



# **Installation Instructions ST535 / ST536 Temperature Programmers**

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See separate handbooks for User Instructions  
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# Installation

## Safety Warnings



**DISCONNECT BEFORE  
REMOVING COVER  
(NO USER SERVICEABLE  
PARTS INSIDE)**

### WARNING

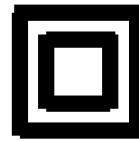
**ISOLATE KILN & PROGRAMMER FROM ELECTRICAL  
SUPPLY BEFORE ATTEMPTING INSTALLATION OR  
REPAIR WORK**

## Installer Information

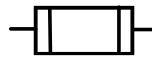
Installation Category: II  
Pollution Class: 2

100-240V ~ 50/60HZ 1.0A

Fuse: 3.15A Anti-surge  
20mm ceramic HRC



IP50



## EMC

To meet Electromagnetic Compatibility requirements the controller lead should not exceed 3.0m in length.

This instrument is designed for use mainly in Domestic, Commercial & Light Industrial environments where electromagnetic interference may cause a loss of accuracy of the displayed temperature reading of up to 3°C. Specified accuracy will be restored when the interference is removed.

# Mounting

## Mounting Location

Mount the instrument on a suitable vertical surface which will not get hot. Choose a position where the instrument is not exposed to direct heat from the kiln - especially when the kiln door or lid is open.

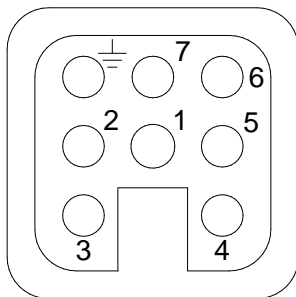
## Wall Mounting Bracket

This is a holsterstyle ABS moulded bracket which can be attached with 2 screws. The bracket mounting holes are spaced 100mm. The instrument can be removed from this bracket for in-hand programming if required.

## Connecting Lead - Single Zone

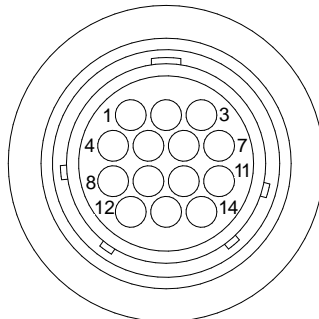
The ST53X range of Temperature Programmers are fitted as standard with a 3m connecting lead and plug. For single zone kilns with only 2 control outputs the plug type will be either a Harting Han7D or Tyco CPC14. The wiring of the mating Han7D kiln socket follows an industry standard (as shown below). **The wiring of the mating CPC14 kiln socket varies between kiln manufacturers!** For kilns requiring 3 control outputs (i.e. require the event/damper/fan output) then either the Harting Han12Q or Harting 15DX (see over) connectors are used.

Han7D plug



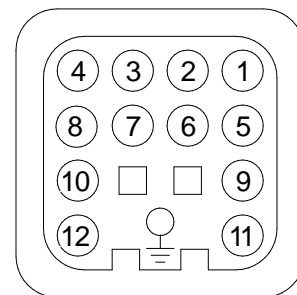
View on pins

CPC14 plug



View on pins

Han12Q plug

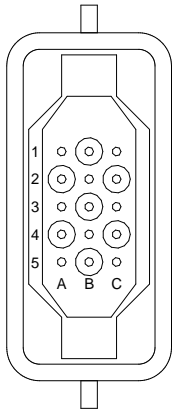


View on pins

<u>Wire function</u>	<u>Wire colour</u>	<u>Han7D pin</u>	<u>CPC14 pin</u>	<u>Han12Q pin</u>
Mains (L) supply	Brown	5	8	5
Mains (N) supply	Blue	2	9	6
Mains Earth	Green/Yellow	8/Earth	11	Earth
Heating control output (L)	White/Black	6	14	1
Alarm control output (L)	Yellow	7	12	2
Control output (N)	Black	1	13	-
Damper/Event/Fan output	Black	-	-	3
Thermocouple +ve	Orange	3	1	11
Thermocouple -ve	White	4	2	12

## Connecting Lead - Multi Zone

For multi-zone kilns, or kilns with more than 2 control outputs the plug type will be a Harting Han15DX. The wiring of this plug is shown below.

Han15DX plug	<u>Wire function</u>	<u>Wire colour</u>	<u>Han15DX pin</u>
	Mains (L) supply	Brown	A1
	Mains (N) supply	Blue	B1
	Mains Earth	Green/Yellow	Clamp
	Control output Zone 1 (L)	White/Black	A2
	Control output Zone 2 (L)	Black	B2
	Control output Zone 3 (L)	Orange/Black	C2
	Alarm Output (L)	Yellow	C1
	Event/Damper Output (L)	Grey	A3
	Thermocouple Zone 1 (+)	Orange (White/Yellow Trace)	B5
	Thermocouple Zone 1 (-)	White (White/Yellow Trace)	C5
	Thermocouple Zone 2 (+)	Orange (Black/Yellow Trace)	B4
	Thermocouple Zone 2 (-)	White (Black/Yellow Trace)	C4
	Thermocouple Zone 3 (+)	Orange (Green/Yellow Trace)	A4
	Thermocouple Zone 3 (-)	White (Green/Yellow Trace)	A5

*View on pins*

Note: the thermocouple connections shown above are for R or S type thermocouples only. For K or N type thermocouples the polarities are reversed and the orange thermocouples wires are replaced with green.

## Contactor Coil Suppression

The coil of each kiln contactor **should be suppressed** with an RC suppressor. RC suppressors must be connected directly across the coil terminals on each contactor. Suitable proprietary RC suppressors are often available from contactor manufacturers as add-on blocks.

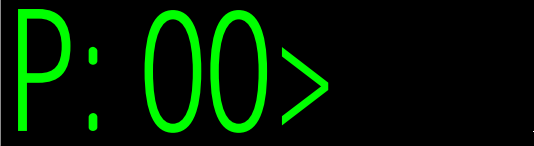
A suitable RC suppressor with insulated wire leads (fly leads) is the Okaya Electric XEB1201B. These are available from Stafford Instruments Ltd. - part number: %SUPP+.

## Configuring

To enter configuration mode power down the ST53X. Press and hold down the **■** key while powering up the ST53X.

The LCD display shows the text "T/C: R" in green characters on a black background.

When the thermocouple type is displayed release the **■** key.

The LCD display shows the text "P: 00>" in green characters on a black background.

The first setup parameter number is now displayed (flashing 00). Refer to the code tables overleaf for a description of the available configurable parameters.

The LCD display shows the text "P: 02>" in green characters on a black background.

Change the parameter number with the **&** & **■** keys. To display the parameter value press the **■** key.

The LCD display shows the number "1320" in green characters on a black background.

The parameter value can now be altered with the **&** & **■** keys. To select another parameter press the **■** key.

Pressing the **■** key at any time causes the configuration parameters to be stored. The instrument will then reboot.

The LCD display shows the text "TIMEOUT!" in large green characters on a black background.

*Note: in the above sequence if no key presses are detected for 30 seconds the instrument will time out and exit configuration mode **without saving any changes**. The buzzer will sound for 3 seconds*

### **ERROR MESSAGES**

***Certain error messages can be disabled by the use of configuration parameters. Error messages should normally be left enabled. Error messages should only be disabled as a short term measure - to diagnose kiln problems for example.***

***The alarm output contact closes at the start of a firing and opens when the firing is complete. If an error message is generated the firing is terminated, the alarm buzzer sounds and the alarm output contact opens. This output is usually used to drive a secondary (policeman) contactor to isolate power to the kiln elements.***

***Error messages are provided to detect kiln faults and so offer some protection to the kiln. For increased protection the use of a heat fuse or other independent over-temperature trip is recommended. For maximum protection an independent thermocouple, trip & heater contactor circuit should be used.***

***Note: Power fail recovery may need to be disabled if un-attended firing is not allowed.***

## Setup Parameters (0 - 31)

<b>No.</b>	<b>Function</b>	<b>Min.</b>	<b>Max.</b>	<b>Default</b>	<b>Notes</b>
0	Thermocouple type	0	3	2	0=K, 1=N, 2=R, 3=S
1	Error 1 enable	0	1	1	0=disabled, 1=enabled
2	Max. user temperature	100	1400	1320	°C
3	Display brightness	0	10	7	0=dim, 10=bright
4	Error 4 enable	0	1	1	0=disabled, 1=enabled
5	Error 5 enable	0	1	1	0=disabled, 1=enabled
6	Error 6 firing hours trip	10	1000	1000	1000=disabled
7	Room temperature trip	30	71	50	°C. 71=disabled
8	Power fail recovery enable	0	1	1	0=disabled, 1=enabled
9	Paused time limit (hours)	1	11	2	11=disabled
10	Set point offset (zone 1)	-99	99	0	°C
11	Proportional band (zone 1)	1	999	55	°C
12	Integral time (zone 1)	0	9999	200	Seconds, 0=disabled
13	Differential time (zone 1)	0	999	10	Seconds, 0=disabled
14	Kiln element power (zone 1)	0	9999	0	1 unit = 0.1kW
15					
16					
17					
18					
19	Error 9 differential temperature trip	0	99	30	°C. 0=disabled
20	Set point offset (zone 2)	-99	99	0	°C
21	Proportional band (zone 2)	1	999	5	°C
22	Integral time (zone 2)	0	9999	0	Seconds, 0=disabled
23	Differential time (zone 2)	0	999	0	Seconds, 0=disabled
24	Kiln element power (zone 2)	0	9999	0	1 unit = 0.1kW
25					
26					
27					
28					
29					
30	Set point offset (zone 3)	-99	99	0	°C
31	Proportional band (zone 3)	1	999	5	°C

## Setup Parameters (32 - 63)

<b>No.</b>	<b>Function</b>	<b>Min.</b>	<b>Max.</b>	<b>Default</b>	<b>Notes</b>
32	Integral time (zone 3)	0	9999	0	Seconds, 0=disabled
33	Differential time (zone 3)	0	999	0	Seconds, 0=disabled
34	Kiln element power (zone 3)	0	9999	0	1 unit = 0.1kW
35					
36					
37					
38					
39					
40	Number of zones	1	3	1	
41	Control Strategy	0	1	1	0=differential, 1=absolute
42	Program Linking (ST536 only)	0	1	0	0=disabled, 1=enabled
43	Engineer lockup on error	0	1	0	0=disabled, 1=enabled
44	Control cycle time	5	120	30	Seconds
45	Event / Damper / Fan relay function	0	3	0	0=disabled, 1=event, 2=damper, 3=fan
46	Remember start delay	0	1	0	0=forget, 1=remember
47	Skip start delay after power failure	0	1	0	0=resume delay, 1=skip delay
48	Reset to factory defaults	0	1	0	1=reset
49					
50					
51					
52					
53					
54					
55					
56					
57					
58					
59					
60	Operating units °C/°F	0	1	0	0=°C, 1=°F
61					
62					
63					

# Configuration Notes

## Parameter   Note

- 10**      **Setpoint offset for zone 1:** This is added to the setpoint defined by the user program. This will normally be left at 0. Units are °C.
- 19**      **Differential Trip (Error 9):** This is the temperature differential allowed between zones during firing. This trip is only active when zone 1 (the master zone) is above 600°C. If either zone 2 or zone 3 temperature deviates from zone 1 temperature by ± the selected amount then ERROR 9 will occur after a short hold-off delay. Units are °C.
- 20**      **Setpoint offset for zone 2:** This is added to the current temperature of zone 1 (for control strategy = differential), or is added to the setpoint defined by the user program (for control strategy = absolute). Ignored for single zone kilns. Units are °C.
- 22**      **PID I for zone 2:** This is set to 0 by default to disable the integral action, which will cause zone 2 to achieve a slightly lower temperature than the setpoint. This can be corrected either by setting a value of (say) 400 for this parameter (at the risk of possible interaction between zones), or, by setting a positive value for parameter no. 20 (setpoint offset).
- 30**      **Setpoint offset for zone 3:** This is added to the current temperature of zone 1 (for control strategy = differential), or is added to the setpoint defined by the user program (for control strategy = absolute). Ignored for single or 2 zone kilns. Units are °C.
- 32**      **PID I for zone 3:** This is set to 0 by default to disable the integral action, which will cause zone 3 to achieve a slightly lower temperature than the setpoint. This can be corrected either by setting a value of (say) 400 for this parameter (at the risk of possible interaction between zones), or, by setting a positive value for parameter no. 30 (setpoint offset).
- 40**      **Zones:** Zone 1 is the master zone which should be allocated to the slowest zone, usually the bottom zone in a kiln.
- 41**      **Control strategy:** Absolute control strategy is the default. With this strategy all the zones follow the same user programmed set point. Differential control strategy is also available. With this strategy the setpoint for zone 1 is as defined by the user program but the setpoint for zones 2 & 3 is the currently achieved actual temperature of zone 1. This strategy ensures that zones 2 & 3 are always able to follow zone 1 (the slowest zone). Control strategy is ignored for single zone kilns.
- 42**      **Linking:** Enables program linking on the ST326 only. Ignored by the ST325. With linking enabled program n can be optionally linked to program n+1 etc.
- 43**      **Engineer lock-up on error:** If this feature is enabled then errors cannot be cleared by cycling the power to the controller i.e: cannot be cleared by the user. This forces an engineer call out to determine the cause of the error and a repair to be implemented.
- 45**      **K5 Output function:** K5 is a programmable output. If set to event mode then K5 is controlled by the user program to open or close at the start of each ramp and to open or close at the start of each soak. If set to damper or fan mode then the user is able to enter damper open & close temperatures or fan on and off temperatures.
- 46**      **Remember start delay:** By default this feature is disabled and the controller sets the initial value for start delay to 00:00. If enabled the controller remembers the user entered start delay from the previous firing (useful for repetitive overnight firings). In either case the actual start delay can be edited by the user.
- 47**      **Skip start delay after power failure:** By default this feature is disabled and in the event of a power failure while executing the start delay the controller times off the remainder of the start delay when power is restored. If enabled the controller immediately starts firing when the power is restored. Note: the controller does not contain a real time clock and so does not know how long the power has been off.
- 60**      **Operating Units °C/°F:** When units are changed the controller will reload its default set of programs (in either °C or °F units as required). **Warning! - this will over-write any existing programs!**



*Notes*

*Notes*

*Notes*

# Characteristics

## Electrical

### **Power supply**

Voltage range: 90 - 264VAC  
Frequency: 50/60Hz  
Power: Controller 4VA (max)  
Switched outputs 125VA

Fuse: 3.15A slow-blow HRC  
20mm x 5mm ceramic

### **Control Relays (5)**

Contact type: SPST NO  
Switched Line voltage O/P @500mA max  
(for contactor driving)

### **Thermocouple**

R,S,K & N type.

### **Lead & Connector**

2m or 3m flexible grey polyurethane lead  
Fitted with either Han7D, CPC14 or Han15DX  
connector

## Environmental

Operating temperature range: -10°C to +55°C  
Storage temperature range: -10°C to +55°C

## Error Handling

Thermocouple failure detection  
Thermocouple reversal detection  
Heater failure detection  
Kiln over-temperature detection  
Room over-temperature detection  
Lock-up on error facility  
Firing run time hours limiter  
User program check  
Alarm buzzer (buzzer)

## Other

Keyboard lock facility & indication  
Kiln heating indicator  
Program running indicator  
Displayed zone number indication  
Energy used display

## Wall Bracket

Material: ABS flame retardant UL 94V-0  
Colour: Dark Grey RAL7012  
Fixing slot centres (vertical): 100mm  
Fixing slot size: 8mm x 4mm

## Temperature

### **Temperature setting**

Range: 0 to 1400°C (R/S) 0 to 1200°C (K/N)  
Resolution: 1°

### **Control Accuracy**

P.I.D. Control  
Reading accuracy:  $\pm 0.25\%$  FSD  $\pm 1$  digit

## Time

Start delay range: 00:00 to 99hr 59min  
Soak time range: 00:00 to 99hr 59min  
Resolution: 1 min

## Ramps

Ramp rate: 0.1 to 9.9°/hour then  
10 to 999°/hour or full power  
Ramps can be heating or cooling

## Enclosure

Material: ABS flame retardant UL 94V-0  
Sealing: IP51  
Size: 100/86mm(W), 210mm(L), 32mm(D)  
Colour: Black/Dark Grey  
(RAL9011/RAL7012)

## Weight

Instrument + wall bracket + cable: 0.841kg (max)

## Packaging

Packaged size: 320 x 230 x 75mm  
Packaged weight: 1.025kg (max)



This instrument complies with  
Council Directive 89/336/EC  
(EMC) & Council Directive  
2006/95/EC (safety)

Council Directives 2002/96/EC & 2003/108/EC  
The crossed out bin symbol, placed on  
this product, reminds you of the need to  
dispose of the product properly at the  
end of its life. Electrical & Electronic  
Equipment should never be disposed of  
with general waste but must be sepa-  
rately collected for proper treatment. In this  
way you will assist in the recovery, recycling &  
reuse of many of the materials used in this  
product.

