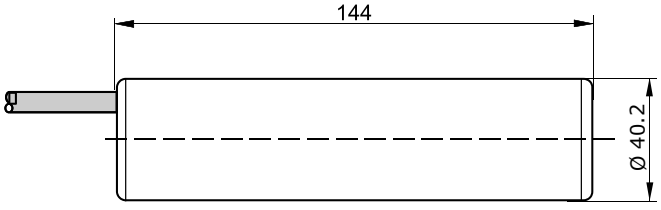
Tippkemper® *ISO 9001:2015 / ATEX* MATRIX elektronik ag

Raspberry Pi based HD IP Camera for Explosive Atmospheres CVG-SEC-ECA-NO

Latest version of this data sheet:
www.tippkemper-matrix.de/p/CVG-SEC-ECA-NO_e.pdf

- Video streaming up to 1920x1080 pixels
- Video streaming up to 90fps
- Supports RTSP
- Photos up to 3280x2464 pixels
- Integrated bar code detection capability
- Configuration and control via Modbus TCP
- Automatic or manual shutter, ISO and white balance
- IEEE 802.3af-2003 compliant Power over Ethernet device

II 2G Ex db IIB T4 Gb,
II 2D Ex tb IIIB T135 °C Db IP67

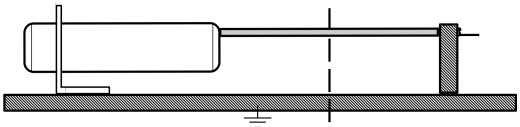
Technical Data / Type	CVG-SEC-ECA-NO
Applicable in Ex zones	Ex Zone 21, 22, 1 and 2
Illumination	Not installed
Camera focus	200 mm, fix
Field of view (FOV)	64° horizontally and 48° vertically (29mm full frame equivalent)
Image sensor	Sony IMX219, 1/4", 8MP
Focal ratio (F-Stop)	f/2.0
Color depth	24 bit true color
Audio	No microphone installed, video feed only
Power supply	IEEE 802.3af-2003 compliant Power over Ethernet (PoE) device
Maximum power dissipation	3.4 W, class 1
Boot up time t_b	$t_b \approx 90$ s
Interface	10/100Mbps Ethernet (please connect to a 100Mbps or 1Gbps network for full performance)
Configuration and control	via Modbus TCP at port 502, big endianness for word and byte order, recommended timeout: 10 s
IPv4 configuration	Automatic IPv4 address retrieval via DHCP and one static address, default is 192.168.200.200 with subnet mask 255.255.255.0
IPv6 configuration	Automatic IPv6 address retrieval via DHCPv6, using SLAAC as fallback
Video stream payload	H.264 encdoded with 0.5 to 20 Mbit/s
Video stream transfer	Real Time Streaming Protocol (RTSP), accessible at port 554 with url /live with up to three clients, e.g. rtsp://192.168.200.200:554/live
Delay of video feed	< 200 ms
Modes of operation	000: Standard Stream, 1640x1232, 30fps, 8Mbit/s 001: High framerate stream, 640x480, 90fps, 10Mbit/s, cropped field of view: 25° by 19° 002: Low bandwidth stream, 640x480, 15fps, 500kbit/s 003: FHD-Stream, 1920x1080, 30fps, 10Mbit/s, cropped field of view: 37° by 21° 004: HD-Stream, 1280x720, 30fps, 5Mbit/s, cropped field of view: 52° by 35° 005: Barcode scanner, 640x480, cropped field of view: 25° by 18° 006: High resolution Barcode scanner, 1920x1080, cropped field of view: 37° by 21° 1006: Image mode, 3280x2464
Supported 2D codes	QR-Code according to ISO/IEC 18004:2015-02
Supported bar codes	Code 128, Code 39, EAN-8, EAN-13, Interleaved 2 of 5, UPC-A and UPC-E
Image inspection	Image comparison and a basic object detector and counter
Embedded computer	Raspberry Pi with customized Rasbian Stretch
Housing	Ø40.2, material: stainless steel 1.4404
Weight	650 g without cable
Optical window	Multiple layers of Corning Gorilla Glas 3
Enclosure rating	IP67 according to IEC 60529:1989 + A1:1999 + A2:2013
Connection cable	Length: 15 m, Cat.5e industrial Ethernet cable type LEONI MegaLine D1-20 S/U superflex 4P 11Y, drag chain suitable (≈5 million bending cycles with bending radius $R_{min} \geq 20$ mm), chemical resistant
Ambient operating temperature range T_{amb}	0 °C to 50 °C
Storage temperature range	−20 °C to 75 °C
Relative humidity	15 % to 90 %
Pollution degree to IEC 60664-1:2007	4
Connection diagram	1) yellow: RX+/DC+ (PoE mode A) 5) grey: DC+ (PoE mode B) 2) green: RX-/DC+ (PoE mode A) 6) red: TX-/DC- (PoE mode A) 3) black: TX+/DC- (PoE mode A) 7) blue: DC- (PoE mode B) 4) orange: DC+ (PoE mode B) 8) brown: DC- (PoE mode B) Connect shield to ⏚ protection earth (over RJ45 plug) Wiring according to ANSI/TIA/EIA 568-A and IEEE 802.3af-2003
Ex related markings	CE Ex designation according to 2014/34/EU ATEX certification number: T_{amb} Date of construction: Electrical data according to the table "Technical data" Manufacturer with address II 2G Ex db IIB T4 Gb, II 2D Ex tb IIIB T135 °C Db IP67 BVS 10 ATEX E130 X 0 °C ≤ T_{amb} ≤ 50 °C Numeral 5 to 8 of the serial number (year/calendar week)
Dimensions:	

CVG-SEC-ECA-NO_e2/2020–04–03/AS

Ex Zone

Safe equipotential bonding for Ex devices:

Check the reliable, noncorrosive holding of the ⏚ PE connection.



NON-HAZARDOUS AREA

The end of the cable must be connected outside the hazardous locations.

The cable shield is to connect to ⏚ PE large-surfaced.

Operation Manual / EU - Declaration of Conformity:

Intended Use
The CVG-SEC-ECA-NO camera system is intended for surveillance, code detection and image inspection within potentially explosive atmospheres. It must be installed and operated in accordance to this operating manual.

Installation prescriptions for hazardous locations
It is necessary to take into consideration the valid international and national rules and regulations (IEC 60079-14:2013). The cable must be protected against damaging. The cable shield must be connected to ⏚ PE short and reliably. The end of the cable must either be installed within a certificated Ex housing or must be installed outside of any Ex area.

General safety informations
The equipment must not be used as protective equipment. The mounting, wiring, application and maintenance must be realized in accordance with the relevant rules and prescriptions. It is necessary to take into consideration the relevant international and national regulations. The sensors are conform to the following standards:

IEC 60529:1989 + A1:1999 + A2:2013, EN 61000-6-2:2005,
EN 61000-6-3:2007 + A1:2011,
ATEX directive: 2014/34/EU, Machine directive: 2006/42/EC,
EMC directive: 2014/30/EU, RoHS directive: 2011/65/EU.

General Notes and disposal
We reserve the right to modify our equipment. Our equipment is designed such way, that it has the least possible adverse effect on the environment. It neither emit or contain any damaging or siliconized substances and use a minimum of energy and resources. No longer usable or irreparable units must be disposed of in accordance with local waste disposal regulations.

Open source software notice
This product uses open software, especially:

- Linux (GPL V2.0)
- OpenCV (3-Clause BSD License)
- GStreamer including Gst-RTSP-Server (LGPL and GPL)
- pymodbus (BSD License)
- Python with SciPy (PSF, GPL compatible, BSD License)
- ZBar and Python-ZBar (LGPL V2.1)

The source code of the most important libraries is stored on the device's internal memory at */usr/local/src*. Please contact Tippkemper-Matrix GmbH if you wish to review the source code of further software packages. All product specific source code, developed by Tippkemper-Matrix GmbH, is provided under GPL V2.0. This product is powered by Raspberry Pi.

Service Access
It is recommended to protect port 22 against access from unsafe or public networks like the internet. This port is intended for service and repair purposes by the manufacturer.

Modbus TCP
Modbus TCP communication is organized in four types of registers:

1. Register type: Coils (writable)

Address	Type	Function (default state underlined)
00001	Bit	Write 1 to trigger a scan in barcode or inspection mode
00003	Bit	Horizontal flip of image 0:off/1:on
00004	Bit	Vertical flip of image 0:off/1:on
00005	Bit	Image denoise filter 0:off/1:on
00006	Bit	Write 1 to make the last image,
00007	Bit	Continuous scan trigger 0:off/1:on

Write trigger bit at address 00001 to initiate scan of barcode or image inspection. The bit will automatically reset once the scan is completed. The continues trigger bit at address 00007 will not reset and will put the device in continuous scanning operation.

2. Register type: Discrete inputs (read only)

Address	Type	Function (default state underlined)
10001	Bit	Service available true/false
10002	Bit	Binary image inspection result accepted/not accepted

Service available bit indicates if a valid configuration was set. The binary result of the image inspector is a truth value of a comparison from the image similarity and the threshold value in image comparison mode. In object count mode it will be true if the number of count objects is within the target range.

3. Register type: Input Registers (read only)

Address	Type	Function
30001	3x uint16	MAC Addresse: 01=HighByte,02=MidByte,03=LowByte
30004	uint32	time stamp of scan result (unix epoch)
30006	string[8]	1 Code type
30010	string[256]	1 Code content
30138	string[8]	2 Code type
30142	string[256]	2 Code content
30270	string[8]	3 Code type
30274	string[256]	3 Code content
30402	string[8]	4 Code type
30406	string[256]	4 Code content

The time stamp provides the number of seconds since the 1. January 1970 at 0 o'clock, known as Unix timestamp. The timestamp is only valid, if the device can access a public NTP server. It can be configured to use internal NTP servers by manually modifying */etc/ntp.conf*. Otherwise, the timestamp will be a random value. Nevertheless, even without an NTP server, the timestamps can still be compared to measure the time between two scans. All further data fields of the input registers provide data from the last code scan or image inspection. Up to four symbols can be read per scan in code detection mode, thus there are four instances of the code result fields. The fields containing the code type are filled with the string *NONETYPE* if no symbol was detected or with one of the following type strings: *CODE39*, *CODE128*, *EAN8*, *EAN13*, *I25*, *UPCA*, *UPCE* or *QRCODE*. Each code type field is followed by the corresponding code content field. The maximum symbol length is restricted by the field size of 256 characters.

4. Register type: Hold registers (writable)

Address	Type	Function
40001	int32	Mode of operation
40003	int32	White ballance mode
40005	float (32 Bit)	image x offset (0.0 to 1.0)
40007	float (32 Bit)	image y offset (0.0 to 1.0)
40009	float (32 Bit)	image width (0.0 to 1.0)
40011	float (32 Bit)	image height (0.0 to 1.0)
40013	int32	High dynamic range (0:off to 3:high)
40015	int32	Shutter speed (0:auto, 1 µs to 10 000 000 µs)
40017	int32	ISO mode (0:auto, ISO 100 to ISO 800)
40019	int32	Saturation (0 to 100, 0:neutral)
40021	int32	Contrast (0 to 100, 0:neutral)
44023	int32	Brightness (0 to 100, 50:neutral)
40025	int32	Sharpness (0:neutral to 100:enhanced)
40027	int32	Frames per second (15 Hz to 30 Hz or 90 if resolution is 640x480)
40029	int32	Bitrate (200 000 to 20 000 000bps)
40031	uint32	static IPv4 device address (192.168.200.200)
40033	uint32	static IPv4 subnetmask (255.255.255.0)
40035	uint32	static IPv4 gateway address (192.168.200.1)

The mode of operation field can be used to restore a system preset, which can always be altered afterwards (e.g., by setting a fixed shutter speed). The following preset modes are available:

Mode	Description	Resolution	Frame rate	Bit rate
0	Standard video	1640x1232	30 Hz	8 Mbit/s
1	High frame rate	640x480	90 Hz	10 Mbit/s
2	Low bandwidth	640x480	15 Hz	0.5 Mbit/s
3	Full HD 1080p	1920x1080	30 Hz	10 Mbit/s
4	HD 720p	1280x720	30 Hz	5 Mbit/s
5	Barcode mode	640x480		
6	HD Barcode modus	1920x1080		
1006	Image mode	3280x2464		

Using photo mode new images can be accessed at anytime under *http://<IP of CVD>/snapshot.<jpg/bgr/rgb/yuv>*. The file extentions determine the picture format. Please note that file extensioins *.bgr*, *.rgb* and *.yuv* produce raw data without header.
The ISO mode field supports 0 for automatic gain and each of the following values: 100, 200, 400, 800.
There are six modes available for white balancing:

Mode	Description
0	No white balancing
1	Automatic white balance
2	Sunlight, about 5200K
3	Cloudy, about 6000K
4	Shade, about 8000K
5	Tungsten bulp, about 2800K
6	Fluorescent lamp, about 4200K

Maintenance
The sensor is maintenance-free. Equipment must only be repaired or serviced by the manufacturer.

EU-Declaration of Conformity
ATEX certification: II 2G Ex db IIB T4 Gb, II 2D Ex tb IIIB T135 °C Db IP67. ATEX declaratioin by manufacturer in accordance to 2014/34/EU, CE 0158. Certification No: BVS 18 ATEX ZQS / E118, QAR No: DE/BVS/QAR13.0004/04. Mr Pablo Daniel Ledergerber, Matrix Elektronik AG, is authorized for the compilation of the documentation. The conformity of the devices with the EC standards and directives and the EC-type examination certificate and the observation of the Quality Safety System ISO 9001:2015 / ATEX with the ATEX module "Production", declares:
Pablo Daniel Ledergerber, Matrix Elektronik AG

CVG-SEC-ECA-NO_e2/2020-04-03/AS

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