

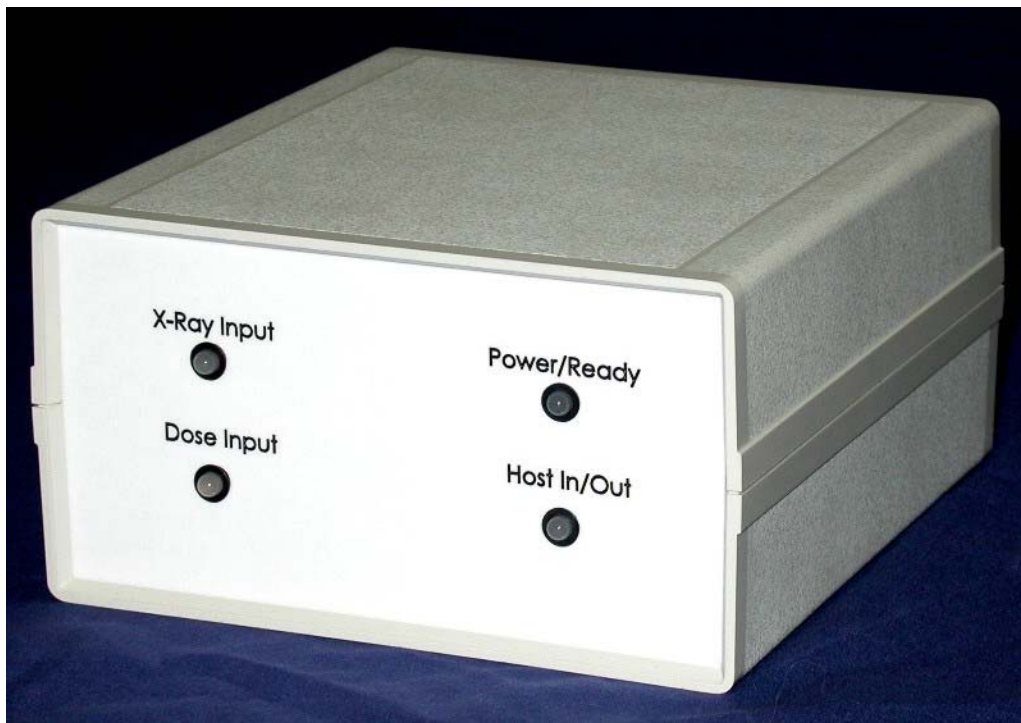
LPI General Radiology Bridge

Technical Operations Manual

Model 323

X-Ray/DAP System to CR/DR Workstation Bridge

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Livingston Products Inc.
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Buffalo Grove, IL 60089

Manual Part Number: 1273 12662

Technical Operations Manual

Model 323

X-Ray/DAP System to CR/DR Workstation Bridge

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1.0 Terms Used In Document

The following terms are used as abbreviations in the remaining sections of this document.

<i>Bridge</i>	The LPI General Radiology Bridge product (M323-nn).
<i>DAP</i>	A Dose Area Product meter. This device attaches to an X-Ray machine and reports the amount of radiation received by a patient.
<i>Workstation</i>	A computer used to acquire and manipulate radiology images. This computer may be connected to a CR Plate reader to input images captured on CR plates or a DR detector to directly input radiology images.
<i>Exposure Report</i>	A message sent to a Workstation which contains the exposure parameters acquired by the Bridge from an X-Ray machine and/or a <i>DAP</i> . The message format is one known by the Workstation and is different for each type of Workstation.

2.0 Parts List

The following parts are provided as components of the Bridge product:

<u>LPI Part Number</u>	<u>Item Description</u>
12660- <i>NN</i>	Main Unit (electronics enclosure); Sub-model <u><i>-NN</i></u> is described below.
12661	Bridge Configuration Cable
12710 ②	Standard X-Ray Interface Cable with gender changer
12711 ②	Standard DAP Interface Cable with gender changer
10934	AC to DC Power Adapter
12662	<i>This Manual</i>
12663	<i>Configuration & Troubleshooting Guide</i> manual;
12664	Configuration Software CD (includes manuals in PDF form);
①	Workstation Interface Cable (part number depends on the Workstation type)

The above items are together considered to be the base M323 product.

The product package should contain quantity 1 of each item listed above.

The Workstation Interface cable part number (shown as ① in the above list) depends on which General Radiology Bridge workstation connection option (sub-model) has been ordered, as discussed in the next section of this document.

The X-Ray interface cable and the DAP interface cable (see ② above) each come with a gender changer for the radiology device connection. This allows standard cables to be used for many X-Ray generator and DAP interfaces. Both cables may not be used at some clinical installations.

All X-Ray machines and DAP devices may not communicate with the Bridge using the standard cables. LPI sells adapters for the standard cables to handle these cases. Please contact LPI to find out if your device requires a cable adapter.

Note: optional equipment may also be required from the X-Ray machine vendor or the DAP vendor to allow the associated device to be connected to an external computer. LPI will assist the client in determining such requirements.

3.0 Workstation Connection Option (M323 sub-model)

The type of Workstation to which the M323 unit is to be connected is designated by the connection option code (-NN) which follows the model number. This code must be specified at the time the product is ordered. Contact Livingston Products Inc or your distributor to determine which connection option is correct for the CR/DR Workstation which is to be supported.

The connection option determines the type of firmware set up in the Bridge by LPI's production department and also the type of Workstation interface cable which is provided.

The information which follows applies to all of the connection options.

4.0 Functional Overview

The LPI General Radiology Bridge product is a device which translates data output from X-Ray Equipment and/or a *DAP* into a form which is accepted as input by a CR/DR Workstation device. It is possible to use the *Bridge* in the following clinical configurations:

- Sites where only an X-Ray machine reports information to the *Bridge*;
- Sites where only a *DAP* reports information to the *Bridge*;
- Sites where both an X-Ray machine and a *DAP* report information to the *Bridge*;

The purpose of the *Bridge* device is to allow the exposure settings and exposure dose data which are output by the X-Ray Equipment and/or *DAP* to be input into the CR/DR Workstation as descriptive information which is appended to the corresponding digital X-Ray image. The *Bridge* device is not involved in the transfer of the X-Ray image into the CR/DR Workstation. It does not provide patient identification information to the workstation.

The *Bridge* device is connected to the X-Ray Equipment and/or *DAP* via LPI RS232 serial communications cables, with optional adapters when necessary (for example, converting parallel printer output to a serial data stream). In some cases an adapter kit is used which contains multiple adapters. The cable/adaptor typically connects to the X-Ray/*DAP* Equipment's serial printer interface, parallel printer interface, or to an RIS system interface.

The *Bridge* device is connected to the Workstation unit via a serial communications cable. This connects to the CR/DR Workstation's X-Ray input interface.

Note: The Bridge is designed to support an optional Ethernet interface to the CR/DR Workstation rather than the serial interface. Contact LPI if this interface is required for your Workstation.

For the X-Ray machine only configuration, data flows out of the X-Ray Equipment and into the *Bridge* device each time an X-Ray image is exposed. The *Bridge* device extracts certain settings and dose information from the input, converts this information to the format that the Workstation expects, and transmits the resulting exposure report to the CR/DR Workstation unit. The *Bridge* performs these functions without any manual interaction.

Note: *If the X-Ray machine has a DAP connected directly to it and the Bridge receives dose measurements from the X-Ray machine, then the DAP is considered part of the X-Ray machine and not a separate device. The Bridge is not connected by a cable to the DAP in this case.*

An option in the Bridge's configuration allows the Bridge to send a request to the X-Ray machine to zero the DAP after the exposure data is acquired. All X-Ray machines may not support this option.

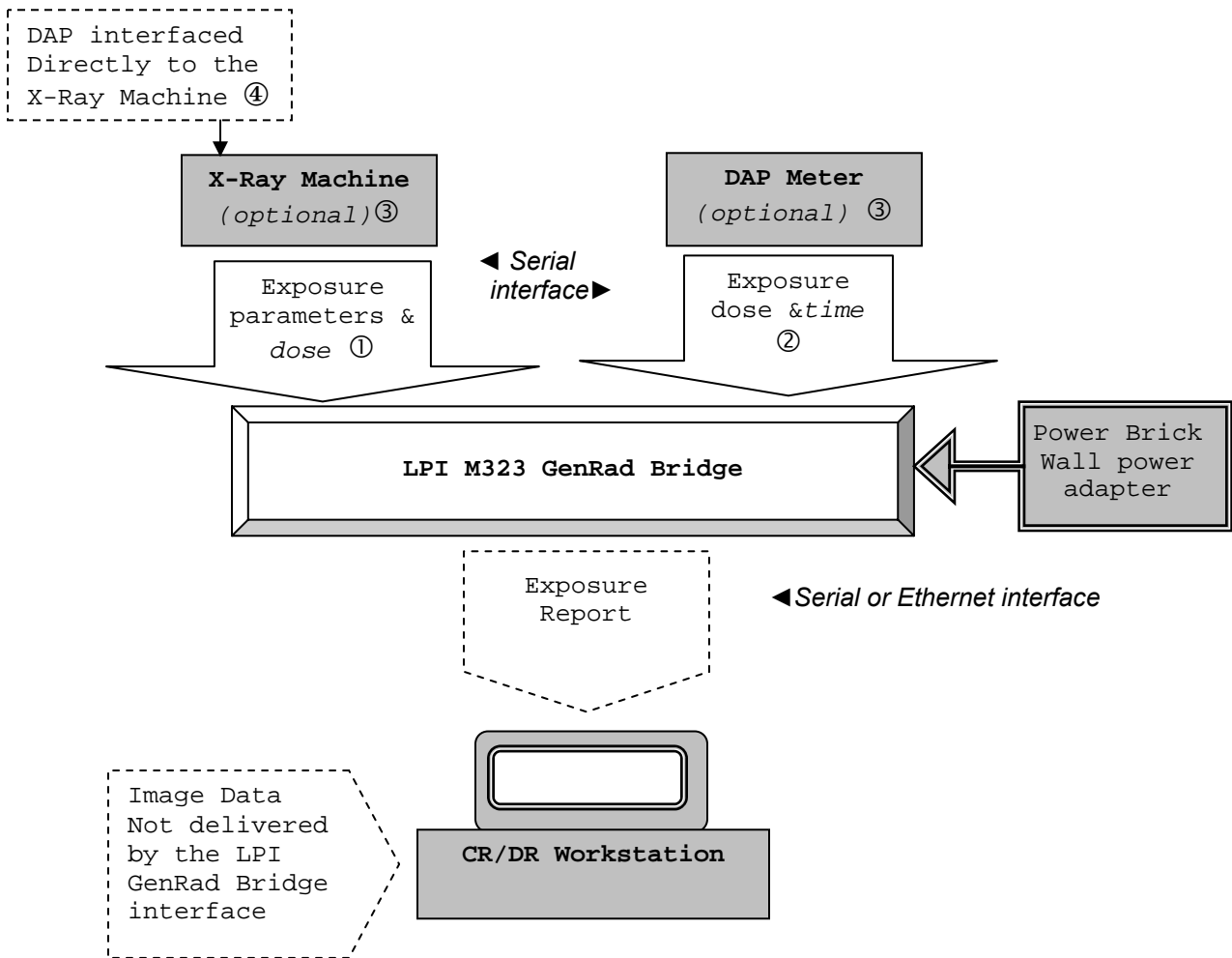
For the X-Ray machine plus DAP configuration, operation is similar. However, the *Bridge* requests dose data from the DAP after it receives the X-Ray Equipment data. It then combines the data from both sources into a single exposure report and transmits the resulting exposure report to the Workstation unit. The *DAP* is reset automatically after it's data has been retrieved. The *Bridge* performs these functions without any manual interaction.

For the DAP only configuration, the *Bridge* checks the *DAP* periodically to detect new dose data and creates an exposure report whenever a new data value is present and stable. An exposure report is created from the dose data and transmitted to the Workstation. The *DAP* is reset automatically after it's data has been retrieved. The *Bridge* performs these functions without any manual interaction.

Notes: *It is possible in DAP only mode to configure the Bridge to ignore DAP values below a certain value. This allows noise values to not be treated as exposures. This filter does not apply to the other DAP interface modes.*

If the X-Ray machine has a DAP connected directly to it and the Bridge receives dose measurements from the X-Ray machine, then the DAP only mode cannot be used. The Bridge must acquire dose data through the X-Ray machine interface.

The following diagram illustrates the connection of the components and flow of data between these components:



Note ①: Some X-Ray machines report dose directly to the Bridge, without a separate DAP device or by using a direct DAP interface (see ④)..

Note ②: Some DAP devices report exposure time in addition to dose data.

Note ③: One of these devices must be interfaced to the Bridge.

Note ④: When the DAP is interfaced directly to the X-Ray machine, it is considered part of the X-Ray machine. A separate interface from the Bridge to the DAP is not used in this case.

It is possible for an X-Ray machine to support a direct connect DAP interface option, but the option is not used at the clinical site -- although a DAP is physically installed (for manual/printer dose recording). In this case, the Bridge interface to the DAP may be used.

The *Bridge* must be configured **at the time of installation** so that its input device interfaces (X-Ray and/or *DAP*) communications characteristics (baud rate, etc.) are set to match those used by the connected Equipment. After the initial configuration is performed and cable connections

are made to the X-Ray and/or *DAP* Equipment and to the CR/DR Workstation, the *Bridge* performs its conversion function automatically. Normally, the *Bridge* will only need to be configured once.

The *Bridge* does not provide any mechanism for matching exposure reports with specific images or with specific patients. The medical technician is responsible for using the CR/DR Workstation and the X-Ray Equipment in a manner which allows images, patients, and exposure data to be correlated.

Each Workstation will support operational procedures which allow the X-Ray technician to match images with the corresponding patient and study. These procedures will also allow exposure reports from the *Bridge* to be associated with the corresponding images.

5.0 Physical Characteristics

The *Bridge* device consists of the following components when used in its normal mode of operation:

- An enclosure which contains the device electronics. Connectors are present on the rear end panel of the enclosure. Status indicators are present on the front end panel.
- An external power adapter that converts AC electrical power to the DC electrical power required by the *Bridge* device's internal electronics;
- A cable (*possibly used with an optional adapter*) which connects the *Bridge* to the X-Ray Equipment (when this interface is used);
- A cable (*possibly used with an optional adapter*) which connects the *Bridge* to the *DAP* Equipment (when this interface is used);
- A cable which connects the *Bridge* to the CR/DR Workstation;

6.0 Status Indicators

Four *Red/Green* Light Emitting Diodes (LEDs) are provided on the front end panel of the *Bridge* device's enclosure. These LEDs are useful during initial setup of the device and to help with troubleshooting any communications problems which might later be encountered.

Following is a summary of each LED's use:

- **POWER/READY**

When this LED is Green, it indicates that the *Bridge* device has power and is ready to process data. It should always be Green during normal operation.

When this LED is Red, it indicates that the *Bridge* device cannot communicate with the CR/DR Workstation

During Bridge configuration, this LED will blink (Green/Off) to indicate that the configuration mode is enabled.

- **X-RAY INPUT**

This LED is Green when the *Bridge* device is processing input data it has received from the X-Ray Equipment. It is turned on when the first data character is received for each exposure and turned off when the last data character is received for that exposure. Typically, this LED is kept on for at least 1 second after an X-Ray is exposed during normal operations – even if it takes less than a second for the data to be output.

This LED turns Red if X-Ray data is in an invalid format or if a communications line error has occurred. It will remain Red until the next exposure data input begins.

If this LED does not turn on and then off after an X-Ray is exposed, the *Bridge* device is not properly connected to the X-Ray Equipment or the *Bridge* device configuration does not match the configuration of the X-Ray Equipment's serial output interface. If it turns Red, the speed and parity of the interface may not be correctly configured or the X-Ray cable may be connected to the wrong X-Ray Equipment connector.

Important: *The Bridge must communicate successfully with the Workstation once when it is powered on — it ignores the X-Ray input until this happens. The X-RAY Input LED can only be used to determine if exposure data is transferred when the Workstation is connected and communicating with the Bridge.*

- **Dose INPUT**

This LED is Green when the *Bridge* device is processing input data it has received from the *DAP* Equipment. It is turned on when the *Bridge* requests dose data and turned off when the response data is received from the *DAP*.

This LED turns Red if *DAP* data is in an invalid format or if a communications line error has occurred. It will remain Red until the next *DAP* data is requested.

If this LED does not turn on and then off, then the *Bridge* is not configured for *DAP* input. This is normal for non-*DAP* installations.

Important: *If a DAP device interface is specified in the Bridge configuration, the Bridge will attempt to communicate with it at power-up. If it cannot do so, the Dose INPUT LED will be set to RED.*

*If only a DAP is configured but communication fails, then the X-Ray INPUT and Dose INPUT LEDs will blink RED in an alternating pattern – this **indicates that there are no valid inputs so the Bridge cannot operate.***

The Bridge must communicate successfully with the Workstation once when it is powered on — it will not poll the DAP for dose input until this happens. The Dose Input LED can only be used to determine if dose data is transferred when the Workstation is connected and communicating with the Bridge.

- **Host In/Out**

This LED is Green when the *Bridge* device is attempting to communicate with the CR/DR Workstation. This occurs when the power is first applied to the *Bridge* device and also each time the *Bridge* has X-Ray exposure data to send to the CR/DR Workstation. During normal operation, the LED turns on briefly (less than 1 second) and then turns off. It may do this twice for each exposure.

This LED turns Red if the *Bridge* cannot communicate with the CR/DR Workstation, either because the Workstation fails to respond or because there has been a communications line error on the Workstation interface.

If the LED alternates between Green and Red, the *Bridge* is retrying a communication which previously failed. After several failed attempts, the *Bridge* will stop retrying and leave the LED on as Red – until the next exposure occurs.

At power-up, the *Bridge* must communicate successfully with the Workstation at least once. It will not stop retrying until this happens – so the LED will alternate between Green and Red forever. This normally means the *Bridge* is not connected to the Workstation correctly.

If a problem is encountered during normal operation of the *Bridge* device, the person who reports the problem to LPI technical support should observe the status LEDs and record their behavior along with the problem description. LPI technical support may ask this person to examine the LEDs during troubleshooting sessions and report the state of each.

Each time power is applied to the *Bridge* device, it illuminates all of its LEDs as Red for 1 second and then Green for 1 second. This acts as a lamp test to show that all LEDs are functioning properly.

The *Bridge* device enclosure's front panel status indicator layout is shown below.



7.0 Connectors

The *Bridge* device's rear panel contains connectors which allow the *Bridge* to be connected to the outside world. The following connectors are provided:

- **15VDC**

This is a DC power receptacle to which the electrical power adapter which converts AC to DC is connected.

Only the LPI provided electrical power adapter supplied with the *Bridge* device product should be attached to this connector.

It is possible to reset the *Bridge* device by removing the power adapter's wall plug, waiting 10 seconds, and then reconnecting the plug. The power adapter plug should not be removed from the *15VDC* receptacle while the adapter's wall plug is plugged into an electrical outlet.

- **DAP/Setup**

This is a **DB9 male** connector which is attached to the *DAP* Equipment interface cable when the *Bridge* is in production mode with an external *DAP*.

During the configuration process (normally performed only at installation time), this connector is connected to the LPI supplied configuration cable. *This cable has a special pin configuration which forces the Bridge into its setup mode of operation at power-up.*

- **X-RAY**

This is a **DB9 male** connector which is attached to the X-Ray Equipment interface cable.

During normal *Bridge* device operation, the X-Ray Equipment cable must always be attached to this connector and to the serial output interface of the X-Ray Equipment if and X-Ray interface is enabled.

During the configuration process, this connector is not used.

- **Host**

This is a **DB9 female** connector which is attached to the CR/DR Workstation interface cable.

During normal *Bridge* device operation, the CR/DR Workstation cable must be attached to this connector and also to the CR/DR Workstation unit. The Workstation Vendor's documentation will describe where at the workstation the cable is connected.

During the configuration process, this connector is not used. *See the Aux description below.*

- **Aux**

This is a **female RJ45** (Ethernet/Network) modular connector. It is only used when an Ethernet Workstation interface is enabled (in this case, the Host DB9 connector is not used. A different Workstation interface cable is also required).

Future *Bridge* implementations may use this connector to support other interfaces.

The power adapter cable should always be removed prior to attaching cables to the DB9 and RJ45 connectors. This is also necessary when removing cables from these connectors.

The *Bridge* device enclosure's rear panel connector layout is shown in the following illustration:

If a gender changer needs to be used on a cable, it is **used at the interface device end**, not at the CR Bridge connector. If a cable Adapter is used, it is normally **used at the interface device end** – unless documentation comes with the adapter that specifies a different connection.



On the bottom of the *Bridge* enclosure, there is a label attached that is similar to the following:

LPI GenRad BRIDGE
MODEL: M323-## S/N 1234
MFG DATE: January, 2009

The label shows model number, manufacture date, and serial number. The ## shown at the end of the model number will appear as a 2 digit number (for example "01") for a production unit, indicating which CR/DR Workstation connection option this *Bridge* unit supports. The serial number (1234 in the above example) follows the model number.

8.0 Cables

To use the Bridge in a production environment, either two or three cables are required:

- Workstation interface cable;
- X-Ray interface cable (may require an optional adapter);
- *DAP* interface cable (may require an optional adapter);

A configuration cable is required for the installer to perform setup of the Bridge at the time it is installed, but this cable is not used when the Bridge is performing its production function. The cable is included with base M323 product. It is a **special cable** used to force the Bridge into configuration mode – an off the shelf cable cannot be used.

Note: *The installer must have a serial port available on the computer used for configuration. A USB-to-RS232 adapter or laptop cardbus serial interface will be required if the computer does not have a built in RS232 port.*

The Bridge's electronics module contains internal optical isolation and filtering components for both the X-Ray and DAP interfaces. These components are not part of the interface cables, as in some older LPI interface products.

CR/DR Workstation Cable

The cable used to connect the *Bridge* device to the CR/DR Workstation unit is provided by LPI as part of the M323 base product. The part number for this cable depends on the connection option, as discussed earlier. It is not normally ordered separately.

If the Ethernet interface option^① is used, an Ethernet crossover cable will be supplied instead of the standard serial interface cable. *If the Bridge is connected through a network switch or hub (instead of directly to the Workstation), it may be necessary to use a standard Ethernet cable rather than a crossover cable – though many modern switches can detect a crossover cable and use it.*

Note ^①: The Ethernet option is not implemented in the first version of the Bridge product.

X-Ray Equipment Cable

A standard cable (Part number 12710), used to connect the *Bridge* device to X-Ray Equipment, is provided by LPI as part of the base package. A gender changer is included with it.

It may be necessary to purchase an optional adapter if the X-Ray machine requires a different serial pin connection than is provided by the standard cable. Please contact LPI to find out if an adapter is required.

DAP Equipment Cable

A standard cable (Part number 12711), used to connect the *Bridge* device to externally interfaced DAP Equipment, is provided by LPI as part of the base package. A gender changer is included with it.

It may be necessary to purchase an optional adapter if the DAP device requires a different serial pin connection than is provided by the standard cable. Please contact LPI to find out if an adapter is required.

Configuration Cable

The Configuration cable which is included with the product (Part number 12661) is not used during normal operation. It is used instead of the *DAP* cable during configuration. The cable has 2 DB9 female connectors. One end of this cable is connected to the personal computer which executes the configuration software, and the other to the **DAP/Setup** Bridge connector. Either end may be connected at either location.

Note that this cable has a special pin configuration which is used by the *Bridge* to select the *configuration mode* at power up. A standard *NULL modem* cable **cannot** be used.

Cable Adapters

Contact LPI for information about available adapters and when each is required. **Do not use standard commercial adapters** (for example, NULL Modem) because they will not connect signals in the correct manner for proper Bridge operation.

9.0 Power Adapter

An AC to DC power adapter is included with the *Bridge* product. This adapter is provided by LPI as part number **10934**. It can take up to 240 VAC as its input.

The adapter has a multi-prong plug cord at one end, the converter module in the center, and a round receptacle plug cord at the other end. The receptacle plug is first plugged into the *Bridge* device's 15VDC receptacle. The pronged cord is then plugged into the wall electrical outlet.

When power is to be removed from the *Bridge* device, the wall plug should always be unplugged first.

10.0 Configuration

The *Bridge* device stores information about its connection to the X-Ray and *DAP* Equipment, and its data handling options internally, in a non-volatile memory (information saved even if power is removed). This information must be set in the *Bridge* device at the time the device is installed.

In general, the following information must be defined by the installer and saved in the *Bridge* device:

- The type (vendor and model) of the connected X-Ray Equipment – or ◀ NONE ▶;
- The type (vendor and model) of the connected DAP Equipment – or ◀ NONE ▶;
- The serial communications settings (for example, the baud rate, data size, and parity) use by the X-Ray Equipment and *DAP* for their communications interfaces;
- A unit ID (A-Z) which allows multiple Bridge units connected to a single Workstation to be individually identified.
- The desired state of some optional features; Both general Bridge options and interfaced device-specific equipment options may be set.
- For an Ethernet Workstation interface, the TCP/IP addresses needed to communicate with the Workstation.

The procedure for storing this information in the *Bridge* device's non-volatile storage is called *configuration*.

Because the *Bridge* device does not include a keyboard or a display, configuration is performed using a personal computer (or possibly the Workstation computer) connected to the *Bridge* device by a special RS232 configuration cable. An LPI configuration utility program (provided on a CD which is included with the base M303 product) is executed on the personal computer (MS/Windows™ based) to provide a human interface for saving configuration information in the *Bridge* device.

The configuration process is described by a separate LPI document:

“LPI General Radiology Bridge - Configuration & Troubleshooting Guide”

A copy of that document is provided on the same CD which provides the configuration utility program and this manual.

During its normal operation, the *Bridge* device stores troubleshooting information within its internal non-volatile memory. The same utility program that is used for configuration can be used to retrieve the troubleshooting information. This information only needs to be accessed if an interface problem is encountered.

It is possible to configure the *Bridge* more than once to support changes in equipment usage or enhancements to the CR/DR Workstation. There is no practical limit on the number of times the *Bridge* can be configured.

It is also possible to load new firmware (control software) into the *Bridge* using the configuration mechanism. This allows product enhancements to be utilized as they become available.

NOTE: *The Connection Option (type of CR/DR Workstation to which the Bridge device is connected) is **not** defined as an install time configuration parameter. The connection type **must be specified at the time the Bridge device is ordered. It cannot be changed in the field.***

11.0 Breaking the Enclosure Seal

The *Bridge* device has no field serviceable components. Its enclosure must not be opened. **Opening the enclosure will void the *Bridge* device's LPI warranty.**

12.0 How to Contact LPI

To order this product or other LPI products and for technical questions, please contact us as follows:

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e-mail: **lpicorp.net**

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