



Froilabo

Precision for life



Dragon 3.1

Software Version 1.33C

User Manual

Ref: UM_Dragon3.1_EN_rev1.5



Read this manual before use!

This document has been prepared with the greatest possible care. However, Froilabo declines all responsibility in the event of errors or omissions. The same applies to any damage resulting from the use of the information contained in this manual.



Froilabo

Precision for life

This manual has been designed to describe the features of the Dragon 3.1 and to help you use it in optimal conditions with the greatest safety for you and your components.

Please pay attention to the advice given below. They will allow you to prevent malfunctions – find possible remedies – and above all to help you use this temperature forcing system with maximum efficiency.

We hope you appreciate this manual and wish you success in using the Dragon.



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How to Use This Manual

It is important to follow the instructions for use provided in this manual to ensure the proper functioning of the device or to exercise a possible claim under the warranty. Read all the instructions herein before starting the device and contact the manufacturer or supplier if you have any doubts about its proper use.

To use this manual:

- Read the manual carefully before using the device for the first time.
- Follow the instructions in the manual.
- This manual is an integral part of the product. Please keep it.
- If you need to transfer this device, be sure to include the user manual.
- In case of loss, on request, we will provide you with a new user manual.

When using this device, certain risks must be taken into consideration, as indicated by the following symbols:



This symbol is intended to draw your attention to information of great importance, indicating potential danger or a risk of bodily injury.



This symbol indicates the safety measures to be followed by the operator or technician to ensure the physical safety of people near the device. These measures should be followed carefully.



This symbol indicates risk of electrical shock.



This symbol indicates risk of burns due to the presence of extreme cold.

Throughout the manual, tips are also provided; these should be taken into account to ensure successful use:

 *A tip or trick to help get full use or performance out of the device.*



General Warnings

Operator Training



Ensure that all persons who install, use, and repair the device are aware of the risks associated with their work and the safety measures to be observed. All operators must read and understand the instructions included in this user manual before handling or using the Dragon.

If hazardous or potentially hazardous products will be used, only persons familiar with the equipment should handle these products. These people must be able to carry out an overall risk assessment. Please contact Froilabo if you have any questions regarding the use of the equipment or the instructions.

Protecting the Product

The equipment you have purchased is designed for professional use. Nevertheless, shocks to the chassis and vibrations must be avoided. Ensure that the equipment is inspected at regular intervals, depending on how often it is used. Also check (at least once every two years) that the safety and unauthorized use labels are still in place.



This device is equipped with basic protection against air and power cuts during operation, but any sudden stop will damage the heating system and the refrigeration system. Read and follow instructions on how to address air or power cuts.

This Product Contains Refrigerants

Companies that install, service, maintain, repair or commission equipment containing refrigerants must have a certificate referred to in article R543-76 of the French Environmental Code or an equivalent certificate issued in the one of the member states of the European Union. Refer to local regulations outside the EU.

This device may contain fluorinated greenhouse gases under the Kyoto Protocol. For more details on disposal of the device, see the section **Disposal** in this manual.



Warranty

Optimal performance will be obtained by following the correct installation and operating instructions provided in this manual. Froilabo SAS guarantees that the equipment will function optimally in accordance with the conditions of installation and use set out in this manual.

The warranty period is 24 months.

It should be clear that the problem or failure must be related to a defect in material or workmanship. **Any further claims for damages are excluded.**

The lifespan of the product is approximately 10 years minimum under the proper conditions of use and respecting the correct inspection and maintenance procedures. Proper use includes following the instructions in this user manual and performing inspection and maintenance work as required.

The photos used in this document are not contractual.





Introduction

The Dragon enables fast and precise thermal cycling of electronic components, capable of being integrated into production lines and quality assurance processes.



The Dragon is designed to cool and heat air before expelling it onto test components, subjecting them to extreme temperatures. Always keep a safe distance from the outlet, which can carry very hot or very cold air and cause burns.

The Dragon allows:

- A temperature range from -72°C up to $+250^{\circ}\text{C}$, depending on the heating mode used
- High stability: $\pm 0,5^{\circ}\text{C}$ once the setpoint is reached when regulating on the AIR thermocouple
- Temperature ramp adjustable from 0.1 to 10°C/s when heating or cooling
- Adjustable airflow from 2.2 to 8.4 L/s (4.7 to 17.7 SCFM)

Resulting from an experience of more than fifty years in the field of intense cold, the refrigeration unit developed by our engineers generates a significant flow of air down to -72°C .

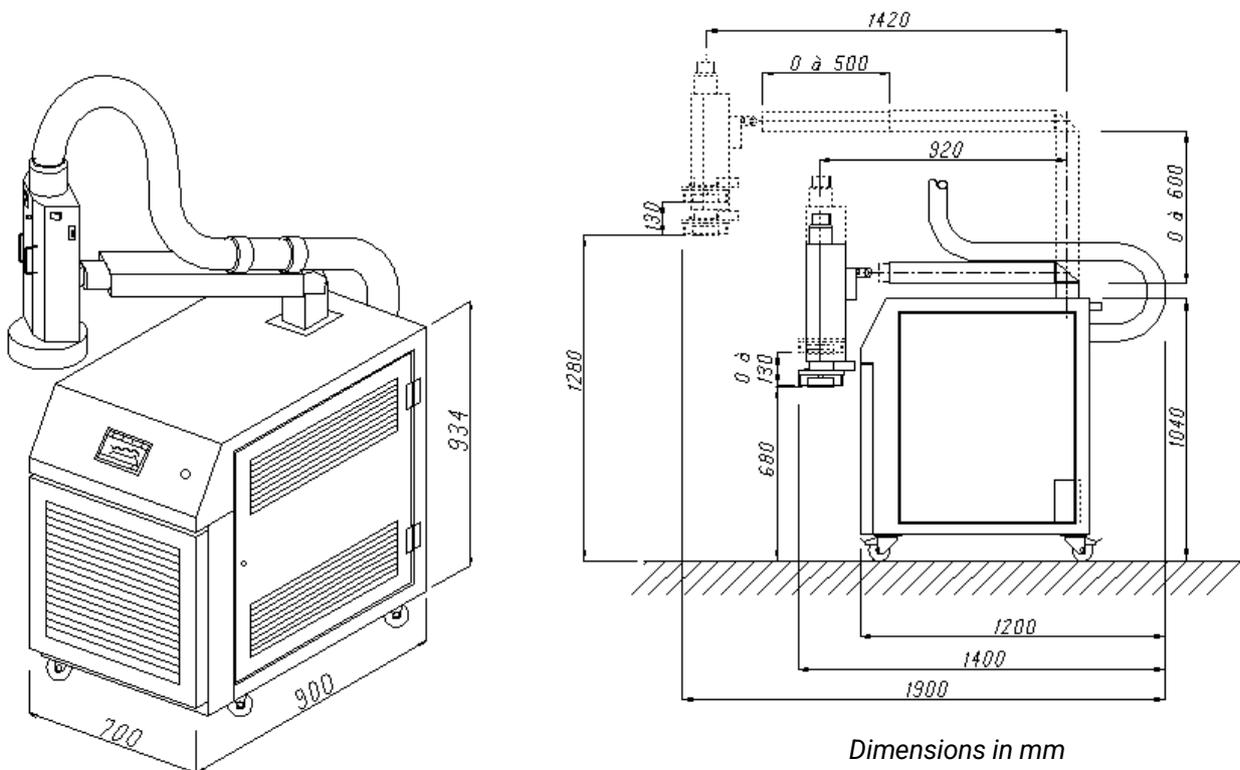
The Dragon features a new type of air dryer preventing any ice formation.



Technical Specifications

Specifications	Thermal air forcing system Dragon 3.1	
Construction		
Type	Galvanised steel	
Paint	Epoxy	
Dimensions (mm)*	1040 * 700 * 900 (H*W*D)	
Weight (kg)	250 kg	
Certification	2014/35/UE Low Voltage 2014/30/UE EMC (Class A limits) 2014/68/UE Pressure Equipment	
Electrical Supply		
Voltage	230 V ± 10% 50 Hz	
Current	Up to 32 A	
Temperature and Airflow		
Ambient temperature	18 to 30°C Relative humidity (max): 70%	
Airflow (outlet)	2.2 to 8.4 L/s / 8 to 30 Nm ³ /h	
Compressed air temperature (supply)	<25°C	
Refrigerants		
Refrigerant	ISCEON 89 (1 st stage)	R508B (2 nd stage)
Load	0.840 kg	0.250 kg

* These dimensions cover the Dragon chassis without taking into account the articulated arm and the head.





Environment



The Dragon must be installed in a ventilated area, with a minimum clearance of 400 mm behind the system and 200 mm on both sides. Locate the Dragon away from heat sources.

Ambient Conditions

Temperature required*:	18 to 30°C
Relative humidity*:	<70%
Altitude:	Below 2000 m

*However, when using the Dragon in extreme conditions (above 25°C and 50% RH), performance could be reduced (including the minimum achievable temperature and high pressure on the refrigeration circuit).



If the area where the Dragon is located is not well ventilated, the heat rejected by the Dragon could cause the ambient temperature limit to be exceeded.

Electrical Supply

Voltage:	230 V ± 10%
Frequency:	50 Hz
Maximum current:	32 A

The Dragon requires a special 2P+E connector for currents up to 32 A.



The electrical outlet in your building must be fitted with a 32 A curve D anti-short circuit magnetothermal protection circuit breaker (motor support) with a 30 mA differential.

Compressed Air Supply

Air temperature:	<25°C
Air pressure:	6 to 8 bars at Dragon inlet
Dew point:	<10°C
Required airflow:	35 Nm³/h

The air should be as clean as possible. Therefore, we recommend the use of a 5µ filter.



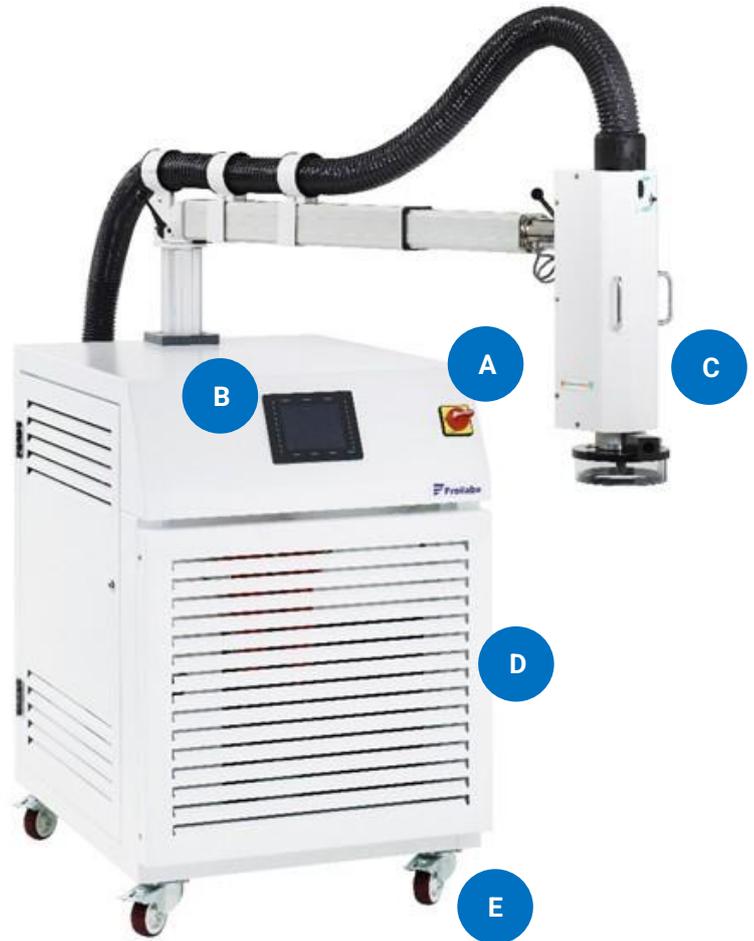
Before Switching On

Before switching on the Dragon for the first time, there are several points to consider. It is necessary to familiarise yourself with the system and its basic functionality.

Main Components

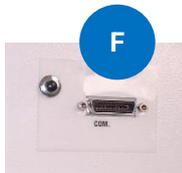
Front

- A. Power switch
- B. Touchscreen
- C. Head with heating elements and air outlet, test bell, arm movement switches, head up/down button, DUT thermocouple connector
- D. Condenser cover
- E. Pivoting casters (locking)



Rear

- F. Connection for external communication (RS-232C or IEEE 488.2)
- G. Electrical inlet
- H. Compressed air inlet





Theory of Operation

The Dragon takes external compressed air and expels it at a controlled temperature and flow rate through the outlet on its head, allowing test components (DUT) to be heated or cooled with convection, subjecting them to extreme conditions.

☞ *In keeping with common practice in test standards, both the Dragon and this manual use the abbreviation "DUT" (Device Under Test) to refer to components, samples, etc. you want to test using the Dragon.*

Modes of Use

The Dragon can be used in two main heating modes:

1. **Hot Mode.** Compressed air is heated as it passes through the head. Temperatures in excess of 30°C can be reached.
2. **Cold/Hot Mode.** A refrigeration circuit cools the compressed air down to -72°C before passing it to the head, where the air is heated to reach the set temperature. The full temperature range is possible in this mode.

The temperature regulation can be done at two different points:

1. **T°C AIR.** A probe integrated into the head which manages the temperature at the outlet.
2. **T°C DUT.** An external thermocouple connected to the head that can be located for temperature regulation on or near the DUTs, depending on your test needs.

This manual explains how to set up and operate the Dragon using the touchscreen or remote control; understanding the functionality on the touchscreen is in large part equivalent to understanding the functionality of the Dragon.

The Dragon is intended to heat or cool air and achieve the set temperature and flow rate in a way that integrates with your testing, but it is not a test system. It has great flexibility to fulfil your requirements, but it is not pre-programmed with any test campaign. If you need help adapting the Dragon to the tests you have defined, please contact Froilabo to schedule a training session.

Clean Dry Air

Any moisture in the air can cause frost to form below 0°C; at the other extreme, heating can boil off any moisture, creating steam. Both cases can damage the Dragon or the DUTs.

The Dragon is equipped with an air dryer to reduce the humidity in the compressed air as much as possible, but beyond the outlet on the head, attention must be paid to the environmental conditions on the DUT.

The Dragon is pre-equipped with different elements:

- 1µ pre-filter with automatic drain and gauge (also used to collect oil from the air inlet)
- 0.01 ppm filter with purge
- Dual cylinder absorption dryer
- particle output filter

☞ *When using the glass test bell that comes with the Dragon, or another nozzle or housing, it is advisable to check the airflow around the DUT to confirm the Dragon can fill the space with the selected airflow if moisture should be excluded.*



Safety of the User, the DUT and the Dragon



The Dragon is designed to cool and heat air before expelling it onto test components, subjecting them to extreme temperatures. Always respect the outlet, which can carry very hot or very cold air and cause burns.

Several safety devices enable safe operation for the operator, for the DUTs and for the Dragon itself, but you must understand the Dragon and be sure to use it with care.

This section describes the most important considerations.

Electrical Safety

The rotating power switch on the front panel cuts all power to the unit when turned off. It is capable of being locked with a standard lock tag or padlock.



Always switch off and lock out the switch before accessing the interior of the Dragon or moving it.

The electrical circuits inside the device are protected with fuses, but these are not sufficient to protect the technician because some circuits use high currents.

Any loss of power can damage the Dragon. Avoid power cuts as much as possible.

Temperature Monitoring

The temperature at the outlet of the head is limited to +260°C. A redundant temperature sensor (T°C SEC, or “security”) in the outlet is always monitored to avoid exceeding this limit when the Dragon is powered on.



An operator with sufficient access can change the upper temperature limit. This function is intended to allow a lower temperature limit than the standard limit of +260°C. Never set the limit **above** +260°C as it may damage the Dragon.

It is never advisable to use a step response with temperature setpoints above +175°C, as overshoots risk exceeding the system temperature limit and stopping the Dragon. Always set a controlled ramp with high temperature setpoints.



In most cases when the Dragon is running and the head is up the temperature and flow are set to standby to protect the operator, but not in all cases. Always assume that the air, outlet and bell are extremely cold or hot and never touch them.

Air Cuts



Air cuts can damage the Dragon and seriously affect its lifespan; always follow the instructions in this manual on how to react to air cuts to minimize any damage and contact Froilabo service.

To avoid burning the heating system or the DUT to the greatest possible extent, the Dragon constantly monitors the pressure at the air inlet.



Refrigeration Circuit

The cooling unit of the system is protected by 2 pressure sensors which will be activated by excessive pressures. This situation can occur when the ambient temperature is too high or if the condenser is clogged with dust.

If the pressure sensors are disconnected, an alarm occurs, and the Dragon cannot be used.

In the Event of a Fault

In the event of a fault, the Dragon prioritises safety. Depending on the fault, it reacts to enter the safest state possible.

The Dragon is equipped with a buzzer to warn of faults. The touch screen allows you to review a list of active alarms and the alarm history.

Follow the advice in this manual on how to react to the various faults and alarms; see section [Faults and Alarms](#) to find out more.



Commissioning Procedure



The Dragon must be installed in a ventilated area, with a minimum clearance of 400 mm behind the system and 200 mm on both sides. Locate the Dragon away from heat sources.



Remember to check the direction of the airflow; this can prevent bodily injury or possible damage to the system.

When positioning the Dragon's head, be careful of the risk of burns at very high or very low temperatures.

1. Connect the Dragon to the air supply. You need a 1/2" NPT fitting.
2. Open the air supply valve to fill the Dragon. The Dragon's dryer should fill up in seconds. Listen for air leaks and locate them before continuing; air should not come out of the head.

☞ When pressurizing the Dragon, it is recommended to open the supply air valve slowly and carefully.

3. Ensure the Dragon's power switch is off, then connect the 32A plug to a supply cable protected by a circuit breaker.
4. Switch on the Dragon by turning the power switch. Verify that the touchscreen turns on and proceeds to the start screen.
5. Position the head before starting any mode (see next section).

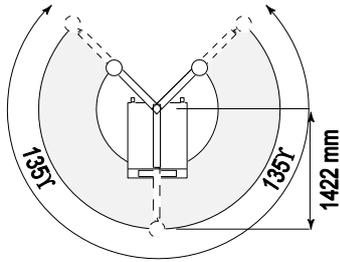


Positioning the Head

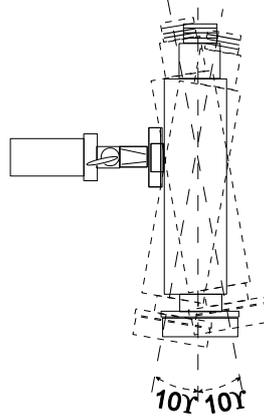
As the system is supplied with adjustable arms, it can be easily adapted to different test benches, thanks to the numerous adjustment possibilities offered by the electric arms.

For positioning the Dragon head and arm, ensure the Dragon is on but not in any mode and then:

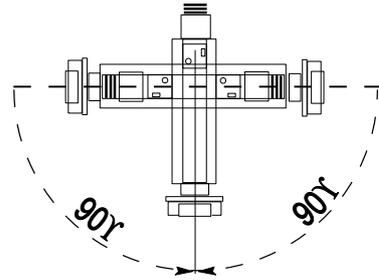
1. Adjust the arm vertically and horizontally using the toggle switches on the head.
2. Adjust the rotary axes manually and then lock them with the handles. Refer to the following illustrations for the ranges of motion:



Arm range of motion



Head tilt adjustment



Head tilt adjustment

☞ To avoid stressing the head supply hose, choose the best solution while positioning the system on the test stand.

3. Start Hot Mode by pressing the button on the touch screen. Wait for the Dragon to start up and be wary of the air that will come out of the head.
4. Select the Manual Mode menu and ensure that a temperature set point of 25°C is selected.



The Dragon does not have a sensor to register physical resistance when lowering the head. Avoid having your hands or your body under your head when it descends.

5. Press the push-button on the head to lower and raise the head pneumatically. Adjust the vertical height of the arm with the switch to ensure that the head arrives at the correct position when descending, i.e., the position that corresponds to the height of your test stand.

☞ To avoid frost formation on the DUT, check the contact between the test bell gasket and the surface of the test stand. Minimise the gaps to minimise the entry of moist air and therefore the formation of frost.



Touchscreen and Usage Guide

The touchscreen on the front of the device allows you to control all the functionality of the Dragon:



It is always on when the Dragon is in operation.

Understanding the functionality on the touchscreen is a big part of understanding the functionality of the Dragon; even the remote-control commands are mainly intended to automate the functionality present on the screen.

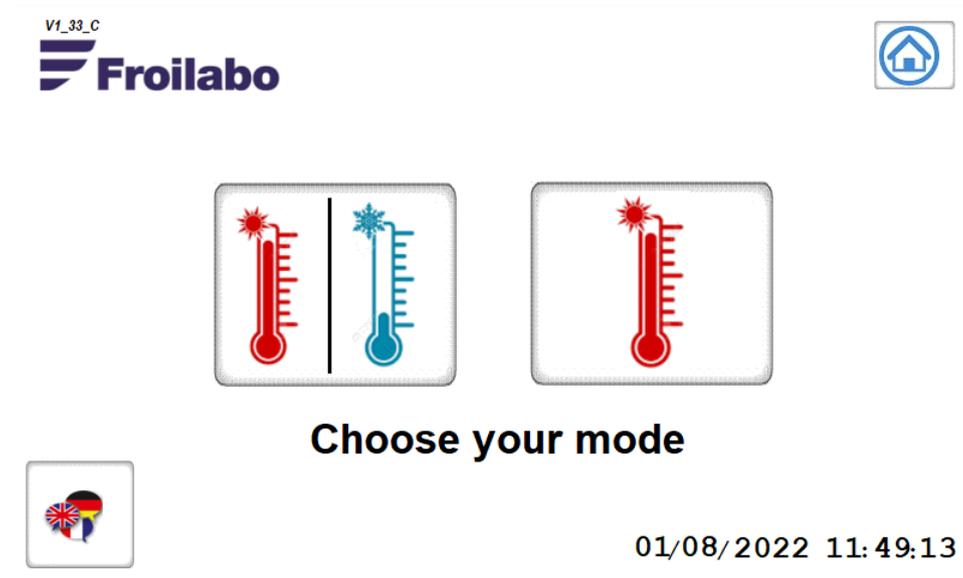
In this section the menus are not described in their order on the screen, but in an order that gives a more natural flow to understanding.



Start Screen

From the start screen, 5 actions are possible:

- Start without mode (home button)
- Start in Cold/Hot Mode
- Start in Hot Mode
- Set system date and time
- Set system language

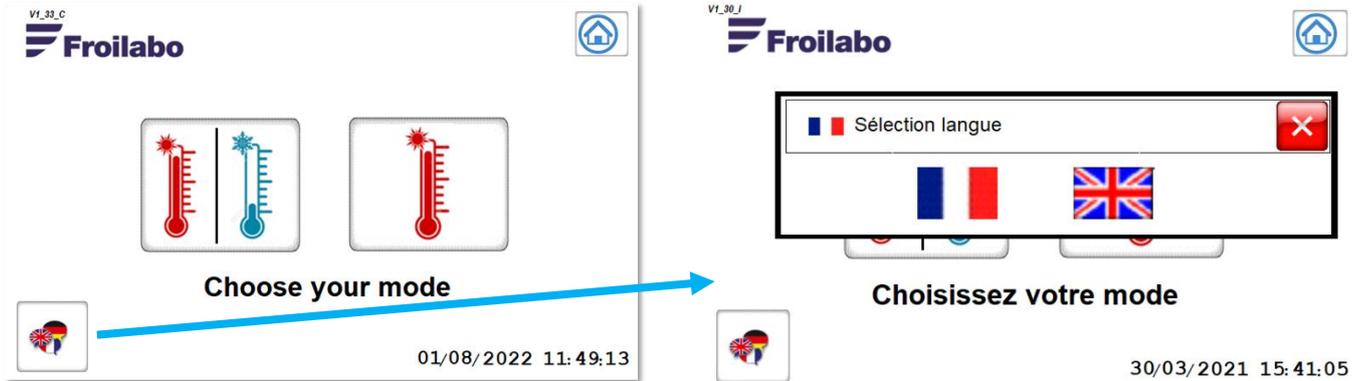




Changing the System Language

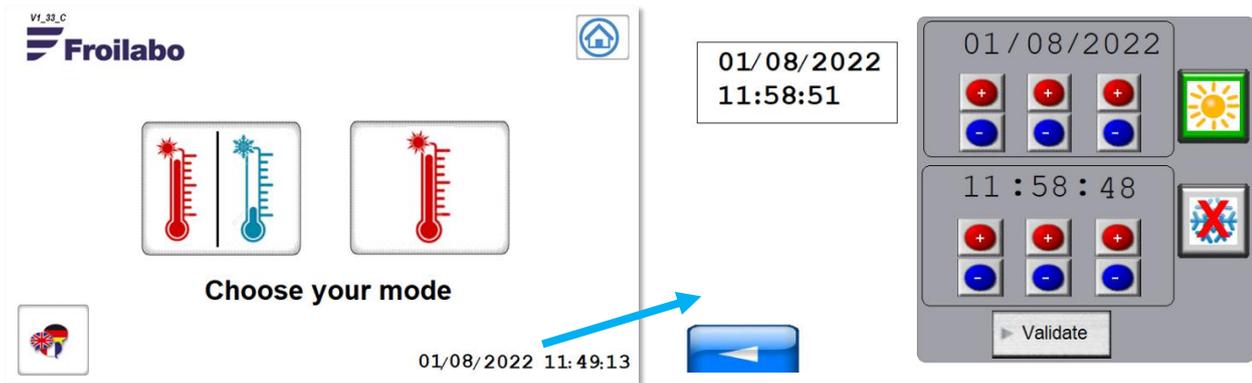
It is possible to choose between French and English.

To do this, press the icon at bottom left and select the desired language:



Setting the Date and Time

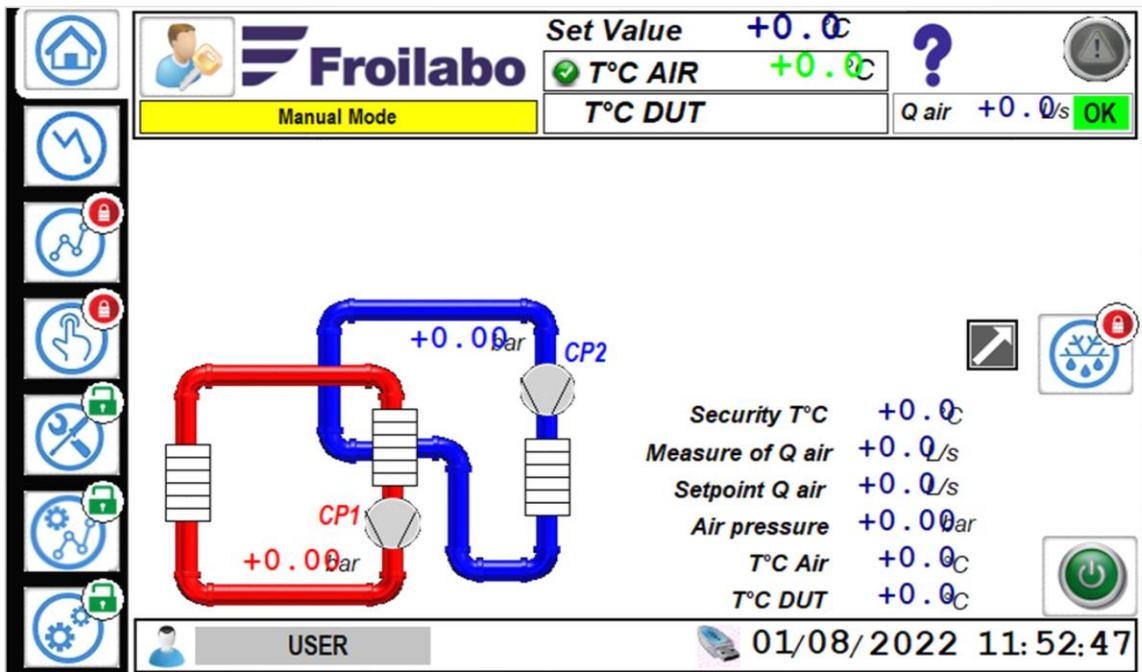
Press on the date and time on the screen for 4 seconds. A menu appears allowing you to set the date and time.



Press on **Validate** to save changes. To exit the menu and save the new settings, press the white back arrow on a blue background.

Starting Without a Mode (Home Button)

It is possible to check the status of the Dragon without a specific mode; however, most menus are locked. Only the first two menus are accessible: the Home screen and the Temperature Curves menu.





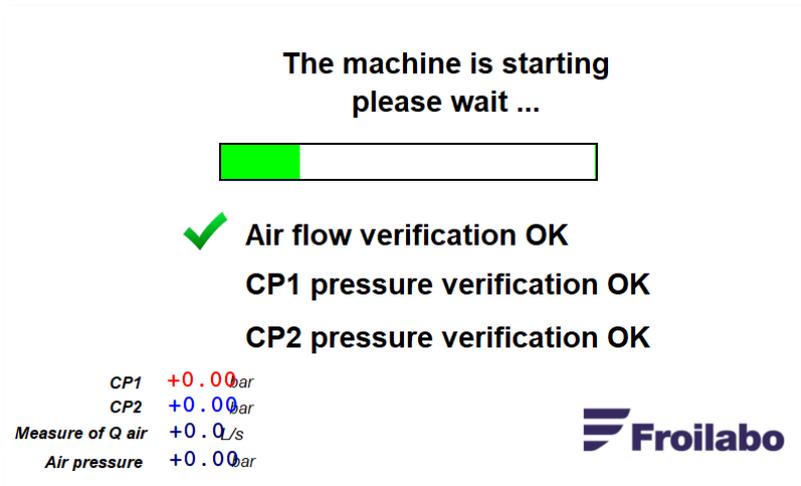
Starting a Heating Mode

Two modes are available from the start screen:

1. **Hot Mode.** Compressed air is heated as it passes through the head. Temperatures in excess of 30°C can be reached.
2. **Cold/Hot Mode.** A refrigeration circuit cools the compressed air down to -72°C before passing it to the head, where the air is heated to reach the set temperature. The full temperature range is possible in this mode.

☞ *It is not advisable to start the Cold/Hot mode more than once per hour to avoid stressing the compressors. Once running, it should be allowed to run for at least 15 minutes to ensure adequate lubrication.*

Starting the Dragon takes several minutes. A progress bar will indicate that the Dragon is starting up in the selected mode.



When the machine completes the start-up phase, the screen displays the home menu. The manual and programming menus are then available. The Dragon enters standby mode.



Standby Mode

Even though it does not correspond to an official mode that can be selected on the Dragon, it is good to understand the behaviour of the Dragon when it is started and in standby mode.

The Dragon raises its head and goes into standby mode with sufficient heating to maintain a safe temperature of $25 \pm 5^\circ\text{C}$ and a low flow rate. This means that the heating element and significant currents may be live inside the device.



Even if the head is up, it does not necessarily mean that the Dragon is on standby. For example, it is possible to move the head up while running a program but maintain the setpoint. Always monitor the temperature readouts and assume the head outlet is very cold or hot.



Never access the interior of the Dragon if it is on, even in standby mode.

It is not advisable to leave the Dragon in standby mode for more than 20 minutes at a time if it is in cool/heat mode. The low flow will cause frost to form on the compressor outlet, as the cooling load will be much lower than normal.



Overview of the Interface

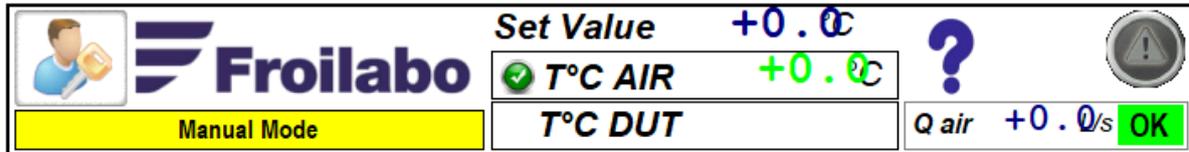
The user interface is composed of 4 zones:

- The list of different menus, box below in red
- The top banner, box below in blue
- The lower banner, box below in yellow
- The main display area, which changes according to the selected menu, box below in green

The screenshot displays the Froilabo control interface. On the left, a vertical menu bar contains icons for home, settings, and other functions. The top banner features the Froilabo logo, 'Manual Mode' status, and a 'Set Value' field set to $+0.0^{\circ}\text{C}$. Below this, a table shows parameters: $T^{\circ}\text{C AIR}$ at $+0.0^{\circ}\text{C}$, $T^{\circ}\text{C DUT}$ at $+0.0^{\circ}\text{C}$, and $Q\text{ air}$ at $+0.0\text{ l/s}$. The main display area shows a schematic of two circulators, CP1 (red) and CP2 (blue), both at $+0.00\text{ bar}$. To the right of the schematic, a list of parameters is shown: Security $T^{\circ}\text{C}$ at $+0.0^{\circ}\text{C}$, Measure of $Q\text{ air}$ at $+0.0\text{ l/s}$, Setpoint $Q\text{ air}$ at $+0.0\text{ l/s}$, Air pressure at $+0.00\text{ bar}$, $T^{\circ}\text{C Air}$ at $+0.0^{\circ}\text{C}$, and $T^{\circ}\text{C DUT}$ at $+0.0^{\circ}\text{C}$. The bottom banner shows the user 'USER' and the timestamp '01/08/2022 12:24:23'.



Top Banner



This banner is the same regardless of the menu selected.

From this banner, it is possible to:

- Access the password dialog
- Access the alarm panel

It also displays:

- The active temperature setpoint
- The measured temperature at the point of regulation (T°C AIR or DUT)
- The measured current airflow (Q air)

Bottom Banner



The bottom banner shows:

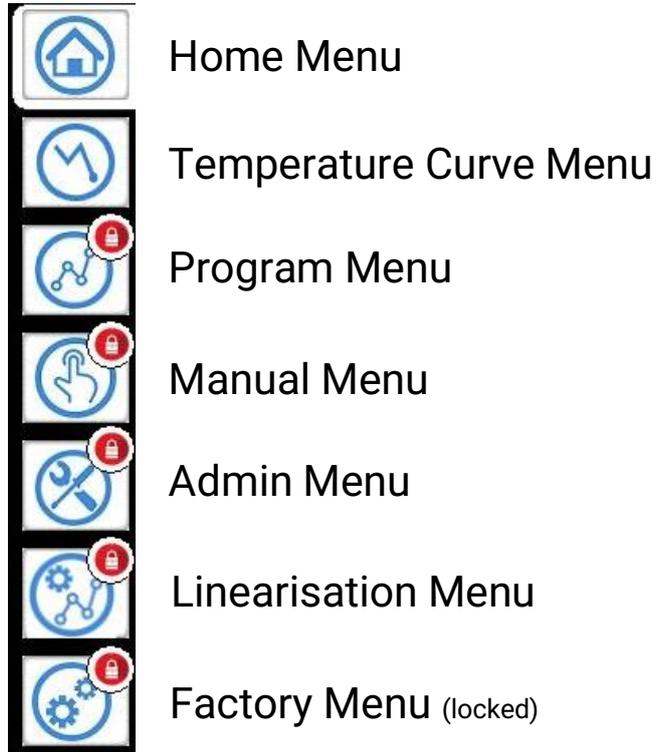
- The operator's current access level
- Whether or not a USB key is connected
- Today's date
- Current time



List of System Menus

On the left side of the screen is a series of tabs for selecting the various menus available to the operator.

Some menus will be blocked depending on the access level of the operator.



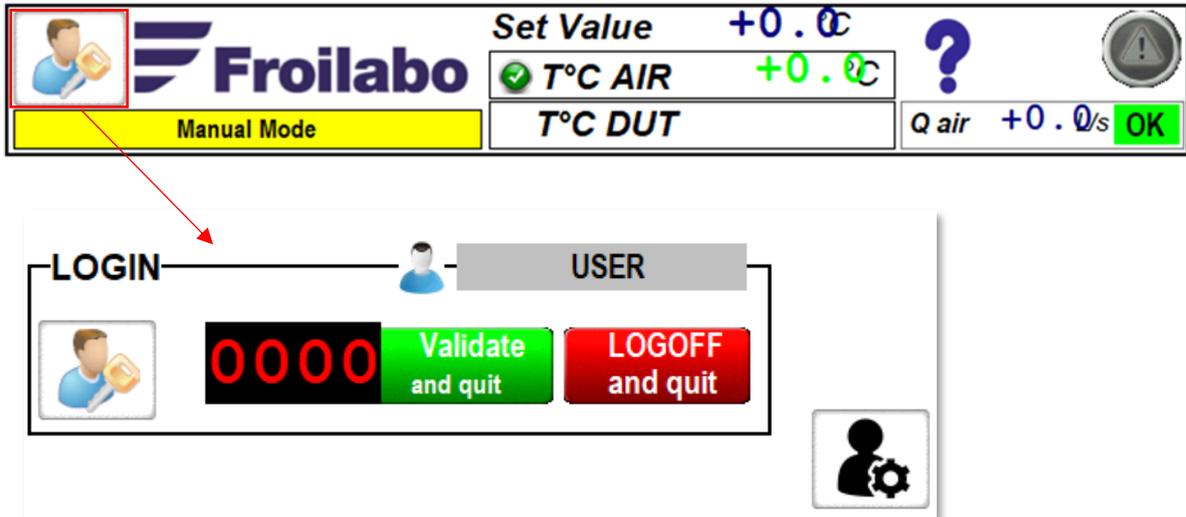


Password and Access Level

Pressing the key icon at top left opens the password dialog.

2 access levels are available:

- **USER:** No password required. Basic functionality.
- **ADMIN:** Dedicated to the advanced use of the machine as well as editing programs, configuring the external communication and the changing certain advanced temperature parameters.



Enter the password and confirm. By default, the access level is USER.

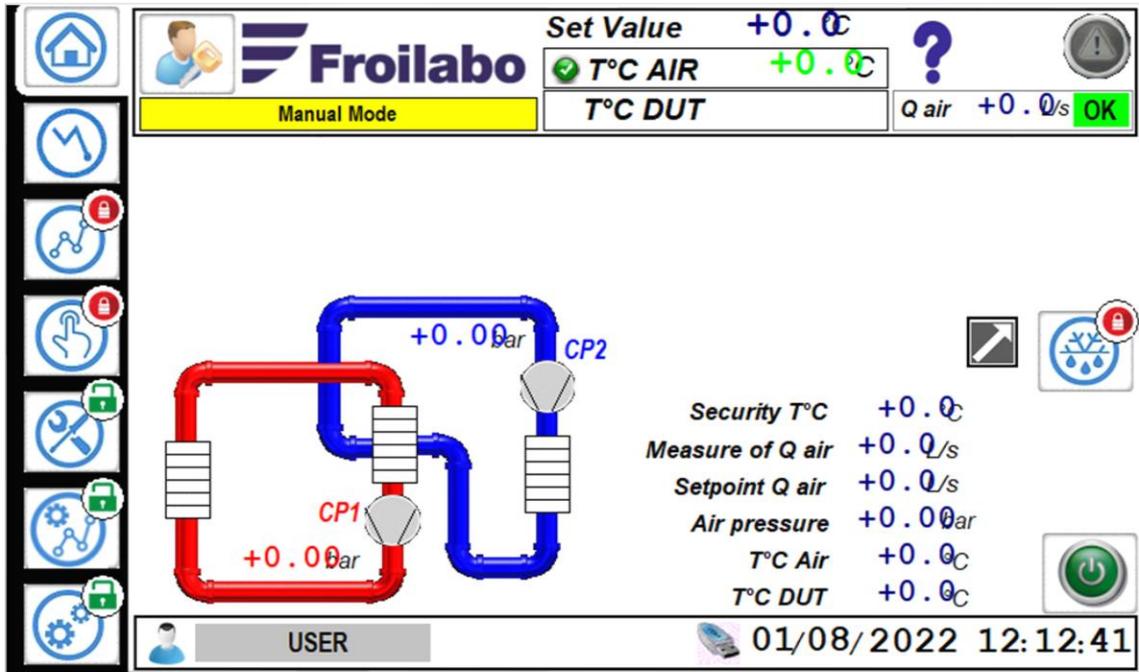
Name	Default Password
USER	0
ADMIN	900

If the operator is logged in as ADMIN, an extra button appears allowing the ADMIN password to be changed.



Home Menu

The Home menu mainly provides a system overview:



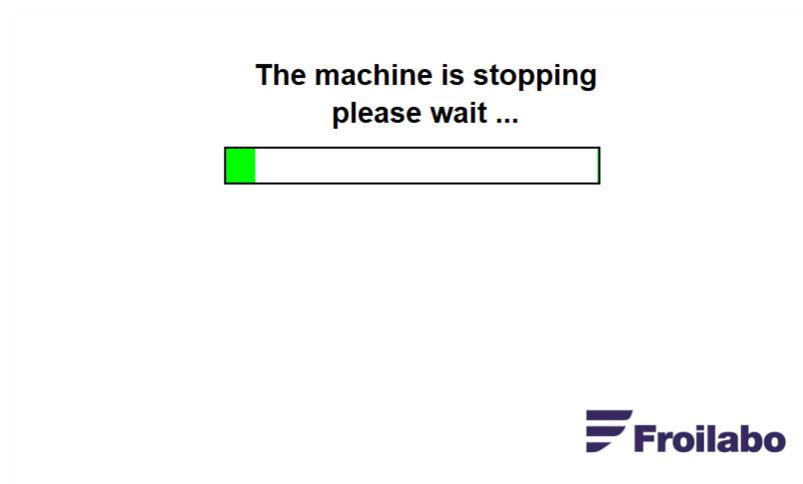
Stopping the Dragon

At bottom right is a power button. It allows the operator to:

- Return to the start screen if the Dragon is not started in one of the two possible heating modes.
- Stop the Dragon if it is started in one of the two modes. A dialog will open to verify that the Dragon should be stopped or cancelled.



Except in an emergency, never stop the Dragon with the main power switch. Always use the onscreen power button to stop operation.





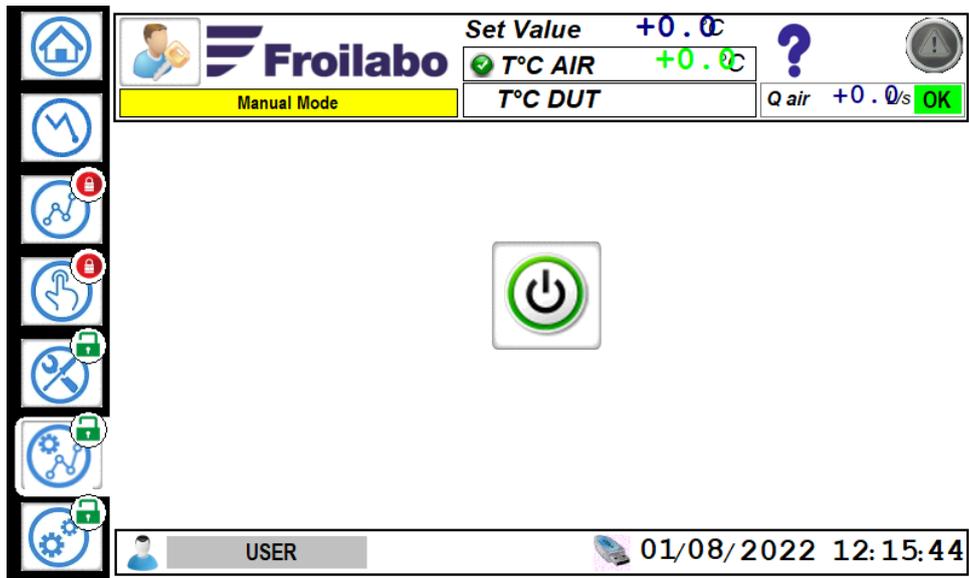
Defrost

The defrost button is located at screen right. This button is used to thaw the refrigeration system after a sudden or unexpected shutdown.

When a defrost cycle is initiated, the Dragon blows dry air for 10 minutes.

☞ *The defrost cycle is not necessary except in special cases, as the Dragon incorporates a defrost cycle into its shutdown sequence.*

The defrost function is locked if the Dragon is not started.



Defrost procedure:

1. Ensure the Dragon's head is pointed in a safe direction.
2. Start the Dragon in Hot Mode.
3. Once the heating mode is started, start the defrost cycle using the button and wait.
4. When the defrost cycle is complete, stop the Dragon using the onscreen power button.



Manual Menu

The Manual menu allows the operator to configure the regulation. Up to 3 temperature, ramp and airflow (Q Air) setpoints can be modified, saved and launched.

All the basic Dragon functionality is represented:

The screenshot shows the 'MANUAL MODE' interface. At the top left, there are controls for 'Choose T°C' (T°C AIR and T°C DUT), 'PID' (P, I, D) settings, and 'Parameter T°C components'. A red power button is visible. Below these are buttons for 'Set Head valve /' and 'Start cycle'. The main display is a table with columns for 'Temperature +0.0%', 'Ramp', and 'Q air +0.0%'. The rows represent setpoints T1, T2, and T3.

	Temperature +0.0%	Ramp	Q air +0.0%
T1	+125.0 °C	+0.0 °C/min	+6.0 L/s
T2	+25.0 °C	+0.0 °C/min	+6.0 L/s
T3	-55.0 °C	+0.0 °C/min	+6.0 L/s

Changing the Manual Setpoints

Up to 3 temperature, ramp and airflow (Q Air) setpoints can be modified, saved and launched.

The 3 setpoints correspond to T1, T2 et T3. The name of the active setpoint is always green.

For each setpoint, it is possible to define:

- Temperature: -72 to +250°C
- Ramp: 0.1 to 10°C/s a ramp of 0.0 means a step response (no ramp)
- Airflow: 2.2 to 8.4 L/s

The **PID** button allows you to choose between the 4 temperature PIDs saved on the Dragon. The selected PID will be applied to the temperature regulation in T°C AIR or T°C DUT.

It is never advisable to use a step response with temperature setpoints above +175°C, as overshoots risk exceeding the system temperature limit and stopping the Dragon. Always set a controlled ramp with high temperature setpoints.

Very low temperatures with very high flow rates can be sustained for only a few minutes, depending on the ambient conditions, the chosen temperature control mode, the volume of the test space, the heat rejection of the DUT if powered, etc. It is recommended to consider the test conditions and to make preliminary proofs of the performance of the Dragon according to the specific use case.



Starting and Stopping a Manual Setpoint

To start a setpoint:

1. Ensure the head is pointed in the correct direction and the head descent distance has been set to match the test stand (see Positioning the Head).
2. Select the setpoint by pressing on the name. The name of the active instruction is always highlighted in green.
3. To drop the head and start regulation on the chosen setpoint, press the onscreen button **Set Head Valve** or the push-button on the head of the Dragon.

 *Pushing the button on the head blocks the touchscreen from raising/lowering the head. It is preferable to use the button on the screen where possible. To unlock the onscreen button, press the button until the icon changes from red to green. But be careful, on descending the head will launch the active setpoint.*

To stop the setpoint, press the **Set Head Valve** button again or push the button on the Dragon's head. The head will come up and the Dragon will go into standby mode.

Choosing a Temperature Regulation Mode (AIR or DUT)

The button **Choose T°C** allows you to change the temperature probe that will be used for temperature regulation. Three types of thermocouples can be selected in the case of T°C DUT, to match the type that is plugged into the Dragon's head.

The choice of T°C DUT sensor will persist unless the T°C DUT sensor is disconnected or faulty and will be valid for all Dragon temperature control, whether a setpoint in Manual mode or in Program mode.

 *A tip to check if there is a problem with the DUT thermocouple: On the Home menu, review the T°C DUT temperature. If it reads +900.0°C, the thermocouple is not connected, badly connected or there is a fault.*

When the regulation is set to T°C DUT, an additional button named **Parameter T°C Components** will be present. This button offers advanced settings to protect the DUT from overtemperature in line with your test procedure. Contact Froilabo for more information.



Program Menu

The Program menu allows you to create a series of setpoints to be completed one after the other.

Program mode

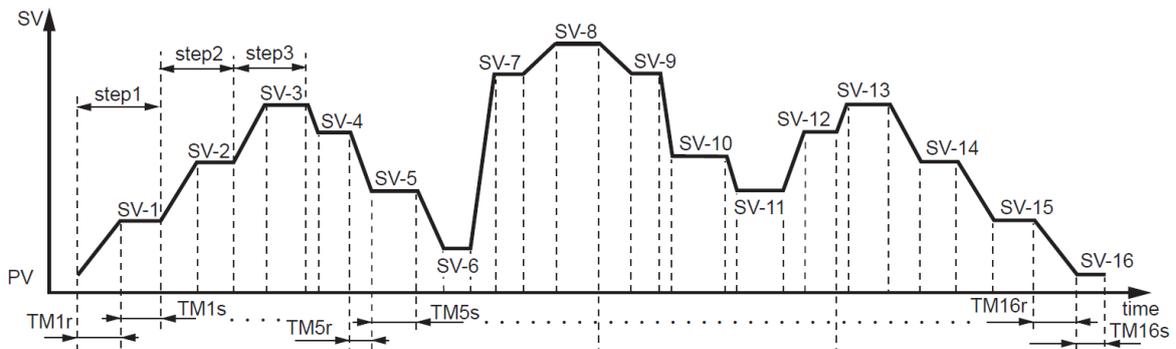
   	N° PRG	1	PID1	PID2	PID3	PID4	0	
	01	+55.0 °C	50 sec	5.0 °C/sec				6.0 L/sec
	02	+0.0 °C	100 sec	2.0 °C/sec				0.0 L/sec
	03	-12.0 °C	0 sec	0.0 °C/sec				0.0 L/sec
	04	+0.0 °C	0 sec	0.0 °C/sec				0.0 L/sec
	05	+0.0 °C	0 sec	0.0 °C/sec				0.0 L/sec
	06	+0.0 °C	0 sec	0.0 °C/sec				0.0 L/sec

The table allows you to choose the desired program. The table header contains:

- The number of the selected program (the Dragon can store up to 20)
- Arrows to select the desired program
- The temperature PID selected for use with the selected program
- The number of loops the program will complete: 0 to 99 iterations

☞ *The program considers that it has no more steps to perform when the next line does not contain a setpoint (0.0) in the airflow box. In the example at the top of the page, the program consists of a single step.*

This simplified diagram illustrates the progression of a fictional 16-step program:



To the left of the table are 4 buttons:

- The **rubbish bin** for deleting a program
- The **two sheets** connected by an arrow to copy a program
- The **sheet and the pen** create a new program
- The **power button** to start the selected program



Creating and Modifying Programs

☞ *Operators with a USER access level can choose and start a program; to modify, create or delete programs, you must be logged into the ADMIN access level.*

On each line, the operator can set the desired values for the following parameters:

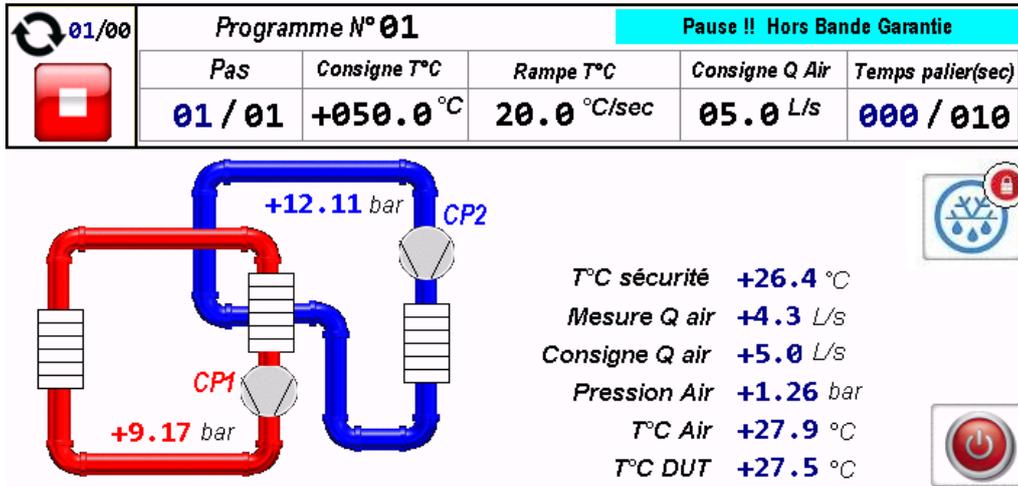
- Temperature: -72 to +250°C
- Dwell time: 0 to 999 s *this corresponds to the length of the program stage*
- Ramp: 0.1 to 10°C/s *a ramp of 0.0 means a step response (no ramp)*
- Airflow: 2.2 to 8.4 L/s

☞ *It is never advisable to use a step response with temperature setpoints above +175°C, as overshoots risk exceeding the system temperature limit and stopping the Dragon. Always set a controlled ramp with high temperature setpoints.*

Starting and Stopping a Program

☞ The Delta Tmax mode and linked parameters configurable in Manual mode can also be used in Program mode; if enabled, they will apply to the program on start.

When a program starts, the screen returns to the Home menu and displays a banner above the system overview:



It is possible to stop the program at any time by pressing the **stop** button.

The program closes automatically if the number of iterations is greater than 0. If the number of iterations is 0, the Dragon will sound the buzzer when the program is complete to alert the operator.

At the end of the program, the buzzer sounds, and the screen displays a window informing the user of program's completion:



If the user does not click on **Yes**, the machine will continue to regulate the temperature and the airflow according to the instructions of the last line of the program so as not to cause a thermal shock to the DUT.

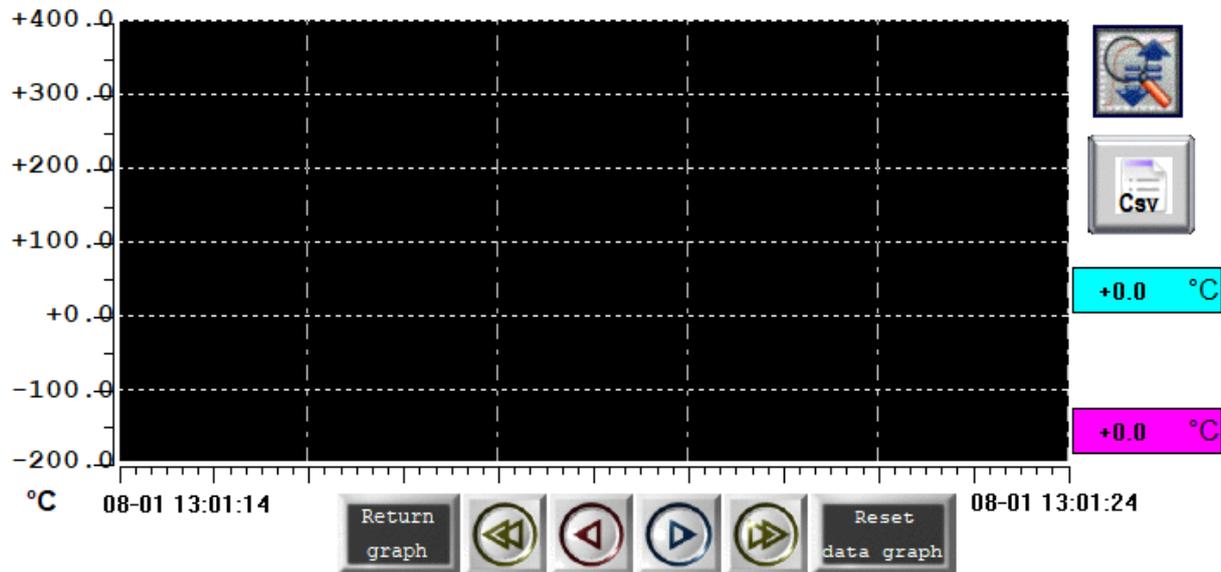
Once the user presses **Yes**, the machine automatically returns to standby mode.



Temperature Curve Menu

This menu allows you to monitor the temperature recorded by the AIR or DUT thermocouple (depending on the active mode) and the temperature logged during the last 30 minutes of operation.

Like the Home menu, it is accessible regardless of the heating mode and level of access chosen.



To the right of the graph are two buttons:

- The **magnifying glass** is used to adjust the limit values on the vertical axis of the graph.
- The **CSV** button allows you to export the temperature data to a CSV file if a USB drive is connected.

The arrows below the graph move the cursor:

- **Single arrows** move the cursor second by second.
- **Double arrows** move the cursor 10 minutes at a time (one screen).

It is possible to scan back up to 30 minutes.

The **Return Graph** button returns the cursor to time t.



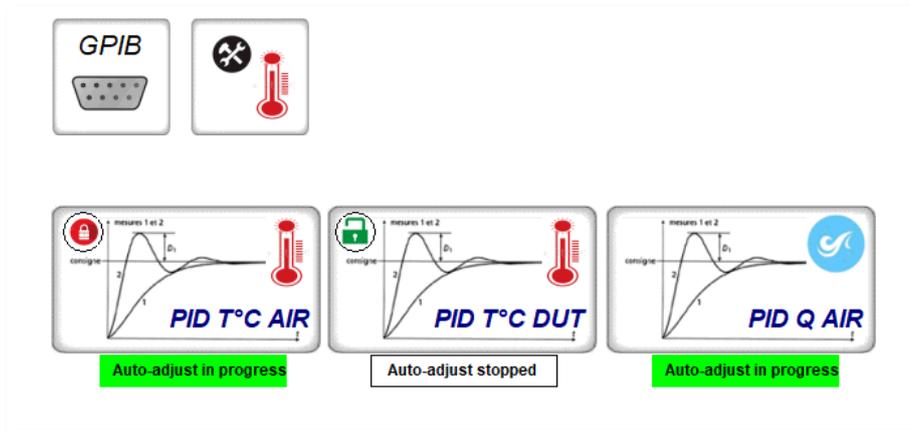
Admin Menu

The Admin menu is accessible to operators with ADMIN access level and allows the operator to change advanced parameter, including the PIDs, and to set, activate and deactivate external communication.



Changing advanced regulation settings on the Dragon, including the PIDs, may result in poor performance and damage the DUT or the Dragon. In most cases, the standard PID is well-calibrated to reach and maintain the desired setpoint. Contact Froilabo for more information or to arrange training.

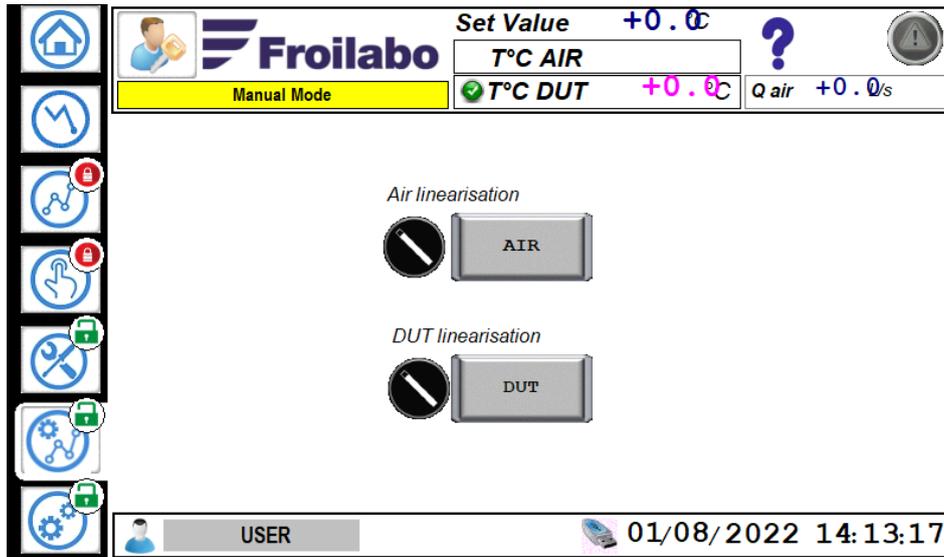
For more information on setting up and activating external communication, see the section External Communication and Remote Control.





Linearisation Menu

The Linearisation menu is used to smooth the temperatures given by the Dragon. It makes it possible to calibrate the link between the acquisition of information and the readout.



To launch it, just press the Linearisation button. It is recommended to calibrate it in advance to use it:

Linéarisation AIR Température

Q AIR +0.0 L/s
Set Value +0.0°C

Input +0.0°C → Output +0.0°C

Low alarm ●
High alarm ●
Offset PV +0.0
SV PUM +0.0

	PV brut	PV cor									
01	-100.0	-100.0	01	+0.0	+0.0	01	+0.0	+0.0	01	+0.0	+0.0
02	+0.0	+0.0	02	+0.0	+0.0	02	+0.0	+0.0	02	+0.0	+0.0
03	+0.0	+0.0	03	+0.0	+0.0	03	+0.0	+0.0	03	+0.0	+0.0
04	+0.0	+0.0	04	+0.0	+0.0	04	+0.0	+0.0	04	+0.0	+0.0
05	+0.0	+0.0	05	+0.0	+0.0	05	+0.0	+0.0	05	+0.0	+0.0
06	+0.0	+0.0	06	+0.0	+0.0	06	+0.0	+0.0	06	+0.0	+0.0
05	+0.0	+0.0	05	+0.0	+0.0	05	+0.0	+0.0	05	+0.0	+0.0
06	+0.0	+0.0	06	+0.0	+0.0	06	+0.0	+0.0	06	+500.0	+500.0

Help ?

To linearise follow the instructions (**Help** icon in the lower right corner) which provide a step-by-step procedure.

☞ Always proceed from the lowest temperature to the highest temperature.



Faults and Alarms

Dragon alarms indicate the presence of a fault and should be taken seriously. This section describes the various faults and the procedures to follow when an alarm is triggered.

Quick Reference Table for Alarms

For more information, refer to section Detailed List of Alarms.

Alarm	Contact Froilabo
DEF 01: T°C > 260°C	Yes
DEF 02: T°C high	Yes
DEF 03: Lack of air	Yes
DEF 04: HP CP1	Yes
DEF 05: HP CP2	Yes
DEF 06: T°C DUT error	Not required
DEF 07: T°C AIR error	Yes
DEF 08: High T° threshold exceeded	Not required
DEF 09: Low T° threshold exceeded	Not required
DEF 10: Pressure sensor CP 2 disconnected	Yes
DEF 12: Low air pressure	Not required
DEF 13: High air pressure	Not required
DEF 14: Pressure sensor CP 1 disconnected	Yes
DEF 15: High air flow	Not required
DEF 16: Communication errors	Yes
DEF 17: T°C K SAFETY error	Yes

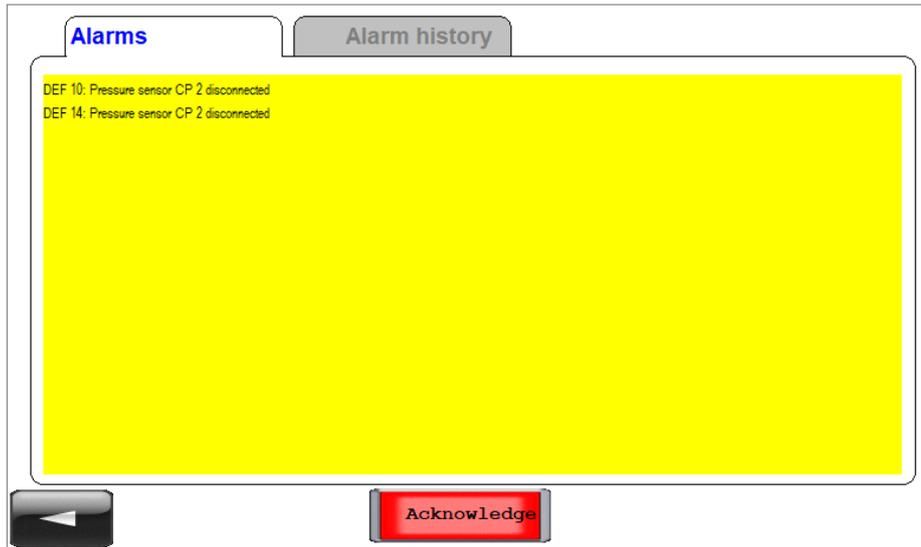


Viewing the Alarms

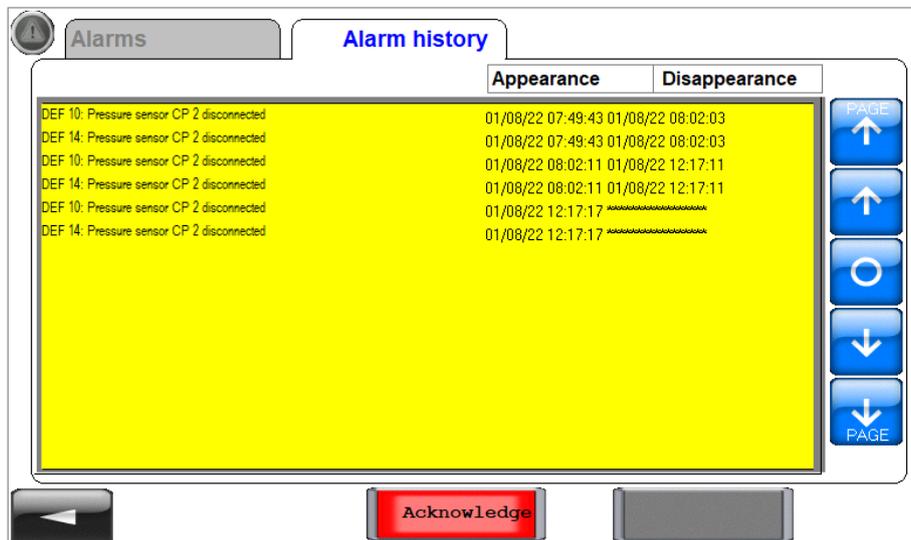
By pressing on the warning triangle in the upper corner of any menu, the alarm panel opens. It has two tabs.



The first tab contains the active alarms and allows the operator to Acknowledge them using the button:



The second tab contains the alarm history, with all the alarms that have appeared on the Dragon, their time of appearance and time of disappearance (problem resolved or alarm acknowledged by the operator):





Detailed List of Alarms

The alarm resolution and prevention advice given in this section is not exhaustive; contact Froilabo for serious defects or if the cause of a defect cannot be identified and resolved.

DEF 01: T°C > 260°C

DEF 02: T°C high

Meaning:	Both alarms indicate that the temperature probe has registered that the current temperature in the head outlet exceeds the upper allowable limit.
Impact:	<p>Power to the heating elements is cut off. The Dragon continues to blow air to cool the head and minimise damage.</p> <p>Possibility of damaging the Dragon's head.</p> <p>Possibility of damaging the DUT due to thermal shock during the temperature rise or after the power to the heating elements has been cut.</p>
Resolution:	<p>If the alarm is acknowledged, the Dragon will restart the last setpoint, and will probably suffer a second temperature overshoot. Change the setpoint to a lower temperature or stop the active program (as the case may be) as soon as the alarm is cleared.</p> <p>Inspect the DUT for damage.</p> <p>Contact Froilabo, describe the mode of use and the setpoints active when the fault occurred.</p>
Prevention:	<p>For any setpoint temperature higher than +175°C, step responses are not recommended. Use a limited temperature ramp to avoid overshoot.</p> <p>Check if the upper temperature limit has been set lower than +260°C and check if this will cause conflicts with the desired temperature setpoint.</p>



DEF 03: Lack of air

Meaning:	The airflow is too low; the compressed air supply is not sufficient or there is a blockage.
Impact:	<p>The Dragon stops the active mode of operation via forced shutdown. It is not possible to start a heating mode until the alarm is acknowledged (the Dragon performs an airflow check during every start sequence).</p> <p>Possibility of damaging the Dragon's head.</p> <p>Possibility of freezing the heat exchanger and damaging the compressors if the Dragon was in Cold/Hot mode.</p> <p>Possibility of damaging the DUT due to thermal shock after power is cut to the heating elements.</p>
Resolution:	<p>If the alarm is acknowledged, the operator can try to restart the Dragon.</p> <p>Before attempting to restart the Dragon, check the compressed air supply; ensure the compressed air system is pressurized and the valve that controls the Dragon's air supply is open. Check for kinks or blockages up to the Dragon air inlet.</p> <p>Try to start the Dragon in Hot mode. Check if the alarm is reactivated.</p> <p>If the Dragon was in Cold/Hot mode during the fault, initiate a defrost cycle. See Defrost. Once the defrost cycle is completed, wait one hour before restarting the Cold/Hot mode.</p> <p>Inspect the DUT for damage.</p> <p>Contact Froilabo, describe the mode of use and the setpoints active when the fault occurred and the behaviour of the Dragon after acknowledging the alarm.</p>
Prevention:	<p>Check that the compressed air supply system is working properly and undergoes preventive maintenance. Ensure the system can meet the Dragon's needs continuously despite other compressed air demands, especially transient demands.</p> <p>Check the air supply hose regularly. Check for kinks or blockages.</p> <p>Ensure that the positioning of the head outlet could not cause significant back pressure (as in a closed test chamber).</p>



DEF 04: HP CP1

DEF 05: HP CP2

Meaning:	The measured pressure in the refrigeration circuit exceeds the safety limits.
Impact:	<p>The Dragon shuts down both compressors and the Cold/Hot operation mode. It is not possible to start the Dragon until the alarm is acknowledged.</p> <p>Possibility of damaging the compressors.</p> <p>Possibility of frost build-up in the heat exchanger.</p> <p>Possibility of damaging the Dragon's head.</p> <p>Possibility of damaging the DUT due to thermal shock after power is cut to the heating elements.</p>
Resolution:	<p>Check and record ambient temperature and humidity if possible. Wait until it is within the limits of use.</p> <p>If the alarm is acknowledged, the operator can try to restart the Dragon. Before trying to restart, wait one hour.</p> <p>Inspect the DUT for damage.</p> <p>If the alarm is reactivated, contact Froilabo, describe the conditions of use before the fault and the behaviour of the Dragon after acknowledging the alarm.</p>
Prevention:	<p>Ensure that the temperature and humidity of the room where the Dragon is installed are not excessive. Remember that the Dragon generates heat during its operation, whether due to the heating of the air or the heat rejected from the condenser. Ensure the room is sufficiently ventilated.</p> <p>Ensure that the temperature of the compressed air supplied to the Dragon is not excessive.</p> <p>Check the condenser and clean it if there is dust.</p>



DEF 06: T°C DUT error

☞ *This alarm is auto-acknowledged by the Dragon. During tests, it is advisable to regularly check that T°C DUT is active (using the remote commands, check the response to the **S** command to positively verify that the regulation continues to be on T°C DUT).*

- Meaning:** A problem prevents a DUT temperature from being recorded; the thermocouple is not connected, the thermocouple is broken or the type of thermocouple is not set correctly.
- Impact:** The Dragon automatically returns to the T°C AIR probe and continues to regulate the temperature in accordance with the active setpoint to protect the head and the DUT.
- The alarm is auto-acknowledged in 2 seconds but remains visible in the history.
- The test underway continues with the regulation on AIR, the regulation does not correspond to the defined test procedure.
- Resolution:** Check that the DUT thermocouple is connected and the correct thermocouple type is set in the **Choose T°C** parameters.
- Prevention:** Each time regulation on DUT is activated, check that it has been activated successfully.

DEF 07: T°C AIR error

- Meaning:** A problem prevents the T°C AIR temperature from being recorded; the thermocouple is broken or the type of thermocouple is not set correctly.
- Impact:** It is not possible to use the Dragon until the problem is solved.
- Dragon out of service.
- Resolution:** Contact Froilabo and schedule a service visit.
- Prevention:** No advice, the AIR thermocouple is not accessible to the operator.

DEF 08: High T° threshold exceeded

DEF 09: Low T° threshold exceeded

- Meaning:** The recorded temperature exceeds the Delta Tmax limits defined by the user.
- Impact:** Possible breach of the test procedure.
- Resolution:** Acknowledge the alarm.
- Review the temperature curves, check the Delta Tmax parameters and the temperature and ramp setpoints.
- Prevention:** Arrange training by Froilabo to understand the proper use of advanced functions such as Delta Tmax and how to adapt them to your test procedures.



DEF 10: Pressure sensor CP 2 disconnected

DEF 14: Pressure sensor CP 1 disconnected

- Meaning:** The Dragon does not register any pressure for the indicated compressor.
- Impact:** It is not possible to use the Dragon until the problem is solved.
Dragon out of service.
- Resolution:** Acknowledge the alarm. Turn off and turn on the Dragon. Confirm that the fault is still present.
Contact Froilabo to schedule troubleshooting and a possible service visit.
- Prevention:** Protect the Dragon from external vibrations as much as possible.

DEF 12: Low air pressure

☞ See also DEF 03: Lack of air.

- Meaning:** The Dragon does not register any pressure for compressed air.
- Impact:** It is not possible to use the Dragon until the problem is solved.
If the Dragon is running when the alarm is encountered, it will force a shut-down and a DEF 03 alarm will be issued as well.
- Resolution:** If the alarm is acknowledged, the operator can try restarting the Dragon.
Before attempting to restart the Dragon, check the compressed air supply; ensure the compressed air system is pressurized and the valve that controls the Dragon's air supply is open. Check for kinks or blockages up to the Dragon air inlet.
Try to start the Dragon in Hot mode. Check if the alarm is reactivated.
If the Dragon was in Cold/Hot mode during the fault, initiate a defrost cycle. See Defrost. Once the defrost cycle is completed, wait one hour before restarting the Cold/Hot mode.
Inspect the DUT for damage.
Contact Froilabo, describe the mode of use and the setpoints active when the fault occurred and the behaviour of the Dragon after acknowledging the alarm.
- Prevention:** Check that the compressed air supply system is working properly and undergoes preventive maintenance. Ensure the system can meet the Dragon's needs continuously despite other compressed air demands, especially transient demands.
Check the air supply hose regularly. Check for kinks or blockages.
Ensure that the positioning of the head outlet could not cause significant back pressure (as in a closed test chamber).



DEF 13: High air pressure

- Meaning:** The Dragon registers excessive pressure on the compressed air.
- Impact:** It is not possible to use the Dragon until the problem is solved.
- Resolution:** Stop the Dragon, then turn it off with the power switch. Shut off the compressed air supply using the supply valve in your building. Check the compressed air supply; ensure that the compressed air system does not have an overpressure and that the supply pressure is constant.
- Reopen the air supply valve as carefully as possible. Try to start the Dragon in Hot mode. Check if the alarm is reactivated.
- Prevention:** Ensure that the compressed air supply system is working properly and undergoes preventive maintenance. Check air system pressure and the Dragon air supply hose regularly.

DEF 15: High air flow

- Meaning:** The Dragon registers excessive airflow in the head outlet.
- Impact:** The Dragon stops.
- Resolution:** Acknowledge the alarm.
- Prevention:** Ensure that the compressed air supply system is working properly and undergoes preventive maintenance. Check air system pressure and the Dragon air supply hose regularly.

DEF 16: Communication errors

 *This alarm does not allow access to most functions on the touch screen because the Dragon cannot finish loading the software. Remote commands may not work.*

- Meaning:** An internal communication problem prevents the loading and use of the software.
- Impact:** The Dragon cannot be used.
- Dragon out of service.
- Resolution:** Contact Froilabo and schedule a service visit.
- Prevention:** Exceptional occurrence, no advice.

DEF 17: T°C K SAFETY error

- Meaning:** A problem prevents the recording of the safety temperature T°C SEC in the head outlet; the thermocouple is broken or incorrectly connected.
- Impact:** The Dragon stops.
- It is not possible to use the Dragon until the problem is solved.
- Dragon out of service.
- Resolution:** Contact Froilabo and schedule a service visit.
- Prevention:** No advice, the safety thermocouple is not accessible to the operator.



External Communication and Remote Control

The Dragon can be monitored or operated remotely via RS-232C or a GPIB communication link using the IEEE 488.2 protocol.

External communication via RS-232C is standard; GPIB communication is an alternative option specified on the order.

The available commands allow you to control many of the Dragon's parameters and setpoints.

RS-232C Communication (Standard)

Connect the DSUB9 connector from your interface cable to the connector on the rear of the Dragon.

To avoid interference, do not connect an intermediate converter between your system and the RS-232 port (e.g., speed converter).

The RS-232C pinout is as follows:

- Pin 1: Not used
- Pin 2: **RXD**
- Pin 3: **TXD**
- Pin 4: Not used
- Pin 5: **GND**
- Pin 6: Not used
- Pin 7: Not used
- Pin 8: Not used
- Pin 9: Not used

GPIB Communication (IEEE 488.2 Option)

Connect the communication cable to the IEEE 488.2 connector on the rear panel of the Dragon.

Some particularities with communication via GPIB:

- The address switch is factory set to 11. To modify the address, please refer to the manual delivered with the GPIB option.
- The last byte of a message should be the character <LF> (line feed).
- The line EOI is ignored.
- For each command sent to the system via GPIB, an "ENTER" command (or a "READ") should be sent immediately afterwards. This is because the GPIB controller has a 32K buffer, and if the input command is not sent immediately afterwards, there will be a loss of synchronization between the command sent and the value to be read.



Configuring External Communication on the Touchscreen

This dialog is accessible in the Admin menu for operators with ADMIN access level.



Stop the Dragon if it is in Hot or Cold/Hot mode before changing the communication settings. Restarting the screen to save the changes will shut down the system by force.

You can change these settings:

- Baud rate in bps
- Stop bits
- Parity
- Data length
- Length of S command response (1 or 2 bytes) *

* For more information, it is recommended to use 2 bytes.

GPIB

Baude Rate BPS

9600 9600 19200 38400 57600

Stop bits

1 bit 2 bits

Parity

NONE Odd Even

Data Lenght

7 bits 8 bits

Octet S command

7 bits 8 bits

Apply and RESTART SYSTEM

After each modification to the communication parameters, the screen must be restarted.

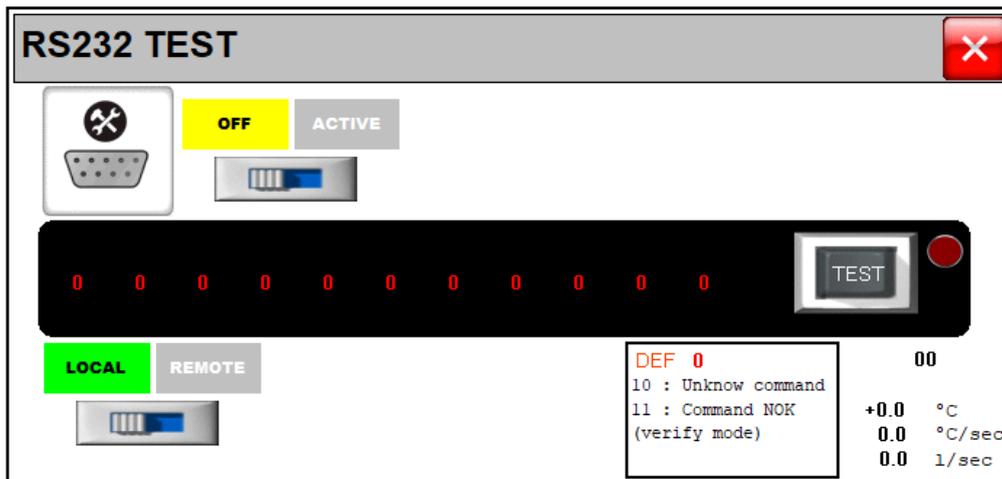
To cancel without saving changes, press the **X**.



Enabling or Disabling External Communication

To enable remote commands (RS-232C or GPIB), toggle the slider on the touch screen to **Active**.

To deactivate the remote controls, toggle the cursor on the touch screen to **OFF**.



The slider at screen bottom toggles between LOCAL and REMOTE modes.

Only an operator with ADMIN access level can enable or disable external communication. Communication will remain on or off even if the operator returns to the USER access level or if the Dragon is turned off and on again; it cannot be turned on or off remotely.



LOCAL or REMOTE Control

Two working modes are available when using external communication:

- LOCAL mode: used to read parameters remotely.
- REMOTE mode: used to modify setpoints and launch programs remotely.

When LOCAL mode is chosen, the user can work using the touch screen or using the communication interface.

When REMOTE mode is selected, only the external communication interface can control the system.



Command Syntax

All commands must be sent in uppercase and end with a carriage return and a line feed.

All responses received from the Dragon will also end with a carriage return and line feed. This sequence is identified in this manual by <CR><LF>, where:

<CR> means a carriage return (hex: 0x0D)
<LF> means a line feed (hex: 0x0A)

An empty string therefore corresponds to *0D 0A* (meaning that only terminators are sent without any arguments).

When the system cannot execute a command, or if a syntax error occurs, the touchscreen will indicate DEF 10 (Unknown command) or DEF 11 (Command not allowed) on the touchscreen in the RS232 Test dialog.

Otherwise, the Dragon will respond as indicated in the command list.



List of Commands

The subsections of this section show the different commands, the modes compatible with their use, and the Dragon's response.

Configure External Communication

R<CR><LF>

Meaning: Set the system to REMOTE control
Mode: LOCAL
Response: The system returns an empty string

L<CR><LF>

Meaning: Set the system to LOCAL control
Mode: REMOTE
Response: The system returns an empty string



Check System Status

S<CR><LF>

Meaning: Return system state
Mode: LOCAL or REMOTE
Response: The response depends on the communication settings (see Configuring External Communication on the Touchscreen)

Octet S command set to 1 byte

The system returns 1 byte described below:

Byte 0 b0: Dragon started in Hot or Cold/Hot mode
b1: Preceding command recognised
b2: Dragon is in REMOTE control mode
b3: Dragon is executing a program
b4: Dragon is executing a program
b5: Dragon has an active alarm
b6: The temperature is being regulated on T°C DUT
b7: The current temperature setpoint has been reached

Command S retour set to 2 bytes

The system returns 2 bytes described below:

Byte 0 b0: Dragon started in Hot or Cold/Hot mode
b1: Preceding command recognised
b2: Dragon is in REMOTE control mode
b3: Dragon is executing a program
b4: Dragon is executing a program
b5: Dragon has an active alarm
b6: The temperature is being regulated on T°C DUT
b7: The current temperature setpoint has been reached

Byte 1 b0: Dragon is ready to operate
b1: Dragon head in up position
b2: Compressor 1 running
b3: Compressor 2 running
b4: Dragon is in standby mode
b5: T°C AIR thermocouple fault
b6: T°C DUT thermocouple fault
b7: Always 1

☞ *The active state for these bits is 1 (logical high).*



DEF<CR><LF>

Meaning: Return list of active faults
Mode: LOCAL or REMOTE
Response: The system returns the 4 bytes described below:

Byte 0	b0:	DEF 01: T°C > 260°C
	b1:	DEF 02: T°C high
	b2:	DEF 03: Lack of air
	b3:	DEF 04: HP CP1
	b4:	DEF 05: HP CP2
	b5:	DEF 06: T°C DUT error
	b6:	DEF 07: T°C AIR error
	b7:	DEF 08: High T° threshold exceeded
Byte 1	b0:	DEF 09: Low T° threshold exceeded
	b1:	DEF 10: Pressure sensor CP 2 disconnected
	b2:	Not used
	b3:	DEF 12: Low air pressure
	b4:	DEF 13: High air pressure
	b5:	DEF 14: Pressure sensor CP 1 disconnected
	b6:	DEF 15: High air flow
	b7:	DEF 16: Communication errors
Byte 2	b0:	DEF 17: T°C K SAFETY error
	b1:	Not used
	b2:	Not used
	b3:	Not used
	b4:	Not used
	b5:	Not used
	b6:	Not used
	b7:	Not used
Byte 3		Not used

☞ *The active state for these bits is 1 (logical high).*

☞ *Alarms cannot be acknowledged remotely.*

W<CR><LF>

Meaning: Return the current temperature setpoint
Mode: LOCAL or REMOTE
Response: The system returns 5 ASCII characters representing the sign of the temperature and the temperature setpoint in tenths of degrees

☞ *Example: A setpoint of +25.0°C corresponds to +0250.
A setpoint of -55.7°C corresponds to -0557.*

☞ *This command is valid for setpoints on T°C AIR or DUT.*



/<CR><LF>

Meaning: Return the current temperature ramp setpoint
Mode: LOCAL or REMOTE
Response: The system returns 4 ASCII characters representing the temperature ramp in hundredths of degrees per second

☞ *Example: A setpoint of 0.8°C/s corresponds to 0080.*

☞ *Remember that a ramp of 0000 corresponds to no ramp (step response).*

F<CR><LF>

Meaning: Return the current airflow setpoint
Mode: LOCAL or REMOTE
Response: The system returns 3 ASCII characters representing the airflow setpoint in tenths of litres per second

☞ *Example: A setpoint of 3.2 L/s corresponds to 032.*

M<CR><LF>

Meaning: Return the current temperature reading from the AIR thermocouple
Mode: LOCAL or REMOTE
Response: The system returns 5 ASCII characters representing the sign of the temperature and the temperature in tenths of degrees

☞ *Example: A reading of +25.0°C corresponds to +0250.
A reading of -55.7°C corresponds to -0557.*

E<CR><LF>

Meaning: Return the current temperature reading from the DUT thermocouple
Mode: LOCAL or REMOTE
Response: The system returns 5 ASCII characters representing the sign of the temperature and the temperature in tenths of degrees

☞ *Example: A reading of +25.0°C corresponds to +0250.
A reading of -55.7°C corresponds to -0557.*



Select, Start or Stop a Program

The operator can load, start or stop a program already saved on the Dragon.

It is not possible to modify the saved programs or define a new program to save in the Dragon's memory.

P=??<CR><LF>

Meaning: Load a specific program
Argument: 2 ASCII characters representing the number of the program
Mode: REMOTE
Response: The system returns an empty string

☞ *Example: To select program number 9, send **P=09<CR><LF>***

☞ *If a program is already running, the program will continue running and the change will not apply until the program completes or is stopped.*

P<CR><LF>

Meaning: Start/stop the active program
Mode: LOCAL
Response: The system returns an empty string

☞ *This command must be sent again to stop the program (toggle command).*

☞ *The program number must be chosen in REMOTE mode.*

☞ *The Dragon must be started to launch a program.*

T<CR><LF>

Meaning: Return the time remaining on the current program step (during a program)
Mode: LOCAL or REMOTE
Response: The system returns 4 ASCII characters representing the remaining step time in seconds

☞ *Example: If 132 seconds remain on the current step, this corresponds to 0132.*

☞ *The remaining step time corresponds to the time remaining on the current program step, not to the time remaining to complete the whole program.*



Change the Manual Mode Setpoints

It is possible to change the Manual temperature, ramp and air flow setpoints in real time.

☞ *The changes will take effect whether the Dragon is in standby mode or a Manual setpoint is already in progress.*

This makes it possible to change the instructions during the operation and therefore to carry out very complex remote test campaigns, even though the Dragon is being operated in "Manual" mode!

Setpoint changes have a particular syntax: to allow the range of setpoint changes to be applied at the same time, the setpoints sent are buffered; they will not be applied until the **G** command is sent.

☞ *After any setpoint changes, send a **G** command to apply the changes.*

Example of a valid sequence:

W=+0500 <CR><LF>	Change the temperature setpoint to +50,0°C
/=0090 <CR><LF>	Change the temperature ramp setpoint to 0,9°C/s
F=060 <CR><LF>	Change the airflow setpoint to 6,0 L/s
G <CR><LF>	Apply all changes

W=?????<CR><LF>

Meaning: Define new temperature setpoint
Argument: 5 ASCII characters representing a positive/negative sign followed by the temperature in tenths of degrees
Mode: REMOTE
Response: The system returns an empty string

☞ *Example: To set the temperature to +98.6°C, send **W=+0986**<CR><LF>
To set the temperature to -52.3°C, send **W=-0523**<CR><LF>*

/=????<CR><LF>

Meaning: Define new temperature ramp setpoint
Argument: 4 ASCII characters representing the ramp in hundredths of degrees per second
Mode: REMOTE
Response: The system returns an empty string

☞ *Example: To set the ramp to 0.1°C/s, send **/=0010**<CR><LF>
To set the ramp to 9°C/s, send **/=0900**<CR><LF>*

☞ *To set a step response (no ramp), send **/=0000**<CR><LF>*

F=???<CR><LF>

Meaning: Define the airflow setpoint
Argument: 3 ASCII characters representing the airflow in tenths of litres per second
Mode: REMOTE
Response: The system returns an empty string

☞ *Example: To set the airflow to 3,2 L/s, send **F=032**<CR><LF>*



G<CR><LF>

Meaning: This command validates and applies the instructions already sent
Mode: REMOTE
Response: The system returns 1 byte described below:

Byte 0	b0:	Temperature setpoint applied (valid setpoint)
	b1:	Ramp setpoint applied (valid setpoint)
	b2:	Airflow setpoint applied (valid setpoint)
	b3:	Always 0
	b4:	Always 0
	b5:	Always 0
	b6:	Always 0
	b7:	Always 0

☞ *The active state for these bits is 1 (logical high).*

The Dragon verifies that the setpoints sent are within the limits of the system. If a setpoint is not valid, it will not apply, and a 0 bit will be returned. If the other instructions are valid, they will still be applied.

☞ *The G command will apply the last temperature, ramp and flow setpoints sent. To ensure that the correct values are applied, it is advisable to always send the temperature, ramp and airflow setpoints as a block, even if some setpoints do not change.*



Raising and Lowering the Head

The head can be raised or lowered remotely.

☞ *The movement is made via the pneumatic actuator, in accordance with the high/low positions already set; it is not possible to manipulate the Dragon's arm remotely. See Positioning the Head.*

☞ *If the head push-button has been used to raise or lower the head, the head position will be locked and unable to be actuated remotely.*



Ensure the head up and down positions have been adjusted and checked before using these commands to avoid damage to components or the workspace.



If a program is not running, raising the head will stop the setpoint. Lowering the head will initiate the loaded manual setpoint.

H<CR><LF>

Meaning: Toggle head position using pneumatic actuator
Mode: LOCAL or REMOTE
Response: The system returns:

- 1 (hex: 01) if the head is moved successfully
- 2 (hex: 02) if the head cannot be moved

U<CR><LF>

Meaning: Raise the head
Mode: LOCAL or REMOTE
Response: The system returns:

- 1 (hex: 01) if the head is raised successfully
- 2 (hex: 02) if the head cannot be raised (locked or already up)

D<CR><LF>

Meaning: Lower the head
Mode: LOCAL or REMOTE
Response: The system returns:

- 1 (hex: 01) if the head is lowered successfully
- 2 (hex: 02) if the head cannot be lowered (locked or already up)



Other Commands

C<CR><LF>

Meaning: Toggle regulation between DUT and AIR thermocouples
Mode: LOCAL or REMOTE
Response: The system returns an empty string

☞ *Always ensure the correct placement of the DUT probe before changing the DUT regulation.*

☞ *If the DUT probe is disconnected or not working, the Dragon will automatically switch back to the AIR probe. To check which temperature sensor is active, use the **S** command after waiting 3-4 seconds for the **C** command to take effect.*

O=2<CR><LF>

Meaning: Start the Dragon in Cold/Hot mode or stop the Dragon if running
Mode: REMOTE
Response: The system returns 3 ASCII characters representing:

OK_ if the Dragon starts/stops successfully
NOK if the Dragon cannot be started/stopped

☞ *This command must be sent again to stop/start the system (toggle command).*

☞ *If the Dragon is in Hot mode when the command is received, the Dragon will stop.*

☞ *The Dragon must be powered on to start it remotely.*

☞ *In order not to shorten the life of the compressors, it is recommended not to start the Cold/Hot mode more than once per hour and to leave it running for a minimum of 15 minutes.*



Communication Test

Before using the remote commands, we recommend testing the external communication with the code provided here:

```
import serial
from time import sleep

def write_serial(com, cmd):
    com.open()
    sleep(1) # ensure the port is open (for slower communication, increase the wait time)
    com.write(str.encode(f"{cmd}\r\n"))
    data = com.readline()
    print(data)
    com.close()
    return data

com = serial.Serial('COM8', baudrate=4800, timeout=1, parity=serial.PARITY_NONE, bytesize=8,
stopbits=1) # 'COM_' Need to be verify on your devises
com.close() # important to clear the serial communication

# check the system

write_serial(com, 'S') # query system status
```



Options and Accessories

The following options and accessories are available to facilitate specific test needs:

- Multiple sizes of double-walled glass test bells
- Rubber nozzles
- ESD-protected equipment (cap + stainless steel nozzle + ESD-free silicone foam sheet)

Several accessories can be added to these options depending on the needs of the user.

Silicone Mat

A silicone mat is provided with the Dragon:

- 500 x 500 x 10 mm
- Average hardness: 15 shores

If you have a special request regarding the size or type of silicon (ESD, etc.), please contact Froilabo for any questions.



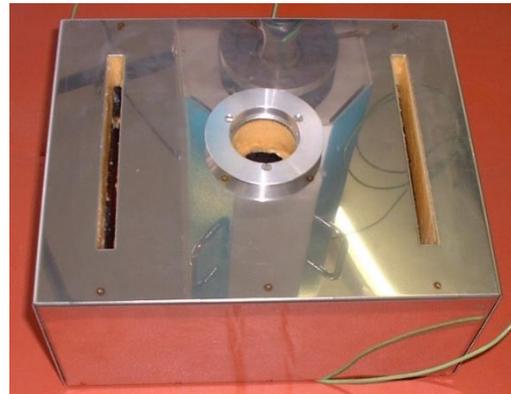
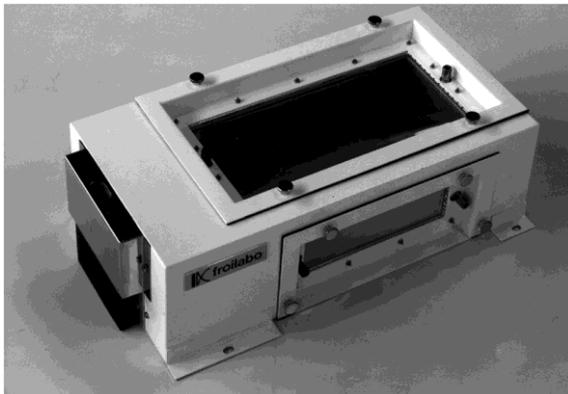
Custom Nozzles

Reference	Dimensions					
	Internal (mm)			External (mm)		
	W	D	H	W	D	H
CLIDRAG000001	34	34	20	45	45	35
CLIDRAG000002	44	35	22	55	45	35
CLIDRAG000003	60	37	20	75	50	35
CLIDRAG000004	65	65	20	75	75	35
CLIDRAG000005	70	35	20	80	45	35
CLIDRAG000006	80	40	20	95	48	35
CLIDRAG000007	90	35	22	100	45	35
CLIDRAG000008	90	77	22	105	90	35
CLIDRAG000009	110	40	20	125	54	35
CLIDRAG000010	117	40	20	125	50	35
CLIDRAG000011	100	30	25	110	40	35
CLIDRAG000012	90	60	25	100	70	35
CLIDRAG000013	50	30	25	60	40	35
CLIDRAG000014	60	30	25	70	40	35
CLIDRAG000015	40	30	25	50	40	35
CLIDRAG000016	100	30	20	115	40	35
CLIDRAG000017	100	100	50	110	110	65
CLIDRAG000018	95	80	25	105	90	35
CLIDRAG000019	90	90	25	100	100	37
CLIDRAG000020	57	57	25	67	67	35
CLIDRAG000021	35	35	34	45	45	49

If you have a specific need for a thermal nozzle or cup, do not hesitate to contact Froilabo with your request.

Custom Test Boxes

Custom test boxes can be quoted on request.





Tube Extensions

Reference	Description	Temperature range
DRAG/HOS1	Extension 1 metre for Dragon	-60°C to +150°C





Maintenance

The Dragon's preventive maintenance requirements are minimal but necessary. This maintenance mainly concerns the condenser, the air dryer and the refrigeration circuit.

Remember that the life expectancy of the device varies according to its service conditions.

Preventive Maintenance

Environment

Check your air supply system frequently and keep it in good working order. Ensure good air pressure and cleanliness.

Check that the temperature and relative humidity of the room where the Dragon is located are maintained within the limits indicated. Ensure the HVAC system in the room is working properly.

Ensure the Dragon is kept a safe distance from airflow obstructions and other heat generating devices.

Cleaning the Condenser

The condenser should be cleaned with a vacuum cleaner at least twice a year to remove dust.

Use a vacuum attachment with a soft brush to avoid damaging the condenser fins.

1. Switch off and unplug the Dragon from the power supply and remove the front cover.
2. Clean the condenser with the vacuum cleaner. Chemicals are not necessary.
3. Replace the front cover before turning the Dragon back on.

Routine Service Visits

In addition to these simple basic tips for taking care of the Dragon, some internal checks may be required once or twice a year on the Dragon depending on the duty cycle. These inspections should be conducted by a specialist. Contact Froilabo to arrange a service visit and inspection:

- Refrigerant pressure should be checked once or twice a year.
- The air dryer must be checked and the 3 filter cartridges replaced after every 1000 hours of operation.



Transport and Disposal

Transportation

Do not tilt the device. Keep the device as free from vibration as possible. At least two people are required to move the unit. Always wear protective gloves.

Contact Froilabo for help with decommissioning, packaging and recommissioning if the device must be moved between buildings.

Disposal

Decontaminate the unit before disposing of it in any way. Contact Froilabo for guidance and observe the applicable legal provisions when disposing of the product.

Information on disposal of electrical and electronic equipment in the European Community: Within the European Union, electrical equipment is subject to national regulations based on Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). According to this directive, it is now prohibited to dispose of industrial appliances (of which this product is a part) delivered after 13.08.2005 with municipal or household waste. For ease of identification, these devices will be marked with the following WEEE symbol:





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