Multi-Purpose R/F System with Portable FPD FLEXAVISION F3 Package

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1. Introduction

R/F systems that were mainly used in the past for diagnosis through gastrointestinal examinations are now widely employed for orthopedics and for non-vascular IVR applications such as ERCP. Under these circumstances, there are demands not only for enhanced visibility of fluoroscopy images at all positions, but also for further reductions in exposure and an adequate field of view to observe the target location with a single imaging examination.

Image digitization integrates realtime image display and network connectivity and has been introduced due to its advantages in terms of medical treatment costs. In particular, due to their superior field of view, image quality and sensor geometry, flat panel detectors (FPDs) are expected to be applied to all types of examinations.

To meet such demands from medical facilities, we developed the FLEXAVISION F3 Package with portable FPD that inherits the excellent performance of the previous FLEXAVISION R/F table (I.I.-CCD fluoroscopy type), while permitting fluoroscopy imaging over the largest field of view in its class.

2. Product Concept

(1) Integrated management of fluoroscopy and radiography data

The FLEXAVISION F3 Package uses a single FPD to handle the fluoroscopy and radiography that were conventionally performed separately by CR and I.I.-DR, to increase the efficiency of examination record management.

(2) Large-field–of-view FPD to support diverse examinations

A 17×14-inch large-field-of-view FPD enhances the efficiency of examinations that require a wide field of view.

(3) Offering new types of examination by using the portable FPD for radiography and fluoroscopy

The FLEXAVISION F3 Package exploits the advantages of the portable FPD to support plain radiography and a variety of other examinations, such as lateral radiography on the tabletop and chest radiography[*2] in a standing position on the bucky stand.

Fig. 1 FLEXAVISION F3 Package

3. System Configuration and Specifications

The FLEXAVISION F3 Package employs a 17×14 inch, portable FPD that supports fluoroscopy. Cesium iodide (CsI) that offers excellent conversion efficiency is used for the X-ray conversion film to deliver high-definition fluoroscopy and radiography images. As with conventional R/F tables, elevating and fixed type tables are available to accommodate various examination objectives. **Table 1** shows the main specifications of the system.

Configuration	Specifications
R/F table	Movement range of imaging chain: 90 cm Transverse movement range of tabletop: 22 cm Table tilting range: 90° to -30° X-ray tube extension: 1.5 m Oblique projection: ± 30°*1 Tabletop height: 69 cm to 95 cm (elevating table type)
X-ray flat panel detector (FPD)	X-ray conversion method: CsI Construction: Portable Field–of-view sizes: 14"×17", 17"×14", 14"×14", 12"×12", 9"×9" Pixel pitch: 160 μm Max. effective pixels: 2,208×2,688 (14"×17") Number of AD conversion bits: 14 bits
Image processor	Storage capacity: 80,000 frames min. Fluoroscopy storage: 1000 frames max. Pulsed fluoroscopy: 15/10/7.5/4 fps Serial radiography: 15 fps Preview image display: 3 s max. Density resolution: 12 bits Noise reduction processing: Recursive filter, multi-frequency processing Real-time image processing: AWC, black/white inversion, vertical/horizontal image inversion, zoom (2× max.) Post-processing: Annotation & measurement (distance, angle) DICOM: Print, Storage, MWM, MPPS*1,*2 IHE*1,*2: SWF, PIR
High-voltage X-ray generator	50 kW inverter system (32 kW for single-phase) or 80kW
X-ray tube	400 kHU (600 kHU also available*1) 0.3/0.8 mm or 0.6/1.2 mm

Table 1 Main specifications

*1 Optional

4. Features of the System

The FLEXAVISION F3 Package portable FPD provides a convenient examination environment able to support a variety of examination scenarios that cannot be handled by a fixed FPD.

(1) Landscape/portrait selection

The 17"×14" FPD can be rotated in its tray as required to switch between portrait and landscape orientations. In the portrait orientation, it can capture images covering the kidneys and bladder during drip infusion pyelography (DIP). In the landscape orientation, it can image the pelvis of a subject with a large body type in a single image.

Fig. 2 Rotating the FPD

(2) One-Panel Solution for diversification of fluoroscopy room operations

Examinations using R/F systems are diversifying beyond fluoroscopic examinations of the gastrointestinal tract, such as stomach examinations, that used to represent the majority of examinations performed using R/F systems. Despite the increased demand for specialized applications, such as mammography and bone mineral density measurement systems, the capacity utilization of general radiography systems remains high. In this situation, the F3 Package improves the space utilization and allows an examination room that was previously dedicated to fluoroscopy to be used as a multi-purpose examination room (used for both fluoroscopy and radiography) that can also handle plain radiography **(Fig. 3)**. Shimadzu offers a One-Panel Solution that applies a single-panel FPD to a variety of examination types from fluoroscopic examinations of the gastrointestinal tract to plain chest radiography and other plain radiography.

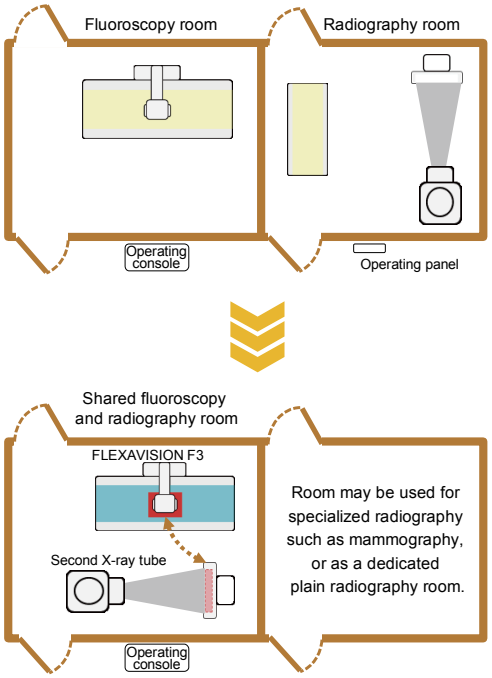

Fig. 3 One-Panel Solution

• Radiography of limbs and hands

The portable FPD can be removed from the R/F table to perform radiography. The limb or hand to be examined is placed in direct contact with the FPD and radiography is performed on the tabletop **(Fig. 4)**.

Fig. 4 Tabletop Radiography of Limbs and Hands

• Chest radiography*2

Chest radiography can be performed with the FPD mounted on the bucky stand. The X-ray tube attached to the R/F table can be rotated into position, or a second X-ray tube suspended from the ceiling may be used.

• Abdominal radiography

When the FPD is mounted in the optional FPD holder, lateral radiography is possible using a second X-ray tube. This is effective for radiography in the decubitus position **(Fig. 5)**.

Fig. 5 Decubitus Radiography

(3) Reduced X-ray exposure dose

Fluoroscopy and radiography can be performed with the X-ray grid removed. This is an effective measure in pediatrics and gynecology where fluoroscopy and radiography must be performed at a lower X-ray exposure dose.

In addition, the new type of collimator allows the BH (Beam Hardening) filter to be selected for the radiological examination. The X-ray exposure dose can be further reduced by using pulsed fluoroscopy that is provided as standard.

5. Conclusion

The F3 Package offers a large field–of-view, portable FPD for the FLEXAVISION R/F System. It is a multi-purpose system that can be used in diverse examination scenarios. The One-Panel Solution delivers added values by creating a shared fluoroscopy and radiography room.

In the future, Shimadzu will further develop its R/F systems to further enhance functionality, improve image quality, and reduce X-ray exposure in order to meet the diversifying needs of the marketplace.

Note) The functions described include options.

*2 WIP