

Sentinel Series

Controller

Electric Power Requirements: 100/240 VAC, 50/60 Hz, 35 Amps

Dimensions: 7.5" High x 18.5" Wide x 16.25" Deep (190mm x 470mm x 413mm)

Customer Interlock: Voltage-free contact which has the capability of safely disabling the unit



Principle of Operation:

The Sentinel Series Controller is an integrated package utilizing powerful **Programmable Logic Controller (PLC)** for all process control, monitoring, and coordination in conjunction with a touch-screen operator display unit. The Sentinel provides the operator with a concise point of control for all processes related to a reactor system. In its standard configuration the unit controls and monitors the reactor's process temperature, external temperature, speed of the mixture, and the pressure within the reactor.

The Sentinel series can also be grouped together and operated via a single workstation computer. The workstation computer is configured to give the operator complete access to each connected Sentinel Controller including all operational capability, recipe functions, and data acquisition. The workstation will store all of the data acquired from each of the Sentinel Controllers.

Applications:

The Sentinel provides the operator with an overview screen displaying all of the reactor conditions. It also provides separate screens for each control loop, alarm/event summary, recipe generation/save/load, and system configurations.

With slight modifications the Sentinel can handle additional functions including but not limited to: Sample Valves, Catalyst Injector, Liquid Pump(s), and more.

Features:

- Temperature Control by an internal thermocouple
- Mixer Speed Control sensor attached to MagneDrive®
- Pressure Indication via a pressure transducer attached to reactor
- Flow Control capability of one or two integrated Mass Flow Controllers (MFC)
- WatchTower Software allows up to four Sentinel units on a single workstation



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Technical Specifications:

Specifications	Standard Sentinel
Electrical Power Requirements	100/240 VAC. 50/60 Hz, 35 Amps
Dimensions	7.5" High x 18.5" Wide x 16.25" Deep (190mm x 470mm x 413mm)
Customer Interlock	Voltage-free contact which has the capability of safely disabling the unit

Temperature Control:

Temperature control is based on an internal thermocouple used as the process variable, and a second, external thermocouple located at the heater/vessel wall interface. The internal thermocouple is used as feedback to the PID algorithm within the PLC to determine the power required from the heater to meet the desired operator entered set point. The heater is normally an electric band heater wrapped around the outside diameter of the vessel. While the vessel is heating, if the external thermocouple reaches the vessel temperature limit, the heater is disabled until the external thermocouple indicates the temperature is within proper operating limits.

Mixer Speed Control:

Mixer speed control is based on a speed sensor attached to the Magnedrive, which senses the shaft rotation. Based on this feedback the motor speed signal is adjusted by the PLC to meet the desired operator entered set point. The PLC will automatically soft ramp between set points to minimize system upset and bearing wear.

Pressure Control:

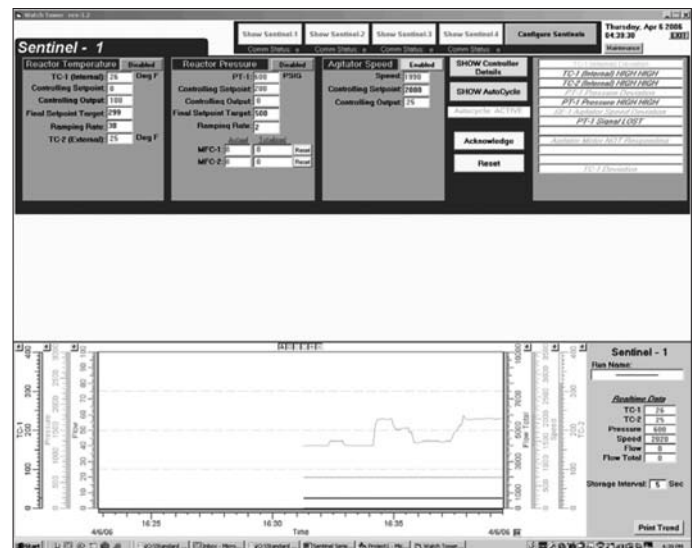
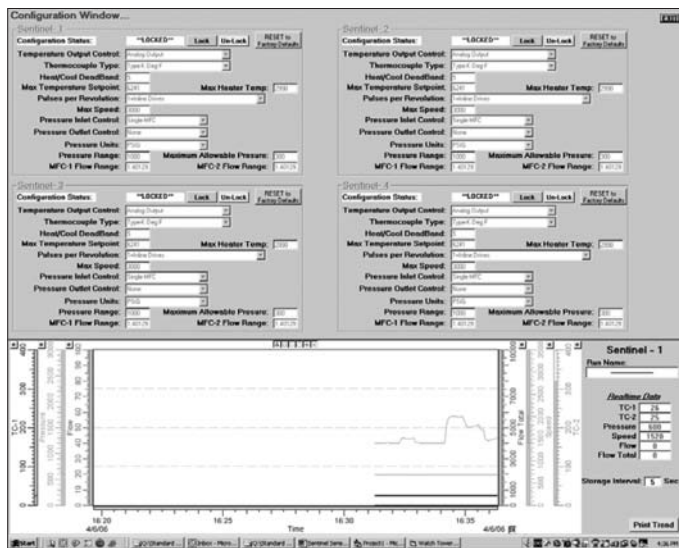
Pressure control is accomplished via a pressure transducer attached to the reactor. The reactor pressure will be adjusted based on the valve control action selected on the Sentinel configuration screen. On/Off or proportional control valves can be utilized to control the pressure. The system can also utilize a mass flow controller to control and maintain reactor pressure. The valves can be placed on the inlet side of the reactor, the outlet side, or both. The Sentinel will adjust to the control scenario selected by the customer in the configuration screen.

Flow Control:

The Sentinel provides the capability of integrating one or two Mass Flow Controllers (MFC's) into the system. The MFC(s) can be used to maintain pressure within the reactor via a closed loop pressure control configuration. It can also be used as an independent gas supply, with stand-alone control set point, while the system utilizes a back pressure valve to control reactor pressure.

Software Information:

The Watchtower package is designed to integrate up to four Sentinel Controllers onto a single supervisor workstation.



Watchtower - Control and Acquisition Software Package:

The "WatchTower Control and Acquisition" package provides the following features:

- Full control of all Sentinel functions
- Automatic cycle creation and control capability
- All event files saved to the workstation
- All process data saved to the workstation in .csv format for import into Excel

Ordering Guide:

Base Controller	Voltage	Operator Interface	Temp. Control	Temp. Sensor	Overtemp Control Action	Speed Control	Motor Size	Pressure Control Indication	Pressure Indication Range	Pressure Unit	Mass Flow Control	Comm. Options	Special Agency Approvals	Special Config.
S	1	1	1	1	1	1	8	4	5	1	2	1	2	1
	A	B	C	D	E	F	G	H	J	K	L	M	N	P

Part Number Example: **S11111184512121** (example selections indicated in yellow below)

Base Controller	
S	Standard Sentinel
-	Industrial Sentinel (consult factory)

A - Voltage	
1	120 Vac (50/60 Hz)
2	240 Vac (50/60 Hz)

B - Operator Interface	
1*	Monochrome
2	Color

C - Temperature Control			
0	None	5	External 35 Amp
1*	Internal 20 Amp	6	External 35 Amp with Cooling
2	External Signal ¹	7	3 Zone Control
3	Internal 20 Amp with Cooling ²	8	3 Zone Control with Cooling
4	External Signal ¹ with Cooling		

D - Temperature Sensor			
0	None		
1*	Type-K Thermocouple °C		
3	Type-K Thermocouple °F		

E - Overtemp Control Action	
0	None
1*	Non-Latching
2	Latching

F - Speed Control	
0	None
1*	Closed Loop DC Motor Control
2	External Signal ³
3	Closed Loop DC Motor Control with Ammeter

G - Motor Size			
0	None	5	1/3 Horsepower (90vdc)
1	1/25 Horsepower	6	1/2 Horsepower (90vdc)
2	1/10 Horsepower	7	1/4 Horsepower (180vdc)
3	1/8 Horsepower	8	1/2 Horsepower (180vdc)
4	1/4 Horsepower (90vdc)		

* Standard Equipment

H - Pressure Control and Indication			
0	None	5	On/Off Inlet Control and Analog Output
1*	Indication Only	6	On/Off Outlet Control and Analog Output
2	On/Off Inlet Control (D)	7	Analog Inlet Control
3	On/Off Outlet Control (vent) (D)	8	Analog Outlet Control
4	On/Off Inlet and Outlet Control (D)		(D=Digital)

J - Pressure Indication Range			
0	None	4	5,000 psi (345 bar)
1	500 psi (34 bar)	5	10,000 psi (689 bar)
2	1,000 psi (69 bar)	6	Custom
3	3,000 psi (207 bar)		

K - Pressure Units	
0	None
1	psig
2	bar

L - Mass Flow Controller			
0	None	3	Single Unit for Pressure Control
1	Single Unit Independent Control	4	Dual Unit for Pressure Control
2	Dual Unit Independent Control		

M - Communication Options	
0	None
1	Ethernet

N - Special Agency Approvals	
0*	None
1	UL/CUL
2	CE
3	Canadian Standard (inspection required)

P - Special Configuration	
0	Conforms to Catalog Number
1	Customer Specified Requirement
2	IS Barrier Configuration

Additional Items Available	
	Watchtower Software - Control (Requires "COMM" Option)
	IS Barrier Module

- NOTES:
- An External Signal selection for Temperature Control routes an external signal to an External Power Module, which is supplied separately. The External Power Module is capable of handling heater power in excess of the Sentinel's internal 20 Amp capability.
 - A Cooling selection for Temperature Control provides an external signal to a cooling solenoid valve, which will circulate water through the vessel-cooling coil. The valve voltage will match that of the Sentinel input of power.
 - An External Signal selection for Speed Control & Indication routes an external signal to an external motor speed controller, which is supplied separately. The external motor speed controller is capable of handling larger DC & AC motors in excess of the Sentinel's internal 1/2 Horsepower capability.

WARNING

FAILURE, IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

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Instrumentation Products Division
 Autoclave Engineers Operation
 8325 Hessinger Drive
 Erie, PA 16509-4679
 Tel: 814 860 5700 • Fax: 814 860 5718
 www.AutooclaveEngineers.com

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