HEC-OM-S019
1st. 2014 Dec

Operation Manual
Air-Thermo
HEA Series

1 Safety Instructions

This manual contains essential information for the protection of users and others from possible injury and/or equipment damage.

- Read this manual before using the product, to ensure correct handling, and read the manuals of related apparatus before use.
- Keep this manual in a safe place for future reference.
- These instructions indicate the level of potential hazard by label of “Caution”, “Warning” or “Danger”, followed by important safety information which must be carefully followed.
- To ensure safety of personnel and equipment the safety instructions in this manual and the product catalogue must be observed, along with other relevant safety practices.

⚠ **Caution**	If instructions are not followed there is a possibility of injury or equipment damage.
⚠ **Warning**	If instructions are not followed there is a possibility of serious injury or loss of life.
⚠ **Danger**	In extreme conditions, there is a possibility of serious injury or loss of life.

- This manual provides the following symbols in addition to “Danger”, “Warning”, and “Caution” to present warning details in an easy-to-understand manner.

⚡	This symbol warns you of potential electrical shock.
🔥	This symbol warns you of potential burns.

⚠ Danger

- During operation or maintenance of the product, do not disable the interlock function of any device. Otherwise unexpected personnel injury or damage to the product may occur.
- When turning on/off the power observe the procedure. Otherwise unexpected malfunction or danger may occur.
- When maintaining, cleaning or in case of emergency, turn off the power source.
- After identifying a problem be sure to check the cause and take necessary countermeasures before turning on the power.
- The product is operated at high voltage.

⚠ Warning

- **The compatibility of equipment is the responsibility of the person who designs the system or decides its specifications.**

  Since the products specified here can be used in various operating conditions, their compatibility with the specific system must be based on specifications or after analysis and/or tests to meet specific requirements.
- **Only trained personnel should handle or operate the product.**

  Transportation, installation and maintenance of the product can be dangerous and should be done by persons who have full knowledge and experience on the product and system. Cover panels of the product should be opened only by qualified service technicians or qualified personnel.
- **Do not modify or reconstruct the unit.**
- **Read all warning and caution labels carefully and keep them in mind.**

  Do not peel off or rub alert warning and caution labels. Confirm locations of alert warning and caution labels.
- **Do not service machinery/equipment or attempt to remove components until safety is confirmed.**

1) Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out positions.
2) When equipment is to be removed, confirm the safety process as mentioned above. Switch off electrical supplies and ensure any high temperature parts have cooled to ambient temperature.
3) Before machinery/equipment is re-started, ensure all safety measures are taken so the product and system can be started in a safe manner.
4) Do not use this product outdoor (indoor use).

1 Safety Instructions Continued

- **Do not use this product outside of the specifications. Contact SMC if it is to be used in any of the following conditions.**

1) Conditions and environments beyond the given specifications.
2) Installations in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverage, recreation equipment, emergency stop circuits, press applications, or safety equipment.

- If abnormal conditions occur, such as abnormal noise or smoke, or water leakage, take the following actions.

  1) Shut down power.
  2) Contact an authorised SMC dealer for repair.

⚠ Caution

- After shutting down the power supply, ensure a time interval at least 3sec between ON and OFF. Restarting the product within that interval may cause it to malfunction.
- Do not use devices that generate electromagnetic radiation such as cellular phones near the product. There is a possibility that this can cause the product to malfunction.
- This unit has several interlock functions, which activate when a dangerous operation or condition occurs to stop the product and make it safe. This is a function to protect personnel and restrict operation that may cause damage to the product or facility, and to remove dangers related to safety.

2 Specifications

2.1 General Description and Intended Use

Air-thermo is intend to control the temperature of the air using thermo-modules(Peltier element).

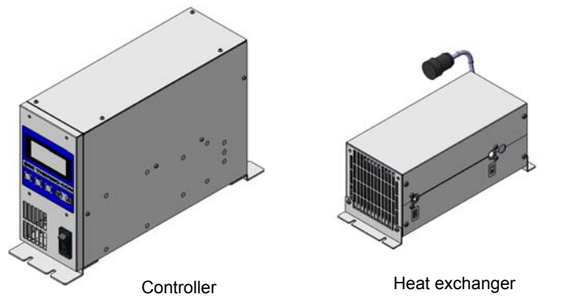
2.2 General Specifications

Item	Spec.
Model No.	HEA Series (see section 2.5)
Operation temp. range	0.0 to 50.0 °C (No dew condensation)
Indication temp. range	-9.9 to 60.0 °C
Ambient environment	Temp: 0 to 40 °C Humidity : 35 to 85%RH Altitude : up to 1000m Environment : No corrosive gas, solvent such as thinner and flammable gas
Storage environment	Temp :-40 to 70 °C (No dew condensation and icing) Humidity : 5 to 95%RH Environment : No corrosive gas, solvent such as thinner and flammable gas
Accuracy related to temp	Indication accuracy: +/- 0.2 °C. Stability: +/- 0.1 °C
Cooling capacity	Approx. 22W (Set temperature 23 °C and ambient temperature 23 °C, flow rate 100L/min(AIR))
Constant temperature air flow rate	20 to 200L/min(ANR)
Constant temperature air inlet pressure	Maximum working pressure: 0.1 MPa Withstand pressure: 0.15 MPa
Fluid	Compressed air
Port size	IN/OUT: Rc1/4
Contact materials	Aluminum, Polyacetal, NBR, SUS
Power supply	Single phase AC100V(+/- 10%), 50/60Hz
Current consumption	Max.3A (100V)
Inrush current	20A or less (100V)
Over current protection	10A circuit protector
Insulation resistance	50MΩ or more (DC500V)
Pollution degree	Pollution degree II
Heat exchanger Cooling method	Air cooled
Main functions	Auto tuning, Off set function, Temperature sensor fine control function, Upper / lower temperature limit alarm function, Output shut off alarm, Serial communication
Input operation and indications	Membrane key sheet LCD display panel (with back light) Output shut off alarm, Upper / lower temperature limit alarm : Relay contact specification DC30V, 2A (Resistance load) DC30V, 1A (Induction load)
Communications	RS-485 Communications: Setting and reading of target temperature, Reading of the value detected by temperature sensor, Reading of warning status, Setting and reading of off-set value. For operation by serial communication, it is necessary to order “Communication Manual”. Use shielded cable for serial communications.

2 Specifications Continued

Item	Spec.	
Temperature sensor	Resistance thermometer sensor (Pt100Ω, 3-wire, class A, 1mA) (cable length: 10 m or less Inserting sensor into ø8 One-touch fittings)	
Painting color	Urban white	
Mass (at dry)	Approx 10kg	
Contents of package	Air-Thermo 1pc Temperature sensor 1pc	Power cable 1pc Temperature sensor cable 1pc

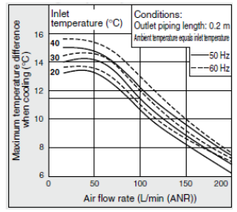
Contents of package



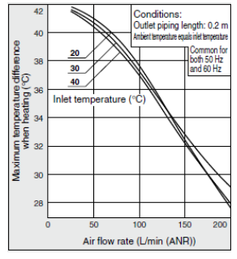
2.3 Performance Charts

Values on the performance charts are not guaranteed values but representative values. Allow margins for safety when selecting the model.

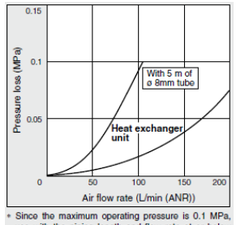
2.3.1 Cooling Capacity



2.3.2 Heating Capacity



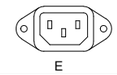
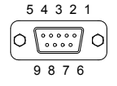
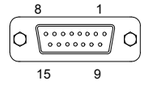
2.3.3 Pressure Loss of Constant Temperature Air



* Since the maximum operating pressure is 0.1 MPa, use with the piping length and flow rate at or below the condition.

2 Specifications Continued

2.4 Connector Specifications

Description	No.	Signal	Style and Part No.
Power supply connector (IEC60320,C14)	N	AC100V	 N L E
	L	AC100V	
	E	PE	
RS-485 Communication connector Note: Always use shielded cable connected to this connector.	1	BUS +	 5 4 3 2 1 9 8 7 6 D-sub 9 pin (socket type) Fixed screw: M2.6
	2	BUS -	
	3-4	Unused	
	5	SG	
	6-9	Unused	
Signal connector Note: Always use shielded cable connected to this connector.	1-2	Remote function 1 : +24V 2 : 24V COM (See section 3 remote ON/OFF function)	 8 1 15 9 D-sub 15 pin (Socket type) Fixed screw: M2.6
	3-5	Unused	
	6	Output Cut off Alarm a contact (OPEN During Alarm)	
	7	Output Cut off Alarm Common	
	8	Output Cut off Alarm b contact (CLOSE During Alarm)	
	9	Temperature Alarm a contact (OPEN During Alarm)	
	10	Temperature Alarm Common	
	11	Temperature Alarm b contact (CLOSE During Alarm)	
	12-14	Unused	
	15	FG	
Temperature sensor connector	1-3	Unused	5 4 3 2 1 9 8 7 6 D-sub 9 pin (socket type) Fixed screw: M2.6
	4	FG	
	5	Unused	
	6-8	PT-RTD	
	9	Unused	

2.5 Model number of product

HEA100 - 1 - □ □

Power supply voltage

1	AC100V

Option/function

Nil	Standard
T	With stand for vertical installation

Temperature sensor cable length

02	2m
04	4m
06	6m
10	10m

2.6 Product Serial Number Code

The production serial number code printed on the label indicates the year and month of production as per the following table:

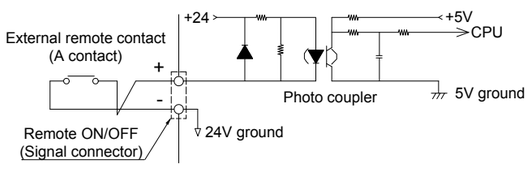
Month \ Year		2012	2013	2014	….	2021	2022	2023	….
		Q	R	S	….	Z	A	B	….
Jan	o	Qo	Ro	So	….	Zo	Ao	Bo	….
Feb	P	QP	RP	SP	….	ZP	AP	BP	….
Mar	Q	QQ	RQ	SQ	….	ZQ	AQ	BQ	….
Apr	R	QR	RR	SR	….	ZR	AR	BR	….
May	S	QS	RS	SS	….	ZS	AS	BS	….
Jun	T	QT	RT	ST	….	ZT	AT	BT	….
Jul	U	QU	RU	SU	….	ZU	AU	BU	….
Aug	V	QV	RV	SV	….	ZV	AV	BV	….
Sep	W	QW	RW	SW	….	ZW	AW	BW	….
Oct	X	QX	RX	SX	….	ZX	AX	BX	….
Nov	y	Qy	Ry	Sy	….	Zy	Ay	By	….
Dec	Z	Qz	RZ	SZ	….	ZZ	AZ	BZ	….

3 Special Features

- Auto tuning
  This function sets the values necessary for the control system such as PID (proportional band, integral time, derivative time and ratio of cooling/ heating gain) automatically.
  If the controlled temperature fluctuates constantly after reaching the target temperature, perform auto tuning. Controller calculates optimum control PID and set automatically. Auto tuning may require time depending on the conditions.

1) Select "2" in control operation.
2) Pressing [AT] key to light "AT" indicator and start auto tuning.
3) Pressing [AT] key stops auto tuning. (“AT” indicator turns off)
4) ” AT" indicator turns off when auto tuning is complete. If not completed after 20min. [ERR19] (AT abnormal) occurs.

- Offset function
  This function controls the temperature slide by an offset value from set point temperature. When the air travels to the target object, a certain deviation occurs between the temperature just before the object and the set temperature of the product due to the influence of ambient temperature on the piping. In this case, if the deviation is input as the offset value, the temperature of the air just before the object can match with the setting value. Internal sensor value for the alarm does not include the offset value. For example, if -0.15 °C is set here, the actual reference temperature for control is lower than the indicated SV by 0.15 °C. Internal sensor value for the alarm does not include the offset value.
- Temperature sensor fine control function
  This is a function to finely control the measurement temperature of the control sensor within the range of -9.99 to 9.99 °C separate from offset function. Control sensor can be corrected by inputting difference (calibration value) between temperature of standard and that of control sensor. For example, if -0.15 °C is set here, the actual reference temperature for control is lower than the indicated SV by 0.15 °C.
  Internal sensor value for alarm = Internal sensor value – Fine control value
- Setting value memory function
  Even if the power is turned off the set values are saved and will be restored at power on.
- Upper / Lower temperature limit alarm function
  This function raises an alarm when temperature of the air is out of allowable upper and lower range. When the alarm is raised, WRN is indicated on LCD. If the air temperature returns to within allowable upper/ lower range, this alarm is automatically cancelled. The allowable upper and lower range of temperature can be set between 0.1 and 10 °C.
- Remote ON/OFF function
  This function turns on and off the temperature control output of the product by switching the contact of an external device. It can restart temperature control by switching from “Remote OFF” to “Remote ON” without the power supply switch of the Temperature Controller turned on.
  - Remote ON : Turns on the temperature control output of the product with external contact “Open”
  - Remote OFF : Turns off the temperature control output of the product with external contact “Close”.



4 Installation

4.1 Installation

⚠ Caution

- Pay special attention to the safety of all personnel when installing and transporting the product.
- Do not install the product unless the safety instructions have been read and understood.
- The product is heavy, be careful when installing or moving the product.

4 Installation Continued

4.2 Environment

⚠ Caution

- Do not use in an environment where the product is directly exposed to water, oil, corrosive gases, chemicals, salt water or steam.
- The product should be installed upright on a stable base.
- Do not install the product in a location where the air inlet and air outlet vents are blocked. Also do not use the product in a sealed enclosure.
- Do not use in an explosive atmosphere.
- Do not mount the product in a location where it can be exposed to prolonged sunlight. Use a protective cover.
- Do not mount the product in a location where it is subject to strong vibrations and/or shock. Check the product specifications.
- Do not use the product where it can be exposed to strong electrical or magnetic emissions.
- Do not mount the product in a location where it is exposed to noise sources (such as discharging equipment, large relay and thyristor).
- Do not mount the product in a location with an altitude of more than 1000 meters.
- Do not mount the product where it is exposed to materials such as silicone, which may generate harmful gas.
- Install the product in a location where the ambient temperature range is between 0 to 40°C and the relative humidity range is between 35 to 80%. No dew condensation is allowed on the unit.
- Do not mount the product in a location exposed to radiant heat.

4.3 Mounting

⚠ Caution

- Be sure to correctly tighten all screws to the required torque. (M4:1.5Nm)

4.4 Piping

- Ensure that the power source and the power supply of the product is turned off (or the power plug must come off)
- Ensure the flow rate of the air is as high as possible to maintain the temperature stability. Therefore, the length of the external piping should be minimized and internal diameter should be as large as possible. Piping must have sufficient strength for the maximum pressure of the air.
- Likewise, if a tube is bent or multiple elbow fittings are used, the piping resistance will increase and the flow rate will decrease. If the flow rate falls, the temperature stability will decrease.

⚠ Caution

- When installing piping or fittings, ensure sealant material does not enter inside the port. When using seal tape, leave 1.5 to 2 threads exposed on the end of the pipe/fitting.
- Be sure to correctly tighten the fitting fittings to the required torque. (Rc1/4:MAX 1N･m)

4.5 Wiring

- Ensure that the power source and the power supply of the product are turned off before connecting the various connectors and power supply cable.
- Supply disconnecting device according to IEC60974-1 and IEC60947-3 for the product must be provided in the end system.
- Do not install the disconnecting device in the place where the operation is difficult. And also the switch of the disconnecting device must comply with the direction of the switch specified by IEC60447.
- The power supply cable shall be connected properly.
- Ensure that there is enough space between the power supply cable and the communication cable of the product and power cables of other equipment.
- Ensure the power supply and ground connections are made correctly.
- Be sure to provide the grounding. The PE line of the power supply cable is available for grounding. Do not connect the ground in common with the ones for equipment that generates strong electromagnetic noise or high frequency.
- Connect the host to this unit with a twisted pair shield cable when applying communication function or external sensor and alarm output function.

4 Installation Continued

- When using the Communication connector and Signal connector, connect the circuit separated from the mains circuit by reinforced insulation.
- Ensure that external instruments connecting to this product provide the enclosure complied with UL61010-1 and use the cable which provide flame resistance (over VW-1).

⚠ Danger

- Never touch the power switch with wet hands to avoid electrical shock.

⚠ Caution

- Do not touch the surface when the set temperature is high. Temperature of the heat exchanger could be high.
- Fluid other than compressed air should not be used.
- If the power switch is turned on at low flow rate, the heat exchanger could be damaged. Ensure the flow rate is enough.
- Do not install the product in a location where the air inlet and air outlet vents are blocked. The heating/cooling capacity and temperature stability may decrease.
- If the product is operating for a long time with large temperature fluctuations after reaching the set temperature, the product may be damaged. Please set the PID values by using the auto-tuning function.

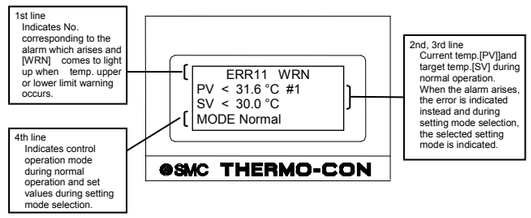
5 Operation

5.1 Power Up

When power is turned on, the software version is indicated on display panel for approx. 1 second.

5.2 Operation

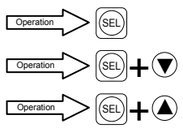
The product begins operation immediately after the power is turned on. The fan and heat exchanger will be running and the product will begin temperature control.
The display can show the following information during operation.



5.3 Settings

Three different levels of settings are available depending on the content, which needs to be set.

Level 1: Used in normal operation e.g. setting of target temperature and offset.
Level 2: Used at maintenance and initial setting for setting of controller/PID.
Level 3: Used at initial setting for the communication function.



The key functions are as follows:

[SEL]: Used to show the item that needs to be changed in selected mode level.
[▽△]: Used to change the value of the item selected.
[RET]: Used to fix the value changed by [▽△] key. Press again to return to current temperature indication.
[AT]: Used to start auto tuning in auto tuning mode
(This function works when the control operation mode is 2 in level setting 1)
When pressed during auto tuning, the auto tuning is stopped.

- When no input is made within 1 minute regardless of setting mode, the display returns to the current temperature indication.
- The data input is written to FRAM and memorized after the power supply is turned off.
- To return all of the setting values to default: Turn on the power supply while pressing [SEL] and [RET] keys.

5 Operation Continued

5.3.1 Level 1－Settings

No.	Modes	Setting contents	Setting range (Min. increment)	Default
1	Target Temp. (No indication on display)	Sets target temp. for control.	0.0 to 50.0°C (0.1°C)	25.0
2	Control Operation	Selects control operation mode from those shown below. 0: stop (No control) 1: Normal operation 2: AT(auto tuning)	0,1,2	1
3	Offset Value	Indicates the offset value of the air temperature used as reference value by the controller (SV + Offset).	-9.99 to 9.99°C (0.01°C)	0.00
4	Allowable Upper Temp. Range	Sets upper limit of temperature range which causes a warning to occur.	0.0 to 10.0°C (0.1°C)	1.5
5	Allowable Lower Temp. Range	Sets lower limit of temperature range which causes a warning to occur.	0.0 to 10.0°C (0.1°C)	1.5
6	High Temp. Cutoff	Sets upper limit of temperature measured by the internal temperature sensor and stops operation of the product.	1.0 to 60.0°C (0.1°C)	60.0
7	Low Temp. Cutoff	Sets lower limit of temperature measured by the internal temperature sensor and stops operation of the product.	-9.9 to 49.0°C (0.1°C)	-9.9

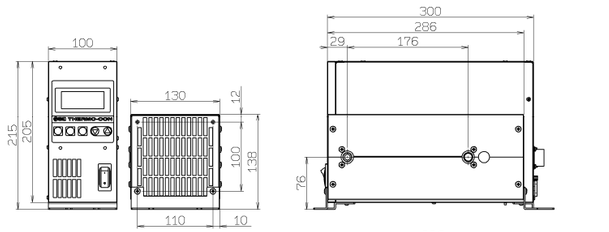
5.3.2 Level 2－Settings

No.	Modes	Setting contents	Setting range (Min. increment)	Default
1	Fine Control of Internal Sensor	Sets the fine adjusting value to calibrate the internal temperature sensor	-9.99 to 9.99°C (0.01°C)	0.00
2	PB Range	Sets PB (Proportional Band) range used for PID control.	0.3 to 9.9°C (0.1°C)	3.0
3	I Constant	Sets integral time used for PID control.	1 to 999sec (1sec)	40
4	D Constant	Sets differential time used for PID control. When 0 is set, differential operation is not made.	0.0 to 99.9sec (0.1sec)	0.0
5	Heating/Cooling Ratio	Sets output ratio of cooling to heating to compensate difference of gain between them.	10 to 999% (1%)	200
6	Output Ratio	Shows output ratio of thermo module by 1%. The prefix symbol "-" stands for cooling and no prefix stands for heating.	-100 to 100% (1%)	-
7	Upper/Lower Temp. Alarm Sequence	Determines whether or not temperature upper/lower limit alarm is output when power is turned on. On : Output Off : Not output	On, Off	Off

5.3.3 Level 3－Settings

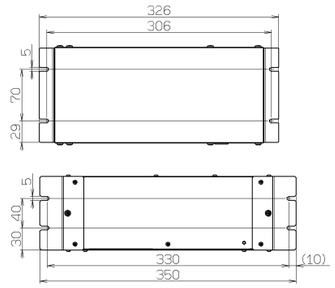
No.	Modes	Setting contents	Setting range	Default
1	Unit Number	Sets the unit No. used. This is applicable only when multiple Thermo-cons are used.	0 to F (Hex decimal)	0
2	Baud Rate	Sets baud rate for communication.	600, 1200, 2400, 4800, 9600, 19200b/s	1200
3	Parity Bit	Sets parity bit for communication. None : No parity Odd : Odd Even : Even	None, Odd, Even	None
4	Data Length	Sets data length for communication.	7Bits, 8Bits	8
5	Stop Bit	Sets stop bit for communication.	1Bit, 2Bits	1

6 Outline Dimensions (mm)

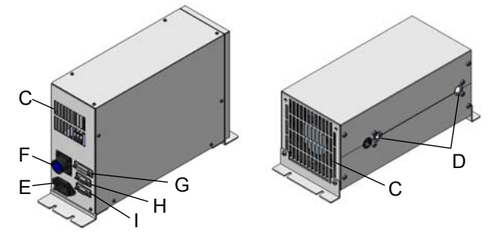


Controller

Heat exchanger



7 Key Parts



A	Power switch	F	AC･DC connector
B	Display/Operation panel	G	Remote･Alarm output connector
C	Heat radiating air suction port	H	Communication connector
D	Compressed air IN･OUT	I	Temperature sensor connector
E	Power connector		

8 Maintenance

8.1 Daily Check

1) Indication of display panel: Check temperature condition and confirm whether or not an alarm has occurred.
2) Confirm that the heat exchanger and panel are free from dust. A large amount of dust may impair the performance.
3) Confirm there is no leakage and check the condition of the piping (e.g.no tight bends or crushed pipes).
4) Confirm there is no abnormal sound, smell or heating from the product.

⚠ Caution

- When cleaning the panel or heat exchanger use a vacuum cleaner to remove the dust. Do not use water or steam since it leads to rusting of the frame.

8.2 General Maintenance

Clean the heat exchanger regularly to avoid any problems.

8 Maintenance Continued

⚠ Caution

- The repair and maintenance services of this unit are performed only at SMC factory. SMC does not provide on-site repair or maintenance service in a national or overseas situation.
- It is recommended to prepare spare units to minimize downtime due to those repair and maintenance services.
- Do not make any modification to the product.
- Do not disassemble the product, unless required by installation instructions.

9 Troubleshooting

9.1 How to reset the alarm

Code	Description	Manner of reset
ERR01	System error 1	Restart the power supply. In the case the alarm can't be reset by above manner, repair is required.
ERR02	System error 2	
ERR03	Back-up data error	Initialization of FRAM or stop and restart of power supply In the case the alarm can't be reset by above manner, repair is required.
WRN	Temp. upper/lower limit alarm	The unit continues controlling and recovers normal condition at any time.
Others		Remove a possible cause and restart. In the case the alarm can't be reset by above manner, repair is required.

9.2 Product alarm codes

Code	Description	Operation status	Reason for alarm setting	Cause / Measure
WRN	Temp. upper/lower limit	Continue	Air temperature is out of limit range.	Product is reaching target temperature. Wait for the temperature to stabilize, then the WRN should disappear.
ERR01	System error 1	Stop	The wire inside the Thermo-con was broken due to vibration during transport.	In the case the alarm can't be reset by above manner, repair is required.
ERR02	System error 2	Stop	The FRAM data was destroyed by high-level noise.	Move the product to an environment with little noise, turn ON the power supply. If there is no alarm, it was caused by noise. Please consult with SMC.
ERR03	Back-up data error	Stop	The memory data was destroyed by high-level noise.	Move the product to an environment with little noise, turn ON the power supply. If there is no alarm, it was caused by noise. Please consult with SMC.
ERR11	DC power supply failure	Stop	DC output voltage of product is reduced.	Check the power voltage.
			The fans at the power supply stops.	Remove foreign matters which might stop the fan.
ERR12	Internal temp. sensor High temp. failure	Stop	Internal temperature sensor value exceeds the high temp. cutoff temperature.	Check the set value for high temp. cutoff temperature and confirm the temperature really reaches this value.
			Flow rate of air is zero.	If the flow rate is zero, the temperature can't be detected and might increase. Confirm the flow is not stopped by valves etc.
ERR13	Internal temp. sensor Low temp. failure	Stop	Internal temperature sensor value is lower than low temp. cutoff temperature.	Check the set value for low temp. cutoff temp. and confirm the temperature really reaches this value.
			Flow rate of air is zero.	If the flow rate is zero, the temperature can't be detected and might increase. Confirm the flow is not stopped by valves etc.
ERR14	Thermostat alarm	Stop	Flow rate is zero.	If flow rate is zero, the temperature cannot be measured and the temperature of heat exchanger may increase. Ensure the air is allowed to flow.
			The fan breaks.	
ERR17	Internal temp. sensor disconnection alarm	Stop	High level noise entered the temperature sensor line.	Check whether unstable temperature is caused by noise. Please consult SMC if it is caused by noise.
ERR19	Abnormal auto tuning alarm	Stop	Overloaded during auto tuning mode	Avoid overload.
Temperature rises and falls +/-1 to 2 ℃ gradually about the set point temperature.		-	Flow rate is low.	Keep the flow rate 20L/min
		-	PID parameters are set incorrectly.	If the temperature cannot be stable at default value, perform auto tuning.

SMC Corporation

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