Thermo Electron

Web Systems, Inc.

STEAM-FOIL®

Operator's Manual

Mead Paper Company
South Lee, Massachusetts
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INTRODUCTION

The Thermo Electron Steam-Foil® will provide Mead Paper with the ability to precisely control moisture. In addition, steam consumption and maintenance requirements will be significantly reduced.

This manual is designed for operational use of the Steam-Foil®. It is not meant to be used as a maintenance guide.

MAIN OPERATOR SCREEN

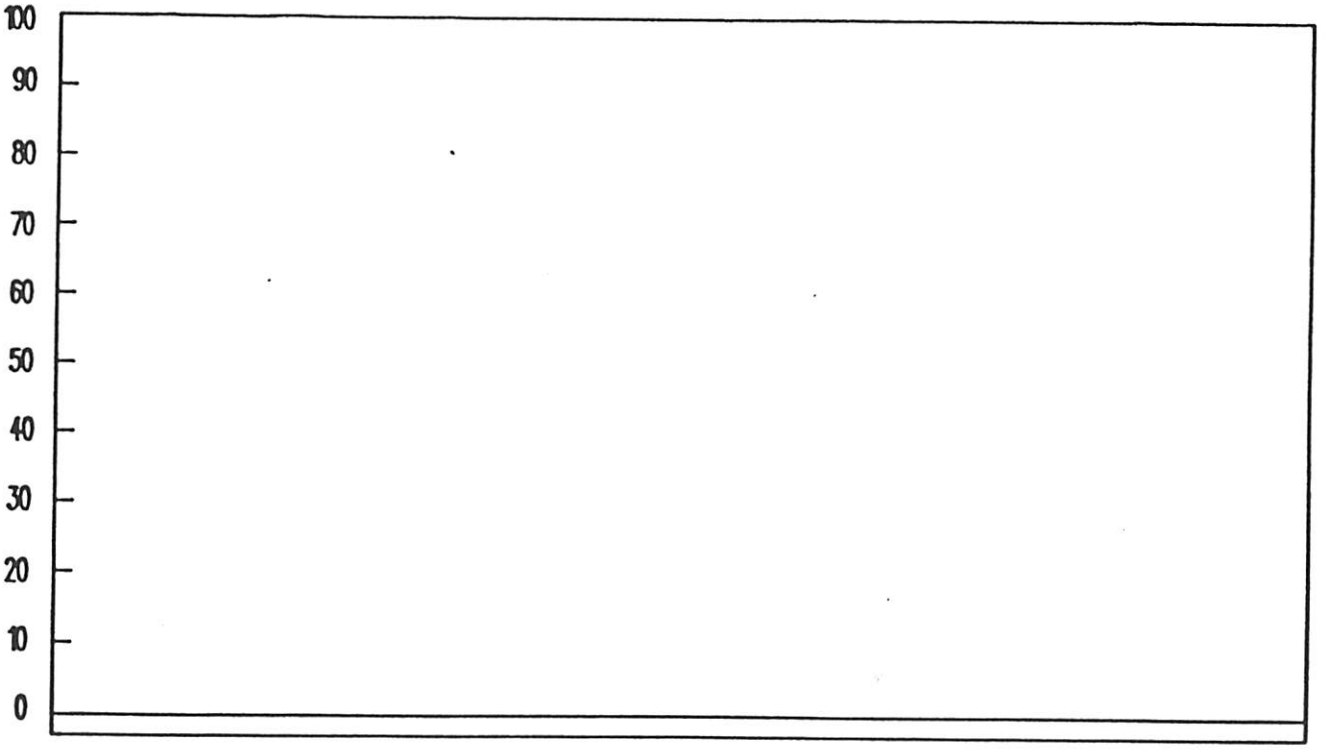
The main operator screen allows the operator to open and close the valves, providing precise application of steam to the sheet. The operator can also access the menu bar at this screen.

The main section of the screen shows the current valve openings for each individual zone. The valve or valves selected for movement are shown in blue, and the remainder of the valves are shown in green. The valve selected is shown in the valve box. The amount the valve is open is shown in the % open box. As data is entered via the numeric keypad, for moving to a zone or to change a valve setting, it is displayed in the set box.

In addition, the current date and time are displayed. The time function will automatically adjust for daylight savings and standard time changes, as well as for leap years.

Profiling Systems Inc.

Steam Foil



KEYPAD

The keypad is arranged in two groups - keys 1 through 20 along the bottom, and the remainder of the keys along the right side. The group on the right side contains ↑↓ and ←→ arrow keys, home, backspace, enter, . (decimal point), -, numbers 0 through 9, and operational keys. The keypad is used to select and enter information which will be used to properly operate the Steam-Foil®. How to use these keys will be explained in detail later in this manual.

HOME - Returns the cursor to the HOME position.

↑↓ ARROW KEYS - These buttons are used to raise or lower valve openings, raise or lower setpoints, or move between parameters in the PID menu.

←→ ARROW KEYS - These buttons are used to move between valves, or to move between screens in the PID menu.

NUMBERS 0-9 - These buttons are used for entering data, i.e. setpoints, valve positions, valve openings.

BACKSPACE - If numerical values are being entered, moves the cursor one space to the left each time the button is pressed. This will erase the digit, and allow the operator to type a new number. This feature will not work after the enter key has been pressed.

ENTER - Causes the data that was typed in to be processed.

F1 TO F20 - These function keys are used to store and recall profiles. A profile that is to be stored is assigned to one of these function keys, and can be recalled by the same function key.

 - Provides access to the PID loop screens.

MENU - Provides access to the menu bar.

MENU BAR

The menu bar allows the operator to access the FUNCTION and PROFILES submenus. In addition, the menu bar contains the SETUP, COM PORT and PID TAGS submenus. The access to the later are protected by password.

The FUNCTION submenu is used for selecting groups of zones or all the zones for simultaneous movement. The PROFILES submenu is used for storing, recalling and deleting grade or size dependant profiles. The SETUP submenu is used for determining what the software will be controlling. The COMPORT submenu establishes the communication link between the host computer and the interface panel. The PID TAGS submenu is used for naming the PID loops.

MENU

To make changes, press ^ to display the menu bar. Press the → arrow key twice. This will display a message at the bottom of the screen to enter the password. Type in the password, then press ENTER. Continue pressing the → arrow key until the desired submenu is highlighted. Use the ↓ arrow key to select the desired function. Make the necessary changes, then move to Exit (or Exit and Save) and press ENTER. The changes will be put into effect.

FUNCTION	PROFILES	SETUP	COM PORT	PID TAGS
Anchor	Scroll n	Steam Foil	Com Port n	tag 1:
Anchor All	Recall Original	Foils n	Baud 9600	new:
	Store at n	Zones n	Reset Valves	
Start Opto	Delete n	Banks n	Load LC4.4TH	Rev 1.xx
Exit	Exit and Save	Exit and Save	Exit and Save	Exit

Function

ANCHOR - Allows the operator to group zones for simultaneous movement

ANCHOR ALL - Allows the operator to move all the zones simultaneously

START OPTO - Initializes communications with Opto 22 boards

EXIT - Leave the menu screen and return to the main operator screen

SCROLL n - Allows the operator to view the profiles stored at each function key location

RECALL ORIGINAL - Used to recall the profile that is currently in use so that it can be stored

STORE AT n - Allows the operator to store a profile at location n

DELETE n - Allows the operator to delete the profile stored at location n

EXIT and SAVE - Exits the menu screen and executes the profile stored at the location indicated by SCROLL n

STEAM-FOIL/MYSTIFIER - Select the unit the software will control

FOILS n - Select the number of foils in use

ZONES n - Select the number of zones in the Steam-Foil

Banks n - Select the number of rows of vales (Mystifier)

EXIT and SAVE - Save the information entered and exit to the main operator screen

Com Port

COM PORT n - Sets the communication port used on the host computer. See the manual that comes with the computer to determine the communication port identification

BAUD - Sets the communication rate between the host computer and the interface panel

RESET VALVES - References the valves, to ensure that they are completely closed.

LOAD LC4.4TH - Downloads the communications program to the LC4 board located in the interface panel

EXIT and SAVE - Saves the information entered and exits to the main operator screen

PID Tags

TAG n - Select the tag name to be changed

NEW - Enter the new tag name

REV x.xx - The revision number of the software in use

EXIT - Returns to the main operator screen

PID LOOPS

The PID loops are used to control various functions within the Steam-Foil system. The most common of these monitor the steam pressure and temperature and the foil temperature. The PID loops will then control the operation of steam pressure control valves and steam superheaters or desuperheaters. Automatic control mode handles all of these chores without operation intervention. Manual mode allows the operator to make adjustments to the control loops during operation.

The PID loop screen is broken into 4 sections. The first section contains the various parameters of the control loop. The first 4 values are used to determine the output of the PID loop and the mode of operation. The remainder of the values are used to tune the PID loop, set the alarm limits, and set display information. This area is password protected.

The second section contains graphs showing the setpoint, alarm limits, and process variable. In addition, this block shows the PID tag and operational mode.

The third section, called set, is used for entering information from the numeric keypad.

The fourth block shows a graph of the trend of the control variable over time. This graph is used for control tuning.

As the operator moves from one variable to the next using the ↑↓ arrow keys, the variable is highlighted. The operator enters the new value, which is displayed in the set box as it is typed. Pressing Enter will change the highlighted value to the new value.

MODE - Toggles between AUTO and MANUAL mode for the PID loop. In AUTO mode, the operator enters the setpoint, and the software controls the response of the PID loop and ensures that the setpoint is maintained. In MANUAL mode, the operator must make adjustments to maintain the proper output.

OUTPUT VAL - Used to control steam pressure control valves, superheaters and desuperheaters. The output value indicates the signal provided to the various components, such as a steam pressure control valve. This value is also displayed on the horizontal graph on the left of the PID screen, and indicated as % open.

PROCESS VAR - Indicates the current output value. This value is a reflection of the setpoint. The goal is for the process variable to achieve and

maintain the setpoint value.

LOW ALARM - Sets the low alarm condition. If the process variable drops below the low alarm, an alarm will alert the operator of this condition. This point is indicated by the letter L on the vertical graph at the left of the PID screen.

HIGH ALARM - Sets the high alarm condition. If the process variable rises above the high alarm condition, an alarm will alert the operator of this condition. This point is indicated by the letter H on the vertical graph at the left of the PID screen.

PROP BAND - Sets the proportional band of the PID loop. This is also known as the gain. This is used to tune the response of the control loop.

INTEGRAL - Sets the integral of the PID loop. This is used to control the response of the control loop.

DERIVATIVE - Sets the derivative of the PID loop. This is used to control the response of the control loop.

ACTION - Changes the direction of the valve being controlled.

HIGH SPAN - This value sets the upper limit displayed on the vertical graph at the left of the PID screen.

LOW SPAN - This value sets the lower limit displayed on the vertical graph at the left of the PID screen.

SETPOINT HIGH - The upper limit of the setpoint. An alarm will indicate the setpoint has exceeded the setpoint high, and the vales will close (see EVENT).

SETPOINT LOW - The lower limit of the set point. An alarm will indicate the setpoint is lower than the setpoint low, and the valves will close (SEE EVENT).

SLEW RATE - currently not in use.

EVENT - Determines what will occur in the event of an alarm. If the event is set to 1, the valves will close if an alarm occurs.

CASCAD LOOP - Used for connecting one PID loop to another. For example, using a sped PID loop to control the steam pressure. Currently not in use.

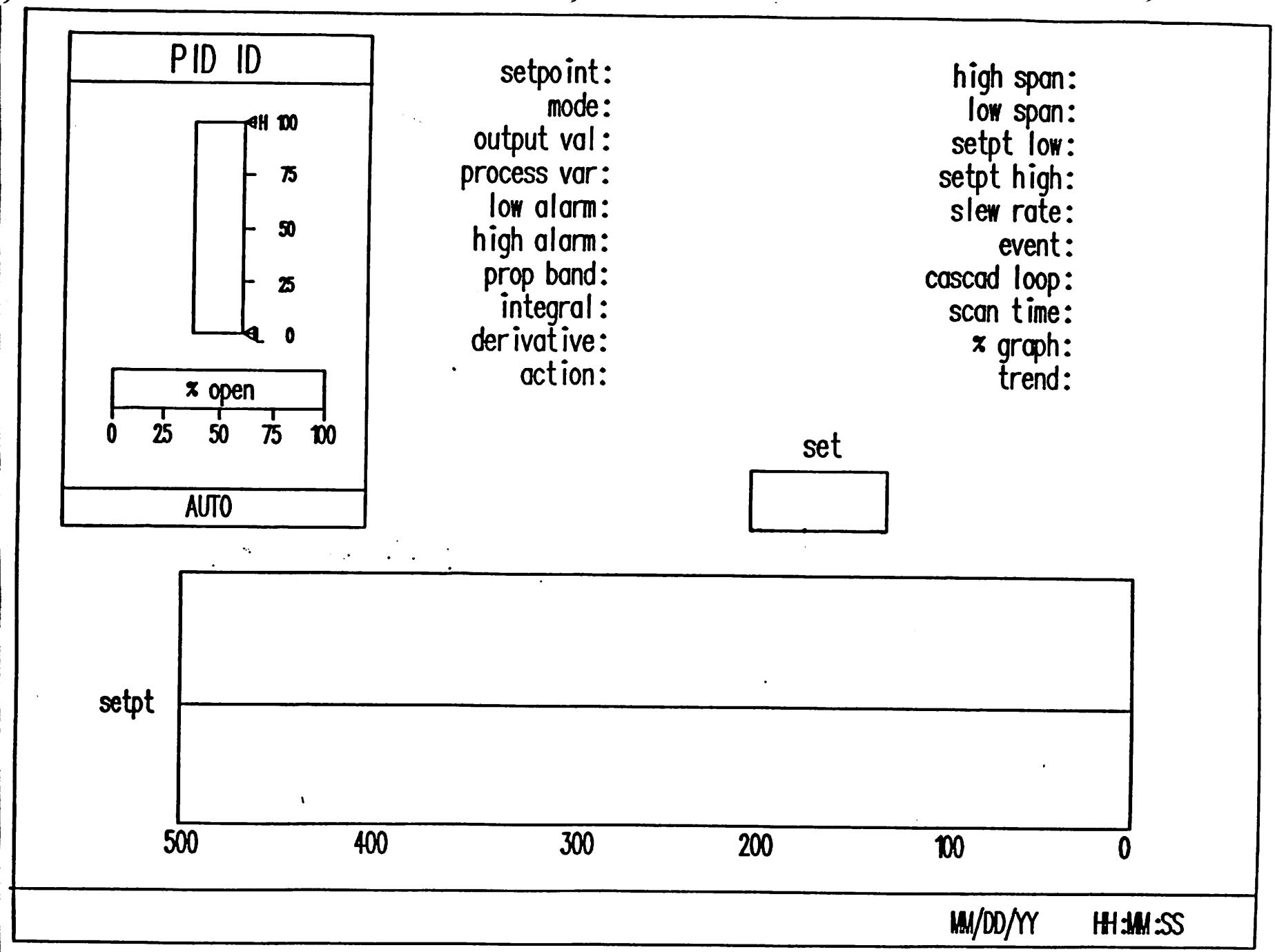
SCAN TIME - Sets the updated rate of the PID loop.

% GRAPH - Sets the high and low points that will be displayed on the setpoint

control graph located at the bottom of the PID screen.

TREND - This toggles the trend plot on and off. The trend displays the response of the PID loop. This is useful for tuning the PID loop.

SET - This block displays values as they are typed in via the numeric keypad.


PID ID
H 100
75
50
25
0
% open
0 25 50 75 100
AUTO
setpoint:
mode:
output val:
process var:
low alarm:
high alarm:
prop band:
integral:
derivative:
action:
high span:
low span:
setpt low:
setpt high:
slew rate:
event:
cascad loop:
scan time:
% graph:
trend:
set
setpt
500 400 300 200 100 0
MM/DD/YY HH:MM:SS

Steam Pressure PID Loop

The steam pressure PID loop is used to control the steam pressure exiting the zones of the Steam-Foil. This steam is applied to the sheet of paper, and is dependent on the application. The steam pressure utilized is determined by tuning, which is performed by Thermo Electron personnel, as well as the mill operators.

The steam pressure is how hard the steam is applied to sheet, while the valves control how much steam is applied. The faster the web, the higher the pressure required to counteract the effect of entrained air. This is necessary so that the steam flows counter to the web direction. This effect can also be achieved by using a lower pressure, but larger valve openings. To correctly tune a system, the proper balance of pressure and valve openings must be found to achieve the desired results, introducing all the steam into the web, while not allowing any of the steam to escape out the front or back of the Steam-Foil.

Steam Temperature PID Loop

The steam temperature PID loop is used to control the steam temperature exiting the zones of the Steam-Foil. Monitoring and controlling the steam temperature is an important function. Different applications depend on different steam temperatures. For applications using the steam for moisture applications require lower temperature steam than applications using steam to control the sheet finish.

Superheated steam is steam that has temperature above saturation for that particular operating pressure. For example, at atmospheric pressure (0 psig.), saturation is at 212° F. Superheated steam is hotter than this temperature, at this pressure. So called "wet" steam is steam colder than this temperature.

Two devices are used to control steam temperature, depending on the quality of the mill supply. A superheater is used to elevate the temperature of the steam, using the mill's main supply to heat the Steam-Foil's regulated supply. A de-superheater uses water to lower the steam temperature to a more usable level. Some installations may not require either of these devices.

Applications using steam to de-water or to improve sheet finish requires several degrees of superheated steam. This is typically 5 to 10 degrees above superheat.

Steam-Foil Temperature PID Loop

The Steam-Foil temperature PID loop monitors the temperature of the Steam-Foil. This is provided for informational use only. It is important that the temperature of the Steam-Foil be high enough to maintain a properly preheated condition. If the Steam-Foil is too cold, moisture may collect on the outside surface of the foil, condense and possibly drip.

SYSTEM OPERATION

This section demonstrates how to use the various functions of the Steam-Foil®. In addition to functions involving the main operator screen, the FUNCTION and PROFILES submenus are discussed.

Open/close 1 valve

1. Use the ←→ arrow keys to move to the desired zone. Zone numbers can be read in the valve block on the right side of the operators screen

   -or-

   Type the desired zone number. Pressing the ← or → arrow key will move the cursor to the selected zone.

2. Type in the desire value. This value is how much the zone is to be increased or decreased by, not the final desired value.

   example: The zone selected is currently 25% open, and the operator wants the valve 40% open. A value of 15% will be entered.

3. Pressing the ↑ arrow key will increase the valve opening by the desired amount. Pressing the ↓ arrow key will decrease the valve opening by the desired amount.

4. If the operator wishes to make a small adjustment of a valve opening, he can use the ↑↓ arrow keys without entering a value. Pressing the ↑ arrow key will increase the valve opening by 1 %. Pressing the ↓ arrow key decrease the valve opening by the same amount.

Open/close a group of valves

1. Use the same procedure as above to select the first valve in the group.

2. Press MENU ^ to access the menu bar.

3. Press the ↓ arrow key once to highlight Anchor, then press the Enter key.

4. Use the → arrow key to select the remainder of the zones in the group.

5. Use the same procedures described in the open/close 1 valve section to open or close the valves.

Open/close all valves

MENU

1. Press ^ to access the menu bar.

2. Press the ↓ arrow key twice to highlight Anchor All, then press the Enter key.

3. Use the same procedures described in the open/close 1 valve section to open or close the valves.

Scroll n

MENU

1. Press ^ to access the menu bar.

2. Press the → arrow key once to highlight the PROFILES submenu.

3. Press the ↓ arrow key once to highlight Scroll.

4. Press the function key (F1 to F20) where the stored profile is located.

- or -

Press the Enter key. This will move to the next profile in numerical order, i.e. if Scroll 5 is currently displayed, pressing the enter key will move to Scroll 6.

note: The number keys can be used instead of the function keys. For example, pressing 7 on the numeric keypad, then Enter, is the same as pressing F7.

Saving a profile

1. Press MENU ∧ to access the menu bar.

2. Press the → arrow key once to highlight the PROFILES submenu.

3. Press the ↓ arrow key once to highlight Scroll.

4. Press the function key where the profile will be stored.

5. Press the ↓ arrow key to highlight Recall Original, then press the Enter key. This will call up the profile from the main operator screen.

6. Press the ↓ arrow key to highlight Store at n, then press the Enter key. The profile is now stored at the desired location.

7. Press MENU ∧ to return the main operator screen.

Deleting a Profile

1. Press MENU ^ to access the Menu bar.
2. Press the → arrow key to highlight PROFILES.
3. Press the ↓ arrow key to highlight Scroll n.
4. Press the function key (F1 - F20) where the profile to be deleted is stored.
5. Press the ↓ arrow key 3 times to highlight Delete n.
6. Press Enter to delete the profile.
7. Press MENU ^ to return to the main operator screen.

Executing a stored profile

1. Press MENU ∧ to access the Menu bar.
2. Press the → arrow key to highlight PROFILES.
3. Press the ↓ arrow key to highlight Scroll n.
4. Press the function key (F1 - F20) where the profile is stored.
5. Press the ↑ arrow key to highlight Exit and Save.
6. Press Enter. This will execute the profile, and return to the main operator screen.

STARTUP/SHUTDOWN PROCEDURES

This section describes how to startup and shutdown the Steam-Foil system. This includes the steam, electrical, and software components of the system.

A shutdown encompasses turning off the system if the Steam-Foil will not be used for an extended period of time, such as a mill shutdown, or if a grade of paper not requiring the Steam-Foil is being run. If the Steam-Foil will be out of operation for only several hours, the system can remain heated without causing any problems with the paper, especially if the mill has a retraction system for the Steam-Foil.

1. Open the 3 preheat drain valves located under the dryer to full open.

2. Open the condensate return hand valve located under the Steam-Foil, on the operator side, to full open.

3. Open the preheat ball valve, located on the gear side, to full open.

4. Allow 15 to 20 minutes to preheat the Steam-Foil.

5. Close the 3 drain valves, then reopen 3 turns.

6. Use the Nematron computer to ensure that the steam pressure is set to 0.

7. Open the 2 hand valves, located above and below the main steam control valve, to full open. Check to ensure that the bypass valve is closed.

8. Using the Nematron computer, set the desired operating pressure via the steam pressure control loop.

9. After 5 to 10 minutes of heating, the unit is now ready for operation.

Shutdown procedure

1. Using the Nematron computer, set the operating pressure to 0 psig. This will close the control valve.

2. Open the 3 drain valves located under the dryer to full open.

3. Close the preheat ball valve.

4. Close the second main steam hand valve.

RECOMMENDED STEAM TEMPERATURE SET POINT
FOR POUNDS OF PRESSURE

LBS OF PRESSURE	RECOMMENDED TEMP SET POINT MINIMUM: SATURATION + 3 DEGREES SUPERHEAT	MAXIMUM: SATURATION + 7 DEGREES SUPERHEAT	SATURATION TEMP REFERENCE
.05	216.5	220.5	213.5
1.0	218.0	222.0	215.0
1.5	219.5	223.5	216.5
2.0	221.3	225.3	218.3
2.5	223.0	227.0	220.0
3.0	224.3	228.3	221.3
3.5	225.6	229.6	222.6
4.0	227.0	231.0	224.0
4.5	228.3	232.3	225.3
5.0	229.6	233.6	226.6
5.5	231.0	235.0	228.0
6.0	232.3	236.3	229.3
6.5	233.6	237.6	230.6
7.0	235.0	239.0	232.0
7.5	236.3	240.3	233.3
8.0	237.6	241.6	234.6
8.5	239.0	243.0	236.0
9.0	240.2	244.2	237.2
9.5	241.3	245.3	238.3
10.0	242.4	246.4	239.4
10.5	243.5	247.5	240.5
11.0	244.5	248.5	241.5
11.5	245.6	249.6	242.6
12.0	246.7	250.7	243.7
12.5	247.7	241.7	244.7
13.0	248.7	252.7	245.7
13.5	249.7	253.7	246.7
14.0	250.8	254.8	247.8
14.5	251.8	255.8	248.8
15.0	252.7	256.7	249.7