

Peltier-type Chiller

Thermo-con/ Compact Type **Air-cooled**



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

HEF Series

Superior temperature control

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

86 % reduction (294 s → 41 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)



CAT.EUS40-76A-UK

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 centre) 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. 11**

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

Dustproof filter **p. 11**

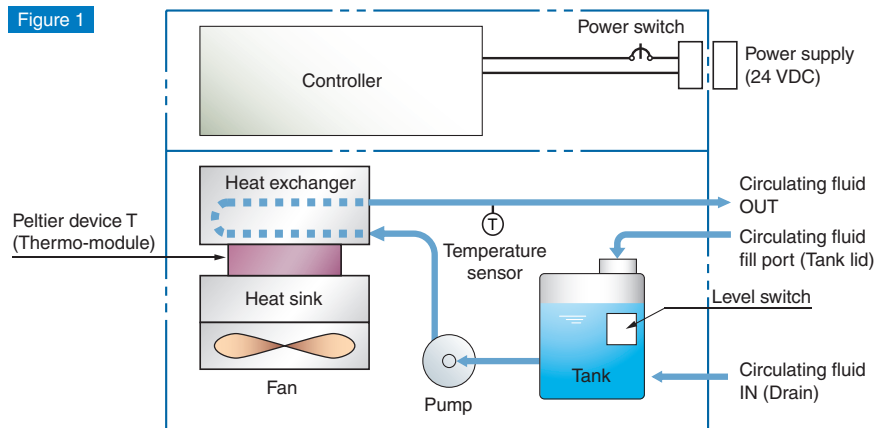
Easy to remove dust, cutting chips, etc., stuck to the filter with a brush or vacuum cleaner



210 mm

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.

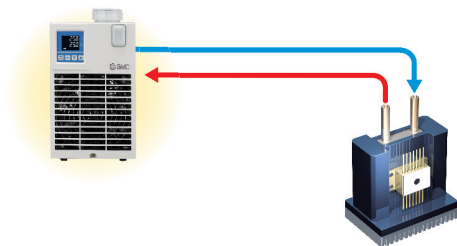
Figure 2 Heat dissipation air flow direction

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.

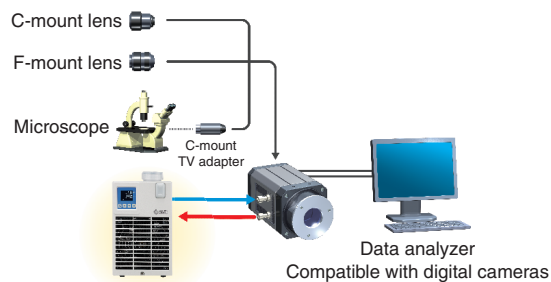


Application Examples

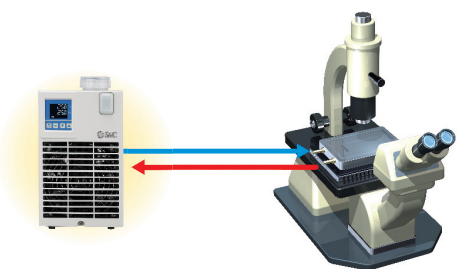
Cool Diode Laser



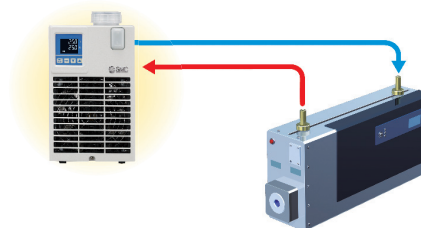
Cool Optical Camera



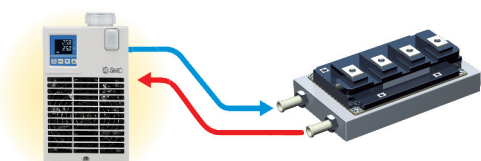
Microscope Cooling Plate



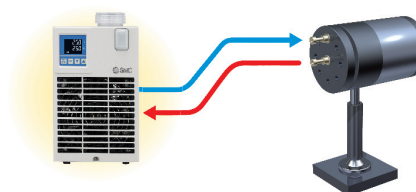
Laser Oscillator



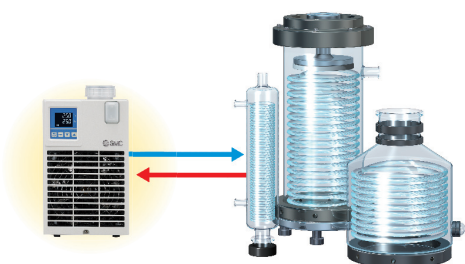
Cool Power Device



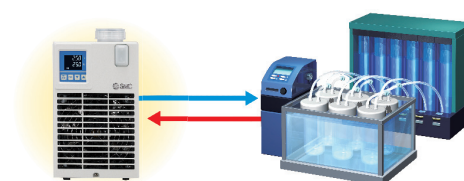
Beam Bumper



Cooling Glass Heat Exchanger

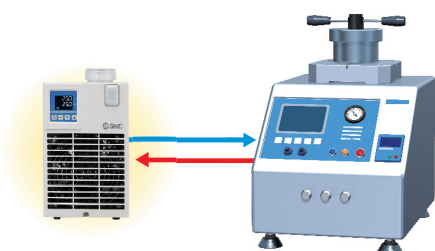


Circulation Between Gas Generation Analyzer and Jacketed Vessel



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

Cooling Sample Embedding Machine



CONTENTS

HEF Series



Thermo-con/Compact Type **Air-cooled** HEF Series

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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 : $1 \times 10^3 \text{ kg/m}^3$

Specific heat C: $4.2 \times 10^3 \text{ J/(kg}\cdot\text{K)}$

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

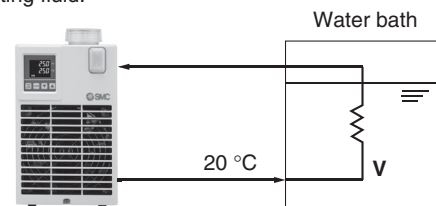
$$Q = \frac{\Delta T \times V \times \gamma \times C}{h \times 60 \times 1000}$$

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

$$= 93.3 \text{ W}$$

Cooling capacity = Considering a safety factor of 20 %,

$$93.3 \text{ W} \times 1.2 = 112 \text{ W}$$



After 15 min,
cool 30 °C down to 20 °C.

Circulating Fluid Typical Physical Property Values

Ethylene Glycol Solution 20 %

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

Water

Density γ : $1 \times 10^3 \text{ [kg/m}^3\text{]}$

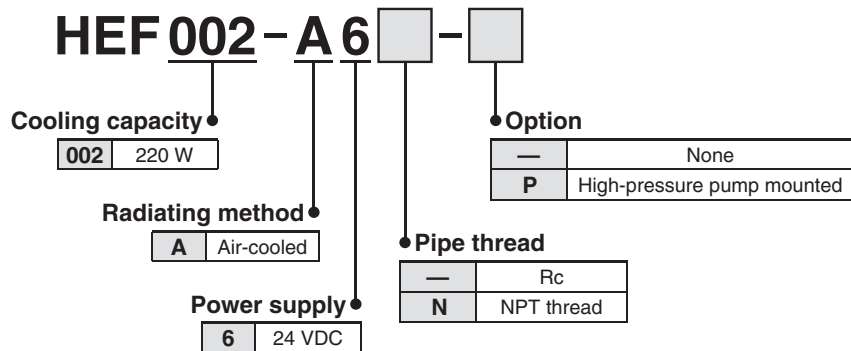
Specific heat C: $4.2 \times 10^3 \text{ [J/(kg}\cdot\text{K)]}$

Thermo-con/ Compact Type

HEF Series **Air-cooled**



How to Order



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
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

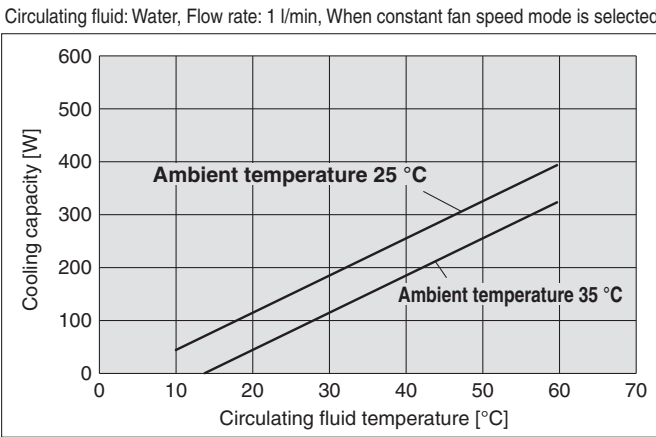
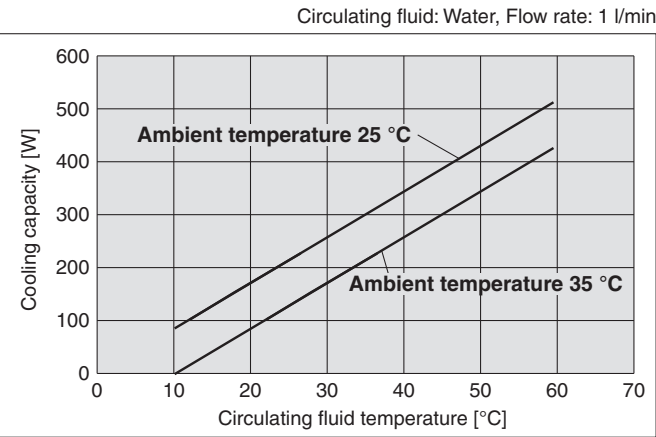
*1 Conditions: Set temperature 25 °C, Ambient temperature 25 °C, Circulating fluid flow rate 1 l/min (For options, refer to the performance charts.)

*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.

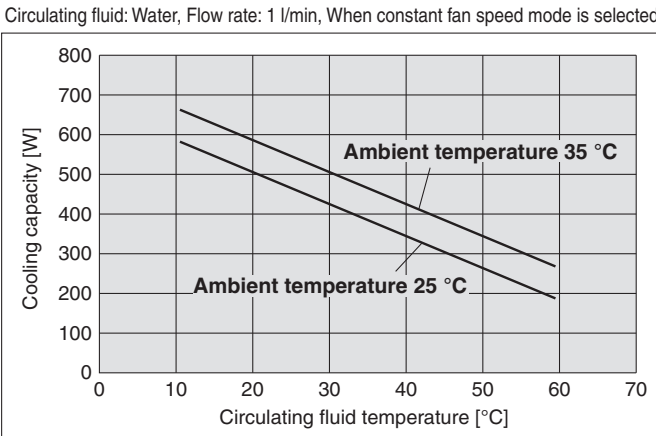
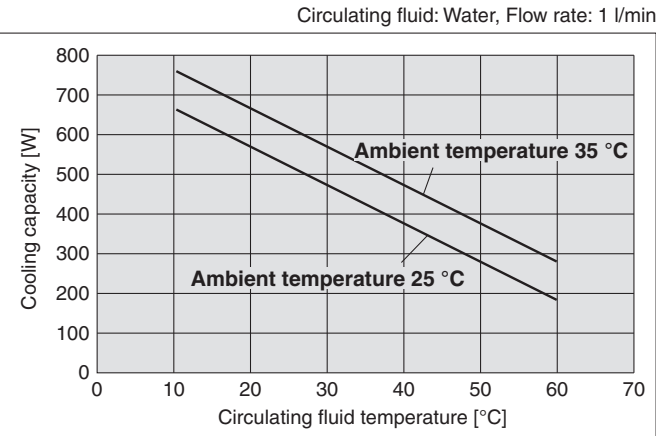
For details, refer to the optional accessory (page 11).

Cooling Capacity



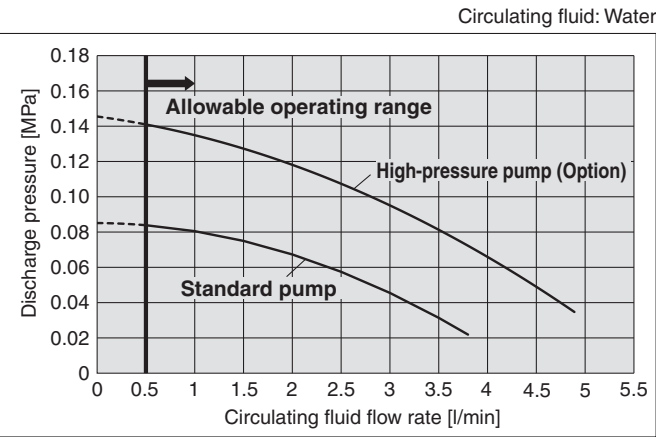
* For the high-pressure pump (Option), the cooling capacity decreases by approx. 20 W.

Heating Capacity

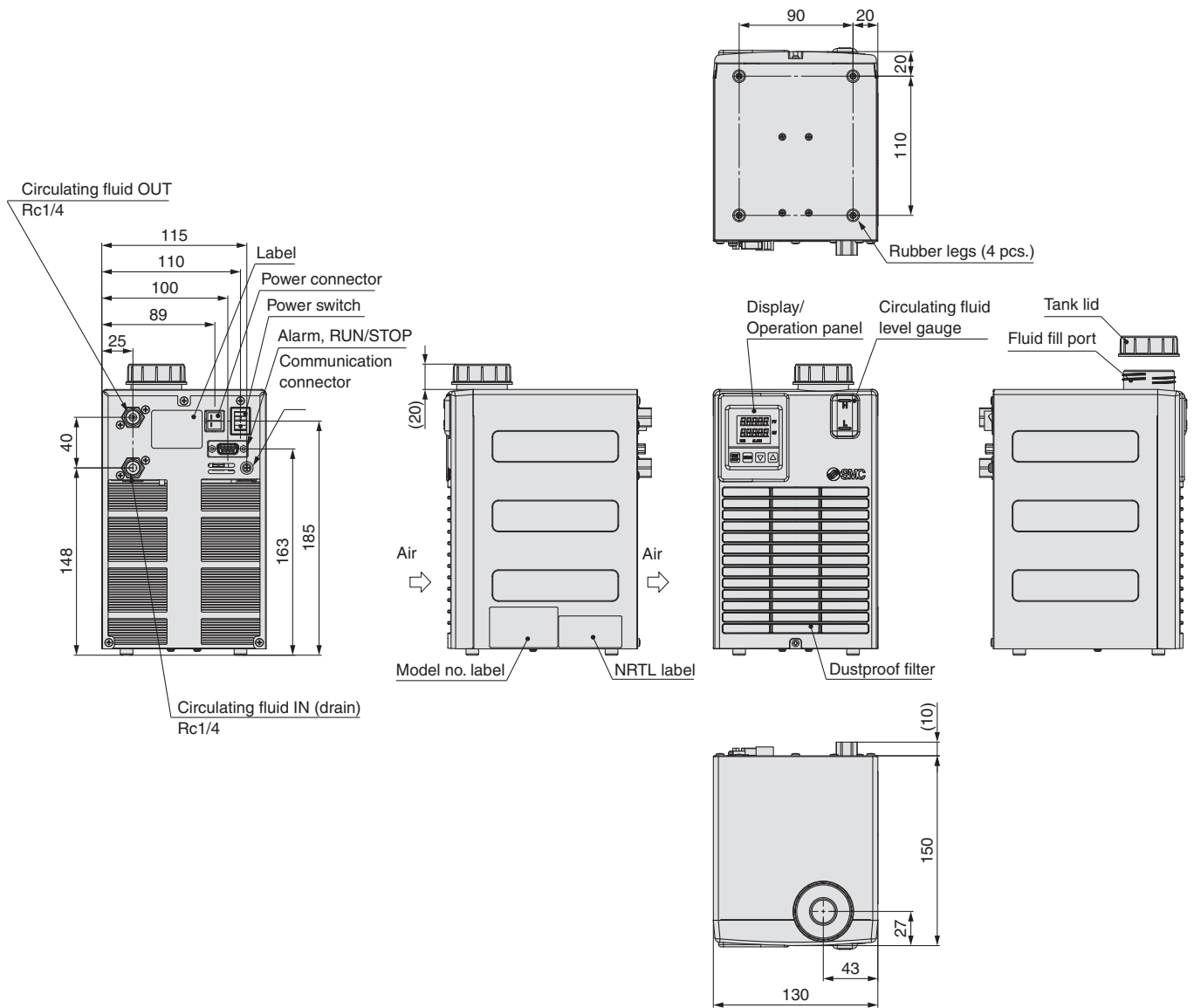


* For the high-pressure pump (Option), the heating capacity increases by approx. 10 W.

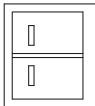
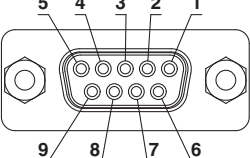
Pump Capacity (Thermo-con Outlet)



Dimensions



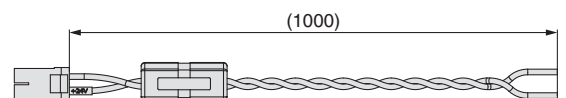
Connector

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 -	

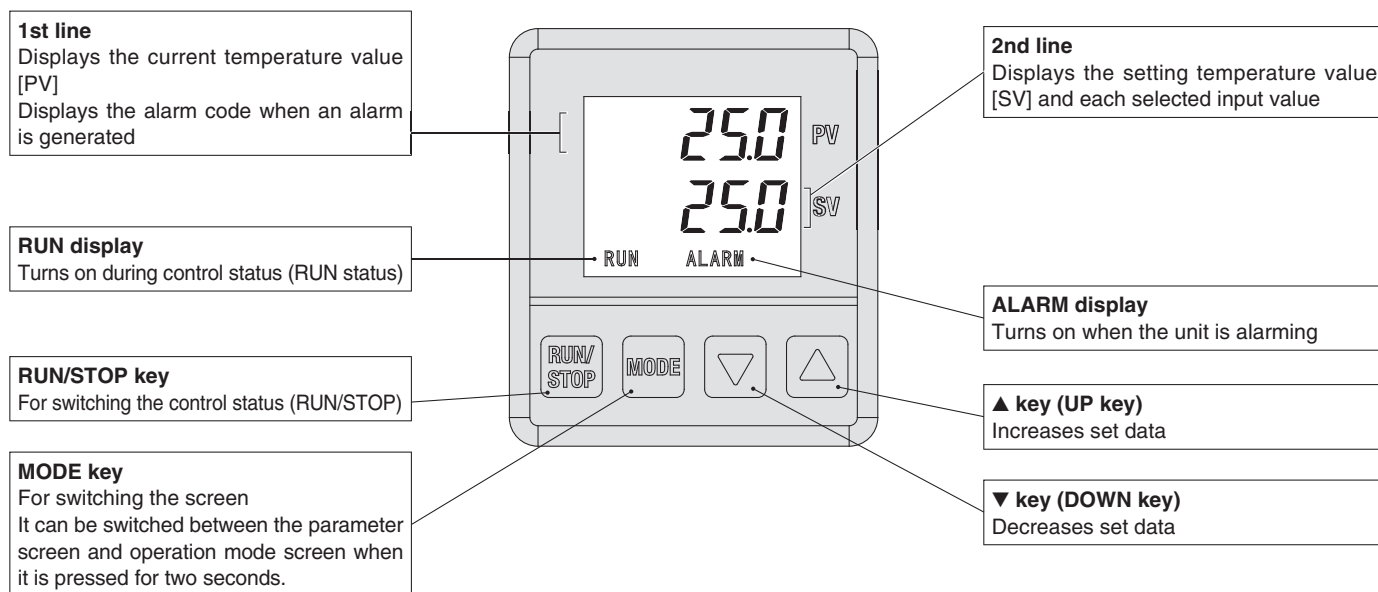
Power Cable (Accessory)

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

Wire colour	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

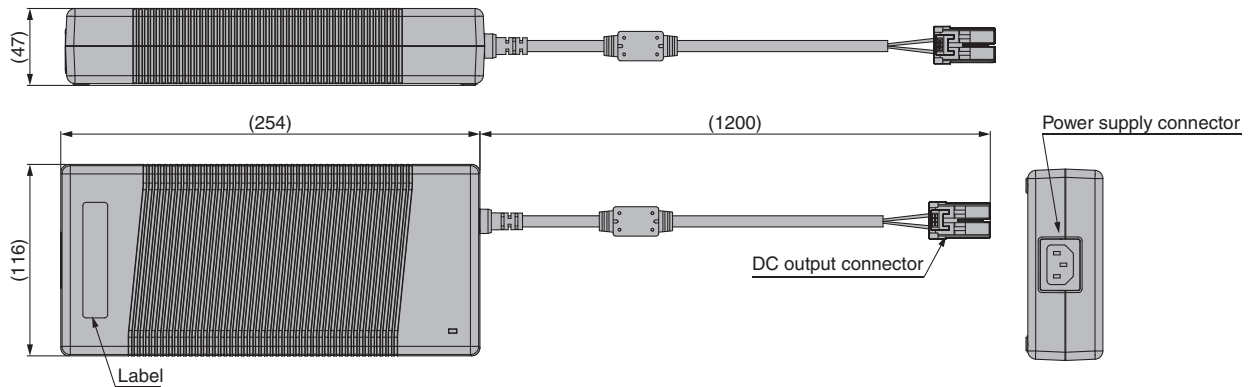
Possible to choose a high-pressure pump in accordance with customer's piping resistance.
Cooling capacity is reduced by approx. 20 W due to the heat generation from the pump.

HEF Series **Air-cooled**

Optional Accessories

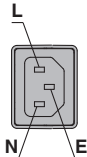
AC Adapter

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

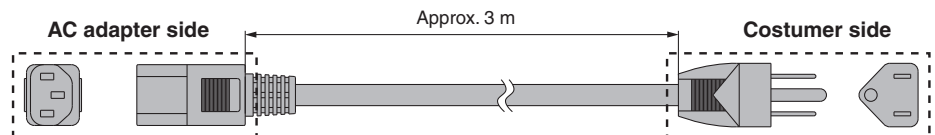
⚠ The power supply cable can only be used for the applicable models shown below. Do not use it for other products.

Power Supply Cable

■ For Single-phase 100/115 VAC type

* Not applicable for the 200 V type.

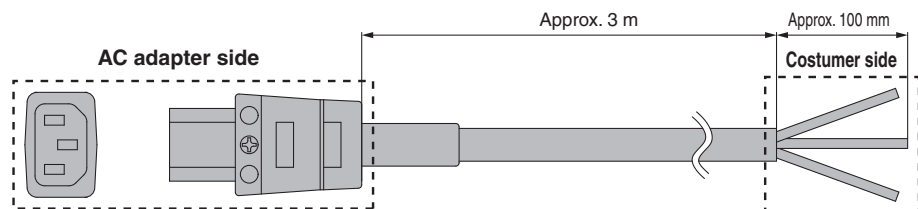
Part no.	Applicable model
HRS-CA001	HEC-S1896



■ 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

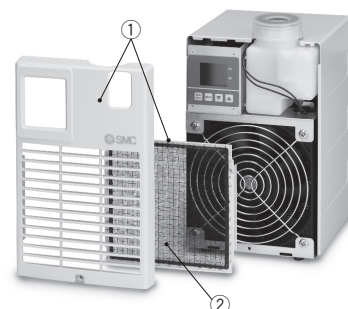


Dustproof Filter

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 the back cover for safety instructions. For temperature control equipment precautions, refer to the “Handling Precautions for SMC Products” and the “Operation Manual” on the SMC website: <https://www.smc.eu>

Design

Warning

1. This catalogue 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. Deionised 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 deionised water (pure water) is used, the thermo-con may be damaged by static electricity.
3. If deionised 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 deionised 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 the back cover for safety instructions. For temperature control equipment precautions, refer to the “Handling Precautions for SMC Products” and the “Operation Manual” on the SMC website: <https://www.smc.eu>

Circulating Fluid

⚠ Caution

- 11. If there is a point where fluid is released to atmosphere externally (tank or piping), minimise 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 minimise 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.

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

Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of “Caution,” “Warning” or “Danger.” They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC) ¹⁾, and other safety regulations.

-  **Caution:** **Caution** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
-  **Warning:** **Warning** indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
-  **Danger:** **Danger** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

- 1) ISO 4414: Pneumatic fluid power – General rules relating to systems.
ISO 4413: Hydraulic fluid power – General rules relating to systems.
IEC 60204-1: Safety of machinery – Electrical equipment of machines.
(Part 1: General requirements)
ISO 10218-1: Manipulating industrial robots - Safety.
etc.

Warning

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalogue information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalogue.
3. An application which could have negative effects on people, property, or animals requiring special safety analysis.
4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

Caution

1. The product is provided for use in manufacturing industries.

The product herein described is basically provided for peaceful use in manufacturing industries.
If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.
If anything is unclear, contact your nearest sales branch.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”. Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first. ²⁾ Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided. This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalogue for the particular products.
- 2) Vacuum pads are excluded from this 1 year warranty.
A vacuum pad is a consumable part, so it is warranted for a year after it is delivered. Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.
2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

Caution

SMC products are not intended for use as instruments for legal metrology.

Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country. Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.

Safety Instructions

Be sure to read “Handling Precautions for SMC Products” (M-E03-3) before using.

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