Single-loop DDC temperature controller

REX-C1

DIN sized/W48×H48

1/16 DIN sized autotuning PID temperature controller


RKC. RKC INSTRUMENT INC.

1/16 DIN sized (48×48mm) autotuning PID controller

So far most of 1/16 DIN sized temperature controllers have used ON/OFF and proportional control, but our REX-C1 has employed PID control which is used in applications requiring high accuracy and stability.

What is PID control? It consists of:
- Proportional action (P) which has relation with process start-up rate and overshoot.
- Integral action (I) which is used to eliminate the difference between the set value and the displayed value (offset).
- Derivative action to prevent the effect by external disturbances.
- Anti-Reset Windup to prevent overshoot.

However, to perform PID control, proper PID constants must be set. REX-C1 automatically calculates and sets optimum PID constants because of the autotuning. Thus, even a non-skilled operator can use the controller easily. Most of 1/16 DIN sized autotuning controllers available from other sources perform autotuning only on proportional band (P), and both of integral (I) and derivative (D) time were fixed. REX-C1 is a complete autotuning PID temperature controller using the algorithm obtained from our long experience.


Difference between PID control and proportional control

Autotuning action
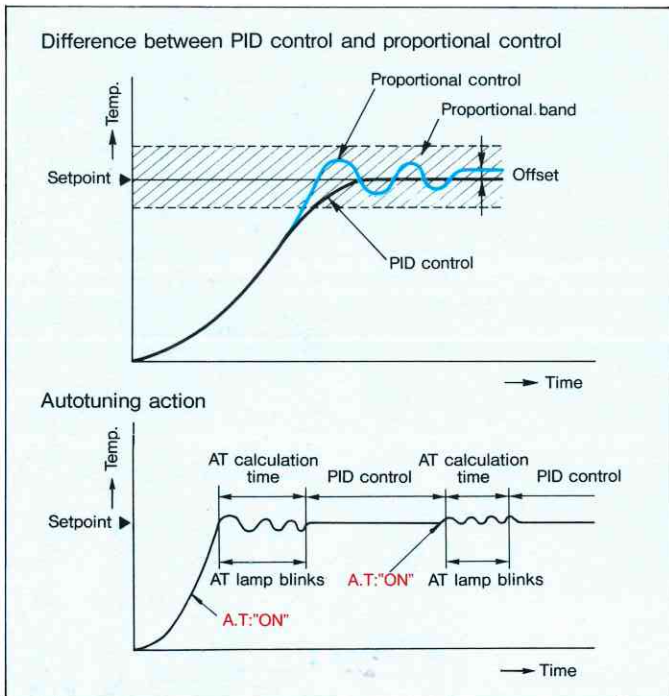
Highly Accurate Control (±0.5%) by MCU calculation

Highly accurate control of ±0.5% is possible on a compact size by the use of microcomputer unit (MCU). The process and set values are both displayed constantly. The use of flat membrane panel improves dust-proof and anti-electro static structure.

Unique LBA (Loop Break Alarm) function

LBA is a function to detect failure in the control loop and produce alarm output. We can list the following as major failure possibilities in the control loop; (1) Heater break, (2) Input disconnection or short-circuit, (3) Operating unit failure such as molten relay contacts, SSR breakage, power failure to operating units, etc. LBA function detects such failures and produce alarm output. The use of LBA function in combination with the temperature alarm makes it pos-

sible to build up a reliable small-sized temperature control system.
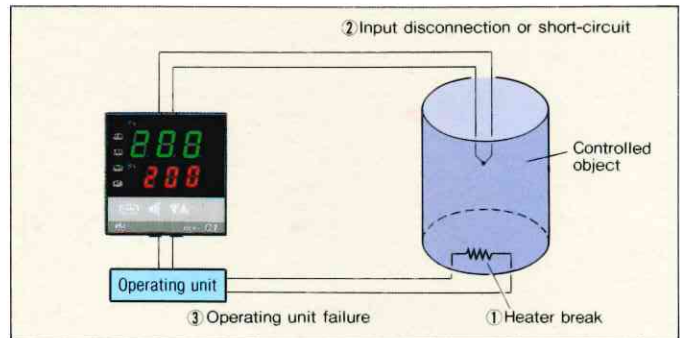
Operating principle

Failures in the control loop are detected by temperature changes within the LBA set time (adjustable from 0.1 to 99.9 minutes) while the control output is on or off. For example, if temperature goes down while the control output is on, a heater might be broken. In such a case, LBA function turns on the LED on the front panel and produces alarm output. The common LBA set time is twice of the integral time (I), but should be adjusted according to the load characteristics. The LBA set time is set to twice of the integral time when autotuning is used. The LBA function can be used both in the reverse (heating) action and the direct (cooling) action.

Wide Supply Voltage Range

REX-C1 can be used from 85V AC up to 264V AC. No need to specify supply voltage.

Abundant Alarm Selection

REX-C1 offers field configurable alarm (process alarm or deviation alarm) and the use or unuse of hold function is also field configurable. The alarm action can be freely selected from the following actions.

Deviation alarm: Is set as the deviation from the main set-point (e.g. +10°C from the main setpoint) and alarm turns on when temperature reaches the alarm setpoint.

Process alarm : Can be set anywhere within the scale range and alarm turns on when temperature reaches the alarm setpoint.
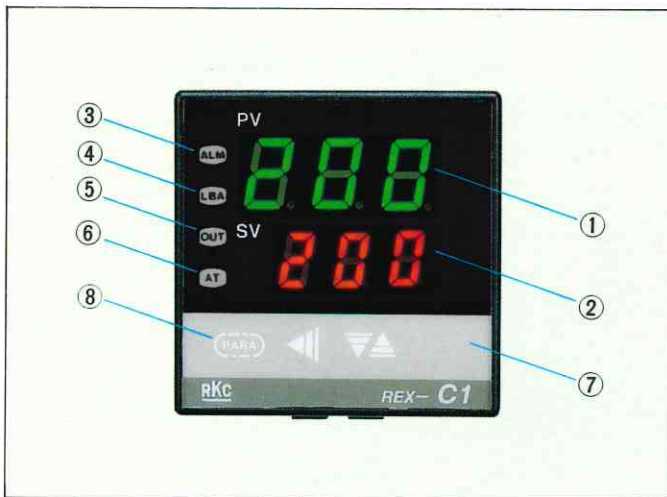
Type of Alarm Action
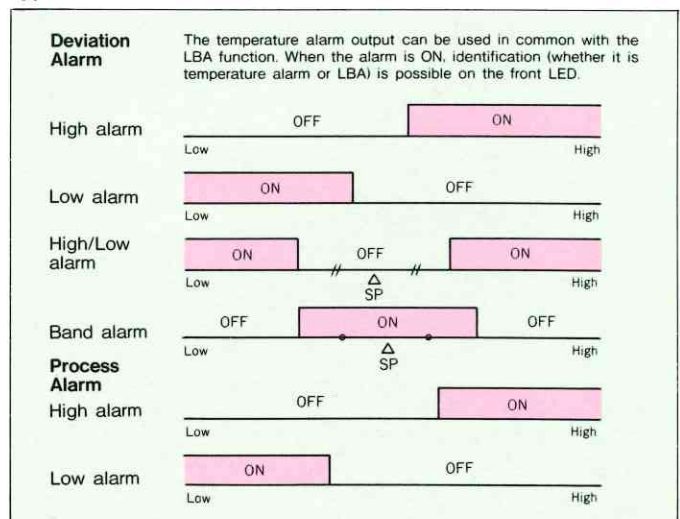
Other Functions

※ Field configurable thermocouple type (K or J). If it is a RTD type, calibration type (DIN or JIS) can be selected.
※ Field selectable °C/°F unit, direct/reverse action, PV bias, and adjustable hysteresis of control action (when used as ON/OFF controller) and alarm action.

Name of Parts

① PV and parameter display
② SV and set data display
③ Temperature alarm lamp (ON when lit)
④ LBA alarm lamp (ON when lit)
⑤ Control output lamp (ON when lit)
⑥ Autotuning lamp (blinks when used)
⑦ Setting keys
   ▼▲ ⋯UP/DOWN key
   ◀▮ ⋯Cursor shift key
⑧ Parameter key

Model and Suffix Code

Model	Suffix code						Description
REX-C1	F	☐	☐–☐＊☐	☐	☐		1/16 DIN sized temperature controller
Control action	F						PID action with AT ※3
Alarm output type ※1	N S L P						No alarm Temperature alarm LBA (Loop Break Alarm) Temp. alarm + LBA (common output)
Input		C R					Thermocouple input RTD input
Output			M V				Relay output SSR drive output
Alarm function selection	Alarm type			1 2			Process alarm ※2 Deviation alarm
	Alarm action				A B C D		High alarm Low alarm High/Low alarm Band alarm
	Hold circuit					N H	No HOLD circuit With HOLD circuit

Item to be specified at the time of ordering

1. Model code.   2. Input and scale range.

Note:
※1 When alarm code is "N" for none or "L" for LBA, no need to specify suffix code colored in beize.
※2 Process alarm is selectable from High or Low alarm only.
※3 Standard control action is reverse action, but direct action is field selectable. If direct action is required at the time of ordering, please specify Z-014 at the end of model code.
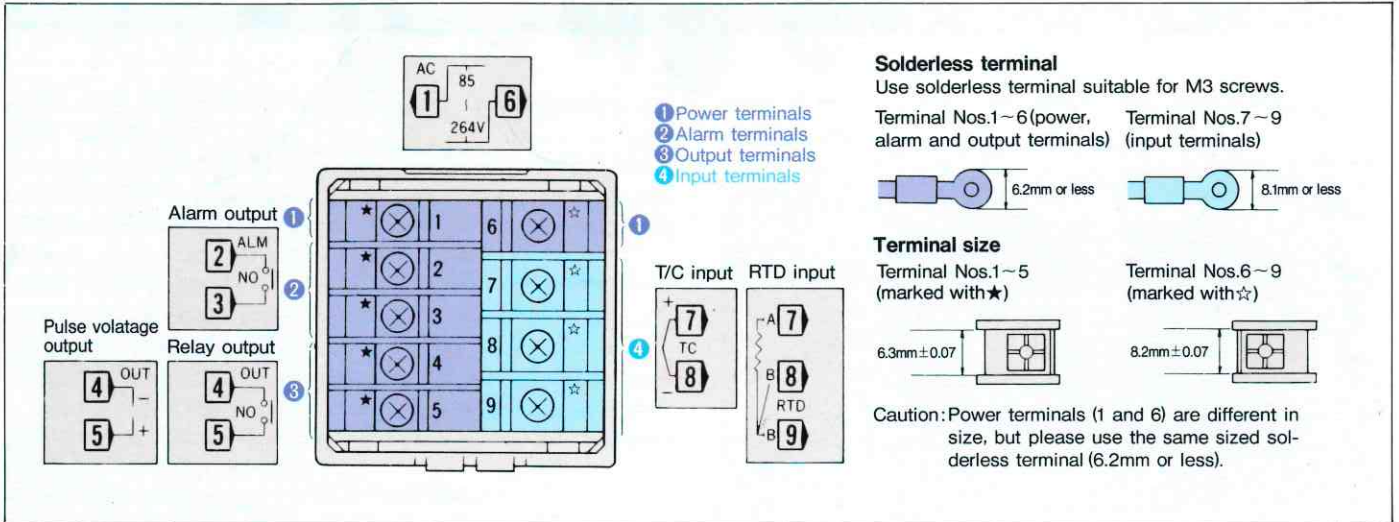

Reverse action   Direct action (Z-014)

The setpoint position in the above figure is the position when I = 0.
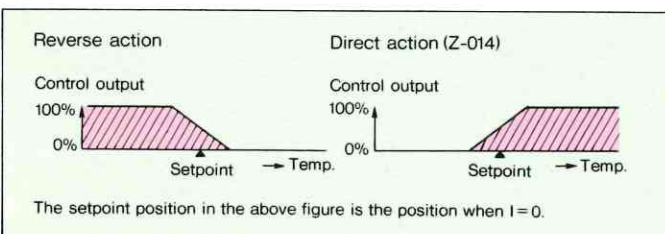
Specifications

Input	:Thermocouple K, J (ANSI/JIS) RTD Pt100 (DIN/JIS)

Effect of external resistance:0.35μV/Ω (T/C input)
Effect of input leadwire resistance:Approx. 0.01% of reading/Ω (RTD input)
Input break action : T/C input⋯⋯UP scale (standard) or DOWN scale (option).
RTD input⋯⋯UP scale
※Alarm output is ON in both UP and DOWN scale.
Action when input is short-circuited:DOWN scale (RTD input)
Sampling cycle : 0.5sec.
Setting accuracy :Setpoint (SV) and alarm set value
±(0.5% of set value + 1 digit) or ±3°C(6°F), whichever is larger.
Other set values⋯within ±0.5% of setting range.
Display accuracy :Same as setting accuracy.
Control action :PID control (DIR or REV action field configurable). ON/OFF, P, PI, PD actions are also available.
P:1(0.1)~range span, but within 200°C(°F)
I :1~999sec.
D:1~999sec.
ARW:1~100% of prop. band
Cycle time:1~100sec.
Control output :Relay contact output, 250V AC 3A (resistive load), 1 form "a" contact.
SSR drive output, 0/12V DC (constant voltage pulse) (load resistance more than 800Ω)
Temperature alarm :Deviation or Process alarm (field configurable)
High, Low, High/Low, Band alarms with/without hold.
Relay contact, 250V AC 1A (resistive load), 1 form "a" contact. (Output is common when LBA is used)
Setting range; −199~+999°C[°F] or
−19.9~99.9°C[°F]
Hysteresis ;2°C[°F]
Loop break alarm :Setting range 0.1~99.9min., relay output 250V AC 1A (resistive load), 1 form "a" contact (output is common temperature with alarm when temperature alarm is supplied).
Power failure backup:Non-volatile memory.
Effect by power failure:Not affected by power failure shorter than 20msec. Power failure longer than 20msec. resets the unit.
Set data lock :Supplied.
Supply voltage :85~264V AC (50/60Hz)
Power consumption:Less than 10VA
Ambient conditions :0~50°C[32~122°F], 45~85% RH.
Weight :Approx. 170g.

Standard Scale Ranges

Input			Standard Ranges
Thermocouple	Type K	JIS/ANSI	0~200°C,0~400°C,0~600°C,0~800°C, 0~999°C(1°C)
		ANSI	0~800°F,0~999°F(1°F)
	Type J	JIS/ANSI	0~200°C,0~400°C,0~600°C,0~999°C(1°C)
		ANSI	0~800°F,0~999°F(1°F)
RTD	Pt100 DIN or JIS		−199~200°C, −100~100°C, 0~200°C, 0~400°C, 0~600°C(1°C)
			−199~99.9°C, 0.0~50.0°C, 0.0~99.9°C(0.1°C) ※4
	Pt100 DIN		−199~999°F, −199~400°F, 0~200°F, 0~500°F, 0~999°F(1°F)
			−19.9~99.9°F(0.1°F) ※4

※4 Resolution 0.1 type is supplied on a different hardware.

Rear Terminal Wiring

AC 85 ~ 264V 1 ... 6

Alarm output ①
2 ALM
3 NO ②

Pulse volatage output
4 OUT −
5 +

Relay output
4 OUT
5 NO ③

① Power terminals
② Alarm terminals
③ Output terminals
④ Input terminals

T/C input
+ 7
TC
− 8

RTD input
A 7
B 8 RTD
B 9

Solderless terminal
Use solderless terminal suitable for M3 screws.

Terminal Nos.1~6 (power, alarm and output terminals)

Terminal Nos.7~9 (input terminals)

6.2mm or less   8.1mm or less

Terminal size
Terminal Nos.1~5 (marked with ★)

Terminal Nos.6~9 (marked with ☆)

6.3mm ± 0.07   8.2mm ± 0.07

Caution: Power terminals (1 and 6) are different in size, but please use the same sized solderless terminal (6.2mm or less).

External Dimensions

1) Panel cutout dimensions (L) when N sets of units are installed horizontally.

$$L = \{45 + 85(N-1)\}\,^{+0.6}_{0}\,(mm)$$

When hard cover is used, this specification is not available.
2) Panel thickness is 1~2.3mm
3) When installing units vertically, keep clearance at least 15mm on both top and bottom.

Mounting brackets

8   100
44
48
48
53
44

Panel cut-out

15
□45 +0.6 0
L
15

Unit : mm

Hard Cover
Used to protect the instrument front panel from dust, etc. Material : Polycarbonate

Subject to change without notice due to design changes.