

Adhesive Inspection Application

Operation instructions

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1 Adhesive inspection software

1.1 Introduction

Adhesive application software (further called Application) provides user interface for adhesive bead inspection. Application does not need any user actions and displays produced glass and adhesive inspection result. Full trajectory of the applied adhesive is scanned with Metralight G2 sensor. If adhesive shape is within limits, the glass is marked as OK, otherwise as NOK.

1.2 Calibration measurements

To measure the adhesive on specific type of glass in production. Two measurements have to be done in advance. One measurement of the glass without the adhesive and one with adhesive. Both measurements are used to calculate the exact dimensions of adhesive on every scanned sample alongside full adhesive trajectory. The results are used as standard. That way, if any property of inspected glass changes in future (changes in adhesive trajectory, amount of adhesive, shape of the glass, shape of adhesive), the calibration measurements can be updated and there is no need for adjustments in system from Metralight or BK Technic.

1.3 Adhesive evaluation

The dimensions of adhesive are measured alongside full robot trajectory. The trajectory is segmented using digital signals to various number of segments. Each segment can be processed using different inspection parameters and different evaluation limits. Each sample in the segment is evaluated as OK/NOK based on limits:

- Minimum and maximum of width and height [% of reference dimension]
- Position deviation left and right [millimetres]

Minimum and maximum of width and height: adhesive dimensions are measured for every sensor sample alongside trajectory of segment and compared against sample from same point on trajectory of calibration measurement. The sample is evaluated as OK if dimensions of adhesive are within width and height limits calculated as percentage of calibration dimensions.

Position deviation left and right [millimeters]: position deviation of the adhesive mass from calibration measurement have to be within limits for marking sample as OK

Sample results are processed using two parameters:

- Window size [millimetres]
- Maximum error in window [percent of window]

Window size [millimetres]: specifies size of window which is moving alongside the trajectory of adhesive. The percentage of NOK samples inside the window is calculated and compared to Maximum error in window parameter. The number of samples within the window is calculated from fixed robot speed configured in configuration file and known sensor frame rate which is 165fps.

Maximum error in window [percentage of window]: adhesive segment is evaluated as OK if the percentage of NOK samples inside the evaluation window never exceed this value for any position of window along segment trajectory. Otherwise the segment is marked as NOK.

Final result for the glass adhesive is OK if all segments of adhesive are marked as OK, otherwise the total result is NOK.

1.4 Application description

Application can run on two levels of access: admin level for logged in users and basic level for not unlogged users. Application menu is shown on right top side only when mouse is hovered over the area and contains five options: Results, Model Settings (admin only), Debug (admin only), Status, Log in/Log out

1.4.1 Results

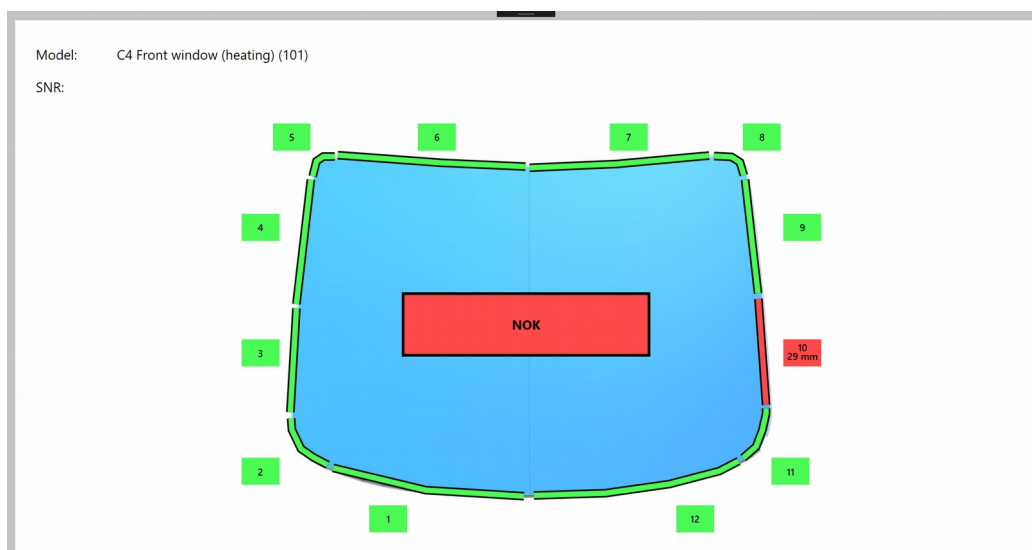
Result screen contains measuring results for produced glasses in position ready to remove by the operator, or shows current progress and result of adhesive application on currently produced glass. The measuring result for produced glass is kept on the screen until the operator removes the glass from the holder and the removal is confirmed by the button.

Screen is split to left and right if the glasses are produced in pair, or shows only one result for big glasses.

Each result panel contains image of glass with numbered segments of the adhesive. If adhesive is not yet measured, the colour is grey, if the segment was measured as OK, the colour is green, if segment is measured as NOK, the segment is RED. Overall result is displayed in middle by text and also by color.

When the segment is marked as NOK, the maximum length of defect found in evaluation window is also displayed under the segment number.

Note: maximum defect size displayed is the size of evaluation window, because the maximum defect is only calculated inside the window, but overall defect can be larger.

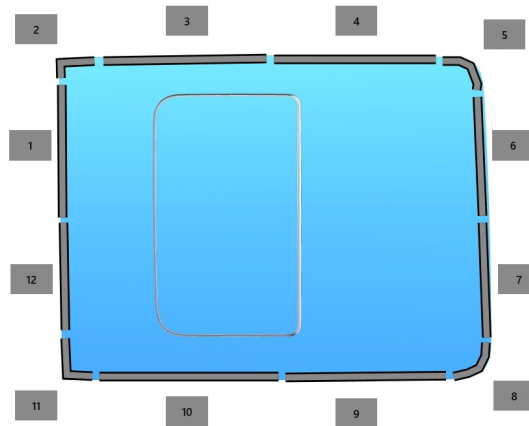


1.4.2 Model settings (admin only)

On model settings page. Every glass result panel can be displayed. By click on segment number, the setting of any of the segment limits can be viewed and updated.

Model settings

Select model 6 - C4 Side sliding window right first



C4 Side sliding window right first
Panel class: C4_side_right_first_sliding_RM
Position (0=center, 1=left, 2=right): 2

Model settings

Select model 6 - C4 Side sliding window right first

| Limits | | |
|--|----------------------|-------------------------------------|
| | Min [% of reference] | Max [% of reference] |
| Width | 30 | 250 |
| Height | 60 | 140 |
| Max. left position deviation [mm]* | | Max. right position deviation [mm]* |
| *in direction of nozzle movement. 0=position inspection is off | | |
| | 5 | 5 |
| Evaluation | | |
| Win. size [mm] | 30 | Max. error [%] |
| | | 30 |

SaveClose

C4 Side sliding window right first
Panel class: C4_side_right_first_sliding_RM
Position (0=center, 1=left, 2=right): 2

1.4.3 Debug screen (admin only)

Debug screen contains options for data logging and system debugging. Options should be used by Metralight or BK Technic only.

1.4.4 Status

By click on status button, the message window is opened and the status of calibration measurements for every glass is displayed. Each row displays status for one glass. After the glass name, three statuses are display with possible values OK or ERROR:

- status is OK when calibration measurement without glue is measured
- status is OK when calibration measurement with glue is measured
- status is OK when calibration measurements are correctly processed and ready for production measurement

On the bottom, sensor state and application version is displayed.

1.4.5 Log in/Log out

Button is used to open login screen or to log out user. Password will be set upon WV request.

1.5 Data logging

Measured results can be logged into CSV file. Pathname of the log file is configured inside XML/config.xml file inside application folder using following XML tag:

```
<save_results_log>C:\Metralight\results.csv</save_results_log>
```

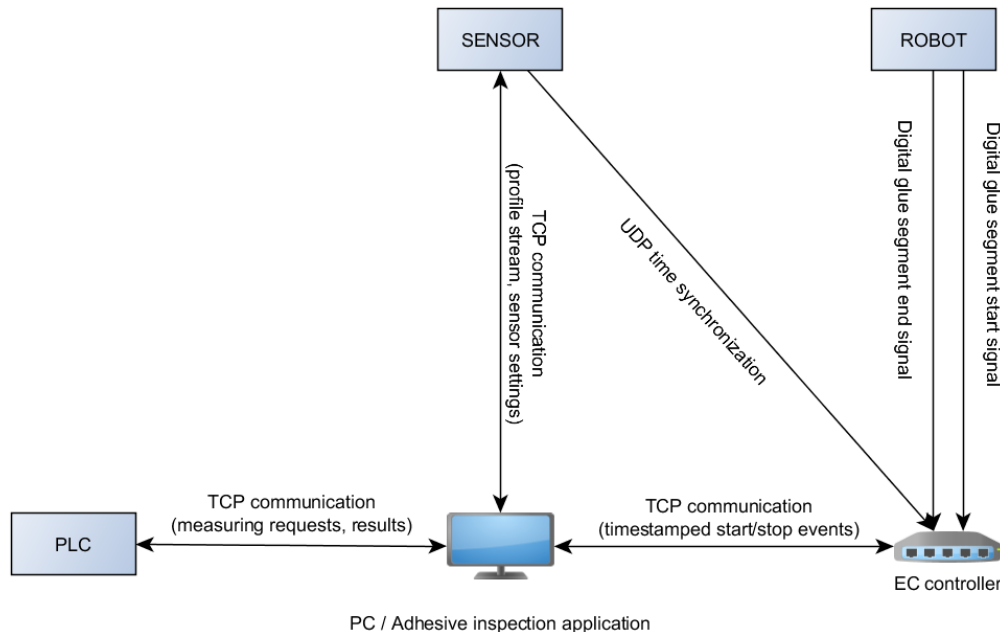
When the tag content is empty, the logging is turned off. The logging should be turned off or file should be cleared from time to time, to avoid filling of hard drive, although the memory consumption of *.csv file is low – about 1 MB for 10000 measurements.

Format of the file is:

| timestamp | barcode | model name | model id | measuring result | zone 1 result | zone 2 result | zone 3 result | zone 4 result | zone 5 result | zone 6 result | zone 7 result | zone 8 result | zone 9 result | zone 10 result | zone 11 result | zone 12 result |
|-------------------------|---------|----------------------|----------|------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|----------------|----------------|----------------|
| 2019-08-09 13:59:56.743 | | C4 Rear window right | 4NOK | ERR | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | |
| 2019-08-09 14:01:38.175 | | C4 Rear window right | 4NOK | ERR | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | |
| 2019-08-09 14:03:38.648 | | C4 Rear window right | 4NOK | ERR | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | |
| 2019-08-09 14:04:45.661 | | C4 Rear window right | 4NOK | ERR | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | |
| 2019-08-09 14:12:36.35 | | C4 Rear window right | 4NOK | ERR | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | |
| 2019-08-09 14:27:33.365 | | C4 Rear window right | 4NOK | ERR | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | |
| 2019-08-09 14:37:17.787 | | C4 Rear window right | 4NOK | ERR | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | |
| 2019-08-09 14:39:49.416 | | C4 Rear window right | 4NOK | ERR | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | |
| 2019-08-09 14:41:16.29 | | C4 Rear window right | 4NOK | ERR | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | |
| 2019-08-09 14:48:21.684 | | C4 Rear window right | 4NOK | ERR | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | |
| 2019-08-09 15:11:41.272 | | C4 Rear window right | 4NOK | NOK | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | |
| 2019-08-09 16:08:39.404 | | C4 Rear window right | 4NOK | NOK | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | |
| 2019-08-11 12:15:18.374 | | C4 Rear window right | 4NOK | NOK | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | |
| 2019-08-11 12:36:19.183 | | C4 Rear window right | 4NOK | NOK | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | OK | INACTIVE | OK | |

2 System hardware overview

Metralight system consists of two devices – G2 sensor for measuring profile of the glue and EC controller for timestamping the start/stop signals from robot. Measuring application runs on VW PC. Time is synchronized using UDP packets between sensor and controller (controller is adjusting its internal time according to sensor).



3 Communication sequence diagram

Measuring process is initiated by PLC when robot is ready for glue application:

- PLC send measure command to application
- Application connects to EC controller and to sensor. Sensor is set up, laser is set on and application begins to receive profile stream. Application then responds to PLC that it is ready for measurement.
- PLC allows robot to start glue application on the glass.
- Robot is applying glue on the glass and send start and end signals to divide trajectory into segments.
- Application receives start/stop events with timestamps (time is synchronized between EC controller and sensor) and profile data. When some segment is finished, it is processed and displayed.
- When glue application is finished by robot, PLC starts to ask for final result.

- ## 4 Device IP addresses

| Station | Device | IP address |
|---------|---------------------|---------------|
| MMB | Ethernet controller | 172.27.178.83 |
| | G2 sensor | 172.27.178.84 |
| MMC | Ethernet controller | 172.27.179.83 |
| | G2 sensor | 172.27.179.84 |
| MMD | Ethernet controller | 172.27.180.83 |
| | G2 sensor | 172.27.180.84 |

| | | |
|------------|---------------------|---------------|
| PGD | Ethernet controller | 172.27.181.83 |
| | G2 sensor | 172.27.180.84 |

5 Troubleshooting

| Problem | Possible reasons | Solution |
|--------------------------------|--|--|
| measuring ends in NOK status | <ul style="list-style-type: none"> • Dirt / glue on laser emitters or lens of the sensor • Bad light conditions on measuring scene – sunlight or light sources with similar wavelength as sensor laser • Real fault/imperfection on applied glue, ie. different amount of the measured glue than in calibration | <ul style="list-style-type: none"> • Clean sensor lens and emitters • Ensure no foreign light source is shining on the measured glue, especially sunlight • Inspect the NOK segment for imperfections. If no imperfection is visible, try to recalibrate the glass. |
| measuring ends in ERROR status | <ul style="list-style-type: none"> • Could not connect to sensor • Could not connect to EC controller • Calibration not ready for requested glass • Start/stop signals are not passed between robot and EC controller | <ul style="list-style-type: none"> • Check cable connection and power supply both to sensor and EC controller, try to ping both devices • If no glue application progress is visible on the screen, verify that robot has programmed start/end signals for requested window, check diodes of connected inputs on EC controller are blinking during glue application • if calibration is not ready, message box with error type is displayed |

5.1 Sensor replacement

1. Unmount and replace the sensor itself according to instructions provided by BK Technic.
2. Connect the ethernet cable powered using POE (Power over Ethernet), from 12 (150mA) to 24 VDC (80mA).
3. Factory IP address is 192.168.0.16. Update host PC network setting, so the range 192.168.0.XX is visible from your computer.
4. Open TLStudio_2.0.3_G1 provided by Metralight (also placed in folder [C:/Metralight](#) on every measuring station).
5. Connect to the sensor on 192.168.0.16 and active port.
6. Go to settings tab.
7. In the section **Clone to sensor** click **Eeprom** button.
8. Select memory clone file provided by Metralight for every measuring station and confirm execution.
9. Memory clone is written in the sensor. Restart sensor by turning power on and off or by disconnecting the sensor.
10. Sensor is started with same setting (including IP) as previous sensor and can be used for measuring.
11. Calibration measurement of every glass should be performed to ensure maximum system precision.

5.2 EC1 controller replacement

1. Note the connection order of the green connectors (and also cables mounted inside the connectors if get loose) before disconnecting.
2. Disconnect all connectors from controller.
3. Replace the controller itself.
4. Connect all connectors in same order.
5. Connect the serial cable provided by Metralight inside the empty slot next to the power connector.
6. Use any available Serial port communication software, which is able to send file over the serial port (i.e. Realterm Serial/TCP terminal (BSD license), IO Ninja (commercial)).
7. Open serial communication to EC controller, baud rate 9600, parity none, 8 data bits, 1 stop bit.

- Example of log when configuration is written successfully into the controller:

