STRONG ELECTRIC

INSTRUCTION MANUAL

CH / CD Series

Digital PID Temperature Controller

CH102 · CH402 · CH502 · CH702 · CH902 | CD101 · CD401 · CD501 · CD701 · CD901

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Document SE-MAN-CH-CD · Revision 1.0 · November 2026

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 CH and CD series are panel-mounted digital PID temperature controllers with a dual four-digit LED display, a universal input and one alarm relay. They are used on extruders, heat presses, ovens, packaging sealers and furnaces wherever a set point has to be held to better than one percent of span without a programmer in the panel.

One family, two bodies. The CH short case sits 78mm behind the panel; the CD long case is 100mm deep and is the version to order when a duct, a terminal rail or a second row of instruments sits directly behind the instrument. The bezels, the cut-outs, the terminals and the front-panel operation are the same, so the same drawing applies to either body.

Model	Series	Bezel W × H (mm)	Cut-out W × H (mm)	Depth (mm)
CH102	CH short case	48 × 48	45 × 45	78
CH402	CH short case	48 × 96	45 × 92	78
CH502	CH short case	96 × 48	92 × 45	78
CH702	CH short case	72 × 72	68 × 68	78
CH902	CH short case	96 × 96	92 × 92	78
CD101	CD long case	48 × 48	45 × 45	100
CD401	CD long case	48 × 96	45 × 92	100
CD501	CD long case	96 × 48	92 × 45	100
CD701	CD long case	72 × 72	68 × 68	100
CD901	CD long case	96 × 96	92 × 92	100

Table 1 — Models and bodies. CH is built in both bodies on the same model number; CD is the long case only.

1.2 What is in the box

- Controller, one piece.
- Panel retaining clip, one piece, fitted to the rear of the case.
- 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	Body
CH102 / CD101	48 × 48 mm	45 × 45 mm	78mm CH · 100mm CD
CH402 / CD401	48 × 96 mm	45 × 92 mm	78mm CH · 100mm CD
CH502 / CD501	96 × 48 mm	92 × 45 mm	78mm CH · 100mm CD
CH702 / CD701	72 × 72 mm	68 × 68 mm	78mm CH · 100mm CD
CH902 / CD901	96 × 96 mm	92 × 92 mm	78mm CH · 100mm CD

Table 2 — The bezel is the first position. CH numbers are the short case, CD numbers the long case.

3.2 Position 2 — control action

Code	Meaning
F	PID, reverse acting — heating. Output rises as the process falls.
D	PID, direct acting — cooling.

3.3 Position 3 — input and measuring range

The input letter selects the sensor type and the two digits after it select the measuring range. Order the letter and the digits together; K02 is not the second K range, it is the 0–400 °C range.

Input	Range
K thermocouple	0–1372 °C (K02 setting 0–400 °C)
J thermocouple	0–750 °C
E thermocouple	0–1000 °C
N thermocouple	0–1300 °C
T thermocouple	−199.9–400.0 °C
R thermocouple	0–1700 °C
S thermocouple	0–1769 °C
B thermocouple	0–1820 °C
W5Re / W26Re	0–2320 °C

Input	Range
Pt100	−199.9–649.0 °C
JPt100	−199.9–649.0 °C
Cu50	−50.0–150.0 °C
Linear	0–5 V, 1–5 V, 0–20 mA, 4–20 mA, scaleable

Table 3 — Inputs. R, S, B and W5Re/W26Re are for kiln and high-temperature work; Pt100 and JPt100 are the two platinum curves, and the instrument must be ordered for the curve the probe follows.

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
V	SSR drive	The input of an external solid state relay
8	Current 4–20 mA	An SCR regulator or a PLC analogue input

3.5 Position 5 — alarm

Code	Alarm type
N	No alarm
A	Deviation high — rises above set point by the alarm value
B	Deviation low — falls below set point by the alarm value
C	Deviation high and low — a window around the set point

Example: CH702FK02-MAB is a 72 × 72mm short-case instrument, reverse acting for heating, K thermocouple over 0–400 °C, relay output, with a deviation-high alarm on the first relay and a deviation-low alarm on the second. The same instrument in the long case is CD701FK02-MAB.

4 Specification

Item	Specification
Display	Dual 4-digit 7-segment LED, PV red above SV green
Input	Thermocouple K, J, R, S, B, E, N, T, W5Re/W26Re; RTD Pt100, JPt100, Cu50; linear 0–5V, 1–5V, 0–20mA, 4–20mA
Input impedance	≥ 1 MΩ on thermocouple and voltage inputs
Sampling period	0.5 s
Accuracy	RTD input ±0.5 %FS ±1 °C; thermocouple and linear ±1 %FS ±1 °C
Cold-junction compensation	Automatic, 0–50 °C ambient
Control method	PID with autotuning, or on/off with adjustable differential
Alarm	One relay, 250 VAC 3 A, N or A/B/C per the ordering code
Supply	220 VAC, 50/60 Hz
Body	CH short case 78mm, CD long case 100mm behind the panel
Case	Flame-retardant ABS; front face sealed to IP65 with the gasket fitted
Operating environment	0–50 °C, 30–85 %RH, no condensation, no corrosive gas

Table 4 — Specification. Figures are for the standard builds.

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.

Terminal numbering is not the same on every model in this family, so this manual does not print a terminal table. The diagram fixed to the side of the instrument is the reference: it is produced with the unit and it covers the build you actually hold. Read it before landing a wire. The figure below is an example of the connections, drawn on one model.

6.1 Relay output (M)

- The relay version switches through a pair of dry contacts 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.
- Which terminals carry that contact depends on the model. Read them off the diagram printed on the side of the instrument.

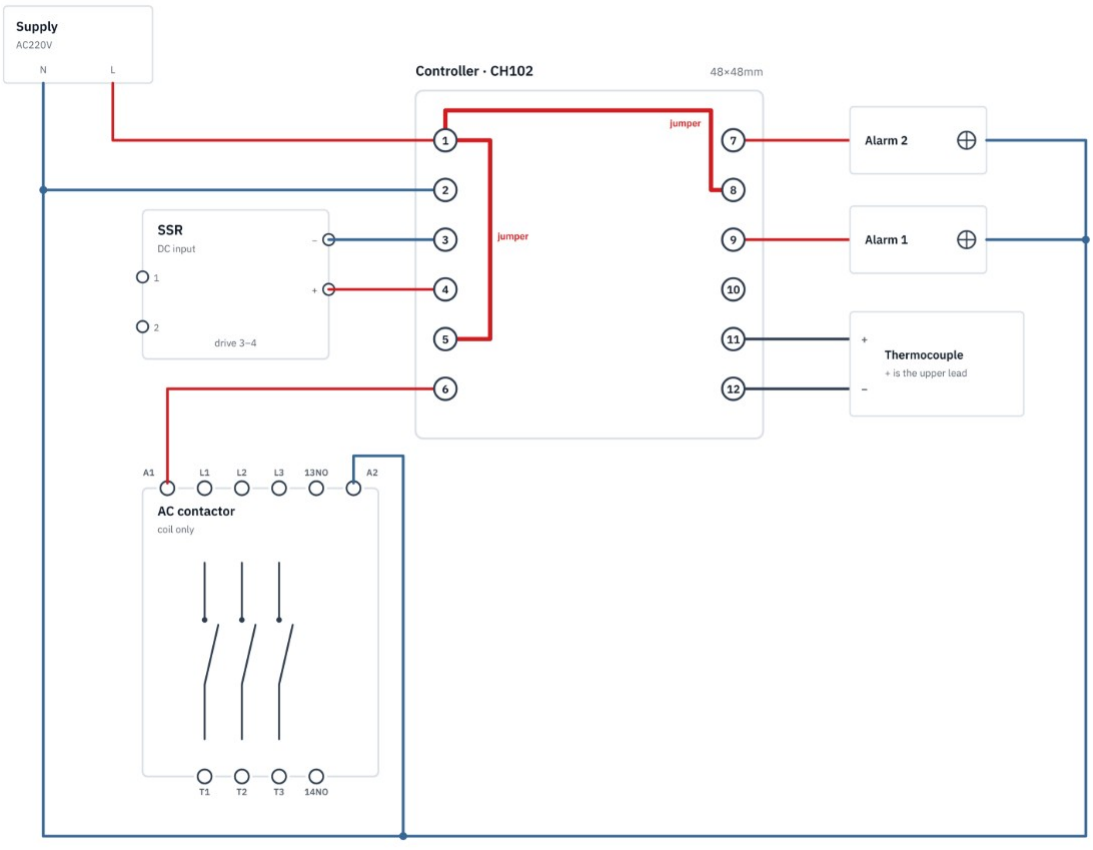


Figure 1 — Example wiring on a CH102: supply, an external solid state relay driven from the control output, a contactor coil on the relay pair, two alarm relays and a thermocouple. This is an illustration of the connections, not a terminal schedule: terminal numbering changes between models, and the diagram printed on the instrument you receive is the reference.

6.2 SSR drive output (V)

- The SSR build delivers a 0–12 VDC pulse, not a contact, on its control-output pair.

- Connect it to the control input of a solid state relay; the SSR input is an LED and the pulse drives it directly. Polarity is marked on the case diagram.
- The relay needs a heat sink sized to its current, and the load current is the SSR's rating, not the controller's.
- On this build the relay contact is not fitted; do not expect a dry contact anywhere on the terminals.

6.3 Current output (8)

- The current build delivers 4–20 mA into a maximum of 500 Ω, on its own output pair.
- 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.
- Polarity and terminal numbers are printed on the case diagram.

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
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

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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.