

C-1812-E4

**SINGLE LOOP
MCU BASED
DIRECT
DIGITAL
CONTROLLERS**

DIN SIZED 96×96mm

REX-F9

DIN SIZED 96×48mm

REX-F4

Under application for
UL-approval

LEADING CONTROLLERS WITH HIGH TECHNOLOGY



RKC INSTRUMENT INC.

More accurate, more functions.

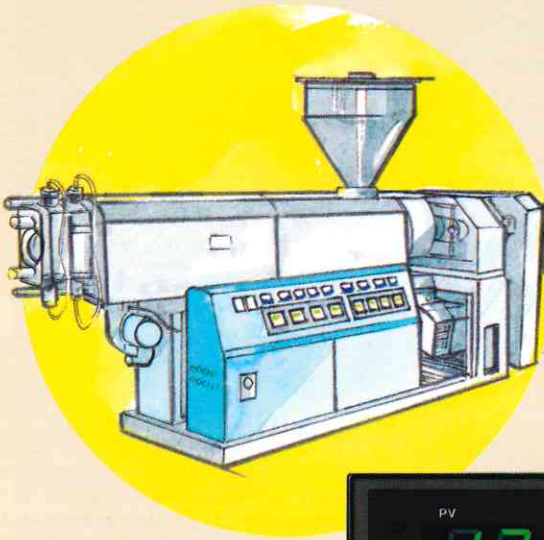
REX-F9 and REX-F4 series are MCU (Micro Computer Unit) based controllers. It is a great debut of a new era's pioneer with variety of functions such as PID constants auto-tuning, °C/°F selection and many others.

"Simpleness is an important factor on a high precision instrument" is our designing concept, and we proceeded the development based on this concept. As a result, we have

eliminated all variable resistors from the hardware to increase reliability and incorporated heat/cool action in a short housing (100mm deep).

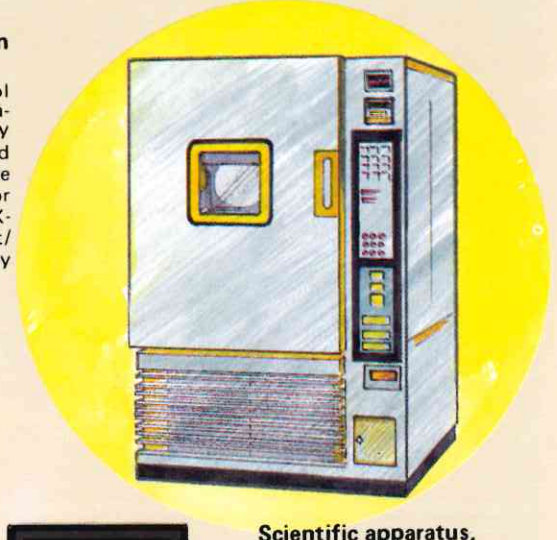
Furthermore, the use of a flat membrane panel eliminates effect by electrostatics, noise and dusts. The use of a hidden key and setting lock switch assures prevention of accidental changing of parameters.

APPLICATIONS



Extrusion and Injection molding

In the temperature control of the extruder, temperature tends to go higher by the heat generation caused by friction between the resin and the screw. For such an application, REX-F4 and REX-F9 with heat/cool outputs will certainly be appropriate.

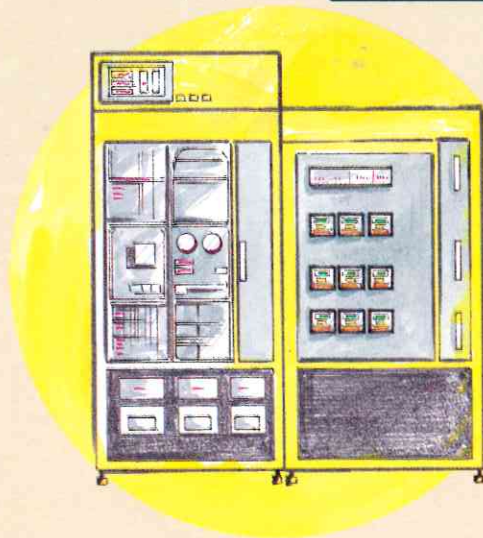


Scientific apparatus, biochemistry, and industrial furnaces

Can be used in constant temperature chamber and drying furnace applications. If miniaturization of the apparatus, operability, and visual design are major factors of selection, models REX-F4 will be appropriate. If more sophisticated functions are required, model REX-F9 will be appropriate.

Semi-conductor manufacturing process

As an accurate PID controller, the instrument performs superb temperature control in CVD* and other process applications. (burn-in aging, bonder, etching, thermal chambers, handlers, etc)



SYSTEM INSTRUMENTATION

Widely used in many systems in various industrial fields.

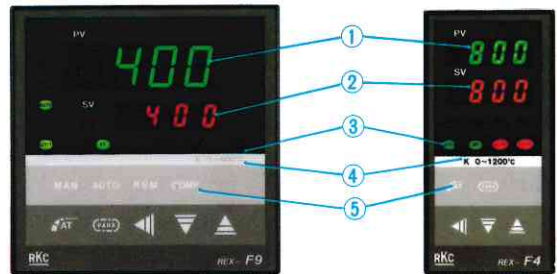
The units contribute to FA (Factory Automation) and LA (Laboratory Automation).



1. STANDARD TYPE

FEATURES

- PID Auto-tuning Function
- Serial Communication Function
- Balanceless Bumpless
- PV Bias
- °C/°F, Direct Action/Reverse Action Selector Function
- Auto/Manual Switching
- Self-diagnosis Function
- Reconfigurable Thermocouple Types and Alarm Actions.



NAMES OF PARTS

- PV display (green)**
Indicates a measured value.
- SV display (orange)**
Indicates a setpoint value.
- Indicator lamps**
(Some lamps are not supplied or different according to the supplied specification.)
 - OUT(H)** ... Lights when output is ON.
 - AT** ... Lights during PID auto-tuning.
 - STEP** ... STEP Function, lights during "CLOSE".

- ALM** ... Lights when alarm output is ON.
 - HBA** ... Lights when HBA output is ON.
 - FAIL** ... Lights when self-diagnosis function detects faults.
 - COMP** ... Lights during computer mode.
 - REM** ... Lights during remote mode.
 - AUTO** ... Lights during auto mode.
 - MAN** ... Lights during manual mode.
 - MV** ... Lights while SV display indicates the output value.
- ④ **Input - Range indication label**

- Setting Keys (Flat Keys)**
 - MAN** ... Pressed to enter manual mode.
 - AUTO** ... Pressed to enter auto mode.
 - COMP** ... Pressed to enter computer mode.
 - AT** ... Pressed to initiate PID auto-tuning.
 - PARA** ... Pressed to scroll parameters for setting and monitoring.
 - Cursor shift key** ... Increment key.
 - Decrement key** ... Decrement key.

For explanation purpose, all functions are shown in this figure.

LIST OF MODEL CODE

● REX-F9

Model	Suffix Code	Description
REX-F9	□ □ □ □ * □ □ □ □ □ □	Direct Digital Controller
Control Action	H F	PID action PID action with auto-tuning
Alarm Action #D	N S D	Not supplied 1 point alarm 2 point alarm } Refer to the table of alarm action (P. 3)
Input	C R □	Thermocouple input RTD input Voltage or current input. Refer to the table of signal code (shown in the right)
Control Output #B #B	M V R E G T	Relay contact output Output for SSR driving Current output Continuous voltage output Trigger output for triac driving Triac output
Analog Input (External Setpoint or Heater Break Alarm) #D H	N □	Not supplied External setpoint function. Refer to the table of signal code (shown in the right) Heater Break Alarm function.
Contact Input #A 1	N □	Not supplied Step, remote/auto, remote auto/manual (switching)
Analog Output 1 (or control output) #B	N □	Not supplied Refer to the table of signal code (shown in the right)
Analog Output 2	N □	Not supplied Refer to the table of signal code (shown in the right)
Communication Function #A 2	N □	Not supplied RS-422A serial communication function

● REX-F4

Model	Suffix Code	Description
REX-F4	□ □ □ □ * 2 □	1/8 DIN sized Direct Digital Controller
Control Action	H F	PID action PID action with auto-tuning
Alarm Action #A	N S D	Not supplied 1 point alarm action 2 point alarm action } Refer to the table of alarm action (P. 3)
Input	C R □	Thermocouple input RTD input Voltage or current input. Refer to the table of signal code (shown below)
Control Output	M V R E G T	Relay contact output Output for SSR driving Current output Continuous voltage output Trigger output for triac driving Triac output
Type	2	Vertical 96(H) x 48(W)mm/ 3.8''(H) x 1.9''(W)
Option #A	N 1 2	Not supplied With STEP function With Heater Break Alarm function.

Signal Code			
1) 0 to 10mV	2) 0 to 100mV	3) 0 to 1V	4) 0 to 5V
5) 0 to 10V	6) 1 to 5V	7) 0 to 20mA	8) 4 to 20mA
9) Others			

The functions paired with the same alphabet are selectable only from either of them.



SPECIFICATIONS

INPUT

- **Input** : Thermocouple (T/C), Resistance Temperature Detector (RTD), DC Voltage · Current (Regarding input types and standard ranges please refer to the last page.)
- **Effect of External Resistance** : Approx. 0.35 $\mu\text{V}/\Omega$ (thermocouple input)
- **Effect of Input Lead Resistance** : Approx. 0.0075% of reading (RTD input)
- **Input Break Action** : Up-scale (as standard, down-scale is also available in case of T/C input as option) [Down-scale for 1 to 5V, 4 to 20mA DC in case of Voltage · Current input.]
- **Sampling Cycle** : 0.5 sec.
- **PV Bias** : -1999 to 9999°C [°F or %]

SETTING

- **External Setting** : Analog signal setting [REX-F9 only] or setting via key pad.
- **Setting Accuracy** :
Set Value (SV)
T/C Within $\pm(0.3\%$ of SV + 1 digit) or $\pm 2^\circ\text{C}$ [4°F] (whichever is larger)
R, S input 0 to 199°C [0 to 399°F] ... within $\pm 5^\circ\text{C}$ [10°F]
B input 0 to 399°C [0 to 799°F] ... out of accuracy guarantee range.
RTD ... Within $\pm(0.3\%$ of SV + 1 digit) or $\pm 0.8^\circ\text{C}$ [1.6°F] (whichever is larger)
Voltage · Current DC
... Within $\pm(0.2\%$ of setting limiter span + 1 digit)
The other SV ... Within $\pm 0.5\%$ of setting range
- **External Setting Signal** (against set value [SV (L)]) [REX-F9 only]
DC Voltage : Please refer to the table of signal code (P. 4)
(Input impedance: more than 250 K Ω)
DC Current : Please refer to the table of signal code (P. 4)
(Input impedance: approx. 250 Ω)
Input Break Action: Down-scale

DISPLAY

- **Input Display Range** : -1999 to -9999°C [°F or %]
- **Input Display Accuracy** : Same as setting accuracy

CONTROL ACTION

- **PID Action** (auto-tuning function also available as option)
ON/OFF · P · PI · PD action also available, Direct/Reverse action field selectable.
Proportional band (P)
: 1 (0.1) to setting limiter span or 0.0 to 100.0% of setting limiter span.
ON/OFF action when P = 0(0.0)
Hysteresis band: 0 to 100
(0.0 to 100.0)°C [°F] or
0 to 100% of setting limiter span
Integral (I) : 1 to 3600 sec.
Derivative (D) : 1 to 3600 sec.
Anti-Reset Windup (ARW): 1 to 100% of proportional band (P).
Proportional Cycle (T) : 1 to 100 sec.

OUTPUT

- **Control Output**:
Relay Contact Capacity 250V AC 3A (resistive load), 1 form "C" contact
SSR Driving 0/12V DC (constant voltage pulse) [load resistance more than 800 Ω]
Current 0 to 20mA or 4 to 20mA DC whichever is specified [load resistance less than 600 Ω], whichever is specified.
Continuous Voltage 0 to 5V, 0 to 10V, 1 to 5V DC [load resistance more than 1 K Ω], whichever is specified.
Trigger for triac driving
..... Zero-cross method for medium capacity triac driving.
Triac Capacity 0.5A (at ambient temperature 40°C), zero-cross method.

ALARM

- **Alarm Action** : Deviation alarm, process alarm (selectable). [Hold action is also selectable.]
Refer to type of alarm action (P. 3).
Relay contact output capacity 250V AC 1A (resistive load)
1 form "A" contact [2 point energizing alarm]
[Malfunction may occur if alarm is used in inductive load.]
Alarm setting range ... -1999 to 9999
Hysteresis band 2°C [°F] or 0.2% of setting limiter span.

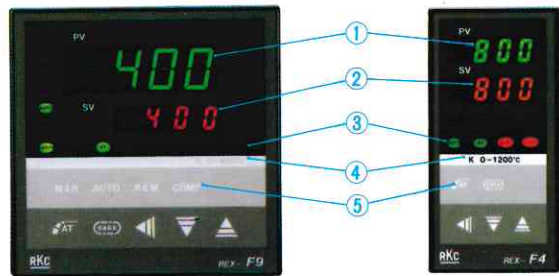
GENERAL SPECIFICATIONS

- **Self-diagnosis** : FAIL display and action (only for communication type).
RAM check, A/D converter check, monitoring of CPU power supply, watch-dog timer.
ERROR display and action (only for non communication type).
RAM check, A/D converter check, monitoring of CPU power supply.
Output ... Relay contact output [OPEN when abnormal], capacity 250V AC less than 0.1A (resistive load) 1 form "A" contact.
- **Supply Voltage** : 100/110V, 200/220V AC or 110/120V, 220/240V AC (50/60Hz) [whichever is specified]
- **Voltage Variation** : Within $\pm 10\%$ of rated supply voltage.
- **Power Consumption** : Less than 8 VA (8.5 VA for communication type) [REX-F9], less than 6 VA [REX-F4]
- **Ambient Temperature**: 0 to 50°C (32 to 122°F)
- **Ambient Humidity**: 45 to 85% RH.
- **Net Weight** : Approx. 800g (approx. 850g for communication type) [REX-F9], approx. 500g [REX-F4].
- **External Dimensions**: Refer to P. 14.
- **Option** : (Refer to the pages of OPTION [P. 12 to 13]).
REX-F9
Communication Function, Analog Output, Heater Break Alarm, External Setting, Function, Contact Input (Step Function, Remote/Auto Switching, Remote · Auto/Manual Switching)
REX-F4
(For communication type, please contact our local distributors).
Data sheet No. PI-1814-E1

2. HEATING · COOLING TYPE

FEATURES

- PID Auto-tuning Function
- Serial Communication Function
- Balanceless · Bumpless
- PV Bias
- Heater Break Alarm Function
- Auto · Manual Switching
- Self-diagnosis Function
- Reconfigurable Thermocouple Types and Alarm Actions



NAMES OF PARTS

- PV display (green)**
Indicates a measured value.
 - SV display (orange)**
Indicates a setpoint value.
 - Indicator lamps**
(Some lamps are not supplied or different according to the supplied specification.)
- OUT(H)** ... Lights when output (heating) is ON.

- OUT(C)** ... Lights when output (cooling) is ON.
- AT** ... Lights during PID auto-tuning.
- STEP** ... STEP Function, lights during "CLOSE".
- ALM1** **ALM2** ... Lights when alarm output is ON.
- HBA** ... Lights when HBA output is ON.
- FAIL** **ERR** ... Lights when self-diagnosis function detects faults.
- COMP** ... Lights during computer mode.
- REM** ... Lights during remote mode.
- AUTO** ... Lights during auto mode.
- MAN** ... Lights during manual mode.
- MV** ... Lights while SV display indicates the output value.

- Input · Range indication label**
 - Setting Keypad (Flat Keys)**
- MAN** ... Pressed to enter manual mode.
- AUTO** ... Pressed to enter auto mode.
- REM** ... Pressed to enter remote mode.
- COMP** ... Pressed to enter computer mode.
- AT** ... Pressed to initiate PID auto-tuning.
- PARA** ... Pressed to scroll parameters for setting and monitoring.
- ▲** ... Cursor shift key.
- ▲** ... Increment key.
- ▲** ... Decrement key.

For explanation purpose, all functions are shown in this figure.

LIST OF MODEL CODE

● REX-F9

Model	Suffix Code	Description
REX-F9	□ □ □ □ □ * □ □ □ □ □ □ □ □	1/4 DIN sized Direct Digital Controller.
Control Action	V W	Heating/Cooling PID action. Heating/Cooling PID action with auto-tuning.
Alarm Action #D	N S D	Not supplied 1 point alarm action } Refer to the table of alarm action (P. 31) 2 point alarm action }
Input	C R □	Thermocouple input RTD input Voltage or current input. Refer to the table of signal code (shown in the right)
Control Output (heating side) #B	M V R E T	Relay contact output Output for SSR driving Current output Continuous voltage output Triac output
Control Output (cooling side) #C	M V R E T	Relay contact output Output for SSR driving Current output Continuous voltage output Triac output
Analog input (External Setpoint or Heater Break Alarm) #D	N □ H	Not supplied External setpoint function. Refer to the table of signal code (shown in the right) Heater break alarm function.
Contact Input #A	N 1	Not supplied Step, remote/auto, remote · auto/manual (switching)
Analog Output 1 (or control output) #B	N □	Not supplied Refer to the table of signal code (shown in the right)
Analog Output 2 (or control output) #C	N □	Not supplied Refer to the table of signal code (shown in the right)
Communication Function #A	N 2	Not supplied RS-422A serial communication function

● REX-F4

Model	Suffix Code	Description
REX-F4	□ □ □ □ □ * 2 □	1/8 DIN sized Direct Digital Controller
Control Action	V W	Heating Cooling PID action Heating Cooling PID action with auto-tuning
Alarm Action #A	N S D	Not supplied 1 point alarm action } Refer to the table of alarm action (P. 31) 2 point alarm action }
Input	C R □	Thermocouple input RTD input Voltage or current input. Refer to the table of signal code (shown below)
Control Output (heating side) #B	M V R E T	Relay contact output Output for SSR driving Current output Continuous voltage output Triac output
Control Output (Cooling side) #C	M V R E T	Relay contact output Output for SSR driving Current output Continuous voltage output Triac output
Type	2	Vertical: 96(H) x 48(W) mm/ 3.8"(H) x 1.9"(W)
Option #A	N 1 2	Not supplied With STEP function With heater break alarm function.

Signal Code			
1) 0 to 10mV	2) 0 to 100mV	3) 0 to 1V	4) 0 to 5V
5) 0 to 10V	6) 1 to 5V	7) 0 to 20mA	8) 4 to 20mA
9) Others			

The functions paired with the same alphabet are selectable only from either of them.



SPECIFICATIONS

INPUT

- **Input** : Thermocouple (T/C), Resistance Temperature Detector (RTD), DC Voltage · Current (For input types and standard ranges, please refer to the last page.)
- **Effect of External Resistance** : Approx. 0.35 $\mu\text{V}/\Omega$ (thermocouple input)
- **Effect of Input Wire Resistance** : Approx. 0.0075%/ Ω of reading (RTD input)
- **Input Break Action** : Up-scale (as standard, down-scale also available in case of T/C input as option) [Down-scale for 1 to 5V, 4 to 20mA DC.]
- **Sampling Cycle** : 0.5 sec.
- **PV Bias** : -1999 to 9999°C [°F or %]

SETTING

- **Setting Accuracy** :
Set Value (SV)
T/C Within $\pm(0.3\%$ of SV + 1 digit) or $\pm 2^\circ\text{C}$ [4°F] (whichever is larger)
R, S input 0 to 199°C [0 to 399°F] ... within $\pm 5^\circ\text{C}$ [10°F] (Input impedance; more than 250 K Ω)
B input 0 to 399°C [0 to 799°F] ... out of accuracy guarantee range.
- RTD ... Within $\pm(0.3\%$ of SV + 1 digit) or $\pm 0.8^\circ\text{C}$ [1.6°F] (whichever is larger)
- DC Voltage · Current
... Within $\pm(0.2\%$ of setting limiter span + 1 digit)
- Other SV ... Within $\pm 0.5\%$ of setting range
- **External Setting Signal** (against set value [SV (L)]) [REX-F9 only]
DC Voltage : Please refer to the table of signal code (P. 6) (Input impedance; more than 250 K Ω)
DC Current : Please refer to the table of signal code (P. 6) (Input impedance: approx. 250 Ω)
Input signal break action: Down-scale.

DISPLAY

- **Input Display Range** : -1999 to -9999°C [°F or %]
- **Input Display Accuracy**: Same as setting accuracy

CONTROL ACTION

- **Heating/Cooling PID Action** (auto-tuning function also available as option)
ON/OFF · P · PI · PD action also available, air cooling/water cooling field selectable.
Proportional band of heating side (Ph)
: 1 (0.1) to setting limiter span or 0.1 to 100.0% of setting limiter span.
When P = 0 (0.0), ON/OFF action for both of heating and cooling action.
hysteresis band : 0 to 100 (0.0 to 100.0)°C [°F] or 0.0 to 100.0%
- Cooling proportional band (Pc) : 1 to 1000% of heating proportional band (Ph).
- Integral (I) : 1 to 3600 sec.
- Derivative (D) : 1 to 3600 sec.
- Anti-Reset Windup (ARW) : 1 to 100% of heating proportional band (Ph).
- Proportional cycle of heating side (Th) : 1 to 100 sec.
- Proportional cycle of cooling side (Tc) : 1 to 100 sec.
- Dead band (D.B.) : 0 to 10 (0.0 to 10.0)°C [°F] or 0 to 10 (0.0 to 10.0)%

OUTPUT

- **Control Output**: (Specify both heating and cooling outputs respectively).
Relay Contact Capacity 250V AC 3A (resistive load), 1 form "A" contact.
SSR Driving 0/12V DC (constant voltage pulse) [load resistance more than 800 Ω]
Current 0 to 20mA or 4 to 20mA DC [load resistance less than 600 Ω] whichever is specified.
Continuous Voltage 0 to 5V, 0 to 10V, 1 to 5V DC [load resistance more than 1 K Ω], whichever is specified.
Triac Capacity 0.5A (at ambient temperature 40°C), zero-cross method.

ALARM

- **Alarm Action** : Deviation alarm, process alarm (selectable).
[Hold action is also selectable.]
Refer to type of alarm action (P. 3).
Relay contact output capacity 250V AC 1A (resistive load)
1 form "A" contact [2 point energizing alarm]
[Malfunction may occur if alarm is used in inductive load.]
Alarm setting range ... -1999 to 9999
Hysteresis band 2°C [°F] or 0.2% of setting limiter span.

GENERAL SPECIFICATIONS

- **Self-diagnosis** : FAIL display and action (for communication type only).
RAM check, A/D converter check, monitoring of CPU power supply, watch-dog timer.
ERROR display and action (for non communication type only).
RAM check, A/D converter check, monitoring of CPU power supply.
Output ... Relay contact output [OPEN when abnormal], capacity 250V AC, less than 0.1A (resistive load) 1 form "A" contact.
- **Supply Voltage** : 100/110V, 200/220V AC or 110/120V, 220/240V AC (50/60Hz). [whichever is specified]
- **Voltage Variation** : Within $\pm 10\%$ of rated supply voltage.
- **Power Consumption** : Less than 8 VA (8.5 VA for communication type) [REX-F9], less than 6 VA [REX-F4]
- **Ambient Temperature**: 0 to 50°C (32 to 122°F)
- **Ambient Humidity**: 45 to 85% RH.
- **Net Weight** : Approx. 800g (approx. 850g for communication type) [REX-F9], approx. 500g [REX-F4].
- **External Dimensions**: Refer to "EXTERNAL DIMENSIONS".
- **Option** : (Refer to the pages of "OPTION" [P. 12 to 13]).
REX-F9
Communication Function, Analog Output, Heater Break Alarm, External Setting Function, Contact Input (Step Function, Remote/Auto Switching, Remote · Auto/Manual Switching)
REX-F4
Heater Break Alarm, Contact Input (Step Function) (For communication type, please contact our local distributors).
Data sheet No. PI-1814-E1

3. MULTI-MEMORY AREA FUNCTION TYPE

FEATURES

- Multi-memory Area
- Ramp Function
- Adjustable Alarm Hysteresis
- Output Limiter
- Parameter Display Lock Function
- PID Auto-tuning Function
- Heating · Cooling PID Action
- Self-diagnosis Function
- Reconfigurable Thermocouple Types and Alarm Actions



NAMES OF PARTS

- ① PV display (green)**
Indicates a measured value.
- ② SV display (orange)**
Indicates a setpoint value.
- ③ Indicator lamps**
(Some lamps are not supplied or different according to the supplied specification.)
- OUT(H)** ... Lights when output (heating) is ON.

- OUT(C)** ... Lights when output (cooling) is ON.
- AT** ... Lights during PID auto-tuning.
- ALM1** **ALM2** ... Lights when alarm output is ON.
- FAULT** ... Lights when self-diagnosis function detects faults.
- RAMP** ... Lights during ramp action.
- EXT** ... Lights when memory area is changeable by external BCD contacts.
- AUTO** ... Lights during auto mode.
- MAN** ... Lights during manual mode.
- MV** ... Lights while SV display indicates the output value.

- ④ Input · Range Indication**
- ⑤ Setting Keypad (Flat Keys)**
- MAN** ... Pressed to enter manual mode.
- AUTO** ... Pressed to enter auto mode.
- EXT** ... Pressed to change memory area by external BCD contacts.
- AT** ... Pressed to initiate PID auto-tuning.
- PARA** ... Pressed to scroll parameters for setting and monitoring.
- ▲** ... Cursor shift key.
- ▲** ... Increment key.
- ▲** ... Decrement key.

For explanation purpose, all functions are shown in this figure.

LIST OF MODEL CODE

● REX-F9

Model	Suffix Code	Description
REX-F9	□ □ □-□ □*N 2-□ □-N	1/4 DIN sized Direct Digital Controller.
Control Action	H	PID action.
	F	PID action with auto-tuning function
	V	Heating/Cooling PID action.
	W	Heating/Cooling PID action with auto-tuning.
Alarm Action	N	Not supplied
	S	1 point alarm action
	D	2 point alarm action
		Refer to the table of alarm action (P. 3)
Input	C	Thermocouple input
	R	RTD input
	□	Voltage current input. Refer to the table of signal code (shown below)
Control Output (heating side)	M	Relay contact output
	V	Output for SSR driving
	R	Current output
	E	Continuous voltage output
	G	Trigger output for triac driving (H, F types only)
Control Output (cooling side)	T	Triac output
	M	Relay contact output
	V	Output for SSR driving
	R	Current output
	E	Continuous voltage output
		(when control action is H, F)
Option	Analog Input	Not supplied
	Contact Input	2
	Analog Output 1 (or Control Output)	#B □
	Analog Output 2 (or Control Output)	#C □
	Communication Function	N

Signal Code Table: 1) 0 to 10mV DC 2) 0 to 100mV DC 3) 0 to 1V DC 4) 0 to 5V DC 5) 0 to 10V 6) 1 to 5V DC 7) 0 to 20mA DC 8) 4 to 20mA DC 9) The Others

#The functions paired with the same alphabet are selectable only from either of them.



SPECIFICATIONS

INPUT

- **Input** : Thermocouple (T/C), Resistance Temperature Detector (RTD), DC Voltage · Current (For input types and standard ranges, please refer to the last page.)
- **Effect of External Resistance** : Approx. 0.35 $\mu\text{V}/\Omega$ (thermocouple input)
- **Effect of Input Wire Resistance** : Approx. 0.0075%/ Ω of read value (RTD input)
- **Input Break Action** : Up-scale (as standard, down-scale also available in case of T/C input as option) [Down-scale for 1 to 5V, 4 to 20mA DC.]
- **Sampling Cycle** : 0.5 sec.
- **PV Bias** : -1999 to 9999°C [°F or %]

SETTING

- **Setting by multi-memory area or front keypad.**
- **Setting Accuracy** :
Set Value (SV)
T/C Within $\pm(0.3\%$ of SV + 1 digit) or $\pm 2^\circ\text{C}$ [4°F] (whichever is larger)
R, S input 0 to 199°C [0 to 399°F] ... within $\pm 5^\circ\text{C}$ [10°F]
B input 0 to 399°C [0 to 799°F] ... out of accuracy guarantee range.
RTD ... Within $\pm(0.3\%$ of SV + 1 digit) or $\pm 0.8^\circ\text{C}$ [1.6°F] (whichever is larger)
DC Voltage · Current
... Within $\pm(0.2\%$ of setting limiter span + 1 digit)
The other SV ... Within $\pm 0.5\%$ of setting range

DISPLAY

- **Input Display Range** : -1999 to -9999°C [°F or %]
- **Input Display Accuracy** : Same as setting accuracy

CONTROL ACTION

- **PID Action** (auto-tuning function also available as option)
ON/OFF · P · PI · PD action also available. Direct/Reverse action field selectable.
Proportional band (P)
: 1 (0.1) to setting limiter span or 0.0 to 100.0% of setting limiter span.
0 (0.0), is ON/OFF action.
hysteresis band: 0 to 100 (0.0 to 100.0)°C [°F] or 0.0 to 100.0% of setting limiter span.
Integral (I) : 1 to 3600 sec.
Derivative (D) : 1 to 3600 sec.
Anti-Reset Windup (ARW): 1 to 100% of proportional band (Ph).
Proportional cycle (T) : 1 to 100 sec.
- **Heating/Cooling PID Action** (auto-tuning function also available as option)
ON/OFF · P · PI · PD action also available. Air cooling/water cooling field selectable.
Heating proportional band (Ph)
: 1 (0.1) to setting limiter span or 0.1 to 100.0% of setting limiter span.
When Ph = 0 (0.0), ON/OFF action for both of heating and cooling.
hysteresis band: 0 to 100 (0.0 to 100.0)°C [°F] or 0.0 to 100.0% of setting limiter span.
Cooling proportional band (Pc)
: 1 to 1000% of heating proportional band (Ph).
Integral (I) : 1 to 3600 sec.
Derivative (D) : 1 to 3600 sec.
Anti-Reset Windup (ARW): 1 to 100% of heating proportional band (Ph).
Heating proportional cycle (Th) : 1 to 100 sec.
Cooling proportional cycle (Tc) : 1 to 100 sec.
Dead band (D.B.) : 0 to 10 (0.0 to 10.0)°C [°F] or 0 to 10 (0.0 to 10.0)% of setting limiter span.

OUTPUT

- **Control Output:** (Specify both heating and cooling outputs respectively in case of heating · cooling type.)
Relay Contact Capacity 250V AC 3A (resistive load), In case of control action H or F type
... 1 form "C" contact,
In case of control action V or W type
... 1 form "A" contact.
SSR Driving 0/12V DC (constant voltage pulse) [load resistance more than 800 Ω].
Current 0 to 20mA or 4 to 20mA DC [load resistance less than 600 Ω] whichever is specified.
Continuous Voltage 0 to 5V, 0 to 10V, 1 to 5V DC [load resistance more than 1 K Ω], whichever is specified.
Trigger for triac ... Zero-cross method for medium capacity triac driving.
Triac Capacity 0.5A (at ambient temperature 40°C), zero-cross method.

ALARM

- **Alarm Action** : Deviation alarm, process alarm (selectable). [Hold action is also selectable.]
Refer to type of alarm action (P. 3).
Relay contact output capacity 250V AC 1A (resistive load)
1 form "A" contact. [2 point energizing alarm.]
[Malfunction may occur if alarm is used in inductive load.]
Alarm setting range ... -1999 to 9999
Hysteresis band 0 to 100 (0.0 to 100.0)°C [°F] or 0.0 to 100.0% of setting limiter span.

GENERAL SPECIFICATIONS

- **Self-diagnosis** : Display and action of FAIL
RAM check, A/D converter check, monitoring of CPU power supply, watch-dog timer.
Output ... Relay contact output [OPEN when abnormal], capacity 250V AC, less than 0.1A (resistive load) 1 form "A" contact.
- **Supply Voltage** : 100/110V, 200/220V AC or 110/120V, 220/240V AC (50/60Hz) [whichever is specified]
- **Voltage Variation** : Within $\pm 10\%$ of rated supply voltage.
- **Power Consumption** : Less than 9.5 VA.
- **Ambient Temperature**: 0 to 50°C (32 to 122°F)
- **Ambient Humidity**: 45 to 85% RH.
- **Net Weight** : Approx. 850g
- **External Dimensions**: Refer to "EXTERNAL DIMENSIONS"
- **Option** : (Refer to the pages of "OPTION" [P. 12 to 13]).
Analog output.

SP-1 Binary Selector Unit

- * 1/16 DIN sized (48 x 48mm).
- * For memory area selection of REX-F9.



SP-1-8N

4. POSITION PROPORTIONING TYPE

FEATURES

- Ramp Function
- Adjustable Alarm Hysteresis
- Output Limiter
- Parameter Display Lock Function
- Auto/Manual Changing
- Valve Position Display
- STEP Function
- Self-diagnosis Function
- Reconfigurable Thermocouple Input Types and Alarm Actions



NAMES OF PARTS

- ① **PV display (green)**
Indicates a measured value.
- ② **SV display (orange)**
Indicates a setpoint value.
- ③ **Indicator lamps**
(Some lamps are not supplied or different according to the supplied specification.)
 - OPEN** ... Lights when OPEN output is ON.
 - CLOSE** ... Lights when CLOSE output is ON.
 - STEP** ... Lights when STEP Function is "CLOSE".
 - ALARM** **REL** ... Lights when alarm output is ON.
 - FAIL** ... Lights when self-diagnosis function detects faults.

- RAMP** ... Lights during ramp action.
- AUTO** ... Lights during auto mode.
- AT** ... Lights during remote mode.
- MAN** ... Lights during manual mode.
- MV** ... Lights while SV display indicates the output value.

- ④ **Input - Range Indication Label**
- ⑤ **Setting Keypad (Flat Keys)**
 - MAN ... Pressed to enter manual mode.
 - AUTO ... Pressed to enter auto mode.
 - POS ... Pressed to indicate the valve position.

- AT** ... Pressed to initiate PID auto-tuning.
- PARA** ... Pressed to scroll parameters for setting and monitoring.
- ◀** ... Cursor shift key.
- ▲** ... Increment key.
- ▼** ... Decrement key.

For explanation purpose, all functions are shown in this figure.

LIST OF MODEL CODE

● REX-F9

Model	Suffix Code	Description
REX-F9	Y □ □-M*N □-□ □-N	1/4 DIN sized Direct Digital Controller.
Control Action	Y	Position proportioning PID action.
Alarm Action	N S D	Not supplied 1 point alarm action 2 point alarm action } Refer to the table of alarm action (P. 3)
Input	C R □	Thermocouple input RTD input Voltage current input. Refer to the table of signal code (shown below).
Control Output	M	Relay contact output
Analog Input	N	Not supplied
Contact Input	N 1	Not supplied Step, Auto/Manual (changeable)
Analog Output 1	N □	Not supplied Refer to the table of signal code (shown below)
Analog Output 2	N □	Not supplied. Refer to the table of signal code (shown below)
Communication Function	N	Not supplied.

Signal Code Table: 1) 0 to 10mV DC 2) 0 to 100mV DC 3) 0 to 1V DC 4) 0 to 5V DC 5) 0 to 10V 6) 1 to 5V DC 7) 0 to 20mA DC 8) 4 to 20mA DC 9) The Others

* For PID action with auto-tuning type, please contact our local distributors.



SPECIFICATIONS

INPUT

- **Input** : Thermocouple (T/C), Resistance Temperature Detector (RTD), DC Voltage · Current.
(For Input Type and Standard Ranges please refer to the last page.)
- **Effect of External Resistance** : Approx. 0.35 $\mu\text{V}/\Omega$ (thermocouple input)
- **Effect of Input Wire Resistance** : Approx. 0.0075%/ Ω of read value (RTD input)
- **Input Break Action** : Up-scale (as standard, down-scale also available in case of T/C input as option) [Down-scale for 1 to 5V, 4 to 20mA DC in case of Voltage a Current input.]
- **Sampling Cycle** : 0.5 sec.
- **PV Bias** : -1999 to 9999°C [$^{\circ}\text{F}$ or %]
- **Feed Back Resistance** : By potentiometer of 135 Ω (standard) [specify within 100 Ω to 10 K Ω]
With adjustment function of feed back resistance.

SETTING

- **Setting Accuracy** :
Set Value (SV)
T/C Within $\pm(0.3\%$ of SV + 1 digit) or $\pm 2^{\circ}\text{C}$ [4°F]
(whichever is larger)
R, S input 0 to 199°C [0 to 399°F] ... within $\pm 5^{\circ}\text{C}$ [10°F]
B input 0 to 399°C [0 to 799°F] ... out of accuracy guarantee range.
- RTD ... Within $\pm(0.3\%$ of SV + 1 digit) or $\pm 0.8^{\circ}\text{C}$ [1.6°F]
(whichever is larger)
- DC Voltage · Current
... Within $\pm(0.2\%$ of Setting limiter span + 1 digit)
The other SV ... Within $\pm 0.5\%$ of Setting range

DISPLAY

- **Input Display Range** : -1999 to - 9999°C [$^{\circ}\text{F}$ or %]
- **Input Display Accuracy**: Same as setting accuracy

CONTROL ACTION

- **PID Action** (Auto-tuning function also available as option.)
ON/OFF · P · PI · PD action also available. direct/reverse action field selectable.
Proportional Band (P)
: 0.1 to 999.9% of setting limiter span.
[Less than 0.1% is unsettingtable]
- Integral (I) : 1 to 3600 sec.
- Derivative (D) : 1 to 3600 sec.
- Anti-Reset : 1 to 100% of proportional band (P).
- Windup (ARW)
- Dead Band : 0.1 to 20.0% of proportional band.
- Hysteresis Band of OPEN-CLOSE output:
0.1 to 20.0% of proportional band.

* Please contact our local distributors in case the type with PID auto-tuning is required.

OUTPUT

- **Control Output** :
Relay Contact Capacity 250V AC 3A (resistive load), 2 form "A" contact.
(OPEN-CLOSE signal for control motor driving 1 point each.)

ALARM

- **Alarm Action** : Deviation alarm, process alarm (selectable).
[Hold action is also selectable.]
Refer to type of alarm action (P. 3).
Relay contact output capacity 250V AC 1A (resistive load)
1 form "A" contact. [2 point energizing alarm.]
[Malfunction may occur if alarm is used in inductive load.]
Alarm setting range ... -1999 to 9999
Hysteresis band 0 to 100 (0.0 to 100.0)°C [$^{\circ}\text{F}$] or 0.0 to 100.0% of setting limiter span.

GENERAL SPECIFICATIONS

- **Self-diagnosis** : FAIL display and action
RAM check, A/D converter check, monitoring of CPU power supply, watch-dog timer.
Output ... Relay contact output [OPEN when abnormal], capacity 250V AC, less than 0.1A (resistive load) 1 form "A" contact.
- **Supply Voltage** : 100/110V, 200/220V or 110/120V, 220/240V AC (50/60Hz) [whichever is specified]
- **Voltage Variation** : Within $\pm 10\%$ of rated supply voltage.
- **Power Consumption** : Less than 9.5VA.
- **Ambient Temperature**: 0 to 50°C (32 to 122°F)
- **Ambient Humidity** : 45 to 85% RH.
- **Net Weight** : Approx. 850g
- **External Dimensions** : Refer to "EXTERNAL DIMENSIONS".
- **Option** : (Refer to the pages of "OPTION" [P. 12 to 13])
Analog output, contact input (STEP function, Auto/Manual function)

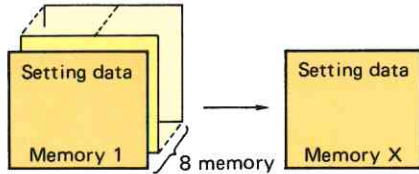
OPTIONAL FUNCTION

Multi-memory area (with RAMP function)

[Available on REX-F9 only]

1) Multi-Memory Area

This is a function to store all set values (such as PID constants, proportional band, etc) as one memory and up to 8 memory areas. This allows you to select a memory area appropriate to a particular control object. The set values in memory areas which are not used for control can be changed too.

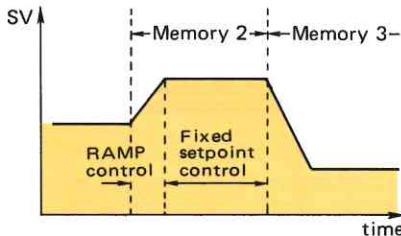


Setting method of memory area

Setting by the front keypad or by the external BCD contact signal. Selection between these two types is done by the EXT key.
 When changed by the front keypad EXT lamp OFF.
 When changed by the external BCD signal EXT lamp ON.

2) RAMP Function

When memory area is changed, the output also changes rapidly if the new SV is different. This RAMP function restricts the rate of temperature rise to the new SV to a value set by the user (The rate is freely settable). This eliminates thermal shock to load which dislikes sudden change of the output.



RAMP setting range

Thermocouple, RTD input 0.0 to 999.9°C (°F)/min.
 Voltage, current input 0.0 to 100.0%/min.
 [against setting limiter span]

Supplied with a RAMP action indicator lamp.

3) Output Limiter

This is a function to set the high limit and the low limit against the operation output (MV) for improvement of controllability and protection of the load.

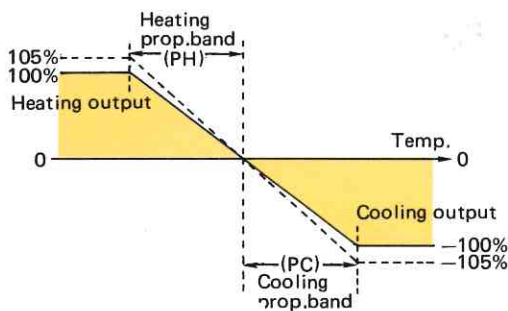
Setting range: Scale limiter LOW must be < Scale limiter HIGH.

For control actions H and F:

High limit -5.0 to 105.0%
 Low limit -5.0 to 105.0%

For control actions V and W:

High limit -105.0 to 105.0%
 Low limit -105.0 to 105.0%

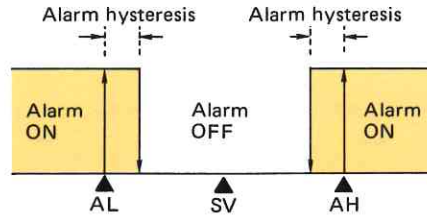


When control action is V or W

4) Alarm Hysteresis Setting

This is a function to set alarm hysteresis to a desired value in the following range.

Setting range: 0 to 100 or 0.0 to 100.0°C (°F or %)



* RAMP, output limiter and alarm hysteresis setting functions are also supplied on the instrument with control action code "Y".

External Setting [REX-F9 only]

With this function, the setpoint of the instrument can be set or changed by the external DC current or voltage signal. The instrument controls the object to maintain this set value. The external setting signal must be fed constantly. During the external setting mode, autotuning function is not available.

The remote setpoint input section is not electrically isolated from the thermocouple input section.

When the setpoint signal is sent from one instrument to two or more controllers, an isolator must be used.

The instrument has the following operation modes and when the mode is changed from one type to the other, the incorporated balanceless bumpless function works to prevent abrupt change in the process because of setpoint and output change. The balanceless bumpless function can be prohibited in the initial setting mode, if unnecessary.

Operation mode

Auto mode

Automatic output operation to perform control with the set values set via RS-422A digital communication links or via front keypad.

Remote mode

Automatic output operation to perform control with the set value set via external analog signal.

Manual mode

Manual output operation to produce manipulated variable (MV) set via RS-422A digital communication links or via front keypad.

Balanceless bumpless at the time of operation mode change

Remote mode ↔ Auto mode

With or without balanceless bumpless of setpoint. This function is field reconfigurable, but can be specified at the time of ordering.

Remote mode ↔ Manual mode

With or without balanceless bumpless of output (MV). This function is field reconfigurable, but can be specified at the time of ordering. In addition, deviation alarm in manual mode can be used against local setpoint or remote setpoint (Field reconfigurable or can be specified at the time of ordering).

Contact Signal Input

The operation mode change or the STEP setpoint change can be performed by not only the front keypad but also the external relay contact signal. (When ordering, please specify which function you use).

Change of STEP setpoint

In the local setting mode, two setpoints (SV1, SV2) are available, and either of the two can be selected by the external contact signal.

(Balanceless bumpless function does not work on this function)
 When contacts are OPEN SV1
 When contacts are CLOSED SV2

* In setting by digital communication or remote mode, setting of SV1 is done.

Change of Remote mode/Auto mode

When contacts are OPEN Auto mode
 When contacts are CLOSED Remote mode

Change of Remote Auto mode/Manual mode

When contacts are OPEN Manual mode
 When contacts are CLOSED Remote Auto mode

Caution: The contact input section is not electrically isolated from the thermocouple input section. When two or more controllers are used, contact signal input wiring must be made individually. Parallel wiring is not allowed.

■ **Serial Communication** [REX-F9, REX-F4]

RS-422A (EIA standards) serial communication is available. Maximum 16 instruments can be used with a single host computer.

Communication method 2-wire half-duplex multi-drop connection, start/stop synchronization system. AXSI x 3.28 protocol

Communication speed 600, 1200, 2400, 4800 BPS (Field reconfigurable or factory preset to the required value at the time of ordering)

Bit structure Please specify one from the following. (Field reconfigurable or factory preset to the required value at the time of ordering)

No.	Start bit	Data bit	Parity bit	Stop bit
1	1	7	Even	1
2	1	7	Odd	1
3	1	7	Even	2
4	1	7	Odd	2
5	1	8	None	1
6	1	8	None	2

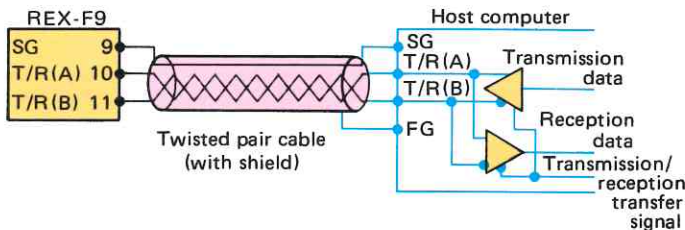
Communication code ASCII code

Max. connection 16 points (address 0 to 15 must be specified)

Computer/local mode Via front keypad, switching

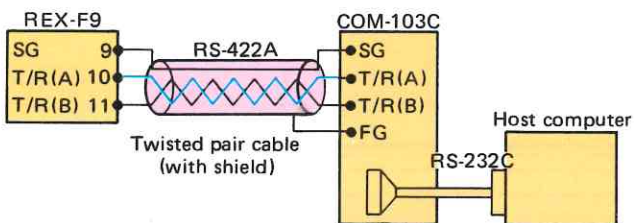
1) When connecting REX-F9 to a host computer with RS-422A interface.

Such a circuit shown below must be incorporated in the host computer.

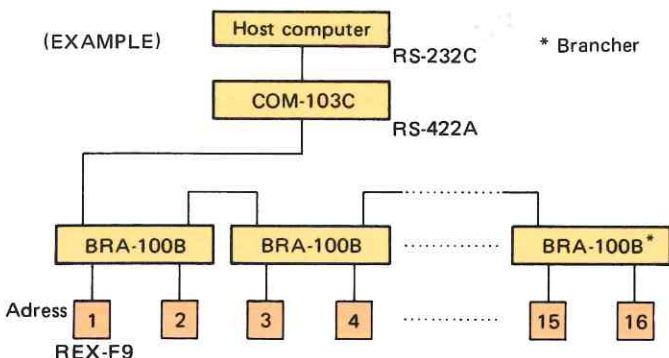


2) When connecting REX-F9 to a host computer with RS-232C interface.

Our RS-422A/RS-232C communication level converter (model COM-103C) must be used.



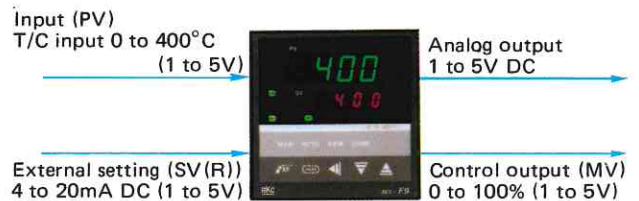
Maximum 16 REX-F9 can be connected to a single host computer.



3) REX-F4 can be also supplied with RS-422A function as option. Specifications are different. Please ask for separate data sheet if necessary. No. [PI-1814-E1]

■ **Analog output**

In addition to the control output, either of manipulated variable (MV), measured value (PV) and local setpoint (SV1), remote setpoint (SV (R)) can be output in DC analog signal form. For example, if the analog signal is 1 to 5V DC, it becomes as follows.

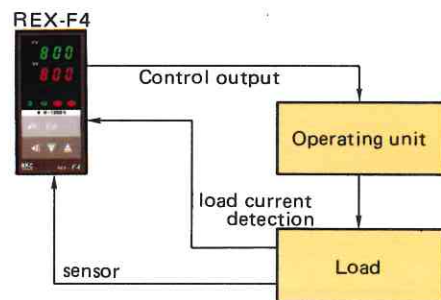


Output scaling (high and low) can be factory preset or field reconfigurable. For output signal, please select one from the following table. Maximum two analog outputs are available, but if the instrument has continuous current or voltage output (code R or E) as control output, the number of available analog output decreases. If continuous current or voltage output is specified on both heating and cooling side, no analog output is available.

Signal Code		
1) 0 to 10mV DC	2) 0 to 100mV DC	3) 0 to 1V DC
4) 0 to 5V DC	5) 0 to 10V DC	6) 1 to 5V DC
7) 0 to 20mA DC	8) 4 to 20mA DC	9) Other

■ **Heater Break Alarm**

As you know, the instrument compares the input with the setpoint (SV1 or SV (R)), makes PID calculation, and produces output signal to the load in the form appropriate to each operating units. Thus, the instrument and other units make a closed loop. Failure of signal from any one of them causes improper control. The instrument can incorporate input break alarm and heater break alarm as option to detect faults. The output from the instrument is relay contact output that can be easily used for alarm. (Max.100A available as option.)



Input Output from current detector (CTL-6-P-N)
 Heater current range ... 0 to 30A
 Setting range 0.0 to 30.0A (0.1A)
 Setting accuracy ±0.5% or ±2A (whichever is larger).
 Output 1 relay contact output, 1A (resistive load), 1 form "a" contact.

The heater break alarm can be used in the following ways.

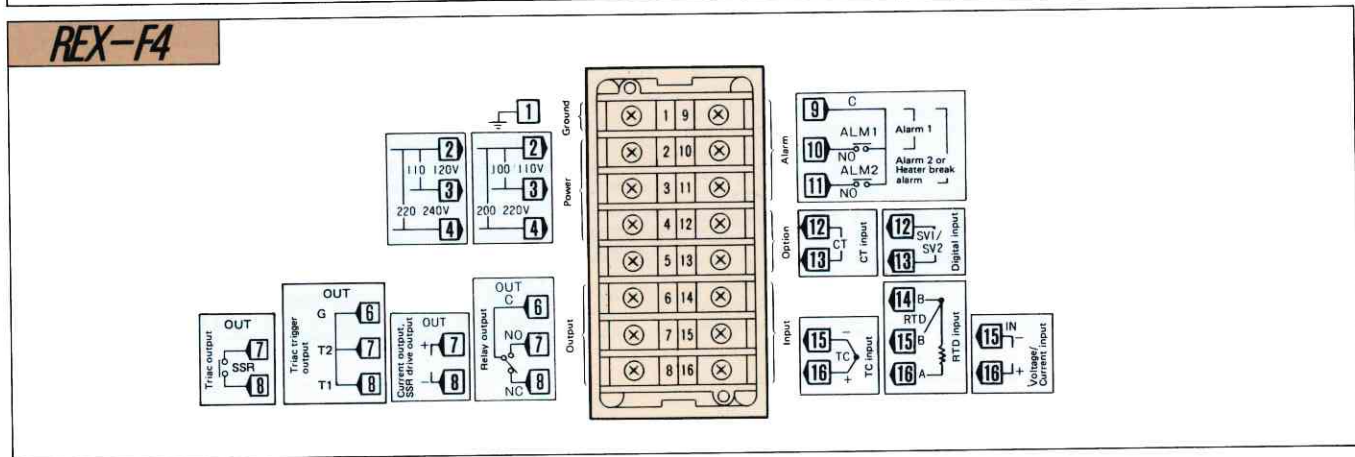
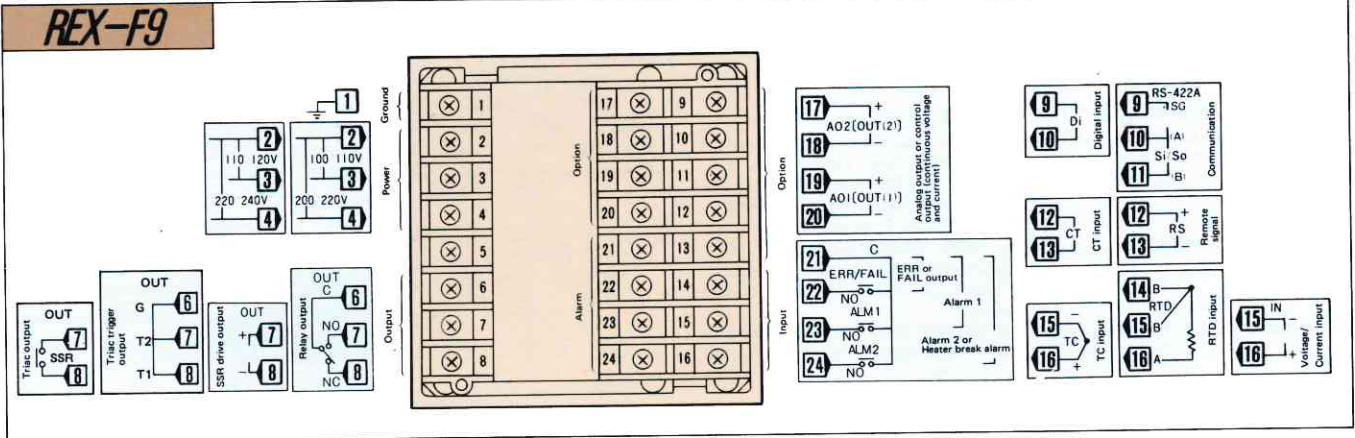
- ① It functions as heater break alarm when control output is ON and the heater current is below the set value of H_{BR} .
- ② It functions as alarm for molten relay contact when control output is OFF and the heater current is above the set value of H_{BR} (to detect molten relay contact, etc)

* Heater break alarm is not available if two alarms are incorporated or if remote setting function is supplied. The heater break alarm is available only on relay output type or SSR (Responsible if ON time is more than 0.5 sec.) output type.

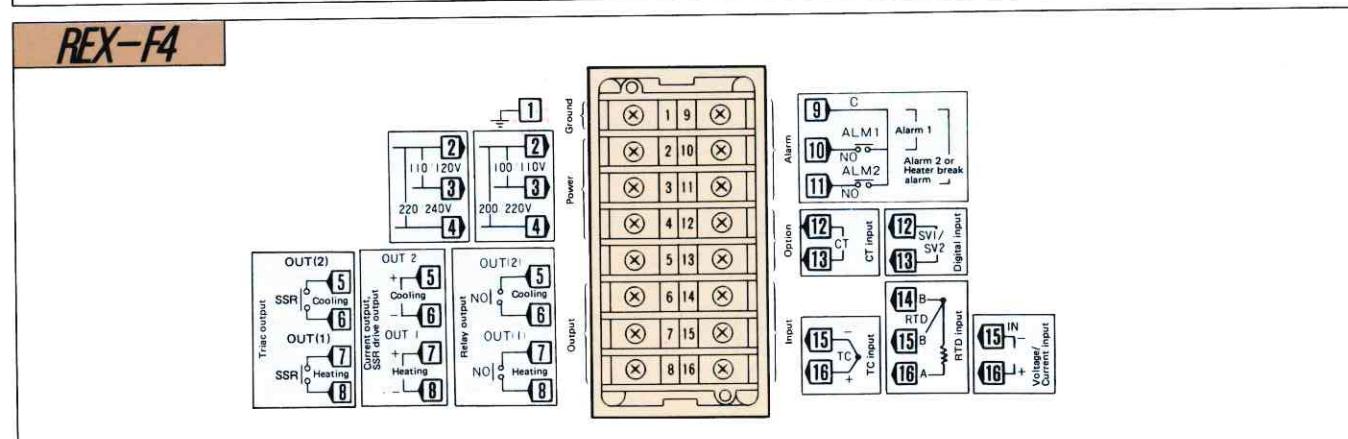
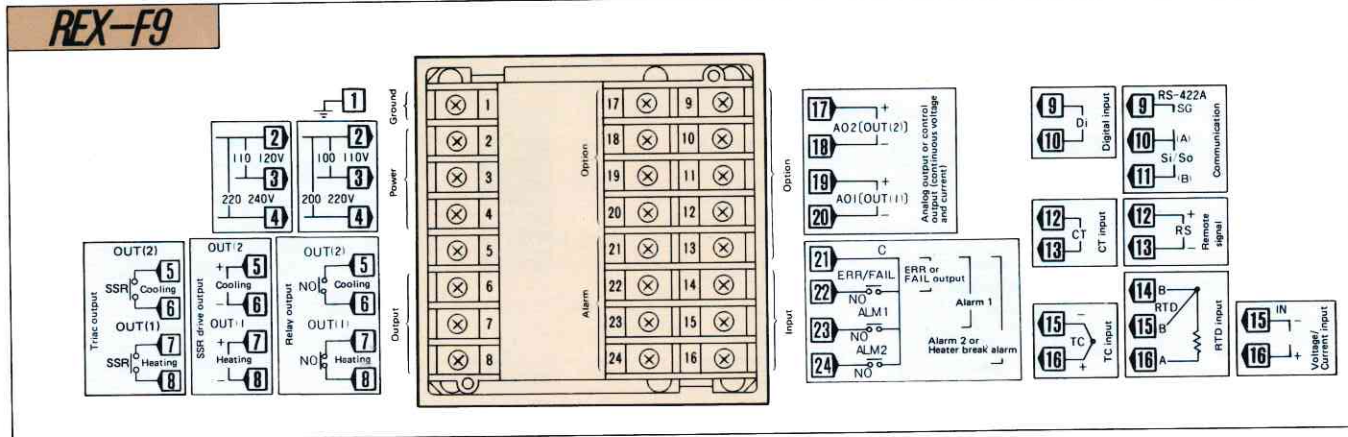
REAR TERMINALS - EXTERNAL DIMENSIONS

1. Standard Type

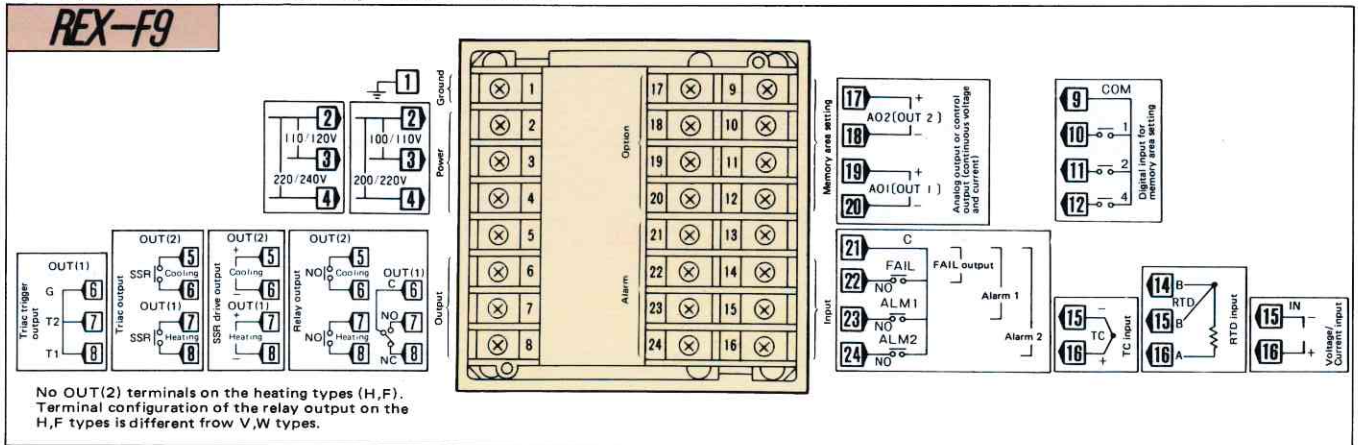
NO: Normally Open, C: Common, NC: Normally Close



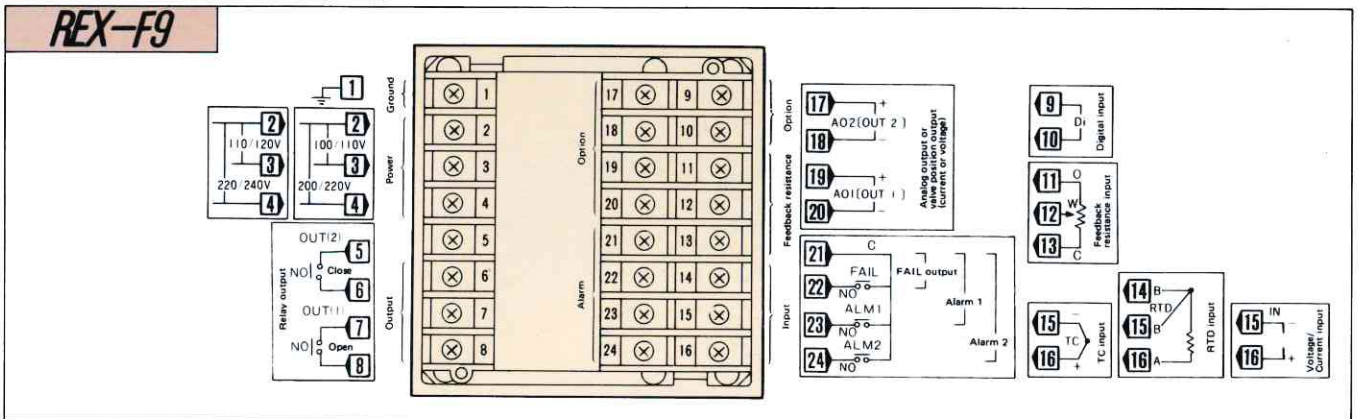
2. Heating · Cooling Type



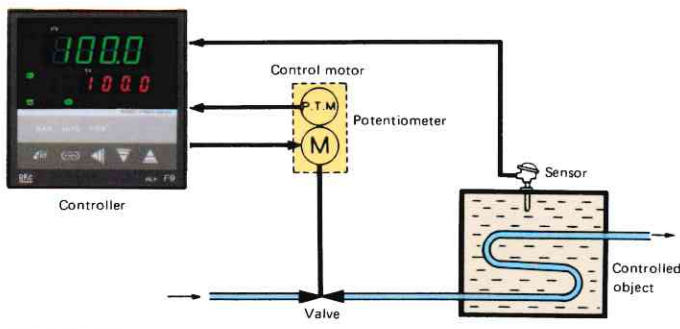
3. Type with Multi-memory Area Function



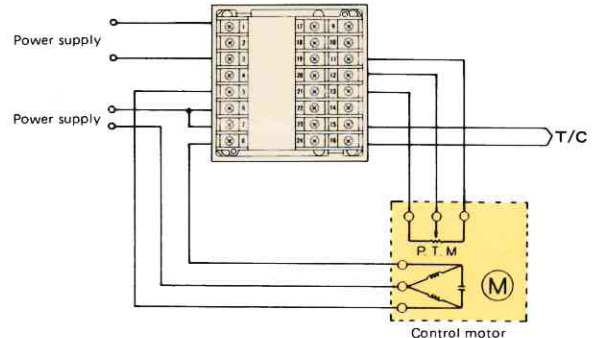
4. Position Proportioning Type



[Application example]



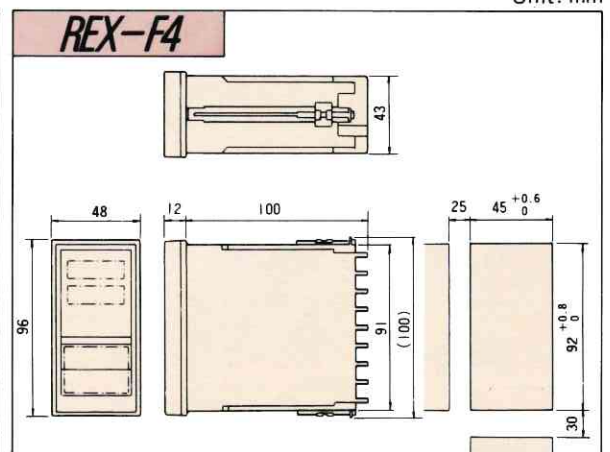
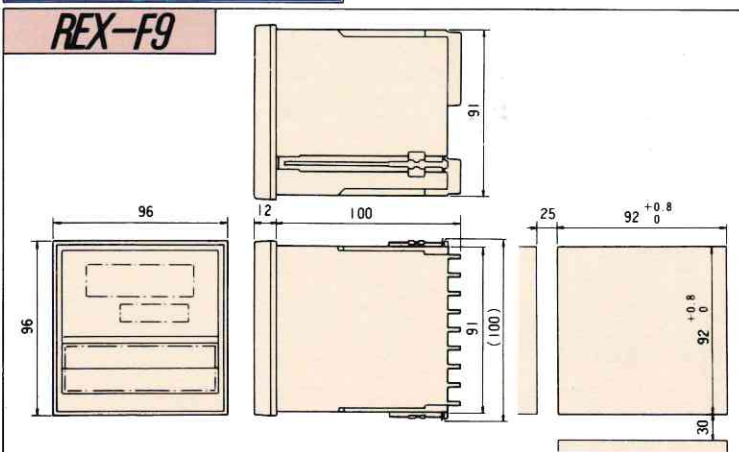
(Alarms and options are not shown)



* If the operation indicator lamp action does not match with the valve position indication, please exchange the wiring (O and C) on either the controller side or the control motor side.

EXTERNAL DIMENSIONS

Unit: mm



STANDARD RANGES

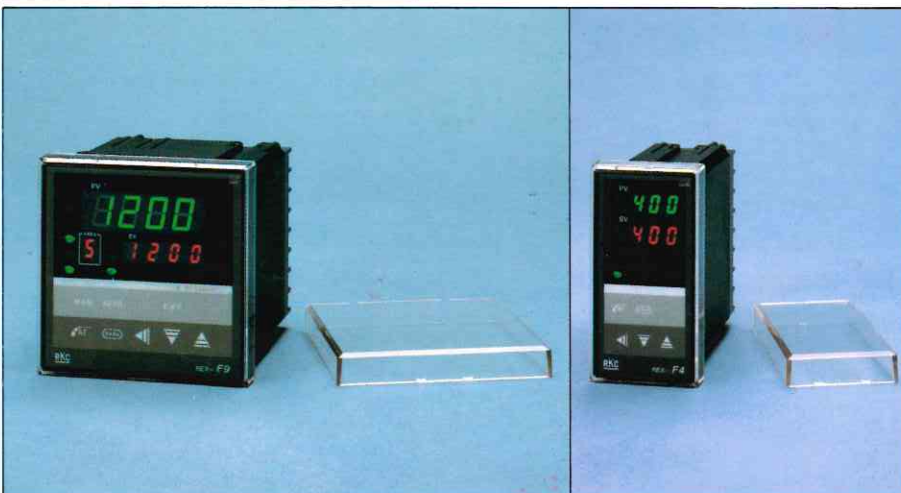
● REX-F9 · REX-F4

The figure in the parenthesis is a minimum resolution.

Input #5		Standard Ranges
Thermocouple	Type K (JIS/ANSI)	0 ~ 200°C, 0 ~ 400°C, 0 ~ 600°C, 0 ~ 800°C, 0 ~ 1000°C, 0 ~ 1200°C, 0 ~ 1372°C (1°C) 0 ~ 800°F, 0 ~ 1600°F, 0 ~ 2502°F (1°F)
	Type J (JIS/ANSI)	0 ~ 200°C, 0 ~ 400°C, 0 ~ 600°C, 0 ~ 800°C, 0 ~ 1000°C, 0 ~ 1200°C (1°C) 0 ~ 800°F, 0 ~ 1600°F, 0 ~ 2192°F (1°F)
	Type R, S (JIS/ANSI)	0 ~ 1600°C, 0 ~ 1769°C (1°C) 0 ~ 3200°F, 0 ~ 3216°F (1°F)
	Type B #2 (JIS/ANSI)	400 ~ 1800°C, 0 ~ 1820°C (1°C) 800 ~ 3200°F, 0 ~ 3308°F (1°F)
	Type E (JIS/ANSI)	0 ~ 800°C, 0 ~ 1000°C (1°C) 0 ~ 1600°F, 0 ~ 1832°F (1°F)
	Type T (JIS/ANSI)	0 ~ 400°C (1°C) 0 ~ 752°F (1°F) -199.9 ~ 400.0°C, -199.9 ~ 100.0°C, -100.0 ~ 200.0°C, 0.0 ~ 350.0°C (0.1°C) -199.9 ~ 752.0°F, -100.0 ~ 200.0°F, -100.0 ~ 400.0°F, 0.0 ~ 450.0°F, 0.0 ~ 752.0°F (0.1°F)
	Type N (NBS)	0 ~ 1200°C, 0 ~ 1300°C (1°C) 0 ~ 2300°F, 0 ~ 2372°F (1°F)
	W5Re/W26Re (ASTEM) #3	0 ~ 2000°C, 0 ~ 2320°C (1°C) 0 ~ 4000°F (1°F)
RTD #4	Pt 100 (IEC/DIN) JPt 100 (JIS)	-199.9 ~ 649.0°C, -199.9 ~ 200.0°C, -100.0 ~ 50.0°C, -100.0 ~ 100.0°C, -100.0 ~ 200.0°C, 0.0 ~ 50.0°C, 0.0 ~ 100.0°C, 0.0 ~ 200.0°C, 0.0 ~ 300.0°C, 0.0 ~ 500.0°C (0.1°C)
	Pt 100 Equivalent to IEC/JIS	-199.9 ~ 999.9°F, -199.9 ~ 400.0°F, -199.9 ~ 200.0°F, -100.0 ~ 100.0°F, -100.0 ~ 300.0°F, 0.0 ~ 100.0°F, 0.0 ~ 200.0°F, 0.0 ~ 400.0°F, 0.0 ~ 500.0°F (0.1°F)
DC Voltage · Current	0 ~ 10mV, 0 ~ 100mV, 0 ~ 1V, 0 ~ 5V, 0 ~ 10V, 1 ~ 5V	0.0 ~ 100.0% (0.1%) { But range and resolution can be specified within -1999 to 9999 and resolution from (1, 0.1, 0.01, 0.001) }
	0 ~ 20mA, 4 ~ 20mA	
		[Input impedance: DC 0 to 10mV ... approx. 5MΩ, DC 0 to 20mA, 4 to 20mA ... 250Ω, Other ... more than 250 KΩ]

- #1 Input impedance More than 5 MΩ.
- #2 0 to 399°C (0 to 799°F) is out of accuracy guarantee range.
- #3 Only supplied on multi-memory function or control action type Y.
- #4 Input lead wire resistance Less than 10Ω per each wire.
- #5 Input ANSI, DIN, JIS same as IEC (International Electrotechnical Commission)

FRONT PLASTIC HARD COVER



The instrument uses membrane type flat keys on the front panel which are effective in protection from electrostatics, noise, and dust. The use of a dual security system (hidden key and internal setting lock switch) assures good protection from misoperation. If a further protection is required, such a plastic cover (hard cover) shown left is offered as option.

Optional terminal cover is available. Please specify REX-F4 or F9 when ordering.

Relative documents
 C-1900-E for COM-100 series
 PI-1814-E for REX-F4 with RS-422A communication
 C-1813-E for REX-C9/C4 series

Subject to change without notice due to design changes.

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