TURCK

Your Global Automation Partner

TIV12MG-Q110N Smart camera with integrated AI

Instructions for Use

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1 About these instructions

These instructions describe the setup, functions and use of the product and help you to operate the product according to its intended purpose. Read these instructions carefully before using the product. This will prevent the risk of personal injury and damage to property. Keep these instructions safe during the service life of the product. If the product is passed on, pass on these instructions as well.

1.1 Target groups

These instructions are aimed at qualified personal and must be carefully read by anyone mounting, commissioning, operating, maintaining, dismantling or disposing of the device.

1.2 Explanation of symbols

The following symbols are used in these instructions:

	DANGER DANGER indicates a hazardous situation with a high level of risk, which, if not avoided, will result in death or serious injury.
	WARNING WARNING indicates a hazardous situation with a medium level of risk, which, if not avoided, will result in death or serious injury.
	CAUTION CAUTION indicates a hazardous situation with a medium level of risk, which, if not avoided, will result in moderate or minor injury.
	NOTICE CAUTION indicates a situation which, if not avoided, may cause damage to property.
	NOTE NOTE indicates tips, recommendations and important information about special action steps and issues. The notes simplify your work and help you to avoid additional work.
▶	**MANDATORY ACTION** This symbol denotes actions that the user must carry out.
⇨	**RESULT OF ACTION** This symbol denotes the relevant results of an action.

1.3 Other documents

Besides this document, the following material can be found on the Internet at www.turck.com:

- Data sheet
- Declarations of conformity
- Quick Start Guide

1.4 Feedback about these instructions

We make every effort to ensure that these instructions are as informative and as clear as possible. If you have any suggestions for improving the design or if some information is missing in the document, please send your suggestions to techdoc@turck.com.

2 Notes on the product

2.1 Product identification

These instructions apply to the following smart camera:

- TIV12MG-Q110N

2.2 Scope of delivery

The delivery consists of the following:

- Smart camera TIV12MG-Q110N
- Quick Start Guide

2.3 TURCK service

TURCK supports you in your projects — from the initial analysis right through to the commissioning of your application. The TURCK product database at www.turck.com offers you several software tools for programming, configuring or commissioning, as well as data sheets and CAD files in many export formats.

For the contact details of our branches worldwide, please see page [▶ 61].

3 For your safety

The product is designed according to state of the art technology. Residual hazards, however, still exist. Observe the following safety instructions and warnings in order to prevent danger to persons and property. TURCK accepts no liability for damage caused by failure to observe these safety instructions.

3.1 Intended use

The industrial smart camera captures images of objects and is designed for fully automatic operation. Image evaluation is performed using previously taught reference images for object differentiation or classification using AI tools. Feedback and data transmission is provided via LEDs on the housing, switching outputs or Ethernet telegrams. Protection class IP67 can only be achieved with a screwed-on protective tube. The usable working distance depends on the selected lens and the object size. Use is only possible with a suitable lens.

The device must only be used as described in these instructions. Any other use is not in accordance with the intended use. TURCK accepts no liability for any resulting damage.

3.2 General safety instructions

- The smart camera falls under the EU AI Act and is classified as an AI system with minimum risk if used as intended.
- The device meets the EMC requirements for the industrial areas. When used in residential areas, take measures to prevent radio frequency interference.
- The device must only be fitted, installed, operated, parameterized and maintained by trained and qualified personnel.
- Only use the device in compliance with the applicable national and international regulations, standards and laws.
- Only operate the device within the limits stated in the technical specifications.
- The devices are not safety components and must not be used for personal protection.

4 Product description

The TIV smart camera is installed in a metal housing. The device has four M12 connectors for power supply, Ethernet connection, external trigger input and four switching outputs, incl. a power supply for optional external lighting.

4.1 Device overview

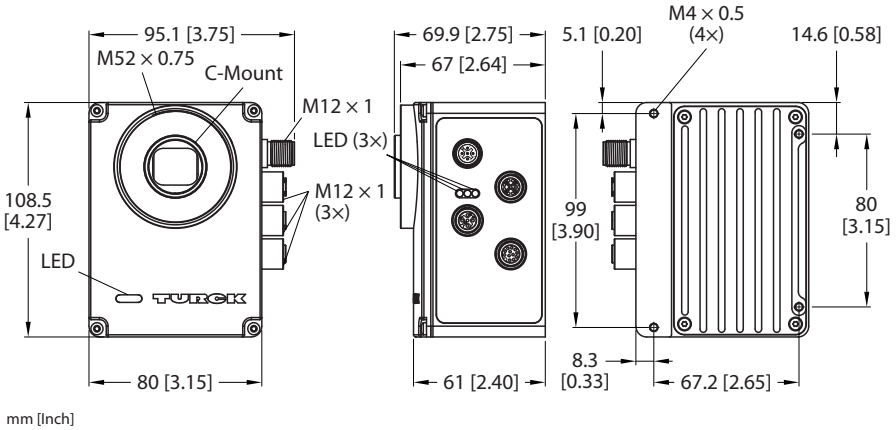


Fig. 1: TIV12MG-Q110N dimensions

4.2 Properties and features

- Sony Pregius S image sensor, IMX545, 12.42 MP, monochrome CMOS with Global Shutter
- Nvidia Jetson Nano, Quadcore CPU+GPU, 4 GB RAM
- 240 GB internal memory
- C-mount thread connection for lenses
- Separate trigger input
- Ethernet interface with 10/100/100 Base T
- Four switching outputs, configurable via TAS and web browser
- Barcode reading and AI tools
- Edge and deep learning
- User-specific neural networks

4.3 Functional principle

The industrial smart camera captures and digitizes images of objects by exposing the image sensor; the images are processed internally for technical applications and are evaluated according to specifications. The lens selected determines the operating distance to objects; the focus and exposure time of the image are defined via the settings of the smart camera. Test objects can be optimally illuminated via external lighting.

For commissioning, the device is first configured and trained with image data sets. The neural network is taught using at least ten good and ten bad images. Captured objects are assigned to previously defined classes.

Taught-in image data sets can be added to the neural network as a basis (edge learning) or a new neural network can be created from an image data set (deep learning).

4.4 Functions and operating modes

The smart camera uses a variety of image recognition and evaluation tools.

Tool	Function
Code Scan	Tool for detecting 1D and 2D barcode types
Difference Check	AI tool for quality control and deviation checking
Classifier	AI tool for classifying objects into user-defined classes
Detector	AI tool for object detection and classification including number per class and coordinates for each object

While Code Scan is not supported by AI, Difference Check, Classifier and Detector work with AI.

Neural networks are created and used for the Difference Check, Classifier and Detector. At least ten good and ten bad images are required for the Difference Check tool (edge learning). Classifier and Detector create a new neural network during training (deep learning). Neural networks can be expanded with new images. The smart camera records can be downloaded and transferred.

The smart camera is configured via the integrated web server dashboard and basic parameters can be set via the TURCK Automation Suite (TAS).

The device has four connectors for power supply, Ethernet connection, external trigger input and four switching outputs, incl. a power supply for optional external lighting.

4.4.1 Code Scan

This tool can detect a variable number of 1D and 2D barcode types in any orientation.

Code Scan can be combined with the detector. Codes can thus be recognized and read out on trained objects. All other codes in the image section are ignored.

Code Scan can be executed in the following modes:

- Fast: When focus and lighting are optimized, this option allows for a short processing time of the codes.
- Robust: If the focus and lighting are not optimized, the longer processing time will result in a better read rate.

The tool detects the following codes:

1D codes	2D codes
■ CODE32 ■ CODE39 ■ CODE93 ■ CODE128 ■ EAN8 ■ EAN13 ■ UPC-A ■ UPC-E ■ MSI ■ ITF ■ GS1128 ■ ISBT128 ■ GS1DATABAR ■ CODABAR	■ DATAMATRIX ■ GS1DATAMATRIX ■ QR ■ PDF417 ■ AZTEC ■ MRZ

4.4.2 Difference Check

Difference Check uses algorithms for quality control and deviation checking.

The tool does this in two steps:

1. Object search in the image
2. Comparison with reference images of the object

For object detection, the previously trained background shot without the object is removed from the current shot with the object. The result is varied several times in order to reliably identify the object in the images. Possible changes can be different exposure, inversion of the image or slight distortion.

After successful object detection, the result is compared with the trained reference shots and the inspection of the shots is evaluated by the smart camera.

The user can create various ROIs (regions of interest) for the object. An ROI contains an image section that is compared with other images to detect differences. ROIs are evaluated separately by the smart camera. An inspection of the images is only good if all ROIs match the reference image. If an ROI deviates, the image is rated as bad. For a good reference image, at least ten good images must be specified; for a poor reference image, at least ten bad images must be specified. The result of the review will improve as more images are added. For successful teach-in of the reference images, recordings only show ROIs with error-free states or only ROIs with error states.

4.4.3 Classifier

The Classifier tool interprets the entire image as an ROI. Images are assigned to a previously defined class. After classes have been created for all images, a new neural network is created from the images.

When using the Classifier, the smart camera attempts to assign the image to a class. To do this, it creates a rating for the image, indicating how well it matches the classes; all classes together make up 100 % of the rating. The class with the highest rating is assigned to the image.

The training data should be selected in such a way that there is as much distance as possible between the first and second assigned class in the evaluation and clear identification is possible. The detection of an object becomes more precise when the object fills the majority of the image section. The image section can be changed by using other lenses or by changing the operating distance between the smart camera and the object.

4.4.4 Detector

The Detector tool detects any number of objects or defined characteristics on the image simultaneously and assigns each of them to one of the previously defined classes.

A confidence score is specified for each object, indicating the match to the assigned class. The orientation of the objects on the image can be arbitrary; even slight overlaps of objects are detected depending on the image dataset. Objects that are not similar to a class are not recognized.

The result may vary depending on the quality of the image data set with the trained reference images per class. Objects on the images should be shown in many variants in the image datasets.

The different positioning within the shot is particularly important, as distortions at the edge of the image due to the height of an object or overlaps with other objects can lead to falsification of the images.

The number of objects and the associated class can be specified for the overall inspection. The user can exclude individual classes, define minimum and maximum values or specify the number of permitted objects per class as required. For the evaluation of the inspection, 0 to 99 units can be taken into account for each class. In this way, for example, the completeness of the objects in the kittings can be checked. The assigned class, the number of objects in a class and two coordinate sets of the images are read out for each detected object via the Ethernet interface. The coordinates always refer to the pixel coordinates of the respective object in the image. In combination with the Code Scan tool, codes on the objects can be read out.

The detector training type can be selected:

- Detector: Rapid detection by rectangles oriented at the edge of the image
- OBB Detector: More precise, but slower detection thanks to exact outlining of the objects by means of oriented bounding boxes (OBB)

The neural network can be trained with various parameters:

- Classes can be selected and deselected and thus excluded from training.
- The resolution of the images in the dataset can be determined and the duration of the training can thus be adjusted.

4.4.5 Trigger input

NOTE
Evaluations of images take approx. 500 ms, depending on the tool.
For a synchronized actuation of the switching output, do not trigger the trigger input faster than the ratings can be performed.

The trigger input is used to trigger images. It can be triggered as follows:

- Hardware trigger via the input on the device
- Software trigger via the Ethernet interface

The desired trigger can be set via the web server. The camera responds to fast triggering with a delay. If the trigger is triggered faster than 1600 images/h, the evaluation of the images is delayed. This delay depends on the number of times triggering occurred. The number of evaluations corresponds to the number of triggers. The recording is evaluated directly at the trigger. Fast triggers, e.g. for reading packages, cause a time delay in the rating at the camera's switching outputs. The number of images displayed on the dashboard is arbitrary and does not show the actual trigger number of the trigger input. The dashboard displays the recordings in chronological order from left (newest) to right (oldest).

The trigger input has the following pin assignment (see [▶ 17]):

Pin	Input	Assignment
Pin 2	Input 2	Slow trigger input
Pin 4	Input 1	Fast trigger input
Pin 5	ISO GND	Connection to controller (PLC)

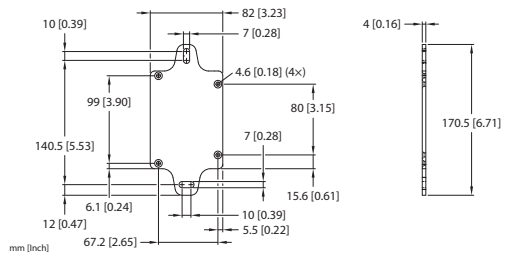
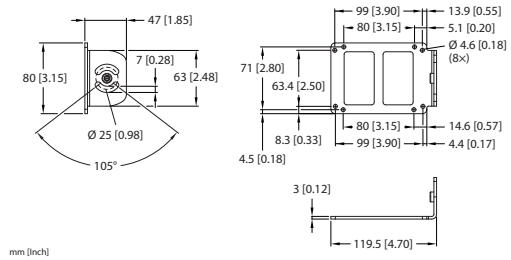
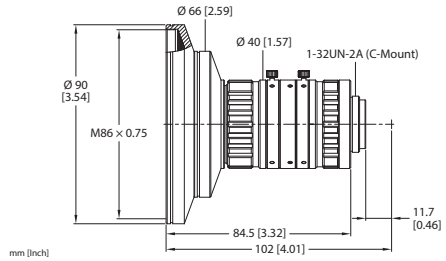
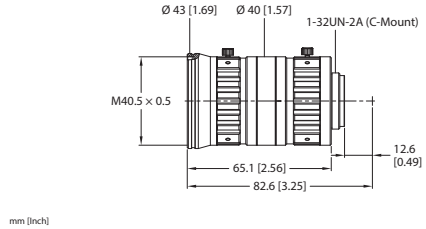
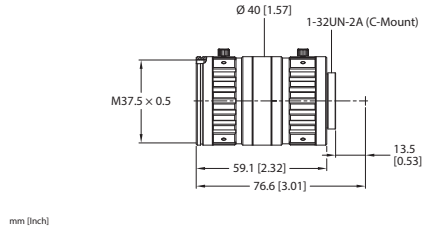
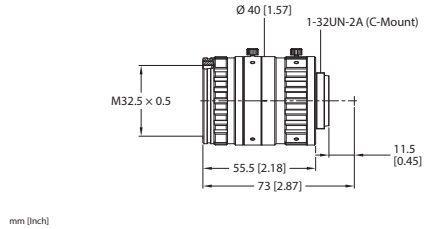
4.4.6 Switching outputs

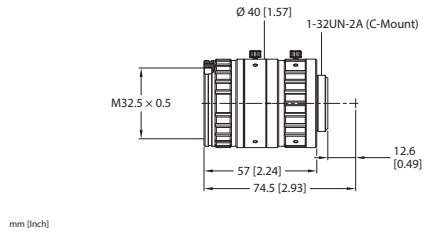
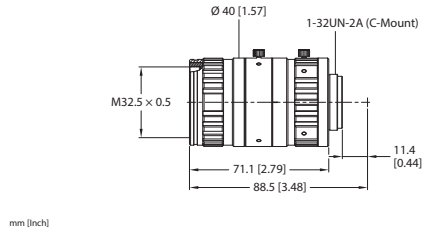
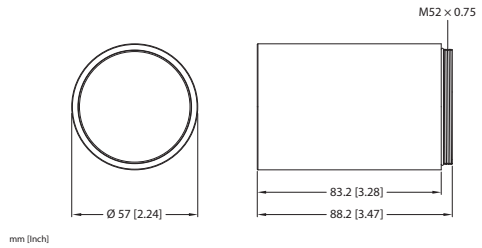
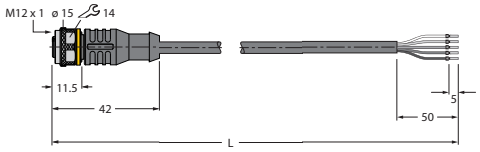
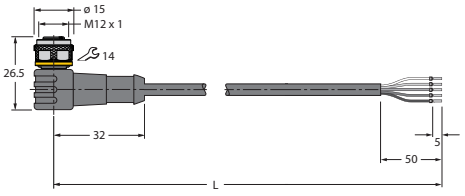
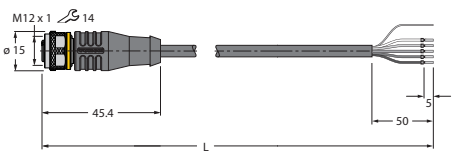
The four switching outputs are configured via the web server. They show the status of the camera and the evaluation of the most recently evaluated inspection.

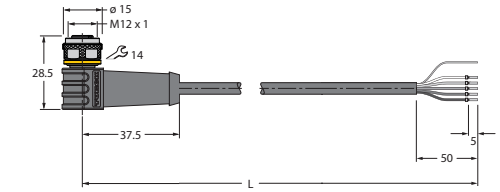
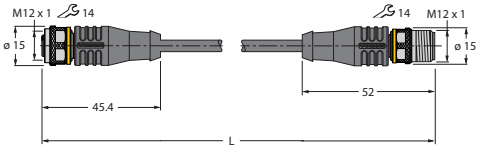
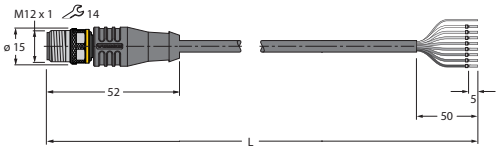
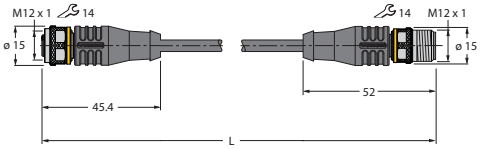
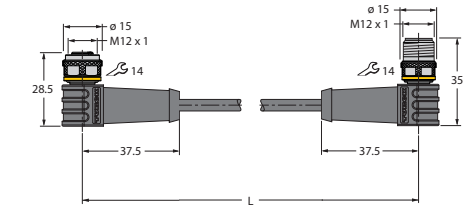
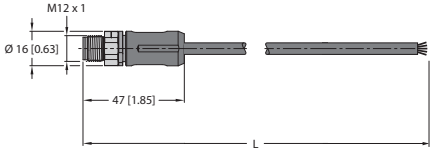
The switching outputs have the following pin assignment (see [▶ 17]):

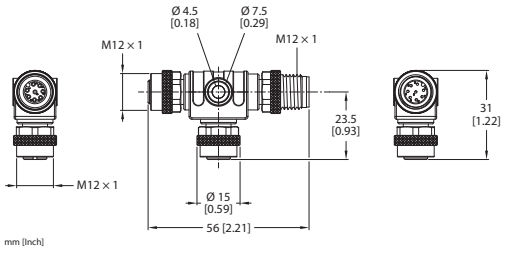
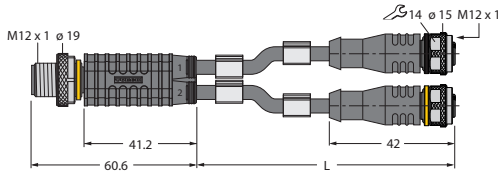
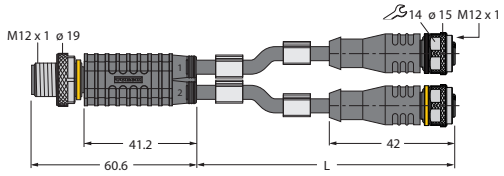
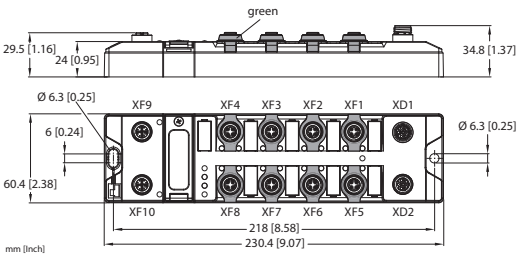
Pin	Output	Assignment
Pin 8	Output 1	System status
Pin 9	Output 2	Inspection feedback OK
Pin 10	Output 3	System status
Pin 11	Output 4	Inspection feedback NOK

4.5 Technical accessories

	ID	Type	Description
	100048564	MW-Q110-S	Mounting bracket for direct mounting on a flat surface
	100048562	MW-Q110-R	Mounting bracket for side mounting with 90° offset
	100052370	OPT-CDP0828	Lens with 8 mm focus
	100052371	OPT-CDP1228	Lens with 12 mm focus
	100052372	OPT-CDP1628	Lens with 16 mm focus
	100052373	OPT-CDP2528	Lens with 25 mm focus

	ID	Type	Description
	100052374	OPT-CDP3528	Lens with 35 mm focus
	100052375	OPT-CDP5028	Lens with 50 mm focus
	10004856	LC-Q110-35	Protective tube for lens with 35 mm focus
	6625016	RKC4.5T-2/TEL	Connection cable, female M12, straight, 5-pin, cable length 2 m, jacket material: PVC, black; resistant to chemicals and oils, flame-resistant, resistant to acids and alkalis, resistant to microbes and hydrolysis, LABS-free; cULus approved; RoHS-compliant; protection class IP67
	6625028	WKC4.5T-2/TEL	Connection cable, M12 female connector, straight, 5-pin, cable length: 2 m, jacket material: PVC, black; shielded; cULus approval
	6626361	RKS4.5T-2/TEL	Connection cable, M12 female connector, straight, 5-pin, cable length: 2 m, jacket material: PVC, black; shielded; cULus approval

	ID	Type	Description
	6626364	WKS4.5T-2/TEL	Connection cable, M12 female connector, angled, 5-pin, cable length: 2 m, jacket material: PVC, black; shielded; cULus approval
	6626388	RKS4.5T-2-RSS4.5T/TEL	Extension cable, M12 female connector, straight, 5-pin to M12 male connector, straight, 5-pin; cable length: 2 m, jacket material: PVC, black; shielded; cULus approval
	6625464	RSS8T-2/TXL	Connection cable, M12 male connector, straight, 8-pin, cable length: 2 m, jacket material: PUR, black; shielded; cULus approval
	6625470	RKS8T-0.3-RSS8T/TEL	Extension cable, M12 female connector, straight, 8-pin to M12 male connector, straight, 8-pin; cable length: 0.3 m, jacket material: PVC, black; shielded; cULus approval
	6629117	WKS8T-0.5-WSS8T/TXL	Extension cable, M12 female connector, angled, 8-pin to M12 male connector, angled, 8-pin; cable length: 0.5 m, jacket material: PVC, black; shielded; cULus approval
	100036442	RSSX-8814-2M	Connection cable for Industrial Ethernet, M12 male connector, X-coded, straight, cable length: 2 m, jacket material: PUR, green

	ID	Type	Description
	6930575	VT2-FKM8-FKM8-FSM8	T-splitter, M12, 8-pin, wired in parallel; female connector — female connector — male connector
	6636536	VBRS12-RKC4.4T RKC8T-0.15/0.15/TXL4300	2-port junction systems — Y-splitter with cable, M12 male connector, straight, 12-pin — 2 × M12 female connector, straight, 4-pin and 8-pin, cable length: 0.15 m, jacket material: PUR, black
	6636537	VBRS8-RKC4.5T RKC8T-0.15/0.15/TXL4400	2-port junction systems — Y-splitter with cable, M12 male connector, straight, 12-pin — 2 × M12 female connector, straight, 5-pin and 8-pin, cable length: 0.15 m, jacket material: PUR, black
	100004427	TBEN-LL-SE-M2	Managed Ethernet switch, 8 × 100-Mbit ports, 2 × 1 Gbit port

5 Installing

CAUTION
Lack of grounding when mounted on the heat sink only
Electric shock
- ▶ To ensure grounding, mount the device in all four screw-on positions.

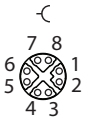
NOTICE
A non-tight connection can lead to ingress of liquids or foreign matter
Damage to the device is possible
- ▶ To achieve protection class IP67, use the device only with an optional protective tube installed.

- ▶ Mount the device on the optional mounting bracket (MW-Q110-R, MW-Q110-S).
- ▶ Mount the lens in accordance with the manufacturer's specifications.

6 Connection

NOTICE
Connection under voltage
The device may have an error condition
- ▶ Only connect the device when it is in a de-energized state.

- ▶ Connect the device to the Ethernet connection via the ETH connector as shown in the figures.



1 = TxD1 +
2 = TxD1 -
3 = RxD2 +
4 = RxD2 -
5 = BID4 +
6 = BID4 -
7 = BID3 -
8 = BID3 +

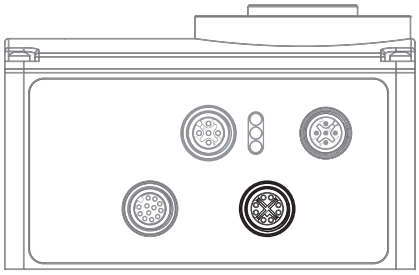
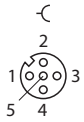


Fig. 2: ETH connector

Fig. 3: Connection via ETH connector

- ▶ Connect the controller to the device via the input connector as shown in the figures.



1 = 24 VDC OUT
2 = IN 2
3 = GND
4 = IN 1
5 = ISO GND

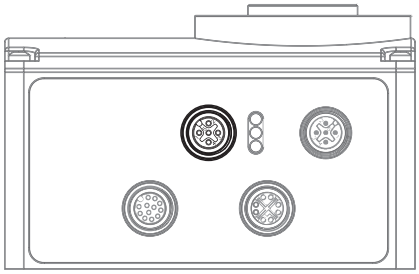
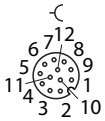


Fig. 4: Input connector

Fig. 5: Connection via input connector

- Connect the device to e.g. a signal lamp via the output connector as shown in the figures.



1 = 24V OUT
2 = 24V OUT
3 = Strobe/Flash
4 = GND
5 = GND
6 = 24V OUT
7 = ISO Vcc
8 = Output 1
9 = Output 2
10 = Output 3
11 = Output 4
12 = GND

Fig. 6: Output connector

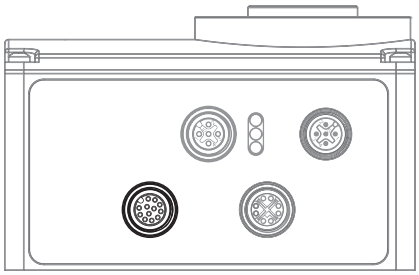
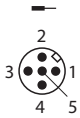


Fig. 7: Connection via output connector

- Connect the device to the supply voltage via the 24 VDC connector as shown in the figures.



1 = 24 VDC
2 = 24 VDC
3 = GND
4 = GND
5 = n.c.

Fig. 8: 24 VDC connector

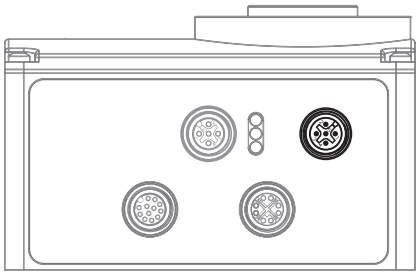


Fig. 9: Connection via 24 VDC connector

7 Commissioning

7.1 Preparing the smart camera

The camera must be prepared to start up the device.

- Remove the protective cap.
- Mount the desired lens (not included).
- Adjust the focus.
- Adjust the aperture.
- Optional: Mount the protective tube (not included in the scope of delivery).

8 Operation

NOTE
The lens may fog up in the event of rapid temperature changes
Images may be distorted
- ▶ When the ambient temperature changes, make sure the smart camera acclimatizes to prevent condensation.

8.1 LEDs

LED	Display	Meaning
Front LED	Multicolor	Software update Object inspection
LINK	Green	Connection indicator
ACT	Yellow	Communication active
PWR	Green	Power indicator

9 Setting

NOTE
The instructions for use apply to software version 5.16.1.
The software is continuously advanced and supplemented. Subsequent software versions may differ from the descriptions in this manual. Please check regularly for updates

The smart camera is set up via the integrated web server. The web server is configured and accessed via the TURCK Automation Suite (TAS).
Optional: If the IP address is known, the camera can be accessed directly.

9.1 Opening a web server

The smart camera can be accessed via the TURCK Automation Suite (TAS). TAS can be downloaded free of charge at www.turck.com.

✓ The device is connected to the PC via the Ethernet interface.
✓ TAS is installed.
▶ Open TAS.
▶ Click **Scan network**.
⇨ TAS displays the connected devices.

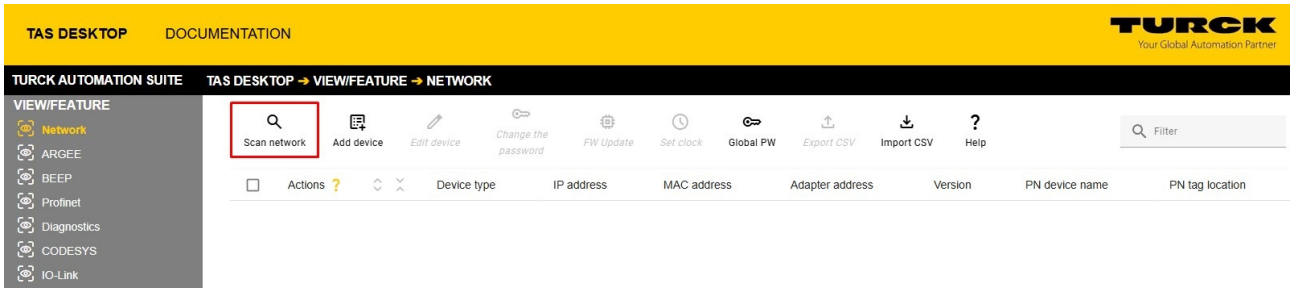


Fig. 10: TAS — Scanning the network

▶ Select the IP address of the device.

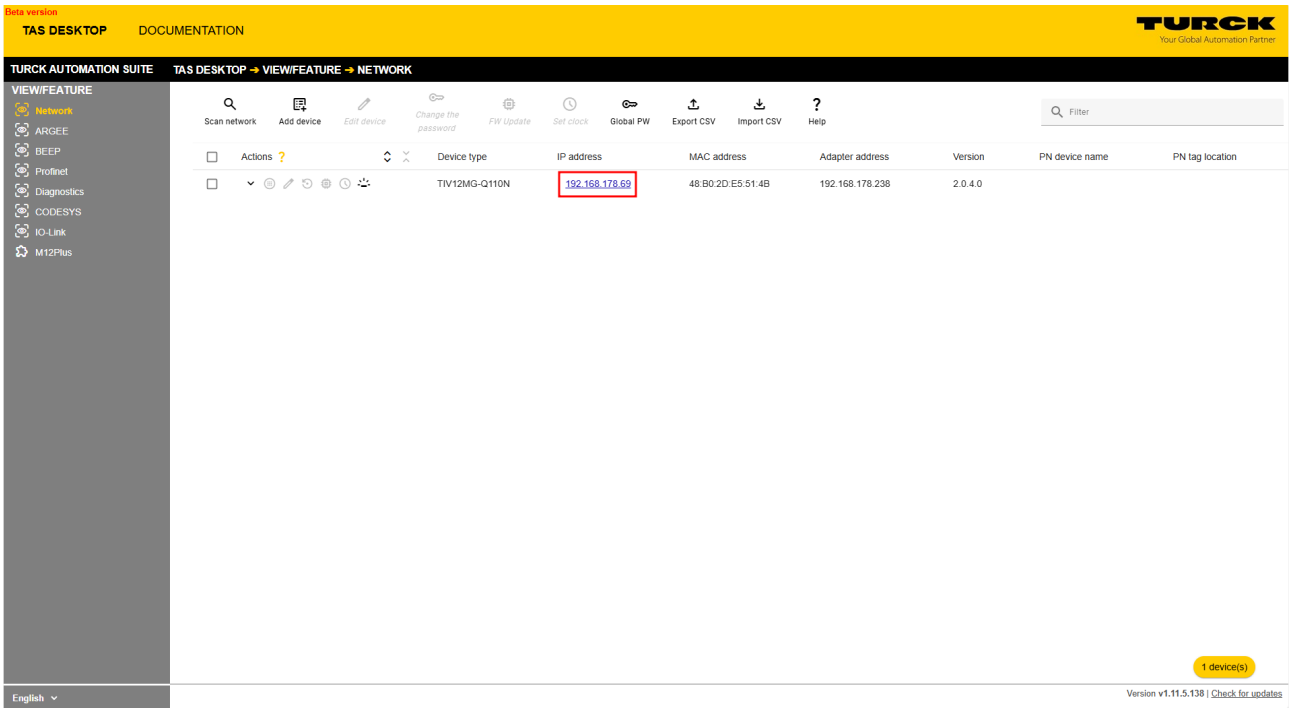


Fig. 11: TAS — IP address

➪ The web server opens.

Log in as an administrator

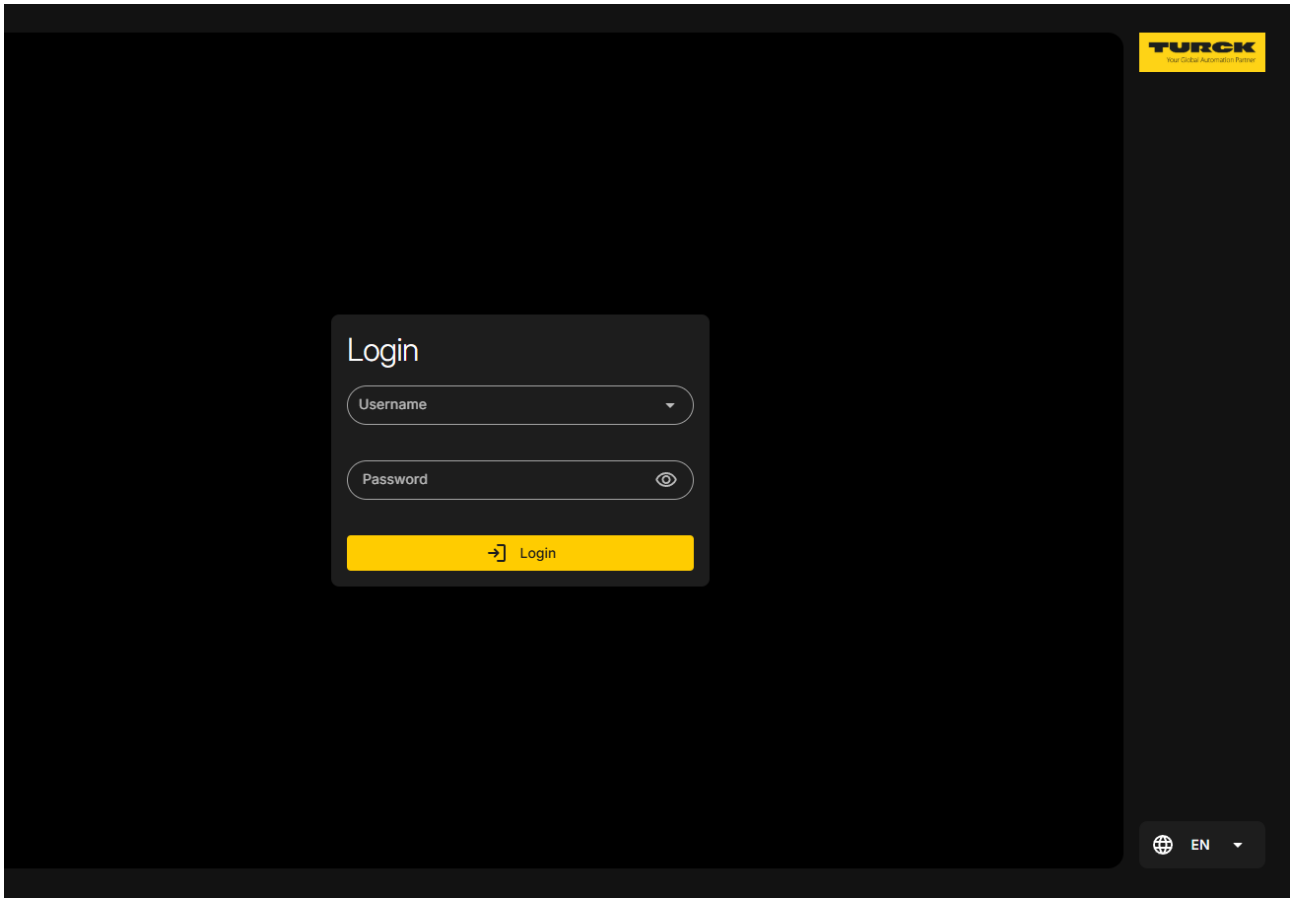


Fig. 12: Web server — Log in as administrator

▶ Enter standard login data:

- User name: **Administrator**
- Password: **passwort**

Log in as user

- ▶ Create login data for a user account.

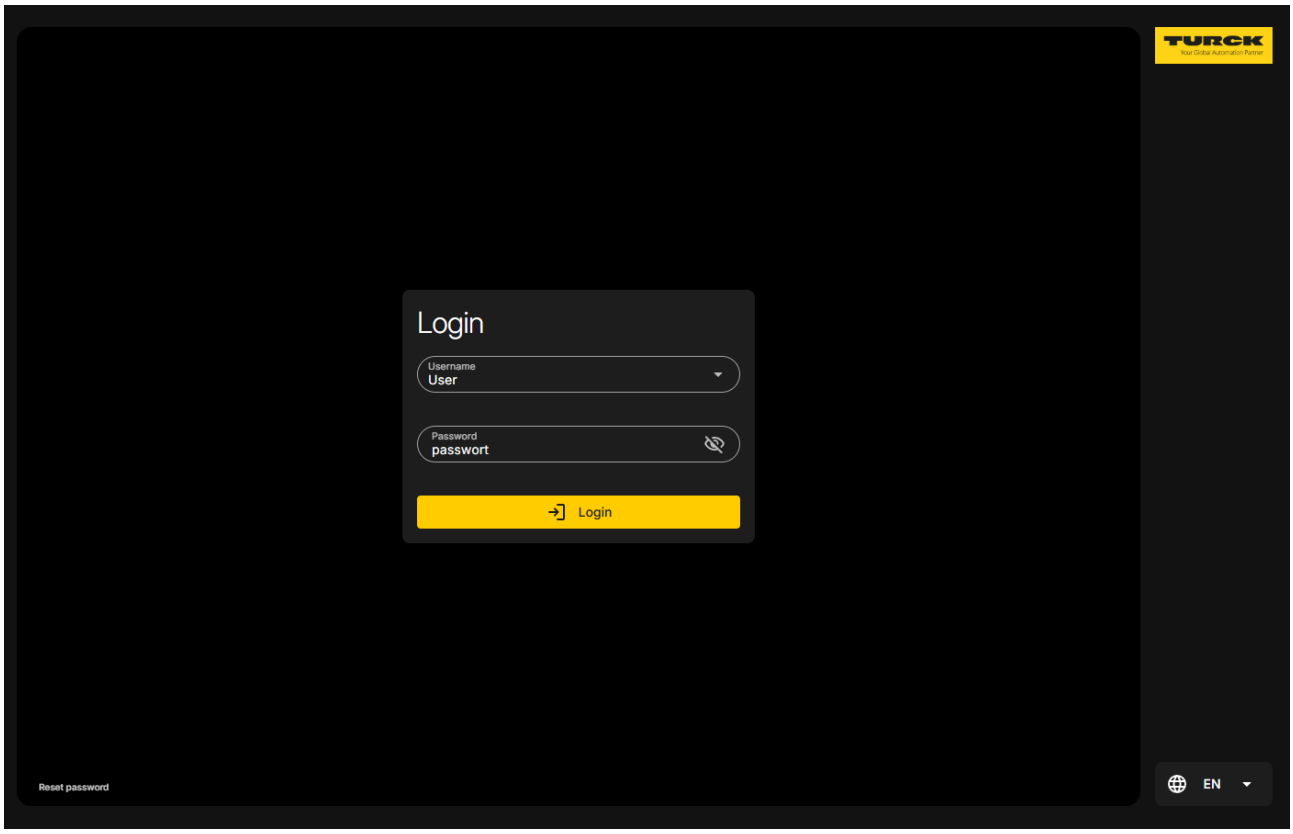


Fig. 13: Web server — Log in as user

▶ Assign a new password for the user account.

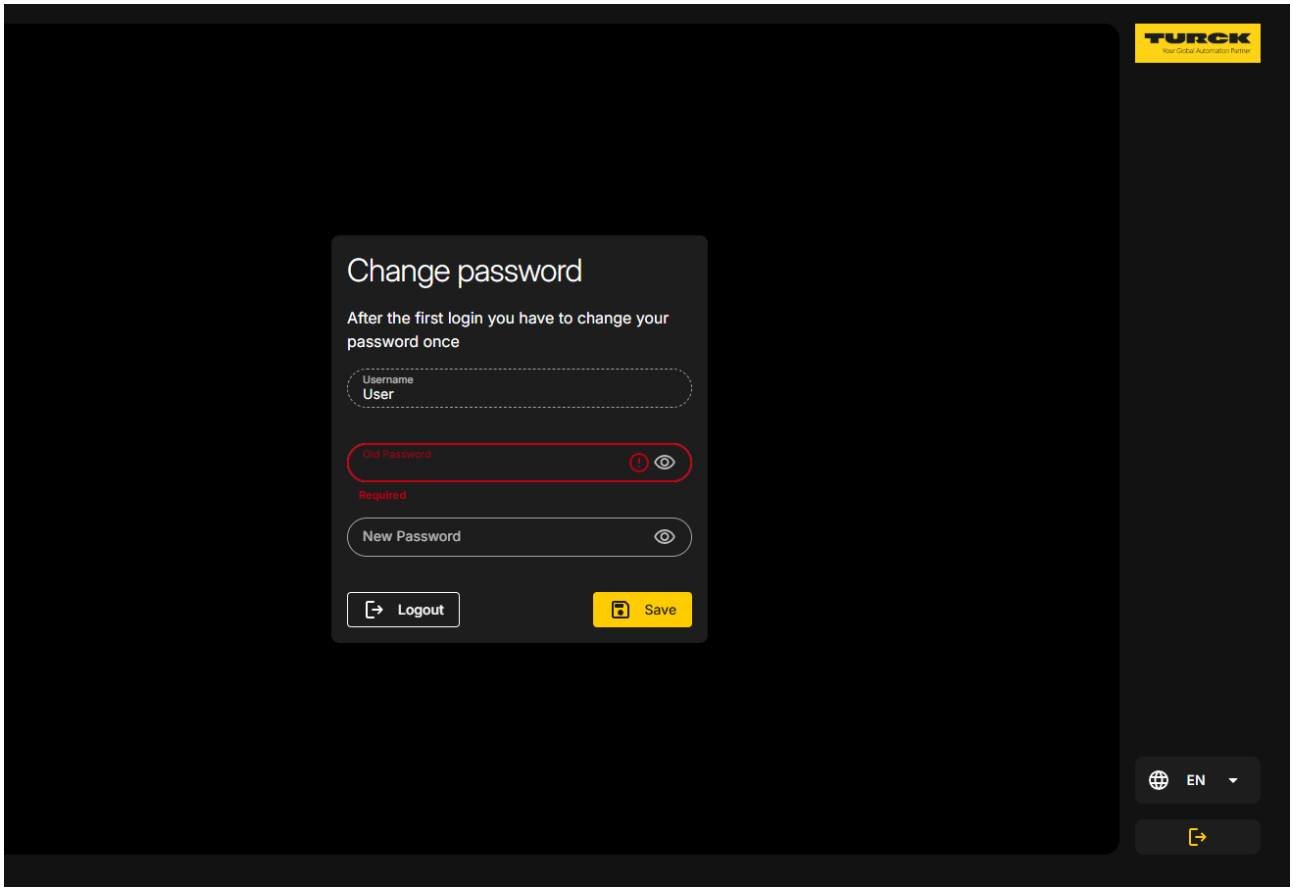


Fig. 14: Web server — New password for user account

9.2 System Settings

▶ Select **System Settings** on the dashboard.

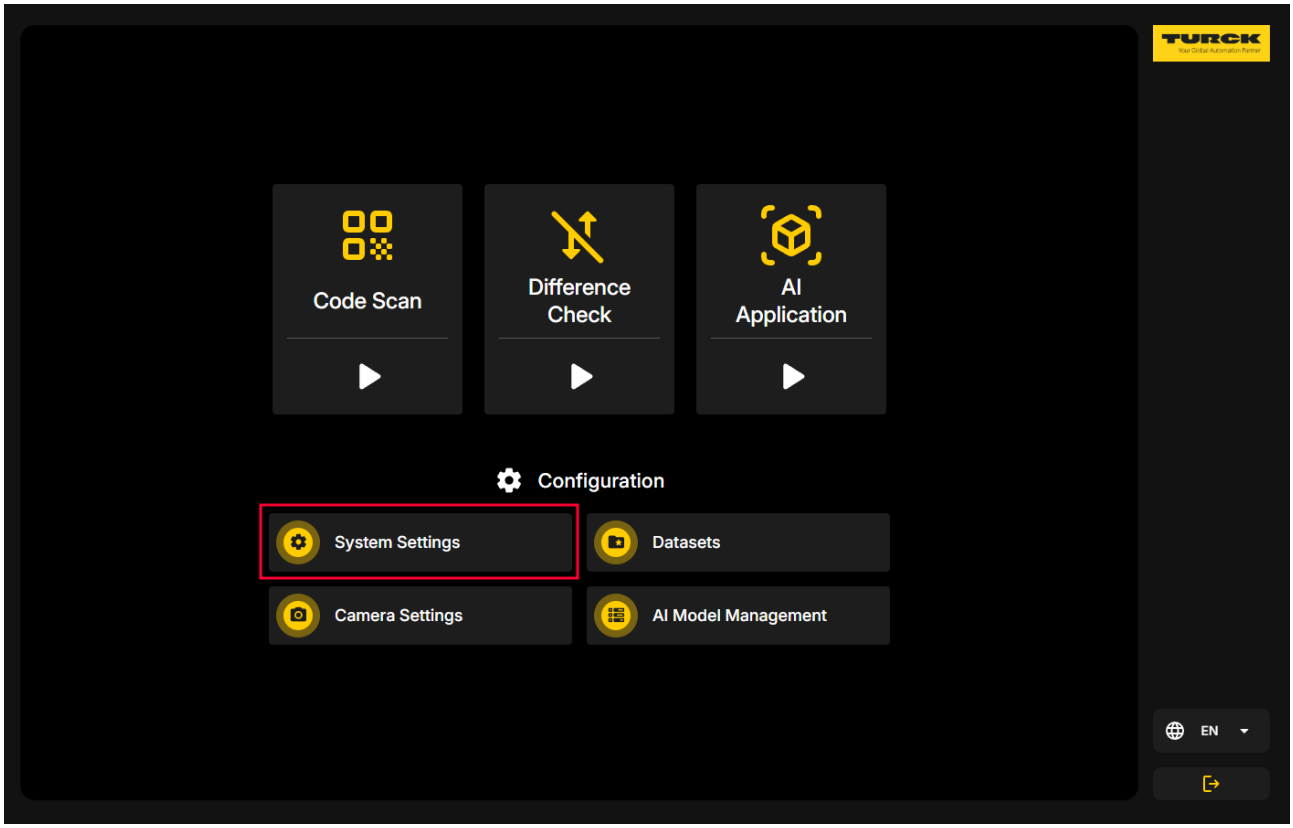


Fig. 15: Dashboard — System Settings

The following settings are made via the system settings:

- General:
  - Reboot
  - Software update
  - Download backup and Restore
  - Download logs
- Remote storage: Data storage via the cloud
- Network
- System time
- Power supply: Selects whether devices connected to the smart camera are supplied with 24 VDC or connected via an external power supply.

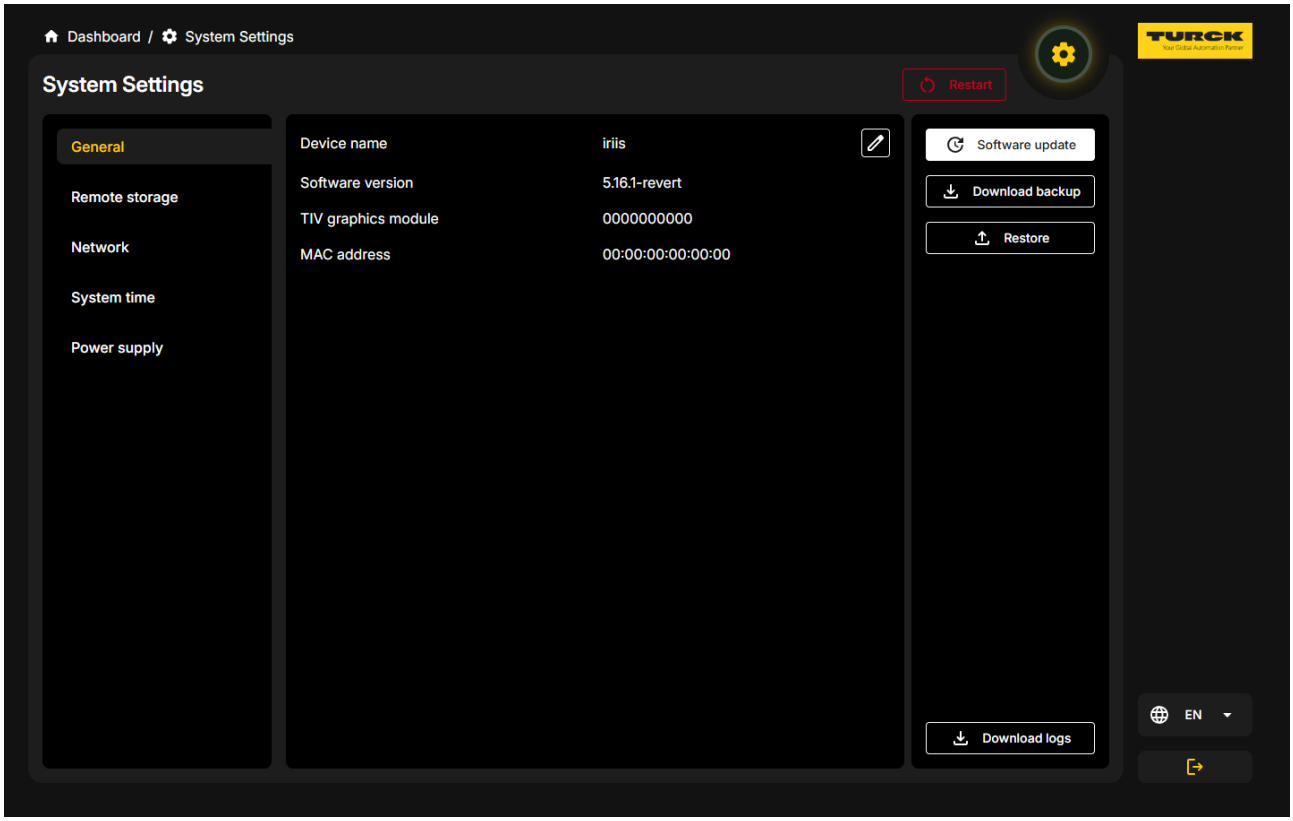


Fig. 16: System Settings

9.3 Camera settings

- On the dashboard, select **Camera Settings**.

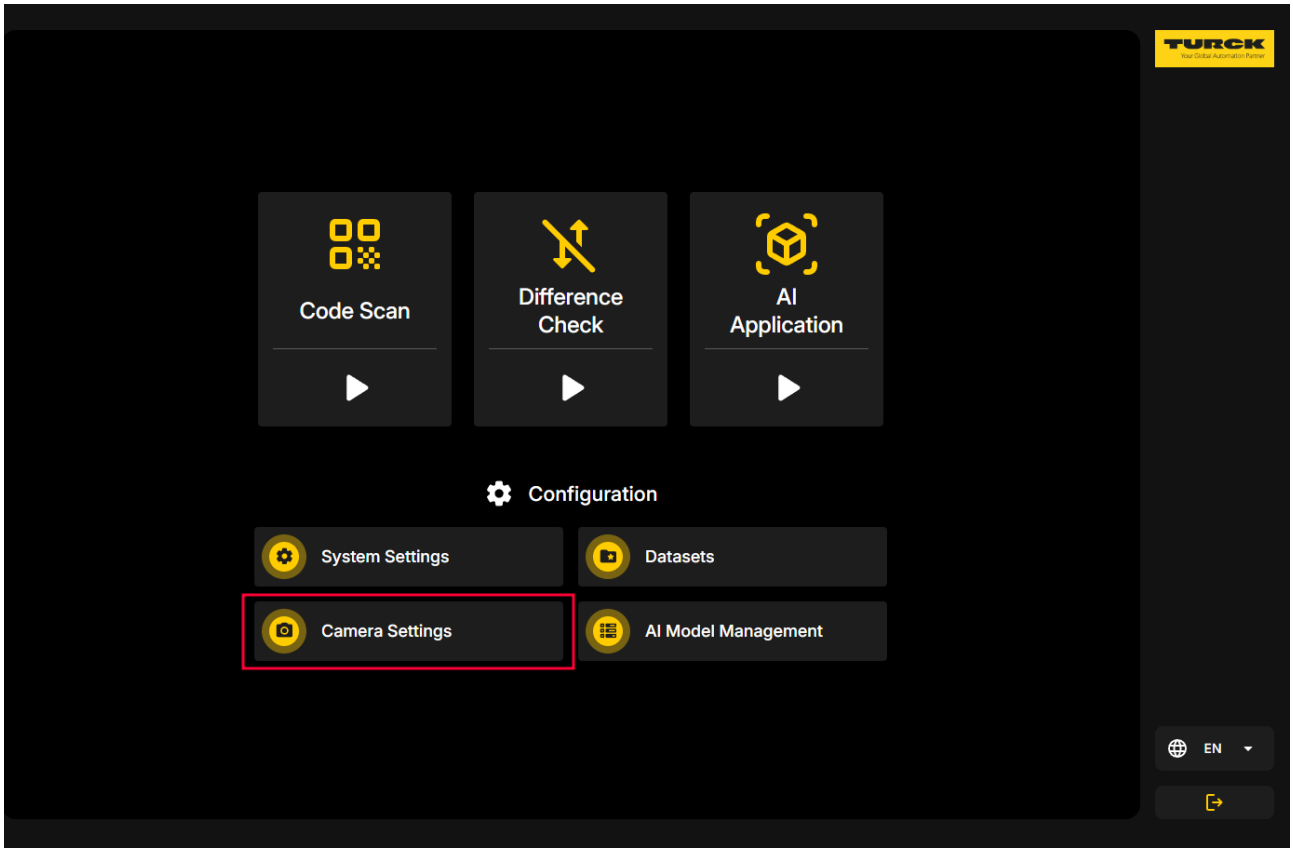


Fig. 17: Dashboard — Camera Settings

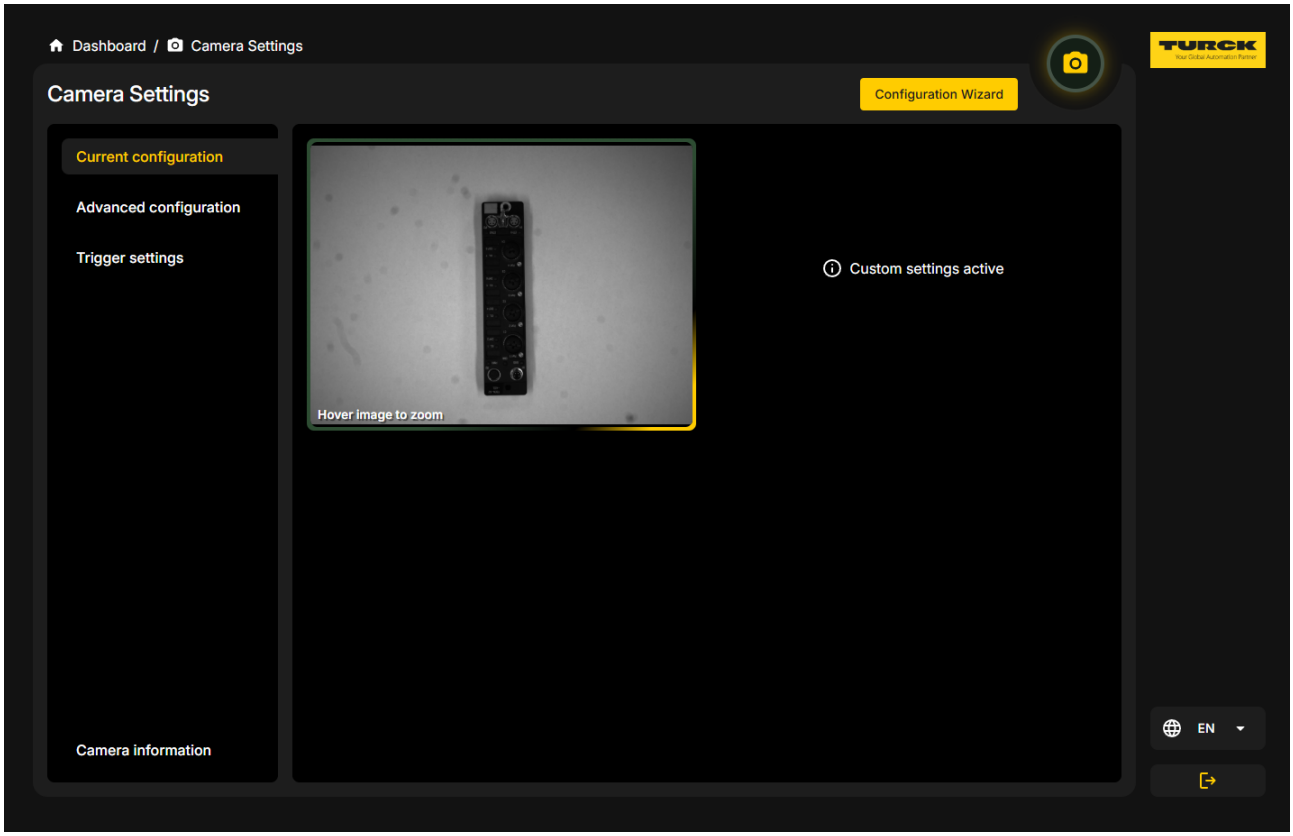


Fig. 18: Camera Settings

The following settings can be adjusted via the camera settings:

- Current configuration: Live recording is displayed
- Advanced configuration: Auto-compensation for images and other fine adjustments
- Trigger settings: Trigger for images
- Configuration Wizard: Tool with help for camera settings

9.3.1 Trigger settings at trigger input

NOTE
Evaluations of images take approx. 500 ms, depending on the tool.
For a synchronized actuation of the switching output, do not trigger the trigger input faster than the ratings can be performed.

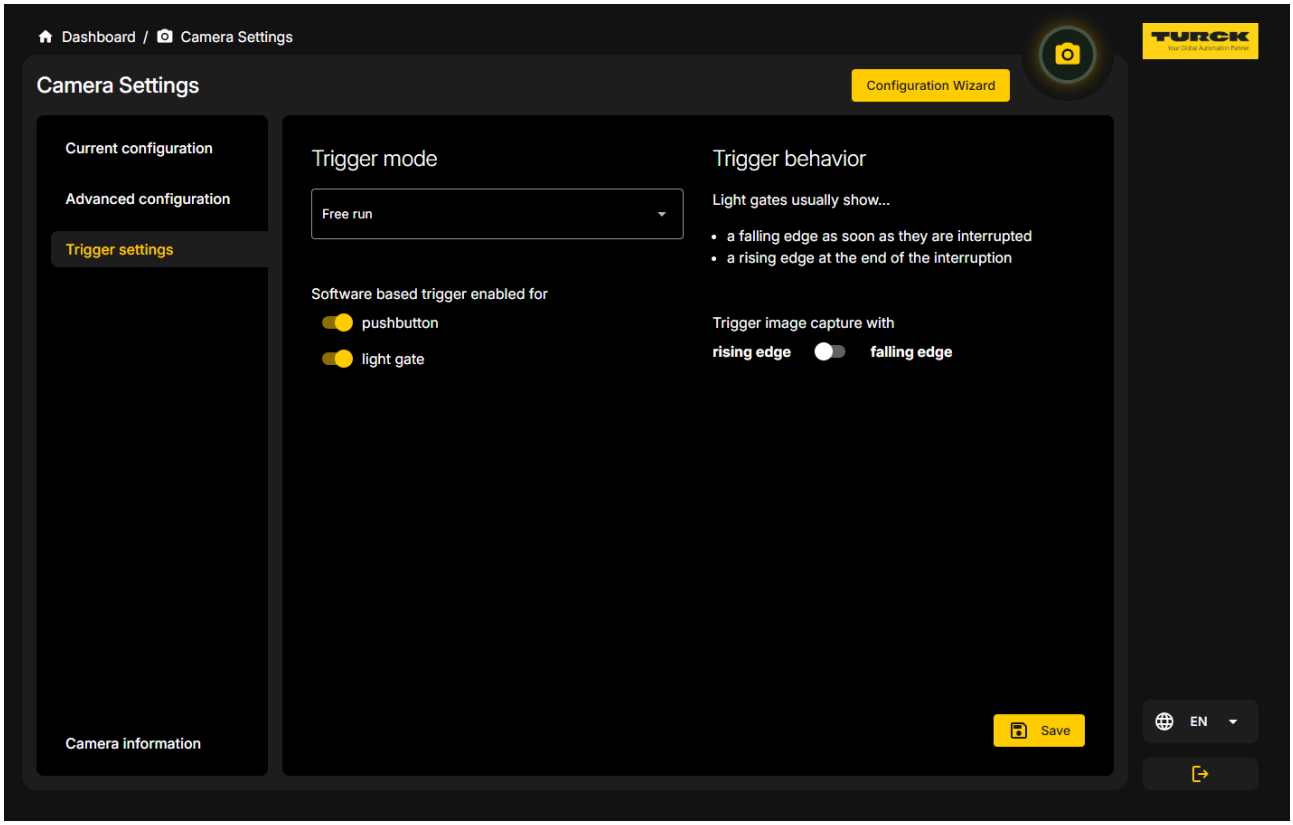


Fig. 19: Trigger settings

The following settings can be made via the Trigger settings option:

- Selection options for the trigger input:
  - Free run: Triggering will evaluate the last image.
  - Software trigger: Triggering will evaluate the next image.
  - Hardware trigger: Triggering will evaluate the image immediately.
- Software-based trigger active for pushbutton or light gate
- Trigger image capture with rising or falling edge

9.4 Smart camera tools

The smart camera web server dashboard allows you to select the tools that you want the smart camera to work with.

- ▶ Prepare the tools before using them for the first time using the following instructions.

9.4.1 Setting the code scan

- ▶ On the dashboard, click **Code Scan**.

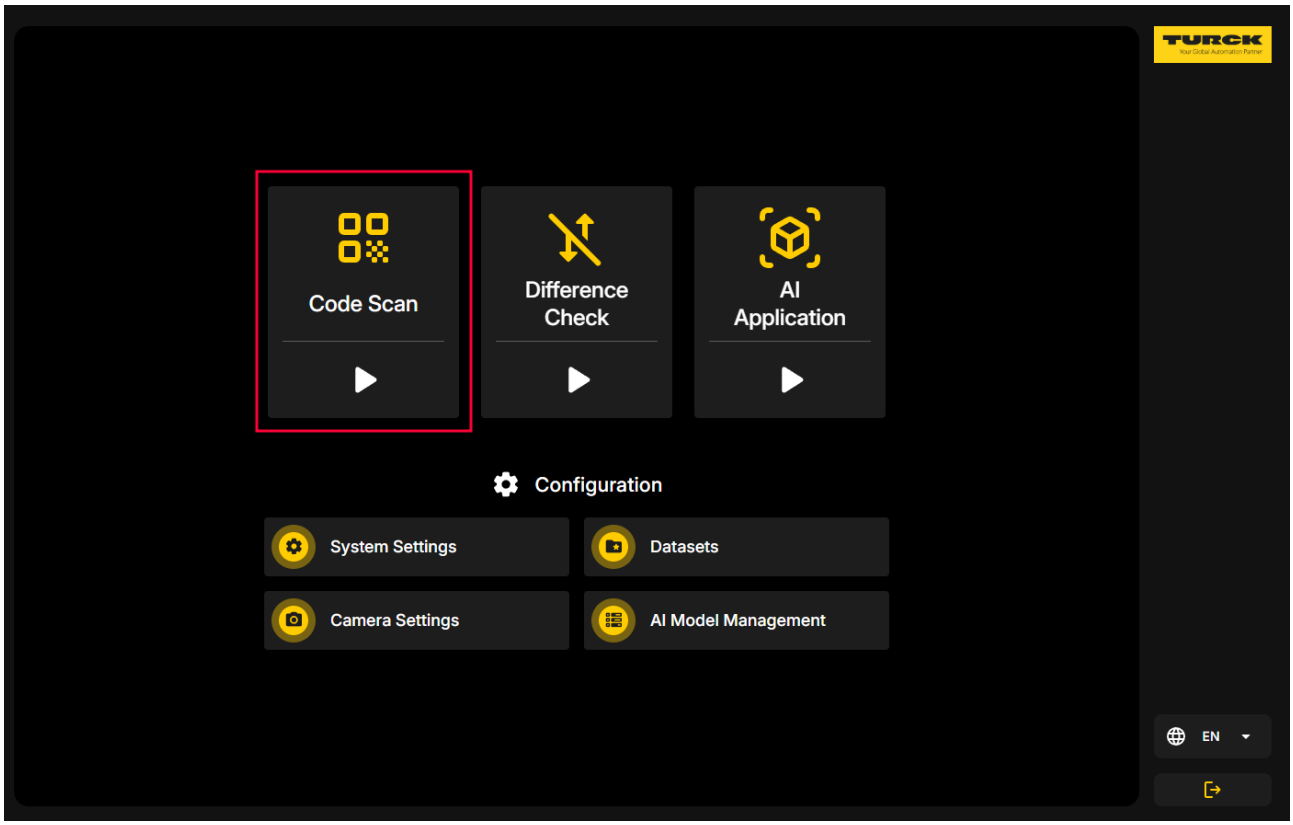


Fig. 20: Dashboard — Code Scan

- ▶ Select what type of codes and how many are read.
- ▶ Select the desired scan mode.

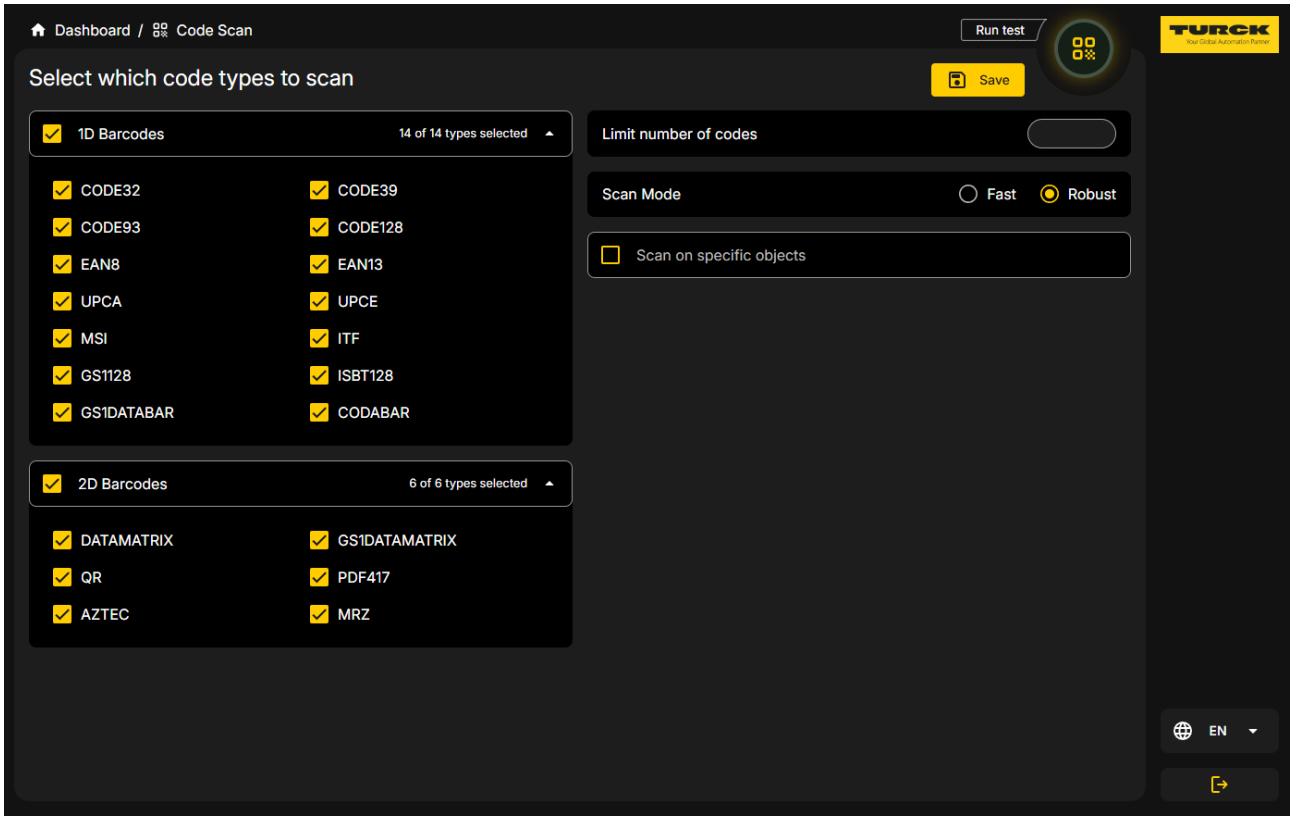


Fig. 21: Code Scan — overview

- ▶ Click **Save** to confirm and click **Run test**.
- ▶ Confirm the warning message to save.

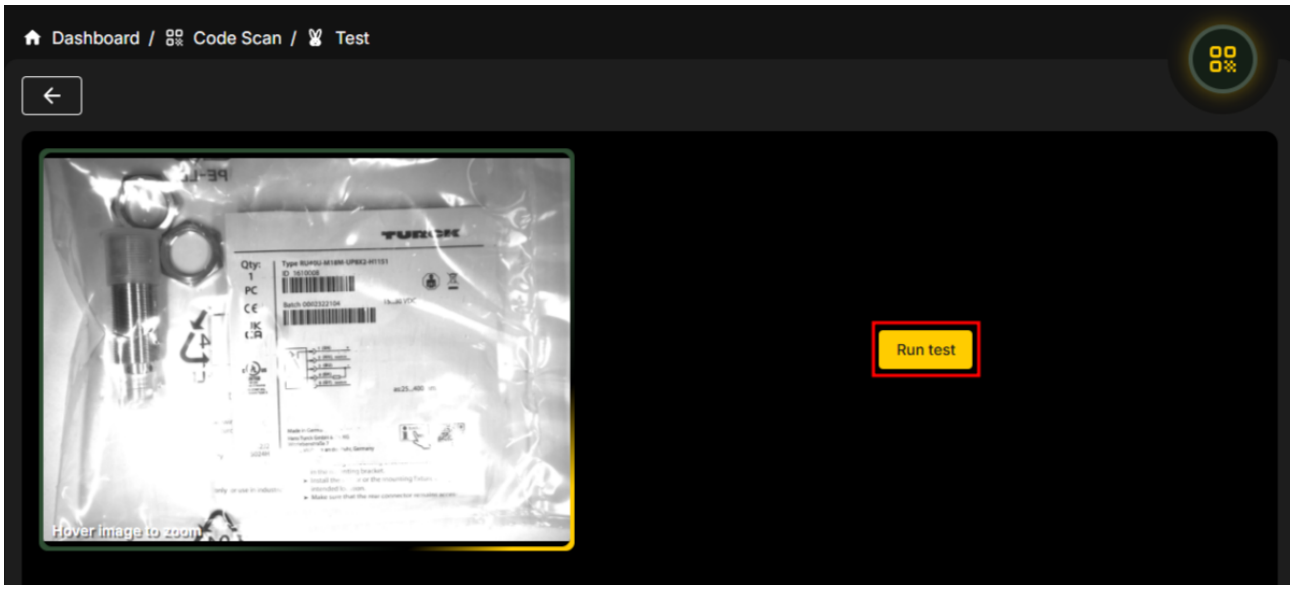


Fig. 22: Code Scan — Live image display, run test

- ⇨ A live image of the object is displayed.
- ▶ Click **Run test**.

➪ The test results show the type and breakdown of the 2D code.

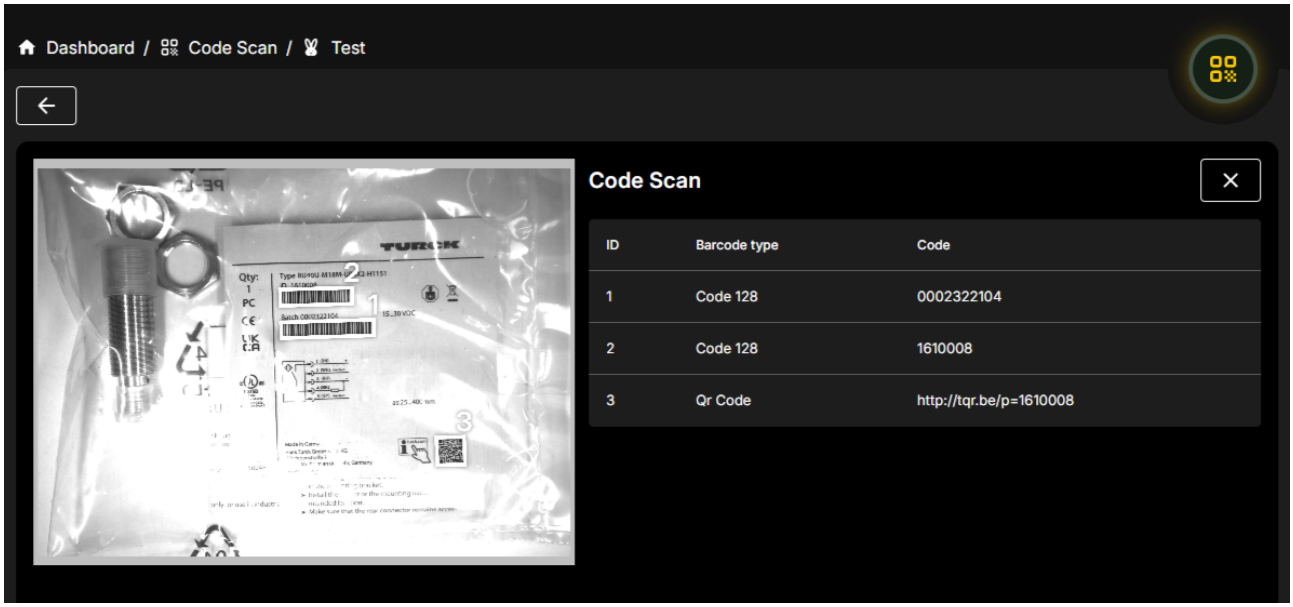


Fig. 23: Code Scan — Test results of the Code Scan

- ▶ Select **X** to make a new image.
- ▶ Select ← to return to the Code Scan settings.
- ▶ Select **Dashboard** to go to the main menu.

9.4.2 Setting the Difference Check

During the Difference Check, the smart camera analyzes one or more ROIs. Prior to this, at least ten good and ten bad shots must be taught and annotated using an annotation mask.

For multiple ROIs: The smart camera checks whether all ROIs match the reference image when new images are taken. If this is not the case, it will indicate that the current image is not OK. **Positive examples** may only contain images in which every ROI is OK. **Negative examples** may only contain images in which every ROI is not OK.

One ROI: The smart camera checks for the ROI that matches the reference image when new images are taken. If this is not the case, it will indicate that the current image is not OK.

- On the dashboard, click **Difference Check**.

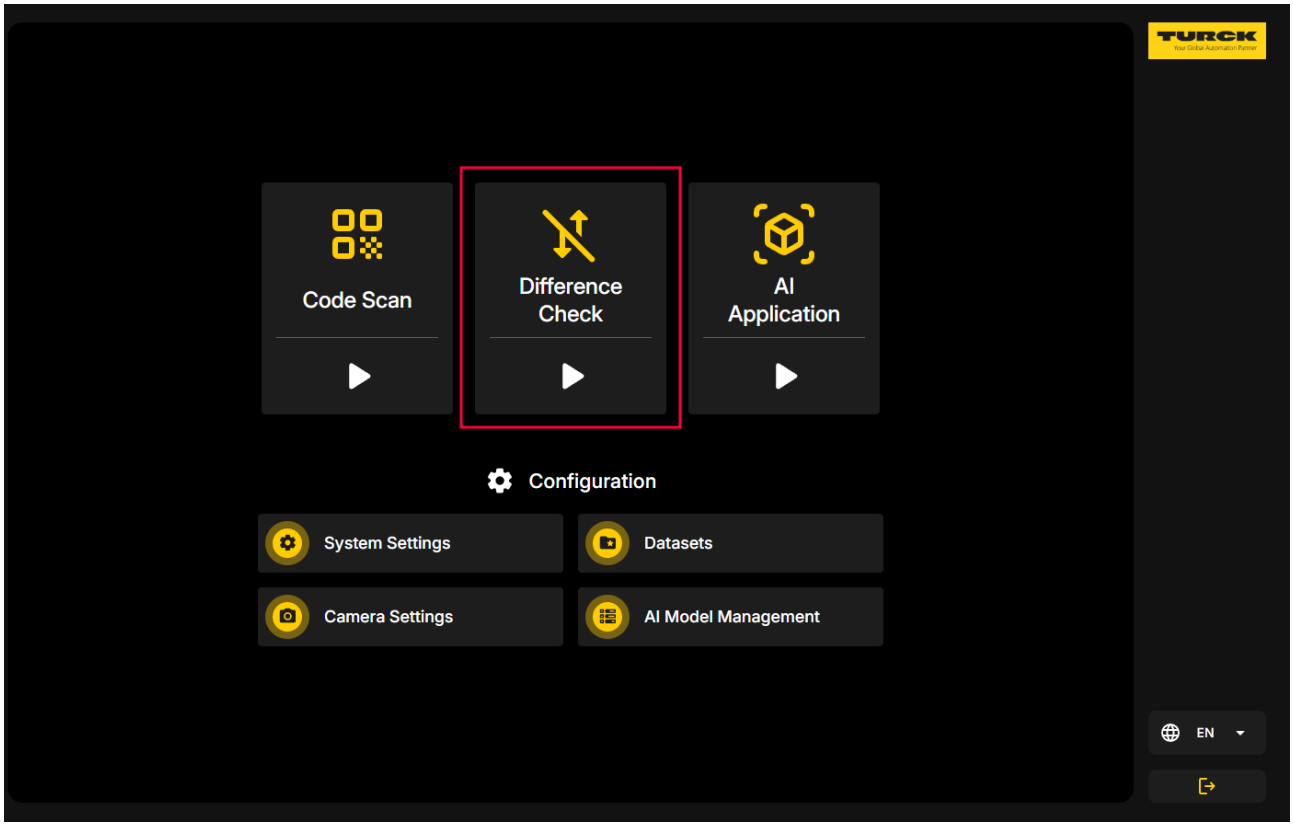


Fig. 24: Select Difference Check on the dashboard

▶ Create a new Difference Check.

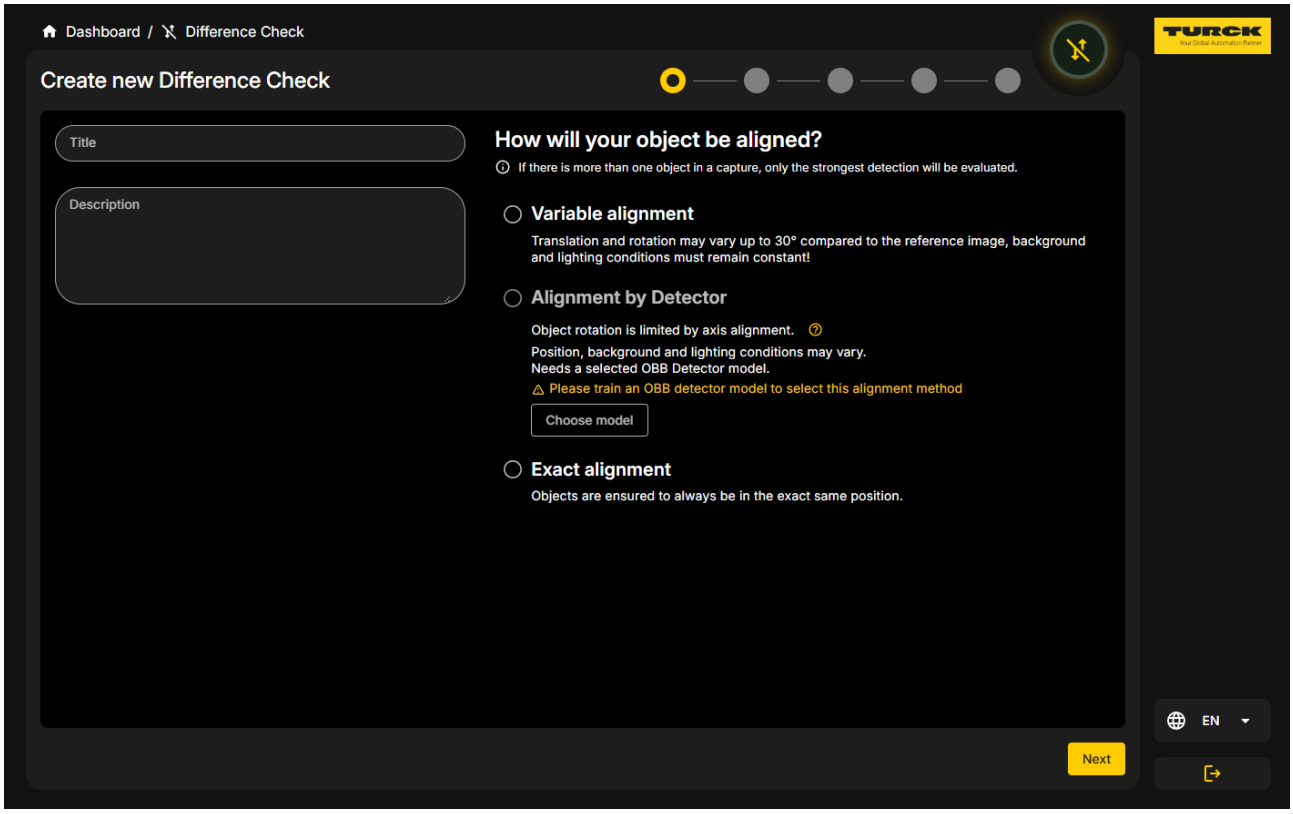


Fig. 25: Difference Check — Creating a new Difference Check

▶ Insert metadata and confirm with **Next**

- **Capture background** without the object.

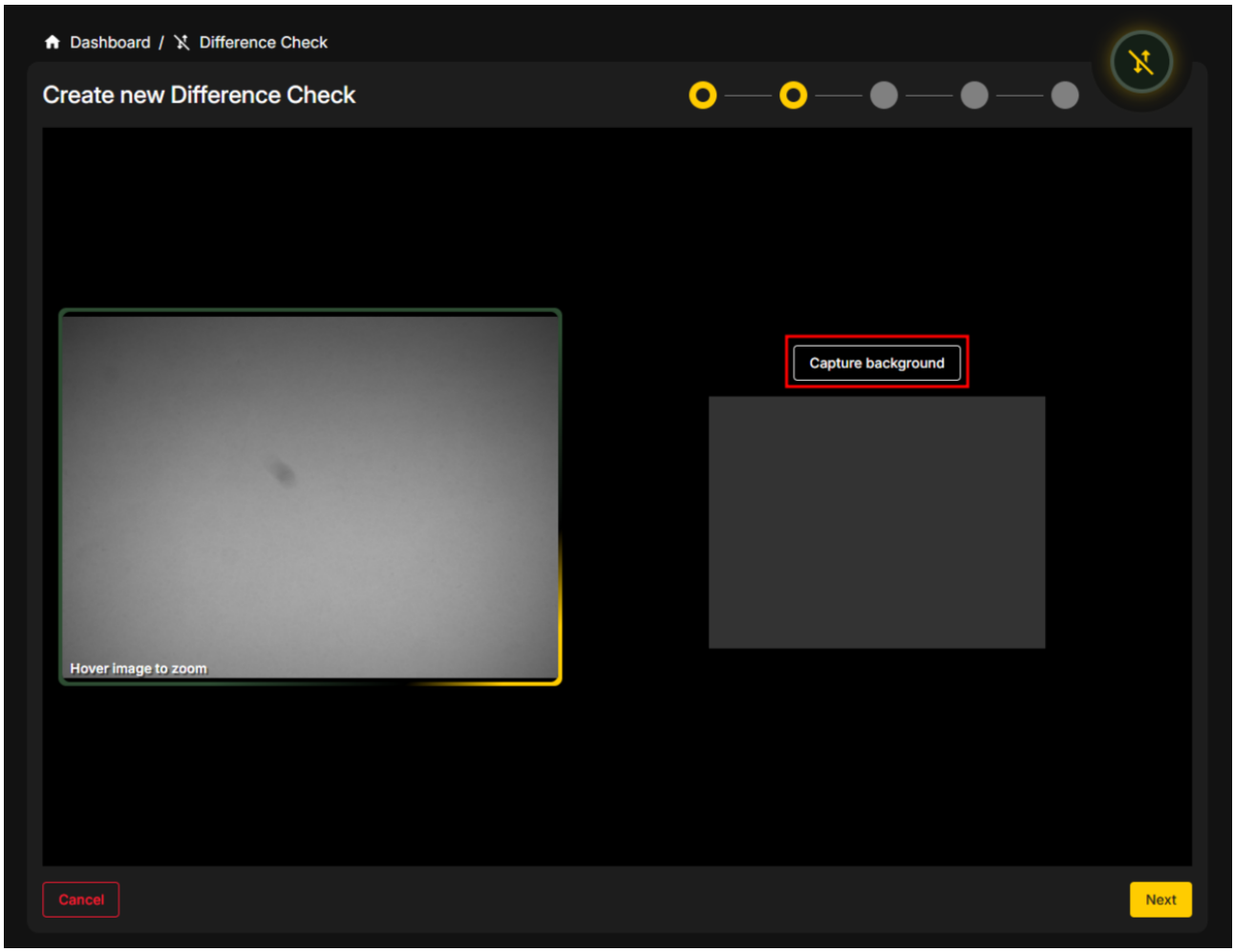


Fig. 26: Difference Check — Capturing the background

- Click **Next**.

- Place the object and **Capture reference image**.

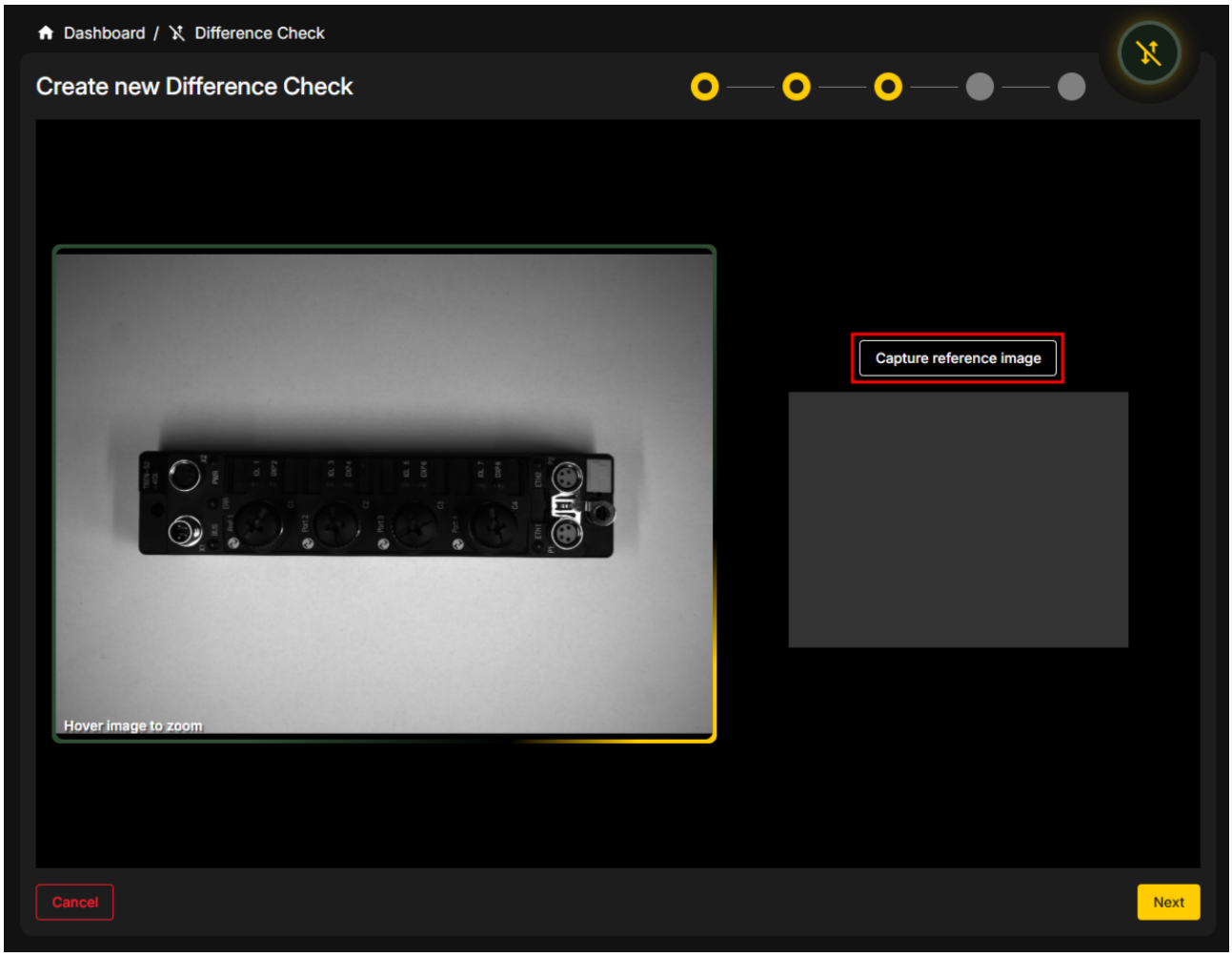


Fig. 27: Difference Check — Capturing a reference image

- Click **Next**.

- Add annotations to ROIs to the reference image. Make sure that the annotations are on the ROIs and do not frame them extensively. The smart camera checks the entire area within the annotation, meaning that open spaces are also included in the test.

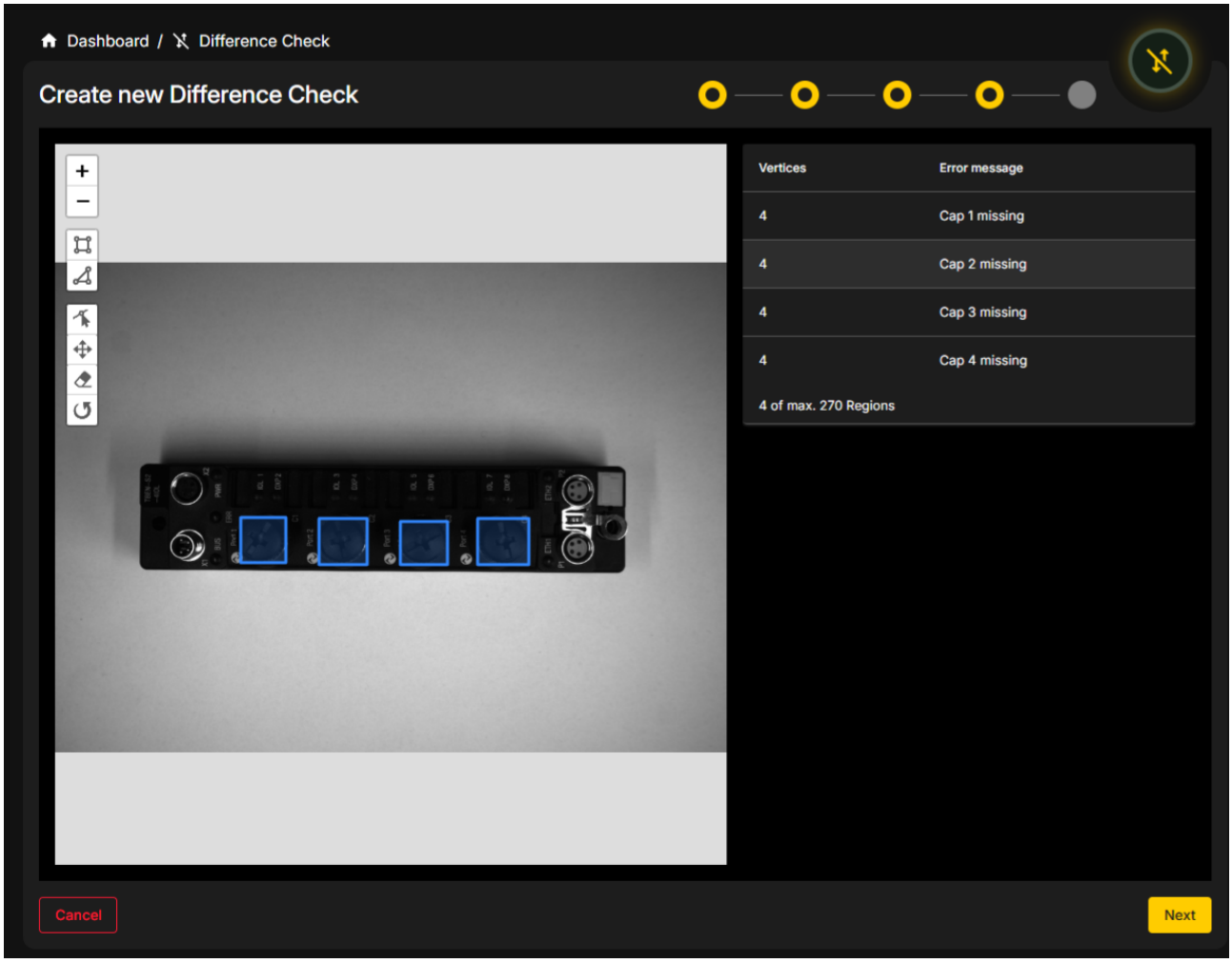


Fig. 28: Difference Check — Adding test regions in the annotation screen

- ▶ Take at least ten good shots and ten bad shots: Do not change the object orientation more than 20° from the first reference image.
- ▶ Click **Save**.

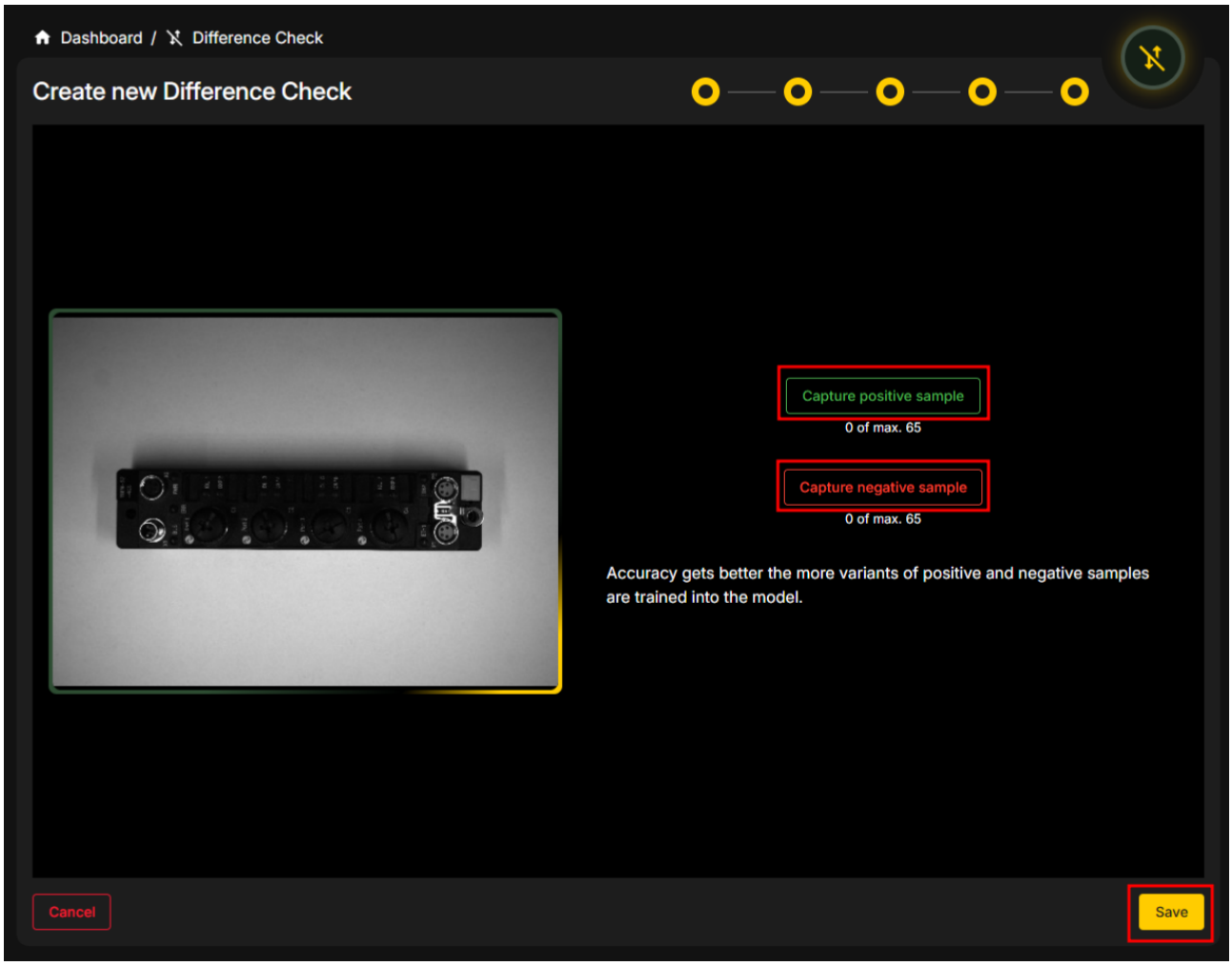


Fig. 29: Difference Check — Capturing and saving positive and negative examples

- ⇨ Training for the Difference Check starts; this takes a few minutes depending on the number of images.
- ⇨ After training, the overview is displayed.

The overview in the **Difference Check**

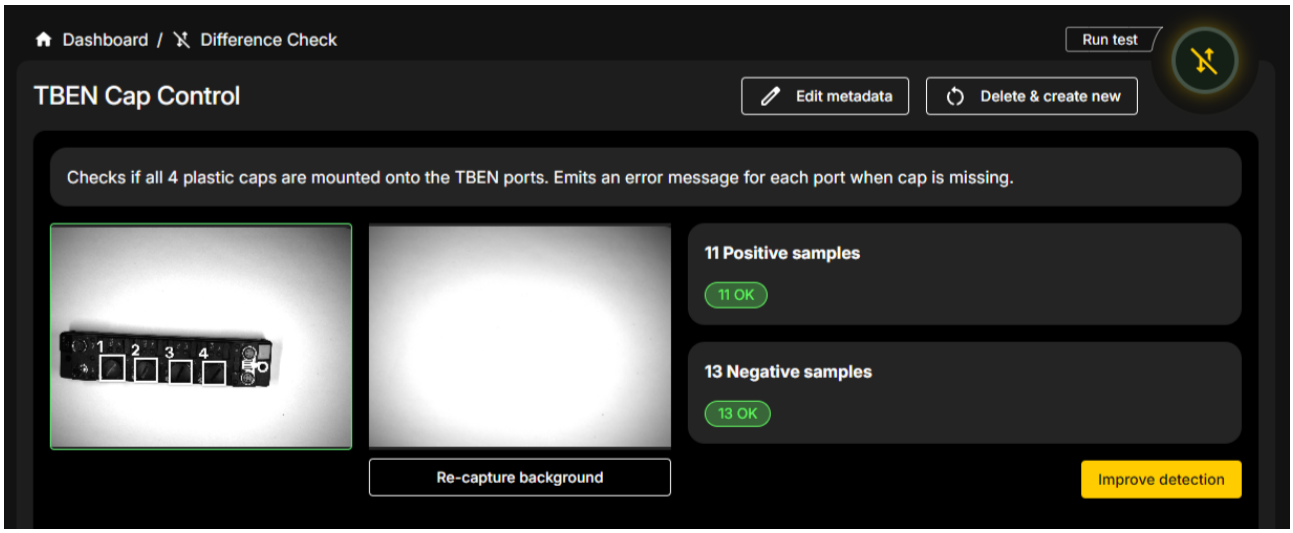


Fig. 30: Difference Check — Overview

The following settings can be made in the main menu of the Difference Check:

- **Re-capture background**, **Edit metadata**, **Improve detection** or **Delete & create new**.

Capturing test images with objects

- Start **Run test** to check the current object.

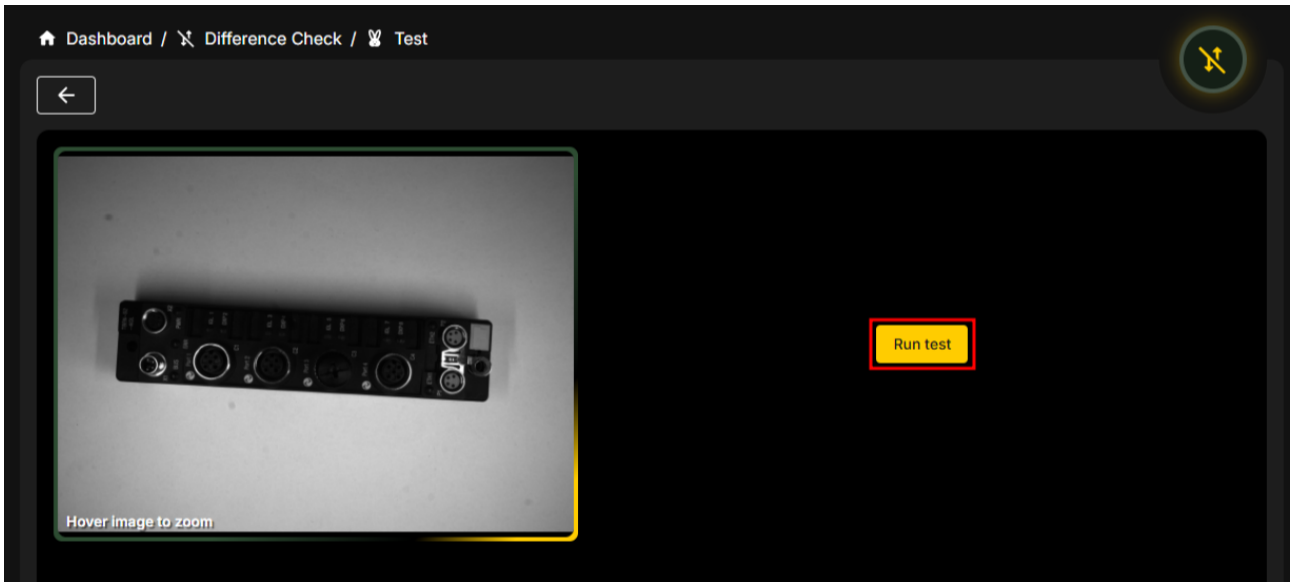


Fig. 31: Difference Check — Running a test

⇨ The test indicates whether the object is OK or not.

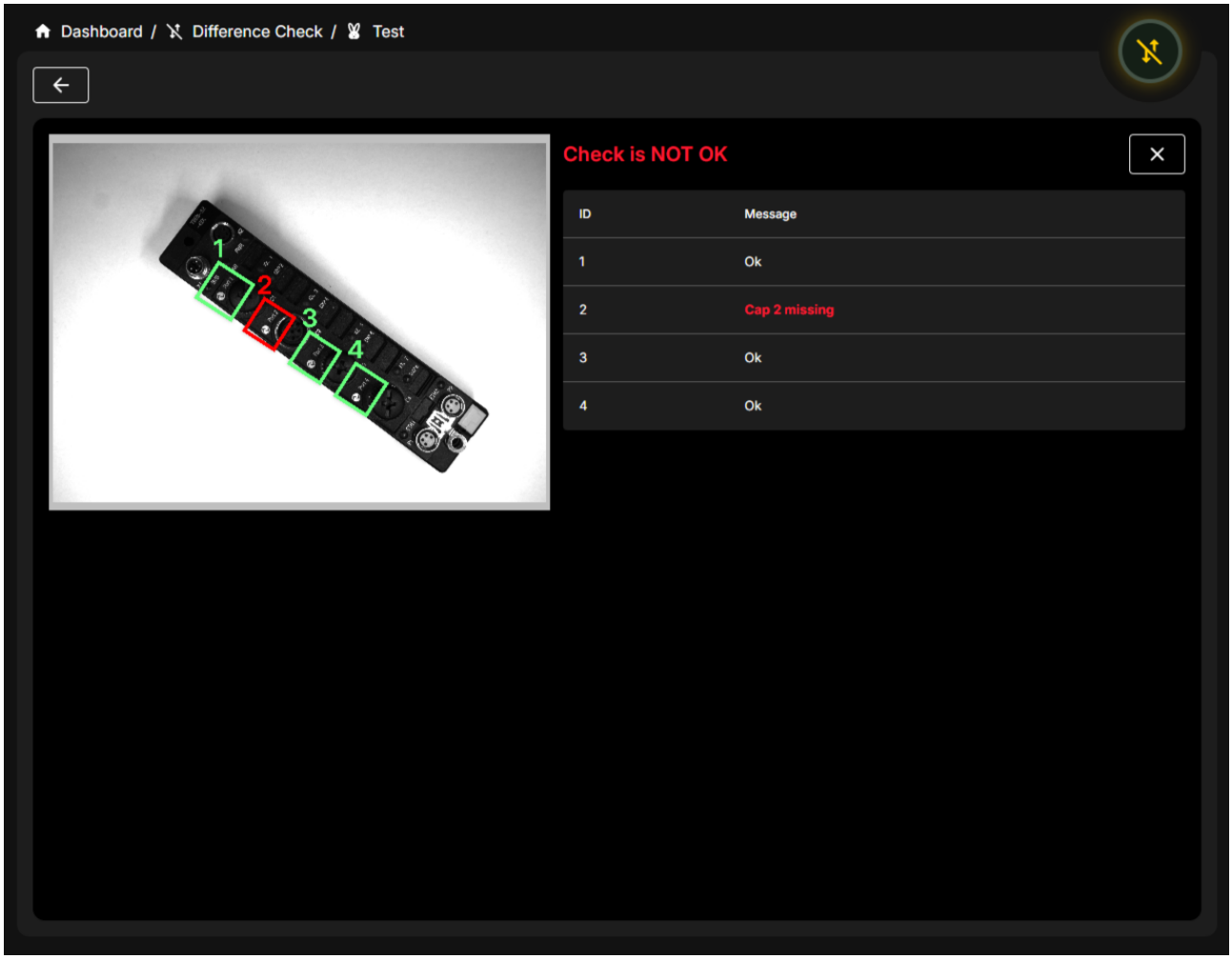


Fig. 32: Difference Check — Test result

- ▶ Select **X** to capture more images.
- ▶ Press ← to return to the overview.

Improving the **Difference Check**

- In the overview, select **Improve detection**.

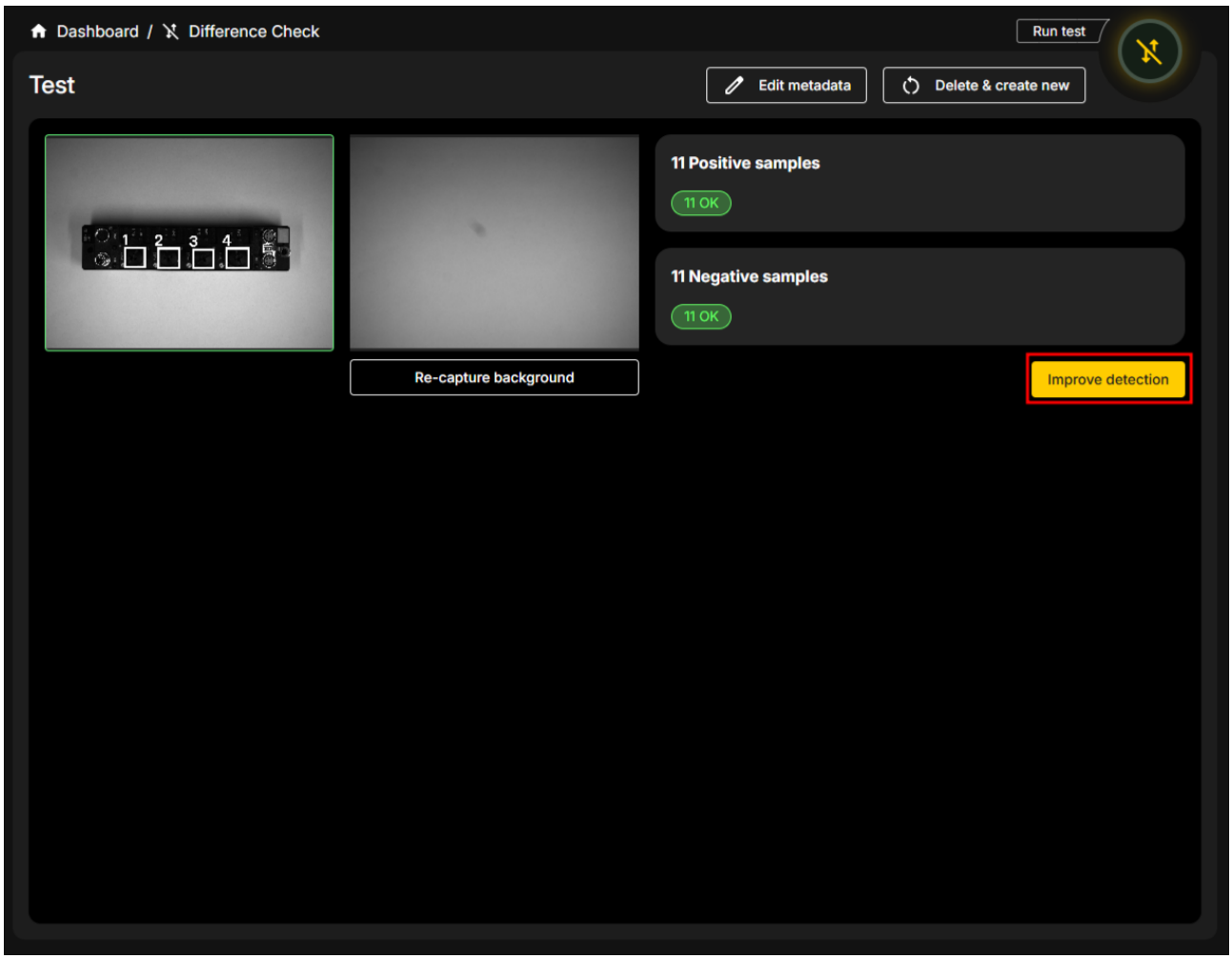


Fig. 33: Difference Check — Improving recognition overview

▶ Select + **Add images**.

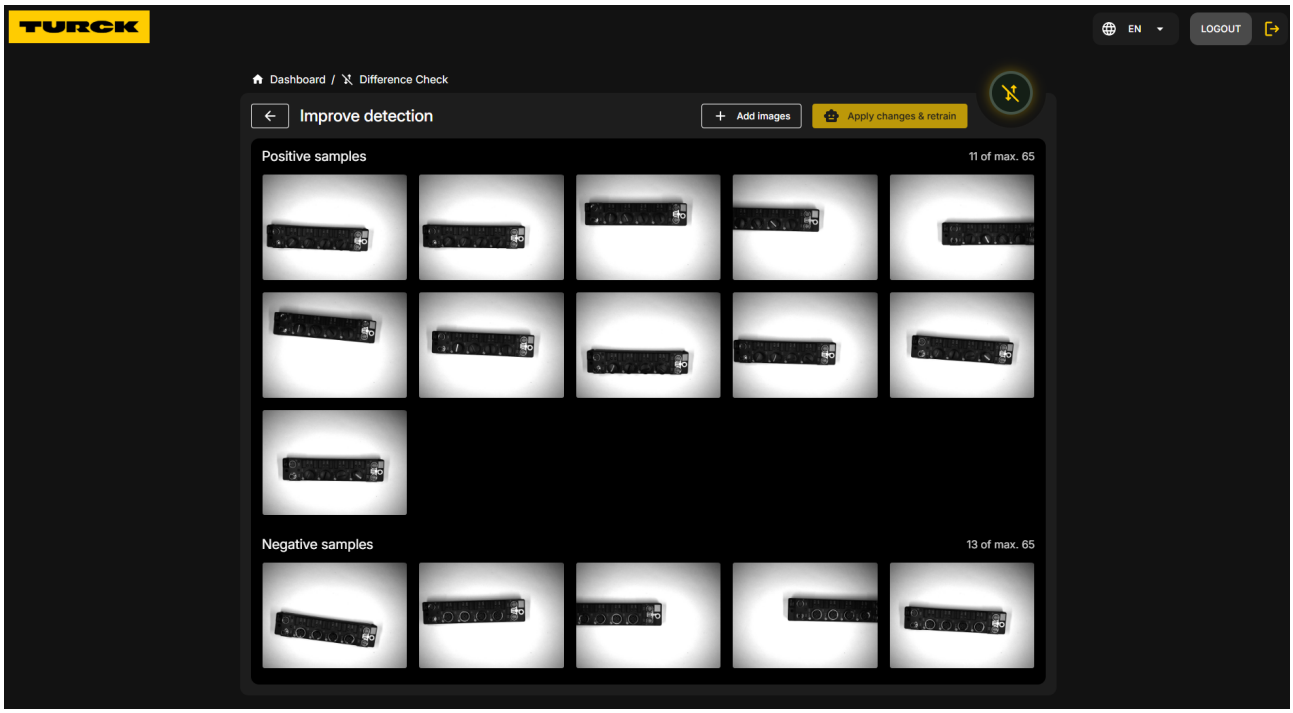


Fig. 34: Difference Check — Improving detection

▶ Add more good and bad images. Do not change the object orientation more than 20° from the first reference image.

▶ Click **Save**.

⇨ Training for the Difference Check starts; this takes a few minutes depending on the number of images.

⇨ After training, the overview is displayed again.

9.4.3 Setting the Classifier and Detector — AI application

Labeling datasets

- Select **Datasets** on the dashboard.

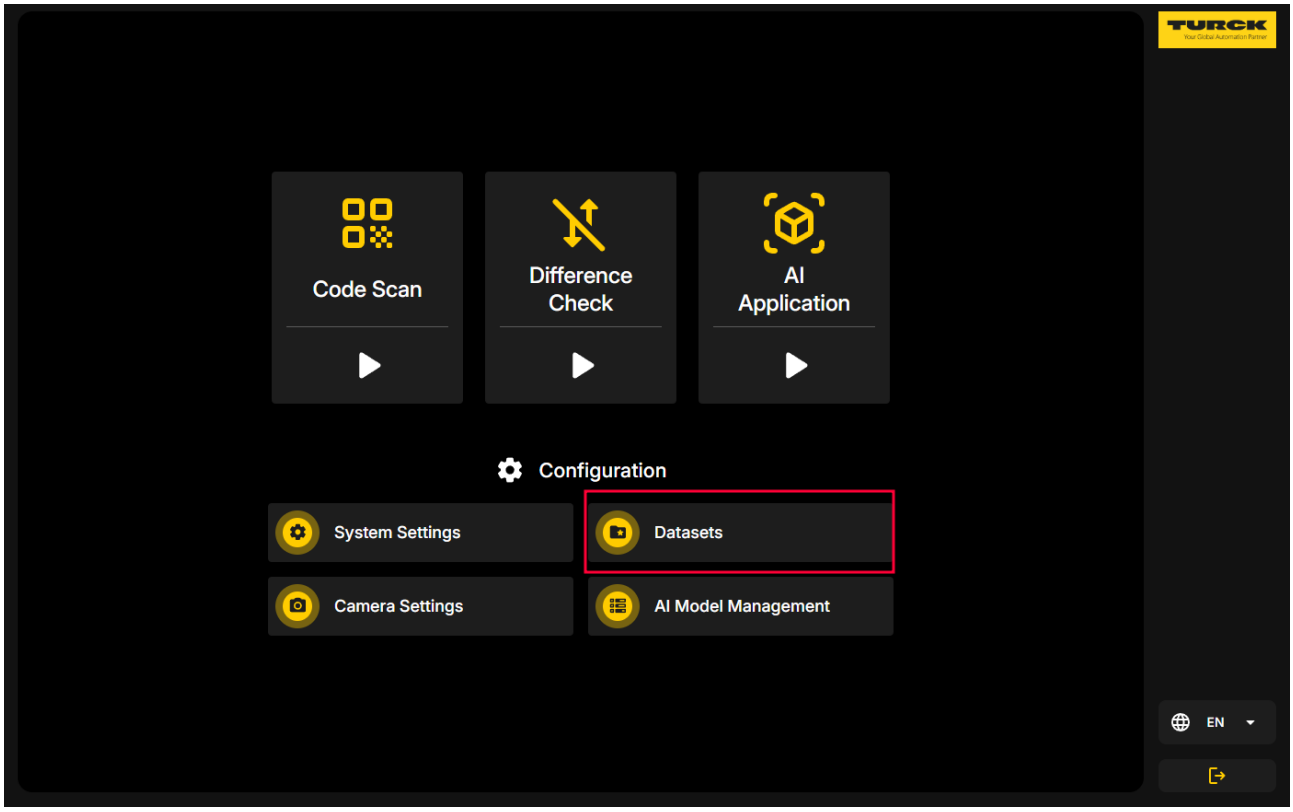


Fig. 35: Dashboard — Datasets

▶ Select + **Create new** to set up a new dataset or **Import** to select an existing record.

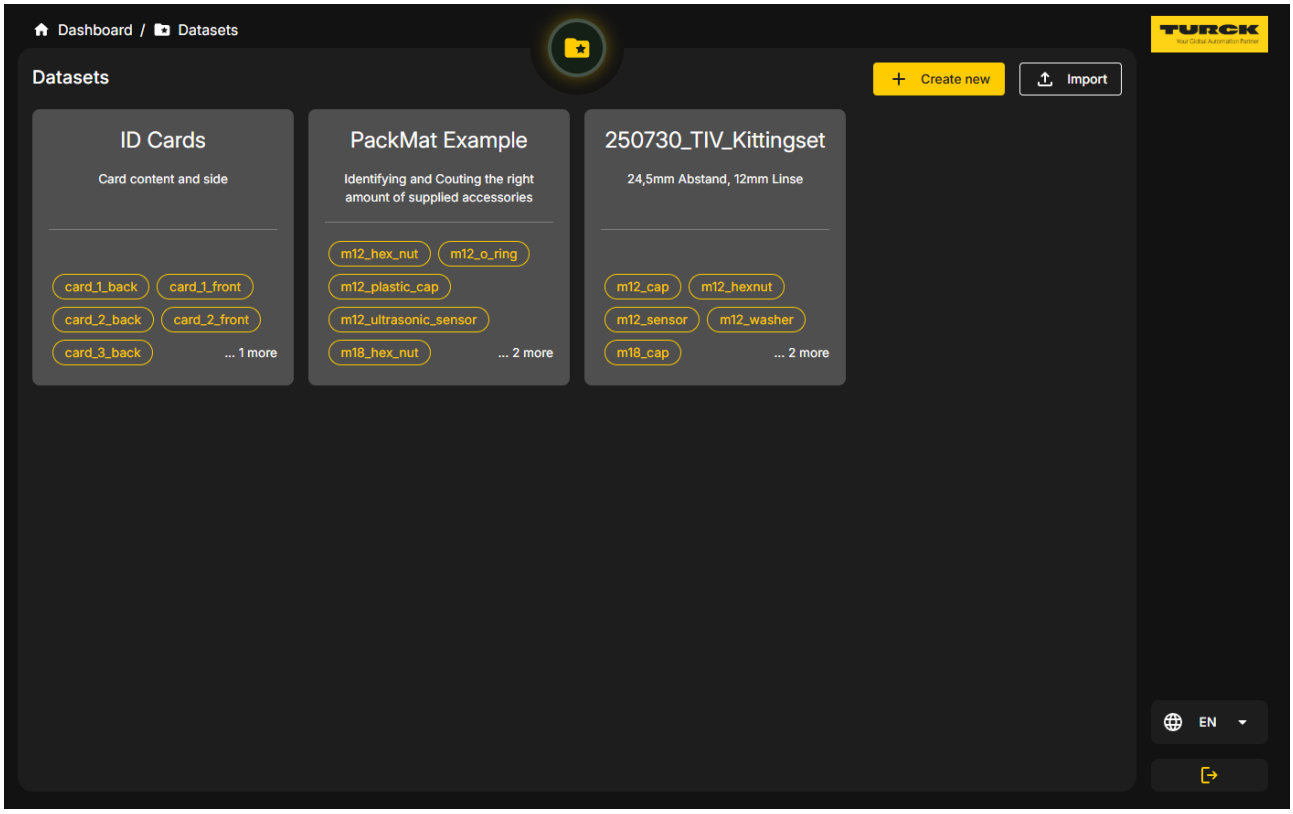


Fig. 36: Overview of datasets

Setting up a new dataset

- Insert title and description.
- Select **Image classes** and assign titles for the desired image classes if the dataset is being used for the AI tool Classifier.
- Select **Region classes** and assign titles for the desired region classes if the dataset is being used for the AI tool Detector.
- Select **Create**.

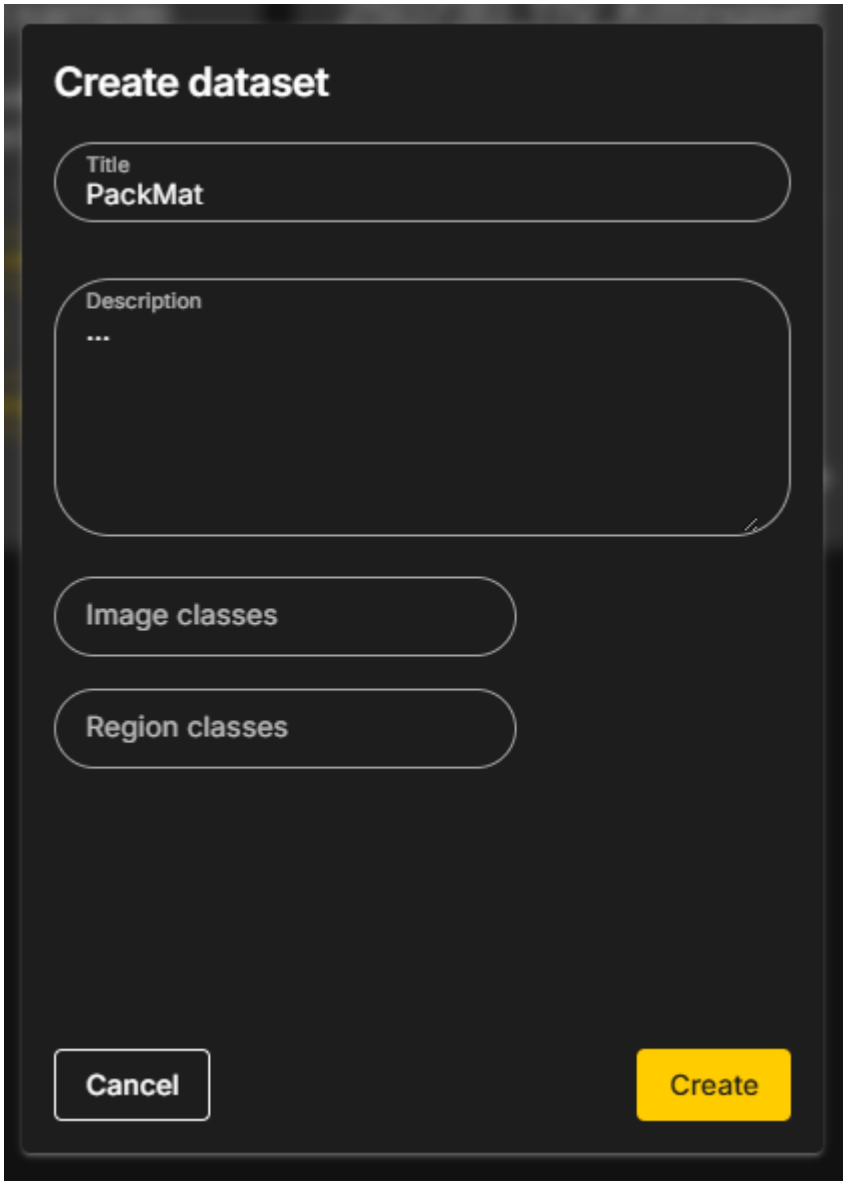


Fig. 37: Creating a dataset

Adding images to the dataset

- Select a dataset from the overview.
- Add images via **Capture**.

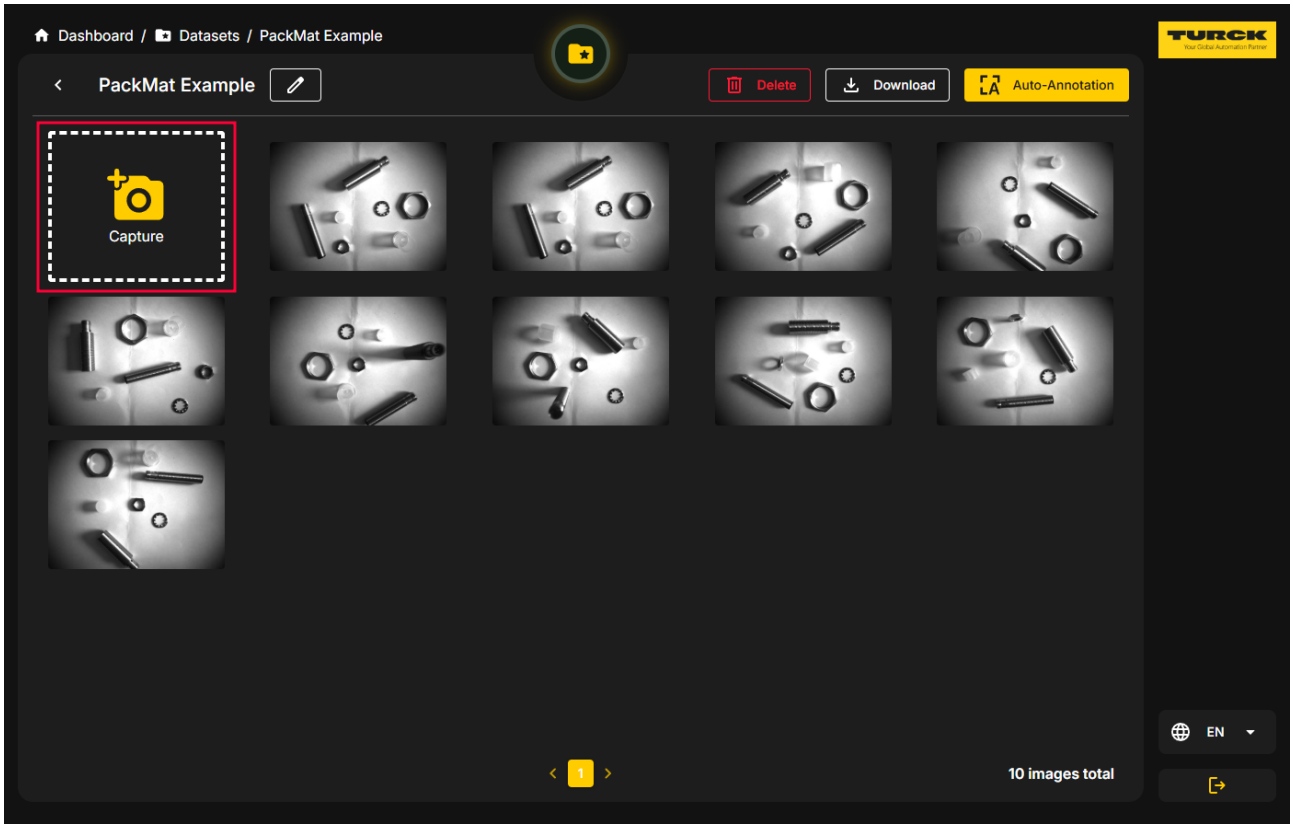


Fig. 38: Capturing new images

⇨ A live images is shown.

▶ Use **Capture Image** to add images.

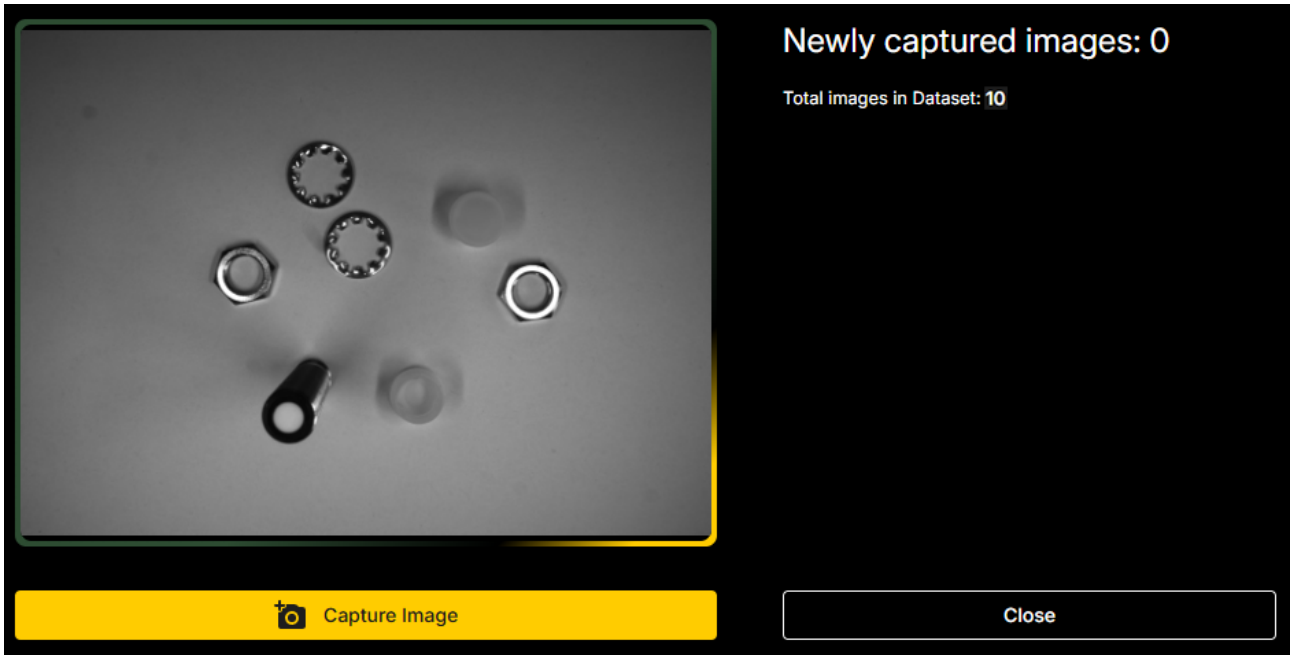


Fig. 39: Adding images to the dataset

⇨ The overview shows how many images have already been made and how many have already been included in the dataset.

The recordings are saved locally via **Download**; **Delete** deletes the dataset.

Annotating the images in the dataset

- Select **dataset**.
- Select recordings that have not yet been annotated and make a note of them using the annotation screen. Annotations are saved automatically.

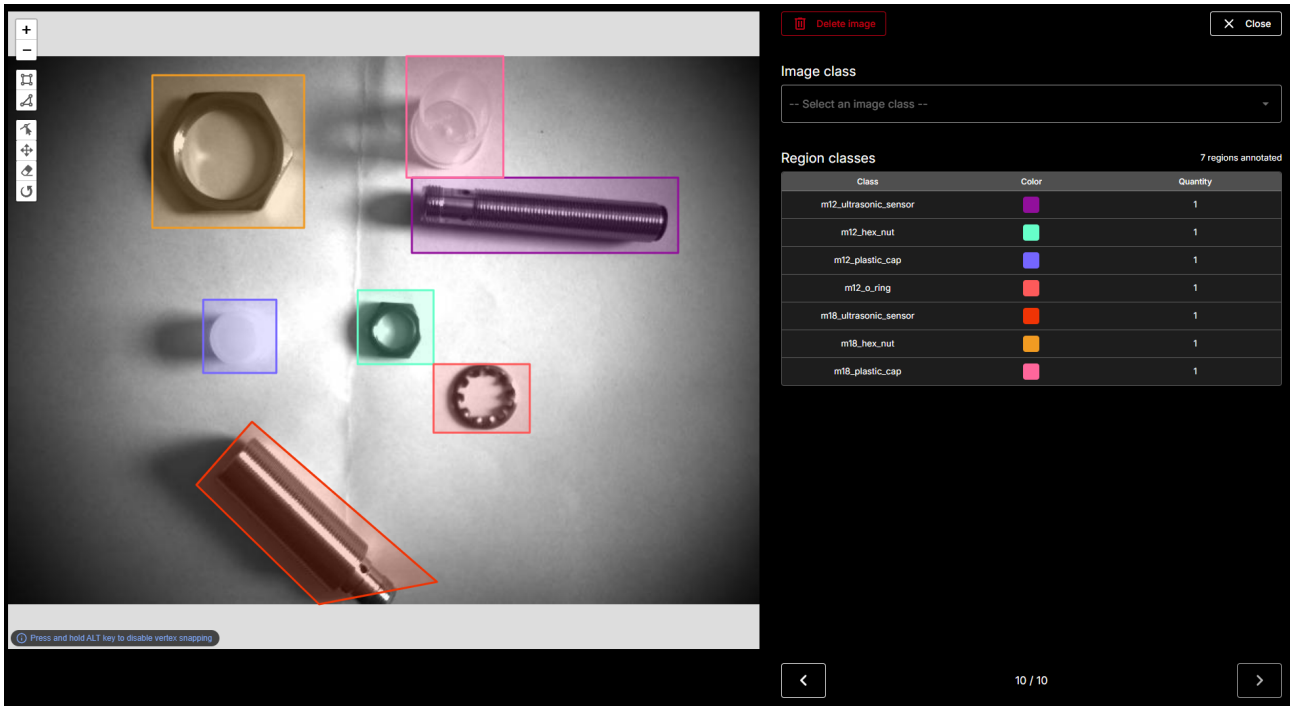


Fig. 40: Annotation screen

- Click **Close** to return to the overview.

Auto-Annotation for new or existing dataset

NOTE
When an auto-Annotation is performed, existing annotations in the dataset are deleted.

If other datasets with image classes are already stored in the neural network of the smart camera, the selected dataset can be automatically annotated by the smart camera, for example if new datasets are to be analyzed according to the same image classes.

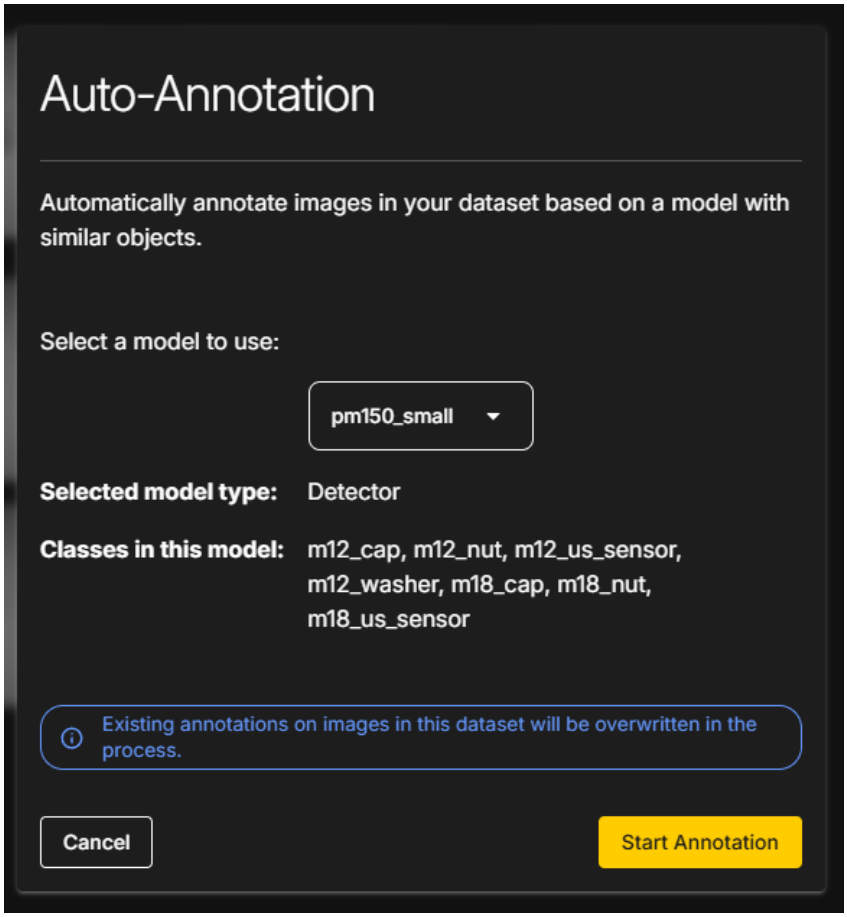


Fig. 41: Auto-Annotation of a dataset

9.4.4 Training an AI model — AI model management

After the image classes and datasets are created, the AI is trained for the **Classifier** and **Detector**.

- ▶ Select **AI Model Management** on the dashboard.
- ⇨ A list of previously created training for the **Classifier** and **Detector** is displayed.

Create new training

- ▶ Select + **Train new model** to train a new model or **Import** an existing model.

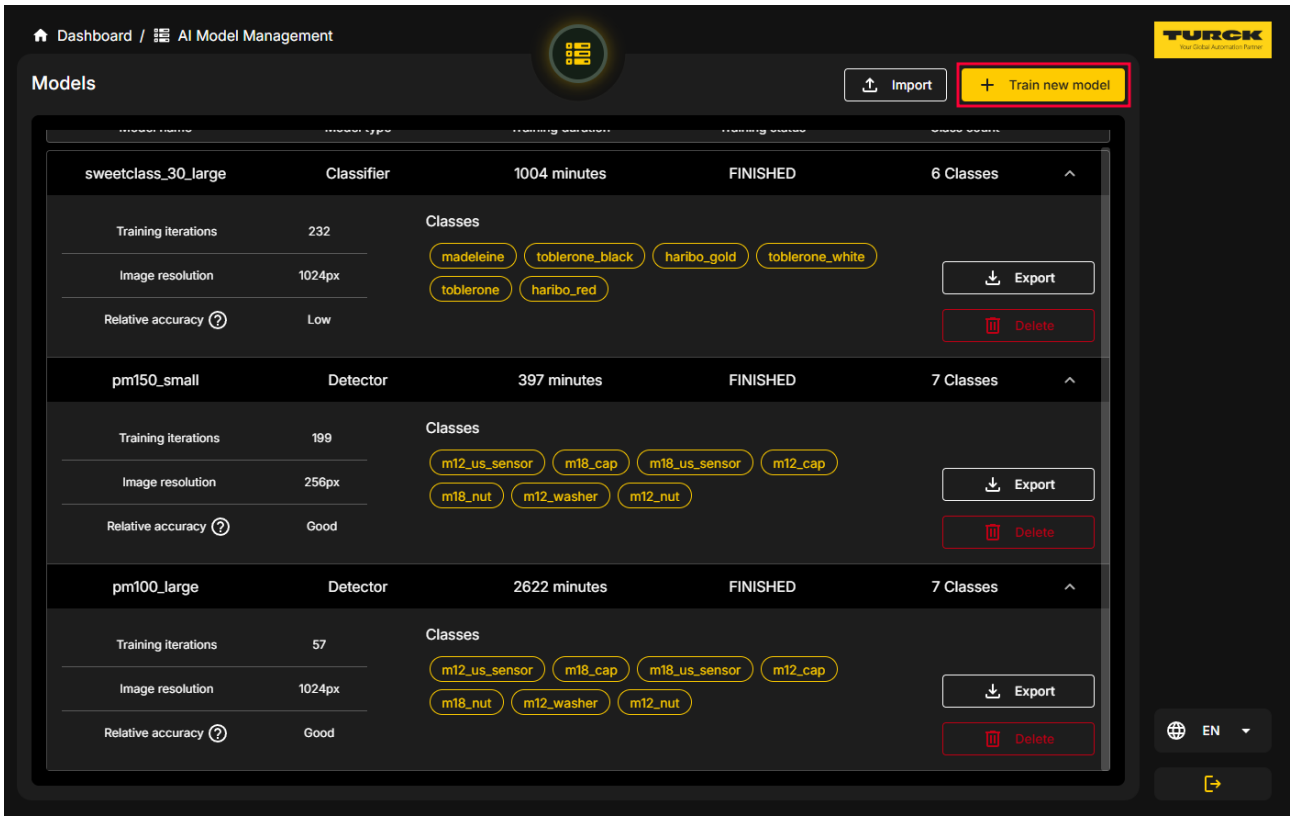


Fig. 42: AI Model Management — New training

- Assign a title and choose whether the classifier or detector should be trained by the AI.

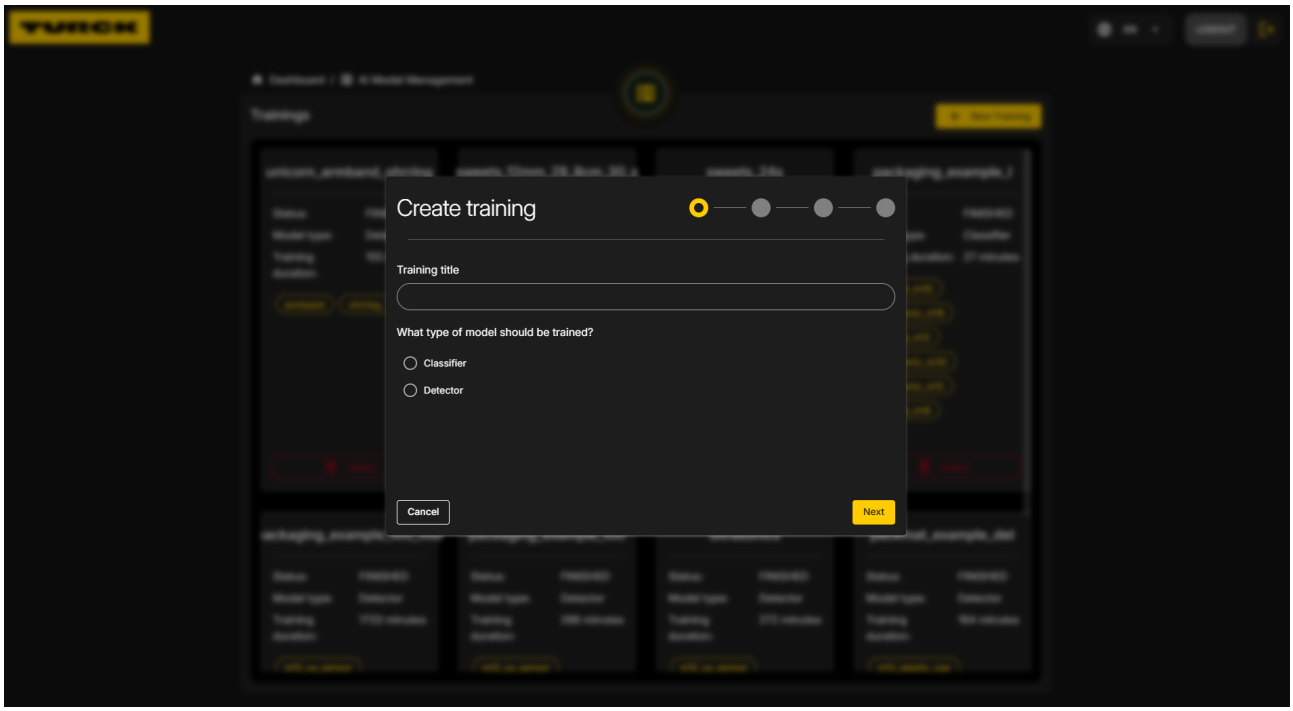


Fig. 43: AI Model Management — Creating training: Select the title and model type

- Confirm with **Next**.
- Select a dataset with which the AI is to be taught.

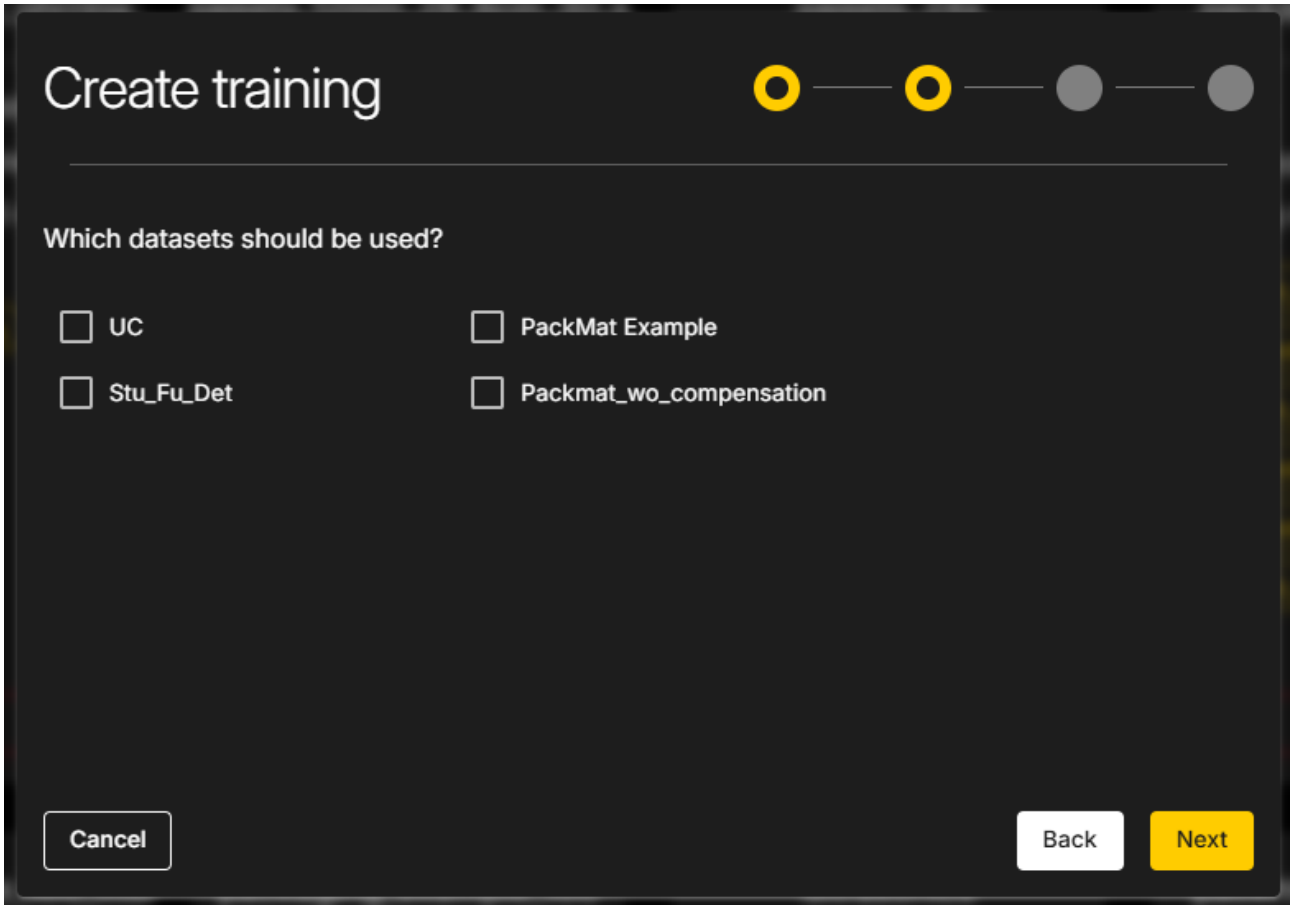


Fig. 44: AI Model Management – Selecting dataset for new training

- Confirm with **Next**.

- Select the image classes to be used for training AI. Multiple image classes can be selected.

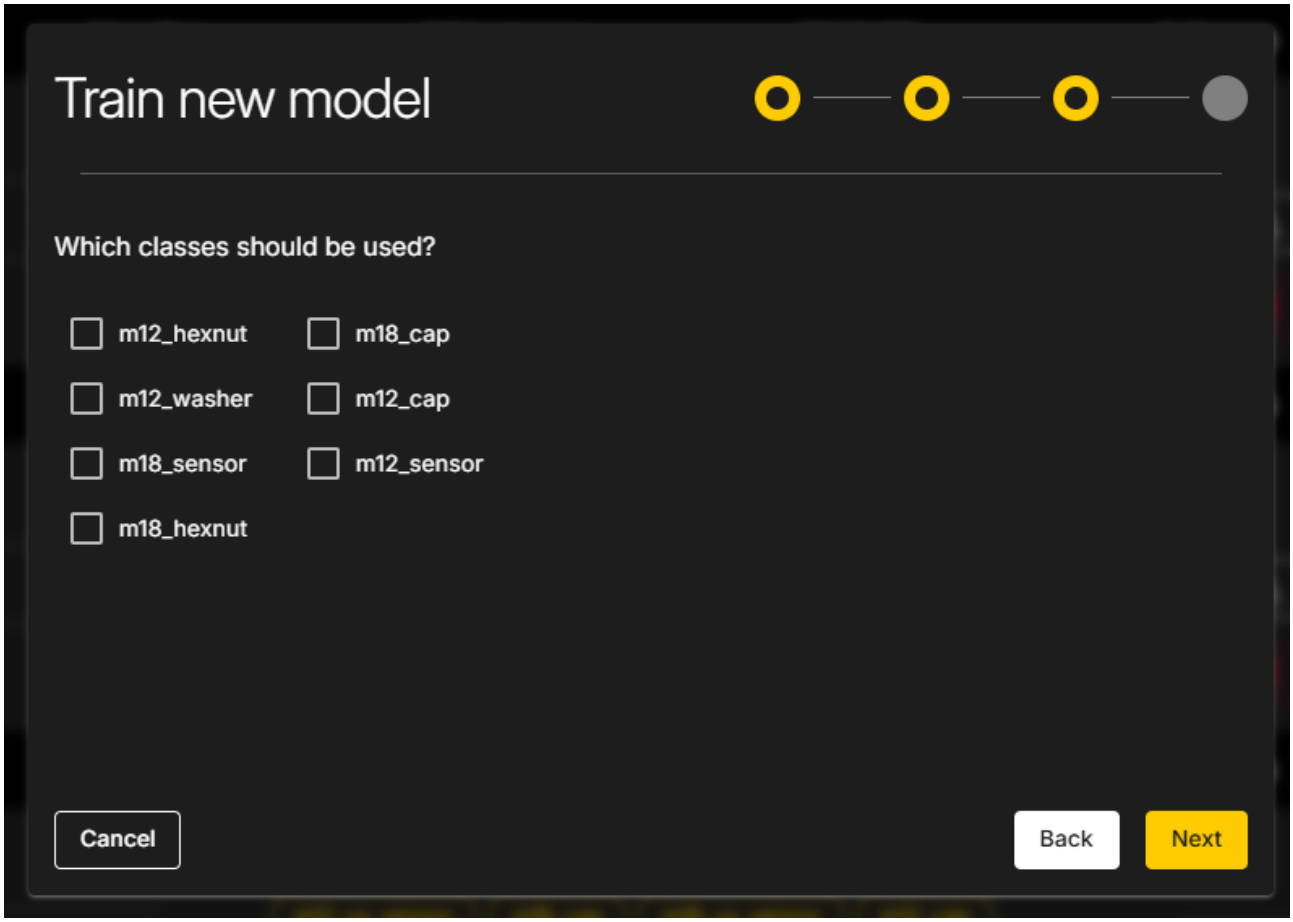


Fig. 45: AI Model Management — Selecting image classes

- Confirm with **Next**.

➪ The number of images used for the training is displayed.

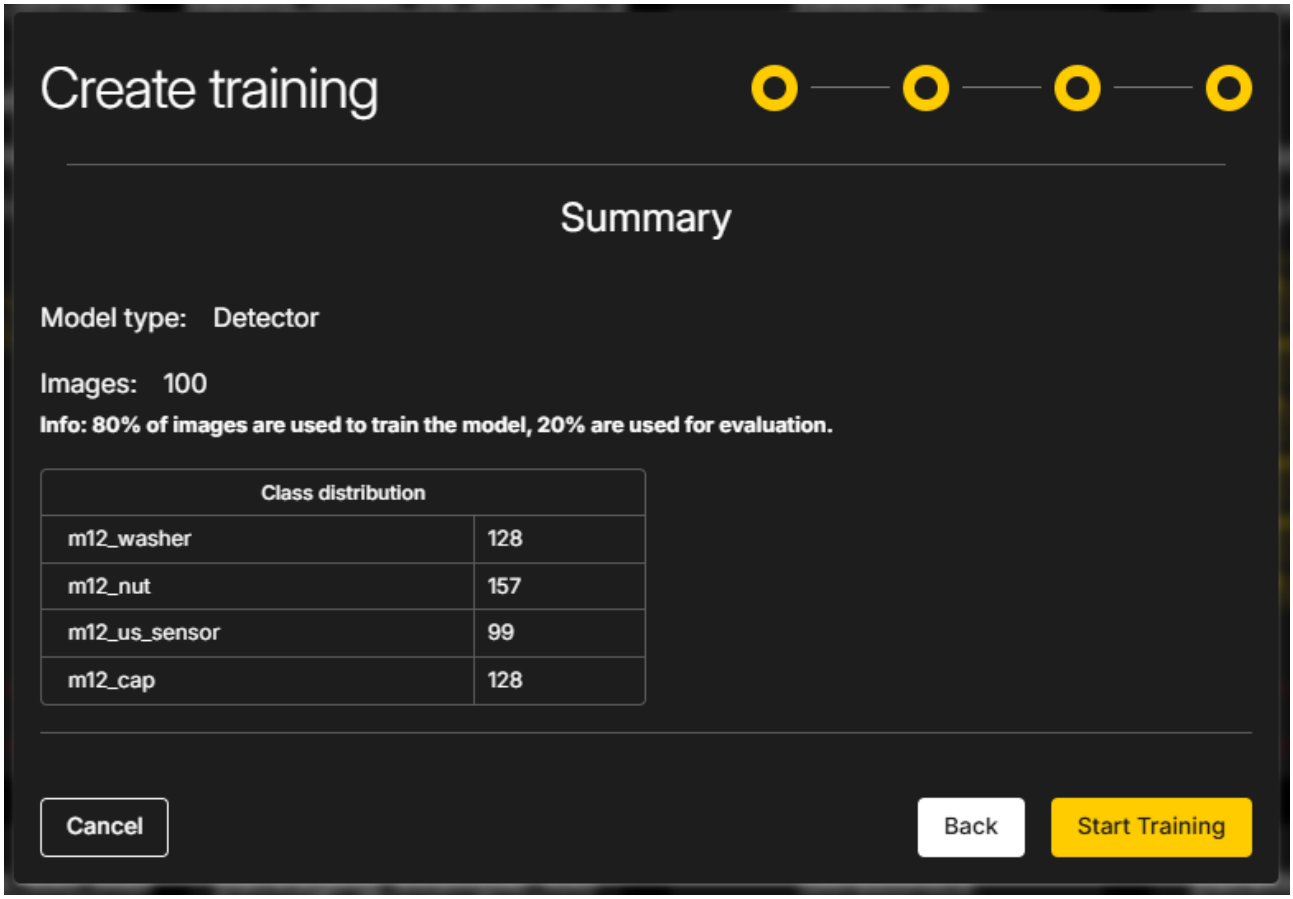


Fig. 46: AI Model Management – Number of images for the training

▶ Select the resolution of the images for training.

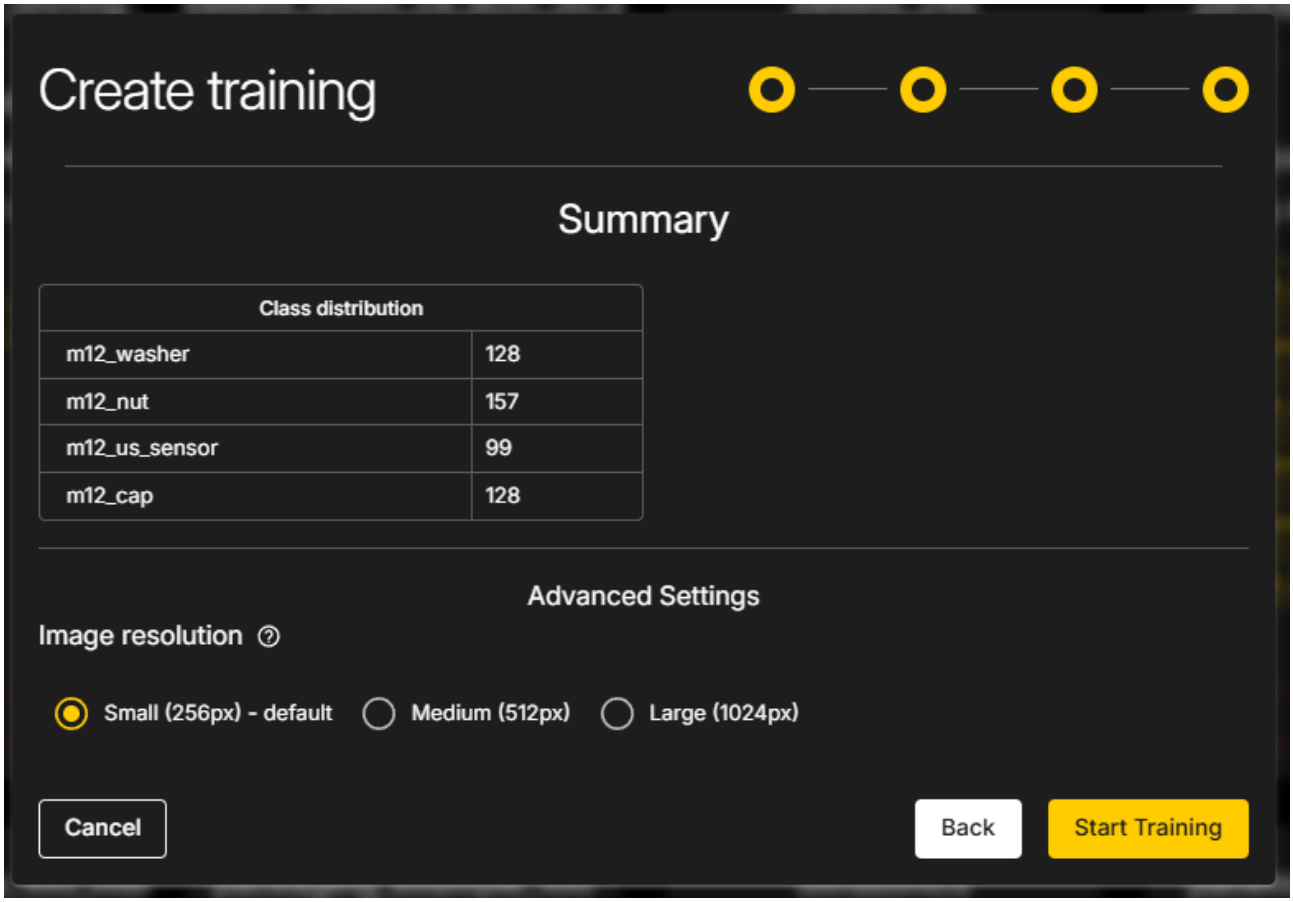


Fig. 47: AI Model Management — Selecting resolution

- ▶ Select **Start Training**.
- ⇨ **Training starts** is displayed. The progress of the training is displayed.
- ⇨ After the smart camera has finished training, the overview of AI model management is displayed.

Canceling training

- ▶ Select **Cancel Training**. Confirm that training is to be canceled.
- ⇨ The overview of AI model management with all available training is displayed.

10 Troubleshooting

If the device does not function as expected, first check whether there is any ambient interference. If there is no ambient interference, check the connections and settings of the device for faults.

If no faults are identified, this indicates that the device is faulty. In this case, decommission the device and replace it with a new device of the same type.

10.1 Reboot

NOTE
Reboot
Data may be lost
- ▶ Before restarting, back up your data by means of an export.

Restart the smart camera if it is no longer accessible on the network:

- ✓ The device is connected to the power supply.
- ▶ Open the service flap on the side of the device with a screwdriver.
- ▶ Press the reset button for 3 s.
- ⇨ The reset takes several minutes. After the reset, refit the service flap.

11 Maintenance

Ensure regularly that the plug connections and cables are in good condition.

The devices are maintenance-free, clean dry if required.

12 Repair

The device is not intended for repair by the user. The device must be decommissioned if it is faulty. Observe our return acceptance conditions when returning the device to TURCK.

12.1 Returning devices

If a device has to be returned, bear in mind that only devices with a decontamination declaration will be accepted. This is available for download at
https://www.turck.de/en/return-service-6079.php
and must be completely filled in, and affixed securely and weather-proof to the outside of the packaging.

13 Disposal

The devices must be disposed of properly and do not belong in the domestic waste.

14 Technical data

	TIV12MG-Q110N
ID	100048288
Image sensor	1/1.1" CMOS, monochrome, global shutter
Resolution	4128 × 3008 pixels
Pixel size	2.74 µm
Frame rate	42 fps
Internal memory	4000 MB
Processor	NVIDIA Jetson Nano 4 GB, quad core 1.4 GHz
Memory expansion	1 × SD/MMC memory card
Operating system	Linux
Lens	C-mount
Electrical data	
Operating voltage	22…26 VDC
Admissible range	Max. 4 A for lighting max. 6 A total current
Short-circuit protection	Yes
Reverse polarity protection	Yes
Communication protocol	TCP/IP RFC1006
Transmission type	Full duplex
Output function	Programmable input/output, 4 × push/pull programmable, optically isolated
Potential separation	Outputs galvanically isolated from Vss
Input function	Trigger in
Display	
Power on display	LED, green
Status display	LED, yellow
Fault signal	LED, red
Design	Rectangular, Q110
Housing material	Aluminum, AL
Housing cooling	Passive
Electrical connection	1 × M12 connector, 12-wire
Ambient conditions	
Ambient temperature	-20…+40 °C
Storage temperature	-40…+70 °C
Relative humidity	25…75 %
Type of protection	IP67 with screwed-on protective tube
Approvals	CE, cULus

15 TURCK branches — contact data

Germany	TURCK GmbH Witzlebenstraße 7, 45472 Mülheim an der Ruhr www.turck.de
Australia	Turck Australia Pty Ltd Building 4, 19-25 Duerdin Street, Notting Hill, 3168 Victoria www.turck.com.au
Austria	Turck GmbH Graumanngasse 7/A5-1, A-1150 Vienna www.turck.at
Belgium	Turck Multiprox N. V. Lion d'Orweg 12, B-9300 Aalst www.multiprox.be
Brazil	Turck do Brasil Automação Ltda. Rua Anjo Custódio Nr. 42, Jardim Anália Franco, CEP 03358-040 São Paulo www.turck.com.br
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Poland	TURCK sp.z.o.o. Wroclawska 115, PL-45-836 Opole www.turck.pl
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