CVIC-MODCVIC

CVIC controller- Release 1.6
MODCVIC module - Release 1.6

Manual no.: 6159932010

Lou Zampini & Associates
2 Douglas Pike, Rt. 7
Smithfield, RI 02917
1 800 353 4676
FAX 1 401 679 0165

Table of contents

SECTION 1 - WARNINGS

1 - INSTALLATION

Mains voltage:
All the controllers of the range (CVIC and MODCVIC) can operate equally from 115V to 230V ± 10%; 50 to 60Hz without adjustment and without fuse change.
The CVIC controllers are supplied with single-phase current. The MODCVIC modules are supplied with three-phase current.

Power:
The average power required for a CVIC-2 system is approximately 0.500KW
The average power required for a CVIC-4 system is approximately 0.650 KW

Circuit-breakers:
Should circuit-breakers be installed at line head, we recommend that you select equipment with the following specifications:

For CVIC controller
- Single-phased 230V 4A - curve C
- Single-phased 115V 6A - curve C

For MODCVIC module
- Three-phase 230V0.75 KVA - Thermal 2.5 to 4 A - Magnetic > 45 A
- Three-phase 115V0.75 KVA - Thermal 4 to 6.3 A - Magnetic > 45 A

Earth:
Make sure that the controller is earthed via a protective conductor. It is recommended to secure the controller to an earthed metal mounting insofar as possible, in order to strengthen immunity to electromagnetic interference.

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

2 - SAFETY

Opening the controller
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 several minutes have 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.

Fuses:
The controller has a thermal protection and a protection by means of fuses in conformance with the major electrical safety requirements as set forth in the Low Voltage Directive 73/23/EEC, amended by directive 93/68/EEC.
Never replace the fuses by fuses of higher value. Never replace both fuses by a short-circuit.

Earth:
The operator is protected by means of a protective conductor which connects the tool to the controller. This protection is efficient only if the controller is correctly earthed as recommended in § 1.

Insulation fault:
The protection of the operator against any insulation fault of the cable or the tool is provided by the controller which stops the fastening tool immediately after detecting the fault. The fault is displayed on the screen.

Burning hazard:
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 **GEORGES RENAULT** 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 fastening tool. It can start again only if the temperature decreases to under 80°C.

Tool change:
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 controller is switched on.

Safety instructions for operating the tools:
For your satisfaction and safety, we recommend that you read carefully the safety guides supplied with the tools to be given to the operators.

SECTION 2 - INTRODUCTION

The electric tightening system is automatically controlled by measuring the power consumption of the tool and monitoring the angle rotation. This technology provides a complement to the range of traditional systems fitted with a torque transducer. The electric power tool connected is either portable (EC) or fixed (MC, MCL).

To familiarise yourself with the keyboard of the controller, refer to paragraph 3.1.3., which explains the procedure that will allow you to program the various parameters of the controller.

1 - CVIC CONTROLLER

Two controller models are available: -2 and -4
For example: CVIC M-2 for controlling tools with a very low torque: ECD5, ECP5, MC35-10, ECA15
CVIC M-4 for controlling all of the other tools in the range.

Each model is available in three versions: L, M and H

Main differences between versions	L	M	H
Programming modes:			
Quick cycle	✓	✓	✓
Automatic programming	✓	✓	✓
Number of cycles	0	7	7
1 cycle in the tool	✓	✓	✓
Number of phases available	3	5	15
Characteristics of the phases:			
Search sequence		✓	✓
Approach	✓	✓	✓
Run down speed	✓	✓	✓
Final speed phase	✓	✓	✓
Action on NOK		✓	✓
Run Reverse			✓
Jump to another phase			✓
Prevailing Torque			✓
Synchronisation phase			✓
Tightening strategies:			
Torque		✓	✓
Torque with angle monitoring	✓	✓	✓
Angle with torque monitoring			✓
Number of stored results	0	100	100

2 - MODCVIC CONTROL MODULE

The MODCVIC is the rackable version of the CVIC controller.
Two models are available: MODCVIC-2 and MODCVIC-4 and two versions: "L" and "H"
Without keyboard or display, the MODCVIC must be connected to a PC, temporarily for programming, data transfer and retrieval of tightening results and permanently to display its real time operation.
A single programming software (CVIS/CVIC PC2000) is used to program the MODCVIC, whether in point-to-point or in network connection.
As many as 32 MODCVICs can be networked to the PC.
The MODCVIC can be connected to only one serial port:

- either to the serial printer to print the tightening results in order of occurrence and simultaneously to the bar code reader
- either to the PC

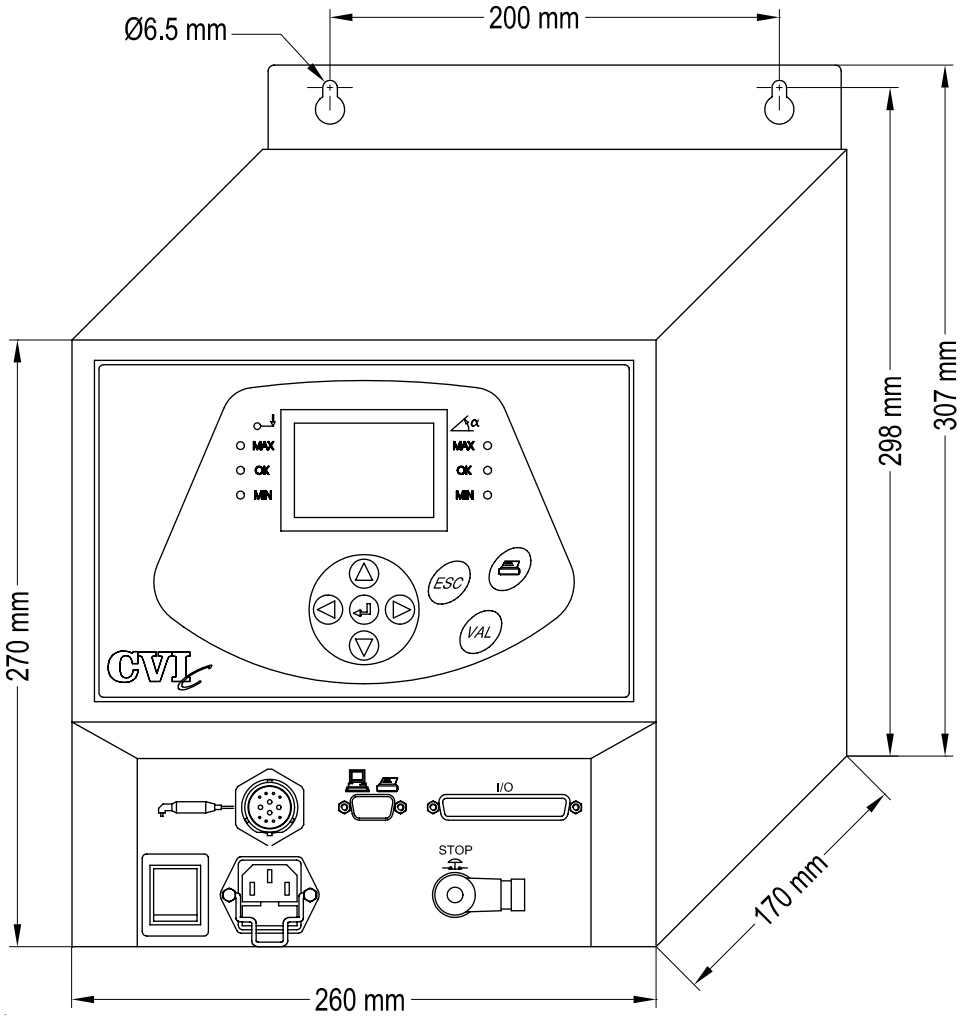
The PLC is connected via the relay Inputs/Outputs.

SECTION 3 - DESCRIPTION OF CVIC CONTROLLER AND MODCVIC MODULE

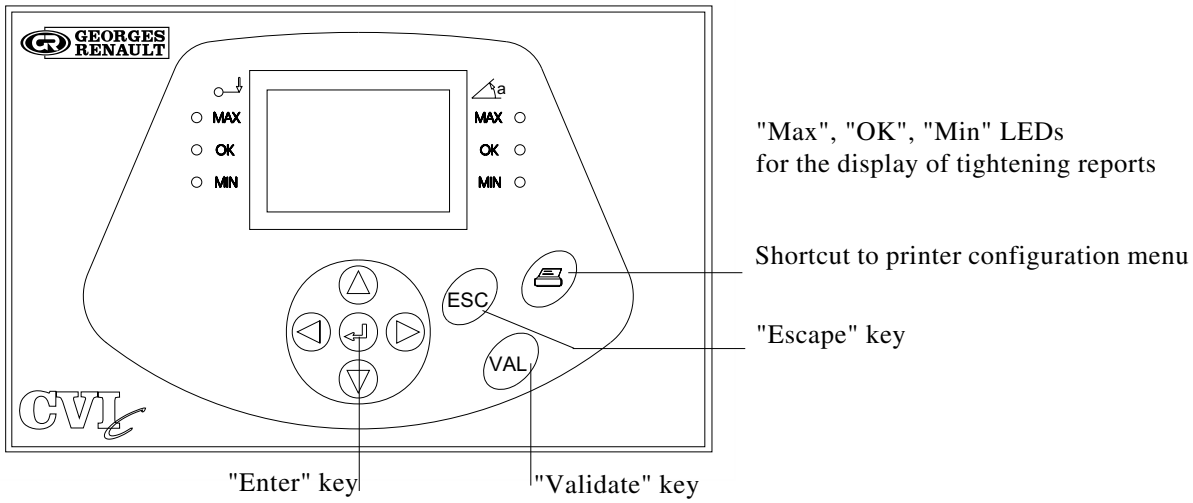
1 - CVIC controller

1.1 - Mechanical characteristics

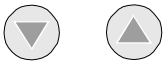
Weight	4 800 g	
Overall size	width	260 mm
	depth	170 mm
	height	270 mm



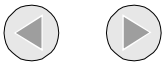
1.2 - Keyboard Layout and Operation



Description of the keys



- to scroll through a menu.
- to scroll through a data entry screen.
- to increment digits in digital entry mode.



- to scroll through a (lozenge-tagged) list.
- to scroll through a data entry field.
- to enter an alphanumerical value.

- to enter an alphanumerical value.
- to validate a change.
- to display the next screen.

- exit a screen without saving changes.

- exit a screen and validate all changes.

- shortcut to the printer configuration menu

1.3 - Example: Setting the Date and Time

This example describes the access to the "DATE" Menu from the control screen. The programming can be started from one of the menus mentioned below. The access and programming procedure is similar whatever the menu. Then the access path is shown as follows:

Menu: MAIN\SERVICE\DATE

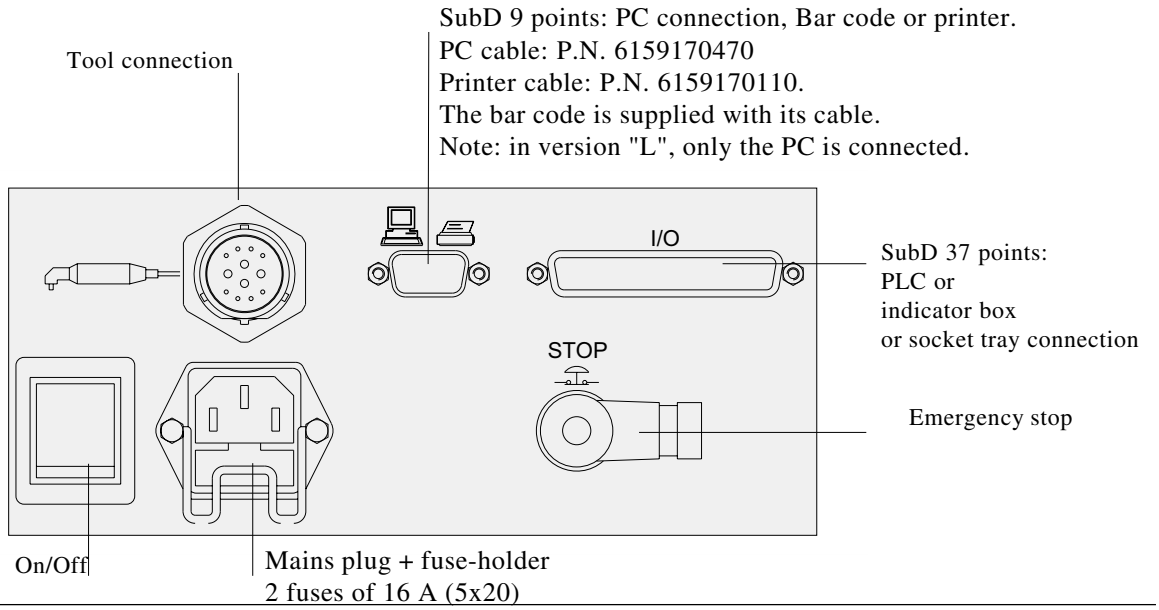
which means that from the MAIN menu, you must select the SERVICE menu, then the DATE menu.

- Press ESC to select the "MAIN" menu.
- Select the "SERVICE" menu by using ▼ and ▲.
- Press ↵ to enter the "SERVICE" menu.
- Select the "DATE" menu by using ▼ and ▲.
- Press ↵ to enter the "DATE" menu.
- Press ▶ to select the date format.
- Press ↵ to validate.
- The cursor will move to the first parameter of the date. Press ↵ to highlight the date.
- The cursor will blink on the first parameter of the date.
- To change the value, press ▼ and ▲.
- To switch to the next parameter, press ◀ or ▶.
- Press ↵ to validate.

1.4 - Screen Symbols

- ↓ means that some information lines cannot be read on the screen. Press ▼ to display them.
- ↓↑ means that some information lines cannot be read on the screen. Press ▼ or ▲ to display them.
- ↑ means that some information lines cannot be read on the screen. Press ▲ to display them.

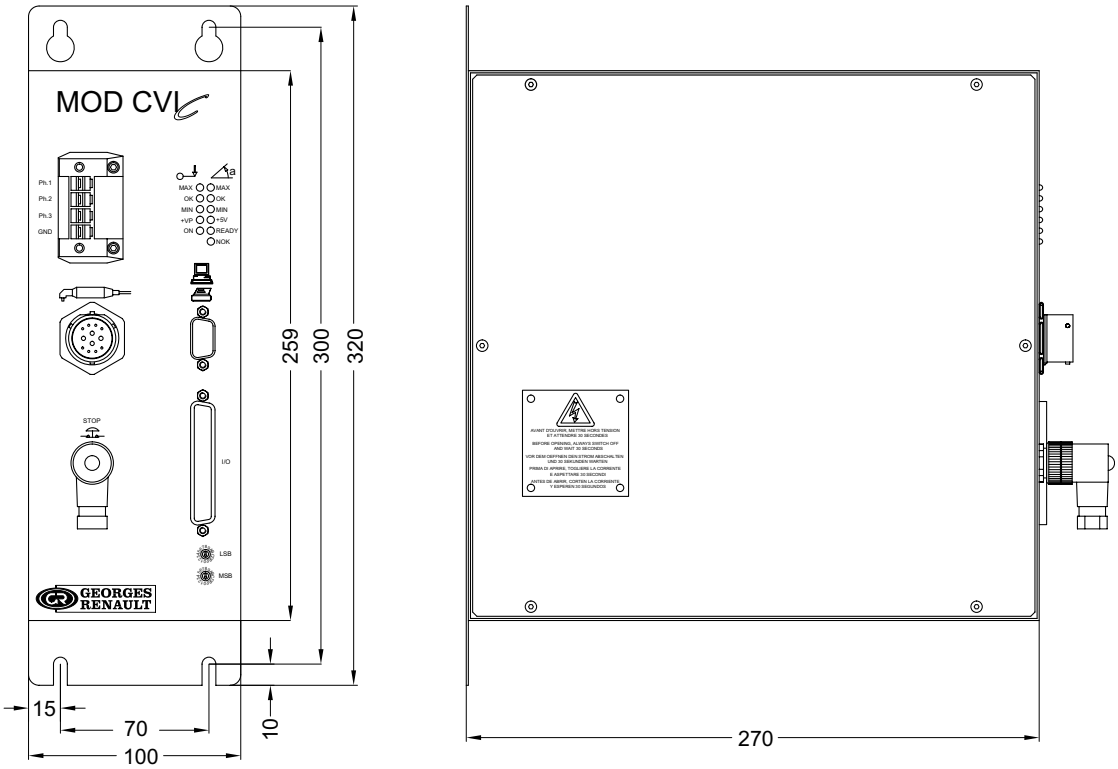
1.5 - Bottom Front Side



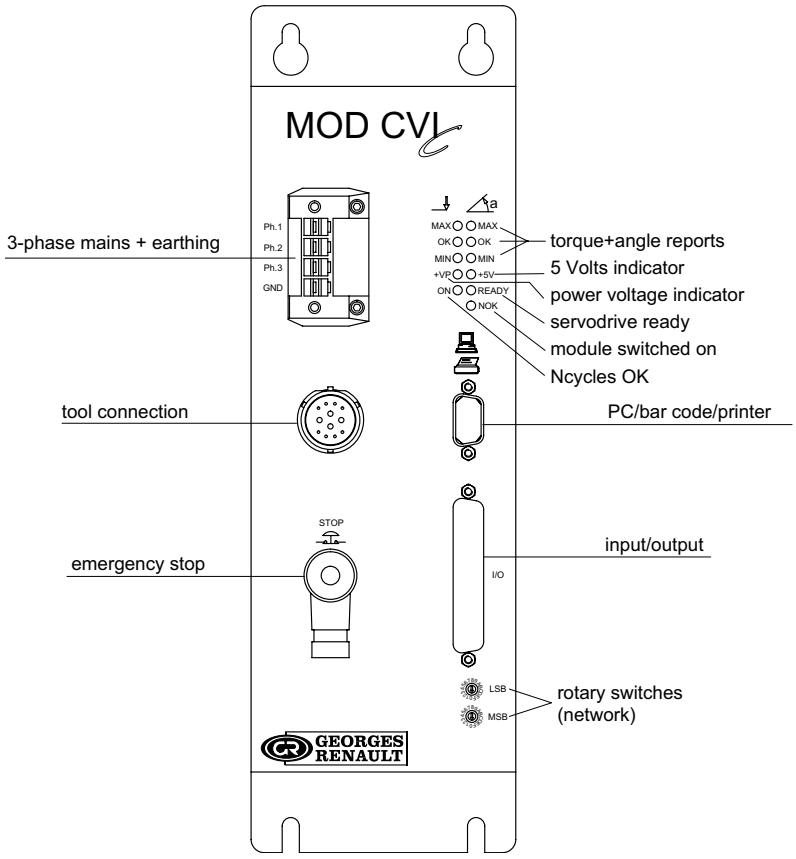
2 - MODCVIC Module

2.1 - Technical and Electrical Features

Weight: 4 300 g
Fastened by means of 4 screws on the back panel of a cabinet

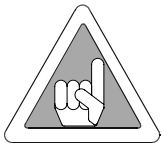


2.2 - Description of the Front Side



SECTION 4 - START-UP

1 - Installation Safety Instructions



Before switching on, make sure that the controller is installed in accordance with the installation and safety instructions mentioned in this manual, Section 1: "Warnings".

2 - Starting up the Controller

On receiving the controller, check that the following elements are included in the support kit:

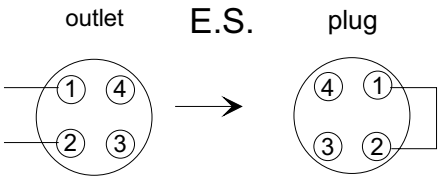
- the SubD 37 point connector
- the mains cable
- 2 fuses of 16A

2.1 - Tool Connection

Make sure that the controller is switched off and connect the tool to the front side of the controller.

2.2 - Emergency Stop

Check that **the "EMERGENCY STOP" (STOP) plug is correctly connected** to the front side of the controller. The emergency stop can be connected either to the PLC, or to a push-button close to the tightening station. If not connected, check that the strap is correctly positioned inside the plug (see diagram opposite). The opening of the " STOP "contact disables the power circuit.



2.3 - Switching on

Trip the switch on the front side of the controller to switch on the controller.

When switched on, the controller automatically detects the correct operation of the tool and of the controller itself. **If everything is OK**, the control screen is displayed by the CVIC.

If a problem occurs when the controller is switched on, the screen displays the message: "*not ready*".

Press ↵ to display a second screen which provides more details about the cause of the problem.

2.4 - Language Selection

- Menu : MAIN\SERVICE\LANGUAGE

- The default language used by the controller is the French language. Use ▼ and ▲ to select your language.

The available languages are: French, English, Spanish, German, Italian and Dutch.

- Validate your selection and press ESC as many times as necessary to go back to the control screen.

See Keyboard Layout and Operation (page 10) and Programming Example (page11) if necessary.

2.5 - Setting the Date and Time

- Menu: MAIN\SERVICE\DATE.
- Allows you to select the format: (DD/MM/YY, MM/DD/YY, YY/MM/DD).
- Setting the date.
- Setting the time.

2.6 - Programming the Tightening Cycles

Presentation of the various tightening cycles.

The controller allows you to have access to various programming levels depending on your knowledge in the field of fastening:

- ***Learning***
  After entering the tightening torque, a guided sequence of tightenings allows the controller to learn the characteristics of the joint to be achieved.

- ***Quick cycles***
  After entering and validating the tightening torque and a maximum tightening angle (optional), the other parameters are automatically set by the controller to default values which comply with most applications.

- ***Cycles***
  In this mode, you can program all the parameters manually (speed, acceleration, run down speed torque, torque tolerances). You can change all the parameters automatically set in the previous 2 programming modes.

For further details, refer to section "Programming the Cycles".

Section 5 - Programming the Version "L" Controller.
Section 6 - Programming the Version "M" and "H" Controller.

SECTION 5 - PROGRAMMING THE VERSION "L" CONTROLLER

1 - "CONTROL" MENU

When starting up the controller, the control screen is displayed by default.
This screen displays the tightening report and the target torque instruction which can be changed directly on the screen.

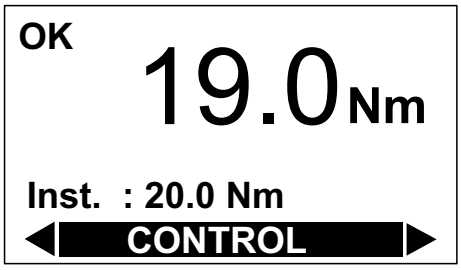
List of tightening reports (this information is shown only after performing a tightening operation):

Accept	accept report
Reject	reject report
TMAX	max. torque
Tmin	min. torque
AMAX	max. angle
Amin	min. angle
Scy	cycle stopped by the interruption of the "cycle start" signal
Imax	stop by overcurrent trip
Time	maximum phase time exceeded (stop by time-out)
Srv	servodrive fault
Prg	programming fault

Press ◀ and ▶ to scroll the menu and move from one screen to another.

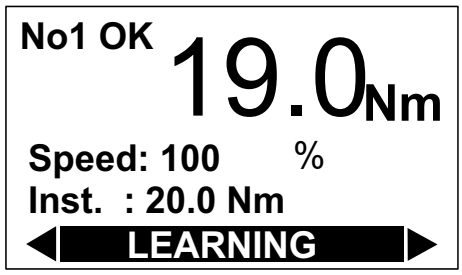
4 screen options are available:

- standard control (OK or NOK) (see screen no.1).
- control with display of the report and of the actual value of the tightening torque (see screen no.2).
- learning (see screen no. 3).
- calibration (see screen no.4).



The "**LEARNING**" screen allows you to determine the best tightening parameters for a given application (run down speed, final speed, etc.).
Before performing the first tightening, the operator must enter the target torque instruction and if required, a speed limitation if the tightening task does not tolerate the maximum speed of the tool (for example: to tighten in a plastic material). The first tightening is performed at reduced speed, the second one at faster speed and the last tightening allows you to finalise the ultimate programming.

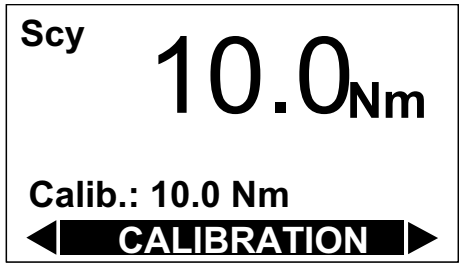
Once the procedure has been completed, the operator will go back to the control screen and save the learning procedure by pressing ↵.



The "**CALIBRATION**" screen allows you to readjust the calibration to the set point of a specific tightening when the automatic calibration has not been deemed sufficient.

After tightening, enter the value read on the standard measuring unit and press ↵ to validate.

In the "MAINTENANCE\CALIBRATION\MANUAL" menu, you can enter up to 5 values. In this case, the correction coefficient corresponds to the mean of the 5 successive tightenings.
This procedure is detailed in the "MAINTENANCE" Section.



2 - "PARAMETERS" MENU

The "PARAMETERS" menu allows you to:

- display the tool features	"SPINDLE" menu
- correct the parameters of the cycle	"CYCLES" menu"
- dedicate the application	"STATION" menu
- program the PC connection	"PC LINK" menu

2.1 - "SPINDLE" Menu

Menu: MAIN\PARAMETERS\SPINDLE
This menu displays the features of the controller and the features read in the tool memory.
The data cannot be changed.

2.2 - "QUICK CYCLE" Menu

Menu: MAIN\PARAMETERS\QUICK CYCLE
It is accessible when no cycle has been saved in the tool memory. This menu allows you to program a cycle without running the LEARNING sequence. By default, the quick cycle contains a run down speed phase and a final speed phase. The operator only programs the target torque and the maximum angle on the screen.

To do so, select a cycle and press  .

For the programming procedure, refer to paragraph 3.1.3.

It is the controller itself which calculates the speeds and all of the other default parameters (minimum speed, maximum speed, etc.).
According to the versions (L - M - H), it is possible to insert and program 1 or several other phases manually.

In the version L CVIC, the tightening cycle is stored in the tool memory and corresponds to cycle "0" (zero). It can include 3 phases: approach, run down speed and final speed phase. Only the run down speed and final speed phases are optimised automatically with the "Learning" and "Quick cycle" programming modes. The approach phase must be inserted and programmed manually. See next pages for the description of the cycle and phases.

2.3 - "CYCLE " Menu

Menu: MAIN\PARAMETERS\CYCLE
It is accessible when a quick cycle has been saved in the tool memory, using one of the LEARNING or QUICK CYCLES programming methods.
It allows you to change the parameters of the Run down speed and Final speed phases obtained in the 2 programming modes.
It allows you to insert an approach phase.
See next pages for the description of the cycle and phases.

2.4 - "STATION" Menu

Menu: MAIN\PARAMETERS\STATION
The "STATION" menu allows you to configure the following parameters:

Unit	Nm/Ft.Lb/In.Lb/Kg.m/Kg.cm
Dir	direction: right/left
Rv speed	this speed is used at each run reverse command by the operator (the run reverse speeds used during the cycle can be programmed in each phase or in each cycle according to the case. (See hereafter in this manual).
Acknow	error acknowledgement: yes/no (to validate start cycle after a reject report).
Scy pulse	start cycle by pulses: the "start cycle" signal is activated by a pulse.
RP duration	A value which is different from 0 allows you to program the pulse (0.1 to 4.0 s) reports (accept, reject) at end of cycle. With a value equal to 0, you can have a constant "0" or "1" status of report.

2.5 - "PC LINK" Menu

Menu: MAIN\PARAMETERS\PC LINK

2.5.1 - Controller

The parameters used for the data transfer to PC are as follows:
RS232/RS422:

RS232	default standard type used for connecting a PC and a single controller
RS422	used in a network configuration only

Baud rate from 300 to 19,200 Bauds, 7 or 8 data bits, 1 or 2 stop bits, no parity/even/odd
Default values: 19,200 Bauds, 8 data bits, 1 stop bit, no parity.

Slave no. : 0-254. In a network configuration, the PC is connected to several controllers at the same time. The "Intermediate" or "end of line" differentiation is obtained by resistance wiring in the connectors of the network cable. (See wiring diagrams).
For further information about the network connection, refer to the "CVIPC" Operator's Manual.

2.5.2 – MODCVIC

For the MODCVIC module, the switching of the communications standard RS232 / RS422 is automatic depending on the address selected by the rotary switches:

- address 0 implies standard RS232 for the connection of a PC and a single controller
- any other address selected implies standard RS422 for a network connection.

The other parameters are set to:

- 19,200 bauds
- 8 data bits
- 1 stop bit
- no parity

They cannot be programmed by the PC.
In the case of a network connection, the "Intermediate" or "end of line" differentiation is obtained by resistance wiring in the connectors of the network cable. (See wiring diagrams).

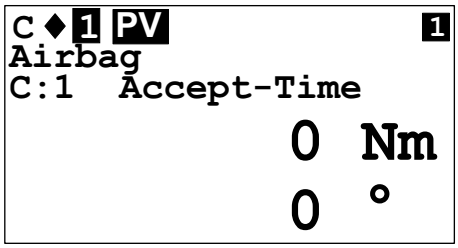
SECTION 6 - PROGRAMMING THE VERSION "M" and "H" CONTROLLER

This section explains how you can change the default settings in the main menus of the controller.

1 - "CONTROL" MENU

Screen no. 1

This screen displays the tightening results of the last run cycle, the detailed tightening report and the status of the NcyOK counter.



List of tightening reports:

Accept	accept report
Reject	reject report
TMAX	max. torque
Tmin	min. torque
AMAX	max. angle
Amin	min. angle
Scy	cycle stopped by the interruption of the "start cycle" signal
Imax	stop by overcurrent trip
Time	maximum phase time exceeded (stop by time-out)
Srv	servodrive fault
Prg	programming fault

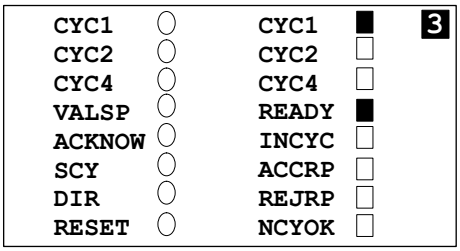
Press ↵ to display an additional message providing information on the origin of the fault.

Press ▲ and ▼ to move from one screen to another

Screen no. 2

Screen no. 2 displays the tightening report: *OK* or *NOK*

Screen no. 3



Screen no. 3 provides information on the status of inputs (left-hand column) and outputs (right-hand column) according to the tightening report.

Press ↵ to display an additional message providing information on the origin of the fault.

2 - "RESULTS" MENU

This menu allows you to display and delete the tightening results.

3 - "PARAMETERS" MENU

The "PARAMETERS" menu allows you to:

- display the tool features	"SPINDLE" menu
- change the programming of a cycle **in detail**	"CYCLES" menu
- **quickly** program a cycle	"QUICK CYCLES" menu
- determine the best programming	"LEARNING" menu
- dedicate the application	"STATION" menu
- program the serial port, the report output, the bar code	"PERIPHERALS" Menu

3.1 - "SPINDLE" Menu

This menu displays the features of the controller and the features read in the tool memory.
The data cannot be changed.

3.2 - "CYCLES" Menu

3.2.1 - Introduction

This menu allows you to change or create the programming of the cycles.
A tightening cycle consists of a sequence of phases run consecutively. Each phase is defined by main parameters and tightening instructions according to the selected type of tightening and motor settings.

Number of phases available	CVIC version M...	5
	CVIC version H...	15

The various phases available in a cycle are:

Search sequence	**S**
Approach	**p**
Run down speed	**D**
Final speed	**F**
Action on NOK	**V**
Empty phase	

The additional phases for version H are:

Run reverse	**R**
Prevailing torque	**P**
Jump	**J**
Synchro waiting	***W***

The procedure for programming the cycle can be broken down as follows:

- Selecting the cycle
- Selecting and sequencing the phases
- Programming the parameters of each phase
- Selecting an Action on NOK or not
- Entering a comment
- Programming the Number of cycles OK

Important: the "0" cycle is a special cycle as it is integrated in the tool memory.
It can include 3 phases: "Approach", "Run down speed" and "Final speed phase".
When connecting the tool, the "0" cycle is selected by the controller if no other cycle input is positioned at 1.
In this way, the tool can be connected and can run its cycle on any controller without new programming.

3.2.2 - Selecting the Cycle

Menu: MAIN\PARAMETERS\CYCLES

The list of the cycles already programmed is displayed. Select a number and press  to validate.

3.2.3 - Programming the Phases

After selecting a cycle, the cursor will move to the line where the various phases of the selected cycle are shown. You will be allowed to modify, insert or delete a phase.

Creating (or changing) a phase:

Using ◀ and ▶ select the phase that you want to change.

To change a phase, press ▼ to select "Chg". Press ↵ to validate.

The phase type is highlighted. Use ◀ and ▶ to select the phase type. Press ↵ to validate.

Inserting a phase

To insert a phase in a cycle already programmed, you must proceed as follows:

1 - Create a blank before the phase before which you want to insert a new phase.

For this purpose, position the cursor on the phase before which you want to insert a new phase.

Select "Ins" by pressing ▼ then ▶.

Press ↵ to validate.

2 - Proceed as before to create a phase.

To change a phase, press ▼ to select "Chg". Press ↵ to validate.

The phase type is highlighted. Use ◀ and ▶ to select the phase type. Press ↵ to validate.

Deleting a phase

Position the cursor on the phase that you want to delete.

Select "Del" by pressing ▼ then ▶. Press ↵ to validate.

Programming the parameters

Using ◀ and ▶, position the cursor on the phase of which you want to program the parameters.

Press ↵ to validate.

Search Sequence Phase (M - H)

The maximum time is simply displayed for the Search sequence phase as it is implicitely equal to the number of rotations multiplied by the rotation time + stop time.

Intertime	time programmed between this phase and the next one: 0 - 20 s
N. rotat.	number of rotations: 1 - 9
Stop time	stop time: 0 - 20 s
Rot. type	rotation type: time/angle
Rot. time	rotation time: 0 - 50 s
or	
Rot. angle	rotation angle: 0 - 999°
Dir	direction: right/left/alternate. If the direction is alternate, half the rotations are clockwise and the other half are in the opposite direction.
Speed	rotational speed: 0 - 100 %
Acceler	acceleration rate: 0 - 20 s

No phase RP

Approach Phase (L - M - H)

It allows you to quickly approach the fastener without reaching the joint. It is particularly recommended in the case of hard joints for which the approach speed should be restricted in order to control the final torque.

Intertime	time programmed between this phase and the next one: 0 - 20 s
N. rotat.	number of rotations performed by the tool during this phase : 0 - 100
T. max	maximum torque which should not be exceeded during this phase: 0 Nm to max. value of the spindle.

Other...

Press ↵.

Thread type	right/left
Speed	rotational speed 0-100 %
Acceler	0-20 s
Reset	The Reset function allows you to reset the torque and/or angle values at the beginning of the current phase.

The phase RP is OK if:

- the torque is lower than the programmed maximum torque
and
- if the programmed number of rotations has been reached

Run down speed Phase (L - M - H)

Max time	phase running time. 0.01 - 99 s
Intertime	time programmed between this phase and the next one: 0 - 20 s
Ttarget	target torque: 0 Nm to max. value of the spindle (screw approach torque)
Other...	

Press ↵.

Motor settings:

Thread	right/left
Speed	rotational speed: 0 - 100 %
Acceler	acceleration rate: 0 - 20 s
Reset	The Reset function allows you to reset the torque and/or angle values at the beginning of the current phase.
External stop	The following conditions must be met for the system to stop the current phase and shift to the next one: - the "external stop" parameter must be on "yes" in this screen - the signal at the "external stop" input of the Input/Output connector must shift to "1".

No phase RP

Final speed Phase (L - M - H)

Max time	phase running time. 0.01 - 99 s
Intertime	time programmed between this phase and the next one: 0 - 20 s
Tightening strategy	torque/torque+angle
Additional strategy for	version H: angle+torque
Tmin	minimum torque: 0 Nm to max. value of the spindle
Ttarget	target torque: 0 Nm to max. value of the spindle
Tmax	maximum torque: 0 Nm to max. value of the spindle
Threshold	angle threshold: 0 Nm to max. value of the spindle.
Amin	minimum angle: 0 - 999°
Amax	maximum angle: 0 - 999°
Asafe	safety angle: 0 - 999°
Other...	

Press ↵

Motor settings

Thread	right/left
Speed	rotational speed: 0 - 100 %
Acceler	acceleration rate: 0 - 20 s
Reset	The Reset function allows you to reset the torque and/or angle values at the beginning of the current phase.
External stop	The following conditions must be met for the system to stop the current phase and shift to the next one: - the "external stop" parameter must be on "yes" in this screen - the signal at the "external stop" input of the Input/Output connector must shift to "1".

Detailed RP. See tightening strategies (torque, torque + angle, angle + torque and prevailing torque) in Appendix 1.

Action on NOK Phase (M-H)

When there is a reject report (max. torque or max. 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.
For example: untighten the screw, repeat tightening, etc.
You must choose first: - the fault(s) to which you want to apply a corrective action.
- the number of tests (from 1 to 99)

Various actions on NOK are available:

End	the tightening cycle is stopped
Rv+End	a Run Reverse phase is run according to the programmed time then the cycle is stopped
Jump	the cycle proceeds to the indicated phase
Rv+Jump	a run reverse phase is run according to the programmed time, then the cycle proceeds to the indicated phase.
Rv time	Run reverse time: 0 - 99 s

No phase RP

Run Reverse Phase (H)

Max time	Phase running timeout: 0.01 - 99 s
Intertime	time programmed between this phase and the next one: 0 - 20 s
Strategy	torque/torque+angle/angle+torque
Tmin	minimum torque: 0 Nm to max. value of the spindle
Tmax	maximum torque: 0 Nm to max. value of the spindle
Tsafe	safety torque: 0 Nm to max. value of the spindle
Threshold	angle threshold: 0 Nm to max. value of the spindle.
Amin	minimum angle: 0 - 999°
A.target	target angle: 0 - 999°
Amax	maximum angle: 0 - 999°

Other...

Press 

Motor settings

Thread	right/left
Speed	rotational speed: 0 - 100 %
Acceler	acceleration rate: 0 - 20 s
Reset	The Reset function allows you to reset the torque and/or angle values at the beginning of the current phase.
External stop	The following conditions must be met for the system to stop the current phase and shift to the next one: - the "external stop" parameter must be on "yes" in this screen - the signal at the "external stop" input of the Input/Output connector must shift to "1".

Detailed RP. See tightening strategies (torque, torque + angle, angle + torque and prevailing torque) in Appendix 1.

Jump phase (H)

This phase allows you to design more sophisticated cycles.

For example: **D F1 V1 F2 --- F3 J1**

D	run down speed	
F1	final speed phase	
V1	action on NOK:	- if NOK, jump to phase 6 (F3) - otherwise, phase F2 is run then the cycle is stopped
---	empty phase:	the cycle is stopped
F3	corrective phase in case of NOK on phase 2	
J1	jump to phase 4 (F2) to finish	

No phase RP

Prevailing Torque Phase (H)

This phase allows you to monitor the load moment (prevailing torque) of a screw or nut.
The initial timeout (expressed in time or angle) is a means of eliminating the shock pulse at the start of the motor and of the mechanism.

Max time	Phase running timeout: 0.01 - 99 s.
Intertime	time programmed between this phase and the next one: 0 - 20 s
A.target	target angle: 0 - 999°
Tmin	minimum torque: 0 to max. value of the spindle
Tmax	maximum torque: 0 to max. value of the spindle
Tsafe	safety torque : 0 to max. value of the spindle
Scy type	type of start: time/angle
Rot. angle or *Rot. time*	angle or rotation time: 0-999 degrees or 0 - 20 s
Dir	direction: right/left
Speed	rotational speed: 0 - 100 %
Acceler	acceleration rate: 0 - 20 s

Detailed RP. See tightening strategies (torque, torque + angle, angle + torque and prevailing torque) in Appendix 1.

Synchro waiting Phase (H)

This phase allows you to synchronise the phases of several controllers.
To synchronise several controllers, you must program a waiting phase for each controller and use the "synchro" signals (see Input/Output section).

Working principle:
Each controller reports to the other controllers that it has reached its waiting phase by setting the "synchro" signal to "0". Then it waits until the other controllers reach their own waiting phase by scanning the "synchro" input.
In the example opposite, controller no. 2 runs the beginning of the cycle (Search sequence, Run down speed), then waits until controller no.1 has completed its phases (Search sequence, Run down speed, Final speed) to proceed together to the end of the cycle. After 10 seconds (max. time programmed by default), the controller continues or stops the cycle.

No phase RP

Programming the action on NOK for each cycle (L-M-H)

Associated with the cycle, this menu allows you to detect anomalies at various stages of the tightening cycle. As soon as a reject report is emitted by a phase (Approach, Final speed phase, Run Reverse, Prevailing torque) one of the 3 following actions can be performed.
- Stop the cycle at this phase.
- Stop the cycle then run reverse a given number of rotations.
- Stop the cycle then run reverse the number of rotations already performed during the approach phase (if any).

This menu is used as an alternative to the insertion of an "action on NOK phase" (see §), with the following advantages:
- Sequencing of a cycle (Approach, Run down speed, Final speed) without inter-phase stop.
- No additional phase.
- A single programming to monitor all the stages of the tightening cycle.

Except for the approach phase, this action on NOK is performed only if an interphase time is programmed.

To access it, highlight "action on NOK" and press  .

1 - Select the relevant action:

- *unused* : the option is disabled.
- *stop cycle*: as soon as one of the torque or angle parameters is out of tolerances at the end of one of the phases, the cycle stops at the end of this phase.
- *run reverse*: the cycle stops under the same circumstances as in the "stop cycle" option, then the tool untightens the programmed number of rotations.
  N. rotat.: number of run reverse rotations performed by the tool in case of fault (0-100). The value 0 causes a run reverse action which is equal to the number of rotations performed in the approach phase if this phase has been programmed. Otherwise, the number of rotations is equal to 0.

Rv. speed : run reverse speed associated to an action on NOK per cycle or per phase.
Thread type : right or left.

When an action on NOK phase has been programmed, it will be processed as a priority with respect to the action on NOK of the cycle.

2 - Comment

It is possible to insert a comment (40 characters as a maximum) between the Cycle field and Number of cycles OK field

3 - Number of cycles OK

NcyclesOK number of correct cycles to activate the "*NCYOK*" output.

To create the phases of a cycle, place the cursor under"*NcyclesOK*".

Press ▼ : "*Chg*" is highlighted.

Press ↵ then ▶ to select the type of phase and press ↵ to validate.

Press ↵ again to describe the contents of the phase.

Press VAL to validate the changes.

To **insert** a phase into the list, use the "*Ins"* function.
The new phase is inserted before the phase highlighted by the cursor.
To **delete** a phase in the list, use the "*Del*" function.

3.3 - "QUICK CYCLES" Menu

This menu allows you to quickly program the cycles. By default, the quick cycles consist of a run down speed phase and a final speed phase. The operator only programs the target torque and the maximum angle on the screen.

To do so, select a cycle and press ↵.

For the programming procedure, refer to paragraph 3.1.3.

It is the controller itself which calculates the speeds and all of the other default parameters (minimum speed, maximum speed, etc.).
According to the versions (L - M - H), it is possible to insert and program 1 or several other phases manually.

3.4 - "LEARNING" Menu

First of all, select a cycle. Before performing the first tightening, enter the target torque instruction, and if required, a speed limitation (if the tightening task does not tolerate the maximum speed of the tool: for example, to tighten in a plastic material). The first tightening is performed at reduced speed, the second one is performed at faster speed, and the last tightening allows you to finalise the programming. Once the procedure has been completed, the operator will go back to the control screen and save the learning procedure by pressing  .

According to the versions (L - M - H), it is possible to insert and program 1 or several other phases manually.

3.5 - "STATION" Menu

- Functions

The "STATION" menu allows you to configure the following parameters:

Screen	*by default*	*Comments*
Name		
Unit	Nm	Nm/Ft.Lb/In.Lb/Kg.m/Kg.cm
Dir		direction: right/left
Rv speed	50%	this speed is used at each run reverse command by the operator (the run reverse speeds used during the cycle can be programmed in the run reverse phases or in the actions on NOK per cycle).
Src. cyc.	keyboard	source of the cycle number: peripheral used to program the current cycle: keyboard, PC, Bar code, Inputs/Outputs. (Binary programming).
Lock.NOK	No	lock N cycles OK: when this function is enabled, the system locks the start cycle as soon as the number of cycles run with an accept report has reached the programmed "NCYCOK". You must send a Reset command to unlock the cycle start.
Scy pulse	No	start cycle by pulses: the "start cycle" signal can be activated with a pulse.
Sp. val.	No	spindle validation: the spindle operation is validated or not by the PLC.
SpV.rev	No	spindle validation at run reverse: through this function, the spindle operation is validated or not in run reverse by the external monitoring system (via the Inputs/Outputs).
Acknow	No	yes/no (to validate start cycle after a reject report).
Cycle 0	No	yes/no (to validate the running of cycle 0).
RP duration	0.0	A value which is different from 0 allows you to program the pulse (0.1 to 4.0 s) reports (accept, reject) at end of cycle. With a value equal to 0, you can program a continuous status of the reports at end of cycle.
K torque/spindle or K torque/cycle.	K torque/spindle	This option allows you to define: - either 1 correction coefficient per spindle; it is stored in the tool memory. It is set to 1 by default and can be modified by performing the manual calibration procedure which can be accessed from the maintenance menu. This coefficient is used to calculate the torque whatever the cycle run. - or 1 correction coefficient per cycle; the coefficient associated to each cycle is stored in the controller memory, except the coefficient of cycle 0 which remains in the tool memory. It is set to 1 by default and can be modified by performing the manual calibration procedure for each of the programmed cycles. The coefficient used to calculate the torque is the coefficient associated to the current cycle.

Caution: It is strongly recommended NOT to program the Scy pulse option if using hand held tools. Since the tool only stops at the end of the tightening cycle, it can cause injury to the operator.

3.6 - Input / Output Configuration

3.6.1 - Overview

The "STATION" menu also allows you to reconfigure the addresses of the input and output functions on the I/O connector. According to the desired operation, you can use either the default configuration, or the dedicated configuration with functions not defined in the default configuration.
Except for the output SYNC signal available only on logical outputs 5 and 8, all of the other functions can be configured on any input or output available. You can configure the same output function on several outputs of the I/O connector.

You will find hereafter a description of the following:

- Input functions.
- Output functions.
- The default configuration.

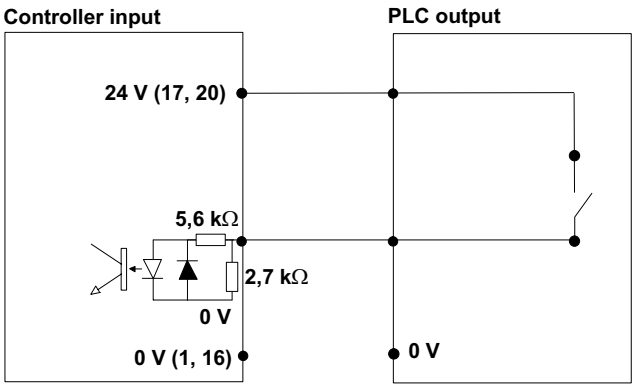
3.6.2 - Description of Inputs

Inputs	Name	L	M	H	Factory configuration	Comments
Cycle 1 selection	CYC1		x	x	x	Binary coding - weight 1, i.e. from 0 to 7
Cycle 2 selection	CYC2		x	x	x	Binary coding - weight 2, i.e. from 0 to 7
Cycle 4 selection	CYC3		x	x	x	Binary coding - weight 4, i.e. from 0 to 7
Spindle validation	SPVAL		x	x	x	Validates or not the tool start - in the tightening direction if "Sp. val." is enabled in the station menu. - in the untightening direction if "Val.rrv." is enabled in the station menu
Tightening direction validation	SPVALFS		x	x		Validates or not the tool start in the tightening direction if "Sp. val." is enabled in the station menu.
Untightening direction validation	SPVRRV		x	x		Validates or not the tool start in the untightening direction if "SpV.rrv" is enabled in the station menu.
Error acknowledgement	ACKNOW		x	x	x	Validates again the tool operation after a reject report if the error acknowledgement function in the "station" menu is enabled.
Start cycle	SCY	x	x	x	x	The cycle is run as long as the signal is at 1. When the signal drops, the cycle stops and the report is sent to the PLC.
Tightening / Untightening	DIR	x	x	x	x	Validates the untightening direction as soon as the start cycle signal appears, at the speed programmed in the station menu and with the maximum current of the tool.
Reset	RESET		x	x	x	This signal resets the tightening reports and deletes the results displayed.
External stop	EXSTOP		x	x		When the parameter is programmed on "yes" in the programming screen of the run down speed, final speed and run reverse phases, the system stops the current phase on a pulse and switches to the next one.
Synchronisation	SYNC			x		Validates the synchronisation of the tightening phases of several controllers (see Appendix).

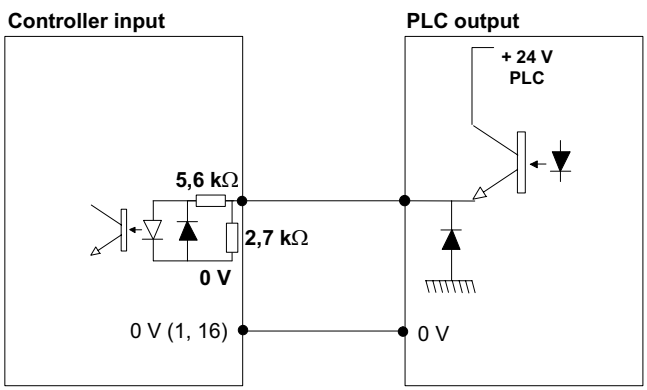
PLC output, CVIC input wiring

Two configurations are available:

A) The CVIC 24 V (contacts 17 and 20) is used as the "common" of a PLC relay board.



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



The inputs are type II as per standard CEI 1131-2 (24V/13mA per input)

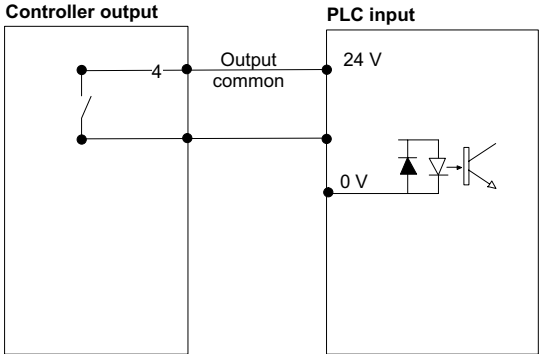
3.6.3 - Description of Outputs

Outputs	Name	L	M	H	Factory configuration	Comments
Cycle 1 acknowledgement	CYC1		x	x	x	Binary coding -weight 1- . The cycle acknowledgement is sent back only if it corresponds to a programmed cycle; otherwise it is at "0".
Cycle 2 acknowledgement	CYC2		x	x	x	Binary coding -weight 2- . The cycle acknowledgement is sent back only if it corresponds to a programmed cycle; otherwise it is at "0".
Cycle 4 acknowledgement	CYC3		x	x	x	Binary coding -weight 4- . The cycle acknowledgement is sent back only if it corresponds to a programmed cycle; otherwise it is at "0".
Ready	READY	x	x	x	x	This signal is at "1" when the controller is in working order.
In cycle	INCYC	x	x	x	x	Response to the Start Cycle request. Drops to "0" at end of cycle.
Global report OK	ACCRP	x	x	x	x	Sent to the PLC when the cycle is over and the global report is OK.
Global report NOK	REJRP	x	x	x	x	Sent to the PLC when the cycle is over and the global report is NOK.
Number of cycles OK	NCYOK		x	x	x	This signal switches to "1" when the number of cycles run with an Accept report is equal to the programmed number of cycles OK.
Synchronisation	SYNC			x		Validates the synchronisation of the tightening phases of several controllers (see Appendix)
Torque report OK	TOROK			x		Sent to the PLC when the cycle is over and the torque report is OK.
Torque report NOK	TORNOK			x		Sent to the PLC when the cycle is over and the torque report is NOK.
Angle report OK	ANGOK			x		Sent to the PLC when the cycle is over and the angle report is OK.
Angle report NOK	ANGNOK			x		Sent to the PLC when the cycle is over and the angle report is NOK.

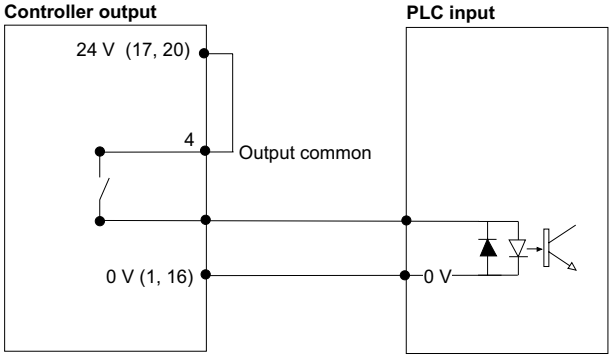
CVIC output, PLC input wiring

Below are shown the two wiring configurations available for the relayed output of the CVIC:

A) The PLC 24 V is connected to the CVIC output common
The PLC inputs do not receive 24 V from the outside.

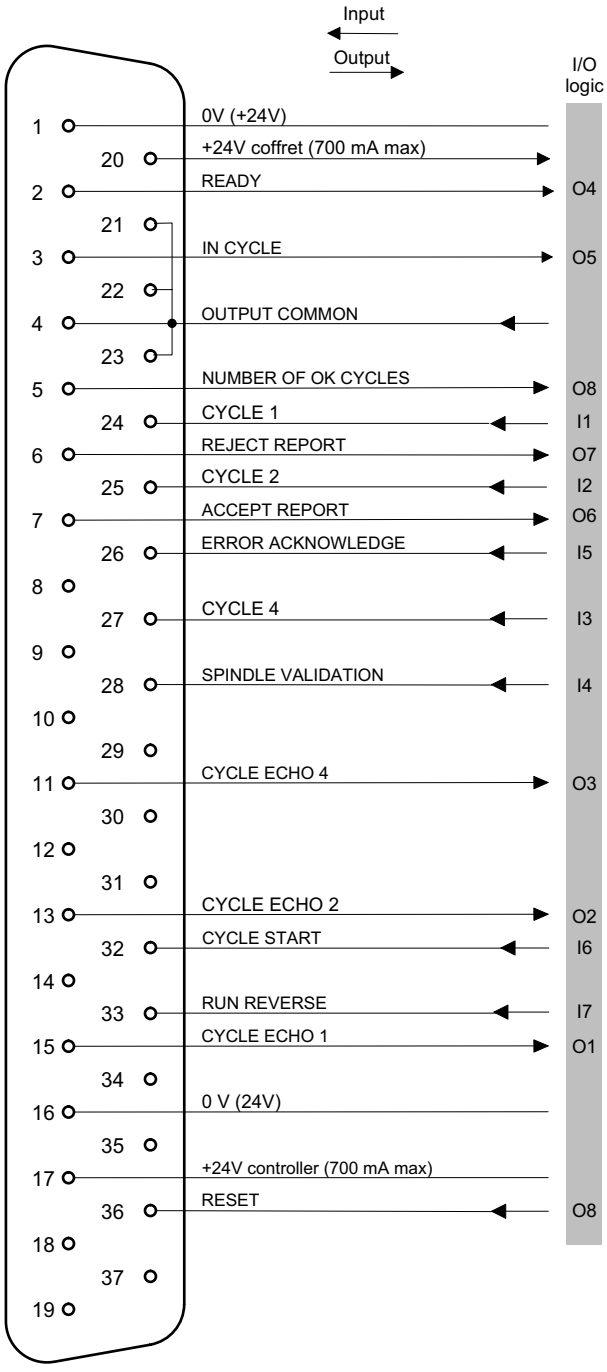


B) The CVIC 24 V is connected to the output common.
The PLC inputs do not receive 24 V from the CVIC.

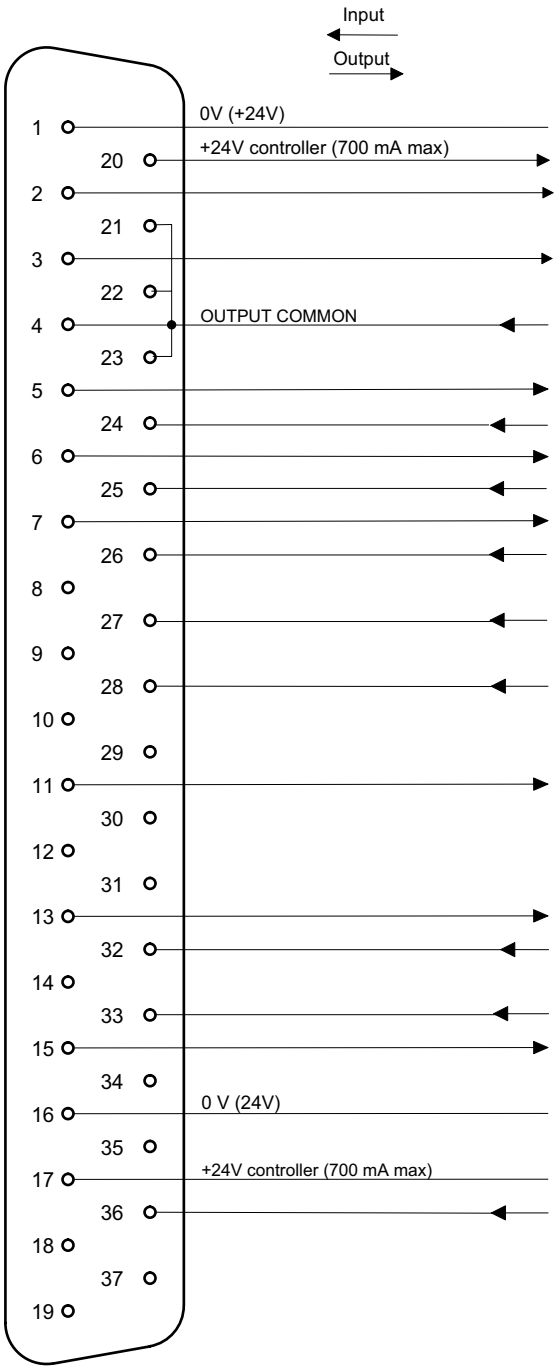


All outputs are active at 1 and relayed in the controller with a common point (4) for all outputs.
Specifications of the contacts:
1A / 150V / 30W max. DC on resistive charge.

Default configuration



Specific configuration



3.7 - "PERIPHERALS" Menu

3.7.1 - Serial Port

The serial port is used for the following functions:

- ♦Data transfer to PC,
- ♦ Bar code and report output,
- ♦ Printing the results in order of occurrence (ASCII)
- ♦ Automatic calibration with the DELTA4000 measuring unit (no programming is required)

- Data transfer to PC

- Controller

The parameters used for the data transfer to PC are as follows:
RS232/RS422:

RS232	default standard type used for connecting a PC and a single controller
RS422	used in a network configuration only

Baud rate from 300 to 19,200 Bauds, 7 or 8 data bits, 1 or 2 stop bits, no parity/even/odd
Default values: 19,200 Bauds, 8 data bits, 1 stop bit, no parity.

Slave no. : 0-254. In a network configuration, the PC is connected to several controllers at the same time. The "Intermediate" or "end of line" differentiation is obtained by resistance wiring in the connectors of the network cable. (See wiring diagrams).
For further information about the network connection, refer to the "CVIPC" Operator's Manual.

- MODCVIC

For the MODCVIC module, the switching of the communications standard RS232 / RS422 is automatic depending on the address selected by the rotary switches:

- address 0 implies standard RS232 for the connection of a PC and a single controller
- any other address selected implies standard RS422 for a network connection.

The other parameters are set to:

- 19,200 bauds
- 8 data bits
- 1 stop bit
- no parity

They cannot be programmed by the PC.
In the case of a network connection, the "Intermediate" or "end of line" differentiation is obtained by resistance wiring in the connectors of the network cable. (See wiring diagrams).

3.7.2 - RP Output

The report is printed according to the following parameters:
Format PC2/PC3/PC4/Specific/PC5A/PC5B/PC5C
Upon request at end of cycle.
(See "Printing format of tightening results" in Appendix 2)

3.7.3 - Bar Code

The bar code reader allows you to automatically select one of the cycles previously programmed in the controller. To enable the bar code reader, you need to do the following:

- declare the source of selection of the cycles as being the bar code.
- configure the serial link:
  - bar code function
  - Baud rate: 9,600 bauds
  - 8 data bits
  - 1 stop bit
  - no parity
- set up the table of selection of the cycles according to the bar code numbers, which can be done only with the CVIS/CVIC PC2000 software.

After reading the bar code, the controller can perform one of the following actions:

- *No action* --> no action is performed
- *Reset* --> reading the code leads to an action which is identical to the Reset action.
- *Reset on NCYCOK* --> reading the code leads to a Reset when the programmed number of cycles OK is reached

SECTION 7 - MAINTENANCE OF THE CVIC CONTROLLER

This section helps the maintenance operator to:
- check that the controller+tool assembly operates correctly.
- know the number of cycles run.
- calibrate the system manually or automatically
- adjust the contrast of the display, update controller date, select the language and program an access code.
- change the memory battery.

1 - "MAINTENANCE" MENU

1.1 - "TEST" Menu

The**"SPINDLE RUN"** menu allows you to check the correct operation of the tool.
Select the speed and rotation direction ("*dir*" reverser for a hand held tool or in the menu for a fixed tool) then press the trigger for a hand held tool of EC type or press the *"on"* button for a fixed tool of MC or MCL type.
Select "*Reset*" to reset the display.
Select "*Fan*" to start the fan and check its working order.

The **"INPUT/OUTPUT"** menu allows you to check the status of inputs, and to test the outputs and the LEDs on the front side.

Testing the outputs:

The cursor blinks on output 1. Press ▼ to move the cursor and ▶ to validate the box or not. The selected output is or is not enabled. Then it is possible to check the efficiency of the status change of this output on the corresponding input, for example on the PLC. Use the same procedure to check that the Max, OK and Min LEDs glow correctly.

1.2 - "CHANNEL TEST" Menu

This menu is used to test the good working order of the controller and tool.
There is a sequence of two tests:
- reading the information contained in the tool memory
- checking the servodrive board

If an error arises, a message is displayed. Press ↵ to display an additional error message.

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 delivery.
The "*Tot.*" (total) and "*Par.*"(partial) counters show the number of cycles run by the tool.
Select the "*Reset*" key to reset the partial counter of the tool.

1.4 - "CALIBRATION" Menu

The calibration procedure is recommended to compensate for any possible drift of the tool torque or after each change of tool element.

1.4.1 - "AUTO SPINDLE" Menu

Important: the tool will be calibrated over its entire operating torque range.
Equipment required: - a torque measuring unit DELTA4000 connected to the CVIC controller via a serial cable.
- the tool to be calibrated with a transducer and its cable.

Program the measuring unit by pressing / to display "standard" in the summary line then to display "Calib CVIC".

Select the type of transducer to be used by pressing then / .

If the measuring unit is not correctly connected or programmed, an error message "Check connection" is displayed on the screen.

Follow the instructions displayed on the CVIC screen. 10 tests can be run and they are performed at various increasing speeds. Run one test after another. **WARNING**: the tightening is performed up to the MAX. torque.

Press VAL to validate the writing in the tool memory.

1.4.2 - "MANU SPINDLE" Menu

This menu is used to manually calibrate the tool to the torque value of the selected cycle. The torque transducer inserted in line with the tool can be connected to any measuring unit in the GEORGES RENAULT range. Run a tightening cycle 5 times and manually enter the values read on the standard instrument.

Warning: the torque and angle reports MUST be correct to allow the procedure to be processed in normal conditions.

The "Reset val" key resets the readings.
The "Reset coeff" key displays coefficient 1 by default.
Depending on the option selected (*K torque/spindle* or *K torque/cycle*) in the "STATION" menu (see § 3.5 page 27), the sensitivity correction coefficient is saved:
- either in the tool memory
- or in the controller

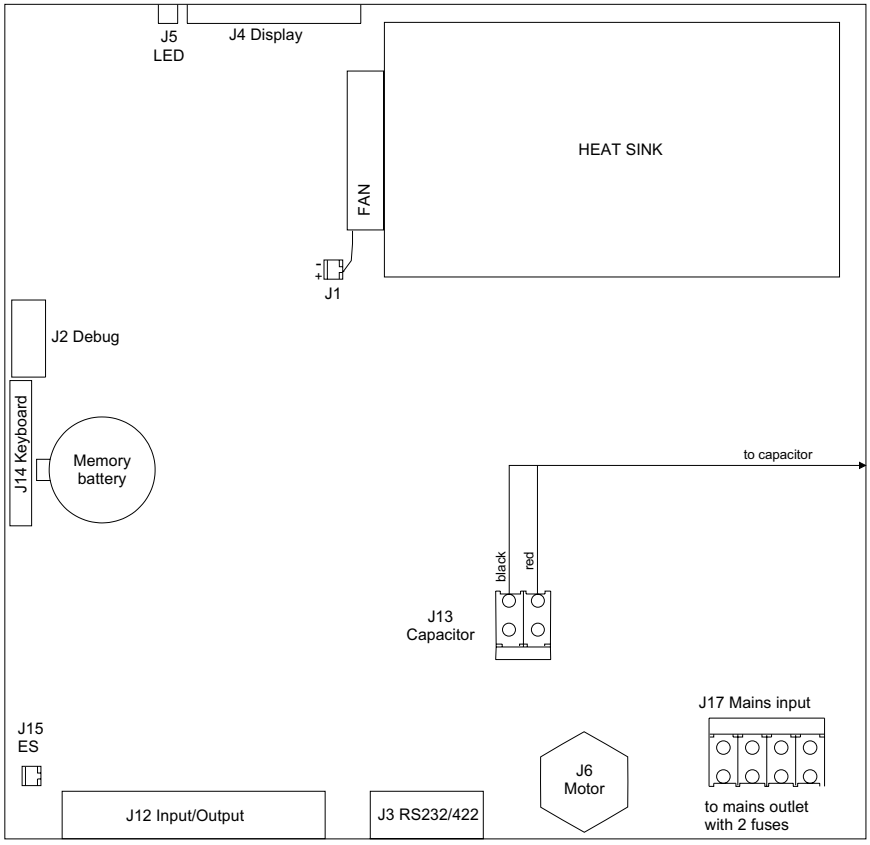
1.5 - Changing the Memory Battery

Memory battery connection : the memory battery allows you to save the parameters and results in case of mains power failure. 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.

Prior to any battery change, it is recommended to save the tightening programmes as well as the results, using the CVIS/CVIC PC2000 software.

Battery number: 6159229060. Capacity: 550 mA/h

Schematic representation of the servodrive board



2 - "SERVICE" MENU

2.1 - "CONTRAST" Menu

Press ◀ or ▶ to adjust the contrast of the display.

When the adjustment of the contrast is such that it no longer allows you to display the menus, the following procedure allows you to activate the contrast menu when switching on:

- Switch off the controller.
- Press VAL and simultaneously switch on the controller.
- Release the VAL key as soon as the Led blinks and the buzzer is active.

Then the "Contrast" menu is enabled. Press ◀ and ▶ to set the ajustment, then press ↵ to validate.

2.2 - "DATE" Menu

Three date formats are available: DD/MM/YY, MM/DD/YY, YY/MM/DD
Refer to the start-up to see the programming details.

2.3 - "LANGUAGE" Menu

Refer to the start-up to see the programming details.

2.4 - "ACCESS CODE" Menu

The access code is used to protect the controller against any keying error.

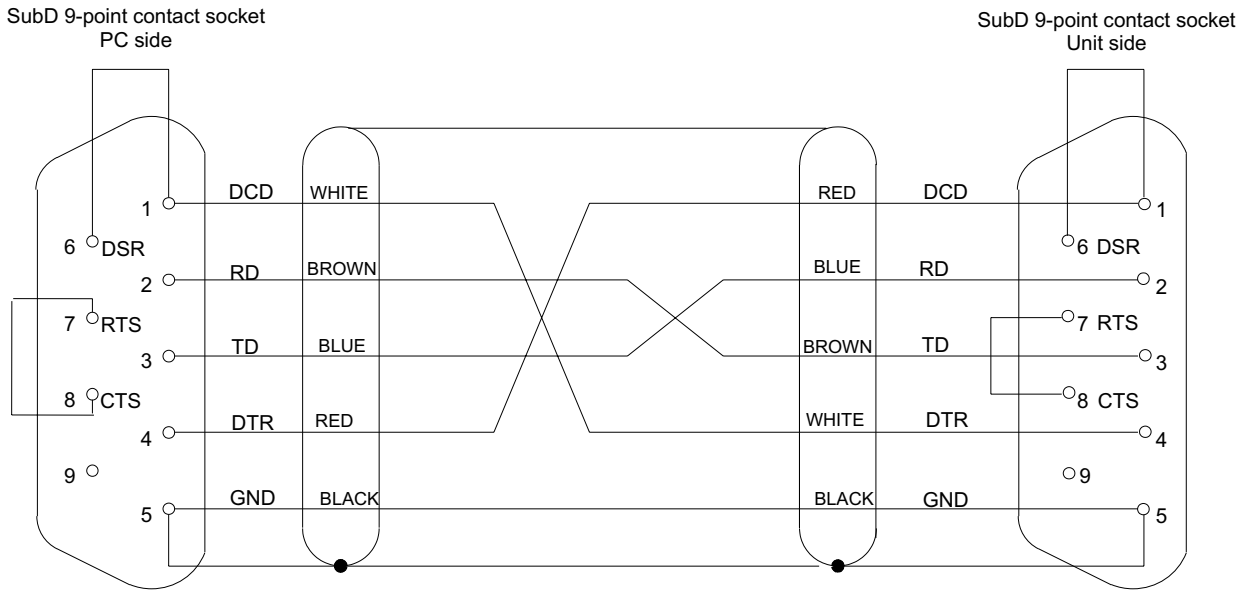
At the time of delivery, no code is programmed; the  icon is displayed on the screen.

Enter the new code (8 alphanumerical characters as a maximum), using the ▲ and ▼ keys to write and the ◀ and ▶ keys to move the cursor. Press ↵ to validate.

Lock access by entering your code again. The padlock icon will lock  , meaning that writing is prohibited. If an access code has been programmed and the operator wants to change the data stored, it is necessary to enter the code each time the controller is switched on.

Appendix - PC wiring diagram

Diagram of PC cable number 6159170470



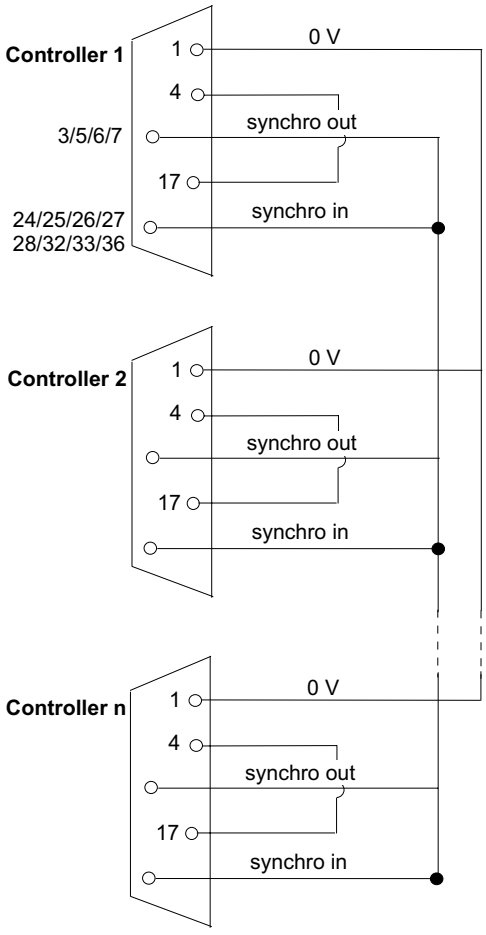
Appendix 2 - Synchronising several CVIC controllers

To synchronise several CVIC version "H" controllers, you must:

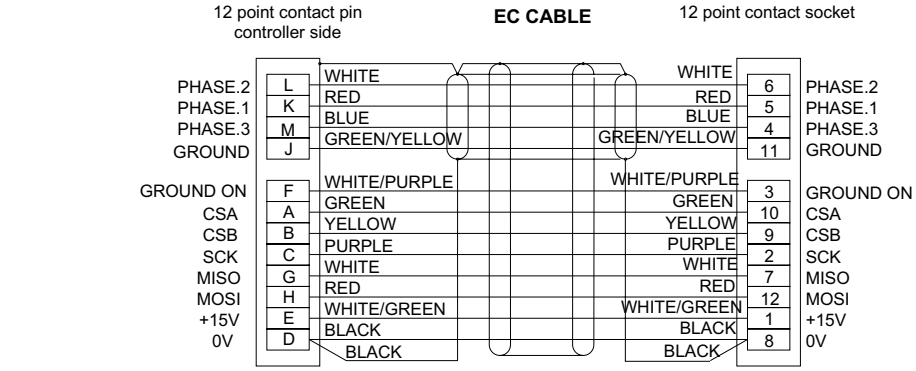
- allocate the synchro in and synchro out signals to unused input and output.
- connect the "synchro" signals of the controllers and program a "Synchro waiting" phase for each controller.

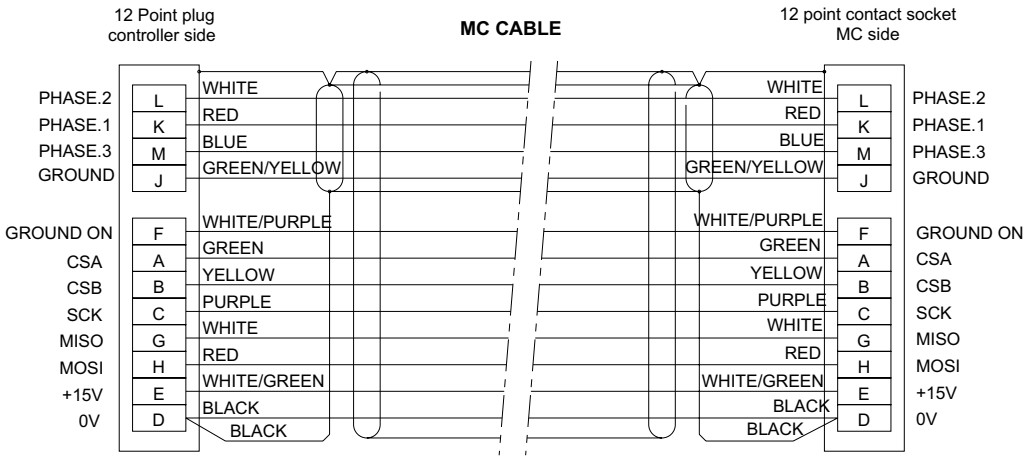
Warning: the 0 Volts (contact 1) of the 37-point connectors of each controller are connected to each other.
All other signals (cycle number, run, ...) must be connected to each controller.

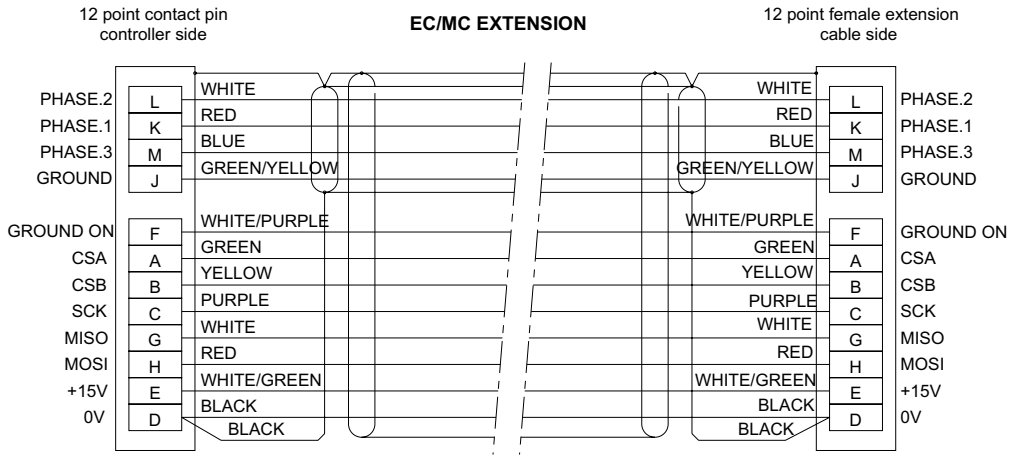
Example of connection diagram:



Appendix - EC, MC and EC/MC extension wiring diagram







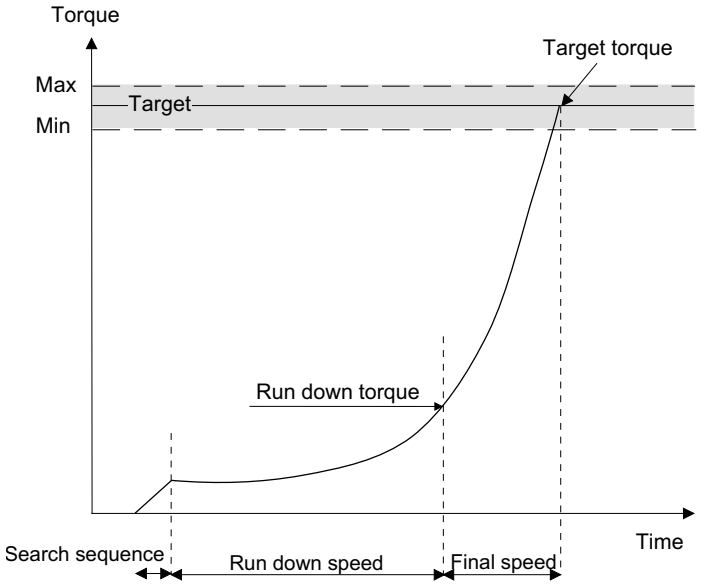
Appendix - Tightening Strategies

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

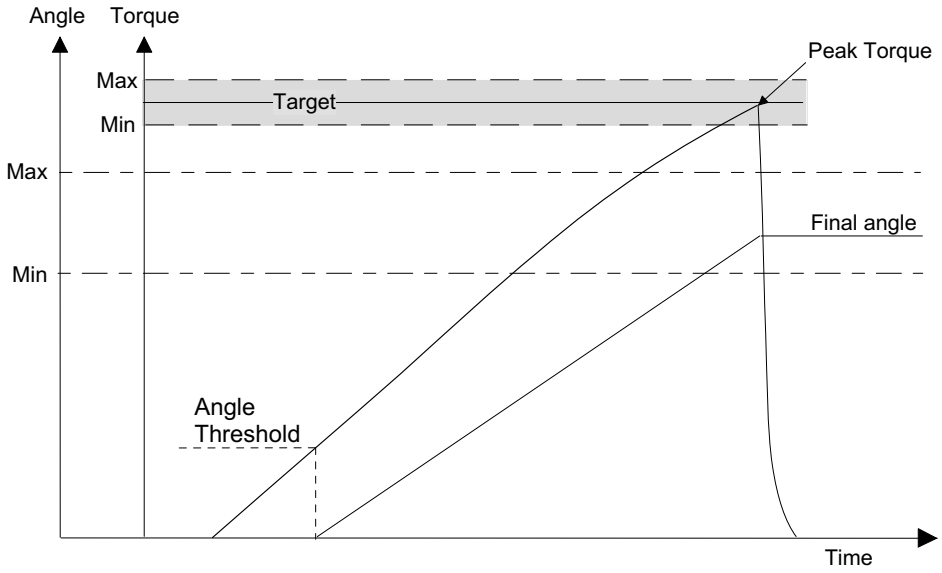


Torque + angle controlled tightening

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 peak torque and the 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

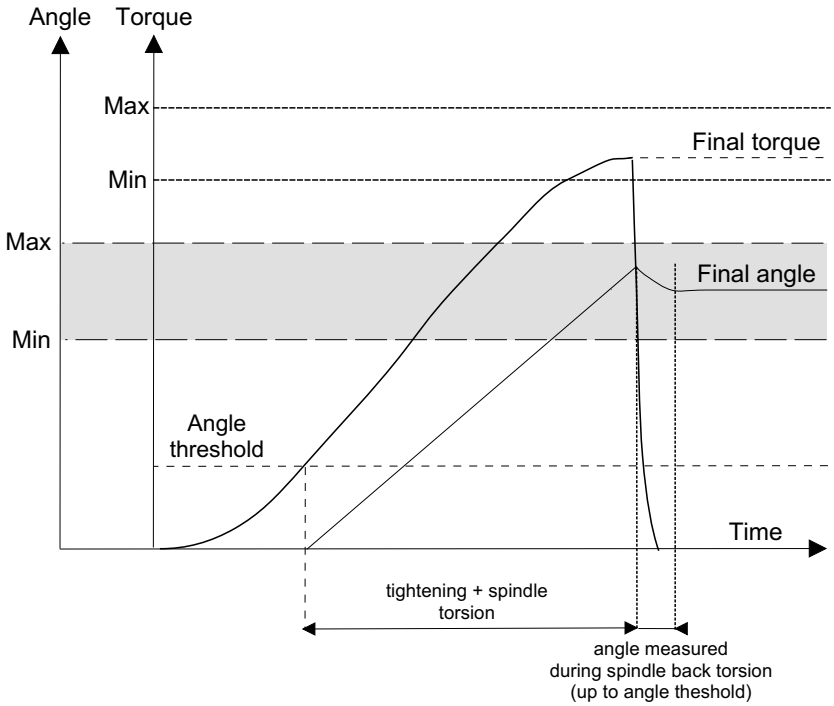
.

Angle + torque controlled tightening

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



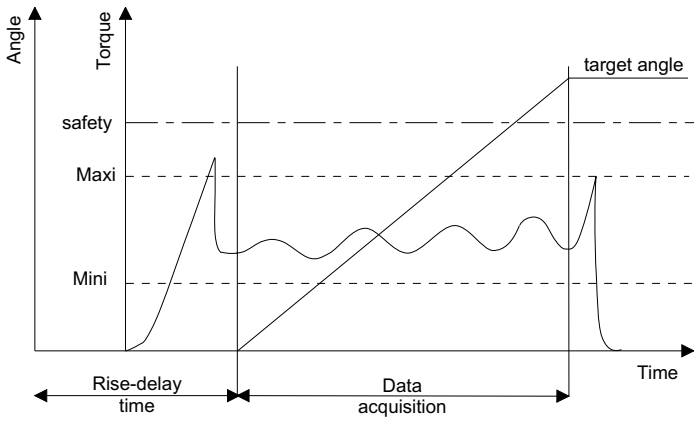
Prevailing torque controlled tightening

This phase allows you to check the residual torque (prevailing torque) that results, for instance from the thread formed with tapping screws.

It is useful to know if the thread is formed correctly during the desired number of rotations without untimely locking or tapping deficiency.

The initial timeout allows you to start the readings when the tool speed is stabilised. The memorised result is the mean of the torque readings 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.



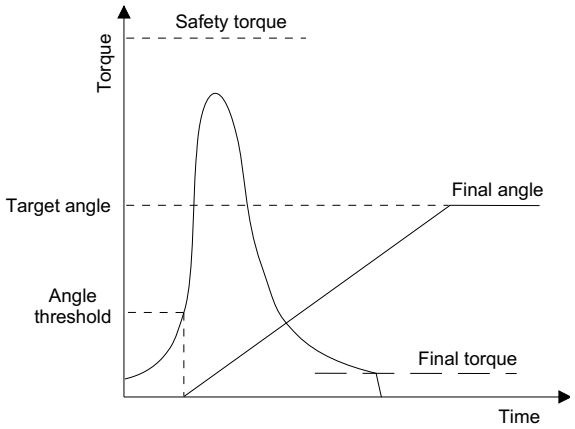
Spindle stop **IF** angle ≥ target angle **OR** torque> safety torque
Accept report **IF** min. torque ≤ torque ≤ max. torque

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

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 - Printing Formats for tightening results

PC2 format

```
1 char.   <CR>
2         set or cycle number
2         fastener number
3         «T=+»
5         torque in 1/10 of Nm
1         <LF>
1         " "
1         <CR>
2         set or cycle number
2         fastener number
3         «A=+»
5         angle in 1/10 of degree
2         <LF>
```

Example of result:
<CR>0109T=+00400<LF> <CR>0109A=+01200<LF> <CR>0109TR=+00580<LF> .

PC3 format

```
1 char.   A  (frame type)
3         station number (1 to 250)
3         port number (1 to 32)
1         parameter set(A to O correspond to sets 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>
3         <LF>
```

Report Code: ASCII code 0100

```
X    X    X    X
|    |    |    |__   1=min. torque
|    |    |_______   1=max. torque
|    |____________   1=min. angle
|_________________   1=max. angle
```

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

@	accept torque	accept angle	F	max. torque	min. angle
A	min. torque	accept angle	H	accept torque	max. angle
B	max. torque	accept angle	I	min. torque	max. angle
D	accept torque	min. angle	J	max. torque	max. angle
E	min. torque	min. angle			

Example of result:

```
A001001BZ@92120811021500041.7500121<CR><CS><LF>
```

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              Rp
                                                 Nm        dg
xxxx     xx   xx   xx   xx/xx/xx   xx:xx:xx   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         " "
16        " "
3         Report code
1         <LF>
```

In "Print at end of cycle" mode, the reading number is replaced by blanks.

Example of result:

```
<CR>1223 02 03 00  18/04/98 09:03:45  0030.2  0120.5          ACCEPT<LF>
```

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 11
xx AA angle report | in binary notation
04 TT torque report
xx
05 where AA or TT = 01 if low report
xx 11 if accept report
06 10 if high report
xx
07
xx
08
xx

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 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 30
xx 30
xx 30
xx 30
xx 30

FF end of frame character

PC5-B format :

Report per spindle (torque, angle, torque rate)

F0 start of frame character

01
xx ← report (in hexadecimal notation): see PC5A
02
xx
03
xx
04
xx
05 where TT or AA = 01 if low report
xx 11 if accept report
06 10 if high report
xx
07
xx
08
xx

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

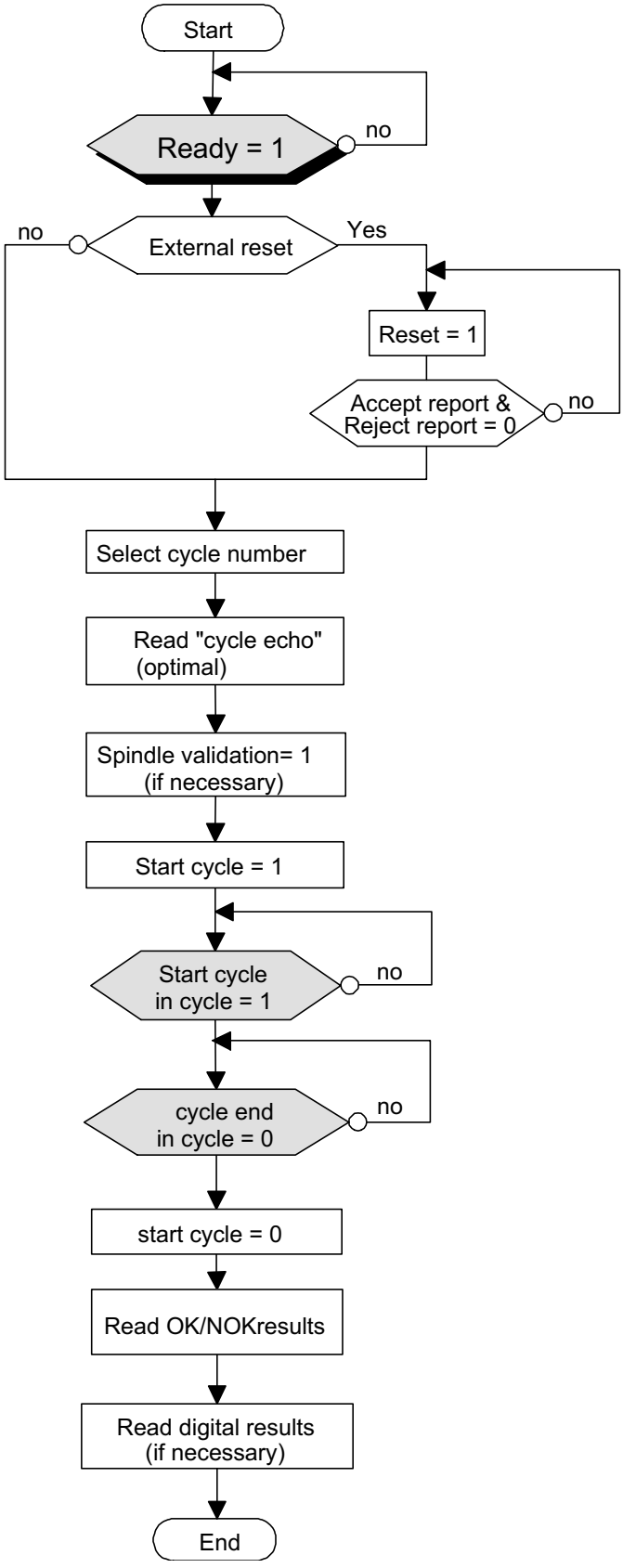
	xx	
	xx	
	xx	target angle in 1/10th of degree (ASCII notation)
	xx	e.g.: 105.0° 30 31 30 35 30
	xx	
Available parameters programmed for 1 spindle (x times the number of spindles)		
	xx	
	xx	
	xx	maximum angle in 1/10th of degree (ASCII notation)
(Cont'd)	xx	e.g.: 110.0° 30 31 31 30 30
	xx	
	xx	30
	xx	30
	xx	30
	xx	30
	xx	30
	xx	30
	xx	30
	xx	30
	xx	30
	xx	30
	xx	30
	xx	30
	xx	30
	xx	30
	01	spindle number
	xx	
	xx	applied torque (ASCII notation)
	xx	e.g.: 100.1 Nm 30 31 30 30 31
	xx	
	xx	
Results of spindle 1 (x times the number of spindles)	xx	
	xx	
	xx	angle (ASCII notation)
	xx	e.g.: 40.0° 30 30 34 30 30
	xx	
	xx	30
	xx	30
	xx	30
	xx	30
	xx	30
	FF	end of frame character

Format PC5-C :

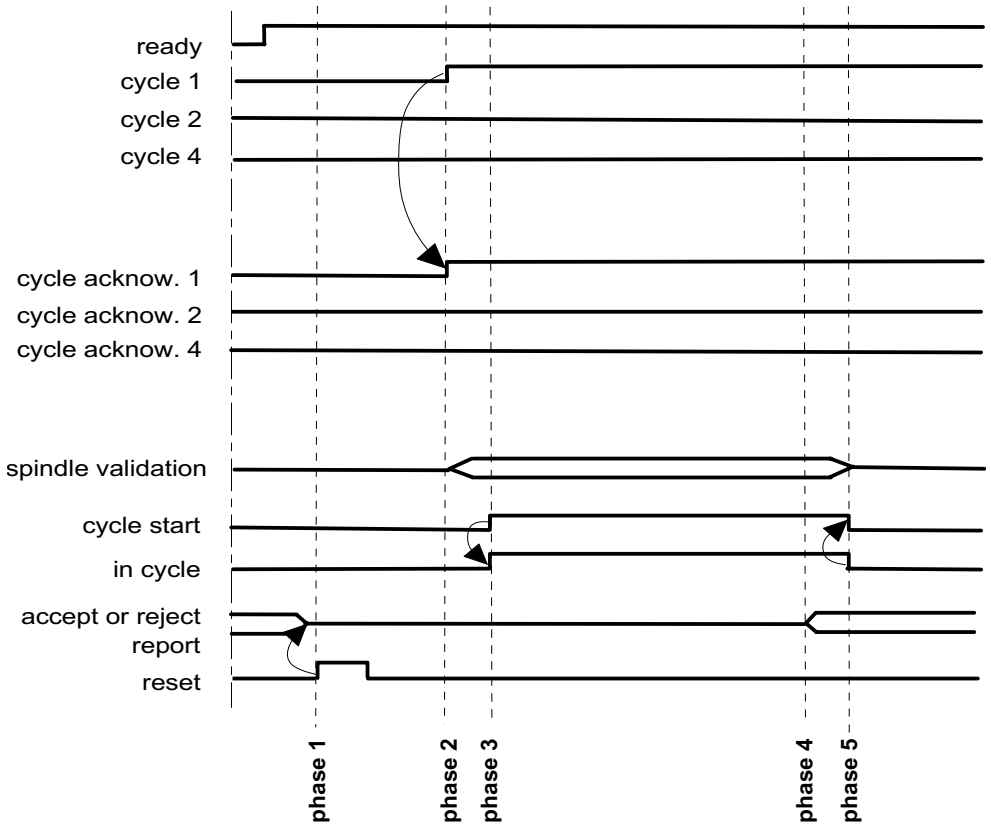
F0	start of frame character
01	spindle number (CVIC 1)
xx	report (in hexadecimal notation as for PC5-A and PC5-B) :
FF	End of frame.

Appendix - CYCLE FLOWCHART AND TIMING CHART

1 - Cycle flowchart



2 - Cycle timing chart



phase 1 : the controller receives cycle n°1 --> cycle acknowledgement n°1 is validated (if the cycle is programmed)

phase 2 : the controller receives the " start cycle " --> validates the "in cycle" signal

phase 3 : at the end of the cycle, the controller validates an "accept" or "reject"report which is sent to the PLC.

phase 4 : the "in cycle" signal returns to zero when all the operations of the system are over.

phase 5 : the Reset signal is sent by the PLC --> resets the report (this PLC command is not compulsory).

IMPORTANT:
To optimise cycle time, the PLC or the numerical control can be synchronised with the "accept report" or "reject report" signal , *but the tightening system is not ready to receive new commands (reset, etc...) only after the resetting of the "in cycle" signal* .