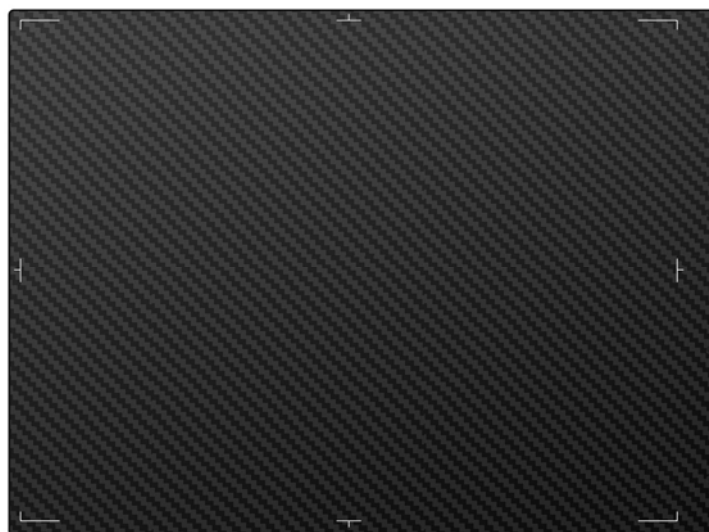




User Manual

Mars1013X

Wireless Digital Flat Panel Detector



E

Ver.: A1
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To Customers

Thank you for purchasing the Mars1013X Wireless Digital Flat Panel Detector (hereinafter referred to as Mars1013X) from iRay Technology Co., Ltd. (hereinafter referred to as iRay Technology) as your X-ray solution.

This user manual describes how to install, use and maintain this product, how to integrate this product into your system, and how to operate the iDetector provided with the Mars1013X.

The illustrations and figures in this manual are only for illustration purposes. The actual equipment may differ.

Store this manual safely so that you can access it in the future.

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Product Disposal



This symbol indicates that this product is not to be disposed of with your domestic or commercial waste. Disposal of this product in an unlawful manner may have a negative impact on health and on the environment.

When disposing of the product, be sure to follow the procedure that conforms to the laws and regulations in your area.

Should you encounter any problems disposing of your product, contact iRay Service Department for assistance.

For Your Safety

- To prevent personal injury or product damage, be sure to read the user manual and all accompanying information carefully and pay attention to all safety precautions before operating the product.
- The installation, debugging, addition, modification and maintenance of this product can only be carried out by qualified professionals.
- This product is not a therapeutic device, only doctors or legally qualified operators can use this product.
- The equipment must be stored and operated in a specified medical environment and maintained by professional maintenance personnel under safe and operable conditions.
- Use only computers and image display monitors recommended in this manual.
- Follow the guidelines described in this manual when installing and using this product.
- For details on product installation and use, please consult your sales representative and product distributor.

Disclaimer

- In no event shall iRay be reliable for any abnormality, product damage and personal injury caused when the instructions of this manual are not followed.
- In no event shall iRay be reliable for any damage, loss, or injury arising from a fire, earthquake, any action or accident by a third party, any intentional or negligent action by users, any trial usage, or other usage under abnormal conditions.
- In no event shall iRay be reliable for any damage, loss, or injury arising from moving, alteration, inspection or repair the product by a person other than an authorized service engineers by iRay.
- In no event shall iRay be reliable for any damage or loss arising from the use of any options or consumable products other than those dedicated as original iRay products.
- Roentgenography, image acquiring, image processing, image reading and image data storage must be performed in accordance with the law of the country where the product is being used.
- In no event shall iRay be reliable for loss of image data for any reason while using the product. The user and operator are responsible for maintaining the privacy of image data acquired from the product.
- Attending physicians assume the responsibility of providing medical care services and the faulty diagnosis, for which iRay bears no liability.
- Specifications, compositions, and appearance of this product is subject to change without prior notice.

Symbols

The symbols that appear in this user manual are classified as follows for better comprehension of their meanings. Make sure that you fully understand them and obey the instructions they contain.

Symbol	Description
 WARNING	This indicates a potentially hazardous situation which, if ignored, may result in severe personal injury, death, or substantial product damage.
 CAUTION	This indicates a potentially hazardous situation which, if ignored, may result in minor personal injury or product damage.
 PROHIBITED	This symbol is used to indicate a prohibited operation.
 NOTE	This symbol is used to emphasize or supplement important information about the main text.
 REFERENCE	This symbol means "refer to the document attached to the CD disk" or "refer to other sections of this manual for information".

Abbreviations

Abbreviations	Explanation
AC	Alternating Current
AED	Automatic Exposure Detection
AP	Access Point
DC	Direct Current
DQE	Detective Quantum Efficiency
DR	Digital Radiography
EMC	Electro Magnetic Compatibility
EMI	Electromagnetic Interference
FPD	Flat Panel Detector
FTP	File Transfer Protocol
HVG	High Voltage Generator
IP	Internet Protocol
ISO	International Standardization Organization
IT	Information Technology
LAN	Local Area Network
LED	Light Emitting Diode
MTF	Modulation Transfer Function

Abbreviations	Explanation
PC	Personal Computer
ROI	Range of Interest
RF	Radio Frequency
SAR	Specific Absorption Rate
SDK	Software Development Kit
SID	Source Image Distance
SN	Serial Number
SNR	Signal to Noise Ratio
SSID	Wireless Network ID
TFT	Thin Film Transistor
UI	User Interface
WL	Window Level
WW	Window Width

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Chapter 1 Safety Information

This chapter gathers safety precautions to ensure safe use of the equipment. Failure to heed the cautions and warnings below can result in personal injury or death.

1.1 Operation and Storage Environment



WARNING

- **Do not operate or store the equipment in or around flammable or corrosive gases, gas mixtures, liquids, chemicals, or other substances.**

Ignoring this warning may result in an explosion, fire, or electric shock, which may result in personal injury, death, or substantial product damage.



CAUTION

- **Do not operate the equipment in any of the locations listed below. Ignoring this warning may result in equipment failure or malfunction, equipment falling, fire, or personal injury.**
 - a) Close to facilities where water is used
 - b) Where it will be exposed to direct sunlight
 - c) Close to the air outlet of an air-conditioner or ventilation equipment
 - d) Close to a heat source such as a heater
 - e) Where the power supply is unstable
 - f) In a dusty environment
 - g) In a saline or sulfurous environment
 - h) Where temperature or humidity is higher than the operating environment
 - i) Where there is freezing or condensation
 - j) In an area prone to vibration
 - k) On an incline or in an unstable area

- **Do not turn on the power switch when there is condensation on the detector or any of its components or accessories.**

Ignoring this warning may result in an explosion, fire, or electric shock, which may result in personal injury, death, or substantial product damage.

- **Be sure to avoid placing the product in close proximity to other devices which could produce electromagnetic interference (EMI). The devices around it must meet the requirements of EMC standards.**

Otherwise, the product may malfunction due to EMI. If necessary, changing direction or position of the product or moving into the shielded place facilitates to reduce EMI.

- **Avoid placing the equipment adjacent to or stacked against other devices.**

Otherwise, improper operation may occur.

-
- **To make it easy to disconnect the plug at any time, avoid placing any obstacles at the power interface.**
Otherwise, it may not be possible to disconnect the plug in an emergency.
 - **Do not place any unnecessary objects on any part of this system or within the moving range of the parts of this product.**
 - **The patient with an active implanted medical device should be kept away from the device.**
 - **Do not let the equipment come into contact with the patient's blood, or other body fluids.**
Otherwise, fire or electric shock may occur. In this case, a disposable protective cover is recommended to protect the device.
 - **Non-medical devices such as a battery charger, and wireless router cannot be used in patient's vicinity.**
-

1.2 Equipment, Interfaces, Power Supply, and Cables



- **Do not connect the detector to any component or accessory other than iRay's specified ones. Do not use any type of power supply other than the one provided with the equipment.**
Ignoring this warning may result in an explosion, fire, or electric shock, which may result in personal injury, death, or substantial product damage.
 - **Turn OFF the power to each piece of equipment before connecting or disconnecting cables and components.**
Otherwise, electric shock may cause death or serious personal injury.
 - **Do not touch the power supply, detector, batteries, cables, connector, or any other components with wet hands. Care should be taken to prevent liquids or conductive materials from intruding into the inside of the equipment.**
Ignoring this warning may result in an explosion, fire, or electric shock, which may result in personal injury, death, or substantial product damage.
 - **To avoid the risk of electric shock, this equipment must only be connected to a supply mains with protective earth.**
 - **Use only dedicated cables for the device. Do not use any cable other than those supplied with this product.**
 - **To prevent a sudden power failure and ensure the reliability of power supply to the system, you are advised to use an external UPS uninterruptible power supply and battery power at the same time.**
Otherwise, data loss may occur if the external power supply is unstable or suddenly interrupted during system operation.
 - **Do not modify the cables or subject the cable to external stress or damage. Avoid placing anything heavy on the cable, stepping on the cable, pulling the cable, or subjecting the cable to excessive bending or bundling.**
Ignoring this warning may result in cable failure, which may result in personal injury, death, or product damage.
-



CAUTION

- **Do not place excessive heavy objects on the equipment.**

Otherwise, the internal sensor may be damaged and the equipment may not work normally to acquire images.

- **Do not hit or drop the equipment.**

The equipment may be damaged if it receives a strong jolt, which may result in fire or electric shock if the equipment is used without being repaired.

- **The three-core power cord plug must be firmly inserted into the grounded AC power socket.**

If contact failure occurs, or if metal objects come into contact with the exposed metal prongs of the plug, fire or electric shock may result.

- **Do not supply power to more than one piece of equipment using the same AC outlet.**

Doing so may result in fire or electric shock.

- **Do not connect a multiple portable socket-outlets or extension cords to the system.**

Otherwise, it may result in fire or electric shock.

- **Be sure to disconnect the power cable by holding the plug or connector, not by pulling the cable itself.**

If you pull the cable too hard, the core wire may be damaged, resulting in fire or electric shock.

1.3 Battery Pack and Battery Charger



WARNING

- **Follow the warnings and all safety information on the battery label.**

Ignoring this warning could result in personal injury or product damage.

- **Do not use the battery pack as a power source for equipment other than Mars1417V and be sure to use only the dedicated battery pack for Mars1417V.**

- **Do not charge the battery pack with any type of battery charger or/and power adapter other than the dedicated ones.**

- **Please do not try to open the battery pack or change its internal structure. Do not insert any object into or pry open the battery pack.**

Attempting to open the battery will damage the battery enclosure, which may cause the battery to release toxic and hazardous substances, resulting in electric shock, burns or fire.

- **Do not attempt to use a battery pack or battery charger that has damaged or expired. If the enclosure is broken or emits unusual odors, smoke, overheats, or leaks anything. Avoid contact with any material leaking from the battery pack.**

If any liquid comes into contact with your skin or eyes, wash the affected area with clean running water and seek immediate medical attention.



CAUTION

- **Do not drop, squeeze or hit the battery with hard objects.**
Otherwise, the battery may be damaged, and may release toxic substances from the battery, causing electric shock, burns, fire and other injuries, rendering the battery unusable.
- **Do not leave, store, or place the battery pack in a location near heat sources or subject to direct sunlight, high temperature, or inflammable materials.**
Otherwise, battery leakage, overheating, damage to the product may occur.
- **Replacing a battery in the host must be carried out by a professional.**
- **Do not let the battery pack and battery charger come into contact with water and other liquids, and keep it dry whenever you use it.**
- **Do not remove the battery directly when the product powered only by the battery is ON.**
- **If the equipment is not used for an extended time period (more than 5 days), it is recommended to remove and charge the battery to 30% to 50% every 3 months or 50% to 70% every 6 months.**
- **The battery pack is a consumable part, which may have expired if consumed quickly after being fully charged.**
For reliable function and safety, battery pack should be replaced when its capacity is noticeably decreased.

1.4 Operation



WARNING

- **Do not disassemble or modify the equipment, its components and accessories. No modification of this product is allowed. If this product is modified, appropriate inspection and testing must be conducted to ensure continued safety of the product.**
Ignoring this warning may result in an explosion, fire, or electric shock, which may result in personal injury, death, or substantial product damage.
- **Personnel not authorized by iRay are prohibited to open the equipment enclosure.**



CAUTION

- **Do not handle the equipment with wet hands.**
Otherwise, it may cause electric shock, resulting in death or serious injury.
- **Make sure the equipment is used on a flat and stable surface to prevent bending and deformation of the equipment.**
Otherwise, the internal image sensor may get damaged.
- **If the detector is placed vertically or in any tilted position, the X-ray detector must be securely placed in the Bucky or securely fastened to a support structure.**
Otherwise, the detector may tip over, causing injury to the operator, or damage to internal equipment.
- **Have the patient take a fixed posture and do not let him/her touch parts unnecessarily.**
If the patient touches connectors or switches, it may result in electric or malfunction of the equipment.
- **Keep the detector under even load (same pressure) during image acquisition.**
Otherwise, the quality of acquired images is not guaranteed.

1.5 Problem Management



- Turn off the detector, unplug the adapter power cable immediately, remove the battery, and contact your sales representative or local iRay distributor if any of the following occurs:
 - a) When there is smoke, an odd smell or abnormal sound
 - b) When liquid has been spilled into the equipment or a metal object has entered the equipment through an opening
 - c) When the equipment has been dropped and is damaged
- When liquid has been spilled into or on any part of the X-ray detector or power supply, or when the X-ray detector, its component, or accessory is dropped, unplug the power supply from the AC outlet, and immediately contact your sales representative or local iRay distributor.

Further use under abnormal conditions may result in severe personal injury, death, or substantial product damage.

1.6 Maintenance, Inspection and Cleaning



- Be sure to turn off the power of the system, unplug the power cable from the AC outlet or/and remove the battery pack from the product when the inspections indicated in this manual are going to be performed.

Ignoring this warning may result in an explosion, fire, or

- Do not immerse the equipment in liquids. NEVER use alcohol, ether and other flammable cleaning agent to clean the equipment for the sake of safety. NEVER use methanol, benzene, acid, alkali or other corrosive liquids to clean the equipment.
- The detector must be repaired by iRay's authorized personnel only.

Ignoring this warning may result in explosion, fire, electric shock, or unknown hazards, which may result in severe personal injury, death, or substantial product damage.



- Make sure that the equipment's surface and plugs are dry before turning ON the power. Otherwise, it may result in fire or electric shock.
- For safety reasons, be sure to cut off the power supply when it is not in use, and never maintain the product while it is in use.
- Clean the plug of power cord periodically by unplugging it from the AC outlet and remove dust and dirt from the plug, its periphery and AC outlet with a dry cloth.

If the power cord is left plugged in for an extended period of time in a dusty, dark and humid environment, the dust around the outlet will absorb moisture, possibly causing insulation failure and a fire.

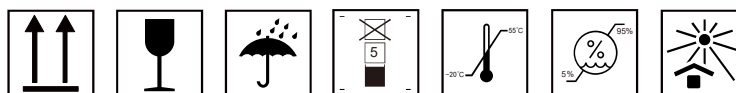
Chapter 2 Regulatory Information

This part depicts the labels attached to the package box, the equipment, and its accessories, and collects some basic regulatory information.

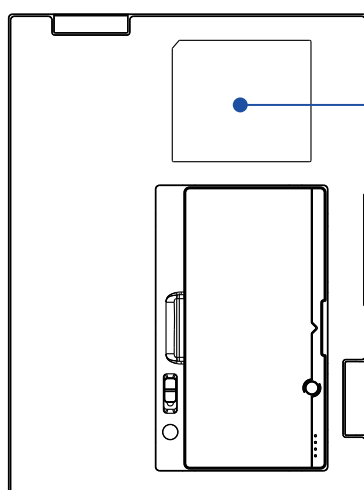
2.1 Labels and Symbols

All labels shown below are for illustration purpose only. Actual product may vary due to product enhancement.

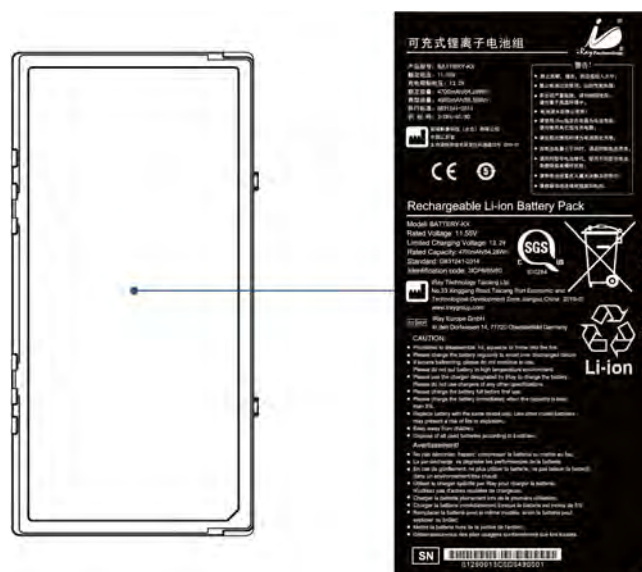
■ Packaging Label



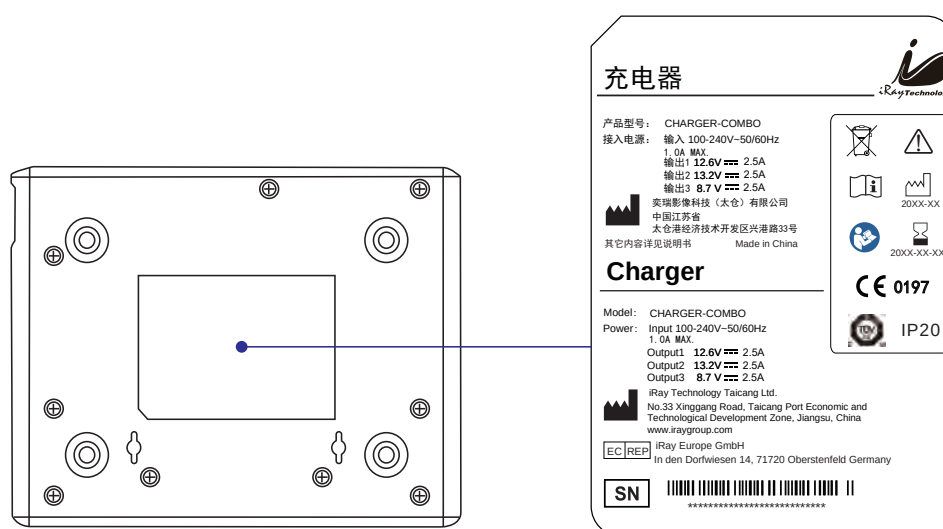
■ Product Label



■ Battery



■ Battery Charger



Symbol	Explanation
	This symbol indicates “Keep the equipment up right”.
	This symbol indicates “Fragile, handle with care”.
	This symbol indicates that the product needs to be protected from moisture.
	This symbol indicates the maximum number of stacks.

Symbol	Explanation
	This symbol indicates that the temperature range to which the product can be safely exposed.
	This symbol indicates that the humidity range to which the product can be safely exposed.
	This symbol indicates “Keep away from direct sunlight”.
	This symbol indicates the manufacturer’s series number which is made of 19 digits as shown below: A₁A₂A₃A₄ B₁B₂ C₁C₂ L M₁M₂D₁D₂Y₁Y₂ X₁X₂X₃X₄ Production Series No. Production Date Production Site Production Version No. Derivative Type Production Type
	This symbol indicates the Unique Device Identification (UDI) of the equipment.
	This symbol indicates the name and address of manufacturer.
	Caution: please refer to the instructions in the user manual.
	This symbol represents reference to the user manual for general information.
	This symbol indicates that the product must be sent to the appropriate facility for recycling when the end user intends to discard the product.
	This symbol indicates the manufacture date (refer to the actual date on the label).
	This symbol is used to indicate the expiration date (manufacture date plus estimated product life).
	This symbol represents nonionizing electromagnetic radiation.
IP _{X5}	This symbol is used to indicate the device passes IPX5 test.
	This symbol is used to indicate the type B applied product has a patient contact part.
	This symbol indicates the operating temperature range of this equipment.
	This symbol indicates that this product is a medical device.
Rx only	This symbol indicates that this device is for prescription use only.

2.2 Safety Standards for Medical Equipment

2.2.1 Medical Equipment Classification

Item	Classification
Type of protection against electrical shock	Externally powered Class I equipment (medical approved adaptor) Internally powered equipment (battery)
Degree of protection against electrical shock	Type B applied part
Degree of protection against ingress of water	IPX5 (Mars1013X) IP20 (Charger-COMBO)
Mode of operation	Continuous operation
Data transfer	Wireless transmission
Flammable anesthetics	- Not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide - Not suitable for use in the oxygen rich environment

2.2.2 Safety Standards Reference

The safety standards listed below apply to the product and its accessories.

- Mars1013X conforms to this IEC 60601-1-2:2014 standard on both immunity and emissions.
- Use only computers and image display monitors complying with IEC 60601-1 or IEC 60950-1.

Standard	Description
IEC 60601-1-2:2014	Medical electrical equipment - Part 1-2: General requirements for basic safety and essential performance - Collateral Standard: Electro-magnetic disturbances - Requirements and tests
IEC 60601-1:2005+A1:2012	Medical electrical equipment - Part 1: General requirements for basic safety and essential performance
IEC 60601-2-54:2009+A1:2015+A2:2018	Medical electrical equipment - Part 2-54: Particular requirements for the basic safety and essential performance of X-ray equipment for radiography and radioscopy
IEC 60601-1-6:2010 +A1:2013	Medical electrical equipment - Part 1-6: General requirements for basic safety and essential performance - Collateral standard: Usability

Standard	Description
IEC 62133-2:2017	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications - Part 2: Lithium systems
UN38.3	UNITED NATIONS "Recommendations on the TRANSPORT OF DANGEROUS GOODS" Manual of Tests and Criteria ST/SG/AC.10/11/Rev.6 Amend.1 Section 38.3

2.3 Guidance and Manufacturer's Declaration for EMC

2.3.1 Important Information Regarding Electromagnetic Compatibility (EMC)

Mars1013X needs special precautions regarding EMC and needs to be installed only by iRay or authorization engineer and put into service according to the EMC information provided in the user manual.

- This equipment in use may be susceptible to electromagnetic interference from portable and mobile RF communications such as mobile (cellular) telephones. Electromagnetic interference may result in incorrect operation of the system and create a potentially unsafe situation.
- The use of accessories and cables other than those specified by iRay, with the exception of accessories and cables sold by iRay of Mars1013X as replacement parts for internal components, may result in increased emissions or decreased immunity of the detector.
- Mars1013X should not be used adjacent to or stacked with other equipment. In case adjacent or stacked use is necessary, the detector should be observed to verify normal operation in the configuration in which it will be used.

2.3.2 EMI Compliance Table

■ Electromagnetic Emissions

Emission Test	Compliance	Electromagnetic Environment-Guide
Conducted and radiated RF emissions CISPR 11	Group 1 Class B	Professional healthcare facility environment
Harmonic distortion IEC 61000-3-2	Class A	
Voltage fluctuations/flicker IEC 61000-3-3	Complies	

2.3.3 EMS Compliance Table

■ Enclosure Port

Phenomenon	Basic EMC Standard	Immunity Test Levels
		Professional Healthcare Facility Environment
Electrostatic Discharge	IEC 61000-4-2	±8kV contact ±2kV, ±4kV, ±8kV, ±15kV air
Radiated RF EM field	IEC 61000-4-3	3V/m 80MHz-2.7GHz 80% AM at 1kHz
Proximity fields from RF wireless communications equipment	IEC 61000-4-3	Refer to table “Proximity Fields from RF Wireless Communications Equipment”
Rated power frequency magnetic fields	IEC 61000-4-8	30A/m 50Hz or 60Hz

■ Proximity Fields from RF Wireless Communications Equipment

Test frequency (MHz)	Band (MHz)	Immunity Test Levels
		Professional Healthcare Facility Environment
385	380-390	Pulse modulation 18Hz, 27V/m
450	430-470	FM, ±5kHz deviation, 1kHz sine, 28V/m
710	704-787	Pulse modulation 217Hz, 9V/m
745		
780		
810		
870	800-960	Pulse modulation 18Hz, 28V/m
930	1700-1990	Pulse modulation 217Hz, 28V/m
1720		
1845		
1970		
2450	2400-2570	Pulse modulation 217Hz, 28V/m
5240	5100-5800	Pulse modulation 217Hz, 9V/m
5500		
5785		

■ Input A.C. Power Port

Phenomenon	Basic EMC Standard	Immunity Test Levels
		Professional Healthcare Facility Environment
Electrical fast transients/burst	IEC 61000-4-4	±2kV 100kHz repetition frequency
Surges Line-to-line	IEC 61000-4-5	±0.5kV, ±1kV
Surges Line-to-ground	IEC 61000-4-5	±0.5kV, ±1kV, ±2kV
Conducted disturbances induced by RF fields	IEC 61000-4-6	3V 0.15MHz - 80MHz 6V in ISM bands between 0.15MHz and 80MHz 80% AM at 1kHz
Voltage dips	IEC 61000-4-11	0% U _T ; 0.5 cycle At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315° 0% U _T ; 1 cycle 70% U _T ; 25/30 cycles Single phase: at 0°
Voltage interruptions	IEC 61000-4-11	0% U _T ; 250/300 cycles

■ Signal Input/Output Parts Port

Phenomenon	Basic EMC Standard	Immunity Test Levels
		Professional Healthcare Facility Environment
Electrostatic discharge	IEC 61000-4-2	±8kV contact ±2kV, ±4kV, ±8kV, ±15kV air
Electrical fast transients/bursts	IEC 61000-4-4	±1kV 100kHz repetition frequency
Surges Line-to-ground	IEC 61000-4-5	±2kV
Conducted disturbances induced by RF fields	IEC 61000-4-6	3V 0.15MHz - 80MHz 6V in ISM bands between 0.15MHz and 80MHz 80% AM at 1kHz

2.3.4 Cable Information Provided Against EMC

Cable	Recommended Cable Length	Shielded/unshielded	Qty.	Classification
AC cable	1.8m	Unshielded	1pc.	AC power
LAN cable	3m	Shielded	1pc.	Signal

2.4 FCC Compliance

Contains FCC ID: 2ACHK-01070189

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/ TV technician for help.

Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

2.5 Radio Frequency (RF) Energy

This device is designed and manufactured not to exceed the emission limits for exposure to radio frequency (RF) energy set by the Federal Communications Commission of the United States.

The exposure standard for wireless devices employing a unit of measurement is known as the Specific Absorption Rate, or SAR. The SAR limit recommended by the general public is 1.6W/kg Averaged over one gram of tissue by IEEE Std 1528.

The FCC has granted an Equipment Authorization for this product with all reported SAR Levels evaluated as in compliance with the FCC RF exposure guidelines. While there may be differences between the SAR levels of various product and at various positions, they all meet the government requirements.

SAR compliance for body-worn operation is based on a separation distance of 0 mm between the unit and the human body. Carry this device at least 0 mm away from your body to ensure RF exposure level compliant or lower to the reported level.

Chapter 3 About the Product

This chapter gives an introduction to the equipment itself, and its packaging contents.

3.1 Overview

The Mars1013X is a wireless digital X-ray flat panel detector (FPD) based on amorphous silicon (a-Si) thin film transistor (TFT) technology. Using cesium iodide (CsI) scintillator, it contains a 3318×2528 active pixel matrix with a pixel size of 100μm, providing high-quality radiographic images. It supports a variety of trigger modes, which can be adapted to both normal DR (digital radiography) Systems and improved DR Systems.

The product supports wireless communication between the detector and the workstation and can be powered by internal rechargeable battery or/and external battery charger.

3.1.1 Intended Use

Mars1013X is indicated for digital imaging solution designed for providing general radiographic diagnosis of human anatomy, and intended to replace radiographic film/screen systems in all general-purpose diagnostic procedures.

The equipment, as a major imaging component, is supplied to the manufacturers of medical diagnostic X-ray photography systems, used in conjunction with the medical diagnostic X-ray photography system to image the object to be checked. It is capable of outputting the acquired static images to a processing device after acquisition.

This equipment provides digital X-ray imaging technology for the diagnosis of disease, injury, or any health problem. It is not suitable for mammography, dental photography, and dynamic imaging photography. Do not use it in pregnant women.

According to Mars1013X's intended use and risk management, imaging and data transfer functions are defined as its essential performance, and obtaining qualified dark field images proves that the essential performance will not affect its intended use.

3.1.2 Key Features

- 10"×13" wireless static flat panel detector used for general radiography
- CsI scintillator
- 100μm pixel size, 16-bit ADC HD image details
- Supports wireless high-speed data transfer
- Powered by battery pack or/and external power supply

3.2 Packaging Contents

Detector (Mars1013X)	Power Adapter	Battery Pack (2pcs)
Battery Charger (Charger-COMBO)	Control Box	AC Power Cable (1.8m)
Gigabit Ethernet Cable (3m)	CD	Documents
	Gain&Defect Cali files SDK EN/CN User Manual	OQC Test Report Packing List Product Certificate
Portable Handle (Optional)	Sync Box (Optional)	Software Dongle (Optional)



CAUTION

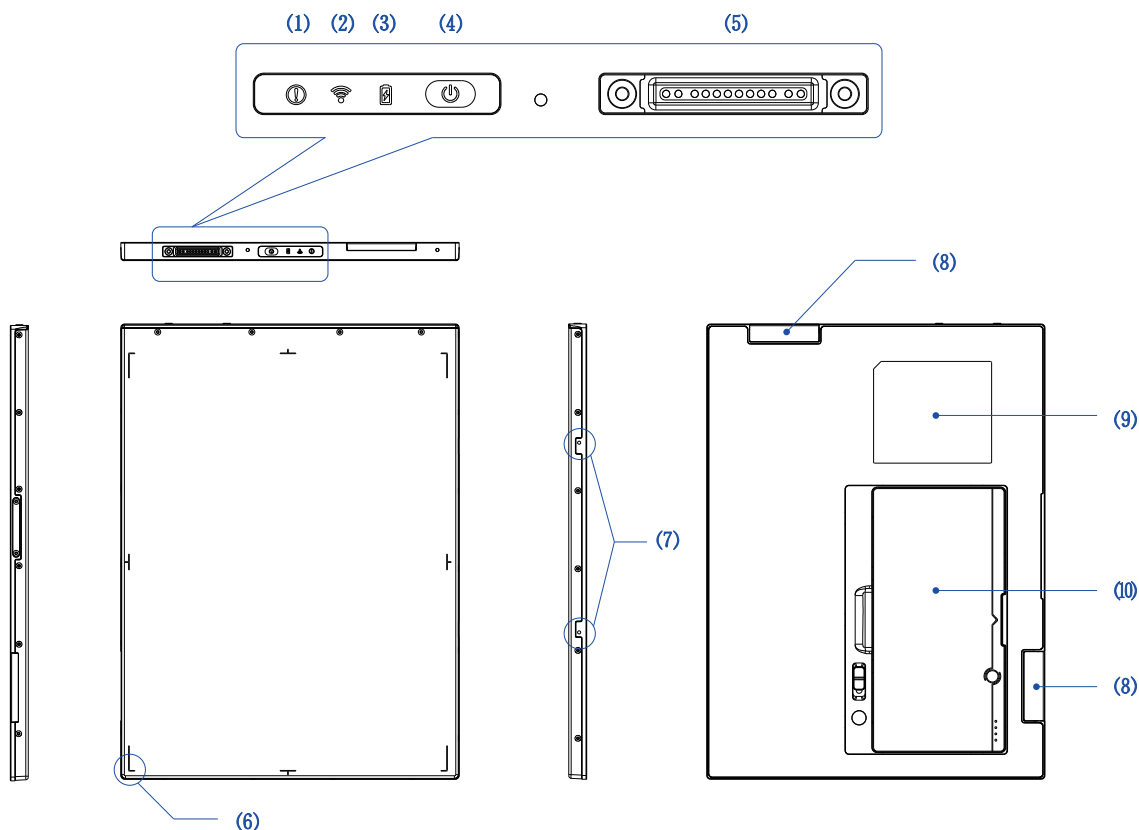
- Choose an appropriate AC power cable in regions and/or countries where the power supply is intended to be used.
- Check the above items carefully to make sure they are complete and confirmed by iRay engineers. If anything is missing or damaged, please contact your iRay dealer.



NOTE

Due to different customization requirements of customers, the appearance, functions, interfaces, and packing list of your product are slightly different.

3.3 Product Description



No.	Figure	Name	Description
(1)		Status indicator	Indicates the status of detector
(2)		Link indicator	Indicates the link status of detector
(3)		Power indicator	Indicates the power status of the detector
(4)		Power button	Powers ON/OFF the detector
(5)		DC input interface	24V DC power input interface
(6)	/	Image starting point	Indicates the first pixel location
(7)	/	Handle mounting hole	Indicates the position of the mounting hole
(8)	/	Antenna cover	Indicates the position of antennas
(9)	/	Detector label	See Section 2.1 for Labels and Symbols
(10)	/	Battery compartment	Indicates the position where the battery is installed

■ Power Button

Function	FPD Status		Remarks
Power ON	Power OFF	Short-hold	Make sure the battery is installed and the power is greater than 10% or/and the detector is connected to the DC power supply. Short-hold for 4 seconds to turn ON the detector
Forced restart		Long-hold	Long hold the power button more than 7s, and release it when the power indicator is ON
Battery activation	Power ON	Triple-click	Release after three short presses (interval <1s)
Forced restart		Long-hold	Hold the power button for more than 7 seconds, and release it when the power indicator is OFF and then ON
Power OFF		Short-hold	Hold the power button for 4 seconds, and release it when the power indicator is OFF

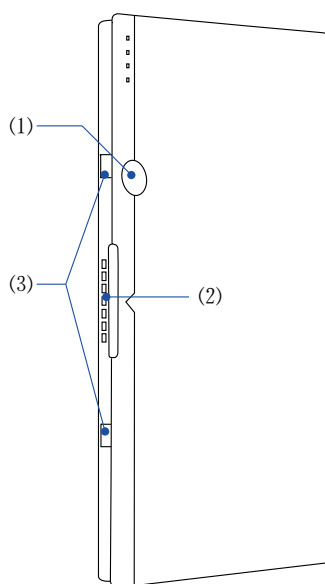
■ LED Indicators

LED	Status	Figure	FPD Status
Power indicator	OFF		Power OFF
	Steady orange		Power ON, battery level < 20%, no DC input
	Steady green		Power ON, battery level ≥ 20%, no DC input
			Power ON, no battery inserted, no DC input
	Flashing orange		Power OFF, battery level < 20%, with DC input
	Flashing green&orange		Power OFF, 20% ≤ battery level < 95%, with DC input
	Fast flashing green		Power OFF, 95% ≤ battery level < 100%, with DC input
Link indicator	OFF		Shut down
			Wired connection broken or wireless connection not ready
	Steady green		Wired connection is built (for service mode only)
Status indicator	Steady blue		Wireless connection enabled
	OFF		Shut down
	Steady green		Exposure enabled

LED	Status	Figure	FPD Status
	Flashing green	 	Image transmission in progress
	Steady orange		Error
	Flashing orange	 	Safety mode

3.4 Accessories Description

3.4.1 Battery



No.	Name	Description
(1)	Touch display	Displays power level after a touch
(2)	Battery connector	7-pin battery connector
(3)	Pilot pin	/

■ Battery Lock

To ensure the safety of the battery during transportation or storage, the battery can be set to ship mode, that is, the battery is locked with no voltage output.

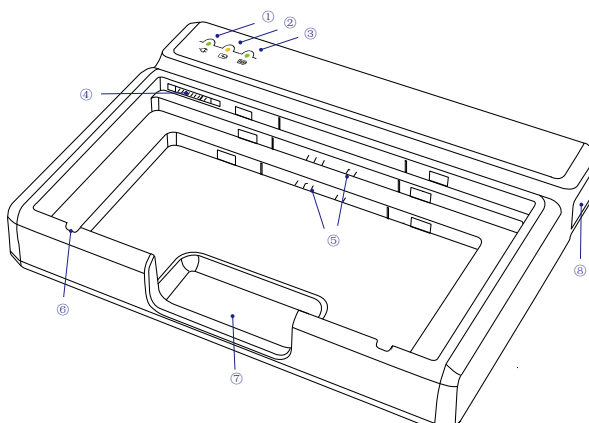
Method	Steps
Locks via factory configuration	/
Locks via web	- Power the FPD with adaptor, turn it on, and then connected it to the PC - Insert a battery - Type http://192.168.8.8/cgi-bin/shipmode.cgi?action=on in the Web to enter ship mode

■ Battery Activation

The battery will be set to the ship mode when shipped. Please activate the battery in the following three methods before using the detector for the first time:

Method	Steps
Activates by powering on the FPD via adapter	- Insert the battery into the battery compartment of FPD - Power the FPD with adaptor, and turn it on - Press the power button about 4s to shut down the detector - Press the power button three times to activate the battery in the shutdown state
Activates via web	- Power the FPD with adaptor, turn it on, and then connected it to the PC - Insert the battery into the battery compartment of FPD - Type http://192.168.8.8/cgi-bin/shipmode.cgi?action=off in the Web to exit the ship mode
Activates by charging the battery via charger	- Insert the battery into the battery charger - Power on the charger and activate the battery in about 3~5 seconds

3.4.2 Battery Charger



No.	Name	No.	Name
①	Power indicator A	⑤	5-pin battery connector
②	Charging indicator B	⑥	Anti-drop lock
③	Full charge indicator C	⑦	Battery removal position
④	8-pin battery connector	⑧	AC jack (connects the supplied AC power cable)



PROHIBITED

Charging two or more batteries at the same time is prohibited. If inserted at the same time, the charger will automatically stop working.

■ Battery LED Indicators

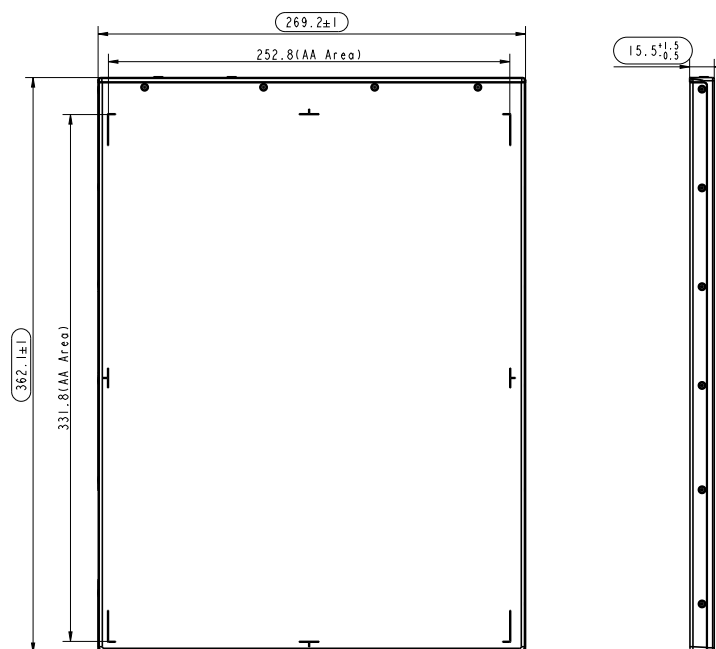
LED Status	Figure	Explanation
All OFF		No AC power input
A steady on		- AC power input - Multiple batteries inserted
A steady on B&C flashing 2 times alternately		Battery insertion self-test
A&B steady on		Battery charging
A&C steady on		Battery fully charged, stop charging
A steady on B&C flashing alternately that does not stop		Battery charging abnormal

Chapter 4 Technical Specifications

This chapter covers the drawings and the technical specifications you may need to better understand this equipment.

4.1 Mars1013X

■ Drawing



■ Specifications

Item	Specification
Model	Mars1013X
Scintillator	CsI (TI)
Image sensor	a-Si TFT
Pixel pitch	100μm
Effective pixel matrix	3318×2528
Active area	331.8mm×252.8mm
ADC	16 bit
MTF	11% for 4.0 LP/mm (@RQA5)

Item	Specification
DQE	21% for 3.0 LP/mm (@RQA5)
	38% for 2.0 LP/mm (@RQA5)
	68% for 1.0 LP/mm (@RQA5)
	100% for 0 LP/mm (@RQA5)
	15% for 4.0 LP/mm (@RQA5)
DQE	25% for 3.0 LP/mm (@RQA5)
	36% for 2.0 LP/mm (@RQA5)
	51% for 1.0 LP/mm (@RQA5)
	67% for 0 LP/mm (@RQA5)
Spatial resolution	5 Lp/mm
Preview image time	1s
Full image time	4.5s
Cycle time	3.5s
Trigger mode	Software/AED
Data interface	Wifi wireless transmission (802.11ac)
X-ray energy	40~150kV
Power supply	Internal power supply: 11.5V(DC), 1.6A, powered by battery pack External power supply: 24V, 0.75A, powered by adapter
Power consumption	Max. 19W
Dimensions	362.1 mm (L)×269.2 mm (W)×15.5 mm (H)
Weight	2kg (battery not included)

■ Environment Requirement

Please confirm that the environment meets the basic requirements of Mars1013X to ensure that the detector can be stored or operated in a reliable environment.

Item	Operation	Storage&Transportation
Temperature	10~35°C	-20~55°C
Humidity	5%~90%RH	5%~95%RH
Atmospheric pressure	700~1060mbar	700~1060mbar



PROHIBITED

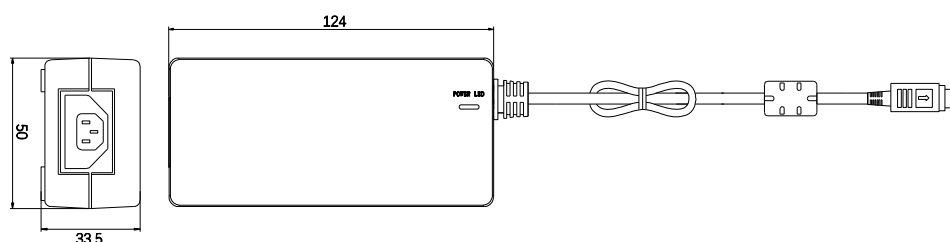
Do not operate the equipment at an altitude of more than 3000 meters.

■ Load Limit of Detector

Item	Uniform Load	Central Load
Location	Over the whole surface	Center diameter 40 mm
Weight	Max.300kg	Max.150kg

4.2 Power Adapter

■ Drawing

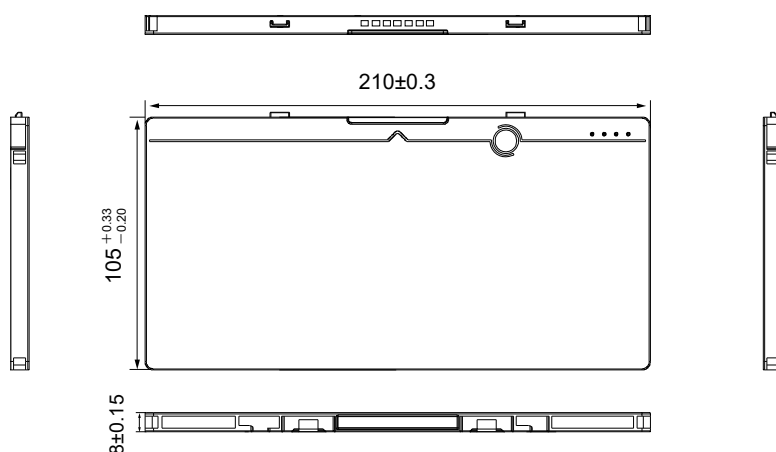


■ Specifications

Item	Specification
Model	LXCP61-024300
Input	100~240V AC input
Output	24V single output, 72W
Dimensions	124mm (L)×50mm (W)×33.5mm (H)

4.3 Battery

■ Drawing

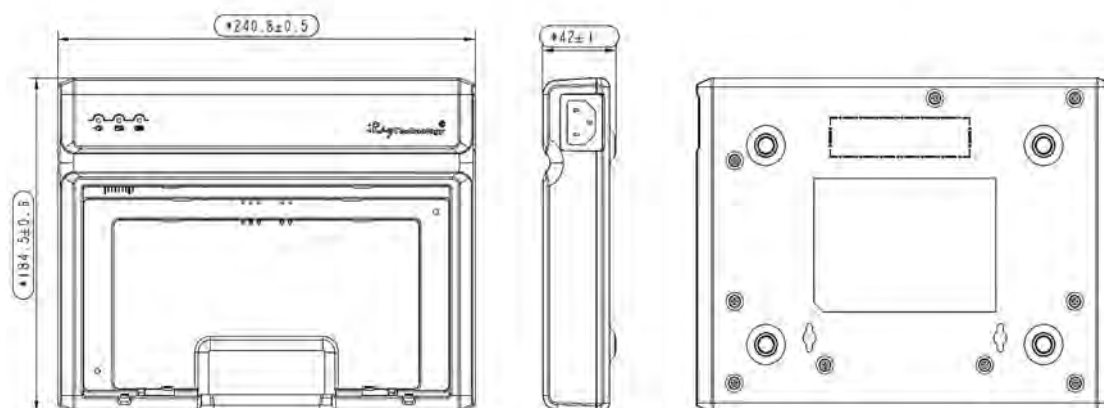


■ Specifications

Item	Specification
Model	Battery-KX
Rated capacity	4900mAh @ Discharge 0.2C
Nominal voltage	11.55V
Limited charge voltage	13.2V
Discharged end voltage	9V
Charging method	CC-CV
Operation temperature	Charge 0°C~60°C Discharge -10°C~60°C
Storage temperature	-20°C~45°C (charge and discharge once every 3 months) -20°C~35°C (charge and discharge once every 6 months)
Relative humidity	5%~95%RH
Dimensions	210mm (L)×105mm (W)×8mm (H)
Weight	0.285kg

4.4 Battery Charger

■ Drawing



■ Specifications

Item	Specification
Model	Charger-COMBO
Simultaneous charging	1 battery pack
Full charging time	≤3hours
Rated power supply	90V~264V (AC)
Dimensions	240mm (L)×184mm (W)×38mm (H)
Weight	0.55kg

4.5 Router (Recommended but not Included)

Item	Requirement
Wireless standard	IEEE 802.11 a/b/g/n/ac
Frequency range	2.412~2.4835GHz, 5.15~5.85GHz
Wireless data rate	802.11b: Max. 11Mbps 802.11a/g: Max. 54Mbps 802.11n: Max. 300Mbps (MIMO 2×2) 802.11ac: Max. 867Mbps (MIMO 2×2)

4.6 Workstation (Recommended but not Included)

■ Specifications

Item	Requirement
Operating system	Windows 7 32/64bit
CPU	Intel Core i7 3.6G
Memory	4G DDR3
Hard disk	640G
Network card	Intel Pro EXP9301CT PRO



CAUTION

- To avoid unnecessary troubles during the process of system integration, it is highly recommended to use the workstation configuration certified by iRay Technology.
- Turn off the firewall and anti-virus software to avoid problems such as detector connection failure or abnormal image.

4.7 Wireless Communication

Item	Description
Wireless standard	IEEE 802.11a/b/g/n/ac
Frequency range	2.412~2.472GHz: ch1~ch13 5.18~5.24GHz: ch36~ch48 5.745~5.85GHz: ch149~ch165
Data transmission rate	802.11b: Max. 11Mbps 802.11a/g: Max. 54Mbps 802.11n: Max. 300Mbps (MIMO 2×2) 802.11ac: Max. 867Mbps (MIMO 2×2)
Modulation	802.11b: CCK, DQPSK, DBPSK 802.11a/g/n: 64 QAM, 16 QAM, QPSK, BPSK 802.11ac: 256 QAM, 64 QAM, 16 QAM, QPSK, BPSK
Transmission power	Max.17dBm
Security	WPA, WPA-PSK, WPA2, WPA2-PSK, WEP 64bit & 128bit
Antenna	Dual Band inner antenna (2pcs.)



CAUTION

The Mars1013X is equipped with a wireless transmission function, which can generate electromagnetic radiation during the operation of the equipment, and can also be affected by electromagnetic cross-talk of other electrical equipment in the environment. Its wireless transmission performance is greatly affected by the placement of physical obstacles and materials. During use, attention should be paid to the following aspects:

- Positions the router as high as possible above the detector
- Reduces the barrier between the detector and the router
- Chooses channels with fewer devices
- Keeps the detector and router far away as possible from strong signal interference sources such as motors and transformers

4.8 IT Network

Item	Description
Purpose for IT-network	Transmits image data, commands and status commands between detector and workstation
Required characteristics	The wireless transmission follows the IEEE 802.11a/b/g/n/ac protocol, supports dual-band 2.4GHz&5GHz, and works on at least two routers
Required configuration	The wireless network card and the FPD must work on the same IP segment such as 192.168.8.XXX, and support IEEE 802.11a/b/g/n/ac protocol
Intended information flow	The detector sends the acquired image data to the workstation, and the workstation sends user's instructions to the detector
Wireless Standard	IEEE 802.11a/b/g/n/ac
Frequency Range	2.412~2.472GHz: ch1~ch13 5.18~5.24GHz: ch36~ch48 5.745~5.85GHz: ch149~ch165
Data Transmission Rate	802.11b: Max. 11Mbps 802.11a/g: Max. 54Mbps 802.11n: Max. 300Mbps (MIMO 2×2) 802.11ac: Max. 867Mbps (MIMO 2×2)
Modulation	802.11b: CCK, DQPSK, DBPSK 802.11a/g/n: 64 QAM, 16 QAM, QPSK, BPSK 802.11ac: 256 QAM, 64 QAM, 16 QAM, QPSK, BPSK
Security	WPA, WPA-PSK, WPA2, WPA2-PSK, WEP 64bit & 128bit



WARNING

- Connection of the detector to an IT-network that includes other equipment could result in previously unidentified risk that should be identified, analyzed, evaluated, and controlled by the manufacturer of the X-ray machine.
- Subsequent changes to the IT network may introduce new risks that require additional analysis.



CAUTION

Changes to the IT-network include:

- Changes in the IT-network configuration
- Connection of additional items to the IT-network
- Disconnecting items from the IT-network
- Update of equipment connected to the IT-network



Hazardous situations resulting from failure of the IT-network:

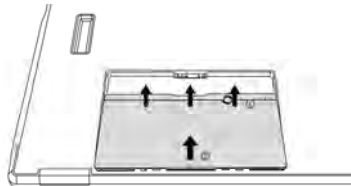
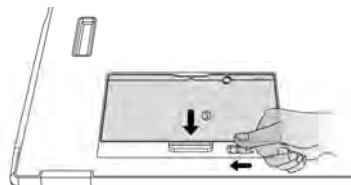
- Failure of completing essential performance
 - Failure of finishing configuration of product
 - Operating system is not compatible
 - Change or update software failed
 - Compatibility of interface
 - Data transfer protocol error
 - Inconsistency of interface or format leads to data distortion
 - Data output failed
-

Chapter 5 Product Installation and Connection

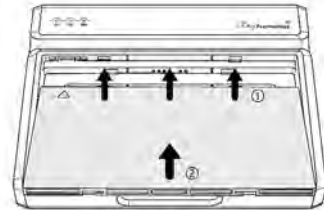
This chapter mainly illustrates how to integrate the Mars1013X system.

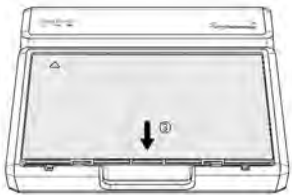
5.1 Installing Components and Accessories

5.1.1 How to Insert a Battery Pack into the Panel

Step	Figure
1. Press and slide the battery lock levers on both sides until fully unlocked, and align the battery connector with that in the battery compartment	
2. Slide the battery pack into battery compartment along the direction shown above (make sure battery level overpass 10%)	
3. Press and slide the battery lock levers on both sides until fully locked	

5.1.2 How to Insert a Battery Pack into a Battery Charger

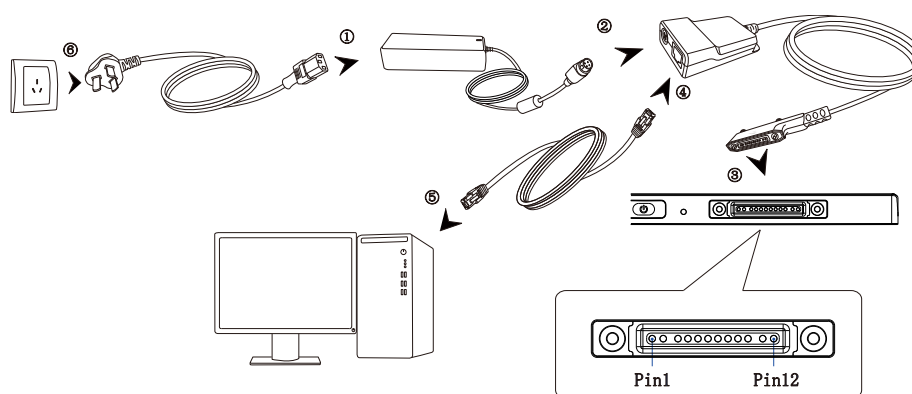
Step	Figure
1. Insert the battery into the battery charger and align the interface in the direction as shown right	

Step	Figure
2. Press the battery down until fixed at the bottom of battery compartment, and supply power to the charger with a power adapter	
3. After the battery is fully charged, remove the battery from the battery charger	

5.2 Detector Connection

5.2.1 Wired Connection

In wired mode, the detector and workstation transmit data and config. information through a Gigabit Ethernet cable connected to the LAN interface on the control box. In this case, the power adapter can power the equipment through the control box, free from a battery pack.



In this mode, follow the steps below to integrate this system:

- Plug one end of the AC power cable into the power adapter connector;
- Insert the adapter plug into the 4-pin DC power interface of the control box;
- Insert the 12-pin plug of the control box into the detector composite interface (the description of pins is shown in the table below);
- Insert one end of the Ethernet cable into the LAN interface of the control box, the other into the LAN interface of PC;
- Plug the other end of AC power cable into an AC outlet with ground protection.

PIN	Definition	Rated Current	Input Voltage Range
PIN1	Negative terminal of DC supply	0.75A	0~24V
PIN2	Positive terminal of DC supply	0.75A	0~24V
PIN3~10	Wired fiber optic cables connect a signal loop	/	/
PIN11	Positive terminal of DC supply	0.75A	0~24V
PIN12	Negative terminal of DC supply	0.75A	0~24V



WARNING

Wired mode is for service mode only, not for clinical applications.



CAUTION

Use the supplied power adapter to power your equipment or charge a battery pack.



NOTE

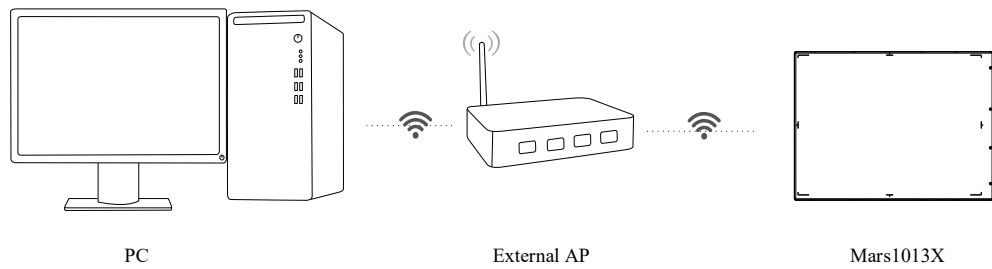
- Do not insert, remove, or drag the cable forcibly. Otherwise, the interfaces can be damaged.
- Sufficient reliability verification tests have been performed on the supplied accessories. iRay assumes no liability for abnormal conditions such as detector damage caused by use of components not verified by iRay engineers.
- Should you intend to replace the product accessories or cables of other models, contact the engineers of iRay Technology to confirm the feasibility.

5.2.2 Wireless Mode

In wireless mode, the detector and workstation transmit data and config. information through a wireless network, which is more flexible and easy to operate than a wired connection.

■ Client Mode

In this mode, an external device (such as a router) acts as an AP (wireless access point), and the connection between the detector (Mars1013X) and the workstation (PC) is established via the wireless network transmitted by the external AP.



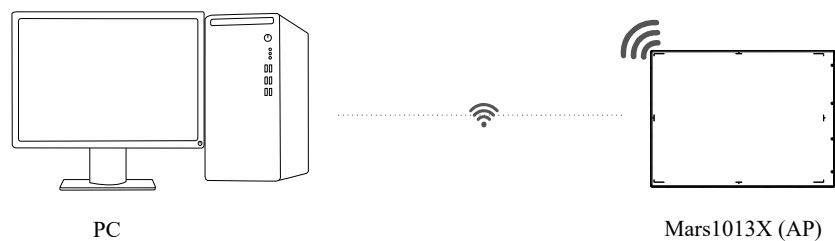
To maximum the wireless transmission performance, attention should be paid to the following aspects:



- Do not block the wireless module of the detector
- Reduce the barrier between the detector and the external AP (router)
- Select channels with less equipment connection
- Keep the detector and router far away as possible from strong signal interference sources such as motors and transformers
- Place the external AP as high as possible above the detector

■ AP Mode

In this mode, the detector (Mars1013X) itself acts as an AP, transmitting wireless hotspots, and the connection between the detector and the workstation is established via the wireless network transmitted by the detector AP.



Chapter 6 Software Installation and Configuration

This chapter guides you to install the software operating environment and configure the software.

6.1 About the SDK

Mars1013X provides you with an SDK for integrating your FPD into your DR system, as well as an iDetector application that can run on the end-user workstation with Windows operating system for detector configuration, image acquisition, image preprocessing, image browsing, and more.

iDetector allows you to control the detector even in the absence of DR systems.

6.2 How to Set up an Operating Environment

■ Decompressing the SDK

Download the SDK from the CD-ROM, decompress it to a location where you need to install it. SDK contains the operating environment installation file or download path in ...\Tools\env_setup.

■ Microsoft .NET Framework

Find the SDK microsoft folder in ...\Tools\env_setup\microsoft\dotnet_setup_url, select the x86 or x64 driver according to the version of your operating system, and install the driver according to the installation prompts.



- Mars1013X must work on Windows 7 or higher operating system, so please install Net Framework 4.5 and above (XP system only supports 4.0 version) to ensure that iDetector can work normally.
- Under XP environment, the setting in bind.txt must use absolute path.

■ Visual C++ Redistributable

To ensure the normal use of Visual C++ applications, find the Tools/env_setup/microsoft/vcredist_x64_vs2013.exe. item in the SDK, and install the VC distribution package vcredist_x86_2013 (or vcredist_x64_vs2013) as required.

6.3 Running the iDetector

Mars1013X provides iDetector as a basic test tool, which can be run immediately by a double click without installation.

Its SDK path includes:

- 32-bit system, iDetector.exe location: ...\Tools\iDetector\w32
- 64-bit system, iDetector.exe location: ...\Tools\iDetector\w64

6.4 Communication Configuration

The Mars1013X supports wired mode (service mode only), wireless client mode, and wireless AP mode.

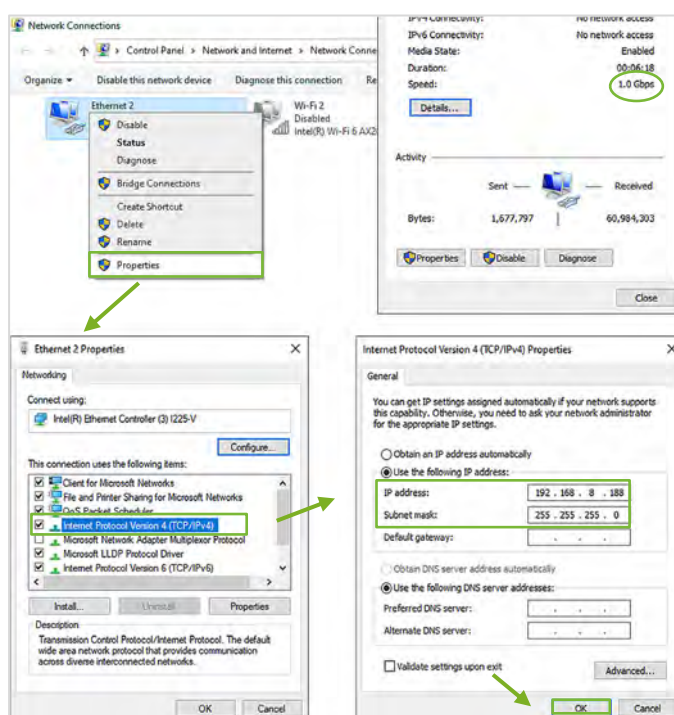
The IP addresses and some other information mentioned below are provided as examples only, and you can configure and connect your FPD according to the actual situation.

6.4.1 Wired Connection

■ Configuring the Wired Mode

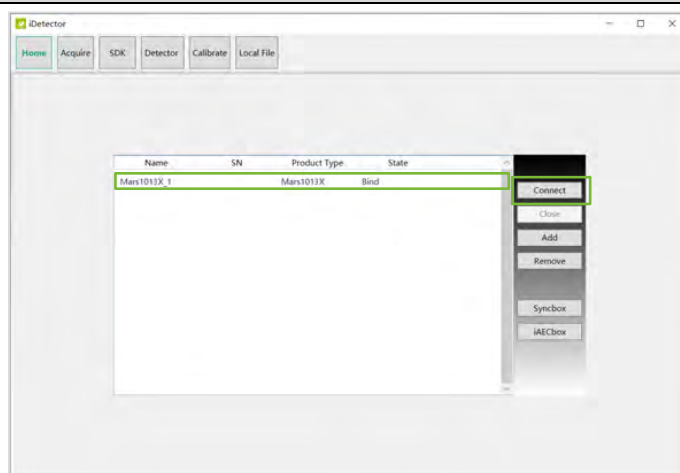
Configuring the Wired Mode

- ① Make a wired connection as described in section 5.2.1
- ② Open the network connection window, right-click [Properties], select and double-click [Internet Protocol Version 4 (TCP/IPv4)], enter the IP address configuration page, select [Use the following IP address], enter the IP address "192.168.8.188" and subnet mask "255.255.255.0", and click [OK] to make the configuration take effect. Check the Ethernet status and ensure that the network speed is 1Gbps



Configuring the Wired Mode

- ③ Double-click iDetector icon in the SDK, select the corresponding product type, and click [Connect] to build the connection

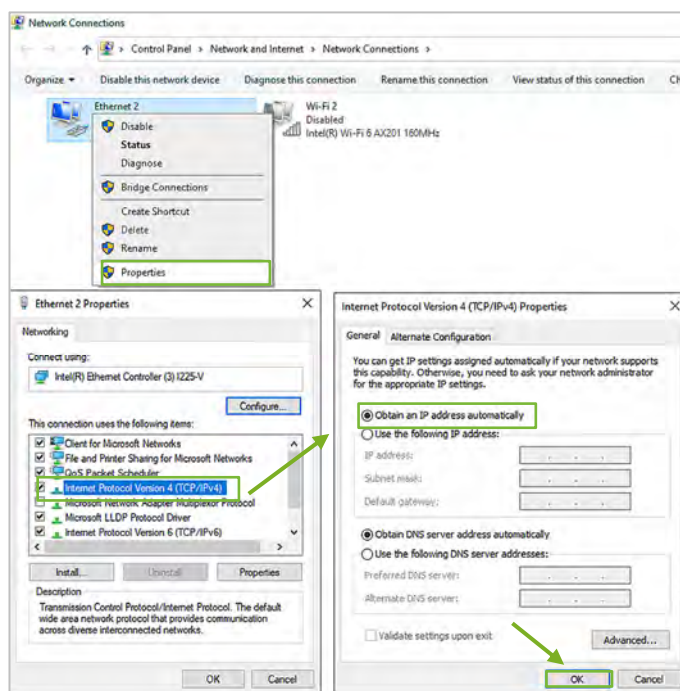


6.4.2 Wireless Client Mode

After completing the wired mode configuration (see Section 6.3.1), router configuration and detector configuration are required to complete the entire wireless Client mode configuration.

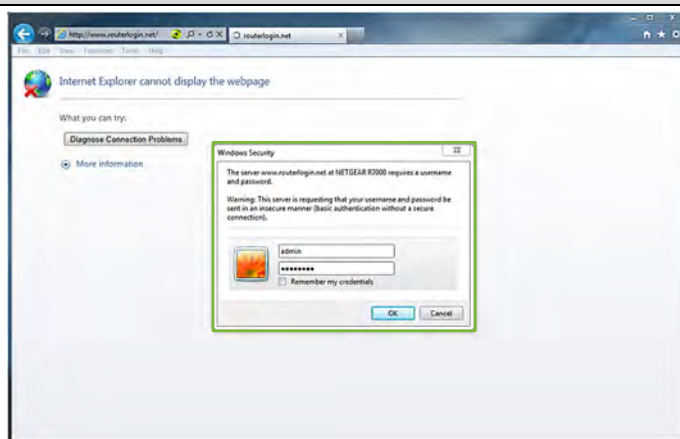
Configuring Your Router

- ① As described in Section 5.2.2, connect one end of the Gigabit Ethernet cable to the LAN interface of workstation and the other end to the that of the router
- ② Open the network connection window, right-click [Properties], select and double-click [Internet Protocol Version 4 (TCP/IPv4)], enter the IP address configuration page, tick [Obtain IP address automatically], and click [OK] to make the configuration take effect



Configuring Your Router

- ③ Open a browser, log in to the external wireless router interface for parameter settings depended on the URL of the wireless router you are using (e.g. 192.168.1.1)



- ④ Proceed with the **wireless setup** as shown on the right:

2.4ghz wireless network:

SSID: NETGEAR_BIG_24

Security: WPA2-PSK

Password: 12345678

Channel: [Check your current Wi-Fi environment and choose a relatively clean channel]

5GHz wireless network:

SSID: NETGEAR_BIG_50

Security: WPA2-PSK

Password: 12345678

Channel: [Check your current Wi-Fi environment and choose a relatively clean channel]

- ⑤ **LAN Setup**

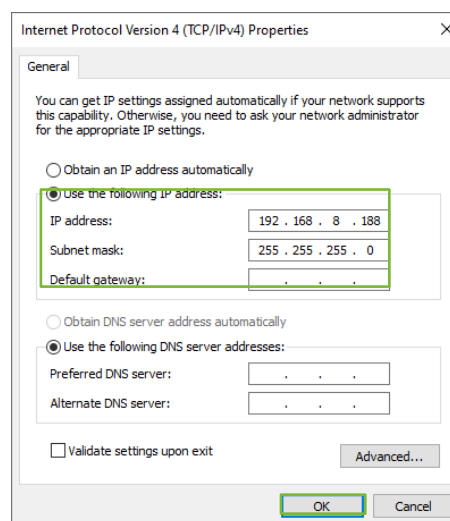
IP address: 192.168.8.1

IP subset mask: 255.255.255.0

- ⑥ After the settings are complete, re-start the wireless router

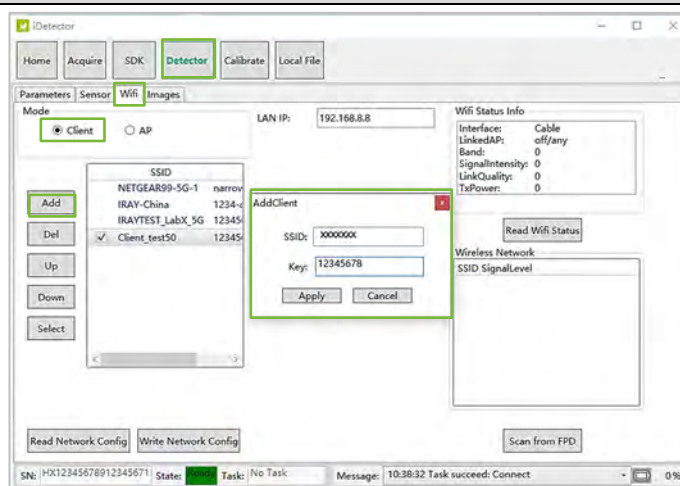
Configuring Your Router

- ⑦ Open the network connection window again, tick [Use the following IP address], set the IP address to 192.168.8.188, subnet mask to 255.255.255.0, and click [OK] to make the configuration to take effect

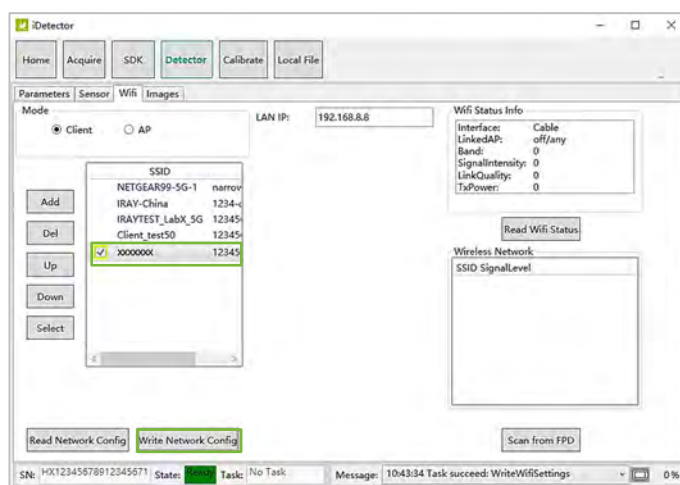


Configuring the Detector

- ① Connect the detector and iDetector through the wired mode described in Section 6.3.1;
- ② Double-click to open iDetector, click the Wifi tab of the Detector page, tick the [Client] mode, click [Add] to Add router wireless account, type the SSID and password created during router configuration, and click [Apply]

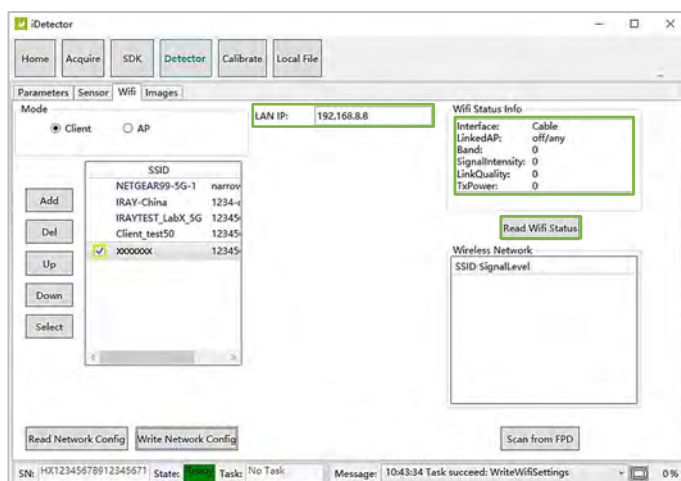


- ③ Select the newly created SSID of the router (✓ is displayed before the selected SSID) and click [Write Config] to save the set parameters



Configuring the Detector

- ④ Switch on the wireless router, make sure that there is a wired connection between the router and the PC and the IP address is 192.168.8.188. Click [Read Wifi Status], check the wireless transmission status, the numeric value indicates that the connection is normal



Select the default SSID and password and the detector will automatically connect to the corresponding wireless network the next time it starts up.

6.4.3 Wireless AP Mode

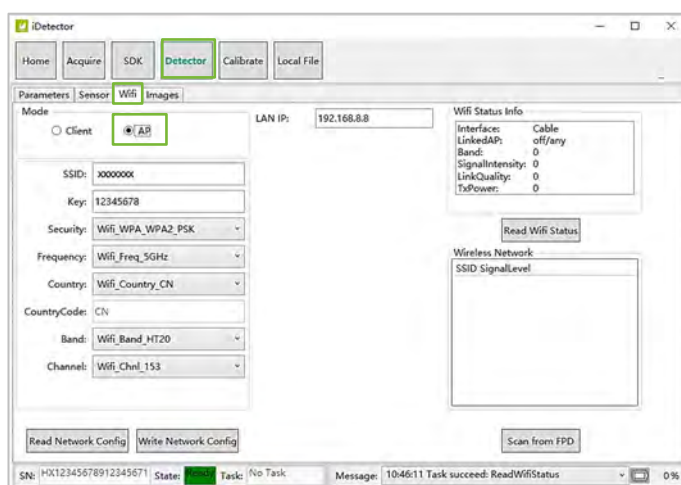


Before configuring the AP mode, make sure that the workstation which a wireless network card has been plugged in has the latest version of the wireless card driver installed.

After completing the wired mode configuration (see Section 6.3.1), detector configuration and external wireless card update are required to complete the entire wireless AP mode configuration.

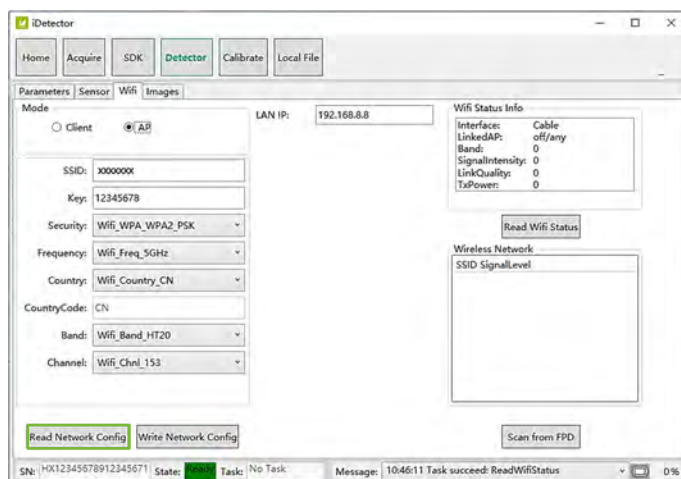
Configuring the Detector

- ① Double-click to run the iDetector, click the [Wifi] tab of the Detector page, and check [AP] mode

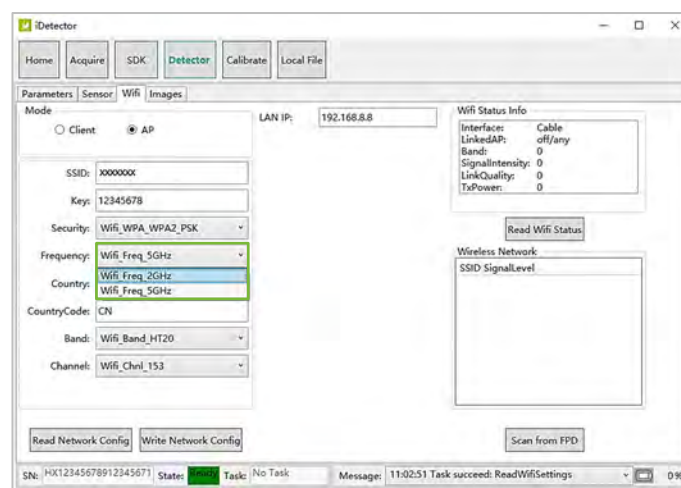


Configuring the Detector

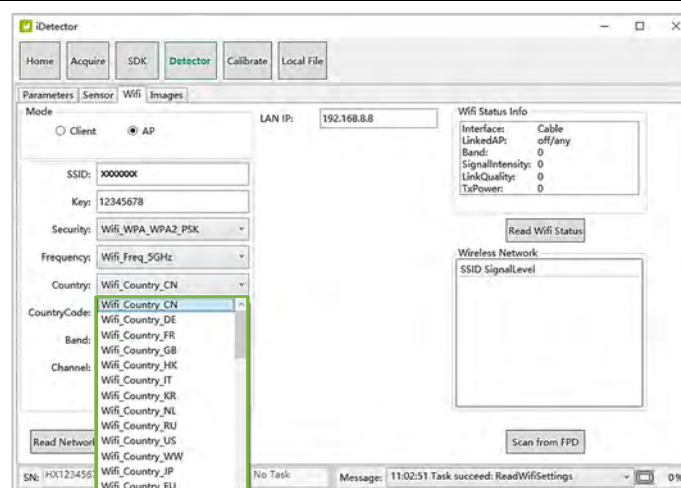
- ② Click [Read Network Config] to get the default configuration, change the SSID and password, and make sure that the SSID is different from the SSID of other existing detectors



- ③ Select a frequency band from the drop-down box of frequency

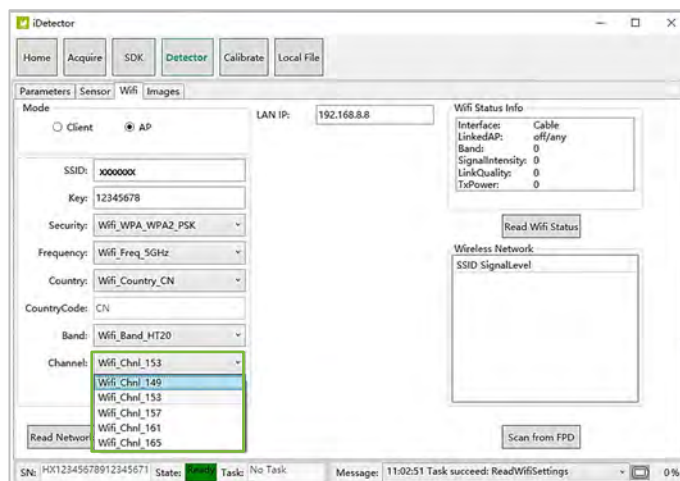


- ④ Select a country code from the drop-down box of country

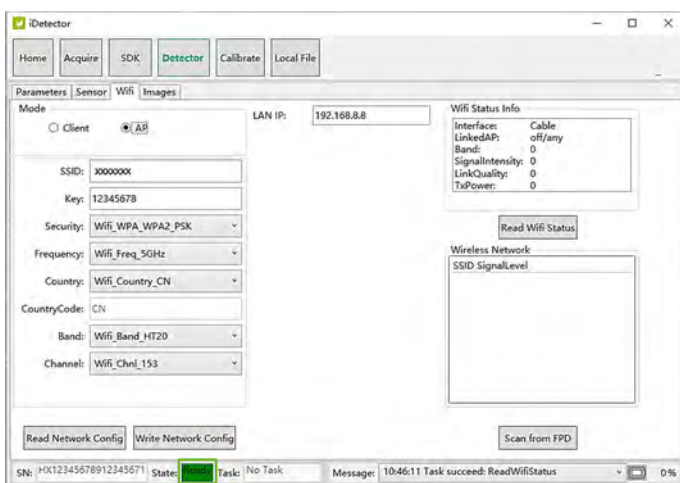


Configuring the Detector

- ⑤ Select an empty channel and frequency from the drop-down box of band and channel, and click [Write Network Config] button

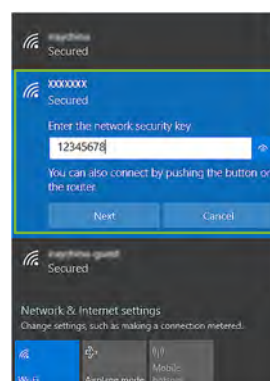


- ⑥ The network cable cannot be unplugged until the status bar state item changes from “busy” to “ready”

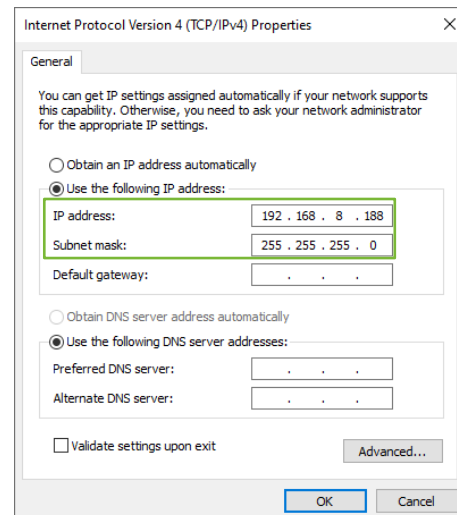


Updating the External Wireless Card

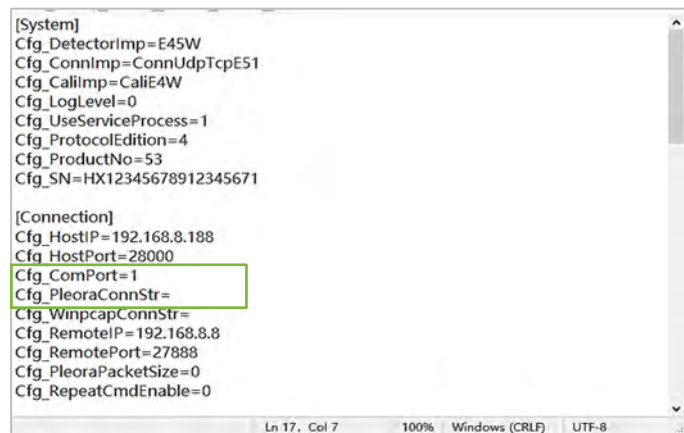
- ① Open the wireless signal list, select the SSID that belongs to the detector, and enter the password



- ② Open the network connection window, select [Internet Protocol Version 4 (TCP/IPv4)], click [Properties] to have the IP address configuration page pop up, set the IP address to 192.168.8.188 and subnet mask to 255.255.255.0



- ③ Make sure that the IP address (192.168.8.188) and port (default 28000) in the config.ini file of the SDK's corresponding detector directory are consistent with that of the PC

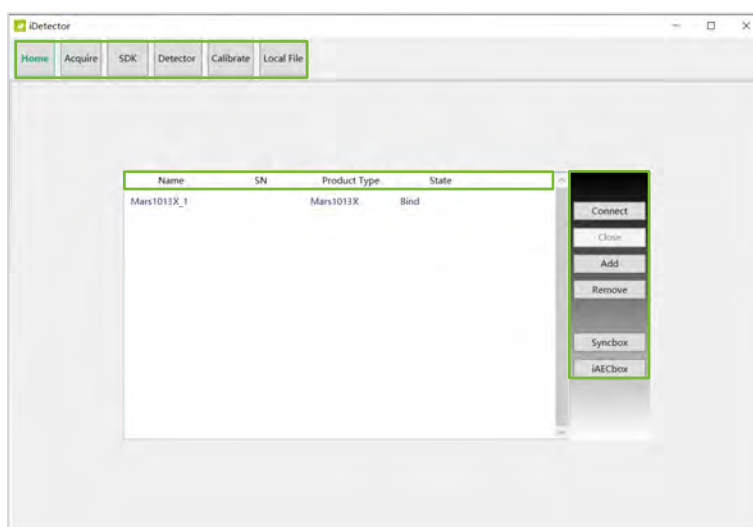


Chapter 7 User Interface

This chapter introduces you to the iDetector user interface and familiarizes you with its functions. The content displayed on the iDetector interface may vary from version to version without prior notice.

7.1 Home Page

Double-click the iDetector icon to run the software, and the home page pops up as shown below:



Item	Description	
Tabs	Home	Connects FPD to PC and checks the PC-FPD connection status
	Acquire	Acquires images, selects calibration modes, saves and processes images
	SDK	Configures Config.ini parameters and log level
	Detector	Configures FPD parameters and trigger modes
	Calibrate	Generates and manages calibration files
	Local File	Opens, views, and processes local images
Information bar	Name	Displays FPD name
	SN	Displays FPD SN
	Product Type	Displays FPD model
	State	Displays FPD connection state (bind, unknown, ready, etc.)
Buttons	Connect	Connects the selected FPD
	Close	Disconnects the selected FPD

Item	Description
Add	Adds a working directory
Remove	Deletes a working directory
Synbox	Open the Synbox configuration window (device optional)



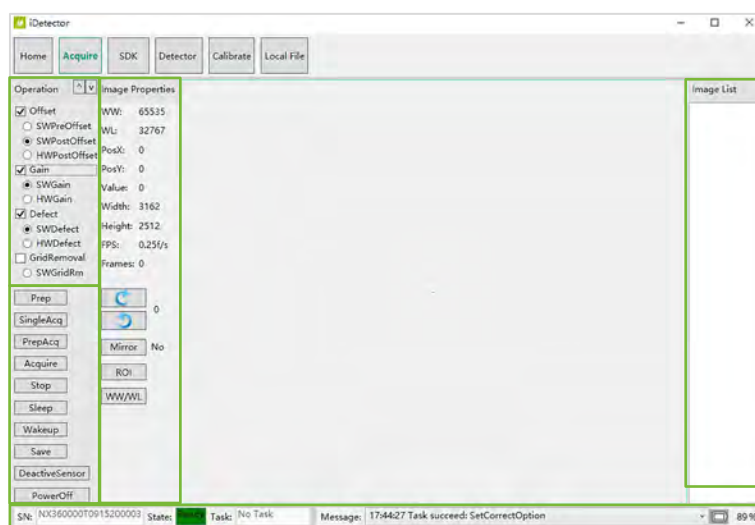
NOTE

Except for the Home page and the Local File page, which can be viewed in offline mode, the other four pages can be viewed only when the detector is connected.

7.2 Acquire Page

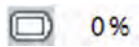
Select the corresponding detector model, and click the [Connect] button on the home page. When the network connection is normal, the detector will respond to the connection command sent by iDetector. After completing a selfcheck, iDetector will automatically jump to the Acquire page.

Acquire page allows you to perform operations including image acquisition, calibration method selection, image storage and processing.



Item	Description
Template Selection	SWPreOffset
	The workstation performs PreOffset calibration
	SWPostOffset
	The workstation performs PostOffset calibration
	HWPPostOffset
	The detector performs PostOffset calibration
Gain	SWGain
	The workstation performs Gain calibration
Gain	HWGain
	The detector performs Gain calibration
Defect	SWDefect
	The workstation performs Defect calibration

Item	Description		
	HWDefect	The detector performs Defect calibration	
	GridRemoval	SWGridRm	The workstation performs grid removal calibration
Instructions	Prep	Prepared for exposure acquisition	
	SingleAcq	Starts single-frame acquisition	
	PrepAcq	Clears and acquires images manually	
	Acquire	Starts exposure and acquisition	
	Stop	Stops acquisition	
	Sleep	Sleeps the FPD	
	Wakeup	Wakes the FPD up	
	Save	Saves the currently acquired images in .raw, or .tiff format	
	DeactiveSensor	FPD enters a low-power mode	
	PowerOff	Powers off the FPD	
	Image properties	WW	Window width
WL		Window level	
PosX		X coordinate of the current cursor location	
PosY		Y coordinate of the current cursor location	
Value		Gray value of the current cursor location	
Width		Image width	
Height		Image height	
FPS		Acquisition frame rate, keeps the latest frame rate after stopping acquisition	
Frames		Displays the number of frames acquired	
		Rotates the image clockwise, 90 degrees every time	
		Rotates the image anticlockwise, 90 degrees every time	
Mirror		Enables or disables the mirror function of images	
ROI		Checks AVG、SV、SNR and other image parameters	
WW/WL		Adjusts WW/WL automatically according to a selection box by a right-click	
Image list		Image List	Displays the latest several acquired images, and double-clicks to view the image details
Status bar	SN	Displays the SN number of the currently-connected detector	
	State	Displays the state of detector, e.g. busy, ready	
	Task	Displays the task being executed	

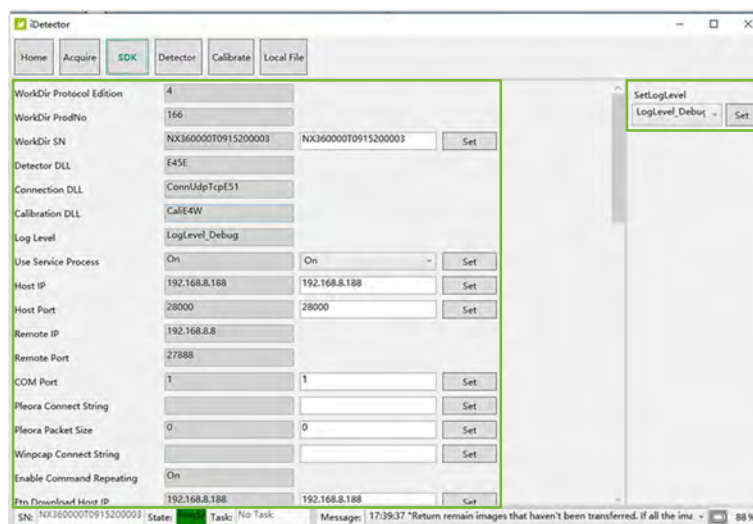
Item	Description
Message	Feedback or result of the detector action, such as succeed, failed
	Displays the remaining percentage of battery, 0% when no battery is plugged in

■ Shortcuts

Shortcut	Description
Double left-click	Centers and maximizes the image
Hold left click and drag	Drags the image that is being displayed
Double right click	Restores WW to 65535 and WL to 32767
Hold right click and drag horizontally	Adjusts the WW
Hold right click and drag vertically	Adjusts the WL
F3	Quickly locates the window width and height of the image

7.3 SDK Page

Click [SDK] tab on the home page to enter the SDK page, where it contains all the parameter information related to the SDK and log level can be set. You can modify some of the modifiable configuration items according to the actual situation.



■ Configurable Parameters

Parameters	Description	Default	Range
WorkDir SN	FPD Serial number	VH300010T080919 0001	\

Parameters	Description	Default	Range
Use Service Process	On/Off	On	On/Off
Host IP	Host IP Address	192.168.8.188	Any valid IP address
Host Port	Host Port Number	28000	Any value
COM Port	COM port communication	1	Any value
Ftp Download Host IP	Host IP set to download files using Ftp command	192.168.8.188	Any valid IP address
Ftp Download Host Port	Host port set to download files using Ftp command	21000	Any value
Ftp Upload Host IP	Host IP set to upload files using Ftp command	192.168.8.188	Any valid IP address
Ftp Upload Host Port	Host port set to upload files using Ftp command	21000	Any value
Default Correct Option	Sets the default correct option	0	-32768~32767
Clear Acq Delay Time (ms)	Sets the clear delay time	2200	0~65535
Preview Image Enable	Enables or disables preview image	On	On/Off
Allow SN Mismatch	Allows or disallows SN mismatch	On	On/Off



WARNING

Before modifying parameters, be sure to familiarize yourself with the functions and modification range of each configuration parameter.

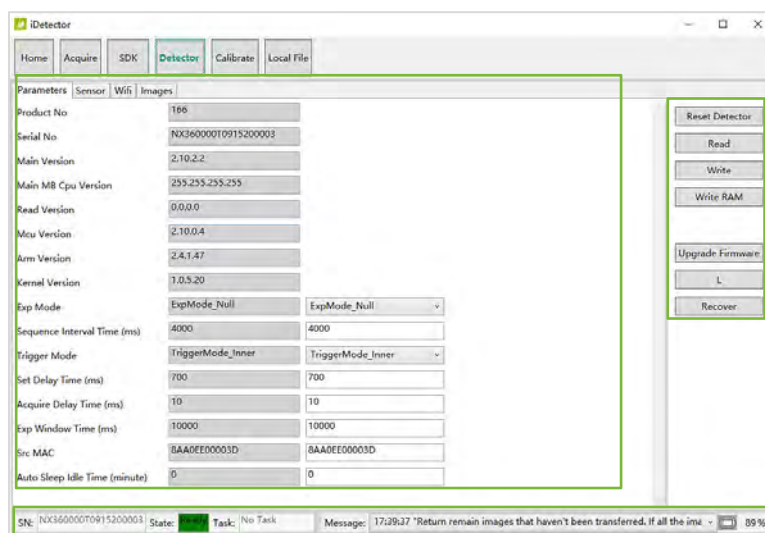
Misconfiguring parameters or items may cause the detector to malfunction, contact iRay Technology engineers to confirm the risks before modifying some parameters.

7.4 Detector Page

Click the [Detector] tab on the Home page to enter the Detector page. This page enables you to view the configuration information of the currently connected Detector, including the SN number, version, IP address and more.

7.4.1 Parameters

When entering the Detector page, you will be directed to the Parameters page by default. The page is mainly divided into three areas: parameter items (including readable&writable parameters), operation buttons and status bar.



Item		Description
Parameters		Displays all parameters of the page, including readable and writable parameters
Buttons	Reset Detector	Resets the detector
	Read	Reads the ROM parameters of the detector
	Write	Writes the ROM parameters of the detector
	Write RAW	Writes the RAM parameters of the detector
	Upgrade Firmware	Upgrades firmware
	L	Uploads log
Status bar		Feedbacks the state of the detector, the information of parameters read or written

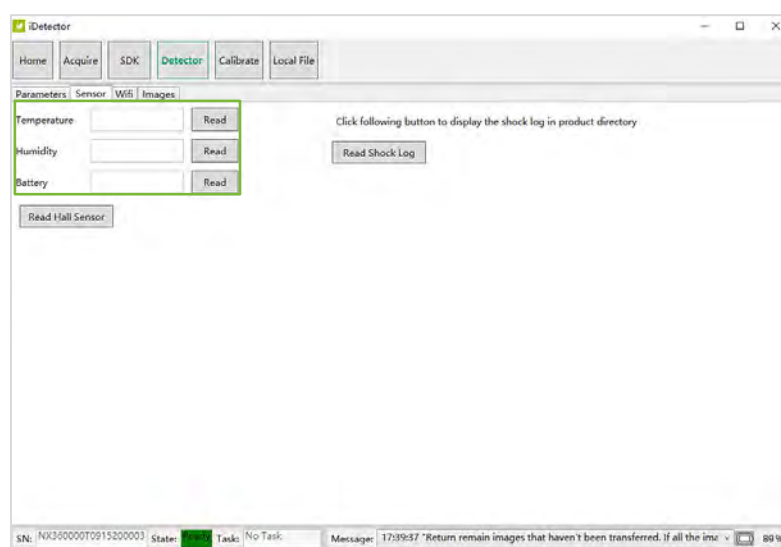
■ Configurable Parameters

Parameters	Description	Default	Range
Inner SubFlow	Selects inner mode	InnerSubFlow_ClearAcq	InnerSubFlow_CycleAcq InnerSubFlow_ClearAcq
Prep CapMode	Enables or disables Acq2	ClearAcq	PreCapMode_ClearAcq PreCapMode_Acq2
Self CapEnable	Enables or disables self-acquisition	Off	On/Off

Parameters	Description	Default	Range
Trigger Mode	Selects trigger mode	TriggerMode_Soft	TriggerMode_Soft TriggerMode_Inner TriggerMode_FreeSync
Sequence Interval Time (ms)	Sets interval time of two acquisition	5000	0~65535
Set Delay Time(ms)	Sets exposure window delay time	1200	1000~6000
Exp Window Time(ms)	Sets exposure window opening time	10000	1000~10000
Acquire Delay Time(ms)	Sets acquisition delay time	10	0~65535
Src IP	FPD IP (matching Remote IP)	192.168.8.8	Any value
Src MAC	FPD MAC address	/	Any value
Self Clear Enable	Enables or disables self-clear	On	On/Off
Self Clear Span Time (ms)	Sets self-clear time	10	1~65535

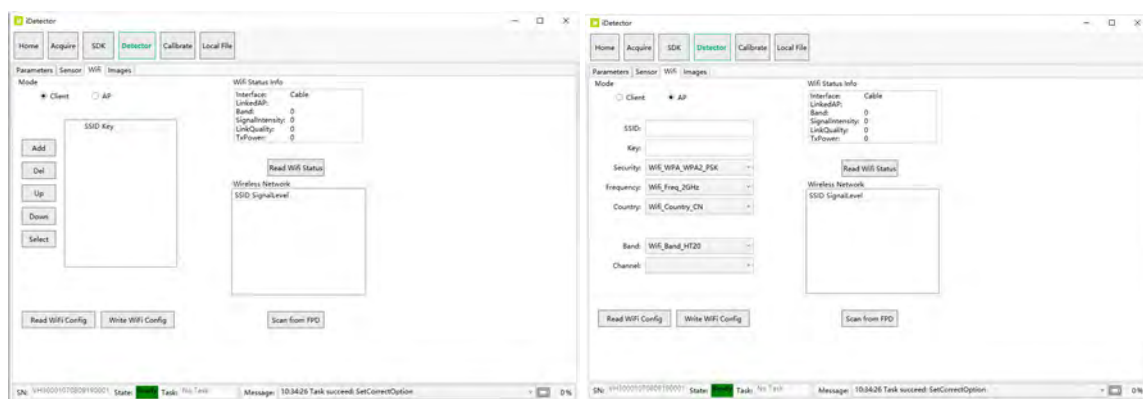
7.4.2 Sensor

The sensor page allows you to check the temperature and humidity of the detector as well as the battery level and charging status.



Item	Description
Temperature	Reads the temperature inside the detector
Humidity	Reads the humidity inside the detector
Battery	Reads the detector battery level and charging status
Read shock log	Reads sensor shock log

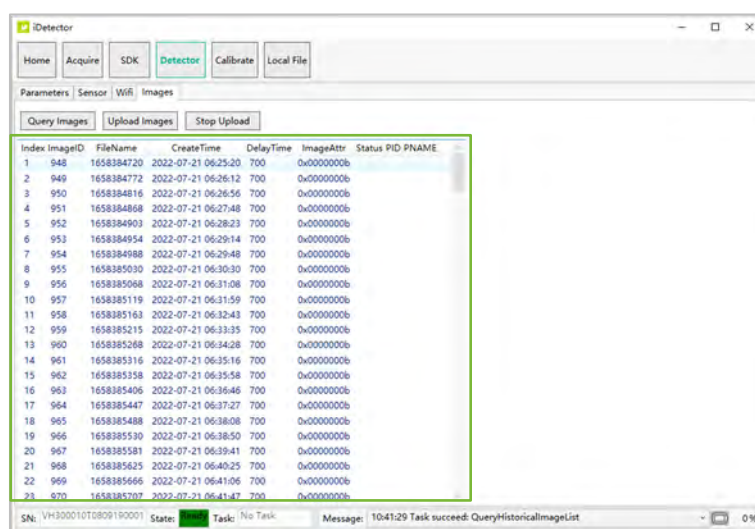
■ Wifi



Item	Description
Client	Add
	Del
	Up
	Down
	Select
	SSID List
AP	SSID
	KEY
	Read Config
	Write Config
	Read Wifi Status
	Scan from FPD
	Security
	Frequency
	Country

Item	Description	
Buttons	Band	Selects a band from the drop-down list box
	Channel	Selects a channel from the drop-down list box
	Read WiFi Status	Reads the working parameters of the detector WiFi module
	Read Config	Reads the WiFi mode Settings in the detector
	Write Config	Updates WiFi working mode Settings in the detector
	Scan from FPD	Sends an instruction asking the FPD to provide a list of SSIDs that can be scanned

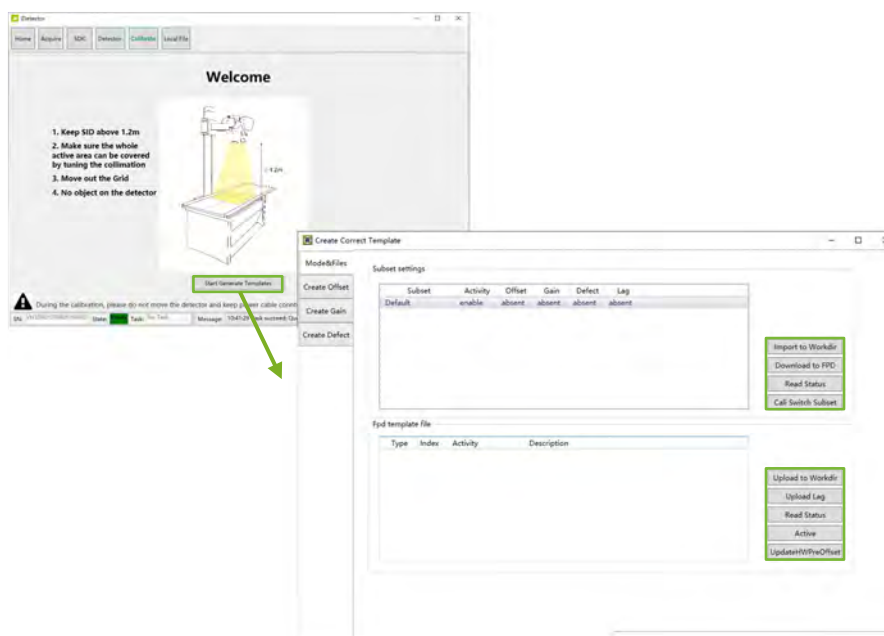
■ Images



Item	Description	
Buttons	Query Images	Queries the list of images inside the detector
	Upload Images	Uploads specific images inside the detector
	Stop Upload	Stops uploading images
Information bar	Index	Numbers a total of 200 images (when the image exceeds 200, the image numbered 200 displays always the most recent image)
	FileName	The name of the image, which is generated based on the date when the image was created, converting the date to seconds
	CreateTime	Displays the image creation time
	DelayTime	Displays the window time when acquiring images
	ImageAttr	Displays the image type, image before or after the correction

7.5 Calibrate Page

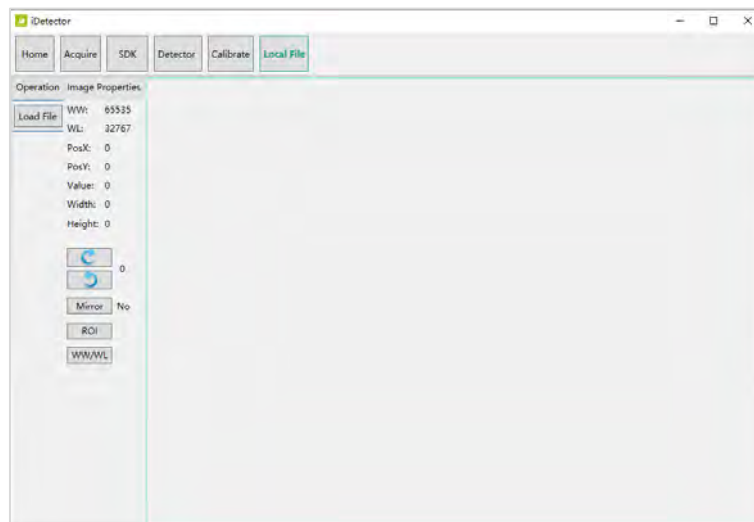
Click [Start Generate Template] on the Calibrate page to enter the template creation page, where you can select application modes, and generate and manage calibration templates.



Page	Description		
Welcome page	Displays precautions and a diagram, and pops up Create Correct Template page by clicking [Start Generate Templates]		
Mode&Files	Subset settings	Import to Workdir	Copies the selected template to the current calibration directory of workstation
		Download to FPD	Downloads the selected template to the FPD
		Read Status	Refreshes the upper-left list status
	Fpd template file	Upload to Workdir	Uploads the selected template to the specified calibration directory of the workstation
		Read Status	Refreshes the lower-left list status
		Active	Activates the selected template
		UpdateHWPreOffset	Forces the FPD to update the Offset template
Create Offset	Creates an Offset calibration template		
Create Gain	Creates a Gain calibration template		
Create Defect	Creates a Defect calibration template		

7.6 Local File Page

This page allows you to open locally saved images supporting three file formats: .raw, .tiff, and .dft, and to search for local images.



Chapter 8 Operation

This chapter describes how to power on and off the product and how to operate the software.

8.1 Startup Procedure

- ① **Checking the operating environment:** Ensure that the operating environment of Mars1013X meets the requirements described in Section 1.1, that the distance between the tube and FPD is greater than 1.2m and that the ray source field of view completely covers the entire effective imaging area of the detector after adjusting the beam limiting device;
- ② **Checking the connection status of the equipment:** In wireless mode, ensure that a battery whose power level is more than 15% has been inserted, and that the wireless communication is configured correctly. In wired mode, make sure the adapter plugged into the AC socket is securely connected to the detector, and that the wired connection is configured correctly;
- ③ **Powering up the Mars1013X:** When the detector is powered only by battery, short-hold the power button for 4 seconds to turn on the detector; when the detector is powered by an external power supply, the detector will power on by default after being powered up. The power indicator is steady on when data link self-test is completed;
- ④ **Preheating:** After a cold start, preheat the detector for 15 minutes until the detector reaches thermal equilibrium before generating calibration templates. If the detector is hot (shut down for a short time or the temperature is stable), just skip this step;
- ⑤ **Establishing a connection between FPD and PC:** Find the working directory corresponding to the detector model Mars1013X, double-click to run the iDetector software, and click the [Connect] button on the Home page to build a connection between FPD and PC.

8.2 Creating Calibration Templates

It is recommended to create or recreate a calibration template when:



NOTE

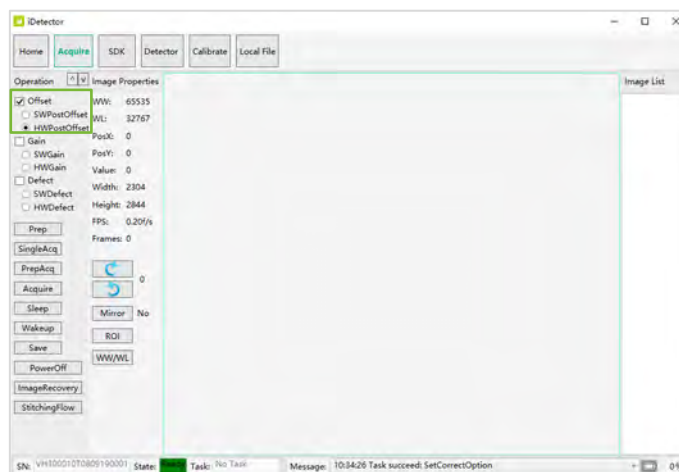
- The detector is first installed in a DR system
- Major changes occur in system settings or hardware configurations
- Every 6 months
- HVG, tube, collimator or exposure environment have been changed
- The relative position of detector and tube changes
- The voltage value of the X-ray tube is changed

The template is saved in the path:

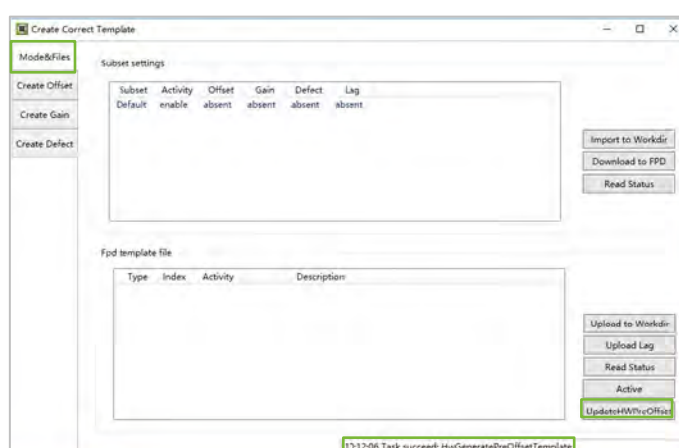
··\Tools\iDetector\64\work_dir\Mars1013X\Correct\default

Creating Offset, Gain, and Defect Templates

- ① Select [HWPostOffset] on the Acquire page

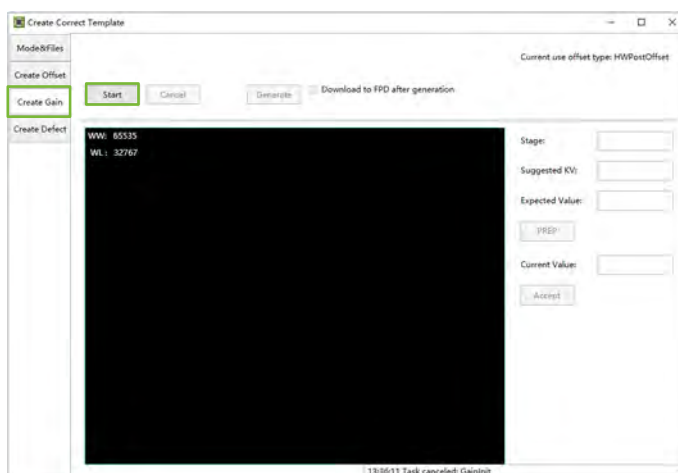


- ② Click [UpdateHWPreOffset] under the Mode & Files tab to start creating the preview template, and wait for the status bar to prompt "Task succeed: HwGenerate PreOffsetTemplate", indicating that the preview template has been created

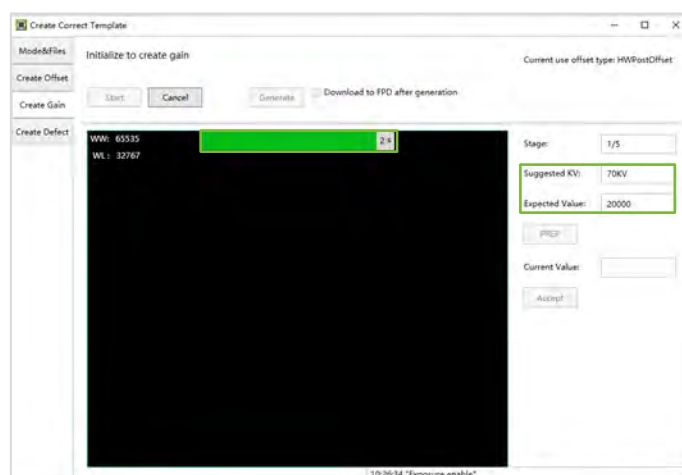


Creating Offset, Gain, and Defect Templates

- ③ Switch to the [Create Gain] tab, start the Gain template generation process, including five stages of image acquisition, click [Start] button, and the “Initialize to create gain” prompt appears

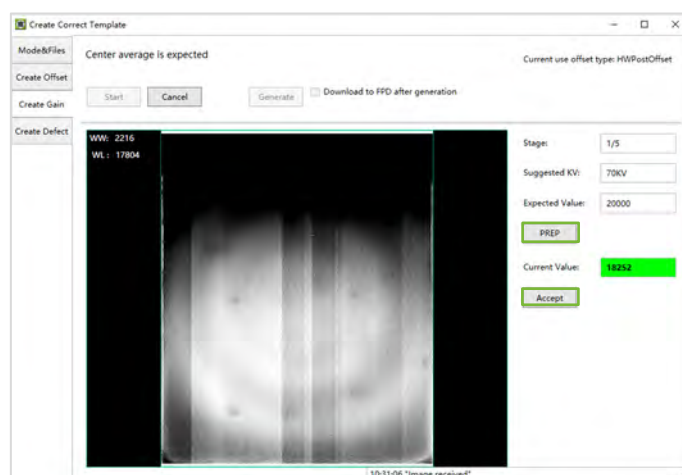


- ④ Adjust the exposure kV value to 70kV, set the X-ray dose to meet the grayscale expectation of 20000, click the [PREP] button (Inner /Freesync mode), or the [Acquire] button (Software mode), wait for the exposure progress bar to appear, and complete the exposure before the progress bar is closed. The progress bar count-down can be set through the [Clear Acquire Delay Time] in the SDK page



- ⑤ When the image meets the requirements (green), click [Accept] and click [PREP] to proceed with the next stage

Note: the color rendered in the Current Value area: yellow indicates that the image does not meet the requirements but still can generate a template; green indicates that the image meets the requirements; red indicates that the image does not meet the requirements, the template cannot be generated, and the dose must be modified to reacquire images

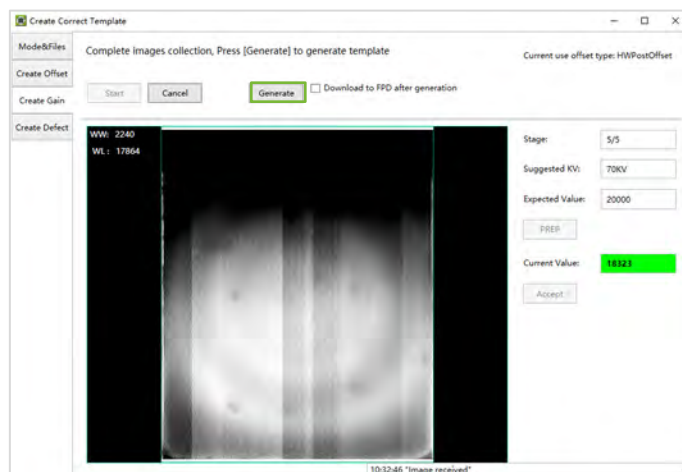


Creating Offset, Gain, and Defect Templates

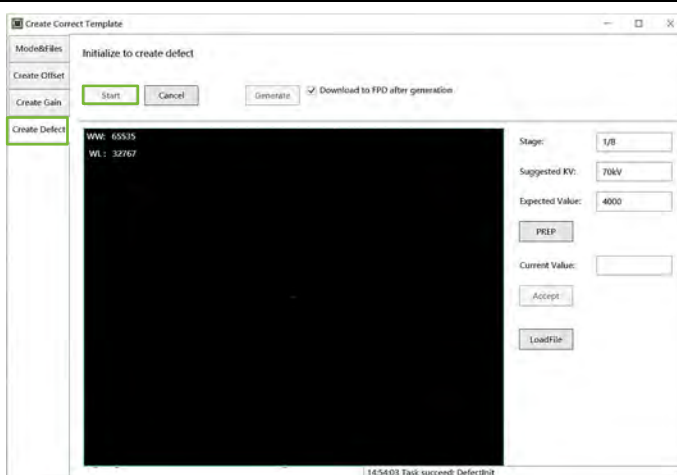
- ⑥ Follow steps ④~⑤ to obtain the remaining 4 images. The suggested kV values and expected value values are shown in the table on the right

Stage	Suggested kV	Expected Value
1~5	70 kV	20000

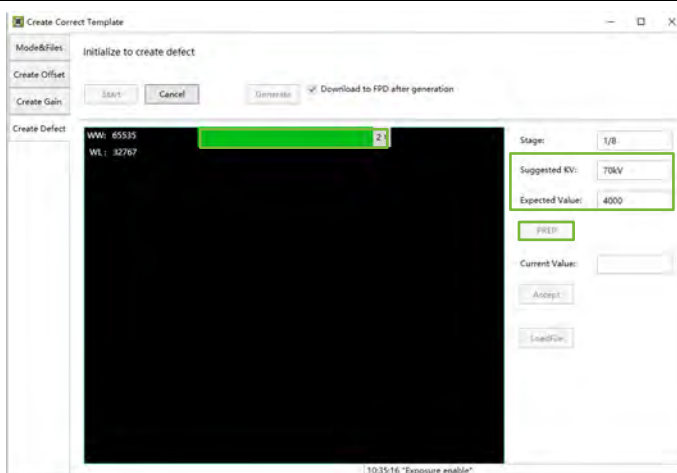
- ⑦ After all the 5 X-ray images are acquired, click [Generate], wait until the status bar appears “Tasksucceed: FinishGeneration Process”. If you use HWGain correction, check [Download to FPD after generation], if you use SWGain, you do not need to check it



- ⑧ Switch to the [Create Defect] tab, start the Defect template generation process, including eight stages of image acquisition, click [Start] button, and the “Initialize to create defect” prompt appears

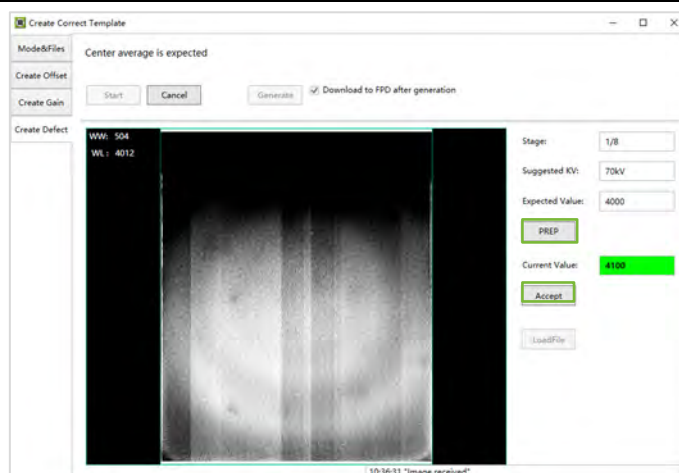


- ⑨ Adjust the exposure kV value to 70kV, set the X-ray dose to meet the grayscale expectation of 4000, click the [PREP] button, wait for the exposure progress bar to appear, and complete the exposure before the progress bar is closed



Creating Offset, Gain, and Defect Templates

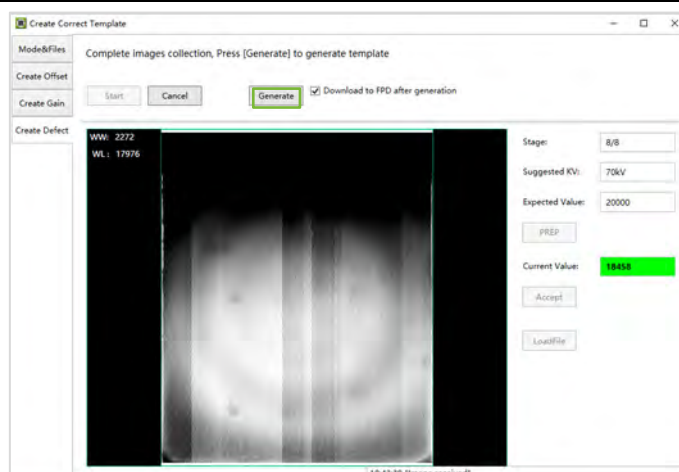
- ⑩ When the image meets the requirements (green), click [Accept] and click [PREP] to proceed with the next stage



- ⑪ Follow steps ⑨~⑩ to obtain the remaining 7 images. The suggested kV values and expected value values are shown in the table on the right

Stage	Suggested kV	Expected Value
1	70kV	4000
2	40kV	4000
3	120kV	16000
4~8	70kV	20000

- ⑫ After all the 8 X-ray image acquisition is completed, click [Generate], wait until the status bar appears "Tasksuc-ceed: FinishGeneration Process". If you use HW Defect calibration, check [Download to FPD after generation], if you use SWGain, you do not need to check it



PROHIBITED

Do not move the detector and its cables during calibration.



CAUTION

Before creating the Gain and Defect templates, be sure to select the HWPostOffset mode.



NOTE

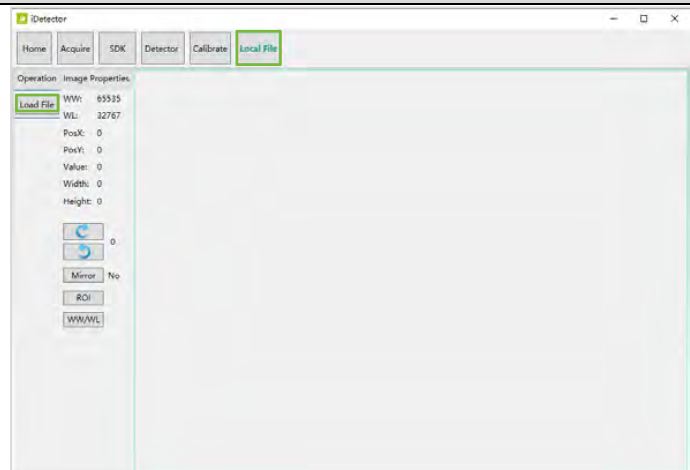
Make sure your X-ray dose is correct. Otherwise, iDetector will remind you to adjust the dose if it is out of range, and then you need to adjust the dose and shoot again.

8.3 Managing the Calibration Templates

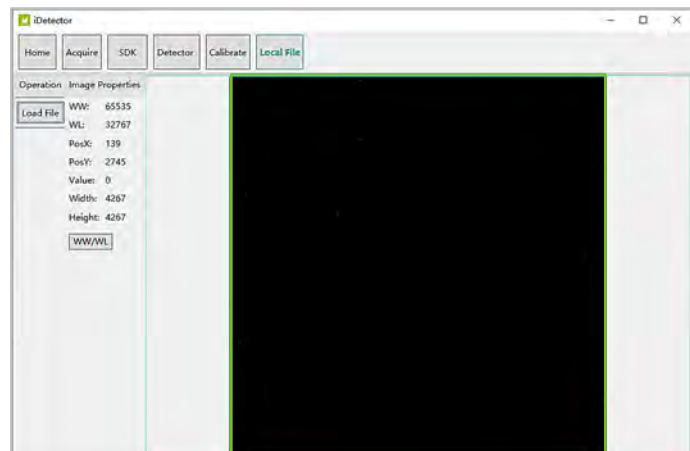
8.3.1 Modifying the Defect Calibration Template

Modifying the Defect Calibration Template

- ① Click [Local File] button on the local file page



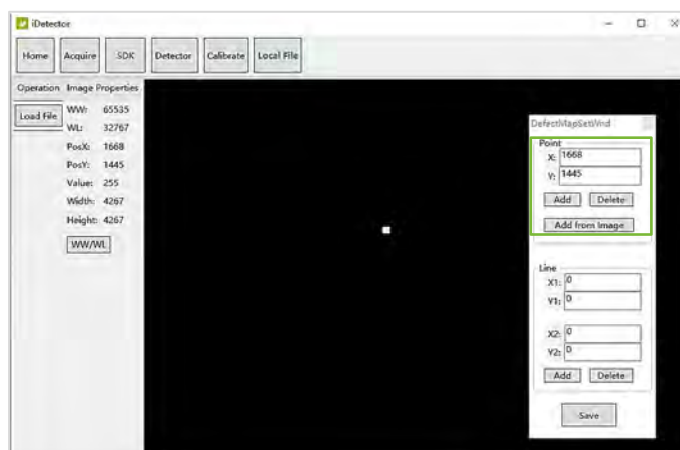
- ② Open a .dft file stored under the path of ...\\Tools\\iDetector\\x64\\work_dir\\Mars1013X\\Correct, and the Defect calibration template will be displayed in the image view area



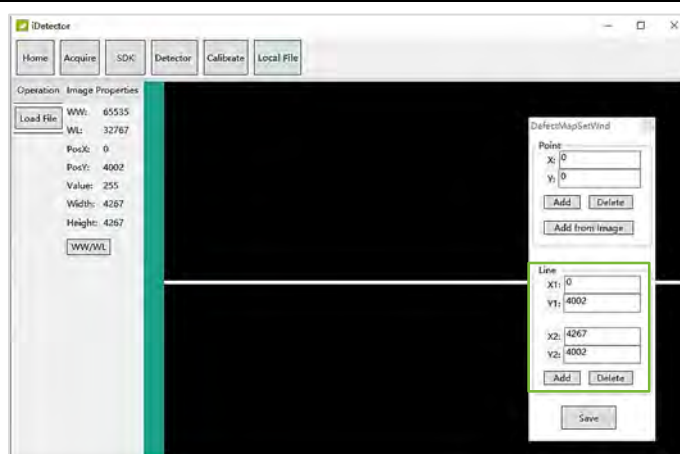
Modifying the Defect Calibration Template

- ③ The defect settings window (Defect-MapSetWnd) shown on the right will pop up

To edit dead points: zoom in on the defect template, find a bad point, enter its X&Y coordinates in the point area, click [Add] to add a dead point, and click [Delete] to delete the dead point



- ④ To edit a bad line: fill in the coordinates of the starting point and end point of the bad line in the Line area, click [Add] or [Delete] to add or delete the bad line, and click [Save] to save the modified Defect template

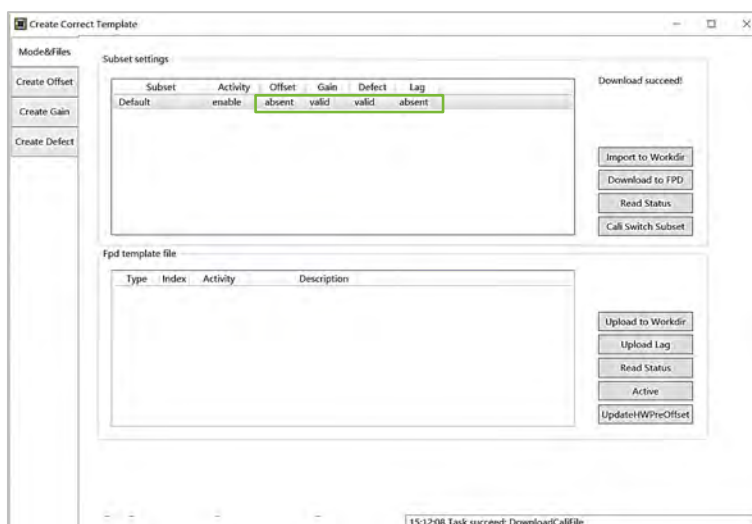


8.3.2 Checking the Validity of Calibration Template

When a template is about to reach the set time threshold after a certain period of time, an alarm will pop-up, and the status of the template on the software interface will be changed to “invalid” status.

You can check the status of the Template on the Create Correct Template page, Calibrate's subpage.

- “Vaild” indicates the selected template exists but is invalid;
- “Invalid” indicates the selected template exists but is invalid;
- “Absent” indicates the selected template has not been created.



NOTE

- To ensure that the template is in the latest state during each acquisition, it is recommended that you check the validity of the template after it is created and before image acquisition is performed, so as to avoid image quality degradation due to the absence of image calibration templates.
- You can enable /disable the template validity inspection switch by setting the Cfg_CaliValidity_Enable parameter in config.ini file. The value 1 is for enable, and the value 0 for disable.

8.3.3 Synchronizing the Calibration Template

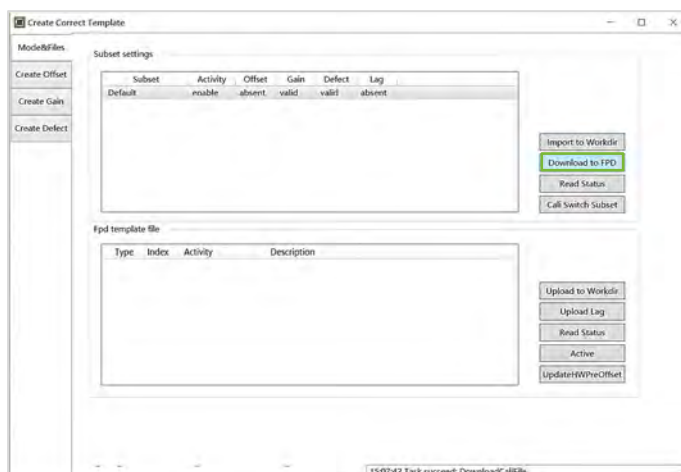
Downloading the PC template to the FPD

- Click the [Read Status] button under the Mode &Files tab to refresh the upper-left list status

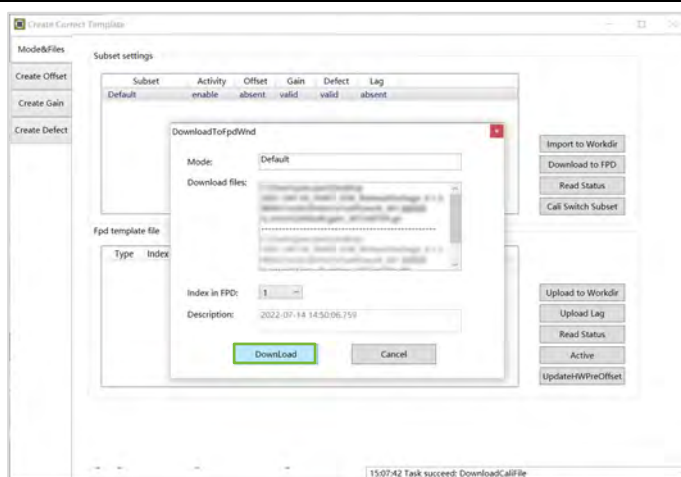


Downloading the PC template to the FPD

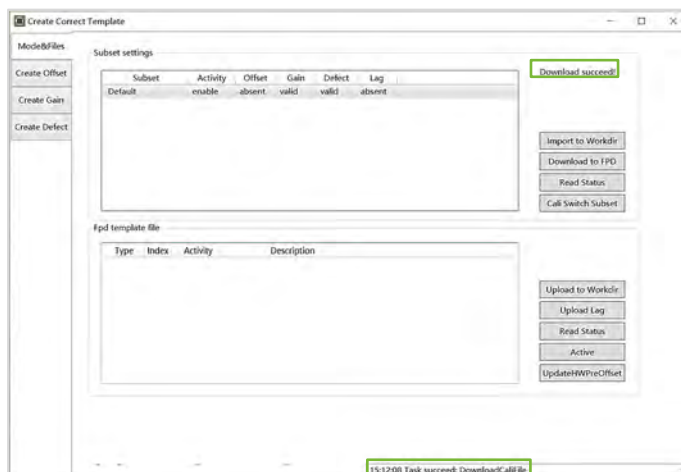
- ② Select the template you intend to download and click [Download to FPD]



- ③ Check whether the file information is correct, if necessary, the template Index in the detector is allowed to be changed, and click [Download] button

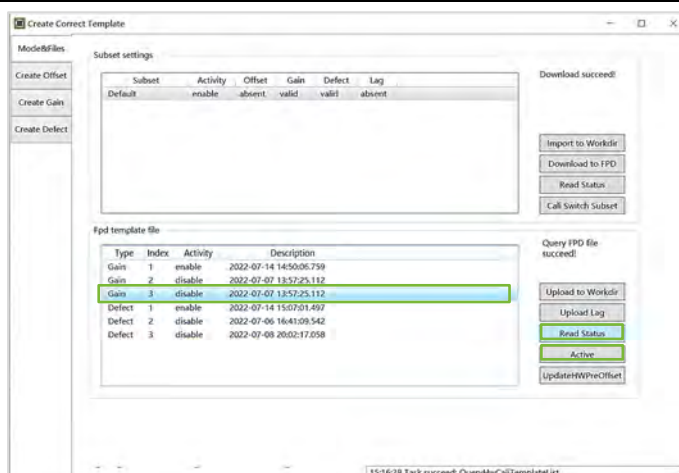


- ④ Wait until “Tasksucceed: Download Cali-File” appears in the status bar, indicating that the template has been downloaded to the detector



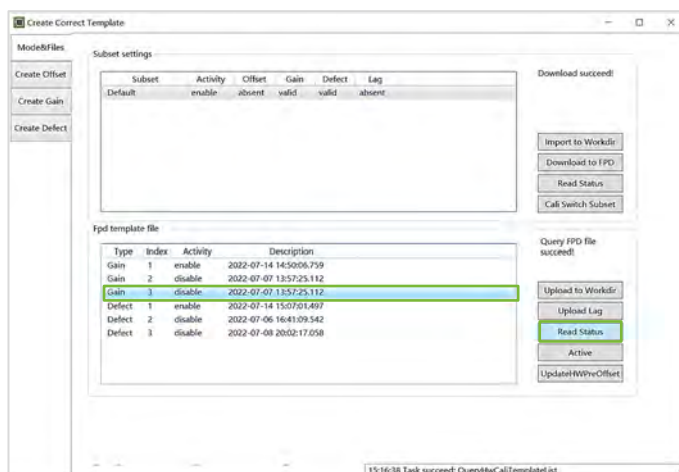
Downloading the PC template to the FPD

- ⑤ Click the [Mode&Files] tab, select the [Read Status] button under the Fpd template file, check whether the template is enabled, if the activity displays “disable”, select the corresponding item, click [Active] to activate the template

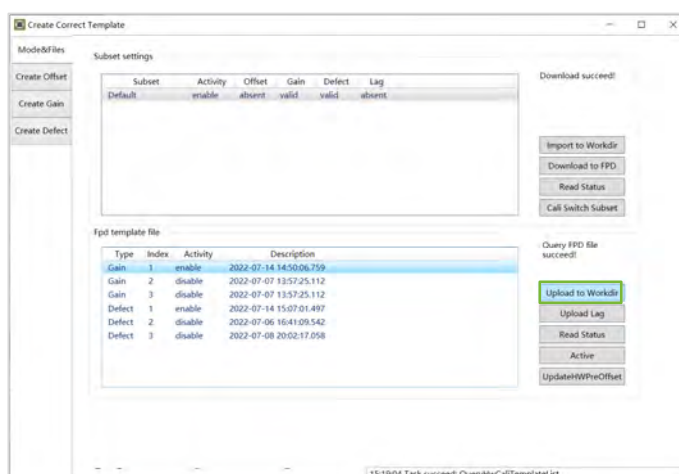


Uploading the FPD template to the PC

- ① On the [Mode&Files] tab, click the [Read] Status button under the Fpd template file, refresh the lower-left list status, and select a template you intend to upload

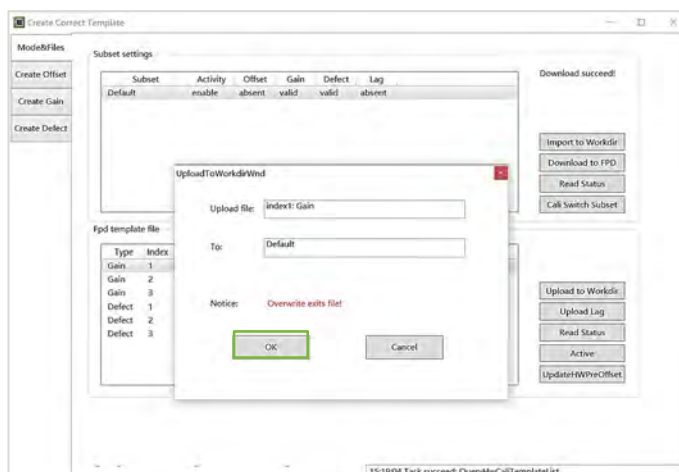


- ② Select the directory under the "Subset settings", and click [Upload to Workdir]



Uploading the FPD template to the PC

- ③ If the pop-up message is correct, click [OK] and wait until "Upload FPD file succeed!" appears
- ④ Verify that the template has been uploaded to the path: work_dir\Mars1013X_192.168.100.8 \Correct\Default



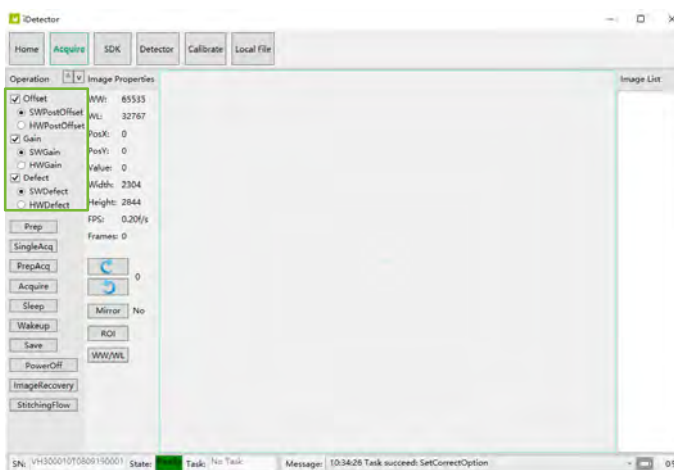
8.3.4 Loading the Calibration Templates

Two calibration methods are available for the Mars1013X:

- The software calibration method is that the workstation to complete all the image calibration process;
- The hardware calibration method is that the detector completes all the calibration process.

Choosing the Calibration Methods

- ① Ensure that the relevant calibration template file exists under the path of work_dir\Mars1013X_192.168.100.8\Correct\Default
- ② Set the calibration method in Acquire page:
Software calibration method:
Offset mode: "SWPostOffset"
Gain mode: "SWGAIN"
Defect mode: "SWDefect"



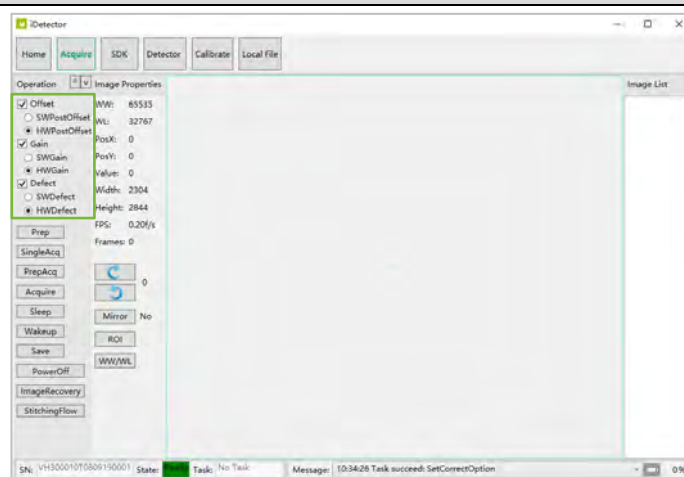
Choosing the Calibration Methods

① Hardware calibration method:

Offset mode: “HWPostOffset”

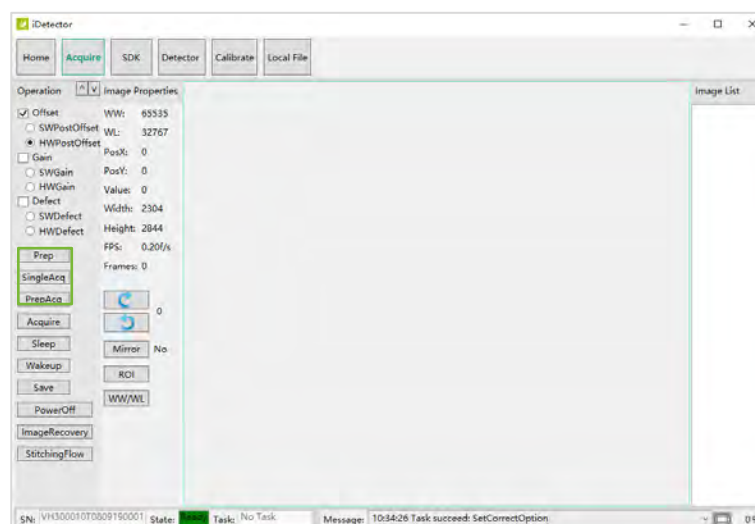
Gain mode: “HWGain”

Defect mode: “HWDefect”



8.4 Acquiring and Saving Images

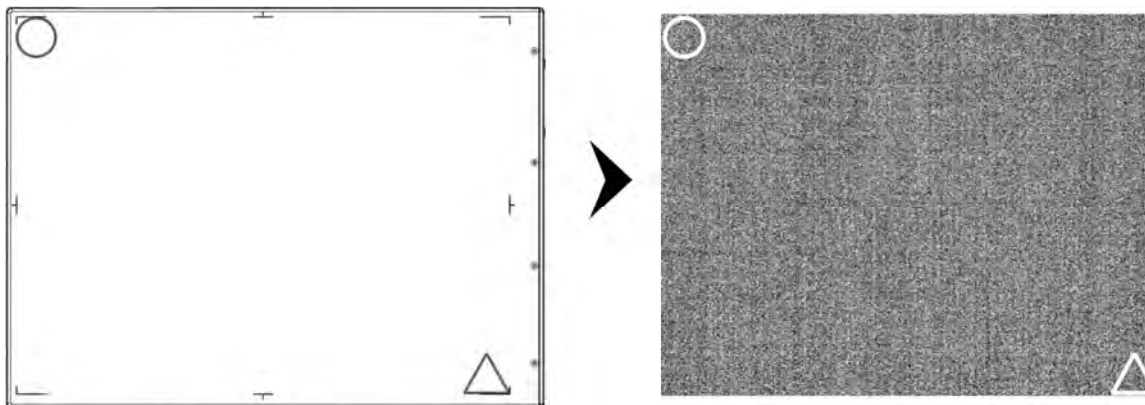
After loading the corresponding calibration method, click the [Acquire], [SingleAcq], [PrepAcq] or [Prep] button to start the image acquisition. You can directly browse to the current detector output image in the Image List area on this page. Click the [Stop] button to stop the acquisition action and enter the standby state.



Click the [Save] button in the location where you intend to save the image, and fill in the name and path of the saved image in the pop-up dialog box. The newly acquired images will also appear in the Image List, choose a image, right click it and click [Save] to save this image.

■ Imaging Direction

The corresponding relationship between the imaging direction of the detector and its actual position (where ○ is the zero point position) is shown in the figure below:



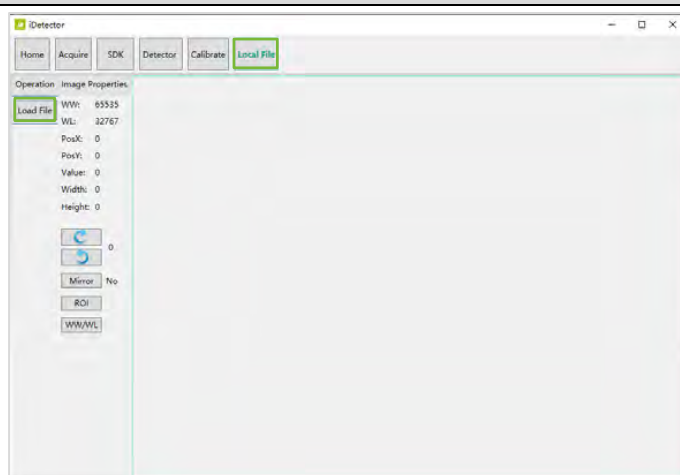
CAUTION

- Do not remove the battery or cut the power supply during exposure, otherwise the detector will be powered off and the image cannot be acquired.
- Do not inflict vibration during exposure. Otherwise, it may result in poor image quality caused by noise.
- Do not use the equipment near devices generating a strong magnetic field. Otherwise, it may cause image noise, artifacts or incorrect images.

8.5 Viewing and Uploading Images

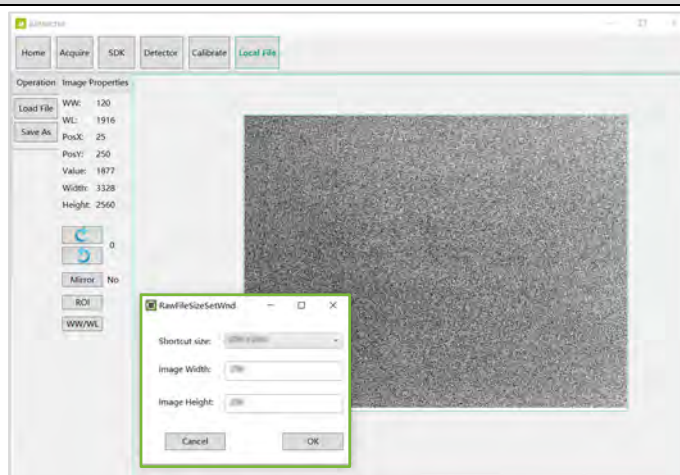
Viewing the Local Images

- ① Click the [Load File] button on the Local File page to choose an image in .dft, .raw, or .tiff format from the workstation

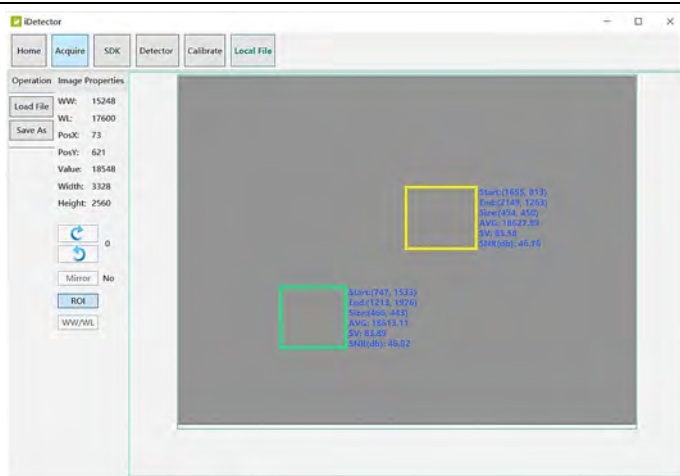


Viewing the Local Images

- Click [Open] or double-click the file, .tiff or .dft file will be opened directly. As for a .raw file, a dialog box as shown on the right will pop up, and it can be opened after entering the correct image size, and clicking [OK]. If the size input is wrong, you unfortunately will get an error message

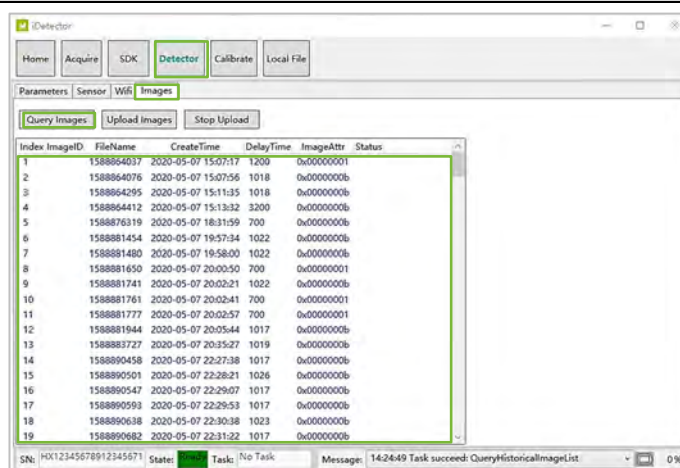


- After opening the image, you can utilize the ROI tool, right-click to select an image area, and view the AVG, SNR and other attribute values of the image



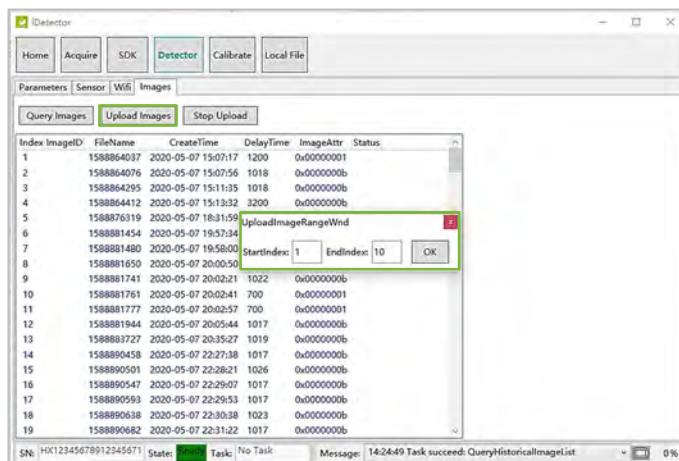
Uploading FPD Images to the PC

- Make sure the firewall is turned off before uploading images from the detector
- Click the [Images] tab in the Detector page, click the [Query Images] button, and the images stored inside the detector will be listed in the information bar



Uploading FPD Images to the PC

- ③ Click [Upload Images], enter the indexes of the starting image and the ending image, click [OK], and wait until the status bar shows “Success”, indicating that the upload is finished; During the upload process, the upload can be terminated by clicking [Stop Upload]. The uploaded image is saved in the upload folder under the corresponding detector working directory



8.6 Upgrading Firmware



WARNING

Firmware upgrade could lead to serious consequences of FPD unavailability. Do not carry it out on your own but with the support of the after-sales technicians of iRay Technology.



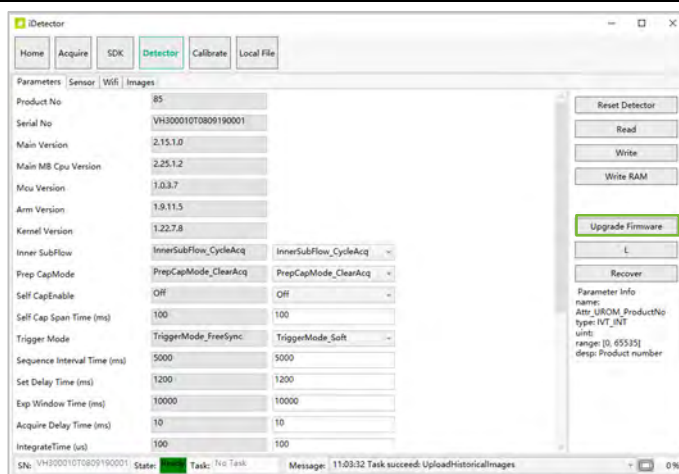
CAUTION

Prior to firmware upgrade, make sure the battery whose level is greater than 80%, or that an external power source is connected.

8.6.1 Upgrading Firmware via the iDetector

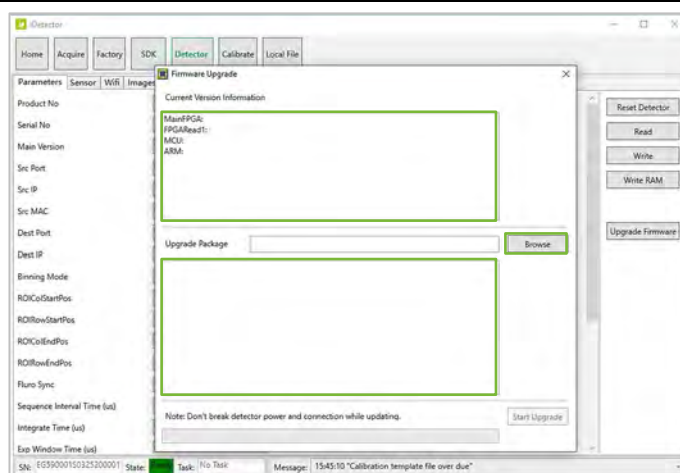
Upgrading Firmware via the iDetector

- ① Click the [Parameters] tab in the Detector page and click the [Upgrade Firmware] button to enter the Firmware Upgrade page



Upgrading Firmware via the iDetector

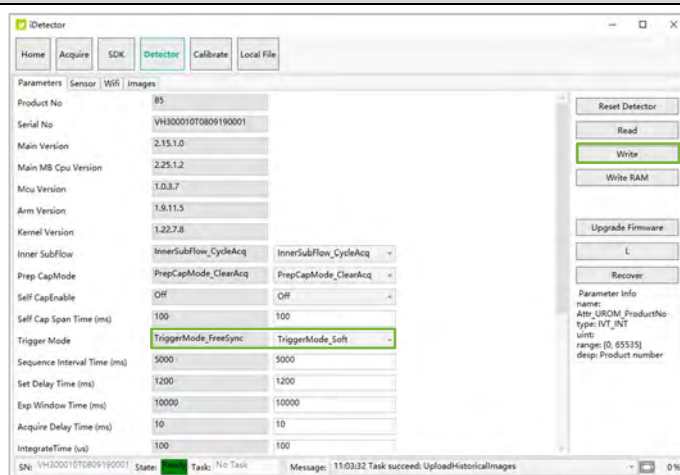
- ② The Current Version Information area displays the current firmware version. Click [Browse] to select the .ifirm file to be upgraded. After loading the file, the new firmware version will be displayed in the information box below. Click [Start Upgrade] to start the upgrade. When it is complete, the detector will automatically restart



8.6.2 Upgrading Firmware via a Web

Upgrading Firmware via a Web

- ① Go to the Detector page, click the Parameters tab, select mode “TriggerMode_Soft” in the drop-down box of Trigger Mode, and click [Write]

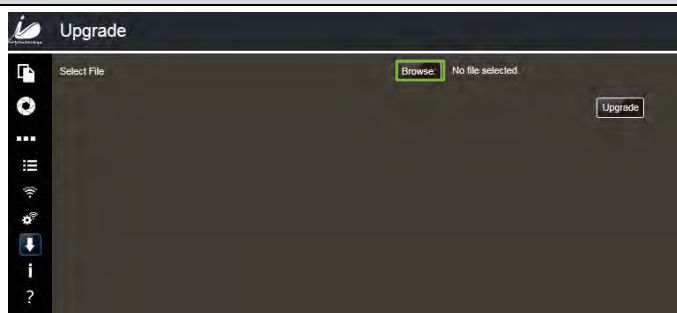


- ② Open a browser, enter 192.168.8.8 in the search bar, and press Enter, enter User name to “admin”, Password to “iray”, and click [login] button

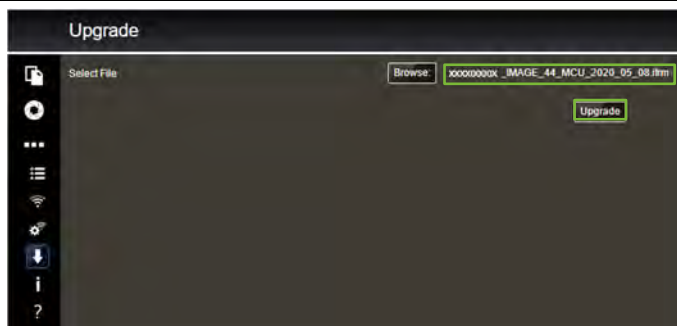


Upgrading Firmware via a Web

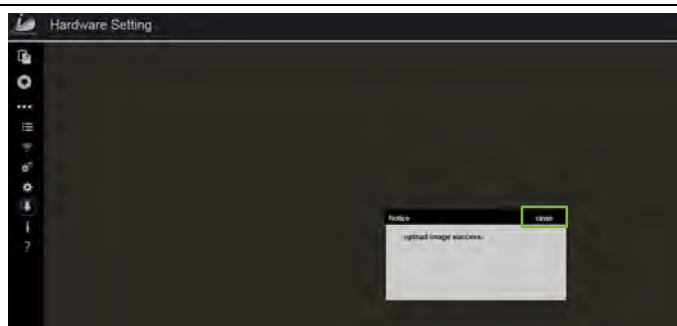
- ③ Click [Browse]



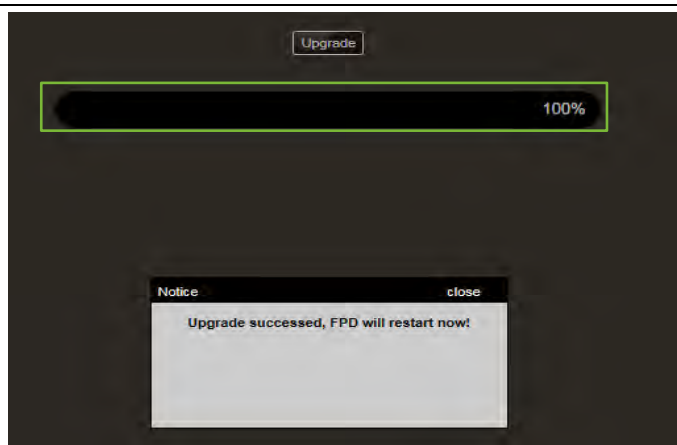
- ④ Select an open the file to be updated (such as MCU, FPGA, ARM), the name of which will be displayed on the interface, and click [Upgrade]



- ⑤ After uploading, click [Close] to close the dialog box as shown on the right



- ⑥ Wait for the progress bar of the page to reach 100%. If the upgrade is successful, the prompt displaying “Upgrade succeed, FPD will restart now!” will appear. Otherwise, the upgrade failed
- ⑦ After the upgrade, the detector will restart



NOTE

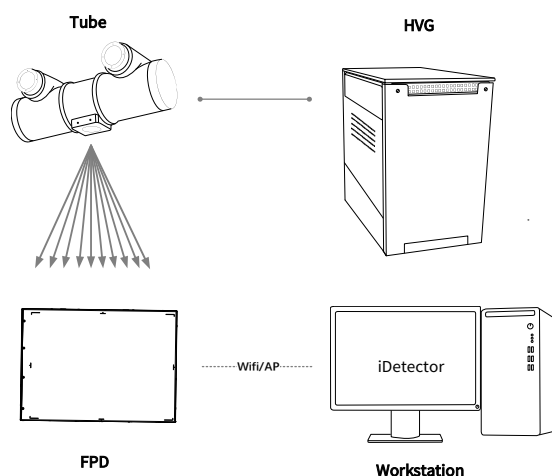
- You can upgrade MCU, ARM, and FPGA separately, or upgrade all firmware files (files whose names contain “ALL”) together.
- After the upgrade is complete, you can click the [Upgrade Firmware] button under the Detector page and check whether the firmware version is updated in the Current Version Information area of firmware upgrade page.

8.7 Shutdown Procedure

- ① **Disconnecting the iDetector:** Click the [Close] button on the Home page to disconnect the FPD and PC;
- ② **Powering off the detector:** Short-hold the power button for 4 seconds and release it when the power LED is off to turn off the detector; If the FPD is powered by an external power source, disconnect the detector with the adapter; If the FPD powered by a battery, the battery whose power level is less than 15% should be removed and charged with a charger;
- ③ **Disinfection and cleaning:** Perform disinfection and cleaning as described in Section 11.3.

Chapter 9 Workflow

This chapter details the workflow of the three trigger modes (Software Mode, Inner2 Mode, and FreeSync Mode) applicable to Mars1013X.



9.1 Software Mode

Software mode acts as a basic way to acquire X-ray images. In this mode, iDetector or SDK does not control the X-ray generator, and you determine the X-ray exposure time by clicking the buttons on the Acquire page.

9.1.1 Operating Process

■ PrepAcq

- ① In the Parameters tab of the Detector page, select [TriggerMode_Soft] in the drop-down box of Trigger Mode, and click [Write];
- ② Click [PrepAcq] on the Acquire page to get ready for exposure;
- ③ The FPD is ready. Wait until the prompt message changes from “Exposure Prohibited” to “Exposure Enable”;
- ④ Perform an exposure when the exposure timer appears (expose as soon as the X-ray generator is ready, the longer the waiting time, the worse the image quality);
- ⑤ Wait for the image to be uploaded by the SDK.

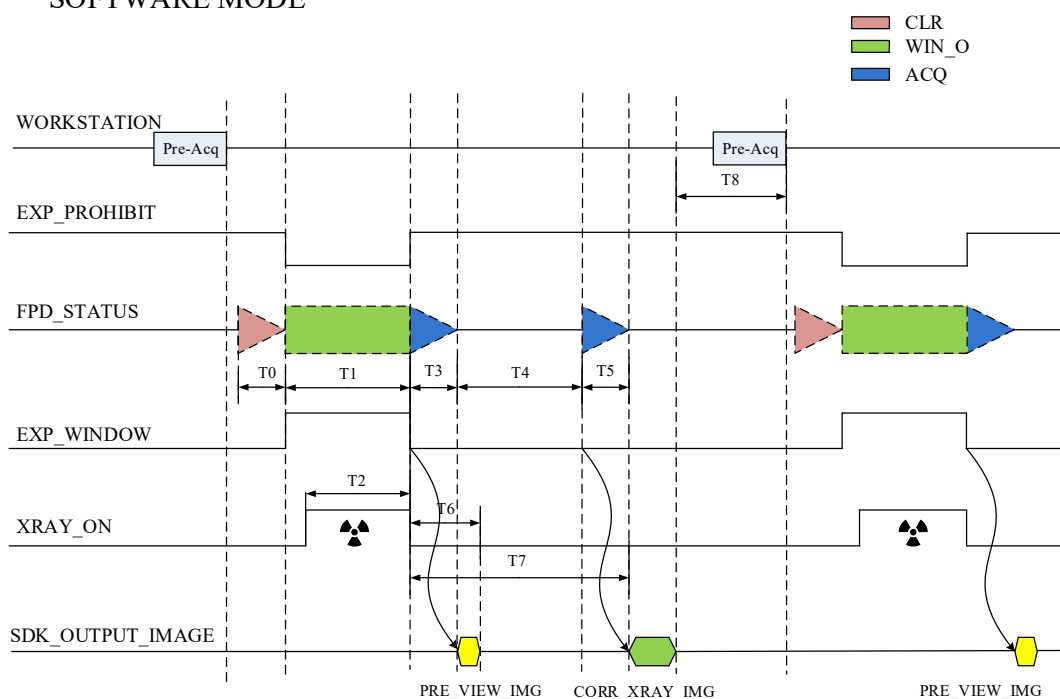
■ Prep+Acq

- ① In the Parameters tab of the Detector page, select [TriggerMode_Soft] in the drop-down box of Trigger Mode, and click [Write];
- ② Click [Prep] on the Acquire page to get ready for exposure;
- ③ The FPD is ready. Wait until the prompt message changes from “Exposure Prohibited” to “Exposure Enable”;
- ④ Perform an exposure when the exposure timer appears (expose as soon as the X-ray generator is ready, the longer the waiting time, the worse the image quality);
- ⑤ After the exposure, click [Acquire] in the Acquire page and wait for the SDK to upload the image.

9.1.2 Sequence Diagram

■ PrepAcq

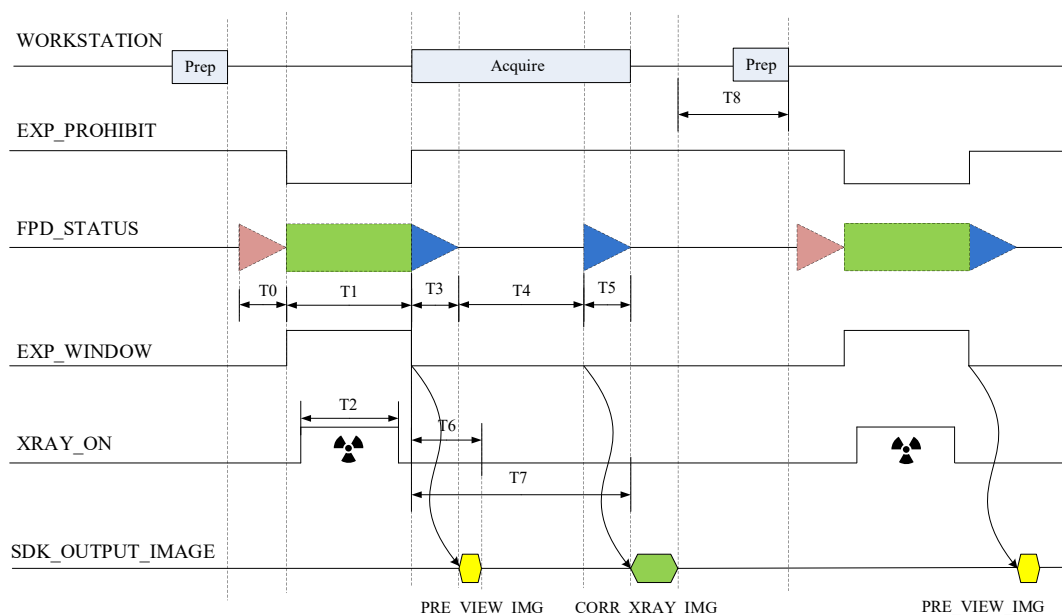
SOFTWARE MODE



■ Prep+Acq

SOFTWARE MODE

CLR
WIN_O
ACQ



Time	Description	Min.	Typ.	Max.	Unit
T0	FPD prepare time (from the time the detector receives the “Prep” command to the time the detector is ready to proceed)	-	-	1	s
T1	FPD window opening time (exposure time allowed)	700 (0~700)	3200 (700~3200)	5000 (3200~5000)	ms
T2	X-ray exposure time	-	-	-	-
T3	Time to acquire bright field images	-	-	0.5	-
T4	Post Delay Time	700 (0~700)	3200 (700~3200)	5000 (3200~5000)	-
T5	Time to acquire post-dark images	-	-	0.5	-
T6	Interval from the end of the exposure window to the time the preview image is received	-	-	1	s
T7	Interval from the end of the exposure window to the time the full image is received	-	-	2	s
T8	Interval from when the detector completes the image output to when it is able to respond to the next command	-	-	-	s

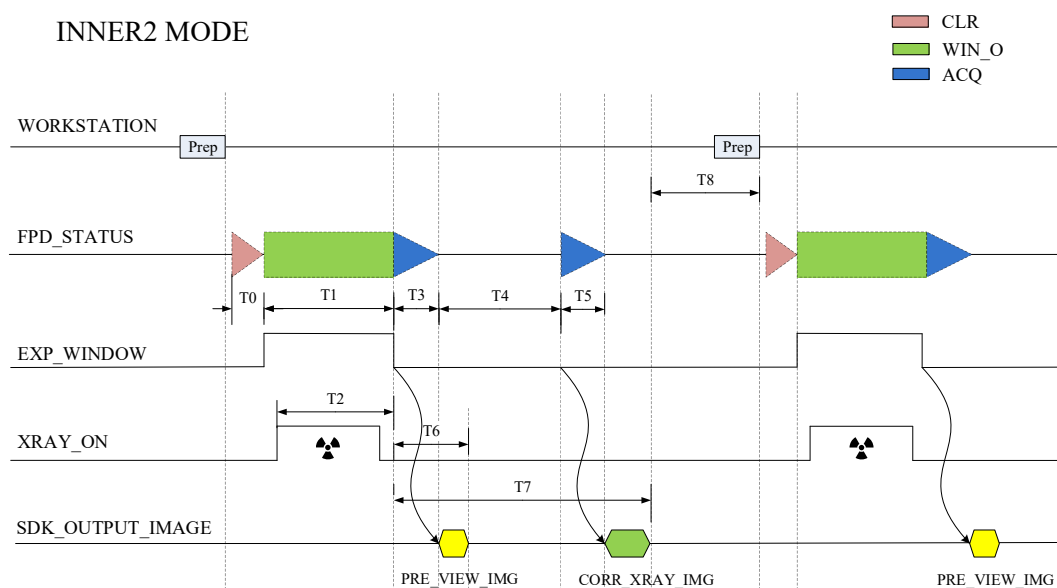
9.2 Inner2 Mode

In Inner2 mode, the workstation does not control the X-ray generator, and the user decides when the X-ray is shot.

9.2.1 Operating Process

- ① In the Parameters tab of the Detector page, select [TriggerMode_Inner] in the drop-down box of Trigger Mode, and click [Write];
- ② Click [Prep] on the Acquire page to get ready for exposure;
- ③ FPD is ready. Wait until the prompt message changes from “Exposure Prohibited” to “Exposure Enable”;
- ④ Perform an exposure (expose as soon as the X-ray generator is ready, the longer the waiting time, the worse the image quality);
- ⑤ After the exposure, the X-ray sensor inside the detector will trigger the sensor to acquire the image;
- ⑥ Wait for the image to be uploaded by the SDK.

9.2.2 Sequence Diagram



Time	Description	Min.	Typ.	Max.	Unit
T0	FPD prepare time (from the time the detector receives the “Prep” command to the time the detector is ready to proceed)	-	-	1	s
T1	FPD window opening time (exposure time allowed)	700 (10~700)	3200 (700~3200)	5000 (3200~5000)	ms

Time	Description	Min.	Typ.	Max.	Unit
T2	X-ray exposure time	-	-	-	-
T3	Time to acquire bright field images	-	-	0.5	s
T4	Post Delay Time	700 (10~700)	3200 (700~3200)	5000 (3200~5000)	ms
T5	Time to acquire post-dark images	-	-	0.5	s
T6	Interval from the end of the exposure window to the time the preview image is received	-	-	1	s
T7	Interval from the end of the exposure window to the time the full image is received	-	-	2	s
T8	Interval from when the detector completes the image output to when it is able to respond to the next command	-	-	-	-

9.3 FreeSync Mode

In FreeSync mode, the user does not interact with the workstation, and the image is uploaded to and displayed on the workstation immediately after X-ray exposure.



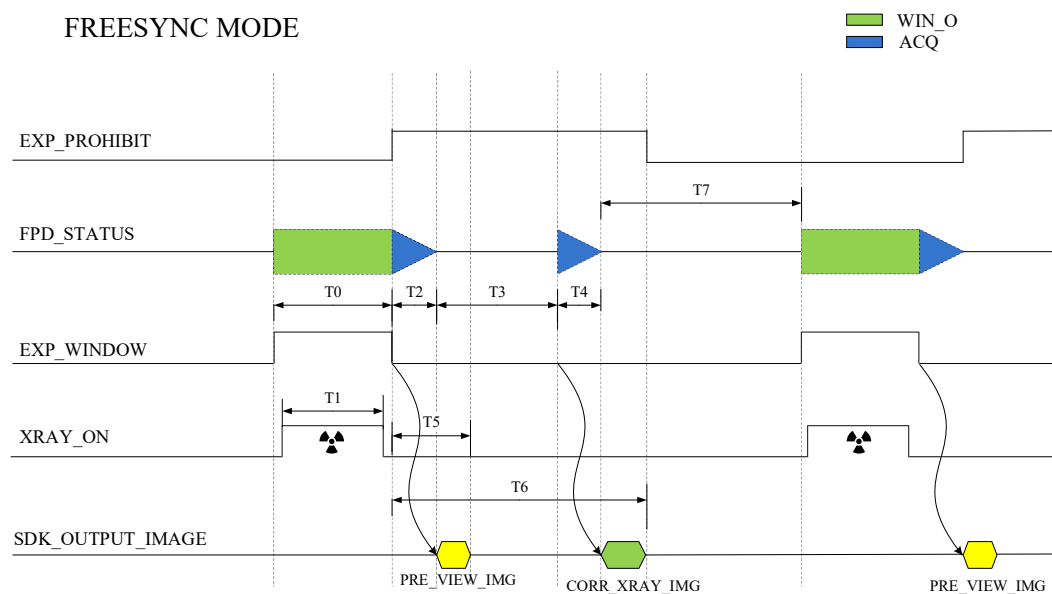
NOTE

- In FreeSync mode, changing any parameters written to ROM or RAM is not allowed. The user needs to switch to Software mode first, write the modified parameters, and then switch to FreeSync mode.
- It is not recommended to switch working modes too frequent.

9.3.1 Operating Process

- ① In the Parameters tab of the Detector page, select [TriggerMode_Freesync] in the drop-down box of Trigger Mode, and click [Write];
- ② Check the status bar of the Acquire page to make sure FPD is ready;
- ③ Shoot X-rays and the FPD receives X-rays;
- ④ After the exposure, the X-ray sensor inside the detector will trigger the sensor to acquire the image;
- ⑤ Wait for the image to be uploaded by the SDK.

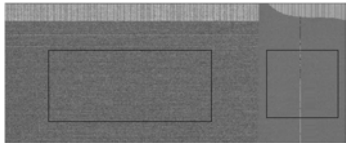
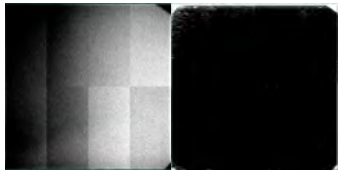
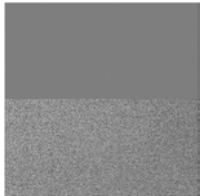
9.3.2 Sequence Diagram

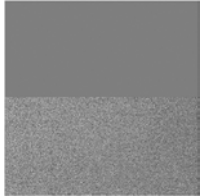


Time	Description	Min.	Typ.	Max.	Unit
T0	FPD window opening time (exposure time allowed)	700 (10~700)	3200 (700~3200)	5000 (3200~5000)	ms
T1	X-ray exposure time	-	-	-	-
T2	Time to acquire bright field images	-	-	0.5	s
T3	Post Delay Time	700 (10~700)	3200 (700~3200)	5000 (3200~5000)	ms
T4	Time to acquire post-dark images	-	-	0.5	s
T5	Interval from the end of the exposure window to the time the preview image is received	-	-	1	s
T6	Interval from the end of the exposure window to the time the full image is received	-	-	2	s
T7	Interval from when the detector completes the image output to when it is able to respond to the next command	-	-	-	-

Chapter 10 Troubleshooting

This chapter illustrates some symptoms that you may face and their possible solutions. If the problems persist even if you perform the solutions listed below, immediately stop operation and contact your local distributor or iRay Technology. Be sure to inform them of the product model, SN, and detailed malfunctions.

Failure	Figure	Cause and Solution
TFT damaged		If a part of the dark-field image is smoother than the normal part, the TFT is likely to be broken by a strong impact. Please contact after-sales department or your product distributor to replace the TFT
Defect overcalibration		When the corners are not fully illuminated and the gray value of the unilluminated area does not change with the shooting conditions, the defect pixels in the same row or column will be misjudged as bad lines if they exceed a certain proportion Changes the Cfg_MaxBadPointsInLinePercent coefficient in the <code>work_dir\Mars1013X\CaliDynamic.ini</code> configuration file to 25, and increase this parameter appropriately to avoid excessive bad lines affecting the image
Too low gray value for dark field image		If there is a large bad area in the image with the gray value less than 500, it may be that the following parameters configuration is inappropriate, resulting in misjudgment Cfg_StdHardCut1Min=500 Cfg_StdHardCut1Max=65000 Lowers the value of Cfg_StdHardCut1Min in the <code>work_dir\Mars1013X\CaliDynamic.ini</code> file to avoid misjudgment caused by offset value

Failure	Figure	Cause and Solution
Too low gray value for light field image		If there is a large bad area in the image, and the gray value is lower than 500 or higher than 65000, it may be that the bright field is not acquired as required; consider increasing or decreasing the exposure dose If X-ray emitted by tube cannot meet the bright field gray value higher than 500, it can be judged that the tube output dose does not meet the standard, resulting in a misjudgment. At this time, it is necessary to lower the value of Cfg_StdHard Cut1Min2 in the <u>work_dir\Mars1013X\ CaliDynamic.ini file</u>, until it will not cause misjudgment due to the low offset value
 NOTE	When failure occurs on the detector, the main operations information can be read out from the log file in ...\DetectorDir\detector.log.	
	The cfg_loglevel in the config.ini file can be set to 0 to display more detailed command interaction information.	

Chapter 11 Service Information

This chapter presents the service information, including service life, a checklist of the periodic inspection and maintenance, as well as the contact information of iRay after-sales service department.

11.1 Product Life

The product life is expected to be up to 7 years under proper regular inspection and maintenance.



NOTE

- The whole product life cycle is subject to that of the detector. For other replaceable parts, their replacement will not affect the whole product life, even if their service life is shorter than that of the detector.
- Main parts that required to maintain the functioning of this product will be stocked for 5 years after the termination of production to prepare materials for repair.



CAUTION

Do not remove the tamper-evident seal on the enclosure. Otherwise, the product will not be guaranteed.

11.2 Regular Inspection and Maintenance

11.2.1 Daily Inspection

To ensure the safe use of the equipment, perform the following checks on the detector and its accessories every day before and after use.

Stage	Checklist	Operation	Solution
Before startup	Operating environment	Check the operating environment to ensure that it meets the requirements described in Section 1.1	Use air conditioning to make the temperature change gradually, ensuring that the temperature difference between the detector and the room does not form condensation
	Detector	Check if the detector is damaged	Contact the sales representative or local distributor of iRay
		Check if the screws on the detector are loose	Choose a screwdriver that fits the size to tighten the loose screws

Stage	Checklist	Operation	Solution
		Check whether the surface of the detector is clean and dry, and whether dust and impurities are attached to the interface	Refer to Section 11.3 to clean and disinfect the equipment, or clean the pins
		Check that the detector is plugged into a battery or connected to a power adapter	Refer to Chapter 5 for properly connecting internal or external power sources
		Check if the battery is damaged	Contact the sales representative or local distributor of iRay to replace a battery
	Cables	Check whether the cable is damaged and whether the cable shell is torn	Contact the sales representative or local distributor of iRay to replace a cable
		Check whether all cable connectors and interfaces are securely connected	Align the connector at the interface until it is fully inserted without loosening
After startup	AP/Client Connection	Check whether the AP/Client mode is properly connected (the Link indicator steady blue on)	Reconfigure the connection mode as described in Section 6.3
	Battery power/Power adapter	Check whether the battery power is sufficient or the external power input is stable	Replace a fully charged battery, or connect an external UPS
After shutdown	LEDs	Check whether the equipment is powered off normally and all LED indicators are off	Contact the sales representative or local distributor of iRay
	Equipment surface	Check that patient contact surfaces have been cleaned and disinfected	Refer to Section 11.3 to clean and disinfect the equipment

11.2.2 Monthly or Yearly Inspection

To ensure good performance and reliability of your equipment, perform the following checks monthly/annually:

Checklist	Frequency	Operation	Solution
Bad points Dark state noise Image uniformity	Yearly	Uses system checker	If this problem occurs, please contact the sales representative or local distributor of iRay
Resolution	Yearly	Detects by resolution map or using resolution test card	
Linear	Yearly	Examines the image gray value to evaluate linear	

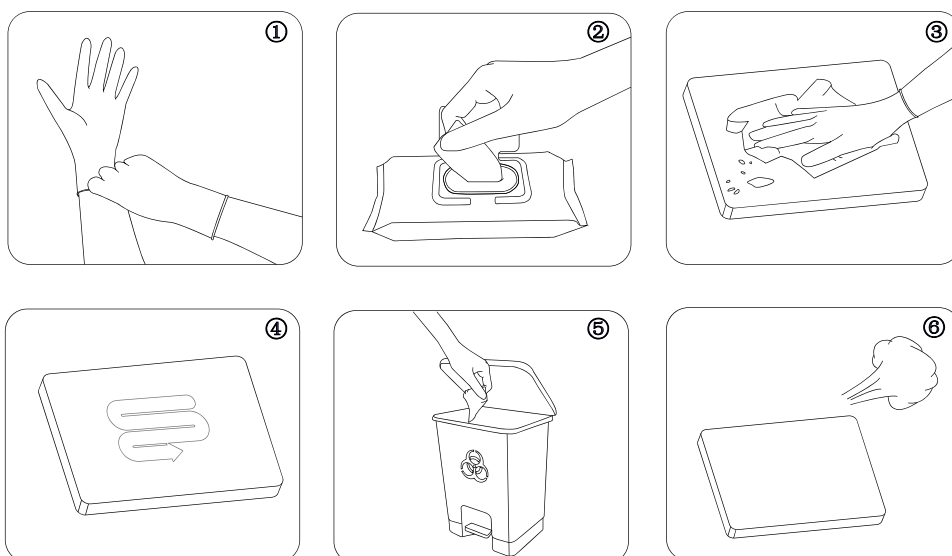


The detector must be repaired by iRay-authorized technicians only.

11.3 Cleaning and Disinfection

After the equipment being used, in order to ensure proper hygiene and cleaning of the equipment, the following steps must be followed:

- ① Put on single-use PPE gloves;
- ② Open package lid, pull out a wipe through opening, and close the lid to retain moisture;
- ③ If present, remove visible soil, prior to disinfecting;
- ④ Disinfect all sides of patient contact surface from top to bottom in an “S” shaped pattern using as many as wipes as needed, and keep the surface obviously wet for two minutes. If needed, place wipe over plastic card to disinfect grooves or gaps which may not easily to be accessed;
- ⑤ After disinfection, dispose of the used wipes and gloves into the medical waste bin;
- ⑥ Let the surface air dry.



- Before cleaning, ensure that the equipment is powered off and all cables are removed.
- After the equipment is used, please clean the equipment in time to prevent the dirt from drying and sticking.
- A waterproof non-woven cover is recommended as an isolation layer between the detector and the bleeding patient.
- Do not spray the detector directly with disinfectant or detergent.
- Never use flammable cleaning detergent such as alcohol, ether, and corrosive liquids such as methanol, benzene, acids, and bases to clean equipment.

- **Recommended commercial brands of disinfecting wipes:**

Alcohol-Quat solution: PDI Super Sani-Cloth® Germicidal Disposable Wipes;

Alcohol-Chloride solution: Clinell® Universal Wipes

- If the two disinfecting wipes above are not readily available in your area, you can make up your own disinfection solvent based on the ingredient concentrations below.



NOTE

Alcohol-Quat solution: containing the following active ingredient concentrations:

- 0.25% n-Alkyl dimethyl ethylbenzyl ammonium chlorides
- 0.25% n-Alkyl dimethyl benzyl ammonium chlorides.
- 55.00% Isopropyl Alcohol.

Alcohol-Chloride solution: containing the following active ingredient concentrations:

- ≤0.5% Benzalkonium chloride
 - ≤0.5% Didecyl dimethyl ammonium chloride
 - ≤0.10% Polyhexamethylene biguanide (PHMB).
-

11.4 After-Sales Service

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