



## *Special – NGS1\_C\_nn*

### ■ Description

Goal of subgraph NGS1\_C is the exact detection of the gap position and the gap width inside the 'Preposition ROI' from subgraph NGS1\_b.

The detection path is:

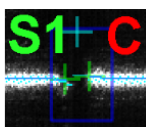
- Laser line tracking from left and from right side ('two lines').
- If there is a gap (a break), the position is found.
- If there is no break (line ends are crossing over each other), the position result from the second detection ('one line') of subgraph NGS1\_B is chosen or the gap searched again in a separate "Dark gap ROI" (above the laser line) in the grey image.
- In a separate "Light gap ROI" (above the laser line) a "Bright gap" is searched. If a "Bright gap" is found, and before was a zero gap detected ('two lines' had no break), then the result from the bright gap detection will be used.

So we have 4 possible position results:

- a break from 'two lines'
- a zero gap from 'Dark gap'
- a zero gap from second detection of subgraph NGS1\_B ('one line')
- a 'Bright gap' position

nn: declaration of the actual subgraph version (here: version 42).

### ■ Icon



NGS1\_C\_42

Comment for the new graph

■ Parameters

Filter Groups of NGS1\_C\_42

G00 INIT

G10 edge detection

G20 gap dark detection

G22 gap bright detection

G30 logic

G35 ROI gaplight

G00 INIT

Filters of G00 INIT

P01 ImageArithmetic

P02 BinarizeDynamic

P03 offset Binarization

P04 linefeature -1 or grey dark 1

P05 draw PositionCrosses 1 or 0

Attributes of P01 ImageArithmetic

Verbosity level

None

TimeWindow

1

frames

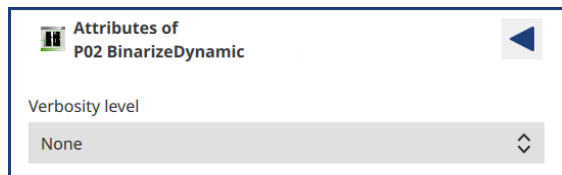
Operation

Mean

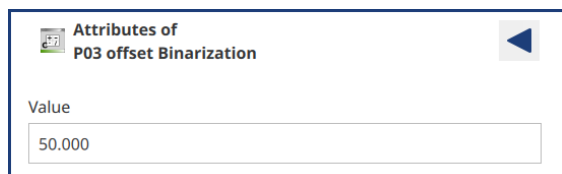
Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.





TimeWindow	<p>Number of single camera images that are "laid over each other" for the analysis.</p> <p>Not suited for curved weldings!</p>
Operation	<p>Div. functions for the image overlaying, especially:</p> <p><b>SUM</b>      Sum over "TimeWindow" images</p> <p><b>Mean</b>      Mean filter over "TimeWindow" images</p> <p><b>Median</b> Median filter over "TimeWindow" images</p> <p>The grey image calculations will be done in the original image ROI (not in the overlayed)!</p>



Parameter	Comment
Verbosity level	<p>Selection of verbosity level. Larger verbosity levels offer more overlay information.</p> <p>Display of the binarized image area in the "Preposition ROI".</p>





Parameter	Comment
Value	<p>Used for detection of greylevel values for the gap. The higher the value, the darker the gap must be compared with the blank intensity.</p> <p>[Greylevel]</p>


**Attributes of**  
**P04 linefeature -1 or grey dark 1**


Number

Parameter	Comment
Number	-1      Use resultat from 'one line'
	1        Use resultat from 'Dark gap'



**Attributes of**  
**P05 draw PositionCrosses 1 or 0**









Number

Parameter	Comment
Number	0        No marking
	1        Marks the found gap position with a cross

## G10 edge detection

Fine search of the gap position from the 'two line' detection.

**Filters of**  
**G10 edge detection**


 P01 fine LineTracking left  
 P02 fine LineTracking right  
 P03 offsetLeft px  
 P04 offsetRight px  
 P05 percentage pos cross  
 pos cross left  
 pos cross right



**Attributes of  
P01 fine LineTracking left**

Verbosity level  
Low

Tracking Threshold  
100

Double Tracking bool  
0

upper or lower  
1

mean x pixel  
1

search area y upper pixel  
3

search area y lower pixel  
3

mean area y pixel  
5

Maximum Gap Width  
0

Maximum Number of Gaps  
0

Maximum height jump  
3

Starting Point Width Pixel  
5

Starting Point Height Pixel  
5

**Attributes of  
P02 fine LineTracking right**

Verbosity level  
Low

Tracking Threshold  
100

Double Tracking bool  
0

upper or lower  
1

mean x pixel  
1

search area y upper pixel  
3

search area y lower pixel  
3

mean area y pixel  
5

Maximum Gap Width  
0

Maximum Number of Gaps  
0



Maximum height jump  
3

Starting Point Width Pixel  
5

Starting Point Height Pixel  
5

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Tracking threshold	Minimum grey scale value for an image pixel that it's defined to belong to the laser line. [Greylevel]
DoubleTracking	0 The laser line is tracked from left to right side. 1 The laser line is tracked first from left to right side, and then once again from right to left side.
upper or lower	
mean x	Number of pixels in X direction, used for averaging the brightness in order to define the next point of the laser line. [Pixel]

search area y	This parameter defines the maximum limits for the search area in Y direction, used for searching the next tracking point. [Pixel]
mean area y	Number of pixels in Y direction, over which the "Average brightness in X direction" is averaged, in order to define the next laser line point. [Pixel]
Maximum Gap Width	Maximum allowed width of a laser line interruption: If the number of side by side laying pixels, having a lower grey scale value than the search threshold, exceeds this parameter figure, the line interrupts counter figure is raised by 1. [Pixel]
Maximum Number of Gaps	Maximum number of laser line interrupts: If the number of line interrupts per laser line becomes higher than this parameter, the line search is stopped and a line interrupt warning is released.
Maximum height jump	Maximum interrupt in Y direction: If the height jump of the laser line exceeds this parameter, the line search is stopped. [Pixel]
search area y	This parameter defines the maximum limits for the search area in Y direction, used for searching the next tracking point. [Pixel]
Starting Point Width	Width of the search area from the left resp. right image border to find the vertical start position of the laser line. [Pixel]
Starting Point Height	Height of the search area on the left resp. right image border to find the vertical start position of the laser line. [Pixel]


**Attributes of P03 offsetLeft px**


Value


**Attributes of P04 offsetRight px**


Value

Parameter	Comment
Value	Constant offset to shift the left resp. right found gap rim. [Pixel]



**Attributes of  
P05 percentage pos cross**

Verbosity level  
 None

Weighting Percent  
 50

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information. Marks with a cross the found gap position.
Weighting	Position (in %) between Minimum and Maximum.

**Attributes of  
pos cross left**

Verbosity level  
 None

**Attributes of  
pos cross right**

Verbosity level  
 None



Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information. Marks with a cross the found left resp. right gap rim position.

## G20 gap dark detection

Fine search of the gap position with the 'Dark gap' detection.

**Filters of  
G20 gap dark detection**

P01 low pass grey level  
 P02 extremum dark gap




**Attributes of P01 low pass grey level**


Verboesity level  
None

Filter length N Pixel  
1

Kind of low pass  
Mean

Parameter	Comment	
Verboesity level	Selection of verboesity level. Larger verboesity levels offer more overlay information.	
Filter length	During the 'Tracking' on the laser line, the grey scale values of the found intensity values are averaged over "Filter length" pixel. The higher the value the flatter is the intensity curve for the analysis. [Pixel]	
Kind of low pass	<b>Mean</b>	Mean filter over "Filter length" pixel
	<b>Median</b>	Median filter over "Filter length" pixel


**Attributes of P02 extremum dark gap**


Verboesity level  
None

Extremum type  
Minimum

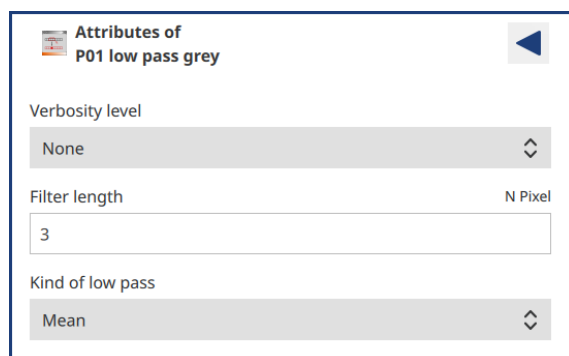
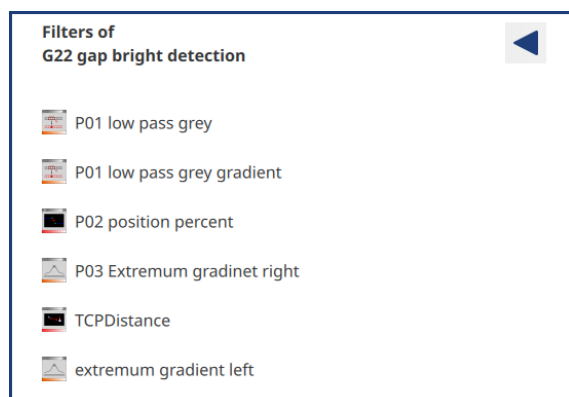
Parameter	Comment	
Verboesity level	Selection of verboesity level. Larger verboesity levels offer more overlay information.	
Extremum type	<b>Minimum</b>	The lowest intensity is the gap position
	<b>Maximum</b>	The highest intensity is the gap position





## G22 gap bright detection

Fine search of the gap position with the 'Bright gap' detection.



Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Filter length	During the 'Tracking' on the laser line, the grey scale values of the found intensity values are averaged over "Filter length" pixel. The higher the value the flatter is the intensity curve for the analysis. [Pixel]
Kind of low pass	<b>Mean</b> Mean filter over "Filter length" pixel <b>Median</b> Median filter over "Filter length" pixel

Verbosity level  
 None

Filter length N Pixel  
 3

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Filter length	During the 'Tracking' on the laser line, the grey scale value changes of the found intensity values are averaged over "Filter length" pixel. The higher the value the flatter is the intensity changes curve for the analysis. [Pixel]

Weighting Percent  
 50

Parameter	Comment
Weighting	Position (in %) between Minimum and Maximum.

Verbosity level  
 None

Extremum type  
 Maximum

Search direction  
 From right

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.



Extremum type	<b>Minimum</b>	Searches the smallest intensity change of the laser line
	<b>Maximum</b>	Searches the biggest intensity change of the laser line
Search direction	<b>From left</b>	Check the intensity changes from the left to the right side
	<b>From right</b>	Check the intensity changes from the right to the left side

**Attributes of TCPDistance**

Verbosity level  
 None

Type of laser line  
 Line laser 1

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information. Marks the actual TCP position with a green cross.
Type of laser line	<b>Line laser 1</b> Do not use <b>Line laser 2</b> For SOUVIS6000 applications <b>Line laser 3</b> Do not use <b>GrayscaleImage</b> Do not use <b>DistanceFromScannerCenter</b> Do not use

**Attributes of extremum gradient left**

Verbosity level  
 None

Extremum type  
 Minimum

Search direction  
 From left

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Extremum type	<b>Minimum</b> Searches the smallest intensity change <b>Maximum</b> Searches the biggest intensity change
Search direction	<b>From left</b> Check the intensity changes from the left to the right side <b>From right</b> Check the intensity changes from the right to the left side

G30 logic

Filters of  
G30 logic

 maxYoffsetOverlapp in px

 maxZdiffforZeroGap in px

Attributes of  
maxYoffsetOverlapp in px

Value

5.000

Parameter	Comment
Value	Gives a measure how much the two found edge positions horizontally may overlap to be detected still as a gap and not as a zero gap (crossing over). [Pixel]

Attributes of  
maxZdiffforZeroGap in px

Number

5.000

Parameter	Comment
Number	Gives a measure how big the vertical distance of the two found edge positions at least must be to be detected still as a gap and not as a zero gap (crossing over). [Pixel]



## G35 ROI gaplight

Filters of  
G35 ROI gaplight



P01 light threshold bright gap



Attributes of  
P01 light threshold bright gap



Number

Parameter	Comment
Number	The mean intensity in the "Light gap ROI" must reach at least the value 'Number' that a bright gap is detected. [Greylevel]





■ Measured values for plotter

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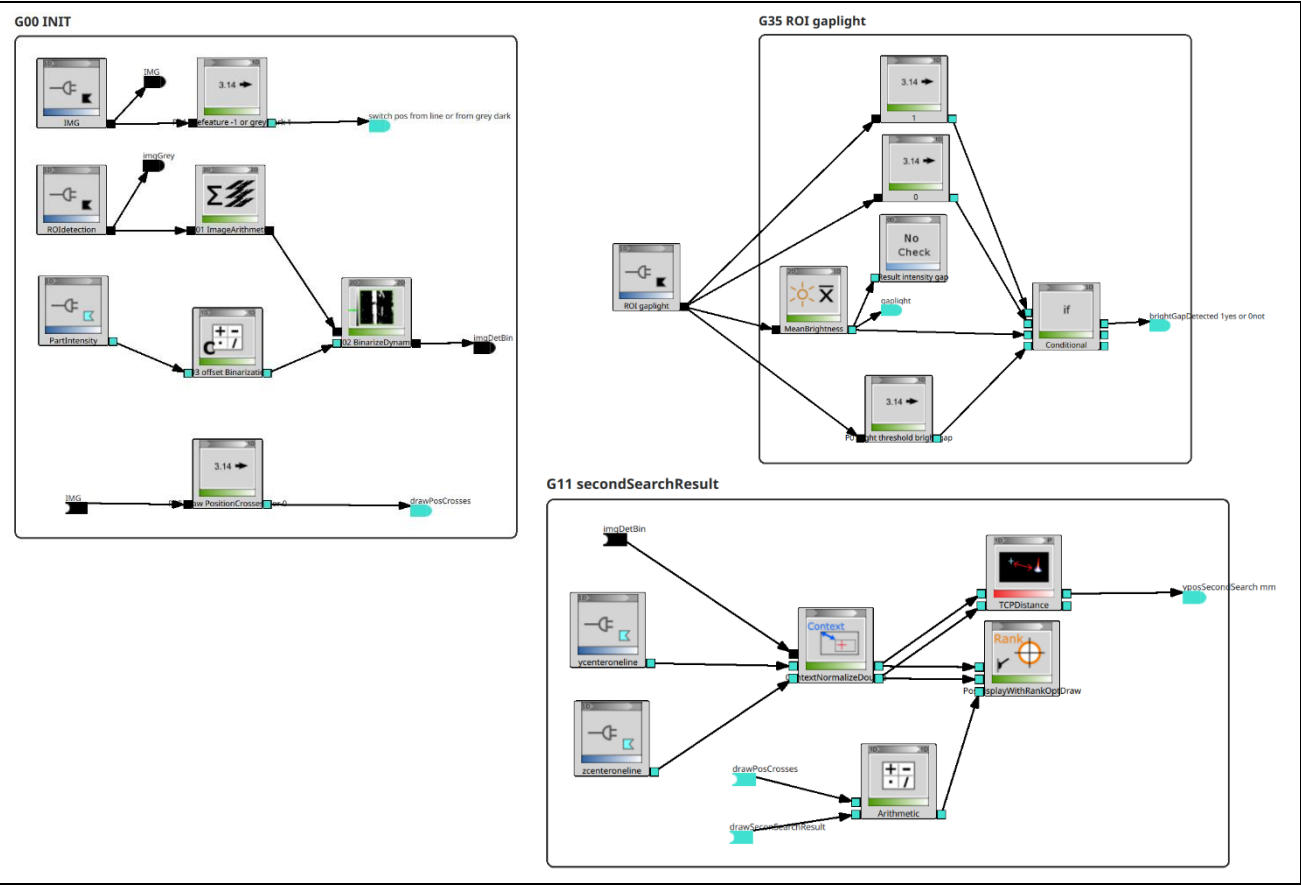
■ Subgraphs interface

IN bridges

OUT bridges

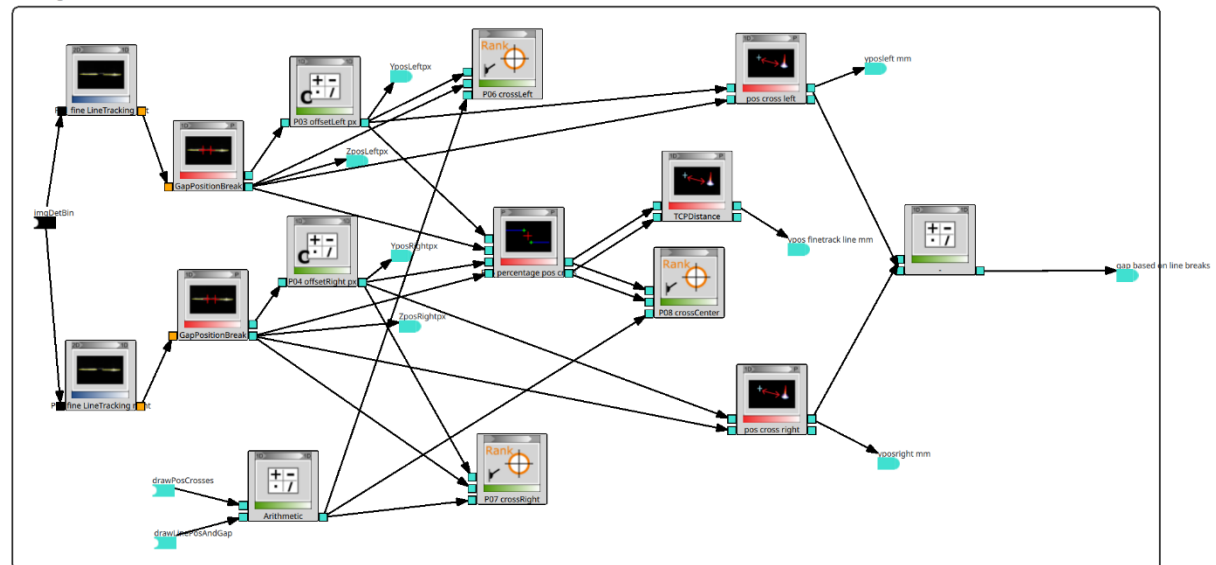
 <b>image</b>	IMG ROI detection ROI greydark ROI gaplight	 <b>value</b>	ypos raw mm gap raw mm
 <b>line</b>	doubleline		
 <b>value</b>	PartIntensity		

■ Graph block diagram

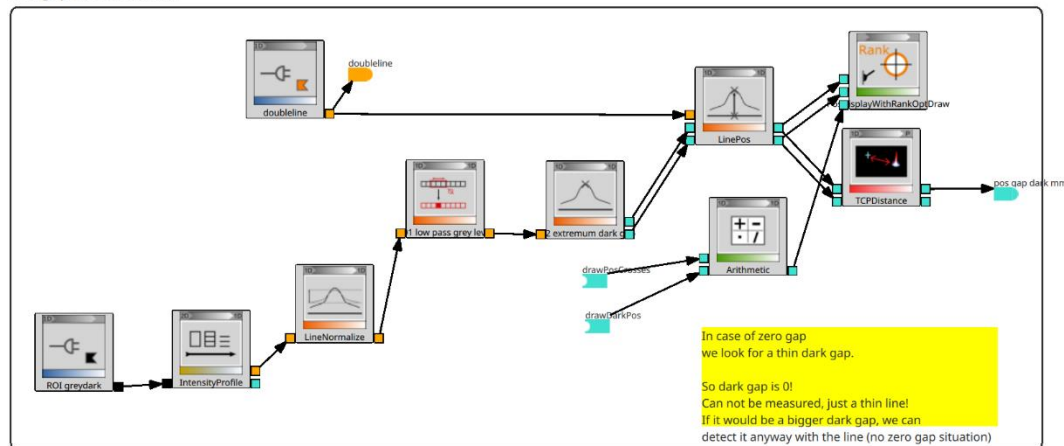




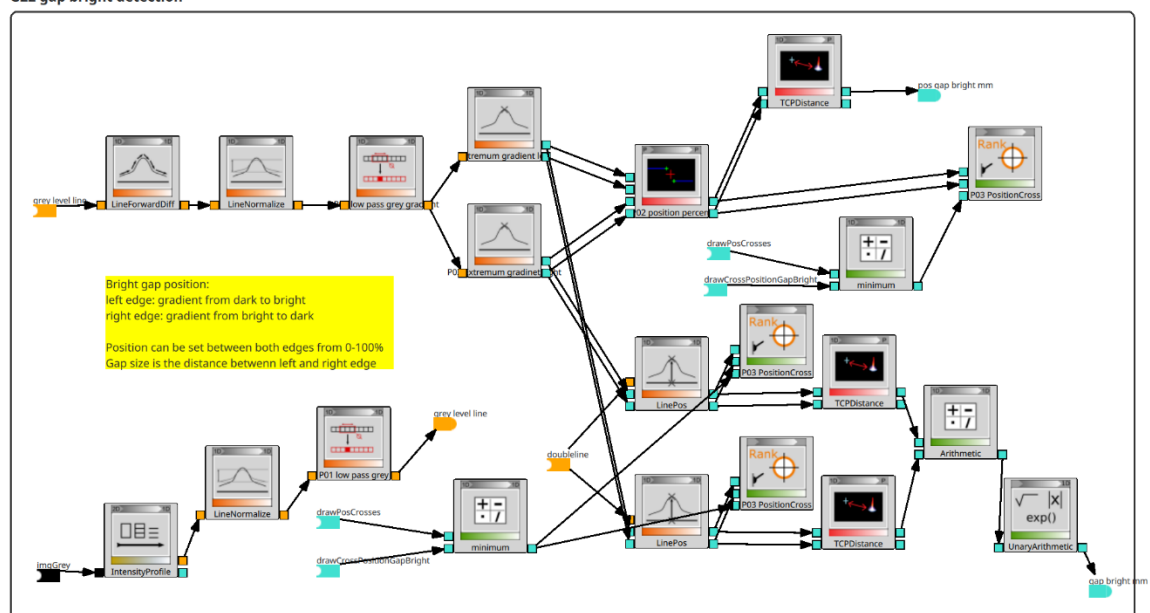
## G10 edge detection



## G20 gap dark detection



## G22 gap bright detection



## G30 logic

checks if zero gap situation is present  
(it is when Ypos left > Ypos right)  
Also a bit overlap is possible in case of step height

Was bright gap (process light in gap) detected AND also zero gap (Ypos left > ypos right)?  
Only in case both is true we want to use later bright gap measurement.

Yes: returns 1  
No: returns 0

Final position result:

In case we have zero gap AND bright gap detected we pass the position result from bright gap calculation

Else:

If no bright gap and no zero gap we pass the position result based of line detection  
If no bright gap but zero gap we pass the dark gap position result OR the position result from second search (choose via switch in INIT group)

returns the position from second search OR the position from dark gap detection.  
Depends on the switch in INIT group.

Final Gap size result:

In case we have zero gap AND bright gap detected we pass the result from bright gap calculation

Else:

If no bright gap and no zero gap we pass the normal line based real gap size  
If no bright gap but zero gap we pass: gap = 0

