



AD 2100 audio synchronizer

Operation & Service Manual

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STANDARD EQUIPMENT WARRANTY

Pixel warrants that the goods sold under this contract will be free from defects in material and workmanship for a period of 1 year, and this warranty will be limited to the repair and replacement of parts and the necessary labor and services required to repair the goods.

IT IS EXPRESSLY AGREED THAT THIS WARRANTY WILL BE IN LIEU OF ALL WARRANTIES OF FITNESS AND IN LIEU OF THE WARRANTY OF MERCHANTABILITY.

SAFETY SUMMARY

The general safety information in this part of the summary is for both operating and servicing personnel.

Power Source

This product is intended to operate from a power module connected to a power source that will not apply more than 125 volts RMS (or 250V when unit is wired to operate from 220V or 240V supplies) between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

Ground the Product

This product is grounded through the grounding conductor of the power module power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the product input or output terminals. A protective ground connection by way of the grounding conductor in the power module cord is essential for safe operation.

Danger Arising Form Loss of Ground

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating) can render an electric shock.

Use the Proper Fuse

To avoid fire hazard, use only the fuse of correct type (Pixel products use slow blow fuses), voltage rating, and current rating as specified in the parts list for your product Refer fuse replacement to qualified service personnel.

Do Not Operate in Explosive Atmospheres

To avoid explosion, do not operate this product in an explosive atmosphere.

Do Not Operate Without Covers

To avoid personal injury, do not remove product covers or panels. Do not operate the product without the covers and panels properly installed.

Do Not Service Alone

Do not perform internal service or adjustment of this product unless another person capable of rendering first aid and resuscitation is present. When performing a service use isolation transformer to provide power. Replace parts with the same voltage ratings, and current ratings as specified in the parts list for your product.

AD2100 Operation Manual

Scope

This document describes the functionality of PIXEL AD2100 Audio Delay Synchronizer. The desired delay is entered and the synchronizer will determine and maintain the actual delay. Increase or decrease commands will be sent to the memory system to adjust the delay to the desired time.

Keypad

The keypad is a 16 key custom keypad. Keys are arranged according to the following drawing.

DUMP	1	2	3
MODE	4	5	6
HELP	7	8	9
ENTR	+/-	0	.

LCD display

A back lit LCD display is utilized which displays 2 lines of 20 characters each.

Bargraph display

It consists of 32 LED segments per channel. One step corresponds to 3 dB. Input overload (red LED is lit) and peak hold are utilized.

Input and output level adjustment

Four potentiometers are available on the front panel for adjustments of input and output signal levels.

Dump (Bypass)

When the synchronizer detects that the user requests a 0 delay the DUMP routine will invoke the bypass operation, and cause the LCD to display "DUMP MODE" on the top line and "RELEASE KEY TO EXIT" on the bottom line. As soon as the bypass is deactivated the delay will build up to its proper value.

DUMP can also be activated from remote unit through connector on the back panel.

Mode Select

The mode of operation is selected by pressing the MODE key. Additional key presses sequence the display through available modes. When the desired mode appears, pressing the ENTER key causes that mode to be executed.

Available modes are:

1.) Local Fixed Mode

In this mode user selects the desired delay by entering it on the keypad. Pressing the ENTER key this mode is executed, and display will show:

Increasing (or Decreasing) Delay
Delay: x.xxx Sec.

When desired delay is reached, the display will show:

Holding Delay
Delay: x.xxx Sec.

If the MODE key is pressed while AD2100 is changing the delay time, this will pause the delay change. By pressing the ENTER key the delay change will resume.

2.) Field Delay Mode

In this mode delay can be increased in 1/10 of a field steps. When this mode is selected the display will show:

Field Delay Mode
Enter: 1 - NTSC 2 – PAL

The next screen is:

Number of fields
Enter: XX.x

When desired delay is reached the display will show:

Field delay mode
Delay: XX.x Fields

3.) Local Variable Mode

In this mode, delay can be manually increased or decreased from front panel keypad. When this mode is selected the display will show:

Local Variable Mode
Manual Inc./Dec.

By pressing 1 on the keypad, delay is INCREASED, and by pressing 2 delay is DECREASED.
The display will show:

Manual Increase (or Decrease)
Delay: X.xxx Sec.

When key is depressed, the delay will remain set to the currently displayed value and display will show:

Holding Delay
Delay: X.xxx Sec.

AD 2100 will stay in this mode until another mode is selected by pressing the MODE key, so that the delay can be adjusted as many times as keys 1 and 2 are pressed.

4) Remote Mode

Remote delay mode derives the delay time from remote unit through connector on the back panel and creates the delay that is the sum of the remote delay +/- an offset delay. The value of the offset may be input by the front panel keypad, and if no offset is specified, it is assumed to be 0. When this mode is selected, the display will show:

Remote + Offset Mode
Enter: X.xxx Sec.

Entering the offset delay (no sign for the delay increase, and - sign for the delay decrease) and pressing ENTER, AD21 00 will start adjusting the delay.

The display will show:

Increasing (or Decreasing) Delay
Delay: X.xxx Sec.

When desired delay is reached, the display will show:

Holding Delay
Delay: X.xxx Sec.

Help

From each mode of operation an explanation about that mode can be requested by pressing the HELP key.

1.) When LOCAL FIXED MODE is selected by pressing the HELP key the display will show:

Enter fixed delay
value.

Pressing the HELP key again the display will show:

**Press MODE key to
pause.**

Pressing the MODE key returns to LOCAL FIXED MODE display or by pressing the ENTER key the normal operation will resume.

2.) When FIELD DELAY MODE is selected by pressing the HELP key the display will show:

**Field Delay Mode
Delay = XX.X Fields**

Pressing the HELP key again the display will show:

**Enter the delay
in Fields**

Pressing the HELP key again the display will show:

**Increment step is
1/10 of Field**

Pressing the HELP key again the display will show:

**Press 1 for NTSC
Press 2 for PAL**

Pressing the MODE key returns to FIELD DELAY MODE display.

3.) When LOCAL VARIABLE MODE is selected by pressing the HELP key the display will show:

**Increase or Decrease
by manual key press.**

Pressing the HELP key again the display will show:

**Key 1 to Increase
Key 2 to Decrease**

Pressing the MODE key returns to LOCAL VARIABLE MODE display.

4.) When REMOTE MODE is selected by pressing the HELP key, the display will show:

**Enter fixed offset
to add to remote.**

Pressing the HELP key again, the display will show:

**Value may be entered
positive or negative**

Pressing the HELP key again, the display will show:

**Current Remote Delay
Delay: x.xxx Sec.**

Pressing the MODE key returns to REMOTE MODE display or by pressing the ENTER key the normal operation will resume.

TECHNICAL DESCRIPTION

The Pixel AD2100 Audio Synchronizer achieves high performance broadcast specifications through utilization of 16 bit Delta/Sigma A-D (Analog to Digital) conversion and over-sampling.

Delay is manually adjustable from 0 to 5.461 seconds in 1 millisecond steps, and automatically adjustable with 1 ms resolution.

The unit has front panel controls for delay setting and operating mode, and an LCD readout which provides a continuous indication of the actual delay.

A LED "Bar Graph" type meter is provided for visual monitoring of the audio input signal. In addition, front adjustments are provided for ease of input and output audio level setting.

An automatic audio delay increment mode is provided to allow the unit to immediately begin incrementing delay after selection of 0 delay via the dump command. This feature will be commonly used if the unit is employed in a talk show censoring application. Sophisticated utilization of microprocessor and digital hardware coupled with advanced software algorithms ensures the most transparent audio possible during the delay change period.

Stereo capability is provided within the unit. As a result, absolute channel to channel phase integrity is maintained.

The self powered two channel unit occupies one rack unit (1.75 inches) of standard 19 inch rack mount space with audio input and output on standard XLR type connectors.

TECHICAL SPECIFICATIONS

Configuration	Two channel tracking (stereo)
Delay Capacity	5.461 seconds at full 48 kHz sampling.
Frequency response	+/- 0.5 dB, 20 Hz - 22 kHz, reference 1 kHz.
Dynamic range	> 95 dB, 20 Hz - 22 kHz band limited, un-weighted
Dump capability	front panel dump push button causes instant 0 delay with subsequent loss of audio in memory.
Encoding format	16 bit linear PCM, 48 kHz sample rate.
THD + Noise	< 0.01 % upper 20 dB of Dynamic Range.
SMPTE IM distortion	< 0.02% upper 20 dB of Dynamic Range
Separation	> 80 dB
Channel phase match	+/- 1° to 15 kHz.
Bypass	automatic relay bypass in the event of power failure.

INPUTS

Configuration	active balanced 20 k Ω input impedance, jumper selected to 600 Ω .
Gain	variable front panel trim 24 dB maximum.
Max input level	+/- 27 dBu

OUTPUTS

Configuration	active balanced 10 Ω impedance
Gain	variable front panel trim.
Max input level	+/- 27 dBu into 10 k Ω load +/- 24 dBu into 600 Ω load

POWER

115/230 V AC, 50/60 Hz
50 watts maximum.

ENVIRONMENTAL

Operating temperature	0°C to +45°C
Storage temperature	-55°C to + 75°C
Humidity	10- 95%, non condensing

PHYSICAL

Width	19.0" (43.8 cm)
Height	1.75" (4.5 cm)
Depth	19.0" (43.8 cm)
Weight	9.4 lb (4.26 kg)

Allow additional depth of 1.5" (3.8 cm) for cable radius.

NOTE: specifications subject to change without notice

AD2100 THEORY OF OPERATION

A-D/D-A section

The Audio Synchronizer is configured to operate with balanced audio lines. The input amplifiers made of U47/U65 are high impedance and configured as instrumentation amplifiers. Switches S7/S8 are used to terminate input line with 600 ohm. DC CMRR is minimized by adjusting R16/R17 and AC CMRR by adjusting R125/R126. Switches S5/S6 are included for selecting the proper headroom in 4 ranges from 0dBm to 24dBm. Fine level adjustment is accomplished by means of 19K pots that are located on the front panel and connected through headers J14/J15. K1, K2, K3 and K4 are relays that are used to switch the unit between bypass and operate mode. On power up, built in delay switches relays into operate mode after few seconds delay, thus allowing power supply to settle down. Early power failure detection switches relays into bypass mode providing for smooth transition.

After being buffered audio signal enters A-D converter U48, CS5326. CS5326 is 8X oversampling, 16 bit converter that provides serial output at 48KHz word rate. Timing signals are derived from circuitry that consists of U54, U98A, U59, U55, U60 and U99. U48-23, CLKIN gets 6.144 MHz, U48-15, SCLK gets 3.072 MHz, and U48-14, UR gets 48 kHz. Delay reset on power up is set by R109 and C156.

Data and necessary timing signals are supplied to Bar Graph Display through U68 and J7. Timing signals for delayed data processing are derived from variable clock V ARCLK/2 coming from PLL section by means of U56 and U57. U58 is a troubleshooting aid, used to switch between delayed and non-delayed operation, and is controlled by switch S3. In either mode selected, signal enters 8X oversampling digital filter U49, SM5813AR, and then D-A converters U50/U53. AD1862 is 20 bit D-A converter that gives excellent signal to noise performance, while 16 most significant bits are used for improved signal linearity. U51/U52 are low noise Op-Amps and are used as current to voltage converters. Analog filtering is obtained through active filter consisting of U66B,C/U67B,C.

Switches S1/S2 are again included for selecting the proper headroom in 4 ranges from 0dBm to 24dBm. Fine level adjustment is accomplished by means of 10K pots that are located on the front panel and connected through headers J16/J17.

Output stage consists of U66A,D/U67A,D and U63, U64, U61 and U62. L T1010 is low noise driver capable of driving large capacitive loads Le. long cables.

PLL section

PLL section produces variable clock that is used by processor circuitry to increase or decrease delay. Reference frequency enters phase detector U44, U46B, and phase error between reference and VCO feedback frequency gets translated into error voltage by D5,D6, U19A. This error voltage controls VCO (D2, L 1, U 18D). Increase or decrease of frequency is controlled by microprocessor through U45D and U19C. By varying VCO-s frequency change in the relative timing positions for read and write addresses are achieved.

Memory and Address section

Serial data coming from A-D converter, U48, is converted into parallel data by means of U29, U30, U31 and U32. Data is then stored into left and right memory banks (U6, U7, U8, U91 U2, U3, U4, U5). Memory addresses are decoded and generated by U10, U11, U12, U13, U15, U16 and U41 under microprocessor control. Data to be output is latched by U25, U26, U27, U28 and converted into serial data stream by U21, U22, U23 and U24.

Microprocessor section

U70, 80C30, is microprocessor that controls the operation of AD21 00 in conjunction with ROM 27128, U73, and PAL-s 22V10 U78, U83. They generate all necessary timing and functional procedures. Header J4 is connected to front panel key pad, which is used to enter desired delays and modes of operation.

Header J5 is connected to front panel LCD delay. Pot R88 controls the viewing angle of the LCD display.

U71, X2444, is a nonvolatile RAM memory that stores the mode of operation and delay values that were last entered. If the power fails, upon subsequent power up, this last mode of operation is recalled from memory and automatically reentered.

Switch S1 is used to setup maximum delay, and should not be changed in the field!

U90 and U91 generate time base for controlling real time delays and it is decoded by U86, U87, U88, U89 and latched by U84 and U85.

J6 is communication port.

J3 is port through which desired delay is entered when unit operates in remote mode and it is in form of high going pulse. Pulse is high for, as many milliseconds as delay is desired.

Power supply section

AC voltage is filtered through LC line filter and additional protection is achieved by transient voltage suppressor, RV1, fuse and RC snubber R500, C500. Transformer T1 can be used for 110V or 220V operation. It has two secondaries of which one is center tapped. D500 is rectifier bridge for +5V. Unregulated +5V is supplied to fan. MC78T05, U500 is +5V digital voltage regulator.

D503 is bridge rectifier that provides unregulated voltages for +12V analog - U501, -12V analog - U502, -12V digital- U506, and -5V digital- U503, regulators.

U504 monitors +5VD, +12VA, -12VA and line voltage for overvoltage and undervoltage. It also provides power failure output that is used to switch input and output relays into bypass mode.

ADJUSTMENT PROCEDURE

Put the oscilloscope probe at U47C/U65C pin 8, marked as the test points TP1/TP2. Set the oscilloscope to DC, 50uS and 20mV per division.

Adjustment of DC CMRR.

By inserting jumpers JP1/JP2 tie inputs together, and adjust R16/R17 for minimum output change when input voltage is changed from -5V to +5VDC.

Adjustment of AC CMRR.

With inputs still tied together and driven by common 10kHz, 10Vp-p sinusoid, adjust R125/R126 for the minimum AC component at the output.

With proper calibration this stage offers a CMRR of about 110dB well into the kHz range.

Adjustment of PLL center frequency.

Connect the oscilloscope probe to U19 pin 7. Press and hold the front panel 'DUMP' button. Misadjust the PLL by tweaking L1 so that the error voltage grows negative until the PLL loses lock i.e. error voltage becomes noisy. Tweak L1 the other way until lock is achieved again. Read that voltage. Repeat the same procedure for the positive voltage excursion. Read the positive lock-in voltage. Adjust L1 so that the error voltage is set to the middle point of measured positive and negative lock-in voltages.

Adjusting the speed of delay time acquisition.

Turn R8, located in the PLL section, clockwise if slower change desired, and vice versa. The slower the change, the less the pitch shift is and the longer the time to acquire the desired delay. Make the compromise that suits your need the best.

Adjustment of the LCD display viewing angle.

Observing the LCD display adjust R88 until desired result is obtained.

Adjustment of audio level.

Adjust the front panel potentiometers clockwise to increase the audio level.

Explanation of switches, their functions and settings

a.) SW1 is 8 position DIP switch that is used to select maximum delay. The proper setting is:

- 1 = on**
- 2 = on**
- 3 = on**
- 4 = off**
- 5 = on**
- 6 = on**
- 7 = off**
- 8 = on**

To verify that switch setting is in the right position put the unit into LOCAL mode of operation and enter 8 seconds delay. The LCD display should show:

**Error in time entry.
Max Value: 5.461**

b.) S1, S2, S5, S6 are two position DIP switches. They adjust for the proper headroom on the input and the output, respectively. "ON" position means that the signal level is increased. Adjust the front panel pots clockwise for maximum gain.

On the input side, NEVER allow for signal at U48 pins 2 and 27 to be greater than 7Vp-p.

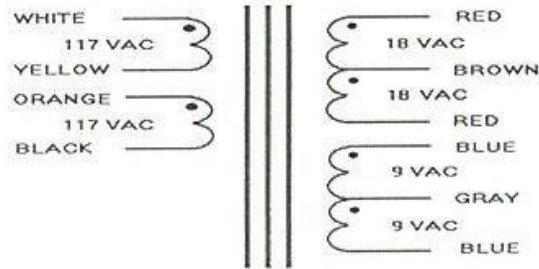
On the output side, NEVER allow for signal at U61, U62, U63 and U64 pin 5 to be greater than 15Vp-p.

Return the front panel pots to middle position.

c.) S3 is the slide switch that selects between delayed and non-delayed mode of operation. When S3 is in "N" position delayed mode is selected.

d.) S7 and S8 are slide switches that connect 600 ohm termination to the input line. Observing the unit from the front panel side and setting the switches to the right, 600 ohms termination is selected.

120/240 V POWER SUPPLY MODIFICATION



PRIMARIES ARE INSIDE A BLACK SLEEVE

120V Configuration

Connect together:
WHITE & ORANGE
YELLOW & BLACK

240 V Configuration

Input wires: WHITE & BLACK
Connection: YELLOW & ORANGE