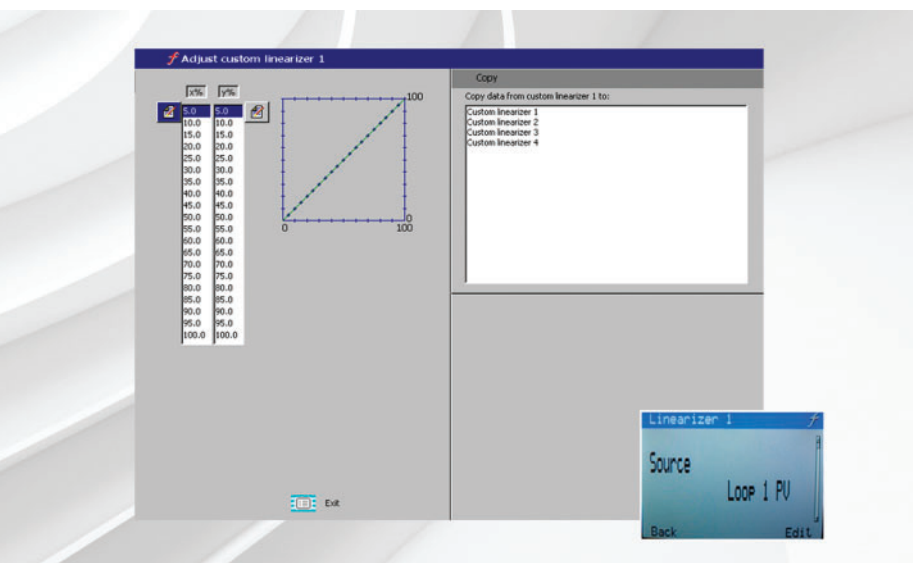


ScreenMaster and ControlMaster

Process recorders, controllers and indicator



Configuring and using custom linearizers

Measurement made easy

ControlMaster CM15,
CM30 and CM50

Introduction

A linearizer is required when an input signal range does not have a linear relationship to the display range required. This most commonly applies to temperature-type inputs.

For example:

- an RTD input uses a resistance input signal and requires a linearizer to display that signal as a valid temperature (for example, a PT100- or PT1000-type curve)
- a thermocouple-type input uses a mV input signal and requires a linearizer configured for the type of thermocouple being used (for example, type K or type T) to display the temperature correctly.

Because temperature inputs are the most common inputs that require a linearizer, suitable linearizer types are normally pre-programmed into a recorder or controller. However, non-standard inputs need to use a programmable custom linearizer to obtain the correct display.

Inputs that may require a custom linearizer include non-standard temperature inputs (for example, an Ni100 RTD or a less common thermocouple type), level inputs from unusually shaped vessels (and therefore not linear) or the measurement of gas concentrations such as hydrogen and oxygen.

Custom linearizers are available on both ScreenMaster paperless recorders and ControlMaster controllers. They are freely assignable and enable the measurement, control and recording of special input relationships.

This publication details how to customize ScreenMaster and ControlMaster linearizers.

Linear/Non-linear relationships

A linear relationship is displayed as a straight line. Figure 1 shows a linear relationship where 50 % of the input to the linearizer equals 50 % of the output from the linearizer.

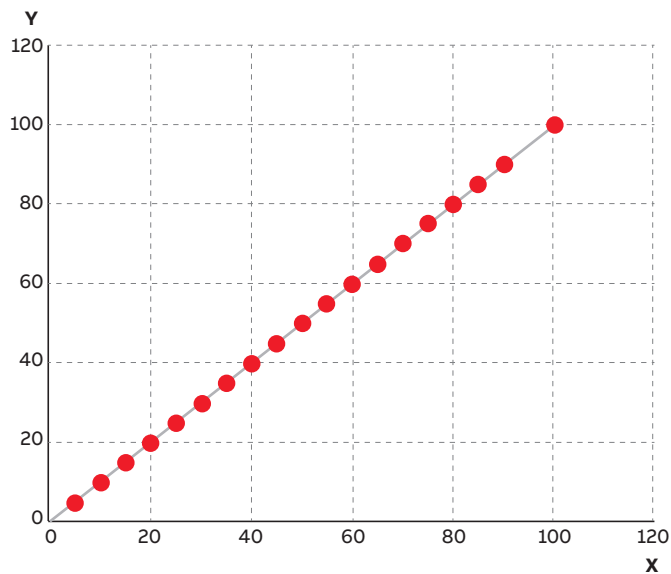


Figure 1 Linear input relationship

A non-linear relationship is displayed as a curve. Figure 2 shows a non-linear relationship where 20 % of the input to the linearizer equates to 62 % of the output from the linearizer.

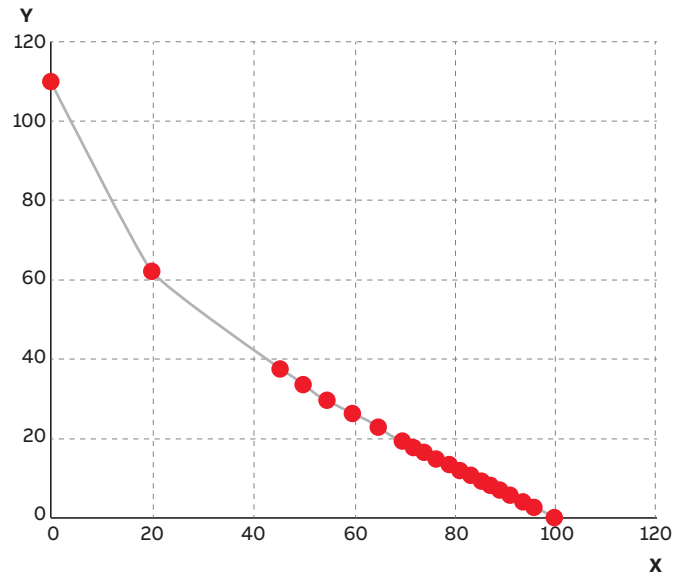


Figure 2 Non-linear input relationship

Customizing the linearizers

Both ScreenMaster and ControlMaster linearizers work by converting the linearizer's physical input to a representative engineering output to be displayed on the screen.

The linearizer has an X and a Y axis. The X axis is the input to the linearizer expressed as a percentage of the fullscale electrical range and the Y axis is the output from the linearizer expressed as a percentage of the fullscale engineering range. Setting both input and output percentages's to the same figure (for example, x = 50 % and y = 50 %) results in a linear relationship (see Figure 1).

The custom linearizer has 20 breakpoints. These are the 20 points that make up the curve. To create the curve:

- 1 select 20 values from the electrical input range
- 2 Using the equation:

$$\frac{100}{\text{Full scale range}} \times \text{Value of breakpoint in units}$$
 - a calculate where, in percentage terms, each input value falls within the fullscale electrical range
 - b calculate, in percentage terms, the engineering range value required at each breakpoint

Table 1 is an example from a customer's application where the required engineering range is not linear. The fullscale electrical and engineering ranges are 18.75 mA and 10 respectively.

Custom linearizers are available on all ScreenMaster paperless recorders and also on the ControlMaster range of controllers and indicator. The basic use and operation is identical for all products but the method of configuration for the ScreenMaster range differs from ControlMaster.

Table 1 produces the linearizer curve shown in Figure 3.

mA input (electrical range)	% (X axis)	LF a-p1 (engineering range)	% (Y axis)
0.35 mA	1.86	0.01	0.1
1.05 mA	5.6	0.03	0.3
1.73 mA	9.22	0.05	0.5
2.39 mA	12.75	0.07	0.7
2.70 mA	14.4	0.08	0.8
3.25 mA	17.33	0.10	1
4.41 mA	23.52	0.14	1.4
4.92 mA	26.24	0.16	1.6
5.95 mA	31.73	0.20	2.0
7.80 mA	41.6	0.3	3.0
9.15 mA	48.8	0.4	4.0
10.00 mA	53.33	0.5	5.0
10.70 mA	57.06	0.6	6.0
11.26 mA	60.05	0.7	7.0
11.70 mA	62.4	0.8	8.0
12.10 mA	64.53	0.90	9.0
12.50 mA	66.66	1.00	10.0
14.95 mA	79.73	2.00	20
17.00 mA	90.66	4.00	40
17.48 mA	93.22	5.00	50.0

Table 1 Example of non-linear linearizer curve requirement

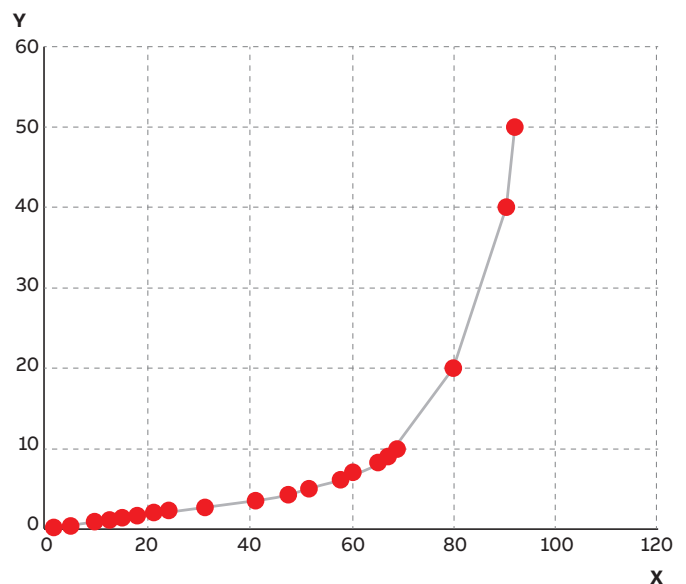


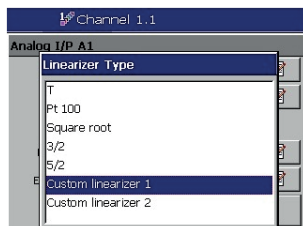
Figure 3 Example of a non-linear input requirement

...Customizing the linearizers

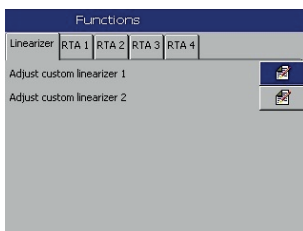
ScreenMaster paperless recorders

When any non-RTD input is configured, a list of linearizer types containing the most common options for thermocouple and flow applications can be selected. The list includes 2 custom linearizers.

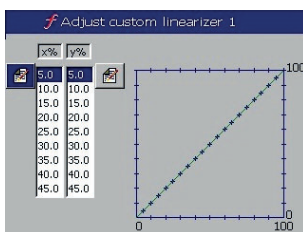
- 1 Select the linearizer to apply to the input.



- 2 Select the linearizer to configure from the **Functions** page:



- 3 Enter the calculated breakpoint values to create the correct curve:



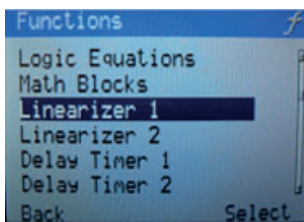
When all breakpoints have been entered, exit and save the configuration as the current configuration. The input begins using the customized curve.

ControlMaster controllers and indicator

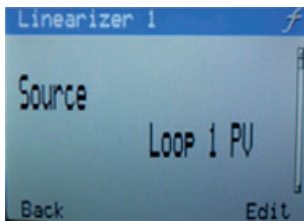
The configuration method is slightly different for ControlMaster because only pre-configured linearizers are located in the linearizer type list selected during input configuration.

On ControlMaster, because custom linearizers can be assigned to any analog signal that allows for non-linear outputs as well as inputs, they are located in the **Functions** page of the configuration level.

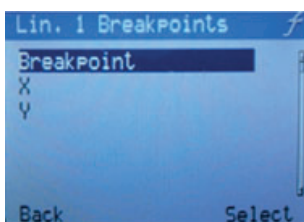
- 1 Select the linearizer to apply to the input:



- 2 Select the input source to assign to the Linearizer:



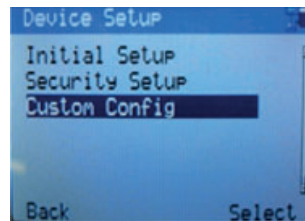
- 3 Select and modify the breakpoints to create the required curve:



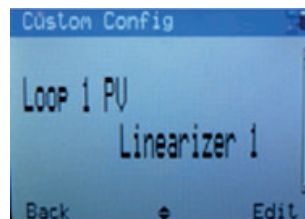
When the linearizer has been fully programmed, ensure its output is assigned as the source of the variable it is to represent.

For example, to monitor or control the fluid level in a non-linear shaped vessel, assign the output of the linearizer to the process variable:

- 1 Enter the **Device Setup** level and select **Custom Config**:



- 2 Assign the Loop 1 PV source to the linearizer:



The process variable displayed is now the linearizer output.

For more information or assistance, contact the Recording & Control team.

Notes

ABB Limited**Measurement & Analytics**

Howard Road, St. Neots
Cambridgeshire, PE19 8EU
UK

Tel: +44 (0) 870 600 6122

Fax: +44 (0)1480 217 948

Email: enquiries.mp.uk@gb.abb.com

ABB Inc.**Measurement & Analytics**

125 E. County Line Road
Warminster, PA 18974
USA

Tel: +1 215 674 6000

Fax: +1 215 674 7183

abb.com/measurement



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