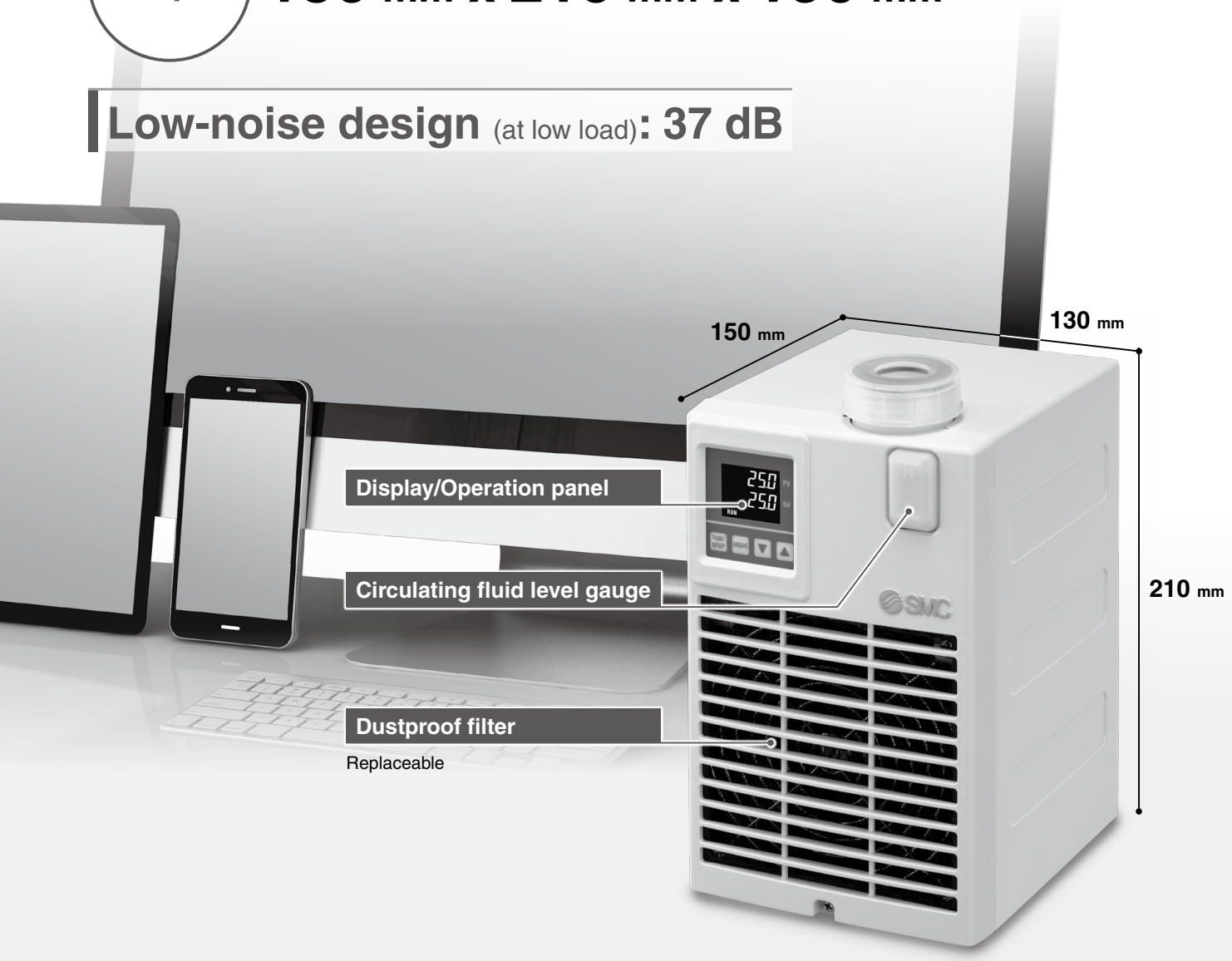
Peltier-type Chiller

Thermo-con/Compact Type Air-cooled

HEF Series

Compact **130** Width mm x **210** Height mm x **150** Depth mm

Low-noise design (at low load): 37 dB



Cooling capacity: 220 W

Temperature stability: ±0.1°C

Set temperature range: 10°C to 60°C

Superior temperature control

Now only takes about 41 seconds to lower the temperature by 10°C

86% reduction (41 s ← 294 s)

* Compared with the existing product HECR002
* Time to change the circulating fluid temperature from 30°C to 20°C (when the circulating fluid IN and OUT are directly connected)

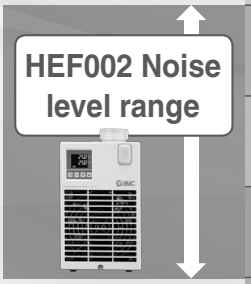
Can precisely control the temperature

Precisely control the temperature of the circulating fluid by using the Peltier device. Refrigerant-free and environmentally friendly

Low-noise design 37 dB (at low load)

This product generates less **vibration**, **dust**, and noise due to its lack of moving parts, such as a compressor.
The noise is kept low by reducing the fan speed in low-load operation.
Customers can reduce the noise by setting the unit to constant fan speed mode when the noise at high load is concerned.

* Note that in constant fan speed mode, cooling performance is reduced.



Noise Level

Sound level	Noise level reference	Sound example
20 dB	Whisper	The sound of leaves touching each other or the sound of snow falling
30 dB	Very quiet	Suburbs late at night or the sound of writing with a pencil
40 dB		A quiet residential area in the daytime or in the library
50 dB	Normal	External unit of a home air conditioner (close distance) or in a quiet office
60 dB		In a moving car, normal conversation, or in a department store
70 dB	Noisy	In a car driving at high speed, in a noisy office, or the sound of cicadas (close distance)
80 dB		On a running train, ambulance siren (close distance), or inside a pachinko parlor
90 dB	Very loud	Karaoke bar (in the center) or the barking of a dog (close distance)

Refrigerant-free

Fluid contact material: Stainless steel, Resin, Rubber

(Aluminum and copper material-free)

# of a heat source or process fluid

Easy maintenance

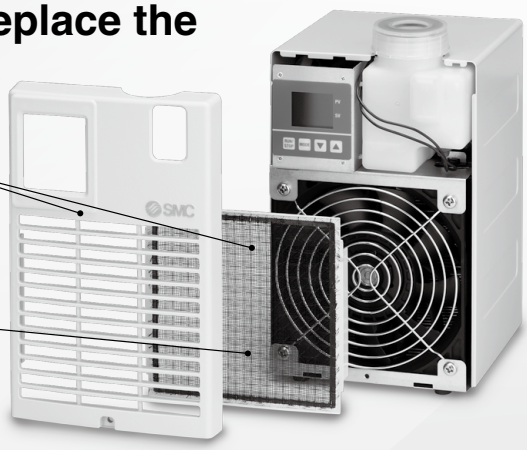
Easy to clean and replace the dustproof filter

Dustproof filter set p. 563

Integrated with the front panel grille. Easy to install and remove

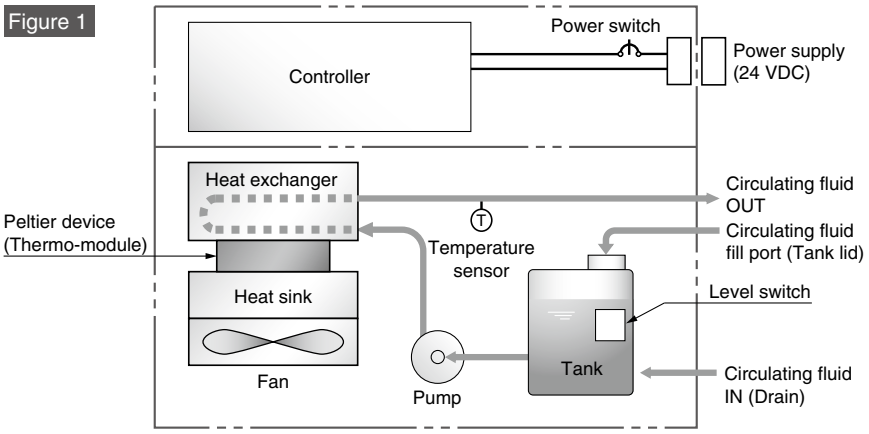
Dustproof filter p. 563

Easy to remove dust, cutting chips, etc., stuck to the filter with a brush or vacuum cleaner



Construction and Principles

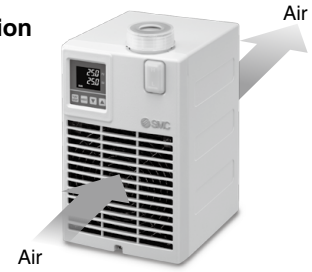
Figure 1



The thermo-con is constructed as shown in Figure 1. The circulating fluid outlet temperature is controlled precisely by a Peltier element (thermo module) between the heat exchanger and heat sink which is controlled by supplying DC power supply. The circulating fluid returns to the tank and is transferred by the pump which is built into the thermo-con, then it goes through the heat exchangers and temperature sensor and out from the circulating fluid outlet.

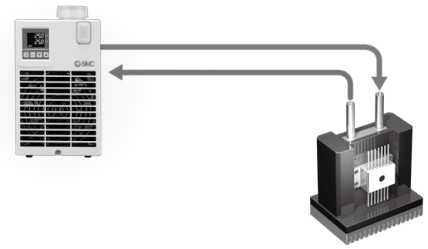
Figure 2 **Heat dissipation air flow direction**

The heat dissipation air flow direction is as shown in Figure 2. Air is taken from the front of the Thermo-con and discharged from the rear. Do not cover the inlet and outlet vents.

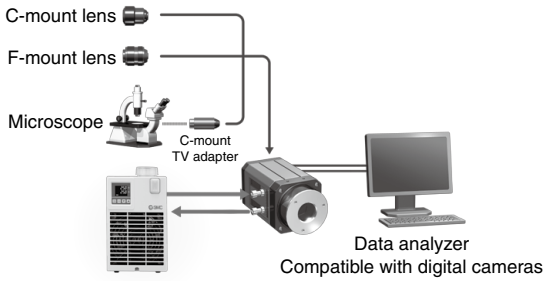


Application Examples

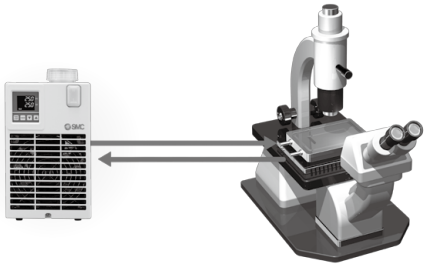
Cool Diode Laser



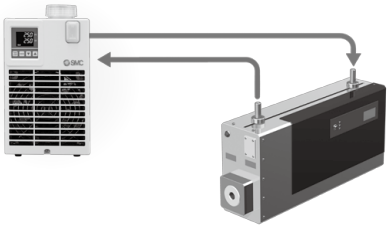
Cool Optical Camera



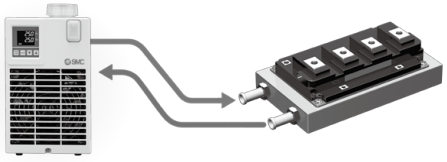
Microscope Cooling Plate



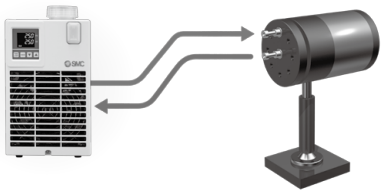
Laser Oscillator



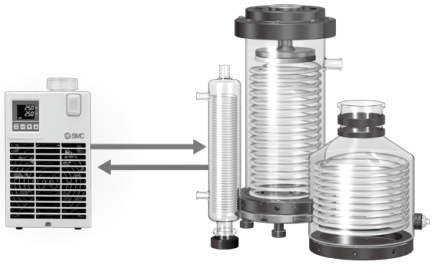
Cool Power Device



Beam Bumper



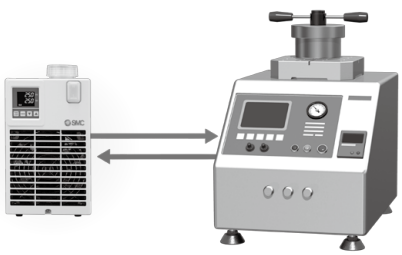
Cooling Glass Heat Exchanger



Circulation Between Gas Generation Analyzer and Jacketed Vessel

∗ Open bath type (Can be connected to a water tank, etc., and the temperature can be directly controlled.)

Cooling Sample Embedding Machine



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HEF Series

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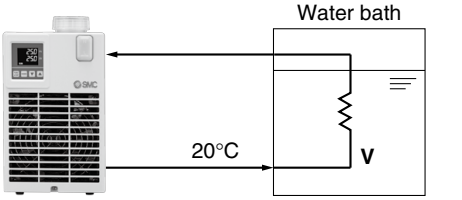
HEF Series Air-cooled
Cooling Capacity Calculation

Example	When cooling the object below a certain temperature in certain period of time.

Cooled substance total volume V : 2 L
Cooling time h : 15 min
Cooling temperature difference ΔT : Temperature difference: 10°C (10 K). Cool from 30°C (303 K) to 20°C (293 K).
Circulating fluid : Tap water
Density γ : 1 x 10^3 kg/m^3
Specific heat C: 4.2 x 10^3 J/(kg·K)

∗ Refer to the information shown below for the typical physical property values by circulating fluid.



$$Q = \frac{\Delta T \times V \times \gamma \times C}{h \times 60 \times 1000}$$

$$= \frac{10 \times 2 \times 1 \times 10^3 \times 4.2 \times 10^3}{15 \times 60 \times 1000}$$

= 93.3 W

Cooling capacity = Considering a safety factor of 20%,
93.3 W x 1.2 = 112 W

Circulating Fluid Typical Physical Property Values

Ethylene Glycol Solution 20%

Temperature [°C]	Density ρ [kg/m^3]	Specific heat C [J/(kg·K)]
10	1.03 x 10^3	3.93 x 10^3
20	1.03 x 10^3	3.95 x 10^3
30	1.02 x 10^3	3.97 x 10^3
40	1.02 x 10^3	3.98 x 10^3
50	1.01 x 10^3	4.00 x 10^3
60	1.01 x 10^3	4.02 x 10^3

Water

Density γ: 1 x 10^3 [kg/m^3] **Specific heat C: 4.2 x 10^3 [J/(kg·K)]**

Thermo-con/ Compact Type

HEF Series Air-cooled

How to Order

HEF 002 – A 6 □ – □

Cooling capacity

002	220 W

Radiating method

A	Air-cooled

Power supply

6	24 VDC

Pipe thread

Nil	Rc
N	NPT thread

Option

Nil	None
P	High-pressure pump mounted

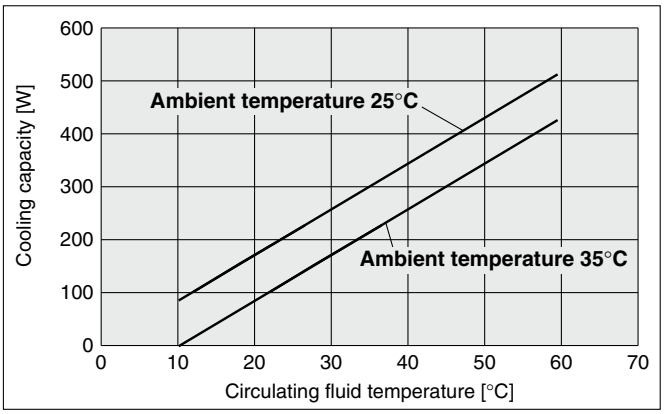
Specifications

Cooling method		Thermoelectric device (Thermo-module)
Radiating method		Forced air cooling
Control method		Cooling/Heating automatic shift PID control
Ambient temperature/humidity		10 to 35°C, 35 to 70% RH (No condensation)
Circulating fluid system	**Circulating fluid**	Tap water, Ethylene glycol aqueous solution (20% or less)
	Set temperature range	10.0 to 60.0 °C (No condensation)
	Cooling capacity	220 W (Tap water)*1
	Heating capacity	500 W (Tap water)*1
	Temperature stability	±0.1°C*2
	Pump capacity	Refer to the performance charts.
	Tank capacity	Approx. 110 mL
	Port size	Rc1/4
	Fluid contact material	Stainless steel, EPDM, NBR, Ceramics, PPE, PPS, Carbon, PP, POM
Electrical system	**Power supply**	24 VDC ±10%
	Power consumption	12.5 A (Peak current 18 A)
	Alarm	Refer to “Alarm.”
	Communications	RS-232C/RS-485
Weight		Approx. 3.5 kg
Noise level		37 to 60 dBA (45 dBA: When set to constant fan speed mode)*4
Accessories		DC input power supply cable (1 m), Operation Manual (The 24 VDC power supply should be prepared by the customer.)*3
Safety standards		CE/UKCA marking, UL (NRTL) standards

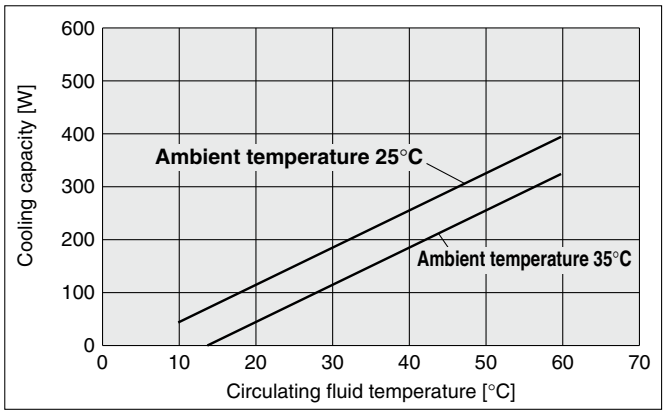
*1 Conditions: Set temperature 25°C, Ambient temperature 25°C, Circulating fluid flow rate 1 L/min (For options, refer to the performance charts.)
*2 The indicated values are when there is a stable load without turbulence. It may be out of this range depending on the operating conditions.
*3 An AC adapter and a power supply cable suitable to this product are available as optional accessories.
For details, refer to the optional accessory (page 563).
*4 For customers who want to reduce the noise of high loads, the noise can be suppressed to 45 dBA or less by setting the product to constant fan speed mode. However, be aware that this will result in a decrease in the cooling capacity.

Cooling Capacity

Circulating fluid: Water, Flow rate: 1 L/min



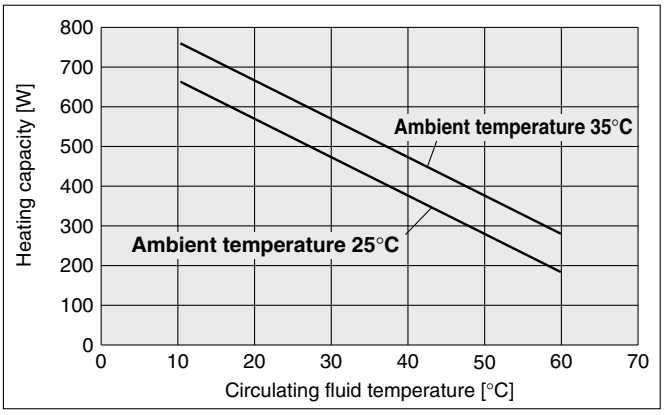
Circulating fluid: Water, Flow rate: 1 L/min, When constant fan speed mode is selected



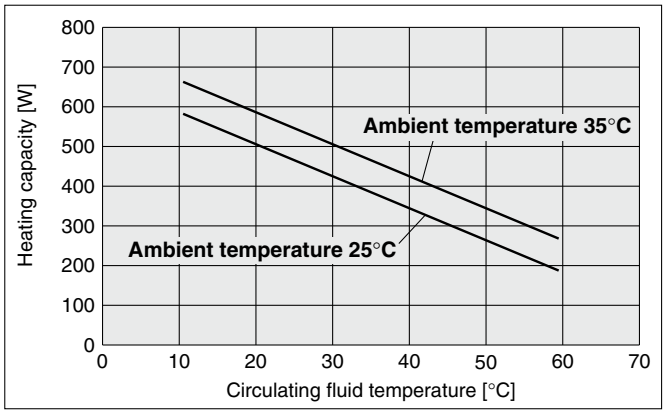
∗ For the high-pressure pump (Option), the cooling capacity decreases by approx. 20 W.

Heating Capacity

Circulating fluid: Water, Flow rate: 1 L/min



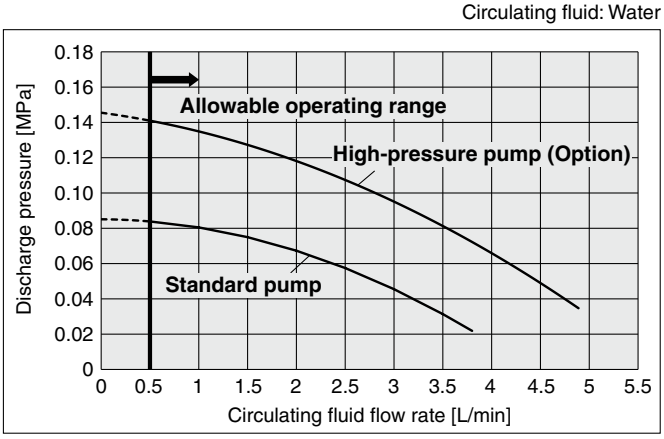
Circulating fluid: Water, Flow rate: 1 L/min, When constant fan speed mode is selected



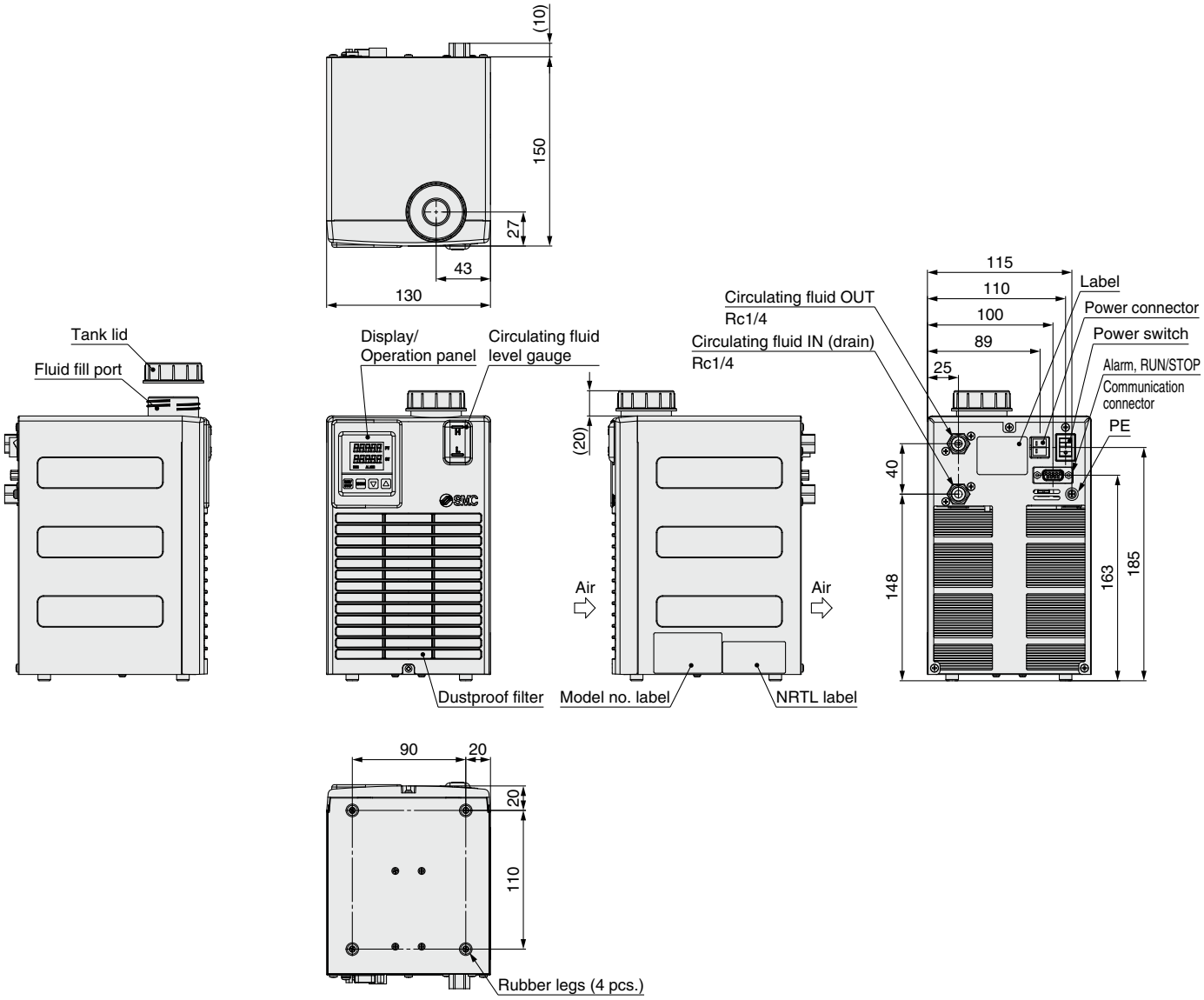
∗ For the high-pressure pump (Option), the heating capacity increases by approx. 10 W.

Pump Capacity (Thermo-con Outlet)

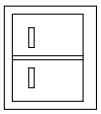
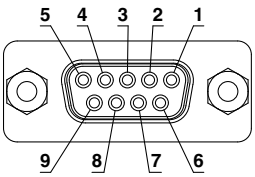
Circulating fluid: Water



Dimensions



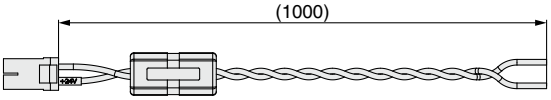
Connector

Connector name	No.	Signal contents	Connector type/Part no.
Power connector	1	24 VDC +	 J.S.T. Mfg. Co., Ltd. JFA connector J4000 series SC02B-J42SK-GHXR
	2	24 VDC –	
Alarm, RUN/STOP, Communication connector	1	RS-485 BUS +	 D-sub 9 pin (socket type) Holding screw: M2.6
	2	RS-232C RD	
	3	RS-232C SD	
	4	RUN/STOP signal input	
	5	SG	
	6	Output cutoff alarm (open when alarm occurs)	
	7	Common for output cutoff alarm	
	8	RUN/STOP signal input	
	9	RS-485 BUS –	

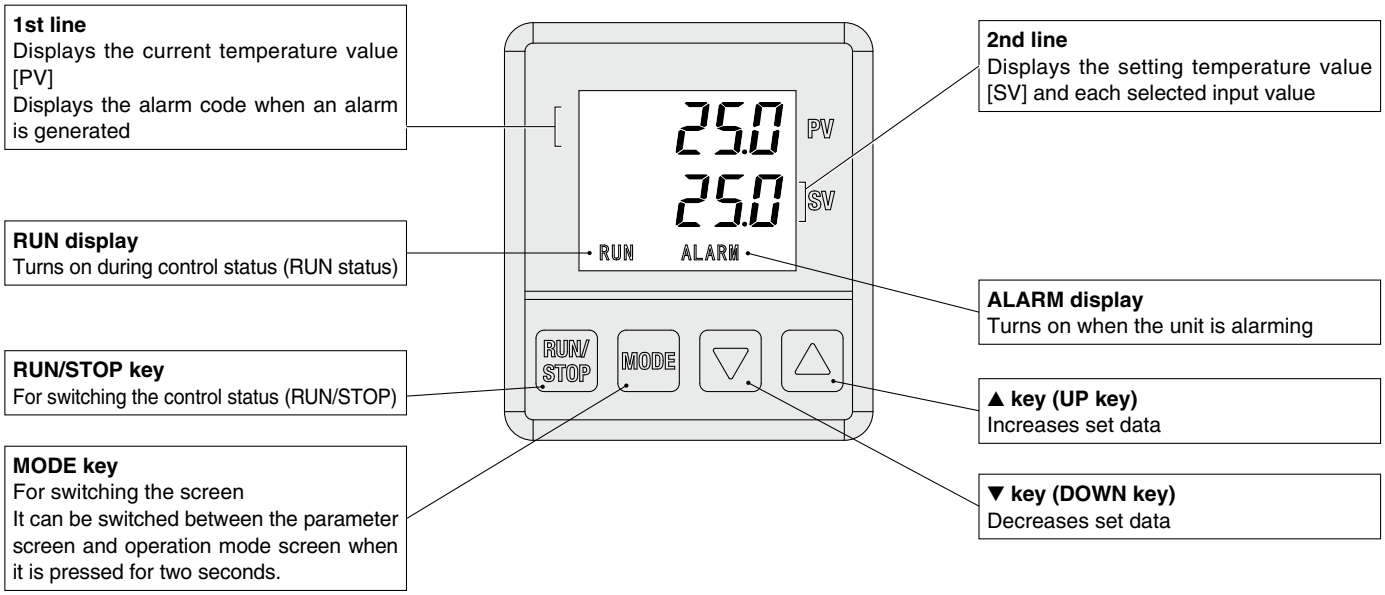
Power Cable (Accessory)

Connector: J42FSC-02V-KX (J.S.T. Mfg Co., Ltd.-made)
Cable: 16AWG

Wire color	Contents
Brown	24 VDC +
Blue	24 VDC –



Operation Display Panel



Alarm

This product can display eight types of alarm codes and they can be read using serial communication.
In addition, it can relay output as an alarm contact output when an alarm is generated.

Alarm

Alarm code	Alarm description	Operation status	Main reason
AL0	Memory error	Stop	There is an abnormality with the memory data in the controller due to a high level of noise.
AL1	Controller error	Stop	There is an abnormality with the data in the controller due to a high level of noise.
AL2	Temp. sensor disconnection alarm	Stop	The temperature sensor has been disconnected or short-circuited.
AL3	Temp. sensor short circuit alarm	Stop	There is a short-circuit in the temperature sensor.
AL4	Temp. sensor high temp. error alarm	Stop	The temperature sensor has exceeded the high temperature cutoff setting.
AL5	Temp. sensor low temp. error alarm	Stop	The temperature sensor has exceeded the low temperature cutoff setting.
AL6	Low fluid level alarm	Stop	The amount of circulating fluid in the tank has dropped.
AL7	Thermostat alarm	Stop	The thermostat has activated due to clogging of the heat sink of the filter or product, or failure of the fan or pump.

Maintenance

The maintenance of this unit can only be performed by returning it to be repaired at one of SMC's sites. As a rule, SMC will not conduct on-site maintenance.

HEF Series Air-cooled
Option

* **Options have to be selected when ordering the thermo-con. It is not possible to add them after purchasing the unit.**

P Option symbol

High-Pressure Pump Mounted

HEF002-A6□-P

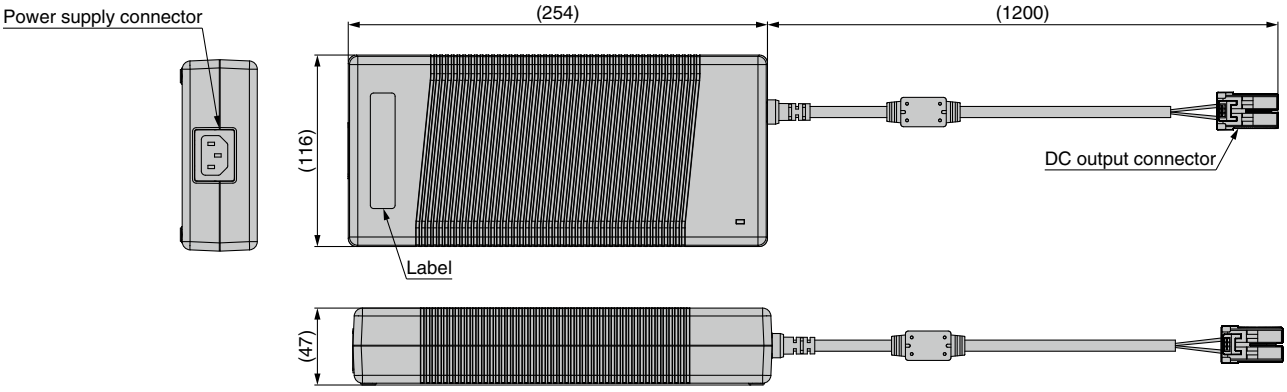
High-pressure pump mounted

Possible to choose a high-pressure pump in accordance with customer's piping resistance.
Cooling capacity is reduced by approx. 20 W due to the heat generation from the pump.

Optional Accessories

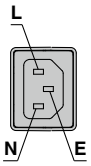
AC Adapter

Part no.	Applicable model
HEC-S1896	INR-244-831 HEF002-A6



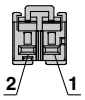
Power supply connector
IEC60320 C14 (or equivalent)

Pin no.	Signal contents
N	100-240 VAC
L	100-240 VAC
E	PE



DC output connector
JST: J42FSC-02V-KX

Pin no.	Signal contents
1	24 VDC +
2	24 VDC –



Specifications

Power supply input	100-240 VAC, Single-phase, 50/60 Hz, Max. 3.9 A
DC output	24 VDC, Max. 12.5 A
Operating environment	Ambient temperature: 0 to 40°C, Humidity: 20 to 80%RH, (no condensation)
DC output connection	Thermo-con (HEF002-A6, INR-244-831)

∗ Not for use with other products

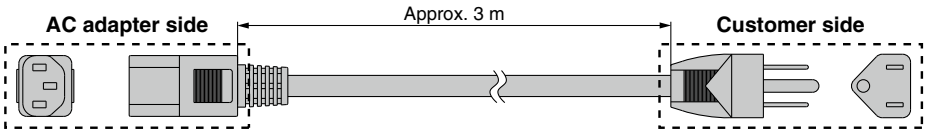
⚠ The power supply cable can only be used for the applicable models shown below. Do not use it for other products.

Power Supply Cable

■ For Single-phase 100/115 VAC type

∗ Not applicable for the 200 V type.

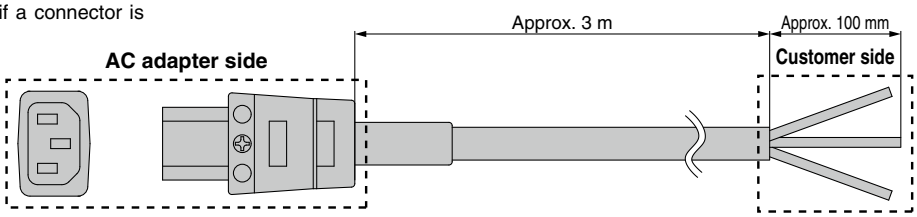
Part no.	Applicable model
HRS-CA001	HEC-S1896



■ For Single-phase 200 VAC type

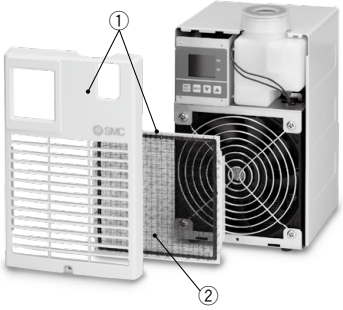
∗ Can also be used with the 100 V power type if a connector is provided by the customer

Part no.	Applicable model
HRS-CA002	HEC-S1896



Dustproof Filter

Part no.	Applicable model
HEF-FL001	HEF002-A6
HEF-FL002	



Parts List

No.	Description	Part no.	Note
①	Dustproof filter set	**HEF-FL001**	Front panel, Filter: 1 piece each
②	Dustproof filter	**HEF-FL002**	Filter: 1 piece

HEF Series
Specific Product Precautions

Be sure to read this before handling the products. Refer to page 605 for safety instructions and pages 606 to 609 for temperature control equipment precautions.

Design

⚠Warning

1. This catalog shows the specifications of the thermo-con.

1. Check the detailed specifications in the separate "Product Specifications", and evaluate the compatibility of the thermo-con with customer system.
2. Although a protection circuit as a single unit is installed, the user is requested to carry out a safety design for the whole system.

Handling

⚠Warning

1. Thoroughly read the operation manual.

Read the operation manual completely before operation, and keep the manual where it can be referred to as necessary.

2. If the set temperature is repeatedly changed by 10°C or more, the thermo-con may fail in short periods of time.

Operating Environment/Storage Environment

⚠Warning

1. Keep within the specified ambient temperature and humidity range.

Also, if the set temperature is too low, condensation may form on the inside of the thermo-con or the surface of piping even within the specified ambient temperature range. Dew condensation can cause failure, and so must be avoided by considering operating conditions.

2. The thermo-con is not designed for clean room usage.

The pump and fan generate dust.

3. Low molecular siloxane can damage the contact of the relay.

Use the thermo-con in a place free from low molecular siloxane.

Transportation/Movement/Installation

⚠Caution

1. Avoid strong vibration and/or impact.

The product is precision equipment. Do not apply vibration or impact during transportation.

2. Caution when moving a heavy object.

This product is heavy. Use adequate caution to avoid injury when picking up and setting down the product, and dropping accidents should be avoided.

3. Installation

When installing the product, mount it on a flat surface with no inclination.

Radiation Air

⚠Caution

1. The inlet for radiation air must not be exposed to particles and dust as far as possible.

2. Do not let the inlet and outlet for radiation air get closed.

3. If more than one thermo-con is used, consider their arrangement so that the downstream sides of the thermo-cons suck radiation air from the upstream sides.

Otherwise, the performance at the downstream sides may deteriorate. Also, the set temperature may not be achieved depending on the value of the set temperature and the load. In such a case, take countermeasures such as changing the direction of the thermo-cons to prevent the deterioration of performance.

4. A filter is built in. Clean the filter periodically.

Circulating Fluid

⚠Caution

1. Use a fluid that is listed in the specifications.

2. Deionized water (pure water) [with an electric conductivity of approx. 1 μS/cm] can be used, but may lose its electric conductivity.

Also, if a facility supplying deionized water (pure water) is used, the thermo-con may be damaged by static electricity.

3. If deionized water (pure water) is used, bacteria and algae may grow within a short period.

If the thermo-con is operated with bacteria and algae present, its cooling capacity or the capacity of the pump may deteriorate. Replace all deionized water (pure water) regularly according to the conditions (once a month as a guide).

4. If using a fluid other than those listed in the specifications, please contact SMC beforehand.

5. The max. operating pressure of the resin tank is 0.1 MPa.

If this pressure is exceeded, leakage from the tank in the thermo-con may result.

6. Select piping length and diameter to allow the circulating fluid flow rate of 0.5 L/min or larger.

If the flow rate is less than these values, the thermo-con will not be able to provide precise control, and the repeated cooling and heating operations may cause it to fail.

7. A magnet driven pump is used as the circulating pump.

Fluids which contain metal powders such as iron powder cannot be used.

8. The thermo-con must not be operated without circulating fluid.

The pump can break due to idling.

9. If the tank lid is opened after the supply of circulating fluid, the circulating fluid may spill out depending on the condition of the external piping.

10. If an external tank is used, the circulating fluid may spill out from the internal tank lid depending on where the external tank is installed.

Confirm that the internal tank has no leakage if using an external tank.

HEF Series
Specific Product Precautions

Be sure to read this before handling the products. Refer to page 605 for safety instructions and pages 606 to 609 for temperature control equipment precautions.

Circulating Fluid

⚠Caution

11. If there is a point where fluid is released to atmosphere externally (tank or piping), minimize the piping resistance at the circulating fluid return side.

If the piping resistance is too large, the piping may be crushed or the built-in circulator tank may be deformed or cracked because the pressure in the piping for return will become negative. The built-in circulator tank is made of resin (PE). Therefore, the tank may be crushed if the pressure is negative. Special attention must be paid if the flow rate of the circulating fluid is high. To avoid a negative pressure of –0.02 MPa or below, the piping return should be as thick and short as possible to minimize piping resistance. It is also effective to restrict the flow rate of circulating fluid or remove the gasket of the internal tank for the release to atmosphere.

12. Fluorinated fluid falls outside of the specifications.

If it is used in the thermo-con, static electricity will be generated by the flow of fluid. This static electricity may be discharged to the board of the thermo-con, causing damage, operation failure, or loss of data such as set temperatures.

Also, as the specific gravity of the fluorinated fluid is 1.5 to 1.8 times that of water, the pump will be overloaded, which also causes fluorinated fluid to fall outside the specifications. Therefore, if fluorinated fluid is to be used, please contact SMC and we will introduce you to other suitable products (water-cooled type).

13. Avoid operation with cavitation or bubbles due to low fluid level in the tank. This may shorten the pump life.

14. If tap water is used, it should satisfy the quality standards shown below.

Tap Water (as a Circulating Fluid) Quality Standards

The Japan Refrigeration and Air Conditioning Industry Association
JRA GL-02-1994 "Cooling water system – Circulating type – Make-up water"

	Item	Unit	Standard value	Influence	
				Corrosion	Scale generation
Standard item	pH (at 25°C)	—	6.0 to 8.0	○	○
	Electric conductivity (25°C)	[μS/cm]	100*1 to 300*1	○	○
	Chloride ion (Cl^-)	[mg/L]	50 or less	○	
	Sulfuric acid ion (SO_4^{2-})	[mg/L]	50 or less	○	
	Acid consumption amount (at pH4.8)	[mg/L]	50 or less		○
	Total hardness	[mg/L]	70 or less		○
	Calcium hardness ($CaCO_3$)	[mg/L]	50 or less		○
	Ionic state silica (SiO_2)	[mg/L]	30 or less		○
Reference item	Iron (Fe)	[mg/L]	0.3 or less	○	○
	Copper (Cu)	[mg/L]	0.1 or less	○	
	Sulfide ion (S_2^-)	[mg/L]	Should not be detected.	○	
	Ammonium ion (NH_4^+)	[mg/L]	0.1 or less	○	
	Residual chlorine (Cl)	[mg/L]	0.3 or less	○	
	Free carbon (CO_2)	[mg/L]	4.0 or less	○	

*1 In the case of [MΩ•cm], it will be 0.003 to 0.01.
• ○: Factors that have an effect on corrosion or scale generation
• Even if the water quality standards are met, complete prevention of corrosion is not guaranteed.

15. The tank capacity is approx. 110 mL. When the fluid level goes below the Low level, "ERR20" (Low fluid level alarm) will be triggered.

Maintenance

⚠Warning

1. Prevention of electric shocks and fire

Do not operate the switch with wet hands. Also, do not operate the thermo-con when water is present on its exterior surface.

2. Action in the case of error

If any error such as an abnormal sound, smoke, or bad odor occurs, cut off the power at once, and stop supplying and conveying fluid. Please contact SMC or a sales distributor to repair the thermo-con.

3. Regular inspection

Check the following items at least once a month. The inspection must be done by an operator who has sufficient knowledge and experience.

a) Check the displayed contents.
b) Check the temperature, vibration level, and for abnormal sounds in the body of the thermo-con.
c) Check the voltage and current of the power supply system.
d) Check the circulating fluid for leakage, contamination, and the presence of foreign matter. Replace the fluid when necessary.
e) Check the flow condition and temperature of the radiated air.