Part 2: Hardware guide.

This guide covers electrical, mechanical and environmental aspects of CURRERA-R.

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CURRERA-R Intelligent Vision System overview

CURRERA-R Intelligent Vision System is highly integrated, compact, cost and energy efficient solution for rapid deployment of Machine Vision and Imaging systems using field proven tools and operating systems.

Document Scope

This document covers CURRERA-R hardware related information required for successful planning and implmentation of the CURRERA-R Intelligent Vision System. It contains specifications of electrical interfaces, connectors and their pinouts, mechanical drawings, specifications of operating environmental conditions and other information required for integration and use.

Audience

Engineers, managers and everyone involved in planning, development and deployment of Machine Vision and Imaging Systems based on CURRERA-R.

Document updates and other important information

Please visit our support web site at **www.ximea.com/support** to receive up to date technical information as well as most recent drivers and firmware.

CURRERA-R Online Support and Online Community

We are inviting you to visit the CURRERA online community section at **www.ximea.com/community** to ask for advice regarding any specific questions related to the CURRERA-R as well to contact our technical support and field application engineers any time at **www.ximea.com/support**.

CURRERA-R Models, P/N Decoder

Basic Models table:

CURRERA-R Model P/N:	Sensor Resolution:	Sensor:	Shutter:	BW/Color:	CPU:	RAM:	SSD Storage:
RL04xx	752×480	MT9V034C12STM	Global	B/W	Z530 1.6GHz	1024MB	3.6GB
RL04Cxx	752×480	MT9V034C12STC	Global	Color	Z530 1.6GHz	1024MB	3.6GB
RL13xx	1280×1024	EV76C560ABT-EQV	Global	B/W	Z530 1.6GHz	1024MB	3.6GB
RL13Cxx	1280×1024	EV76C560ACT-EQV	Global	Color	Z530 1.6GHz	1024MB	3.6GB
RL50xx	2592×1944	MT9P031I12STM	Rolling	B/W	Z530 1.6GHz	1024MB	3.6GB
RL50Cxx	2592×1944	MT9P031I12STC	Rolling	Color	Z530 1.6GHz	1024MB	3.6GB

Model P/N Decoder:

R L 50C 24

	Env. protectionn class
R	IP67

	CPU
L	Z530 1.6GHz

	Resolution:	Sensor:	Color:
04	752×480	MT9V034C12STM	B/W
04C	752×480	MT9V034C12STC	Color
13	1280×1024	EV76C560ABT-EQV	B/W
13C	1280×1024	EV76C560ACT-EQV	Color
50	2592×1944	MT9P031I12STM	B/W
50C	2592×1944	MT9P031I12STC	Color

I/O	Digital I/O Type
OC	Open Collector
24	Voltage Logic*

* Voltage Logic according to the IEC 61131-2

System Architecture

CURRERA-R (further referred to as the “device”) is essentially an ultra compact Personal Computer (PC) and Machine Vision Camera, integrated within compact and rugged IP67 class housing.

Its image sensor is connected to the PC via a 2.5Gbit/s high speed data bus. The entire transfer of image data to RAM transfer is highly optimized and requires no CPU resources. All the CPU capacity is available for the Vision or Imaging Software.

The PC is powered by a 45nm technology INTEL ATOM x86 CPU with 1.6GHz processor clock. In further has 533MHz DDR2 data RAM and Solid State Drive (SSD) with error correction and wear balancing. Independent system watch dog processor monitors system health and is capable of restarting the system in the case of a power supply brown out and/or software malfunction.

Interfaces

Similar to the standard PC, CURRERA-R is equipped with complete set of hardware interfaces providing connectivity to standard PC pheripherals including the Gigabit Ethernet, USB, RS-232 and Isolated Digital parallel I/O’s for connection to Automation Interfaces and target hardware integration. One internal Micro SD card slot equpped by 32GB micro SDHC Class 10 card. VGA analog interface is available for connection to a standard PC monitor.

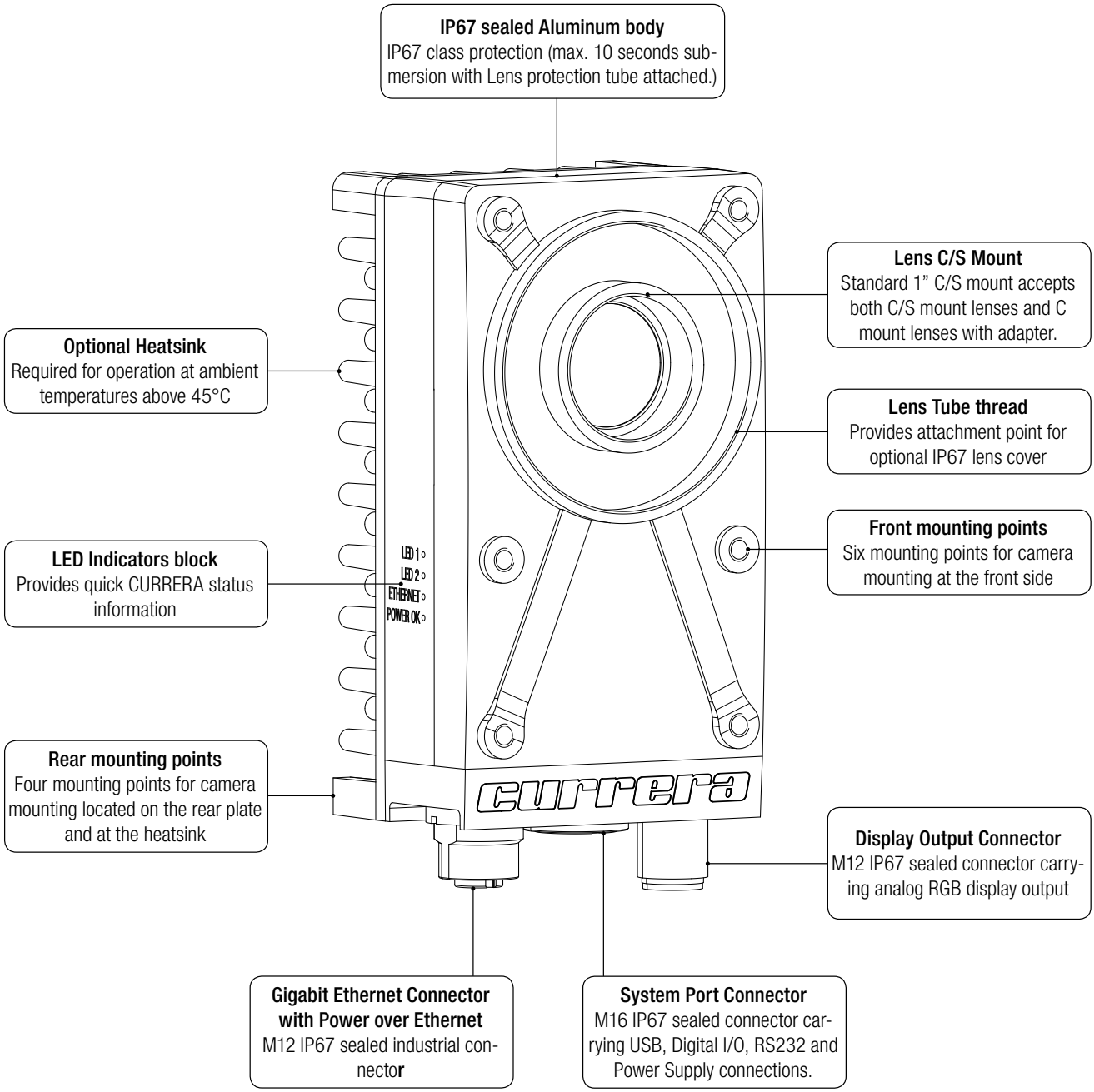
Power supply options and requirements

Versatile power supply options CURRERA-R either over Gigabit Ethernet, using Power Over Ethernet (PoE) standard in a Class 0 device, or through the System Port from external DC source, ranging from 12V to 48V DC. Actual power requirements range will be from 7W to 13.5W depending on the supply voltage and CPU usage.

Hardware and system overview

External hardware features

CURRERA-R shown with heatsink attached



Electrical Interfaces & Connectors

Interfaces list, specifications and precautions

System Port - aggregates following interfaces:

USB 2.0 High speed interface:

Expansion for more than one USB device is possible using a standard powered USB hub or system breakout box. USB Interface and its ground is galvanically connected to the housing. ⚠Maximum DC load of the USB VCC is 100mA peak. Cable must conform to USB standard both in terms of characteristic impedance and shielding.

RS-232 Serial Interface:

Standard RS-232 serial port for up to 1Mb/s transfer rate. Rx and Tx data only, no hardware handshake signals. RS-232 Interface and its ground is galvanically connected to the housing.

Digital Inputs:

Four user configurable, high speed, isolated outputs.
Logic state 0: U<5V, I<0.5mA; Logic state 1: U>11V, I> 5mA

Note1: ⚠Maximum current load per input is 12mA. ⚠Maximum input voltage is 24V DC.
Note2: Valid for units without the I/O suffix: Four user configurable, high speed, isolated current mode inputs with one ground common line. Can by readily used with 5V high side switched sources. ⚠For higher then 5V Vin sources the current shall be limited to 10mA by adding a serial resistor Rs according to the following equation: Rs= (Vin-1.5)/0.01-360

Digital Outputs:

Open collector option (OC I/O suffix): four user configurable, high speed, isolated open collector, low side switched outputs with one common ground line and isolated auxiliary 5V common source. Note: ⚠Maximum current load per switch is 100mA. ⚠Maximum open switch voltage is 24V DC. ⚠No inductive loads are allowed. ⚠Maximum current load for the 5V digital outputs common source is 60mA.

Voltage output option (24 I/O suffix): Four user configurable, high speed, isolated voltage, high side switched outputs with one common ground line and one common voltage supply, according to the IEC 61131-2. Notes: ⚠Maximum current load for each digital output is 1A. ⚠Maximum source voltage 48V. ⚠Minimum source voltage 6V. Note: Valid for units marked without the I/O suffix: Four user configurable, high speed, isolated open collector, low side switched outputs with one common ground line and isolated auxiliary 5V common source. ⚠Maximum current load per switch is 100mA. ⚠Maximum open switch voltage is 24V DC. ⚠No inductive loads are allowed. ⚠Maximum current load for the 5V digital outputs common source is 60mA. See the **"Usage of Digital Inputs and Digital Outputs"** on CURRERA support pages for more information.

Power Supply Input:

Provides optional power supply feed where PoE is not available. 12-48V DC 7-13.5W, maximum allowed ripple 200mV. ⚠Power Supply input is isolated towards the device electronics and the housing and has 200V isolation limitation towards Ethernet signals. Shall your Ethernet wiring require more than 200V isolation, you must use PoE or ensure that your power supply provides required isolationP

Gigabit Ethernet with PoE

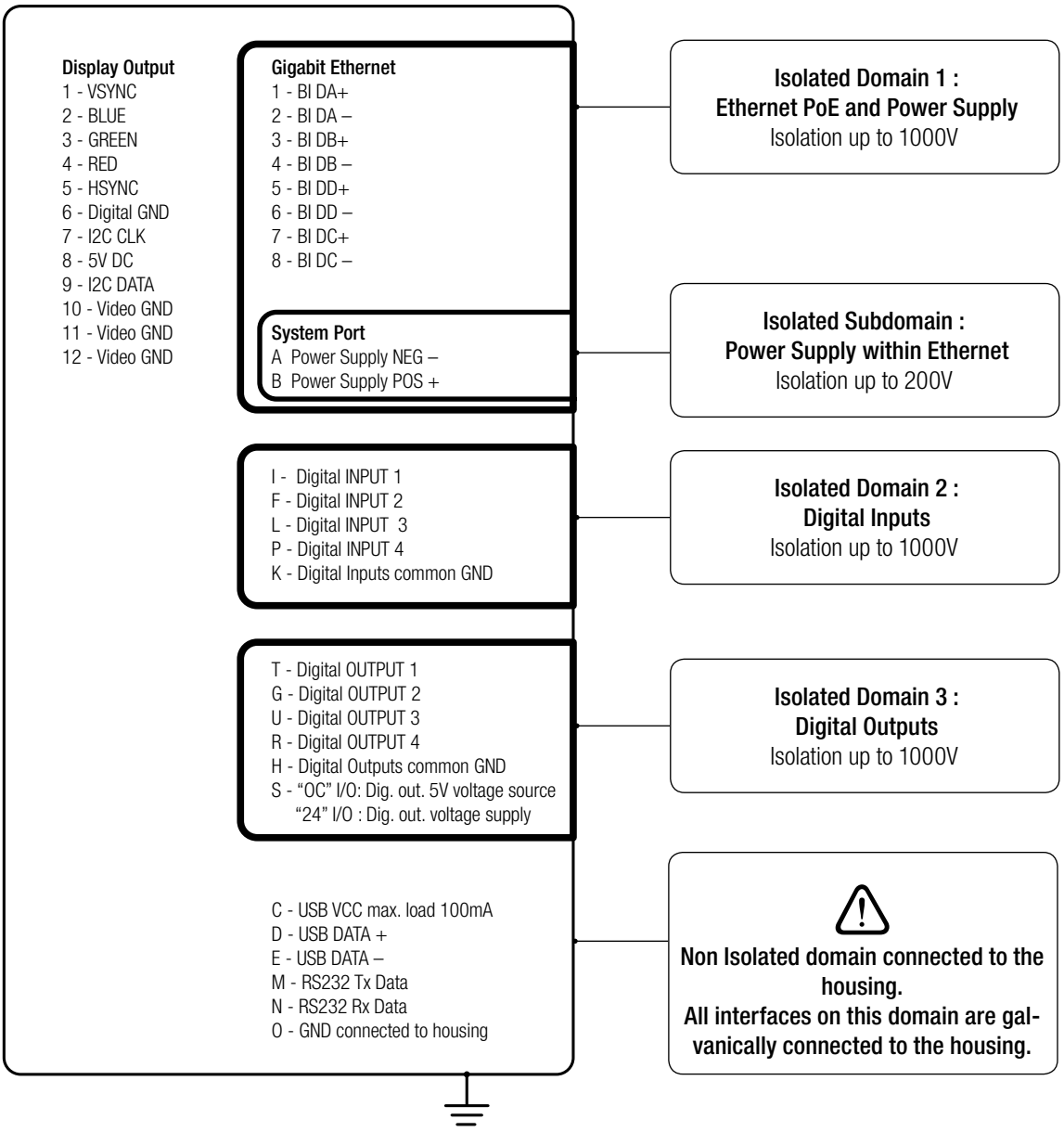
1000BASE-T IEEE802.3af compliant Ethernet interface with Power Over Ethernet (PoE) Class 0.

Display output

Analog RGB display, 75 ohms, VESA compliant with resolution up to 1920x1080 pixels.

Isolation domains & Grounding precautions

Following illustration shows the Galvanically Isolated domains and connectors pins assignment per domain.

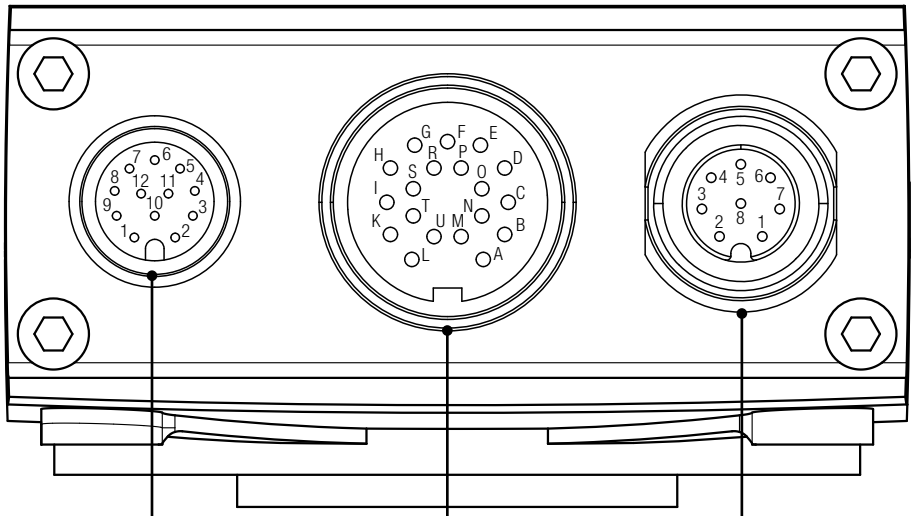


Grounding

⚠Connections to the non-isolated domain interfaces shall be always kept at the same ground potential to avoid ground currents and possible issues or hardware damages.

Electrical Interfaces & Connectors

Connectors, pin assignments and mating connectors



Display output

Pin Nr.	Function:	Comment:
1	VSYNC	
2	BLUE	
3	GREEN	
4	RED	
5	HSYNC	
6	Digital GND	
7	I2C CLK	
8	5V DC	max. load 50mA
9	I2C DATA	
10	Video GND	
11	Video GND	
12	Video GND	
	SHIELD	

M12 male socket, 12 pins
Binder P/N: 09-3491-969-12

Compatible mating connectors:
Binder P/N:
99-1492-822-12
99-1492-812-12
99-1492-992-12

System Port

Pin Nr.	Function:	Comment:
A	Power Supply NEG –	12V - 48V DC 13.5W
B	Power Supply POS +	12V - 48V DC 13.5W
C	USB 5V VCC +	100mA max. load
D	USB DATA +	
E	USB DATA –	
F	Digital INPUT 2	Isolated
G	Digital OUTPUT 2	Isolated
H	Digital outputs COMMON	Isolated
I	Digital INPUT 1	Isolated
K	Digital inputs COMMON	Isolated
L	Digital INPUT 3	Isolated
M	RS232 TX Data	
N	RS232 RX Data	
O	Ground - Chassis	
P	Digital INPUT 4	Isolated
R	Digital OUTPUT 4	Isolated
S	"OC" I/O option 5V output!	max. load 60mA
	"24" I/O option V supply	max. 48V input!
T	Digital OUTPUT 1	Isolated
U	Digital OUTPUT 3	Isolated
	SHIELD	

M16 female socket, 19 pins
Binder P/N: 09-0464-90-19

Compatible mating connectors:
Binder P/N:
99-5461-00-19 ; 99-5461-15-19
99-5461-75-19 ; 99-5661-00-19
99-5661-15-19 ; 99-5661-75-19
99-5461-40-19 ; 99-5861-15-19

Gigabit Ethernet with PoE

Pin Nr.	Function:	Cable wire Color*:
1	BI DC –	WHITE-BLUE
2	BI DD+	WHITE-BROWN
3	BI DD –	BROWN
4	BI DA –	ORANGE
5	BI DB+	WHITE-GREEN
6	BI DA+	WHITE-ORANGE
7	BI DC+	BLUE
8	BI DB –	GREEN
	SHIELD	

* Color codes may vary depending on cable manufacturer

M12 female socket, 8 pins
Binder P/N: 09-3482-275-08

Compatible mating connectors:
Binder P/N:
99-1487-812-08
99-1489-814-08
99-1487-914-08
99-1487-992-08
99-1487-822-08

Notes:
1. Not all combinations of connectors are possible. Please inquire technical support for details.

2. Please see the CURRERA-R system brochure or our online shop for a list of available cables and accessories.

Electrical Interfaces & Connectors

Cables and cabling requirements

Cabling Shielding

In general, all cables connected to the device requires a shielding jacket which must be connected to the interface connector to ensure EMC compliance. No plastic body connectors or unshielded cables are allowed. USB data lines and the monitor port signals require additional internal shield jackets due to signal integrity requirements. It is also recommended to have separate shield jackets on the RS-232 data lines and Digital I/O's to minimise crosstalk.

Cabling Wire gauges

Power supply wire gauges shall provide low enough resistance to supply the camera with at least 12V DC measured across the input terminals and 13.5W load. Ethernet PoE wiring

LED Indicators

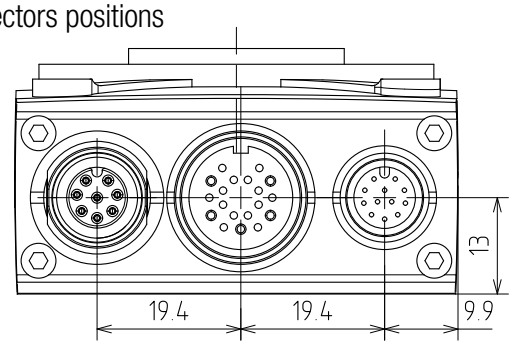
LED 1	- Red	- Software configurable indicator
LED 2	- Orange	- Software configurable indicator
Ethernet	- Blue	- Ethernet Activity
Power OK	- Green	- Power Present, either via PoE or via Power Supply input

Please see the CURRERA-R Quick start guide to learn more about the LEDs configuration options.

Mechanical - dimensions and mounting

Front side mounting

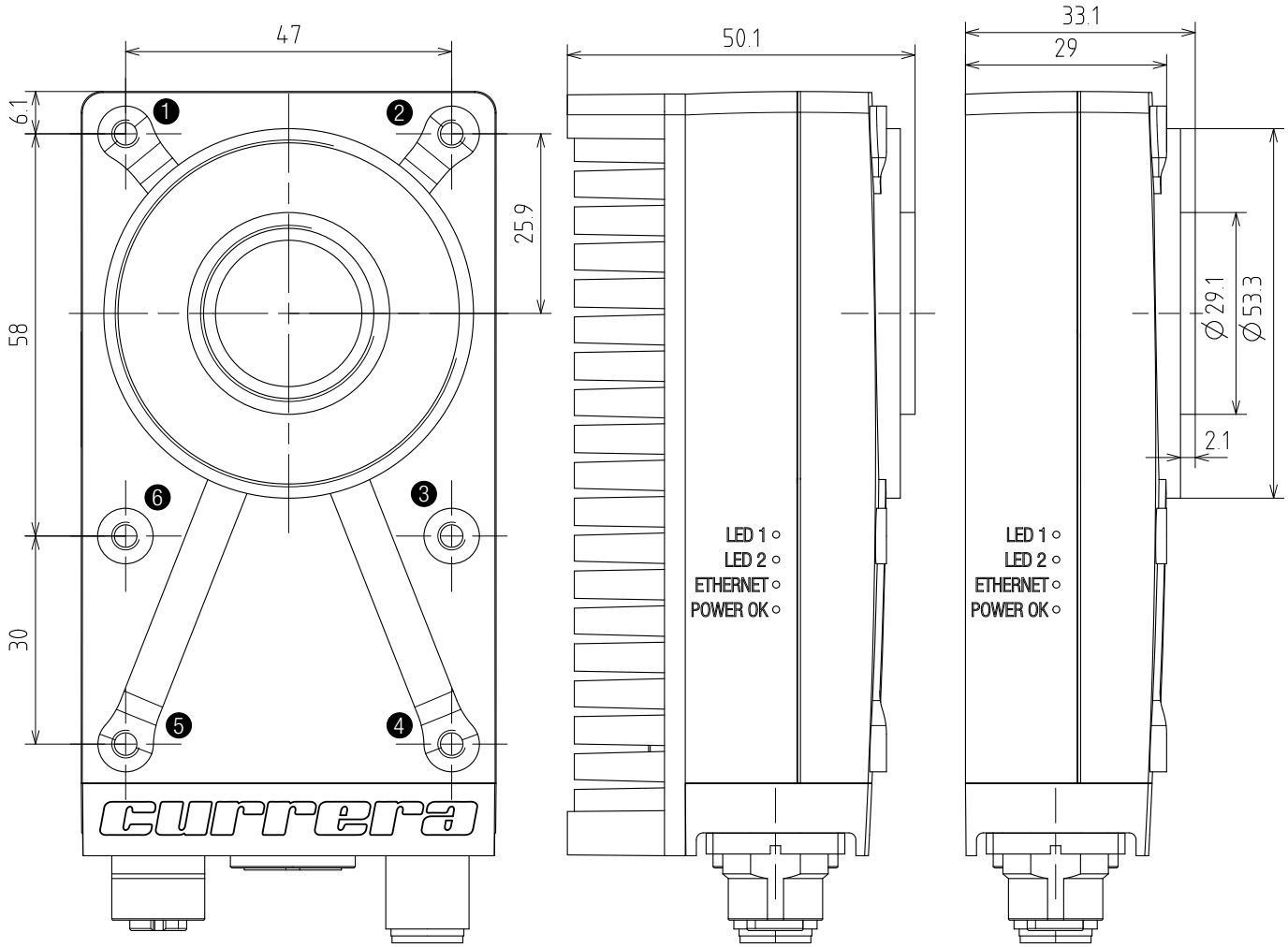
Bottom View
Connectors positions



Front View
Mounting points positions

Side View
Dimensions with heatsink

Side View
Dimensions without heatsink

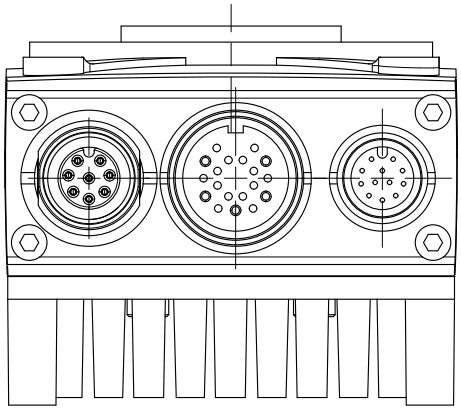


Six mounting threads M4 on the front side.
Maximum depth of the screw is limited to 5mm.
Max. screws torque is 1.3 N-m @ 5mm screw depth

Mechanical - dimensions and mounting

Rear side mounting, heatsink notes

Bottom View with heatsink attached

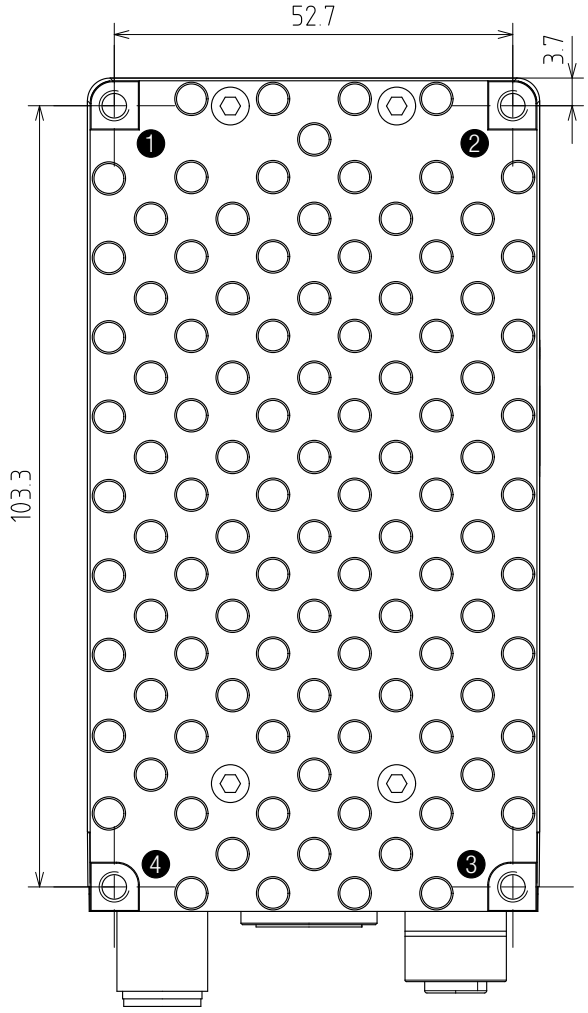


Heatsink use, installation and precautions.

Continuos operatio above 45°C ambient temperature at full CPU load requires use of heatsink.

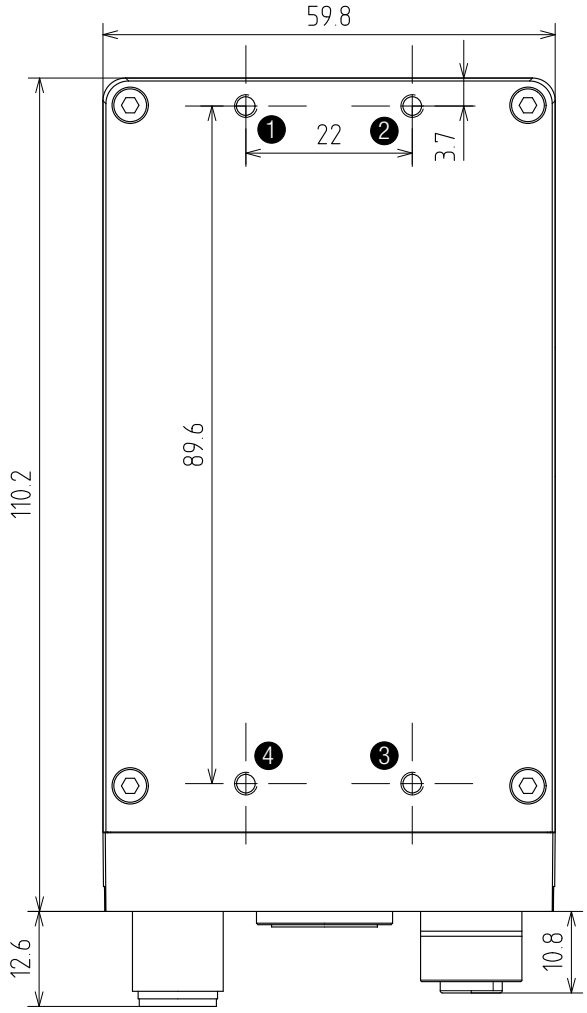
Heatsink kit comes with the heatsink itself, four M3x8 mounting screws and a temperature conductive gap filler already placed on the heatsink and protected by transparent plastic film against contamination and damage.
Installation requires removal of the protection film and simple attachment of the heatsink by four screws to the back panel of the device. ⚠ Max. screws torque is 0.5 N-m

Bottom View with heatsink attached
Mounting points positions



Four mounting points M4 on the heatsink.
⚠ Max. depth of the screws is 6mm.
⚠ Max. screws torque is 1.3 N-m
@ 5.5mm screw depth

Rear View without heatsink
Dimensions & Mounting points positions



Four mounting points M3 on the rear panel.
⚠ Max. depth of the screws is 6mm.
⚠ Max. screws torque is 0.5 N-m
@ 5.5mm screw depth

Environmental

Operating conditions and requirements.

Operating ambient temperature and conditions without heatsink

0°C - 45°C, requires obstacle free air flow path around device body

Operating ambient temperature and conditions with heatsink

0°C - 65°C, requires obstacle free air flow path around device body and heatsink

Storage ambient temperature and conditions

15°C - 65°C, relative humidity 5% - 95% no condensing

Operating Humidity, Maximum Altitude

Without lens protection tube: relative humidity 5% - 95% no condensing, Max. altitude 2500m. With lens protection tube: not critical, otherwise preferred relative humidity 5% - 95% no condensing

Water and liquids

Without lens protection tube: IP60, no water in contact with the device body, no condensation allowed. With lens protection tube: IP67, limited to 5 minutes @ 1m water depth

⚠Note: Ingestion of water or fluids into the camera body for any reason will void the warranty.

Freezing water and liquids, Corrosive fluids, Salt water

Precautions shall be taken to not allow water to freeze on the device body

No liquids other than water are allowed to get in contact with the device body when the lens protection tube (lens sheath) is attached. No corrosive fluids of any kind shall get in contact with the device body. No salt water shall get in contact with the device body

Vibrations and shock

Operating vibration random:	10Hz - 1000 Hz $5g_{rms}$
Operating vibration sinusoidal:	10Hz - 1000 Hz $5g_{rms}$
Operating shock:	50g, 3ms half sine, 18 shocks, 6 orientations
	30g, 11ms half sine, 18 shocks, 6 orientations

EMC compliance, EMC immunity

CE, FCC part 15 Class A device compliant, radiated emissions within EN55011 Class A at 10m EMC Immunity Complies to EN61326:1997 +A2:2001 Table 1, except exposed Image sensor For EMC compliance you must operate this device with shielded cabling.

Ionising Radiation, Cosmic Rays

No operation or storage allowed in presence of man-made Ionising Radiation. Note: natural cosmic rays may cause bad pixels on the image sensor and as such are not covered under the warranty.

EMC Compliance declaration

CE and FCC Compliance

XIMEA GmbH
Hansestraße 81
48165 Münster
Deutschland

VERIFICATION

Model:	**CURRERA-R -** RS04, RL04, RS13, RL13, RS50, RL50
Type of equipment:	Industrial Personal Computer, Industrial Camera
Applicable Directives:	89/336 IEEC Electromagnetic Compatibility Directive 72/23 IEEC Low Voltage Directive
Standards of conformity:	EN 55011 Group 1, Class A, EMCl Limits for Electromagnetic Compatibility EN 50082-1 Electromagnetic Compatibility - Generic Immunity Standard EN 61010-1 Part 1: General Safety Requirements
Other Tests:	FCC Part 15A Radiated Emissions Limits

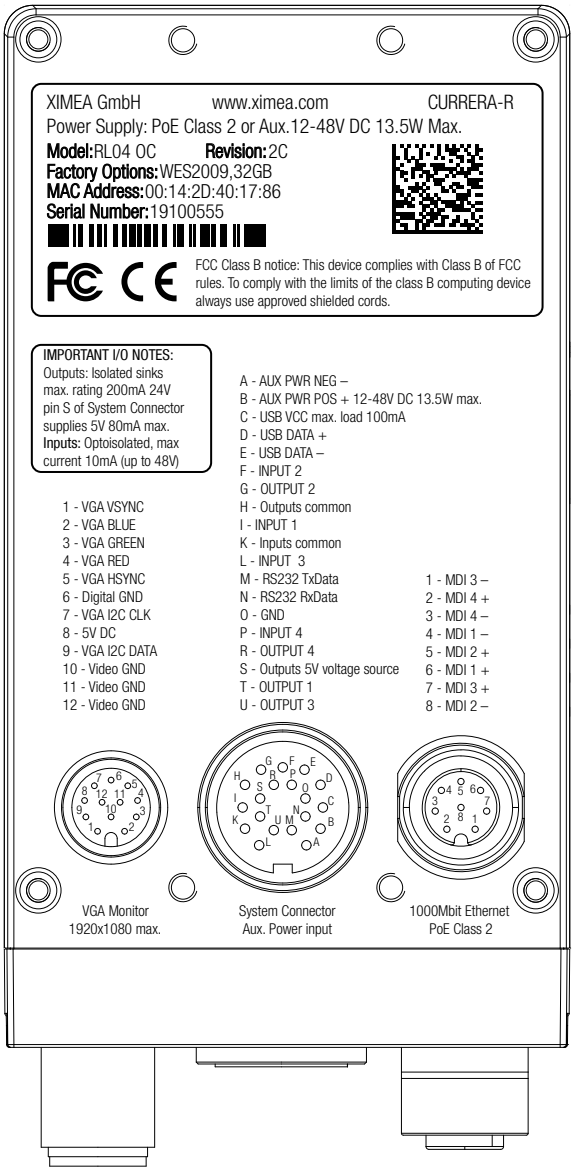
XIMEA GmbH hereby declares that the device specified above conforms to the Directives and Standards, when installed and operated in accordance with the specifications set forth by XIMEA GmbH. The original copy of this document is kept at XIMEA with copies of the relecant test data and certificates, which constitute the requred technical file for self declaration.

..... January 17th, 2011
Signature

Serial numbers and labels

Label placement

Label is placed on rear side of camera. Contains model, serial number and HW version, Factory Options barcoded serial number in Code 128 and Datamatrix. Connector pins assignments included for reference as well. In mass production the pins assignments may be left out.



Hardware Specifications Table

Electrical, Mechanical and Environmental:

Power Requirements	Power over Ethernet IEEE802.3af, Class 0: typ. 7W max. 12W	Power via System Port: 12-48V DC typ. 7W, max. 13.5W
Housing Dimensions without heatsink	WxHxD 59.2 x 109.8 x 31 mm	Optional Lens Sheath: height 60 mm, internal diameter 50mm
Housing Dimensions with heatsink	WxHxD 59.2 x 109.8 x 48 mm	Weight: 262g
Environmental	Ingress Protection: IP67 with lens sheath tube attached	Operating temperature with heatsink -10°C to +65°C
		Operating temperature without heatsink -10°C to +40°C

Interfaces and Connectors:

Connector	Signals	Mating Connectors:
Ethernet	1000BASE-T IEEE802.3af Ethernet with PoE	M12 M 8pins, Binder, P/N: 09-3482-275-08
Monitor	VGA max 1920 x 1080 pixels resolution	M12 F 12pins, Binder, P/N: 99-1492-822-12
Multi I/O Connector	4x Isolated Inputs, 5-24V 12mA max input current, 100nS trigger delay, user configurable	M16 M 19pins, Binder, P/N: 99-5461-00-19
OC I/I option	4x Isolated Outputs, 5-24V 100mA max sink current, 100nS output delay, user configurable	
24 I/O option	4x Isolated Outputs, 6-48V 1A max high side switch, 20us - 100us output delay, user configurable	IEC
	RS232 Serial Port, non isolated, up to 1Mb/s	
	High Speed USB, non isolated, 5V, max 100mA device power supply capable	
	Auxiliary Power Supply 12-48V DC typ. 7W, max. 12W	

Note 1: Contact sales for cable and connectors kits for your application.

CURRERA-R Processor, Memory and Video Options, available options: RLxx

Processor and Chipset	DDR2 RAM	SSD	Internal Micro SDHC Card	External Micro SDHC Card Slot	Analog Video Output
RLxx Intel Atom Z530 1.6GHz US15W	1GB 533MHz	4GB	optional	standard	XVGA max 1600 x 1200

CURRERA-R Sensors, available options: RL04 WVGA, RL13 1.3MPx, RL50 5Mpx

Sensor	WVGA Aptina MT9V034C12STM -04 suffix		1.3MP e2v EV76C560BB -13 suffix		5MP Aptina MT9P031I12STM -50 suffix	
Resolution	752 x 480 pixels		1280 x 1024 pixels		2592 x 1944 pixels	
Type	CMOS Global Shutter		CMOS Global Shutter		CMOS Rolling Shutter	
Active Area Size	1/3" 4.51 x 2.88 mm		1/1.8" 6.9 x 5.5 mm		1/2.5" 5.7 x 4.28 mm	
Sensor Pixel size	6 x 6 µm		5.3 x 5.3 µm		2.2 x 2.2 µm	
Dynamic range (typ.)	55dB linear ; 110dB HDR / linlog		62dB linear ; 100dB HDR / linlog		70dB linear	
Sensitivity	4.8V / lux-sec		6V / lux-sec (TBD)		1.4V / lux-sec	
Color Filter	N/A - Black and White		N/A - Black and White		N/A - Black and White	
Bit Depth	8,10,(12) bits		8,10 bits		8,10,12 bits	
Gain	0-12 dB		0-24 dB		0-42 dB	
Exposure time	10µs - 1s		5µs - 1s		33µs - 1s	
Basic Readout Modes	Resolution:	fps:	Resolution:	fps:	Resolution:	fps:
Full Resolution	752 x 480 px	60	1280 x 1024 px	60	2592 x 1944 px	15
Half Resolution	376 x 240 px	200	640 x 512 px	100	1296 x 972 px	45
Quarter Resolution	-	-	320 x 240 px	200	648 x 486 px	80
Linescan			1280 x 32 px	1600		

All cameras supports:
- arbitrary sized partial readout window with granularity 2x2 pixels
- image flipping H and V

Note 2: All sensors are available in both Black and White and Color Bayer RGB versions, please contact sales for availability
Note 3: Other readout and ROI readout modes available.
Note 4: OEM and large integrators customized versions available.

Hardware Specifications Tables (cont.)

Digital Inputs and Outputs Timing Tables:

Model	Digital Input to register change	Register change to Digital Output	Digital Input (Triger) to Digital Output (Strobe)	Trigger (Digital Input) to start of exposure	Trigger (Digital Input) to Strobe (Digital Output)	Trigger (Digital Input) to start of exposure
RL04 -OC	< 0.1 µs	< 0.1 µs	19 µs	31µs	11 µs	11 µs
RL13 -OC, 8bit/	< 0.1 µs	< 0.1 µs	0.3 µs	2 µs	18.63 µs	31µs
RL13 -OC, 10bit/	< 0.1 µs	< 0.1 µs	19 µs	42 µs	18.63 µs	42 µs
RL50 -OC	< 0.1 µs	< 0.1 µs	11 µs	11 µs	308 ns	2 µs

Model (, VCC_AUX voltage)	Digital Input to register change	Register change to Digital Output HI-LOW / LOW-HI	Trigger (Digital Input) to Strobe (Digital Output) HI-LOW / LOW-HI	Trigger (Digital Input) to start of exposure
RL04-24,12V	< 0.1 µs	109µs / 15µs	119µs / 26µs	11 µs
RL04-24,24V	< 0.1 µs	109µs / 18µs	119µs / 29µs	11 µs
RL13-24,8bit/ ,12V	< 0.1 µs	109µs / 15µs	127µs / 33µs	31µs
RL13-24,8bit/ ,24V	< 0.1 µs	109µs / 18µs	127µs / 36µs	31 µs
RL13-24,10bit/ ,12V	< 0.1 µs	109µs / 15µs	127µs / 33µs	42 µs
RL13-24,10bit/ ,24V	< 0.1 µs	109µs / 18µs	127µs / 36µs	42 µs
RL50-24,12V	< 0.1 µs	109µs / 15µs	109µs / 15µs	2 µs
RL50-24,24V	< 0.1 µs	109µs / 18µs	109µs / 18µs	2 µs

Please see the CURRERA-R Quick start guide to learn more about the available trigger modes and their selection.

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For further and current information , please visit the CURRERA support pages at https://www.ximea.com/support/projects/currera/wiki

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