

COOLING SYSTEMS

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Selecting a cooling system

Outsourcing your cooling loop to a company that builds thousands of cooling systems per year guarantees a quality product and enables you to focus your engineering efforts on your own area of expertise. Turnkey systems also accelerate the design process, reduce inventory levels, and simplify production. End users prefer integrated systems because they are easy to install and simple to operate.

Our three types of cooling systems can be tailored to your precise requirements with a range of standard options or completely custom designed. Lytron's cooling systems are used in a variety of applications including semiconductor equipment, diagnostic equipment, medical and industrial lasers, analytical instruments, oncology machines, data centers, electron microscopes, printing equipment, plasma etch systems, and solder reflow ovens.

Custom Chillers and Cooling Systems for Maximum Uptime

Lytron specializes in the design and manufacture of custom chillers, liquid-to-liquid cooling systems, and liquid-to-air cooling systems for semiconductor equipment, medical equipment, lasers, wind turbines, trains, and other mission critical applications. We're able to meet your most challenging thermal and mechanical specifications.

Our systems engineering team works with our cooling system and heat exchanger technologies to arrive at the optimum solution for your application. We can custom design and manufacture the heat exchanger and select the best pump for your system. In addition, our systems manufacturing engineers ensure that your cooling system is Designed-for-Manufacturability (DFM) and serviceability.

We ship thousands of cooling systems every year, and all of our custom systems are built at Lytron in the same facility where they were designed. Our integrated approach to design, supply chain management, and production allows us to control the entire manufacturing process, from the selection of components to assembly and test, resulting in excellent quality.

Our capabilities include but are not limited to the following:

- -85°C to 200°C (-121°F to 392°F) Process Temperatures
- 1/4 hP to 40 hP Refrigerated Units with Cooling Capacities up to 150 kW
- Liquid-to-Liquid Cooling Systems with Cooling Capacities up to 300 kW
- ±0.1°C Temperature Stability
- Cascade Refrigeration Systems
- Single, Dual, Triple, and Quadruple Cooling Loops
- Fluids Compatibility (Water, EGW, PGW, Fluorinert[™], HFE, Galden[®], PAO, Silicone Oils, etc.)
- Communications (Ethernet/TCP-IP Mod Bus, RS232/RS485, Dry Contacts, 4-20 mA, 0-10 Volts, etc.)
- Industry Standards and Certifications (IEC 60601-1, IEC 61601-1, SEMI S2, S8, F47, UL, MET, CE certified, WEEE, RoHS, etc.)
- Custom Configurations and Sizes Including Rack Mount, Mobile, and Skinless for Integration into Your Equipment
- Air-Cooled or Water-Cooled
- Companion Assemblies
- Design for Quiet Operation/Reduced Acoustic Levels
- Class 7 Cleanroom Compliance





Custom LCS pump stand for cooling medical equipment features a reduced acoustic emissions design (<60dBA), a deionization purity sensor, an airflow sensor, IEC 60601-1 compliancy, and an electrical box and pump on slides for serviceability



Custom water-cooled chiller for semiconductor equipment features custom communications and dual rated electrical configuration

Custom Cooling

Recirculating Chillers

Recirculating chillers can provide precise temperature control and cooling below ambient temperature. They can be designed as stand-alone systems or designed for integration within a larger system. With extensive experience designing chillers for front-end and back-end semiconductor equipment, medical equipment, lasers, and more, Lytron can meet all of your chiller requirements.



"Copy exact" -85°C cascade chiller features a VFD pump, programmable pressure controller, dual voltage, and SEMI S2 and F47 compliance



Recirculating chiller compatible with dielectric fluid features a custom turbine pump to support high supply pressure applications, 15-pin interlock, and other customizations



Water-cooled chiller designed to SEMI S2 and F47 with dual voltage, numerous alarms, a low flow and low level shutdown, and more





Semi-frameless chiller designed to fit in a tight space inside of a larger piece of equipment features RS232 communications, dual voltage, and a custom condenser designed and built by Lytron

Liquid-to-Liquid Cooling Systems

When a large amount of heat needs to be removed and chilled facility water is available, a Liquid-to-Liquid Cooling System (LCS) may be the solution. An LCS, also known as a water-to-water heat exchanger, can reduce energy consumption and save a significant amount of money over air cooling. LCSs offer precise temperature control of process water ($\pm 0.5^{\circ}$ C) and transfer the waste heat to facility water.



Skinless, 25kW LCS pump stand designed to cool four independent heat sources and be integrated into larger equipment



LCS for medical imaging contains two liquid cooling and one air cooling loop—all managed by the cooling system controller



LCS with dual voltage and MET and CE certification designed for use in printing industry



"Copy exact" LCS featuring two separate cooling loops, $\pm 0.1^{\circ}$ C temperature stability, interlock 10/100 Ethernet communications, a VFD for enhanced pump performance, and a drip tray for leak detection

Liquid-to-Air Cooling Systems

A liquid-to-air cooling system, also known as an ambient cooling system or Modular Cooling System (MCS), provides cost-effective cooling for applications that don't require a recirculating chiller, tight temperature control, or cooling below ambient temperature. An MCS consists of a heat exchanger, a fan, a pump, a reservoir, and a controller. MCSs can be customized in numerous ways to meet challenging thermal and mechanical requirements.



Built-to-specification MCS for a medical equipment application, with two standard Lytron heat exchangers and a stainless steel centrifugal pump



MCS for a medical application with a custom aluminum flat tube heat exchanger, an accumulator, and an automatic air purge device

System Design and Quality



Your Lytron cooling system design team can serve as an extension of your engineering team, providing specification development, thermal, electrical, and mechanical design, prototype development and testing, and full production.



Our manufacturing engineers and supplier quality engineers work closely with our key suppliers to ensure we deliver to you the highest quality products on time to your exact specifications.

Custom Cooling Systems

Worldwide Service and Support

Lytron understands how important it is to ensure that your chiller or cooling system maintains the absolute maximum up time, which is why our systems are backed by outstanding service and support. We recognize that most custom systems are integrated into equipment that may end up anywhere in the world, so we offer support when and where you need it: a worldwide network of service centers for installation support, commissioning, service, and maintenance, and access to in-house service technicians 24 hours per day, 7 days per week. Partnering with our customers, we can set up additional service capabilities where needed, including on-site service and service contracts. Our service and support capabilities include:

- Specialized test facilities with factory-trained and certified technicians
- In-house and/or onsite services for repairs, exchanges, or upgrades
- Installation, commissioning, and start-up assistance
- Precision tuning and system optimization
- Custom preventative maintenance plans
- Tailored refurbishment management plans
- Extended warranty programs

Service Centers

Lytron has an extensive service operation. In addition to our three USA service centers located in Massachusetts, New Hampshire, and California, we also offer service in 18 countries to support our Europe, Asia, and North America customers. Our service centers stock a broad inventory of spare parts and are staffed by factory-certified technicians. System diagnosis is usually completed within 24 hours of receipt of the unit and repairs are carried out within 48 hours of service authorization.

Training Programs

Since chillers and cooling systems are often sold as sub-systems in OEM equipment, Lytron offers OEMs customized training programs so your service engineers can provide front-line support. The trainings can be conducted either at your facility or at one of our service centers.



Standard Cooling Systems Technology Overview

Lytron offers three types of cooling systems—compressor-based chillers, liquid-to-liquid cooling systems, and ambient cooling systems. Each unit can be modified with a wide range of options, and, for OEM volumes, we will design and manufacture unique features on standard systems or totally custom systems. Our standard cooling system technologies include:



Recirculating Chillers (Kodiak®) Cooling capacities up to 11 kW (150 kW for custom)

Kodiak compressor-based recirculating chillers are an ideal solution when you need precise temperature control $(\pm 0.1^{\circ}C)$ and cooling below ambient temperature. Applications include semiconductor equipment, medical equipment, medical and industrial lasers, electron microscopes, analytical instrumentation, and printing equipment.



Liquid-to-Liquid Cooling Systems (LCS™)

Cooling capacities up to 150 kW (300 kW for custom)

Liquid-to-liquid cooling systems offer precise temperature control of process water and transfer the waste heat to facility water. They are ideal for high heat load applications where precise temperature control ($\pm 0.5^{\circ}$ C or $\pm 1.0^{\circ}$ C) is needed and chilled facility water is available. Applications include medical equipment, data center equipment, industrial machine tools, printing equipment, semiconductor equipment, and cabinet cooling.



Modular Cooling Systems (MCS™)

Cooling capacities up to 3.5 kW (20 kW for custom)

Modular cooling systems, or ambient cooling systems, are non-refrigerated, liquid-to-air cooling systems. They are a cost-effective alternative to recirculating chillers for applications where precise temperature control and cooling below ambient temperature are not required. Applications include analytical equipment, cabinet cooling, medical equipment, and laser systems.

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Cooling Systems



Kodiak compressor-based recirculating chillers are the ideal solution when you need precise temperature control or cooling below ambient temperature. Kodiak chillers offer outstanding performance and high reliability as well as quiet operation and ease-of-use.

- Precise temperature control: Our custom PID controller and advanced refrigeration control circuit ensure that the Kodiak maintains ±0.1°C (0.2°F) stability.
- Quiet operation: The components inside the Kodiak have been performance-matched for quiet operation. In addition, vibration-isolation of the compressor (and pump in RC006–RC045) and foam padding on panels minimize vibration noise.
- Many options and features: The Kodiak was designed for flexibility—a wide variety of pumps, controllers, and additional safety and monitoring features allow you to tailor a Kodiak to your specific application.
- High reliability: We are so confident that our Kodiak chillers will provide years of trouble-free operation that we offer a 2-year warranty.
- Advanced ergonomic design: Our chillers look as good as the equipment they cool. Our industry-leading industrial design is as functional as it is attractive.
- CE certified and ITSNA tested to UL 61010A-1 (RC006 RC045) or MET tested to UL 1995 (RC095-RC115)

Custom Spotlight:

Lytron's custom products leverage existing standard products as well as previously designed custom products. Using these industry-proven technologies, we can reduce your time to market while giving you the customizations, quality, and reliability you need. This custom water-cooled chiller handles specialty cooling fluid and is MET and CE compliant.

See page 8 for more custom cooling systems.



Standard Cooling Systems

GRAPHS 16 SPECS 18

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Thermal Performance Graphs





¹ Temperature represents output temperature of water assuming 20°C ambient air conditions. Performance subject to change due to variations such as fluid type or operating conditions.

GRAPHS 16 SPECS 18 SELECT 27



Kodiak Specifications and Part Number Configuration

	First select your)		RC006	RC009	RC011	RC022	RC030	RC045	RC095	RC115
		Cooling capacity ¹	W kBTU/Hr	825 2.8	1050 3.6	1650 5.6	2400 8.2	3450 11.8	5900 20.1	9600 32.7	11000 37.5
		Compressor capacity	HP	1⁄4	1/3	1/2	3/4	1	1½	3	1/2
		Temperature stability ^{1, 2}					± 0).1℃			
		Fluid connections				½″F	NPT			³⁄4″ F	NPT
		Reservoir capacity		1 gal/	4 liters	2 gal/8	3 liters	6 gal/2	3 liters	1.75 gal	6.5 liters)
		Coolant temperature range			2	10°F to 95°F	/5°C to 35°	с		39°F to 95°F	7⁄4℃ to 35℃
		Ambient temperature range		5	0°F to 95°F/	'10°C to 35	°C		41°F to 95°F/5℃ to 35℃		
		Dimensions (W x D x H)	inches mm	12.5 x 19 318 x 48	9.0 x 22.0 83 x 559	14.8 x 24 376 x 62	l.5 x 26.5 23 x 673	21.4 x 27 543 x 70	7.8 x 31.9 05 x 810	32.0 x 43.0 x 45.0 813 x 1092 x 114	
	Next nick an	Weight	dry lbs (kg)	97 (44)	100 (45)	122 (55)	166 (75)	260 (118)	270 (122)	517	(235)
ms	electrical	Electrical configurations and	d full load a	mperage ³							
E	configuration	G03 : 115V, 60 Hz, 1ph	Amps	9.9	12.2	14.3	n/a	n/a	n/a		
.s/		H03: 230V, 50 Hz, 1ph	Amps	4.5	5.3	6.3	9.5	13.7	17.2		
S'		J03 : 208/230V, 60 Hz, 1ph	Amps	n/a	5.8	7.4	10.0	14.5	19.6		ļ
ng		M01: 200-220V, 50 Hz, 3 ph; 208-230V, 60 Hz, 3 ph	Amps							22.2	22.2
<u>:</u>		R01: 460V, 60 Hz, 3 ph	Amps							11.0	11.0
ŏ		T01 : 380V, 50 Hz, 3 ph	Amps							11.0	11.0
	Now, select a pump	Pump options (visit www.Ly	rtron.com fo	r guidanc	e on selec	ting a pur	np; refer	to page 17	for syste	m pump g	(raphs)
		BB: PDP ⁴ , Brass, 1.3 gpm/4.9 lpr	n	٠	•	•	•				
<u>o</u>		BC: PDP ⁴ , Brass, 1.8 gpm/6.8 lpr	m	0	0	0	0				
E		BE: PDP ⁴ , Brass, 2.3 gpm/8.7 lpr	n	0	0	0	0				
St		BG: PDP ⁴ , Brass, 4.3 gpm/16.3 lp	pm			0	0	•	•		
		CB: PDP ^{4, 5} , Stainless Steel, 1.3 g	gpm/4.9 lpm	0	0	0	0				
		CC: PDP ^{4, 5} , Stainless Steel, 1.8 g	gpm/6.8 lpm	0	0	0	0				
\mathbf{M}		CE: PDP ^{4, 5} , Stainless Steel, 2.3 g	jpm/8.7 lpm	0	0	0	0				
GRAPHS		CG: PDP ^{4, 5} , Stainless Steel, 4.3 g	jpm/16.3 lpm			0	0	0	0		
- 16 -		AA: Centrifugal, ½ HP6		0	0						
BBB		DA: Centrifugal, ¼ HP ⁶				0	0	0	0		
SPECS		DF: Centrifugal, 1.5 HP ⁶								•	•
- 18		EC: Turbine, ¼ HP ⁶		0	0	0	0				
		EB: Turbine, ½ HP6				0	0	0	0		
SELECT		ED: Turbine, Bronze, 1.5 HP ⁶								0	0
- 27 -		FB: Turbine, Stainless Steel, ½ H	p 6			0	0	0	0		ļ
\square		FD: Turbine, Stainless Steel, 1.5	hp⁵							0	0

Continue on next page

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Specifications and Part Number Configuration Kodiak

		RC006	RC009	RC011	RC022	RC030	RC045	RC095	RC115
ct your troller	Controller options (visit www.Lytron.co	m for a fu	II descrip	tion of the	ese option	s)			
	Package 17: Digital temperature display, calibration offset, low flow shut-off, auto-restart, °C/°F toggle.	0	0	0	0	0	0		
	Package 2: Package 1 plus digital pressure sensing, low level, low/high temperature, pressure display, audible alarm and alarm mute, fault shut-off (toggle on/off), relay contacts.	•	•	•	•	•	•		
	Package 3: Package 2 plus RS232.	0	0	0	0	0	0		
	Package 4: Digital temperature and pressure display, low level, low/high temp, low/high refrigerant pressure visual/audible alarms, low coolant flow and low refrigerant pressure shut off, auto-restart, and °C/°F toggle.							•	•
	Package 5: Same as Package 4 plus 25 pin D connector with DC signal for low flow, low level, low/high temperature alarms.							0	0
	Package 6: Same as Package 4 plus 9 pin D connector with RS-232 communication.							0	0
	Package 7: Same as Package 5 with RS-485 communication.							0	0
	Package 8: Same as Package 5 with 4-20mA remote set point and retransmission.							0	0
	Package 9 : Same as Package 5 with 0-10VDC remote set point and retransmission.							0	0
	Package A: Same as Package 4 plus RJ45 connector with Ethernet communication.							0	0
d any	Available options (visit www.Lytron.com	n for a ful	l descripti	ion of the	se options	;)	1		1
tional	External flow valve	0	0	0	0	0	0	0	0
	External pressure relief valve	0	0	0	0	0	0	0	0
	Anti-siphon system	0	0	0	0	0	0	0	0
	Air filter	0	0	0	0	0	0	•	•
	5 micron coolant filter ^{8,9}	0	0	0	0	0	0	0	0
	Heater ¹⁰			0	0	0	0		
	Internal insulation package	0	0	0	0	0	0	0	0
	Low temperature operation ¹¹		0	0	0	0	0	0	0
	Water-cooled condenser			0	0	0	0	0	0
	0.1°C set point	0	0	0	0	0	0		
	Deionization package ^{8,12}	0	0	0	0	0	0	0	0
	High purity plumbing	0	0	0	0	0	0	0	0
	PAO compatibility			O10	0	0	0		
	Remote start ¹³	0	0	0	0	0	0	0	0

• = standard \circ = available option ¹ At 20°C setpoint, 20°C ambient, 60Hz input supply ² Assumes stable load ³ With standard pump ⁴ PDP = Positive Displacement Pump ⁵ Only available with high purity plumbing ⁶ Actual flow rate depends on system pressure drop. See pumps overview on www.lytron.com for information on how to calculate flow rate ⁻ 5 piece min order ⁸ Not available with AA and DA pump ³ For RC095 and RC115, ships loose to allow protection of the chiller or customer's equipment ¹⁰ Not available in GO3 electrical configuration ¹¹ Requires internal insulation package ¹² Recommended when selecting higher purity option ¹³ Included in controller packages 5-9 and A

To arrive at a part number

RC011 G03 BB 2 M

RC011 chiller with G03 (115V, 60 Hz, 1ph) electrical configuration, a BB pump, and controller package 2
 Customization options (A 4 digit option code will be assigned at time of order, based on selected options. Leave blank if no additional options selected.)

Use our product selector at www.Lytron.com to automatically select the right chiller based on your specifications.

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Cooling Systems

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Lytron's Liquid-to-Liquid Cooling System (LCS20) offers precise temperature control of process water and transfers the waste heat to your facility water via a liquid-to-liquid heat exchanger. It is an excellent solution for high heat-load or high ambient temperature applications where chilled facility water is available.

- Large cooling capacity in a compact package: An LCS is a great solution for high heat loads where space is at a premium. With 20 kW of cooling, our LCS20 provides over three times the capacity of a comparably-sized recirculating chiller.
- Tight temperature control: We maintain the fluid temperature to within ±0.5°C, despite fluctuations in the facility water temperature and flow rate. Our PID controller varies the facility water flow rate through the heat exchanger based on the process water temperature to achieve this stability.
- **Contamination-free:** The process cooling loop of the LCS is isolated from the facility water. This separation protects your equipment, keeping it free from facility water contaminants. It also eliminates the risk of condensation near your equipment if the facility water is below the dew point.
- **Reliable**, **quiet**, **and energy efficient**: The LCS system contains very few moving parts—this makes it inherently reliable and quiet. The only components requiring power are the pump, motor, and controller, so it is also extremely energy efficient.
- ITSNA tested to UL 61010A-1 and CE certified

Custom Spotlight:

A customer had a total heat load of 25 kW and access to facility water. They needed to cool four independent heat sources and wanted the cooling system integrated into their machine. Lytron provided a fully-engineered skinless system that included integrated temperature and pressure sensors and was designed for serviceability.

See page 8 for more custom cooling systems.





The increasing heat load densities in datacom equipment centers require ever more sophisticated approaches to cooling, including liquid cooling. Designed for data center cooling, the LCS50 is a 150 kW liquid-to-liquid cooling system that supplies precise temperature-controlled coolant to your liquid cooled racks and transfers the waste heat to facility water.

- High reliability: The LCS50 is designed to be extremely reliable. Redundant pumps ensure the system always provides coolant to your racks. The controller tracks the actual operation hours for each pump and the backup pump is tested periodically to guarantee its operation if needed. The controller warns you of any system problems via various alarms and offers lockout protection and communication packages for remote monitoring.
- **Protection and isolation of datacom equipment:** According to ASHRAE, the benefits of an LCS for liquid cooling include "preventing condensation by delivering coolant to the rack, equipment, or electronics above the dew point," "isolating the electronics from the harsher facility water," and "minimizing the coolant volume near the technology so that a coolant leak would be less catastrophic."¹
- Easy to install: The unit is equipped with casters for easy mobility and leveling feet that disengage the casters. The inlets and outlets of the facility (primary) and process (secondary) coolant loops can be configured for a raised floor or overhead plumbing.
- Energy efficient and quiet: Liquid cooling the electronics cabinet is significantly more energy efficient than air cooling.
- UL/CE/CSA and RoHS

¹ American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (2006). Liquid Cooling Guidelines for Datacom Equipment Centers. Atlanta.



Custom Spotlight:

A customer needed a liquid-to-liquid cooling system for medical imaging equipment. This custom unit contains three separate cooling loops, two liquid cooling and one air cooling, all managed by the unit's controller.

See page 8 for more custom cooling systems.

Standard

Cooling Systems

LCS Performance Graphs



LCS50 Thermal Performance Graph¹

Cooling Systems

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LCS50 Primary Side Pressure Drop





- ³ Includes pressure drop through system. See LCS specifications and options for pump descriptions.
- ⁴ See www.Lytron.com for larger plumbing diagram.









		LCS20	LCS50
Cooling capacity		20 kW (68 kBTU/Hr) at 4.3 GPM process and 10 GPM facility and 20°C Initial Temperature	150 kW (512 kBTU/Hr) at 75 GPM process and 100 GPM facility and 10°C Initial Temperature
Tomporaturo stability		+ 0.5°C	± 1.0°C
Fluid connections		≟ 0.5 C ¾″ FNPT	2" copper flange terminated
Reservoir capacity		6 gal/22 liters	N/A
Coolant temperature range		50°F to 140°F/10°C to 60°C	41°F to 95°F/5°C to 35°C
Facility water temperature range		50°F to 95°F/10°C to 35°C	39°F to 54°F/4°C to 12°C
Ambient temperature range		41°F to 104°	F/5°C to 40°C
Facility flow rate		2 to 10 gpm/8 to 38 lpm	25 to 100 gpm/95 to 379 lpm
Facility pressure		100 psi/7 bar max	100 PSI/ 7 bar max
Facility pressure drop		15 psi/1 bar at max flow	See Pressure Drop Graph
Dimensions (W x D x H)	inches mm	21.4 x 27.8 x 31.9 543 x 705 x 810	24.0 x 48.0 x 76.3 610 x 1219 x 1938
Weight	lbs kg	140 64	900 408
Electrical configurations and full load amp	perage ¹		
G01: 100-120V, 50/60 Hz	Amps	7.2	N/A
J01: 200-240V, 50/60 Hz	Amps	3.6	N/A
L01: 208-230 VAC, 50/60 Hz, 3ph	Amps	N/A	18
P01 : 460 VAC, 50/60 Hz, 3ph	Amps	N/A	9
Pump options (visit www.Lytron.com for g	guidance on selecting	a pump; refer to page 22	for system pump graphs)
BG: PDP ² , Brass, 4.3 gpm/16.3 lpm		•	
CG: PDP ^{2,3} , Stainless Steel, 4.3 gpm/16.3 lpm		0	
DA: Centrifugal, ¼ HP ⁴		0	
EB: Turbine, ½ HP ⁴		0	
FB: Turbine, Stainless Steel, ½ HP ^{3,4}		0	
DE: Centrifugal, 3 HP, 2 per system			•
Controller options (visit www.Lytron.com	for a full description	of these options)	
LCS20 Only Package 1: Digital temperature disp	olay, °C/°F toggle,	٠	
LCS20 Only Package 2: Package 1 plus low leve	l indicator, low flow	0	
LCS50 Only Package 3: RS232 controller with d flow, and pressure display; modulating valve sta alarms for low/high temperature, low flow, pum failure; relay contacts for each alarm; and lock-o	igital temperature, tus reporting; visual p, power, or sensor ut protection.		•
LCS50 Only Package 4: Package 3 plus visual al for dew point; option to control set point based	arm and relay contacts on dew point offset		0
LCS50 Only Package 5: RS232 and Ethernet cor temperature, flow, and pressure display; modula reporting; visual alarms for low/high temperature, or sensor failure; relay contacts for each alarm; a	ntroller with digital iting valve status low flow, pump, power, and lock-out protection.		0
LCS50 Only Package 6: Package 5 plus visual al	arm and relay contacts on dew point offset		0
for dew point; option to control set point based or on fixed temperature with user defined dew p	point override.		
for dew point; option to control set point based or on fixed temperature with user defined dew p Available options (visit www.Lytron.com f	ooint override.	of these options)	
for dew point; option to control set point based or on fixed temperature with user defined dew p Available options (visit www.Lytron.com f External flow valve	ooint override.	of these options)	
for dew point; option to control set point based or on fixed temperature with user defined dew p Available options (visit www.Lytron.com f External flow valve External pressure relief valve	ooint override.	of these options) o	
for dew point; option to control set point based or on fixed temperature with user defined dew p Available options (visit www.Lytron.com f External flow valve External pressure relief valve 5 micron coolant filter ⁵	ooint override.	of these options) 0 0 0 0	
for dew point; option to control set point based or on fixed temperature with user defined dew p Available options (visit www.Lytron.com f External flow valve External pressure relief valve 5 micron coolant filter ⁵ DI water cartridge ⁵	ooint override.	of these options) 0 0 0 0 0 0 0 0	
for dew point; option to control set point based or on fixed temperature with user defined dew p Available options (visit www.Lytron.com f External flow valve External pressure relief valve 5 micron coolant filter ⁵ DI water cartridge ⁵ High purity plumbing	ooint override.	o 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
for dew point; option to control set point based or on fixed temperature with user defined dew p Available options (visit www.Lytron.com f External flow valve External pressure relief valve 5 micron coolant filter ⁵ DI water cartridge ⁵ High purity plumbing Heater ⁶	ooint override.	o 0	
for dew point; option to control set point based or on fixed temperature with user defined dew p Available options (visit www.Lytron.com f External flow valve External pressure relief valve 5 micron coolant filter ⁵ DI water cartridge ⁵ High purity plumbing Heater ⁶ Internal insulation package	ooint override.	0 0	•
for dew point; option to control set point based or on fixed temperature with user defined dew p Available options (visit www.Lytron.com f External flow valve External pressure relief valve 5 micron coolant filter ⁵ DI water cartridge ⁵ High purity plumbing Heater ⁶ Internal insulation package 80 mesh coolant filters on process and facility si	ooint override.	of these options)	•
for dew point; option to control set point based or on fixed temperature with user defined dew p Available options (visit www.Lytron.com f External flow valve External pressure relief valve 5 micron coolant filter ⁵ DI water cartridge ⁵ High purity plumbing Heater ⁶ Internal insulation package 80 mesh coolant filters on process and facility si Dual modulating valves	ooint override.	of these options)	•
for dew point; option to control set point based or on fixed temperature with user defined dew p Available options (visit www.Lytron.com f External flow valve External pressure relief valve 5 micron coolant filter ⁵ DI water cartridge ⁵ High purity plumbing Heater ⁶ Internal insulation package 80 mesh coolant filters on process and facility si Dual modulating valves • = standard ° = available option 'With standard p	ooint override. or a full description of des ump ² PDP = Positive Displace	of these options)	

Standard Cooling Systems



A Modular Cooling System (MCS) is a cost-effective and reliable alternative to refrigerated chillers for applications where precise temperature control and cooling below ambient temperature are not required. It consists of a high performance Lytron heat exchanger integrated with a fan, pump, and tank in a durable metal chassis.

- Extremely efficient: All components are performance-matched for maximum cooling capacity. Lytron has more than 50 years of experience in thermal design, so you can be sure that the most critical component of the MCS, the heat exchanger, is designed for optimum performance.
- Easy-to-operate: This easy-to-use, turnkey cooling package takes the guesswork and effort out of building a cooling loop. All you need to do is fill the tank and flip the switch.
- Compatible with a range of coolants: We offer systems with copper heat exchangers for use with water, stainless steel heat exchangers for use with deionized water, and aluminum heat exchangers for use with oil or Ethylene Glycol/Water (EGW) mixture. This ensures that we have a product optimized for virtually any cooling fluid.
- **19**["] **(48 cm) rack mount version available:** Integration into your system is simple with our rack-mounted versions (MCS20 and MCS30).
- Extremely reliable: All components in the MCS have been designed for long life and high reliability—a Lytron MCS will provide years of trouble-free operation.
- ITSNA tested to UL 61010A-1 and CE certified

Custom Spotlight:

A customer needed a tightly packaged MCS to integrate into their system. Lytron engineers selected a high-efficiency OEM Coil heat exchanger, a long-life centrifugal pump, and a compact reservoir for the unit.

See page 8 for more custom cooling systems.



Performance Graphs *MCS*™





MCS40 and MCS50 Thermal Performance



MCS Positive Displacement Pumps 10 LPM Bar 80 BC/CC 50 Hz BC/CC 60 Hz Fluid Pressure (PSI) BE/CE 50 Hz BB/CB 50 Hz BE/CE 60 Hz 40 BB/CB 60 Hz Ŧ 1 T T Water Flow Rate (gpm)







Standard Cooling Systems



MCS[™] Specifications and Part Number Configuration





irst select your			MCS20	MCS30	MCS40	MCS50		
nodel humber	Cooling capacity using water, 25°C initial temperature difference	W BTU/Hr	1300 4,450	2100 7,150	2400 8,200	3500 12,000		
	Fluid Inlet Connections		½″ FNPT	½″ Barb	½″ FNPT	½″ FNPT		
	Fluid Outlet Connections		½″ FNPT	½″ Barb	½″ FNPT	½″ FNPT		
	Reservoir capacity		0.75 gal/2.8 liters					
	Maximum liquid temperature		131°F/55℃					
	Dimensions (W x D x H)	inches mm	17.3 x 15 439 x 38	5.1 x 13.3 34 x 338	15 x 15 x 24 381 x 381 x 610			
	Rack Mount Dimensions (W x D x H)	inches mm	19 x 15.1 x 12.3 482 x 384 x 312		n/a			
	Weight – stand alone	lbs (kg)	35 (16)	37 (17)	60 (27)	65 (29)		
	Weight – rack mount	lbs (kg)	23 (10)	25 (11)	n/a	n/a		
	Recommended coolant		water	oil, EGW	water	water		
Next, select an electrical	Available electrical configurations ar	nd full load a	mperage ³					
onfiguration	G01: 115V, 60Hz, 1ph	Amps	5.3	5.3	n/a	n/a		
	G02: 115V, 60Hz, 1ph	Amps	n/a	n/a	5.6	5.8		
	H01: 230V, 50/60 Hz, 1ph	Amps	2.5	2.5	n/a	n/a		
	J02 : 230V, 50/60 Hz, 1ph	Amps	n/a	n/a	2.7	2.8		
Now, select	Pump options (visit www.Lytron.com for guidance on selecting a pump; refer to page 25 & 26 for system pump grap							
a pump	BB: PDP ⁴ , Brass, 1.3 gpm/4.9 lpm		•	•				
	BC: PDP ⁴ , Brass, 1.8 gpm/6.8 lpm		0	0	•	•		
	BE: PDP ⁴ , Brass, 2.3 gpm/8.7 lpm		0	0	0	0		
	CB: PDP ^{4,5} . Stainless Steel, 1.3 gpm/4.9 lp							
		om	0					
	CC: PDP ^{4,5} , Stainless Steel, 1.8 gpm/6.8 lp	om om	0					
	CC: PDP ^{4,5} , Stainless Steel, 1.8 gpm/6.8 lp CE: PDP ^{4,5} , Stainless Steel, 2.3 gpm/8.7 lp	om om om	0 0 0					
	CC: PDP ^{4,5} , Stainless Steel, 1.8 gpm/6.8 lp CE: PDP ^{4,5} , Stainless Steel, 2.3 gpm/8.7 lp AB: Centrifugal, ½ HP ⁶	om om om	0 0 0 0	0				
	CC: PDP ^{4,5} , Stainless Steel, 1.8 gpm/6.8 lg CE: PDP ^{4,5} , Stainless Steel, 2.3 gpm/8.7 lp AB: Centrifugal, ½ HP ⁶ DA: Centrifugal, ½ HP ⁶	om om om	0 0 0 0 0	0 0	0	0		
Add the ambient	CC: PDP ^{4,5} , Stainless Steel, 1.8 gpm/6.8 lg CE: PDP ^{4,5} , Stainless Steel, 2.3 gpm/8.7 lp AB: Centrifugal, % HP ⁶ DA: Centrifugal, % HP ⁶ Package Options		0 0 0 0	0 0	0	0		
Add the ambient package	CC: PDP ^{4,5} , Stainless Steel, 1.8 gpm/6.8 lg CE: PDP ^{4,5} , Stainless Steel, 2.3 gpm/8.7 lg AB: Centrifugal, ½ HP ⁶ DA: Centrifugal, ½ HP ⁶ Package Options Package 1: Ambient Package	om	0 0 0 0	0 0	0	•		
Add the ambient package Add any additional	CC: PDP ^{4,5} , Stainless Steel, 1.8 gpm/6.8 lg CE: PDP ^{4,5} , Stainless Steel, 2.3 gpm/8.7 lg AB: Centrifugal, ½ HP ⁶ DA: Centrifugal, ½ HP ⁶ Package Options Package 1: Ambient Package Additional Options	om	0 0 0 0	0 0	0	0		
Add the ambient package Add any additional options	CC: PDP ^{4,5} , Stainless Steel, 1.8 gpm/6.8 lg CE: PDP ^{4,5} , Stainless Steel, 2.3 gpm/8.7 lg AB: Centrifugal, ½ HP ⁶ DA: Centrifugal, ½ HP ⁶ Package Options Package 1: Ambient Package Additional Options M002: Heavy duty casters		0 0 0 0	0 0 •	0 •	0 0		
Add the ambient package Add any additional options	CC: PDP ^{4,5} , Stainless Steel, 1.8 gpm/6.8 lg CE: PDP ^{4,5} , Stainless Steel, 2.3 gpm/8.7 lg AB: Centrifugal, ½ HP ⁶ DA: Centrifugal, ½ HP ⁶ Package Options Package 1: Ambient Package Additional Options M002: Heavy duty casters M062: Rack mount configuration			0 0 0	0	•		
Add the ambient package Add any additional options	CC: PDP ^{4,5} , Stainless Steel, 1.8 gpm/ds lg CE: PDP ^{4,5} , Stainless Steel, 2.3 gpm/ds lg CE: PDP ^{4,5} , Stainless Steel, 2.3 gpm/8.7 lg AB: Centrifugal, ¼ HP ⁶ Package Options Package 1: Ambient Package Additional Options M002: Heavy duty casters M062: Rack mount configuration M004: High purity plumbing (stainless ste exchanger, nickel-plated bulkhead	el heat fittings)		0 0 0	0	0 0		
Add the ambient package Add any additional options	CC: PDP ^{4.5} , Stainless Steel, 1.8 gpm/6.8 lg CE: PDP ^{4.5} , Stainless Steel, 2.3 gpm/8.7 lg AB: Centrifugal, ½ HP ⁶ DA: Centrifugal, ½ HP ⁶ Package Options Package 1: Ambient Package Additional Options M002: Heavy duty casters M062: Rack mount configuration M004: High purity plumbing (stainless ste exchanger, nickel-plated bulkhead M063: Rack mount configuration and hig purity plumbing	el heat fittings)		0 0 0 0	0	• •		

• = standard \circ = available option ¹ Oil @ 70°F, 50/50 EGW ² Includes pressure drop through system. Visit www.Lytron.com for guidance on selecting a pump. ³ With standard pump ⁴ PDP = Positive Displacement Pump ⁵ Only available with high purity plumbing ⁶ Actual flow rate depends on system pressure drop. See www.Lytron.com for information on how to calculate flow rate.

MCS20 G01 BB 1 MCS20, 115V, 60 Hz operation, with BB pump and no additional options

MCS40 G02 BC 1 M002 MCS40, 115V, 60 Hz operation, with BC (brass) pump, and heavy duty casters

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To arrive at a part number

Standard Cooling

Systems

specs

SELEC

Selecting a Cooling System

Selecting a Recirculating Chiller

Selecting the proper recirculating chiller is a function of four factors:

- 1. Heat load generated by the device being cooled (Q)
- 2. Maximum acceptable temperature of the fluid exiting the heat source (T_{OUT})
- 3. Fluid flow rate (v)
- 4. Ambient operating conditions

Often, an equipment manufacturer will specify the cooling capacity, set point temperature, and flow rate of the required chiller. In this case, selecting a chiller is easy. Simply mark the intersection of the desired cooling capacity and the set point temperature on the chiller graph. Any chiller with a performance curve above or equal to this point will provide enough capacity. Next, use the pump graph to select a pump that meets the desired flow rate.

Example:

A chiller needs to supply 2 gpm at 20°C to an x-ray tube that generates 2,000 W of heat. The power supply is 60 Hz. Marking this point on the chiller graph (Fig 1) we can see that an RC022 would be an appropriate choice. From looking at the pump curves (Fig 2) we see that a BE pump would provide the necessary flow rate. For more examples, please visit www.Lytron.com.





Standard

Cooling

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Selecting a Liquid-to-Liquid Cooling System

In most LCS sizing applications, we know the temperature of the facility water (T_F), the desired process set point temperature (T_p), the flow rate through the process (\mathbf{v}_p) and the heat load of the process, Q. To determine the required capacity, Q/ITD, we first need to calculate the change in temperature, ΔT , through the process. We can do this either by using the heat capacity graphs found on www.Lytron.com or by solving the heat capacity equation:

Facility Side

$$\dot{v}_{F}$$
, T_{F}
 $- - LCS - - - T_{p} + \Delta T$
 \dot{v}_{p} , T_{p}
Heat Source, Q

$$Q = \mathbf{m} C_p \Delta T$$

Next, we calculate Q/ITD to find the required cooling capacity. Q is the process heat load. ITD, the Initial Temperature Difference, is the difference in temperature between the warm return water, $(T_p + \Delta T)$, and the cold facility water (T_F) .

$$\frac{Q}{ITD} = \frac{\overset{\bullet}{m}C_{P}\Delta T}{T_{p} + \Delta T - T_{F}}$$

Finally, refer to the LCS performance graph to determine the facility process flow rate required to achieve the calculated Q/ITD.

Example:

A solder reflow oven requires a process set point of 20°C. The heat load is 10 kW and the process water flow rate is 5 gpm. The facility water is at 10°C.

Using heat capacity graphs, which can be found on www.Lytron.com, we find that the ΔT through the process is approximately 7.6°C for the condition 10 kW at 5 gpm.

Selecting a Cooling System

We can now solve for Q/ITD as follows:

$$\frac{Q}{ITD} = \frac{10 \text{ kW}}{20^{\circ}\text{C} + 7.6^{\circ}\text{C} - 10^{\circ}\text{C}} = 0.57 \frac{\text{kW}}{^{\circ}\text{C}}$$

Referencing the LCS performance graph, we can see that a facility flow rate above 2 gpm will meet the required performance.



Selecting a Modular Cooling System (MCS)

To select the correct MCS, you first need to determine Q/ITD. Q is the heat load, and ITD is the Initial Temperature Difference, or the difference between the MCS liquid inlet temperature and the ambient air temperature. Then, using the MCS performance graph, draw a horizontal line at the calculated Q/ITD value and a vertical line at the process flow rate. If the intersection of those is on or below the system curve, it will meet the required thermal capacity. Finally, check that the pump will provide sufficient flow rate.

Example:

A laser produces 700 W of waste heat. The water temperature exiting the laser should be less than 35°C. Ambient room temperature is 20°C. The laser equipment requires a flow rate of at least 1 gpm. Which MCS system should be selected? First, determine Q/ITD:

 $Q/ITD = 700 W/(35^{\circ}C-20^{\circ}C) = 46.7 W/^{\circ}C$

Using the thermal performance graph, you can see that at flow rates above 0.5 gpm, the MCS20 will provide adequate performance. The standard BB pump offers a flow rate of 1.3 gpm so it will work well.



MCS Positive Displacement Pumps

