Delivering Excellence Through
Innovation & Technology

RICARDO

GSQA

Gear Shift Quality Assessment

ricardo.com

Ricardo Gear Shift Quality

Ricardo have a complete suite of Gear Shift Quality hardware and software tools to allow transmission analysis and development. From basic synchroniser design software through to complete shift system and driveline modelling and gear shift durability test rig software, the GSQA Manual system is one part of this suite.

- Ricardo Gear Shift Quality Assessment (GSQA) systems are utilised by 120 users globally
- Ricardo continually develops the GSQA system and has done so for the last 20 years

GSQA Manual

Why Ricardo?

Proven gear shift measurement and analysis tools and techniques

- Objective measurement and simulation tools to enhance end user shift experience
- Easy assessment of comfort, sportiness, speed, delay, feel and sound relative to target
- Shift quality development experts for 25+ years

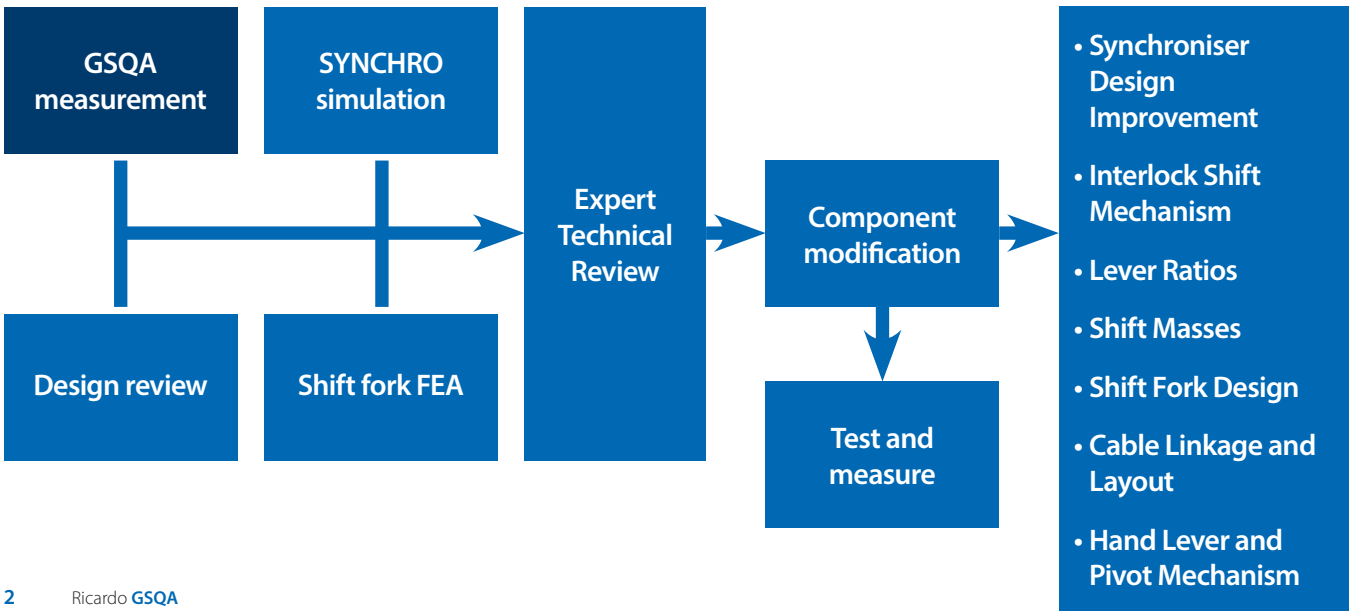
Gear design, inspection and manufacture specialists

- Expert overview from transmission design, inspection & manufacturing teams
- Component supplier leadership, external reviews and audits supports implementation

Experts in system and vehicle integration

- Minimising project risk through expert peer design reviews
- Support in interpreting analysis results, from transmission design and attribute groups and the vehicle project team

Gear shift quality improvement approach

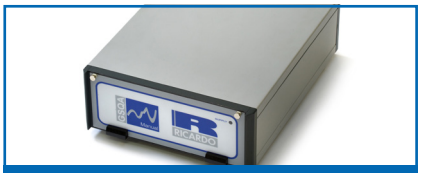


Ricardo GSQA System Products

For quotations, please contact shiftquality.sales@ricardo.com

General Assemblies

GSQA Manual System



Integrated Signal Conditioning Unit

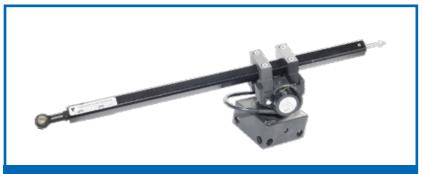
Light/Heavy Duty Commercial

Static Clutch Module

Gearknob Force Transducer

Potentiometer Assembly

Spare Parts



Linear Travel Sensor

Suction Cup

Speed Sensors

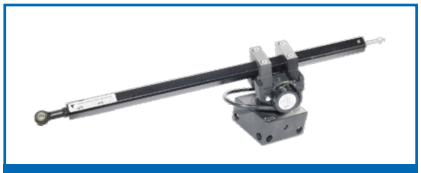
Laptop

Touchscreen

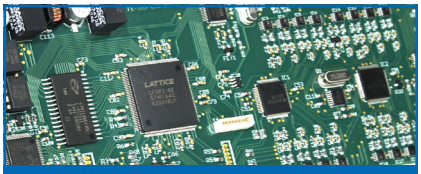
Software

Upgrades

Gearknob Upgrade

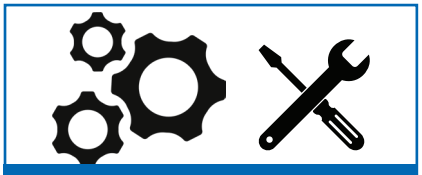


Angular Travel Sensor



USB Interface Upgrade

Service



Annual Maintenance Contract

Calibration

GSQA Training

GSQA Manual System - GA-GSQA-01

The Ricardo Gear Shift Quality Assessment (GSQA) base system for manual transmissions together with data acquisition and analysis software. This enables you to perform your own shift quality assessment programs, both dynamically and statically in-vehicle.

GSQA Manual System

Includes

1x GA-GSQA-02 Gearknob Force Transducer

- Fore/Aft (X) ±400N Crossgate (Y) ±200N Vertical (Z) ±100N

1x GA-GSQA-04 Potentiometer Assembly

- 3-axis potentiometer system for Fore/Aft (X), crossgate (Y) and vertical (Z) position measurement

1x GA-GSQA-05 Integrated Data Acquisition & Signal Conditioning Unit

- 25kHz sampling rate
- 16 analogue channels, 32 CAN input connectivity
- 10-36 V DC
- USB output connectivity

Installation Hardware Package

- Mounting frame incl suction cup and universal location bracket for potentiometer assembly
- All tools required for installation

Protective Watertight Flight Case

- Foam inserts shaped to secure all hardware

12-Month Warranty

- 12 month hardware warranty and software support

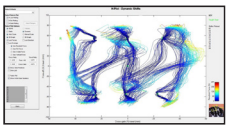
Manuals

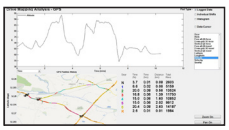
- Detailed user manuals in English covering both acquisition and analysis software operation

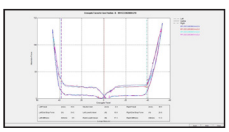
GSQA Software Package

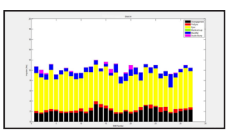
- 2x user licences for the Ricardo Gearshift Data Acquisition Software (GDAS) v6.5 or higher
- 2x user licences for the Ricardo Objective Gearshift Analysis Software (OGAS) v6.5 or higher

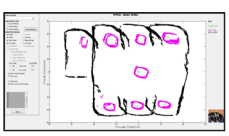
Please note: The base system does not include a laptop which is required for the running of the GSQA software











Gearknob Force Transducer - GA-GSQA-02

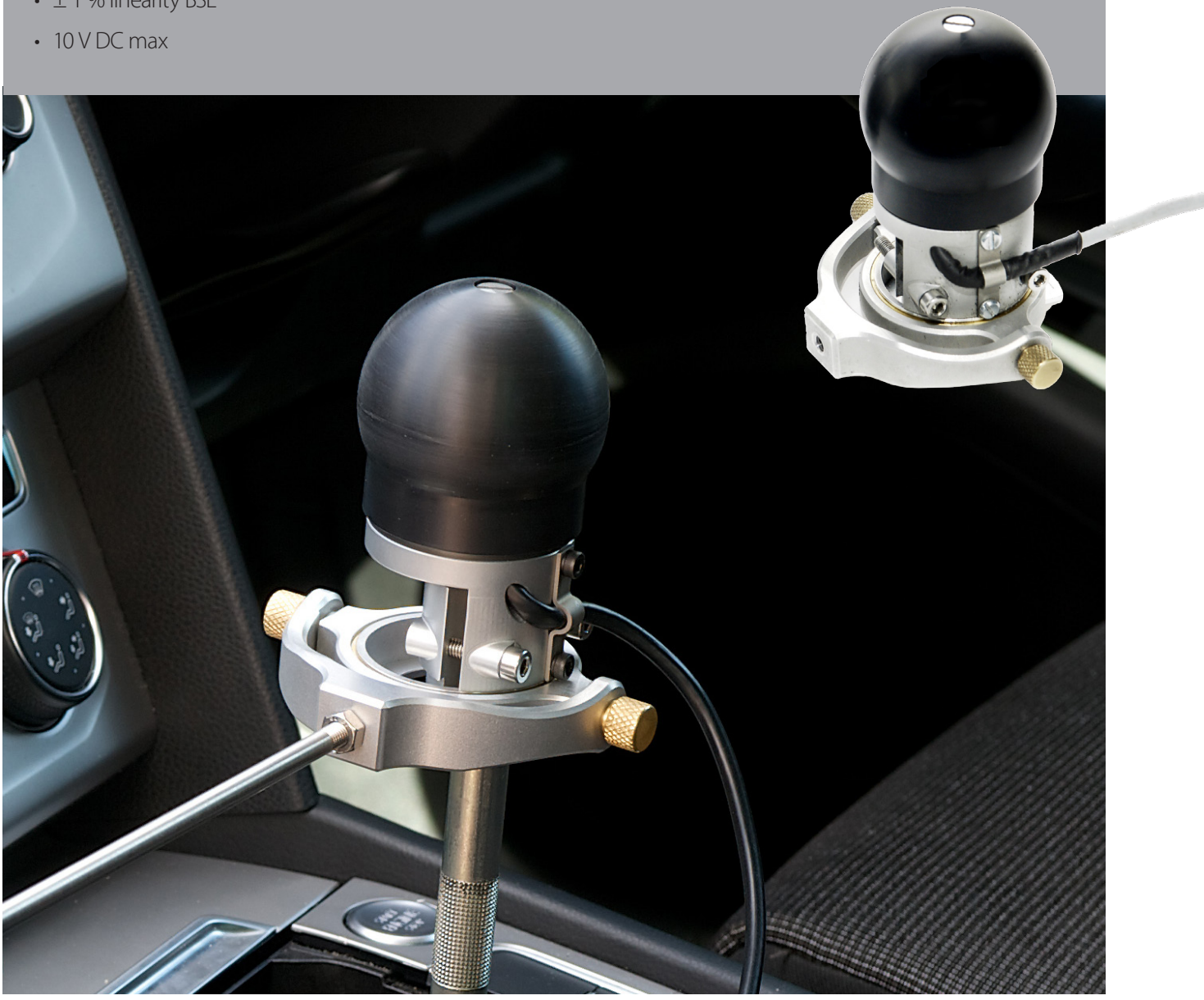
Gearknob Force Transducer

The Gearknob Transducer fits onto the shift lever with the factory gearknob and gaiter removed. It contains three calibrated strain gauges to measure applied force in X, Y and Z. It has a rotating attachment gimbal to ensure continuous alignment with the shift lever pivot point.

Includes

Standard Measurement Range

- Fore/Aft (X) ±400N Crossgate (Y) ±200N
  Vertical (Z) ±100N
- Can be calibrated to customer's requirements
- 0.5 $^{mV}/_{V}$ FS typical sensitivity
- ± 1 % linearity BSL
- 10 V DC max
- -34 to +50 °C Operating Range
  - 0.06 % Sensitivity Change per °C
  - 0.02 N Zero Shift per °C
- 350g Weight



Travel Sensor Assembly - GA-GSQA-04

The Linear Travel Sensor Assembly is a 3-axis assembly for Fore/Aft (X), Lateral (Y) and Vertical (Z) displacement measurement of the shift lever. It consists of two components; a 2-axis angular potentiometer and a single axis linear potentiometer.

Potentiometer Assembly

Includes

Linear

- 252mm stoke
- Virtually infinite resolution
- < ± 0.1 % linearity
- ± 0.01 mm repeatability
- -40 to +100 °C operating range

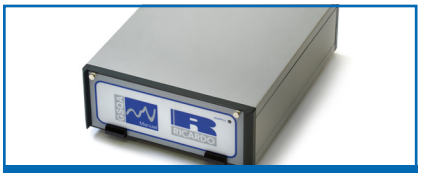
Lateral

- < 0.12 Nmm torque
- Virtually infinite resolution
- ± 0.1 % linearity
- ± 1 % repeatability
- Continuous rotation
- 5 kΩ nominal resistance
- -65 to +130 °C operating range

Vertical

- < 0.03 Nmm torque
- Virtually infinite resolution
- ± 0.1 % linearity
- ± 0.0012 % FS repeatability
- Continuous rotation
- 5 kΩ Nominal resistance
- -40 to +100 °C operating range

Integrated Data Acquisition & Signal Conditioning Rack - GA-GSQA-05



Integrated Signal Conditioning Unit

This unit is the computer behind the GSQA manual system and contains all the necessary I/O cards required to acquire and condition the necessary data for GSQA analysis. The rear panel provides connections for all analogue and digital channel inputs.

Includes

- 25kHz sampling rate
- 16 analogue channels
- USB output connectivity
- 32 CAN input connectivity

1x Power Regulation Card

- 10-36 V DC input range

1x USB and CAN Communication Card

- -15 to +50°C operating range

3x Transducer Amplifier Cards

- 5v at 40mA or 10v at 30mA power supply
- Two amplifiers per card individually configurable
  - Gain 1-5000 (x1, x10, x100, x1000) in 1, 2, 5 steps
  - < ± 0.01 % linearity
  - 0.01 %/°C stability
  - -25 to +50°C operating range

2x Operational Amplifiers

- 0 and 12v internal power supply
- Two amplifiers per card individually configurable
  - Gain (x1, x2, x5 Steps)
  - < ± 0.1 % linearity
  - 0 to +50°C operating range

1x Frequency to Voltage Card

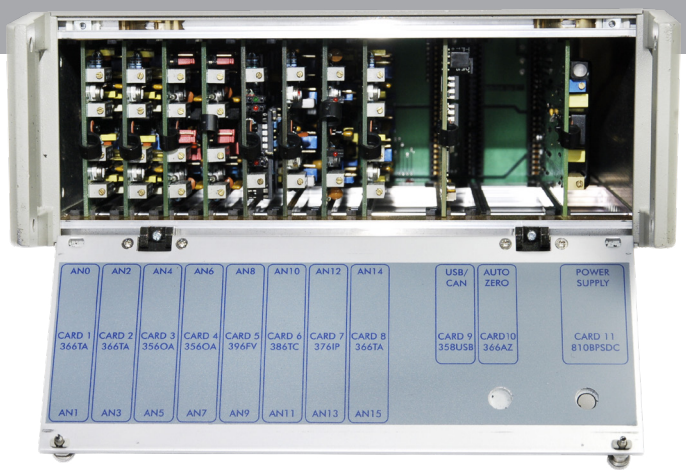
- Two amplifiers per card individually configurable
  - Min 0-50Hz, max 0-20kHz both with 0 to 10v output
  - 20 kΩ impedance typical
  - +12v at 50mA current limited power supply
  - < ± 0.1 % FS
  - -25 to +50°C operating range

1x Thermocouple Amplifier Card

- Two amplifiers per card individually configurable
  - K-type thermocouple input
  - ± 10v into 2 kΩ output
  - ± 1 °C, ± 0.5 % FS
  - -25 to +50°C operating range

1x ICP Module Card

- Two amplifiers per card individually configurable
  - 0.2Hz – 30kHz (-3dB) frequency range
  - ± 10v into 2 kΩ output
  - 0 to +50°C operating range



Static Clutch Module - GA-GSQA-07

The Static Clutch add-on module enables measurement of the clutch pedal characteristics (engine on, vehicle stationary).

Static Clutch Module

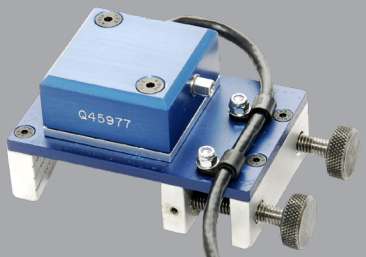
Includes

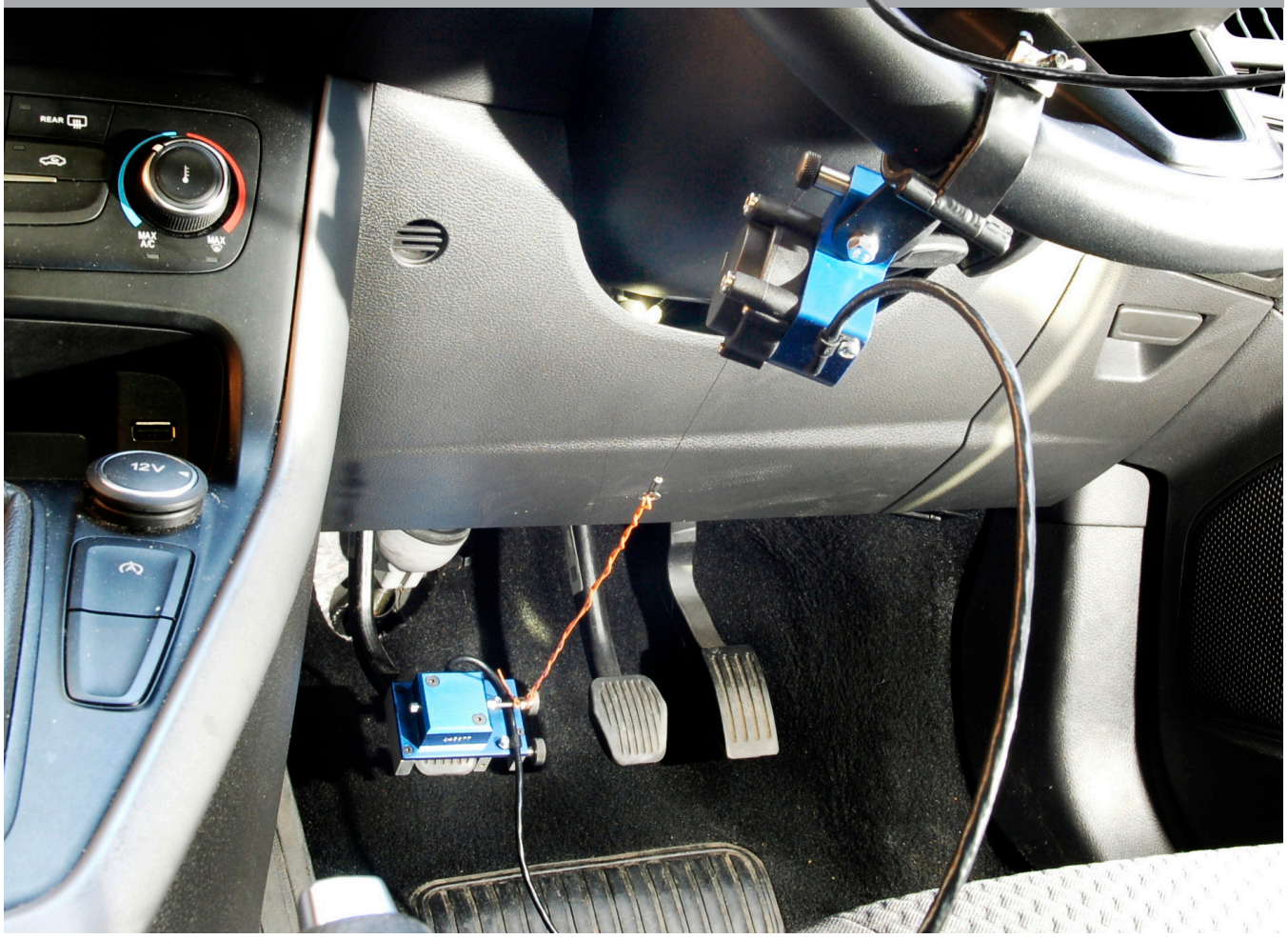
1x Travel Sensor

- 380mm stroke
- 2.5 $^{mV}/_{mm}$ nominal output (at 1 V DC)
- ± 0.5 % linearity FS
- -25 to +75 °C operating range

1x Pedal Force Sensor

- 500N measurement range
- 700 Ω bridge resistance
- 10 V DC max (5 V DC recommended)





Commercial Vehicle Modules - GA-GSQA-10/11

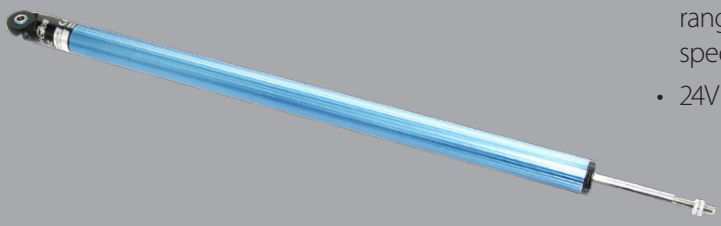
Light/Heavy Duty Commercial

The light & heavy duty commercial vehicle modules allow measurement of manual commercial/truck transmissions featuring double H-gates, superimposed H-gates with range/split switches and longer travel envelopes. A 24 volt supply is required for the heavy duty module.

Includes

Light Duty Commercial Vehicle Module (GA-GSQA-10)

- Additional and adjustable installation hardware to enable installation of the standard GSQA manual equipment in larger cabin vehicles
- Extended reach linear potentiometer for use with standard angular potentiometer assembly
  - 300 mm stroke (standard 252 mm)



Heavy Duty Commercial Vehicle Module (GA-GSQA-11)

In addition to light duty;

- Range/splitter switch which interacts with the vehicle systems
- Signal box for range/split switch, able to operate pneumatic actuators where fitted
- An electrical actuation system is also provided
- As not all trucks have the same method of switching range or split, customers will be required to supply specifications of the vehicles they wish to interact with
- 24V DC supply

Replacement Parts

SP-GSQA-01

Standard linear potentiometer as included in the travel sensor assembly.

Linear Travel Sensor

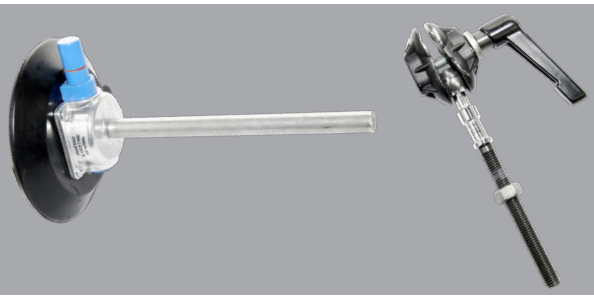
- 252mm stoke
- Virtually infinite resolution
- < ± 0.1 % linearity
- ± 0.01 mm repeatability
- -40 to +100 °C operating range

SP-GSQA-02

Suction cup as included in the standard GSQA Manual system.

Suction Cup

- 150 mm diameter suction surface
- 215 mm length support arm
- 1.9 kg weight
- Support mounting bracket available separately



SP-GSQA-03

Speed sensors for use with the GSQA Manual system.

Speed Sensors

- Pack of 3
- Available in 30mm, 60mm, 120mm
- 350 Ω resistance
- 90 mH nominal inductance
- -10 to +85 °C operating range

Laptop

SP-GSQA-04

Laptop suitable for GSQA measurement and analysis.

- Pre-installed with GSQA software and licences
- Recommended specifications
  - Windows 10
  - Intel Core i7
  - 8GB RAM
  - 500GB SSD storage
  - 15.6" FHD display

Touchscreen

SP-GSQA-05

Touchscreen interface for easy single user in-vehicle use with GSQA Manual system.

- 7" Touchscreen display
- Multiple AV inputs
- Built-in speaker
- Suction cup for windscreen mounting
- 0.7 kg weight

All individual components within the GSQA Manual system and additional modules can be supplied separately.

Please contact shiftquality.sales@ricardo.com for a customised quote for any faults, repairs, replacement or spare parts needed.

Software Licenses

Software

The standard GSQA Manual system includes 2x GDAS and 2x OGAS licences. Additional software licences may be purchased.

GSQA Manual

Software

S-GSQA-GDAS Gearshift Data Acquisition Software

- 1x user licence for the Ricardo gearshift data acquisition software (GDAS) v6.5 or higher

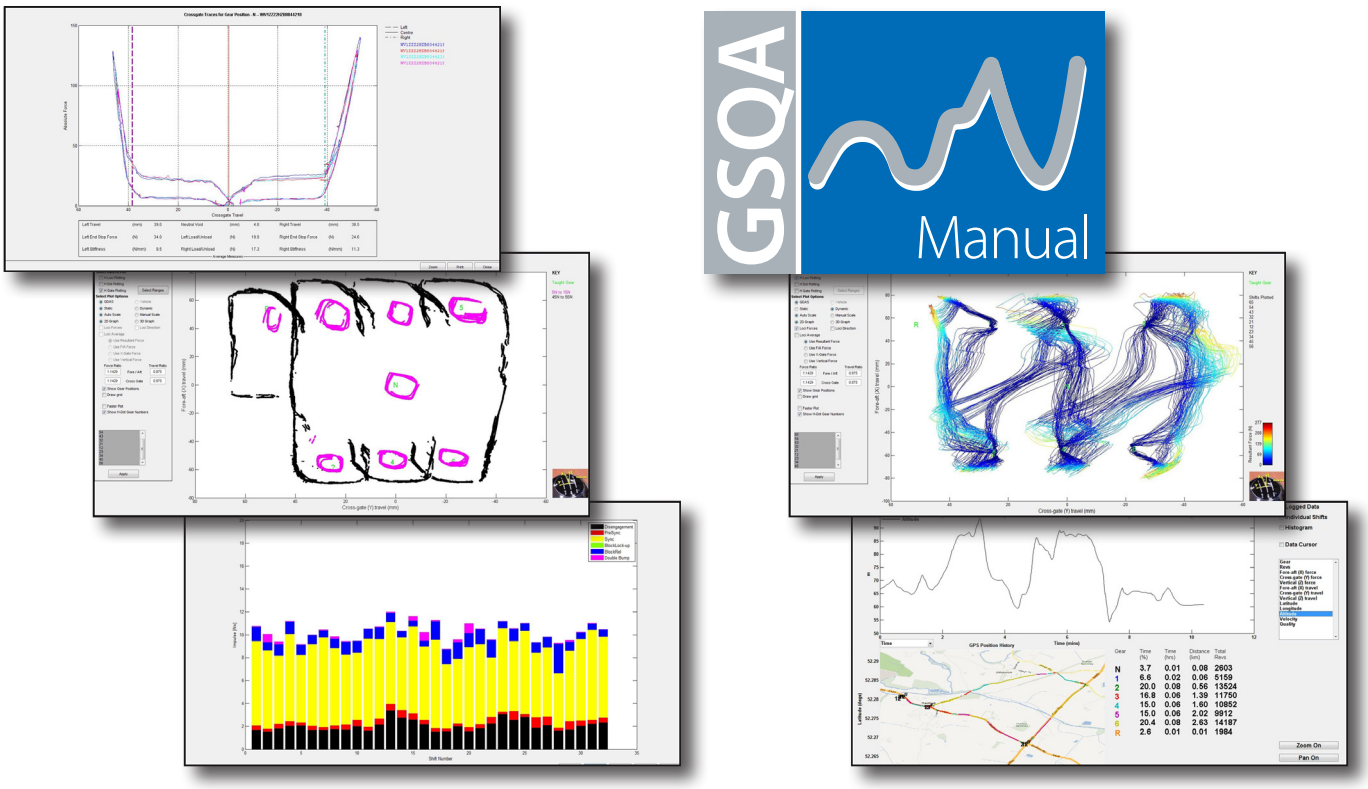
S-GSQA-OGAS Gearshift Data Acquisition Software

- 1x user licence for the Ricardo objective gearshift analysis software (OGAS) v6.5 or higher

Licences are supplied node locked to either a PC or a USB dongle, allowing them to be shared by a number of users.

The GSQA system software suite runs as an executable (.exe), not requiring any proprietary software.

The software suite can also run in the proprietary software MathWorks Matlab (not included), allowing the custom measures feature to be used.

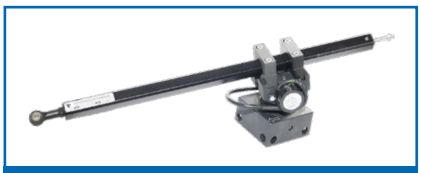


Gearknob Upgrade

UG-GSQA-01

Gearknob Force Transducer upgrade to new centred gimbal design. Replaces older offset arm pivot design.

- Fore/Aft (X) ±400N Crossgate (Y) ±200N Vertical (Z) ±100N
- 0.5 mV/V FS typical sensitivity
- ± 1 % linearity BSL
- 10 V DC max
- -34 to +50 °C operating range
- 0.06 % sensitivity change per °C
- 0.02 N zero shift per °C
- 350g weight

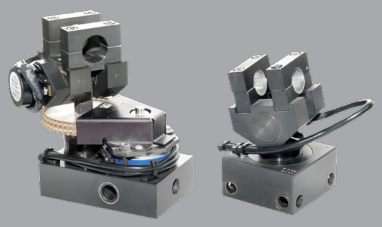


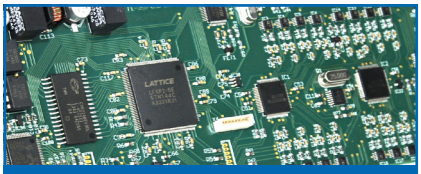
Angular Travel Sensor Upgrade

UG-GSQA-02

Travel Assembly upgrade of the 2-axis angular potentiometer to new compact belt-less design.

- Linear potentiometer not included; carried over from existing hardware
- Lateral (Yaw) < 0.12 Nmm torque Vertical (Pitch) < 0.03 Nmm torque
- Virtually infinite resolution
- ± 0.1 % linearity
- 5 kΩ nominal resistance
- -40 to +100 °C operating range



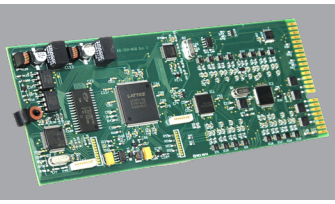


USB Interface Upgrade

UG-GSQA-03

USB/CAN interface card upgrade from FE358 to FE359 specification.

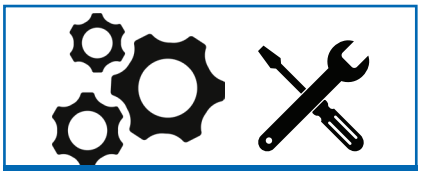
- USB drivers signed by Microsoft
- 2x 8-channel 16bit A to D converters
- 16x 25 kS/s sampling rate



Service and Support

Maintenance Support Contracts

Available in software only, hardware only, or as a combined package, for duration of 12 or 24 months.



Annual Maintenance Contract

AMC-GSQA-12COMB Combined Annual Maintenance Contract (Includes both SW and HW Contracts)

- Preferential rates for training
  - Offer preferential rates for refresher training courses in utilisation of data acquisition hardware or analysis software
- Email/telephone support is available to all GSQA customers during the period of the contract
  - Includes speaking directly to Ricardo GSQA engineers (including Development Programmers)

AMC-GSQA-12SW Software Annual Maintenance Contract

- Supply new general software releases to customer, free of charge
- Direct contact support to discuss any GSQA related topics, such as;
  - Instruction of using the software
  - Software problems and solutions
  - Data interpretation and explanation of test results
- Customise up to 2 objective measures to client specific requirements

AMC-GSQA-12HW Hardware Annual Maintenance Contract

- System calibration
  - Provide 1x standard GSQA system re-calibration and certification annually
  - Shipping costs of the GSQA system to and from Ricardo MTC (UK) are borne by the customer
  - Any defective or missing parts would be subject to a repair quotation
- Preferential rates for system repairs/components
  - Offer preferential rates for system repairs (following expiry of standard warranty period)

Calibration

Calibration of GSQA System. Full kit calibration included in hardware annual maintenance contract.

Calibration

- Calibration available for single, multiple channels or whole GSQA System
- Shipping costs of the GSQA System to and from Ricardo MTC (UK) are borne by the customer
- Calibration is recommended annually to ensure accuracy of GSQA System
- One full kit calibration is included within the hardware and combined annual maintenance contracts
- A calibration rig package is available for purchase to enable customers to calibrate their own GSQA System
  - Includes multi-function calibrator, calibration hardware and electrical connection hardware
  - Includes user manuals in English

GSQA Training

GSQA Training

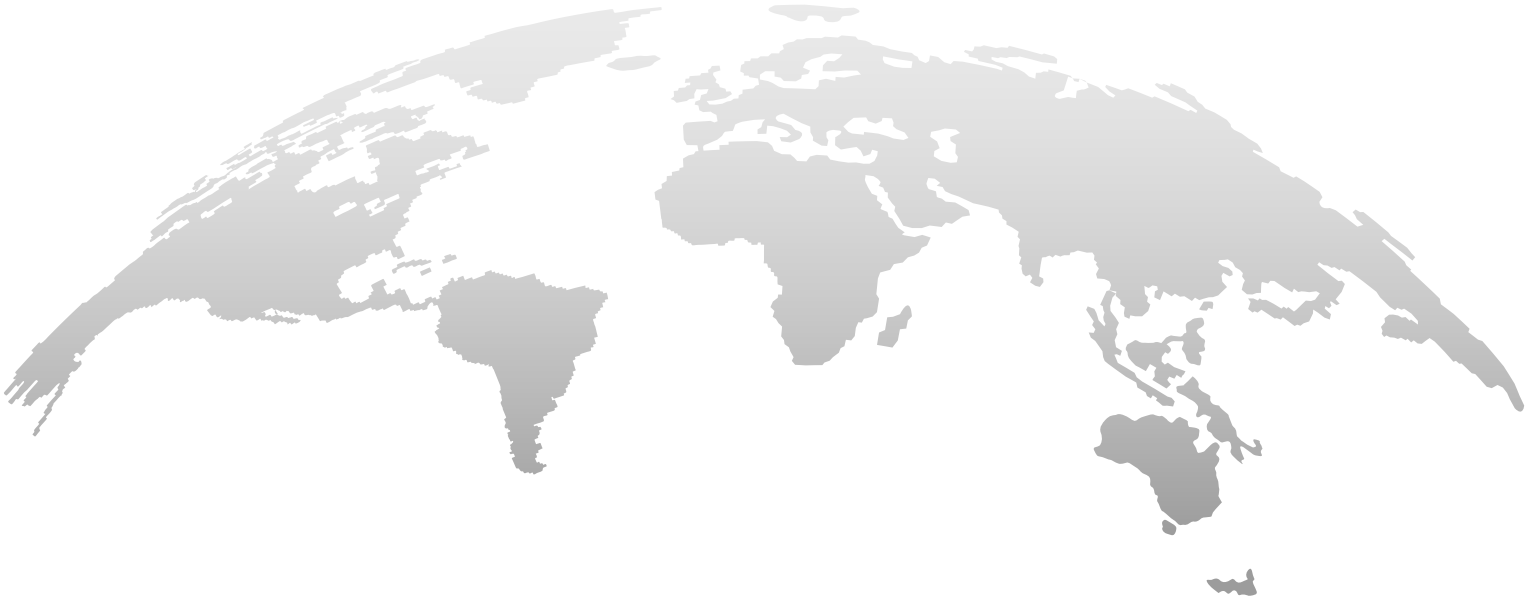
Training Courses in the use of the GSQA System, provided at Client site or at Ricardo MTC (UK).

T-GSQA-3D 3-Day Standard Training Course

- Provided in English
- Includes Standard GSQA training items and advanced techniques where time allows;
  - Introduction to and overview of the GSQA System (hardware and software)
  - Introduction to fundamental synchroniser performance during gear shifting
  - GSQA System installation and set-up
  - Use of the Gearshift Data Acquisition Software (GDAS)
  - GSQA data collection methods and techniques
  - Use of the Objective Gearshift Analysis Software (OGAS)
  - Gearshift data analysis methods and techniques
  - GSQA data management and archiving
  - Results printing
  - Import/export of gearshift quality data
  - GSQA Troubleshooting
- The training will be 'hands-on' in nature and will contain a mixture of classroom and in-vehicle training

T-GSQA-2D 2-Day Advanced Training Course

- Provided in English
- Includes advanced GSQA methods and techniques;
  - Usage of speed sensors
  - Usage of CAN signals
  - GPS duty cycle module
  - Subjective vs. objective data assessment
  - Creating custom measures
- The training will be 'hands-on' in nature and will contain a mixture of classroom and in-vehicle training
- This two day advanced course is designed for GSQA users who have either completed the three day standard course or are competent GSQA System users



For any specific questions relating to this document, or to discuss your business needs and requirements, please use the following global contacts:

GSQA Sales/Quotations

For existing and new GSQA customers

shiftquality.sales@ricardo.com

GSQA Software Support

For existing GSQA customers

shiftquality.support@ricardo.com

RICARDO

GSQA Manual

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Innovation & Technology