

Custom Engineered Process Control Panels



5
Control Panels
Managing
5
Circulation
Heating Systems

Application: Cleaning and applying chromate coating to aircraft parts

Tempco's process controllers provide integrated solutions to manage your thermal loop system.

Why spend your valuable time engineering, designing, sourcing components and building Industrial Power Control Panels? Our UL 508A Certified Panel Shop can meet all your requirements for a multitude of processing control applications, from the simplest single zone panel to the most complex thermal loop system.

We offer standard or custom engineered power control panels backed by over 35 years of experience in the process heating industry. We apply our vast knowledge and expertise to every system we design and manufacture.

**Consult us with your requirements.
We welcome your inquiries**



Assembly of two panels with temperature controllers and motor drives. Also includes Programmable Logic Controllers (PLC) with communication capabilities pre-programmed by our engineers.

Application: Industrial Processing System



Application: automated wood laminating press system

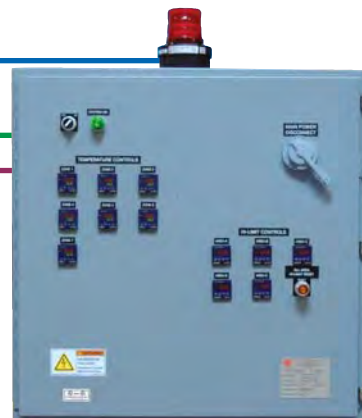
**Control Panels
are Engineered &
Manufactured in our 508A
Certified Panel Shop.**

YOUR SATISFACTION IS GUARANTEED!





Application: Outdoor Control Panel for a 1,000 gallon water holding tank with internal temperature control, NEMA 4 construction and enclosure heater



Application: paint curing for decorative landscaping rocks and stone.

Standard Designs
See Page 13-44

Custom Designs:
See Page 13-46

Enclosure Options:
See Page 13-49

Obtaining the leading edge process control panel that you need is one thing.

Acquiring it at the cost and time you have in mind is quite another.

Achieve your goals with TEMPCO.
One Company, One Solution.



TEMPCO 250KW Skid Mounted Circulation Heater and Power Control Panel:

Application: hot air heating for waste reduction management.

Features: main circuit breaker, SCR power control, FM high limit, CE certification, 6 – output circuit load fusing, lifting eyebolts on frame

Application: Controlling Infrared Heating Panels for thermoforming equipment



Tempco Power Control Systems:

A Convenient Package For Virtually Any Thermal Loop Application



Standard Control Panels

Temperature Control Panels – Standard Design For Industrial Process Applications



Design Features

- * NEMA 12 enclosure
- * Model TEC-4100 1/4 DIN or TEC-9100 1/16 DIN temperature control, dual display with auto-tuning
- * Model TEC-410 1/4 DIN or TEC-910 1/16 DIN high limit control with FM approval and manual reset pushbutton switch
- * Main Power: 240 or 480 VAC, single or three phase
- * High limit safety contactor
- * Fused turn handle disconnect

Heater Power Output

- SCR output device and fused sub-circuits
- Solid state relays with individual relays per fused sub-circuit
- Mechanical or Mercury relays

These standard control panels range in capacity from 4.8KW through 332KW and use NEMA 12 enclosures.

The general purpose control panels are set up to run process heating systems such as circulation, duct heaters or any other resistive load.

All control panels are shipped factory pre-wired according to the National Electrical Code, eliminating the need by the customer to design your own control system, purchase separate components and construct your own working temperature control system.

The standard temperature control systems are supplied with the standard features listed. They are based on SCR power controls, solid state or mercury relays.

- * Power on pilot lamp
- * Control transformer, fused secondary
- * Power output connections hardwired to fuse holders
- * Sensor input connections at labeled terminal strips
- * Ventilation fan and filter standard for systems over 15KW
- * Tagging of door-mounted parts with 2-color engraved phenolic labels
- * 1 set of wiring schematics and control manuals

Silicone Controlled Rectifier (SCR) Power Controls are a solid state device that provides infinitely variable power to accurately maintain setpoint temperature and extends heater life by maintaining a stable process temperature.

- Single-phase systems use single-phase zero cross SCRs.
- Three-phase systems use 2-leg three-phase zero cross SCRs.

Solid State Relays offer many of the benefits of SCRs but often at a lower cost. Maintenance costs are potentially lower due to less costly SSRs used per control circuit.

Mercury Relays offer a low-cost alternative to SCRs and SSRs for process heating applications and provide longer life than a mechanical contactor due to their self renewing mercury contacts.

See page 13-47 for some of the more common control panel options.

See page 13-46 for Custom Control Panels



Standard Temperature Control Panels For Industrial Process Applications

Total per Phase Amps	Volts	Phase	Total KW	Number of Fused Sub-Circuits	Panel Size Code	Part Number		
						with SCR	with SS Relays	with Mechanical Contactors
20	240	1	4.8	1	A	PCS20001	PCE20001	PCM20001
	480	1	9.6	1	A	PCS20002	PCE20002	PCM20002
	240	3	8.3	1	B	PCS20003	PCE20003	PCM20003
	480	3	16.6	1	B	PCS20004	PCE20004	PCM20004
30	240	1	7.2	1	A	PCS20005	PCE20005	PCM20005
	480	1	14.4	1	A	PCS20006	PCE20006	PCM20006
	240	3	12.4	1	C	PCS20007	PCE20007	PCM20007
	480	3	24.9	1	C	PCS20008	PCE20008	PCM20008
60	240	1	14.4	1	C	PCS20009	PCE20009	PCM20009
	240	1	14.4	2	C	PCS20010	PCE20010	PCM20010
	480	1	28.8	1	D	PCS20011	PCE20011	PCM20011
	480	1	28.8	2	D	PCS20012	PCE20012	PCM20012
	240	3	24.9	1	D	PCS20013	PCE20013	PCM20013
	240	3	24.9	2	E	PCS20014	PCE20014	PCM20014
	480	3	49.8	1	D	PCS20015	PCE20015	PCM20015
	480	3	49.8	2	E	PCS20016	PCE20016	PCM20016
100	240	3	41.5	1	F	PCS20017	—	PCM20017
	240	3	41.5	2	F	PCS20018	PCE20018	PCM20018
	240	3	41.5	3	G	PCS20019	PCE20019	PCM20019
	480	3	83.0	1	F	PCS20020	—	PCM20020
	480	3	83.0	2	G	PCS20021	PCE20021	PCM20021
	480	3	83.0	3	G	PCS20022	PCE20022	PCM20022
150	240	3	62.2	2	H	PCS20023	—	PCM20023
	240	3	62.2	3	I	PCS20024	—	PCM20024
	240	3	62.2	4	J	PCS20025	—	PCM20025
	480	3	124.5	2	H	PCS20026	—	PCM20026
	480	3	124.5	3	I	PCS20027	—	PCM20027
	480	3	124.5	4	J	PCS20028	—	PCM20028
200	240	3	83	2	K	PCS20029	—	PCM20029
	240	3	83	3	K	PCS20030	—	PCM20030
	240	3	83	4	L	PCS20031	—	PCM20031
	240	3	83	5	L	PCS20032	—	PCM20032
	480	3	166	2	K	PCS20033	—	PCM20033
	480	3	166	3	K	PCS20034	—	PCM20034
	480	3	166	4	L	PCS20035	—	PCM20035
	480	3	166	5	L	PCS20036	—	PCM20036
300	480	3	249	4	M	PCS20037	—	PCM20037
	480	3	249	5	M	PCS20038	—	PCM20038
	480	3	249	6	N	PCS20039	—	PCM20039
	480	3	249	7	N	PCS20040	—	PCM20040
400	480	3	332	5	O	PCS20041	—	PCM20041
	480	3	332	6	O	PCS20042	—	PCM20042
	480	3	332	7	P	PCS20043	—	PCM20043
	480	3	332	8	P	PCS20044	—	PCM20044
	480	3	332	9	P	PCS20045	—	PCM20045

Panel Size Code — Dimensions are Approximate

Panel Code	Inches			Millimeters		
	Height	Width	Depth	Height	Width	Depth
A	20	16	8	510	405	205
B	20	20	8	510	510	205
C	24	24	10	760	610	255
D	30	24	12	915	610	305
E	36	24	12	915	610	305
F	36	30	12	915	760	305
G	36	36	12	915	915	305
H	42	30	12	1065	760	305

Panel Code	Inches			Millimeters		
	Height	Width	Depth	Height	Width	Depth
I	42	36	12	1065	915	305
J	48	36	12	1220	915	305
K	60	36	12	1525	915	305
L	72	30	12	1830	760	305
M	72	36	12	1830	915	305
N	72	30	16	1830	760	405
O	60	36	20	1525	915	510
P	72	30	20	1830	760	510

Ordering Information

See page 13-48



Note: Mercury Relays are available on request.



Temperature Control Panels — Custom Designed/Manufactured for any Industrial Process Applications



Typical Design Features

- * NEMA, UL, CSA or IEC enclosure
- * Choice of temperature controller
- * Circuit breaker, fused or no disconnect enclosure
- * Main Power: Any up to 600 VAC three phase
- * Heater Power: Any up to 600 VAC three phase
- * PLC based control with touch panel display
- * Fan, heat-tube, air conditioning or other cooling
- * Anti-condensation heating
- * Outer sensor or power input connections at labeled terminal strips
- * Higher Short Circuit Current Rating (SCCR) 5KA standard

Tempco's made-to-order control panels are engineered to solve practically every process heating application including zoned infrared arrays for thermoforming and drying ovens.

Output power devices can be an SCR, solid state relays or mercury relays. It is recommended that for infrared arrays, only SCRs or solid state relays be used for the most stable element temperature. For halogen (tungsten) elements phase angle fired SCRs with soft start capability should be used.

All control panels are shipped factory pre-wired in accordance with the National Electrical Code, NFPA79, UL508A and any special local electrical codes required by the customer. UL508A certification available only when requested.

See page 13-47 for some of the more common custom control panel options.

Ordering Information

To request a quote see page 13-48



Custom Temperature Control Panels — Typical Options

1. Pre-wired outlets for heater power Female twist lock style panel mount connectors and male plugs can be added to the exterior of the enclosure for circuits of 480 VAC and 30 Amp and under.

2. Pre-wired panel jacks for temperature sensors Female panel mount jack connectors and plugs can be added to the exterior of the enclosure.

3. Other standard voltages such as 208, 380, 415, 575 or 600 VAC — Special single or three phase systems can be manufactured to customer requirements.

4. Current meter, single phase A current transformer and a door-mounted analog or digital meter reads the average load current.

5. Current meter, three phase A set of three current transformers, a door-mounted analog or digital meter and a four-position switch allows the customer to read the average load current on all three phases.

6. Voltage meter, single phase A door-mounted analog or digital meter reads the voltage applied to the main input of the control panel.

7. Voltage meter, three phase A door-mounted analog or digital meter and a four-position switch allows the customer to read the voltage applied to the main input on all three phases.

8. Optional controls The standard 1/16th DIN control can be replaced by 1/8 or 1/4 DIN size controls.

9. Base—Load—Controller When used with a zero-fired SCR Power Controller, a base-load-controller can help eliminate light flicker normally associated with large zero-fired loads. High harmonics and low power factor caused by large phase-fired loads can also be improved using a base-load-controller.

10. Heater power lamp Door-mounted pilot lamp gives an indication of applied heater power.

11. Circuit breaker instead of main fused disconnect Replaces the standard fused disconnect with a circuit breaker to provide automatic overcurrent protection.

12. Individual sub-circuit circuit breakers instead of fusing Replaces the standard sub-circuit fusing with internally mounted circuit breakers.

13. Annunciation, audible horn Provides for an audible horn to sound based on the temperature control's alarm condition. An acknowledge pushbutton switch is included. The horn would be mounted on the exterior of the enclosure.

14. Annunciation, flashing beacon Provides for a flashing light to turn on based on the temperature control's alarm condition. An acknowledge pushbutton switch is included. The beacon would be mounted on the exterior of the enclosure.

15. Enclosure heater for outdoor use A silicone rubber heater with thermostat or ceramic bulb enclosure heater to prevent freeze and condensation protection is mounted inside the enclosure. It would be properly sized for the enclosure used.

16. Mechanical cooling For control systems that are used in hot environments or require complete enclosure sealing, active or passive cooling can be incorporated into the control panel. This includes cooling fans, air conditioners or vortex cooling.

17. Integral liquid level controls Basic one-level liquid level controls can be incorporated into the safety contactor circuit to turn off the heater if the tank reaches a dangerously low level. Multi-level liquid level switch systems can be incorporated to provide pump or valve controls to maintain required levels.

18. Chart recorder A strip chart recorder can be mounted in the door to provide historical data records of the process being controlled.

19. Special paint The enclosure can be custom painted to provide environmental protection or a unique color.

20. Tagging internal parts Engraved phenolic tags can be added to the subpanel to identify components as depicted on the drawings provided. The tags will be attached to the subpanel near the identified part.

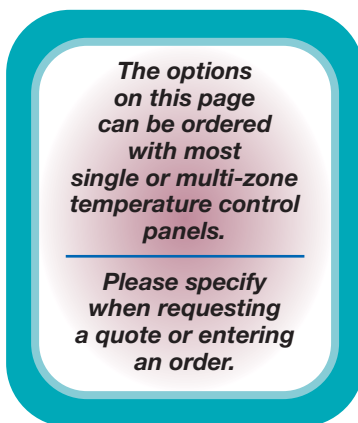
21. Utility outlet 120 VAC for maintenance instruments, powered externally or internally. If powered internally, limited to 2 Amps.

22. Internal lighting package A useful option for routine maintenance or troubleshooting.

23. Floor stand kit This option provides a 12" stand kit for any wall-mounted enclosure, making it a free-standing floor model.

24. Enclosure mechanical options Miscellaneous options such as a drip or solar shield can be added to the enclosure.

25. Approval drawings This option is for when the customer requires approval drawings prior to release for manufacturing. (Standard documents are normally shipped with each control panel). With this option, Tempco will provide a copy of the proposed general layout drawing and electrical schematic for customer approval. The production process would not begin until after the *approval drawings* are signed and returned to Tempco.



**Please Consult Tempco if the Option You Require is Not Listed.
We Welcome Your Inquiries!**



Request for Quote

Temperature Control Panel Quote Request Worksheet

1. General Information: Customer: _____ Date: _____
Contact Person: _____ Phone _____ E-mail: _____
Quote Number: _____ Quoted By: _____ Date: _____

2. Operating Environment:

Description of Application: _____
Heated Medium (liquid, solid, vapor) & Name _____ Process temperature _____
Installation Environment: indoor, wet, dry _____ NEMA rating (if required) _____
Hazardous Location Rating (if required) Class, Division, Group, Zone _____
Minimum & Maximum Ambient Temperatures _____

3. Control Panel Requirements:

Tempco Catalog Number (if applicable) _____ Quantity _____ Drawing Available _____
Any Enclosure Size Limitations _____ Wall Mounted Floor Mounted
Number of Controlled Zones _____ Heater Catalog Number _____
Heater Specifications: Watts _____ Volts _____ Phase _____ Amps _____ Number of Circuits _____ Quantity _____
Output Control Device: Magnetic Contactor SCR SSR Mercury Displacement Relay
Temperature Controller Model Number _____ Temperature Controller Sensor Type _____
Maximum Available Short Circuit Current Rating (SCCR) at Panel _____ KA (SCCR requirement)
FM High Limit Required (K t/c standard input) _____ Agency Approval(s) Required _____

4. Other Special Features Required: _____

Ordering Information

**Custom Engineered/Manufactured
Power Control Panels
Available From Tempco.
We Welcome Your Inquiries!**

1. For **Standard Process Control Panels** with the standard list of features, match your heater requirements to the control panels listed on page 13-45. Verify that the number of circuits match between the process heater and control panel and the watts and volts are sufficient.
2. If you require a **Standard Control Panel with Optional Features**, fill out a copy of the Quote Request Worksheet and fax it to Tempco. We will review your requirements and return to you a quote for a temperature control system matched to your needs.
3. If you require a **Custom Control Panel**, fill out a copy of the Quote Request Worksheet and fax it to Tempco. Include as much information as you can regarding the heater and application requirements. We will review your requirements and return to you a quote for a temperature control system matched to your needs.



Temperature Control Panels — Enclosure Options

Tempco's **Control Panels** are built using NEMA 12 manufactured enclosures. Tempco can also design and manufacture panels to other standard NEMA ratings as described below.

The **Standard NEMA Enclosure Definitions** are listed for your convenience. Also included are comparison charts for indoor and outdoor enclosures.

Include the **NEMA Enclosure Rating** required on your Request for Quote.

Standard: NEMA 12 — resistant to dirt, and dripping non-corrosive liquids

OPTIONAL:

Type 1
general purpose

Type 3
weather and wind blown dust resistant

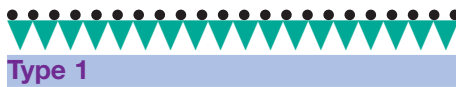
Type 3R
weather resistant

Type 4
moisture and wind blown dust resistant

Type 4X
moisture and corrosion resistant

Type 7
explosion resistant

Standard NEMA (National Electrical Manufacturers' Association) Enclosure Ratings



Type 1

Enclosures are intended for indoor use primarily to provide a degree of protection against contact with the enclosed equipment in locations where unusual service conditions do not exist.

Type 3

Enclosures are intended for outdoor use primarily to provide a degree of protection against windblown dust, rain, and sleet; and to be undamaged by the formation of ice on the enclosure.

Type 3R

Enclosures are intended for outdoor use primarily to provide a degree of protection against falling rain and sleet, and to be undamaged by the formation of ice on the enclosure.

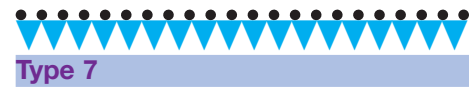


Type 4

Enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, and hose-directed water; and to be undamaged by the formation of ice on the enclosure.

Type 4X

Enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, and hose-directed water; and to be undamaged by the formation of ice on the enclosure.



Type 7

Enclosures are capable of withstanding the pressures resulting from an internal explosion of specified gas, and containing such an explosion sufficiently that an explosive gas-air mixture existing in the atmosphere surrounding the enclosure will not be ignited.

Type 12

Enclosures are intended for indoor use primarily to provide a degree of protection against dust, falling dirt, and dripping non-corrosive liquids.

Comparison of Indoor Rated Enclosures

Provides a degree of protection against the following conditions:	Type of Enclosure				
	1	4	4X	7	12
Incidental contact with enclosed equipment	X	X	X	X	X
Falling dirt	X	X	X	X	X
Falling liquids and light splashing		X	X	X	X
Dust, lint, and fibers		X	X	X	X
Hosedown (hose directed water)		X	X	X	
Oil and coolant seepage				X	X
Corrosive agents			X	X	
Potentially explosive gas-air mixture				X	
Windblown Dust		X	X		

Comparison of Outdoor Rated Enclosures

Provides a degree of protection against the following conditions:	Type of Enclosure			
	3	3R	4	4X
Incidental contact with enclosed equipment	X	X	X	X
Rain, snow and sleet	X	X	X	X
Windblown dust	X		X	X
Hosedown (hose-directed water)			X	X
Corrosive agents				X



Note: CSA and IEC class enclosures are also available.