QUICKSTART

Ruler E

3D vision

EN

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Sensor Intelligence.

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Detailed addresses and additional representatives and agencies at **www.sick.com**

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1 Safety

- Read the entire Quickstart before using the device.
- Connection, assembly, and settings must be performed by competent technicians.
- Do not connect external I/O signals to the device while it is powered. This may damage the device.
- Do not use the device in areas with risk for explosion.
- Safe operation has a dependency on the selected laser class of the device (see **B**). Carefully study the Laser safety section **A** and the safety instructions in Ruler E Reference Manual.

2 Product Specification

Ruler E is a high-speed 3D camera that can measure up to 10,000 shape profiles/s. The device is factory calibrated and measurements are provided in a metric scale (mm). The camera can also provide gray scale and laser scatter information at the same time.

Ruler E has an in-built light source (laser). It is designed for rough industrial environments, and is protected by a robust IP65 housing. It is available in several variants (see **E**) with options for different fields-of-view, laser power, window material, heating elements for cold environments, and laser scatter measurements.

Ruler E serves as a data streamer, from which the measurement data is transferred through a Gigabit Ethernet connection to a PC for further processing. The Ruler can be started, stopped and configured by applications running on the PC. Note that the 3D Camera Development software is required to build such applications. Ruler E is intended to be the vision component in a machine vision system.

The ISM Radio Frequency Classification is Group 1, Class A (EN55011).

⚠ **Warning:** Class A equipment is intended to be used in an industrial environment.

3 Connections C

Ruler E is connected to a 24 V DC power supply, and to a PC running Windows 7/XP equipped with a Gigabit Ethernet network board.

- The power supply is connected to the Power I/O connector (M12 connector).
- The Gigabit Ethernet board in the PC is connected to the Gigabit Ethernet connector, either directly or through an Ethernet switch.
- I/O signals that are used, for example pulse trigger signals from encoders or an enable signal from a photoelectric switch, are connected to the Power I/O and the Encoder connector respectively (M12 connectors).

4 System Requirements

▸ PC	Recommended: Windows XP Pro 32/64 bit or Windows 7 32/64 bit, at least 4 GB memory, Gigabit Ethernet network card supporting jumbo frames.
▸ Ethernet cable	Up to 70 m using CAT 6 cables. For longer distances or tough environments, opto cables can be used.

5 Installation B

⚠ Ensure that all laser safety requirements for the appropriate laser class system are fulfilled (see **A** and Ruler E Reference Manual).

⚠ Ensure that the Ruler is unpowered during the installation process.

- Install the Gigabit Ethernet board **a** and the 3D Camera Development software **b** on the PC.
- Mount the Ruler in respect to the defined field-of-view **F**, and other equipment to be used by the vision system such as encoder and photoelectric switch.
- If I/O signals are used, such equipment may be connected to the Power I/O via a T-junction **c** or a terminal box **d**. Encoder is connected directly to the Ruler.
- Connect the Gigabit Ethernet connector on the Ruler to a dedicated Gigabit network, or directly to the Gigabit network connector on the PC using a Gigabit Ethernet cable **e**.
- Connect an unpowered 24 V DC power supply **f** to the Power I/O connector on the Ruler.
- Switch on the power supply.

For detailed installation instructions, see the Ruler E Reference Manual that can be found on the 3D Camera Development software CD, or downloaded from:
visionsupport.sick.com

6 Service and Maintenance

The Ruler E contain no user serviceable parts inside. The warranty of the device will be void if opened.

⚠ **Warning:** To avoid hazardous radiation exposure, the power to the laser unit of the Ruler must be turned off before maintenence is performed

- Check screw connections and connectors at regular intervals.
- Clean the housing with a soft cloth, dry or dampened with a mild water diluted cleaning agent without powder additives.

In case of unit failure, please contact SICK or a SICK representative that delivered the unit for further instructions.

7 Further Information

For more information on the Ruler E, please refer to the Ruler E Reference Manual.

For support issues, please visit the online support on:
supportportal.sick.com.

More product information is also available on:
www.sick.com

A

Laser Safety

The legal regulations on laser safety for the laser class of Ruler E must be adhered to.

Ruler E class 3B

is equipped with a Class 3B laser according to EN/IEC 60825-1:2014 and EN/IEC 60825-1:2007. It complies with 21 CFR 1040.10 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007. It cannot be considered as a stand-alone unit and must only be used as part of a laser system which incorporates additional features depending on class 3B.

⚠ **Danger: Ruler E 3B has to be considered dangerous to retinas if exposed. The classification to class 3B leads to the necessity of additional safety requirements which have to be fulfilled.**

- **The user has to name a laser safety officer (follow national standards).**
- **A key-box with a removable key d. Without the key it should not be possible to power-on the laser unit.**
- **A connector readily available for connecting a remote emergency stop and/or remote barrier interlock.**
- **A beam attenuator and an emission indicator must be available in the system.**
- **The device must be integrated into a setup with adequate optical encapsulation according to laser safety regulations (safety interlock and casing).**

Ruler E class 2 (2M)

is equipped with a Class 2 laser according to EN/IEC 60825-1:2014 (2M according to EN/IEC 60825-1:2007). It complies with 21 CFR 1040.10 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

⚠ **CAUTION: Class 2 (2M) lasers emit visible radiation in the wavelength range from 400 nm to 700 nm where eye protection is normally afforded by aversion responses including the blink reflex. However, viewing of the output is hazardous if the user employs optical instruments within the beam or suppresses aversion responses intentionally. Temporary irritating optical influence (glare, flash blindness, after-image) on the human eye can not be excluded, in particular in combination with low ambient light level.**

- **Do not stare into beam.**
- **Do not view the laser beam directly with optical instruments like magnifying glasses.**
- **Do not aim the laser beam of the device at the eyes of a person.**

For both laser classes

- **Reconsider newest laser safety regulations.**
- **Do not open the housing of the device.**

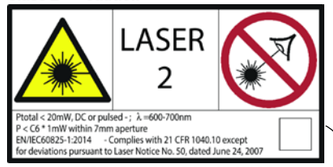
⚠ **Danger: The laser may be activated as soon as the Ruler E is powered on. Avoid direct exposure to the laser beam. Avoid looking at the laser reflection.**

Ruler E is a laser product, and operation using procedures other than those specified herein may result in hazardous radiation exposure.

- During installation and alignment operations appropriate eye protection should be used.
- To sustain these specific laser classes no maintenance is necessary.

Important: Should the Ruler E be included into a system/ casing, so that the laser safety notice signs are hidden, additional signs must be placed beside the exit aperture of the laser beam on the system/casing. Additional signs are not included in the delivery.

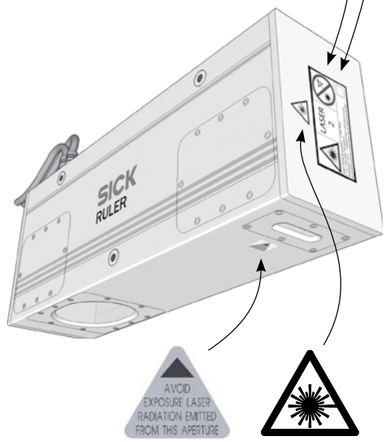
Class 2 – "Caution"



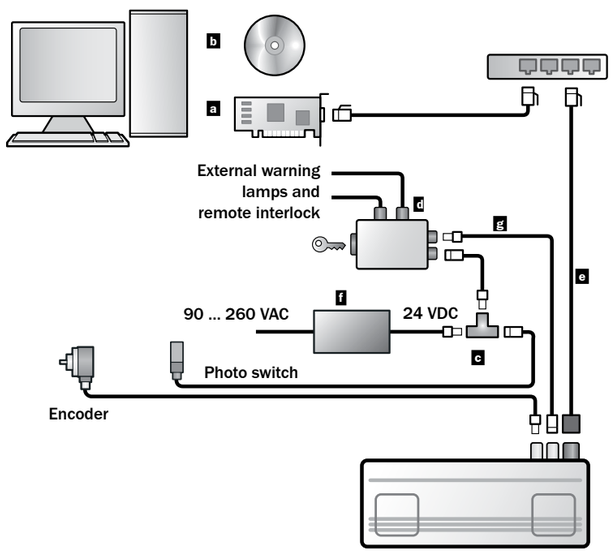
LASER RADIATION - DO NOT STARE
INTO BEAM OR USE WITH MAGNIFIERS
CLASS 2 LASER PRODUCT

Class 3B – "Danger"

WARNING - LASER RADIATION
AVOID DIRECT EXPOSURE TO BEAM
CLASS 3B LASER PRODUCT

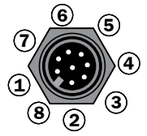


B



C

POWER I/O CONNECTOR



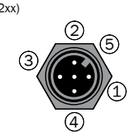
Pin	Signal	Remark
1	In1	Enable (24 V)
2	Power	24 VDC power supply
3	Out1	Reserved (do not connect)
4	In2	Reset (24 V)
5	TRA	TRA RS-485
6	TRB	TRB RS-485
7	GND	Ground
8	In3	Laser power supply (24 VDC)

ENCODER CONNECTOR

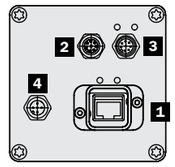
Pin	Signal	Remark
1	In_A+	Phase 1, RS-422 +
2	In_B+	Phase 2, RS-422 +
3	In_B-	Phase 2, RS-422 -
4	In_A-	Phase 1, RS-422 -
5	AUX GND	Encoder ground (<100 mA)
6	–	Reserved
7	In4	Monitor Enable (24 V)
8	Out2	Reserved (do not connect)

HEATING CONNECTOR

(Ruler-Ex2xx)



Pin	Signal	Remark
1	Power	24 VDC power supply
2	GND	Ground
3	GND	Ground
4	Power	24 VDC power supply
5	Out_A	Temperature control



1 Gigabit Ethernet
2 Encoder (M12, 8 pin)
3 Power I/O (M12, 8 pin)
4 Heating (by option) (M12, 5 pin)

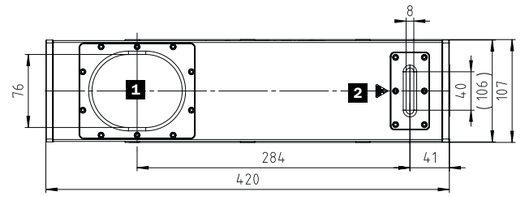
I/O signal levels	Low	High	Remark
Class B outputs (24 V)	0 ... +2.5 V	(U_{supply} - 2.5 V) ... U_{supply}	Max output current: 100 mA (in total)
Device inputs (24 V)	0 ... +2.0 V	+7.0 ... U_{supply}	Reset, Enable, Monitor Pulldown 30 kΩ.

Differential signal	Input voltage range	Input differential Threshold voltage	Differential driver output (min)	Remark
RS-485	–7 ... +12 V	±200mV	±2,0V	Termination 100 Ω
RS-422 (Encoder)	–7 ... +12 V	±200mV	----	Termination 100 Ω

D

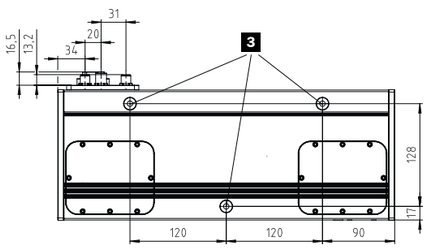
Ruler E600

(Ruler-E2xxx)

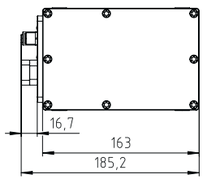


Ruler E1200

(Ruler-E1xxx)

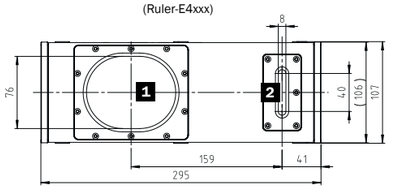


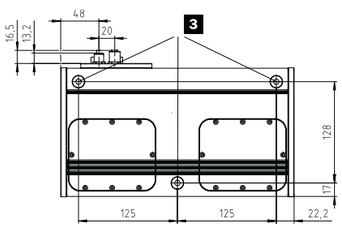
All models



Ruler E150

(Ruler-E4xxx)





1 Image sensor
2 Laser unit
3 Fastening threads (M8 x 15 mm)

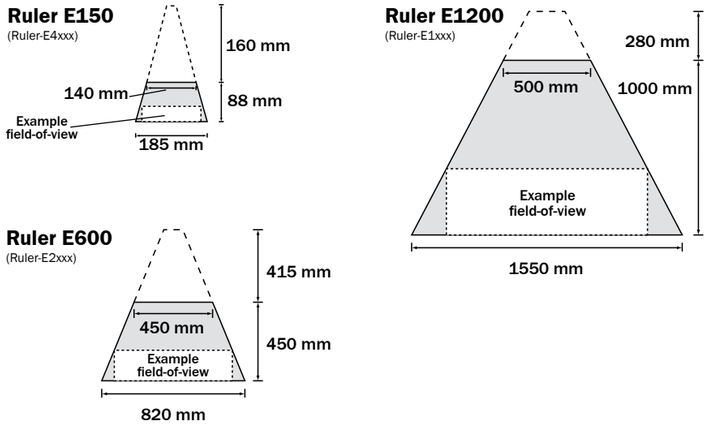
E

Ruler	E150	E600	E600 S	E600 B	E600 SB	E600 HB	E1200	E1200 S	E1200 H	E1200 B	E1200 FH	E1200 SH	E1200 SB	E1200 HB	E1200 SHB
Type	E4111	E2111	E2112	E2121	E2122	E2221	E1111	E1112	E1211	E1121	E1511	E1212	E1122	E1221	E1222
Part number	1044434	1029237	1029238	1028042	1029239	1050303	1028041	1029230	1029231	1029233	1074639	1029232	1029234	1029235	1029236
Performance	10,000 3D profiles/s														
Interfaces	Gigabit Ethernet														
Host platform[1]	PC, Windows 7/XP														
Development environment	.Net Assembly, C, or C++ (VS .NET 2003)														
Synchronisation of data	Free running, photo switch enable, rotary encoder trig														
Encoder interface	RS-422														
Max. encoder frequency	2 MHz														
Digital inputs	3 x HIGH = 10 V ... 28.8 V														
Digital outputs	-														
Heating Output						Class B; <100mA			Class B; <100mA		Class B <100mA	Class B; <100mA		Class B; <100mA	Class B; <100mA
Supply voltage	24 VDC ± 20%														
Current consumption	<1 A, continous current <8 A and inrush current <20 A when using the heating														
Ripple	<5 Vpp														
House Dimensions (L x H x D)	295 x 163 x 107 mm	420 x 163 x 107 mm													
Weight	5.1 kg	7.0 kg													
Enclosure rating	IP 65														
Housing material	Aluminium, surface grey varnished. Connectors: nickel-plated brass.														
Window material	Float glass, AR coated.	Float glass, AR coated	Float glass, AR coated	Float glass, AR coated	Float glass, AR coated	Float glass, AR coated	Float glass, AR coated	Float glass, AR coated	Float glass, AR coated	Float glass, AR coated	PMMA	Float glass, AR coated	Float glass, AR coated	Float glass, AR coated	Float glass, AR coated
Shock load	15 g, 3 x 6 directions														
Vibration load	5 g, 58 ... 150 Hz														
Laser class[2]	2 (2M)	2 (2M)	2 (2M)	3B	3B	3B	2 (2M)	2 (2M)	2 (2M)	3B	2 (2M)	2 (2M)	3B	3B	3B
Laser wavelength	660 ±15 nm														
Laser filter	60 nm FWHM														
Imager	CMOS														
Max. profile width (pixels)	1536	1536	1536	1536	1536	1536	1024	1024	1024	1024	1024	1024	1024	1024	1024
Typical height resolution[3]	0.05 mm	0.2 mm	0.2 mm	0.2 mm	0.2 mm	0.2 mm	0.4 mm	0.4 mm	0.4 mm	0.4 mm	0.4 mm	0.4 mm	0.4 mm	0.4 mm	0.4 mm
Scatter measurement			Scatter		Scatter			Scatter				Scatter	Scatter		Scatter
Heating elements						Heating			Heating		Heating	Heating		Heating	Heating
Ambient temperature Operation:	0 ... +45 °C	0 ... +45 °C	0 ... +45 °C	0 ... +45 °C	0 ... +45 °C	–30 ... +40 °C	0 ... +45 °C	0 ... +45 °C	–30 ... +40 °C	0 ... +45 °C	–30 ... +40 °C	–30 ... +40 °C	0 ... +45 °C	–30 ... +40 °C	–30 ... +40 °C
Storage:	–30 ... +70 °C														

[1] Recommended PC for Vision System: Windows XP Pro 32/64 bit or Windows 7 32/64 bit, at least 4 GB memory, Gigabit Ethernet network card supporting jumbo frames. (For evaluation purposes, a PC with lower performance may be sufficient)
[2] Class 2 according to EN/IEC 60825-1:2014; Class 2M according to EN/IEC 60825-1:2007. Complies with 21 CFR 1040.10 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007
[3] Typical - the given height resolution is relevant for relative measurements and depends on the object distance from the Ruler and on the 3D algorithm used

F

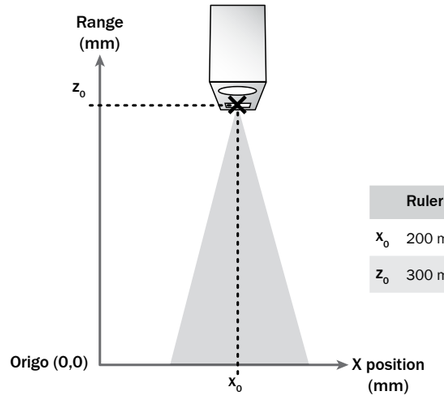
Field of view



	Ruler E150	Ruler E600	Ruler E1200
Example FOV[1]	50 x 150 mm	250 x 600 mm	250 x 1200 mm
Total height range	88 mm	450 mm	1000 mm
Stand-off	160 mm	415 mm	280 mm
Max. distance	248 mm	865 mm	1280 mm
Width at stand-off level	140 mm	450 mm	500 mm
Width at max. distance	185 mm	820 mm	1550 mm
Height resolution[2]	0.05 mm	0.2 mm	0.4 mm
Max. profile rate	10 000 profiles/s	10 000 profiles/s	10 000 profiles/s

[1] Height x Width
[2] Typical - the given height resolution is relevant for relative measurements and depends on the object distance from the Ruler and on the 3D algorithm used

Position of the device in measurements' coordinate system



	Ruler E150	Ruler E600	Ruler E1200
x_0	200 mm	500 mm	1000 mm
z_0	300 mm	1054 mm	2054 mm

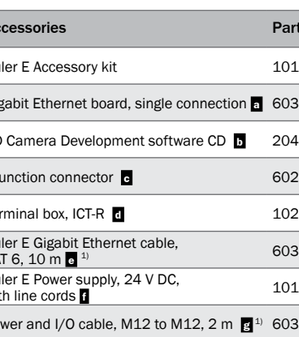
G

Accessories	Part.No.
Ruler E Accessory kit	1014241
Gigabit Ethernet board, single connection a	6032329
3D Camera Development software CD b	2047925
T-junction connector c	6026503 [2]
Terminal box, ICT-R d	1029242
Ruler E Gigabit Ethernet cable, CAT 6, 10 m e [1]	6032322 [2]
Ruler E Power supply, 24 V DC, with line cords f	1014242 [2]
Power and I/O cable, M12 to M12, 2 m g [1]	6030121 [2]
I/O cable, M12 to open, 2 m [1]	6029330 [2]
Encoder cable, M12 to open, 2 m [1]	6029330 [2]
Ruler E Heating cable, 5 m [1]	6032911
RS-422 encoder terminal	6033175
Opto adapter	6032331
Opto fibre, 100 m	1014338

[1] Cables are available in different lengths.
[2] Included in the Ruler E Accessory kit.

H

Max. speed (½ pixel resolution)



Best resolution ($^1/_{16}$ pixel resolution)