SIEMENS

SIMATIC

Vision Sensor SIMATIC VS 110

Manual

Edition 07/2002
A5E00162495-01

Safety Guidelines

This manual contains notices intended to ensure personal safety, as well as to protect the products and connected equipment against damage. These notices are highlighted by the symbols shown below and graded according to severity by the following texts:

Danger
indicates that death, severe personal injury or substantial property damage will result if proper precautions are not taken.

Warning
indicates that death, severe personal injury or substantial property damage can result if proper precautions are not taken.

Caution
indicates that minor personal injury can result if proper precautions are not taken.

Caution
indicates that property damage can result if proper precautions are not taken.

Notice
draws your attention to particularly important information on the product, handling the product, or to a particular part of the documentation.

Qualified Personnel

Only **qualified personnel** should be allowed to install and work on this equipment. Qualified persons are defined as persons who are authorized to commission, to ground and to tag circuits, equipment, and systems in accordance with established safety practices and standards.

Correct Usage

Note the following:

Warning
This device and its components may only be used for the applications described in the catalog or the technical description, and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens.

This product can only function correctly and safely if it is transported, stored, set up, and installed correctly, and operated and maintained as recommended.

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Disclaimer of Liability

We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcomed.

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A5E00162495-01

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Preface

Purpose of the Manual

This manual describes Vision Sensors SIMATIC VS 110. It supports you during the installation, commissioning and operation of the Sensors.

The manual is intended for persons working in the fields of programming, configuration, commissioning, servicing programmable logic controllers and image processing devices.

Certifications, Standards and Approvals

Certifications

The SIMATIC VS 110 product range has the following certifications :

- Underwriters Laboratories, Inc.: UL 508 (Industrial Control Equipment)
- Canadian Standards Association: CSA C22.2 Nummer 142, (Process Control Equipment)
- Factory Mutual Research: Approval Standard Class Number

CE Label

The SIMATIC VS 110 product range meets the requirements and protenction guidelines of the following EC Directives:

- 89/336/ECC (EMC Directive)

C-Tick Mark

The SIMATIC VS 110 product range meets the requirements of the AS/NZS 2064 (Australia and New Zealand) standard.

Standards

The SIMATIC VS 110 product range meets the requirements and criteria of the IEC 61131-2.

Guide

For easy and fast access of special information, the manual contains the following access aids:

- At the beginning of the manual you will find a complete table of contents.
- At the end of the manual you will find a comprehensive index which gives you rapid access to the information you need.
- In the chapters, you will find information that gives you an overview of the contents of the section on the left column of every chapter.

Additional Information

An installation instruction manual in paper form is supplied for the installation and wiring of the product.

You will find a "Getting Started" on the CD supplied for the first commissioning of SIMATIC VS 110.

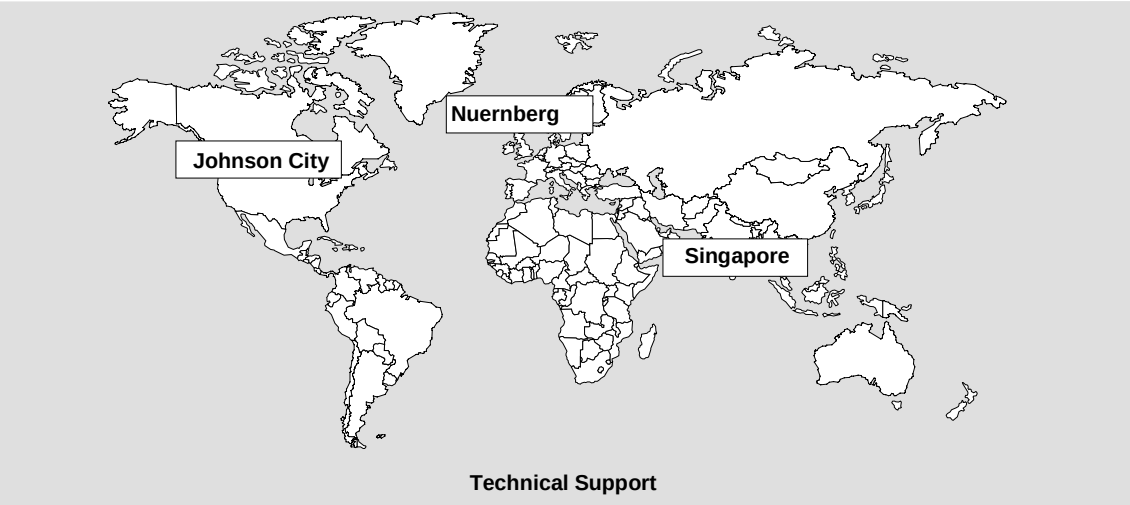
Additional Support

If you have questions on how to use the products described in this manual that are not answered here, please contact your local Siemens dealer or office.

http://www.siemens.com/automation/partner

A&D Technical Support

Available worldwide, around the clock:



Worldwide (Nuremberg) **Technical Support** Local time : 0:00 bis 24:00 / 365 days Phone: +49 (0) 180 5050-222 Fax: +49 (0) 180 5050-223 E-mail: adsupport@ siemens.com GMT: +1:00		
Europe / Africa (Nuremberg) **Authorization** Local time: Mo.-Fr. 8:00 bis 17:00 Phone: +49 (0) 180 5050-222 Fax: +49 (0) 180 5050-223 E-mail: adsupport@ siemens.com GMT: +1:00	**America** (Johnson City) **Technical Support and Authorization** Local Time: Mo.-Fr. 8:00 bis 17:00 Phone: +1 (0) 770 740 3505 Fax: +1 (0) 770 740 3699 E-mail: isd-callcenter@ sea.siemens.com GMT: -5:00	**Asia / Australia** (Singapore) **Technical Support and Authorization** Local time: Mo.-Fr. 8:30 bis 17:30 Phone: +65 (0) 740-7000 Fax: +65 (0) 740-7001 E-mail: simatic.hotline@ sae.siemens.com.sg GMT: +8:00
Generally, German and English are spoken on the Technical Support and Authorization hotline.		

Service & Support on the Internet

In addition to our documentation, we offer our Know-how online on the internet at:

http://www.siemens.com/automation/service&support

where you will find the following:

- The newsletter, which constantly provides you with up-to-date information on your products.
- The right documents via our Search function in Service & Support.
- A forum, where users and experts from all over the world exchange their experiences.
- Your local representative for Automation & Drives via our representatives database.
- Information on field service, repairs, spare parts and more under "Services".

Contents

1 Product Overview

1.1 Product Description

The Vision Sensor SIMATIC VS 110 is the fast and cost-effective solution to simple visual inspection tasks involving small parts.

SIMATIC VS 110 operates using the backlight technique. A shadow image of the test object (black object in front of a white background) is created. The test is made by comparing the shape with a trained (learned) model.
The tests performed are as follows:

- Is the object present?
- Are its shape and area OK?
- Is it aligned correctly?
- Is it complete?

You can count the number of test objects by means of a connected controller.

The device is available in two versions: SIMATIC VS 110 for "large test objects" (6GF1 011-1AA with sensor head 6GF2 002-8AA) and SIMATIC VS 110 for "small test objects" (6GF1 012-1AA with sensor head 6GF2 002-8BA).

Features

- Shape test using the backlight technique in the infrared range with a wavelength of 880 nm (NIR) invisible to the human eye.
- Alignment of the sensor head using a live picture on the PC (adjust software).
- Automatic and external triggering.
- Functions for training and evaluating (recognition) either interactively using the device buttons or signal-controlled via the integrated inputs/outputs.
- Up to 15 different models can be trained and stored permanently
- Each model can be trained in two views (A and B). To sort the test objects, there are 3 digital outputs (OK_A, OK_ B, N_OK) available.
- Simple, automated training of test objects
- Permitted height deviation can be set
- Support when setting the quality limit
- Position-controlled activation of actuators
- Rejection of untrained test objects (N_OK)

You will find the technical specifications of SIMATIC VS 110 in Appendix A.2

Dimensions of the Test Objects

The two figures below show the permitted dimensions of the test objects in a three-dimensional field. One figure shows the dimensions for SIMATIC VS 110 for "large test objects" (6GF1 011-1AA with sensor head 6GF2 002-8AA) and the other shows the dimensions for SIMATIC VS 110 for "small test objects" (6GF1 012-1AA with sensor head 6GF2 002-8BA).

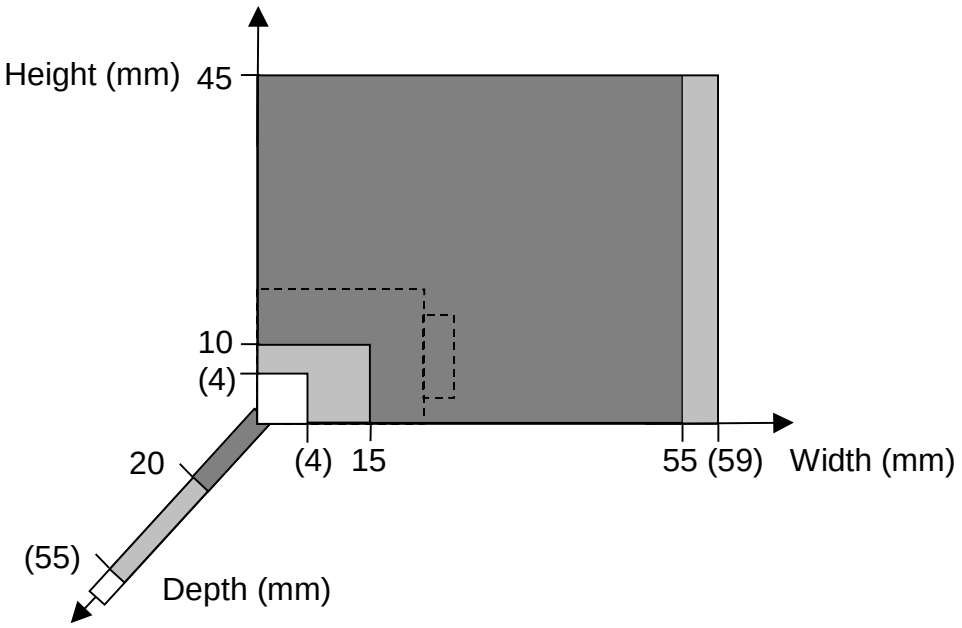
Test objects whose dimensions are in the dark gray area are ideal for evaluation.

It may under certain circumstances be possible to evaluate test objects whose dimensions are in the light gray area (see Appendix A.2.2).

If both versions can be used for your test object, you should preferably use SIMATIC VS 110 for "small test objects". Your test object then appears larger in the sensor field of view and can be evaluated better.

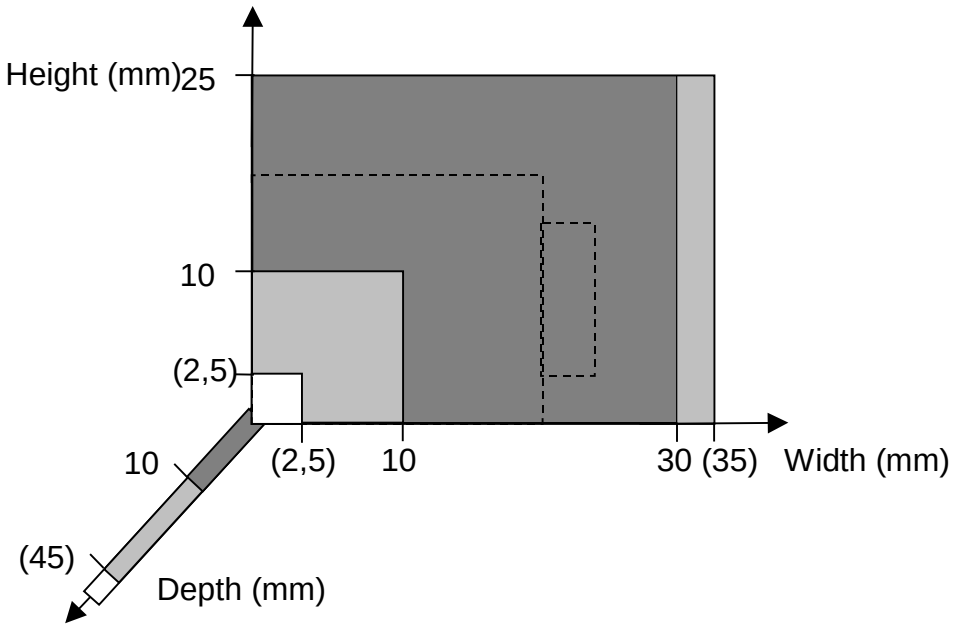
SIMATIC VS 110 for "large test objects"

(6GF1 011-1AA with sensor head 6GF2 002-8AA)



SIMATIC VS 110 for "small test objects"

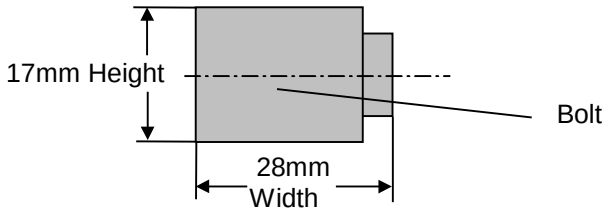
(6GF1 012-1AA with sensor head 6GF2 002-8BA)



In these figures, the bolt shown below is indicated by the broken line.

Using the sensor head for "large test objects", the bolt is an ideal object for evaluation. The width, height and depth are within the dark-gray area. (Depth and height are identical in this case since they are both the diameter of a round part.)

Using the sensor head for "small test objects", the bolt can only be evaluated if the test objects are transported with a certain precision and possibly at a lower conveyor speed because the depth is in the light-gray area.



Resolution

	SIMATIC VS 110 for "large test objects" (6GF1 011-1AA with sensor head 6GF2 002-8AA)	SIMATIC VS 110 for "small test objects" (6GF1 012-1AA with sensor head 6GF2 002-8BA)
CCD resolution	0.11 mm	0.06 mm
Operating threshold After the operating threshold, differences are detected.	0.45 mm	0.25 mm
Reliable test possible from: Here, a precise and reproducible parts feed and positioning is necessary. Ideally externally triggered and flat parts.	0.9 mm	0.5 mm
Typical test possible from: Typical test means that the parts are fed through under normal production conditions.	1.8 mm	1.0 mm

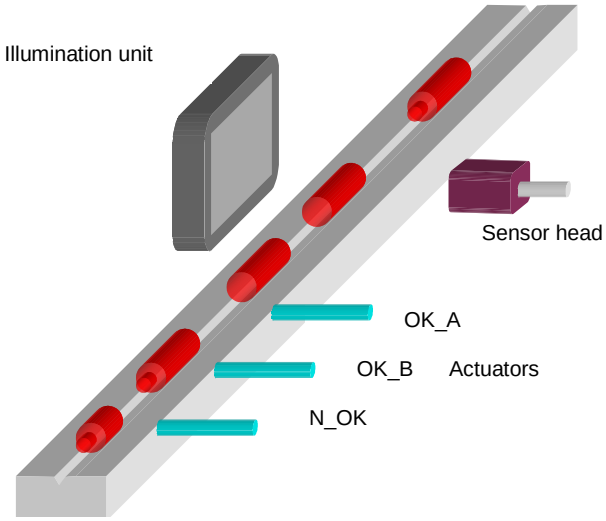
1.2 Components

The full Vision Sensor SIMATIC VS 110 consists of

- a **sensor head** with CCD sensor chip (CCD = Charge Coupled Device) for sensing the test object. The sensor head is light sensitive in the invisible near infrared range (NIR).
- an **evaluation unit** for processing the image information, to allow operator control of the sensor and for communication with other devices, such as SIMATIC controllers
- an infrared **illumination unit** (wavelength 880 nm) to create the shadow image of the test objects (backlighting)
- **cables** to connect the individual components
- **installation instructions** for installing and wiring the SIMATIC VS 110
- a **CD** with
  - the adjust software that runs under Windows (95, 98, ME, NT 4.0, 2000 or XP) allowing the picture recorded by SIMATIC VS 110 to be displayed on a PG/PC
  - this manual SIMATIC VS 110 (German and English)
  - Getting Started

You will find an overview of the complete range of components in Appendix A.1

1.3 Test Arrangement



- The test objects are transported past the sensor head by a suitable conveyor system (oscillating conveyor, linear conveyor, conveyor belt, tool holder circulation system, grab unit).
- A test object is captured by the sensor when it is located between the sensor head and the illumination unit.
- Using suitable devices and equipment (for example, a conveyor trough), you must make sure that the position and alignment of the test object is reproducible in each measurement.
- Before it can be tested, the test object must be entirely within the sensor field of view; touching the edge at the left, right, or top is not permitted. The test object may only touch or even extend beyond sensor field of view at the bottom of the sensor field.
- The image captured by the sensor is a shadow image (black object in front of a white background) of the test object.
- By training, the data of the model are stored in SIMATIC VS 110.
- In the evaluation mode, the data of the model and the current test object are compared.
- Digital output signals are set to indicate the result of this comparison. OK_A is set if the test object was recognized in View A, OK_B is set if if the test object was recognized in View B and N_OK is set if the test object was not recognized. These output signals can then control, for example, actuators that sort the test objects.
- At the evaluation unit, you can enter the position of the actuators, the speed of the conveyor, and the time for which the digital output signals are set.

Automatic / External Triggering

To train and evaluate successfully, you must make sure that the test object is captured completely in the sensor field of view and at a suitable position. You have two methods of triggering available:

- Automatic triggering

  If you use automatic triggering, images of the test object are recorded and evaluated continuously.

  You can only use automatic triggering when the test object is fed horizontally into the sensor field of view (for example, a conveyor belt) and when there are no other moving parts in the sensor field of view.

  SIMATIC VS 110 then checks automatically whether or not a test object is located in the sensor field of view and, if this is the case, starts evaluation.

  When using automatic triggering, you must not modify the conveyor system during or after training. The transport speed must remain constant.

- External Triggering

  In all other cases, you can run the evaluation with a suitable external trigger signal. With external triggers, the image is captured once when the trigger signal is generated.

  Generally, this produces higher accuracy than can be achieved with automatic triggering. In this case, you generate an exact trigger point, for example with a laser light barrier.

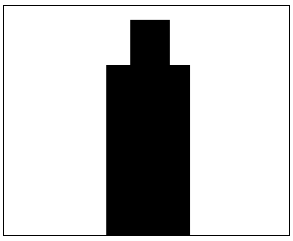
  You must make sure that there is only one test object in the sensor field of view at the trigger time.

  You will find an arrangement with an external trigger in Section 2.4

1.4 Important Conditions for Installation

The test objects may only touch the **lower** edge of the sensor field of view.(The **upper** edge of the sensor field of view is the side of the sensor head with the two labels.) As a result, some arrangements are permitted and others are not:

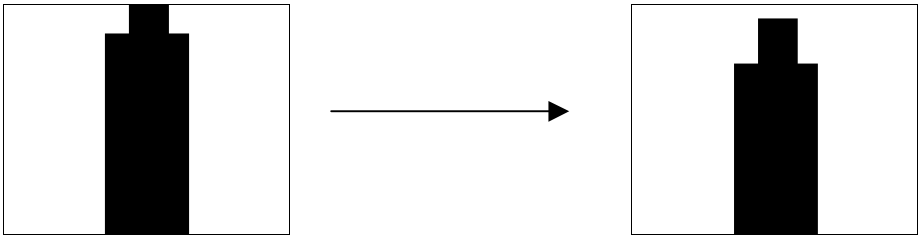
Permitted: The test object touches only the lower edge of the sensor field of view.



permitted

Not permitted: The test object touches the lower and upper edge of the sensor field of view.

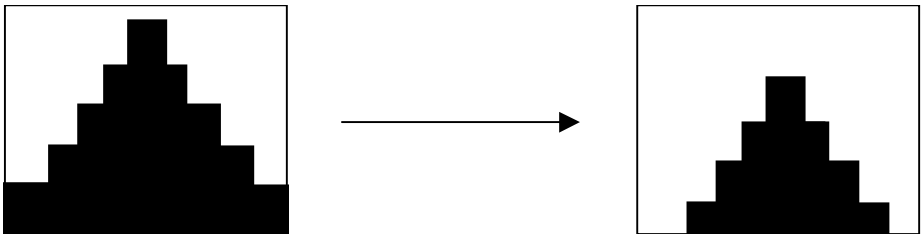
Remedy: You can adjust the sensor head upwards so that the top of the test object is fully visible within the field of view.



not permitted permitted

Not permitted: The test object touches the lower edge and sides of the sensor field of view.

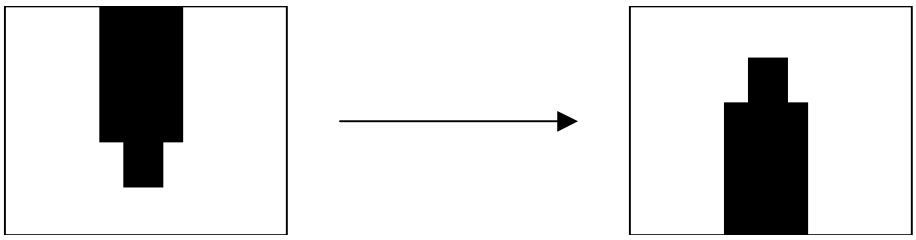
Remedy: You can adjust the sensor head upwards so that the part of the test object that is too wide is located below the sensor field of view.



not permitted permitted

Not permitted: The test object touches the top edge of the sensor field of view.

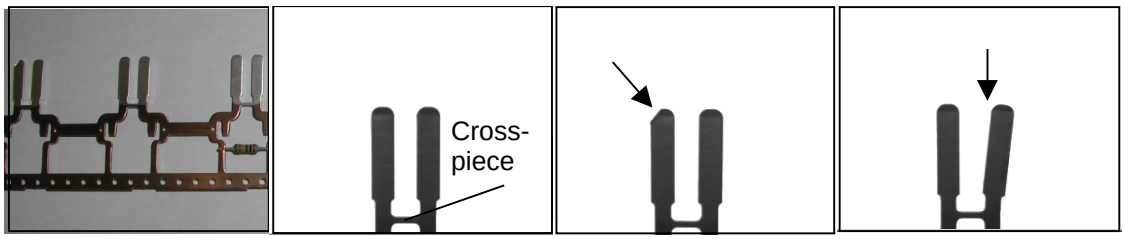
Remedy: You can rotate the sensor head through 180° so that from the point of view of the sensor head, the test object once again touches the bottom edge of the sensor field of view.



not permitted permitted

1.5 Applications

Example 1 : Contact Tabs, Distinguishing between Good and Bad Parts



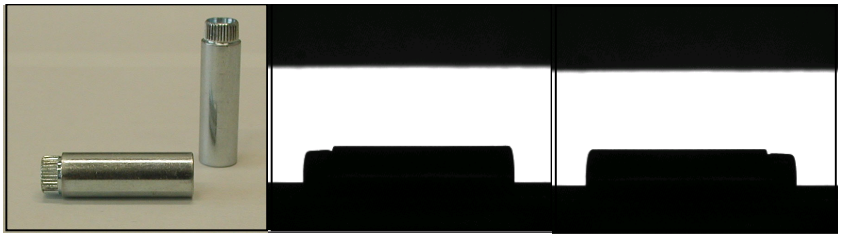
Good part Bad part Bad part

The bad parts can be rejected. For example, incomplete or bent parts are sorted out and diverted.

In this case, it is important that the crosspiece is within the sensor field of view, otherwise SIMATIC VS 110 would detect two parts.

Arrange the test object so that it only touches the bottom edge of the sensor field of view. In other words, with this type of endless strip, the material joining the contact tabs must be outside the field of view.

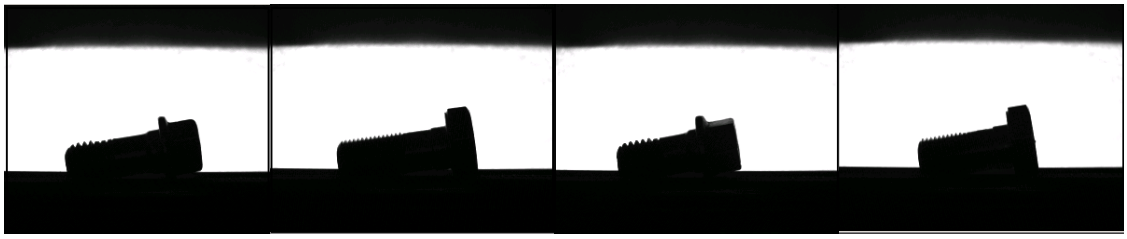
Example 2: Bolts, Distinguishing between View A and View B



Bolts in View A Bolts in View B

Bolts are fed to a machine for further processing only in View A. Bolts in View B are diverted.

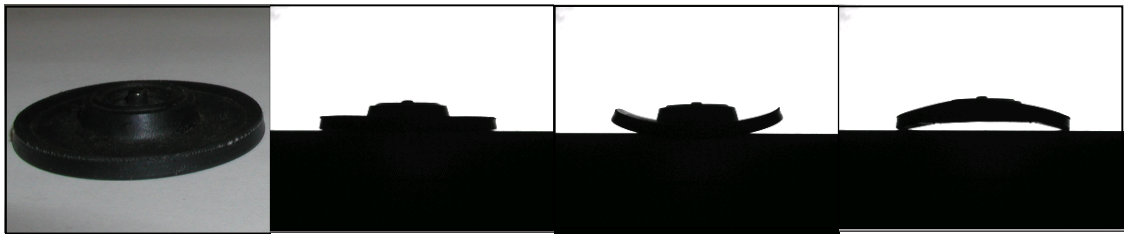
Example 3: Screws, Distinguishing Different Types of Screws



Type 3 Type 4 Type 6 Type 7

Type 6 was trained and is recognized as a good part, types 3, 4 and 7 are rejected.

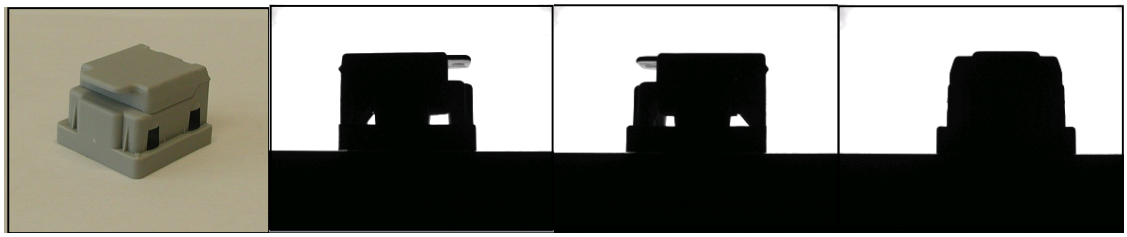
Example 4: Rubber Membranes, Distinguishing between Good and Bad Parts



Good part Bad part Bad part

Membranes lying flat are recognized as good parts. Misshapen parts are rejected.

Example 5: Sealing Cap (injection moulded), Position Test

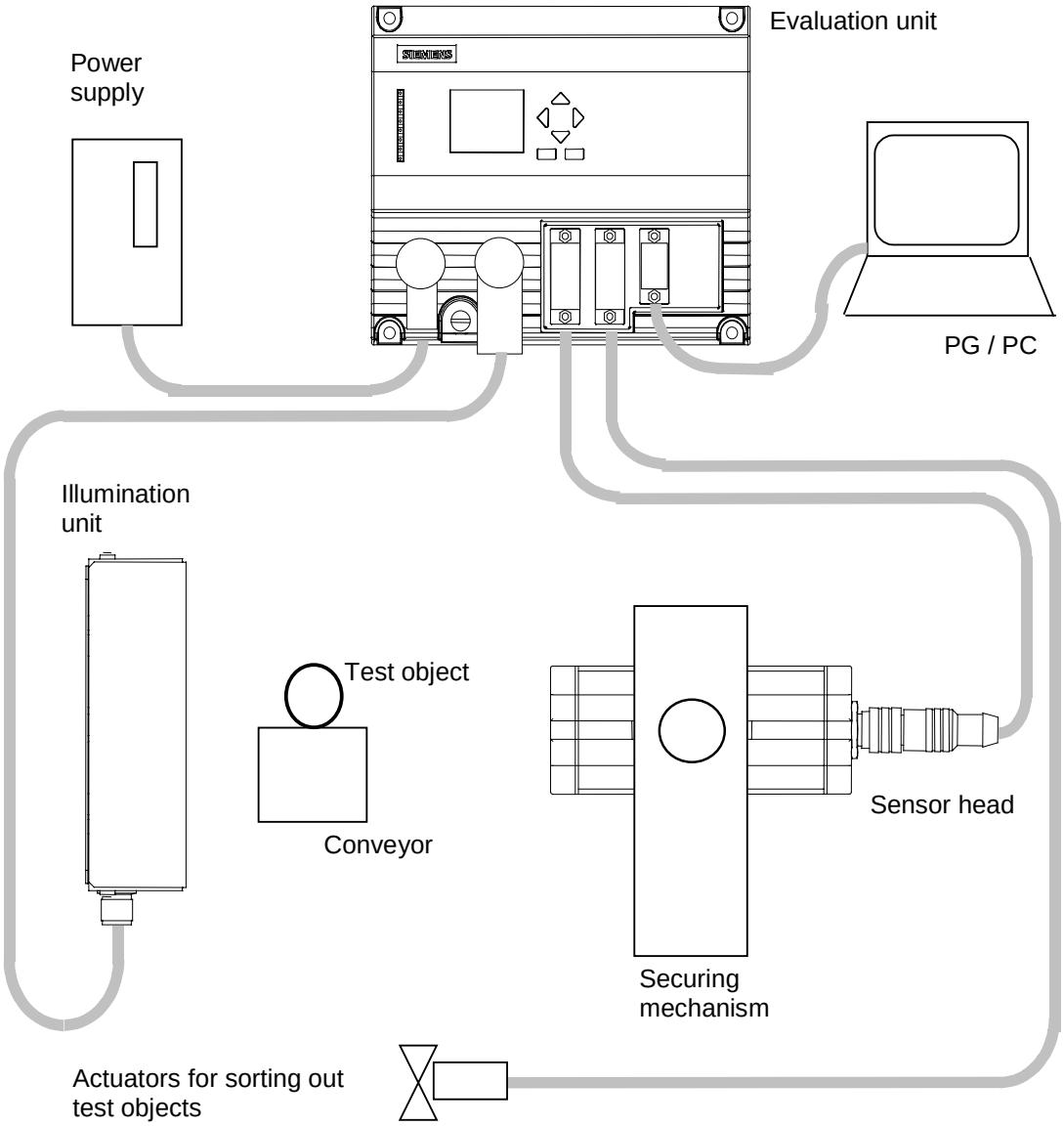


Correct position Wrong position Wrong position

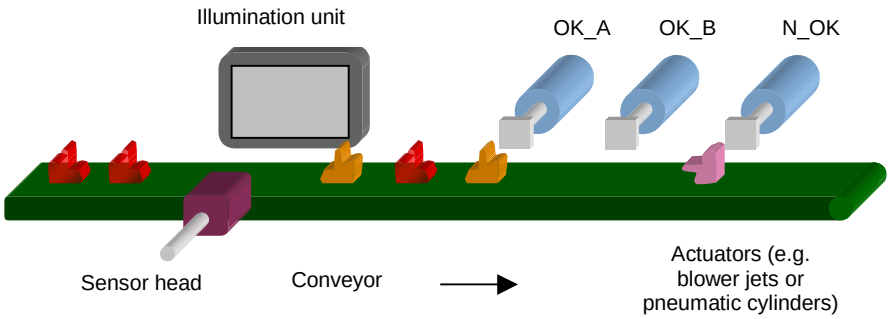
The correct position of the sealing cap is trained. In this position, it is fed, for example, to a grab for further processing. Caps in the wrong position or open caps are diverted.

2 System Integration

2.1 Configuration



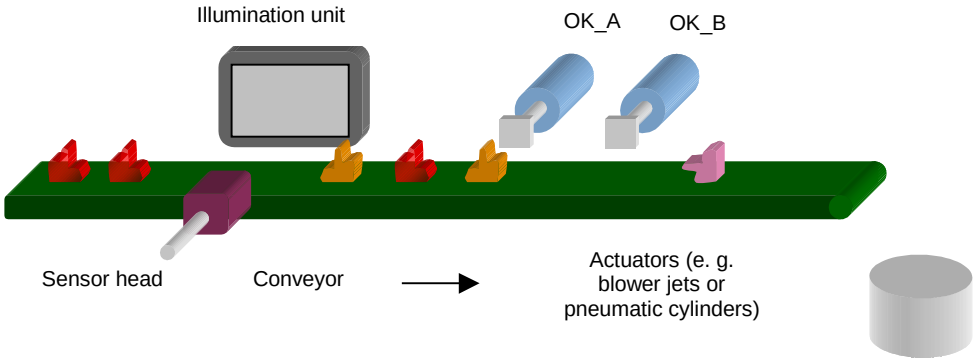
2.2 Conveyor Belt/Linear Conveyor



- The test objects are transported past the sensor head on a conveyor belt or by a linear conveyor.
- A test object is captured by the sensor when it is located between the sensor head and the illumination unit (backlighting). An external trigger signal is not necessary.
- The digital output signals OK_A, OK_B and N_OK are set depending on the result of the comparison. These can then be used, for example, to control actuators (blower jets, pneumatic cylinders) that divert the test objects. The actuators should be positioned at a distance of at least 75 mm to a maximum of 500 mm after the sensor head.

Suggested Arrangements

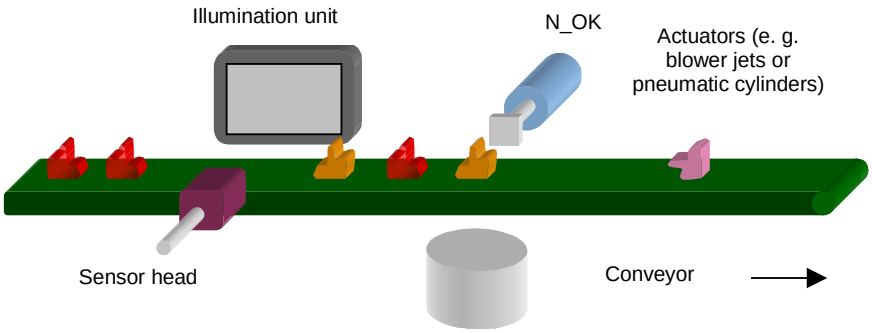
- **Reliable Arrangement:**
  - Only good parts in View A or B are fed to the process (actuators OK_A, OK_B).
  - All test objects that are not recognized are diverted at the end of the conveyor. The N_OK output signal is not wired up.



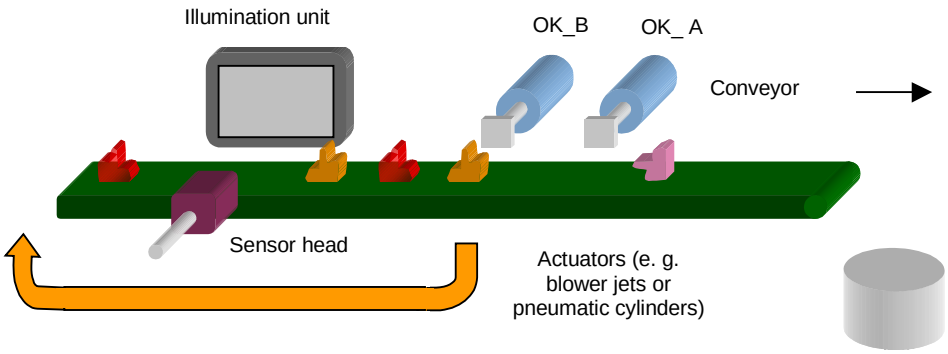
- **Simple Arrangement**
  - Bad parts are ejected (N_OK).
  - All good parts continue into the process at the end of the conveyor. The output signals OK_A and OK_B are not wired up.

Note

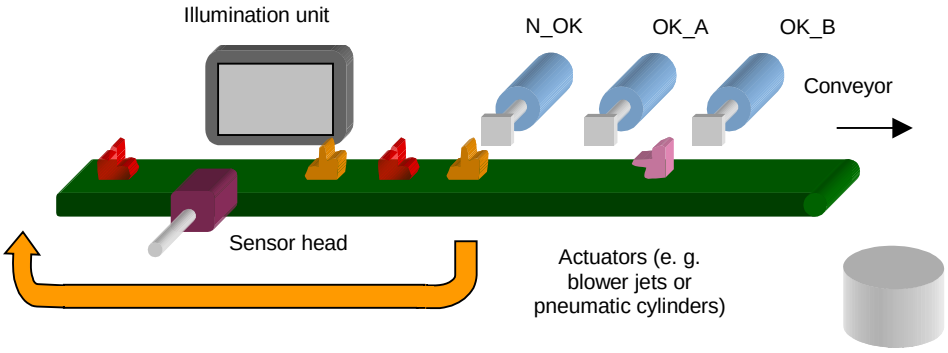
If, for example, due to variable speeds, the bad parts are not ejected, they will also be fed into the next part of the process!



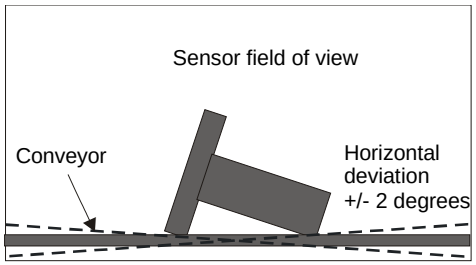
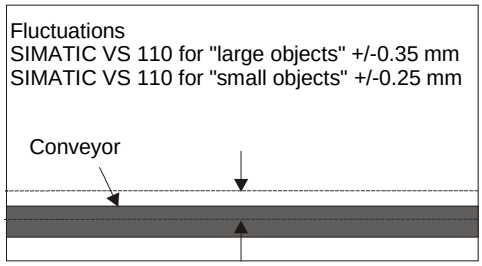
- **Checking the View**
  - Only good parts in View A are fed to the process (OK_A).
  - All test objects in View B are returned to the start of the conveyor (OK_B).
  - All test objects that are not recognized are diverted at the end of the conveyor. The N_OK output signal is not wired up.



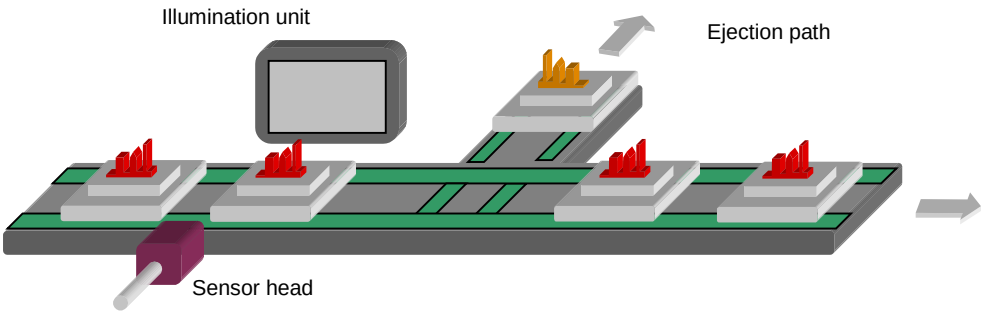
- **Sorting Type A, Type B**
  - With this arrangement, you can sort two "similar" test objects (type A, type B) at the same time (for example, two screws of different lengths)
  - Actuator OK_A for type A, actuator OK_B for type B
  - Actuator N_OK returns all unrecognized test objects back to the start of the conveyor belt. The unrecognized test objects could be other parts or test objects of type A or type B in the wrong view.
  - Test objects that were not ejected, for example due to variable speeds of the parts are collected at the end of the conveyor.



Installation Guide for Conveyor Belts / Linear Conveyors

Transport speed The test objects must be transported at a constant speed to allow the actuators to sort out the test objects at the correct position on the conveyor belt.	
Transport path • Straight transport path • Horizontal path from left to right or right to left. Maximum deviation ± 2° from the lower edge of the sensor field of view. • If the conveyor is visible in the sensor field of view, it must have a smooth edge running parallel to the transport path. The bright background within which the test object moves is located above the edge. • The test objects may only be in visible contact with this edge. If parts of the test objects are hidden by this edge, the part that is hidden must remain at the same height the entire time that the test object is moving through the sensor field of view.	
Fluctuations in the conveyor The sensor tolerates slight fluctuations perpendicular to the transport direction. If the evaluation needs to be highly accurate, precision belts with a milled flat surface are advisable. If there are larger fluctuations, a mask should be fitted so that the conveyor is hidden from the sensor head. The fluctuations of the test object in the vertical direction (tip to tip) are then permitted as specified in Appendix A.2.2 in the "Height" table. There are points provided on the illumination unit for fitting a mask. If the test for the permitted vertical deviation between model and test object is activated, the fluctuation of the conveyor must not exceed the "Y-Limit" limit value of the vertical deviation (see Section 5.1)	

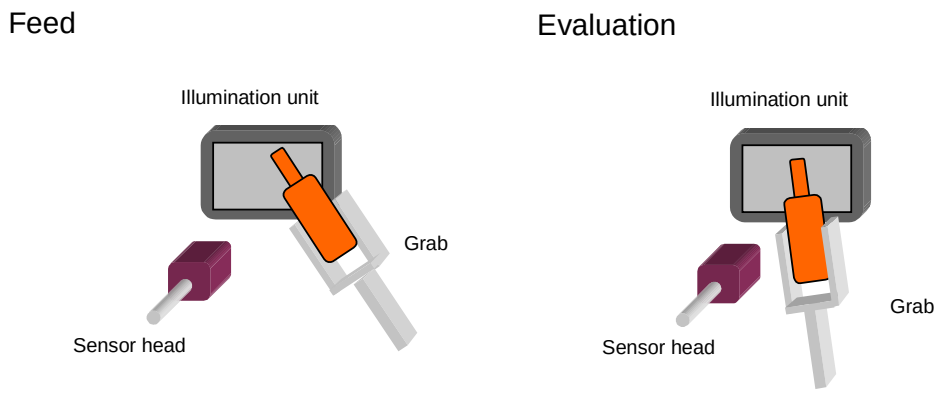
2.3 Tool Holder Circulation Systems



- A test object is captured by the sensor when it is located between the sensor head and the illumination unit (backlighting).
- The digital output signals OK_A, OK_B and N_OK are set depending on the result of the comparison. These control the ejector system that ejects the test objects.

If you use a tool holder circulation system, read the instructions under "Linear Conveyors / Conveyor Belt".

2.4 Grab Units



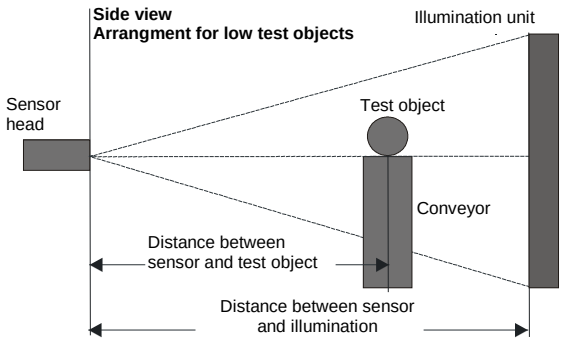
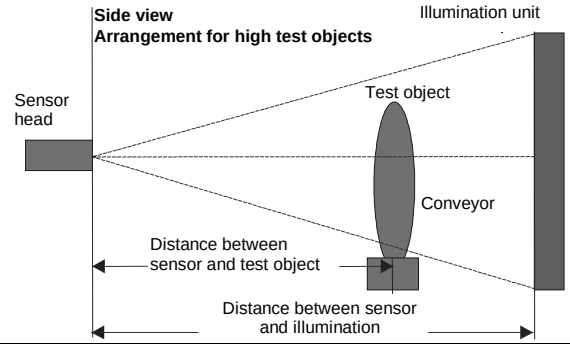
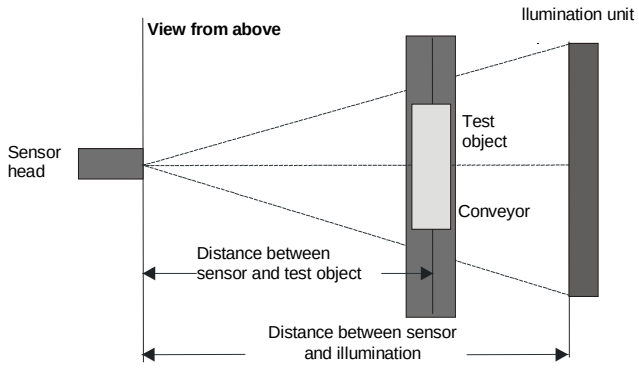
- The test object is guided between the sensor head and the illumination unit by a grab.
- As soon as the test object is in the correct position, an external trigger signal (for example a light barrier or controller) starts the training and/or detection.
- At this moment, the grab and test object may only extend beyond the lower border of the sensor field of view. If possible, the grab should not be visible in the sensor field of view.
- You must take whatever measures are necessary to make sure that the position and alignment of the test object can be reproduced with each measurement.
- Digital output signals are set to indicate the result of this comparison. These control the grab that sorts the test objects.

3 Installation

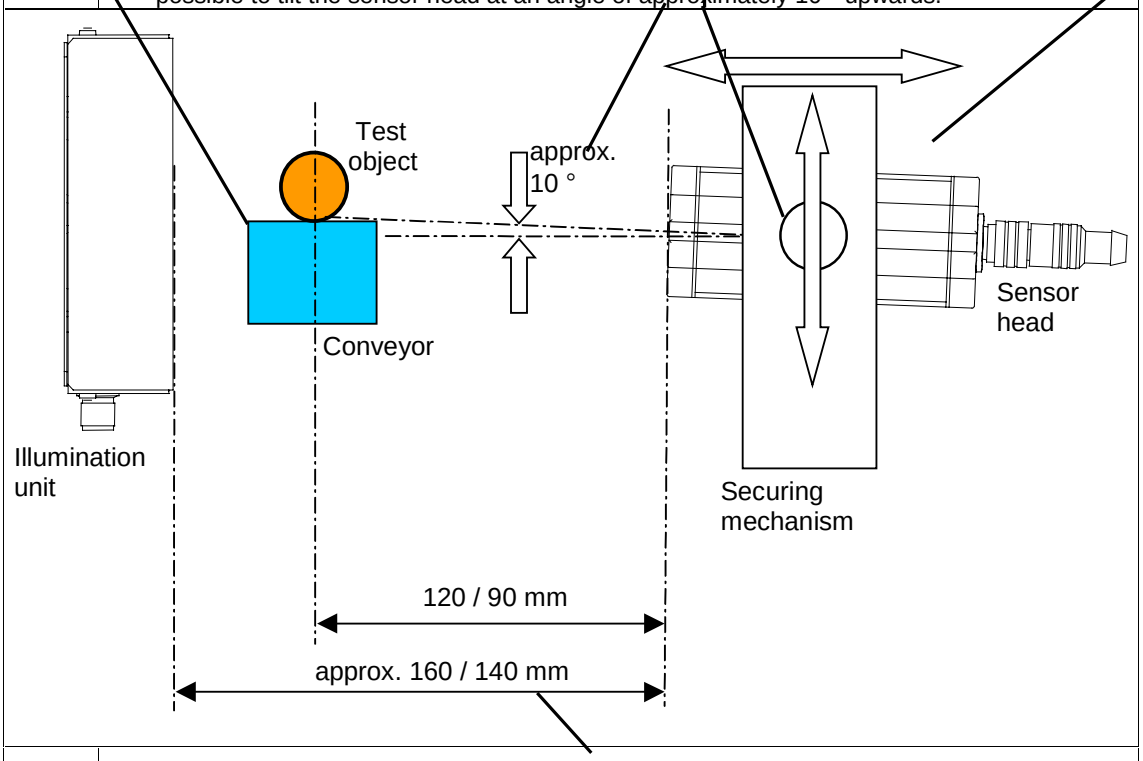
3.1 Installing Components

Basic Arrangement

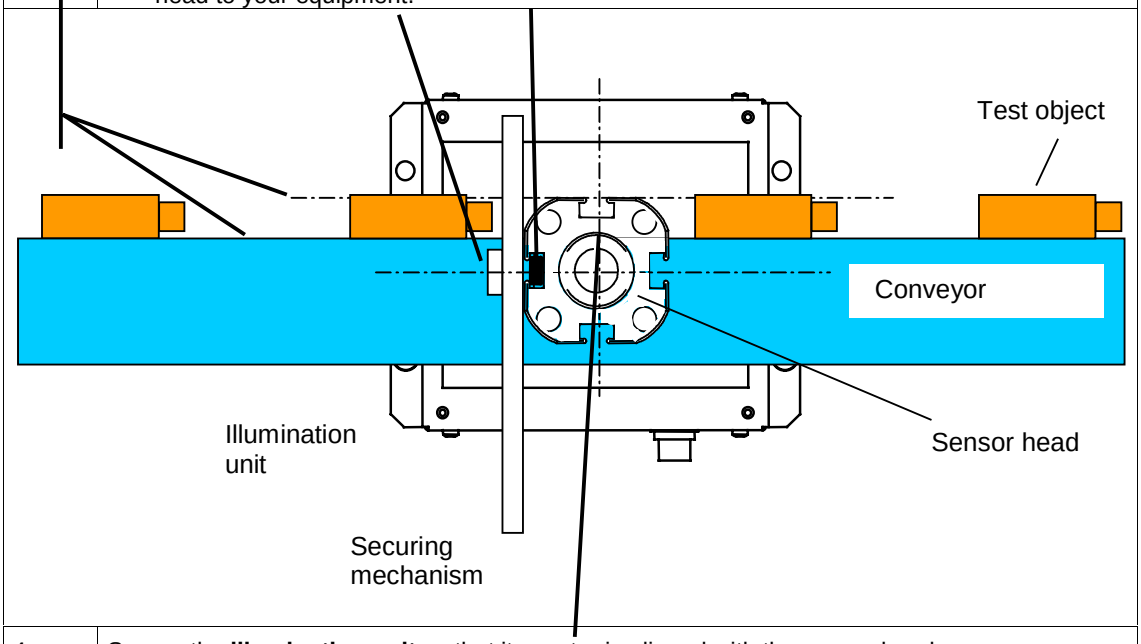
To achieve the ideal arrangement of the sensor head, test object, conveyor, and illumination unit, you have the two options below:

• **Arrangement for Low Test Objects** (Height < 20 mm with SIMATIC VS 110 for "large test objects" (6GF1 011-1AA with sensor head 6GF2 002-8AA) or height < 12 mm with SIMATIC VS 110 for "small test objects" (6GF1 012-1AA with sensor head 6GF2 002-8BA) By arranging the test object in the upper half of the illumination unit, you avoid light reflections on the test object and on the conveyor.	
• **Arrangement for High Test Objects** Arrange the individual components so that the conveyor is outside the sensor field of view. Make sure that the test object does not extend beyond the top border of the image!	
View from Above	

Steps in Installation

Step	Activity
1	• Refer to the information in Section 1.4 and the suggested arrangements in Section 3.1 • Align the **sensor head** so that its mid axis is at the same height as the upper edge of the conveyor. • Secure the head so that it is still possible to slightly readjust the distance to the test object and the height of the sensor head (for example,–5 mm / +20 mm). It should also be possible to tilt the sensor head at an angle of approximately 10° upwards.
	
2	• Make sure that you keep to the specified distances to the test object and to the illumination unit. The higher values apply to SIMATIC VS 110 for "large test objects" (6GF1 011-1AA with sensor head 6GF2 002-8AA). The lower values apply to SIMATIC VS 110 for "small test objects" (6GF1 012-1AA with sensor head 6GF2 002-8BA). Remember that the specified distance to the test object applies to the edges of the test object that create the shadow image. Example: ´With a round part such as shown above, the distance must be measured to the middle of the object whereas with a square object, the front edge of the object is relevant.

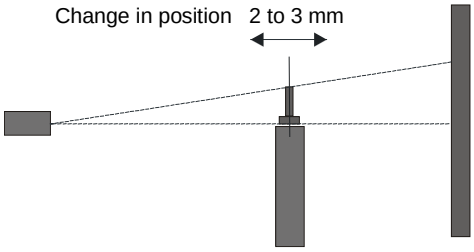
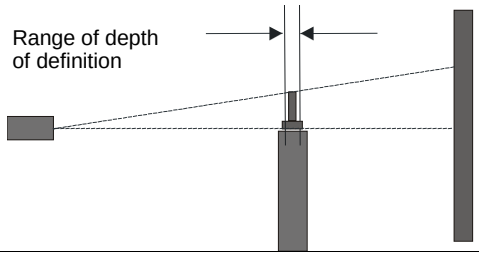
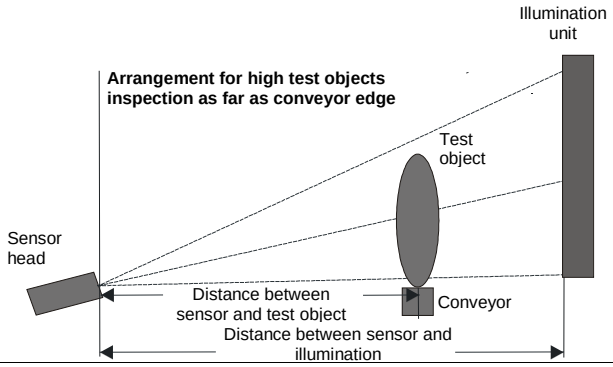
Step	Activity
3	• The upper edge of the sensor head must be parallel to the conveyor. • When installing horizontally, the side of the sensor head with the labeling must be at the top. Rule: The sensor head must always be installed so that the side with the glass window is opposite the illumination unit and the test objects move between them. • Insert the supplied mounting plate into the T-slot of the sensor head and secure the sensor head to your equipment.



4	Secure the **illumination unit** so that its center is aligned with the sensor head.
5	Install the **evaluation unit** so that it is easily accessible for the operator.
6	Install the **actuators** required for sorting the test objects. This might be, for example, a compressed-air operated ejector.
7	If you want to use an external trigger (see Section 1.3): **Install the external trigger.** You can, for example, use a light barrier.

For the fine adjustment of the sensor head, you have adjust software on your PG / PC. The adjust software shows you an image as seen by the sensor head (see Section 4.2).

Notes on Installation

Changes in size due to distance tolerance and tilting A change in position from test object to test object of 2 to 3 mm in depth is tolerated. Try to keep the distance from the test objects to the sensor as constant as possible (for example, with a guide rail or by using compressed air to position the test object against a fixed limit stop).	
Image sharpness of uneven test objects All the edges relevant for creating the shadow image should, when possible, be located within the depth of definition of the sensor. See Appendix A.2.2	
Arrangement for high test objects when inspection is necessary as far as the conveyor Arrange the sensor head at a slight angle to the test object so that the test object is located within the sensor field of view and the conveyor is not visible.	

3.2 Wiring Components

Connect the evaluation unit with the other components using the connectors on the front panel. The pinning of the connectors is described in Appendix A.4.

Caution!

Do not connect or disconnect cables when the power supply is on.

Warning

Risk of injury to persons and damage to equipment.

In hazardous areas (risk of explosion), injury to persons or damage to equipment can occur if you close or open an electrical circuit (for example, plugging in a connector, fuses, switches) while a SIMATIC VS 110 is operating.

Do not connect or disconnect any live circuits unless certain that an explosion is impossible.

If you install the VS 110 in Class I, Division 2, Group A, B, C, D or. Class I, Zone 2, Group IIC, you must either provide a suitable disconnector for this environment (for example a gas-tight switch) or install the disconnector in the safe zone.

Make sure that if you use the system under FM conditions, the connector to the I/O is screwed tight and that the hexagon nut on the connector to the power supply is securely tightened with a wrench. Make sure that both connectors can only be released using tools and not simply by hand.

Do not insert or remove the RS-232 cable in hazardous areas.

All other components must also be suitable for FM if you use them in a hazardous environment.

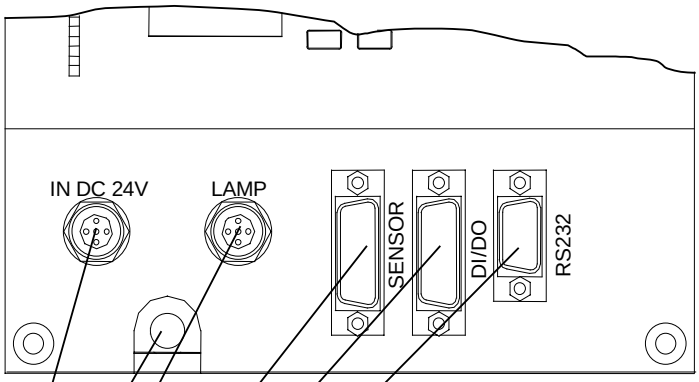
Warning

EXPLOSION HAZARD. DO NOT DISCONNECT EQUIPMENT UNLESS AREA IS KNOWN TO BE NONHAZARDOUS

Apart from the RS-232 cable (6ES7 901-1BF00-0XA0) all the cables are supplied (see Appendix A.1).

Warning

Grounding the VS 110 cancels the floating installation of the power supply.



Connector	Type	No. Pins x Cable Cross Section	M/F
Power supply	Circular M12	4 x 0.56 mm^2	Male
Functional ground	Screw connector	-	-
Illumination unit	Circular M12	4 x 0.23 mm^2	Female
Sensor head (shielded cable)	HD sub-D	26 x 0.09 mm^2	Female
I/O	Sub-D	15 x 0.14 mm^2	Female
RS-232	Sub-D	9	Male

* The supplied ferrite ring must be fixed to the sensor cable (approx. 50 mm from connector to evaluation unit).

Step	Activity
1	Read the guidelines on preventing electrical interference (see Section 3.3).
2	Connect the **evaluation unit** to the **sensor head** and the **illumination unit** with the cables.
3	Wire the **actuators** via the digital outputs OK_A, OK_B, and N_OK of the I/O connector.
4	If you are working with an external trigger, connect the **external trigger signal** via digital input TRG.
5	If you intend to control the SIMATIC VS 110 with a **PLC**, connect the other digital inputs and outputs as described in Section 6.1.
6	Connect **functional ground** of the evaluation unit to chassis ground (diameter of the ring: M5, cable cross section 1.5 mm^2).
7	Connect the evaluation unit to the 24 V **power supply** (2 A).
8	Connect the **PC / PG** via the RS-232 interface. The PC / PG is required only for setting up the sensor. Optional (not supplied with the package): RS-232 cable 5 m long, connectors prefitted at SIMATIC VS 110 end and controller / PC end (pinning, see Appendix A.4).

Caution!

The illumination unit of the SIMATIC VS 110 contains a light-emitting diode and is classified as a "CLASS 1 LED PRODUCT" in compliance with IEC 60825-1. To use the illumination unit correctly, read through this information thoroughly and keep it for reference. If you encounter problems with the illumination unit, inform your nearest "Authorized Siemens Agency". To avoid direct exposure to the light of the diode, it is not permitted to open the casing.

CLASS 1 LED PRODUCT

LICHT EMITTIERENDE DIODE KLASSE 1

TO EN 60825

Note

The **DC load power supply** must meet the following requirements:

Only low voltage less than or equal to 24 V DC safely isolated from the power supply network must be used for the load current supply. Safe isolation can be implemented, for example, by adhering to the specifications in

VDE 0100-410 / HD 384-4-41 S2 / IEC 60364-4-41

(as functional extra-low voltage with reliable isolation) or

VDE 0805 / EN 60950 / IEC 60950

(as safety extra-low voltage (SELV) or VDE 0106 Part 101).

Note

The supply chassis of the I/O must be connected to the supply chassis of the evaluation unit.

3.3 Guidelines on Preventing Electrical Interference

To avoid interference, you must shield your system. Low-frequency (LF) and high-frequency (HF) interference signals can result in an incorrect response if the system is badly grounded or not shielded.

Interference signals can be caused, for example, by switching relays or contactors (high rates of change in current or voltage, HF interference signals) or by different ground potentials between two parts of a system (LF interference signals).

Using/Laying Interference-Proof Cable

- The cable to the sensor head and the RS-232 cable must be shielded.

The standard cables supplied by Siemens meet these requirements.

- All plug-in connections must be secured by screws or a locking mechanism.
- Signal lines must not run parallel to power cables. A separate cable channel must be used with a minimum clearance of 50 cm from power cables.

Note

For more detailed information, refer to the installation manual *S7-300 Programmable Controller, Hardware and Installation in the section on "Wiring"*.

4 Putting into Operation

You can operate the Vision Sensor SIMATIC VS 110 interactively or controlled by signals:

- In this chapter, you will learn about interactive operation using the operator control and display field of the evaluation unit.
- Chapter 6 explains the options open to you with signal-controlled operation.

4.1 Turning on the Device

Turn on the power on the evaluation unit. The text "SIMATIC VS 110 V ..." and the current firmware version appear on the display.

SIMATIC VS 110 first tests the sensor head and the illumination. You should therefore feed any test objects through in the start-up phase. If a test fails, this is indicated by the following:

- The SF LED is lit
- The "In Operation" (IN_OP) output signal is set to 0 (see Section 6.1)
- The error message "SELF TEST Camera not found" or "SELF TEST No Light Check Lamp" or "SELFTEST Low Light Check Lamp" error message appears on the display (see Chapter 7).

You can exit this state with the OK button or with the RES input signal (see Section 6.1).

The illumination operates with invisible light in the infrared range. The illumination is on when the control lamp in the middle of the illumination panel lights up briefly.

After testing the sensor head and the illumination, the saved settings and model data are checked. If the data are invalid, either the error message "Settings not found" or "Model corrupt" appears (see Chapter 7). After confirming this error message, the "Settings" or the "STOP" menu is displayed. The menus are described in Chapter 5

"Settings" menu:

```
> Trigger
  Output
  Y-limit
  ESC ↓     OK
```

"STOP" menu level:

```
> Train
  RUN
  Delete
      ↓     OK
```

If there are no errors in the self test, either the RUN menu or the STOP menu is displayed depending on the status when you last shut down.

"RUN" menu:

```
> M 01   RUN
  Q=
  Δy=
      OK:Menu
```

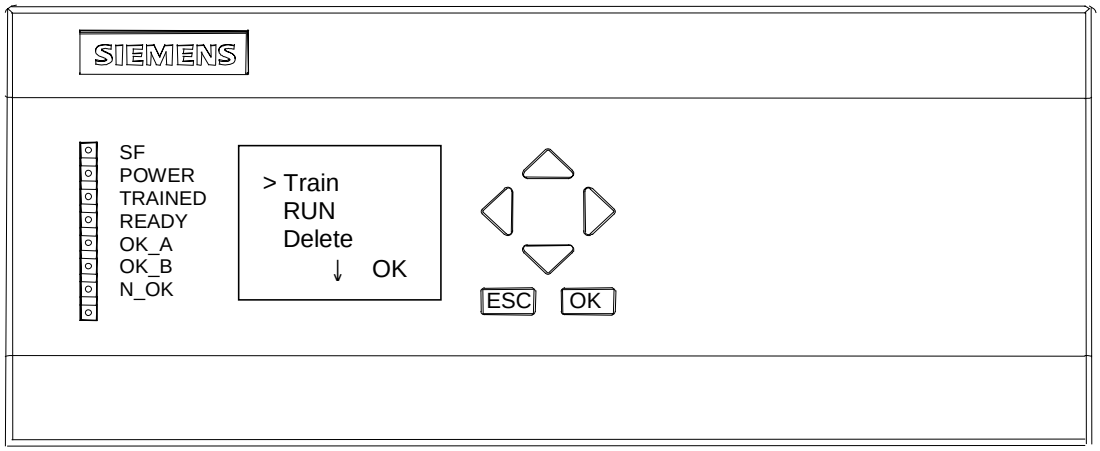
"STOP" menu level:

```
> Train
  RUN
  Delete
      ↓    OK
```

4.1.1 Control and Display Panel

The operator is guided by menus in the display panel.

- The menu items appear in the first three lines of the display panel. The cursor **>** points to the selected menu item.



- In the fourth line of the display panel, you can see which buttons of the control panel are currently available (**OK**, **ESC**, ▲, ▼, ◀, ▶). Using the buttons of the control panel, you can navigate within menus and from one menu to another:
  - With the arrow buttons ▲ and ▼ , you can move the cursor up and down and select the menu command you require.
  - With **OK**, you confirm your selection and move on to the next step.
  - With **ESC**, you return to the previous menu

Description of the LEDs

LED	Function
SF	Group error
POWER	Power supply turned on
TRAINED	Trained: 1 = selected model has been trained 1 = acknowledgment signals during training (RDY=0) 0 = selected model has not been trained 0 = training active
READY	Ready: 1 = SIMATIC VS 110 in the run mode 0 = device starting up 0 = SIMATIC VS 110 in the stop mode
OK_A	Result of evaluation: Test object recognized in View A. The LED is lit when the corresponding output signal changes.
OK _B	Result of evaluation: Test object recognized in View B. The LED is lit when the corresponding output signal changes.
N_OK	In the "RUN" (evaluation) mode: Result of evaluation "Not OK" In the "STOP" mode: set to 0 If group error occurs or during training • **External trigger:** The N_OK digital output is set to "1" for the duration of the set pulse time. • **Automatic trigger:** The N_OK digital output is always set to "1" and is permanently active.

Setting Numeric Values

You select the places of a value with the arrow buttons ◀ and ▶.

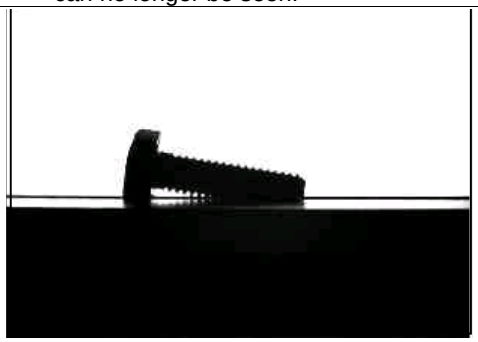
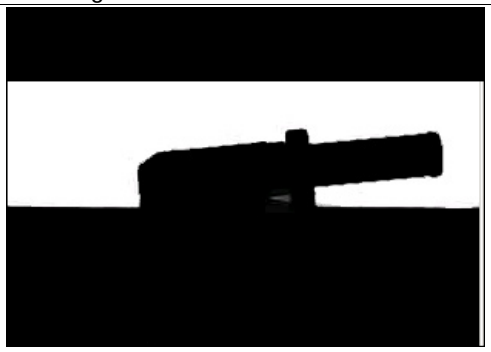
You change the value of a place in the number with the arrow buttons ▲ and ▼.

The speed at which the numeric value changes depends on how long you press the arrow buttons. As soon as you release the arrow buttons, the rate of change returns to the slowest level again.

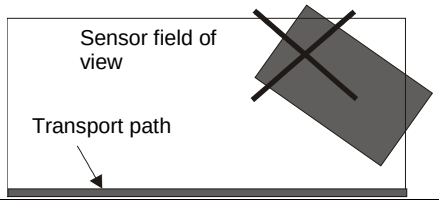
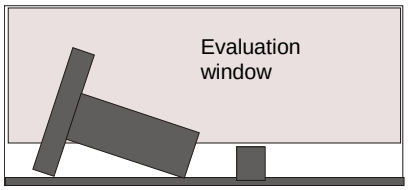
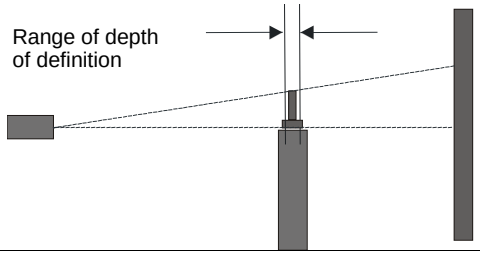
4.2 Adjusting the Sensor with the Adjust Software

Before you start to work with the SIMATIC VS 110, you must first align the sensor head correctly using the adjust software on a PG / PC. The adjust software shows you an image as seen by the sensor head. For more detailed information on the adjust software, refer to Appendix A.7.

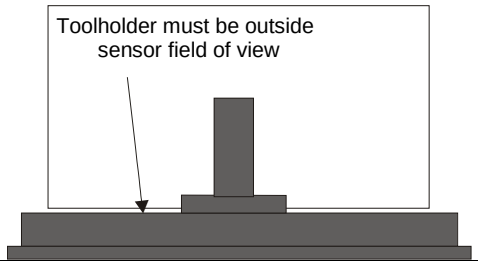
Step	Activity	Result:
1	**Starting the adjust software on the PC / PG** • Turn on the PG /PC and wait until the computer has booted. • Turn on the evaluation unit. • Connect the two devices over a serial cable. • Insert the CD with the adjust software "ADJUST-SW". The program starts automatically. • If the program does not start automatically, you can start it manually by selecting the CD drive and double-clicking on ADJUST-SW. • Turn the evaluation unit to STOP.	Once the adjust software has started, the sensor field of view is displayed on the PC/PG monitor. The displayed image is updated several times per second.
2	**Adjusting the Sensor** • Set the distance between the sensor and test object: 120 mm for SIMATIC VS 110 for "large test objects" (6GF1 011-1AA with sensor head 6GF2 002-8AA) and 90 mm for SIMATIC VS 110 for "small test objects" (6GF1 012-1AA with sensor head 6GF2 002-8BA) . • Align the sensor so that the conveyor is parallel with the lower edge of the image. The adjust software supports you by displaying markers at the edge of the image. • Make sure that there is a light background above the conveyor. SIMATIC VS 110 creates a rectangular evaluation zone in this light background and the model test object must pass through this later. This area must not change significantly during evaluation. The evaluation zone must be at least 1/4 of the image height and 2/7 of the image width. The type of conveyor (for example, tool holder) can have a considerable influence on the size of the evaluation area. • Turn off the conveyor. • Position the test object in the middle of the field of view of the sensor. • Adjust the sensor until a sharp shadow image of the test object is obtained in the middle of the sensor field of view. • Make sure that both the widest and highest test object fits in the sensor field of view. The test object must be completely within the sensor field of view; touching the edge of the field view to the left, right, or top is not permitted (minimum distance to the edge for the SIMATIC VS 110 for "large test objects" approximately 4 mm and for the SIMATIC VS 110 for "small test objects" approx. 2 mm). The test object may only touch or even extend beyond sensor field of view at the bottom of the sensor field. • If the size of the test object is less than 1.8 mm (SIMATIC VS 110 for "large test objects" 6GF1 011-1AA with sensor head 6GF2 002-8AA) or 1.0 mm (SIMATIC VS 110 for "small test objects" 6GF1 012-1AA with sensor head 6GF2 002-8BA), details can no longer be detected with certainty. These values correspond to the resolution of the sensor head (see Appendix A.2.1). As a result, it is possible that test objects with narrow vertical bridges can be detected as objects with different lengths.	

Step	Activity	Result:
3	• Adjust the vertical alignment and angle of the sensor head until the surface of the conveyor can no longer be seen.	
	 Image: The upper line visible in the image is the back edge of the conveyor.	 Image: The surface of the conveyor can no longer be seen in the image.
4	• Make sure that there are no light reflections on the test object or conveyor. - Reflections are seen by the sensor head as light areas and the test object is interpreted as a bad part. - Reflections make the test object smaller for the sensor head and as a result they are evaluated less precisely. **Reflections on the test object caused by external sources** External light that includes an infrared component (sunlight, bulbs, halogen lamps) can cause reflections that can affect the evaluation detrimentally. Fluorescent lamps do not cause problems. Block out external light so that no light can fall on the test object or the conveyor. Remember that light conditions can change (the direction of sunlight at different times of day, turning on the ceiling lighting). The worst problems arise from reflections on the conveyor that were not present when the test object was trained and from shiny surfaces of the test object. **Reflections on the test object caused by the illumination unit** Light coming from the side can cause reflections. Mask the illumination unit so that only the sensor field of view is illuminated. Remember the minimum dimensions of the evaluation zone as explained in Step 2. There are points provided on the illumination unit for fitting a mask.	
	 Light reflected on the test object	 Correct view
5	• Secure the sensor Check that the sensor is in the correct sensor position	

Remember the following points when adjusting the sensor:

Parts in the evaluation window Make sure that there are no moveable parts other than the test object in the sensor field of view.	
Parts of the conveyor / tool holder jutting into the image There should not be any parts of the conveyor or tool holder that jut into the image. These reduce the evaluation window to such an extent that the lower part of the test object is located outside the evaluation window and can no longer be evaluated.	
Image sharpness of uneven test objects All the edges relevant for creating the shadow image should, when possible, be located within the depth of definition of the sensor. See Appendix A.2.2	
Dirt on the lens and illumination panel If the number of errors rises significantly, clean the lens and illumination panel with a lint-free cloth.	

If you use a tool holder circulation system, please remember the following points:

Tool holder The distinguishing characteristics of the test object must be visible. The tool holder must be outside the sensor field of view. If this is not possible, you can hide the tool holder with a mask on the illumination panel.	

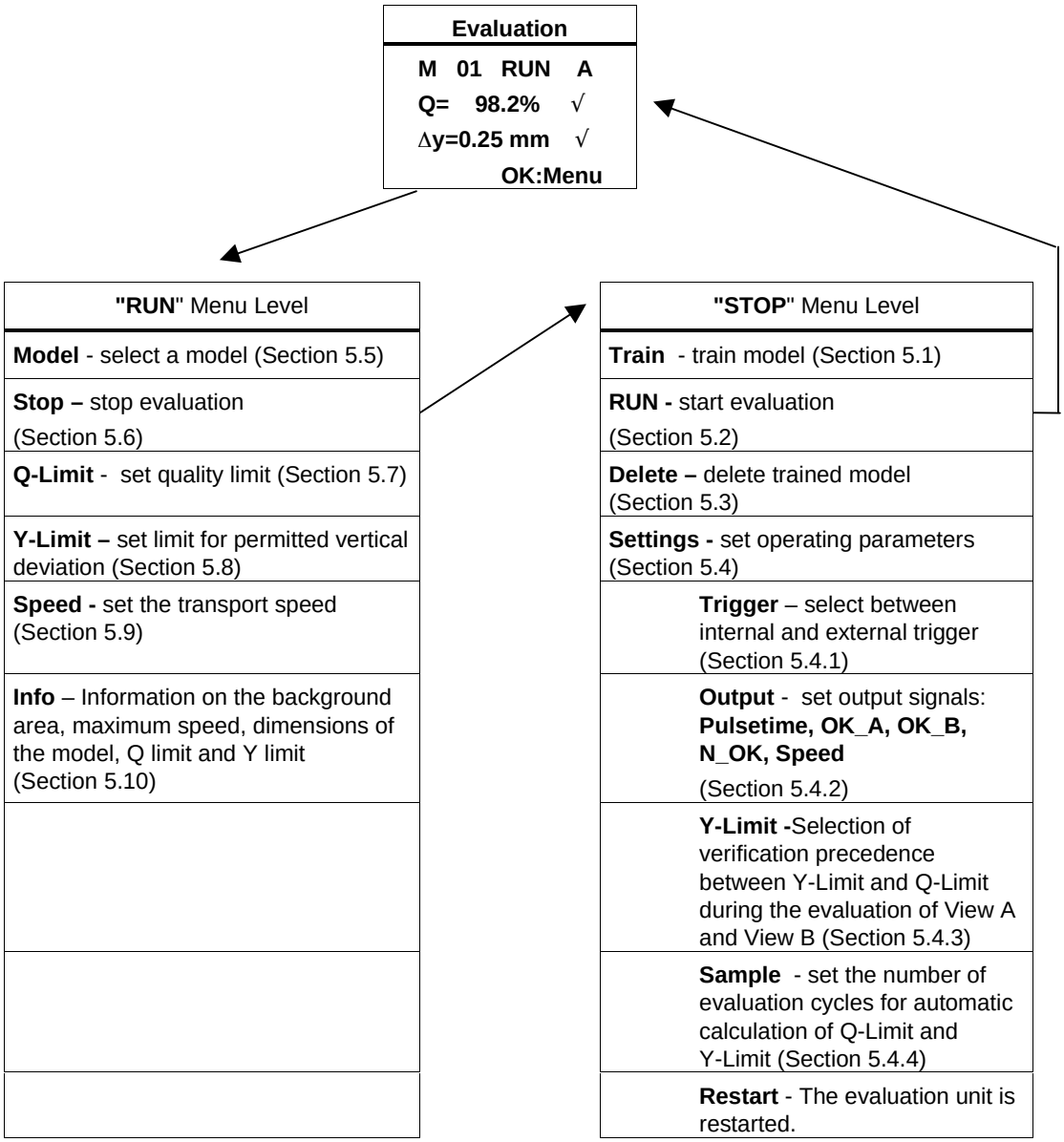
Please note the instructions on installing the components in Section 3.1

5 Functions for the Operator

This chapter describes how to work with the evaluation unit. You do not require a PG or PC.

Overview Menu

The following menus are available on the display of the evaluation unit:



5.1 Train: Train Model

SIMATIC VS 110 trains a model and then compares the test objects passing through the sensor field of view on the conveyor with the model.

Training involves the following steps:

Train Background
Train View A: Train model in View A
Train View B: Train model in View B
Train Limits: Train model, calculate Q-Limit (quality limit) and Y-Limit (limit for permitted vertical deviation) automatically

Note

SIMATIC VS 110 is designed so that the entire training can take place during operation while parts are being transported. **During every phase of training, only "good" parts must be allowed through the sensor field of view.**

You can train up to 15 different models. During the evaluation, however, the test objects can only ever be compared with one model. Each model can be trained in View A and View B (optional).

Response of Digital Output N_OK

With an **external trigger:** The N_OK digital output is set to "1" for the duration of the set pulse time.

With an **automatic trigger:** The N_OK digital output is always set to "1" and is permanently active.

Caution!

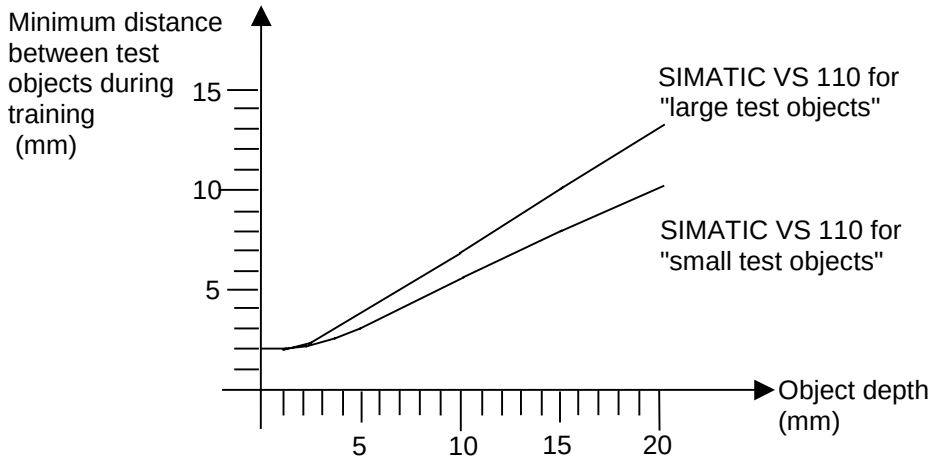
From the start to end of training, digital output N_OK is active to ensure reliable ejection of untested parts.

Depending on the particular implementation, this means that, for example a mechanical pusher or pneumatic cylinder is triggered and there may be risk of injury.

Minimum Spacing during Training

When using **an external trigger**, there must never be more than one test object in the sensor field of view at the trigger time.

When using an **automatic trigger**, several test objects can be visible in the sensor field of view at the same time. The following minimum spacing must be maintained between the test objects:



If training in this way is not possible, feed the models through one at a time.

Selecting the "Train" Menu Sequence

Step	Display	Activity
1	**M 01 RUN A** **Q= 98.2% √** **Δy=0.25 mm √** **OK:Menu**	If you are already evaluating test objects, you are in the evaluation mode (RUN). To change to the "RUN" menu level, press the **OK** button
1	**Model** **> Stop** **Q-Limit** **↓ OK**	Select STOP with ▼ and ▲ and then press the **OK** button
2	**> Train** **RUN** **Delete** **↓ OK**	You are now at the "Stop" menu level. Select Train with ▼ and ▲ and then press the **OK** button
3	**Train** **Model: 01** **(new)** **ESC ←↕→ OK**	Select Model 1 with ▼ and ▲ and press the **OK** button **New** indicates that you have not yet trained a model with this number. **Overwrite** indicates that the previously trained model with this number will be overwritten when you run the training function again.

Train Background

SIMATIC VS 110 detects the parts of the image that do not change and therefore belong to the background of the image.

Here, it is important that there are test objects moving through the sensor field of view.

SIMATIC VS 110 creates a rectangular evaluation zone in the light background and the model must pass through this later. This area must not change significantly during evaluation. The evaluation zone must be at least 1/4 of the image height and 2/7 of the image width.

The type of conveyor (for example, tool holder) can have a considerable influence on the size of the evaluation area.

Step	Display	Activity
1	**Model 01** **Train** **Background** **ESC OK**	Press the **OK** button to train the background.
2	**Model 01** **Background** **Training . .** **ESC**	**Convey test objects through the field of view** Remember to keep to the minimum spacing between test objects. (If there is not enough movement detected in the sensor field of view, you will be prompted to transport test objects: "Please move objects"

The following situations can lead to difficulties when training the background:

- A test object with considerable detail is transported very slowly through the sensor field of view
- The test object as a very small total area
- There was not enough space between the test objects or the conveyor speed was too high

Remedy:

- Check whether the test subject requires less than 5 seconds to pass through the sensor field of view. The start time is the moment the object enters the sensor field of view.
- Increase the minimum spacing between the test objects. If necessary, feed the test objects through individually.

If this is not possible in your configuration, you can train the background without test objects by passing other objects that meet the requirements above through the sensor field of view manually.

Train View A: Train Model in View A

By training a model, you provide the evaluation unit with information on the appearance of the test objects.

SIMATIC VS 110 detects the moving part, records the data from the part and saves this data as model values.

You can train parts in two different views. For a screw, for example,

- you can train in View A when the screw head appears first in the sensor field of view and
- you can train in View B when the screw head appears last in the sensor field of view

Step	Display	Activity
1	**Model 01** **Background** **Done** **ESC OK**	Press the **OK** button to train View A. (With **ESC**, you can repeat training the background. The background you have just trained is discarded.)
2	**Model 01** **View A** **Train?** **ESC OK**	To start training in View A, press the **OK** button
3	**Model 01** **View A** **Training . .** **ESC**	**Feed in** an undamaged model aligned in View A. Remember to keep to the minimum spacing between test objects.
4	**Model 01** **View A** **Done.** **ESC OK**	Press the **OK** button (With **ESC**, you can repeat the training for View A. The model you have just trained is discarded.)

Train View B: Train model in View B

You can either train the model in View B or use a different model. This allows you to sort out to model test objects at the same time. The model test objects must only have similar widths when using automatic triggering. With an external trigger, View A and View B can be completely different.

Step	Display	Activity
1	**Model 01** **View B** **Train?** **ESC:No OK**	The sequence of activities is the same as when training in View A. (If you do not want to train the model in View B, press the **ESC** button)

Train Limits: Train Model, Calculate Q-Limit (quality limit) and Y-Limit (limit for permitted vertical deviation) Automatically

Note

To calculate the Q limit and Y limit, feed only good parts through.

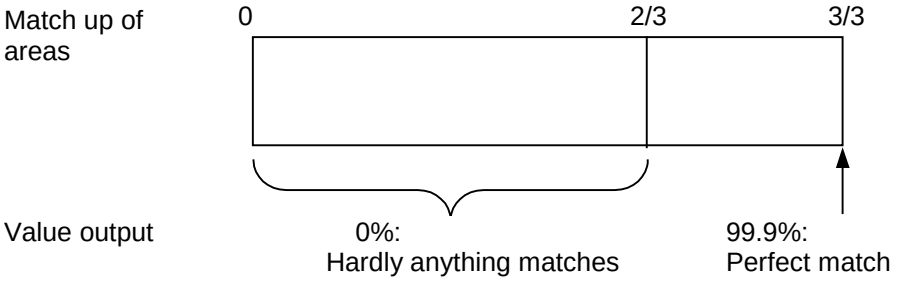
Q-Limit

The quality limit specifies the degree to which the test object must match the trained model. All test objects with a quality higher than the quality limit are accepted as good parts.

SIMATIC VS 110 calculates the quality limit automatically:

- To do this, a certain number of model test objects the pass through the sensor field of view are evaluated. You specify the number of evaluations with the **Sample** parameter (default 10) under **Settings**.
- The data are then compared with the data of the model and the degree to which the shapes of the model and the test object match up is evaluated (quality).

  The range of values is between 0% (very little matches up) and 99.9% (perfect match). All test objects whose area matches the pattern to a degree calculated as less than two thirds (2/3), are given a value of 0%. All test objects whose area match is better than two thirds are given a value between 0% and 99.9%. To achieve the score, the remaining third is divided into 100 equal parts.



- The quality limit is set by SIMATIC VS 110 on completion of the training and is lower than the lowest detected quality value. In other words, all parts fed through during the calculation of the quality limit will also be detected as good parts during subsequent evaluation.

If the models have large differences, it is advisable to increase the value of "Sample" (> 50 parts) so that you can cover the range of fluctuation reliably. As an alternative, select models representing the greatest and smallest dimensions and train these. You can then work with lower values for "Sample".

After automatically calculating the quality limit, you can, if necessary, change the value manually. If, for example, you want to reject parts with slight deviations that would otherwise be accepted at the automatically calculated limit, you would increase the value set for the limit.

Y-Limit

The Y-Limit parameter specifies the threshold value for the permitted vertical deviation between the model and test object. Y-Limit is calculated using the same procedure as for the quality limit. The range of values is between 0 and 9.99 mm. During training, the threshold value for the permitted vertical deviation is calculated automatically. Test objects with a greater deviation are detected as bad parts (N_OK). This deviation must be within the values specified as vertical fluctuation of the test object in the "Height" table in Appendix A.2.2. You can choose between the two following options:

1. The evaluation of Q-Limit has precedence over the evaluation of Y-Limit (both evaluations are active).

   Select this method of verification if View A and View B have different quality values. Using the "Settings" menu command, set the Y-Limit parameter to "Disabled".

2. The evaluation of Y-Limit has precedence over the evaluation of Q-Limit (both evaluations are active).

   Select this verification method if View A and View B only have different heights and not different quality values. Using the "Settings" menu command, set the Y-Limit parameter to "Enabled".

Step	Display	Activity
1	**Model 01** **Train** **Limits?** **ESC OK**	Press the **OK** button to start automatic calculation of the Q limit and Y limit.
2	**Model 01** **Training ...** **A: 1 of 10** **ESC**	**Feed test objects through** (here, at least 10). Remember to keep to the spacing between test objects. View A or B along with the number of evaluated test objects is displayed. With each evaluation, the counter is incremented by 1. When the counter reaches 10, the quality limit is calculated automatically and displayed.
3	**Model 01** **Q-Limit** **= 99.2%** **ESC OK**	Accept the automatically calculated quality limit with the **OK** button. (If you press **ESC**, you change to manual input of the quality of the range of values of 0 to 99.9%)
4	**Model 01** **Y-Limit** **=0.76 mm** **ESC OK**	The automatically calculated threshold value for the permitted vertical deviation is displayed here. Accept the value with the **OK** button. (If you press **ESC**, you change to manual input with a possible range of values from 0 to 99.9 mm)
5	**Model 01** **Train done** **Run?** **ESC OK**	Start the evaluation mode with the **OK** button.

5.2 RUN: Start Evaluation

In the "RUN" mode, SIMATIC VS 110 calculates the quality for each test object and compares this with the quality limit "Q-Limit". The quality is a value between 0% and 99.9%.

Vertical deviation Δy of each test object is calculated in addition. Δy can have values between 0 and 9.99 mm.

- If the quality is higher than Q-Limit and the vertical deviation is below Y-Limit, the part is detected as a **good part**. In other words, it is "identical" to the trained model. The OK_A or OK_B LED is lit and the corresponding output OK_A or OK_B is set.
- If the quality is lower than Q-Limit or the vertical deviation is above Y-Limit, the part is detected as a **bad part**. The N_OK LED is lit and the N_OK output is set.

The display shows the calculated quality **Q** and the vertical deviation **Δy** (if enabled) for each test object.

- **A** or **B** indicates that the test object was recognized as a good part in View A or B. **N** indicates that the test object was not recognized.
- The √ symbol indicates which value was kept to.

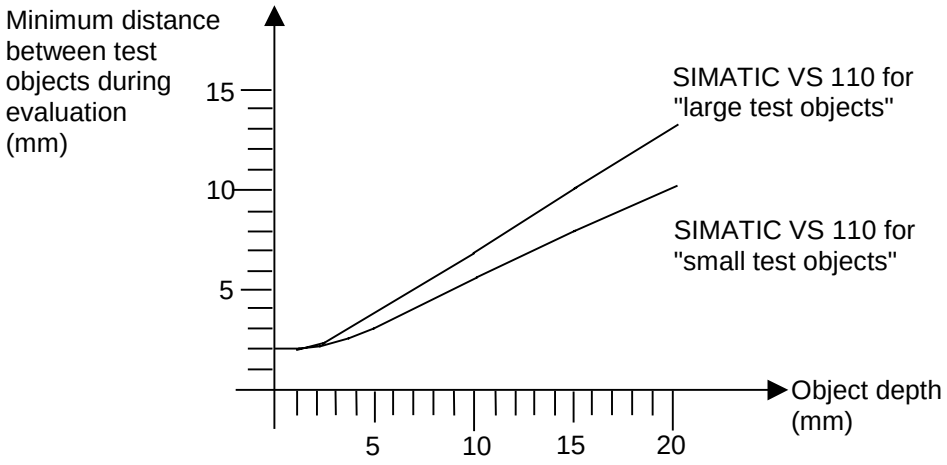
Step	Display	Activity
1	**Train** **> RUN** **Delete** **↓ OK**	In the "STOP" menu on the evaluation unit, select RUN with the arrow buttons ▲ and ▼ **and press "OK "**
2	**Run** **Model: 01** **(trained)** **ESC ←↕→ OK**	Select the model with ▼ and ▲ and press the **OK** button You can choose between 15 test objects (models). **Trained** indicates that you have already trained a model with this number. **Empty** indicates that there is no trained model with this pattern.
3	**M 01 RUN A** **Q= 98.2% √** **Δy=0.25 mm √** **OK:Menu**	**Convey test objects through the field of view** Make sure that you keep the distance between the test objects as shown in the table below.

The "Info" menu command (Section 5.10) displays information on the background area, the maximum speed, the dimensions of the models, the Q limit, and the Y limit.

Minimum Spacing for Evaluation

When using an **external trigger**, there must never be more than one test object in sensor field of view at the trigger time.

When using an **automatic trigger**, several test objects can be visible in the sensor field of view at the same time. During evaluation, the same minimum spacing must be maintained between the test objects as was used during the training:



5.3 Delete: Delete Trained Model

All the data obtained during training (shape data and the "Q-Limit" and "Y-Limit" values) of the selected model are deleted. Deleting cannot be reversed.

Step	Display	Activity
1	**Model** **> Stop** **Q-Limit** **↓ OK**	If you are at the "RUN" menu level (evaluation), select STOP with ▼ and ▲ and press the **OK** button
2	**Train** **RUN** **> Delete** **↓ OK**	Select Delete with ▼ and ▲ and then press the **OK** button
3	**Delete** **Model 01?** **(trained)** **ESC ←↕→ OK**	Select Model with ▼ and ▲ and press the **OK** button
4	**Model M 01** **Delete?** **ESC OK**	With the **OK** button, you delete the model

5.4 Settings: Setting Operating Parameters

With the "Settings" menu command, you set the parameters required for operation.

You can set the following parameters:

- Trigger: Select between internal and external trigger
- Output: Set output signals (Pulsetime, OK_A, OK_B, N_OK, Speed)
- Y-Limit: Selection of verification precedence between Y-Limit and Q-Limit during the evaluation of View A and View B
- Sample: Set the number of training cycles for automatic calculation of the quality limit "Q-Limit"

The first time you commission, all you need to do is set the "Trigger" parameter. You can use the defaults for all other values.

- With the arrow buttons ▲ and ▼ , you can move the cursor up and down and select the value you require.
- Confirm your selection with "**OK**". The set value is identified by the √ symbol.

5.4.1 Trigger: Set the Type of Trigger

Parameters	Description	Possible Values	Default
Trigger	The image capture is triggered automatically or externally via the TRG digital input	Auto External	Auto

To train and evaluate successfully, you must make sure that the test object is captured completely in the sensor field of view and at a suitable position. You have two methods of triggering available:

- **Automatic Triggering**

  If you use automatic triggering, images of the test object are recorded and evaluated continuously.

  You can only use automatic triggering when the test object is fed horizontally into the sensor field of view (for example, a conveyor belt) and when there are no other moving parts in the sensor field of view.

  SIMATIC VS 110 then checks automatically whether or not a test object is located in the sensor field of view and, if this is the case, starts evaluation.

  When using automatic triggering, you must not modify the conveyor system during or after training. The transport speed must remain constant.

- **External Triggering**

  In all other cases, you can run the evaluation with a suitable external trigger signal. With external triggers, the image is captured once when the trigger signal is generated.

  Generally, this produces higher accuracy than can be achieved with automatic triggering. In this case, you generate an exact trigger point, for example with a laser light barrier.

  You must make sure that there is only one test object in the sensor field of view at the trigger time.

  You will find an arrangement with an external trigger in Section 2.4

Step	Display	Activity
1	**RUN** **Delete** **> Settings** ↑ **OK**	In the "STOP" menu on the evaluation unit, select **Settings** with the arrow buttons ▲ and ▼ and press "**OK** "
2	**> Trigger** **Output** **Y-Limit** **ESC** ↓ **OK**	Select Trigger with the arrow buttons ▲ and ▼ and press "**OK** "
3	**Trigger** **> Auto** √ **External** **ESC** **OK**	Select the trigger type with the arrow buttons ▲ and ▼ and press "**OK** "
4	**> Trigger** **Output** **Y-Limit** **ESC** ↓ **OK**	You return to the STOP menu with the **ESC** button

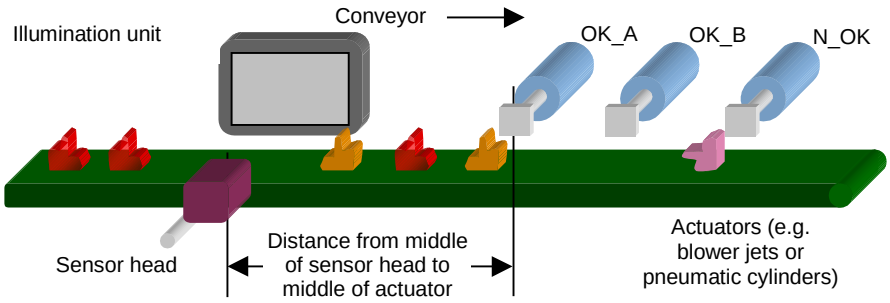
5.4.2 Output: Set Output Signals for Actuators

Parameters		Description	Possible Values	Default
Output		Setting output signals.		
	Pulsetime	Time for which the digital outputs OK _A, OK_ B, and N_OK are set	5 to 999 ms	30 ms
	OK_A	Only when Trigger = Auto is set: Delayed output of the OK_A signal (test object was recognized in View A)	75 to 500 mm	200 mm
	OK_B	Only when Trigger = Auto is set: Delayed output of the OK_B signal (test object was recognized in View B)	75 to 500 mm	300 mm
	N_OK	Only when Trigger = Auto is set: Delayed output of the N_OK signal (test object was not recognized)	75 to 500 mm	400 mm
	Speed	Only when Trigger = Auto is set: Here, you enter the speed of the conveyor.	10 to 450/300 mm/s	100 mm/s

In the evaluation mode, the digital output signals are set depending on the result of the comparison. OK_A is set if the test object was recognized in View A, OK_B is set if the test object was recognized in View B and N_OK is set if the test object was not recognized. These output signals can then control, for example, actuators that sort the test objects.

Set the delay and the length of time for which the signal is set on the evaluation unit.

If you work with an external trigger, you cannot set a delay or speed. In this mode, the delay is decided by internal activities (range between 5 ms and 200 ms).



Step	Activity
1	Measure the distance from the middle of the sensor head to the middle of the "OK_A" actuator.
2	Measure the distance from the sensor head to the other actuators.
3	Select the time for which the output signal will be set.
4	Select the "Output" parameter in the "Settings" menu.
5	Select the "OK_A" parameter and enter the distance you measured in step 1.
6	If necessary, repeat step 5 for the other actuators OK_B and N_OK.
7	Select the "Speed" parameter.
8	Enter the speed of the conveyor. (Based on the speed and the distances, SIMATIC VS 110 calculates the delay with which the outputs will be activated.) You can also change the speed at anytime in RUN (evaluation mode).
9	Select the "Pulsetime" parameter.
10	Enter the time for which the output signals will be set as obtained in step 3 (applies to OK_A, OK_B and N_OK).

5.4.3 Y Limit: Selection of verification precedence between Y-Limit and Q-Limit during the evaluation of View A and View B

Parameters	Description	Possible Values	Default
Y-Limit	Selection of verification precedence • Disable: Q-Limit Y-Limit • Enable: Y-Limit is evaluated before Q-Limit.	Enable Disable	Disable

With the Y-Limit parameter, define the method of verification for Y-Limit and Q-Limit during the evaluation of View A und View B.

During training ("Train" menu command, Section 5.1), you set the maximum permitted deviation. Test objects with a greater deviation are detected as bad parts (N_OK).

With the "Y-Limit" menu command (Section 5.8), you can connect the value later.

Model and test object can deviate from each other in a vertical direction. This deviation must be within the values specified as vertical fluctuation of the test object in the "Height" table in Appendix A.2.2.

You can select between the following two methos:

1. The evaluation of Q-Limit has precedence over the evaluation of Y-Limit (both evaluations are active).

   Select this verification method if View A and View B have different quality values. Using the "Settings" menu command, set the Y-Limit parameter to "Disabled".

2. The evaluation of Y-Limit has precedence over the evaluation of Q-Limit (both evaluations are active).

   Select this verification method if View A and View B only have different heights and not different quality values. Using the "Settings" menu command, set the Y-Limit parameter to "Enabled".

5.4.4 Sample: Number of Evaluation Cycles for the Quality Limit

Parameters	Description	Possible Values	Default
Sample	Specifies the number of evaluation cycles for automatic calculation of the quality limit "Q-Limit" and the limit for permitted vertical deviation "Y-Limit".	1 to 99	10

During training, SIMATIC VS 110 automatically calculates the quality limit "Q-Limit" and the limit for the permitted vertical deviation "Y-Limit" for the evaluation of the test objects. All test objects whose quality is greater than the set quality limit and whose vertical deviation is below the Y limit are recognized as good parts (see Section 5.1).

To do this, a certain number of model test objects the pass through the sensor field of view are evaluated. You specify the number of evaluations with the Sample parameter.

5.5 Model: Select a Model

In the "Model" menu, you can choose between 15 models. Before they can be selected, they must first be trained (see Section 5.1).

Step	Display	Activity
1	**> Model** **STOP** **Q-Limit** **ESC ↓ OK**	In the "RUN" menu on the evaluation unit, select Model with the arrow buttons ▲ and ▼ **and press "OK** "
2	**Run** **Model: 01** **(trained)** **ESC ←↕→ OK**	Select the model with ▼ and ▲ and press the **OK** button You can choose between 15 test objects (models). **Trained** indicates that you have already trained a model with this number. **Empty** indicates that there is no trained model with this pattern.
3	**M 01 RUN A** **Q= 98.2%** √ **Δy=0.25 mm** √ **OK:Menu**	

5.6 STOP: Stop the Evaluation Mode

With the "STOP" menu command, you stop the evaluation (RUN) and change to the "STOP" menu level.

5.7 Q-Limit: Set the Quality Limit

You can change the previously calculated quality limit in the "Q-Limit" menu.

If you increase the quality limit,

- the quality of the match of the test objects is increased
- less test objects are recognized as good parts.

If you reduce the quality limit,

- the quality of the match of the test objects decreases
- more test objects are recognized as good parts.

The range of values is between 0 and 99.9%.

For more detailed information on the quality limit, refer to Section 5.1

Step	Display	Activity
1	**Model** **STOP** **> Q-Limit** **ESC ↓ OK**	In the "RUN" menu on the evaluation unit, select Q-Limit with the arrow buttons ▲ and ▼ and press "**OK** "
2	**Model 01** **Q-Limit** **= 98.7%** **ESC ←↕→ OK**	Set the Q-Limit with the arrow buttons ▼, ▲ , ◀ and ▶ and press the **OK** button.
3	**Q-Limit** **set to** **97.7%** **OK**	When you press the **OK** button, you change to the "RUN" menu level

5.8 Y-Limit: Set the Limit for Permitted Vertical Deviation

In the "Y-Limit" menu, you can change the previously set limit value for the permitted vertical deviation between the model and test object.

The range of values is between 0 and 9.99 mm.

For more detailed information on the limit value, refer to Section 5.1

Step	Display	Activity
1	**STOP** **Q-Limit** **> Y-Limit** **ESC ↓ OK**	In the "RUN" menu on the evaluation unit, select Y-Limit with the arrow buttons ▲ and ▼ and press "**OK** "
2	**Model 01** **Y-Limit** **=0.63 mm** **ESC ←↕→ OK**	Set Y-Limit with ▼, ▲ , ◀ and ▶ and press the **OK** button.
3	**Y-Limit** **set to** **0.44 mm** **OK**	When you press the **OK** button, you change to the "RUN" menu level

5.9 Speed: Set the Conveyor Speed

With the "Speed" menu, you can set the speed of the conveyor.

The range of values is between 10 and 450 mm/s or 10 and 300 mm/s.

For more detailed information on the "Speed" parameter, refer to Section 5.4.2

Step	Display	Activity
1	**Q-Limit** **Y-Limit** **> Speed** **ESC ↓ OK**	In the "RUN" menu on the evaluation unit, select SPEED with the arrow buttons ▲ and ▼ **and press** "**OK**"
2	**Speed** **v=100.0** **mm/s** **ESC ←↕→ OK**	Set the Speed parameter with the arrow buttons ▼, ▲ , ◀ and ▶ and press the **OK** button. Only change the speed in small steps (message displayed: "Change in small steps")
3	**Speed** **set to** **120.0 mm/s** **OK**	When you press the **OK** button, you confirm the value.
4	**Speed** **V=120.0** **mm/s** **ESC ←↕→ OK**	When you press the **ESC** button, you change to the "RUN" menu level

5.10 Info: Using the Information Function

With the "Info" menu item, you can obtain information on the following:

- the background area
- the maximum speed
- the dimensions of the model
- Q limit and Y limit.

Step	Display	Activity
1	**Y-Limit** **Speed** **> Info** **ESC ↓ OK**	In the "RUN" menu on the evaluation unit, select INFO with the arrow buttons ▲ and ▼ **and press "OK** "
2	**Model 01** **Background** **A=29x35 mm** **1/7 ↓ OK**	You can display further information with the arrow buttons ▲ and ▼ When you press the **OK** button, you change to the "RUN" menu level

Information Display	Description
Model 1 **Background** **A=29x35 mm** **1/7 ↓ OK**	When the background (white surface) was trained, an evaluation zone of 29 x 35 mm was selected
Model 1 **Max. Speed** **V=300 mm/s** **2/7 ↕ OK**	The maximum speed with which the objects can be transported are displayed here. The maximum speed depends on the width of the test object and the width of the trained background. The maximum speed is as follows: • SIMATIC VS 110 for "large test objects" (6GF1 011-1AA with sensor head 6GF2 002-8AA) in the range 10 to 450 mm/s • SIMATIC VS 110 for "small test objects" (6GF1 012-1AA with sensor head 6GF2 002-8BA) in the range 10 to 300 mm/s Note that you must not exceed the valid maximum rate. This means the distance of rates must be selected accordingly. The speed has to be reduced for deep objects. See also Appendix A.2.2
Width (mm) **View A=9** **View B=8** **3/7 ↕ OK**	Width of the model in View A and View B
Height (mm) **View A=12** **View B=13** **4/7 ↕ OK**	Height of the model in View A and View B

Information Display	**Description**
Variance **A=05.3%** **B=09.0%** **5/7 ↕ OK**	The variance is obtained during the automatic calculation of the quality limit and the limit for the permitted vertical deviation. The value specifies the extent to which the models differed that were trained while obtaining the values (View A and View B).
Direction= **L→R** **6/7 ↕ OK**	This indicates the direction in which the models were conveyed during training: • (L→R: from left to right) • (R→L: from right to left)
Autoset: **QL=98.7 %** **YL=1.76 mm** **7/7 ↑ OK**	Shows the automatically calculated values for: • Q-Limit (quality limit) • Y-Limit (limit for permitted vertical deviation)

6 Controlling from a Programmable Controller

As an alternative to operator control from the control panel, you can also control SIMATIC VS 110 with a programmable controller. This makes it possible to train and work almost automatically.

6.1 Control Signals

You will find the pinning of the I/O interface in Appendix A.4

Input Signals

Name	Function
DISA	Disable: Disable manual control panel input, model selection and training via digital I/O
SEL0	Select 0: Model selection: bit 0 / train background
SEL1	Select 1: Model selection: bit 1 / train View A
SEL2	Select 2: Model selection: bit 2 / train View B
SEL3	Select 3: Model selection: bit 3 / quality limit/calculate limit value for the vertical deviation automatically
TRN	Train: train new model
TRG	Trigger: An evaluation is started on the positive-going edge
RES	Reset: Reset error

Output Signals

Name	Function	LED
IN_OP	In Operation: 1 = SIMATIC VS 110 functional, no error 0 = error message.	SF (group error)
TRD	Trained: 1 = selected model has been trained 1 = acknowledgment signals during training (RDY=0) 0 = selected model has not been trained 0 = training active	TRAINED
RDY	Ready: 1 = SIMATIC VS 110 in the run mode 0 = device starting up 0 = SIMATIC VS 110 in the stop mode	READY
OK_A	Result of evaluation: Test object recognized in View A.	OK_A
OK_B	Result of evaluation: Test object recognized in View B.	OK _B
N_OK	In the "RUN" mode (evaluation): Result of evaluation "Not OK" (signal length depends on the width of the test object and conveyor speed) In the "STOP" mode: set to 0 If group error occurs or during training • **External trigger:** The N_OK digital output is set to "1" for the duration of the set pulse time. • **Automatic trigger:** The N_OK digital output is always set to "1" and is permanently active.	N_OK

6.2 Selecting the Mode

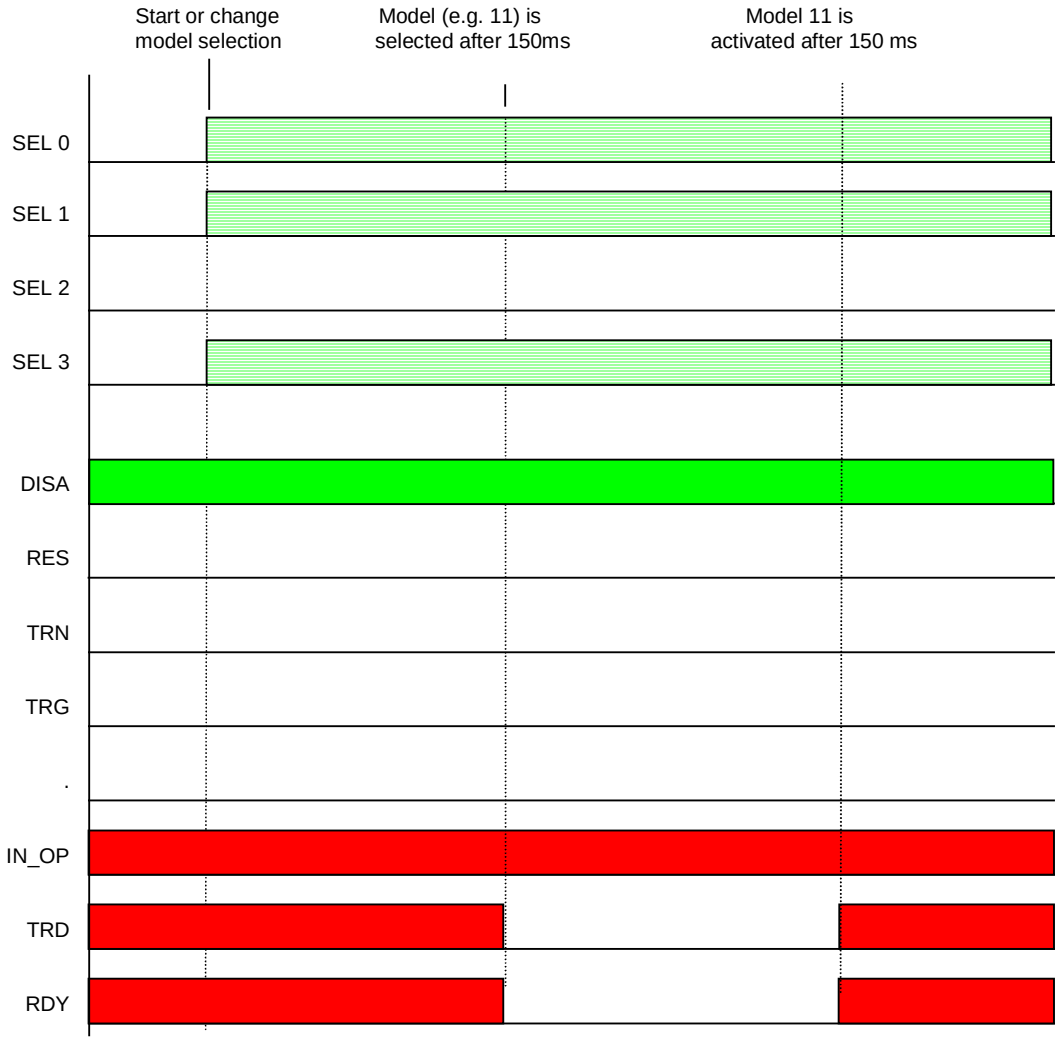
You can use the following modes:

- Model: select a model
- Train: train a model
- Run: start evaluation

The modes are described in Chapter 5.

6.2.1 Model: Select a Model

To select a model, apply the appropriate bit pattern to the inputs SEL0 to SEL3. You can select model 1 to 15. If you select model 0, the last selected model is retained.



Selecting a model

Step	Input	Output	Description
1	TRN=0 TRG=0 RES=0 DISA=1		Prepare for model selection
2	SEL0=1 SEL1=1 SEL2=0 SEL3=1		Select a pattern (here model 11)
		TRD=0 RDY=0	The changeover is started
		TRD=1 RDY=1	The changeover is completed after 150 ms, model 11 is selected

6.2.2 Train: train model

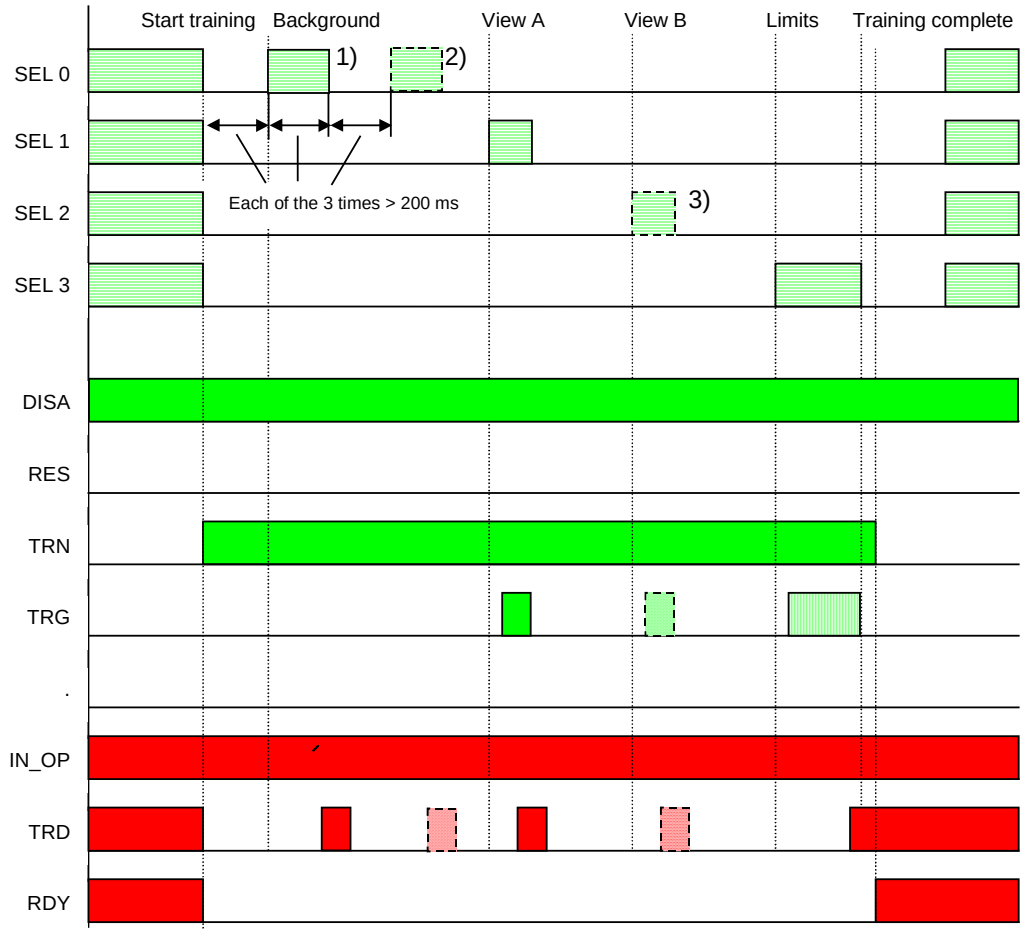
Training involves the following steps:

- Train background
- Train View A
- Train View B (optional)
- Train limits: Calculate quality limit/ limit value for the vertical deviation automatically

You select the individual steps with SEL0 to SEL3. You must keep to this order.

Training Sequence with External Triggering

If you work with an external trigger, you must apply the trigger signal to input TRG when training Views A and B and when automatically calculating the quality limit. The **trigger signal** must be applied for **at least 5 ms**.



1) If the background is learned with parts being fed through, this signal must remain set until acknowledged by TRD.
2) If no parts are fed through, an image of the background can be made using a second pulse.
3) Only when the model is required in view B

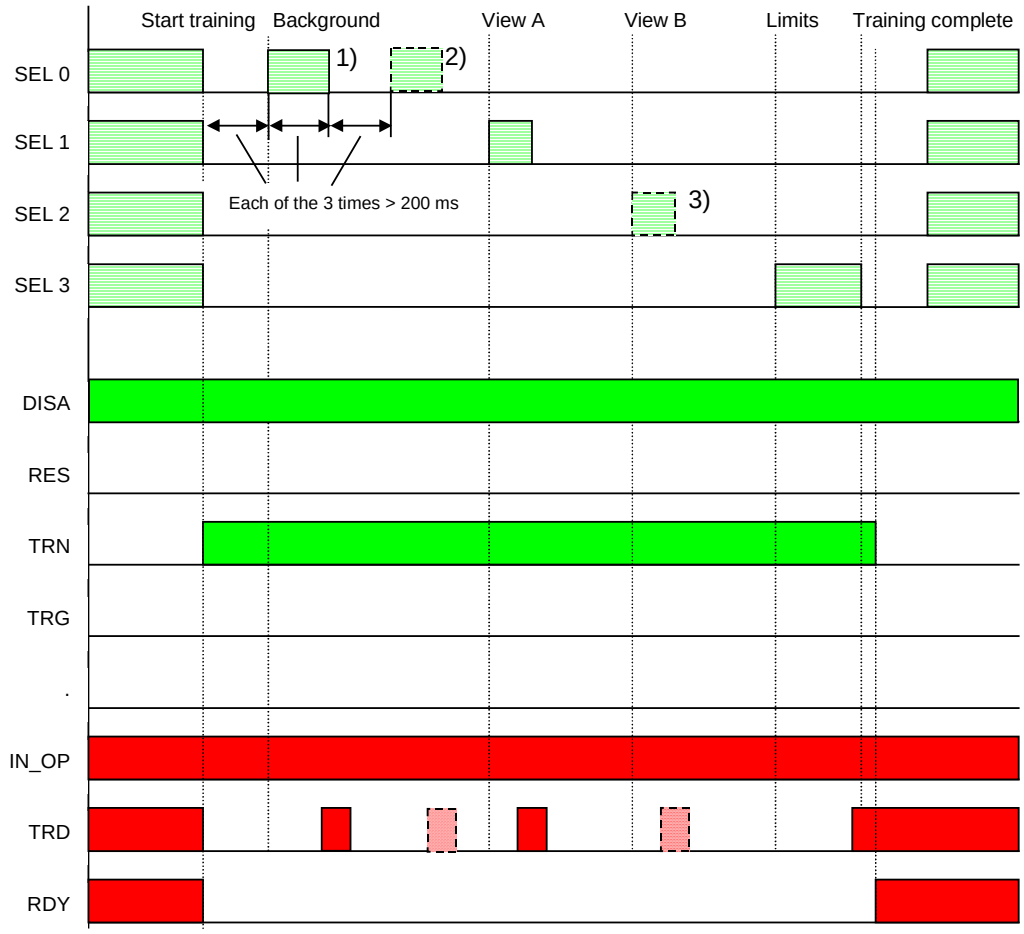
Note

After an error has occurred, you must set the signals SEL0 to SEL3 and the signal TRN to 0 and then reset the error with the RES signal.

Training Sequence with External Triggering

Step	Input	Output	Description
1	DISA=1 TRN=1 SEL0..3=0		Start training resert model selection
		TRD=0	Training active (previously active model is trained)
		RDY=0	RDY signal changes to FALSE
2	Wait at least 200 ms SEL0=1 Wait at least 200 ms SEL0=0 Wait at least 200 ms SEL0=1		**Train background** (If no parts are moved, you can make an image of the current background with a second pulse.)
		TRD=1	1st TRD Background done
3	SEL0=0		
		TRD=0	
4	SEL1=1 TRG=1		**Train View A** Feed a model through in View A
		TRD=1	2nd TRD Version A done
5	SEL1=0 TRG=0		
		TRD=0	
6	SEL2=1 TRG=1		**Train View B** Feed a model through in View B (If the model is not required in View B, continue with SEL3=1)
		TRD=1	3rd TRD Version B done
7	SEL2=0 TRG=0		
		TRD=0	
8	SEL3=1		**Train limits: Calculate quality limit/limit value for the vertical deviation automatically** Feed parts through
	TRG= 1-0...1-0		External: Feed parts through and apply trigger pulses
		TRD=1	4th TRD Quality done, when all training cycles are completed. The selected model is trained.
9	SEL3=0		
10	TRN=0		Resets the "Train" start signal
		RDY=1	RDY signal changes to TRUE

Training Sequence with Automatic Triggering



1) If the background is learned with parts being fed through, this signal must remain set until acknowledged by TRD.
2) If no parts are fed through, an image of the background can be made using a second pulse.
3) Only when the model is required in view B

Training Sequence with Automatic Triggering

Step	Input	Output	Description
1	DISA=1 TRN=1 SEL0..3=0		Start training reset model selection
		TRD=0	Training active (previously active model is trained)
		RDY=0	RDY signal changes to FALSE
2	Wait at least 200 ms SEL0=1 Wait at least 200 ms SEL0=0 Wait at least 200 ms SEL0=1		**Train background** (If no parts are moved, you can make an image of the current background with a second pulse.)
		TRD=1	1st TRD Background done

Step	Input	Output	Description
3	SEL0=0		
		TRD=0	
4	SEL1=1		**Train View A** Feed a model through in View A
		TRD=1	2nd TRD Version A done
5	SEL1=0		
		TRD=0	
6	SEL2=1		**Train View B** Feed a model through in View B (If the model is not required in View B, continue with SEL3=1)
		TRD=1	3rd TRD Version B done
7	SEL2=0		
		TRD=0	
8	SEL3=1		**Train limits: Calculate quality limit/limit value for the vertical deviation automatically** Feed parts through
		TRD=1	4th TRD Quality done, when all training cycles are completed. The selected model is trained.
9	SEL3=0		
10	TRN=0		Resets the "Train" start signal
		RDY=1	RDY signal changes to TRUE

6.2.3 RUN: Start Evaluation

Step	Input	Output	Description
1	TRN=0 TRG=0 RES=0 DISA=1		Prepare evaluation. The model was selected previously with "select model".
			The outputs are set depending on the result of the evaluation
		OK_A	OK_A : Test object recognized in View A
		OK_B	OK_B : Test object recognized in View B
		N_OK	N_OK: Test object not recognized

7 Diagnostics

When operating the SIMATIC VS 110, you will receive messages at various points (error messages or warnings/notes). The messages are output on the display. The messages are listed below along with an explanation of their meanings and how to react to them.

Error Messages:

If there is an error message, the signal "IN_OP" (in operation) changes to 0.

If error messages are generated, a group error is displayed and when using

- **external trigger:**
  The N_OK digital output is set to "1" for the duration of the set pulse time.
- **automatic trigger:**
  The N_OK digital output is always set to "1" and is permanently active.

No.	Message	Description	Remedy:
1	Sensor not found	The sensor head is defective or not connected In the RUN mode, this error message appears only after a problem state has existed for longer than 30 s. Until the appearance of this error message, reliable ejection is guaranteed by the outputting the NOK signal.	Check the connection to the sensor head. The connector is possibly not correctly inserted. It is also possible that the cable to the sensor head is damaged or the sensor head or the evaluation unit is defective.
2	No light check lamp	The sensor head is receiving no or far too little light from the illumination unit. In the RUN mode, this error message appears only after a problem state has existed for longer than 30 s. Until the appearance of this error message, reliable ejection is guaranteed by the outputting the NOK signal.	Check the following possible causes: • The sensor head is positioned incorrectly, in other words not aligned with the illumination unit. • The line-of-sight between the illumination unit and the sensor head is obstructed • The illumination unit is not connected to the evaluation unit • The illumination unit is defective • The sensor head is defective • The sensor head is so dirty that the light is not getting through to the sensor

No.	Message	Description	Remedy:
3	Low light check lamp	The image recorded by the sensor head is not good enough for reliable evaluation.	Check the following possible causes: • The sensor head is dirty • The sensor head is defective • There is a strong external source of light interfering with the sensor field of view • If the test object or the front edge of the conveyor is reflecting light from the illumination unit, you can reduce this by masking unnecessary areas of the illumination panel. • Is there reflection from parts of the system or from the test objects due to the alignment of the sensor head? • Are there transparent or translucent objects in the sensor field of view?
4	Frame error	An error has occurred transferring the image from the sensor head to the evaluation unit causing loss of a single image or there is a permanent problem in the transfer of the image from the sensor head to the evaluation unit. In the RUN mode, this error message appears only after a problem state has existed for longer than 30 s. Until the appearance of this error message, reliable ejection is guaranteed by the outputting the NOK signal.	Check the cable between the sensor head and the evaluation unit for damage. Attempt to acknowledge the error. If the same error message appears again, attempt to reset the evaluation unit by turning it off and on again. In a noise polluted environment: Shield cables and remove any possible sources of interference. If the problem cannot be solved by shielding cables etc., the device is defective. Send the sensor head and evaluation unit in for repair.
5	Settings not found	The system parameters were not found or could not be restored.	Set the system parameters again.
6	Model corrupt	The active model could not be read from the EPROM or has not been trained.	Retrain the model.
7	Can't find background	After training the background, no evaluation zone could be identified, for example because the sensor field of view is too dark, only objects in the picture....	When training the background, make sure that the objects move completely through the field of view. You may need to check the position of the lamp using the adjust software.
8	Background too small	The evaluation zone is too small after training the background (height less than 1/4 image height, width less than 2/7 of the image width)	Check the arrangement of the sensor head and illumination unit. The conveyor may be taking up too much space in the image.

No.	Message	Description	Remedy:
9	Object too wide	Train View A or train View B: The test object is too wide	Check the following possible causes: • You have not kept to the dimensions as specified in the manual. You may find that changing to a sensor head with more suitable dimensions will solve the problem. If you are sure that your test object has the correct dimensions, please check the following: - whether the distance between test object and sensor head is correct - SIMATIC VS 110 "large test objects": whether an approximately 4 mm wide and high evaluation area is available. - SIMATIC VS 110 "small test objects": whether an approximately 2 mm wide and high evaluation area is available. Using the adjust software, you can check the visible dimensions of the object. Tip: By increasing or reducing the distance between the sensor head and the test object, it is possible to train smaller or larger objects although the depth of focus and resolution is somewhat reduced. • The trained background is too small for the test object you want to train. For remedy, refer to message 8
10	Object too narrow	Train View A or train View B: The test object is too narrow	
11	Object too high	Train View A or train View B: The test object is too high	
12	Object too little	Train View A or train View B: The test object is too low	
13	Object too far at top	Train View A or train View B: The test object is too near to the upper border	
14	Object too left	Training View A or training View B with external trigger: The test object is too near to the left border	
15	Object too right	Training View A or training View B with external trigger: The test object is too near to the right border	
16	Object widths too different	Training View B with autotrigger: The difference in width between View A and View B is too great	The test objects must have similar widths to be able to train in View A and View B.
17	Identical objects	View A and View B cannot be distinguished from one another with the selected Y-Limit setting made under "Settings".You have probably selected a wrong sequence during the verification of the Y-Limit and Q-Limit. (see chapt. 5.4.3).	If View A and View B have different qualitiy values, the evaluation of Q-Limit should have precedence over the evaluation of Y-Limit (Y-Limit = Disable). If View A and View B only have different heights and not different quality values, the evaluation of Y-Limit should have precedence over the evaluation of Q-Limit (Y-Limit = Enable). The test object View A and View B must differ adequately from each other and one must not fall within the tolerance of the other. For example, View A + toleranz contains View B is not permitted. Limit the visible part of the object to the limits of what is really relevant to the test and then repeat the training.
18	Error in signal sequence	Error signaled when training using a PLC	A timing error occurred when training via the digital inputs/outputs. Make sure that you keep to the correct timing.
19	Invalid disable signal change	The disable signal changes during training	You must not change over from operation using the buttons on the evaluation unit to operation by the digital inputs/outputs or vice versa during training. Exit training.

No.	Message	Description	Remedy:
20	Invalid limits	Training the quality limit failed.	The models you have fed through are incorrect or are too different from each other. Make sure that you only feed good parts through when training the limit value.
21	Invalid sensor	The connected sensor head is not supported by the firmware of this evaluation unit.	Based on the MLFB (order) number, check whether or not the connected sensor heads belong to this evaluation unit. Check whether the firmware version of the evaluation unit supports the connected sensor head and, if necessary, update the firmware.

Warnings/Notes

No.	Message	Description	Remedy:
1	Trigger too fast	When using an external trigger, the next trigger pulse occurs before the previous image evaluation is complete. Caution: The last requested evaluation will not be made but ignored.	The test objects are being fed through faster than the specified rate or the trigger signal is bouncing. Reduce the rate or debounce the trigger signal.
2	Warning: Change in small increments	Warning displayed before you change the speed parameter in the RUN mode. Changing the speed parameter in the RUN mode can lead to parts not being ejected correctly.	If you make changes to the value in the RUN mode, make changes in small steps. Repeat the procedure until a suitable speed is set.
3	This will delete all models	This message is displayed if you change the trigger mode.	Check whether you really want to change the mode. When you change the mode, the trained models are deleted since they cannot be used any more.
4	Can only select trained model	You have attempted to select a model that has not been trained.	Train the model. Afterwards, you can start the evaluation.
5	This will stop processing	This message is displayed when you change from the "RUN" menu to the "STOP" menu.	Check whether or not you really want to cancel the evaluation.
6	Please reset for auto cal	The lamp and camera are calibrated only during the self-test. Since a recalibration of the lamp is necessary at certain intervals (approximately every 50 days) due to aging of the lamp, you will be prompted to restart the evaluation unit.	Restart the evaluation unit using the "Resart" menu command in the "Settings" menu of the "STOP" menu levle (STOP > Settings > Restart).

A Appendix

A.1 Components of the Product

Full Packages

MLFB	Description
6GF1 011-1AA	**SIMATIC VS 110 for "large test objects"**: Full package for shape testing tasks complying: • **Sensor head** (6GF2 002-8AA) to IP65 for **test object sizes from 15(7)...55(59) mm x 10(7)...45 mm x 0...20(55) mm (W x H x D)** for infrared operation. It may under certain circumstances be possible to evaluate test objects with dimensions shown in brackets (see Appendix A.2.2). • **Sensor cable** (6GF9 002-8CD) for sensor heads SIMATIC VS 100, 2.5 m long, can be plugged in at both ends, capable of trailing + ferrite ring (A5E00159706) • **Illumination unit**, infrared backlight illumination (6GF9 004-8AA) to IP40 • **Illumination cable** (6GF9 002-8CE) SIMATIC VS 100 for backlight illumination, 2.5 m long, can be plugged in at both ends, capable of trailing • **Evaluation unit** (6GF1 018-1AA) SIMATIC VS 110 to IP40 • **Power supply cable** (6GF9 002-8CA) SIMATIC VS 100, 10 m long • **Digital communication cable** (6GF9 002-8CB) SIMATIC VS 100, 10 m long • **Documentation package** (6GF7 011-1AA) SIMATIC VS 110 containing manuals/commissioning CD and installation instructions
6GF1 012-1AA	**SIMATIC VS 110 for "small test objects"**: Full package for shape testing tasks complying: • **Sensor head** (6GF2 002-8BA) to IP65 for **test object sizes from 10(4)...30(35) mm x 10(4)...25 mm x 0...10(45) mm (W x H x D)** for infrared operation. It may under certain circumstances be possible to evaluate test objects with dimensions shown in brackets (see Appendix A.2.2). • **Sensor cable** (6GF9 002-8CD) for sensor heads SIMATIC VS 100, 2.5 m long, can be plugged in at both ends, capable of trailing + ferrite ring (A5E00159706) • **Illumination unit**, infrared backlight illumination (6GF9 004-8AA) to IP40 • **Illumination cable** (6GF9 002-8CE) SIMATIC VS 100 for backlight illumination, 2.5 m long, can be plugged in at both ends, capable of trailing • **Evaluation unit** (6GF1 018-1AA) SIMATIC VS 110 to IP40 • **Power supply cable** (6GF9 002-8CA) SIMATIC VS 100, 10 m long • **Digital communication cable** (6GF9 002-8CB) SIMATIC VS 100, 10 m long • **Documentation package** (6GF7 011-1AA) SIMATIC VS 110 containing manuals/commissioning CD and installation instructions

Components, Accessories

MLFB	Description
6GF7 011-1AA	**Documentation package** SIMATIC VS 110 containing manuals/commissioning CD and installation instructions
6ES7 901-1BF00-0XA0	**RS-232 connecting cable to PG/PC**: SIMATIC S7, connecting cable for HMI adapter and PC/TS adapter 5 m long

A.2 Technical Specifications

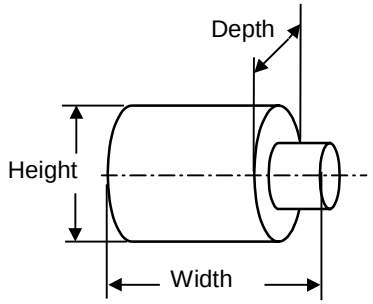
A.2.1 Vision Sensor SIMATIC® VS 110

Illumination Unit	
Light source	LED, wavelength 880 nm (NIR), designed as flasher lamp with a flash duration of 20...300 us, diffuse Light emitting diode class 1 DIN EN 60825-1:1994+A11:1996+A2:2001
Casing	Metal with plastic diffuser
Dimensions (W x H x D) in mm	155.5 x 130 x approx. 39, active illumination area 116 x 93 with multiple securing options
Weight	approx. 0.55 kg
Rated voltage	16.5 V
Degree of protection	IP 40 to IEC 60529

Sensor Head		
Image capture	CCD chip ¼", 640 x 480 square pixels; full-frame shutter with automatic exposure time	
Picture data transfer	58 pictures/s, digital picture transfer	
Two versions available each with fixed lens for two different test object sizes and installation positions	**SIMATIC VS 110 for "large test objects"** **(6GF1 011-1AA with sensor head 6GF2 002-8AA)**	**SIMATIC VS 110 for "small test objects"** **(6GF1 012-1AA with sensor head 6GF2 002-8BA)**
Distance from sensor front edge to test object	120 mm	90 mm
Distance from sensor front edge to illumination	approx. 160 mm	approx. 140 mm
Casing	Aluminum profile casing, anodized black	
Dimensions (W x H x D) in mm	42 x 42 x 100	
Weight	approx. 0.24 kg	
Rated voltage	16.5 V	
Degree of protection	IP 65 to IEC 60529	

Evaluation Unit		
Operator controls	4-row text display and 6 control buttons	
Training new types	Innovative training technique with automatic limit value calculation	
Number of storable types	15 different types each in two possible positions, selectable using control buttons or digital inputs, stored in non-volatile memory	
Triggering tests	External (via digital input) or automatic	
Adjust Software	PC software for displaying the sensor image during installation and adjustment of the sensor head and illumination on supplied CD	
Casing	Plastic, all cables can be plugged in, suitable for installation without cubicle	
Dimensions (W x H x D) in mm	170 x 140 x 76	
Weight	approx. 0.5 kg	
Degree of protection	IP 40 to IEC 60529	
Interfaces on the evaluation unit		
• Interface for load current supply	4-pin circular connector (male) for load current supply Cable length: 10 m (4 x 0.56 mm^2)	
• Illumination control	4-pin circular connector (female) for power supply and triggering the flasher lamp Current consumption at 16.5 V Cable length: 2.5 m (4 x 0.23 mm^2)	
• Sensor head interface	Digital interface (26-pin sub-D female connector) for connecting the SIMATIC VS 110 sensor head Current consumption at 16.5 V Cable length: 2.5 m (26 x 0.09 mm^2)	
• Digital inputs for 24 V d.c.	8; one with interrupt trigger input for standard binary sensors, seven others as control inputs with PLC capability	
• Digital outputs for 24 V d.c.	6; three quality outputs 0.5 A for direct control of pneumatic valves (15-pin sub-D female connector for inputs/outputs) Cable length: 10 m (15 x 0.14 mm^2)	
• Integrated interface	RS-232 (9-pin sub-D, male connector) for commissioning support Cable length: 5 m	
	SIMATIC VS 110 for "large test objects" **(6GF1 011-1AA with sensor head 6GF2 002-8AA)**	**SIMATIC VS 110 for "small test objects"** **(6GF1 012-1AA with sensor head 6GF2 002-8BA)**
Resolution		
• CCD resolution	0.11 mm	0.06 mm
• Operating threshold	0.45 mm	0.25 mm
• Reliable test from	0.9 mm	0.5 mm
• Typical test	1.8 mm	1.0 mm

A.2.2 Limit Values for the Evaluation of the Test Objects



Width			
SIMATIC VS 110 for "large test objects" (6GF1 011-1AA with sensor head 6GF2 002-8AA)		**SIMATIC VS 110 for "small test objects" (6GF1 012-1AA with sensor head 6GF2 002-8BA)**	
Width	Max. part rate (parts/s)	**Width**	Max. part rate (parts/s)
7-9 mm	<= 25	4-9 mm	<= 25
10-19 mm	24-20	10-19 mm	24-15
20-29 mm	19-15	20-29 mm	14-10
30-39 mm	14-10	30-35 mm	9-5
40-49 mm	9-5		
50-59 mm	< 5		

Height			
SIMATIC VS 110 for "large test objects" (6GF1 011-1AA with sensor head 6GF2 002-8AA)		**SIMATIC VS 110 for "small test objects" (6GF1 012-1AA with sensor head 6GF2 002-8BA)**	
Height	Fluctuation of the test object in the vertical direction (tip-to-tip)	**Height**	Fluctuation of the test object in the vertical direction (tip-to-tip)
4-9 mm	0.75-1.5 mm	2.5-9 mm	0.4-1 mm
10-19 mm	2-4 mm	10-19 mm	2-4 mm
20-29 mm	4-6 mm	20-25 mm	4-2 mm
30-39 mm	6-8 mm		
40-45 mm	8-5 mm		

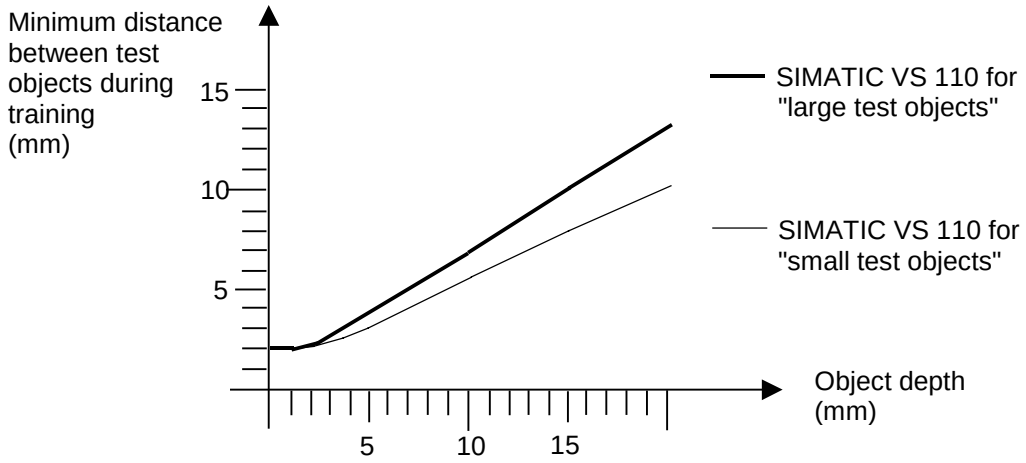
- You can test higher test objects providing that the test objects extend beyond the sensor field of view only at the bottom.
- Note for installation: If the conveyor has fluctuations greater than 0.7 mm or 0.5 mm, you must fit a mask (for example on the illumination panel) so that the conveyor is no longer visible or the conveyor must be located outside the sensor field of view.
- The fluctuation values are specified as amplitudes; in other words, 1 mm corresponds to a tolerance of ±0.5 mm

Depth			
SIMATIC VS 110 for "large test objects" (6GF1 011-1AA with sensor head 6GF2 002-8AA)		**SIMATIC VS 110 for "small test objects" (6GF1 012-1AA with sensor head 6GF2 002-8BA)**	
Depth	Maximum conveyor speed	**Depth**	Maximum conveyor speed
0-10 mm	450 mm/s	0-5 mm	300 mm/s
11-20 mm	225 mm/s	6-10 mm	150 mm/s

- Greater depths up to 55 or 45 mm can be achieved if the test objects are conveyed with sufficient accuracy and, in some cases, by reducing the conveyor speed.
- The maximum conveyor speeds in this table are recommendations. If the test objects have a suitable geometry, and the distance between them is adequate, higher speeds are also possible.
- The maximum speeds apply, in particular, to the autotrigger mode. They can however be considered as guidelines when using external triggering. With suitable conditions, much faster speeds are possible.

Minimum Distance for Training/Evaluation

The test objects must always be visible to the sensor head as clearly separate objects in the sensor field of view. This is particularly critical at the sides of the image when test objects have a greater depth.

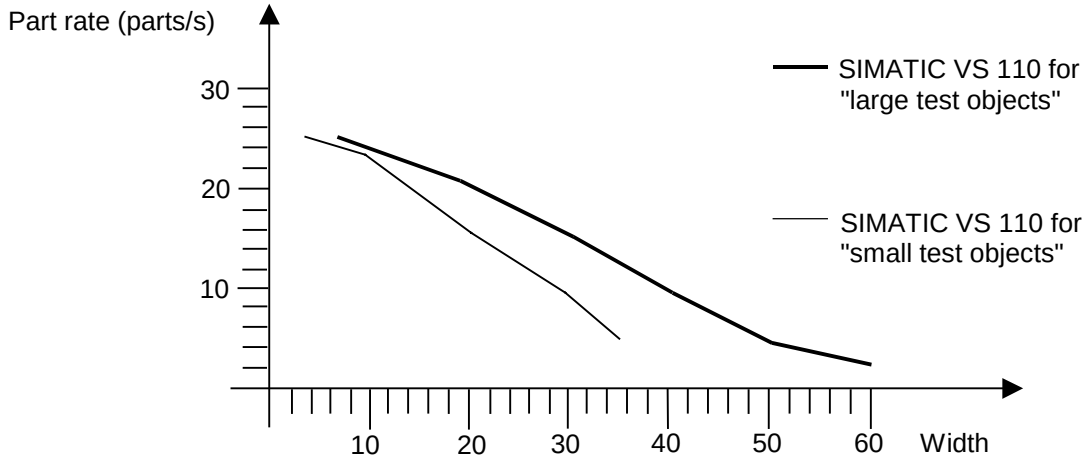


SIMATIC VS 110 for "large test objects" (6GF1 011-1AA with sensor head 6GF2 002-8AA)		SIMATIC VS 110 for "small test objects" (6GF1 012-1AA with sensor head 6GF2 002-8BA)	
Minimum Distance	Object depth	**Minimum Distance**	Object depth
2 mm	0-1 mm	2 mm	0-1 mm
2-4 mm	1-5 mm	2-3 mm	1-5 mm
4-7 mm	5-10 mm	3-6 mm	5-10 mm
7-10 mm	10-15 mm	6-8 mm	10-15 mm
10-13 mm	15-20 mm	8-10 mm	15-20 mm
When training the background, the distances may need to be increased.			

Permitted Part Rates

The permitted part rates are decided by the following:

- The width of the parts. The greater the depth, the lower the part rate.
- The size of the parts. More computing time is required to evaluate large parts.
- The transport speed. The part rate rises with the transport speed (maximum permitted transport speed, see following table)



SIMATIC VS 110 for "large test objects" (6GF1 011-1AA with sensor head 6GF2 002-8AA)		**SIMATIC VS 110 for "small test objects" (6GF1 012-1AA with sensor head 6GF2 002-8BA)**	
Permitted part rate (parts/s)	Width	**Permitted part rate (parts/s)**	Width
<= 25	7-9 mm	<= 25	4-9 mm
24-20	10-19 mm	24-15	10-19 mm
19-15	20-29 mm	14-10	20-29 mm
14-10	30-39 mm	9-5	30-35 mm
9-5	40-49 mm		
< 5	50-59 mm		

You must keep a minimum distance between the test objects during the evaluation (see following table). When parts touch, this lowers the reliability of the test.

Under certain circumstances, (small test objects, external triggering, only View A trained) much higher part rates can be achieved (up to 40 parts/s).

Maximum Permitted Conveyor Speed

The main factor that decides the maximum permitted conveyor speed is the width of the test objects. Other factors include:

- The depth of the test objects. The greater the depth, the greater the perspective distortion experienced particularly when the test object is evaluated at the left or right edge of the image.
- Unsharp test objects due to movement. At very high speeds, the areas at the edges are no longer sharp.

SIMATIC VS 110 for "large test objects" (6GF1 011-1AA with sensor head 6GF2 002-8AA)		**SIMATIC VS 110 for "small test objects" (6GF1 012-1AA with sensor head 6GF2 002-8BA)**	
Maximum Permitted Conveyor Speed	Width of the test object	**Maximum Permitted Conveyor Speed**	Width of the test object
450 mm/s	7-53 mm	300 mm/s	4-30 mm
225 mm/s	54-59 mm	150 mm/s	30-35 mm

Reliable Recognition of Extraneous Parts

Extraneous parts are bad parts that should be detected as "N_OK".

Fluctuations in the conveyor can lead to less reliable recognition:

- The sensor head assumes that it is seeing test objects of different heights
- It is possible that the test object extends beyond the evaluation area specified during training.
- Flat parts that would otherwise just pass the test, are seen as being below the minimum height

SIMATIC VS 110 for "large test objects" (6GF1 011-1AA with sensor head 6GF2 002-8AA)		**SIMATIC VS 110 for "small test objects" (6GF1 012-1AA with sensor head 6GF2 002-8BA)**	
Minimum Height of an Extraneous Part	Fluctuation in the conveyor	**Minimum Height of an Extraneous Part**	Fluctuation in the conveyor
5 mm	<= 0.75 mm	3 mm	<= 0.5 mm
10 mm	<=4 mm	7 mm	<=2 mm
18 mm	<=8 mm	11 mm	<=4 mm

- The minimum height is the visible height in the sensor field of view. Any masking caused by the conveyor or fitted masks must be added.
- The fluctuation values are specified as amplitudes; in other words, 1 mm corresponds to a tolerance of ±0.5 mm
- If the conveyor fluctuates by more than 0.7 mm or 0.5 mm, it must be masked.

A.2.3 General Data

Power Supply	
Supply voltage (U_N)	24 V d.c.; (20.4...28.8 V d.c., safety extra-low voltage (SELV)). SIMATIC VS 110 does not have integrated protection against high-energy spurious pulses in the µs range (surge pulse). For external measures, see EMC.
• Input voltage protected against polarity reversal	Yes
• Voltage loss (can be bridged)	≥ 20 ms
Current consumption (I_N)	I max. = 2 A (maximum load of 1.5 A over the digital inputs/outputs)
Fuse	max. 10 A
Making current	I_1 max. 10 A; < 1 ms
Safety requirements complying with	IEC 61131-2 corresponds to DIN EN 61131-2

Electromagnetic Compatibility (EMC)		
Pulse-shaped interference		
	Test voltage	Corr. to severity
Electrostatic discharge complying with IEC 61000-4-2	Discharge in air: ±8 kV Contact discharge: ±6 kV	3
Burst pulse (fast transients) complying with IEC 61000-4-4	2 kV (power supply cable) 2 kV (signal line)	3
Surge complying with IEC 61000-4-5		
	Test voltage	Corr. to severity
• Unbalanced coupling	2 kV (power supply cable) direct voltage with protective elements	3
• Balanced coupling	1 kV (power supply cable) direct voltage with protective elements	3
Sine-shaped disturbance		
	Test values	Corr. to severity
Radio frequency electromagnetic fields complying with IEC 61000-4-3 complying with IEC 61000-4-3	10 V/m at 80 % amplitude modulation of 1 kHz in the range from 80 MHz to 1000 MHz 10 V/m at 50 % pulse modulation at 900 MHz	3

Electromagnetic Compatibility (EMC)		
Radio frequency continuous conducted on lines and line shields complying with IEC 61000-4-6	Test voltage 10 V at 80 % amplitude modulation of 1 kHz in the range from 9 kHz to 80 MHz	3
Emitted interference		
Limit class	Radiation of electromagnetic fields complying with EN 55011: Limit class A, group 1 Emission of interference over line a.c. supply complying with EN 55011: Limit class A, group 1 Sensor head and illumination are within the limit value to comply with EN 55022 class B	

Transport and Storage of Modules	
With regard to transport and storage conditions, the SIMATIC VS 110 is better than required by IEC 61131-2. The following information applies to modules transported or stored in their original packaging. The climatic conditions correspond to IEC 60721-3-3, Class 3K7 for storage and IEC 60721-3-2, Class 2K4 for transport. The mechanical conditions correspond to IEC 60721-3-2, Class 2M2.	
	Permitted Range
Free fall	≤ 1 m (up to 10 kg)
Temperature	-30 °C to +70 ° C
Air pressure	1080 to 660 hPa (corresponds to a height of -1000 to 3500 m)
Relative humidity (at +25 °C)	5 to 95 %, no condensation
Sine-shaped oscillations complying with IEC 60068-2-6	5 - 9 Hz: 3.5 mm 9 - 500 Hz: 9.8 m/s^2
Shock complying with IEC 60068-2-29	250 m/s^2, 6 ms, 1000 shocks

Mechanical Environmental Conditions for Operation	
The SIMATIC VS 110 is designed for fixed installation in an environment protected from the weather. SIMATIC VS 110 meets the conditions for use complying with DIN IEC 60721-3-3: • Class 3M3 (mechanical requirements) • Class 3K3 (climatic environmental conditions)	
Mechanical environmental conditions, sine-shaped oscillations	
Frequency range in Hz	Test values
10 ≤ f < 58	0.075 mm amplitude
58 ≤ f < 500	1 g constant acceleration
Test for mechanical environmental conditions	
Test for / Test standard	Remarks

Mechanical Environmental Conditions for Operation		
Oscillations Oscillation test complying with IEC 60068-2-6 (sine)		Type of oscillation: Frequency sweeps with a rate of change of 1 octave/minute. 10 Hz ≤ f < 58 Hz, constant amplitude 0.075 mm 58 Hz ≤ f < 500 Hz, constant acceleration 1 g 10 Hz ≤ f ≤ 55 Hz, amplitude 1 mm (only sensor head and illumination) Period of oscillation: 10 frequency sweeps per axis in each of the 3 perpendicular axes
Shock	Shock test complying with IEC 60068-2-29	Type of shock: half sine Strength of the shock: • Evaluation unit: 10 g peak value / 6 ms duration • Sensor head, illumination: 10 g peak value / 6 ms duration Direction of shock: 100 shocks in each of the 3 perpendicular axes
	Shock test complying with IEC 60068-2-27	Sensor head, illumination: • 70 g peak value / 6 ms duration 3 times in each direction • 30 g peak value / 11 ms duration 3 times in each direction

Climatic Environmental Conditions for Operation		
Environmental Conditions	Permitted Range	Note
Temperature	0 to +50 °C	
Temperature change	Max. 10 °C/h	
Relative humidity	Max. 95 % at +25 °C	No condensation, corresponds to relative humidity degree 2 to IEC 61131-2
Air pressure	1080 to 795 hPa (corresponds to a height of -1000 to 2000 m)	
Contaminant concentration	SO_2: < 0.5 ppm; RH < 60 %, no condensation H_2S: < 0.1 ppm; RH < 60 %, no condensation	Test: 10 ppm; 4 days Test: 1 ppm; 4 days

Test voltages to IEC 61131-2	
Circuits with rated voltage U_e to other circuits or ground	Test voltage
0 V < U_e ≤ 50 V	350 V
50 V < U_e ≤ 100 V	700 V
100 V < U_e ≤ 150 V	1300 V
150 V < U_e ≤ 300 V	2200 V

A.2.4 Interface Digital Inputs/Outputs

Module-Specific Data	
Number of inputs	8
Number of outputs	6
Cable length, unshielded	10 m
Voltage, Currents, Potentials	
Rated voltage Load current supply L+	24 V d.c.
Permitted rated voltage Load current supply L+	20.4 V to 28.8 V
Current consumption L+	Dependent on configuration
Number of simultaneously controllable inputs	8
Number of simultaneously controllable outputs	6
Total current of the outputs	max. 1.5 A with max. 0.5 A/output
Electrical isolation	No
Data for Selecting a Sensor	
Input voltage • Rated value • For signal "1" • For signal "0"	 24 V d.c. from 13 to 30 V -30 V to +5 V
Input current • For signal "1"	 Typical. 7 mA
Input signal characteristics	"Trigger" input to IEC61131-2 type 2 Other inputs: IEC61131-2 type 1
Connection of two-wire BERO	Max. 1.5 mA
Data for Selecting an Actuator	
Output voltage • For signal "1"	 Min. L+ (-1.3 V)
Output current • For signal "1" Rated value Permitted range • For signal "0" (residual current)	 0.5 A 5 mA to 0.5 A max. 0.5 mA
Off delay (with resistive load) • from "0" to "1"	max. 100 µs
Load resistor	Max. 48 Ω to 4 KΩ
Lamp load	max. 5 W
Parallel wiring of 2 outputs	No
Operating frequency: • With resistive load • With inductive load to IEC 947-5-1, DC 13 • With lamp load	 Max. 100 Hz Max. 0.5 Hz at 0.5 A Max. 10 Hz
Limit on inductive cut-off voltage	Typical. L+ (-53 V)
Short-circuit protection of the output • Operating threshold	Electronic Typical. 1 A

A.3 Standards and Approvals

IEC 61131-2

SIMATIC VS 110 meets the requirements and criteria of the standard IEC 61131-2.

CE Mark

SIMATIC VS 110 meets the requirements and protective aims of the following EU directive.

89/336/EEC "Electromagnetic Compatibility" (EMC Directive)

The EU conformity certificates are available for the relevant authorities and are kept at the following address:

Siemens Aktiengesellschaft

Bereich Automatisierungstechnik

A&D AS RD 42

Postfach 1963

D-92209 Amberg,
Germany

EMC Directive

The SIMATIC VS 110 is designed for use in an industrial environment:

Area of Application	Requirements	
	Emitted interference	Immunity
Industry	EN 50081-2 : 1993	EN 61000-6-2 : 1999

Marks for Australia and New Zealand

SIMATIC VS 110 meets the requirements of the standard AS/NZS 2064 (Class A).

UL Approval

UL Mark Underwriters Laboratories (UL) to Standard UL 508:

- Report E 85972

CSA Approval

CSA Certification Mark Canadian Standard Association (CSA) to Standard C 22.2 No. 142:

- Certification Record: 212191-0-000

FM Approval

Factory Mutual Approval Standard Class Number 3611,

Class I, Division 2, Group A, B, C, D

Class I, Zone 2, Group IIC

Temperature class: T4 at 50 °C ambient temperature

Warning

Risk of injury to persons and damage to equipment.

In hazardous areas (risk of explosion), injury to persons or damage to equipment can occur if you close or open an electrical circuit (for example, plugging in a connector, fuses, switches) while a SIMATIC VS 110 is operating.

Do not connect or disconnect any live circuits unless certain that an explosion is impossible.

If you install the VS 110 in Class I, Division 2, Group A, B, C, D or. Class I, Zone 2, Group IIC, you must either provide a suitable disconnector for this environment (for example a gas-tight switch) or install the disconnector in the safe zone.

Make sure that if you use the system under FM conditions, the connector to the I/O is screwed tight and that the hexagon nut on the connector to the power supply is securely tightened with a wrench. Make sure that both connectors can only be released using tools and not simply by hand.

Do not insert or remove the RS-232 cable in hazardous areas.

All other components must also be suitable for FM if you use them in a hazardous environment.

Warning

EXPLOSION HAZARD. DO NOT DISCONNECT EQUIPMENT UNLESS AREA IS KNOWN TO BE NONHAZARDOUS

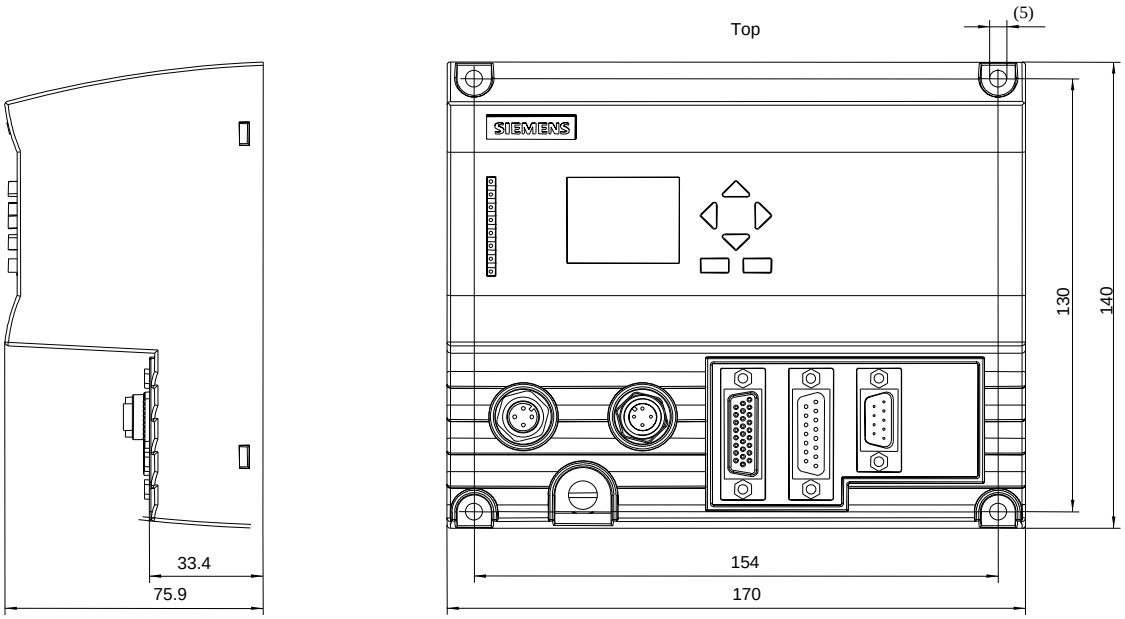
Installation Guidelines

According to IEC 61131-2, SIMATIC VS 110 is an enclosed apparatus, according to the UL/CSA certification it is an "enclosure type" (type 1).

The installation guidelines and safety notices specified in the documentation must be adhered to during commissioning and operation.

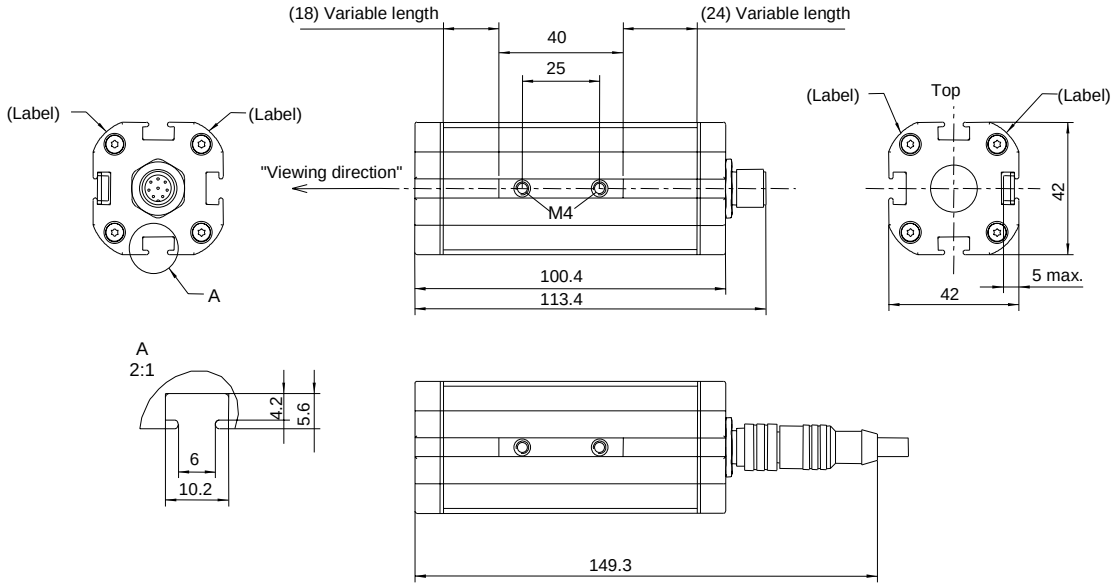
A.4 Installation Dimensions

Evaluation Unit



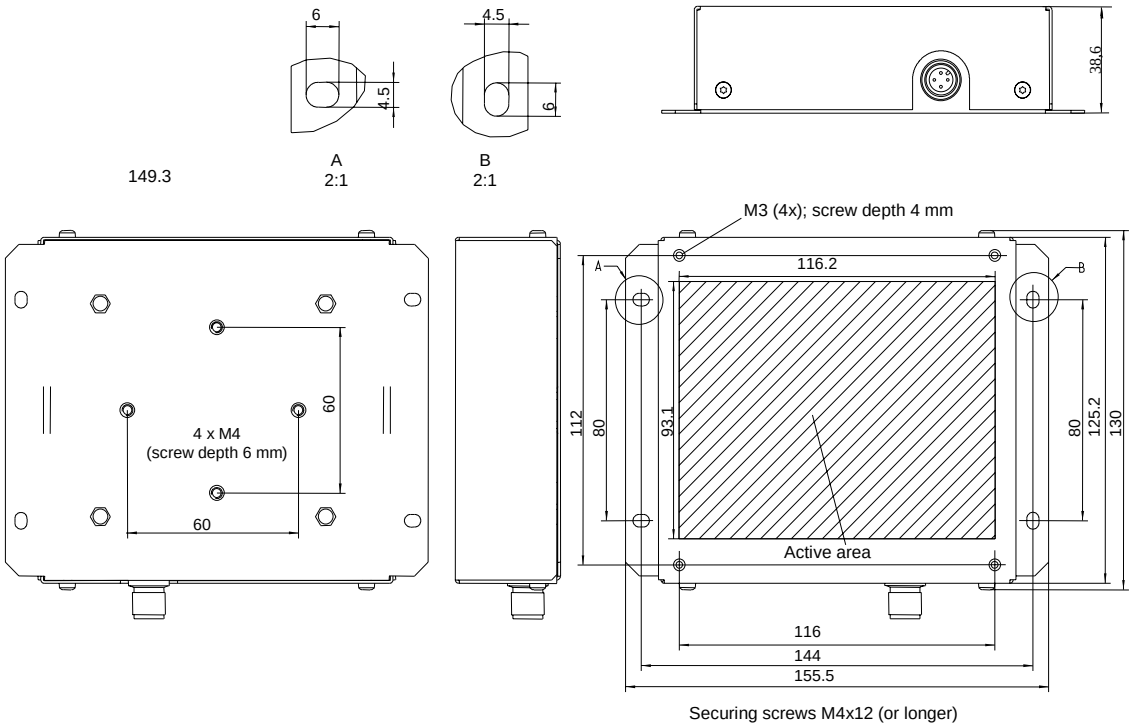
Securing screws: M4x12 or longer
Permitted static bending radius: PS cable approx. R40
Permitted static bending radius: Illumination cable approx. R25
Permitted static bending radius: Sensor cable approx. R40
Permitted static bending radius: I/O cable approx. R50

Sensor head



Permitted static bending radius of cable: approx. R40

Illumination Unit



A.5 Interface Assignment of the Evaluation Unit

Power supply of "IN DC 24V" (0

Connector	Name	Function	Direction	Wire Color
1	+24V	24 V power supply	-	red
2	+24V	24 V power supply	-	orange
3	M	Ground	-	black
4	M	Ground	-	brown

Interface to Illumination Unit "LAMP" (socket)

Connector	Name	Function	Direction
1	+16V	16.5 V power supply	-
2	LIGHT	Pulse to start a light flash (24 V)	Output
3	M	Ground	-
4	M	Ground	-

Interface to Sensor Head "SENSOR" (socket)

Connector	Name	Function	Direction
Casing		Shield	-
9	M		-
10	M		-
14		+16V	-
20	TxDP	Image data +	Input
21	TxDN	Image data -	Input
22	CLK_P	Image synchronization +	Output
23	CLK_N	Image synchronization -	Output
24	RxD_P	Sensor parameter +	Output
25	RxD_N	Sensor parameter -	Output
26	M		-

I/O Interface "DI/DO" (socket)

Connector	Name	Function	Direction	Wire Color
1	DISA	Disable: Disable manual button control	Input	black
2	SEL0	Select 0: Model selection: bit 0 / train background	Input	brown
3	SEL1	Select 1: Model selection: bit 1 / train View A	Input	green
4	SEL2	Select 2: Model selection: bit 2 / train View B	Input	orange
5	SEL3	Select 3: Select model: bit 3 / calculate quality limit/maximum vertical deviation automatically	Input	yellow
6	TRN	Train: train new model	Input	red
7	TRG	Trigger: An evaluation is started on the positive-going edge	Input	blue
8	RES	Reset: Reset error	Input	violet
9	IN_OP	In Operation: 1 = SIMATIC VS 110 functional, no error 0 = error message.	Output	white-black
10	TRD	Trained: 1 = selected model has been trained 1 = acknowledgment signals during training (RDY=0) 0 = selected model has not been trained 0 = training active	Output	white-brown
11	RDY	Ready: 1 = SIMATIC VS 110 in the run mode 0 = device starting up 0 = SIMATIC VS 110 in the stop mode	Output	white-green
12	OK_A	Result of evaluation: Test object recognized in View A.	Output	white-orange
13	OK_B	Result of evaluation: Test object recognized in View B.	Output	white-yellow
14	N_OK	In the "RUN" (evaluation) mode: Result of evaluation "Not OK" In the "STOP" mode: set to 0 If group error occurs or during training • **External trigger:** The N_OK digital output is set to "1" for the duration of the set pulse time. • **Automatic trigger:** The N_OK digital output is always set to "1" and is permanently active.	Output	white-red
15	-	-	-	-

RS-232 Interface, Floating "RS232" (pin)

Connector	Name	Function	Direction
Casing	Shield	Shield	-
2	RxD	Receive:	Input
3	TxD	Transmit:	Output
5	M	Ground	-

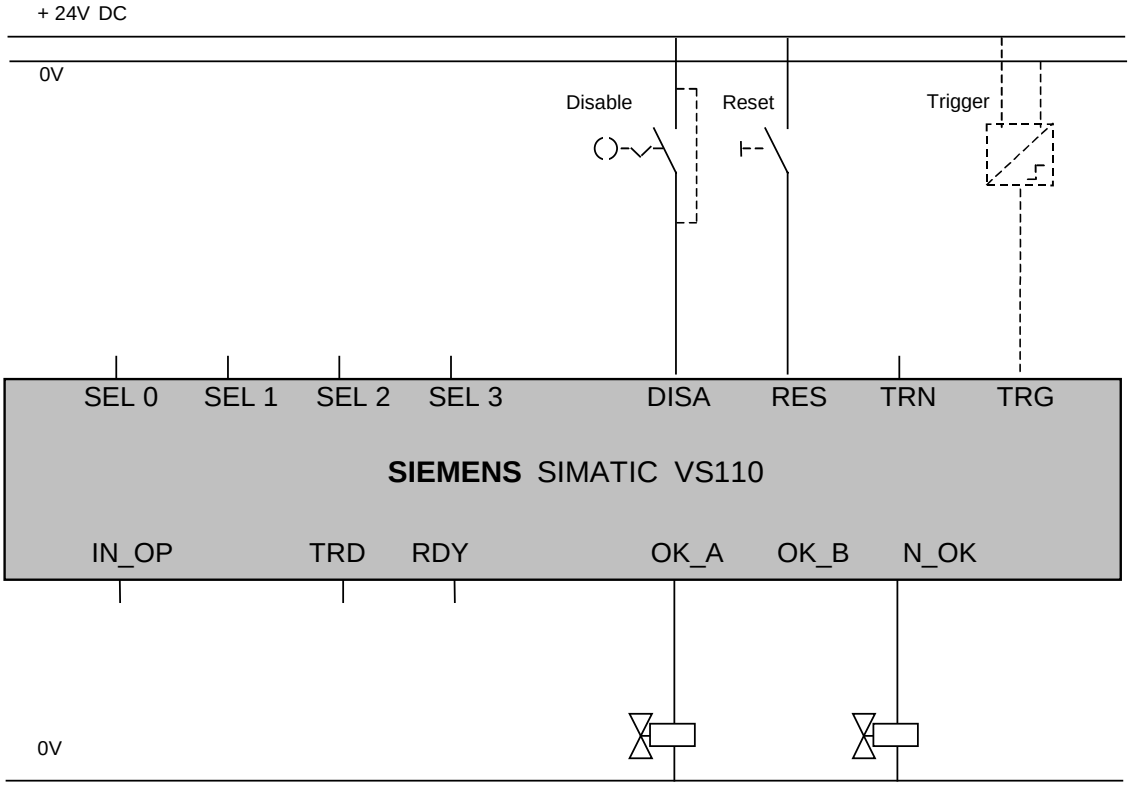
A.6 Wiring Suggestions

Controlling with Control Panel Buttons

The equipment is controlled from the control panel.

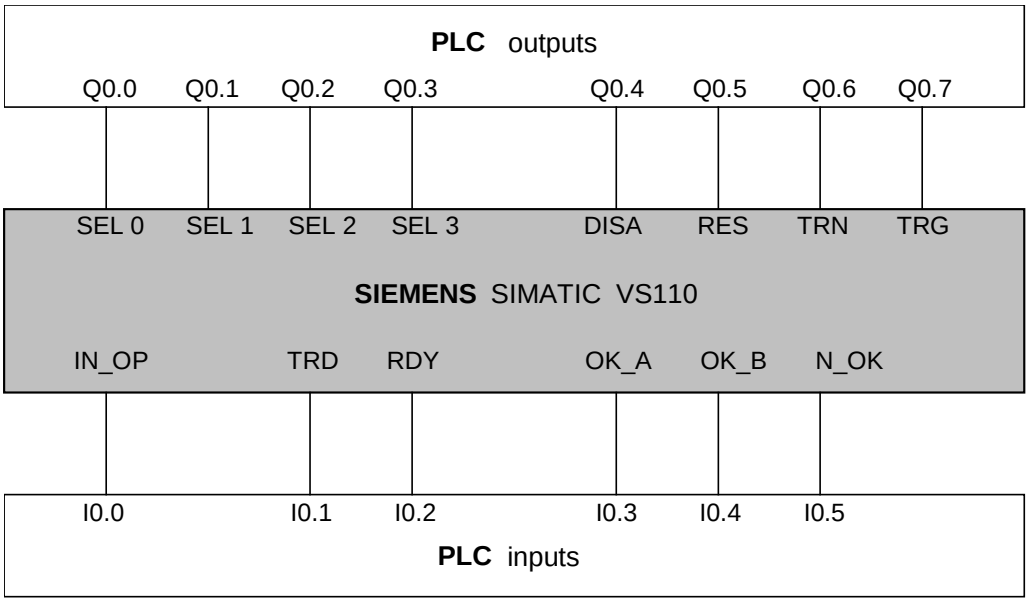
Using a keyswitch, you can disable the buttons by applying +24 V at the DISA input (disable).

Error messages are acknowledged via the RES input (reset).



Controlling with a Programmable Controller

The inputs and outputs of the programmable controller are connected directly to the SIMATIC VS 110.



A.7 Adjust Software for SIMATIC VS 110

The adjust software is used to adjust the sensor head.

A.7.1 Requirements

- Microsoft Windows PC (95, 98, ME, NT 4.0 2000 or XP)
- Intel or compatible processor Pentium 200 MHz or faster
- Graphics card/monitor with at least 65536 colors and 640 x 480 resolution
- Serial interface with 115200 Kbps supported by Windows as COM1...9. This must be a different interface than that used by the mouse

A.7.2 Preparations

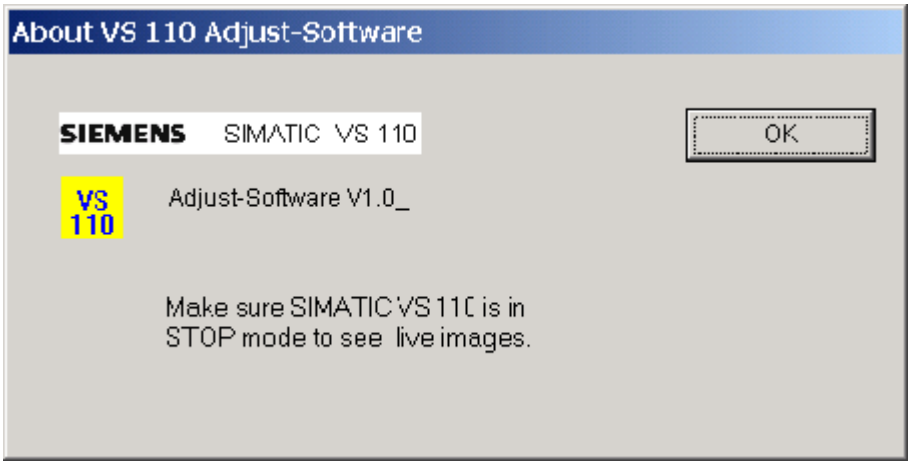
Connect the PC and the evaluation unit using an RS-232 null modem cable (6ES7 901-1BF00-0XA0).

Note

Establish the serial connection only when Windows has completed startup and close the connection before restarting the PC.

If a PC is started while the evaluation unit is connected over the serial cable, you may encounter problems with the mouse.

After starting the program, a message is displayed telling you that the SIMATIC VS 110 must be in STOP mode so that live pictures can be displayed.

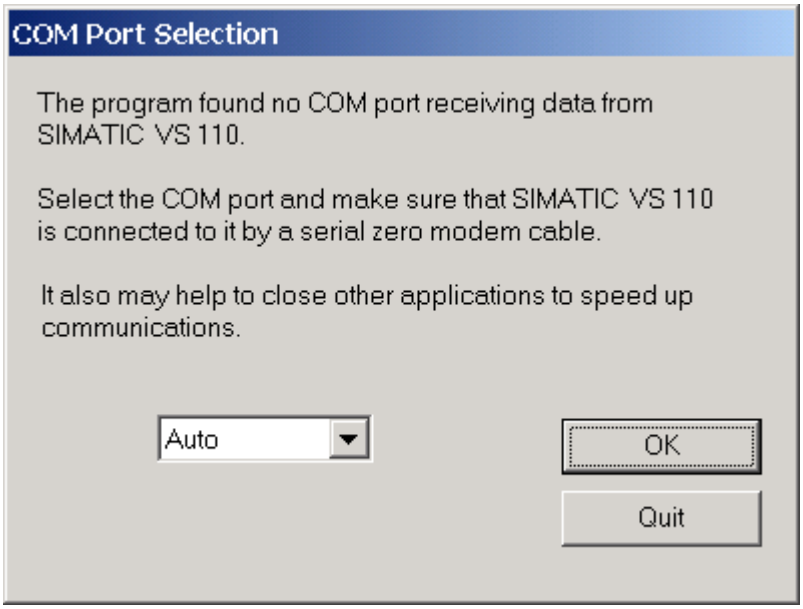


You must acknowledge this message with "OK".

After starting the program, it automatically searches for the interface to which the evaluation unit is connected. This is only possible after the evaluation unit has completed its self test.

During the automatic interface selection, all the available serial interfaces are investigated to find out whether or not data can be received from the evaluation unit over them. The first interface to meet this requirement is selected.

Very occasionally, automatic detection fails to find a connected evaluation unit. If the program does not find an interface, the following dialog box appears:



In this case, you have the option of either

- running another automatic search or
- selecting the interface to which the evaluation unit is connected manually.

If you want to cancel the search, you can close the program with "Quit".

You can see that a connection was established successfully because "Online" is displayed in the title bar. You can also see which interface is being used for the connection.

A.7.3 Displaying Pictures to Adjust the Sensor Head

To be able to display pictures, the evaluation unit must be in "Stop" mode.

You can recognize the reception of new image data by the changing green symbol in the right upper corner of the screen.

Display when using automatic triggering

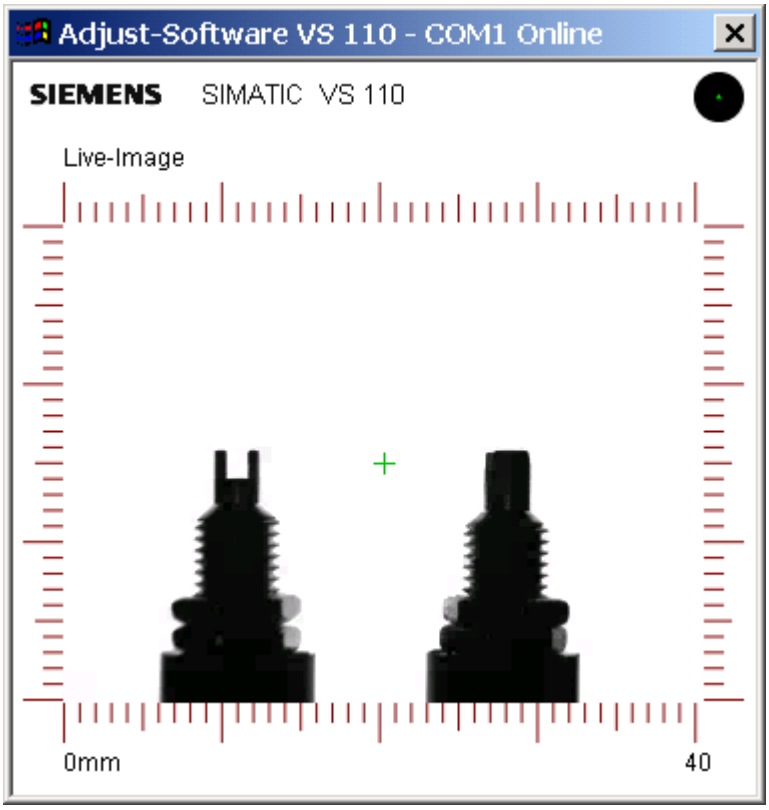
1-5 images per second are transferred and displayed.

Once an image has been received, the message "Live-Image" appears on the left above the image.

Display when using external triggering

An image is transferred and displayed with every trigger signal. The message "Triggered Image" is displayed above the image.

If no trigger signal is received within approximately 4 seconds, the display changes to "Live Image" and 1-5 images per second are displayed just as with automatic triggering.



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