



Design of a Data Acquisition System for a Mitsubishi Mirage RX Supercar

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Introduction

The use of data acquisition systems during vehicle development has become an important development tool for all aspects of motorsport, particularly as obtaining accurate data allows team to greatly improve performance. This project focuses on the design of a bespoke data acquisition system for Spencer Sport to implement on their Mitsubishi Mirage RX Supercar to obtain valuable chassis parameter data to aid with further development. The design will centre around the Motec C187 data logger, belonging to UWTSD.

Project Aims

- Identify the requirement for the data acquisition system (DAS) and determine the necessary analysis required to develop the Mirage further.
- Research the capabilities of the Motec C187 and supporting hardware.
- Design a loom specifically for the Mitsubishi Mirage RX Supercar
- Identify and source all materials and sensors required to manufacture the DAS

Research

Several areas were thoroughly investigated to allow for the design of the bespoke DAS. These areas are as follows:

- Data Acquisition in Motorsport
- DAS System Application (Rallycross & The Mitsubishi Mirage RX Supercar)
- Controller Area Networking (CAN)
- Hardware Specifications and requirements
- Capabilities of the supporting Software
- Logging Frequencies (Sampling Rates) [1][2]

In relation to the application, there are important key factors that must be considered when making hardware decisions to ensure the quality and reliability of the system such as:

- IP Ratings
- Vibrations
- The effect of external heat sources [4]
- Electromagnetic Interference (EMI)
- Resolution, Reliability and Accuracy of the sensors

Design

Finalised Chassis Parameters along with selected sensors and suppliers are shown in Table 1

Table 1: Parameters, Sensors & Suppliers

Parameter	Sensor Selected	Supplier
Wheel Speed	Hall Effect	KA Sensors
Damper Travel	Linear Potentiometer	KA Sensors
Steering Angle	Rotary Potentiometer	KA Sensors
Brake Pressure	Pressure Transducer	KA Sensors
Air Flow	Pitot Tubes	Motec
Ride Height	Laser Transducer	KA Sensors
Tyre & Brake Temperatures	Infra-Red Temperature Sensor	Izze Racing
GPS & Yaw	Speedbox RTK	Race Technology

Deutsch AS Standard Series connectors and **Tefzel** wiring have been chosen due to high specifications and ability to withstand the harsh rallycross environment. The cost of the materials and components required for manufacture is **£12,261.44** as shown in Table 2

Table 2: Bill of Materials Summary

Item	Total Cost
Sensors	£8,114.15
Connectors	£4,297.33
Wiring	£65.46
Consumables	£226.86
Total: £12,261.44	

Figures 1 & 2 show the proposed finalised design schematics for the complete data acquisition system.

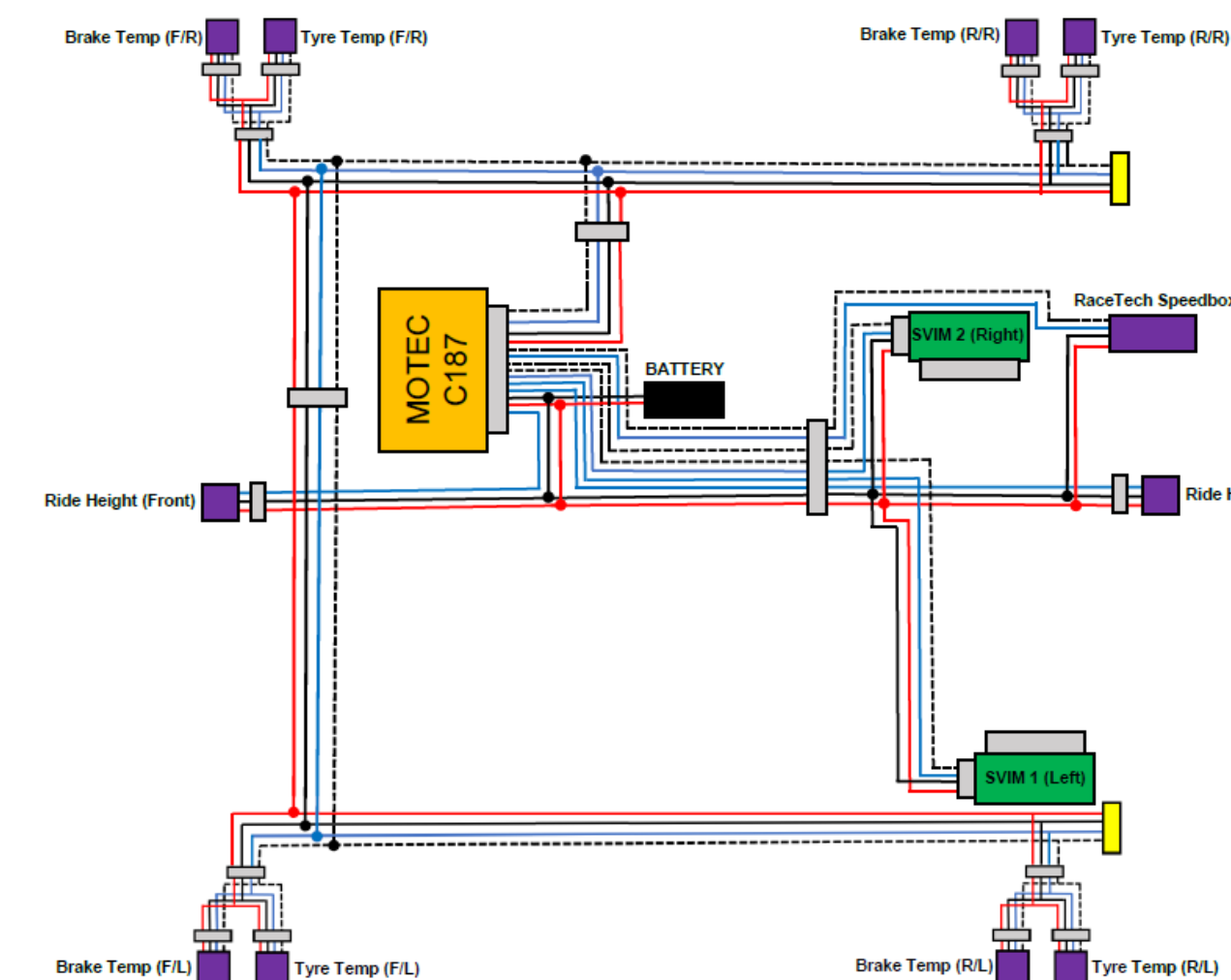


Figure 1: Motec C187 & CAN Schematic

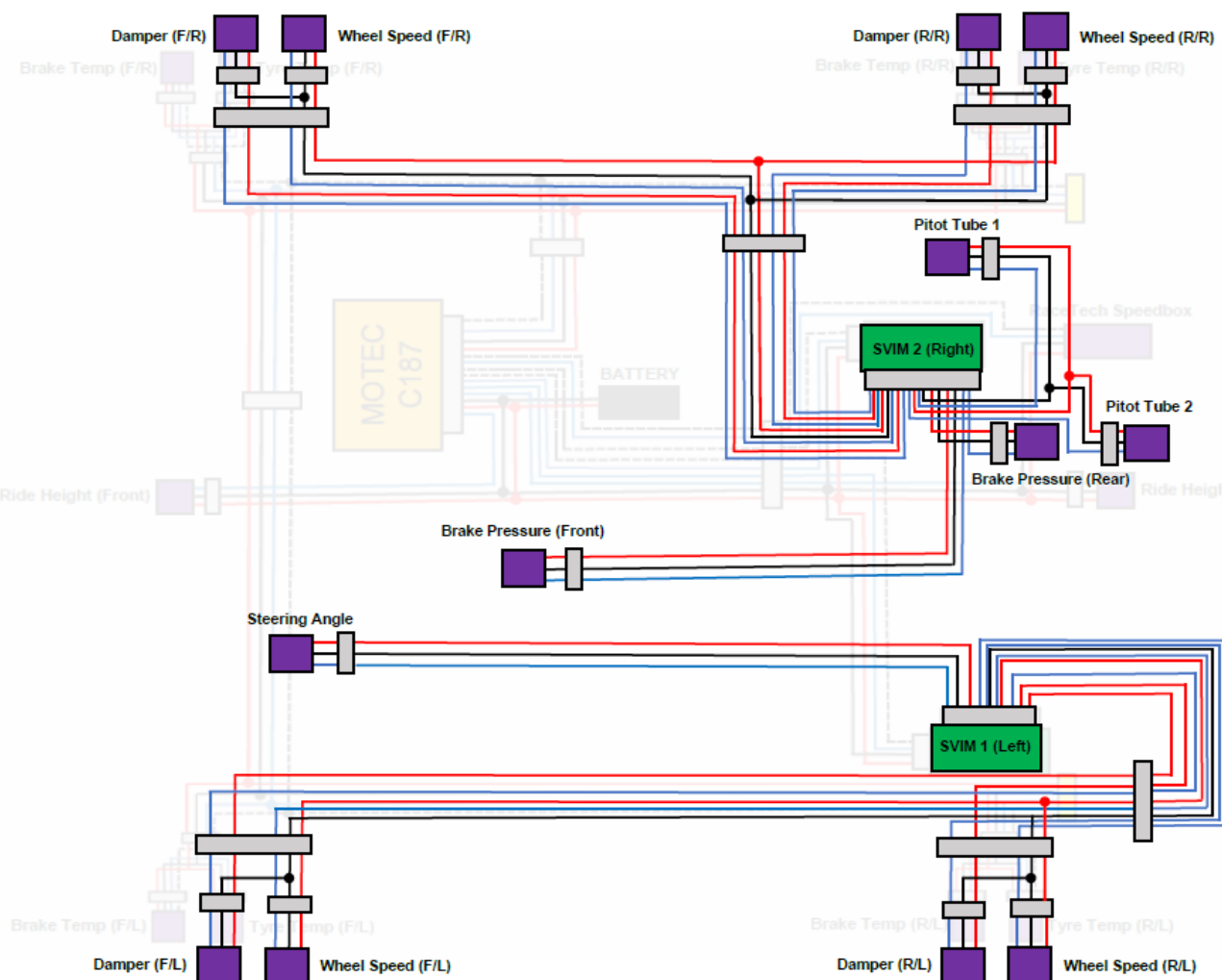


Figure 2: SVIM Schematic

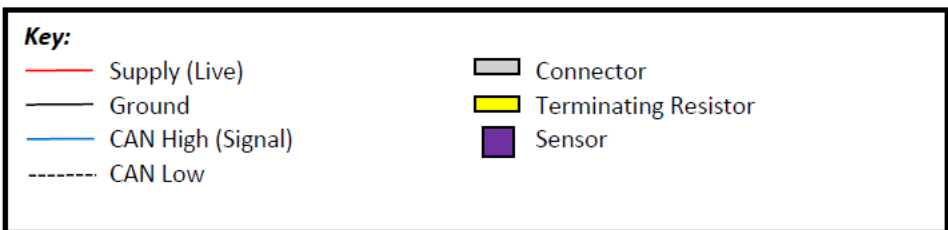


Figure 3: Supporting Schematics Key

Conclusions

As no budget has been specified for the DAS, this has allowed for a high specification design concept for the Mitsubishi Mirage RX Supercar to aid Spencer Sport to maximise both performance and vehicle handling characteristics whilst ensuring the durability of the DAS.

References

[1] Segers, J., 2008. *Analysis Techniques for Racecar Data Acquisition*. Warrendale, USA: SAE International.

[2] Fey, B., 1993. *Data Power - Using Racecar Data Acquisition*. First ed. Tennessee: Towery Publishing, Inc..

[3] Morello, J., 2014. *A Non Traditional Solution for High Vibration Connection Systems*, Warrendale, USA: SAE International.

[4] Almubarak, A. A., 2017. The Effects of Heat on Electronic Components. *Int. Journal of Engineering Research and Application*, 7(5), pp. 52-57