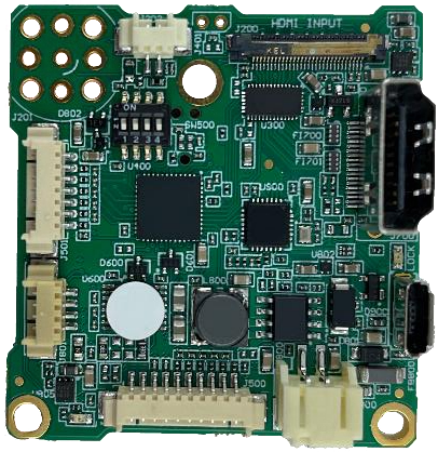
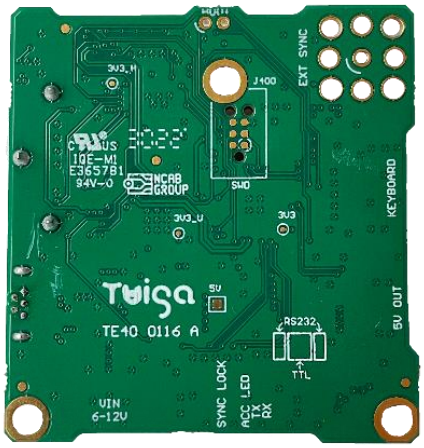
Vision & Innovation

HDMI 4K

Technical Manual





P/N – TV10 0077: HDMI 4K interface board for Sony FCB-4K camera range

P/N – TV50 0024: Mounting kit for TV10 0077 – HDMI 4K I/F board
Includes: 30-way micro-coax camera cable, 2-way cable (power supply), 10-way cable (RS232/TTL), 7-way cable (GPIOs), right angle black anodized bracket, screws and spacers

P/N – TV50 0017: Cable kit for TV10 0077 – HDMI 4K I/F board
Includes: 30-way micro-coax camera cable, 2-way cable (power supply), 10-way cable (RS232/TTL)

Available connectors: VOPTEM37 (Add external sync connector)

Table of content

Revision History

Date	Revision	Description	Modified by	Note
26/11/18	A	Creation of the document	TLE	
28/09/20	B	Added video format compatibility list	CBO	
21/10/21	C	Update DIP switch information for new camera support Remove RS232 automatic baud rate detection	TLE	
18/05/22	D	Add distinct command to power off camera Add inquiry for 5V and camera power status	TLE	
07/04/23	E	Update board and kit references	CBO	
03/03/25	F	Change document organization and graphical chart	CBO	

Key features

- HDMI 1.4b video output
- Video resolution up to 2160p30
- Support Sony ES8230, EW9500H and ER camera range
- 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 20m
- Low power mode
- 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.

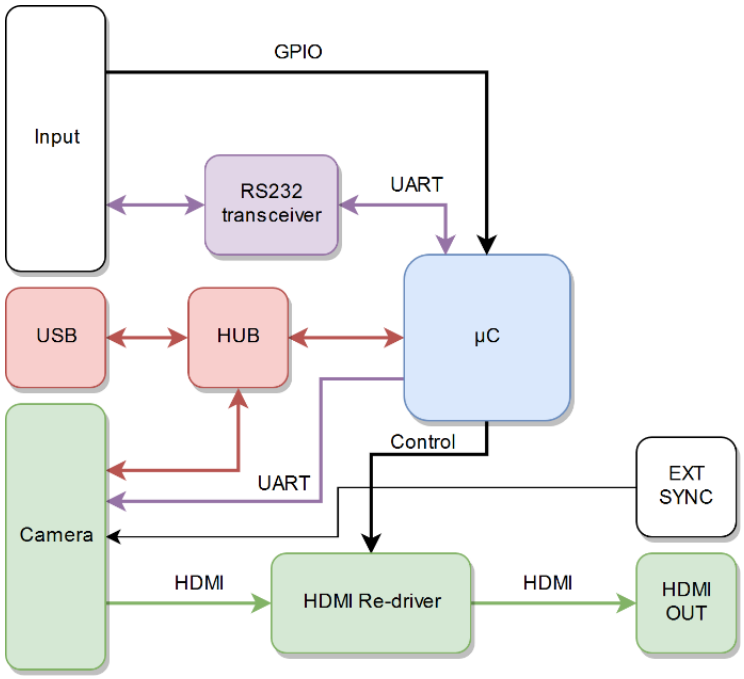
This standard is compatible with most of the existing displays, it gives a lot of flexibility. This is ideal for short distance applications. Our board adds a feature to increase output signal gain to go up to 20m cable length.
The HDMI 4K board provides video signal from 4K camera blocks to HDMI output. It has an eco-mode to reduce the system consumption but also the signal strength.
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 2160p30
- 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.

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.

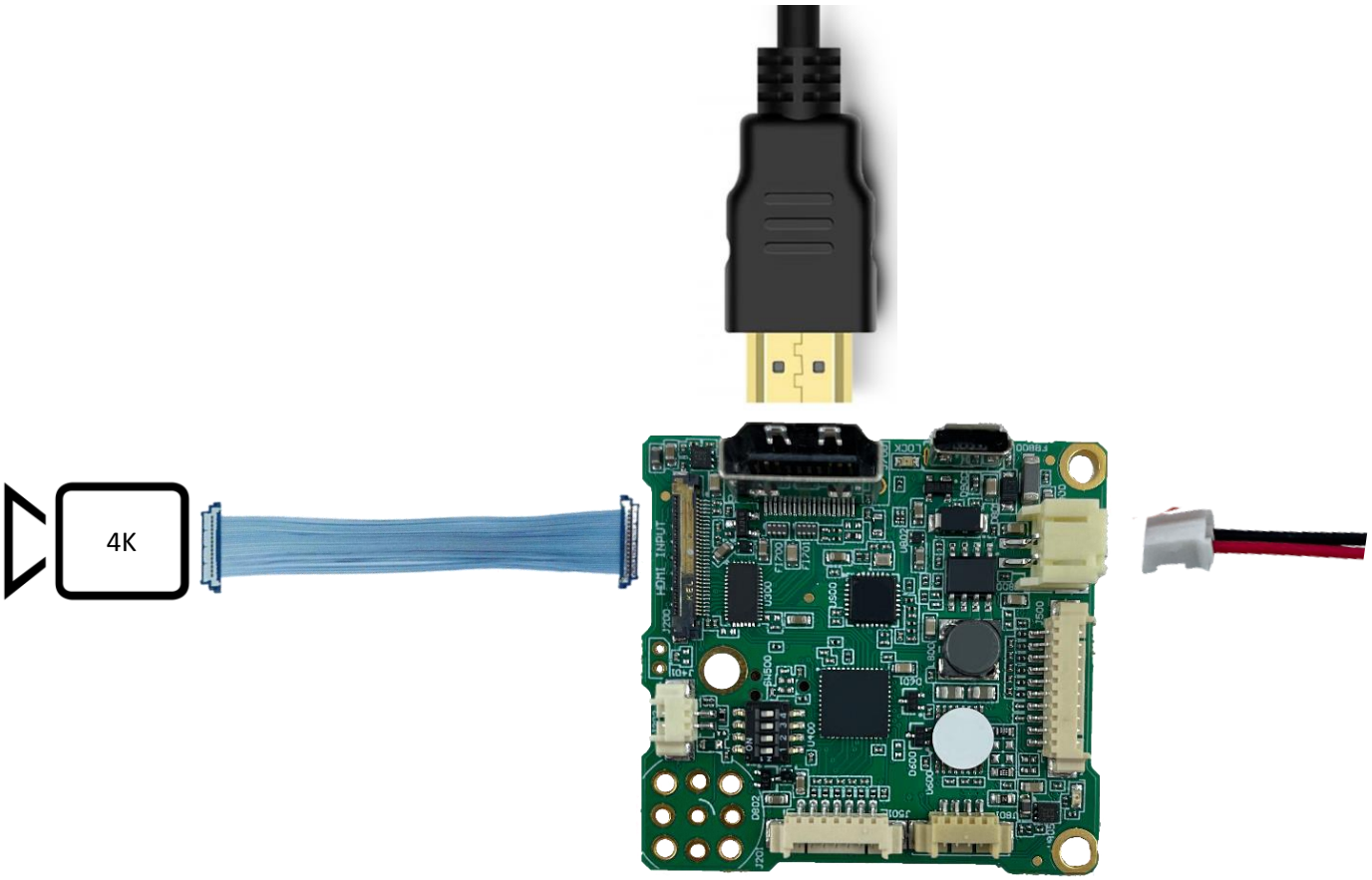
A green blinking LED helps to know in which state the board is, it is quick feedback to be sure no error happened.

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 the internal command “5V output”.

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 the register 72.

HDMI video output

The output is compliant to HDMI 1.4b, 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:

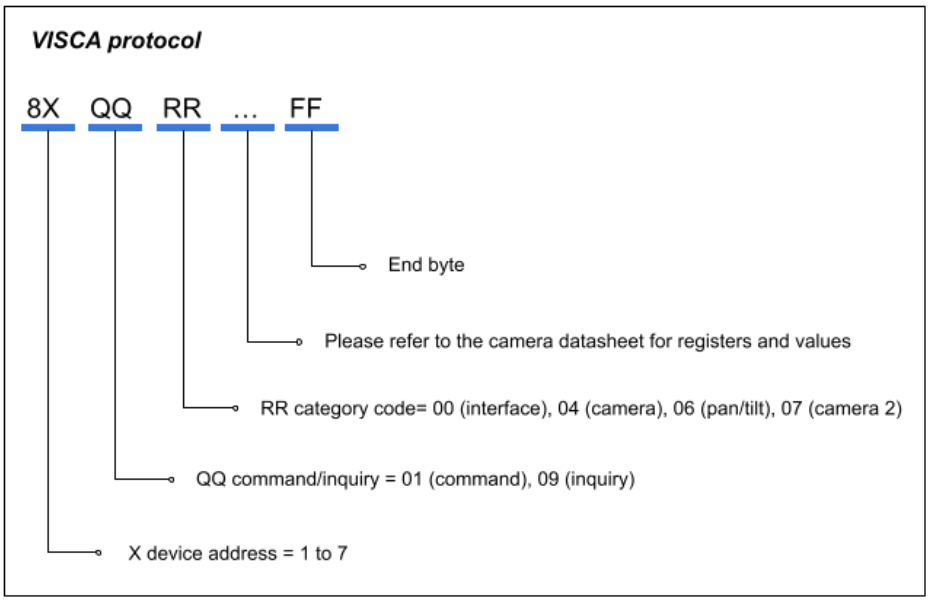
1. RS232 / UART TTL 3V3 connector (J500): it allows you to send VISCA commands to the camera or to configure internal features. To switch from RS232 to TTL configuration some hardware modifications are needed. Please contact us at info@i2s.fr for more information.

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.

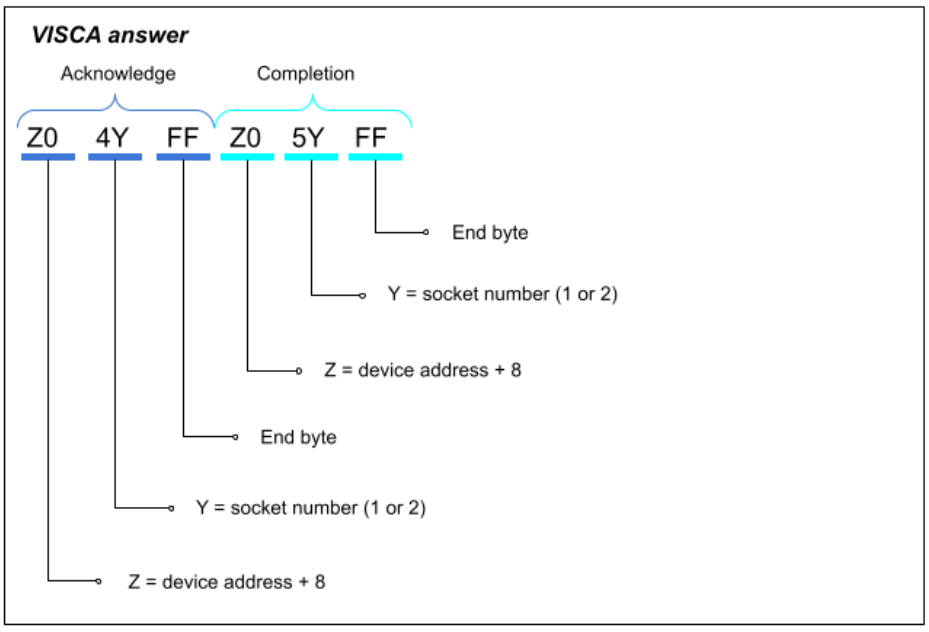
The baud rate of the serial interface will follow the baud rate configured in the camera.

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:

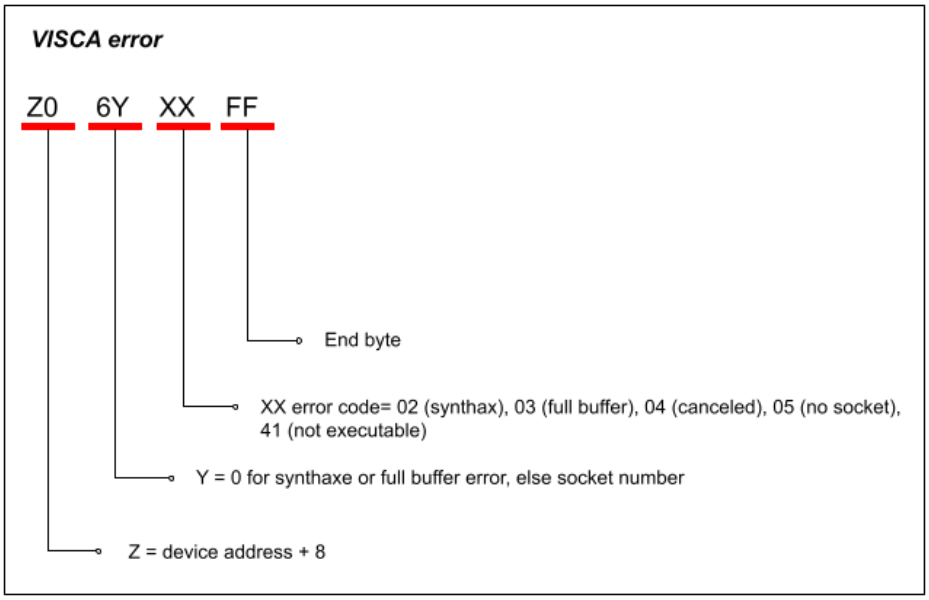


The camera answer follows this structure:



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 features

The board internal features are accessible from the connector J500 and J900 using custom VISCA commands specifically targeted at the board itself and are not transferred to the camera:

Feature	Command	Inquiry	Answer	Comments
Software version	N/A	0x81 09 01 02 FF	0x09 50 0x 0y FF	'x' is the major version 'y' is the minor version
5V output ON	0x81 01 01 EE 02 FF	N/A	0x90 41 FF 90 51 FF	Turns on the 5V output
5V output OFF	0x81 01 01 EE 03 FF	N/A	0x90 41 FF 90 51 FF	Turns off the 5V output
5V output status	N/A	0x81 09 01 EE FF	0x09 05 0x FF	0x02: 5V output ON 0x03: 5V output OFF
HDMI Eco mode ON	0x81 01 01 1C 02 FF	N/A	0x90 41 FF 90 51 FF	Disables the HDMI signal boost
HDMI Eco mode OFF	0x81 01 01 1C 03 FF	N/A	0x90 41 FF 90 51 FF	Enables the HDMI signal boost
HDMI High Gain	0x81 01 01 1A 02 FF	N/A	0x90 41 FF 90 51 FF	Set the HDMI signal gain to maximum value
HDMI Low Gain	0x81 01 01 1A 03 FF	N/A	0x90 41 FF 90 51 FF	Set the HDMI signal gain to lowest value
Standby Mode ON	0x81 01 01 1E 02 FF	N/A	0x90 41 FF 90 51 FF	Disable the video output
Standby Mode OFF	0x81 01 01 1E 03 FF	N/A	0x90 41 FF 90 51 FF	Enable the video output
Sleep Mode OFF	0x81 01 01 00 02 FF	N/A	0x90 41 FF 90 51 FF	Turn ON the camera power
Sleep Mode ON	0x81 01 01 00 03 FF	N/A	0x90 41 FF 90 51 FF	Turn OFF the camera power
Camera power status	N/A	0x81 09 01 00 FF	0x09 05 0x FF	x: 0x02 if the camera power is ON 0x03 if the camera power if OFF
System reset	0x81 01 01 DE DE FF	N/A	N/A	Reset the whole system (µC, camera)

For commands that are available through GPIO and VISCA protocol, the priority is given to the GPIO.

HDMI output optimization

The HDMI output of the TV10 0077 board can be adjusted to manage different use cases and optimize power consumption. Those settings can be controlled through VISCA command or GPIO.

The table below indicates the recommended settings for different cable length:

Cable length	HDMI Gain	HDMI Eco mode
Short	LOW	ON
Long	HIGH	OFF

The default settings at start-up are gain low and Eco Mode Off.

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.

Because not all supported cameras have the same formats available, please refer to the table below to change format:

1	2	3	4	Configuration
OFF	OFF	OFF	OFF	Default camera format
ON	OFF	OFF	OFF	3840×2160p29.97
ON	ON	OFF	OFF	3480×2160p25
OFF	ON	OFF	OFF	3840×2160p23.98
ON	ON	ON	OFF	1920×1080p59.94
OFF	ON	ON	OFF	1920×1080p50
ON	OFF	ON	OFF	1920×1080i59.94
OFF	OFF	ON	OFF	1920×1080i50
OFF	OFF	ON	ON	1920×1080p29.97
ON	ON	OFF	ON	1920×1080p25
OFF	ON	OFF	ON	1920×1080p23.98
ON	OFF	OFF	ON	1280×720p59.94
OFF	OFF	OFF	ON	1280×720p50
ON	OFF	ON	ON	720×480p59.94
OFF	ON	ON	ON	720×576p50
ON	ON	ON	ON	Default camera format

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

Camera GPIOs

Six GPIOs are available on J501 connector, each one is dedicated to a specific camera function:

Pin	Functions	Description
CDE0	Zoom Tele	Zoom tele while button is activated, and stop zoom when released
CDE1	Zoom Wide	Zoom wide while button is activated, and stop zoom when released
CDE2	Freeze	Freeze/unfreeze the camera output
CDE3	Memory Preset	1s activation: Camera preset save 5s activation: Camera preset recall
CDE4	Auto-focus	One push auto focus
CDE5	Color bar	Toggle between camera live output and camera colorbar

Each associated function is triggered when the GPIO is pulled to ground.

System GPIOs

Six GPIOs are available on J500 connector, allowing to manage some system features:

Pin	Functions	Description
CDE6	Video output enable	Each activation toggles the HDMI output (enable/disable)
CDE7	Low power mode	1s activation: Toggle standby mode 5s activation: Toggle sleep mode
CDE8	Activate Eco mode	Decrease power consumption, but also signal strength
CDE9	Activate HDMI Gain	Increase the HDMI signal gain
CDE10	Active 5V output	Turn ON the 5V output when activated.
CDE11	Reserved	

Each associated function is triggered when the GPIO is pulled to ground.
For commands that are available through GPIO and VISCA protocol, the priority is given to the GPIO.

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 system state every 2 seconds. The number of blinks indicates the current state.

Status	Blinks number	Description
Sleep Mode	0	Camera shutdown
Standby Mode	1	HDMI output shutdown, camera ON
Searching camera	2	The system tries to detect camera
Format change ongoing	3	The format update procedure is running
Running mode	4	Camera is detected and format is correct

The system power consumption in different mode is given below:

Mode	Power
Sleep mode	0.2W
Standby mode	2.9W
Running mode	4.1W

Please note that these measures are with Sony FCB-ER8530 camera in 4k30.

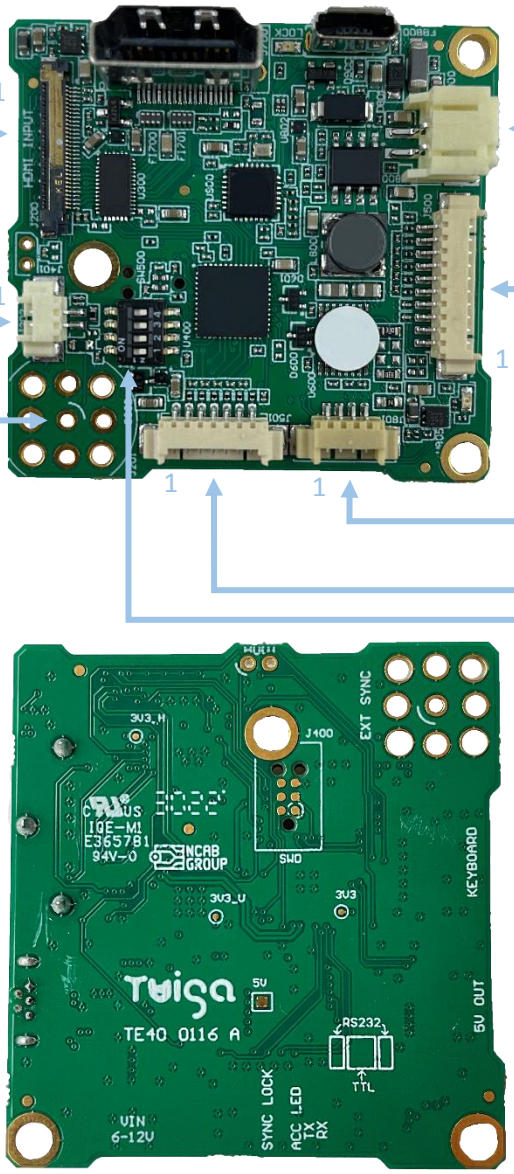
Connectors

J700	HDMI 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

J202	External sync connector
1	GND
2	Ext Sync

J201	External sync connector
VOPTEM37	 or



J900	Micro-USB connector

J800	Power supply
1	6 to 12 VDC
2	GND

J500	Communication & System GPIOs
1	NA
2	GND
3	Rx
4	Tx
5	CDE11
6	CDE10
7	CDE9
8	CDE8
9	CDE7
10	CDE6

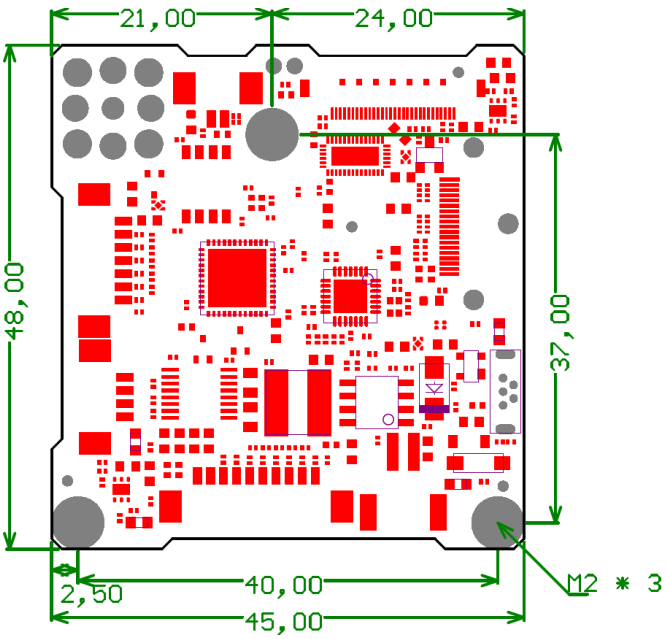
J801	5V output
1	+5V
2	+5V
3	GND
4	GND

J501	Camera GPIOs
1	GND
2	CD0
3	CD1
4	CD2
5	CD3
6	CD4
7	CD5

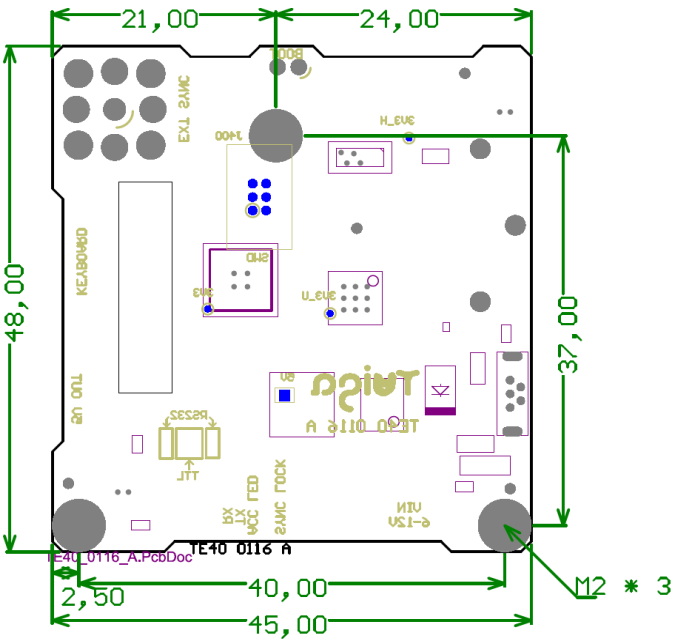
DIP switches				Configuration
1	2	3	4	
OFF	OFF	OFF	OFF	External
ON	OFF	OFF	OFF	2160p29.97
ON	ON	OFF	OFF	2160p25
OFF	ON	OFF	OFF	2160p23.98
ON	ON	ON	OFF	1080p59.94
OFF	ON	ON	OFF	1080p50
ON	OFF	ON	OFF	1080i59.94
OFF	OFF	ON	OFF	1080i50
OFF	OFF	ON	ON	1080p29.97
ON	ON	OFF	ON	1080p25
OFF	ON	OFF	ON	1080p23.98
ON	OFF	OFF	ON	720p59.94
OFF	OFF	OFF	ON	720p50
ON	OFF	ON	ON	480p59.94
OFF	ON	ON	ON	576p50
ON	ON	ON	ON	External

Form factor

TOP



BOTTOM



48mm (H) x 45mm (W) x 11mm (D)

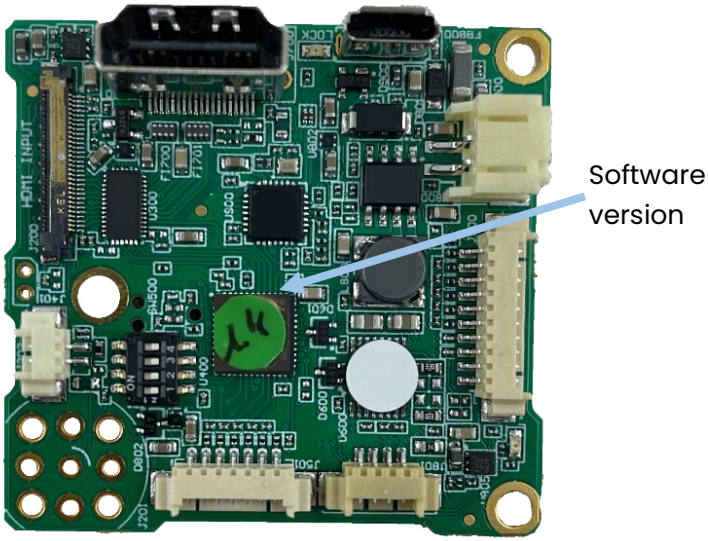
3 holes Ø 3mm

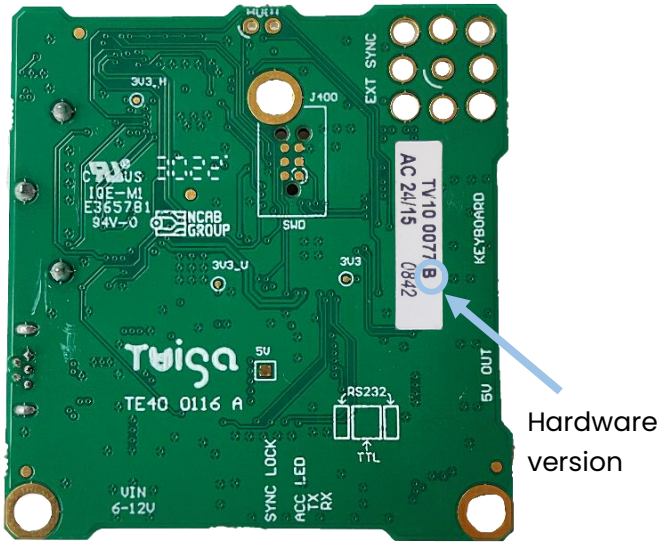
13g

Troubleshooting

Get hardware and software version

The hardware version is a letter written close to the reference of the board TV10 0077 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 4K 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 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

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.