

# Instruction Manual

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**2090MDC**  
HDTV MONITORING DOWNCONVERTER

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# *Preface*

## **About This Manual**

This manual describes the features of a specific module of the 2000 Series Modular Products family. As part of this module family, it is subject to Safety and Regulatory Compliance described in the 2000 Series frame and power supply documentation (see the *2000 Frames Instruction Manual*).



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# *2090MDC HDTV Monitoring Downconverter*

## **Introduction**

The 2090MDC HDTV Monitoring Downconverter enables a user to view and evaluate an HDTV signal using a variety of low cost monitors including NTSC/PAL composite or component analog and serial digital. The 2090MDC is a two module set which includes a front media module with indicators and controls and a passive rear module for cable connections. Input signal standard is selected automatically. Each module fits into any standard module location in a 2000 frame. In addition to downconversion capabilities, the 2090MDC offers the features listed below:

- Accepts any of the following High Definition input signal standards:
  - 1920/1035i 59.94/60Hz (SMPTE 240M),
  - 1920/1080i 59.94/60 Hz (SMPTE 274M),
  - 1920/1080i 50 Hz (SMPTE 295M), or
  - 1280/720p/59.94/60 Hz (SMPTE 296M).
- Provides the following outputs:
  - Two HD 1.5 Gbps outputs,
  - Two serial digital (270 Mbps) outputs,
  - Two NTSC/PAL analog composite outputs, and
  - Three analog component outputs (Y/G, U/B and V/R).
- Four different aspect ratio modes can be chosen from the following:
  - Letterbox,
  - Amorphous,
  - Full Screen, and
  - Zoom.

## Installation

Installation of the 2090MDC module is a process of:

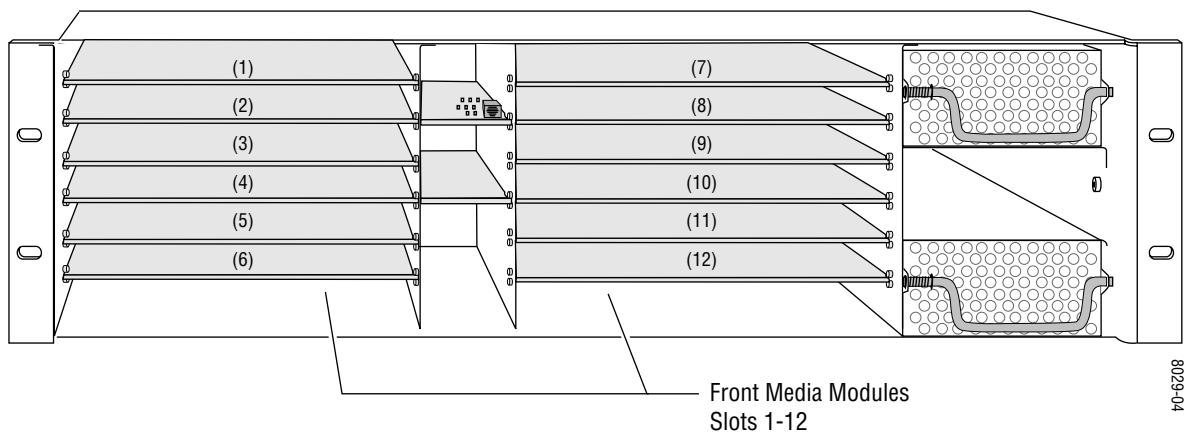
- Placing the passive rear module in a frame slot,
- Placing the front media module in the corresponding rear slot, and
- Cabling signal ports.

The 2090MDC module can be plugged in and removed from a 2000 Series frame with power on. When power is applied to the module, LED indicators reflect the initialization process (see *Power Up on page 5*).

### Module Placement in the 2000 Frame

There are twelve cell locations in the 3 RU frame to accommodate either analog or digital modules. The 2090MDC consists of a two module set consisting of a front media module and a passive rear module. Each 2090MDC media module plugs into the front of the 2000 frame mid-plane as illustrated in [Figure 1](#). The passive rear module plugs into the corresponding rear slot to provide the input and output interface connectors.

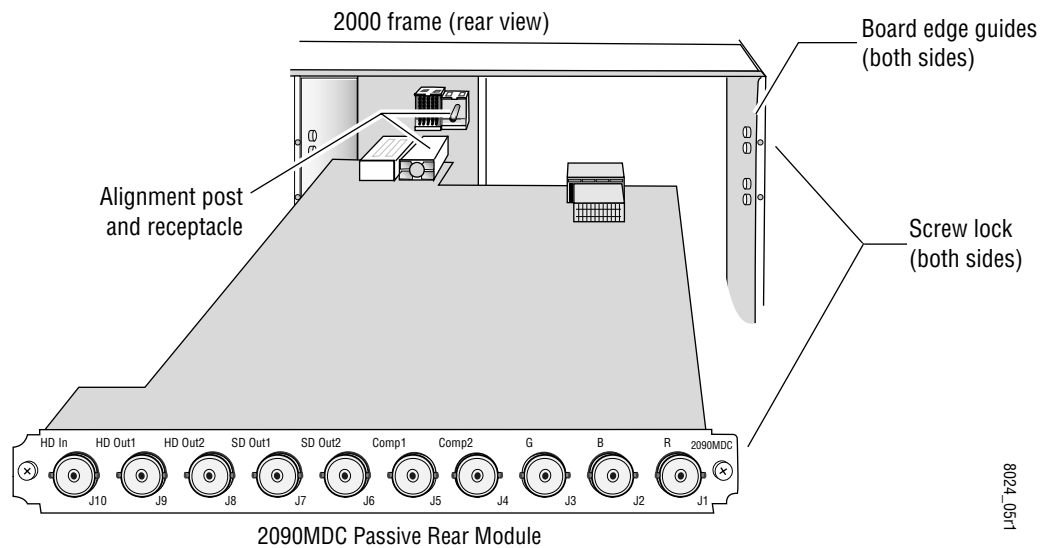
Figure 1. 2000 Series Frame, Front Slots



1. Install the passive rear module first by inserting it into any rear slot (1 – 12) of the frame as illustrated in [Figure 2](#).

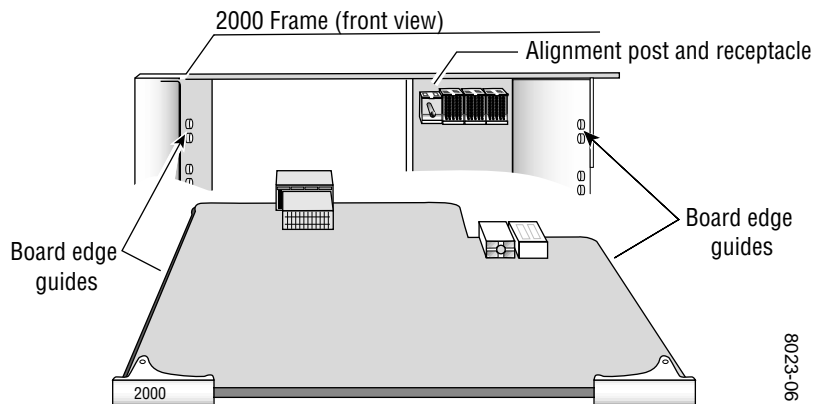


Figure 2. Installing Passive Rear Module



2. Verify that the module connector seats properly against the midplane.
3. Secure the module to the rear of the frame with the two screw locks on either side of the back panel using a crossblade screwdriver.

Figure 3. Installing Front Media Module



4. With the component side up, insert the front media module in the corresponding front slot (see [Figure 3](#)).
5. Verify that the module connector seats properly against the midplane and rear module connector.
6. Press firmly on both ejector tabs to seat the module.

## Cabling

All cabling to the 2090MDC module is done on the corresponding passive rear module at the back of the 2000 frame. Refer to [Figure 4](#) for a detailed illustration of the rear connections referenced below.

**Note** At the back of this manual are overlay cards that can be placed over the BNC connectors to identify specific 2090MDC connector functions.

## Inputs

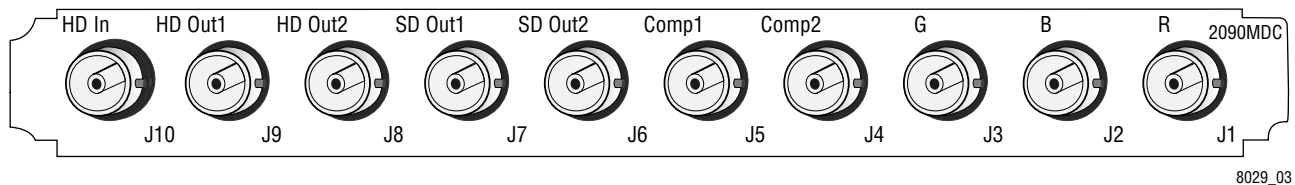
Connect an HD video input to BNC J10. The 2090MDC will accept any of the HD video standards listed in the Serial HD Input specifications in [Table 5 on page 17](#).

## Outputs

Connect video monitors to the following outputs provided on the passive rear module:

- HD Out1 and HD Out 2 – two output BNCs (J8/J9)
- SD Out1 and SD Out2 – two serial digital output BNCs (J6/J7)
- NTSC/PAL composite – two output BNCs (J4/J5)
- Component analog – three output BNCs (J3–Y/G, J2–U/B, J1–V/R)

Figure 4. 2090MDC Input/Output Connectors



8029\_03

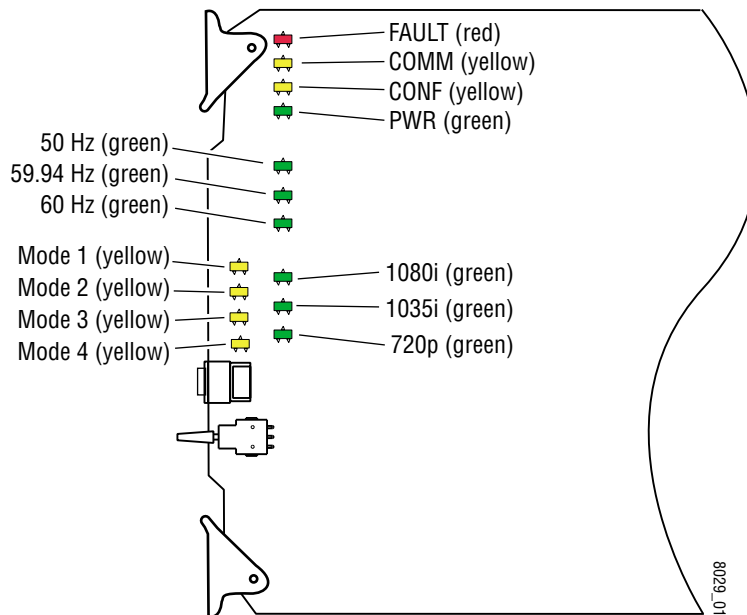
# Power Up

The front LED indicators and configuration switches are illustrated in [Figure 5](#). Upon power-up, the green PWR LED should light and the yellow CONF LED should illuminate for the duration of module initialization.

## Operation Indicator LEDs

With factory default configuration and a valid input signal connected, the green PWR LED and one of the input and output standard LEDs should be on. Refer to [Table 1 on page 6](#) to see a complete list of possible operating conditions and the resulting indicator status.

Figure 5. LEDs and Configuration Switches



A red FAULT LED indicates an error situation and, when noted with the other indicator LEDs, can indicate a specific problem area. Table 1 describes signal output and LED indications for the various input/reference combinations and user settings.

Table 1. Indicator LEDs and Conditions Indicated

LED	Indication	Condition
<b>FAULT (red)</b>	Off	Normal operation
	On continuously	Module has detected internal fault
	Long flash	Configuration problems, check inputs and settings
<b>COMM (yellow)</b>	Off	No activity on frame communication bus
	Long flash	Location Command received by the module from a remote control system
	Short flash	Activity present on the frame communication bus
<b>CONF (yellow)</b>	Off	Module is in normal operating mode
	On continuously	Module is initializing, changing operating modes or updating firmware
<b>PWR (green)</b>	Off	No power to module or module's DC/DC converter failed
	On continuously	Normal operation, module is powered
<b>50 Hz (green)</b>	On	Indicates field rate of input signal is 50 Hz
<b>59.94 Hz (green)</b>	On	Indicates field rate of input signal is 59.94 Hz
<b>60 Hz (green)</b>	On	Indicates frame rate of input signal is 60 Hz
<b>1080i (green)</b>	On	Indicates input signal standard is 1080i
<b>1035i (green)</b>	On	Indicates input signal standard is 1035i
<b>720p (green)</b>	On	Indicates input signal standard is 720p
<b>Mode 1 (yellow)</b>	On	Monitor output display mode is set for letterbox mode
<b>Mode 2 (yellow)</b>	On	Monitor output display mode is set for amorphous mode
<b>Mode 3 (yellow)</b>	On	Monitor output display mode is set for Full Screen mode
<b>Mode 4 (yellow)</b>	On	Monitor output display mode is set for Zoom mode

Table 2 provides the possible input and output conditions and LED states that result from different input signals.

Table 2. Input and Output Conditions

Input Signal	Standard LED	Field/Frame Rate LED	Output Signal
No signal or invalid signal	All LEDs off	All LEDs off	No valid output
1080i/50 Hz	1080i	50 Hz	PAL
1080i/59.94 Hz	1080i	59.94 Hz	NTSC
1080i/60 Hz	1080i	60 Hz	NTSC
1035i/59.94 Hz	1035i	59.94 Hz	NTSC
1035i/60 Hz	1035i	60 Hz	NTSC
720p/59.94 Hz	720p	59.94 Hz	NTSC
720p/60 Hz	720p	60 Hz	NTSC

# Configuration

The 2090MDC can be configured locally using on-board switches and jumpers or remotely using the 2000NET network interface.

The following parameters can be set on the 2090MDC module:

- Monitor output display mode,
- Pedestal on and off (525 rate only),
- Zoom factor (Zoom mode only),
- Horizontal position (Full Screen and Zoom mode), and
- Control mode – Local/remote or local control only (remote control lockout).

## Monitor Output Display Modes Description

The 2090MDC module provides Letterbox, Amorphous, Full Screen, and Zoom monitor output modes. Each is explained below and illustrated in [Figure 6 on page 8](#).

**Note** In modules with line rate inputs of 525 lines/frame, the pedestal level can be turned on or off in all four modes.

### Letterbox Mode

In Letterbox mode, the whole HD picture is converted to a full SD picture with horizontal resolution of 720 horizontal pixels and vertical resolution of 360 (NTSC) or 430 (PAL) lines (per frame).

### Amorphous Mode

In Amorphous mode, the whole HD picture is converted to a full SD picture with horizontal resolution of 720 horizontal pixels and vertical resolution of 486 (NTSC) or 576 (PAL) lines. No picture information is lost but vertical stretch occurs causing objects on screen to appear taller.

Figure 6. Monitor Output Mode Examples




Letterbox – Mode 1  
Complete picture in Letterbox format with blanking at top and bottom

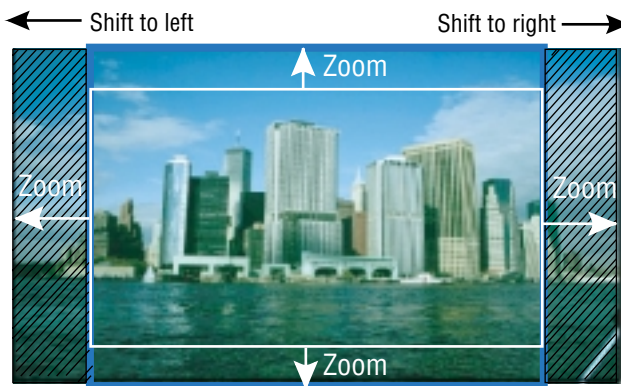


Amorphous – Mode 2  
Complete picture with vertical distortion (objects appear taller), no blanking at top or bottom




Full Screen – Mode 3  
Complete picture with no distortion; can be shifted left or right

 = Horizontal shift



Zoom – Mode 4  
Complete picture which can zoom from letterbox to full screen with horizontal shift adjustment at any zoom level greater than minimum letterbox

 = Horizontal shift

## Full Screen Mode

The Full Screen mode provides a monitor output with a complete SD picture with no distortion. The picture display can be shifted to the left or right with the on-board paddle switch, or set remotely in the Mode and Signal Standard display.

The horizontal shift occurs in steps of eight pixels of the input signal. The maximum number of pixels the display can be moved horizontally differs in each input standard. The maximum number of pixels that can be shifted for the three input standards are given in [Table 3](#).

*Table 3. Horizontal Shift Values In Full Screen and Zoom Mode*

<b>Input Standard</b>	<b>Maximum Steps</b>
1080i	60 steps (8 pixels per step)
1035i	68 steps (8 pixels per step)
720p	40 steps (8 pixels per step)

## Zoom Mode

The Zoom mode outputs display that can be zoomed in size from letterbox (minimum) to undistorted full screen (maximum). The display can be shifted from left to right with the on-board paddle switch or set remotely in the Mode and Signal Standard display.

In Zoom mode, the maximum number of pixels the display can be moved horizontally is a function of the input standard ([Table 3](#)) and the magnitude of the zoom. The horizontal shift occurs in steps of eight pixels of the input signal. At maximum Full Screen zoom factor the maximum number of pixels can be moved. At minimum Letterbox mode, no horizontal shift is possible.

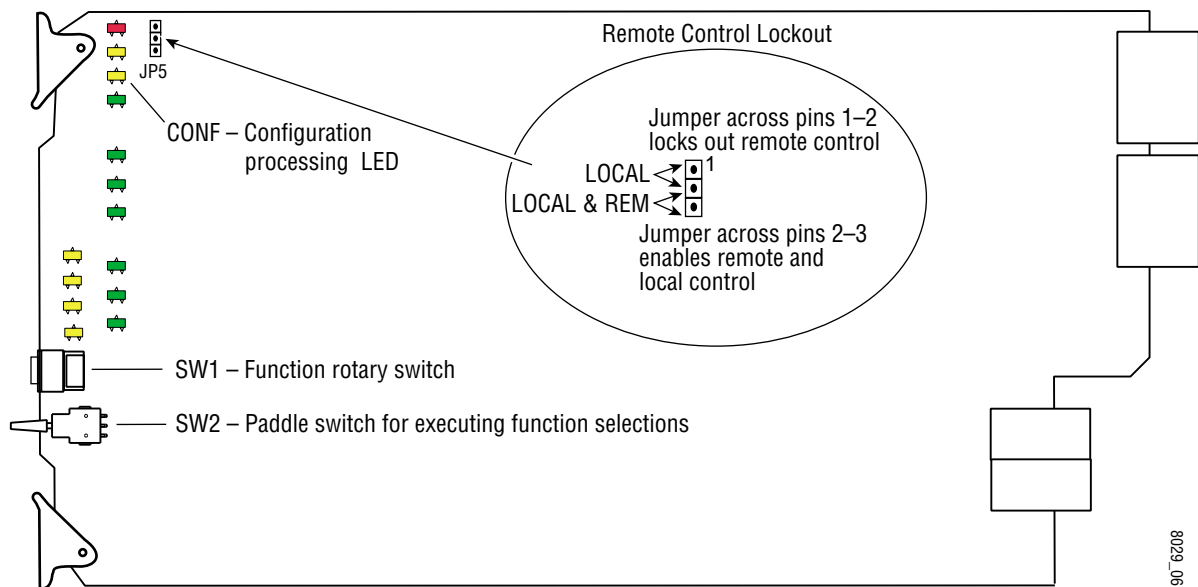
## Local On-board Module Configuration

The 2090MDC module can be configured locally using the jumper, and rotary and paddle switches shown in Figure 7. The CONF LED indicates status of the configuration process.

These components perform the following:

- Jumper JP5 – sets control mode for Local only or Remote and Local.
- SW 1 Function (rotary) switch – selects functions performed by paddle switch SW2. Refer to Table 4 for details.
- SW2 (paddle) switch – executes the functions selected by rotary switch. Refer to Table 4 for details.
- CONF (configuring) LED – when on, indicates the module is initializing or processing configuration information.

Figure 7. Module Configuration Jumpers and Switches

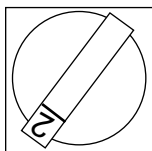


### Remote Control Jumper

When the jumper is placed across pins 1 and 2 of jumper block JP5 (see Figure 7), module output mode settings are adjustable from the local on-board switches only. To have both local and remote access, set the jumper across pins 2 and 3.



## Configuring Output Modes and Mode Parameters



To select the output modes and set other mode parameters with the local on-board switches, refer to the instructions below and [Table 4](#).

1. Use the Function rotary switch, SW1, shown in [Figure 7 on page 10](#) and at left, to enter each Function selection 1 through 4.
2. When a function has been selected, use the paddle switch, SW2, to perform the selected functions by moving the paddle switch left or right according to the instructions in the table below.

**Note** In Full Screen and Zoom mode the number of pixels that can be shifted horizontally per step of the paddle switch depends on the input standard and zoom magnitude as detailed in [Table 3 on page 9](#).

3. Holding the paddle switch in the left or right position will increase the number of steps in the functions below, whether zoom factor or horizontal shift. The number of steps will depend on the length of time the switch is held in either position and the starting value of the horizontal position or zoom.

Table 4. 2090MDC Mode Configurations

Rotary Switch Position	Function Name	Paddle Switch Left	Paddle Switch Right	Function Description
0	–	–	–	Inactive
1	Mode Select:	Select	Select	Use paddle switch to select output mode from Letterbox, Amorphous, Full Screen or Zoom. Choice will be indicated by front Mode LEDs (yellow).
2	Left/Right Shift:	Left	Right	In Full Screen and Zoom Mode, use the paddle switch to move the display to left or right. Note that full Letterbox mode (minimum zoom) is not adjustable.
3	Zoom In/Zoom Out:	Zoom In	Zoom Out	In Zoom Mode, use the paddle switch to zoom in and out. Minimum is Letterbox (right), maximum is Full Screen (left).
4	Setup Level	7.5%	0%	In all modes with 525 line rate input, use the paddle switch to set pedestal level to 7.5% (left) or 0% (right). Not active in 625 Hz line rate input.
5-F	–	–	–	Inactive

## Remote Configuration and Monitoring

2090MDC configuration and monitoring can be performed remotely using the 2000NET interface (see Figure 8). This section describes the GUI access to the module configuration functions. Refer to the 2000NET Network Interface Module Instruction Manual for information on setting up and operating the 2000 frame network.

For remote access, make sure jumper block JP5 on the module is set for both Local and Remote access (Figure 5).

**Note** The physical appearance of the menu displays shown in this manual represent the use of a particular platform, browser and version of 2000NET module software. They are provided for reference only. Displays will differ depending on the type of platform and browser you are using and the version of the 2000NET software installed in your system.

Figure 8. 2000NET GUI

The Links section lists the frame and its current modules. The selected link's Status page is first displayed and the sub-list of links for the selection is opened. The sub-list allows you to select a particular information page for the selected device.

Content display section displays the information page for the selected frame or module (frame slot icons are also active links).

Media Module	Net Card	Empty	Empty
Empty		Media Module	Empty
Media Module	Empty	Empty	
Media Module		Empty	
Media Module		Media Module	Power Sled
Media Module		Empty	

**Frame Status**  
 Model : 2000T3N Description : Module Frame  
 Frame Location : Studio B  
 Temperature State : PASS Fan Status Summary : PASS

**Properties**  
 Vendor : Gross Valley Group Net Card Software Version : 2.0.0  
 Media Slots : 24

0612-13

The 2000 modules can be addressed by clicking on a specific module icon in the frame status display or on a module name or slot number in the link list on the left.

The 2090MDC will indicate a SMPTE Alarm fault on the Frame Status display for the following alarms:

- Internal fault,
- Configuration fault, or
- Data error.

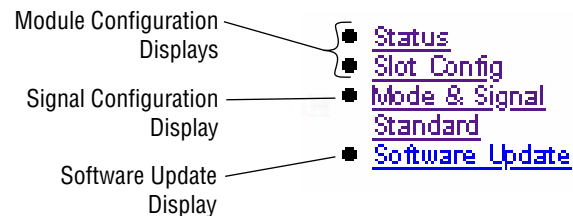
## Module Configuration Displays

The 2000 GUI provides the following links and displays for the 2090MDC module (Figure 9):

- Module Configuration displays showing status and slot configuration information (location and user assigned names),
- Signal Configuration displays, and
- Software Update display.

The Module Configuration displays are the same for all remote controllable 2000 modules. Refer to the 2000NET manual for more information on these displays. Some functions listed may not be supported by a particular module. These will be indicated as not supported.

Figure 9. 2090MDC Display Links



## Software Update Displays

The Software Update display allows you to download new software versions for the module. Refer to the 2000NET manual and the Grass Valley Group web site at <http://www.grassvalleygroup.com> for complete details and new software versions.

## Signal Configuration Displays

This section discusses the Signal Configuration Displays available to set and monitor the 2090MDC module parameters remotely.

### Mode and Signal Standard

The Mode and Signal Standard display is shown in Figure 10. After selecting a mode, select the Apply button to activate it. The displays for each mode will differ and are illustrated in this section.

Each display will report the following items for the current module status:

- Input Standard (1080i, 1035i, 720p or No input),
- Field Rate (50 Hz, 59.94 Hz, or 60 Hz), and
- Output Standard (525 or 625).

This display provides controls for setting the following functions on the 2090MDC module:

- Monitor output mode (Letterbox, Amorphous, Full Screen or Zoom). Refer to *Monitor Output Display Modes Description on page 7* for details on each mode.
- Pedestal on and off for all modes (525 line rate only).
- Horizontal Shift in Full Screen mode (Figure 11).
- Zoom factor (minimum letterbox to maximum full screen) and horizontal shift in Zoom mode (Figure 12).

- Use This Link
- [Status](#)
  - [Slot Config](#)
  - [Mode & Signal Standard](#)
  - [Software Update](#)

Figure 10. Mode and Signal Standard Display

**2090MDC Mode & Signal Standard**  
 Model : 2090MDC Description : Monitoring Down Converter  
 Frame Location : Modular Lab , Slot : 2  
 Input Standard : 720p Field Rate : 59.94 Hz Output Standard : 525

Mode: Selection Current Setting  
 Letterbox Letterbox  
 Apply

Pedestal: Selection Current Setting  
 On On  
 Apply

Select mode of output monitor to one of the following:  
 ✓ Letterbox  
 Amorphous  
 Full Screen  
 Zoom

Set pedestal level of output to On or Off (all modes).

When Letterbox or Amorphous modes are chosen, the display will be similar to the illustration in Figure 10. If the Output Standard is 525, the Pedestal selection will appear and allow control of the setup level to on or off. Select the desired condition and select the Apply button to activate it. The Pedestal selection will not appear when the module is operating with a 625 line rate.

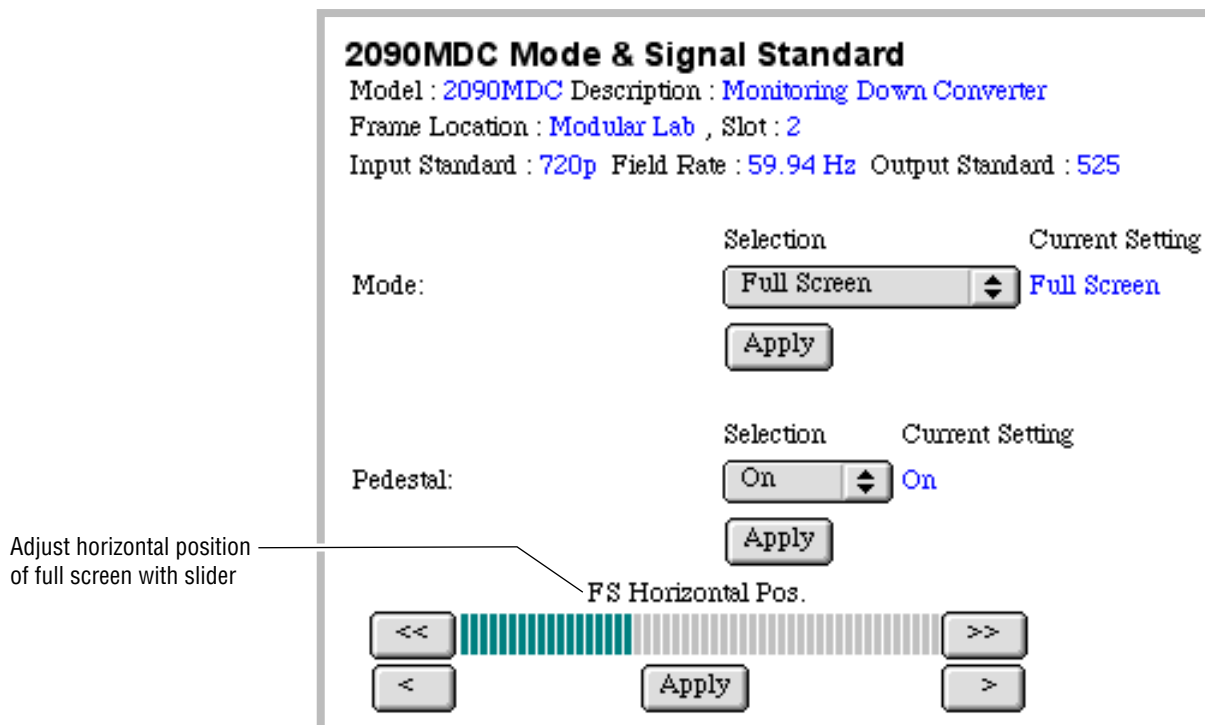
When Full Screen mode is chosen, the display will appear similar to that of Figure 11. Refer to the explanation for *Full Screen Mode on page 9* for complete details on this mode.

Use the FS Horizontal Pos. slider to move the Full Screen display to the left or right. Use the single (1X) or double arrows (10X), then press the Apply button.

Note that when using the single arrow, each step change (approximately eight pixels in either direction) may require up to seven clicks of the single arrow. This is due to the division of the bar display into 256 steps. Shifting the display is a function of the maximum number of steps for the input standard divided by 256.

To determine exactly how many clicks will move the display one step if this is required, refer to Table 3 on page 9. Make the approximate number of clicks before pressing the Apply button. The returned bar position will be an approximate (rounded off) value. The double arrows will increment the display by approximately 10 times in the same manner.

Figure 11. Full Screen Output Mode Display



In Zoom mode (Figure 12), use the Zoom slider to set the zoom factor from full letterbox (minimum) to full screen (maximum). Use the single (1X) or double arrows (10X), then press the Apply button.

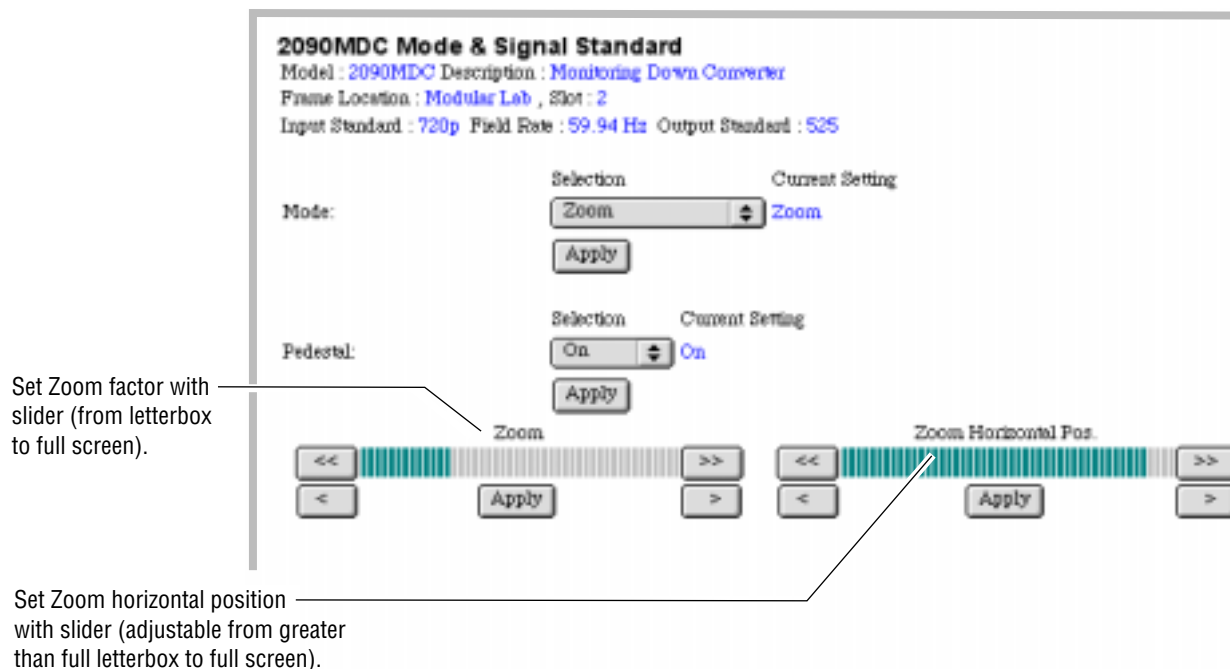
The Zoom magnitude has 35 possible values. To increment the Zoom by one step will require up to eight clicks on the single arrow due to the number of divisions of the bar display. Make the approximate number of clicks before pressing the Apply button. One double arrow click will increment the Zoom by one step.

Use the Zoom Horizontal Pos. slider to move the display to the left and right. Use the single (1X) or double arrows (10X), then press the Apply button. (Note that in minimum full letterbox mode, the horizontal display is not adjustable.)

Note that when using the single arrow, each step change (approximately eight pixels in either direction) may require up to seven clicks of the single arrow. This is due to the division of the bar display into 256 steps. Shifting the display is a function of the maximum number of steps for the input standard divided by 256. A larger number of clicks will be required when the picture has been zoomed down to less than Full Screen size.

To determine exactly how many clicks will move the display one step if this is required, refer to Table 3 on page 9. Make the approximate number of clicks before pressing the Apply button. The returned bar position will be an approximate (rounded off) value. The double arrows will increment the display by approximately 10 times in the same manner.

Figure 12. Zoom Mode Display



# Specifications

Table 5. 2090MDC Specifications

Parameter	Value
<b>Serial HD Input</b>	
Number and type of inputs	1 BNC
Input impedance	75 Ohm
Input signal formats	1.5 Gbit serial digital conforming to the following SMPTE formats: 240M (1920/1035i 59.94/60 Hz), 274M (1920/1080i 59.934/60 Hz) 295M (1920/1080i 50 Hz) 296M (1280/720p 59.94/60 Hz)
Signal level	800 mV $\pm$ 10%
Return loss	>15 dB to 1.5 GHz
<b>Serial HD Outputs</b>	
Number and type of outputs	2 BNC
Output impedance	75 Ohm
Output signal formats	1.5 Gbit serial digital conforming to the following SMPTE formats: 240M (1920/1035i 59.94/60Hz), 274M (1920/1080i 59.934/60 Hz) 295M (1920/1080i 50 Hz) 296M (1280/720p 59.94/60 Hz)
Output level	800 mV $\pm$ 10%
Return loss	>10 dB to 1.5 GHz
<b>Serial Digital Outputs</b>	
Number and type of outputs	2 BNC
Output impedance	75 Ohm
Signal type	Serial digital video conforming to SMPTE 259M 10-bit 4:2:2 component standard
Signal level	800 mV $\pm$ 10%
Return loss	>15 dB to 270 MHz
<b>NTSC/PAL Analog Composite Outputs</b>	
Number and type of outputs	2 BNC
Output impedance	75 Ohm
Signal type	Conforming to SMPTE 170M (NTSC), CCIR-624 (PAL)
Signal level	1 V p-p
Differential gain	0.3%
Differential phase	0.4 °
Luminance nonlinearity	$\pm$ 1%
Chroma nonlinear gain	$\pm$ 1.2%
Chroma nonlinear phase	$\pm$ 0.3 °
Frequency response – luma	$\pm$ 0.1 dB @ 5.5 MHz
Frequency response – chroma	-2 dB @ 1.3 MHz
Return loss	> 40 dB to 5.5 MHz
<b>Analog Component Outputs</b>	

Table 5. 2090MDC Specifications - (continued)

<b>Parameter</b>	<b>Value</b>
Number and type of outputs	3 BNC
Output impedance	75 Ohm
Signal type	Component analog video (SMPTE 253M)
Signal level	1 V p-p nominal
Return loss	> 40 dB to 5.5 MHz
<b>Performance</b>	
Aspect ratio modes	Letterbox, amorphous, full screen, zoom
Power	< 15 W
<b>Environmental</b>	
Frame temperature range	0 to 45 ° C
Operating humidity range	0 to 90% non condensing
Non-operating temperature	-10 to 70 ° C



## Service

The 2090MDC modules make extensive use of surface-mount technology and programmed parts to achieve compact size and adherence to demanding technical specifications. Circuit modules should not be serviced in the field unless otherwise directed by Customer Service.

### Power-up Diagnostics Failure

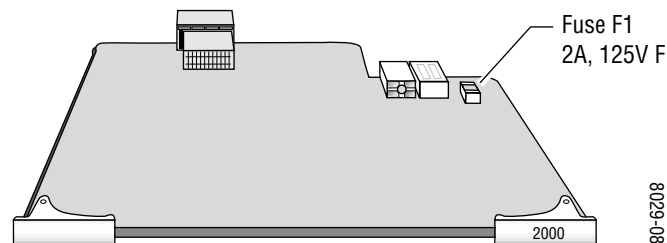
If the module has not passed self-diagnostics, do not attempt to troubleshoot. Return the unit to Grass Valley (see [Module Repair](#)).

### Troubleshooting

If your module is not operating correctly, proceed as follows:

- Check frame and module power. If power is not present, check the fuse on the front Media module as illustrated in Figure 13.
- Check for presence and quality of input signals.
- Verify that source equipment is operating correctly.
- Check cable connections.

Figure 13. Location of Front Module Fuse



### Module Repair

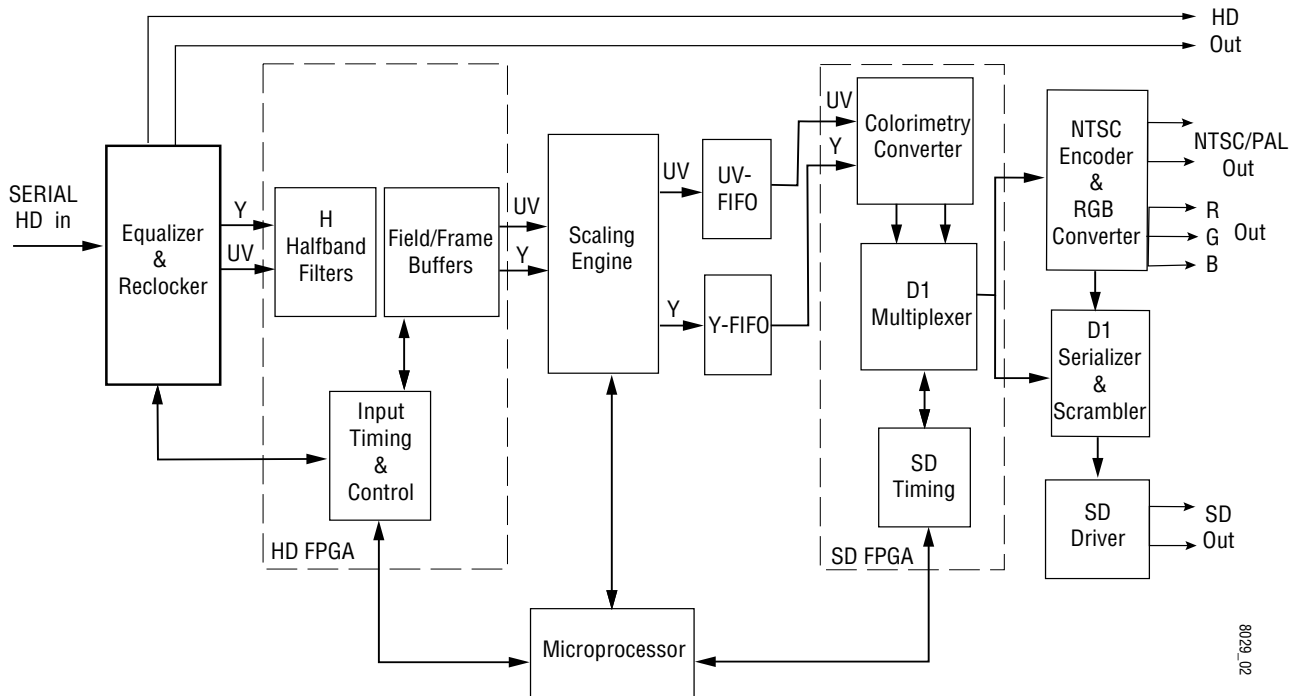
If the module is still not operating correctly, replace it with a known good spare and return the faulty module to a designated Grass Valley repair depot. Call your Grass Valley representative for depot location.

Refer to [Contacting Grass Valley Group](#) at the front of this document for the Grass Valley Customer Service Information number.

## Functional Description

A block diagram of the 2090MDC is shown in [Figure 14](#).

Figure 14. 2090MDC Block Diagram



### Input Processing

The input section equalizes, re-clocks and de-serializes the HD input signal.

One equalized and reclocked version of the input is fed back to the rear looping BNC connector assembly through an output driver to become the two HD outputs.

### Scaler

The parallel video from the input processor is filtered and decimated in the field/frame buffer in the HD FPGA and enters the scaling engine IC. Video data from the Input Processing section is scaled down so that it will fit onto a standard definition screen. The amount and type of scaling is programmed by the user; locally, by setting on-board switches, or remotely through the frame controller.

## UV and Y FIFOs

The UV and Y FIFOs act as buffers between the output of the scaler and the monitor output section. The FIFOs perform field rate conversion from 60 Hz to 59.94 Hz.

## Colorimetry Converter

The colorimetry converter converts the color value from the coding matrix used for HD video (ITU BT 709) to the corresponding value (ITU BT 601) in the standard definition coding matrix. This conversion is done in the SD FPGA.

## Multiplexer

The multiplexer section of the SD FPGA multiplexes the Y and UV data into one D1 data string.

## NTSC/RGB Encoder

The D1 signal from the Multiplexer splits off and one path enters the NTSC Encoder and RGB Converter circuitry. The digital parallel data in D1 format is encoded into analog NTSC and also converted to analog RGB. These signals are fed through output drivers to the two looping BNCs for NTSC/PAL video and a set of RGB outputs for feeding component monitors.

## Scrambler and Serializer

The other D1 signal path from the Multiplexer enters Scrambler and Serializer circuitry which converts the output into two SDI outputs. These SDI outputs are sent to an SD driver and then to the rear connector assembly as the two 601 outputs.

## Timing

Each FPGA contains timing circuitry to generate all necessary input and SD video timing signals needed by the other components. An output pixel clock is also produced via a phase lock loop locked to the input bit rate.

## **Microcontroller**

The microcontroller configures the other components:

- At power up,
- When the standard of the input signal changes, and
- When the user changes the output display mode using the front panel pushbuttons or remote control settings.

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