Commercial Vehicle TPMS User Guide

1 Modifications

Date	Modifications	Author	Version	Modified Sheets	Approved		
					By	Date	Signed
16/01/06	Document Creation	GMS	1_00	ALL			
19/06/06	Explanation of simulated sensors mode changing Simadd example provided	GMS	1_00	4, 12			
02/07/07	Generic document Created from customer specific version & template updated	GMS / GU	1_00	ALL			
28/11/07	Updated with bf1s template. Digityre Operation and screen shots added	GMS	1_01	All			
04/12/07	Changes after 1st read through	GMS	1_02	All			
07/12/07	Changes after 2nd read through	GMS	1_03	All			
14/02/2008	Text updates Template update	JRS	1_04	All	GMS	14/02/2008	GMS

2 Brief System Overview:

The Commercial Vehicle TPMS (Tyre Pressure Monitoring System) is used to monitor the status of tyres fitted to a multi-wheeled vehicle. The system receives RF datagrams transmitted from sensors that are fitted inside the vehicle's wheels. The wheel sensors transmit information such as pressure, temperature and remaining sensor life. The information is processed inside the TPMS ECU and then transmitted on the vehicle's J1939 CAN bus. The signals can then be processed by the vehicle's other systems.

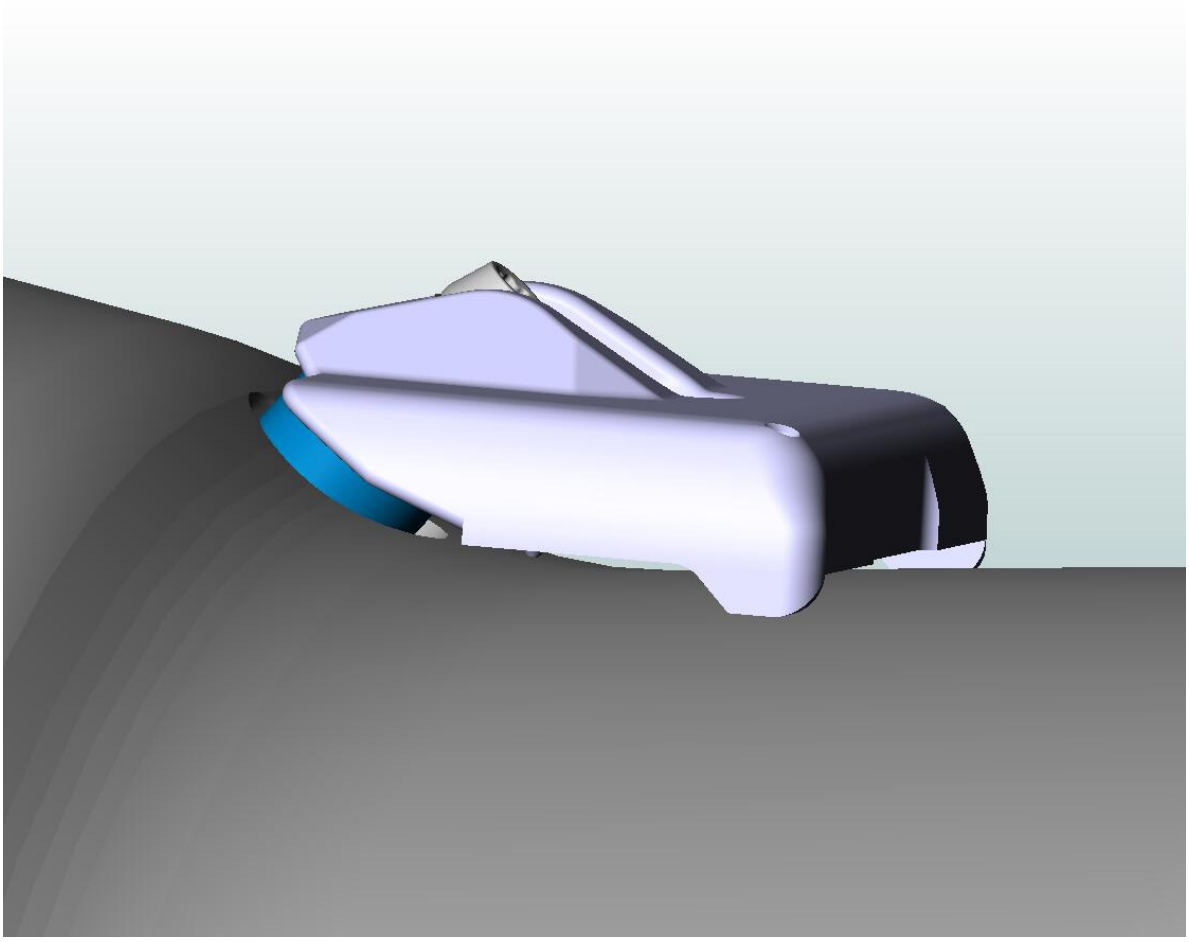
Data is received by antennae mounted on the vehicle and sent to the ECU. Received data is collected by the ECU into a 100 deep internal buffer of active sensors. The serial number, pressure, temperature and remaining sensor life (RSL) of every active sensor is then broadcast on the J-1939 bus at intervals of 10 seconds.

The serial number of recently received sensor data is compared against all of the stored sensor data in the list and if there is no match with any of the existing positions then the new sensor is added to the active sensor list and the time to send is set to the current time.

If the serial number is the same as an existing serial number then the pressure, temperature and RSL values are compared to the current values in the list. If all of the values are the same only the time of receiving the data is updated (time to send is not changed) If any of the data is different then all of the data is updated and the time to send is set to the current time (an updated sensor is broadcast on the J1939 immediately).

If the time exceeds (cparam - Sensor_timeout) for any sensor, then the ECU continues to send J1939 messages for this sensor at 10 seconds interval for the next 30 seconds (three updates) with the data readings marked as unavailable. After this time the sensor is then erased from the active sensor list.

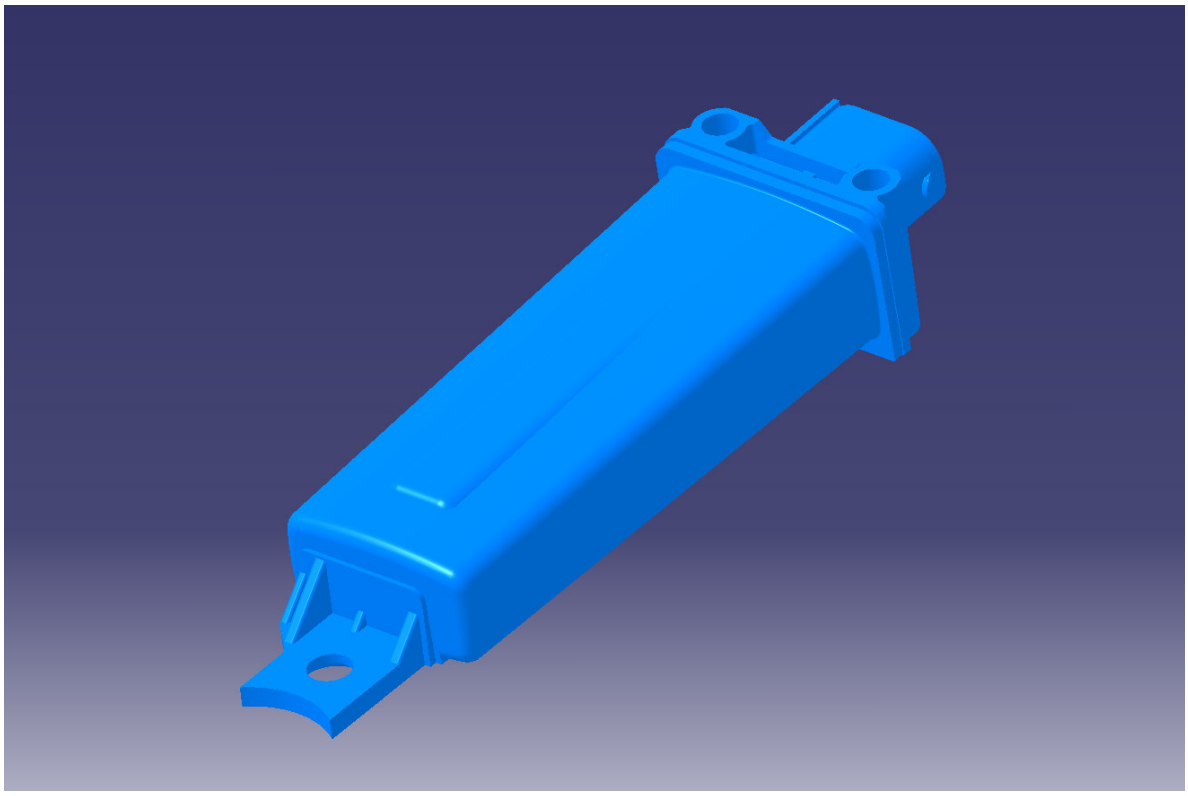
3 Commercial Vehicle Sensors



Each commercial vehicle wheel sensor is mounted to the wheel rim using a particular valve, suited to that rim. The feet of the sensors make contact with the rim creating a three point fixing.

The commercial vehicle wheel sensors are configured to transmit at a rate of one transmission every 60 seconds, unless the sensor detects a pressure deviation (+ve or –ve) of 0.4bar (5.8psi), when it will transmit at a rate of 1 Hz for 255 seconds.

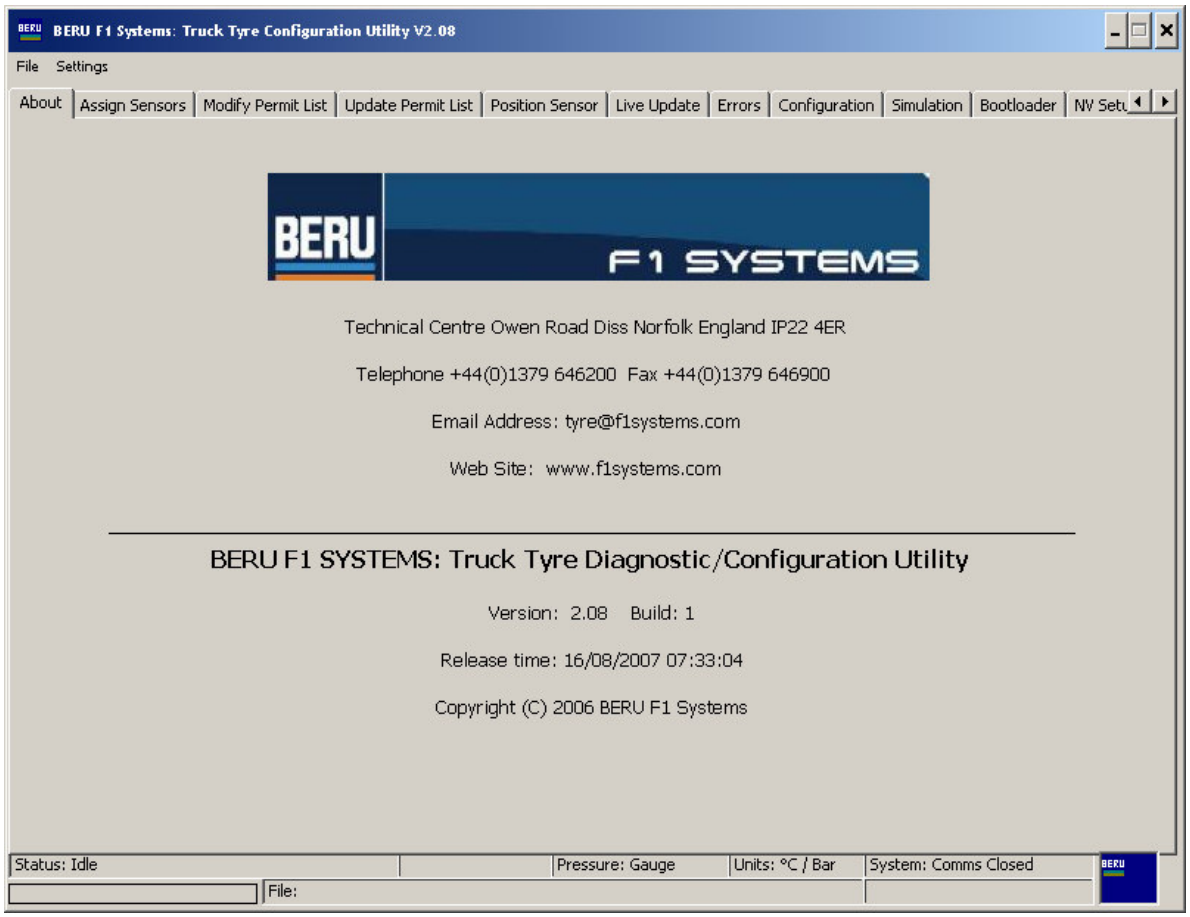
4 DGA+ Antenna



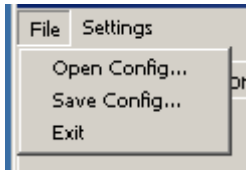
The DGA+ Antenna is used to receive the RF datagrams from the TPMS sensors and transmit the information to the TPMS ECU using a LIN bus connection.

5 Truck Tyre Configuration Utility

The BERU f1systems Truck Tyre Configuration Utility is a PC program that is used to configure the Commercial Vehicle TPMS ECU.



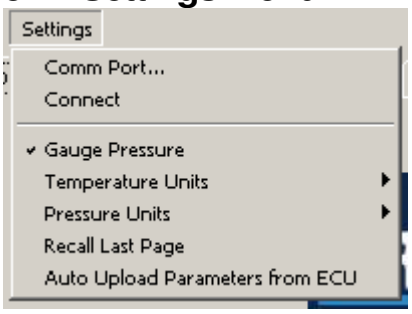
5.1 File Menu



The file menu has 3 options.

- Open config – open a previously saved configuration
- Save config – save the current configuration
- Exit – close the program

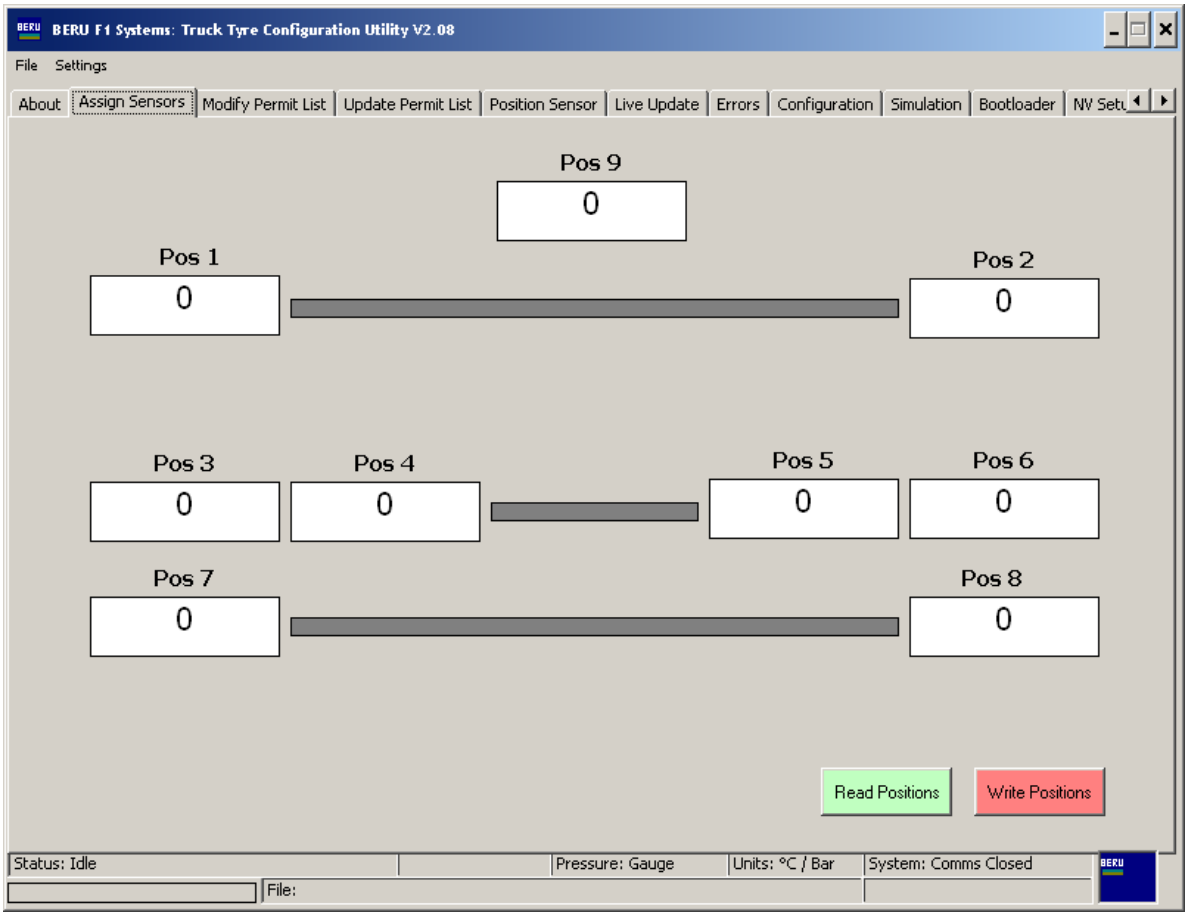
5.2 Settings Menu



The settings menu is used to configure the port used to communicate with the ECU and how TPMS data is displayed on the PC screen.

- Comm Port – The selected port must be that connected to the ECU
- Connect – Attempt to connect to the ECU.
- Gauge Pressure – Display all pressures as Gauge values (+1bar will be added to all absolute values)
- Temperature Units – Display temperatures as ℃ or ℉
- Pressure Units – Display pressure values as Bar or psi.
- Recall Last Page – When the software is started the last active page when previously closed will be displayed
- Auto Upload Parameters from ECU – If selected the PC software will automatically look for any connected ECU and read the configuration parameters in to the Configuration Utility.

5.3 Assign Sensors



The assign sensors page is used to assign sensors to positions on the vehicle. Every sensor used on a vehicle must have its serial number programmed into the assign sensors page. This is the mechanism used to determine which sensor on the vehicle has an issue. The received sensor serial number is compared with the information entered into this page and the data allocated to a particular position.

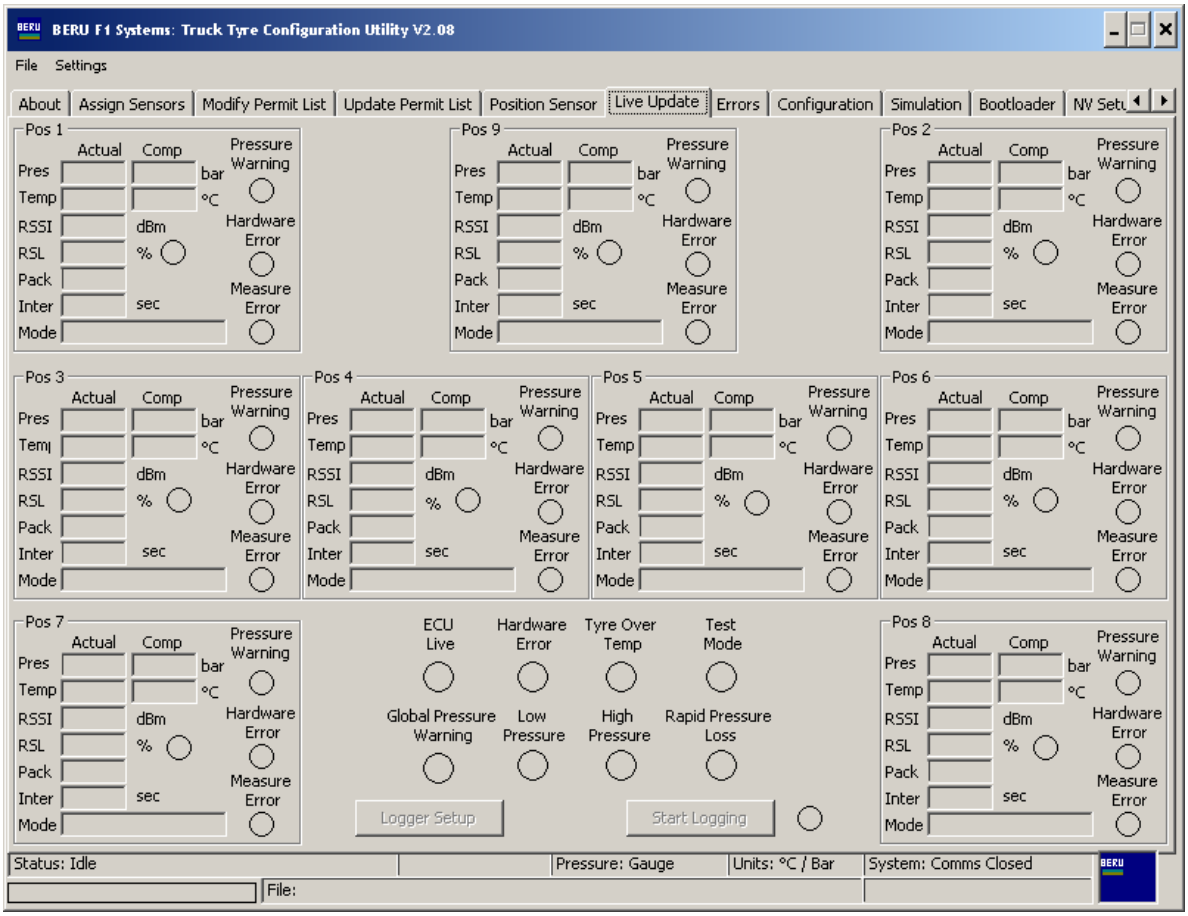
A value of zero entered into any of the positions above will disable that position.

Once the serial numbers of all of the sensors have been entered the information must be written to the ECU by clicking the 'Write Positions' button. Similarly position information can be read from the ECU by clicking on the 'Read Positions' button.

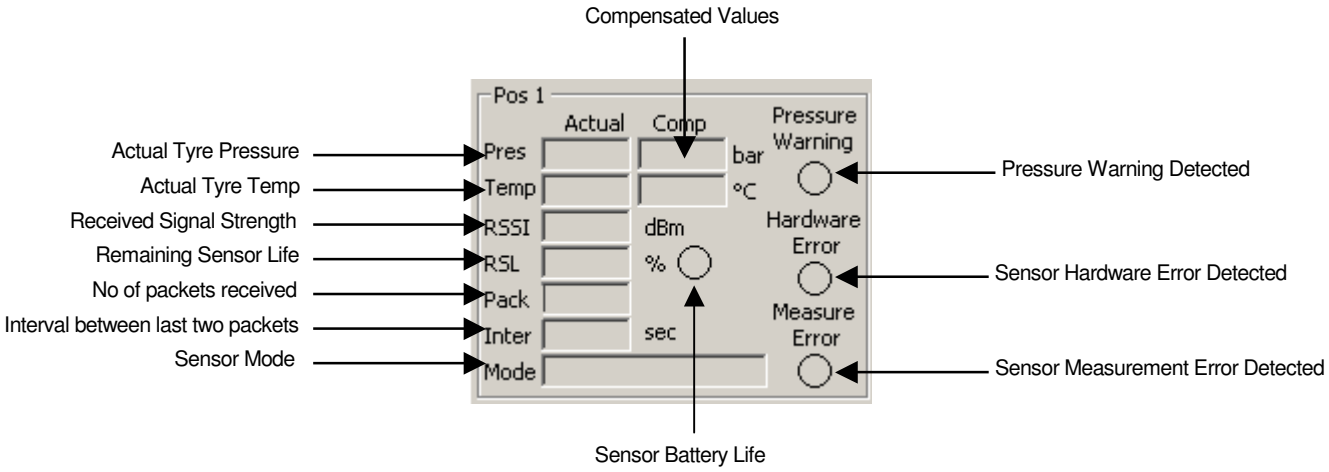
5.4 Modify Permit List
5.5 Update Permit List
5.6 Position Sensor
5.7 NV Setup
5.8 Create Permit List

The above pages are used to enable multiple sets of sensors to be used on a single vehicle, please contact BERU f1systems for further information.

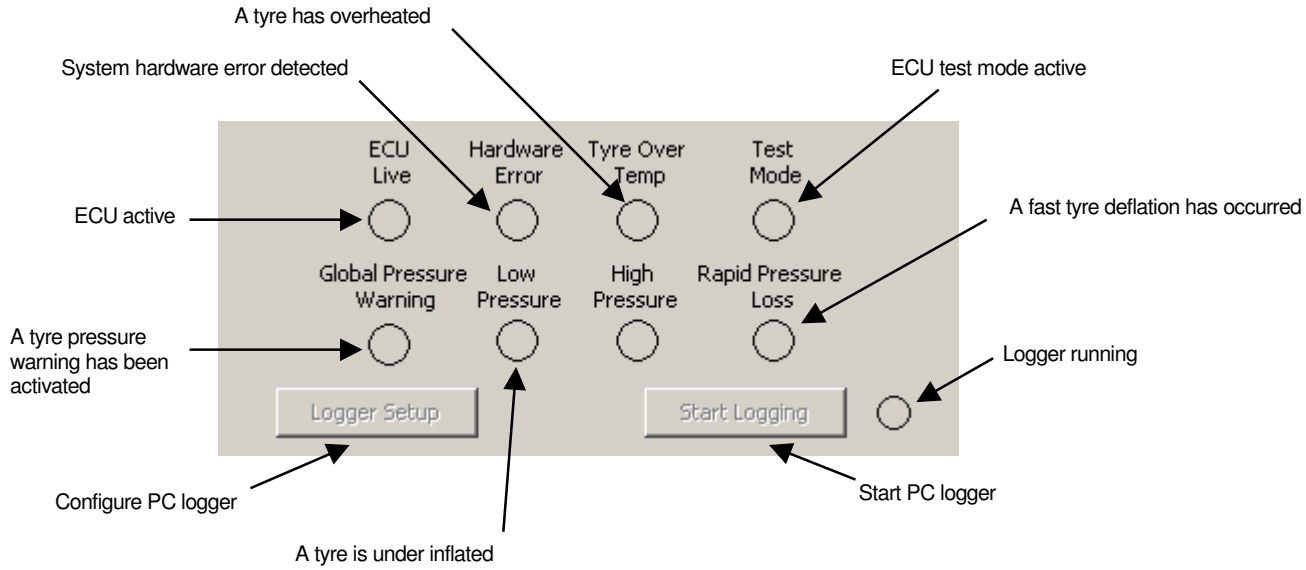
5.9 Live Update



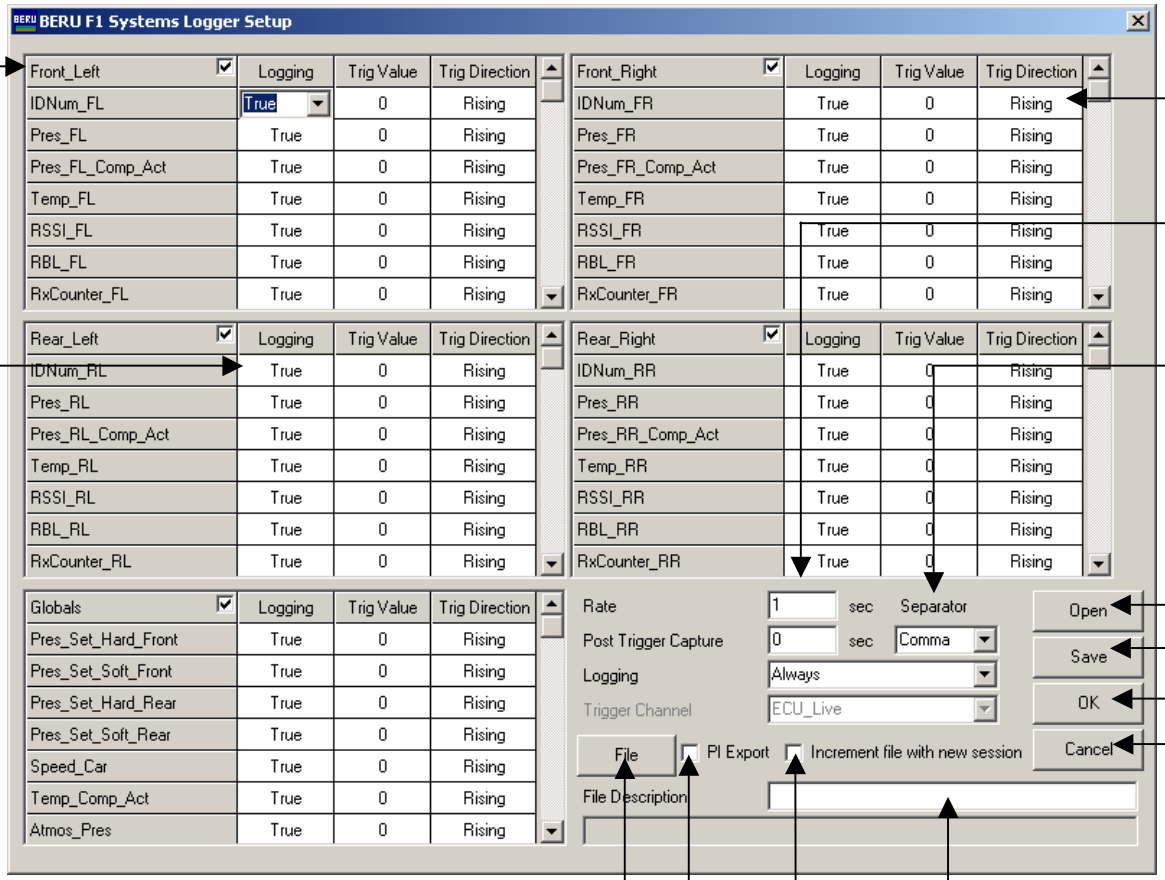
The 'Live Update' page displays the current status of the TPMS system. Any datagram transmissions from 'Assigned' sensors that have been received by the system will be displayed on this page. Each sensor has its own dedicated section of the screen



There are also a number of global status indicators, these are:



By clicking on the 'Logger Setup' the logging configuration page can be accessed.



Wheel position

Select whether this channel is logged

If this channel is to be used as the trigger to activate the logging, select the trigger direction for the channel

Enter the rate for DigiTyre to write data to the log file (1Hz recommended)

Enter the separator to be used in the log file (Comma recommended)

Used to load an existing logger configuration

Used to save the current logger configuration

Accept the current logger configuration and return to the Live Update page

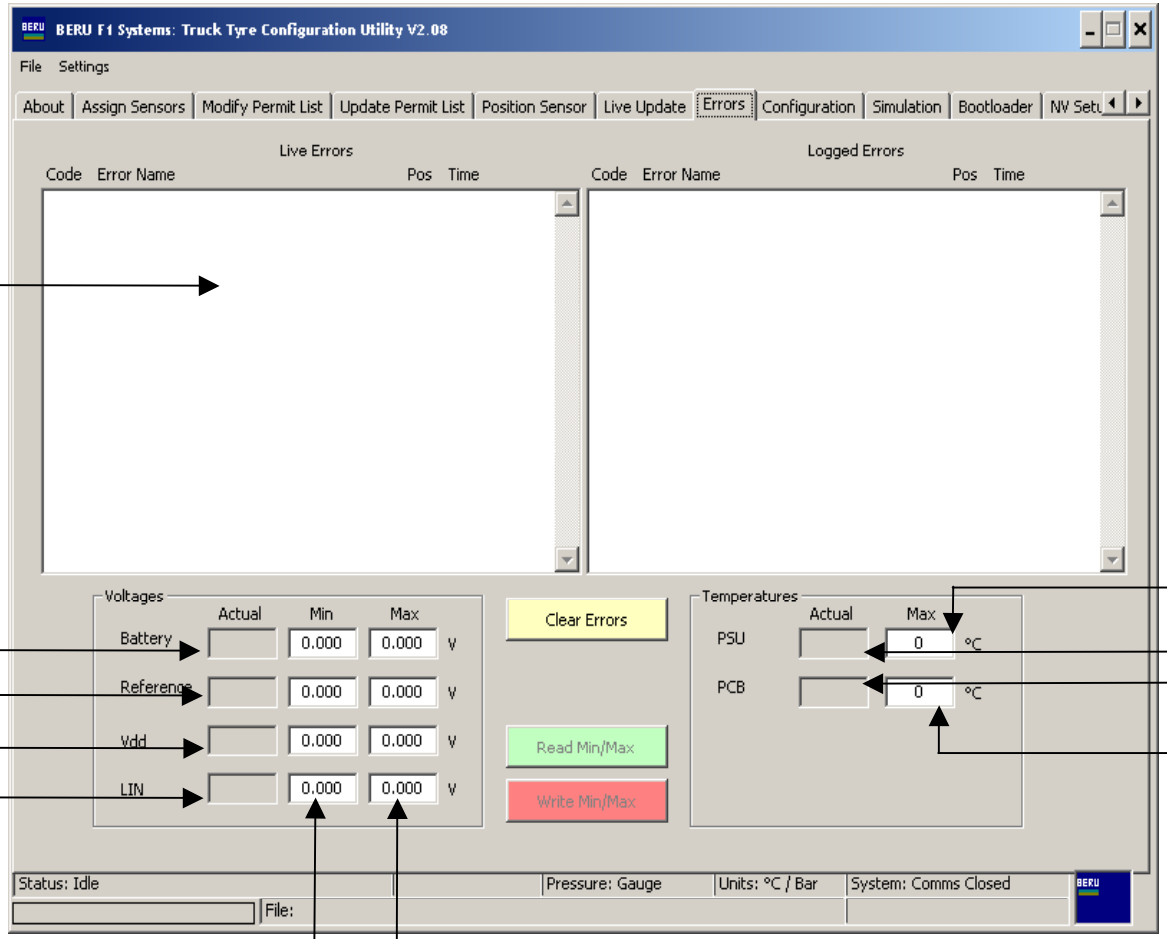
Discard changed to the logger configuration and return to the Live Update page

Used to set the file name for the log file to be stored using

Used to set the store in the data in the log file in a format which can be imported into Pi Toolbox

Checking this means that each time you start and stop the logging, a new log file will be created, with sequentially increasing file names

Enter any comments you want recorded in the header of the log file here. e.g. car setup, wheel fitted, weather conditions etc.



Active errors are shown in here.
The Error Code, Error Name (description), Position of the Error (FL, FR, RL or RR) and Time the error has been active are also displayed

Current supply voltage to the TPMS ECU

Current internal TPMS ECU voltage

Current internal TPMS ECU voltage

Current internal LIN voltage

Minimum allowable voltage. If the voltage drops below this, a Status Fault is set.

Maximum allowable voltage. If the voltage drops below this, a Status Fault is set.

Maximum allowable ECU PSU temperature

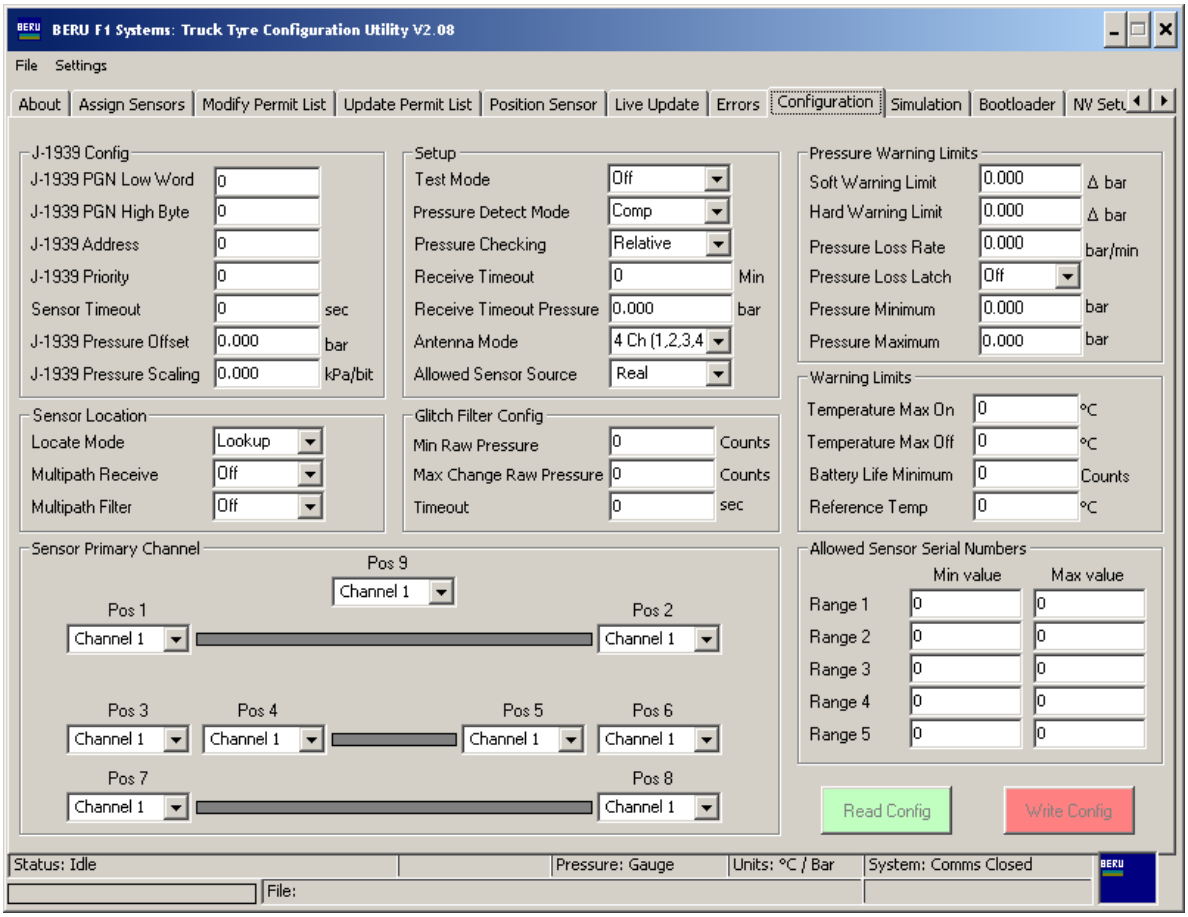
Current TPMS ECU PSU temperature

Current TPMS ECU PCB temperature

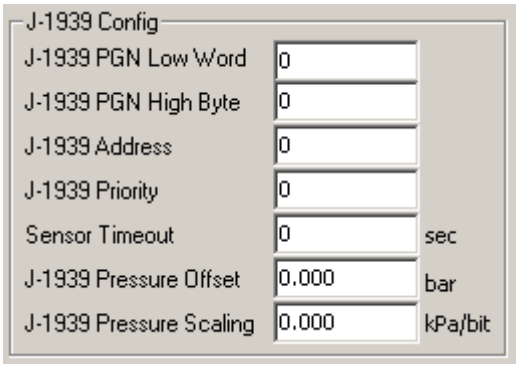
Maximum allowable ECU PCB temperature

5.10 Configuration Page

This page is used to configure the majority of the ECU's set-up. Each section of the page is used to configure a different part of the ECU.



5.10.1 J-1939 Configuration



J-1939 PGN Low Word & J-1939 PGN High Byte – These two values are combined to create the 24-bit Parameter Group Number

J-1939 Address – Parameter Group Number Address (application specific)

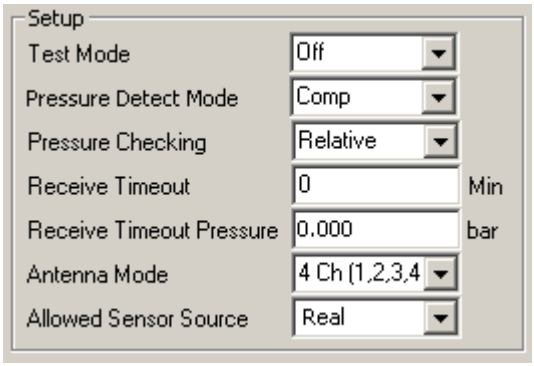
J-1939 Priority –This value is used to define the priority during arbitration. '000' is the highest priority and is usually associated with high-speed control messages. Low priority is used for non-critical configuration and information messages.

Sensor Timeout – The amount of time that a sensor datagram will be transmitted on the bus after datagram reception has stopped.

J-1939 Pressure Offset –Offset applied to all pressure values sent on the bus

J-1939 Pressure Scaling – Scaling applied to all pressure values sent on the bus

5.10.2 Reception Configuration



Test Mode – Enable one of the Internal Test modes. BERU f1ystems engineers may require selection of one of these modes during system installation testing

Pressure Detect Mode – Select if the system is to use compensated or actual pressure values for deflation detection

Pressure Checking – Select if an actual or relative pressure value will be used for the deflation limits

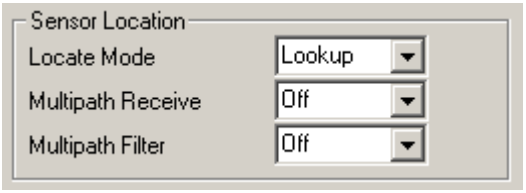
Receive Timeout – The amount of time that is allowed before the system will flag a sensor as 'not responding' (Recommend 195 seconds)

Receive Timeout Pressure – The pressure value that will be transmitted for a sensor when it has timed out (we recommend that a high value is used as a low value will trip deflation alarms)

Antenna Mode – The number of antennae that are connected to the system are configured here

Allowed Sensor Source – Select if 'Real' or 'Simulated' sensors are in use

5.10.3 Sensor Detection

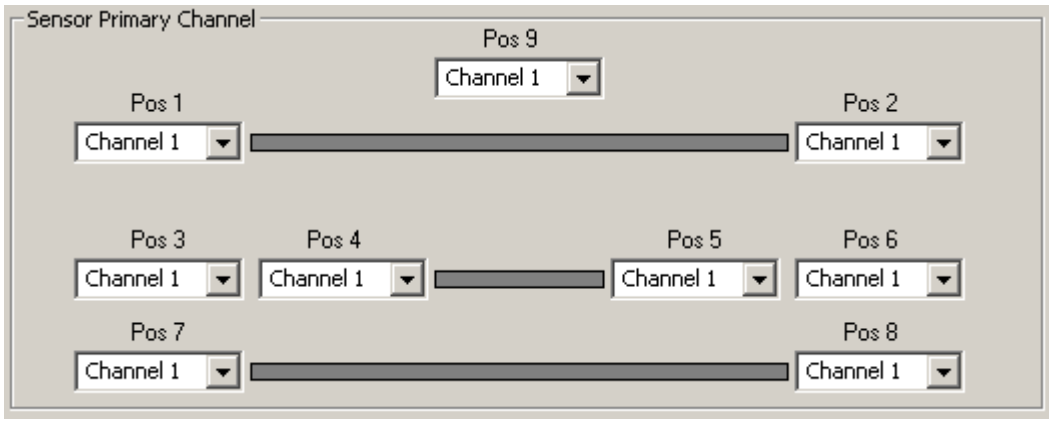


Locate Mode – Select if sensors are entered into the Assign page or into a position file (Not covered in this manual)

Multipath Receive – If Multipath receive is turned on then any antenna can receive the signals from any wheel sensor. If it is turned off then only the antenna configured as that wheel sensors primary channel will receive that sensors data

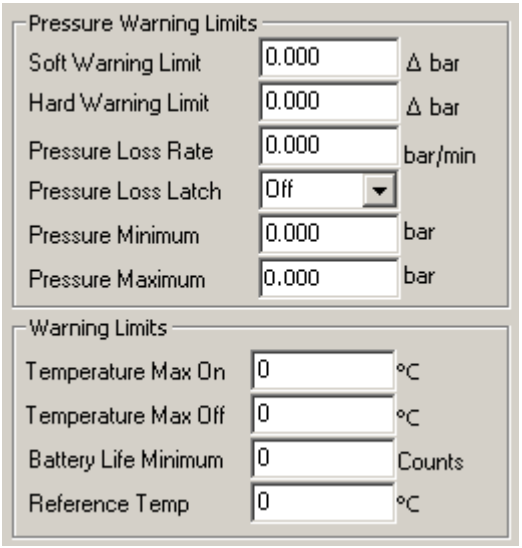
Multipath Filter – When the Multipath filter is turned on (recommended) then the amount of reception packets for a sensor will only increase by one count (even if all antennas received a sensors transmission) If it is turned off then any antenna that received a sensors data will cause the packet counter to increase (which means the packet counter will increase very quickly and can lead to misinterpretation of the data)

5.10.4 Sensor Primary Channel



In this section a sensor's primary antenna channel is selected. We recommend that the antenna closest to a wheel sensor be configured as its primary channel.

5.10.5 Warning Limits



Soft Warning Limit – This is an early warning limit for a deflation of a tyre. In 'Relative' mode the deviation from the compensated pressure should be entered. In 'Absolute' mode the actual pressure value should be entered when the warning should be activated.

Hard Warning Limit - This is a final warning limit for a deflation of a tyre. In 'Relative' mode the deviation from the compensated pressure should be entered. In 'Absolute' mode the actual pressure value should be entered when the warning should be activated.

Pressure Loss Rate – If a tyre is deflating at a rate greater than the specified value then the system will immediately issue a 'Hard Warning'.

Pressure Loss Latch – If the rapid pressure loss rate warning has been activated then the alarm can be latched and will be activated even if the ECU is power cycled.

Pressure Minimum – The absolute minimum pressure warning. The 'hard warning' alarm will be activated if the pressure in the tyre is below this value.

Pressure Maximum - The absolute maximum pressure warning. The 'hard warning' alarm will be activated if the pressure in the tyre is above this value.

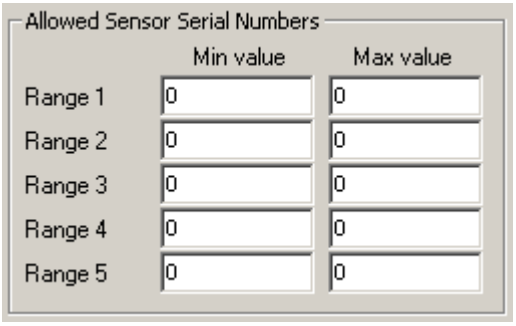
Temperature Max On – The 'hard warning' will be activated if the temperature in any tyre exceeds the defined limit.

Temperature Max Off– The temperature warning will be turned off when the temperature in the tyre at fault drops below the entered limit.

Battery Life Minimum – If the remaining sensor life value drops below this limit, then the sensor low battery warning will be activated.

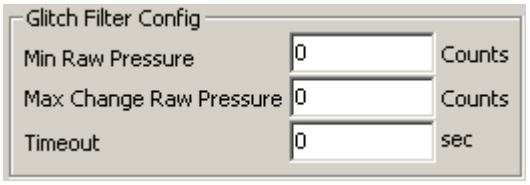
Reference Temp – The temperature entered into this field is the value to which the compensated pressure values will be calculated.

5.10.6 Serial Number Limitation



If values are entered into these fields, then sensors between the maximum and minimum values in each range will be allowed by the system. Numbers outside of these ranges will be ignored. If all of the fields are zero then all sensors will be accepted by the system.

5.10.7 Glitch Filter



Do not modify these values.

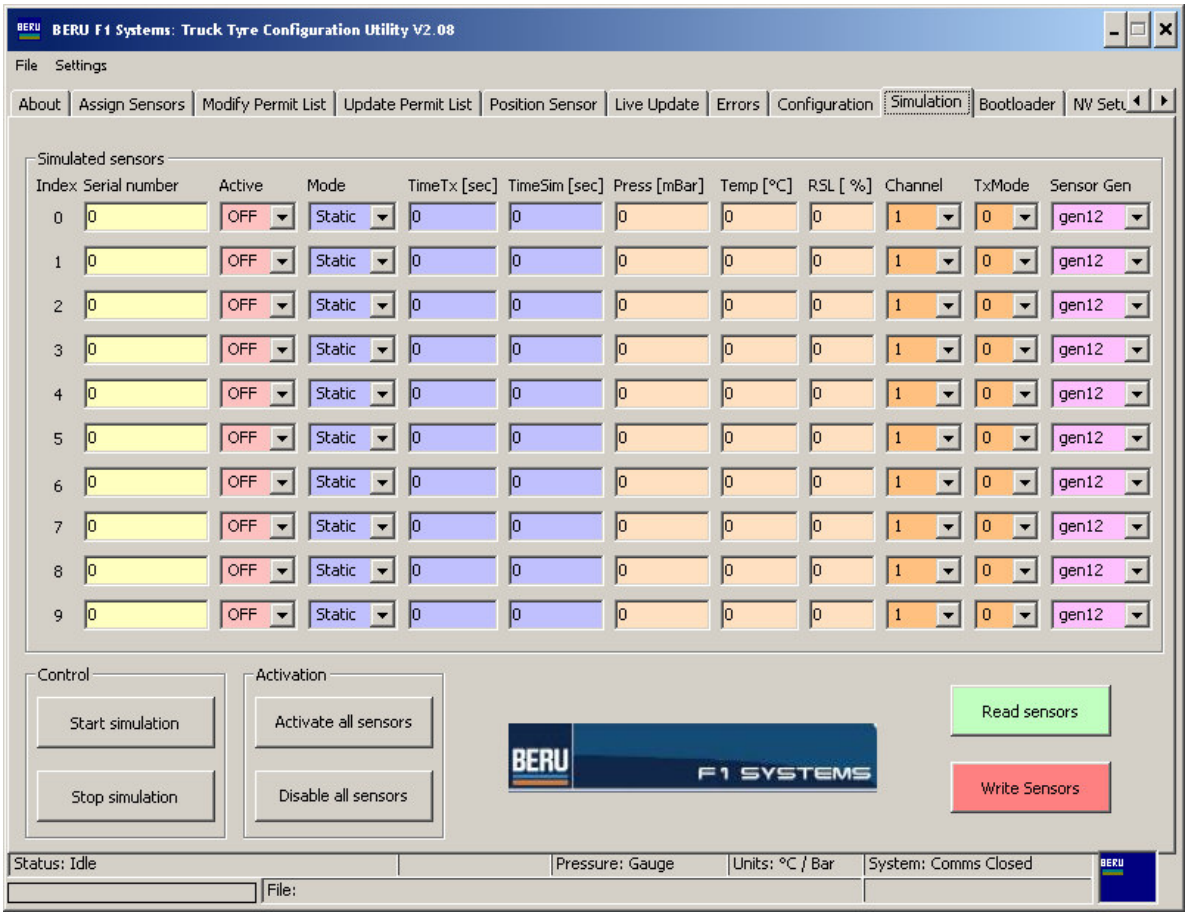
Once all of the configuration parameters haves been selected the configuration must be written to the ECU by clicking the 'Write Config' button. Alternatively a configuration can be read from an ECU by clicking the 'Read Config' button.

6 Sensor Simulation

The sensor simulation mode can be used to simulate the system's operation on the bench without the need for wheel sensors to be present.

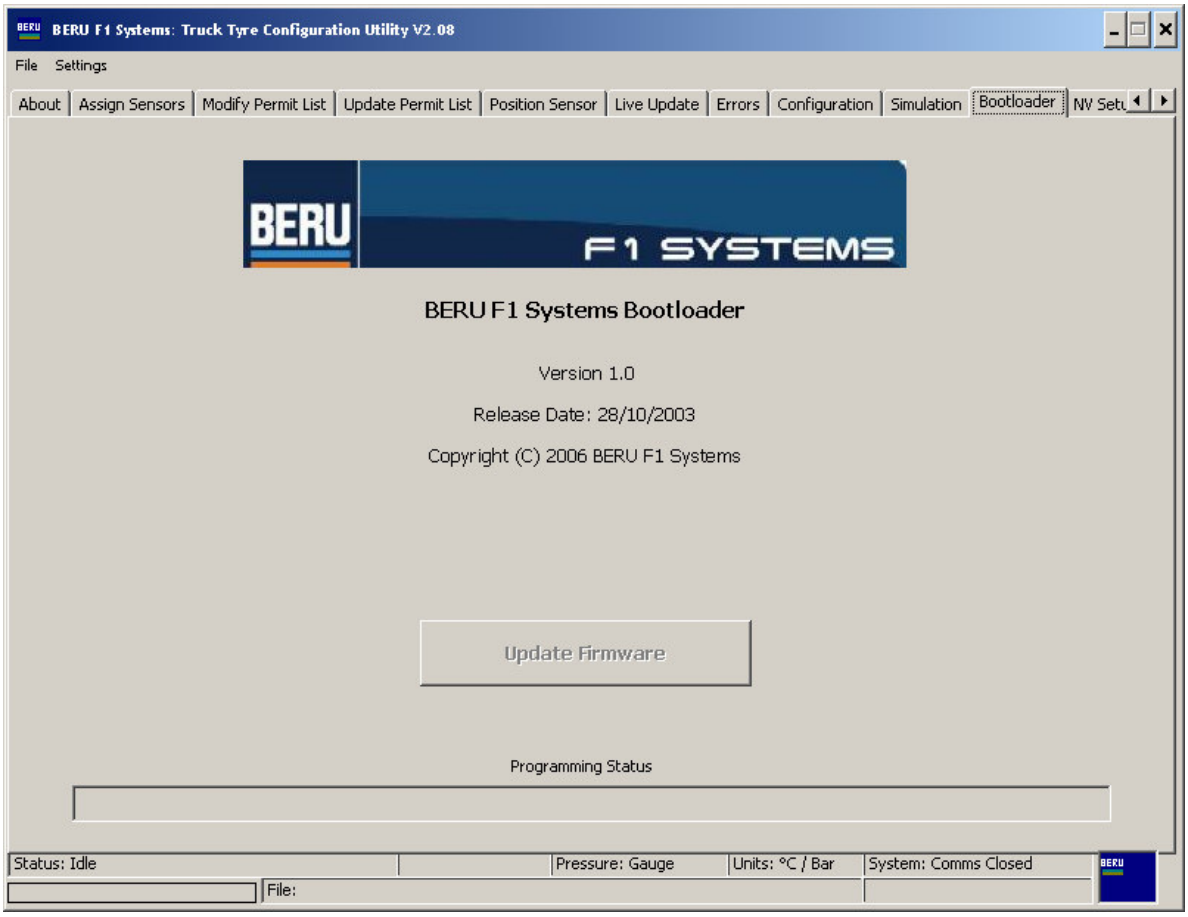
The Appendix contains further information on the operation of the simulation mode.

If you need to activate the sensor simulation features then please contact BERU f1systems.



7 Bootloader

The bootloader page is used to update the ECU firmware. This is a very rare occurrence and will normally only need to be used during the development phase of a project when a customer requires specific changes to the systems operation. All of the ECU reprogramming is performed over the RS232 link, which must remain connected whilst bootloading is in progress.



With an ECU connected click the 'Update Firmware' button to start the bootloading process. You will be prompted to select the file to be programmed into the ECU. From this point on the process is automatic.

8 Terminal Page

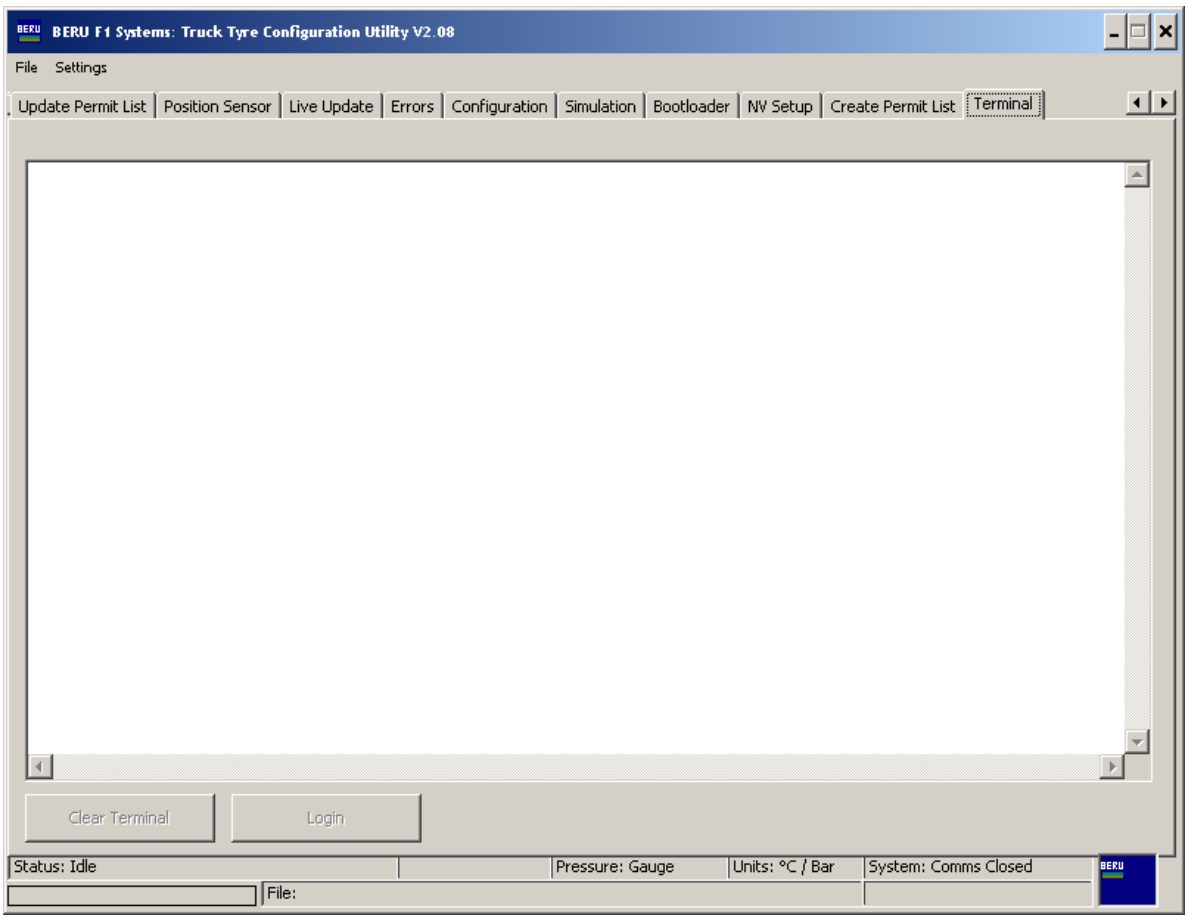
The 'Terminal Page' is used to communicate directly with the ECU. Occasionally you may be asked by BERU f1systems engineers to enter commands into this page.

All key presses are echoed on the terminal screen as they are typed.

It is essential that all commands be entered using the specified mixture of upper and lower case.

Typing 'Help' or '?' Followed by pressing enter will display a list of all of the available commands.

Further information on the commands is available in the Appendix



8.1.1 Simulation Mode

Features to simulate the RF data have been included in the firmware. This is when real sensor data is bypassed and the receiver collects data directly from the simulated sensor buffer. The Commercial Vehicle TPMS ECU allows the simulation of up to 10 different sensors and stores data in the same format as a real sensor.

In the Truck Tyre software three different simulation modes are implemented:

1. mode 0 – values of data are not changed
2. mode 1 – raw data are incremented every time when the sensor simulation time elapses
3. mode 2 – raw data are decremented every time when the sensor simulation time elapses

Note: The active simulation mode of the sensors in the simulation is changed using the 'simadd' command, see page 12.

Data scaling
All of the data transmitted on the J-1939 bus are scaled as below:

Tyre pressure
Resolution: 40 mBar/bit gain, 0 mBar offset
Data range: 0 – 10.2 Bar

Tyre temperature
Resolution: 0.03125 °C/bit gain, -273 °C offset
Data range: -40 °C to 127 °C

Remaining Sensor Life in %
(0.4% per bit, 0 to 100%)

9 Message format

Extended CAN identifier format

9.1.1.1.1	Priority				PGN (Parameter Group Number)														Source address							
9.1.1.1.1	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

10 Data format

Byte position	No of bytes	Description
1 – 4	4	Sensor ID (LSB is send first)
5	1	Tire pressure
6 – 7	2	Tire temperature (LSB is send first)
8	1	Remaining sensor life in %

11 System Start-up:

When power is supplied to the ECU a sign-on message and the 'User>' prompt will be displayed.

When the 'User>' prompt is displayed, the amount of features which can be accessed from the terminal are restricted, this is to prevent the accidental modification of critical system parameters.

```
I'm alive...

Starting application...

EEPROM NV data is valid...

Copying EEPROM NV data to RAM: Ok

Error description table is valid...

CParam Table is valid and version is correct...


MC9S12DP256 TPMS ECU Application
Copyright 2002-2006 BERU F1 Systems
Program      : TruckTPMS.h12
Part No.     : F1-37-4767
Version      : 01.00
PC Compat    : 002
Permit Size  : 450
Date         : 12-Jan-2006
Author       : Sonic/Damian

Serial No.   : 000
Revision     : @
Date code    : 020801
Cust code    : 000

Age          : 480
Power-ups    : 77

Initialising Variables...
Initialising Ports...
Initialising ADC subsystem...
Initialising SPI subsystem...
DAC Initialised
Initialiaing CAN...
Computed mask: 01010000000
Initialiaing J1939...
Initialiaing LIN...
Initialising OS...
Initialising Tasks...
Initialising Daughter Board... None
Watchdog enabled...

USER>
```

12 User Mode Commands:

In the 'User>' mode the following commands are available:

```
The following commands are available:

?                     : This help screen...
?e                    : List error descriptions...
help                  : Do you really need to ask
setnom                : Set nominal pressures
clrnom                : Clear nominal pressures
check                 : Check sensor positions, learn if required
learn                 : Learn sensor positions
unlearn               : Clear learnt sensor positions
can rx [0-1]          : Display received CAN messages
can tx [0-1]          : Display transmit CAN messages
lin rx [0-3]          : Display received LIN messages
ping [fl-rr][all]     : Send a lf-0 command
autoping [fl-rr][all] : Repeat send a lf-0 command
autoping [off]        : Stops Autopinging
sdata                 : Display sensor data values
cdata                 : Display CAN data values
last [1-10]           : Display last sensor rx buffer values
live                  : Display live sensor rx buffer values
adcs0                 : Display ADC0 values
adcs1                 : Display ADC1 values
diags                 : Display internal volts and temps
minmax                : Display volts and temps min/max
errors                : Display error log
alarms                : Display alarm status
ver                   : Software version info
testmode [0-8]        : Request test mode to be set
list all              : List all permitted sensors
list learnt           : List learnt sensors
allow [serno]         : Allow a sensor
block [serno]         : Block a sensor
allow all             : Allow all sensors
block all             : Block all sensors
pos [serno][pos][set] : Position a sensor via permit list
assign[serno][pos]    : Position a sensor via learnt list
```

Useful Command Descriptions

last [1-10]

Enter a value at the end of this command e.g. 5 to show the last 5 received sensor datagrams.

live

Enables a cyclic update of the current received sensor, press escape to exit.

testmode

Testmode followed by enter will display a list of all of the possible testmodes.

testmode [0-10]

Entering 'testmode followed by a number will activate a specific test mode, this will remain active until the power is cycled or the command 'testmode 0' is entered.

testmode 7
Testmode 7 will initiate the ECU to display on the terminal the current information being received by the antennas, this will indicate the serial number of the sensor received and also the antenna on which is has been received.

testmode 10
Testmode 10 will initiate the ECU to display on the terminal screen the current information being collected / updated / deleted to and from the active sensors list, this will display the serial number of a sensor which is added / updated / received in the active sensors list
.

BERU Prompt

To access all of the systems parameters the operator needs to login, this is achieved in this version of software by typing 'login' followed by enter. The prompt should then change to 'BERU>'.

In the final releases of the software access to the 'BERU>' login will be restricted with a password system that is disabled during the development phases of the project.

```
BERU> ?

The following commands are available:

?                     : This help screen...
?e                    : List error descriptions...
help                  : Do you really need to ask
setnom                : Set nominal pressures
clrnom                : Clear nominal pressures
check                 : Check sensor positions, learn if required
learn                 : Learn sensor positions
unlearn               : Clear learnt sensor positions
can rx [0-1]          : Display received CAN messages
can tx [0-1]          : Display transmit CAN messages
lin rx [0-3]          : Display received LIN messages
ping [fl-rr][all]     : Send a lf-0 command
autoping [fl-rr][all] : Repeat send a lf-0 command
autoping [off]        : Stops Autopinging
sdata                 : Display sensor data values
cdata                 : Display CAN data values
last [1-10]           : Display last sensor rx buffer values
live                  : Display live sensor rx buffer values
adcs0                 : Display ADC0 values
adcs1                 : Display ADC1 values
diags                 : Display internal volts and temps
minmax                : Display volts and temps min/max
errors                : Display error log
alarms                : Display alarm status
ver                   : Software version info
testmode [0-10]       : Request test mode to be set

list all              : List all permitted sensors
list learnt           : List learnt sensors
allow [serno]         : Allow a sensor
block [serno]         : Block a sensor
allow all             : Allow all sensors
block all             : Block all sensors
pos [serno][pos][set] : Position a sensor via permit list
assign [serno][pos]   : Position a sensor via learnt list
list details          : List details of permit list
add [serno]           : Add a sensor to the permit list
del [serno]           : Delete a sensor from the permit list
del all               : Delete all sensors from the permit list

debug [on|off]        : Debug mode control
loads                 : Processor loading

dacset [0-7][0-5000]  : Set DAC test output (tm = 2)
dacall [0-5000]       : Set all DAC test output (tm = 2)
hsdset [0-255]        : Set HSD (PortA) output (tm = 3)
poff [mbar]           : Offset pressure (tm = 5)
toff [°C]             : Offset temperature (tm = 5)
soff [km/h]           : Offset car speed (tm = 5)
aoff [°C]             : Offset ambient temperature (tm = 5)

cpdisp                : Display CPARAMs
cpedit                : Single line edit of CPARAM
cpdefault             : Force use of default CPARAMs

adc0gain [gain]       : Set ADC0 gain (10000 = 1) in NV
adc1gain [gain]       : Set ADC1 gain (10000 = 1) in NV
dac0gain [gain]       : Set DAC0 gain (10000 = 1) in NV
getgains              : Display DAC and ADC gains in NV
baudrate [1-6]        : 1:4800 2:9600 3:19200 4:38400 5:57600 6:115200
```

```
serialno              : Set Serial Number in NV
hwrev                 : Set Hardware Revision in NV
datemade              : Set Date of Manufacture in NV
custno                : Set Customer ID Number in NV
clrons                : Clear Power-up counter in NV
clrhrs                : Clear Life time in NV
clrerr                : Clear error list in NV
mmdefault             : Reset min max diag values
eedefault             : Force use of default NV Data

asdisp                : Display active sensor list
asdel [serno]         : Delete sensor from the active list by serial number
asdel [[idx]]         : Delete sensor from the active list by index
simstart              : Start active sensors simulation
simstop               : Stop active sensors simulation
simdisp               : Display simulated sensor list
simdefault            : Force use of default simulated data
simdel    [serno]     : Delete sensor from the simulated list by serial number
simdel    [[index]]   : Delete sensor from the simulated list by index
simactive [serno]     : Allow simulated sensor by serial number
simactive [[index]]   : Allow simulated sensor by index
siminactive [serno]   : Block simulated sensor by serial number
siminactive [[index]] : Block simulated sensor by index
simactive all         : Allow all simulated sensors
siminactive all       : Block all simulated sensors
simadd [ .. ]         : Add sensor to the simulated list (11 parameters)
```

assign [serno] [pos]
Using this command a wheel sensor can be assigned to a particular position on the vehicle (FL, FR, RL, RR). When data is received for an assigned sensor it can be viewed with the 'sdata' command or viewed on the 'Live page' of the digityre software.

E.g: 'Assign 12345 fl' will assign sensor serial no 12345 to the fl channel.

sdata – sensor data
The 'sdata' command will display the current assigned sensor data.

asdisp
Display the list of active sensors

asdel [serno]
Manually delete an active sensor from the active sensor list – requires a serial number to be entered.

asdel [idx]
Manually delete an active sensor from the active sensor list – requires the index to be entered

simstart
Start the active sensor simulation, this will automatically output the simulated sensor information on the J1939 bus and automatically modify the sensor values.

simstop
Halt a currently running sensor simulation.

simdefault
Force the ECU to enter the default simulation values into the simulation table.

simdel [serno]
Delete a sensor from the simulation table – requires a serial number to be entered.

simdel [index]
Delete a sensor from the simulation table – requires the sensor index to be entered.

simactive [serno]

Enable a sensor in the simulation table, allowing its data to be used and output on the J1939 bus.

siminactive [serno]
Stop a simulated sensors information from being used and output on the J1939 bus.
simactive all
Enable all of the sensors in the simulation table.

siminactive all
Disable all of the sensors in the simulation table.

simadd [][][][][][][][]: Add sensor to the simulated list, order of params as below
[serno][active][simmode][tTx][tSim][P][T][RSL][ch][txmode][sensortype]
This command allows the user to enter specific sensor parameters into the simulation table.
A sensor can only be added to the table if there is a space available in the list. If the list already contains the maximum of 10 sensors then a sensor must be removed with the 'simdel' command before a new sensor can be added.

All of the information in the command needs to be entered. The new sensor will then be included in the sensor in the simulation table. Alternatively the parameters of a sensor already in the list can be modified by using the serial number of a sensor already in the list, in the command.

[ser no] – serial number [0 – 4294967295]
[active] – sensor is active or inactive [on / off]
[simmode] – simulation mode [0-2]
[tTx] period of data transmission in sec [0-255]
[tsim] – period of data simulation in sec [0-255]
[p] - pressure in mBar [0-14000]
[t] – temperature in °C [-40 to 127]
[RSL] – percentage of remaining sensor life [0-100]
[ch] – antenna channel that receives the data [0-3]
[Txmode] – sensor transmission mode [0-3] this parameter is for future expansion but is still required to be entered.
[sensortype] – for Commercial Vehicle enter [GEN2T]

e.g.
simadd 123 on 2 255 255 5000 25 100 0 0 gen2t

13 C-Parameters (cpdisp – C-parameter display)

All of the major functions of the ECU are controlled by a set of 'C-parameters'. These parameters contain the values of all of the major system functions including CAN id's, bus speeds, alarm limits and scalings. These values are stored in a non-volatile area of memory in the ECU and all changes will be remembered when the ECU is power cycled. . Care must be taken when modifying any of the C-parameter values, as it is possible to completely disable the ECU if the wrong values are entered.

If you need to return the ECU to the factory default C-parameter settings then the command: 'cpdefault' will return all values to their factory settings.

Not all of the C-parameter values are relevant to the Commercial Vehicle TPMS and we have only detailed those that may need to be modified during the development phase.

Typing 'cpdisp' followed by enter will display a list of all of the internal system parameters.

```
BERU> cpdisp

Watchdog          L     1
Password          L     0
Serial_tx_mode    R     0
Permit_any_sensor L     1
Locate_mode       L     6
Lock_when_moving  L     0
Moving_speed      L    30
Moving_by_sensor  L     1
Moving_sensors    L     1
Auto_set_nominal  L     0
Auto_check_moving L     0
Stationary_time   L    30
Moving_time       L    50
No_of_wheels      R     4
Reference_temp    L    25
Reference_pres    L  1000
LED_mode          L     3
LED_single_warn   L     0
Lamp_test_dur     L    10
Fault_flash_dur   L   255
Response_wait_dur L    50
Mode2_wait_dur    L    50
Antenna_mode      L    15
Ping_retries_max  L     5
Ser_match_retries L     2
Ser_learn_counts  L     2
Ser_learn_retries L     5
Multipath_rx      L     1
Multipath_filter  L     1
Multipath_timeout L   800
Allow_21          L     1
Ping_code         L    64
Ping_pwr_del      L     4
Ping_pwr_dur      L     8
Stat_ping_rate    L     0
Allow_mode2_check L     1
DeltaP_latch      L     0
OverPres_latch    L     0
Pres_detect_mode  L     1
Pres_output_mode  L     0
Rx_timeout        L   120
Rx_tout_def_pres  L  6375
Speed_hysteresis  L    10
Lamp_hold_time    L     0
Lamp_hold_spd_max L   350
LH_spd_max_hyster L     1
Abs_pres_max      L  6000
Abs_pres_min      L   800
DeltaP_lim        L   200
Soft_warn_map     L   800   800   800   800   800   800   800   800   800   800
Hard_warn_map     L   800   800   800   800   800   800   800   800   800   800
```

```
Speed_map          L     0    50   100   150   200   250   300   350   400   450
Temp_max_on        L   125
Temp_max_off       L   115
RBL_min            L     2
Test_mode          L     0
CAN_temp_scale     L     1
CAN_pres_scale     L     1
Ext_CAN_port       R     0
Ext_CAN_rate       R     0     3
CAN_rx_timeout     R  1100
Ext_CAN_ID_tx_1    R   513   514   515   516   517   518
Ext_CAN_ID_tx_2    R   519   520   521   522   523   524   525   526   527
Ext_CAN_rx_Speed   R   640     0     0     2   255 65535
Ext_CAN_rx_TAmb    R   640     1     0     1   255 65535
Ext_CAN_rx_APres   R   640     2   133    30   255 65535
Ext_CAN_rx_NomSet  R   640     3     0     1   255 65535
Ext_CAN_rx_WrnAck  R   640     4     0     1   255 65535
Ext_CAN_rx_DashID  R   641
VBat_max           L 18000
VBat_min           L  9000
VRef_max           L  5200
VRef_min           L  4500
Vdd_max            L  5200
Vdd_min            L  4500
VLin_max           L 17000
VLin_min           L 11500
Temp_PSU_max       L   100
Temp_PCB_max       L   100
J1939_PGN_LW       R 65310
J1939_PGN_HB       R     0
J1939_Address      R    51
J1939_Priority     R     6
Sensor_timeout     R   140
GEN12_RBL_max      R    90
GEN21_RBL_max      R    90
GEN2T_RBL_max      R    60
Recognise_sensor   R     0
SE_mode            L     0

BERU>
```

13.1 C-Parameter Editing

There are two types of C-parameter: single value and multiple values, these are modified as follows:

NOTE: The 'BERU>' prompt must be displayed indicating that the user is logged into the parameter editing features of the ECU.

Single Value parameters:
Type 'cpedit' followed by enter. (or press CTRL and 'E' together)

XXXXXX will now be displayed on the screen as the prompt.

Type in the name of the single value cparameter (including underscores) followed by a space and the new parameter value:

e.g. 'SE_mode 1' followed by enter will change the value of SE_mode to 1.

Type 'cpdisp' followed by enter to confirm that the parameter value has changed.

Multiple Value parameters:
A multiple value C-parameter is:

```
Ext_CAN_ID_tx_1   R   513   514   515   516   517   518
```

It contains 6 elements (513, 514, 515, 516, 517, 518)

Element 513 is in position 0, 514 is in position 1, 515 is in position 2 etc.

To modify these values Type 'cpedit' followed by enter. (or press CTRL and 'E' together)

XXXXXX will now be displayed on the screen as the prompt.

Type in the full name of the C-parameter (including underscores) followed by a space and then an open square bracket '[' then add the position of the parameter (the first position is read as 0) followed by another square bracket, a space and then the new value.

e.g. 'Ext_CAN_ID_tx_1 [2] 555 will change the element 515 to a value of 555

Type 'cpdisp' followed by enter to confirm that the parameter value has changed.

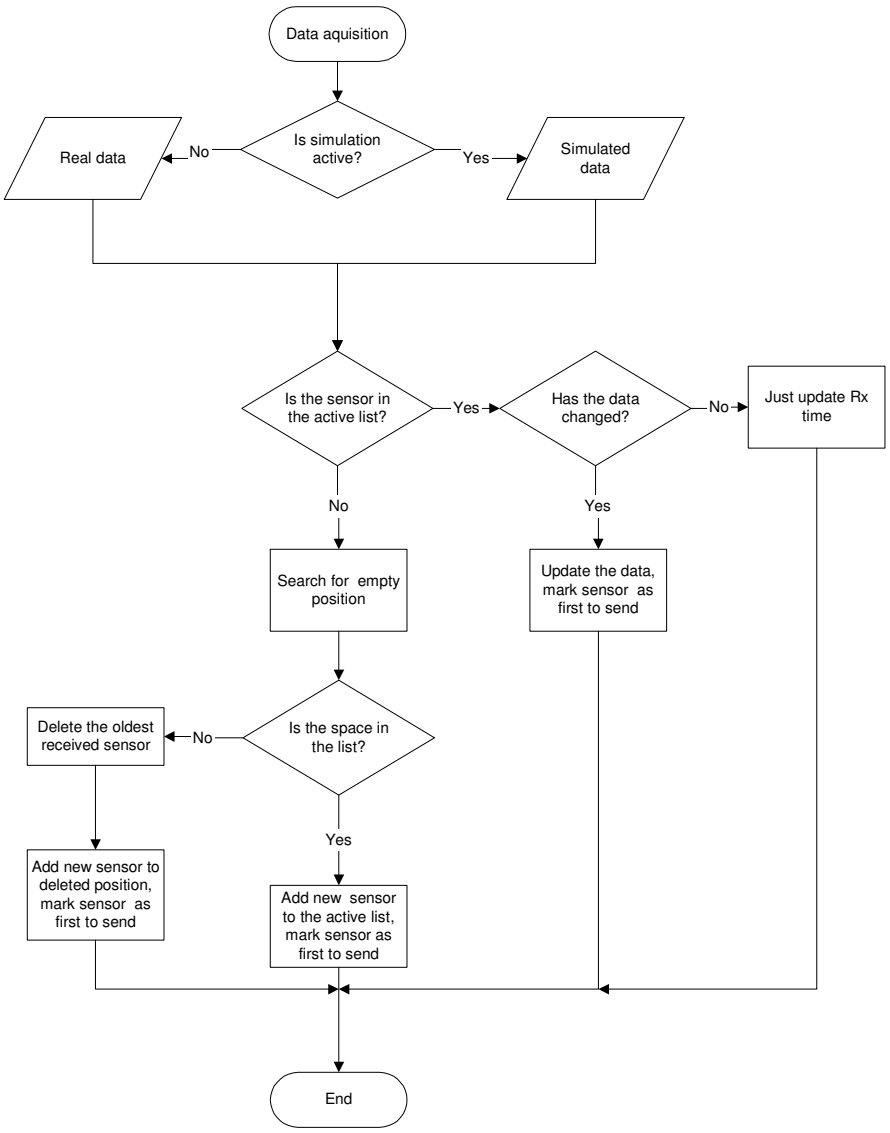
14 Software Engineer Mode

Setting the C-parameter SE_mode to 1 activates software engineer mode.
This mode is useful for software developers as it displays additional diagnostic information for all commands. E.g. sensor serial numbers are displayed in hex format and raw sensor data is displayed.

Truck TPMS release 1.0 Embedded Code

Data aquisition flow diagram

Damian Lemke - 11 January 2006

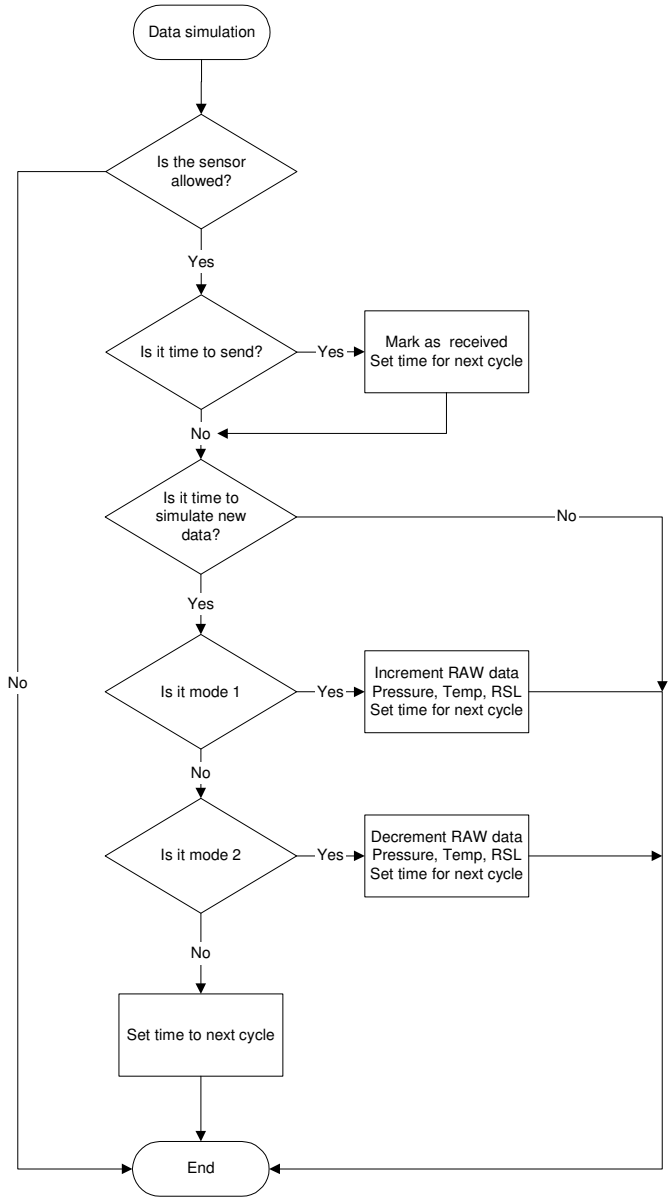


Note
Active test mode 10 shows a lot of diagnostic information.
Active SE_mode (cparam SE_mode = 1) shows additional information (eg. raw data, hex value of the serial number, time, etc.).

Truck TPMS release 1.0

Sensor simulation flow diagram (for single sensor)

Damian Lemke - 11 January 2006



Note
Active test mode 10 and SE_mode (cparam SE_mode = 1) shows a lot of diagnostic information.

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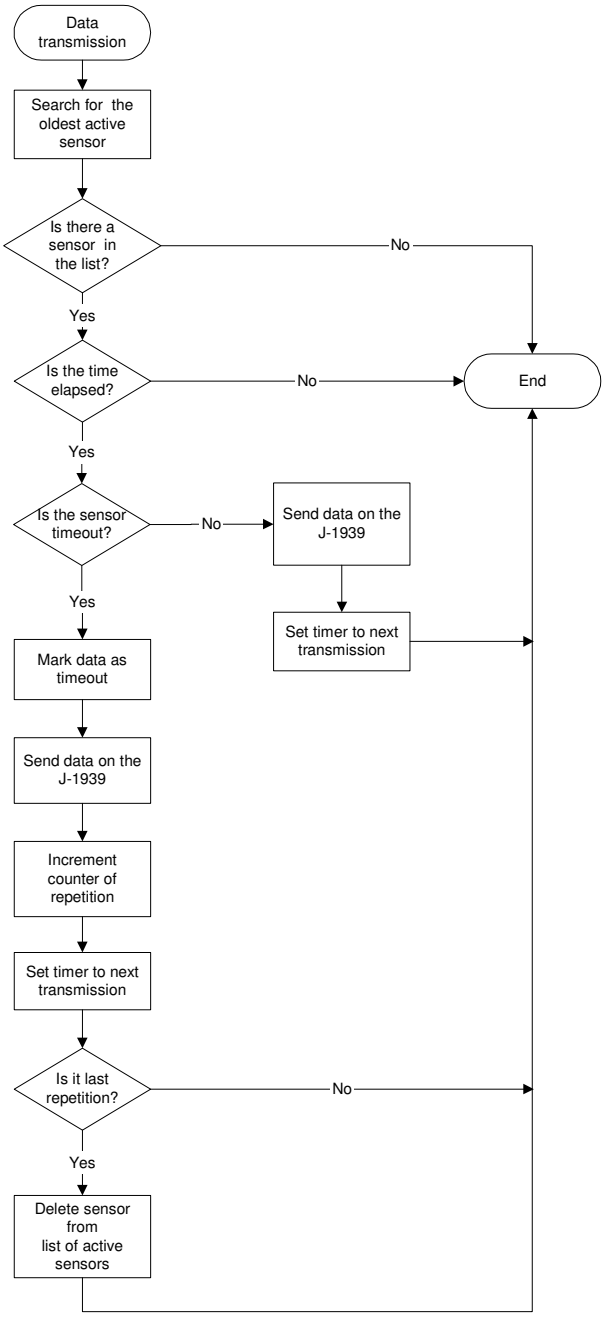
Data transmission flow diagram

Damian Lemke - 11 January 2006



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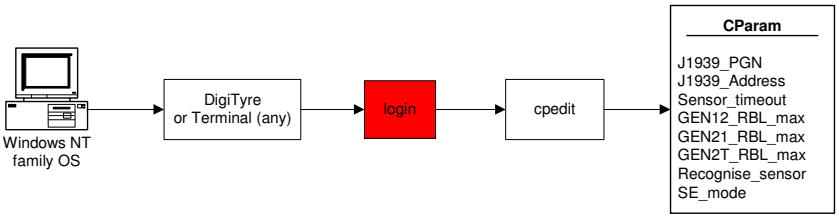
System configuration

Damian Lemke - 02 July 2007

New CParam

Parameter	Description
J1939_PGN_LW	Parameter Group Number low word (16-bit value) PDU Format + Group Extension
J1939_PGN_HB	Parameter Group Number high byte (8-bit value) Data Page Bit
J1939_Priority	This 3-bit value is used to define the priority during arbitration (0 is the highest priority)
J1939_Address	Address which is send on the J-1939 bus
Sensor_timeout	Timeout for the sensor for received data
GEN12_RBL_max	The greatest value of Percentage Sensor Life (this value correspond to 100% RBL) for GEN 1.2 sensor
GEN21_RBL_max	The greatest value of Percentage Sensor Life (this value correspond to 100% RBL) for GEN 2.1 sensor
GEN2T_RBL_max	The greatest value of Percentage Sensor Life (this value correspond to 100% RBL) for GEN 2T sensor This is value for truck sensor.
Recognise_sensor	If value equals 1 ECU recognise sensor generation (serial number is used for generation recognition) If value equals 0 all data are handle as GEN2T truck sensors (this value should be used)
SE_mode	Mode for software engineers only, shows additional data if test mode exists (eg. RAW data, serial numbers as HEX values, etc.) SE_mode = 0 – SE mode is inactive (this is recommended value) SE_mode = 1 – SE mode is active (it should be used by software developers only)

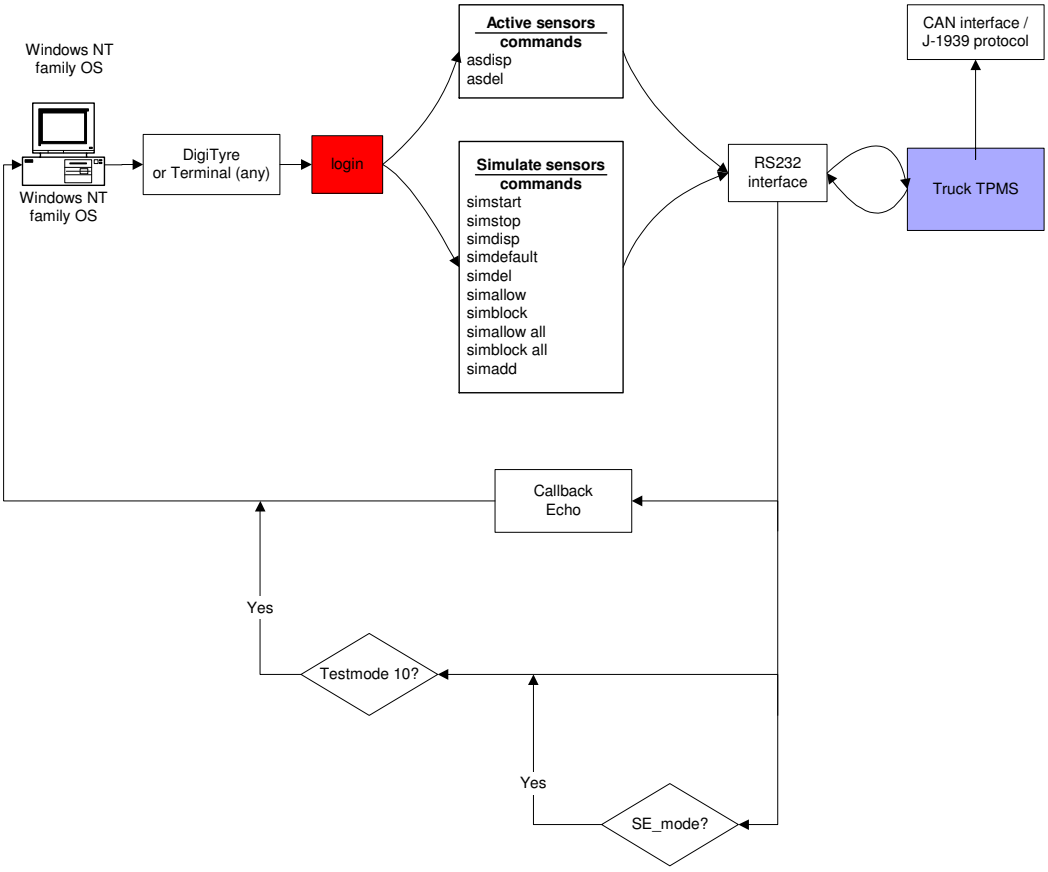
Flow diagram for Truck TPMS configuration



Truck TPMS release 1.0

Debugging System architecture - flow diagram

Damian Lemke - 02 July 2007



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System debugging commands

Damian Lemke - 02 July 2007

Simulated sensor list					
simstart	Start simulation of active sensors				
simstop	Stop simulation of active sensors				
simdisp	Display the list of simulated sensors				
simdefault	Force use of default simulated data				
simdel	Delete the sensor from the list of simulated sensors	Serial number	0	4292967295	Serial nubmber of the simulated sensor to delete
		[Index **]**	0	9	Index of the sensor to delete in the simulated sensors list
simactive	Allow simulation of the sensor	Serial number / index	0	4292967295	Serial number of the simulated sensor to allow
		[Index **]**	0	9	Index of the sensor to delete in the simulated sensors list
siminactive	Block simulation of the sensor	Serial number / index	0	4292967295	Serial number of the simulated sensor to block
		[Index **]**	0	9	Index of the sensor to delete in the simulated sensors list
simactive all	Allow simulation of all sensors				
siminactive all	Block simulation of all sensors				
simadd	Add is added to the list if all sensor to the list of simulated sensors (sensor parameters are correct)	Serial No / index			Serial number
		Active	OFF ON		Enable/disable simulation of the sensor
		SimMode	0	2	mode 0 - data are not changed mode 1 - raw data are incremented at every simulation mode 2 - raw data are decremented at ever simulation
		tTx	0	255	How often data should be send expressed as sec
		tSim	0	255	How often new data should be simulated expressed as sec
		Pressure	0	depend on the sensor type	Value of the pressure expressed as mBar Max value for: GEN12 - 6375 GEN21 - 4630 GEN2T - 14000
		Temperature	-40	127	Temperature expresses as deg C
		RSL	0	100	Percentages Remain Sensor Life expressed
		Channel	0	3	Number of simulated channel (which antenna receive that data)
		Tx mode	0	3	
		Sensor	GEN12 GEN21 GEN2T		Type of simulated sensor. It is important because, real data are scaled to raw values of selected sensor.

Note
Testmode 10 enable diagnostic informations send by RS232 (data are scaled to real values, decimal format)
SE_mode enable additional diagnostic informations (eg. RAW data, timers, serial number as hexadecimal value etc.)