Environment

OPERATOR INTERFACE

- On / off key
- Keys for browsing through the menus
- "Escape", "Validate" and "Print" keys
- Alphanumeric keyboard
- LEDs for reading reports
- Accept – Mini – Maxi

CONNECTIONS

- Digital torque transducer
- PC connection
- Infrared link for PC connection
- Parallel printer
- Charge indicator lamp
- Battery charger
- Analog transducer
- Input / output

How to order

<table>
<thead>
<tr>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>DELTA4000 unit</td>
</tr>
</tbody>
</table>

ACCESSORIES INCLUDED

<table>
<thead>
<tr>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universal charger</td>
</tr>
<tr>
<td>Mains power cord (to be specified on order):</td>
</tr>
<tr>
<td>EUROPE (Except G.B.)</td>
</tr>
<tr>
<td>G.B.</td>
</tr>
<tr>
<td>U.S.A.</td>
</tr>
</tbody>
</table>

OPTIONAL ACCESSORIES

<table>
<thead>
<tr>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extra battery block</td>
</tr>
<tr>
<td>SDOPC software (please consult our department)</td>
</tr>
<tr>
<td>Analog torque cable, 2m long</td>
</tr>
<tr>
<td>Analog torque cable, 5m long</td>
</tr>
<tr>
<td>Spirally wound analog torque cable (stretched: 2m)</td>
</tr>
<tr>
<td>Unit/PC connection cable, RS232C type</td>
</tr>
<tr>
<td>Parallel printer cable</td>
</tr>
</tbody>
</table>
**Delta 4000**

**DESIGNED FOR YOUR CHECKING CAMPAIGNS**

**DELTA4000** is an easy-to-use versatile system which allows you to measure torque values proceeding from analog or digital transducers.

The parameters and features of all the transducers in the range are stored in DELTA4000 and are taken into account by simple selection of the transducer:

- Rotary transducers, CMD4000 type
- Static transducers, ST4000 type
- Handle wrenches, CD or CF type.

The transducers of EM type electric tightening tools (digital torque transducer) are AUTOMATICALLY recognised.

**CHECKING CAMPAIGNS**

- **Checking operation:**
  Sequence of checking operations throughout the assembly line to make sure that the tightening tools are still tightening to the specified torque. Each checking operation includes all the parameters required for its performance (type of transducer to be used – number of required readings – specified torque – tolerances – etc.).

- **Manual sequencing:**
  As the checks progress, the operator calls the checking operation corresponding to the station in front of him in the order chosen by him/her.

- **Automatic sequencing:**
  The selection of the various operations to be carried out is automatically in increasing order, which saves the operator the handling operations to select them.

- **Number of operations:**
  You can program up to 1,000 operations. Each operation can include 4 to 5,000 reading results according to the number of operations stored.

**APPLICATIONS**

- Calibration of torque wrenches
- Reading the torque applied by pneumatic oil pulse wrenches.
- Calibration of controlled electric nutrunners.

Its memory contains up to 5,000 results. **Lightweight and self-contained**, it can operate during 8 hours without second charge or change of batteries. An easily extractible extra battery block allows you to double this operating time. The data autosave allows you to perform this operation without loss of results.

As a simple versatile system, DELTA4000 offers the possibility of connecting all types of **printers** in parallel. Two types of **PC link**, infrared and serial RS232C are available.

Successive check of the torque applied by the tightening tools

Calibration of pneumatic screwdrivers
INTEGRATED STATISTICAL CALCULATIONS

- CAM, CP and CPK calculation and measurement of mean range on torque values in accordance with ISO and CNOMO standards.
- Data screening (date or value interval).
- Tolerance interval selection.
- "Population homogeneity" test.
- "Normal distribution" test.

The results of the measurements can be exported to other software programmes:
- Statistical calculation software in order to:
  - Store the results and perform statistical calculations in the same way as with the measuring unit.
  - Display histograms or control charts.
- Excel type software or any other database in order to:
  - Save and process the results.
  - Display the reading curve.

2 OPERATING MODES

Acquisition Mode:
In this mode, DELTA4000 allows the operator to acquire and store torque values:
- Either automatically, after each tightening operation.
- Or manually, by pressing the VAL key.
In manual mode, 2 types of reading are available:
- Peak: displays and stores the maximum torque read.
- Track: the values displayed follow the evolution of the torque in a continuous process.
Examples of application in track mode:
- Hand torque measuring wrenches (CF, CD).
- Reading the tension in a joint with a force meter.
- Calibration of assembling machines in “static mode”.
In this mode, the values are not stored.

Programming Mode:
With its intuitive ergonomic design, DELTA4000 can be programmed by using the 5 browsing keys and the multifunction alphanumeric keys of the keyboard.
It is supplied with a standard programming configuration which meets most common applications. However, several programming menus are available to help personalize the programming very easily. It can be re-configured in no time.
The unit is multilingual: French, English, German, Spanish ..., other languages on request.

FIELDS OF APPLICATION

Car industry
Aeronautics
TGV (high speed train)
Electronics
Features

POWER REQUIREMENTS

POWER SUPPLY
Extractable and rechargeable battery of 6 x 1.2 V (7.2V) NiMH elements inside or outside the unit.

BATTERY LIFE
8 hours – 1,000 Discharging / Recharging cycles– Programmable automatic stop.

BATTERY CONTROL
Weak battery indication – Power miser – Charge level test – Global data backup during battery change.

CHARGER
Multi-voltage 115/230 Volts with multi-standard mains power cord.

TORQUE

2 TRANSDUCER INPUT CONNECTIONS
Connection of strain gauge transducers, CMD / ST / CD / CF / TD type or others.

TRANSDUCER RANGE

<table>
<thead>
<tr>
<th>Transducer Range</th>
<th>4001</th>
<th>4005</th>
<th>4010</th>
<th>4050</th>
<th>4100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torque Resolution</td>
<td>1-15 Nm</td>
<td>10-70 Nm</td>
<td>10-150 Nm</td>
<td>100-700 Nm</td>
<td>100-1500 Nm</td>
</tr>
<tr>
<td>Absolute Maximum Uncertainty (unit alone)</td>
<td>± 0.006 Nm</td>
<td>± 0.06 Nm</td>
<td>± 0.6 Nm</td>
<td>± 6 Nm</td>
<td></td>
</tr>
</tbody>
</table>

RANGE CHANGEOVER
Automatic, according to the transducer selected.

SENSITIVITY
Automatic selection according to the transducer selected.

TRANSDUCER LOAD
Automatic selection according to the transducer selected.

SPECIAL MODE
Automatic reading in the case of fixed electric power tools.

UNITS
Nm – Ft.lb – In.lb – N – daN – kN

SETTING

JOINT
Selection of the type of joint and application: Hard - Standard - Soft - Breakaway

ZERO POINT ADJUSTMENT
Automatic zero correction and digital storage on each reset of the display.

DISPLAY RESET
Manual - External - Automatic (programmable).

OPERATING MODE
Acquisition mode.
Program mode.

COMMUNICATION

LEDs
Tightening reports: Torque OK - Mini torque – Maxi torque.

INPUT
Resetting the reading and storing the result (0 – 24V ; input impedance 560kΩ).
Resetting the reading without storing the result (0 – 24V ; input impedance 560kΩ).

OUTPUT
3 tightening reports: Accept – Mini – Maxi (External power supply 5 to 30V ; Max. current 100mA).
Torque reached for action on external device (External power supply 5 to 30V ; Max. current 100mA).
Analog torque output (0-10V ; max. load 10kΩ)

MEMORY
Up to 5,000 results (for 1 single operation programmed) including Torque, Date and Time.
1 curve that can be programmed and displayed on PC.
Up to 1,000 checking operations (4 results)

STATISTICS
ISO and CNOMO: CAM, CPK, Mean, Standard deviation ....

PRINTER
Connected to SubD 25 point parallel port with printing:
either in order of occurrence (reading after reading, automatically).
or in increments of N readings starting from a given date.

P.C. DOWNLOADING
Via serial link RS232 on SubD 9 points.
Via infrared link.

MISCELLANEOUS

WEIGHT
875 g

OVERALL SIZE
Depth 170 mm - Width 230 mm - Height 100 mm

TEMPERATURES
Storage : from -10°C to +60°C - Operation: from 0°C to +50°C
Features

**POWER REQUIREMENTS**

**POWER SUPPLY**
Extractible and rechargeable battery of 6 (1.2 V) NiMH elements (i.e. 7.2 V) inside or outside the unit.

**BATTERY LIFE**
8 hours – 1,000 Discharging / Recharging cycles – Automatic stop when not used during the selected time.

**BATTERY CONTROL**
Weak battery indication – Power miser – Charge level test – Global backup of context during battery change.

**CHARGER**
Multi-voltage 115/230 Volts with multi-standard mains power cord.

**TORQUE**

<table>
<thead>
<tr>
<th>2 TRANSUDER INPUT CONNECTIONS</th>
<th>4001</th>
<th>4005</th>
<th>4010</th>
<th>4050</th>
<th>4100</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRANSUDER RANGE</td>
<td>1-15 Nm</td>
<td>0.7-11 ft-lb</td>
<td>10-70 Nm</td>
<td>7.4-52 ft-lb</td>
<td>10-150 Nm</td>
</tr>
<tr>
<td>TORQUE RESOLUTION</td>
<td>± 0.006 Nm ± 0.004 ft-lb ± 0.01 Nm ± 0.007 ft-lb ± 0.01 Nm ± 0.007 ft-lb ± 0.1 Nm ± 0.07 ft-lb ± 0.1 Nm ± 0.07 ft-lb</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAXIMUM RESOLUTION (unit alone)</td>
<td>± 0.006 Nm ± 0.004 ft-lb ± 0.01 Nm ± 0.007 ft-lb ± 0.01 Nm ± 0.007 ft-lb ± 0.1 Nm ± 0.07 ft-lb ± 0.1 Nm ± 0.07 ft-lb</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**RANGE SWITCHING**
Automatic, according to the transducer selected.

**SENSITIVITY**
Automatic selection according to the transducer selected. Automatic reading in case of fixed electric power tools. 0.5 to 2.5 mV/V for any other transducer (load to be specified).

**TRANSUDER LOAD**
Automatic selection according to the transducer selected. Automatic reading in case of fixed electric power tools. Torque: from 1 to 10 000 Nm for any other transducer. Force: from 1 to 50 000 daN.

**UNITS**
Nm – Ft.lb – In.lb – N – daN - kN

**MEMORY**
Up to 1 000 results including Torque, Date and Time

**PRINTER**
Connected on SubD 25 point parallel port with printing:
- either in order of occurrence (reading after reading, automatically)
- or in increments of N readings starting from a given date

**PC DOWNLOADING**
Via serial link RS232 on SubD 9 points
Via infrared link

**WEIGHT**
875 g. / 1.93 lbs

**OVERALL DIMENSIONS**
Depth: 170 mm - Width: 230 mm – Height: 100 mm

**TEMPERATURES**
Storage: from –10°C to +70°C / 14°F to 140°F
Operation: from 0°C to +50°C / 32°F to 122°F
Environment

OPERATOR INTERFACE

On/off key
Browsing keys in the menus.
“Escape”, “Validation”, “Printer” keys.

Numeric keypad

CONNECTIONS

Digital torque transducer
PC connection

Infrared link for PC connection
Input/output
Parallel printer
Analog transducer
Charge indicator lamp
Battery charger

PART No
SIGMA2001 unit 615 935 037 0

ACCESSORIES INCLUDED
PART No
Universel charger 615 922 948 0
Multilanguages documentation 615 993 800 0

START-UP KIT
to be ordered with the controller
Including: Plug and cable

PLUG
PART No
A 615 917 201 0
C 615 917 202 0
D 615 917 205 0
B 615 917 203 0
E 615 917 204 0

PART No PART No
Optional accessories
Extra battery block 615 935 036 0
DELTA PC software* 615 927 520 0
Analog torque cable, 2 m long 615 917 251 0
Analog torque cable, 5 m long 615 917 252 0
Spirally wound analog torque cable (stretched: 2 m) 615 917 253 0
Unit/PC connection cable, type RS232C 615 917 047 0
Parallel printer cable 615 917 057 0

*available in 2001

Part No
Extra battery block 615 935 036 0
DELTA PC software* 615 927 520 0
Analog torque cable, 2 m long 615 917 251 0
Analog torque cable, 5 m long 615 917 252 0
Spirally wound analog torque cable (stretched: 2 m) 615 917 253 0
Unit/PC connection cable, type RS232C 615 917 047 0
Parallel printer cable 615 917 057 0

*available in 2001
SIGMA2001 is an easy-to-use system which allows you to measure torque values proceeding from analog or digital transducers.

The parameters and features of all the transducers of the range are stored in SIGMA2001 and are taken into account by simple selection of the transducer:

- Dynamic transducers of CMD4000 type
- Static transducers of ST4000 type
- Torque screwdrivers TD2001
- Hand wrenches of CD or CF type

The transducers of EM type electric tightening tools (digital torque transducer) are AUTOMATICALLY recognised. Its memory contains up to 1,000 results. Lightweight and self-contained, it can operate during 8 hours without second charge or change of batteries. An easily extractible extra battery block allows you to double this operating time.

A simple, although complete system, SIGMA2001 offers the possibility of connecting all types of printers in parallel. Two types of PC link, infrared and serial RS232C.

The associated “DELTA PC” PC software allows you to:

- Download, display and store the results recorded in the unit
- Transfer these data to an Excel type file or other data base
- Perform statistical calculations in accordance with ISO or CNOMO standards

APPLICATIONS

Calibration of pneumatic screwdrivers

Sampling check of the torque applied in a joint

Checking the torque on multi-spindle machine

Calibration of controlled electric screwdrivers

Calibration of torque wrenches
Sigma 2001

THE SIMPLEST OF ALL MEASURING UNITS

MEASURING SCREEN
Value of measured torque on 5 digits + decimal point.
Display of the mean and range of the last 5 measurements.
Selection of the operating mode: peak/track.
Selection of the reset mode: manual/automatic/external.

2 OPERATING MODES

Acquisition Mode:
In this mode, SIGMA2001 allows the operator to acquire and store torque values in:
• Automatic mode: after each tightening operation
• Manual mode: by pressing the “VAL” key.
In manual mode: 2 types of reading can be used:
• Peak: displays and stores the maximum torque read
• Track: the values displayed follow the evolution of the torque in a continuous process.
Examples of applications:
• Hand torque measuring wrenches (CF, CD).
• Reading the tension in a joint with a load transducer.
• Calibration of assembling machines in “static mode”
In this mode, the values are not stored.

Programming Mode:
With its proven ergonomic programming design, SIGMA2001 can be programmed by using the 5 browsing keys of the keyboard.
It is supplied with a standard programming configuration which meets most common applications. However, several programming menus are available and are quite easy to modify.
The unit is multilingual: French, English, German, Spanish, other languages on request.

FIELDS OF APPLICATION

Car industry  Aeronautics  TGV (high speed train)  Electronics
Torque wrenches and screwdrivers

SETTING OR CHECKING THE TORQUE APPLIED IN A JOINT

The CD – CF and TD type torque transducers are used to check and correct torque on already tightened joints by breakaway measurement on re-tightening.
They also allow you to perform the tightening operation itself while monitoring the progress of the torque value. The active component is a bending test bar to which the strain gauges are glued.
They can be connected to any measuring unit of the GEORGES RENAULT range by means of a plug located at the end of the arm or the cord.

TORSION STATIC TORQUE WRENCHES - CD Series

FLECTION STATIC TORQUE WRENCHES - CF Series (patented)

Essentially designed to be fitted with open end wrenches for any torque check on components such as brake or injection pipes, etc. where it is impossible to use socket type bits, these wrenches include flection test pieces. Due to their original design, measurement is independent both of the point of application of the force and hand position. To allow this, it is essential that the nut axis be at a fixed distance from the mechanical bit stop, a condition met by Facom "series 20" bits.

TD2001 TORQUE SCREWDRIVER

The screwdriver is fitted with a spirally wound cord (extended length 1.5 m) for connection to a torque measuring unit.
It is supplied in a case specially designed for screwdriver bits.
For any tightening accessory, refer to the “Tightening Accessories” catalogue.

Uncertainty for any type of transducer: ± (0.3 % of the measurement + Linearity)
Strain gauges

MONITOR WHILE SETTING THE TORQUE APPLIED IN A JOINT

These rotary transducers can be inserted between the nutrunner and the fastener, with or without our range of transducer-holders.
The test piece is rotated by means of two oil-proof bearings and a rotary collecting system / anti-bounce multipoint contact brushes for electrical connections.

CMD4000 - TORQUE Series (for torque monitoring, it can be used with any type of GEORGES RENAULT measuring unit)

CCMD5000 - TORQUE & ANGLE Series (can be used with the TORQUE & ANGLE measuring unit COSMOS5000)

These transducers allow you to measure two parameters:
- Torque measurement by means of strain gauges (left and right rotations).
- Angle measurement by means of an optical encoder (count up and count down).
They are indispensable to check and test precision or safety joints, for which tightening strategies using the rotation angle of the fastener are implemented.

Uncertainty for any type of transducer: ± (0.3% of the measurement + Linearity)

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>MODEL</th>
<th>TORQUE RANGE</th>
<th>SENSITIVITY</th>
<th>UNCERTAINTY</th>
<th>SQUARE DRIVE</th>
<th>DIMENSIONS (mm)</th>
<th>MAX SPEED</th>
<th>WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>615 165 131 0</td>
<td>CMD4001</td>
<td>1 - 15</td>
<td>1.475</td>
<td>10</td>
<td>0.02 ± 0.5</td>
<td>3/8 9.52</td>
<td>73 50.0</td>
<td>/ 2000 0.2</td>
</tr>
<tr>
<td>615 165 132 0</td>
<td>CMD4005</td>
<td>5 - 70</td>
<td>1.475</td>
<td>100</td>
<td>0.10 ± 0.5</td>
<td>3/8 9.52</td>
<td>73 50.0</td>
<td>/ 2000 0.2</td>
</tr>
<tr>
<td>615 165 133 0</td>
<td>CMD4010</td>
<td>10 - 150</td>
<td>1.475</td>
<td>100</td>
<td>0.20 ± 0.5</td>
<td>1/2 12.70</td>
<td>73 47.5</td>
<td>/ 2000 0.4</td>
</tr>
<tr>
<td>615 165 134 0</td>
<td>CMD4050</td>
<td>50 - 700</td>
<td>1.475</td>
<td>1000</td>
<td>1.00 ± 0.5</td>
<td>3/4 19.05</td>
<td>100 62.0</td>
<td>/ 1000 0.9</td>
</tr>
<tr>
<td>615 165 135 0</td>
<td>CMD4100</td>
<td>100 -1500</td>
<td>1.475</td>
<td>1000</td>
<td>2.00 ± 0.5</td>
<td>1 25.40</td>
<td>143 92.0</td>
<td>/ 1000 2.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>MODEL</th>
<th>TORQUE RANGE</th>
<th>SENSITIVITY</th>
<th>UNCERTAINTY</th>
<th>SQUARE DRIVE</th>
<th>DIMENSIONS (mm)</th>
<th>MAX SPEED</th>
<th>WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>615 165 136 0</td>
<td>CMD5001</td>
<td>1 - 15</td>
<td>1.475</td>
<td>10</td>
<td>0.02 ± 0.5</td>
<td>3/8 9.52</td>
<td>73 50.0</td>
<td>/ 2000 0.4</td>
</tr>
<tr>
<td>615 165 137 0</td>
<td>CMD5005</td>
<td>5 - 70</td>
<td>1.475</td>
<td>100</td>
<td>0.10 ± 0.5</td>
<td>3/8 9.52</td>
<td>73 50.0</td>
<td>/ 2000 0.4</td>
</tr>
<tr>
<td>615 165 138 0</td>
<td>CMD5010</td>
<td>10 - 150</td>
<td>1.475</td>
<td>100</td>
<td>0.20 ± 0.5</td>
<td>1/2 12.70</td>
<td>73 47.5</td>
<td>/ 2000 0.7</td>
</tr>
<tr>
<td>615 165 139 0</td>
<td>CMD5050</td>
<td>50 - 700</td>
<td>1.475</td>
<td>1000</td>
<td>1.00 ± 0.5</td>
<td>3/4 19.05</td>
<td>100 62.0</td>
<td>/ 1000 1.2</td>
</tr>
<tr>
<td>615 165 140 0</td>
<td>CMD5100</td>
<td>100 -1500</td>
<td>1.475</td>
<td>1000</td>
<td>2.00 ± 0.5</td>
<td>1 25.40</td>
<td>143 92.0</td>
<td>/ 1000 4.0</td>
</tr>
</tbody>
</table>
ST4000 series Static Transducers

These static transducers are intended to be secured to a mounting base which can resist the applied torques. They are designed for the tuning of nutrunners (measuring stall or shut-off torque) and torque wrenches (torque-limiting, mechanical or digital reading type) and can be used with any type of GEORGES RENAULT measuring unit.

A small joint simulator can be inserted between the transducer and the nutrunner which sets the nutrunner to rotate for a better measurement of the setting torque (see accessories below).

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>MODEL</th>
<th>TORQUE RANGE Nm</th>
<th>SENSITIVITY mV/V</th>
<th>LINEARITY UNCERTAINTY Nm</th>
<th>SQUARE DRIVE Inch</th>
<th>Dimensions (mm)</th>
<th>WEIGHT kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>615 165 141 0</td>
<td>ST4001</td>
<td>1 - 15</td>
<td>1.475</td>
<td>10</td>
<td>0.02</td>
<td>3/8</td>
<td>9.52</td>
</tr>
<tr>
<td>615 165 142 0</td>
<td>ST4005</td>
<td>5 - 70</td>
<td>1.475</td>
<td>100</td>
<td>0.10</td>
<td>3/8</td>
<td>9.52</td>
</tr>
<tr>
<td>615 165 143 0</td>
<td>ST4010</td>
<td>10 - 150</td>
<td>1.475</td>
<td>100</td>
<td>0.20</td>
<td>1/2</td>
<td>12.70</td>
</tr>
<tr>
<td>615 165 144 0</td>
<td>ST4050</td>
<td>50 - 700</td>
<td>1.475</td>
<td>1000</td>
<td>2.00</td>
<td>3/4</td>
<td>19.05</td>
</tr>
<tr>
<td>615 165 145 0</td>
<td>ST4100</td>
<td>100 - 1500</td>
<td>1.475</td>
<td>1000</td>
<td>2.00</td>
<td>1</td>
<td>25.40</td>
</tr>
</tbody>
</table>

Uncertainty for any type of transducer: ± (0.3% of the measurement + Linearity)

Cable types and measurement unit connectors are provided for connecting measuring units and transducers.

Tuning and checking unit to test measuring equipment

The tuning and checking unit can substitute a torque transducer and simulate several sensitivity values to check the correct tuning of torque measuring equipment. This check can be carried out only on the "torque transducer" analog input of the units.

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>MODEL</th>
<th>DIMENSIONS mm</th>
<th>SENSITIVITY mV/V</th>
<th>UNCERTAINTY % value</th>
</tr>
</thead>
<tbody>
<tr>
<td>615 936 007 0</td>
<td>BCE4005</td>
<td>122 x 78 x 56</td>
<td>0.5 - 0.7 - 1.475 - 1.75 - 2</td>
<td>± 0.07</td>
</tr>
</tbody>
</table>
All GEORGES RENAULT transducers are designed to operate – for tightening as well as untightening procedures – within a temperature range from –10° up to +60°C and are fitted with an automatic compensation system against temperature effects. The principle consists in producing an electrical signal, through the intermediary of a wire strain gauge bridge, which is proportional to the distortion of the transducer test piece.

NOTE: The range above the rated capacity must be avoided, as the transducers are likely to exceed their limit of elasticity.

A torque transducer is checked and calibrated according to two criteria:

**Linearity** which is checked against the least error squares line: all the points must be within a defined torque interval (see tables related to transducers) with respect to this line for the transducer to be accepted.

**The sensitivity** of the transducer which is measured from the least error squares line and is represented by the slope of the line above. The acceptance limit is ± 0.3% of the theoretical sensitivity.

**Transducer tuning bench**

Our torque balance for the tuning of torque transducers is located in an air-conditioned room. The magnitudes associated to the torque (length and weight) as well as the equipment necessary for measuring the electrical signal are strictly monitored and compared with national standards by the Bureau National de Métrologie (BNM) and the Laboratoire National d’Electricité (LNE). A tuning certificate showing the traceability of our equipment is issued with each transducer.

**CONNECTIONS**

**TORQUE TRANSDUCERS**

- **A**: + Power supply
- **B**: - Power supply
- **C**: + Measurement
- **D**: - Measurement
- **E**: Weight
- **F**: Automatic decimal point

The automatic switching of the decimal point is only used with the former generations of measuring units (such as CMC2001).

**TORQUE & ANGLE TRANSDUCERS**

- **A**: Clock
- **B**: Count up / count down
- **C**: + 5 Volts
- **D**: 0 Volt
- **E**: Not connected
- **F**: Not connected
- **G**: Weight
- **H**: Decimal point
- **J**: + Transducer power supply
- **K**: - Transducer power supply
- **L**: + Measurement
- **M**: - Measurement