Design Description:

Fault Tolerant Fuel Control System

Disclaimer: This design description document is not complete and it is used for illustration of typical set of design description, The document is to be for feature demonstration purposes only.

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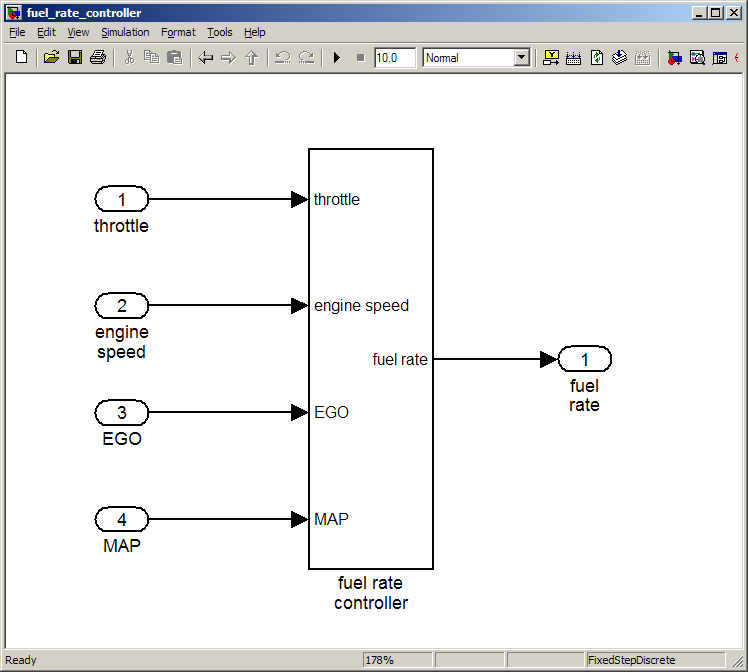
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## Interface Definition

  
*Image 1: High level block diagram of the System*

### Input Signals

#### Throttle Sensor

**Description:** The throttle position sensor shall have a normal and a failed control mode within a state diagram used to design the failure detection logic.

**Data Type:** double

**Nominal Ranges:**

#### Manifold Absolute Pressure Sensor

**Description:** The manifold absolute pressure (MAP) sensor shall have a normal and a failed control mode within a state diagram used to design the failure detection logic.

**Data Type:** double

**Nominal Ranges:**

#### Oxygen Sensor

**Description:**

**Data Type:** double

**Nominal Ranges:**

#### Speed Sensor

**Description:**

**Data Type:** uint8

**Nominal Ranges:**

### Output Signals

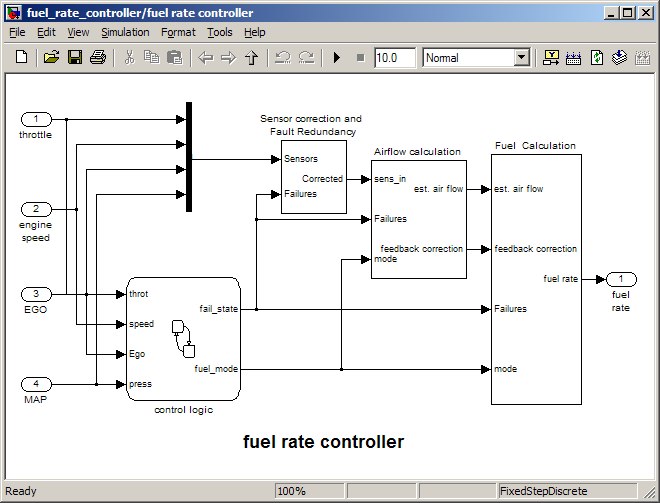
#### Fuel Rate

**Description:**

**Data Type:** double

**Nominal Ranges:**

## Subsystems



### Mass airflow estimation

Model Element: fuelsys/fuel rate controller/Airflow calculation

Details: The controller will use engine speed, throttle position and manifold pressure to estimate the mass airflow through the engine. This was very important change.

### Determination of pumping efficiency

Model Element: fuelsys/fuel rate controller/Airflow calculation/Pumping Constant

Details: The airflow calculation will use a calibratible table to determine the pumping efficiency of the engine based on engine speed and manifold pressure.

### Adjustment of estimated airflow

Model Element: fuelsys/fuel rate controller/Airflow calculation/Integrator

Details: The fuel system will use an exhaust gas oxygen sensor to adjust the estimated airflow.

### Failure Control Vector

The controller shall provide access to the internal vector of failure flags that indicate what sensors are in a failure condition.

### Fueling Modes

The controller shall provide access to the fueling mode indicator that will identify when the controller is using operating in a stoichiometric mode, a programmed enrichment mode, or the fuel disabled mode.

## Failure Management Subsystem

#### Oxygen sensor disabled during warmup

Model Element: State: Oxygen\_Sensor\_mode.O2\_warmup

Trans: [t > o2\_t\_thresh]

Details: During a calibratible warm up period the oxygen sensor correction will be disabled.

#### Enriched mixture usage

Model Element: State: Fueling\_Mode.Running.Rich\_Mixture

Details: The fuel system will use an enriched mixture whenever a sensor has failed.

#### Manifold pressure failure mode

Model Element: fuelsys/fuel rate controller/Sensor correction and Fault Redundancy/MAP Estimate

Details: When the manifold pressure sensor is in a failure mode, manifold pressure will be estimated from a lookup table based on engine speed and manifold pressure.

#### Speed sensor failure detection

Model Element: Trans: [speed==0 & press < zero\_thresh] / Sens\_Failure\_Counter.INC

Details: The fuel system will detect failures in speed sensor when speed is measured as 0 and manifold pressure is below a calibratible threshold.

#### Disable fuel system due to sensor failure

Model Element: State: Fueling\_Mode.Fuel\_Disabled.shutdown

Details: The fuel system will disable fuel when two or more sensors have failed to prevent the possibility of fire.

#### Disable fuel system due to engine speed

Model Element: State: Fueling\_Mode.Fuel\_Disabled.overspeed

Details: The fuel system will disable fuel whenever the engine speed exceeds a calibratible threshold.