W A T L O W

YOUR HEAT SOLUTIONS RESOURCE

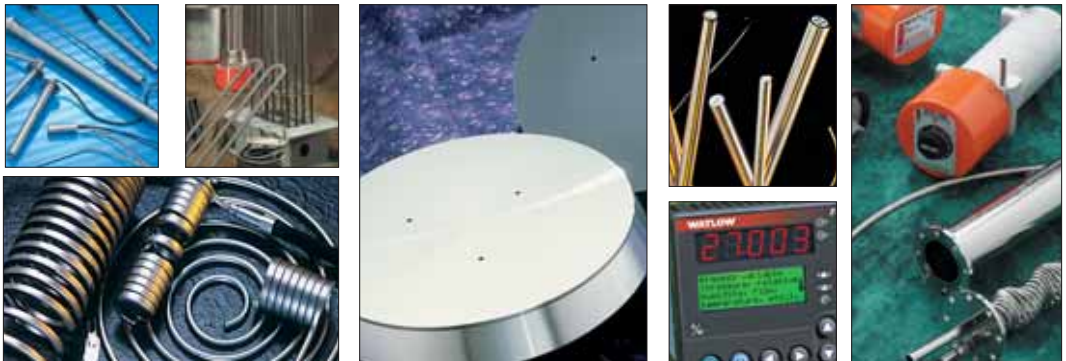
HEATERS

SENSORS

CONTROLLERS

SOFTWARE

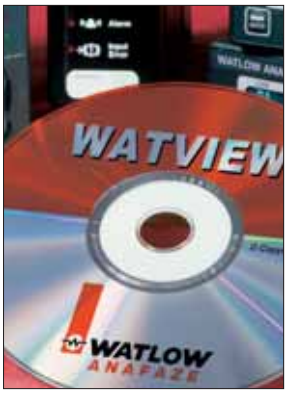
SYSTEMS



Watlow:
Your Heat Solutions Resource






Watlow designs and manufactures the components of a thermal system- heaters, sensors, controllers and software– and provides systems services, offering you the ease and assurance of a single source partner. Our commitment to quality and customer service gives you the confidence that Watlow components are the right choice for your applications.

Watlow offers you:

Same Day Shipment on various items ordered by 5 p.m. your time

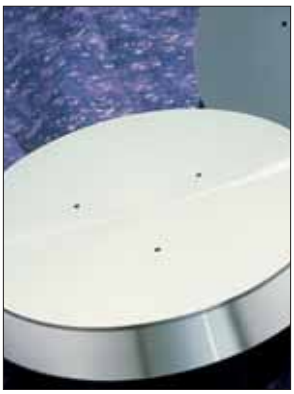
Ship-to-Stock and Just-In-Time delivery programs available

Fast prototyping

Sales engineer support on custom design and Made-to-Order items

Commitment to Total Quality and Total Customer Satisfaction

Heaters









Band & Nozzle Heaters

Led by the high performance MI Band heater, the patented, flexible THINBAND® heater and the standard mica band heater for specialized constructions, Watlow's band and nozzle heaters are ideal for every type of plastic processing equipment.

Sheath Material	Typical Maximum Watt Densities W/cm²	(W/in²)	Maximum Operating Temperatures	
Stainless steel with mica insulation	8.5	(55)	540°C	(1000°F)
Stainless steel with mineral insulation Nozzle Barrel	 35.7 15.5	 (230) (100)	760°C	(1400°F)
Aluminized or zinc steel with mica insulation	8.5	(55)	480°C	(900°F)

Applications:

- *Extruders*
- *Blown film dies*
- *Injection molding machines*
- *Other cylinder heating applications*

Cable Heaters

The versatile Watlow cable heater can be formed to a variety of shapes as dictated by its many applications. These small diameter, high performance units are fully annealed and readily bent to your desired configuration.

Sheath Material	Typical Maximum Watt Densities W/cm²	(W/in²)	Maximum Operating Temperatures	
Inconel® or stainless steel	4.6	(30)	650°C	(1200°F)

Applications:

- *Plastics injection molding nozzles*
- *Semiconductor manufacturing and wafer processing*
- *Hot metal forming dies and punches*
- *Sealing and cutting bars*
- *Restaurant and food processing equipment*
- *Cast-in heaters*
- *Laminating and printing presses*
- *Air heating*
- *Heating in a vacuum environment*
- *Textile manufacturing*

Inconel® is a registered trademark of the Special Metals Corporation.

Cartridge Heaters

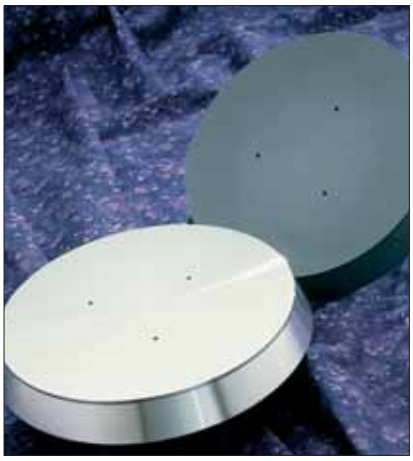
The Watlow FIREROD® heater has over 50 years of industry leading expertise as the premier choice in swaged cartridge heating. With premium materials and tight manufacturing controls, the FIREROD heater continues to provide superior heat transfer, uniform temperatures and resistance to oxidation and corrosion in demanding applications and high temperatures.

Sheath Material	Typical Maximum Watt Densities W/cm²	(W/in²)	Maximum Operating Temperatures	
Incoloy®	62	(up to 400)	760°C	(1400°F)
Stainless steel	62	(up to 400)	540°C	(1000°F)

Applications:

- *Molds*
- *Dies*
- *Platens*
- *Hot plates*
- *Sealings*
- *Fluid heating*
- *Life sciences*
- *Aerospace*
- *Semiconductor*
- *Foodservice equipment*

Cast-in Heaters



When Watlow creates a custom-engineered aluminum cast-in product, the result is more than just a heater. It's a "heated part" that becomes a functional component of your equipment, designed in the exact shape and size you need. The IFC heated part consists of a Watlow heater element built into custom metal shapes designed specifically for your application.

Material	Typical Maximum Watt Densities W/cm²	(W/in²)	Maximum Operating Temperatures	
319 and 356 Aluminum	15.5	(100)	400°C	(752°F)
Pure aluminum	15.5	(100)	450°C	(842°F)
IFC (stainless, nickel, Inconel®, aluminum, copper, bronze)	9.3	(60)	760°C	(1400°F)

Applications:

- *Semiconductor manufacturing*
- *Foodservice equipment*
- *Plastics processing*
- *Medical equipment*
- *Hot glue melt*
- *Circulation heating*

Circulation & Process Heaters

Watlow's circulation heaters are compact heating solutions for fluids such as purified and inert gases, supercritical fluids and liquids like de-ionized water for use in semiconductor and electronics industries as well as for general liquid and gas heating applications. Watlow's industrial process heater lines of immersion, circulation and duct heaters are used to heat a myriad of high and low viscosity fluids ranging from de-ionized and process water, oils, solvents, rinse agents, caustic solutions, etc. to process gases like air, nitrogen, purified and inert gases as well.

Applications:

- *Oil and gas field equipment*
- *Refineries and petrochemical plants*
- *Chemical and industrial gas plants*
- *HVAC duct heating*
- *Open tanks and heat treat baths*
- *Textile drying*
- *Heat transfer and lube oil systems*
- *Semiconductor processing equipment*
- *Precision cleaning equipment*
- *Power generation systems*
- *Emissions control systems*
- *Supercritical fluid heating*
- *In-line water boilers*

Product	Heater Element Sheath Materials	Body and Vessel Materials	Typical Applications and Watt Densities•
RAPID RESPONSE Circulation Heater	Incoloy®, copper, 304 stainless steel and 316L stainless steel	Incoloy®, copper, 304 stainless steel and 316L stainless steel	Gases, vapors, liquids, supercritical fluids; up to 15kW in compact configurations, process temperatures up to 600°C (1112°F), operating pressure up to 411 bar (6000 psi)
CAST-X SERIES 1000 Circulation Heater	Copper coated steel	Cast aluminum	Liquid heating – paint, food, solvents, glycol
UNIVERSAL SOLVENT Circulation Heater	304 stainless steel	Cast aluminum, Teflon® coated	Low flash point liquids, gases up to 1500 psi
STARFLOW Circulation Heater	316L stainless steel	316L stainless steel	Inert gases, liquids 3.9 - 5.4 W/cm^2 (25 - 35 W/in^2)
VERSALINE Circulation Heater	Incoloy®, 316 stainless steel, 304 stainless steel	316 stainless steel, 304 stainless steel	Fluids, vapors and gases depending on the application, up to 31 W/cm^2 (200 W/in^2)

Circulation & Process Heaters (con't.)

Product	Heater Element Sheath Materials	Body and Vessel Materials	Typical Applications and Watt Densities
Immersion Heaters	Inconel®, Incoloy®, 304 stainless steel, 316 stainless steel, steel, copper	Plugs – 1 - to 2½ in. NPT; brass, steel, 304 stainless steel, 316 stainless steel Square Flange – 2½, 3⅛, 4½ in.; brass, steel, 304 stainless steel, 316 stainless steel, Inconel® materials ANSI flange – Class 150 to 1200 lb., 2 - 36 in. size; steel, 304 stainless steel, 316 stainless steel, Inconel® materials	Oils to 4.6 W/cm² (30 W/in²); water to 15.5 W/cm² (100 W/in²); gases to 4.6 W/cm² (30 W/in²); other liquids 1.2 - 4.7 W/cm² (8 - 30 W/in²)
Circulation Heaters	Inconel®, Incoloy®, 304 stainless steel, 316 stainless steel, steel, copper	Vessel – steel, 304 stainless steel, 316 stainless steel, Inconel® 1 to 2½ in. NPT screw plugs; ANSI flanges – See immersion heaters	Oils to 4.6 W/cm² (30 W/in²); water to 15.5 W/cm² (100 W/in²); gases to 4.6 W/cm² (30 W/in²); other liquids 1.2 - 4.7 W/cm² (8 - 30 W/in²)
Engine Preheaters	Copper, steel, Incoloy®	Vessel – steel	Up to 100°C (210°F); up to 13.9 W/cm² (90 W/in²)
Over the Side Heaters	Incoloy®, steel	L-shaped, O-shaped, drum, vertical loop	Viscous fluids, freeze protection 1.2 - 9.3 W/cm² (8 - 60 W/in²)
Duct Heaters	Incoloy®	Steel mounting flange/terminal box (insulated); Modular duct 6kW to 2.2MW (uninsulated)	Air to 650°C (1200°F); up to 6.2 W/cm² (40 W/in²)

Ceramic Fiber Heaters

Ceramic fiber heaters integrate a high temperature iron-chrome-aluminum (ICA) heating element wire with ceramic fiber insulation. Numerous stock, standard and/or custom shapes can be provided, achieving the "heated insulation" concept for your high temperature, non-contact radiant applications. The ceramic fiber insulation isolates the high temperatures inside the heated chamber from the outside. The heaters are low mass, fast heating, with high insulation values and the self-supported heating elements that offer some of the highest temperature heating capabilities within the Watlow family of heater designs.

Sheath Material	Typical Watt Densities W/cm²	(W/in²)	Maximum Operating Temperatures (Depends on watt densities)
Molded ceramic fiber	1.8	(11.5)	1205°C (up to 2200°F)

Applications:

- *High temperature furnaces*
- *Metal melting, holding and transfer*
- *Semiconductor processing*
- *Glass, ceramic and wire processing*
- *Analytical instrumentation*
- *Fluidized beds*
- *Laboratory and R&D*
- *Other high temperature process applications*

Flexible Heaters

Flexible heaters from Watlow are just what the name implies: thin, bendable and shaped to fit your equipment. You can use your imagination to apply heat to the most complex shapes and geometries conceivable without sacrificing efficiency or dependability. Watlow utilizes several flexible insulating materials and various elements including a patented resistive element construction to produce flexible heated parts that are durable, safe and cost-effective.

Sheath Material	Maximum Watt Densities W/cm²	(W/in²)	Recommended Watt Densities W/cm²	(W/in²)	Maximum Operating Temperatures	
Silicone rubber	12.4	(80)	0.78	(5)	260°C	(500°F)
Polyimide (Kapton®)	12.4	(80)	0.78	(5)	200°C	(390°F)
HT foil	17.0	(110)	3.1	(20)	595°C	(1100°F)
Neoprene	1.7	(11)	0.31	(2)	120°C	(250°F)
Alcryn® melt-processible rubber	0.31	(2.0)	0.08	(0.5)	50°C	(122°F)
Polycarbonate thermoplastic	0.31	(2.0)	0.08	(0.5)	75°C	(167°F)

Applications:

- *Medical equipment such as blood analyzers, respiratory therapy units and hydrotherapy baths*
- *Freeze protection for military hardware, aircraft instrumentation and hydraulic equipment*
- *Battery heating*
- *Foodservice equipment*
- *Factory bonding / subassemblies*
- *Any application requiring a flexible shape or design*
- *Analytical equipment*
- *Aerospace equipment*
- *Freeze protection*
- *Transportation equipment*
- *Semiconductor equipment*

Multicell Heaters

The multicell heater from Watlow offers independent zone control for precise temperature uniformity, loose fit design for easy insertion in and removal from the equipment and extreme process temperature capability. The heaters are available with up to eight independently controllable zones and one to three internal thermowells for removable sensors. Custom assemblies are available.

Sheath Material	Typical Maximum Watt Densities W/cm²	(W/in²)	Maximum Operating Temperatures	
Incoloy®	6.2	(40)	1230°C	(2250°F)

Applications:

- *Super plastic forming with diffusion bonding*
- *Hot forging dies*
- *Heated platens*
- *Furnace applications*
- *Superheating of air and other gases*
- *Fluidized beds for heat treating*
- *Glass forming, bending and tempering*
- *Long heater needs (1219 cm (40 foot))*
- *Soil remediation*
- *Aluminum processing*

Radiant Heaters

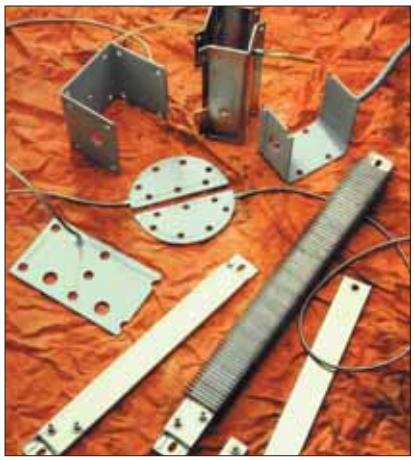
With Watlow's diverse RAYMAX® heater line, we have a solution for almost any application requiring radiant heat. Our capabilities cover a wide range of needs, from contamination-resistant panel heaters to fast-responding quartz tubes to rugged tubular elements and high temperature ceramic panels.

Sheath Material	Typical Maximum Watt Densities W/cm²	(W/in²)	Maximum Operating Temperatures	
Incoloy® tubular	6.2	(40)	815°C	(1500°F)
Molded ceramic fiber	4.6	(30)	1095°C	(2000°F)
Quartz tube	7.0	(45)	870°C	(1600°F)
Stainless steel emitter strip	4.6	(30)	700°C	(1300°F)

Applications:

- *Thermoforming*
- *Food warming*
- *Paint and epoxy curing*
- *Heat treating*
- *High temperature furnaces*
- *Tempering and annealing processes*

Strip Heaters



Watlow's mica and 375 strip heaters are the versatile solution for a number of applications. They can be bolted or clamped to a solid surface for freeze and moisture protection, food warming and other applications or utilized as a non-contact radiant heater. The 375 finned strip heaters are commonly used for air heating, drying ovens and space heaters.

Sheath Material	Typical Maximum Watt Densities W/cm²	(W/in²)	Maximum Operating Sheath Temperatures	
Aluminized steel with refractory insulation	15.5	(100)	593°C	(1100°F)
Stainless steel with refractory insulation	14.0	(90)	650°C	(1200°F)
Stainless steel with mica insulation	7.8	(50)	540°C	(1000°F)
Stainless steel with mineral insulation	15.5	(100)	760°C	(1400°F)
Zinc steel with mica insulation	8.5	(55)	480°C	(900°F)

Applications:

- *Dies and molds*
- *Tank and platen heating*
- *Thermoforming*
- *Packaging and sealing equipment*
- *Ovens*
- *Food warming equipment*
- *Vulcanizing presses*
- *Duct, space and air heaters*
- *Incubators*
- *Autoclaves*
- *Freeze and moisture protection*

Thick Film Heaters

Watlow layers thick film resistor and dielectric materials on quartz, stainless steel and ceramic substrates to produce high performance industrial heaters. The thick film heaters provide very fast temperature response and fine thermal uniformity on a low-profile heater. Thick film heaters are ideal for applications where space is limited, where conventional heaters can't be used, when heat output needs vary across the surface, or in ultra-clean or aggressive chemical applications.

Material	Typical Watt Densities W/cm²	(W/in²)	Maximum Operating Temperatures	
430 Stainless steel (*radiant*)	5	(35)	550°C	(1022°F)
430 Stainless steel (*conduction*)	11.5	(75)	550°C	(1022°F)
Aluminum oxide (*radiant*)	3.5	(23)	550°C	(1022°F)
Aluminum oxide (*conduction*)	11.5	(75)	550°C	(1022°F)
Aluminum nitride (*conduction*)	23	(150)	300°C	(572°F)
Quartz (*radiant*)	3	(20)	400°C	(752°F)
Quartz (*clamp on*)	3	(30)		

Applications:

- *Ultra-pure aggressive chemicals*
- *Large panel processing*
- *Analytical equipment*
- *Foodservice equipment*
- *Packaging sealing equipment*
- *Life sciences sterilizers and GC/mass spectroscopy*
- *Semiconductor wafer process equipment*
- *Plastics hot runner nozzles and manifolds*

Tubular Heaters

Watlow's WATROD tubular heater elements and flat FIREBAR elements are designed primarily for direct immersion in liquids such as water, oils, solvents and process solutions, molten materials as well as air and gases. By generating all the heat within the liquid or process, these heaters are virtually 100 percent energy efficient. These versatile heaters can also be formed and shaped into various geometries for radiant heating and contact surface heating applications. UL® and CSA component recognized elements available.

Applications:

- *Furnaces and ovens*
- *Molten salt baths*
- *Foodservice equipment*
- *Semiconductor equipment*
- *Die casting equipment*
- *Metal melt and holding*
- *Fluidized beds*
- *Boilers*
- *Radiant heating*
- *Process air heating*
- *Drying and warming*

Product	Available Sheath Diameters	Sheath Materials	Maximum Sheath Temperature	Typical Watt Densities*
WATROD Tubular	6.6, 8.0, 9.5, 10.9, 12.0, 12.4, 15.9 mm (0.260, 0.315, 0.375, 0.430, 0.475, 0.490, 0.625 in.)	Inconel®	To 815°C (1600°F)	To 18.6 W/cm² (120 W/in²), dependent on sheath material, watt density and heater application
		Incoloy®	To 815°C (1600°F)	
		304 stainless steel	To 650°C (1200°F)	
		316 stainless steel	To 815°C (1600°F)	
		Steel	To 400°C (750°F)	
		Copper	To 175°C (350°F)	
Single-Ended Tubular	9.5, 10.9, 12.0, 12.4, 15.9 mm (0.375, 0.430, 0.475, 0.490, 0.625 in.)	Incoloy®	650°C (1200°F)	To 7 W/cm² (45 W/in²)
		304 stainless steel		
High Temperature WATROD	9.5 and 10.9 mm (0.375 and 0.430 in.)	Inconel® 600	To 980°C (1800°F)	To 4.7 W/cm² (30 W/in²)
MULTICOIL	12.0 and 12.4 mm (0.475 and 0.490 in.)	See WATROD	See WATROD	See WATROD
FIREBAR Flat Tubular	⅝ in.: 5.9 x 16.5 mm (0.235 x 0.650 in.)	Incoloy®	760°C (1400°F)	To 14 W/cm² (90 W/in²)
		304 stainless steel	650°C (1200°F)	
	1 in.: 5.9 x 25.7 mm (0.235 x 1.010 in.)	Incoloy®	760°C (1400°F)	To 14 W/cm² (90 W/in²)
		304 stainless steel	650°C (1200°F)	

* These are typical maximums and vary based on application parameters.

Sensors









Thermocouples

Watlow has more than 80 years experience designing and manufacturing thermocouples for almost every application.

Features

- Tube and wire thermocouples for general applications
- Mineral insulated thermocouples for high temperature applications
- Hybrid thermocouples for high abuse applications
- High performance thermocouples for specialty and custom applications

Applications:

- *Plastics injection molding machinery*
- *Food processing equipment*
- *Engine and turbine exhaust gas*
- *Semiconductor processing*
- *Heat treating and metals processing*
- *Medical equipment*
- *Aerospace industries*
- *Packaging equipment*
- *Test stands*

RTDs & Thermistors

Watlow's platinum resistance elements are specially designed to ensure precise and repeatable temperature versus resistance measurements. The sensors are made with controlled purity platinum wire and high purity ceramic components and constructed in a unique strain-free manner.

Features

- Wide temperature ranges of -200° to 650°C (-328° to 1200°F)
- Special RTDs available to 850°C (1560°F)
- Interchangeable
- Accurate
- Standardized
- Sensitive
- Repeatable

Applications:

- *Air conditioning and refrigeration servicing*
- *Furnace servicing*
- *Foodservice processing*
- *Medical research*
- *Textile production*
- *Plastics processing*
- *Petrochemical processing*
- *Microelectronics*
- *Air, gas and liquid temperature measurement*

Plug and Play "Smart" Products

Watlow is the leader in developing smart plug and play sensors and DeviceNet™ networked temperature transmitters.

Products

- SERIES DX DeviceNet™ temperature transmitter
- INFOSENSE™-P high accuracy thermocouples and RTDs
- WATCOUPLE Thermocouples: long-life, high temperature and high accuracy
- INFOSENSE™ Sensor Technology: doubles original sensor accuracy

XACTPAK® Cables

The unique properties of XACTPAK® mineral insulated, metal-sheathed cable make it ideally suited to solve a wide variety of problem applications. The outer sheath protects the thermocouple from oxidation and hostile environments, and the mineral insulation provides excellent high temperature dielectric strength.

Features

- Diameters down to 0.25 mm (0.01 in.)
- Temperature ranges from 0° to 1480°C (32° to 2700°F)
- Cryogenic cable available upon request
- Fireproof
- High pressure rated
- Cold and thermal shock resistant
- Gas tight and moisture proof
- Formable and weldable
- Corrosion resistant
- High temperature rated

Applications:

- *Atomic research / nuclear reactors*
- *Blast furnaces / vacuum furnaces*
- *Catalytic reformers*
- *Diesel engines*
- *Food and beverage*
- *Glass and ceramic*
- *Heat treating*
- *Jet engines / rocket engines*
- *Medical*
- *Power stations / steam generators*
- *Refineries and oil processing*

SERV-RITE® Wire & Cables

Since 1914, Watlow Richmond's SERV-RITE® thermocouple wire and thermocouple extension wire have been known for premium performance and reliability. All Watlow Richmond SERV-RITE wire is manufactured under ISO 9001 2001quality standards.

Features

- Insulation temperature ranges from -200° to 1290°C (-328° to 2350°F)
- Calibration certificates per AMS 2750, ASTM E207, E220 and E230
- Solid or stranded wire constructions
- Wide selection of insulation types
- Select metallic overbraid and wraps
- Broad stock offering
- Custom constructions available

Applications:

- *Aerospace industries*
- *Composite component manufacturing*
- *Automotive*
- *Cryogenic applications*
- *Electric power plants*
- *Food processing*
- *Glass, ceramic and brick manufacturing*
- *Laboratories*
- *Medical equipment*
- *Petrochemical*
- *Metal processing*

Connectors, Transmitters & Accessories

Watlow provides a wide array of connectors, transmitters and other sensor accessories for the ongoing maintenance and repair of sensing devices.

Products

- Plugs, jacks and miniconnectors
- Wide range of analog transmitters
- Heads and connector blocks
- Protection tubes and thermowells

Controllers








Single-Loop Controllers

Auto-Tuning

Available in 1/32, 1/16, 1/8 and 1/4 DIN sizes, agency approved Watlow single-loop, auto-tuning temperature controllers automatically set PID control parameters for optimum system performance. Manual settings also permit on-off, P, PI or PID control modes. All Watlow auto-tuning controllers are designed and manufactured to withstand harsh industrial environments and come with a three-year warranty for Control Confidence®.

Controller	DIN Size	Accuracy	Operating Environment
SERIES SD3C	1/32 DIN Panel	±0.10%	-18 to 65°C (0 to 150°F)
SERIES SD6C	1/16 DIN Panel	±0.10%	-18 to 65°C (0 to 150°F)
SERIES SD8C	1/8 DIN Panel	±0.10%	-18 to 65°C (0 to 150°F)
SERIES SD4C	1/4 DIN Panel	±0.10%	-18 to 65°C (0 to 150°F)
SERIES SD31	1/32 DIN Panel	±0.10%	-18 to 65°C (0 to 150°F)
SERIES 96	1/16 DIN Panel	±0.10%	0 to 65°C (32 to 150°F)
SERIES 988/989	1/8 DIN Panel	±0.10%	0 to 65°C (32 to 150°F)
SERIES F4P	1/4 DIN Panel	±0.10%	0 to 65°C (32 to 150°F)
SERIES PD	DIN-Rail	±0.10%	0 to 65°C (32 to 150°F)

Applications:

- *Batch process*
- *Electroplating*
- *Environmental chambers*
- *Foodservice equipment*
- *Furnace / ovens*
- *Medical and dental equipment*
- *Packaging*
- *Plastics processing*
- *Pulp and paper*
- *Semiconductor manufacturing*

Basic

Watlow's agency approved basic temperature controllers are compact and offer an economical cost effective control solution for less demanding applications requiring basic on-off control. Reliability is further enhanced with either a NEMA 4X front panel or totally enclosed electronics. All Watlow basic controllers are designed and manufactured to withstand harsh industrial environments, and come with a three-year warranty for Control Confidence®.

Controller	DIN Size	Accuracy	Operating Environment
SERIES CF	Open board, DIN-Rail or 1/8 DIN Square	±1.00%	0 to 55°C (32 to 131°F)
SERIES CV	Open board, DIN Rail or 1/8 DIN Square	±1.00%	0 to 55°C (32 to 131°F)

Applications:

- *Foodservice equipment*
- *General process control*
- *Percent power, open loop control*
- *Plastics and textile processing*
- *Heat or cool control*
- *HVAC*

Time/Temperature Profiling

Ideal for applications that change temperature over time, Watlow's agency approved time/temperature profiling (ramping) controllers set new standards of performance. PID auto-tuning makes setup easy. All are available with a broad range of industry standard I/O and communication options. All Watlow time/temperature profiling controllers are designed and manufactured to withstand harsh industrial environments, and come with three-year warranty for Control Confidence®.

Controller	DIN Size	Accuracy	Operating Environment
SERIES SD3R	1/32 DIN Panel	±0.10%	-18 to 65°C (0 to 150°F)
SERIES SD6R	1/16 DIN Panel	±0.10%	-18 to 65°C (0 to 150°F)
SERIES SD8R	1/8 DIN Panel	±0.10%	-18 to 65°C (0 to 150°F)
SERIES SD4R	1/4 DIN Panel	±0.10%	-18 to 65°C (0 to 150°F)
SERIES 96	1/16 DIN Panel	±0.10%	0 to 65°C (32 to 150°F)
SERIES 981/982	1/8 DIN Panel	±0.10%	0 to 55°C (32 to 130°F)
SERIES F4S	1/4 DIN Panel	±0.10%	0 to 55°C (32 to 130°F)
SERIES F4D	1/4 DIN Panel	±0.10%	0 to 55°C (32 to 130°F)

Applications:

- *Environmental chambers*
- *Complex process furnaces*
- *Any process that changes variables over time*
- *Semiconductor manufacturing*
- *Processes needing data logging*
- *Processes requiring slidewire control of valves or positions*

Limits & Alarms

Watlow limit controllers provide agency approved performance in safety limit applications, including UL®, CSA, A.G.A. and FM (on some models). All are available with industry standard I/O options. All Watlow limit/alarm controllers are designed and manufactured to withstand harsh industrial environments, and come with a three-year warranty for Control Confidence®.

Controller	DIN Size	Accuracy	Operating Environment
SERIES LF	Open Board, DIN-Rail or 1/8 DIN Square, potted case	±1.00%	0 to 55°C (32 to 131°F)
SERIES LV	DIN Rail or 1/8 DIN Square	±1.00%	0 to 55°C (32 to 131°F)
SERIES SD3L	1/32 DIN Panel	±0.10%	0 to 65°C (32 to 150°F)
SERIES SD6L	1/16 DIN Panel	±0.10%	0 to 65°C (32 to 150°F)
SERIES SD8L	1/8 DIN Panel	±0.10%	0 to 65°C (32 to 150°F)
SERIES SD4L	1/4 DIN Panel	±0.10%	0 to 65°C (32 to 150°F)
SERIES 97	1/16 DIN Panel	±0.10%	0 to 65°C (32 to 150°F)

Applications:

- *High and low safety limit control*
- *Environmental chambers*
- *Furnace / ovens*
- *Semiconductor*
- *Boiler*

Multi-Loop Controllers

2-Loop

Agency approved Watlow two-loop, auto-tuning temperature controllers automatically set PID control parameters for optimum system performance. Manual settings also permit on-off, P, PI or PID control modes. Data communications or remote operation or data logging. All are available with a broad range of industry standard I/O options. All Watlow two-loop controllers are designed and manufactured to withstand harsh industrial environments, and come with a three-year warranty for Control Confidence®.

Controller	DIN Size/Size	Accuracy at 25°C	Channel Scan Time
SERIES PD	DIN-Rail 42 mm x 118 mm x 128 mm	±0.10%	0.10 seconds
SERIES N7	78 mm x 198 mm x 61 mm	±0.30%	0.20 to 1.00 seconds
SERIES 998/999	1/8	±0.10%	0.20 seconds
SERIES F4D	1/4	±0.10%	0.10 seconds
MINICHEF® 2000	3¼ in. x 2 in.	±0.20% for Type J T/C and RTD ±0.35% for Types K and E T/C	0.25 seconds
SERIES 733/734	10 1/16 in. x 4 in. x 2 in.	±0.10%	0.20 to 1.00 seconds

Applications:

- *Any process requiring two control loops*
- *Foodservice equipment*
- *Complex process furnaces*
- *Environmental chambers*
- *Processes requiring control / monitoring from a computer*

4- to 48-Loop

With up to 48 control loops, Watlow Anafaze PID controllers deliver the options and performance demanded by complex process applications. Each controller offers a wide range of I/O options with exceptional accuracy. Inputs can be multiple and mixed, including thermocouple, RTD and process.

Multiple job/recipe storage makes batch setups fast. Auto-tuning PID control sets optimum control parameters. Versatile alarms and serial communications round out the features. In addition, the PPC-2000 and CPC400 controllers give users the ability to add ladder-logic programs to the PID control. The SERIES D8 controller offers DeviceNet™ communications in four and eight loop models. Optional Windows®-based software permits remote operation and monitoring with standard Windows® operating systems. Three-year warranty.

Controller	DIN Size/Size-	Accuracy at 25°C	Channel Scan Time
4-Loop			
CLS204	⅛	±0.07%	0.17 seconds
CPC404	⅛	±0.07%	0.17 seconds
SERIES D8	⅛	±0.07%	0.17 seconds
8-Loop			
CLS208	⅛	±0.07%	0.33 seconds
CPC408	⅛	±0.07%	0.33 seconds
SERIES D8	⅛	±0.07%	0.33 seconds
16-Loop			
CLS216	⅛	±0.07%	0.67 seconds
MLS316	⅛	±0.07%	0.67 seconds
32-Loop			
MLS332	⅛	±0.07%	1.33 seconds
8- to 48-Loop			
PPC-2000	Panel or DIN-Rail mountable	±0.1%	0.22 seconds (8-input module) to 0.67 seconds (32-input module)
Alarm Scanner and 16- Channel Data Logger			
CAS200	⅛	±0.07%	0.67seconds
Limit 8-Channel			
TLME	235 mm x 93 mm x 66 mm	±5.00%	1.00 second
TLMP	235 mm x 93 mm x 66 mm	±1.00%	1.00 second

Applications:

- *Electronics*
- *Plastics*
- *Rubber*
- *Textiles*
- *Packaging applications*
- *Metals*
- *Paper industry*
- *Automotive*
- *Chemical*
- *Sealing*
- *Foodservice*
- *Semiconductor equipment*

Power Controllers

Watlow solid state power controllers complement the rapid switching required by PID temperature controllers and help deliver optimum system performance and service life. Available in 1-phase and 3-phase/2-leg and 3-leg configurations, Watlow power controllers meet most industrial heating applications. Random, zero cross or phase angle fire options match the power controller to the application requirement. DIN-A-MITE® SCR power controllers provide a convenient DIN rail mount package in current ratings from 18 to 100 amperes – a good replacement for equal mercury displacement relays. QPAC SCR power controllers rated up to 1,000 amperes for those large process heating applications. POWER SERIES microprocessor based SCR power controllers with ratings from 65 to 250 amperes. The POWER SERIES offers extensive system and heater diagnostics features and agency approvals. SERIES CZR is a CSA, VDE and UL® recognized contactor with ratings from 18 to 50 amperes single phase. Single solid state relays from 10 to 75 amperes. E-SAFE® relay is a 3-pole hybrid solid state/mechanical relay with current ratings of 20 and 40 amperes and is UL®-508 listed and C-UL®. E-SAFE is a good mercury displacement relay replacement in the amperages it serves.

Controller	Amps	Configurations	Firing Options
DIN-A-MITE A	Up to 25 amps	Single-phase	Contactor or burst fire
DIN-A-MITE B	Up to 40 amps	Single- & three-phase	Contactor or burst fire
DIN-A-MITE C	Up to 80 amps	Single- & three-phase	Contactor, burst, phase
DIN-A-MITE D	Up to 100 amps	Single-phase	Contactor or burst fire
SSR	From 10 to 75 amps	Single-phase	V~(ac) or V⎓(dc) contactor
QPAC	From 150 to 1,000 amps	Single- & three-phase	Contactor, burst, phase
POWER SERIES	From 65 to 250 amps	Single- & three-phase	Contactor, burst, phase
SERIES CZR	From 18 to 50 amps	Single-phase	V~(ac) or V⎓(dc) contactor
E-SAFE	From 20 to 40 amps	Three-phase	24, 120 and 220 input, V~(ac) contactor

Applications:

- *Semiconductor processing*
- *Plastics processing*
- *Heat treating*
- *Drying ovens*
- *Foodservice equipment*
- *Petroleum / chemical*
- *Lighting equipment*
- *Glass processing*
- *Furnace / oven*

Note: For DIN-A-MITE amperage rating see applicable output rating curves for proper application.

Control Boxes and Consoles

Watlow UL® 508 listed control boxes are convenient, easy to use and ready to connect control packages for your Watlow heaters. Control boxes include Watlow auto-tune PID temperature controllers and Watlow power switching devices, along with hi limits, relays, fusing, indicators and on/off switch. Industry standard I/O options meet virtually every heating application for low current applications up to 480V~(ac).

Features

- UL® 508 listed control boxes
- NEMA 4 and 4X panels
- On/off and PID controls available
- Ratings up to 480V~(ac), 50 amps, single-phase and 3-phase configurations
- I&M manuals

Superior Watlow temperature controls are packaged into convenient consoles. Available in 1, 2 and 4 loop configurations, each unit is supplied with a heavy duty fused line cord, fused output receptacle, SSR and on/off rocker switch. A well ventilated, powder-coated metal case ensures excellent heat dissipation.

Features

- Compact size
- Easy to use, self contained unit
- Ratings up to 240V~(ac) and 8 to 16 amps
- Serial communications options

Control Panels

Watlow control panels utilize industry leading Watlow process controllers, limits, alarms and power controllers. Watlow uses only high reliability components to ensure a long service life and ease of maintenance in the field. Standard design control panels are shipped within 10 working days of order placement. You can choose either NEMA 1, 4, 4X, 7 or 12 enclosures. Standard panels can drive up to 480V~(ac), 3-phase, 240kW heating systems. Custom panels can be designed and configured for virtually every application up to 2.5 MW and beyond.

Features

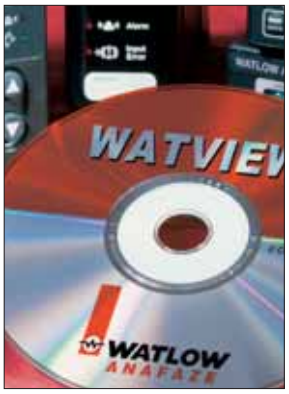
- Circuit breakers, disconnects, fusing and safety interlocks
- Single and multizone process controllers
- Cooling by fan / filter, external heat sinks
- Documentation, schematics and I&M manuals
- Gauges, meters and displays
- Ground fault protection
- Limit controllers, alarm lights and annunciators
- Motor starters
- Relays, sequencers
- Switches, push buttons
- Transformers
- UL® 508 listing

SOFTWARE









ANAWIN® 3

ANAWIN® 3 provides easy-to-use, Windows®-based setup and monitoring of Watlow Anafaze PPC-2000 controllers. The combination of advanced modular software design, along with Watlow Anafaze expertise in multi-loop temperature control, makes ANAWIN 3 the logical choice for modern temperature control applications. As a part of the Watlow Total Thermal Solution, ANAWIN 3 is ready to link temperature controllers, power controllers, heaters and sensors in a simple, friendly, graphical format. Simply install it on any desktop or notebook PC running Windows® 98, NT 4.0, ME, 2000 and XP Professional and you're ready to configure, monitor and maintain critical processes.

Applications:

- *Continuous data logging*
- *Exporting data to Microsoft® Excel® spreadsheets*
- *Viewing data on trend plot graphs*
- *Customizable overview screens with user-imported graphics and real time data from the controllers*

WATCONNECT

WATCONNECT is Watlow's new Windows®-based software library for Modbus™-RTU and Modbus™-TCP communications. This software tool kit makes it easy for programmers working in Visual Basic, C, C++ and Visual C++ to develop Windows® applications that communicate with Watlow controllers using Modbus™ protocols. The simplicity of the interface insures a short learning curve and shortened development times for Human Machine Interface (HMI) or other applications that communicate with controllers.

The main benefit of the tool kit is that the programmer does not need to learn the details of the Modbus™ protocol or the operation of a Windows® serial port to successfully develop programs that read and set parameter values in controllers. The library provides four, easy-to-use functions: open port, close port, read data and write data. To use these functions, the programmer just needs to know the communications port settings and address of the desired data.

Features

- Allows communication with one to 247 controllers
- Is safe for multithreaded applications
- Single-source solution
- License-agreement allows user written applications to be distributed royalty free
- Sample code provided for Visual C++ and Visual Basic environments
- Reads and writes all standard Modbus™ data table locations: coils, inputs and registers
- Can handle custom-named ports such as serial port expanders

WATVIEW

WATVIEW is a Human-Machine Interface (HMI) software package to set up and monitor Watlow temperature and process controllers. WATVIEW operates under Windows® 98, NT 4.0, ME, 2000 and XP Professional, providing logging, graphing and display of controller parameters for multiple controllers. With easy controller setup, a recipe and alarm manager, data-logging, trend plot graphing, animated custom overview screens and a superior online help system, WATVIEW has what you need to optimize and maintain your control application. WATVIEW supports SERIES 96, SERIES SD, F4P, MICRODIN®, F4S, F4D, CLS200, MLS300 and CPC400 temperature controllers as well as SERIES 97 limit controllers and CAS200 alarm scanners and POWER SERIES power controllers. WATVIEW provides a simple means of setting up and operating a network of controllers from a personal computer.

WATVIEW software is available in three editions:

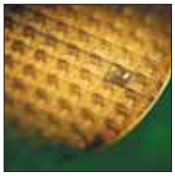
- **WATVIEW Configurator Edition** includes only the spreadsheet display, setup screens and recipe manager without calendar-start. This edition is available as a free download on www.watlow.com.
- **WATVIEW Runtime Edition** includes all the features of the Configurator edition plus alarm management, recipe calendar-start user event log, data logging and trend graphing
- **WATVIEW Developer Edition** includes all the features of the Runtime edition plus the custom screen designer and user-defined variables

Applications:

- *Continuous data logging of user-selected parameters*
- *Exporting data to Microsoft® Excel® spreadsheets*
- *Viewing data on trend plot graphs, with storage available for an unlimited number of graphs*
- *Customizable overview screens with user-imported graphics and real time data from the controllers*

Single Iteration









Single Iteration

Single Iteration is the engineering services division of Watlow, conceived and established specifically to help clients solve challenging thermal system problems.

Single Iteration services its clients with an unparalleled ability to conceptualize, evaluate, design and prototype innovative thermal solutions.

As a reliable single source, Single Iteration can assist you from concept development all the way through manufactured product, reducing design-cycle time and improving the overall cost effectiveness of your project.

Whether you're developing a new process/product or revamping an existing one, partnering with Single Iteration on your next design/development project can help ensure success.

Capabilities:

- Thermal sciences specialists
- Broad experience in thermal technologies
- Proven project-management process with attention to detail
- Proven ability to meet demanding schedules
- Pragmatic, real-world perspective
- Objective insight
- Creativity
- Works as an extension of the client's development team
- Knowledge of production demands

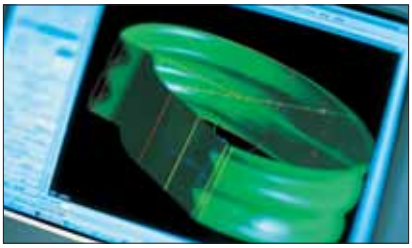
Watlow Thermal Management Systems











Watlow's integrated assemblies and systems are composed of multiple thermal components including electric heaters, sensors, control electronics and electrical, electronic and mechanical components and sub-assemblies. These integrated systems are ideal for customers requiring an engineering, design or manufacturing partner. Watlow focuses on assembly and system performance optimization as well as thermal integration and manufacture/assembly.

Capabilities:

- Clean room assembly
- Precision CNC machining, laser cutting, etc.
- Thermal application expertise
- Electromechanical manufacture, assembly and test
- High precision welding and brazing
- Sheet metal fabrication
- Control systems, panels and sub-panel assemblies to UL® 508
- Custom firmware development
- PLC integration and programming

Product areas of focus:

- Integrated Control Systems – Multi-functional sub-panel and full control panels and wiring for equipment system control
- Thermo-Electro-Mechanical Systems – Integrated and optimized thermal component integration into electromechanical assemblies and systems
- Field Upgrade Kits

Applications:

- *Analytical instruments*
- *Biotechnology instruments*
- *Clinical diagnostic instruments*
- *Foodservice equipment*
- *Fuel cells and other power equipment*
- *Patient care equipment*
- *Semiconductor processing equipment*

Watlow Process Systems









Watlow has the resources and staff to design and fabricate highly engineered heaters, control panels and heating system packages for the processing industries. Our application engineers work hand in hand with our customer's technical staff to generate detailed proposals with clear technical descriptions. This close communication continues with detailed approval drawings for customer review prior to fabrication. We utilize robust design and fabrication techniques to ensure optimal system performance and longevity. Complete I&M manuals, nameplates and as-built drawing packets and specification sheets are provided to support set up. Commissioning and start up services are also available. Our products and capabilities include:

Electric Process Heaters

- ASME Section I and VIII code stamps
- PED conformance up to Category IV
- Canadian Registration Numbers (CRN)
- NEC, CEC, and ATEX hazardous area compliance
- Flanged immersion heaters to 60-inch, ANSI Class 2500
- Vessel fabrication to 60 inch diameter and one inch specialty plate wall thickness
- Duct heater assemblies including frame, base ducting and mounting flanges
- Design temperatures to 900°C (1650°F)
- Design pressures to 300+bar (4500 psi)
- NEMA 1, 4, 4x, 4/7, 7 and 12 terminal housings
- Passivation and electropolishing of wetted surfaces
- Process sensors and instrumentation as required
- Other specialty designs upon requested

Process Heating Systems

- Matched set process heater and control panel
- Multi-heater and vessel "stacked" heater systems
- Heater, vessel and control panel interconnected and mounted onto a structural skid frame, inclusive of process sensors and instrumentation

Testing and Certification

Ensuring and documenting the quality of materials and workmanship are an important part of our business. Some of the testing and certification we can provide are:

- Hydrostatic pressure testing of heaters and vessels
- NDE, including radiography, dye penetrant, ultrasonic thickness and magnetic particle testing
- Charpy impact, Brinnel hardness and tensile testing
- MTRs and positive material identification testing
- Earthquake, stress or vibration calculations

Applications:

- *Steam superheaters*
- *ESP penthouse dryers*
- *SCR emissions control heating*
- *Water / wastewater heating*
- *Heat transfer systems*
- *Storage tank heating*
- *Mole sieve & catalyst regen*
- *Hydrocarbon & process gases*
- *Fuel preheating*
- *Asphalt heating*
- *LNG heating systems*
- *Lube oil heating systems*
- *Hot gas generators*
- *Process gas & liquid heating*
- *Instrument air dryers*

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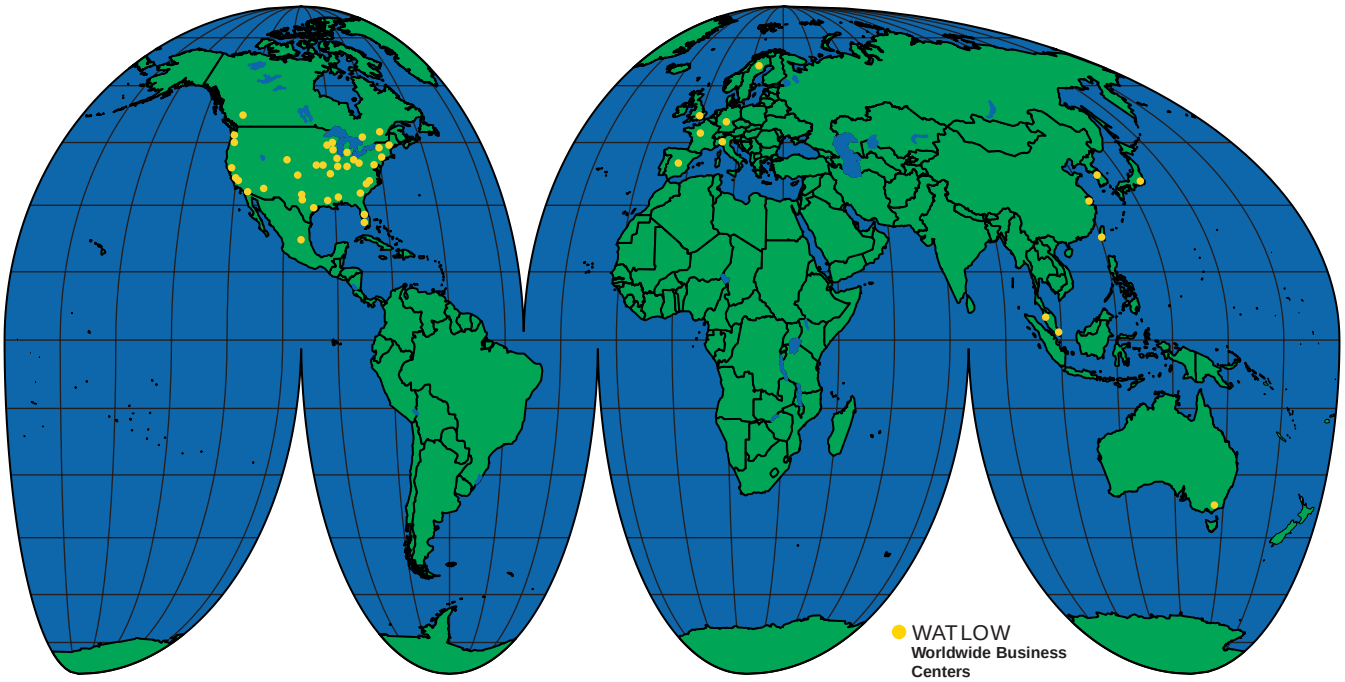

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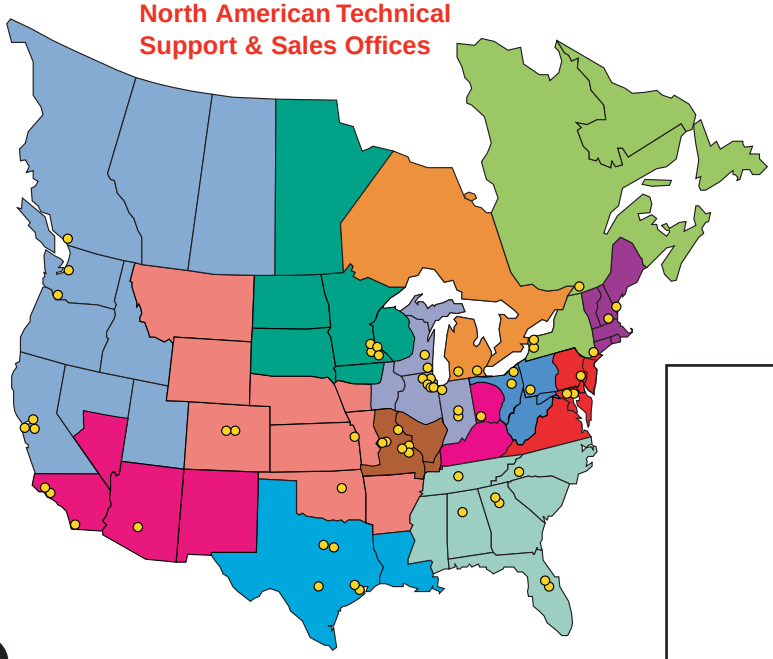

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