Wireless Digital Flat Panel Detector

NDT1013LA

User Manual

Version ： A0

Doc ID ： 167-201-02

Release Date:： 2021.01.13

Before operating, please read this user manual and pay attention to all safety precautions.

Please ensure that this user manual is properly maintained so that it can be accessed at any time (reserve).

Please use it correctly based on full understanding of the content.

Congratulations on your purchase of the Flat Panel Detector (hereinafter referred to as NDT1013LA) which is manufactured by iRay Technology Company Ltd. (Hereinafter referred to as iRay).

Please take time to read through this user guide in order to utilize the product effectively. We hope you enjoy the experience with iRay NDT1013LA.

If you have any questions or suggestions, please feel free to contact us.

To Customers

Congratulations on your purchase of the Fixed Digital Flat Panel (hereinafter referred to as NDT1013LA) which is manufactured by iRay Technology Co.Ltd. (Hereinafter referred to as iRay).

At iRay, we strive to not only make the world-class products that deliver the best value possible to our customers but also offer the highest quality of service and customer care. Please take time to read through this user guide in order to utilize the product effectively. We hope you enjoy the experience with iRay NDT1013LA

If you have any questions or suggestions, pleasedo not hesitate to contact us.

Notes on usage and management of the equipment

1. Read all of the instructions in the user guide before your operation. Give particular attention to all safety precautions.
2. Only a physician or a legally certified operator should use this product.
3. The equipment should be maintained in a safe and operable condition by maintenance personnel.
4. Use only the dedicated cables. Do not use any cables other than those supplied with this product.
5. Request your sales representative or local iRay dealer to install this product。

Caring for your environment

This symbol indicates that this product is not to be disposed of with your residential or commercial waste.

Recycling iRay Equipment

Please do not dispose of this product with your residential or commercial waste. Improper handling of this type of waste could have a negative impact on health and on the environment. Some countries or regions, such as the European Union, have set up systems to collect and recycle electrical or electronic waste items. Contact your local authorities for information about practices established in your region. If collection systems are not available, call iRay Customer Service for assistance.

Disclaimer

1. iRay shall not be liable to the purchaser of this product or third parties for any damage, loss, or injury incurred by purchaser or third parties as a result of fire, earthquake, any accident, misuse or abuse of this product.
2. iRay shall not be liable to any damage, loss, or injury arising from unauthorized modifications, repairs, or alterations to this product or failure to strictly comply with iRay's operating and maintenance instructions.
3. iRay shall not be liable for any damage or loss arising from the use of any options or consumable products other than those dedicated as Original iRay Products by iRay Technology.
4. It is the responsibilities of the user/attending physicians for maintaining the privacy of image data and providing medical care services. iRay shall not be responsible for the legality of image processing, reading and storage nor it shall be responsible for loss of image data for any reason.
5. Information regarding specification, compositions, and appearance of this product is subject to change without prior notice.

Copyright

Trademarks

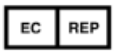
Symbols and Conventions

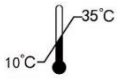
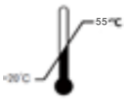
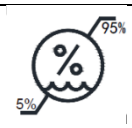
The following symbols and conventions are used throughout the user guide.

	Identify the conditions under which improper use of the product may cause death or serious personal injury.
	Identify conditions under which improper use of the product may cause minor personal injury.
	Identify conditions under which improper use of the product may cause property damage.
	Indicate a prohibited operation.
	Indicate an action that must be performed
	Indicate important operations and restrictions.
	Indicate operations for reference and complementary information.

Labels and markings on the equipment

The contents of the label and mark on iRay NDT1013LA product are indicated as below:

Symbol	Description
	Caution: please refer to the instructions in the user manual.
	Indicates that the equipment has passed CE testing and the CE Notified Body number follows it.
	Serial number of the product.
	Name and address of the manufacturer.
 20XX-XX	Manufacturing date of this product.
 20XX-XX-XX	Expiring date of this product.
	Name and address of iRay authorized representative in the European region.
	Consultation of the user guide for general information.
	This product is not to be disposed of with your residential or commercial waste.
	Safety Signs: Please refer to the user guide for safety instructions.
	Safety Signs： Dangerous Voltage.

	Handled with care.
	Operational temperature limits.
	Storage temperature limits.
	Fragile
	Keep away from sunlight
	Keep dry
	Storage Humidity limits.
	Keep the equipment up right.
	Do not roll the transportation package.
	Stacking limit number.
ON	Switch to this position means power on for part of the equipment
OFF	Switch to this position means power off for part of the equipment

Contents

1. General Description

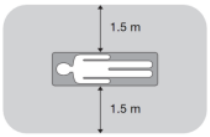
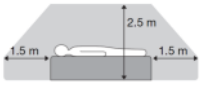
1.1. Safety Precautions

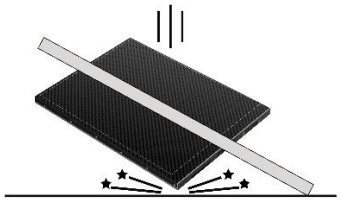
Follow these safeguards and properly use the equipment to prevent injury and damage to any equipment/data

WARNING	
Installation and environment of use 	**Do not use or store the equipment near flammable chemicals such as alcohol, thinner, benzene, etc.** If chemicals spill or evaporate, it may result in fire or electric shock through contact with electric parts inside the equipment. Also, some disinfectants are flammable. Be sure to take care when using them. **Do not connect the equipment with anything other than specified.** Doing so may result in fire or electric shock. **All the patients with active implantable medical devices should keep away from the equipment.**
Power supply 	**Do not operate the equipment using any type of power supply other than the one indicated on the rating label.** Otherwise, it may result in fire or electric shock. **Do not handle the equipment with wet hands.** You may experience electric shock that could result in death or serious injury. **Do not place heavy object such as medical equipment on cables and cords. Do not pull, bend, bundle, or step on them to prevent their sheath from being damaged, and do not alter them neither.** Doing so may damage the cords, which could result in fire or electric shock. **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 turn ON the system power when condensation has formed on the equipment.** Doing so may result in fire or electric shock.

Power supply  	**Do not connect a multiple portable socket-outlet or extension cord to the system.** Doing so may result in fire or electric shock. **To avoid the risk of electric shock, this equipment must only be connected to power supply with protective earth.** Not doing so may result in fire or electric shock.
	**Securely plug the power cord into the AC outlet.** 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. **Be sure to turn OFF the power to each piece of equipment before connecting or disconnecting the cords.** Otherwise, you may get an electric shock that could result in death or serious injury. **Be sure to hold the plug or connector to disconnect the cord.** If you pull the cord, the core wire may be damaged, resulting in fire or electric shock.
WARNING	
Handling  	**Never disassemble or modify the equipment. No modification of this equipment is allowed. Parts of the NDT1013LA that are not serviced or maintained while in use with the patient.** Doing so may result in fire or electric shock. Also, since the equipment incorporates parts that may cause electric shock as well as other hazardous parts, touching them may cause death or serious injury. **Do not place anything on top of the equipment.** The object may fall and cause an injury. Also, if metal objects such as needles or clips fall into the equipment, or if liquid is spilled, it may result in fire or electric shock. **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. **Do not put the equipment and pointed objects together.** The equipment may be damaged. If so, the equipment should be used in bucky.

	Have the patient take a fixed posture and do not let the patient touch parts unnecessarily. If the patient touches connectors or switches, it may result in electric shock or malfunction of the equipment.
When a problem occurs	**Should any of the following occurs, immediately unplug the powercable or battery, and contact your sales representative or local iRay dealer:** When there is smoke, an odd smell or abnormal sound. When liquid has been spilled into the equipment or a metal object has entered through an opening. When the equipment has been dropped and damaged.
Maintenance and inspection 	**Please turn OFF the power of the equipment and unplug the power cord of adaptor before cleaning.** **NEVER use alcohol, ether and other flammable cleaning agent for safety. NEVER use methanol, benzene, acid and base because they will erode the equipment.** **DON'T dip the equipment into the liquid.** **Please make sure that the equipment's surface & plugs are dry before turning ON.** Otherwise, it may result in fire or electric shock.
	**Clean the plug of the power cord periodically by unplugging it from the AC outlet and removing dust or dirt from the plug, its periphery and AC outlet with a dry cloth.** If the cord is kept plugged in for a long time in a dusty, humid or sooty place, dust around the plug will attract moisture; this could cause insulation failure that may result in a fire. **For safety reasons, be sure to turn OFF the power to each piece of equipment when performing inspections indicated in this manual.** Otherwise, electric shocks may occur.
CAUTION	

Installation and environment of use	**Do not install the equipment in any of the locations listed below. Doing so may result in failure, malfunction, equipment falling, fire or injury.** Close to facilities where water is used Where it will be exposed to direct sunlight Close to the air outlet of an air-conditioner or ventilation equipment Close to heat source such as a heater Where the power supply is unstable In a dusty environment In a saline or sulfurous environment Where temperature or humidity is high Where there is freezing or condensation In areas prone to vibration On an incline or in an unstable area **Take care that cables do not become tangled during use. Also, be careful not to get your feet caught by cable.** Otherwise, it may cause a malfunction of the equipment or injury of the user due to tripping over the cable.  
Power supply	**Always connect the three-core power cord plug to a grounded AC power outlet.** **To make it easy to disconnect the plug at any time, avoid putting any obstacles near the outlet. Otherwise, it may not be possible to disconnect the plug in an emergency.** **Be sure to ground the equipment to an indoor grounded connector. Also, be sure to connect all the grounds for the system to a common ground.** **Do not use any power source other than the one provided with this equipment.** Otherwise, fire or electric shock may be caused due to leakage.
Handling	**Do not spill liquid or chemicals onto the equipment. In case the patient is injured, it is not allowed to contact with blood or other body fluids.** Doing so may result in fire or electric shock. In such a situation, protect the equipment with a disposable cover as necessary. **Turn OFF the power and pull out the plug to each piece of equipment for safety when not used.**
CAUTION	

Handling	**Handle the equipment carefully.** **Do not submerge the equipment in water.** **The internal image sensor may be damaged if something hits against it or it is dropped.**  **Do not place excessive weight on the equipment.** **Be sure to use the equipment on a protected foam. Otherwise, the internal image sensor may be damaged. Be sure to securely hold the detector while using it in upright positions. Otherwise, the detector may fall over, resulting in injury to the user or patient, or may flip over, resulting in damage to the inner device.** Keep the same load (same pressure) on the detector when acquiring the image. Or the image will be incorrect.
CAUTION	

⚠ CAUTION	**Do not operate close to fire, do not use in high temperatures** **Do not invert positive and negative poles** **Do not contact with metal in case of a short circuit** **Do not insert sharp objects into the battery** **Do not hit the battery** **Do not stand on the battery** **Do not use the battery for purposes other than those stipulated in the rules** **Do not dispose of the battery or change its internal structure** **Do not submerge the battery in water; please keep it dry in storage and do not contact with water while in use** **Please charge the battery with the charger provided by Manufacturer** **Do not mix the battery with ones not provided by Manufacturer** **Do not charge the battery with a broken charger.** **Charge the battery regularly to avoid over-discharge failure.** **Do not use the battery when it is severe ballooning.**

1.2. Notes for Use

When using the product, take the following precautions. Otherwise, problems may occur and the product may not function correctly.

Before exposure

- Be sure to check the connection of all the parts are set properly & check the detector is kept in insulated cover that operator or patient can't touch the detector directly before powered up.
- Be sure to check the product daily and confirm it work properly.
- Sudden heating of the room in cold areas will cause condensation on the product. In this case, wait until the condensation evaporates before performing an exposure. If it is used when condensation is formed, problems may occur in the quality of captured images. When an air-conditioner is used, be sure to raise/lower the temperature gradually to prevent condensation.

- The product should be warmed up for 15 minutes before exposure or updating the gain map and defect map.
- Make sure wave form of the energy going to the X ray tube is square not pulse.
- Be cautious with circumstance that someone has radio isotope recently injected into them, it may cause panel transmit image without x ray.
- Once powered off, please wait at least 60s before power on again

During exposure

- Do not move Power Cable or Ethernet Cable during exposure, or it may cause image noise or artifacts, even incorrect images.
- Do not use the product near the equipment generating a strong magnetic field. Otherwise, it may cause image noise, artifacts or even incorrect images.

After Usage

- After every examination, wipe the patient contact surfaces with disinfectants such as ethanol, to prevent the risk of infection. For details on how to sterilize, consult a specialist.
- Do not spray the product directly with disinfectants or detergents.
- Wipe it with a cloth slightly damped with a neutral detergent. Do not use solvents such as alcohol, benzene and acid. Doing so may damage the surface of the product.
- It's recommended to use a waterproof non-woven cover as the isolated layer between product and the blooding patient.

2. General Description

NDT1013LA（configuration：NDT1013LA, hereinafter referred as NDT1013LA） is a wireless X-ray flat panel detector based on amorphous flexible silicon thin-film transistor technologies. It is developed to provide the good quality of radiographic image, which contains an active matrix of 3328×2560 with 100 um pixel pitch. The scintillator of NDT1013LA is CsI(Caesium Iodide) which is direct deposit. Since NDT1013LA supports multiple trigger modes, which designed for field inspection application, including Industry Non-Destructive Testing and Security Inspection..

2.1. Scope

This manual contains information about iRay NDT1013LA product. All operators must read and understand this manual before using equipment. All information in this manual, including the illustrations, is based on equipment prototype. If configuration of your equipment does not have any of these items, information about these items in the manual does not apply to your equipment.

2.2. Principle

Detectors contain a layer of scintillator material, which converts the x-rays into light. Directly behind the scintillator layer is an amorphous silicon pixel array contains a photodiode which generates an electrical signal in proportion to the light produced by the portion of scintillator layer in front of the pixel. The signals from the photodiodes are amplified and encoded by additional electronics positioned behind the sensor array in order to produce an accurate and sensitive digital representation of the x-ray image.

2.3. Characteristics

- Wireless static flat panel detector
- AED
- 802.11ac
- 16-bit AD

2.4. Intended Use

IRay will provide equipment and software support for integration of system. NDT1013LA is a 10x12 wireless portable flat panel detector designed for field inspection application, including Industry Non-Destructive Testing and Security inspection.

According to the NDT1013LA intended use and the result of risk management, identifying and describing the essential performance as the following:

To get image of dark field, the NDT1013LA shall be not influenced to the imaging acquisition.

To keep the data transmission function, the NDT1013LA shall be not influenced to the data and signal transmission

2.5. ESSENTIAL PERFORMANCE

According to the Luna series INTENDED USE and the result of risk management, image acquisition and data transmission are defined as ESSENTIAL PERFORMANCE.

Getting dark image proves that ESSENTIAL PERFORMANCE does not influence INTENDED USE. Method for getting dark image in detail refers to section “installation” and “operation”.

2.6. Application Specification

Intended OPERATOR:

All of use, maintenance and operation steps should be carried out by the operator who has accepted the professional training offered by the company's customer service staff.

2.7. The relative position between newborns and detector

Because of the crosstalk effect of Amorphous silicon flat-panel detector, Pay attention to the relative position of newborns and detector, Otherwise, the image is prone to abnormal light lines.

2.8. Product Components

The product is configured with the components below

Item	Description	Quantity
NDT1013LA Detector	/	1pcs
Adapter	/	1pcs
Battery pack	/	2pcs
Gigabit Ethernet cable	/	1pcs
AC power cable	/	1pcs
DC power cable	/	1pcs
Battery charger	/	1pcs
CD ROM	/	1pcs

2.9. Environment

	Temperature	Temperature Variation	Humidity	Atmospheric Pressure	Atmospheric Pressure Variation
Operating	10~35℃	<1k/min	5%~90% RH	700~1060hPa	<10kp/min (1kp=1.0197E-5Pa)
Storage (without battery)	-20~60℃	<1k/min	5%~95% RH	600~1060hPa	<10kp/min (1kp=1.0197E-5Pa)

2.10. Components Dsecription

2.10.1. Detector

2.10.2. Indicator

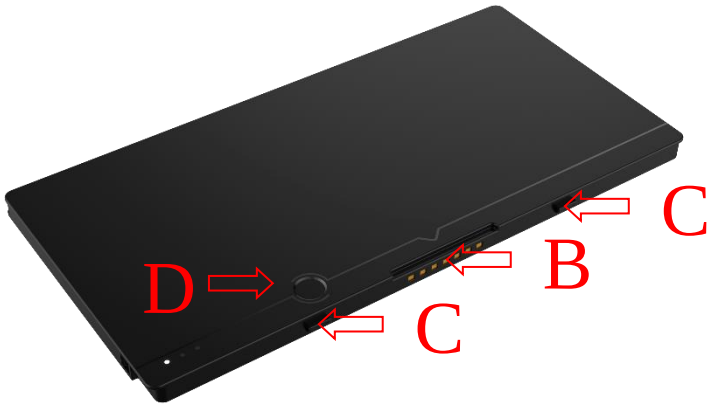
External Signals Input and Control Panel

Control Panel

NO.	Item	Description
A	Status indicator	Detector status
B	Link indicator	Detector link status
C	Power Indicator	Detector Power indicator
D	Power button	Power button

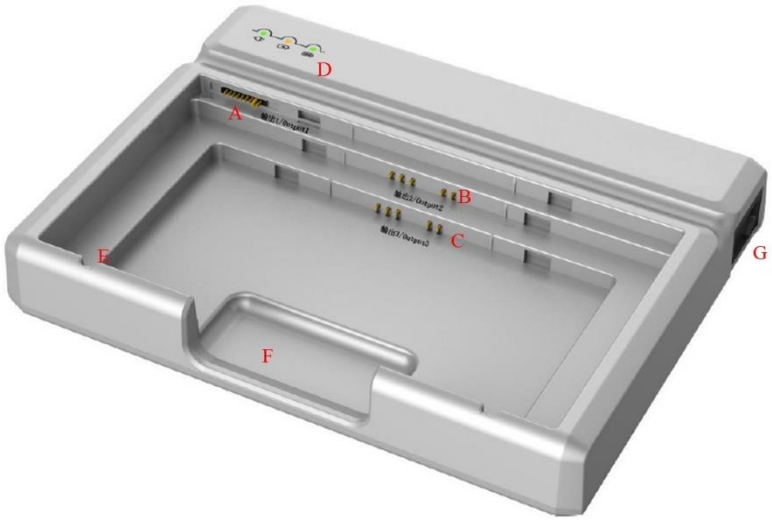
E	DC Input Interface	24V DC input

2.10.3. Battery Pack



NO.	Item	Description
A	Battery Label	/
B	Battery Interface	7-pin battery connector
C	Guide Block	/
D	Touch Display	Show battery level after touching

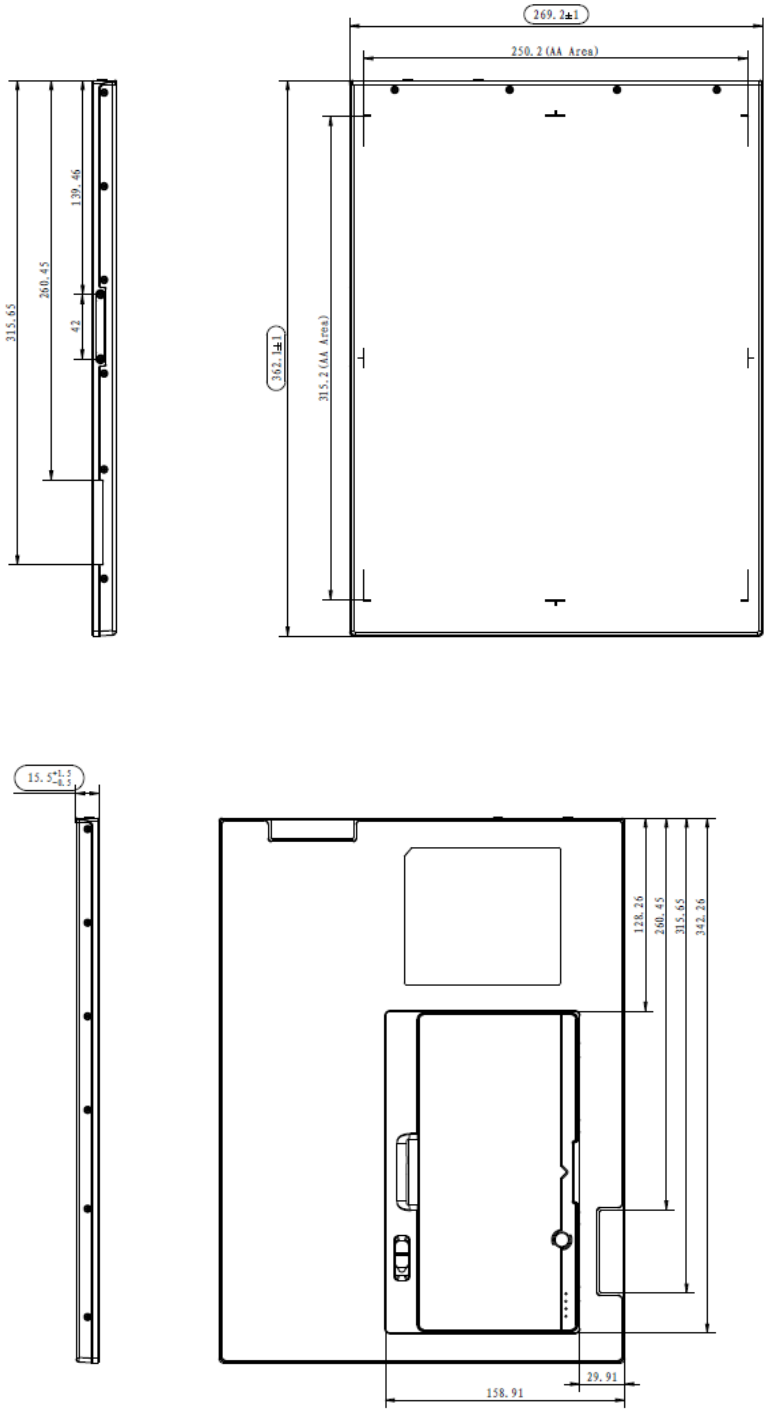
2.10.4. Battery Charger



Item	Name	Description
A	Battery Interface A	8 Pin Battery connector
B	Battery Interface B	5 Pin Battery connector
C	Battery Interface C	5 Pin Battery connector
D	Indicator	The indicator definition is as follow
E	The limit ball plug	/
F	Hand Pull Position	/
G	AC Jack	220V AC input

2.11 Product Specification

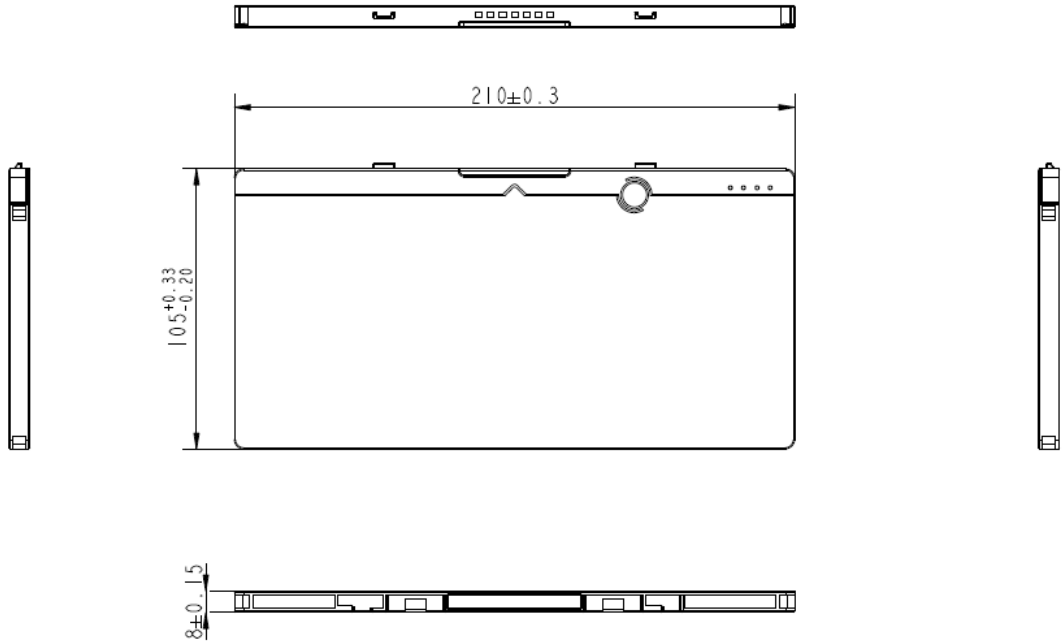
2.11. Detector



Item	Specification
Model	NDT1013LA
Image Sensor	a-Si (Amorphous Silicon) TFT
Scintillator	CsI
Pixel Size	100um

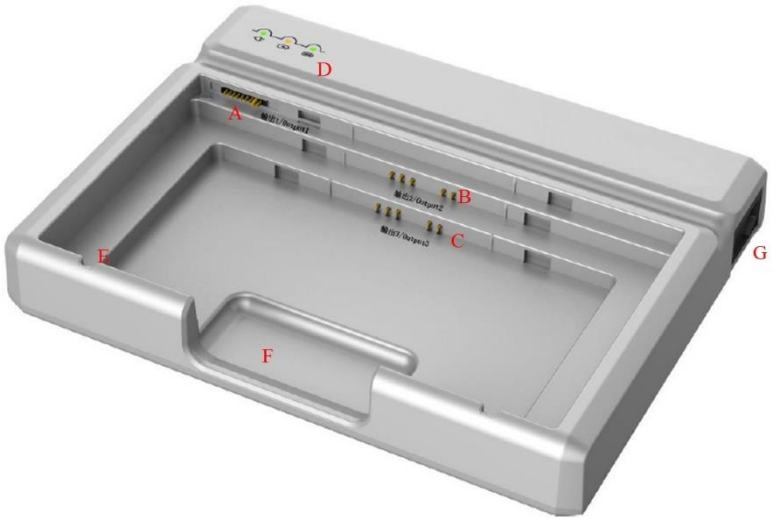
Fill Factor	60%
Effective Array	3152*2502
Effective Area (H x V)	315.2 mm*250.6mm
Spatial Resolution	5 lp/mm
Image Transfer	WIFI
Cycle Time	5s
Power Consumption	19W Max
Weight	2kg(with battery)
Image Transfer	Wireless : IEEE802.11 a/b/g/n/ac
Wireless Frequency Range	2.412~2.472GHz, 5.18~5.22GHz; 5.745~5.85GHz
Data Transmission Power	13dBm (Typ.) @802.11a 16dBm (Typ.) @802.11b 14dBm (Typ.) @802.11g 13dBm (Typ.) @802.11n HT20 11dBm (Typ.) @802.11n HT40 16dBm@2.4GHz 13dBm@5GHz
Wireless Modulation	11b: DSSS (DBPSK, DQPSK and CCK) 11a/g/n: OFDM (BPSK, QPSK,16QAM, 64QAM)
Wireless Band	2.4GHz≤35MHz 5.GHz≤50MHz
X-ray Energy	40-150kV
Trigger Mode	Software/AED
SID	0-180cm

2.11.2. Battery



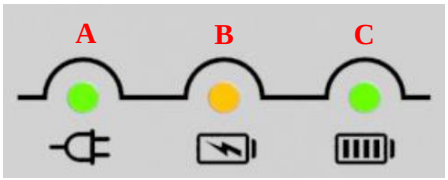
Item	Specifications
Model	Battery-KX
Rated Capacity	Min. 4700mAh, Typ. 4900mAh @ Discharge 0.2C
Nominal Voltage	11.55V
Charge Voltage	13.2V
Discharged End Voltage	9V
Charging Method	CC-CV
Operating Temperature	Charge 0℃-+60℃, Discharge-10℃-+60℃
Storage Temperature	1 month-20℃-+50℃ 3 month -20℃-+45℃ 6 month -20℃-+35℃
Relative Humidity	5%~95%
Dimension (L × W × H)	210 x 105 x 8 mm
Weight	0.285kg

2.11.3. Battery Charger

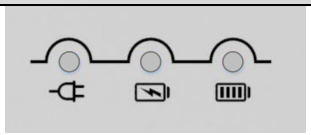


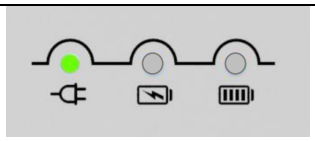
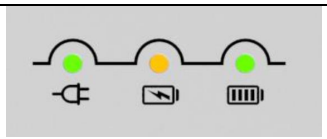
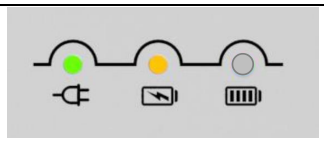
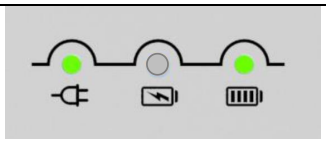
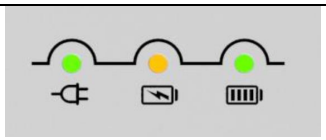
Item	Specifications
Model	Charger-Combo
Simultaneous Charging	1 battery pack
Full charging time	≤3 hours
Rated power supply	90V~264V(AC)
Dimension (L × W × H)	240 x 284 x 38 mm
Weight	0.55 kg

The battery charger indicator definition:



Item	Name	Description
A	Power Indicator	/
B	Charging Indicator	/
C	Charge Full Indicator	/

X Indicator	Lighting Status	Operating Status
All off		No power input

A indicator on		● AC Power input ● Multiple batteries inserted
A indicator on B and C alternately blink 2 times		Battery insertion self-test
A and B indicator on		Battery Charging
A and C indicator on		Battery capacity full, charging stops
A indicator on B and C alternately blinking		Battery charging abnormal

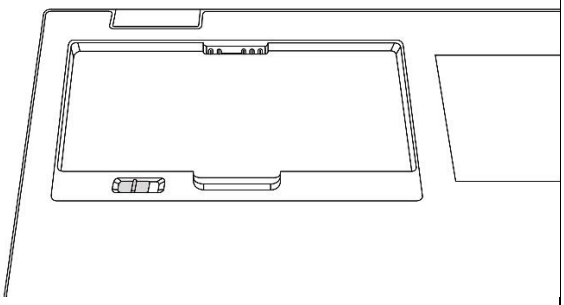
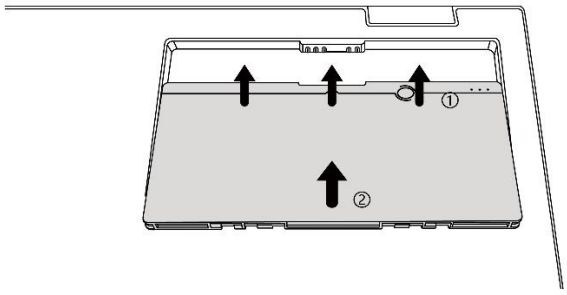
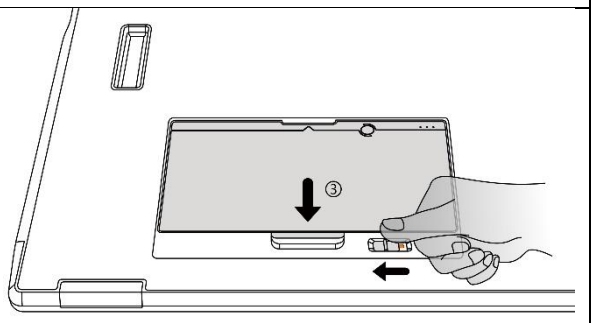
Two or more battery charging at the same time is prohibited, if inserted at the same time, the charger will automatically stop working.

3. Basic Operation

3.1. Preparation

3.1.1. Attach Battery Pack

The product can be powered by both a battery pack and DC power. Once the battery pack is inserted or DC power is connected, detectors will be turned on immediately. If neither battery nor DC power is connected, panel will power off. Please see below for battery installation.

Make sure that connectors on the battery pack are pointed to the opening in the battery compartment.	
Slide battery package into battery compartment (Make sure battery capacity overpass is 15%).	
Slide the battery lock lever.	

3.1.2. Adapter

Detector supports an external adapter powered, It gets CB certificate No. SG PSB-MD-00005 and NRTL certificate No. U8V 093768 0016.The ports defined as bellow:

No.	Definition	Voltage Range	Rated Current
P1	DC Power Negative	0~0.5V	0~0.42A
P2	DC Power Positive	23~25V	0~0.42A
P3	DC Power Positive	23~25V	0~0.42A
P4	DC Power Negative	0~0.5V	0~0.42A

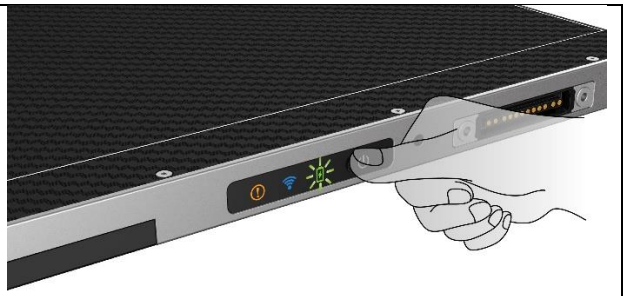
In order to meet the safety and function requirements of the detector, standard components are recommended.

	AC Adapter

3.2. Routine Operation

3.2.1. Starting Up

On the control panel, users can press the power button to turn on.

When the detector is powered down, the user presses the button for 4 seconds to turn on the detector if the battery is inserted and the capacity is not less than 7%, or DC power is connected.	

After booting up, users can check the indicator of the detector.

Power indicator:

Power Indicator	Lighting Status	Status		
		Battery Capacity	DC Input	Description
OFF		N/A	N/A	Detector is off
Green ON		N/A	YES	Detector is on
Orange Blinking		≥7% & ＜15%	NO	Detector is on
Green Blinking		≥15% & ＜95%	YES	Detector is on
Green&Orange Blinking		＜95%	YES	Detector is off

Link indicator:

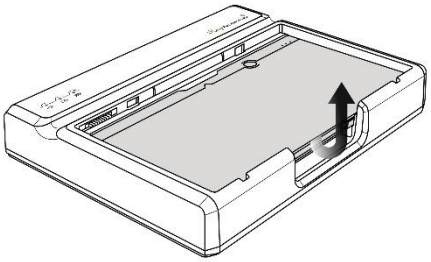
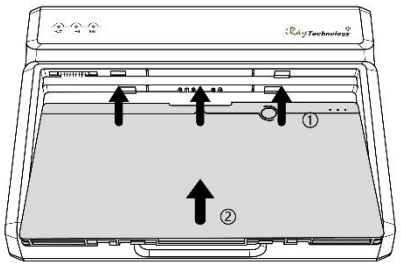
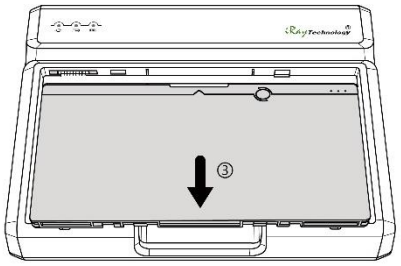
Link Indicator	Lighting Status	Description
OFF		Detector is turned off Wired connection broken and wireless connection not ready
Blue ON		Wireless connection is enabled
Green ON		Wired connection is enabled (Service Mode)

Status indicator：

Mode Indicator	Lighting Status	Description
OFF		Detector is off
Green ON		Exposure is allowed
Orange ON		Error

3.3. Battery Charger Installation

Operation	Figure

● Unload Battery from battery charger.	
● Insert battery into battery charger. ● Note the interface position as figure.	
● Press the battery to the bottom of battery compartment.	

4. Software Setup

4.1. System requirement

iDetector is developed and deployed on Windows Operation System, it can be run on Windows XP/Windows 7/Windows 8/Windows 10, OS should install latest service pack. And requires computer memory 4 GB minimum. The firewall should be shut down to avoid commuication issue.

4.2. Environment setup

Setup files and download url are included in SDK directory: Tools\env_setup

1. Please install Microsoft .NET Framework 4.5(Windows XP only can install V4.0). Download from Microsoft web site, please.

2. Visual C++ redistributed package need to be installed: vcredist_x86_2013(or vcredist_x64_vs2013).

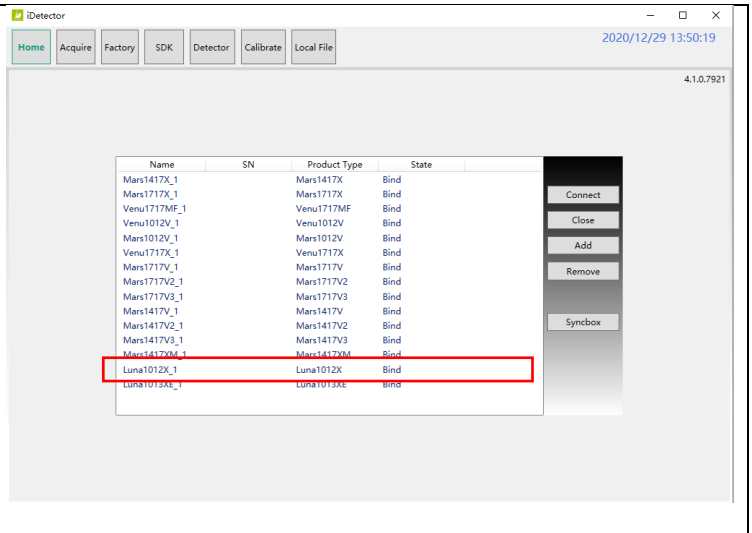
3. For Windows XP, full path should be used in file “bind.txt”.

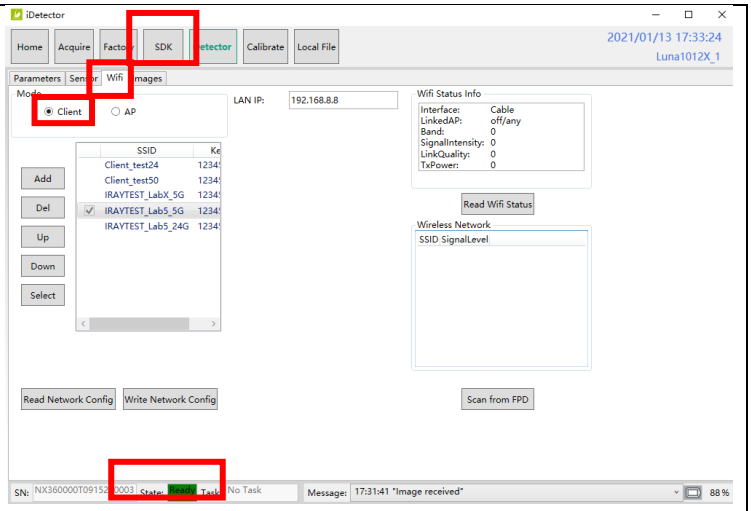
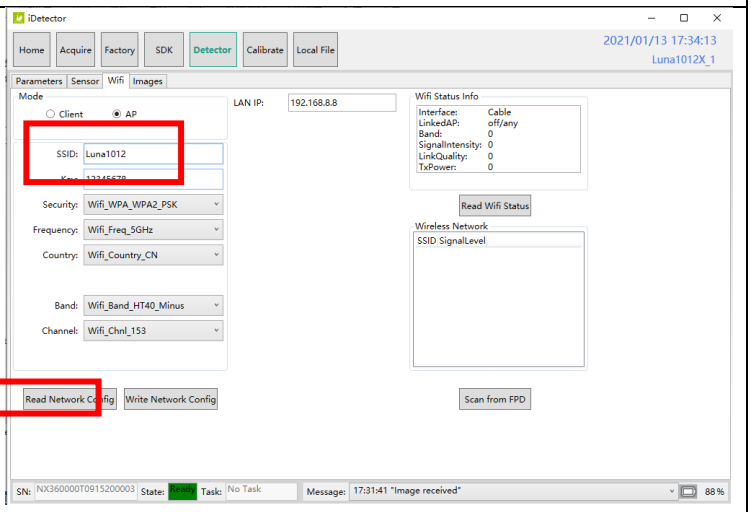
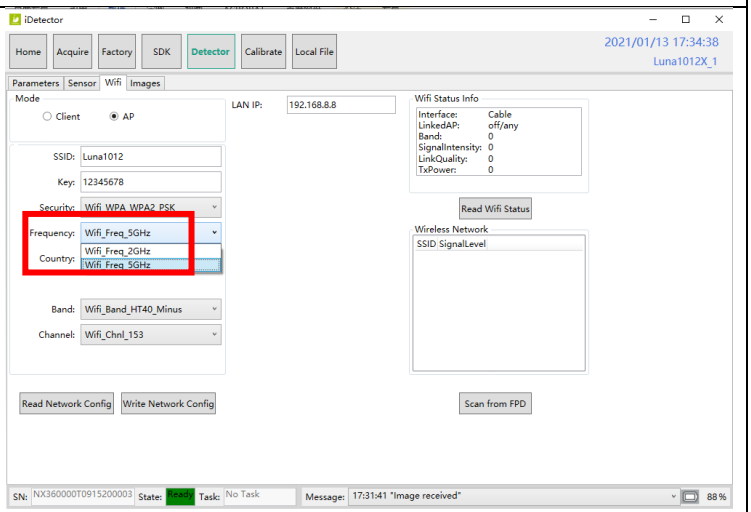
The wifi information should be configured for first use with wired connection. The configuration can be changed when needed.

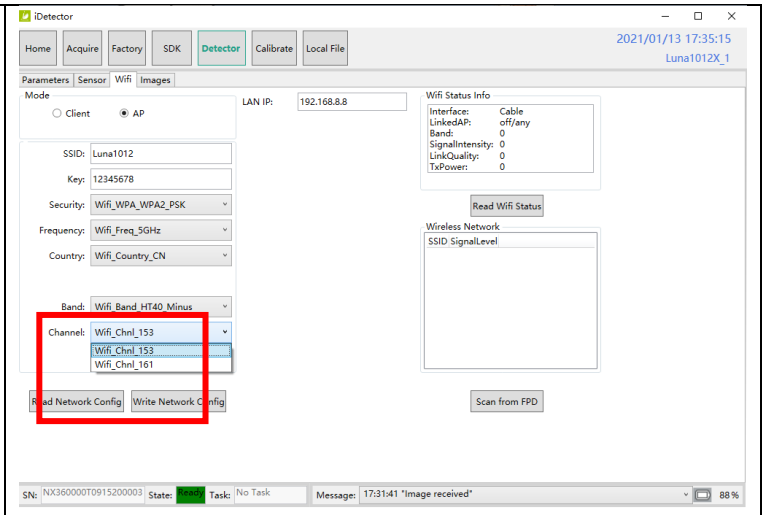
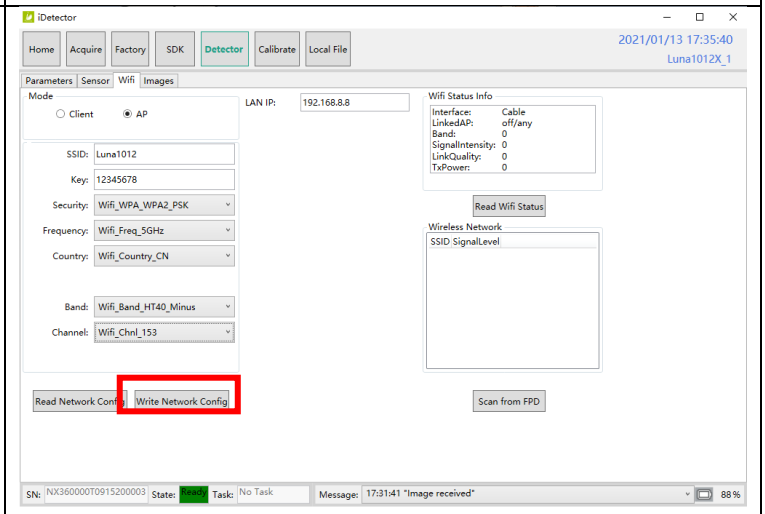
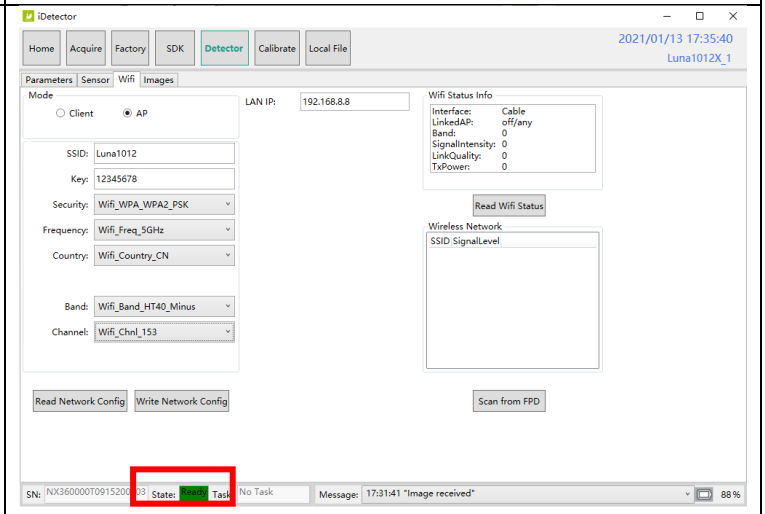
4.3. Wireless Connection

The default IP address (IPv4) of the detector is 192.168.8.8, the PC address (IPv4) should be configured as 192.168.8.xxx, which should be the same as the value of parameter “Cfg_HostIP”in file “*\work_dir\NDT1013LA\config.ini”

4.3.1. AP Mode

On the main window of Home page， Select the instance of “NDT1013LA” and use the “Connect” button the build the connection.	

After finishing building the connection, click “Read Config”button on the “Wifi”tab of “Detector” pag to get the current wifi configuration.	
Click “Read Network Config” to get default setting. Change SSID and password setting. make sure SSID is different from other already exist;	
Change channels and frequency setting	

Click "Channel" and choose a clean frequency and channel	
Click "Write Network Config"	
Waiting FPD status be "Ready"	

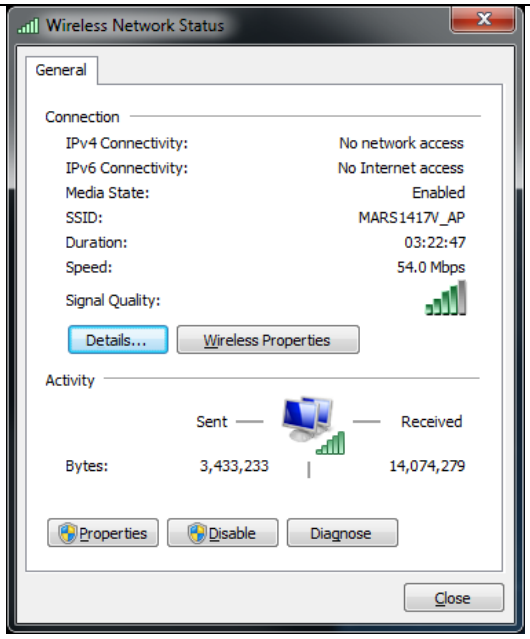
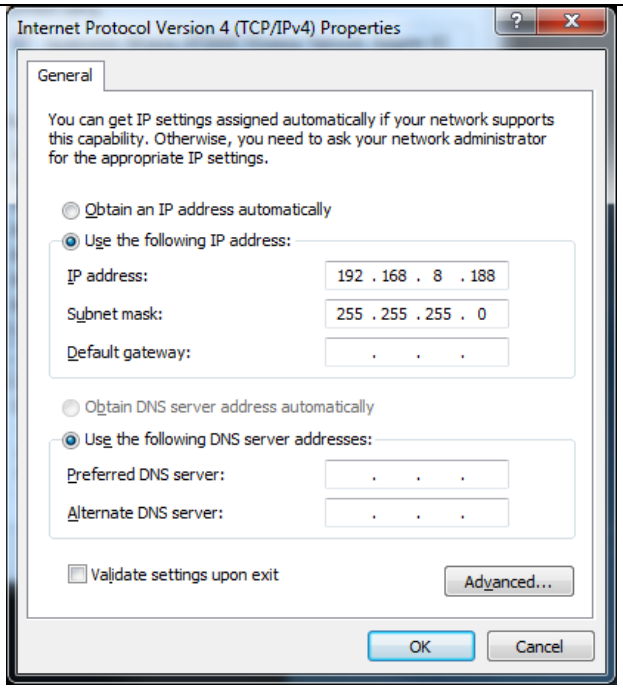
4.3.2. Client Mode

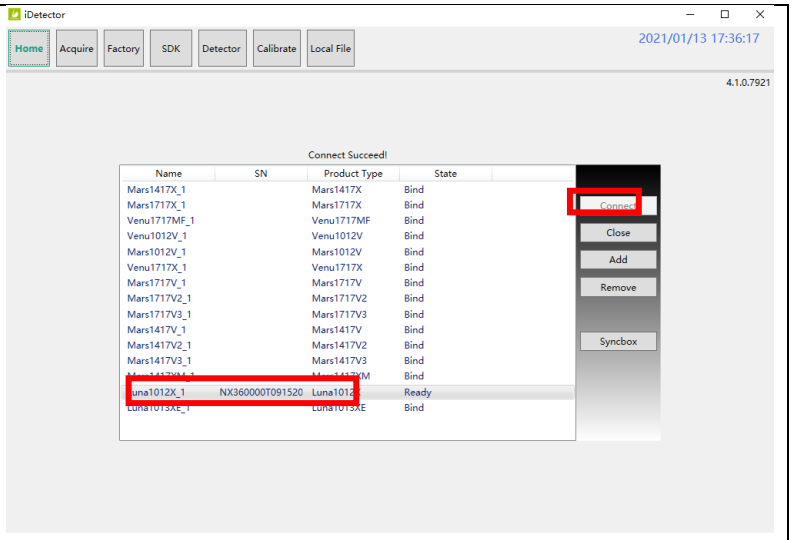
Add: add the information of the access point, such as SSID and password.

Select: Select the Access Point that needs to be connected to.

4.3.3. Configuration of external wireless card

Open local wireless signal list	
Select SSID which belongs to detectors; Input password and log into system	

Open wireless card configuration	
open IPV4 setting	
IP setting as follows IP address: 192.168.8.188 Subnet mask: 255.255.255.0	IP address: 192.168.8.188 Subnet mask: 255.255.255.0

Open SDK and choose product start connection	

4.4. Software UI

SDK supply iDetector as tool softwore:

32-bits iDetector.exe: Tools\iDetector\w32

64-bits iDetector.exe: Tools\iDetector\x64

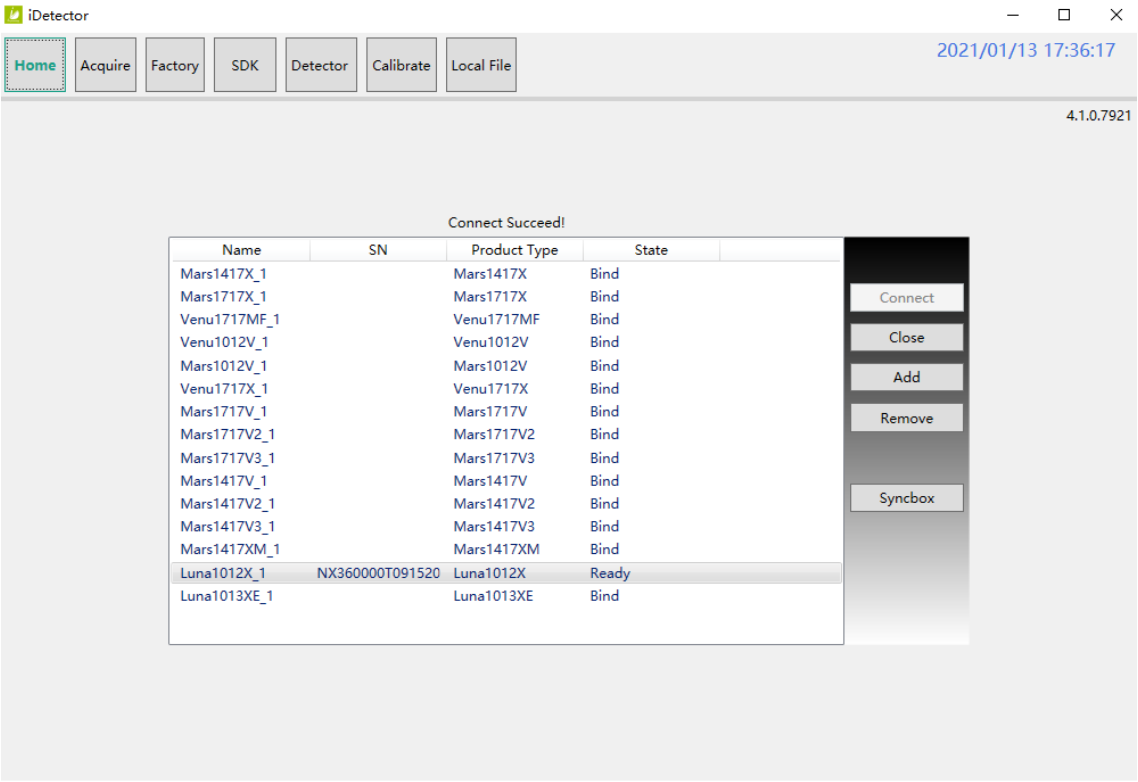
Double click iDetector.exe to run the software. For different software version, the UI maybe has little difference.

For this manual, the example is based on SDK_*_xxxx. This UI is almost the same for different versions of iDetector.

Tab	Function description
Home	Connect FPD and view the connect state
Acquire	Acquire image, select correction mode, save image and process image
SDK	config.ini setting, log level setting
Detector	Configurate parameters for detector.
Calibrate	Generate calibration files and manage the calibration files
Local File	Open and view local images.

4.4.1. HomePage

The main function in this page is to connect detector.

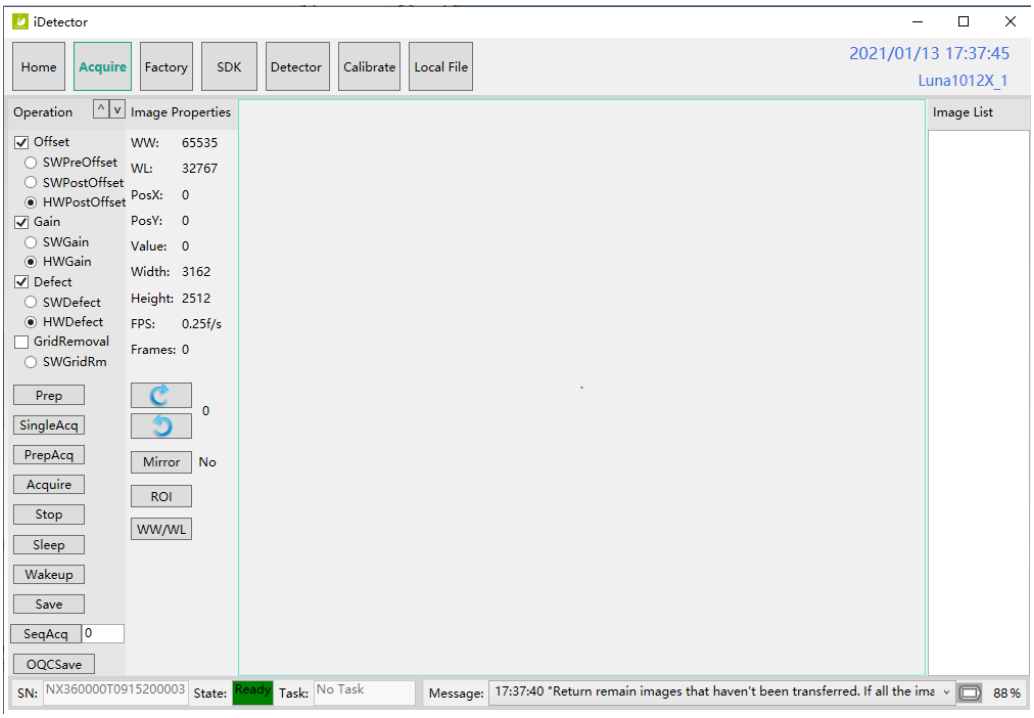


Item	Function description
Name	Display the name of detector
SN	Display the SN of detector
Product Type	Display the type of detector
State	Display the connection state (Bind, Unknown, Ready etc.)

Button	Function description
Connect	Click this button to connect the selected detector.
Close	Click this button to disconnect the selected detector.
Add	Add work directory
Remove	Remove work directory
Syncbox	Open Syncbox configuration window(Optional device)

4.4.2. Acquire Page

This page is used to acquire image under different work mode, and user can select correction options too. When acquire image finished there will be a preview image shown on the screen (if the correction option is selected, otherwise only the raw images will be shown).The propertities of image is displayed on the left of image window.And on the right of image window there is a list to show thumbnail of images. User can select it and double click to see for detail. User can rotate, reverse or mirror image. User can get the value of AVG and SNR by ROI tool. The acquired images can be save as raw, tiff or dicom formats. Both raw and tiff formats support single frame and continuous frames save.



Status bar shows detector's serial number, the current task and state of detector, and feedback information of command. Status bar is also can be seen in other pages, and they are all the same.

Item	Description
SN	SN number of current connected detectors
State	Detectors state , eg busy, ready
Task	the current task of detector
Message	feedback information of command,eg succeed,failed

Functions in this Page.

Correction Menu		Description
Offset	HWPostOffset	Do hardware PostOffset correction for image if checked
Gain	HWGain	Do hardware Gain correction for image if selected
Defect	HWDefect	Do hardware defect correction for image if checked
Acqurie Button		**Description**
Prep		Clear. Prepare to integrate.
SingleAcq		Acquire once
PrepAcq		Clear and acquire
Acquire		Seriers acquire images
Save		Save the current image, the format is raw and tiff
ActiveSensor		Active sensor
DeactiveSensor		Deactive sensor
PowerOff		Shutdown detector
Stitchingflow		Image stitching flow
Image Properties& Image Process		**Description**
WW		window width
WL		window level
PosX		X coordinates of the current cursor at the point
PosY		Y coordinates of the current cursor at the point
Value		Value of the current cursor at the point
Width		Image width
Height		Image height
FPS		Frame rate
Frames		Display the frame count
		Rotate the image clockwise, 90 degrees every time.

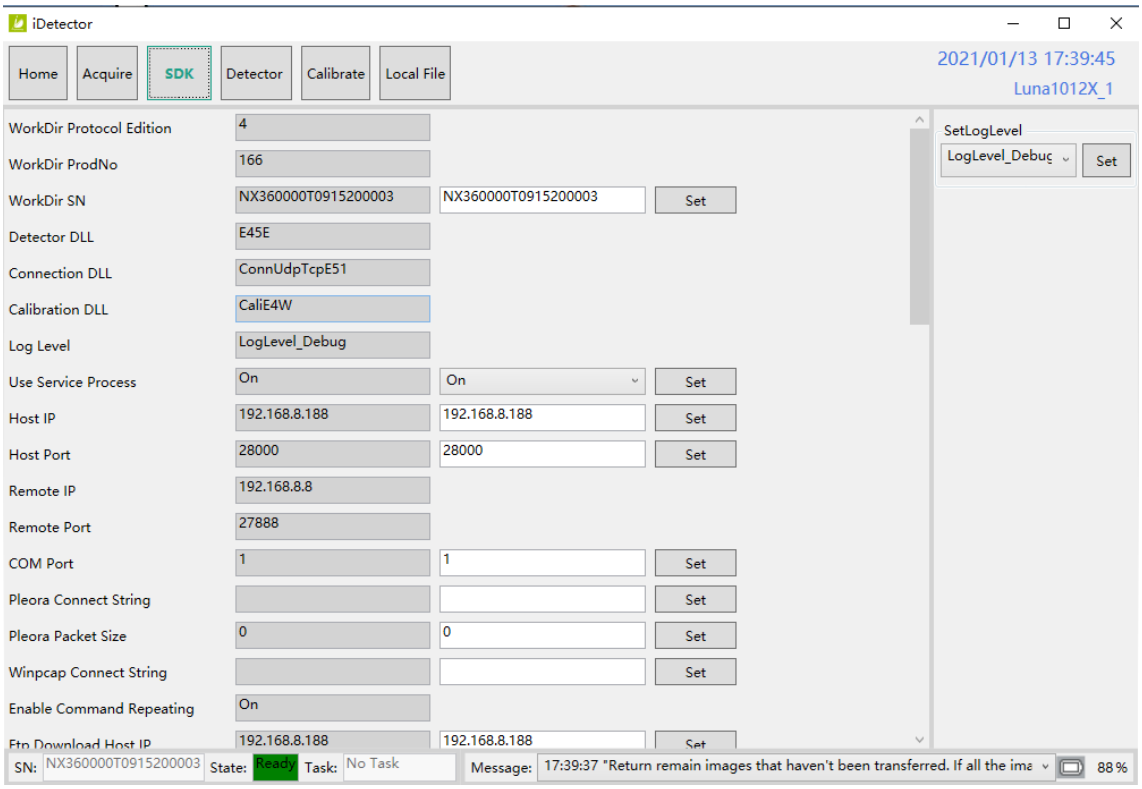
	Rotate the image anticlockwise, 90 degrees every time.
Mirror	Open or close mirror
ROI	ROI tool, to view the image of the AVG, SV, SNR and other parameters with right click. Press "ctrl" key, can create several ROI area.
WW/WL	Auto adjust WW/WL based on selected area by right button of mouse.
Image List	Show thumbnails

When the image is displayed on the screen, maybe the user want to see details by dragging or zoom in/out the image, for convenience, these are some shortcuts.

1. Click the left mouse button: movie playback function operation area display.
2. Double-click the left mouse button: the image display in center and with maximum size;
3. Double-click the right mouse button: restore the window level and width for WL:32767/WW:65535;
4. Drag the left mouse button to drag the image display;
5. Lateral-drag the right mouse button to adjust the window width, and vertical-drag the right mouse button to adjust the window level;
6. F3 Key: Quickly locate the image window width and window level.
7. F4 Key: Adjust window width and window level automatically.

4.4.3. SDK Pgae

SDK page is used to set parameters in config.ini and log level.



Different log level will show different details. It is recommended to set the log level as Debug

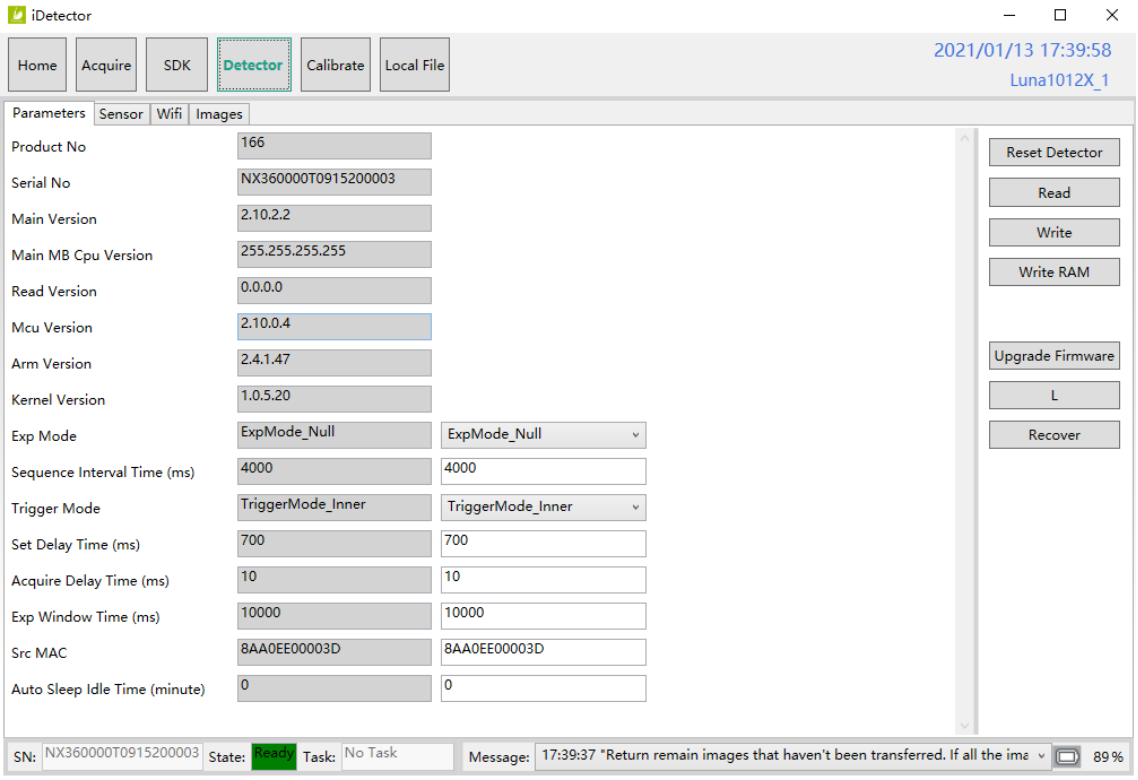
4.4.4. Detector Page

In this page, there are Parameters, Sensor and Images tab.

- **Parameters**

1. Enter Detector page, the tab of Paramters is activity by default. There are 5 regions in this page.
2. Parameter name region: lists the paramters.
3. Parameter read region: read the parameters, the values of the parameters are displayed in this area by Read.
4. Parameter write region: write parameter. Entered value of the corresponding parameter in this area can be write to detector.
5. Operation region: functional operation buttons area.

6. Status bar region: status bar for detector state and information of reading or writing parameters, etc.



Configuration parameters description as below:

Name	Description	Configurable
Product No.	Type of detector product	N
Serial No.	Serial number of the detector	N
Main Version	Firmware version number of the FPGA	N
Read Version	N/A	N
MCU Version	Firmware version number of the MCU	N
Arm Version	Version number of the ARM App	N
Kernel Version	Version number of ARM Kernel	N
Trigger Mode	Tirgger mode of the detector	Y
Set Delay Time(ms)	Exposure window for AED mode which use a fixed window	Y
Acquire Delay Time(ms)	Exposure window for getting image which use a dynamic window	Y

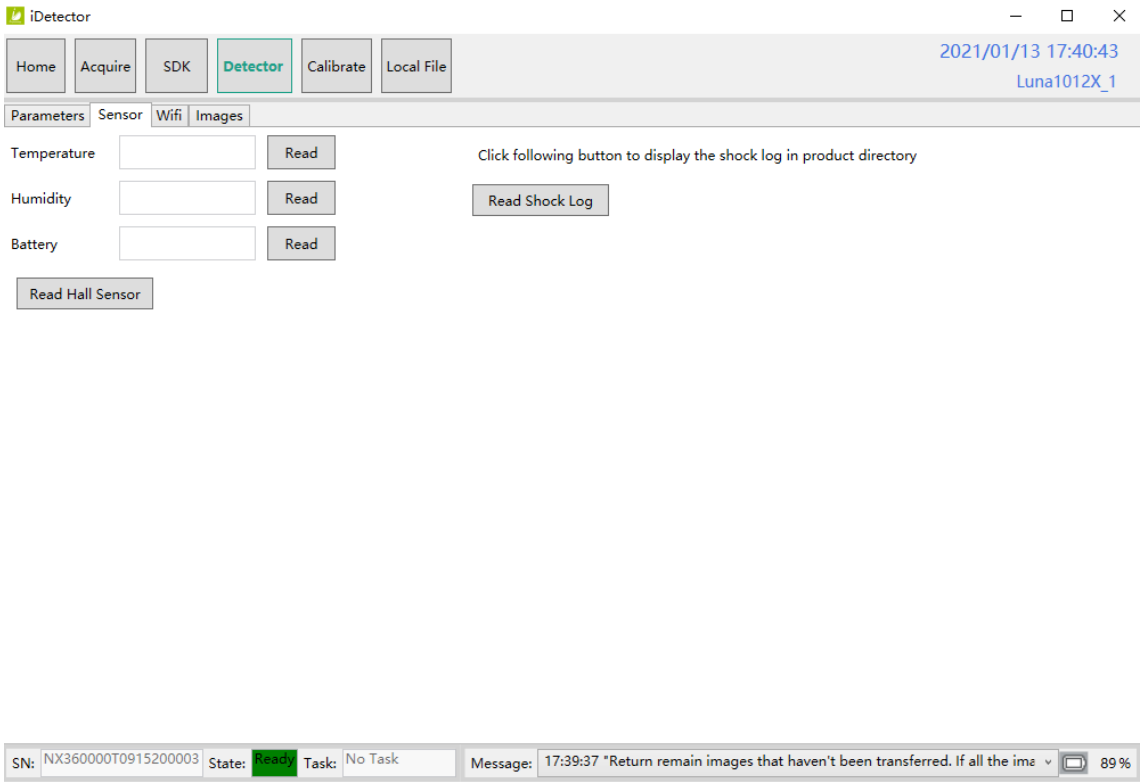
Exp Window Time(ms)	Max exposure window for command trigger which use a dynamic window	Y
Src MAC	Detector MAC	Y

Button function description:

Function Button	Description
Reset Detector	Reset Detector
Read	Read parameters
Write	Write parameters
Write RAM	Write parameters into RAM(will lost changes after reset)
Upgrade Firmware	Upgrade firmware
L	Upload detector log to the specified directory

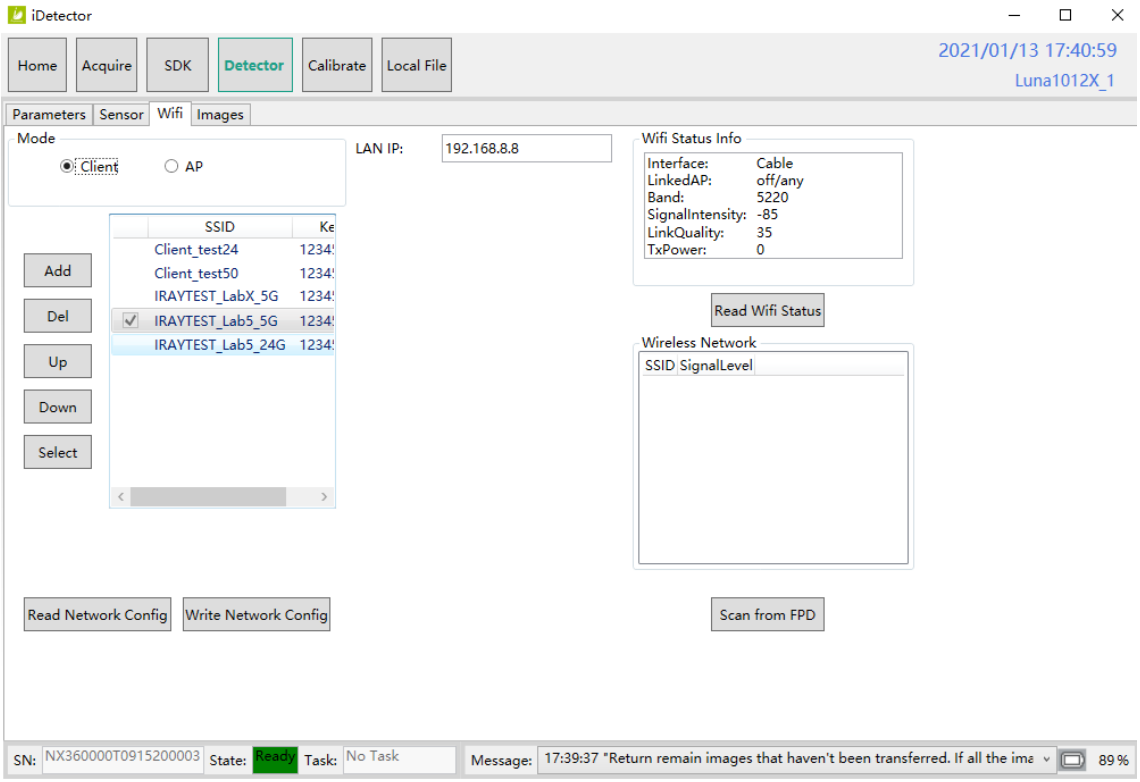
- **Sensor**

The mainly function in this page is to probe the temperature and humidity of the detector. Click "Read" button to get the value of the temperature or humidity.



Sensor type	Explanation
Temperature	Read detector temperature
Humidity	Read detector humidity
Battery	Read the capacity of the battery

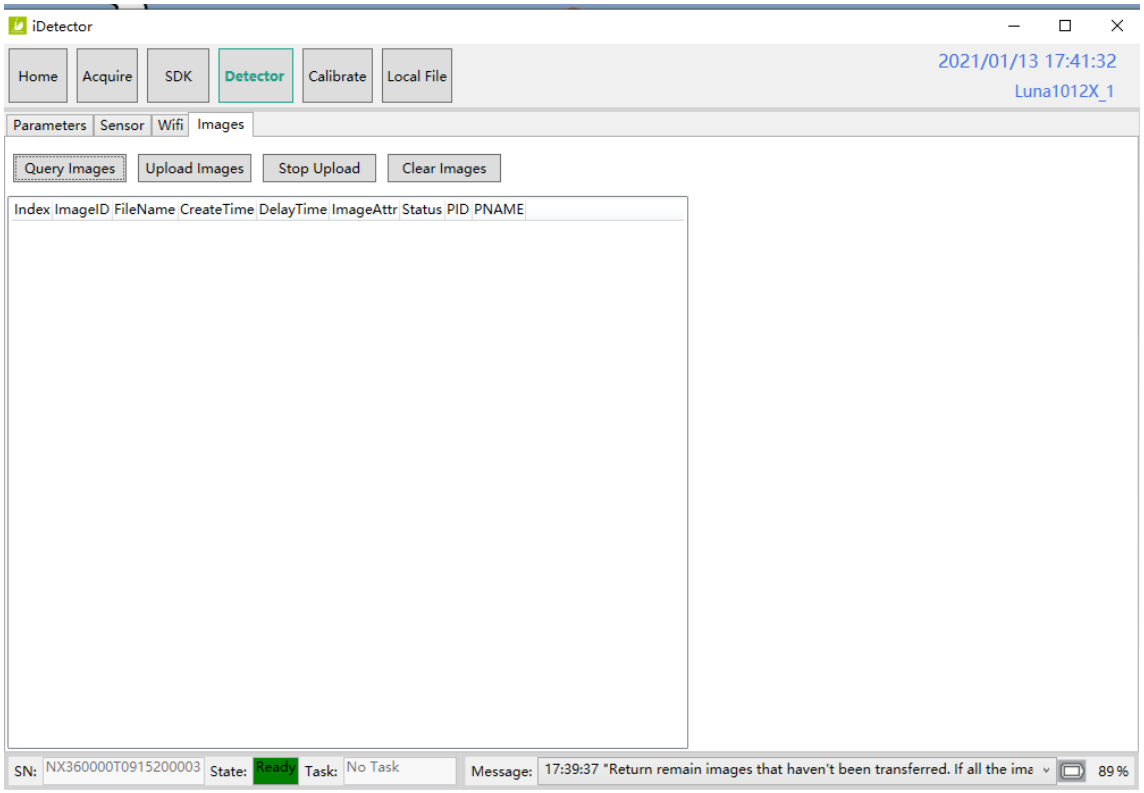
- **Wifi**



User can config the wireless connect parameters on this tab.

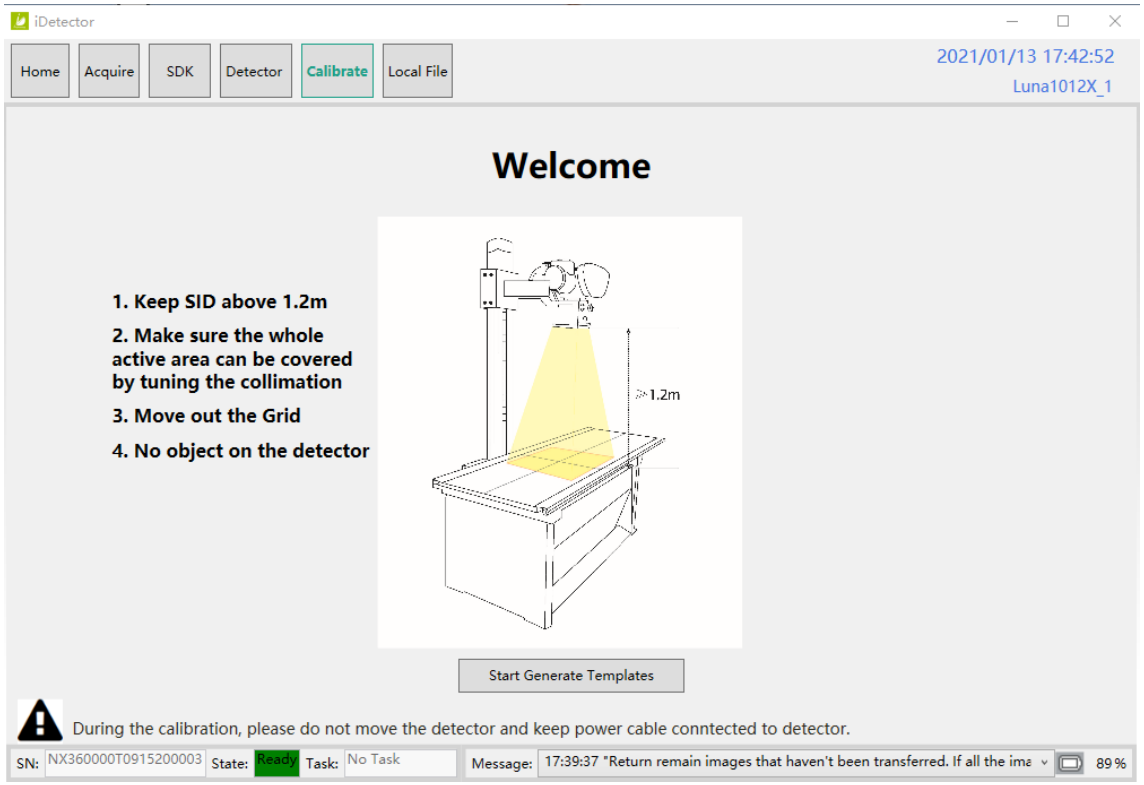
- **Images**

You can Query and upload Images from detector to Workstation.

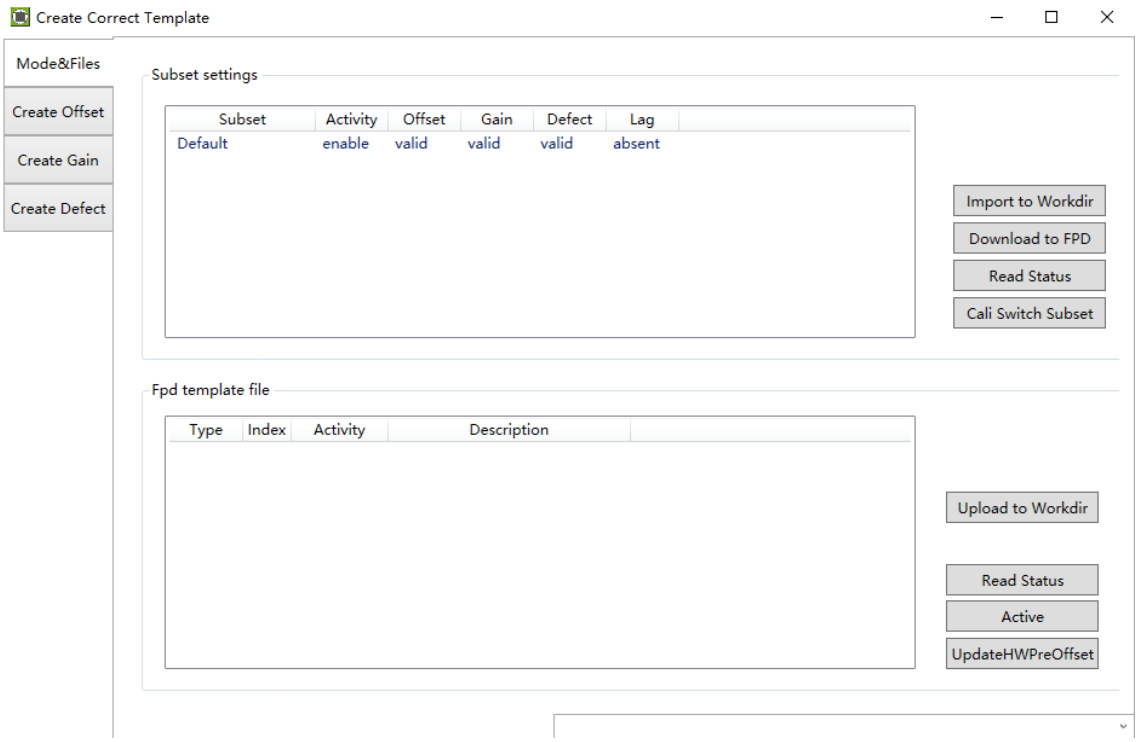


4.4.5. Calibrate Page

Offset, Gain, Defect calibrate files can be generated and managed in this page.



Click “Start Generate Templates” to enter generating templates page.



SubTab	Description
Mode&Files	Manage template files
Create Offset	Create Offset template
Create Gain	Create Gain template
Create Defect	Create Defect template

Mode&Files page	Description
Import to Workdir	Copy template file into current calibration directory.
Download to FPD	Select one item first. Then click this button to download selected template file(s) into detector.
UpLoad to Workdir	Select one item in Fpd template file control and select one item in Subset settings control. Click this button to upload selected template from detector into specified calibration directory.
Upload Lag	Upload Lag into SDK current directory
Active	Select one item in list. Click this button to activate selected template for hardware correction.

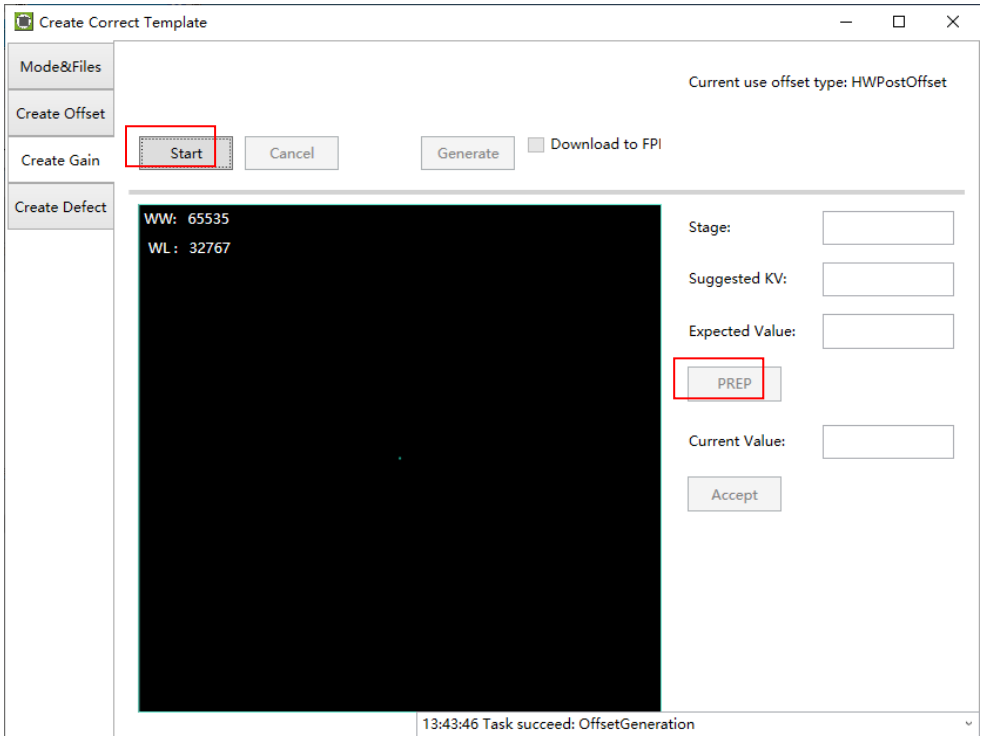
UpdateHWPreOffset	Force detector update Offset template
ReadStatus	Get the current state of template for hardware correction, enable/disable

- **Generate Gain Template File**

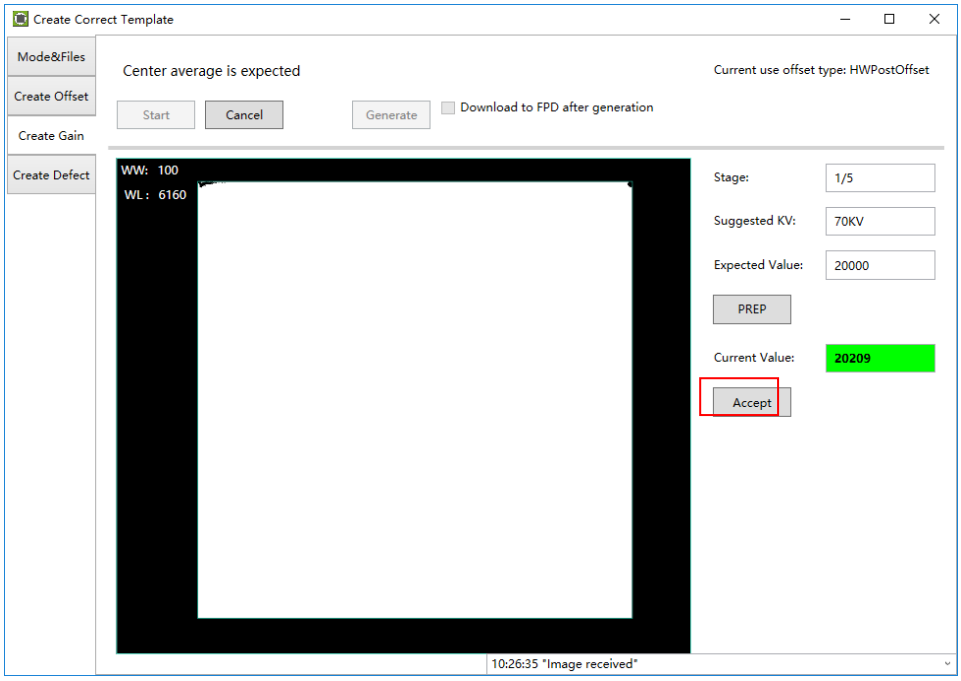
If the relative position between tube and detector changed or KV value changed, it suggest to create gain template file.

1. Enter Create Gain page

   Click "Start" button to start process, the offset type should be selected, then start to get the images.



2. Click PREP button, then exposure after Acquire button enable. After receving the PREP request, the detector needs some time to be ready, the decounting bar will apear when the exposure window is opened. After exposure user can click Acquire button to acquire the X-Ray image.



The gain template generation process needs 5 images total, the UI gives the recommended KV and target value, user can use different ones if needed.

After accepting the current image, the “Stage” will turn to 2/5, 3/5 and so on.

The current value box will show different colors, the definitons are as below:

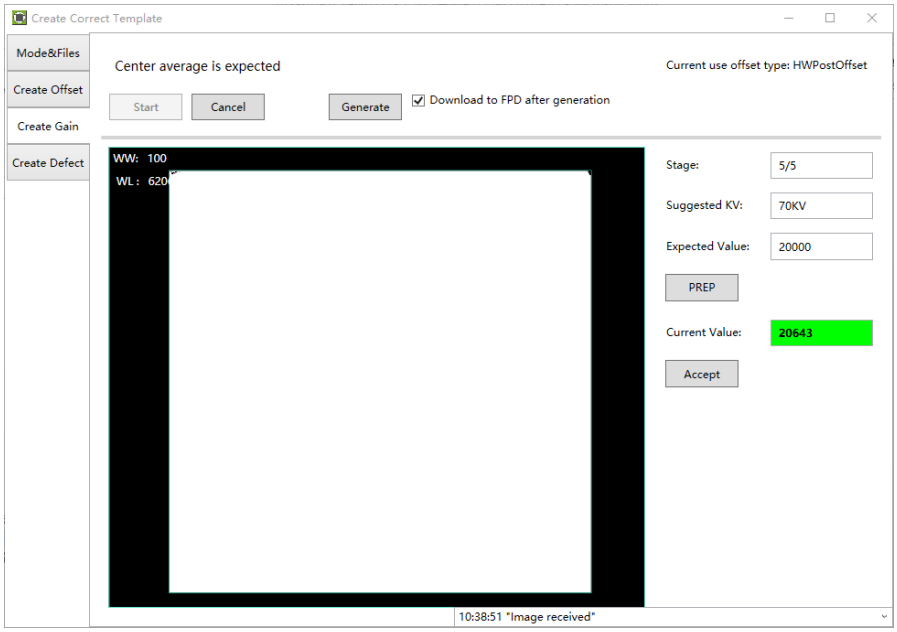
Yellow: The current value is higher or lower than the expected one, user decides if acceptable. For example, the expected value is 20000, and user needs 40000 as the gain piont, the yellow warning can be ignored, and the value can be accepted still.

Green: The value is good.

Red: The value is un-acceptable.

3. After getting 5 images, user can generate the Gain template by “Generate” button, and the process can be exited from at anytime by using “Cancel” button.

   If “Download to FPD after generation” is checked, then the download UI will appear after finishing generating. User can refer to the part of “Generate Defect Template File"



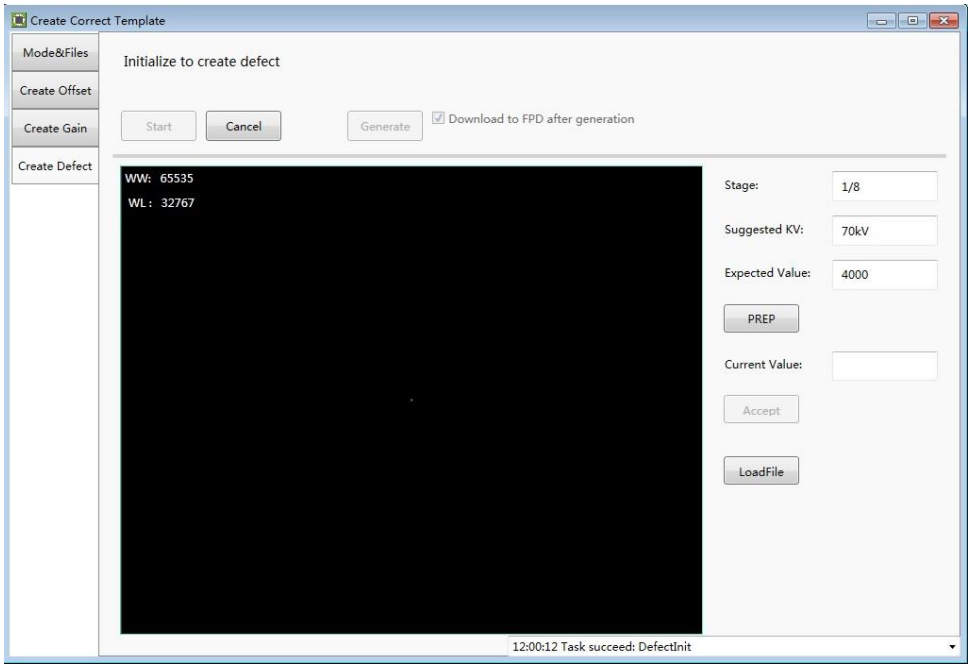
4. When the generating process is finished, the UI will give the message of successful.

- **Generate Defect Template File**

The process of generate defect map is quite similar with the one of gain map.

1. On the “Create Defect” page, user can start the generating process by “Start” button.

   And the process can be quit by “Cancel”.

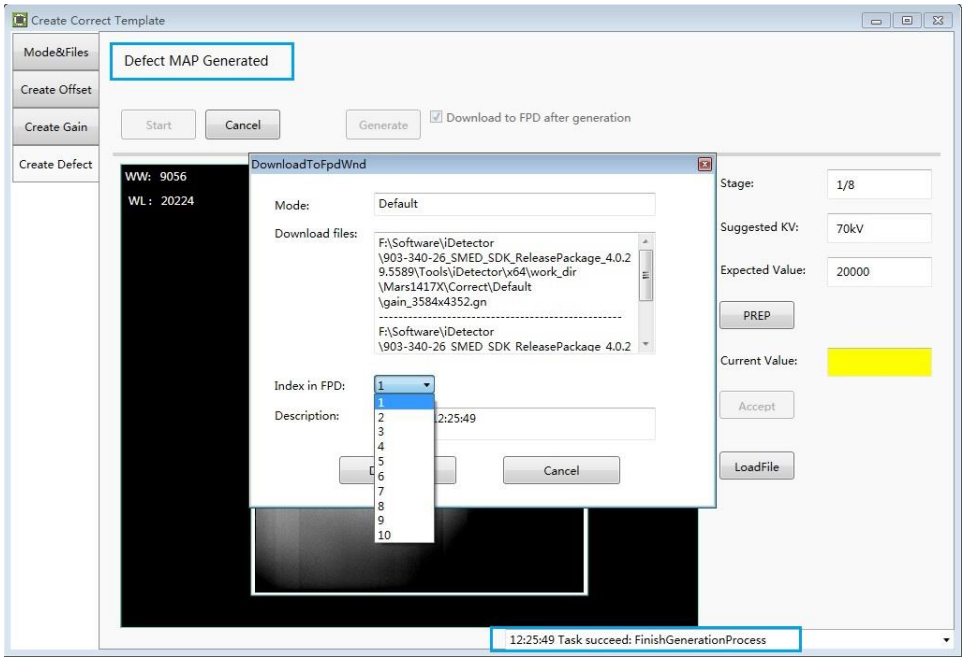


2. There are 8 images that need to be acquired, the UI gives the recommend KV and expected image value, user should refer with them.

3. If the option “Download to FPD after generation” is checked, the download UI will appear after finishing generating the defect map which will takes a little time.

   The field of “Index in FPD” means that the detector can store several correction maps and choose one set to active as user wants.

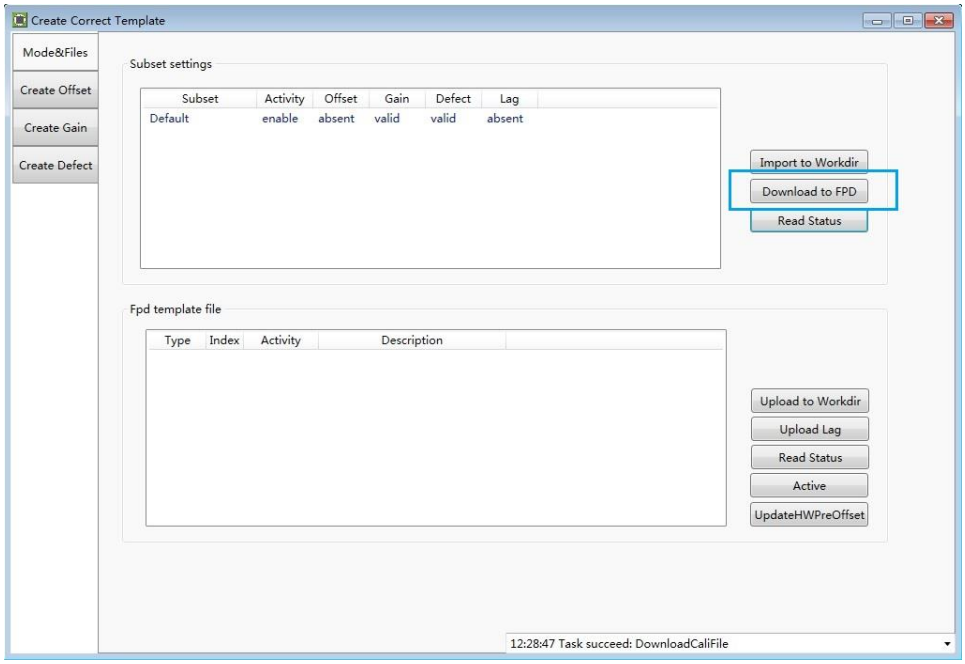
   The “Download files” part show the directory of the generated map stored on the workstation.



4. After choosing the stored index of FPD, the download process can be started by the “Download” button, user should wait the process until it is finished.

5. The correction map also can be managed at anytime on the page of “Mode&Files”.

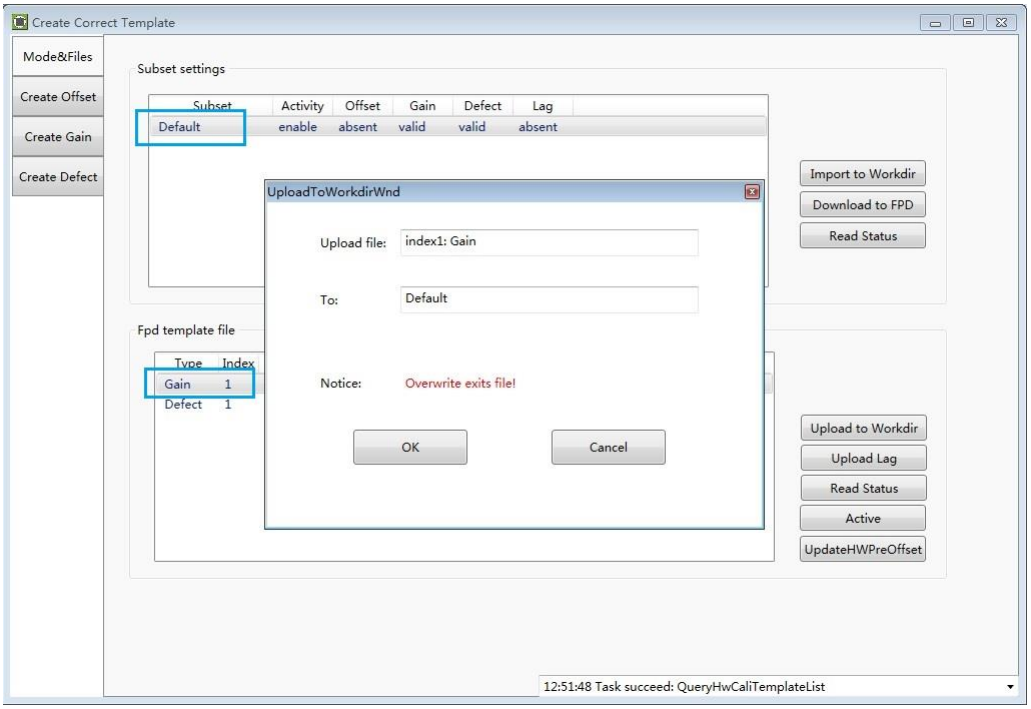
   Choose the item of “Default” in the Subset settings part and click “Download to FPD” to finish downloading the maps into the detector.



- **Upload the correction files**

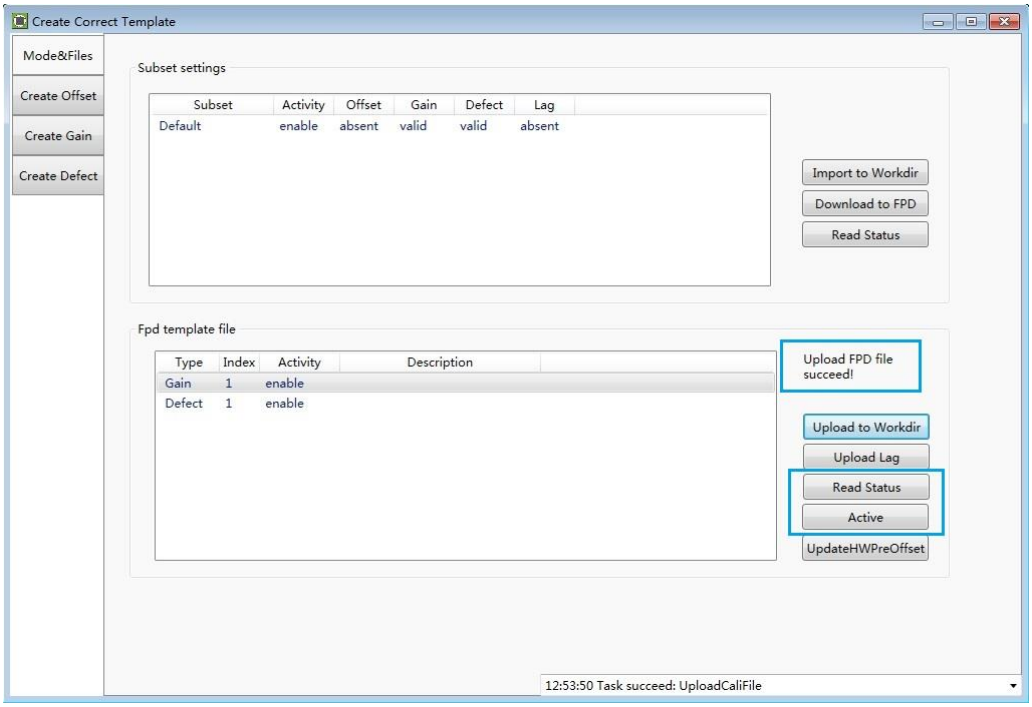
1. The correction maps can be uploaded to the workstation too.

   Choose the gain or defect in the “Fpd template files”and the “Default” directory in the “Subset settings”, then click the “Upload to workdir”.



2. When the upload process is finished, the UI will give the message.

The correction maps should be enabled before using hardware correction, read status first, then choose the gain or defect, enable the map by clicking “Active” button.



4.4.6. Local Page

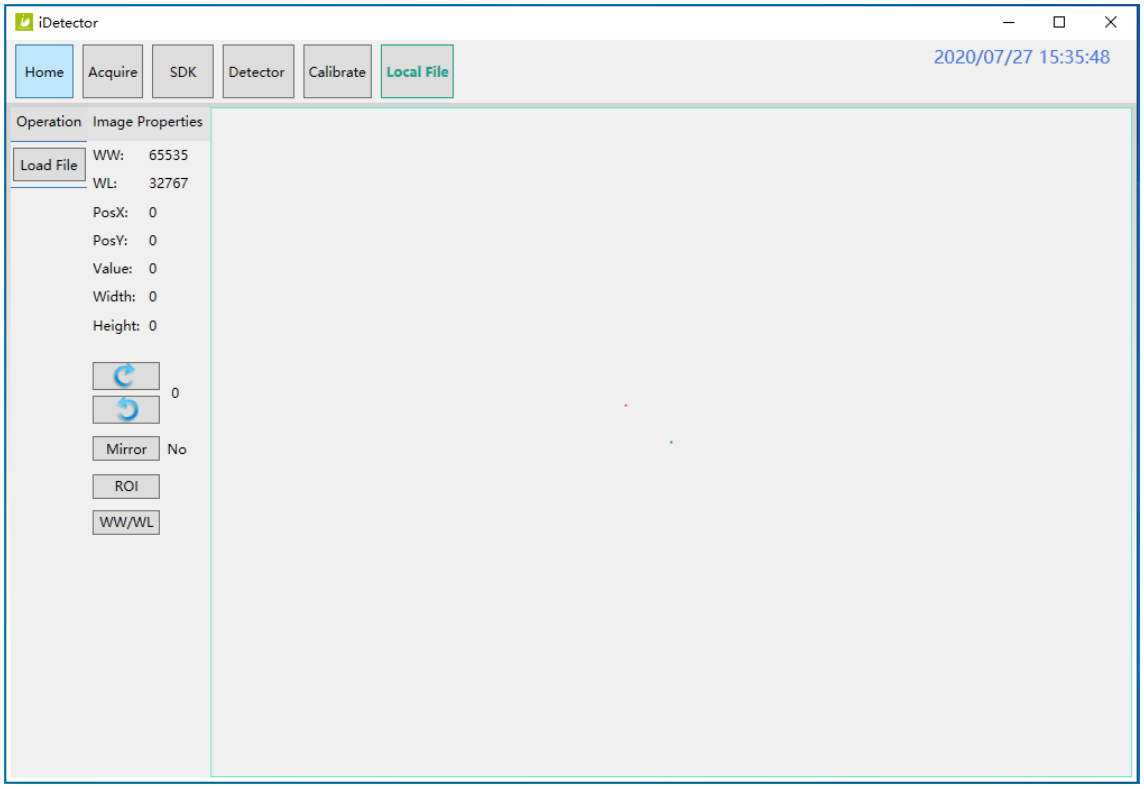
In this page user can open the image files saved in local, the file formate can be dcm, raw, tiff, dft. When the software is disconnected to detector, the file still can be opened.

Click “Load File”, there will be an open file wizard. Select file and click open or double click the file. The tiff file will be opened directly. For the raw file or dft file there will be a dialog to select image size. Select correct size to open image files. If the file is not correct user will get an error message.

The pixel matrix is defined as below:

Active area : 4267*4267

What needs to be notice is only the active area pixels will be displayed when use load file funtion, the value of dummy pixels and empty channels will be filled by 65535.



This page provides ROI tool, which can see the AVG, SNR, and other properties of the choosen image area by right mouse button.

This page provides WW/WL tool as Acquire page . Click this button to auto adjust WW/WL based on selected area by right button of mouse.

Image Properties& Image Process	Description
WW	window width
WL	window level
PosX	X coordinates of the current cursor at the point
PosY	Y coordinates of the current cursor at the point
Value	Value of the current cursor at the point
Width	Image width
Height	Image height

	Rotate the image clockwise, 90 degrees every time.
	Rotate the image anticlockwise, 90 degrees every time.
Mirror	Open or close mirror
ROI	ROI tool，to view the image of the AVG, SV, SNR and other parameters. Press "ctrl" key, can create several ROI area.
WW/WL	Auto adjust WW/WL based on selected area by right button of mouse.

4.5. List of the HAZARDOUS SITUATIONS resulting from a failure of the IT-NETWORK

a) The operating system is not compatibility;

b) Change or update the software failed;

c) The compatibility of the interface;

d) The data transfer protocol error;

e) The inconsistent of interface or format leads to data distortion;

f) The data output failed;

5. Operation Instructions for Image Acquisition

NDT1013LA provides SDK for users to integrate detector into their DR system. Additionally, it also provides an application for demonstration, i.e. IDetector. User can use IDetector to control detector without DR system.

5.1. Steps for acquiring image

- Make sure the hardware is connected correctly and then power on.

  Once powered off, please wait at least 60s before power on again

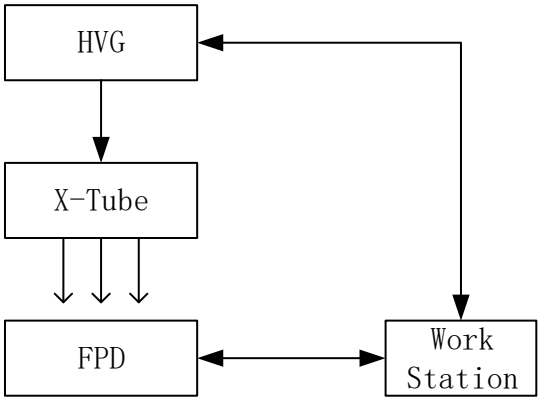
- Wait until initialization is complete
- Connect the software
- choose the synchronization mode
- Generate HWPreOffset, Gain and Defect template after the detector reaches thermal equilibrium
- Acquire images in the selected mode

To Acquire X-ray image is the main operation of NDT1013LA. Most importantly, detector should build synchronization with X-ray generator. NDT1013LA has one synchronization modes to acquire X-ray image, which is Software Mode.

5.2. Software Mode

5.2.1. Block Diagram

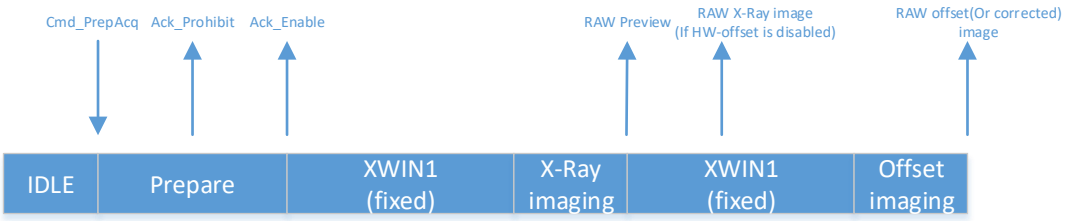
Software mode is the basic way to acquire X-ray image. Please see figure below for general feature. Workstation is a host PC device installed with iDetector and SDK. FPD is the Flat Panel Detector and HVG is the High Voltage Generator. In this mode, Workstation does not have to control X-ray generator. Users would decide when to shoot X-ray.



5.2.2. Work Flow(PrepAcq)

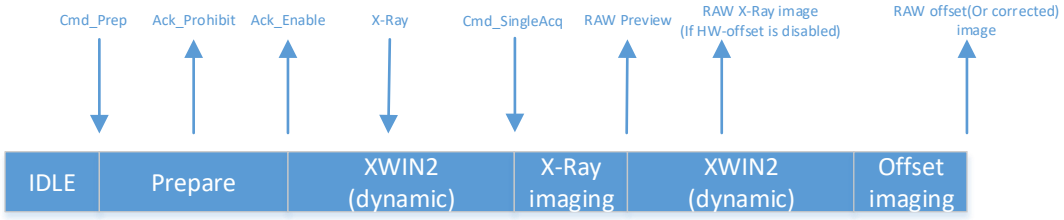
Select HWPostOffset、HWGain、HWDefect. If user need the raw image, please de-select all these correction options.

Also, the software correction is supported.



1. Send Cmd“PrepAcq” on UI “Acquire” page.
2. After receiving the Cmd_PrepAcq, it will start the prepare process, and send back the acknowlage of “Prohibit” and “Enable”, the “XWIN” will be started.
3. The XWIN is configured by parameter “Clear Acq Delay Time” on “SDK” page, the unit is “ms”.
4. User needs to make sure the X-Ray ends within the XWIN.
5. The detector will send the images after the XWIN closed.
6. The preview image will be always sent, which is 4x4 averaging, the raw X-Ray image will be sent if the HW correction is disabled with the raw offset image follows, otherwise, the X-Ray image will not be sent and only the corrected image will be transferred.

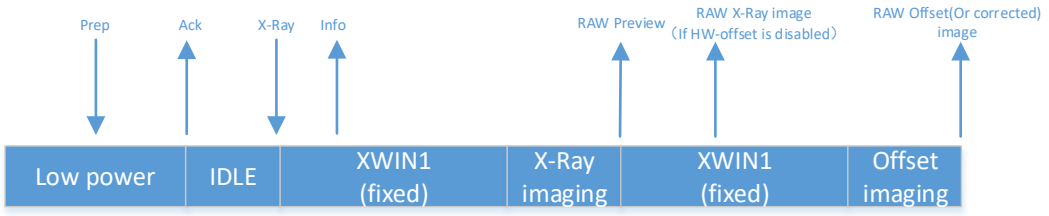
5.2.3. Work Flow(Prep+Acq)



1. Send Cmd“Prep” on UI “Acquire” page.
2. After receiving the Cmd_Prep, it will start the prepare process, and send back the acknowlage of “Prohibit” and “Enable”, the “XWIN” will be started.
3. The max XWIN is configured by parameter “Exp Window Time” on “Detector” page “Parameter” tab, the unit is “ms”.
4. User starts the X-Ray.
5. Send “SingleAcq” on UI “Acquire” page after the X-Ray is end.
6. The preview image will be always sent, which is 4x4 averaging, the raw X-Ray image will be sent if the HW correction is disabled with the raw offset image follows, otherwise, the X-Ray image will not be sent and only the corrected image will be transferred.

5.3. AED Mode

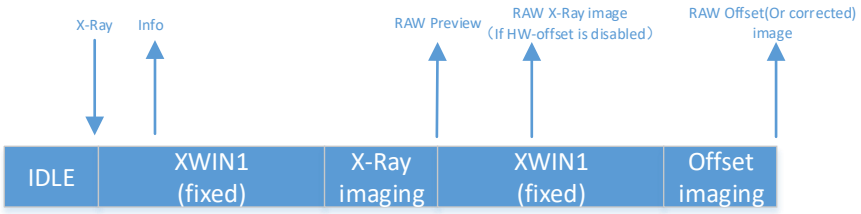
5.3.1. Inner



1. The detector is in low power state, user needs to send Cmd “Prep” to make the detector exit to idle state which indicated by the acknowledge to Cmd “Prep”.
2. When the detector is in idle state, user can start the X-Ray any time.
3. When the X-Ray starts, the detector will sense the X-Ray automaticlly, the XWIN is configured by parameter “Set Delay Time” on “Detector” page “Parameter” tab, the unit is “ms”, user needs to make sure that the XWIN is larger than the X-Ray time.

4. After the XWIN is end, then the detector will start the acquisition flow.
5. The preview image will be always sent, which is 4x4 averaging, the raw X-Ray image will be sent if the HW correction is disabled with the raw offset image follows, otherwise, the X-Ray image will not be sent and only the corrected image will be transferred.

5.3.2. Freesync Mode



1. For Freesync mode, there is no low power state.
2. When the detector is Idle, user can start the exposure flow any time.
3. When the X-Ray starts, the detector will sense the X-Ray automaticlly, the XWIN is configured by parameter “Set Delay Time” on “Detector” page “Parameter” tab, the unit is “ms”, user needs to make sure that the XWIN is larger than the X-Ray time.
4. After the XWIN is end, then the detector will start the acquisition flow.
5. The preview image will be always sent, which is 4x4 averaging, the raw X-Ray image will be sent if the HW correction is disabled with the raw offset image follows, otherwise, the X-Ray image will not be sent and only the corrected image will be transferred.

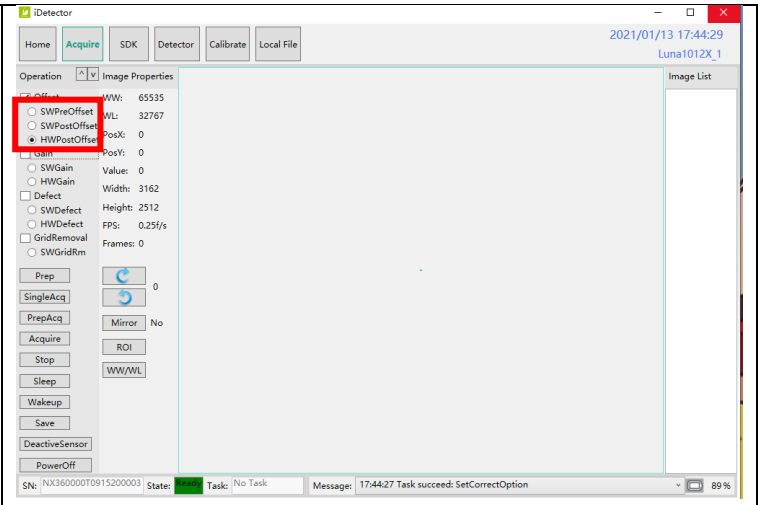
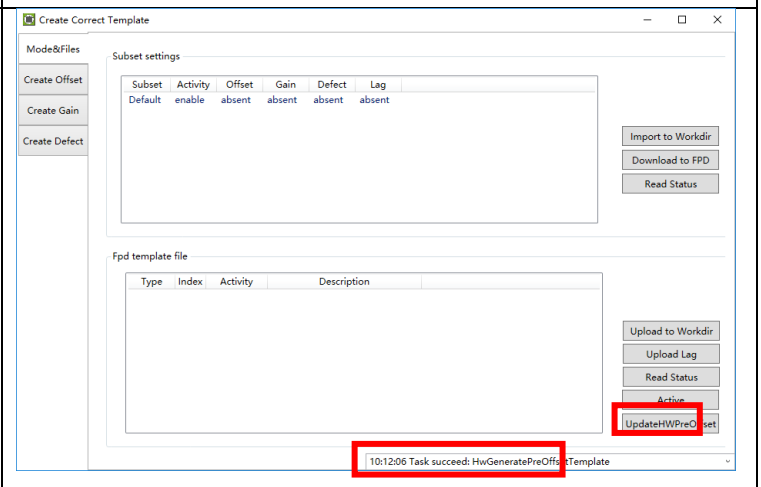
5.4. After use

1. Disconnect the software
2. Power off
3. Keep it clean
4. Store under specified conditions

5.5. Correction and Calibration Template Generation

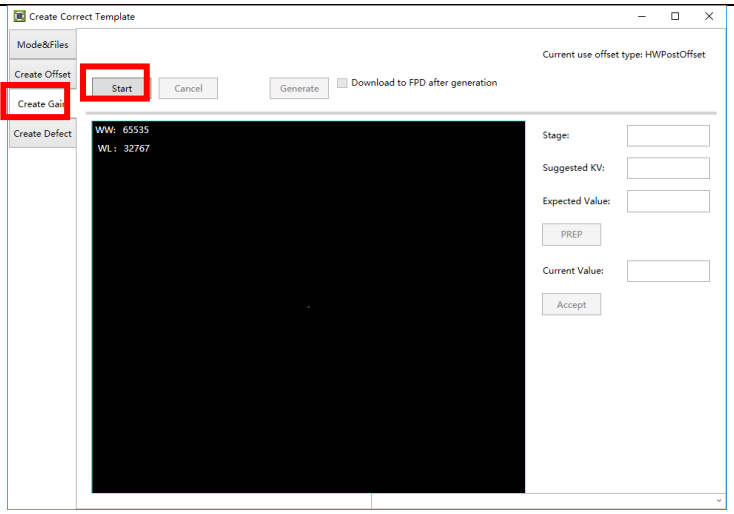
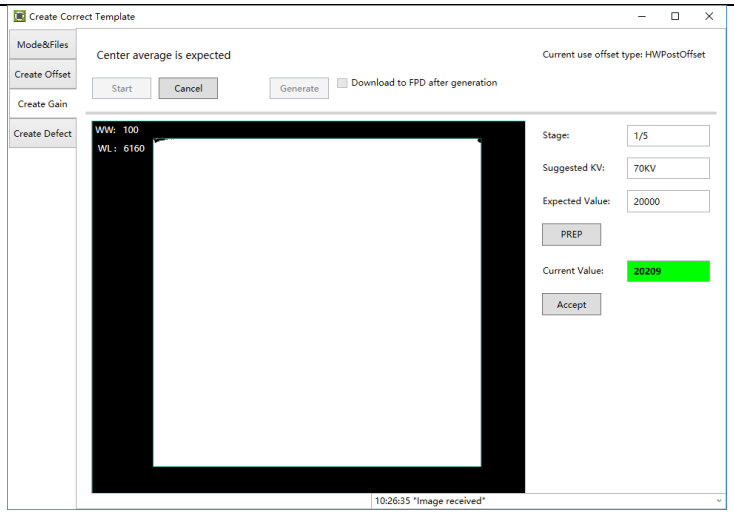
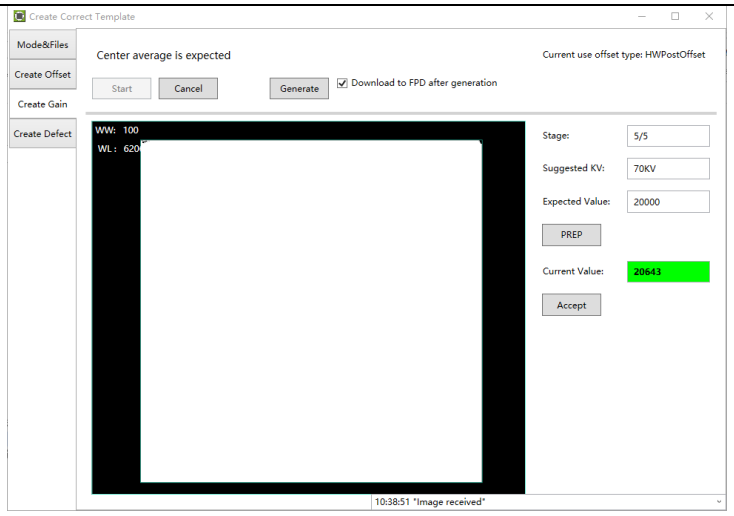
The correction and calibration should be performed after installation and it is recommended to perform the new correction and calibration after any major change on the system settings and hardware configuration. On the other hand, it is also recommended to do the correction and calibration in each 6 months.

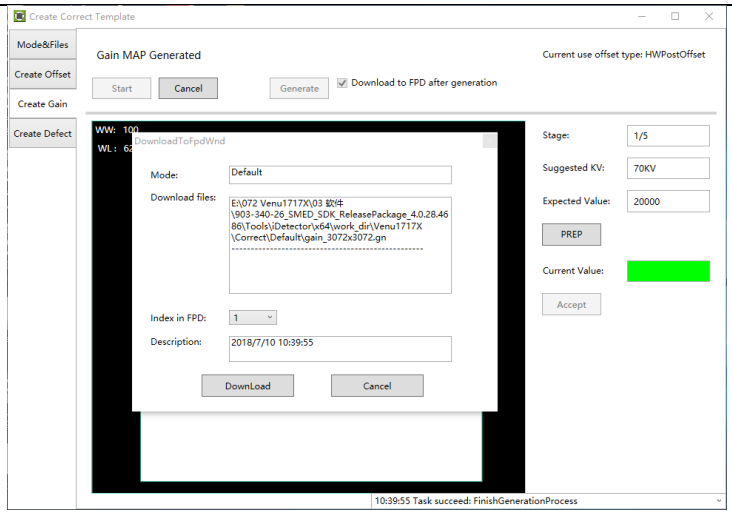
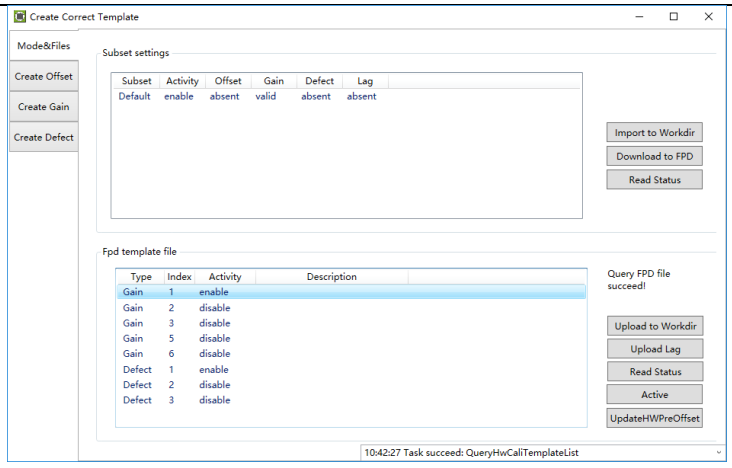
5.5.1. HW pre-offset Template Generation

Enter Acquire interface, select HWPostOffset option	
Enter Calibrate interface, click UpdateHWPreOffset button. Waiting until status bar displayed: "Task succeed: HwGeneratePreOffsetTemplate"	

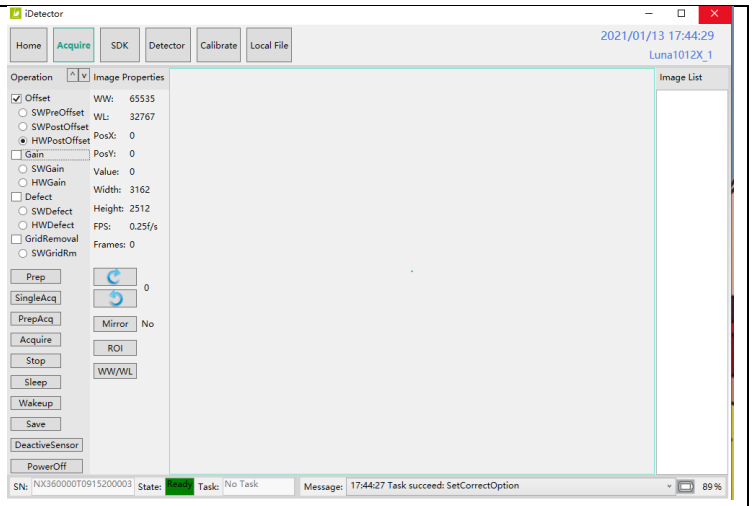
5.5.2. Gain Calibration Template Generation

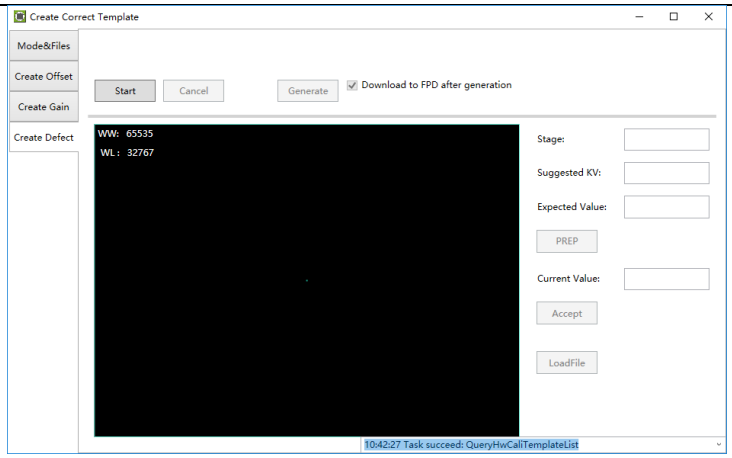
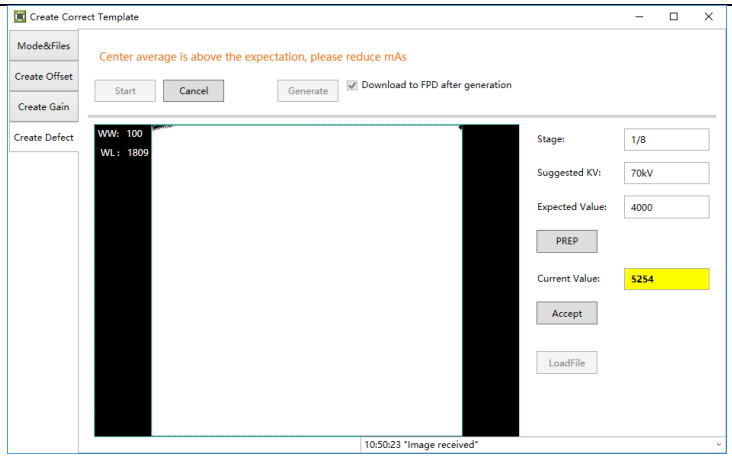
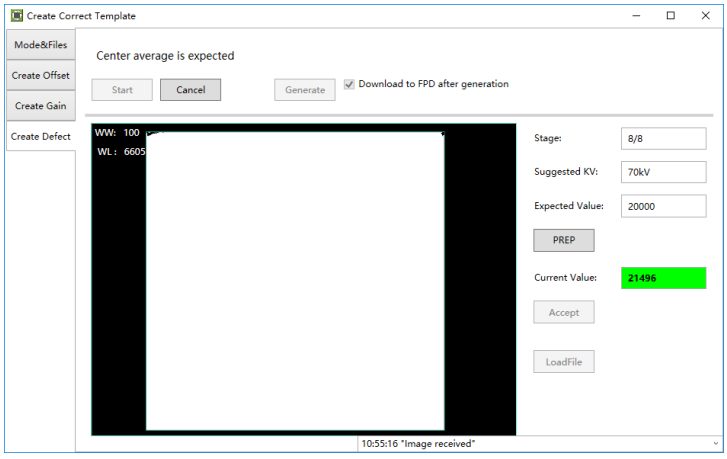
If the relative position between tube and detector changed or KV value changed, it suggest to create gain template file.

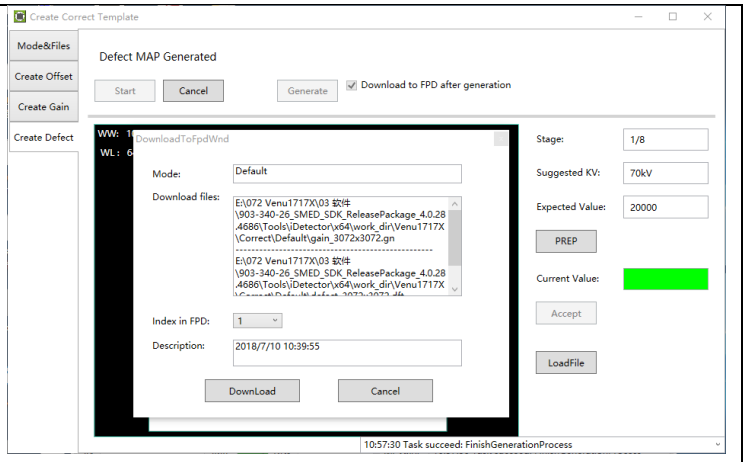
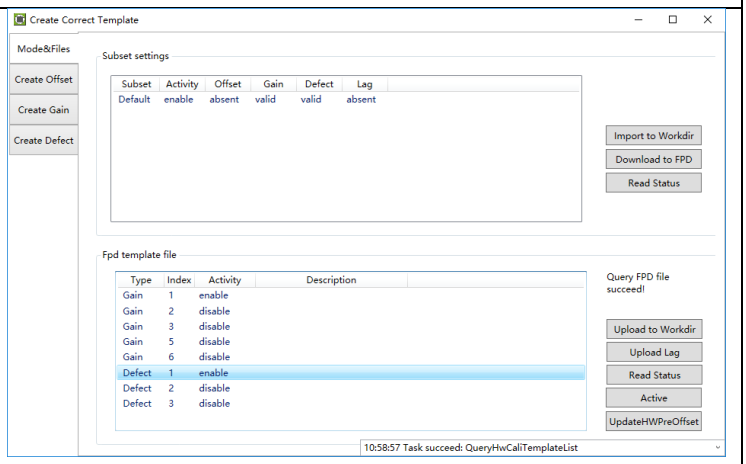
Enter Create Gain page Click "Start" button to start process.	
Click PREP button, acquire image. Please exposure after Acquire button enable. And click Acquire button to acquire image after exposure end. Click Accept button after acquired image. If Current Value textbox is yellow, click PREP button. Re-acquire images after adjust generator parameters. Note: In different trigger mode, the operation maybe have little difference. Please follow the UI tips. **Mind:** If the detector is in inner or Freesync mode, then user should finish the exposure before the time bar counting ends. And the click on Acquire is not necessary for inner or Freesync.	
Create gain template need several images. You can click Generate button to generate Gain template once one image was captured. But it may lead to imperfect template quanlity.	

Download template file dialog will pop up if "Download to FPD after generation" option was checked. Click Download button to download the template into the detector.	
Select Mode&Files tab. Click Read Status button to check whether just downloaded gain template is enable. If not, please click Active button to enable.	

5.5.3. Defect Correction Template Generation

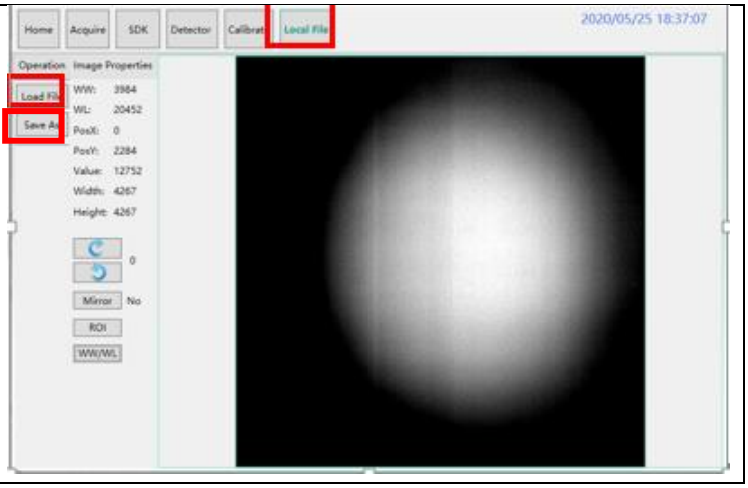
Enter Acquire UI. Choose HWPostOffset. Enter Calibrate UI. Select Create Defect tab.	

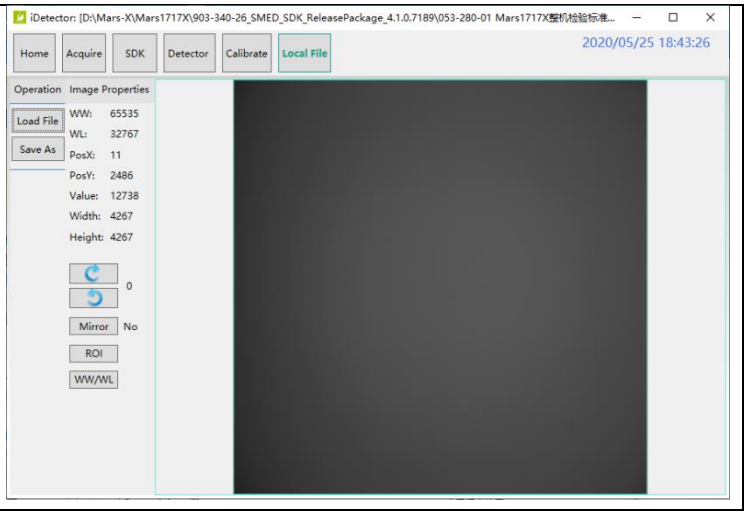
Click "Start" button to start process. Click PREP button, acquire image. Please exposure after Acquire button enable. And click Acquire button to acquire image after exposure end. Click	
Accept button after acquired image. If Current Value textbox is yellow , click PREP button. Re-acquire images after adjust generator parameters. Note: In different trigger mode, the operation maybe have little difference. Please follow the UI tips.	 Create Correct Template Mode&Files Create Offset Create Gain Create Defect Center average is above the expectation, please reduce mAs Start Cancel Generate Download to FPD after generation WW: 100 WL : 1809 Stage: 1/8 Suggested KV: 70kV Expected Value: 4000 PREP Current Value: 5254 Accept LoadFile 10:50:23 "Image received"
You can click Generate button to generate Gain template after acquired required images.	 Create Correct Template Mode&Files Create Offset Create Gain Create Defect Center average is expected Start Cancel Generate Download to FPD after generation WW: 100 WL : 6605 Stage: 8/8 Suggested KV: 70kV Expected Value: 20000 PREP Current Value: 21496 Accept LoadFile 10:55:16 "Image received"

Download template file dialog will pop up if "Download to FPD after generation" option was checked. Click Download button to download the template into the detector.	
Select Mode&Files tab. Click Read Status button to check whether just downloaded gain template is enable. If not, please click Active button to enable.	

5.6. Local Image Check

"OPEN" provides two features for image check and uploading. Local Image Check, Panel Image Upload. Local Image Check defines function to check image saved in Workstation. Panel Image Upload defines function to upload images stored in panel.

Click "Local File" button in "Local File" UI, choose the specified file In this page user can open the image files saved in local, the file formate can be raw, tiff, dft. When the software is disconnected to detector, the file still can be opened.	

Click “Load File”, there will be an open file wizard. Select file and click open or double click the file. The tiff file will be opened directly. For the raw file or dft file there will be a dialog to select image size. Select correct size to open image files. If the file is not correct user will get an error message. NDT1013LA image size: 4267*4267	

This page provides ROI tool, which can see the AVG, SNR, and other properties of the choosen image area by right mouse button.

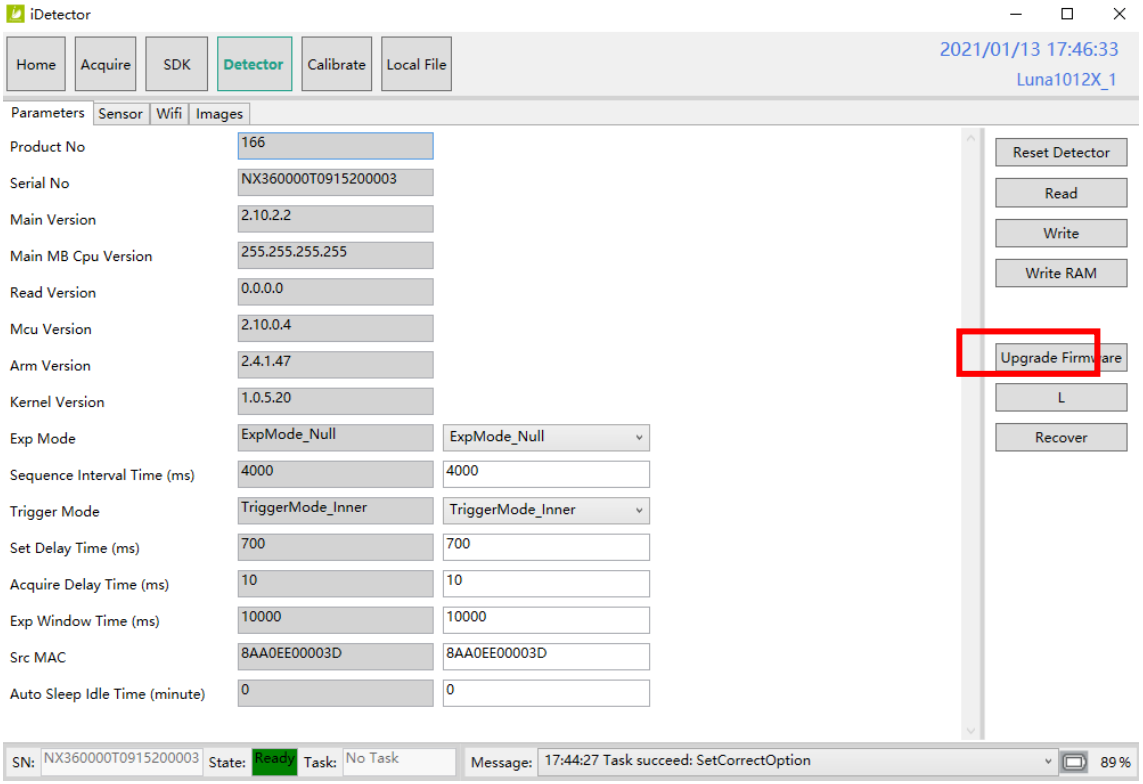
This page provides WW/WL tool as Acquire page . Click this button to auto adjust WW/WL based on selected area by right button of mouse.

Image Properties& Image Process	Description
WW	window width
WL	window level
PosX	X coordinates of the current cursor at the point
PosY	Y coordinates of the current cursor at the point
Value	Value of the current cursor at the point
Width	Image width
Height	Image height
	Rotate the image clockwise, 90 degrees every time.
	Rotate the image anticlockwise, 90 degrees every time.
Mirror	Open or close mirror
ROI	ROI tool，to view the image of the AVG, SV, SNR and other parameters. Press "ctrl" key, can create several ROI area.
WW/WL	Auto adjust WW/WL based on selected area by right button of mouse.

5.7. Firmware Upgrade

Panel supports upgrading firmware with IDetector, also allows the use of the Web way to upgrade the firmware, if a user needs to upgrade the firmware, please complete the following steps.

On “Detector” Page，“Parameter” Tab，user can upgrade firmware by entrance button “Upgrade Firmware”.



The firmware upgrade package may contain firmware of several units: ARM, FPGA, MCU.

NDT1013LA_IMAGE_44_ALL_20XX_XX_XX.ifrm

Word “ALL” indicates the file contains the firmware upgrade file for all units.

NDT1013LA_IMAGE_44_ARM_20XX_XX_XX.ifrm

Word “ARM” indicates the file is only for ARM.

NDT1013LA_IMAGE_44_FPGA_20XX_XX_XX.ifrm

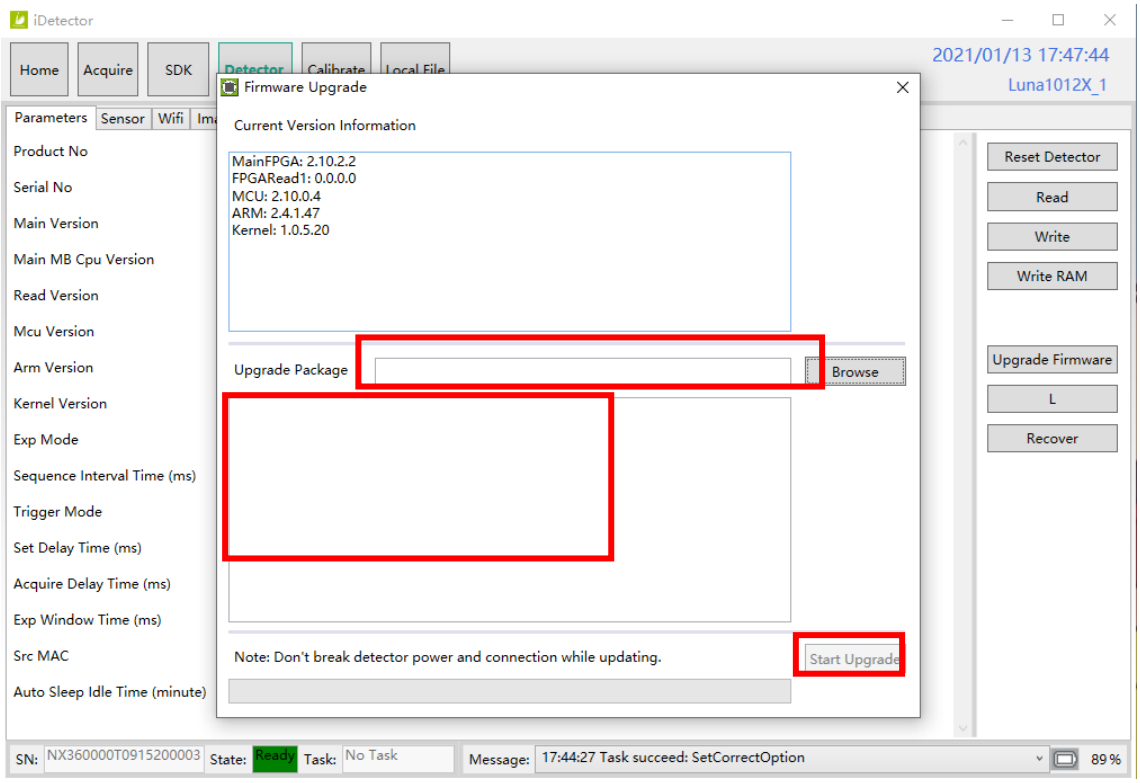
Word “FPGA” indicates the file is only for FPGA.

NDT1013LA_IMAGE_44_MCU_20XX_XX_XX.ifrm

Word “MCU” indicates the file is only for MCU.

User can choose one of these files as required to start the upgrade.

Choose the file that needs to be upgraded, and must check the package info to confirm if it is correct.



Note:

1. There is a progress bar for indication. Make sure battery is inserted and battery capacity is over 25%
2. Please make sure that iDetector shows “Ready”. It can also be checked by click “Config” button, there is firmware version.

6. Regulatory Information

FCC Compliance

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

  Reorient or relocate the antenna.

  Increase the separation between the panel and receiver.

  Connect the panel into an outlet different from the receiver is connected.

  Consult the distributor or an experienced radio/TV technician for help.

- Operation is subject to the following two conditions.

  The panel may not cause harmful interference.

  The panel must accept any interference received, including interference that may cause undesired operation.

- This device complies with FCC SAR exposure limits set forth for an uncontrolled environment. The equipment can be used in close proximity to the human body without any restrictions.
- Note: the grantee is not responsible for any changes or modifications not expressly approved by the party responsible for compliance. such modifications could void the user's authority to operate the equipment.

7. Trouble Shooting

Please refer to service manual. If the problem persists, turn off the panel and contact iRay service department (***service@iraygroup.com***). We would provide the best service

8. Service Information

8.1. Service Office Information

Service Office
Tel: +86 21 50720560
Fax: +86 21 50720561
E-mail: service@iraygroup.com
Location: No.33 Xinggang Road, Taicang Port Economic and Technological Development Zone, Jiangsu, China PC: 215434

8.2. Product Lifetime

The estimated product lifetime is up to 5 years under appropriate regular inspection and maintenance.

8.3. Regular Inspection and Maintenance

In order to ensure the safety of patients and operator, to maintain the performance and reliability of the panel, be sure to perform regular inspection at least once a year. If necessary, clean up the panel, make adjustments or replace consumables such as fuses etc. There may be cases where overhaul is recommended depending on conditions. Contact iRay service office or local iRay dealer for regular inspection or maintenance.

8.4. Repair

If problem cannot be solved, contact your sales representative or local iRay dealer for repairs. Please refer to the label and provide the following information:

Product Name:

Series Number:

Description of Problem: as clearly as possible.

8.5. Replacement Parts Support

Main parts (parts required to maintain the function of the product) of this product will be stocked for 5 years after discontinuance of production for repairing.

Appendix A Information of Manufactures

COMPANY: iRay Technology Taicang Ltd.

ADDRESS: No.33 Xinggang Road, Taicang Port Economic and Technological Development Zone, Jiangsu, China

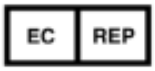
ZIP CODE: 215434

TELEPHONE: +86 0512-53690872

FAX: +86 0512-53690872

HOMEPAGE: *WWW.IRAYGROUP.COM*

Appendix B Information of Europe Representative



COMPANY:	iRay Europe GmbH
ADDRESS:	IN DEN DORFWIESEN 14, 71720 OBERSTENFELD GERMANY
ZIP CODE:	/
TELEPHONE:	+49-7062-977 88 00
FAX:	+49-7062-976 0571
HOMEPAGE:	WWW.IRAYEUROPE.COM