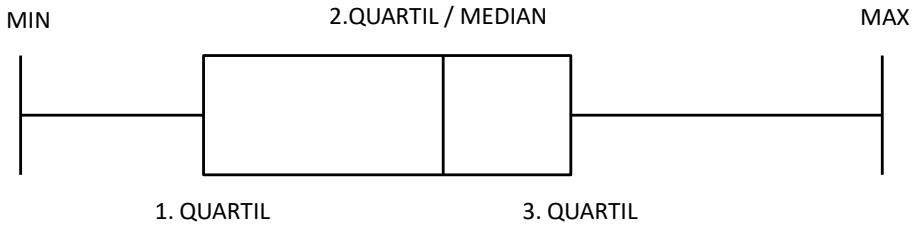
LGF_Boxplot_UDInt

Short description

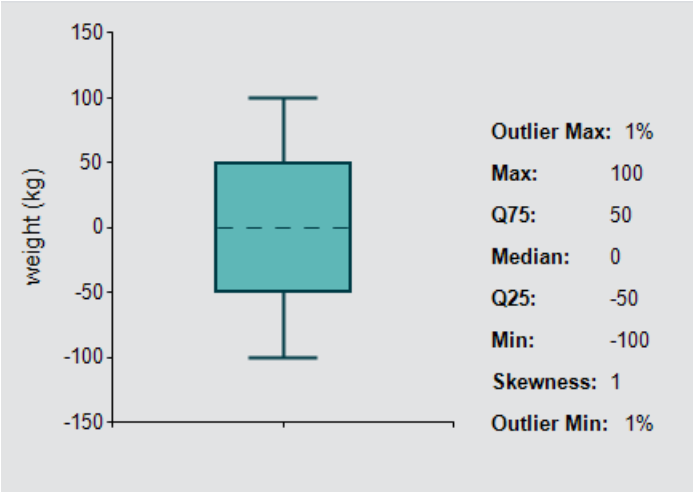
If you want to get an overview of existing data, you can use a Boxplot diagram. A Boxplot shows you in which area the data is located and how it is distributed over this area. A Boxplot consists of the following parameters:

- Minimum (smallest occurring value of the sample)
- Lower or first quartile (below this value are 25% of the sample values)
- Median or second quartile (below this value are 50% of the sample values)
- Upper or third quartile (below this value are 75% of the sample values)
- Maximum (largest occurring value of the sample)

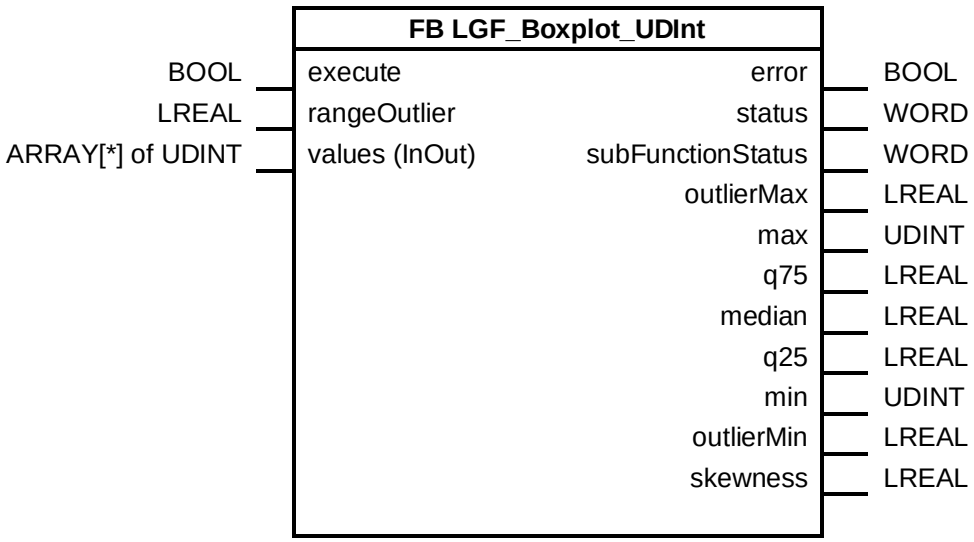


WinCC-Control

To visualize the Boxplot, the Siemens Industry Online Support offers you a Net-Control, which you can use in conjunction with WinCC Runtime Professional. You can find the download under the entry ID: 81662739.



Block



Input parameters

Parameters	Data type	Description
execute	BOOL	Activation of the calculation with each positive edge.
rangeOutlier	LREAL	Outlier detection: • 0: Outlier detection is deactivated • 0-1: Invalid value • >1: Outlier detection is activated.

Input/output parameters (InOut)

Parameters	Data type	Description
values	ARRAY[*] of UDINT	Array that should be used for calculation.

Output parameters

Parameters	Data type	Description
outlierMax	LREAL	Upper outliers in %.
max	UDINT	Maximum Value, not an outlier.
q75	LREAL	3rd quartile or Q75 of the data series.
median	LREAL	2nd quartile or Median of the data series.
q25	LREAL	1st quartile or Q25 of the data series.
min	UDINT	Minimum Value, not an outlier.
outlierMin	LREAL	Lower outliers in %.
skewness	LREAL	Skewness of the data series.
error	BOOL	FALSE: No error TRUE: An error occurred during the execution of the FB.
status	WORD	16#0000-16#7FFF: Status of the FB, 16#8000-16#FFFF: Error identification (see following Table).
subFunctionStatus	WORD	Status or return value of the called FCs and system blocks.

Status and error displays

status	Meaning	Remedy / notes
16#0000	No error	-
16 #7000	Block is not being edited	-
16#7001	First FB call.	-
16#8200	Negative array boundary not allowed	Check the array at the input.
16#8600	Error in command “LGF_ShellSort_UDInt”.	Check the error code in “subFunctionStatus”. Information on this block can be found in the documentation of this block.
16#9101	The parameter “rangeOutlier” type is invalid	Enter a valid “rangeOutlier” value for the parameter: • 0: Outlier detection is deactivated • >1 Valid value.

Principle of operation

The block sorts the data series and then calculates the so-called “five-point summary”:

Characteristic value of the five-point summary	Output parameter of the block
Minimum (smallest occurring value of the sample)	min
Lower or first quartile (below this value are 25% of the sample values)	q25
Median or second quartile (below this value are 50% of the sample values)	median
Upper or third quartile (below this value are 75% of the sample values)	q75
Maximum (largest occurring value of the sample)	max

If outlier detection is activated, the block first calculates the limits. From these limit values, the values are recognized as outliers:

$$Bound_{lower} = q25 - rangeOutlier * (q75 - q25)$$

$$Bound_{upper} = q75 + rangeOutlier * (q75 - q25)$$

The block then calculates new values for the parameters “max” and “min”, which lie within the outlier limits. The outliers are counted and output as a percentage.

To make it easier to judge how the data is distributed, the block also calculates the skew. The skewness lies between the values -1 and 1 with the following meaning:

- -1: extremely left skewed distribution
- 0: symmetrical distribution
- 1: extreme right-skew distribution

The elements of the passed array are sorted in ascending order by the block. The “LGF_Shellsort_UDInt” block is used for sorting.

The parameters are calculated as follows:

Parameters	Formula
q25 (1st quartile)	$q_{25} = x_{(k)}$ with $k = \frac{\left\{\left[\frac{1}{2}(n+1)\right]+1\right\}}{2} = \frac{n+3}{4}$
median / q50 (2nd quartile)	$q_{50} = x_{([n+1]/2)}$
q75 (3rd quartile)	$q_{75} = x_{(n+1-k)}$ with $n+1-k = \frac{3n+1}{4}$ n := number of samples (size of array) If the result of the element to be determined (from which the quartiles can be derived) is not an integer, the quartile is calculated from the linear fraction between the two adjacent samples.
skewness	$\text{skewness} = \frac{(q_{25} + q_{75}) - 2 * \text{q}_{50}}{\text{q}_{75} - \text{q}_{25}}$ **Note:** This is just an approximation.

Further information on libraries in TIA Portal:

- Topic page libraries
  https://support.industry.siemens.com/cs/ww/en/view/109738702
- Guideline on Library Handling
  https://support.industry.siemens.com/cs/ww/en/view/109747503
- Programming Guideline for S7-1200/1500 in chapter “Libraries”
  https://support.industry.siemens.com/cs/ww/en/view/81318674
- Programming Styleguide
  https://support.industry.siemens.com/cs/ww/en/view/81318674