



# 4857 Reactor Controller

Fully integrated control,  
monitoring, and data  
handling of temperature,  
pressure, stirring speed,  
and other parameters,  
for up to two reactors  
from a single controller.



# 4857

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The 4857 Reactor Controller provides integrated, centralized control, monitoring capability, and data handling for up to two differently configured reactors.

The Parr 4857 Controller has been added to our product line to meet one or more of the following needs.

**1. The use of a PC as the user interface.** This controller provides the user full control of all reaction parameters (heating, cooling, stirring speed, alarms, etc.) from the PC; not just the temperature as in the 4836 and 4843 Controllers.

**2. The use of a PC to display, log and archive reaction parameters.** All reaction parameters are digitally transferred continuously to the PC. Software is included to configure real time displays as well as to log reaction data.

Earlier controllers composed of discrete modules contained a combination of analog and digital data. The analog data had to be processed thru an A to D converter and was not convenient to combine with the primary digital signal.

**3. The control of two reactors from a single controller and PC.** The dual version of this control provides full integral control to one or two reactors from a single controller at a very attractive price.

**4. The control of more than the usual number of process variables.** With up to eight PID controls available. The Expanded version of this controller can control multiple heaters, read

and log multiple pressures or control related functions.

**5. The use of simple logic functions.** While its capabilities are well short of the Series 4871 Process Controllers, the logic module available for these controllers can provide significantly enhanced control capabilities.

The Parr Model 4857 Reactor Controller has been developed to provide an integrated, control system for controlling laboratory reactors using a Personal Computer as the user interface and the data acquisition and processing station.

Unlike earlier model controls that relied on discrete components to control and monitor temperature, pressure, stirring speed and other parameters, the 4857 Controller provides integrated, centralized control and monitoring capability and data handling.

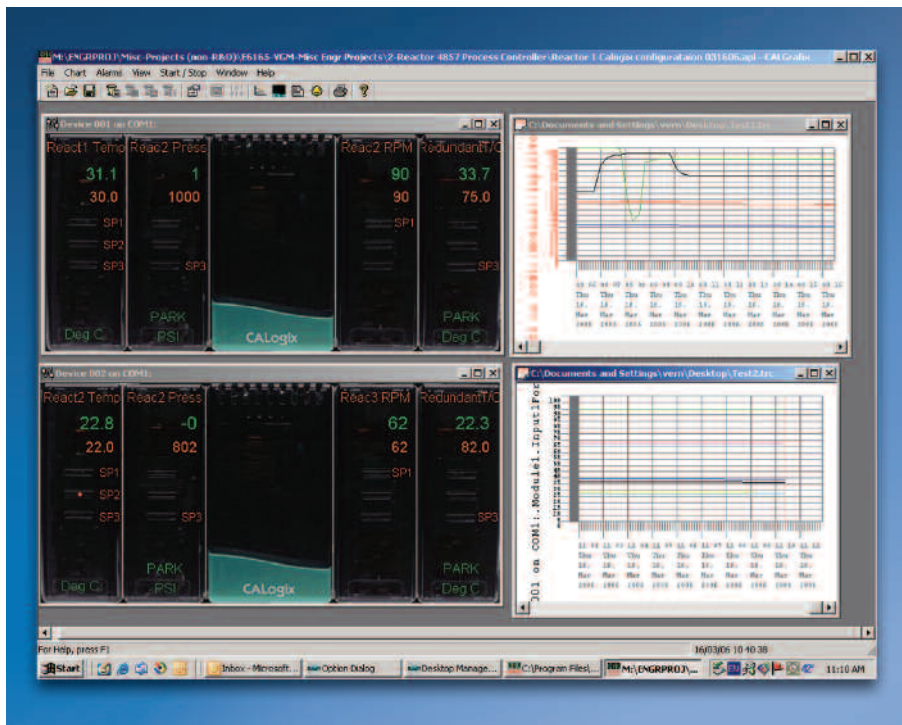
## There are four principal components to the 4857 Controller.

**1. The Control Module** contains the control circuitry as well as the connections for the transducer inputs, directional communications ports for connection to the PC, and control signals to the power controller.

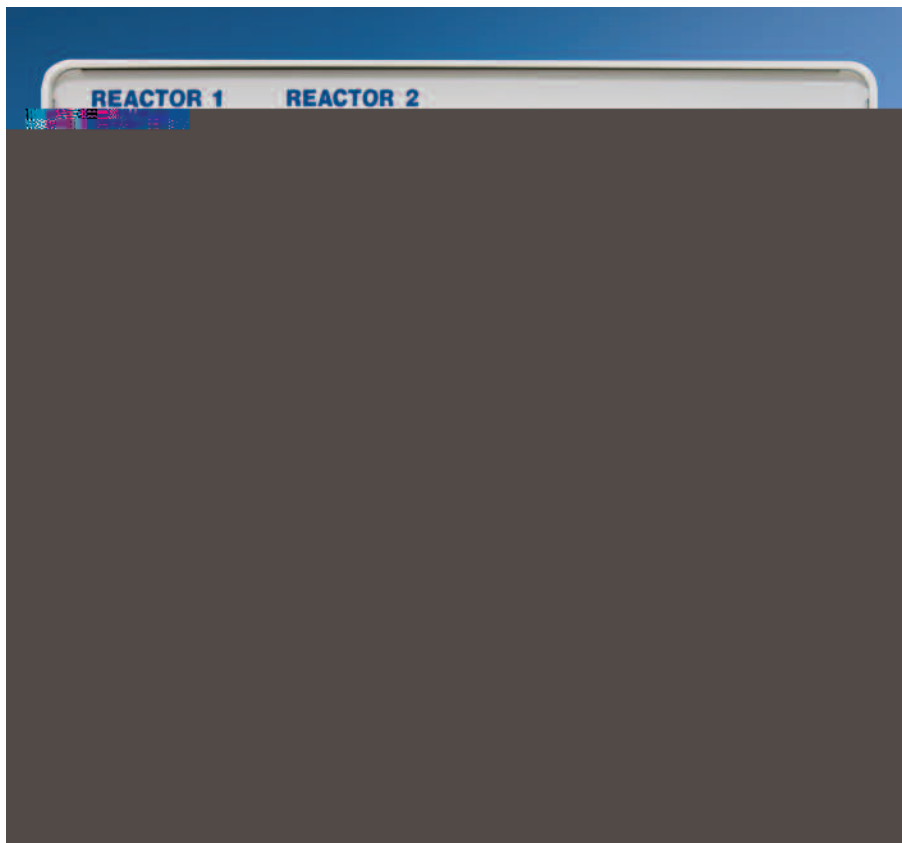
**2. The Power Control Module** handles all of the switching and control of the high current heater and stirrer motor circuits. This isolates these loads from the control circuitry.

**3. A Personal Computer** supplied by the user, provides the user operating interface, the real time parameter status display and graphing and data logging permanent storage capability.

**4. The Operating Software** provides a graphical interface to fully configure and operate the controller from the PC.



Screenshot from remote PC showing display, control, log, and archive reaction parameters for two different reactors simultaneously.



4857B back panel showing the control outputs for two reactors.

## Single, Expanded or Dual Reactor Control

The Model 4857 Reactor Controller is available in three configurations.

### A. Standard.

This configuration includes a single control rail with up to four individual modules. It is well suited for controlling a single reactor with PID controls for temperature, pressure, stirring and one more parameter.

### B. Dual Reactor.

This configuration includes two control rails set up to control two separate reactors thru two 4875 Power Control boxes.

### C. Expanded.

This configuration includes two control rails with up to 8 PID Control Modules. This provides the capability to control or monitor multiple temperatures, pressures or other operating parameters.

## Modular Design

The control is modular in design and the standard configuration can include up to four different operating modules.

### 1. Temperature Control

The temperature control module can accept either thermocouples or RTD temperature sensors. It has three outputs that are used for heating and cooling control and for alarm actuated heater cut off.

The control function is a full proportional, integral and derivative (PID) control with auto-tune capabilities.

The controller provides ramp and soak programming and can store up to 31 profiles each with up to 126 segments.

The temperature in the reactor is transmitted to the PC on a continual basis.



## 2. Pressure Monitoring

The pressure monitoring module is set up to accept its input from a pressure transducer mounted on the reactor. It can be set to accept a wide variety of operating ranges. Operating pressures are transmitted continuously to the PC.

While in most applications pressures are controlled by either a forward or back pressure regulator, this module is also a PID controller and can be used to actuate automatic valves to control pressures in the reactor.

One of the outputs from the pressure monitoring module is connected to the alarm relay to shut off power to the heater if the high pressure limit is reached during operation.

## 3. Stirrer Speed, Control, and Display

This module together with the motor speed controller in the 4875 Power Controller provides closed-loop control of the stirrer speed. Stirring speeds can be set from either the PC operating screen or a potentiometer on the face of the 4857 Controller. The stirring speed is transmitted continuously to the PC for display and logging.

The motor speed control included in this controller drives the motor at a constant, user settable speed using a PI closed loop control algorithm. As the viscosity of the contents of the reactor increases, the load on the motor increases and hence the voltage required to maintain the desired set point increases. The motor

speed control module monitors this parameter that can be correlated to the viscosity of the reactants. This is a very effective tool for monitoring the progress of polymerization reactions.

## 4. Redundant Temperature Monitoring and Control

A second, independent temperature control module can be installed in this controller. It can be used to monitor secondary temperatures of the heater or vessel wall. The outputs from this module can be used for back up high temperature alarms and shut down.

## 5. Auxiliary Pressure Monitoring

A second pressure monitoring module can be added to monitor and record the pressure in an auxiliary vessel such as a high pressure gas burette. This can be quite useful in determining the gas uptake and a plot will show relative reaction rates.

## 6. Logic Control

The logic control module offers three physical digital input channels and three digital outputs. Additional virtual digital inputs are provided that mirror the output state of PID blocks. Virtual outputs are also offered with the following functionality.

**Changing set-point.** The set point of a PID module can be changed using an output function block. By entering the required value the set point will be changed when switching from low (0) to high (1) logic state.

**Manual Power.** PID control can be suspended and replaced by a constant proportional output by using a manual power function block.

**Autotune.** A PID module can be tuned using an output logic block.

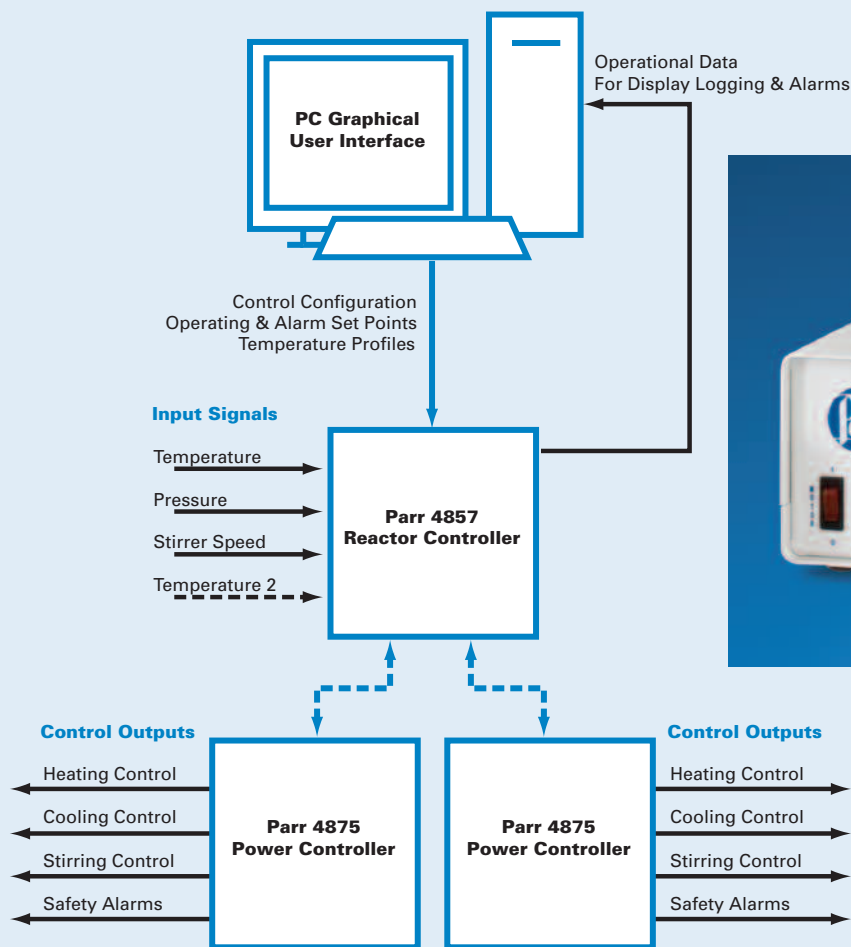
**Program.** A logic program output can be used to run, stop or hold a set point program (profile).

The module provides limited logic function block programming that can be used for controlling a system by linking associated inputs and outputs using logic, timer, counter and comparator functions. This logic capability, aside from the functionality outlined above, can be used, for example, to control valves used to introduce reactants or release products at predefined times or based on the state of system.

## PC Requirements

Parr does not furnish the PC as part of this control. The minimum requirements for the PC are:

- Pentium III processor with a minimum of 256 MB of RAM
- Windows 2000 or XP Operating System
- Minimum of 40 MB free hard disk space
- CD ROM Drive
- Graphics display capable of at least 256 colors and 1024 x 768 screen resolution (SVGA)
- RS-232 Serial COM Port or USB Port
- Mouse and keyboard



The 4875 Power Controller can be custom built to match the users experimental setup.

**4875 Power Controller**

The 4875 Power Controller includes all of the high current circuitry required to control the heating, cooling, over temperature or pressure protection and stirrer motor in a typical reactor. A standard 4875 Power Controller will include:

1. A solid-state relay sized to handle the current drawn by the vessel heater. This is commonly a 25-amp relay with its protective fuses.
2. A solid-state relay sized to drive a solenoid valve to control the flow of cooling water to the vessel.

3. A motor speed controller that converts the analog output signal from the controller to the electrical signal required to drive the specific stirrer motor. A circuit breaker for the motor is also provided.

4. A lockout relay to shut down the heater circuit should an alarm condition be detected.
5. Status lights for the principal functions.

6. Connections of appropriate style for the power input and device outputs.

Custom power controllers will be built for reactors where controls for additional heaters, or other accessories are required.

One Model 4875 Power Controller is required for each reactor if the Dual Control option is chosen. Since the Power Controller is set up to the individual reactor's heating and stirring loads, two quite dissimilar reactors can be controlled with a single 4857 Reactor Controller.

The power controller is normally located near the reactor in installations where the actual control is done remotely from a control room or station.

## Ordering Guide

### 4857A Reactor Controller for One Reactor

*Including:*

- One control CPU
- Temperature Control Module with Thermocouple
- Pressure Monitoring Module with Transducer
- Tachometer and Motor Voltage Display Module
- Operating and Configuration Software
- One 4875 Power Controller
- All Required Connecting Cables

**Order No. Description**

4857AEA	Reactor Controller Single 115V
4857AEF	Reactor Controller Single 230V

### 4857B Reactor Controller for Two Reactors

*Including:*

- Two Control CPU's
- Two Temperature Control Modules with Thermocouples
- Two Pressure Monitoring Modules with Transducers
- Two Tachometers and Motor Voltage Display Modules
- Operating and Configuration Software
- Two 4875 Power Controllers
- All Required Connecting Cables

**Order No. Description**

4857BEA	Reactor Controller, dual 115V
4857BEF	Reactor Controller, dual 230V

### 4857C Custom Reactor Controller

This model of the 4857 is reserved for custom modification. It can be equipped with up to 8 control / monitoring modules that can be mixed and matched to control multiple heaters or add additional instrumentation as required.

**Order No. Description**

4857CEA	Reactor Controller, dual 115V
4857CEF	Reactor Controller, dual 230V

### Expansion Modules

The 4857A Controller can accept one additional expansion module. The 4857B can accept up to two. The 4857C can accept any configuration of modules up to a total of eight.

- TCM: Temperature Control Module with Thermocouple
- PMM: Pressure Monitoring Module with Transducer
- TMM: Tachometer and motor current display module with pickup (4857C only)
- LCM: Logic Control Module

### 4857E Dual Control Expansion Module

The 4857E Expansion Module includes a second CPU and rail, with TCM, PMM, TMM and 4875 Power Controller.

To convert a 4857A Single Control to a 4857B Dual Controller:

**Order No. Description**

4857EEA	Dual Expansion Module 115V
4857EEF	Dual Expansion Module 230V

For Cooling Control:

**Order No. Description**

A160HW3EB	Solenoid Valve Package 115V
A160HW3EE	Solenoid Valve Package 230V



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