RAD

Serial Radiography Support for the Mobile X-ray System MobileDaRt Evolution™ MX8 Version

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1. Introduction

To monitor the changes in patients' conditions in isolation wards and Intensive Care Units (ICU) for infectious diseases like COVID-19, moving patients from their rooms to examination rooms like CT scans involves risks. Therefore, it is becoming necessary to manage patients' conditions without moving them from their rooms.

Our stationary diagnostic X-ray system, RADspeed Pro, allows for serial radiography under respiration, enabling the acquisition of video data. Additionally, using Konica Minolta's X-ray video analysis workstation "KINOSIS" for image analysis of video data helps in managing patients' conditions. By realizing bedside serial radiography with a mobile X-ray system, it is possible to manage patients' conditions without moving them from their rooms to examination rooms. We are introducing the MobileDaRt Evolution MX8 Version, developed to enable bedside serial radiography **(Fig.1)**.

KINOSIS is limitedly available abroad currently.

2. Serial Radiography Compatibility

Adopting Konica Minolta's Digital Radiography (DR) system compatible with serial radiography, the MobileDaRt Evolution MX8 Version enables serial exposure by rapidly and intermittently emitting multiple pulses of X-ray in coordination with the Image Panel Detector's (FPD) image accumulation action **(Fig.2)**.

2.1 FPD
Wireless serial radiography is possible using a cassette-type FPD. The basic specifications are shown in **Table 1**. Besides the FPD compatible with serial radiography, a lightweight FPD exclusively for static radiography is also available.

2.2 Integration with X-ray Video Analysis Workstation "KINOSIS"
Video data acquired through serial radiography can be sent to the X-ray video analysis workstation "KINOSIS," enabling image analysis to support patients' condition management using "KINOSIS." Various image processing performed by "KINOSIS" can enhance the visibility of the captured images. It

Fig.1 Appearance of MobileDaRt Evolution™ MX8 Version

Table 1 Basic Specifications of Wireless FPD

	Serial Radiography Compatible		Exclusive to Still Photography	
Size	17 × 17 inches	14 × 17 inches	17 × 17 inches	14 × 17 inches
Effective FOV	424.8 × 424.8mm	348.8 × 425.6mm	424.8 × 424.8mm	348.8 × 425.6mm
Number of Pixels	4,248 × 4,248	3,488 × 4,256	4,248 × 4,248	3,488 × 4,256
Dimensions	460(W)×460(D)×15(H)mm	384(W)×460(D)×15(H)mm	460(W)×460(D)×15(H)mm	384(W)×460(D)×15(H)mm
Weight	3.2kg	2.6kg	2.3kg	1.9kg
Dust and Water Resistance	IPX6		IP56	
Scintillator	CsI			
Pixel Pitch	100μm/200μm			
Wireless LAN	5.0GHz/2.4GHz			
Battery	Lithium-Ion Capacitor			

is expected that this image processing will visualize and quantify "movement," which can be used for symptom estimation and functional evaluation.

2.3 Continuous Pulse X-ray Irradiation
In coordination with the FPD's image accumulation action, pulse X-rays are exposed rapidly and intermittently. Up to 15 still images per second can be captured continuously for up to 20 seconds, allowing for a maximum of 300 images in serial radiography.

2.4 Minimizing Tube Current-Time Product
Serial radiography increases the patient's exposure compared to standard static radiography. Therefore, it is necessary to minimize the exposure per pulse as much as possible. While the minimum tube current-time product was 0.32mAs in devices only for static radiography, serial radiography required exposures with a smaller tube current-time product. Hence, improvements in the stability of X-ray output at low doses have allowed us to reduce the minimum tube current-time product to 0.1mAs.

3. Design Enhancements for Operator Convenience

To increase convenience in the medical field, the following features have been added to the X-ray system:

3.1 FPD Docking Mechanism
Considering the possibility of FPD batteries running low during rounds, previous systems required connecting the FPD to the system via a cable for charging. However, forgetting to connect the cable during rounds could lead to insufficient battery charge. With the increase in the device's applications, including serial radiography, the frequency of FPD use and the need for charging are expected to rise. Therefore, we developed an FPD docking mechanism that automatically connects the FPD to the system for charging when stored in the device **(Fig.3)**. This mechanism not only prevents forgetting to charge the FPD battery but also eliminates the need for cable connections, improving workflow.

Clinical imaging provision : KONICA MINOLTA, INC.

Fig.2 Compatibility with serial radiography

Fig.3 FPD Docking Mechanism

3.2 DR System Power-Off Feature for Low Battery Levels

When the battery level of the system main body is low, an alert is continuously displayed on the X-ray control panel above the touch panel monitor, notifying the operator. If not charged within 10 minutes, the system main body powers off. Furthermore, if there is no touch operation on the DR system for a set period after the system main body is powered off, the DR system will automatically shut down in coordination with the system main body. This interaction between the system main body and the DR system prevents the battery from draining to zero if the DR system's power is inadvertently left on.

4. Conclusion

We introduced the newly supported serial radiography feature and the FPD docking mechanism developed for the MobileDaRt Evolution MX8 Version. This system is expected to reduce the workload on operators and patients alike, contributing to greater efficiency and improved diagnostic quality not only in hospital rounds but also in operating rooms, ICUs, emergency medicine, NICUs, and more. We will continue to provide better systems by considering feedback from the medical field.

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