V8 SUPERCARS AUSTRALIA PTY LTD
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Invitation to Tender for Supercars Control Electrics & Electronics System 2021-2025

1. Introduction

The governing body of Supercars Australia is seeking tenders for the exclusive supply of the control electrics and electronics system. The supply agreement shall commence in 2021 to facilitate the development of the sport's new racing platform and prototype, GEN3, to be raced at the commencement of 2022 Supercars championship season. The supply agreement is for a term of 5 years.

As part of the process, we are looking at various options which are listed in this document.

2. Timeline

a.	Supercars issue RFQ	Wed	06/01/2021
b.	All questions relating to RFQ sent to Supercars, ECU interface software and data analysis software to be supplied to SC for evaluation	Wed	20/01/2021
c.	Quotes received	Wed	27/01/2021
d.	Selection date (SC may vary this date at its discretion)	Fri	05/02/2021

SC reserves the right to introduce a second round of consultation with selected suppliers between item d. which consequently may delay the selection date.

3. Technical Requirements

The electrics and electronics package for GEN3 must meet the technical requirements further below and includes the following items:

- ECU – Engine Control Unit
- DRS – Data Recording System
- DAS – Data Analysis Software
- DD – Driver Display
- VRS – Video Recording System
- PCDM – Power Control & Distribution Module (min 1)
- ADR – Accident Data Recorder
- GPS – Global Positioning System
- TS – Telemetry System
- SW – Steering Wheel
- SLM – Shift Light Module
- MSPB – Membrane Switch Panel Box
- BIR – Battery Isolation Relay
- Sensors – The data source for the various electrical systems.

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a) ECU – Engine Control Unit

i. General Requirements

The firmware may be required to be written to comply with FIA software inspection requirements.

The ECU will be used to control multiple different naturally aspirated V8 engines in the GEN 3 Supercar. All engines will have a single throttle body / plenum style inlet manifold system. Specific features of the intended engine include:

- Variable camshaft timing (both inlet and exhaust).
- Drive by wire (DBW) throttle actuation.
- Direct fuel injection (TBC)*
- Knock control.
- Assisted shift (paddle shift).
- Push to pass.

*Direct fuel injection is under review. It is envisioned that we will only require a port injection ECU's. *Please supply information and costings on both port and DI ECU options.*

ii. ECU - Inputs and Outputs

Minimum Requirements:

• Analogue voltage inputs	17
• Analogue temperature inputs	6
• Auxiliary inputs	4
• Auxiliary outputs	8
• CAN buses	3
• Digital inputs	4
• Half bridges	10
• Ignition low side outputs	8
• Injector low side outputs	8
• Injector peak and hold outputs	8
• Knock inputs (double ended)	2
• Lambda inputs (wide band; can be an external module)	2
• LIN Communication	1
• Serial inputs (RS232)	1
• Universal digital	12

iii. ECU - Internal Sensors

• Internal accelerometer (3 axis) +/- 20g	1
○ Please supply filtering frequency.	
• Internal voltage sensor	1
• Internal current sensor	1
• Internal temperature sensor	1

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iv. Vehicle ECU
- An ECU with a SC proprietary firmware will be required for SC vehicles.
- This ECU's firmware must only be available to SC and must not be available to any competitor, associate or be available in the open market.
- This ECU must not have live tuning while the engine is running.

v. Dyno ECU
- An ECU with a SC proprietary firmware will be required for engine suppliers and SC for the purpose of dyno testing engines.
- This ECU's firmware must only be available to SC and must not be available to any competitor, associate or be available in the open market.
- This ECU must have live tuning while the engine is running.
- The ability to measure individual cylinder Lambda inputs on all eight cylinders.
- Quick Lambda tuning function on all individual Lambda inputs (one button adjustment using all eight Lambda inputs).
- "Lambda Was" tuning function on all individual Lambdas.

vi. Environmental
- A minimum IP rating of IP54.
- Ability to withstand vehicular accidents greater than 50G.
    - Please supply your IK rating.
- Comply with electromagnetic compatibility directive 2004/108/EC.
- ISO 9001 certification is preferred.

1. Operating Temperature
- -25°C to 100°C internal temperature.
    - Whilst not common, we have experienced ECU internal temperatures in excess of 100°C.
    - Whilst not common, we have experienced cabin temperatures in excess of 70°C.

2. Storage Temperature
- -25°C to 80°C internal temperature.

vii. Mechanical
- Housing material: Please supply material details.
- Mounting: Please supply mounting details and drawings.
- Physical dimensions: Please supply physical dimensions.
- Connectors - military spec or high-quality plastic connectors are acceptable. *Please submit both options if you offer both connectors.*
- Crimping and assembly tools must be easily available from any electrical harness manufacturer.

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viii. Validation

Please supply short company history, proposed ECU validation and if possible historical use of ECU, specifically if used in other motorsport applications and series.

ix. Electrical Requirements

1. Supply Voltage
   - Nominal operating voltage: 13.5V.
   - Continuous DC operating system: 8.0V – 18V.
   - Any system must be able to be fully operational in less than 1s.

2. Analogue Temperature Inputs
   - Typically used with variable resistor two wire sensors such as engine temperature, air temperature etc.
   - Pullup to 5V: Please specify the pullup resistor value.
   - Must have continuous input voltage protection. *Please specify protection limits.*

3. Analogue Voltage Inputs
   - Supply of 5V +/- 0.005V
   - 5V power supply reference must be specified in ECU for ratiometric measurements.
   - Must have continuous input voltage protection. *Please specify protection limits i.e., maximum current and voltage input.*
   - Ability to support absolute and ratiometric measurements.

4. Digital Inputs
   - Please outline your specifications for digital inputs.

5. Half Bridges
   - 5A plus continuous current, 10A peak current.
   - Suitable for servo throttle (DBW).
   - Suitable for general purpose DC servo drive.

6. Ignition Outputs
   - Please outline your specifications for ignition outputs.

7. Injector Outputs
   - Please outline your specifications for injector outputs.

8. Universal Digital Inputs
   - Programmable trigger levels +/-10V.
   - Programmable hysteresis levels 0.1V to 6.0V.
   - Programmable digital filtering.
   - Suitable for hall/optical and magnetic sensors.
   - Switchable pullup resistor. Please specify pullup specifications.
   - Typically used for ref/sync, cam position, wheel speed, turbo speed etc.

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x. Security Requirements

- 128bit encryption key generation.
- Multiple user levels (minimum of three).
- Individual password or key security for each level.
- Available functionality for each level must be configurable.
- Each ECU must be individually numbered, both physically and in firmware.
- Each ECU must have the SC identification / logo embossed on the external case.
- Strict security protocol surrounding the management and distribution of Teams (and SC) data, ECU files and encryption keys. Confidential agreements will be part of the supply agreement.

xi. Communications Requirements

1. ECU
   - One bi-directional communication interface is required to communicate with the ECU and download the logged data.
   - If propriety communication cable is required, this needs to be included in final costing.

2. CAN Bus
   - Ability to interface with power distribution module(s) (PDM), data logger, accident data recorder (ADR), judicial camera, lap beacon, vehicle Lambda module (if required), dyno Lambda modules, keypad, electric power steering (EPS) and tyre pressure monitoring system (TPMS).
     - Specific CAN device requirements TBC.
   - All CAN bus parameters must be user configurable.
   - The ability to receive user defined CAN messages i.e., switches (including rotary switches) and sensors.
   - Ability to monitor all CAN bus diagnostics.
   - All CAN buses must have a CAN utilisation channels.

3. LIN
   - User configurable baud rate

4. RS232
   - User configurable baud rate

xii. ECU Functionality

1. General
   - All inputs and outputs must user allocatable.
   - All inputs must have user configurable calibration parameters. Where possible a calibration library.

2. Ambient Calculations
   - Ability to calculate ambient pressure from manifold pressure sensor.

3. Assisted Shift Control
   - Currently assisted shift systems are under review. At this stage, an E-shift system is likely.
   - User configurable mode switch input (typically rotary switch).

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- User configurable 3 axis gear down shift engine speed table.
- User configurable 3 axis power on table.
- User configurable gear shift delay parameter.
- User configurable reverse gear selection strategy.
- User configurable 4 axis gear shift timing table.
- User configurable 4 axis ignition cut table.
- User configurable 4 axis ignition timing retard table.
- User configurable 4 axis fuel cut table.
- User configurable 3 axis engine speed match table and parameters.
- User configurable 3 axis actuator timing table and parameters.
- User configurable actuators parameters.
- User configurable clutch strategy.
- User configurable throttle blip strategy.
- User configurable automatic shift mode.

4. Auto Start
   - User configurable inputs for auto start including throttle activate, deactivate, stall timeout and cranking time.

5. Cooling Fans
   - Whist this is currently not used, SC would like this functionality as an option.

6. Diagnostics
   - In depth diagnostics for engine reference and engine synchronisation inputs.
   - All sensor voltages to have user configurable high / low diagnostic inputs and where possible a user configurable diagnostic delay.
   - All diagnostic channels must be available for logging and CAN bus transmission.
   - All functions must have a status channels which must be available for logging and CAN bus transmission.
   - Ability to monitor all ECU internal and absolute voltages and diagnostics.

7. Drive By Wire (DBW)

a. General
   - Comprehensive fault diagnostics and reinstate strategies if diagnostic resets.

b. Throttle Servo
   - User configurable two axis linearisation table.
   - User configurable PID control.
   - User configurable sensor diagnostics.
   - User configurable positions (main and tracking).
   - User configurable actuator parameters.
   - Calculated servo control channels to monitor overall control.
   - Ability to monitor all throttle servo aim channels.
   - Comprehensive throttle servo diagnostics.
   - User configurable warnings.

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c. Throttle Pedal
- User configurable four axis translation table.
- User configurable sensor diagnostics.
- User configurable positions (main and tracking).
- Ability to monitor all throttle pedal aim channels.
- Comprehensive throttle pedal diagnostics.
- User configurable warnings.
- Note: possible requirement for additional axis or table for use as parity adjustment.

8. Driver Switch Configuration
- User configurable multiple switch inputs i.e., engine run switch, gear shift requests, driver / tyre lights.
- User configurable multiple rotary switch inputs.
- User configurable allocation of switches to multiple areas and tables.
- User configurable switch configuration, including active edge, pull up control, threshold, and hysteresis.
- Ability to assign a CAN receive message as driver switch input.
- Ability to monitor switch pin voltages and diagnostics.

9. Electric Water Pump
- Whist this is currently not used, SC would like this functionality as an option.

10. Engine Run Switch
- Ability to use driver switch input as engine run switch input.

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11. Fuel Aim
    - The fuel aim tables are used by the fuel closed loop and the efficiency-based functions.
    - Multiple 3 (or 4) axis user configurable fuel aim tables.
    - SC only, 3 axis user configurable fuel aim table.
        - This table is used to mandate the regulated maximum Lambda as set by SC.
        - This table needs to be the overriding table when the SC user configurable thresholds are exceeded.
    - SC only, user configurable fuel aim trim function (activated by driver switch).
    - User configurable fuel aim tables activated by various safety limits i.e., exceeded predetermined coolant and oil temperature, etc.

12. Fuel Closed Loop Control
    - Enable function.
    - User configurable exhaust transport delay table.
    - User configurable fault delay.
    - User configurable fault threshold.
    - User configurable activate thresholds, i.e., throttle pedal, engine speed and inlet manifold pressure, etc.
    - User configurable short-term gains.
    - User configurable 4 axis minimum trim tables.
    - User configurable 4 axis maximum trim tables.
    - User configurable long-term gains and decays.
    - User configurable diagnostics outputs.
    - Comprehensive diagnostics strategies.

13. Fuel Composition
    - User configurable fuel composition sensor input.
    - This will be used for monitoring the fuel composition only. No tuning adjustments is required from this sensor.

14. Fuel Film / Transient
    - Comprehensive fuel film or fuel transient module.
    - Must have positive and negative trims.

15. Fuel Injector Configuration
    - Sequential injection.
    - User configurable 4 axis injector linearisation table.
        - Preference is for supplier to supply a drop-down library of calibrated injectors.
    - User configurable injector actuator parameters.
    - Ability to run either peak and hold or saturated injectors.
    - Whilst we envision that only one injector per cylinder will be require, please list if you can provide primary and secondary injectors, and if there are any constraints associated in doing so.
    - Comprehensive injector diagnostics.
    - User configurable Injector warnings.

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16. Fuel Injection
    - User configurable 4 axis efficiency table.
    - User configurable fuel volume overall trim parameter.
    - User configurable 3 axis fuel volume cranking table.
    - User configurable 3 axis fuel volume post start table.
    - User configurable 4 axis fuel volume gear compensation.
    - User configurable 4 axis fuel volume upshift compensation.
    - User configurable 3 axis individual cylinder fuel volume compensation tables.
    - User configurable 3 axis inlet air temperature post start compensation.

17. Fuel Model
    - Whilst not essential, a volumetric efficiency fuel model is preferred.
    - User configurable physical properties for the engine, i.e., capacity and fuel characteristics.
    - Ability to run engine load mode as either inlet manifold pressure or throttle position.
    - Background modelling of fuel and air density.
    - User configurable correction parameter for inlet air temperature sensor offset.
    - Complex redundancy tables and sensor estimates need to be available i.e., inlet manifold pressure estimate table, estimate inlet air temperature, estimate fuel temperature, etc.
    - Comprehensive fault diagnostics and reinstate strategies if diagnostic resets.

18. Fuel Pumps
    - Ability to activate multiple pumps.
    - User configurable prime and hold time parameters.
    - User configurable pump drive parameters.
    - User configurable pump open circuit parameter.
    - User configurable diagnostics outputs.

19. Fuel Timing
    - User configurable fuel timing edge.
    - User configurable 3 axis main fuel timing table
    - User configurable 2 axis fuel timing limit table.
    - User configurable 2 axis fuel timing makeup table.

20. Fuel Used
    - Fuel used calculation including 2 (or 3) axis correction table.

21. Gear
    - Ability to input both main and tracking gear position sensors.
    - User configurable parameter to set each individual gear input in both main and tracking sensors.
    - User configurable 2 axis gear ratio table.
    - User configurable 2 axis gear position tolerance table.
    - User configurable input filter on both main and tracking inputs.

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- User configurable gear position input diagnostics.
- User configurable default and delay settings to ignore each gear source method.
- Complex estimate gear calculation strategy based on multiple source inputs.
- Must have multi-level redundancy methods to calculate estimate gear based on the default of previous gear / method.
- gear shift count (up & down into each gear), fastest & slowest up & down shift times into each gear, barrel overshoot or 'kick-back' count & measurement, barrel sensor error count, pneumatic pressure, compressor duty cycle & engine/gearbox runtime counter, declined downshift counter.
- Clear hierarchy order from gear main to the multiple estimate gear sources.
- Comprehensive fault diagnostics and reinstate strategies if diagnostic is reset.
- User configurable drop gear input. Prefer drop down menu.
- User configurable final drive ratio parameter.

22. Global Positioning System (GPS)
    - Ability to receive a GPS signal and return all GPS parameters for logging.

23. Hybrid Capabilities
    - Hybrid integration is being considered for the GEN 3 project. It is expected that this will not be used for the start of 2022. Please supply information re ECU integration with batteries, battery management systems (BMS), motor controllers and high voltage power distribution units (PDU).

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24. Identification Lights
    a. Driver Light
        - User configurable light output generated from driver switch input.
    b. Pit Switch Light
        - User configurable light output generated from driver pit switch input.
    c. Rain Light
        - User configurable flashing rain light output generated from driver switch input.
    d. Stall Light
        - Stall light strategy.
        - User configurable stall light time out parameter.
    e. Tyre Light(s)
        - User configurable light(s) output generated from driver switch input(s).

25. Idle control
    - Enable function.
    - Idle control needs to be a combination of throttle servo control and ignition timing control.
    - User configurable 2 axis idle mass flow cranking table.
    - User configurable 3 axis idle aim compensation table.
    - User configurable 3 axis idle feedforward table.
    - User configurable activation parameters including throttle pedal (threshold and hysteresis) and engine speed.
    - User configurable 2 axis idle aim table.
    - User configurable 4 (or 5) axis mass feedforward tables.
    - User configurable PID control.
    - User configurable idle ignition timing limit advance.
    - User configurable throttle aim maximum.
    - User configurable steering feedforward table.

26. Ignition Coil
    - User configurable 2 axis coil charge timetable.
    - User configurable coil charge time limit tables.
    - User configurable coil driver parameters.
    - User configurable multi spark parameters.

27. Ignition Timing
    - Ignition timing cranking table.
    - User configurable 4 axis ignition timing main table.
    - User configurable overall trim parameter.
    - User configurable limits advance and retard.
    - User configurable 3 axis engine load ignition timing table.
    - User configurable 3 axis individual cylinder ignition timing tables.
    - User configurable 3 axis ignition timing compensation tables i.e., coolant temperature, gear, manifold pressure, and inlet air temperature.
28. Knock Control
    - Enable function.
    - Multiple user configurable DSP knock measurement frequency level channels.
    - User selectable frequency(s) modes.

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- User configurable 3 (or 4) axis threshold tables.
- User configurable 3 axis recovery table.
- User configurable 2 axis delay.
- User configurable 2 (or 3) axis trim gain table.
- User configurable 2 (or 3) axis trim limit table.
- User configurable knock window start.
- User configurable 2 (or 3) axis knock window width.
- User configurable knock sensor cylinder allocation.
- User configurable individual cylinder knock level gain.
- User configurable knock warnings, trim, and level.
- User configurable diagnostics outputs.

29. Lambda
    - Compatible with NTK or Bosch LSU 4.9 (Bosch LSU 4.9 preferred).
    - Sample rate: Please specify the maximum sample rate.
    - 2 Lambda inputs required. Bank 1 and bank 2.
    - Quick Lambda tuning function.
    - Lambda was function.
    - Lambda heater strategy.
    - Lambda normalised channels (calculated lambda without fuel closed loop control).
    - User configurable Lambda filter.
    - Lambda filtered channels.
    - Comprehensive diagnostics.
    - User configurable Lambda warnings.

30. Lap Beacons
    - Ability to receive lap beacon(s) and generate individual sector and lap times.
    - User configurable main beacon ID.
    - User configurable beacon ignore time.
    - User configurable scrutineering pit entry beacon ID.
    - User configurable scrutineering pit exit beacon ID.
    - User configurable scrutineering control line beacon ID.

31. Logging
    - Multi-level data logging system.
    - ECU file (with security) to be embedded in the log file.
    - Individual security required for each level. Encryption key preferred.
    - Onboard logging capacity – 250MB minimum (prefer larger).
        - User configurable capacity at each level.
    - Configurable logging systems for each level.
    - Ability to restrict channels dependant on user (this can be done at a firmware level).
    - User configurable channel and parameters selection.
        - Please list maximum channel count.
    - User configurable logging rates between 1Hz and 1000Hz (preferred).
        - Please list available logging rates.

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- User configurable logging request channels.
  - Ability to create individual log files based on various logging requests.
- All diagnostic channels must be loggable.

32. Push to Pass
    - Various push to pass methods are under review but as minimum, provision is required for a push to pass system.
    - User configurable input and output.
    - User configurable sequence time.
    - User configurable sequence number.
    - User configurable sequence reset.
    - We will be trialling a throttle-based push to pass system. For this we will need an addition 3 axis throttle translation table that is activated by the push to pass switch.

33. Reference / Synchronisation Sensor
    - Ability in receive magnetic or hall sensors. Software pull up for hall sensors control preferred.
    - User configurable engine speed reference modes. Drop down library of common engine configurations preferred.
    - User configurable sensor input threshold parameters.
    - User configurable 2 axis hysteresis and debounce tables.
    - Comprehensive sensor states, specifically during the cycle lock phase.
    - Comprehensive diagnostics.

34. Sensor Offsets
    - User configurable offset sensor function. Selected sensors only.

35. Scrutineering Algorithms
    - Written at firmware level with user defined parameters and limits.
    - Examples of scrutineering algorithms:
      - Real time gear ratio calculation with pass / fail output channel. Will require user configurable gating.
      - Real time drop gear ratio calculation with pass / fail output channel. Will require user configurable gating.
      - Real time fuel pressure scrutiny with pass / fail channel. Will require user configurable gating.
      - Real time gear shift timing scrutiny with pass / fail channel. Will require user configurable gating.
      - Real time individual cylinder ignition timing scrutiny with pass / fail channel. Will require user configurable gating.
      - Real time Lambda (bank 1 and bank 2) breach time percent (previous lap) with EOL output percentage. Will require user configurable gating.
      - Real time Lambda sensor calibration scrutiny. This is based on the entered air calibration values referenced to the air calibration numbers used by the sensor.
      - Real time fuel composition sensor scrutiny with a pass / fail channel. Will require user configurable parameters.

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- Various real time calculations to capture and compare vehicle speed passing beacons at pit entry and exit, and vehicle speed when the pit switch is activated and deactivated. Will require user configurable inputs and gating.
- Various statistics and counters with user configured parameters to capture selected inputs i.e., engine speed, oil temperature, transaxle temperature, etc.

- User configurable parameter for ambient pressure as used by the TPMS.

36. Speed Limiters

a. Engine Speed Limit

- User configurable maximum engine speed limit.
- User configurable maximum engine speed limit ignition range.
- Note, ignition range must work below maximum engine speed limit.
- User configurable maximum engine speed limit fuel range.
- User configurable maximum engine speed limit fuel limit.
- User configurable engine speed limit warning.
- User configurable engine speed limit warning delay.

b. Vehicle Pit Speed Limit

- User configurable vehicle pit speed limit maximum.
- User configurable vehicle pit speed limit mode selection i.e., engine speed limit, throttle control or a combination of both throttle control and engine speed limit.
- User configurable vehicle pit speed limit throttle limit offset.
- User configurable vehicle pit speed limit error limit.
- User configurable vehicle pit speed limit error limit maximum.
- User configurable vehicle pit speed limit error limit minimum.
- User configurable vehicle pit speed limit error gain.

c. Sensor Driven Engine Speed Limits

- User configurable maximum engine speed limit for various critical engine sensors, oil pressure, coolant temperature, etc.
- User configurable enable modes, minimum and maximum threshold, 3 axis tables, hysteresis, and delay parameters for each sensor limit.

d. Throttle Servo Fault Speed Limit

- User configurable maximum engine speed limit.

37. Test Modes

- Ignition timing lock test.
- Input capture on all universal digital inputs: Inductive and Hall effect.
- Individual injector test with user definable RPM.
- Individual cylinder ignition output test with user definable RPM.
- Individual cylinder fuel cut and bank cut.
- User configurable engine speed test mode.
- Fuel pump(s) test mode.
- Gear shift actuator test mode (upshift and downshift).

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- Throttle servo test mode (static and step) with user definable test parameters.
- Compare mode(s) with the ability to accurately compare two ECU files and highlight and differences.

38. TPMS Requirements
    - User configurable ambient pressure input. This parameter is sent to the TMPS ECU via CAN.

39. Variable Camshaft Timing
    - User configurable three axis table.
    - User configurable PID control.
    - User configurable pin parameters.
    - User configurable position offset.
    - User configurable actuator parameters.
    - Calculated actuator control channels to monitor overall control.
    - Ability to monitor all camshaft aim channels.
    - Comprehensive diagnostics.
    - User configurable warnings.
    - Note: possible requirement for additional axis or table for use as parity adjustment.

40. Vehicle Speed
    - User configurable 3 (or 4) axis wheel speed circumference tables. Separate tables for front and rear.
    - User configurable switch input for axis input (linked to tyre light).
    - Must have multi-level redundancy methods to calculate vehicle speed.
    - Clear hierarchy order for each vehicle speed calculation method.

xiii. Software

1. ECU Interface Software
    - Ability to receive lap beacon(s) and generate individual sector and lap times.
    - User configurable screen layouts with multiple worksheets and workbooks.
    - Ability to “compare” two different ECU files. I.e., overlap to see the differences between two files.
    - Ability to apply various maths to individual sites and tables.
    - Ability to interpolate or apply smoothing functions to various sites / tables.
    - Ability to import / export tables and sensor calibration files.
    - Ability to view all channels in real time in the form of a time series plot.
        - With pause, rewind and zoom functions.
    - Ability to assign preferred channel units.
    - Comprehensive help menus and detailed description in ECU interface software.

2. Data Migration
    - Interface software needs to have the ability to migrate tables, calibration tables and parameters.
    - Clear display / warning if data migration is not achieved.

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b) DRS – Data Recording System

The Data Recording System is the equipment used to record the data that is presented by the various sensors and calculations that comprise the electronics package of the GEN3 Car. The capabilities of the DRS are critical in determining the ability to effectively manage and scrutineer the GEN3.
The DRS may or may not be integrated with the ECU. If the ECU and DRS are separate, then any communications connection between these modules should be CAN based.
The DRS shall provide the following operational "user logging" characteristics:

- Sample rates of up to 1000Hz on any single channel with a gross sample rate of at least 20,000 samples per second.
- A section of memory shall be reserved for "scrutineering logging", and shall provide the following characteristics:
- Sample rates of up to 1000Hz on any single channel with a gross sample rate of at least 20,000 samples per second.
- The ability to start and stop the logging system based on channel values. The ability to stop logging after a set time period (which could be provided by a calculated timer channel), until re-armed by the stop logging condition. This allows a race-start to be logged and retained at endurance events.
- A system that provides pre-trigger on the start condition (e.g., 30 seconds), would be viewed favourably. This is particularly useful for incident investigation.
- The DRS shall provide a Real Time Clock (RTC) that is settable from the scrutineer's computer. All data recorded in the scrutineering section shall be referenced to the RTC. This facility is essential for incident investigation.

· In addition to the "Maths Channels" that will be employed in the DAS (specified further below), "Maths Channels" should also be present in the DRS.

- The CAN link need to be sized accordingly to meet the requirements implied by this document.
- The following additional characteristics are required:
- Race teams shall only be allowed access to the user logging area.
- The scrutineering team shall be allowed access to the user logging area as well as the special scrutineering logging area. This may be implemented as two "downloads", resulting in two separate data files.
- The scrutineer shall be able to set the maximum sample rate individually for each physical input that is available to be logged in the user area. This maximum sample rate shall affect the raw input as well as any calculation or data that is derived from that physical input. Maximum sample rates would typically be 1000Hz to indicate an unrestricted channel, 5Hz to restrict a channel to diagnostics purposes only, and 0Hz to disable a channel.
- There are no sample rate restrictions on the scrutineering area of memory, with all channels being available at all times.
- It is essential that all aspects of the system configuration can be inspected by viewing the configuration files that are stored in the various sub-systems.

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- Connectors - military spec or high-quality plastic connectors are acceptable. *Please submit both options if you offer both connectors.*

Inputs (minimum)

- 10 x Analogue voltage inputs (24 optional).
- 4 x Analogue temperature inputs (8 optional).
- 4 x Digital inputs.
- 4 x Speed inputs with voltage measuring capability.
- 4 x Switched inputs.
- Compatible with VIM input expanders.

Outputs (minimum)

- 4 x PWM, digital or switched outputs (8 optional)—for devices such as shift lights, warning lights, a gearbox oil pump or a thermo fan.

Communications

- 2 x CAN with individually programmable CAN bus speeds
- 1 x RS232
- 250 MB logging memory (500 MB + USB optional)
- Logging rates up to 1000 samples per second
- Fast Ethernet download
- Includes i2 Standard data analysis software (Pro Analysis upgrade available)

c) DAS – Data Analysis Software

The Data Analysis Software shall be capable of performing all analysis required on the data that is retrieved form the Data Recording System.

- Ability to open ECU file from log file.
- Ability for typical overlays (time or distance reference), multiple zoom functions, etc.
- Ability for complex math channels with built in filters and functions.
- Ability for channel aliasing.
- Ability to synchronise individual log files based on GPS time.
- Ability to set global display limits for channels.
- Ability for in-depth channel reports.
- Ability to generate histograms, scatter plots, mixture maps, etc.
- Any software or support cost for data interpretation software needs to be included in final costs.
- Comprehensive help menus and detailed description in the data interpretation software.

d) DD – Driver Display

The driver display shall be capable of the displaying the following:

- Shift Lights LED array.
- Sufficient warning messages capabilities to allow the driver to make judgement call if the pit to car link is lost (radio; telemetry).
- Flag / Track State warning system.

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- Lap time.
- Connectors - military spec or high-quality plastic connectors are acceptable. *Please submit both options if you offer both connectors.*

e) VRS – Video Recording System

The Video Recording System has been a separate system but shall become more tightly integrated into the electronics package in GEN3 and linked to the scrutineering logging. The essential requirements for the VRS package are:

- The ability to record and store up to 9 hours of video. A higher compression rate may be permissible to achieve recording for more than 4 hours – although this rate will need to be settable to allow better quality recording for typical Supercars races.
- A frame rate of 30Hz or above.
- Support for an on-screen display of certain car parameters (e.g., Throttle position, Brake pressure, Road Speed, Gear Position, Time of Day) as text (as a minimum) so that the video can be used independently of the data recorded by the data recording system.
- An easily removable storage medium for the recorded video. Easily removable means the use of no tools required. This is essential.
- Real time stamping of the data. This is essential.
- Connectors - military spec or high-quality plastic connectors are acceptable. *Please submit both options if you offer both connectors.*

f) PCDM – Power Control & Distribution Module

A Power Control and Distribution Module shall be included to manage and protect the power supply circuits used in the GEN3 Car.

- The PCDM shall be connected to the rest of the electronics system via CAN bus.
- The PCDM shall be restricted to controlling >48 output channels.
- The PCDM may allow a minimum of 48 “switch” inputs.
- The PCDM outputs shall be able to be controlled either directly from the switches, or in combination with control signals generated within the DRS/ECU and communicated over the CAN bus. Currents limits will be defined at a later date.
- One or more units may be used to fulfill the above requirements.
- Connectors - military spec or high-quality plastic connectors are acceptable. *Please submit both options if you offer both connectors.*

g) ADR – Accident Data Recorder

The Accident Data Recorder may or may not be part of the overall electronics package and its access shall be restricted to Supercars only. The ADR functionality could be built in the Data Recording System but would require the inclusion of a high-g / high sample rate triple axis g-force sensor. The g-force measurement capabilities of the ADR must comply with the minimum FIA requirements.

- The device should also incorporate a lithium battery as a secondary power source.

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- Connectors - military spec or high-quality plastic connectors are acceptable. *Please submit both options if you offer both connectors.*

h) GPS – Global Positioning System

The GPS unit could be built in the ECU or be an external device. The update rate of the GPS shall not exceed 10-50hz.

- Connectors - military spec or high-quality plastic connectors are acceptable. *Please submit both options if you offer both connectors.*

i) TS - Telemetry System

- A live telemetry system which operates with negligible latency (i.e., telemetry data user sees must effectively align with the live vision and timing they are also seeing/receiving at the same time)
- Minimum 35 Cars able to be simultaneously supported by the telemetry system at a Supercars event (up to 26 permanent entries & 4 wildcards, plus Safety Car, Medical Car, Recovery Car, Race Control 1 & 2 Vehicles)
- System's operation must be able to be centrally controlled by Supercars, including ability to remotely troubleshoot data connection to each Car.
- Capable of distribution of data to numerous users in different locations simultaneously through available pit lane network infrastructure, including 'grouping' channels from each Car for control of distribution to various users (e.g., all channels to Supercars Technical, approved channels to Teams, pre-determined channel sets to Race Control, to television for use in broadcast, etc.)
- High level of data security, including encryption from Car to centralised receiver/server and separate encryption for distribution to all end users via existing pit lane network infrastructure.
- System will operate at all locations throughout Australia and New Zealand, with the capability to be expanded if required for additional international events in the future.

j) SW - Steering Wheel

A complete steering wheel with paddle shift switch mechanism including the CAN control switch system, switches and Display with integrated shift lights.

The minimum specification should be as follows:

- 8 RGB configurable high intensity shift lights.
- 6 RGB configurable warning lights.
- 13Way Deutsch Autosport quick release column connector.

Inputs:

- 10 user configurable snap action switches.
- 5 user configurable 10 position rotary inputs.
- 2 Gear paddle inputs.
- 2 Progressive clutch paddle inputs (optional).
- Up to 3 external switch inputs.

Outputs:

- Up to 3 user configurable discrete low side outputs.

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- Dedicated Radio Output – functional even if power is lost.

Interfaces:

- 100 MHz Ethernet.
- 2 CAN 2.0B interfaces with fully flexible CAN configuration.
- RS232 serial interface.

Power Supply:

- 8V to 80V input voltage range with reverse polarity protection.
- Connectors - military spec or high-quality plastic connectors are acceptable. *Please submit both options if you offer both connectors.*

While integrated, the electronics of the steering wheel needs to be transferable to a new steering wheel housing.

k) SLM – Shift Light Module

If not integrated in the steering wheel or driver display, the SLM must comply with the following specification:

- LED display used for driver warning light system, shift lights or other indicators Connected Via CAN network.
- Minimum 8 RBG LED array, independently controlled.
- Connectors - military spec or high-quality plastic connectors are acceptable. *Please submit both options if you offer both connectors.*

l) MSPB – Membrane Switch Panel Box

The minimum specification for the MSPB is as follows:

- Each MSPB must be highly configurable.
- Each switch can be configured as being either momentary or latching.
- Initial switch status selectable as being either ON or OFF.
- Each switch can have up to 8 individually programmable stages.
- Switches can be arranged in groups.
- LEDs display switch status, linked to switch or feedback from PCDM output channel.
- LEDs displays output channel error status or any user defined warnings.
- ON and OFF activation timers for each switch.
- Each key can be assigned to several CAN addresses.
- Independent definition of CAN identifiers.
- Adjustable EL backlight and LED intensity.
- Connectors - military spec or high-quality plastic connectors are acceptable. *Please submit both options if you offer both connectors.*

m) BIR – Battery Isolation Relay

The minimum specification for the BIR is as follows:

- Fully electronic with no moving parts.
- Totally sealed against water and dirt.
- Completely resistant to shock and vibration.
- delay between transmitting the engine kill signal and disconnecting the battery allowing ECUs time to perform a shutdown sequence before electrical power is lost.

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- Fully integrated with built in alternator run-down circuitry.
- Driver operation by a single internal ON-OFF button/switch.
- External operation by single or multiple 'strike' button(s).
- Connectors - military spec or high-quality plastic connectors are acceptable. *Please submit both options if you offer both connectors.*

n) Sensors

Indicative sensor list to quote for:

	Engine / Chassis	Description	Type
1	Chassis	Damper FL	Position
2	Chassis	Damper FR	Position
3	Chassis	Damper RL	Position
4	Chassis	Damper RR	Position
5	Chassis	Wheel Speed FL	Speed
6	Chassis	Wheel Speed RL	Speed
7	Chassis	Wheel Speed Rear	Speed
8	Chassis	Brake Front	Pressure
9	Chassis	Brake Rear	Pressure
10	Chassis	Clutch	Pressure
11	Chassis	GPS	
12	Chassis	Accel X	Accelerometer
13	Chassis	Accel Y	Accelerometer
14	Chassis	Accel Z	Accelerometer
15	Chassis	Gear Position Main	Position
16	Chassis	Gear Position Tracking	Position
17	Chassis	Gearbox Pressure	Pressure
18	Chassis	Gearbox Temperature	Temperature
19	Chassis	Airjack	Pressure Switch
20	Chassis	Steering	Position
21	Chassis	Tyre Pressure FL	TPMS
22	Chassis	Tyre Pressure FR	TPMS
23	Chassis	Tyre Pressure RL	TPMS
24	Chassis	Tyre Pressure RR	TPMS
25	Chassis	Tyre Temperature FL	TPMS
26	Chassis	Tyre Temperature FR	TPMS
27	Chassis	Tyre Temperature RL	TPMS
28	Chassis	Tyre Temperature RR	TPMS
29	Engine	Fuel Level Switch	Switch
30	Engine	Fuel Temp	Temperature
31	Engine	Fuel Pressure	Pressure
32	Engine	Manifold Pressure	Pressure
33	Engine	Manifold Temperature	Temperature
34	Engine	Mass Air Flow (MAF)	Mass
35	Engine	Ambient Temperature	Temperature
36	Engine	Oil Pressure	Pressure
37	Engine	Oil Temperature	Temperature
38	Engine	Coolant Temperature	Temperature
39	Engine	Coolant Pressure	Pressure
40	Engine	Lambda LH	Ratio

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41	Engine	Lambda RH	Ratio
42	Engine	Engine Speed	Speed
43	Engine	Cam Position Bank 1 Inlet	Position
44	Engine	Cam Position Bank 1 Exhaust	Position
45	Engine	Cam Position Bank 2 Inlet	Position
46	Engine	Cam Position Bank 2 Exhaust	Position
47	Engine	Throttle Position 1 (Main)	Position
48	Engine	Throttle Position 2 (Tracking)	Position
49	Engine	Pedal Position 1 (Main)	Position
50	Engine	Pedal Position 2 (Tracking)	Position
51	Engine	Knock sensor Bank 1	Frequency
52	Engine	Knock sensor Bank 2	Frequency
53	Engine	Crankcase Pressure	Pressure

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4. Commercial

a. Current projections include a starting grid of 24 Supercars in 2022 however this number may change marginally depending on the total number of Racing Entitlement Contracts "RECs" issued prior to the commencement of the 2022 Supercars Championship. Additional supply requirements will be in accordance with demand.

b. The tenderer can opt to tender for the complete system or any element of it; however, tendering for the whole control electrics and electronics system may be more attractive to Supercars. The tenderer may elect to tender to supply any one or more of the components and this will be considered by Supercars.

c. Attached with this tender is a pricing table excel workbook. You must complete and return the excel workbook by completing the pricing tables for each component you wish to tender (found on separate tabs within the excel workbook). When completing the pricing table:
   i. Please do not update the summary page.
   ii. Please update each tab with reference to the components you wish to tender.
   iii. Please only update cells highlighted light blue.
   iv. Please provide your pricing in AUD, CIF Brisbane, Australia including applicable taxes (excluding GST, import duties, and handling ex Brisbane)
   v. Please provide your pricing based on an MOQ of 30 for each component.
   vi. For each pricing table (tender ECU, DRS, DAS etc.), please include an itemized component list and price each item. You can add lines to each pricing table if you wish or you can group into headings and provide a separate pricing list detailing the itemized components list. If you provide a separate itemized component list it should reconcile to your excel workbook.
   vii. If you have any questions completing the pricing tables, please email Mark Adams madams@supercars.com

d. The supplier may be required to provide track support for race meetings and Supercars Test Days.

e. The supplier must ensure that the availability of parts throughout the duration of the agreement will not directly impact Supercars' supply and/or cost.

f. Prices quoted in year 1 remain fixed for the duration of the agreement.

g. Prices must be quoted in AUD. The foreign exchange risk will remain with the supplier.

h. The successful control electrics and electronics system supplier will contract directly with Supercars Australia and will be prohibited from entering into any arrangement or agreement with individual Supercars Teams.

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i. Components requirements:
- Prototype components sufficient for two (2) Supercars must be supplied to Supercars at its nominated address by no later than Monday, 22nd of February 2021. The supply and distribution of these prototype components will be at the cost of the supplier.
- Minimum of 4 ECU (for dyno testing only) will be required by Monday, 22nd of February 2021.

j. ECU Firmware Revision
Annual Revision:
SC requires annual firmware revisions, specifically for security purposes, as well as for minor updates.
All costs relating to this annual firmware revision will be the responsibility of the supplier.

As Required Firmware Revisions:
SC may require additional firmware revisions during each year.
The cost of the first firmware revision each year will be the responsibility of the supplier. All subsequent revisions will be the responsibility of SC.

Software Revision:
SC may require revisions or additional features added to the ECU interface and or data interpretation software to suit their requirements during each year. The cost of the first software revision each year will be the responsibility of the supplier. All subsequent revisions will be the responsibility of SC.
All "bug fix" update will be at the responsibility of the supplier and must be rectified in timely manner.

k. For all discussions relating to commercial opportunities with Supercars, please contact Cameron Price (CFO; cprice@supercars.com) and Jamie Black (General Manager – Commercial; jblack@supercars.com) within the previous timeline provided.

5. Control Electrics & Electronics System Sign Off Test

a. Track testing is required to sign off the part. The supplier is required to provide track support at no additional cost. If occurring outside a session organized by Supercars, the organization and cost is the responsibility of the control supplier.

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6. Tender Document

It is expected that each tender document, due for delivery on or before 05/02/2021, will include the following:

a. Complete bill of material, including component weights, defining all components to support the function of the control electrics and electronics system and a CAD file in STEP format.

b. Approach of the engineering phase, if required, and detailed timing plan including the sign off testing.

c. The warranty terms and conditions that will apply to the control electrics and electronics system detailing limits for all relevant parameters.

d. As much as is possible, details of any projects the potential supplier/manufacturer has delivered or is delivering which relate to the technical or operational aspects of this projects. For each project, the role of the supplier/manufacturer should be detailed and with whom the contract exists or existed.

7. Delivery point

All tenders should be delivered by e-mail to:

Mr. Vincent Dumarski
Technical Projects Manager
Supercars Australia Pty Ltd
45 Nerang Street
Southport, Qld 4215

E-mail: vdumarski@supercars.com

8. Final Note

The selection of the winning bidder will be at Supercars' complete discretion. Additionally, there is no guarantee that a bidder will be successful.

Appendix A
Brisbane & GC Area: 3 Teams (6 Cars)
Melbourne: 6 Teams (12 Cars)
Albury: 1 Team (4 Cars)
Sydney: 1 Team (2 Cars)