



Software manual
ifm Vision Assistant

GB

Radar distance sensor with IO-Link

R2D100

R2D102

R2D200

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1 Preliminary note

You will find instructions, technical data, approvals and further information using the QR code on the unit / packaging or at documentation.ifm.com.

1.1 Symbols used

- ✓ Requirement
- Instructions
- ▷ Reaction, result
- [...] Designation of keys, buttons or indications
- Cross-reference
-  Important note
Non-compliance may result in malfunction or interference.
-  Information
Supplementary note

1.2 Legal and copyright information

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- Windows® is the property of → Microsoft Corporation, USA

1.3 Open source information

-  For more open source information see: documentation.ifm.com.

2 Safety instructions

Please read the operating instructions prior to set-up of the device. The device must be suitable for the application without any restrictions.

If the operating instructions or the technical data are not adhered to, personal injury and damage to property can occur.

3 Intended use

The software manual describes the following functions of the ifm Vision Assistant software:

- Recognising the device in the local subnet.
- Configuring the device.
- Collecting, storing and evaluating data of the device.
- Displaying detailed status information.
- Outputting the target reflections.

4 Getting started



Information on installation and electrical connection → Operating instructions for the device at www.ifm.com.

Requirements:

- ifm Vision Assistant software. → Download: www.ifm.com.
- An IO-Link master. → Accessories: documentation.ifm.com.

Start the ifm Vision Assistant:

- ▶ Connect the radar position sensor to a PC via the IO-Link master.
- ▶ Install and start the ifm Vision Assistant software on the PC.
- ▶ Use the [Find sensor] button on the start page of the ifm Vision Assistant to connect the device with the software (→ [Connecting the device](#)  13).
- ▷ ifm Vision Assistant opens with the [Monitor] view.

Select target:

- ▶ Select the target in the [Radar settings] area.
- ▶ Set the output signal parameters in the [Switch point setting] area.
- ▶ Set the output polarity (PNP/NPN) in the [Device setup] area.
- ▷ In the [Monitor] area, the **selected target reflection** is marked in the live image with a crosshair, and the individual process values of the selected target reflection are output in the status display on the left side of the image.
- ▷ The outputs OUT1 and OUT2 provide switching or analogue signals according to their parameter setting.

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- the software or the software content will be free of bugs, errors, viruses or other defects,
- any results, output, or data provided through or generated by the software will be accurate, up-to-date, complete or reliable,
- the software will be compatible with third party software,
- any errors in the software will be corrected.

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Demo software and templates are provided “as is” (that is: excluding warranty) and “as available”, without any warranty of any kind, either express or implied. The user acknowledges and agrees to use the software at user’s own risk. In no event shall ifm be held liable for any direct, indirect, incidental or consequential damages arising out of the use of or incorrect use the software. The user may use the software solely for demonstration purposes and to assess the software functionalities and capabilities.

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2. Upon complete payment of the purchase price for the customer-specific application program, ifm transfers the non-exclusive, locally and temporarily unrestricted usage right thereof to the customer, without the customer acquiring any rights of any kind to the standard software module on which the individual or customer-specific adaptation is based. Notwithstanding these provisions, ifm reserves the right to produce and offer customer-specific software solutions of the same kind for other customers based on other terms of reference. In any case ifm retains a simple right of usage of the customer-specific solution for internal purposes.
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6 Installation

6.1 System requirements

Software

The following software is required for operation.

- Operating system: Windows 10 (32/64 bits)
- ifm Vision Assistant software: 2.6.21 or higher



Other versions

- ▷ Other versions of software and firmware may contain modified or new functions that are not described in this software manual.

Hardware

The following hardware is required for operation:

- Hard disk: min. 1 GB free memory space
- Monitor: Resolution of min. 1024x768 pixels, 32-bit colour depth

Accessories



Information about available accessories at www.ifm.com

6.2 Hardware



- ▷ Detailed information on installation and electrical connection can be found in the operating instructions of the device: documentation.ifm.com

6.3 Software

Install the ifm Vision Assistant:

- ▶ Download the ifm Vision Assistant from the website: www.ifm.com
- ▶ Copy the zip file to a directory on the PC and unzip.
- ▷ The ifm Vision Assistant is installed and can be started via the “ifmVisionAssistant.exe”.



The ifm Vision Assistant does not start

- ▷ If the ifm Vision Assistant does not appear within 5 to 10 seconds after starting:
 - ▶ Check the system requirements.

6.3.1 Uninstall

Uninstalling the ifm Vision Assistant:

- ▶ Delete the installation folder of the ifm Vision Assistant.
- ▷ The ifm Vision Assistant is uninstalled.



- ▷ Existing settings and log files are not deleted.

Deleting the settings and log files:

- ▶ Delete the following directory: "%AppData%\ifm electronic\ifmVisionAssistant"

6.4 Command line parameters

The command line parameters influence the start of ifm Vision Assistant by attaching parameters to the exe file. Several parameters can be appended one after the other, separated by a space.

Command line parameters via command prompt

Start ifm Vision Assistant via the command prompt:

- ▶ In the prompt, add the command line parameters after `ifmVisionAssistant.exe` separated by a space.
- ▷ Example: `"ifmVisionAssistant.exe -log"`

Command line parameters via Windows

Start ifm Vision Assistant with command line parameters via Windows:

- ▶ Right-click on [ifm Vision Assistant].
- ▶ Click on [Properties] in the submenu.
- ▶ Click on the [Shortcut] tab.
- ▶ Click on the [Target] field and move the cursor to the end of the line.
- ▶ Enter a space followed by the command line parameter.
- ▶ Click [OK].

Available command line parameters

The following command line parameters are available:

Command line parameter	Description
<code>-disableclosebtn</code>	Disables the button for terminating ifm Vision Assistant.
<code>-log</code>	Creates a log file for detailed error analysis. The log file is saved in the following folder: "%APPDATA%\ifm electronic\ifmVisionAssistant\logs"

Command line parameter	Description
<code>-autoconnect filename.xml</code>	Automatically establishes the connection to a device. The file " filename.xml " must contain the following XML code: <pre><?xml version="1.0" encoding="UTF-8"?> <sensor> <sensorType>R2Dxxx</sensorType> <addressType>IP</addressType> <name>My sensor</name> <address> <ip>192.168.0.69</ip> <pcic_port>50010</pcic_port> <web_port>80</web_port> <mac>00:02:01:21:b9:ee</mac> </address> </sensor></pre> ► Adjust the information in the XML file: IP address, ports, etc.
<code>-geometry [screen]:[width]x[height]+[x]+[y]</code>	Sets the windows size and position of ifm Vision Assistant (incl. Windows frame). The minimum window size is 1024x768 pixels. Example: <pre>-geometry 1:1380x768+0+0"</pre> The window is placed on screen 1 (screen=1). The window size including Windows frame is set to 1380x768 (width = 1380 and height = 768). The window is positioned at the top left (x=0 and y=0). When negative values are entered for the window position x and y, the opposite corner is used as zero point. Example: " +0+0 " window at the top left " -0+0 " window at the top right " +0-0 " window at the bottom left " -0-0 " window at the bottom right
<code>-frameless</code>	Starts ifm Vision Assistant without the native Windows frame window.
<code>-cmd "Mon:rec:startRecording=file.dat"</code>	Switches to the [Monitor] area after the start and starts recording data. A PowerShell script can be used to automatically insert the date and time into the file name of the recording: <pre>-cmd "Mon:rec:startRecording=c:/dat/ \$((Get-Date).ToString('yyyy-dd- MM-hh-mm-ss'))_Cam.dat"</pre>
<code>-cmd "Mon:rec:durationSecs=-1"</code>	Sets the duration of the recording in seconds. " -1 ": unlimited recording time
<code>-cmd "Mon:rec:fileSplitSizeMB=3000"</code>	Splits the recorded data into blocks. The block size can be set in MB. The file names of the blocks contain a continuous counter.
<code>-cmd "Mon:g2d:deviceByIndex=2"</code>	Sets the video source by index. For example, an external frame grabber can be used as a video source. For notebooks, index=" 1 " is often the built-in camera.
<code>-cmd "Mon:g2d:deviceByName=Hauppauge Cx23100 Video Capture_2"</code>	Sets the video source by name. For example, an external frame grabber can be used as a video source.

Kiosk mode

In kiosk mode, the Windows frame is hidden and ifm Vision Assistant cannot be closed normally by the user. The mode is ideal for trade fairs and demonstrations.

Use the kiosk mode:

► Use the following command line parameters in succession:

```
ifmVisionAssistant.exe -disableclosebtn -frameless
```



The key combination “Ctrl+F4” closes ifm Vision Assistant.

7 Start page

The start page contains the basic functions of the ifm Vision Assistant.

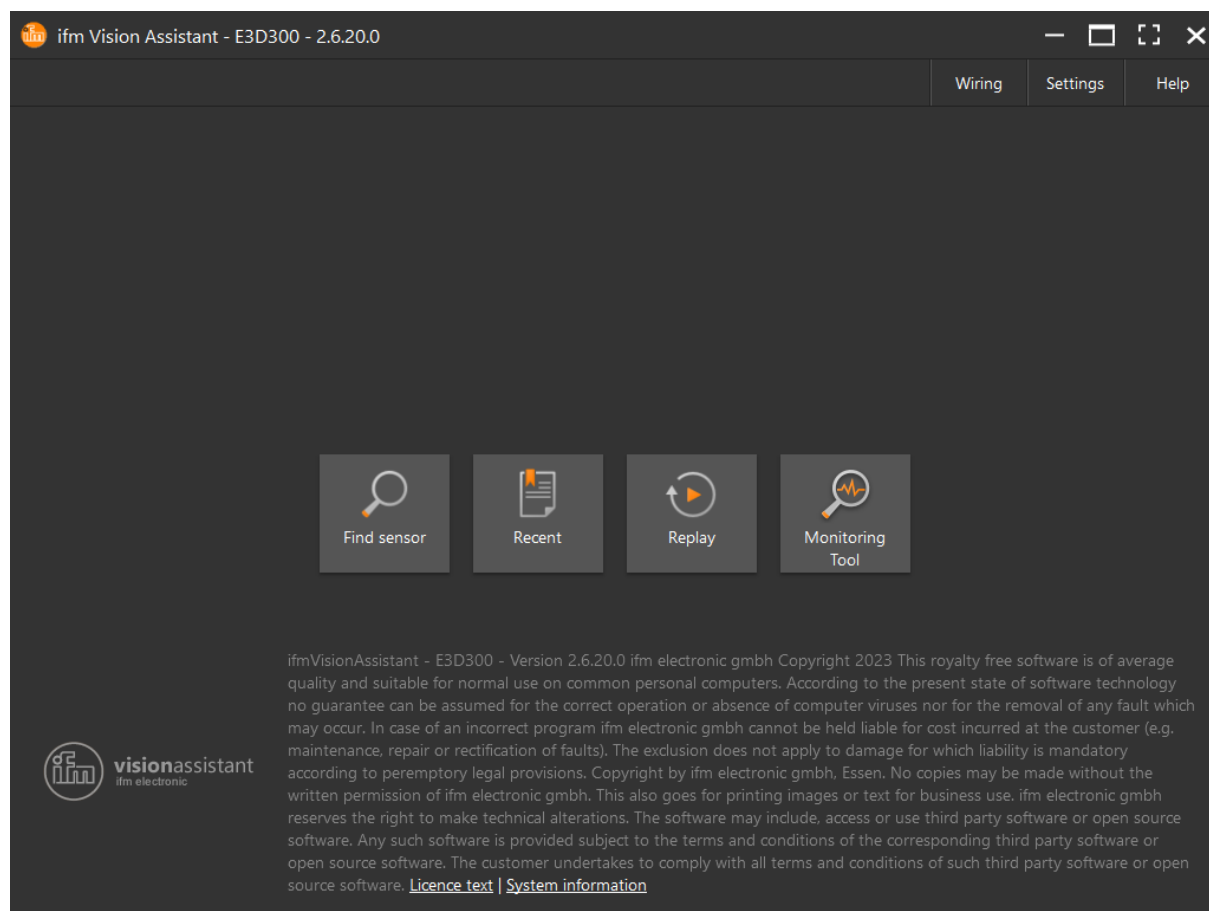


Fig. 1: Start page

Indicator	Name	Description
	Zoom out	Reduces the size of the window.
	Zoom in	Enlarges the window.
	Full screen	Displays the window in full screen.
	Exit	Closes the software.

Tab. 1: Title bar



With the F11 key, you can switch between full screen and window view.

Name	Description
[Wiring]	Displays information on wiring and connection aids.
[Settings]	Sets the language and colour of the user interface.
[Help]	Displays the documentation and contact information of the support.

Tab. 2: Menu bar

Button	Name	Description
	Find sensor	Searches for connected devices and displays them in a list. For this function, the device must be connected.
	Recent	Displays devices that have already been used before in a list. For this function, the device must be connected.
	Replay	Plays back a saved image capture.
	Monitoring Tool	Starts the Monitoring Tool.

Tab. 3: Buttons



If the devices are connected via the [Find sensor] or [Recent] buttons, the [Monitoring Tool] can no longer be started.

- ▶ Start the [Monitoring Tool] and then connect the devices.

7.1 Connecting the device

✓ ifm Vision Assistant software. Download: www.ifm.com.

✓ An IO-Link master. → Accessories: documentation.ifm.com.

- ▶ Connect the device with an IO-Link master. The device is supplied with operating voltage via the IO-Link master.



When using a USB master, the power supply via the USB port is not sufficient. Therefore, an additional external power supply with 24 V DC is required.

- ▶ Connect the IO-Link master to the PC via USB or Ethernet.
- ▶ Install and start the ifm Vision Assistant software on the PC.
 - ▷ ifm Vision Assistant opens with the start page.

Depending on the IO-Link master used, the device is connected to the ifm Vision Assistant in different ways:

- ▶ [Connecting a new device automatically \(→ □ 13\)](#)
- ▶ [Connecting a new device manually \(→ □ 14\)](#)

If a device has already been connected to the ifm Vision Assistant, it can be selected directly via the [Recent] button the next time the software will be started:

- ▶ [Connecting a device already in use \(→ □ 14\)](#)

7.1.1 Connecting a new device automatically

IO-Link master used: e.g. AL1060

- ▶ Click on the [Find sensor] button on the ifm Vision Assistant start page.
 - ▷ The ifm Vision Assistant searches for connected devices. A list shows the devices found and their settings.
- ▶ Click on a found device.
 - ▷ The connection to the device will be established.



If the device is not found:

- ▶ Check the connections and the operating status of the device.
- ▶ Switch off the power supply to the device, restart the ifm Vision Assistant and switch on the device again.
- ▶ Connect the device manually (→ [Connecting a new device manually □ 14](#)).

7.1.2 Connecting a new device manually

IO-Link master used: e.g. AL13xx.

- ▶ Click on the [Find sensor] button on the ifm Vision Assistant start page.
 - ▷ The ifm Vision Assistant searches for connected devices. The device is not found.
- ▶ Click on the message [Manual connection].
 - ▷ The window [Manual connection] is displayed.
- ▶ Click on the required device in the [Select the type of sensor] list.
- ▶ In the [Master type] list, set the connection between the PC and the IO-Link master: [USB] or [Ethernet].
- ▶ Select the master address in the [Master address] list.



The IP address of the master can be configured, for example, with ifm moneo or the Ethernet configuration tool (Hilscher)→ www.ifm.com.

- ▶ In der Liste Port den Port wählen.
- ▶ Click on the [Connection] button.
- ▷ The connection to the device will be established.

7.1.3 Connecting a device already in use

- ▶ Click on the [Recent] button on the ifm Vision Assistant start page.
 - ▷ The ifm Vision Assistant searches for recently used devices. A list shows the devices found and their settings.
- ▶ Click on a found device.
- ▷ The connection to the device will be established.

7.2 Playing back image captures

The [Replay] function plays back a saved image capture. Recordings are saved in the "Monitor" area.

The function contains the following operating elements:

Operating element	Name	Description
	Previous image	Jumps to the previous image.
	Replay	Starts the replay.
	Next image	Jumps to the next image.
	Pause	Pauses the replay.
	Progress bar	Indicates the current position of the replay.
[Open other file]	Open other file	Opens another image capture.

Tab. 4: Operating elements

Playing back image captures

- ▶ Click on the [Replay] button: 

- ▷ A window for opening an image capture is displayed. The image captures are saved in the following folder by default: %appdata%\ifm_electronic\ifmVisionAssistant\capture
- ▶ Select an image capture.
- ▶ Click on the [Open] button.
- ▷ The image capture is displayed.

7.2.1 Converting an image capture

This function converts an image capture into another output format. The image capture is converted via the following operating elements.

Operating element	Type	Description
[Output format]	List	Sets the output format.
[Output file path]	Output field	Displays the set output directory.
[...]	Button	Sets the output directory.
[Output range]	List	Sets the output range.
[Convert]	Button	Starts converting the image capture.



Depending on the output format set, some operating elements are not displayed.

Output format

Output format	Description
[HDF5 ifm streams (*.h5)]	Flexible data container.
[ADTF data capture files (*.dat)]	Proprietary format.

Output range

Output range	Description
[Whole file]	Converts the whole image capture.
[From the current position to the end of the file]	Converts from the current position of the progress bar to the end of the image capture.
[From start to current position]	Converts from the start of the image capture to the current position of the progress bar.
[Only the next image]	Converts the next image of the image capture, viewed from the current position of the progress bar.

Converting an image capture:

- ✓ The saved image capture is opened.
- ▶ Change to the [Convert] section: .
- ▶ Set the file type under [Output format].
- ▶ Select the path and the file name under [Output file path].
- ▶ Set under [Output range] which part of the image capture is to be converted.
- ▶ Click on the [Convert] button.
- ▷ The converted image capture is saved under the selected file path.

7.3 Monitoring Tool

The Monitoring Tool can be purchased as additional software.

The Monitoring Tool contains functions for simultaneous monitoring of several devices. The devices are displayed in dashboards.

In the dashboard view, live images and status messages from the sensors are clearly displayed so that process sequences can be monitored both directly in the production environment and at a central location in real time.



Further information on the monitoring tool can be found at www.ifm.com.

8 Layout of user interface

The user interface is divided into the following areas:

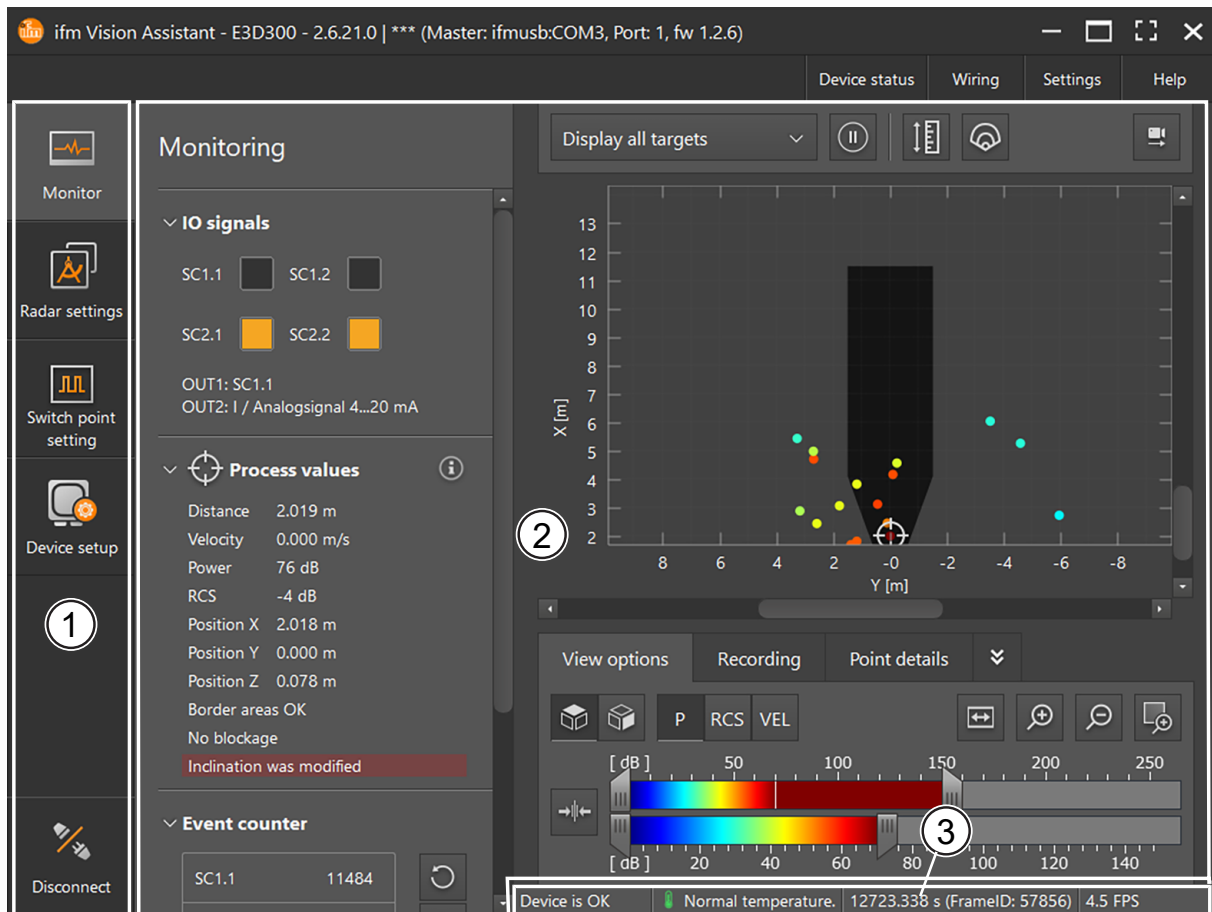


Fig. 2: User interface

- 1: Navigation bar
- 2: Main area
- 3: Status bar

1. Navigation bar

The buttons in the navigation bar are used to switch between the different areas of ifm Vision Assistant.

Button	Name	Description
	Monitor	Displays the received data of the device (→ Monitor 19).
	Radar settings	Displays the setting options for selecting the target reflections (→ Radar settings 25).
	Switch point setting	Displays the setting options for the signal output via OUT1 and OUT2 (→ Switch point setting 32).
	Device set-up	Displays the device configuration (→ Device set-up 36).
	Disconnect	Disconnects from the device.

2. Main area

The main area displays the area selected with the navigation bar. In the example above, this is the [Monitor] area with the status display on the left, the live image on the right and the tabs in the lower screen area.

3. Status bar

The status bar shows current device information:

- The current device status:
 - Normal operating status: "Device is OK".
 - Diagnostic messages: e.g. "Function check"
 - Warnings or error message: e.g. "Maintenance required"
- The temperature of the device: e.g. "Temperature normal"
- The **Frame ID**
- The refresh rate (FPS = frame per seconds) at which the signals from the sensor are displayed in ifm Vision Assistant.

9 Monitor

In operating mode, the [Monitor] section displays the current process values of the target reflections, the output signals of the digital switching channels SC1.1, SC1.2, SC2.1 and SC2.2 as well as the events of the counters.



Fig. 3: Monitor area

- 1: Status indicators
 - IO signals (→ [19](#)) and assignment of the OUT1 and OUT2 outputs
 - Process values (→ [20](#)) of the selected target reflection
 - Status messages about the device
 - Event counter (→ [20](#)): Switching cycles, inclination, covering
- 2: Live image monitor
 - Target reflections
 - Selected target reflection
- 3: Tabs
 - Display options (→ [21](#))
 - Recording (→ [23](#))
 - Point details (→ [23](#))

9.1 Status indicators

9.1.1 IO signals

The [IO signals] section shows the status of the digital switching channels SCx.x. When the switching conditions are fulfilled, the digital LED lights up yellow. The output configuration of OUT1 and OUT2 is also displayed. The switching channels can be freely assigned to the OUTx outputs.

- SC1.1 and SC1.2: Switching channels related to the process value 'distance'
- SC2.1 and SC2.2: Switching channels related to the process value 'velocity'
- OUT1: Output assignment at pin 4 (switching channel SCx.x)
- OUT2: Output assignment at pin 2 (switching channel SCx.x or analogue signal)

9.1.2 Process values

The [Process values] section shows the current measured values of the **selected target reflection**. The selected target reflection is marked with a crosshair in the live image.

The following process values are displayed:

- Distance in metres
- Velocity in metres per second
 - Negative sign when the target reflection is moving towards the sensor.
 - Positive sign when the target reflection moves away from the sensor.
- **Power** in decibels
- **RCS** in decibels
- Position X / Position Y / Position Z in metres
- Status messages about the device:
 - Messages about the covering of the device
 - Notification about exceeded limit areas (→ [Range filter](#) □ 26), [Clipping volume](#) (→ □ 27)
 - Message on the inclination of the device (→ [Inclination](#) □ 31)



The process values 'distance' and 'velocity' are used for signal output via the switching channels SCx.x (→ [IO signals](#) □ 19).



Call up explanations for position X / position Y / position Z:

- ▶ Click on the following symbol in the top right-hand corner of the live image: 
- ▶ Click on "Inclination ⓘ" to access additional explanations.

9.1.3 Event counter

This section shows the events of the counters. The counters can be reset individually using the [↺] button.

- Switching cycle counter SC1.1, SC1.2, SC2.1, SC2.2: Number of switching operations at the respective switching channel.
- Inclination: Number of times the set inclination tolerance (→ [Inclination](#) □ 31) is exceeded.
- Covering: Number of times the sensing face is covered. Covering is detected when the sensor can no longer receive signals because, for example, a thick layer of ice, severe soiling on the sensor surface or an object in the blind zone of the sensor covers the sensor surface.

9.2 Live image monitor

The live image shows the target reflections in the **area to monitor** of the sensor as coloured dots.

A list box in the upper image area can be used to select whether all **target reflections**, filtered target reflections or only the **selected target reflection** will be displayed.

The selected target reflection will be marked with a crosshair.

The live image will be continuously updated.

The colours used for the target reflections and the view (top view or side view) can be set ([→ Display options](#) [21](#)).



- Enlarge/reduce live image by scrolling with the mouse button.
- Centre the live image using the right scroll bar.

Display / operating element	Name	Description
	Crosshairs	Marking of the selected target reflection whose process values are displayed in the left image area.
	List: • Display all targets • Display filtered targets • Display process values	Selection of the target reflections to be displayed. The selected target reflection is marked with a crosshair. • All targets: Display of all target reflections detected by the device within the detection area to monitor. • Filtered targets: Display of all target reflections that match the set criteria (→ radar settings) • Process values Display of the selected target reflection. All other target reflections will be hidden.
	Freeze the current result	The live image and the process values in the status display will no longer be updated.
	Measure distance between two points	► Freeze the current result. ► With the mouse button pressed, draw a line between two target reflections. The distance between the two target reflections is displayed in the live image.
	Show detection areas	Showing and hiding the three detection areas of the radar position sensor. The areas are shown in three shades of grey and represent the entire area to monitor . The detection areas are marked with the following symbols: : Area in which a person is detected. : Area in which a corner reflector with an edge length of 50 mm is detected. : Area in which a car is detected. In order for a target reflection to be detected, it must have a sufficient RCS value.

Tab. 5: Live image operating elements

9.3 Display options

With the [View options] tab, the display of the live image can be adjusted.

Operating element	Name	Description
	Switch to top view	Shows the sensor's field of view in top view.
	Switch to side view	Shows the sensor's field of view in side view.
P	Power	Opens the colour setting for the process value 'power'
RCS	RCS	Opens the colour setting for the process value 'RCS'
VEL	Velocity	Opens the colour setting for the process value 'velocity'

Operating element	Name	Description
	Colour range	The colour of the target reflections can be set using the two sliders: The colour range is from dark blue (= lowest measured value) to turquoise, green, yellow orange and dark red (= highest measured value). The colour setting applies to the process value selected via the P, RCS or VEL button. There is no colour setting for the process value 'distance' because the distance can be checked via the coordinates in the live image.
	Button	Automatically adjusts the colour range.
	Upper slider	Sets the colour range roughly.
	Lower slider	Sets the colour range accurately.
	Fit to window	Adjusts the image area of the live image to the window size.
	Zoom defined area	Enlarges a selectable image area of the live image.
	Zoom out	Reduces the image zone of the live image. The zoom level can also be changed using the mouse wheel.
	Zoom in	Enlarges the image zone of the live image. The zoom level can also be changed using the mouse wheel.

Tab. 6: Operating elements view options

Setting the colour range

- ▶ Select process value with the buttons [P], [RCS] or [VEL].
- ▶ Use the upper sliders to set the required measuring range.



Before setting the measuring range, it may be useful to display the maximum and minimum process values in a selection of relevant target reflections: [Point details](#) (→ [23](#)).

- ▶ Use the lower sliders to adjust the colour spectrum within the range set above: Move the sliders to split up the colour range more finely.
 - ▷ The lower colour range is marked in the upper colour range by white lines.

The reflection points will be immediately updated in the live image according to the colour setting.

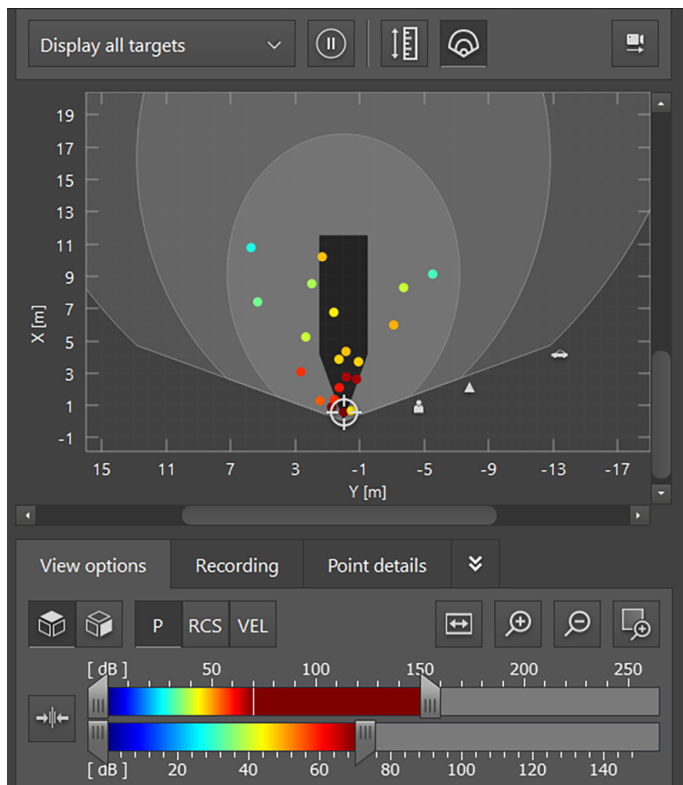


Fig. 4: Colour range example for P (power): The darker the shade of red, the greater the power of the reflection point in dB



By clicking on a colour range, the entire colour range can be moved by holding down the left mouse button.

9.4 Recording

With the [Record options] tab, the measurements of the device can be recorded in a video or image.

Operating element	Name	Description
Duration	List: - Infinite 1 min 2 min 4 min 8 min	Sets the duration of the image capture. Approx. 20 MB/minute are required. If the duration is set to [Continuous], the image capture is limited by the free memory capacity of the data carrier.
File size	List: - No splitting 100 MB 700 MB (CD-R) 1 GB 4.7 GB (DVD-R)	The [No splitting] file size is limited by the free space of the data carrier and the set duration.
	Start/Stop	Starts or stops the image capture. The recording will be saved in a file with the extension "*.h5".
- / 02:00	Image capture time	Shows the duration of the current image capture and the maximum capture time.

Tab. 7: Recording operating element

9.5 Point details

In the [Process values] status indication on the left side of the window, only the process values of the selected target reflection marked with the crosshairs are displayed.

The process values of freely selectable target reflections can be retrieved via the [Point details] tab.

- Selecting an operating element: Highlight a single target reflection by clicking or select several target reflections by dragging a range.
- ▷ The table in the lower part of the screen shows the process values of the selected target reflection. If more than two target reflections are selected, the maximum and minimum measured values of the detected targets will be displayed as well as the number of all detected target reflections within the selection.

Operating element	Description
	Tool for selecting a single target reflection in the live image.
	Tool for selecting a rectangular area and selecting all target reflections contained in it.
	Tool for selecting a circular area and selecting all target reflections contained in it.

Tab. 8: Operating elements point details



The process values of a target reflection are also displayed when the mouse pointer remains on the required target reflection (mouse-over function).

10 Radar settings

In the [Radar settings] area, the settings for selecting the **selected target reflection** can be managed. Changes to the settings will be updated directly in the live image.

In the live image, the same functions as in the [Monitor ([→ Live image monitor](#) [□ 20](#))] area are available.

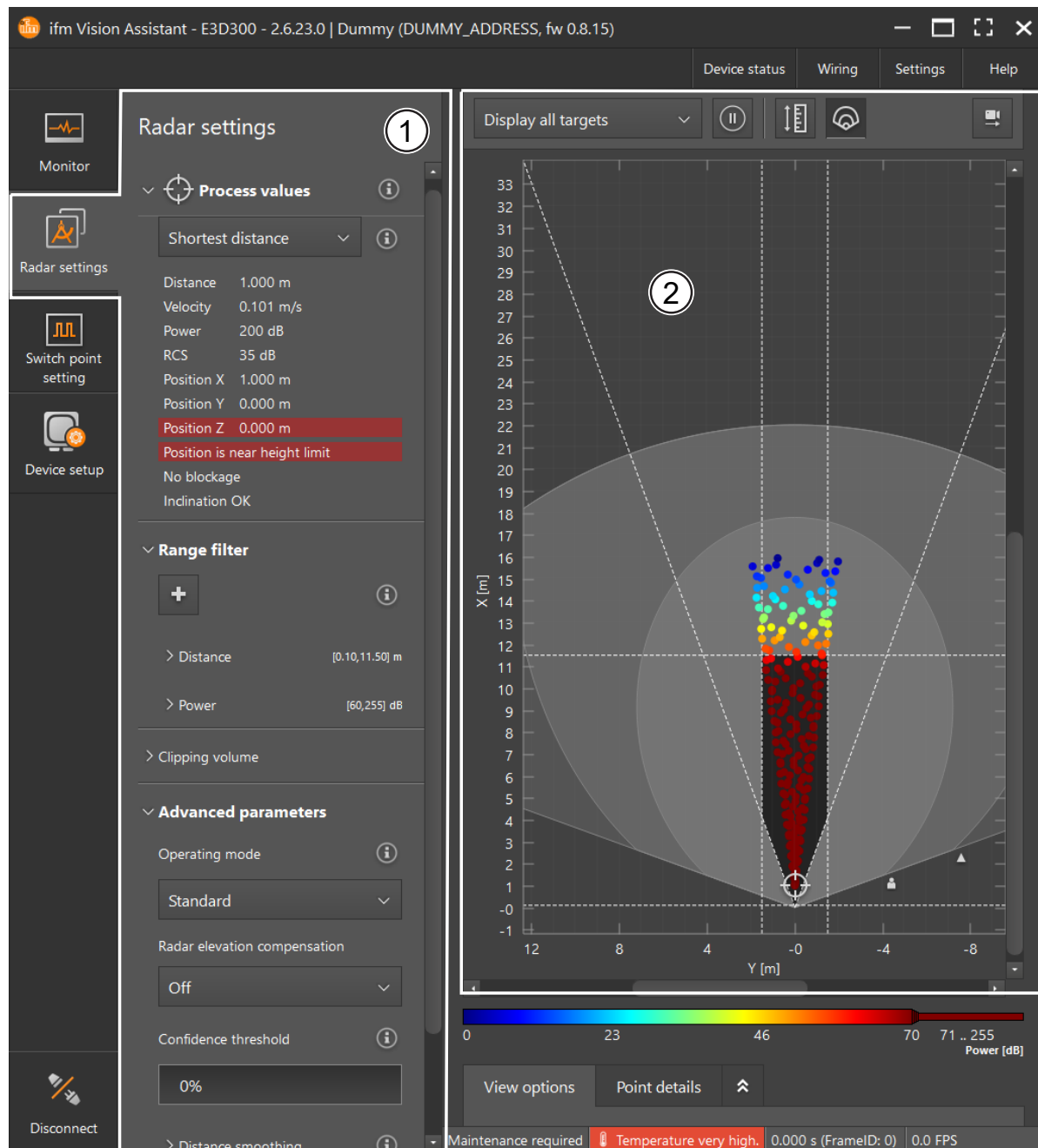


Fig. 5: Radar settings

1: Setting range

- [Radar settings process values](#) ([→ □ 26](#))
- [Range filter](#) ([→ □ 26](#))
- [Clipping volume](#) ([→ □ 27](#))
- [Extended parameters](#) ([→ □ 28](#))

2: Live image radar settings

10.1 Radar settings process values

Only the process values of the **selected target reflection** will be output via the IO-Link interface.

Selecting a selection rule determines according to which the **selected target reflection** will be selected from all detected target reflections.

The selection takes into account the setting of further selection criteria (range filter, clipping volume, extended parameters).

Selection rules

- Shortest distance
- Strongest power
- Strongest **RCS**
- Highest absolute velocity
- Longest distance

Further selection criteria:

- [Range filter](#) (→ [26](#))
- [Clipping volume](#) (→ [27](#))
- [Extended parameters](#) (→ [28](#)).

Parameter setting:

- ▶ Open the list field [∨] and choose a selection rule.
- ▶ Set further selection criteria.
- ▷ The current process values (distance, velocity, power, RCS, position) of the selected target reflection are displayed in the setting area on the left side of the screen.

10.2 Range filter

Threshold values for the process values can be set via the range filter, which reduces the selection of target reflections.



The selection rule for selecting the selected target reflection (→ [Radar settings process values](#) [26](#)) only considers target reflections within the filtered area.

- ▶ Activate the range filter for the process values via the button [+]:
- RCS
- Velocity



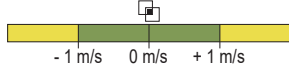
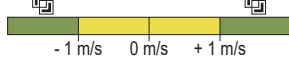
The range filter for power is already available.



There is no range filter for distance, as this filtering is performed by the sensor's field of view, see [clipping volume].

- ▶ Enter the minimum and maximum limits for the respective filter or set them by dragging the handles in the histogram.
- ▷ The filter settings take effect immediately and change the display of the target reflections in the live image.

Operating element	Name	Description
	Deleting a filter	The filter will be deleted after confirmation.

Operating element	Name	Description
	Within the range	Additional criterion for velocity filter:  Only target reflections within the set range are taken into account. In the example shown: Only target reflections with a velocity of less than 1 m/s in positive direction (away from the sensor) or negative direction (towards the sensor) are considered. This also includes static targets (velocity = 0 m/s).
	Out of range	Additional criterion for velocity filter:  Only target reflections outside the set range are taken into account. In the example shown: Only target reflections with a velocity of more than 1 m/s in positive direction (away from the sensor) or negative direction (towards the sensor) are considered, i.e. no static targets.
	Telephoto	Automatic adjustment of the histogram view to the changed settings.

Tab. 9: Filter operating elements

10.3 Clipping volume

The sensor's **field of view** can be set via the clipping volume. The field of view is shown as a black area within the **Detection range**.



The clipping volume has the function of a range filter for distance.



The selection rule for selecting the selected target reflection (→ [Radar settings process values](#) [26](#)) only considers target reflections within the clipping volume.

- Set the top or side view via the [Anzeigeoptionen] tab:  / 
- Display detection areas via the button in the live image: 
- Set upper and lower limits for the clipping volume: Fixed assignment via the input fields in the left setting range or dragging the boundary lines in the live image.
- ▷ The input takes effect immediately. If the previously selected target reflection is no longer within the newly set clipping volume, a new target will be selected.

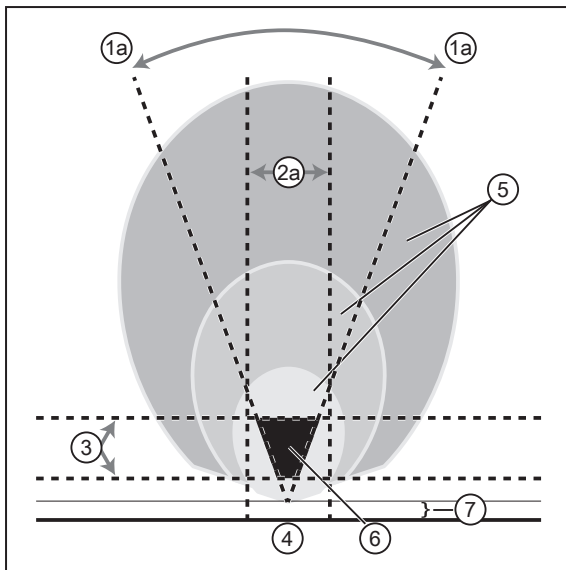


Fig. 6: Volume limitation top view

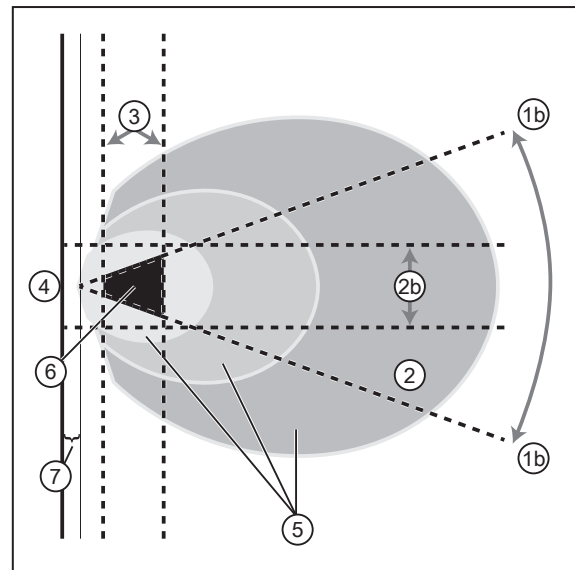


Fig. 7: Volume limitation side view

1a:	Horizontal angle: Angle of aperture with top view to the right and left (-70°...70°)
2a:	Lateral limitation: Straight-line limitation when viewed from above to the right and left
1b:	Vertical angle: Angle of aperture for side view down and up (-25°...25°)
2b:	Height limitation: Straight-line limitation with side view downwards and upward
3:	Distance limitation: Minimum and maximum distance of the object to the sensor
4:	Centre point of the sensor
5:	Area to monitor of the sensor (3 Detection areas)
6:	The sensor's set Field of view (= volume clipping = ROI)
7:	Dead space within which no signal evaluation is possible

Tab. 10: Limit values for the volume clipping



The limit values refer to the centre of the sensing face.
More information → Operating instructions.

10.4 Extended parameters

Additional application-specific settings can be made on the radar sensor via [Advanced parameters] .



The selection rule for selecting the selected target reflection (→ [Radar settings process values](#) □ 26) only considers target reflections that correspond to the extended parameter settings.

10.4.1 Operating mode

By setting the operating mode, it is possible to choose between a higher area to monitor or a higher accuracy:

Operating mode	Standard (factory setting)	Long range
Max. distance	20 m	50 m
Distance resolution	100 mm	360 mm
Max. velocity	± 4.6 m/s	± 15 m/s
Velocity resolution	0.15 m/s	0.38 m/s
Switching frequency	20 Hz	20 Hz



The values are for orientation only. More detailed information can be found in the respective technical data sheets at documentation.ifm.com.

10.4.2 Radar elevation compensation

Radar elevation compensation can be used to automatically adjust the field of view when the position of the sensor changes in the vertical direction (pitch).

- [Off]:
The field of view remains constant when the sensor is tilted (pitched).
- [Ground aligned]:
The field of view is realigned according to the inclination of the sensor. By restricting the Height limitation (→ [Clipping volume](#) □ 27), the viewing area is cut off upwards and downwards.

Factory setting: Off



► In the [View options] tab, switch to side view to see the effect of the [Ground aligned] setting in the live image.

10.4.3 Confidence threshold

The confidence threshold is a measure of the quality of the position of a detected target reflection determined by the sensor. Each position of a target reflection is defined by a confidence value. Target reflections whose confidence values are below the set limit value are filtered out.

- A low confidence threshold increases the number of reflections displayed.
- A high confidence threshold decreases the number of target reflections displayed.

Factory setting: 40%

10.4.4 Smoothing

When smoothing is activated, an exponential moving average will be formed from the process value of the selected target reflection. The smoothing filter reduces fluctuation of the process value in the case of rapidly changing measured values.

Two smoothing filters are available:

- Distance smoothing
- Velocity smoothing

The smoothing filter influences the process value according to the following formula:

$\text{Smoothed process value} = \text{Weighting factor} * \text{current measured value} + (1 - \text{weighting factor}) * \text{moving average value}$

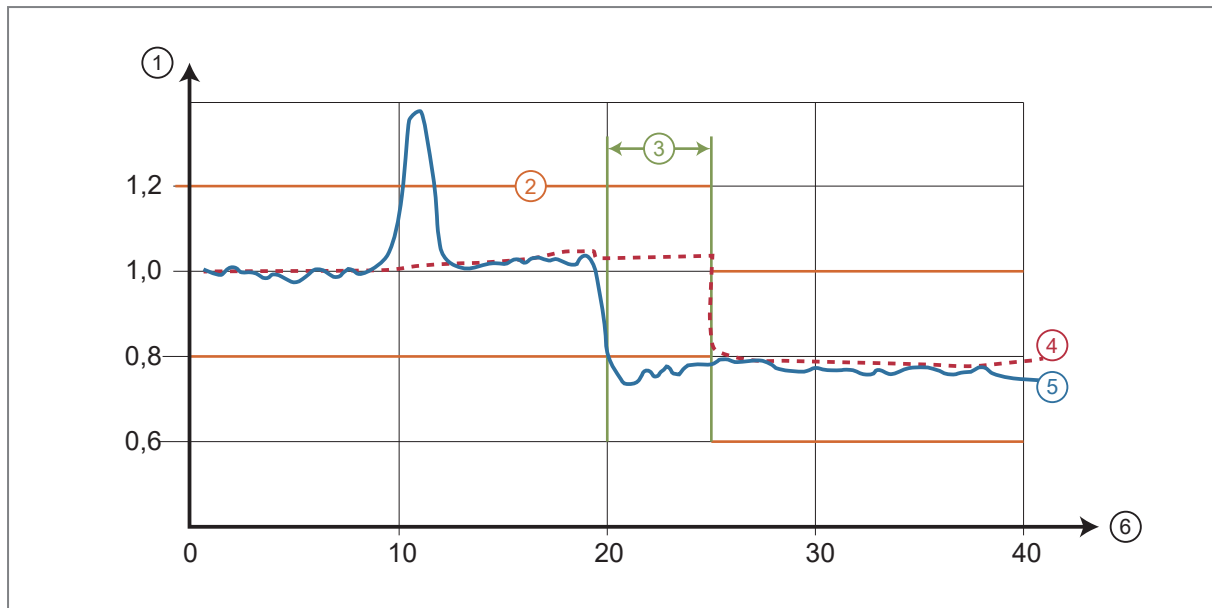


Fig. 8: Influence of the smoothing filter on the process values 'distance' or 'velocity'

- 1: Process value (distance or speed)
- 2: Tolerance
- 3: Duration
- 4: Smoothed process value
- 5: Non-smoothed process value
- 6: Time

Weighting factor

Weighting factor The weighting factor determines how strongly the current measured value is taken into account in the moving averaging of the process value.

Example (compare above formula):

With a weighting factor of 0.1, 10 % of the current measured value will be included in the averaging of the process value (distance or velocity). With a weighting factor of 1, only the current measured value will be output (no averaging).

Tolerance

The tolerance setting can be used to ignore measured value outliers. Current measured values outside the tolerance range will not be taken into account when averaging the process value.

Distance smoothing example:

If the current moving average is set at 1 m and a tolerance of 0.2 m, only distance values of 0.8...1.2 m will be considered.

Duration

The duration is used to set how long an outlier must be outside the tolerance range in order to be taken into account as the current measured value for averaging the process value.

Example:

With a setting of 500 ms, only reflections that occur outside the tolerated distance for longer than 500 ms will be taken into account. However, this only applies if no other target reflection is within the tolerance range during the same time.

Parameter setting:

- Activate the smoothing filter by clicking on the check box.
- Configure the filter by setting weighting factor, tolerance and duration.

10.4.5 Inclination

A change in position of the sensor in vertical or horizontal direction is detected by the sensor. By setting an inclination tolerance, it can be determined from which position change a message is output in the [Monitor] area and counted by the event counter.

Current inclination

The current inclination of the sensor can be defined via two parameters:

- [Pitch]: Vertical inclination up or down along the y-axis
 - [Roll]: Horizontal inclination to the left or right along the x-axis
- Update the current inclination of the sensor with the [↻] button.

Nominal inclination

The nominal inclination describes the required mounting position of the sensor.

- Set the required inclination manually via the parameters [Pitch] and [Roll].

- or -

- Adopt current inclination values of the sensor with the [↕] button.



In the [Monitor] or [Radar settings] areas, a window can be opened with explanations of the X, Y and Z positions and to teach the nominal inclination.

- Click on the following symbol in the top right-hand corner of the live image: .
- Click on "Inclination ⓘ" to access additional explanations.
- Activate the check box at the bottom of the window and click [OK] to accept the current inclination as the nominal inclination.

Inclination tolerance

The inclination tolerance describes the maximum permissible deviation between the current inclination and the nominal inclination.

When the inclination tolerance is exceeded, a message is provided (→ [Event counter](#) □ 20).

- Set the inclination tolerance manually via the [Pitch] and [Roll] parameters.

11 Switch point setting

The OUT1 and OUT2 outputs can be configured in the [Switch point setting] area.

The switching channel SCx.x parameters can be set individually and freely assigned to the outputs OUTx.

The process values 'distance' and 'velocity' of the **selected target reflection** can be monitored via switching signals at OUT1 and OUT2 (selection SCx.x), by an analogue signal at OUT2 (current or voltage signal) and by IO-Link signals at OUT1.

Changes to the settings will be updated directly in the live image.

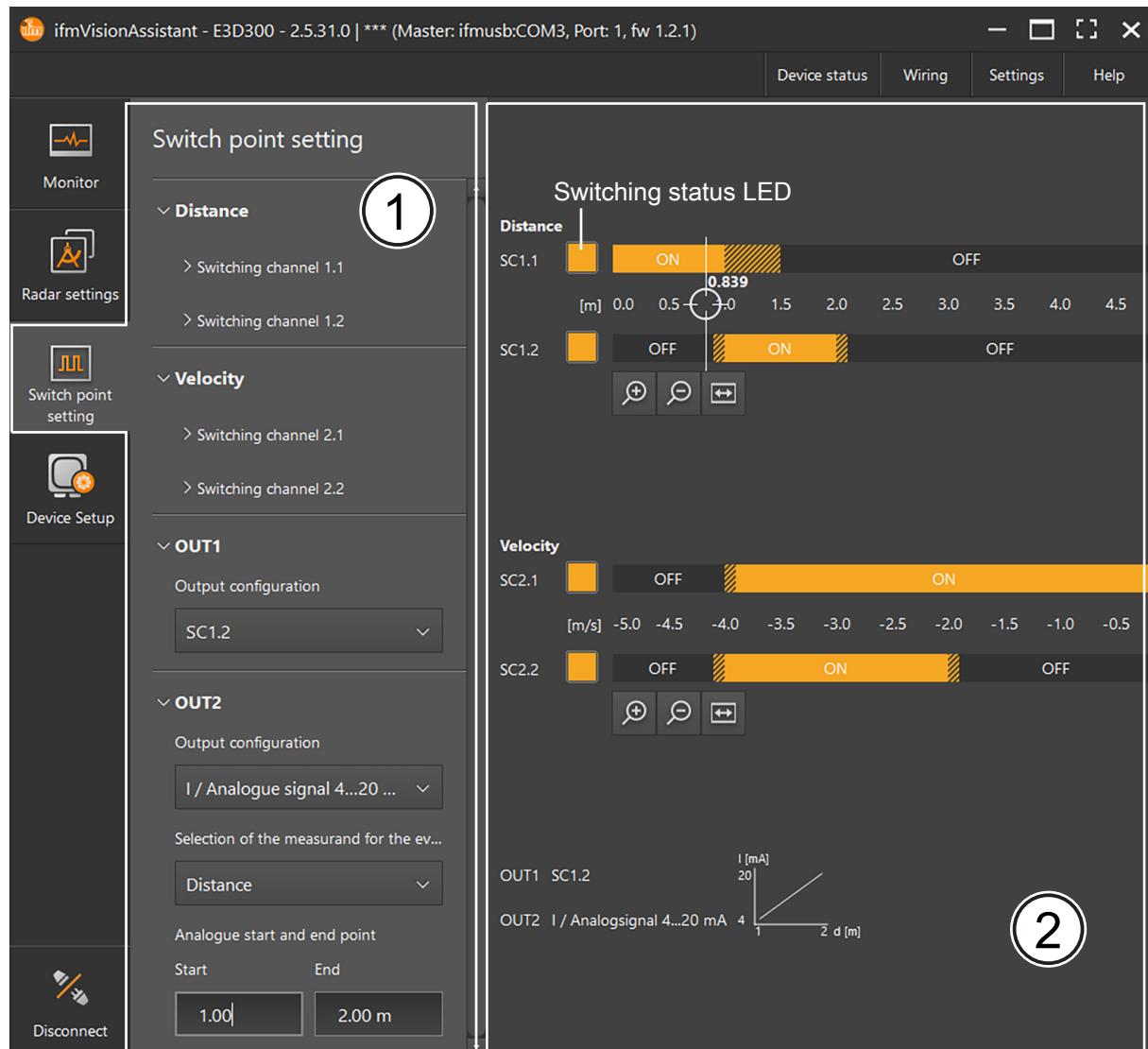


Fig. 9: Switch point setting

1: Setting range

- [Switching channels \(distance or speed\)](#) (→ [33](#))
- [OUT1](#) (→ [34](#))
- [OUT2](#) (→ [34](#))

2: Switch point setting live image

11.1 Switching channels (distance or speed)

In this section, the parameters of the switching channels SCx.x will be set.

- Switching channels 1.1 and 1.2: switching channels for distance monitoring.
- Switching channels 2.1 and 2.2: switching channels for velocity monitoring.

Switch point logic

Depending on the setting of the switch point logic, the hardware output changes its switching status when the switch point is exceeded:

- [High active]:
= normally open → the output will be closed: ON
- [Low active]:
= normally closed → the output will be opened: OFF

Switch point mode

Three switch point modes can be selected for each switching channel. Alternatively, the switching channel can be disabled.

- [Deactivated]:
If the [Deactivated] mode is set for a switching channel, then the switching channel will be permanently in the disabled state regardless of the process value. The data bit in the IO-Link data stream is permanently 0 regardless of the process data value.
- [Single Point]:
Only one switching point (SP1) is set or taught manually. The reset point (rP1) results from the set hysteresis (H).

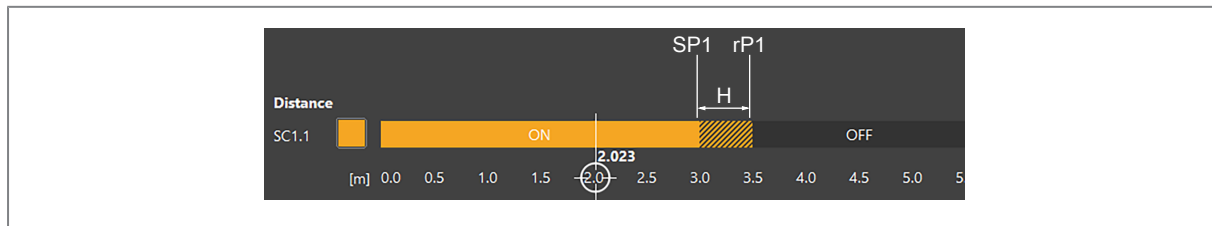


Fig. 10: SC1.1 (distance measurement): "High active" logic; Single-point mode

- [Two Point]:
A switch point (SP1) and a switch-off point (SP2) are set or taught manually.

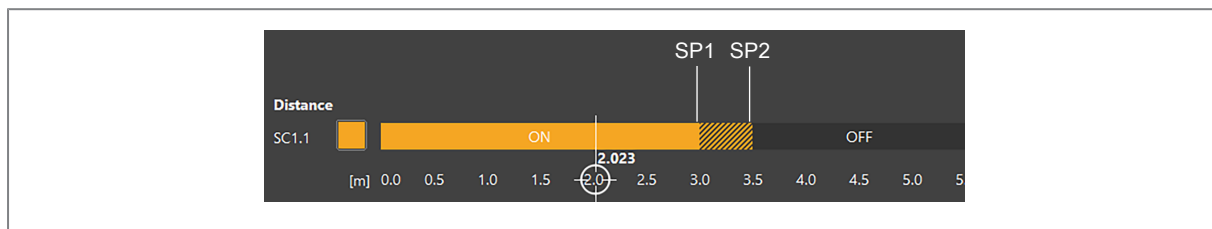


Fig. 11: SC1.1 (distance measurement): "High active" logic; Two-point mode

- [Window]:
Two switch points (SP1 and SP2) are set or taught manually. The two switch points delimit a window area. The reset points (rP1 and rP2) result from the set hysteresis (H).

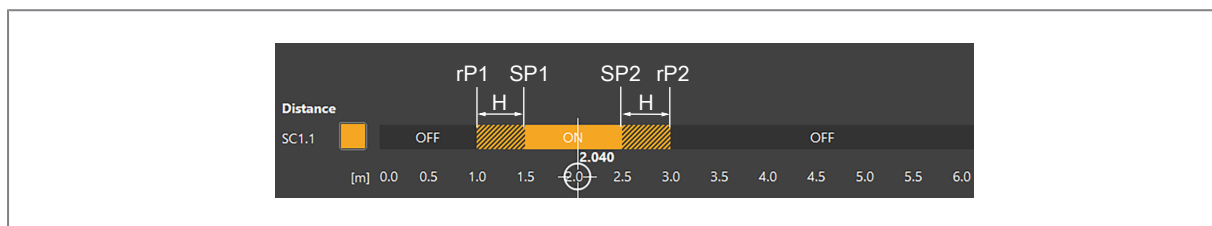


Fig. 12: SC1.1 (distance measurement): "High active" logic; Window mode

Switch point

Depending on the switch point mode, 1 or 2 switch points can be set, see illustrations above.

The switch points must be within the detection range of the sensor → Technical data: www.ifm.com.

When measuring velocity via the switching channels SC2.1 or SC2.2, the switch point can also be in the negative range:

- The velocity of the selected target reflection will be output with a negative sign when the target moves towards the sensor.
- The velocity of the selected target reflection will be output with a positive sign when the target moves away from the sensor.

Hysteresis

The hysteresis can be set for the [Single Point] and [Window] modes. It defines the reset point, see figures above.

Start-up delay

For each individual switching channel SCx.x, a delay time can be set with which the output switches.

Switch-off delay

For each individual switching channel SCx.x, a delay time can be set with which the output is reset.

11.2 OUT1

In this section, the switching channel for output OUT1 is selected to monitor the distance or speed of the selected target reflection.

Monitoring takes place with the parameter set for SCx.x (→ [Switching channels \(distance or speed\)](#) □ 33).

Output configuration

- [Off]:
The physical output OUT1 becomes highly resistive so that no signal can be output. The status of the SCx.x switching channels continues to be transmitted via the IO-Link interface.
- [SC1.1] or [SC1.2]:
Assignment of a switching channel to monitor the distance.
- [SC2.1] or [SC2.2]:
Assignment of a switching channel for velocity monitoring.



If the switch point mode [Deactivated] has been set for the selected switching channel, the hardware output OUT1 is inactive and the IO-Link data stream is still active.

11.3 OUT2

In this section, the switching channel for output OUT2 will be selected to monitor the distance or velocity of the selected target reflection.

Monitoring takes place with the parameter set for SCx.x (→ [Switching channels \(distance or speed\)](#) □ 33).

Alternatively, OUT2 can output an analogue signal proportional to the distance or velocity of the selected target reflection.

Output configuration

- [Off]:
The physical output OUT2 becomes highly resistive so that no signal can be output.

- [SC1.1] or [SC1.2]:
Assignment of a switching channel for distance measurement.
- [SC2.1] or [SC2.2]:
Assignment of a switching channel for velocity measurement.



If the switch point mode [Disabled] has been set for the selected switching channel, the hardware output will be inactive.

- [I / analogue signal 4...20 mA]:
OUT2 outputs an analogue signal between 4 and 20 mA.
- [U / analogue signal 0...10 V]:
OUT2 outputs an analogue signal between 0 and 10 V.

If OUT2 is configured as an analogue output, further fields will appear to set the process value and the analogue signal:

Selection of the measurand for the evaluation

- [Distance]:
The analogue signal refers to the process value 'distance' of the selected target reflection.
- [Velocity]:
The analogue signal refers to the process value 'velocity' of the selected target reflection.

Analogue start / end point

- [Start]:
Lower measured value at which the output signal is 4 mA or 0 V.
- [End]:
Upper measured value at which the output signal is 20 mA or 10 V.

12 Device set-up

Marking

Freely definable identifiers with a maximum length of 32 characters:

- Application-Specific Tag
- Function Tag
- Location Tag

Serial number

The serial number of the device is displayed here and can be copied to the clipboard using the [Copy to clipboard] button.

Output logic

Selection of the output polarity for the physical switching outputs OUT1 and OUT2.

- PNP (negative switching; factory setting)
- NPN (positive switching)

Transmitter configuration

Setting to enable and disable the radar transmitting unit

- Controlled by PDOut: Control through IO-Link communication
- Off: Transmitter permanently off
- On: Transmitter permanently on
- Switch-off via external signal active: Switching off the transmitter via input IN1 (PIN 5)
- Switch-on via external signal active: Switching on the transmitter via input IN1 (PIN 5)

LED mode

The two LEDs indicating the switching status of OUT1 and OUT2 as well as the status LED can be switched off permanently by selecting [Off].

Import / export

The settings made in the ifm Vision Assistant can be saved to a file with the extension *.cfg using the [Export] command. This saves the settings and they can be transferred to the same device or to other devices using the [Import] command.

Factory settings

The device can be reset in 2 ways:

- Reset application:
The device is reset to the default settings. This affects all changed application-specific parameters.
- Factory setting:
The device is reset to the delivery status. This concerns all changed application-specific parameters as well as all writeable device identification parameters (application-specific identifier, installation identifier, location identifier) and the events of the counters.

Find me / identification

The sensor can be located remotely in the system via the IO-Link interface. When using the [Flash on] command, the switching status LEDs will flash. The function can be deactivated via the [Flash off] command.

Glossary

Area to monitor

The area to monitor is the maximum range that can be monitored by the sensor. It can be displayed as a grey area in the live image via the [Show detection areas] button. The area to monitor is divided into several detection areas. A restricted field of view can be set within the area to monitor.

Corner reflector

Corner reflectors consist of three electrically conductive surfaces that are at a 90° angle to each other. Due to this positioning, incident radar waves are optimally reflected to the sensor. Corner reflectors can be used as an adjustment aid or mounted on objects with low reflectivity to increase their RCS value. Corner reflectors can be ordered as accessories from ifm.

Detection ranges

The detection ranges are parts of the area to monitor of a sensor with different target object detectability. The detection ranges serve as approximate reference values and refer to a free field without extraneous reflections.

Distance resolution

The distance resolution describes the minimum distance at which two targets can still be differentiated from each other. At a distance resolution of 100 mm, two targets can be 100 mm close together and still be perceived as two separate targets.

Frame ID

In an FMCW radar (Frequency-Modulated-Continuous-Wave-Radar), starting at a start frequency, the frequencies are continuously scanned until the stop frequency is reached. The difference between the start and stop frequency is the bandwidth. A pass from start to stop frequency is called a chirp and the total of all chirps in a period are called a frame. Each of these frames is described by a unique identifier, the frame ID.

Power

Power (P) is a measure of how well a target is detectable by radar, i.e. how much of the emitted energy is reflected from a target. The higher the P-value, the better the reflectivity and thus the visibility of the target. The P-value depends on the

distance and the position of the object. The performance reflected from the targets decreases with increasing distance from the sensor.

RCS

RCS stands for Radar Cross Section (radar signature) and is a measure of how well a target is detectable by radar, i.e. how much of the emitted energy is reflected from a target. The higher the RCS value, the better the reflectivity and thus the visibility of the target. The RCS value depends on factors such as material, size and angle of incidence, but not on the distance of the reflection target, as long as a reflection is not affected by the distance.

ROI

Region of Interest (ROI) is the area that is taken into account when evaluating the target reflections. Targets outside this area will not be taken into account. The area can be adjusted individually under the radar settings.

Selected target reflection

The selected target reflection is the target reflection selected from the totality of all target reflections via the selection rule (e.g. "Shortest distance") and further radar settings and marked by a crosshair. The process values of the selected target reflection are displayed in the [Monitor] area.

Target reflection

The radar sensor continuously emits electromagnetic waves reflected by objects (targets) and evaluated by the sensor. These target reflections depend on various parameters (see RCS) and are displayed in colour in the live image.

Visible range

The visible range - also referred to as Field of View (FOV) - is the area that can be monitored by the sensor. The maximum visible range is identical with the area to monitor. The visible range can be reduced to a "volume clipping" (Region of Interest = ROI). This can be set in the [Radar settings] area.