

Experience Using RADspeed Pro after Adding POWER GLIDE



Yoshiyuki Ioka, R.T.

Department of Radiology, Japanese Red Cross Aichi Medical Center Nagoya Daini Hospital
(formerly Japanese Red Cross Nagoya Daini Hospital)

Yoshiyuki Ioka

1. Hospital Introduction

Japanese Red Cross Aichi Medical Center Nagoya Daini Hospital (formerly Japanese Red Cross Nagoya Daini Hospital) (Fig. 1) is a foundation hospital in the eastern part of Nagoya City. The hospital is equipped with advanced medical equipment and the latest facilities and was the first hospital in Aichi Prefecture to be approved as a regional medical care support hospital. The hospital provides regional medical care as a critical care center, general perinatal care center, disaster base hospital, and designated regional cancer care hospital, and is also accredited by Joint Commission International (JCI), an international organization that evaluates the quality of medical care and patient safety.

The hospital also goes by the name “Yagoto Nisseki,” taken from the name of the local area, and the nearby subway station is also called “Yagoto Nisseki Station.” The hospital has 806 beds (804 general beds and 2 beds for class 1 infectious diseases) and 1,859 members of staff (as of June 1, 2021), with 41 radiological technologists on staff including 30 men and 11 women.

The general radiography examination room is located in the Diagnostic Imaging Center (Fig. 2) on the first basement floor of ward 3, where one dedicated chest radiography system and four



Fig.2 Diagnostic Imaging Center Reception

general radiography systems are in operation. General radiography is a crucial examination used to prepare radiographs of various parts of the body, such as the chest, abdomen, and every bone in the body. The importance of general radiography is shown by the approx. 10,000 examinations performed in April 2021 alone.

2. Background to Acquisition of RADspeed Pro

In May 2019, one of our four general radiography systems was replaced due to aging equipment. Shimadzu’s RADspeed Pro was selected based on the following primary requirements: (1) able to perform long view radiography with ease, (2) X-ray tube support can be controlled with ease, (3) substantial improvement in patient imaging



Fig.1 External View of Japanese Red Cross Aichi Medical Center Nagoya Daini Hospital
(formerly Japanese Red Cross Nagoya Daini Hospital)

throughput. As well as the ability to perform tomosynthesis and long view radiography with ease, RADspeed Pro comes equipped with convenient functions such as an automatic system tracking function and auto-positioning function for imaging. However, due to the multifunctional design of the X-ray tube support control unit and collimator unit, the equipment is heavy, weighing approx. 300 kg. As a result, we have had concerns about the large physical strain on operators when manually operating the X-ray tube support. Therefore, when the general radiography systems were updated in February 2021, we added the “POWER GLIDE” power assist function to our existing RADspeed Pro system to reduce the physical strain on operators when manually operating the X-ray tube support.

3. Outline of Existing System

3.1 X-Ray Tube Support Control Unit

The X-ray tube support control unit has a liquid crystal display (touch panel) that displays the patient's name and SID, and can also be used to adjust radiographic conditions and irradiation field size (Fig. 3). The X-ray tube support has a vertical travel range of 1,600 mm and can be rotated freely and fixed at any angle on the vertical axis.

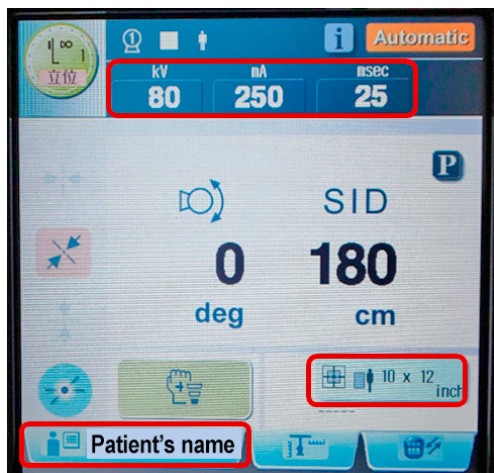


Fig.3 LCD Screen
The LCD screen can be used to check the patient's name and adjust radiographic conditions and irradiation field size.

3.2 Long View Radiography

After setting a Start Position and End Position, the operator simply presses the set button and the system automatically adjusts the X-ray tube angle and image receptor (FPD) in the Bucky stand to their imaging positions in preparation for radiography. If two acquisitions are needed, the total acquisition time is about 5 seconds. The number of acquisitions

is determined automatically based on the size of the target area. For standing radiography, the Bucky stand image receptor is moved up and down automatically following the changing angle of the X-ray tube. Because of this movement, a fender wall must also be installed for safety reasons (Fig. 4). The fender wall has hand grips on both sides and a belt that restrains the trunk of the patient. The position of the hand grips can also be adjusted vertically and rotated. Our hospital's own measuring rulers has also been fixed in place on the acrylic board of the fender wall. There are two pins on the bottom at the front of the fender wall on either side that lock the fender wall in place once moved into a specific position. This lock can be released by moving the fender wall while depressing either one of the pins.



Fig.4 Fender Wall for Long View Radiography With a Fixed Measuring Ruler. Hand Grips on both Sides and Belt for Trunk Restraint

3.3 Automatic System Tracking Function

The X-ray tube support follows the vertical movement of the image receptor of the Bucky stand or Bucky table. It tracks movement when the X-ray tube is in a specific position longitudinally and transversally. The image receptor in the Bucky table also tracks the swing angle of the X-ray tube (Fig. 5).

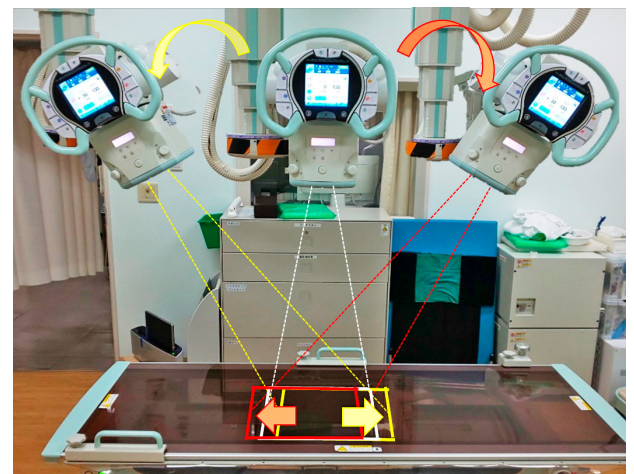


Fig.5 Automatic System Tracking Function
Image receptor tracks the X-ray tube swing angle.

3.4 Auto-Positioning Function

The auto-positioning function automatically moves the X-ray tube support to a position preset in the generator program at the touch of a button on the remote control. Frequently used imaging positions can also be stored in the remote control (up to four positions).

4. Overview of Added Functions: POWER GLIDE and Single-Axis Move Buttons

4.1 POWER GLIDE

POWER GLIDE, which uses GLIDE Technologies, assists system operation by quickly detecting forces applied to the X-ray tube support handle by the operator, calculating the necessary power assistance, then driving three motors in the longitudinal, transverse and vertical directions. The level of power assistance provided by POWER GLIDE can be switched between three levels via touch panel controls on the X-ray tube support LCD screen (Fig. 6). Operators can select the optimum power assist level for a given control scenario, such as High for large movements when repositioning the X-ray tube support between standing and supine radiography, or Low for less power assistance and more precise positioning. Acceleration (Acc), deceleration (Dec), and maximum speed (Speed) can also be adjusted along each axis of motion from the Power Assist Setting Menu (Fig. 7), allowing power assist levels to be customized to the preferences of the facility.

GLIDE Technologies is comprised of five component technologies: sensing technology, torque control

technology, shock reduction technology, stability control technology, and balance technology.

(1) Sensing Technology

The handle instantly detects force applied along three axes (longitudinally, transversally, and vertically) even while the handle is rotated vertically or horizontally. This allows the X-ray tube support to be controlled by the exact same method as conventional systems.

(2) Torque Control Technology

Eliminates unnaturalness during movement by compensating for the characteristics of the motor and system and always transmitting accurate torque without delay.

(3) Shock Reduction Technology

Reduces sudden jerks in movement by the system, such as when the operator inadvertently applies a strong force on the control handle.

(4) Stability Control Technology

Enables control over the direction of the system by detecting force applied by the operator in multiple directions.

(5) Balance Technology

Enables smooth operation by absorbing the elastic force in the spring arising from vertical movement by the X-ray tube support.

4.2 Single-Axis Movement Buttons (Fig. 8)

This feature moves the X-ray tube at a constant speed in a predetermined direction, such as transversally, when a single-axis movement button is depressed.



Fig.6 LCD Screen: Changing the Power Assist Level

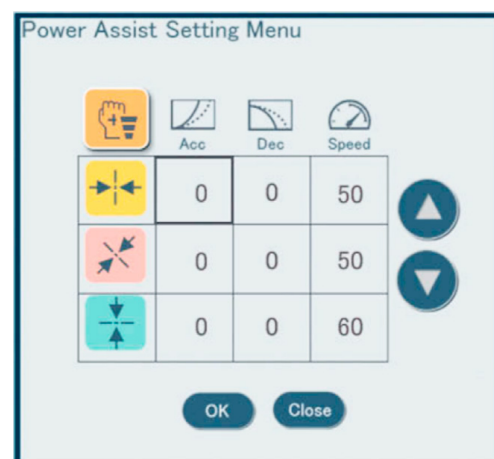


Fig.7 Power Assist Setting Menu
Acceleration, deceleration, and optimum speed can be adjusted along each axis of motion.



Fig.8 Single-Axis Movement Buttons

5. Experience Using the Existing RADspeed Pro System

5.1 X-Ray Tube Support Control Unit

Displaying patient names on the LCD screen has made patient verification easier and reduced patient misidentification. Displaying the SID on the screen has also freed operators from the time-consuming task of using measuring tape mounted on the collimator to measure SID. The size of the irradiation field can be switched with ease from the LCD screen. The X-ray tube support has a wide range of movement range that makes radiography safer by removing the need for patients to stand on a platform when imaging areas nearer the floor, such as during pediatric radiography or standing radiography of the knee. The X-ray tube support can also be fixed at any angle around the vertical axis, making positioning for axial projections of the shoulder easy.

5.2 Long View Radiography

Although the fender wall takes time to install, the trunk restraining belt and hand grips are secure and allow for safe radiography of patients with disabilities. Our hospital's own measuring ruler has also been attached to the fender wall, which eliminates any concerns about forgetting to attach a ruler. However, because the fender wall stands 20 cm above the floor (two 10-cm steps), caution is needed when patients step on and off the stand. When radiography includes multiple acquisitions, caution is also needed to avoid positional misalignments during image synthesis caused by poor breath-holding or patient movement. The fender wall is held securely in place by its pins, but in the rare instance either of the pins

is released, a warning is displayed on the X-ray tube support LCD screen. Knowing that safety measures are in place to prevent radiography from proceeding should a pin be released provides peace of mind.

5.3 Automatic System Tracking Function

The X-ray tube support follows the vertical movement of the Bucky stand image receptor. This feature has eliminated examination delays caused by smaller operators physically unable to reach the X-ray tube support control unit. This feature also shortens positioning times for operators who work alone, as the operator no longer needs to move both the X-ray tube support and image receptor. In addition, the X-ray tube support follows the vertical movement of the Bucky table to maintain a constant SID, eliminating the need to continuously measure SID based on the height of the Bucky table. Because the FPD in the Bucky table also tracks the swing angle of the X-ray tube, there is less need to worry about missing the irradiation field when radiography is performed at an angle, such as during pelvic inlet and outlet radiography.

5.4 Auto-Positioning Function

Using the auto-positioning function via a remote control allows the operator a better overall view when controlling the X-ray tube support, enabling easy visual confirmation of the patient, medical personnel, and potential obstacles for safer positioning. The topmost button on the remote control (Fig. 9) is linked to a position preset in the generator program, which helps to prevent SID errors and positioning errors during radiography. Even if there is no preset position linked in the generator program, frequently used positions stored in designated locations on the remote control are



Fig.9 Auto-Positioning Remote Control
 a) Linked to a preset position in the generator program
 b) Standing SID 180 cm
 c) Supine
 d) Lateral (side view)
 e) Patella axial view (retract position)

available. At our hospital, the remote control has the following positions stored in order from top to bottom: standing SID 180 cm, supine, lateral (side view), patella axial view. Having these positions stored via the remote control has been extremely useful. At our hospital, one remote control is kept on the wall near the control console and another is kept near the Bucky stand. The back of each remote control is magnetized, so they can be carried and operated within the hand or while attached to a support column or another structure. This feature has reduced the distance covered by the operator and physical burden of positioning.

6. Experience Using the Added Functions: POWER GLIDE and Single-Axis Movement Buttons

6.1 POWER GLIDE

Auto-positioning alone does not yet provide the flexibility the X-ray tube support needs to handle a wide variety of radiography sites and positions. For this reason, the X-ray tube support must often be operated manually. The newly added POWER GLIDE provides smooth movement from beginning to end when manually operating the X-ray tube support and does not result in unnatural movements that can be stressful for the operator. Although there was a learning curve when adjusting to POWER GLIDE, it did not take long to become familiar with the new feature. Operators can select from three power assist levels on the X-ray tube support LCD screen to suit their preference, and POWER GLIDE has received a number of favorable comments including that even physically weaker operators can now operate the X-ray tube support one-handed with ease. POWER GLIDE also automatically reduces the power assistance to its lowest level when the exposure field lamp is turned on, a feature that helps with more precise positioning.

6.2 Single-Axis Movement Buttons

When radiography is being performed by multiple operators, an operator behind the X-ray tube support can hand the X-ray tube support over to an operator in front of the system by simply pressing a single-axis movement button. This has reduced the physical strain on operators who no longer need to place themselves in awkward positions to hand the X-ray tube support over to another operator.

7. Summary

The RADspeed Pro general radiography system not only improves the efficiency of radiography work, it also offers excellent convenience and safety. POWER GLIDE, which was added to our RADspeed Pro system, is an evolution of the power assist function we are familiar with seeing in portable (mobile) radiography systems and provides smooth and natural movement. POWER GLIDE not only reduces the physical strain on the operator when manually operating the X-ray tube support, it also helps improve patient throughput. POWER GLIDE comes with three power assist levels and conveniently drops its power assistance to the lowest level when the exposure field lamp is turned on. One area of concern in terms of safety is the potential for accidents arising from contact between the X-ray tube support and a patient, medical personnel, or operator since the X-ray tube support is often under automatic control by the auto-positioning function or automatic system tracking function. Therefore, we would like to see the X-ray tube support equipped with sensors or other safety measures that stop the X-ray tube support just before contact or when contact is detected.

Unauthorized reproduction of this article is prohibited.