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tuttnauer

Sterilization & Infection Control Products

OPERATION

and

MAINTENANCE MANUAL

Prevacuum Steam Heated Autoclave

and Manual Hinged Door

Model 5596 SP-1

S/N. 2307085

Cat. No. MAN205-0076- 036E Rev A

Manufactured by: ***Tuttnauer Co. Ltd.***, *P.O.Box 35292, Jerusalem, Israel Tel: 972 2 6581611, Fax: 972 2 6520271*
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INCOMING INSPECTION

The autoclave should be unpacked and inspected for mechanical damage upon receipt. Observe packing method and retain packing materials until the unit has been inspected.
Mechanical inspection involved checking for signs of physical damage such as: scratched panel surfaces, broken knobs, etc.

If damage is apparent, file a claim with the carrier. The manufacturer is responsible for products shipped F.O.B. The autoclave is carefully inspected prior to shipment and all reasonable precautions are taken in preparing it for shipment to assure safe arrival at destination.

WARRANTY

We certify that this device is guaranteed to be free from defects in material and workmanship for one year against faulty components and assembly.
The warranty does not include consumable items such as: gaskets, glassware, printer thermal paper and heaters' and does not replace routine treatment and preventive maintenance to be performed according to instructions in paragraph 10.1 'Preventive and Periodical Maintenance.

This warranty does not include malfunction that result from clogged piping or any other defect caused by the building utilities. This warranty is valid only if the water quality, supplied to the machine, complies with the water quality requirements on par. 2.4.

Our obligation is limited to replacing the autoclave or parts, after our examination, if within one year after the date of shipment they prove to be defective. This warranty does not apply to any machine, which has been subjected to misuse, neglect, accident or improper installation or application, nor shall it extend to machines, which have been repaired or altered outside the factory without prior authorization from us.
The autoclave should not be used in a manner not described in this manual!

Note

If there is any difficulty with this machine, and the solution is not covered in this manual, contact our representative or us first.
Do not attempt to service this instrument yourself!
Stipulate *the model* and *serial number* (S.N.) and describe the difficulty as clearly as possible so we may be able to diagnose the problem and hence provide a prompt solution.

For technical information or service please contact our representative at:
Tuttnauer USA Co.
25 Power Drive Hauppauge
NY, 11788, USA
Tel:(800)624 5836, (631)737 4850
Fax:(631)737 07 20
Email: info@tuttnauer.com
Our web site: www.tuttnauer.com

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1. GENERAL INFORMATION

1.1 Introduction

This autoclave is designed to cover a large field of applications for hospitals and medical centers as well as pharmaceutical and biotechnological industries.

The autoclave operates with saturated steam as the sterilizing agent, and has a temperature range of up to 137°C (279°F) and pressure up to 2.3 bars (34 psi).
The autoclave is made of stainless steel, double – walled structure.

The autoclave is equipped with one manual door, provided with a locking mechanism, activated by the steam pressure inside the chamber, preventing the opening of the doors when the chamber is pressurized.

The autoclave has an automatic shutdown system. If no buttons or switches are pressed for four hours, it will go into stand by mode and a led lights up (blinking every second), indicating that the system has gone into stand by mode.

Twelve sterilization programs are available four for unwrapped instruments (gravity), four for wrapped instruments (vacuum) and packages and four for slow pressure exhaust.
Two test programs are also available, the VACUUM TEST for checking the tightness of the chamber and piping system and the BOWIE DICK test enabling to check the efficiency of the sterilization process.

The control system of the sterilizer is based on “State-of –the –Art” microcomputer technology, ensuring a highly reliable and safe operation. The computerized control unit ensures a fully automatic operation through the entire cycle, hence after setting the pre-selected parameters and starting the operation, no further intervention is necessary.

This autoclave is equipped with automatic utilities shut down or power off parameter that can be programmed by the user (see par 4.3.3 System Set-Up).
The autoclave is constructed of stainless steel, having a double - walled structure.

The selected program, the main phases of the cycle and the status of the machine are controlled and displayed on digital readouts. For process documentation, the important information concerning operation is printed in hard copy.

The system is equipped with two temperature sensors, two pressure transducers having the following functions:

- The temperature sensors: the condense temperature (control, monitoring and printout) and the drain temperature (control).
- The pressure transducers: the chamber pressure (control, monitoring and printout) and the jacket pressure (control and monitoring).
- Two pressure gauges indicate the pressure in the jacket and in the chamber.

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A programming mode, which can be accessed by a code, enables the technician to set a number of additional parameters and operation modes.
The keyboard located on the front panel enables the operator to start and stop the cycle.

Optionally, a personal computer can be connected to the control system, through the interface board RS232, which can be operated 8 meters away from the autoclave. The PC, operating under WINDOWS displays the status, data and processing in real time in graphic and digital form at the same time recording and logging the data.
The communication PC-control unit enables the complete control of the autoclave through the PC, including program selection, starting and stopping the cycle, setting of parameters and the real time clock (data and time of the day).

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1.2 Standards

Every autoclave meets applicable requirements of the following standards:

1. A.S.M.E. Code, Section VIII Division 1 for unfired pressure vessels.
2. Complies with Underwriters Laboratories (U.L) requirements.
3. Tested according to Standard EN 285.

Tuttnauer is approved for ISO 9001:2000 (Quality Systems) and ISO 13485 (Quality Systems for Medical Devices).

1.3 Specifications

Description		Model 5596 SP-1
Chamber Dim.	W	20'' (510 mm.)
	H	20'' (510 mm.)
	D	38'' (970 mm.)
Chamber volume		250 l (9 ft^3)
External dim.	W	44" (1120mm).
	H	75" (1910 mm).
	D	56" (1430mm).
Degree of protection		IPX 4

Utilities		
Steam Supply		1/2" 75 PSI, 100 lbs/hr Peak, 55lbs/hr Averge
Cold water supply Maximum hardness value 0.7º2.0mmol/l Recommended temperature 15°C		1/2", 50-80 PSI 8 GPM Peak, 170 GPM Avg.
Compressed air requirements		Pressure 90-110 PSI, 3.5 SCFM 3/8" thread connection.
Electrical data:		
Voltage		1pH, 115V/60 Hz.
Current	Consumption	5A
	Utility	10A

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2. FUNCTIONAL DESCRIPTION

2.1 The Piping System

The piping system of the autoclave consists of air-operated ball valves, which controls the condense and steam flow in and out of the chamber, operates the vacuum, and the air inlet valve. The air pulses to the pneumatic valves are transmitted through solenoid pilot valves, operated at 24VDC. (The water valves are of Globe type).

The functions of the valves are as follows:

Air-operated valves

Steam inlet valve (93); introduces the steam from the jacket into the chamber, for heating and maintaining the chamber temperature during the sterilization phase.

Steam to jacket (91); enters the steam into the jacket to accelerate the heating of the chamber and to maintain a stable and uniform temperature in the chamber during the sterilization and drying stages.

Air inlet valve (43); enters filtered ambient air at the end of the cycle to break the vacuum and enable the opening of the door.

Fast exhaust and vacuum valve (75); has two functions: to exhaust the steam from chamber and to connect the chamber to the ejector to create vacuum in the chamber in the air removal and drying stages.
In the two stages, exhaust and vacuum, the flow path of the fluids is through the ejector to drain.

Condensate valve (74); evacuates the condensate from the chamber during heating and sterilization phases and isolates the chamber from the drain pipe, during vacuum generation. It operates like a slow exhaust valve at the end of slow pressure program.

Water to ejector valve (15); is connected to the feed water supply and supplies the water required for the operation of the ejector.

.

Note: The valve numbers are in accordance with the valve numbering list and piping diagram at the end of the manual.

Pneumatic safety component is installed in the autoclave:

A pneumatic switch that prevents entry of steam into the chamber while the door is open (see pneumatic switch VM830 in drawing on page 7).

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2.2 The Pneumatic Control System

The control of the pneumatic valves is performed through compressed air, as described below:
The pneumatic valves are air-air control type, fitted with two commands, an opening command received through solenoid valve at a pressure of 6 bars - output by the control system and a permanent closing command at a pressure of 3 bars, connected to all valves.

The pneumatic control system is built as follows (refer to drawing on the next page).
The incoming compressed air supply at a pressure of 6-8 bars is set by means of a pressure regulator at 6 Bars and transmitted to the entrance of the pilot solenoid valve battery.

The solenoid valve battery is mounted on a manifold branch base, through which all the solenoids are connected to the compressed air supply.

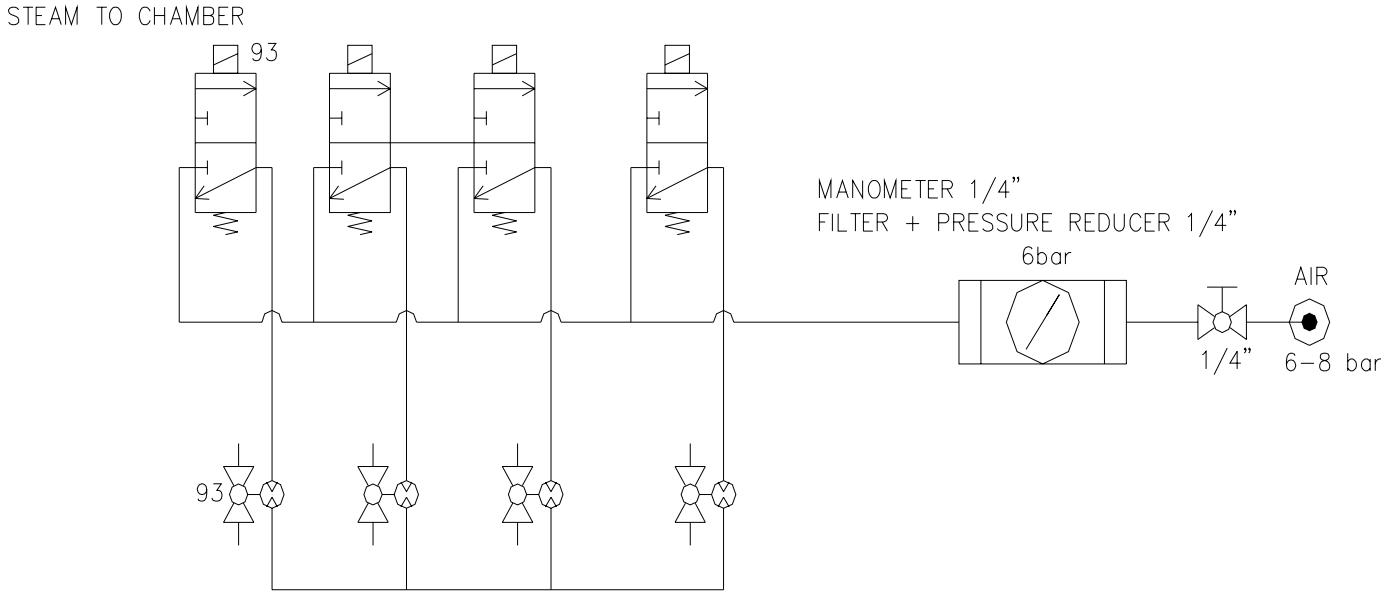
As long as a pneumatic valve does not receive from the control system an opening command the close command which is permanently present will determine the shut-off position of the valve.

When an open command at 6 bars reaches a pneumatic valve, it overcomes the opposite close command at 3 bars, and sets up the valve in position open.
A non-return valve mounted between the outlet side of the manifold branch and the pressure reducer prevents the flow of air to the solenoid battery.

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HORIZONTAL AUTOCLAVE
WITH MANUAL HINGED DOOR
(FOR AIR-SPRING VALVES)



Tolerance:

tuttnauer	Description: MHD Pneumatic Diagram.		Job No.:	Scale: 1:1	Drawing No: Pneumatic Diagram MHD-ASV
Material:	Design: Igor P. 03.06.04	Drawing: Igor P. 03.06.04	Quant./Unit: 1		Quant./Job:
	Rev.No: 00	Preparation By:	Approved By:		Q.C.:

2.3 The Electric System

The electric system of the autoclave comprises of the power circuits, including the commands, switching and protective components, required for the operation of the electric equipment of the machine.

The following parts are located in the electric box, mounted on the side of the autoclave and having the dimensions 40 x 30 x 20 cm.

- The contactor for the drive of the heaters.
- The solid state relays for the command of the heaters, water pump and vacuum pump.
- The circuit breakers for protection of all power circuits.
- The power supply for powering of electronic circuitry and solenoid valves.
- Protective relays.
- The wiring and connection elements.

The power circuits of the steam generator and the vacuum system are connected to the live terminals in the electric box at a one-phase voltage, 1x 115V 60Hz.
It is important to achieve a steadfast grounding screw connection to the metal-sheet enclosure of the electric box and metal parts of the autoclave.

The earth installation at the customer's site must be built in compliance with the laws and regulations in force and International IEC 61010-1 electrical safety standards and certified by the competent authorities.



Only authorized electricians are allowed to serve the electrical system!

Description of the Electrical Equipment

The three-phase heating circuits of the steam generator are driven by contactor and protected by circuit breakers one on each phase. The command signal for the contactor is output by the microcontroller through a solid state relay.
The water pump of the generator and the vacuum pump are driven by the solid state relays, the command signals are output by the microcontroller system.
The command circuits are energized by a power supply with four outputs, as indicated below:

- 5 VDC for the digital circuits.
- 24 VDC for the solenoid valves.

The coils of the solenoid valves are connected with an end at +24V and with the other end to the control output of the controller.
The command is active; i.e. the solenoid valve is actuated when the control voltage output is low (less than 2V) with respect to ground.
Fuses attain the protection of the electric and electronic circuits operated in direct current and current limiting circuits, inside the power supply stabilizers.
Two protective relays are designed to stop the pumps operation in case of interruption of the other phases and save the important data from the RAM memory in case of power failure.

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2.3.1 The Control System

The Main Board
Contains the electronic micro-controller system, which controls and monitors the physical parameters of the process and performs the operation sequence of the machine according to the selected program.
The dimensions of the main board are 30x15x10cm.
The main board contains the following elements:

- 16 digital inputs
- 24 digital outputs
- 6 PT 100 inputs
- 7 Inputs of 4 –20mA to read the pressure sensors
- Serial ports
- CPUs.
- 2 ADC's for reading temperature and pressure sensors.

Each ADC maintains at least 3 temperature sensors (PT100), and 3 pressure sensors (4–20mA). All connections to the main board are via rigid contactors for quick, efficient and dismantling and transport.

Digital Inputs
The digital inputs are:

- ϕ/1
- open/close for door positions
- safety switches
- switches for water level

The input voltage will not exceed 24VDC. The input must be protected from high voltages by means of an Opto-coupler.

Digital Outputs
Digital outputs are used to activate solenoid valves, relays and SSR for the pumps and heating elements.
The command is 24 VDC, but this can be changed and allowed to move between 10-30VDC.
Each output is up to 2A, however all the outputs together will not have a capacity greater than 110 W.

Analog inputs for Reading Temperature
Temperature will be measured using PT100.
The system contains 2 ADC components, each component being able to read 3 PT100 sensors. The system contains circuits with a direct connection of PT100 (3 wires) that do not interchange on the way.
The measurement range is 77-302ºF.
The resolution range is 32.8ºF.
The accuracy surrounding the sterilization temperature at the time of sterilization is in the range of ± 32.90ºF.
Calibration of the temperature circuit requires a special code.

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Analog Inputs for Reading Pressure
The system contains 6 inputs for reading pressure from 4 – 20mA sensors. There are at least 3 sensors on each ADC.
The pressure reading occurs from inside the chamber, the steam entrance, and sealed doors.
Each sensor has an output of 4mA. The system allows the measurement range of the sensor to be set by external software.

Measuring pressure in chamber
The display and printing scale is in psi units.
The measurement range is 1.47 – 48.2 psig absolute.
The resolution measurement and display is 0.14 psig.
The accuracy of the measurement is 1% of of the range, i.e.0.58 psig.
Calibration of the pressure circuit requires a special code.

Measuring jacket pressure
The measurement range is 1.47 – 48.2 psig absolute.
The resolution measurement and display is 0.14 psig.
The accuracy of the measurement is 1% of the range, i.e. 0.58 psig.
Calibration of the pressure circuit requires a special code.

Measuring generator pressure
The measurement range is 14.5 – 87 psia (absolute).
The resolution measurement and display is 0.29 psi.
The accuracy of the measurement is maximum 1%from the range i.e. 0.72 psi.
Calibration of the pressure circuit requires a special code.

3 Serial Ports
The control system contains 3 serial ports according to the following specifications:

- Serial Ports for the connection of up to 2 command panels (RS485).
- 1 Serial Port connected to an external PC computer (RS232).

If it will be necessary to convert some functions or to reprogram or to reload the software of the autoclave from distance, a modem can be connected using above-mentioned ports. This enables the service technicians to attend the machine from miles away, using the ADMC software thus allowing full control of the machines.

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2.4 Water Quality

2.4.1 Built-in Steam Generator

The distilled or mineral – free water supplied to the steam generator should be in accordance with the specifications below:

Physical Characteristics and Maximum acceptable contaminants levels in water or steam, for steam generator

(In compliance with ISO 11134 and ISO 13683)

Evaporate residue	**≤ 15 mg/l**
Silica	**≤ 2 mg/l**
Iron	**≤ 0.2mg/l**
Cadmium	**≤ 0.005 mg/l**
Lead	**≤ 0.05 mg/l**
Rest of heavy metals	**≤ 0.1 mg/l**
Chloride	**≤ 3 mg/l**
Phosphate	**≤ 0.5 mg/l**
Conductivity	**≤ 50 µs/cm**
pH	**6.5 to 8**
Appearance	**colorless, clean, without sediment**
Hardness	**< 0.1 mmol/l**

Compliance with the above data should be tested in accordance with approved analytical methods, by an authorized laboratory.

Attention:
The use of water for the autoclave that does not comply with the table above may have severe impact on the working life of the sterilizer and can invalidate the manufacturer's guarantee.

The use of soft water is strictly forbidden!

2.4.2 Water for the Vacuum System and the Drain Cooling

The feed water supplied to the liquid ring vacuum pump must meet the following requirements:

- Hardness: 0.7 - 2 mmol/l, 4-12 °(German) of $CaCO_3$,
  7.2-21°(French) of $CaCO_3$, 72- 215 mg/l of $CaCO_3$
- Recommended temperature: 15°C

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Note:
The use of heavy scaled water for the vacuum pump cooling, can cause blocking of the rotor and put the pump out of operation. This invalidates the guarantee for the vacuum pump. The use of soft water is strictly forbidden!

Note:
Please consult a water specialist

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3. STERILIZATION PROGRAMS

Following are the names, relevant programs with related temperatures of the 12 sterilization cycles and 2 test programs， which are pre-set by the manufacturer.

Cycle no.	Program	Temp ºF
01& 02	Unwrapped	250
03 & 04	Unwrapped	270/274
05& 06	Wrapped	270
07-	Wrapped	274
08-	Wrapped	250
09& 10	Materials that require a slow pressure exhaust	250
11 & 12-	Materials that require a slow pressure exhaust	250
13	B&D test	274
14-	Leak test	

3.1 Programs description

If vacuum pulse is determined '= 0' in any program by the operator, the program can be used as a 'Gravity' program. A message 'Gravity' is displayed on the right side of the screen.

Program 1 and 2- for Unwrapped (Fast 250)

This program is intended for unwrapped rigid parts (i.e. instruments) and other goods, which its manufacturer declares their compliance to be sterilized in the following conditions:

- Sterilization temperature 250ºF
- Sterilization time: 15 min.
- Dry time: 10 min.

Performance description:

Residual air is displaced due to 3 vacuum pulses (down to 25 kPa) and 2 steam pulses up to 160 kPa. The third vacuum pulse is followed with introducing saturated (controlled) steam into the chamber to the required sterilization temperature.

Sterilization period is controlled in a way that the sterilization temperature will not drop below the required temperature; neither will increase by more than 37.4ºF. The saturated steam conditions are controlled in such a way that fluctuation of pressure does not allow a drop below 1kPa, neither an increase of 3 kPa above the high limit of the Ste. Temperature.

Fast exhaust stage is performed by discharging rapidly the pressure from the chamber. When the pressure reaches a level of 115 kPa the vacuum pump is activated until a pressure drop to 25 kPa.

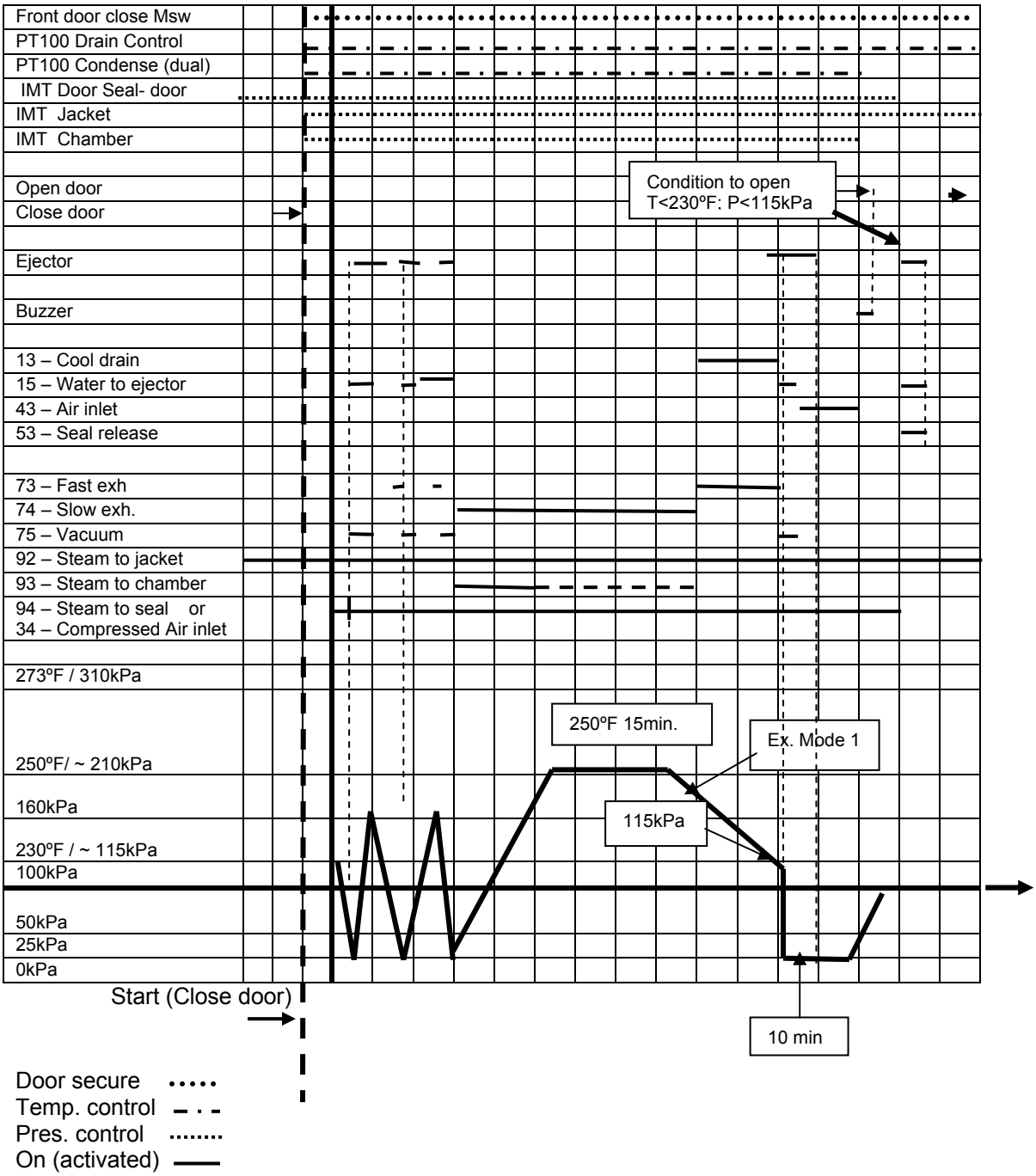
Pressure equilibration. To enable the door to be opened, air is introduced to the chamber through a microbiological filter till equilibrium with atmospheric pressure.

Note:

The pressure of the chamber must be below 115 kPa to enable the door to be opened.

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Program: 1 and 2



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Program 3 & 4 Unwrapped – 274

This program is intended for unwrapped rigid parts (i.e. instruments) and other goods, which its manufacturer declares their compliance to be sterilized in the following conditions:

- Sterilization temperature 270ºF (for program 3) and 274ºF (for program 4)
- Sterilization time: 5 min.
- Dry time: 15 min.

Performance description:
Residual air is displaced due to 3 vacuum pulses (down to 25 kPa) and 2 steam pulses up to 160 kPa. The second vacuum pulse is followed with introducing saturated (controlled) steam into the chamber to the required sterilization temperature.

Sterilization period is controlled in such a way that the sterilization temperature will not drop below the required temperature, neither will increase by more than 37.4ºF. The saturated steam conditions are controlled in such a way that the fluctuation of pressure does not allow a drop below 1kPa, neither an increase of 3 kPa above the high limit of the Ste. Temperature.

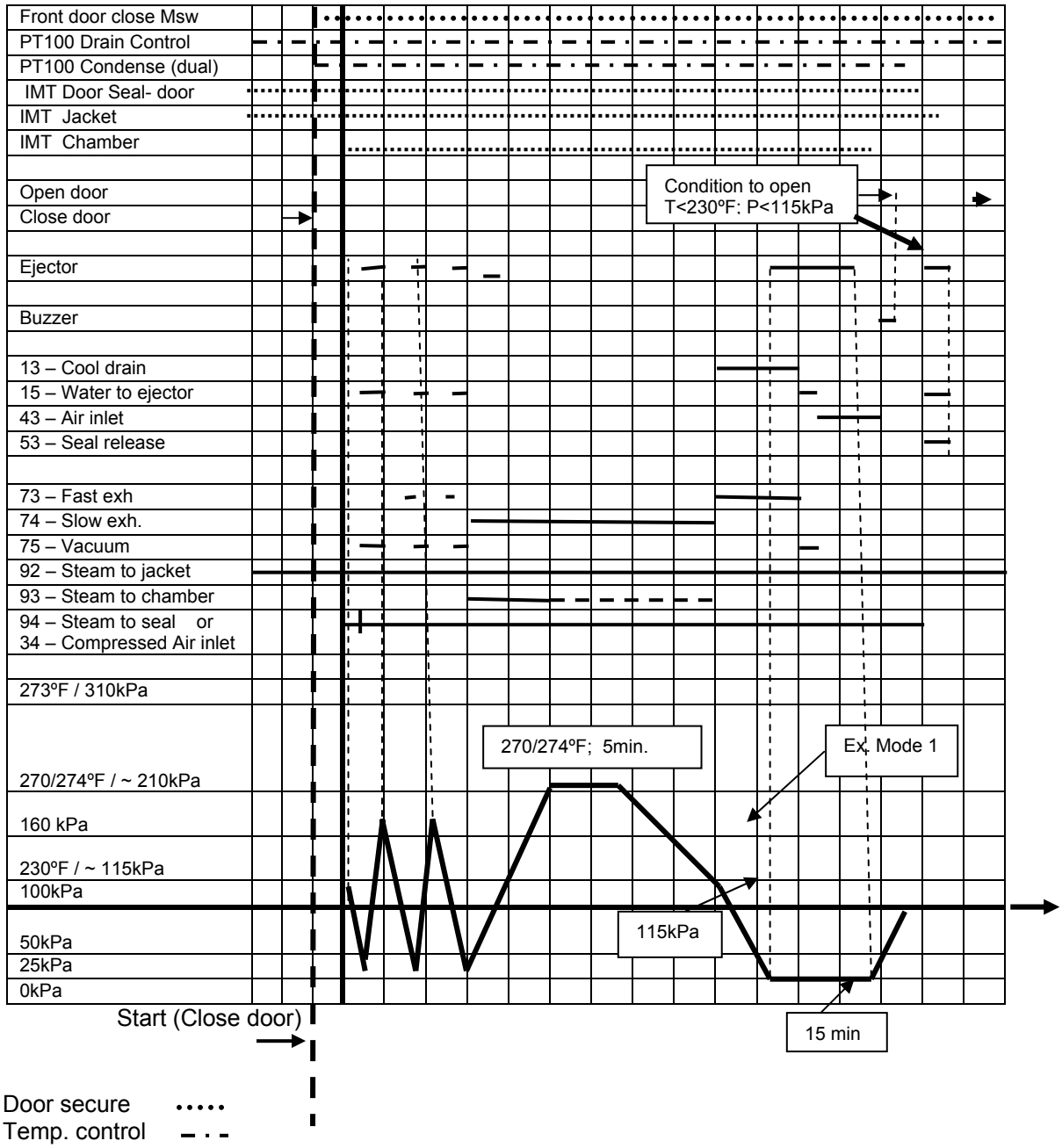
Fast exhaust stage is performed by discharging rapidly the pressure from the chamber. When the pressure reaches a level of 115 kPa the vacuum pump is activated till a pressure drop to 25 kPa.

Pressure equilibration. To enable the door to be opened, air is introduced to the chamber through a microbiological filter till equilibrium with atmospheric pressure.

Note:
The pressure of the chamber must be below 115 kPa to enable the door to be opened.

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Program: 3 & 4



Door secure •••••
Temp. control – · –
Pres. control ·····
On (activate ——

For program 4 - 3 vacuum pulses.

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Program 5 Wrapped – 270

This program is intended for wrapped materials (i.e. instruments), porous load and other goods, which its manufacturer declares their compliance to be sterilized in the following conditions:

- Sterilization temperature 270ºF
- Sterilization time: 3 min.
- Dry time: 15 min.

Performance description:
Residual air is displaced due to 4vacuum pulses (down to 25 kPa) and 3 steam pulses up to 160 kPa. The 4th vacuum pulse is followed with introducing saturated (controlled) steam into the chamber to the required sterilization temperature.

Sterilization period is controlled in a way that the sterilization temperature will not drop below the required temperature, neither increase by more than 37.4ºF. The saturated steam conditions are controlled in a way that the fluctuation of pressure does not allow a drop below 1kPa, neither an increase of 3 kPa above the high limit of the Ste. Temperature.

Fast exhaust stage is performed by discharging rapidly the pressure from the chamber. When the pressure reaches a level of 115 kPa the vacuum pump is activated till a pressure drop to 25 kPa.

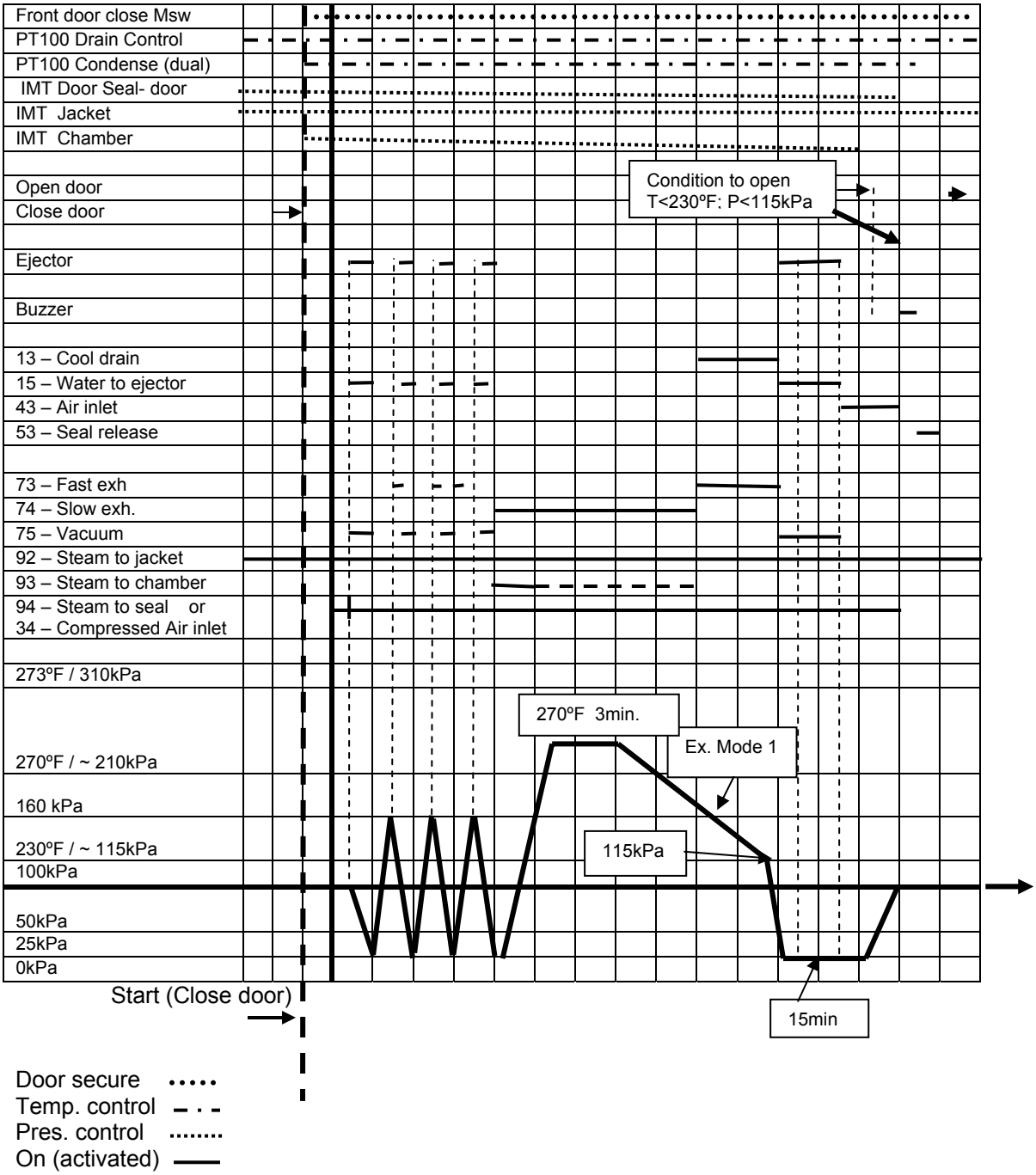
Drying is achieved by evacuating the vapor from the chamber in "under-pressure" phase along a period of 15 minutes.

Pressure equilibration. To enable the door to be opened, air is introduced to the chamber through a microbiological filter till equilibrium with atmospheric pressure.

Note:
The pressure of the chamber must be below 115 kPa to enable the door to be opened.

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Program: 5



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Program 6 Wrapped – 270

This program is intended for wrapped materials (i.e. instruments), porous load and other goods, which its manufacturer declares their compliance to be sterilized in the following conditions:

- Sterilization temperature 270ºF
- Sterilization time: 10 min.
- Dry time: 10 min.

Performance description:

Residual air is displaced due to 4 vacuum pulses (down to 25 kPa) and 3 steam pulses up to 160 kPa. The 4th vacuum pulse is followed with introducing saturated (controlled) steam into the chamber to the required sterilization temperature.

Sterilization period is controlled in such a way that the sterilization temperature will not drop below the required temperature, neither will increase by more than 37.4ºF. The saturated steam conditions are controlled in such a way that the fluctuation of pressure does not allow a drop below 1kPa, neither an increase of 3 kPa above the high limit of the Ste. Temperature.

Fast exhaust stage is performed by discharging rapidly the pressure from the chamber. When the pressure reaches a level of 115 kPa the ejector is activated till a pressure drop to 25 kPa.

Drying is achieved by evacuating the vapor from the chamber in "under-pressure" phase along a period of 15 minutes.

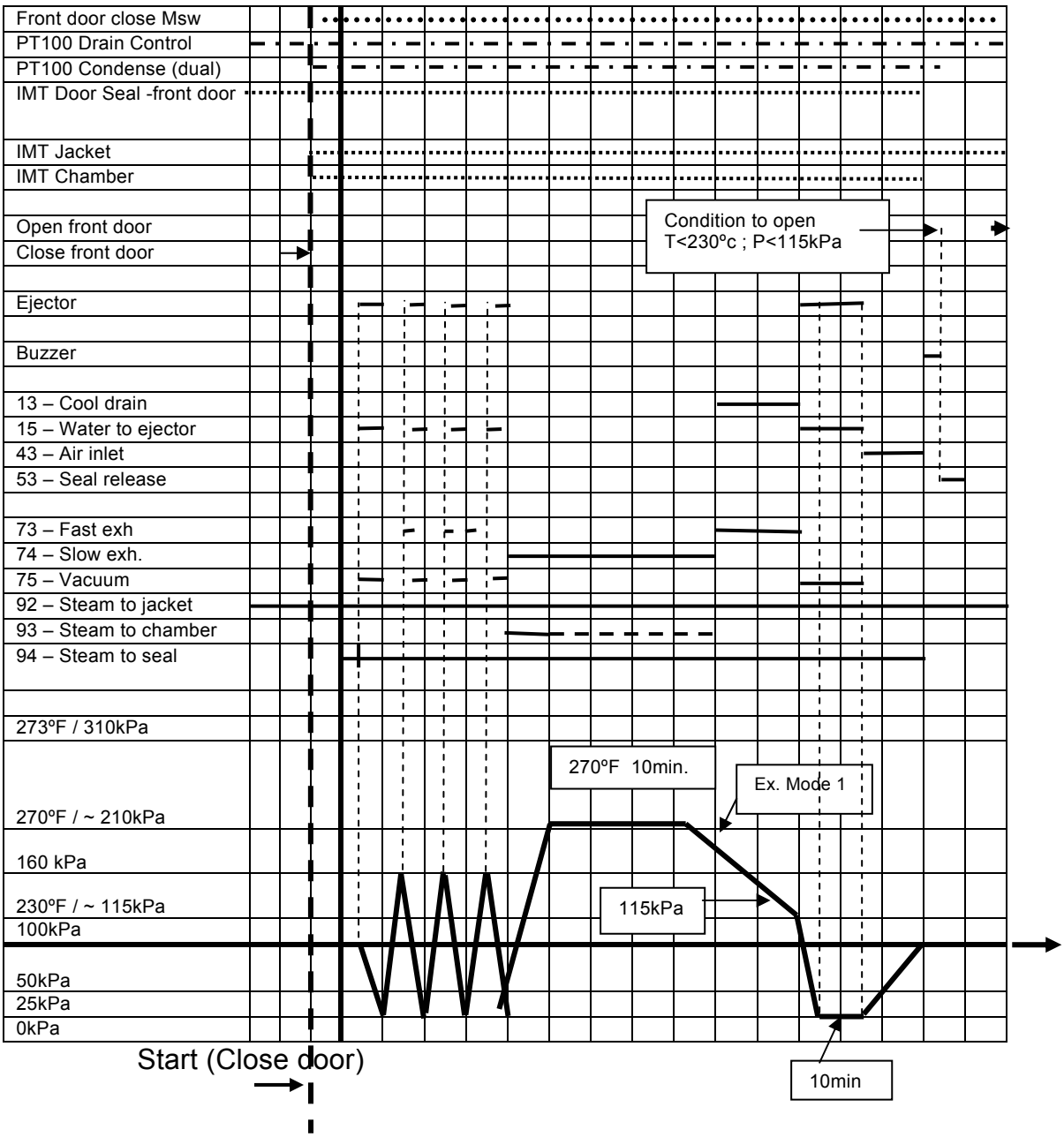
Pressure equilibration. To enable the door to be opened, air is introduced to the chamber through a microbiological filter till equilibrium with atmospheric pressure.

Note:

The pressure of the chamber must be below 115 kPa to enable the door to be opened.

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Program: 6



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Program 7- for Wrapped materials (with Dry 274)

This program is intended for wrapped materials (i.e. instruments), porous load and other goods, which its manufacturer declares their compliance to be sterilized in the following conditions:

- Sterilization temperature 274ºF
- Sterilization time: 7 min.
- Drying period of 15 min.

Performance description:
Residual air is displaced due to 4 vacuum pulses (down to 25 kPa) and 3 steam pulses up to 160 kPa. The 4th vacuum pulse is followed with introducing saturated (controlled) steam into the chamber to the required sterilization temperature.

Sterilization period is controlled in such a way that the sterilization temperature will not drop below the required temperature, neither will increase by more than 37.4ºF. The saturated steam conditions are controlled in such a way that the fluctuation of pressure does not allow a drop below 1kPa, neither an increase of 3 kPa above the high limit of the Ste. Temperature.

Fast exhaust stage is performed by discharging rapidly the pressure from the chamber. When the pressure reaches a level of 115 kPa the ejector is activated till a pressure drop to 25 kPa.

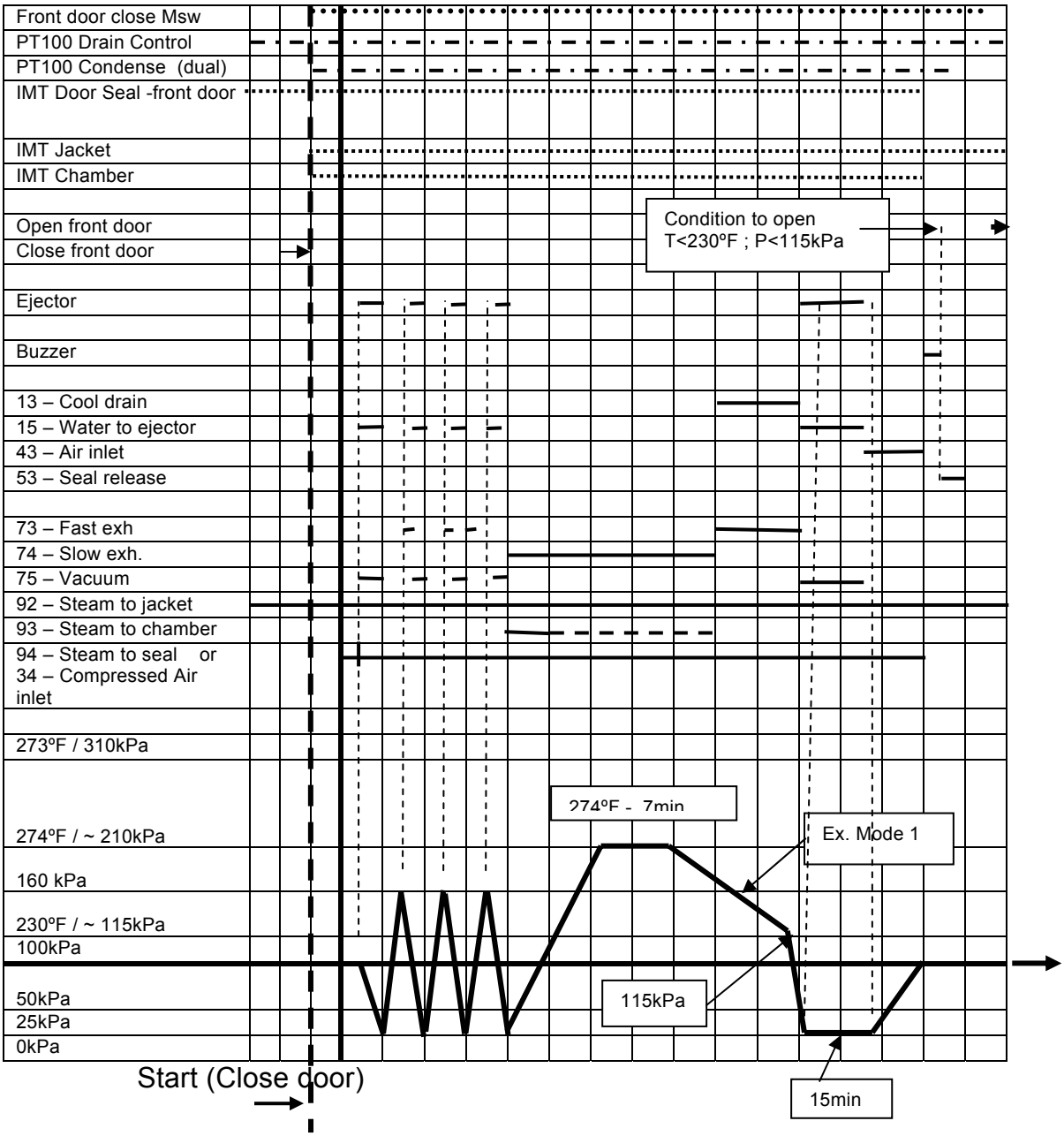
Drying is achieved by evacuating the vapor from the chamber in "under-pressure" phase along a period of 15 minutes.

Pressure equilibration. To enable the door to be opened, air is introduced to the chamber through a microbiological filter till equilibrium with atmospheric pressure.

Note:
The pressure of the chamber must be below 115 kPa to enable the door to be opened.

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Program: 7



Door secure·····
Temp. control– · -
Pres. control·····
On (activated) ——

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Program 8 Wrapped – 250

This program is intended for wrapped materials (i.e. instruments), porous load and other goods, which its manufacturer declares their compliance to be sterilized in the following conditions:

- Sterilization temperature 250ºF (121ºC)
- Sterilization time: 15 min.
- Dry time: 10 min.

Performance description:
Residual air is displaced due to 4 vacuum pulses (down to 25 kPa) and 3 steam pulses up to 160 kPa. The 4th vacuum pulse is followed with introducing saturated (controlled) steam into the chamber to the required sterilization temperature.

Sterilization period is controlled in such a way that the sterilization temperature will not drop below the required temperature, neither will increase by more than 37.4ºF. The saturated steam conditions are controlled in such a way that the fluctuation of pressure does not allow a drop below 1kPa, neither an increase of 3 kPa above the high limit of the Ste. Temperature.

Fast exhaust stage is performed by discharging rapidly the pressure from the chamber. When the pressure reaches a level of 115 kPa the ejector is activated till a pressure drop to 25 kPa.

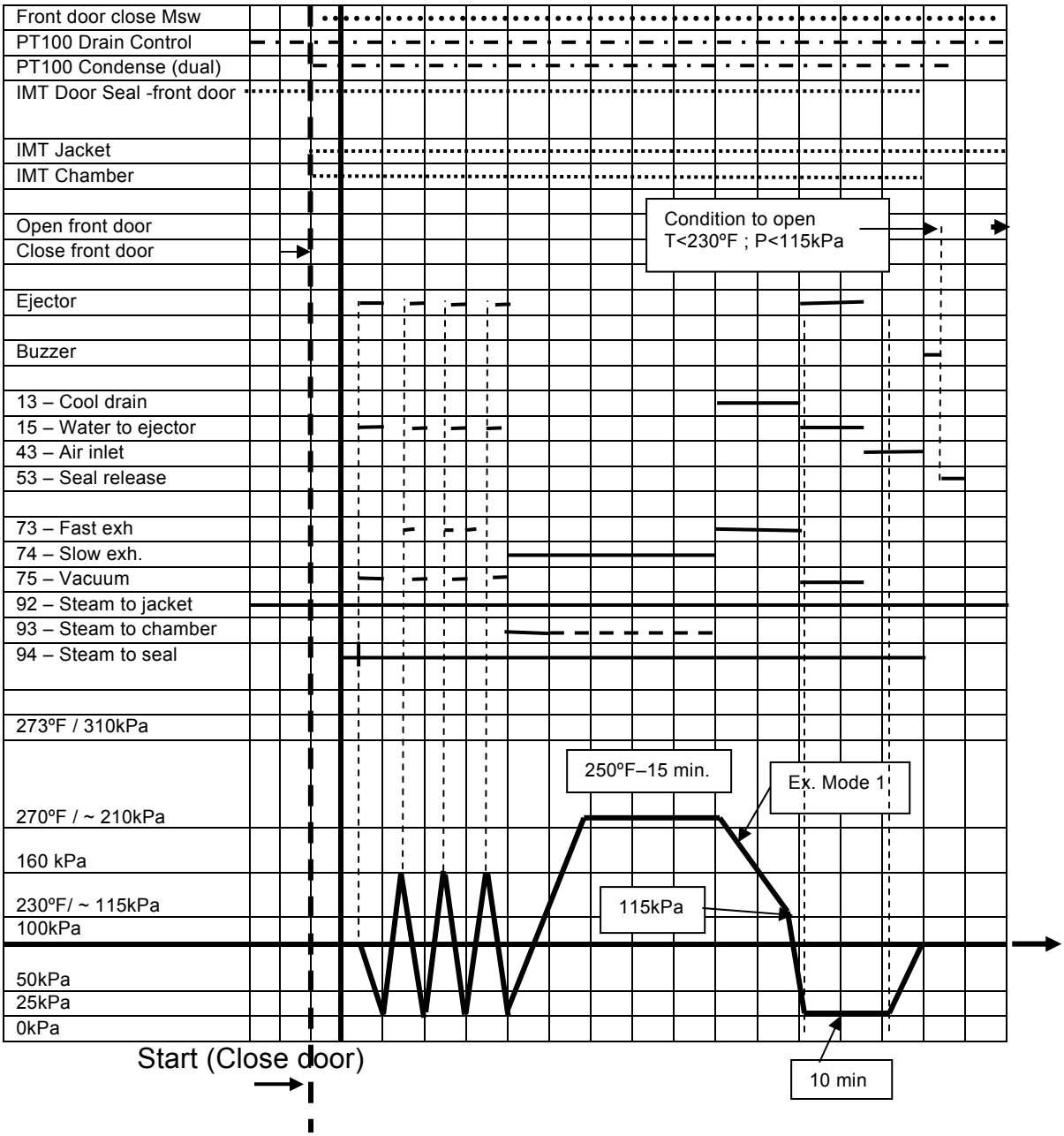
Drying is achieved by evacuating the vapor from the chamber in "under-pressure" phase along a period of 15 minutes.

Pressure equilibration. To enable the door to be opened, air is introduced to the chamber through a microbiological filter till equilibrium with atmospheric pressure.

Note:
The pressure of the chamber must be below 115 kPa to enable the door to be opened.

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Program: 8



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Program 9 and 10 slow pressure – 250

This program is intended for materials that require a slow pressure exhaust and other goods, which its manufacturer declares their compliance to be sterilized in the following conditions:

- Sterilization temperature 250ºF
- Sterilization time: 15 min.
- Slow discharge of the pressure.

Performance description:

Residual air is displaced due to 3 vacuum pulses (down to 25 kPa) and 2 steam pulses up to 160 kPa. The 3rd vacuum pulse is followed with introducing saturated (controlled) steam into the chamber to the required sterilization temperature.

Sterilization period is controlled in such a way that the sterilization temperature will not drop below the required temperature, neither will increase by more than 37.4ºF. The saturated steam conditions are controlled in such a way that the fluctuation of pressure does not allow a drop below 1kPa, neither an increase of 3 kPa above the high limit of the Ste. Temperature.

Slow exhaust stage is performed by discharging the pressure very slowly from the chamber. When the pressure reaches a level of 115 kPa the ejector is activated till a pressure drop to 25 kPa.

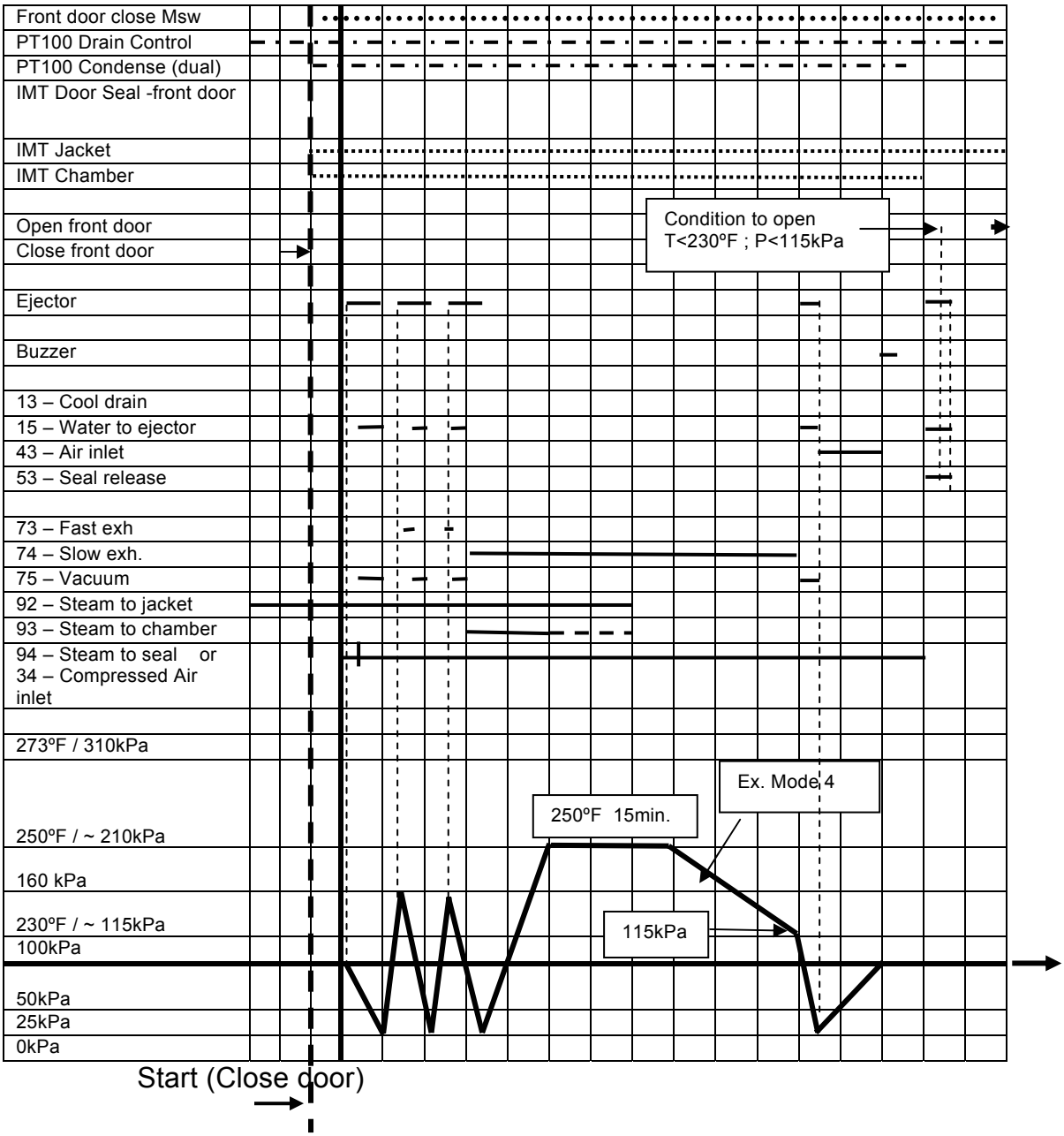
Pressure equilibration. To enable the door to be opened, air is introduced to the chamber through a microbiological filter till equilibrium with atmospheric pressure.

Note:

The temperature of the chamber must be below 203ºF and the pressure must be below 115 kPa to enable the door to be opened.

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Program: 9 and 10



Door secure·····
Temp. control · -
Pres. control·····
On (activated)——

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Program 11 & 12 - for slow pressure

This program is intended for materials that require a slow pressure exhaust and other goods, which its manufacturer declares their compliance to be autoclaved in the following conditions:

- Temperature 250ºF
- Time: 30 min.

These programs may also be used for milk pasteurization (with a capacity of 500 bottles/cycle) and comply with the international standards for pasteurization

Performance description:
Residual air is displaced due to 1 steam pulses up to 160 kPa, followed by introducing saturated (controlled) steam into the chamber to the required temperature.

Hold period is controlled in such a way that the temperature will not drop below the required temperature, neither will increase by more than 37.4ºF. The saturated steam conditions are controlled in such a way that the fluctuation of pressure does not allow a drop below1kPa, neither an increase of 3 kPa above the high limit of the Ste. Temperature.

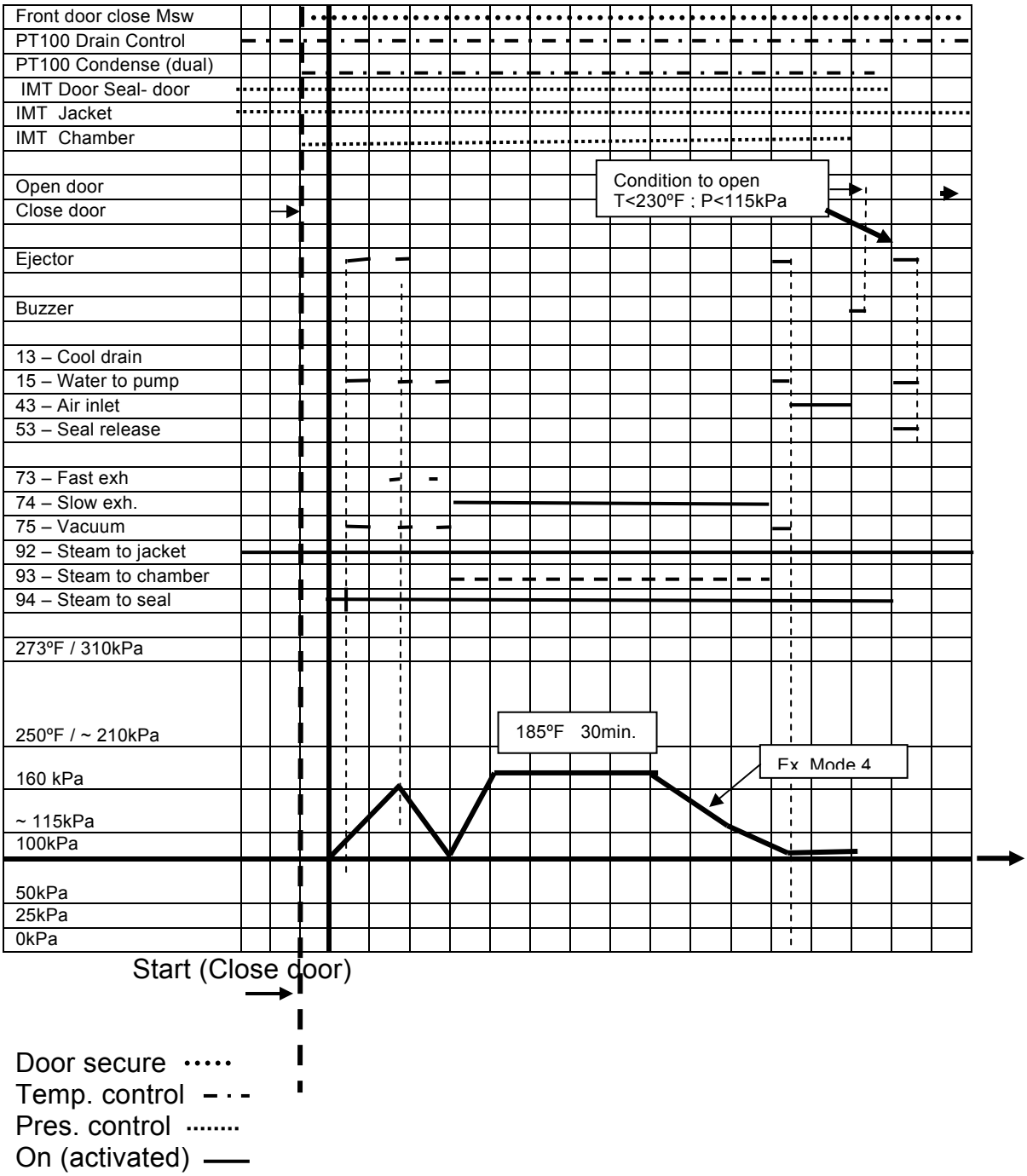
Slow exhaust stage is performed by discharging the pressure slowly from the chamber. When the pressure reaches a level of 115 kPa the ejector is activated till the pressure reaches atmospheric pressure

Pressure equilibration. To enable the door to be opened, air is introduced to the chamber through a microbiological filter till equilibrium with atmospheric pressure.

Note:
The temperature of the chamber must be below 203ºF and the pressure must be below 115 kPa to enable the door to be opened.

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Program: 11 & 12



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Program 13 "Bowie & Dick Test”

This program is intended to test residual air in the chamber. The parameters are locked in such a way that they can not be changed. These are the parameters:

- Sterilization temperature 274ºF
- Sterilization time 3.5 min.
- Drying period of 2 min.

Performance description:
Residual air is displaced due to 4 vacuum pulses (down to 25 kPa) and 3 steam pulses up to 160 kPa. The 4th vacuum pulse is followed with introducing saturated (controlled) steam into the chamber to the required sterilization temperature.

Sterilization period is controlled in such a way that the sterilization temperature will not drop below the required temperature, neither will increase by more than 37.4 ºF. The saturated steam conditions are controlled in such a way that the fluctuation of pressure does not allow a drop below1kPa, neither an increase of 3 kPa above the high limit of the Ste. Temperature.

Fast exhaust stage is performed by discharging rapidly the pressure from the chamber. When the pressure reaches a level of 115 kPa the ejector is activated till a pressure drop to 25 kPa.

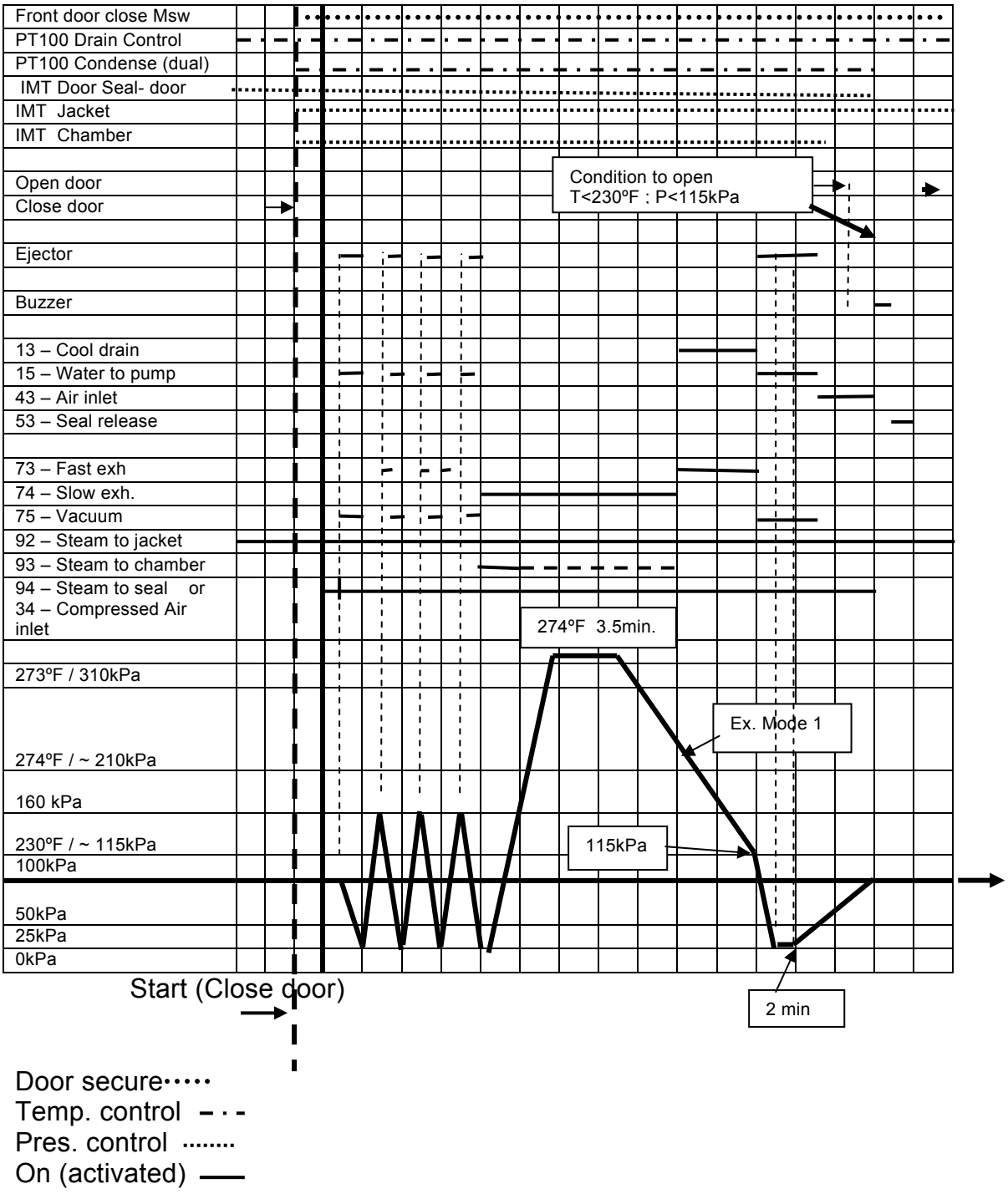
Drying is achieved by evacuating the vapor from the chamber in "under-pressure” phase along a period of 5 minutes.

Pressure equilibration. To enable the door to be opened, air is introduced to the chamber through a microbiological filter till equilibrium with atmospheric pressure.

Note:
The pressure must be below 115 kPa to enable the door to be opened.

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Program: 13- Bowie & Dick



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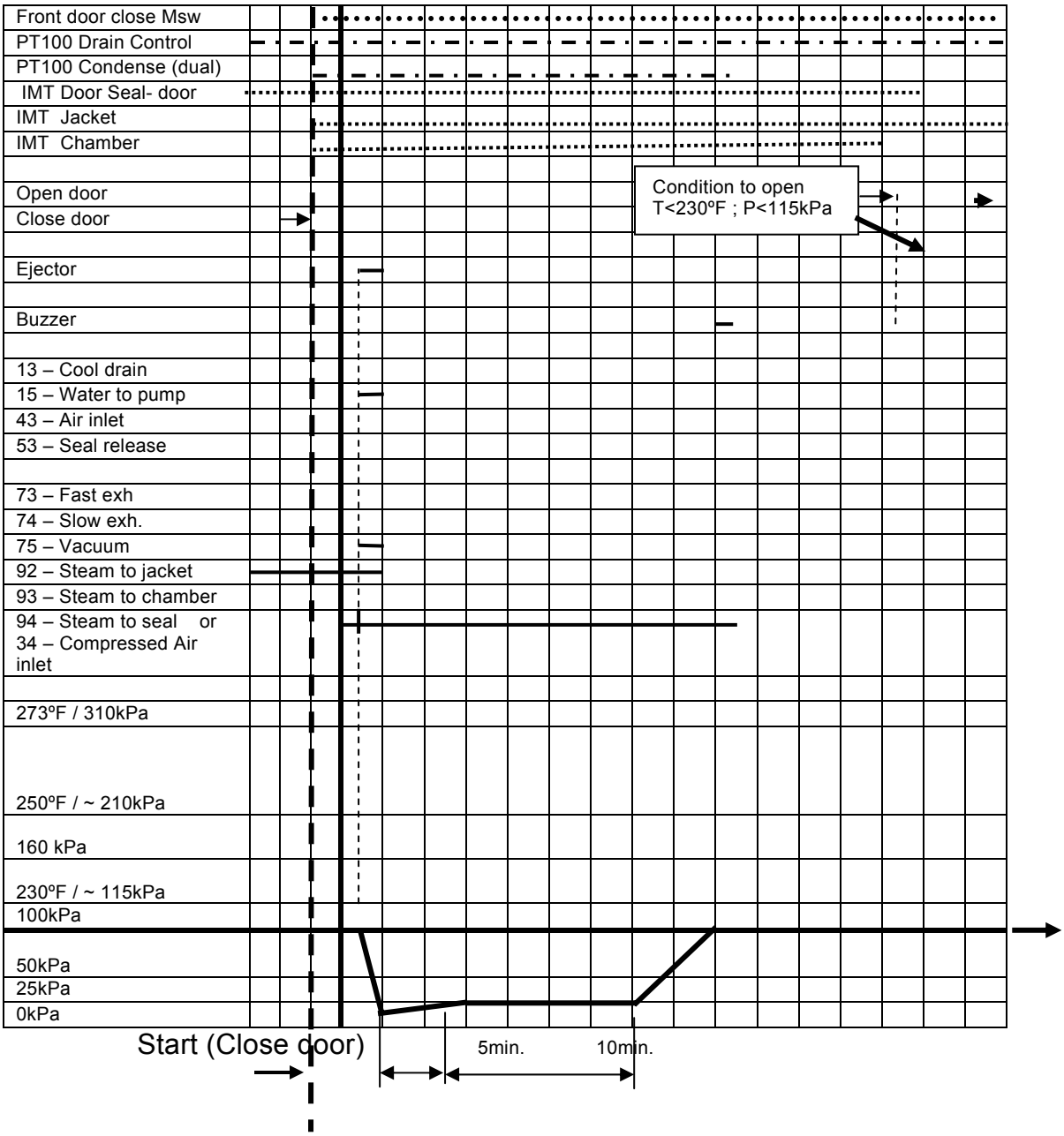
Program 14 "Air leakage Test”

This program is intended to test air leakage to chamber through the door seal or any other seals.
This test is performed in vacuum phase.

Performance description:
Vacuum is built up in the chamber down to 10kPa. At this stage all valves and motors are shut.
A period of 5 minutes is counted to enable stabilization of pressure.
During the next 10 minutes the pressure is monitored.
The allowable change of pressure during these 10 minutes is 1.3kPa.

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Program: 14- Air leakage test

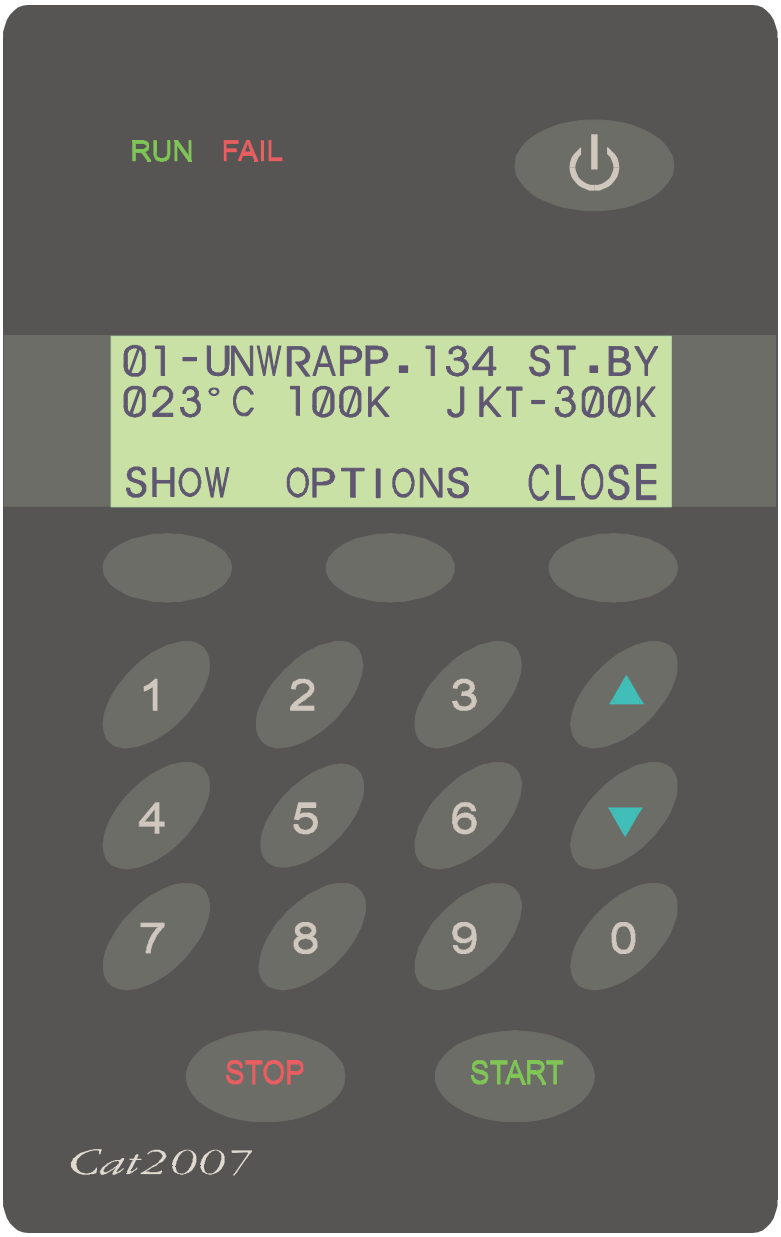


Door secure•••••
Temp. control – · -
Pres. control ·····
On (activated) ——

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4. CONTROL AND MONITORING

Control Panel ‘CAT 2007’



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4.1 Description of panel 'CAT 2007'

The Operation Panel is composed of the following parts:

- 4 rows display, 20 characters in each row.
- 18 key pads
- 2 LED's (Fail, Run)
- 1 locking key

4.1.1 Keypad

STANDBY



The ON/ST.BY key is located on the top right side of the panel. Pressing the keypad lights up the operation panel. When there are 2 panels, both light up even though only one was pushed.

The 3 Command Keypads
F1-3: Functions 1-3



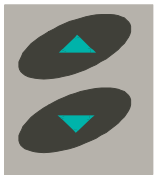
F1 F2 F3

These keypads are found under the display. The function to be performed will be listed on the display above the keypad.

10 Digit keypads

These keypads are used for 2 purposes.
In normal working conditions, the program option is used – pressing on the number keypad, for example no. 3 selects program 3.
Under display mode, the keypads will be used as number keypads to enter a code or a number.

UP/DN Keypads



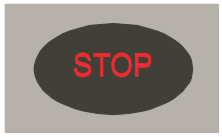
In normal working conditions they are used to browse through the different cycles.
Under set-up mode they will change numeric values or cause the display to progress to the next screen.

START Keypad



When the autoclave is in Ready position, pressing on START key activates the cycle.

STOP



This key is active whilst the autoclave is in process. Pressing this key at any stage of the cycle stops operation.

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Canceling the FAIL message

At the end of an aborted process the FAIL light is turned on and an error message is displayed on the screen indicating the cause of the failure.
Pressing the STOP key cancels the displayed message and switches off the FAIL light.

RUN/FAIL LED's



The operation panel contains 2 small LED's are located on the top left corner. The RUN LED (green) lights when the autoclave is in process. When the system has been turned off at the ST.BY keypad, the RUN LED flashes for 1/2 a second for every 2 seconds showing there is still power entering the system (i.e. the appliance has not been switched off).
The FAIL LED (red) lights when there is a problem with the system.
In specific situations the LED will be in FLASH mode.

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4.1.2 Display

The CAT2007 display consists of 4 alphanumeric rows with 20 characters in each row:

First Row

First 3 characters define the Cycle no. (Ranges from 1-14)
There are 8 characters to define the Cycle name.
The final 5 characters at the right of the row are allocated to displaying the status of the appliance or the stage in which the cycle is found whilst running.

- When the autoclave is in waiting stage – ST.BY
- When the autoclave is ready to work – READY
- When a process ends correctly – END
- When a program ends incorrectly – FAIL

The names of the stages follow:

- Vacuum
- Exh. (Exhaust)
- Heat
- Dry
- Ster. (sterilization)
- Test

Following are the 14 cycles, names and relevant temperatures:

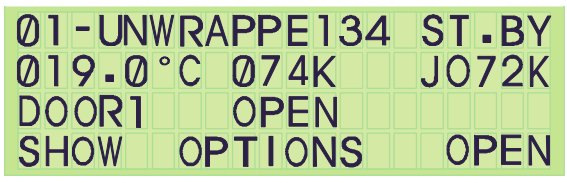
Cycle no.	Program	Temp ºF
01& 02	Unwrapped	250
03 &4	Unwrapped	270/274
05&06	Wrapped	270
07-	Wrapped	274
08-	Wrapped	250
09& 10	Materials that require a slow pressure exhaust	250
11 & 12-	Materials that require a slow pressure exhaust	250
13	B&D test	274
14-	Leak test	

Second Row:

This row displays the temperature in the chamber, pressure in the chamber, and jacket pressure.

Third Row:

This row is used to display messages to the operator such as DOOR1 OPEN.



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Fourth Row:
In the bottom row the names of the commanding keypads appear.
Under the display there are three keypads without symbols or names
These keypads receive their commands by the name that appears above them in the 4th row of the display. During a cycle, the fourth row is used to display the timers, such as STE Time 02:25, or during pre-vacuum, to display the stage of the pulse, such as puls1 – pump to 21K.

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4.2 Description of Displayed Messages and Safety Measures

03 – Manual Stop	This message is displayed and the FAIL indicator lights up after the STOP key is pressed for more than 1 second during the cycle (excluding the drying stage).
100 – Man. Stop	This message is displayed and the FAIL indicator lights up after the STOP key is pressed for longer than one second in the drying stage.
05-Door Unlock	This message is displayed if either of the following occurs: The START button is pressed and the door is not closed; If during a cycle or the pressure drops in the gasket.
06-Temp. Error	If the temperature sensor, disconnected for any reason during the heating stage, temperature is either higher than 140ºC or lower than 5ºC..
07- Low Heat	This message is displayed and sterilization does not start if the autoclave has not reached sterilization temperature after heating for the maximum time as defined in the HEAT T.O. parameter.
08- Low Temp.	This message is displayed, fail indicator lights up and cycle is aborted, if the temperature drops for more than 5 sec. below the required sterilization temperature.
09- High Temp.	This message is displayed, fail indicator lights up and program is aborted: If the temperature rises 3ºC (5ºF) above the required sterilization temperature during the sterilization cycle.
10- Low Pres.	This message is displayed, fail indicator lights, and the program is aborted if the pressure drops for more than 5 sec. below the pressure correlated to the required sterilization pressure.
11-High Pres.	This message is displayed, fail indicator lights, and the program is aborted, if pressure rises above the pressure correlated to the sterilization temperature plus +3ºC (5ºF)- for more than 5 sec.
12-Low Vacuum	This message is displayed if after 18 min. the system has not reached at the Vac Dip1or Vac Dip2 values during the pre-vacuum stage. It also appears if the Leak Test program fails.
13 – Jacket not Ready	This message is displayed if the START key was activated before the jacket reached the desired pressure.
21 – Door1 Safe Switch	If while raising door1 of an automatic sliding door, the door1 switch closes the door will open, and this message will appear.
22 – Door2 Safe Switch (not applicable)	if during raising door2 of an automatic sliding door the door2 switch closes, the door will open, and this message will appear.

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23 – Door1 Gasket Low Vacuum	This message indicates that during opening Door1, you do not achieve the proper vacuum in Gasket1.
24 – Door2 Gasket Low Vacuum (not applicable)	If whilst opening Door2, you do not achieve the proper vacuum in Gasket2.
25 – Vac Res. Empty	This message is a result of a safety mechanism indicating that If during the pre-vacuum stage, drying stage, vac. test or leak test it is revealed that the lower float switch in the vacuum water reservoir is open for more than 1 second (so there is no water entering the water reservoir and the pump has therefore been closed to protect it).i.e. Vfloat –L = “1”
27 – First Close Door	This message appears if there was an attempt to perform IN/OUT Test while the door was open.

4.2.1 Informative Messages

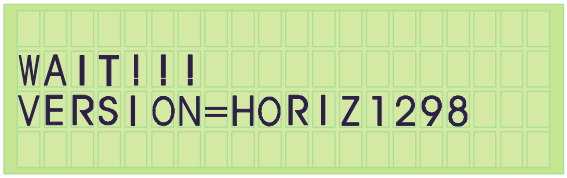
Calibration	This message appears automatically on panel 2 during calibration.
Closing Door Wait	When an automatic door is closing, this message is displayed so that the operator will wait until the closing operation of the automatic door ends.
Open Door Wait	Whilst an automatic door is opening, this message is displayed in order that the operator will wait until the opening operation of the automatic door ends.
Door1 Open	This message appears when Door1 is open. It will also appear if the door is supposedly closed but there is not enough pressure in the gasket to seal it properly.
Door2 Open (not applicable)	This message appears when Door2 is open. It will also appear if the door is supposedly closed but there is not enough pressure in the gasket to seal it properly.
Door 1 & 2 Open (not applicable)	This message appears when both doors are open.
Under Test	This message appears on panel 2 during the IN/OUT Test and during Set Up.

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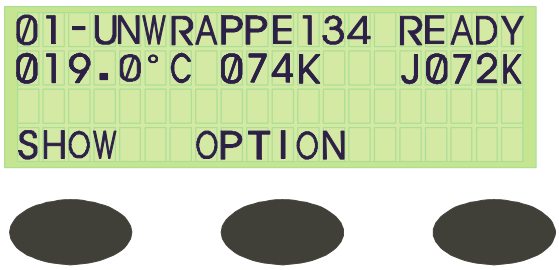
4.3 Operating the Control Panel

4.3.1 Starting up the System

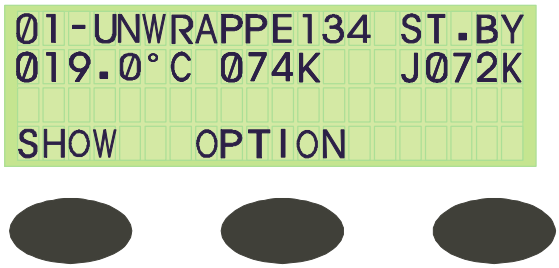
After turning on the system, the following screen is displayed for a few seconds:



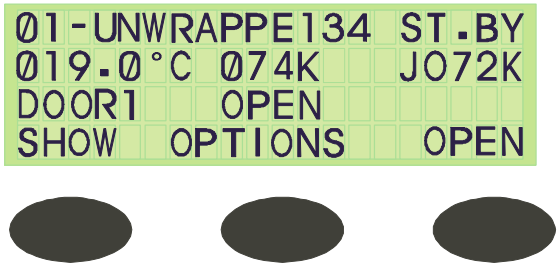
After a few seconds the **Stand By** screen is displayed.



This is the central screen from which all operations can be performed.
It is also the "**Ready**" screen from where cycles can be started when all the relevant conditions are fulfilled.
If the system is ready the display appears as follows:



If the system is not ready it will not allow you to start the cycle.
If, for example, Door1 is open when the system is turned on, the display will warn the operator of this in the 3rd row of the display allocated to messages, and the screen will appear as follows:



The 3 command keys in the Stand By screen are:

Above the left keypad (F1)	Show
Above the middle keypad (F2)	Option
Above the right keypad (F3)	Open

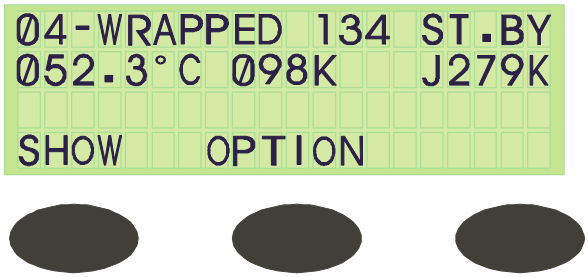
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4.3.2 Selecting a Cycle

A cycle can only be selected during Stand By from the Stand By / Ready screen which displays the cycle number and name in the top row.

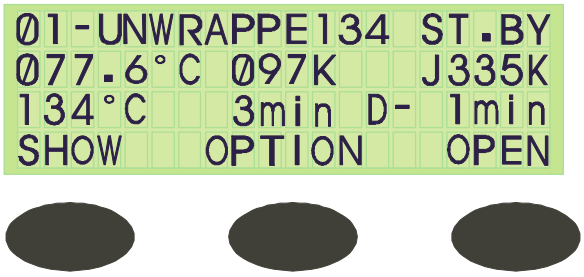
A cycle can be selected as follows:

- Press the UP/DN keypad to change the cycle where pressing UP moves to the next program and pressing DOWN moves to the previous program.
- Press on a number. When pressing on keypad 4 the chosen program will be number 4, and so on.



Selecting a 2 digit cycle:
When 2 numbers are pressed within 2 seconds of each other, then both the numbers define the program number (when the program number is 10 or above). For example; to choose program 12, number 1 must be pressed, and within 2 seconds number 2 must be pressed.

Show Parameters
After selecting the cycle, pressing the SHOW command key presents the following screen:



where the message displayed in the 3rd row describes the following:

- the temperature; the sterilization temperature
- the time; the sterilization time
- D-Time; drying time.

This screen is displayed for 10 seconds after which it automatically returns to the ST.BY screen.
This command key is not active for cycle 12 – Leak Test.
Once the following conditions have been fulfilled,

- There is enough steam pressure in the jacket.
- Enough air pressure for the pneumatic valves (option).
- Doors closed.
- Enough water pressure for cooling (option).
- Enough water in the vacuum water reservoir.

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The SETUP has been checked and the display is in the ST.BY /Ready mode, press START to run the cycle:
The RUN LED lights and the cycle is in progress.
After this, LED's switch off and the appliance is in Stand By or RUN program (depending on if the power turned off at the last time in order to run a program).

Power On Reset Test

1. Turn on the appliance
2. Be sure that all the valves and outputs, including LED's on the panel, are turned off.
3. Be sure the last illumination of the panels is turned on.
4. Be sure the message – Wait!!!
   Version = (version name) appears on the 2 panels with the correct version.
5. Be sure that 2 LED's in each panel are turned off, the message deleted and the system passes to the Stand By stage.

In/Out Test – Design:

The system contains a stage called In/Out Test Stage. This includes all the required elements for the In/Out Test.
The test includes:

1. Testing all the outputs. Each time only one output is turned on. The output passes to 'ON' for a maximum time of 15 seconds or until the UP keypad is pressed.
   The command begins from output number 1 until 24.

2. Testing of all the digital inputs should take a maximum time of 15 seconds for each input. When the input is found in "0" it will show 'ON' on the screen. When the input is in "1", it will show 'OFF' on the screen.

3. All the analog inputs will be displayed on the screen without a filter. As such it will be able to calibrate them at the time that the display is on the screen via. the computer.
4. At the end of the stage, it will allow the In/Out Test to start afresh or to exit. When exit is chosen, the system will initialize from new.

5. Inputs for the In/Out Test require a code.

Testing the In/Out Routine

1. Turn on the system.

2. Press the OPTION keypad. The right command keypad will be called InOut.
   By pressing on this key, the screen displays:
   Code: Enter In Out Test
   Code: Enter the code 2ØØ7.
   The screen will display the message 'Digital Ø1 On!!!'. Be sure that OUTØ1 is on.
   Press on 'UP'. The screen will display the message 'Digital OUTØ2 on!!!'. Be sure that OUTØ2 is on.

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4.3.3 System Set-Up (changing parameters and values)

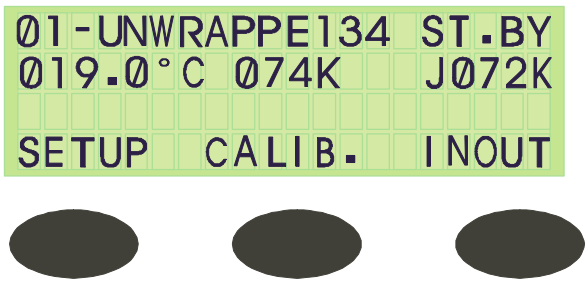
Note:

- The system allows 15 seconds for values to be entered. If this time elapses, the display will move on automatically to the next screen.
- When codes are not entered within the 15 seconds, the RUN and FAIL lamps light and the display return to WAIT and then the Stand BY screen.
- If the code is incorrect the above will also occur.
- When the display shows ØØØØ and a single value (i.e. between 1-9) is to be entered, the Ø must first be pressed. The single value can not be entered on its own, for example, to enter the number 4, the value is entered by pressing the Ø three times and then the number 4.
- When a value is to be entered, the right command keypad is Enter:
  - If the value is entered via the digit keypad, after the final digit is entered, the system automatically transfers to the next screen, and Enter need not be pressed.
  - If the value is entered using the UP/DN arrows, the Enter keypad must always be pressed to progress to the next screen.

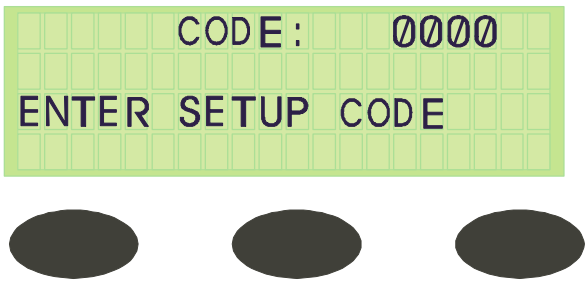
The system setup includes the following functions:

Clock – Date and Time, Language, Doors Number, Door Type & Atmospheric Pressure

To check the system has been set up correctly, press the OPTION keypad in the ST.BY screen.
The screen displayed is as follows:



Press the SETUP keypad. The system requests a code.

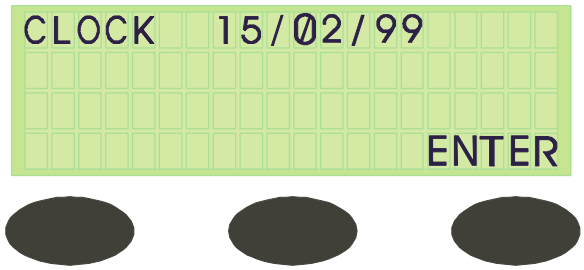


Enter the code and the display automatically moves on to the next screen after the last digit is entered.

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Clock
The clock first displays the date and then the time.

Date
The date is always displayed as day/month/year.



Press the UP/DN keys to change the value.

1. Press ENTER (the right command keypad), after selecting the desired value to move on to the next value, i.e. the 'day value' will be underlined.
2. Press the UP/DN keypad to change the value and ENTER. The 'month value' will be underlined and the process continues.
3. To change the Year value to ØØ, keep pressing the DOWN key until you get to Ø, press ENTER.

If no changes are to be made, then continue pressing ENTER to skip to the next step. After the year value, when ENTER is pressed the display changes to the Time display.

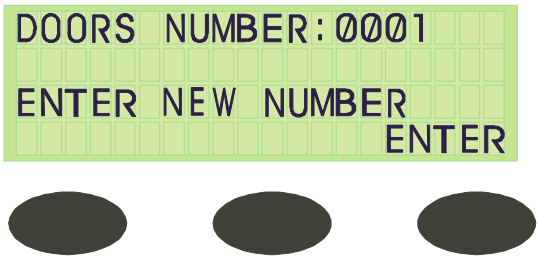
Time
Time is always displayed in hour/min/sec.
When entering the screen, the hour value is underlined.
Press the UP/DN key to change this value.
Press ENTER (the right command key), to move on to the 'minute value'.
Continue the process until the time is correct.
If no changes are to be made, press ENTER to move on to the 'minute value'.
Pressing ENTER after the second value has been changed automatically skips to the next screen – the Language screen.
If there were no changes to be made, continue pressing ENTER until the Language screen is displayed.

Language (Option)
4 popular languages have been specified with Latin letters only: English, German, French and Spanish.
This screen is only applicable if using different languages.
The right command key will be ENTER.
If English is being used, leave the code at Ø and press ENTER to move on to the next screen – Doors Number.
If the language requires changing, press the appropriate number from the choice below and then press ENTER.

English	Ø
German	1
French	2
Spanish	3

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Doors Number
After entering the language, the display is as follows:
This autoclave has one door, press ØØØ1. Press ENTER and the system moves on to the next screen.



Door Type
In this model the door is a manual hinged door, the Door Type is ØØØØ. Enter these values either through the UP/DN keys and then press ENTER, or physically enter the digits whereby the screen will automatically progress to the next display after entering the fourth digit.

Atmospheric Pressure
The atmospheric pressure at Sea Level is 100kPa. For every 100m above sea level, the atmospheric pressure drops 1kPa, and for every 100m below sea level, the atmospheric pressure increases 1kPa.
If pressure is set correctly, press ENTER and the next screen appears. If pressure needs to be altered, this may be done either through the digit keypad or the UP/DN keypads.

Jacket (Jacket Type)
- Jacket – the steam to the chamber passes from the jacket press -1

F. O. Mode
This mode enables F.O. calculations, the processing being based on data fed by two temperature sensors one mounted in the chamber, one on the condense pipeline.
The F.O. calculation is performed for cycles with Ster. Temp. in the range of 215ºF - 273ºF, especially used in Programs 9-12.
F.O. = 0 (disabled),
F.O. 1= total heating time + total cycle time + cooling time.
F.O. 2 = compensates the difference between heating time, cooling time and exhaust. Calculates using factor 1.5 of the total accumulated heating and cooling time and converts that into the equivalent sterilization time.
Temp. F.O. = Determines the temp. at which F.O. calculations should begin.

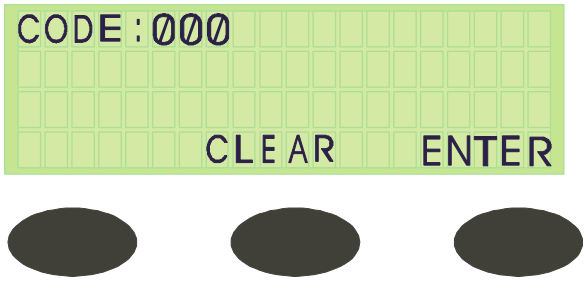
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4.3.4 Changing Cycle Parameters

The screen that allows for parametric changes appears as follows:
Pressing Clear or Enter before entering the code returns to the Stand by screen, and the RUN & FAIL LED's are lit.
Enter the correct code only via the UP/DN keypads; press ENTER to proceed to the next screen.
Pressing the UP/DN keypads can also change all parameter values.

Code 1 or 11 Parameters

STE Temp – Required sterilization temperature for the process



Entry code	1 or 11
Resolution	1
Minimum value	230ºF
Maximum value	278ºF

STE Time – Required sterilization time for the process

Entry code	1 or 11
Resolution	1 minute
Minimum value	1 minutes
Maximum value	99 minutes

Dry Time – Required drying time for the process:

Entry code	1 or 11
Resolution	1 minute
Minimum value	Ø minutes
Maximum value	99 minutes

Heat T.O. – Maximum time for heating the chamber for starting sterilization
When the duration of the heating stage is longer than Heat T.O., the program will collapse with the message 'Low Heat'.

Entry code	11
Resolution	10 seconds
Minimum value	1200 seconds (20 minutes)
Maximum value	3600 seconds (60 minutes)

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Ex Mode – The method for exhausting the steam at the end of the process

Ex Mode	
Fast Ex	1
N.A.	2
Slow Ex. (waste)	3
Slow Ex. (liquids)	4
Cooling with compressed air	5
Cooling with water circulation	6

EndTemp – Ending Temperature (Exhaust Stage)

Defines the temperature at which the process ends for opening the door.

Entry code	11
Resolution	34ºF
Minimum value	180ºF
Maximum value	280ºF

PulsNum. – No. of pulses in the pre vacuum stage

Entry code	11
Resolution	1
Minimum value	0
Maximum value	10

VacDip1 – Vacuum value in the first pulse

Defines the vacuum value in pulse no.1 of the pre vacuum stage.

Entry code	11
Resolution	0.1 psia
Minimum value	1 psia
Maximum value	14 psia

VacDip2 – Vacuum value in the remaining pulses

This value defines the vacuum in the remaining pulses in the pre-vacuum stage (not just pulse no. 2)

Entry code	11
Resolution	0.1 psia
Minimum value	1 psia
Maximum value	14 psia

VacTime1 – Waiting time in the first pulse

In the prevacuum stage, in the first pulse after reaching VacDip1, there is a waiting time known as VacTime1 (in seconds).
This delay occurs so vacuuming can continue.

Entry code	11
Resolution	1 second
Minimum value	3 seconds
Maximum value	1800 seconds (30 minutes)

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Wtr Time – Time for entering the water into the generator after the autoclave is touching the water –(not applicable)
This value defines in seconds the time that the water pump continues working and entering water to the steam generator after the upper electrode touches water, to prevent a situation wherein immediately after the electrode touches water the pump immediately begins operation.

Entry code	11
Minimum value	Ø second
Maximum value	90 seconds

LimitP add – Adding pressure to the maximum pressure
This value defines addition to the maximum pressure that is computed to the jacket control.
For example: When the desired temperature is 273ºF, the maximum temperature maintained in the jacket will be adjusted to a temperature of 137ºC (i.e. 48PSi) When this pressure is not enough, it can be increased by changing the value of the LimitP add.
If the parameter value remains Ø, the maximum pressure in the jacket will be 332kPa, however if this value will be 10, the maximum pressure will be 49.6PSi.

Entry code	11
Resolution	0.5 psia
Minimum value	Øpsia
Maximum value	7 psia

Calib Code:
This parameter is used to set the calibration code.

Entry code	107

Pulse Pres1 – The pressure in pulse no.1 in the pre-vacuum stage
This defines the first pulse pressure in the pre-vacuum stage.
If it is defined as 100kPa, the system will not enter steam into the chamber; however the vacuum pump will immediately operate to create a vacuum.
If the value is defined over 100kPa, the system will open the steam valve to the chamber until the desired pressure is reached.

Entry code	11
Resolution	1psi
Minimum value	14.7 psi
Maximum value	45 psi

Pulse pres2 – The pressure in pulse 2 and onwards in the pre vacuum stage
After the completion of pulse no.1, the system will enter steam by the defined value in puls press.

Entry code	11
Resolution	1 psi
Minimum value	14.7 psi
Maximum value	45 psi

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Heat Step - Waiting time between heating and sterilization
This parameter allows partial entry into the sterilization stage with a reduction of overshoot and the reduction difference between the different sensors that are entered into the chamber for control or validation.
In the heating stage the system stops heating before entering sterilization according to the Heat Step value. When this value is 2 minutes, the system stops at 35.6ºF before entering sterilization and will proceed at a rate of 33.80 ºF/min during the Heat Step.

Entry code	11
Resolution	1 min.
Minimum value	Ø psia.
Maximum value	10 psia.

This is the final parameter under Code 11. After pressing ENTER the display will return to the ST.BY screen

Dry Vac. - Dry Vac. =0 ; Vacuum pump works continuously.
Dry Vac. = 5; Vacuum pump works for 5 min. after which air is introduced for 30 sec. of ON- and 30 sec. OFF intervals (depending on the interval selected by the operator).

Entry code	11
Resolution	0.1 min.
Minimum value	Ø
Maximum value	13

Code 13 Parameters:
ReqPrs+ - The addition to the required pressure for sterilization
This parameter allows the pressure point that will be maintained during the sterilization stage to be set in the following manner:
If the desired temperature is 273ºF, the required pressure (from the tables) is 44.2psi.
When the ReqPrs+ is Ø, the system will be maintained at 44.2 psi during the sterilization stage. When the ReqPrs + equals 0.7 psi, the system will be maintained at 44.9 psi in the sterilization stage. It is advised to work with a value of 0.5 psi.

Entry code	11
Resolution	0.1 psia
Minimum value	0.1 psia
Maximum value	4 psia

Select PT100
There are 2 sensors that regulate cycles – one in the condense water, and one in drain.
Selections:
1. Sensor on the condensate line - dual (No.1) & (No.2).
2. Sensor on the drain output (No.5).

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For the normal mode cycles, if sensor number 2 is not connected (faulty), the system will automatically work with sensor no.1 (the sensor in the condense), even if 2 was selected, as 2 is only an option.

This is the final parameter under Code 13. Pressing ENTER returns the display to the ST.BY screen.

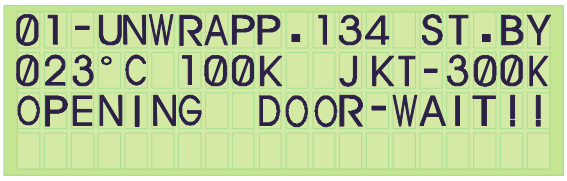
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4.3.5 Display Function (applicable only for automatic doors)

Displays when Opening or Closing the Doors

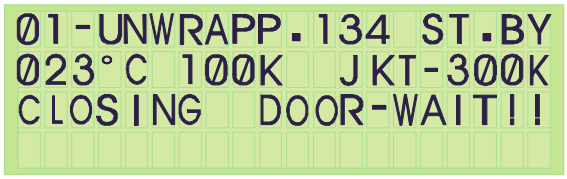
Opening an Automatic Door

During the process of opening an automatic door, the message OPENING DOOR – WAIT will appear in the 3rd row.



Closing an Automatic Door

During the process of closing an automatic door, the message CLOSING DOOR – WAIT will appear in the 3rd row.

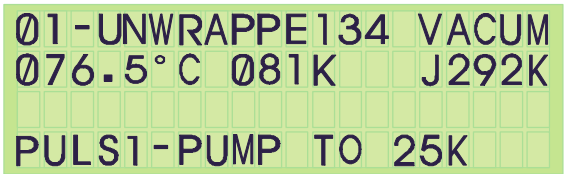


If the pressure in the chamber is higher than 115 kPa it will not be possible to open the door.

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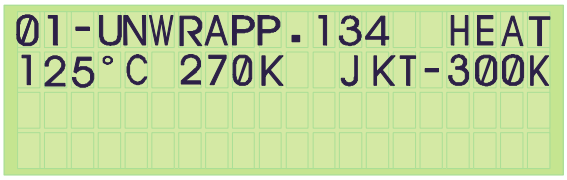
4.3.6 Display During a Cycle

Display During the Pre-Vacuum Stage

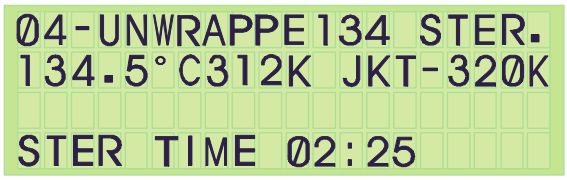


When the cycle passes to the Heat stage the steam enters the system, in place of 'PUMP TO 25K', it will display 'HEAT TO 160K'.
When the cycle passes to the Exhaust stage, ', it will display 'EXH TO 100K'.

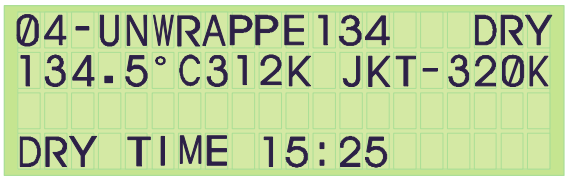
Display During the Heating Stage



Display during the Sterilization Stage

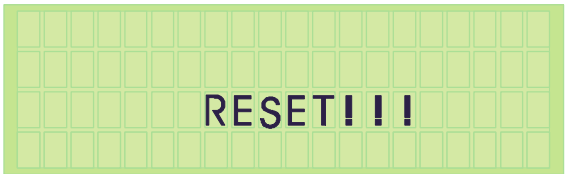


Display During the Drying Stage



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Help:
If at any stage there is a problem, the system can be turned off at the power switch. Turn on the power again, while pressing the STOP keypad until you hear a long buzz. After loading the screen, the screen lights with the message below.
The display returns to the ST.BY screen and you can continue from there.

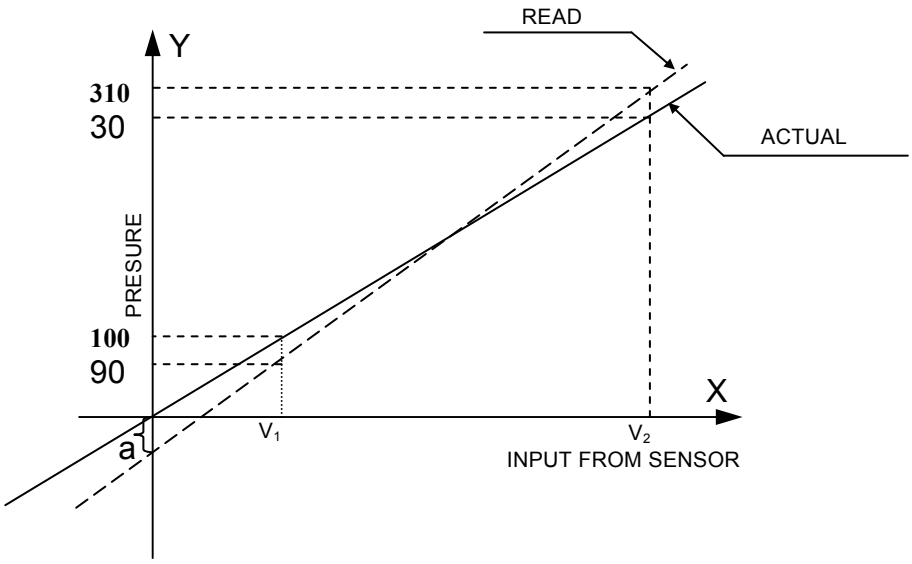


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5. CALIBRATION

The calibration of temperature and pressure is performed digitally.
The temperature and pressure measuring circuits are designed with components having a 1% precision. The temperature circuit is linear and has an output of 100mV-2400mV for a temperature range of 20°C-150°C.
The pressure circuit is also linear and has an output of 100mV-2400mV for a pressure range of 0-400kPa.
The measuring at the A/D is void for values higher than 2400mV or lower than 100mV.
Even though the precision of the components of the circuit is 1%, the acceptable deviation can reach ± 5%, therefore calibration is necessary.
The system has a non-erasable memory in which the offset and gain data of the sensors are stored.

This data may be inserted to the system, through programming or through the autoclave.
In this chapter we shall describe the calibration of temperature and pressure through the autoclave, the programming calibration procedure is altogether identical.



The calibration method enables to insert this data into the system in order to perform the automatic correction of the OFFSET and GAIN.
It is recommended to find the two points which have to be inserted to the system, before performing the calibration.

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5.1 CALIBRATING TEMPERATURE and PRESSURE

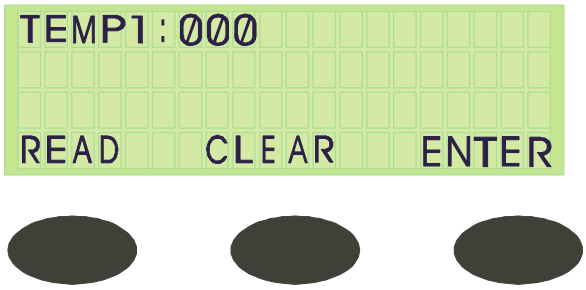
Return to the ST.BY screen and select the OPTION command keypad.
The word CALIB is displayed above the middle command key. Press the middle keypad and the same screen for entering the SETUP code will appear.

Enter the correct code via the digit keypad. The system begins displaying the calibration options.
Note:

- If the code is not entered within 15 seconds, the display returns to the Stand BY screen.
- If the code is incorrect it will return to the ST.BY screen
- In all screens following the code entry screen, the middle command keypad is Clear and the right keypad is Enter. Pressing on either of these keys opens the next screen.
- The values in all the following screens can only be changed via the UP/DN keypads. When the correct value is displayed, press Enter and the system will progress to the next screen.

The following screens appear the entry code screen for Calibration the following screens appear:

5.1.1 Temp 1:



Temperature of sensor 1.
This screen requires a code Press the UP key once to enter the code value ØØ1 and press ENTER.
A screen displaying 4 Temp values appears:

A100	**R100**
A130	**R130**

Pressing the right button (F3) allows you to move around the different values, which may be changed using the UP/DN key only.
After F3 is pressed, when it is on the last value, the next screen Will appear.
Pressing the middle button (F2) will read the value of the sensor.
Pressing STOP will stop the cycle.

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5.1.2 Temp 2:
Temperature of sensor 2.
Refer to Temp1 for instructions.

5.1.3 Temp 3 (Option):
Temperature of sensor 1.
Refer to Temp1 for instructions.

5.1.4 Temp 4 (Option):
Temperature of sensor 2.
Refer to Temp1 for instructions.

5.1.5 Chm Pres: (Chamber Pressure)
This screen requires a code to be entered.
Press the UP key once, to enter the value ØØ1 and press ENTER.
This provides the screen giving 4 pressure values:

A100	**R100**
A300	**R300**

Pressing the right button (F3) allows you to pass to the different values, which may be changed using the UP/DN key only.
After F3 is pressed when it is on the last value, it moves on to the next screen.
Pressing the middle button (F2) reads the value of the sensor.
Pressing STOP will stop the cycle.

5.1.6 Jkt Pres: (Jacket Pressure)
Jacket Pressure.
Refer to Chm Prs for instructions.

5.1.7 Gen Pres:
Generator Pressure.
Refer to Chm Prs for instructions.

5.1.8 D1 Pres:
Pressure in Gasket1.
Refer to Chm Prs for instructions.

5.1.9 D2 Pres: (Option)
Pressure in Gasket 2.
Refer to Chm Prs for instructions.
After Enter is pressed, the Calibration options are concluded and the display returns to the ST.BY screen.

This calibration method enables the technician to change a certain point without affecting a second point.

There are two working temperatures: 134, 121 . When checking chamber TC for 134°C it shows 132°C. When checking chamber TC for 121°C it shows 121°C

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The temp for 134°C needs correction without changing the accurate Temp of 121°C.

The data should be set as follows:

Upper Row	**A 121.0**	**R 121.0**
	A 132.0	**R 134.0**

The system calibrates the new offset and gain and loads them into the non-erasable memory.

As a result, while running a 134°C program the correction is automatically made, while at 121°C there is no change.

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6. PREPARATION BEFORE STERILIZATION

Instruments to be sterilized must be clean washed and disinfected, free of any residual matter, such as debris, blood, pads or any other material. Such substances may cause damage to the contents being sterilized and to the sterilizer.

1. Wash instruments immediately after use, to dispose of any residue.

2. Follow manufacturer's instructions on the use of instruments/washing etc. for cleaning and lubricating. Before placing an instrument into the sterilizer tray, make sure that instruments composed of different (stainless steel, carbon steel, etc.) are separated and placed in different trays.

Note: Check manufacturer's instructions for sterilization of each item.

3. If of carbon steel instruments are used with stainless steel trays, the tray should be lined with a towel or paper wrap before placing the instrument. There should be no direct contact between the carbon steel and the stainless steel trays.

4. All instruments must be sterilized in an open position.

5. Place a sterilization indicator strip in each tray.

6. Once a week use a biological spore test indicator in any load to ensure sterilization.

7. Make sure that all the instruments remain apart during the sterilization cycle.

8. Empty canisters should be placed upside-down in order to prevent accumulation of water.

9. Do not overload sterilizer trays. Overloading will cause inadequate sterilization and drying.

10. Allow a distance of approximately 1" between trays to permit circulation of steam.

11. Wrapped instruments should be packed in material which promotes drying, such as autoclave bag, autoclave paper and muslin towels.

NOTE:
Verify that the packaging method is in accordance with good practice approach and the packaging materials are in accordance with the applicable standards (e.g. EN868 series).

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The following is recommended:

Tubing

Rinse tubing after cleaning with pyrogen free water. When placing in tray, ensure that both ends are open, without sharp bends or twists.

Packs

Place packs upright on trays, side by side.
Packs should not touch the chamber walls.

Sterilization of Liquids

Use only heat-proof glass, filled 2/3 full.
Ensure that the glass container is covered but not sealed to prevent pressure build-up.

Loading

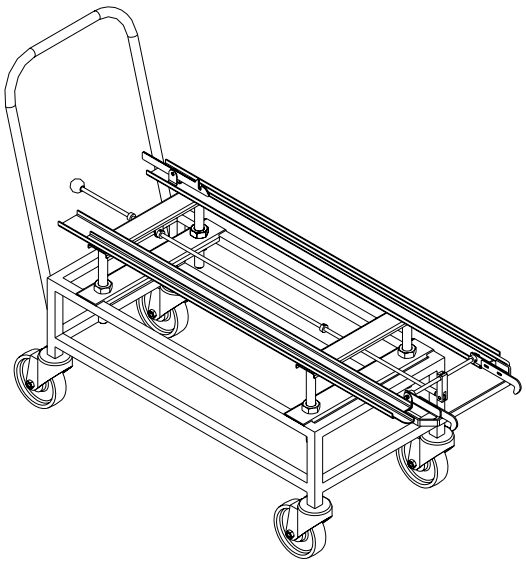
Every machine is supplied either with two (or more) stainless steel shelves, or with rails for loading carriage from a loading cart..

The loading cart is made of stainless steel and comes with adjustable legs to balance the height of the loading cart to rails in the sterilizer chamber.. It is designed to slide smoothly off the carriage into the sterilization chamber.

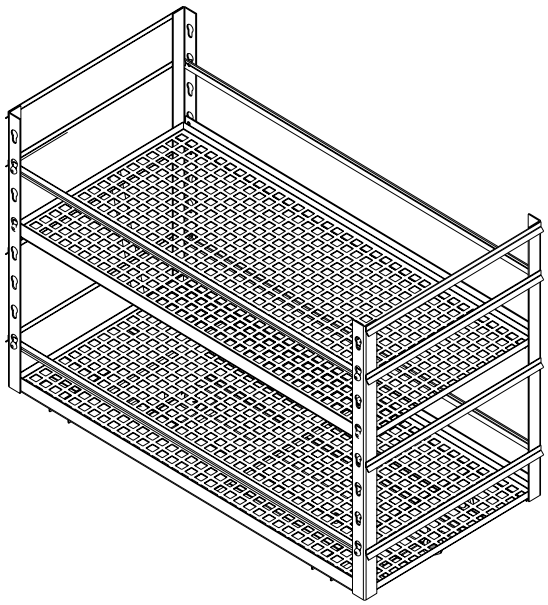
The cart moves on four heavy - duty castors, which are mounted on its base.

When loading the materials to be sterilized into the chamber, observe the rules described in this chapter.

Do not overload the carriage or the shelves as this can have adverse effects on the results of the sterilization and drying. Leave space between the packs or wrapped instruments to allow complete removal of air pockets in the air removal stage, and for free penetration of steam in the heating and sterilization stages.
chamber.



Transfer Carriage



Loading Cart

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Unloading

Upon cycle completion, unload the load from the sterilizer immediately; put it aside to cool down.

Put the carriage or the containers aside to cool down.

Do not transfer hot load to metal shelves for cooling. Perform a visual inspection to ascertain that sterilizing indicators have made the required colour change, and that the load is dry.

The load shall be rejected if:

a. The package has been compressed.

b. The package is torn.

c. The load is wet (water droplets signs).

d. The load fell on the floor.

e. Condense can be observed on the lid.

f. The PCD or other Indicator present – Faulty cycle.



During loading and unloading use safety gloves and glasses in accordance with local safety regulations and good practice.

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7. INSTALLATION INSTRUCTIONS

Only qualified and authorized personnel are allowed to install, check, and test, maintain and serve the autoclave.

Mounting

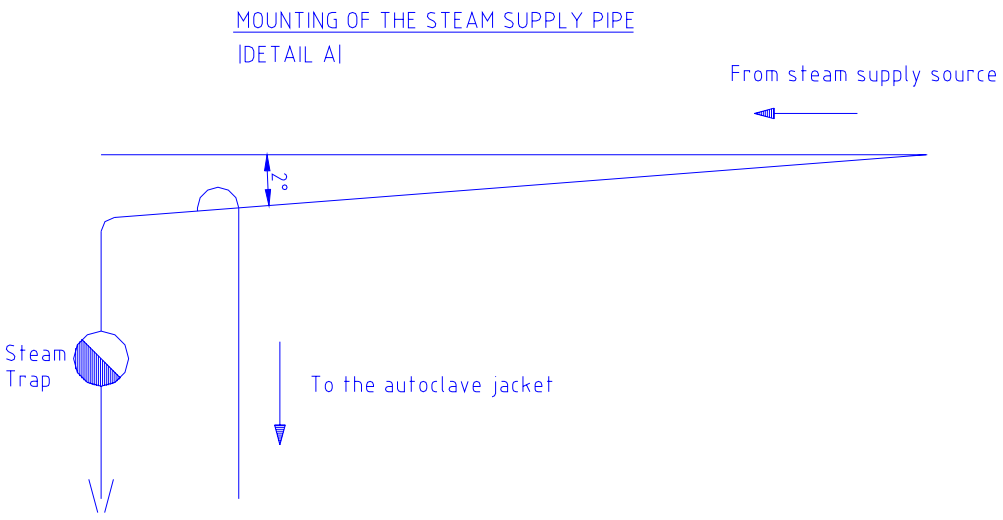
- Check after unpacking the autoclave that the Serial Number (S/N) on its nameplate corresponds with the accompanied documents.
- Place the autoclave on a level surface, leaving adequate space around it for operation and service requirements.
- The ambient temperature around the autoclave must not exceed 40ºC, 80% humidity and the room should be ventilated 10 air changes/hour.
- Do not use the autoclave in presence of dangerous gases and vapours.

Utilities

Connect the autoclave to the utility supplies as follows:

Steam

- For the autoclaves that receive steam from the building supply its pressure should be 4-6 bar (50-80 psi).
- The steam trap should not exceed 2 meters from the machine.
- Connect the steam inlet to the building steam source by a 1/2'' pipe.



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Air

- Connect the air connector on the autoclave to the building air source by means of a 3/8” pipe at 6 to 7.5 bar (90 to 110 psi)
- If there is no external air source, use a small air compressor.

Water

- The autoclave should be supplied with tap water; its hardness should not 0.7-2mmol/l. See also 2.4 Water quality.
- The tap water pressure should be 4 to 6 bar (50 to 80 psi).
- Connect the feed water to the network by a 1/2” pipe.

Drain

Connect the following outlets directly to a drain funnel. Or connect them through a drain collector pipe of 2” that should be covered. The drain system should be vented.

Connect the system drain by 3/4 “pipe.

Electricity

Connect the power cord: Three phases, Neutral and Grounding to the live terminals R, S, T, N in the electrical box and the ground wire- GND to the grounding screw connection. The required outlet for the electrical supply is, 115 V/ 10 A.

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Preliminary Inspection

Caution!
Only qualified personnel or authorized electrician are permitted to perform this inspection.
After installation and prior to putting the machine into operation, the following preparing and checkout procedure is to be fulfilled.

- Check that the water inlets and the drain outlets are correctly connected to the utilities and the manual taps on the external lines and on the autoclave piping are open.
- Check that the manual bypass screws (on the base of the pilot solenoid valves) are set in neutral position, i.e. the slit on the head of the screw is set in horizontal position.
- Search for leaks and fix piping joints if necessary.
- Check Grounding!! (see par. 10.2).
- Check insulation!!(see par 10.2).
- Check at the electrical network switchboard, if the circuit of the autoclave is switched on and fuses or circuit breakers are not interrupted, if the correct voltages are present in the autoclave-generator control box, according to the specifications.
- Check if circuit breakers in the control box are switched on.

If the results of the above checkouts are positive, the autoclave is ready for operation.

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8. OPERATING INSTRUCTIONS

1. Check that the feed water valve is open.
2. Check that the compressed air valve is open.
3. Power the autoclave by turning on the main power switch, observe the gauge and see that the generator reached its pressure.
4. Check that the jacket pressure gauge, reaches 2.4 bars,

   The sterilization cycle can be started.
5. Open the door by turning the door wheel handle, counter clockwise to release the locking arms.
6. Load the sterilizer.
7. Close the door by pushing it towards the chamber frame and turning the wheel handle clockwise until the word READY appears in the first row, indicating autoclave is ready to start operation.
8. Select the sterilization program according to the type of material to be sterilized by pressing the relevant keys as described in Chapter 4. Press the START key, to operate the cycle. The entire sterilization process automatically proceeds. The signal light RUN on the control panel is lit.
9. At the end of the cycle a buzzer sounds, and the word END is displayed. Open the door as described in par 5 while OPEN is displayed above this key.
10. Take out the sterilized material from the chamber following the steps indicated in the ‘Unloading’ paragraph.

    Note : In case of failed cycle or manual stop by operator, the two LED's RUN and FAIL are lit. The reason for failure is displayed on the screen.

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9. PRINTER

9.1 Printer Operation

The autoclave is equipped with a character printer, which prints out a process data enabling process follow up.
The data is printed on thermal paper recording the following information:

- Software version (is printed only on Power On)
- Real time
- Selected program
- Sterilization pressure
- Sterilization temperature
- Sterilization exposure time
- Summary of performed cycle and identification hints.

During process, data is printed.
After the preliminary printing, the autoclave starts performing the sequence of operations of the cycle. The measured values of temperature and pressure are printed at (every two sec.) fixed time intervals, according to the phase of the process, as shown in the table below.
The data is printed from the bottom up, beginning with the date and ending with “O.K.” for a complete cycle or “FAIL” for an aborted cycle.

For an example of a typical printout, see next page.

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PRINTER OUTPUT	DESCRIPTION
Autoclave: 2307085	Autoclave serial no.
Name : __--------	Name of the operator to be filled in .
Load #: 0030	To be filled in manually by the operator.
14/01/2003 13:45:16	Date and time the cycle ended
F11:30 187.6ºF 0.13 In	If cycle fails, conditions at time of failure.
CYCLE FAILED! ! !	Message displayed if cycle fails.
Manual Stop - 03	If operator presses the manual stop button.
♦ S11:28 274.5ºF 32 psi	The time, temperature and pressure during sterilization.
H10:08 273.3ºF 32 psi	The time, temperature and pressure during the heating stage.
H06:04 270.5ºF 30 psi	The time, temperature and pressure during the heating stage.
H02:00 245ºF 21 psi	The time, temperature and pressure during the heating stage.
H03:00 161.1ºF 23.5 In	The time, temperature and pressure during the heating stage.
V00:22 180.3ºF 23.5 In	The time, temperature and pressure during air removal (vacuum).
Exhaust mode: 1	Exhaust mode: fast exhaust and process ends..
Dry time : 015 min	Drying time of the selected program
Ster time: 007.0 min.	Preset sterilization time of the selected program.
Ster Temp: 274ºF	Sterilization temperature in chamber for selected program.
Cycle: 07 wrapped	Selected program: wrapped Instruments.
14/01/2003 13:29:31	Date/month/year time/min./sec.
Version = HORIZ us3M3	Number and version of the software program.

♦

Legend

V - Air removal stage

S - Sterilization stage

E - Exhaust stage

H - Heating stage

F - Fail

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9.2 Printer Handling

The printer is driven and controlled automatically by the control unit, while the autoclave performs a sterilization program.

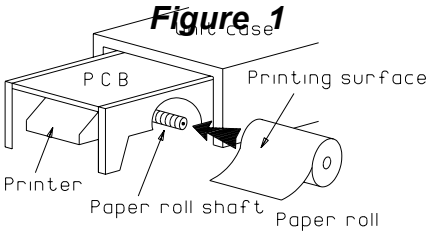


Figure 1

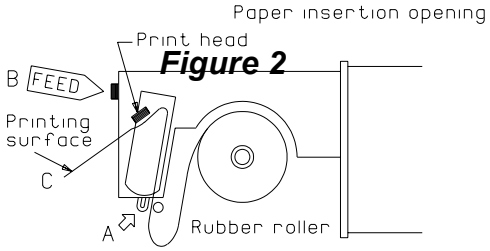


Figure 2

To set the paper roll in the printer perform the following steps:

1. Gently push the front panel clips. Remove panel.
2. Pull out printer gently.
3. Place roll with printing showing surface. (See Figure 1) Gently push the paper face down into insertion opening (A) in Figure 2. Keep pressing the feed switch (B) until the paper comes out from the print head (C).
4. When the paper comes out, insert it in the paper cutter (the slot in the front panel) and reassemble the front panel on the unit.

Printer is now ready for use!

NOTE: If the paper is not pulled in by the rollers even when you press the feed switch (B) push the paper in.

5. To ensure correct operation of the printer perform the following:
   - Turn the main switch to the OFF position.
   - Turn the main switch to the ON position while pressing the feed switch. Print all built in characters to verify that the printer performs an operation.

Check the following to ensure the proper operation of the printer:

- Avoid contact between the paper and the hot parts of the autoclave, as the paper will be blackened.
- Do not pull out the paper roll from the paper insertion opening.
- Use only the 58mm. wide thermal paper rolls, supplied by your dealer.

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10 .MAINTENANCE OF AUTOCLAVE

10.1 Preventive and Periodical Maintenance

	User	1. Clean the strainer at the bottom of the chamber. 2. Verify that the door gasket and the surface that the gasket is pressed on are clean.
Daily	**User**	3. Before starting operation, ensure the compressor tank is drained of water (if applicable). 4. In case the autoclave is used to sterilise liquids, it is imperative to clean the chamber at the end of every day. **Clean the chamber while the autoclave is cold.**
Weekly	**User**	1. Clean the cabinet and door parts, the internal walls of the autoclave, the shelves and the shelf rails with a soft cloth and detergent. Clean the chamber while the autoclave is cold. The detergent should be washed and flushed away. **Caution** **Do not use steel wool or steel brush as this can damage the chamber!** 2. Place several drops of oil on all the door axis. 3. Verify that the water quality complies with the requirements as detailed in par. 2.4 ' Water quality'.
Monthly	**Tech**	1. Allow the safety valve to blow off by lifting the handle up for a few seconds. **Do it very carefully to avoid injuries!!!**
3 months	**Tech**	1. Clean water strainers on pipelines while autoclave does not operate (idle). 2. Verify sewage pipe is not clogged ensuring free drainage of sewage liquids. It is important that sewage liquids do not overflow at the working site. 3. Disassemble the steam –traps and clean them. The cleaning operation requires the cleaning filter inside the steam-trap to be. This can be done by rinsing and removing any dirt, which causes blockage. 4. Check the piping connections and tighten where necessary to avoid leakage.
6 months	**Tech**	1. Replace 0.02μ air filter
Yearly	**Tech**	1. Perform an overall check of the locking system and replace worn parts. 2. Check and tighten where necessary the electrical connections in the electrical board, connection box, motors, electrical valves, locking device screws and instrumentation. 3. Clean the electronic control unit, using a vacuum cleaner. 4. Check the door gasket and replace if damaged. 5. Calibrate and validate the autoclave. 6. Perform safety tests to (pressure vessel and electricity) referring to loca rules, regulations or law shall be applied in compliance with the law.

Notes:

1. Keeping the inside of the autoclave clean will ensure its life and its proper operation.
   Use only mineral-free water as detailed in par. 2.4 Water Quality.
2. If you see or hear anything extraordinary, stop using the autoclave and call for service.

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SERVICE INSTRUCTIONS

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10.2 Safety Tests after Repair



ATTENTION!

Following every repair or dismantling the enclosure, the service engineer should perform two safety electrical test as follows:

1. *Enclosure Leakage Current Test.*
   . Perform the test using the Megger: (electrical potential 500 V). The insulation resistance should be at least 2 MΩ.
   Success criteria - no leakage.

2. *Protective Earth Impedance Test*
   Measure the resistance between Grounding of any metallic port end the Grounding pin of the power cord plug, use the Ohmeter.
   Success criteria resistance - 0.3 Ω.

Upon completion of the tests, document and sign work order and log book.

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10.3 Troubleshooting

Symptoms		Possible causes check-ups and tests		Corrections
1. Control unit not energised. No displays and lights on the front panel.	1.1	The control circuit breaker switched off.	1.1	Check and switch on the circuit breaker.
	1.2	The power switches on the front panels of the autoclave or of the steam generator are off, or defective.	1.2	Replace the defective switch.
2. Steam generator does not operate.	2.1	Water pump defective or blocked.	2.1	Repair or replace pump. Replace motor.
	2.2	Blocking or low water pressure in the pump circuit.	2.2	Adjust water pressure, ensure a free circulation of water.
	2.3	Circuit breaker trips, because of overload or damage.	2.3	Check and remove the overload or replace circuit.
	2.4	Upper electrode short-circuited.	2.4	Clean or replace upper electrode.
	2.5	Electronic pressure transducers or measuring circuits faulty or out of calibration.	2.5	Check, calibrate pressures switches or replace them.
	2.6	Lower electrode dirty or rusted.	2.6	Clean or replace the electrode.
	2.7	Circuit breakers in the heaters circuit switched off or damaged.	2.7	Turn off or replace the circuit breakers.
	2.8	Contactor controlling the heat up current is damaged.	2.8	Check the cause and replace contactor.
	2.9	Control system trouble.	2.9	Replace boards.
	2.10	Heaters burnt out.	2.10	Replace defective heaters, check if the water level is sufficiently high.
	2.11	Solenoid or pneumatic steam supply stuck or defective.	2.11	Repair or replace solenoid or pneumatic valve.

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Symptoms		Possible causes check-ups and tests	Corrections	
3. Steam pressure goes beyond the control point.	3.1	Pressure switch faulty or incorrectly set.	3.1	Check, repair or replace the pressure switch.
	3.2	Contacts at contactor welded because of short circuit.	3.2	Check the cause, replace the damaged contactor.
4.The conditioning phase (pre-vacuum does not work).	4.1	Check if the trouble is due to pump or its electrical supply circuit.	4.1	See solutions indicated in par. 2.
	4.2	The vacuum valve passing water through the vacuum pump stuck or damaged.	4.2	Check, repair or replace the water to pump valve.
	4.3	The exhaust to pump valve stuck or damaged.	4.3	Check repair or replace the fast exhaust valve.
	4.4	Door improperly closed, gasket damaged or incorrectly seated on the groove.	4.4	Close the door, fix or replace the gasket.
	4.5	Leakage at the vacuum or exhaust piping.	4.5	Check and tighten fitting joints, replace defective packing.
	4.6	Steam inlet valve blocked or damaged.	4.6	Fix or replace the steam valve.
No steam inlet or low steam pressure.	4.7	Low pressure at the steam supply line.	4.7	Check the steam generator as shown in par. 2.
	4.8	Control system trouble.	4.8	Replace the control boards.
5. Pre-vacuum phase completed but temperature and pressure are low and the sterilization point is not reached or takes a long time to reach it.	5.1 5.2	Low pressure at the steam supply line. Steam inlet valve clogged or damaged.	5.1 5.2	Check steam generator, fix pressure. Check and fix or replace the steam valve.
	5.3	Electronic pressure transducers or measuring circuits faulty or set too low.	5.3	Set correctly or replace boards.
	5.4	Control system trouble.	5.4	Replace the control boards.

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Symptoms		Possible causes check-ups and tests	Corrections	
6. Temperature rises above the preset sterilization value.	6.1	Steam pressure too high.	6.1	Check and set correctly the pressure switch of the generator and the pressure reducer.
	6.2	Steam valve leaks.	6.2	Fix or replace the steam valve.
	6.3	Control system trouble.	6.3	Replace control boards.
7. Fast or slow exhaust phases do not function; chamber pressure remains high or exhaust takes too long.	7.1	The fast or slow exhaust valves stuck or damaged.	7.1	Repair or replace damaged valve.
	7.2	Steam valve leaks.	7.2	Repair or replace steam valve.
	7.3	Control system trouble.	7.3	Replace control boards.
8. Drying stage does not work.	8.1	Trouble with the vacuum system.	8.1	See par. 2 and 4.
	8.2	Steam valve leaks.	8.2	Repair or replace steam valve.
	8.3	Control system trouble.	8.3	Replace control boards.
9. The air inlet does not work.	9.1	Air inlet valve clogged or damaged.	9.1	Repair or replace air valve.
	9.2	Air filter clogged.	9.2	Replace air filter.
10. Unsatisfactory results of sterilization process.	10.1	Incomplete removal of air pockets.	10.1	See trouble related to vacuum system par. 2 and 4.
	10.2	Sterilization conditions improper temperature or pressure too low, sterilization time too short.	10.2	Set correctly the temp. and time according to the sort and quantity of material.
	10.3	Incorrect loading of autoclave, air trapped in the load.	10.3	See par. on ‘Preparation before Sterilization’.

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Symptoms		Possible causes check-ups and tests	Corrections	
11. Drying incomplete packs remain wet.	11.1	Insufficient steam pressure to jacket.	11.1	Set or fix the pressure switch.
	11.2	Insufficient vacuum.	11.2	See problems related to vacuum par. 2 and 4.
	11.3	Steam trap does not eliminate the condensate.	11.3	Clean or repair the steam trap.
	11.4	Incorrect loading of the autoclave.	11.4	Reload the autoclave appropriately.
12. Problems related to the control system.	12.1	Check if the flat cable or MOLEX connectors between the control boards and keyboard are well plugged in.	12.1	Plug in firmly the MOLEX connectors.
	12.2	Power supplies out of order.	12.2	Fix or replace the power supply.
	12.3	Control boards or keyboard.	12.3	Replace defective board of microcomputer unit.
	12.4	Paper to printer missing or quality unsuitable.	12.4	Insert a paper roll inside the printer. Ensure the appropriate type of paper is used.
	12.5	Flat cable connection between control board and printer is not plugged in correctly.	12.5	Plug in connection or replace it.
	12.6	Printer damaged.	12.6	Replace the printer.
	12.7	Temperature sensor disconnected or loose connection. Sensor damaged.	12.7	Fix connection or replace sensor.
	12.8	Pressure transducer, bad. Mechanical or electrical connections or transducer damaged.	12.8	Fix connection or replace transducer.

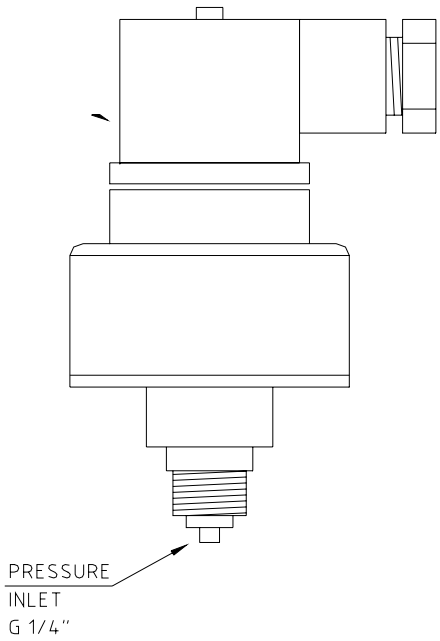
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10.4 Absolute Pressure Transducer

The control unit is fitted with three pressure transducers, for the control and monitoring of chamber pressure, for the control of jacket pressure, and for the control of gasket pressure.

The transducer type TECSIS 3296 is a membrane pressure sensor and electronic measuring circuit, having the following specifications:
Pressure gauge: 0-4bar abs.
Output span current: 4-20mA
Supply voltage: 10V to 30V

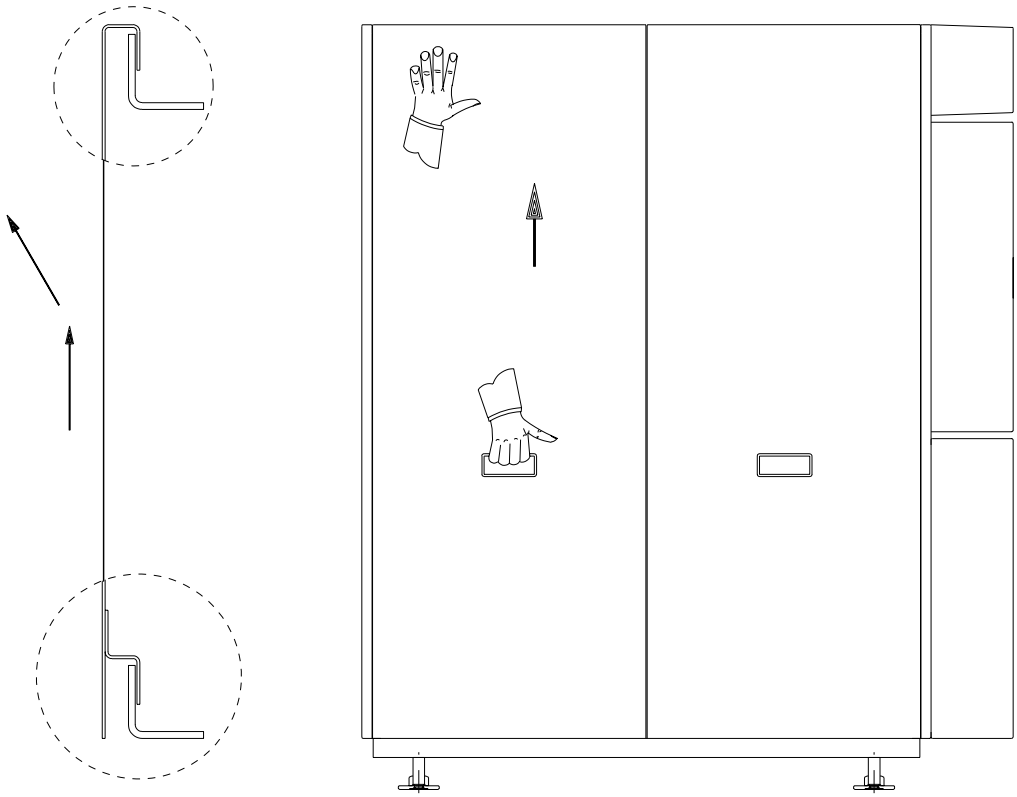
The terminals at the connector of the device are 1 (+24V) and 2 (OUT) to the controller output.



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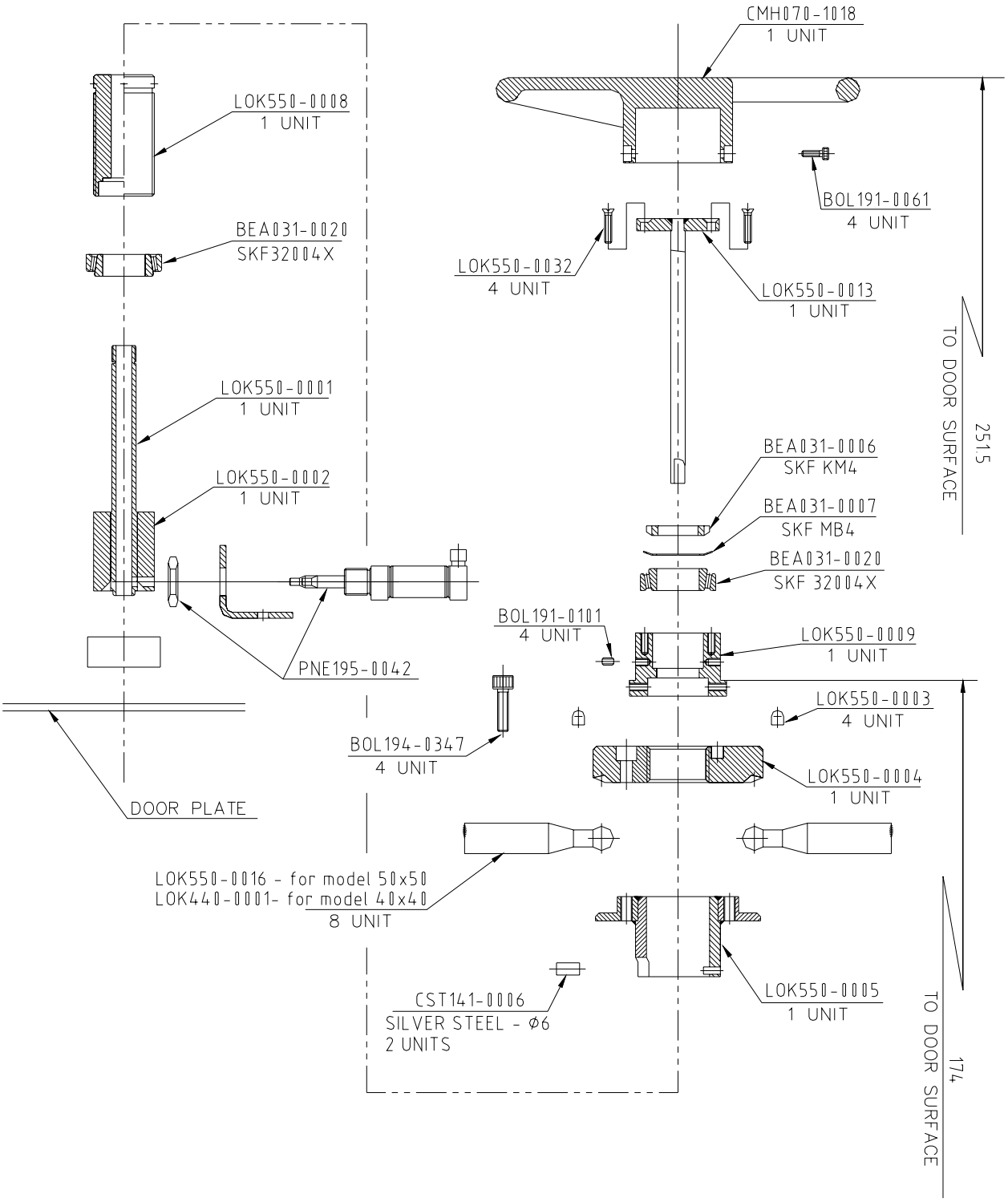
10.5 Dismantling the Cabinet's Side Panels

Push the side cover upward and pull out.



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10.6 Details of the Locking Mechanism



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11. SPARE PARTS

	Part No.	Description
R	ARM029-0006	Pressure Reducer, Steam, 1/2", Miyawaki
R	ARM100-0069	Steam Trap, 1/2", without bypass,N125W, Nicholson
R	ARM100-0070	Steam Trap, 1/2", with bypass, N125WSLR, Nicholson
R	ARM172-0003	Check Valve, Swing, 1/2", Pegler
R	ARM172-0004	Check Valve, Swing, 3/4", Pegler
_	CTP201-0002	POWER SUPPLY, 24V, PU65-14C
_	CTP201-0003	POWER SUPPLY, 5V, PU30-10SLC
_	CTP201-0079	Panel, Keypad CAT 2004
_	CTP201-0090	Board, Electronic, HORIZ V6
_	CTP201-0091	Board, Electronic, HORAN V6
R	ELE034-0018	Circuit Breaker, 1ph, 6A, Moeller
R	ELE035-0012	Switch, Rocker, 16A
R	ELE036-0004	Microswitch With Antena Spring
R	FIL175-0039	Filter,Air, 0.01m, 1/2", Dommick-Hunter
_	FIL175-0047	Filter, Water, 3/4", Oventrop
_	FIL175-0048	Filter, Water, 1/2" "Oventrop"
R	GAS550-0001	Gasket, Door, Silicon, 9mm, Model 55XX
R	GAU029-0003	Gauge, Pressure, Steam, 0-60 psi, 2.5"
R	GAU029-0012	Gauge, Pressure, Air, 1/4"
R	GAU029-0023	Gauge, Pressure, Steam, -1+60 psi
_	PNE195-0034	Reducer, air pressure with manometer MAFR 200 8A, Mindman
R	PNE195-0039	Silencer 1/8"
_	PUM056-0002	Ejector, Water, ELL, 3/4", Penberthy
_	SOL026-0001	Valve, Solenoid 1/4"x1.6
R	SVL029-0031	Valve, Safety, Steam, 1/2"-40 psi (ASME), Spence
R	THE002-0003	Paper, Roll, Printer, DPU-20
_	THE002-0005	Printer, DPU-20, Seiko
_	THE003-0003	Sensor, Temperature, Silicon, PT100, 6X80
_	THE003-0004	Sensor, Temperature, PT100x2, 6X100
_	THE006-0006	Transducer, Pressure, -1+3 Bar abs (Tecsis 3296)
_	VLV170-0001	Valve, Manual, 1/2"
_	VLV170-0021	Valve, Needle, 1/4", Bronze
_	VLV170-0035	Valve, Manual Ball, 1/2"
_	VLV170-0055	Valve, Manual Ball, Mini, 1/4"
_	VLV170-0333	Valve, Air-Spring Operated, Diaphragm, 1/2" Schubert
_	VLV170-0334	Valve, Air-Spring Operated, Diaphragm, 3/4" Schubert
_	WIR040-0070	Cable, Flat, Printer, 25CM, 34P

R – Recommended spare parts list (to be maintained by the operator)

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SPARE PARTS FOR THE LOOKING MECHANISM OF THE DOOR

	Part Number	Description
-	**BEA 031 – 0020**	Bearing
-	**BOL 191 – 0061**	SST socket head screw MC-1/4x25
-	**BOL 191 – 0101**	SST socket screw VW/O head 1/4x1/4
-	**BOL 194 – 0347**	Steel screw with head 3/8x35
-	**CMH 070 – 1018**	Locking handle
-	**CST 141 – 0006**	Steel pipe
-	**LDK 550 – 0008**	Main locking bolt
-	**LOK 550 – 0001**	Main locking shaft
-	**LOK 550 – 0002**	Bushing
-	**LOK 550 – 0003**	Okolon stopper
-	**LOK 550 – 0004**	Upper arm holder
-	**LOK 550 – 0005**	Lower arm holder locking arm base
-	**LOK 550 – 0009**	Locking arm base
-	**LOK 550 – 0013**	Securing arm
-	**LOK 550 – 0016**	Fastening arm
-	**LOK 550 – 0032**	Main bolt holder
-	**PNE 195 – 0042**	Piston

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12. VALVES NUMBERING

The valves in the drawing and the manual are numbered according to their function. The following list includes all the valve numbers that are in use in Tuttnauer.

0.	FUNCTION	01. Change-over : steam / electricity 02. Locking door cylinder (front door) 03. Locking door cylinder (Rear door)
1.	FEED WATER	11. – cool jacket 12. – cool heat exchanger 13. – cool fast exhaust 14. – to reservoir 15. – to vacuum pump/ ejector 16. Water outlet 17. Shut 18. – to air detector
2.	MINERAL FREE WATER	21. Mineral free water - inlet 22. Detergent 23. To spray 24. Recycling inlet 25. Recycling outlet
3.	COMPRESSED AIR	31. Air inlet 32. Air inlet - to chamber 33. To splash cooling pipe 34 – 1. To door 1 seal 34 – 2. To door 2 seal 38 – 1. Open door 1 38 – 2. Open door 2 39 – 1. Close door 1 39 – 2. Close door 2
4.	AIR	41. Air release N.C. 42. Air release N.O. 43. Filtered air - inlet 44. Air Inlet 45. Air Leak Test

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5.	VACUUM	51. Vacuum - break 52. Vacuum - to pump Vacuum - from door 1 seal 53-2. Vacuum - from door 2 seal
6.	DRAIN	61. – from reservoir 62. – from jacket overflow 63. – from vacuum pump / ejector 64. – from chamber 65. – from cooler 66. – from sanitary filter 67. – from steam generator 68. – jacket 69. – condense from seal
7.	EXHAUST	70. Exhaust – from chamber 71. Exhaust – to reservoir 72. Exhaust – to drain 73. Fast exhaust 74. Slow exhaust 75. Exhaust to ejector / to vacuum pump 76. Exhaust – from heat exchanger 77. Exhaust – from steam generator 78. Exhaust through heat exchanger (pre-vacuum stage only) 79. Jacket steam trap
8.	GAS	81. Inlet 82. Main inlet 83. Inlet through humidifier
9.	STEAM	90. – from building source 91. – to jacket (From outer source) 92. – inlet 93. – to chamber 94-1. – to door 1 seal 94-2. – to door 2 seal 95. – to heat exchanger 96. – to sanitary filter 97. – from steam generator – to activate ejector – to air detector

NOTE: S- SANITARY VALVE.

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13. PRESSURE VS TEMPERATURE FOR SATURATED STEAM

psia	InHg	°F	kPa	°C
1.5	2.95	114.5	10	45.8
2.2	4.44	129.3	15	54.1
2.9	5.90	140.2	20	60.1
3.6	7.39	149.1	25	65.0
4.4	8.86	156.4	30	68.9
5.1	10.34	162.9	35	72.7
5.8	11.81	168.6	40	75.9
6.5	13.30	173.8	45	78.8
7.3	14.76	178.4	50	81.3

psia	psig	°F	kPa	°C
14.7	0.0	212.0	101.4	100.0
14.8	0.1	212.2	102.0	100.1
14.8	0.1	212.4	102.0	100.2
14.9	0.2	212.5	102.7	100.3
14.9	0.2	212.7	102.7	100.4
15.0	0.3	212.9	103.4	100.5
15.0	0.3	213.1	103.4	100.6
15.1	0.4	213.3	104.1	100.7
15.1	0.4	213.4	104.1	100.8
15.2	0.5	213.6	104.8	100.9
15.2	0.5	213.8	104.8	101.0
15.3	0.6	214.0	105.5	101.1
15.4	0.7	214.2	106.2	101.2
15.4	0.7	214.3	106.2	101.3
15.5	0.8	214.5	106.9	101.4
15.5	0.8	214.7	106.9	101.5
15.6	0.9	214.9	107.6	101.6
15.6	0.9	215.1	107.6	101.7
15.7	1.0	215.2	108.2	101.8
15.7	1.0	215.4	108.2	101.9
15.8	1.1	215.6	108.9	102.0
15.8	1.1	215.8	108.9	102.1
15.9	1.2	216.0	109.6	102.2
16.0	1.3	216.3	110.3	102.4
16.1	1.4	216.5	111.0	102.5
16.1	1.4	216.7	111.0	102.6
16.2	1.5	216.9	111.7	102.7
16.2	1.5	217.0	111.7	102.8
16.3	1.6	217.2	112.4	102.9
16.4	1.7	217.4	113.1	103.0
16.4	1.7	217.6	113.1	103.1
16.5	1.8	217.8	113.8	103.2
16.5	1.8	217.9	113.8	103.3
16.6	1.9	218.1	114.5	103.4
16.6	1.9	218.3	114.5	103.5
16.7	2.0	218.5	115.1	103.6
16.8	2.1	218.7	115.8	103.7
16.8	2.1	218.8	115.8	103.8
16.9	2.2	219.0	116.5	103.9
16.9	2.2	219.2	116.5	104.0
17.0	2.3	219.4	117.2	104.1
17.1	2.4	219.6	117.9	104.2

psia	psig	°F	kPa	°C
17.1	2.4	219.7	117.9	104.3
17.2	2.5	219.9	118.6	104.4
17.2	2.5	220.1	118.6	104.5
17.3	2.6	220.3	119.3	104.6
17.4	2.7	220.5	120.0	104.7
17.4	2.7	220.6	120.0	104.8
17.5	2.8	220.8	120.7	104.9
17.5	2.8	221.0	120.7	105.0
17.6	2.9	221.2	121.3	105.1
17.7	3.0	221.4	122.0	105.2
17.7	3.0	221.5	122.0	105.3
17.8	3.1	221.7	122.7	105.4
17.8	3.1	221.9	122.7	105.5
17.9	3.2	222.1	123.4	105.6
18.0	3.3	222.3	124.1	105.7
18.0	3.3	222.4	124.1	105.8
18.1	3.4	222.6	124.8	105.9
18.2	3.5	222.8	125.5	106.0
18.2	3.5	223.0	125.5	106.1
18.3	3.6	223.2	126.2	106.2
18.3	3.6	223.3	126.2	106.3
18.4	3.7	223.5	126.9	106.4
18.5	3.8	223.7	127.6	106.5
18.5	3.8	223.9	127.6	106.6
18.6	3.9	224.1	128.2	106.7
18.6	3.9	224.2	128.2	106.8
18.7	4.0	224.4	128.9	106.9
18.8	4.1	224.6	129.6	107.0
18.9	4.2	224.8	130.3	107.1
18.9	4.2	225.0	130.3	107.2
19.0	4.3	225.1	131.0	107.3
19.0	4.3	225.3	131.0	107.4
19.1	4.4	225.5	131.7	107.5
19.2	4.5	225.7	132.4	107.6
19.3	4.6	225.9	133.1	107.7
19.3	4.6	226.0	133.1	107.8
19.4	4.7	226.2	133.8	107.9
19.4	4.7	226.4	133.8	108.0
19.5	4.8	226.6	134.4	108.1
19.6	4.9	226.8	135.1	108.2
19.6	4.9	226.9	135.1	108.3
19.7	5.0	227.1	135.8	108.4
19.8	5.1	227.3	136.5	108.5
19.8	5.1	227.5	136.5	108.6
19.9	5.2	227.7	137.2	108.7
19.9	5.2	227.8	137.2	108.8
20.0	5.3	228.0	137.9	108.9
20.1	5.4	228.2	138.6	109.0
20.2	5.5	228.4	139.3	109.1
20.3	5.6	228.6	140.0	109.2
20.3	5.6	228.7	140.0	109.3
20.4	5.7	228.9	140.7	109.4
20.4	5.7	229.1	140.7	109.5

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psia	psig	°F	kPa	°C	psia	psig	°F	kPa	°C
20.5	5.8	229.3	141.3	109.6	24.6	9.9	239.2	169.6	115.1
20.6	5.9	229.5	142.0	109.7	24.7	10.0	239.4	170.3	115.2
20.6	5.9	229.6	142.0	109.8	24.7	10.0	239.5	170.3	115.3
20.7	6.0	229.8	142.7	109.9	24.8	10.1	239.7	171.0	115.4
20.8	6.1	230.0	143.4	110.0	24.9	10.2	239.9	171.7	115.5
20.9	6.2	230.2	144.1	110.1	25.0	10.3	240.1	172.4	115.6
21.0	6.3	230.4	144.8	110.2	25.1	10.4	240.3	173.1	115.7
21.0	6.3	230.5	144.8	110.3	25.2	10.5	240.4	173.7	115.8
21.1	6.4	230.7	145.5	110.4	25.3	10.6	240.6	174.4	115.9
21.1	6.4	230.9	145.5	110.5	25.3	10.6	240.8	174.4	116.0
21.2	6.5	231.1	146.2	110.6	25.4	10.7	241.0	175.1	116.1
21.3	6.6	231.3	146.9	110.7	25.5	10.8	241.2	175.8	116.2
21.3	6.6	231.4	146.9	110.8	25.6	10.9	241.3	176.5	116.3
21.4	6.7	231.6	147.5	110.9	25.7	11.0	241.5	177.2	116.4
21.5	6.8	231.8	148.2	111.0	25.8	11.1	241.7	177.9	116.5
21.6	6.9	232.0	148.9	111.1	25.9	11.2	241.9	178.6	116.6
21.7	7.0	232.2	149.6	111.2	25.9	11.2	242.1	178.6	116.7
21.7	7.0	232.3	149.6	111.3	26.0	11.3	242.2	179.3	116.8
21.8	7.1	232.5	150.3	111.4	26.1	11.4	242.4	180.0	116.9
21.9	7.2	232.7	151.0	111.5	26.2	11.5	242.6	180.6	117.0
21.9	7.2	232.9	151.0	111.6	26.3	11.6	242.8	181.3	117.1
22.0	7.3	233.1	151.7	111.7	26.4	11.7	243.0	182.0	117.2
22.1	7.4	233.2	152.4	111.8	26.4	11.7	243.1	182.0	117.3
22.1	7.4	233.4	152.4	111.9	26.5	11.8	243.3	182.7	117.4
22.2	7.5	233.6	153.1	112.0	26.6	11.9	243.5	183.4	117.5
22.3	7.6	233.8	153.8	112.1	26.7	12.0	243.7	184.1	117.6
22.4	7.7	234.0	154.4	112.2	26.8	12.1	243.9	184.8	117.7
22.4	7.7	234.1	154.4	112.3	26.8	12.1	244.0	184.8	117.8
22.5	7.8	234.3	155.1	112.4	26.9	12.2	244.2	185.5	117.9
22.6	7.9	234.5	155.8	112.5	27.0	12.3	244.4	186.2	118.0
22.7	8.0	234.7	156.5	112.6	27.1	12.4	244.6	186.8	118.1
22.8	8.1	234.9	157.2	112.7	27.2	12.5	244.8	187.5	118.2
22.8	8.1	235.0	157.2	112.8	27.3	12.6	244.9	188.2	118.3
22.9	8.2	235.2	157.9	112.9	27.4	12.7	245.1	188.9	118.4
23.0	8.3	235.4	158.6	113.0	27.5	12.8	245.3	189.6	118.5
23.1	8.4	235.6	159.3	113.1	27.6	12.9	245.5	190.3	118.6
23.1	8.4	235.8	159.3	113.2	27.7	13.0	245.7	191.0	118.7
23.2	8.5	235.9	160.0	113.3	27.7	13.0	245.8	191.0	118.8
23.3	8.6	236.1	160.6	113.4	27.8	13.1	246.0	191.7	118.9
23.4	8.7	236.3	161.3	113.5	27.9	13.2	246.2	192.4	119.0
23.4	8.7	236.5	161.3	113.6	28.0	13.3	246.4	193.1	119.1
23.5	8.8	236.7	162.0	113.7	28.1	13.4	246.6	193.7	119.2
23.6	8.9	236.8	162.7	113.8	28.2	13.5	246.7	194.4	119.3
23.7	9.0	237.0	163.4	113.9	28.3	13.6	246.9	195.1	119.4
23.7	9.0	237.2	163.4	114.0	28.4	13.7	247.1	195.8	119.5
23.8	9.1	237.4	164.1	114.1	28.5	13.8	247.3	196.5	119.6
23.9	9.2	237.6	164.8	114.2	28.6	13.9	247.5	197.2	119.7
24.0	9.3	237.7	165.5	114.3	28.6	13.9	247.6	197.2	119.8
24.1	9.4	237.9	166.2	114.4	28.7	14.0	247.8	197.9	119.9
24.1	9.4	238.1	166.2	114.5	28.8	14.1	248.0	198.6	120.0
24.2	9.5	238.3	166.9	114.6	28.9	14.2	248.2	199.3	120.1
24.3	9.6	238.5	167.5	114.7	29.0	14.3	248.4	199.9	120.2
24.4	9.7	238.6	168.2	114.8	29.1	14.4	248.5	200.6	120.3
24.4	9.7	238.8	168.2	114.9	29.2	14.5	248.7	201.3	120.4
24.5	9.8	239.0	168.9	115.0	29.3	14.6	248.9	202.0	120.5

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psia	psig	°F	kPa	°C	psia	psig	°F	kPa	°C
29.4	14.7	249.1	202.7	120.6	34.6	19.9	258.6	238.7	125.9
29.5	14.8	249.3	203.4	120.7	34.7	20.0	258.8	239.4	126.0
29.5	14.8	249.4	203.4	120.8	34.8	20.1	259.0	240.2	126.1
29.6	14.9	249.6	204.1	120.9	34.9	20.2	259.2	240.9	126.2
29.7	15.0	249.8	204.8	121.0	35.0	20.3	259.3	241.6	126.3
29.8	15.3	250.0	205.5	121.1	35.1	20.4	259.5	242.3	126.4
29.9	15.4	250.2	206.2	121.2	35.3	20.6	259.7	243.1	126.5
30.0	15.5	250.3	206.8	121.3	35.4	20.7	259.9	243.8	126.6
30.1	15.6	250.5	207.5	121.4	35.5	20.8	260.1	244.5	126.7
30.3	15.6	250.7	208.9	121.5	35.6	20.9	260.2	245.3	126.8
30.5	15.8	250.9	210.3	121.6	35.7	21.0	260.4	246.0	126.9
30.5	15.8	251.1	210.3	121.7	35.8	21.1	260.6	246.8	127.0
30.6	15.9	251.2	211.0	121.8	35.9	21.2	260.8	247.6	127.1
30.7	16.0	251.4	211.7	121.9	36.0	21.3	261.0	248.3	127.2
30.8	16.1	251.6	212.4	122.0	36.1	21.4	261.1	249.1	127.3
31.0	16.3	251.8	213.7	122.1	36.2	21.5	261.3	249.9	127.4
31.0	16.3	252.0	213.7	122.2	36.5	21.8	261.5	251.4	127.5
31.1	16.4	252.1	214.4	122.3	36.5	21.8	261.7	251.4	127.6
31.2	16.5	252.3	215.1	122.4	36.6	21.9	261.9	252.2	127.7
31.3	16.6	252.5	215.8	122.5	36.7	22.0	262.0	252.9	127.8
31.4	16.7	252.7	216.5	122.6	36.8	22.1	262.2	253.7	127.9
31.5	16.8	252.9	217.2	122.7	36.9	22.2	262.4	254.5	128.0
31.6	16.9	253.0	217.9	122.8	37.0	22.3	262.6	255.2	128.1
31.7	17.0	253.2	218.6	122.9	37.1	22.4	262.8	256.0	128.2
31.8	17.1	253.4	219.3	123.0	37.2	22.5	262.9	256.8	128.3
31.8	17.1	253.6	218.9	123.1	37.4	22.7	263.1	257.5	128.4
31.9	17.2	253.8	219.6	123.2	37.5	22.8	263.3	258.3	128.5
32.0	17.3	253.9	220.3	123.3	37.6	22.9	263.5	259.1	128.6
32.1	17.4	254.1	221.0	123.4	37.7	23.0	263.7	259.8	128.7
32.2	17.5	254.3	221.7	123.5	37.8	23.1	263.8	260.6	128.8
32.3	17.6	254.5	222.4	123.6	37.9	23.2	264.0	261.4	128.9
32.4	17.7	254.7	223.1	123.7	38.0	23.3	264.2	262.2	129.0
32.5	17.8	254.8	223.7	123.8	38.1	23.4	264.4	263.0	129.1
32.6	17.9	255.0	224.4	123.9	38.3	23.6	264.6	263.8	129.2
32.6	17.9	255.2	225.1	124.0	38.4	23.7	264.7	264.6	129.3
32.7	18.0	255.4	225.8	124.1	38.5	23.8	264.9	265.4	129.4
32.8	18.1	255.6	226.5	124.2	38.6	23.9	265.1	266.2	129.5
32.9	18.2	255.7	227.2	124.3	38.7	24.0	265.3	267.0	129.6
33.0	18.3	255.9	227.8	124.4	38.8	24.1	265.5	267.8	129.7
33.1	18.4	256.1	228.6	124.5	39.0	24.3	265.6	268.6	129.8
33.3	18.6	256.3	229.3	124.6	39.1	24.4	265.8	269.4	129.9
33.4	18.7	256.5	230.0	124.7	39.2	24.5	266.0	270.3	130.0
33.5	18.8	256.6	230.7	124.8	39.3	24.6	266.2	271.1	130.1
33.6	18.9	256.8	231.5	124.9	39.4	24.7	266.4	271.9	130.2
33.7	19.0	257.0	232.2	125.0	39.5	24.8	266.5	272.7	130.3
33.8	19.1	257.2	232.9	125.1	39.7	25.0	266.7	273.5	130.4
33.9	19.2	257.4	233.6	125.2	39.8	25.1	266.9	274.3	130.5
34.0	19.3	257.5	234.4	125.3	39.9	25.2	267.1	275.1	130.6
34.1	19.4	257.7	235.1	125.4	40.0	25.3	267.3	275.9	130.7
34.2	19.5	257.9	235.8	125.5	40.1	25.4	267.4	276.7	130.8
34.3	19.6	258.1	236.5	125.6	40.3	25.6	267.6	277.5	130.9
34.4	19.7	258.3	237.3	125.7	40.4	25.7	267.8	278.3	131.0
34.5	19.8	258.4	238.0	125.8	40.5	25.8	268.0	279.1	131.1

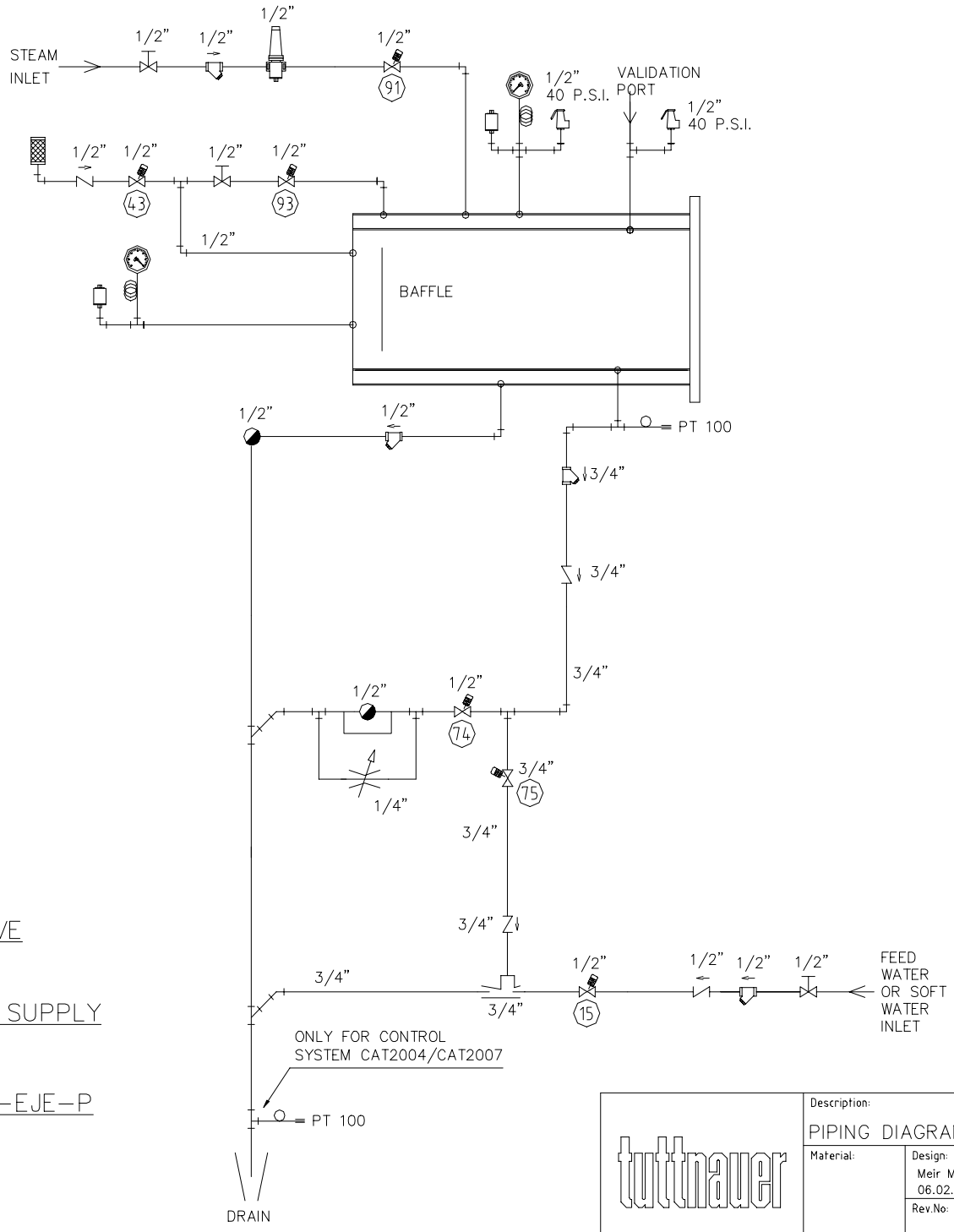
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psia	psig	°F	kPa	°C	psia	psig	°F	kPa	°C
40.6	25.9	268.2	280.0	131.2	45.8	31.1	275.2	315.8	135.1
40.7	26.0	268.3	280.8	131.3	45.9	31.2	275.4	316.5	135.2
40.9	26.2	268.5	281.7	131.4	46.0	31.3	275.5	317.2	135.3
41.0	26.3	268.7	282.6	131.5	46.2	31.5	275.7	318.5	135.4
41.1	26.4	268.9	283.4	131.6	46.3	31.6	275.9	319.2	135.5
41.2	26.5	269.1	284.3	131.7	46.4	31.7	276.1	319.9	135.6
41.4	26.7	269.2	285.1	131.8	46.6	31.9	276.2	321.3	135.7
41.5	26.8	269.4	286.0	131.9	46.7	32.0	276.4	322.0	135.8
41.6	26.9	269.6	286.8	132.0	46.8	32.1	276.6	322.7	135.9
41.7	27.0	269.8	287.7	132.1	47.0	32.3	276.8	324.1	136.0
41.8	27.1	270.0	288.5	132.2	47.1	32.4	277.0	324.7	136.1
42.0	27.3	270.1	289.4	132.3	47.3	32.6	277.2	326.1	136.2
42.1	27.4	270.3	290.2	132.4	47.4	32.7	277.3	326.8	136.3
42.2	27.5	270.5	291.1	132.5	47.5	32.8	277.5	327.5	136.4
42.3	27.6	270.7	291.9	132.6	47.7	33.0	277.7	328.9	136.5
42.5	27.8	270.9	292.8	132.7	47.8	33.1	277.9	329.6	136.6
42.6	27.9	271.0	293.6	132.8	47.9	33.2	278.1	330.3	136.7
42.7	28.0	271.2	294.5	132.9	48.0	33.3	278.2	330.9	136.8
42.8	28.1	271.4	295.3	133.0	48.0	33.3	278.4	331.0	136.9
43.0	28.3	271.6	296.2	133.1	48.1	33.4	278.6	331.6	137.0
43.1	28.4	271.8	297.1	133.2	48.3	33.6	278.8	333.0	137.1
43.2	28.5	271.9	297.9	133.3	48.4	33.7	279.0	333.7	137.2
43.3	28.6	272.1	298.8	133.4	48.5	33.8	279.1	334.4	137.3
43.5	28.8	272.3	299.7	133.5	48.7	34.0	279.3	335.8	137.4
43.6	28.9	272.5	300.6	133.6	48.8	34.1	279.5	336.5	137.5
43.7	29.0	272.7	301.5	133.7	49.0	34.3	279.7	337.8	137.6
43.9	29.2	272.8	302.4	133.8	49.1	34.4	279.9	338.5	137.7
44.0	29.3	273.0	303.3	133.9	49.2	34.5	280.0	339.2	137.8
44.1	29.4	273.2	304.2	134.0	49.4	34.7	280.2	340.6	137.9
44.3	29.6	273.2	305.4	134.0	49.5	34.8	280.4	341.3	138.0
44.4	29.7	273.4	306.1	134.1	49.7	35.0	280.6	342.7	138.1
44.6	29.9	273.6	307.5	134.2	49.8	35.1	280.8	343.4	138.2
44.7	30.0	273.7	308.2	134.3	49.9	35.2	280.9	344.0	138.3
44.8	30.1	273.9	308.9	134.4	50.1	35.4	281.1	345.4	138.4
45.0	30.3	274.1	310.3	134.5	50.2	35.5	281.3	346.1	138.5
45.1	30.4	274.3	311.0	134.6	50.4	35.7	281.5	347.5	138.6
45.2	30.5	274.5	311.6	134.7	50.6	35.9	281.7	348.9	138.7
45.4	30.7	274.6	313.0	134.8	50.7	36.0	281.8	349.6	138.8
45.5	30.8	274.8	313.7	134.9	50.8	36.1	282.0	350.3	138.9
45.6	30.9	275.0	314.4	135.0	51.0	36.3	282.2	351.6	139.0

Legend:
psia — absolute pressure in psi
Psig — gauge pressure in psi
kPa — absolute pressure in kilo-Pascal
InHg — pressure (vacuum) in inch-Mercury

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SAFETY RELIEF VALVE

FILTER/STRAINER

PRESSURE GAUGE

STEAM TRAP

AIR–SPRING VALVE

MANUAL TAP

NON RETURN VALVE

PRESSURE TRANSDUCER

AIR–FILTER

TEMPERATURE SENSOR, PT 100

STEAM PRESSURE REDUCER

EJECTOR

VALVE NUMBER

STEAM TRAP WITH BYPASS

NEEDLE VALVE

HORIZONTAL AUTOCLAVE WITH MANUAL DOOR, BUILDING MAIN STEAM SUPPLY SOURCE, EJECTOR

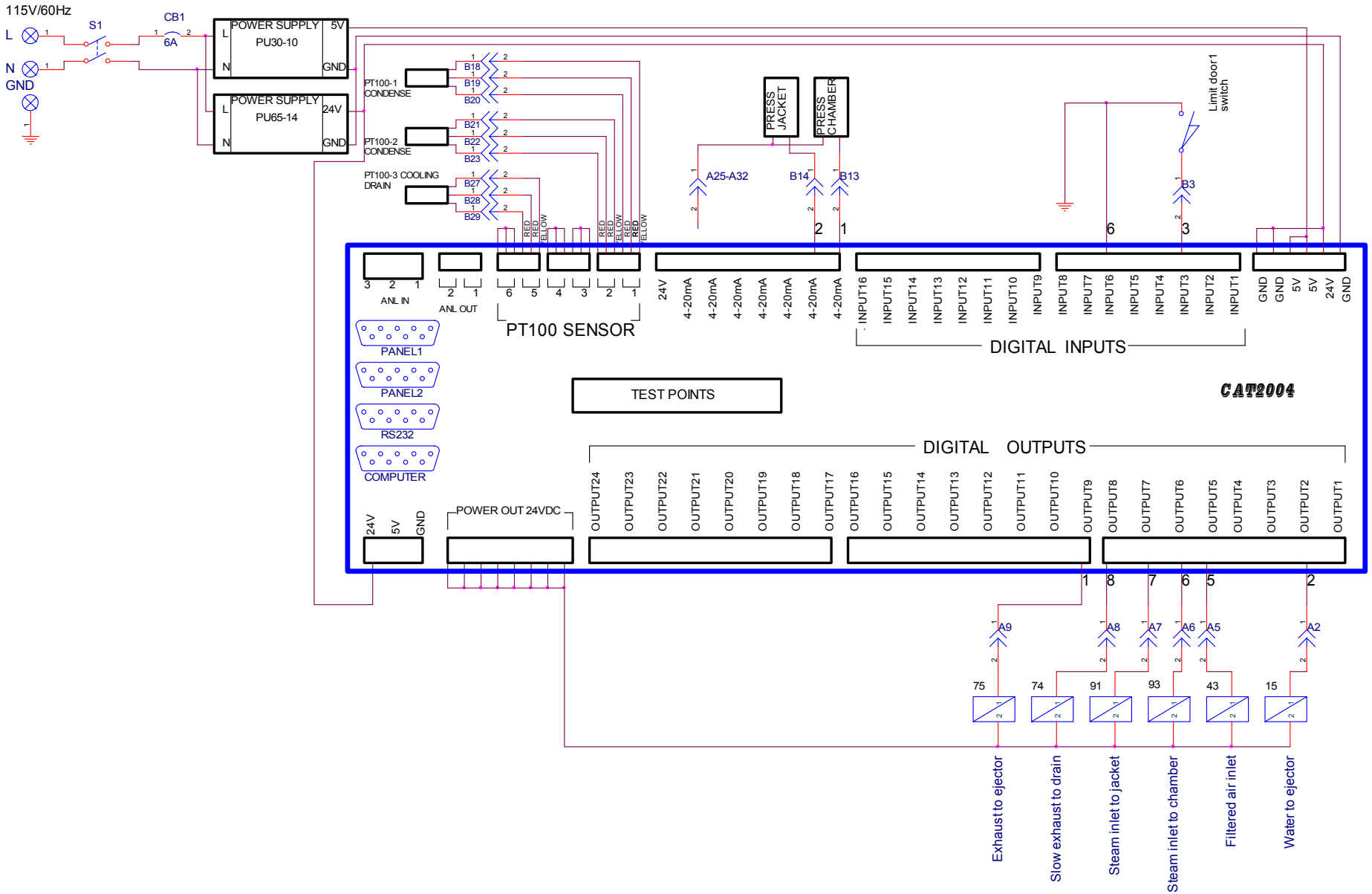
MODEL: 515196–1R–SP–EJE–P

CAT. NO. PIP5596–P012

tuttnauer

Description: PIPING DIAGRAM.		5596	Job No.:	Scale: 1:1	Drawing No: 515196–1R–SP–EJE–P
Material:	Design: Meir M. 06.02.00	Drawing: Alex Z. 03.03.03	Quant./Unit: 1		Quant./Job:
	Rev.No: 05	Preparation By: Igor P. 13.10.03	Approved By:		Q.C.:

Tolerance:



Autoclave's Electrical Drawing

Title	Electric control for horizontal autoclave with one manual door
Size	A3
Document Number	H01MU02N
Rev	4
Date:	Tuesday, June 01, 2004
Sheet	1 of 1

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XPCS Manual

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Definitions

PC – Personal computer.

Program – a complete, self-contained set of computer instructions that you use to perform a specific task such as word processing, accounting or data management. Program is also called Application.

PCS – Cat Technologies LTD. code development, controlling and communication technology.

PCS Target platform – Cat Technologies LTD. controlling system based on PCS card.

PCS communication – exchange data between PCS components via RS232 or RS485, using PCS data exchange protocol.

Download – Send data to the hardware target platform.

Upload – Retrieve data from the hardware target platform.

Calibration - adjusting analog input presentation value by changing gain and offset values.

Overview

XPCS is a Data exchange program that enables to perform downloading of PCS code, downloading/uploading analog inputs gain and offset values. The program is using PCS communication module, to connect between target platform and PC.

XPCS Aim

- Download PCS code data.
- Calibration.

Minimum Requirements

- Pentium processor or equivalent.
- 32MB of RAM, 32 MB of free hard drive space.
- CD-ROM drive.
- Available serial communication port.
- Windows 9X/NT 4.

User Requirements

To operate this program, user needs a basic knowledge of PCS.

Installation

- Select the CD drive by double click on its icon.
- When the window open, find and double click on the file "setup.exe"

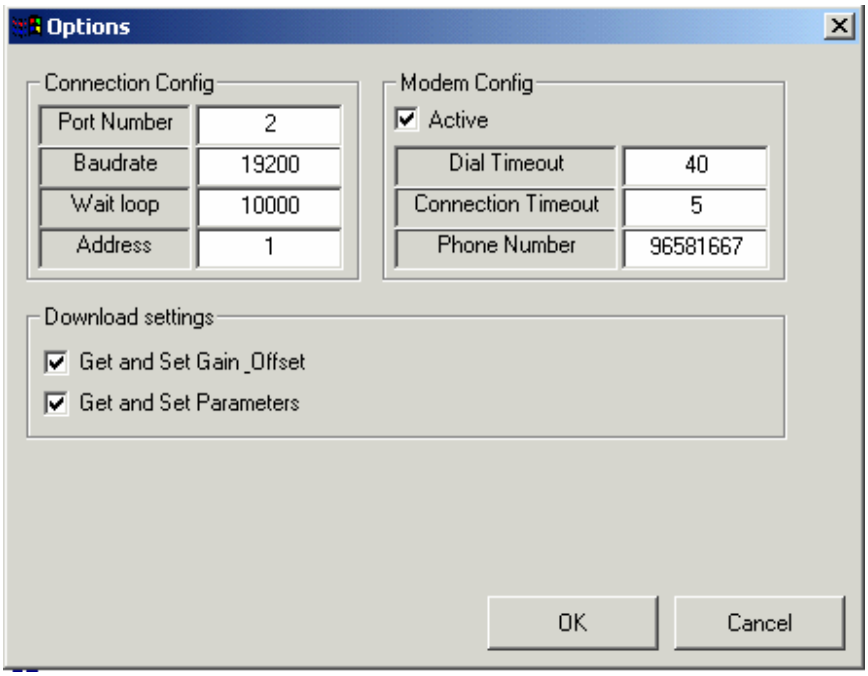
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- This will launch the installer, follow the on screen instructions.

Using XPCS

Configuring the program

On 'XPCS' main window, press 'Options' button. 'Options window will be displayed.



Configuring communication settings

In 'Port Number' text box type serial port number connected to the PCS Target platform, or modem port number for remote connection.

In 'Baudrate' text box type the PCS Target platform baud rate. Usually the value is: 19200.

'Wait loop' is a communication time error counter. To fix communication problems with remote targets via modem, try to insert greater value.

In 'Address' text box, insert the PCS Target address.

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Modem Configurations

To connect to the remote target via a modem, select 'Active' check box in 'Modem Config' frame.

'Connection Timeout' is the waiting time in seconds to retrieve the requested data from the PCS target platform. If no data is retrieved from the target after the waiting time, the program generates a communication time error.

'Dial Time Out' is a waiting time in seconds to be used by the local modem trying to connect to the remote modem. After this time has elapsed, the program generates a timeout error.

'Phone Number' is the phone number dialed to.

Download Setting configuration

If 'Get and set Gain Offset' has been checked, when program performing download, all gain and offset values will be stored before PCS code downloading, and restored after downloading is completed.

If 'Get and Set Parameters' checked, when program performing download, all parameters will be stored before PCS code downloading and restored after downloading is completed.

Note: The program stores parameters only in these conditions:

- ***CAT Technologies ADMC Program is Installed on the PC.***
- ***The Downloaded file (DWN) has the same name as one of the ADMC type files (for example if downloaded file name is: LabTN2.DWN, the ADMC file is compatible, because ADMC type file: LabTN2.mdb exist).***

Note: Only current selected Program (For example: 1-Instruments) parameters will be saved and restored.

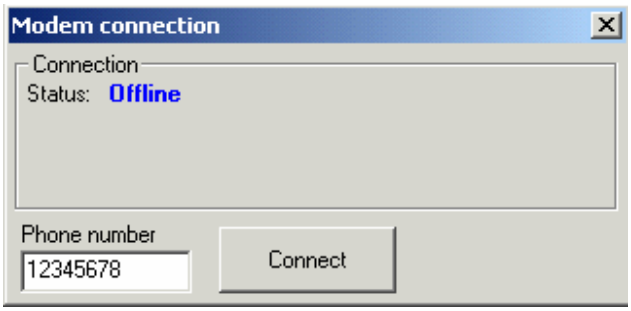
Note: Because the PCS target platform parameters saving process are complex, restoring Parameters task takes a long time (few minutes)!

Note: There is no need to edit options every time that the program starts running. The program saves the settings by pressing the 'OK' button and starts up with the last settings.

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Connecting to the PCS Target platform

The program can be connected to the PCS Target by RS232 serial cable, or via a modem. If the program is configured to perform connection via a modem (Modem Active selected), pressing 'Go Online' button on main XPCS window will display 'Modem connection' dialog box:



By pressing 'Connect' button, the program will try to connect to the remote PCS Target. Opening connection between remote PCS Target and PC, performs the following tasks:

- Check if COM Port is available.
- Detect modem.
- Dial a phone number.
- Wait for connection establishment.
- Check if remote target platforms are connected.

If one of the tasks fails, the program will abort connection process and will display relevant error message.

If 'Modem active' option is not selected, the program will open communication port, by pressing 'Connect'. In this case, communication establishment tasks will be:

- Check if COM Port is available.
- Open COM Port.

Note: In this case the program is not checking if target platform is connected.

After connection was established, the main XPCS window will be displayed.



When program is online, buttons 'Go offline', 'Calibration', 'Download' will be displayed.

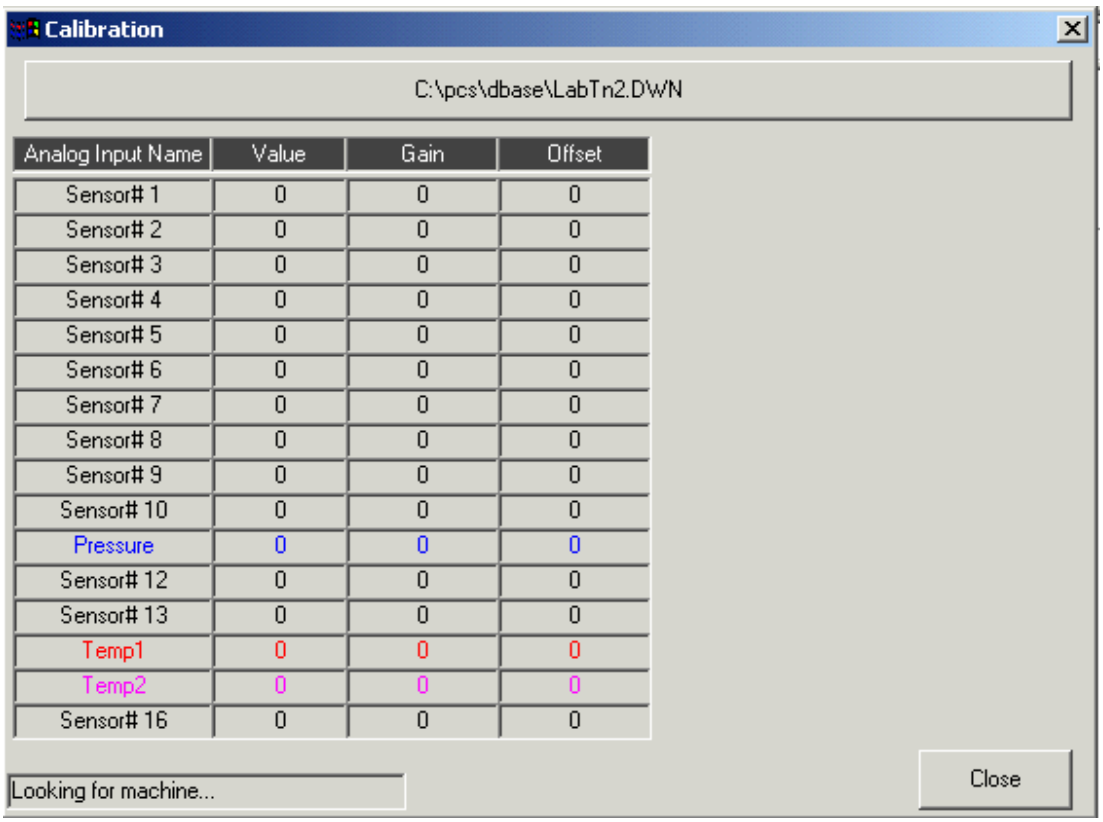
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Pressing 'Go Offline' button will close current connection and buttons 'Go Online', 'Options' and 'Database' will be displayed on the main XPCS window:



Pressing 'Calibration' button will display 'Calibration' window.
Pressing 'Download' button will display 'Download' window.

Calibration window



The calibration window will try to connect with the PCS Target platform. The connection tasks are:

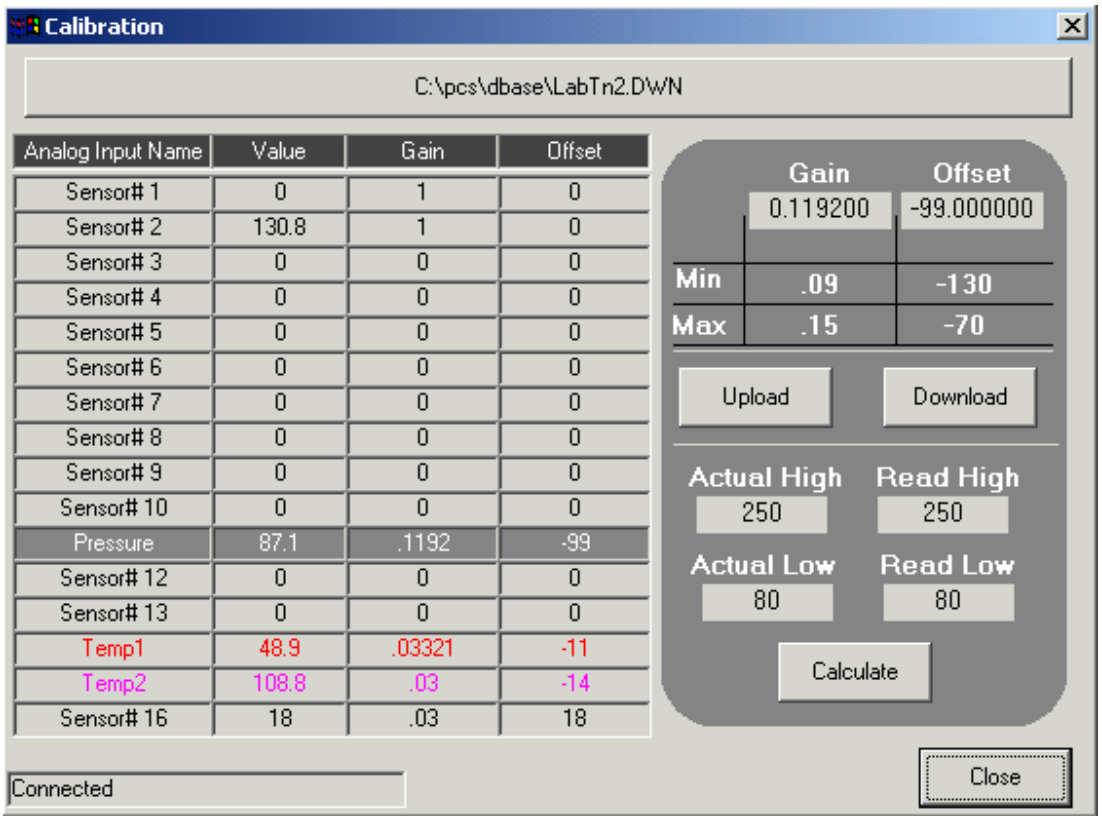
- Check if target is connected. In the status bar "Looking for machine…" is displayed.
- Uploading 16 Analog inputs gain and offset values. In the status bar "Uploading Gain & Offset…" is displayed.
- Uploading analog inputs values. In the status bar "Connected" is displayed. This task is performed periodically every 500 milliseconds. This allows real time refreshing of the analog inputs values.

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Type File button

This button enables to select target type file (e.g. in the calibration window below, the file is: "C:\pcs\dbase\LabTn2.DWN"). Pressing this button will display 'Open file' dialog box. If the program will find a file with the same name in ADMC directory, in the Inputs table, the Analog inputs names will be displayed in color.

When the program is connected, rows, the program will display the calibration tool by double clicking on one of the input table rows. With this tool you can calibrate the selected analog input.



Description of the Calibration tool

Gain text box – use it for manual inserting of the Gain value.
Offset text box – use it for manual inserting of the Offset value.

Min and Max – limits for gain and offset values. If the ADMC compatible type file is not found, Min and Max labels will show "N/A".

Note: When Min and Max are N/A, you must be very careful, because the gain and offset values are not limited in this case and wrong gain or offset values may be inserted.

Upload button – Press this button to upload gain and offset values from the target platform. All 16 analog inputs gain and offset values will be uploaded.

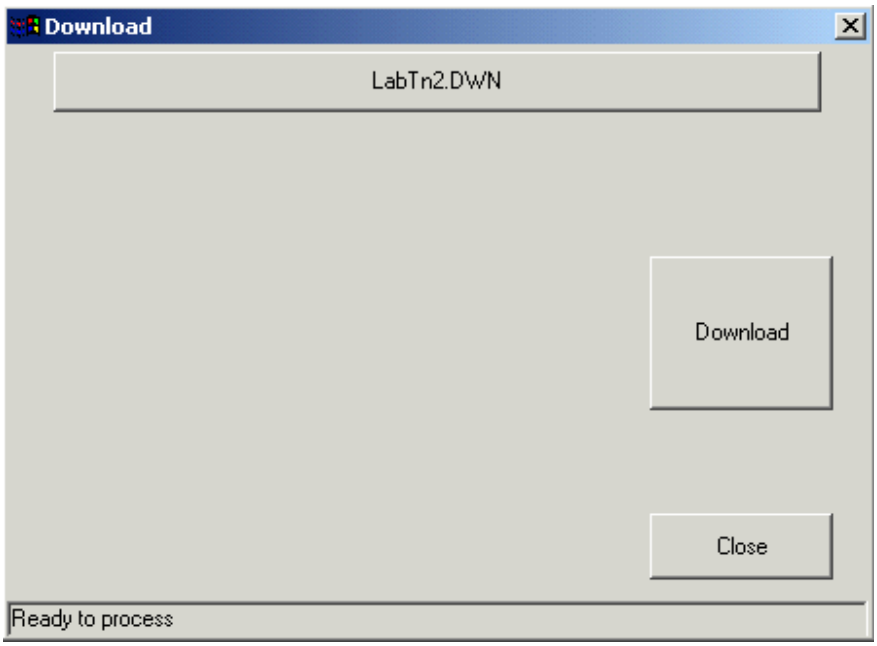
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Download button – Press this button to download Gain and Offset of the current selected analog input. The values displayed in Gain and offset text boxes will be downloaded. If Inserted values are wrong, relevant error message will be displayed and download operation will be aborted.

Calculation
Calculate Gain and Offset values by inserting the following 4 values: Actual High, Actual Low, Read High and Read Low to the formula. For more information about Gain and offset calculation see User Manual supplied with PCS Target platform. Pressing 'Calculate' button will calculate new Gain and Offset values. The new values will be displayed in the Gain and Offset text boxes.

Close button
Pressing this button will close 'Calibration' window and display main XPCS window.

Download window



This window enables downloading the PCS code file.

Type file button
Press this button to select the requested file to be downloaded. The PCS Downloadable file type is: *.DWN. The names of the selected file are displayed on the button.

Note: No need to select type file, if the requested file name is already displayed on the button (In the example above: "LabTn2.DWN").

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Status Bar

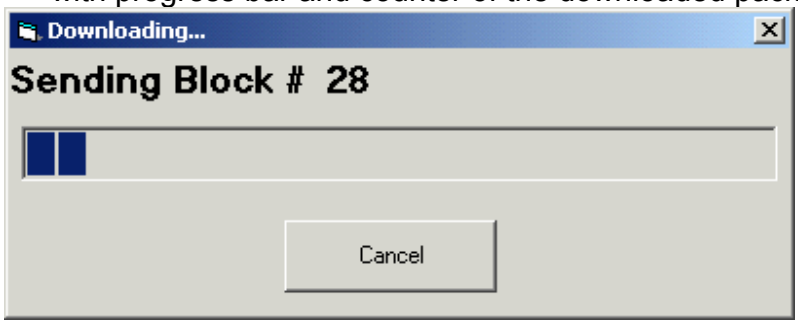
The status bar at the bottom of the window displays the current downloading process status (In the example above: "Ready to process").

'Download' Button

Press this button to perform downloading of the selected file. While performing downloading, the program will display downloading process progress messages. After downloading process is completed, the status bar will display "Download Finished".

Download Tasks

- Check if PCS Target is connected. Status message: "Looking for machine..." is displayed.
- If 'Get and Set Gain & Offset' option in 'Options' window is selected, the program will upload values of all analog inputs gain and offset. The message: "Uploading Gain and Offset..." will be displayed in the status bar.
- If 'Get and Set Parameters' option in 'Options' window is selected, and downloaded file type is ADMC compatible, the program will upload all parameters of the current selected program (e.g.: 1-instruments). The message: "Uploading Parameters..." will be displayed in the status bar.
- Download file. The program will display 'Downloading…' dialog window with progress bar and counter of the downloaded packets:



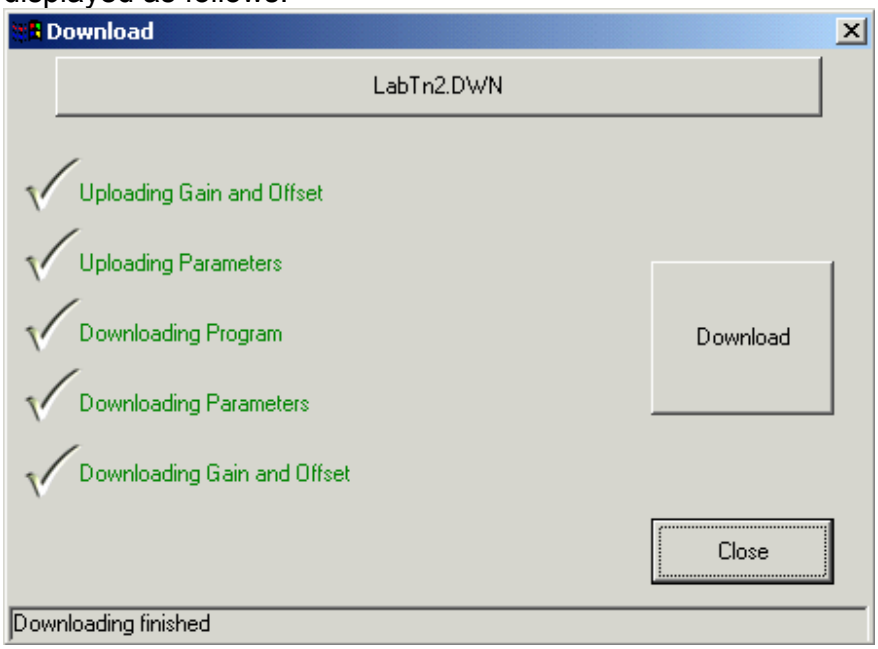
- Wait for target platform startup. After downloading of the file is completed, the PCS Target platform restarts. It takes a few seconds until the target starts running with the new code and before downloading parameters and gain/offset. The technician must wait until the target will start again to communicate with the PC. The message: "Waiting for machine startup..." will be displayed in the status bar.
- If 'Get and Set Parameters' option in 'Options' window is selected, and downloaded file type is ADMC compatible, the program will download all parameters of the current selected program (e.g.: 1-instruments). The message: "Downloading Parameters..." will be displayed in the status bar.
- If 'Get and Set Gain & Offset' option in 'Options' window is selected, the program will download values of all analog inputs gain and offset. The message: "Downloading Gain and Offset..." will be displayed in the status bar.

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- When download process is completed, the message "Download Finished" will be displayed in the status bar.

Note: If error occurs during download process, relevant error massage will be displayed. The message box with 'Retry' option will be displayed.

After completion of the downloading process, the download window will be displayed as follows:



Note: Upload and Download green messages of the Parameters and Gain & Offset tasks are displayed only if the relevant options were selected in the 'Options' window.

Expectable errors list

Can not upload Gain and Offset!
Description: This message may be displayed during download process, when the program is trying to upload Gain and Offset values.
Reason: Probably a communication failure between PCS Target and the PC.
Tips: Check if communication RS232 cable is connected. If it is a modem connection, check if Modem cable is connected. In this case it can be that the remote modem cable is disconnected or RS232 cable between the remote modem and target platform is disconnected.

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**Can not upload Parameters!**
Description: This message may be displayed during download process, when the program is trying to upload Parameters.
Reason: Probably a communication failure between PCS Target and the PC.
Tips: Check if communication RS232 cable is connected. If it is a modem connection, check if Modem cable is connected. In this case it can be that the remote modem cable is disconnected or RS232 cable between the remote modem and the target platform is disconnected.

**Fail download program!**
Description: This message may be displayed during download process, when the program is trying to download the code file.
Reason: Probably a communication failure between PCS Target and the PC, or downloaded file is wrong or damaged.
Tips: 1. Check if communication RS232 cable is connected. If it is a modem connection, check if Modem cable is connected. In this case it can be that the remote modem cable is disconnected or RS232 cable between the remote modem and target platform is disconnected.
2. Try to download another file.

**Fail download Parameters**!
Description: This message may be displayed during download process, when the program is trying to download Parameters.
Reason: Probably a communication failure between PCS Target and the PC, or PCS target platform is damaged and can not save data on flash memory.
Tips: 1. Check if communication RS232 cable is connected. If it is a modem connection, check if Modem cable is connected in this case it can be that the remote modem cable is disconnected or RS232 cable between the remote modem and target platform is disconnected.
2. Try to change the target electronic card.

**Fail Downloading Gain and Offset!**
Description: This message may be displayed during download process, when the program is trying to download Gain and Offset values.
Reason: Probably a communication failure between PCS Target and the PC, or PCS target platform is damaged and can not save data on flash memory.
Tips: 1. Check if communication RS232 cable is connected. If it is a modem connection, check if Modem cable is connected in this case it can be that the remote modem cable is disconnected or RS232 cable between the remote modem and target platform is disconnected.
2. Try to change the target electronic card.

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**Error Opening Type file: *File Name***
Description: This message may be displayed during download process, when the program is trying to open ADMC compatible type file (*.mdb) in order to get parameters data.
Reason: The file may be damaged or used by another application.
Tips: Try to download another file. If operation succeeds, try to find what application is using the file.if this file is not used by another application, restart the PC. If the problem continues, probably the files are damaged. In this case try to replace the file with an identical file from the ADMC installation CD under 'Support' directory.

**Invalid Actual High value!**
Invalid Actual Low value!
Invalid Read High value!
Invalid Read Low value!
Description: These messages are displayed when the user is trying to calculate Gain and Offset by pressing the 'Calculate' button in the 'Calibration' window.
Reason: Wrong number or non- numeric data has been inserted in one of the text boxes.
Tips: Type the right Numeric data in the text box.

**The Actual High value is not in range!**
The Actual Low value is not in range!
The Read High value is not in range!
The Read Low value is not in range!
Description: This message is displayed when the user is trying to calculate Gain and Offset by pressing the 'Calculate' button in the 'Calibration' window.
Reason: A wrong number has been inserted in one of the text boxes. A right number must be: 1<Number<1000.
Tips: Type the right number that is included in the above range.

**Read High must be equal or great than Read Low!**
Description: This message is displayed when the user is trying to calculate Gain and Offset by pressing the 'Calculate' button in the 'Calibration' window.
Reason: Read High value is lees than Read Low value
Tips: Read High value must be greater than Read Low value.

**Can not calculate. Invalid values found! …**
Description: This message is displayed when the user is trying to calculate Gain and Offset by pressing the 'Calculate' button in the 'Calibration' window.
Reason: Read High value - Read Low value = 0
Tips: Read High value must be greater than Read Low value.

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The Gain value must be equal or less than …
The Gain value must be equal or greater than …
The Offset value must be equal or less than …
The Offset value must be equal or greater than …

Description: These messages are displayed when the user is trying to download Gain and Offset by pressing the 'Download' button in the 'Calibration' window.
Reason: Gain or Offset value displayed in Gain or Offset text boxes are not in permitted limits.
Tips: The value in the Gain or Offset boxes must be in Min/Max limits.



Invalid Gain Value!
Invalid Offset Value!

Description: These messages are displayed when the user is trying to download Gain and Offset by pressing 'Download' button in the 'Calibration' window.
Reason: Probably the Gain or Offset value displayed in Gain or Offset text boxes are not numeric data.
Tips: Type numeric value in Gain or Offset text boxes.

**Illegal Port number:** …

Description: This message is displayed when the user is pressing the 'OK' button in the 'Options' window.
Reason: Wrong port number is inserted.
Tips: Type value: 0>VAL>17 in 'Port Number' text box.

**Illegal Baudrate: …**

Description: This message is displayed when the user is pressing 'OK' button in the 'Options' window.
Reason: Wrong Baud rate is inserted.
Tips: Type values 9600 or 19200 in 'Baudrate' text box.

**Illegal Wait Loop value: …**

Description: This message is displayed when the user is pressing 'OK' button in the 'Options' window.
Reason: Wrong Wait Loop value is inserted.
Tips: Type numeric value in 'Wait Loop' text box.

**Illegal Autoclave Address:**

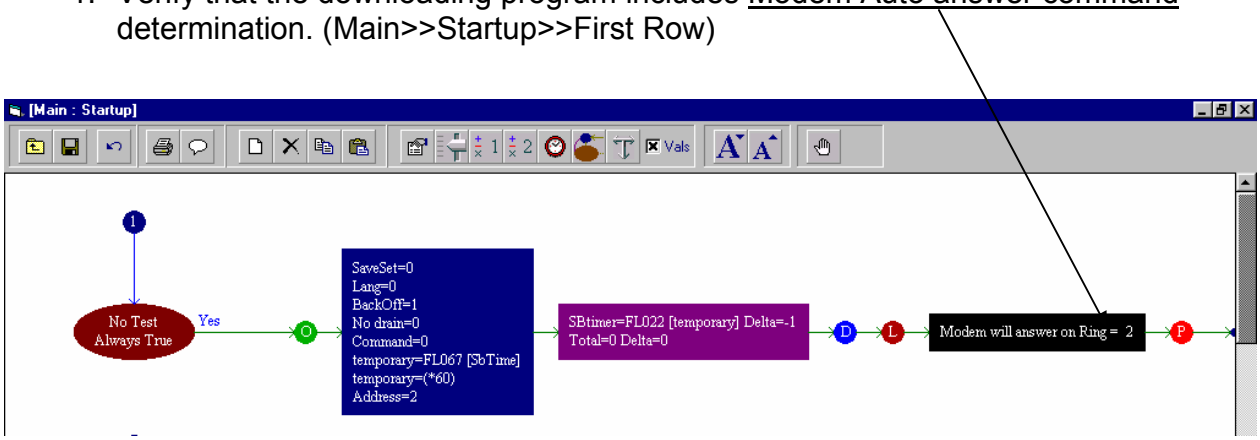
Description: This message is displayed when the user is pressing 'OK' button in the 'Options' window.
Reason: Wrong Address value is inserted.
Tips: Type numeric value: 0<VAL<17.

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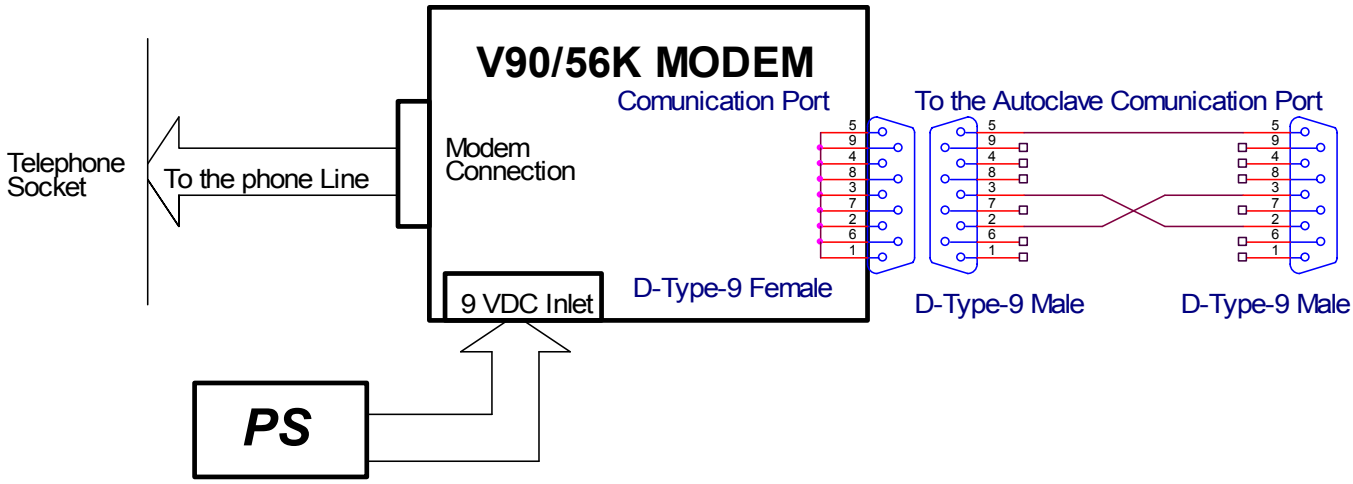
Illegal Dial Timeout:
Description: This message is displayed when the user is pressing 'OK' button in the 'Options' window.
Reason: Wrong Dial Timeout value is inserted.
Tips: Type numeric value.

Steps for the Modem Connection

1. Verify that the downloading program includes Modem Auto answer command determination. (Main>>Startup>>First Row)



2. Connect RS232 to Modem Converter according the following diagram .
3. Check the Jumpers State according RS232 communication.
4. Turn On the Modem.
5. Turn On the Autoclave.
6. The System is ready to be connected by Modem.



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