RAD

Development of the New - "RADspeed Pro™ SR5 Version" - Radiography System

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1. Introduction

Our RADspeed Pro series radiography systems are widely used in many medical facilities as a system that achieves high operability and improved examination efficiency. This is made possible with a variety of optional features, such as power assist, auto-positioning, synchronized vertical movement, and automatic irradiation field tracking functionality. However, the tasks required of physicians and radiological technologists are becoming increasingly advanced and complex, making it more challenging to perform these tasks while paying adequate attention to patients.

In response, we have developed the new RADspeed Pro SR5 Version, equipped with optional camera functionality that can acquire live images from a camera integrated into the collimator on monitors located on the X-ray tube support and display them on the X-ray high-voltage generator operation console **(Fig. 1)**. This functionality helps operators balance patient care with task execution. This article details the modifications made from the previous model and provides an in-depth explanation of the camera functionality for assisting operator vision.

Fig.1 RADspeed Pro™ SR5 Version

2. Modifications from Previous Model

2.1 X-Ray High-Voltage Generator Operation Console

The operation console of the X-ray high-voltage generator has been completely redesigned with a 10-inch color LCD touch panel for enhanced operability **(Fig. 2)**. The console is equipped with buttons for both coarse and fine adjustments of tube voltage, which allows changing settings to the desired value more quickly.

In addition, the illumination feature from the previous model has been retained. This enables the operator to visually confirm the system's status based on color-coded indicators. For example, the indicators illuminate green when the system is ready for exposure and red when an error occurred. That allows the operator to confirm the system status at a glance.

Fig.2 X-Ray High-Voltage Generator Operation Console

2.2 Ceiling-Mounted X-Ray Tube Support

The X-ray tube support now features a 12-inch large LCD touch panel with excellent visibility, allowing operators to modify exposure settings and irradiation field size. Furthermore, an illumination function has been incorporated into the upper surface of the control unit. The illumination color of the indicators enables the operator to visually confirm the system's status.

Like the previous model, the X-ray tube support includes optional power assist functionality that uses precise motor control to aid handle operations. This feature, based on our proprietary GLIDE Technologies™, detects the force applied to the handle via sensors and adjusts the motor operating for each axis accordingly. The assist level can be selected from three settings depending on the operationg situatione. For example, when large movements are needed, the unit can be moved quickly with a light force, while fine positioning can be performed with high precision, allowing the operator to adapt to various situations.

Additionally, the lock release button has been improved so that it changes its display orientation according to the position of the X-ray tube (supine or standing), which facilitates intuitive operation. Moreover, an all-free switch and hand grip have been newly installed at the bottom of the X-ray tube support, making it easier to operate even when the X-ray tube is located in a high position **(Fig. 3)**.

Fig.3 Hand Grip on the Lower Area of the X-Ray Tube Support

2.3 Wireless Hand Switch and Remote Control (Fig. 4)

A wireless exposure hand switch is now available (optional). This enables operators to activate the ready mode within the radiography room so they can immediately start the exposure from the control room. This workflow reduces the time required for positioning and exposure, thereby improving examination efficiency.

Additionally, the remote controller for auto-positioning functionality (optional) has also been made wireless, allowing operators to perform auto-positioning operations from any location without worrying about the cable.

3. Features of the VISION SUPPORT Camera Functionality

The newly introduced VISION SUPPORT functionality, is designed to assist the operator's vision. The live video captured by the camera integrated into the collimator is displayed on the monitors of both the X-ray tube support and the X-ray high-voltage generator operation console. To ensure patient privacy, the camera is equipped with a physical shutter for shielding.

VISION SUPPORT functionality comprises three main features that assist the operator's vision during various stages of the examination workflow, from positioning to retaking images.

3.1 "Live View Display" Assists Accurate Patient Positioning

Live View Display overlays color-coded markers on camera images to assist accurate positioning of the patient. The X-ray detector region is marked with blue lines, the irradiation field is marked with yellow lines, and the AEC (Auto Exposure Control) detection fields are marked with blue shading **(Fig. 5)**.

Fig.4 Wireless Hand Switch (Left) and Wireless Remote Control (Right)

Fig.5 Live View Display Function

As part of the examination workflow, the operator can adjust the patient's positioning in the radiography room by visually checking the live view displayed on the X-ray tube support console. Then, in the control room, the operator can perform a final check of the patient positioning using the monitor on the X-ray high-voltage system console before initiating X-ray exposure. This workflow ensures smooth and accurate patient positioning.

Note: AEC detection field overlay display is not supported in the U.S. market.

3.2 "Motion Detection" Reduces the Frequency of Retakes Due to Patient Movement

The Motion Detection function shows patient movement as green areas on the screen and displays a message when a certain level of movement is detected. This reduces the frequency of retakes caused by patient motion (Fig. 6).

After positioning the patient, the operator initiates motion detection using the buttons on the X-ray tube support console or the wireless hand switch. The operator then checks for movement on the monitor in the control room. If no movement is detected, X-ray exposure is performed. If movement is detected, the patient is repositioned before proceeding. That workflow reduces the frequency of retakes.
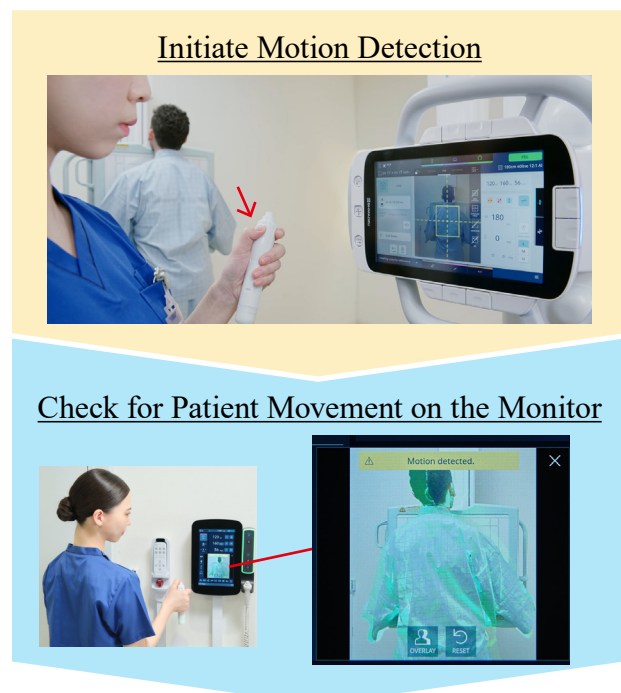

Initiate Motion Detection

Check for Patient Movement on the Monitor

Fig.6 Motion Detection Function

3.3 "Last Position Display" Supports Positioning Corrections

The Last Position Display function shows the camera image captured during the most recent X-ray exposure. This helps the operator reposition the patient more smoothly, if a retake is necessary after an image has been rejected (Fig. 7).

For radiographic views with a required position that is difficult to maintain, such as frontal views of the cervical spine or a shoulder joint, the patient may have moved since the previous exposure. If movement occurred, the Last Position Display function can be used as a reference for repositioning.
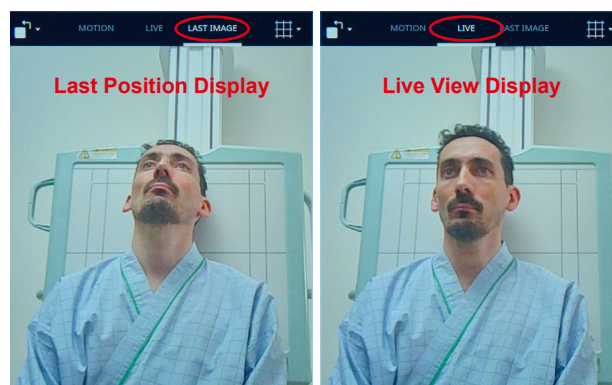

Last Position Display

Live View Display

Fig.7 Last Position Display Function

4. Conclusion

This article described the RADspeed Pro SR5 Version radiography system, which is equipped with camera functionality that helps operators provide patient care while efficiently performing their tasks. By enabling operators to monitor patients from both the examination room and the control room, the camera functionality contributes to improved patient care and workflow efficiency during examinations.

Shimadzu continues to promote imaging transformations (IMX) by incorporating AI and IoT technologies to provide new added value to X-ray imaging systems. Through IMX measures, the aim is to develop products that reduce the burden on both operators and patients from the perspective of medical professionals.

Finally, we would like to express our sincere gratitude to all the medical professionals who generously cooperated and contributed to the development of this system.