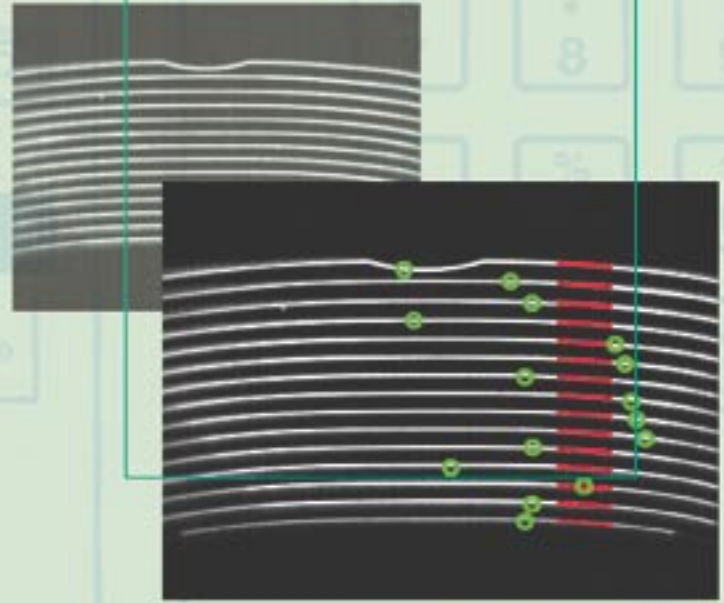


easy
automation



ECM-th

Electrical
control
of the
defrosting
circuit



1. General

The machine perform the following tests:

- Measuring of the electrical resistance
- Overvoltage test
- Detection of the wire continuity.
- Hot Spot detection
- If required, double resistance measuring

The standard configuration is developed in order to supply a “turn key” machine suitable for the industrial environment. It is composed of:

1. Air-conditioning control cabinet with
 - Industrial touchscreen PC and industrial keyboard
 - Power supply for overvoltage
 - ECM th software
2. Remote screen in print room
3. Thermocamera

2. Configuration

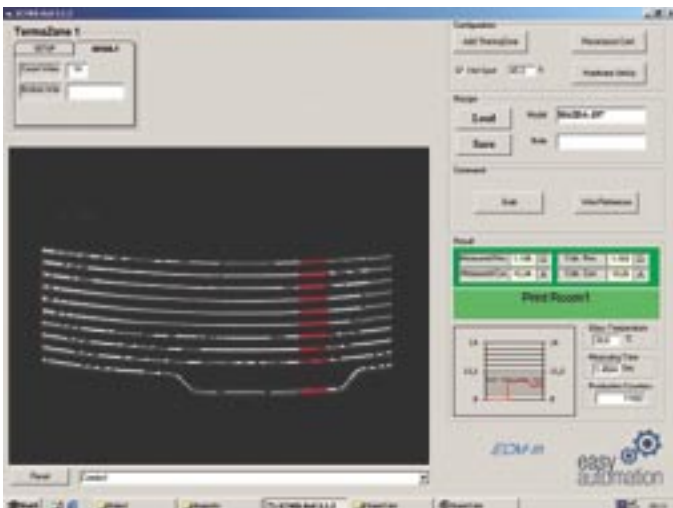
The machine can be used either in an automatic line or in a semiautomatic checking station.

2.1. Automatic

The ECM-th has been developed to work integrated in a production line. It can be positioned in the standard layout configuration before the soldering station or integrated directly with the clip soldering system SDEA and used in the soldering station without adding any time to the soldering process. This is possible because the ECM th performs its work during the cooling time of the soldering process. Depending on the line cycle time, can be added the bus bar brushing system in the same station. This is an advantage in new production lines allowing area and cost reduction.

2.2. Semiautomatic

The ECM-th can be used also for off-line checking, using a configurable support table, the operator load manually the glass, press the pedal switch, and wait for the test result. The soldering device SDEA and the brushing system can be integrated in this station.



ECM th main windows

3. Electrical resistance measuring

The machine measure the resistance through a volt-amperometer method, can be supplied with a calibration certificate with the followings specification:

Specifications	Minimum	Maximum
Range of measurement	0.5 Ω	2.5 Ω
Repeatability	0.005 Ω	-
Balance for the thermal derive	By a pyrometer	-
Measuring time	-	0.3 sec.

The historical values of the resistance are graphical represented, both on the results screen of the industrial PC and in the result screen of the PC in the print room.

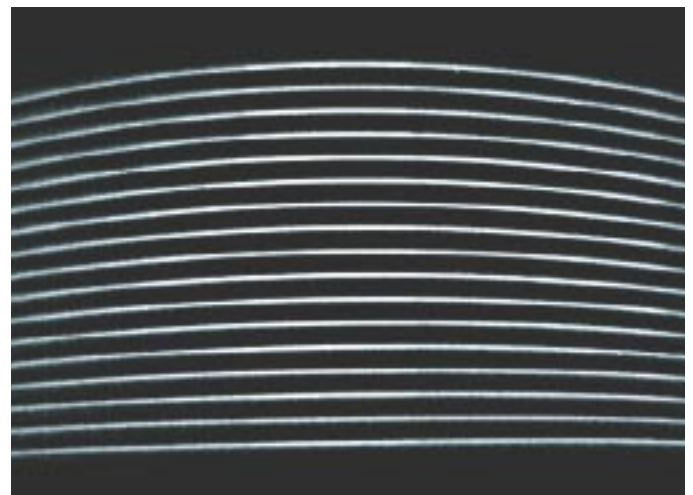
4. Overvoltage

After the measuring of the resistance the system perform an overvoltage to over load the electric circuit in order to heat the wires and break wires that have local defects. The time of the overvoltage is defined into the hardware set up page, a minimum value necessary to let the circuit visible by the themocamera is between 0,5 to 1,5 sec.

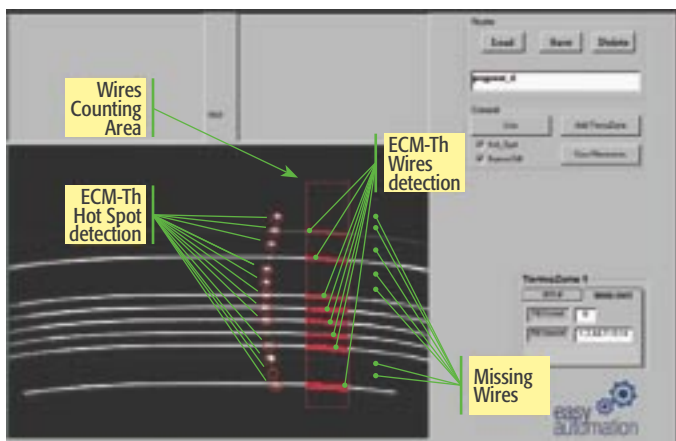
5. Wires continuity by thermovision

During the over voltage the wire continuity of the circuit is detected. The wires are heated by the current flowing through them, so the thermo-vision system can “see” all the continuos wires. The software has been developed taking into analysis and test several algorithms, having in mind to reach the goal of 0 PPM defects. To do this , the following choice have been made:

- a) Thermoimage balanced and filtered. The Easy Automation algorithm filter the non homogenous glass temperature by a robust system that balance the glass cooling and heating. In this way all the problems related on the non uniform glass temperature and the thermoimage reflection have been completely solved. Also we have a resulting image very clear as showed in the following image.



- b) Code algorithm that works taking into account all the area information and not a single line/pixel. This allow to have a very stable counting system. As stability example: the ECM-th can generate automatically a recipe for a new model.
- c) Hot Spot detection on each single wire. This is important to reach 0 PPM, because if a wire breaks during the heating, the hot spot could be at a level lower than the other wires. To detect it, Easy Automation has developed a code, to check hot spot referred to its single wire level. As reported in the picture above, the algorithm detect hot spots on wires that break during heating. Also the wires n° 3 breaks but it is heated enough to be measured. In this case the level of hot spot is lower than the continuous wires but it is still detected.



- d) Operator errors could always occur, to reduce them the software for continuity detection don't require any parameter. The code auto detect the best parameters.

Other features:

- Indication of the N° of the interrupted wires.
- No glass edge detection, to avoid false wire measurement;
- Recipe wizard;
- Glass temperature variation in a wide range.
- Measurement of the current and heating of each single wire

Wire	Resistance	Current
1	1.128	1.262
2	1.138	1.158
3	1.138	1.158
4	1.176	1.267
5	1.171	1.160
6	1.138	1.142
7	1.107	1.171
8	1.107	1.171
9	1.107	1.171
10	1.107	1.171

Specification	Minimum
Time for continuity measurement	From 0,5 to 1,5 sec.
Distance between close wires	15 mm
Possibility to detect the position of the broken wire	Yes
Possibility to detect the position of the hot spot	Yes
N° of wires counting zones	Infinite
Hot spot detection	1 for wire

6. Double resistance measuring

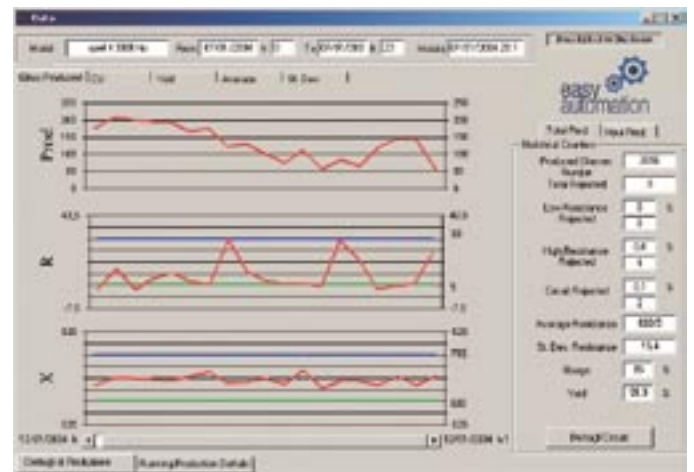
For reason connected with the rejected glass management, can be useful to know if at the end of the test the wire with hot spot is interrupted or not. To do this the machine can perform , at the end, a second resistance

measurement , in order to compare it with the value of the first measure. If the variation exceed the imposed value then the output is for interrupted wire, else the output is for hotspot.

7. Results

The results are displayed on the following devices:

- Control PC
- Lamp alarm
- Print room remote screen
- Any PC, ethernet connected with the machine
- On the supervisor system, ethernet connectet with the PC



Supervisor page

In the Control PC results windows, strips with green, orange or red color are activated immediately after each test, in order to have a direct view of the single testing step. Inside these strips are reported the referring and the measured data. In the results windows are present a graphics of resistance/current trend.

All the information of the processed glasses as glass number, model, date, all parameters, all measured value etc. are stored in a database usable by the most common software (Excel, Access ect.). In this way the full trackability of the glass is guarantied, and production statistics can be generated easily as the user needs.

8. Option

For the stand alone configuration:

- Electrical brushing heads with bus bar electrical contact
- Clip Soldering Device SDEA
- Glass stops for the manual squaring of the glass
- Glass supports
- Thermocamera support

For the in line configuration:

- Squaring conveyor
- Bridgshaped frame
- Clip Soldering Device SDEA
- Electrical brushing heads with bus bar electrical contact
- Thermocamera support

Key Points

- 1) Complete turn key system performing all the necessary tasks: resistance measurement, continuity detection, hot spot detection, backlights heating, remote screen, database, supervisor etc.
- 2) Built for industrial environment (industrial cabinet, industrial PC, air-conditioning, industrial connection, etc.)
- 3) Reliable measuring system with 0 PPM goal
- 4) Not sensible to different glass temperature
- 5) Broken line position detection
- 6) Single line hot spot detection
- 7) Single line heating/current measurement
- 8) Easy to use



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