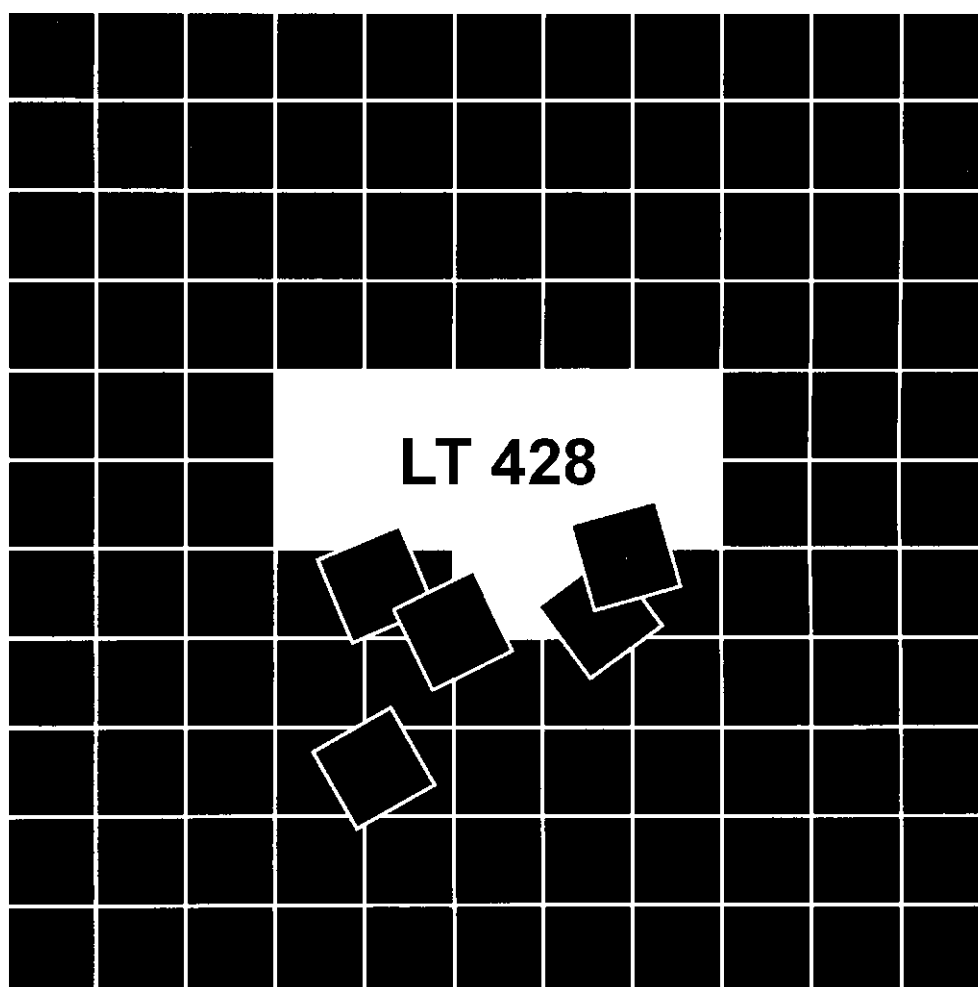


LEADER

COMPONENT DIGITAL SYNC GENERATOR

INSTRUCTION MANUAL



LEADER ELECTRONICS CORP.

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GENERAL SAFETY SUMMARY

◆ To Avoid Personal Injury

It is recommended that only qualified personnel with technical knowledge use this instrument only after reading and fully understanding all functions of the instrument described in this instruction manual.

This instrument is not designed and manufactured for consumers.




If you do not have enough knowledge on electricity, to avoid personal injury and prevent damage to this product, please be sure to use this product only under the supervision of an engineer who has sufficient knowledge about electronics.

◆ Precautions on Contents

Should you find the contents in this manual and any of its technical terms confusing, please feel free to contact your local Leader agent.

◆ Symbols and Terms

Following terms and symbols indicate necessary warnings and cautions used in this manual and on the product are there for safe operation.

<p style="text-align: center;">< Symbol ></p> 	<p>The sections where this symbol is marked in this manual or instrument, if not correctly performed or practiced, could result in personal injury or cause serious danger to the instrument. Misuse could also produce unintentional movement to create an operational impediment on the instrument or other products that might be connected to it. Be sure to refer to the safety precautions in this manual to safely use the part of the instrument where the symbol is marked.</p>
<p style="text-align: center;">< Term ></p>  <p style="text-align: center;">WARNING</p>	<p>Warning statements identify warning conditions that if disregarded or not correctly performed or adhered to, could result in serious personal injury or even loss of life.</p>
<p style="text-align: center;">< Term ></p>  <p style="text-align: center;">CAUTION</p>	<p>Caution statements identify warning conditions if disregarded or not correctly performed or adhered to, could result in personal injury or damage to the instrument.</p>

GENERAL SAFETY SUMMARY

Review the following safety precautions to avoid operator's injury and loss of life and prevent damage and deterioration to this instrument. To avoid potential hazards, use this product as specified.



WARNING

♦ **Warnings on the Cases and Panels of the Instrument**

Operator should not remove any cases or panel for any reasons. If you touch inside the instrument it could result personal shock or fire hazard. Refrain from spilling any liquid on or inserting anything flammables or piece of metal into the ventilation of the instrument. Such actions could cause fire, shock, malfunction and be an accident hazard while the power is on.

♦ **Warnings on Power Line.**

- **Make sure to connect only to the rated power line voltage. Excess voltage may cause fire.**

Confirm the voltage of the commercial power line before connecting the AC power cord. The power frequency of the power line should be 47 to 63 Hz.

• **Warning on the Power Cord**

Attached Power Cord is applied only for this instrument.

Use only the optional power cord that is attached to this instrument. The use of the power cord other than that attached could cause fire hazard.

If the attached cord is damaged stop using it and contact your local Leader agent.

Should you use a damaged cord, it could cause a shock or create a fire hazard.

When you pull out the cord be sure to hold it by plug and pull from the socket not by holding the cord wire.

GENERAL SAFETY SUMMARY



WARNING

♦ **Warning on Installation Environments**

• **About the Guaranteed Operating Temperature Range**

Operate the instrument between the temperature range of 5 to 40 °C. Operating the instrument at higher temperatures could cause a fire hazard.

Rapid changes of temperatures from cold to warm can create internal moisture or condensation and could damage the instrument. If there is a possibility of moisture condensation allow the instrument to sit for 30 minutes without the power on.

• **About the Guaranteed Operating Humidity Range**

The product must be free of condensation while in use.

Do not operate the instrument with wet hands. This could cause a shock and fire hazard.

• **About the Operation in the Presence of Gasses**

Operating the instrument in and near the presence or storage locations of flammable, explosive gasses or fumes could create an explosion and fire hazard.

Do not operate the instrument anywhere near such environments.

• **Avoid Insertions**

Do not insert metals or flammable objects or drop liquid on or into the instrument.

To do so could cause fire, shock, malfunction and create a dangerous accident hazard.

♦ **Warning while Operating**

While operating the instrument in smoke, fire, or a bad smell, occurs, turn off the instrument at once for it could cause a fire hazard. When such a case occurs, turn off the power switch and pull the plug of the cord from the plug socket. Contact your local Leader agent after confirming there is no fire.

♦ **Warning about Ground**

The instrument has a ground terminal to avoid electric shock hazard and to protect the instrument from damage. Ensure that the product is properly grounded for safe operation.

GENERAL SAFETY SUMMARY



CAUTION

- ◆ **Caution on Input/Output Terminals**

Input Terminals are rated with a maximum input. Do not supply an input over the specified rating in the standard section of the instruction manual. Also, do not supply external power to Output terminal, this could cause the instrument to malfunction.

- ◆ **Caution when Not to Using Instrument the for a Long Time**

Make sure to disconnect the power cord from the socket when you do not use the instrument for a long time.

Please conform to the above warnings and cautions for safe operation. There are cautions in each area of in this instruction manual, so please conform to each caution. If you have any questions about this manual, please feel free to contact your local Leader agent

1. Introduction

Thank you for purchasing Leader's measuring instruments.

Please read this instruction manual carefully to ensure correct and safety operation.

If you have any difficulties or questions on how to use the instrument after you have read this manual, please feel to contact your local Leader agent.

1.1 Scope of Warranty

This Leader instrument has been manufactured under the test quality control guidelines. Leader shall not be obligated to furnish free service during the warranty period under the following conditions.

1. Repair of malfunction or damages resulting from fire, natural calamity, or improper voltage applied by the user.
2. Repair of an instrument that has been improperly repaired, adjusted, or modified by personnel other than a factory - trained Leader representative.
3. Repair of malfunctions or damages resulting from improper use.
4. Repair of malfunctions caused by devices other than this instrument.
5. Repair of malfunction or damages without the presentation of a proof of purchase or receipt bill for the instrument.

1.2 Operating Precautions



WARNING

1.2.1 Line Voltage

Confirm that the power line voltage is correct before connecting the power cord.

The voltage range is indicated on the rear panel.

The instrument must be connected to the rate line voltage and line frequency of 47 to 63 Hz.



CAUTION

1.2.2 Short and External Input to Output Terminal

- **Short on Output Terminal**

Do not short the output terminal. To do so could cause damage to the instrument.

- **External Signal to Output Terminal**

Do not apply an external signal to the output terminal. Addition of an external signal to the output terminal could cause damage to the instrument or any product connected to it.



CAUTION

1.2.3 Installation

Do not use the instrument in the following environments.

- **Do not place the instrument under direct sunlight or near a heater or stove.**

Avoid moving the instrument abruptly from cold to warm environments, as it may cause condensation.

Operating temperature range: 5 to 40 °C

- **High Humidity Environments**

Do not place or operate the instrument in high humidity environments such as a bathroom, or near a humidifier.

- **Dust Place**



CAUTION

1.2.4 Mechanical Shock

Be careful not to drop the instrument or expose it to severe mechanical shock.

1.2.5 Calibration

The instrument is checked under strictest quality controls at the factory and proper operation is confirmed before Shipping. Accuracy, however, might change slightly over time due to the age and general deterioration of the components.

Periodic calibration for the instrument is highly advisable. For more details on calibration, please contact your local Leader agent.

1.2.6 Routine Maintenance

Before cleaning procedure starts, power down the instrument and disconnect the plug from the socket.

Avoid the use of thinner or benzene solvents for cleaning cases, panels, knobs since this might remove the paint or damage plastics surfaces.

Wipe cases, panels, knobs lightly with a soft cloth damped with neutral detergent.

Do not drop water or detergent, or insert metal objects into the instrument while cleaning. To do so, could cause shock or fire hazard.

2. General and Applications

2.1 General

The LT 428 Component Digital Sync Generator includes all basic features for professional sync, timing and test signals in one half-sized box.

The new digital studios need cost efficient and reliable synchronization for the main equipment to work reliably. For this purpose LEADER offers the LT 428 as the fully integrated solution eliminating any costs associated with modular structures, support of many different signal types and extensive operating facilities.

Analog Black Burst is still routinely used for timing purposes, also in digital installations, where processing delays are often on the order of several fields.

The LT 428 Component Digital Sync Generator is designed with the multiple delays of digital television installations in mind, but also fulfils all synchronization requirements when used with a combination of digital and traditional analog video systems.

The LT 428 Component Digital Sync Generator is a multi-standard sync generator and provides sync and test signals for both NTSC, PAL and for SDI outputs of 525/59.94 and 625/50 systems. Each of the reference Black Burst outputs and the Test Signal Generator output can be individually selected in system (NTSC/PAL) and timed in fine steps over the complete sequence. The serial digital black and test signals can be timed with a resolution of 37 ns over a ± 1 field range.

The analog Black bursts are timeable in sub-nanosecond resolution over a ± 4 fields sequence for PAL and ± 2 fields sequence for NTSC.

The timing of analog Test Signal Generator follows the timing of the SDI generator, i.e. with a 37ns resolution but over a ± 4 fields sequence for PAL and ± 2 fields sequence for NTSC.

2.2 Configuration

The operation of LT 428 Component Digital Sync Generator is based on a PC Remote Control. The PC Remote Control program makes it easy to manage all timing, patterns and audio features in one screen.

The settings for the PC Remote Control are either loaded from the PC or downloaded from the generator. When the settings are loaded from the PC the data is transferred immediately to the generator, overwriting the actual state.

At exit from the panel, data is stored in a file on the PC for later use.

Four presets can be stored in the instrument and also in 4 separate files on the PC. Any preset can then be recalled either from the PC or from the generators internal memory.

The hidden button on the front plate can select the stored presets in the generator.

Communication between LT 428 and PC via standard RS-232 protocol makes it possible to use any kind of PC.

Status of current functions and systems will be displayed at any time corresponding to the LED's on the LT 428 front panel.

2.3 Applications

The LT 428 is designed to manage slave as well as master operations as a stand-alone unit. In systems where LT 428 operates as a master the reference is locked to an internal, high stability TCXO oscillator (**T**emperature **C**ontrolled **X**tal **O**scillator).

For use in slave applications the GENLOCK function is used.

The GENLOCK function features genlock to NTSC and PAL video signals, Black Burst house sync or a 10 MHz reference clock, e.g. from a GPS receiver. The GENLOCK function features passive loop-through, and has a common timing facility for the generator.

To genlock this instrument with an external signal, set the Genlock System manually to NTSC or PAL corresponding to the signal format.

This instrument does not automatically select the format. Refer to Section 5.5.2.5.1, "GENLOCK" for settings.

3. Specification

3.1 Safety Characteristics

This apparatus has been designed and tested in accordance with the safety Class I requirements of EN 61010-1 ("Safety Requirements for Electrical Measuring Apparatus"), and is safe as supplied. This manual contains information and warnings, which must be followed during operation to ensure operator and service personnel safety.

3.2 Performance Characteristics

Characteristics expressed in numerical values with stated tolerances are guaranteed tolerances, when the instrument is calibrated at 25°C and after 20-min. warm-up. Specified numerical data without tolerances indicate typical values at nominal ambient temperature (25°C) and reflects an average performance.

3.3 Specification

3.3.1 Master Frequency Reference TCXO

Temperature drift:	±2.5 ppm (0-50°C, ref. 25°C)
Ageing:	±1 ppm/year; first year then better

3.3.2 Remote Control

Input Interface:	RS-232 port, 9 pole D-sub, male
Protocol:	SCPI based
Baud rate.	9600 bps

3.3.3 Analog GENLOCK

Input:	75 Ω looped through
Return loss:	>36 dB to 6 MHz

3.3.3.1 GENLOCK Signal (NTSC or PAL)

Amplitude:	Nominally ± 3 dB
S/N ratio:	>26 dB
Input SCH phase:	Nominally ±45°
Pull-in range fsc:	± 50 Hz

3.3.3.2 Timing Facilities

Timing range:	PAL: ±4 fields
	NTSC: ±2 fields

3.3.4 Analog Black Burst Outputs

Connector:	BNC
Output impedance:	75 Ω

Return loss:	>36 dB, to 5 MHz
Sync amplitude:	PAL: -300 mV ± 5 % NTSC: -286 mV ± 5 %
Burst amplitude:	PAL: 300 mV ± 5 % NTSC: 286 mV ± 5 %
Timing range:	PAL: ± 4 fields NTSC: ± 2 fields
SCH phase:	adjustment $\pm 180^\circ$

3.3.5 Test Signal Generator

3.3.5.1 SDI TSG output

Connector:	BNC
Output impedance:	75 Ω
Format:	270 Mb/s serial, complies with ITU-R BT 656 and SMPTE 259 M
Return loss:	>15 dB, 5 – 270 MHz
Timing range:	PAL: ± 1 field NTSC: ± 1 field
Embedded Audio:	1kHz stereo, silence and off

3.3.5.2 VIDEO output

A color phasing of the output is unlocked to the Black Burst outputs.

Connector:	BNC
Output impedance:	75 Ω
Return loss:	>36 dB, to 5 MHz
Sync amplitude:	PAL: -300 mV ± 5 % NTSC: -286 mV ± 5 %
Burst amplitude:	PAL: 300 mV ± 5 % NTSC: 286 mV ± 5 %
Video accuracy:	Nominal ± 2 %
Timing range:	PAL: ± 1 fields NTSC: ± 1 fields
SCH phase:	adjustment $\pm 180^\circ$
S/N ratio:	50 dB unweighted to 5 MHz

3.3.5.3 Common Test Signals, SDI and Analog Generator

All signals are in standard 4x3 aspect ratio.

Patterns dedicated for PAL:	EBU Color Bar 75 % Color Bar + red CCIR Line 18
Patterns dedicated for NTSC:	SMPTE Color Bar

FCC Color Bar

Patterns common for NTSC/PAL:	Color Bar ITU801	Color Bar 100 %
	75 % Red	Crosshatch
	PLUGE	SDI Check Field
	Digital Grey	Staircase 5 step
	Staircase 10 step	15 KHz BI / Wh
	White 100 %	Black
	Window 10 %	Window 15 %
	Window 20 %	Window 100 %

3.3.6 AES/EBU Audio Generator

Serial digital audio generator with test tones.

Connector:	XLR
Output format:	Balanced 110 Ω . According to AES3 1992
Amplitude:	3V _{P-P} Typically
Data bitrate:	3.072 Mbps
Coding:	Linear, 20-bits two's complement binary biphasic mark
Pre-emphasis:	None
Timing:	+10.4 μ s to -9.6 μ s in 0.8 μ s steps

3.3.6.1 AES/EBU Output signals

Tones:	Stereo 500 Hz	
	Stereo 1 kHz	
	Stereo EBU 1 kHz, single click in ch. A	
	Stereo 8 kHz	
Click rate:	1 or 3 s.	
Levels:	Silence	
	0 dBFS	-9 dBFS
	-12dBFS	-15 dBFS
	-16 dBFS	-18 dBFS
	-20 dBFS	

3.3.7 Wordclock (WCLK) Generator

Connector:	BNC
Output impedance:	75 Ω
Output characteristics:	HC-MOS clock, 0 – 5 V un-terminated
Reference output:	44.1 or 48 kHz

The 48 kHz is both frequency and phase locked to the video.

The 44.1 kHz is the CD audio sample frequency and frequency locked to the video frequency

3.3.8 Analog Audio Generator

Connector:	XLR
Output format:	Balanced 30 Ω Balanced by active circuitry.
Reference Amplitude:	0 ± 0.8 dBu, corresponding to 775 mV

3.3.8.1 Analog Audio Output Signals

Tones:	Stereo 500 Hz Stereo 1 kHz Stereo EBU 1 kHz, single click in ch. A Stereo 8 kHz	
Click rate:	1 or 3 s.	
Levels:	+10 dBu	+8 dBu
	+7 dBu	+6 dBu
	+5 dBu	+4 dBu
	+3 dBu	+2 dBu
	+1 dBu	0 dBu
	-1 dBu	-2 dBu
	-3 dBu	-4 dBu
	-5 dBu	-6 dBu
	-7 dBu	-8 dBu
	-9 dBu	-10 dBu
	-11 dBu	-12 dBu
	-13 dBu	-15 dBu
	-18 dBu	-20 dBu
	-24 dBu	-27 dBu
	-30 dBu	-33 dBu
	-36 dBu	Silence

3.3.9 Presets

Four preset set-ups can be stored in the unit. Besides essential data for the individual Presets all user accessible parameters for the outputs are included and stored in non-volatile memory.

The Presets are named Preset 1 – 4 in the unit.

In the PC Remote Control each preset is identified by:

Name (24 characters, no space)
Author
Date of modification

The preset name is displayed in the Preset Status box in the System Status window, when the preset is active.

The front panel LEDs using the hidden Preset button also displays preset status. See operation instructions.

3.3.10 Environmental Conditions

3.3.10.1 Regulations and Standards

- ♦ EN 55103-1 (emissions)
- ♦ EN 55103-2 (immunity)

3.3.10.2 Climatic Conditions

Temperature range:

Ambient operating: +5° - +40°C (41°F - +104°F)

Humidity:

Non condensing (IEC 721)

3.3.11 Power Supply

Voltage: 90 - 250 VAC
Frequency: 47 - 63 Hz
Power consumption: 25 W max.

3.3.12 Mechanical Data

Mechanical data for cabinet

Height: 42 mm (1.66")
Width: 217 mm (8.54")
Depth: 380 mm (15")
Weight: 1.5 kg (3.3 lbs)

Mechanical data for cabinet fitted with 19" rack mount

Height: 44 mm (1.73")
Width: 442 mm (18.4")
Depth: 380 mm (15")
Weight: 2.3 kg (5.1 lbs)

Mechanical data for two cabinets side by side, fitted with 19" rack mount

Height: 44 mm (1.73")
Width: 442 mm (18.4")
Depth: 380 mm (15")
Weight: 3.8 kg (8.4 lbs)

3.3.13 Accessories

Mains cable	1
Interface cable	1
Rack Mount Kit	1
CD-ROM	1

4. Installation

4.1 Initial Inspection

Check the contents of the shipment for completeness and possible transport damage. If the contents are incomplete or damaged, a claim should be filed with the carrier immediately and the LEADER ELECTRONICS CORP. should be notified in order to facilitate the repair or replacement of the instrument.

4.2 Safety Instruction

4.2.1 Grounding

Before any other connection is made, the instrument must be connected to a protective earth conductor via the three-core mains cable.

Before connecting the equipment to the mains of the building installation, the proper functioning of the protective earth lead of the building installation needs to be verified.

Warning: Any interruption of the protective conductor inside or outside the instrument is likely to make the instrument dangerous. Intentional interruption is prohibited.

4.3 Mains Voltage Cord and Fuses

Different power cords are available for the various voltage outlets.

Note:

If the mains plug has to be adapted to the local situation, a qualified person should only do it. This instrument is equipped with a tap-less switch mode power supply that covers most nominal voltage ranges in use: 90-250V AC RMS. This obviates the need to adapt to the local mains voltage.

The mains frequency is 47-63 Hz.

Warning: This instrument is intended not to have the fuse renewed. If the fuse is damaged the power supply unit is also affected.

4.4 Rack Mounting

The LT 428 Component Digital Sync Generator is in a half size 19" rack cabinet. The instrument is intended for rack mounting as well as desktop use. A rack mount kit for conventional 19" rack is included.

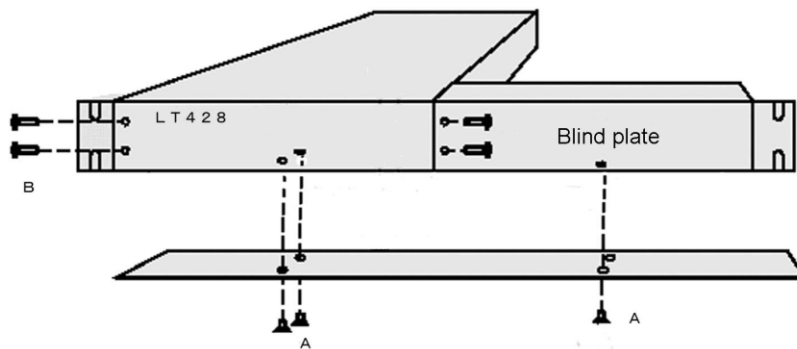
When the Sync Generator is used in desk top applications LEADER recommend the mounting of the four self-adhesive rubber feet, included in the rack mount kit.

The included rack mount kit features ability to mount one or two units in a 19" rack system. The rack mount instruction, see below, specifies the parts.

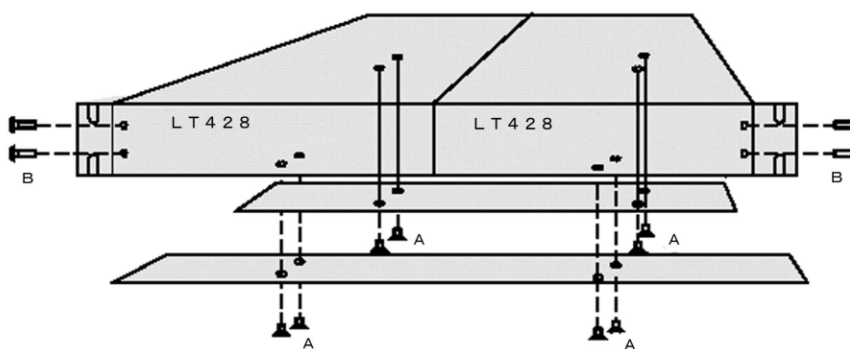
Rack Mount Instructions

The LT 428 is delivered with the following mounting parts:

- | | | |
|-------|--------------------------------------|----------|
| 1 pc. | Side bracket | |
| 1 pc. | Blind plate including rack mount ear | |
| 2 pc. | Support base plates | |
| 4 pc. | Pan head screws M2.5x6 | B |
| 8 pc. | Countersink screws M2.5x6 | A |
| 4 pc. | Pan head screw M6x16 for rack frame | |
| 4 pc. | Rack frame clips/nuts M6 | |
| 4 pc. | Rubber feet (for table top use) | |



Single LT 428 with Blind plate



Double set of LT 428

The LT 428 has no built-in cooling fan and will therefore rely on air convection from the air vent holes in the front, back and sides of the cabinet. Do not cover the air vent holes.

If several cabinets are mounted above each other in a 19" rack, special attention must be paid to the temperature inside the rack.

If the LT 428 is mounted between other instruments with high surface temperature, this cooling may not be sufficient. Under these circumstances, it is recommended to make space between the instruments, and to establish forced circulation (cooling) in the rack.

5. Operating Instructions

5.1 Instrument Description

The Sync Generator is designed with a fixed hardware configuration. However, through its ingenious design the hardware allow for flexible software configuration of most parameters and for multiple broadcast standards.

The software configuration is controlled remotely by means of a PC Remote Control program running on a standard PC and an RS-232 SCPI communication protocol sending commands and queries to the LT 428.

LED's on the front panel indicate the actual generator output formats. The actual and the preset instrument settings are all stored in the instrument's Flash PROM memory for immediate recall by the PC Remote Control program or simply by the front panel preset button.

5.2 Front Panel

The front panel LED's of the Sync Generator indicates the operation status of each generator. The LED's for the video outputs indicate the selected TV system (NTSC/PAL) for the given output.

The selected Audio Generator is indicated under AUDIO and the current clock frequency of the Wordclock output is given under WCLK.

The GENLOCK LED indicates the selected input reference is valid and the internal genlock loop is locked.

The POWER LED indicates the main power is on and the built in power supply, including the fuse, is intact.

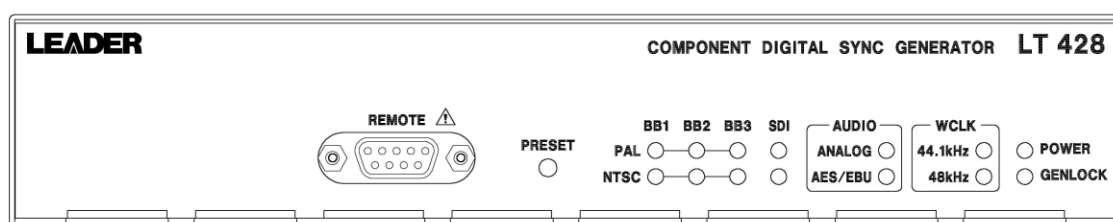
Besides the D-SUB connector for communication to the PC a hidden button is placed on the front panel. This button is placed behind the front panel (for protection against unintended operation) and is accessible through a hole marked PRESET using a pen or equivalent tool. Pressing the PRESET button gives access to indication of selected preset, selecting another preloaded preset and resetting the entire unit to factory settings. For indicating the different preset modes the LED's for the video generators (BB1-TSG for NTSC+PAL) is used as described in the scheme below.

PRESET indication:

Mode	LED pair lit
No PRESET	No LED's
PRESET 1	BB1 (NTSC+PAL)
PRESET 2	BB2 (NTSC+PAL)
PRESET 3	BB3 (NTSC+PAL)
PRESET 4	SDI (NTSC+PAL)

PRESET selection:

Impact to PRESET button	PRESET status	Indication on LED's
A short press	Indicates active PRESET	One pair or no LED pair lit in 2 sec.
Hold for 3 sec. or more.	Scrolling through the PRESETs. Stop when selected preset has been reached	LED pairs are scrolling
Hold for 20 sec.	FACTORY PRESET is loaded	After scrolling 3 times through all pairs, all LED's are lit.



Front panel connector

The front panel connector is intended to interface the unit to PC control using a COM port. The connector is a D-SUB 9 pole male configured for RS-232 communication based on SCPI protocol. See chap. 6 Remote interface for a technical description.

Connecting the interface cable from the PC to the unit special attention must be paid to the power source of both parties. When the controlling PC is mains power operated the ground potential of the mains power supply for both instruments has to be taking in consideration. To reduce problems concerning different mains power ground potential both instruments need to have common mains power source.

Negligence of this matter can cause damages to the LT 428 or the PC COM port
--

5.3 How to Get Started

These Instructions tell you how to connect your LT 428 to the PC for the very first time.

1. Connect the LT 428 Component Digital Sync Generator unit to the mains using the power cord.
2. Using the interface cable connect LT 428 to your PC by selecting COM1 (or COM2) on your PC and the D-SUB connector on the LT 428 front panel.
3. Insert the CD-ROM in the CD-ROM drive of your PC. Copy the "LEADER" folder on the CD-ROM to an arbitrary folder on the hard disk. Double-click "LT428. EXE" or create a shortcut for it and double-click the shortcut. The "information" dialog box opens. Click "OK."

A file named "LT428.INI" is created in the folder where "LT428.EXE" is located, and the application program starts.

Note: "LT428.INI" contains various settings related to the application.

Note that if you move or delete this file, the settings made up to that point will be lost. If you delete this file, the "LT428.INI" file is created again the next time the application program is started. The various settings related to the application are set to default values.

4. You are now ready to start communication between the unit and the PC Remote Control. In the PC Remote Control toolbar click on Connect and Connect Using, which allows you to open the communication and synchronizes the settings.

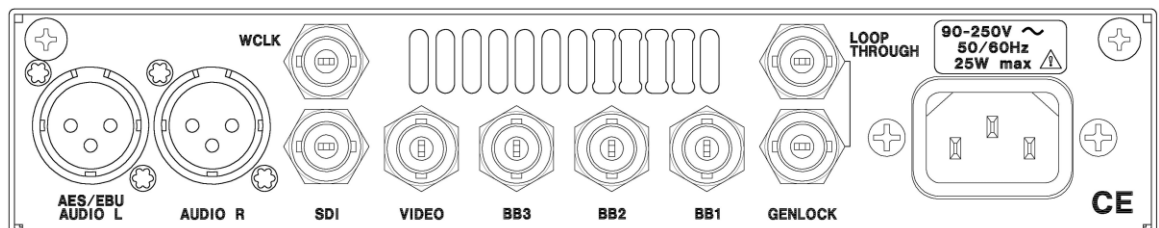
Using Generator Settings will transfer the current settings of the unit to the PC Remote Control.

PC Settings will transfer the initial settings of PC Remote Control to the unit.

Viewing the entire configuration is done through clicking on View and System Status. To modify the settings for a specific generator double click inside the boundaries of the settings of each generator.

5.4 Rear Panel

The rear panel of the unit contains all output connectors and also input connectors for GENLOCK signals are placed here. Furthermore the rear panel features connectors for mains power and two ground terminals. All electrical specifications are specified under Specification.



5.5 PC Remote Control Program

5.5.1 Application Description

The PC Remote Control is designed to serve as operating panel for LT 428 Component Digital Sync Generator solely. It will not work with any other LEADER product. All settings, configurations and calibration of Sync Generator are executed from the PC Remote Control interface. The application can be run both online with the unit connected to the PC or offline using the software in a special DEMO MODE.

As mentioned in the introduction the PC Remote Control program will operate on any Windows® operating system from Windows® 95 and newer versions, including Windows® NT. The interface application software is intended to run from the hard drive of a PC; but the application can also be executed from the CD-ROM itself, a network or other media. If the media is write protected or for other reasons the interface can not install an INI file on the media, the last stored settings are read again.

5.5.2 Menu Description

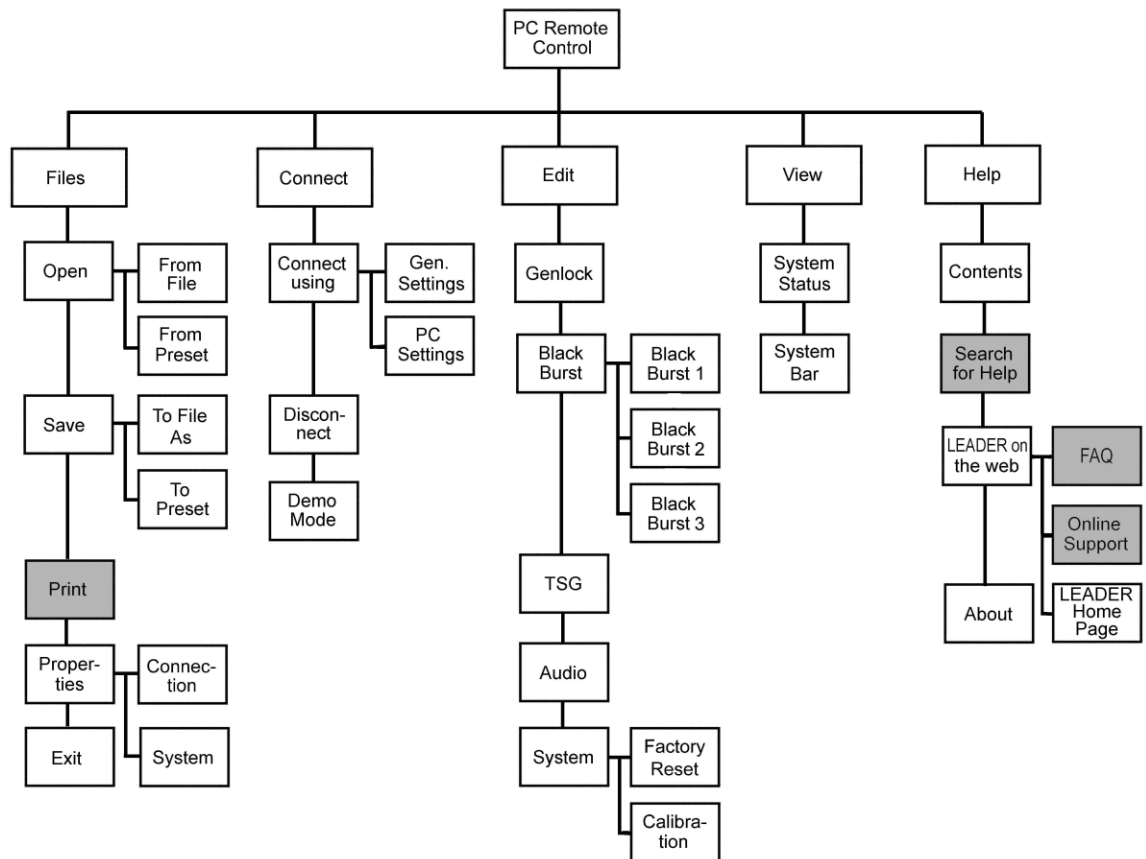


Fig. 1: Menu tree of LT 428 PC Remote Control (shaded boxes are not implemented)

5.5.2.1 Files Menu

The menus under Files are similar in nature to other Windows® applications. Here are menus featuring opening and saving presets and files. Furthermore the RS-232 interface communication details and lock of calibration and editing are handled here.

5.5.2.2 Open

The Open menu enables you to open an already existing file or preset. Performing an Open command will read the file or preset settings into the PC Remote Control and give a connected unit the same set of configuration.

From File: Opening an already existing file will read the settings into the PC Remote Control and give a connected unit the same set of configuration.

From Preset: Opening an already existing preset will read the settings into the PC Remote Control and give a connected unit the same set of configuration and leave the unit in the given preset status.

5.5.2.3 Save

The Save function enables you to save the current configuration into a file on the hard drive or as preset loaded in the memory of the connected unit.

To File: Save To File will store the current configuration into a file on the hard drive. The file can be read by the Windows applications only and can be given any name.

To Preset: Save To Preset enables you to store the current configuration into the memory of the connected unit. The preset can be given a name and a date and these data will be recognized by the PC Remote Control. The unit can hold 4 different configurations in its preset bank and these can be selected from the front panel.

5.5.2.3.1 Print: Not available

5.5.2.3.2 Properties

The Properties menu serve as control for the RS-232 interface communication details, the calibration and the editing lock.

Connection The Connection menu enables you to modify the status of the RS-232 interface communication port and indicate the default Baud rate and Flow Control. In the Port settings the communication port is selectable from COM1-COM4.

System: Checking the Lock Editing option will disable editing of the LT428. Checking the Lock Calibration will disable user calibration.

5.5.2.3.3 Exit:

The Exit menu will close the PC Remote Control and save the current settings in an INI file on the hard drive. If the media, from where the PC Remote Control program is executed, is write protected or you click on **No** to the question "Save changes to LT 428 PC Remote Control?" no data are saved.

5.5.2.4 Connect Menu

The features under the Connect menu serve as controls for the communication to the LT 428 unit.

5.5.2.4.1 Connect Using

The Connect Using menu opens the communication between the PC Remote Control and a unit connected. The communication between the PC Remote Control and the unit can be established in two modes depending on operation.

Generator Settings: The communication can be established by the PC Remote Control reading the current settings of the unit. To open the communication click on the desired functionally.

PC Settings: The communication can be established by the PC Remote Control writing its current/last settings. To open the communication click on the desired functionally.

5.5.2.4.2 Disconnect

Disconnect is used to abort communication between the PC Remote Control program and a connected unit before disconnecting the interface cable.

5.5.2.4.3 Demo Mode:

The Demo Mode is a way to demonstrate or operate the PC Remote Control off line. In this mode it is not necessary to connect a LT 428. Running the program in Demo Mode give you access to all the output features of the unit and access to store a set-up as a file. A set-up saved as a file can be uploaded to the unit at any time, when a unit is connected.

5.5.2.5 Edit Menu

The menus under Edit all give direct access to the edit window to the given generator or access to the calibration routine.

5.5.2.5.1 Genlock

The Genlock facility enables you to lock all outputs of the LT 428 to a number of relevant video and clock sources. The outputs of LT 428 are locked to the source in frequency and phase.

System: System refers to the list of relevant video and clock sources LT 428 is able to use as external reference.
PAL and **NTSC** mode LT 428 will expect a video signal of the given system.
Internal mode: all outputs of LT 428 are locked to the internal high stability TCXO oscillator.

10 MHz mode: the source is expected to be a 10 MHz reference. The internal oscillator will be locked to the reference and LT 428 will act as in Internal Mode. Due to the internal reference the timing feature is disabled. When the reference source is valid and the oscillator circuit is in lock, the "Genlocked" LED on the front panel, will be lit.

To genlock this instrument with external signal, manually set the Genlock System to NTSC or PAL corresponding to the signal format.

- (1) Double-click System in the Genlock menu on the LT 428 PC Remote Control screen.
- (2) Click ▼ in the System menu on the Edit Genlock Setting screen. Select NTSC or PAL from the Internal, PAL, NTSC, or 10 MHz, then click OK.

Timing: All outputs of LT 428 are timeable with reference to the Genlock video signal. All outputs are timed in parallel in resolution of the individual output. For timing details see Black Burst menu.

5.5.2.5.2 Black Burst

All three Black Burst outputs are digitally generated under digital system and are independent in timing and generation of TV system (NTSC/PAL).

The three Black Burst generators (BB1 – BB3) are identical in operation and functionality.

Black Burst Black Bursts are digitally generated under the digital system and is independent in timing and generation of TV system (NTSC/PAL). The digital system has a resolution of 0.15 ns and the timing range of 4 fields for NTSC and 8 fields for PAL.

<i>System:</i>	<p>The digital outputs are able to generate Black Burst in the following formats: PAL, PAL with ID, NTSC 7.5% and NTSC 0%</p>
<i>Timing:</i>	<p>The digital unit is generating Black Burst with a resolution of 0.15 ns and the timing range of 4 fields for NTSC and 8 fields for PAL. Field, Line and Offset can be modified within their relevant limits.</p> <p>Edit of the number of Fields, Lines or Offset of ns to be advanced or delayed can be done in 3 ways. The modifications are typed directly in the edit boxes using number keys and sign. Incrementing or decrementing by the up/down buttons, or using the timing bar. Using the timing bar by grabbing the pointer with the mouse cursor and moving it, for quick timing.</p>
<i>SCH-Phase:</i>	<p>The digital system features adjustment of the SCH-Phase in the range of $\pm 180^\circ$ in a resolution of 1°, operated using the up/down buttons, or typed in directly.</p>

5.5.2.5.3 SDI

The Test Signal Generator contains 23 basic patterns and signals, including Color Bars for the respective TV systems. The TSG outputs signals in two formats simultaneously, Analog Composite (VIDEO output) and SDI (SDI output) and has a common 4 or 8 fields timing range with 37 ns resolution.

Analog and SDI Settings.

The SDI output features separate settings for embedded audio.

The Analog Composite output features SCH-Phase adjustment in 1° resolution.

Common settings:

<i>System</i>	<p>The VIDEO and SDI output generates patterns in NTSC 7.5%/525-lines, NTSC 0%/525lines and PAL/625lines systems. One common system for both output at a time.</p>
<i>Timing:</i>	<p>The digital unit is generating Analog and Digital test signal outputs with a resolution of 37 ns and the timing range of 4 fields for NTSC and 8 fields for PAL. Field, Line and Offset can be modified within their relevant limits.</p> <p>Edit of the number of Fields, Lines or Offset of ns to be advanced or delayed can be done in 3 ways. The modifications are typed directly in the edit boxes using number keys and sign. Incrementing or decrementing by the up/down buttons, or using the timing bar. Using the timing bar by grabbing the pointer with the mouse cursor and moving it, for quick timing.</p>

<i>SCH-Phase:</i>	The digital system features adjustment of the SCH-Phase for the analog test signal generator in the range of $\pm 180^\circ$ in a resolution of 1° , operated using the up/down buttons, or typed in directly.
<i>Pattern:</i>	The Test Signal Generator contains basic patterns and signals, including Color Bars for the respective TV systems. The list of signals consists of patterns for NTSC and PAL. The TSG outputs signals in two formats simultaneously, Analog Composite (VIDEO output) and SDI (SDI output).
Analog Settings:	The Analog Composite output features common timing and SCH-Phase adjustment in 1° resolution.
SDI Settings:	The SDI output features common timing and separate settings for embedded audio.

5.5.2.5.4 Audio

LT 428 contains two independent audio generators, Analog Audio and AES/EBU digital audio and a WordClock output (WCLK).

Due to common rear connectors, only one audio generator can be active at a time.

The AES/EBU generator features selectable sample rate, video reference lock, timing and a number of tones and levels.

The Analog Audio generator features four tones in a large number of levels and right channel identification.

<i>Output</i>	Selectable between Analog audio and digital AES/EBU. Some of the fields in the menu may be greyed out, indicating that this parameter is not valid for that format.
<i>System</i>	In Genlocked mode the AES/EBU generator locks to both video systems and in Internal mode the audio generator is locked to the internal reference.
<i>Timing</i>	Editing can be done in 3 ways. The modifications are typed directly in the edit box using number keys. Incrementing or decrementing by the up/down buttons, or using the timing bar. Using the timing bar by grabbing the pointer with the mouse cursor and moving it, for quick timing.
<i>Click Period</i>	Selected by ticking off the appropriate field
<i>Wordclock</i>	Selectable between standard 48 kHz and CD-audio sample frequency of 44.1 kHz.
<i>Tone</i>	Selectable in the field between a number of frequencies.
<i>Level</i>	Selectable by using the scroll bar.

5.5.2.5.5 System

The System menu enables you to calibrate the main oscillator using this PC Remote Control. Also all video outputs can be set to the same TV system (NTSC/PAL) during a Factory Reset. Performing a Factory Reset replace all current settings with the settings the unit has from factory and will not affect any of the four user presets.

Factory Reset: Factory Reset overwrites all current settings with the settings the unit has from factory.
The reset is selectable between: **NTSC 7.5%/525**, **NTSC 0%/525** or **PAL/625**

The factory settings are listed in 10.4 Reset Configuration.

Note: Factory Reset will not affect the memory of any of the four user presets.

Calibration: The calibration menu enables you to calibrate the unit without taking it out of a rack and out of service. The unit is calibrated using this PC Remote Control and a general-purpose counter connected to the BB1 terminal. This adjustment will affect the frequency of the main oscillator only; no other circuits needs frequent calibration. To secure the factory calibration the unit is secured with a calibration lock function



Warning: If you perform calibration, the original calibration value cannot be reverted even if factory default settings are recalled using the PRESET switch.

Calibration procedure:

1. Turn on the unit and connect it to a PC running the PC Remote Control program.
2. Connect a general-purpose counter (better than 0.1 ppm in tolerance) to the Black Burst output.
3. Unlock the calibration mode in Files/Properties/System and enter the calibration menu at Edit/System/Calibration
4. Click on Unlock and expect a TTL clock at 4.5 MHz on the BB1 connector. There is now access to calibrate the main oscillator and using the up/down buttons to calibrate the BB1 outputs to 4,500,000 Hz.
5. The calibration is stored in the unit by clicking on Save. By clicking on Cancel at any time before clicking on Save, the calibration mode will be terminated and the unit will hold the present calibration.

Note: Make sure to lock the calibration mode in Files/Properties/System to ensure no calibration is made by mistake.

5.5.2.6 View Menu

5.5.2.6.1 System Status:

The System Status window will expand the Front Panel window and provide a view of settings of all outputs.

Besides information on timing, pattern and audio types and tones, the System Status gives information on unit serial no., SW release, Preset Status and serial communication (SCPI)

status.

Editing of the settings is accessible by double click on each generator. By double click on a generator the corresponding generator window opens and enables editing.

The System Status window is not default and opens by checking System The settings are stored in an ini file on the used PC.

5.5.2.6.2. Status Bar:

The Status Bar is default and is shown below the Front Panel or System Status window. This bar provides information on communications from the PC Remote Control to the connected unit. The Status Bar states if an unit is present or not (connected/disconnected), which COM port is selected and baud rate. Also it shows if the PC Remote Control program is used in Demo Mode.

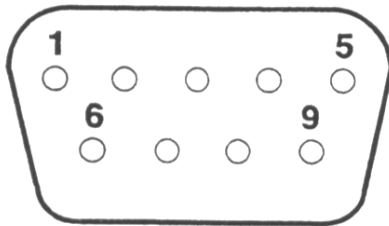
6. Remote Interface

Reference documents

IEEE 488.2-1987: IEEE Standard Codes, Formats, Protocols, and Common Commands
SCPI 1995.0: Standard Commands for Programmable Instruments, Vol I-IV.

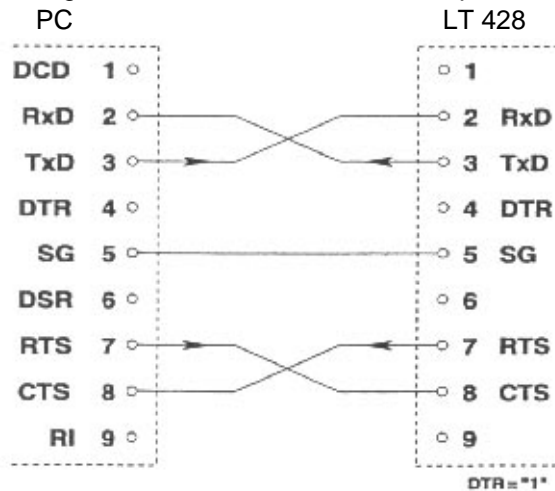
6.1 Connector Description

Connector type:
9 pin sub-D male



6.2 Protocol

The serial remote operates electrically as an RS-232C communication port. The parameter setting for the RS-232C communication port is described in paragraph 5.5, 2.3.2, page 5-5.



Minimum Configuration of cable between PC and LT 428.

NOTE: A standard "NULL-MODEM" cable may be used as well

The LT 428 communication protocol complies with the:

- ♦ SCPI 1995.0:
Standard Commands for Programmable Instruments, Vol I-IV. This protocol which is based on the IEEE 488.2 (IEEE Standard Codes, Formats, Protocols, and Common Commands).

For the description of the commands a basic knowledge of operation of the instrument is assumed.

To use the serial remote interface a basic knowledge of the SCPI programming and computer control is also recommended.

6.3 Configuration and Syntax

Control characters of the RS-232 interface:

	Control character	Function
	0A _{hex}	Terminator, i.e. new line <LF>

Buffers:

Receive buffer: 512 bytes
Transmit buffer: 128 bytes.

Serial port:

The 9-pin RS-232 connector consists of

Pin	Name	Description
1:	DCD	Not used
2:	RxD	Receiver pin
3:	TxD	Transmitter pin
4:	DTR	Not used
5:	SG	Signal ground
6:	DSR	Not used
7:	RTS	Request to send
8:	CTS	Clear to send
9:	RI	Not used.

6.4 General Information

The remote system is organized in a tree structure. The structure defines sub-systems. In order to access command lower in the tree or in different branches the entire command string should be used. Indentation is used to indicate the root level and the branches. The highest level to the left. The complete command always includes all the root levels.

A space between a command string and an option is required, except in a query * where a space is not allowed.

Enter more than one command on a line by using a semicolon “;” as divider. A command line is terminated by <CR> >LF>. If the next command is part of the same command system the separation is a “;” only. If the next command is part of another command system the “;” is followed by a “.”.

Parameters are separated from the header by a space. A comma separates several parameters.

Character strings should be placed in single or double quotation marks.

The valid parameter ranges are shown in the command tables. Non valid values generate an error message.

6.5 Syntax Elements

;	Semicolon separates two commands of a command.
:	Colon separates the keywords of a command. In a command line, a colon “:” after a separating semicolon “;” indicates the root control level.
,	Comma separates the parameter command.
?	Question mark identifies a query command (Query commands are formed by adding a question mark to the header).
*	Asterisk identifies a common command. (Common commands consists of a header preceded by an asterisk and possibly followed by one or more parameters)
' or "	Single or double quote introduces and terminates a character string.
#	Double dagger introduces block data.
Space	Space Character separates header and parameters.
	Parameters divided by a “ ” indicates an “or” selection between the values shown. Only one value may be used at a time.

6.6 Command Syntax

A command consists of a “header” and one or several “parameters”. Header and parameters are separated by space.

A header may consist of several keywords.

6.7 Syntax of Program Messages

A command or query is called a program message unit. Such a program message unit consists of a header, or a header separated by a space from one or more parameters. The program header separator between the header and the first parameter must be at least one “white space” character. The header consists of one or more mnemonics (key words) describing the command. The parameters in a message unit are also referred to as “Data Elements”. They are mutually separated by a comma (,), which is referred to as “Data Separator”. Furthermore the following rules are valid:

- ◆ Any one of the “white space” characters (dec. 0..9, 11.. 32) may:
 - precede a header
 - precede the Message Terminator
 - be placed in between the header and the parameter
 - be placed in between two consecutive parameters
- ◆ String data in a parameter must be specified between quotes. A quote may either be a “single quote” (dec. 39) or a “double quote” character (dec. 34)

One or more program message units (commands) may be send within a single program message. Program message units are separated by a semicolon (;). A message of one or more units is terminated by a program message terminator.

The program message terminator must be the following code:

- ◆ LF <line feed> (dec.10) code

Note:

Most controller programming languages send the terminator automatically, but allow it to be changed.

Basically there are two types of program headers:

- ◆ Compound headers
 - Commands have a compound header consisting of one of more key words (mnemonics), mutually separated by a colon (:) character. Such as a colon may also precede the header.
- ◆ Command headers
 - The program messages that are standardized are called common commands. Their headers always start with an asterisk (*) character

Each key word in a compound command header represents a node in the command tree. The left most key word is the root node, representing the highest hierarchical level in the command tree. Subsequent keyword represents sub nodes under the root node.

6.8 Long and Short Form

Program messages may be sent in either long or short form

- ♦ The long form is the full word
- ♦ The short form is the first character of the long form

The short form in a syntax specification is shown in upper case, and the remaining part of the long form is shown in lower case characters.

Note:

Upper and lower case, as used in syntax specification, is only a notation habit to facilitate distinction between long and short form. The generator itself does not differentiate between upper and lower case characters.

In program messages, either the long or short form may be used in any mix of upper or lower case characters. There is no semantic difference between upper and lower case in program messages.

6.9 Syntax of Response Messages

The response to a query is a response message unit, consisting of one or more parameters (data elements). Successive parameters are separated by a comma (.). If there are multiple queries in a program message, the multiple response message units are grouped together in the corresponding response message.

Response message units are separated by a line feed (LF).

The instrument will always send the response data in capitals. Headers are not sent in the response messages, parameters only.

7. Commands Summary

All commands listed consists of both a set- and request-command unless specifically listed in the table as <Query only> or <No query>

7.1 Mandated Commands

Command	Parameter	Status after *RST	Remarks
*CLS	-		Clear Status Command
*ESE			
*ESE?			
*ESR?			
*IDN?			Device identification query
*OPC			
*OPC?			
*RST			Reset Command
*SAV	<1 to 4 >		
*RCL	<1 to 4 >		
*SRE			
*SRE?			
*STB?			
*TST?			
*WAI			

7.2 Required Commands

7.2.1 SYSTem Subsystem

Command	Parameter	Status after *RST	Remarks
:ERRor?		-	<Query only>
:VERSion?		-	<Query only>
:PRESet			
[:RECall]	<1 to 4>		
:STORe	<1 to 4>		
:NAME	<1 to 4>,<name>		Note 1
:AUTHor	<1 to 4>,<author name>		Note 1
:DATE	<1 to 4> [,<year>,<month>,<day>]		

7.2.2 STATus Subsystem

Command	Parameter	Status after *RST	Remarks
:OPERation			
[:EVENT]?			<Query only>
:CONDition?			
:ENABle			
:ENABle?			
:QUEStionable			
[:EVENT]?			<Query only>
:CONDition			
:ENABle			
:ENABle?			
:PRESet?			<Query only>

7.3 Instrument Commands

7.3.1 INPut Subsystem

Command	Parameter	Status after *RST	Remarks
:GENLock			
:SYSTem	INTernal PALBurst NTSCburst F10MHZ	INTernal	
:DELay	<Field>,<Line>,<HTime>	0,0,0	
:CALibrate			
:ENABLe	OFF ON		
:ADJust	UP DOWN MIN MAX		
:STORE	-		<No query>
:GENLock?	-	-	<Query only>

7.3.2 OUTPut Subsystem

Command	Parameter	Status after *RST	Remarks
:BB1			
:SYSTem	PAL PAL_ID NTSC JNTSC	Depends on factory reset: PAL, NTSC, or JNTSC	Note 2
:DELay	<Field>,<Line>,<Htime>	0,0,0	
:SCHPhase	<-179 to 180>	0	
:BB1?	-	-	<Query only>

Command	Parameter	Status after *RST	Remarks
:BB2			
:SYSTem	PAL PAL_ID NTSC JNTSC	Depends on factory reset: PAL, NTSC or JNTSC	Note 2
:DELay	<Field>,<Line>,<Htime>	0,0,0	
:SCHPhase	<-179 to 180>	0	
:BB2?	-	-	<Query only>
:BB3			
:SYSTem	PAL PAL_ID NTSC JNTSC	Depends on factory reset: PAL, NTSC, or JNTSC	Note 2
:DELay	<Field>,<Line>,<Htime>	0,0,0	
:SCHPhase	<-179 to 180>	0	
:BB3?	-	-	<Query only>
:TSGenerator			
:PATtern	See Chap. 10, LT 428 Signals	Depends on factory reset: CBEBu or CBSMpte	
:SYSTem	PAL NTSC JNTSC	Depends on factory reset: PAL, NTSC, or JNTSC	Note 2
:DELay	<Field>,<Line>,<Htime>	0,0,0	
:SCHPhase	<-179 to 180>	0	
:EMBAudio	See Chap. 10, LT 428 Signals	OFF	Digital output only
:TSGenerator?	-	-	
:AUDio			<No query>
[:OUTPut]	ANALog AESebu	AESebu	
:ANALog			
:SIGNal	See Chap. 10, LT 428 Signals	S1KHZ	
:LEVel	See Chap. 10, LT 428 Signals	0	
:CLICk	1 3	3	
:ANALog?			
:AESebu			
:SYSTem	PAL NTSC	Depends on factory reset: PAL, or NTSC	Note 2

Command	Parameter	Status after *RST	Remarks
:SIGNal	See Chap. 10, LT 428 Signals	S1KHZ	
:LEVel	See Chap. 10, LT 428 Signals	Depends on factory reset: -18 or -20	
:TIMing	See Chap. 10, LT 428 Signals	0	48kHz only
:WORDclock	F441KHZ F48KHZ	F48KHZ	
:CLICk	1 3	3	
:AESebu?			

Note 1: String data must NOT contain any spaces, as this is not supported in this version.

Note 2: The system selected depends on the factory reset applied. Another system for the factory reset may be selected by means of the PC Remote Control software delivered with the instrument. See also chapter 10.4 Reset Configuration.

8. Commands Explanation.

8.1 Mandated Commands

- *CLS CLEAR STATUS
Clear the SCPI error queue.
- *ESE STANDARD EVENT STATUS ENABLE COMMAND
The device accepts this command but the functionality has not been implemented in this version.
- *ESE? STANDARD EVENT STATUS ENABLE QUERY
The device responds to this command but the functionality has not been implemented in this version, i.e. the answer should be ignored.
- *ESR? STANDARD EVENT STATUS REGISTER QUERY
The device responds to this command but the functionality has not been implemented in this version, i.e. the answer should be ignored.
- *IDN? IDENTIFICATION QUERY
The response contains four fields:
Field 1: Company name
Field 2: Product name
Field 3: KU number
Field 4: Software release, i.e. the software status of all programmable parts in the LT 428.

Example: *IDN? *response: LEADER,LT428,KU012345,1.0*
- *OPC OPERATION COMPLETE
The device accepts this command but the functionality has not been implemented in this version.
- *OPC? OPERATION COMPLETE QUERY
The device accepts this command but does not respond to it because the functionality has not been implemented in this version.
- *RST RESET
Resets the device to factory preset status. The four presets are NOT reset, i.e. any user preset will NOT be erased
- *SAV SAVE PRESET
Please refer to the command: *SYSTem:PRESet:STORe*
- *RCL RECALL PRESET
Please refer to the command: *SYSTem:PRESet:RECall*

- ***SRE SERVICE REQUEST ENABLE**
The device accepts this command but the functionality has not been implemented in this version.
- ***SRE? SERVICE REQUEST ENABLE QUERY**
The device responds to this command but the functionality has not been implemented in this version, i.e. the answer should be ignored.
- ***STB? READ STATUS BYTE QUERY**
The device responds to this command but the functionality has not been implemented in this version, i.e. the answer should be ignored.
- ***TST? SELF-TEST QUERY**
The device accepts this command but the functionality has not been implemented in this version.
- ***WAI WAIT TO CONTINUE**
The device accepts this command but does not respond to it because the functionality has not been implemented in this version.

8.2 Required Commands

8.2.1 SYSTem Commands

- **SYSTEM:Error?**
Command for reading an SCPI error message from the error queue. See chapter: **Error! Unknown switch argument.. Error! Unknown switch argument**, for a complete list of error codes.

Example:

SYST:ERR? response: -102,"Syntax error"

SYSTem:VERSion?

Command for reading the SCPI version to which the RS-232 implementation complies.

Example:

SYST:VERS? response: 1995.0

- **SYSTem:PRESet[:RECall]**
Command to recall a stored generator configuration from a preset. Four user presets from 1 to 4 are available.

Example:

SYST:PRES:REC 3 recall preset 3.

- **SYSTem:PRESet:STORe**
Command to store the actual configuration in a preset. Four user presets from 1 to 4 are available.

Example:

SYST:PRESet:STOR 2 store configuration in preset 2

- **SYSTem:PRESet:NAME**
Command for naming a user preset. Four user presets from 1 to 4 are available. The number of characters in the name are limited to sixteen, 16, and may NOT contain spaces.

Example:

SYST:PRESet:NAME 2,"WHAT" name preset number 2 "WHAT"
SYST:PRESet:NAME? 2 response: "WHAT"

- **SYSTem:PRESet:AUTHor**
Command for naming the author of a user preset. Four user presets from 1 to 4 are available. Number of characters in the name are limited to sixteen, 16, and may NOT contain spaces.

Example:

SYST:PRESet:AUTH 1,"Monroe" name author of preset number 2 to "Monroe"
SYST:PRESet:NAME? 2 response: "MONROE"

- **SYSTem:PRESet:DATE**
Command for settings the date of a user preset. Four user presets from 1 to 4 are available. The date should be entered as year, month, day.

Example:

SYST:PRESet:DATE 2,00,6,1 date preset number 2 to june1, 2000
SYST:PRESet:DATE? 2 response: 00,06,01

8.2.2 **STATus Commands**

- **STATus:OPERation[:EVENT]?**
- **STATus:OPERation:CONDition?**
- **STATus:OPERation:ENABle**
- **STATus:QUESTionable[:EVENT]?**
- **STATus:QUESTionable:CONDition?**
- **STATus:QUESTionable:ENABle**
The device accepts and responds to these commands, but the functionality has not been implemented in this version, i.e. any answer should be ignored.
- **STATus:PRESet?**
The device returns the status of the user preset, i.e. whether a user preset is active or not.

Examples:

STAT:PRESet? response: 2, i.e. preset 2 is active
STAT:PRESet? response: OFF, i.e. no preset is active

8.3. Instrument Commands

8.3.1. INPut Commands

- INPut:GENLock:SYSTem

Command for selecting the GENLOCK system. Possible selections are

System	Description
INTernal	Internal
PALBurst	PAL burst lock
NTSCburst	NSTC burst lock
F10MHZ	10 MHz lock

Example:

INP:GENL:SYST *F10MHZ* set system to 10 MHz lock
 INP:GENL:SYST? response: *F10MHZ*

- INPut:GENLock:DELAy

Command to set the delay for the GENLOCK input. The delay is defined by three parameters

<Field>, <Line>, <HTime>

where **<Field>** sets the field offset, **<Line>** sets the line offset and **<HTime>** sets the horizontal time in ns, i.e.

HTime(PAL) < 64000.0 ns

HTime(NTSC) < 63492.1 ns

If this command is issued when the GENLOCK system is internal or 10 MHz the timing will be saved and restored whenever PALBurst or NTSCBurst is selected.

It is not possible to select a delay outside the range of the selected system. See the table below.

ANALOG			
PAL, 625 lines		NTSC, 525 lines	
Field	Line	Field	Line
-3	-0, ..., -312	-	-
-2	-0, ..., -311	-	-
-1	-0, ..., -312	-1	-0, ..., -262
-0	-0, ..., -311	-0	-0, ..., -261
+0	+0, ..., +312	+0	+0, ..., +262
+1	+0, ..., +311	+1	+0, ..., +261
+2	+0, ..., +312	+2	+0
+3	+0, ..., +311	-	-
+4	+0	-	-

Example:

INP:GENL:DEL +2,+5,+123.5 set delay to 2 field, 5 line & 123.5 ns
 INP:GENL:DEL? response: +2,+005,+00123.5

- **INPut:GENLock:CALibrate:ENABle**
Command to enable calibration of the internal 10 MHz oscillator reference. This command must be issued before using the INP:GENL:CAL:ADJ command

Example:

<i>INP:GENL:CAL:ENAB ON</i>	enable calibration of the internal 10 MHz reference
<i>INP:GENL:CAL:ENAB?</i>	response: <i>ON</i>

- **INPut:GENLock:CALibrate:ADJust**
Command to calibrate the internal 10 MHz reference. The reference is adjusted by setting a parameter, which may be UP, DOWN, MIN or MAX. It is NOT possible to access and/or issue the actual values.

Example:

<i>INP:GENL:CAL:ADJ UP</i>	increment the 10 MHz reference
<i>INP:GENL:CAL:ADJ DOWN</i>	decrement the 10 MHz reference
<i>INP:GENL:CAL:ADJ MAX</i>	set the reference to maximum deviation
<i>INP:GENL:CAL:ADJ MIN</i>	set the reference to minimum deviation

- **INPut:GENLock:CALibrate:STORe**
Command to store the current setting of the internal 10 MHz reference.
- **INPut:GENLock?**
Command to display the status and the settings of the genlock. The response is defined as
<lock info>,<system>,<Field>,<Line>,<HTime>

where **<lock info>** is either **GENLOCKED** or **UNLOCKED**.

For an explanation regarding the rest of the response see the commands: *INP:GENL:SYST* and *INP:GENL:DEL*.

When selecting Internal or 10MHz system, the parameters **<Field>,<Line>,<HTime>** will have no meaning. In these cases the returned values should be discarded and only the relevant parameters should be used.

Examples:

<i>INP:GENL?</i>	response: <i>UNLOCKED,NTSCBURST,+1,+212,+00000.2</i>
<i>INP:GENL?</i>	response: <i>GENLOCKED,F10MHZ,+1,+0,+0</i>
<i>INP:GENL?</i>	response: <i>GENLOCKED,PALBURST,+1,+1,+1234</i>

8.3.2 OUTPut Commands

- OUTPut:BB1:SYSTem
- OUTPut:BB2:SYSTem
- OUTPut:BB3:SYSTem

Command to select the system of the three Black Burst output. Systems available are

System	Description
PAL	PAL
PAL_ID	PAL with line 7 pulse
NTSC	NTSC with setup
JNTSC	NTSC no setup

Example:

OUTP:BB1:SYST PAL_ID set system for BB output 1 to PAL with line 7 pulse
 OUTP:BB1:SYST? response: PAL_ID

- OUTPut:BB1:DELaY
- OUTPut:BB2:DELaY
- OUTPut:BB3:DELaY

Command to set the delay of the three Black Burst output. The delay is defined by three parameters

<Field>, <Line>, <HTime>

where **<Field>** sets the field offset, **<Line>** sets the line offset and **<HTime>** sets the horizontal time in ns, i.e.

HTime(PAL) < 64000.0 ns

HTime(NTSC) < 63492.1 ns

It is not possible to select a delay outside the range of the selected system. See the table below.

ANALOG			
PAL, 625 lines		NTSC, 525 lines	
Field	Line	Field	Line
-3	-0, .., -312	-	-
-2	-0, .., -311	-	-
-1	-0, .., -312	-1	-0, .., -262
-0	-0, .., -311	-0	-0, .., -261
+0	+0, .., +312	+0	+0, .., +262
+1	+0, .., +311	+1	+0, .., +261
+2	+0, .., +312	+2	+0
+3	+0, .., +311	-	-
+4	+0	-	-

Example:

OUTP:BB2:DEL -2,-4,-3245.2 set delay for BB output 2 to -2 field, -4 line & -3245.2 ns
 OUTP:BB2:DEL? response: -2,-004,-03245.2

- OUTPut:BB1:SCHPhase
- OUTPut:BB2:SCHPhase
- OUTPut:BB3:SCHPhase

Command to set the SCH-Phase of the three Black Burst output. The SCH-Phase value must be in the range

$$180 < \text{SCH-Phase} \leq +180$$

Example:

OUTP:BB2:SCHP -160

set the SCH-Phase for BB output 2 to -160deg

OUTP:BB2:SCHP?

response: -160

- OUTPut:BB1?
- OUTPut:BB2?
- OUTPut:BB3?

Command to display the complete settings of the three Black Burst output. The response contains five fields:

<System>,<Field>,<Line>,<HTime>,<SchPhase>

For an explanation of the response, see the commands: OUTP:BBn:SYST, OUTP:BBn:DEL and OUTP:BBn:SCHP, where n: 1-3

Example:

OUTP:BB1?

response: PAL,+2,+123,+12345.5,-160

- OUTPut:TSGenerator:PATtern

Command to select the pattern of the VIDEO/SDI output. Refer to Chapter 10 LT 428 Signals for a description of the patterns available.

Not all the patterns are available in both systems. Trying to select a pattern, which is not available in the active system, will result in an error, namely: **-200,"Execution error"**.

Example:

OUTP:TSG:PATT WIN100

set the pattern for a 100% window

OUTP:TSG:PATT?

response: WIN100

- OUTPut:TSGenerator:SYSTem

Command to select the system of the VIDEO/SDI output. Systems available are

System	Description
PAL	PAL
NTSC	NTSC with setup
JNTSC	NTSC no setup

If the current pattern is invalid in the selected system, the pattern will be reset to a valid pattern in the new system. See Chapter 10, LT 428 Signals, for the pattern reset list.

Example:

OUTP:TSG:SYST PAL

set the system for PAL

OUTP:TSG:SYST?

response: PAL

- **OUTPut:TSGenerator:DElay**
Command to set the delay of the VIDEO/SDI output. The delay is defined by three parameters

<Field>, <Line>, <HTime>

where **<Field>** sets the field offset, **<Line>** sets the line offset and **<HTime>** sets the horizontal time in ns, i.e.

HTime(PAL) < 64000.0 ns

HTime(NTSC) < 63492.1 ns

It is not possible to select a delay outside the range of the selected system. See the table below.

ANALOG			
PAL, 625 lines		NTSC, 525 lines	
Field	Line	Field	Line
-3	-0, .., -312	-	-
-2	-0, .., -311	-	-
-1	-0, .., -312	-1	-0, .., -262
-0	-0, .., -311	-0	-0, .., -261
+0	+0, .., +312	+0	+0, .., +262
+1	+0, .., +311	+1	+0, .., +261
+2	+0, .., +312	+2	+0
+3	+0, .., +311	-	-
+4	+0	-	-

Example:

OUTP:TSG:DEL -2,-4,-3245.2

set the delay for the TSG to -2 field, -4 line & 3245.2 ns

OUTP:TSG:DEL?

response: -2,-004,-03245.2

- **OUTPut:TSGenerator: SCH Phase**
Command to set the SCH-Phase of the VIDEO output. The SCH-Phase value must be in the range

180 < SCH-Phase <= +180

Example:

OUTP:TSG:SCHP -123

set the SCHPhase for -123deg

OUTP:TSG:SCHP?

response: -123

- **OUTPut:TSGenerator:EMBaudio:SIGNal**
Command to select the signal of the embedded audio in the TSG SDI output. Refer to Chapter 10 LT 428 Signals, for a description of the signals available.

Example:

OUTP:TSG:EMB:SIGN

set the embedded audio to OFF

OUTP:TSG:EMB:SIGN?

response: OFF

- **OUTPut:TSGenerator?**
Command to display the complete settings of the TSG output. The response contains seven fields:

<Pattern>,<System>,<Field>,<Line>,<HTime>,<SchPhase>,<EmbAudio>

For an explanation of the response, see the commands: *OUTP:TSG:PATT*, *OUTP:TSG:SYST*, *OUTP:TSG:DEL*, *OUTP:TSG:SCHP* and *OUTP:TSG:EMB:SIGN*.

Example:

OUTP:TSG? *response: CBEBU, PAL,+2,+123,+12345.5, -160,OFF*

- **OUTPut:AUDio:OUTput**
Command to select the output of the audio signal. The output may be either analog or AES/EBU audio.

Example:

OUTP:AUD:OUTP AES select AES/EBU as the audio output
OUTP:AUD:OUTP? *response: AESEBU*

- **OUTPut:AUDio:ANALog:SIGNal**
Command to select the audio signal of the analog audio output signal. Refer to Chapter 10, LT 428 Signals, for a description of the analog audio signals available.
Please note that the settings will be updated even though the output of the audio signal has been selected as AES/EBU. The settings will take effect the next time the analog audio output is selected.

Example:

OUTP:AUD:ANAL:SIGN S1KHZ set the analog audio signal to Stereo 1 kHz
OUTP:AUD:ANAL:SIGN? *response: S1KHZ*

- **OUTPut:AUDio:ANALog:LEVel**
Command to select the audio level of the analog audio output signal. Refer to Chapter 10, LT 428 Signals, for a description of the analog audio levels available.
Please note that the settings will be updated even though the output of the audio signal has been selected as AES/EBU. The settings will take effect the next time the analog audio output is selected.

Example:

OUTP:AUD:ANAL:LEV 4 set the analog audio level to +4 dBu
OUTP:AUD:ANAL:LEV? *response: 4*

- **OUTPut:AUDio:ANALog:CLICk**
Command to select the click rate for the audio signal of the analog audio output signal. Refer to Chapter 10, LT 428 Signals, for a description of the analog audio levels available. The click rate can be a click every 1 or 3 seconds.
Please note that the settings will be updated even though the output of the audio signal has been selected as AES/EBU. The settings will take effect the next time the analog audio output is selected.

Example:

OUTP:AUD:ANAL:CLIC 3 set the click rate to every 3 seconds
OUTP:AUD:ANAL:CLIC? *response: 3*

- OUTPut:AUDio:ANALog?

Command to display the complete settings of the analog audio output. The response contains three fields:

<Signal>,<Level>,<Click>

For an explanation of the response, see the commands: *OUTP:AUD:ANAL:SIGN*, *OUTP:AUD:ANAL:LEV* and *OUTP:AUD:ANAL:CLIC*.

Example:

OUTP:AUD:ANAL? response: *S1KHZ,SILENCE,1*

- OUTPut:AUDio:AESebu:SYSTem

Command to select the audio system of the AES/EBU audio output signal. Possible selections are PAL or NTSC

Please note that the settings will be updated even though the output of the audio signal has been selected as ANALOG. The settings will take effect the next time the AES/EBU audio output is selected.

Example:

OUTP:AUD:AES:SYST PAL set the AES/EBU audio system to PAL
OUTP:AUD:AES:SYST? response: *PAL*

- OUTPut:AUDio:AESebu:SIGNal

Command to select the audio signal of the AES/EBU audio output signal. Refer to Chapter 10, LT 428 Signals, for a description of the AES/EBU audio signals available.

Please note that the settings will be updated even though the output of the audio signal has been selected as ANALOG. The settings will take effect the next time the AES/EBU audio output is selected.

Example:

OUTP:AUD:AES:SIGN S500HZ set the AES/EBU audio signal to Stereo 500 Hz
OUTP:AUD:AES:SIGN? response: *S500HZ*

- OUTPut:AUDio:AESebu:LEVel

Command to select the audio level of the AES/EBU audio output signal. Refer to Chapter 10, LT 428 Signals, for a description of the AES/EBU audio levels available.

Please note that the settings will be updated even though the output of the audio signal has been selected as ANALOG. The settings will take effect the next time the AES/EBU audio output is selected.

Example:

OUTP:AUD:AES:LEV -12 set the AES/EBU audio level to –12 dBFS
OUTP:AUD:AES:LEV? response: *-12*

- **OUTPut:AUDio:AESebu:TIMing**
Command to select the audio timing of the AES/EBU audio output signal. Refer to chapter 10, LT 428 Signals, for a description of the AES/EBU audio timing available.
Please note that the settings will be updated even though the output of the audio signal has been selected as ANALOG. The settings will take effect the next time the AES/EBU audio output is selected.

Example:

OUTP:AUD:AESebu:TIM -1.6 set the AES/EBU audio timing to -1.6 us
OUTP:AUD:AESebu:TIM? response: -1.6

- **OUTPut:AUDio:AESebu:WORDclock**
Command to select the sample rate of the AES/EBU generator and of the Wordclock output. The frequency can be either 44.1 or 48 kHz. Please note that the settings will be updated even though the output of the audio signal has been selected as ANALOG. The settings will take effect the next time the AES/EBU audio output is selected.

Example:

OUTP:AUD:AESebu:WORD F441KHZ set the sample rate to 44.1 kHz
OUTP:AUD:AESebu:WORD? response: *F441KHZ*

- **OUTPut:AUDio:AESebu:CLICk**
Command to select the click rate for the audio signal of the AES/EBU audio output signal. Refer to Chapter 10 LT 428 Signals for a description of the analog audio levels available. The click rate can be a click every 1 or 3 seconds.
Please note that the settings will be updated even though the output of the audio signal has been selected as ANALOG. The settings will take effect the next time the AES/EBU audio output is selected.

Example:

OUTP:AUD:AESebu:CLIC 1 set the click rate to every 1 second
OUTP:AUD:AESebu:CLIC? response: *1*

- **OUTPut:AUDio:AESebu:?**

Command to display the complete settings of the AES/EBU audio output. The response contains six fields:

<System>,<Signal>,<Level>,<Timing>,<WordClock>,<Click>

For an explanation of the response, see the commands: OUTP:AUD:AESebu:SYST, OUTP:AUD:AESebu:SIGN, OUTP:AUD:AESebu:LEV, OUTP:AUD:AESebu:TIM, , OUTP:AUD:AESebu:WORD and OUTP:AUD:AESebu:CLIC.

Example:

OUTP:AUD1:AESebu:? response: PAL,S500HZ,-12,-1.6,F441KHZ,1

9. Error Codes

9.1 Command Errors [-199, -100]

Error Number	Error string [description/explanation/example]
-101	Invalid character A command or parameter contains an invalid character, e.g. a header containing an ampersand, SYST:VERS&.
-102	Syntax error An unrecognized command or data type was encountered, e.g. a string was received when the generator didn't accept strings.
-108	Parameter not allowed More parameters was received than expected for the command, e.g. the *IDN?; command accepts no parameters, so receiving *IDN? 2; is not allowed
-112	Program mnemonic too long The header contains more than twelve characters.
-114	Header suffix out of range The command is invalid because the value of the numeric suffix attached to the program mnemonic is out of range, e.g. OUTP:BB12? is illegal because only 3 BB's exists.
-121	Invalid character in number An invalid character for the data type was encountered, e.g. an alpha in a decimal value.
-124	Too many digits The mantissa of a decimal numeric data element contained more than 255 digits.

9.2 Execution Errors [-299, -200]

Error Number	Error string [description/explanation/example]
-200	Execution error
-222	Data out of range Indicates that a legal program data element was received but could not be executed because the interpreted values was outside the range as defined by the device, e.g. the command OUTP:BB1:SCHP 200; is illegal since the SCHPhase can not exceed 180deg.

9.3 Device Specific Errors [-399, -300]

Error Number	Error string [description/explanation/example]
-360	Communication error A communication error on the serial port was detected
-361	Parity error in program message Parity bit not correct when data received on the serial port
-362	Framing error in program message A stop bit was not detected when data was received, e.g. a bad rate mismatch.
-363	Input buffer overrun Software or hardware input buffer on serial port overflows .

10. LT 428 Signals

Symbols:

PAL: Only in 625-lines PAL system.

NTSC: Only in 525-lines NTSC system.

X: Both PAL and NTSC systems

10.1 Video Patterns.

	Remote name	LT 428
CBAR		
SMPTE C.Bar	CBSMpte	NTSC
EBU C.Bar	CBEBu	PAL
FCC C.Bar	CBFCc	NTSC
C.Bar ITU801	CBEBu8	X
100 % C.Bar	CB100	X
75 % C.Bar+Red	CBRed75	PAL
75 % Red	RED75	X
M.BURST		
CCIR Line18	CCIR18	PAL
WINDOW		
Window 10 %	WIN10	X
Window 15 %	WIN15	X
Window 20 %	WIN20	X
Window 100 %	WIN100	X
15kHz BI/Wh	BLWH15KHZ	X
White 100 %	WHITe100	X
Black	BLACKk	X
SPECIAL		
SDI Check Field	SDICheck	X
Digital Grey	DGRey	X
LINEARITY		
Staircase 5step	STAircase5	X
Staircase 10step	STAircase10	X
PATTERNS		
Crosshatch	CROShatch	X
PLUGE	PLUGe	X

10.2 Pattern Selections after System Change

The tables apply when one or more signals only exists in one system.

COLORBAR GENERATOR:			
PAL Specific patterns:			
EBU C.Bar	→	SMPTE C.Bar	
75 % C.Bar+Red	→	SMPTE C.Bar	
CCIR Line18	→	SMPTE C.Bar	
NTSC specific patterns:			
SMPTE C.Bar	→	EBU C.Bar	
FCC C.Bar	→	EBU C.Bar	

10.3 Audio Signals

	Remote name	Embedded	Analog	AES/EBU
Signals				
Off	OFF	X		
Silence	SILence	X		
Stereo 500 Hz	S500HZ		X	X
Stereo 1 kHz	S1KHZ	X	X	X
Stereo EBU 1 kHz	SEBU1KHZ		X	X
Stereo 8 kHz	S8KHZ		X	X
Digital audio Levels				
Silence	SILence		X	X
0 dBFS	0			X
-9 dBFS	-9			X
-12 dBFS	-12			X
-15 dBFS	-15			X
-16 dBFS	-16			X
-18 dBFS	-18			X
-20 dBFS	-20			X
Analog audio Levels				
+10 dBu	10		X	
+8 dBu	8		X	
+7 dBu	7		X	
+6 dBu	6		X	
+5 dBu	5		X	
+4 dBu	4		X	
+3 dBu	3		X	
+2 dBu	2		X	
+1 dBu	1		X	
0 dBu	0		X	

	Remote name	Embedded	Analog	AES/EBU
-1 dBu	-1		X	
-2 dBu	-2		X	
-3 dBu	-3		X	
-4 dBu	-4		X	
-5 dBu	-5		X	
-6 dBu	-6		X	
-7 dBu	-7		X	
-8 dBu	-8		X	
-9 dBu	-9		X	
-10 dBu	-10		X	
-11 dBu	-11		X	
-12 dBu	-12		X	
-13 dBu	-13		X	
-15 dBu	-15		X	
-18 dBu	-18		X	
-20 dBu	-20		X	
-24 dBu	-24		X	
-27 dBu	-27		X	
-30 dBu	-30		X	
-33 dBu	-33		X	
-36 dBu	-36		X	
Silence	SILence		X	
Digital AudioTiming				
-9.6 μ s	-9.6			X
-8.8 μ s	-8.8			X
-8.0 μ s	-8.0			X
-7.2 μ s	-7.2			X
-6.4 μ s	-6.4			X
-5.6 μ s	-5.6			X
-4.8 μ s	-4.8			X
-4.0 μ s	-4.0			X
-3.2 μ s	-3.2			X
-2.4 μ s	-2.4			X
-1.6 μ s	-1.6			X
-0.8 μ s	-0.8			X
+0.0 μ s	+0.0			X
+0.8 μ s	+0.8			X
+1.6 μ s	+1.6			X
+2.4 μ s	+2.4			X
+3.2 μ s	+3.2			X
+4.0 μ s	+4.0			X
+4.8 μ s	+4.8			X
+5.6 μ s	+5.6			X

	Remote name	Embedded	Analog	AES/EBU
+6.4 μ s	+6.4			X
+7.2 μ s	+7.2			X
+8.0 μ s	+8.0			X
+8.8 μ s	+8.8			X
+9.6 μ s	+9.6			X
+10.4 μ s	+10.4			X

10.4 Reset Configuration

Whenever the SCPI command ***RST** is issued and/or the preset button on the front is used as a reset, (pressing it for more than 15 seconds), the actual settings will be reset according to the following:

	PAL	NTSC 7.5 % setup	NTSC 0 % setup
BB1-3:			
System	PAL	NTSC	JNTSC
Delay	0,0,0.0	0,0,0.0	0,0,0.0
ScH-Phase	0	0	0
TSG			
Pattern	CBEBu	CBSMpte	CBSMpte
System	PAL	NTSC	JNTSC
Delay	0,0,0.0	0,0,0.0	0,0,0.0
ScH-Phase	0	0	0
Embedded Audio	OFF	OFF	OFF
AES/EBU Audio	On	On	On
System	PAL	NTSC	NTSC
Signal	S1KHZ	S1KHZ	S1KHZ
Level	-18	-20	-20
Timing	0	0	0
Click	3	3	3
Wordclock	F48KHZ	F48KHZ	F48KHZ
Signal	S1KHZ	S1KHZ	S1KHZ
Analog Audio			
Signal	S1KHZ	S1KHZ	S1KHZ
Level	0	0	0
Click	3	3	3

11. **Maintenance**

When calibration or service is required, contact your local Leader agent.



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