Muner AE project

Project description

F1 smart controller

Design a smart controller able to acquire inputs and manage outputs

Muner AE project

Smart Controller Specifications

- Inputs
  - 1 analogue single ended/or digital: Barometric pressure sensor
    - Range 800-1200 mBar
    - Operating temperature range -40 to 85°C
    - One of the two or both of the following requirements must be satisfied
      - Relative accuracy over pressure 25 Pa
      - Absolute accuracy 250 Pa
    - Signal bandwidth required 10Hz
  - 1 analogue single ended/or digital : accelerometer one/three-axis
    - Range up to +/- 15G
    - Resolution up to 10bit at full scale
    - Supply voltage: to be defined
  - Optionally the sensors can be located on a separate board that transmits wireless to a main board. Any detail to be defined
- Compulsory Output
  - ~~Three options available~~:
  - 1 communication line, CAN or Ethernet, to be linked to a PC for data monitoring
- Optional output: 1 HiSide 1 A producing a modulated PWM whose duty cycle is a mapped function of barometric pressure

Muner AE project

Smart Controller Specifications

- Power Supply
  - Range: 10 V – 16 V (available on the car)
  - Protection over-voltage, polarity inversion
  - Max consumption typical <100 mA~~, quiescent < 5 mA (Hside driver not included)~~
    (wireless devices must be not taken into account)
- Operating temperature range 0-105°C
- Volume and weight: as small as possible (the physical dimension will be part of the evaluation)
  Note: smart IC packages can be just only evaluated
- Connectors: free
- Heat rejection: detailed data must be provided
- IPX protection: not requested

Muner AE project

Project specifications

- Evaluate signal conditioning
  - Sampling frequency
  - Filters
- Evaluate board logic complexity, and select the proper CPU
- Provide management code for the I/O, with diagnoses
- Mechanics:
  - Provide a mechanical draft of the logger box and connectors
  - sensor package, installation and wiring on the car not required

Muner AE project

Project design

- First design with an evaluation board
- Finalization with a custom board

Muner AE project

Project stages

- Internal group organization
  - Who does what and when
- Project planning
  - Describe the steps like brainstorming, study, design, prototype, whatever…

Muner AE project

Final custom board

The board has to be design in order to comply with the following requirements:

- Automotive compliant when available
- Size reduction respect the evaluation version
- Protection, recoveries, diagnostics
- Self check systems
- Firmware and application code suggestions
- Cost reduction if possible respect the evaluation version
- Qualification/validation processes, standards involved
- Whatever is relevant for the project, also not included in the specs

Muner AE project

Project deliverables

- Group organization and planning
- Architecture of the system
- Code samples
- Project main components and interconnections
- Technologies selected (sensors, board, components...)
- Pros and cons of the different choices (also discarded choices)
- Maintenance requested by the system
- Whatever relevant carried on during workshop

Additional notes

- For the purpose of this project, the additional compliances to the FIA F1 Technical Regulation can be skipped

Appendix 1

Example of application: measurement of the dynamic pressure on the DRS wing

Closed position

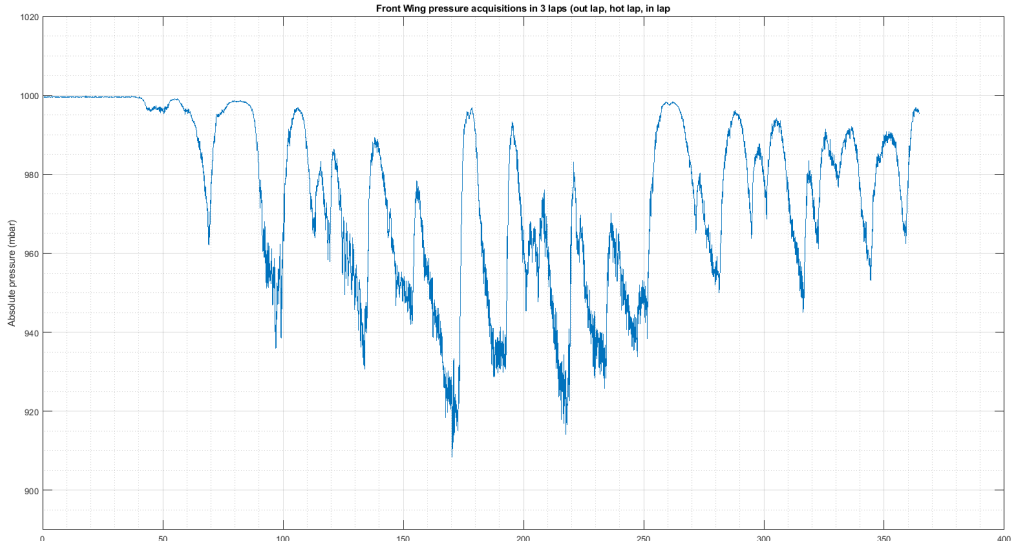
Open position

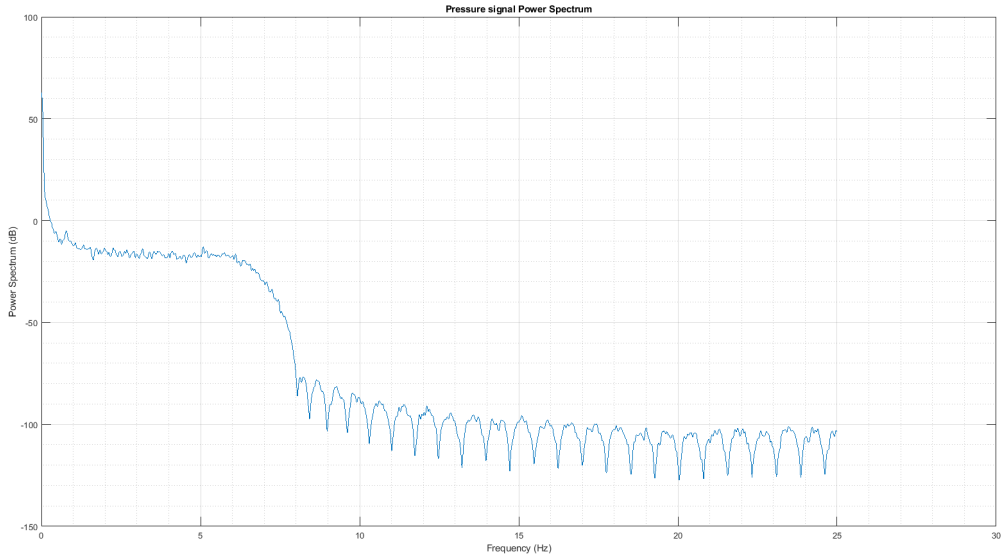
- Pink box: sensor
- Cyan box: main board

Muner AE project

Appendix 2

Example of barometric pressure data (MAT file available)





Appendix 3

Example of accelerometer signal (MAT file available)