured into 6 values using "FMSSimulatorRemoteTerminal" About window
VIN Style	2 VIN styles are available for Au FMS Simulator: Fixed or Variable. It can be configured using "FMSSimulatorRemoteTerminal" About window
Firmware Build #	Display the current firmware build # of FMS Simulator that's hooked up with the serial port.. (The firmware build number of FMS Simulator demonstrated in Figure 4-2 is 32K-BUILD07122018-02)

4.5　Step 2: Remote Control the FMS Simulator

Remote control includes a scale bar, 2 check boxes (**Dynamic, Quiet**), and 2 push buttons (**Down**, **Up**), as shown in Figure 4-6. These tools are able to remote control the output/simulated signal of Au FMS Simulator **Plus** editions.
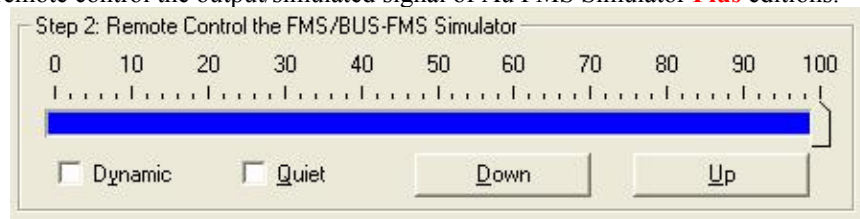
Figure 4-16　　PC remote terminal control panel step 2

The **scale bar** represents the control step values from 0% to 100%. The sliding action can be made by 4 methods: keyboard, mouse or Down/Up buttons from remote terminal and the push button on the device.

They are summarized in Table 4-2

Table 4-2   Control methods for scale bar

	Action	Function
Mouse	Left click	Left click bring the slide to the desire location.
	Drag	Click and hold left button drag the slide to desire location
Keyboard	▲ or ►	Increase the scale range in 1 interval
	▼ or ◄	Decrease the scale range in 1 interval
	Pg Up	Increase the scale range in 10 interval
	Pg Dn	Decrease the scale range in 10 interval
Remote terminal / Device	"Down" button	Decrease the scale range in 1 interval
	"Up" button	Increase the scale range in 1 interval

The functions for the 2 push buttons and 2 check boxes are listed in Table 4-3.

Table 4-3   Functions for push button and check boxes in step 2 (Remote Terminal)

Tool		Function
Push Button	Down	Decrease the control step value in 1
	Up	Increase the control step value in 1
Check box	Dynamic	Switch between dynamic mode / static mode
	Quiet	Turn on/off buzzer

Chapter 5 Data Configuration

In Table 5-1, some special simulation results at control step value of 0%, 20%, 40%, 60%, 80%, and 100% are listed. Please refer to Table 5-16 through Table 5-25 for a complete list.

Table 5-1 FMS Simulation result vs. Control Step Values (with Fixed VIN style, Device SN: 1300)

Parameters	0%	20%	40%	60%	80%	100%
Engine Total fuel used	0.0	250.0	500.0	750.0	1000.0	2105540607.5
Actual Engine – Percent Torque	-125%	-75%	-25%	25%	75%	125%
Fuel Level 1	0.0%	20.0%	40.0%	60.0%	80.0%	100.0%
Fuel Level 2	0.0%	19.6%	39.6%	59.8%	79.6%	100.0%
Engine Speed	0.000	1606.375	3212.750	4819.125	6425.500	8031.875
Engine Total Hours of Operation	0.0	250.0	500.0	750.0	1000.0	999999.0
High Resolution Total vehicle distance	0	500000	1000000	1500000	2000000	21055406075
Tachograph vehicle speed	0.000	50.199	100.398	150.598	200.797	250.996
Ambient Air Temperature	-273.000000	-154.750000	-36.500000	81.750000	200.000000	1734.968750
Engine Coolant temperature	0	10	60	110	160	210
Fuel Rate	0.00	56.75	113.55	170.30	227.10	3212.75
Instantaneous Fuel Economy	0.00	9.56	19.13	28.70	38.26	125.50
Service Brake Air Pressure Circuit #1	0	400	800	1200	1600	2000
Service Brake Air Pressure Circuit #2	0	400	800	1200	1600	2000
Aftertreatment 1 Diesel Exhaust Fluid Tank 1 level	0.0%	20.0%	40.0%	60.0%	80.0%	100.0%
High resolution engine total fuel used	0.000	250.000	500.000	750.000	1000.000	4211081.215
Total Fuel Used (Gaseous)	0.0	250.0	500.0	750.0	1000.0	2105540607.5
Brake Pedal Position	0.0%	20.0%	40.0%	60.0%	80.0%	100.0%
Retarder selection, non-engine	0.0%	20.0%	40.0%	60.0%	80.0%	100.0%
Accelerator pedal position	0.0%	20.0%	40.0%	60.0%	80.0%	100.0%
Actual Retarder - Percent Torque	-125%	-75%	-25%	25%	75%	125%
Wheel Based Speed	0.000	50.199	100.39	150.598	200.797	250.996
Vehicle identification number (Fixed Style)	1M8GDM9AXKP001300*	1M8GDM9AXKP001300*	1M8GDM9AXKP001300*	1M8GDM9AXKP001300*	1M8GDM9AXKP001300*	1M8GDM9AXKP001300*
Driver 1 working state	110=Error	000=Rest	000=Rest	011=Drive	011=Drive	011=Drive
Driver 2 working state	110=Error	011=Drive	011=Drive	000=Rest	000=Rest	000=Rest
Vehicle motion	00=Vehicle motion not detected	01=vehicle motion detected	01=vehicle motion detected	01=vehicle motion detected	01=vehicle motion detected	01=vehicle motion detected
Driver 1 time related states	0000=normal	0000=normal	0000=normal	0000=normal	0000=normal	0000=normal
Driver 1 card	00=Card not present	00=Card not present	00=Card not present	01=Card present	01=Card present	01=Card present
Driver 2 time related states	0000=normal	0000=normal	0001=15 min bef. 4-1/2hr	0000=normal	0000=normal	0000=normal
Driver 2 card	01=Card present	01=Card present	01=Card present	00=Card not present	00=Card not present	00=Card not present

Driver 1 identification	*	DE_40848523709 92000*	DE_40848523 70992000*	DE_40848523 70992000*	DE_40848523 70992000*	DE_4084852370 992000*
Driver 2 identification	*	FR_53243299215 46000*	FR_532432992 1546000*	FR_532432992 1546000*	FR_53243299 21546000*	FR_5324329921 546000*
Retarder Torque Mode	0B0000	0B0100	0B1000	0B1100	0B0000	0B1000
System event	01=tachogr. Event	00=no tachogr. Event	00=no tachogr. event	00=no tachogr. event	00=no tachogr. Event	00=no tachogr. event
Direction indicator	01=Reverse	00=Forward	00=Forward	00=Forward	00=Forward	00=Forward
Vehicle Overspeed	00=No overspeed	00=No overspeed	00=No overspeed	01=Overspeed	01=Overspeed	01=Overspeed
Tachograph performance	01=perform. Analysis	00=normal perform.	00=normal perform.	00=normal perform.	00=normal perform.	00=normal perform.
Handling information	01=handling info.	00=no handling info.	00=no handling info.	00=no handling info.	00=no handling info.	00=no handling info.
Diagnostics supported	not supported	not supported	not supported	not supported	not supported	not supported
Requests supported	not supported	not supported	not supported	not supported	not supported	not supported
SW-version supported	4.04	4.04	4.04	4.04	4.04	4.04
Fuel Type	0x00	0x14	0x04	0x04	0x04	0x04
Cruise control status	0B000	0B100	0B000	0B100	0B000	0B100
Telltale Status ID = 0	011=Cond. Info	000=off	000=off	000=off	000=off	011=Cond. Info
Telltale Status ID = 1	011=Cond. Info	000=off	000=off	000=off	000=off	011=Cond. Info
Telltale Status ID = 2	011=Cond. Info	000=off	000=off	000=off	000=off	011=Cond. Info
Telltale Status ID = 3	011=Cond. Info	000=off	000=off	000=off	000=off	011=Cond. Info
At least one PTO engaged	11=Not available	00=No PTO engaged	00=No PTO engaged	00=No PTO engaged	00=No PTO engaged	01=At least 1
PTO state	11111=not available	00000=off/disabled	00000=off/disabled	00000=off/disabled	00000=off/disabled	00101=Set
Engine Percent Load at Current Speed	0%	25%	50%	75%	100%	125%
Gross Combination Vehicle Weight	0	128510	257020	385530	514040	642500
Service distance	-160635	-96380	-32125	32130	96385	160640
Axle Weight (Location 00)	0.0	2500.0	5000.0	7500.0	10000.0	321275.0
Axle Weight (Location 01)	0.0	2505.0	5005.0	7505.0	10005.0	321275.0
Axle Weight (Location 10)	0.0	2510.0	5010.0	7510.0	10010.0	321275.0
Axle Weight (Location 11)	0.0	2515.0	5015.0	7515.0	10015.0	321275.0
Axle Weight (Location 12)	0.0	2520.0	5020.0	7520.0	10020.0	321275.0
Axle Weight (Location 13)	0.0	2525.0	5025.0	7525.0	10025.0	321275.0
Axle Weight (Location 20)	0.0	2530.0	5030.0	7530.0	10030.0	321275.0
Axle Weight (Location 21)	0.0	2535.0	5035.0	7535.0	10035.0	321275.0
Axle Weight (Location 22)	0.0	2540.0	5040.0	7540.0	10040.0	321275.0
Axle Weight (Location 23)	0.0	2545.0	5045.0	7545.0	10045.0	321275.0
Status 2 of doors	10=Error	00=all doors disabled	00=all doors disabled	00=all doors disabled	00=all doors disabled	00=all doors disabled
Ramp/Wheel chair life	10=Error	00=inside bus	00=inside bus	00=inside bus	00=inside bus	00=inside bus
Position of Doors	1110=Error	0010=all doors closed	0010=all doors closed	0010=all doors closed	0010=all doors closed	0010=all doors closed

yy/mm/dd/hr/min/sec	1985/01/01/18:05:40	2035/03/07/18:08:09	2085/05/13/18:09:34	2135/07/19/18:11:52	2185/09/25/18:13:06	2235/12/31/18:16:08
Lock Status Door 1 - 10	10=Error	01=Locked	01=Locked	01=Locked	01=Locked	01=Locked
Open Status Door 1 - 10	10=Error	01=Open	01=Open	01=Open	01=Open	01=Open
Enable Status Door 1 - 10	10=Error	01=Enabled	01=Enabled	01=Enabled	01=Enabled	01=Enabled
Alternator Status 1 - 4	10=Error	01=charging	01=charging	01=charging	01=charging	01=charging
Selected Gear	park	-75	-25	25	75	125
Current Gear	park	-75	-25	25	75	125
Hybrid Battery Pack Remaining Charge	0.0000%	32.1275%	64.2550%	96.3825%	128.5100%	160.6375%
Steering Wheel Angle	-31.374	-18.824	-6.274	6.275	18.825	31.375
Bellow Pressure Front Axle Left	0.0	1285.1	2570.2	3855.3	5140.4	6425.5
Bellow Pressure Front Axle Right	0.0	1285.1	2570.2	3855.3	5140.4	6425.5
Bellow Pressure Rear Axle Left	0.0	1285.1	2570.2	3855.3	5140.4	6425.5
Bellow Pressure Rear Axle Right	0.0	1285.1	2570.2	3855.3	5140.4	6425.5

Note: The hr/min/Sec parameter are real time self-running parameters, it is not controlled by the control steps.

5.1   Data for Common parameters:

The status of the 4 lights (Cruise, Brake, Clutch, and Parking) will be set to ON at following steps, as summarized in table 5-2.
1.   Cruise light will be on when control steps are larger than 40%.
2.   Brake light will be on at step 20%, 40%, 60%, 80%, and 100%.
3.   Clutch light will be on at step 10%, 30%, 50%, 70%, and 100%.
4.   Paking light is only available for BUS FMS Simulator, it will be on at from step 0 to 10%, and at step 100%.

Table 5-2 Controlled Steps vs. "Cruise, Brake, Clutch, Parking" status

Step Value	Cruise, Brake, Clutch, Parking ON	FMS
>= 40%	Cruise	Both
20, 40, 60, 80, 100%	Brake	Both
10, 30, 50, 70, 100%	Clutch	Both
0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 100%	Parking	Both

Driver related parameters, includes Driver ID, Driver working state, Driver card, and Driver time related states, are summarized in table 5-3 and 5-4.

Table 5-3 Controlled Steps vs. "Driver 1" status

	Driver 1 ID	Driver 1 working state	Driver 1 card	Driver 1 time related states
0%	*	110 = Error	00 = Card not present	0000 = normal
1%	4084852370992000*	111 = not available		
2%	*	001 = Driver available		
3%		010 = Work		
4-49%		000 = Rest		
50%				0001 = 15 min before 4-1/2hr
51%	4084852370992000* note: *: Driver 1 ID Delimiter	011 = Drive	01 = Card present	0010 = 4-1/2hr reached
52%				0011 = 15 min before 9hr
53%				0100 = 9hr reached
54%				0101 = 15 min before 16 hr
55%				0110 = 16hr reached
56%				1110 = Error
57%				1111 = not available
58-100%				0000 = normal

Table 5-4 Controlled Steps vs. "Driver 2" status

Step Value	Driver 2 ID	Driver 2 working state	Driver 2 card	Driver 2 time related states
0%	*	110 = Error		
1%	*	111 = not available		
2%		001 = Driver available		0000 = normal
3%		010 = Work		
4-39%				
40%				0001 = 15 min bef. 4-1/2hr
41%				0010 = 4-1/2 hr reached
42%	5324329921546000* note: *: Driver 2 ID Delimiter		01 = Card present	0011 = 15 min bef. 9hr
43%				0100 = 9hr reached
44%		011 = Drive		0101 = 15 min bef. 16hr
45%				0110 = 16hr reached
46%				1110 = Error
47%				1111 = not available
48-50%				0000 = normal
51-100%		000 = Rest	00 = Card not present	

Overspeed is set at "No Overspeed" at step 0 – 41%, it is set to "Overspeed" at step 42 – 100%.

Table 5-5 Controlled Steps vs. Overspeed

	0 - 41%	42 - 100%
Overspeed	00 = No Overspeed	01 = Overspeed

Direction indicator indicates "Reverse" from step 0 – 10%, and "Forward" from step 11 – 100%.

Table 5-6 Controlled Steps vs. Direction Indicator

Step Value	0 - 10%	11 - 100%
Direction Indicator	01 = Reverse	00 = Forward

Telltale status for telltale block at each control step is summarized in table 5-7. For detail information of FMS Tell Tale Status Block ID and name, please refer to Bus FMS-Standard Table for Telltale status.

Telltale status is set to 000 (off) at step 4- 99% for all Telltale blocks.

Telltale status is set to 001 (Cond. Red) at step 1% for all Telltale blocks.

Telltale status is set to 010 (Cond. Yellow) at step 2% for all Telltale blocks.

Telltale status is set to 011 (Cond. Info) at step 0% and step 100% for all Telltale blocks.

Table 5-7 Controlled Steps values vs. Telltale Status for Block ID 0, 1, 2, 3, 4,

	0%		1%		2%		3%		4 - 99%		100%	
Telltale Block ID	0~3	4	0~3	2	0~3	2	0~3	2	0~3	2	0~3	2
Telltale Status	1 - 15	1 - 4	1 - 15	1 - 4	1 - 15	1 - 4	1 - 15	1 - 4	1 - 15	1 - 4	1 - 15	1 - 4
Simulated Status	011 = Cond. Info		001 = Cond. Red		010 = Cond. Yellow		111 = not available		000 = off		011 = Cond. Info	

Supported Software version (SW version Supported) is varied depends on the version of the connected FMS Simulator Device, it is listed in Table 5-8.

Control steps vs. other common FMS parameters is listed in Table 5-9.

Table 5-8 SW version supported and displayed for each FMS Simulator Edition

Edition of FMS Simulator	SW Version Supported
Au Value Package FMS Simulator **non-plus** Edition	Not displayed on GUI
Au Truck FMS Simulator **non-plus** Edition	Not displayed on GUI
Au Bus FMS Simulator **non-plus** Edition	Not displayed on GUI
Au Truck and Bus FMS Simulator **non-plus** Edition	Not displayed on GUI
Au Value Package FMS Simulator **Plus** Edition	00.00
Au Truck FMS Simulator **Plus** Edition	04.00
Au Bus FMS Simulator **Plus** Edition.	00.04
Au Truck and Bus FMS Simulator **Plus** Edition	04.04

Table 5-9 Controlled Steps vs. other Common FMS parameters

Parameters	Step Value = 0 %	Step Value = 1-100 %
Drive Recognize	00 = vehicle motion not detected	01 = vehicle motion detected
Tachograph performance	01 = perform. analysis	00 = normal perform.
System event	01 = tachograph event	00 = no tachograph Event
Handling information	01 = handling info.	00 = no handling info.
Diagnostics supported	not supported	
Requests supported	not supported	

5.2   Data for Truck FMS only Parameter:

Axle location Bit-mapped position number is counting front to rear when facing in the direction of normal vehicle travel.

Tire location Bit-mapped position number is counting left to right when facing in the direction of normal vehicle travel.

The 10 axle weight location is illustrated in Figure 5-1. Detail axle weight at each location can be found from Table 5-16 through Table 5-25.
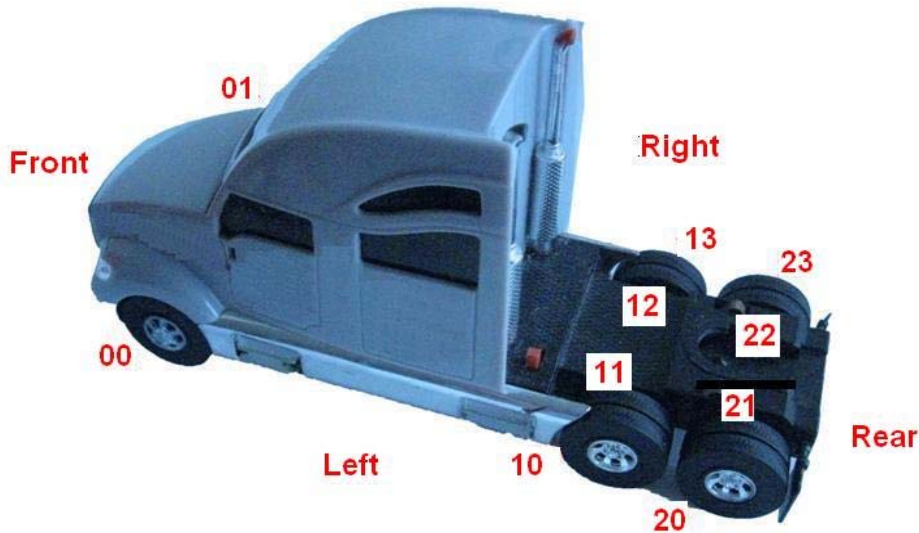
Figure 5 – 1   10 axle weight location

On Truck FMS only parameter, there are 4 PTO Drive Engagement statuses and 4 PTO States simulated, they are summarized in Table 5-11.

Table 5-11 PTO Drive Engagement and PTO state at each step value

		0%	1%	2 – 10 %	11 – 99%	100%
PTO Drive Engagement	11 = Not Available		10 = Error	01 = At least one PTO drive is engaged	00 = No PTO drive is engaged	01 = At least one PTO drive is engaged
PTO State	11111= not available		00101= Set		00000 = off/disable	00101 = Set

5.3   Data for Bus FMS only Parameters

There are 3 Door Control statuses for up to 10 doors: Lock, open, enable. Each status can be at one of the 4 possible conditions:

>   Locked Status (Locked/unlocked/not available/error)

>   Open status (open/closed/not available/error)

>   Enable Status (Enabled/Disabled/not available/error)

Door control status, Status 2 of doors, position of doors, Alternator status, and Ramp/wheel chairlift status are summarized in table 5-12.

Table 5-12 Controlled Steps values vs. Bus FMS only Parameters

Bus FMS only Parameters	0%	1%	2%	3 %	4% -100%
Lock Status Door 1- 10	10=Error	11=not available	00=Unlocked	01=Locked	
Open Status Door 1- 10	10=Error	11=not available	00=Closed	01=Open	
Enable Status Door 1- 10	10=Error	11=not available	00=Disabled	01=Enabled	
Alternator Status 1-4	10=error	11=not available	00=not charging	01=charging	
Status 2 of doors	10=Error	11=not available	01=at least 1 enabled	00=all doors disabled	
Ramp/Wheel Chairlift	10=Error	11=not available	01=outside bus	00=inside bus	
Position of doors	1110 = Error	1111 = not available	0000 = at least 1 is open	0001 = closing last door	0010 = all doors closed

5.4   PGN List

Au Truck/Bus FMS Simulator supported PGN, PGN description, and SPNs are listed in Table 5-15.

Table 5-15 List of PGN and SPN

PGN	Description (short)	Parameters	SPN	Truck /Bus	Reference
65257(FEE9)	Fuel Consumption (LFC)	Engine Total fuel used	250	Both	1.1.1
65257(FEE9)	Dash Display 1 (DD1)	Fuel Level 1	96	Both	1.1.2
		Fuel Level 2	38	Both	
61444(F004)	Electronic Engine Controller #1 (EEC1)	Actual Engine – Percent Torque	513	Both	1.1.3
		Engine Speed	190	Both	
65253(FEE5)	Engine Hours, Revolutions (HOURS)	Engine Total Hours of Operation	247	Both	1.1.4
65260(FEEC)	Vehicle Identification (VI)	Vehicle identification number	237	Both	1.1.5
64977(FDD1)	FMS-standard Interface Identity / Capabilities (FMS)	Diagnostics supported	2804	Both	1.1.6
		Requests supported	2805	Both	
		SW-version supported	2806	Both	
65217(FEC1)	High Resolution Vehicle Distance (VDHR)	High Resolution Total vehicle distance	917	Both	1.1.7
65217(FEC1)	Tachograph (TCO1)	Vehicle motion	1611	Both	1.1.8
		Driver 1 working state	1612	Both	
		Driver 2 working state	1613	Both	
		Vehicle Overspeed	1614	Both	
		Driver 1 card	1615	Both	
65217(FEC1)	Tachograph (TCO1)	Driver 2 card	1616	Both	
		Driver 1 time related states	1617	Both	
		Driver 2 time related states	1618	Both	
		Direction indicator	1619	Both	
		Tachograph performance	1620	Both	
		Handling information	1621	Both	

		System event	1622	Both	
		Tachograph vehicle speed	1624	Both	
65262(FEEE)	Engine Temperature 1 (ET1)	Engine Coolant temperature	110	Both	1.1.9
65269(FEF5)	Ambient Conditions (AMB)	Ambient Air Temperature	171	Both	1.1.10
65131(FE6B)	Driver's Identification (DI)	Driver 1 identification	1625	Both	1.1.11
		Driver 2 identification	1626	Both	
65266(FEF2)	Fuel Economy (LFE)	Fuel Rate	183	Both	1.1.12
		Instantaneous Fuel Economy	184	Both	
65198(FEAE)	Air Supply Pressure (AIR1)	Service Brake Air Pressure Circuit #1	1087	Both	1.1.13
		Service Brake Air Pressure Circuit #2	1088	Both	
64777(FD09)	High Resolution Fuel Consumption (Liquid) (HRLFC)	High resolution engine total fuel used	5054	Both	1.1.14
65110(FE56)	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Information (AT1T1I)	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 level	1761	Both	1.1.15
64893(FD7D)	FMS Tell Tale Status (FMS1)	Telltale Block ID	N/A	Both	1.1.16
		Telltale Status 1-15	N/A	Both	
61441(F001)	Electronic Brake Controller 1 (EBC1)	Brake Pedal Position	521	Both	1.1.17
64962(FDC2)	Electronic Engine Controller 14 (EEC14)	Fuel Type	5837	Both	1.1.18
65199(FEAF)	Fuel Consumption (Gaseous) (GFC)	Total Fuel Used (Gaseous)	1040	Both	1.1.19
61440(F000)	Electronic Retarder Controller 1 (ERC1)	Retarder Torque Mode	900	Both	1.1.20
		Actual Retarder - Percent Torque	520	Both	
		Retarder selection, non-engine	1716	Both	
65265(FEF1)	Cruise Control/Vehicle Speed 1 (CCVS1)	Parking Brake Switch	70	Both	1.2.1
		Wheel Based Speed	84	Both	
		Cruise control status	527	Both	
		Cruise control active	595	Both	
		Brake Switch	597	Both	
		Clutch Switch	598	Both	
		PTO state	976	Truck	
61443(F003)	Electronic Engine Controller #2 (EEC2)	Accelerator pedal position	91	Both	1.2.2
		Engine Percent Load at Current Speed	92	Truck	
65258(FEEA)	Vehicle Weight (VW)	Axle weight	582	Truck	1.2.3
		Axle Location	928	Truck	
		Tire Location	928	Truck	
65216(FEC0)	Service Information (SERV)	Service distance	914	Truck	1.2.4
64932(FDA4)	PTO Drive Engagement (PTODE)	At least one PTO engaged	3948	Truck	1.2.5
65136(FE70)	Combination Vehicle Weight (CVW)	Gross Combination Vehicle Weight	1760	Truck	1.2.6
65102(FE4E)	Door Control 1 (DC1)	Ramp/Wheel chair life	1820	BUS	1.3.3
		Position of Doors	1821	BUS	
		Status 2 of doors	3411	BUS	
64933(FDA5)	Door Control 2 (DC2)	Lock Status Door 1	3412	BUS	1.3.4
		Open Status Door 1	3413	BUS	
		Enable Status Door 1	3414	BUS	
		Lock Status Door 2	3415	BUS	
		Open Status Door 2	3416	BUS	
		Enable Status Door 2	3417	BUS	
		Lock Status Door 3	3418	BUS	

		Open Status Door 3	3419	BUS	
		Enable Status Door 3	3420	BUS	
		Lock Status Door 4	3421	BUS	
		Open Status Door 4	3422	BUS	
		Enable Status Door 4	3423	BUS	
		Lock Status Door 5	3424	BUS	
		Open Status Door 5	3425	BUS	
		Enable Status Door 5	3426	BUS	
		Lock Status Door 6	3427	BUS	
		Open Status Door 6	3428	BUS	
		Enable Status Door 6	3429	BUS	
		Lock Status Door 7	3430	BUS	
		Open Status Door 7	3431	BUS	
		Enable Status Door 7	3415	BUS	
		Lock Status Door 8	3415	BUS	
		Open Status Door 8	3415	BUS	
		Enable Status Door 8	3415	BUS	
		Lock Status Door 9	3415	BUS	
		Open Status Door 9	3415	BUS	
		Enable Status Door 9	3415	BUS	
		Lock Status Door 10	3415	BUS	
		Open Status Door 10	3415	BUS	
		Enable Status Door 10	3415	BUS	
65254(FEE6)	Time / Date (TD)	Seconds	959	BUS	1.3.5
		Minutes	960	BUS	
		Hours	961	BUS	
		Day	962	BUS	
		Month	963	BUS	
		Year	964	BUS	
65237(FED5)	Alternator Speed (AS)	Alternator Status 1	3353	BUS	1.3.6
		Alternator Status 2	3354	BUS	
		Alternator Status 3	3355	BUS	
		Alternator Status 4	3356	BUS	
61445(F005)	Electronic Transmission Controller 2 (ETC2)	Current Gear	523	BUS	1.3.7
		Selected Gear	524	BUS	
65112(FE58)	Air Suspension Control 4 (ASC4)	Bellow Pressure Front Axle Left	1725	BUS	1.3.8
		Bellow Pressure Front Axle Right	1726	BUS	
		Bellow Pressure Rear Axle Left	1727	BUS	
		Bellow Pressure Rear Axle Right	1728	BUS	
64695(FCB7)	Vehicle Electrical Power #4 (VEP4)	Hybrid Battery Pack Remaining Charge	5464	Bus	1.3.9
61449(F009)	Vehicle Dynamic Stability Control 2 (VDC2)	Steering Wheel Angle	1807	Bus	1.3.10

5.5   Detail Data from step 0 to 100%

The simulation result vs. control step value (from 0 to 100) is illustrated from Table 5-16 to Table 5-25.

Table 5-16 FMS Simulation result vs. control step values (from 0 to 11)

Parameters	0	1	2	3	4	5	6	7	8	9	10	11
Wheel Based Speed (km/hr)	0	2.508	5.02	7.527	10.039	12.547	15.059	17.566	20.078	22.586	25.098	27.609
Accelerator pedal position (%)	0.0	0.8	2.0	2.8	4.0	4.8	6.0	6.8	8.0	8.8	10.0	10.8
Total fuel used (L)	0.0	12.5	25.0	37.5	50.0	62.5	75.0	87.5	100.0	112.5	125.0	137.5
Fuel Level (%)	0.0	0.8	2.0	2.8	4.0	4.8	6.0	6.8	8.0	8.8	10.0	10.8
Engine Speed (rpm)	0	80.25	160.625	240.875	321.25	401.5	481.875	562.125	642.5	722.75	803.125	883.5
Total Engine Hours (hr)	0.0	12.5	25.0	37.5	50.0	62.5	75.0	87.5	100.0	112.5	125.0	137.5
Total vehicle distance (m)	0	25000	50000	75000	100000	125000	150000	175000	200000	225000	250000	275000
Tachograph. vehicle speed (km/hr)	0	2.508	5.02	7.527	10.039	12.547	15.059	17.566	20.078	22.586	25.098	27.609
Ambient Air Temperature	-273.00	-267.09	-261.19	-255.28	-249.38	-243.44	-237.53	-231.63	-225.72	-219.81	-213.88	-207.97
Engine Coolant Temperature (°C)	-40.0	-38	-35.0	-33	-30.0	-28	-25.0	-23	-20.0	-18	-15.0	-13
Fuel Rate	0.00	2.8	5.65	8.5	11.35	14.15	17.00	19.85	22.70	25.5	28.35	31.2
Instantaneous Fuel Economy	0.00	0.48	0.96	1.43	1.91	2.39	2.87	3.35	3.83	4.3	4.78	5.26
Vehicle Identification (VIN)	X000	X001	X002	X003	X004	X005	X006	X007	X008	X009	X010	X011
Engine Percent Load	0	1	2	3	5	6	7	8	10	11	12	13
Fuel Consumption (L)	0.000	12.500	25.000	37.500	50.000	62.500	75.000	87.500	100.000	112.500	125.000	137.500
Service Distance (km)	-160635	-157425	-154210	-151000	-147785	-144575	-141360	-138150	-134935	-131725	-128510	-125295
axle weight (location 00) (kg)	0.0	125	250.0	375	500.0	625	750.0	875	1000.0	1125	1250.0	1375
axle weight (location 01) (kg)	0.0	130	255.0	380	505.0	630	755.0	880	1005.0	1130	1255.0	1380
axle weight (location 10) (kg)	0.0	135	260.0	385	510.0	635	760.0	885	1010.0	1135	1260.0	1385
axle weight (location 11) (kg)	0.0	140	265.0	390	515.0	640	765.0	890	1015.0	1140	1265.0	1390
axle weight (location 12) (kg)	0.0	145	270.0	395	520.0	645	770.0	895	1020.0	1145	1270.0	1395
axle weight (location 13) (kg)	0.0	150	275.0	400	525.0	650	775.0	900	1025.0	1150	1275.0	1400
axle weight (location 20) (kg)	0.0	155	280.0	405	530.0	655	780.0	905	1030.0	1155	1280.0	1405
axle weight (location 21) (kg)	0.0	160	285.0	410	535.0	660	785.0	910	1035.0	1160	1285.0	1410
axle weight (location 22) (kg)	0.0	165	290.0	415	540.0	665	790.0	915	1040.0	1165	1290.0	1415
axle weight (location 23) (kg)	0.0	170	295.0	420	545.0	670	795.0	920	1045.0	1170	1295.0	1420
Air Susp. Front Left	0.0	64.2	128.5	192.7	257.0	321.2	385.5	449.7	514.0	578.2	642.5	706.8
Air Susp. Front Right	0.0	64.2	128.5	192.7	257.0	321.2	385.5	449.7	514.0	578.2	642.5	706.8
Air Susp. Rear Left	0.0	64.2	128.5	192.7	257.0	321.2	385.5	449.7	514.0	578.2	642.5	706.8
Air Susp. Rear Right	0.0	64.2	128.5	192.7	257.0	321.2	385.5	449.7	514.0	578.2	642.5	706.8
Service Brake Air #1	0	16	40	56	80	96	120	136	160	176	200	216
Service Brake Air #2	0	16	40	56	80	96	120	136	160	176	200	216
Date (YYYY/MM/DD)	1985/1/1	1987/1/1	1990/1/1	1992/1/1	1995/1/2	1997/1/2	2000/1/2	2002/1/3	2005/1/3	2007/1/3	2010/2/4	2012/2/4
Selected Gear	Park	-123	-120	-118	-115	-113	-110	-108	-105	-103	-100	-98
Current Gear	Park	-123	-120	-118	-115	-113	-110	-108	-105	-103	-100	-98

Table 5-17 FMS Simulation results vs. control step values (from 12 to 24)

Parameters	12	13	14	15	16	17	18	19	20	21	22	23	24
Wheel Based Speed (km/hr)	30.117	32.629	35.137	37.648	40.156	42.668	45.176	47.688	50.199	52.707	55.219	57.727	60.238
Accelerator pedal position (%)	12.0	12.8	14	14.8	16	16.8	18	18.8	20	20.8	22	22.8	24
Total fuel used (L)	150.0	162.5	175	187.5	200	212.5	225	237.5	250	262.5	275	287.5	300
Fuel Level (%)	12.0	12.8	14	14.8	16	16.8	18	18.8	20	20.8	22	22.8	24
Engine Speed (rpm)	963.75	1044.13	1124.38	1204.75	1285.00	1365.38	1445.63	1526.00	1606.38	1686.63	1767.00	1847.3	1927.63
Total Engine Hours (hr)	150.0	162.5	175.0	187.5	200.0	212.5	225.0	237.5	250.0	262.5	275	287.5	300
Total vehicle distance (m)	300000	325000	350000	375000	400000	425000	450000	475000	500000	525000	550000	575000	600000
Tachograph. vehicle speed (km/hr)	30.117	32.639	35.137	37.648	40.156	42.668	45.176	47.688	50.199	52.707	55.219	57.727	60.238
Ambient Air Temperature	-202.06	-196.16	-190.25	-184.31	-178.41	-172.5	-166.59	-160.69	-154.75	-148.84	-142.94	-137.03	-131.13
Engine Coolant Temperature (°C)	-10.0	-8	-5	-3	0	2	5	7	10	12	15	17	20
Fuel Rate	34.05	36.9	39.7	42.55	45.4	48.25	51.05	53.9	56.75	59.6	62.45	65.25	68.1
Instantaneous Fuel Economy	5.74	6.22	6.7	7.17	7.65	8.13	8.61	9.09	9.56	10.04	10.52	11	11.48
Vehicle Identification (VIN)	X012	X013	X014	X015	X016	X017	X018	X019	X020	X021	X022	X023	X024
Engine Percent Load	15	16	17	18	20	21	22	23	25	26	27	28	30
Fuel Consumption (L)	150.000	162.5	175	187.5	200	212.5	225	237.5	250	262.5	275	287.5	300
Service Distance (km)	-122085	-118870	-115660	-112445	-109235	-106020	-102810	-99595	-96380	-93170	-89955	-86745	-83530
axle weight (location 00) (kg)	1500.0	1625	1750	1875	2000	2125	2250	2375	2500	2625	2750	2875	3000
axle weight (location 01) (kg)	1505.0	1630	1755	1880	2005	2130	2255	2380	2505	2630	2755	2880	3005
axle weight (location 10) (kg)	1510.0	1635	1760	1885	2010	2135	2260	2385	2510	2635	2760	2885	3010
axle weight (location 11) (kg)	1515.0	1640	1765	1890	2015	2140	2265	2390	2515	2640	2765	2890	3015
axle weight (location 12) (kg)	1520.0	1645	1770	1895	2020	2145	2270	2395	2520	2645	2770	2895	3020
axle weight (location 13) (kg)	1525.0	1650	1775	1900	2025	2150	2275	2400	2525	2650	2775	2900	3025
axle weight (location 20) (kg)	1530.0	1655	1780	1905	2030	2155	2280	2405	2530	2655	2780	2905	3030
axle weight (location 21) (kg)	1535.0	1660	1785	1910	2035	2160	2285	2410	2535	2660	2785	2910	3035
axle weight (location 22) (kg)	1540.0	1665	1790	1915	2040	2165	2290	2415	2540	2665	2790	2915	3040
axle weight (location 23) (kg)	1545.0	1670	1795	1920	2045	2170	2295	2420	2545	2670	2795	2920	3045
Air Susp. Front Left	771.0	835.3	899.5	963.8	1028	1092.3	1156.5	1220.8	1285.1	1349.3	1413.6	1477.8	1542.1
Air Susp. Front Right	771.0	835.3	899.5	963.8	1028	1092.3	1156.5	1220.8	1285.1	1349.3	1413.6	1477.8	1542.1
Air Susp. Rear Left	771.0	835.3	899.5	963.8	1028	1092.3	1156.5	1220.8	1285.1	1349.3	1413.6	1477.8	1542.1
Air Susp. Rear Right	771.0	835.3	899.5	963.8	1028	1092.3	1156.5	1220.8	1285.1	1349.3	1413.6	1477.8	1542.1
Service Brake Air #1	240	256	280	296	320	336	360	376	400	416	440	456	480
Service Brake Air #2	240	256	280	296	320	336	360	376	400	416	440	456	480
Date (YYYY/MM/DD)	2015/2/4	2017/2/4	2020/2/5	2022/2/5	2025/2/5	2027/2/6	2030/2/6	2032/3/6	2035/3/7	2037/3/7	2040/3/7	2042/3/7	2045/3/8
Selected Gear	-95	-93	-90	-88	-85	-83	-80	-78	-75	-73	-70	-68	-65
Current Gear	-95	-93	-90	-88	-85	-83	-80	-78	-75	-73	-70	-68	-65

Table 5-18 FMS Simulation results vs. control step values (from 25 to 35)

Parameters	25	26	27	28	29	30	31	32	33	34	35
Wheel Based Speed (km/hr)	62.746	65.258	67.766	70.277	72.785	75.297	77.809	80.316	82.828	85.336	87.848
Accelerator pedal position(%)	24.8	26.0	26.8	28.0	28.8	30.0	30.8	32.0	32.8	34.0	34.8
Total fuel used (L)	312.5	325.0	337.5	350.0	362.5	375.0	387.5	400.0	412.5	425.0	437.5
Fuel Level (%)	24.8	26.0	26.8	28.0	28.8	30.0	30.8	32.0	32.8	34.0	34.8
Engine Speed (rpm)	2007.88	2088.25	2168.5	2248.88	2329.13	2409.5	2489.88	2570.13	2650.5	2730.75	2811.13
Total Engine Hours (hr)	312.5	325.0	337.5	350.0	362.5	375.0	387.5	400.0	412.5	425.0	437.5
Total vehicle distance (m)	625000	650000	675000	700000	725000	750000	775000	800000	825000	850000	875000
Tachograph. vehicle speed (km/hr)	62.746	65.258	67.766	70.277	72.785	75.297	77.809	80.316	82.828	85.336	87.848
Ambient Air Temperature	-125.19	-119.28	-113.38	-107.47	-101.56	-95.63	-89.72	-83.81	-77.91	-72.00	-66.06
Engine Coolant Temperature (°C)	22	25.0	27	30.0	32	35.0	37	40.0	42	45.0	47
Fuel Rate	70.95	73.80	76.6	79.45	82.3	85.15	88.00	90.80	93.65	96.50	99.35
Instantaneous Fuel Economy	11.96	12.43	12.91	13.39	13.87	14.35	14.83	15.30	15.78	16.25	16.74
Vehicle Identification (VIN)	X025	X026	X027	X028	X029	X030	X031	X032	X033	X034	X035
Engine Percent Load	31	32	33	35	36	37	38	40	41	42	43
Fuel Consumption (L)	312.500	325.000	337.500	350.000	362.500	375.000	387.500	400.000	412.500	425.000	437.500
Service Distance (km)	-80320	-77105	-73895	-70680	-67470	-64255	-61040	-57830	-54615	-51405	-48190
axle weight (location 00) (kg)	3125	3250.0	3375	3500.0	3625	3750.0	3875	4000.0	4125	4250.0	4375
axle weight (location 01) (kg)	3130	3255.0	3380	3505.0	3630	3755.0	3880	4005.0	4130	4255.0	4380
axle weight (location 10) (kg)	3135	3260.0	3385	3510.0	3635	3760.0	3885	4010.0	4135	4260.0	4385
axle weight (location 11) (kg)	3140	3265.0	3390	3515.0	3640	3765.0	3890	4015.0	4140	4265.0	4390
axle weight (location 12) (kg)	3145	3270.0	3395	3520.0	3645	3770.0	3895	4020.0	4145	4270.0	4395
axle weight (location 13) (kg)	3150	3275.0	3400	3525.0	3650	3775.0	3900	4025.0	4150	4275.0	4400
axle weight (location 20) (kg)	3155	3280.0	3405	3530.0	3655	3780.0	3905	4030.0	4155	4280.0	4405
axle weight (location 21) (kg)	3160	3285.0	3410	3535.0	3660	3785.0	3910	4035.0	4160	4285.0	4410
axle weight (location 22) (kg)	3165	3290.0	3415	3540.0	3665	3790.0	3915	4040.0	4165	4290.0	4415
axle weight (location 23) (kg)	3170	3295.0	3420	3545.0	3670	3795.0	3920	4045.0	4170	4295.0	4420
Air Susp. Front Axle Left	1606.3	1670.6	1734.8	1799.1	1863.3	1927.6	1991.9	2056.1	2120.4	2184.6	2248
Air Susp. Front Axle Right	1606.3	1670.6	1734.8	1799.1	1863.3	1927.6	1991.9	2056.1	2120.4	2184.6	2248
Air Susp. Rear Axle Left	1606.3	1670.6	1734.8	1799.1	1863.3	1927.6	1991.9	2056.1	2120.4	2184.6	2248
Air Susp. Rear Axle Right	1606.3	1670.6	1734.8	1799.1	1863.3	1927.6	1991.9	2056.1	2120.4	2184.6	2248
Service Brake Air #1	496	520	536	560	576	600	616	640	656	680	696
Service Brake Air #2	496	520	536	560	576	600	616	640	656	680	696
Date (YYYY/MM/DD)	2047/3/8	2050/3/8	2052/3/9	2055/4/9	2057/4/9	2060/4/10	2062/4/10	2065/4/10	2067/4/10	2070/4/11	2072/4/11
Selected Gear	-63	-60	-58	-55	-53	-50	-48	-45	-43	-40	-38
Current Gear	-63	-60	-58	-55	-53	-50	-48	-45	-43	-40	-38

Table 5-19 FMS Simulation results vs. control step values (from 36 to 46)

Parameters	36	37	38	39	40	41	42	43	44	45	46
Wheel Based Speed (km/hr)	90.355	92.867	95.375	97.887	100.398	102.906	105.418	107.926	110.438	112.945	115.457
Accelerator pedal position (%)	36.0	36.8	38.0	38.8	40.0	40.8	42.0	42.8	44.0	44.8	46.0
Total fuel used (L)	450.0	462.5	475.0	487.5	500.0	512.5	525.0	537.5	550.0	562.5	575.0
Fuel Level (%)	36.0	36.8	38.0	38.8	40.0	40.8	42.0	42.8	44.0	44.8	46.0
Engine Speed (rpm)	2891.38	2971.75	3052	3132.38	3212.75	3293.00	3373.38	3453.63	3534.00	3614.25	3694.63
Total Engine Hours (hr)	450.0	462.5	475.0	487.5	500.0	512.5	525.0	537.5	550.0	562.5	575.0
Total vehicle distance (m)	900000	925000	950000	975000	1000000	1025000	1050000	1075000	1100000	1125000	1150000
Tachograph. vehicle speed (km/hr)	90.355	92.867	95.375	97.887	100.398	102.906	105.418	107.926	110.438	112.945	115.457
Ambient Air Temperature	-60.16	-54.25	-48.34	-42.44	-36.50	-30.59	-24.69	-18.78	-12.88	-6.94	-1.03
Engine Coolant Temp.(°C)	50.0	52	55.0	57	60.0	62	65.0	67	70.0	72	75.0
Fuel Rate	102.15	105.00	107.85	110.7	113.55	116.35	119.20	122.05	124.90	127.7	130.55
Instantaneous Fuel Economy	17.22	17.7	18.17	18.65	19.13	19.61	20.09	20.56	21.04	21.52	22.00
Vehicle Identification (VIN)	X036	X037	X038	X039	X040	X041	X042	X043	X044	X045	X046
Engine Percent Load	45	46	47	48	50	51	52	53	55	56	57
Fuel Consumption (L)	450.000	462.500	475.000	487.500	500.000	512.500	525.000	537.500	550.000	562.500	575.000
Service Distance (km)	-44980	-41765	-38555	-35340	-32125	-28915	-25700	-22490	-19275	-16065	-12850
axle weight (location 00) (kg)	4500.0	4625	4750.0	4875	5000.0	5125	5250.0	5375	5500.0	5625	5750.0
axle weight (location 01) (kg)	4505.0	4630	4755.0	4880	5005.0	5130	5255.0	5380	5505.0	5630	5755.0
axle weight (location 10) (kg)	4510.0	4635	4760.0	4885	5010.0	5135	5260.0	5385	5510.0	5635	5760.0
axle weight (location 11) (kg)	4515.0	4640	4765.0	4890	5015.0	5140	5265.0	5390	5515.0	5640	5765.0
axle weight (location 12) (kg)	4520.0	4645	4770.0	4895	5020.0	5145	5270.0	5395	5520.0	5645	5770.0
axle weight (location 13) (kg)	4525.0	4650	4775.0	4900	5025.0	5150	5275.0	5400	5525.0	5650	5775.0
axle weight (location 20) (kg)	4530.0	4655	4780.0	4905	5030.0	5155	5280.0	5405	5530.0	5655	5780.0
axle weight (location 21) (kg)	4535.0	4660	4785.0	4910	5035.0	5160	5285.0	5410	5535.0	5660	5785.0
axle weight (location 22) (kg)	4540.0	4665	4790.0	4915	5040.0	5165	5290.0	5415	5540.0	5665	5790.0
axle weight (location 23) (kg)	4545.0	4670	4795.0	4920	5045.0	5170	5295.0	5420	5545.0	5670	5795.0
Air Susp. Front Axle Left	2313.1	2377.4	2441.6	2505.9	2570.2	2634.4	2698.7	2762.9	2827.2	2891.4	2955.7
Air Susp. Front Axle Right	2313.1	2377.4	2441.6	2505.9	2570.2	2634.4	2698.7	2762.9	2827.2	2891.4	2955.7
Air Susp. Rear Axle Left	2313.1	2377.4	2441.6	2505.9	2570.2	2634.4	2698.7	2762.9	2827.2	2891.4	2955.7
Air Susp. Rear Axle Right	2313.1	2377.4	2441.6	2505.9	2570.2	2634.4	2698.7	2762.9	2827.2	2891.4	2955.7
Service Brake Air #1	720	736	760	776	800	816	840	856	880	896	920
Service Brake Air #2	720	736	760	776	800	816	840	856	880	896	920
Date (YYYY/MM/DD)	2075/4/11	2077/5/12	2080/5/12	2082/5/12	2085/5/13	2087/5/13	2090/5/13	2092/5/13	2095/5/14	2097/5/14	2100/6/14
Selected Gear	-35	-33	-30	-28	-25	-23	-20	-18	-15	-13	-10
Current Gear	-35	-33	-30	-28	-25	-23	-20	-18	-15	-13	-10

Table 5-20 FMS Simulation results vs. control step values (from 47 to 57)

Parameters	47	48	49	50	51	52	53	54	55	56	57
Wheel Based Speed (km/hr)	117.965	120.477	122.984	125.496	128.008	130.516	133.027	135.535	138.047	140.555	143.066
Accelerator pedal position (%)	46.8	48.0	48.8	50.0	50.8	52.0	52.8	54.0	54.8	56.0	56.8
Total fuel used (L)	587.5	600.0	612.5	625.0	637.5	650.0	662.5	675.0	687.5	700.0	712.5
Fuel Level (%)	46.8	48.0	48.8	50.0	50.8	52.0	52.8	54.0	54.8	56.0	56.8
Engine Speed (rpm)	3774.88	3855.25	3935.5	4015.88	4096.25	4176.5	4256.875	4337.13	4417.5	4497.75	4578.13
Total Engine Hours (hr)	587.5	600.0	612.5	625.0	637.5	650.0	662.5	675.0	687.5	700.0	712.5
Total vehicle distance (m)	1175000	1200000	1225000	1250000	1275000	1300000	13250000	1350000	1375000	1400000	1425000
Tachograph. vehicle speed (km/hr)	117.965	120.477	122.984	125.496	128.008	130.516	133.027	135.535	138.047	140.555	143.066
Ambient Air Temperature	4.88	10.78	16.69	22.63	28.53	34.44	40.34	46.25	52.19	58.09	64.00
Engine Coolant Temp.(°C)	77	80.0	82	85.0	87	90.0	92	95.0	97	100.0	102
Fuel Rate	133.4	136.25	139.05	141.90	144.75	147.60	150.45	153.25	156.1	158.95	161.8
Instantaneous Fuel Economy	22.48	22.96	23.43	23.91	24.39	24.87	25.35	25.83	26.3	26.78	27.26
Vehicle Identification (VIN)	X047	X048	X049	X050	X051	X052	X053	X054	X055	X056	X057
Engine Percent Load	58	60	61	62	63	65	66	67	68	70	71
Fuel Consumption (L)	587.500	600.000	612.500	625.000	637.500	650.000	662.500	675.000	687.500	700.000	712.500
Service Distance (km)	-9640	-6425	-3215	0	3215	6425	9640	12850	16065	19275	22490
axle weight (location 00) (kg)	5875	6000.0	6125	6250.0	6375	6500.0	6625	6750.0	6875	7000.0	7125
axle weight (location 01) (kg)	5880	6005.0	6130	6255.0	6380	6505.0	6630	6755.0	6880	7005.0	7130
axle weight (location 10) (kg)	5885	6010.0	6135	6260.0	6385	6510.0	6635	6760.0	6885	7010.0	7135
axle weight (location 11) (kg)	5890	6015.0	6140	6265.0	6390	6515.0	6640	6765.0	6890	7015.0	7140
axle weight (location 12) (kg)	5895	6020.0	6145	6270.0	6395	6520.0	6645	6770.0	6895	7020.0	7145
axle weight (location 13) (kg)	5900	6025.0	6150	6275.0	6400	6525.0	6650	6775.0	6900	7025.0	7150
axle weight (location 20) (kg)	5905	6030.0	6155	6280.0	6405	6530.0	6655	6780.0	6905	7030.0	7155
axle weight (location 21) (kg)	5910	6035.0	6160	6285.0	6410	6535.0	6660	6785.0	6910	7035.0	7160
axle weight (location 22) (kg)	5915	6040.0	6165	6290.0	6415	6540.0	6665	6790.0	6915	7040.0	7165
axle weight (location 23) (kg)	5920	6045.0	6170	6295.0	6420	6545.0	6670	6795.0	6920	7045.0	7170
Air Susp. Front Axle Left	3019.9	3084.2	3148.4	3212.7	3277	3341.2	3405.5	3469.7	3534	3598.2	3662.5
Air Susp. Front Axle Right	3019.9	3084.2	3148.4	3212.7	3277	3341.2	3405.5	3469.7	3534	3598.2	3662.5
Air Susp. Rear Axle Left	3019.9	3084.2	3148.4	3212.7	3277	3341.2	3405.5	3469.7	3534	3598.2	3662.5
Air Susp. Rear Axle Right	3019.9	3084.2	3148.4	3212.7	3277	3341.2	3405.5	3469.7	3534	3598.2	3662.5
Service Brake Air #1	936	960	976	1000	1016	1040	1056	1080	1096	1120	1136
Service Brake Air #2	936	960	976	1000	1016	1040	1056	1080	1096	1120	1136
Date (YYYY/MM/DD)	2102/6/15	2105/6/15	2107/6/15	2110/6/16	2112/6/16	2115/6/16	2117/6/16	2120/6/17	2122/7/17	2125/7/17	2127/7/18
Selected Gear	-8	-5	-3	neutral	2	5	7	10	12	15	17
Current Gear	-8	-5	-3	neutral	2	5	7	10	12	15	17

Table 5-21 FMS Simulation results vs. control step values (from 58 to 67)

Parameters	58	59	60	61	62	63	64	65	66	67
Wheel Based Speed (km/hr)	145.574	148.086	150.598	153.105	155.617	158.125	160.637	163.145	165.656	168.164
Accelerator pedal position (%)	58.0	58.8	60.0	60.8	62.0	62.8	64.0	64.8	66.0	66.8
Total fuel used (L)	725.0	737.5	750.0	762.5	775.0	787.5	800.0	812.5	825.0	837.5
Fuel Level (%)	58.0	58.8	60.0	60.8	62.0	62.8	64.0	64.8	66.0	66.8
Engine Speed (rpm)	4658.38	4738.75	4819.13	4899.38	4979.75	5060	5140.38	5220.63	5301	5381.25
Total Engine Hours (hr)	725.0	737.5	750.0	762.5	775.0	787.5	800.0	812.5	825.0	837.5
Total vehicle distance (m)	1450000	1475000	1500000	1525000	1550000	1575000	1600000	1625000	1650000	1675000
Tachograph. vehicle speed (km/hr)	145.574	148.086	150.598	153.105	155.617	158.125	160.637	163.145	165.656	168.164
Ambient Air Temperature	69.91	75.81	81.75	87.66	93.56	99.47	105.38	111.31	117.22	123.13
Engine Coolant Temp(°C)	105.0	107	110.0	112	115.0	117	120.0	122	125.0	127
Fuel Rate	164.60	167.45	170.30	173.15	176.00	178.8	181.65	184.5	187.35	190.15
Instantaneous Fuel Economy	27.74	28.22	28.70	29.17	29.65	30.13	30.61	31.09	31.56	32.04
Vehicle Identification (VIN)	X058	X059	X060	X061	X062	X063	X064	X065	X066	X067
Engine Percent Load	72	73	75	76	77	78	80	81	82	83
Fuel Consumption (L)	725.000	737.500	750.000	762.500	775.000	787.500	800.000	812.500	825.000	837.500
Service Distance (km)	25700	28915	32130	35340	38555	41765	44980	48190	51405	54615
axle weight (location 00) (kg)	7250.0	7375	7500.0	7625	7750.0	7875	8000.0	8125	8250.0	8375
axle weight (location 01) (kg)	7255.0	7380	7505.0	7630	7755.0	7880	8005.0	8130	8255.0	8380
axle weight (location 10) (kg)	7260.0	7385	7510.0	7635	7760.0	7885	8010.0	8135	8260.0	8385
axle weight (location 11) (kg)	7265.0	7390	7515.0	7640	7765.0	7890	8015.0	8140	8265.0	8390
axle weight (location 12) (kg)	7270.0	7395	7520.0	7645	7770.0	7895	8020.0	8145	8270.0	8395
axle weight (location 13) (kg)	7275.0	7400	7525.0	7650	7775.0	7900	8025.0	8150	8275.0	8400
axle weight (location 20) (kg)	7280.0	7405	7530.0	7655	7780.0	7905	8030.0	8155	8280.0	8405
axle weight (location 21) (kg)	7285.0	7410	7535.0	7660	7785.0	7910	8035.0	8160	8285.0	8410
axle weight (location 22) (kg)	7290.0	7415	7540.0	7665	7790.0	7915	8040.0	8165	8290.0	8415
axle weight (location 23) (kg)	7295.0	7420	7545.0	7670	7795.0	7920	8045.0	8170	8295.0	8420
Air Susp. Front Axle Left	3726.7	3791	3855.3	3919.5	3983.8	4048	4112.3	4176.5	4240.8	4305
Air Susp. Front Axle Right	3726.7	3791	3855.3	3919.5	3983.8	4048	4112.3	4176.5	4240.8	4305
Air Susp. Rear Axle Left	3726.7	3791	3855.3	3919.5	3983.8	4048	4112.3	4176.5	4240.8	4305
Air Susp. Rear Axle Right	3726.7	3791	3855.3	3919.5	3983.8	4048	4112.3	4176.5	4240.8	4305
Service Brake Air #1	1160	1176	1200	1216	1240	1256	1280	1296	1320	1336
Service Brake Air #2	1160	1176	1200	1216	1240	1256	1280	1296	1320	1336
Date (YYYY/MM/DD)	2130/7/18	2132/7/18	2135/7/19	2137/7/19	2140/7/19	2142/7/19	2145/8/20	2147/8/20	2150/8/20	2152/8/21
Selected Gear	20	22	25	27	30	32	35	37	40	42
Current Gear	20	22	25	27	30	32	35	37	40	42

Table 5-22 FMS Simulation result vs. control step values (from 68 to 77)

Parameters	68	69	70	71	72	73	74	75	76	77
Wheel Based Speed (km/hr)	170.676	173.184	175.695	178.207	180.715	183.227	185.734	188.246	190.754	193.266
Accelerator pedal position (%)	68.0	68.8	70.0	70.8	72.0	72.8	74.0	74.8	76.0	76.8
Total fuel used (L)	850.0	862.5	875.0	887.5	900.0	912.5	925.0	937.5	950.0	962.5
Fuel Level (%)	68.0	68.8	70.0	70.8	72.0	72.8	74.0	74.8	76.0	76.8
Engine Speed (rpm)	5461.63	5541.88	5622.25	5702.63	5782.88	5863.25	5943.5	6023.88	6104.13	6184.5
Total Engine Hours (hr)	850.0	862.5	875.0	887.5	900.0	912.5	925.0	937.5	950.0	962.5
Total vehicle distance (m)	1700000	1725000	1750000	1775000	1800000	1825000	1850000	1875000	1900000	1925000
Tachograph. vehicle speed (km/hr)	170.676	173.184	175.695	178.207	180.715	183.227	185.734	188.246	190.754	193.266
Ambient Air Temperature	129.03	134.94	140.88	146.78	152.69	158.59	164.50	170.44	176.34	182.25
Engine Coolant Tempe(°C)	130.0	132	135.0	137	140.0	142	145.0	147	150.0	152
Fuel Rate	193.00	195.85	198.70	201.55	204.35	207.2	210.05	212.9	215.70	218.55
Instantaneous Fuel Economy	32.52	33	33.48	33.96	34.44	34.91	35.39	35.87	36.35	36.83
Vehicle Identification (VIN)	X068	X069	X070	X071	X072	X073	X074	X075	X076	X077
Engine Percent Load	85	86	87	88	90	91	92	93	95	96
Fuel Consumption (L)	850.000	862.500	875.000	887.500	900.000	912.500	925.000	937.500	950.000	962.500
Service Distance (km)	57830	61040	64255	67470	70680	73895	77105	80320	83530	86745
axle weight (location 00) (kg)	8500.0	8625	8750.0	8875	9000.0	9125	9250.0	9375	9500.0	9625
axle weight (location 01) (kg)	8505.0	8630	8755.0	8880	9005.0	9130	9255.0	9380	9505.0	9630
axle weight (location 10) (kg)	8510.0	8635	8760.0	8885	9010.0	9135	9260.0	9385	9510.0	9635
axle weight (location 11) (kg)	8515.0	8640	8765.0	8890	9015.0	9140	9265.0	9390	9515.0	9640
axle weight (location 12) (kg)	8520.0	8645	8770.0	8895	9020.0	9145	9270.0	9395	9520.0	9645
axle weight (location 13) (kg)	8525.0	8650	8775.0	8900	9025.0	9150	9275.0	9400	9525.0	9650
axle weight (location 20) (kg)	8530.0	8655	8780.0	8905	9030.0	9155	9280.0	9405	9530.0	9655
axle weight (location 21) (kg)	8535.0	8660	8785.0	8910	9035.0	9160	9285.0	9410	9535.0	9660
axle weight (location 22) (kg)	8540.0	8665	8790.0	8915	9040.0	9165	9290.0	9415	9540.0	9665
axle weight (location 23) (kg)	8545.0	8670	8795.0	8920	9045.0	9170	9295.0	9420	9545.0	9670
Air Susp. Front Axle Left	4369.3	4433.5	4497.8	4562.1	4626.3	4690.6	4754.8	4819.1	4883.3	4947.6
Air Susp. Front Axle Right	4369.3	4433.5	4497.8	4562.1	4626.3	4690.6	4754.8	4819.1	4883.3	4947.6
Air Susp. Rear Axle Left	4369.3	4433.5	4497.8	4562.1	4626.3	4690.6	4754.8	4819.1	4883.3	4947.6
Air Susp. Rear Axle Right	4369.3	4433.5	4497.8	4562.1	4626.3	4690.6	4754.8	4819.1	4883.3	4947.6
Service Brake Air #1	1360	1376	1400	1416	1440	1456	1480	1496	1520	1536
Service Brake Air #2	1360	1376	1400	1416	1440	1456	1480	1496	1520	1536
Date (YYYY/MM/DD)	2155/8/21	2157/8/21	2160/8/22	2162/8/22	2165/8/22	2167/8/22	2170/9/23	2172/9/23	2175/9/23	2177/9/24
Selected Gear	45	47	50	52	55	57	60	62	65	67
Current Gear	45	47	50	52	55	57	60	62	65	67

Table 5-23 FMS Simulation result vs. control step values (from 78 to 86)

Parameters	78	79	80	81	82	83	84	85	86
Wheel Based Speed (km/hr)	195.773	198.285	200.797	203.305	205.816	208.324	210.836	213.344	215.855
Accelerator pedal position (%)	78.0	78.8	80.0	80.8	82.0	82.8	84.0	84.8	86.0
Total fuel used (L)	975.0	987.5	1000.0	105277980.5	210554961.0	315831941.5	421108922.0	526385902.5	631662883.0
Fuel Level (%)	78.0	78.8	80.0	80.8	82.0	82.8	84.0	84.8	86.0
Engine Speed (rpm)	6264.75	6345.13	6425.5	6505.75	6586.125	6666.375	6746.75	6827	6907.375
Total Engine Hours (hr)	975.0	987.5	1000.0	50949.9	100899.9	150849.9	200799.8	250749.8	300699.7
Total vehicle distance (m)	1950000	1975000	2000000	1054670305	2107340610	3160010915	4212681220	5265351525	6318021830
Tachograph. vehicle speed (km/hr)	195.773	198.285	200.797	203.305	205.816	208.324	210.836	213.344	215.855
Ambient Air Temperature	188.16	194.06	200.00	276.72	353.47	430.22	506.97	583.72	660.47
Engine Coolant Temp(°C)	155.0	157	160.0	162	165.0	167	170.0	172	175.0
Fuel Rate	221.40	224.25	227.10	376.35	525.65	674.9	824.00	973.5	1122.75
Instantaneous Fuel Economy	37.30	37.78	38.26	42.62	46.98	51.35	55.71	60.07	64.43
Vehicle Identification (VIN)	X078	X079	X080	X081	X082	X083	X084	X085	X086
Engine Percent Load	97	98	100	101	102	103	105	106	107
Fuel Consumption (L)	975.000	987.500	1000.000	211504.060	422008.121	632512.182	843016.243	1053520.303	1264024.364
Service Distance (km)	89955	93170	96385	99595	102810	106020	109235	112445	115660
axle weight (location 00) (kg)	9750.0	9875	10000.0	11106	12212.5	13319	14425.5	15531.5	16638.0
axle weight (location 01) (kg)	9755.0	9880	10005.0	11111	12217.5	13324	14430.5	15536.5	16643.0
axle weight (location 10) (kg)	9760.0	9885	10010.0	11116	12222.5	13329	14435.5	15541.5	16648.0
axle weight (location 11) (kg)	9765.0	9890	10015.0	11121	12227.5	13334	14440.5	15546.5	16653.0
axle weight (location 12) (kg)	9770.0	9895	10020.0	11126	12232.5	13339	14445.5	15551.5	16658.0
axle weight (location 13) (kg)	9775.0	9900	10025.0	11131	12237.5	13344	14450.5	15556.5	16663.0
axle weight (location 20) (kg)	9780.0	9905	10030.0	11136	12242.5	13349	14455.5	15561.5	16668.0
axle weight (location 21) (kg)	9785.0	9910	10035.0	11141	12247.5	13354	14460.5	15566.5	16673.0
axle weight (location 22) (kg)	9790.0	9915	10040.0	11146	12252.5	13359	14465.5	15571.5	16678.0
axle weight (location 23) (kg)	9795.0	9920	10045.0	11151	12257.5	13364	14470.5	15576.5	16683.0
Air Susp. Front Axle Left	5011.8	5076.1	5140.4	5204.6	5268.9	5333.1	5397.4	5461.6	5525.9
Air Susp. Front Axle Right	5011.8	5076.1	5140.4	5204.6	5268.9	5333.1	5397.4	5461.6	5525.9
Air Susp. Rear Axle Left	5011.8	5076.1	5140.4	5204.6	5268.9	5333.1	5397.4	5461.6	5525.9
Air Susp. Rear Axle Right	5011.8	5076.1	5140.4	5204.6	5268.9	5333.1	5397.4	5461.6	5525.9
Service Brake Air #1	1560	1576	1600	1616	1640	1656	1680	1696	1720
Service Brake Air #2	1560	1576	1600	1616	1640	1656	1680	1696	1720
Date (YYYY/MM/DD)	2180/9/24	2182/9/24	2185/9/25	2187/9/25	2190/10/25	2192/10/25	2195/10/26	2197/10/26	2200/10/26
Selected Gear	70	72	75	77	80	82	85	87	90
Current Gear	70	72	75	77	80	82	85	87	90

Table 5-24 FMS Simulation result vs. control step values (from 87 to 93)

Parameters	87	88	89	90	91	92	93
Wheel Based Speed (km/hr)	218.363	220.875	223.383	225.895	228.406	230.914	233.426
Accelerator pedal position (%)	86.8	88.0	88.8	90.0	90.8	92.0	92.8
Total fuel used (L)	736939863.5	842216844.0	947493824.5	1052770805.0	1158047785.5	1263324766.0	1368601746.5
Fuel Level (%)	86.8	88.0	88.8	90.0	90.8	92.0	92.8
Engine Speed (rpm)	6987.625	7068	7148.25	7228.625	7309	7389.25	7469.625
Total Engine Hours (hr)	350649.7	400599.6	450549.6	500499.5	550449.4	600399.4	650349.4
Total vehicle distance (m)	7370692135	8423362440	9476032745	10528703050	11581373355	12634043660	13686713965
Tachograph. vehicle speed (km/hr)	218.263	220.875	223.383	225.895	228.406	230.914	233.426
Ambient Air Temperature	737.22	813.97	890.72	967.47	1044.22	1120.97	1197.72
Engine Coolant Temperature (°C)	177	180.0	182	185.0	187	190.0	192
Fuel Rate	1272.05	1421.35	1570.6	1719.90	1869.2	2018.45	2167.75
Instantaneous Fuel Economy	68.79	73.16	77.52	81.88	86.24	90.60	94.96
Vehicle Identification (VIN)	X087	X088	X089	X090	X091	X092	X093
Engine Percent Load	108	110	111	112	113	115	116
Fuel Consumption (L)	1474528.425	1685032.486	1895536.546	2106040.607	2316544.668	2527048.729	2737552.789
Service Distance (km)	118870	122085	125295	128510	131725	134935	138150
axle weight (location 00) (kg)	17744.5	18851.0	19957	21063.5	22170	23276.5	24382.5
axle weight (location 01) (kg)	17749.5	18856.0	19962	21068.5	22175	23281.5	24387.5
axle weight (location 10) (kg)	17754.5	18861.0	19967	21073.5	22180	23286.5	24392.5
axle weight (location 11) (kg)	17759.5	18866.0	19972	21078.5	22185	23291.5	24397.5
axle weight (location 12) (kg)	17764.5	18871.0	19977	21083.5	22190	23296.5	24402.5
axle weight (location 13) (kg)	17769.5	18876.0	19982	21088.5	22195	23301.5	24407.5
axle weight (location 20) (kg)	17774.5	18881.0	19987	21093.5	22200	23306.5	24412.5
axle weight (location 21) (kg)	17779.5	18886.0	19992	21098.5	22205	23311.5	24417.5
axle weight (location 22) (kg)	17784.5	18891.0	19997	21103.5	22210	23316.5	24422.5
axle weight (location 23) (kg)	17789.5	18896.0	20002	21108.5	22215	23321.5	24427.5
Air Susp. Front Axle Left	5590.1	5654.4	5718.6	5782.9	5847.2	5911.4	5975.7
Air Susp. Front Axle Right	5590.1	5654.4	5718.6	5782.9	5847.2	5911.4	5975.7
Air Susp. Rear Axle Left	5590.1	5654.4	5718.6	5782.9	5847.2	5911.4	5975.7
Air Susp. Rear Axle Right	5590.1	5654.4	5718.6	5782.9	5847.2	5911.4	5975.7
Service Brake Air #1	1736	1760	1776	1800	1816	1840	1856
Service Brake Air #2	1736	1760	1776	1800	1816	1840	1856
Date (YYYY/MM/DD)	2202/10/27	2205/10/27	2207/10/27	2210/10/28	2212/11/28	2215/11/28	2217/11/28
Selected Gear	92	95	97	100	102	105	107
Current Gear	92	95	97	100	102	105	107

Table 5-25 FMS Simulation result vs. control step values (from 94 to 100)

Parameters	94	95	96	97	98	99	100
Wheel Based Speed (km/hr)	235.934	238.445	240.953	243.465	245.973	248.484	250.996
Accelerator pedal position (%)	94.0	94.8	96.0	96.8	98.0	98.8	100.0
Total fuel used (L)	1473878727.0	1579155707.5	1684432688.0	1789709668.5	1894986649.0	2000263629.5	2105540607.5
Fuel Level (%)	94.0	94.8	96.0	96.8	98.0	98.8	100.0
Engine Speed (rpm)	7549.875	7630.25	7710.5	7790.875	7871.125	7951.5	8031.875
Total Engine Hours (hr)	700299.3	750249.3	800199.2	850149.2	900099.1	950049.1	999999.0
Total vehicle distance (m)	14739384270	15792054575	16844724880	17897395185	18950065490	20002735795	21055406075
Tachograph. vehicle speed (km/hr)	235.934	238.445	240.953	243.465	245.973	248.484	250.996
Ambient Air Temperature	1274.47	1351.22	1427.97	1504.72	1581.47	1658.22	1734.97
Engine Coolant Temperature (°C)	195.0	197	200.0	202	205.0	207	210.0
Fuel Rate	2317.00	2466.3	2615.60	2764.9	2914.15	3063.45	3212.75
Instantaneous Fuel Economy	99.33	103.69	108.05	112.41	116.77	121.13	125.50
Vehicle Identification (VIN)	X094	X095	X096	X097	X098	X099	X100
Engine Percent Load	117	118	120	121	122	123	125
Fuel Consumption (L)	2948056.850	3158560.911	3369064.972	3579569.032	3790073.093	4000577.154	4211081.215
Service Distance (km)	141360	144575	147785	151000	154210	157425	160640
axle weight (location 00) (kg)	25489.0	26595.5	27702.0	28808	29914.5	31021	32127.5
axle weight (location 01) (kg)	25494.0	26600.5	27707.0	28813	29919.5	31026	32127.5
axle weight (location 10) (kg)	25499.0	26605.5	27712.0	28818	29924.5	31031	32127.5
axle weight (location 11) (kg)	25504.0	26610.5	27717.0	28823	29929.5	31036	32127.5
axle weight (location 12) (kg)	25509.0	26615.5	27722.0	28828	29934.5	31041	32127.5
axle weight (location 13) (kg)	25514.0	26620.5	27727.0	28833	29939.5	31046	32127.5
axle weight (location 20) (kg)	25519.0	26625.5	27732.0	28838	29944.5	31051	32127.5
axle weight (location 21) (kg)	25524.0	26630.5	27737.0	28843	29949.5	31056	32127.5
axle weight (location 22) (kg)	25529.0	26635.5	27742.0	28848	29954.5	31061	32127.5
axle weight (location 23) (kg)	25534.0	26640.5	27747.0	28853	29959.5	31066	32127.5
Air Susp. Front Axle Left	6039.9	6104.2	6168.4	6232.7	6296.9	6361.2	6425.5
Air Susp. Front Axle Right	6039.9	6104.2	6168.4	6232.7	6296.9	6361.2	6425.5
Air Susp. Rear Axle Left	6039.9	6104.2	6168.4	6232.7	6296.9	6361.2	6425.5
Air Susp. Rear Axle Right	6039.9	6104.2	6168.4	6232.7	6296.9	6361.2	6425.5
Service Brake Air #1	1880	1896	1920	1936	1960	1976	2000
Service Brake Air #2	1880	1896	1920	1936	1960	1976	2000
Date (YYYY/MM/DD)	2220/11/29	2222/11/29	2225/11/29	2227/11/30	2230/11/30	2232/11/30	2235/12/31
Selected Gear	110	112	115	117	120	122	125
Current Gear	110	112	115	117	120	122	125

Appendex A - Remote Terminal Installation Guide

A remote terminal program can be used to control and display detail information of simulated FMS signals on a PC screen.

1. Double click the "Au Setup FMS Simulator Remote Terminal V1.00A" application file in the software disc, as shown in Figure A-1.

Figure A-1

2. "Welcome to the Au FMS Simulator Remote Terminal Ver 1.00A Setup Wizard" window pop up, click "Next" to continue (Figure A-2).

3. "License Agreement" window pop up, please read the license agreement and select "I accept the agreement", click "Next" to continue (Figure A-3).
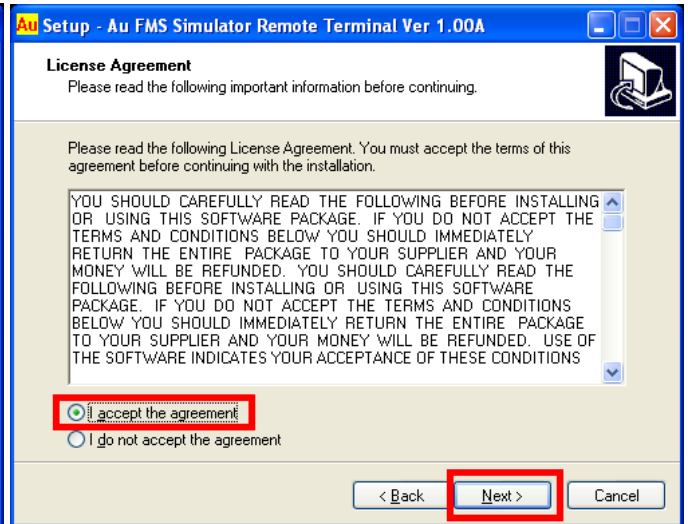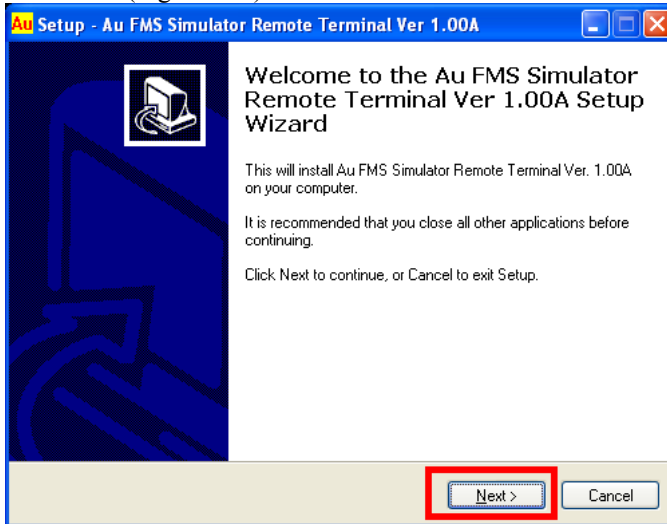
Figure A-2   Figure A-3

4. "Select Destination Location" window pop up, use the default folder, and click "Next" to continue (Figure A-4).

5. "Select Start Menu Folder" window pop up, use the default folder and click "Next" to continue (Figure A-5).
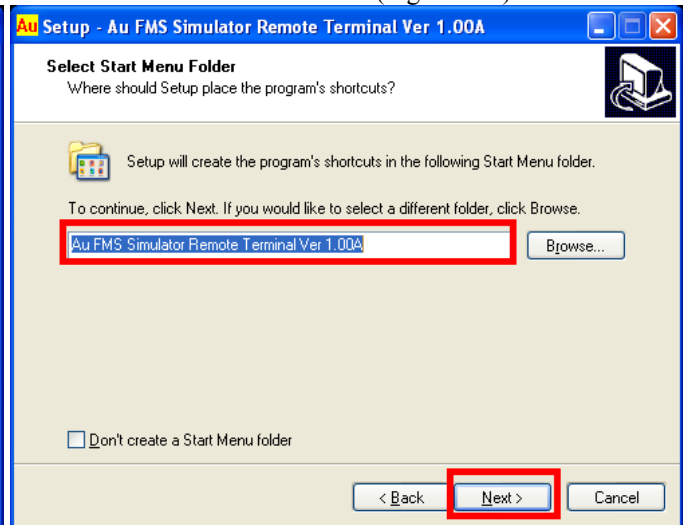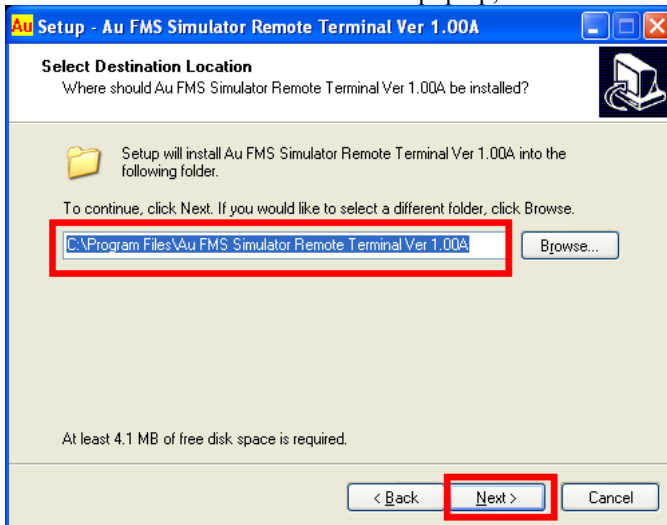
Figure A-4   Figure A-5

6. "Select Additional Tasks" window pop up, check both "Create a desktop icon, and create a Quick Launch icon", click "Next" to continue (Figure A-6).
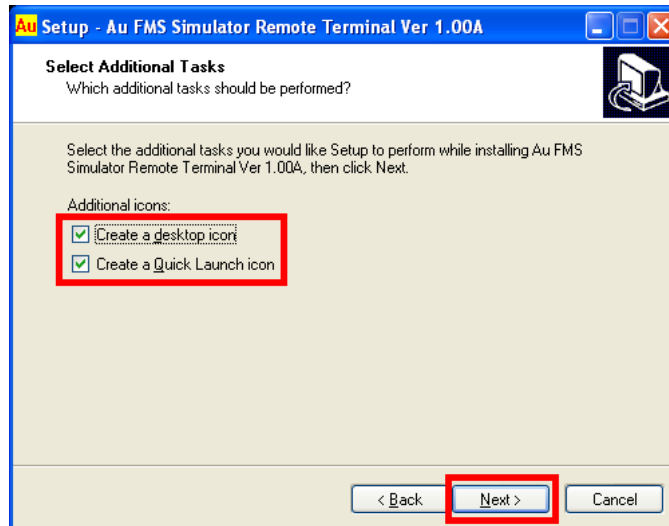
Figure A-6

7. "Ready to Install" window pop up, click "Install" (Figure A-7)
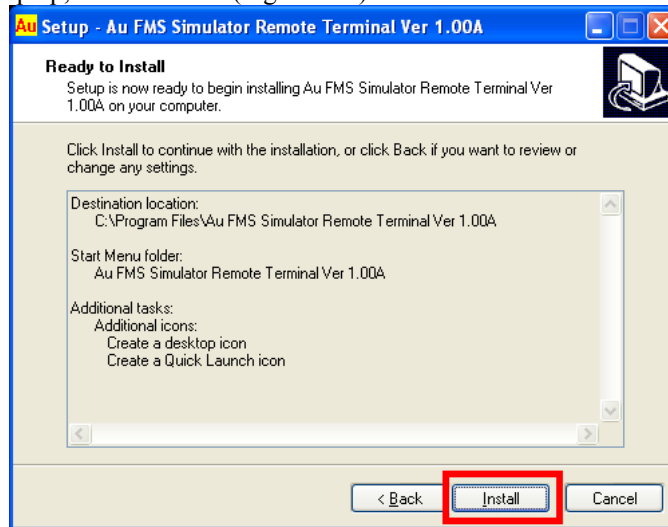
Figure A-7

8. Check "launch Au FMS Simulator Remote Terminal", click "Finish" (Figure A-8)
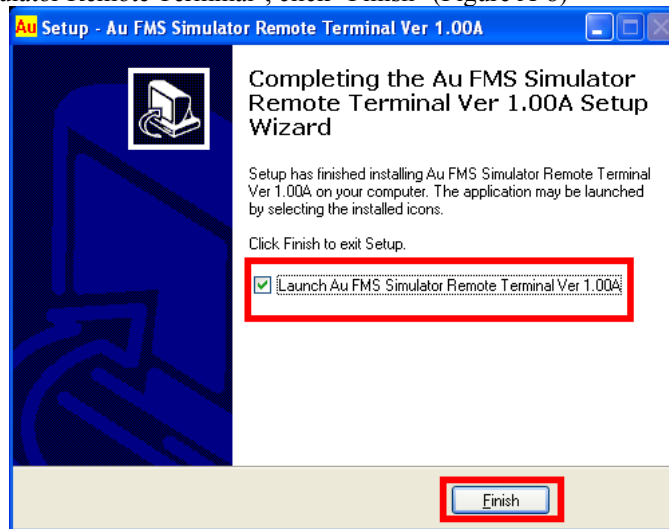
Figure A-8

Au FMS Simulator Remote Terminal will be launched.

Appendex B - License Management

Upgrading Au FMS Simulator can be done in-field in a few seconds. Providing the FMS simulator device is hooked up to PC and license upgrade code is ready.

B-1 What's needed to upgrade Au FMS Simulator License?

1. License upgrade code, which can be ordered from the following web link: http://www.auelectronics.com/System-FMSSimulator.htm
2. A PC equipped with serial port and a serial extension cable or a PC equipped with USB port and a "USB to Serial Converter".
3. Au FMS Simulator.
4. Au FMS Simulator Remote Terminal. (Refer to Appendix A for how to install)

B-2 Step by Step License Upgrading Procedure

1. Connect PC with Au FMS simulator.
2. Launch Au FMS Simulator Remote Terminal program, select the Serial Communication Port that was used to connect FMS simulator, e.g. COM4, then click "Connect" button, notice that Product ID showing "Truck FMS" (Figure B-1)
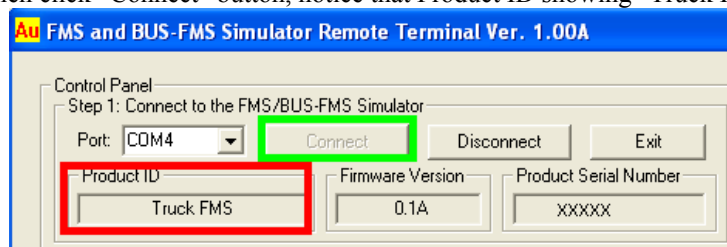
Figure B-1

3. Click Au icon on the top left corner of Au FMS Simulator Remote Terminal, click "About FMS Simulator Remote Terminal…" as shown in Figure B-1.
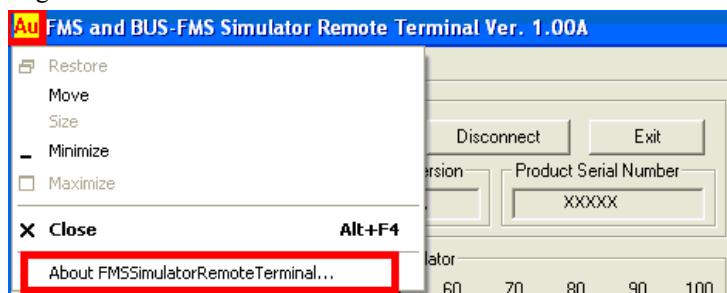
Figure B-2

4. "About FMS and BUS-FMS Simulator Remote Terminal V1.00A" window show up (Figure B-3). Enter a validate license code in the license management toolset, and then click "Validate license" button.

Note: Each Au FMS Simulator will have a unique Serial Number and may have a different Product ID (FMS Simulator Edition).
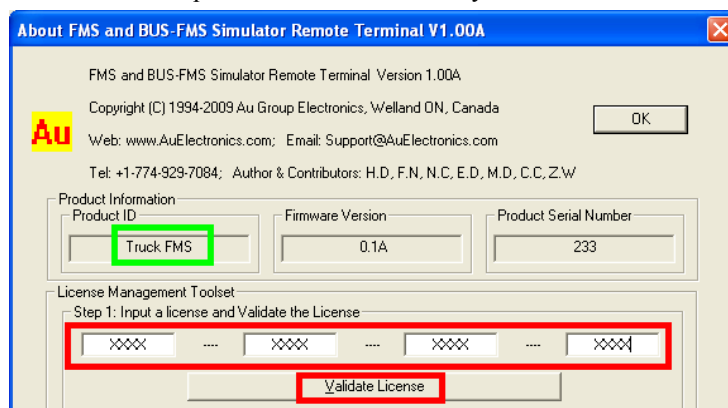
Figure B-3

5. Au FMS Simulator License Toolset will check if entered license number is valid or not. If not, "Sorry, Invalidate license!" will show up, click OK (Figure B-4).
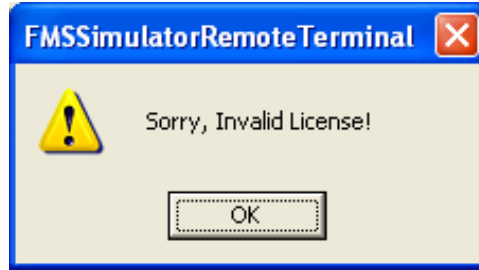
Figure B-4

6. After a validate license is entered, Updated license Information will display, as demonstrated here in Figure B-5, Truck FMS will be upgraded to Truck and Bus FMS Simulator Plus Edition, click "Update License" button.
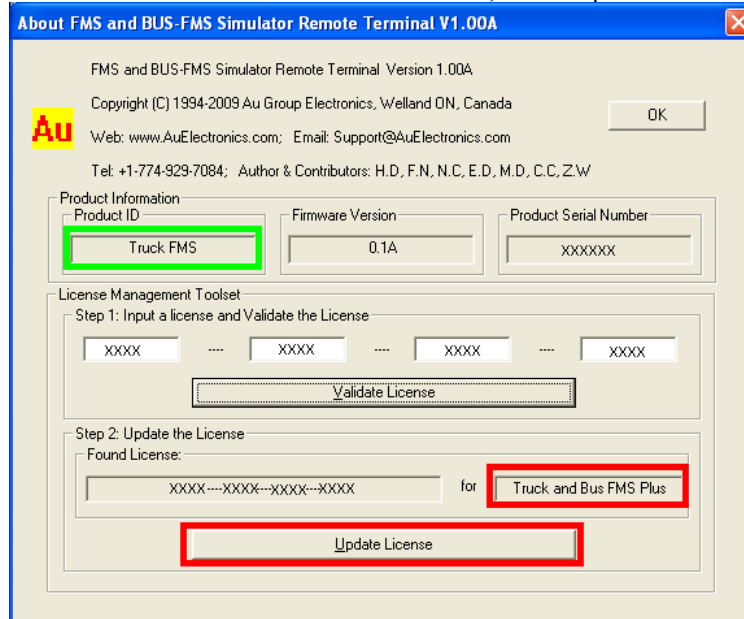
Figure B-5

7. When it is updated successfully, a beep will be heard. FMS About window will close automatically, and the Product ID (Edition of FMS Simulator) will update to the new edition (Truck and Bus FMS Plus Edition in this demonstration, as shown in Figure B-6).
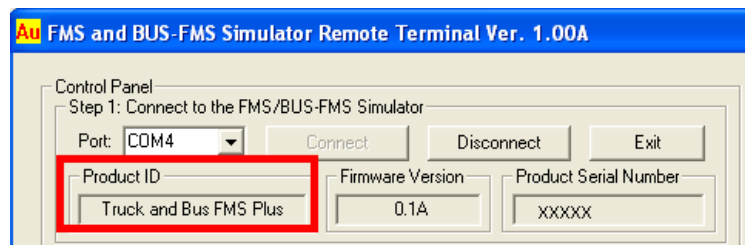
Figure B-6

Appendex C - Au PIC Serial Bootloader Application Note

With the built-in Serial Bootloading feature, future released firmware of Au FMS Simulator can be in-filed updated in a few minutes.

C-1   What's needed Before Install Au PIC Bootloader?

1. A PC equipped with serial port or PC equipped with USB port + "USB to Serial Converter".
2. Serial cable to connect a PC to a PIC target board.
3. Au PIC Bootloader installation program (it is available through Au Group Electronics)
4. An encrypted PIC-code file with extension of "Aud" (it will be provided by Au Group Electronics for different products, e.g. Au FMS Simulator, etc.)

C-2   How to Install Au PIC Bootloader?

Note: If you have the Au PIC Bootloader installed on your PC before, please bypass step 1 to step 8, and start with step 9.

1. Double click icon of the "Setup Au PIC Bootloader V1.00B" to start installing Au PIC Bootloader, as shown in Figure 1

Figure 1 - Setup Au PIC Bootloader V1.00A icon

2. "Welcome to the Au PIC Bootloader Setup Wizard" window show up, click "Next" (Figure C- 2)
3. "License Agreement" window show up, read the license agreement and select "I accept the agreement", then click "Next" to continue (Figure C-3).
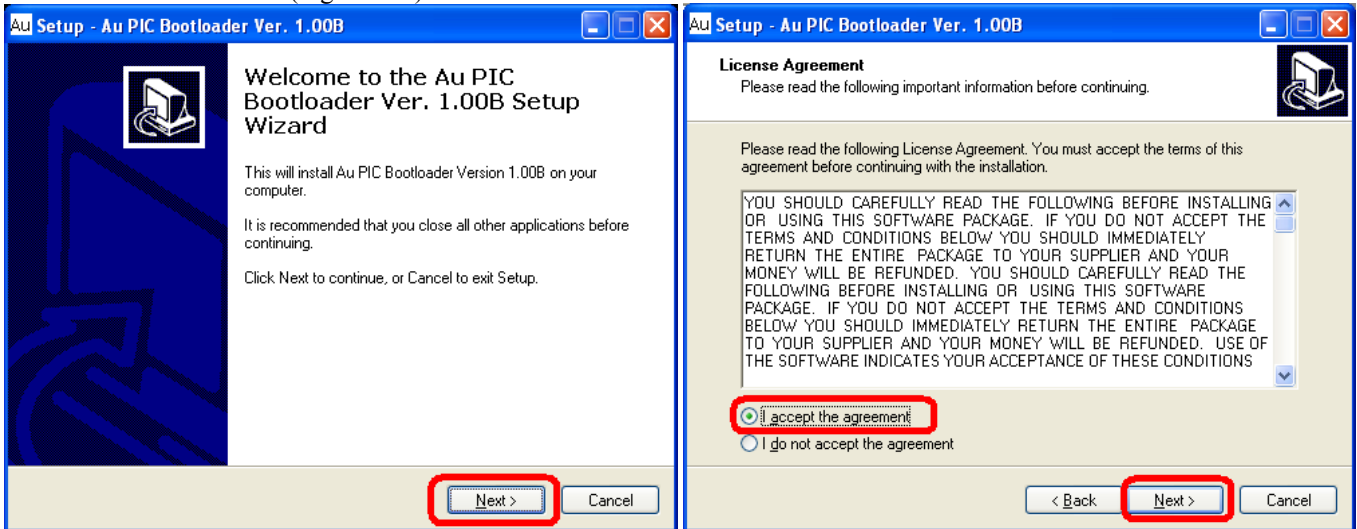
Figure C-2   Figure C-3

4. "Select Destination" window shows up, use default path: C:\Program Files\ AU PIC Bootloader", then click "next" to continue (Figure C-4).
5. "Select Start Menu Folder" window show up, use default setting "AU PIC Bootloader", then click "next" (Figure C-5).
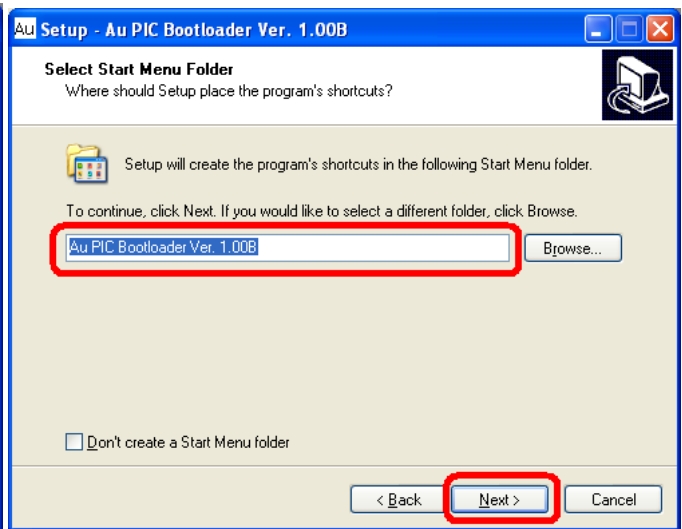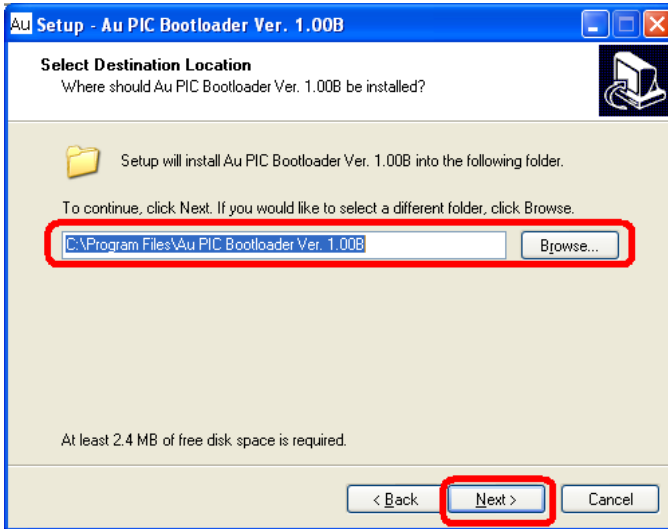
Figure C-4   Figure C-5

6. "Select Additional Task" window shows up, check both "create a desktop icon" and "Create a quick launch icon", and then click "next" to continue (Figure C-6).
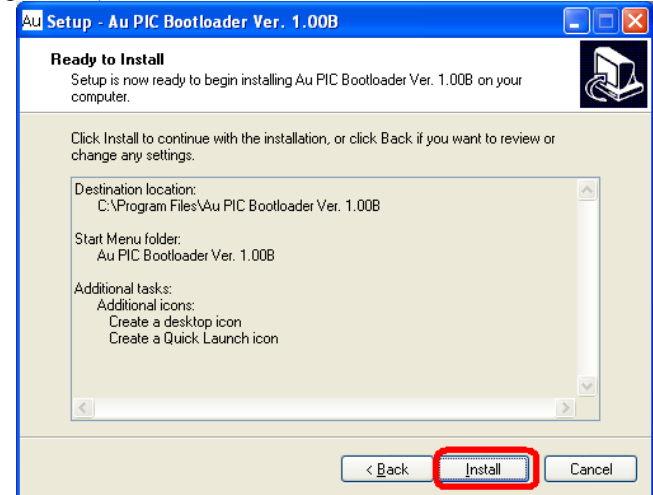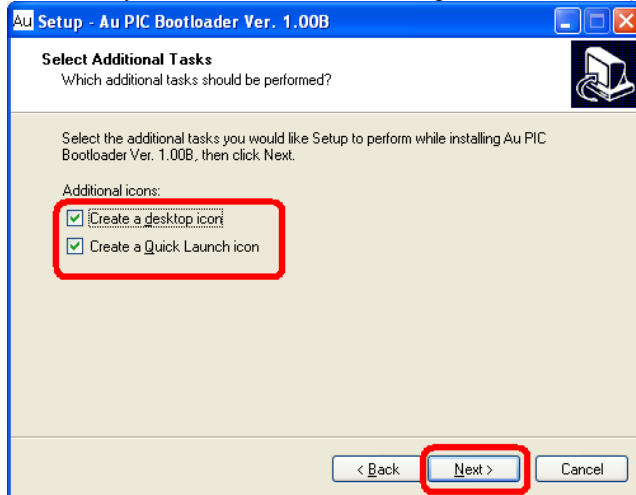7. "Ready to Install" window shows up. Click "Install" (Figure C-7).

Figure C-6   Figure C-7

8. After a few seconds, "Completing the Au PIC Bootloader Setup Wizard" window shows up, check "launch Au Bootloader", click "Finish" to exit setup (FigureC-8).
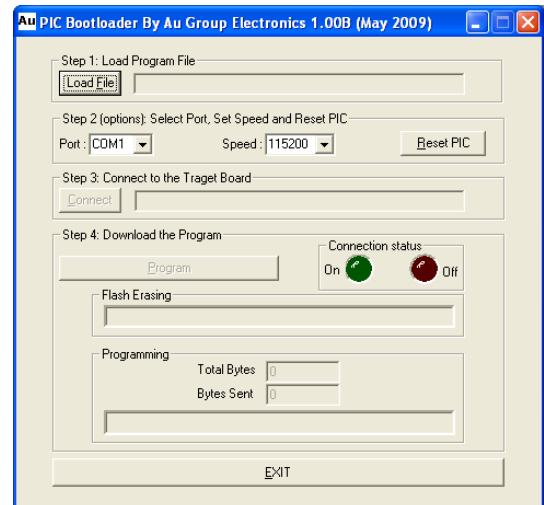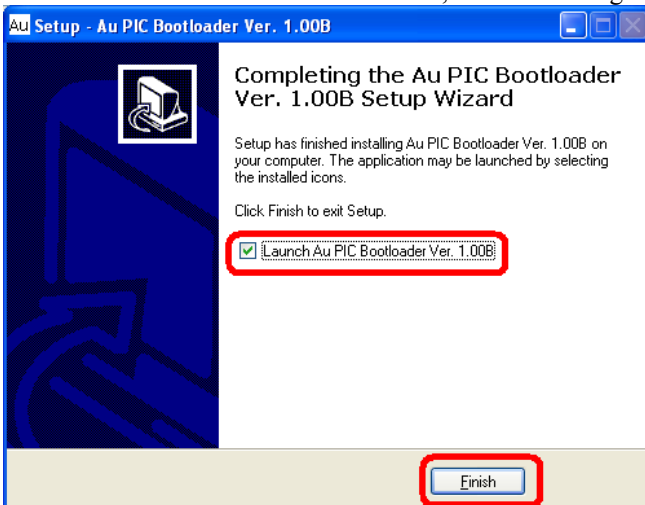9. Au PIC18 Bootloader is launched, as shown in Figure C-9

Figure C-8   Figure C-9

C-3   How to Use Au PIC Bootloader?

Note: The following demonstration used a J1939 simulator as an example. Actual device and .aud file name in your application may be changed without further notice.

Step 1. **Load Program File:**

Connect Au J1939 Simulator to a PC, then click "Load File" button (Figure C-10). Select file type with ".Aud" extension, then click "Open"
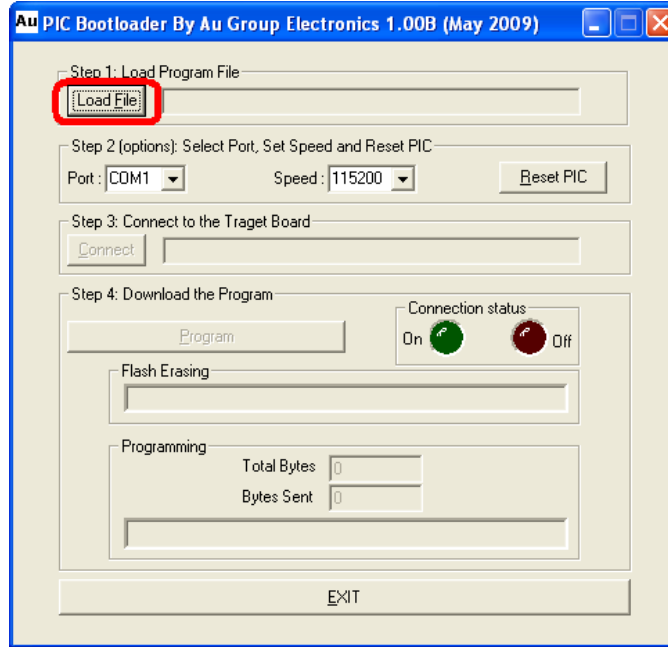

Figure C-10

Step 2. **Select port, set speed, and Reset PIC**

- Select proper serial communication port, which is used to connect with Au FMS Simulator.
- Set the communication Baud Rate at 115200 bps, as shown in Figure C-12
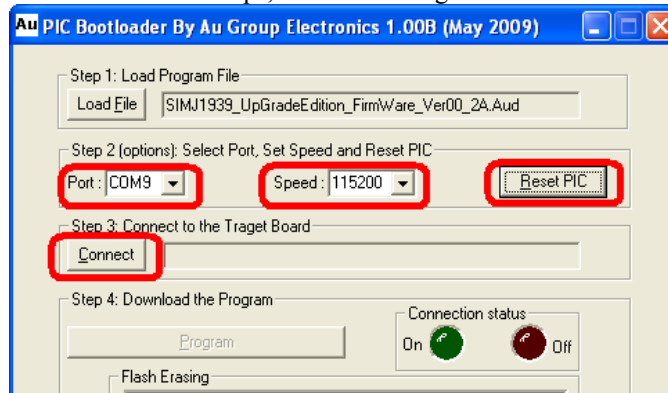
Figure C-12

- Trigger target board into Bootloader mode by one of the following 2 ways:

Hardware Trigger Method:

Press and hold **Menu** button on Au FMS simulator, then connect +9~+12V DC power supply to Au FMS Simulator, the "**BTLD**" LED will blink indicating it has entered the Bootloader mode.

Software Trigger Method:

Connect +9~+12V DC power supply to Au FMS Simulator at the "FMS" side, then click "Reset PIC" button on Au PIC Bootloader User Interface (Figure C-12)."BTLD" LED will be blinking.

Step 3. **Connect to target board**

Within 10 seconds, click "Connect" button (Figure C-12).

Note: There is a 10 seconds time-out period to let the Bootloader program connecting to Au FMS Simulator, if user failed to do so, please repeat step 2.

The "**BTLD**" LED on Au FMS Simulator will be constant on, also the connection status indicator – the Green light on Bootloader GUI will be on, notice that "Program" button now been activated, Also the target board PIC Bootloader information "Au-CB0301, F458, 20M, BTL232-E-001 1.00A" will show up, as shown in Figure C-13.
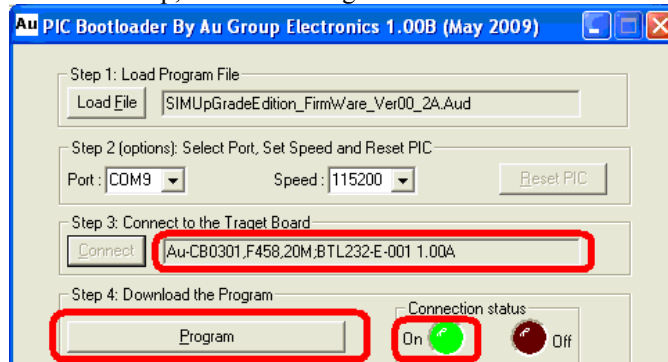

Figure C-13

Step 4. **Download program to Au J1939 Simulator**

Click "Program" button (Figure C-13).

The flash of the J1939 Simulator will be erased first, it takes a few seconds. Then the pre-loaded "xxxx.Aud" file will be programmed into Au J1939 Simulator, and the programming status will show up (Figure C-14).

This process may take a few minutes depending on the file size and communication speed. When programming finished, click "exit" to exit Bootloader mode (Figure C-15).
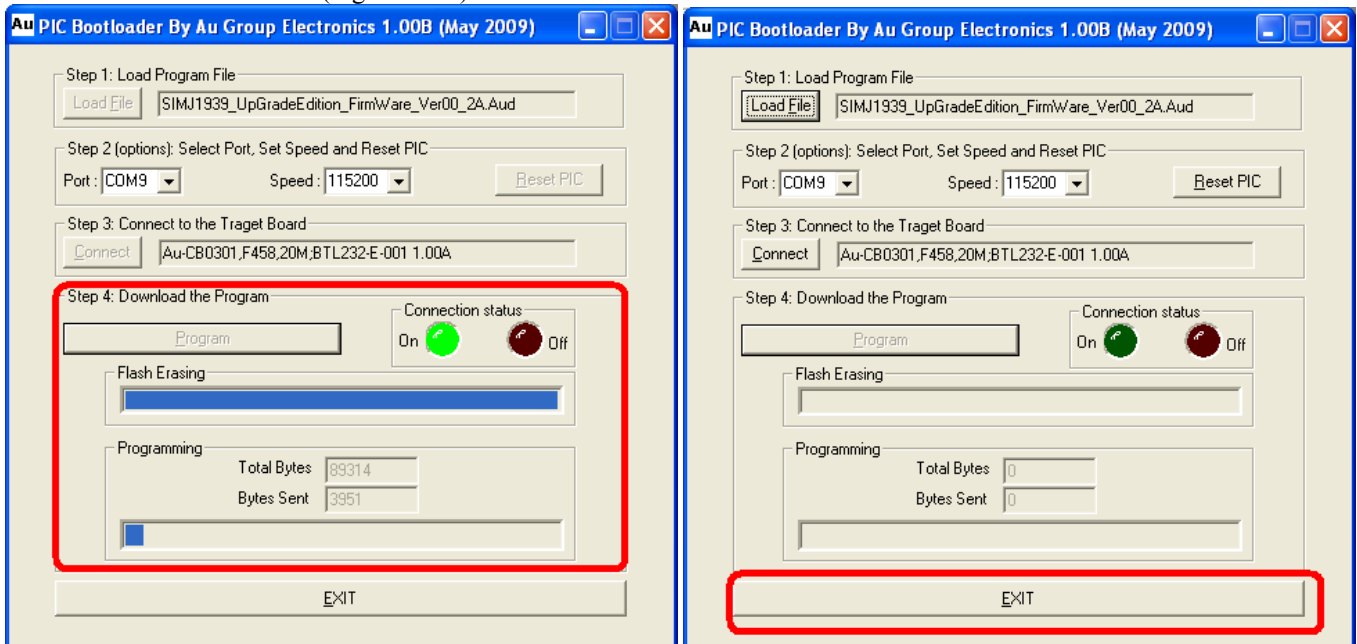

Figure C-14   Figure C-15

The Au J1939 Simulator should function normally with the new code now.

Thank You for choosing Au Group Electronics products.

Should you have any question or comments, please contact us at:
support@AuElectronics.com

Please visit our website for recent product releases and the latest news.
www.AuElectronics.com

Our products can be ordered 24/7 at our on-line store:
http://www.auelectronics.com/products/

We look forward to serving you again in the near future.