

LINCON Functions for Linear Conversion

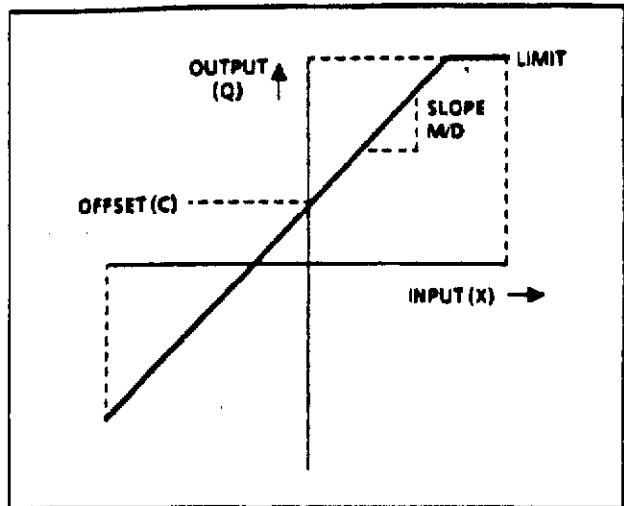
LINCON S11

DESCRIPTION

The LINCON function may be used for signal scaling or for performing calculations. It provides a combination of multiplication, division and addition for up to four variables.

FEATURES

- Four quadrant operation.
- User-programmable slope and offset.
- Automatic limiting at full scale output.



SPECIFICATION

Control language:-

```

      LINCON
X-----SPEC-----VALUE-----Q
      S11           Zm
  
```

Equation:-

$$Q = \frac{M \cdot X}{D} + C$$

Accuracy:-

Exact if D is a factor of M.X; otherwise result truncated to form integer.

Table 1 Program rung data

Sym	Location	Use	Range
X	Rung Input	Input variable	± 32767
Zm	Value location	Start of parameter list (4 locations)	Any write-enabled table usable by Special Functions
Q	Rung output	Result of calculation	Limited at ± 32767

Table 2 Value data

Sym	Location	Use	Range
F	Zm	Fault code and flags	See tables 3,4 (zero = no fault)
M*	Zm + 1	Multiplier	± 32767
D*	Zm + 2	Divisor	± 32767
C*	Zm + 3	Offset	± 32767

* Data set up by user.

Table 3 Fault conditions

Conditions	Result Q	Code in Zm	
		Numeric Value	States ON
Programming error. No VALUE after SPEC.	0	-	-
Programming error. Invalid VALUE location: (a) Number instead of address. (b) Zm in write protected memory. (c) Zm in table not usable by special functions. (d) Zm + 3 beyond end of data tables memory areas.	0	-	-
Divide by zero (D=0)	0	5	0 & 2
Calculated result ≤ -32767	-32767	65	0 & 6
Calculated result $\geq +32767$	+32767	129	0 & 7

Table 4 Meaning of individual Zm flags

State ON in Zm	Condition Indicated
0	Any condition leading to wrong answer
2	Divide by zero
6	Negative limit operative
7	Positive limit operative

APPLICATION NOTES

1. Accuracy limitations

LINCON provides accurate calculation for reasonably large numeric values.

Truncation can lead to a large percentage error in small numeric output. The user is recommended to check whether it will matter if the answer is almost one too small.

2. Example of signal scaling

(a) Required characteristic

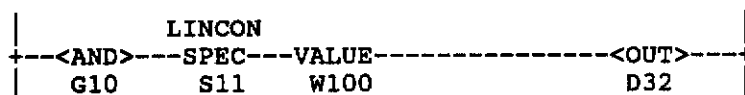
Input (location G10) : 0 to 90 representing required angle in degrees.

Output (location D32) : 6400 to 32000 representing 4 to 20mA corresponding to 0° to 90°.

(b) Calculation of scaling factors

Output range	=	M	= 32000 - 6400
			= 25600
Input range	=	D	= 90 - 0
			= 90
Offset	=	C	= output for zero input
			= 6400

(c) Program rung



(d) Value data

W100	flags	(output by LINCON function)
W101	25600	(multiplier M)
W102	90	(divisor D)
W103	6400	(offset C)

3. Preset value data

It is usual for some of the 'value' data to be calculated during the design stage of the particular application. Such data would be incorporated in the preset data table so that it can be stored and transported on cassette tape. For controllers with a write protected P table it is necessary for the user to arrange copying of the preset data into a working value data. The data sheet for MOVE function T20 shows a typical program employing LOCATE and MOVE functions for this purpose.



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