CVIS II

Release 4.1

Operator's Manual

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SECTION 1 - SAFETY INSTRUCTIONS

1 - GENERAL INSTRUCTIONS



To reduce risk of injury, everyone using, installing, repairing, maintaining, changing accessories on, or working near this tool must read and understand the safety instructions before performing any such task. Failure to follow all instructions listed below, may result in electric shock, fire and/or serious personal injury.

SAVE THESE INSTRUCTIONS CAREFULLY

Our goal is to produce tools that help you work safely and efficiently. The most important safety device is the operator. Care and good judgement are the best protection against injury. All possible hazards cannot be covered here, but we have tried to highlight some of the important ones.

2 - WORK AREA HAZARDS

Keep your work area clean and well lit. Cluttered benches and dark areas invite accidents. Do not operate power tools in explosive atmospheres, such as in the presence of flammable liquids, gases, or dust. Power tools create sparks which may ignite the dust or fumes. Keep bystanders, children, and visitors away while operating power tool. Distractions can cause the operator to lose control.

3 - ELECTRICAL SAFETY



It is not possible to open the door of the controller when the controller is switched on. Only experienced and qualified personnel (authorised electricians) are entitled to open the CVIS door and access to the inside of the controller.
The tools and electrical equipment must be plugged into an outlet properly installed and grounded in accordance with all relevant codes and ordinances. Never remove the grounding prong or modify the plug in any way. Do not use any adaptor plugs. Check with a qualified electrician if you are in doubt as to whether the outlet is properly grounded. If the tools should electrically malfunction or break down, grounding provides a low resistance path to carry electricity away from user.
Never replace the fuses by fuses of higher value. Never replace fuses by a short-circuit. Avoid body contact with grounded surfaces such as pipes, radiators, ranges and refrigerators. There is an increased risk of electric shock if your body is grounded.
Do not expose power tools to rain and wet conditions. Water entering a power tool will increase the risk of electric shock.
Do not abuse the cable. Never use the cable to carry the tool or pull the plug from an outlet. Keep cable away from heat, oil, sharp edges or moving parts.
Replace damaged cables immediately. Damaged cables increase the risk of electric shock.
When operating a power tool outside, use an outdoor extension cord marked "W-A" or "W". These cables are rated for outdoor use and reduce the risk of electric shock.

4 - PERSONAL SAFETY

4.1 - General

The operator must stay alert, watch what he/she is doing and use common sense when operating a power tool. Do not use tool while tired or under the influence of drugs, alcohol, or medication. A moment of inattention while operating power tools may result in serious personal injury.
Dress properly. Do not wear loose clothing or jewelry. Contain long hair. Keep your hair, clothing, and gloves away from moving parts. Loose clothes, jewelry or long hair can be caught in moving parts.
Avoid accidental starting. Be sure switch is off before plugging in. Carrying tools with your finger on the switch or plugging in tools that have the switch on invites accidents. Remove adjusting keys or switches before turning the tool on. A wrench or a key that is left attached to a rotating part of the tool may result in personal injury. Do not overreach. Keep proper footing and balance all times. Proper footing and balance enables better control of the tool in unexpected situations.
Use safety equipment. Always wear impact-resistant eye and face protection. Serious injury can result from over-torqued or under-torqued fasteners, which can break, or loosen and separate. Released assemblies can become projectiles. Assemblies

requiring a specific torque must be checked using a torque meter.
Note: so called "click" torque wrenches do not check for potentially dangerous over-torqued conditions. Do not use hand sockets. Use only power or impact sockets in good condition.

4.2 - Earthing connection

Make sure that the controller is grounded via a protective conductor. The tool is connected to earth by means of a green/yellow conductor via the controller. This protects the operator from any electric shock. The earthing contact of the tool connectors is longer than all other connectors. Should the tool be connected or disconnected while voltage is applied, the "earthing" connection will take priority and protect the operator from any electric shock. It is recommended not to carry out this operation when voltage is applied.

4.3 - Differential circuit-breaker

4.3.1 - Internal device

The controller is fitted with a differential circuit-breaker for user protection. Any insulation defect in the cable or in the tool is detected by this device. The tool motor stops when a leakage current exceeding 150 mA in 50 µs is detected by the device and a warning message is displayed on the screen of the machine. The device protects the operator from any electric shock and protects the servodrive from the deterioration of the power stage. The device is reset as from the next start cycle order (if the short-circuit is no longer present). See test procedure in the "Maintenance" section.

4.3.2 - External device

The decision to install an external differential circuit-breaker depends on the type of internal electric network in the customer's plant. This device detects any insulation defect between one of the phases of the network and the earth, immediately stops the tool by automatic power cutoff and protects the operator from any electric shock.
Should circuit-breakers be installed at line head, we recommend that you select equipment with the following specifications:

Single-phased 230V	10 A - curve D
Single-phased 115V	20A - curve D

5 - TOOL USE HAZARDS

There is a real burning risk when in contact with the accessible parts of the tool. The selection of the tool and of the controller takes account of the operating conditions as stated by the user, who shall not exceed the operating limits as specified by the manufacturer at the time of the selection.
Any excessive internal temperature of the tool electric motor if higher than 100°C is detected by the controller and stops the tool. It can start again only if the temperature decreases to under 80°C.
Use clamps or other practical way to secure and support the workpiece to a stable platform. Holding the workpiece by hand or against your body is unstable and may lead to loss of control. Be ready to counteract normal or sudden movements, using both hands.

Do not force tool. Use the correct tool for your application. The correct tool will do the job better and safer at the rate for which it is designed.
Do not use tool if switch doesn't turn it on or off: any tool that cannot be controlled with the switch is dangerous and must be repaired.

Disconnect the plug from power source before making any adjustments, changing accessories or storing the tool. Such preventive safety measures reduce the risk of starting the tool accidentally.
Store idle tools out of reach of children and other untrained persons. Tools are dangerous in the hands of untrained persons.

Maintains tools with care. Keep cutting tools sharp and clean. Properly maintained tools, with sharp cutting edges are less likely to bind and are easier to control.
Check for misalignment or binding of moving parts, breakage of parts, and any other condition that may affect the tools operation. If damaged, have the tool serviced before using. Many accidents are caused by poorly maintained tools.

Use only accessories that are recommended by the manufacturer for your model. Accessories that may be suitable for one tool may become hazardous when used on another one.

Although our cables are designed to work under drastic conditions, we recommend that you check the following points for longer service life:

- Bending radii should not be lower than 10 times the cable diameter.

- Friction with the outer sheath should be restricted.
- Any direct pull on the cable should be avoided.

6 - TOOL CARE AND SERVICE

Tool service must be performed only by qualified repair personnel. Service or maintenance performed by unqualified personnel could result in a risk of injury.

Only experienced and qualified personnel (authorised electricians) are entitled to open and have access to the inside of the controller. To eliminate the risk of electric shock, the inside of the controller shall not be serviced until at least one minute has elapsed after switching off the controller. It is necessary to check that the capacitors are completely discharged. Since the temperature of the internal radiator can reach 75°C, it is important to check that this temperature cannot cause burns.

In order to eliminate the risk of electric shock and damage to components, the controller MUST be switched off prior to any tool change. The new tool is automatically recognised as soon as the rack is switched on.

When servicing a tool, use only identical replacement parts. Use of unauthorised parts or failure to follow Maintenance instructions may create a risk of electric shock injury.

SECTION 2 - DESCRIPTION AND OPERATION

1 - GENERAL

The CVIS II controller can control 1 portable ER type and/or fixed EM type electric power tool. It is supplied ready to operate. The default settings meet a large number of applications.

The CVIS II includes one station. In general, the station name is the name of the application.

1.1 - Tightening and untightening strategies

Tightening types: Torque, Torque+Angle, Angle+Torque, Prevailing Torque.
Untightening types: Torque, Torque+Angle, Angle+Torque.
Optional: current monitoring.

1.2 - Number of cycles and phases

The system allows you to perform **15 tightening cycles of 8 phases each**.
The cycles are numbered from 1 to 15.
- **4 quick cycles (rundown speed/final speed) are pre-programmed** in the controller. Torque and/or angle settings are to be updated before use.

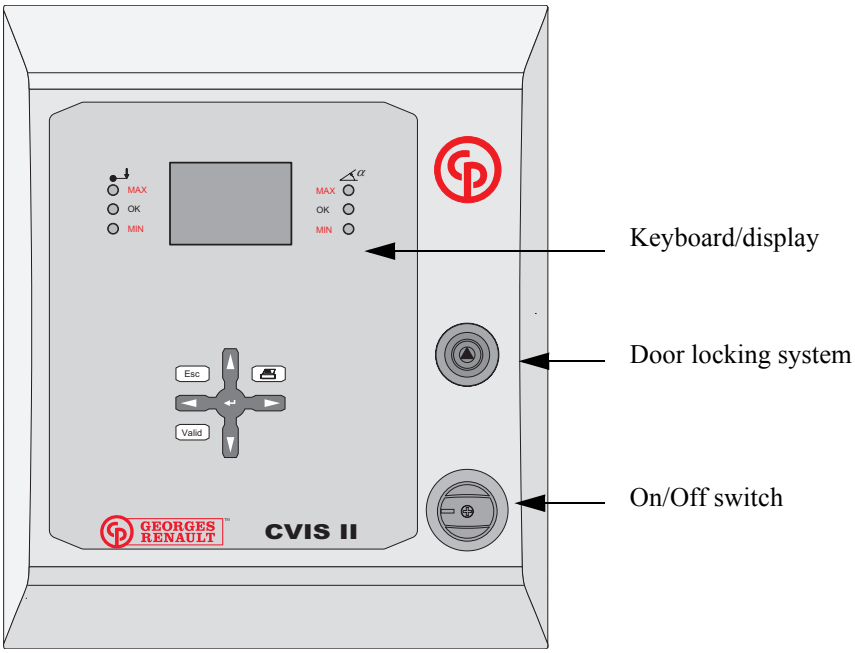
1.3 - Memory size:

Up to 3 000 tightening results according to the number of cycles.

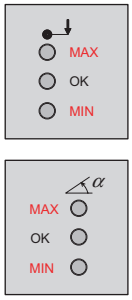
1.4 - Number of curves

2 curves are stored: the last "correct" curve and the last "reject" curve. The curves are not displayed on the controller screen, but they can be seen using the CVIPC 2000 software.

2 - OVERVIEW



2.1 - Report LEDs



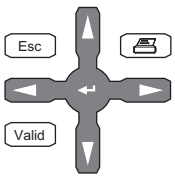
torque higher than programmed tolerances
correct torque
torque lower than programmed tolerances

angle higher than programmed tolerances
correct angle
angle lower than programmed tolerances

2.2 - Symbols used for screen display

*	star	used when an option is to be selected, to mean "all the values".
♦	diamond	option to be selected among several values.
⛔	no entry	unauthorised entry, tool not connected or in operation.
	cycle in progress	on the top left-hand side of the screen.
X	reject report	
OK	accept report	
·	decimal point	the decimal point format is "." ; since its position is not set, the operator must type it in, using the keyboard

2.3 - Navigation keys



to scroll through a list
to scroll through a data entry field.

to scroll through a menu
to scroll through a data entry screen

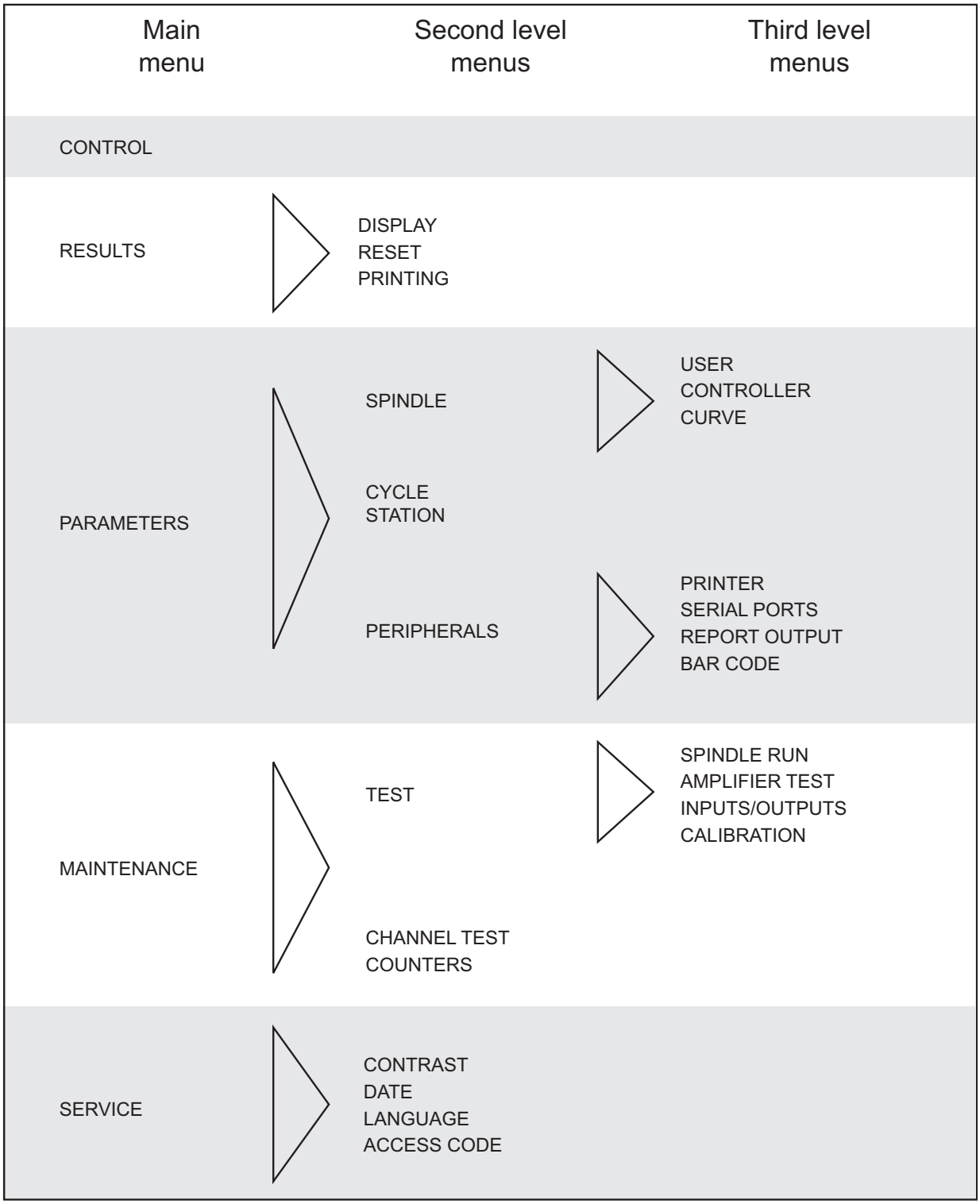
to validate a change
to display the next screen

End — to get back to the previous menu **WITHOUT** saving the parameters.

Valid — to get back to the previous menu **AFTER** saving the parameters.

to print tightening results in "order of occurrence".

2.4 - Menu block diagram



SECTION 3 - INITIAL START-UP

1 - ON RECEIVING THE CONTROLLER

Check that the following items are included in the kit supplied with the controller:
- the SubD 37 pt (input/output) connector
- the triangular wrench to open the controller
- the certificate of conformity and the safety instructions
- the CDROM

On delivery, a separate kit can be provided according to the country of destination. The kit includes the following items:
- the mains plug
- the Operator's Manual

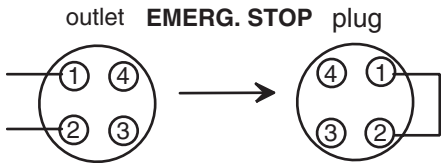
2 - INSTALLATION

2.1 - Mains connection

The controller can operate equally from 115 to 230V ± 10% / 50 to 60Hz without adjustment and without fuse change.

2.2 - Instant stop wiring

At the time of power up, check that the "INSTANT STOP" (EMERG. STOP) plug is connected correctly on the right-hand side of the controller. The instant stop can be connected either to the PLC, or to a push-button close to the tightening station. If it is not connected, check that the strap is correctly positioned in the plug (see opposite diagram). The opening of the Emergency Stop contact disables the power circuit .



Note that it is recommended to wire the "INSTANT STOP" when using portable tools but that this is absolutely mandatory for fixed tools.

2.3 - Power consumption

Although the peak power can reach 3 KVA per channel during the final speed phase, it is recommended to adjust the power circuits according to the maximum average power.
The average power consumption per channel depends on the type of tool which is connected, on the type of joint and on the tightening frequency. However, due to the heat dissipation of the servodrives, the maximum average power should not exceed 0.5 KVA per channel.

1 channel:	AvP	< 0.5 KVA
2 channels:	AvP	> 1 KVA

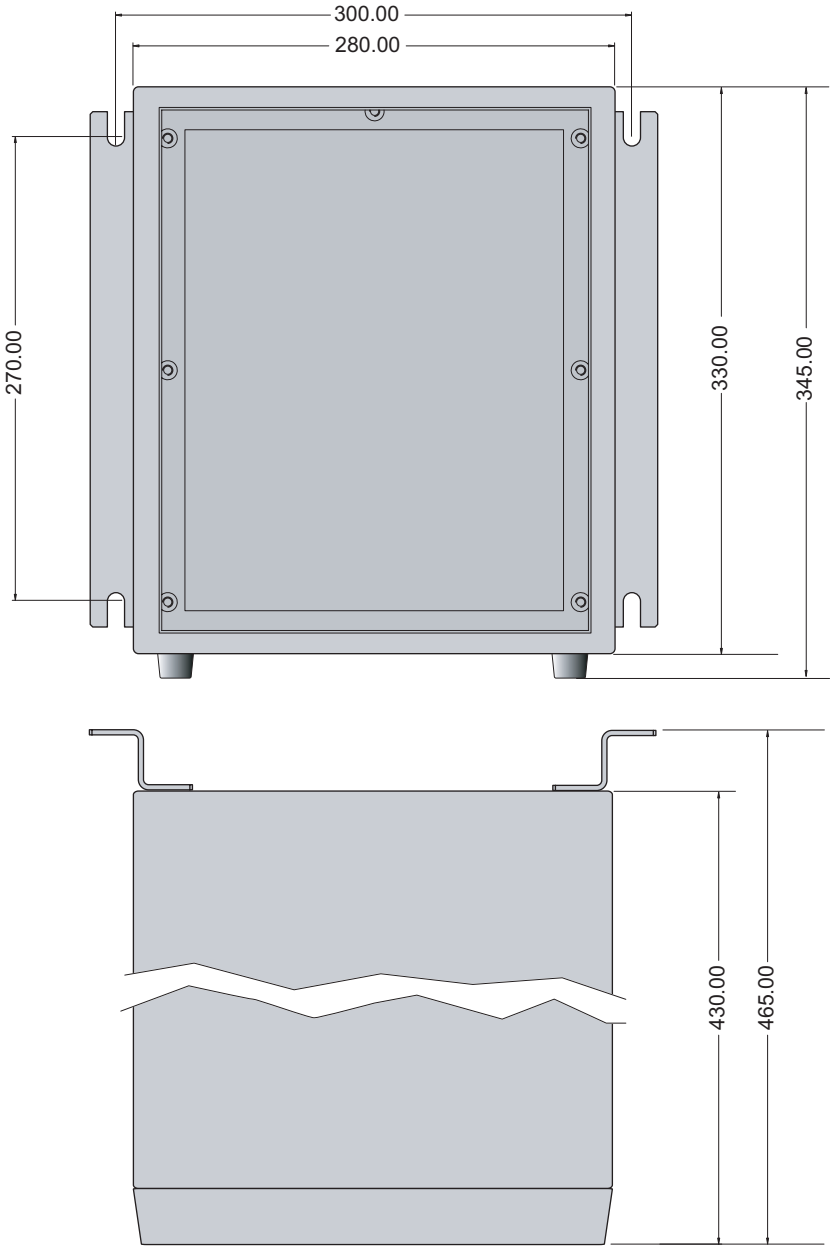
2.4 - Overall size, weight and fastening

When installing the controller, a minimum clearance of 5 cm shall be provided on the right-hand side for the cables.

	Weight
CVIS II	17 kg

Fastening screw type to be used: M6

The dimensions indicated are the upper limits.



2.5 - Temperature

The maximum temperature of use is 45°C.

3 - START-UP

- Connect the tool(s) cable(s) on the right-hand side of the controller.
- Rotate the switch on the front side (on the bottom right-hand corner) to switch on the controller.

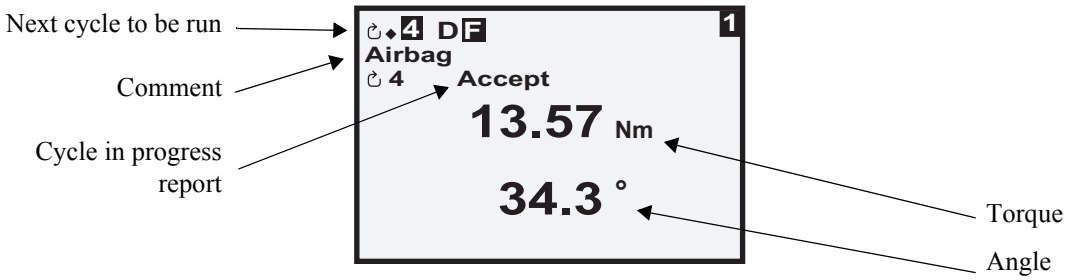
An initialisation message is shown and the front side LEDs glow for a few seconds.

The language option screen is displayed.
Use the ◄ and ► keys to select the language used by the controller and press Valid to validate.
Specify whether this screen should be displayed next time the controller is switched via "start-up selection: yes/no".
Press ↵ to validate.

When the controller is switched on, the correct operation of the servodrive, transducer and tool(s) is detected by the controller itself. If nothing is displayed on the screen, switch on the controller and press simultaneously any key. The "Contrast" screen is displayed and shows a percentage. Use the ► or ◄ keys to modify the display contrast and press Valid to validate.

3.1 - Control Screens

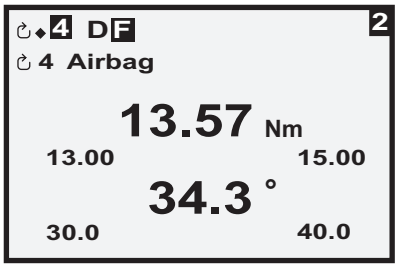
If everything is OK when switching on, the control screen of one of the cycles is displayed by the controller.
In "Control" mode, the results are saved in **real time.**
The **result** is displayed at the end of the cycle or at the end of the phase according to the programming.



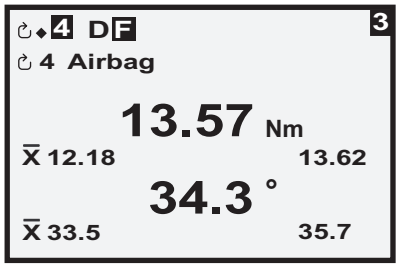
To shift to another cycle, press ◄ or ►

To shift to another screen, press ▼ or ▲

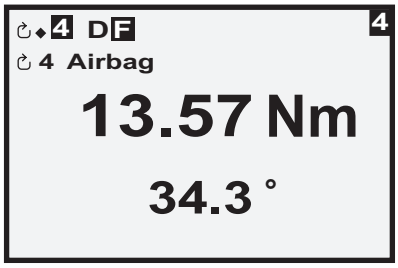
The following is displayed on screen no.002: minimum and maximum tolerances programmed in the cycle.



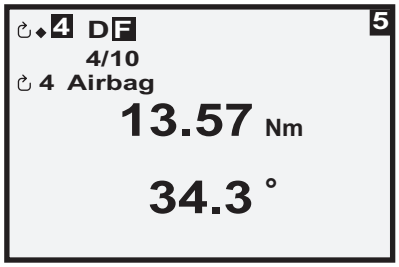
In addition, the following is displayed on screen no.003:
- the average value of the last 5 results of the cycle.
- the range of the last 5 results of the cycle.



The following is displayed on screen no.004: torque value in large type for an easy reading.



The following is displayed on screen no.005: number of OK cycles/programmed number of OK cycles.



To print the results at the end of each cycle, press the ⎙ key.

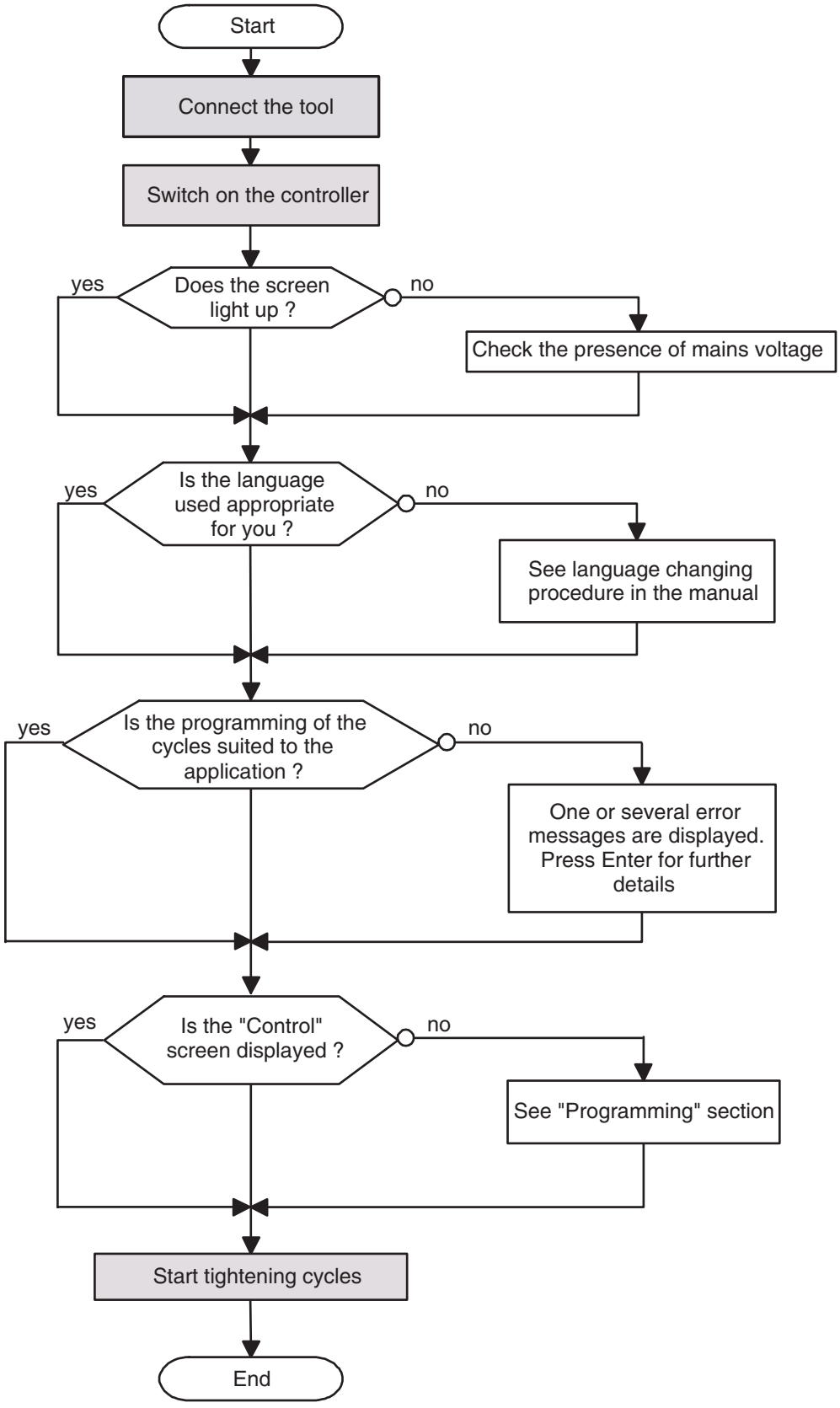
A screen which allows you to set up the printing is displayed:
valide/dévalide autorise ou non l'impression des résultas à la fin de chaque cycle
peripheral printer/computer. For the "computer" peripheral, the header and the footer are not printed.
format PC2/PC3/PC4/specific/PC5A/PC5B/PC5C
*type*all/reject/accept
Press ↵ to validate.

Press Valid or Esc to display the "Main" menu.

3.2 - Trouble-shooting help screen

If a problem occurs when the controller is switched on, the controller displays a trouble-shooting help screen according to the cause detected. Use the ▼ and ▲ keys to select the highlighted message and press ↵ to display a second message which will provide more details about the cause of the problem. For further information, refer to the Maintenance section.

3.3 - Initial start-up flowchart



3.4 - "Service" Menu

3.4.1 - Language selection

Use the ◄ and ► keys to select the language used by the controller and press Valid to validate.
Specify whether this screen should be displayed next time the controller is switched on via "start-up selection: yes/no".
Press ↵ to validate.

3.4.2 - Contrast adjustment.

The "Contrast" screen is displayed and shows a percentage.

Use the ► and ◄ keys to modify the display contrast and press ↵ to validate.

3.4.3 - Setting the date and time

You can choose among 3 formats: DD/MM/YY, MM/DD/YY, YY/MM/DD.
Press the ► or ◄ keys to select the date format. Press ↵ to validate.
The cursor blinks on the first digits of the date. Press ↵ to highlight the date.
Use the ▼ and ▲ to change the number and use the ► and keys to move through the field.
Press Valid to validate or Esc to exit the screen without saving changes.

3.4.4 - Access Code

With the access code, the user can protect the data (parameters, spindle, cycles, etc...) against any keying error. To enter an access code, enter the code (twice) using 8 characters as a maximum and press Valid to validate the code. In this way, the data will be protected and the padlock in the bottom left-hand corner of the screen will lock.
To enter new data, enter the code again. If the code is correct, the padlock will unlock. As a result, the data will no longer be protected. At any time, the existing code can be modified or suppressed.

A special code has been created for maintenance technicians. It takes precedence over the access code (or user code) and also allows you to modify the parameters stored in the tool memory. The superuser code is for GEORGES RENAULT technicians only.

SECTION 4 - PROGRAMMING

The programming of the controller is done via the "PARAMETERS" menu to:
- customise the station according to the application.
- display and modify the features of the spindle.
- program the tightening cycles.
- program the peripherals and miscellaneous.

Use the ▼ and ▲ keys to move the cursor and press ↵ to validate.

1 - STATION

From the main menu, move the cursor to "PARAMETERS", then to "STATION" and press ↵ to validate.
Use the ▼ and ▲ keys to move the cursor and use the ► and ◄ keys to modify, then press ↵ to validate.
The cursor is positioned on the name of the station.

Station name	10 alphanumeric characters as a maximum.	
Torque unit	Nm, Ft.Lb, In.Lb, kg.m, kg.cm	
Cycle source	• the keyboard (by default). • the "cycle no." inputs from a PLC, a socket tray, etc. • the PC connected to the controller. • a code read by a bar code reader. In this case, a "cycle no./code" cross reference table indicates the cycle number to be selected. The parameters in this table can be defined in the CVIPC software.	
Spindle validation	none (by default), I/O, PLC.	This function prohibits the start of the tool as long as the "Spindle validation" signal is not enabled via the I/O or the PLC: • In the Tightening direction only if the "Spindle validation on Run reverse" parameter is not selected. • In both directions, tightening and untightening, if the "Spindle validation on Run reverse" parameter is selected. • Selecting "none", which is the default value, prohibits this function.
Error acknowledgement	yes/no.	When this function is programmed on "yes" the start of the spindle is not validated after a reject report. The "error acknowledgement" input (contact no. 26 of the Input/Output connector) must be validated (for example with a push-button) to let the spindle start again.
Pulse start cycle	yes/no.	When this mode is enabled, the cycle is started on the pulse of the "start cycle" signal and is not maintained at "1" throughout the run. If "no" is selected, the signal remains enabled throughout the cycle. For safety reasons, this function is not available when using portable tools.
Run reject spindles	yes/no.	When this mode is enabled, the system only runs the spindles with a reject report from the previous cycle. A reset command must be sent to start all the spindles.
Lock on Ncycle OK	yes/no.	When this function is enabled, the controller will lock the cycle start as soon as the number of OK cycles run has reached the programmed "NCYCOK. A reset command must be sent to unlock the cycle start.
Spindle validation on run reverse	yes/no	This parameter is always combined with the "Spindle validation" parameter and allows the run reverse to be validated, or not, by the external monitoring system via the I/O or the PLC.
AZC on cycle start	yes/no	This mode allows you or not to run the tests at the cycle start. It is useful not to run the tests for spindles already subjected to stress when the cycle starts.

Reject report on start cycle release	yes/no	This mode prevents or not the reject report from being systematically printed when the SCY signal drops during the cycle.
Reject report on stop because of timeout	yes/no	This mode allows the reject report to be sent or not at the end of the maximum duration of the cycle
Test cycle	cycle number	This cycle is run as a self-test. It is programmed like a standard cycle.
Pulse RP	0 - 4 s ≠ 0: the accept or reject report is a variable pulse. 0: the accept or reject report is a maintained level.	
Current monitoring	yes/no	When this function is enabled, you can enter current tolerances in the cycle parameters.
Sensitivity coefficient	normal/per cycle	available for all cycles or individually per cycle.
230V / 120V:	230V by default	indicates mains voltage to the controller. This parameter is used in the "ergo-stop" function.
Submenu "INPUTS or OUTPUTS"		
The various input/output functions can be allocated to the physical Inputs (I1 to I8) and the Outputs (O1 to O8). See default or customised configuration insection: "Connections and Installation".		

Submenu "RUN REVERSE":

Run reverse speed	0 to 100%	This speed can be used for any untightening, operation (except for a cycle run reverse phase). **Warning:** when speed equals to 0, untightening is forbidden.
Minimum torque		Minimum torque allowing to detect a real untightening of the assemby
Minimum angle		Minimum angle allowing to detect a real untightening of the assembly
Maximum time		Maximum untightening duration (when it equals to 0, untightening is continuous)

Remark: real untightening of the screw is detected when torque ≥ minimum torque AND angle ≥ minimum angle (the angle being measured from the minimum torque).
When both programmed values equal to 0, there is no detection.

2 - SPINDLE

2.1 - "Spindle/User" menu

This menu allows you to display the features of the tool which is connected.
With its integrated memory, the tightening tool is automatically recognised by the system.



To change the tool, switch off the controller, replace the tool and switch on the controller.
The "tool change" message is displayed on the screen to inform the operator that the new tool has been recognised and taken into account.

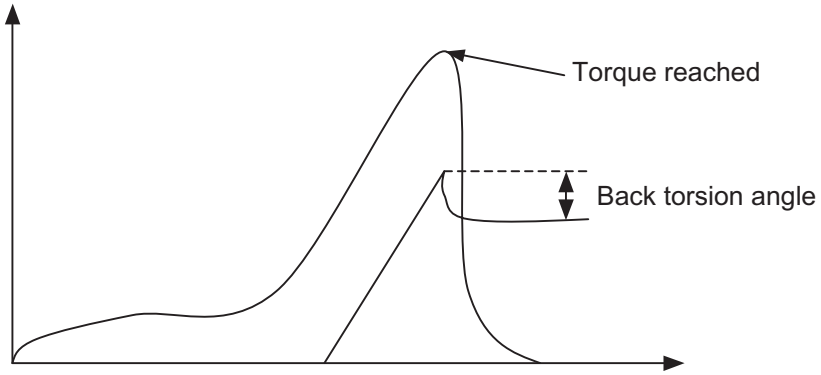
2.2 - "Spindle/Controller" menu

Some parameters can be changed:

Fastener number	3 alphanumeric characters as a maximum.	
Comment	15 alphanumerical characters as a maximum.	
ergo-stop	yes/no	When this functionality is enabled, the jerk felt by the operator at the end of the tightening operation is attenuated.
nominal load coeffi-cient	1.0 by default.	This coefficient allows you to take into account the efficiency of a reduction gear added to the tool. For example: 1.8 for a reduction of 2 with an efficiency of 90%.

reduction coefficient	1.0 by default.	This coefficient allows you to take into account an additional reducing gear. For example, when using a gear reduction of 2, the gear reduction coefficient will be 2.
torsion coefficient	0 to 1 °/Nm	This coefficient allows to compensate a possible mechanical torsion of an extension of spindle or of a crowfoot (which you can use only when tightening with target angle)

Remark: this coefficient can be measured on the curve registered on the machine from the back torsion angle and the torque reached.



Press Valid to validate the screen.

2.3 - "Spindle/Curve" menu

The "Spindle/Curve" menu is used to define the **parameters for memorising** the curves.
Measuring time 0.5 - 1 - 2 - 5 - 10 - 20 seconds.
Torque threshold 0 to max. spindle. A value equal to 0 allows you to memorise the last x seconds of the tightening before the motor stops. A value which is different from 0 allows you to memorise the last x seconds of the tightening **after** overstepping the triggering threshold.
Press Valid to validate the screen.

3 - CYCLE

A tightening cycle consists of a sequence of phases run consecutively.
Each phase is defined by main parameters, tightening instructions and motor settings.
The different phases available are as follows:

- **S** Search sequence
- **D** Run down speed
- **F** Final speed
- **V** Action on NOK
- **R** Run reverse
- **P** Prevailing torque monitoring
- **J** Phase jump

To improve easiness of use, 5 cycles have been "pre-programmed". The first 3 cycles include the "Rundown speed" and "Tightening" phases which are the most commonly used phases. The fourth cycle includes only the "run reverse" phase and the fifth includes only the "Prevailing Torque monitoring" phase.

In the main menu, cursor to "PARAMETERS" then to "CYCLE" using the ▼ and ▲ keys and press ↵ to validate. The list of the cycles is displayed.

Select the cycle using the ▼ and ▲ keys and press ↵ to validate.
Comment allows you to customise the cycle (14 characters as a maximum).
Number of cycles OK 1 - 999. This function activates the output no. 5 of the Input/Output receptacle when the number of cycles run with an accept report is equal to the programmed number of cycles. For example: if the number of OK cycles = 3, it is necessary to run 3 "OK" cycles to have the output signal shift to "1".
The list of phases making up the cycle is displayed on the third line.

Press ↵ to update the phase programming.

To **shift to another phase**, press the ▼ key and press ↵ to validate, then select the new phase using the ► and ◄ keys and press ↵ to validate.

To **insert a phase**, selected from the list of phases, press the ▼ key then press the ► key. Insert the number of phases by pressing the ↵ key as many times as necessary. Press the ▲ key. The cursor blinks. Press ▼ to highlight the new phase then press the ◄ key to shift to another phase. From then on, follow the phase shift procedure.

To **delete a phase**, press the ▼ key to highlight the phase, select the delete function using the ► key and press the ↵ key to delete the phase.

When a cycle has been updated, the "Parameters updated/save/ignore" screen.

Select your choice using the ► and ◄ keys and press ↵ to validate.

3.1 - Motor Settings and Other Parameters

Bandwidth 2/4/8/16/32/64/128/256/512/1024 Hz.
Thread type right/left.
Rotational speed 0 - 100 % (0% to secure the motor in position). Up to 130% in some cases for the run down speed.
Acceleration rate 0.1 - 40.00 s. The transition between the speeds of 2 consecutive phases can be adjusted as follows (if the interphase time is o s).
"acceleration rate" < 0.02 s: transition as quick as possible, with braking. To be used on hard tightening.
"acceleration rate" ≥ 0.02 s: more flexible transition. To be used on standard or soft tightening. 0.04 s as a minimum is recommended.
Power 0 - 100 %.
Torque reset yes/no.
Angle reset yes/no.
The reset function set to "yes" allows you to reset the torque and/or angle values at the beginning of the current phase. These are only digital values (standard display and memory); there is no compensation at the transducer.
External stop yes/no. To have the system stop the current phase and shift to the next one, the following conditions must be met:
- the "external stop" parameter must be on "yes" in this screen.
- the signal on the "external stop" input of the input/output connector must shift to "1".

3.2 - Search sequence phase

Stop time 0 - 99 s. Phase running time: simply displayed for the Search sequence phase as the timeout is implicitely equal to the number of rotations multiplied by the rotation time + stop time.
Number of rotations 1 - 99.
Stop time 0,01 - 20 s.
Rotation type time/angle.
Rotation time 0 - 20 s
or R*otation angle* 0 - 9999.5°.
Direction right/left/alternate. If the direction is alternate, half the rotations are clockwise and the other half are in the opposite direction.
Rotational speed 0 - 130%
Acceleration rate 0.01 - 40.00 s.
Power 1 - 100 %.

3.3 - RunDown speed phase

Timeout 0 - 99 s. Phase running time.
Stop time 0.01 - 20 s.
Target torque 0 to max. value of the spindle (screw approach torque).
Angle threshold 0 to max. value of the spindle.
Other press ↵ to display the "Motor settings and other parameters" menu.

The tightening results of the Run Down speed phase are not saved.

3.4 - Final speed phase

Timeout 0 - 99 s. Phase running time.
Stop time 0.01 - 20 s.
The other instructions depend on the tightening strategy (see table below).

Instructions	Tightening strategies: Torque	Torque + angle	Angle + torque
Min, max torque			
Target torque			
Safety torque			
Angle threshold			
Min, max angle			
Target angle			
Safety angle			

Torque 0 to max. value of the spindle.
Angle threshold 0 to max. value of the spindle.
Angle 0 - 9999.5°.
Other press ↵ to display the "Motor settings and other parameters" menu.

Optional: current monitoring.
The minimum and maximum electric current values are programmed experimentally: the max. current value must be read during the test cycle, then the cycle must be run at least 3 times to define the electric current values to be programmed.

3.5 - Action on NOK phase

When a report is rejected (max. torque or angle reached, etc.), it is possible to apply a specific corrective action to the cycle, either by stopping the cycle or by programming a corrective phase.
Examples: untighten the screw or the 2 screws, restart tightening, etc.
End end of cycle.
Rrv+end run reverse+ end of cycle.
Jump jump to phase "x".
Rrv+jump Run reverse + jump to phase "x".
Jump OK jump to phase "x", if preceding phase has an accept report
Rrv+jump OK run reverse + jump to phase "x", if preceding phase has an accept report.
Run reverse time 0 - 99 s.
Thread type right/left.
Rotational speed 0 - 100 % (0% to secure the motor in position). Up to 130% in some cases for the run down speed.

3.6 - Run reverse phase

Timeout 0 - 99 s. Phase running time.
Int. time 0.01 - 20 s.

The other instructions depend on the untightening strategy (see table below).

Instructions	Untightening strategies		
	Torque	Torque + angle	Angle + torque
Min, max torque	■	■	■
Target torque	■	■	
Breakaway torque	■	■	
Safety torque	■	■	■
Min, max angle		■	■
Target angle			■
Angle threshold		■	■
Bandwidth	■	■	■

Torque 0 to max. value of the spindle.
Angle threshold 0 to max. value of the spindle.
Angle 0 - 9999.5°.
Other press ↵ to display the "Motor settings and other parameters" menu.

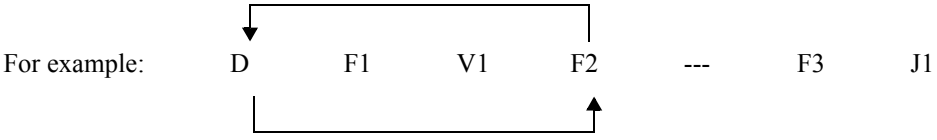
3.7 - Prevailing torque phase

This phase allows you to check the residual torque (prevailing torque) of a mechanical assembly.
Examples of mechanical assemblies: gearbox, crankshaft, etc. The initial timeout (expressed in time or angle units) allows you to eliminate the "jerk" when starting the motor and the mechanism.
Timeout 0 - 99 s. Phase running time.
Stop time 0.01 - 20 s.

Target angle 0 - 9999.5 degrees.
Min., max. torque 0 - max. value of the spindle.
Safety torque 0 - max. value of the spindle.
Start type time or angle.
Time or angle 0 - 20 s or 0 - 9999.5 degrees.
Offset reset yes/no. Allows you to reset the offset value previously detected on starting the phase.
Prevailing offset ignore/add to the measurement/subtract from the measurement. The average value of the prevailing torque is used as an offset, to be added to or subtracted from the reading in the following phases.
Constant shift 0-9999. When this value is 0, the average value of the prevailing torque is used as an offset, to be added to or subtracted from the reading in the following phases. When it is different from 0, this value is subtracted from the prevailing torque value.
Refer to Motor Settings and Other Parameters
For further information, refer to Appendix - Tightening strategies.

3.8 - Jump phase

This phase allows you to design more sophisticated cycles.

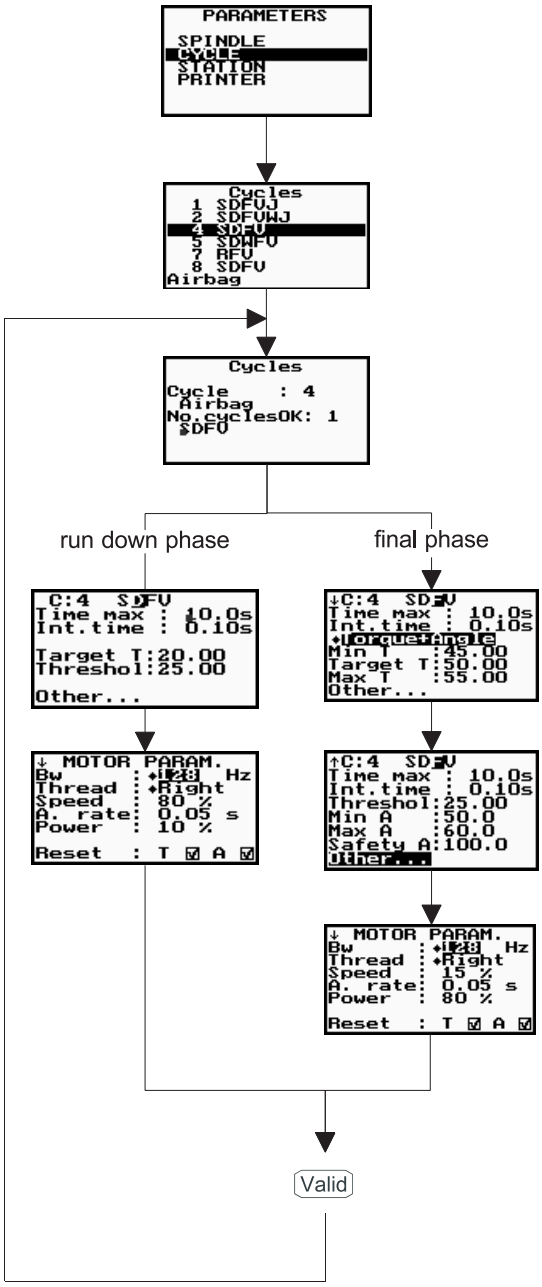


D run down speed
F1 final speed.
V1 action on NOK:- if NOK, jump to phase 6 (F3).
- otherwise, run phase F2 then stop the cycle.
--- empty phase: stops the cycle.
F3 SCY phase in case of NOK on phase 4.
J1 jump to phase 4 (F2) to finish.

3.9 - "Empty" phase

An "empty" phase" is a phase which has not been programmed.
The tightening cycle is run from the first programmed phase until the first "empty" phase is reached. If any other phases are programmed after an "empty" phase, they can only be run if a conditional jump is executed from the main program to one of these phases (refer to "jump" and "action on NOK" phases).

3.10 - Changing the Programming of a Cycle (flowchart)



Validate ↵

Select cycle number ▼ ▲

Validate ↵

If the correction coefficients are programmed "per cycle", press ◄ to display them.

Validate ↵

Symbols used on the keyboard:

To shift from one line to another: ▼ ▲

To shift the blinking cursor: ► ◄

To change a parameter, highlight it: ↵

To change a character or parameter: ▼ ▲

Press ↵ to validate

Important: the Valid key validates all the changes

4 - PERIPHERALS

4.1 - Printer

type EPSON by default/EPSON LQ/IBM/IBM pro/HP DeskJet/HP LaserJet/HP 840
page length 6 - 80
upper margin 0 - 74
page width 1 - 80
left margin 0 - 79
Press Valid to save the parameters.

4.2 - Serial Port

The serial link is used in 3 functions: PC downloading, report output, bar code.

The parameters are as follows:
RS232 default standard type used for a point-to-point connection (1 PC and 1 controller).
RS422 inter. only used in a network configuration (intermediary CVIS II).
RS422 end of line only used in a network configuration (end of line CVIS II).
Speed 300/600/1200/2400/4800/9600/19200 bauds,
Data bits 8/7
Stop bit 1/2
Parity even/odd/none

In a network configuration, the PC is connected to several controllers at the same time. Each controller bears a slave number.
Slave no 0

For further information about the network connection, refer to the "CVIPC 2000" Operator's Manual.
Press Valid to save the parameters.

4.3 - - Report output

format PC2/PC3/PC4/Specific/PC5A/PC5B/PC5C.
on request/at end of cycle the tightening results are transmitted on the serial link either on request, or at each end of cycle..
The word "Unused" displayed at the bottom of the screen means that the function is idle.
Press Valid to save the parameters.

4.4 - Bar code

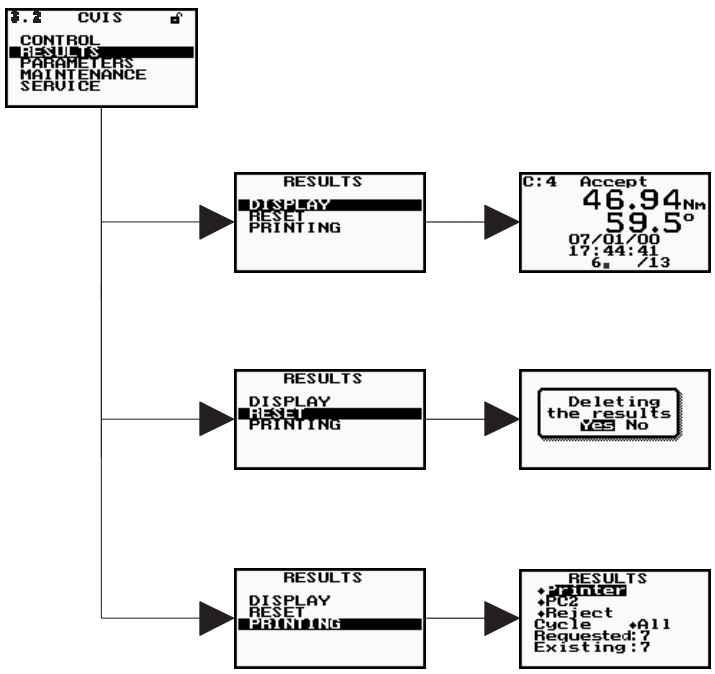
The code read by a bar code reader can be used to start a tightening cycle (See the "Station/Parameters" menu).
The code will be saved with the tightening result and displayed on the control screen.
As the bar code is read by the controller, it can perform one of the following actions:
No action No action.
Reset reading the code trips an action which is identical to a reset.
Reset on NCYCOK reading the code leads to a Reset when the programmed number of cycles OK is reached.
The word "Unused" displayed at the bottom of the screen means that the function is idle.
Press Valid to save the parameters.

5 - PRINTING THE PARAMETERS

You can print the parameters of the "Station", "Spindle", "Cycle" and "Peripherals" menus at any time by pressing the key

SECTION 5 - RESULTS

The "Results" Menu allows you to display, delete, or configure the printing parameters of the tightening results.



Use the ▼ / ▲ keys to display the various results or enter the number you wish to display.

Use the ► / ◄ keys to select and ↵ to validate

Select the results you want to print, their format and destination.

1 - DISPLAY

This screen allows you to display the tightening results which have been stored, with the date and time they were stored.
Using the ▼ / ▲ keys, scroll through the tightening results.
You can also **select** a measurement no. to be displayed: move the cursor with the ▼ / ▲ keys, highlight a number and press ↵ to validate.

2 - Reset

This code allows you to suppress the data
To delete the results of a station, press ► / ◄, enter yes or no to confirm and press ↵ to validate.

3 - PRINTING

A screen allows you to set the printing parameters:

Peripheral	printer/computer. For the "computer" peripheral, the header and the footer are not printed.
Format	PC2/PC3/PC4/specific/PC5A/PC5B/PC5C
Type	all/reject/accept
Cycle	all/per cycle number
Requested	number of results you wish to print
Existing	number of existing results according to the type (all/reject/accept)

Press Valid to start printing,

RESULTS

SECTION 6 - MAINTENANCE

1 - "MAINTENANCE" MENU

1.1 - "TEST" Menu

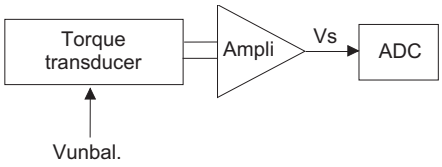
The "Test" menu is used for the following:
- check the smooth operation of the tool at free speed ("Spindle run" menu).
- test the torque measurement ("Amplifier test" menu)
- display and test the inputs/outputs ("Inputs/Outputs" menu).
- check and/or correct the calibration of the torque measuring system.

1.1.1 - "Spindle Run" Menu

This menu allows you to check that the tool operates correctly at free speed.
Select the speed and rotational direction, then press the trigger for an ER type tool or validate the "on" signal for an EM type tool.
To reset the values, highlight "RESET" at the bottom of the screen with the ↓ key and press ↵ to validate.

1.1.2 - "Amplifier Test" Menu

This menu allows you to check the calibration of the torque measuring system.
The torque measuring system can be represented by the opposite diagram:



Zero compensation:
The purpose is to correct the zero drift of a torque transducer. The torque transducer being stress-free, the transducer zero is measured and this value will be subtracted from the next torque measurement. If the compensation voltage exceeds 400 mV, there is a "compensation error" and the cycle cannot start. The spindle must be changed. This test is performed at each cycle start or at each Reset command.
When this screen is displayed, a compensation measurement is taken (measured value) and compared with the former value. Validate to save this reading as a new reference value.
Note: the torque transducers of the GEORGES RENAULT range can have a zero value of approximately 50µV/V, which corresponds to an output voltage of 100 mV for the amplifier (with a supply voltage of 10 V and an amplifier gain of 200).

Torque Unbalance Test:
The purpose of this test is to monitor the drift of the torque transducer and amplifier line gain versus time. It is automatically started when displaying this menu or at each cycle start or each Reset request. A reference unbalance is sent to the torque transducer. The measurement is compared with the last saved measurement (reference value) and displayed on the "measured value" line.
A deviation lower than ± 0.5% is the sign of a correct setting. If the setting is not correct, the cycle start is not validated and the sensitivity will have to be corrected again before getting back to this screen to save the new reference value.

1.1.3 - "Inputs/Outputs" Menu

This menu is used to test the inputs/outputs of the station.
You can display the status of the 8 inputs.
You can check the status of the 8 outputs set to 0 or 1.
Use the →, ← and ↵ keys to activate or deactivate the outputs.
Note: The allocation of the input/output functions to the physical Inputs/Outputs can be programmed in the "Parameters/Station" menu. Refer to the default or customised configuration in the "Connections and installation" section.

1.1.4 - "Calibration" Menu

This menu is used to calibrate the sensitivity correction coefficient(s).
Select the cycle number to be run, then start the tool.
At the end of the cycle, the torque result is displayed. Then enter the "reference" torque (read with an on-line transducer and a measuring instrument) on the "Refer" line; the coefficient is computed automatically and displayed on the second line.
You can run as many as five consecutive cycles: then the mean of the coefficients is computed.

Press Valid to save this new correction coefficient.
Note: if this is programmed in the "Station/Parameters", the coefficients are different according to the selected cycle.

1.2 - "Channel Test" Menu

This menu is used to test the global operation of the controller and tool.
There is a sequence of three tests:
- tool --> reading the information contained in the tool memory.
- transducer --> measuring the AZC and unbalance.
- board --> servo board check.

If an error arises, a message is displayed. Press ↵ to display a complementary error message
To test the rotation of the motor, select "Motor Test" and press ↵: the motor starts at low speed and low power (10 %) rightward and then leftward. A check of the actual speed and current is performed and a test report is displayed on the last line:
V<< means the actual speed is too low.
I>> indicates that Imax has been exceeded.

1.3 - "Counters" Menu

This menu allows the maintenance technician to know the number of cycles run.
The "controller" counter shows the number of cycles run since the time of delivery.
The "Total" and "Partial" counters show the number of cycles run by the tool.
Validate the highligthted "Reset" function by pressing the ↵ key to reset the partial counter of the tool.

2 - OTHER MAINTENANCE OPERATIONS

2.1 - Resetting the controller

It may be useful to erase all the data stored in a controller when you want to shift to a new application.
The procedure is as follows:
- switch off the controller.
- press ↵ and simultaneously switch the controller on.
- hold the key pressed down until the LEDs blink and the contrast adjustment is displayed.
- press either of the ► / ◄ keys to stop the automatic contrast adjustment
- adjust the contrast using the ► / ◄ keys
- press Valid to validate.

The controller has been reset.

2.2 - Backup battery for parameters and results

The backup battery is located on the microprocessor board. At the time of supply, the battery is connected.
It allows you to back up parameters and results in case of mains power failure. A maximum lifetime of 10 years is indicated in the manufacturer's specifications. For safety purposes, it is recommended to change the battery every 5 years.
Located beside the memory battery, strap JP1 allows you to connect the battery or not.

The strap can be disconnected to prevent the battery from running down if the board is stored a long time.

Schematic representation of the board

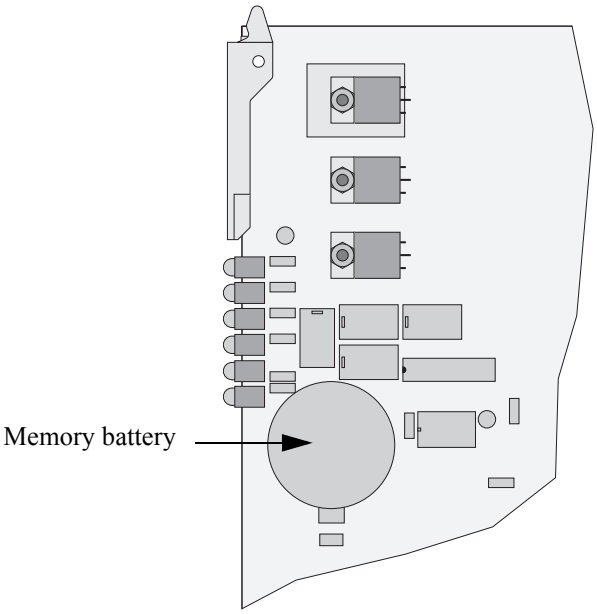
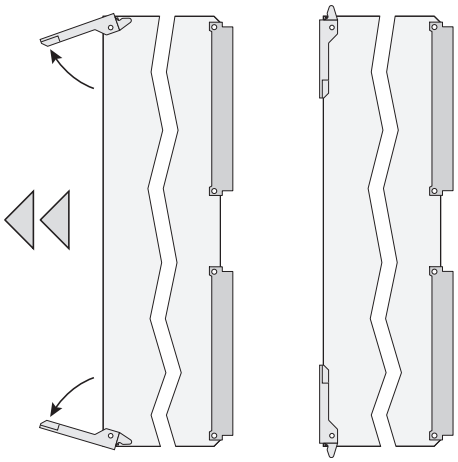


Diagram showing how to extract the board



2.3 - Replacing the fuses

- 1 (10 x 38) 8 Am main fuse located in the controller's fuse box
- 1 (6.3 x 32) 20A-250V quick-acting fuse for the servodrive

2.4 - Testing the differential circuit-breaker

The test procedure is as follows:
- switch off the controller.
- open the door with the triangular wrench.
- switch on the controller.
- run the tool.
- press the "test" button on the front right-hand side of the servodrive board.
- the lamp lights up a short instant and the motor stops.
- switch off the controller.
- close the controller with the triangular wrench.
- switch on the controller.

2.5 - Autotest cycle

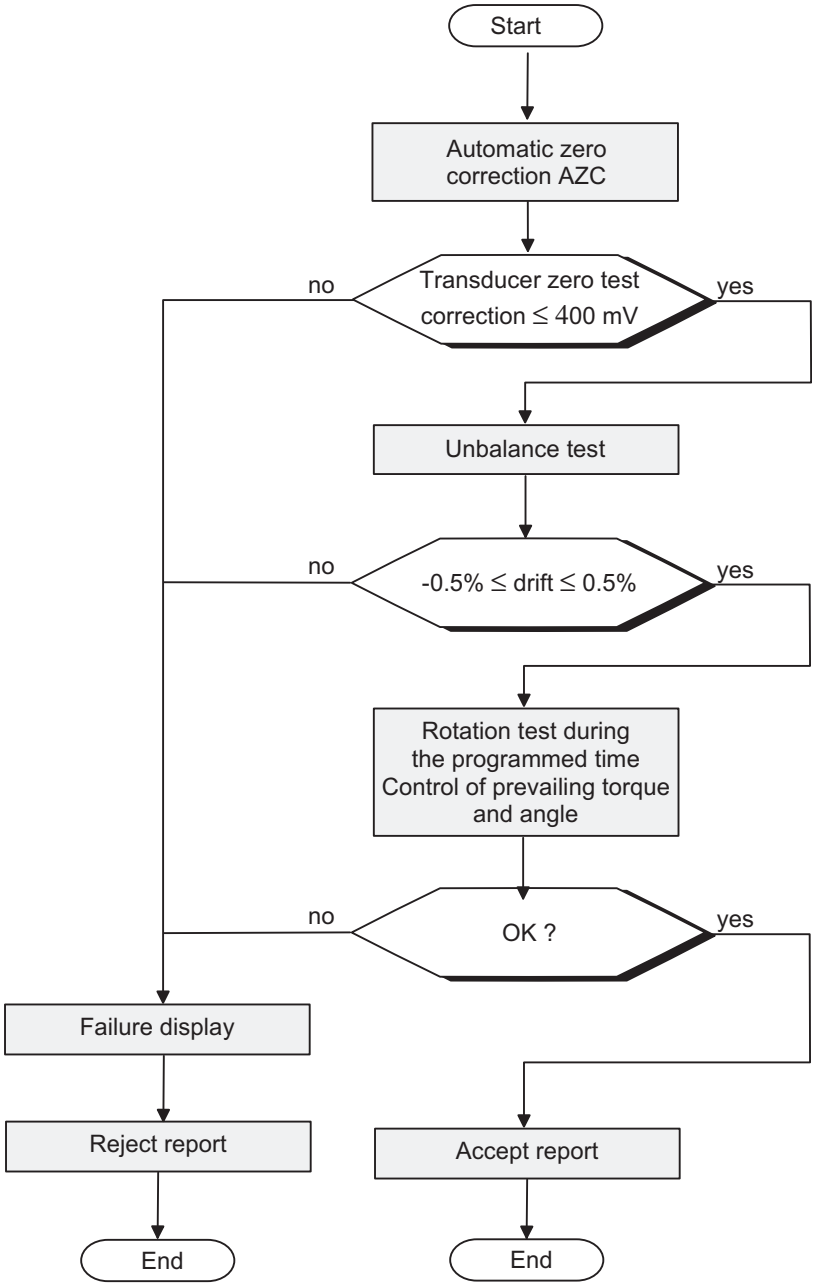
The autotest cycle allows you to check that:

- the prevailing torque is lower than the programmed maximum torque setting.
- the rotation angle ranges between the programmed minimum and maximum angle settings.

As for any other cycle, the automatic zero correction and the unbalance test are performed at the beginning of the cycle.
The autotest cycle usually includes a single tightening phase.
At the end of the cycle, according to the 3 tests in the following flowchart, the "accept report" or "reject report" information gives the result.

The following parameters are for information only:	
Max time	1 s
Tightening type	torque and angle
Tmin	0 Nm
Ttarget	5 Nm
Tmax	4,5 Nm
Amin	300 °
Amax	3000 °
Asafe	3000 °
Angle threshold	0 Nm
Baud rate	100 %
Power	20 %

Autotest cycle flowchart



3 - TROUBLE-SHOOTING HELP

3.1 - Warning

Choose one of these 2 methods to look for information in this document:

- Locate the error message(s) displayed on the screen of the controller among the messages listed in the document. A detailed explanation helps you understand the message(s). Cross-references leading to the error causes are suggested whenever this is possible.
- Select the relevant symptom among those listed. Each possible cause is numbered to make the search easier when cross-references are used.

3.2 - Coded messages

Message displayed	Meaning of the message	Refer to cause no.
E01	Emergency stop activated. The emergency stop also generates a "thermal fault" error on the servodrive.	
E02	Station busy: downloading in progress (for instance)	
E03	Number of cycles OK reached if the parameter "Lock on Ncycle OK" of the Station menu is activated.	
E04	No cycle programmed in the controller or the cycle validated by the input/output port is nonexistent. A question mark will be displayed on the screen where the number of the cycle should be.	
E05	The tool does not start when set to "on". No "spindle validation" signal although the corresponding parameter in the Station Menu is activated. No spindle programmed in the cycle.	
E06	Station "ready" signal fault (for instance: for MULTICVI, it could be either a communication problem with a slave MODCVI, or a servodrive communication problem, or a tool communication problem).	
E07	The tool does not start following a reject report. If the "Error acknowledgement" parameter of the Station menu is activated, the cycle start is inhibited. To release the tool start, you must activate the "Error acknowledgement" signal on the input/output port.	
E08	Unbalance or compensation fault of the tool transducer as a result of an external Reset request.	

3.3 - Messages in plain text

Message displayed	Meaning of the message	Refer to cause no.
-	The spindle has not completed the full cycle. In complex cycles, the spindle may have completed a phase correctly without completing the cycle.	
Accept	Accept report.	
AMAX	The angle measured from the angle threshold is higher, at the end of the cycle, than the programmed maximum angle.	
Amin	The angle measured from the angle threshold is lower, at the end of the cycle, than the programmed minimum angle.	01, 02
Ang	The difference between the main angle transducer and the secondary angle transducer is higher than the programmed tolerance.	
Board missing	Servodrive board not found.	

Message displayed	Meaning of the message	Refer to cause no.
Compensation fault	At rest, the torque transducer signal is above the ±300mV acceptable threshold (offset). This means that a significant drift of the strain gauge has begun; the only answer is to change the transducer.	18, 28
Control or downloading in progress	The cycle cannot start because parameters are being downloaded from the PC.	
Dcy	The cycle has been prematurely stopped by the "run" signal drop. If this occurs little time before the normal end of the cycle, the tightening settings can range within the programmed tolerances but there is a reject report.	
Ext	The cycle has been stopped by activation of the "external stop" signal (if this option has been programmed in the relevant phase).	
Grou	A spindle report is "rejected" because the spindle has been "grouped" with another spindle which has a reject report.	
Imax	The cycle has been stopped because the current has reached x% of the maximum threshold programmed in the tool. Check that the "power" (x%) programmed in the cycle is sufficient. This overconsumption can also be the result of a short-circuit, a cable problem, a resolver problem or a loss of adjustment of this resolver, etc.	
M	Reject report.	
Maximum filter lower than maximum tolerance	The statistical calculation parameters are incorrect.	
Minimum filter higher than maximum filter	The statistical calculation parameters are incorrect.	
Minimum filter higher than minimum tolerance	The statistical calculation parameters are incorrect.	
Minimum tolerance higher than maximum tolerance	The statistical calculation parameters are incorrect.	
MMAX	The torque reached at the end of the cycle is higher than the programmed maximum torque of the secondary checking transducer or current monitoring.	
Mmin	The torque reached at the end of the cycle is lower than the programmed minimum torque of the secondary checking transducer or current monitoring.	
Motor drive fault	The motor rotation test with a low speed setting gives a speed value lower than a given value or the current is higher than a given value.	
No cycle programmed	No cycle programmed in the controller or the cycle validated by the input/output port is nonexistent. A question mark will be displayed on the screen where the number of the cycle should be.	
Nval	The spindle has not been programmed in the cycle, or has not been validated if the "spindle validation" function is used. This happens on multi-spindle stations. This is information displayed on the screen; it is not an error.	
PLC task error	Internal error.	
Prg	The cycle has been stopped by a programming fault. For example: the programmed torque is higher than the capacity of the spindle connected.	
Printer busy	The printing has stopped due to a full buffer or a lack of paper.	

Message displayed	Meaning of the message	Refer to cause no.
Res	Unsteady resolver signal. Fault detected on the signal given by the main angle transducer (resolver).	19
RMAX	The torque rate ΔC/Δ∝ at the end of the cycle, is higher than the programmed maximum torque rate.	
Rmin	The torque rate ΔC/Δ∝ at the end of the cycle, is lower than the programmed minimum torque rate.	
Servo board fault	The controller has detected a thermal contact fault, a differential fault or maximum current reached.	15, 17, 19, 20, 25, 26
Servo fault	The cycle has been stopped by a fault on the servodrive board: temperature fault, differential fault or maximum current reached.	15, 17, 19, 20, 25, 26
Spi	There has been a fault during access to the tool memory (reading or writing).	
Srv	The cycle has been stopped by a fault on the servodrive board: temperature fault, differential fault or maximum current reached (50A).	
Syn	The cycle has stopped on a synchro waiting phase.	
The number of measurements is lower than 15.	The statistical calculation cannot be performed due to the lack of tightening results.	
Time	The cycle has been stopped after runout of the programmed maximum time to run the last phase of the tightening cycle. This means that the stop conditions have not been met.	
TMAX	The torque reached at the end of the cycle is higher than the programmed maximum torque.	01, 02, 06, 07, 08
Tmin	The torque reached at the end of the cycle is lower than the programmed minimum torque.	04, 05, 09, 10, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28
Tool change	The serial number of the connected tool is different from the number saved in the controller memory.	12
Tool fault	The controller has detected tool parameters which are different from the ones saved in the controller memory. It may be a link error.	12
Tool link error	The tool parameters cannot be read in its memory.	14, 24, 29
Tool programming error	It has not been possible to program the tool parameters in its memory.	14, 24, 29
Tool version error	The data contained in the tool memory is not compatible with the data contained in the controller memory. The tool cannot run when connected to this controller. You must update either the tool memory or the controller software so that the tool and controller become compatible.	
Transducer fault	The controller has detected a compensation fault or an unbalance fault in the tranducer.	18, 28
Trd	The cycle does not start due to a transducer fault: the offset or the unbalance test are too important	18, 28, 33
Unbalance fault	The unbalance measured at the beginning of the cycle is more than ±0.5% different from the one which was last saved in the tool memory.	18, 28
Wrong day	The date and time entered are incorrect.	
Wrong hour	The hour entered is incorrect	
Wrong minute	The minutes entered are incorrect.	
Wrong month	The month entered is incorrect.	

Message displayed	Meaning of the message	Refer to cause no.
Wrong second	The seconds entered are incorrect.	
Wrong year	The year entered is incorrect	

3.4 - Operating problems due to adjustment problems

Symptoms	Possible causes	No.	Check
The tool starts, then stops immediately without running the rundown speed cycle.	The "stall torque" instruction is too low The programmed current is too low. The acceleration time is too short compared to the maximum time. The maximum time is too short or null.	01	Check the values programmed for the run down and final speed sequences.
	A machine part impedes the rotation of the tool.	02	Switch off the controller, disconnect the tool and check that the tool is driven by the output shaft in both directions of rotation. Make sure there is no hard spot.
The tool skips the rundown sequence.	The "current" instruction is too low. The acceleration time is too short. The rundown instruction is too low. The maximum rundown time is too short. The spindle is not validated in the sequence.	03	Check the values programmed for the run down sequence.
Seen from the controller side, the tool does not reach the programmed torque or hardly reaches it.	The power programmed during the relevant phase is not sufficient.	04	Check and increase the programmed value if necessary.
	The tool is not suited to the task.	05	Check that the tool performances are compatible with the required torque.
Dispersion or abnormal deviation in the tightening results.	The rundown torque is too high as compared to the final torque.	06	Check the torque rise curves. Reduce the speed of the tool in case of hard joints. Check the value of the rundown torque: The recommended value is close to a quarter of the final torque.
	The deceleration between the rundown phase and the final phase is too slow.	07	Reduce the transition interval between the rundown and tightening phases.
	The tightening speed is too high; the consequence of inertia is the significant overstepping of the set value.	08	Reduce the speed of the tightening phase. The technology of electric motors equipped with a "resolver" allows the speed reduction up to 1 % of the maximum speed of the tool.
The torque displayed by the controller is far from the actual torque.	The coefficient of the tool nominal load has been updated by mistake.	09	This coefficient should be equal to 1, except in the case of additional reduction gears. Check its value in the "Parameter/Tool" menu.
The torque value is constantly equal to 0; there is no error message.	The coefficient of the tool nominal load has been set to 0 by mistake.	10	This coefficient should be equal to 1, except in the case of additional reduction gears. Check its value in the "Parameter/Tool" menu.

3.5 - Operating problems due to wear or breakdown

Symptoms	Possible causes	No.	Check
The tool does not start whether in tightening, or run reverse mode. The screen is idle.	The controller is switched off	11	Check: • the condition of the On/Off switch of the controller. • that the mains voltage on the input side of the controller is not null. • the condition of the controller fuses.
The tool does not start whether in tightening, or run reverse mode. MESSAGE: "Tool fault"	The tool has been changed.	12	The "Tool fault" message is displayed. You must read the parameters of the new tool. If validating the new tool does not correct the problem, check the following points: Note: Following a tool change, it is recommended NOT to update the transducer unbalance and compensation values and to keep the ones saved in the memory tool. This task should only be performed after repairing or changing the transducer.
MESSAGE: E01	Missing Emergency stop connector or emergency stop button engaged.	13	Check for links in the emergency stop connector and check that the emergency stop button is not engaged.
MESSAGE: "Tool fault"" (tool link error)	The electrical links between the controller and the tool are faulty.	14	The cable(s) is(are) not connected. The connectors are insufficiently screwed or inserted. There are twisted contacts or contacts pushed back in one of the connectors. Check the continuity and insulation of every electrical link in the cables; change them if necessary.
Tightening report: "Srv"	Insulation defect, stop induced by the differential circuit-breaking	15	Check that the "Differential" message is displayed correctly by pressing the Enter key twice. In that case, look for the insulation defect: it could be in the motor, in the cable or in the controller.
MESSAGE: "None"	The tool trigger is faulty	16	Check that the cycle starts: a report is generated. In the "Maintenance - Inputs/Outputs" menu, check the switching of input no. 6. If there is a fault, test the switch between 6 and D in the tool connector ($\leq 6\ \Omega$).
MESSAGE: "not ready" (blinking) (Control menu) or "servodrive error" (Channel Test menu)	Servodrive not ready: Open thermal contact. Could also result from a resolver fault or a resolver link fault	17	Check the condition of the "thermal contact" LED on the front side of the servodrive. If the LED is lit, check the motor temperature and the connections (if necessary).

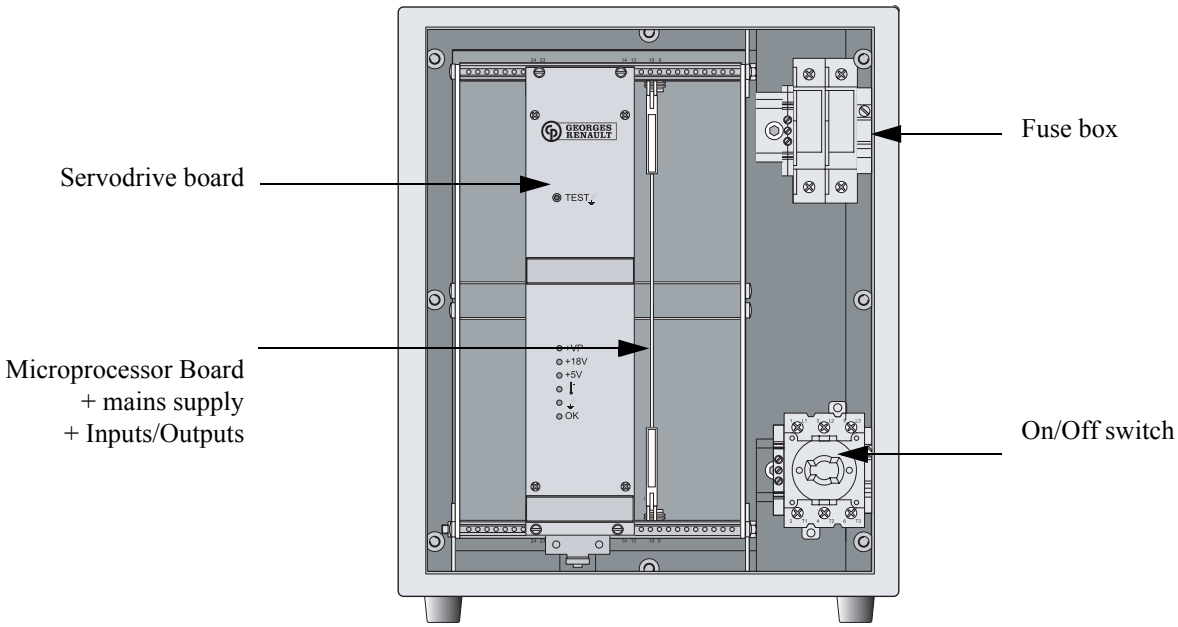
Symptoms	Possible causes	No.	Check
MESSAGE: "Trd"	The unbalance value measured at the beginning of the cycle is more than 0.5% different from the value saved in the tool memory. The compensation value is > 300mV	18	This means that the transducer sensitivity or the amplifier gain has changed. In the "Maintenance" menu, perform a dynamic calibration to calculate the new sensitivity coefficient. Then read and save the new unbalance and compensation values in the tool. If the value is sligthly above 300mV, one of the strain gauges is probably being disintegrated by chemicals. Changing the transducer is necessary. If the value is far above 300mV, before deciding that it is due to a drift of the strain gauge, you must check the electrical continuity between the transducer and the amplifier. Check the impedances of the transducer: Mains supply section: 375 Ω±2.5 or 750 Ω±5 Measuring section: 350 Ω±2.5 or 700 Ω±5 Caution: the "memory" board could be involved. Check its connectors or contact the aftersales dept.
The tool does not start, but the tightening cycle is performed. Tightening report: "Scy" (if the operator releases the trigger before the end of the time delay).	- Interruption of at least 2 phases of the motor - Resolver fault or resolver link fault: this incident can be detected in different ways, depending on the position of the motor. Refer also to cause No. 20.	19	Check the AB/BC/CA impedances of the motor (some Ω, the values must be ± 0.1). Check the AA/BB/CC continuities of the motor cable. If the first 2 points are OK, then the breakdown comes from the controller: change the servodrive of the faulty channel or change the controller. Check the impedances of the motor: if ER 18-19 (excitation) 38Ω±10 20-21 (sine) 105Ω±30 8-9 (cosine) 105Ω±30 if EM 1-2 (excitation) 38Ω±10 3-4 (sine) 105Ω±30 5-6 (cosine) 105Ω±30 Check the insulation between those signals. Check the 1-1/2-2/3-3/4-4/5-5/6-6 continuities of the motor cable.
Tightening report: "Tmin Amin". If you look up the "information" entry, the cycle has been stopped by the "maximum current" instruction.	Resolver fault or resolver link fault.	20	Check cause No. 19 for the points about the resolver.
The tool does not always start.	Faulty contact in the trigger switch.	21	In the "Maintenance - Inputs/Outputs" menu, check the switching of input no. 6. If there is a fault, test the switch between 6 and D in the tool connector (≤ 6 Ω).

Symptoms	Possible causes	No.	Check
Seen from the controller side, the tool does not reach the programmed torque or hardly reaches it. The motor overheats. The tool is stopped by the "maximum current" instruction.	The sensitivity programmed in the tool is incorrect. In that case, the actual torque is much higher than the one given by the controller: If the tool transducer is faulty, the cycle will not start because the "compensation" and "unbalance" measurements detect the fault at every cycle start.	22	When the controller is switched on, it reads the sensitivity saved in the tool memory. To check the sensitivity, connect a standard torque measuring line in series with the tool. Check if the results between the 2 measuring lines are consistent. To modify the sensitivity, refer to the Operator's Manual. To check the tranducer, refer to No. 18.
	The angle-head efficiency has deteriorated to a large extent.	23	Check the torque ripple of the "torque versus time" curve saved in the unit. Disconnect the tool angle-head and check manually for any hard spot. Change the angle-head.
	The "memory" board is faulty.	24	Check the data in the tool memory, and especially the sensitivity and the associated load compared to the calibration certificate issued with the tool. Change the memory board: in that case, it will be necessary to program the tool memory again. This operation can only be performed in "superuser" mode by authorized operators (access code).
	One of the three phases is not activated. The possible causes are: • Damaged winding in the motor. • Faulty cable. • Faulty speed servodrive.	25	Check the impedances between AB/BC/CA The values are equal to a few ohms and should be balanced. Refer to No. 19. Test the AA;BB;CC links Check that the contacts are neither twisted nor pushed back. If the former points are correct, change the servodrive, (a phase changeover can be idle).
	The tuning of the resolver is disturbed.	26	No check is possible. Rule out every other possible cause. Change the motor and send it back to GEORGES RENAULT for maintenance.
Dispersion or abnormal deviation in the tightening results.	The angle head is faulty.	27	Check the torque ripple of the "torque versus time" curve saved in the unit. Disconnect the tool angle-head and check manually there is no any hard spot. Change the angle-head.
	Faulty welding in the torque transducer. An electrical link is disrupted when the transducer is under stress.	28	Measure the impedances of the transducer when stress-free then apply torque stress and make sure the impedances remain identical. After having ruled out every other possible cause, change the transducer.
	Abnormal noise. Damaged or cut shielding.	29	Check the position of the strands of wire in the tool handle. Change the cables.

Symptoms	Possible causes	No.	Check
The tool does not run in run reverse mode.	The Tightening/Untightening reversing gearbox is faulty. The run reverse speed is set to 0.	30	In the "Tests, Inputs/outputs" menu, check the switching of bit 7 when the reversing gearbox is activated. Check the "Spindle validation on run reverse" parameter. Test commutation between pins 2 and 5 of the tool connector. Check the value of the run reverse speed in the "Parameters/Station" menu. If the reversing gearbox is running correctly, the tool LEDs should blink.
The motor stops suddenly; performing another action on the trigger starts the tool again.	The serial link between the tool and the controller is disrupted. This could be due to faulty shielding.	31	Check the value of the noise shown on the "torque versus time" curve saved in the controller memory. Change the cables.
The tool does not run in tightening mode, but runs in run reverse mode.	Loss of controller memory.	32	Check the presence of tightening cycles. Check that the selected cycle is programmed correctly.
	Transducer fault.	33	Refer to No. 18 and 22.
	The Tightening/Untightening reversing gearbox is stuck in run reverse mode.	34	Refer to No. 30.

SECTION 7 - CONNECTIONS AND INSTALLATION

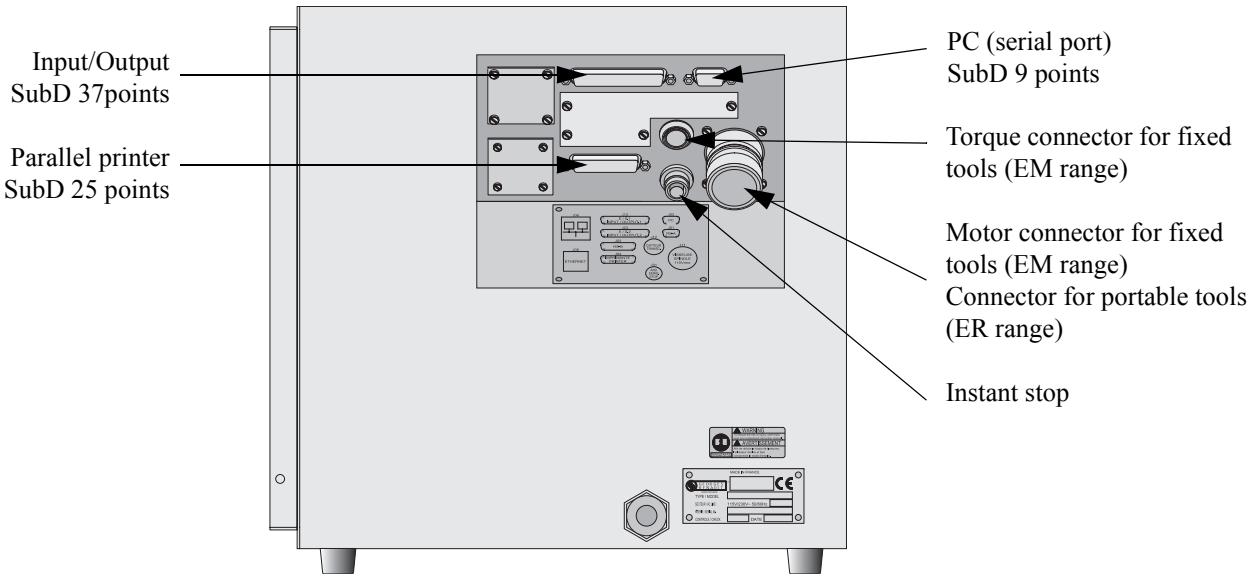
1 - INTERNAL VIEW



The diagram, characteristics and references used to order boards are detailed in the appendices at the end of this document.

2 - CONNECTIONS AND PERIPHERALS

2.1 - Connection side view



2.2 - List of connectable tools

The controller automatically recognises the tool features by reading the tool-integrated memory. serial number, type of tool, sensitivity, nominal load, gear ratio.
The diagrams of the tool cables are described in the appendix at the end of this manual.

PORTABLE TOOLS			FIXED TOOLS
Angle head	**In-line**	**Pistol grip**	EM35-10J
ERA15J	ERD5J	ERP5J	EM35-20J
ERA20J	ERD20J	ER20PJ	EM38-10J
ERA30J	ERD30J	ER30PJ	EM38-20J
ERA40J	ERD50J	ERP3L	EM51-10J
ERA60J	ERD70J	ERP3LT	EM51-20J
ERA70J	ERD120J	ERP5L	EM60-10J
ERA90J	ERD150-6J	ERP5LT	EM60-20J
ERA115J	ERD200-6J	ERP10L	EM60-30J
ERA125J	ERD250-6J	ERP10LT	EM80-10J
ERA150J		ERP20L	EM80-20J
ER180		ERP20LT	EM80-30J
ERA200J		ERP20S	EM80-40J
ERA125-6J		ERP30S	EM106-10J
ERA250-6J			EM106-20J
ERA300-6J			EML38-20J
ERA400-6J			EML51-20J
Former compatible range			EML60-20J
ER20J	ER20DJ	ERP20J	EML60-30J
ER30J	ER30DJ	ERP30J	EML80-40J
ER50J	ER50DJ		
ER90J	ER70DJ		
ER120J			
ER180J			

2.3 - Input / Output Description

2.3.1 - Inputs

The 7 input connections are optocoupled and active at "1" (24 Volts).
The current consumed per input is 10mA.

cycle number	Binary coding 1-2-4-8. The cycles are numbered from 1 to 15.
start cycle	The cycle runs as long as the signal is on "1". When the signal drops, the cycle stops and the report is sent to the PLC.
Run reverse	Authorises the untightening of the spindles at the "cycle start", at the programmed speed and high-potential current.
Reset	Resets the tightening reports.
error acknowledgement	Deletes report ouputs without erasing the memory of the "cycle OK" counter.
spindle validation	Allows, or not, the start of the spindle in the tightening or untightening directions or both, depending on the programming of the "Station" menu.
external stop	When the parameter is programmed to"yes" in the programming screen of the rundown speed, final speed and run reverse phases, the system stops the current phase and shifts to the next one as soon as the signal shifts to "1".



These various functions can be configured on the various physical inputs (see default configuration on the wiring diagram). To change the programming, refer to the "Parameters/Station" screen.

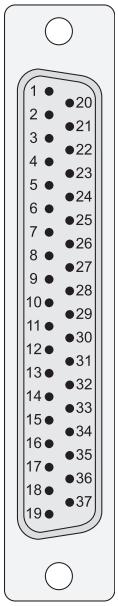
2.3.2 - Outputs

The 6 outputs are active at "1" and relayed in the controller.
I max DC = 1A Vmax DC = 150V, Pmax DC = 30W

These various functions can be configured on the various physical outputs (see default configuration on the wiring diagram). To change the programming, refer to the "Parameters/Station" screen.

ready	This signal is at "1" when the controller is in working order.
cycle acknowledge	Binary coding 1-2-4-8. The cycle acknowledge is sent back only if it corresponds to a programmed cycle. Otherwise it is at "0".
cycle in progress	Response to the Start Cycle request. Drops to "0" at the end of the cycle.
number of cycles OK	This signal switches to "1" when the number of cycles run with an Accept report is equal to the programmed number of cycles OK.
accept report	Sent to the PLC when the cycle is over and the report is OK.
reject report	Sent to the PLC when the cycle is over and the report is NOK.

2.3.3 - Inputs/Outputs wiring diagram (by default)

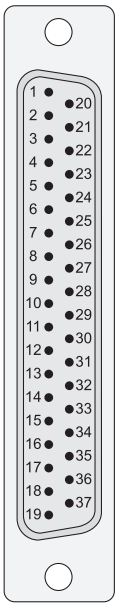


	(⎸ signal input) (⎿ signal output)	Logical outputs
1	0V (+24V)	
2		
3	⎿ Cycle in progress	O5
4	⎸ υ Outputs common	
5	⎿ Number of cycles OK	O8
6	⎿ Reject report	O7
7	⎿ Accept report	O6
8		
9	⎿ Cycle 8 acknowledge	O4
10		
11	⎿ Cycle 4 acknowledge	O3
12		
13	⎿ Cycle 2 acknowledge	O2
14		
15	⎿ Cycle 1 acknowledge	O1
16	0V (24V)	
17	⎿ +24V unit (max. 700 mA)	
18		
19		

		Logical inputs
20	⎿ +24V unit (max. 700 mA)	
21	⎸ υ Outputs common	
22	⎸ υ Outputs common	
23	⎸ υ Outputs common	
24	⎸ Cycle 1	I1
25	⎸ Cycle 2	I2
26	⎸ Error acknowledgement	I8
27	⎸ Cycle 4	I3
28		
29	⎸ Cycle 8	I4
30		
31		
32	⎸ Start cycle	I6
33	⎸ Run reverse	I7
34		
35		
36	⎸ Reset	I5
37		

2.3.4 - Customized Inputs/Outputs wiring diagram

The following table is for you to write down your own configuration.



	(signal input) (signal output)	Logical Outputs
1	0V (+24V)	
2		
3		O5
4	υ Outputs common	
5		O8
6		O7
7		O6
8		
9		O4
10		
11		O3
12		
13		O2
14		
15		O1
16	0V (24V)	
17	+24V unit (max. 700 mA)	
18		
19		

		Logical Inputs
20	+24V unit (max. 700 mA)	
21	υ Outputs common	
22	υ Outputs common	
23	υ Outputs common	
24		I1
25		I2
26		I8
27		I3
28		
29		I4
30		
31		
32		I6
33		I7
34		
35		
36		I5
37		

List of available functions (outputs):

CYC1	Cycle 1 acknowledge
CYC2	Cycle 2 acknowledge
CYC4	Cycle 4 acknowledge
CYC8	Cycle 8 acknowledge
INCYC	Cycle in progress
ACCRP	Accept report
REJRP	Reject report
NCYCOK	Number of cycles OK
READY	Tool ready
READY	Tool ready
TOROK	Torque OK
TORNOK	Torque not OK
TRQMIN	Min. torque
TRQMAX	Max. torque
ANGOK	Angle OK
ANGNOK	Angle not OK
ANGMIN	Min. angle
ANGMAX	Max. angle
RUNREV	Run reverse detected

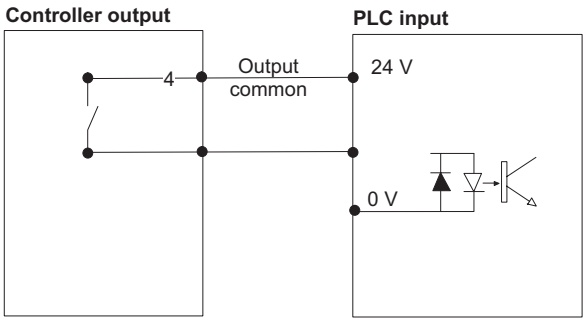
List of available functions (inputs):

CYC1	Cycle 1
CYC2	Cycle 2
CYC4	Cycle 4
CYC8	Cycle 8
RESET	Reset
SCY	Start cycle
DIRECTION	Run reverse
ACKNOW	Error acknowledgement
VALSP	Spindle validation
SPVALFS	Spindle validation in final speed phase
SPVALRRV	Spindle validation in run reverse phase
EXSTOP	External stop of a phase

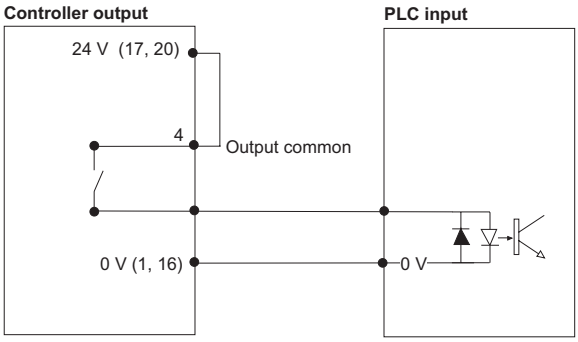
2.3.5 - Controller output, PLC input wiring

Two available wiring configurations of the controller relayed output connections are available as shown below:

The PLC 24 V is connected to the output common.
The PLC inputs do not receive external 24 V.



The controller 24 V is connected to the output common.
The PLC inputs receive the 24 V from the controller.

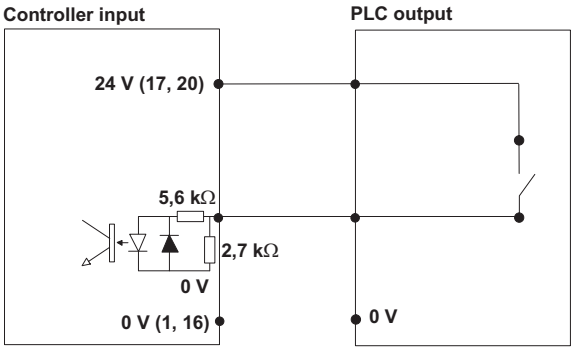


The inputs are as per type II of standard CEI 1132-2 (24V/13mA per input).
Note: in some cases (capacitance on the PLC inputs), it may be necessary to insert a 47Ω /1W resistor on the outputs used, in order to limit surges.

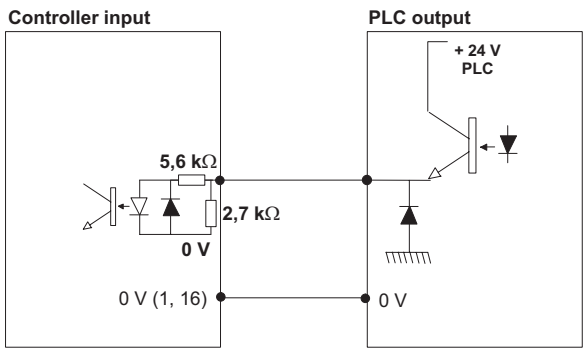
2.3.6 - PLC output, controller input wiring

Two configurations are available:

The controller 24 V (contacts 17, 19 and 20) is used as"common" of a PLC relay board.



By default, the PLC 24 V is sent to the inputs of the controller.

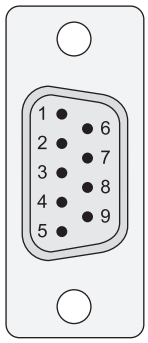


2.4 - PC connection

The PC connection is necessary for:
- networking up to 32 spindles.
- programming the parameters of several controllers in real time while controlling the spindles.
- increasing memory capacity to save the results and tightening curves.
- saving the parameters and results on floppy disk to secure the traceability of the applications.
- transferring data to spreadsheet (results and curves) for subsequent analysis.
- connecting a bar code reader.

2.4.1 - "Point-to-point" connection in RS232 between the PC and a single controller

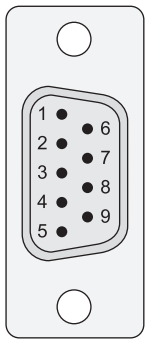
Wiring diagram of the PC connector:
Link RS232
Note: the diagram of the connecting cable between the PC and the controller is described in the appendix located at the end of this document.



Pin	Signal
1	
2	RXD
3	TXD
4	
5	0V
6	
7	RTS
8	CTS
9	

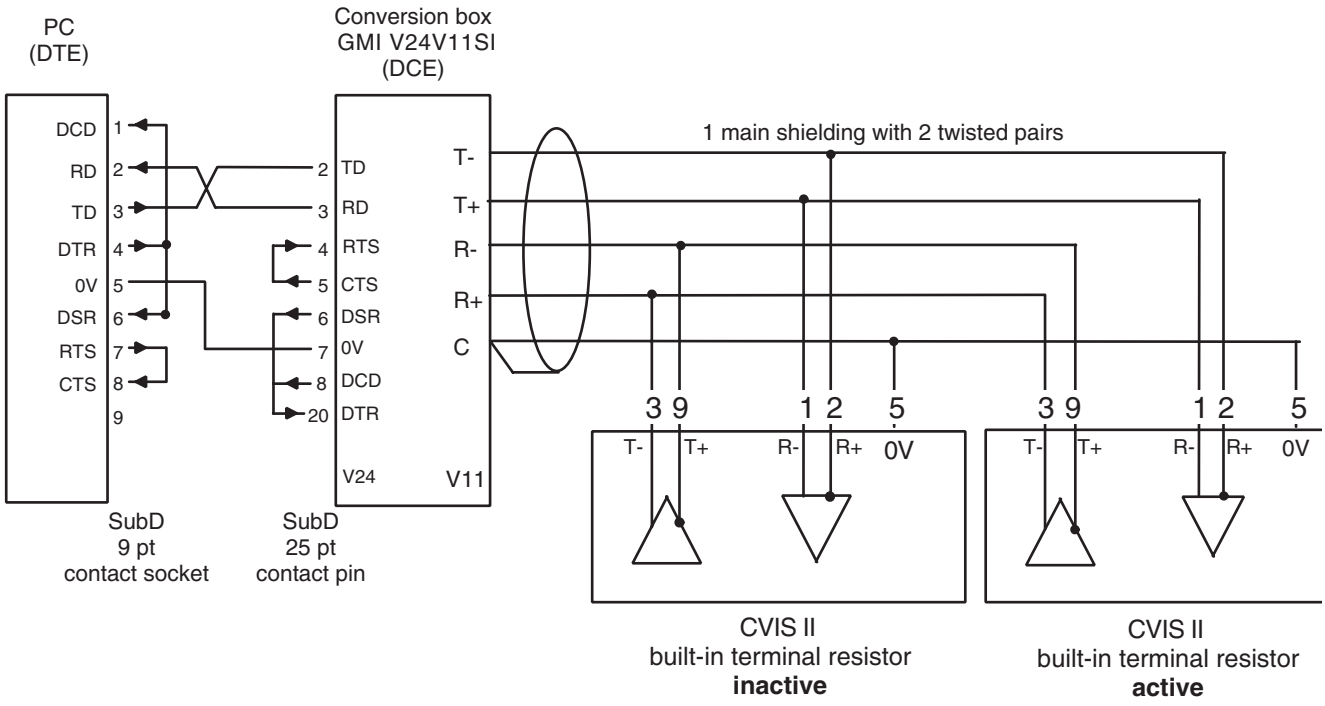
2.4.2 - "Network" connection at RS422 between the PC and several controllers

Wiring diagram of the PC connector:
Link RS422



Pin	Signal
1	R-
2	R+
3	T-
4	
5	0V
6	
7	
8	
9	T+

Example of a "network" connection:



2.5 - Parallel printer

The main types of printers are recognised by the system. The connection is provided by the 25 pt connector located on the controller side, by means of a standard cable for parallel printer.

2.6 - Instant stop connector

The description and wiring diagram of the instant stop are described in the Initial start-up section.

APPENDIX 1 - TIGHTENING STRATEGIES

1 - TORQUE-CONTROLLED TIGHTENING

The recorded value is: the peak torque

Spindle stop:

if torque ≥ target torque

Accept report

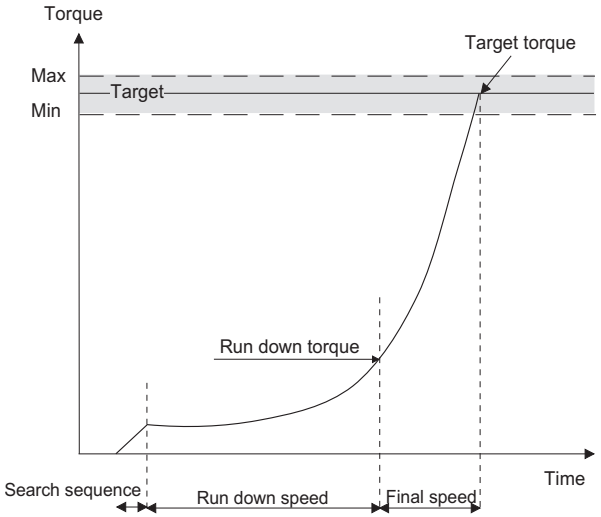
IF min. torque ≤ peak torque ≤ max. torque

Optional: current monitoring

IF min. torque ≤ peak torque ≤ max. torque

AND min. current ≤ final current ≤ max. current

Adjusting the bandwidth : To obtain a correct joint, it is necessary to apply a given torque, but it is also necessary for this torque to be converted into a load in the fastener. Yet, at the end of the final speed phase, on a very hard joint, if a high torque is applied during a very short time period (shock), the torque measured can be very high without generating a significant load increase in the fastener. In this case, the bandwidth is not adapted to the joint and it must be adapted through successive approaches. In most joints, the bandwidth is equal to 128 Hz.



2 - TORQUE + ANGLE CONTROLLED TIGHTENING

The start of the angle threshold counting should be within the linear area of the torque increase.
The angle measurement takes into account the torsion/back torsion of the spindle by measuring the angle during the torque drop phase, until the threshold value of the angle counting start is overstepped.

The recorded values are the following: peak torque and final angle

Spindle stop

IF torque ≥ target torque

OR angle > safety angle

Accept report

IF min. torque ≤ peak torque ≤ max. torque

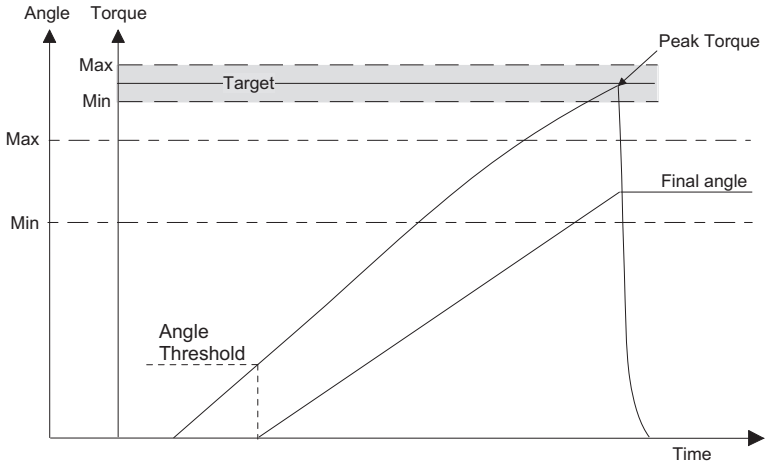
AND min. angle ≤ final angle ≤ max. angle.

Optional: current monitoring

IF min. torque ≤ peak torque ≤ max. torque

AND min. angle ≤ final angle ≤ max. angle.

AND min. current ≤ final current ≤ max. current



3 - ANGLE + TORQUE CONTROLLED TIGHTENING

The start of the angle threshold counting should be within the linear area of the torque increase.

The angle measurement takes the torsion of the spindle into account. This is obtained by measuring the torsion angle of the spindle when the torque drops at the end of the final speed phase until the moment when the torque is again equal to its value at the beginning of the angle counting.

The recorded values are the following: final torque and final angle

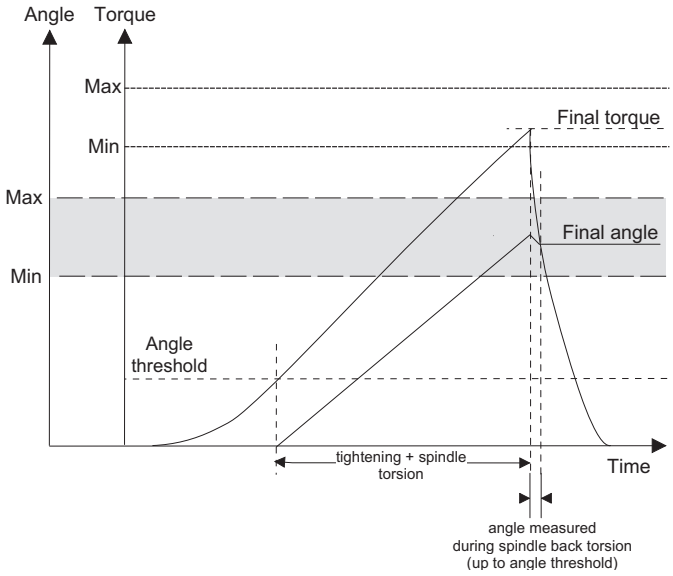
Spindle stop

IF angle ≥ target angle OR torque > max. torque

Accept report

IF min. torque < final torque < max. torque

IF min. angle < final angle < max. angle



4 - TORQUE + ANGLE + TORQUE RATE CONTROLLED TIGHTENING

Spindle stop

IF torque ≥ target torque OR angle > safety angle

OR torque rate < min. torque rate OR torque rate > max. torque rate

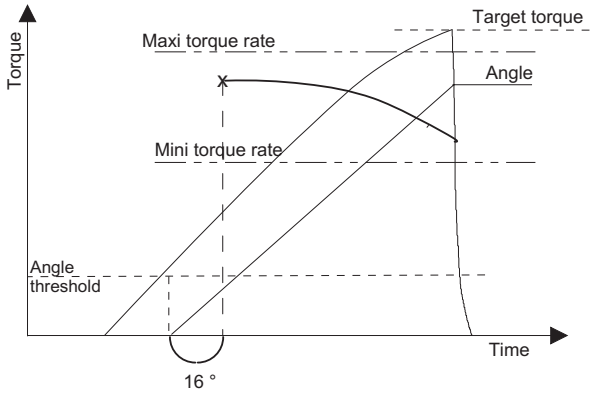
Accept report

IF min. torque < final torque < max. torque

IF min. angle < final angle < max. angle

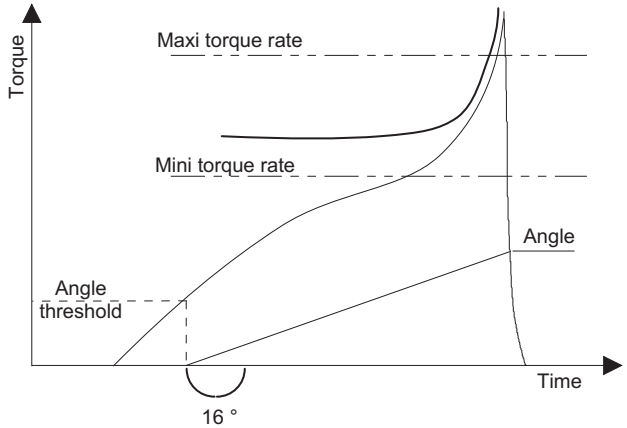
IF min. torque rate < final torque rate < max. torque rate

Tightening with an "accept" report

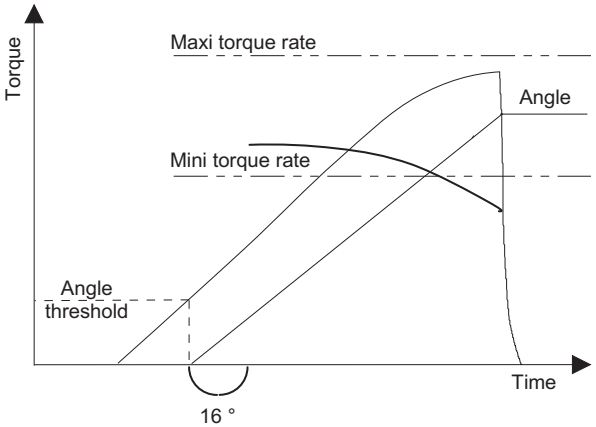


The torque rate computation is based on the principle of the yield point computation. Starting from the angle threshold, the system measures the rotation angle of the spindle. After 16° (or 32°), the first torque rate computation is performed. Then a computation is carried out every degree and the final result is the value read at the time the target torque is reached. This principle allows you to detect an abnormal torque rate (missing washer, presence of 2 washers, etc.).

Tightening with a "reject" report: max. torque rate



Tightening with a "reject" report: min. torque rate



5 - ANGLE + TORQUE + TORQUE RATE CONTROLLED TIGHTENING

Spindle stop

IF angle ≥ target angle **OR** torque > max. torque

OR torque rate < min. torque rate **OR** torque rate > max. torque rate

Accept report

IF min. torque < final torque < max. torque

IF min. angle < final angle < max. angle

IF min. torque rate < final torque rate < max. torque rate

according to the option selected (mean torque or min./max. torque)

6 - STRATEGY INCLUDING ADDITIONAL CONTROL (CURRENT)

To make the fastening task even more reliable, it is possible to add a current control to most tightening strategies (torque, torque+angle, angle+torque, etc.).
This additional control enables you to check the coherence between the value of the torque measured by the torque transducer, and the current consumed by the motor.
This "current" information varies from one tool to another and is not calibrated against the torque. It is thus necessary to establish a similarity on an experimental basis for each tool: you must read the value of the maximum current reached at the end of a cycle and then execute that cycle at least 3 times to define the "minimum current" and "maximum current" value to be programmed.

Spindle stop

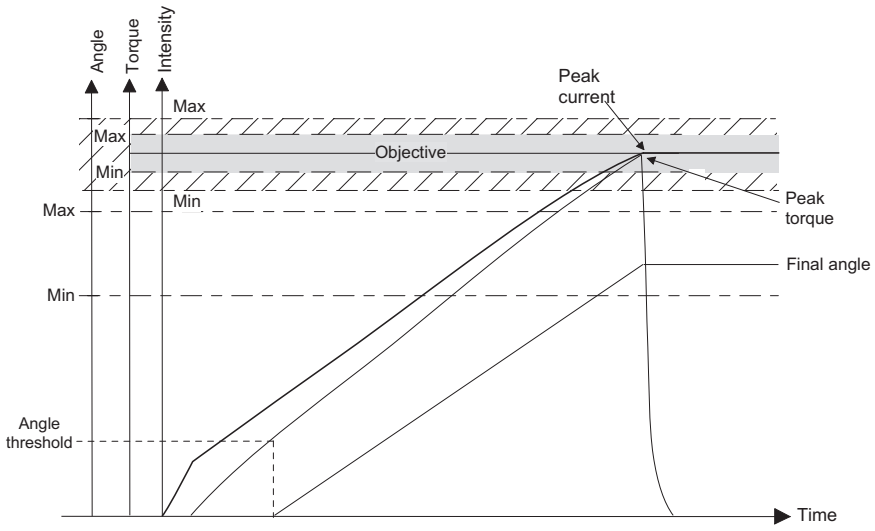
Stop condition for the tightening strategy selected

OR current ≥ max. current

Accept report

Accept report condition for the tightening strategy selected

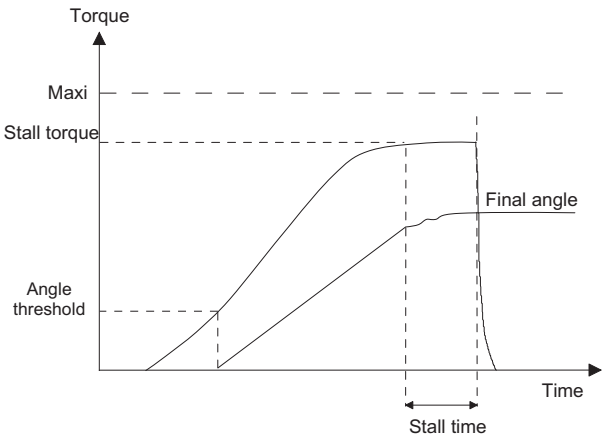
AND min. current < current < max. current



7 - STALL TORQUE CONTROLLED TIGHTENING

This tightening strategy is used to check the tuning of a tightening unit in static mode with the possibility of monitoring the linearity of its torque transducer.

The stall torque tightening is also used when you want to keep a constant torque on a joint, either to compensate a creep in a seal, or to keep a load on a joint during a complex operation. During this phase, as long as the motor has not reached its torque value, the motor is controlled on the speed loop. When the stall torque is reached, the torque control and stall are performed on the current loop. The stall time can be set between 0.1 and 10 seconds.To avoid the overheating of the motor, in this type of application it is recommended to oversize the tightening unit.
The thermal contact located in the motor provides protection in case of overheating.
The max. torque must be programmed to a value higher than the desired stall torque.



The recorded values are the following: final torque and final angle

Spindle stop
IF stall time elapsed
OR torque > max. torque
OR angle > max. angle

Accept report
IF min. torque ≤ final torque ≤ max. torque
IF min. angle ≤ final angle ≤ max. angle

8 - PREVAILING TORQUE CONTROLLED TIGHTENING

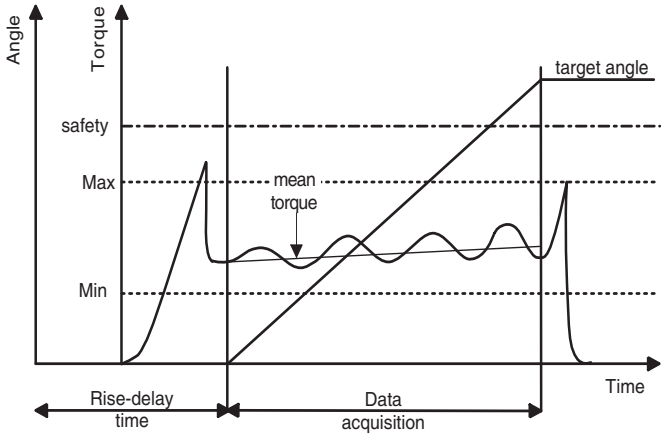
This phase allows you to check the residual torque (prevailing torque) of a mechanical assembly.

Examples of mechanical assemblies: gearbox, crankcase, etc. This phase is useful to know if there is a mechanical "hard" spot in the assembly and also to detect the absence of a component in the joint (crankshaft or connecting rod bearing shell, gear, control of the friction torque of a Nylstop nut) when the residual torque is higher than the min. torque.

Two types of monitoring are available, according to an angle or to a torque

1 Prevailing torque monitoring, with time- or angle-controlled stop:

The initial timeout (threshold), expressed in time or angle units, allows you to eliminate the "shock" when starting the motor and the mechanism.The memorised result includes the minimum and maximum values and the mean of the torque measurements during the acquisition phase. The system stops the acquisition of the torque and angle when the motor stops. The torque pulse at the motor stop is not taken into account.



The recorded values are the following: mean torque, minimum torque read and maximum torque read.

Spindle stop
IF angle ≥ target angle **OR** torque > safety torque

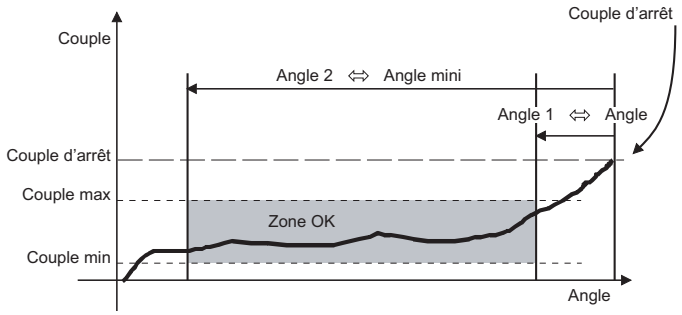
Accept report
IF min. torque ≤ instant torque ≤ max. torque (by default)
or **IF** min. torque ≤ torque average ≤ max. torque (optional)

2 Prevailing torque monitoring, with torque-controlled stop:

The phase is stopped when the target torque is reached. Then the prevailing torque is controlled between the angle 1 ("angle" parameter) and the angle 2 ("minimum angle" parameter), which are measured back from this target point.
The stored torque values are:

- the lower torque (detected in this 1-2 angle area),
- the upper torque (detected in this 1-2 angle area),
- the peak torque measured during the phase.

The torque is OK if it is contained inside this angle area between the minimum and maximum torque parameters.
If the angle covered from the start is lower than the "minimum angle" parameter (i.e. the angle 2), there is a "minimum angle" error.



"Offset" use: ignore/add/subtract
The average value of the measurements is memorised and considered as a positive or negative "offset" for the torque measurements of the next phases of the cycle. For example: a cycle consist of a Prevailing torque phase (P) followed by a Final speed phase (F). The prevailing torque phase gives an average value of 10 Nm. If the final speed phase instruction is 50 Nm and if the "offset" parameter is programmed to "subtract", the torque will actually rise to 60 Nm.

9 - YIELD POINT CONTROLLED TIGHTENING

The principle of the yield point controlled tightening is based on the fact that the torque rate ($\Delta T / \Delta\alpha$) remains constant as long as the tension stresses applied to the screw are lower than the yield point and then decrease beyond that point. The torque rate is calculated throughout the torque increase and it is compared to a reference torque rate calculated at the beginning of the tightening cycle, in an area where the constraints are much lower than those of the yield point. The calculation starts from the angle threshold. The reference torque rate is known when the spindle has run the first N degrees, N being the $\Delta\alpha$ value (number of samples) allowing the calculation of the torque rate. The system stops when the torque rate becomes lower than the "reference torque rate" by X%, X being the percentage of the target torque rate. **It is the yield point.**

The default values are: N = 16 and X% = 50

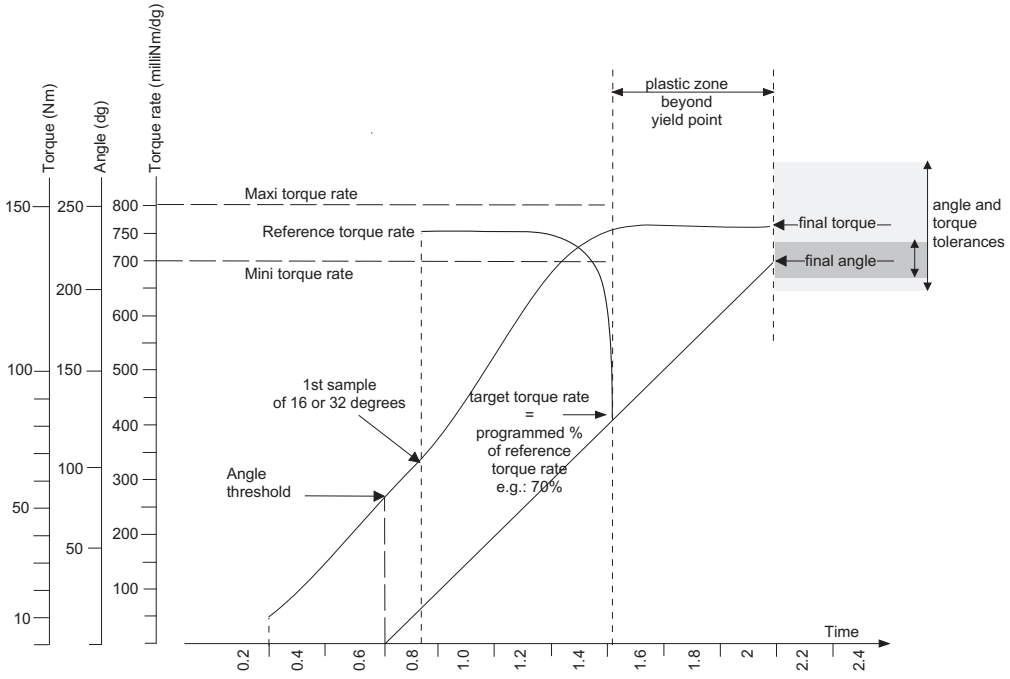
When tightening in the plastic zone, the system waits until the spindle reaches a given angle (angle in plastic zone) after the yield point, then it stops the motor.

The recorded values are the following: final torque, final angle and final torque rate.

Spindle stop
IF (torque rate ≤ x% of the reference torque rate
OR angle in plastic zone exceeded
OR "reference torque rate" > max. torque rate **OR** < min. torque rate
OR torque > max. torque
OR angle > safety angle
OR torque rate > max. torque rate

Accept report
IF reference torque rate ≤ max. torque rate
AND reference torque rate ≥ min. torque rate
AND min. torque ≤ torque ≤ max. torque

AND min. angle ≤ angle ≤ max. angle



10 - TORQUE + ANGLE CONTROLLED UNTIGHTENING

In addition to monitoring the untightening of the fastener, the system monitors the number of degrees reached while maintaining a residual torque in the fastener.
The control phase starts **IF** torque > breakaway torque

The recorded values are the following: final torque and final angle
Spindle stop
IF torque ≤ target torque
OR torque > safety torque
OR angle > max. angle
Accept report
IF torque < safety torque
AND min. torque ≤ final torque ≤ max. torque
AND min. angle ≤ final angle ≤ max. angle

11 - ANGLE + TORQUE CONTROLLED UNTIGHTENING

The recorded values are the following: final torque and final angle.

Spindle stop

IF angle ≥ target angle

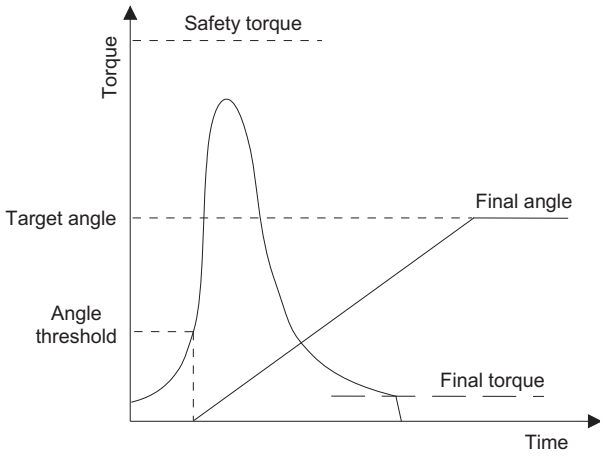
OR torque > safety torque

Accept report

IF torque < safety torque

AND min. torque ≤ final torque ≤ max. torque

AND min. angle ≤ final angle ≤ max. angle



APPENDIX 2 - PRINTING FORMATS FOR RESULTS

1 - PC2 FORMAT

1	char.	<CR>
2		range or cycle number
2		fastener number
3		«T=+»
5		torque in 1/10 of Nm
1		<LF>
1		“ “
1		<CR>
2		range or cycle number
2		fastener number
3		«A=+»
5		angle in 1/10 of degree
1		<LF>
1		“ “
1		<CR>
2		range or cycle number
2		fastener number
3		«TR=+»
5		torque rate in 1/1000 Nm/dg
1		<LF>
1		“ “

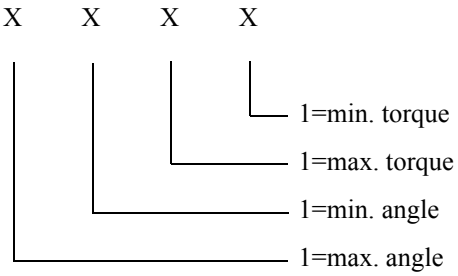
The last result in the list ends with <LF><LF> instead of <LF>"".
Example of result: <CR>0109T=+00400<LF> <CR>0109A=+01200<LF> <CR>0109TR=+00580<LF> .

2 - PC3 FORMAT

1	char.	A (frame type)
3		station number (1 to 250)
3		port number (1 to 32)
1		configuration (A to O correspond to configurations 1 to 15)
1		Z (system identifier)
1		report code (see chart below)
6		date (year, month, day)
6		time(hour, minute, second)
8		torque
5		Angle
1		<CR>
1		Checksum (modulo sum 256 of the previous characters) not calculated for the moment
1		<LF>

The last result in the list ends with <LF><LF> instead of <LF>.

Report code : ASCII code 0100



According to the various combinations, the following characters will be obtained:

@	accept torque	accept angle
A	min. torque	accept angle
B	max. torque	accept angle
D	accept torque	min. angle
E	min. torque	min. angle
F	max. torque	min. angle
H	accept torque	max. angle
I	min. torque	max. angle
J	max. torque	max. angle
0x00	on servodrive fault or spindle belonging to reject group or cycle start drop or cycle not completed for spindle or transducer fault	

Example of result: A001001BZ@92120811021500041.7500121<CR><CS><LF>

3 - PC4 FORMAT

Title
Names of the columns of the lines of results (depending on the language) and measuring unit on a 2nd line:

Rdg N°	Sp	Cy	Ph	Date	Time	Torque	Angle	Torque rate	Stanby characters	CR
						Nm	dg	Nm/dg		
xxxx	xx	xx	xx	xx/xx/xx	xx:xx:xx	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxx

Result

1	char.	<CR>
4		Reading number
1		" "
2		Spindle number
1		" "
2		Cycle number
1		" "
2		Phase number (= 2 blanks if cycle result)
1		" "
8		Date in DD/MM/YY format
1		" "
8		Time in hh:mm:ss format
2		" "
6		Torque
2		" "
6		Angle
2		" "
6		Torque rate
2		" "
6		Stanby characters
2		" "
3		Report code in 3 letters
1		<LF>

In "Print at end of cycle" mode, the reading number is replaced by blanks.
If one of the values is missing in the unit (eg: torque rate), it is replaced by blanks.

Example of result: <CR>1223 02 03 00 18/04/03 09:03:45 0030.2 0120.5 0.5680 B <LF>

Report code : The codes emitted on letters are used for digital report outputs or printouts. All these codes correspond to specific displays. The table below shows the corresponding codes displayed. On the contrary, if some messages on the screen do not correspond to a letter, it means that they are not emitted.

Code emitted on 3 letters			Code displayed on the screen
1st Letter	2nd Letter	3rd Letter	
"A"			"Accept"
"R"			"R"
	"t"		"Tmin"
	"T"		"TMAX"
	"a"		"Amin"
	"A"		"AMAX"
	"r"		"Rmin"
	"R"		"RMAX"
	"m"		"Mmin"
	"M"		"MMAX"
	"G"		"Grou"
		"V"	"Srv"
		"P"	"Prg"
		"S"	"Esc"
		"A"	"Ang"
		"S"	"Dcy"
		"i"	"Imax"
		"t"	"Time"
		"e"	"Ext"
		"o"	"Syn"
		"-"	"---"

4 - PC5-A FORMAT

Report per spindle: torque rate, torque, angle:

F0	start of frame character			
01				
xx	report (in hexadecimal notation):			
02				
xx		00		
03		TR	torque rate report	
xx		AA	angle report	in binary notation
04		TT	torque report	
xx			where TR, AA or TT =01	if low report
05			11	if accept report
xx			10	if high report
06				on servodrive fault
xx				spindle belonging to reject group
07			00	cycle start drop
xx				cycle not completed for spindle
08				transducer fault

e.g.: if accept report for all the spindles

F0 01 3F 02 3F 03 3F 04 3F 05 3F 06 3F 07 3F 08 3F

Reading results of spindle 1 (x times the number of spindles):

01	spindle number
xx	
xx	applied torque (ASCII notation)
xx	e.g.:100.1 Nm
xx	30 31 30 30 31
xx	
xx	
xx	angle (ASCII notation)
xx	e.g.:40.0 °
xx	30 30 34 30 30
xx	

xx

xx torque rate (ASCII notation)
xx e.g.:0.900 Nm/°
30 30 39 30 30
xx

xx

FF end of frame character

5 - PC5-B FORMAT

Report per spindle: torque, angle, torque rate:

F0 start of frame character

01

xx report (in hexadecimal notation):

02

xx 00

03 TT torque report | in binary notation

xx AA angle report | in binary notation

04 TR torque rate report | in binary notation

xx where TR, AA or TT =01 if low report

05 11 if accept report

xx 10 if high report

06 on servodrive fault

xx spindle belonging to reject group

07 00 cycle start drop

xx cycle not completed for spindle

08 transducer fault

e.g.:if accept report for all the spindles

F0 01 3F 02 3F 03 3F 04 3F 05 3F 06 3F 07 3F 08 3F

Available parameters programmed for 1 spindle (x times the number of spindles):

01 spindle number in BCD

xx

xx minimum torque in 1/10th of Nm (ASCII notation)
xx e.g.: 90.0 Nm
30 30 39 30 30
xx

xx

xx

xx target torque in 1/10th of Nm (ASCII notation)
xx e.g.: 100.0 Nm
30 31 30 30 30
xx

xx

xx

xx maximum torque in 1/10th of Nm (ASCII notation)
xx e.g.: 110.0 Nm
30 31 31 30 30
xx

xx

xx

xx minimum angle in 1/10th of degree (ASCII notation)
xx e.g.: 100.0 °
30 31 30 30 30
xx

xx

xx

xx target angle in 1/10th of degree (ASCII notation)
xx e.g.: 105.0 °
30 31 30 35 30
xx

xx

xx

xx maximum angle in 1/10th of degree (ASCII notation)
xx e.g.: 110.0 °
30 31 31 30 30
xx

xx

xx

xx minimum torque rate in 1/100th of Nm/degree (ASCII notation)
xx e.g.: 1.22 Nm/°
30 30 31 32 32
xx

xx

xx

xx target torque rate in 1/100th of Nm/degree (ASCII notation)
xx e.g.: 0.98 Nm/°
30 30 30 39 38
xx

xx

xx

xx maximum torque rate in 1/100th of Nm/degree (ASCII notation)
xx e.g.: 1.30 Nm/°
30 30 31 33 30
xx

xx

Results of spindle 1 (x times the number of spindles):

01 spindle number

xx

xx applied torque (ASCII notation)
xx e.g.: 100.1 Nm
30 31 30 30 31
xx

xx

xx

xx angle (ASCII notation)
xx e.g.: 40.0 °
30 30 34 30 30
xx

xx

xx

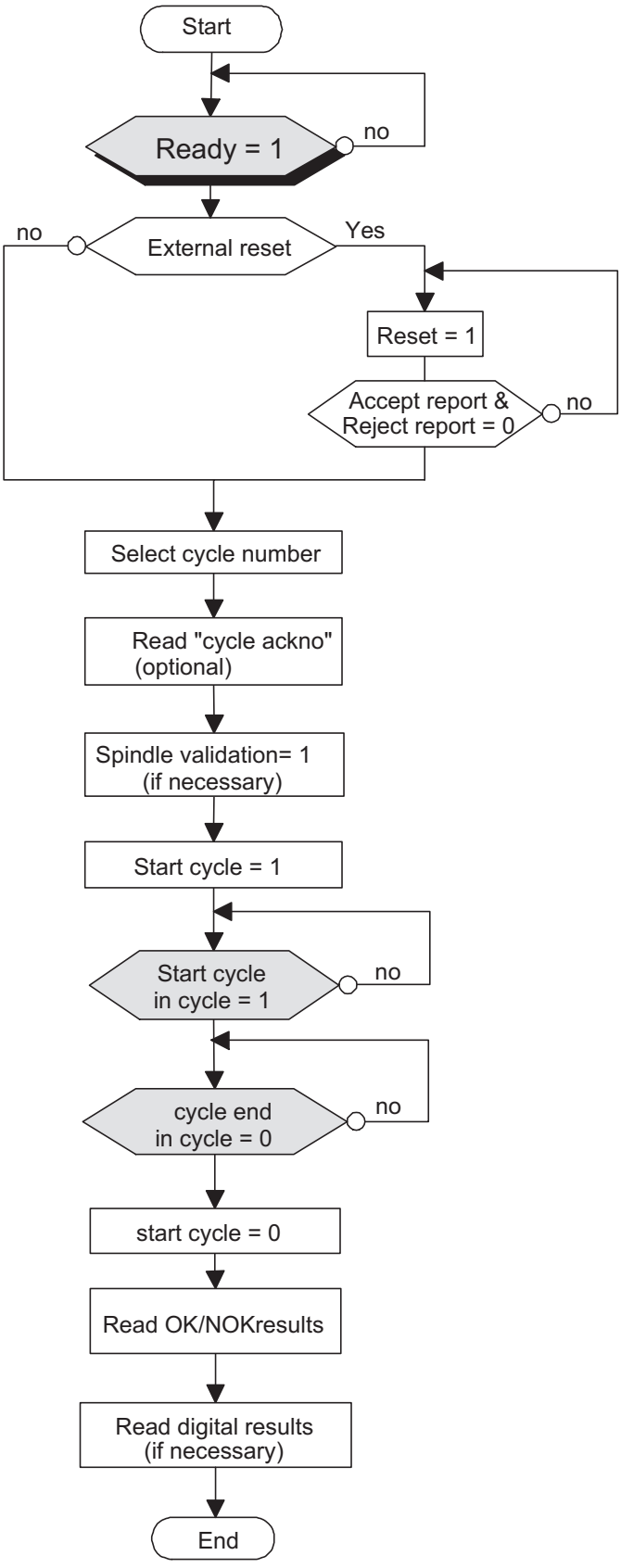
xx torque rate (ASCII notation)
xx e.g.: 0.900 Nm/°
30 30 39 30 30
xx

xx

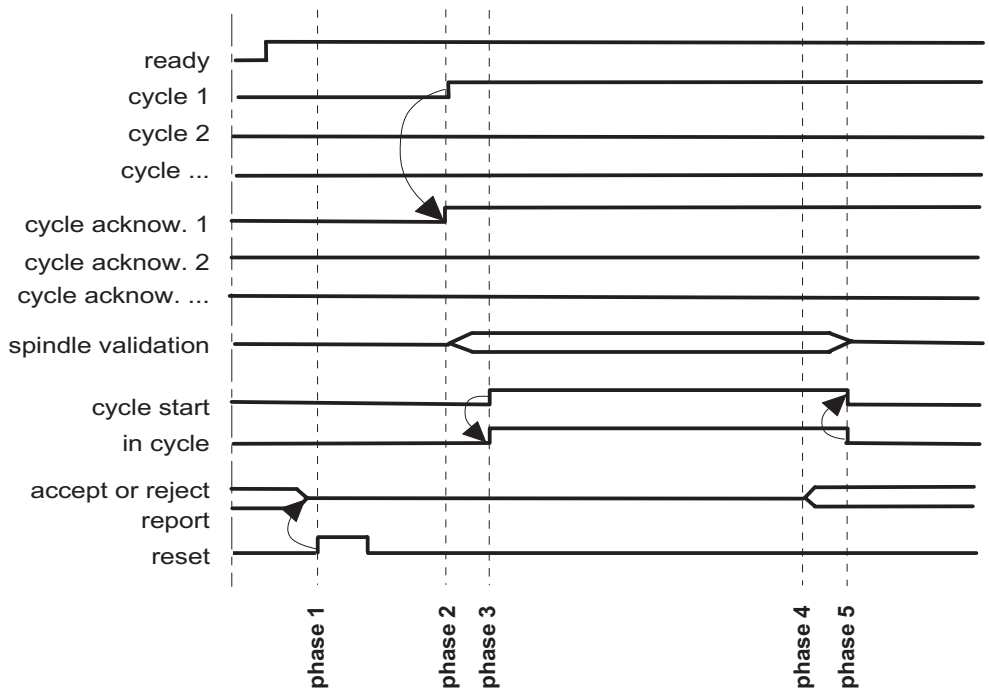
FF end of frame character

APPENDIX 3 - CYCLE FLOWCHART AND TIMING CHART

1 - CYCLE FLOWCHART



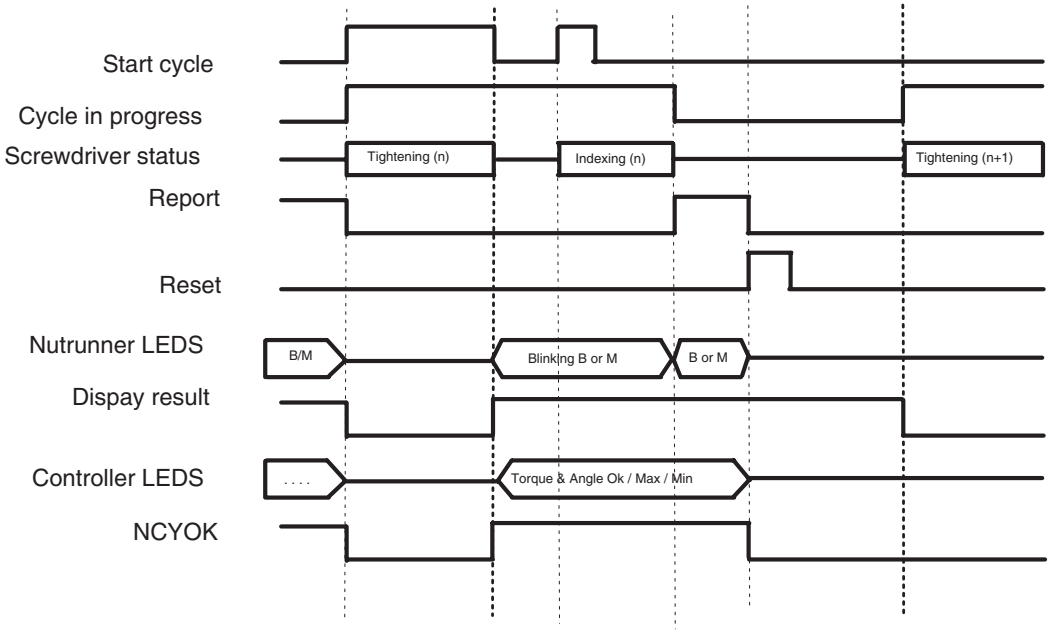
2 - CYCLE TIMING CHART



- phase 1 : resetting is initiated by the PLC --> resets the report. (This PLC control is not compulsory).
- phase 2 : the controller receives cycle no. 1 --> cycle acknowledge no.1 is validated (if the cycle is programmed).
- phase 3 : the controller receives the "cycle start" --> validates the "in cycle" signal.
- phase 4 : at the end of the cycle, the controller validates an "accept" or "reject" report which is sent to the PLC.
- phase 5 : the "in cycle" signal returns to zero when all the operations of the system are over.

To optimise cycle time, the PLC or digital control can be synchronised with the "accept report" or "reject report" signal but the tightening system is not ready to receive new commands (resetting, etc.) until the "in cycle" signal has dropped.

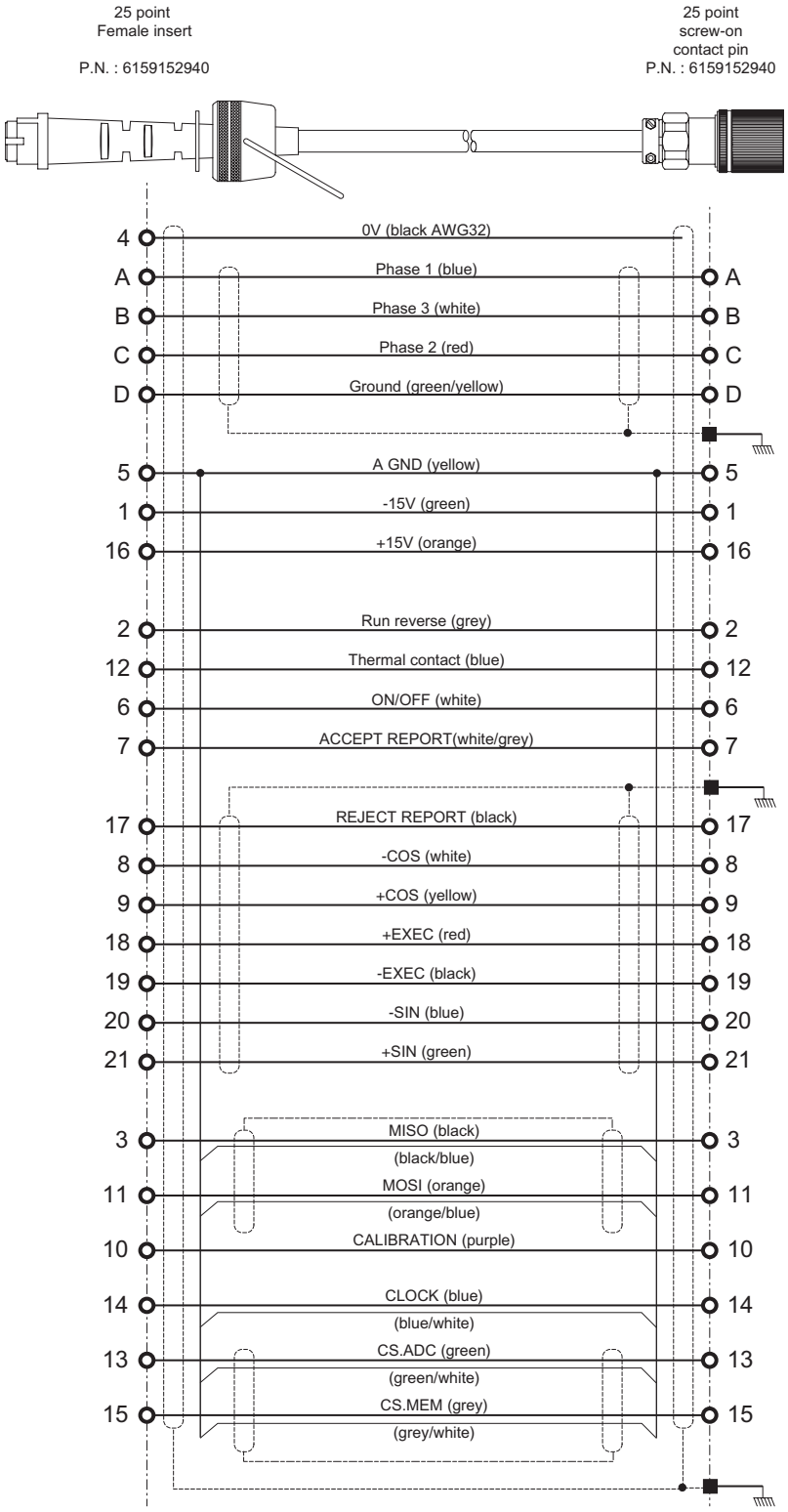
Timing chart when using a crowfoot tool



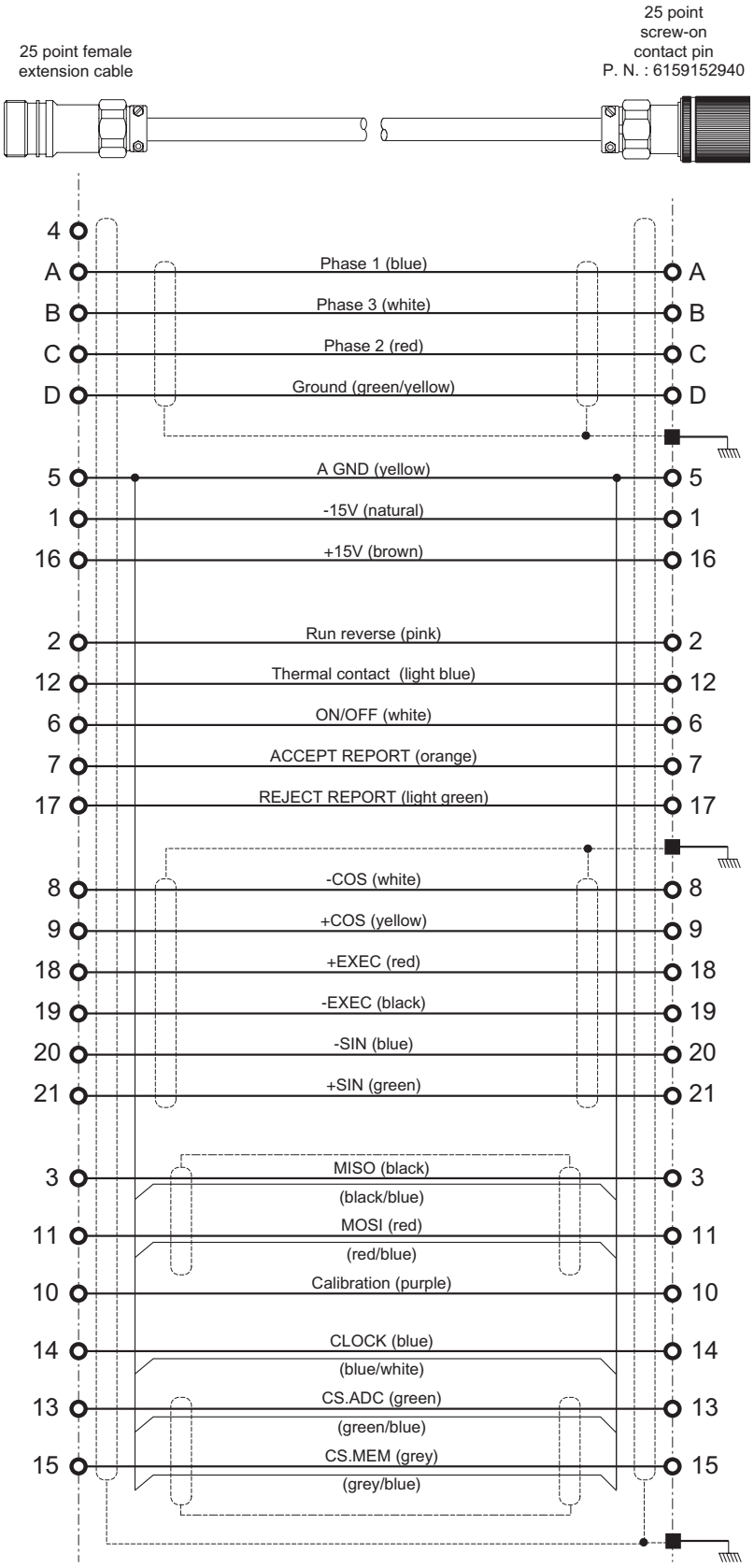
CYCLE FLOWCHART AND TIMING CHART

APPENDIX 4 - CABLES AND CONNECTORS

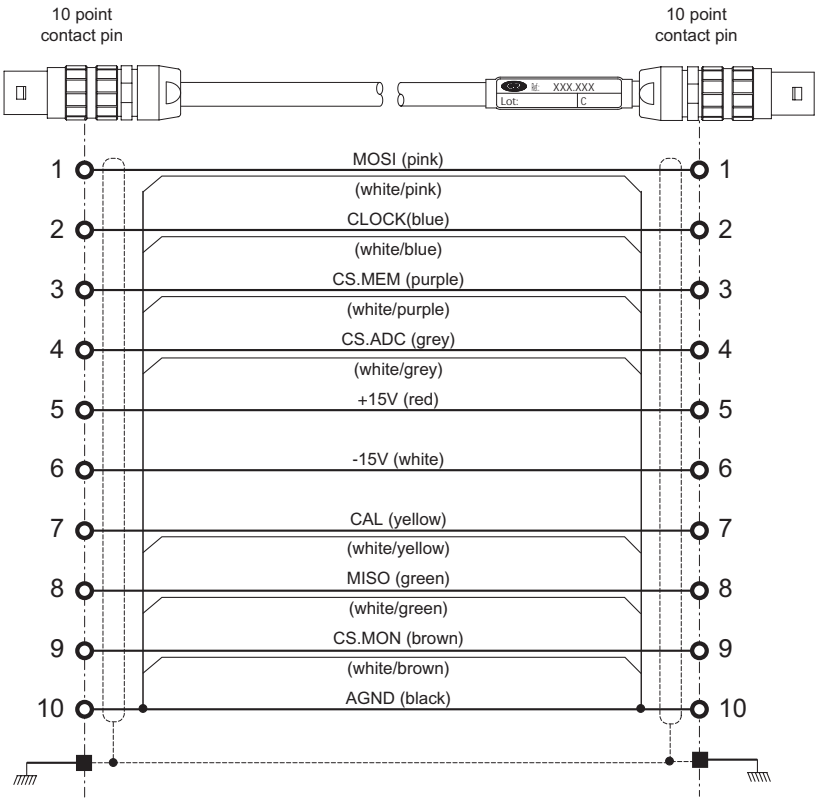
1 - CABLE (ELECTRIC POWER PORTABLE TOOL "ER" RANGE)



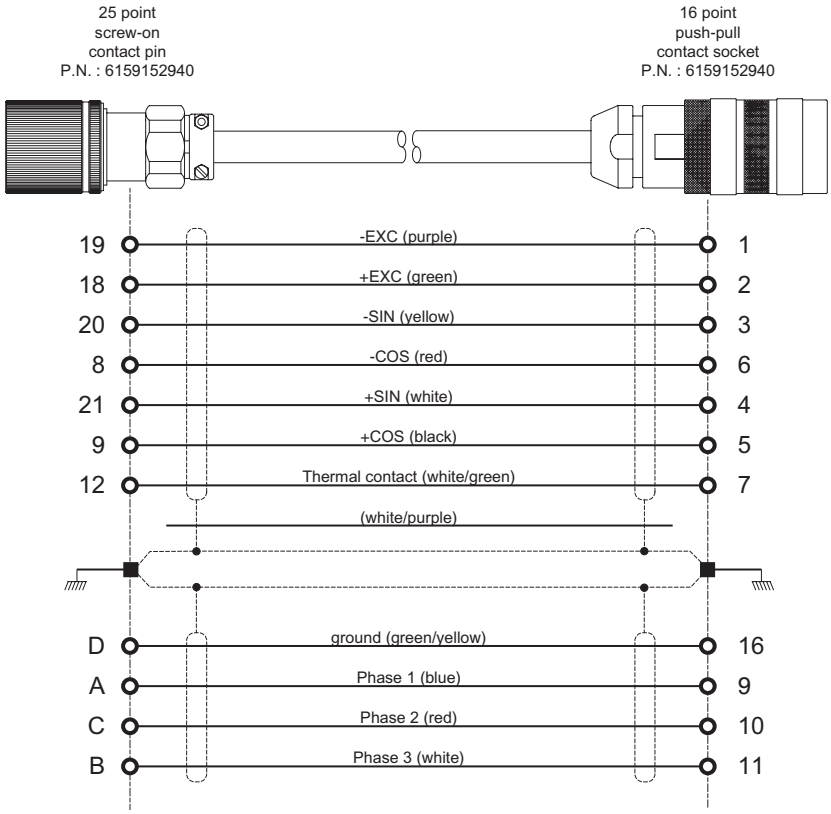
2 - CABLE COUPLER (PORTABLE ELECTRIC POWER TOOL, "ER" RANGE)



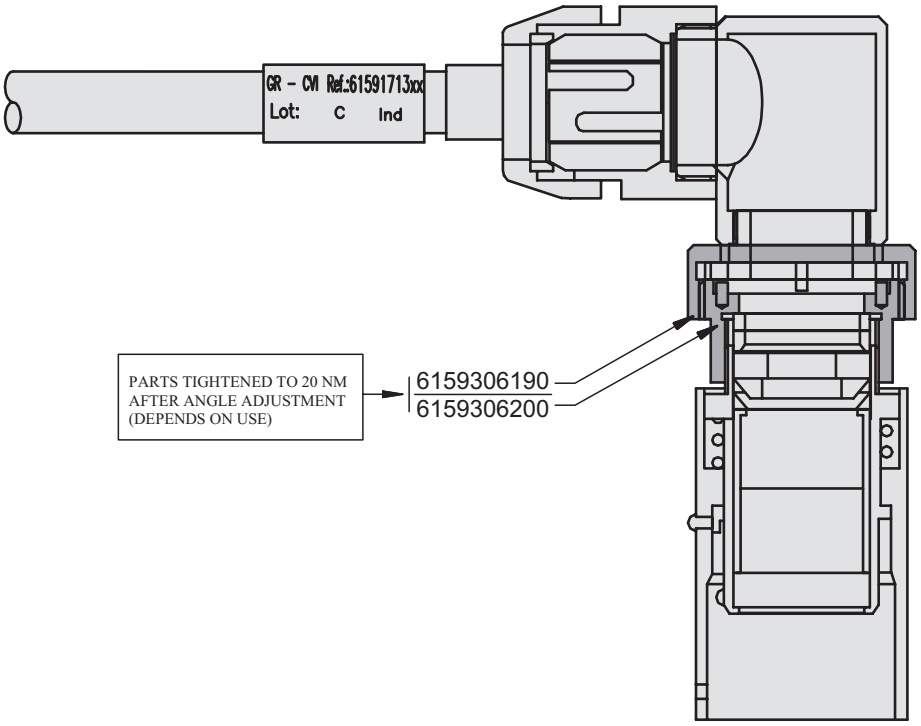
3 - MOTOR CABLE (FIXED ELECTRIC POWER TOOL, "EM" RANGE)



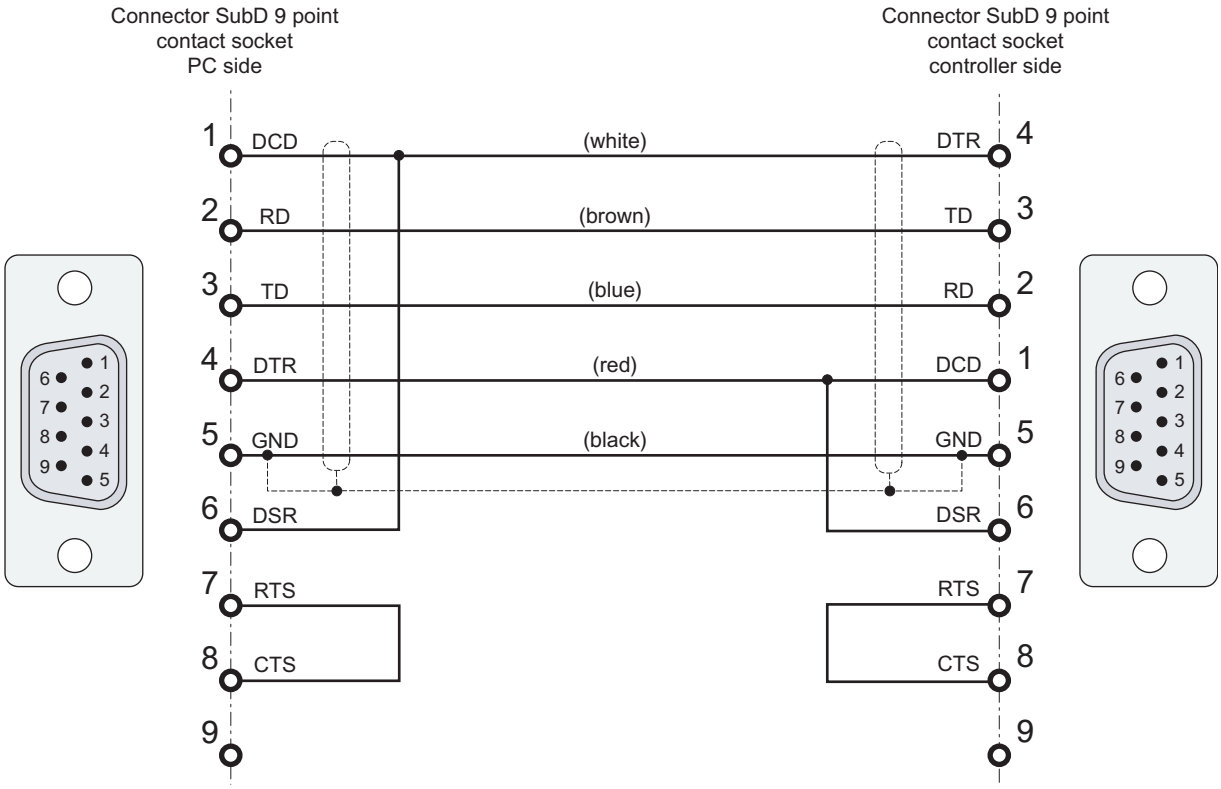
4 - TORQUE CABLE (FIXED ELECTRIC POWER TOOL, "EM" RANGE)



5 - RECOMMENDATION FOR TIGHTENING A BENT CABLE FOR EM



6 - PC/CONTROLLER CABLE



APPENDIX 5 - ELECTRONIC BOARDS

1 - MICROPROCESSOR + POWER SUPPLY + I/O BOARD

1.1 - Function

Controls the electric motor, the tightening cycles and communication (serial lines; parallel input and output links, field bus), together with the storing of the results.

1.2 - Technical features

Power supply:	5 VDC / 300mA
Microprocessor:	Motorola 68332
Communication processor:	68302 (3 serial links)
flash EPROM:	512 ko
saved RAM:	1 Mo

1.3 - Description

Plug-in board without front panel (size 220 x 233.35).

2 - - SERVODRIVE BOARD 8515

2.1 - Features

Working voltage:	from 110 to 250 VAC
Maximum current :	50 A
Installed power:	single-phase: 1,8 kW
Protections:	ceramic quick-acting fuse 20A (6.3x32)
	excess current 60A
	integrated differential circuit-breaking

2.2 - Function

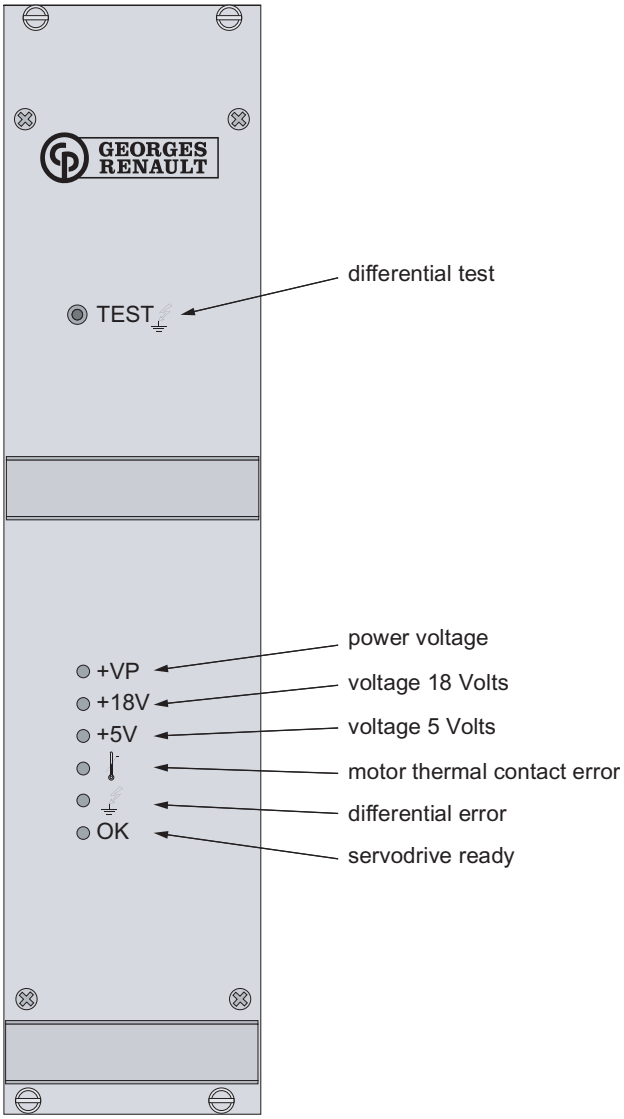
Controls autosynchronous 6-pole motors, equipped with a resolver type location sensor.

2.3 - Description

6U board, integrated in a shielded 12TE drawer and fitted with two 48-point connectors, type 41612 shape F.

Overall size: 261.75 x 60.62 x 250 mm.

Description of the front side of the servodrive board



APPENDIX 6 - PARTS LIST

Part number	Description	Drawing No.
6159326180	CVIS II controller	8285
6159187215	Servodrive board	8515
6159188270	Microprocessor + power supply + I/O board	8606
6159189980	CVIS II keyboard	8279
6159234610	Display	8602-1502
6159188130	Display board	8602
6159224770	Chemical condenser 5600 µF/400V	-
2050478153	Warning label	2050478153
6159228870	Lithium button battery 3V48mAh CR2450	-
6159153890	Instant stop connector	-
6159229920	10x38 8A AM Fuses	-
6159305190	Wall-hanging system	8213

PARTS LIST

APPENDIX 7 - GLOSSARY

Acceleration rate	This is the time expressed in seconds for the tool to switch from the initial speed (the speed during the previous phase) to the speed requested in the next phase. The acceleration rate characterises the acceleration or deceleration of the tool.
Angle reset	This is the action for resetting the angle value. It is usually performed at the beginning of the cycle for the whole cycle but it can also be performed at the beginning of any phase of the cycle. In the latter case, the final torque report takes the events into account from the latest Resetting action.
Angle threshold	This is the torque value from which the angle measurement is started in a phase which takes the screw angle as a basis. It is usually set to 50% of the final torque for a "Torque+Angle" tightening strategy. It is set as low as possible from the linear zone of the joint for an "Angle + Torque" strategy.
Autotest cycle	It is possible to run an autotest cycle to regularly check the correct operation of the tool at free speed. This autotest cycle can be any cycle among the tightening cycles; only its programming is specific to check that the tool runs at a given angle and that the torque transducer provides correct indications. This function is recommended for automatic stations.
AZC	This is an Automatic Zero Control. This task consists in measuring the residual signal of the transducer (offset) when the latter is stress-free, to store it then to subtract it from the measurement. This allows you to display a torque equal to zero when no torque is applied.
Bandwidth	The bandwidth of a system is expressed in Hertz. This is the ability of a system to react more or less rapidly or to eliminate (filter) more or less interferences. For most tightening applications, a 128 Hz bandwidth is defined which allows to find a compromise between speed and filtering. When the bandwidth is reduced, the system filters to a higher extent (eliminates more interferences) but it is slower, which may result in a difference between the torque applied and the torque measured by the system.
Cycle	A cycle is a tightening program which consists of several concatenated phases, each phase being adapted to the various stages of the tightening cycle. Depending on the systems, it is possible to pre-program and select one or several tightening cycles. This allows the same tool to perform tightenings with various adjustments.
Ergo–stop	When this functionality is enabled, the jerk felt by the operator at the end of the tightening operation is attenuated.
External stop	Generally speaking, the tool is stopped when the magnitude being monitored (torque, angle, torque rate) has been reached. It is an internal stop. It is possible to cause the tool to stop through an external event generated by a PLC for example. In this case, the "external stop" function must be enabled and the "external stop" input must be connected to the source of the event. The internal stops are no longer active.
Gear ratio coefficient	This coefficient is used when a mechanical subassembly is added to a standard tool and when it modifies the overall mechanical gear ratio of the tool. This is the case when an additional gear ratio stage is positioned on the tool output shaft. The angle value displayed is the angle value measured when the tool is of standard type, multiplied by this coefficient.
Nominal load	The "nominal load" is the value of the torque for which the transducer generates the "sensitivity" signal. This data is stored in the tool. The unit reads the nominal load each time it is switched on and each time there is a tool change in order to constantly compute the correct torque value. This data can be displayed but cannot be modified.
Nominal load coefficient	This coefficient is used when a mechanical subassembly is added to a standard tool and when it modifies the output torque of the tool. This is the case when an additional gear ratio stage is positioned after the torque transducer. The torque value displayed is the torque value measured by the tool transducer, multiplied by this coefficient.

GLOSSARY

Phase	A phase corresponds to a basic program step of the cycle. The program runs the phases one after another, from the first one to the last one. As an example: a typical cycle includes a runDown speed phase (D) then a final speed phase (F), each containing the data required for their execution. The maximum number of phases varies according to the systems.
Power	This is the word used to define the maximum current and therefore the maximum torque allowed in a phase. It is expressed as a percentage of the maximum current for a given tool. For instance, 100% corresponds to the full power available to run a phase. 50% indicates that the tool will not be able to supply more than 50% of its maximum torque. The Torque / Power correlation is given for information. There is no calibration between these magnitudes.
Safety angle	This is an angle value which causes the tool to stop when the said value is reached whereas all the other stop conditions have failed. This applies to the strategies where the stop magnitude is different from the angle. It allows you to protect the tool or the joint in the event of a fault.
Safety torque	This is a torque value which causes the tool to stop when the said value is reached whereas all the other stop conditions have failed. This applies to the strategies where the stop magnitude is different from the torque. The safety torque allows you to protect the tool or the joint in the event of a fault.
Sensitivity	Sensitivity is a coefficient expressed in mV/V which indicates the value of the signal generated by the torque transducer when the said transducer is supplied with 1 V and for a torque equal to the "nominal load". This data is stored in the tool. The unit reads the sensitivity each time it is switched on and each time there is a tool change in order to constantly compute the correct torque value. This data can be displayed but cannot be modified.
Station	A station is a combination of tools operating together in a synchronous mode. The simplest station consists of one tool only. The maximum number of tools depends on the system. An overall report is produced for the station.
Torque reset	This is the action for resetting the torque value. It is usually performed at the beginning of the cycle for the whole cycle but it can also be performed at the beginning of any phase of the cycle. In the latter case, the final torque report takes the events into account from the latest Resetting action.