◆ VANDEWIELE   ◯ PROTECHNA

User Manual

ARRAYCAM 5420

for Tricot Machines

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For further information, please contact:

PROTECHNA Herbst GmbH & Co KG

Lilienthalstr. 9
85579 Neubiberg
Germany

Telephone: +49 (0)89 608 114-0
Fax: +49 (0)89 608 114-48
E-Mail: info@protechna.de
Internet: www.protechna.de

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1   Safety instructions

- Always obey all warnings and instructions that are displayed or indicated on the unit itself, or are mentioned in this manual.

- This unit is sensitive to electrostatic discharges, which can damage its internal parts and impair their normal operation. Take the necessary precautions for handling components sensitive to electrostatic discharges.

- Before cleaning the unit or removing or installing any options, always disconnect the unit from the power supply.

- Do not use any liquid cleaning agents or cleaning sprays when cleaning the unit; use only a moistened cloth.

- Never operate the unit at locations where there is a risk that water or other liquids can penetrate into the unit.

- The installation location chosen for the unit must be absolutely stable, since severe vibrations such as the result of dropping the unit can seriously damage it.

- Make absolutely sure that the voltage values specified for the unit power supply are complied with.

- Never attempt to insert objects through the openings on the unit, since the voltages that are present within the interior can cause short circuits or electric shocks.

- Except for the interventions explicitly described in the manual, you must never attempt to repair the unit yourself. Otherwise you expose yourself to the risk of coming into contact with parts that are live at high voltages.

- Although the power emitted by the transmitter of the laser setting aid (optional) is not sufficient to be hazardous (laser class 1), direct eye contact with the laser light beam should be avoided.

The electrical connection must only be carried out by suitably qualified technical personnel.

Before making the electrical connection, you must make absolutely sure that there is no danger to come into contact with any parts that might carry live electricity.

**Use for the intended purpose
in the sense of point 1.1.2.c
EC Machinery Directive**

Point 1
The ArrayCam 5420 system is intended for monitoring fabric on textile warp knitting machines and may be mounted and operated only on such machines.

The EMC requirements to DIN/EN 50082-2 and DIN/EN 50081 part 2 for industrial equipment are satisfied.

Point 2
The ArrayCam 5420 system must be permanently installed at the place of use.

Point 3
The camera unit must be mounted on the free-standing beam frame; the control unit must be mounted on the control cabinet or on the free-standing beam frame. This work may be performed only by PROTECHNA technicians or by skilled workers (mechanic,   electrician) of the customer.

2   Functional description

The ArrayCam 5420 is a camera-based fabric monitoring system for use on warp knitting machines for monitoring the fabric for impermissible variations in the stitch pattern.

The camera system consists of a control unit with an associated camera unit. The camera unit is a modular design and consists of a master module with an extension module if necessary.

The master module contains the evaluation unit with 6 cameras. This allows the coverage of a monitoring width of 3600 mm for a 130" machine. The monitoring width can be extended with appropriate extension modules for wider machines up to a maximum of 280" working width.

The camera unit is equipped with LED lights. Imaging data, fault coordinates and parameters are transmitted to the control unit 5420. All system settings are made at the control unit 5420.

3   General instructions

For an optimum performance of the camera system, the following requirements are necessary:

1.   The camera system must be installed according to the installation instruction

2.   Changing external lighting influences (sunlight / shadowing) should be avoided as far as possible, since they may cause false stoppages or malfunctions.

3.   If highly transparent fabrics are being produced and moving parts of the machine are visible through the fabric, it is important in such cases that constructive measures are taken to create an even dark background (for instance by fitting shield plates, etc.) so that the moveable parts of the machine are not within the field of view of the cameras.

4.   The edges of the fabric must always be set exactly. This is the only way to ensure that the entire width of the fabric is monitored.

5.   Any dirt on the viewing windows of the cameras must always be removed.

6.   There must be no objects in the field of view of the cameras obstructing a clear view of the fabric in the area between the cameras and the fabric

4   Operation of the menu system

The control unit 5420 allows the complete control and parameterisation of the camera system. The relevant input pages are illustrated and described on the following pages.

4.1   Meaning of the keys
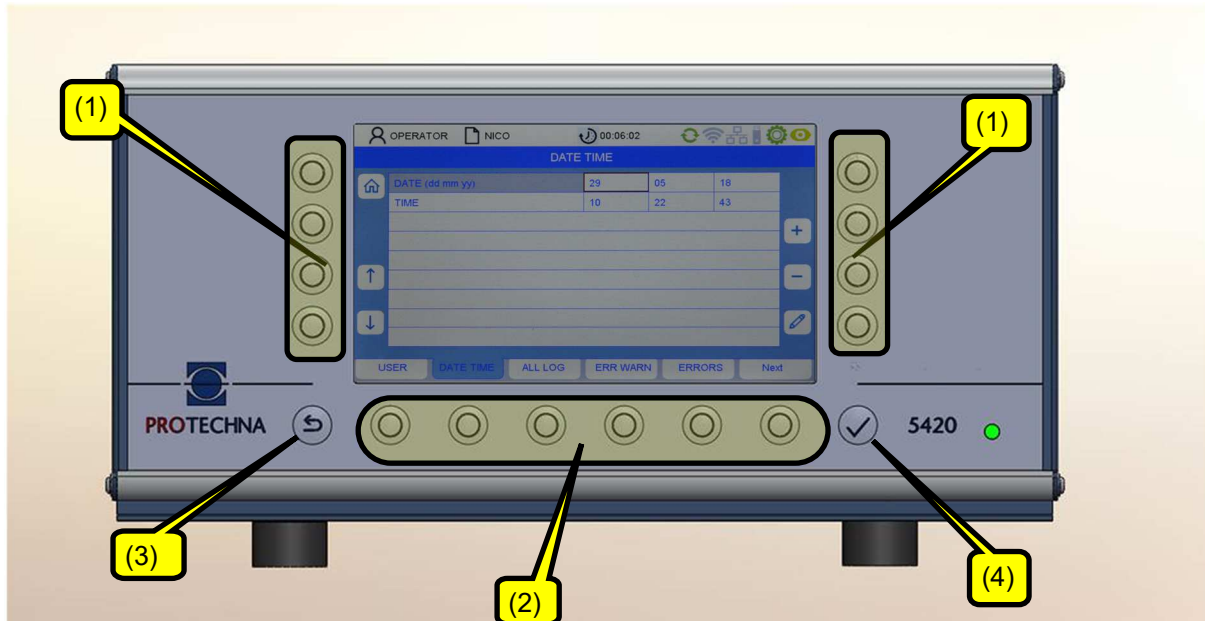
Softkeys (1): The meaning of the keys is described on the screen

Menu keys (2): The meaning of the keys is described on the screen

Keys with a fixed assignment ESCAPE (3) and ENTER (4)

The keys (1) and (2) refer to the screen symbol next to the key.

4.2   Entering text
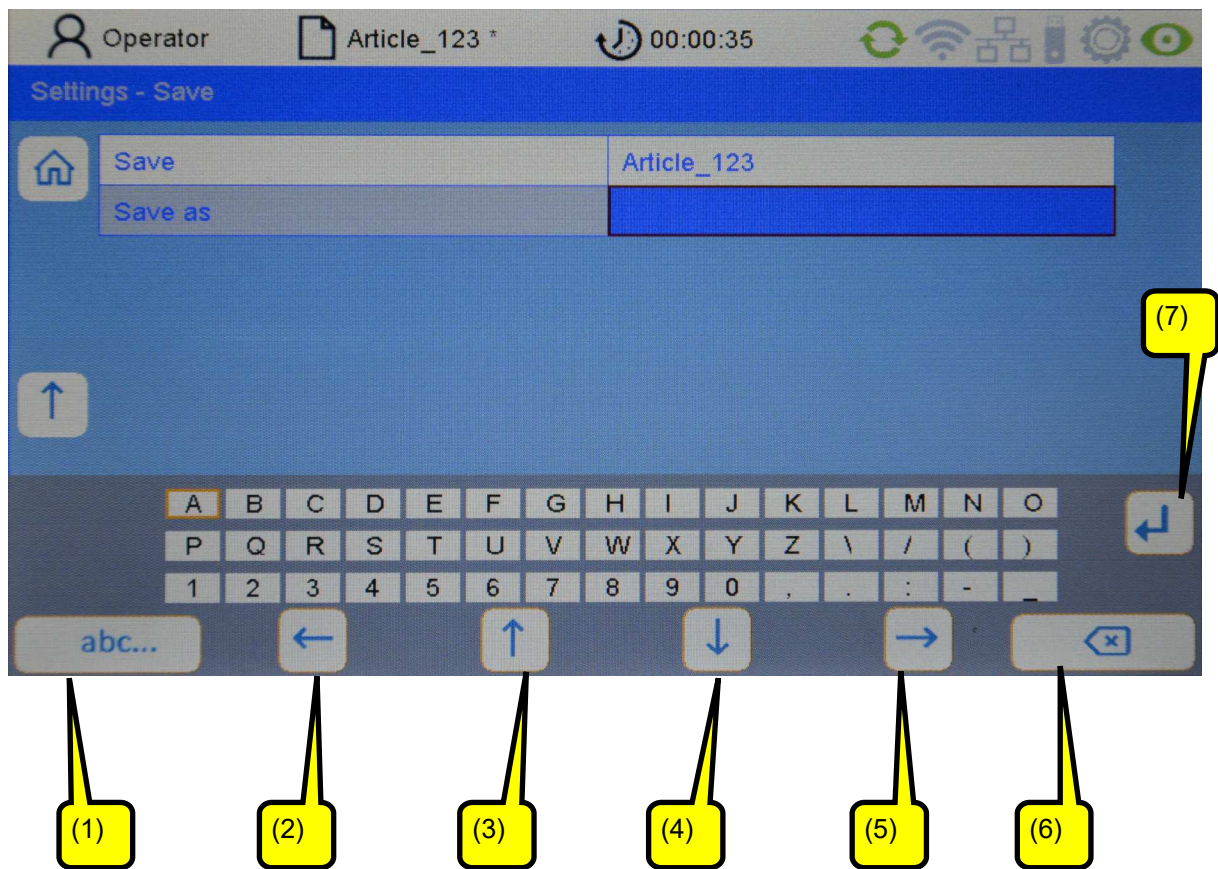
If alphanumeric characters can be entered in fields, a virtual keyboard appears after pressing the pencil key

- The DELETE key deletes the characters in the selected field
- The arrow keys (2-5) are used to select a character on the screen matrix. The actual character is marked
- Key (1) is used to switch the keypad. (e.g. Changeover from uppercase to lowercase)
- With the RETURN-key (7) you accept the selected character to be appended
- ENTER   is used to accept the selected character
- Inputs   ✔   not accepted with   ENTER will be discarded
                               ✔

4.3 Entering numbers
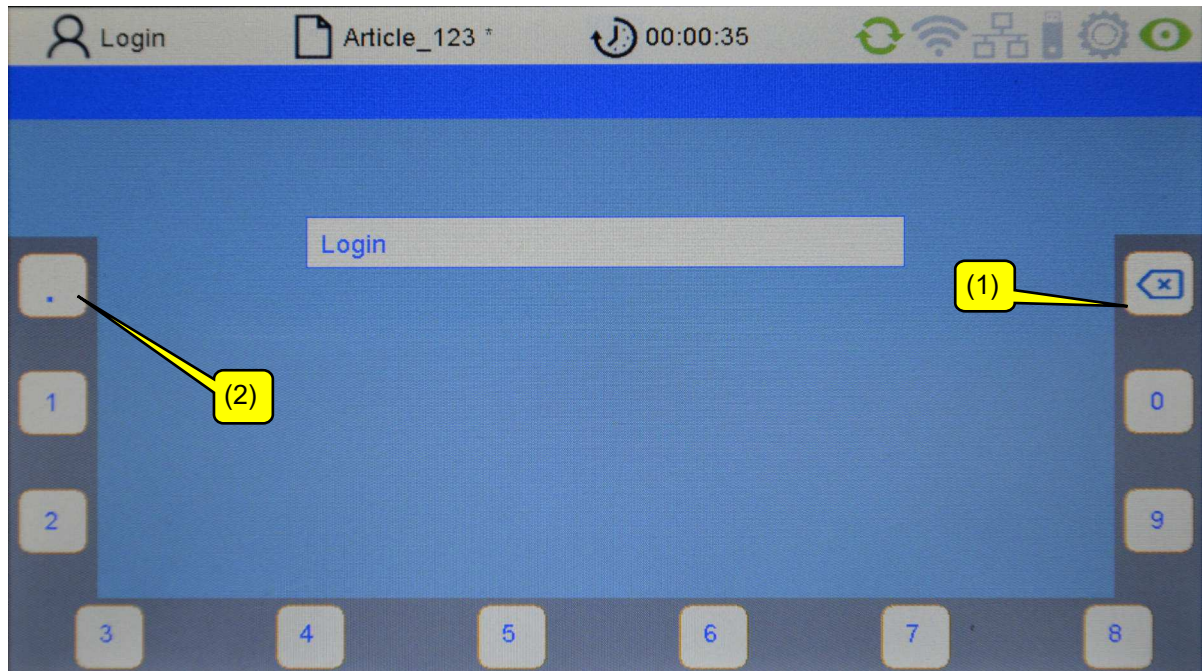
- The DELETE key (1) deletes the numbers from right to left.
- The decimal point key (2) is used for entering floating point numbers.
- Pressing the ENTER key ✔ accepts the new number string. The virtual number pad disappears and you are in the actual submenu.

4.4 Navigation within the menu

At the bottom edge of the screen there is a bar showing the available sub-menus. Pressing the respective menu key calls up the respective submenu.

4.5 Navigation within the submenu

In the submenus, the callable menu items are formed as register tongues.
The highlighted tab (here Camera) displays the currently selected submenu.

Some submenus, such as the Service submenu, are accessible only by users with special rights. If you don´t have the necessary access right for entering e.g. the Service menu, a login menu will then appear which allows the password to be entered (see chapter 4.6).

Pressing the Home key 🏠 takes you back to the main menu.

Pressing the Escape key ↩ aborts actual dialogues or takes you to the higher-level menu.

To edit a parameter, first select it within the relevant menu. The image below shows an example of how to do this:

Use the arrow keys (3) to select the requested parameter within the submenu. The current parameter is highlighted in gray.

If there is a selection range for this parameter you can use the +/- keys (1) to page through the selection range. If on the other hand the parameter is assigned a numeric value you can change the value using both the +/- keys and also the Pencil key (2). The Pencil key takes you to a new numeric input menu (see the chapter "Entering numbers").

There is no need to accept changed parameter values individually. Changed values are accepted automatically when you exit the respective menu. It is sufficient to press the key for another submenu or to skip back by pressing the Home key (1). The data are then loaded to the ArrayCam system.

To permanently save a changed parameter value, the respective article must be saved (see the chapter "Saving an article").

4.6   Operator Login

As a non-registered user you will automatically be asked to enter the password for submenus which need authorization. The password for the operator is factory set to "11111".
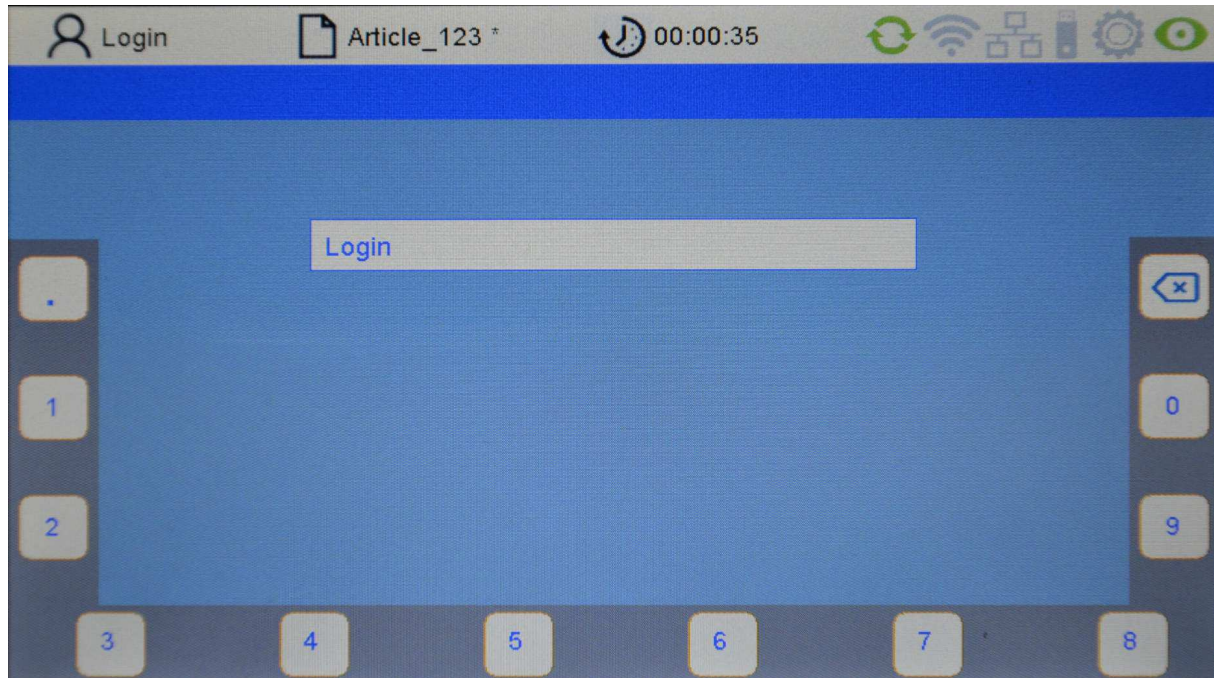
By pressing the keys for the numbers around the edge of the screen, you can enter the user specific password (numeric combination) (see also the chapter "Entering numbers").

When the password is entered incorrectly, the message appears „Wrong password".

You can then enter the password again

5 main screen
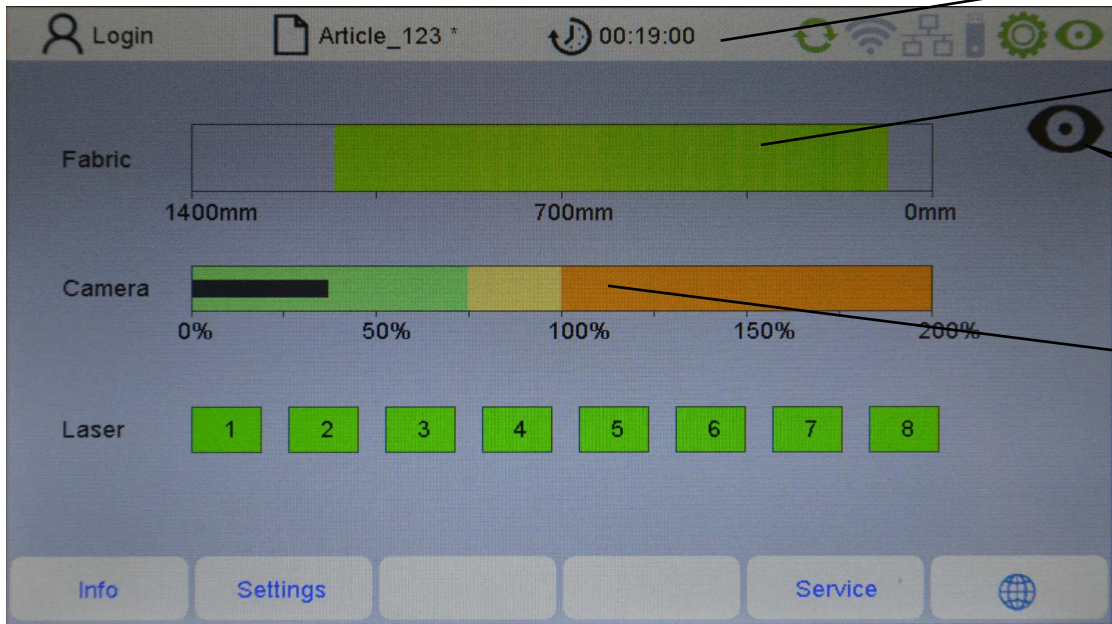
The main screen consists of several parts: a status bar (A), the fabric image (B) and the signals of the camera and laser monitoring (C).
The test mode can be switched on and off by pressing the key (1) (see test mode).

Status bar
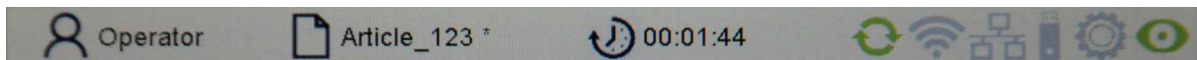
The status bar shows the operating conditions of the machine as described below.

Symbol		Beschreibung
⚇ Operator		Current user ID
🗎 Article_123 *		Current produced article (* means not saved yet)
⟳ 00:01:44		Current production period
🔄	🔄	Communication with ArrayCam OK / out of order
⚙	⚙	Machine is running / not running
👁	👁	Monitoring active / not active test mode (flashing)

Fabric image

The image shows the last fabric produced. Please note that this image is not a 1:1 representation of

the fabric but a false colour image interpretation carried out by the camera system.

The colours are based on a traffic light system:
- Green: The fabric is OK.
- Yellow: Critical situation, however, not yet detected as a fault.
- Red: A fault has been detected in the fabric.
- Dark gray: Adjusted blanking areas (eg: separation gates) are not monitored. (see chapter 6.3)

The camera system detects fabric faults based on variations in brightness in the fabric that is produced. These can be dark areas (for instance shadowing) or brighter areas (for instance a missing thread).
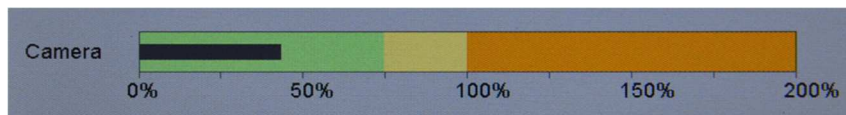
Display of camera monitoring

The display shows the common status of the activated monitoring modules. The black bar should preferably move in the green area (fabric is good) or in the yellow area (fabric is critical). If a defect is detected, the bar will remain in the red area. The machine is stopped unless it is operating in test mode.

Display of the laser light barrier monitoring (optional)
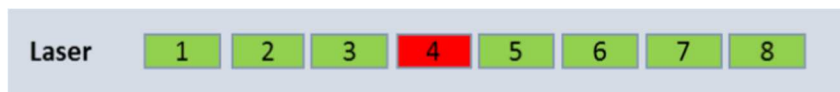
The display only appears if a light barrier module is installed. It shows the status of the respective light barrier (here 1-8) in colour

- Gray: the laser light barrier is not activated
- Green: the laser light barrier is active. The fault detection works.
- Red: the laser light barrier (here 4) has detected a fault. The machine is stopped unless it is operating in test mode.

Test Mode

When the test mode is switched on, the symbol in the status bar flashes yellow.
The fault detection of the camera and the optional laser light barriers work normally. Detected defects are displayed, but do not lead to a stop of the machine!

The test mode facilitates the optimization of the monitoring parameters.

6   Setting the camera system

There are two different ways to set the camera system

Predefined parameter sets allow an easy and fast adjustment of the camera system. For typical defects in the fabric, there are these sets of setting parameters, such as Plain, striped fabric, transparent fabric or velour. You may change the sensitivity setting only, to optimize the fault detection. A description of this procedure can be found in chapter 6.1 Quick Setting.

If this simplified setting procedure does not allow reliable fault detection, you can alternatively make the settings user-specifically. The monitoring consists of one or two monitoring modules, which must be set separately.
If the fault detection with one monitoring module is insufficient, another monitoring module can be activated. Each monitoring module can be optimized to detect a particular type of defect.
The fault detection is therefore responsive if either monitoring module 1 or monitoring module 2 have detected a fault. For example, it is also possible to optimize a monitoring module for fast detection of clearly visible defects, while the second monitoring module also detects fine defects, but requires more time. For a description, see 6.2 User-specific setting.

To set the camera system, you should first switch the camera system to "Test Mode". This prevents the machine from being stopped if the camera settings are not set correctly yet.

6.1 Quick start instructions

Select the **"Settings"** menu in the menu bar of the main screen. If you are not registered yet, enter the operator password. You are in the **„Camera"** submenu then.

Hint: The path to reach each submenu is always displayed in row 2 of corresponding submenu.
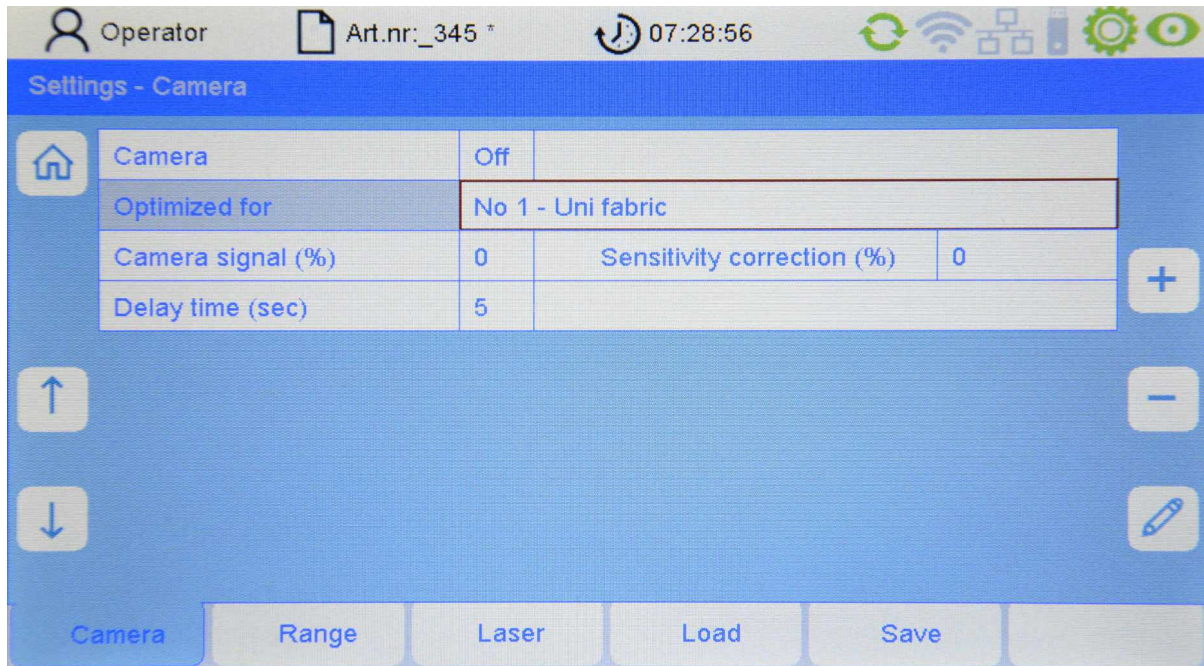
Use the arrow keys (up / down) to select the respective menu item.

Camera
Here the monitoring of the camera can be switched on and off.

Optimized for
Presets are predefined setting parameter sets for the most common types of defects, depending on the product produced. Please select
- Uni fabric
- Transparent fabric
- Striped fabric
- Velour
- User defined settings

Preferably use one of these presets. If the fault detection does not work satisfactorily for any of these presets, you can also configure the camera monitoring user-specifically, as described in the next chapter.

Camera signal (%)
Here, the sensitivity of the camera system can be changed. You can enter values between -20% and + 20% here. The higher the value, the higher the sensitivity. In this case the camera signal and the amplitude of the signal bar on the main page will tend to be higher.

Increasing the sensitivity also increases the signal level. As long as the signal level is below 100%, the machine will not turn off. Exceeding the signal level of more than 100% is interpreted as a fault and causes the machine to stop.

Delay Time (sec)
The time between starting the machine and starting the monitoring function is set here (start delay).

The delay time must be long enough to ensure that the fabric faults are out of the monitoring area after the machine has been started.

ATTENTION: When the monitoring is started with a fault present, the fault detection at that point will not operate correctly for quite a long period of time.

6.2   User defined settings

Select the **"Settings"** menu in the menu bar of the main screen. Select the „**Camera**" submenu then.
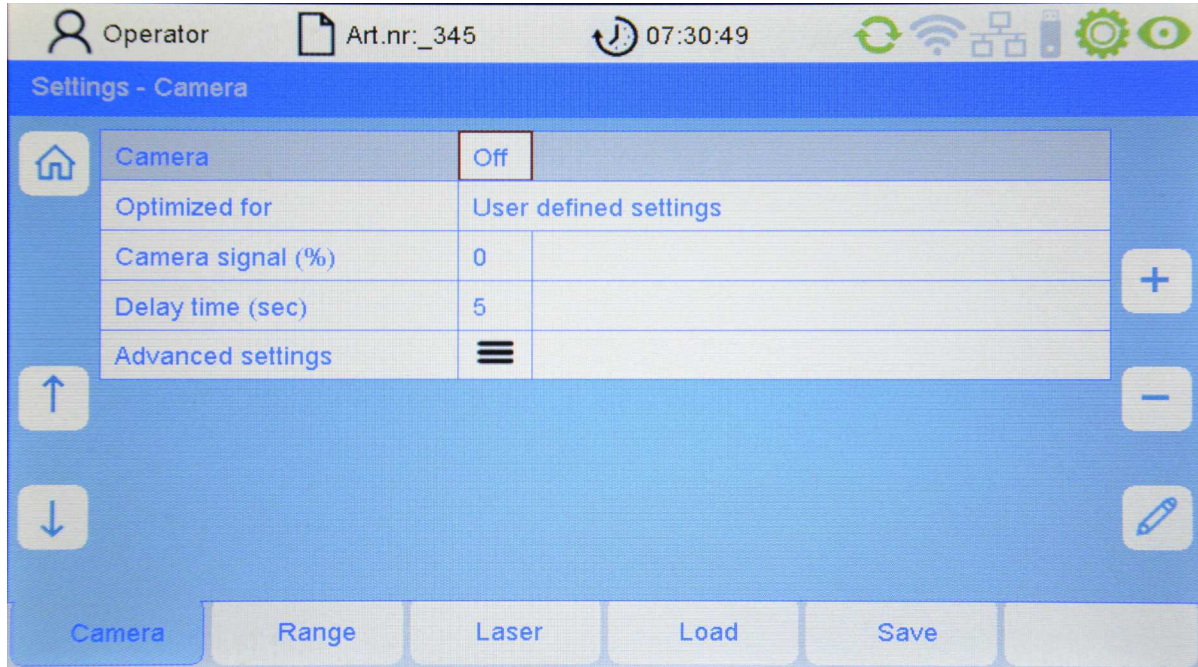
Optimized for
To enter the advanced settings submenu, use the + or - key to select „**User defined settings**".

Advanced Settings
To define user-specific settings, use the arrow keys to select „Advanced setting" and type ENTER.
You are then in the submenu „**Camera surveillance module 1**" where you can optimize the camera parameters (see next chapter).

Setting the Camera surveillance module 1

Select the **"Settings"** menu in the menu bar of the main screen. Select **„Camera - User defined settings - Advanced Settings - Camera surveillance module 1"** subsequently. This path is also shown in row 2 of this submenu.

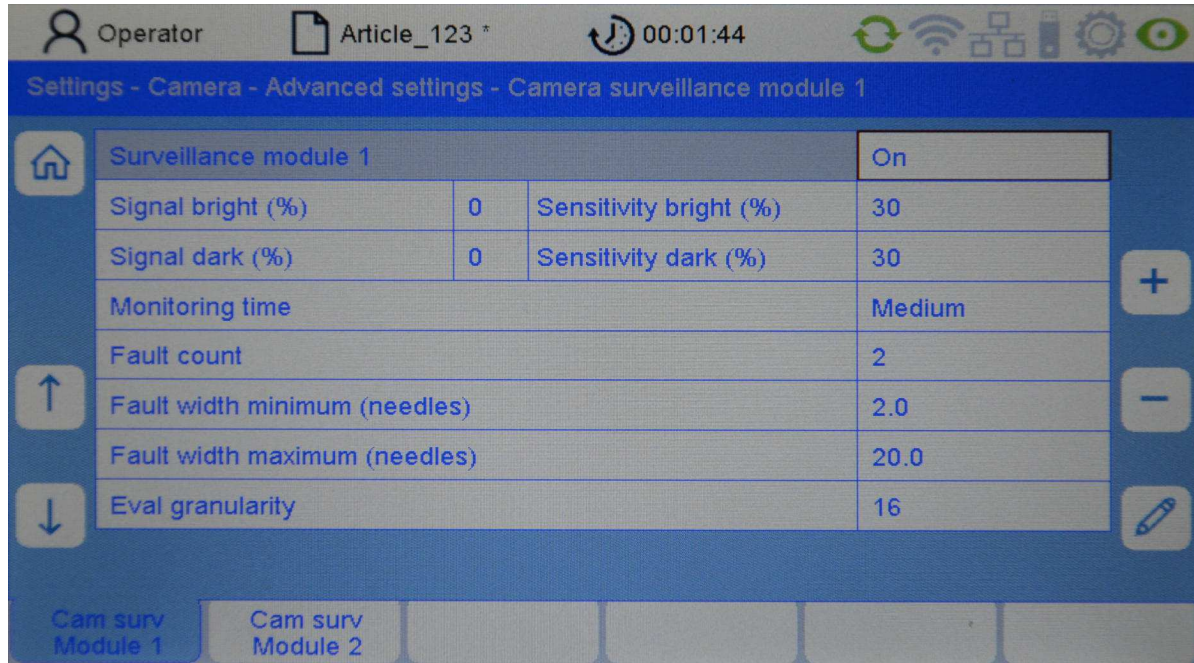Here you can configure the camera evaluation 1 and adapt it to the produced fabric.

Surveillance module 1
The monitoring function for camera evaluation 1 can be activated or deactivated here.

Sensitivity bright/dark
Here you can adjust the sensitivity for both types of analysis, bright and dark, independently of each other.

When you increase the sensitivity, the signal level will also rise. As long as the signal level remains in the green or yellow area, the machine will not be switched off. When the signal level exceeds 100% (red area), this is interpreted as a fault and leads to a machine stop.

The signal level for Bright / Dark can be seen to the right of **"Signal Bright (%)"** and **"Signal Dark (%)".**

The standard value for the sensitivity is 30%. When setting the sensitivity, please take care that the signal has a sufficient distance (<70%) to the switch-off threshold. When the signal exceeds the switch-off threshold (100%) whilst fault-free fabric is passing the camera, this leads to a switch-off of the machine (the camera interprets the signal as a fabric fault even though there is no fabric fault present).

Normally all faults are shown as a dark line on the main screen, so that the sensitivity for bright faults (Sensitivity bright) should be reduced in order to avoid false stops of the machine.

Monitoring Time

For each calculation cycle of the camera system, a certain number of measured values are aggregated during the specified monitoring period (averages).

A long monitoring period is particularly necessary when the measurements may be affected by short-term interference and this interference should not lead to a shut down of the machine, respectively the faults to be detected can be noticed visually only with difficulty.

It does lead, however, to longer fabric faults, since the time until switching off the machine is also longer.

There are three levels available for the averages:

Short   Monitoring period approx. 1 second
Medium   Monitoring period approx. 3 seconds
Long   Monitoring period approx. 10 seconds

A longer monitoring period reduces the noise caused by the surface structure of the fabric. If such materials are being produced, please use the settings Medium or Long.

Fault count

The fault counter defines the number of measurements during which a continuous fault must be detected before the machine is switched off.

Increasing the value of the fault counter increases the length of the faults before the machine is switched off, but reduces the risk of false stops.

Setting the monitoring period to "medium" (approx. 3 seconds) and the fault counter to 4, results in a switch-off time of approx. 12 seconds.

Setting the monitoring period to "long" (approx. 10 seconds) and the fault counter to 1, results in a switch-off time of approx. 10 seconds, but has two advantages:
- The noise is less. The sensitivity setting can be higher.
- If the defect is big, the machine will then be switched off before the 10 seconds have elapsed.

Therefore we recommend: Setting the fault counter to 1 or 2 and preferably setting the monitoring period higher to reduce the noise.

Fault Width Minimum/Maximum

The two values "minimum fault width" and "maximum fault width" specify the fault widths, which can be detected by the camera system for the monitoring module (in needle widths or stitch widths). Important here is the lower limit, which for thread break monitoring is generally set to just above 2.

The fault width should be set to at least 2 stitch widths. This setting allows a missing thread to be detected as a fault. The value can be increased when only faults, which are several needles wide, should be detected, for example, a setting of 3 for faults across 2 needles or a setting of 4 for faults across 3 needles.

The maximum fault width should always be set to a value between 20 and 30. For "normal" faults across 1 to 2 needles, please select a value of 20, for wide faults and for a structured surface select a value of 30.

Eval Granularity
Here, the fineness of the envelope is set. For a striped fabric please choose a small value (2-8), for a plain fabric you can set the value to 32.

Setting the Camera surveillance module 2

Another camera evaluation can be activated in addition to the camera evaluation 1. This second monitoring module is identical to the monitoring module 1 in respect of how it operates and how it is set up.

The evaluation parameters can be optimised at each monitoring module for different type of faults. Thus, for instance, monitoring module 1 can be set for short detection times to detect big defects and monitoring module 2 can be set to a longer switch-off time for very fine defects.

Select the **"Settings"** menu in the menu bar of the main screen. Select „**Camera - User defined settings - Advanced Settings - Camera surveillance module 2**" using the keys: arrows ,+,- and Enter, subsequently. This path is also shown in row 2 of the submenu.

The setting up of camera evaluation 2 is performed analogous to that for camera evaluation 1 as described in the previous chapter.

6.3 Setting the camera monitoring range

Select the "**Settings**" menu in the menu bar of the main screen. Select „**Range**" then.
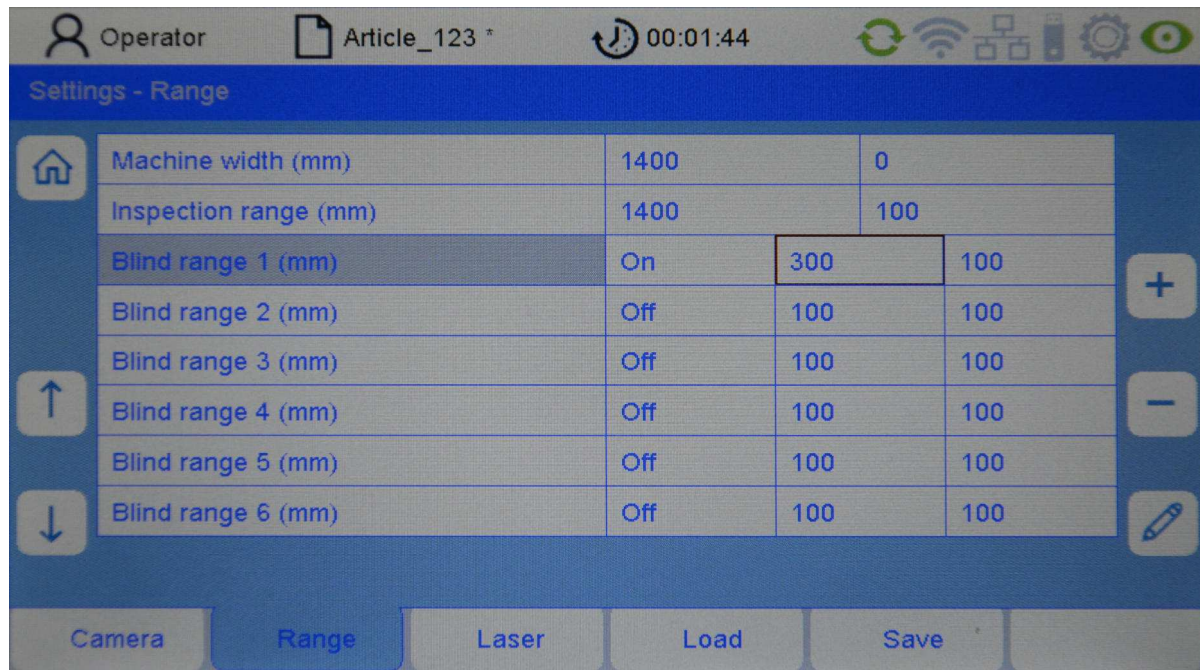
This view displays the maximum range and the setting of the monitoring width and the blanked out areas.

Machine Width
The maximal monitoring range of the camera is oriented at the guide bar. The zero position is usually the right-hand end of the guide bar.

Inspection range
The monitoring width specifies the range of the fabric that is monitored by the camera system. It can here be adjusted to suit the current manufactured article width.

The start point and end point are measured from the zero position, which is usually the right-hand end of the guide bar.

Blind range 1 … 6
When the fabric being produced includes separation gaps or other areas, which should not be monitored, these areas must be blanked out to exclude them from monitoring.

Up to 6 separation gaps can be stored. The separation gaps can then be activated / deactivated individually. You can then enter the position (start / end) of the separation gap.

The values for the positions of the separation gaps are measured from the zero position, which is usually the right-hand end of the guide bar.

7. Setting the laser light barriers (optional)

Select the "**Settings**" menu in the menu bar of the main screen. If you are not registered yet, enter the operator password. Select „**Laser**" then.
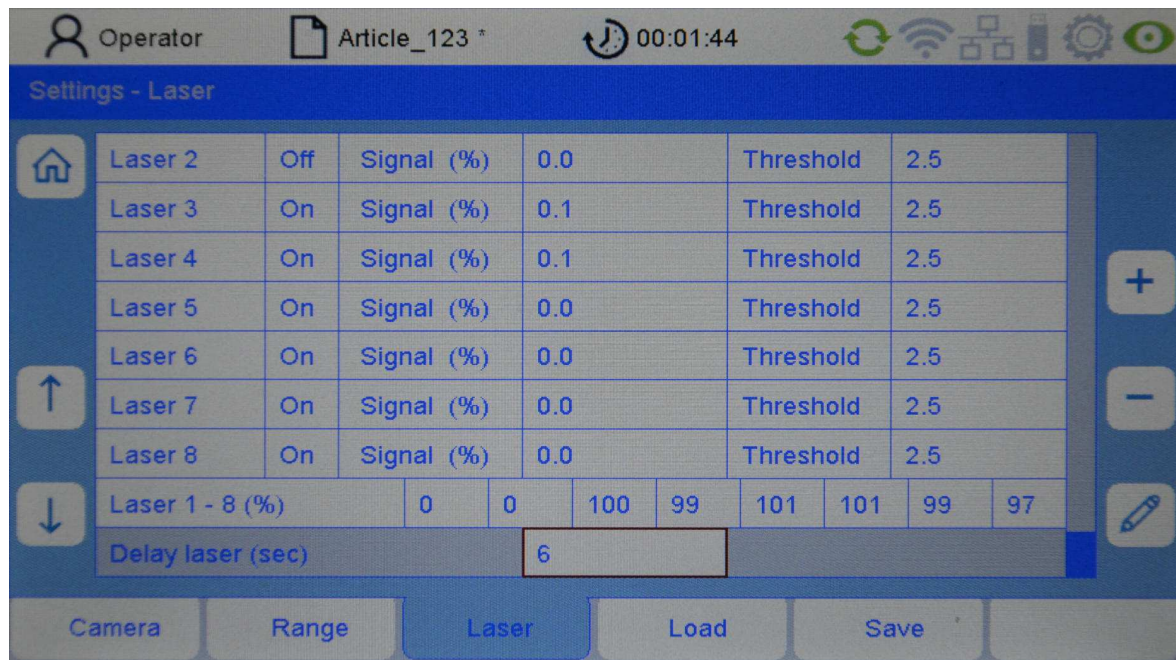
Laser 1 … 8:   field right beside **Laser (1...8)**
Here, the optional laser light barriers can be activated separately. Use the arrow keys to select the Laser light barrier you want to modify.

A maximum of 8 laser light barriers can be connected. The number of the respective laser light barrier is also referred to below as a channel.

ON   laser light barrier is activated

OFF   laser light barrier is deactivated

Laser 1 … 8 :   field right beside **Signal (%)**
Display of the noise level for this channel, in relation to the reception level, when the machine is running

and

display of the signal level when a thread passes through the laser light barrier (thread signal) - for this channel in relation to the reception level.

These displays are also important when setting up the individual switching thresholds (switch levels).

There is no input possibility.

Laser 1 … 8   field right beside **Threshold (%)**

Setting the switching threshold (sensitivity)

Display and input possibility for the switching threshold (sensitivity) of the channel in relation to the reception level.

The input range is between 0.5% (high sensitivity) and 90.0% (low sensitivity).

To determine the value for the switching threshold, see also: **Laser 1 … 8 Noise (%)**

The switching threshold (sensitivity) must be set between the values of the noise level (Noise) and the thread signal.

Example:
Noise level (Noise)   1%
Thread signal (Noise)   10%
Switching threshold approx. (Switch Level)   6% - 8%

Delay Laser (sec)
Here you can set a start delay (if required) for the optional laser light barriers.

Laser 1 ... 8 (%)
Display of the reception level of the laser light barrier that is connected and activated, in relation to a pre-set reference value.

The display should be approx. 100% +/-10%. This display is unavailable for channels that are not activated.

There is no input possibility.

8. Saving and loading an article

All parameters in the Settings menu can be saved in article files and reloaded later. These include settings of the camera system, the monitoring area and the laser light barriers.

In the event that a similar article has been produced before, you can select the corresponding data record and save it under a new name for the new article to be produced.

In order to reset the monitoring system to the default setting, there is an article file "Default". When this file is loaded, the monitoring system is in the default state.

Loading an article (Load)

Select the "**Settings**" menu in the menu bar of the main screen. If you are not registered yet, enter the operator password. Select „**Load**" then.
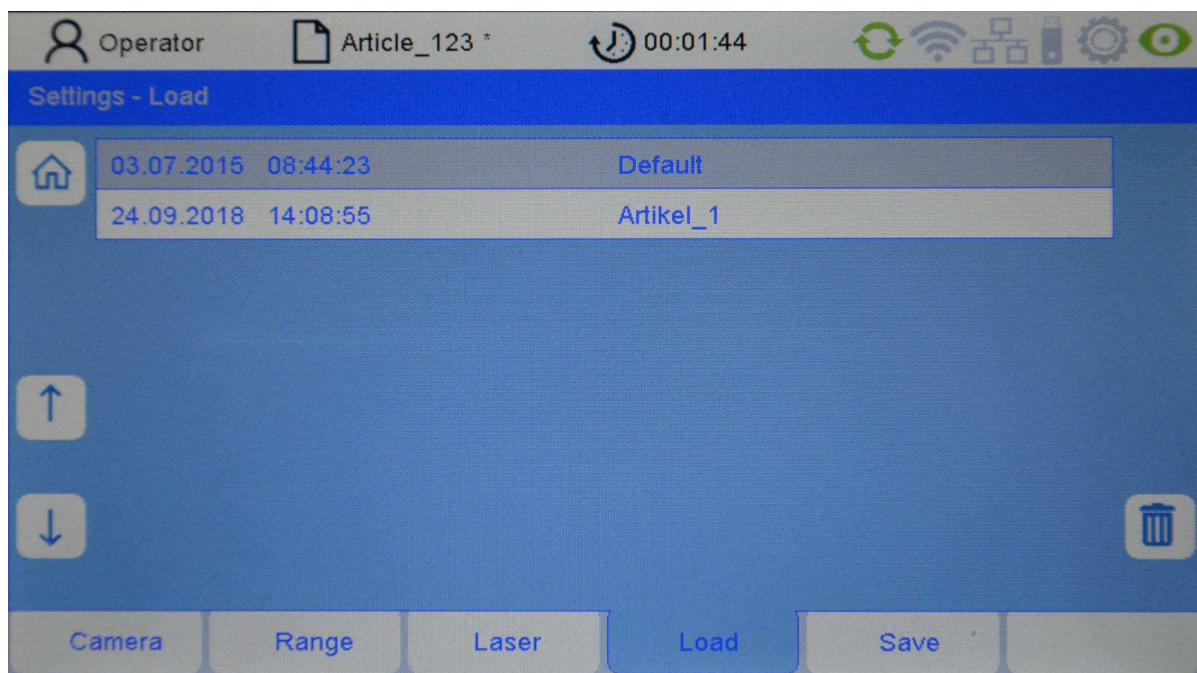
Use the arrow keys to select the desired article. Press „Enter" to load the selected article. All settings in the Setup menu will then be replaced by the settings of the saved article.

Deleting an article (Delete)

Pressing the trash button deletes the current article.
ATTENTION: at the moment there is no query, if this is really wanted.

Note: The default article cannot be deleted.

Saving an article (Save)

Select the "**Settings**" menu in the menu bar of the main screen. Select „**Save**" then.

If you press Enter, the article will be re-saved under the same name.

Hint: The line "Save" displays the file name of the current article. This corresponds to the display of the article in the status bar. A * indicates that changes have been made under this article but not yet saved.

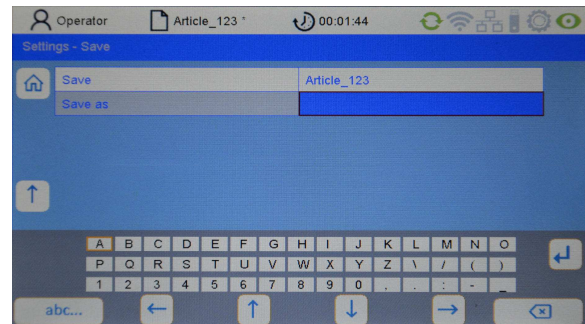**Saving the article under a new name (Save as)**

By saving a current article under a new name you can create a new article.

Select the "**Settings**" menu in the menu bar of the main screen. Select „**Save as**" then.

Here the article is displayed with its current name. (Save As: screen 1).
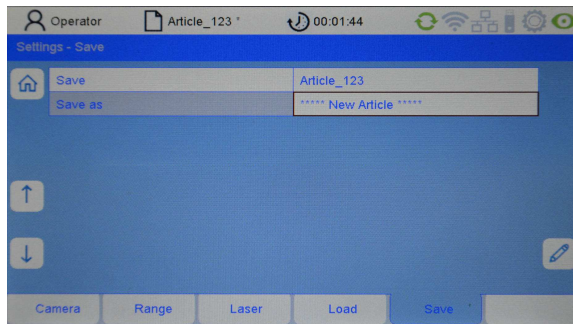
Save As: screen 1   Save As: screen 2

Use the arrow keys to select the „Save as" row.

After pushing the pencil key you can enter a new name of the current article. (see Save as screen 2 and refer to chapter „Entering of text")

Once you have entered the new article name save it by pressing the "Enter" button.

If an article with this name already exists, a confirmation is displayed, requesting whether you really want to overwrite the article: "Article already exists. Do you want to overwrite?".

Important: Please only press the buttons for Yes or No.

9. Service functions

9.1 Version information

Select the "**Info**" menu in the menu bar of the main screen. You are in the „**Version**" menu then.
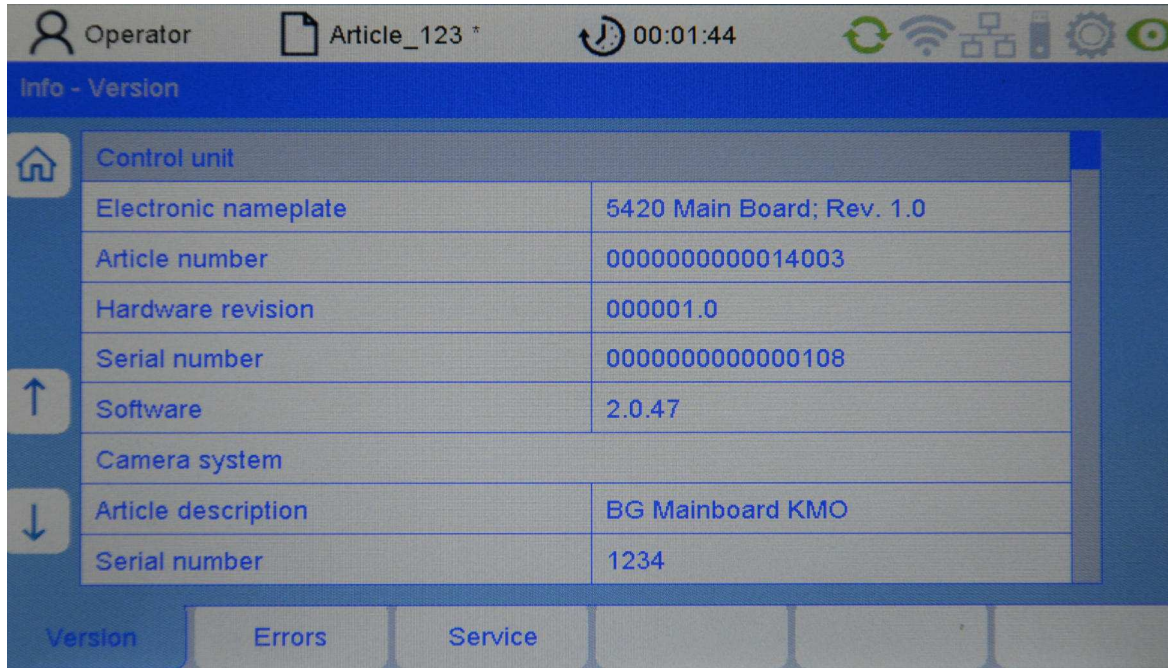
The following information about the control unit is logged here (read only):

Electronic nameplate
Motherboard control unit

Article number
Article number of the control unit

Hardware revision
Hardware version of the control unit

Serial number
Serial number of the control unit

Software
Software version of the control unit

The data of the camera system are listed below (read only).

Article description
Article description

Serial number
Serial number

Production date
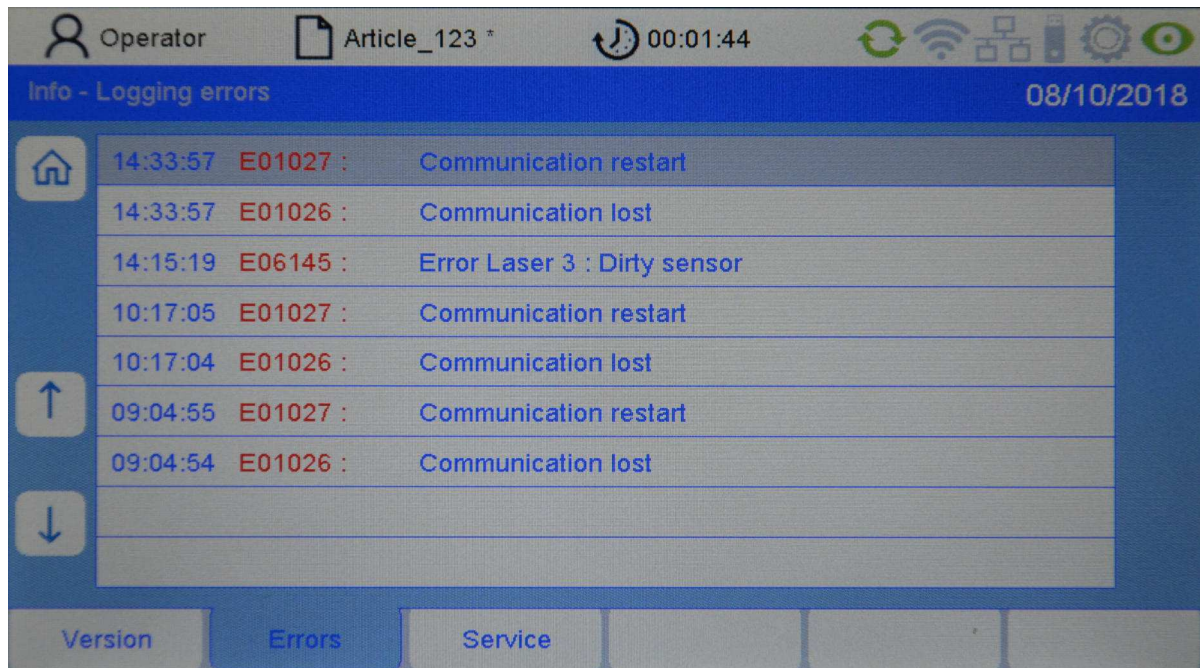Production date

Software revision
Software version

Hardware revision
Hardware version

9.2   Error logging

Select the „**Info**" menu in the menu bar of the main screen. Then select the submenu „**Error**".

Here the errors are displayed in reverse chronological order (from top to bottom)..

The format of an error logging is as follows:

Time stamp	Message number	Message text

If there are more error messages than can be displayed on a page, you can use the arrow keys to scroll up and down.

9.3   Saving service files

Select the „**Info**" menu in the menu bar of the main screen. Then select „**Service**". Please insert a USB stick to the USB service port (back of the control unit). If no USB stick is inserted, an error message appears.
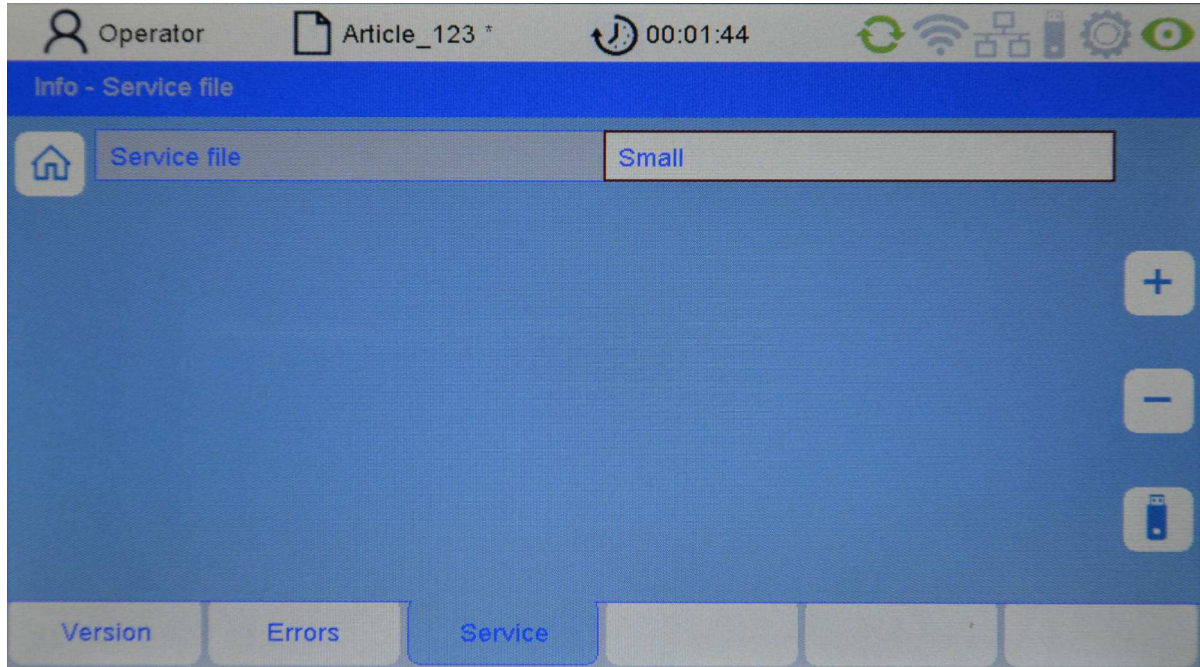
You can now use the service file parameter to determine the scope of the service file. The following variants are available:

Small	Configuration, the last 4 camera logs, operating system logs, version numbers
Standard	as Small, but in addition: camera images
Complete	as Standard, but in addition: core dump file, calibration report, selvedge recognition report

Press the key „USB stick" . Then press the „Download" key.

9.4   Service access to the device

Service access is via the **"Service"** menu on the main screen entering the Service password. For further information please refer to the service manual.

10. Maintenance and Cleaning

- Please make sure that all plug connectors are securely screwed into the control unit. Plugs that are not screwed in correctly can impair the operation of the monitoring system in a negative way.

- Before cleaning the unit or removing or installing any options, always disconnect the unit from the power supply. Do not use any liquid cleaning agents or cleaning sprays when cleaning the unit; use only a moistened cloth.

- Keep the camera front glasses of the ArrayCam clean. Avoid putting fingerprints on the front glasses. Use only a non-linting cloth to clean the front glasses. Please note that glass cleaning liquid may be used for these front glasses.

A   Technical Data

Electrical connection

Operating voltage	100 V to 240 V +/-10% 47 Hz to 63 Hz
Power consumption	120V: max. 1,8 A 230V: max. 1,0 A

Ambient conditions

Operation
Temperature range	0° C … +40° C
Relative humidity	5% … 85% non-condensing

Transport/Storage
Temperature range	-40° C … +85° C
Relative humidity	15% … 95% non-condensing

Safety classification

IP 54

Measurements and Weights

Type	Length	Diameter	Weight
130"	3780 mm	112 mm	18,5 kg
180"	4980 mm	112 mm	26,2 kg
210"	5990 mm	112 mm	31,0 kg
240"	6780 mm	112 mm	34,8 kg
280"	7380 mm	112 mm	37,6 kg

B   CE declaration of conformity

In preparation
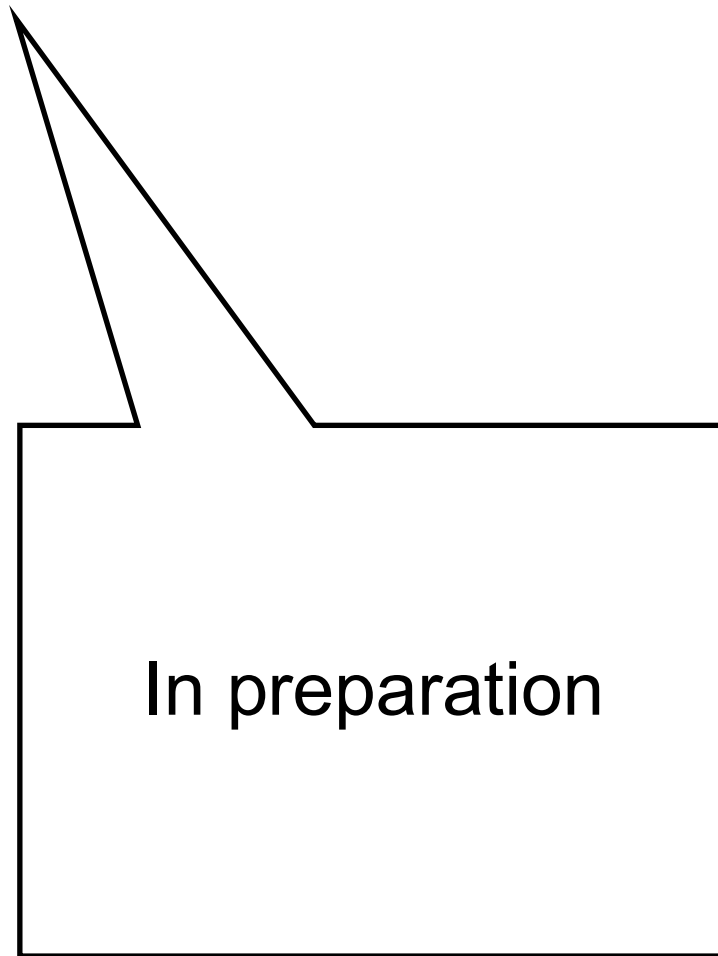
C   Laser Classification

Device Description   Laser Light Barrier

Type   LLi 480

Laser Type   Semi conductor Laser 660 nm

With this device the Laser power output meets the

**Class 1
according to DIN EN 60825-1**

VDE 0837
Part 1

Maximum Laser power output 0.22 Milliwatt

Protechna Herbst GmbH & Co KG, Ottobrunn, 20.01.1995
Development department

Dipl. Ing. W. Bühler

Development Manager

Warranty Exclusion
When used for other purposes, structural changes and manipulation of the device.

For your notes