



Design and Manufacture of Video Pipeline Inspection Systems
A Full Service Company
www.rstechserv.com

NovaSTAR LED Pan and Tilt Zoom Color Camera

Model 10-1655

OPERATOR MANUAL



Made in USA

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Reserved

Operator and Equipment Safety

It is important to be familiar with RS Technical Services CCTV equipment operation, maintenance, and safety issues.



Read the entire manual before operating the equipment.

To prevent personal injury or damage to equipment when making electrical connections or when setting-up or maintaining the transporter or camera, **turn off Camera power.**

Inspect all transport, camera, lighting cables, and bridles before and after each use. Replace any broken, worn or frayed bridles or cables.



Always use care when near an open manhole, and when climbing in or out of a TV inspection vehicle. The transporter and camera assembly can be placed into the pipeline **without** personnel entering the manhole. Use proper lifting ropes, cranes and winches for lifting equipment in/out of manholes.

System Power



CAUTION: NEVER CONNECT OR DISCONNECT ANY EQUIPMENT WITH CAMERA POWER TURNED ON

The Inspection System requires a steady supply of 120VAC to operate properly. Before starting the generator or connecting shore power, make sure that ALL equipment inside the vehicle has been turned **OFF**. Turn down the controls for camera power and cable reel speed. If a generator is to be used, allow the generator to warm up for a few minutes prior to starting any equipment.

Note: Refer to the appropriate generator operator's manual for starting.

Verify that the voltage and frequency indicators on the controller power supply are in the green normal zone.



Caution: If the voltage or frequency fluctuates into the red zones on the controller power supply, **DO NOT** turn on any of the equipment in the truck. Check shore power or the generator for proper operation, or have them checked by a qualified technician.



Caution: Before turning on any equipment, plug the keyboard into the data collection system and plug the Desktop Controller into the AUX INPUT jack located on the Controller Power Supply's front panel.

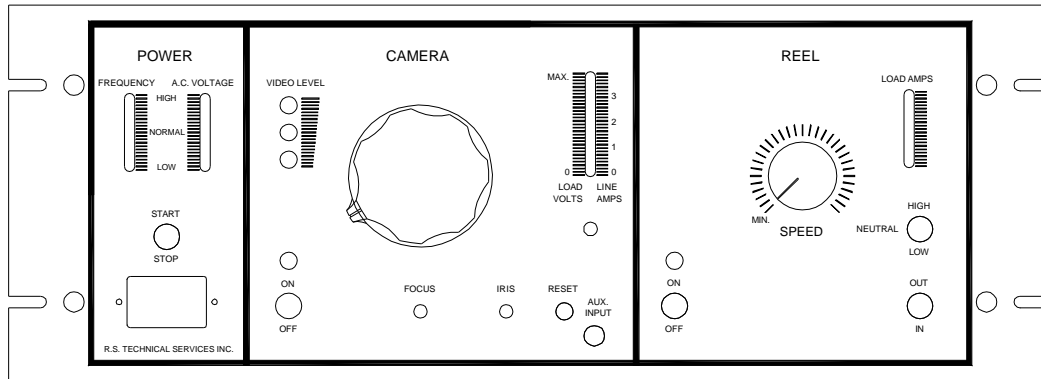
CAUTION EYE HAZARD

Avoid long term exposure to high intensity LED light source

Camera Operation

Refer to the Controller Power Supply manuals for detailed instructions.

Controller Power Supply Model 20-2000



Note: When the system mains power is on, the controller power supply Frequency and Voltage indicators will show if the system power is within the normal range.

1. Camera control section of the Controller Power Supply

The adjustable camera power supply provides a nominal 120V DC to the camera, transporter and other down-hole inspection equipment. This section also has video-processing circuitry, which extracts the video signal transmitted by the camera. A microphone audio preamplifier provides audio to a video recorder or data collection system.

The ON/OFF switch controls the power supply that provides power to the camera and optional transporters and lights. Above the switch is a green LED to indicate that the camera power supply is **on**.

The knob adjusts the output voltage of the power supply.

The Dual Function Desktop Controller plugs into the AUX. INPUT.

The VIDEO LEVEL LED's indicate the presence of a video signal. Depending on the light in the pipe and the camera iris setting, the red, yellow or green LED will be lit. Green is optimal. If the red LED is lit there may be a video problem.

The LOAD VOLTS / LINE AMPS indicator displays the relative output **voltage** or **current** from camera power supply. The switch located below the indicator toggles between voltage and current.

The FOCUS switch controls the camera focus function. The IRIS switch controls the iris setting in fixed lens cameras and the zoom setting in cameras with zoom capability.

The red RESET LED will flash indicating that the over current circuit has detected an over current condition and has disconnected the DC voltage from the output connector. To reset, place the ON/OFF switch in the **OFF** position. Turn the camera control knob to minimum and wait about 45 seconds to allow the power supplies to discharge. Place the ON/OFF switch in the **ON** position, if the RESET LED continues flashing, place the ON/OFF switch in the **OFF** position and correct the fault.

2. Short form camera-operating instruction with the Model 20-2000 Controller

The ON/OFF switch is in the **OFF** position before connecting camera to transporter unit, or Dual Function Desktop Controller to the Controller Power Supply.

Set the control knob in the Camera section to “**MINIMUM**” or full counter clockwise.

Set the SPEED control knob to the ‘**MINIMUM**’ or full counter clockwise.

With the Camera Power switch **OFF**, plug the Dual Function Desktop Controller into the front panel jack marked **AUX. INPUT**.

Turn the Camera Power switch to **ON**. A video picture should appear on the display. If the video picture is flashing off and on, the camera voltage setting is too low. Increase the voltage setting until the flashing stops.

Note: In some cases the minimum controller voltage setting may be below the camera’s minimum operating voltage.

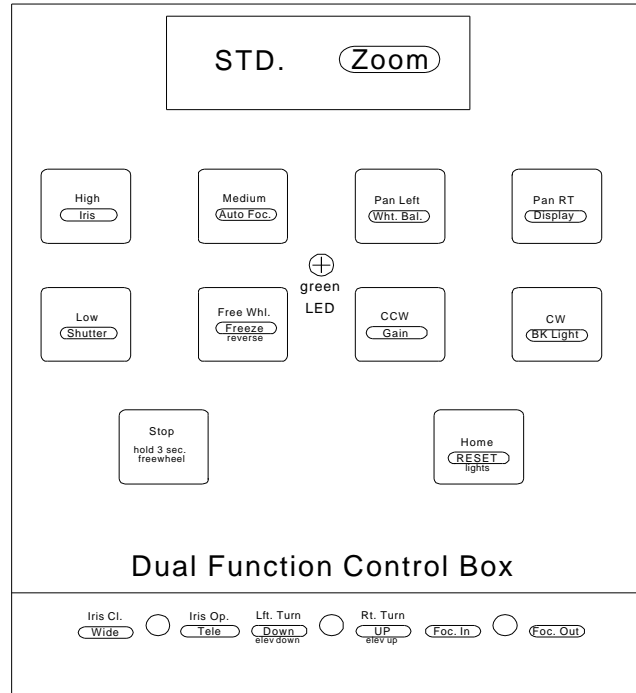
CAUTION EYE HAZARD

**Avoid long term exposure to
high intensity LED light source**

Set the **STD. Zoom** rocker switch on the Dual Function Desktop Controller to the **Zoom** position. Press the **Stop** key, and use the **Down / UP** switch to set the LED lights to the desired intensity.

Press the **RESET** key to set the zoom camera to normal setting.
Go to section 4 for detailed camera information.

3. Dual Function Desktop Controller



The **STD. Zoom** rocker switch located at the top rear portion of the controller allows each key or switch to control two separate functions. Each key and switch has one function lettered in red and one in blue. The red functions are active when the **STD. Zoom** rocker switch is set to **STD.** The blue functions are active when the **STD. Zoom** rocker switch is set to **Zoom.**

The exceptions are the Foc In./ Foc. Out and Wide / Tele switches. These functions are outlined in the General Zoom Camera information section.

Every function change will cause the green transmit LED to flash. The green transmit LED is located at the center of the key panel.

To enable the standard functions, See Tables 1 and 2, set the toggle switch to **STD.** These functions control the transporter functions and the camera's pan, rotate and Iris functions.

To enable the zoom functions, See Tables 3 and 4, set the **STD. Zoom** rocker switch to **Zoom.**

The **Reset** key gives the operator the ability to return the camera to the starting or default camera function settings.

Dual Function Control Box Identifications:

Top Panel:

Mode rocker switch **STD** / **Zoom** (standard / zoom)

Front Panel:

10 control keys

Green LED indicator

Rear panel:

Auxiliary input allowing the daisy chaining of additional control boxes.

Cable with plug.

Key function: STANDARD (red)

High	Transporter	High speed mode
Medium	Transporter	Medium speed mode
Low	Transporter	Low speed mode
Free Whl reverse	Transporter	free wheel tractor/ hold down reverse in SDT* mode
Stop	Transporter	All stop (tractor) hold three seconds for freewheel
Pan Left	Camera	pan left
Pan Rt	Camera	pan right
CCW	Camera	counter clockwise rotation
CW	Camera	clockwise rotation
Home/lights	Camera/SDT	rotates camera to home/ turns on SDT* lights

**Storm Drain Tractor*

Table 1

Toggle switch functions: STANDARD (red)*

Iris Cl.	standard camera zoom camera	closes camera iris wide angle – zoom out
Iris Op.	standard camera zoom camera	open camera iris telephoto – zoom in
Foc. In	standard camera zoom camera	Focus in
Foc. Out	standard camera zoom camera	Focus out
Lft. Turn/ elev down	SDT	turn left, lower elevator/camera
Rt. Turn/ elev down	SDT	turn right, raise elevator/camera

**Standard pan and rotate cameras*

Table 2

Key function: ZOOM (blue)

Iris	Adjusts lens F-stop (f2.8, f4, f8, f10 etc.)
Auto focus	Switches between auto focus/manual focus. Auto focus is the default. Alternately adjusting Focus in/ Focus out will also switch to the manual focus mode.
Shutter	Shutter adjustment from 1 second to 1/10000 second. Default is 1/60 second.
Freeze	Stop motion of live video
White balance	Adjust for light type, sun light, incandescent light (auto)
Display	Show or hide manual settings
Gain	Adjust gain range -3dB to 28 dB (controls brightness of picture)
Back light	Increases foreground brightness when illuminated from the rear
Reset	Return to power up default settings

Stop	Toggles the LED change intensity function on / off
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Table 3

Toggle switch functions: ZOOM (blue)

Wide	Zoom out
Tele	Zoom in
Up	Adjust camera functions (iris, shutter, gain, etc.) Increases camera LED intensity
Down	Adjust camera functions (iris, shutter, gain, etc.) Decreases camera LED intensity
Focus in	Focus in
Focus out	Focus out

Table 4

4. Camera Operation

Turn the ON/OFF switch to **ON**. Adjust the knob clockwise until “OVER VOLTAGE” is displayed on the monitor. Then adjust the knob counter clockwise until “OVER VOLTAGE” is no longer displayed. This is the voltage setting where the camera and the transporter are at their most efficient running point. The monitor should now have a steady video picture displayed.

The camera function settings will be in their default settings. Toggling the focus switch in either the **STD** or **Zoom** mode will switch the camera to manual focus.

Pressing the **Reset** key while the Dual Function Control Box’s **STD/ Zoom** rocker switch is set to **Zoom** will return the camera functions to their default settings, as described in the General Zoom Camera information section.

General Zoom Camera information:

The following description unless otherwise noted assumes that the Dual Function Control Box is in the **Zoom** mode:

When operating in the **Zoom** mode some of the camera features can be changed allowing the operator to improve the video quality. To return to the default settings press the **RESET** key.

When the camera is first turned on or the **RESET** key is pressed the camera will measure the available light and adjust the camera accordingly. The electronic shutter will be set to 1/60 second. The iris will be set as large as possible with the gain set at 0 dB. If the iris is set to f 1.8 the camera will increase the gain until the best picture is achieved. If there is not enough light the camera will increase the iris and gain settings to their maximum settings.

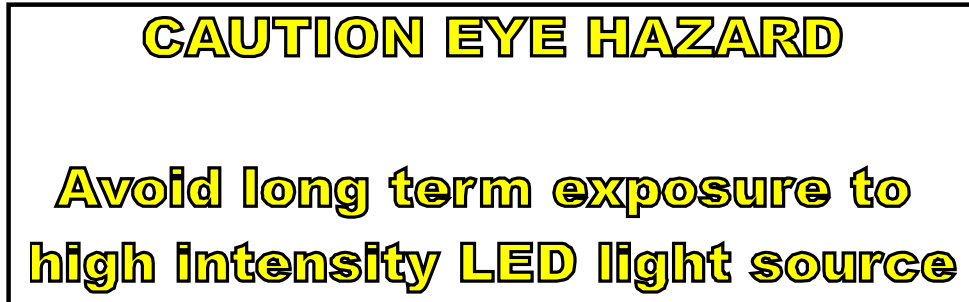
The **RESET** command can also be used to re-adjust the camera to changing pipe conditions while the transporter is in operation.

When **RESET** is pressed the camera’s auto focus function is enabled. While the camera is being transported down the pipe the auto focus function may cause the focus to fluctuate while trying to establish a new focus point. To disable auto focus, use the **Foc. In / Foc. Out** switches to activate the manual focus mode. The focus can now be manually adjusted using **Foc. In / Foc. Out** switches.

The **Wide / Tele** (telephoto) switch and the **Foc. In / Foc. Out** (focus) switch functions are active in both the standard **STD** and the **Zoom** modes.

In the **STD** mode the focus changes in discrete steps the same as the OMNI II and the OMNI III cameras. In the **Zoom** mode the focus changes continuously.

When the transporter and zoom camera are in motion it is easier to adjust the cameras focus in discrete steps.



The zoom camera has six light intensity steps plus an off position. To change the light intensity level set the **STD. Zoom** rocker switch to **Zoom**. Press the **Stop** key and then toggle the **Down / Up** switch to the desired level of light.

At this time you may also use the **Reset** function to re-adjust the camera settings for the new illumination level.

On-screen Icons

The **BK Light** (back lighting on / off), **Stop** and **Reset** functions do not have on-screen icons.

When the **Display** key is pressed the zoom icon will be displayed for several seconds. When the **Wide / Tele** switch is toggled the zoom icon will reappear showing the relative position of the zoom lens setting. The vertical line inside the icon delineates the change over point from optical zoom to digital zoom. Pressing the **Display** key a second time will cause the display to toggle off. **Reset** will also return the display function to the off condition.

It should be noted that the **Display** key might have to be pressed twice to activate the function after a **Reset**.

After the **Display** function is activated the following are the on-screen presentations;

Pressing **Foc In / Foc Out** (Focus in/ out) switch will present an icon that looks like a hand with an F (Manual focus). An icon that looks like a mountain represents infinity and an icon that looks like a human bust represents the closest focal setting.

Pressing the **Freeze** key will present an icon that looks like a camera with the word CAPTURE next to it.

Pressing the **Wht Bal** key (white balance) and then toggling the **Down / Up** switch will display one of four icons. The sun icon is displayed when the camera is set in the daylight mode. The light bulb icon is displayed when the camera is set in the indoor mode. The dual ramp icon represents the one set white balance setting which is not available for use. The ATW icon is displayed when the camera is set in the automatic

white balance setting. The shutter speed, iris (f-stop) and gain data (dB) will also be displayed. Use the **Reset** key to exit the white balance function.

When either the **Iris**, **Shutter** or **Gain** keys are pressed the shutter speed, f-stop (iris) and gain data will be displayed. To adjust these functions press the appropriate key and then make the adjustment by toggling the **Down or Up** switch. Use the **Reset** key to exit from these functions.

Zoom Camera Applications

Most video inspections should be performed with the zoom camera operating with the default settings set and with the **Auto focus** feature turned off.

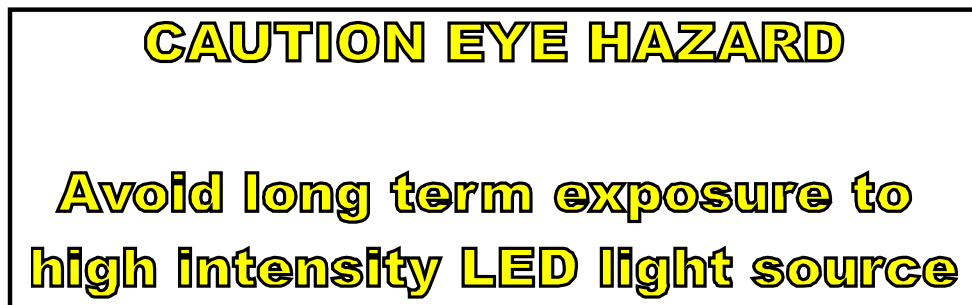
There may be situations where there is a bright light source in front of the Zoom camera. This may cause the foreground to darken. If this is the case, set the **STD. Zoom** rocker switch to **Zoom** and press the **BK Light** (back lighting) key. This may increase the brightness in the foreground.

When the camera is stationary, the LED light intensity level is low and the lens is zoomed out, you may be able to increase the video brightness by adjusting the camera functions manually. The **Shutter** speed can be set as slow as one second. The **Iris** setting can be increased as large as f1.8 and the **Gain** can be increased as high as 28dB. Using different combinations of these three controls you can optimize the video picture for the available light.

The zoom camera determines the white balance by measuring the dark level and adjusts the color accordingly. In some colored pipe may cause the color to be shifted. The white balance may be shifted by the **Wht Bal** and set at sunlight, more blue or indoor light, and more red.

If you are having trouble and are wondering if the camera is capable of providing a video signal, you can perform the following test. Set the **STD. Zoom** rocker switch to **STD.** then hold the **Wide/Tele** switch to **Wide** for 20 seconds. The text RST OMNI STAR should be displayed. Every few seconds the text should change colors.

Setting the LED Light Intensity



To change the LED light intensity set the Dual Function Control Box **STD. Zoom** rocker switch to **Zoom**. Then press the **Stop** key followed by toggling the **Down / Up** switch. The light intensity can be set to six levels or the LED lights can be turned off. This setting is temporary

and will not be saved. When the camera is powered down and then turned on again the previously set light intensity setting will be restored.

To save the setting, set Dual Function Control Box **STD. Zoom** rocker switch to **STD.** then hold the **Foc In** toggle switch for 15 seconds until “CALIBRATE MODE ON” is displayed. Press the **Stop** key to save the setting.

Note: Do not press the High, Medium, Free Whl or Stop keys. Doing so will change the head rotation/swing limit setting. If one of these keys is pressed by mistake, turn off the power to the camera.

Head Rotation/Pan limits Calibration

This procedure is for cameras with software version 17 or earlier.

CAUTION:

Always remove the camera from the transporter or place the transporter on blocks so the wheels or treads are off the ground before calibrating. The transporter will engage during calibration.

Set the Dual Function Control Box **STD. Zoom** rocker switch to **STD.** then hold the **Foc In** toggle switch until “CALIBRATE MODE ON” is displayed.

Note: When setting the limits make sure that the head is not touching the mechanical stops. Setting the limits too close to the mechanical stops could cause the head motion motors to be damaged.

After the camera limits are re-calibrated, check the limits. If the motors can be heard while the head is positioned at the limits then the limits are set too close to the mechanical stops and the calibration must be repeated.

- A. Hold the **Pan Left** key until the camera head pans to the desired limit then press the **High** key.
- B. Hold the **Pan Right** key until the camera head pans to the desired limit then press the **Medium** key.
- C. Hold the **CCW** key until the camera head rotates to the desired limit then press the **Low** key.
- D. Hold the **CW** key until the camera head rotates to the desired limit then press the **Free Whl** key.
- E. Pressing a combination of the keys described above position the head so it is upright and pointed straight ahead. When the head is correctly positioned press the **Home** key.
- F. Make sure that the LED light intensity is set to the desired start up level. See the Setting the LED Light Intensity section.
- G. Press the **Stop** key to store the information.

If you access the calibration mode by accident, exit by immediately pressing the **Stop** key or turn off the power to the camera.

Maintenance

Each time the Zoom camera is removed from the pipeline, wash the entire assembly.

Inspect camera cradle and hardware.

Inspect camera lens for scratches and cracks.

Inspect the front of the camera for debris and clean as needed.

Inspect the camera clamps, fins, skids and, mounting hardware.

Inspect the power cable and watertight connections for damage.

Inspect the bridle, clamps, skids, rails, and mounting hardware.

Technical Specifications

Enclosure mechanical

Overall length:	16.25-inches (excluding interconnect cables)
Construction:	High strength aluminum with corrosion resistant steel top rails
Corrosion protection:	Anodized per MIL-A-8625D
Camera body:	Maximum diameter 3 inches

Enclosure environmental

Degree of protection:	IPX7 IEC 60529
Watertight:	UL-50 Type 6P (NEMA 6P)

Pan & tilt camera head

The articulated camera head provides 350° of axial rotation and 260° of lateral swing, providing 360° viewing of lateral pipelines which are perpendicular to the direction of the camera travel.

The rotational diameter of the articulated head is less than 4-inches.

The articulated camera head is mechanically driven by spur gears via two precision DC motors.

All drive components are sealed to protect them from water and grit.

Image sensor

¼"-type Super HAD CCD
Pixels: 768H x 494V.
Total Pixels: approx. 380,000
Minimum illumination 1.5 lux (50IRE)

Minimum illumination

Less than .5 lux to produce a usable NTSC (National Television System Committee) color video picture.

Resolution

460 TV Lines, Horizontal
Produces more than 330 TV lines horizontal x 350 TV lines vertical

Input voltage

Nominal 120VDC (85VDC to 130VDC)

Video output

A 1-volt signal at the monitor after transmission through up to 2,500-feet of double armored single conductor cable.

Signal to noise ratio

>50dB

Lens

10X Optical Zoom. $f = 4.2$ mm (wide) to 42mm (tele) F1.8 to F2.9
An optical grade sapphire window, installed inside the camera head enclosure, provides protection to the camera lens.

Digital zoom

4X (40X with optical zoom)

Integrated light source

The light source consists of High Intensity White LED's, 56, placed around the periphery of the camera lenses. The operator can select six intensity levels or turn the lighting off.

Safety agency

Designed to meet the following safety standards.

ISA 82.02.01: Electrical and Electronic Test, Measuring, Controlling and Related Equipment

CSA C22.2#21010.1: Electrical Equipment for Measurements, Control and Laboratory use.

IEC60529 Degrees of Protection Provided by Enclosures

ANSI/UL 50 Enclosures Provided by Electrical Equipment

Lamp and camera power

The camera's internal power supply regulates the voltage supplied by the Controller Power Supply.