



Type F21100 Tube Furnace

OPERATION MANUAL
AND PARTS LIST
SERIES 1260

Model #	Voltage	Control
F21125	120	Manual
F21120	240	Manual
F21120-33	230	Manual
F21130	240	Single Set Point
F21130-33	230	Single Set Point
F21135	120	Single Set Point

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Operation



Caution

Monitor furnace if percent time input is set greater than 40% on and particularly when the control is set on "9" or above. The furnace may overheat and burn out the elements or thermocouple if not properly monitored under these conditions.



Caution

Do not use in the presence of flammable or combustible chemicals. Fire or explosion may result; this device contains components which may ignite such materials.



Hot Surface

"Caution: Hot Surface. Avoid Contact." To avoid burns, do not touch this furnace on the exterior or interior surfaces during use or for a period of time after use.

Operation of Manual and Automatic Models

Observe These Warnings Before Operating Your Furnace:

Manual Control Models (F21120-33, F21125, F21120)

The control switch is a combination ON/OFF switch and temperature control. The furnace is ON at any setting of the control switch except in the OFF position. Turn the control switch counterclockwise to set rate of heating.

Cycle Light: The amber cycle light will illuminate whenever the power is being applied to the elements.

The marks on the control indicate the percent of time power is applied to the heating elements. An increase in percent time "On" results in a higher chamber temperature. Adjust control switch to maintain desired temperature setting. To turn the furnace off, turn control either fully clockwise or fully counterclockwise to the OFF position.

Pyrometer

The pyrometer with a thermocouple indicates the chamber temperature. It does not control the furnace in any manner. It is provided to enable the operator to observe the temperature within the chamber.

Operation

All Modes Single Set Point Temperature Control (Automatic)
(F21130, F21130-33, F21135)



Warning

To avoid personal injury do not use in the presence of flammable or combustible chemicals; fire or explosion may result. This device contains components which may ignite such materials.



Hot Surface

Caution: Avoid Contact. To avoid burns, this furnace must not be touched on the exterior or interior surfaces during use or for a period of time after use.



Warning

Always wear safety glasses or a safety shield and high temperature gloves when loading or unloading the furnace. Long sleeved, fire retardant clothing and a fire retardant apron is also recommended.

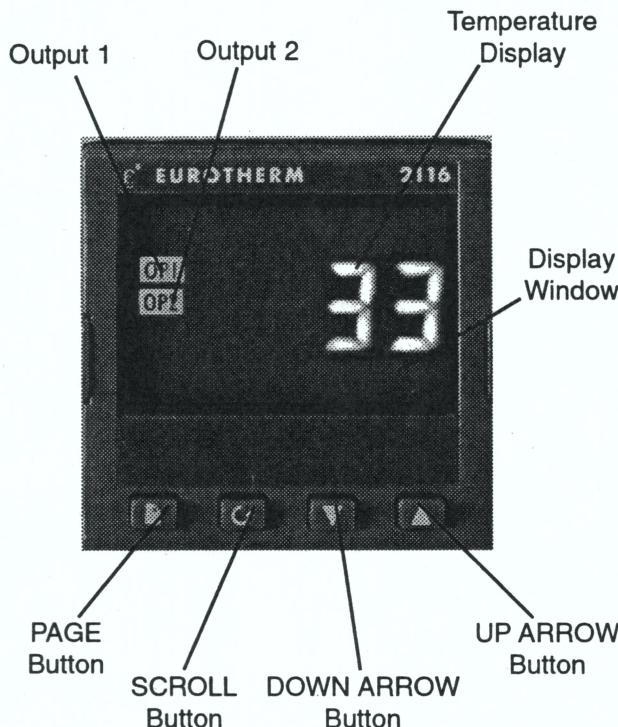
Power Switch

Both the ON/OFF power switch and the digital display will illuminate when power is switched ON. The furnace will begin to heat to the controller's current setpoint.

Cycle Light

The amber cycle light will illuminate whenever the power is being applied to the heating elements. The cycle light will turn on and off as the furnace reaches the setpoint.

Single Setpoint Controller



The **single setpoint model** furnace controller is a single setpoint controller which provides a single digital display to indicate the current chamber temperature or setpoint temperature. This temperature controller features sensor break protection and self-tuning capability.

Basic Operation

When the controller is turned ON it will perform a short self-test and then display the measured value (process value) in the HOME DISPLAY.

Buttons and Indicators

OP1 (Output 1): Illuminates when the logic output is ON.

OP2 (Output 2): Illuminates when the relay output is ON (will go out during an alarm situation).

PAGE button: Allows you to select a new list of parameters.

SCROLL button: Allows you to select a parameter within a list of parameters.

DOWN button: Allows you to decrease a value.

UP button: Allows you to increase a value.

Single Setpoint Models



Note

If at any time you want to return to the HOME DISPLAY, simultaneously press the PAGE and SCROLL buttons.

To View or Change the Setpoint

To view the setpoint, press and release the UP or DOWN buttons. If you want to change the setpoint, continue pressing until the desired setpoint value is displayed and then release the button. A few seconds after the button is released, the controller will accept the new value and revert to the HOME DISPLAY.

desired setpoint value is displayed and then release the button. A few seconds after the button is released, the controller will accept the new value and revert to the HOME DISPLAY.

To View the Display Units

From the HOME DISPLAY press the SCROLL button. The display will show the temperature units in °C/F/K and then return to the HOME DISPLAY. (Call Customer Service if you require a different temperature unit.)

To View the % Output Power

From the HOME DISPLAY press the SCROLL button twice. Press and release the UP or DOWN button to view the % output power. This value is a read-only value and cannot be changed.

Controller Parameters

Home display

°C: Temperature units in Celsius. Temperature units can not be changed without entering the configuration. Contact Customer Service if a different temperature unit is required.

OP: % output power demand.

IdHi: Deviation high alarm.

AI List

IdHi: Deviation high alarm.

Atun List

tunE: One-shot autotune enable.

Pid List

Pb: Proportional band (in display units).

SINGLE SETPOINT CONTROLLER

ti: Integral time in seconds.

td: Derivative time in seconds.

ACCS List Code: Access code (Code needed to enter or change the other configuration parameters which are not normally accessible.) Not accessible.

Alarms

The controller will flash an alarm message in the home display if an alarm condition is detected.

2FSH: Measured value full scale high alarm.

IdHi: Measured value deviation high alarm.

S.br: Sensor break: check that sensor is connected correctly.

L.br: Loop break: check that the heating circuits are working properly.

Ld.F: Heater Circuit fault: indication of either an open or short solid state relay, a blown fuse, missing supply or open circuit heater.



Note

The following alarm messages are factory default settings and may vary if you have changed the configuration of your controller:

IDHi: = 50°C

2FSH = 1225°C

Sensor Break Protection

This controller provides sensor break protection in the event the thermocouple opens. If an open thermocouple condition occurs, the digital display will blink "S.br" and the power to the heating element will be shut OFF (Cycle light will extinguish).

Over-Temperature Protection (OTP)

The OTP will be in effect during any alarm condition when the temperature of the furnace has deviated beyond the limit. The "Deviation High" alarm is the only alarm value which can be changed. To change it, press

the SCROLL button until "IdHi" appears on the display. Press the UP or DOWN button to select the OTP value you desire. We recommend a value of 20° above your working temperature to provide protection for your work-load.

Tuning

This controller incorporates a self-tuning feature which determines the optimum control parameters for the best temperature accuracy with your load and setpoint. Use this feature the first time you use your furnace and each time you change either your setpoint or the type of load you are heating. Barnstead|Thermolyne recommends you use this feature to provide the best temperature accuracy the controller can attain. To use the tuning feature:

1. Adjust the setpoint to your desired value.
2. Press the PAGE button until display reads, "Atun."
3. Press the SCROLL button. Display will read, "tunE."
4. Press the UP or DOWN button to select, "on."
5. Simultaneously press the PAGE and SCROLL buttons to return to the HOME DISPLAY. The display will alternately flash between "tunE" and the HOME DISPLAY while tuning is in progress.
6. The controller will then turn the heating on and off to induce an oscillation. When the measured value reaches the required setpoint the first cycle will end.
7. Tuning will be complete after two oscillation cycles and then the tuner will turn itself off.
8. Normal control function will resume after the controller calculates tuning parameters.

**Note**

"Stat" and "Sp.rr" in Sp list must be set to OFF or "tunE" will not initiate.

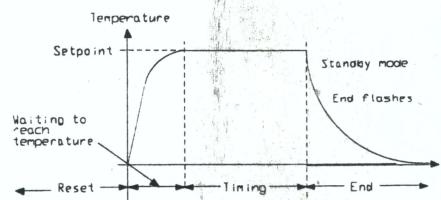
**Note**

Furnace must be at ambient temperature before starting a tune.

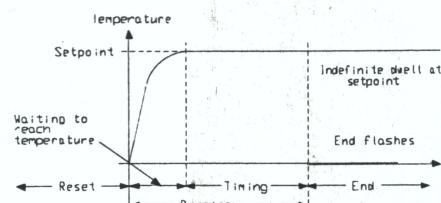
**Note**

Tune has completed when "tunE" stops flashing on display.

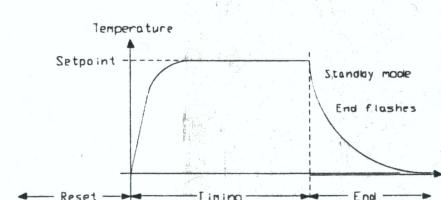
Single Ramp & Dwell



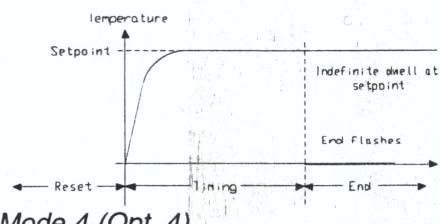
Mode 1 (Opt. 1)



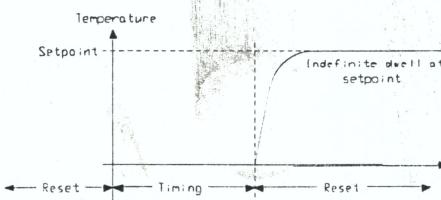
Mode 2 (Opt. 2)



Mode 3 (Opt. 3)



Mode 4 (Opt. 4)



Mode 5 (Opt. 5)

Functions

This type of controller has single ramp and dwell programming capabilities. The Ramp and Dwell can be configured to five different modes.

1. Mode 1 (Opt. 1) is a Ramp (if needed) to the Setpoint temperature, a Dwell, and then a cool down.
2. Mode 2 (Opt. 2) is the same as mode 1, except the controller continues to heat at the Setpoint after the Dwell has completed. (This mode does not cool down.)
3. Mode 3 (Opt. 3) is the same as mode 1, except the Dwell time includes the Ramp (if needed).
4. Mode 4 (Opt. 4) is the same as mode 2, except the Dwell time includes the Ramp (if needed).
5. Mode 5 (Opt. 5) is a Dwell (delay time) before the controller Ramps (if needed) to the Setpoint temperature.

Program Overview

- A program mode can be set by changing the "tm.OP" variable to "Opt. 1, Opt. 2, Opt. 3, Opt. 4, or Opt. 5."
- A Ramp rate may be set by changing the "SPrr" variable to a value. The Ramp rate units are in degrees per minute.
- The Dwell time can be set by changing the "dwEl" variable to the desired value. Dwell time units are in minutes.
- The program Status can be set by changing the "StAt" variable to "run" or "oFF." This variable will start or stop the program.



Note

The program must be stopped and the controller must be displaying the actual temperature before beginning the Setup.

Program Setup

1. Press the PAGE button until the "SP" is displayed.
2. Press the SCROLL button once, "SPrr" (Ramp Rate) will be displayed, set the desired Ramp rate with the UP or DOWN buttons, if the ramp to set-point feature is needed. If the Ramp rate is not needed, then set to "OFF" with the UP or DOWN buttons.
3. Press the SCROLL button once, "tm.OP" (Ramp & Dwell mode) will be displayed, select the desired mode with the UP or DOWN buttons. (Opt. 1, Opt. 2, Opt. 3, Opt. 4, Opt. 5)
4. Press the SCROLL button once, "dwEll" will be displayed, set the desired Dwell time with the UP or DOWN buttons. (Dwell in minutes.)
5. Press the PAGE button until the Actual temperature is displayed.

Running the Program

1. Press the SCROLL button until "StAt" is displayed, set to "run" with the UP or DOWN buttons.
2. Press the PAGE button to display Actual temperature.

Stopping the Program

Press the SCROLL button until "StAt" is displayed, set to "oFF" with the UP or DOWN buttons.

Clearing the Flashing End

Press the PAGE and SCROLL buttons at the same time.

SINGLE RAMP & DWELL CONTROLLER

Verifying a Running Program

Press the SCROLL button until "StAt" is displayed. The display will show "run" if the program is running, or "oFF" if it is not running. Press the PAGE button to display Actual temperature.

Furnace Loading



Caution

Do not overload your furnace chamber. Failure to observe this caution could result in damage to furnace components.

Furnace Loading

For best results of furnace loading and temperature uniformity, use only the center six inches of the furnace chamber.

Keep objects away from thermocouple.

Use insulated tongs and mittens when loading and unloading furnace.

Always wear safety glasses.

Use the proper process tube.

Preventative Maintenance

Preventative Maintenance

Contamination is a major cause of element failure, therefore, when possible, remove the fume forming material before heating. (e.g., cleaning cutting oil from tool steel).

Housekeeping is vital to your electric furnace—KEEP IT CLEAN! Run your furnace up to 871°C empty occasionally to burn off the contamination that may exist on the insulation and elements. Run for approximately two hours with the process tube removed.

Element life is reduced somewhat by repeated heating and cooling. If the furnace is to be used again within a few hours, it is best to keep it at the operating temperature or at a reduced level such as 260°C.

During normal use the thermocouple in your furnace can become oxidized and cause inaccurate readings; therefore, we suggest that if you regularly use your furnace **you should change your thermocouple once every six months to assure the accuracy of your meter readings.**



Warning

To avoid electrical shock, this furnace must always be disconnect from the power supply prior to maintenance and servicing.

Refer servicing to qualified personnel.

General Cleaning Instructions

Wipe exterior surfaces with lightly dampened cloth containing mild soap solution.

Troubleshooting



WARNING

THIS FURNACE CONTAINS REFRactory CERAMIC INSULATION WHICH CAN PRODUCE RESPIRABLE FIBERS AND DUST WHEN HANDLED. THESE FIBERS CAN CAUSE IRRITATION AND CAN AGGRAVATE PRE-EXISTING RESPIRATORY DISEASE. THE INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (IARC) HAS CLASSIFIED REFRactory CERAMIC FIBER AS POSSIBLY CARCINOGENIC.

AFTER SERVICE REFRactory CERAMIC FIBER DUST MAY CONTAIN CRYSTALLINE SILICA, WHICH MAY CAUSE LUNG DAMAGE (SILICOSIS) AND WHICH HAS BEEN CLASSED BY IARC AS A PROBABLE CARCINOGEN.

The refractory ceramic materials are located in the hearth collar and in the chamber of the furnace. Tests performed by the manufacturer indicate that there is no significant risk of exposure to dust or respirable refractory ceramic fiber resulting from operation of the equipment under normal conditions. However, there may be a risk of exposure to respirable refractory ceramic dust or fiber when repairing or maintaining the insulating materials, or when otherwise disturbing the materials in a manner which causes release of dust or fibers therefrom. Through the use of proper handling procedures you can work safely with these insulating materials and minimize any exposure. Accordingly, before you repair or replace any insulating materials, or perform any other servicing on this product which could disturb or cause exposure to dust from insulating materials, you should consult the appropriate Material Safety Data Sheets (MSDS's) for such products with respect to proper handling and appropriate protective equipment. For additional MSDS's, or additional information concerning the handling of refractory ceramic products, please contact the Customer Service Department of Barnstead International.

REFER SERVICING TO QUALIFIED PERSONNEL.



WARNING

Disconnect from the power supply prior to maintenance and servicing.

Refer servicing to qualified personnel.

The Troubleshooting section is intended to aid in defining and correcting possible service problems. When using the chart, select the problem category that resembles the malfunction. Then proceed to the possible causes category and take necessary corrective action.

TROUBLESHOOTING

Problem	Possible Causes	Corrective Action
The power switch light does not illuminate.	The furnace is not connected to power supply.	Check furnace connection to power supply.
No display on Single Set Point Control	ON and OFF power switch defective.	Replace power switch.
The furnace does not heat.	No power.	Check power source and fuses or breakers.
	Thermocouple is open or thermocouple leads reversed. Controller malfunction. control. Element burned out. Solid state relay defective. Chamber section not connected to base.	Replace thermocouple or check thermocouple connections. Verify and correct all parameters and configuration values. If "malfunction" persists, replace Replace element. Replace solid state relay. Reconnect chamber section to base.
Slow heatup.	Low line voltage. Heavy load in chamber. Wrong heating element. Low SPrr setting.	Install line of sufficient size and proper voltage. (Isolate furnace from other electrical loads.) Lighten load in chamber to allow heat to circulate. Install proper element. Increase setting.

TROUBLESHOOTING

Problem	Possible Causes	Corrective Action
Repeated element burnout.	Overheating furnace. Control malfunction. Incorrect element. Oxidized thermocouple leading to inaccurate reading. Wired improperly.	Keep furnace under maximum temperature. Closer supervision of control setting. Replace control. Install proper element. Replace thermocouple. Check wiring diagram for correct wiring of your furnace.
Inaccurate temperature readout.	Oxidized or contaminated thermocouple. Poor thermocouple connection. Improper loading procedures. Poor ventilation of base. Thermocouple connections reversed. *Static charge on pyrometer case. breathing on cover, Control out of calibration. P.I.D. values invalid. Control malfunction.	Replace thermocouple. Tighten connections. Use proper loading procedures. Clear area around furnace base. Reconnect thermocouple correctly. Dispel static charge by treat for static charge. Contact Barnstead International Re-tune control. Verify and correct all parameter and configuration values. If "malfunction" persists, replace control.

*Applies to the manual temperature control models.

Maintenance and Servicing

Maintenance and Servicing

To Replace Vestibule End Caps

- a. Disconnect furnace from power supply.
- b. Remove the metal end cap.
- c. Remove old vestibule. Insert the new vestibule, aligning the two holes in the vestibule with the holes on the bracket.
- d. Before pushing the metal end caps back onto the chamber, insert the two screws through the holes in the metal end cap and vestibule. Then, start the two screws into the holes in the bracket two or three turns, push the metal end cap onto the chamber and finish tightening the two screws.
- e. Reconnect furnace to power supply.



Note

Perform only maintenance described in this manual. Contact an authorized dealer or our factory for parts and assistance.

To Replace Heating Element

- a. Disconnect furnace from power supply.
- b. Disconnect the cord from furnace chamber to control base. Identify the color and placement of the thermocouple extension wires and disconnect from control base.
- c. Remove furnace chamber from the bracket.
- d. Remove both end caps and vestibules of furnace chamber.
- e. Remove terminal plate with four screws to expose wiring. (Note placement and connection of thermocouple and element wires.)
- f. Remove two element lead wires from terminal block. Also, remove thermocouple by removing two screws on terminal block then pulling it straight back.
- g. Remove the four screws that secure heating element tube inside the case, then slide out the old heating element tube.
- h. Insert new heating element tube and thread each element lead wire through the brass bushings.
- i. Secure heating element tube to case.
- j. Reinstall thermocouple and connect thermocouple and new element lead wires to terminal block.
- k. Replace terminal plate.
- l. Insert the screw on the terminal plate through the mounting bracket and secure with knob.
- m. Replace both end caps and vestibules.
- n. Reconnect power cord from furnace chamber to control base.
- o. Reconnect thermocouple extension wires to control base

- terminal block. Looking from the rear of the furnace, reconnect the red wire to the terminal on the far right side of the block. The yellow wire connects to the terminal second from the right side of the terminal block.
- p. Reconnect furnace to power supply.
-

To Replace Pyrometer (Manual Control Models)

- a. Disconnect furnace from power supply.
 - b. Remove furnace chamber from control base.
 - c. Turn control base upside down and remove bottom cover.
 - d. Remove black and red wires from terminal block on back of unit.
 - e. Remove pyrometer from dial plate of control base.
 - f. Insert new pyrometer and secure to dial plate.
 - g. Looking from the rear of the furnace, reconnect red thermocouple extension wire to the terminal on the far right side of the terminal block. Reconnect black thermocouple extension wire to the terminal second from the right side of the terminal block.
 - h. Replace bottom cover.
 - i. Turn control base upright and secure furnace chamber to it.
 - j. Reconnect furnace to power supply.
-

To Replace Manual Temperature Control Switch

- a. Disconnect furnace from power supply.
- b. Remove furnace chamber from control base.
- c. Turn control base upside down and remove bottom cover.
- d. Remove control knob with two Allen set screws.
- e. Remove two screws by pulling straight out.
- f. Disconnect wires from control. Identify or mark wires disconnected from control to insure proper placement and connection when reinstalling. Remove defective control.
- g. Looking from the rear of the furnace, insert new control with the H₁ (vertical lead) and H₂ (horizontal lead) leads on top and secure to dial plate.
- h. Replace knob by sliding knob over shaft.
- i. Reconnect the wires identified or marked in Step (f) to new control.
- j. Replace bottom cover.
- k. Turn control base upright and secure furnace chamber to it.
- l. Reconnect furnace to power supply.

MAINTENANCE AND SERVICING

To Replace Furnace Chamber

- a. Disconnect furnace from power supply.
 - b. Remove black knob holding furnace chamber to bracket and remove furnace chamber.
 - c. Remove terminal plate on back of furnace chamber.
(Note placement and connection of wires.)
 - d. Disconnect thermocouple extension wires and power cord from terminal block.
 - e. Remove back terminal plate on new furnace chamber.
 - f. Insert power cord and thermocouple extension wires through their proper holes in the bracket on the new furnace chamber. (See Figure 2 for placement and connection of wires.)
 - g. Replace back terminal plate.
 - h. Insert screw on back terminal plate through bracket slot and secure with knob.
 - i. Reconnect furnace to power supply.
-

To Replace Type K (Chromel/Alumel) Thermocouple (Manual Control Models)

- a. Disconnect furnace from power supply.
- b. Remove knob that holds furnace chamber to the bracket and remove the furnace chamber.
- c. Remove terminal plate on back of furnace chamber.
- d. Remove two screws that secure the old thermocouple and remove thermocouple by pulling straight back.
- e. Insert the new thermocouple until tip extends approximately 1/4" into the heating chamber. Connect the lead marked (+) on insulator of thermocouple to the terminal across from yellow thermocouple extension wire, and fasten the other thermocouple lead (-) to the remaining terminal. (See Figure 2.)
(A polarity test of the lead wire is easily made with the use of a magnet. On chromel/alumel thermocouples and extension wires, the non-magnetic wire is positive (+) and the magnetic wire is negative (-).)
- f. Replace terminal plate.
- g. Insert the screw on the terminal plate through the mounting bracket and secure with knob.
- h. Reconnect furnace to power supply.

To Replace Type Platinel II Thermocouple (Single Set Point Control Models)

- a. Disconnect furnace from power supply.
- b. Remove knob that holds furnace chamber to the bracket and remove the furnace chamber.
- c. Remove terminal plate on back of furnace chamber.
- d. Remove two screws that secure the old thermocouple and remove thermocouple by pulling straight back.
- e. Insert the new thermocouple until tip extends approximately 1/4" into heating chamber.
- f. Connect the blue and yellow beaded thermocouple lead to the terminal across from yellow thermocouple extension wire and the other thermocouple lead to the remaining terminal. (See figure 2)
- g. Insert the screw on the terminal plate through the mounting bracket and secure with knob.
- h. Reconnect furnace to power supply.

MAINTENANCE AND SERVICING

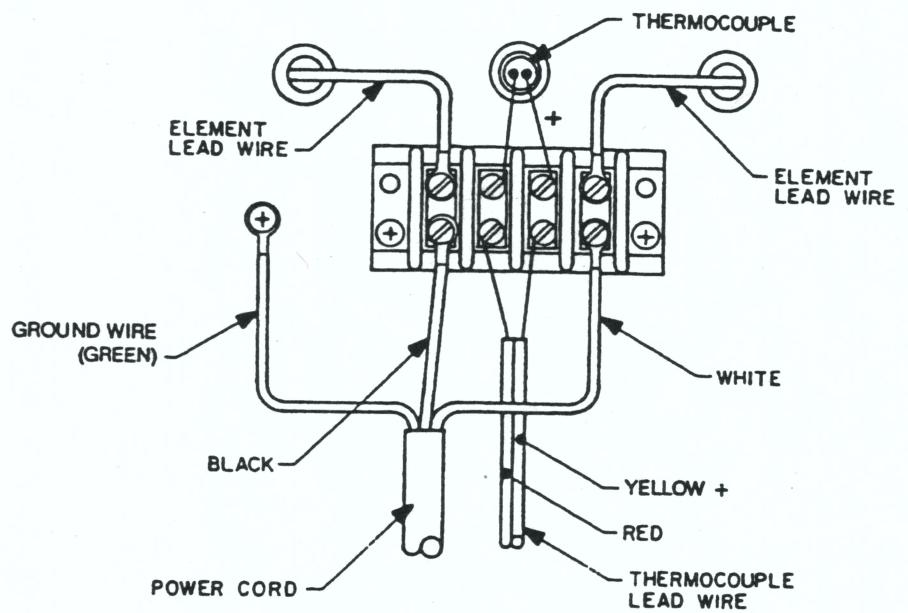


Figure 2 All Models

Replacement Parts List

Replacement Parts List Series 1259

Part Number	Description	Model Number
EL211X1B	120V Element	F21125, F21135
EL211X2B	230V Element	F21120, F21130, F21130-33, F21120-33
TC211X1A	Thermocouple, Chromel/Alumel	All Manual Control Models
TC662X1A	Thermocouple, Platinel II	All Electronic SSP Models
CN71X105	Electronic SSP Control	All Electronic SSP Models
CNX60	Manual Control	F21125
CNX61	Manual Control	F21120, F21120-33
ME1260X1	Pyrometer	F21120, F21120-33, F21125
RYX34	Solid State Relay	F21130, F21130-33, F21135
440-0020	Fuse, Type ABC, 250V, 8 Amp	F21120, F21120-33, F21130, F21130-33
2-58147 Fuse, 15 Amp	F21125, F21135	
SWX143	Main Power Switch	F21125, F21135
SWX144	Main Power Switch	F21120, F21120-33, F21130, F21130-33
CAX44	Filter, EMI	F21130-33, F21120-33
CS1260X4	Furnace Chamber Complete, 240V	F21120, F21120-33, F21130, F21130-33
CS1260X3	Furnace Chamber Complete, 120V	F21125, F21135

Ordering Procedures

Ordering Procedures

Please refer to the Specification Plate for the complete model number, serial number, and series number when requesting service, replacement parts or in any correspondence concerning this unit.

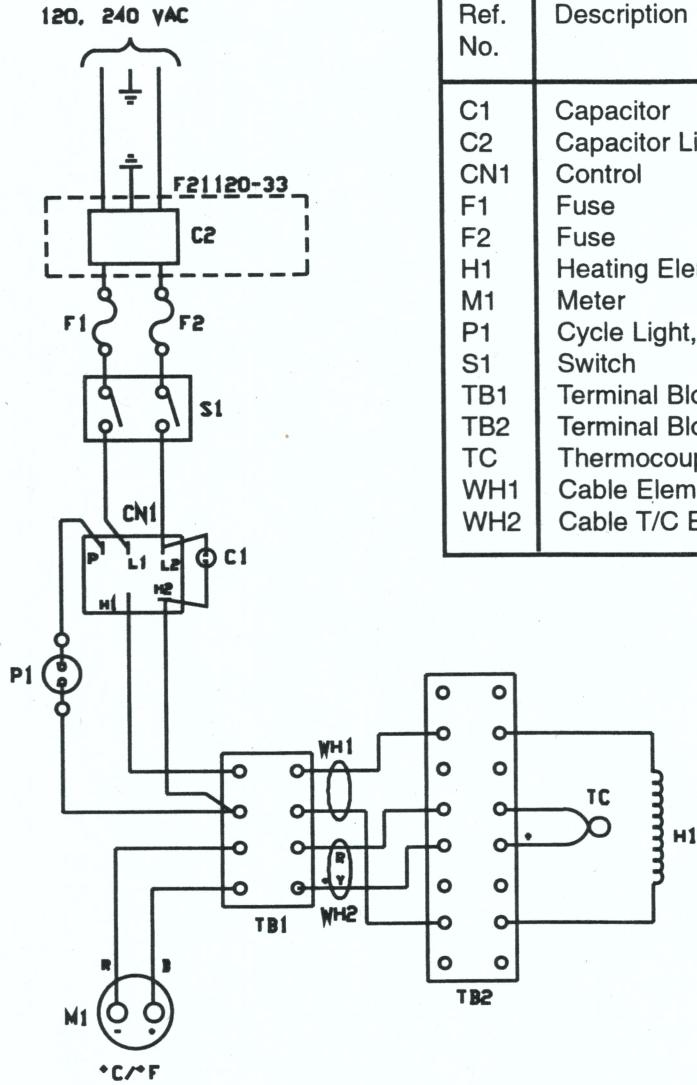
All parts listed herein may be ordered from the **Barnstead International** dealer from whom you purchased this unit or can be obtained promptly from the factory. When service or replacement parts are needed we ask that you check first with your dealer. If the dealer cannot handle your request, then contact our Customer Service Department at 563-556-2241 or 800-553-0039.

Prior to returning any materials to **Barnstead International**, please contact our Customer Service Department for a "Return Materials Authorization" number (RMA). Material returned without a RMA number will be refused.

Wiring Diagrams

Diagram Component List

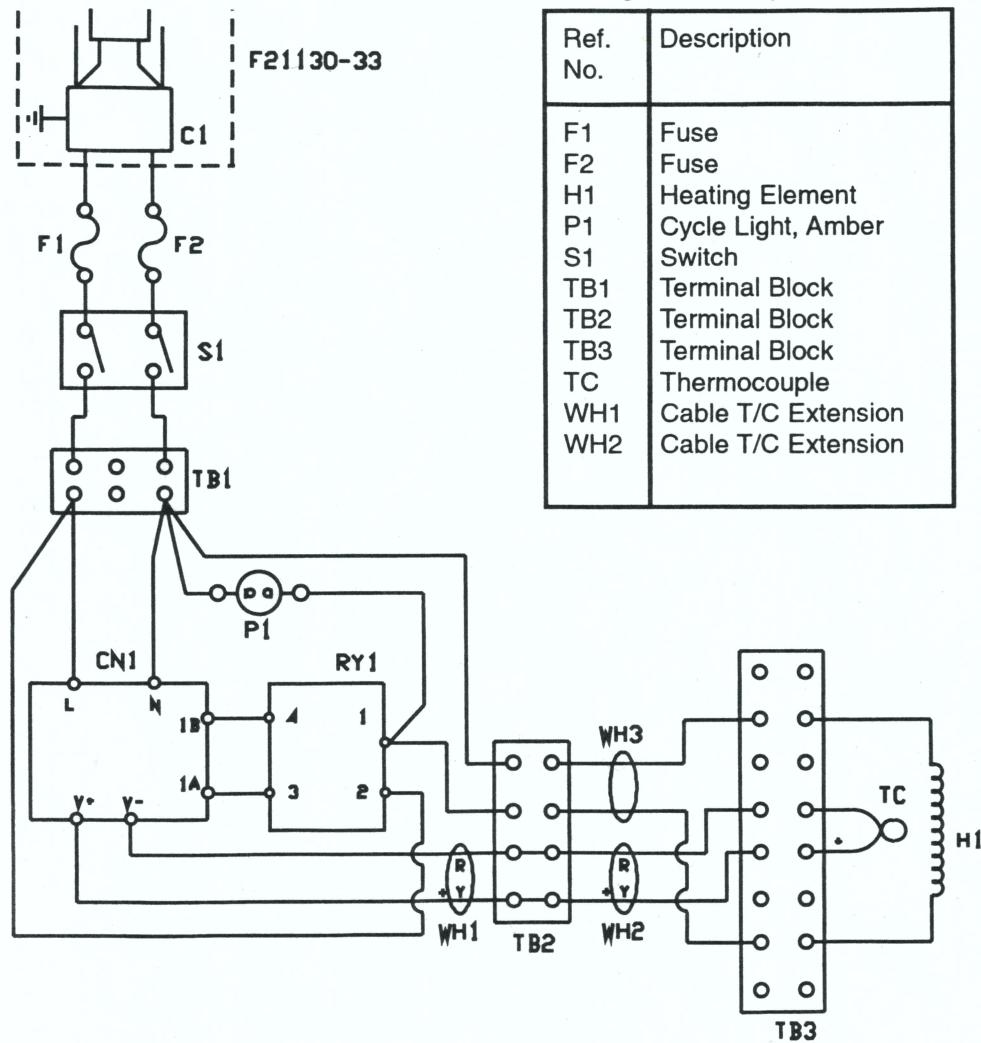
Ref. No.	Description
C1	Capacitor
C2	Capacitor Line Filter
CN1	Control
F1	Fuse
F2	Fuse
H1	Heating Element
M1	Meter
P1	Cycle Light, Amber
S1	Switch
TB1	Terminal Block
TB2	Terminal Block
TC	Thermocouple
WH1	Cable Element Power
WH2	Cable T/C Extension



Wiring Diagram for Models F21120, F21120-33, F21125

Diagram Component List

Ref. No.	Description
F1	Fuse
F2	Fuse
H1	Heating Element
P1	Cycle Light, Amber
S1	Switch
TB1	Terminal Block
TB2	Terminal Block
TB3	Terminal Block
TC	Thermocouple
WH1	Cable T/C Extension
WH2	Cable T/C Extension



Wiring Diagram for Models F21130, F21130-33, F21135