# LEAMING INDUSTRIES

# MTS-2B BTSC STEREO GENERATOR

INSTRUCTION BOOK

IB 002122-02 H



**LEAMING INDUSTRIES**
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# MTS-2B TABLE OF CONTENTS

## 1.0 QUICKSTART

*NOTE:* The MTS-2 is equipped with safety lock switches. To change the position of a switch, you must first pull the switch handle outward, move it to the desired setting, and then release it.

This section is provided for those who want to skip directly to connecting the MTS-2 into their system. At the minimum, please see the Connection Diagrams in the Appendix at the rear of this manual, and read the remainder of this section (1.X).

1.1 Configure Video Modulator to accept BTSC Stereo in the format you wish to use. Refer to Section 3.3.

1.2 Loop baseband video through the MTS-2 on its way to the video modulator. Refer to Section 3.2.

1.3 Connect the BTSC output of the MTS-2 to the input of the video modulator. Refer to Section 3.3.

1.4 Connect Audio Program(s) to the MTS-2. Refer to Section 3.1.

1.5 Connect Power.

1.6.1 If using Baseband Multiplex Stereo feed to TV channel modulator, adjust Aural Carrier Deviation at video modulator. Refer to Section 4.1.

1.6.2 If using 4.5 MHz feed to video modulator, adjust CARRIER LEVEL output of MTS-2. Refer to Section 4.2.

1.7 Adjust AUDIO LEVELS at MTS-2. Refer to Section 4.3.

## 2.0 INTRODUCTION TO THE MTS-2

2.1 MODEL

This manual covers the MTS-2B. The MTS-2B will be referred to either as such, or more generically, as just MTS-2 in this manual.

2.2 MTS-2B FEATURES

The MTS-2B stereo generator accepts discrete left and right audio channels and encodes them into the BTSC format, for transmission to viewers/listeners via an NTSC television modulator which is BTSC-Stereo-capable. The end user generally receives the stereo program with a commercial consumer-grade stereo television.

The MTS-2 has dual stereo inputs; the second input may be used for local ad insertion or as an audio backup. Either input, if mono, can be synthesized into stereo (i.e. Input A, Input B, both, or neither input).
An AGC (Audio Automatic Gain Control) is included in the MTS-2 to monitor and correct incoming audio program level variations.

A Second Audio Program (SAP) carrier input is provided. This may be used with a Leaming SAP-2 Generator to provide a second audio program, in addition to the stereo program.

The MTS-2 is also equipped with a phase inversion indicator which recognizes left-right polarity inversion errors, and a sync phase control which may minimize buzz created by some video channel scramblers.

Outputs from the MTS-2 are provided at both baseband (multiplex) and 4.5 MHz. Both outputs may be used simultaneously.

A Bessel-null test-tone is built into the MTS-2 to ensure simple and accurate system calibration when the composite baseband interface is used.

## 3.0 INSTALLATION

### 3.1 AUDIO INPUT

The MTS-2 requires a left and a right audio input signal. Refer to Connections diagram D2, at the end of this manual:

For signals from a balanced source, Connect a shielded audio cable pair from the left channel of your stereo audio program source to the left channel of Input "A" ("A Audio In","LEFT") on the MTS-2. Run an additional shielded cable pair from the right channel of your program source to the right "A" input ("A AUDIO IN","RIGHT"). Be sure that the + goes to the +, and the - goes to the -.

For signals from an unbalanced source, connect the high to the + and the shield to the -. Also, tie the - to the "G" (Ground) terminal if the two chassis are not otherwise electrically grounded to each other.

*NOTE*: The screw-terminal strips located on the back panel of the MTS-2 may be removed (unplugged) for ease in wiring.

#### 3.1.1 SECOND ("B") AUDIO INPUT

The "B" input may be used either for local ad insertion or for backup audio. The "B" input is wired with the same procedure as that listed in Section 3.1 for the "A" input, except that it is connected to Input B ("B AUDIO IN") on the back of the MTS-2 (rather than Input A). See Section 3.5 for information regarding the selection of A/B inputs and stereo synthesis.

### 3.2 VIDEO SYNC IN CONNECTIONS

The MTS-2's "VIDEO SYNC IN" loop "IN" must be connected to baseband video (unscrambled). The loop "OUT" is to be connected as noted in 3.3.1, 3.3.2, or 3.3.3, depending on the format selected:

## 3.3 COMPOSITE BASEBAND OR 4.5 MHz TO TV MODULATOR

TV channel modulators generally accept BTSC stereo in either of two common formats:

1) As a Composite (multiplexed baseband "audio") or
2) On a 4.5 MHz (sub)carrier.

The MTS-2 provides both formats simultaneously. Either format produces excellent results. The selection of which format to use is dependent on what your TV modulator will accept, and which has been adopted as the preferred method in your system.

Refer to connection diagrams D2 through D4 (located at the rear of this manual)

### 3.3.1 BASEBAND STEREO MULTIPLEX TO TV MODULATOR

This method uses the audio modulator built into the associated TV channel modulator; the 4.5 MHz modulator in the MTS-2 is not used. First, verify that your TV modulator is capable of accepting a baseband multiplex BTSC audio signal.

*NOTE*: All TV channel modulators require configuration to accept a BTSC stereo multiplex signal, instead of mono audio. In most cases, this may be accomplished by re-positioning a few switches or jump-jacks in the modulator. Specifically, the 75 µS pre-emphasis, and any audio limiting, if present, must be removed. The modulator must have a wide "audio" bandwidth (flat through approx. 110 kHz). Contact your TV modulator manufacturer for configuration instructions.

Once your TV modulator has been properly configured to accept BTSC stereo as a baseband multiplex signal, refer to diagram D2 (at the rear of this manual) for an illustration of the external hookup:

Connect the "VIDEO SYNC IN" loop "OUT" on the MTS-2 to the "Video In" on your TV modulator.

Then connect a shielded audio cable from the "BTSC MULTIPLEX OUT" on the MTS-2 to the "Audio In" on the TV modulator.

*NOTE*: The BTSC MULTIPLEX OUTPUT of the MTS-2 is not balanced, but, for convenience in driving a balanced load, three terminals are provided: The + (Red) goes to the +, any one of the MTS-2's G (Chassis Ground) terminals goes to - (Black), and another G (chassis ground) terminal goes to the shield (drain) wire.

For signals to an unbalanced load, connect the + (red, high) to the +, and the shield (and Black, if present) to "G" (Ground) terminals at both the MTS-2 and the video modulator.

*NOTE*: If you are using the 4.5 MHz (Audio Carrier) output of the MTS-2, instead of the baseband multiplex output of the MTS-2, there is no need to connect anything to the "Audio In" of the video modulator or the "BTSC MULTIPLEX OUT" on the MTS-2.

### 3.3.2 4.5 MHz AUDIO CARRIER WITH VIDEO

If the TV modulator you are using accepts the 4.5 MHz audio carrier on the same cable as video, rather than on a separate cable from video, refer to diagram D3:

Connect a jumper cable from the "VIDEO SYNC OUT" of the MTS-2 to the "AUDIO CARRIER IN" of the MTS-2.

Connect another cable from the "AUDIO CARRIER OUT" on the MTS-2 to the "Video plus 4.5 MHz Input" on your TV modulator.

*NOTE*: If you are using the BTSC MULTIPLEX OUT (baseband) of the MTS-2, instead of the AUDIO CARRIER OUT (4.5 MHz) of the MTS-2, there is no need to connect anything to the AUDIO CARRIER OUT of the MTS-2.

### 3.3.3 4.5 MHz AUDIO CARRIER SEPARATE FROM VIDEO

If the TV modulator you are using requires separate video and 4.5 MHz inputs, refer to diagram D4:

Connect one cable from the "VIDEO SYNC OUT" connector on the MTS-2 to the "Video In" on the TV modulator.

Connect another cable from the "AUDIO CARRIER OUT" on the MTS-2 to the "Audio Carrier In" on the TV channel modulator. Then install a 75 ohm terminating resistor on the "AUDIO CARRIER IN" connector on the MTS-2.

## 3.4 VIDEO SCRAMBLING

Because most video scramblers work at TV I.F. (45.75 & 41.25 MHz), the stereo connections are generally unaffected. However, if there is any possibility that the video is scrambled at baseband, loop the unscrambled video through the "VIDEO SYNC IN" loop of the MTS-2 before the scrambler; the MTS-2 will not function properly if it is receiving sync-suppressed baseband video (i.e. the stereo pilot cannot sync to baseband-scrambled video).

## 3.5 LOCAL & REMOTE AUDIO INPUT SELECTION

*NOTE:* The MTS-2 is equipped with safety lock switches. To change the position of a switch, you must first pull the switch handle outward, move it to the desired setting, and then release it.

The Input Selector switch is at the left end of the MTS-2's front panel. The "A" and "B" positions of the front panel switch will override remote A/B control.

To remotely switch from Input "A" to Input "B", wire the "A/B" terminal on the rear panel of the MTS-2 to any control which is capable of pulling a 10 k-ohm line, normally at +5 volts, to within one volt of ground.

Place the front-panel switch in the "REM" (center) position. The MTS-2 switches from Input "A" to Input "B" when terminal "A/B" is grounded.

### 3.5.1 AD INSERTION WITH STEREO SYNTHESIS

The MTS-2 is equipped with a built-in stereo synthesizer, for use if the source programming is mono. The MTS-2 is normally in true stereo. By appropriately installing one wire jumper on the remote connector, combinations of true and synthesized stereo can be selected: A & B true stereo; A true & B synthesized, or both A & B synthesized.

The stereo synthesizer is enabled by grounding pin 6 of the remote terminal plug on the back panel of the MTS-2. Leaving pin 6 open (ungrounded) results in true stereo capability and no stereo synthesis.

To automatically select synthesized stereo whenever the "B" input channel is selected (either locally or remotely), connect pin 6 to pin 4 on the Remote terminal plug. Then, when pin 4 is grounded (e.g. by local commercial insertion equipment) pin 6 is also grounded, selecting the "B" input and stereo synthesis together.

*NOTE*: If the program source is mono and the corresponding MTS-2 input is configured for true stereo, the listener will hear mono even though his stereo indicator is on. To eliminate this misleading condition, the MTS-2 may be switched to mono with the front-panel "STEREO-MONO-TEST" switch, or the mono program may be synthesized to stereo.

If the program source is mono and the corresponding MTS-2 input is configured for synthesized stereo, the listener will hear an apparently stereo source with considerable ambiance and some (artificial) directionality.

If a stereo program source is fed through the synthesizer, some directionality remains, and the ambiance will be changed. If the original stereo had very little ambiance, it will be increased noticeably; if the original program had considerable ambiance, it will be reduced somewhat. The overall effect is generally quite pleasing.

*NOTE*: The stereo synthesizer will not automatically follow A/B selection if a remote controller is forcing pins 4 & 6 either high or low and the front panel A/B selector is used to override the remote controller. Under these conditions, the input will be as selected on the front panel of the MTS-2, but the stereo/synthesis will be as forced by the remote controller. Typically, this is of little consequence, and is likely to occur only if the remote controller is attempting to select the "B" input, but the MTS-2's input selector has been placed in "A" to prohibit remote selection. The result will be the desired program ("A"), but in synthesized stereo. This can be overcome, if necessary, by inhibiting the remote controller.

## 4.0 OPERATION

*NOTE:* The MTS-2 is equipped with safety lock switches. To change the position of a switch, you must first pull the switch handle outward, move it to the desired setting, and then release it.

### 4.1 SETTING THE AUDIO CARRIER DEVIATION

If your are using the 4.5 MHz Audio Carrier Output of the MTS-2, its deviation has been calibrated at the factory; it is not field-adjustable. Skip to Section 4.2.

If you are using the composite baseband multiplex output of the MTS-2, the aural carrier deviation must be accurately set at the TV channel modulator. (Otherwise, stereo channel separation will be less than optimum.)

The TEST position of the "STEREO MONO TEST" switch (located on the MTS-2's front panel) activates a test tone, and shuts off the audio inputs, to facilitate setting the deviation of an external audio modulator.

The most convenient and accurate way of verifying correct deviation is to use the test tone and a spectrum analyzer to observe the first Bessel-null of the carrier.

As alternate methods, you may use either the meter or the peak modulation (±25 kHz) light on your TV modulator.

*NOTE:* If a video scrambler is being used in conjunction with the BTSC stereo generator, to avoid possible interaction with the calibration tone, the scrambler should be off or in the bypass mode while setting the audio deviation.

#### 4.1.1 SPECTRUM ANALYZER & TEST TONE METHODS:

Move the "STEREO MONO TEST" switch to the "TEST" (bottom) position. Both the "A" & "B" input lights will illuminate. Using a spectrum analyzer, look at the audio carrier from your TV modulator. (For a clear picture, 20 kHz to 50 kHz resolution per division is suggested.) Using the front-panel deviation control on the TV modulator, null the carrier (to the first Bessel-null; see diagram 4-1).

To verify that the deviation is adjusted correctly, check the amplitude of the 15.734 kHz stereo pilot sidebands relative to the audio carrier. To do so, set the test switch to the "STEREO" (top) position and, at reduced audio input levels, look at the audio carrier and both sidebands using a spectrum analyzer (one sideband should be 15.734 kHz above the audio carrier and another sideband should be 15.734 kHz lower than the audio carrier). If the deviation is properly adjusted, the two sidebands should be approximately 16 dB down from the carrier (Refer to diagram 4-2). If they are not, after repeating the Bessel Null procedure, repair and calibration of the equipment is needed.

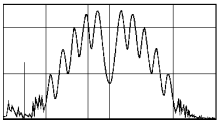


Figure 4-1A
Correct Bessel-null

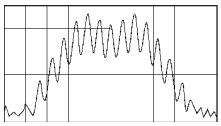


Figure 4-1B
Incorrect Bessel-null

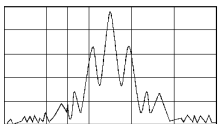


Figure 4-2
Main Audio Carrier with
Pilot Carrier Sidebands

Horizontal:

20 kHz/div

Vertical:

10 dB/div

(All Views)

4.1.2 USING THE METER OR PEAK FLASHER ON THE TV MODULATOR:

If you are using the meter on your TV modulator to set the deviation, move the MTS-2's "STEREO MONO TEST" switch to "TEST" (bottom position). Increase the Aural Carrier Deviation (not Level) until the "±25 kHz" or "100%" or "0 VU" light on the TV modulator comes on. Then, back it off until the light "just" goes off.

*NOTE*: If SAP or scrambling is being used, be sure that it is off or in the bypass mode while setting the deviation.

*OPERATIONAL NOTE*: The audio peak flasher on the TV modulator may flash during normal stereo operation, and more so if SAP is also present.

4.2 AUDIO CARRIER LEVEL ADJUSTMENT

When using the 4.5 MHz audio carrier output from the MTS-2, the carrier level must be adjusted, generally both at the MTS-2 and at the TV modulator. In a typical case, such as when an MTS-2 feeds a Scientific Atlanta 6350, the audio carrier level is adjusted first at the MTS-2 while monitoring the TV channel output of the SA 6350 with a spectrum analyzer: Increase the carrier level at the MTS-2 until the audio carrier output of the 6350 ceases to increase, indicating that the 6350 has achieved limiting. This is the optimum drive level to the 6350; less drive results in noisier audio, and more drive may splatter the audio into the video. Then adjust the Aural Carrier Level on the 6350 to set it at the desired output level, which, in most cable systems, is 15 dB below the (unmodulated) video carrier.

## 4.3 AUDIO LEVELS

The MTS-2 is equipped with two sets of level controls on the front panel: "A LEVEL" "LEFT" & "RIGHT" and "B LEVEL" "LEFT" & "RIGHT". Audio program levels are monitored with dual peak-reading LED bargraph metering.

*NOTE*: Always verify that the AGC switch on the front panel is in the "OFF" position before making any audio level adjustments.

With the AGC switch in the "OFF" position, adjust the corresponding level controls so that both the left and the right meters read approximately 0 VU with average program peaks. The red LEDs may flash briefly with very loud program peaks.

SEE SECTION 5 FOR AGC OPERATION.

## 4.4 AUDIO PHASE INVERSION

When audio phase inversion is detected by the MTS-2, the INV PROG PHASE LED illuminates. Phase inversion, in a mono or stereo source with negligible separation, results in low or no audio level from a mono TV receiver. The source of the inversion should be located and corrective action taken.

The MTS-2's Automatic Phase Corrector (APC) can correct audio phase inversion, if enabled by grounding pin 8 of the "REMOTE" connector on the rear panel.

When the APC is enabled and the incoming program phase is incorrect, after a several second delay, the MTS-2 will invert (correct) the phase of one channel. The INV indicator will remain lit until the phase reversal is corrected externally. The delay is provided to allow for special stereo effects which briefly alter the phase, such as those often found in movies with Dolby Surround Sound ®. During movies which make extensive use of Surround Sound, it may be preferable to leave the MTS 2's APC inactive. Inadvertent APC activation by Surround Sound will result in a brief reduction of center-screen audio levels, especially for viewers without stereo TV's.

### 4.4.1 ENABLING/DISABLING AUTOMATIC PHASE CORRECTION

The auto-phase-correction (APC) feature may be enabled by an external contact closure, from pin 8 of the REMOTE connector to ground. The factory default setting is APC Disabled (no connection to pin 8).

## 4.5 UNLOCK LIGHTS

There are two "UNLOCK" LED's on the front panel: one above the "SYNC PHASE" control, and one above the "CARRIER LEVEL" control.

When the MTS-2 is first powered up, both lights will illuminate and flash briefly.

If the "SYNC UNLOCK" LED is continually illuminated or flashing, the MTS-2 is not receiving suitable video to lock to. The MTS-2 will continue to produce a BTSC stereo signal, but the stereo image may shift slightly.

The "SYNC UNLOCK" LED may illuminate sporadically when the source is an analog videotape or another source with relatively unstable sync. This is normal; it merely indicates that the stereo pilot is working to track the varying video sync. Since the pilot lock cannot (and should not) track very rapidly, the video sync irregularities will not normally become audible in the program material.

If the "CARRIER UNLOCK" LED is illuminated, the 4.5 MHz Audio Carrier is off frequency. If this light illuminates regularly during use, the unit requires servicing.

## 4.6 SYNC PHASE ADJUSTMENT

The "SYNC PHASE" control is used to adjust the phase of the audio pilot relative to horizontal sync, in order to possibly reduce buzz in your system.

This adjustment will have essentially no effect in a system with negligible intermodulation products. The benefits of this control are usually most noticeable when using a scrambling system which amplitude modulates the audio carrier, especially if the scrambler and/or descrambler are not optimally aligned.

Some listeners may detect a reduction of sync buzz if the transmitting pilot phase is optimized for their receiving equipment.

This adjustment may be done while viewing the audio carrier output of the TV channel modulator with a spectrum analyzer:

Temporarily eliminate the audio inputs from the MTS-2 (Either set the input level controls fully counter-clockwise, or, if the "B" input is unused, select it, or disconnect the input at the plug block on the rear panel).

Verify that the scrambling system is on and video is present.

With a spectrum analyzer, observe the 15.734 kHz sidebands adjacent to the audio carrier.

Adjust the Sync Phase until the amplitude of the 15,734 Hz sidebands is equal. (They will be approximately 16 dB below the carrier amplitude).

Alternatively, the adjustment may be made "by ear":

Listen to your system with a BTSC decoder (e.g.: A Leaming TSD, or a high-quality stereo TV or VCR). Minimize the audible sync buzz by adjusting the Sync Phase control on the front panel of the MTS-2.

## 4.7 SAP CARRIER LEVEL SETTING

When using the composite stereo (baseband multiplex) output from the MTS-2 to the TV modulator, rather than 4.5 MHz, it is important to first set the audio carrier deviation at the TV audio modulator using the Bessel-null (10.396 kHz) test tone built into the MTS-2, as described above, in Section 4.1. Do that with the SAP carrier off. Thereafter, that control must not be changed; aural carrier deviation by the SAP carrier must be set by the SAP generator's CARRIER LEVEL control.

The MTS-2B is set to accept a SAP carrier at 1.5 Vp-p to produce ±15 kHz deviation of the audio carrier by the 5H (78,670 Hz) SAP carrier. Leaming SAP generators produce 1.5 Vp-p when their carrier level control is at mid-position.

The actual SAP carrier level setting (and resultant deviation of the 4.5 MHz audio carrier) is not extremely critical, and has no effect on the SAP audio level (as the SAP channel carrier is itself frequency modulated by the SAP audio).

A too-high SAP carrier level will result in a slight over-deviation of the main/stereo audio carrier. A too-low SAP carrier level will result in the SAP audio becoming noisy and dropping out. The correct SAP carrier level is that which deviates the 4.5 MHz audio carrier ±15 kHz. This may be observed with a spectrum analyzer; view the main audio carrier at any point in the transmission chain. The SAP carrier sidebands appear adjacent to the main audio carrier, one 78.670 kHz above, and the other 78.670 kHz below, each at a level 20 dB below the main carrier when the SAP carrier switch is "ON" (normal run mode; if the SAP carrier switch is in "TEST", the 78,670 Hz sidebands will be 16 dB below the audio carrier). It is easiest to observe this if the main audio is switched off and is in the mono mode, not stereo. Do not attempt to set the SAP carrier level with the MTS-2 in the Test mode, as the main carrier and the SAP carrier sidebands will be down in Bessel Nulls.

## 5.0 AGC (AUDIO AUTOMATIC GAIN CONTROL)

The AGC amplifier monitors and corrects incoming audio transmission levels in order to maintain satisfactory signal levels for the listener.

### 5.1 USING THE AGC

Before activating the AGC, be sure that the audio levels have been set according to the directions in Section 4.3. To reiterate briefly: Set the AGC "ON REM OFF" switch in the OFF mode. Set the "A/B INPUT SELECTOR" switch to correspond with the input you are using. Adjust the appropriate level controls (Input A or B) on the MTS-2 until the amber "0 VU" LED flashes occasionally on loud program material, and the red "+3" LED flashes only rarely and briefly (on very loud program peaks).

Now, move the AGC switch to the "ON" position. The green LED above the AGC switch should illuminate. There should be no noticeable level changes. However, if the levels were set high, for demonstration purposes, you should notice an abrupt drop toward normal.

If the program pauses, or its level drops more than 20 dB below normal, the AGC LED will dim slightly, indicating that the automatic level control is holding the gain at the last setting. If the program level remains at or below that level for 10 seconds, the AGC LED will extinguish and the gain will gradually return to its normal setting, the same as if in the "OFF" mode. The AGC will automatically be re-activated when the program returns.

### 5.2 AGC SWITCH & REMOTE

The switch for the AGC, on the front panel, has three positions: "ON", "REM" (Remote), and "OFF".

The AGC can be remotely activated by connecting the "AGC" terminal on the rear panel of the MTS-2 to chassis ground via a user-supplied switch, if the front panel "AGC","ON REM OFF" switch is in the Remote (center) position.

## 6.0 SPECIFICATIONS

### OVERALL PERFORMANCE

| | |
|---|---|
| FREQUENCY RESPONSE: | 20 Hz to 15 kHz, ±0.5 dB |
| DISTORTION: | 0.5% max THD |
| SEPARATION : | >26 dB, 20 Hz-14.5 kHz<br>>30 dB typical, 50 Hz-10 kHz |
| SIGNAL TO NOISE: | >65 dB, overall through receiver and expander |
| PILOT PROTECTION: | >60 dB at 15.734 kHz |
| COMPRESSOR, L-R: | dbx® licensed (BTSC Standard) |
| AUDIO PROCESSING: | Automatic Gain Control (AGC);<br>10 dB in = 5 dB output change.<br>Max. gain increase = 12 dB (nom.) |
| **VIDEO SYNC INPUT** | Direct loop-through of 75 ohm line |
| NOMINAL INPUT LEVEL: | 1 Vp-p (0.5 to 2 Vp-p) |

### AUDIO BASEBAND INPUT

| | |
|---|---|
| NOMINAL INPUT LEVEL:<br>(APL) | 0 dBm, adjustable ±10 dB<br>(Peak Program Level is 10 dB above APL) |
| AUDIO INPUT IMPEDANCE: | 100 k-ohms, balanced |
| SAP CARRIER INPUT LEVEL: | 1.5 Vp-p into 10 k-ohms= ±15 kHz deviation |
| **BASEBAND OUTPUT** | (Into Hi-Z load; Source Z= 75 ohms) |
| COMPOSITE STEREO MPX: | 0.1 V/ kHz deviation |
| TEST TONE: | 2.5 Vp-p @ 10.4 kHz<br>(First Bessel-null frequency for ±25 kHz deviation of audio carrier) |

| | |
|---|---|
| **4.5 MHz OUTPUT** | Direct loop-through of 75 ohm line |
| LEVEL: | 0.4 Vp-p, adjustable |
| DEVIATION, PEAK: | Mono (Sum Ch.) ±25 kHz<br>Stereo Pilot ±5 KHz<br>Stereo (Diff.) ±50 kHz<br>Test Tone ±25 kHz |
| FREQ. TOLERANCE: | ±0.0025% (±112 Hz) |
| HARMONICS: | -50 dB re: .250 Vp-p or better |
| **AUDIO LEVEL INDICATORS:** | Peak-reading 10-segment LED bargraphs (L&R) |
| **LED INDICATORS:** | A/B Input Selection<br>Phase Inversion/Correction<br>AGC Active<br>Stereo Synthesizer On<br>Video Sync Unlocked<br>Audio Carrier Frequency Unlocked |
| **CONTROLS, FRONT PANEL:** | Input Levels (4: "A" L&R and "B" L&R)<br>A/B Input Switch with Remote position<br>AGC On/Off with Remote position<br>Stereo/Mono/Test Switch<br>Sync Phase Adjust<br>4.5 MHz Carrier Level |

**CONNECTORS, REAR PANEL:**

| | | |
|---|---|---|
| Power, AC, 120/240 V: | IEC 320 plug (recessed, 3 pins) | |
| or Power, DC, 48 V: | 3-terminal Barrier Strip | |
| | Negative | TERM. 1 |
| | Chassis | TERM. 2 |
| | Positive | TERM. 3 |

RF (4 Type "F" standard, BNC optional):

| | |
|---|---|
| 4.5 MHz Loop | In |
| | Out |
| Video (sync) Loop | In |
| | Out |

Audio & Misc.: 4 Detachable Screw-terminal Plug Blocks:

"A" & "B" Stereo Inputs: two 5-pin blocks

| | |
|---|---|
| R+ | PIN 1 |
| R- | PIN 2 |
| G | PIN 3 |
| L+ | PIN 4 |
| L- | PIN 5 |

BTSC MPX Out / SAP Carrier In: 5-pin block

| | |
|---|---|
| SAP + | PIN 1 |
| Ground | PIN 2 |
| Ground | PIN 3 |
| BTSC + | PIN 4 |
| Ground | PIN 5 |

Remote Controls: 8-pin block:

| | |
|---|---|
| Sync Output | PIN 1 |
| AGC Enable | PIN 2 |
| Chassis Ground | PIN 3 |
| A/B Input Select | PIN 4 |
| Reserved | PIN 5 |
| Stereo Synth. Select | PIN 6 |
| 18V Out 0.2 A Max. | PIN 7 |
| Phase Correct Enable | PIN 8 |

**POWER & MECHANICAL**

VOLTAGE: 120 VAC (105-125 V, 50-60 Hz) Standard
or 220 VAC (210-250 V, 50-60 Hz) Factory Config.
or 48 VDC (40-70 V) Factory Configured

CONSUMPTION: 10 VA

FUSE: Slow-Blow, 1/4" x 1-1/4" tubular cartridge, in socket on rear panel.
120 or 240 V: 1/2 A;
48 V: 1 A

SIZE: 1.75" H x 19" W x 14" D
Mounts in one standard 19-inch rack space

WEIGHT: 8 lb. net, 11 lb. shipping

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

## 7.0 AUDIO PERFORMANCE EVALUATION

When verifying performance specifications of the MTS-2, be sure that none of its features interfere with the item being tested. Specifically, frequency response tests should run with the AGC off and at a level approximately 20 dB below 100% modulation. The reason is that the standard pre-emphasis will cause apparent frequency response errors, when running at 100% modulation at high frequencies, due to over-modulation limiting. Additionally, if the AGC is on, the apparent steady-state sine-wave frequency response will be in error (at any signal level) due to the gain changing in an attempt to "correct" the modulation level difference caused by the pre-emphasis. In normal operation, this is not a problem, as actual program material typically consists of rapidly-changing complex tones, unlike the slowly-changing simple tone customarily used to measure frequency response. This may be verified by using white or pink noise to test frequency response, with or without the AGC active.

### 7.1 AGC FUNCTIONALITY VERIFICATION

The operation of the AGC is nearly transparent. Over-modulation is quickly halved (in dB) and low levels are raised very slowly, so the apparent dynamic range is retained and audible gain changes are essentially eliminated.

To demonstrate that the unit is indeed functioning, intentionally apply a noticeably higher-level signal. Then switch the AGC from "OFF" to "ON". There should be a noticeable decrease in the audio level. When the AGC is switched off, the audio level will gradually return to its "normal" setting.

## 8.0 TROUBLESHOOTING

### 8.1 COMMON SETUP ERRORS

If the problem is low program level when listening in mono, but the stereo level seems OK, the phase of either the Left channel or the Right channel (but not both) needs to be reversed. Refer to sections 3.1 and 4.4.

If the problem is somewhat excessive noise, and you are using the 4.5 MHz connection to the video modulator (not the baseband multiplex connection), the front-panel Audio Carrier Level control of the MTS-2 probably needs to be set higher. Refer to section 4.2.

If the program is overly sibilant ("hissy"; too much treble), and you are using the baseband multiplex connection to the video modulator (not the 4.5 MHz aural carrier), it is very likely that the TV modulator has not been configured to accept Baseband Multiplex Stereo. In addition, poor separation will be caused by this same error. Once the video modulator is properly configured, follow the setup instructions in section 4.1.

*EXPLANATORY NOTE*: The likely reason that the TV Channel Modulator may not have been configured to accept a BTSC Multiplex Stereo signal is that, when shipped from the factory, Channel Modulators are typically configured to accept Mono Program Audio, not Multiplex Stereo. Usually, it is simple to re-configure the modulator, for BTSC stereo, using its internal jumper-jacks or switches. (Refer to the Channel Modulator's instruction manual for instructions.)

*NOTE*: Mono uses 75 microsecond pre-emphasis, and may have a 15 kHz audio low-pass filter. However, BTSC stereo requires its pre-emphasis to be in the stereo generator, not at the modulator. In addition, the modulator must have flat frequency response up to at least 50 kHz, and possibly up to 110 kHz (depending on whether SAP and PRO channels are in use).

## 8.2 TROUBLESHOOTING WITH A STEREO DECODER

First, determine that the MTS-2 alone is functioning normally. If you have access to a Leaming TSD (Television Stereo Decoder), or any other suitable stereo decoder, connect it directly to the output of the MTS-2 stereo generator. Follow the instructions that came with the stereo decoder.

### 8.2.1 USE YOUR EARS

Even if you are connecting audio-analyzer instrumentation to the stereo decoder, also listen to the stereo program from the audio outputs of the stereo decoder. Human ears can usually detect significant problems much more quickly than meters, and audible traits of the problem will generally reveal its cause.

Once the MTS-2 has been determined to be functioning normally, re-connect the MTS-2 to the video modulator, and connect the stereo decoder to a monitor output of the cable system, through a set-top convertor box if necessary. Repeat the performance tests. Re-read section 7.0 through 8.1.

If no professional stereo decoder is available, connect the channel to a known-good stereo TV.

Use appropriate attenuators in the line to keep from overloading the monitor's front-end.

## 8.3 TROUBLESHOOTING WITHOUT A STEREO DECODER

If no stereo decoder is available, but a spectrum analyzer or an oscilloscope is available, and an audio signal generator is also available, some troubleshooting is still possible.

### 8.3.1 TROUBLESHOOTING WITH A SPECTRUM ANALYZER

To help determine if the MTS-2 is not functioning properly, check the 4.5 MHz output of the MTS-2 (even if you are not using it), directly at the back panel of

the MTS-2, with a spectrum analyzer. Use the procedure in section 4 of this manual. If the sidebands appear as described (and illustrated if Figs. 4-1A and 4-2), the test tone and the stereo pilot of the MTS-2 are functioning correctly.

When using a spectrum analyzer to view the 4.5 MHz output of the MTS-2 in Stereo mode, with no audio program inputs, the 15.734 Hz stereo pilot sidebands should be approximately 16 dB below the center frequency of the audio carrier.

Next, while still observing the stereo pilot on the spectrum analyzer, apply audio to both Left and Right channels at 0 VU (100% modulation). The aural carrier should appear frequency-modulated, deviating ±25 kHz from the center frequency. Then turn down the audio on one channel (either Left or Right) while leaving the other at 0 VU. Modulated Sidebands should appear, centered at approx. 32 kHz above and below the aural carrier.

Reconnect the MTS-2 into the video modulator and connect the spectrum analyzer to the channel output of the video modulator (or the cable system) and tune the spectrum analyzer to the aural carrier frequency of that TV channel. Repeat the tests from the preceeding paragraph; the results should look identical, if the interface with the video modulator is correct, and if any video scrambling has been bypassed.

If these appear normal, the MTS-2 is generally functioning correctly. However, this simple test only indicates that the MTS-2 has an output which is modulated by the audio, and that the hookup to the video modulator is possibly correct. It cannot show that the internal calibration of the stereo generator is correct. For that, and to verify correct interface with the video modulator, a stereo decoder is essential.

### 8.3.2 TROUBLESHOOTING WITH AN OSCILLOSCOPE

If just an oscilloscope is available, it is still possible to check the basic normality of the composite baseband multiplex output of the MTS-2.

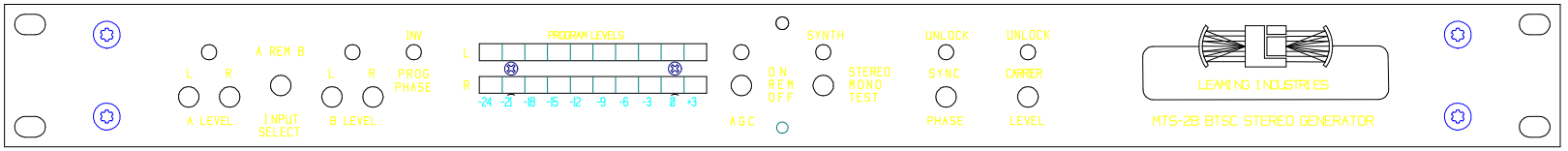
Place the "STEREO-MONO-TEST" switch in the "TEST" position. The output should be 10.396 kHz at 2.5 Vp-p. Next, with no audio input to the MTS-2, move the "STEREO-MONO-TEST" switch to the "STEREO" position. The output should be the 15,734 Hz pilot at 0.5 Vp-p (ignore the noise peaks; read the "average" peak). The absolute values are not critical, but the 5:1 ratio is critical. If this ratio is correct, the test tone and the stereo pilot of the MTS-2 are functioning correctly.

*NOTE:* When in the stereo mode, the 15,734 Hz sine-wave-shape on the oscilloscope will appear slightly noisy. This is normal, caused by the difference-channel compander operating at very high gain in the absence of an audio signal.

Next, while still observing the stereo pilot on the oscilloscope, connect an

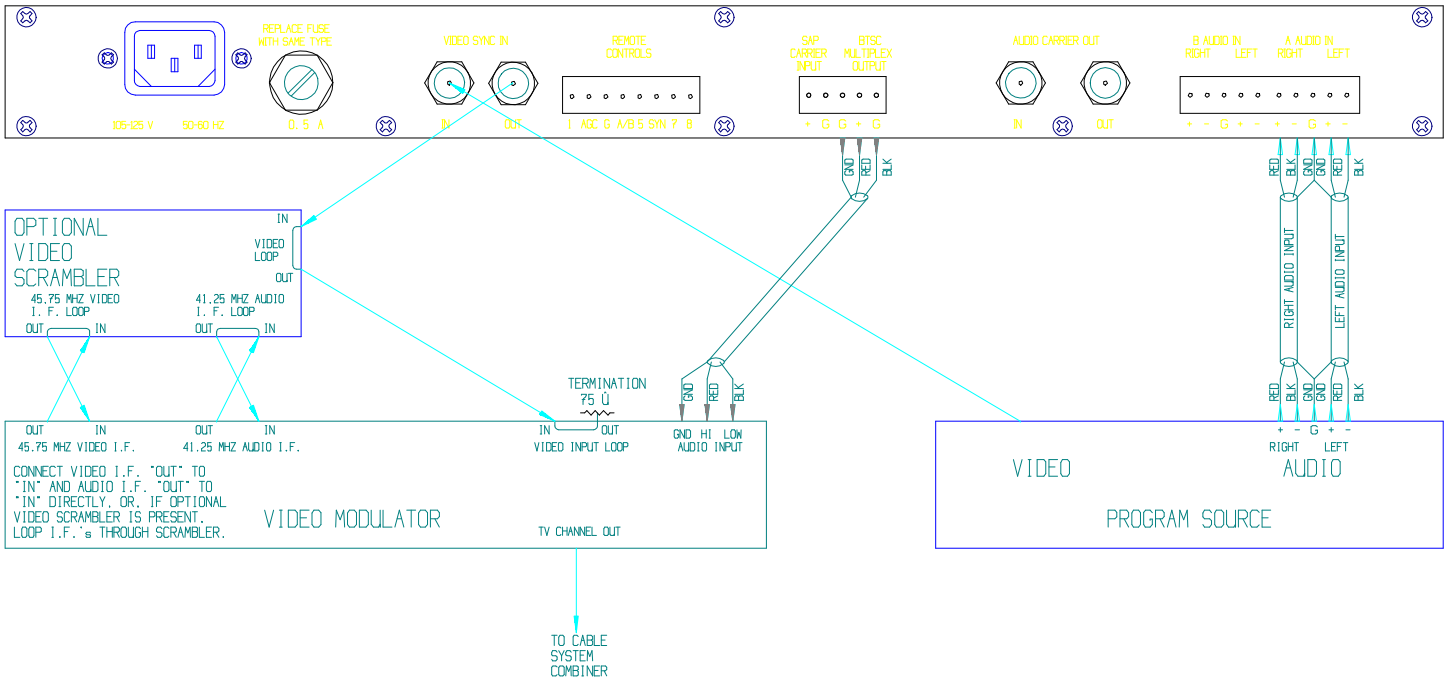
audio signal generator to the Left and Right audio inputs of the MTS-2. Set the signal generator to produce a 1000 Hz tone at approx. 1 volt RMS. Connect the oscilloscope to sync on the audio signal generator. Set the MTS-2 input level controls to cause an indication of 0 VU (100% modulation) on the MTS-2's meters.

The baseband output should appear on the oscilloscope as a 2.5 Vp-p 1000 Hz sine wave with a 0.5 Vp-p 15,734 Hz sine wave riding on it. Then turn down the audio on one channel (either Left or Right) while leaving the other at 0 VU. An envelope should appear on the oscilloscope similar to that above, but with an amplitude-modulated 31,468 Hz tone added (the Difference Channel Carrier). The phase and amplitude of the modulated envelope are difficult to describe, because of the effects of the dbx® difference-channel companding, but if what you see resembles this, the MTS-2 does have a modulated output. For more meaningful evaluation, a stereo decoder is necessary.




STEREO GENERATOR FRONT VIEW (ABOVE)

REAR VIEW, CONNECTIONS (BELOW)



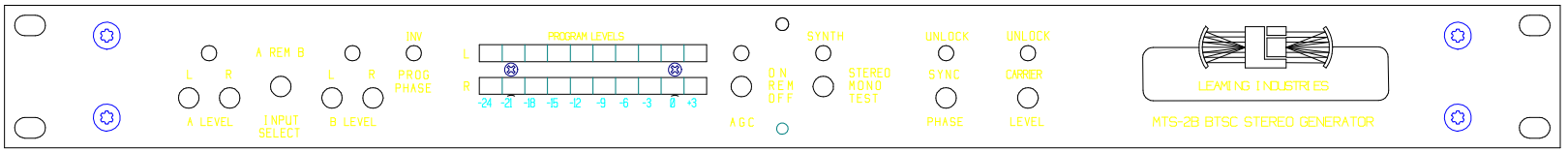

D2

STEREO @ BASEBAND (COMPOS. MPX.) CONNECTIONS, MTS-2 TO VIDEO MOD.

LEAMING INDUSTRIES, INC.
15339 Barranca Parkway, Irvine, Calif. 92618 (714) 727-4144

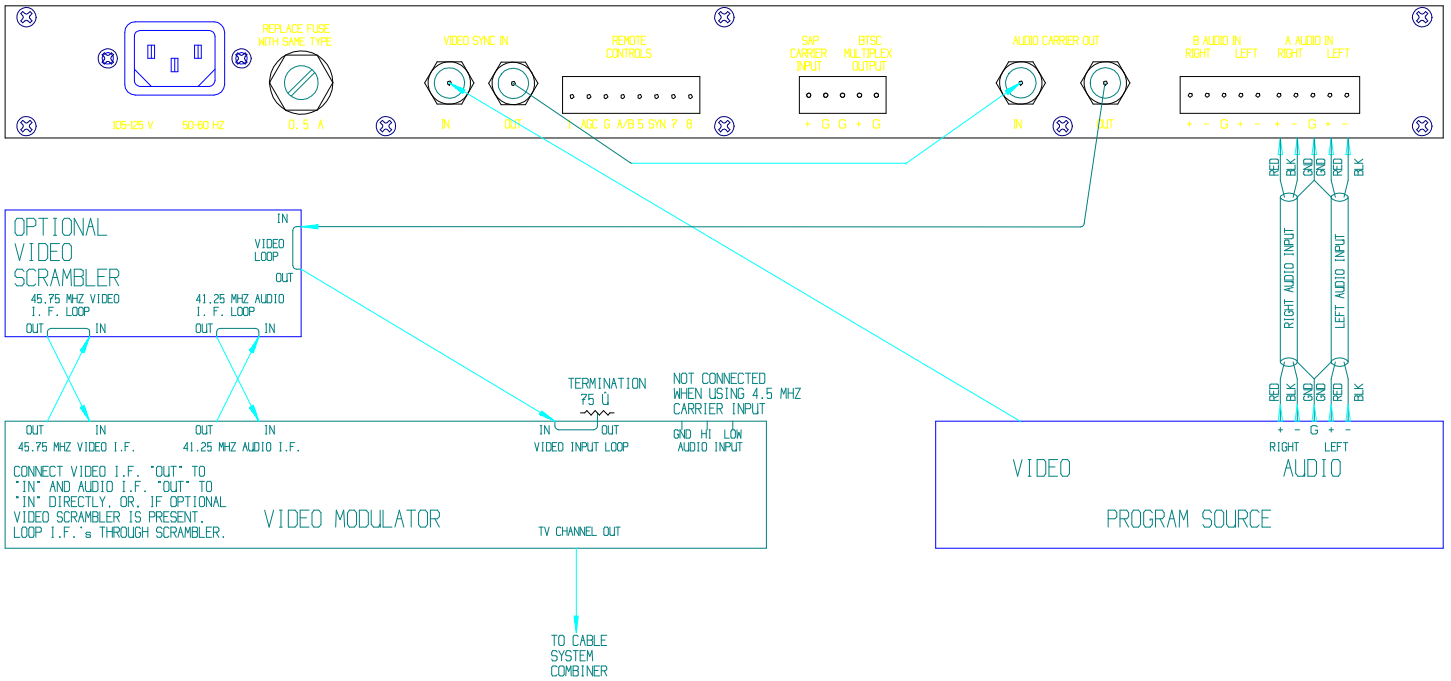
| BY: K.G.Rauch | DATE: 29 DEC 97 | DWG.NO. ADTS212 | REV. |
|---|---|---|---|
| CKD: R.F.L. | DATE: | AD 003092-12 | A |

| SYM | REVISION DESCRIPTION | REV CKD BY | DATE |
|---|---|---|---|




STEREO GENERATOR FRONT VIEW (ABOVE)

REAR VIEW, CONNECTIONS (BELOW)




D3

STEREO @ 4.5 MHZ WITH VIDEO CONNECTIONS, MTS-2 TO VIDEO MOD.

LEAMING INDUSTRIES, INC.
15339 Barranca Parkway, Irvine, Calif. 92618 (714) 727-4144

| SYM | REVISION DESCRIPTION | REV CKD BY | DATE |
|---|---|---|---|

| BY: K.G.Rauch | DATE: 29 DEC 97 | DWG.NO. ADTS213 | REV. |
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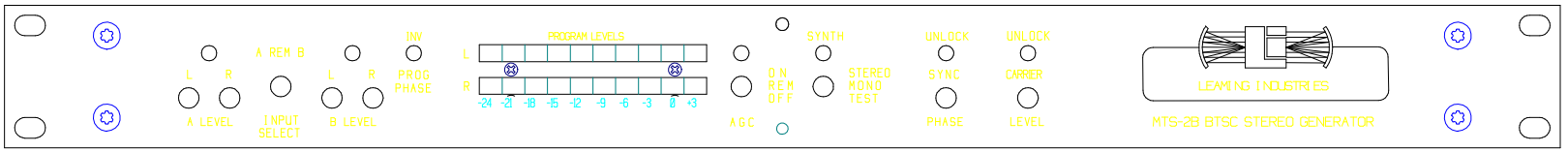
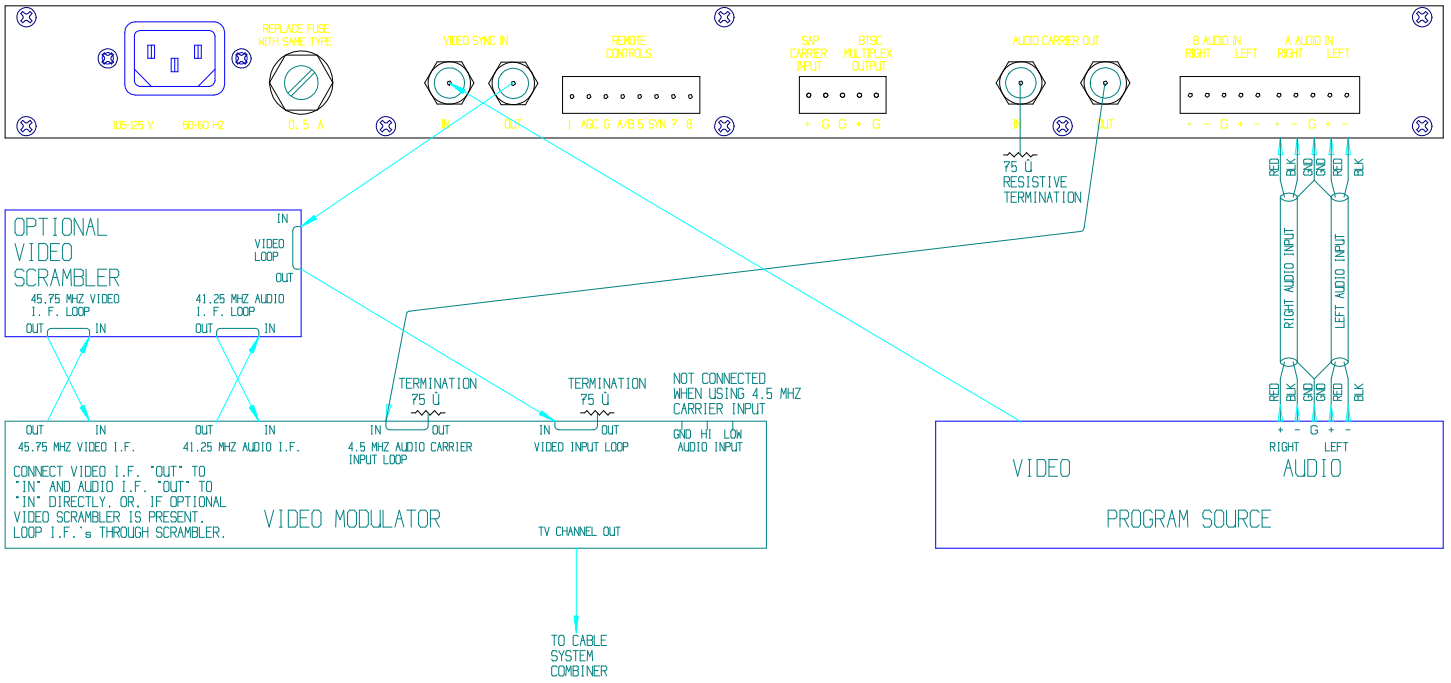
| CKD: R.F.L. | DATE: | AD Ø3Ø92-13 | A |




STEREO GENERATOR FRONT VIEW (ABOVE)

REAR VIEW, CONNECTIONS (BELOW)




D4

STEREO @ 4.5 MHZ SEPARATE FROM VID. CONNECTIONS. MTS-2 TO VIDEO MOD.

LEAMING INDUSTRIES, INC.
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| BY: K.G.Rauch | DATE: 29 DEC 97 | DWG.NO. ADTS214 | REV. |
|---|---|---|---|
| CKD: R.F.L. | DATE: | AD 003092-14 | A |

| SYM | REVISION DESCRIPTION | REV CKD BY | DATE |
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