leaf
truehdmi
audio video matrix

LT2020E

leaf
truehdmi

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2	20/11/12	Update.
3		
4		
5		

NOTE:

- During initial set up and during any changes to the installation, please switch off and unplug mains power (from this system and any equipment that is to be connected to it) prior to connecting any leads / cables. Plug in and switch power back on again after all interconnection leads are in place.

- Do not run HDBaseT / Zone Cat5e/6/6a cabling with or in close parallel proximity to mains power cables.

- Do not connect any part of this equipment to Power Over Ethernet devices. Damage may result.

- During operation the Leaf LT2020E and associated LTB1E breakouts may feel hot to the touch. This is quite normal. Please ensure that these items have sufficient cool air flow around them.

Table of Contents

1 Introducing the Leaf True LT2020E Matrix system

1.1 Overview

The Leaf True HDMI Matrix System comprises a Leaf **LT2020E** interface unit and Leaf **LTB1E** breakouts. The Leaf True HDMI Matrix system is designed to accept HDMI A/V sources at its 20 inputs and route them to up to 16 remotely located breakouts and up to 4 local HDMI outputs. In this document, each input signal source is termed a *source* and each output and breakout is called a *zone.*

Additional features include Ethernet through feed capability, infrared (IR) control through feed and RS232 through feed capability between the interface and breakouts. Note that these are through feeds only and have no direct control function of the Leaf True system.

Leaf True LT2020E

Leaf True LTB1E

Interconnection between a Leaf True interface and associated Leaf True breakouts is via one single cat5e/6/6a four pair cable for each breakout. Single cat5e /6 /6a cable interconnect between these components is made possible through the use of HDBaseT technology. This technology enables Video and Audio, as well as Ethernet, IR, and RS232 through feed to be all sent by a single cable per zone over large distances.

Cabling specifications and information can be found in supplementary documentation.

The Leaf True system is designed to be controlled via RS232 commands from 3rd party control systems. Control of basic switching functions can be (also or instead) achieved via a proprietary Leaf controller such as the Leaf TC3 connected by 6 wire Telco cable and RJ12 (6P6C) modular connectors.

Manual control of the basic switching functions can be also be achieved by the use of a front panel mounted touch screen on the LT2020E.

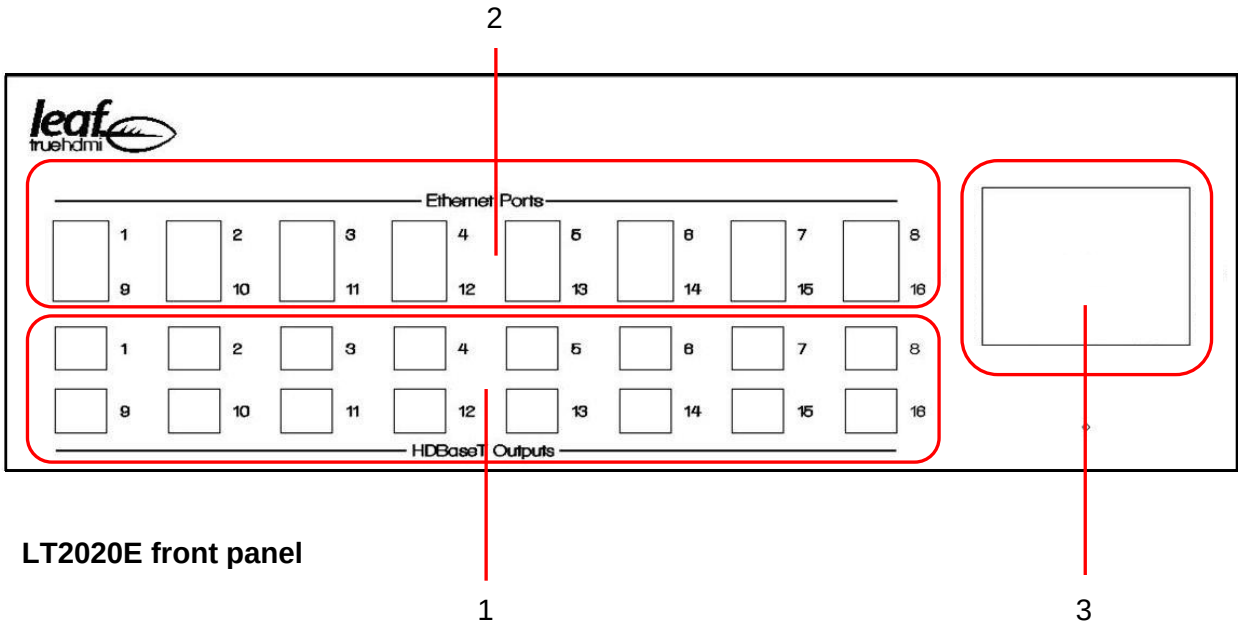
The LT2020E is built into a 3RU rack-mountable metal housing and is provided with rubber feet should table / desktop mounting be preferred.

2 Front Panel Layout

The LT2020E front panel is fitted with connectors, visual indicators and control devices as depicted below.

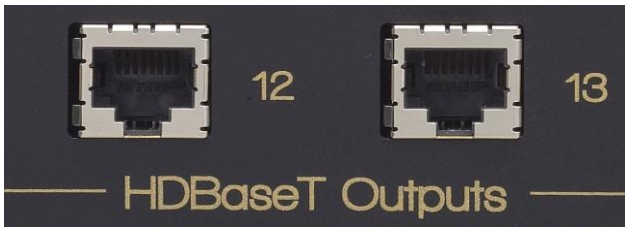
1. 16 x HDBase T RJ45 type ports labelled HDBaseT outputs for connection to the zone breakouts (LTB1E)
2. 16 x ethernet RJ45 type ports for connection of optional ethernet equipment

3. A Touch Screen control panel



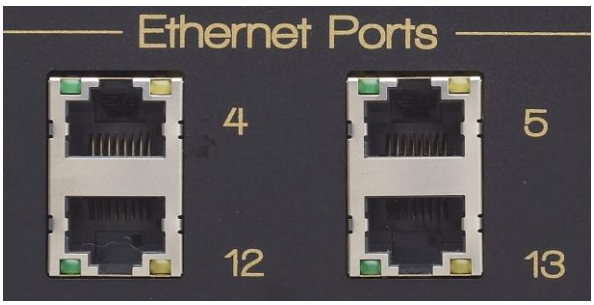
LT2020E front panel

2.1 HDBase T Connections



Each Leaf True breakout is connected to the interface by way of a single Cat5e/6/6a four pair cable to the HDBaseT output or zone ports across the lower part of the front panel.

2.2 Ethernet Ports



The Ethernet ports across the upper part of the front panel of LT2020E are for optional connection of Ethernet facilities for direct routing to remote Ethernet ports at each LTB1E breakout.

The Ethernet connection is 100Base-T full duplex. An external Ethernet router / switch may be added for added flexibility and performance.

The Orange LED on the Ethernet ports indicate handshake between the LT2020E and host Ethernet devices to which it is connected, but does not necessarily indicate data flow from end to end.

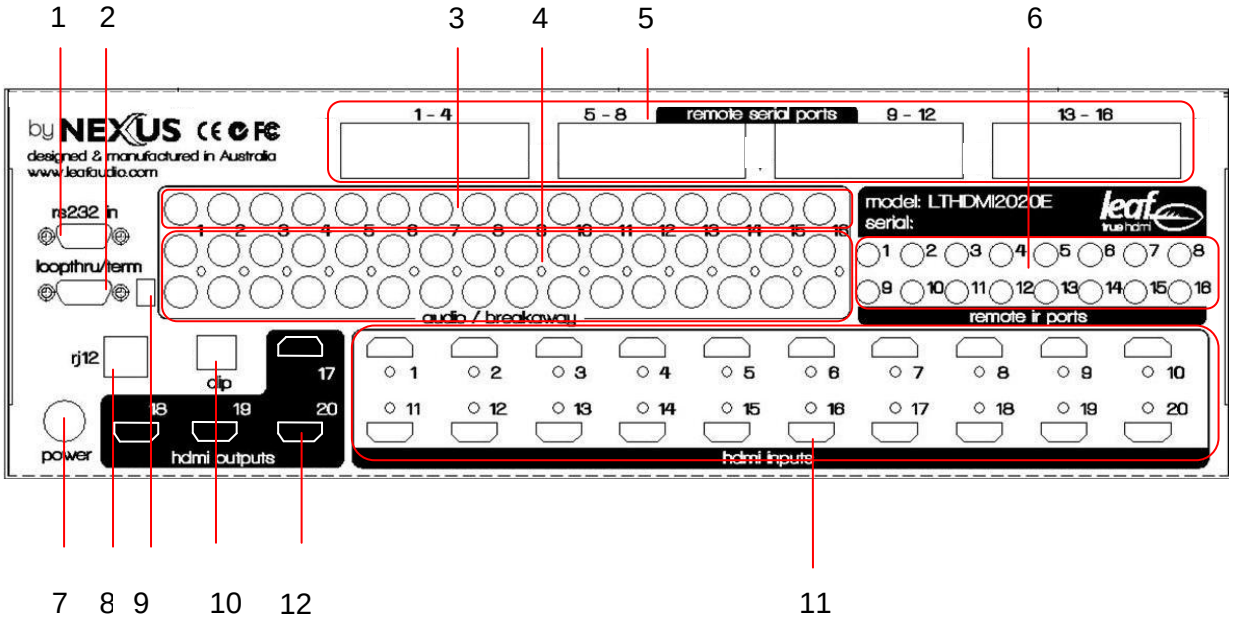
2.3 Front Panel Touch screen

Details of the front panel touch screen and its operation are yet to be finalised as of the date this manual was prepared..

3 Rear panel layout:

The LT2020E rear panel has the following fittings as depicted below.

1. 1 x RS232 serial control input connector
2. 1 x RS232 serial control out (loop thru) connector
3. 16 x RCA S/PDIF (digital coax) audio input sockets
4. 16 x pairs of RCA line level stereo output sockets
5. 16 x RJ45 type RS232 serial data ports
6. 16 x 3.5mm Tip Ring Sleeve sockets for connection of IR devices
7. 1 x 4 pin DIN Power connector receptacle
8. 1 x RJ12 type Leaf Control input port
9. 1 x RS232 Terminate switch
10. 1 x 4 way Dip Switch module
11. 20 x HDMI Input or source ports.
12. 4 x local HDMI output ports.



3.1 RJ12 control port

The 6 wire RJ12 port enables the LT2020E to be controlled by a proprietary LEAF controller such as the TC3.

3.2 4 way DIP switch module

The rear panel accessible 4 position DIP switch controls functionality of the LT2020E. The table below summarizes the settings: The individual switches are labelled with their switch number and ON – OFF position.

NOTE: The interface will only read the DIP switch settings on power-up. The unit must be powered off and then back on again for it to respond to any change of the DIP switch settings.

DIP SWITCH	OFF (UP)	ON (down)
1	Global IR direction IN IR RX detectors at LTB1E breakouts IR TX blasters at LT2020E	Global IR direction OUT IR RX detectors or devices at LT2020E IR TX blasters at LTB1E breakouts
2	IR Input device type (Applies when DIP 1 =ON) IR RX detectors (e.g. Leaf Hammerhead) at LT2020E	IR Input device type (Applies when DIP 1 =ON) IR direct drive from control system* (5 volt only) at LT2020E *Must connect IR IN with a stereo (tip,ring,sleeve) lead / modified stereo lead or Mono lead with suitable adaptor.(Ref: sect 3.5)
3	Normal Mode	Compatibility Mode
4	Future Function	Future Function

Table 1: Dip Switch Settings

3.3 Digital Coax (S/PDIF) audio inputs:

The upper row of RCA sockets 1 to 16 are configured as digital coax (S/PDIF) stereo audio input ports. They can be used as either alternative audio inputs (selectable with discrete Audio Only commands) or the input points for audio only sources.

3.4 Stereo RCA analog outputs

The lower 2 rows of RCA sockets 1-16 are configured as stereo analog audio outputs for connection to local devices such as centralised external amplifiers.

The source audio for these outputs can be either an HDMI input source, digital coax (S/PDIF) stereo connector input or audio return from a zone breakout input.

The RCA outputs may be routed manually or automatically (the default).

With automatic routing active, the RCA audio outputs will follow the zone audio output of the same number. (example: If zone 4 is selected to source 2, then in automatic mode the RCA audio will also come from source 2).

When a manual RCA audio output routing command is sent it will override this automatic function for that output. When this output is switched off using a manual audio command, automatic mode will be re-activated for that output.

Selectable audio sync delay is also available independently on these audio output ports (ref: Audio Sync Delay).

3.5 3.5mm – (1/8 inch) IR ports

The 3.5mm (1/8 inch) Remote IR connectors are used for routing external IR control signals in one direction between the LT2020E and the connected LTB1E breakouts. These connections are treated as through connections. That is, IR port 1 connects to the breakout connected to Zone 1, through to port 16 being connected to the breakout at Zone 16.

The IR ports support direct connection and drive of Leaf “hammerhead” and other compatible 5 volt, 3 wire (Tip Ring Sleeve / stereo plug) IR detectors to Leaf LB41 and other compatible 2 wire (mono plug) IR blasters.

The system wide operating direction of the IR detectors and blasters (either Hub to Zones or Zones to Hub) is configurable by DIP Switch 1.

If the IR Direction is set to “Hub to Zones” by DIP switch 1 (ON/ down), the IR ports on the LT2020E can be further configured by DIP Switch 2 to accept direct IR drive from an external control system or similar instead of stand-alone IR detectors.

(See table 1 for DIP switch configuration details.)

For this configuration, the IR leads from the control system to the Leaf LT2020E need to be 3.5mm (1/8 inch) Stereo (Tip Ring Sleeve) leads or Mono (Tip Sleeve) leads fitted with suitable adaptors at the Leaf LT2020E end. For IR connection from Control4, standard stereo leads may be used. Other control systems may require the “Ring” connection of these leads at the LT2020E end to be left “floating”, “not connected”, or connected to “Tip”. This can also be achieved by the use of suitable adaptors.

Suitable adaptors for either purpose would be a “mono 3.5mm (1/8inch) jack (socket) to stereo 3.5mm (1/8inch) plug adaptors”, connected at the Leaf LT2020E end of each IR lead from the control system. Adaptors which appear to be suitable include: Radio Shack 274-374, and Altronics P0340.

If the IR input type is set to IR RX detector (DIP Switch 2 OFF/up):

then the IR output will be automatically modulated at 38Khz.

If the IR input type is set to IR direct drive (DIP switch 1:ON/down & DIP switch 2 ON/down):

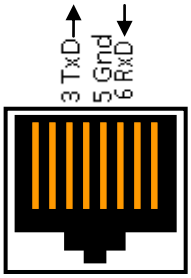
then the received IR input will be directly passed through to the IR output.

Any external IR drive voltage should not exceed 5V.

3.6 RJ45 type “RS232 through” ports

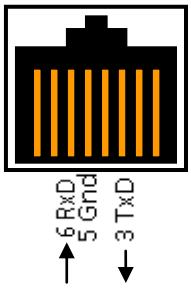
The LEAF True system provides a bi-directional, full duplex “RS232 through” capability between the LT2020E and each of the connected LTB1E Breakouts through specific RJ45 connectors. These are for optional use by external RS232 equipment. Connection from these ports to RS232 equipment would typically be achieved through the use of RJ45 to DB9 RS232 adaptor leads. Leaf Audio has suitable RJ45 to RS232 (DB9) Female adaptor leads (LT45DB9Female) available for sale. Male DB9 RS232 connection may require the additional of M-M gender bender(s).

For convenience the pinouts of the RJ45 type “RS232 through” ports is shown below.



At LTHDMI1616

RJ45 type “RS232 Through” port(s) receptacle (Front view)

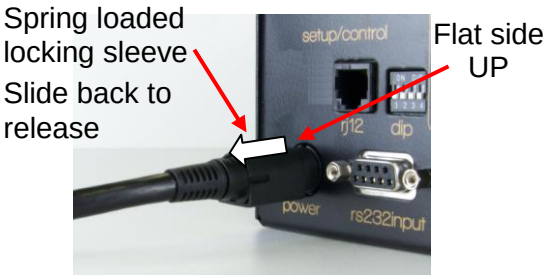


At LTB1 / LTB1E (Breakouts)

3.7 4 pin DIN power connector

The LT2020E requires 4 Pin 12V power.

WARNING. Failure to use the correct power supply as provided by Leaf Audio may result in incorrect operation and / or damage to the Leaf True Matrix system.



The power supply is fitted with a locking connector. Be sure to slide back the locking sleeve on the plug before attempting to connect or disconnect it at the LT2020E. Flat Side UP is the correct orientation.

3.8 RS232 Serial Control connectors

The unit can be controlled by serial commands through the RS232 input port. Typically this would be connected to a control system with a straight through DB9 Male to Female RS232 lead. Some control systems may require only the TxD, RxD and Gnd wires of an RS232 lead to be connected. The pin configurations of these 3 connections on the DB9 plug is: TxD = Pin 2, RxD = Pin3, Gnd = Pin5.

3.8.1 Single LT2020E use

- The RS232 Input port is used for controlling the unit.
- The TERM (Termination) switch (ref: para 3.10) must be set to ON (Up).

3.8.2 Multiple LT2020E use

- Multiple units can be chained together and addressed on the same RS232 link by connecting the RS232 thru (out) port on one unit to the RS232 input port of the next unit.

The last unit in the chain must have the TERM (Termination) switch (ref:para 3.10) set to ON (Up), while all other units in the chain must have this switch set to OFF (Down). The RS232 Input port is used for controlling the units.

3.9 RS232 Termination (TERM) Switch

The RS232 termination switch must be used to correctly terminate any RS232 control connection as described in paragraphs 3.8.1 and 3.8.2.

3.10 HDMI Input ports

Standard HDMI input ports are provided for the purpose of connecting HDMI sources. They are labelled 1 to 20.

All Leaf True systems accord with the HDMI 1.4 specification and includes support of 3D formats.

4 BREAKOUTS

A Breakout is the “receiving end” of the Leaf True system and one is required for each connected HDBaseT “zone” of the Leaf True system.

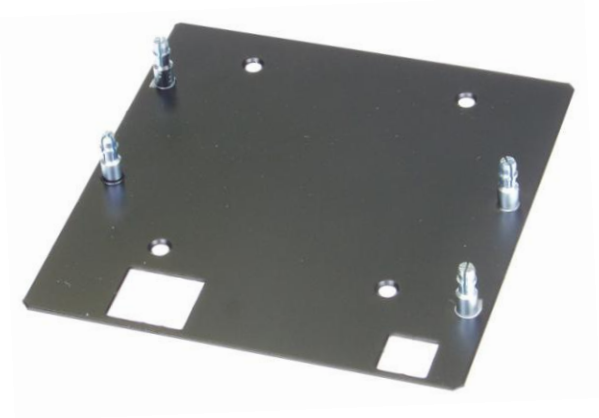
The Leaf LTB1E is the required breakout for this system.

4.1 Local Power

Each breakout (LTB1E) is required to be powered by its own (local) power supply and to be connected via a Cat5e / Cat6 / Cat6a four pair cable link from its HDBaseT port to the associated HDBaseT port on the LT2020E. Use only the power supplies that are provided by Leaf Audio for this purpose.

4.2 Mounting Bracket

Each LTB1E is supplied with a mounting bracket which is designed to be attached to the mounting surface and have the breakout clipped to it.



4.3 Status LEDs

A set of 3 Status LEDs are visible through apertures in the right hand side of the LTB1E.

LEDs 3, 2, 1.

The Status LEDs operations are*:*

LED 1 FLASHING (heartbeat) = The local 12V DC power supply is connected and active.

LED 2 ON = The HDBaseT Cat5e / Cat6 cable link to the LT2020E has been made successfully and is ready for video.

LED 3 ON = Protected (HDCP) video content is being transferred on the HDBaseT link.

FLASHING = Non protected (no HDCP) video content is being transferred on the HDBaseT link. Irregular flashing may indicate an issue with the video link.

OFF = No video content is being transferred.
(Usually means that no source has been selected for that zone).

5 SYSTEM FEATURES

5.1 EDID Management

The Extended Display Identification Data (EDID) of all sinks (TVs, Display Panels, etc) attached to a zone are merged and presented to the source. This ensures that the source outputs the correct audio and video format to all sinks .

When a sink is switched to a source the LT2020E remembers its EDID. After a calibration, or each time new sinks are switched, the combination or merge of this sink EDID and previously switched sink EDIDs is calculated and stored for use thereafter until power off or recalibration.

This guarantees true repeater functionality while minimising interruption to active TVs or Display panels when selecting sources.

5.2 Calibration

This process effectively gathers all of the information from the source and sink devices (EDID and HDCP keys data) and pre-calculates the EDID merging and HDCP key list. This results in faster switching times and isolates the effect on one zone from another zone when new connections are routed. Calibration can be achieved manually via the touch screen or under serial control of a connected control system. Ref: sect 6.2.

5.3 Exclusive Source Selection (Zone Lock mode)

A source can be locked to a particular zone. The exclusive source selection feature enables enhanced features, such as multichannel audio, 3D etc, to become active in the locked zone (if supported by both the source and zone equipment) – even if other zones in the system do not support these features.

- This feature is activated by RS232 command.
- Any one zone can be locked to a desired source thus creating a so-called “locked connection”.
- Effectively this feature overrides the system merged EDID for this connection and allows the unique EDID for the zone to be passed through to the source. A typical example would be switching a 3D-capable zone to a 3D-capable source in instances where not all zones in the system can support 3D.
- No other zone can connect to a source that is locked.
- Multiple locked connections are allowed but locked sources cannot be shared.
- When the zone of a locked connection is disconnected the source is unlocked and available for selection by other sources.
- When the zone of a locked connection changes to a new source the existing source is unlocked.
- When a global command is sent then the existing source is unlocked
- Locking a zone to a source that is already switched to one or more other zones will cause that source to disconnect from those zones.

5.4 Audio Only Source

Any of inputs 1 to 16 can be set up as an audio only source by connecting a desired stereo (S/PDIF) digital audio source to a nominated digital coax (S/PDIF) RCA socket (1 to 16) and leaving the associated HDMI input port vacant. The audio only source can then be selected as per normal (source selection 1 to 16) and will transmit the selected audio together with a “black” video signal.

5.5 Flexible Audio Routing

Flexible audio routing within the system allows audio from:

- HDMI sources (1-20)
- Digital Coax (S/PDIF) (1-16) audio input connectors on the LTB1E Breakouts
- Digital Coax (S/PDIF) (up to 16) audio input connectors on the LT2020E

to be routed to the Stereo RCA analog output connectors on the LT2020E.

The source range for the selected audio inputs under this feature becomes:

- HDMI input ports: 1 to 20
- LTB1E Breakouts: 21 to
- 37 LT2020E: 41 to 56

This feature is activated by specific RS232 commands. Refer to separate documentation for further detail.

[notes: If Multichannel Audio is selected as the source for the RCA analog outputs then that output will be muted. S/PDIF audio performance from LTB1E breakouts may be unreliable in instances where the Cat5e / Cat6 / Cat6a four pair cabling to them exceeds approximately 50 metres or is subjected to electrical interference.]

5.6 Audio Sync Delay

Each pair of stereo RCA audio output ports has programmable audio sync delay capability which may be useful to bring the audio from these ports and the displayed video closer to synchronism. This feature is activated by specific RS232 commands. Refer to separate documentation for further detail.

6 Operation

6.1 Apply Power

Once power is applied to the LT2020E it will go through a Power Up routine lasting a minute or two.

When this routine is completed the unit will reconnect the most recent state (Source – Zone selection or standby)

6.2 Calibration

The system should be calibrated on first use or after any new devices (source or zone equipment) are added or port allocations changed. Failure to correctly calibrate a system may lead to interruption to audio and video at zones when other zones are switched to a source that is already in use.

The system may be calibrated under RS232 control or manually by following these steps.

1. Turn on all sources and zone equipment (AV receiver or TV). Ensure that zone equipment (AV receivers, TV's etc) are set to the correct HDMI input.

2. Calibrate the system by following the touch screen menu. When calibration commences, each source will be temporally switched to each zone in sequence until all switched combinations are exhausted. This process may take a few minutes.

3. The system will then return to its previous state.

6.3 Creating input to output switched selections

While this would typically be performed by RS232 commands from your control system, basic selections may also be performed manually at the touch screen.

6.4 Clear all switched selections / Global OFF

While this would typically be performed by RS232 commands from your control system, it may also be performed manually from the touch screen.

LT2020E: MAIN MATRIX UNIT		
	FEATURE	**SPECIFICATION**
1	INPUTS: DIGITAL-AUDIO/VIDEO	(20x) HDMI inputs VIDEO FORMATS: 480p,576p,720p50/60,1080i50/60,1080p50/60,HDMI1.4 Mandatory 3D formats as a minimum.DVI formats. AUDIO FORMATS: LPCM,AC3,DTS,DD+,DTS-HD (in Multichannel mode)
2	ETHERNET PORTS.	(16x) ETHERNET INPUTS 100Base-Tx full-duplex Ethernet on all ports
3	OUTPUTS: HDBaseT	(16x) HDBase-T Outputs Uncompressed HD video - Supports all formats as in item 1. One cable carries: Video, Audio, Ethernet, IR, RS232.
4	OUTPUTS: LOCAL AUDIO	(16x) 2Ch RCA ANALOG OUTPUTS FORMAT: Analog Stereo. Programmable audio delay Sources for these audio outputs may be routed independently from HDMI inputs, remote (breakout) or local SPDIF inputs.
	INPUTS: LOCAL AUDIO	(16X) S/PDIF INPUTS
5	SYSTEM CONTROL	(1x) RJ12 Leaf Proprietary Remote control (1x) RS232 DB9 IN (1x) RS232 DB9 LOOPOUT Bank select and termination selectors.
6	INFRA RED REMOTE CONTROL THROUGHPUT ONLY (No direct control by IR)	(16x) DIRECTIONAL IR INPUTs. Support for: Direct IR, IR TX Bug, IR RX Bug. Modulated 38Khz and Envelope. (16x) RJ45 RS-232 PORT for remote control to breakouts. Up to 115200 Baud.
7	DISPLAY/CONTROL	Front Panel Touch Screen, enables basic selection and display of the connections within the matrix.
8	PHYSICAL LAYOUT	RACK MOUNTABLE (3RU) REMOTE ETHERNET AND HDBaseT RJ45s, AND TOUCH SCREEN AT FRONT ALL OTHER CONNECTORS AT REAR RJ12 FOR CONNECTION TO LEAF CONTROLLER USER INTERFACE (BASIC): TOUCHSCREEN PANEL. STANDARD RACK EARS AND FEET INCLUDED.
9	NUMBER OF INPUTS/OUTPUT	20 /16
10	EXPANDABILITY	Bank Select Switch and Audio Breakaway
11	POWER	60W 5A 12V DC. Consumption depends on resolution of distributed video and features enabled. 120W supply included – Use Leaf Audio supply only.
12	DIMENSIONS (W, D, H)	418(484 incl rack ears) x 290mm, x 133mm(147mm incl feet)

LTB1E: BREAKOUT		
	FEATURE	**SPECIFICATION**
1	INPUTS: MAIN A/V	(1x) HDBase-T Input . See LT2020E for further specification.
2	OUTPUTS: AUDIO/VIDEO	(1x) HDMI output
3	INPUT: AUDIO	(1X) Digital coax (S/PDIF) via RCA socket Audio return from RCA socket specification: Range: ~50 metres. Less if subjected to electrical interference, cable type, power supplies used etc.
4	OUTPUTS: ETHERNET	(1x) ETHERNET OUTPUT
5	OUTPUTS:RS232	(1x) RS-232 PORT (BLACK RJ45 CONNECTOR) Up to 115200 Baud.
6	OUTPUT: IR THROUGHPUT	IR LED DRIVER 38KHz... OR... IR INPUT. (Selected by main unit). 3.5mm TRS female connector
7	NUMBER OF INPUTS/OUTPUT	1/1
8	POWER	Local power required 12W (1A @ 12V).
9	DIMENSIONS (W,D,H)	116mmx121mmx31mm(36mm with wall plate fitted)

NEXUSTECHNOLOGIES
LTHDMI2020E

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient or relocate the receiving antenna.

Increase the separation between the equipment and receiver.

Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

Modifications not expressly approved by the manufacturer could void the user's authority to operated the equipment under FCC rules.