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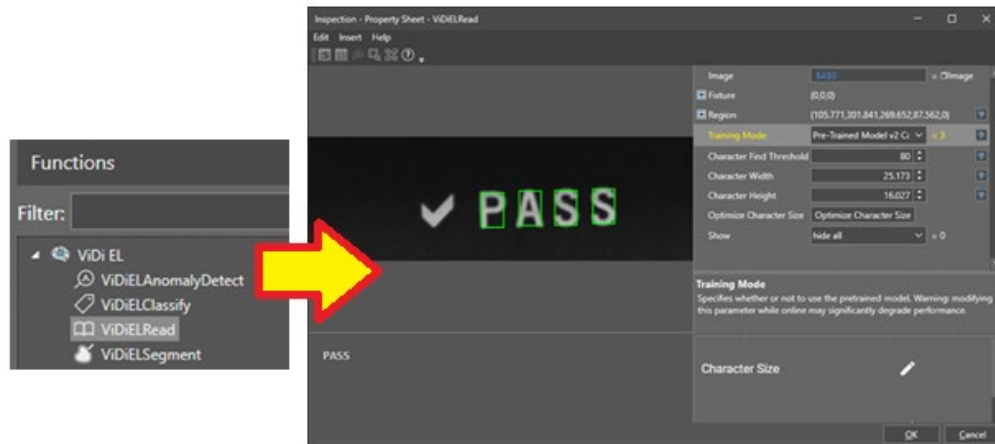
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ELRead Overview

The *ViDiELRead* tool enables automatic text recognition, including letters, numbers, and symbols, from images or live camera feeds. It offers two operational modes:

- User-Trained: Allows you to define specific text patterns by labeling examples and is ideal for achieving higher accuracy on user-specific characters or fonts.
- Pre-Trained: Uses built-in models for immediate deployment.

Additionally, the tool supports three fielding options to accurately detect and interpret text within different image contexts (Variable, Fixed and Flexible Fielding).



ELRead Tool Considerations

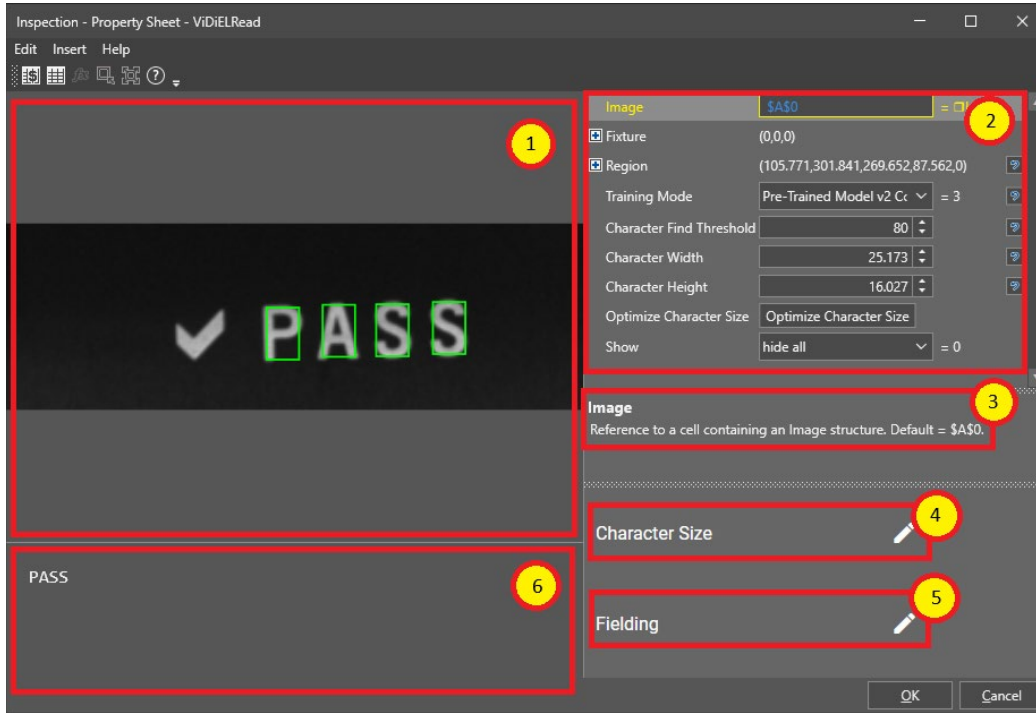
The ELRead tool is based on powerful Artificial Intelligence algorithms, allowing it to read text in challenging situations where conventional tools are unlikely to be able to read text robustly and reliably.

It is important to keep in mind that the greater the reading challenge, the longer the execution time will be for the ELRead tool compared to text where the letters can clearly be distinguished from the background.

Some relevant aspects to consider in the image are:

- Contrast: Difference in tones between the text and the background.
- Homogeneous background: The text background can have different textures, lighting changes, different background colors, material blends, shadows, etc.
- Text consistency: Ideally, the text should be as consistent as possible in size, font type, color, and thickness.
- Font type: It is recommended that a single font be used.
- Size: ELRead has the ability to read text with variations in text size. The more homogeneous the size, the less runtime the tool requires.

1. ELRead Tool Settings



Element	Description
1	Image display
2	Tool settings
3	Quick help from last element selected on Tools settings
4	Manual character size editor
5	Fielding options
6	Tool previously found character(s) result

1.1 Image Display

Shows current image where the tool is executed. This window also displays results. Every character has a bounding box around the letter or number.

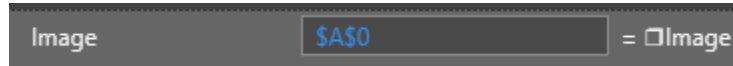


1.2 Tool Settings

These are the properties of the tool. This area allows you to interact externally with graphic controls on the spreadsheet to modify parameters without opening the tool settings.

1.2.1 Image

Commonly this attribute is linked to Cell A0, but it can be assigned to another cell where we apply filters or any other tool that gives an #Image as a result.



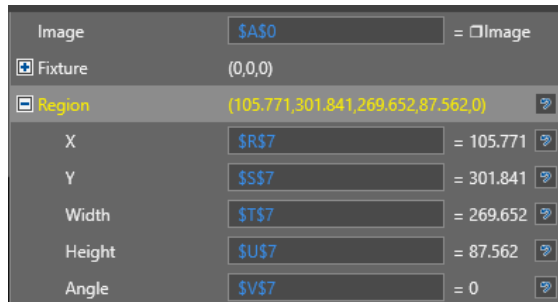
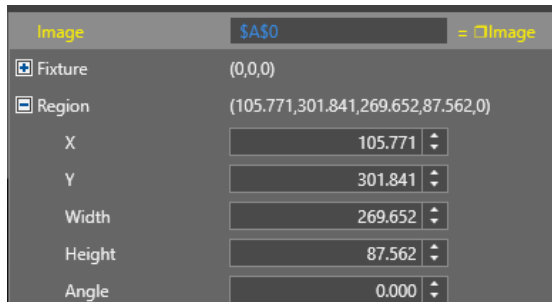
1.2.2 Fixture

These settings are where values of **X**, **Y**, and **Angle** are assigned. This tool can use coordinates manually assigned or can take the result from any other cells that gives feedback on how the ROI must be positioned within the full image. For example, a result from a RedLine Pattern can be linked (Row, Col, Angle)



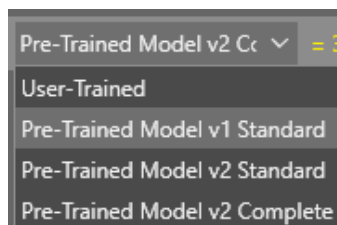
1.2.3 Region

This is the description of where the ROI must work on the image, if tool is manually assigned then commonly you will see numerical values and those values will take the relative values from the Image and **Fixture** settings. If on **Region** values are cells references that means that the values are taken from cells assigned.



1.2.4 Training Mode

This property gives the opportunity to declare the type of model to be used during the reading process, in general there are two main options, **User Training** and **Pre-trained** (default).



- **User-Trained:** Type in the characters manually when training the tool. Results in more-accurate reads.
- **Pre-Trained Model v1 Standard:** This model requires a tight bounding box for character size and works best for monospace fonts. Supports uppercase characters, numerical digits, and the following special characters: ':', '/', '-', '+', '&'

- **Pre-Trained Model v2 Standard:** This improved model can recognize fonts with variable character size and requires a bounding box that fits the average character size. The model is more robust and tolerates the character size changes much better. Supports uppercase characters, numerical digits, and the following special characters: ':', '/', '-', '+', '&'
- **Pre-Trained Model v2 Complete:** This improved model provides additional character support on top of the v2 Standard model. The model is more robust and tolerates the character size much better. Supports uppercase and lowercase characters, numerical digits, all printable ASCII symbols and the '€' character.

Note that **Pre-trained v1** allows -10% to +5% on character size tolerances, while **Pre-training V2** allows -15% to +30%.

Training Mode	Pre-Trained Model v2 Cc ▾ = 3
	User-Trained
	Pre-Trained Model v1 Standard
	Pre-Trained Model v2 Standard
	Pre-Trained Model v2 Complete

1.3 Character Find Threshold

Defines the minimum confidence threshold for classifying a candidate as a character. The final scores combine the likelihood of being a character and matching a specific character class. As a result, low-scoring characters can still appear as possible characters.

You can set the threshold between 0 and 100. The default value is 50.

This characteristic is enabled when **Training Mode** is on **Pre-trained v2 Standard** or **Complete** is selected.

Character Find Threshold	80 ▴ ▾
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1.4 Character Width

This setting allows to manually assign or declare an external reference on the value of the width character on the image could be. This value is in image pixels.

Character Width	25.173 ▴ ▾
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1.5 Character Height

Same as Character Width, but defines the number of pixels that the height of the character could be on the image.

Character Height	16.027 ▴ ▾
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1.6 Optimize Character Size

Pressing this button, the ELRead Tool will search for an estimated amount of Height and Width that the character could be. This estimation is based on the actual text selected by the Region parameter.

To improve the results, the recommendations is to define a single font type. The ROI should have only one line of text and should avoid a mixture of font sizes.

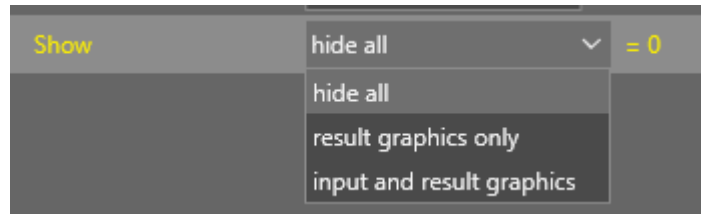
When ELRead finishes the optimization process, it will rewrite the Character Width and Character Height parameters.

Optimize Character Size	Optimize Character Size
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1.7 Show

Select the type of graphic to overlay on the image.

- **Hide all:** No results graphics will be displayed on the processing image
- **Results graphics only:** Displays the bounding boxes on each character identified by the tool
- **Input and result graphics:** Shows bounding box on each character plus the ROI where the ELRead tool is executing within the image



1.8 Character Size



Clicking the Pencil allows you to manually declare a proposed bonding box on the character by pointing and clicking on the cyan box displayed on the image. Position and size are the only characteristics you are allowed to adjust.



To accept the assigned bonding box, click the Check. Clicking X will cancel the bonding box assignment.



1.9 Fielding

To access Fielding options, click the Pencil.



1.9.1 Fielding Type options

ELRead tool has three options to interact with the text on the ROI:

1. Variable Number of Characters

The tool reads all the characters on the image.

Fielding Type

☒ Variable number of characters

☐ Fixed number of characters

☐ Flexible Fielding

Acceptable Characters

☐ Any character

☐ Numerical characters only

☐ Alphabetical characters only

☐ Alphanumeric characters only

Acceptable Characters: Specify what type of characters the *ViDIELRead* tool recognizes.

- Any character: The tool searches for letters, numbers, and symbols (for example <, \$, ?)
- Numerical character only: The tool searches for numbers only
- Alphabetical characters only: The tool searches for letters only
- Alphanumeric characters only: The tool searches for numbers and letters

Number of lines: To enter the number of rows in the **Number of lines** input field, first check the **Specify the number of lines** option. Defining this value allows the ELRead tool to have the capability to read as many lines defined are on the image.

Number of lines

☒ Specify the number of lines

Number of lines

1

2. Fixed number of characters

Fielding Type

☐ Variable number of characters

☒ Fixed number of characters

☐ Flexible Fielding

Patterns

Pattern Name	Pattern	
ROW1	A\\d\\d\\d	Delete Edit

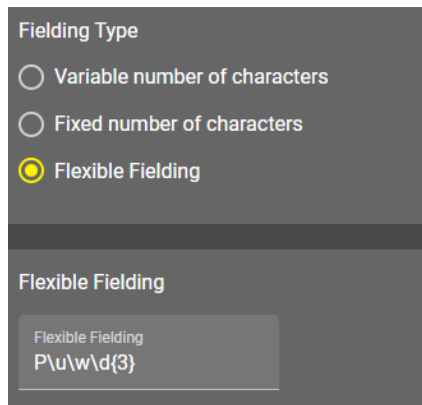
The tool reads a character pattern or character patterns on the image. Consider that the tool recognizes characters that do not fit the provided pattern but will return an error as a result.

The pattern uses a simple regular expression style composed of constant characters (alphanumeric and special characters) and metacharacters.

You can use the following metacharacters:

- "\d": matches any numerical character [0-9]
- "\l": matches any alphabetical character [a-z, A-Z]
- "\w": matches any alphanumeric character [a-z, A-Z, 0-9]
- "\" matches any character.

3. Flexible Fielding



Flexible fielding allows you to capture specific texts and filter out false detections. You can define flexible fielding by using a series of fixed anchoring and flexible Regex-like patterns. Flexible fielding filters out candidates for different characters based on these patterns, finding the combination that best matches the specified patterns.

You can capture specific portions of the flexible fielding. A string output reports the detected characters that match a capture group. The string output does not report other detected characters. You can use the non-captured groups to align the text or to filter out false or flaky detections.

Flexible fielding estimates a fielding score from the individual scores of the fielded characters.

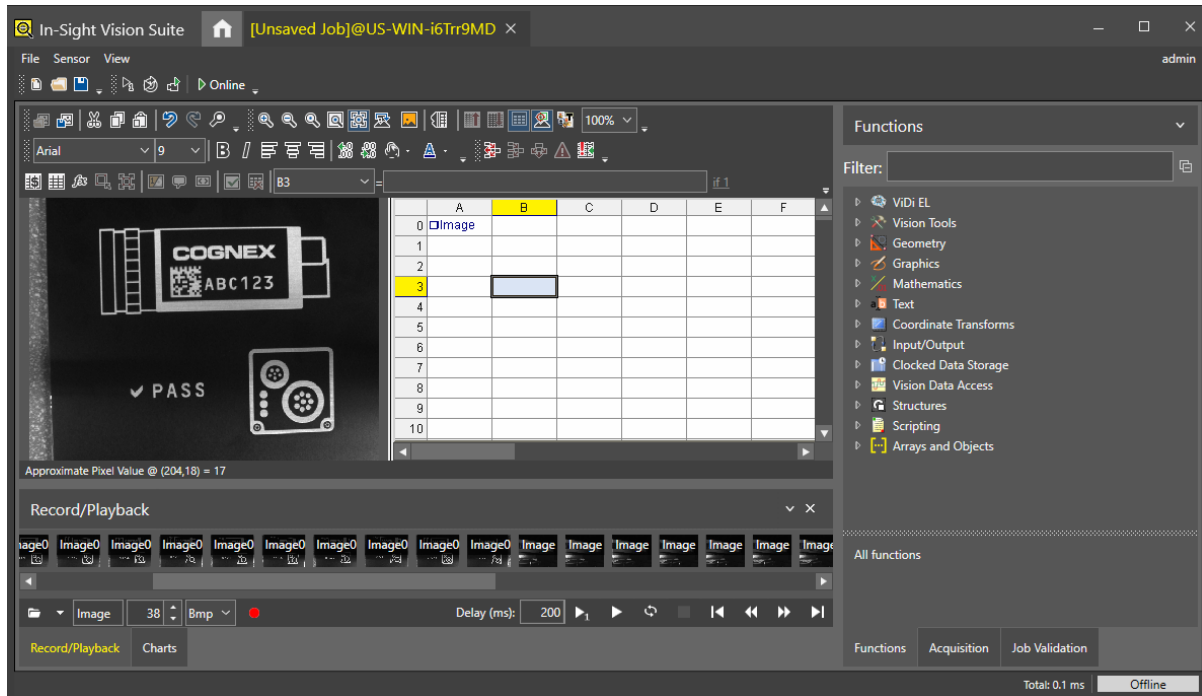
Make sure that all expected characters are read correctly before applying the flexible fielding expression. If needed, adjust the character size, and the character find threshold, or both.

Flexible fielding provides the following metacharacters for creating regular expressions:

- ".": Any single character including newlines
- "\d": Digit [0-9]
- "\l": Lowercase letter [a-z]
- "\u": Uppercase letter [A-Z]
- "\w": Alphanumeric [a-zA-Z0-9]
- "[...]": Character set, for example [0-9A-Z] matches digits or uppercase A-Z
- "*", "+, ?": Zero or more, one or more, zero or one of the preceding characters

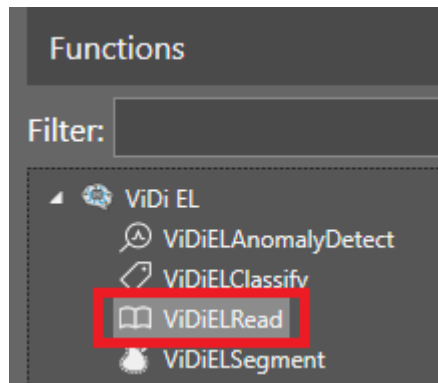
- "{n}, {n,}, {n,m}": Exact, minimum, or range of repetitions
- "()": Captures part of the matched pattern

The following section goes through a typical setup for the ELRead tool and makes modifications to allow operators to interact with the tool from an HMI within the spreadsheet.

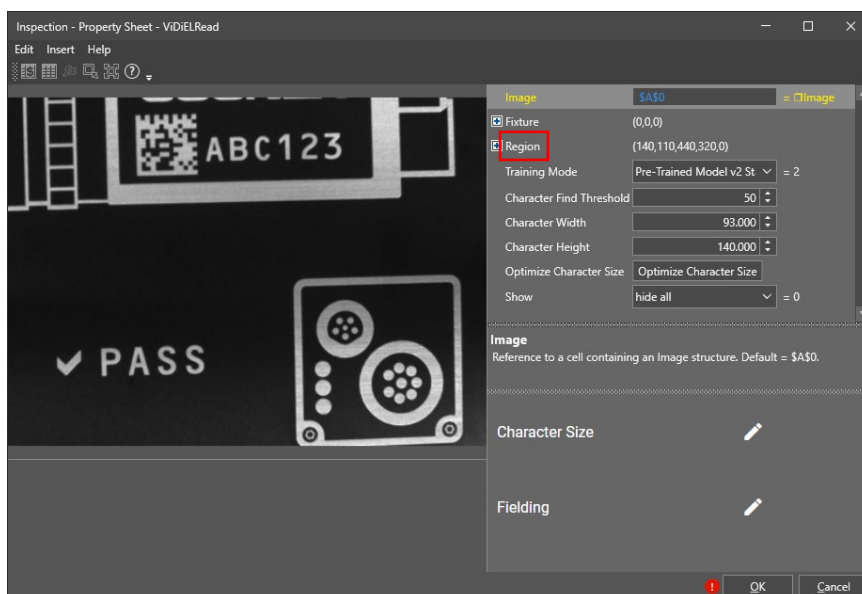


2.1 Using Optimize Character Size

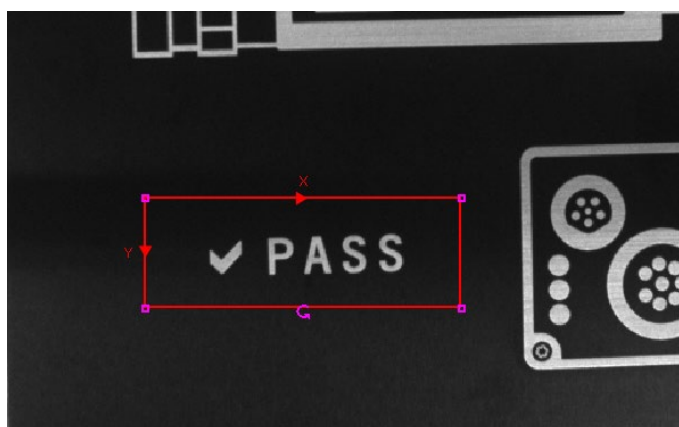
1. Create a new Spreadsheet program and open an image to apply ELRead tool.
2. In Functions, search for Vidi EL group and drag and drop ELRead tool on Cell B2.



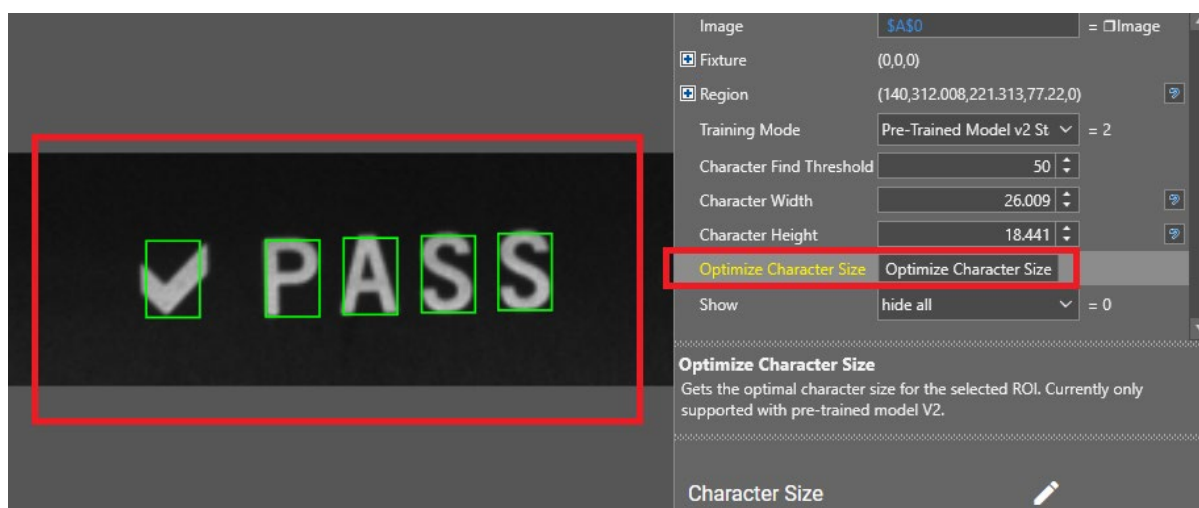
3. When the vision tool is dropped on the cell, the properties window will appear.



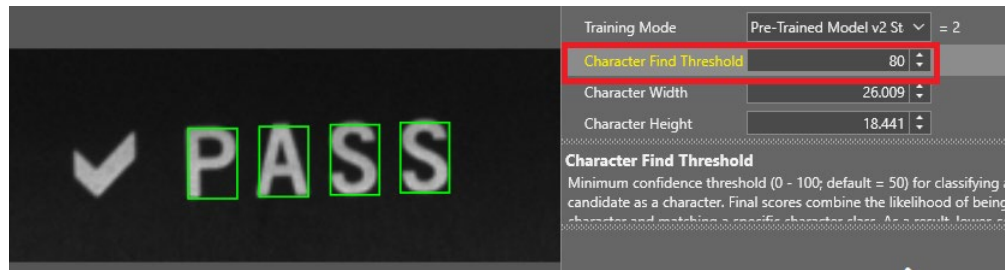
4. Double click on Region setting to define the ROI where the tool will be working and modify as needed on the app. The ROI can be adjusted on position, size, and angle. When the ROI is on the desired area, press **Enter**.



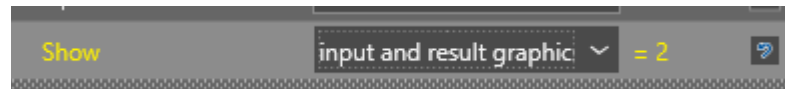
5. Click **Optimize Character Size**. ELRead will automatically search for text on the image and propose a bounding box for the text and display a green rectangle on each character found on the image.



6. Select **Character Find Threshold** to avoid finding extras that are not part of the text.



7. On **Show**, select **Input and result graphics**.



8. Click **OK** to close ELRead tool setting window and display the spreadsheet.

	A	B	C	D	E	F	G	H	I
0									
1									
2			String	Passed	Index	Char	Score	2nd Char	2nd Score
3		VIDIELRe	PASS	1.000	0.000	P	99.532	J	0.000
4					1.000	A	99.309	1	0.000
5					2.000	S	99.902	:	0.000
6					3.000	S	99.902	:	0.000
7									

2.2 Complementing the Program for HMI Use

Before you create a simple program capable of reading text on the image, some modifications need to be made to allow a user to make certain changes without disrupting the job. To access any parameter within the tool, you must stop the inspection process and access Cell B3 to make any modifications.

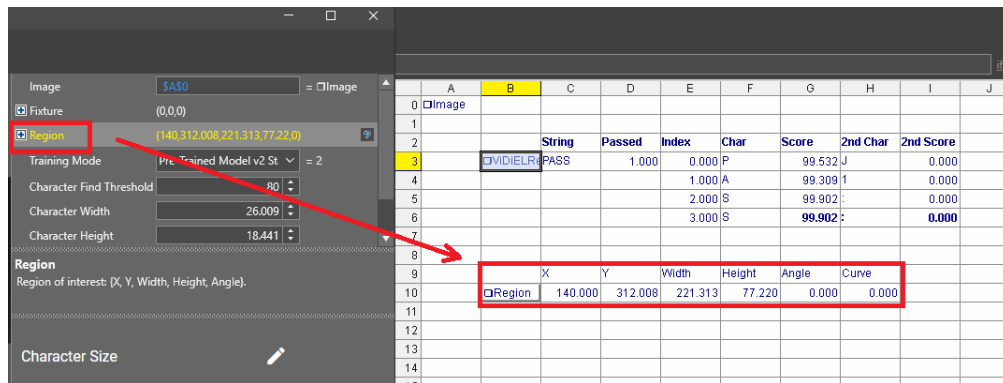
Note: Any changes to the tool's ROI or expected character size will cause the tool to take more time for each change that is made.

Here are some tips and tricks to improve the vision tool.

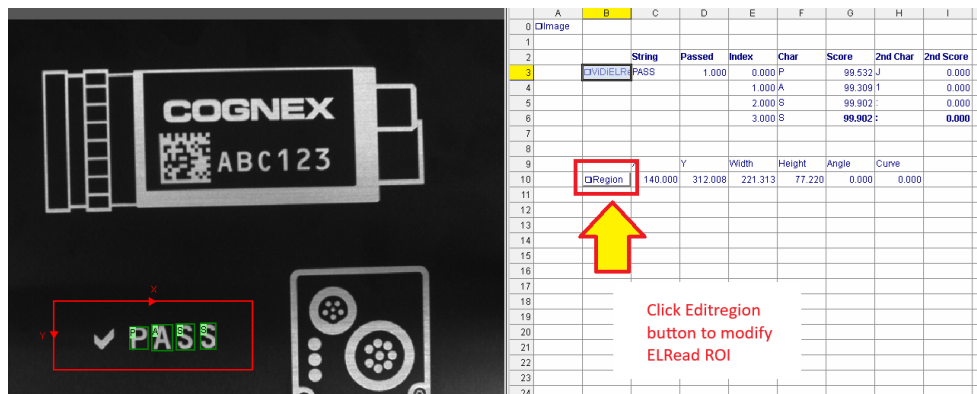
2.2.1 Create external region user control

Some applications require that users move the ROI.

1. Double click the ELRead tool to display settings window.
2. Drag and drop the **Region** setting on a cell with a clear row on the spreadsheet. Consider that this procedure will automatically insert labels and extra functions, so we recommend dropping the **Region** setting where there are two clear rows. In our example, the Region setting is dropped on Cell B9.



- Click **OK** to close settings window.
- On Cell B10 is now a user control button that allows to modify the Region where the ELRead tool will extract information on the image. So, there is no need to access the ELRead settings window again. From now on if user needs to modify the region just click on cell where the **EditRegion** control was created.



Before ELRead ROI modification.

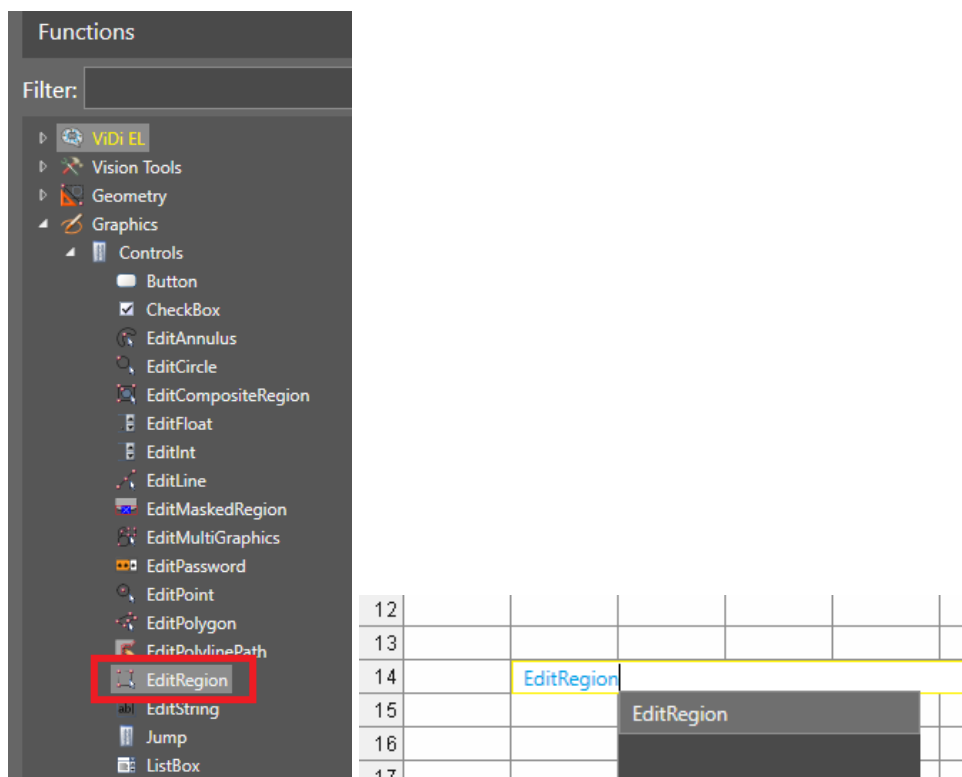


After ELRead new ROI assigned

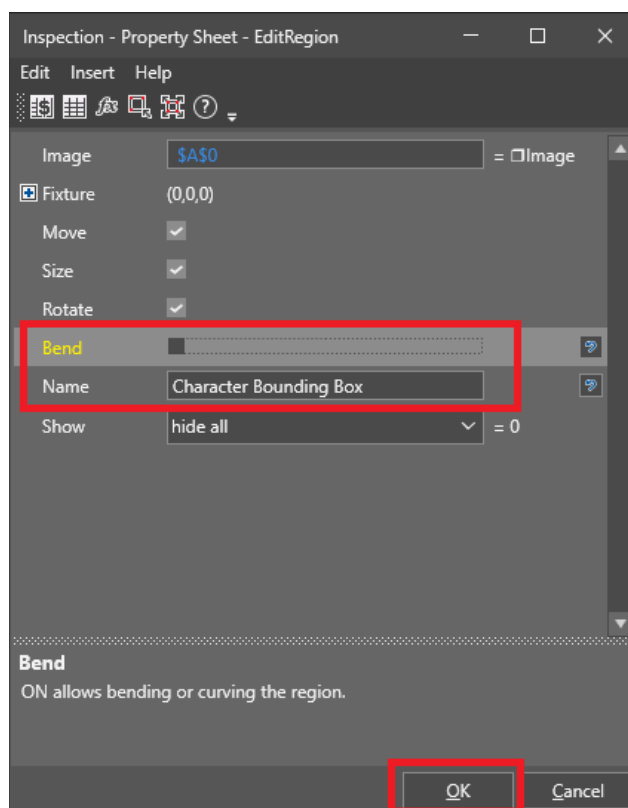
2.2.2 External Definition for Character Height and Width

Like the ROI tool, there is the capability to generate a user control that externally gives graphical information to the Height and Width of a character.

- On Cell B14, use the function control called **EditRegion**. Search for the control in **Functions->Graphic->Controls->EditRegion** or manually type the name, EditRegion, directly on the cell and press **Enter**.



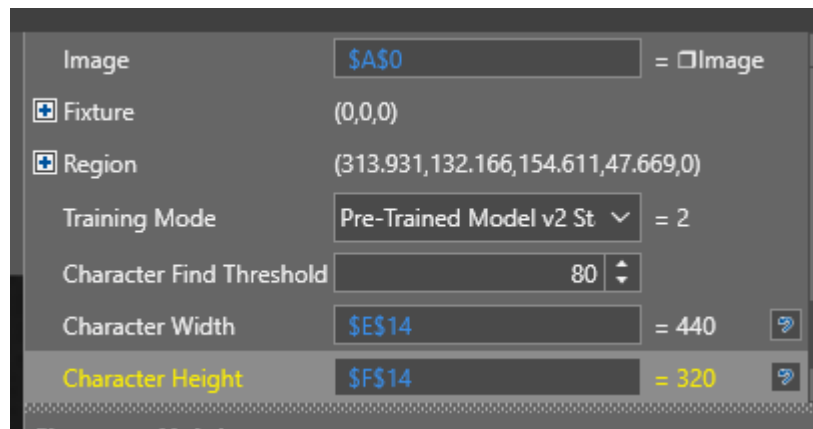
2. Uncheck the **Bend** setting.
3. Enter a name for the tool in the **Name** setting.
4. Click **OK** to close control settings window.



- On the spreadsheet, Rows 13 and 14 will be added. For our purpose, only Cells E14 and F14 are needed.

	A	B	C	D	E	F	G	H	I
11									
12									
13			X	Y	Width	Height	Angle	Curve	
14		Character	140.000	110.000	440.000	320.000	0.000	0.000	
15									

- Double click on Cell B3 to access the ELRead settings window.
- To assign Cell E14 and F14 **Character Width** and **Character Height** settings, double click on **Character Width** text. This allows you to select a cell to be assigned.
- Click Cell E14 and press Enter.
- Do the same for Character Height and link it with Cell F14.



- Click **OK** to close the ELRead tool window settings.
- You can modify Height and Width of the Character bounding box with Cell B14, where the new **EditRegion** button was placed. When any modification is done by this new button, the information will be passed automatically to the ELRead tool (remember that this will cause the tool to take a little longer on the first inspection with the new setting but will be consistent after subsequent inspections until another change is made).

	A	B	C	D	E	F	G	H	I
0	Image								
1									
2			String	Passed	Index	Char	Score	2nd Char	2nd Score
3		aVIDIELRe	ABC123	1.000	0.000	A	99.309	/	0.000
4					1.000	B	89.008	/	0.000
5					2.000	C	99.570	0	0.018
6					3.000	1	86.176	/	0.001
7									
8									
9		X	Y		Width	Height	Angle	Curve	
10		Region	313.931	132.166	154.611	47.669	0.000	0.000	
11									
12									
13		X	Y		Width	Height	Angle	Curve	
14		Character	388.232	142.929	16.992	27.863	0.000	0.000	
15									
16									
17									
18									

2.2.3 External access to Optimize Character Size

Similar to Section 2.2.1, you can create an external user control.

1. Open the ELRead settings.
2. Select and drop **Optimize Character Size** on Cell B17.

The screenshot shows the ELRead settings window on the left and a spreadsheet on the right. In the settings window, the 'Optimize Character Size' option is highlighted with a red box and set to 'False'. A red arrow points from this box to cell B17 in the spreadsheet, which also contains a red box around the text 'Optimize Character Size'.

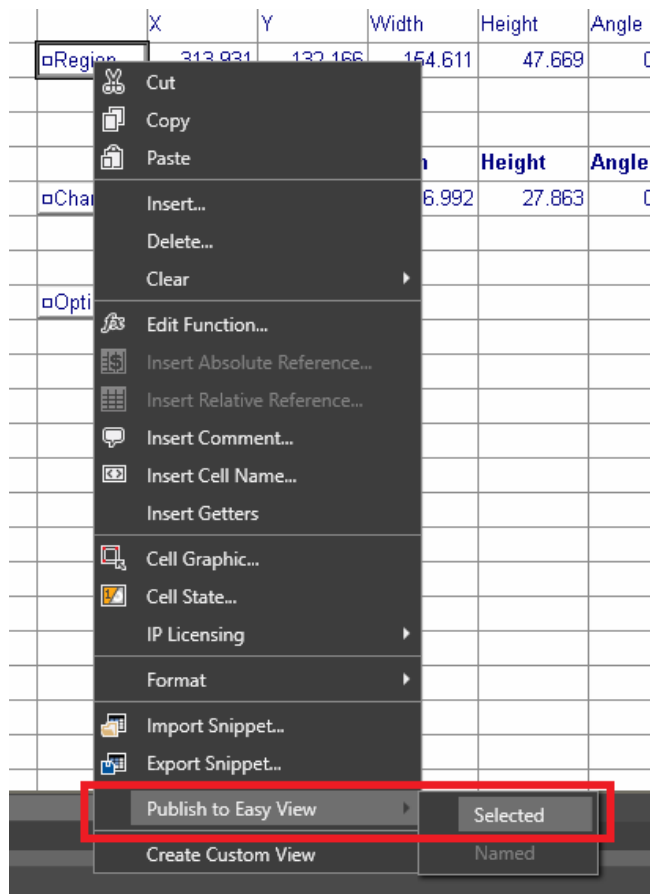
	A	B	C	D	E	F	G	H	I
0	Image								
1									
2			String	Passed	Index	Char	Score	2nd Char	2nd Score
3		VIDIELR	ABC123	1.000	0.000	A	99.309	I	0.000
4					1.000	B	89.008	/	0.000
5					2.000	C	99.570	0	0.018
6					3.000	I	86.176	/	0.001
7									
8									
9			X	Y	Width	Height	Angle	Curve	
10		Region	313.931	132.166	154.611	47.669	0.000	0.000	
11									
12									
13			X	Y	Width	Height	Angle	Curve	
14		Character	368.232	142.929	16.992	27.863	0.000	0.000	
15									
16									
17		Optimize Character Size							
18									

3. Click **OK** to close the ELRead settings window (this will have the same runtime affect for the next inspection).

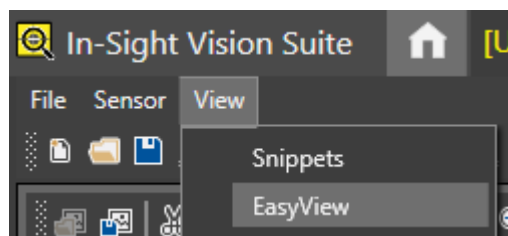
2.3 Create an Interactive HMI

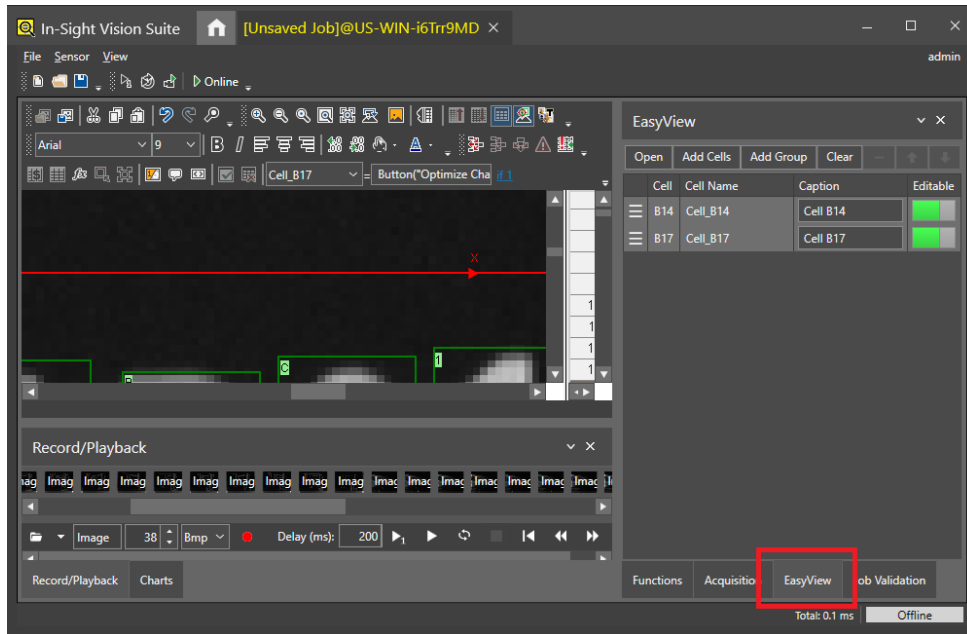
The reason to create the external user controls for the ELRead tool is to view the results on the HMI, so there's no need to open the ISVS software to modify the tools settings again.

1. Right click on Cell B10 (EditRegion for ROI) and select **Publish to Easy View -> Selected** option.

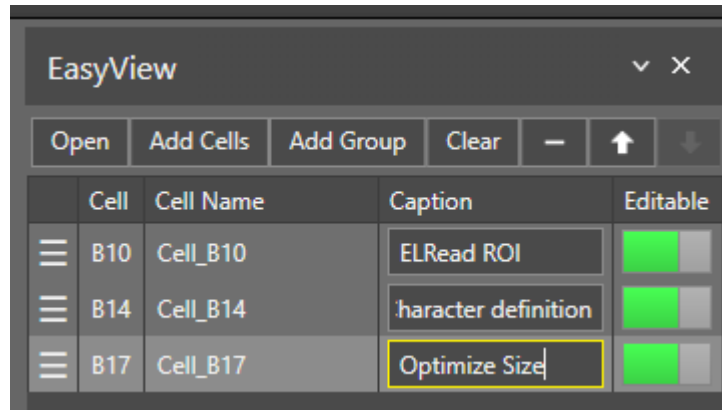


2. Do the same procedure to Cells B14 and B17.
3. Open **View->Easy View** to show the Easy View tab, if it is not visible.

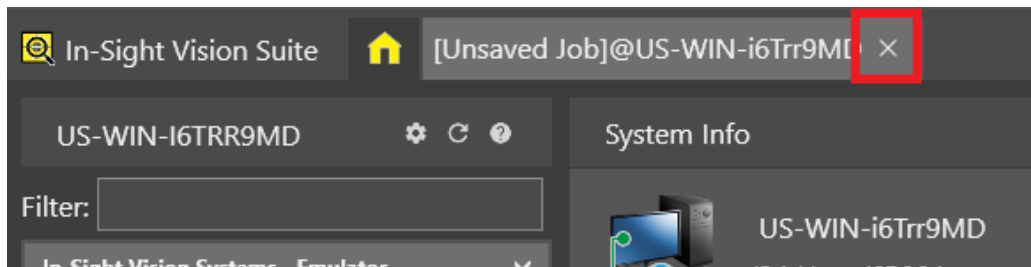




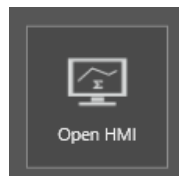
4. Modify the **Caption** column to assign representative names to each cell reference.

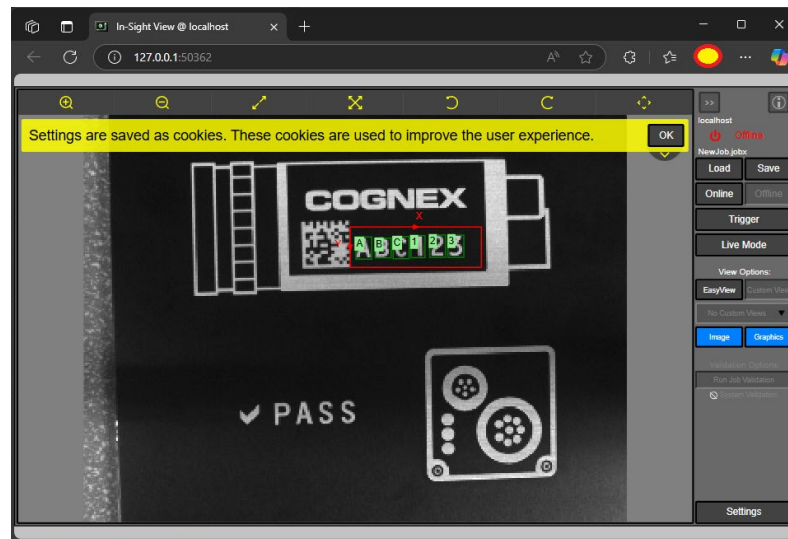


5. **Save the job.**
6. Click **X** to close the tab.

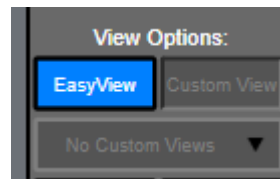


7. Click **Open HMI** to access the WebHMI. This action will open a web browser that access the HMI on the camera.





8. Click **EasyView** to show published cells.



9. Now any modifications of ROI, Character Size definition, or Automatic Optimization on character size can be done with these controls.

