

# DLG Test Report 7421

Continental

## ProViu® 360

2nd Generation Surround View

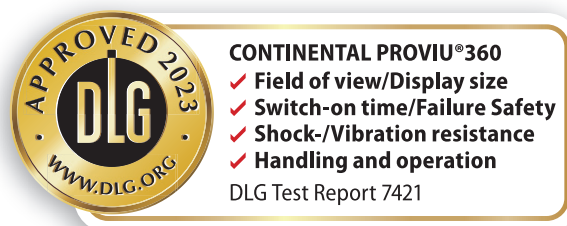


**CONTINENTAL PROVIU®360**  
✓ Field of view/Display size  
✓ Switch-on time/Failure Safety  
✓ Shock-/Vibration resistance  
✓ Handling and operation  
DLG Test Report 7421



## Overview

A test mark “DLG-APPROVED for individual criteria” is awarded for agricultural products which have successfully fulfilled a scope-reduced usability testing conducted by DLG according to independent and recognised evaluation criteria. The test is intended to highlight particular innovations and key criteria of the test object. The test may contain criteria from the DLG test scope for overall tests, or focus on other value-determining characteristics and properties of the test subject. The minimum requirements, test conditions and procedures as well as the evaluation bases of the test results will be specified in consultation with an expert group of DLG. They correspond to the recognised rules of technology, as well as scientific and agricultural knowledge and requirements. The successful testing is concluded with the publication of a test report, as well as the awarding of the test mark which is valid for five years from the date of awarding.



The DLG test on surround-view systems assesses driver assistance systems for their suitability for use on agricultural and forestry vehicles. The test evaluates the following technical parameters: field of view, imaging size, signal propagation delay and image resolution, shock and vibration resistance as well as handling and operation by farmers in field conditions. The test was carried out in line with the DLG test framework “Surround View Systems” (date of issue October 2022). Other criteria were not tested.

## The product

### Manufacturer and applicant

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### Description and technical data

The tested product which is discussed in the following report is the ProViu®360 Surround View system.

The system consists of a display screen, an ECU (Electronic Control Unit) and four cameras. There is one camera mounted on the front, rear and sides of the vehicle. The ECU processes the feeds from the four cameras and stitches them to one panoramic image that is displayed on the screen. This image gives operators a bird’s eye view of the vehicle.

Table 1:

Technical data – Display screen, ECU, cameras (manufacturer specifications)

	Display screen	ECU	Cameras
Product name	ProViu® Display screen	SVU220 ECU	SVC211 Cam
Display screen size	10.1“	-/-	-/-
Resolution	1280 x 720	-/-	1280 x 800
Casing material	Aluminium	Aluminium	Aluminium
Input voltage range	8 V to 24 V	8 V to 16 V	8 V to 16 V
Reverse polarity protection	yes	yes	-/-
EMC compliance	ECE-R10	ECE-R10	ECE-R10
Vibration resistance	ISO16750, Road vehicles	5 to 200 Hz/5 g	5 to 200 Hz/5 g
Shock resistance	ISO 16750-3 rigidly mounted parts	100 g, 10 ms, 6x	50 g, 6 ms, 10x
IP rating	IP67	IP5K2	IP6K7
Dimensions	270 mm x 177 mm x 33 mm	205 mm x 100 mm x 27 mm	23 mm x 23 mm x 39 mm
Weight	1.6 kg	450 g	23 g

## Assessment in brief

The surround-view system was tested according to the DLG-APPROVED partial test scheme. In this test, the technical properties are assessed at the lab and in the field.

In the field tests, the operators also assessed the ease of mounting the system to the vehicle. The data on the service life of the product, e.g. resistance to shocks and vibration, were sourced from external non-DLG test reports.



Figure 2:  
The Surround View system consists of the display screen, ECU and four cameras

Table 1:  
Overview of results

DLG QUALITY PROFILE	Evaluation
<b>Field of vision and imaging size</b>	
– Field of vision	✓ *
– Imaging size	✓ *
– Optical resolution	✓ *
– Signal propagation delay	■ ■ ■ ■ □ **
<b>Switch-on time and reliability</b>	
– Switch-on time	■ ■ ■ ■ ■ **
– Reliability	✓ *
<b>Shock and vibration resistance</b>	
– Vibration and shock	■ ■ ■ □ □ **
– IP rating	■ ■ ■ ■ ■ **
– Impact test	✓ *
– EMC	✓ *
<b>Handling and operation</b>	
– Day/night toggle	■ ■ ■ ■ ■ **
– Camera brightness compensation	■ ■ ■ ■ ■ **
– Automatic direction/speed changes	✓ *
– 3D imaging	✓ *

The DLG test framework provides the following options in its evaluation schemes:

\* ■ ■ ■ or better = meets, exceeds or clearly exceeds the specified DLG standard, □ = meets the legal requirements for marketability, ■ = failed

\*\* Evaluation range: requirements fulfilled (✓) / requirements not fulfilled (✗)

<b>Signal propagation delay</b>	System	
○	< 300 ms	
+	< 200 ms	
++	< 100 ms	
<b>Switch-on time</b>	System	
○	≤ 10 seconds	
++	< 6 seconds	
<b>IP rating</b>	Camera	Display screen
○	≥ IP67	≥ IP20
+	≥ IP68	≥ IP31
++	IP6K9	≥ IP67
<b>Vibration resistance</b>	Camera, display screen	
○	ISO 16750-3 Road vehicles, sprung masses	
+	ISO 16750-3 Utility vehicles, decoupled cabin	
<b>Shock resistance</b>	Camera, display screen	
○	ISO 16750-3 Parts rigidly attached to the body	
+	ISO 16750-3 Parts in doors and flaps	

Evaluation range: + + / + / ○ / - / - - (○ = Standard, n.e. = no evaluation)

## The method

### Field of vision and imaging size

The field of view is tested and evaluated in the field. This test verifies whether the operator can see a 1.70m tall person at any time as the person is moving or standing in the surrounding area of the machine. This is particularly essential in those areas where the camera images overlap which may present blind spots. At the same time, it is acceptable if the system renders the person as a double image on the screen. Systems that superimpose, distort and stitch the images must be tested for suitability on agricultural ground such as fields and meadows. An about 1.70 m tall person who stands or moves within a defined field of view must be rendered on the display screen at least as a 7mm tall person. This measure also defines the minimum size of the screen. The screens should be mounted in a forward view position without obstructing the operator's line of sight.

The optical resolution is characterised by the so-called Triangle Orientation Discrimination (TOD) method. In this test, an observer is asked to identify the orientation of a triangle (up, down, left, or right) relative to the size and contrast of the image. The test involves a certain number of observers (at least three in this case). Their task is to identify the random orientation of a triangle (up, down, left, right). The number of correctly identified orientations is a measure for characterising the optical performance of the system as a whole.

The signal propagation delay is measured and evaluated in a special test setup at the lab. The

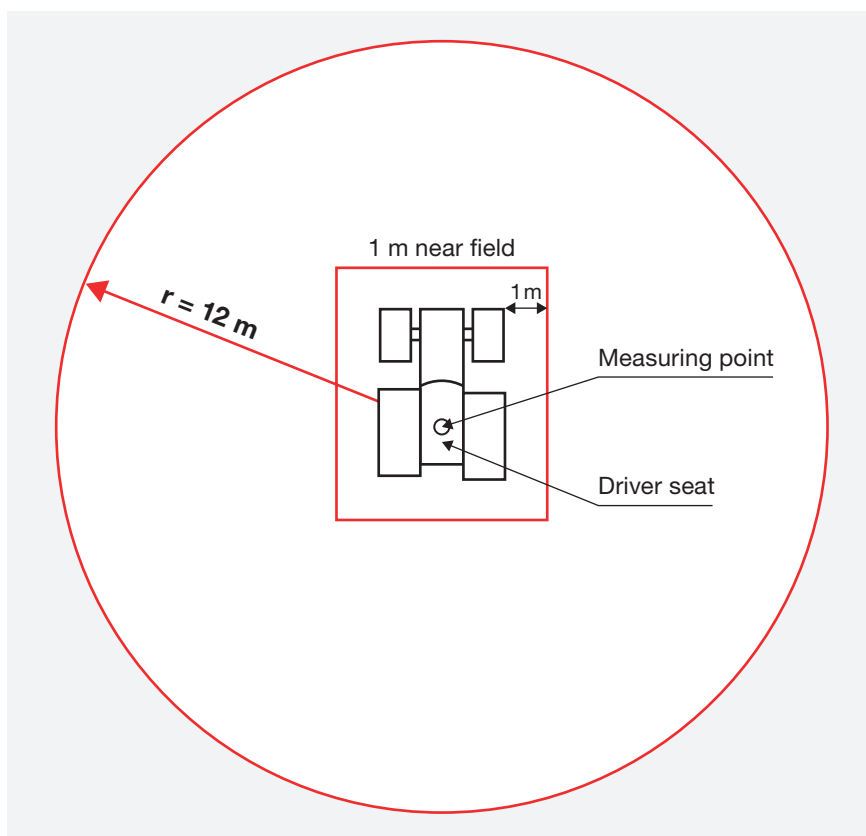


Figure 3:  
Surround view by ProViu® 360

measurements and evaluations are made in line with ISO 16001. This standard specifies that the signal propagation delay must not exceed 300 ms. A signal propagation delay of less than 200 ms is considered as “good”, a delay of less than 100 ms as “very good”.

### Switch-on time and reliability

The switch-on time is verified and evaluated in the field test. The switch-on time should be as short as possible. The recording of the switch-on time starts the moment the machine is started (e.g. when the ignition key is turned) and stopped when the image appears on screen. The requirement is that the switch-on time must not exceed 10 seconds.

A switch-on time of less than 6 seconds is rated as “good”.

The reliability of the system is verified and evaluated in field conditions by simulating a malfunction by disconnecting the camera feed lines. Any malfunction must be alerted by the screen taking on a bright colour or displaying a pictogram. It must not go black, because a black screen would not alert the driver at night.

### Vibration and shock resistance

The ISO 16750-3 standard defines the mechanical load to which electrical and electronic equipment on on-road vehicles is exposed in various test cycles.

The test cycle “Passenger cars, sprung masses (vehicle body)” examines the vibration resistance of all system components by applying a minimum load. Components that pass this test cycle

meet the minimum requirements. Components that pass also the “Utility vehicles, decoupled cabin” test cycle are evaluated as “good”.

The minimum requirements in terms of shock resistance are verified in the test cycle “Parts rigidly attached to the body”. Components that pass also the test cycle “Parts in doors and flaps” are evaluated as “good”.

The components must withstand the above test cycles without any mechanical damage.

The IP rating is assessed on the basis of external information that is provided by various test reports. The minimum requirement on the camera and its connectors is IP67 compliance. This specifies a dust-tight casing (the first digit is 6) which is also protected against temporary immersion (the second digit is 7). A casing that is protected against permanent submersion (IP68) is evaluated as “good”.

The minimum IP rating for the cab-mounted display screen is IP20. This is based on the assumption that a modern cab is dry and not exposed to dust. A display screen that withstands dripping water (IP31) is rated as “good”. A monitor that is dust-proof and withstands temporary immersion (IP67) is evaluated as “very good”.

A system where all components (cameras, leads, connectors) outside the cab withstand cleaning with a pressure washer is evaluated as a “very good”.

The impact test is carried out and evaluated in field conditions and in line with UN-ECE R46. In this test, a pivoting 6.8 kg arm is raised to a 30° angle and then released to impact the front and the side of the camera. Vehicle-

mounted cameras are impact tested in direction of travel and from the side, if possible. The bracket of a vehicle-mounted camera may twist but must not be damaged by the impact. This applies also to the camera.

All system components must meet UN-ECE R10 standards which outline the range of tolerated interferences and susceptibility to such interferences. All components must bear the appropriate approval marks.

### Handling and operation

The manual is assessed by the operators during the practical part of the test.

They complete an evaluation sheet that covers the following parameters: practicality of the manual, system installation and start-up. The minimum number of evaluators is three. All three must be experienced users of the system.

In addition to this, the operators assess the following features:

- Day/night mode screen toggle  
(o ≙ no, + ≙ manually, ++ ≙ automatically)
- Camera brightness compensation  
(o ≙ no, + ≙ manually, ++ ≙ automatically)
- Heated cameras (yes/no)
- Cleaning system available (yes/no)
- Protection bar available (yes/no)
- Customizable overlays  
(o ≙ no, + ≙ static, ++ ≙ operator customisable)
- Automatic change of direction/speed (yes/no)
- 3D imaging (o ≙ no, + ≙ yes, ++ ≙ rotating)
- AR functionality (the technique of overlaying the image with visual elements or hidden areas) (yes/no)

## Detailed account of the test results

The system was mounted on a Fendt 1050 tractor which was used in all tests. The camera brackets were still pre-production units at the time of the tests.

### Field of vision and imaging size

As a person walked the perimeter of the 1 m near-field area around the machine and the perimeter of the field of view (12 m radius), the operator was able to view the person at all times. This applied also to the overlapping zones. As the person walked the perimeter of the field of view, the system rendered a double image of the person, which is acceptable. The rendered image was smallest when the person was on the side of the vehicle on the 12 m perimeter. The image was larger than 7mm.

The optical resolution of the system was examined and assessed in field conditions. The observers clearly identified the correct orientation of the individual test patterns.

The signal propagation delay measured was 114.8 ms, which scores as “good”.

### Switch-on time and reliability

The system boots up in less than 6 seconds. This is rated as “good”. The rear-view camera feed is displayed on the screen after only 2 seconds.

The reliability of the system was verified and evaluated in field conditions. The screen of the pre-production model went black when one of the cameras failed. This shortcoming was acknowledged by the

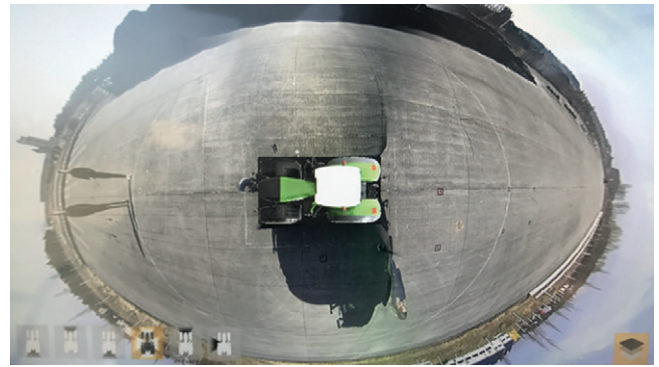


Figure 4:  
The overlapping zone

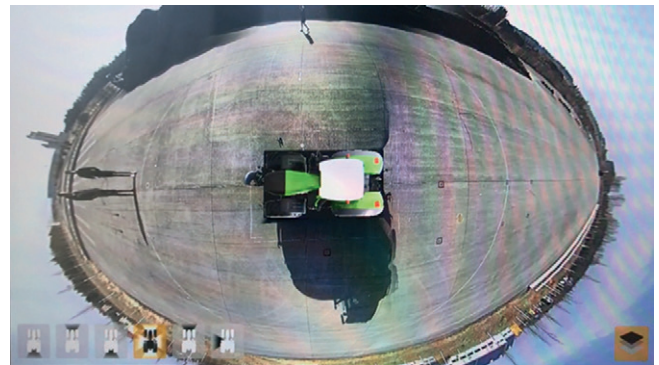


Figure 5:  
Minimum imaging size



Figure 6:  
Optical resolution

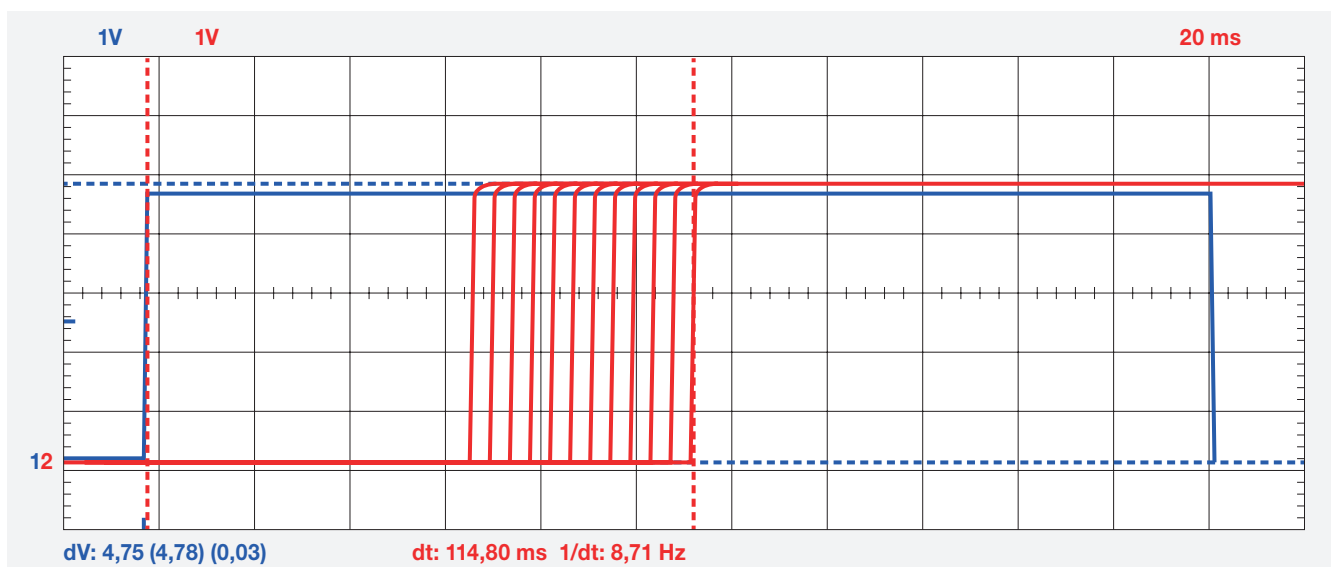


Figure 7:  
The signal propagation delay

manufacturer who is going to solve the issue in the next firmware version before the product goes to market. The updated screen will then alert camera failure by going pink or blue or by displaying a pictogram.

### **Vibration, shock, EMC and IP rating**

All components of the surround-view system are state of the art and meet the required specifications.

The camera casings comply with the highest IP6K9 rating which means “very good”. The connector complies with IP6K7 rating (manufacturer information). This means that it must be shielded before the machine can be cleaned with a high-pressure washer. The display screen is rated to IP67, which is “very good”.



*Figures 8 and 9:  
Impact test on the front-mounted camera*

The impact test was carried out with the system mounted on the test tractor. All cameras withstood the test without damage. The pre-production holders of the side-mounted cameras bent to the rear under the impact – which is a tolerable and reasonable consequence to avoid damage.

### **Manual and operation**

As the surround-view system is not marketed to retail customers but to OEM manufacturers, it does not have a manual or start-up instructions.

All persons involved in the test rated the surround-view system as “good” and would also recommend the system, because it allows operators to watch linkage coupling processes at front and rear, which is considered very useful in practical operation.

The system’s ability to adapt screen and camera brightness to the ambient light was found to “very good”. A heating or cleaning system or a protection bar for the cameras is not available. The overlay is a default OEM setting and is not customisable to individual needs. The view switches automatically relative to the current direction of travel and speed. Freely rotating 3D imaging is also available.

## **Summary**

In the tested criteria, the ProViu® 360 Surround View system met all requirements of the applicable test framework and as such was found suitable for agricultural use.

The test results confirm that the ProViu® 360 Surround View camera system meets all requirements of the DLG test framework on the individual criteria “Field of vision and imaging size”, “Switch-on time and reliability”, “Resistance to shock and vibration, EMC and IP rating”.

With respect to ingress of dirt and water and often difficult viewing situations around agricultural vehicles or machines, the ProViu® 360 camera system is rated as suitable for use in these applications. The test operators, too, would recommend the system for use in agriculture.

## Further information

### Testing agency

DLG TestService GmbH,  
Gross-Umstadt location, Germany

The tests are conducted on behalf of DLG e.V.

### DLG test framework

DLG-Approved test on surround-view systems  
(as 10/2022)

### Department

Tractors, machines and utility vehicles

### Test engineer(s)

Dipl.-Ing. (FH) Andreas Horn\*

\* Author

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As one of the leading organisations in the agricultural and food market, DLG organises international trade fairs and events in the specialist areas of crop production, animal husbandry, machinery and equipment for farming and forestry work as well as energy supply and food technology. DLG's quality tests for food, agricultural equipment and farm inputs are highly acclaimed around the world.

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