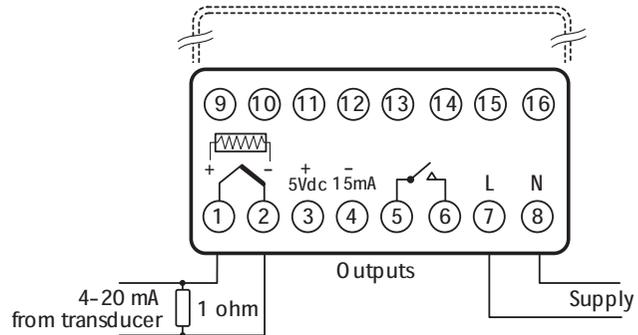**Linear Input Calibration (continued)**

1   Power up the controller, and in response to the prompt **, ⌐PЬ** *nonE* select an appropriate Linear Range from the table below.

Ensure that the Nominal Signal Span chosen is wider than the transducer's actual signal span, and the Nominal Scale is wider than the full scale of the engineering units to be displayed.

Linear Range	Nom. Signal Span	Nom. Scale Span	Max. Scale Settings
Lin 1	0–20 mV	0 – 100	0 – 400
Lin 2	4–20 mV	0 – 100	-25 to 400
Lin 3	0–20 mV	0 –1000	0 to 3000
Lin 4	4–20 mV	0 – 1000	-250 to 3000
Lin 5	0–20 mV	0 – 2000	0 to 3000

2   Select **u⌐, Ь**, then select the process unit, *°C*, *°F*, *Bar*, *PSI*, *Ph*, or *rh*. If the required unit is not shown select *Set*.

3   Allocate the output devices at function **SP 1.d** as described in *SET-UP*, enter the configuration into the memory and proceed as follows:

Calculate the values for the controller settings for **hɪ.SC** and **SPA⌐** using the example below as a guide:

4 to 7mV input from transducer is required to display 0 - 110 units

Chose Linear Range Lin4   4-20mV = 0 to 1000 units.

hɪ.SC = $\dfrac{\text{Nominal Signal Span} \times \text{required span}}{\text{actual signal span}}$

$\dfrac{(20\text{-}4) \times (110\text{-}0)}{(7\text{-}4)} = 587$

SPA⌐ = $(hi.SC \text{ - nominal scale span}) \times \dfrac{hi.SC}{\text{Nominal Scale Span}}$

$(587\text{-}1000) \times \dfrac{587}{1000} = -242$

These settings should provide the correct scaling adjustment, but a value for **ZE⌐o** may need to be established by applying the lowest and highest mV input signal and recording the display offset. Check that this is the same at each end, and enter this plus or minus value as a **ZE⌐o** adjustment. Should there be a difference between the two readings, a further adjustment of the **SPA⌐** setting can be made.

Calibration to Another Instrument (continued)

2   Adjust using the `SPAn` function

   2.1   Chose a temperature near the bottom and another near the top of the scale.

   2.2   Run the process at the lower temperature (T_1). Note the error (E_1) between the controller and the instrument readings.

   2.3   Repeat at the upper temperature (T_2) and note error (E_2).

   2.4   Substitute the values for T_1, T_2, E_1 and E_2 in the expression below to calculate `SPAn`

$$\frac{E_2\text{-}E_1}{T_2\text{-}T_1} \text{ X } hi.SC = SPAn$$

For *hi.SC* settings see level 2.

Example:	T_1	T_2
Instrument reading	58°	385°
Controller reading	60°	400°
Error	E_1(-) 2°	E_2 (-) 15°

$$\frac{(-15) - (-2)}{385 - 58} \text{ x } 450 = \frac{(-13) \text{ x } 450}{327} = (-)17.9$$

   2.5   Therefore adjust *SPAn* to (-) 18 to correct error.

Notes: (1)   After making the adjustment the reading will immediately change. Allow time for the temperature to stabilise at T_2 before making any further adjustment. At this point, a *ZEro* adjustment may be needed, refer to step 1 above.

      (2)   Check that the temperature correctly stabilises at T_2 and then adjust setpoints to T_1. If an error is present at T_1 repeat from step 2.

LINEAR INPUT CALIBRATION

In addition to the ten temperature inputs, the controller has five linear input ranges which can be calibrated to display a range of engineering units. This procedure involves making adjustments to the controller's `hi.SC` , `ZEro` and `SPAn` adjustments found in function menu levels 2 and 3.

Note: The controllers linear inputs are in mV. If your transducer provides an output in mA this should be converted to mV by feeding the controller input via a high stability one ohm resistor, see figure page 26. Other low Vdc signals can be connected via a suitable voltage divider network to match the controller input requirements.

Heat Cool Strategy Configuration (continued)

If no improvement, return to the original value and;

In level 1 halve the value of `CYC.2`

If the process hunts between heating and cooling, a deadband setting may be needed. Enter a small value, eg. 1 and observe the process. Increase the setting until hunting stops.

Level 1 adjust value `SEt.2`

Water cooled applications

Water cooled applications operating at temperatures greater than 100°C may suffer from the non linear effect caused by water turning to steam. This can be countered by the non linear setting for SP2;

In level 2 set `SP2.b` to **nL in**

Multi zone applications

When tuning multi zone applications like extruders, distortions due to thermal interaction between adjacent zones can be minimised by running autotune on all controllers at the same time.

CALIBRATION TO ANOTHER INSTRUMENT

If the controller and instrument readings are different, the `ZEro` and/or `SPAn` function in Function Menu Level 3 will require adjustment.

Adjust `ZEro` to make an equal adjustment across the full scale of the controller and `SPAn` to make a correction when the error increases/decreases across the scale.

1   To adjust using the `ZEro` function

    1.1   Substitute measured values in the expression:

        Instrument reading – controller reading = `ZEro`

        Example:

        Instrument reading = 396°
        Controller reading = 400°
            396 – 400   = (-)4°

    1.2   Adjust `ZEro` to (-) 4° to correct error.

        To make a correction when there are different errors across the scale.