



# ST31XB Series

## Installation Instructions

### ST31XB Series (ST312B, ST315B & ST316B) Temperature Programmers

*Supplied by:-*



**FIRED UP KILNS**  
*and pottery supplies*

[www.staffordinstruments.co.uk](http://www.staffordinstruments.co.uk)



See separate handbook for User Instructions  
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# Installation

## Safety Warnings



**ISOLATE  
BEFORE  
REMOVING  
COVER**

### WARNING

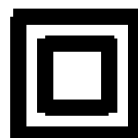
**ISOLATE KILN & PROGRAMMER FROM ELECTRICAL  
SUPPLY BEFORE OPENING THIS INSTRUMENT FOR  
INSTALLATION, CONFIGURATION OR REPAIR PURPOSES**

## Installer Information

Installation Category: II  
Pollution Class: 2

230V ~ 50HZ 1.0A

Fuse: 3.15A Anti-surge  
20mm ceramic HRC



**IP65**



## EMC

To meet Electromagnetic Compatibility requirements both the thermocouple lead and the power leads should not exceed 3.0m in length.

This instrument is designed for use mainly in Domestic & 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.

The cable entry in the instrument base should normally be positioned downwards to guard against moisture ingress.

### Wall Mounting Bracket

This is a single part holster-style metal bracket. The instrument can be removed from this bracket for in-hand programming if required.

### Direct Wall Mounting

If direct wall mounting is required screw the instrument back box to the wall using the 4 moulded holes on 90mm x 110mm centres.

***Note: these holes are sealed from the interior of the instrument. It is not good practice to drill further holes in the base of the instrument because this will compromise both the IP65 sealing and the double insulation.***

## Configurations

### Kiln Contactor Driving

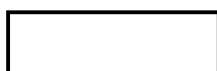
For operating kilns with contactors fitted please refer to the wiring diagrams on pages 4,5 & 6.

### Direct Kiln Driving (option P-SSR)

For directly driving the elements of small kilns of up to 6kW with an internal SSR (Solid State Relay) please contact the factory.

### Option Codes

A option code box is provided on the yellow warning label attached to the top surface of the base box shows any special options:-



Standard configuration - for contactor driving.  
Internal link is fitted between terminals %L+ and %O+.  
See diagram on pages 5 & 6.



SSR Option - for direct driving of kiln elements.

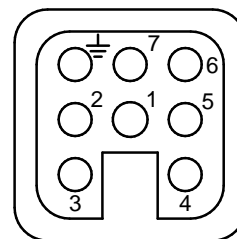
Non-standard instruments will have other option codes.

## Wiring

### Connector

If the instrument has been pre-wired with a cable & plug **ensure that the plug is compatible with the connector fitted to the kiln.** The standard connector is Harting type HAN 7D or similar.

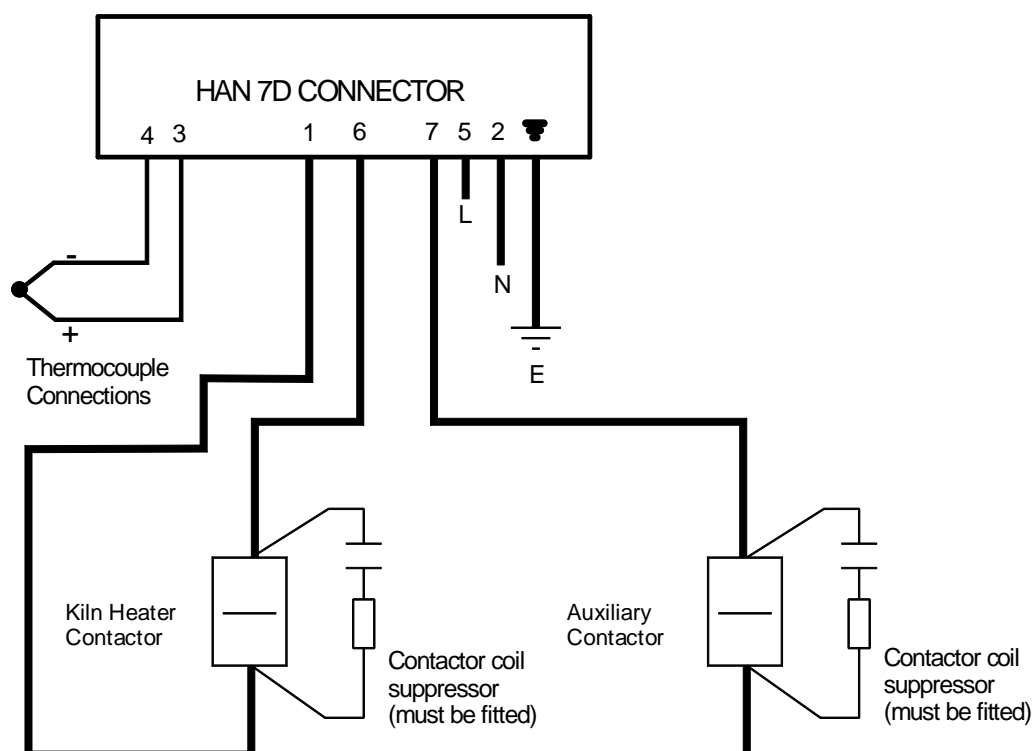
### HAN 7D Pinout



*View on pins*

### Kiln Connections

Compatible kiln connector wiring is shown below:-



### Connector Pin List

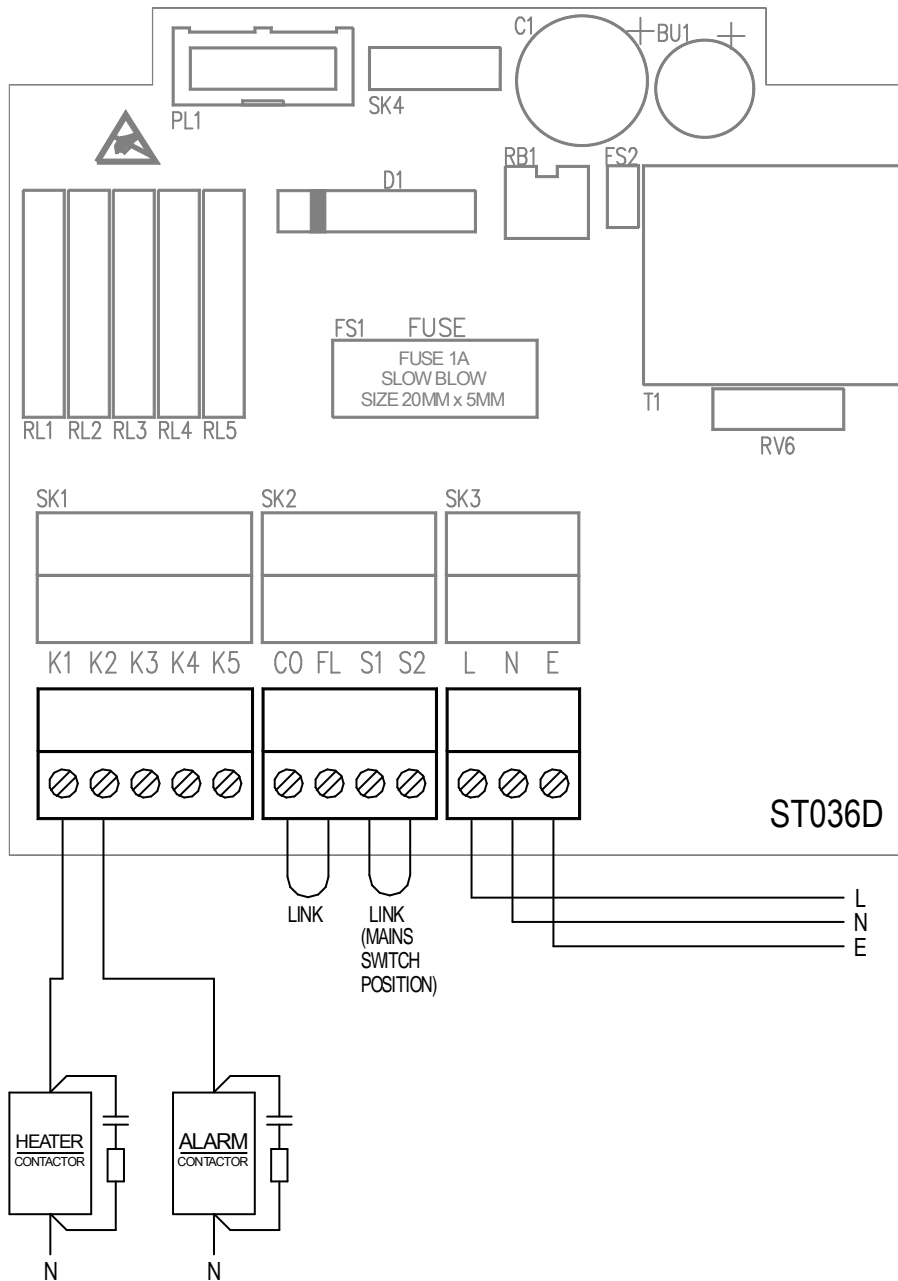
1	Neutral to contactors	5	Mains Live supply
2	Mains Neutral supply	6	Kiln Power contactor Live
3	Thermocouple +	7	Auxiliary contactor Live
4	Thermocouple -	Earth	Earth

### Contact Suppression

The coil of each contactor **should be suppressed** with an RC suppressor. The RC suppressor must be connected directly across the coil terminals on the contactor. Suitable proprietary RC suppressors are often available from contactor manufacturers as add-on blocks. A suitable RC suppressor with insulated wire leads is available from Farnell Electronic Components as part number: 1187659 - these **are also available from Stafford Instruments Ltd.**

## Wiring In - ST036C/D PCB

If a pre-wired cable & plug is not fitted then the instrument can be wired to the kiln as shown below.



### Configuration

The relay contacts are volt-free. To power the contacts fit a jumper link between terminals FL (fused live) & CO (common) as shown above. A jumper link should also be fitted between terminals S1 & S2 (if a mains switch is not fitted).

### Note

The auxiliary / alarm relay (RL2) contacts close at the start of firing and open when firing is complete. The contacts also open if an error message is generated. This relay can be used to drive a secondary contactor to isolate kiln power.

# Installation - Contactor Driving

## Configuring

The following installation parameters of the instrument can be configured:-

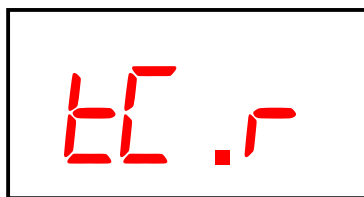
- ◆ Thermocouple type default: R type
- ◆ Maximum allowed kiln temperature default: 1320°C (R/S), 1200°C (K/N)
- ◆ Kiln power rating default: 0.0kW
- ◆ Maximum firing time hours limit default: disabled
- ◆ Ambient (room) temperature trip: default: 50°C
- ◆ Error 1 enabled/disabled default: enabled
- ◆ Error 4 enabled/disabled default: enabled
- ◆ Error 5 temperature overshoot limit: default: disabled
- ◆ Power fail recovery enabled/disabled default: enabled
- ◆ Lock-up on error enabled/disabled default: disabled
- ◆ PID process cycle time default: 30 seconds
- ◆ PID values defaults: P=55, I=200, D=10

To enter configuration mode power down the instrument. Press and hold down the START/STOP key while powering up the instrument.

Release the START/STOP key when the thermocouple type is displayed.

**Note: in the sequence below if no key presses are detected within 15 seconds the instrument will exit configuration mode and configuration changes will not be saved.**

## Installation



- ☐ °C
- ☐ °C/hr
- ☐ hr.min

The currently configured thermocouple type letter will flash. This can be altered with the  $\uparrow$  &  $\downarrow$  keys to R,S,K or N type (rShh). Press the START/STOP key.



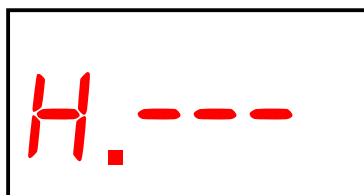
- ☒ °C
- ☐ °C/hr
- ☐ hr.min

The maximum allowable kiln temperature is now displayed. This can be altered with the  $\uparrow$  &  $\downarrow$  keys. Press the START/STOP key.



- ☐ °C
- ☐ °C/hr
- ☐ hr.min

The currently configured kiln power rating in kW is now displayed. This can be altered with the  $\uparrow$  &  $\downarrow$  keys. Press the START/STOP key.



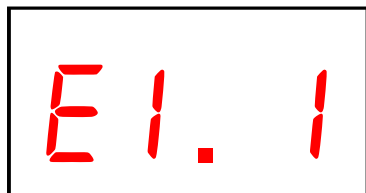
- ☐ °C
- ☐ °C/hr
- ☐ hr.min

The maximum firing hours limit is now displayed. This can be altered with the  $\uparrow$  &  $\downarrow$  keys in the range 10 to 999 hours or disabled (---). If this limit is exceeded the controller will show ErrE. Press the START/STOP key.



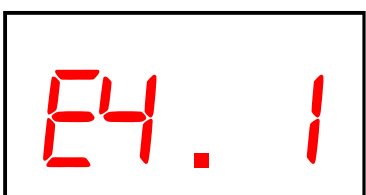
- ☐ °C
- ☐ °C/hr
- ☐ hr.min

The ambient temperature trip level is now displayed. This can be altered with the **▲** & **▼** keys in the range 30°C to 70°C or disabled (**At .--**). If this temperature is exceeded the controller will show **Err1**. Press the START/STOP key.



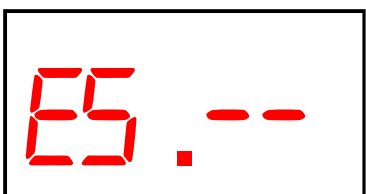
- ☐ °C
- ☐ °C/hr
- ☐ hr.min

Error 1 (heating failure) message status is now displayed. This can be altered with the **▲** & **▼** keys. **E1 . 1** indicates that error 1 is enabled. **E1 . 0** indicates that error 1 is disabled. Press the START/STOP key.



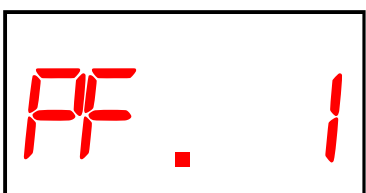
- ☐ °C
- ☐ °C/hr
- ☐ hr.min

Error 4 (contactor welded) message status is now displayed. This can be altered with the **▲** & **▼** keys. **E4 . 1** indicates that error 4 is enabled. **E4 . 0** indicates that error 4 is disabled. Press the START/STOP key.



- ☐ °C
- ☐ °C/hr
- ☐ hr.min

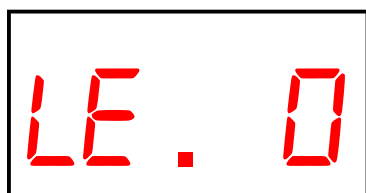
Error 5 (overshoot limit exceeded) message status is now displayed. This can be altered with the **▲** & **▼** keys to **E5 . 0** (10°C), **E5 . 20** (20°C), **E5 . 30** (30°C), **E5 . 40** (40°C), **E5 . 50** (50°C) or **E5 . --** (disabled). Press the START/STOP key.



- ☐ °C
- ☐ °C/hr
- ☐ hr.min

Power failure handling status is now displayed. This can be altered with the **▲** & **▼** keys. **PF . 1** indicates that power failure recovery is enabled. **PF . 0** indicates that power failure recovery is disabled. Press the START/STOP key.

The lock-up on error facility described below is used to prevent the clearing of errors by cycling the power to the instrument - to force an engineer call-out. Errors are cleared by entering this configuration mode.



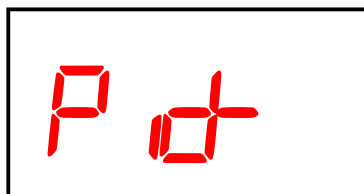
- ☐ °C
- ☐ °C/hr
- ☐ hr.min

Lock-up on error status is now displayed. This can be altered with the **▲** & **▼** keys. **LE . 1** indicates that lock-up on error is enabled. **LE . 0** indicates that lock-up on error is disabled. Press the START/STOP key.



- ☐ °C
- ☐ °C/hr
- ☐ hr.min

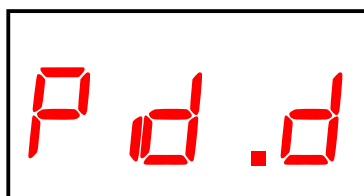
This parameter is the process cycle time in seconds for PID control and the hysteresis in °C for on/off control. This can be altered in the range 1 to 120 with the **▲** & **▼** keys. The factory set default value for PID control is 30 seconds. For on/off control the recommended value for hysteresis is 1°C. Press the START/STOP key.



- ☐ °C
- ☐ °C/hr
- ☐ hr.min

The PID menu is now displayed. To review or change PID settings press the **↑** or **↓** keys. **Only enter the PID menu if you know what you are doing!** To skip PID setting press the START/STOP key.

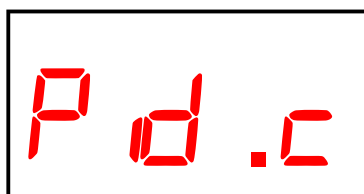
Pressing the START/STOP key causes the instrument to store the configuration data and then leave configuration mode by resetting itself without changing PID values.



- ☐ °C
- ☐ °C/hr
- ☐ hr.min

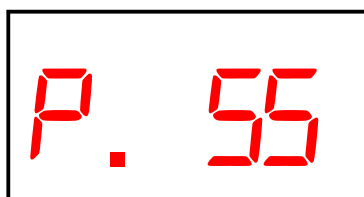
If the START/STOP key is pressed when this menu is shown then the factory default values for PID will be reloaded. The default values are P: 55°C, I: 200 seconds, D: 10 seconds.

Pressing the START/STOP key causes the instrument to reload the factory default values for PID, store the configuration data and then leave configuration mode by resetting itself.



- ☐ °C
- ☐ °C/hr
- ☐ hr.min

If the START/STOP key is pressed when this menu is shown then the menu for reviewing or changing P (the proportional band) is shown:-



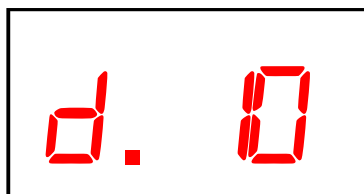
- ☐ °C
- ☐ °C/hr
- ☐ hr.min

To change the proportional band use the **↑** or **↓** keys. The factory default value for the proportional band is 55°C. It can be changed in the range 0°C to 999°C. If 0°C is selected then PID control is disabled and on/off control enabled. The hysteresis for on/off control is set using the cycle time parameter and the recommended value for hysteresis is 1°C. To change I (the integral time) press the START/STOP key:-



- ☐ °C
- ☐ °C/hr
- ☐ hr.min

To change the integral time use the **↑** or **↓** keys. The factory default value for the integral time is 200 seconds. It can be changed in the range 10 seconds to 999 seconds. To disable the integral term press the **↓** key when I=10 to select I=0. To change D (the derivative time) press the START/STOP key:-



- ☐ °C
- ☐ °C/hr
- ☐ hr.min

To change the derivative time use the **↑** or **↓** keys. The factory default value for the derivative time is 10 seconds. It can be changed in the range 0 seconds (disabled) to 999 seconds. To exit the configuration setting press the START/STOP key.

The instrument will now store the new PID data, store the configuration data and then leave configuration mode by resetting itself.



**IMPORTANT**

***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 (such as the Stafford Instruments ST121) is recommended. For maximum protection an independent thermocouple, trip & heater contactor circuit should be used.***

***Error messages should normally be left enabled. Error messages should only be disabled as a short term measure - to diagnose kiln problems for example. Power fail recovery may need to be disabled if un-attended firing is not allowed.***

# Installation

## Notes

## Notes

# Characteristics

## Electrical

### **Power supply**

Voltage range: 85 - 265VAC  
Frequency: 50/60Hz  
Phases: 1  
Power: 4VA

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

### **Control Relays**

Contact type: SPST NO volt-free  
nominal 230VAC switching  
@300mA max (contactor driving)

### **Thermocouple**

R,S,K & N type.

### **Connectors**

Pluggable Terminal blocks (5mm pitch)  
%Rising clamp+type

### **Thermocouple Connector**

Pluggable terminal block (3.5mm pitch)  
%Rising clamp+type

## Error Handling

Thermocouple failure detection  
Thermocouple reversal detection  
Heater failure detection  
Kiln over-temperature detection  
Room over-temperature detection  
Firing run time hours limiter  
Alarm buzzer

## Other

Keyboard lock facility + indicator  
Kiln heating indicator  
Program running indicator

## Weight

Instrument + wall bracket: 0.710kg  
Shipping weight: 1.180kg

## Temperature

### **Temperature setting**

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

### **Control Accuracy**

P.I.D. Control or on/off control (selectable)  
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: 1 to 999°C/hour or full power  
Ramps can be heating or cooling

## Environmental

Operating temperature range: -10°C to +55°C  
Storage temperature range: -10°C to +55°C  
RH: Maximum relative humidity 80% for  
temperatures up to 31°C decreasing linearly to  
50% relative humidity at 55°C.

## Enclosure

Material: ABS	Size: 120x122x58mm
Sealing: IP65	Fixings: 90x110mm (4 off)
Colour: Light Grey (RAL 7035)	Holster style wall mounting bracket



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.