Dolby® LM100 Broadcast Loudness Meter User's Manual

Issue 5 Part Number 91846

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Regulatory Notices

FCC

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Canada

This Class A digital apparatus complies with Canadian ICES-003.

EU/EMC

This unit complies with the EMC requirement of EN55103-1 and EN55103-2 when operated in an E2 environment in accordance with this manual.

This equipment complies with the EMC requirements of EN55022 and EN55024 when operated in accordance with this manual.

Important Safety Instructions

1. Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. Do not use this apparatus near water.
6. WARNING: To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture.
7. Clean only with dry cloth.
8. Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
9. No naked flame sources, such as lighted candles, should be placed on the apparatus.
10. Protect the power cord from being walked on or pinched, particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
11. Only use attachments/accessories specified by the manufacturer.
12. Unplug this apparatus during lightning storms or when unused for long periods of time.
13. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as the power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

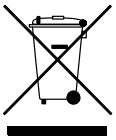
14. Do not expose the apparatus to dripping or splashing; no objects filled with liquids, such as vases, shall be placed on the apparatus.
15. CAUTION: This equipment contains a lithium battery. Danger of explosion if the battery is incorrectly replaced. Replace only with the same or equivalent type. Do not disassemble, crush, puncture, short external contacts, or dispose of in fire or water. Dispose of the used battery in accordance with local law.
16. CAUTION: Troubleshooting must be performed by a trained technician. To reduce the risk of electric shock, do not attempt to service this equipment unless you are qualified to do so.
17. Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
18. This apparatus must be earthed (grounded) by connecting to a correctly wired and earthed power outlet.
19. Ensure that your mains supply is in the correct range for the input power requirement of the unit.
20. In order to reduce the risk of electrical shock, the power cord must be disconnected when the power supply assembly is removed.
21. This equipment is designed to mount in a suitably ventilated 19-inch rack; ensure that any ventilation slots in the unit are not blocked or covered.
22. The mains power disconnect device for this unit is the plug-in mains cord rather than a power switch. The mains cord must remain readily accessible for disconnecting mains power.
23. To avoid exposure to dangerous voltages and to avoid damage to the unit, do not connect the rear-panel Ethernet port to telephone circuits.
24. As the colours of the cores in the mains lead may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows:
    - The green and yellow core must be connected to the terminal in the plug identified by the letter E, or by the earth symbol ⏚, or coloured green, or green and yellow.
    - The blue core must be connected to the terminal marked with the letter N or coloured black.
    - The brown core must be connected to the terminal marked with the letter L or coloured red.
25. The power cord with CEE7/7 plug supplied with this unit for use in Continental Europe must be connected to a polarised mains socket, or the socket must be supplied via a residual current breaker (RCD). This power cord is not suitable for use in the UK. To use the cord in the UK cut off the CEE7/7 plug and replace with an approved BS 1363 13A plug:
    - The green and yellow core must be connected to the terminal in the plug identified by the letter E, or by the earth symbol ⏚, or colored green, or green and yellow.
    - The blue core must be connected to the terminal marked with the letter N or colored black.
    - The brown core must be connected to the terminal marked with the letter L or colored red.
26. This apparatus must be earthed.

Fuses

WARNING: Check that the correct fuses have been installed. For continued protection against risk of fire, replace only with fuses of the same type and rating. For details on fuse rating and instructions on fuse replacement, see Main Fuse.

WEEE

PRODUCT END-OF-LIFE INFORMATION



This product was designed and built by Dolby Laboratories to provide many years of service, and is backed by our commitment to provide high-quality support. When it eventually reaches the end of its serviceable life, it should be disposed of in accordance with local or national legislation.

For current information, please visit our website at: www.dolby.com/environment.

IMPORTANT SAFETY NOTICE

This unit complies with safety standard EN60065 as appropriate. The unit shall not be exposed to dripping or splashing and no objects filled with liquids, such as coffee cups, shall be placed on the equipment. To ensure safe operation and to guard against potential shock hazard or risk of fire, the following must be observed:

GB

- Ensure that your mains supply is in the correct range for the input power requirement of the unit.
- Ensure fuses fitted are the correct rating and type as marked on the unit.
- The unit must be earthed by connecting to a correctly wired and earthed power outlet.
- The power cord supplied with this unit must be wired as follows:

Live—Brown Neutral—Blue Earth—Green/Yellow

IMPORTANT – NOTE DE SECURITE

Ce materiel est conforme à la norme EN60065. Ne pas exposer cet appareil aux éclaboussures ou aux gouttes de liquide. Ne pas poser d'objets remplis de liquide, tels que des tasses de café, sur l'appareil. Pour vous assurer d'un fonctionnement sans danger et de prévenir tout choc électrique ou tout risque d'incendie, veillez à observer les recommandations suivantes.

F

- Le selecteur de tension doit être placé sur la valeur correspondante à votre alimentation réseau.
- Les fusibles doivent correspondre à la valeur indiquée sur le materiel.
- Le materiel doit être correctement relié à la terre.
- Le cordon secteur livré avec le materiel doit être cablé de la manière suivante:

Phase—Brun Neutre—Bleu Terre—Vert/Jaune

WICHTIGER SICHERHEITSHINWEIS

Dieses Gerät entspricht der Sicherheitsnorm EN60065. Das Gerät darf nicht mit Flüssigkeiten (Spritzwasser usw.) in Berührung kommen; stellen Sie keine Gefäße, z.B. Kaffeetassen, auf das Gerät. Für das sichere Funktionieren des Gerätes und zur Unfallverhütung (elektrischer Schlag, Feuer) sind die folgenden Regeln unbedingt einzuhalten:

D

- Der Spannungswähler muß auf Ihre Netzspannung eingestellt sein.
- Die Sicherungen müssen in Typ und Stromwert mit den Angaben auf dem Gerät übereinstimmen.
- Die Erdung des Gerätes muß über eine geerdete Steckdose gewährleistet sein.
- Das mitgelieferte Netzkabel muß wie folgt verdrahtet werden:

Phase—braun Nulleiter—blau Erde—grün/gelb

NORME DI SICUREZZA – IMPORTANTE

Questa apparecchiatura è stata costruita in accordo alle norme di sicurezza EN60065. Il prodotto non deve essere sottoposto a schizzi, spruzzi e gocciolamenti, e nessun tipo di oggetto riempito con liquidi, come ad esempio tazze di caffè, deve essere appoggiato sul dispositivo. Per una perfetta sicurezza ed al fine di evitare eventuali rischi di scossa êlettrica o d'incendio vanno osservate le seguenti misure di sicurezza:

I

- Assicurarsi che il selettore di cambio tensione sia posizionato sul valore corretto.
- Assicurarsi che la portata ed il tipo di fusibili siano quelli prescritti dalla casa costruttrice.
- L'apparecchiatura deve avere un collegamento di messa a terra ben eseguito; anche la connessione rete deve avere un collegamento a terra.
- Il cavo di alimentazione a corredo dell'apparecchiatura deve essere collegato come segue:

Filo tensione—Marrone Neutro—Blu Massa—Verde/Giallo

AVISO IMPORTANTE DE SEGURIDAD

Esta unidad cumple con la norma de seguridad EN60065. La unidad no debe ser expuesta a goteos o salpicaduras y no deben colocarse sobre el equipo recipientes con liquidos, como tazas de cafe. Para asegurarse un funcionamiento seguro y prevenir cualquier posible peligro de descarga o riesgo de incendio, se han de observar las siguientes precauciones:

E

- Asegúrese que el selector de tensión esté ajustado a la tensión correcta para su alimentación.
- Asegúrese que los fusibles colocados son del tipo y valor correctos, tal como se marca en la unidad.
- La unidad debe ser puesta a tierra, conectándola a un conector de red correctamente cableado y puesto a tierra.
- El cable de red suministrado con esta unidad, debe ser cableado como sigue:

Vivo—Marrón Neutro—Azul Tierra—Verde/Amarillo

VIKTIGA SÄKERHETSÅTGÄRDER!

Denna enhet uppfyller säkerhetsstandard EN60065. Enheten får ej utsättas för yttre åverkan samt föremål innehållande vätska, såsom kaffemuggar, får ej placeras på utrustningen. För att garantera säkerheten och gardera mot eventuell elchock eller brandrisk, måste följande observeras:

S

- Kontrollera att spänningsväljaren är inställd på korrekt nätspänning.
- Konrollera att säkringarna är av rätt typ och för rätt strömstyrka så som anvisningarna på enheten föreskriver.
- Enheten måste vara jordad genom anslutning till ett korrekt kopplat och jordat el-uttag.
- El-sladden som medföljer denna enhet måste kopplas enligt foljande:

Fas—Brun Neutral—Blå Jord—Grön/Gul

BELANGRIJK VEILIGHEIDS-VOORSCHRIFT:

Deze unit voldoet aan de EN60065 veiligheids-standaards. Dit apparaat mag niet worden blootgesteld aan vocht. Vanwege het risico dat er druppels in het apparaat vallen, dient u er geen vloeistoffen in bekers op te plaatsen. Voor een veilig gebruik en om het gevaar van electrische schokken en het risico van brand te vermijden, dienen de volgende regels in acht te worden genomen:

NL

- Controleer of de spanningscaroussel op het juiste Voltage staat.
- Gebruik alleen zekeringen van de aangegeven typen en waarden.
- Aansluiting van de unit alleen aan een geaarde wandcontactdoos.
- De netkabel die met de unit wordt geleverd, moet als volgt worden aangesloten:

Fase—Bruin Nul—Blauw Aarde—Groen/Geel

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Introduction

This chapter introduces the updated Dolby® LM100 Broadcast Loudness Meter and covers:

- LM100 Front and Rear Panels
- LM100 Configurations

Beset by loudness discrepancies—between programs or channels of television services—the broadcast, satellite, and cable TV industries have long required a simple method for quantifying perceived audio levels. These industries have traditionally controlled their program levels using either a PPM or VU meter, neither of which measures subjective loudness.

The LM100 features revolutionary measurement technologies capable of quantifying the subjective loudness of broadcast programming, eliminating the need for home listeners to adjust the volume.

For details on Dolby metadata, see *A Guide to Dolby Metadata*, available at dolby.com.

The LM100 measurement algorithms yield more consistent results than either PPM or VU meters with sources that primarily contain dialogue. They comply with EBU R128, ITU-R BS.1770-1, ITU-R BS.1770-2, and IEC 61672-1 and 61672-2.

The LM100 can determine the unweighted true-peak level per ITU-R BS.1770-1 Annex 2. The LM100 measures the loudness range in accordance with EBU Tech 3342, and displays measurements in an easy-to-understand numerical format.

You can use the LM100 in applications ranging from postproduction and quality control to final transmission and program turnaround.

The LM100 accepts stereo PCM, two-channel analog (baseband), and multichannel Dolby E and Dolby Digital (AC-3) audio inputs. For a facility working with analog or two-channel PCM audio, the unit can accurately quantify the subjective loudness of dialogue (and therefore the overall program level), which is useful in almost any environment where audio levels must be assessed. For facilities working with Dolby Digital or Dolby E signals, the LM100 can also measure or validate the existing dialogue level (also known as dialogue normalization, or `dialnorm`) parameter value within a Dolby Digital or Dolby E program by making a direct, objective comparison to the actual measured dialogue level value.

It can also display a range of other audio signal information. The unit includes a set of user-definable alarms and monitoring functions that can inform an operator of input loss, signal clipping, RF overmodulation, high or low signal levels, silence, phase errors, and incorrectly set dialogue level values. A dedicated GPI/O port provides a tally of these alarm conditions, with more extensive monitoring available through the serial ports and an internal event log.

1.1 LM100 Front and Rear Panels

The front panel includes:

- Controls to easily select the input source, program, and/or individual channels for measurement
- Dedicated controls to pause and reset the measurement function
- LEDs that indicate fault, error, and audio alarm conditions
- A headphone jack with volume control

For detailed information on the LM100 front panel, see Chapter 3.

The rear panel provides the following:

- AES3 digital input connectors with loop-through
- Two balanced analog inputs on combination XLR/quarter-inch TRS connectors
- A pair of RCA connectors for confidence and signal-presence monitoring of the selected source
- GPI/O status and alarm connectors

For detailed information on the LM100 rear panel, see Chapter 2

Note: The LM100 front- and rear-panel serial interfaces provide for the Dolby remote software, other remote control, status logging, and a means for updating firmware.

1.2 LM100 Configurations

The unit is available in the following two configurations:

- The LM100-LTC includes a linear timecode input that allows signal-condition alarm events to be logged against an external timecode (LTC) input.
- The LM100-NTSC includes an RF input specifically for CATV and NTSC off-air television measurement applications. The RF tuner also includes a composite video output. The RF input replaces the timecode input, therefore logging in this version is referenced to the internal clock.

Getting Started

This chapter gets you started using the LM100 in a basic configuration, and includes the following sections:

2.1 Unpacking and Inspection

Before unpacking the unit, inspect the outer carton for shipping damage. If the carton shows damage, inspect the unit in those areas.

Several essential items are provided with the unit, including:

- Power cords for use in the United States and continental Europe.
- A bag containing 75 ohm terminators, rackmount screws and washers, and a serial connection cable for the front-panel RS-232 port.
- Safety notices.
- Warranty information: Fill out the warranty card and return it to Dolby Laboratories.

Note: To maintain your eligibility for software upgrades, register your product on the software upgrades page at dolbysupport.com.

2.2 Safety Information

Before you begin installing your LM100, refer to the Important Safety Instructions.

2.3 Mounting

The LM100 is a 1-U rackmount unit that operates at ambient temperatures of up to 50°C (122°F). It ventilates through the rear and side panels.

Caution: Do not mount the LM100 directly above heat-generating equipment. Ensure adequate ventilation. The temperature inside a poorly ventilated rack can be considerably higher than ambient room temperature.

2.4 Rear-Panel Connections

The rear-panel connections include:

- AES3 digital inputs with loop-through
- Analog inputs and outputs
- Serial ports
- GPI/O ports
- Power supply

Make all other connections before connecting the power supply.

Figure 2-1 shows the **RF Input** and **Video Output** ports available on the LM100-NTSC. Figure 2-2 shows the **Timecode Input** port available on the LM100-LTC. All other connectors are identical on both models.

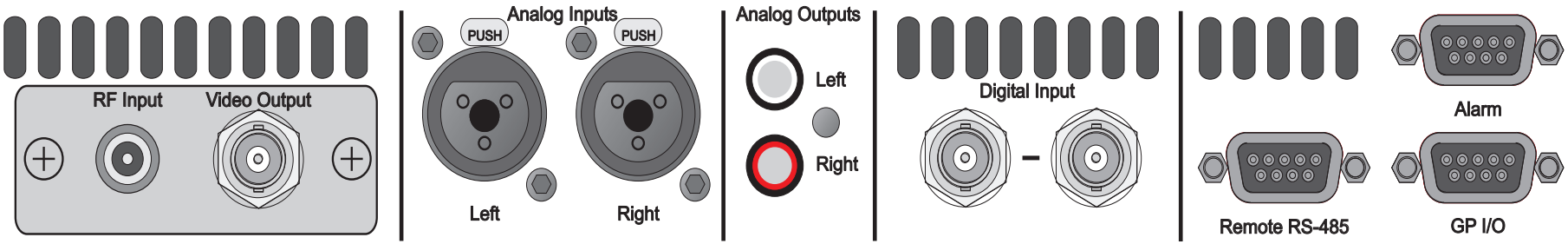


Figure 2-1 LM100-NTSC Rear-Panel Audio and Data Ports

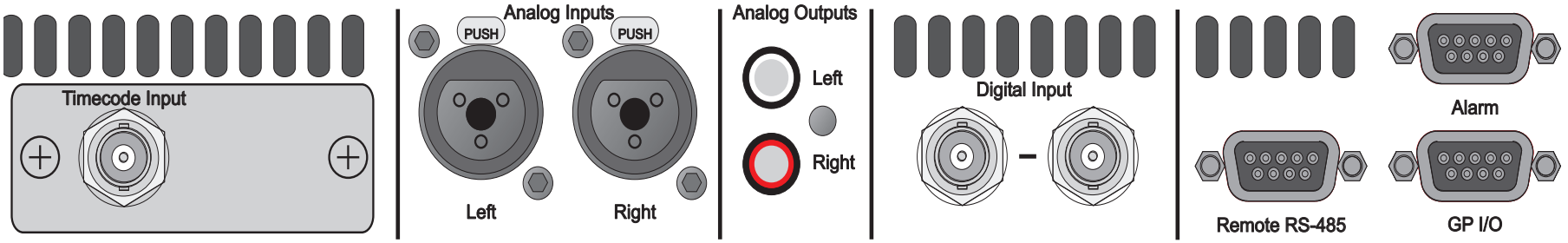


Figure 2-2 LM100-LTC Rear-Panel Audio and Data Ports

2.4.1 Analog Inputs

Each analog audio input jack accepts either a male XLR connector or a quarter-inch TRS connector. The maximum input signal level is +22 dBu.

2.4.2 Analog Outputs

The Left and Right analog outputs are provided on standard RCA connectors for confidence monitoring of the active audio program. They carry a two-channel audio signal automatically downmixed from a multichannel signal if necessary.

2.4.3 Digital Inputs

The digital input BNC connectors are AES-3id compliant. The unit processes Dolby® E, Dolby Digital, and PCM audio streams, with up to 24-bit resolution. You can use the second BNC as a passive loop-through to connect to other equipment; otherwise, it must be terminated using a standard 75 ohm termination.

2.4.4 Remote RS-485

You can use the remote RS-485 port for software upgrades, to connect to a custom-built remote-control software interface, or to send system log file entries to any device that can receive ASCII text strings using the RS-485 protocol. For details, see Section 5.7.

2.4.5 Alarm

Individual signal-condition alarms trigger pins on this port. You can connect this port to any device that can detect a TTL voltage level change. For details, see Section 5.5.

2.4.6 GPI/O

Specific LM100 status information and control inputs are provided through the **GP I/O** port. You can use a GPI/O device with the LM100 without setting it to Remote mode. For details, see Section 5.8.

2.4.7 NTSC

The LM100-NTSC includes a standard **RF Input** port. Use a standard 75 ohm RF cable to connect the LM100 to either a cable TV input or an antenna receiving off-air signals.

The LM100-NTSC **Video Output** is a standard composite video signal available on a female BNC connector. It allows confidence monitoring of the video for the active program.

2.4.8 LTC

The LM100-LTC includes a **Timecode Input** port that can read linear timecode per the SMPTE 12M specification.

2.5 Power

Warning: Before applying power, check the main fuse using the following procedure.

The LM100 uses a universal switching power supply that handles the full range of nominal mains voltages between 90 and 264 VAC and any frequency between 50 and 60 Hz.

Main Fuse

The main fuse rating is:

T 1A L (1 amp, 250 V, 20 mm, time-lag, low breaking capacity) for all operating voltages.

Warning: To reduce the risk of fire, replace fuses only with the same type and rating.

To inspect or replace the main fuse:

1. Slide open the fuse compartment in the AC power input housing by placing the tip of a small screwdriver in the notch.
2. Carefully pull out the fuse carrier.
3. Either replace the fuse with a new one, or check that the current fuse has the correct rating.
4. Slide the fuse compartment back into place, then snap the fuse compartment closed.

Internal Fuse

The switching power supply contains a separate fuse. Most fault conditions should be protected by the main fuse.

If you find it necessary to replace the internal fuse, be certain to replace it with a fuse of the same type and rating as printed on the switching power supply board.

No Power Switch

There is no power switch on the LM100. To apply power, connect the power cord to a live outlet.

2.6 Using the Default Measurement Display

As soon as power is applied, the LM100 is ready to measure. The unit computes infinite loudness for all channels measured and the loudest true-peak level for any current channel according to ITU-R BS.1770-2. True-peak measurements have an instant attack, a peak hold of 0.75 second, and a constant decay of 12 dB, ±2 dB, per second following the peak hold. Figure 2-3 shows an example screen.

Figure 2-3 Default Measurement Display Example

Pressing the **Enter** button takes you through the measurement cycle, which varies for each measurement type.

The LM100 is a very flexible instrument. Subsequent chapters in this manual provide the details on how to set the LM100 up for optimal measurement of any input in any environment.

2.7 Using the Dialogue and All Display

When Dialogue Intelligence™, infinite term, and either Leq(A) or ITU-R BS:1770-1 measurement are all enabled, the LM100 allows you to compare at a glance the measured value of just the dialogue and the measured value of all the channels in the program. Figure 2-4 shows an example.

Figure 2-4 Dialogue and All Display Example

This is not a default behavior. You must enable it on the `System Settings` menu as described in Section 4.3.7.

2.8 Installing the Remote Software

We strongly recommend that you continue on to install the remote management software. Universal Remote provides quick access to the LM100 functions, including some that are not available from the unit front panel.

Use of Universal Remote allows the LM100 to be located in another room or at a distance from the operator. While Universal Remote is in operation, the **Remote** button on the front panel of the unit is lit and access to the setup menu via the front-panel buttons is disabled.

Note: The RS-232 specification limits serial cable length to 50 feet. Using low capacitance cables can, however, extend this limit up to 147 feet. Refer to the specification for exact information.

2.8.1 Operating Systems

Universal Remote can be installed on a PC that runs Microsoft® Windows® XP or Windows 7. Dolby provides a Java Runtime Environment (JRE) with the Universal Remote software. You do not need to reinstall it if a JRE is already in place on your machine.

2.8.2 Installing the Software

Universal Remote software is provided as a download. We recommend that you visit dolbysupport.com to verify that you have the most recent release. To download software, follow the instructions on the site.

Once you have downloaded the software to your machine, simply double-click the executable file labeled unirem_x.x.x-installer_xxx.exe and follow the prompts.

2.8.3 Hardware Connection

To connect the LM100 to its remote control device, use a serial cable from your computer to either the front-panel **Remote RS-232** port or the rear-panel **Remote RS-485** port.

Note: You can use a USB-to-serial adapter to connect the serial cable to a laptop. However, these adapters occasionally cause enough delay to interfere with data communications. This problem is mostly likely to occur during firmware upgrades. Take care to establish the best possible connection before beginning an upgrade.

Supported RS-232 to USB Adapters

Dolby has tested the following adapters and approved them for use with the Universal Remote software:

- Digi International® Edgeport/8 with driver version 5.58.0
- Sealevel® SeaLINK® USB to RS-232 converter with driver version 2.08.02.0

While Dolby Laboratories' evaluation of available adapters and associated drivers was not exhaustive, some products not listed may also function properly.

2.8.4 Configuring the Unit for Remote Operation

An LM100 arrives configured to communicate with the remote application at 115,200 baud, using the unit address 8280.

The remote response from the unit is fastest at 115,200 baud, so we recommend using that rate if possible. The unit does support slower communication rates. The unit address is only important when more than one LM100 is attached to the same serial port. Contact your technical support representative if you need assistance with unit addressing.

You can change the default remote operation settings from the unit front panel on the `System Settings` portion of the `Setup` menu. Follow these steps.

1. At the main status screen, press **Setup**.
2. At the main `Setup` menu, press ↓ until the highlighted item on the LCD second line reads `System Settings` (six times).
3. Press **Enter**.
4. Press ↓. The second line reads `Baud Rate`. Press **Enter** if you need to change it. Then press ↓ until the baud rate you wish to use is highlighted in the display. Press **Enter**. Then press **Esc** to return to `System Settings`.
5. Press ↓ twice. The second line reads `Unit Address`. Press **Enter** if you need to change it.
6. Use the arrow keys enter a new unit address. Then press **Enter** to commit to the new address.

2.8.5 Beginning and Ending Remote Operation

To begin remote operation, on the LM100 unit front panel, press and release **Shift** once so that the key lights up, then press ←. While in remote mode, ← (labeled **Remote**) glows, and setup commands cannot be made using the unit front panel. Status displays remain accurate in remote mode.

To end remote operation, press **Shift** then ← again.

2.8.6 Starting the Universal Remote Software

To start the remote software in Windows:

1. Go to **Programs** > **Dolby Laboratories** > **Universal Remote**.
2. Click **Universal Remote**.

The machine displays the main application screen shown in Figure 2-5.

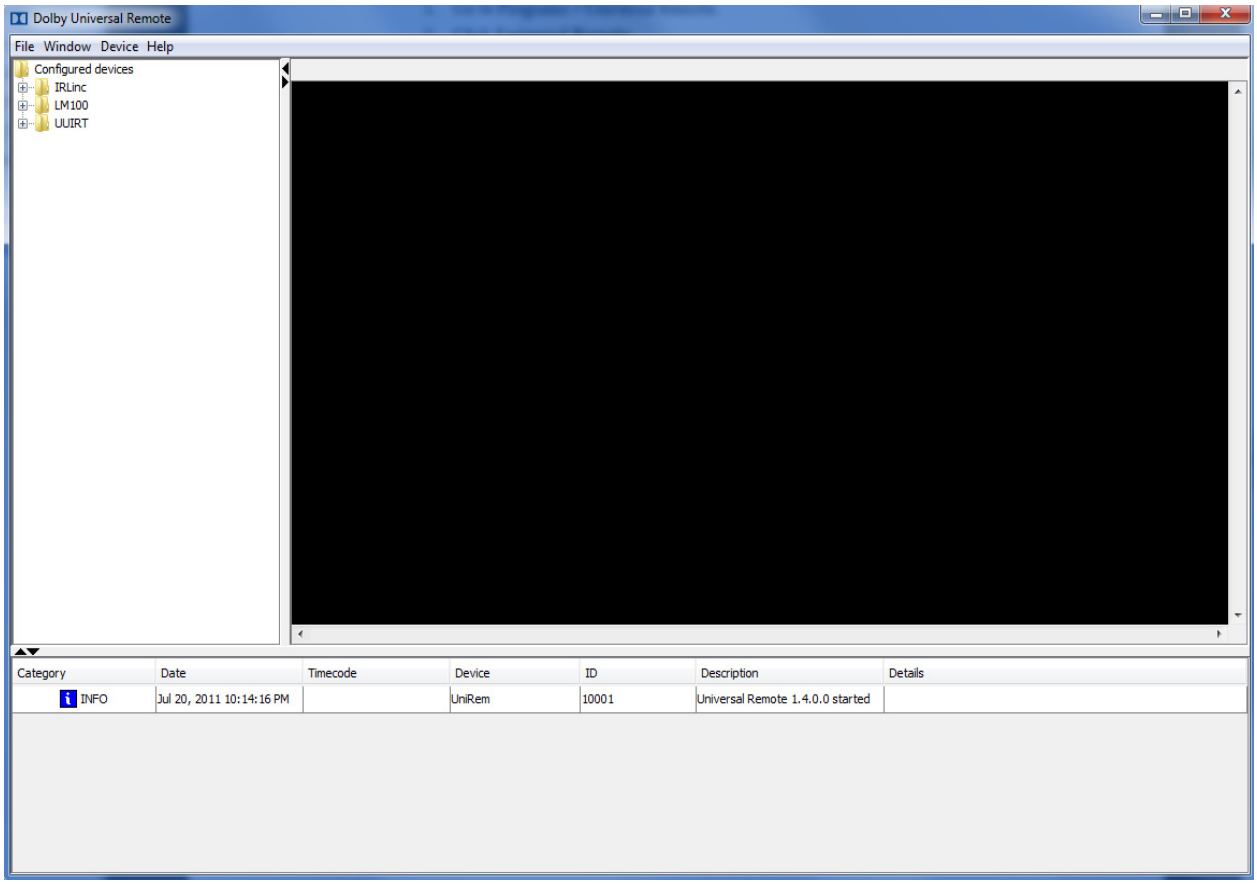


Figure 2-5 Universal Remote Main Screen

Connect to one of your configured devices to begin work.

See the online help for detailed information on using the Universal Remote effectively.

Front-Panel Controls

This chapter describes the LM100 front-panel controls.

Figure 3-1 LM100 Front Panel

The material includes:

- Button Functions
- Button Combinations for Special Functions
- LED Indicators
- The RS-232 Connection
- The Headphone Connection

3.1 Button Functions

You use the LM100 front-panel buttons to navigate menus, for measurement related functions, and for special functions, such as hardware resets, factory resets, and firmware upgrades. Following is a description of each button.

3.1.1 Navigation Buttons

The front-panel buttons control the operation of the LM100. The front of each button is labeled with its primary function.

Above or below some buttons are alternate functions. To enable an alternate function, press the LM100 **Shift** button and then press the corresponding button. The **Shift** button lights when pressed, and remains lit until you press a button with an associated shift command, press **Shift** again, or press the LM100 **Esc** button.

Pressing ← scrolls through the status menus. In setup menus and the `Dolby E Metadata` and `Dolby Digital Metadata` status menus, when selecting an option, pressing ← returns the display to the next-higher menu level without activating your selection. Pressing **Shift** followed by ← activates remote operation. The ← button glows, and the unit remains in remote operation until the same combination is pressed again. In the `Headphone Volume` or `Brightness` menu, pressing ← decreases the setting incrementally.

Pressing ↑ moves the selection from the current menu option to the one above. In the `Headphone Volume` or `Brightness` menu, pressing ↑ increases the setting

incrementally. In the main status screen, pressing **Shift** followed by ↑ increases the RF channel number when the RF input is selected.

Pressing ↓ moves your selection from the current menu item to the one below.

In the `Headphone Volume` or `Brightness` menu, pressing ↓ decreases the setting incrementally.

In the main status screen, pressing **Shift**, ↓ decreases the RF channel number when the RF input is selected.

Pressing → scrolls through the status menus. In setup menus and the `Dolby E Metadata` and `Dolby Digital Metadata` status menus, when a menu option is selected, pressing → displays the submenu for that option.

Pressing **Shift**, → displays the `Brightness` menu.

When you select a menu option, pressing **Enter** displays the submenu for that option.

When you select a menu option, pressing **Enter** displays the submenu for that option. In the `Main Setup` menu, when a parameter setting is selected, pressing **Enter** activates the selected parameter and displays the next-higher menu level. In the main status screen, pressing **Enter** scrolls through the display options on the right side of the screen.

In the main status screen, pressing **Enter** scrolls through the display options on the right side of the screen.

In a status menu, pressing **Setup** displays the last setup menu viewed.

In a setup menu, pressing **Setup** displays the main setup menu. In a setup menu, pressing the **Status** combination (**Shift** followed by **Setup**) displays the last status menu viewed. In a status menu, pressing the **Status** combination displays the main status screen.

Pressing **Esc** returns the display to the next-higher menu level without activating a selected parameter.

In the `Headphone Volume` or `Brightness` menu, pressing **Esc** returns the display to the last menu viewed. **Reset** and **Pause** are dedicated controls for measuring loudness. For details on loudness measurement functions, see Section 5.1.

3.2 Button Combinations for Special Functions

In special cases, you may need to reset the LM100 or upgrade the firmware. Table 3-1 shows the button combinations to press for each of these special functions.

Table 3-1 Special Function Button Combinations

Function	Action/Result
Hardware reset	Press **Shift**, **Esc**, and → simultaneously to reboot the LM100.
Firmware upgrade	During reboot, press and hold **Setup**; the status display provides you with the option of upgrading the unit firmware or completing the boot sequence.

Table 3-1 Special Function Button Combinations (continued)

Function	Action/Result
Factory reset	During reboot, press and hold **Enter**; the status display provides you with the option of restoring factory defaults or completing the boot sequence. **Note:** Restoring factory defaults includes all presets and GPI/O configuration assignments.

3.3 LED Indicators

The **Audio Alarm** indicator glows if a user-configurable signal-condition alarm is triggered, as described in Section 5.5.

The **Error** indicator glows when an error prevents the unit from processing the selected input correctly (for example, if there is a loss of input signal or the input signal does not match the requirements for the selected input type). Error conditions are detailed in Table 3-2. When the **Error** indicator is triggered, the `Error Stats` status menu provides more information regarding the source of the error, as detailed in Table 3-2

Note: The **Fault** indicator glows if there is an LM100 hardware fault.

Table 3-2 Error Conditions and Indicators

Menu Display	Error	Corrective Action
`Invld Frmt` (Invalid format)	The input format does not match the selected decode format.	Check the input signal format or change the selected decode format.
`Invld Rate` (Invalid rate)	The input is a valid PCM signal, but the sampling rate is not 32, 44.1, or 48 kHz.	Use the correct sampling rate.
`Invld Prog` (Invalid program)	The input is a valid Dolby® E signal, but the selected Dolby E program number is not present in the input stream.	Select a valid program number for the input stream.
`DE Frm Dsc` (Dolby E frame discontinuity)	The Dolby E frame count is not continuous, indicating a missing frame or edit.	Check the Dolby E stream.
`Invld AES Ch` (Invalid AES channel)	The input is a valid Dolby Digital signal, but the selected AES3 channel contains an invalid bitstream.	Select a valid AES3 channel setting.
`Invld Bstr` (Invalid bitstream)	The digital input is selected, but the unit is receiving a bitstream that is not Dolby E or Dolby Digital.	Provide a valid bitstream.
`No Input`	Input is missing.	Change the input selection or check the input source.
`Invld Ch Md` (Invalid channel mode)	The input is a valid Dolby E signal, but the metadata indicates more channels than exist in the selected program.	Check the channel mode configuration parameter within the selected program in the Dolby E stream.
`RF Ov Prot` (RF overmodulation protection enabled)	The Dolby E metadata RF overmodulation protection parameter is enabled in one or more of the programs.	Check the Dolby E stream.
`No DD Md` (No Dolby Digital metadata)	Dolby E metadata does not contain Dolby Digital metadata.	Check the Dolby E stream.

Table 3-2 Error Conditions and Indicators (continued)

Menu Display	Error	Corrective Action
`Uncal` (Uncalibrated)	The unit is uncalibrated.	Return the unit to the factory for calibration.

3.4 The RS-232 Connection

The **Remote RS-232** port can be used for software upgrades, to connect to a custom-built remote-control software interface, or to send LM100 system log file entries to any device that can receive ASCII text strings using the RS-232 protocol. For details, see Section 5.7.

Note: Connecting a cable to this port disables the rear-panel **Remote RS-485** port.

3.5 The Headphone Connection

You can connect headphones to the LM100 for confidence monitoring of the active program. To adjust headphone volume, press **Shift** followed by **Enter.** Adjust the headphone volume with the up and down arrow keys, then press **Enter** to commit to the new volume level.

Menus

This chapter explains how to navigate through the Dolby® LM100 menus. It also provides a detailed description of the status menus and the main setup menu.

The material includes:

4.1 Menu Basics

The front-panel screen displays status menus that show the current measurement and settings, and setup menus that control the unit functions.

The status menus and main setup menu are separate structures. To view the main setup menu when a status menu is displayed, press **Setup.** To view a status menu when a setup menu is displayed, press **Shift** followed by **Setup**.

Note: If you do not press a front-panel button within the interval set on the `Screen Saver Timeout` setup menu, the LM100 displays a screen saver that inverts the display. Pressing any front-panel button returns the screen to normal.

4.2 The Status Menus

The status menus display the current measurement values and active settings for a selection of setup parameters and the condition and content of input signals.

The main status screen shows the current measured loudness value and information regarding the input stream status.

You can display additional input stream status information by pressing the ← and → buttons to scroll through the other status menus.

4.2.1 Main Status Screen

When you power on the LM100, the main status screen appears.This is the most important LM100 screen, showing the measured loudness values. This screen is usually divided into three sections, although one display option divides the screen into two sections. Examples of the main status screen receiving a Dolby Digital bitstream appear in Figure 4-1, Figure 4-2, Figure 4-3, and Figure 4-4.

Figure 4-1 Main Status Screen with the Default ITU-R BS.1770-2 Measurement Type

Figure 4-2 Main Status Screen with the EBU R128 Measurement Type

Figure 4-3 Main Status Screen with the ITU-R BS.1770-1 Measurement Type

Figure 4-4 Main Status Screen with the Leq(A) Measurement Type

If the LM100 detects no input, it displays a message, as shown in Figure 4-5.

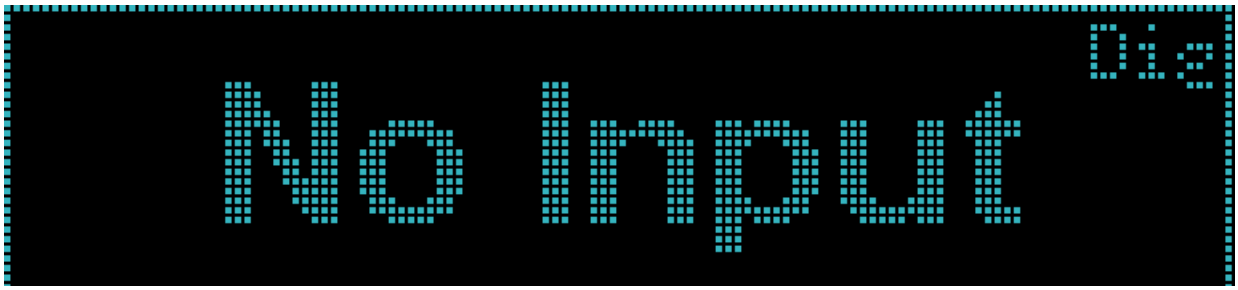


Figure 4-5 Main Status Screen with No Input Signal

Input Identifier

The input stream is identified in the upper left section of the display. When the source is Dolby Digital, the channel mode appears. If an LFE channel is included, it is indicated by an L to the right of the channel mode. Immediately next to the channel mode, the data rate in kbps appears.

When the source is Dolby E, the screen displays the program configuration, the bit depth of the Dolby E stream, and the currently selected program, as shown in Figure 4-6.

Figure 4-6 Main Status Screen when Receiving a Dolby E Stream

When the source is PCM, the sample rate appears, as shown in Figure 4-7.

Figure 4-7 Main Status Screen when Receiving a PCM Signal

When the input is an analog signal, no additional information appears, as shown in Figure 4-8.

Figure 4-8 Main Status Screen when Receiving an Analog Signal

When the input is an RF signal, the channel number, tuning mode (`Cable`, `CableHRC`, `CableIRC`, or `Off-Air`), and input audio type appear, as shown in Figure 4-9.

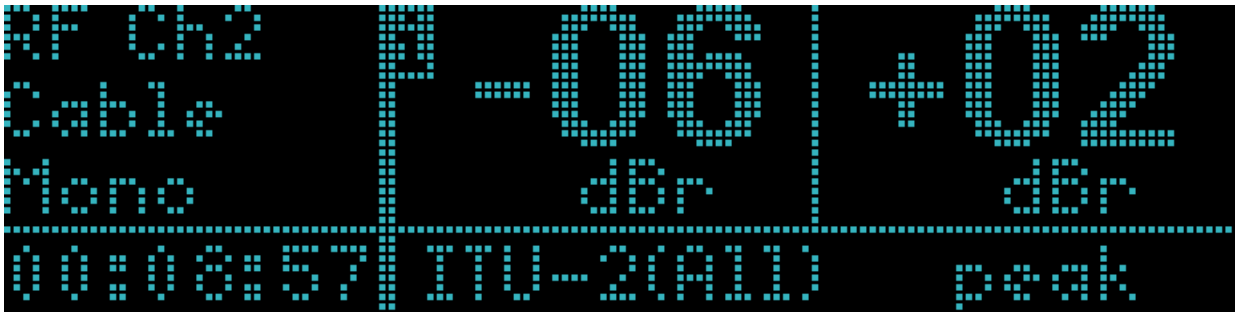


Figure 4-9 Main Status Screen when Receiving an RF Signal

Measurement Timer

If the LM100 is in Infinite measurement mode, a time counter appears in the lower left portion of the screen, as shown in Figure 4-1. This indicates the amount of time that has elapsed since the measurement was reset.

If you pause the measurement, that area flashes `paused`, and the **Pause** button also flashes.

When the LM100 is in Short-Term mode with Dialogue Intelligence™ enabled, the time counter appears when dialogue is not detected, indicating the amount of time elapsed since dialogue was last detected. While dialogue remains undetected, the measurement value in the center section flashes and a second value appears at the bottom of the center section. That value shows the current non-dialogue-based measurement; the flashing value shows the last valid dialogue-based measurement, and the counter shows the time elapsed since the dialogue-based measurement stopped. When dialogue-based measurement resumes, the time counter and the second value no longer display.

Measurement Displays

The remainder of the screen displays information relative to the current measurements.

The center number, –28 in Figure 4-1, is the current measured loudness value. The letter at the top left of this portion of the display indicates whether the measurement method is short term `(s)` or infinite `(i)`. For more information see Section 5.3. The channels currently being measured appear in parentheses next to the name of the selected measurement type (`EBU`, `ITU-2`, and so on).

The value at the far right is the largest peak value currently being measured from any individual channel within the program. This peak meter has an instant attack, a peak hold of 0.75 second, and a constant decay of 12 dB/second, ±2 dB/second, following the peak hold.

The main status screen also provides different display modes. Press **Enter** to scroll through these different modes on the right side of the screen.

When measuring Dolby Digital or Dolby E signals, the far right section of the default screen shows the setting for the `dialnorm` value contained in the metadata stream. If you press **Enter**, this section of the display shows the largest true-peak value. If you press **Enter** a second time, this section of the display shows the largest sample peak value. If you press **Enter** a third time, the screen displays only a single, larger magnification of the loudness measurement. Pressing **Enter** a fourth time displays the default screen where the `dialnorm` value appears on the far right.

Note: When the measurement type is ITU-2, one additional measurement is included in this sequence of displays (the loudness range measurement). The display sequence repeats following this measurement screen.

Note: When the measurement type is EBU mode, two additional measurements are included in this sequence of displays. In addition to the loudness range measurement, the display sequence includes a momentary maximum loudness measurement. The display sequence repeats following this measurement screen.

If the LM100 is using the infinite method with Dialogue Intelligence enabled and dialogue is not detected, the measurement value holds and begins to flash until the unit detects dialogue again.

When using the short-term method with Dialogue Intelligence enabled, if dialogue is not detected, the measurement value flashes and a second value appears at the bottom of the center section, as previously discussed. That value shows the current non-dialogue-based measurement; the flashing value shows the last valid dialogue-based measurement, and the time counter in the lower left section shows the time elapsed since the dialogue-based measurement stopped.

When dialogue-based measurement resumes, the time counter and the second value no longer appear. When you select the analog input, an additional display mode is now available. This additional mode displays the recommended value for setting the dialogue level parameter in downstream Dolby Digital or Dolby E encoding equipment; this recommended value allows the operator to simply calculate a `dialnorm` value when measuring analog sources. Figure 4-10 shows an example of this display.

Figure 4-10 Main Status Screen Displaying a Recommended dialnorm Setting for an Analog Input

Note: The valid range for the `dialnorm` value is from –1 to –31 dBFS*. However, the derived analog `dialnorm` feature on the LM100 can, in some cases, display measured values below –31, indicating that the input levels are too low to be properly set through the `dialnorm` parameter in downstream Dolby Digital or Dolby E equipment.

* ATSC: *Digital Audio Compression Standard (AC-3),* Advanced Television Systems Committee, Washington, DC, Doc. A/52, Dec. 20, 1995.

4.3 Measurement Screen Cycles

Pressing the **Enter** button while the main status screen is displayed takes you through a cycle of input signal measurements.

The measurements displayed, and their sequence, depend on the input signal and on the selected measurement type. The following sections list the main status screen measurements in the order they are displayed, with the measurement that appears in the center of the screen shown on the left of the pipe, and the measurement that appears in the right side of the screen shown on the right of the pipe. Display descriptions without the pipe separator show just the single measurement indicated.

4.3.1 Digital Signal Measurement Display Sequences

For digital inputs (PCM, Dolby E, or Dolby Digital), the measurement cycles are:

If Leq(A) or ITU-R BS.1770-1 is the selected measurement type:

- Loudness | `dialnorm`
- Loudness | true peak
- Loudness | sample peak
- Loudness

If Leq(A) or ITU-R BS.1770-1 is selected with dialogue and all display enabled:

- Loudness | `dialnorm`
- Loudness | true peak
- Loudness | sample peak
- Loudness
- Speech Loudness | Nonspeech loudness of all channels

If ITU-R BS.1770-2 is the selected measurement type:

- Loudness | `dialnorm`
- Loudness | true peak
- Loudness | sample peak
- Loudness
- Loudness Range

If EBU R128 is the selected measurement type:

- Loudness | `dialnorm`
- Loudness | true peak
- Loudness | sample peak
- Loudness
- Loudness range
- Momentary maximum loudness

4.3.2 Analog Signal Measurement Display Sequence

For an analog input, the display cycles are:

If Leq(A) or ITU-R BS.1770-1 is the selected measurement type:

- Loudness | true peak
- Loudness | sample peak (looks the same as true peak)
- Left channel peak level| Right channel peak level
- Loudness
- Suggested
- `dialnorm`

If Leq(A) or ITU-R BS.1770-1 is the selected measurement type with the dialogue and all display enabled:

- Loudness | true peak
- Loudness | sample peak (looks the same as true peak)
- Left channel peak level| Right channel peak level
- Loudness
- Suggested
- `dialnorm`
- Speech loudness | Loudness of all channels

If ITU-R BS.1770-2 is the selected measurement type:

- Loudness | true peak
- Loudness | sample peak (looks the same as true peak)
- Left channel peak level| Right channel peak level
- Loudness
- Suggested
- `dialnorm`
- Loudness Range

If EBUis the selected measurement type:

- Loudness | true peak
- Loudness | sample peak (looks the same as true peak)
- Left channel peak level| Right channel peak level
- Loudness
- Suggested
- `dialnorm`
- Loudness Range
- Momentary maximum loudness

4.3.3 RF Signal Measurement Display Sequence

For an RF signal the display cycles are:

If Leq(A) or ITU-R BS.1770-1 is the selected measurement type:

- Loudness | true peak
- Loudness | sample peak (looks the same as true peak)
- Left channel peak level | Right channel peak level
- Loudness

If Leq(A) or ITU-R BS.1770-1 is the selected measurement type with dialogue and all display enabled:

- Loudness | true peak
- Loudness | sample peak (looks the same as true peak)
- Left channel peak level | Right channel peak level
- Loudness
- Speech loudness | Loudness of all channelss

If ITU-R BS.1770-2 is the selected measurement type:

- Loudness | true peak
- Loudness | sample peak (looks the same as true peak)
- Left channel peak level | Right channel peak level
- Loudness
- Loudness Range

If EBU R128 is the selected measurement type:

- Loudness | true peak
- Loudness | sample peak (looks the same as true peak)
- Left channel peak level | Right channel peak level
- Loudness
- Loudness range
- Momentary maximum

4.3.4 Units of Measurement

The unit of measure for digital signals depends on the selected measurement type:

- EBU R 128 measurements are expressed in units of LUFS.
- ITU-R measurements are expressed in units of LKFS.
- Leq(A) measurements are expressed in units of dBFS.

Analog measurements, by default, are expressed as dBu. Analog measurements are expressed as dBr if the analog calibration setting is not 0 dBu. RF measurements are based on a relative scale (expressed as dBr) referenced to 100 percent modulation of the monophonic sound carrier (25 kHz peak deviation).

4.3.5 Level Meters

The level meter display provides a more familiar PPM-style meter for each input channel. Figure 4-11 shows an example. The meters have an instant attack time and a constant decay of 12 dB/second, ±2 dB/second. Each channel signal is identified at the bottom of the screen. The scale is displayed on the left side and represents LKFS, dBFS, dBu, or dBr, depending on the input signal type and processing mode.

Figure 4-11 Level Meter Displaying a Dolby E 7.1 Input

Press **Enter** to zoom in on the upper portion of the scale.

4.3.6 Metadata Status

The `metadata status` menu enables you to check the settings of key metadata parameters in either a Dolby E or Dolby Digital input stream.

4.3.7 Digital Input Status

The `Digital Input Status` menu indicates whether a digital input signal is locked. If it is, the menu also displays the sample rate, validity bit status, and individual channel-status parameter values.

4.3.8 Error Statistics

The `Error Stats` menu provides error-related information for the LM100, its input signals, or a digital input stream.

The `Error Condition` display provides information regarding current errors that are preventing the unit from processing the selected input correctly. Two common error

conditions are a loss of input signal and an input signal that does not match the requirements for the selected input type. Press **Enter** to view details when an error appears. More information on specific errors is available in Table 3-2.

The other items in the `Error Stats` menu provide a historical count of the following error types: Dolby E CRC, Dolby Digital CRC, AES3 coding, AES3 confidence, AES3 parity, AES3 CCRC, and Dolby E discontinuity.

To reset the error count on a single error type, press **Enter** to view the `Error` detail menu, then press **Enter** again to reset the count to zero.

To reset all error counts, select `Clear All Errors` and press **Enter**. A confirmation prompt appears. Press **Enter** to confirm the global reset, or **Esc** to exit the prompt without resetting the counts.

4.3.9 Alarm Statistics

You can define the configuration of each audio alarm. For details, see Section 5.5.

When an alarm is triggered:

- The **Audio Alarm** LED indicator flashes.
- A pulse is sent to the global alarm pin on the **GPI/O** port.
- A pulse is sent to the corresponding pin on the **Alarm** port.
- An entry is generated in the system log.
- The appropriate alarm statistic is incremented.

There are six different signal condition alarms: `Input Clipping`, `Over Level`, `Under Level`, `Dialnorm`, `Phase Error`, and `Digital Input Loss`. For the LM100-NTSC, there are two additional alarms: `RF Overmodulation` and `RF Input Loss`.

To reset the alarm count on a single alarm type, press **Enter** to view the `Alarm Detail` menu, then **Enter** again to reset the count to zero.

To reset all alarm counts, select `Clear All Alarms` and press **Enter**. A confirmation prompt appears. Press **Enter** to confirm the global reset, or **Esc** to exit the prompt without resetting the counts.

Alarm statistics can also be sent as a text log to a device connected to a serial port. For details, see Section 5.5.

4.3.10 System Log

The `System Log` menu displays up to 480 logged events. Events such as signal-condition alarms and errors are automatically added to the log; you can add and remove other indications through the `System Log` setup menu.

To view the most recently logged event, press **Shift**, ↑. To view the earliest logged event in the LM100 memory, press **Shift**, ↓.

To view any event in more detail, select the event and press **Enter**. If the event log is full and another event occurs, the system log discards the oldest event and registers the current event. You can clear the system log using the `System Log Control` menu.

Each event is logged against either the time of day or (optionally) a timecode value in the LM100-LTC. When logging against time of day, an event registered in the last 24 hours displays the time in the `System Log` menu; events beyond 24 hours display the date.

System log entries can also be sent as ASCII text strings to a device, such as a PC running a terminal emulation application, connected to either the front- or rear-panel serial port. For details, see Section 5.5.

4.3.11 System Status

The `System Status` menu shows the current LM100 hardware and software versions and indicates whether an option card is installed. To receive LM100 software upgrade notifications, please register your unit on the Dolby support page at dolbysupport.com.

The `Latency` menu displays the time it takes for audio to pass from the input connector to the analog output connectors, and is specific to the type of input stream. You can adjust `PCM Latency` in the `Monitor Control` setup menu.

4.4 The Main Setup Menu

In the `Main Setup` menu, you can configure the LM100 to suit your needs. When viewing a status menu, or any setup menu, pressing **Setup** displays the `Main Setup` menu. If any setup menu display is unchanged for five minutes, the display reverts to the `Main Setup` menu.

4.4.1 Measurement Control

In the `Measurement Control` menu you can configure the following:

- `Channel Select`
- `Measurement Type`
- `Measurement Method`
- `Short Term Window`
- `Meter Scale`
- `Channel Select`
- `Dialogue Intelligence`

The proper settings are determined by factors such as whether the LM100 is being used in a live or postproduction environment, for multichannel or stereo material, for quality control or off-air monitoring, or for aligning the loudness of multiple services. It is important that you understand how to set these parameters.

Measurement Type

Choose ITU-R BS.1770-2 (the default), EBU R128, ITU-R BS.1770-1, or Leq(A).

Measurement Method

Choose either short term or infinite.

Short-Term Window Length

When the selected measurement type is ITU-R BS.1770-2, you can choose either three or ten seconds for the length of the short-term measurement window. When EBU R128 is selected, the short-term window is locked to the length required by the standard, which is three seconds. When any other measurement type is selected, the short-term window is locked to ten seconds to maintain backward compatibility with previous versions of LM100 firmware.

Meter Scale

This control changes the displayed loudness levels to be relative to the digital loudness reference level set in the `Alarm Control` menu. As an example, if the digital loudness reference value is set to –24 LKFS and the measured loudness is –18 LKFS, the screen will display `+06 LU`. The relative loudness units displayed are dB for Leq(A) measurements and LU for all others.

Note: When `Meter Scale` is set to `Relative` and `Display Resolution` is set to `High`, the measurement method indicator (the `S` or `I` in reverse video representing short term or infinite term) that is displayed at the top right of the vertical bar that separates the metadata area from the primary measurement area is repositioned to be to the top left of this vertical separator. This change allows enough room in the primary measurement area to fit the relative measurements. Values such as `+22.0`, due to the size of the plus sign, take up more area than was previously available. In some cases, the left edge of the plus sign will touch (not overlap) the vertical separator.

Channel Select

In this menu you determine which of the channels available the LM100 will monitor. Selecting the proper channel is crucial if you are monitoring material where dialogue exists in only one channel.

Note: When the measurement type is EBU R128 or ITU-R BS.1770-2, the channel selection is locked to the `ALL` setting.

Dialogue Intelligence

Use this control to turn Dialogue Intelligence on or off. For more information, see Section 5.2.

Dialogue Intelligence cannot be used when the measurement type is either EBU R128 or ITU-R BS.1770-2.

4.4.2 Input Control

In the `Input Control` menu, you can configure the following:

- `Input Source`
- `Decode Format`

- `Dolby E Program`
- `AES3 Channel Select` mode
- `Analog Input Cal` (calibration) settings

On the LM100-NTSC, you can also configure:

- `RF Tuning Mode`
- `RF Channel`
- `RF Second Language`

Input Source

In the `Input Source` menu, you can select the input to use for a measurement.

A special input source selection (`RF/Digital`) expects RF input by default, but automatically switches to digital input if a valid Dolby E or Dolby Digital signal is present on the **Digital Input** connector. This is used when the LM100-NTSC is simultaneously connected to the digital audio and the channel 3/4 remodulated outputs of a digital cable set-top box. Thus, when the set-top box is tuned to an analog tiered service, the unit measures the signal directly from the RF tuner; when the set-top box is tuned to a digitally tiered service, the unit autodetects the presence of a Dolby Digital stream from the S/PDIF output on the digital set-top box, and measures it.

Decode Format

Use the `Decode Format` menu to select the bitstream type you want the LM100 to decode. This parameter is normally set to `Autodetect`. However, you can override this setting and specify a bitstream type.

Dolby E Program

Use the `Dolby E Program` menu to identify which program to measure in a Dolby E stream.

Note: When the input source is a valid Dolby E signal, the selected Dolby E program number must be present in the input stream, or no measurement can be made.

AES3 Channel Select

Use the `AES3 Channel Select` menu to specify how the unit recognizes a Dolby Digital signal from the digital input.

Selecting `Channel 1` or `Channel 2` specifies that the Dolby Digital input must be contained within that channel. Selecting `Channel 1+2` requires a Dolby Digital stream in both channels. When you select `Autodetect`, the LM100 locks onto the first signal it recognizes. We recommend `Autodetect` unless there is a signal present in just one channel.

Analog Input Calibration

Use the `Analog Input Cal` menu to match the LM100 to the standard operating level for your facility. For example, if 0 VU = +4 dBu (1.23 V_{RMS}), set the analog input calibration to +4 dBu. This allows a 1 kHz line-up level at 0 VU to display 0 dBr on the LM100.

You also use this parameter to calculate the recommended `dialnorm` value when measuring an analog input signal.

Note: When the `Analog Loudness Ref` setting is not zero, measurement for the analog input is expressed in dBr. When the setting is zero, the measurement is expressed in dBu, reflecting that 0 dBu = 0.775 V_{RMS}.

Table 4-1 Common Reference Levels

Reference	Analog Loudness Ref	Volts	Digital Loudness Ref
SMPTE RP155	+4 dBu	1.23 V_{RMS}	–20 dBFS
EBU R68	0 dBu	0.775 V_{RMS}	–18 dBFS

RF Tuning Mode

This feature is available only on the LM100-NTSC.

Use the `RF Tuning Mode` menu to select the frequency plan (`Off-Air`, `Cable STD`, `Cable HRC`, or `Cable IRC`) used for tuning RF signals.

RF Channel

This feature is available only on the LM100-NTSC.

Use the `RF Channel` menu to select the channel number used for tuning RF signals.

Note: The channel number can also be selected from the main status screen, by pressing **Shift**, ↑ or ↓.

RF Second Language

This feature is available only on the LM100-NTSC.

Use the `RF Second Language` menu to specify whether you want to measure the second language channel (if available) when receiving RF signals.

Monitor Control

Use the `Monitor Control` menu to configure the **Analog Outputs** (headphone and rear-panel line outputs).

DAC on Nonaudio

The `DAC on Non-Audio` menu controls whether a digital input signal flagged as nonaudio (via the AES3 channel status byte 0 bit 1) is muted or sent to the headphone and analog outputs.

PCM Latency

The `PCM Latency` menu allows the user to set the latency from the **Digital Input** to the **Analog Outputs** for a PCM signal.

4.4.3 Alarm Control

The LM100 alarm capabilities are among its most useful and versatile functions, as described in Section 5.5. Use the `Alarm Control` menu to set the parameters that trigger alarms.

- `Input Clipping`
- `RF Overmodulation`
- `Digital Loudness Reference`
- `Analog Loudness Reference`
- `RF Loudness Reference`
- `Over Level`
- `Under Level`
- `Dialnorm Threshold`
- `Digital Input Loss`
- `RF Input Loss`
- `Phase Error`
- `DE RF Overmod Protect`
- `Track Measurement`
- `Alarm Output Polarity`

Input Clipping

Use the `Input Clipping` menu to configure the parameters of the input clipping alarm. Table 4-2 defines alarm parameters.

Table 4-2 Input Clipping Alarm Parameters

Menu Item	Controls	Increment	Range
`Alarm`	Enables or disables the alarm.	NA	Enabled/Disabled
`Length`	The number of samples by which the input must exceed the clip threshold to trigger the alarm.	10	10 to 200 samples
`Digital Threshold`	The amplitude threshold for the alarm when the input is digital.	0.1	0 to –20 dBFS

Table 4-2 Input Clipping Alarm Parameters (continued)

Menu Item	Controls	Increment	Range
`Analog Threshold`	The amplitude threshold for the alarm when the input is analog.	0.1	+22 to –20 dBr or dBu*
`RF Threshold`	The amplitude threshold for the alarm when the input is RF.†	0.1	+10 to –20 dBr

* When the `Analog Loudness Ref` setting is not zero, the analog threshold is expressed in dBr. When the setting is zero, it is expressed in dBu.

† Only on the LM100-NTSC.

RF Overmodulation

This feature is available only on the LM100-NTSC.

Use the `RF Overmodulation` menu to enable or disable the overmodulation alarm for RF input signals. When enabled, any signal that modulates the aural carrier by more than 101 percent triggers the alarm.

Digital Loudness Reference

Use the `Digital Loudness Ref` menu to set the reference loudness level for digital input signals. This reference level is used by the over-level and under-level threshold alarms.

When the measurement type is EBU R128, this value is automatically locked to –23 LUFS. When the measurement type is ITU-R BS.1770-2, this value is automatically locked to –24 LKFS.

Analog Loudness Reference

Use the `Analog Loudness Ref` menu to set the reference loudness level for analog input signals. This reference level is used by the over-level and under-level threshold alarms.

Note: When the `Analog Loudness Ref` setting is not zero, measurement for the analog input is expressed in dBr. When the setting is zero, the measurement is expressed in dBu, reflecting that 0 dBu = 0.775 V_{RMS}.

RF Loudness Reference

This feature is available only on the LM100-NTSC.

Use the `RF Loudness Ref` menu to set the reference loudness level for RF sources. This reference level is used by the over-level and under-level threshold alarms.

Over Level

The over-level alarm is triggered when the input signal loudness level exceeds the chosen threshold relative to the selected digital or analog loudness reference level.

The `Over Level` menu allows you to set the parameters listed in Table 4-3.

Table 4-3 Over Level Alarm Parameters

Menu Item	Controls	Range
`Alarm`	Enables or disables the alarm.	Enabled/Disabled
`Threshold`	The loudness threshold for the alarm. The alarm triggers if the measured loudness value exceeds the loudness reference plus the threshold for the duration specified in `Time`.	1 to 31 dB
`Time`	The duration of the over-level condition required to trigger the alarm.	0 to 300 seconds

Under Level

The under-level alarm is triggered when the input signal loudness level falls below the chosen threshold relative to the selected digital or analog loudness reference level. This alarm is useful for identifying silence and/or near-silent conditions.

The `Under Level` menu allows you to set the parameters listed in Table 4-4.

Table 4-4 Under-Level Alarm Parameters

Menu Item	Controls	Range
`Alarm`	Enables or disables the alarm.	Enabled/Disabled
`Threshold`	The loudness threshold for the alarm. The alarm triggers if the measured loudness value falls below the loudness reference minus the threshold for the duration specified in `Time`.	1 to 31 dB
`Time`	The duration of the under-level condition required to trigger the alarm.	0 to 300 seconds

Table 4-5 Under-Level Alarm Parameters

Menu Item	Controls	Range
`Alarm`	Enables or disables the alarm.	Enabled/Disabled
`Threshold`	The loudness threshold for the alarm. The alarm triggers if the measured loudness value falls below the loudness reference minus the threshold for the duration specified in `Time`.	1 to 31 dB
`Time`	The duration of the under-level condition required to trigger the alarm.	0 to 300 seconds

dialnorm Threshold

The `dialnorm Threshold` alarm is triggered when the measured loudness value of the input signal deviates from the `dialnorm` value already carried within the Dolby E or Dolby Digital input stream. This alarm is useful for identifying Dolby E and Dolby Digital bitstreams with incorrect dialogue level values.

The `dialnorm Threshold` menu allows you to set the parameters listed in Table 4-6.

Table 4-6 dialnorm Threshold Alarm Parameters

Menu Item	Controls	Range
`Alarm`	Enables or disables the alarm.	Enabled/Disabled

Table 4-6 dialnorm Threshold Alarm Parameters (continued)

Menu Item	Controls	Range
`Threshold`	The threshold for the alarm. The alarm triggers if the measured loudness value deviates by more than this value either above or below the dialogue level value carried in the metadata for the duration specified in `Time`.	1 to 20 dB
`Time`	The duration of the `dialnorm` threshold condition required to trigger the alarm.	0 to 300 seconds

Digital Input Loss

The `Digital Input Loss` alarm is triggered if digital input becomes invalid or disappears. Use the menu to enable or disable the alarm.

RF Input Loss

This feature is available only on the LM100-NTSC.

The `RF Input Loss` alarm is triggered if RF input becomes invalid or disappears. Use the menu to enable or disable the alarm.

Phase Error

The `phase error` alarm is triggered when a stereo signal's Left and Right channels are out of phase. Use the `Phase Error` menu to enable or disable the phase error alarm.

DE RF Overmod Protect

The `DE RF Overmod Protect` alarm is triggered when a Dolby E signal with the `RF Overmod` metadata field enabled is detected. Use the menu to enable or disable the alarm.

Track Measurement

You can control all the alarm counters using the front-panel **Reset** button or the GPI/O port.

If you set `Track Measurement` to `Enabled`, pressing **Reset** clears all the alarm counters simultaneously, as well as resetting the measurement. If you disable this setting, pressing **Reset** has no effect on the alarm counters.

Alarm Output Polarity

When an alarm is triggered, the LM100 generates a pulse on the associated **Alarm** port pin, as listed in Table 5-3, as well as on the alarm pin on the GPI/O port. Use the `Alarm Output Polarity` menu to set the polarity for the alarm outputs to either `Active-Low` or `Active-High`.

4.4.4 User Presets

The LM100 can use up to four presets. When you save a preset, the LM100 stores the complete memory of all active settings. Saving a preset writes over any preset previously stored to that preset number. Use the `User Presets` menu to save or recall a preset.

To save a preset, follow these steps:

1. Navigate the `Save Preset` menu.
2. Select a preset number to save, then press **Enter.**
   The `Save Preset` menu appears, as shown in Figure 4-12.

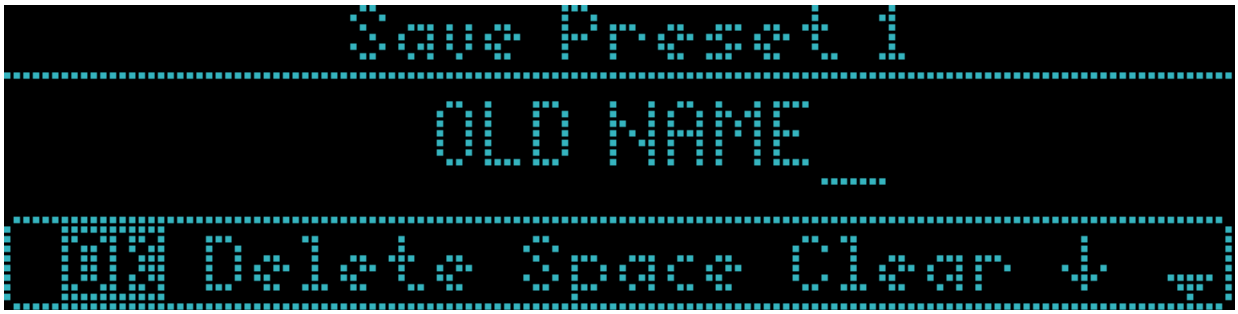


Figure 4-12 Save Preset Menu

3. Press ➔ to highlight `Clear`, then press **Enter.**
   The old preset name disappears.
4. Use the arrow buttons to highlight each character in the new preset name, pressing **Enter** after highlighting each character.
5. When the name is complete, highlight `OK`, then press **Enter.**
   The confirmation prompt in Figure 4-13 appears.

Figure 4-13 Save Preset Prompt

6. If the new preset name is correct, press **Enter** to save the preset with that name. If not, press **Esc,** and return to step 1.
   When the new name is saved, the display reverts to the main status screen, briefly showing a confirmation message as in Figure 4-14.

Figure 4-14 Preset Confirmation Message

To recall a preset follow these steps:

1. Navigate to the `Recall Preset` menu.
2. Select a preset to recall, then press **Enter.**

4.4.5 System Log

Use the `System Log` menu to control the characteristics of the internal system log**.**

- `Time Stamp Mode`
- `Periodic Loudness`
- `Metadata Log`
- `Bitstream CRC Log`
- `System OK Log`
- `Track Measurement`
- `Clear System Log`

Time Stamp Mode

When using the LM100-LTC with a valid timecode input, the system log can use either the time of day or linear timecode as the log entry time stamp. Use the `Time Stamp Mode` menu to change this setting.

Periodic Loudness

The system log can store the current measured loudness value at regular (that is, periodic) time intervals, as set in the `Periodic Loudness` menu. This allows you to use the LM100 to simultaneously track and log the changes in the loudness of programs or services over many hours or days. When the measurement type is ITU-R BS.1770-2, the periodic loudness also enters the loudness range measurement into the system log. When the measurement type is EBU R128, the periodic loudness also enters the momentary maximum loudness measurement in addition to the loudness range and measured loudness values.

Note: When measuringwith the infinite method, additional settings appear in the `Periodic Loudness` menu, which enables the measurement to automatically reset at the same time interval as the periodic measurement itself logs. For example, if you select `30 Seconds with Reset`, the LM100 generates a "periodic loudness" system log entry based on the integrated level for the past 30 seconds, and then resets the infinite measurement before continuing.

Metadata Log

When this is enabled, the metadata parameters shown below within a Dolby E or Dolby Digital bitstream are added to the system log. This is done whenever a Dolby E or Dolby Digital bitstream is first detected, and subsequently when any of these parameters change value:

- Dolby Digital channel mode
- Dolby Digital LFE channel
- Dolby Digital data rate

- Dolby Digital dialogue level
- Dolby E program configuration
- Dolby E bit depth
- Dolby E frame rate
- Dolby E Px channel mode
- Dolby E Px LFE channel
- Dolby E Px `dialnorm`

Bitstream CRC Log

When this is enabled, any CRC errors in Dolby E or Dolby Digital bitstreams are logged. You can use this log to monitor and ensure that Dolby Digital or Dolby E bitstreams are not corrupted and/or do not contain errors.

System OK Log

When this is enabled, a `System OK` message is logged at hourly intervals. You can use this log to verify the ongoing correct operation of the LM100 within the system log.

Track Measurement

You can control the system to follow the **Reset** and **Pause** controls provided on the front-panel buttons or through the **GPI/O** port.

When this is enabled, pressing the **Reset** button clears the system log and resets the measurement; pressing **Pause** stops new entries from generating in the system log as well as pausing the measurement. If you disable this setting, the **Reset** and **Pause** buttons have no effect on the system log.

Clear System Log

When this is enabled, you can manually delete all entries in the system log.

4.5 System Settings

The `System Settings` menus allow you to configure several unit behaviors.

- `Remote Baud Rate`
- `Remote Mode`
- `Unit Name`
- `Unit Address`
- `Time/Date`
- `Screensaver Timeout`
- `True Peak Channel ID`
- `Enable Dialogue & All Display`

Remote Baud Rate

This setting controls the speed (baud rate) of the **RS-232** and **RS-485** serial ports.

Remote Mode

When you select `Remote`, the LM100 can be controlled from a remote-control application or device over the serial ports. When you select `Logging`, the serial ports output each system log entry as an ASCII text string as it is generated. This output can be displayed and stored by any standard terminal application.

Unit Name

You can name your unit using up to 12 characters. This is useful for identifying the LM100 from remote-control applications. To enter a name, go to the `Unit Name` menu and use the procedure for text entry.

Unit Address

The `unit address` allows each LM100 to be uniquely identified when using a software remote-control application over the serial connection, using either the **RS-232** or the **RS-485** connection. You can connect more than one LM100 to the same RS-485 link, provided that each unit is assigned a unique address.

Time/Date

Use the `Time/Date` menu to set the internal real-time clock.

Screensaver Timeout

After a defined period of inactivity, the LM100 applies a screen saver to prolong the life of the display screen. Use the `Screensaver Timeout` menu to set this period of inactivity.

True-Peak Channel ID

Choose `On` to identify the channel in which the measured peak on the display occurred. Choose `Off` not to identify it.

Enable Dialogue and All Display

This menu item is available only while the LM100 is using the infinite measurement method with Dialogue Intelligence enabled. Unless both are true, the item is not visible.

The selected measurement type can be either Leq(A) or ITU-R BS.1770-1.

Choose `On` to allow `Dialogue` and `All` measurements. Choose `Off` to prevent this display from appearing.

Features

This chapter focuses on the unit's primary functions, and the best uses for each of them.

5.1 Measuring Equivalent Loudness

The Dolby® LM100 Broadcast Loudness Meter initially employed a standardized measurement method called Leq(A) coupled with Dolby Dialogue Intelligence™ technology, which allowed the LM100 to automatically measure only the dialogue portions of the programming. Combined, these methods were used to accurately determine the dialogue normalization metadata value for Dolby Digital, Dolby Digital Plus, and Dolby E broadcast content.

The updated LM100 can now use the EBU R128 measurement algorithm, as well as ITU-R BS.1770-1 and BS.1770-2. Both ITU-R algorithms estimate loudness by computing the frequency weighted energy average over time similar to Leq(A), and each algorithm produces a single value representing the overall loudness level. The core ITU-R algorithm of both BS.1770-1 and BS.1770-2, however, is based on two filters in cascade: a prefilter (a high-frequency shelving-type filter), followed by Leq(RLB), a revised low B-weighting filter (a type of highpass filter). The EBU R128 and ITU BS.1770-2 loudness measurements use a loudness gating method to better estimate the perceived loudness of the signal. The gating function is driven by a 400 ms moving average, updated every 100 ms to provide a 75% overlap between successive gating blocks. The loudness is then estimated using a –70 dBFS absolute gate and a –10 dB relative gate threshold. The short-term loudness measurement is ungated.

The updated LM100 now has the ability to compute the Loudness Range (LRA) in accordance with EBU Tech 3342 and ITU Draft Revision to Recommendation ITU-R BS.1770, Annex 3. The LRA measurement is a front-end three-second moving average, updated every 500 ms to provide an 83% overlap between successive LRA blocks. While the minimum specified overlap is 66%, an overlap of 83% was selected for alignment with the Loudness Range implementation in other Dolby products. The LRA measurement is then estimated using a –70 dBFS absolute loudness gate and a –20 dB relative gate threshold.

5.1.1 Effects of Choosing the EBU R128 Measurement Type

Selecting the EBU R128 measurement type has several automatic effects:

- Dialogue Intelligence is locked off.
- The measurement method is set to infinite.
- `Channel Select` is locked to `All`.
- The digital loudness reference value is locked to –23 LUFS.
- The short-term window length is locked to three seconds.
- The meter scale is set to `Absolute`.
- Loudness measurements are displayed in LUFS.

- The main status screen displays `LUFS EBU(All)` beneath numeric measurements.
- A Loudness Range measurement screen is displayed among the measurement screen cycle.
- A momentary maximum loudness measurement screen is displayed among the measurement screen cycle.

5.1.2 Effects of Choosing the ITU2 Measurement Type

Choosing the ITU-R BS.1770-2 measurement type has several automatic effects:

- Dialogue Intelligence is locked off.
- The measurement method is set to infinite.
- `Channel Select` is locked to `All`.
- The digital loudness reference is locked to –24 LKFS.
- The short-term window length is set to three seconds.
- The meter scale is set to `Absolute`.
- Loudness measurements are displayed in LKFS.
- The main status screen displays `LKFS ITU 2(All)` beneath the numeric measurement.
- A Loudness Range measurement screen is displayed among the measurement screen cycle.

5.1.3 Effects of Choosing the ITU-1 or Leq(A) Measurement Type

Choosing the ITU-R BS.1770-1 or Leq(A) measurement type has several automatic effects:

- Dialogue Intelligence is unlocked and set to `On`.
- The measurement method is set to short term.
- `Channel Select` is unlocked and set to `All`.
- The digital loudness reference is unlocked and set to –24 LKFS.
- The short-term window length is locked to ten seconds.
- The meter scale is set to `Absolute`.
- Loudness measurements are displayed in units of LKFS (ITU-R BS.1770-1) or dBFS (Leq(A)).
- The main status screen displays `LKFS ITU-2(<channel>)` beneath the numeric measurement, according to the `Channel Select` setting.

5.1.4 Measuring Digital Sources

When digital input is selected, and the unit is receiving a two-channel linear PCM digital audio signal, the default main status screen indicates the measured loudness value side by side with the unweighted peak level value. The unweighted peak value indicates the largest peak value detected from all channels present on the input.

When the digital input is selected and receiving a Dolby Digital or Dolby E stream, the default main status screen indicates the measured loudness value side by side with the `dialnorm` value contained within the input stream. Ideally, these values are nearly the same, thereby confirming the accuracy of this extremely important metadata parameter (value). If the measured loudness value is significantly different from the `dialnorm` value, when the program broadcasts, it will sound either louder or softer than programs with accurate `dialnorm` settings. You can use the loudness measurement information to make

adjustments, either to the dialogue level parameter value within the Dolby Digital or Dolby E stream, or to the source audio levels.

Measurements in the digital domain are referenced to digital full scale, and are expressed in dBFS.

5.1.5 Measuring Analog Sources

When the selected input is analog, the LM100 can also provide a suggested value for `dialnorm` (by pressing **Enter** four times from the main status screen). This can be useful when setting the `dialnorm` parameter value prior to encoding the program for digital distribution via Dolby E or Dolby Digital. This recommended value automates the process of calculating a `dialnorm` value when measuring analog sources. The calculated (that is, derived) value is based on the analog input calibration. See Figure 4-8.

Analog measurements, by default, are based on the dBu scale, or on a relative scale (expressed as dBr) if the analog calibration setting is not 0 dBu.

5.1.6 Measuring RF Modulated Sources

When the **RF Input** is selected and a particular channel is tuned, the default main status screen indicates the measured loudness value side by side with the unweighted peak value.

Measurements in the RF domain are referenced to 100 percent modulation of the monophonic sound carrier (25 kHz peak deviation) and are expressed in dBr.

5.2 Dialogue Intelligence

Dialogue Intelligence allows the LM100 to automatically base ITU-R BS1770-1 or Leq(A) measurements on the portions of the input signal that contain the characteristics of dialogue. This powerful feature provides users at all skill levels with the capability to easily quantify the level of dialogue within broadcast programs. By combining Dialogue Intelligence with extensive logging and alarm capabilities, the LM100 opens up the possibility of automated measurement, QC, and control.

Note: The `dialnorm` parameter within a Dolby Digital bitstream is, after all, also known as dialogue level, and the term `dialnorm` is an abbreviation of “dialogue normalization.” Thus, when the `dialnorm` value is properly implemented across multiple programs, the home listener can switch between programs and perceive the dialogue in each program at the same level.

When you first enable Dialogue Intelligence, the LM100 takes a few moments to analyze the input signal before confirming that dialogue is or is not present. During this analysis, a “listening” icon appears, as shown in Figure 5-1. When the analysis is complete, either `No Dialogue` or a dialogue-based measurement value appears.

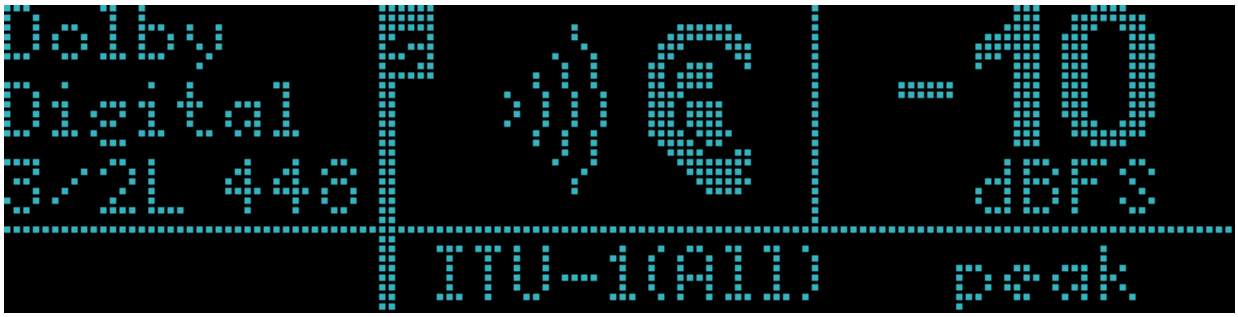


Figure 5-1 Listening Icon Display before Dialogue Intelligence Computes

When you enable Dialogue Intelligence, the measurement is based solely on the portions of the input signal recognized as having the characteristics of speech. Portions of the input signal that do not primarily contain the characteristics of dialogue are not included in the measurement value.

Note: The Dialogue Intelligence algorithm is designed to return a dialogue-based measurement value only when this input signal primarily contains the characteristics of dialogue. Therefore, on rare occasions, the algorithm may ignore a section of the program that contains dialogue but may also be coincident with other types of signals and spectra, such as music or effects. This behavior increases the accuracy and confidence of the dialogue-based measurement value.

5.3 Measurement Methods: Short Term vs Infinite

The LM100 has two methods of operation relating to the measurement period, infinite and short term. This section describes their behavior.

Table 5-1 shows application examples that best utilize short-term and infinite methods.

Table 5-1 Application Examples for Short-Term and Infinite Methods

Short Term	Infinite
Live broadcast event	Program ingest
Postproduction and/or mixing with audio engineer	Postproduction to check conformance with delivery requirements, including `dialnorm`
Quality control: Measuring short-term program dynamics (or the short-term dynamics in dialogue level when Dialogue Intelligence is enabled)	Quality control: measuring overall program for normalization and/or `dialnorm` provisioning purposes (dialogue-based measurement when Dialogue Intelligence is enabled)
Logging short-term periodic loudness history	Logging infinite (long-term) loudness history
Analog cable services: Audio modulator deviation adjustments for cable head-ends (dialogue-based measurement when Dialogue Intelligence is enabled)	

5.3.1 Infinite Method

Infinite measurements cover the entire period since the measurement was last reset.

The EBU R128, ITU-R BS.1770-1, ITU-R BS.1770-2, and Leq(A) algorithms are all available using the infinite method.

Enabling Dialogue Intelligence allows you to simply quantify all the sections of the program that contain only dialogue and use the ending measurement value for analysis and normalization. This value is also commonly used to set the dialogue normalization parameter within Dolby Digital and Dolby E bitstreams.

The infinite method is typically used when it is possible to measure the entire duration of the program (for example, all 30 seconds of a commercial or the whole two hours of a movie). It provides the most accurate measurement. This method is most often used in ingest, QC, and postproduction applications where audio metadata is being authored and levels can, in most cases, be controlled and adjusted.

It is also possible to use the infinite method to measure short sections of content rather than an entire program. The LM100 `Periodic Loudness with Reset` capability makes it easy for content creators to monitor program loudness during production and editing. -For example, selecting `1 Minute with Reset` ensures that the longest average measurement displayed will be integrated over one minute, helping the operator to more accurately assess the average program loudness when repeating the same portion of content over and over. For more details, see Periodic Loudness. This method is effective when the loudness level of the sections being measured represents the entire program.

5.3.2 Short-Term Method

Short-term method displays a measurement value for the previous three or ten seconds (as determined by the `Short Term Window` setting) as a sliding window. Figure 5-2 shows an example of the short-term window set to ten seconds. The first measurement value displayed corresponds to 0–10 seconds, the next to 1–11 seconds, the next to 2–12 seconds, and so forth. When EBU R128 is the selected measurement type, each interval is three seconds long, but the principle is the same.

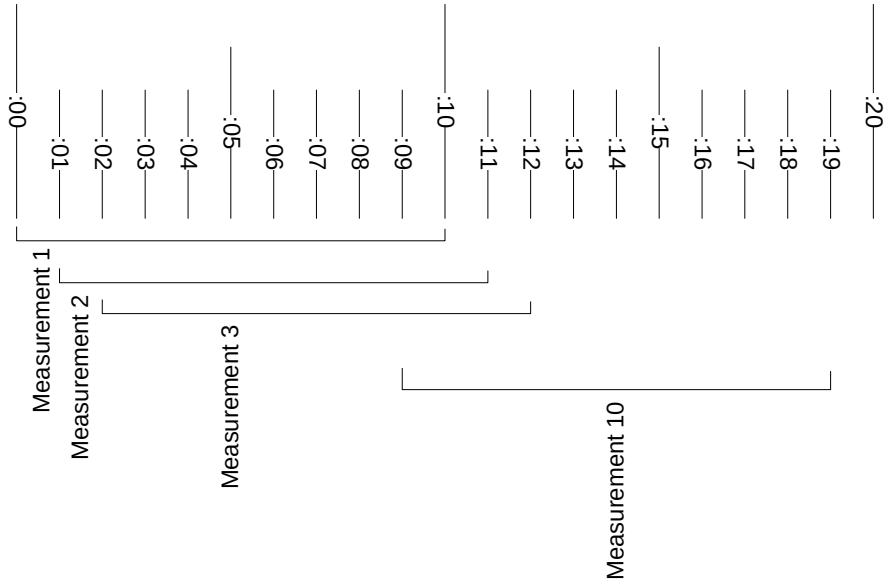


Figure 5-2 Short-Term Measurements

Note: Figure 5-2 provides an example only; it is not meant to imply that measurements are computed only once every second. Short-term measurements are actually computed and displayed far more frequently. Figure 5-2 merely illustrates the behavior of the computation.

As the short-term measurement only considers the last three or ten seconds of program material, the measurement value has the potential to be much more dynamic than that measured with the infinite method. Highly processed channels and programming will most likely not exhibit this behavior.

The benefit of this measurement method is that it allows the operator to see short-term variations within a program in loudness level or in dialogue level when Dialogue Intelligence is enabled. Many skilled audio operators prefer to use the short-term measurement, as they find the information on near-term dynamics to be very useful when mixing or producing a program and they are capable of managing overall program loudness by reading the short-term measurement.

The short-term method is also very useful for measuring and logging the loudness history of a given program during the QC, postproduction process, or particular television service/channel in a cable head-end facility. Figure 5-3 shows results from an LM100 with Dialogue Intelligence enabled in logging mode, using a PC to capture the periodic loudness values, was used to help a broadcaster determine the speech level values for programs and commercials from 5:30 p.m. through midnight. Figure 5-3 clearly reveals an hour when speech levels were elevated (approximately 5 dB on average), whereas the programming that preceded and followed this particular program clearly had lower speech levels.

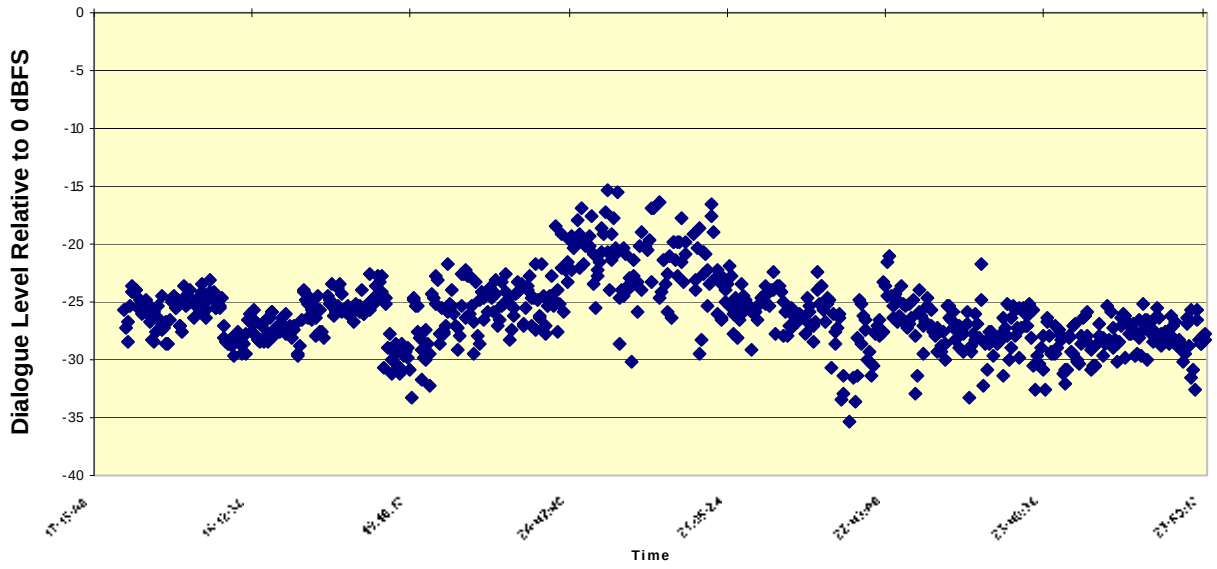


Figure 5-3 Short Term Dialogue Level History Example Using the LM100 Logging Features

Note: In Figure 5-3, each blue data point represents an individual speech measurement.

Differing Short-Term Measurement Lengths

It is important to understand that the length of the short-term measurement window depends on the measurement type:

- EBU R128 requires a three-second measurement.
- ITU-R BS.1770-2 supports either a three-second or a ten-second measurement. The default is three seconds, but this can be changed on the system settings menu, or in the Universal Remote application.
- ITU-R BS.1770-1 and Leq(A) require a ten-second measurement to be backward compatible with previous versions of the LM100 firmware.

5.4 Channels for Measurement

For Leq(A) or ITU-R BS.1770-1 measurements, the LM100 can base its loudness measurement on one (`Left`, `Center`, or `Right`), two (`Stereo`), or all (`All`) input channels. EBU R128 and ITU-R BS.1770-2 require that all channels be measured.

Because dialogue is almost always mixed primarily to the Center channel, the default is Center, making it ideal for a 5.1-channel program with dialogue. If a program without a Center channel is present on the input, the unit automatically measures the Left and Right channels by summing the individual channel powers. The channels actually being measured (as opposed to the `Channel Select` setting) display in parentheses next to the word representing the currently selected measurement type on the main status screen.

The other selections are available if you need to quantify loudness on specific channels. `All` measures the signal by combining the individual channel powers from each channel present on the input.

Note: When using the Leq(A) measurement type, a two-channel 1 kHz sine wave with a `Channel Select` setting of `Stereo`, `All`, or `Center` displays a loudness measurement +3 dB over the peak level, assuming both channels contain highly correlated signals.

5.5 Alarms

The alarm setup system provides a high level of flexibility, so you can configure alarms to trigger only for conditions that you consider important. LM100 alarm types are defined in Table 5-2.

Table 5-2 Available Alarm Types

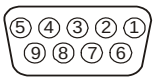
Alarm	Definition
`Input Clipping`	The input signal exceeds a user-defined clip level for a user-defined number of samples.
`RF Overmod` (LM100-NTSC only)	The RF input signal is greater than or equal to 101 percent modulation of the monophonic audio RF carrier.
`RF Input Loss` (LM100-NTSC only)	The RF input carrier is absent.
`Over Level` Loudness above threshold	The measured loudness level exceeds the user-defined threshold for a user-defined duration.
`Under Level` Loudness below threshold	The measured loudness level falls below the user-defined threshold for a user-defined duration. This can be used as a silence alarm.
`Digital Input Loss`	Digital AES3 input is required but missing.
`Dialnorm Threshold`	The `dialnorm` value carried within the Dolby E or Dolby Digital bitstream input differs from the user-defined threshold for a user-defined duration.
`Phase Error`	The stereo signal's Left and Right channels are out of phase.
`DE RF Ov Protect` Dolby E RF overmodulation protection	The `DE RF Overmod` metadata field is enabled.

Use the `Alarm Control` setup menu to control the alarm parameters, as described in Section 4.3.4.

Any alarm condition triggers the **Audio Alarm** LED, increments the associated counter in the Alarm Stats menu, triggers the global alarm GPI/O pin, and triggers the appropriate GPI/O on the **Alarm** port, as listed in Table 5-3.

You can use the **Alarm** port to create a notification method in your studio or control room. This can alert you to specific alarms (see Table 5-3), while recording alarms you define as less urgent in the `Alarm Stats` menu and the system log.

Table 5-3 Alarm Output Port

Connector Map	Pin	Status Parameter or Function
	1	Input clip detection counter
	2	RF overmodulation counter (LM100-NTSC only)
	3	Loudness above threshold counter
	4	Loudness below threshold counter
	5	Digital input loss counter
	6	Dialnorm threshold counter
	7	Asserted during an error condition
	8	Asserted when hardware is faulty
	9	Signal ground

5.6 System Log

The system log is capable of storing 480 individual time-stamped events. If you connect a remote interface cable to either the front- or rear-panel serial ports described in Section 5.7, you can store a record of every logged event.

Each alarm condition is stored in the internal system log in the following format:

```
Date Time | Alarm ID | Description | Count
```

The description field contains information about the alarm type, as well as the associated signal measurement when the alarm triggered. Following is a sample text log from the LM100:

```
19 Feb 2011 13:49:50 | 1001 | RF Overmodulation | Count: 1

19 Feb 2011 13:50:23 | 2001 | Input Format | Dolby Digital

19 Feb 2011 13:51:19 | 3002 | LM100 OK |

19 Feb 2011 13:51:34 | 4000 | Dolby Digital Channel Mode | 3/2
```

Logged events can be displayed on the `System Log` status menu. Figure 5-4 shows a sample display of the system log.

Figure 5-4 System Log Status Menu

In the `System Log` menu, to view the most recently logged event, press **Shift**, then ↑. To view the earliest logged event in the LM100 memory, press **Shift**, then ↓. To view details of an event on the `System Log` status menu, highlight that event and press **Enter**. Figure 5-5 shows an entry detail display.

Figure 5-5 System Log Entry Detail Display

5.7 Serial Ports

You can use the rear-panel **Remote RS-485** port or the front-panel **Remote RS-232** port for software upgrades, to connect to a custom-built remote-control software interface, or to send system log events to any device that can receive ASCII text strings through the remote interface cable you connect to the LM100.

Note: The **Remote RS-485** port is deactivated if a cable is connected to the **Remote RS-232** port.

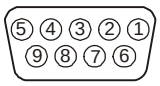
For any use, the settings on the `System Settings` menu must match the connected computer, as described in Section 4.3.7.

To generate a text-based error log to a remote device, set `Remote Mode` to `Logging`.

5.8 GP I/O Port

The **GP I/O** port provides the dedicated functions listed in Table 5-4. You don't have to be in remote mode to use a **GP I/O** device with the LM100; thus, you can maintain full access to all front-panel control functions and display information.

Table 5-4 GP I/O Port

Connector Map	Pin	Direction	Connection	Note
	1	Input	Source select	0 = Next source, *open*—no action
	2	Input	Channel up	0 = Increment channel, *open*—no action
	3	Input	Channel down	0 = Decrement channel, *open*—no action
	4	Input	Pause	0 = Toggle pause/run, *open*—no action
	5	Input	Reset	0 = Reset, *open*—no action
	6	Output	Alarm	Programmable polarity (for details on alarm control, see Section 4.3.4)
	7	Output	Compressed input	0 = Not compressed 1 = Compressed
	8	Output	Measurement running	0 = Paused 1 = Running
	9	—	Signal ground	

To be recognized, input signals must be asserted for at least 50 ms.

The pin 2 and pin 3 functions are provided only on the LM100-NTSC. Each time either of these pins is grounded, the RF channel number increases incrementally (pin 2) or decreases incrementally (pin 3) by one. If the input remains grounded for more than 500 ms, the RF channel number increases or decreases continuously until the pin is released.

Pins 4, 5, and 6 duplicate the functions of the front-panel **Pause** and **Reset** buttons and the **Alarm** LED, respectively.

5.9 NTSC Model

The LM100-NTSC enables you to monitor program audio from either cable or off-air sources using the **RF Input.** This allows you to use the LM100 on program material in its final delivery format.

5.10 LTC Model

The LM100-LTC receives linear timecode at rates of 23.98, 24, 25, 29.97, and 30 Hz, and supports drop- and non-drop-frame modes. You can set up the system log to record events by time of day or by timecode stamp by using the `System Log` setup menu.

LM100 Specifications

Core Measurement Algorithms
ITU-R Rec. BS.1770 Annex 1 and 2

Leq(A) (IEC 60804)

Dialogue Intelligence Algorithm
Proprietary; patent pending

Audio Sampling Rates
32, 44.1, and 48 kHz

Digital Audio Input
BNC female connector with loop-through, 75, unbalanced, AES-3id (SMPTE 276M)

Formats supported: PCM data up to 24 bits; Dolby® E data supported in 16-, 20-, and 24-bit modes at 48 kHz; Dolby Digital (AC-3) data at 32, 44.1, and 48 kHz sample rates

Analog Audio Inputs
Two Neutrik® combination XLR/quarter-inch TRS connectors, electronically balanced

Maximum input level: ~ +22 dBu

Input impedance: 10k ohm

User-definable nominal operating levels

Analog Audio Output
Two RCA-type connectors, unbalanced, stereo

Maximum output level: 2 V_{RMS} into a 10k ohm load per IEC 61938

RF Input
Only on the LM100-NTSC

F-type female connector with internal 75 ohm termination

Tuner frequency range: 55.25 to 801.25 MHz

Supports BTSC-encoded stereo signals

Selectable CATV or “off-air” modes

CATV mode supports the Cable Television Channel Identification Plan per EIA 542 (User-selectable: Standard, HRC, or IRC channel identification plans)

Video output: composite, BNC female

Headphone Output
Quarter-inch standard stereo headphone jack, level adjustable

Timecode Input
Only on the LM100-LTC

BNC female, unbalanced per SMPTE 12M-1999

Supports 23.98, 24, 25, 29.97 and 30 Hz frame rates, including drop- and non-drop-frame modes

Serial Remote Control Input
Front: 8-pin female mini-DIN connector, RS-232

Rear: 9-pin female D-connector, RS-485 (SMPTE 207M)

Alarm Port
9-pin female D-connector, 0–5 V TTL level

User-definable alarms: input clip detection, modulation overload, loudness above threshold, loudness below threshold (silence), `dialnorm` threshold, and AES input loss

General Purpose Input/Output (GP I/O) Port
9-pin female D-connector, 0–5 V TTL level

Measurement/Analysis System Log
480 events stored in internal nonvolatile RAM

(Unlimited event storage and retrieval via serial ports)

Power Requirements
90–264 VAC, 50–60 Hz, auto-sensing, 15 W maximum; unit designed to operate from a centrally switched power source

Dimensions and Weight
1-U rackmount: 44 × 483 × 375 mm (1.75 × 19 × 14.75 inches)

Net: 2.5 kg (5.5 lb)

Environmental Conditions
Operating: 0°C to 50°C (32°F to 122°F), natural convection cooling, 0% to 98% relative humidity (noncondensing)

Nonoperating: –20°C to +70°C (–4°F to +158°F)