Tuttnauer
Your Sterilization & Infection Control Partners

OPERATION
&
MAINTENANCE
MANUAL

Pre-vacuum Steam Heated Autoclave with One Manual Hinged Door

Model 5596 SP-1R ND

S.N.: 2912082

CE

Cat. No. MAN205-0076072EN Rev A May 2010

Manufactured by: **Tuttnauer Co. Ltd.**, Har Tuv Industrial zone B P.O. Box 170, Beit Shemesh 99000, Israel.
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INCOMING INSPECTION

Upon receipt, the autoclave should be unpacked and inspected for mechanical damage. Observe packing method and retain packing material until the unit has been inspected.

Mechanical inspection involves 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 supplied Ex Factory. These products are carefully inspected prior to shipment and all reasonable precautions are taken in preparing them for shipment to assure safe arrival at their 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 with the exception of glassware, lamps and heaters.

The warranty does not include and does not replace routine treatment and preventive maintenance to be performed according to instructions in the Preventive and Periodical Maintenance paragraph.

Our obligation is limited to replacing the device 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 device that has been subjected to misuse, neglect, accident or improper installation or application, nor shall it extend to products, 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 instrument, 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** and describe the difficulty as clearly as possible so that we may be able to identify the problem and hence provide a prompt solution.

For technical information or service please contact us at:

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Tel: (800)624 5836, (631)737 4850
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Email: info@tuttnauer.com
Our web site: www.tuttnauer.com

Safety Instructions

The autoclave has unique characteristics. Please read and understand the operation instructions provided by the manufacturer before the first operation of the autoclave. The following issues may require clarification: The operation of the autoclave; the door safety mechanism; the door closing mechanism; the dangers involved in circumventing safety means; and finally, the selection of an appropriate sterilization program.

Make sure that you know the placement of the main power switch, the position of the water cut-off valve, where the steam and compressed air disconnection valves are located.

Autoclave maintenance is crucial for the correct and efficient function of the device.

The daily B&D test and the weekly spore test are part of the preventive maintenance plan, along with the annual validation of the sterilization processes that ensures appropriate temperature dispersion within the chamber.

 **Warning!**

Never use the autoclave for the sterilization of corrosive products and chemicals, such as: Acids, bases and phenols, volatile compounds or solutions such ethanol, methanol or chloroform nor radioactive substances.

Safety Operation Instructions

1. NEVER start a new autoclave or a new steam generator, before the safety, licensing, and authorization department has approved it for use.
2. All autoclave users must receive training in proper usage from an experienced employee. Every new employee must undergo a training period under an experienced employee.
3. A written procedure must be established for autoclave operation, including: Daily safety tests; seal inspection and door hinge inspection; smooth action of the closing mechanism; chamber cleaning; prevention of clogging; preservation from corrosion; and finally, what is permitted and what is prohibited for sterilization and choosing a sterilization program.
4. If there is a steam generator – drain it daily.
5. If there is an air compressor – drain it daily.
6. Before use, check inside the autoclave chamber to ensure that no items have been left from a previous cycle.
7. Before loading the autoclave, clean the strainer on the chamber floor.
8. Load trays in such a way as to allow steam to move freely among all items.
9. Liquids may be sterilized only with the “liquids” program. The container must be covered but not sealed. Sealed bottles may only be sterilized using a special program. The bottle must be either Pyrex or a Borosilicate glass bottle.

10. When sterilizing plastic materials, make sure that the item can withstand sterilization temperature. Plastic that melts in the chamber is liable to cause a great deal of damage.
11. Individual glass bottles may be placed within an appropriate container that will be placed on a tray. Never place glass bottles on the floor of the autoclave. Never fill more than 2/3 of the bottle volume.
12. On closing the autoclave door, make sure that it is properly locked before activating.
13. Verify once, again that you have chosen the appropriate sterilization program.
14. Before withdrawing trays, wear heat resistant gloves.
15. Before opening the door, verify that there is no pressure in the chamber (chamber pressure gauge is located on the autoclave's front panel).
16. Open the door slowly to allow steam to escape and wait 5 minutes before you remove the load. When sterilizing liquids, wait 10 minutes.
17. Once a month, ensure that the safety valves are operating; and once a year, that a certified inspector performs a chamber pressure safety test.
18. Once annually, or more frequently, effective tests must be performed, i.e., calibration and validation.
19. Check the condition of assemblies on a regular basis. Make sure there are no leaks, breaks, blockages, whistles or strange noises.
20. Perform maintenance operations as instructed.
21. Notify the person in charge immediately of any deviation or risk of proper function of the device.
22. It is strictly forbidden for any person to enter the autoclave’s chamber. If, for any reason (for cleaning, maintenance or if something falls down), it is necessary to enter the chamber, the person must ensure the system cannot be accidently turned ON.

Instructions for Contaminated Waste

1. Verify that the contaminated waste at the sterilization station is packed in the correct bags/containers.
2. Verify that there are no leaks and that the package is correctly marked.
3. Large containers with a narrow spout may “behave” like a sealed bottle.
4. It is preferable to sterilize solutions in small containers rather than in differently-sized containers or in large containers.
5. It is recommended not to stand in front of the door when it opens, because steam may be discharged when the door is opened.
6. It is recommended to support sterilization bags at the bottom – especially when they are hot.

Attention:

IF THE UNIT IS USED IN MANNER NOT SPECIFIED BY THE MANUFACTURER, THE PROTECTION PROVIDED BY THE EQUIPMENT MAY BE IMPAIRED.

KEEP THE DOOR CLOSED DURING THE DAY OR SHIFT. WHEN THE AUTOCLAVE IS NOT OPERATING, AT NIGHT OR ON THE WEEKEND, LEAVE THE DOOR OPEN.

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 279°F (137°C) and pressure up to 34 psi (2.3 bars).

The autoclave is equipped with one manual hinged door, locked and unlocked by rotating wheel located on front of the door. The door locking mechanism incorporates a safety lock which prevents the door locking mechanism from rotating, locking the door in the closed position while there is pressure in the chamber. This is achieved by means of a pneumatic cylinder controlled by a pressure switch sensing the pressure inside the sterilization chamber. The moment this pressure switch senses a pressure above 2 psig, the pneumatic cylinder enters the door locking mechanism preventing it from rotating, and will only be released when the chamber pressure drops below 2 psig.

The interlock system of the door is based on the following opening conditions:

- The door cannot be opened while the autoclave is in operation.
- The door cannot be opened if the chamber is under pressure.
- The door cannot be opened if there is liquid in the chamber.
- A door cannot be opened at the end of the cycle if:
  - *a.* the chamber temperature is higher than the preset final temperature, or
  - *b.* the liquid load temperature is higher than the preset final temperature.

The sealing of the chamber is achieved through a heat resistant silicone gasket, located in a groove around the door opening of the autoclave.

The control system of the sterilizer is based on 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 operator intervention is necessary.

The autoclave has an automatic shutdown system. If no buttons or switches are operated for four hours, it will go into SLEEP mode and a LED lights up (blinking every second), indicating that the system is in the SLEEP mode.

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.

The system is equipped with four temperature sensors, two pressure transducers, two pressure gauges, and safety devices having the following functions:

The temperature sensors are located:

1. In the drain – (control)
2. In the condensate line(double) – (control, monitoring, and printout)
3. In the chamber – (control, monitoring, and printout)
4. In the chamber dedicated to the independent **Eliwell** temperature controller

The pressure transducers measure:

1. Chamber pressure – (control, display, and printout)
2. Jacket pressure – (control and monitoring)

The pressure gauges:

1. Chamber pressure
2. Jacket pressure

The safety devices:

1. **RT112** pressure switch – (prevents the opening of the door if there is pressure in the chamber).
2. A **GICAR** controller connected to a water level electrode which detects if there is any liquid in the chamber.
4. An **Eliwell** temperature controller connected to a PT100 in the chamber prevents opening of the door if:
   a. the chamber temperature is higher than the preset final temperature, or
   b. the liquid load temperature is higher than the preset final temperature.

The keyboard located on the front panel enables the operator to select a sterilization program, and start/stop a cycle.

A programming mode, which can be accessed by a code, enables the technician to set up the system, set and change a number of additional parameters and operational modes and performing a calibration.

Optionally, a personal computer can be connected to the control system, through the interface board RS232, which can be operated up to 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. For a distance more than 8 meters, a RS 485 interface and a modem are required.

The communication PC-control unit utilizing ADMC software enables the complete control of the autoclave through the PC, including program selection, starting and stopping a cycle, setting of parameters, and the real time clock (date and time of the day).

 **Warning!**

Do not operate the autoclave in the presence of dangerous gases and vapors.

It is strictly forbidden to enter the autoclave chamber!

If, for any reason (for cleaning, maintenance or if something falls down), it is necessary to enter the chamber, the person must lock the system by pressing the emergency switch and take the key with him to prevent accidents and unauthorized use.

1.2 Standards

Tuttnauer company meets the provisions of the **Medical Device Directive 93/42EEC** and **PED 97/23EEC** and the following standards:

ASME	American Society of Mechanical Engineers
	Section VIII, Division 1, for unfired pressure vessels.
AAMI/ANSI-ST8	Hospital sterilizers
EN 285	Large Sterilizers.
EN 554	Validation and routine control.
UL	Underwriters Laboratories, Inc.

Tuttnauer company is also approved for ISO 9001; 2008 (Quality Systems) and ISO 13485 (Quality Systems for Medical Devices).

1.3 Specifications

Product data		Model 5596 SP-1R ND
Chamber volume		**250L**
Chamber dimensions	**W**	**510 mm 20"**
	H	**510 mm 20"**
	D	**970 mm 38"**
External dimensions	**W**	**710 mm 28"**
	H	**1910 mm 75"**
	L	**1520 mm 60"**
Degree of protection		**IPX 4**
Utilities		
Tap Water supply Maximum hardness value 0.7-2.0 mmol/l. Recommended temperature 60°F (15°C)		1. Connection: ½" thread. 2. Pressure: 30–70 psi (2–5 bar)
Compressed air requirements		1. Connection: ¼" thread 2. Pressure: 85-115 psi (6-8 Bar) 3. Consumption: 3.5 SCFM
Steam		1. Connection: ½" thread 2. Pressure: 50-65 psi (3.5-4.5 bar)
Electrical data		**1 Ph, 115V/ 60Hz, 3 A**
Electric cable requirements		**3 X 13 AWG**

1.4 Symbol Description

Symbol	Description
	Caution! Consult accompanying documents
	Caution! Hot surface.
	Caution! Hot steam.
	Protective earth (Ground)

1.5 Utility Labels

Utility	Specification
Mineral Free Water (If required)	30–70 psi (2–5 bar)
Tap Water	30–70 psi (2–5 bar)
Steam	50-65 psi (3.5–4.5 bar)
Compressed Air	85–115 psi (6–8 bar)
Electricity	**1 Ph, 115V/ 60Hz, 3 A**

2. INSTALLATION

2.1 Environmental Conditions

Ensure all shut-off valves or switches from the building services to the autoclave, for example compressed air, electricity, steam, water, etc. are clearly marked, and are located in an easy to reach, unrestricted area.

Ensure all personnel working with or around the autoclave are properly trained in the location of all the shut off valves and switches that supply services from the building to the autoclave.

The ambient atmosphere around the autoclave must not exceed 104 ºF (40 ºC), 80% relative humidity, and the room should be ventilated 10 air changes/hour.

Place warning signs related to the possible dangers of operating autoclaves in prominent positions. See the Symbol Description paragraph for explanations of the dangers.

 **Warning!**

Do not use the autoclave in presence of dangerous gases and vapors.

2.2 Mounting

Place the autoclave on a suitable level surface, leaving adequate space around it for operation and service requirements.

Level the autoclave before connecting the utilities.

Utilities

Connect the autoclave to the utility supplies as follows:

Air

Connect the air connection of the autoclave to the compressed air supply of the building by means of a ¼” pipe at Pressure: 85-115 psi (6-8 Bar)

Tap Water

Tap water for operating the ejector;

- Hardness should not exceed 0.7–2 mmol/l See also chapter "Water Quality".
- Pressure should be in the range of 30–70 psi (2–5 bar)
- Connection to the network by a ½” pipe.

Attention:

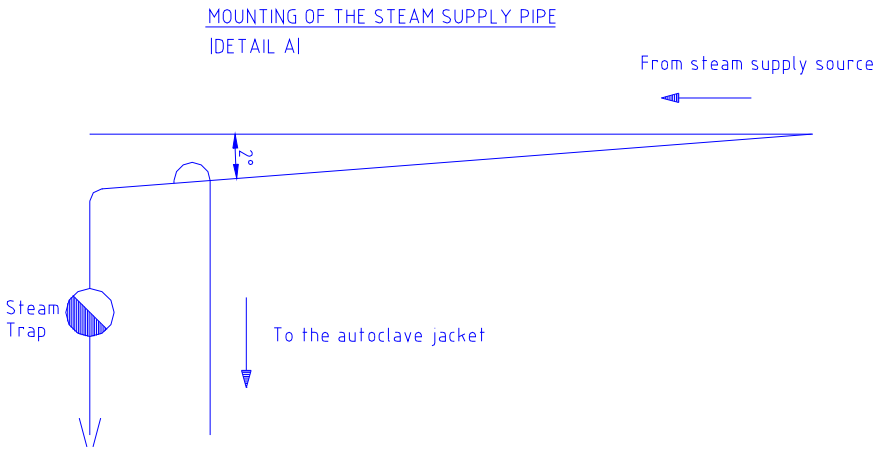
Connection of water system to the autoclave must be performed through "BACK FLOW PREVENTION SYSTEM" installation as per EPA regulations and local regulations.

Drain

- Connect the following outlets directly to the drain funnel. Or connect them through a drain collector pipe of 4-6” that should be covered. The drain system should be vented.
- General drain outlet by a ¾" pipe.

Steam

- Connect the building steam supply to the autoclave by ½ pipe.
- The steam supply pressure should be between 50-65 psi (3.5-4.5 bar). (See also Utilities Table).
- The steam trap should not exceed 2 meters from the machine.



Electrical Power Connection

Warning!

Only a qualified electrician may perform the electrical connections!

The electrical units should not be placed near water sources.

Connect the power cord to the electric box of the autoclave

The electrical data is:	**1 Ph, 115V/ 60Hz, 3 A**
Electric cable requirements:	**3 X 13 AWG**

Warning!

It is strictly forbidden for any person to enter the autoclave chamber.

If, for any reason (for cleaning, maintenance or if something falls down), it is necessary to enter the chamber, the person must lock the system by pressing the emergency switch and take the key with him to prevent accidents and unauthorized use.

2.3 Preliminary Check

After installation, and prior to putting the machine into operation, the following checkout procedure is to be fulfilled:

- Check connection to local sewage. Check that the sewage pipeline is not clogged. (Pour water for this task).
- Check connection of the compressed air, pay attention to the door, set the pressure to 85-115 psi (6-8 bar)
- Check connection to tap water. Open the water valve. Manually test the water valves by over-riding the appropriate solenoid valve. If there are no leaks, –leave the water manual inlet taps open.
- Check connection to steam. Open the steam valve. Manually test the steam valves by over-riding the appropriate solenoid valve. If there are no leaks, – leave the steam manual inlet taps open.
- Check connection to electricity –**To be performed by an authorized electrician only!**

Performing Safety Tests

- Check the tightness of all the nuts and screws. Dismantle the cover of the steam generator, (if applicable).
- Test the earth continuity
- Check current leakage. Check Voltage and Amperage.
- Check pressure setting of the steam.
- Adjust the legs of the transfer carriage to equal the height of loading cart to rails in the sterilization chamber, (if applicable).
- Operate the generator, (if applicable).
- Run a cycle.
- Call for an authorized inspector to test and approve the autoclave; generator and, assembled system.

3. FUNCTIONAL DESCRIPTION

3.1 The Piping System

The piping system of the autoclave consists of air-operated valves, which control the condensate and steam flow in and out of the chamber, operate the vacuum, and the air inlet valve. The air pulses to the pneumatic valves are transmitted through solenoid pilot valves, operated at 24VDC.

The functions of the valves are as follows:

Steam to jacket (91) – introduces 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.

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

Air inlet valve (43) – introduces filtered ambient air into the chamber at the end of the cycle to break the vacuum and enable the opening of the door.

Fast exhaust and vacuum valve (75) – This valve performs two functions:

1) To exhaust the steam from chamber.
2) To connect the chamber to the ejector to create vacuum in the chamber in the air removal and drying stages.

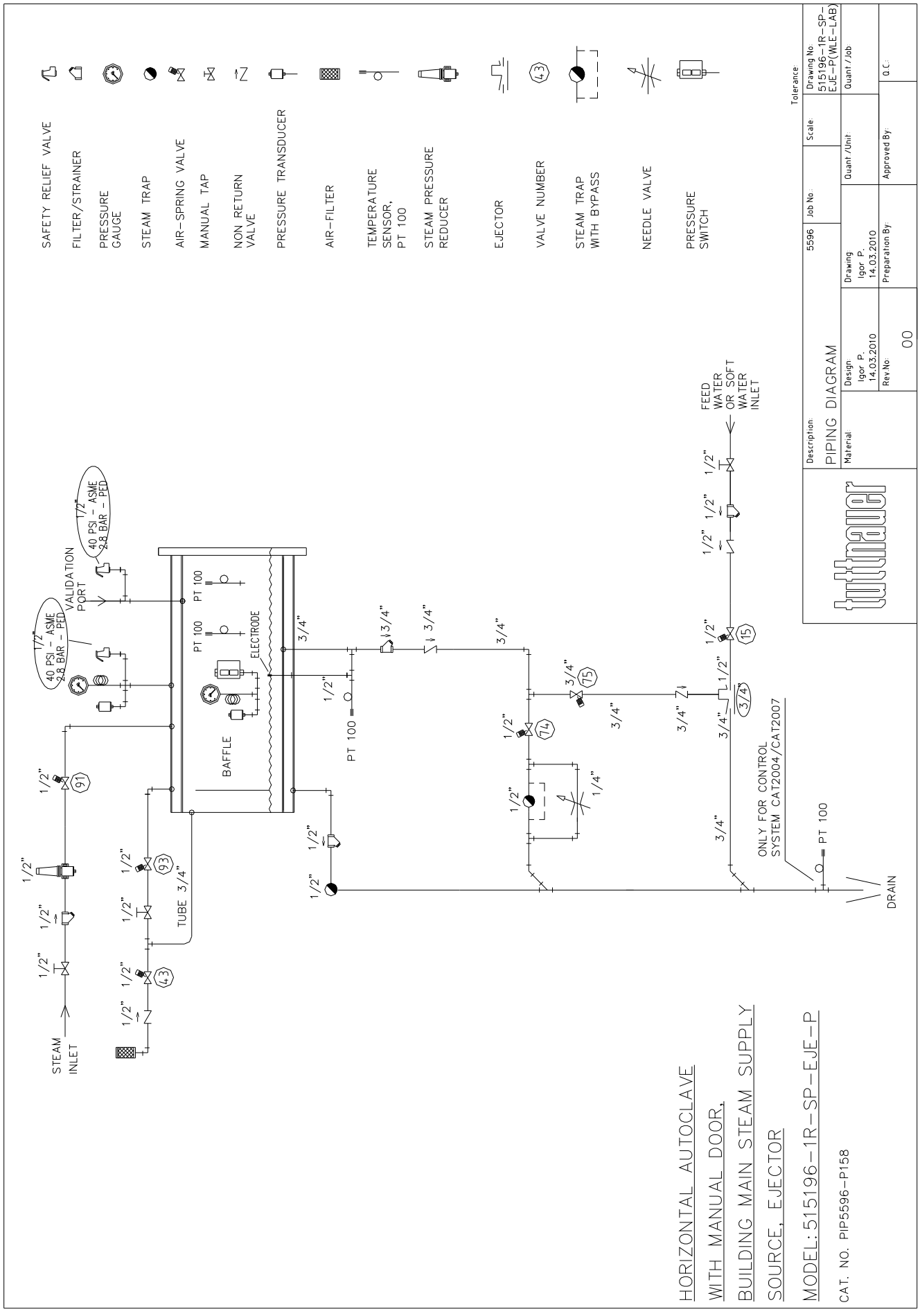
Condensate valve (74) – evacuates the condensate from the chamber during heating and sterilization phases and isolates the chamber from the drain pipe, during vacuum generation. It operates like a slow exhaust valve at the end of slow pressure programs.

Water to ejector valve (15) – is connected to the tap water and supplies the water required by the operation of the ejector.

Note:

The valve numbers are in accordance with the valve numbering list and piping diagram.

PIPING SYSTEM DRAWING



3.4 The Pneumatic Control System

The control of the pneumatic valves is done through compressed air, as described below:

The compressed air supply at a pressure of 6-8 bar (85-115 psi), and is reduced by a pressure reducer to 6 bars (85 psi) and transmitted to the inlet of the pilot solenoid valve battery.

The pneumatic control system is built as follows (refer to drawing on the next page):

Air is transmitted to the inlet of the pilot solenoid valve battery, which is mounted on a manifold branch base. Through the manifold, all the solenoids are connected to the compressed air supply.

The 24VDC solenoids are operated by controller.

When the solenoid is operated, it transfers the compressed air to activate the appropriate air valve.

The pneumatic valves are air operating, and spring closing valves:

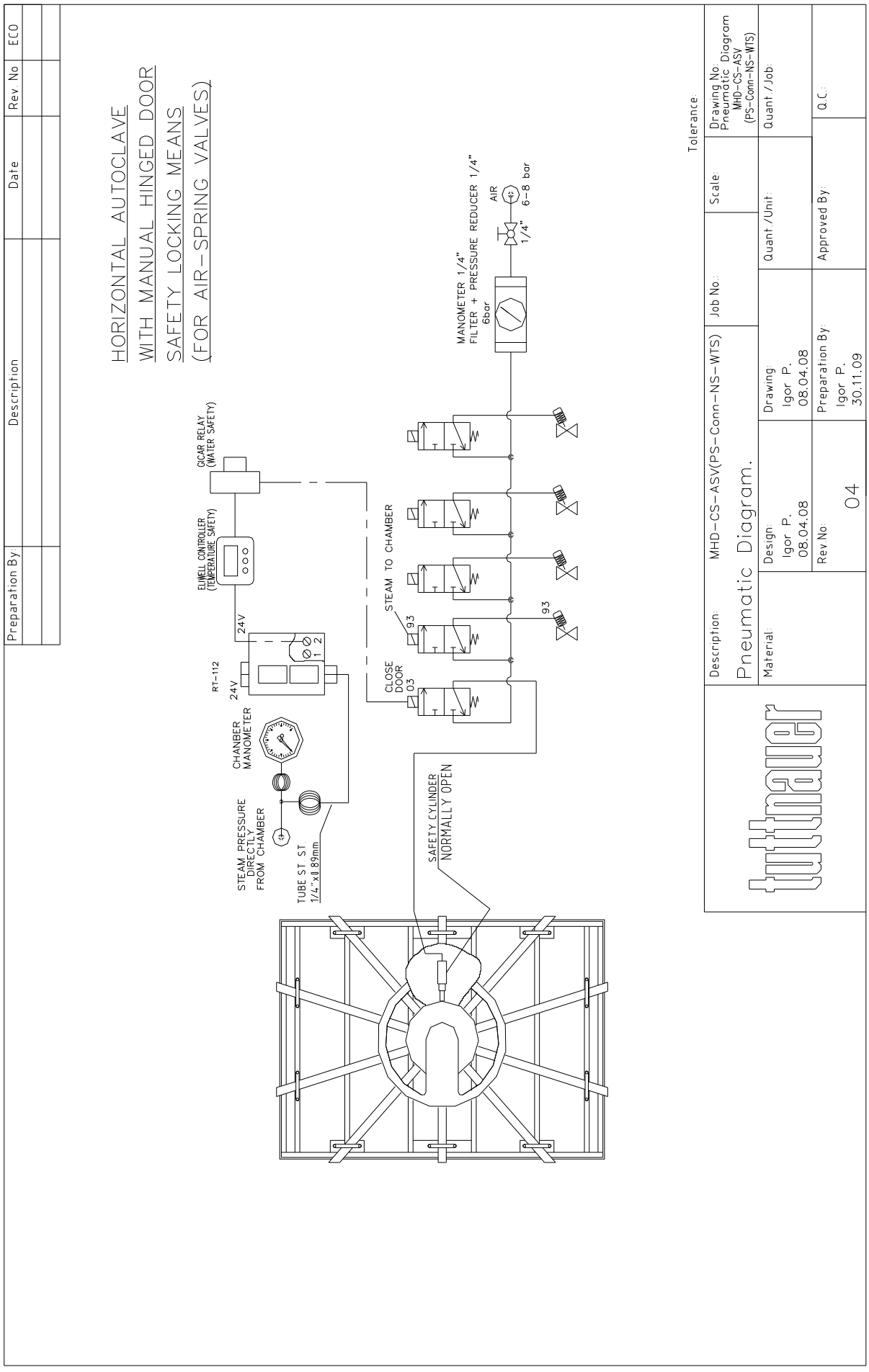
Air-activated and spring-return are fitted with two commands:

An opening command comes from a solenoid valve at a pressure of 6 bars output by the control system, and a permanent closing by a built-in spring valve.

Pneumatic safety measures:

- **RT112** pressure switch prevents the opening of the door if there is pressure in the chamber.

PNEUMATIC CONTROL SYSTEM DRAWING



3.3 Absolute Pressure Transducers

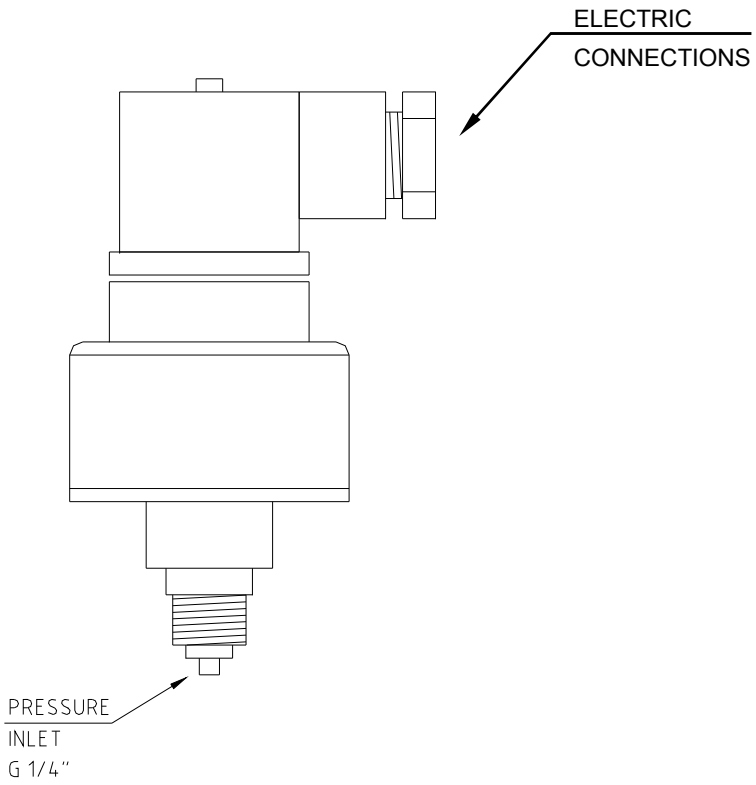
The transducer type MT 3296 is a membrane pressure sensor and electronic measuring circuit, with the following specifications:

- Pressure range: 0–58 psia (0-4bar).
- Output span current: 4-20mA
- Supply voltage: 10V to 30V

The autoclave is fitted with two pressure transducers for controlling & monitoring:

1. Chamber pressure – (control, display, and printout)
2. Jacket pressure – (control and monitoring)

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



3.4 The Electrical System

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

The following parts are located in the electrical box, mounted on the upper side of the autoclave:

- Electrical control board.
- Circuit breakers for protection of all power circuits.
- Power supplies for powering of electronic circuitry and solenoid valves.
- Wiring and connection elements.
- One main power switch.

It is important to achieve a good grounding 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 of the NEC.

Caution!

Only authorized electricians are allowed to install or attend the electrical system!

Description of the Electrical Equipment (see Electrical Drawings)

The command circuits are energized by a power supply with two outputs, as indicated below:

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

The coils of the solenoid valves are 24V and are operated by the controller. The solenoid valves are activated when the control voltage output is low (less than 2V) with respect to ground. A Circuit Breaker (CB1 4A) protects all power circuits.

3.5 The Control System

The Main Board

Controls and monitors the physical parameters of the process and performs the operation sequence of the machine, according to the selected program.

The main board contains the following elements:

- 16 digital inputs
- 24 digital outputs
- 6 PT 100 inputs
- 7 inputs of 4–20mA
- Voltage inputs for the electrodes for water level
- 2 analog outputs of 4–20mA
- Serial ports
- CPUs.
- 2 ADCs 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 connectors for quick and efficient dismantling.

Digital Inputs

The digital inputs are 0/1:

- Open/close for door positions
- Safety cut-off switches
- Pressure cut-off switches
- Switches for water level

The input voltage is 24VDC. The input is protected from high voltages by means of an Opto-coupler.

Digital Outputs

Digital outputs are used to activate solenoid valves and relays.

Each output is up to 2A, however all the outputs together will not have a capacity higher than 110 W.

The command voltage is 24 VDC, but it can vary in the range of 10–30VDC.

Analog inputs for Reading Temperature

Temperature is 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 80–300ºF (25–150ºC).
The resolution is 0.2 ºF (0.1ºC).
The accuracy of the temperature is $\pm$ 1 ºF (0.5ºC).
Calibration of the temperature circuits requires a special engineer access code.

Analog Inputs for Control and Reading Pressure

The system contains 6 inputs for control and reading transducer pressure from 4–20mA sensors. There are at least 3 sensors on each ADC.
The chamber, the jacket, and the door gasket are monitored by the pressure transducers.
Each sensor has an output of 4–20mA. The system allows the measurement range of the sensor to be set by external software (via RS232).

Measuring chamber pressure

The display and printing scale are in kPa and psi units.

The measurement range is 30 inHg–72 psia (0-500 kPa).

The resolution measurement and display is 0.15 psi (1kPa).

The accuracy of the measurement is a maximum 1% of the range, i.e. 1.0 psi (±5 kPa).

Calibration of the pressure circuit requires a special engineer access code.

Measuring jacket pressure

The measurement range is 14.5–72 psia (100-500 kPa).

The resolution measurement and display is 0.15 psi (1 kPa).

The accuracy of the measurement is a maximum 1% of the range, i.e. 0.5 psi (±4 kPa).

Calibration of the pressure circuit requires a special engineer access code.

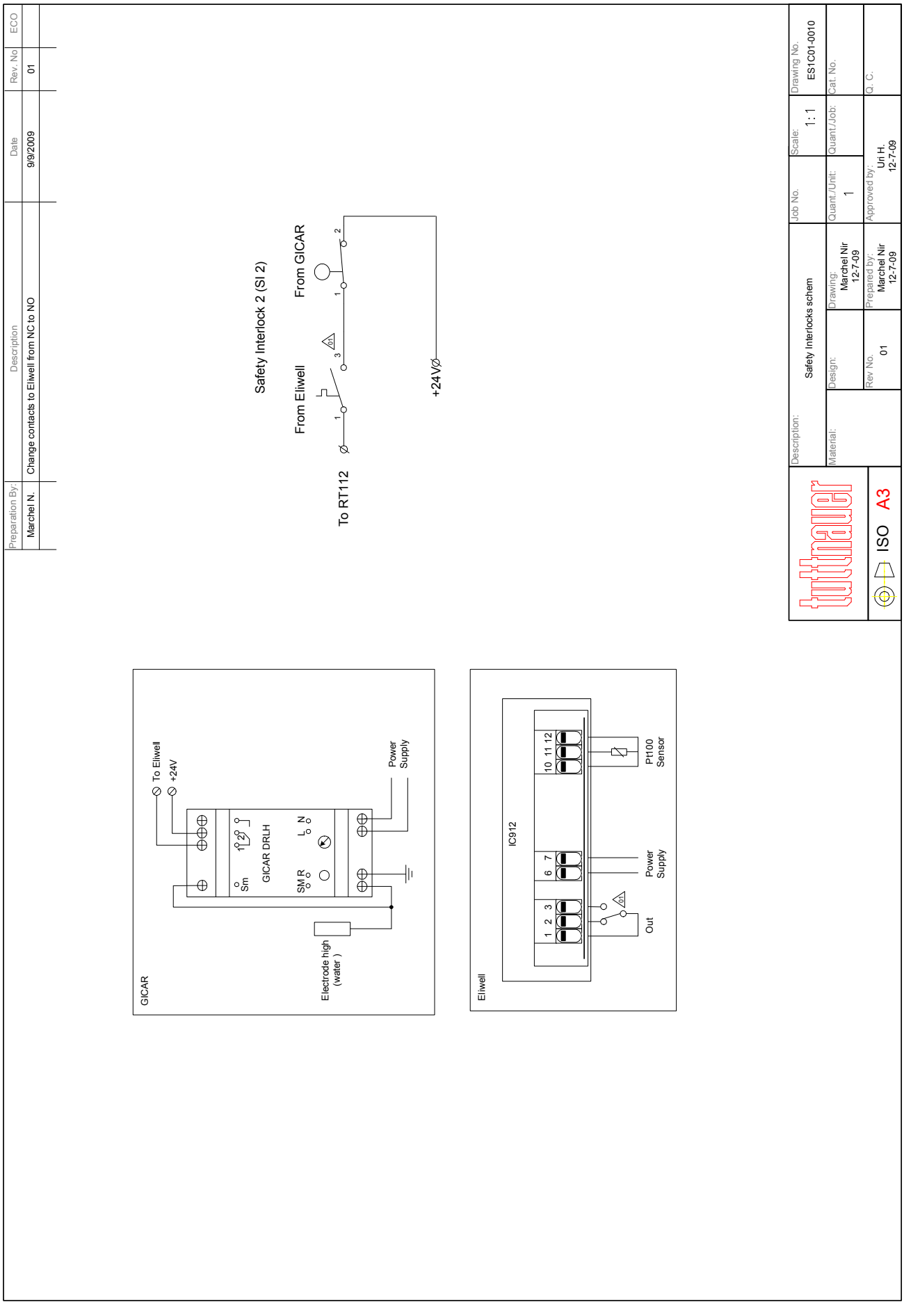
3 Serial Ports

The control system contains 3 serial ports (1optional) according to the following specifications:

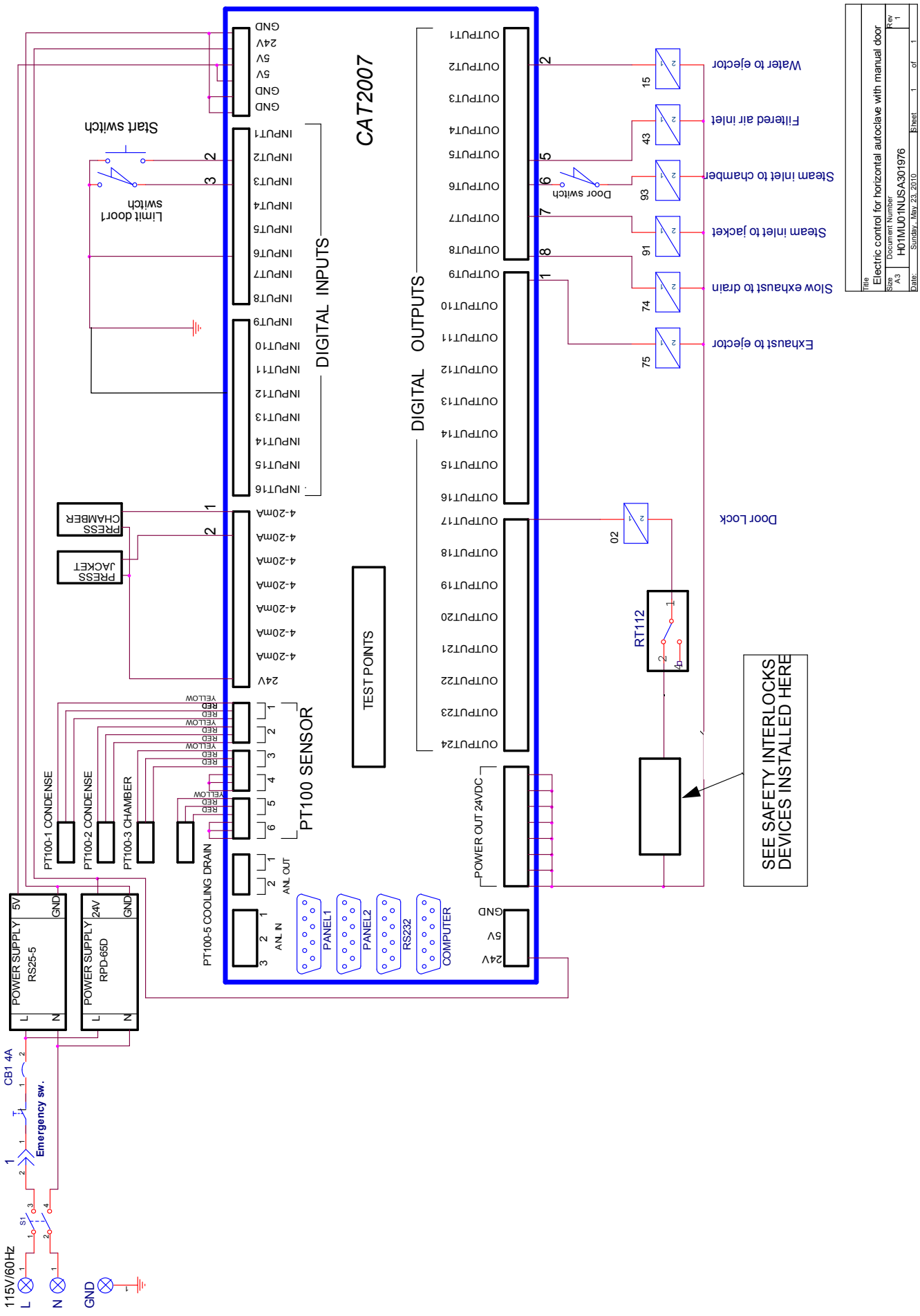
- 2 Serial Ports for the connection of up to 2 command panels.
- 1 Serial Port connected to an external PC computer (RS232/485).
- 1 Serial Port (optional)

Serial Port RS232 is included in the system to connect to an external PC up to a distance of 8 meters. If it becomes necessary to convert certain functions, re-program, re-load software of the autoclave from a distance of over 8 meters, a modem and Serial Port RS 485 are required. This enables service technicians to attend to the unit from a remote site. ADMC software enables full control of the autoclave.

SAFETY INTERLOCK DEVICES



ELECTRICAL CONTROL SYSTEM DRAWING



3.6 Water Quality

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

(According to EN 285:2006).

	Contaminants in water supplied to generator	Contaminants in condensate at steam inlet to sterilizer
Evaporate residue	≤ 10 mg/l	N/A
Silicate (SiO_2)	≤ 1 mg/l	≤ 0.1 mg/l
Iron	≤ 0.2mg/l	≤ 0.1mg/l
Cadmium	≤ 0.005 mg/l	≤ 0.005 mg/l
Lead	≤ 0.05 mg/l	≤ 0.05 mg/l
Rest of heavy metals except iron, cadmium, lead	≤ 0.1 mg/l	≤ 0.1 mg/l
Chloride (Cl)	≤ 2 mg/l	≤ 0.1 mg/l
Phosphate (P_2O_5)	≤ 0.5 mg/l	≤ 0.1 mg/l
Conductivity (at 25°C)	≤ 5 µs/cm	≤ 3 µs/cm
pH value (degree of acidity)	5 to 7.5	5 to 7
Hardness (Σ ions of alkaline earth)	≤ 0.02 mmol/l	≤ 0.02 mmol/l
Appearance	Colorless, clean, without sediments	

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

Attention:

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

Tap Water Supply

Maximum hardness value 0.7-2.0 mmol/l

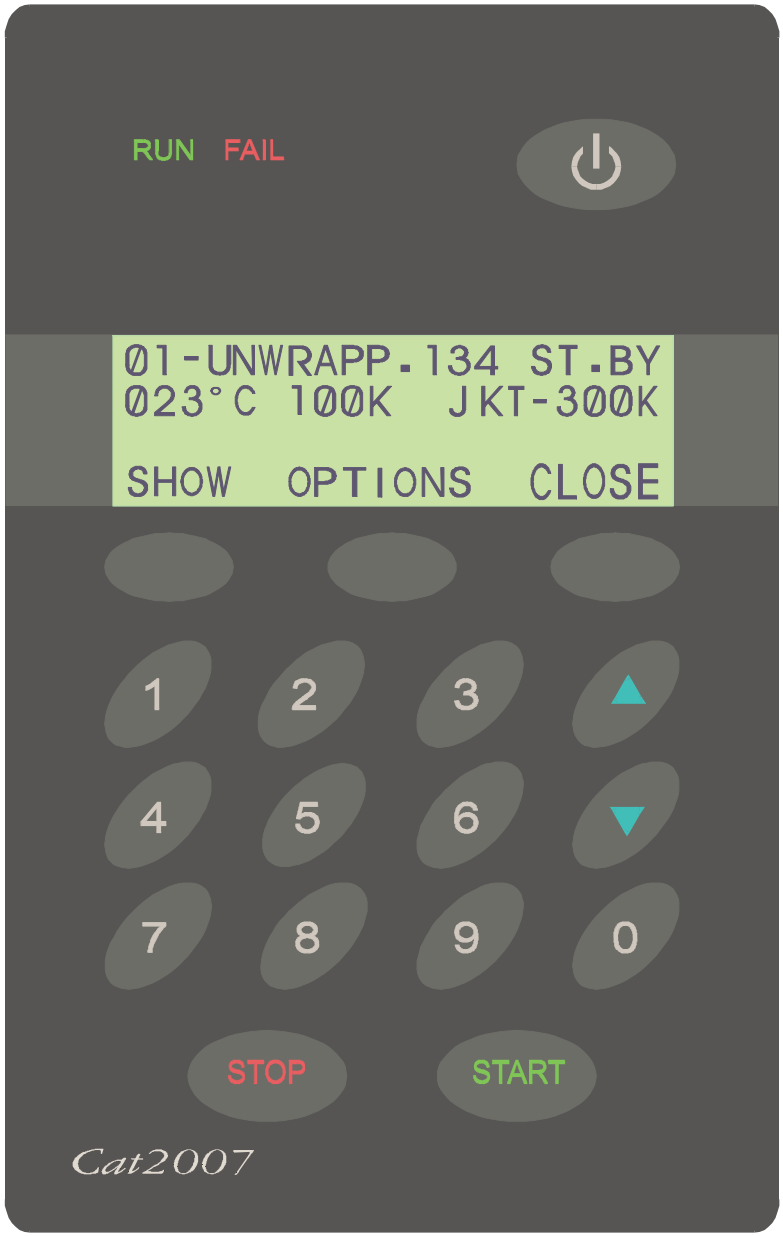
Note:

The use of soft water for the steam generator is strictly forbidden! (If applicable)

Please consult a water specialist!

4. CONTROL AND MONITORING

Control Panel CAT 2007



4.1 Description of Panel CAT 2007

The Operation Panel is consists of the following parts:

- 4 rows display, 20 characters in each row.
- 17 keys
- 2 LEDs (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. Press this key to light up the operation panel. When there are 2 panels, both light up even though only one was operated.

3 Command Keys

F1- 3: Functions 1- 3

F1 F2 F3

These keys are found under the display. The function to be performed is displayed above each key.

10 Digit keys

These keys are used for 2 purposes:

Under normal working conditions the program option is used. Press on the number key. For example, no. 3 selects program 3.

Under the display mode, the keys are used as number keys to enter a code or a number.

UP/DN

Under normal working conditions, they are used to browse through the different cycles.

Under set-up mode they change numeric value or move the display to the next screen.

START

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

STOP

This key is active while the autoclave is in operation. Pressing STOP at any stage of the cycle stops the operation.

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.

Press the STOP key to cancel the displayed message and switch off the FAIL light.

RUN/FAIL LEDs

The operation panel contains 2 small LEDs which 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 by the ST.BY key, the RUN LED will flash for 1/2 a second for every 2 seconds indicating that the system is still ON. The FAIL LED (red) lights when there is a problem with the system.

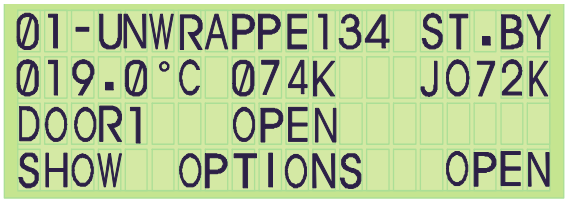
4.1.2 Display

Note:

Temperature and pressure measuring units differ according to the country of operation. Temperature and pressure are displayed in both ºC or ºF and kPa or psi, respectively.

The CAT2007 display consists of 4 alphanumeric rows with 20 characters in each row **(see Figure below)**

First Row
First 3 characters define the Cycle no. (ranges from 1–14)
8 characters define the cycle name.
The 5 final characters at the right end of the row are allocated for displaying the status of the autoclave or the stage of the cycle in operation.



1. ST. BY - indicates that the autoclave is in the waiting stage.
2. READY - indicates that the machine is ready for operation.
3. END - indicates that the process has ended correctly.
4. FAIL - indicates that the program has ended due to failure.

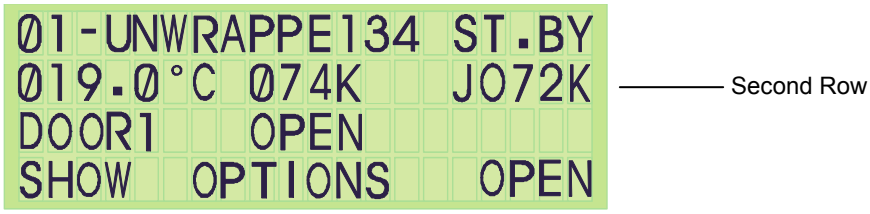
The names of the stages are:

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

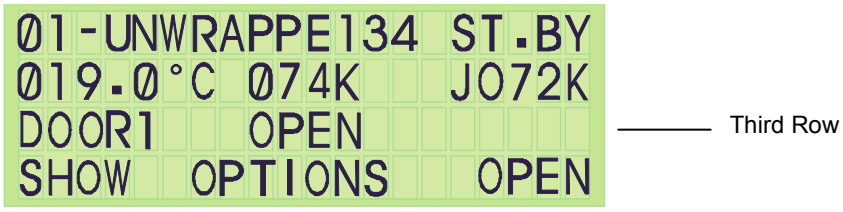
The 14 cycles, names of programs and relevant temperatures are listed below:

Cycle no.	Program	Temp ºF
1, 2, 3	Un-wrapped	270
4,	Un-Wrapped	270
5, 6	Wrapped	270
7	Wrapped	275
8	Wrapped	250
9, 10, 11, 12	Slow exhaust	250
13	B&D test	274
14	Leak test	—

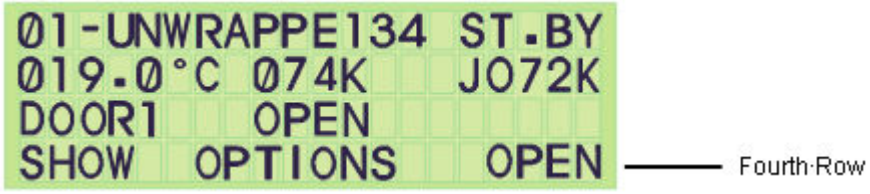
Second Row:
This row displays the temperature in the chamber, pressure in the chamber, and jacket pressure.



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



Fourth Row:
On the bottom row, the names of the commanding keys appear. Under the display there are three keys without symbols or names. These keys 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.



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 or if during a cycle or the pressure drops in the gasket.
06 - Temp. Error	If the temperature sensor is disconnected for any reason during the heating stage, temperature is either higher than 284ºF (140ºC) or lower than 41ºF (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 secs. below the required sterilization temperature.
09 - High Temp.	This message is displayed, fail indicator lights up and program is aborted: If the temperature rises by 3ºC (5ºF) above the required sterilization temperature during the sterilization cycle.
10 - Low Pres.	This message is displayed, fail indicator lights up 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 up and the program is aborted, if pressure rises above the pressure correlated to the sterilization temperature by 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 (N/A)	If, while closing, Door #1 of an automatic sliding door, the door safety bar feels resistance, the door will open, and this message will appear.
22 - Door2 Safe Switch (N/A)	If, while closing, Door #2 of an automatic sliding door, the door safety bar feels resistance, the door will open, and this message will appear.

23 - Door1 Gasket Low Vacuum (N/A)	This message indicates that during opening Door #1, you do not achieve the proper vacuum in Gasket1.
24 - Door2 Gasket Low Vacuum (N/A)	If whilst opening Door #2 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 is open.

Informative Messages

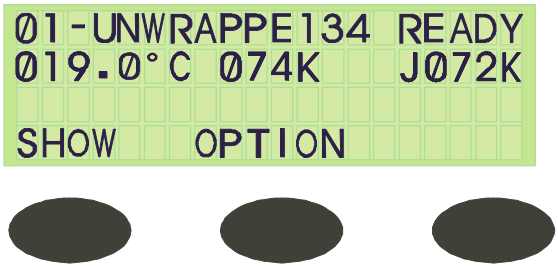
Calibration	This message appears on the panel during calibration.
Closing Door Wait (N/A)	When an automatic door is closing, this message is displayed so that the operator waits until the closing operation of the automatic door is completed.
Open Door Wait (N/A)	When an automatic door is opening, this message is displayed so that the operator waits until the opening operation of the automatic door is completed.
Door1 Open (N/A)	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 (N/A)	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 (N/A)	This message appears when both doors are open.
Under Test (N/A)	This message appears on panel 2 during the IN/OUT Test and during Setup.

4.3 Operating the Control Panel

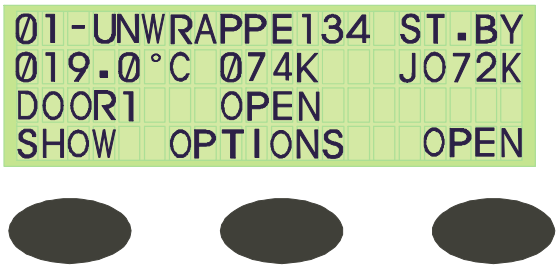
4.3.1 Starting up the System

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 are performed.
It is also the “Ready” screen from where all cycles can be started, when relevant conditions are met.
If the system is ready the display appears as follows:



If the system is not ready it will not allow you to start a 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 following screen appears:



The 3 command keys on the Stand By screen are:

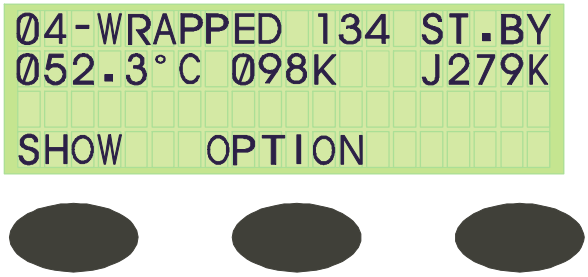
Above the left key (F1)	Show
Above the middle key (F2)	Option
Above the right key (F3)	Open

4.3.2 Selecting a Cycle

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

To select a cycle:

1. Press the UP/DN keys to change the cycle where pressing UP moves to the next program and pressing DOWN moves to the previous program.
2. Press on a number; press key 4 to select program 4

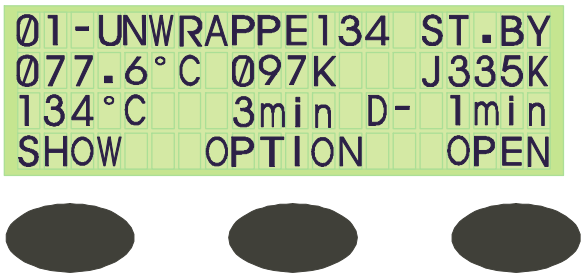


Selecting a 2 digit cycle:

For programs with double digits (for program 10 or above), both numbers are to be pressed within 2 seconds of each other. 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, when pressing the SHOW command key the following screen is displayed:



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 14 – Leak Test.

Running a Cycle
Before starting a cycle, make sure to check the following:

- There is enough steam pressure in the jacket.
- There is enough air pressure for the pneumatic valves.
- The door is closed.
- There is enough water pressure for cooling, (if applicable).
- There is enough tap water pressure in for the operation of the ejector.

When the SETUP has been checked and the display is in the Stand By /Ready mode, press START to run the cycle; the RUN LED lights up and the cycle is in progress.
At the end of the cycle, the LED switches OFF, and the appliance is in the Stand By mode.

Powering ON the Reset Test

1. Turn ON the appliance.
2. Check that all the valves and outputs, including LEDs on the panel are turned OFF.
3. Check the last illumination of the panels is turned ON.
4. Check the message – Wait!!! Version = (version name) appears on the 2 panels with the correct version.
5. Select two-digit program numbers by pressing each digit-key within 2 seconds of each other.
6. Check that the LEDs on the panel is turned OFF, the message deleted and the system moves to into the Stand By Mode.

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:

- Testing all the outputs. Each output is turned ON one at a time. The output passes to ‘ON’ for a maximum time of 15 seconds or until the UP key is pressed.
- The command begins from output number 1 until 24.
- 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.
- 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 PC.
- 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.
- Inputs for the In/Out Test require a code.

Testing the In/Out Routine

1. Turn ON the system.
2. Press the OPTION key. The right command key will be called In/Out.

By pressing on this key, the screen displays:

Code:

3. Enter In /Out Test

Code:

4. Enter the code 2ØØ7.

The screen will display the message ‘Digital Ø1 On!!!’ Be sure that OUTØ1 is ON.

5. Press on ‘UP’, the screen displays the message ‘Digital OUTØ2 ON!!!’ Be sure that OUTØ2 is ON.

4.3.3 System Setup (Changing Parameters and Values)

Note:

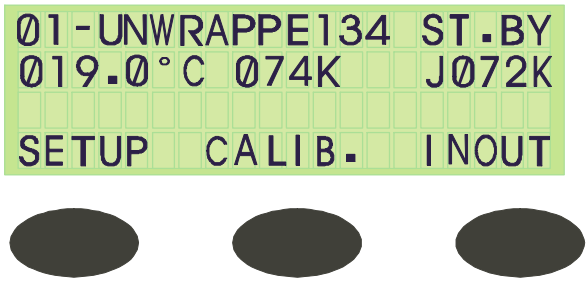
- The system allows 15 seconds for values to be entered. If this time passes and the panel has not been touched, the display will automatically move to the next screen.
- When codes are not entered within 15 seconds, the RUN and FAIL LEDs light and the display returns to WAIT and then to the Stand BY screen.
- If the code is incorrect the above will also occur.
- When the display shows ØØØØ and a single value (between1-9) is to be entered, the Ø must be pressed first. The single value cannot 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 key is ENTER:
- If the value is entered via the digital key, after the final digit is entered, the system automatically moves to the next screen, and ENTER need not be pressed.
- If the value is entered using the UP/DN keys, ENTER must always be pressed to progress to the next screen.

The system setup includes the following functions:

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

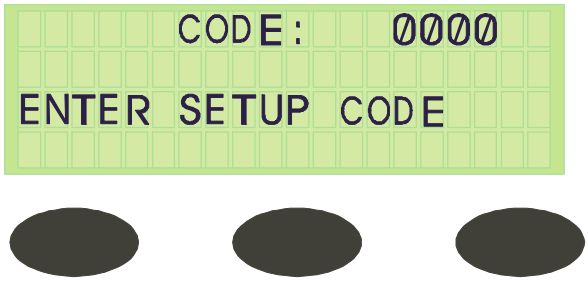
To check that the system has correctly been set, press the OPTION key on the ST.BY screen.

The screen displayed is as follows:



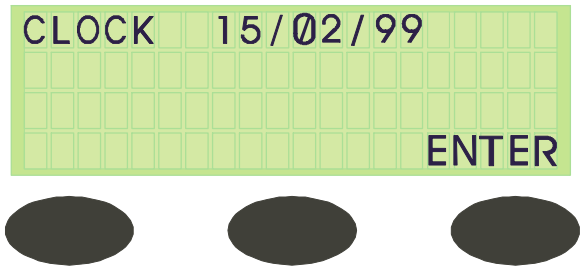
Press the SETUP key. The system requests a code.

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



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 key), 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 keys 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, continue pressing ENTER to skip to the next step. After entering the 'year value', when ENTER is pressed, the display changes to the Time display.

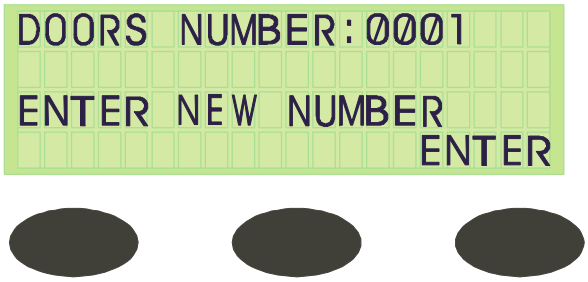
Time
Time is always displayed in hour/min/sec.
When entering the screen, the 'hour value' is underlined.
Press the UP/DN keys to change this value.
Press ENTER (the right command key), to move on to the 'minute value'.
Continue the process until the time is correct.
If no changes are to be made, press ENTER to move on to the 'second value'.
Pressing ENTER after the second value has been changed automatically skips to the next screen – the Language screen.
If there are 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 relevant if using different languages.
The right command key is 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 to be changed, press the appropriate number as specified below and then press ENTER.

English	Ø
German	1
French	2
Spanish	3

Doors Number

After entering the language, the following message is displayed:



This autoclave has one door, press ØØØ1. Press ENTER, and the system moves to the next screen.

Door Type

There are 3 different door types for autoclaves – Manual Door, Automatic Hinged Door, or Automatic Sliding (horizontal or vertical) Door.

In this autoclave, 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 enter the digits whereby the screen will automatically progress to the next display after entering the fourth digit.

Atmospheric Pressure

The standard atmospheric pressure at Sea Level is 14.5psi. For every 1000ft. above sea level, the atmospheric pressure drops 0.45psi, and for every 1000ft below sea level, the atmospheric pressure increases 0.45psi.

(The standard atmospheric pressure at the sea level is 100 kPa and for every 100m above sea level, the atmospheric pressure drops by 1kPa, and for every 100m below sea level, the atmospheric pressure increases by 1kPa.)

When the door of the autoclave is open then set Atm. Pres. Parameter is entered into the program memory and will serve as reference for correct pressure control and monitoring.

If pressure is set correctly, then press ENTER and the next screen appears. If pressure needs to be altered, this may be done either through the digital key or the UP/DN keys.

F – 0 Mode

This mode enables F – 0 calculations, the processing being based on data fed by two temperature sensors. One mounted in chamber and one on the condensate pipeline.

The F - 0 calculations is performed for cycles with sterilization temperatures in the range of 215ºF - 273ºF (101ºC–134ºC), especially used in programs 9–12.

F – 0 = 0 (unable)

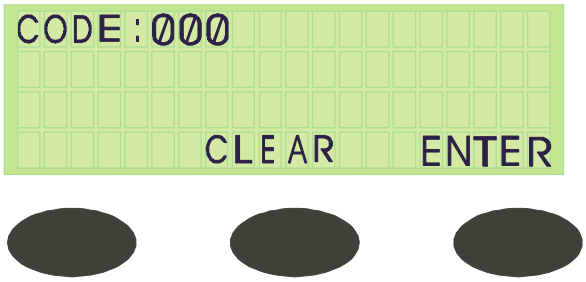
F – 1 = total heating time + total cycle time + cooling time.

F – 2 = compensate 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 – 0 = determines the temperature at which F – 0 calculations should begin.

4.3.4 Changing Cycle Parameters

The screen that allows for parametric changes appears as follows:



1. Press CLEAR or ENTER before entering the code to return to the Stand By screen; the RUN & FAIL LEDs are lit.
2. Enter the correct code via the UP/DN keys.
3. Press ENTER to proceed to the next screen.
4. Press the UP/DN keys to change all parametric values.

Cycle Setup Parameters

CODE 1 OR 11 PARAMETERS

STE Temp – Required sterilization temperature for the process

Entry code	1
Resolution	1º
Minimum value	221 ºF (105ºC)
Maximum value	278 ºF (137ºC)

STE Time – Required sterilization time for the process

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

Dry Time – Required drying time for the process

Entry code	1
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	1 minute
Minimum value	20 minutes
Maximum value	60 minutes

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

Entry code	11
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	1º
Minimum value	104 ºF (40ºC)
Maximum value	278 ºF (137ºC)

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

Entry code	11
Resolution	1
Minimum value	1
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 psi (1 kPa)
Minimum value	0.15 psia (1 kPa)
Maximum value	10.8 psia (75 kPa)

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 psi
Minimum value	0.15 psia (1kPa)
Maximum value	10.8 psia (75kPa)

VacTime1 – Waiting time in the first pulse

In the pre-vacuum stage, in the first pulse after arriving at VacDip1, there is a waiting time known as VacTime1 (in seconds).

This delay occurs so that air removal and vacuuming can continue.

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

VacTime2 – Waiting time for the remaining pulses

For the remaining pulses (following pulse no.1) in the pre-vacuum stage, after arriving at the VacDip2 stage there is a time delay known as VacTime2 (in seconds).

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

WtrTime – Time for entering the water into the generator after the electrode is touching the water.

This value defines the time (in seconds) during which the water pump continues to work and enter water to the steam generator after the upper electrode touches water.

This is done to prevent a situation where right after the electrode touches water, the pump immediately stops operating.

Entry code	11
Minimum value	Ø second
Maximum value	90 seconds

LimitP add – Adding pressure to the maximum pressure
This value defines the addition to the maximum pressure, computed to the jacket control.
For example, when the desired temperature is 134ºC (273ºF) the maximum temperature maintained in the jacket will be adjusted to a temperature of 137ºC (i.e. 332kPa) - 278 ºF (48 psi)
When this pressure is not enough, it can be increased by changing the values of the LimitP add.
If the parameter value remains Ø, the maximum pressure in the jacket will be 32.4 psig, however if this value will be 10, the maximum pressure will be 35 psig.

Entry code	11
Resolution	0.5 psi (1 kPa)
Minimum value	ØkPa/psia
Maximum value	4.35 psia (30 kPa)

PulsPres1 – 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 ejector will immediately start operating 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	1 psi (5kPa)
Minimum value	14.5 psia (100 kPa)
Maximum value	44 psia (300 kPa)

PulsPres2 – 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 pulse press.

Entry code	11
Resolution	1 psi (5 kPa)
Minimum value	14.5 psia (100 kPa)
Maximum value	44 psia (300 kPa)

CODE 13 - PARAMETER

ReqPrs+ - The addition to the required pressure for sterilization
This parameter sets the pressure point maintained during the sterilization stage in the following manner:
If the desired temperature is 273°F (134ºC), the required pressure (from the tables) is 44.2 psi (305kPa).
When the ReqPrs+ is Ø, the system pressure will be maintained at 44.2 psi (305kPa) during the sterilization stage. When the Reqprs+ equals 0.5 psi (5kPa), the system will be maintained at 44.9 psi (310kPa) in the sterilization stage. It is advised to work with a value of 0.5 psia (7kPa).

Entry code	13
Resolution	0.1 psi (1 kPa)
Minimum value	0.1 psia (2 kPa)
Maximum value	4 psia (20 kPa)

Select PT100

There are 3 temperature sensors that regulate cycles:

1. Sensor 1 & 2: — in the condensate line: PT100 – No. 1 & 2
2. Sensor3: — in the chamber: PT 100 – No. 3
3. Sensor 5: — in the cooling drain: PT100 – No. 5

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

Entry code	13
Resolution	1
Minimum value	1
Maximum value	5

Stay Time - Delay time between heating and sterilization

This parameter allows partial entry to the sterilization stage with a reduction of the 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 will stop heating before entering Sterilization according to the STAY TIME value. When this value is set to 2 minutes, the system will stop 2ºC before entering sterilization and will proceed at a rate of 1ºC/min during the STAY TIME.

Entry code	11
Resolution	1 minute
Minimum value	Ø minute
Maximum value	15 minutes

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;

Entry code	11
Resolution	1 (Mode)
Minimum value	Ø
Maximum value	90

Bio Cycle

Entry code	33
Resolution	1 (Mode)
Minimum value	Ø
Maximum value	1

Air Detector

Entry code	33
Resolution	1 (Mode)
Minimum value	Ø
Maximum value	1

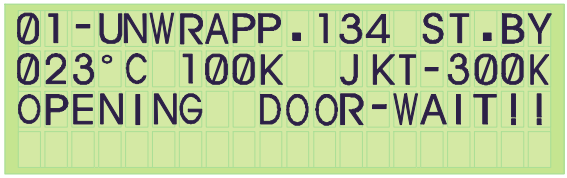
4.3.5 Door Display Function

(Applicable only for automatic doors)

Displays when Opening or Closing the Doors

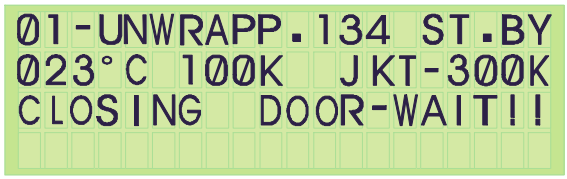
Opening an Automatic Door

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



Closing an Automatic Door

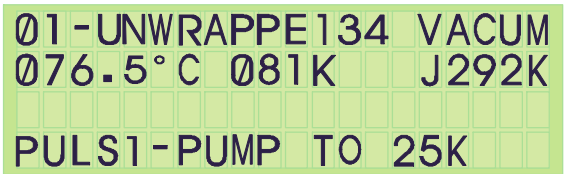
During the process of closing an automatic door, the message CLOSING DOOR – WAIT will appear in the 3rd row.



If the pressure in the chamber is higher than 2.7 psig (115 kPa) it will not be possible to open the door.

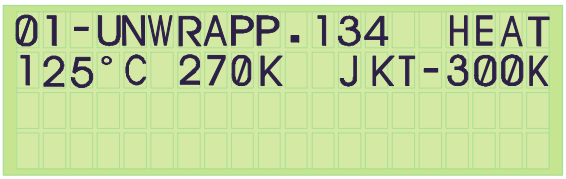
4.3.6 Display during a Cycle

Display during the Pre-Vacuum Stage

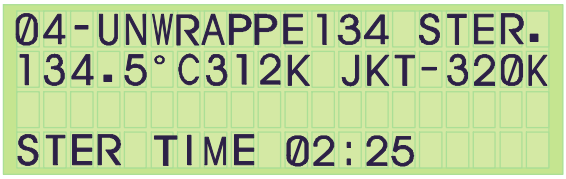


When the cycle passes to the Heat stage the steam enters the system, in place of 'PUMP TO 25K', it will display 'HEAT TO 160K'.
When the cycle passes to the Exhaust stage,' it will display 'EXH TO 100K'.

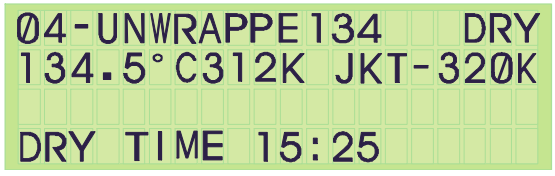
Display during the Heating Stage



Display during the Sterilization Stage

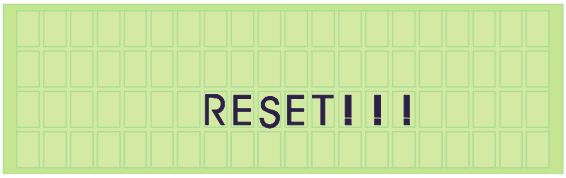


Display during the Drying Stage



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 key 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.

5. PRINTER

5.1 Printer Output

The autoclave is equipped with a character printer, which prints a detailed history of each cycle performed by the instrument (for the record or for subsequent consideration).

The printing is made on plain paper with 24 characters per line and contains the following information:

- Software version
- Real time
- Selected program
- Sterilization pressure
- Sterilization temperature
- Sterilization time
- Summary of performed cycle and identification hints.

When the sterilization cycle begins the printer starts printing the above data.

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 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.

PRINTER OUTPUT	DESCRIPTION
Autoclave: 2912082	Autoclave serial no.
Name : __--------	Name of the operator to be filled in .
Load #: 0030	To be filled in manually by the operator.
21/05/2010 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.
H11:28 274.5ºF 32psi	The time, temperature and pressure during sterilization.
H10:08 273.3ºF 32psi	The time, temperature and pressure during the heating stage.
H06:04 270.5ºF 30psi	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.
21/05/2010 13:29:31	Date/month/year time/min./sec.
Version = Horiz US3M7 Eje	Number and version of the software program.

Legend

V - Vacuum stage
S - Sterilization stage
E - Exhaust stage
H - Heating stage
F - Fail

Note:

The process is printed from the bottom to the top – starting with version.

5.2 Printer Operation

Caution!

Do not perform the following operation, since they may be damage the printer.

1. Do not carry out blank printing without recording paper and no ink ribbon in the unit, this may damage the printing head.
2. Do not drop any foreign subjects as paper clips, or splits pins, etc. into the printer unit.
3. Do not pull the paper in printer forcibly by hand or pull the paper in opposite way to paper feed direction.
4. Replace ink ribbon cassette before the ink of this ribbon runs out completely. Ribbon damaged by excess use may result in printing problems. Do not apply ink on this ribbon cassette.

Opening/Closing the Front Panel

1. Press, with your finger, on the left side of the front panel and pull it forward when the lock is released. It opens about 180° around the fixed axis.
2. For closing, press the front panel, tightly close it until a click sound is heard. Also, confirm, on closing, that paper is not jammed.

Opening/Closing the Ribbon Cover

1. When paper is out of the front cover, cut it off.
2. Press, with your finger, on the dent on the left side of the ribbon cover and pull it forward. It opens, approximately, 180° around the fixed axis.
3. For closing, press the ribbon cover and close it tightly.

Paper Feeding

1. With the LF switch pressed once, paper is fed by one line.
2. Paper is fed continuously while it is continuously pressed.
3. To feed paper, do not pull it forcibly. Use the LF switch.
4. During pressing the LF switch, the data can not be received.

Replacing Ribbon Cassette

1. Turn off the power.
2. Open the ribbon cover.
3. In case the paper is out from front cover, cut the paper or remove this paper.
4. Remove the old ribbon cassette by pulling it out by the edge market with “PULL”.
5. Insert ribbon between the printing head and the platen, verifying that the new ribbon cassette is in the correct direction. Press cassette down from the knob side.
6. Turn the ribbon cassette knob clockwise (see arrow) to cancel slack.

Note:

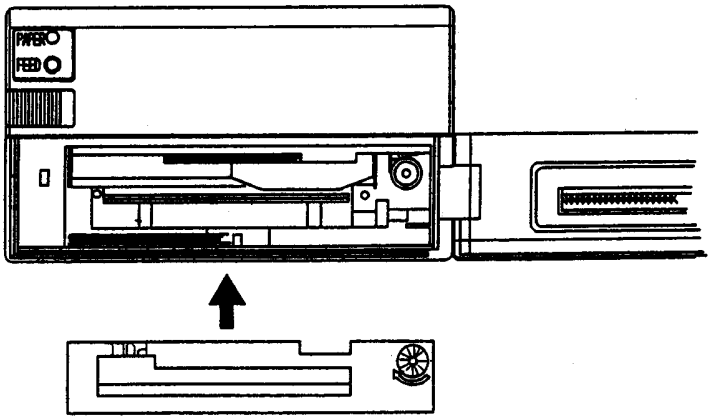
a. In case the ribbon cassette is kept in the printer to long, the printing paper may be contaminated.

b. Continuous printing under low temperature may result in light-color characters due to the characteristics of the ink.

c. Do not attempt to print without the ribbon cassette since this may damage the printer's head.

d. Replace ribbon cassette before wearing out completely.

e. Use original ribbon cassette.



5.3 Printing Paper

The Paper Roll

Before inserting paper into the printer verify that the beginning of roll paper to the inner core must be as follows.

1. No folds. Paper must be rolled on the inner core
2. No flap
3. Do not stick the paper to the core. (If an inner core is available)

Recommended paper:

One ply paper	45 ~55 Kg/1000 pcs/1091 x 788 mm
2 ply paper	No carbon paper Original paper (34 Kg paper)+copy paper 1 pcs (34 Kg paper)
Total thickness	0.13 mm or less

Replacing the Paper Roll

1. Open the front cover.
2. Press outwards the arms of the paper-roll clip (see drawing) and remove the roll's core. Remove, at this time, excessive paper by using the LF switch.
3. Cut the edge of the Printing Paper according to the following drawing.
4. Insert the new paper into the paper-roll clip of the printer mechanism.

When auto-loading function is specified, paper is loaded automatically.

When auto-loading function is not specified, push the LF switch until the paper enters the printer mechanism.

5. Press slightly the paper holder in the direction marked with an arrow (see drawing) and insert paper roll. Verify that the paper holder holds the roll's core.
6. After canceling the slack of the printing paper, close the front panel.
7. After setting the paper, press LF switch once. The printer turns to data input printing mode.

Note:

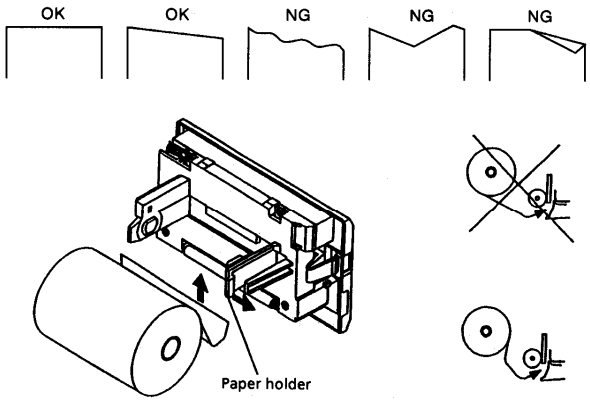
a. Verify that the paper winding direction is correct.

b. Do not replace paper while the autoclave is operating.

c. Do not pull the paper in reverse direction of paper feed. This may damage the printing head.

d. If the paper strip is not perpendicular to the printer, the printer may be jammed.

In case the printer is jammed, turn OFF the power switch immediately and pull out, slowly, the excessive paper. Pulling the paper must be done perpendicular to the printing head.



Paper Near End

When the paper roll is near the end, the paper-near-end is detected and printing is stopped. Power supply to the printing solenoid and motor is immediately stopped and BUSY PE signals are displayed.

When data still exists in the input buffer, the remaining data in the buffer is printed before stopping.

Discharge remaining paper with the LF switch, set new paper and push the LF switch. Then normal print mode is created after cancellation of BUSY and PE output.

This function can be selected by Dip-Switch setting.

Paper End

This feature detects that there is no paper in the printer. When there is no printing paper, printing stops and BUSY and PE signal are displayed.

Printing is also stopped in case data remains in the input buffer.

Install a new paper roll as described in para. 5.5 Then BUSY PE is canceled.

When auto loading function is available, printer automatically feeds recording paper a few lines by inserting the recording paper into the paper inlet.

5.4 Mechanical Alarm

When trouble in the mechanism results in locking of the motor, power supply to the printing solenoid and motor is stopped and BUSY signal as well as FAULT signal are displayed.

To recover from alarm state, after correcting causes for the malfunction, either re-supply power or input RESET signals.

For severe trouble, turn power OFF and call for service.

5.5 Auto Loading Function

This printer is equipped with a function that can automatically load paper. With paper inserted, it is automatically fed a few lines. When printing paper is not perpendicular to the printing head or not properly fed, take out paper gently and insert it once again.

If not using this function, cancel this with the Dip-Switch. Paper insertion is, then, performed with the LF switch.

After paper is inserted, with the LF switch pressed and detached, print ready state is created.

6. STERILIZATION PROGRAMS

6.1 Program Descriptions

The autoclave is equipped with 12 programmable sterilization programs and two test programs. The test programs are pre-set by the manufacturer in such a way, that their parameters are not changeable.

Following are the names, relevant programs with related temperatures of the 12 sterilization cycles and 2 test programs.

Cycle no.	Program	Temp ºF
1, 2, 3	Un-wrapped	270
4,	Un-Wrapped	270
5, 6	Wrapped	270
7	Wrapped	275
8	Wrapped	250
9, 10, 11, 12	Slow exhaust	250
13	B&D test	274
14	Leak test	—

Programs 1, 2, 3, Un-wrapped Goods, With Purge (Process Sample)

These programs are intended for un-wrapped rigid (like instruments) and other goods, which their manufacturers declare their compliance with the following sterilization conditions:

- Sterilization temperature: 270ºF
- Sterilization time: 3 min
- Purge time 30 sec

Performance Description:

Saturated (controlled) steam is introduced into the chamber to the required sterilization temperature after 30 seconds of purge.

Sterilization is controlled in such a way that the sterilization temperature will not drop below the required temperature, neither will increase by more than 3.4ºF. The saturated steam conditions are controlled in such a way that the fluctuation of pressure does not allow a drop below 0.14 psi, neither an increase of 0.44 psi above the high limit of the Ste. Temperature.

Fast exhaust is performed by rapidly discharging the pressure from the chamber. The ejector is activated until the pressure drops to 7.39 inHg.

Pressure equilibration enables the door to be opened. Air is introduced into the chamber through a microbiological filter until equilibrium is reached with atmospheric pressure.

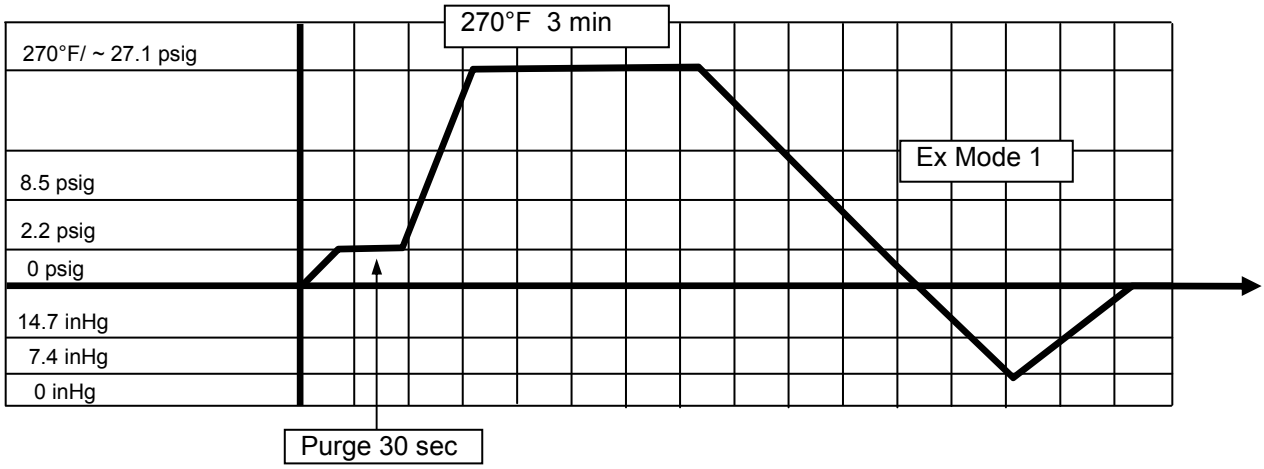
Note:

The temperature of the chamber must be below the end sterilization temperature and the pressure must be below 2.0 psig to enable the door to be opened.

Caution!

Care should be taken to preserve the sterility of unwrapped instruments in a non-sterile environment.

Programs 1, 2, 3, Un-wrapped Goods, With Purge (Process Sample)



Program 4 for Un-wrapped Goods, With Purge (Process Sample)

This program is intended for un-wrapped rigid (like instruments) and other goods, which their manufacturers declare their compliance with the following sterilization conditions:

- Sterilization temperature: 270ºF
- Sterilization time: 10 min
- Purge time 30 sec

Performance Description:

Saturated (controlled) steam is introduced into the chamber to the required sterilization temperature after 30 seconds of purge.

Sterilization is controlled in such a way that the sterilization temperature will not drop below the required temperature, neither will increase by more than 3.4ºF. The saturated steam conditions are controlled in such a way that the fluctuation of pressure does not allow a drop below 0.14 psi, neither an increase of 0.44 psi above the high limit of the Ste. Temperature.

Fast exhaust is performed by rapidly discharging the pressure from the chamber. The ejector is activated until the pressure drops to 7.39 inHg.

Pressure equilibration enables the door to be opened. Air is introduced into the chamber through a microbiological filter until equilibrium is reached with atmospheric pressure.

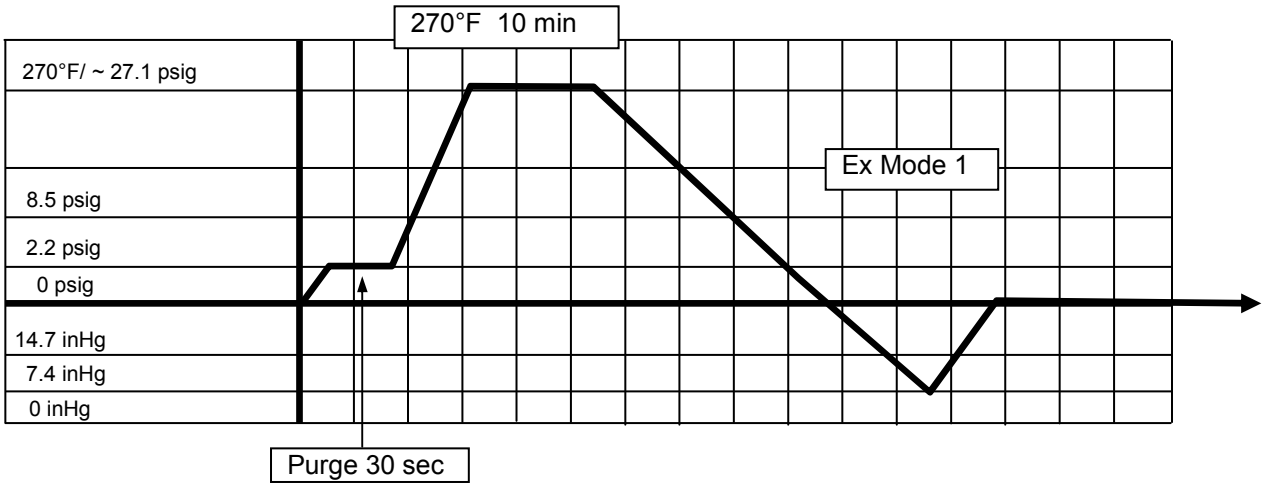
Note:

The temperature of the chamber must be below the end sterilization temperature and the pressure must be below 2.0 psig to enable the door to be opened.

Caution!

Care should be taken to preserve the sterility of unwrapped instruments in a non-sterile environment.

Program 4 for Un-wrapped Goods, With Purge (Process Sample)



Programs 5, 6 - for Wrapped goods 270ºF (Process Sample)

These programs are intended for wrapped materials (like instruments), porous loads and other goods, which their manufacturers declare their compliance with the following sterilization conditions:

- Sterilization temperature 270ºF
- Sterilization time 4 min for program 5 (10 min for program 6)
- Drying time 30 min for program 5 (20 min for program 6)

Performance Description:

Residual air is displaced by 4 vacuum pulses (down to 7.4inHg) and 3 steam pulses up to 8.5 psig. The 4th vacuum pulse is followed by the introduction of saturated (controlled) steam into the chamber to the required sterilization temperature.

Sterilization is controlled in a way that the sterilization temperature will not drop below the required temperature, neither increase by more than 3.4ºF. The saturated steam conditions are controlled in a way that the fluctuation of pressure does not allow a drop below 0.14 psi or an increase of over 0.44 psi, above the high limit of the Ste. Temperature.

Fast exhaust is performed by rapidly discharging the pressure from the chamber. The ejector is activated until the pressure drops to 7.4 inHg.

Drying is achieved by evacuating the vapor from the chamber in an "under-pressure" phase for a period of 30 min for program 5, and 20 min for program 6).

Pressure equilibration enables the door to be opened. Air is introduced into the chamber through a microbiological filter until equilibrium is reached with atmospheric pressure.

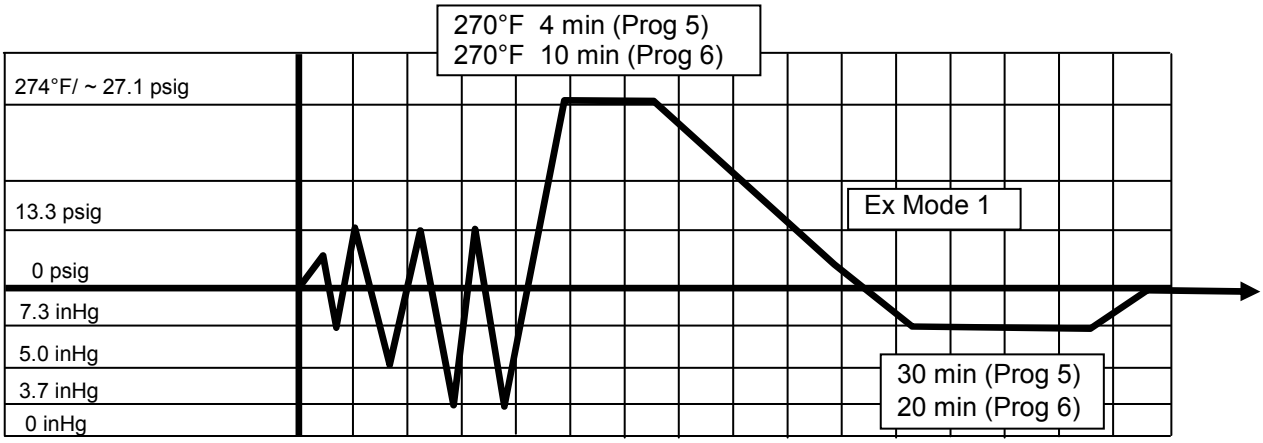
Note:

The temperature of the chamber must be below the end sterilization temperature in the range of 140ºF - 212ºF and the pressure must be below 2.0 psig to enable the door to be opened.

Important:

In order to obtain good sterilization results, dry time is essential.

Programs 5, 6 - for Wrapped Goods 270ºF (Process Sample)



Program 7 - for Wrapped Goods 275ºF (Process Sample)
This program is intended for wrapped materials (like instruments), porous loads and other goods, which their manufacturers declare their compliance with the following sterilization conditions:

- Sterilization temperature 275ºF
- Sterilization time 3 min
- Drying time 20 min

Performance Description:

Residual air is displaced by 4 vacuum pulses (down to 7.4inHg) and 3 steam pulses up to 8.5 psig. The 4th vacuum pulse is followed by the introduction of saturated (controlled) steam into the chamber to the required sterilization temperature.

Sterilization is controlled in a way that the sterilization temperature will not drop below the required temperature; neither will increase by more than 3.4ºF. The saturated steam conditions are controlled in such a way that the fluctuation of pressure does not allow a drop below 0.14 psi, neither an increase of 0.44 psi above the high limit of the Ste. Temperature.

Fast exhaust is performed by rapidly discharging the pressure from the chamber. The ejector is activated until the pressure drops to 7.4 inHg.

Drying is achieved by evacuating the vapor from the chamber in an "under-pressure" phase for a period of 20 minutes.

Pressure equilibration enables the door to be opened. Air is introduced into the chamber through a microbiological filter until equilibrium is reached with atmospheric pressure.

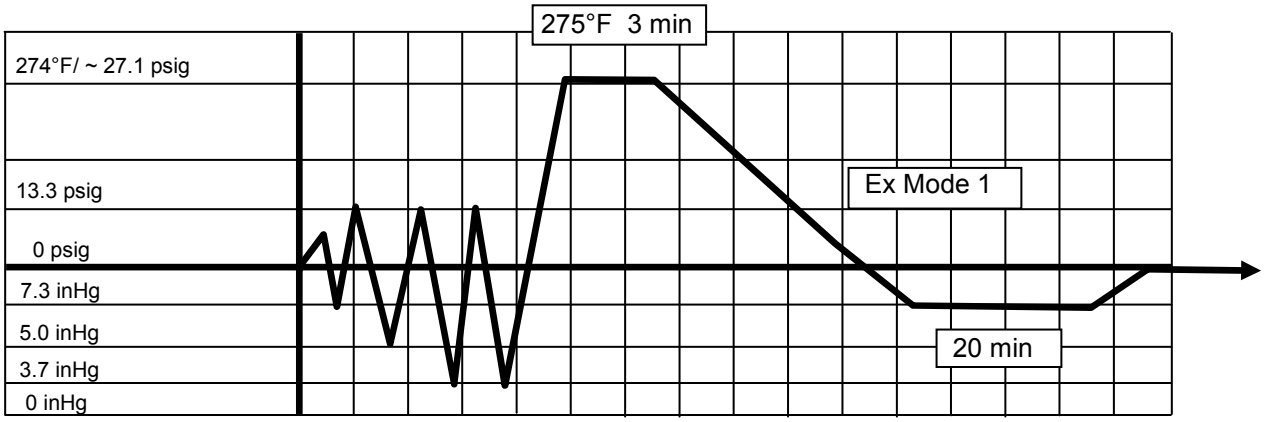
Note:

The temperature of the chamber must be below the end sterilization temperature in the range of 140ºF - 212ºF and the pressure must be below 2.0 psig to enable the door to be opened.

Important:

In order to obtain good sterilization results, dry time is essential.

Program 7 - for Wrapped Goods 275ºF (Process Sample)



Program 8 - for Wrapped Materials 250ºF (Process Sample)

This program is intended for wrapped materials (like instruments), porous loads and other goods, which their manufacturers declare their compliance with the following sterilization conditions:

- Sterilization temperature 250ºF
- Sterilization time 30 min
- Drying time 45 min

Performance Description:

Residual air is displaced by 1 vacuum pulse (down to 7.4inHg). The vacuum pulse is followed by the introduction of saturated (controlled) steam into the chamber to the required sterilization temperature.

Sterilization is controlled in a way that the sterilization temperature will not drop below the required temperature; neither will increase by more than 3.4ºF. The saturated steam conditions are controlled in such a way that the fluctuation of pressure does not allow a drop below 0.14 psi, nor an increase of 0.44 psi above the high limit of the Ste. Temperature.

Fast exhaust is performed by rapidly discharging the pressure from the chamber. The ejector is activated to allow the chamber to reach the "under-pressure" phase for drying.

Drying is achieved by evacuating the vapor from the chamber in an "under-pressure" phase for a period of 45 minutes.

Pressure equilibration enables the opening of the door. Air is introduced into the chamber through a microbiological filter until equilibrium is reached with atmospheric pressure.

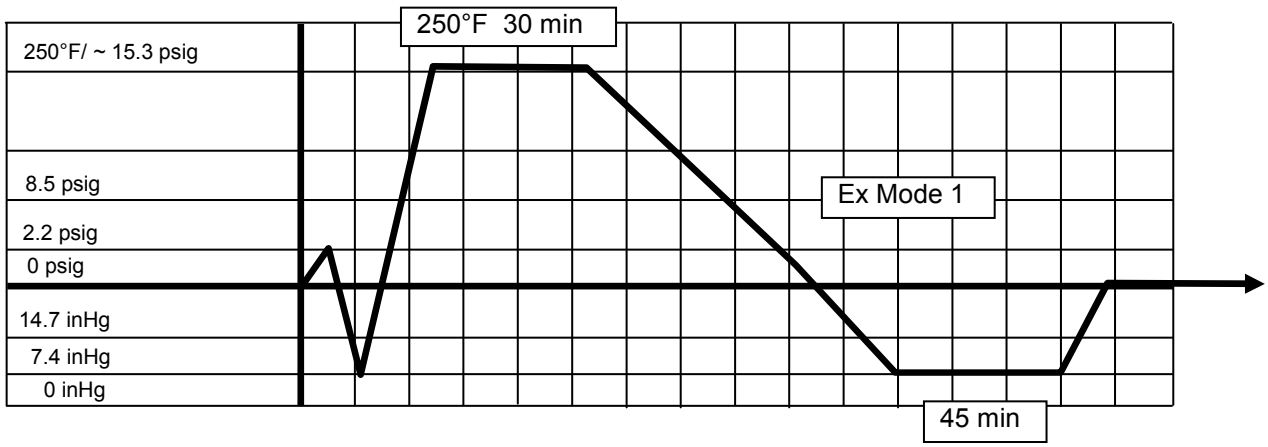
Note:

The temperature of the chamber must be below the end sterilization temperature in the range of 140ºF - 212ºF, and the pressure must be below 2.0 psig to enable the door to be opened.

Important:

In order to obtain good sterilization results, dry time is essential.

Program 8 - for Wrapped Materials 250ºF (Process Sample)



Program 9, 10, 11, 12 for Liquids Slow exhaust 250ºF, With Purge (Process Sample)

These programs are intended for liquids in open or closed containers, but not sealed containers, which their manufacturers declares their compliance with following sterilization conditions:

- Sterilization temperature 250ºF
- Sterilization time 30 min
- Purge: 30 sec
- Slow exhaust

Performance Description:

The Saturated (controlled) steam is introduced into the chamber to the required sterilization temperature.

Sterilization is controlled in a way that the sterilization temperature will not drop below the required temperature; neither will it increase by more than 3.4ºF. The saturated steam conditions are controlled in such a way that the fluctuation of pressure does not allow a drop below 0.14 psi, nor an increase of 0.44 psi above the high limit of the Ste. Temperature.

Slow exhaust is performed by slowly discharging the pressure from the chamber.

Pressure equilibration enables the opening of the door. Air is introduced into the chamber through a microbiological filter until equilibrium is reached with atmospheric pressure.

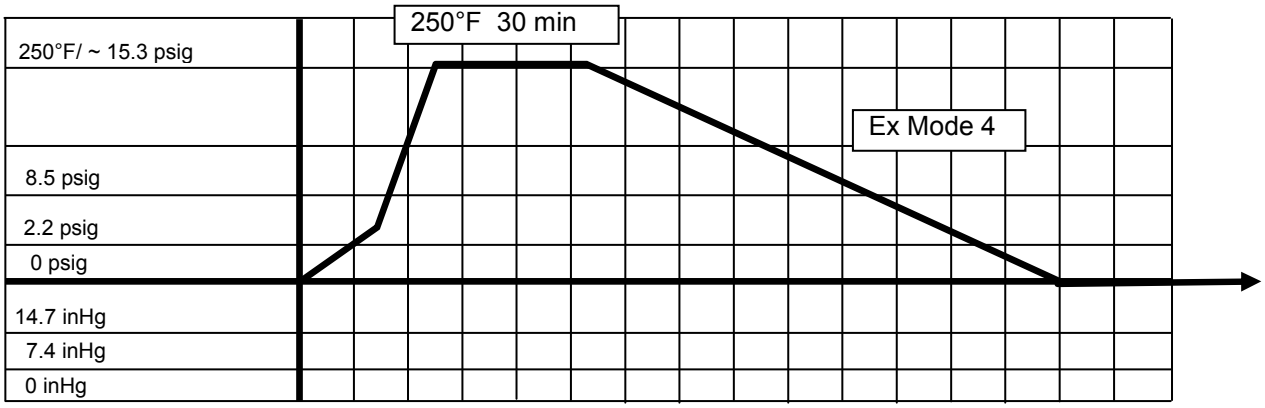
Note:

The temperature of the chamber must be below the end sterilization temperature in the range of 140ºF - 212ºF, and the pressure must be below 2.0 psig to enable the door to be opened.

Important:

Because of the difficulty to standardize the liquid cycle load, this cycle is not intended for sterilization of materials that come into contact with patients, and should be used for non-clinical applications only.

Program 9, 10, 11, 12 for Liquids Slow exhaust 250ºF, With Purge (Process Sample)



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 cannot be changed. These are the parameters:

- Sterilization temperature 274ºF
- Sterilization time 3.5 minutes
- Drying time 2 minutes

The Bowie & Dick test pack should be placed horizontally on the bottom front of the loading rack, near the door and over the drain.

Press 1 and then 3 within 2 seconds. This will select the cycle number "13" Bowie& Dick test. Press the START key to run the test. This cycle is pre-programmed and cannot be modified.

Performance Description:

Residual air is displaced by 4 vacuum pulses (down to 7.4 inHg) and 3 steam pulses up to 8.5 psig. The 4th vacuum pulse is followed by the introduction of saturated (controlled) steam into the chamber to the required Ste. Temperature.

Sterilization is controlled in a way that the sterilization temperature will not drop below the required temperature neither it will increase by more than 5ºF. The saturated steam conditions are controlled in such a way that the fluctuation of pressure does not allow a drop below 0.14 psi or an increase of over 0.44 psi above the high limit of the Ste. Temperature.

Fast exhaust is performed by rapidly discharging the pressure from the chamber. The ejector is activated until the pressure drops to 7.4 inHg.

Drying is achieved by evacuating the vapor from the chamber in an "under-pressure" phase for a period of 2 minutes.

Pressure equilibration enables the door to be opened. Air is introduced into the chamber through a microbiological filter until equilibrium is reached with atmospheric pressure.

Note:

The temperature of the chamber must be below 230 ºF and the pressure must be below 2psig to enable the door to be opened.

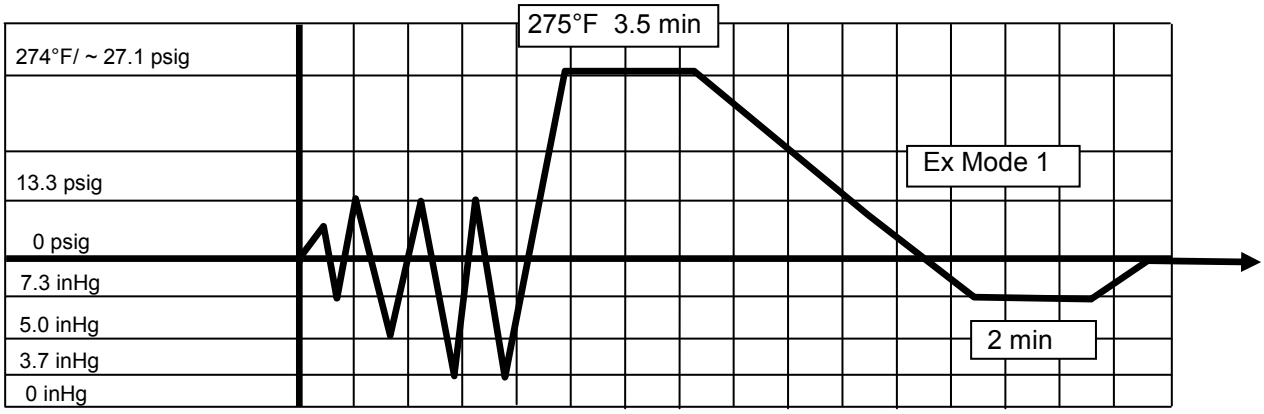
Pass/Fail step

Remove the hot test pack from the autoclave carefully.

Remove the indicator sheet from the package and have it examined by a person trained to interpret the Bowie & Dick Test.

If the test fails, repeat the test. If the test continues to fail, notify your authorized Tuttnauer technical representative for service.

Program: 13- Bowie & Dick Test



Program 14 Air Leakage Test

This program is intended to test air leakage in the chamber, through the door seal or any other components.

This test is performed in the vacuum phase.

Press number 1 and then number 4 within two seconds, to select cycle 14 -Air Leakage test.

Press START to automatically run the pre-programmed AAMI air leakage cycle parameters.

At the end of the cycle, the unit printer will print "PASS" or "FAIL" on the tape printout.

In the event of test failure, repeat the test. In case of repeated test failure, notify your authorized Tuttnauer technical representative.

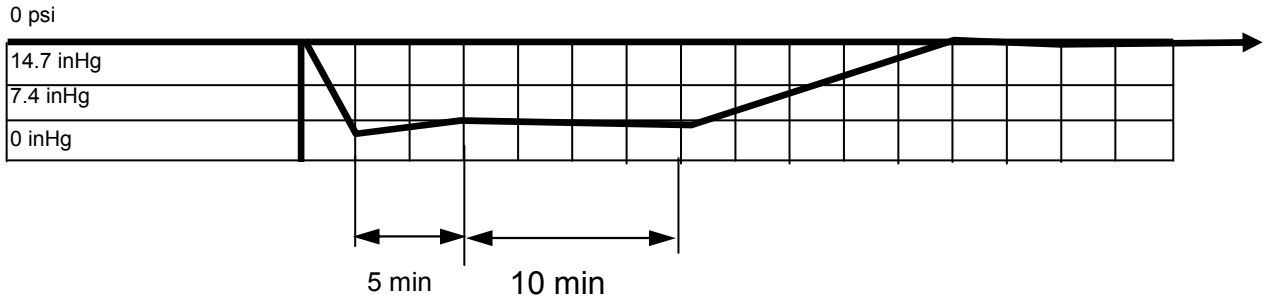
Performance Description:

A vacuum is drawn in the chamber down to 6 inHg. At this stage all valves, and other components are closed; and in the next 5 minutes the pressure is stabilized.

During the next 10 minutes the pressure is monitored.

The allowable change of pressure during these 10 minutes is 0.19 psig.

Program: 14- Air Leakage Test



7. PREPARATION BEFORE STERILIZATION

Note:

Liquids can only be sterilized in an autoclave with two temperature sensors in the chamber.

Instruments to be sterilized must be clean, free from 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. Before placing an instrument into the sterilizer, make sure that the instruments which are not of the same metal (stainless steel, carbon steel, etc.) are separated.

Note:

Check manufacturers' instructions for sterilization of each item.

3. In case 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 inch (2.5 cm) 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.

Attention:

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).

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 in slow discharge of the pressure

Use only heat-proof glass, filled 2/3 full.

Ensure that the glass container is covered but not sealed to prevent pressure build-up.

7.1 Loading

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

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

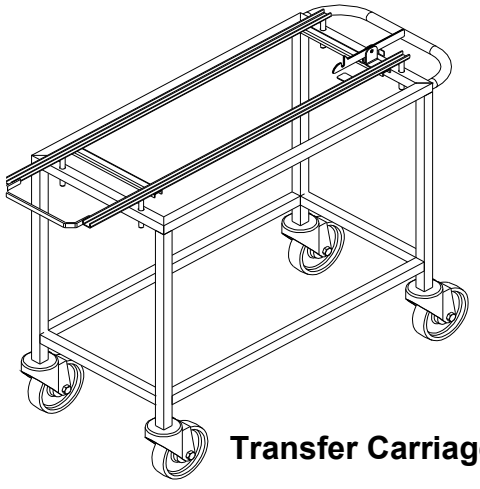
The carriage moves on four heavy-duty castors, which are mounted on its base. The two castors on the rear of the carriage are equipped with brakes. When the transfer carriage is put in position for loading or un-loading the cart from the autoclave, the brakes must be applied.

Caution!

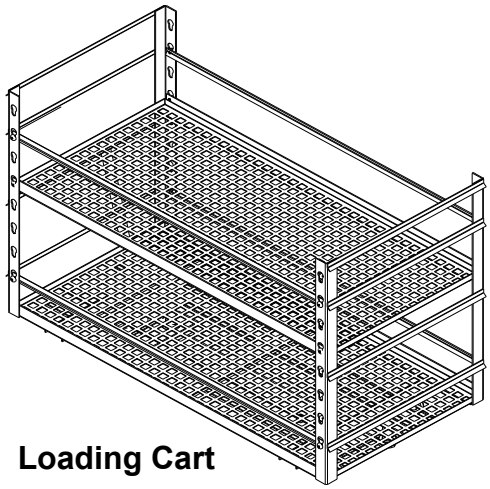
It is strictly forbidden to load or unload the loading cart, if the transfer carriage wheels brakes are not applied.

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

Do not overload the cart 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.



Transfer Carriage



Loading Cart

7.2 Un-loading

1. When the buzzer signals the successful completion of a cycle, open the door and let the load cool down for several minutes.
2. Maneuver the Transfer Carriage into position to line up the rails with the rails of the autoclave, lock the two locking wheels.
3. Remove the loading cart (or the containers) onto the Transfer Carriage and place aside to cool down.
4. Allow the load to cool down in an area with minimum passing traffic (to avoid the possibility of touching the hot load), and without air movement (air conditioning, etc.). Do not touch the hot load. Hot loads absorb moisture and may absorb bacteria from the hand.
5. Do not transfer a hot load to metal shelves for cooling. Perform a visual inspection to ascertain that sterilizing indicators have made the required color change, and that the load is dry.

The load is to 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.

Warnings!

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

It is strictly forbidden to enter the autoclave chamber!

If, for any reason (for cleaning, maintenance or if something falls down), it is necessary to enter the chamber, the person must lock the system by pressing the emergency switch and take the key with him to prevent accidents and unauthorized use.

8. OPERATING INSTRUCTIONS

Attention!

Liquids can only be sterilized if there are two PT 100 flexible temperature sensors in the chamber.

Warning!

Do not operate the autoclave in the presence of dangerous gases and vapors. Observed the manufacturer recommendations sterilization data for each type of material.

Starting the autoclave

1. Check that the feed water manual valve is open.
2. Check that the compressed air manual valve is open, and the pressure is set at 115 psi.
3. Check that the steam inlet manual valve is open.
4. Power the autoclave by turning ON the main power switch.
5. Check that the jacket pressure gauge, reaches 2.4 bars (35 psi).

Note:

Before the first operation of the day, warm up the jacket for at least 20 minutes with the door closed, even if the READY LED is lit up, and carry out a BOWIE & DICK test.

Running a Sterilization Program

1. Open the door by turning the door wheel handle, counter clockwise to release the locking arms.
2. Load the sterilizer.
3. For liquid loads, choose the two containers that contain the most liquid, and insert the two temperature sensor into both.
4. 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.
5. Select the sterilization program according to the type of material to be sterilized by pressing the relevant keys as described in Chapter 3.
6. Press the START key, to operate the cycle. The entire sterilization process automatically proceeds. The signal light RUN on the control panel is lit.
7. At the end of the cycle a buzzer sounds, and the word "END" is displayed. Press the STOP key to cancel the buzzer. Open the door as indicted in step 6 and take out the sterilized material from the chamber ensuring the environment is sterile.

Note:

Verify that the pressure in the chamber is atmospheric pressure. Do not attempt to open the door if the pressure in the chamber is above atmospheric pressure. When a sterilization program is running, the LED RUN lights up on the control panel.

Caution!

The sterility of un-wrapped instruments cannot be maintained if exposed to a non-sterile environment.

Warning!

Loading or unloading of material from the chamber can only be done when the door is completely open. It is forbidden to put a hand or any other part of the body inside the chamber while closing the door.

8.1 Failed Cycle

Note:

In case of a failed cycle or of a manual stop by the operator, the two LEDs RUN and FAIL are lit. The reason for failure is displayed on the screen. At the end of the cycle an interrupted sound is heard. Press STOP to cancel the alarm.

In the case of a failed cycle do the following:

1. Press STOP.
2. Solve the problem.
3. Log the displayed message in the autoclave log book or any other appropriate document.
4. If you cannot solve the problem, turn OFF the autoclave and call for Service.

Note:

Verify that the pressure in the chamber is atmospheric pressure. Do not attempt to open the door if the pressure in the chamber is above atmospheric pressure.

8.2 Aborting a Cycle

1. Press the STOP key; the autoclave automatically goes through a shut down sequence. The unit will either open the drain valve to remove pressure from the chamber or open the vacuum break valve, depending upon the phase of the cycle.
2. The autoclave will signal the operator that the cycle has been aborted and will advise the operator when the door can be opened. (see above)

Note:

When a power failure occurs, the autoclave holds the cycle at that point when the power was lost. The system stays in the locked down safe mode until the power is restored. At the power restoration the controller follows the abort sequence described above.

Warning!

DO NOT ATTEMPT TO OPEN THE DOOR UNTIL NOTIFIED THAT THE ABORT SEQUENCE IS COMPLETE. IF THE CONTROLLER DOES NOT INDICATE THAT THE SEQUENCE IS COMPLETE, DO NOT ATTEMPT TO OPEN THE DOOR. CONTACT YOUR TUTTNAUER TRAINED AND CERTIFIED AUTOCLAVE TECHNICIAN.

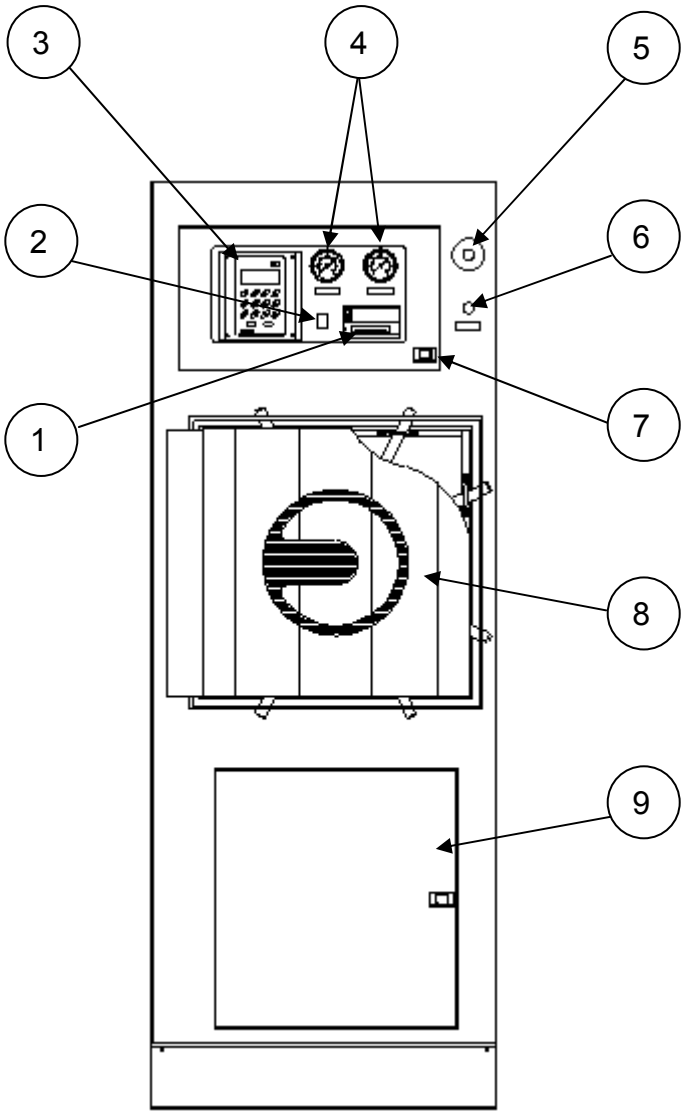
8.3 Repeating a Cycle

The Protection Glass Door is a safety and maintenance feature to protect the control panel, manometers and switches, from steam during opening of the chamber-door at the end of a program.

Since it is inconvenient to reach beyond the glass panel whilst the autoclave is in operation, an additional switch has been mounted on the front outer panel, to allow for external operation control.

If the operator does not require to select a different cycle, he just presses the START switch after the loading has been completed, and does not need to open nor close the Protection Glass Door every time the autoclave is operated.

The Emergency STOP switch terminates the operation of the autoclave at any time.



Legend:

1. Printer
2. Operating Switch
3. Operation Panel
4. Chamber and Jacket pressure gauges
5. Emergency STOP switch
6. START Switch
7. Protection Door Latch
8. Chamber Door
9. Service Access Door

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SERVICE INSTRUCTIONS

Warning!

These service instructions are for the use of qualified personnel only! To avoid electric shocks, do not perform any servicing other than that specified in the operating instructions unless you are qualified to do so. Refer all servicing to qualified service personnel.

When servicing the autoclave, disconnect the all electrical power supplies to the unit. This is done by switching OFF the main power supply switch, or by un-plugging the electrical power main supply cords.

9. MAINTENANCE OF AUTOCLAVE

9.1 Preventive and Periodical Maintenance

User	**Before each cycle**	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. 3. Keep the door closed between sterilizing cycles.
	Daily	1. Clean the door gasket every day with a soft cloth. 2. Before the first operation of the day, warm up the jacket for at least 20 minutes with the door closed, even if the READY LED is lit up. 3. Keep the door closed between sterilizing cycles. 4. Carry out a BOWIE & DICK test at the beginning of each day after warm up. 5. Drain the compressor tank before starting operation (if applicable). 6. If sterilizing liquids, clean the chamber at the end of every day. 7. At the end of the day leave the door open.
User	**Weekly**	1. Clean the cabinet and door parts, the internal walls of the autoclave, the shelves and the shelf rails with a soft cloth and household detergent. **Clean the chamber while the autoclave is cold.** The detergent shall be flushed away with water. If you used tap water, for the final flush use distilled or mineral-free water. ⚠ **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 spindles and pins (if applicable). 3. Drain the generator (if applicable) as follows: a. Switch OFF the power. b. Wait until the pressure decreases to 0.5 bar (watch the pressure gauge). c. Open the drainage manual valve for a few seconds till the glass tube becomes empty, and then close the valve. d. Drain the water level tube by opening the tube's valve located at the bottom elbow connecting the tube to the vessel. 4. At the end of the week, or if the autoclave will stand for a prolonged period, clean the chamber when it is cold, and leave the door open.

Technician/User	**Monthly**	**On Autoclaves with Automatic Doors** 1. Once a month before the weekend, follow these steps: a. Remove the door gasket, and thoroughly clean the door gasket groove. b. Remove any stains or corrosion from the door gasket groove, and blow out all traces of dirt with compressed air. c. Thoroughly clean the door gasket. d. Leave the door gasket out for the weekend. e. Before start of day/shift after the weekend, replace the door gasket according to the instructions in the “Replacing the Door Gasket“ section.
Technician	**Quarterly**	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 cleaning of the strainer inside the steam-trap. 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. 5. De-scale the generator (if applicable). 6. Verify that the water quality complies with the requirements as detailed in the Water Quality paragraph.

Technician	**6 months**	**On Autoclaves with Manual Doors** 1. Every six months before the weekend, follow these steps: a. Remove the door gasket, and thoroughly clean the gasket and the groove. b. Leave the door gasket out for the weekend. c. Before start of day/shift after the weekend, replace the door gasket according to the instructions in the "Replacing the Door Gasket" section. **All autoclaves** 1. Replace the 0.01μ air filter
	Yearly	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. Ensure periodical tests are done on time. 6. Check the steam-traps and replace if worn. 7. Calibrate the control system 8 Validate the applicable cycles 9. Check and verify tight closing of all tightening bolts of the side guides, as well as top and bottom guides (if applicable). Replace worn bolts if necessary (on horizontal or vertical door). 10. Check and verify tight closing of all tightening bolts of the bronze strips. Replace worn bolts if necessary (on horizontal or vertical door). 11. Check and verify tight closing of all tightening bolts of the door guide rail (including the door's wheel). Replace worn bolts if necessary (on horizontal or vertical door). 12. Check the hydraulic piston including oil level. Check the hydraulic system for leakage, worn or loose component (on horizontal or vertical door). 13. Disassemble the door cover, check and tighten all locking mechanism bolts (on manual or automatic hinged doors). 14. Check operation of the micros-witches. Verify that they are placed tightly as required. 15. Check the safety valve. Allow the safety valve to blow off by letting the pressure increase until it reaches the working pressure + 10%. This verifies that the safety valve operates as required and the valve's seat is kept free of mineral deposits. **Note:** **Yearly maintenance should always be accomplished by a trained sterilizer service technician.**

Notes:

1. Keeping the inside of the autoclave clean will lengthen its life and its proper operation.
2. Ensure the chamber is empty and cold during all cleaning.
3. For all cleaning use ordinary household stainless cleaner, and rinse first with tap water, and then with distilled or mineral free water.
4. Use only mineral-free water for the steam generator as detailed in the Water Quality paragraph, (If applicable).
5. Keep the door closed between sterilizing cycles.
6. If you **see** or **hear** anything extraordinary, stop using the autoclave and call for service.

Periodical Tests

1. Once a year calibrate and validate the autoclave.
2. Periodical safety tests (pressure vessel and electricity) shall be performed by an Authorized Inspector at intervals as required by the local laws, rules or regulations.

Periodical safety tests should be performed by an authorized inspector at intervals as required by local law, rules or regulations.

Notes:

Ensure periodical tests are done on time!

9.2 Safety Tests after Repair

Attention!

After every repair or dismantling the enclosure, the autoclave should pass two electrical safety test by the qualified Service Engineer. The following shall be performed:

1. Enclosure Leakage Current Test.

Every autoclave should pass this test as follows:

1. Connect the electrical cord to the autoclave.
2. Turn on the main switch on the right side of the autoclave.
3. Short-circuit the L and N pins on the cord's plug.
4. Connect the Short-circuit pins to the L pole on the Megaohm Tester.
5. Connect the earth pins to the earth pole on the Megaohm Tester.
6. Impose an electrical potential of 500-1000V on the tested autoclave. The insulation resistance should be at least 2 MΩ.

The test is successful if there was no leakage.

2. Protective Earth Impedance Test

1. Connect the grounding pin of the power cord plug to one pole of an Ohmmeter.
2. Connect any other metallic part (preferable – the metallic part of the locking screw) to the second pole of the Ohmmeter.
3. The resistance should not exceed 0.3 Ω.

After performing these tests, the Service Engineer should complete and sign the Work Order and the Log Book.

9.3 Troubleshooting

Symptoms	Possible causes check-ups and tests	Corrections
1. Control unit not energized. No displays and lights on the front panel.	1.1 The control circuit breaker switched off or defective. 1.2 The power switch on the front panel of the autoclave is defective.	1.1 Switch on the circuit breaker or replace it. 1.2 Replace the defective switch.
2. Low pressure or no steam pressure from the external source.	2.1 Low pressure on the steam supply line. 2.2 Pressure reducer faulty or set too low.	2.1 Fix pressure on the steam supply line. 2.2 Set or replace the pressure reducer.
3. Steam pressure goes up beyond the control point.	3.1 The electronic pressure transducers or measuring circuits faulty or out of calibration. 3.2 Leakage through the steam to jacket valve.	3.1 Check and calibrate pressure-measuring circuits or replace transducers. 3.2 Check, fix or replace the steam to jacket valve.
4. The conditioning phase (pre-vacuum) does not work. Vacuum not produced in the chamber or vacuum level insufficient.	4.1 The vacuum valve passing water through the ejector stuck or damaged. 4.2 The exhaust to ejector valve stuck or damaged. 4.3 Door not properly closed, gasket damaged or incorrectly set.	4.1 Check, repair or replace the vacuum valve. 4.2 Check, repair or replace the exhaust to ejector valve. 4.3 Close the door, fix or replace the gasket.
	4.4 Leakage at the vacuum or exhaust piping.	4.4 Check and tighten fitting joints, replace the defective piping.
	4.5 Control system trouble.	4.5 Replace the control boards.
Steam does not flow through the steam inlet or low steam pressure.	4.6 Steam inlet valve blocked or damaged.	4.6 Fix or replace the steam valve.
	4.7 Low pressure at the steam supply line.	4.7 Check the steam supply pressure as shown in par. 2.
5. Pre-vacuum phase completed but temperature and pressure is low and the sterilization point is not reached or takes a long time to do so.	5.1 Steam inlet valve blocked or damaged. 5.2 Low pressure at the steam supply line. 5.3 Control system trouble.	5.1 Fix or replace the steam valve. 5.2 Check the steam supply pressure as shown in par. 2. 5.3 Replace the control system.
6. Temperature rises above the preset sterilization value.	6.1 Steam valve leaks. 6.2 Steam line pressure too high or pressure reducer set too high. 6.3 Control system trouble.	6.1 Repair or replace the steam valve. 6.2 Adjust steam pressure correctly. 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. 7.2 Steam valve leaks. 7.3 Control system trouble.	7.1 Repair or replace the damaged valve. 7.2 Repair or replace the steam valve. 7.3 Replace the control boards.

Symptoms	Possible causes check-ups and tests	Corrections
8. Drying stage does not work.	8.1 Trouble with the vacuum system. 8.2 Steam valve leaks. 8.3 Control system trouble.	8.1 See par 4. 8.2 Repair or replace the steam valve. 8.3 Replace the control boards.
9. The air inlet does not work.	9.1 Air inlet valve clogged or damaged. 9.2 Air filter jammed.	9.1 Repair or replace air inlet valve. 9.2 Replace the air filter.
10. Unsatisfactory results of sterilization process.	10.1 Incomplete removal of air pockets. 10.2 Sterilization conditions improper temperature or pressure too low, ster. time too short. 10.3 Incorrect loading of autoclave, air trapped in the load.	10.1 See trouble related to vacuum system par 4. 10.2 Set the temp. and time correctly according to the sort and quantity of material. 10.3 See par. Preparation before Sterilization.
11. Drying incomplete packs remain wet.	11.1 Insufficient steam pressure to jacket. 11.2 Insufficient vacuum. 11.3 Steam trap does not eliminate the condensate. 11.4 Incorrect loading of the autoclave.	11.1 Set or fix the pressure transducer. 11.2 See problems related to vacuum par 4. 11.3 Clean or repair the steam trap. 11.4 Reload the autoclave correctly.
12. The door does not close.	12.1 Low pressure at the air supply line. 12.2 CLOSE DOOR solenoid valve transmitting air pressure to the door actuator is stuck or damaged. 12.3 Door drive actuator damaged. 12.4 OPEN DOOR button is defective. 12.5 Control system trouble.	12.1 Set the air pressure; 22psi. 12.2 Fix or replace solenoid valve. 12.3 Fix or replace actuator. 12.4 Replace the button. 12.5 Replace the control boards.
13. The door does not seal.	13.1 Low pressure at the air supply. 13.2 Low steam pressure at the door gasket. 13.3 The pressure to gasket pneumatic valve blocked or damaged. 13.4 The solenoid or pneumatic valves, which control the pressure or vacuum to gasket stuck or damaged. 13.5 Control system trouble.	13.1 Set the air pressure; 22psi. 13.2 Set the steam pressure; 1.5 - bar. 13.3 Fix or replace the pneumatic valve. 13.4 Repair or replace the defective valve. 13.5 Replace the control boards.
14. The door does not open.	14.1 Low pressure at the air supply line. 14.2 Insufficient vacuum to gasket, due to trouble with the vacuum system. 14.3 Gasket improperly seated or damaged. 14.4 OPEN DOOR solenoid valve transmitting air pressure to the door actuator is stuck or damaged. 14.5 Door drive actuator damaged.	14.1 Set the correct air pressure (which has to be atmospheric pressure). 14.2 See paragraph 2. 14.3 Mount the gasket suitably or replace it. 14.4 Repair or replace the faulty valve. 14.5 Fix or replace actuator.

Symptoms	Possible causes check-ups and tests	Corrections
15. Problems related to the control system. The keypad or display out of order. No response when pressing any key on the keyboard. Disordered response to manual controls. Pressing one key gives the effect of pressing a different key. Cycle does not start when pressing the START key. Pressing the STOP key, system does not react. Switching the instrument on, initialisation is not correct. Printer does not work or printing is incoherent.	15.1 Check if the flat cable or MOLEX connectors between the control boards and keyboard are well plugged in. 15.2 Power supply out of order. 15.3 Control boards or keyboard faulty. 15.4 Paper to printer missing or quality unsuitable. 15.5 Flat cable connection between control board and printer is not plugged in correctly. There are interruptions or loose contacts. 15.6 Printer damaged.	15.1 Plug in firmly the MOLEX connectors. 15.2 Fix the power supply. 15.3 Replace the defective board of the microcomputer unit. 15.4 Insert a paper roll inside the printer. Make sure you use the correct type of paper. 15.5 Plug in the connection or replace it. 15.6 Fix connection or replace the printer.
16. Cycle FAIL due to Temperature High or Low Pressure High or Low	16.1 Temperature sensor disconnected or loose connection. Sensor damaged. 16.2 Pressure transducer, faulty. Mechanical or electrical connections or transducer damaged.	16.1 Fix connection or replace the sensor. 16.2 Fix connection or replace the transducer.

9.4 Test Points – Cat 2007

NUT TP	FUNCTION
TP1	GND
TP2	Analog Input N 13 (Door 1 Press.)
TP3	Analog Input N1 (Cond. Temp.)
TP4	Analog Input N14 (Door2 Press.)
TP5	Analog Input N 2 (Cond. Temp.2)
TP6	Analog Input N 15
TP7	Analog Input N 3 (Temp.)
TP8	Analog Input N 16
TP9	Analog Input N 4 (h-electrode)
TP11	Analog Input N 5 (l-electrode)
TP13	Analog Input N 6 (Pressure)
TP15	Analog Input N 7 (Jacket press.)
TP17	Analog Input N 8 (Gen. Press.)
TP19	Analog Input N 9 (Temp.2)
TP21	Analog Input N 10 (T5)
TP23	Analog Input N 11 (T6)
TP25	Analog Input N 12 (Chamber Electrode)

9.5 Calibration

The programming of the calibration procedure is almost identical for both temperature and pressure. Calibration is performed digitally.

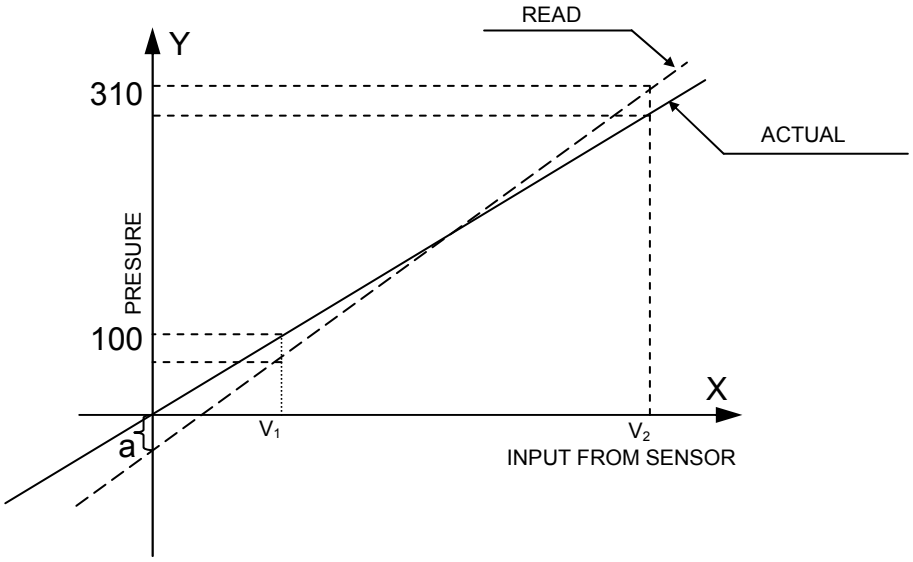
The temperature and pressure measuring circuits are designed with components having a 1% precision. The temperature circuit is linear and has an output of 100mV-2400mV for a temperature range of 68°F-302°F (20°C-150°C).

The pressure circuit is also linear and has an output of 100mV-2400mV for a pressure range of 0 -58 psi. (0-400 kPa).

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 into the system, through either programming or directly through the autoclave.



The calibration method enables the insertion of this data into the system in order to perform the automatic correction of the OFFSET and GAIN.

Before calibrating it is recommended to find two points that have to be inserted into the system (temperature or pressure).

9.5.1 Calibrating Temperature and Pressure

Return to the ST.BY screen and select the OPTION command key.

The word CALIB is displayed above the middle command key. Press the middle key and the same screen for entering the SETUP code will appear.

Enter the correct code via the digital key; the system begins displaying the calibration options.

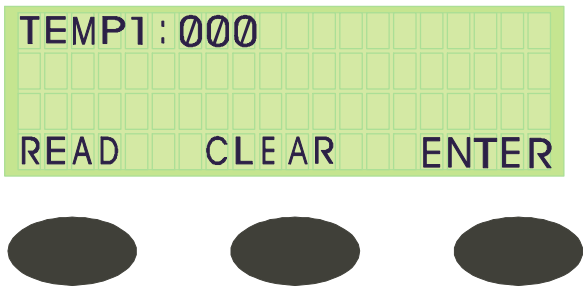
Note:

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

Once the entry code has been entered, the following screens appear:

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:

A 140 (100)	**R 140 (100)**
A 226 (130)	**R 226 (130)**

Press the right button (F3) to scroll through the different values, which may be changed using the UP/DN keys only.
After F3 is pressed, when it is on the last value, the next screen will appear.
Press the middle button (F2) to read the value of the sensor.
Press STOP to discontinue a cycle.

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

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

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

Temp 5 (Drain)
Temperature of sensor 5
Refer to Temp1 for instructions.

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:

A 14.5 (100)	**R 14.5 (100)**
A 43.5 (300)	**R 43.5 (300)**

Press the right button F3 to access different values that may be changed using the UP/DN keys only.
After F3 is pressed when it is on the last value, it moves to the next screen.
Press the middle button F2 to read the value of the sensor.
Press STOP to discontinue a cycle.

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

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

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

D2 Pres: (Option) N/A
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 273 °F and 250 °F (134°C - 121°C):
When checking chamber TC for 273 °F (134°C) it shows 270 °F (132°C)
When checking chamber TC for 250 °F (121°C) it shows 250 °F (121°C)
The temp for 273 °F (134°C) needs correction without changing the accurate Temp of 250 °F (121°C)

The data should be set as follows:

Upper Row	**A 250 (121)**	**R 250 (121)**
	A 270 (132)	**R 273 (134)**

The system calibrates the new Offset and Gain and loads them into the non-erasable memory.
As a result, while running a 273 °F (134°C), program the correction is automatically made, while at 250 °F (121°C) there is no change.

9.5.2 An Example of Temperature Calibration:

Sensor no. 1 reads – 140°F (60°C) and the actual temperature is 149°F (65°C) (in the lower range), and in the upper range reads 130°C (266°F) and the actual temperature is 275°F (135°C).

In order to calibrate and to change the values do the following:

1. Press OPTION (F2).
2. Press CALIBRATION (F2).
3. The system will ask an entering code, enter the code.
4. Temperature 1 is displayed. To change temp 1, enter the code and press ENTER – (F3); several numbers will appear on screen. On the left side of the uppermost row, a cursor appears which enables the user to change temperatures.
5. Insert the actual temperature that was measured 149°F (65°C) and press ENTER (F3); the cursor will point to the Read temperature – R. (upper right) Insert the read temperature, which was measured in the autoclave 140°F (60°C), and press ENTER. The cursor will point to the actual –the lower left number.
6. Insert the actual temperature that was measured 275°F (135°C) and press ENTER (F3), the cursor will point to the Read temperature – R (lower right). Insert the read temperature, which was measured in the autoclave (130°C), and press ENTER. Pressing ENTER will bring you to the calibration of temperature 2. – If you want to calibrate temperature 2 repeat all calibration steps, if not, press ENTER until the main screen is displayed.

9.6 Testing the Safety Valves

Attention!

Make sure that the test is performed while the door is closed.

Testing the Jacket Safety Valve

1. Mark the position of the pressure regulator adjustment knob.
2. Turn the adjustment knob one turn in the pressure increase direction.
3. On the solenoid valve battery, open manually valve 91. This is done by turning the adjustment screw until the screw's slot is vertical.
4. Operate the autoclave and verify that the pressure increases.
5. Verify that the safety valve blows in the range of 40–44psi (2.8–3.0 Bar).
6. If the safety valve did not blow at the pre-set pressure stop the operation of the autoclave, decrease the pressure to atmospheric pressure and replace the safety valve with a new one.
7. If the safety valve was replaced, repeat step 1—5 to test the new one.
8. Close solenoid valve 91 (screw's slot is horizontal).
9. Readjust the pressure regulator to the original position. Use the marking as mentioned above in step 1

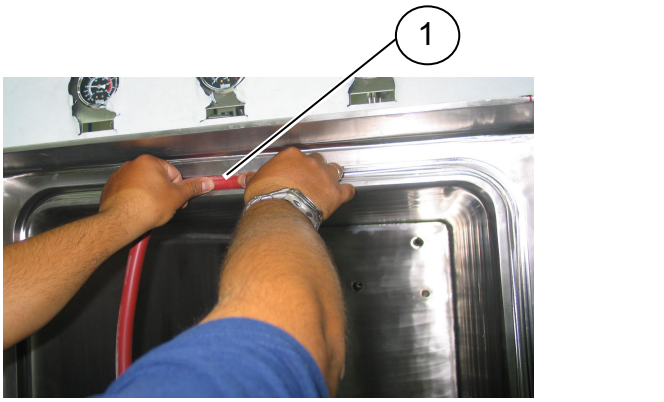
9.7 Replacing the Door Gasket

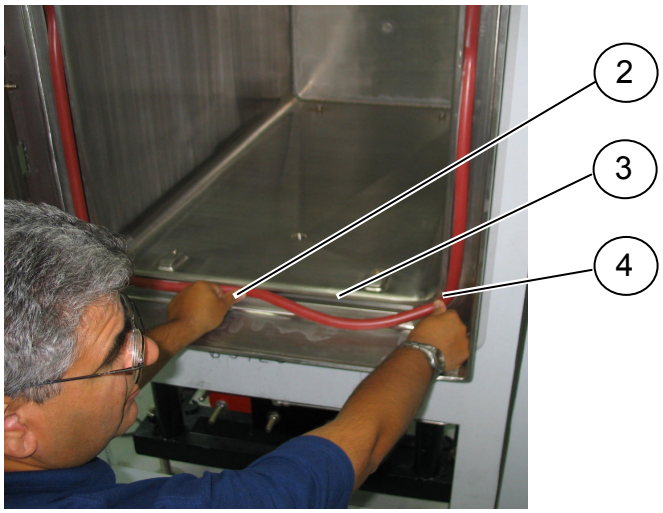
Warning!

Before replacing the gasket, verify that the autoclave is cold; that the power is turned off; and, that there is no pressure in the jacket and in the chamber.

1. Remove the damaged gasket.
2. Check the new gasket and verify that it is not damaged.
3. Verify that the gasket groove is clean.
4. Begin inserting the gasket into the groove by pressing it into the middle of the upper part of the groove. Verify that the point of the glued end (1) (the part of the silicon tube where the two ends meet) is placed in the middle of the upper groove.
5. Insert the gasket into the groove in the middle of each side (2) (top, bottom, left and right) and in each corner.
6. Continue to insert the gasket into the groove in the middle of each loose part, i.e. between two inserted points (3) & (4).

The final adjustment of the gasket will be done automatically at the first "closing door."





10. SPARE PARTS LIST

	Part No.	Description
R	**ARM029-0006**	Pressure Reducer, Steam, ½", Miyawaki
R	**ARM100-0069**	Steam Trap, ½", without bypass,N125W, Nicholson
R	**ARM100-0070**	Steam Trap, ½", with bypass, N125WSLR, Nicholson
R	**ARM172-0018**	Check Valve, Swing, ½", NPT, St.St., CK-6
R	**ARM172-0020**	Check Valve, Swing, ¾", NPT, St.St., CK-6
—	**CMH440-0003**	Strainer, chamber drain, 44/55
R	**CMT196-0004**	Electrode, Water Level, Assembly, for TTA, Length: 58mm
—	**CTP200-0040**	Control Unit, Electronic, CAT2007, Horizontal, Complete
—	**CTP201-0079**	Panel, Keypad CAT 2007
—	**CTP201-0090**	Board, Electronic, HORIZ V6
—	**CTP201-0091**	Board, Electronic, HORAN V6
—	**CTP201-0152**	Power Supply, 5V, RS-25, Mean Well
—	**CTP201-0160**	Power Supply, 24V, RPD-65, Mean Well
—	**CTP201-0230**	Electronic Level Regulator, one electrode, 115V, DRL H S, Gicar
—	**ELC456-0003**	Cable, Assy. Printer, Citizen 920, Horizontal
R	**ELE034-0017**	Circuit Breaker, 1 pole, 4A, FAZ-C4, Moeller
R	**ELE035-0012**	Switch, Rocker, 16A
R	**ELE035-0022**	Single Polar Switch Hor.
—	**ELE035-0095**	Push-button actuator, Green, M22-D-G, Moeller
—	**ELE035-0096**	Contact Element, M22-K01, Moeller
—	**ELE035-0135**	Pushbutton, mushroom, KPMP2-10R+key, contact blocks with holder KCBH-02, ABB
R	**ELE036-0019**	Microswitch, MP320-5MAL, Microprecision Electronics
R	**FIL175-0039**	Filter,Air, 0.01m, ½"
—	**FIL175-0064**	Strainer, ½" , St.St, Y Type, VS01, Victory valves
—	**FIL175-0065**	Strainer, ¾" , St.St, Y Type, VS01, Victory valves
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, ¼"
R	**GAU029-0023**	Gauge, Pressure, Steam, -30+60 psi
R	**PNE195-0039**	Silencer ⅛", SFE 180, Sistem Pneumatica
—	**PUM056-0002**	Ejector, Water, ELL, ¾", Penberthy

	Part No.	Description
—	**SOL024-0014**	Subbase. Joinable, 35300048, Joucomatic ASCO
—	**SOL024-0015**	Connector, with integrated LED indicator, size 22, DIN 43650, 88122405, Asco
—	**SOL024-0016**	Solenoid valve, 1.2mm, w/o DIN connector, 18900002, Joucomatic
—	**SOL024-0017**	Filter/regulator, 25µm, 1/8, 34225201, Joucomatic
—	**SOL025-0051**	Battery, 8 Solenoid Valves, NC, Complete, Series 189, ASCO
R	**SVL029-0031**	Valve, Safety, ½"-40 psi (ASME), Bronze base, 19M DC L40, Conbraco
—	**THE002-0009**	Printer, CBN-920, parallel, CITIZEN
R	**THE002-0010**	Paper, Roll, Printer CBN-920
R	**THE002-0020**	Ribbon, Ink, Printer CBN-920
—	**THE003-0003**	Sensor, Temperature, Silicon, PT100, 6X100
—	**THE003-0004**	Sensor, Temperature, PT100x2, 6X100
—	**THE003-0022**	Sensor, Temperature, PT-100, 6x150, 1m Flexible st.st. Hose
—	**THE003-0032**	Controller, temperature, PT100/115 VAC, IC 912, Eliwell
—	**THE005-0024**	Switch, Pressure, RT112, Danfoss
—	**THE006-0006**	Transducer, Pressure, -1+3 Bar abs (Tecsis 3296)
—	**VLV170-0001**	Valve, Manual, ½", NPT, DN 15, DIN 3844
—	**VLV170-0024**	Valve, Needle, ¼", St.St
—	**VLV170-0055**	Valve, Manual, Ball, Mini, ¼", Sistem Pneumatica
—	**VLV170-0140**	Valve, water/steam, Air-Spring Operated, NC, Angle Seat, ¾", St.St., 7010, Schubert
—	**VLV170-0142**	Valve, water/steam, Air-Spring Operated, NC, Angle Seat, ½", St.St., 7010, Schubert
R	**VLV171-0011**	Gasket, Replacement Kit, Air-Spring Angle Seat Valve, ½", 7010, Schubert
R	**VLV171-0012**	Gasket, Replacement Kit, Air-Spring Angle Seat Valve, ¾", 7010, Schubert

Note:

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

SPARE PARTS FOR THE DOOR LOCKING MECHANISM

See Appendix 2 for exploded view of door locking mechanism.

	Part No.	Description
_	**BEA031-0006**	Washer, Tooth Lock, KM4, SKF
_	**BEA031-0007**	Washer, Locking, MB4, SKF
_	**BEA031-0020**	Bearing, Ball, 32004X, SKF
_	**BOL191-0061**	Bolt, Hex. Socket head, St.St., 1/4*25
_	**BOL191-0101**	Screw Set, Hex. Socket, St.St. 1/4*25
_	**BOL191-0136**	Screw, Flat Head, Socket Cap, 1/4NC*5/8"
_	**BOL194-0347**	Screw, Socket Head, Cap, Steel, 3/8NC*1½"
_	**CMH070-1018**	Locking Wheel, Door 44 XX, 55 XX
_	**LOK550-0037**	Pin, lower arm holder, 44 XX, 55 XX
_	**LOK550-0001**	Axis, Central, Locking Mechanism, 44XX, 55XX
_	**LOK550-0002**	Bushing, Central Axis, Locking Mechanism, 44XX, 55XX
_	**LOK550-0003**	Stopper, Ocolon, Locking Mechanism, 44XX, 55XX
_	**LOK550-0004**	Arm Holder, Upper, Door Locking Mechanism, 44XX, 55XX
_	**LOK550-0005**	Arm Holder, Lower, Door Locking Mechanism, 44XX, 55XX
_	**LOK550-0008**	Bushing, outer, Locking Mechanism, 44XX, 55XX
_	**LOK550-0009**	Base, Locking Wheel, Door Locking Mechanism, 44-55
_	**LOK550-0013**	Safety Rod, Door Locking Mechanism, 44-55
_	**LOK550-0016**	Locking Arm, Door Locking Mechanism, 55 XX
R	**PNE195-0042**	Piston Assy. Manual Door, 1", 55 XX

Note:

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

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

5.	VACUUM	51. Vacuum - break 52. Vacuum - to pump 53-1. Vacuum - from door 1 seal 53-2. Vacuum - from door 2 seal 54. Vacuum Test N.C.
6.	DRAIN	61. Drain – from reservoir 62. Drain – from jacket overflow 63. Drain – from vacuum pump / ejector 64. Drain – from chamber 65. Drain – from cooler 66. Drain – from sanitary filter 67. Drain – from steam generator 68. Drain – jacket 69. Drain – 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. Steam – from building source 91. Steam – to jacket (From outer source) 92. Steam – inlet 93. Steam – to chamber 94-1. Steam – to door 1 seal 94-2. Steam – to door 2 seal 95. Steam – to heat exchanger 96. Steam – to sanitary filter 97. Steam – from steam generator 98. Steam – to activate ejector 99. Steam – to air detector

Note:

S - SANITARY VALVE.

12. 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

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

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

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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XPCS Manual

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 lets you perform downloading of PCS code; downloading/uploading analog inputs gain and offset values. The program uses PCS communication module, to connect between target platform and PC.

XPCS Aim

1. Download PCS code data.
2. Calibration.

Minimum Requirements

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

User Requirements

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

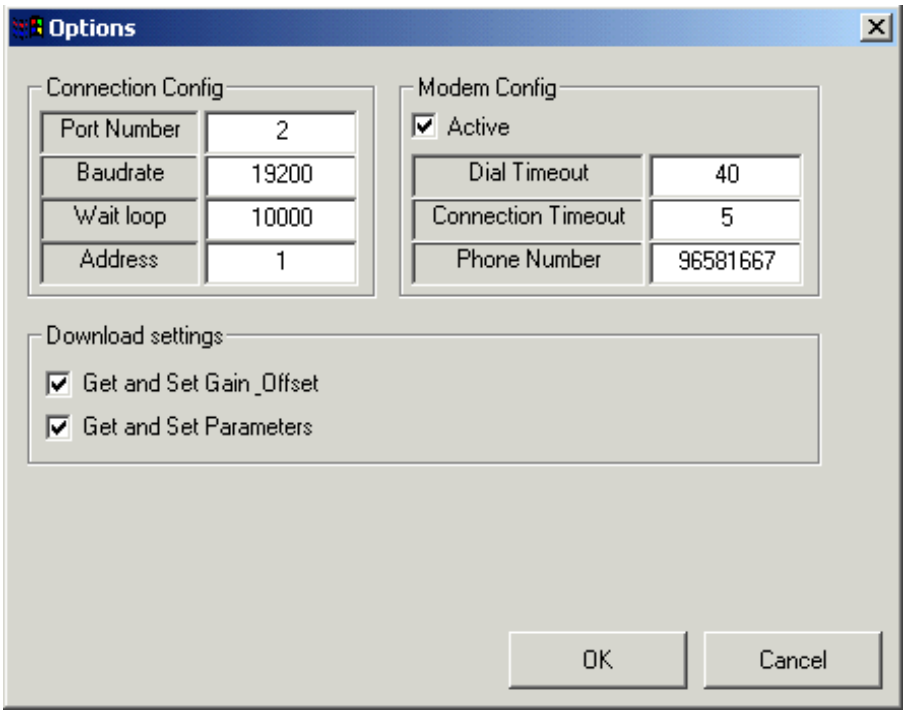
Installation

1. Select the CD drive by double-clicking on it.
2. When the window opens find and double-click on the file "setup.exe"
3. This will launch the installer, follow the on-screen instructions.

Using XPCS

Configuring the Program

On 'XPCS' main window, press the 'Options' button; the 'Options' Box opens.



Configuring Communication Settings

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

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

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 request 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 a specific destination.

Download Setting Configuration

If 'Get and set Gain Offset' are checked, when the program downloads, all gain and offset values will be stored before PCS code downloading, and restored after downloading is completed.

If 'Get and Set Parameters' are checked, when the program downloads, 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 Installed on 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 files: LabTN2.mdb exists).

Note:

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

Note:

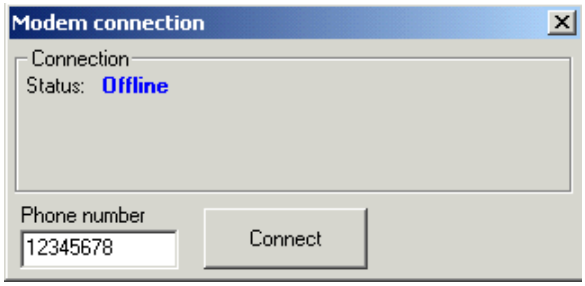
Because the PCS target platform parameters saving process are complex, restoring Parameters task takes long time (few minutes)!

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.

Connecting to the PCS Target platform

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



By pressing the '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:

1. Check if COM Port is available.
2. Detect modem.
3. Dial a phone number.
4. Wait for a connection establishment.
5. Check if remote target platforms are connected.

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

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

6. Check if COM Port is available.
7. Open COM Port.

Note:

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

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

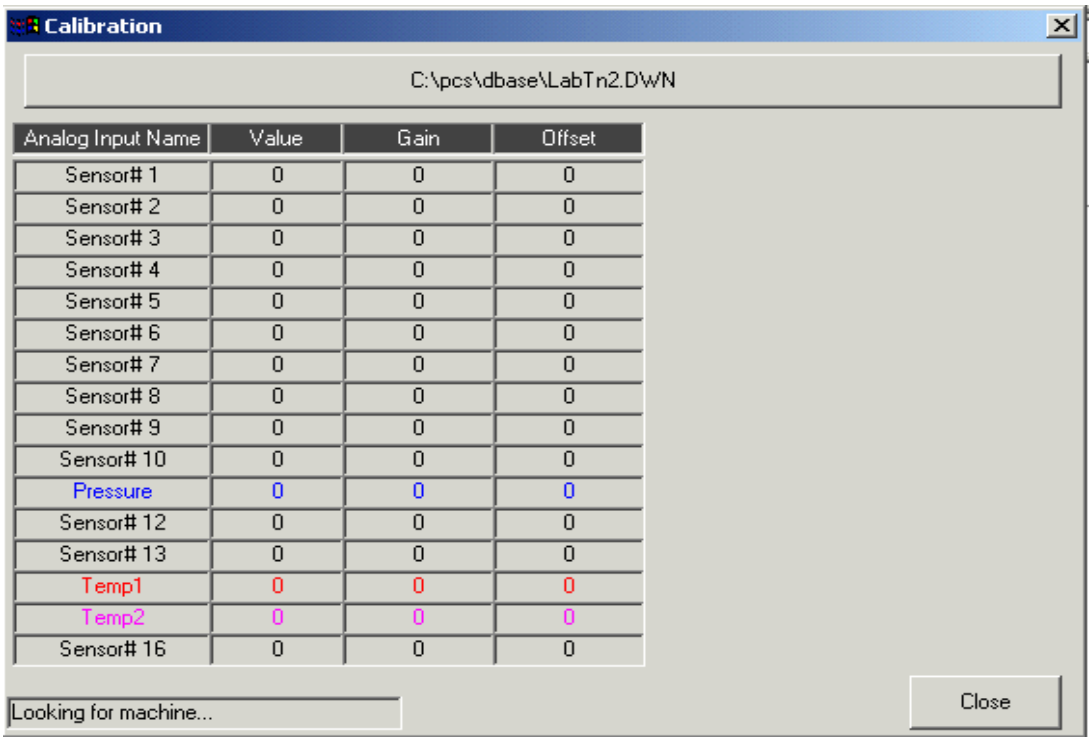
When program is online, the 'Go offline', 'Calibration' and 'Download' buttons will be displayed.

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

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

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

Calibration Window



The calibration window will try to connect with the PCS Target platform.

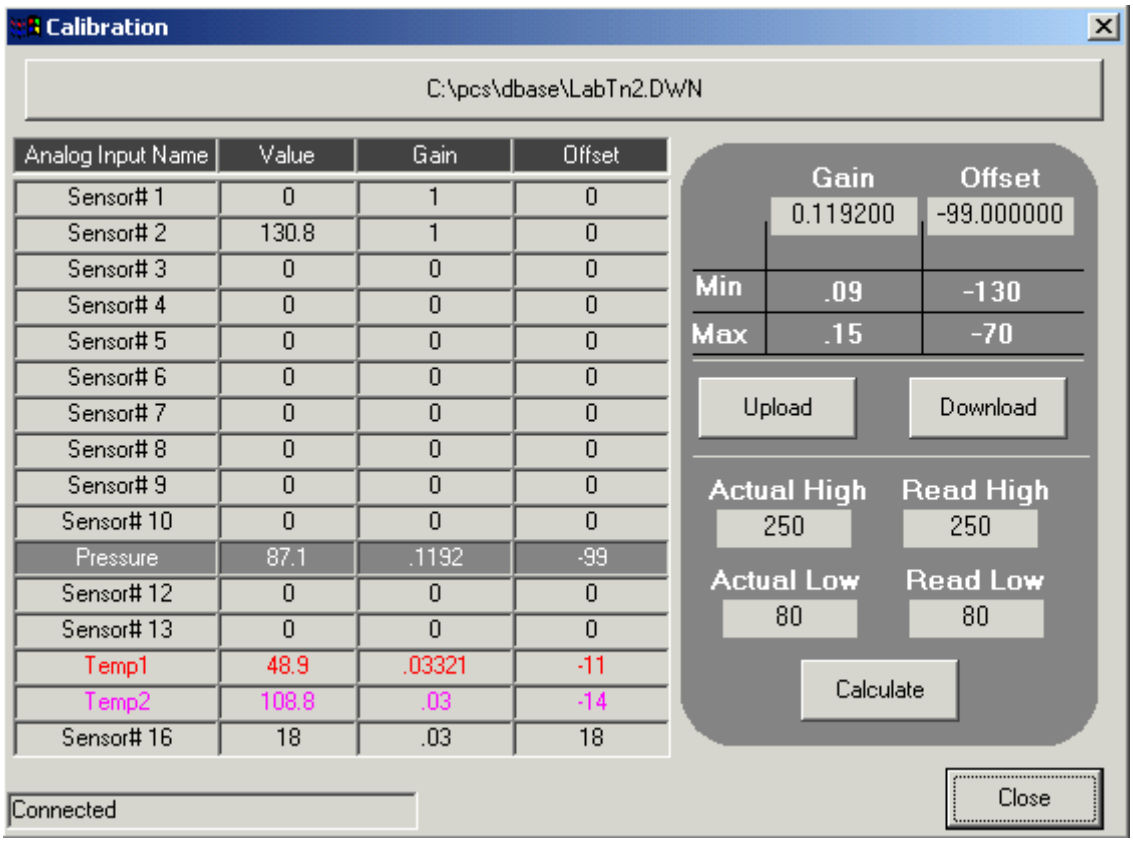
The connection tasks are:

8. Check if target is connected. In the status bar "Looking for machine…" is displayed.
9. Upload all 16 analog inputs Gain and Offset values. In the status bar Uploading gain & offset…" is displayed.
10. 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.

Type File Button

This button enables the user to select a 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, by double clicking on one of the input table rows, the program will display the calibration tool. 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 incorrect 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.

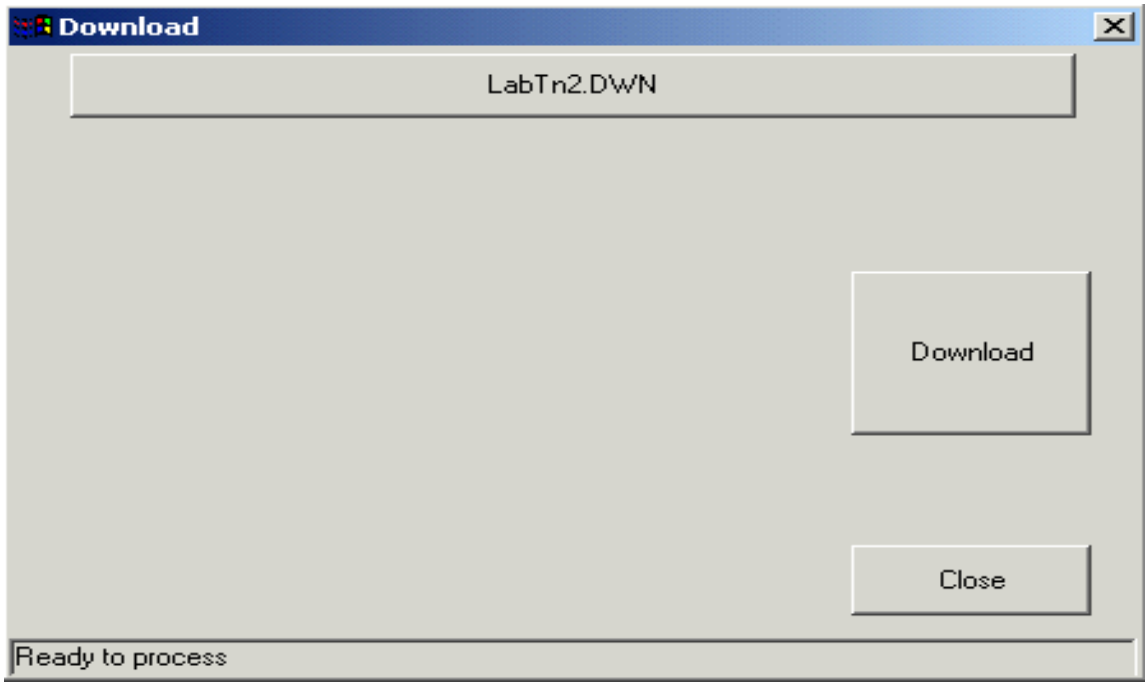
Download button – Press this button to download Gain and Offset of the current selected analog input. The values displayed in Gain and Offset text boxes will be downloaded. If inserted values are wrong, a relevant error message will be displayed and the download operation will be aborted.

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 the user manual supplied with the PCS Target platform. Pressing the '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 the 'Calibration' window and display main XPCS window.



Download window

This window enables downloading of 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 a file-type, if the requested file name is already displayed on the button. (In the above example: "LabTn2.DWN".)

Status bar

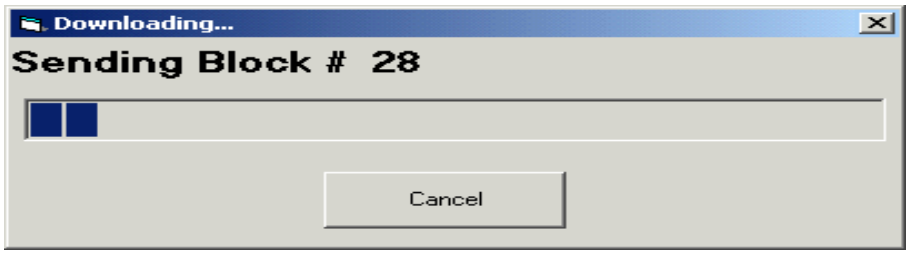
The status bar at the bottom of the window displays the current downloading process status. (In the example above: "Ready to process").

Download button

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

Download Tasks

1. Check if PCS Target is connected. Status message: "Looking for machine..." is displayed.
2. If the '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 on the status bar.
3. If 'Get and Set Parameters' option in 'Options' window is selected, and the 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 on the status bar.
4. Download file. The program will display the 'Downloading…' dialog window with progress bar and counter of the downloaded packets:



5. Wait for the target platform startup. After the 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 on the status bar.

6. 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 on the status bar.

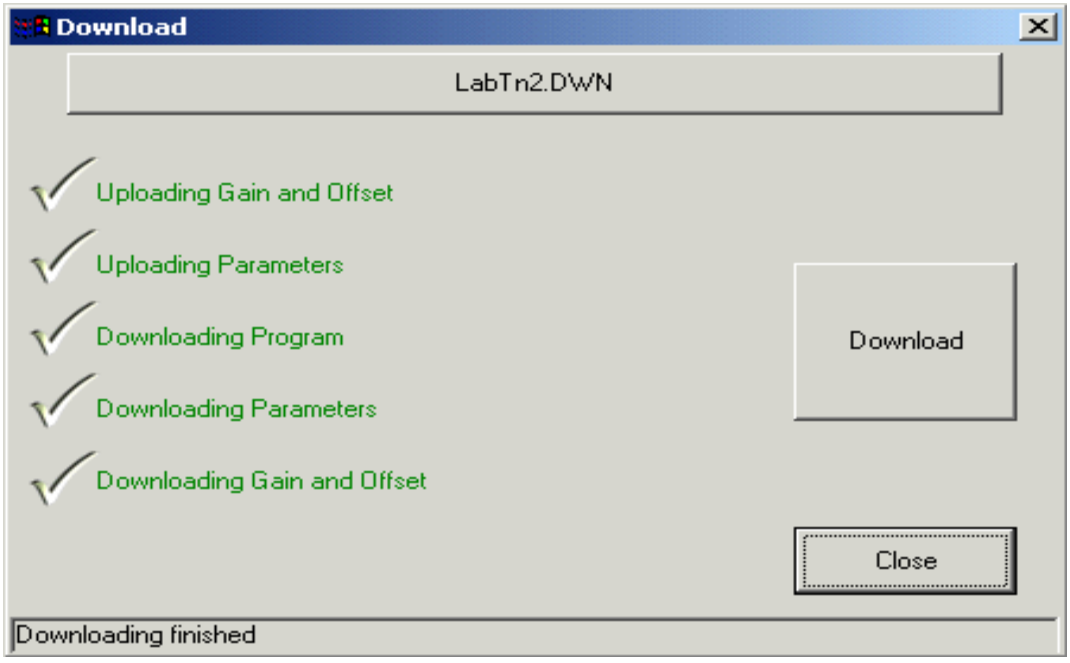
7. If 'Get and Set Gain & Offset' option in 'Options' window is selected, the program will download values of all analog inputs gain and offset. The message: "Downloading Gain and Offset..." will be displayed on the status bar.

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

Note:

If an error occurs during download process, the relevant error message will be displayed. The message box with the 'Retry' option will be displayed.

After the 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

Cannot 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 the RS232 communication cable is connected. If it is a modem connection, check if the modem cable is connected, in this case it can be that the remote modem cable is disconnected or the RS232 cable between the remote modem and target platform is disconnected.

Cannot Upload Parameters!

Description: This message may be displayed during download process, when the program is trying to load Parameters.

Reason: Probably a communication failure between PCS Target and the PC.

Tips: Check if the 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 the 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 the downloaded file is either incorrect or damaged.

Tips: 1. Check if the communication RS232 cable is connected. If it is a modem connection, check if modem cable is connected. In this case it may 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 cannot save data on flash memory.

Tips: 1. Check if the communication RS232 cable is connected. If it is a modem connection, check if the modem cable is connected. 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 the PCS target platform is damaged and cannot save data on flash memory.

Tips: 1. Check if the communication RS232 cable is connected. If it is a modem connection, check if the modem cable is connected. It may 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.

 **Error Opening Type file: *File Name***

Description: This message may be displayed during the downloading process, when the program is trying to open the 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 and in the worst case, restart the PC. If the problem persists, 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: This message is displayed when the user is trying to calculate Gain and Offset by pressing the 'Calculate' button in the 'Calibration' window.

Reason: An incorrect number or non-numeric data has been inserted in one of the text boxes.

Tips: Type the correct 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: An incorrect number has been inserted in one of the text boxes. A correct number must be entered: 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 less than Read Low value

Tips: Read High value must be greater than Read Low value.

Cannot 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.

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: This message is 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: This message is 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 presses 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 presses the 'OK' button in the 'Options' window.

Reason: Wrong Baud rate is inserted.

Tips: Type values 9600 or 19200 in the 'Baudrate' text box.

Illegal Wait Loop value: …

Description: This message is displayed when the user presses the '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 presses the 'OK' button in the 'Options' window.

Reason: Wrong Address value is inserted.

Tips: Type numeric value: 0<VAL<17.

Illegal Dial Timeout:

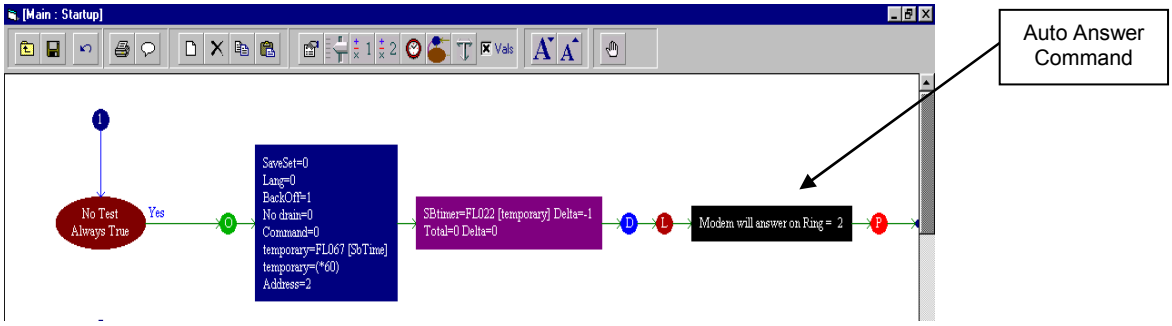
Description: This message is displayed when the user presses the 'OK' button in the 'Options' window.

Reason: Wrong Dial Timeout value is inserted.

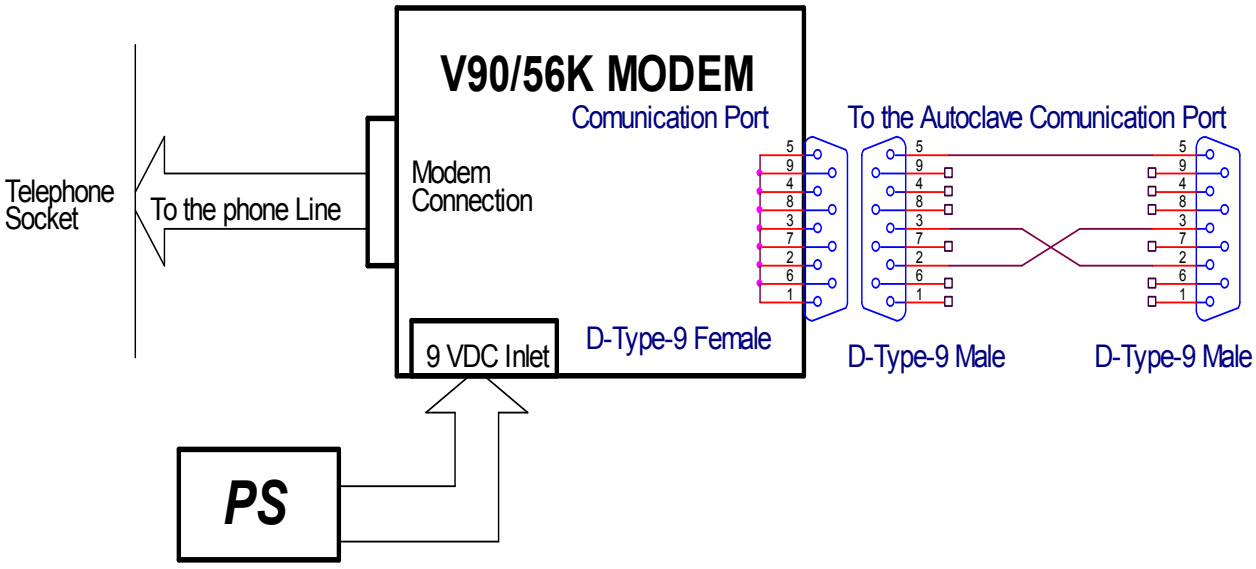
Tips: Type numeric value.

MODEM CONNECTION

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



2. Connect RS232 to Modem Converter according the following diagram:



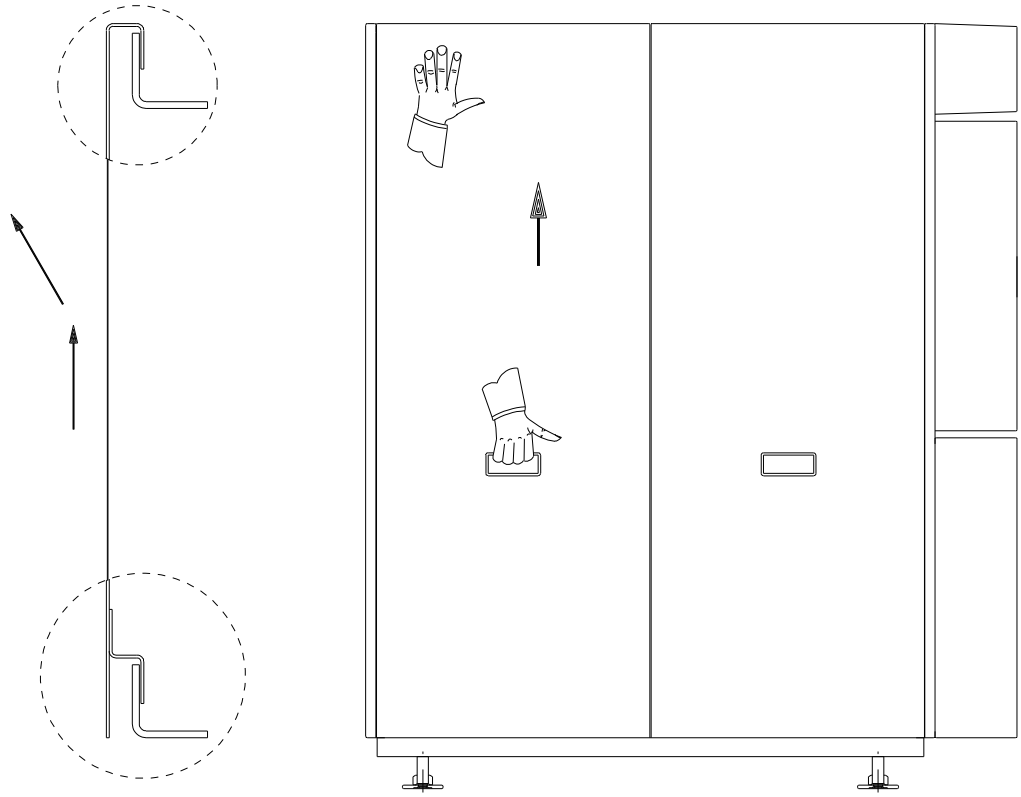
3. Check the Jumpers State according RS232 communication.
4. Turn ON the modem.
5. Turn ON the autoclave.

The system is ready to be connected by modem.

APPENDIX 1

Dismantling the Cabinet Side Panels

Push the side cover upward and pull out.



APPENDIX 2

Exploded View of Door Locking Mechanism