STRONG ELECTRIC

INSTRUCTION MANUAL

REX-C Series

Digital PID Temperature Controller

REX-C100 · REX-C400 · REX-C410 · REX-C700 · REX-C900

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Read this manual before installing or wiring the controller. The instrument is a panel-mounted control device and must be installed by a qualified electrician with the supply isolated. Keep this manual with the machine for the life of the installation.

1 Summary

The REX-C series is a panel-mounted digital PID temperature controller with a dual four-digit LED display, a universal input and one or two alarm relays. It is used on heat presses, extruders, ovens, furnaces, packaging sealers and any heating process that needs a set point held to better than one percent of span.

The controller reads the process value from a thermocouple, an RTD or a linear signal, compares it with the set point and drives a heating output by PID or on/off control. Three output stages are available as separate order codes: a relay contact, a voltage pulse for an external solid state relay, and an analogue current output for an SCR power regulator or a PLC input.

Four bezel sizes share one body and one terminal arrangement, so the same wiring diagram applies whichever size the panel takes.

1.1 Models covered

Model	Bezel W × H (mm)	Panel cut-out W × H (mm)	Depth (mm)	Typical use
REX-C100	48 × 48	45 × 45	110	Dense multi-loop panels, small machines
REX-C400	48 × 96	45 × 92	110	Vertical strip next to other 96 mm instruments
REX-C410	96 × 48	92 × 45	110	Horizontal strip, same body rotated
REX-C700	72 × 72	68 × 68	110	Legacy panels cut for 72 mm
REX-C900	96 × 96	92 × 92	110	Main control position, largest display

Table 1 — Bezels. Depth is measured from the front bezel to the rear of the case.

1.2 What is in the box

- Controller, one piece.
- Panel retaining clip, one piece (fitted to the case on the C100 and C400).
- This manual.

Sensors, contactors, solid state relays and heat sinks are ordered separately, because the correct part depends on the process, not on the controller.

2 Safety

The controller switches mains voltage. Three rules prevent almost every failure and every injury reported on this class of instrument.

2.1 Before wiring

- Isolate the supply, lock it out and verify the absence of voltage at the terminals you are about to touch.
- Fit a fuse or a miniature circuit breaker on the supply to the controller. The instrument is not a protective device and cannot interrupt a fault current.

- Use cable rated for the panel voltage and the ambient temperature, with ferrules on stranded conductors. A loose terminal is the most common cause of a controller that fails after a year.

2.2 Where the instrument must not be installed

- In an atmosphere containing flammable or explosive gas, vapour or dust.
- Where condensation can form on the case, or where water, oil or coolant can reach it.
- In direct sun, against a hot surface, or in the rising air above a heater or a transformer.
- Where vibration or shock reaches the case — mount the instrument on a rigid panel, not on a bracket.

2.3 Do not modify the instrument

The case is sealed and the calibration is set at production. Opening the case, drilling it, or replacing the terminal block voids the warranty and removes the accuracy the instrument was supplied with.

3 Ordering code

The code on the side label is built in five positions. Read them left to right: the bezel, the control action, the input and its range, the output stage, then the alarm pair.

3.1 Position 1 — bezel

Code	Bezel	Cut-out
REX-C100	48 × 48 mm	45 × 45 mm
REX-C400	48 × 96 mm	45 × 92 mm
REX-C410	96 × 48 mm	92 × 45 mm
REX-C700	72 × 72 mm	68 × 68 mm
REX-C900	96 × 96 mm	92 × 92 mm

3.2 Position 2 — control action

Code	Meaning
F	PID, reverse acting — output rises as the process falls. Heating.
D	PID, direct acting — output rises as the process rises. Cooling, or a compressor duty.

3.3 Position 3 — input and measuring range

The two digits after the input letter are a code, not a sequence: K01 is 0–200 °C while K13 is 0–100 °C. Order the letter and the digits together.

Input	Codes and measuring range
K	K01 0–200 · K02 0–400 · K03 0–600 · K04 0–800 · K05 0–1000 · K06 0–1200 · K07 0–1372 · K13 0–100 · K14 0–300 °C
J	J01 0–200 · J02 0–400 · J03 0–600 · J04 0–800 · J05 0–100 · J06 0–1200 °C
R	R01 0–1600 · R02 0–1769 · R03 0–1350 °C (accuracy not guaranteed below 400 °C)

Input	Codes and measuring range
S	S01 0–1600 · S02 0–1769 °C (accuracy not guaranteed below 400 °C)
B	B01 400–1800 · B02 0–1769 °C (accuracy not guaranteed below 400 °C)
E	E01 0–800 · E02 0–1000 °C
N	N01 1–1300 · N02 0–1300 °C
T	T01 −199.9–400.0 · T02 −199.9–100.0 · T03 −199.9–200.0 · T04 0–350.0 °C (accuracy held from −199 to 100 °C)
Pt100	D01 −199.9–649.0 · D02 −199.9–200.0 · D03 −100–50 · D04 −100–100 · D05 −100–200 · D06 0–50 · D07 0–100 · D08 0–200 · D09 0–300 · D10 0–500 °C
Cu50	P01 −50.0–150.0 · P02 0–150.0 · P03 0–100 · P04 −50.0–0 · P05 −50.0–100.0 · P06 −50.0–50.0 · P07 −50–150 · P08 0–150 · P09 0–100 · P10 0–50 °C
Linear	401 0–5 VDC · 601 1–5 VDC · 701 0–20 mA · 801 4–20 mA, all scaleable over 0.0–100.0

Table 2 — Input codes. The 0–20 mA and 4–20 mA inputs need a 250 Ω resistor across the terminals, fitted externally.

3.4 Position 4 — output stage

Code	Output	What it drives
M	Relay contact, 250 VAC 3 A	A contactor coil, or a heater up to 3 A directly
V	Voltage pulse 0–12 VDC	The input of an external solid state relay
8	Current 4–20 mA (0–10 mA on request)	An SCR power regulator, a recorder or a PLC analogue input
T	SCR zero-crossing output	A thyristor module, zero-crossing trigger
G	SCR phase-shift pulse	A thyristor module, phase-angle trigger

3.5 Positions 5 and 6 — alarm pair

The first letter sets alarm 1, the second sets alarm 2. Letters follow the factory set below; N means the alarm is not fitted on that channel.

Code	Alarm type
N	No alarm
A	Deviation high — the process rises above set point by the alarm value
B	Deviation low
C	Deviation high and low — a window around the set point
D	Band — outside a band around the set point
E	Deviation high, hold action

Code	Alarm type
F	Deviation low, hold action
G	Deviation high and low, hold action
H	Process high — an absolute temperature
J	Process low — an absolute temperature
K	Process high, hold action
L	Process low, hold action

Table 3 — Alarm types. Hold action keeps the relay latched after the condition clears, until the operator resets it.

Example: REX-C700FK02-MAB is a 72 × 72 mm instrument, reverse acting for heating, K thermocouple over 0–400 °C, relay output, with a deviation-high alarm on channel 1 and a deviation-low alarm on channel 2.

4 Specification

Item	Specification
Display	Dual 4-digit 7-segment LED, PV red above SV green
Input	Universal: thermocouple K, J, R, S, B, E, N, T; RTD Pt100, Cu50; linear 0–5 V, 1–5 V, 0–20 mA, 4–20 mA
Input impedance	≥ 1 MΩ on thermocouple and voltage inputs
Sampling period	0.5 s
Accuracy	±0.5 %FS ±1 °C at 25 °C ambient, after 30 minutes warm-up
Cold-junction compensation	Automatic, 0–50 °C ambient
Control method	PID with autotuning, or on/off with adjustable differential
Proportional band	0 to full span, in 1 °C steps
Integral and derivative	0–3600 s, integral 1 s steps, derivative 1 s steps
Control period	1–100 s, set per output stage
Output M	Relay contact, 250 VAC 3 A resistive
Output V	Voltage pulse, 0–12 VDC, 30 mA maximum
Output 8	Current, 4–20 mA into 500 Ω maximum
Alarm relays	One or two, 250 VAC 3 A, N or A to L per the ordering code
Supply	220 VAC, 50/60 Hz, 10 VA
Insulation resistance	≥ 50 MΩ at 500 VDC between terminals and case
Dielectric strength	1500 VAC, one minute, between supply and input terminals
Operating environment	0–50 °C, 30–85 %RH, no condensation, no corrosive gas
Storage environment	−10 to 60 °C, 30–85 %RH
Vibration resistance	10–55 Hz, 0.75 mm amplitude, 2 hours per axis
Case	Flame-retardant ABS, front face sealed to IP65 with the gasket fitted
Weight	REX-C100 0.19 kg · C400 0.29 kg · C900 0.37 kg

Table 4 — Specification. Figures are for the standard builds; a custom range or a linear input follows the same housing and terminal arrangement.

5 Installation

5.1 Panel preparation

Cut the rectangular opening to the size in Table 1 and deburr it. The cut-out tolerance is +1 mm; a tighter hole will not take the case, and a looser one will let the bezel sit proud of the panel.

When several instruments are mounted side by side, leave at least 25 mm between openings horizontally and 30 mm vertically, so the retaining clips can be reached and the cases do not share each other's heat.

5.2 Mounting

- Slide the instrument through the panel from the front, with the gasket in place.
- Fit the retaining clip on the rear of the case and tighten it against the panel back face.
- Do not overtighten: the case deforms and the gasket stops sealing.

- Keep the rear of the case clear of cable ducts and hot surfaces. The case dissipates about 3 W and needs free air.

5.3 Wiring order

- Supply first, on terminals 1 and 2, through the fuse or breaker.
- Input next, thermocouple on terminals 6 and 7 for the standard build; observe polarity on the thermocouple.
- Output last, terminals 3 and 4 for the relay or SSR-drive builds.
- Alarm relays on the terminals marked ALM1 and ALM2. Check the label on the case, not this manual, if the two differ.

Separate the input cable from the mains cables: run it in its own duct, and where it must cross a mains cable, cross at a right angle. A thermocouple lead lying parallel to a heater cable picks up more error than the whole accuracy specification allows.

6 Wiring

Three output stages, three different circuits. The controller is the same in each case; what changes is what sits between it and the heater.

6.1 Relay output (M)

- Terminals 3 and 4 are a dry contact, rated 250 VAC 3 A resistive.
- Up to 3 A the heater can be switched directly. Above that the contact closes a contactor coil, and the contactor switches the heater.
- Never use the relay to switch a motor or a transformer directly: the inrush current welds the contact.

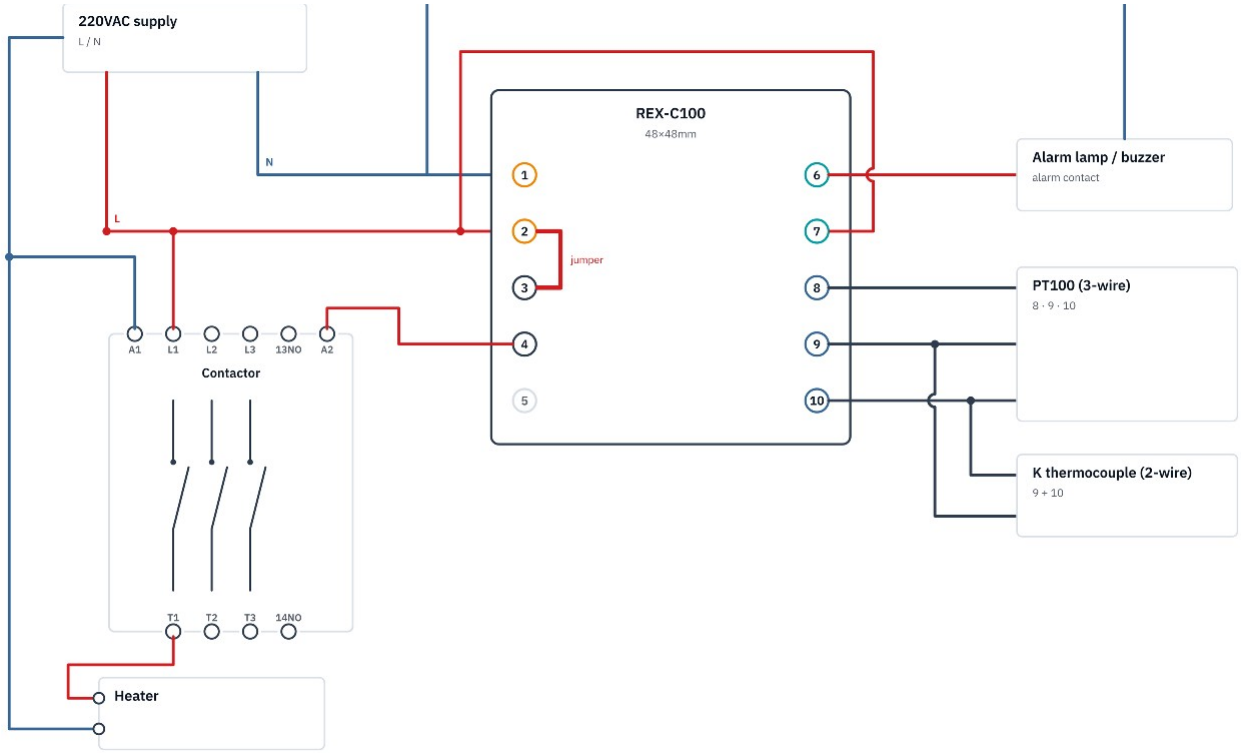


Figure 1 — REX-C100 relay build wired through a contactor. Terminals 1 and 2 supply, 3 and 4 the control contact, 6 and 7 the alarm relay, 8 to 10 the input. The jumper between 2 and 3 is the internal supply link on this build; do not remove it.

6.2 SSR drive output (V)

- Terminals 3 and 4 deliver a 0–12 VDC pulse, not a contact.

- Connect it to the control input of a solid state relay; the SSR's input is an LED, and the pulse drives it directly.
- The relay needs a heat sink sized to its current, and the load current is the SSR's rating, not the controller's.

6.3 Current output (8)

- Terminals 3 (+) and 4 (−) deliver 4–20 mA into a maximum of 500 Ω.
- This output drives an SCR power regulator, a recorder or a PLC analogue input; it cannot switch a load.
- Set the output to continuous mode, not time-proportioning, or the signal will step instead of ramp.

6.4 Sensor wiring

- Thermocouple: use compensating cable of the same letter as the sensor, and keep the polarity. Reversed polarity reads low by twice the cold-junction offset.
- Pt100, two wires: the lead resistance adds to the element. 0.4 Ω of copper is about 1 °C of error; use three wires where the controller supports it.
- Screened cable: earth the screen at the panel end only, never at both ends.
- A thermocouple that is earthed through its sheath and also at the panel creates a loop. Insulate the probe body from the earthed metal if the reading drifts when the heater switches.

7 Operation

7.1 Front panel

Item	Function
PV display (red)	Process value — what the sensor reads
SV display (green)	Set point — what the process is being asked to hold
SET key	Enter the set-up menus; confirm a value
< and > keys	Move between digits and between parameters
Up and Down keys	Change the value
OUT indicator	Lit while the control output is on
ALM1 / ALM2	Lit while the alarm relay is closed
AT indicator	Flashing while autotuning runs

7.2 Setting a set point

- Press SET once; the SV display flashes.
- Use < and > to select a digit and Up or Down to change it.
- Press SET again to store. The display stops flashing and control resumes from the new value.

7.3 PID parameters

P is entered as a proportional band in degrees, I and D in seconds. A starting point for most heating loops is a band of 3 to 8 % of span, an integral of 60 to 180 s and a derivative of 10 to 30 s.

Loop	P band	I	D
Small mass: nozzle, small platen	2–4 %	20–60 s	0–20 s
Heat press, extruder barrel, small oven	3–8 %	60–180 s	10–30 s

Loop	P band	I	D
Kiln, furnace, oil tank	5–15 %	180–600 s	30–90 s
Very inert: autoclave, heavy tunnel load	10–20 %	600–1200 s	60–150 s

Table 5 — Starting values. Adjust from here on the machine, not from the table.

7.4 Autotuning

Autotuning drives the output through several cycles and measures the response. Run it on a machine that can take full power for a few minutes without spoiling product, and with the real load in place: a tune done on an empty oven will overshoot when the oven is loaded.

During the tune the AT indicator flashes and the process value swings. When it stops, the controller has written new P, I and D values; note them down, because a factory reset returns the defaults.

7.5 Parameter table

Hold SET for three seconds to enter the parameter menu. The PV display shows the parameter code and the SV display shows its value; SET steps to the next parameter. If no key is pressed for thirty seconds the instrument returns to the normal display and the change is lost, so press SET to store each value as you set it.

Code	Parameter	Range	Factory default
PV / SV	Measured value / set point	Full span	—
AL1	Alarm 1 setting	Full span	—
AL2	Alarm 2 setting	Full span	—
ATU	Autotuning: 0 off, 1 start	0 / 1	0
P	Proportional band. 0 selects on/off control	0 to full span	30
I	Integral time. 0 removes integral action	0–3600 s	240
D	Derivative time. 0 removes derivative action	0–3600 s	60
Ar	Reference value, written by autotuning	Set by AT	25
T	Control period. Relay builds 20 s, SSR drive 2 s	1–100 s	20 / 2
OH	On/off differential, used when P = 0	1–100 units	2
SC	Measurement correction, an offset added to the reading	−200 to 200 units	0
LCK	Data lock, see 7.6	0000–0111	0000

Table 6 — Parameters. The defaults suit a general heating loop; change P, I, D only after the instrument has been through autotuning or after a run on the actual machine.

With P set to 0 the controller works as an on/off controller and the differential in OH decides how far the process must fall before the output returns. That is the correct setting for a compressor, a solenoid valve or any load that must not be pulsed.

7.6 Data lock

LCK stops an operator changing parameters by accident. Four levels, from the most open to the most closed:

LCK	What can still be changed
0000	Every parameter
0001	Set point, AL1 and AL2 only
0011	Set point only
0111	Nothing; the instrument is read-only

Set the lock before the machine leaves the workshop, and record the level on the commissioning sheet. The engineering parameter set behind the lock is a service function and is not described here; the values are written at production and should not be changed in the field.

8 Fault finding

8.1 Error messages

Display	Meaning	What to do
Input over-range	The signal is above the top of the range set by the input code	Check the input code against the sensor; confirm the sensor is not in a hotter zone than the range allows
Input under-range	The signal is below the bottom of the range	Check the sensor and the wiring; a reversed thermocouple reads low
Sensor open	No signal at the input terminals	Check the probe continuity, the terminal screws and the compensating cable
Equipment error	The instrument has failed its own self-test	Return the unit with the order code and the date of purchase

Table 7 — Error messages. An error message that appears and clears at the same rate as the heater switching is an electrical noise problem, not a sensor problem.

8.2 Symptoms

Symptom	Likely cause	What to do
Display dead, no backlight	No supply, blown fuse, or reversed supply polarity	Check the supply at terminals 1 and 2, then the fuse
Display shows an over-range or under-range code	Sensor open, reversed, or the wrong input code for the sensor	Check the sensor with a meter; confirm the input code on the label matches the sensor
Reading drifts when the heater switches	Input cable parallel to a mains cable, or an earth loop through the probe sheath	Re-route the input cable, earth the screen at one end only
Reading is offset by a constant amount	Cold junction not settled, or a thermocouple of the wrong letter	Let the instrument warm up for 30 minutes; check the letter on the probe
Process sits below the set point and never arrives	Integral too slow, or the output cannot deliver enough power	Shorten the integral time; check the heater current with a clamp
Oscillation with a period of minutes	Proportional band too narrow, or the integral too fast	Widen the band by 50 %, then lengthen the integral time
Oscillation with a period of seconds	Control period too short for a relay output	Set the control period to 10–20 s, or move to SSR drive
Relay clicks continuously and the display flickers	Supply sagging under load, or a heater short	Measure the supply at the terminals while the output is on
Alarm relay chatters	Alarm value too close to the process value, or noise on the input	Widen the gap between alarm and set point; check the input screening
Unit resets when the heater switches	Supply shared with a large inductive load	Feed the controller from its own circuit, or fit an RC suppressor on the contactor coil

Table 8 — Fault finding. If the fault persists, return the instrument with the code from the side label.

9 Warranty

Every STRONG ELECTRIC controller carries a three-year warranty from the date of dispatch. A unit that fails within that period is replaced from stock rather than returned for repair, so a machine does not wait for a parcel to travel.

The warranty covers the instrument as supplied. It does not cover damage from a reversed supply, a short circuit on the output, water or metal ingress, an opening of the case, or operation outside the environment in Table 4.

10 Private label and OEM

This controller can be supplied with your brand instead of ours: your logo and model reference printed on the front, your packaging, your datasheet and your declaration of conformity. Minimum order 500 pcs per model, ten working days printing lead time after the artwork is approved, 30 % deposit with the balance before dispatch.

Artwork: a vector file (AI, EPS, SVG) or a 300 dpi PNG. We return a proof on the exact case drawing before anything is printed.

11 Contact

Company	Strong Electric (Beijing), since 2005
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Address	Beijing, China

Quote the order code from the side label, the date of purchase and the machine the controller is fitted to when you contact us about a warranty claim.