Product Specification

Virtual Meter for Semana I

Rev. 1.0

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| --- | --- | --- |
| Approval | Revision | Author |
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|  | 09/21/2015 | 09/07/2015 |

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# History of Changes

|  |  |  |  |
| --- | --- | --- | --- |
| Rev. | Details | Author | Date |
| 1.0 | First creation for “Semana I” activity | E. Rios | 9/07/2015 |
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# Operating Conditions

Voltage level, current consumption, operating voltage range, humidity conditions, etc. are not specified for this product.

# Functional Specification

The virtual meter product is an electronic device that can be connected to a CAN network to receive input values in engineering units and display them in real time in a simulated pointer gauge.

## Gauge Selection

The device may be configured to display one of the 4 supported gauges specified in section *5. Variation Table*. The software binary file for each variation is provided independently to each other.

## Gauge Pointer Simulation

### Pointer movement filter

For all gauges, the pointer movement should be smooth. I.e. the pointer should not make sudden changes of position, but simulate the actual behavior of a physical pointer. I.e. the pointer can’t change from an indication position of “10” to an indication position of “20” regardless of the unit.

Instead, the pointer movement should follow a “target value vs. displayed value” strategy.

The refresh rate, incremental value and all other filter details are not specified in this document. It is responsibility of the design team to define these values and strategy to achieve the best looking effect.

### Pointer “Fast Speed”

Independently of each pointer’s specification, there are times (such as during IG OFF->ON) when the pointer needs to move faster than during normal operation.

In “fast speed mode”, the pointer must be capable of moving from its lower value to its highest value in 1 second.

Unless otherwise is specified, the fast speed mode should be used during normal operation.

## Communication Specification

CAN 2.0A network should be supported. However, the standard CAN format is used for communication with this device (refer to section *6. CAN Specification* for details)

The display value and the display units are determined by separated CAN messages as stated in section *6. CAN Specification*

## System On/Off conditions

### Ignition Switch Status

The status of the ignition switch is received through the IGN\_1 signal (CAN). And it determines the ON/OFF status of the system.

When the system is energized (power on), the IG status must be assumed to be OFF until the first CAN message is received.

### Ignition Off -> On

When the IG status changes from OFF to ON, the system should display the default gauge (speedometer, tachometer, etc.) and the displayed value should be refreshed every time a new input message is received.

After the initial power on, the input value must be assumed to be zero until the first CAN value is received (unless otherwise is specified in each gauge’s section).

When the gauge changes from IG On->Off->On (i.e. an input value has been received already), the device must remember the last display value at the time of IG ON->OFF, and return from the zero position to the remembered value in “fast speed mode” (see section 4.1.2 for details on fast speed mode) upon IG OFF->ON.

### Ignition On->Off

When the IG status changes from ON to OFF, the pointer should return to its zero position in “fast speed mode”, and 5seconds later, the display contents must be hidden (blank display).

If input values are received through CAN during IG OFF, these values should be ignored.

### Error Condition

If the IGN\_1 signal is not received during 2 seconds continuously, IG OFF state must be assumed.

# Meter Variations

The system displays one of the following gauges according to the software variation loaded:

* Speedometer
* Tachometer
* Fuel Gauge
* Oil Temperature Gauge

It is not mandatory that the system can switch between different gauges on runtime, however, the cluster should not display an incorrect gauge or value during startup or upon IG OFF->ON.

## Speedometer

### Inputs

|  |  |  |  |
| --- | --- | --- | --- |
| Signal Name | Value Range | Resolution (lsb value) | Default Value |
| SPEED\_INPUT | 0~20000 | 0.01 km/h | 0 km/h |
| SYSTEM\_UNIT | 0~1 | 0: Metric  1: English/Imperial | 0: Metric |

### Output

Pointer gauge indication from 0 to 120 MPH for Imperial system.

Pointer gauge indication from 0 to 100 Km/h for metric system.

### Normal Operation

The speedometer gauge reflects the input value immediately when a new value is received through CAN at a maximum refresh rate of 20 frames-per-second (fps).

When a value higher than the above specified range is received, the maximum indication value should be maintained.

If a value equal to or higher than 300km/h is received, the pointer must return to its zero position until a valid value is received.

### Error Mode

If the SPEED\_INPUT signal is not received during 2 seconds, the pointer must return to its zero position until a valid value is received.

If the SYSTEM\_UNIT signal is not received during 2 seconds, the default value must be used.

Upon IG OFF, the stored value must be zero while in error mode.

## Tachometer

### Inputs

|  |  |  |  |
| --- | --- | --- | --- |
| Signal Name | Value Range | Resolution (lsb value) | Default Value |
| TACHO\_INPUT | 0~8000 | 1 rpm | 0 rpm |

### Output

Pointer gauge indication from 0 to 8000 rpm with red zone indication at above 7000 rpm.

### Normal Operation

The tachometer gauge reflects the input value immediately when a new value is received through CAN at a maximum refresh rate of 20 frames-per-second (fps).

When a value higher than the above specified range is received, the maximum indication value should be maintained.

If a value equal to or higher than 7000 rpm is received, the gauge indication must blink at a rate of about 1Hz. (pointer On/Off blinking)

If a value equal or higher than 10000 rpm is received, the gauge must return to its zero position until a valid value is received.

### Error Mode

If the TACHO\_INPUT signal is not received during 2 seconds, the pointer must return to its zero position until a valid value is received.

Upon IG OFF, the stored value must be zero while in error mode.

## Fuel Gauge

### Inputs

|  |  |  |  |
| --- | --- | --- | --- |
| Signal Name | Value Range | Resolution (lsb value) | Default Value |
| FUEL\_INPUT | 0~400 | 0.1 lts | 0 lts |
| SYSTEM\_UNIT | 0~1 | 0: Metric  1: English/Imperial | 0: Metric |

### Output

The fuel gauge has 5 marks between its minimum and maximum displayable value. However, a small space (about 10 degrees) should be available between the zero position and the Empty mark.

The current units are displayed on screen. However, the input value (CAN) is assumed to be always litters.

### Normal Operation

The fuel value is received every 100 ms, and the display value is determined as the average of the last 5 readings (input values).

During normal operation (after the initial display value is reached after IG ON), the fuel gauge’s pointer speed should be of 10 seconds from Meter E to Meter F marks.

When a value higher than the above specified range is received, the current position should be maintained and the received invalid value must be ignored (not considered in the average calculation).

The gauge indication position is determined as follows:

|  |  |
| --- | --- |
| Gauge Mark | Value (lts) |
| Below E | 0 |
| E Mark | 5 |
| 1/4 | 10 |
| 1/2 | 20 |
| 3/4 | 30 |
| F Mark | 40 |

### Error Mode

If the FUEL\_INPUT signal is not received during 2 seconds, the last value must be maintained and the calculation of the average value must be stopped.

If the SYSTEM\_UNIT signal is not received during 2 seconds, the unit display must be turned off (no unit display)

Upon IG OFF, the stored value must be the current display value.

## Oil Temperature Gauge

### Inputs

|  |  |  |  |
| --- | --- | --- | --- |
| Signal Name | Value Range | Resolution (lsb value) | Default Value |
| OILTEMP\_INPUT | 0~5000 (-100° to 400°) | 0.1 °C or °F | 0° |
| SYSTEM\_UNIT | 0~1 | 0: Metric  1: English/Imperial | 0: Metric |

The unit of the OILTEMP\_INPUT gauge is determined by the SYSTEM\_UNIT signal. E.g. when OILTEMP\_INPUT = 1250, and SYSTEM\_UNIT = 0, the input is 125.0°C. However, if SYSTEM\_UNIT = 1, the input is 120.0°F.

### Output

The temperature gauge has a C (cold) and a H(hot) mark, and three indication marks equally separated between them (5 marks total).

### Normal Operation

The temperature gauge reflects the input value immediately when a new value is received through CAN.

The pointer speed should be of 2 seconds from its minimum position to its maximum position.

Regardless of the input unit, all values < 0°C and > 200°C must be ignored (current display value is kept).

When a value higher than 150°C is received, the gauge indication must blink at a rate of about 1Hz. (pointer On/Off blinking)

When a value higher than 300°C is received, the pointer must return to its zero position until a valid value is received.

### Error Mode

If the OILTEMP\_INPUT signal is not received during 2 seconds, the pointer must return to its zero position until a valid value is received (and blinking process must stop at the next ON phase)

If the SYSTEM\_UNIT signal is not received during 2 seconds, the input value must be ignored until a valid value is received.

Upon IG OFF, the stored value must be the last valid input value.

# CAN Specification

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Message ID | Signal | Description | Start Position (Byte:bit) | Length (bits) |
| 101 | SPEED\_INPUT | Speed Input | 1:0 | 16 |
| 224 | TACHO\_INPUT | Tachometer Input | 3:1 | 14 |
| 1BA | FUEL\_INPUT | Fuel Input | 4:2 | 10 |
| 1C1 | OILTEMP\_INPUT | Oil Temperature Input | 2:2 | 14 |
| 34A | SYSTEM\_UNIT | System Unit | 6:3 | 1 |
| 24B | IGN\_1 | Ignition Switch State | 2:0 | 1 |

CAN Frame Layout (Reference)

Byte (B) / bit (b) numbering scheme:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |