1. The objective of the standard and the scope of its application

The purpose of the **Instruction** – standard, is to clearly define the esthetic requirements of products manufactured by Riverdi sp. z o.o. (further: Riverdi). The document defines the criteria to be observed during the assembly of a given product. The manual describes the modules 3.5", 4.3", 5.0", 7.0",10.1″ 12.1″ and 15.6″.

2. Test environment

2.1. Sampling method

Sample size: 100% (in the exceptional stations can be defined by the quality department)

2.2. Environmental conditions

Temperature: 15 – 25 ºC

Humidity: 25 – 65 %RH

Lighting: 1000 ~ 1300 LUX

Inspection time: 6 - 10s

2.3. Inspection conditions (distance/angle)

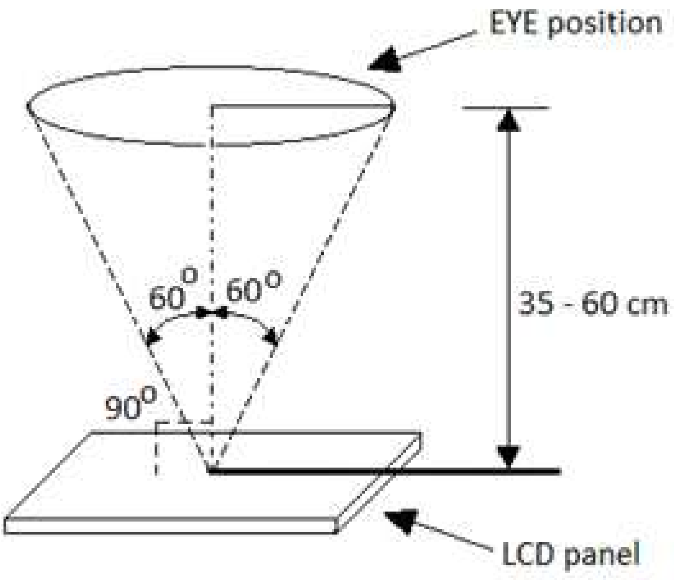
2.3.1 Distance:

The distance between the module and the inspector’s eye should be 35 – 60 cm.

2.3.2 Inspection angle

60º from the front surface of the module in the vertical direction

60º do przedniej powierzchni modułu w kierunku pionowym



3. Definition

TP – Touch Panel

TFT – Thin Film Transistor

FFC – Flat Flexible Cable,

PCB – Printed Circuit Board,

AA - TFT – Active area – area displayed by the LCD

VA - TP – Visual area – transparent area in the touch panel or cover glass

Dot – Foreign particles classified as pollution of different colors located in the visual area of the module,

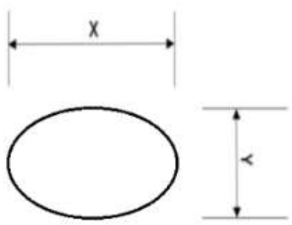
DD – Defect dimension,

3.1. Delamination of the touch panel/LCD polarizer – airs bubble between layers.

Touch panel – air bubble between cover glass (front glass) and sensor, called also a **fish eye.**

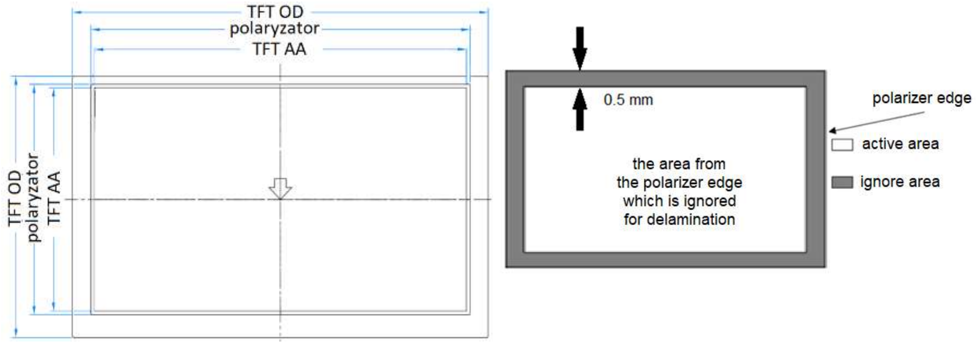
Display – air bubble between polarizer and TFT glass, the visible air bubble does not touch the edge (3.1.1.) or second case of the defect, air bubble touches the edge of the polarizer (3.1.2.). Delamination phenomena are visible as the brighter area when LCD is turned off.

3.1.1 Delamination in the AA or VA area (component visible area (transparent)). For the elliptical air bubble, the size has to be determined according to the below formula



$$D = \frac{(x+y)}{2}$$

3.1.2 Delamination at the edge, only in LCD (never in TP)



3.2. Dead pixel - the point (subpixel) on the display which can seem dark or bright in the AA area.

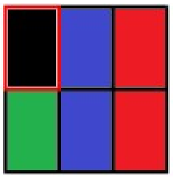
Bright pixel – The bright point (subpixel) of the same size on the black pattern.

Dark pixel – The dark point (subpixel) of the same size on the R-red, B-blue, G-green and white pattern.

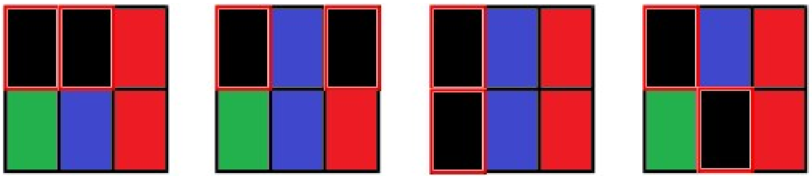
2 pixel adjacent – dark or bright subpixel damage in the one-pixel area or adjacent to each other (from two adjacent pixels)

Example:

Bright or dark pixel (subpixel) damage:



2 pixels adjacent:

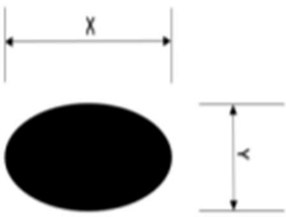


pattern: white, black, R – red, G – green, B – blue

3.3. Line defect – all lines vertical or horizontal independent of color visible on the RGB display

3.4. Contamination/Scratch, points type – impurities in different shapes and in various colors.

Impurities can appear in two shapes: spherical/elliptical and oblong, the size should be determined using the formulas below.

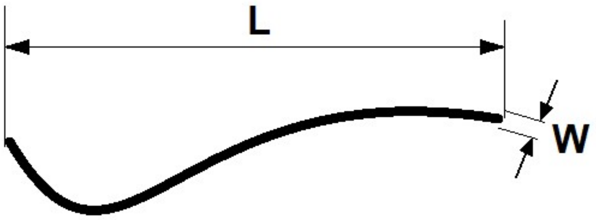


$$D = \frac{(x + y)}{2}$$

3.5. Contamination - linear type - longitudinal impurities, may occur with different color.

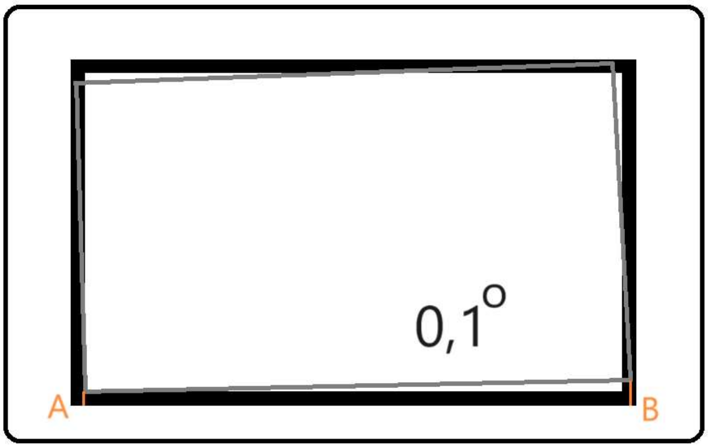
The distance between the pollen must be greater than 10 mm.

The size should be determined from the figure below.



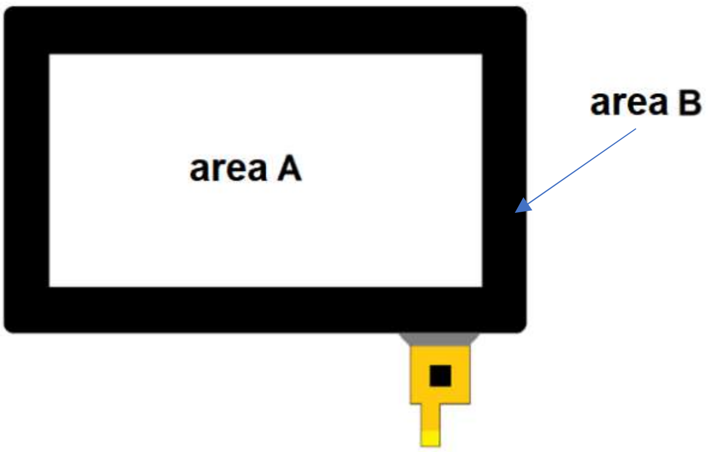
3.6. Stain – contamination of the module surface in the form of a stain

3.7. Angular tolerance

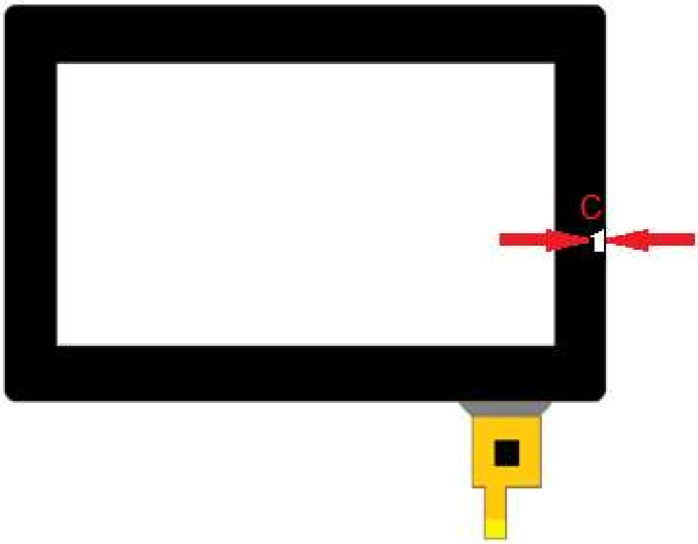


X= |A-B|

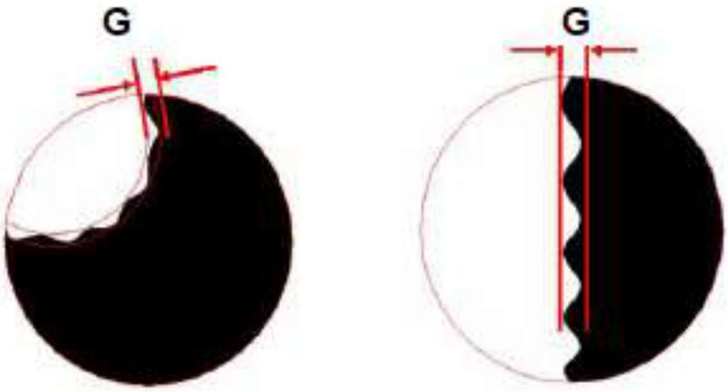
3.8. Touch panel areas



3.9. Glass chipping [C]– the size is measured from edge to inside of the component.



3.10. Paint defect – ZigZag – G measured from the highest point of the painted surface to the lowest point deep into the edge of the component. A defect for edges and corners.



4. Criteria

Defects are classified as two types, **major and minor**.

Defects are classified as follows:

Major - serious defect. Any defect may result in functional failure or reduce the suitability of the product for a particular purpose. For example, electrical failure, deformation, etc.

Minor - minor defect. A defect that does not reduce the usefulness of the product for its intended purpose, e.g. point defects.

Classification of the defects:

Defect	Type
Pixel defect	major
Line defect	major
Flicker	major
Delamination	major
Scratches, spatter and cracks - TFT	major
Scratches, spatter and cracks of the glass- TP	major
Dot	minor
Fish eye	minor
Scratches of the metal housing	minor
Deformation of the housing	major
Stain, fingerprints	minor
Scratches of the TP paint	major
Positioning of the PCB on module	minor
Correct assembling FFC and PCB on module	major

4.1. Visual criteria

4.1.1 Inspection when the LDS is turned on.

Defect	Description		Criteria
Dead pixel*	Dark pixel	subpixel	N ≤ 2
		2 adjacent	N = 1
		3 adjacent	not allowed
	Bright pixel	subpixel	N ≤ 1
		2 adjacent	not allowed
Line defect	Vertical lines		not allowed
	Horizontal lines		not allowed
Flicker	blinking, leaping screen		not allowed

4.1.2 Inspection when the LDS is turned off.

Dot/point scratche*	Size [mm] / diagonal – P	D < 0.2*	D = 0.2	0.2 < D ≤ 0.3	0.3 < D ≤ 0.4	0.4 < D ≤ 0.5	D > 0.5	max quantity of the impurities
	P < 5”	ignore	N ≤ 4	N = 0	N = 0	N = 0	N = 0	4
	5” ≤ P ≤ 7”	ignore	N ≤ 4	N ≤ 1	N = 0	N = 0	N = 0	4
	7” < P ≤ 10.1”	ignore	N ≤ 4	N ≤ 2	N ≤ 2	N = 0	N = 0	4
	10.1”<P≤12.0”	ignore	ignore	N ≤ 4	N ≤ 3	N ≤ 2	N = 0	5
	12.0” > P	ignore	ignore	ignore	N ≤ 4	N ≤ 4	N = 0	6

* at least five (N≥5) larger than 0.05mm (>0.05) at a distance of less than 3mm **should be cleaned** („galaxy”)

The distance between two defects have to be bigger than 10 mm for LCD smaller than 5” (LCD<5”), and 20 mm for LCD bigger or equal than 5” (LCD≥5”)

	Diagonal – P	W - width [mm]	L - length [mm]	acceptable quantity N
Linear impurities	P < 5”	W ≤ 0.05	L ≤ 1.8	ignore
		W ≤ 0.05	L > 1.8	not allowed
		0.05 < W ≤ 0.1	L ≤ 0.8	N ≤ 2
		0.05 < W ≤ 0.1	L > 0.8	not allowed
		W > 0.1	-	not allowed
	5” ≤ P ≤ 7”	W ≤ 0.05	L ≤ 2.2	ignore
		W ≤ 0.05	L > 2.2	not allowed
		0.05 < W ≤ 0.1	L ≤ 1.3	N ≤ 2
		0.05 < W ≤ 0.1	L > 1.3	not allowed
		W > 0.1	-	not allowed
	7” < P ≤ 10.1”	W ≤ 0.05	L ≤ 3	ignore
		W ≤ 0.05	L > 3	not allowed
		0.05 < W ≤ 0.1	L ≤ 2	N ≤ 2
		0.05 < W ≤ 0.1	L > 2	not allowed
		W > 0.1	-	not allowed
	10.1” < P ≤ 12.0”	W ≤ 0.05	L ≤ 5	ignore
		W ≤ 0.05	L > 5	not allowed
		0.05 < W ≤ 0.1	L ≤ 4	N ≤ 2
		0.05 < W ≤ 0.1	L > 4	not allowed
		W > 0.1	-	not allowed
	P > 12.0”	W ≤ 0.05	L ≤ 10	ignore
		W ≤ 0.05	L > 10	not allowed
		0.05 < W ≤ 0.1	L ≤ 7	N ≤ 2
		0.05 < W ≤ 0.1	L > 7	not allowed
		W > 0.1	-	not allowed
The distance between two defects have to be bigger than 10 mm for LCD smaller than 5” (LCD<5”), and 20 mm for LCD bigger or equal than 5” (LCD≥5”)				

	Diagonal – P	Size – D [mm]	Acceptable quantity N
TP delamination Fish eye*	P ≤ 7”	D ≤ 0.2	N ≤ 1
		D > 0.2	not allowed
	7”< P ≤ 10.1”	D ≤ 0.3	N ≤ 2
		D > 0.3	not allowed
	10.1”< P ≤ 12.0”	D ≤ 0.4	N ≤ 3
		D >0.4	not allowed
	P > 12.0”	D ≤ 0.5	N ≤ 3
		D >0.5	not allowed

Polarizer delamination – edge only in LCD*	Air bubbles on the polarizer	C ≤ 0.5 mm	C > 0.5
		allowed	not allowed

Angle tolerance*	0.1^0 for all diagonals	
	Diagonal	Value X [mm]
	2.83”	0,10
	3.5”	0,15
	4.3”	0,20
	5.0”	0,20
	7.0”	0,30
	10.1”	0,40
	12.1”	0,45

DISPLAY					
Linear scratches	Diagonal – P		W - width [mm]	L - length [mm]	acceptable quantity N
	≤7”	LVL I	W ≤ 0.025	-	N ≤ 1
		LVL II	0.025 < W ≤ 0.05	L ≤ 4	N ≤ 1
			0.025 < W ≤ 0.05	L > 4	not allowed
		LVL III	W > 0.05	-	not allowed
	7” < P ≤ 10.1”	LVL I	W ≤ 0.025	-	N ≤ 2
		LVL II	0.025 < W ≤ 0.05	L ≤ 6	N ≤ 1
			0.025 < W ≤ 0.05	L > 6	not allowed
		LVL III	W > 0.05	-	not allowed
	10.1” < P ≤ 12.0”	LVL I	W ≤ 0.025	-	N ≤ 2
		LVL II	0.025 < W ≤ 0.05	L ≤ 10	N ≤ 1
			0.025 < W ≤ 0.05	L > 10	not allowed
		LVL III	W > 0.05	-	not allowed
	P > 12.0”	LVL I	W ≤ 0.07	-	ignore
		LVL II	W = 0.07	L ≤ 10	N ≤ 5
			W = 0.07	L > 10	not allowed
		LVL III	W > 0.07	-	not allowed

TOUCH PANEL / GLASS 1 mm						
Linear scratches	Diagonal – P		W - width [mm]	L - length [mm]		acceptable quantity N
	P ≤ 7”	LVL I	W ≤ 0.025	-		N ≤ 2
		LVL II	0.025 < W ≤ 0.05	area A	L ≤ 12	N ≤ 1
				area B	L ≤ 7	N ≤ 1
			0.025 < W ≤ 0.05	area A	L > 12	not allowed
				area B	L > 7	not allowed
		LVL III	W > 0.05	-		not allowed
	7” < P ≤ 10.1” *1 N max 2 *2 DD ≥ 30 mm	LVL I	W ≤ 0.025	-		N ≤ 2
		LVL II	0.025 < W ≤ 0.05*1	area A	L ≤ 17	N ≤ 2*2
				area B	L ≤ 10	N ≤ 1
			0.025 < W ≤ 0.05	area A	L > 17	not allowed
				area B	L > 10	not allowed
		LVL III	W > 0.05	-		not allowed

	10.1” < P ≤ 12.0” [*1] N max 2 [*2] DD ≥ 30 mm	LVL I	W ≤ 0.025	-		N ≤ 3
		LVL II	0.025 < W ≤ 0.05 [*1]	area A	L ≤ 20	N ≤ 2 [*2]
				area B	L ≤ 14	N ≤ 1
			0.025 < W ≤ 0.05	area A	L > 20	not allowed
				area B	L > 14	not allowed
		LVL III	W > 0.05	-		not allowed
	P > 12.0” [*1] N max 3 [*2] DD ≥ 30 mm	LVL I	W ≤ 0.025	-		N ≤ 4
		LVL II	0.025 < W ≤ 0.05 [*1]	area A	L ≤ 25	N ≤ 3 [*2]
				area B	L ≤ 17	N ≤ 1
			0.025 < W ≤ 0.05	area A	L > 25	not allowed
				area B	L > 17	not allowed
		LVL III	W > 0.05	-		not allowed

Chipping	Size / Diagonal	C ≤ 0.05 [mm]	0.05 < C ≤ 0.2 [mm]	0.2 <C ≤ 0.3 [mm]	**acceptable quantity N**
	≤5”	ignore	N ≤ 2	N ≤ 1	2
	5”<	ignore	N ≤ 3	N ≤ 2	3
Distance between two defects 20 mm					

Paint defect (various color) clearance	Size / Diagonal	D ≤ 0.05 mm	0.05 <D≤ 0.1 mm	0.1 <D≤ 0.2 mm	0.2 <D≤ 0.3 mm	D> 0.3 mm	**acceptable quantity N**
	P ≤ 5”	ignore	N ≤ 2	N ≤ 0	N ≤ 0	not allowed	2
	5”<P≤12.0”	ignore	N ≤ 3	N ≤ 1	N ≤ 0	not allowed	3
	P > 12.0”	ignore	N ≤ 4	N ≤ 2	N ≤ 3	not allowed	6
Distance between two defects 20 mm							

Paint defect – ZigZag	Deepth	
	G ≤ 0.2	G > 0.2 mm
	allowed	not allowed

Protruding front transport foil [mm] - L	L ≤ 1.0 mm
Area protected with foil - from the edge inwards (TP only) [mm] - C	C ≤ 0.5 mm
Smudges, fingerprints, stains	Invisible in the light 1000 - 1300 LUX

Scratches on the housing	**Length**	**Width**
	L < 50mm	W<0.1mm

External dimensions	according with drawing
Components position	according with drawing

5. Register of changes

Data	Description	Author
01.08.2019	Establishment of the document	Katarzyna Stępień
02.08.2019	Verification and comments	Radosław Fularczyk
05.08.2019	Improvement of the document	Katarzyna Stępień
05.08.2019	Approval and publication - first edition of the document	Katarzyna Stępień
21.01.2020	Introducing changes in pk: 4.1; 4.15; 4.2	Katarzyna Stępień
28.08.2020	Changed the range of displays size for the spot defect parameter	Katarzyna Stępień
21.10.2020	Introducing changes in pk: 4.1, removing 4.2 chapter	Aneta Kryń Katarzyna Stępień
20.08.2021	Redefined defects, i.e. point and line scratches	Katarzyna Stępień Aneta Kryń
14.02.2021	Defect definition - linear contamination (Italian) Change of the criterion for polarizer delamination from 0.3 to 0.5 - rev 1.3	Katarzyna Stępień Aneta Kryń
29.06.2022	Determination of the definition of delamination, and definition of inspection conditions - light intensity. Addition of the criterion of acceptability of paint defects.	Katarzyna Stępień
26.04.2023	Determination of paint defect – zigzag – point 3.9 and determining the level of acceptability.	Katarzyna Stępień
01.06.2023	Define how to determine quantities for linear impurities section 3.5 - Version 1.6	Katarzyna Stępień
28.02.2024	Change of criteria regarding painting defects and clearances. Adding a table with the angle for individual modules. Change in the acceptability criterion for delamination in TP Defining the criteria for the transport protective of film – version 1.7	Katarzyna Stępień
25.11.2024	Extension of criteria to module 12.1" and 15.6"	Katarzyna Stępień