

Cognex 3D-L68 Hardware Reference



2024 November 20

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Precautions

To reduce the risk of injury or equipment damage, observe the following precautions when you install the Cognex product:

- The 3D sensor3D sensor requires a UL or NRTL listed power supply with a 24VDC output that meets the following rating requirements:
 - At least 1A1,5 A continuous current.
 - A maximum short circuit current of less than 4A.
 - A maximum power of less than 50VA and marked as a Limited Power Source (LPS) or National Electrical Code (NEC) Class 2.

Any other voltage creates a risk of fire or shock and can damage the components. Applicable national and local wiring standards and rules must be followed.

- This product is intended for industrial use in automated manufacturing or similar applications.
- The safety of any system incorporating this product is the responsibility of the assembler of the system.
- Do not install Cognex products where they are exposed to environmental hazards such as excessive heat, dust, moisture, humidity, impact, vibration, corrosive substances, flammable substances, or static electricity.
- Route cables and wires away from high-current wiring or high-voltage power sources to reduce the risk of damage or malfunction from the following causes: over-voltage, line noise, electrostatic discharge (ESD), power surges, or other irregularities in the power supply.
- Do not expose the image sensor to laser light. Image sensors can be damaged by direct, or reflected, laser light. If your application requires laser light that might strike the image sensor, use a lens filter at the corresponding laser wavelength. For suggestions, contact your local integrator or application engineer.
- This product does not contain user-serviceable parts. Do not make electrical or mechanical modifications to product components. Unauthorized modifications can void your warranty.
- Changes or modifications not expressly approved by the party responsible for regulatory compliance could void the user's authority to operate the equipment.
- Include service loops with cable connections.
- Ensure that the cable bend radius begins at least six inches from the connector. Cable shielding can be degraded or cables can be damaged or wear out faster if a service loop or bend radius is tighter than 10X the cable diameter.
- This device should be used in accordance with the instructions in this manual.
- All specifications are for reference purposes only and can change without notice.

Symbols

The following symbols indicate safety precautions and supplemental information:

 **WARNING:** This symbol indicates a hazard that could cause death, serious personal injury or electrical shock.

 **CAUTION:** This symbol indicates a hazard that could result in property damage.

 **Note:** This symbol indicates additional information about a subject.

 **Tip:** This symbol indicates suggestions and shortcuts that might not otherwise be apparent.

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Safety Labels

LASER LIGHT

DO NOT STARE INTO THE BEAM
CLASS 2 LASER PRODUCT

$P_0 \leq 5 \text{ mW} \mid \lambda = 450 \text{ nm}$

DIN EN 60825-1:2022 / IEC 60825-1:2014



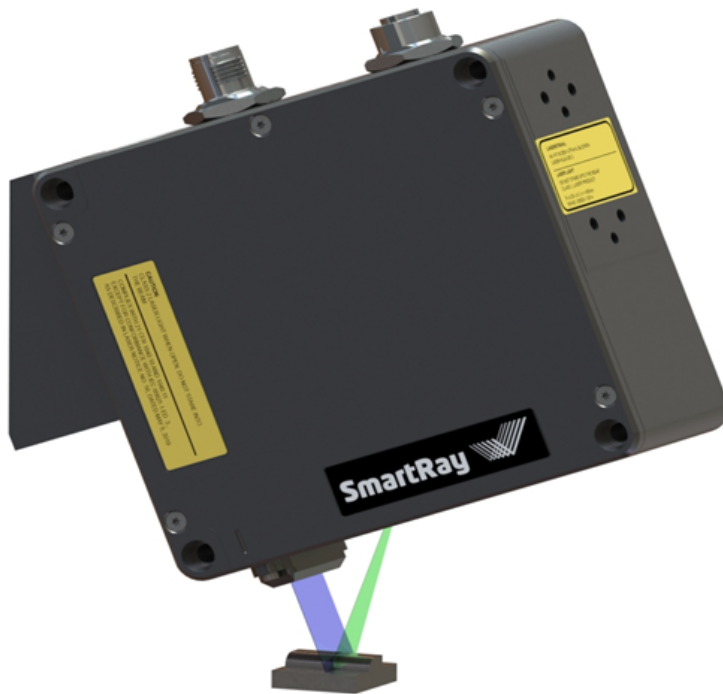
System Components

The Cognex 3D-L68 sensor product consists of the following components:

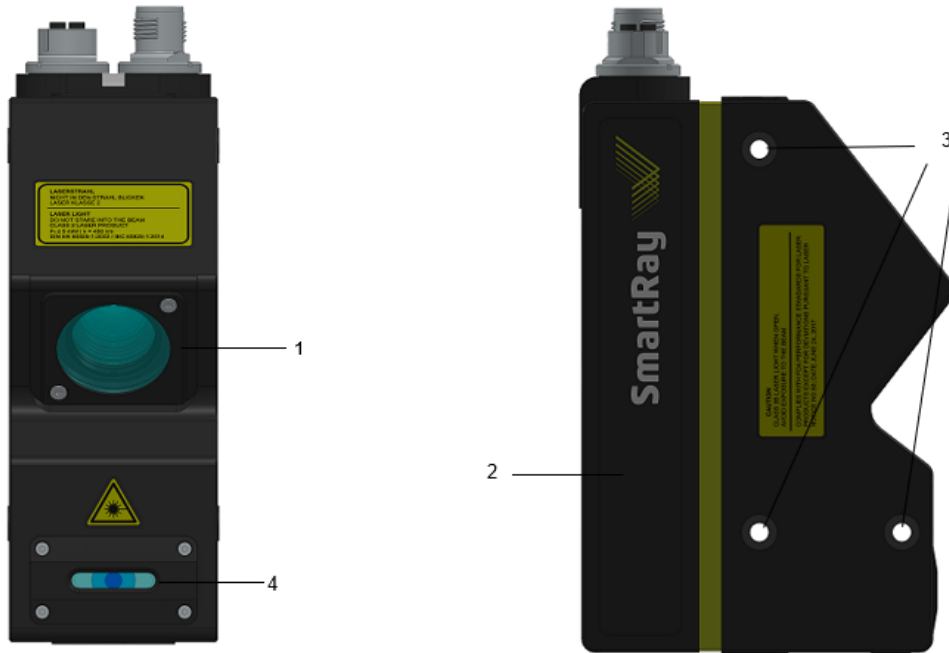
- The 3D-L68 3D sensor model: L68-020-001
- 1x Power-I/O-Encoder cable
- 1x Ethernet cable
- Separated Extra Low Voltage (SELV) power supply

The 3D-L68 Sensor

A triangulation sensor measures objects by imaging the intersection of a uniform planar light source and an object. The sensor projects a sheet of light through a measurement area. The 3D sensor captures this area at an angle, out of the plane of the sheet. When an object passes through the sheet, a laser stripe appears on the object's visible surface, which is imaged onto the detector. The software reduces the image data to a representative profile. Profiles are combined into a range image which contains 3D information (height, volume, etc).

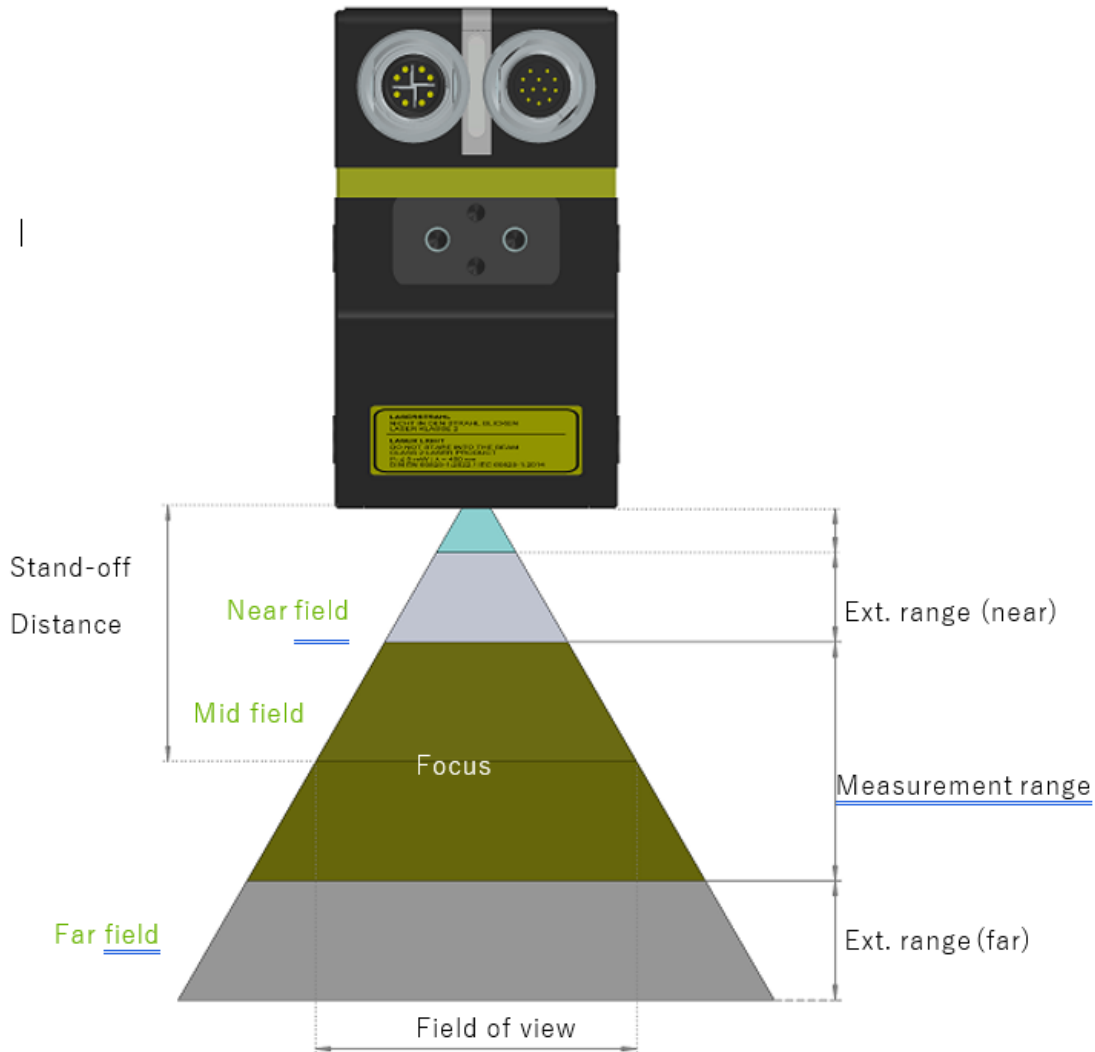


Sensor View Front | Side




Feature	Description
1	Camera
2	Housing
3	Through holes (with additional thread) for mounting screws
4	Laser output

Sensor Specifications



Specification	Description
Typical Field of view (near mid far)	22 mm 25 mm 29 mm
Measurement range	20 mm
Stand-off distance [mm]	64 mm
Typical vertical resolution [μm] (Z)	0.9 μm – 1.4 μm
Typical lateral resolution [μm] (Y)	5.0 μm – 7 μm

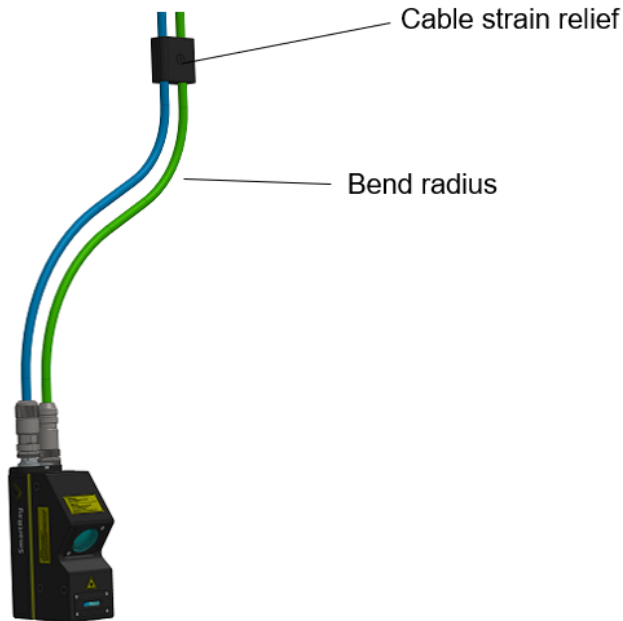
Hardware Specification

Specification	Description
Part number laser class 2; L68-020-001	
Mounting	Specular mount
Weight	742 g
Maximum points / 3D pro- file	4096
Typical scan rate ¹	up to 40 kHz
Typical 3D point rate	up to 163 million points/sec
Interface	Gigabit Ethernet (1 Gbit/sec)
Inputs	2x Inputs (5 – 24 VDC) Quadrature Encoder (AB-Channel, RS-422 standard)
Outputs	2x Outputs, 24 VDC (max. 20 mA)
Trigger	The following triggers are supported: START Trigger support on Input 1 DATA Trigger support on Quadrature Encoder Input (Max. DATA trigger rate: 1 MHz) DATA Trigger support on Input 2 (Max. DATA trigger rate: 5 kHz)
Input voltage Power	24 VDC ± 15% ripple 10 W
Laser wavelength	450 nm
Laser class	2
Maximum ambient light	10,000 lx
EMC test	as per EN 61 000-6-2, EN 61 000-6-4, EN 61326-1:2013-07
Electrical safety	as per EN 61 010-1-3
Protection class	as per EN 61 040-3
Laser safety inputs	24 V DC +/- 15%
Enclosure rating	IP67
Air humidity	Maximum 90%, non-condensing
Temperature (operation storage)	0 – 40° C -20 – 70° C
Compatible accessories	Power-I/O-Encoder cable: 6.320.0XX Ethernet cable: 6.303.0XX in 5m or 10 m

¹ Scan rate and point rate are dependent on the configured field of view (FOV), measurement range and exposure time. The scan by definition considers maximum points/3D pro- file i.e. full FOV. The typical scan/point rate range has been estimated considering an exposure time of 1 µs, min-max MR and full FOV. The typical scan rate can be further boosted by windowing the FOV.

Bending Radius / Strain Relief Device

The following image shows the strain relief device and bending radius of the cables:



	<p>ATTENTION Risk of damage to the cables</p> <p>Going below the minimum bending radius results in damage to the cables and can lead to faulty transfer of signals and data. Any damage leads to mandatory replacement of the cables.</p> <p>Adhere to the minimum admissible bending radius</p>
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The typical bending radius to be used is shown in the following table:

Minimum bending radius (d = diameter)

Installation type	Formula	Minimum bending radius for Cognex cables (d = 7.8 mm)
Fixed	5 x d	39.5 mm
Freely moving	10 x d	79.0 mm
Constantly moving	12 x d	94.8 mm

If the cables are constantly in motion (operating on the robot/axis), it is important to ensure that a strain relief device is mounted, which does not allow transverse and tractive forces on the connector and socket of the sensor.

	<p>ATTENTION Risk of damage to the cables</p> <p>If the cables are constantly in motion (operation on the robot/axis), they can be damaged.</p> <ul style="list-style-type: none"> • Install a strain relief. Make sure that the strain relief does not permit transverse and tensile forces on the plug connector and socket of the sensor. • In case of damage, cables must be replaced.
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Ambient Conditions

Observe the following ambient conditions for your 3D-L68 sensor:

Admissible storage temperature	20 to +70 °C
Relative atmospheric humidity	40 to 90%, non-condensing

Installation

Perform the following steps to install the 3D-L68 sensor and prepare it for operation

1. Check that the sensor maintains the correct "stand-off distance" between sensor and object, according to the technical specifications of the sensor model.
2. Connect the Power-I/O-Encoder cables to the socket on the mounted sensor.

NOTE: Do not power on the sensor.



In order to avoid damage to the sensor, follow these instructions:

- Before you provide power to the sensor, ensure that the corresponding pin of an **unused sensor input** is terminated (mechanically fixed).
- Verify the pin is connected to Ground.
- The input signal voltage must not exceed the operating voltage (VCC).



In order to avoid damage to the sensor, follow these instructions:

- Before sensor power-up, ensure that the corresponding pin of an **unused sensor output** is mechanically fixed in an insulated screw joint.
- Ensure that the pin is **not** connected to Ground.

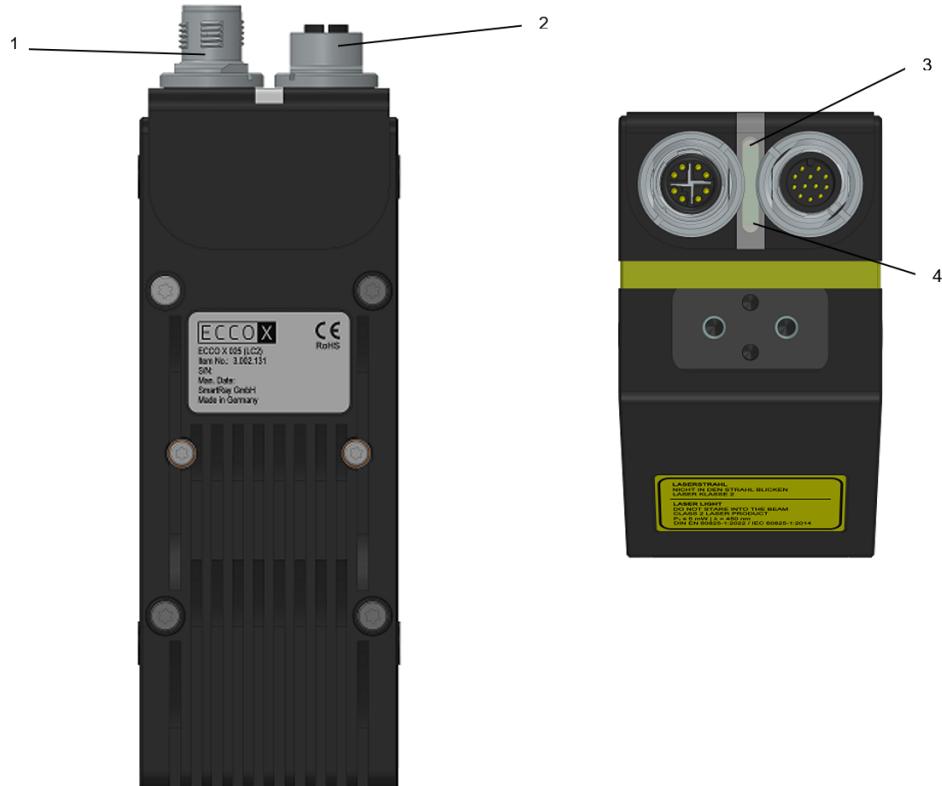
3. Connect the Ethernet cables to the socket on the mounted sensor.
4. Connect the Ethernet cables to the host computer.
5. If necessary, attach a strain relief device.

When laying the cables, pay attention to compliance with the minimum bending radius.

6. Connect the Power-I/O-Encoder cables to a 24 V power supply.
7. Apply the supply voltage.
8. Check readiness for operation.

The Boot status | Connection LED indicates if the sensor is ready for operation and the connection works efficiently.

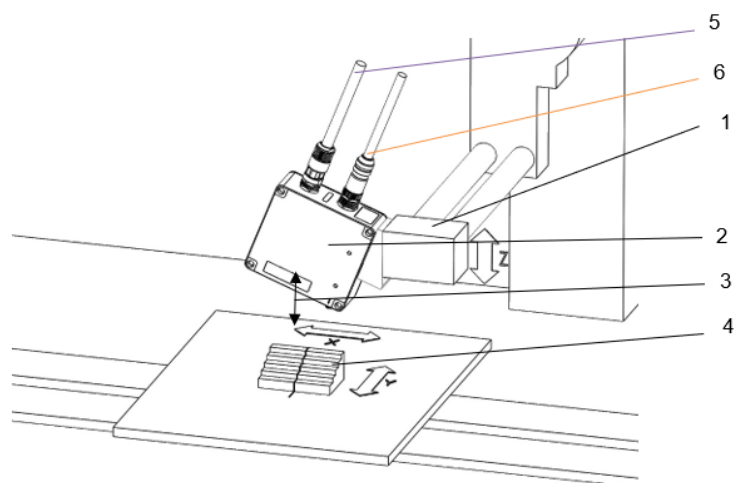
9. Install the SDK to start capturing data from the sensor.



1	Power connector
2	Ethernet connector
3	Boot status LED Connection LED
4	Laser Power LED (Orange)

The 3D-L68 can be damaged by improper handling. Keep the original packaging for shipping the 3D sensor.

- Unpack the sensor and cables from packaging.
- Fix the sensor in place.



Feature	Description
1	Stand / Holder
2	3D sensor
3	Stand-off distance
4	Object for inspection
5	Ethernet cables
6	Power I/O Encoder cables

Laser LED

The Laser LED indicates the following operating states of the laser's sensor:

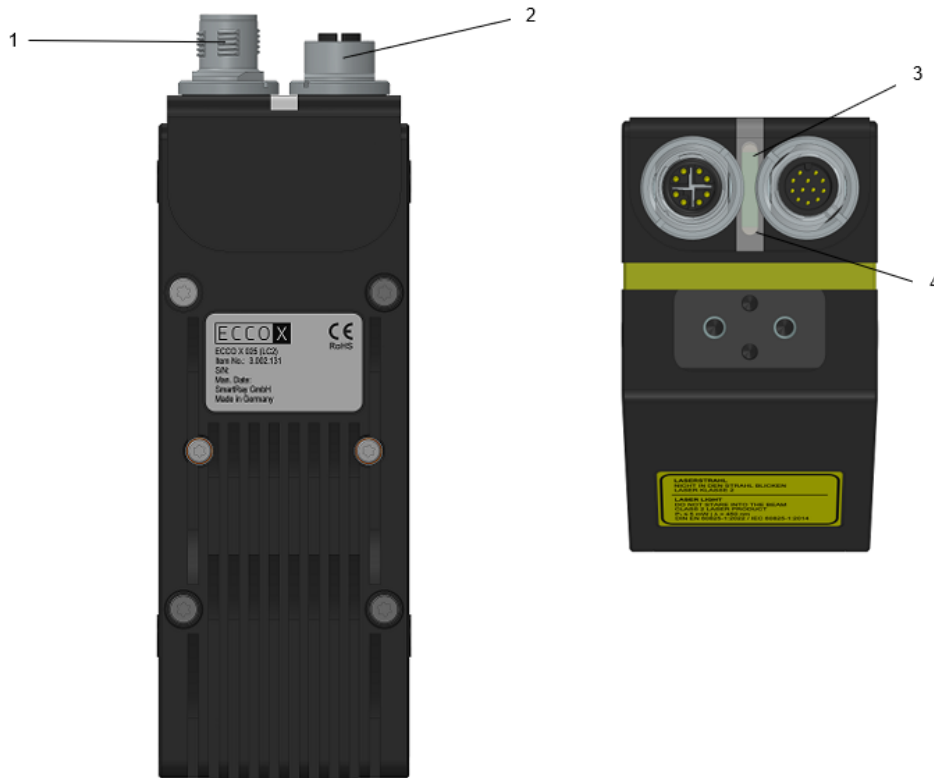
Power LED	Meaning
ORANGE	Laser's sensor is provided with a supply voltage of 24 V

Boot status LED | Connection LED

The Boot / Connection LED indicates the following operating states of the sensor:

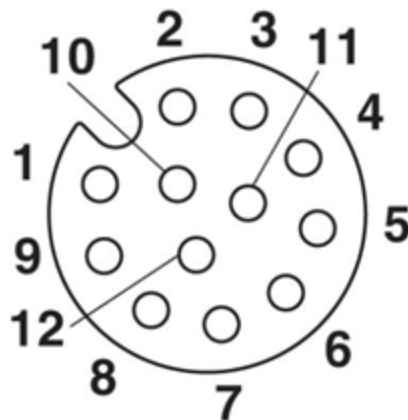
Boot status LED Connection LED	Meaning
WHITE (blinking at slow frequency)	Booting state on power-up
WHITE (blinking at higher frequency)	Boot state (during firmware update)
GREEN (blinking at low frequency)	Boot complete, "Waiting for connection" state
GREEN (blinking at high frequency)	Data acquisition in progress
GREEN (solid)	Connection between host computer and sensor has been established
RED (solid)	Error state
RED (blinking)	Fault detected during self-test mode
YELLOW (blinking)	Self-Test Mode (powering sensor without Ethernet cable connected)

Connecting Cables



Component	Description
1	Power connector
2	Ethernet connector
3	Boot status LED Connection LED
4	Laser Power LED (Orange)

M12 Connector




Pin	Wire Color	Signal	Description
Pin 1	Brown – Blue	Ground	Operating voltage -, 0 V
Pin 2	Brown – Red	VCC	Operating voltage +, 24 VDC \pm 15% ripple
Pin 3	Grey	Input 1	5 – 24 V
Pin 4	Red	Output 2	24 V (max. 20 mA)
Pin 5	Orange	Output 1	24 V (max. 20 mA)
Pin 6	Brown	Encoder B-	RS-422 compliant
Pin 7	Green	Encoder A+	RS-422 compliant
Pin 8	Blue	Input 3	Laser Safety Input-, GND
Pin 9	White - Yellow	Input 4	Laser Safety Input+, 24 VDC
Pin 10	White - Black	Input 2	5 – 24 V
Pin 11	Black	Encoder B+	RS-422 compliant
Pin 12	Yellow	Encoder A-	RS-422 compliant
	Yellow - Green or Black (thick wire)	EARTH	Grounding Shield

Connection Setup

After you have mounted and provided power to the 3D-L68 sensor successfully, establish a connection between the sensor and the host computer. Prior to this, make sure that you have installed the latest version of the supported software development kit (SDK) on your host computer.

Refer to your VisionPro software documentation for details on using a 3D-L68 sensor to acquire 3D image data.

	<p>NOTICE</p> <p>Make sure to configure the IP address of your computer network card to lie in the same range of the sensor's IP address.</p>
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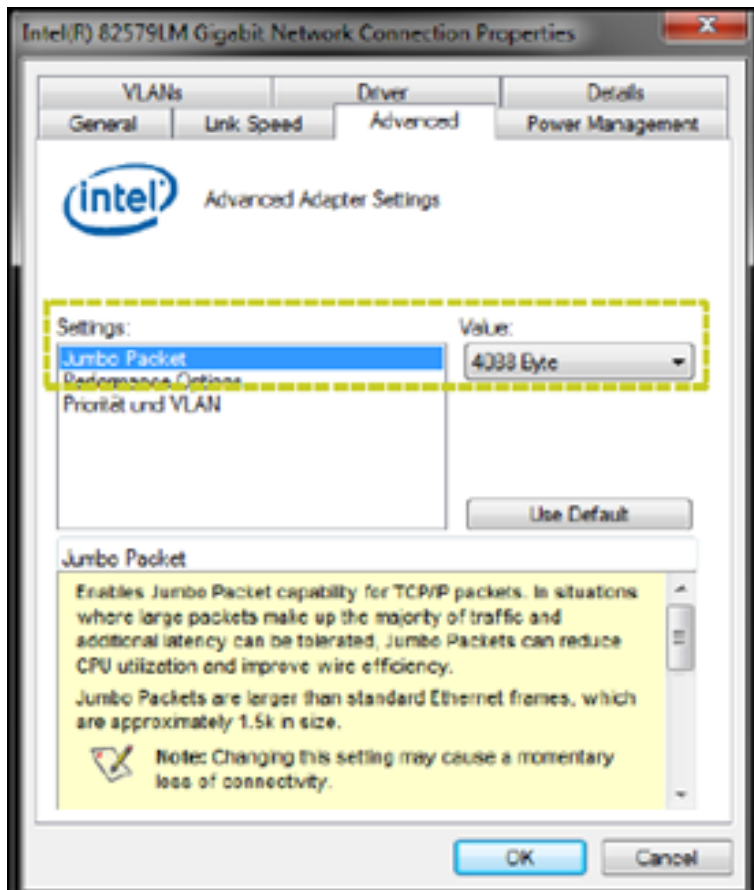
Host Computer

Host computer:

Operating system	Windows 10
RAM	A minimum of 8 GB RAM Cognex recommends 16 GB RAM
Windows Firewall	Cognex recommends disabling the Windows Firewall when using the 3D-L68 sensor

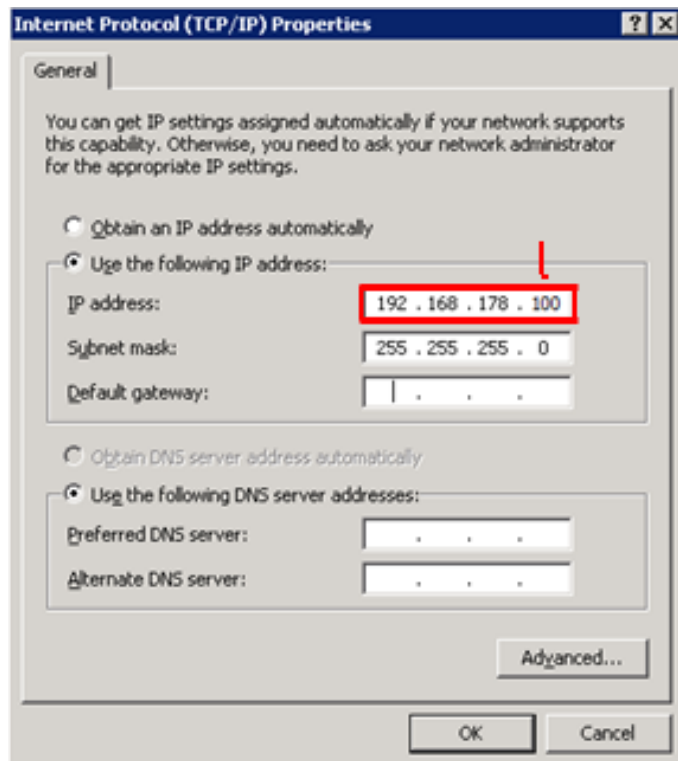
Network Card

Cognex strongly recommends you use an Intel Gigabit Network Card dedicated to the 3D sensor in your production environment. Select a network adapter that support a minimum of 4088 bytes jumbo packet size.



IP Address of the Host Computer

The last three numbers may not be the sensor IP-address (e.g. 200, 201) or 0.



Factory Default 'IP address | Port number'

The sensors shipped by SmartRay is configured with the following standard IP address and port number:

- Default IP address: 192.168.178.200
- Port number: 40

Use the available connection manager to configure the IP address of the sensor.

Capturing Data

After proper installation and connection, the Cognex 3D-L68 is ready for operation.

The 3D sensor generates 3D data of an object line by line, and therefore a relative movement between the sensor and/or the object is necessary to create the complete 3D model of the scanned object.

Data from the 3D sensor can be grouped into 2 parts:

- Non-calibrated data
 - Live Image (Setup & Debug)
 - 3D Profile
 - Intensity
 - Laser Line Thickness
- Calibrated Data
 - Point Cloud
 - Z-map
 - Intensity_{Z-Map}
 - Laser Line Thickness_{Z-Map}

The 3D-L68 distinguishes between two different kinds of coordinate systems:

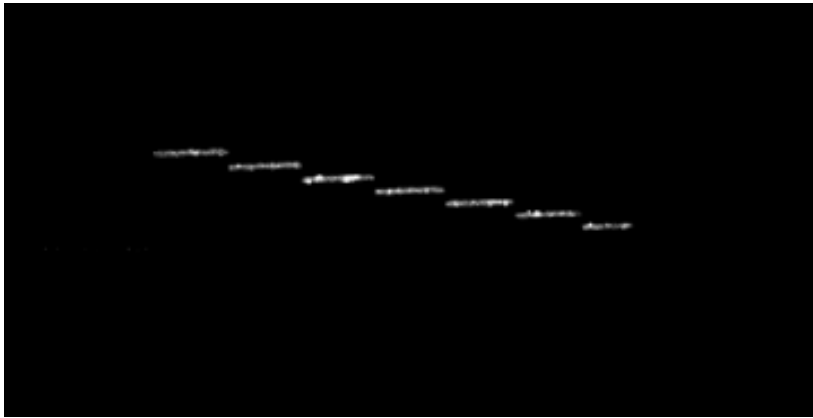
- Image coordinate
(non-calibrated coordinates in pixels)
- World coordinate
(calibrated coordinates in millimeters)

Live Image

The Live Image enables to start the capture of a live video stream from the sensor with the configured sensor parameters (ROI / Exposure / Gain, etc.).

Designation	Description
General	<p>The Live Image represents a normal video stream (i.e. 2D-images type in pixel). The Live Image is very helpful in setting up the sensor parameters and debugging to assist in capturing your 3D-data.</p> <p>Note Using the settings in your VisionPro application, you should setup the Live Image following these tips:</p> <ul style="list-style-type: none"> • Not under-exposed • Not over-exposed • Optimum exposure; the laser line reflected from the object is thin and sharp.
Format/Bit depth	Image / 8, i.e. 8 bits/pixel (range 0 – 255)

A live image example:



Non-calibrated 3D Image Data Types

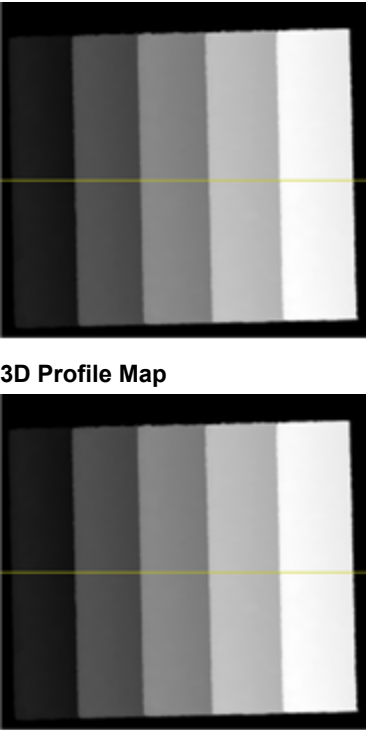
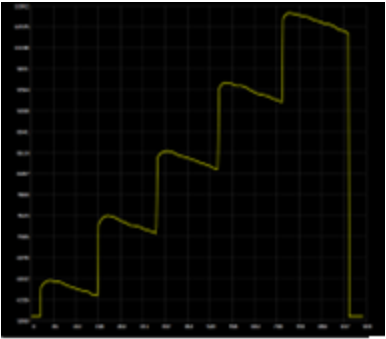
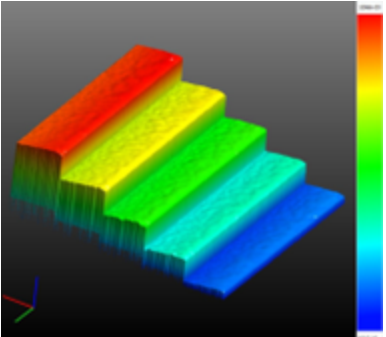
The sensor offers the following Non-Calibrated 3D image formats (in pixel e.g. in image coordinate system):

- 3D Profile
- Intensity
- Laser Line Thickness

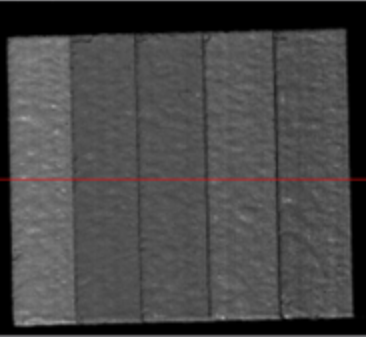
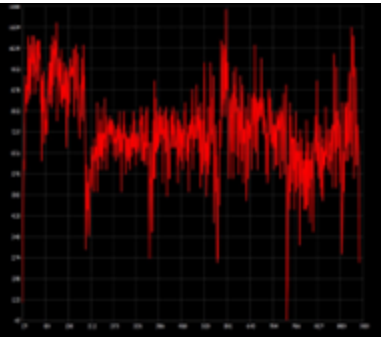
These image formats are abbreviated as PIL (**P**rofile, **I**ntensity, **L**aser Line Thickness).

3D Profile

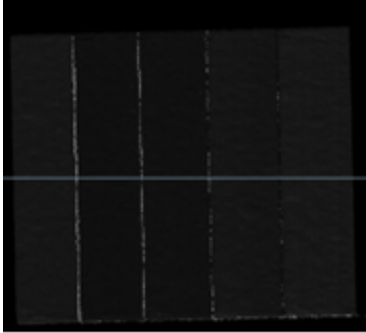
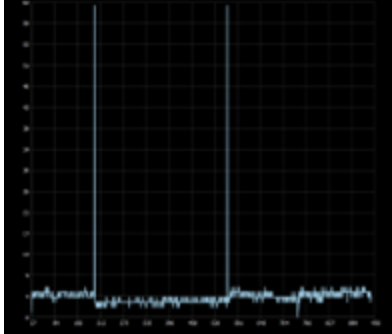
Designation	Description
General	The non-calibrated 3D Profile image is an image, which represents for each pixel the height (Z-dimension) of the scanned object.
Data format	16 bit image (Ex: PNG format)

Designation	Description	
<p>3D Profile example: Bit depth: 16 bits/pixel (range 0 – 65535)</p>	<p>3D Profile Map</p> 	<p>Graphic analysis</p>  <p>3D Visualization</p> 

Intensity

Designation	Description	
<p>General</p>	<p>The non-calibrated Intensity image is an image, which represents for each pixel the intensity of the reflected light from the scanned object.</p>	
<p>Data format</p>	<p>16 bit image (Ex: PNG format)</p>	
<p>Intensity example: Bit depth: 16 bits/pixel (range 0 – 65535)</p>	<p>Intensity Map</p> 	<p>Graphic analysis</p> 

Laser Line Thickness

Designation	Description	
General	The non-calibrated Laser Line Thickness image is an image, which represents for each pixel the thickness of a laser line of the scanned object.	
Data format	16 bit image (Ex: PNG format)	
Laser Line Thickness example: Bit depth: 16 bits/pixel (range 0 – 65535)	Laser Line Thickness Map 	Graphic analysis 

Calibrated 3D Image Data Types

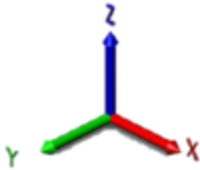
With the help of a calibration file, i.e. a look up table (LUT), that is unique for each and every sensor, the non-calibrated pixel coordinates (X_{Image} , Y_{Image}) are converted to calibrated coordinates (X_{World} , Y_{World} , Z_{World}).

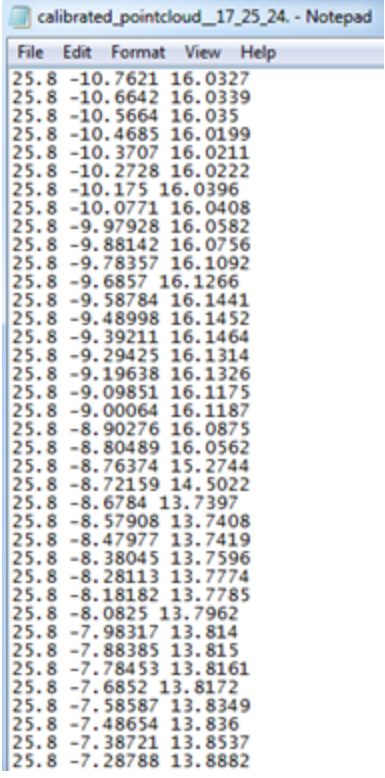
The sensor offers the following calibrated 3D-image formats (in world coordinates X_{World} , Y_{World} , Z_{World} with points in mm):

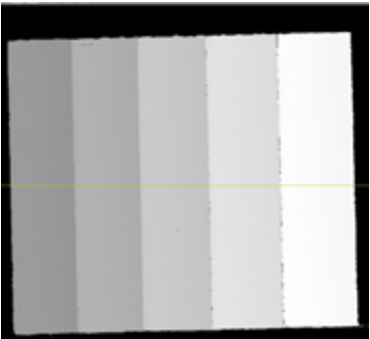
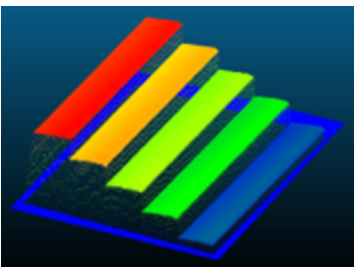
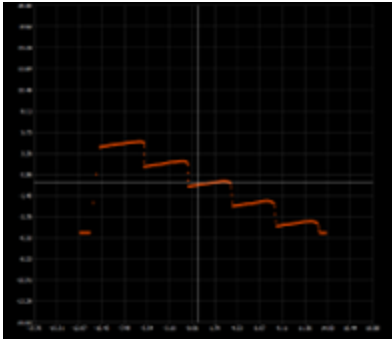
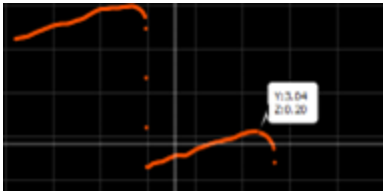
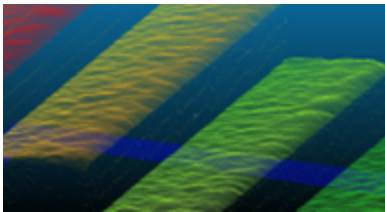
- Point Cloud
- Z-Map
- Intensity_{Z-Map}
- Laser Line Thickness_{Z-Map}

These image formats are abbreviated as ZIL (**Z**-Map, **I**ntensity, **L**aser Line Thickness)

Point Cloud


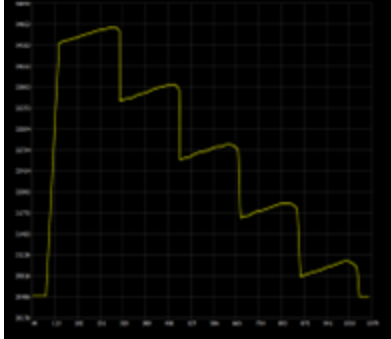
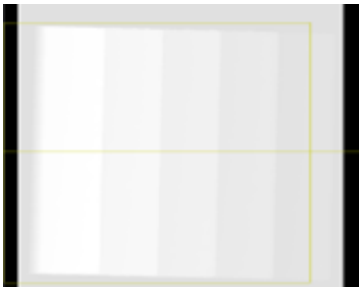
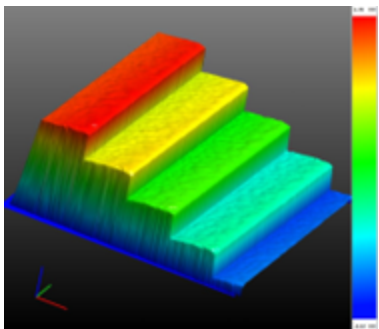
Designation	Description
General	<p>The Point Cloud is a calibrated 3D point cloud, which represents for each point the calibrated point cloud coordinates (X_{World}, Y_{World}, Z_{World}) of the scanned object.</p> 

Designation	Description	
Data format	<p>The calibrated point cloud coordinates (X_{World}, Y_{World}, Z_{World}) are available in the following formats:</p> <ul style="list-style-type: none"> • ASCII (*.asc) • CSV (*.csv) <p>NOTE ASCII-separator: X Y Z ('whitespace' separated), CSV-separator: X,Y,Z ('comma' separated) or X;Y;Z ('semi-colon' separated).</p>	 <p>The screenshot shows a Notepad window titled 'calibrated_pointcloud_17_25_24. - Notepad'. The window contains a list of 3D coordinates in ASCII format, with each line representing a point: '25.8 -10.7621 16.0327'. The coordinates are listed in descending order of their X-value, starting from -10.7621 and ending at -7.28788.</p>

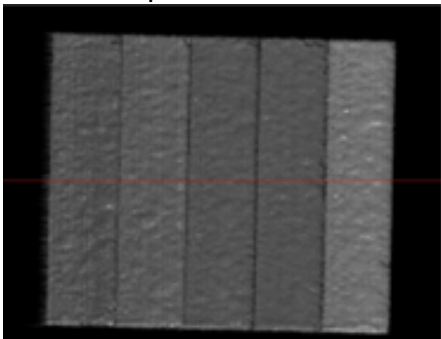
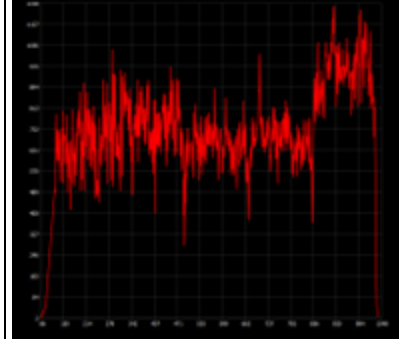
Designation	Description	
Example	<p>3D Profile Map</p>  <p>3D Visualization of a Point Cloud</p> 	<p>Point Cloud of a 3D Profile</p>   <p>3D Visualization of a Point Cloud – close-up</p> 

Z-Map

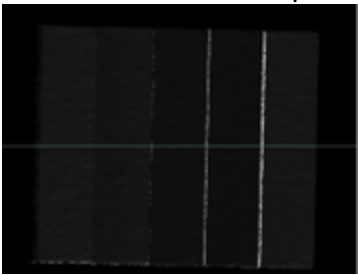
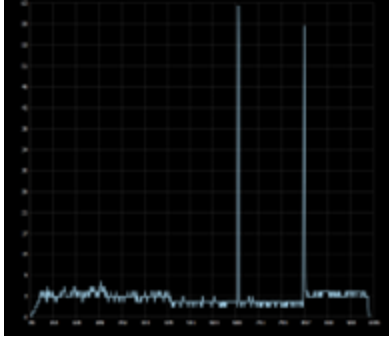
Designation	Description
General	<p>The Z-map is an image, which represents for each pixel the calibrated height (Z-dimension) of the scanned object in world coordinate system.</p> <p>NOTE VisionPro converts calibrated Point Cloud to a Z-map. For more information on decoding your Z-map pixels back to real world units, i.e. in millimeters, refer to your VisionPro software documentation.</p>
Data format	<p>16-bit image (Ex: PNG format)</p> <p>NOTE A pixel with a value 32,768 (2^{15}) reflects a height value of 0 mm.</p>

Designation	Description	
<p>Z-Map example: Bit depth: 16 bits/pixel (range 0 – 65535)</p>	<p>Z-Map</p> 	<p>Graphical analysis</p> 
	<p>Z-Map</p> 	<p>3D Visualization</p> 

IntensityZ-Map

Designation	Description	
<p>General</p>	<p>The Intensity_{Z-Map} image is an image, in which each pixel represents the intensity of the reflected light from the scanned object, additionally realigned to the Z-map.</p>	
<p>Data format</p>	<p>16-bit image</p>	
<p>Intensity_{Z-Map} example: Bit depth: 16 bits/pixel (range 0 – 65535)</p>	<p>Intensity_{Z-Map}</p> 	<p>Graphical analysis</p> 

Laser Line Thickness_{Z-Map}

Designation	Description	
General	The Laser Line Thickness _{Z-Map} image is an image, in which each pixel represents the thickness of the laser line, additionally realigned to the Z-map.	
Data format	16-bit image	
Laser Line Thickness example: Bit depth: 16 bits/pixel (range 0 – 65535)	<p data-bbox="440 405 745 436">Laser Line Thickness_{Z-Map}</p> 	<p data-bbox="917 405 1133 436">Graphical analysis</p> 

Cleaning and Maintenance

Deposits (dirt, dust etc.) on the front glass of the sensor and the glass region from where the laser is emitted can affect the quality of the measurements. Therefore, regular cleaning is recommended.



Disconnect the 3D sensor from the electrical power supply

Return the unit to Cognex for repair work.



Unauthorized constructional modifications to the sensor can have an adverse effect on safety. SmartRay is solely responsible for repairs. Opening the housing will lead to loss of the guarantee.

Customer Service and Support

For repairs and related maintenance-related requests, contact Cognex Customer Support:

[Cognex Customer Support](#)

Cognex Corporation

One Vision Drive



Natick, MA 01760-2059

Sales: +1 855 426-4639

Support: 508-650-4100

Regulations and Conformity

Note: For the most current CE declaration and regulatory conformity information, see the Cognex support site: cognex.com/support.

Safety and Regulatory	
Manufacturer	Cognex Corporation One Vision Drive Natick, MA 01760 USA
	Model Name: Regulatory Model L68-020-001 This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take immediate measures. This equipment complies with the essential requirements of the EU Directive 2014/30/EU. Declarations are available from your local representative.
EU RoHS	Compliant to the most recent applicable directive.
FCC	FCC Part 15, Class A This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
Korea 	Regulatory Model L68-020-001 This device is certified for office use only and if used at home, there can be frequency interference problems.
TÜV	Regulatory Model L68-020-001
	NRTL: TÜV SÜD SCC/NRTL OSHA Scheme for UL/CAN 61010-1.
	CB report available upon request. TÜV SÜD, IEC/EN 61010-1.

L68 is intended to be used indoors only, at altitude ≤2000m above sea level and Pollution degree 2.

中国大陆RoHS (Information for China RoHS Compliance)

根据中国大陆《电子信息产品污染控制管理办法》(也称为中国大陆RoHS), 以下部份列出了本产品中可能包含的有毒有害物质或元素的名称和含量。



	Hazardous Substances 有害物质					
Part Name 部件名称	Lead (Pb) 铅	Mercury (Hg) 汞	Cadmium (Cd) 镉	Hexavalent Chromium (Cr (VI)) 六价铬	Polybrominated biphenyls (PBB) 多溴联苯	Polybrominated diphenyl ethers (PBDE) 多溴二苯醚
Regulatory Model xxxx	X	O	O	O	O	O

This table is prepared in accordance with the provisions of SJ/T 11364.

这个标签是根据SJ/T 11364 的规定准备的。

O: Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB / T26572 - 2011.

表示本部件所有均质材料中含有的有害物质低于GB / T26572 - 2011 的限量要求。

X: Indicates that said hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB / T26572 - 2011.

表示用于本部件的至少一种均质材料中所含的危害物质超过GB / T26572 - 2011 的限制要求。

For European Community Users

Cognex complies with Directive 2012/19/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 4 July 2012 on waste electrical and electronic equipment (WEEE).

This product has required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment, if not properly disposed.

In order to avoid the dissemination of those substances in our environment and to diminish the pressure on the natural resources, we encourage you to use the appropriate take-back systems for product disposal. Those systems will reuse or recycle most of the materials of the product you are disposing in a sound way.



The crossed out wheeled bin symbol informs you that the product should not be disposed of along with municipal waste and invites you to use the appropriate separate take-back systems for product disposal.

If you need more information on the collection, reuse, and recycling systems, please contact your local or regional waste administration.

You may also contact your supplier for more information on the environmental performance of this product.

