DELFT IMAGING

User Manual

Delft Light

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About this manual

The Delft Light is especially designed for TB screening projects in remote locations. All components like the X-ray tube and detector operate on rechargeable batteries and the system comes as a complete package with a tube and detector stand.

This user manual complements the reference manuals provided with this system and cannot replace these manuals. When the user manual and the reference manual differ, the reference manuals are considered as leading.

Important notices

Delft Imaging does not assume responsibility for the misuse of the Delft Light soft- and hardware. Since Delft Imaging cannot control the use of the Delft Light, it shall not be held responsible for any direct or consequential personal injury or damage.

Introduction

Consideration on deployment

The Delft Light is a portable X-ray system which can be deployed in almost any venue, room or even a tent. Local radiation safety rules need to be followed to obtain high quality images with the least amount of radiation (ALARA principle).

Because of its nature there is no 'standard' setup for the Delft Light while this always depend on the venue used, amount of space, patient flow etc. Some considerations for a correct use are:

- Patient flow, where do patients enter/exit the room?
- X-ray beam direction. Where does the primary beam point to? This maybe a trade off with the patient flow.
- Radiographer area. What is a safe distance for the radiographer, additional lead shielding available?
- What is the maximum distance between the X-ray and detector stand? Minimum distance should be at least 120 cm.

Notice for save operations

The Delft Light is a fully **battery-operated X-ray system**. Annex A provides detailed information on the correct use and storage. Some important considerations:

Battery (X-ray/detector)

- Always store the batteries is a save location (the backpack) when not in use.
- Always check the batteries on mechanical damage and or leakage before use.
- Never use a battery with apparent mechanical damage and/or leakage
- Always use the delivered battery chargers and power cords.
- When the Delft Light is not in use for a longer period recharge the batteries at least every 5 months.

ATXtreme (X-ray)

- Although the Delft Light is a portable system the X-ray generator and tube weigh 8 kg. Take special care when mounting the X-ray part to the provided stand.
- Always use the fall save mechanism attached to the stand to prevent the X-ray tube from dropping when adjusting the system to the required height.

Flat panel detector

- Always use the fall save mechanism attached to the stand to prevent the detector from dropping when adjusting the system to the required height.
- Always use the provided detector holder to prevent damage to the image sensor.

Installation

Assembly of the X-ray and detector (wall) stand

Attach the upper part of the detector and X-ray stand to the lower using the provided guidance strip and bolts. Determine the best way to setup the stands in the available venue, see above considerations on correct placement.

Take all components out of the backpack. Before starting, make sure both the detector and X-ray batteries are fully charged.

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Detector installation

<table>
<tr>
<td>1. If not done put the detector in the holder. Make sure the image area faces the front of the holder. The battery part should be visible on the back. Make sure the battery is full before installing it. See image for reference.</td>
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<tr>
<td>2. Carefully hang the detector holder on the Versarix holder. Power on the detector using the power button on the side.</td>
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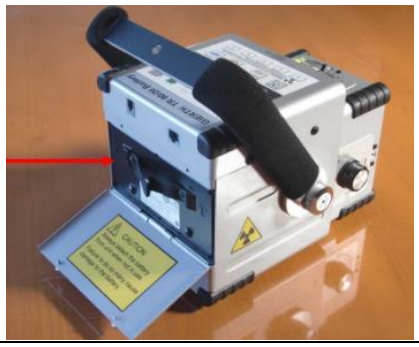
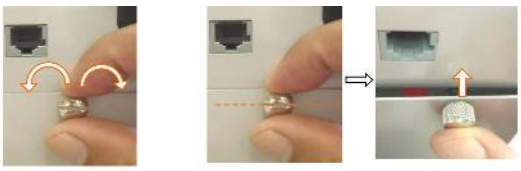
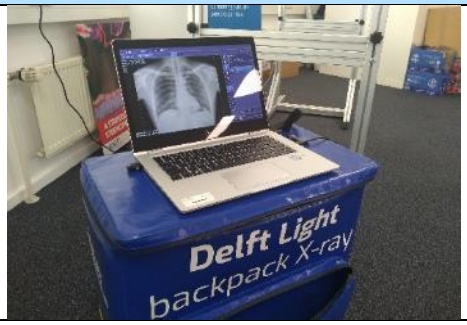
X-ray tube/generator installation (ATXtreme)

1. Unpack X-ray stand from flight case and assemble. (Refer to Delft Light instruction movie how-to).	
2. Using the grip on the ATXtreme attach the grip to the spring-arm of the X-ray stand and securely fasten the provided screw, level the ATXtreme using the provided level. Measure SID with provided ruler.	
3. Install the Li-Ion battery.	
4. How to open/close battery compartment:	
5. Attach the exposure switch to RJ45 connector on the back of the ATXtreme.	
6. Power on X-ray by pressing the power button. After initialisation the display will show kV and mAs settings of the last exposure taken.	

Operator laptop

1. Unpack X-ray laptop from backpack and put it on a stable surface (the top of the backpack can be used for this).	
2. Connect the CXDI LAN cable between the laptop and detector using the provided USB-c-2-UTP converter. See image for reference.	
3. Power on the laptop and logon to the CANON NE software.	

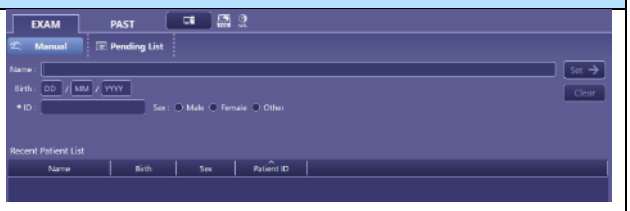
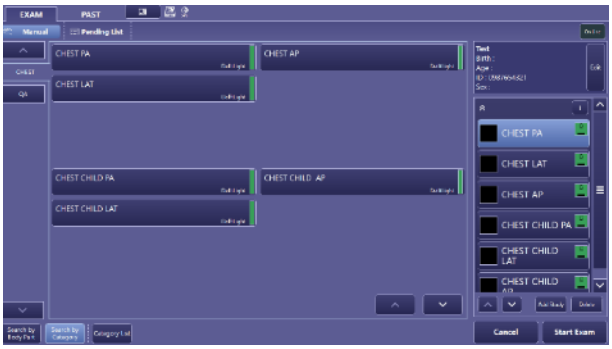
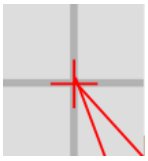
Workflow step by step

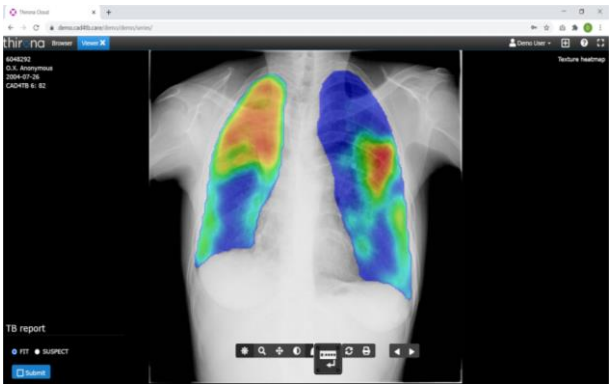
After installation of all components the system can be used to start screening. The Delft Light supports several methods of Patient identification:

- Using an existing (radiology) Information System using Dicom Modality Worklist protocols
- Typing in the patient demographics
- Using a bar- or QR scanner which will automatically fill in the required demographics like, Name, Sex, Date of Birth and a unique identifier by scanning the bar- or QR-code.

The following procedure should be done before the patient or participant is called into the room.

Making an image

1. Press **EXAM TAB**. Depending on the method of entry either scan the bar- or QR-code or manual enter the required patient demographics. Press **Start Exam.**	
2. Select the required protocol (CHEST PA) Press **Start.**	
1. After initialisation a green bar showing **Ready** will appear on the right upper corner. Call in the participant/patient and position him/her in the correct way.	
2. Press the collimation light button and adjust detector and X-ray height using the provided laser cross.	 
3. Select the required kV/mAs setting on the ATXtreme by using the preselect buttons.	

4. Ask the participant/patient to breath in and hold and immediate press the expose button. After a few seconds the image will appear. Check image and collimation adjust ROI if necessary, press **END EXAM.**	
5. Press CAD4TB button to display CAD4TB score and heatmap.	

Shutting down system

1. Shutdown the laptop by pressing the **System Button.**	
2. Press **shutdown** Button. The laptop will shut down. Disconnect USBs-2-UTP converter and put the laptop in the front of the backpack.	
3. Power off the CXDI 702c detector by pressing the power button on the side for > 3 seconds. Remove the detector cable and take out the detector of the stand, put cable and detector in backpack.	
4. Power off by pressing the Power button. Remove the X-ray unit from the stand and remove the battery. Store components in the backpack.	

ANNEX A TECHNICAL SPECIFICATIONS DELFT LIGHT

Items		Specification
Electrical Power		1,35 kW @ 90 kV, 15 mA
Device power source	22.2 VDC (Battery)	22.2 VDC (Battery)
Battery		DC 59,2 V, Li+ battery
Frequency		120kHz
kV, mA		40-90 kV / 2 kV steps
X-ray exposure time range [sec]		0.01 ~ 1 sec / 0,01 steps
Accuracy of output	Accuracy of radiation output	± 10%
X-ray tube	Model	Toshiba D – 0814
	Inherent filtration	0.8mm AL
	Focal spot	0.8 x 0.8mm
	Anode heat storage	10.000 HU
Total filtration (HVL)	Tube Inherent Filtration	0.8mm AL
Beam limiting device	Addition Filtration	0.5mm AL
Size		22(H)x18(W)x25(H) cm
Weight		7 kg
Detector		CXDI 702-c
Effective pixel area		2240 x 2992
A/D conversion		14/16 bits
Preview time		< 3 sec
DQE		85%
Size		35 x 43 cm
Weight		3 kg

ANNEX B Suggested exposure time table for an average person weighing 70 kg.

Region	Diagn. Ref. value (cGy x cm²)	Pro-jection	SID (cm)	Grid	kV	mAs
Cranium	110	PA	100	x	78	6,3
	100	LAT	100	x	68	5,6
Thorax	20	PA	120-180	x	90	1,0
	100	LAT	120-180	x	120	2,5
		AP	100	x	76	2,1
Abdomen	550	AP	100	x	80	7,0
Cervical spine		AP	100	x	64	4,2
		LAT	100	x	70	4,2
Thoracic spine	220	AP	100	x	74	7,0
	320	LAT	100	x	84	7,3
Lumbar spine	320	AP	100	x	84	8,1
	800	LAT	100	x	90	8,5
Pelvis	500	AP	100	x	84	6,4
		LAT	100	x	94	8,5
Hip		AP	100	x	84	4,2
Shoulder + Clavicle		AP	100	x	74	4,2
Upper arm		AP/LAT	100		60	4,0
Elbow		AP	100		52	4,0
		LAT	100		50	5,0
Hand + Wrist		AP	100		50	3,0
		LAT	100		54	4,0
Femur		AP	100		70	3,5
		LAT	100		70	2,8
		AP	100		64	4,2
		LAT	100		64	3,5
Tibia + Fibula		AP	100		64	3,5
		LAT	100		64	3,5
Ankle		AP	100		54	6,4
		LAT	100		50	4,0
Ankle joint		LAT	100		56	4,0
Toe		AP	100		46	3,0

ANNEX C MOBISUN SOLARPANEL

The **Delft Light** (backpack X-ray) has an option to use it with the Mobisun solarpanel, Li-ION battery and inverter. This system is to power all required components with a portable(6kg) solar/powerpack!

The internal battery capacity is enough to recharge the X-ray and detector batteries and power the CANON laptop and CAD4TB tablet.

The 25 Watt integrated solar panel takes 16 hours to fully charge the Mobisun internal battery again. It is also possible to use the GRID to recharge the internal battery, which takes approx. 2,5 hours.

KEY features:

- Output 230 VAC @ 250 Watt
- Output 2 x USB, 5 Volt, 3,2 Amp
- Peak power 500 Watt,
- Battery capacity 70 Ah, 256 Wh
- Water resistant IPX4
- Possible to add more portable solarpanels to reduce recharging time
- Dimensions 550x300x50 mm
- Weight 6 kg

Operation
Install the Mobisun in a location where it can capture most of the (sun) light. Attach the delivered power cable to the 230 VAC power outlet on the side. Select 230 VAC AC operation by flipping the switch to 230 VAC. Now the internal battery is able to power the two battery chargers (one for the detector, one for the X-ray) and the laptop