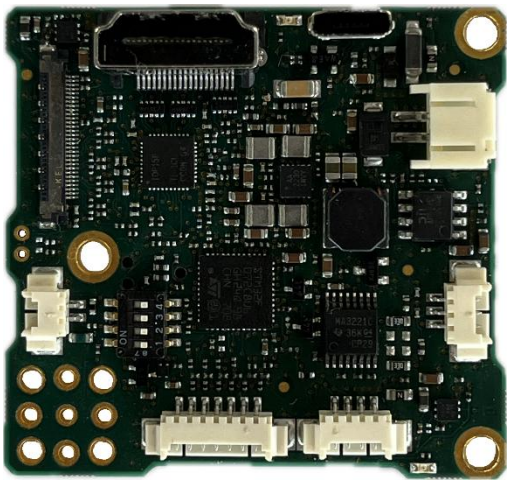
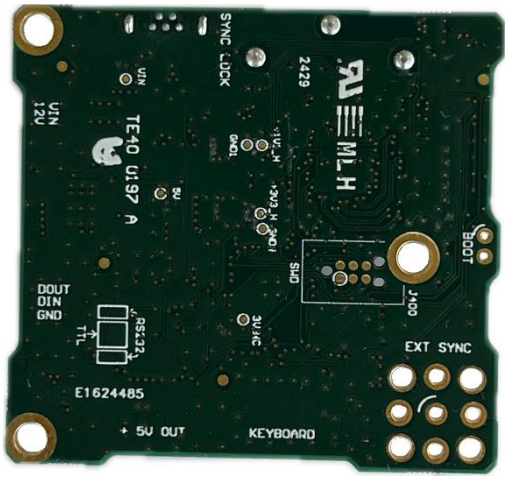
Vision & Innovation

HDMI 4K60

Technical Manual





P/N – TV10 0097: HDMI 4K60 interface board for Sony FCB-4K camera range

P/N – TV50 0029: Mounting kit for TV10 0097 – HDMI 4K60 I/F board
Includes: 30-way micro-coax camera cable, 2-way cable (power supply), 3-way cable (RS232/TTL), 7-way cable (GPIOs), right angle black anodized bracket, screws and spacers

P/N – TV50 0008: Cable kit for TV10 0097 – HDMI 4K60 I/F board
Includes: 30-way micro-coax camera cable, 2-way cable (power supply), 3-way cable (RS232/TTL)

Available connectors: VOPTEM37 (Add external sync connector)

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Revision History

Date	Revision	Description	Modified by	Note
10/07/25	A	Creation of the document	CBO	
14/04/26	B	Update internal registers for v1.2	CBO	
30/07/26	C	Add GPIOs configuration registers for v1.3	CBO	

Key features

- HDMI 2.0b video output
- Video resolution up to 2160p60
- Support the latest Sony ER9500 in 4K60
- Communication UART – RS232/TTL using VISCA
- Video mode selection by DIP switches
- USB micro-B communication & update
- Power supply 6V-12VDC
- Auxiliary power output 5VDC, 1A
- Drive HDMI cable up to 10m
- Operating temperature [0°C; 60°C]

General description

HDMI technology is an internationally recognized standard able to transmit uncompressed ultra-high-definition video signals from camera to screen.

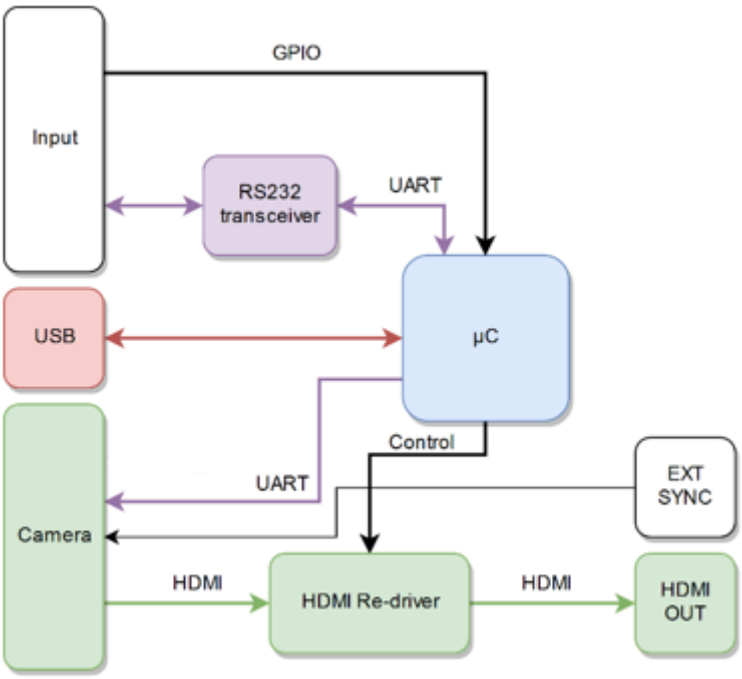
This standard is compatible with most of the existing displays, it gives a lot of flexibility. This is ideal for short distance applications.
The HDMI 4K board provides video signal from 4K camera blocks to HDMI output. Go to the next level with the full compatibility with the latest Sony FCB-ER9500 which provides 4K60.
This compact solution is very easy to connect and can be rear mounted on Sony 4K range of cameras without hampering the mechanical integration.

The HDMI 4K supports the external synchronization input from Sony FCB ER-8550 camera. It provides benefits to users in a multi-camera environment: broadcast application, image stitching, pulsed lighting sync or thermal/visible image overlapping.

Benefits of this solution

- Standard and reliable HDMI video transmission
- Video format supported from HD to Ultra HD up to 2160p60
- Latency involved by the board is negligible
- Designed to be mounted on 4K Sony camera
- RS232 / TTL serial communication easy switch by moving two resistors
- Supports external synchronisation input for the ER8550 camera
- GPIOs connector to easily send basic VISCA commands (zoom in / out, freeze on / off, focus)
- Can control external device via 5V manageable output

Block diagram



Video acquisition

The board acquires the HDMI video from the 4K camera, transmits it and provides uncompressed HDMI video on the output connector. Video output keeps the same format as the camera and can go from HD to Ultra HD in 4K60.

Communication

By default, the board is configured in RS232. It is possible to switch to UART TTL 3V3 communication but that requires hardware modifications. For more information, please contact us at info@i2s.fr and we will ensure that you are able to do the changes. The board can be ordered in UART TTL 3V3 configuration if requested.

A micro-USB connector allows when plugged in a computer, to communicate via a virtual COM port. This port can be used to perform a software update, to send commands to the camera or to manage internal features of the board.

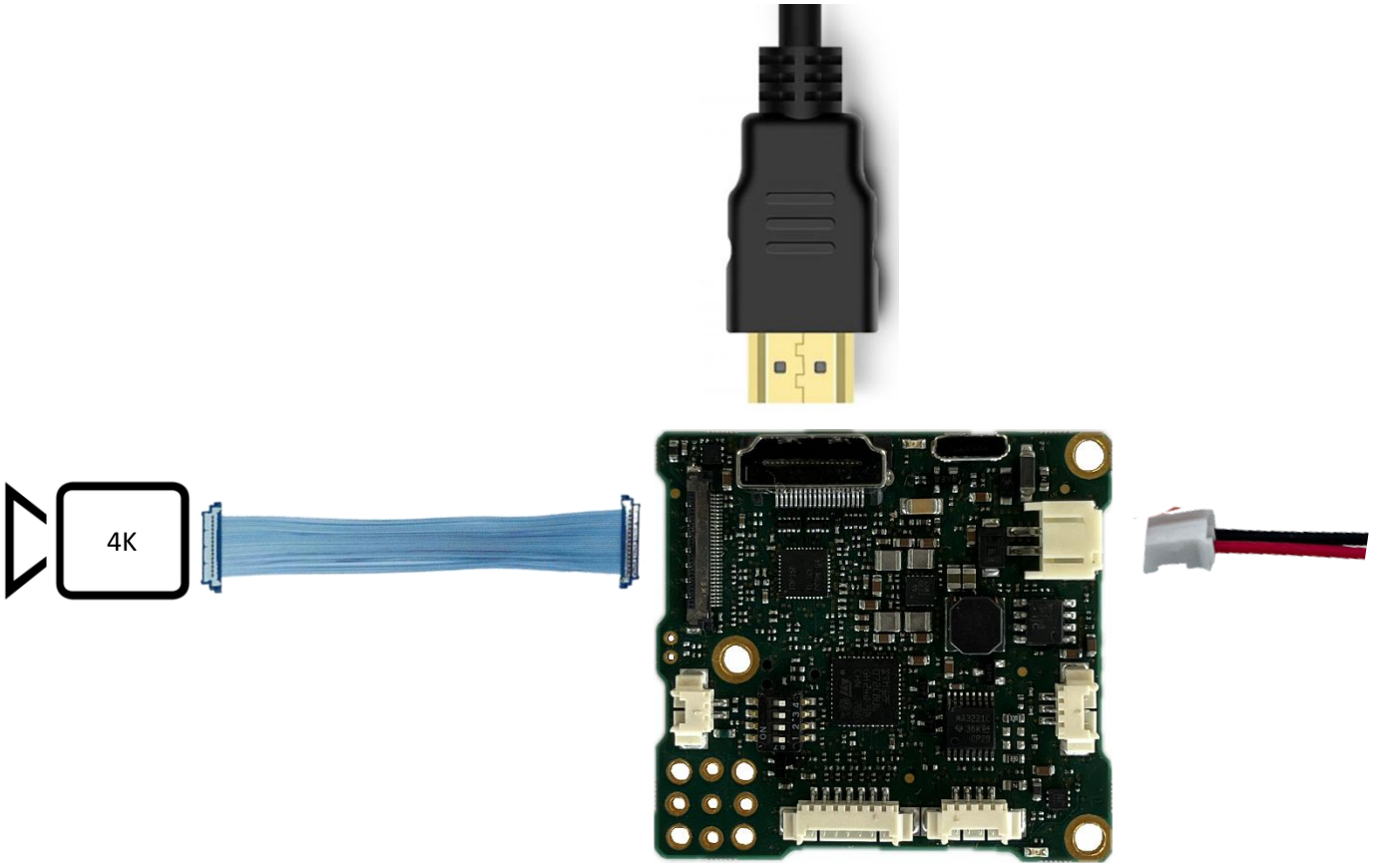
A green blinking LED helps to know in which state the board is, it is quick feedback to be sure no error happened.

Power supply

The power input through the 2 ways connector J800 supports from 6V to 12V (1,5A). The camera is powered by the board.
You can notice that a 5V output is available on the connector J801 and can be managed via an internal register.

Accessing the video

Quick setup



Installation steps:

1. Connect the KEL cable between the board J200 and the 4K camera.
2. Connect the HDMI cable to the output connector of the board J700 and to the HDMI monitor.
3. Connect the 2-way power supply cable on J800 connector. Power input of the board is 6V to 12V (1,5A), red wire is for V+ and black wire is for the ground.
4. Now you can power the board.

Video characteristics

TMDS video input supported resolutions

	25	29.97	30	50	59.94	60
1280x720p	✓	✓	✓	✓	✓	✓
1920x1080p	✓	✓	✓	✓	✓	✓
3840x2160p	✓	✓	✓	✓	✓	✓

The video format from the 4K camera can be configured by sending VISCA command using register 72.

HDMI video output

The output is compliant to HDMI 2.0b, available on the HDMI connector J700. The output video format is the same as the camera (see TMDS video input resolutions supported upper).

System configuration

Communication

Communication with the camera can be done through 2 connectors:

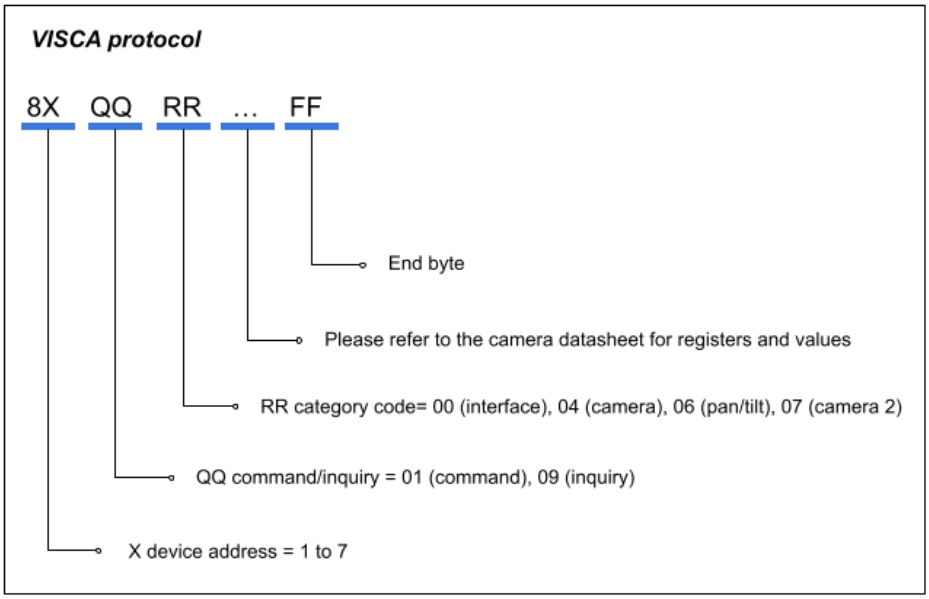
1. RS232 / UART TTL 3V3 connector (J501): it allows you to send VISCA commands to the camera or to configure internal features. To switch from RS232 to TTL configuration some hardware modifications are needed. Please contact us at info@i2s.fr for more information.

2. Micro-USB connector (J900): using CDC protocol to communicate with the camera or configure internal features. When plugged in a computer, a virtual COM port will be created.

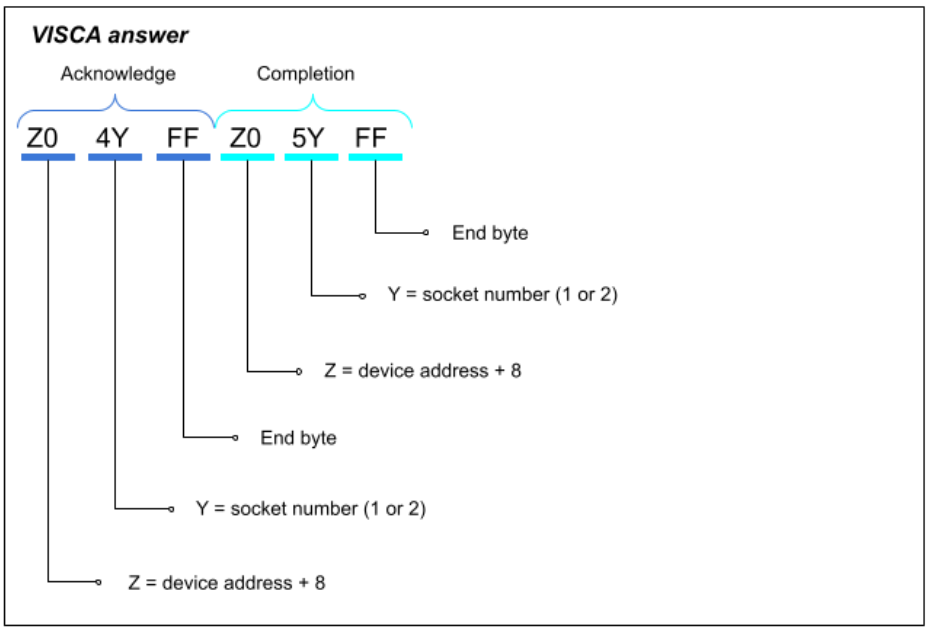
The baud rate of the serial interface will follow the baud rate configured in the camera.

To the camera

The camera communication uses VISCA protocol and will follow camera specifications. It is a standard protocol for camera blocks following this structure:

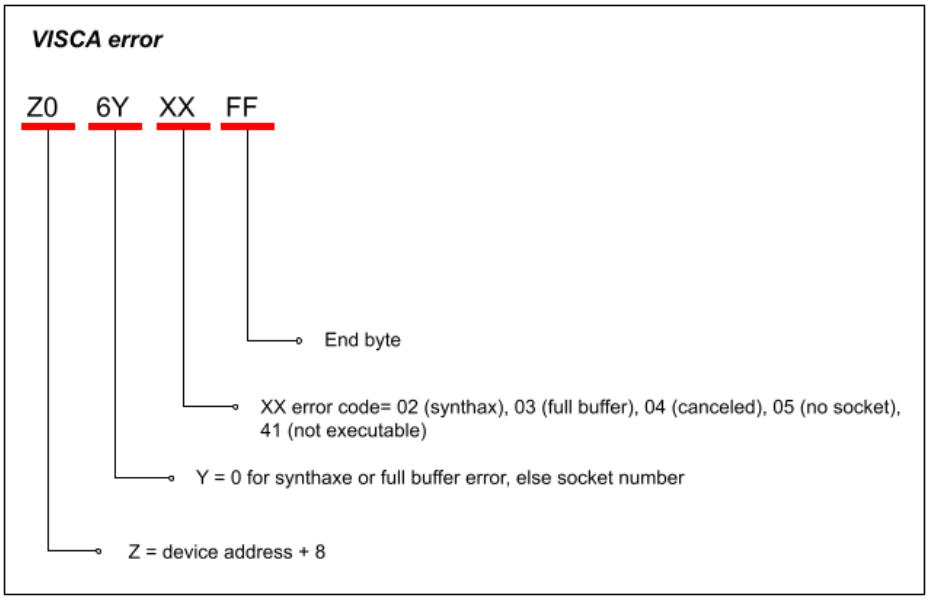


The camera answer follows this structure:



The time between the acknowledgement and the completion packet depends on the command. The answer for an inquiry is Z0 5Y followed by the information requested with FF as end byte.

If an error occurs, here the answer structure:



Example: Zoom In command with a speed of 7 is 0x81 01 04 07 27 FF and the expected answer is 0x90 41 FF followed by 0x90 51 FF.

You can communicate using communication software like Termite or the camera brand communication tool like Sony FCB Control software.

To the internal registers

The board internal registers are accessible from the connector J501 and J900 using custom VISCA commands specifically targeted at the board itself and are not transferred to the camera:

Register name	Addr	Saved	Set command	Comments	Inquiry command	Inquiry answer
REG_SOFT_VERSION_H	0x01	No	NA	Software version MSB	0x82 09 06 01 FF	0xA0 50 01 00 0y FF
REG_SOFT_VERSION_L	0x02	No	NA	Software version LSB	0x82 09 06 02 FF	0xA0 50 02 00 0y FF
REG_BOARD_REBOOT	0x05	No	0x82 01 06 05 00 01 FF	Reboot the board	NA	NA
REG_BOARD_NB_BOOT_H	0x07	No	NA	System boot counter high	0x82 09 06 07 FF	0xA0 50 07 0y 0y FF
REG_BOARD_NB_BOOT_M	0x08	No	NA	System boot counter medium	0x82 09 06 08 FF	0xA0 50 08 0y 0y FF
REG_BOARD_NB_BOOT_L	0x09	No	NA	System boot counter low	0x82 09 06 09 FF	0xA0 50 09 0y 0y FF
REG_BOARD_RUNTIME_H	0x0A	No	NA	Runtime High	0x82 09 06 0A FF	0xA0 50 0A 0y 0y FF
REG_BOARD_RUNTIME_MH	0x0B	No	NA	Runtime Middle High	0x82 09 06 0B FF	0xA0 50 0B 0y 0y FF
REG_BOARD_RUNTIME_ML	0x0C	No	NA	Runtime Middle Low	0x82 09 06 0C FF	0xA0 50 0C 0y 0y FF
REG_BOARD_RUNTIME_L	0x0D	No	NA	Runtime Low	0x82 09 06 0D FF	0xA0 50 0D 0y 0y FF
REG_DBG_LED	0x12	Yes	0x82 01 06 12 0y 0y FF	0x00: LED OFF 0x01: LED ON	0x82 09 06 12 FF	0xA0 50 12 00 0y FF
REG_CONFIG_SAVE	0x13	No	0x82 01 06 13 00 01 FF	Save registers values to flash	NA	NA
REG_CONFIG_LOAD	0x14	No	0x82 01 06 14 00 01 FF	Reload registers values from flash	NA	NA
REG_PATTERN_ENABLE	0x20	No	0x82 01 06 20 00 0y FF	0x00: Disabled 0x01: Enabled *	0x82 09 06 20 FF	0xA0 50 20 00 0y FF
REG_VIDEO_DETECTED	0x28	No	NA	0x01: video detected 0x00: video not detected	0x82 09 06 28 FF	0xA0 50 28 00 0y FF
REG_HDMI_DETECTED	0x29	No	NA	0x01: HDMI detected 0x00: HDMI not detected	0x82 09 06 29 FF	0xA0 50 29 00 0y FF
REG_ZOOM_IN_SPEED	0x2A	Yes	0x82 01 06 2A 00 0y FF	GPIO zoom in speed configuration from 0 to 7	0x82 09 06 2A FF	0xA0 50 2A 00 0y FF
REG_ZOOM_OUT_SPEED	0x2B	Yes	0x82 01 06 2B 00 0y FF	GPIO zoom out speed configuration from 0 to 7	0x82 09 06 2B FF	0xA0 50 2B 00 0y FF
REG_CAM_VENDOR_ID_H	0x30	No	NA	Camera vendor ID MSB (default: 0xFF)	0x82 09 06 30 FF	0xA0 50 30 0y 0y FF
REG_CAM_VENDOR_ID_L	0x31	No	NA	Camera vendor ID LSB (default: 0xFF)	0x82 09 06 31 FF	0xA0 50 31 0y 0y FF
REG_CAM_MODEL_ID_H	0x32	No	NA	Camera model ID MSB (default: 0xFF)	0x82 09 06 32 FF	0xA0 50 32 0y 0y FF
REG_CAM_MODEL_ID_L	0x33	No	NA	Camera model ID LSB (default: 0xFF)	0x82 09 06 33 FF	0xA0 50 33 0y 0y FF
REG_CAM_UART_BYPASS	0x34	No	0x82 01 06 34 0A 05 FF	Bypass the communication for camera update **	NA	NA
REG_5V_OUTPUT_ENABLE	0x40	Yes	0x82 01 06 40 0y 0y FF	0x00: disable 5V output 0x01: enable 5V output	0x82 09 06 40 FF	0xA0 50 40 0y 0y FF
REG_CAMERA_POWER_ENABLE	0x41	Yes	0x82 01 06 41 0y 0y FF	0x00: disable camera power 0x01: enable camera power	0x82 09 06 41 FF	0xA0 50 41 0y 0y FF

Register name	Addr	Saved	Set command	Comments	Inquiry command	Inquiry answer
REG_GPIO_STATE	0x40	Yes	0x82 01 06 40 0y 0y FF	yy = 0b00xxxxxx (x=0 for output, x=1 for input)	0x82 09 06 40 FF	0xA0 50 40 0y 0y FF
REG_GPIO_OUTPUT	0x41	Yes	0x82 01 06 41 0y 0y FF	yy = 0b00xxxxxx (x=0 for < 200mV, x=1 for = 3V3)	0x82 09 06 41 FF	0xA0 50 41 0y 0y FF
REG_GPIO_INPUT	0x42	No	NA	yy = 0b00xxxxxx (x=0 for < 200mV, x=1 for = 3V3)	0x82 09 06 42 FF	0xA0 50 42 0y 0y FF
REG_GPIO_1_CMD	0x43	Yes	0x82 01 06 43 0y 0y FF	VISCA command to send to the camera in input mode ***	0x82 09 06 43 FF	0xA0 50 43 0y 0y FF
REG_GPIO_2_CMD	0x44	Yes	0x82 01 06 44 0y 0y FF	VISCA command to send to the camera in input mode ***	0x82 09 06 44 FF	0xA0 50 44 0y 0y FF
REG_GPIO_3_CMD	0x45	Yes	0x82 01 06 45 0y 0y FF	VISCA command to send to the camera in input mode ***	0x82 09 06 45 FF	0xA0 50 45 0y 0y FF
REG_GPIO_4_CMD	0x46	Yes	0x82 01 06 46 0y 0y FF	VISCA command to send to the camera in input mode ***	0x82 09 06 46 FF	0xA0 50 46 0y 0y FF
REG_GPIO_5_CMD	0x47	Yes	0x82 01 06 47 0y 0y FF	VISCA command to send to the camera in input mode ***	0x82 09 06 47 FF	0xA0 50 47 0y 0y FF
REG_GPIO_6_CMD	0x48	Yes	0x82 01 06 48 0y 0y FF	VISCA command to send to the camera in input mode ***	0x82 09 06 48 FF	0xA0 50 48 0y 0y FF

* Note: Pattern is not available on all cameras, please make sure that your camera supports it.

** Note: The board needs to be restarted after the camera update to enable the communication again. Be sure that your camera can be updated only using the Kel cable (no need to connect any FFC cable).

*** Note: In input configuration the GPIOs are active low and output value is not taken into account. Here the VISCA commands you can select to be sent when the GPIO is activated:

Configuration	Action	Control	VISCA command
0x00: Zoom In	Press Release	Zoom In Zoom Stop	0x81 01 04 07 02 FF 0x81 01 04 07 00 FF
0x01: Zoom Out	Press Release	Zoom Out Zoom Stop	0x81 01 04 07 03 FF 0x81 01 04 07 00 FF
0x02: Zoom In variable speed	Press Release	Zoom In variable speed (Y) Zoom Stop	0x81 01 04 07 2Y FF 0x81 01 04 07 00 FF
0x03: Zoom Out variable speed	Press Release	Zoom Out variable speed (Y) Zoom Stop	0x81 01 04 07 3Y FF 0x81 01 04 07 00 FF
0x04: Focus switch Manual / Auto	Press Release	Focus switch Manual / Auto	0x81 01 04 38 10 FF
0x05: Focus one push	Press Release	Focus one push	0x81 01 04 18 01 FF
0x06: Focus far	Press Release	Focus Far Focus Stop	0x81 01 04 08 02 FF 0x81 01 04 08 00 FF
0x07: Focus near	Press Release	Focus Near Focus Stop	0x81 01 04 08 03 FF 0x81 01 04 08 00 FF
0x08: Freeze toggle	Press Release	Freeze toggle	0x81 01 04 62 0Y FF (Y=2 for ON, Y=3 for OFF)
0x09: Mirror toggle	Press Release	Mirror toggle	0x81 01 04 61 0X FF (Y=2 for ON, Y=3 for OFF)
0x0A: Flip toggle	Press Release	Flip toggle	0x81 01 04 66 0Y FF (Y=2 for ON, Y=3 for OFF)

0x0B: Mute toggle	Press Release	Mute toggle	0x81 01 04 75 10 FF
0x0C: Memory preset	Short press Pressed more than 1 second	Memory preset Recall Memory preset Set	0x81 01 04 3F 02 0Y FF 0x81 01 04 3F 01 0Y FF with Y corresponding to the preset number (set at the GPIO number)
0XFF: No command sent	Press Release	Nothing	Nothing

Examples:

- Use GPIO 1 as input for Freeze toggle: input is the default configuration, send the command 0x82 01 06 43 00 08 FF to attribute the function and save command 0x82 01 06 13 00 01 FF.

- Use GPIO 3 as input for polling only: input is the default configuration, send the command 0x82 01 06 45 0F 0F FF to attribute no function avoiding sending VISCA command to the camera when the GPIO is active, and save command 0x82 01 06 13 00 01 FF.
  Polling is done by reading register REG_GPIO_INPUT with this command 0x82 09 06 42 FF.
  Each GPIO value is read in a bit of the answer: 0xA0 50 42 0y 0y FF with yy = 0b00xxxxxx.

- Use GPIO 5 as output: send command 0x82 01 06 40 02 0F FF (0x2F = 0b00101111, will configure GPIO 5 as output and the others as inputs) and save command 0x82 01 06 13 00 01 FF.
  Set output level: send command 0x82 01 06 41 0y 0y FF with yy = 0b00010000 for GPIO 5 high level (3V3) and yy = 0b00000000 for GPIO 5 low level (0V) and save if needed.

Control camera video format

Four DIP switches are used to select the video format of the camera. The value is checked each time power is issued to the camera and the camera format is automatically set accordingly.
Please refer to the table below to change format:

1	2	3	4	Configuration
OFF	OFF	OFF	OFF	Default camera format
OFF	OFF	OFF	ON	3840×2160p60
OFF	OFF	ON	OFF	3480×2160p50
OFF	OFF	ON	ON	3840×2160p30/29.97
OFF	ON	OFF	OFF	3840×2160p25
OFF	ON	OFF	ON	1920×1080p60/59.94
OFF	ON	ON	OFF	1920×1080p50
OFF	ON	ON	ON	1920×1080 p30/29.97
ON	OFF	OFF	OFF	1920×1080p25
ON	OFF	OFF	ON	1280×720p60/59.94
ON	OFF	ON	OFF	1280×720p50
ON	OFF	ON	ON	1280×720p30/29.97
ON	ON	OFF	OFF	1280×720p25
ON	ON	OFF	ON	1920x1080i60/59.94
ON	ON	ON	OFF	1920x1080i50
ON	ON	ON	ON	480p60/59.94

Please note that video formats can depend on the camera model used.

Camera GPIOs

Six GPIOs are available on J500 connector, each one is dedicated to a specific camera function:

Pin	Action	Control	VISCA command sent
Ctrl1	Press Release	Zoom + Zoom stop	0x81 01 04 07 23 FF 0x81 01 04 07 00 FF
Ctrl2	Press Release	Zoom – Zoom stop	0x81 01 04 07 33 FF 0x81 01 04 07 00 FF
Ctrl3	Press Release	Focus Auto / Manual	0x81 01 04 38 10 FF
Ctrl4	Press Release	Focus near Focus stop	0x81 01 04 08 33 FF 0x81 01 04 08 00 FF
Ctrl5	Press Release	Focus far Focus stop	0x81 01 04 08 23 FF 0x81 01 04 08 00 FF
Ctrl6	Press Release	Image freeze toggle	0x81 01 04 62 02 FF 0x81 01 04 62 03 FF

To activate it you need to connect the pin to the ground. ESD filters and anti-bounce have been added. You can use existing keyboard to easily control them.

External synchronization

An input for an external synchronization signal is available on a simple 2-way connector (J202) or on a coaxial connector (J201). The synchronization signal is directly forwarded to the camera. The *Sync Lock* LED turns on when the camera is locked on the synchronization signal.

Note: The external synchronization feature is **only** available with the **ER8550 camera**. The external synchronization signal format must match the camera's format.

Board status

The status LED displays the state of the system, depending on its blinking rate and the number of blinks.

Board status	Blink state	Description
Initialization	Regular blinking, every 200ms	The board is collecting data from the camera
Ready	Regular blinking, every second	Video output working and communication available
Camera disabled	Regular blinking, every 5 seconds	No video, camera power is disable, see register 0x41
Re-driver error	Irregular blinking, 1 pulse per second	Communication error with the HDMI re-driver
Camera error	Irregular blinking, 2 pulses per second	Communication error with the camera

Connectors

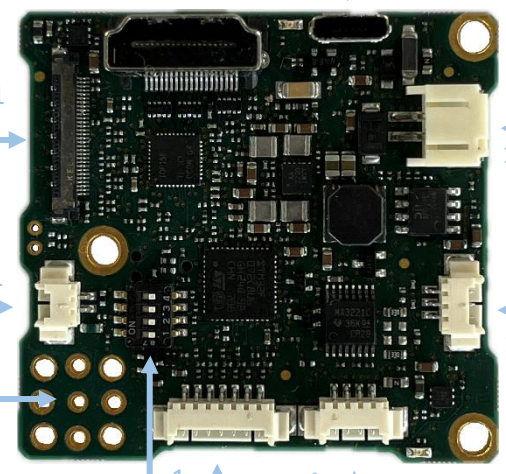
J700	HDMI connector

J900	Micro-USB connector

J200	4K TMDS camera input
1	DC_IN
2	DC_IN
3	DC_IN
4	DC_IN
5	RESET
6	UART_TX
7	UART_RX
8	GND
9	USB_D +
10	USB_D -
11	GND
12	USB_VBUS
13	+5.0V OUT
14	Hot Plug Detect
15	EXT_SYNC_LOCK
16	EXT_SYNC
17	XSD0_ACC_LED
18	GND
19	TMDS Data 2 +
20	TMDS Data 2 -
21	GND
22	TMDS Data 1 +
23	TMDS Data 1 -
24	GND
25	TMDS Data 0 +
26	TMDS Data 0 -
27	GND
28	TMDS Clock +
29	TMDS Clock -
30	GND

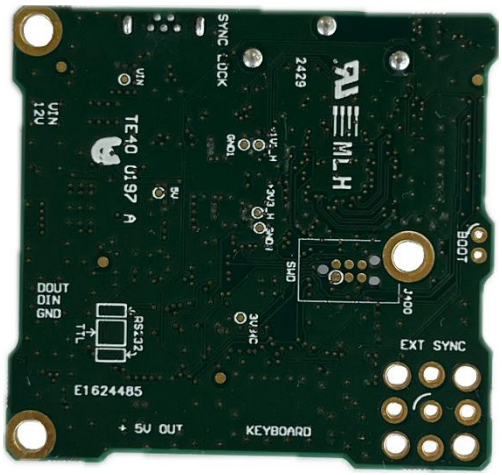
J800	Power supply
1	6 to 12 VDC
2	GND

J501	Communication
1	GND
2	Tx
3	Rx

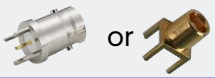


J801	5V output
1	+5V
2	+5V
3	GND
4	GND

J202	External sync connector
1	GND
2	Ext Sync



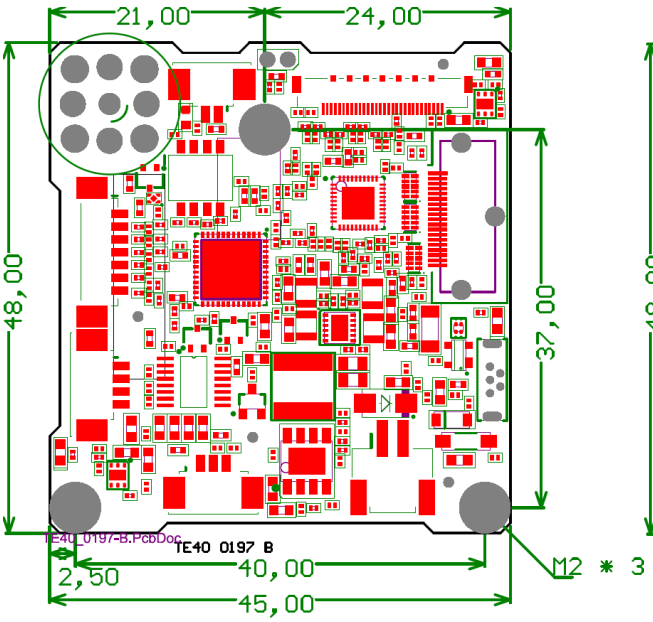
J500	Camera GPIOs
1	GND
2	Zoom Tele
3	Zoom Wide
4	Auto/Manual Focus
5	Focus Near
6	Focus Far
7	Freeze

J201	External sync connector
VOPTEM37	 or

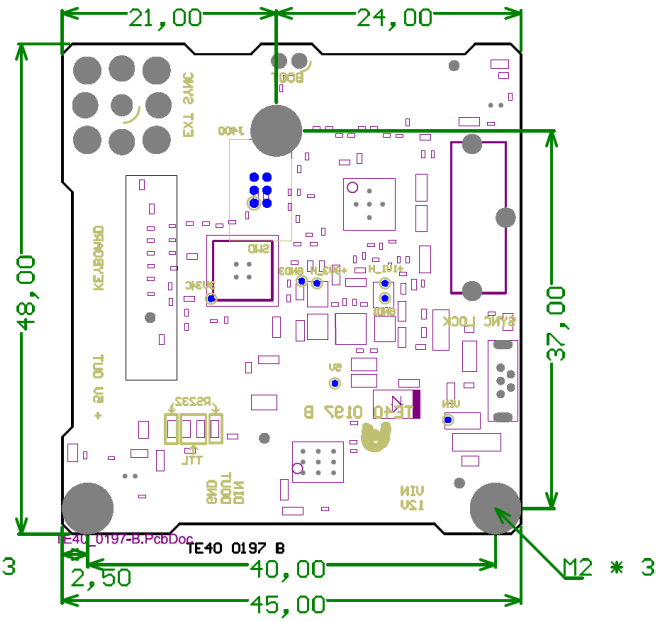
DIP switches				Configuration
1	2	3	4	
OFF	OFF	OFF	OFF	External format
OFF	OFF	OFF	ON	2160p60
OFF	OFF	ON	OFF	2160p50
OFF	OFF	ON	ON	2160p30/29.97
OFF	ON	OFF	OFF	2160p25
OFF	ON	OFF	ON	1080p60/59.94
OFF	ON	ON	OFF	1080p50
OFF	ON	ON	ON	1080 p30/29.97
ON	OFF	OFF	OFF	1080p25
ON	OFF	OFF	ON	720p60/59.94
ON	OFF	ON	OFF	720p50
ON	OFF	ON	ON	720p30/29.97
ON	ON	OFF	OFF	720p25
ON	ON	OFF	ON	1080i60/59.94
ON	ON	ON	OFF	1080i50
ON	ON	ON	ON	480p60/59.94

Form factor

TOP



BOTTOM



48mm (H) x 45mm (W) x 13mm (D)

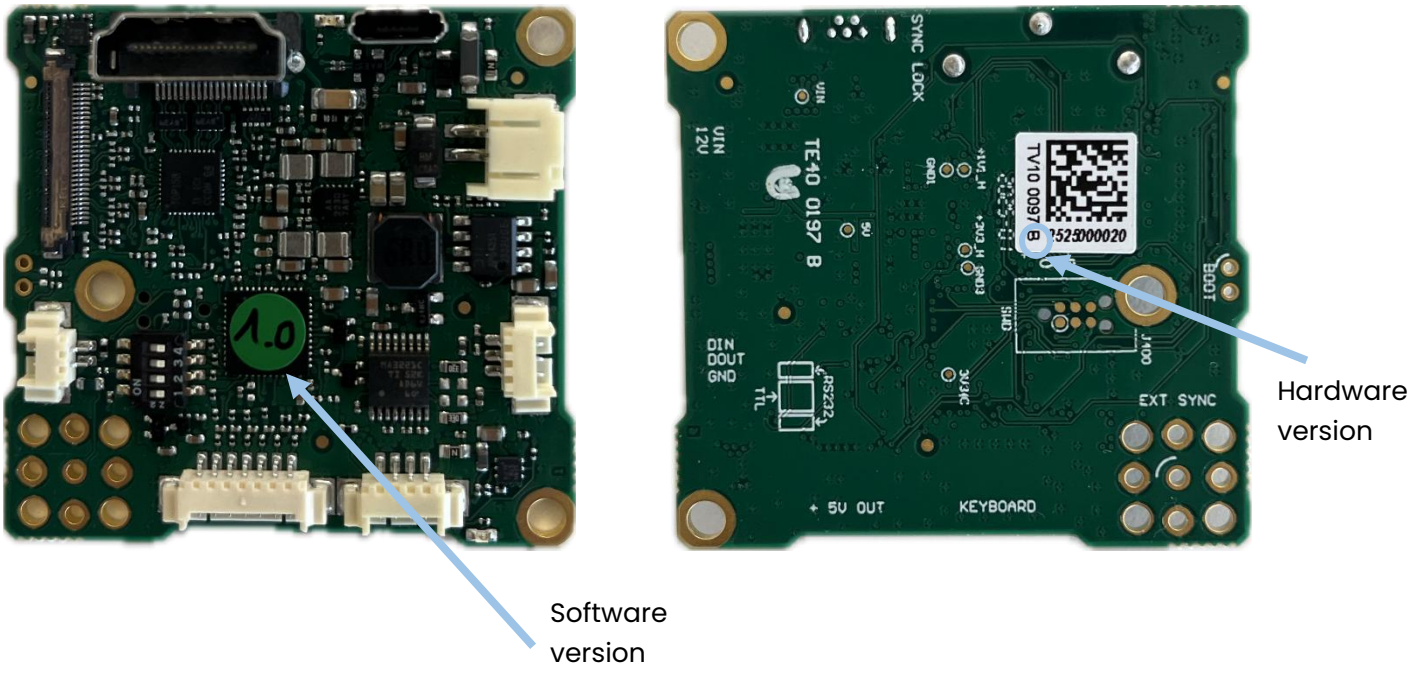
3 holes Ø 3mm

13g

Troubleshooting

Get hardware and software version

The hardware version is a letter written close to the reference of the board TV10 0097 on the bottom side of the board. The software version is written on a green sticker stuck on the top side of the board. Be careful, the HDMI 4K60 can be updated by the customer, in this case the green sticker can be not at the correct version.



Update via micro-USB

An update of the board is possible by distance, you need a Micro-USB cable to connect a computer with the board. A specific driver and "Dfu-util" are needed for the update. If you need to update the board, please send us a mail at info@i2s.fr and we will provide you support ant the tools.

Common issues

If you have any problem getting the video, here are some points you need to check:

- Power supply is correctly connected to the board, no consuming issue or overheating of the board.
- No damaged cable, you can check using other 30-way Kel cable, if possible, check the output cable used to get the video
- Check your display compatibility with the video format you want to read
- The video format of the camera is correct and supported by the board
- Try with another HDMI 4K compatible camera to be sure the issue is not coming from the camera
- Make sure to turn on the board with the 6-12V power supply before connecting the USB cable

If you are not able to find the cause of the issue, please contact us at info@i2s.fr and we will give you support. Explain us the problem you are facing with as much details as possible and please add the hardware and software version of your board.