

4848T Reactor Controller with Touchscreen

Operating Instruction Manual

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PREFACE

Related Instructions

The following publications are also included to further your understanding of this instrument and its component parts:

No.	Description
201M	Limited Warranty

Scope

These instructions cover the installation, operation and maintenance of Model 4848T Reactor Controller as used with laboratory reactors and pressure vessels. The users should study the instructions carefully before using any of these controllers so that they will fully understand the capabilities and limitations of this equipment and the safety precautions to be observed in its operation.

Applications

Each 4848T Reactor Controller consists of a packaged temperature control unit completely wired and assembled with appropriate power and safety relays, switches and pilot lights.

These units are designed specifically for use with reactors and pressure vessels and are to be used only with equipment.

Intended Usage

This controller has been designed for use with pressure vessels and reactors. It has been designed, built, and tested to strict physical and electrical standards. However, it is the user's responsibility to install and operate it in conformance with local pressure and electrical codes.

If the instrument is used in a manner not specified by Company, the protection provided by the equipment may be impaired.

Unpack Carefully

Unpack the equipment carefully and check all the parts against the packing list. If shipping damage is discovered, report it immediately to the delivering carriers. Examine the components closely for any loose parts or shipping damage and be sure to check all layers of packing materials thoroughly so as not to overlook any parts which might otherwise be discarded.

Explanation of Symbols

II	On position, full power heater switch
I	On position, half power heater switch
O	Off Position
~	Alternating Current (AC)
	This **CAUTION** symbol may be present on the Product Instrumentation and literature. If present on the product, the user must consult the appropriate part of the accompanying product literature for more information.
	**Protective Earth (PE) terminal.** Provided for connection of the protective earth (green or green/yellow) supply system conductor.

Safety Information

To avoid electrical shock, always:

1. Use a properly grounded electrical outlet of correct voltage and current handling capability.
2. Ensure that the equipment is connected to electrical service according to local and national electrical codes. Failure to properly connect may create a fire or shock hazard.
3. For continued protection against possible hazard, replace fuses with same type and rating of fuse.
4. Disconnect from the power supply before maintenance or servicing.

To avoid personal injury:

1. Do not use in the presence of flammable or combustible materials; fire or explosion may result. This device contains components which may ignite such material.
2. Refer servicing to qualified personnel.

Provisions for Lifting and Carrying

Before moving the instrument, disconnect all connections from the rear of the apparatus. Lift the instrument by grabbing underneath each corner.

Cleaning & Maintenance

Periodic cleaning may be performed on the exterior surfaces of the controller with a lightly dampened cloth containing mild soap solution. All power should be disconnected and the power cord should be unplugged when cleaning the 4848T Controller.

There are no user serviceable parts inside the product other than what is specifically called out and discussed in this manual. Advanced trouble-shooting instructions beyond the scope of this manual can be obtained by calling Company in order to determine which part(s) may be replaced or serviced.



CAUTION! Ensure that any hot surfaces have had adequate time to cool before cleaning or maintaining the reactor and/or its components.

General Specifications

Electrical Ratings
115VAC, 15.0 Amps, 50/60 Hz
230VAC, 15.0 Amps, 50/60 Hz

Before connecting a controller to an electrical outlet, the user must be certain that the electrical outlet has an earth ground connection and that the line, load and other characteristics of the installation do not exceed the following limits:

Voltage: Fluctuations in the line voltage should not exceed 10% of the rated nominal voltage shown on the data plate.

Frequency: Controllers can be operated from either a 50 or 60 Hertz power supply without affecting their operation or calibration.

Current: The total current drawn should not exceed the rating shown on the data plate on the controller by more than 10 percent.

Thermocouple: Unless otherwise specified, all 4848T Controllers operate with a Type-J (Iron-Constantan) thermocouple. The total resistance of the thermo-couple and the lead wires should not exceed 100 ohms. If the resistance of the thermocouple circuit is higher, it will not function properly.

Environmental Conditions

This instrument is intended to be used indoors.



CAUTION! Do not use in hazardous atmospheres.

Operating: 15 °C to 35 °C; maximum relative humidity of 80% non-condensing. Installation Category II (over voltage) in accordance with IEC 664. Pollution degree 2 in accordance with IEC 664.

Altitude Limit: 2,000 meters.

Storage: -25 °C to 65 °C; 10% to 85% relative humidity.

General Instructions

Set the controller on a sturdy bench or table where there is convenient access to an electrical outlet with the appropriate supply voltage and current ratings in accordance with national and local electrical code requirements. Leave a space of at least twelve inches between the controller and the heater of the reactor so that the controller will not be affected by radiant heat.

User's Responsibility

All Reactors and Pressure Vessels are designed and manufactured with great care to assure safe operation when used within their prescribed temperature and pressure limits.

But…the basic responsibility for safety when using this equipment rests entirely with the user; who must:

1. **Select a reactor or pressure vessel** that has the capability, pressure rating, corrosion resistance, and design features that are suitable for its intended use. Our engineers will be glad to discuss available equipment and material options with prospective users, but the final responsibility for selecting a reactor or pressure vessel that will perform to the user's satisfaction in any particular reaction or test must rest with the user .

   In exercising the responsibility for the selection of pressure equipment, the prospective user is often faced with the choice between over or under-designed equipment. The hazards introduced by under-designed pressure vessels are readily apparent, but the penalties that must be paid for over-designed apparatus are often overlooked. Recognizing these criteria, our reactors and pressure vessels are offered in several different styles, each designed for convenient use in daily operation within certain temperature and pressure limits, using gaskets, closures, and other elements carefully selected for safe operation within the limits specified for that design. But in order to preserve the validity of these designs, all temperature and pressure limits must be observed, and no attempt should be made to increase these limits by making alterations or by substituting components which are not recommended by Company.

2. **Install and operate** the equipment within a suitable barricade, if required, with appropriate safety accessories and in full compliance with local safety codes and rules.

   All standard pressure vessels are provided with either a suitable relief device or a means to attach one (typically in the form of a plugged opening). When a pressure vessel is delivered without a pressure venting device, it is the customer's responsibility to provide pressure relief in order to protect the operator and the equipment from destructive high pressures. If you need more information or need help in selecting a proper relief device, please contact Company.

3. **Establish training procedures** to ensure that any person handling the equipment knows how to use it properly.

4. **Maintain the equipment** in good condition and establish procedures for periodic testing to be sure the vessel remains structurally sound.

INSTALLATION

Connections

Labeled connections are provided on the rear panel of the controller.



4848T Reactor Controller (230V), Back Side

COOLING ONLY

The cooling output connector is to be used only with Company cooling solenoid valve assemblies supplied with the appropriate cooling power cord.

HEATING ONLY

The heating output connector is to be used only with Company heater assemblies supplied with the appropriate heater power cord.

MOTOR

The motor output connector is to be used only with Company motor assemblies supplied with the appropriate motor power cord.

Secure the clamp on motor cord to the controller with the provided screw next to the motor socket for safety purposes.

Other appropriate connectors are provided on the rear panel of the controller.

The **PRIMARY TEMP INPUT** connection is for the Primary Temperature Module sensor input.

The **TEMPERATURE INPUT** connection is for the Aux Temp sensor input.

The **PRESSURE INPUT** connection is for the Pressure Module sensor input.

The **RPM INPUT** connection is for the RPM Module sensor input.

The **USB** and **ETHERNET** connection is for Communication output.

COMPONENT SUMMARY



4848T Reactor Controller, Front Side

Switches and Indicators

The **MAIN POWER** switch on the back of the controller will cut off power to the controller. Take care to position the controller such that the main power switch may be accessed easily when the controller needs to be disconnected.

The **HEATER** Switch is a manual, three-position, illuminated switch which controls the amount of power sent to the heater. In the HIGH (**II**) position, full power is developed by the heater. In the middle (**O**) position the heater is off. In the LOW (**I**) position, a diode is switched into the system to allow only one-half of the rated voltage to be supplied to the heater. This low setting will be most useful when operating the reactor at temperatures below 175 °C. Power for the heater is supplied through a solid state relay controlled by the temperature control module. The light in the heater switch will glow only when current is flowing to the heater.

The **HIGH LIMIT** indicator light will glow if the controller receives an indication from any of its sensors that a high temperature or high pressure limit has been reached and the **HIGH LIMIT RESET** has opened. When the light comes on, the user must find the source of the problem, correct it, and then manually reset the system using the **HIGH LIMIT RESET** button on the front of the controller.

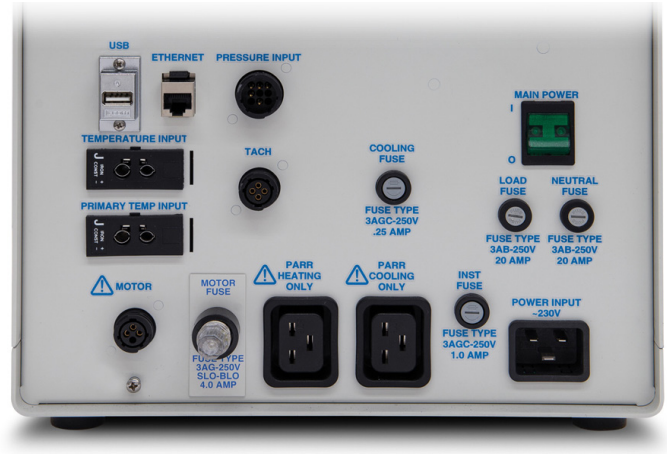
The **MOTOR CONTROLS** consist of:

1. **AUTO/MANUAL** switch
2. **ON/OFF (I/O)** switch
3. **SPEED** control knob

The **SPEED** control knob should be turned down to a minimum setting before turning on the motor switch to minimize electrical surges within the speed control unit.

When the auto/manual switch is in manual mode, the speed control knob will adjust the motor stirring speed. When the auto/manual switch is in auto mode, the RPM module will adjust the motor stirring speed.

Protective Fuses and Relays



4848T Reactor Controller (230V), Back Side

An **instrument fuse** is mounted on the back panel. This is a Fast-acting, 250VAC, 2.0 amp fuse, intended to protect the temperature control module and any installed display modules.

The **motor reset/motor fuse** provides overload protection for 0-90VDC motors. This is a re-settable breaker designed to protect the motor if it becomes overloaded. The breaker will have a rating selected to match the motor on the apparatus.

A **lighted fuse holder** provides protection for 0-180 VDC motors. A light will come on if the motor becomes overloaded and the fuse burns out. The fuse rating will be selected to match the motor on the apparatus.

A **load fuse** is mounted on the back panel on 115V systems. This fast-acting, 250VAC, 20 amp fuse is intended to protect the controller and prevent electric shock hazard from fault from occurring.

Two **load fuses** are mounted on the back panel on 230V systems. These are fast-acting, 20 Amps, 250VAC and are intended to protect the controller and to prevent electric shock hazard from fault from occurring.

The 4848T Controller has a number of fuses which are intended to be field serviceable. See the Parts List Section on page 23 for more information.

CAUTION! Unplug unit before servicing. For continued protection against possible hazard, replace fuses with same type and rating of fuse.

Thermocouple burnout protection is included in each of these controllers. If the thermocouple should burn out, or if there is a break in the thermocouple circuit, the apparent temperature will rise to the top of the sensor limit, triggering a sensor break alarm.

High Limit Reset

Each Series 4848T Controller has a high temperature limit control which will trip the High Limit Relay and shut off the heater if the temperature reaches a preset level. If tripped, the lockout relay will pop out, thereby preventing the system from heating the reaction when the temperature falls back below the limit setting. This must be manually reset before heating can occur again.

On Model 4848T Controllers the high temperature limit is preset at the factory to 375 °C for most systems. If the temperature exceeds the limit, the controller alarm condition will appear.

Motor Speed Control

4848T Controllers are equipped with a solid state speed control module for use with the variable speed, DC motors installed on stirred reactors. The module itself (approximately 4 inches square) is mounted inside the chassis on the bottom plate. A motor switch and a speed adjustment potentiometer are mounted on the front panel. Each module also requires a resistor matched to the horsepower of the motor with which it will be used, as listed in the following table:

Motor Rating	Motor Voltage	Resistor Required	Part Number
1/17 HP	90 VDC	0.25 ohm	876E6
1/8 HP	90 VDC	0.10 ohm	876E3
1/4 HP	90 VDC	0.05 ohm	876E
1/4 HP	180 VDC	0.10 ohm	876E3
1/2 HP	90 VDC	0.025 ohm	876E2
1/2 HP	180 VDC	0.05 ohm	876E
3/4 HP	180 VDC	0.035 ohm	876E5

4848T Controllers furnished as a part of a complete stirred reactor system will have the proper resistor installed at the factory. Any controller sold separately will require a motor specification so that the proper resistor may be provided.

COMPONENT SUMMARY *(Continued)*

Always turn the speed control knob fully counter-clockwise to the off position before turning on the motor switch, then advance the knob clockwise slowly to develop the desired speed. Do not overload the motor. Any high speed or high viscosity load which trips the circuit breaker (90 VDC motors) is too heavy. Reduce the speed to avoid overloading and use the reset button on the rear panel to restart the motor.

Adjustments To Speed Control Board

There are five trimpots in the speed control module that can be used to adjust the performance of the motor. These are set at the factory for optimum performance and should not be disturbed unless customized settings are required to match a particular set of operating conditions. The instructions below should be followed carefully if these controls are to be readjusted.

The **CL**, current limiting/torque adjustment is set at the factory to 1.5 times the motor rating. It is intended to protect both the module and the motor against overloads and heavy surge currents during startup. It can also serve as a torque limiting device by reducing the maximum power output of the system.

The **IR**, compensation adjustment is used to improve motor control under varying load conditions. If the loads do not fluctuate, this control can remain at approximately one-fourth of full setting. But if the motor speed drops more than 2% under load, this adjustment should be increased. If it is set too high, the motor speed will fluctuate in a cyclical manner.

The **MAX**, maximum speed adjustment controls the maximum speed of the motor. To increase the motor speed, turn the control knob on the front panel to its maximum setting, then use the MAX trimpot to raise the speed to the desired level. Note, however, that the motor may become dangerous if the speed is raised above the motor's rated rpm.

The **MIN**, minimum speed adjustment can be used to raise the minimum motor speed. To change this setting, turn the control knob on the front panel to its minimum setting, then adjust the MIN trimpot to obtain the desired minimum speed, this adjustment will also affect the maximum setting, making it necessary to adjust both MAX and MIN trimpots to obtain the desired spread.

The **ACCEL**, acceleration adjustment is normally set to provide controlled acceleration from zero to full speed in 2 seconds. It can be adjusted to higher or lower acceleration times anywhere between 0.5 and 4 seconds, but changing this setting will affect the MAX speed and IR compensation which will have to be readjusted. If the acceleration time is reduced to 0.5 seconds (6 o'clock trimpot position), increase the IR trimpot one quarter turn clockwise and decrease the MAX trimpot one fifth turn counterclockwise. If the acceleration time is increased to the maximum time of 4 seconds (full rotation), the IR trimpot must be decreased and the MAX increased in the same rotation amounts mentioned above.

Solenoid Valve Module

This module provides a solenoid valve, a metering valve and all parts needed to assemble an automatic cooling system for any reactor. It usually is installed in a cold water line with a flow connection to the cooling coil and an electrical connection to the cooling socket on the back of the 4848T Controller. Coolant will then be admitted to the coil whenever cooling is called for by the controller, thereby minimizing any temperature overshoot. This system is particularly advantageous when holding fixed temperatures below 150 °C or for controlling exothermic reactions. Compressed air can be used as a coolant if the amount of heat to be removed is not large.

Access to the Controller Cabinet

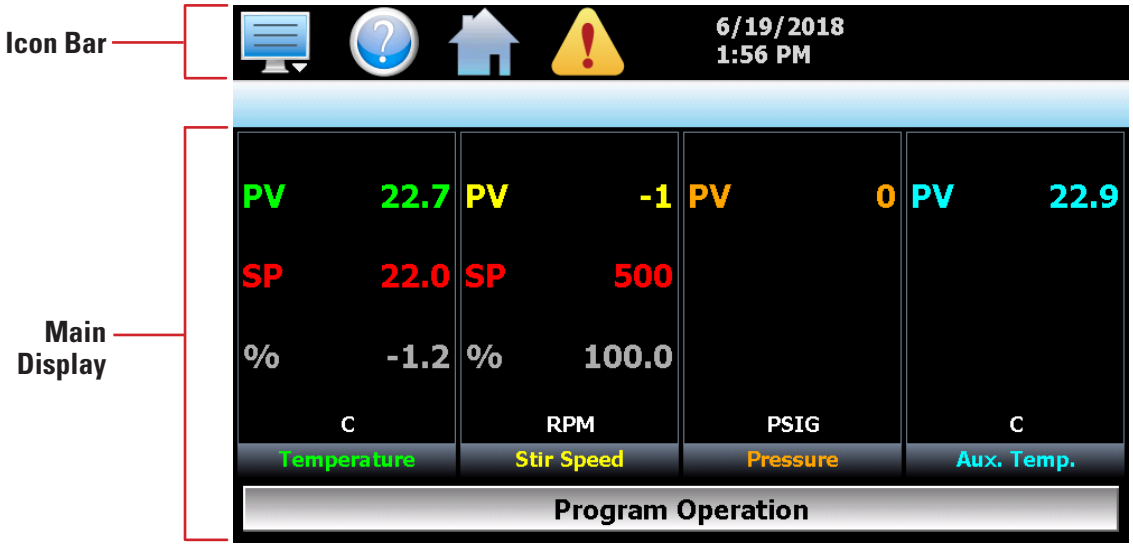
To open the controller cabinet, unplug the power cord and remove the five screws on each side of the enclosure. Then lift the top cover upwards, providing full access to all internal components.



CAUTION! Inside of controller cabinet should be accessed by qualified personnel only.

Touchscreen Interface

The 4848T display is split into two sections; the icon bar and main display area.



Main Screen

	The **DISPLAY ICON** will open the main menu for navigating to the different control and monitoring screens. Menu items will dynamically appear providing available options based on the system area the user is in, i.e., security, data logging, setup, etc.
	The **INFORMATION (HELP) ICON** will display text based help associated with the current screen. Help is available in 10 languages based on the user selection in the offline setup of section of 4848T.
	The **HOME ICON** will return the user to the main view from anywhere in the 4848T application. The main view is set by the OEM in the 4848T configuration and can be the single or dual loop, chart, alarm, alarm history, event or digital IO view.
	The **ALARM ICON** will appear and flash when a new system alarm occurs. Pressing the alarm icon will take the user directly to the alarm monitor screen in order to view and /or reset the active alarm condition.
	The left and right **NAVIGATION ARROWS** will appear on screens that provide additional information that the user can scroll to such as the loop view screens, charts or program entry screen in order to cycle through each step of a ramp/soak program.

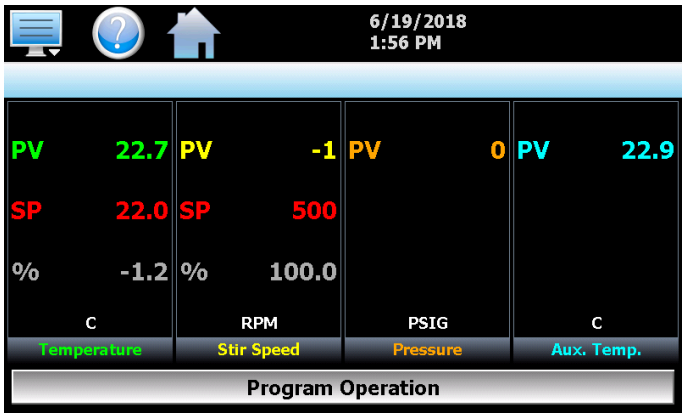
Note: *A single press of the left or right arrows will scroll program steps to the next step or screens to the next available screen option (i.e. chart number). Pressing and holding the arrow keys will continue the item scrolling until the last step of the program is reached or the button is released.*



CAUTION! Do not use any sharp or metal objects on the touchscreen as they may damage the surface. Also be sure that hands and fingers are free from oils or chemicals which may mar the surface of the touchscreen.

INSTRUCTIONS FOR THE 4848T REACTOR CONTROLLER

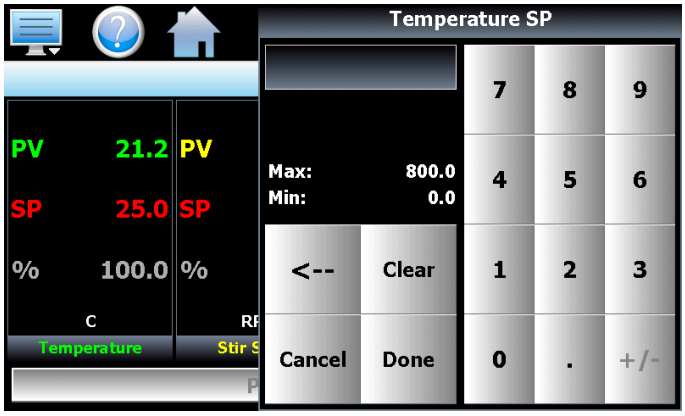
Main Screen



The **Main Screen** of the 4848T shows basic information for all four modules:

- Temperature Control Module
- Motor Control Module
- Pressure Module
- Auxiliary Temperature Module (Option 1 or 2)
  1) High Temperature Cut Off Module (HTM)
  2) External Temperature Limit Module (ETLM)

The **Setpoint (SP)** for each module can be adjusted by touching the screen where it displays the **SP** value.



The **Process Value (PV)** for each module (Temperature, pressure, RPM) is also shown in real time.

The % shows the power percentage output in real time.



Temperature Control Module

The current temperature is shown under **PV**. Selecting **SP** will allow you to change the intended temperature setpoint. The heater output is shown under **%**.



Motor Control Module

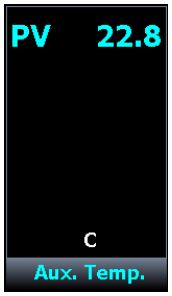
The current RPM is shown under **PV**. Selecting **SP** will allow you to change the intended RPM setpoint. The motor output is shown under **%**.



Pressure Module

The current pressure is shown under **PV**.

(See the Alarms section of this manual for instructions on adjusting the pressure alarm.)



Auxiliary Temperature Module (HTM)

High Temperature Cut Off Module

The current temperature is shown under **PV**.

(See the Alarms section of this manual for instructions on adjusting the Auxiliary Temperature alarm.)



Auxiliary Temperature Module (ETLM)

External Temperature Limit Module

The external temperature is shown under **PV**. **SP** is the external temperature cut-off set point. **%** is an indicator of ETLM state. When it is at 100% it will allow the Temperature Control Module to modulate heater output. When it is at 0% it will disallow further heating until the external temperature falls back below **SP**.

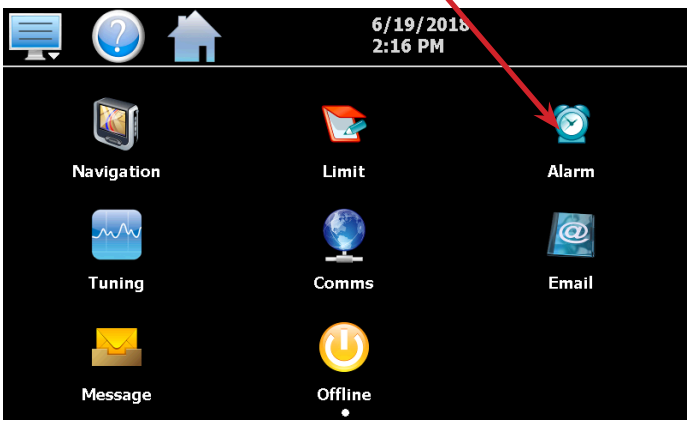
Alarm Settings

To access Alarm Settings from the main screen, select the following:

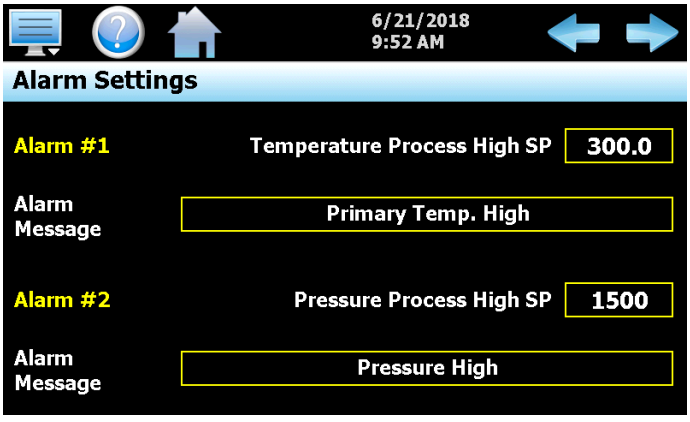
1.  Select the **Display Icon** in the icon bar at the top of the screen
2. 

Select the **Settings Option** from the main display
3.  Select the **Display Icon** in the icon bar at the top of the screen
4. 

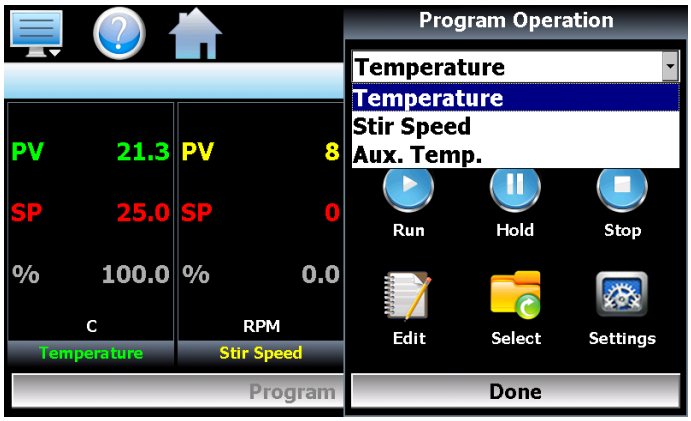
Select the **Alarm Option** from the main display



The **Alarm Settings Menu** is shown below and can be adjusted for the Primary Temperature, Pressure, and Auxiliary Temperature. Use the Navigation Arrows in the icon bar to scroll between Alarm #1, #2, and #3.



Program Operation



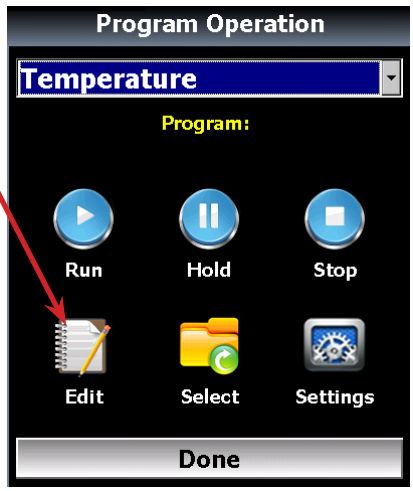
To access **Program Operation**, select the Program Operation button at the bottom of the main display on the main screen.

Program Operation allows the **Temperature Control Module** or the **Motor Control Module** to be operated in Automatic Program (ramp and soak) mode. The module being worked on appears in the drop box on top of the window.

Temperature Control Module

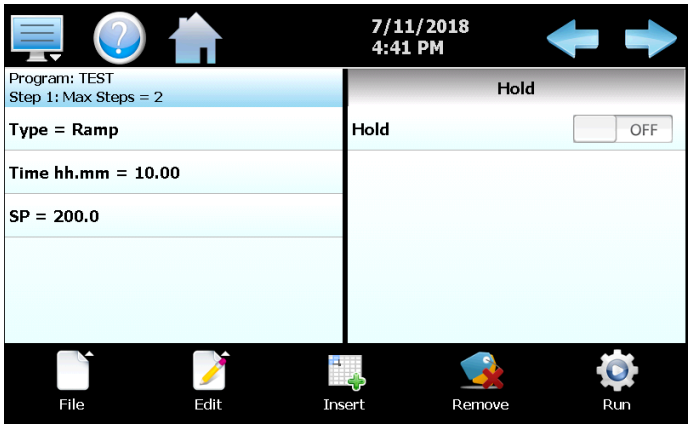
The Temperature control module screen is shown below. The **Run**, **Hold**, and **Stop** functions are only utilized when an Automatic Program (ramp and soak) is active. During typical setpoint operation these functions are not used.

To create a ramp and soak program, select the **Edit** option.



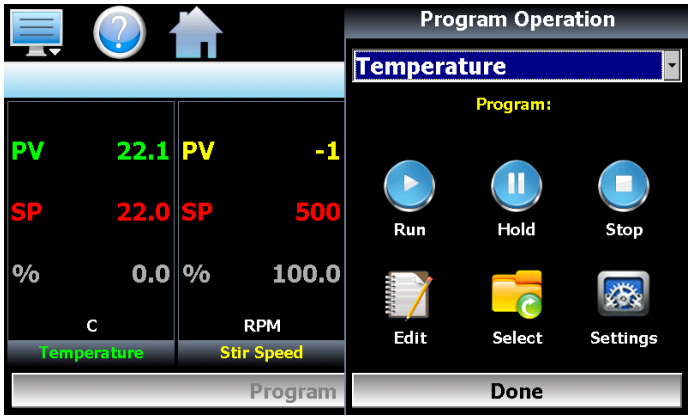
INSTRUCTIONS FOR THE 4848T REACTOR CONTROLLER *(Continued)*

The ramp and soak program is shown below. The program details can be entered here.



Use the navigation arrows in the icon bar to cycle between each step, and **Insert** or **Remove** to adjust the number of steps.

File and then select **Save** from the pop up menu to save the program to the 4848T, and then Home to return to the main screen. To engage the program, click on Program Operation.



The ramp and soak program must be selected by clicking on Select, and then selecting the program that you wish to execute. When this is complete, click on Run.

If you wish to hold or stop the program, return to the Program Operation screen and click on Hold or Stop.

Sample Program

A program to heat from 25 °C to 200 °C over the course of 2 hours, hold for 1 hour, and then cool as quickly as possible.

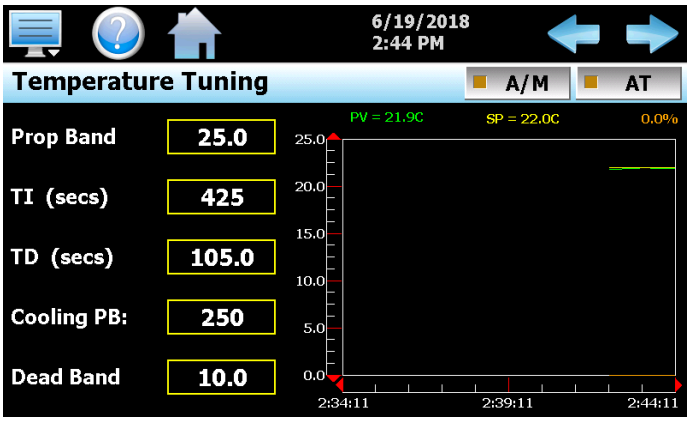
Step 1:	Type	= Ramp
	Time hh.mm	= 0.00
	SP	= 25
Step 2:	Type	= Ramp
	Time hh.mm	= 2.00
	SP	= 200
Step 3:	Type	= Soak
	Time hh.mm	= 1.00
Step 4:	Type	= Ramp
	Time hh.mm	= 0.00
	SP	= 25.0
Step 5:	Type	= End
	SP	= 25
	Cycle Count	= 1

Tuning

The 4848T has a set of default PID values intended to give reasonable control across a wide range of conditions, but tighter control can be had by auto-tuning the system.

To autotune the temperature meter from the main screen, select the following:

1.		Select the **Display Icon** in the icon bar at the top of the screen
2.		Select the **Settings Option** from the main display
3.		Select the **Display Icon** in the icon bar at the top of the screen
4.		Select the **Tuning Option** from the main display to enter the Temperature Tuning screen



The PID settings can be adjusted here manually. Unless the operator has a background in PID control, however, autotuning is recommended.

Autotuning is a method to help the controller determine the best PID settings to control tightly around the intended setpoint. To do an autotune, fill the pressure vessel with conditions as equivalent to the intended process as possible (do a blank run), and heat it up to the intended setpoint. Once the temperature has reached setpoint, click on AT to engage the autotune. During the autotune process, the temperature will rise by a few degrees, drop back down to setpoint, and repeat this process perhaps three times. This can take a good deal of time, especially in large vessels or in cases at low temperatures. When the autotune is complete, the controller will return to regular setpoint mode, maintain the intended setpoint, and it will have rewritten the PID values here to better values.

If you need to halt the autotune before completion, click on the AT button again.

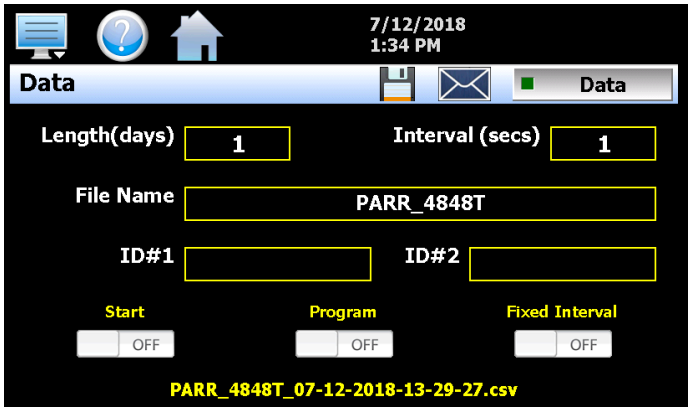
Data Collection

To set the 4848T to collect data, data collection must first be enabled. Select the Display Icon and then Data.

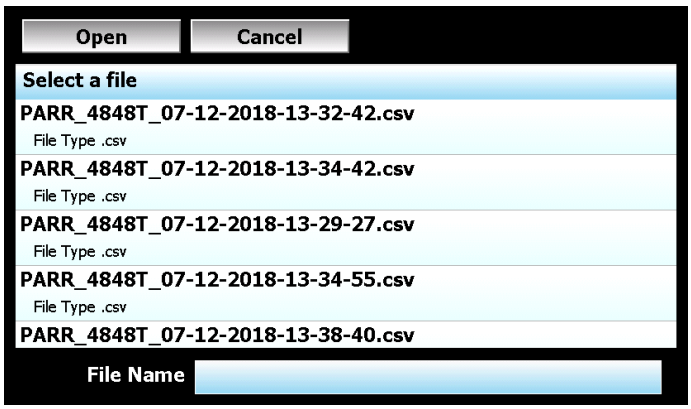
1.		Select the **Display Icon** in the icon bar at the top of the screen
2.		Select the **Data Option** from the main display

INSTRUCTIONS FOR THE 4848T REACTOR CONTROLLER *(Continued)*

The Start Button is used to automatically start logging data when the 4848T is powered up. Switch the **Start** toggle to the **ON** position and then press the **Data** button to begin recording data. When you are finished recording, press the **Data** button again to stop recording.

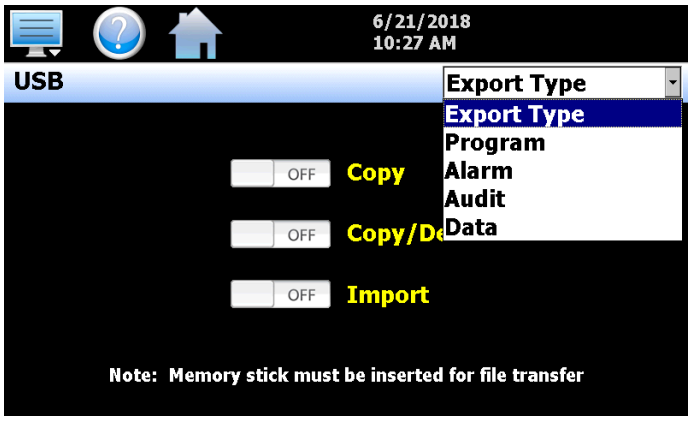


Insert a USB stick into the back of the 4848T. Press the Display Icon, and then the **Open** button.



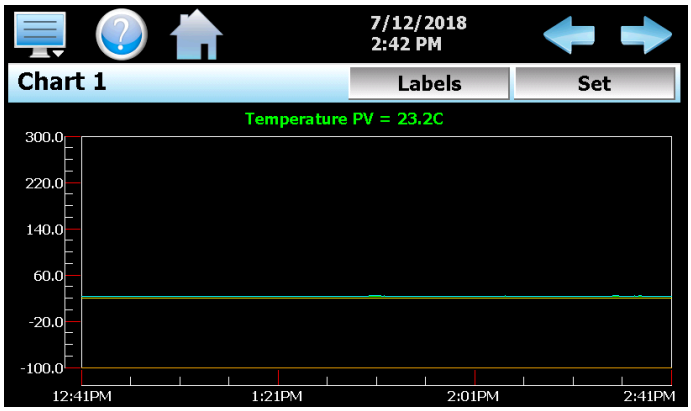
A list of files will be shown. Select the file corresponding to the most recent time and press the **Open** button. The 4848T will display a chart of the data selected, and select Return to prepare this data for copy to the USB stick.

Select the **Display Icon**, and then USB. On the USB Screen, select the type of data to export to the USB, and then select the appropriate copy action to write to the USB.



Charting

To create a chart, click on the Display Icon, and then Chart. The Set button will allow you to customize which variables are charted, along with axis properties.



Adjusting time

To adjust the time from the main screen, select the following:

1.  Select the **Display Icon** in the icon bar at the top of the screen
2. 

Select the **Settings Option** from the main display
3.  Select the **Display Icon** in the icon bar at the top of the screen
4. 

Select the **Offline Option** from the main display
5.  Select the **Display Icon** in the icon bar at the top of the screen
6. 

Select the **Clock Option** from the main display

Reset Defaults

The 4848T can be reset to it's factory defaults easily. This is an excellent measure in the event that the controller is not operating properly.

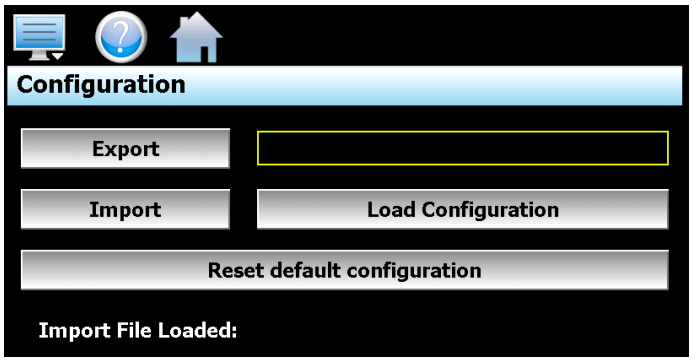
To reset the 4848T back to the factory default settings, select the following:

1.  Select the **Display Icon** in the icon bar at the top of the screen
2. 

Select the **Settings Option** from the main display
3.  Select the **Display Icon** in the icon bar at the top of the screen
4. 

Select the **Offline Option** from the main display to enter Offline Mode
5.  Select the **Display Icon** in the icon bar at the top of the screen
6. 

Select the **Configuration Option** from the main display to access the Configuration screen



Press the **Reset default configuration** button to return the settings to the factory defaults.

COMMUNICATIONS

This section provides instructions on how to use the 4848T communication interfaces. As a standard, the 4848T is equipped with an Ethernet interface for user communications.

Ethernet Communications

The 4848T provides two forms of Ethernet communication interfaces for monitoring and controlling the system across a network. The web server interface provides a monitor only connection, while the VNC server interface allows a user to manipulate and control the 4848T remotely by viewing the 4848T display directly on their PC screen.

NOTE: *In order to use Ethernet communications, the 4848T must be properly connected to a network. To connect the 4848T to a network, connect the touchscreen's Ethernet port to your network using a standard CAT5 cable connection. Note that after connecting the network cable, it may be necessary to cycle power to the 4848T in order for it to obtain a valid IP address.*

Guide to Smart Networking Practices

The expansion of Ethernet onto the industrial floor has brought forth a new realm of possibilities from the gathering of information to the inherent control of equipment from anywhere around the world. The flexibility and convenience that this provides makes it a very desirable feature for new equipment. The 4848T provides this ability, but there are considerations that must be taken by the end user to protect their equipment and investment.

Just like placing a personal computer on the internet opens it up to outside attack, placing your 4848T on a network poses the same risk. The first thing to remember is this: The most likely cause of problems is not a hacker trying to sabotage your equipment, but more often to be related to the ubiquity of PCs with Ethernet cards, the ease with which your own co-workers can "hang stuff on the network", and careless or nonexistent internal security measures. Accidental problems are more common than deliberate ones.

Allowing anyone access to the 4848T by placing it on the office LAN, also opens the door for accidental shutdown, damage to equipment, loss of data, lost time, etc. This is possible even by the most well-intentioned co-workers. Thus, there are several steps that should be taken to minimize this risk.

The first is to never mix your office LAN with your control LAN. The control LAN should be a separate network that consists of your 4848T controller(s) and possibly any other equipment that you may have that is related to the operation of the system. It should be separated from your office LAN by a firewall, or at minimum, a bridge or router. A control network and a business network have two entirely different purposes and their interaction should be closely controlled.

It is also unwise to assume that any Ethernet capable devices themselves have any security features at all. The 4848T VNC server only provides minimal single-password based security access. Separating the control LAN from the office LAN using a firewall would increase security and only allow control access that is based on a combination of IP source address, destination address, and port number. This is by no means completely "hacker-proof", but it should keep the well-meaning co-workers out.

Another hazard is connecting consumer "plug and play" devices to your control LAN. A printer for example, might flood the network with traffic in a "broadcast storm" as it tries to self-configure or advertise its presence to all nodes on the network. Faulty devices, for example defective NIC cards, can transmit large amounts of bad packets (i.e., runts, which are abnormally short Ethernet frames) into your network. Using switches instead of hubs will limit the effect of such problems.

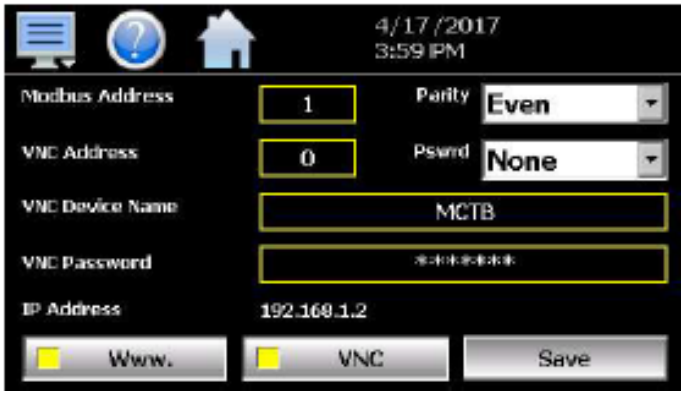
The most commonly overlooked source of problems is cabling. Not all cables are created equal. Electrical noise generated by factory equipment or other electrical equipment in the area, could easily corrupt transmitted data over the network and cause devices to "lock up" or shut down the VNC server, both of which then require the 4848T to be shut down and restarted to clear the problem.

Select the right cable for the environment. Shielded twisted pair (STP) cable is naturally more noise immune and is preferable to unshielded twisted pair or UTP in noisy situations. STP should have at least 40dB CMRR and less than 0.1pF capacitance unbalance per foot. Ground STP cable, making sure the ground is connected only at one end. CAT5 STP patch panels normally provide a grounding strip or bar. Hubs and switches don't provide grounding, use cables.

It's wise to be pessimistic about a cable's ability to reject noise from 230 VAC and 460 VAC power lines and electrically "noisy" equipment in the area. Capacitance imbalance in cables greater than 70pF per 100m can introduce harmonic distortion resulting in bit errors. The cost of cable is quite small compared to total equipment cost, so if you're looking to save money, this is not a place to do it. Choose a well designed cable to minimize bit-error rate after installation, and that will give faster throughput with fewer glitches.

Using the Web Server

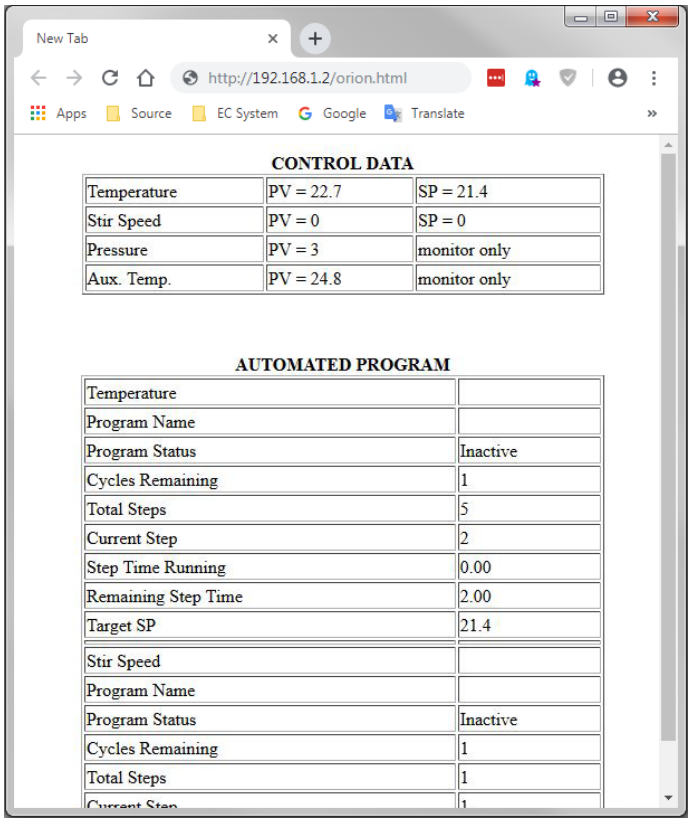
The 4848T web server allows a user to remotely monitor operations anywhere via a PC's standard web browser. When enabled, the web server provides a detailed status page of the current operating conditions. The web server can be enabled and disabled by pressing the web server (Www.) button on the communications screen (select "Comms" from the Device\Settings\Set menu).



You must use the assigned IP address to access the 4848T. The IP address is shown on the communications screen and is also included in the notifications list. Write down the IP address so you will have it later to enter into your web browser.

NOTE: *Contact your network administrator prior to enabling the web server of the 4848T. Company policy may prohibit the use of web servers for security reasons. Future Design Controls is not responsible for the use of, nor makes any claims as to the security of the web server interface over your network. The use of the web server is the responsibility of the end user.*

To access and view the 4848T web page, enter the following link in your PC's browser address window: http://"IPaddress"/orion.html. Using the IP address from the sample screen, the entry would be: http://192.168.1.2/orion.html. The following example is typical of the 4848T web page appearance. The web page updates automatically every 30 seconds and provides information on each individual control loop, ramp/soak program status, alarm status and system event status.



Using the VNC Server

The 4848T VNC server allows a user to remotely monitor and control 4848T by directly viewing and manipulating the touchscreen over the network. You must use the assigned IP address and VNC port number to access 4848T. The IP address is shown on the communications screen and is also included in the notifications list. Write down the IP address and port number so you will have it to enter into your VNC viewer.

COMMUNICATIONS *(Continued)*

There are many VNC viewers available for both PC and tablet use. Due to the ever changing market and availability of such applications, it is not possible to test them all for compatibility or provide assistance for their use with the 4848T. It is the responsibility of the end user to test the chosen VNC client for compatibility with the 4848T prior to putting the unit into service. If the VNC client viewer has compatibility issues with the 4848T, it can cause the VNC server to stop responding and/or shut down requiring power to be cycled to the 4848T in order to reboot the system and restart the server.

Company has tested and recommends the use of RealVNC's viewer. It has been tested for compatibility with the 4848T and a free version can be obtained from RealVNC for PC/MAC use. RealVNC does offer a version for the iPad that can be obtained through the App Store for a small fee.

> ***NOTE:*** *Contact your network administrator prior to enabling the VNC server of the 4848T. Company policy may prohibit the use of VNC servers and/or viewers for security reasons. Company is not responsible for the use of, nor makes any claims as to the security of the VNC server interface over your network. The use of the VNC server is the responsibility of the end user.*

Once the connection is established, the current 4848T display will be shown on your desktop. The image will be a duplicate of what is on the 4848T. As you manipulate the screen, the display of the 4848T will also be manipulated so that any local operator will be able to see what is happening and vice versa.



Multiple instances of the VNC viewer can be started on your PC. By running multiple viewers, you can have access to multiple 4848T controllers right from your desktop. The heading of each VNC viewer window will use the "VNC Device Name" entry for the header. By entering a unique name for each 4848T, you can identify each VNC connection and know which system you are accessing.

The VNC viewer is meant to be used for short term control access to the 4848T. It is not meant for long term monitoring of system operation. If long term monitoring access is desired, use the built-in web server of the 4848T or a PC with FDC software to monitor and control the 4848T over its serial communications port. The web server interface and PC software is designed for long term monitoring and status updates.

Due to the nature of VNC operation, and for security reasons, the VNC viewer connection should not be left open on your desktop. The viewer connection should be opened in order to perform the necessary control and/or status check of system operation, and then closed once the task is complete. Accidental manipulation of the control or erroneous network activity could cause connection problems over the VNC interface and result in the VNC server shutting down and requiring the 4848T to be restarted in order to regain access.

> ***NOTE:*** *Some viewers may also contain additional features for file transfer and other high level functions. These functions are NOT compatible with the 4848T. Any attempt to use them may cause the 4848T VNC server to malfunction and require power to be cycled in order to reboot the system.*

PARTS LIST

Fuses

Part No.	Fuse	Rating
139E6	Instrument Fuse	Fast acting, 1 Amp, 250VAC
139E10	Cooling Fuse	Fast acting, .25 Amp, 250VAC
2074E	Line Fuse(s)	Fast acting, 20 Amp, 250VAC
959E5	Motor Board Fuse (A+)	Very Fast acting, 8 Amp, 250VAC
185E2	Motor Board Fuse (L)	Fast acting, 10 Amp, 250VAC
	Motor breaker / fuse	
139E8	1/2 hp, 180VDC	Slo-blo, 2.5 Amp, 250VAC
139E19	1/4 hp, 180VDC	Slo-blo, 1.5 Amp, 250VAC
139E20	3/4 hp, 180VDC	Slo-blo, 4.0 Amp, 250VAC
801E	1/12 hp, 90VDC	Circuit breaker, 1.0 Amp
801E	1/17 hp, 90VDC	Circuit breaker, 1.0 Amp
801E3	1/8 hp, 90VDC	Circuit breaker, 1.5 Amp
801E2	1/4 hp, 90VDC	Circuit breaker, 2.5 Amp
801E4	1/2 hp, 90VDC	Circuit breaker, 5.0 Amp

CAUTION! For continued protection against possible hazard, replace fuses with same type and rating of fuse.

Cooling Solenoids

Part No.	Description
A160HW3EB	Solenoid Valve Pkg 115V
A160HW3EE	Solenoid Valve Pkg 230V
A160HW7EB	Solenoid Valve Pkg 115V 10FT
A160HW7EE	Solenoid Valve Pkg 230V 10FT
A160HW8EB	Solenoid Valve Pkg 115V 20FT
A160HW8EE	Solenoid Valve Pkg 230V 20FT
A160HW9EB	Solenoid Valve Pkg 115V 30FT
A160HW9EE	Solenoid Valve Pkg 230V 30FT

Accessories

Temperature (Temperature Control Module)
Aux. Temp. (Auxiliary Temperature Module)

Part No.	Description
A470E2	Thermocouple extension wire, 5-ft
A470E4	Thermocouple extension wire, 10-ft
A470E7	Thermocouple extension wire, 15-ft
A470E5	Thermocouple extension wire, 20-ft
A470E8	Thermocouple extension wire, 25-ft
A470E6	Thermocouple extension wire, 30-ft
A470E9	Thermocouple extension wire, 35-ft
A470E10	Thermocouple extension wire, 40-ft
A472E	Thermocouple, type-J, 7-1/2" length
A472E2	Thermocouple, type-J, 9-1/2" length
A472E3	Thermocouple, type-J, 11-1/2" length
A472E4	Thermocouple, type-J, 5-1/2" length
A472E5	Thermocouple, type-J, 21-1/2" length
A472E6	Thermocouple, type-J, 15-1/2" length
A490E	Dual T/C, type-J, 7-1/2" length
A490E2	Dual T/C, type-J, 9-1/2" length
A490E3	Dual T/C, type-J, 11-1/2" length
A490E4	Dual T/C, type-J, 5-1/2" length
A490E5	Dual T/C, type-J, 21-1/2" length
A490E6	Dual T/C, type-J, 15-1/2" length
A511E2	Heater T/C, type-J, bayonet style
A511E4	Heater T/C, dual, type-J, bayonet style

PARTS LIST *(Continued)*

Pressure (Pressure Module)

Part No.	Description
A1905E5	Pressure harness, 5-ft, covered
A1905E	Pressure harness, 10-ft, covered
A1905E8	Pressure harness, 15-ft, covered
A1905E3	Pressure harness, 20-ft, covered
A1905E9	Pressure harness, 25-ft, covered
A1905E7	Pressure harness, 30-ft, covered
A1905E10	Pressure harness, 35-ft, covered
A1905E11	Pressure harness, 40-ft, covered
A1906EP02	Transducer, 200 psi
A1906EP05	Transducer, 500 psi
A1906EP10	Transducer, 1000 psi
A1906EP20	Transducer, 2000 psi
A1906EP30	Transducer, 3000 psi
A1906EP50	Transducer, 5000 psi
A2599HC2	Transducer cooling body assembly
A2685HC	Cooling sleeve assembly
2083HC	Cooling sleeve for A2599HC2
827HC	O-rings for cooling sleeve
2714HC	Hose nipple

Note: *Additional Pressure Ranges are available upon request.*

Stir Speed (Motor Control Module)

Part No.	Description
A1001E	Optical sensor for cart reactor
A1001E2	Optical sensor for bench reactor
A1001E3	Optical sensor for gear box drives
A1001E4	Optical sensor for 4553/54/77/78
A1001E6	Optical sensor for 5100 reactor
A1001E8	Optical sensor for 3:1 gear box drive
A1001E9	Optical sensor for 4555 reactor
A1001E10	Optical sensor for 10:1 gear box drive
A1831E	Optical sensor for 5500 Compact Reactor
1564HC	Slotted wheel for cart, bench, & low pressure (1:1) reactors
1564HC2	Slotted wheel for low pressure (2:1) reactors
3056HC	Slotted wheel for 5500 Compact Reactor
A1177E8	Tachometer harness, 5-ft
A1177E	Tachometer harness, 10-ft
A1177E4	Tachometer harness, 15-ft
A1177E2	Tachometer harness, 20-ft
A1177E5	Tachometer harness, 25-ft
A1177E3	Tachometer harness, 30-ft
A1177E6	Tachometer harness, 35-ft
A1177E7	Tachometer harness, 40-ft