Revision: 11.2022-001

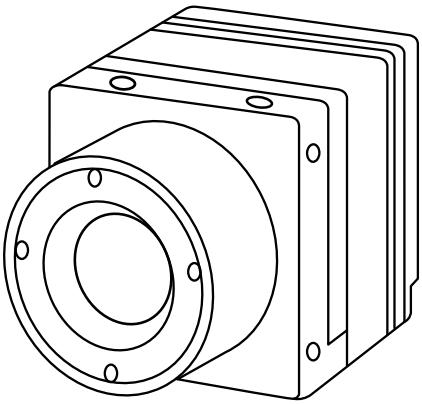
ICI | INFRARED CAMERAS INC

Industry

GC-76/GC-106 GAS LEAK DETECTION CORE

USER MANUAL

PLEASE READ THIS MANUAL BEFORE SWITCHING THE UNIT ON.
IMPORTANT SAFETY INFORMATION INSIDE.



Shown with a 13 mm lens.

**PLEASE READ THIS MANUAL BEFORE SWITCHING THE UNIT ON.
IMPORTANT SAFETY INFORMATION INSIDE.**

ICI cameras fall under US Federal Law and Export Control.

2105 W. Cardinal Dr. Beaumont, TX 77705

For more information, contact us: (409) 861-0788 | sales@infraredcameras.com | www.infraredcameras.com

Revision History

09.2022-001	Document created
11.2022-001	GC-106 specifications added

Contents

1. Disclaimers

1-1 Terms and Conditions

Warranty Terms and Condition of Sale are made available online at:

https://infraredcameras.com/support/terms-and-conditions-of-sale/

1-2 U.S. Government Regulations

This product may be subject to U.S. Export Regulations. Please send any inquiries to support@infraredcameras.com

1-3 Copyright

1-4 Quality Assurance

Infrared Cameras, Inc. is committed to a policy of continuous development; therefore we reserve the right to make changes and improvements on any of the products without prior notice.

1-5 Customer Help

For customer help, visit:

https://infraredcameras.com/support/

E-mail:

support@infraredcameras.com

2. User Notice

2-1 Calibration of Thermal Devices

Annual calibration of any thermal camera is recommended. Contact customer service to schedule maintenance.

2-2 Accuracy of Thermal Devices

For very accurate results, ICI recommends waiting a minimum of 5 minutes after starting a thermal camera before measuring a temperature.

2-3 Cybersecurity

After the products are connected to the Internet, they may face risks including but not limited to network attacks, hacker attacks, virus infections, etc. The company will not be responsible for the abnormal operation of the products and any loss or liability caused therefrom shall be at your own risk.

2-4 Disposal of Electronic Waste

Electrical and electronic equipment (EEE) contains materials, components and substances that may be hazardous and present a risk to human health and the environment when waste electrical and electronic equipment (WEEE) is not handled correctly.

Equipment marked with the below crossed-out wheeled bin is electrical and electronic equipment. The crossed-out wheeled bin symbol indicates that waste electrical and electronic equipment should not be discarded together with unseparated household waste, but must be collected separately.

All local authorities have established collection schemes under which residents can dispose of equipment at a recycling center or other collection points, or WEEE will be collected directly from households. More detailed information is available from the administration of the relevant local authority. Always dispose of waste in accordance with local, state, and federal regulations.

2-5 Intended Use

The GC-76 core is specially designed to quickly, accurately, and safely detect and locate gas leaks - without system downtime. Temperature measurement up to 120°C (248°F) meets the requirements of industrial settings and is ideal for petroleum, chemical, natural gas, and electric power applications. Monitoring for gas leaks assists in daily equipment maintenance, accident prevention, and environmental protection. The GC-76 can be integrated into fixed mounted and handheld devices.

Environment of use: UAV/UAS integrations, handheld and head-mounted equipment, multi-spectral systems, industrial monitoring, security applications, and other data collection-based inspections among others.

You agree that this product is for civilian use only, and shall not use applications that may infringe the rights of third parties, medical and safety devices or other applications where product failure may lead to life-threatening or personal injury, as well as weapons of mass destruction, chemical and biological weapons, nuclear explosions, unsafe use of nuclear energy, dangerous or humanitarian purposes. Any loss or liability caused therefrom shall be at the your own risk.

2-6 Manual Update

The user manual will be updated from time to time. To access the latest manuals, translations of manuals, and notifications, go to:

https://thermalcamera.com/product-resources/

The manufacturer reserves the right to alter the specifications of the product without prior notification. The manufacturer allows himself the right to modify without any preliminary opinion the technical specifications of the product.

2-7 Scope of Application

Thermal Camera issues generic manuals that cover several cameras within a model line.

This means that this manual may contain descriptions and explanations that do not apply to your particular camera model. This manual may contain technical inaccuracies or typographical errors.

2-8 Authoritative Versions

The authoritative version of this publication is English. In the event of divergences due to translation errors, the English text has precedence.

Any late changes are first implemented in English. Other languages may or may not be available.

2-9 Training

To read about infrared training, visit:

https://infraredtraininginstitute.com/

3. Safety Information

- Operation is subject to the following two conditions: 1 This device may not cause harmful interference, and 2 this device must accept any interference received, including interference that may cause undesired operation.
- This device must be installed by qualified service personnel or system installation personnel.
- Do not disassemble or modify the thermal device. If the device operates abnormally, please contact the supplier and do not dismantle the device on your own.
- Do not point the imager (with or without the lens cover) at intensive energy sources, e.g. devices that emit laser radiation, or the sun. This can affect the accuracy of the camera, and cause damage to the detector.
- Do not use the imager in temperatures higher than 50 °C (122 °F) or lower than -15 °C (5 °F). High/low temperatures can cause damage to the device.
- Do not cut, alter, or place heavy items on the device. These actions may cause an electric short leading to fire or electrocution.
- Prior to start of the device, make sure that the power supply is properly connected. If the power supply is connected incorrectly, the device may be damaged.
- Do not put holes in the device with objects. Damage to the device may occur.
- Do not hit the device with a hammer or apply strong impacts or electric shocks to it. Damage to the device may occur.
- Do not put the device in or near a fire, stove or other high-temperature locations. Damage or ignition of the device may occur.
- Do not put the device in direct sunlight or other high-temperature locations. Damage or ignition of the device may occur.
- Do not get water or salt water on the device or permit the device to get wet. Damage to the device may occur.
- Remove any water or moisture on the device before you install it. Damage to the device may occur.
- If there are fluids on the device and the fluid gets into the eyes, do not rub the eyes. Flush well with water and immediately get medical care.
- Always dispose of device in accordance with local, state and federal regulations.
- Do not use the device if, when used, there is a smoke emitted from the device, the device feels excessively hot, changes color, changes shape, or is in an unusual condition. Speak with a sales office if one or more of these problems occurs.
- Do not use liquids to clean the electronics.
- Clean the case with a damp cloth and a weak soap solution. Do not use abrasives, isopropyl alcohol, or solvents to clean the case or lens/screen.

- Be careful when cleaning the infrared lens. Do not clean the infrared lens too vigorously. This can damage the anti-reflective coating.
- Avoid condensation. Taking the device from cold to hot will cause condensation in the thermal imager. To protect the device, power on the device and wait until it becomes warm enough for the condensation to evaporate.
- Keep device out of reach of children.
- This product is a precise electronic device that must be handled with care during use, storage, and transportation to prevent dangerous actions such as the device being hit by external force, or falling from heights.
- Transport: During transportation and storage the original packaging box must be used.
- Storage: If you do not use the imager for a long period of time, put the device in a cool and dry environment.
- It is recommended to calibrate the device(s) annually.

4. Technical Specifications

	GC-76
Gases Detected	Methane, Nitrous Oxide, Sulfur Dioxide, Phenol, Cyclopentanone, Hydroxycarbonyl, R13, R13B1, R123, R125, R134A, R417A, R422A, R508A,
Pixel Resolution	640 x 512
Accuracy	± 3°C (± 5.4°F) or ± 3%
Temperature Range	-20°C to 120°C (-4°F to 248°F)
Operation Range	-20°C to 50°C (-4°F to 122°F)
Storage Range	-45°C to 85°C (49°F to 185°F)
Detector Type	UFPA (VOx)
Pixel Pitch	12 µm
Spectral Band	7 µm to 8.5 µm
Frame Rate	25 Hz
Humidity	5% to 95%, non-condensing
Pixel Operability	> 99 %
Shock	80 G
Vibration	6.06 G
Dimensions (without lens)	26 mm x 26 mm x 22m (L x W x D ± 0.5 mm) (1.02" x 1.02" (L x W x H ± 0.02")) [1]
Weight (without lens)	21 g (0.74 oz)
Power	4V ~ 6V DC, < 1.3W [2]
Power Protection	Over-voltage; under-voltage; reverse polarity
Interface	RS-232; UART (3.3 V)
Expansion Board	Call for options
Video	Analog: 1 channel PAL or NTSC [3] Digital: BT.656; 8-bit or 14-bit LVCMOS; LVDS [4]
Video Mirror	Horizontal; Vertical; Diagonal [5]
Image Polarity	White hot or black hot
Image Processing	Digital enhancement; Imaging denoising [5]
Reticle	Reveal; Hidden; Shift [5]
Brightness	Adjustable
Zoom	1.0X ~ 8.0X continuous [5]
Palette support [5]	

Internal non-uniformity correction (NUC)

Note:

1. Dimensions without expansion board.
2. Wattage is based on tests without extension boards. Typical working voltage is 4V DC. Expansion boards support 3.5V ~ 18V DC.
3. The analog video output format is PAL-D.
4. 8-Bit or 14-Bit LVCMOS digital video is supported only on the 70 pin connector core.
5. Digital video does not have the zoom and video mirror except for BT.656.

	GC-106
Gases Detected	Sulfur Hexafluoride, Ammonia, Ethylene, Crotonaldehyde, Vinyl Chloride, Trichloroethylene, Propene, Cyclopropanone, Acrylonitrile, Ethyl Cyanoacrylate, 2-Chloropropylene, Allyl bromide, 2-Butynal
Pixel Resolution	640 x 512
Accuracy	± 3°C (± 5.4°F) or ± 3%
Temperature Range	-20°C to 120°C (-4°F to 248°F)
Operation Range	-20°C to 50°C (-4°F to 122°F)
Storage Range	-45°C to 85°C (49°F to 185°F)
Detector Type	UFPA (VOx)
Pixel Pitch	12 µm
Spectral Band	7 µm to 8.5 µm
Frame Rate	25 Hz
Humidity	5% to 95%, non-condensing
Pixel Operability	> 99 %
Shock	80 G
Vibration	6.06 G
Dimensions (without lens)	26 mm x 26 mm x 22m (L x W x D ± 0.5 mm) (1.02" x 1.02" (L x W x H ± 0.02")) [1]
Weight (without lens)	21 g (0.74 oz)
Power	4V ~ 6V DC, < 1.3W [2]
Power Protection	Over-voltage; under-voltage; reverse polarity
Interface	RS-232; UART (3.3 V)
Expansion Board	Call for options
Video	Analog: 1 channel PAL or NTSC [3] Digital: BT.656; 8-bit or 14-bit LVCMOS; LVDS [4]
Video Mirror	Horizontal; Vertical; Diagonal [5]
Image Polarity	White hot or black hot
Image Processing	Digital enhancement; Imaging denoising [5]
Reticle	Reveal; Hidden; Shift [5]
Brightness	Adjustable
Zoom	1.0X ~ 8.0X continuous [5]
Palette support [5]	

Internal non-uniformity correction (NUC)

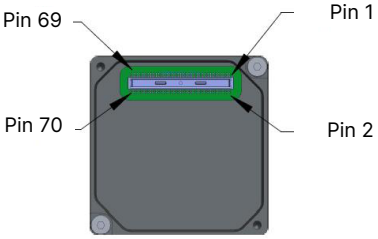
Note:

1. Dimensions without expansion board.
2. Wattage is based on tests without extension boards. Typical working voltage is 4V DC. Expansion boards support 3.5V ~ 18V DC.
3. The analog video output format is PAL-D.
4. 8-Bit or 14-Bit LVCMOS digital video is supported only on the 70 pin connector core.
5. Digital video does not have the zoom and video mirror except for BT.656.

5. Structure

5-1 Pin Layout

The Hirose 70 Pin DF40C-70DP-0.4V(51) connector which includes the power supply interfaces, RS-232 interfaces, UART interfaces, analog video interfaces, BT.656 digital video interfaces, 14-bit or 8-bit LVCMOS digital video interfaces, and 4 keys interfaces are contained on the connector. Users can adopt the Hirose 70 Pin DF40HC(3.0)-70DS-0.4V(51) to implement the connection between the thermal camera and user expansion boards.



5-2 Pin Connector Interface Description

NO.	Name	Type	Description
1, 2, 3, 4,	Power Supply	Power	Power input (4 V ~ 6 V DC) [1]
12, 19-22, 42	--	--	Not available
15	RS-232_RX	Input	RS-232 Serial communication interface [2]
16	RS-232_TX	Output	
9, 11	VGND	Power	Ground of analog video [3]
10	Video	Output	Analog video

PLEASE READ AND UNDERSTAND THE TABLES BEFORE SWITCHING THE UNIT ON.

CONTINUES

CONTINUED FROM PREVIOUS TABLE

NO.	Name	Type	Description		
25	DV1	Output	16-bit or 14-bit or 8-bit LVCMOS Digital video(3.3V)	Data	BT.656 BT.1120 (3.3V)	Data
26	DV0			Data LSB		Data LSB (BT.656)
27	DV3			Data		Data
28	DV2			Data		Data
29	DV5			Data		Data
30	DV4			Data		Data
31	DV7			Data MSB (8-bit)		Data MSB (BT.656)
32	DV6			Data		Data
33	DV9			Data		--
34	DV8			Data		--
35	DV11			Data		--
36	DV10			Data		--
37	DV13			Data MSB (14-bit)		--
38	DV12			Data		--
24	DV14			Data		Data
23	DV15			Data MSB (16-bit)		Data MSB (BT.1120)
39	Line_Valid			Line valid signal		Line valid signal
40	Frame_Valid			Frame valid signal		Frame valid signal
41	Clock			Clock signal		Clock Signal
45	UART_RX	Input/ Output	UART communication interface (3.3V)[2]			
46	UART_RX					
48	KEY1	Input	Button interface (3.3V)	M (menu)		
50	KEY2			+ (plus)		
52	KEY3			- (minus)		
54	KEY4			C (correction)		

PLEASE READ AND UNDERSTAND THE TABLES BEFORE SWITCHING THE UNIT ON.

CONTINUES

CONTINUED FROM PREVIOUS TABLE

NO.	Name	Type	Description	
47	LVDS_CLK+	Output	LVDS_H (VCCIO=2.5V)	Clock Signal
49	LVDS_CLK-			
51	LVDS_ DATA0+			Data
53	LVDS_DATA0-			
57	LVDS_DATA1+			Data
58	LVDS_DATA1-			
61	LVDS_ DATA2+			Data
63	LVDS_DATA2-			
65	LVDS_ DATA3+			Data
67	LVDS_DATA3-			
58	IO0	Input/ Output	Reserved	
60	IO1		Reserved	
62	IO2		Reserved	
64	IO3		Reserved	
66	IO4		Reserved	
68	IO5		Reserved	
5, 6, 7, 8, 13, 14, 17, 18, 43, 44, 55, 56, 69, 70	GND	Power	Ground of power supply [3]	

Note:

1. Typical value of power supply is 4 V DC; here refers to the voltage value of the thermal camera connector, power setup time (10% ~ 90%) < 4 mS, peak current > 1.0 A, ripple and noise < 40 mVp-p.

2. All the TX and RX of serial communication interfaces refer to the thermal camera's sending and receiving.

3. GND and VGND are shorted internally.

PLEASE READ AND UNDERSTAND THE TABLES BEFORE SWITCHING THE UNIT ON.

6. Digital Video

6-1 Digital Video

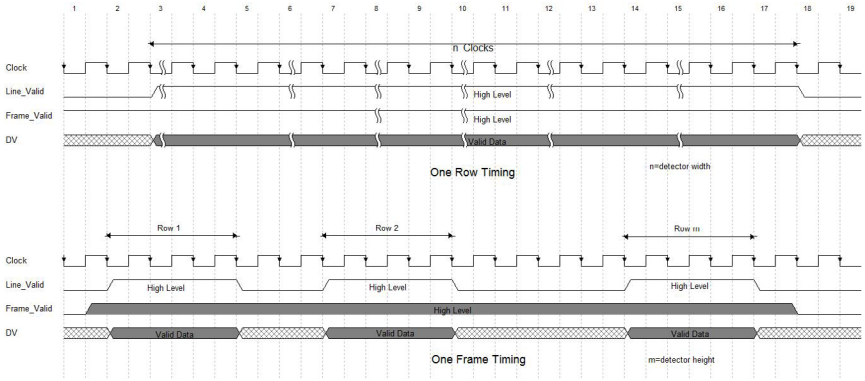
6-1-1 LVCMOS

LVCMOS digital video can be enabled/disabled with control commands. In the open state, users can choose to output raw data (ORG), non-uniform correction (NUC) data, DNS Data, temperature (TEMP) data, and image processing (DRC) data. When choosing to use DRC data, the digital zoom and temperature display functions are not available.

LVCMOS digital video includes 1 Clock signal (Clock), 1 line valid (Line_Valid) signal, 1 valid frame signal (Frame_Valid), and 14 data signals (DV0-DV13).

Pixel data bits are divided into 8-bit and 14-bit. When ORG or TEMP data is produced, the data bits are 14-bits, namely DV[13:0], where DV0 is LSB and DV13 is the MSB. When the user selects DRC, the data bits are 8-bits, namely DV[7:0], where DV0 is LSB and DV9 is for the MSB.

LVCMOS Clock Frequency	
Model	**Clock Frequency**
GC-76	12.857 MHz



Note:

1. Clock rising edge sampling is recommended for DV.
2. The high level is valid for Line_Valid and Frame_Valid.
3. After Line_Valid is valid it lasts for n Clock, which corresponds to the data of the first column to the last column of the row in turn.

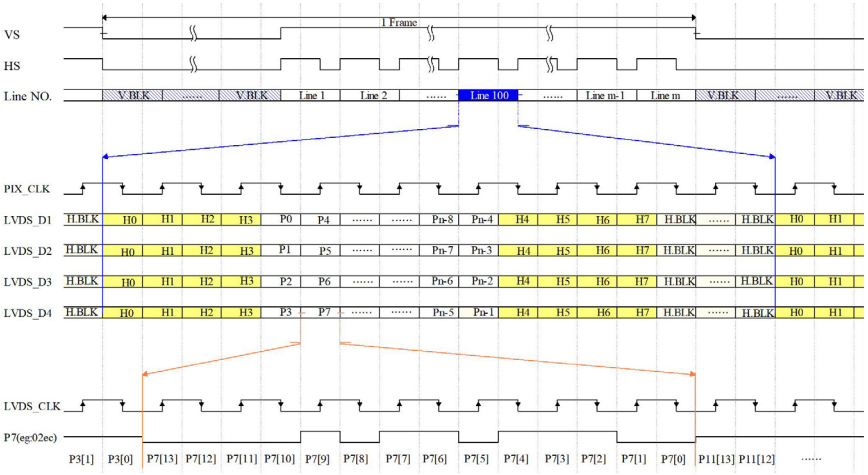
6-1-2 LVDS

LVDS digital video includes one clock signal (LVDS_CLK) and 4 data signals (LVDS_DATA1, LVDS_DATA2, LVDS_DATA3 and LVDS_DATA4) which can be easily analyzed by the domestic mainstream video coding/decoding chip.

LVDS digital video can be enabled/disabled by control commands. When it is enabled, the output of ORG data, NUC data, DRC data, DNS data, and TEMP data can be selected.

When choosing to use DRC data, the digital zoom and temperature display functions are not available.

LVDS Clock Frequency	
Model	**Clock Frequency**
GC-76	22.500 MHz



Sync Code								
	H0	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**
BLANK LINE	3FFF	0000	0000	2AC0	3FFF	0000	0000	2D80
VALID LINE	3FFF	0000	0000	2000	3FFF	0000	0000	2740

6-1-3 BT.656

BT.656 digital video includes 1 Clock signal (Clock) and 8 data signals (dv0-dv7).

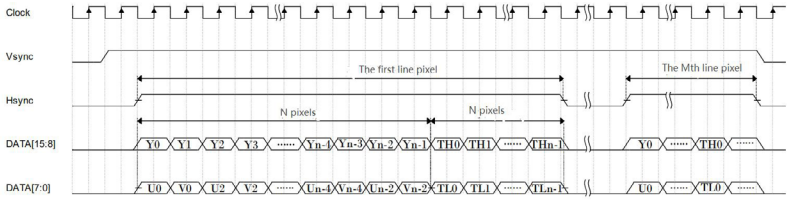
BT.656 digital video supports all functions including brightness/contrast adjustment, polarity selection, palette selection, reticle control, digital zoom, and image flipping functions.

It only supports output DRC data.

6-1-4 CDS_2

CDS_2 digital video contains 1 Clock signal (Clock), 1 frame valid signal (Vsync), 1 line valid signal (Hsync), and 16 DATA signals (DATA).

The video data consists of two parts, the first half of each row of data is divided into an image, which conforms to the YUV422 format. The high 8-bits is the brightness component, the low 8-bits is the chroma component, and the image supports pseudo-color mapping. The second half of each row is divided into temperature data. The actual significant bit is 14-bits, and the higher two bits complement 0.



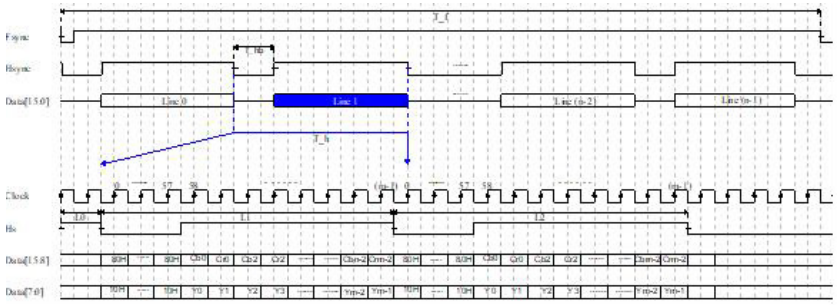
Note:

1. The output image data format is YUV, the high 8-bit is Y component, the low 8-bit is UV component.
2. "T" stands for temperature data (effective data bits are 14-bits lower, two bits higher complement 0), "TH" stands for 8-bits higher, and "TL" stands for 8-bits lower.
3. External synchronization signal mode is adopted. "Vsync" represents frame synchronization signal and "Hsync" represents row synchronization signal.
4. The output data of each row is 2 times of the movement surface array N, such as 640×512 movement, each row contains 640×2=1280 clock cycles (N = 640), and each frame contains 512 rows (M=512).

CDS_2 Clock Frequency	
Model	**Clock Frequency**
GC-76	45.0 MHz

6-1-5 BT.1120

BT.1120 digital video outputs signals line by line. It includes clock signals (Clock), frame valid signal, line valid signal, and 16 data signals (DV0 - DV15). As shown:



When BT.1120 digital video is selected, the digital zoom and temperature display functions are not available.

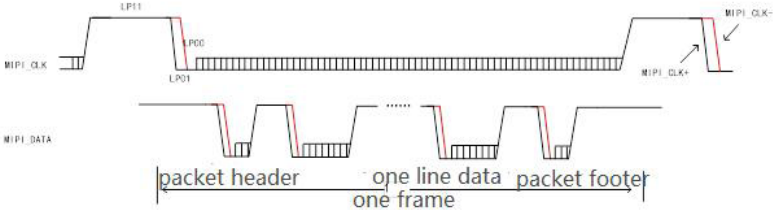
PLEASE READ AND UNDERSTAND THE TABLES BEFORE SWITCHING THE UNIT ON.

7. Protocols

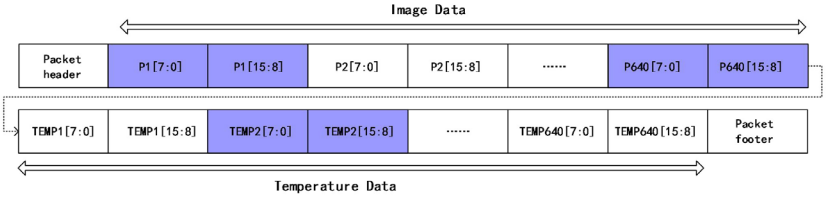
7-1 MIPI Protocol

The GC-76 core uses 4-lane MIPI which includes 1 pair of source-synchronized clocks (MIPI_CLK+, MIPI_CLK-), and 4 pairs of data lines (MIPI_DATA0+, MIPI_DATA0-, MIPI_DATA1+, MIPI_DATA1-, MIPI_DATA2+, MIPI_DATA2-, MIPI_DATA3+, MIPI_DATA3-). The data format and electrical specifications conform to CSI-2 and D-PHY Protocols.

The clock signal enters the high-speed mode at the beginning of each frame and exits at the end of the frame. The inter-frame is in the low-power mode (the data and clock lines are both at 1.2V high level). The CLK frequency of the thermal core is 200MHz.



After the core is powered on it outputs MIPI digital video. Taking 640 × 512 temperature measurement as an example, the core is set to CDS_2 digital video, the output data format is RAW8 (standard MIPI CSI-2 protocol), and the area array should be set to (1280 × 2) *512, which needs to be spliced into 1280 × 512 x 16-bit data by the back end, with the low byte first. The first 640× 16-bits of a line of valid data are image data, and the last 640 × 16-bits are temperature data.



8. User Expansion Boards

There are different user expansion boards and accessories. The boards support multiple interfaces and serve many functions.

Model	Figure	Interface	Connector
Call for information		• USB power supply, typical 5V DC • USB communication • USB UVC Video	USB Type C
Call for information		• Power input: 3.5V~18V DC, typical 12V DC • RS-232, UART • BT.656 digital video • Analog video • 4 Keys	• Hirose 20 pin • DF52-20S-0.8H connector • Molex 20 pin • 52745-2097 connector
Call for information		• Power input: 3.5V~18V DC, typical 12V DC • RS232, RS422 • LVDS digital video • Analog video • 4 keys	DF56C-30S-0.3V
Call for information		• Power input: 3.5V~18V DC, typical 12V DC • RS232, RS422 • Cameralink digital video • Analog video • 4 keys	DF56C-30S-0.3V
Call for information		• Power input: 3.5V~18V DC, typical 12V DC • RS232, RS422 • MIPI digital video • Analog video • 4 keys	DF56C-30S-0.3V

9. Maintenance

9-1 Cleaning the Germanium Lens

Do not use corrosive chemicals on the optical glass components. The germanium window surface is coated with anti-reflection coating. Dust, grease, and fingerprints will produce harmful substances and lead to a decline in performance, or cause scratches. If dirt is found, please use the following methods:

1. Use a blown balloon or a soft brush to clean the lens surface to avoid dust particles scratching the anti-reflection film on lens surface during the wiping process.
2. Use a soft cotton cloth or lens wiping paper and dip in alcohol or lens wiping liquid. Gently wipe the lens surface from the middle to the edge, paying attention to not crack the lens, or use too much wiping liquid. If the lens is still not clean, replace the cloth and repeat operation.

9-2 Disinfecting the Camera Surface

Do not use corrosive cleaning solutions on the optical glass components. Do not get the electronics wet. It is recommended to disinfect the camera surface regularly with a non-corrosive sanitizing product. Follow the directions provided by the manufacturer of the cleaning solution. Adhere to the sanitation protocols and cleaning schedule set forth by the employer.

9-3 Device Calibration

It is recommended to have device(s) re-calibrated annually. Contact customer service to schedule maintenance.

9-4 Storage

When the equipment is not in use, the device should be placed in a dust-free and moisture-free environment with a stable temperature and humidity.

DO NOT USE CORROSIVE CLEANING SOLUTIONS ON THE OPTICAL GLASS COMPONENTS. DISINFECT THE CAMERA SURFACE REGULARLY WITH A NON-CORROSIVE SANITIZING PRODUCT.

CALIBRATE YOUR DEVICES ANNUALLY. CONTACT CUSTOMER SERVICE TO SCHEDULE MAINTENANCE.

10. About Thermal Camera

Infrared Cameras, Inc.
2105 W. Cardinal Dr.
Beaumont, TX 77705

Phone: (409) 861-0788
Toll Free: (866) 861-0788
International: (409) 861-0788

Hours: Monday – Friday 8:00AM - 5:00PM CST

General Inquiry: support@infraredcameras.com
Website: www.infraredcameras.com

You may reach a representative by phone or email.

ICI manufactures complete systems and software. We can provide complete engineering, software, and OEM solutions. Our Fortune 500 clients rely on us for infrared equipment and thermography training (which we offer through the Infrared Training Institute).

In addition to providing custom germanium, silica, and sapphire optics, we also build windows for enclosures, as well as custom pan and tilt units. We can even provide customizable explosion-proof systems.

Our knowledge and experience stems from years of using infrared imaging and temperature measurement instruments to provide solutions to: managers, engineers, scientists, inspectors and operators in space, power companies, medical, pulp and paper, food industry, research and development, and various process industries. You can see our products and services used in industrial, commercial, and government applications worldwide. Originally named Texas Infrared (still DBA), Infrared Cameras, Inc. has been in business since March, 1995.

Thank you for your dedicated and continued support.