WORKSTATION24 AD/DA

24 BIT PERFORMANCE DAW INTERFACE

MYTEK DIGITAL • USA

Owner's Manual

REVISION 4/98

Contents:

1. Quick description of the features.

Workstation AD/DA is more than just a digital audio converter. It is a complete front end for you computer workstation. We will call it here "the Interface". The chart below and on the next page explains the basic setup and functions of the interface. On the next pages you will find diagrams of the signal flow and basic steps for a quick start.

WORKSTATION24 AD/DA

24 BIT PERFORMANCE DAW INTERFACE

MYTEK DIGITAL • USA

POWER ON

EXT. DIGITAL — [AES/EBU / S/PDIF / ANALOG]

INPUT [INPUT / COMPUTER]

MONITOR & DIG OUTS

ADC SYNC [EXT.WCK / INTERNAL]

EXT.DIG. IN LOCK
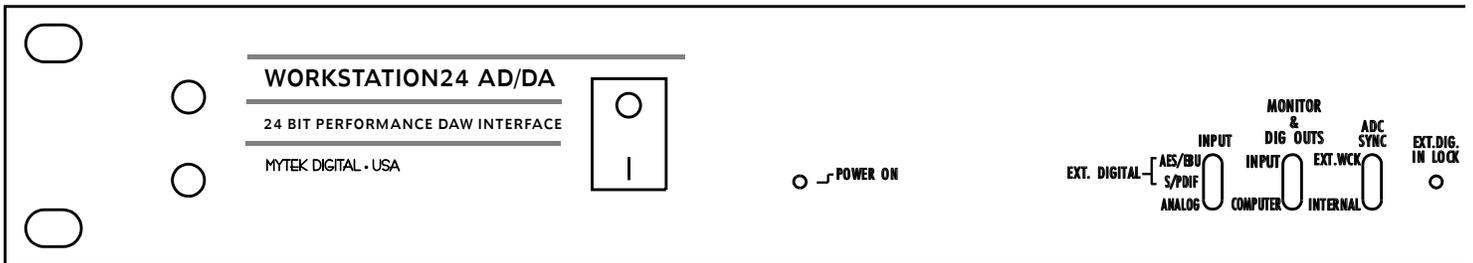
Turns the power on and initiates the converter's self-calibration. Turn it off/on to reset the converter. There is a 5 secs delay before the interface starts to operate after the power up. Power off/on to reset the unit.

Selects the input which then is present on the analog and all digital outputs.

Sets the clock reference. Set it to "Int" unless you are using ext. wordclock sync

(Chapt.7)

Takes out the computer from the signal path.

(See Chapt.6 "stand alone")

EXT.DIG. IN LOCK COMP.DIG. IN LOCK EXT.WCK LOCK

SAMPLING [48kHz / 44.1kHz] HiBit16 [ON / OFF]

OUTPUT LEVEL L —-20dB— R

INPUT LEVEL L —OVER— -20dB— R

Sets the sampling of the ADC and control bits on all digital outs. Must be always set right for digital transfers.

Led shows peak value of the analog and "ext.dig." outs.

Meter shows peak value of the ANALOG input.

The leds indicate lock to a particular signal clock.

HiBit16 converts 24 bit to 16 bit. Use only when going to 16 bit media. (Chapt.8)

Adjusts the analog output level.

(Chapt.3)

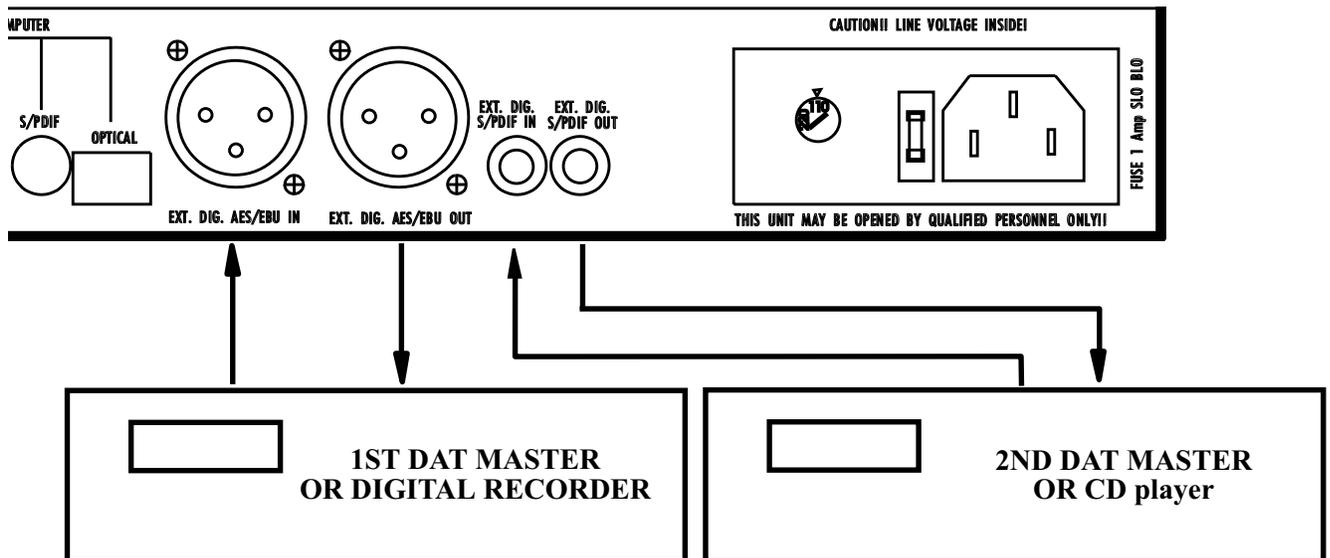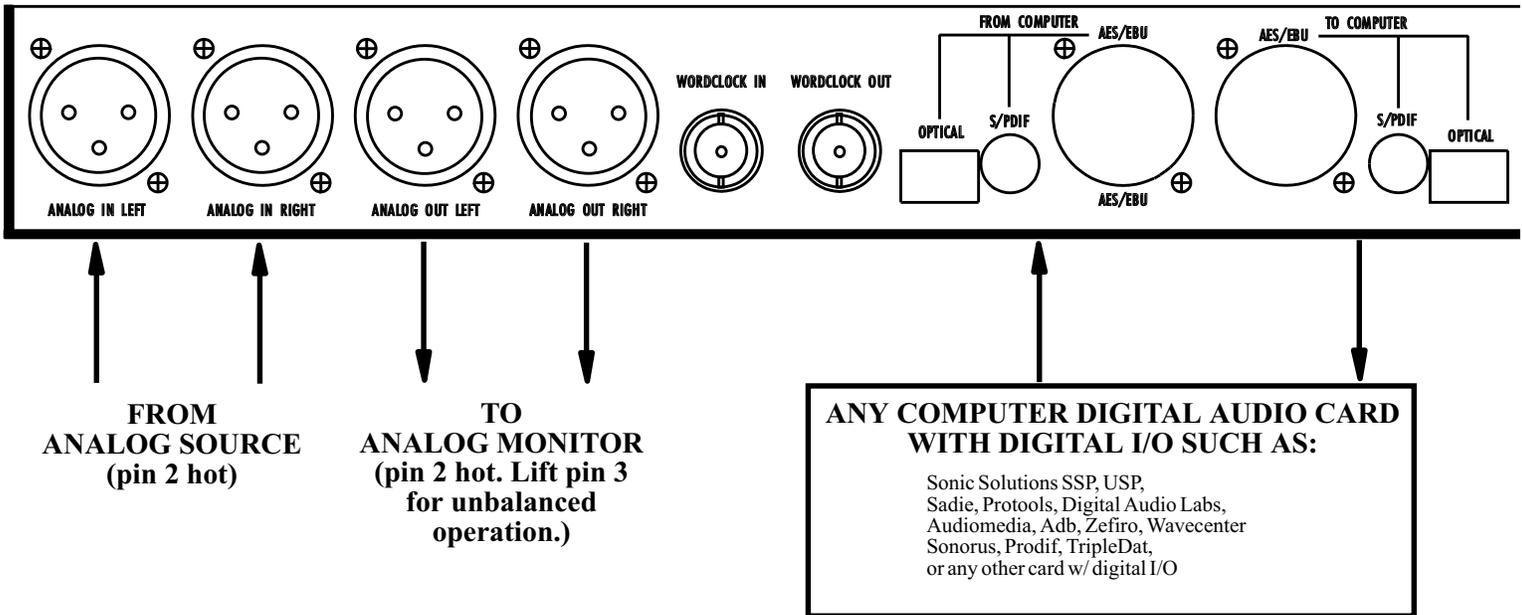Adjusts the analog input level.

(Chapt. 3)

NOTE: All outputs are muted if:
1. external clock is selected but not present.
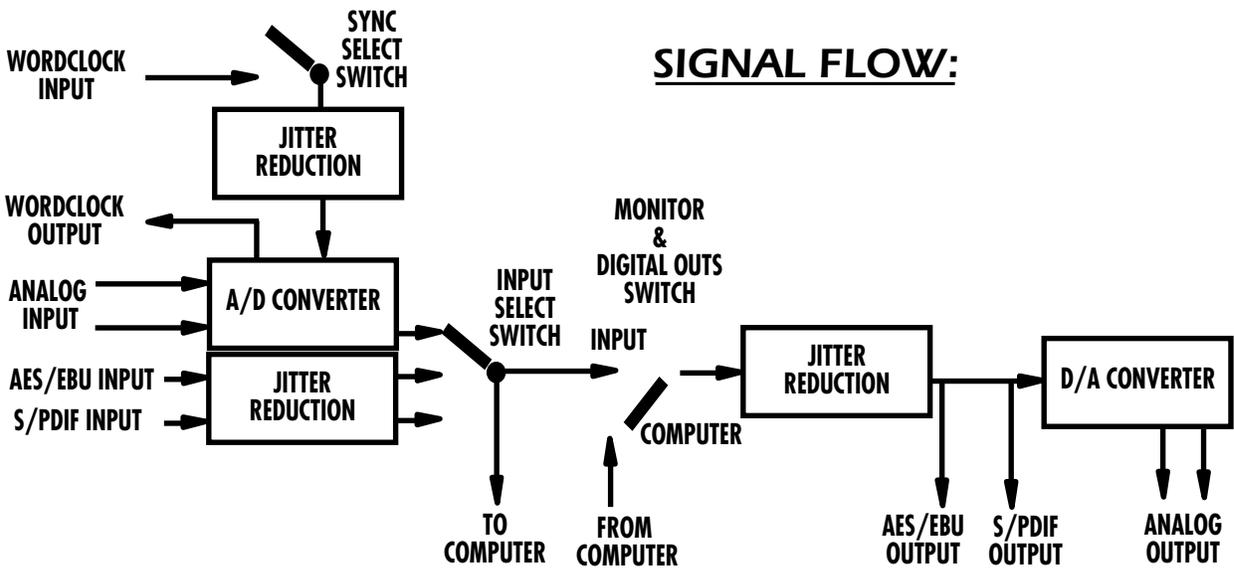2. Digital input with no input signal is selected.
This is done on purpose to avoid interference of unsynchronized clocks which could degrade the sonic performance of the interface.

2

2. Setting up your system.

This diagram shows how to set-up your system. This is the basic setup for a digital workstation and two DAT machines. If you don't use a computer please refer to chapter 6. If you want to use external sync please refer to chapter 7. Digital in/outs can also be used for any other digital device such as CD player, CD recorder, digital multitrack, digital console, sampler etc.

ANALOG IN LEFT ANALOG IN RIGHT ANALOG OUT LEFT ANALOG OUT RIGHT WORDCLOCK IN WORDCLOCK OUT FROM COMPUTER AES/EBU OPTICAL S/PDIF AES/EBU AES/EBU TO COMPUTER S/PDIF OPTICAL

FROM
ANALOG SOURCE
(pin 2 hot)

TO
ANALOG MONITOR
(pin 2 hot. Lift pin 3
for unbalanced
operation.)

ANY COMPUTER DIGITAL AUDIO CARD
WITH DIGITAL I/O SUCH AS:

Sonic Solutions SSP, USP,
Sadie, Protools, Digital Audio Labs,
Audiomedia, Adb, Zefiro, Wavecenter
Sonorus, Prodif, TripleDat,
or any other card w/ digital I/O

COMPUTER S/PDIF OPTICAL EXT. DIG. S/PDIF IN EXT. DIG. S/PDIF OUT CAUTION!! LINE VOLTAGE INSIDE! FUSE 1 Amp SLO BLO

EXT. DIG. AES/EBU IN EXT. DIG. AES/EBU OUT THIS UNIT MAY BE OPENED BY QUALIFIED PERSONNEL ONLY!!

1ST DAT MASTER
OR DIGITAL RECORDER

2ND DAT MASTER
OR CD player

This diagram shows the signal flow.
The jitter reduction circuit stabilizes the bit clock without altering the data bits
All paths are 24 bit.

SIGNAL FLOW:

WORDCLOCK INPUT

SYNC SELECT SWITCH

JITTER REDUCTION

WORDCLOCK OUTPUT

ANALOG INPUT

A/D CONVERTER

AES/EBU INPUT

S/PDIF INPUT

JITTER REDUCTION

INPUT SELECT SWITCH

MONITOR & DIGITAL OUTS SWITCH

INPUT

COMPUTER

TO COMPUTER

FROM COMPUTER

JITTER REDUCTION

D/A CONVERTER

AES/EBU OUTPUT

S/PDIF OUTPUT

ANALOG OUTPUT

Please follow these steps to setup your system:

1. Setup all connections
2. Power up the interface and all other equipment
3. Align the interface analog inputs and outputs (Chapt.3)
4. Operate

4

3. In/out alignment.

Before using the interface you need to align its analog inputs and outputs. You have to arbitrarily decide what will be your "0 VU" reference level. It is usually between -20 and -14dB. It defines how much headroom you have left over the normal operating "0 VU" level. You may set it at the same level as the other piece of equipment. For example Panasonic 3700 is fixed at -18dB (which is btw low for most rock and roll recordings). ADAT is fixed at -15dB which is an optimal level.

There are two ways of precise alignment of in/out level. One requires a reference level tape or CD, while the other requires hi-res digital meter such as Mytek DDD-603. The reference tape containing various tests signals is available from Mytek .

Alignment of in/out level using a reference level tape or CD.

1. Connect the DAT machine or the CD player digital output to one of the external digital inputs.

2. Select the appropriate digital input. Set the monitor switch to "input" and ADC sync to "internal".

3. Play the tape. You have to select the signal that is approx. 1kHz at the operating level you have chosen (let's say you have chosen -15dB).

4. Send the signal from the analog output to the console VU meter. If you don't have a VU meter you can use an AC voltmeter set to measure AC RMS values. "0 VU" at + 4dB corresponds to 1.225 Volts RMS measured between pin 2 and 3 of the output XLRs.

5. Using a tweaker or a small screwdriver adjust the analog outputs so the VU meter reads "0 VU".

6. Set the oscillator in your console at 1kHz and "0 VU". Send the oscillator to the interface analog input.

7. Select the "analog input". Send the signal from the analog output to the VU meter.

8. Adjust the analog input level to get "0 VU" reading at the VU meter.

You now have done the alignment and the interface is set at unity gain. Check the alignment always before performing important work.

Alignment of in/out level using a hi-res digital meter. You can try using the DAT machine meters but this will not give you the needed accuracy.

1. Set the oscillator in your console at 1kHz and "0 VU". Send the oscillator to the interface analog input.

2. Select the "analog input". Connect the digital meter to a digital output.

3. Adjust the analog input level to get appropriate reading of the meter (for example -15dB). Use hi-res calibration mode.

4. Send the analog outputs to the VU meter.

5. Adjust the analog output level to get "0 VU" reading of the VU meter.

You now have done the alignment and the interface is set at unity gain. Check the alignment always before performing important work..

4. Jitter reduction and fromat conversion. Digital inputs and outputs.

Jitter reduction. The interface employs three jitter reduction circuits. One is for the digital inputs, one for external wordclock input and one for the digital outputs and D/A converter. They stabilize the digital audio clock without altering the audio data. It translates to smoother and more transparent sound. "Sonic Solutions" users will especially benefit from these circuits since the original SSP3 card and Sonic optical converters (now not needed) introduce large amount of jitter.

Digital outputs/inputs. Digital outputs comply with the AES/EBU, SPDIF (Consumer IEC 958) and optical Toslink (default set as AES/EBU) standards. (The optical output can be set to SPDIF format by setting the jumper located just by the optical input connector. You will need to cut "AES" connection and add "SPDIF" jumper. You also need to move the IC703 (left from jumper) to position IC704). The outputs are transformer isolated. For best performance use AES/EBU output and a 110 Ohm digital cable. Second in quality comes SPDIF output which should be used with a 75 Ohm video cable. The optical Toslink interface works with plastic fiber cable such as for the ADAT.
All digital inputs will correctly read either AES/EBU or SPDIF signal should that be necessary. Jitter performance however might be compromised because of the impedance mismatch.

Format conversion. The interface provides instant digital format conversion between all digital inputs and outputs. Following rules apply:

-all bits are transferred without change. Signal path is 24 bit.
-sampling frequency flag is set by the switch at the front panel. Must be always set right for digital transfers.
-emphasis flag is transmitted as 50/15us flag.
-user bits are zeroed.
-clock jitter is reduced.

To/from computer digital out/in. Workstation AD/DA is made in three flavors to accommodate various types of workstations on the market. They can be:
-AES/EBU
-SPDIF
-Toslink optical
-Any combination of above (extra in/outs at additional charge)

If your interface has more than one "to/from computer in/out" installed you can use all "to computer" outputs at the same time but only one "from computer" input can be connected at a time.

5. 44.1k or 48k ?

The difference is mainly in the audio band. In case of the Workstation AD/DA the passband for 44.1k is 22k and it is 24k for 48k sampling rate. Although you can hear the benefits of the bandwith extended to 40k, this difference is miniscule. When mixing to DAT the answer is simple - 44.1k because that's what CD is. If you are tracking and are going to mix through an analog console use 48k, but if the console is digital or you expect your recordings to be mixed digitally later, go with 44.1k.

6. Using Workstation AD/DA as a stand alone converter.

Workstation 24 It can be used as a front end for any DAT machine. It certainly sonically outperforms all of them. -103dB THD of the A/D converter is about 15dB less than that of any DAT machine. The converter sounds smoother, more natural and transparent. The setup shown in Fig.6.1 allows for "post recorder" signal monitoring. The external digital outputs can also be used for A/D and D/A conversion but will not allow for "post recorder" monitoring. In this mode the input has to be set to analog, the monitor switch to "input" and the input switch has to be switched to appropriate dig in for playback off the recorder.

If you need to sync your recorder to the external source (for example for video work) you can use the external wordclock sync. This automatically will synchronize the recorder when it's resolved to its digital input clock.
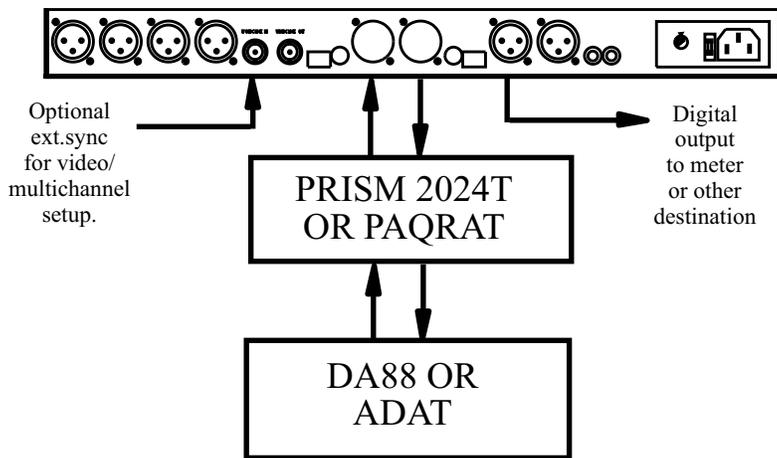
Fig.6.1   24 bit recording using bit splitter
We highly recommend to mix and master to 24 bit tape rather than a DAT machine. Maintaining 24 bit signal path throughout the recording and redithering just before sending the material to CD plant, results in significantly better sounding CD and a better quality archival material. A cost effective 24 bit mastering setup can be assembled using an MDM and a bit splitter as shown on the left. This connection allows for "post MDM" signal monitoring. The Monitor switch has to be set down to "computer".
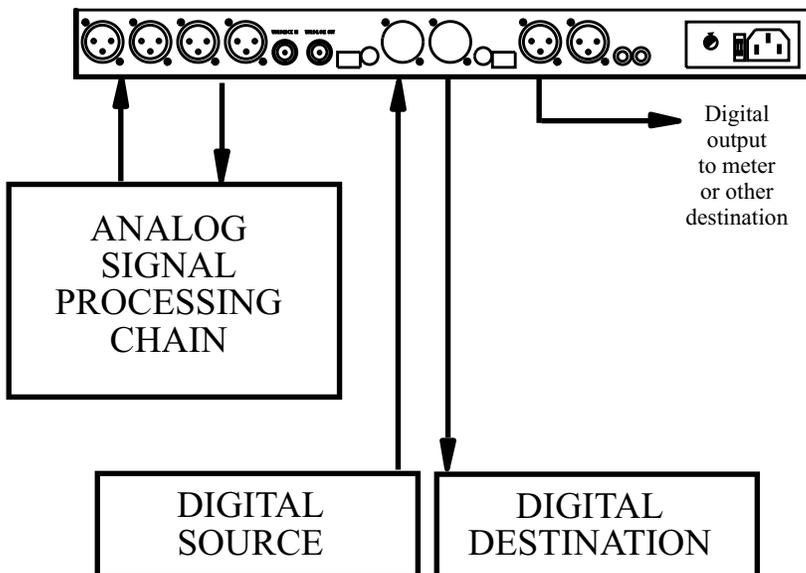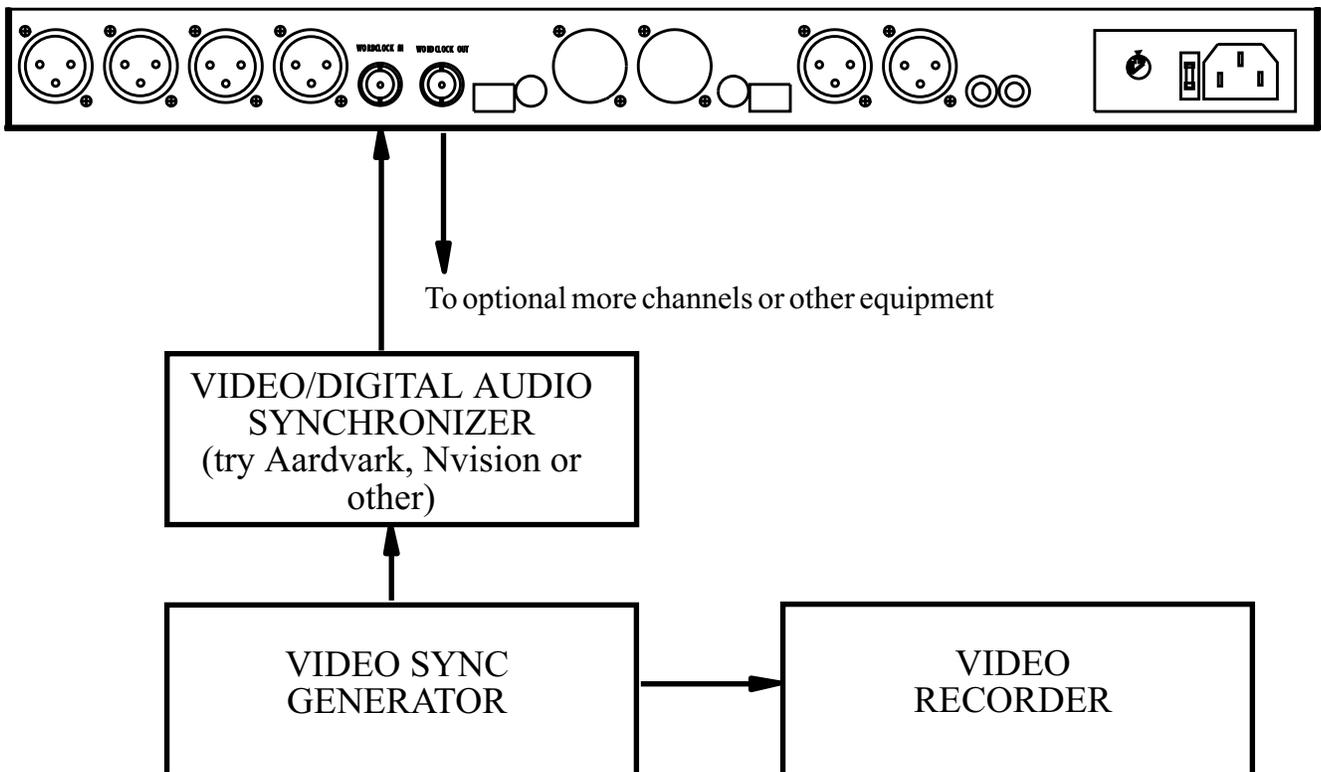

Fig.6.2   Using A/D independent of D/A
A/D and DA sections of the unit can be used independently i.e. on separate clocks and separate signals. In this example the unit is used to convert digital source for analog processing and than convert it back to digital.

7. External synchronization.

External synchronization is needed whenever the interface's A/D clock has to be referenced to a clock of a different device in the system. Here are some examples of the most popular applications:

Sound for picture. The wordclock input of the interface must be connected to a wordclock generator synchronized to video.

To optional more channels or other equipment

VIDEO/DIGITAL AUDIO
SYNCHRONIZER
(try Aardvark, Nvision or
other)

VIDEO SYNC
GENERATOR

VIDEO
RECORDER

Multichannel operation. You can daisy-chain several interfaces in order to get more channels. Let's say you want 8 channels of input/output for your Sonic Solutions station. You will need 4 Workstation AD/DA interfaces and 3 BNC type 75 Ohm cables. You will also need 2 "T" BNC type adapters (Radio Shack).
First interface is the master and the rest are slaves. If you are doing sound for picture you may sync the first unit to video as on the previous page.
You could also daisy chain the units wordclocks but we recommend using the "T" adaptor for more stable clock. The wordclock output of the interface can drive up to 15 LS TTL loads. The wordclock input is one LS TTL load.
The interface outputs wordclock only if "analog input" is selected.
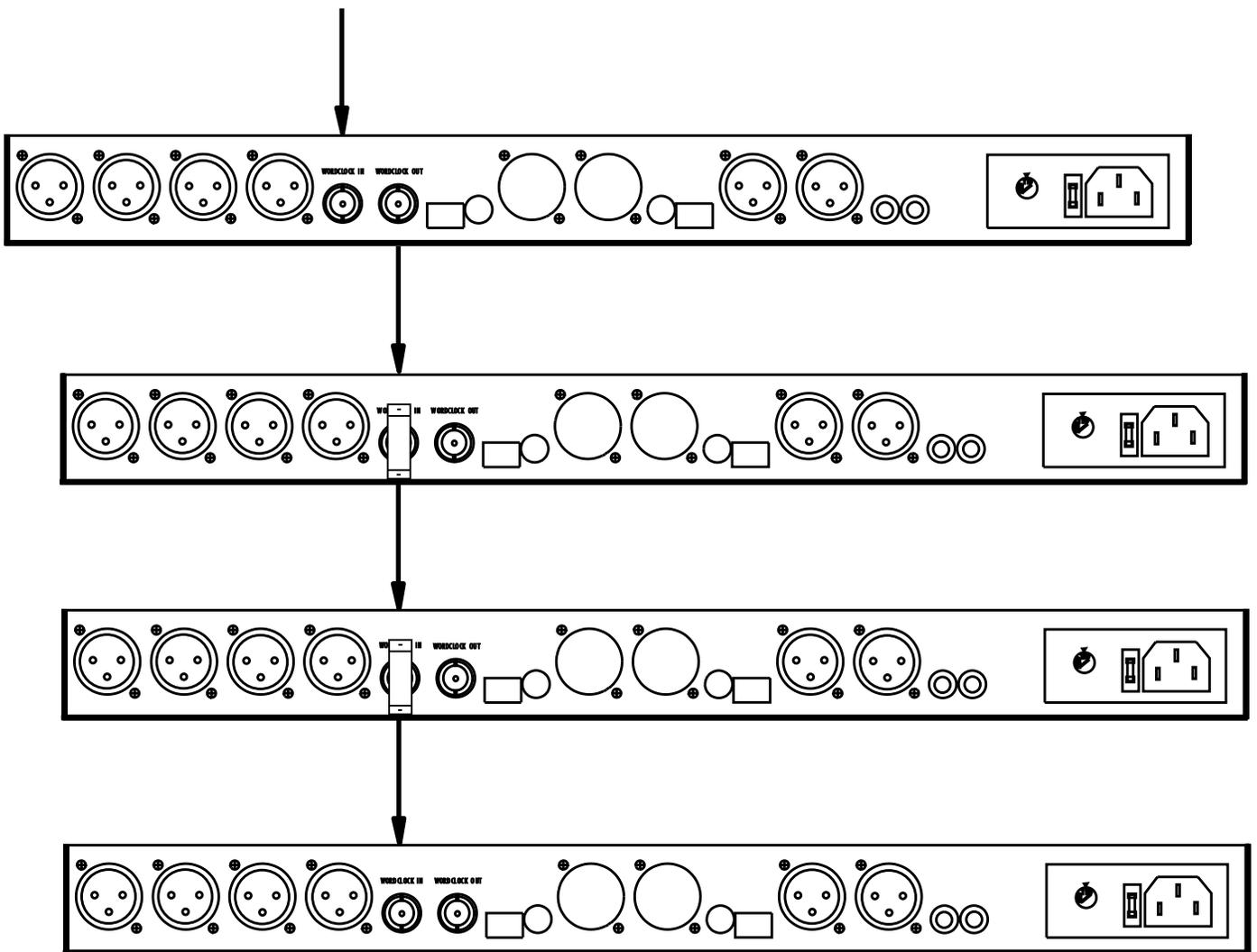
Digital console. If you are using the interface with a digital console such as Yamaha 02R you may either slave the interface to the console or opposite. The latter will not compromise A/D conversion since the converter will be referenced to its internal crystal with almost no clock jitter.

DIGITAL
CONSOLE
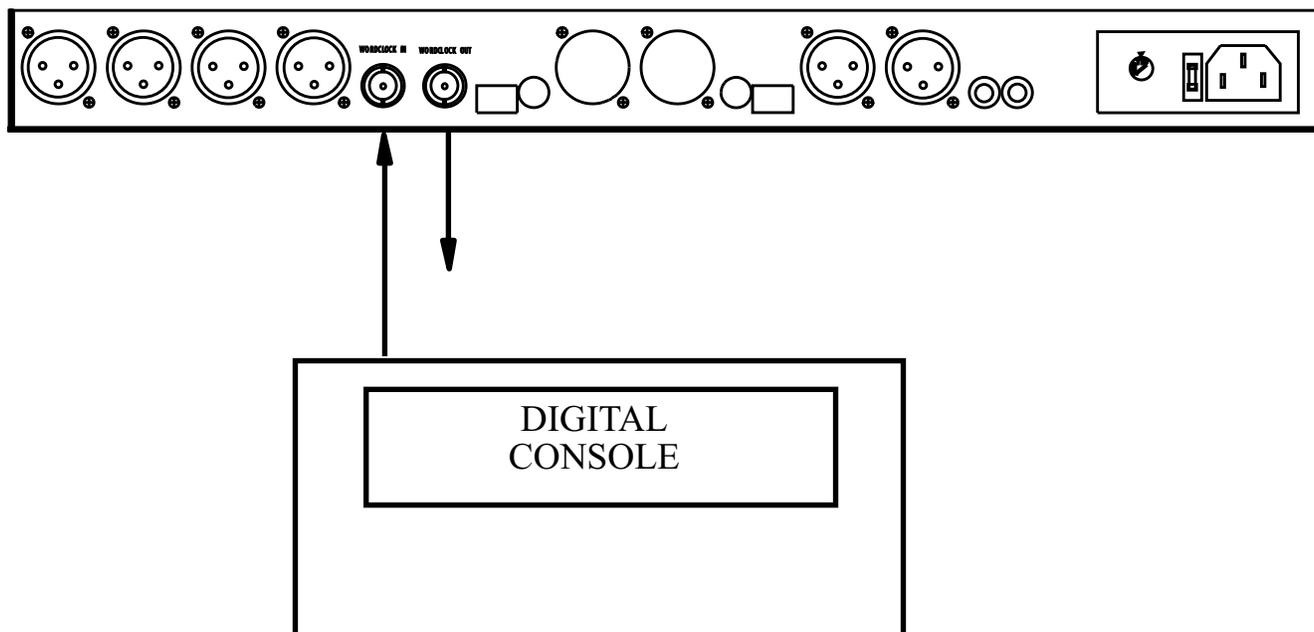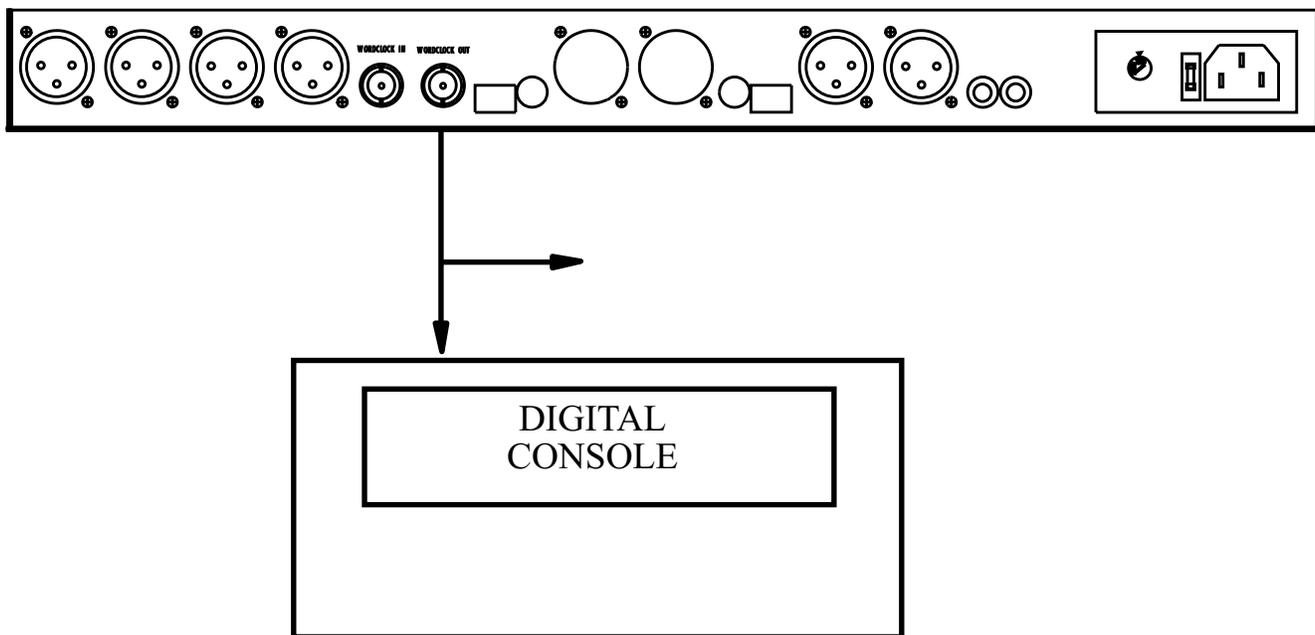
DIGITAL
CONSOLE

6. HiBit-16 (tm) -putting 24 bits onto 16 bit digital tape.

Although the DAT and CD are "16 bit" it is commonly known that 16 bit converters are really 15 bit or less and you need a higher resolution converter to approach theoretical limitations of a 16 bit medium. But still higher resolution is needed for more sound information, especially for fine details, reverbs and ambience sounds. The 24 bit ADC provides the resolution, but the tape is still 16 bit. You can preserve this high resolution by using the HiBit-16 (tm) process which by adding high frequency bias modulates the 16th bit in order to achieve close to 24 bit resolution. It can be achieved thanks to almost ideal differential linearity of the Workstation24 and its very high dynamic range. The program recorded using this method has more detail than if it was "truncated" to 16 bit. The noise floor is now kept flat on the 16 bit level (-96 dB) while the detail is heard through the noise. Truncation on the other hand would produce low level distortion and result in the loss of low level ambience sounds. In the real world the noise floor of the program is nowhere near -96 dB, usually around -70 dB for an analog mix and around -90 dB if going directly from a good mic preamp. In our opinion there is a little benefit from using various "bit mapping" systems which focus on lowering the noise floor to -110 dB at the expense of coloring the sound and boosting (plus modulating) the high frequency noise. HiBit-16 is a linear process which does not affect the sound and does not modulate the noise floor leaving it flat at -96 dB level. When using the process please keep in mind that its effect will be less audible on a program with high noise floor because of the noise becoming a natural "dither" for the converter. In any case however, the low level resolution will be preserved. Here are some graphs illustrating the idea:
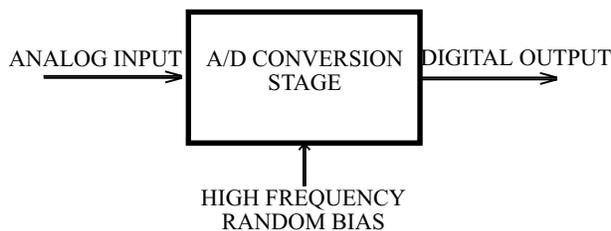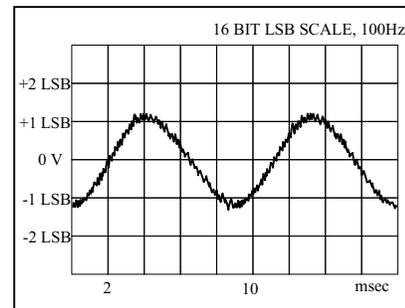
Fig. 6.1- HiBiT-16 process

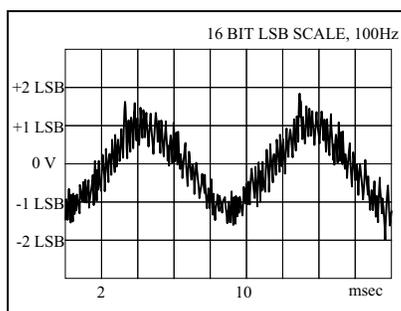Fig. 6.2- Very low noise sinewave
input at -90dBFs

Fig. 6.3- Same signal after
HiBit-16 process.

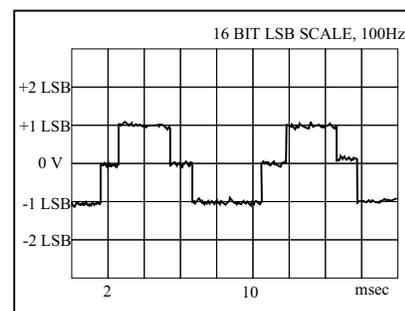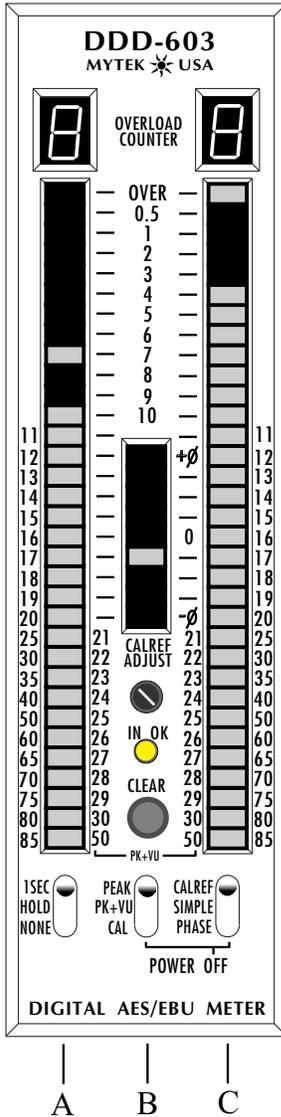Fig. 6.4- Same signal after
16 bit truncation

DDD-603 Digital AES/EBU/SPDIF Meter

ACTUAL SIZE

1.425" wide
12 units fit
into 19" rack

This mastering quality meter has ballistics
and overload indication same as Sony 1630
plus additional very useful peakcounter
and phase meter.
normal "peak mode" shown only:
(there are two more modes:
"peak+VU" and "calibration")

5.25" high (3U), 5.50" deep

DDD-603
MYTEK ✴ USA

OVERLOAD
COUNTER

OVER
0.5
1
2
3
4
5
6
7
8
9
10

11
12
13
14
15
16
17
18
19
20
25
30
35
40
50
60
65
70
75
80
85

+ø

0

−ø

21
22
23
24
25
26
27
28
29
30
50

CALREF
ADJUST

IN OK

CLEAR

PK+VU

11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
50

11
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20
25
30
35
40
50
60
65
70
75
80
85

1SEC
HOLD
NONE

PEAK
PK+VU
CAL

CALREF
SIMPLE
PHASE

POWER OFF

DIGITAL AES/EBU METER

A   B   C

Overload counter counts every time the "over" l.e.d. is lit. The counter counts up to 10. "E" reading means 10 or more. The counter can be cleared by "clear" button.

"Over" l.e.d. shows true digital overload (after 3 subsequent samples exceed max. range).

The L and R bargraph indicates peak value of the signal. The meter ballistics are carefully managed by internal software to naturally represent incoming sound.

The highest lit l.e.d. (including "over" l.e.d.) can be held for 1 sec., memorized or immediately turned off. These functions are controlled by switch A. Memorized segment can be cleared by "clear" button.

The middle small bargraph has two functions controlled by switch C. In the "phase" mode it serves as a phase correlation meter. In the "CALREF" mode the bar shows 0 VU reference level..

"In OK" l.e.d. shows presence of input AES/EBU signal i.e. indicates proper digital connection.

Position "simple" of the switch C leaves active the L and R bargraph only. The overload counter and the middle bargraph are turned off. This feature facilitates equipment operation during long hours of

The front panel finish is black anodized aluminium. The unit is powered through an external international (100-240 VAC) power adaptor (included). Another type external +5V regulated power supply (1.5 Amp per meter) can also be used. DDD-603 is portable, can be placed ontop of a console bridge, mounted into console or in a 19" rack (w/ optional hardware). Both digital input and digital throughput are provided on two XLR connectors mounted in the back. The meter accepts AES/EBU or SPDIF inputs. An RCA to XLR adaptor is required for SPDIF signals.

10. Specifications

A/D Converter

Conversion:	Linear oversampled 1 bit, noise shaping, linear phase digital filter
Resolution:	24 bit
Sample Rate:	44.1 kHz and 48 kHz or wordclock 30-50kHz
Dynamic Range:	117 dB (A-wgt), 114 dB (Tot)
THD + Noise:	-103 dB, (<0.001%)
Input:	+4 dBm balanced or unbalanced, 10 kOhm min., adjustable +/-15dB
Digital Outputs:	AES/EBU, SPDIF, and/or Optical Toslink, depending on option, all simultaneous
External Sync:	Wordclock in and out. 15 LS TTL loads max. on the output.
Mains:	100/110 - 220/240 V switchable
Dimensions:	1 rack space wide by 1 U high by 5.5" deep. (19"x1.75"x5.5")

D/A Converter

Conversion:	Linear oversampled 1 bit, noise shaping, linear phase digital filter
Resolution:	24 bit
Sample Rate:	all standard or 30-50kHz
Dynamic Range:	106 dB (A wgt), 103 dB (Tot)
THD + Noise:	-98 dB
Output:	+4 dBm balanced or unbalanced, 10 kOhm min., adj. -15dB, +10dB
Digital inputs:	AES/EBU, SPDIF, and/or Optical Toslink, depending on option

11. Warranty

This Workstation AD/DA interface is warranted by Mytek to the original purchaser, against defects in workmanship and materials used in manufacture for a period of one year, from the date of shipment.
Faults due to purchaser misuse, unauthorized modifications or accidents are not covered by this warranty.
No other warranty is expressed or implied.
Any faulty unit should be sent, shipping prepaid, to the manufacturer. The serial number of the unit should accompany any request for service.

This unit ser#_____was sold to:

_____

_____

_____

on_____

authorized signature_____