

IMPORTANT: BEFORE TURNING ON POWER, CHECK TIGHTNESS OF ALL ELECTRICAL CONNECTIONS (SOME MAY LOOSEN DURING SHIPPING).

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 general purpose 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.**



Custom Designed Portable Heat Treat System

Ramp/Soak Temperature Controllers and other electronics are mounted in a custom sized portable stainless steel cabinet to power silicone rubber electric heating elements.



Panel with Air Conditioner Cooling

This 304 Stainless Steel, NEMA 4X control panel features a thermostat-controlled, side mounted air conditioner that maintains safe interior temperatures for the electrical components while operating in high outdoor ambient temperatures.

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

YOUR SATISFACTION IS GUARANTEED!

Most Items





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.

Common Designs
See Page 13-58

Custom Designs:
See Page 13-60

Enclosure Types:
See Page 13-63

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.

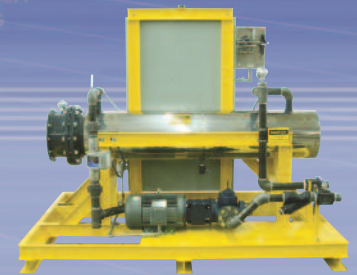
**Achieve your goals with TEMPCO.
One Company, One Solution.**



TEMPCO 90KW Skid Mounted Fuel Circulation Heating System

Application: Hot air heating for waste reduction management.

Features: NEMA 4 Control Panel, Purge & Pressurization Enclosure Protection System, TEC-4100 PID Temperature Controller, TEC-410 FM High Limit Control, PPR-1800 Videographic Data Logger, Intrinsically Safe Sensor Barriers



**Tempco Power Control Systems:
A Convenient Package For Virtually Any Thermal Loop Application**

Temperature Control Panels – Designed for Industrial Process Applications



Design Features

- * NEMA 12 enclosure
- * Model TEC-4400 1/4 DIN or TEC-9400 1/16 DIN temperature control, dual display with auto-tuning and bright LCD displays using NFPA/IEC standard colors
- * 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
- * Class CC & J fusing offers best-in-class current limitation offering reliable interruption of all overcurrents with protection up to 200kA

Heater Power Output

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

These general purpose control panels range in capacity from 4.8KW through 332KW.

They are set up to run process heating systems using circulation heaters, duct heaters or any other resistive load.

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

These general purpose temperature control systems are based on SCR power controls, solid state relays or mechanical contactor and are supplied with the standard features listed.

- * Power On pilot lamp
- * Control transformer, fused primary and secondary
- * Power output connections hardwired to fuse holders
- * Sensor input connections hardwired to labeled terminal blocks
- * High quality Hoffman enclosures & components
- * Ventilation fan and filter standard for SCR & SSR systems
- * Tagging of door-mounted parts with 2-color, laser-etched, aluminum labels
- * 1 set of wiring schematics and control manuals
- * Agency Approvals:



Silicon Controlled Rectifier (SCR) Power Controls are solid state devices that provide infinitely variable power to accurately maintain setpoint temperature and extend heater life by maintaining a stable process temperature.

- Single-phase systems use single-phase zero cross SCRs.
- Three-phase systems use 2-leg zero cross or 3-leg phase-angle SCRs dependant on load type.

Solid State Relays offer many of the benefits of SCRs often at a lower cost, but are limited to an 80 Amp load.

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 13-61 for some of the more common control panel options.

See page 13-60 for Custom Control Panels



Temperature Control Panels For Industrial Process Applications

| Total per Phase Amps | Volts | Phase | Total KW | Number of Fused Sub-Circuits | Part Number with SCR | Panel Size H×W×D (in) | Part Number with SS Relays | Panel Size H×W×D (in) | Part Number with Mechanical Contactors | Panel Size H×W×D (in) |
|----------------------|-------|-------|----------|------------------------------|----------------------|---------------------------------------|----------------------------|-----------------------|--|---------------------------------------|
| 20 | 240 | 1 | 4.8 | 1 | — | — | PCE20001 | 20×20×8 | PCM20001 | 20×20×8 |
| | 480 | 1 | 9.6 | 1 | — | — | PCE20002 | 20×20×8 | PCM20002 | 20×20×8 |
| | 240 | 3 | 8.3 | 1 | — | — | PCE20003 | 24×20×8 | PCM20003 | 20×20×8 |
| | 480 | 3 | 16.6 | 1 | — | — | PCE20004 | 24×20×8 | PCM20004 | 24×20×8 |
| 30 | 240 | 1 | 7.2 | 1 | — | — | PCE20005 | 24×20×8 | PCM20005 | 24×20×8 |
| | 480 | 1 | 14.4 | 1 | — | — | PCE20006 | 24×20×8 | PCM20006 | 24×20×8 |
| | 240 | 3 | 12.4 | 1 | — | — | PCE20007 | 24×20×8 | PCM20007 | 24×20×8 |
| | 480 | 3 | 24.9 | 1 | — | — | PCE20008 | 24×20×8 | PCM20008 | 24×20×8 |
| 60 | 240 | 1 | 14.4 | 1 | PCS20009 | 24×24×12 | PCE20009 | 30×24×8 | PCM20009 | 24×24×8 |
| | 240 | 1 | 14.4 | 2 | PCS20010 | 36×24×12 | PCE20010 | 30×24×8 | PCM20010 | 36×24×8 |
| | 480 | 1 | 28.8 | 1 | PCS20011 | 24×24×12 | PCE20011 | 30×24×8 | PCM20011 | 36×24×8 |
| | 480 | 1 | 28.8 | 2 | PCS20012 | 36×24×12 | PCE20012 | 30×24×8 | PCM20012 | 24×24×8 |
| | 240 | 3 | 24.9 | 1 | PCS20013 | 36×24×12 | PCE20013 | 36×24×8 | PCM20013 | 36×24×8 |
| | 240 | 3 | 24.9 | 2 | PCS20014 | 36×24×12 | PCE20014 | 36×24×8 | PCM20014 | 36×24×8 |
| | 480 | 3 | 49.8 | 1 | PCS20015 | 36×24×12 | PCE20015 | 36×24×8 | PCM20015 | 24×24×8 |
| | 480 | 3 | 49.8 | 2 | PCS20016 | 36×24×12 | PCE20016 | 36×24×8 | PCM20016 | 24×24×8 |
| 100 | 240 | 3 | 41.5 | 1 | PCS20017 | 36×36×12 | — | — | PCM20017 | 36×30×10 |
| | 240 | 3 | 41.5 | 2 | PCS20018 | 36×36×12 | — | — | PCM20018 | 36×30×10 |
| | 240 | 3 | 41.5 | 3 | PCS20019 | 36×36×12 | — | — | PCM20019 | 42×30×10 |
| | 480 | 3 | 83.0 | 1 | PCS20020 | 36×36×12 | — | — | PCM20020 | 42×30×10 |
| | 480 | 3 | 83.0 | 2 | PCS20021 | 36×36×12 | — | — | PCM20021 | 42×30×10 |
| | 480 | 3 | 83.0 | 3 | PCS20022 | 36×36×12 | — | — | PCM20022 | 42×30×10 |
| 150 | 240 | 3 | 62.2 | 2 | PCS20023 | 42×36×12 | — | — | PCM20023 | 42×30×10 |
| | 240 | 3 | 62.2 | 3 | PCS20024 | 42×36×12 | — | — | PCM20024 | 42×30×10 |
| | 240 | 3 | 62.2 | 4 | PCS20025 | 42×36×12 | — | — | PCM20025 | 42×30×10 |
| | 480 | 3 | 124.5 | 2 | PCS20026 | 42×36×12 | — | — | PCM20026 | 42×30×10 |
| | 480 | 3 | 124.5 | 3 | PCS20027 | 42×36×12 | — | — | PCM20027 | 42×30×10 |
| | 480 | 3 | 124.5 | 4 | PCS20028 | 42×36×12 | — | — | PCM20028 | 42×30×10 |
| 200 | 240 | 3 | 83 | 2 | PCS20029 | 42×36×12 | — | — | PCM20029 | 42×36×10 |
| | 240 | 3 | 83 | 3 | PCS20030 | 42×36×12 | — | — | PCM20030 | 42×36×10 |
| | 240 | 3 | 83 | 4 | PCS20031 | 42×36×12 | — | — | PCM20031 | 42×36×10 |
| | 240 | 3 | 83 | 5 | PCS20032 | 42×36×12 | — | — | PCM20032 | 42×36×10 |
| | 480 | 3 | 166 | 2 | PCS20033 | 42×36×12 | — | — | PCM20033 | 42×36×10 |
| | 480 | 3 | 166 | 3 | PCS20034 | 42×36×12 | — | — | PCM20034 | 42×36×10 |
| | 480 | 3 | 166 | 4 | PCS20035 | 42×36×12 | — | — | PCM20035 | 42×36×10 |
| | 480 | 3 | 166 | 5 | PCS20036 | 42×36×12 | — | — | PCM20036 | 42×36×10 |
| 300 | 480 | 3 | 249 | 4 | PCS20037 | 60×49 ³ / ₄ ×12 | — | — | PCM20037 | 48×36×10 |
| | 480 | 3 | 249 | 5 | PCS20038 | 60×37 ⁷ / ₈ ×12 | — | — | PCM20038 | 48×36×10 |
| | 480 | 3 | 249 | 6 | PCS20039 | 60×37 ⁷ / ₈ ×12 | — | — | PCM20039 | 48×36×10 |
| | 480 | 3 | 249 | 7 | PCS20040 | 60×37 ⁷ / ₈ ×12 | — | — | PCM20040 | 48×36×10 |
| 400 | 480 | 3 | 332 | 5 | PCS20041 | 60×53×12 | — | — | PCM20041 | 42×54 ¹ / ₂ ×10 |
| | 480 | 3 | 332 | 6 | PCS20042 | 60×53×12 | — | — | PCM20042 | 42×54 ¹ / ₂ ×10 |
| | 480 | 3 | 332 | 7 | PCS20043 | 60×53×12 | — | — | PCM20043 | 42×54 ¹ / ₂ ×10 |
| | 480 | 3 | 332 | 8 | PCS20044 | 60×53×12 | — | — | PCM20044 | 42×54 ¹ / ₂ ×10 |
| | 480 | 3 | 332 | 9 | PCS20045 | 60×53×12 | — | — | PCM20045 | 60×48×16 |

Enclosure dimensions are for reference only.



Notes: Control panels that utilize cooling fans require a minimum of 6" clearance on both sides to allow for proper air flow.

Panels designed using Mercury Relays are available on request.

Please specify your 3rd party approval requirements.

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



Typical Design Features

- * *NEMA enclosure*
- * *Choice of temperature controller*
- * *Circuit breaker or fused disconnect*
- * *Main Power: Up to 600 VAC three-phase*
- * *Heater Power: Up to 600 VAC three-phase*
- * *Paperless data logger*
- * *PLC based control with touch panel display*
- * *Fan, heat-tube, air conditioning or other cooling methods*
- * *Anti-condensation enclosure heater*
- * *Twist-lock or jack panel connections available for external connection*
- * *Audible/Visual alarms*
- * *Hazardous Locations*

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 contactors, 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.

Ordering Information

To request a quote see page 13-62

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 PPR type data logger recorder (see page 12-2) 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.

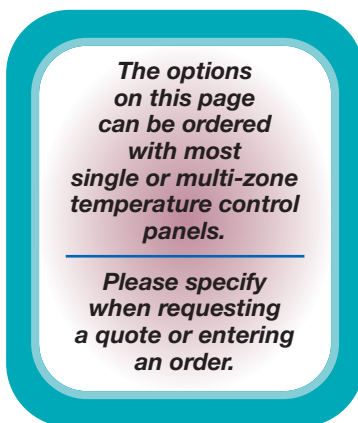
23. Floor stand kit This option provides a 12" stand kit for any wall-mounted enclosure, making it a free-standing floor model.

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.

26. HMI Operator Interface Operator Interface touch screens are available and come pre-programmed by our engineers. A detailed description must be provided by the customer if a custom layout of the HMI is required. Otherwise, general controls and indicators will be included. Works well with or without a PLC option. Available in 4 full color sizes: 4.3", 7", 10" & 15". Built-in paperless data logger included.

27. PLC Automation/Process Control If complex automation is needed, a PLC may be necessary. The PLC will be pre-programmed in-house by our engineering staff. As with the HMI option, a detailed description is required of the customer as to the specifics of the PLC program. Interfaces very well with our HMI option.



Please Consult Tempco if the Option You Require is Not Listed.



Temperature Control Panel Quote Request Worksheet

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

2. Operating Environment:

Description of Application: _____
Heated Medium (liquid, solid, vapor) & Name _____ Process temperature _____
Installation Environment: indoor, wet, dry _____ NEMA rating _____
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
Fused Disconnect or Main Circuit Breaker Required Yes No
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 13-59. 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 E-mail 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.

 **WARNING:** Cancer and Reproductive Harm - www.P65Warnings.ca.gov.

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 (National Electrical Manufacturers' Association) Enclosure Ratings

Type 1 General Purpose

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 Weather Resistant & Windblown Dust Resistant

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 Weather Resistant

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 Moisture & Windblown Dust Resistant

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 Moisture & Corrosion Resistant

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 Explosion Resistant

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 Resistant to Dirt & Dripping Non-Corrosive Liquids

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

Standard Supplied Enclosure: Type 12

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 |

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 | X |
| Oil and coolant seepage | | | | X | X |
| Corrosive agents | | | X | X | |
| Potentially explosive gas-air mixture | | | | X | |
| Windblown dust | | X | X | | |

Five-stage heater control panel with PC controlled SCR for Class 8 truck wind tunnel testing.

