TITUS TECHNOLOGICAL LABORATORIES

3-DRX

AUTOMATIC THREE CHANNEL DIGITAL AES/EBU REPEATER and ANALOG AUDIO SWITCHER

INSTALLATION AND OPERATING MANUAL

INTRODUCTION

The **TITUS TECHNOLOGICAL LABORATORIES 3-DRX AUTOMATIC THREE CHANNEL DIGITAL REPEATER / ADC SWITCHER** was designed to overcome many of the problems associated with stereo broadcasting and production. Automatic insertion of a secondary or tertiary stereo digital or analog audio source upon silence digital error as well as manual control of these and other conditions are just some of the features of the 3-DRX.

In the Automatic mode the microprocessor based 3-DRX operates to correct the loss of digital audio by bringing up a secondary digital source. It does this by sampling the primary digital source for errors in either frequency or digital format or loss of signal. At this point the unit can bring up the secondary digital audio source if so programmed and it is without errors or bring up a tertiary analog source. There are four possible sequences that the 3-DRX can follow that are programmed by the user (explained later in this manual). There is also an audio silence sensor associated with each digital input. This sensor can be programmed into the source changing sequence so that when a source looses audio for an extended period of time but the digital clock exists the 3-DRX will switch to an alternate source (based on the sequence selected).

In the Manual mode the user can control the 3-DRX by the front panel pushbuttons or via the rear panel remote connector. The 3-DRX can also be controlled by a serial link. Programming of the 3-DRX is via an RS-232 serial data link on the rear panel.

Relay outputs are available to indicate which source is active. An open collector output indicates whether the unit is in Automatic or Manual mode. Inputs are TTL level for manual control.

The 3-DRX conforms to the AES-3 and AES-3ID standards for digital formats. In the digital mode (digital 1 or 2 source with digital output) the unit is "transparent", adding approximately 20 frame delay to the signal (well within AES standards). The 3-DRX acts as a repeater in this mode, leaving the stereo digital signal in the digital domain. As a repeater the 3-DRX can be also used to extend the length of a digital cable to double that of a "single hop". In the "transparent" mode the 3-DRX will repeat the same data rate (sampling rate) as the source.

The analog input is converted to digital format. The format is 24 bit, "Professional" with a rear panel selectable sampling rate of 32 kHz, 44.1 kHz, or 48 kHz.

An external "SYNC" connector is provided to offer the user an external input from a digital signal to synchronize the 3-DRX A/D converter to a station source or a non-standard rate if so desired.

The 3-DRX operates from 90 to 264 VAC at 47 Hz to 63 Hz input making the unit quite versatile. Connectors on the rear panel conform to AES-3 XLR type connectors and AES-3ID type BNC connectors. The 3-DRX can be selected to be bridging input, 110 Ohm or 75 Ohm terminating inputs. If power is lost to the unit a bypass relay will bring up the Digital source 1 input directly to the AES outputs bypassing the unit. The indication on the remote relay output will be that of Source 1 and the Auto/Manual indicator output will be "Manual".

NOTE: **Automatic detection of a serial link on the remote connector will override any manual rear panel remote control inputs to the unit. (See installation for details).**

INSTALLATION

After unpacking the 3-DRX check for physical damage to the unit due to shipping. If there is any problem with the unit please contact the factory immediately and notify the carrier of the damage.

The inputs for the 3-DRX are XLR or BNC type with selectable terminations. The selections are 75 Ohm, 110 Ohm, or bridging. Appropriate cable for digital audio should be used. Shielded pair wire should be used to connect to the AES-3 inputs or coax connected to the BNC inputs.

The outputs for the 3-DRX are AES-3 _**OR**_ AES-3ID. Only one output should be used at a time. Select the appropriate output by switching SW-3 #4 ON for AES-3ID (the BNC) or OFF for the AES-3 (XLR) output you are planning to use. SW-3 #3 provides a switchable 110 Ohm termination for the "SYNC" input.

The 3-DRX **analog** inputs are high impedance, balance bridging inputs with pin 2 as "hot". Levels up to +24 dBu can be accommodated. The 3-DRX operates at a fixed bit depth of 24 bits however the sampling rate is rear panel selectable via the first two switches on SW-3. Select the desired sampling rate from the following table:

	SW-3 #1	SW-3 #2
32 kHz	ON	ON
44.1 kHz	OFF	ON
48 kHz	ON	OFF
EXT SYNC	OFF	OFF

The "SYNC" can be from another serial digital source or paralleled with either the Source 1 or Source 2 inputs. This allows the A/D converter to be synchronized with an external source.

The remote I/O connector is multi-functional (see remote I/O connector diagram). This connector provides relay closure output indicating which source is active. It also provides an open collector output indication of operating mode (Automatic or Manual). This port also is used for connection to an RS-232 terminal such as a PC running "Hyperterm" or other such "dumb terminal" mode. The connection is at 9600 baud, 8 bits,
no parity, one stop bit, no handshaking. If an RS-232 is attached to the 3-DRX then no other inputs or outputs (other than the relay outputs) should be connected to the unit. The 3-DRX can also be accessed via a modem attached to this port as well.

NOTE: **The 3-DRX determines if there is an RS-232 serial terminal attached to the remote control I/O port on power-up. A terminal should *not* be attached after power-up as doing so will interfere with normal operation of the 3-DRX.**

NOTE: Before programming the 3-DRX press the fron panel AUTO switch until the LED goes out, putting the 3-DRX into MANUAL mode.

If a serial terminal (or bluetooth terminal) is attached to the 3-DRX the operator can program the unit or control the unit via this terminal. Additionally, the 3-DRX will indicate which output is on line (Digital 1, Digital 2, or Analog) on the terminal. Upon power up the 3-DRX will display the following (on the terminal):

Titus Technological Laboratories
3-DRX Automatic Switcher Version 3.xx
                              MENU

1 = Digital 1 *ON LINE*
2 = Digital 2
3 = Analog
4 = Time Delays - (Audio Silence is now ON)
5 = Sequence Number 1
6 = Power up in AUTO
7 = Operating Mode AUTO
8 = Remote EAS Trigger OFF
A = Output Mode STANDARD
0 = MENU

Selecting **number 1, 2, or 3** will have the 3-DRX bring up either source 1, 2, or 3.

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If **number 4** is selected the following will be displayed:

Digital 1 to Digital 2	**Time Delay: 0 Minutes 2 Seconds**
Digital 1/2 to Analog	**Time Delay: 5 Seconds**
Digital 2 to Digital 1	**Time Delay: 0 Minutes 7 Seconds**
Analog to Digital 1/2	**Time Delay: 10 Seconds**
Time Delay For Digital 2	**Time Delay: 0 Seconds**
Silence on Digital inputs	**Time Delay: 3 Minutes 0 Seconds**
Audio Silence Testing is: ON - Change it? (Y/N)	
Change Time Delays? (Y/N)	

Audio silence testing should be turned off ("N") if using it will interfere with normal operation of the station. Audio silence sensing on the digital inputs is used when a digital clock may be present from the source but there is no actual audio in the data stream. This sometimes happens with some inter-city digital links. However, the user should be aware that the 3-DRX WILL switch to an alternate source if, for example, the announcer stops talking for the duration of the delay! We suggest that this value be set to a high time delay to allow for operator error as opposed to equipment failure.

The time delay for switching to an alternate source is then selected. If an error occurs on an input then the unit will wait for the appropriate time delay and then bring up the next source in the sequence (selected later). If digital source 2 has a problem it will usually be skipped in the sequence.

(NOTE: In version 3.43 and earlier there is a bus muting function. This function should not be turned on <u>with audio silence testing turned off. The combination causes the output of the 3-DRX to periodically "glitch".</u>)

To accept the time delays simply answer "Y". If you answer "N" the unit will respond:
New Time Delays

Digital 1 to Digital 2   Minutes (0 to 5)

You are then asked to select time delays for each of the possible sequence conditions. The Loss of Audio on Digital inputs is input in minutes and seconds. After the last time delay (five of five possible) the unit will display the list of time delays and again ask for confirmation:

Audio Silence Testing is: ON - Change it? (Y/N)
TD OK? (Y/N)

If the time delays are correct answer "Y" to accept them. The delays are stored in nonvolatile ram. If the time delays are unacceptable then type "N" and repeat the process.

NOTE: The "**Time Delay For Digital 2**" is used to start an external device and wait for it to come up. Dialing a Zephyr, for example, would take a few seconds for it to establish a link. To assist with this process, the relay for Source 2 also pulls in. The relay can be connected to whatever device that needs to be started. The Source 2 button LED on the front panel will blink at one second intervals indicating that the 3-DRX is waiting for Source 2 to
come online. Entering 00 seconds will bypass this function.

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Selecting **number 5** from the main menu will bring up the sequence programming section. A sequence is how the 3-DRX reacts to a given error condition, whether it brings up an alternate source and which source. **If, for example, there is no Digital Input # 2 then sequence 3 should be selected! If there is no Analog input then sequence 2 should be selected**! At this time only 4 sequences are programmable. They are:

Sequence #	Action
0	none
1	S1 -> S2 -> S3 -> S2 or S1
2	S1 -> S2 -> S1
3	S1 -> S3 -> S1

Note: S1 = Digital 1, S2 = Digital 2, S3 = Analog inputs,   " -> " indicates source to be brought on line with error (the sequence). One nice feature of the 3-DRX is that if, for example, the unit has Digital input 1 on line and it has a problem *AND* Digital 2 has a

problem then the unit will not bring it up. Other sequences can be custom designed. Consult the factory for details.

When **number 5** is selected from the main menu the following operator interaction is displayed:

Sequence # 1 Sequence OK? (Y/N)N

New Sequence # 2

In this case sequence 2 was selected.

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When **number 6** is selected from the main menu you are selecting which mode the 3-DRX will be in when first powered up. The following interaction is displayed:

Now Power on Auto
Change to Manual? (Y/N)Y

Now Power on Manual

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Number 7 from the main menu allows the operator, from his terminal, to select the operating mode of the 3-DRX. The following is displayed:

Auto Mode OK? (Y/N)?
or
Manual Mode OK? (Y/N)?

Answering "Y" accepts the current mode. Answering "N" will switch the mode.

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Number 8 from the main menu selects whether the EAS mode is on or off. When the EAS mode is active and pins 1 AND 4 are grounded then immediately the 3-DRX will switch to the analog input. As soon as pins 1 AND 4 are released from ground then the 3-DRX will return to the source that was active prior to the EAS selection.

This mode will not interfere with any sequence selected, however will impact on remote selection of analog latch (normal sequence to the analog source is unaffected.)
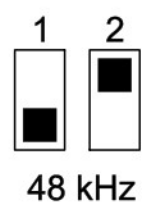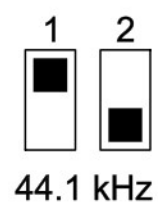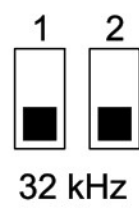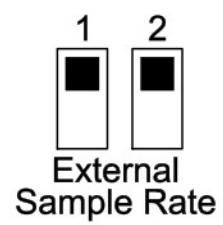
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Number A from the main menu will let the operator choose which AES path internally the 3-DRX will pass to the output. The selection will choose either STANDARD or BYPASS.

In STANDARD mode the 3-DRX will take the input AES data stream that has been "de-serialize" and "de-jittered" and then passed through to the output AES serializer (which allows the 3-DRX to integrate the A/D converter) and then to the output. This is the normal way the 3-DRX operates and lets it function as an AES repeater, reconstructing the AES signal and regenerating it.

In BYPASS mode, the raw AES data input is passed directly to the output without being "processed". The A/D converter output however is serialized and then switched to the output as neededl.

The advantage of the BYPASS mode is any user data that is contained on the AES data stream will be sent directly to the output along with the rest of the AES audio. The 3-DRX has been tested by several companies that impress signals on the AES data stream (other than audio) to the 3-DRX without issues. We recommend keeping the 3-DRX in STANDARD mode unless it has been determined operting in BYPASS mode is desirable.

Source Three Sample Rate

1 2 ■ ■ External Sample Rate	**1 2** ■ ■ 32 kHz
1 2 ■ ■ 44.1 kHz	**1 2** ■ ■ 48 kHz

REMOTE I/O CONNECTOR

All of the features of the 3-DRX are available through the REMOTE I/O connector as well as a few additional items. To control the 3-DRX a relay (or other dry closure), TTL level device, or open collector device is all that is needed. The remote control inputs to the 3-DRX are TTL with internal pull up resistors. Care should be taken not to exceed + 5 VDC on these inputs. Proper shielding is necessary and short runs of wire are recommended.
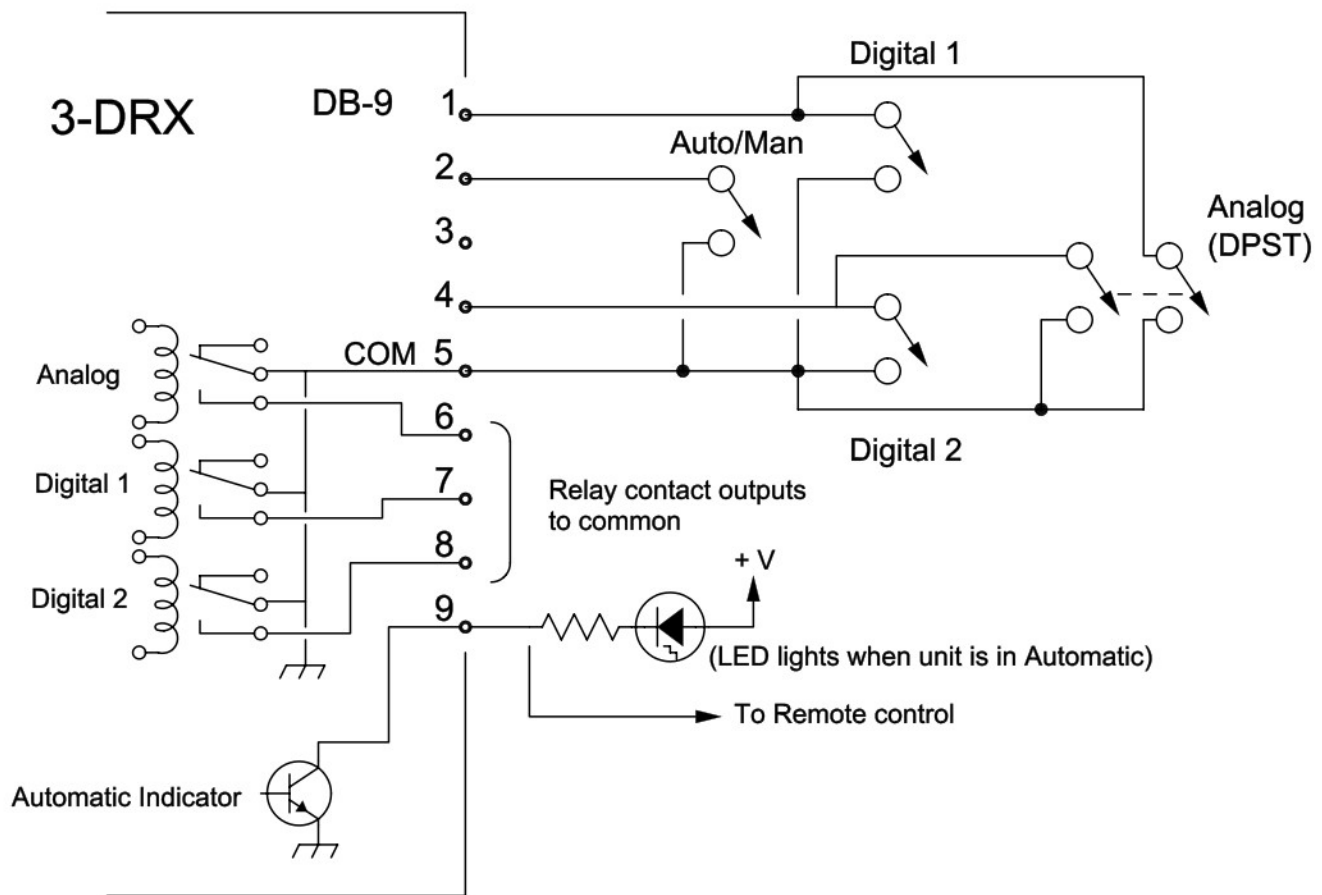
The Source Status outputs from the 3-DRX are relay closure to common ground and are capable of driving up to 500 ma at 50 volts MAXIMUM. The Automatic Manual indicator output is open collector and is capable of driving up to 500 ma at 50 volts MAXIMUM.

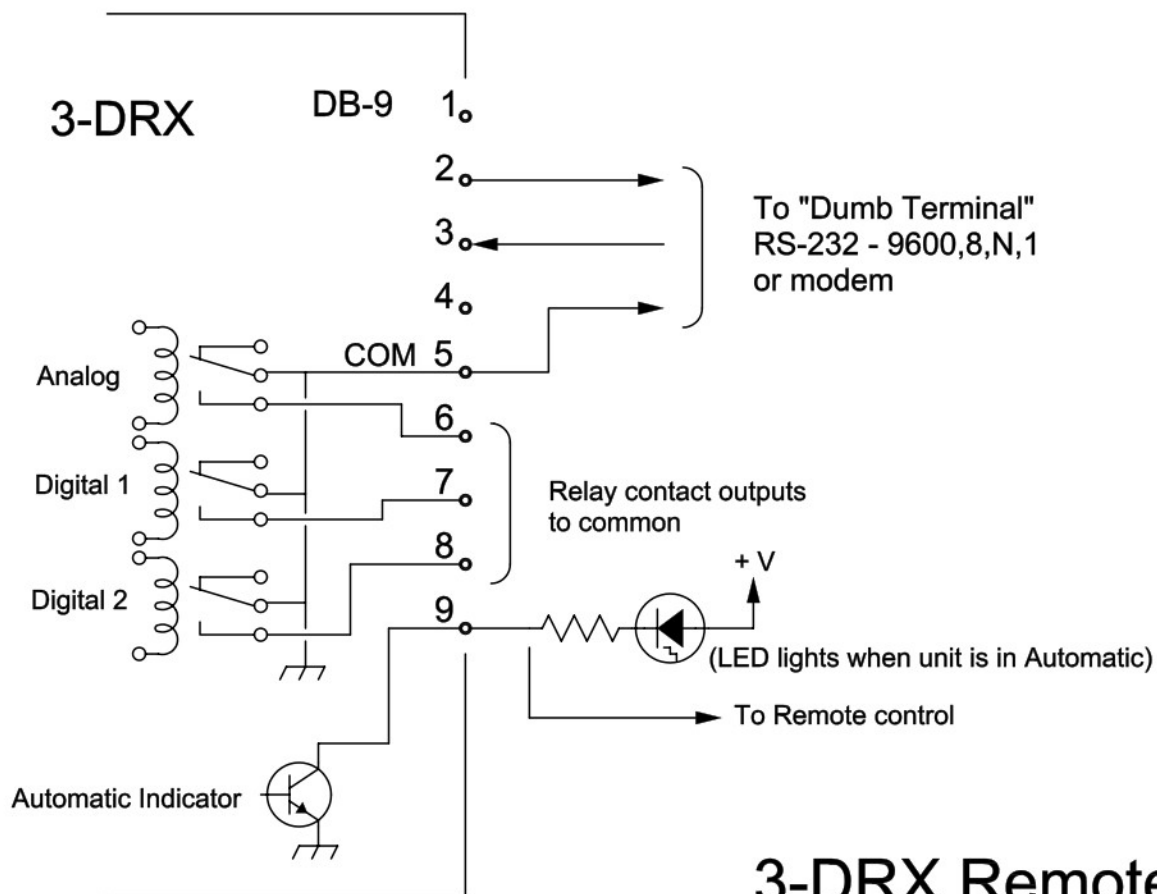The following describe the REMOTE I/O connector:

PIN #   FUNCTION
 1   Put Digital 1 on line **
 2   Select Automatic or Manual in **OR** RS-232 Out to terminal (see text)
 3   RS-232 in to 3-DRX
 4   Put Digital 2 on line **
 5   Relay common and control ground
 6   Analog source on line relay closure
 7   Digital 1 on line relay closure
 8   Digital 2 on line relay closure
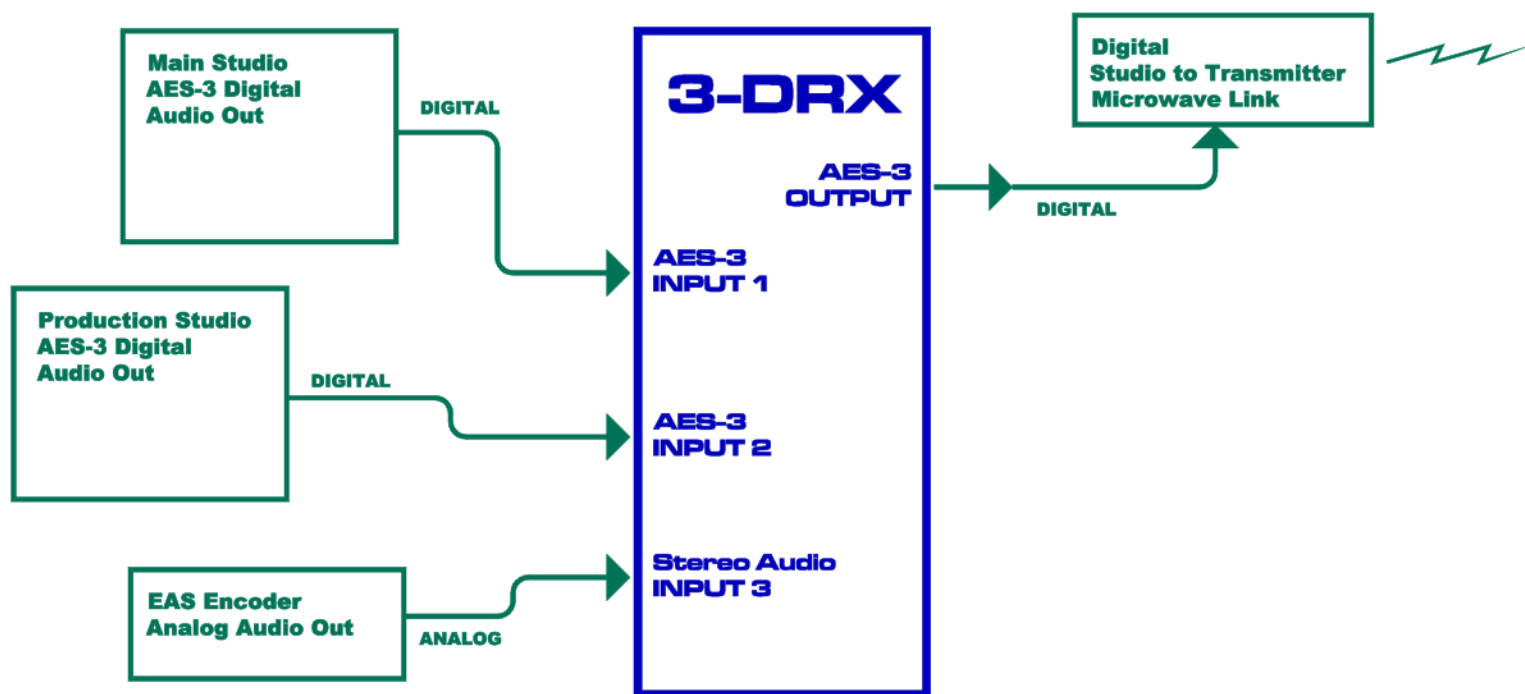 9   Automatic Manual indicator output open collector (see text)

** NOTE: Simultaneously _grounding pin 1 AND pin 4_ will put the Analog source on line. If EAS is selected the 3-DRX will switch immediately to the ANALOG input until _pins 1 AND 4 are ungrounded._
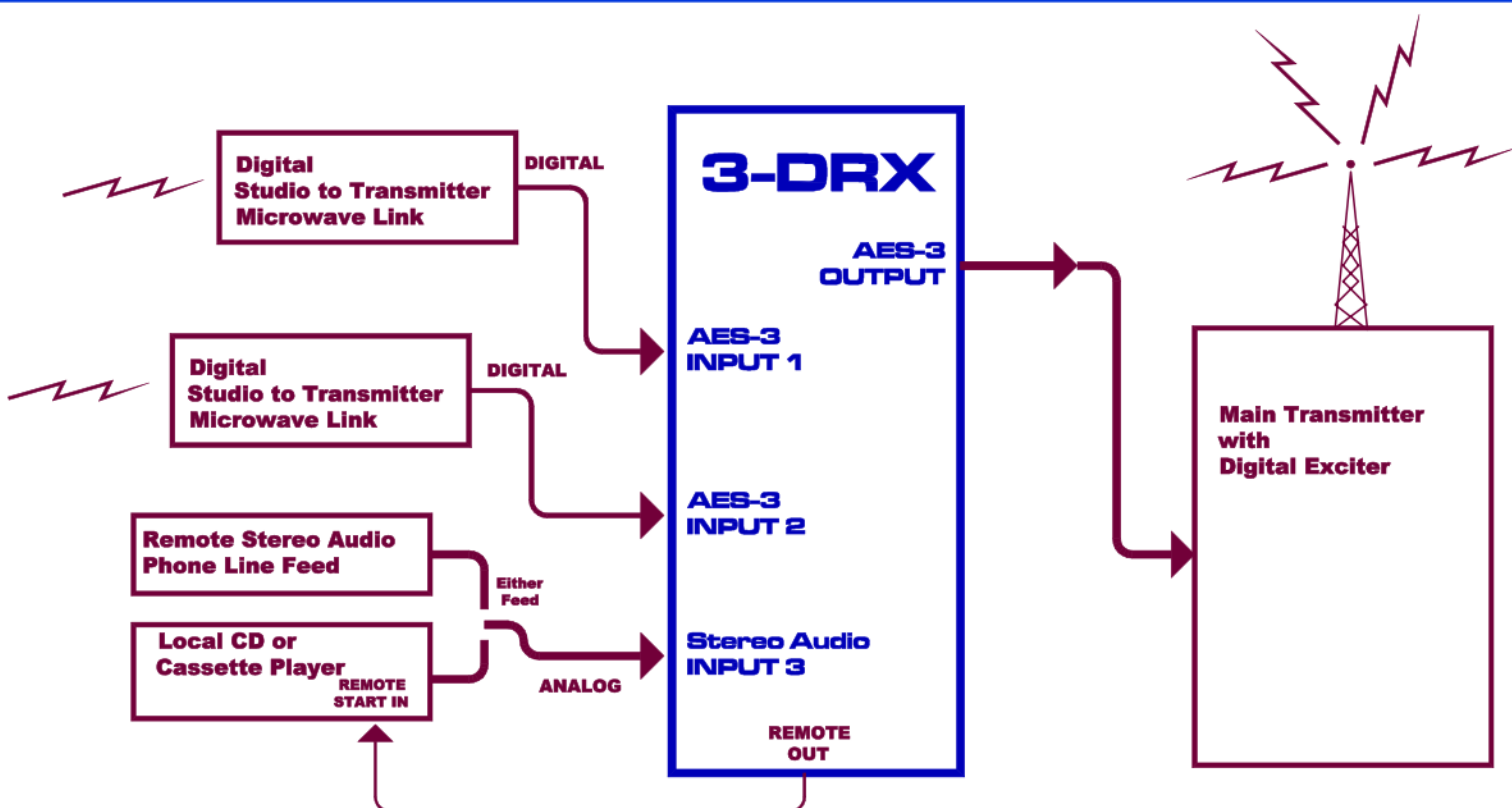
3-DRX DB-9

Digital 1

Auto/Man

Analog (DPST)

Digital 2

1, 2, 3, 4

COM 5

Analog

6

Digital 1   7

Relay contact outputs to common

Digital 2   8

9

+ V

(LED lights when unit is in Automatic)

To Remote control

Automatic Indicator

— *OR* —

3-DRX DB-9

1

2

3   To "Dumb Terminal" RS-232 - 9600,8,N,1 or modem

4

COM 5

Analog

6

Digital 1   7

Relay contact outputs to common

Digital 2   8

9

+ V

(LED lights when unit is in Automatic)

To Remote control

Automatic Indicator

3-DRX Remote Interfacing

3-DRX Located at a typical digital studio complex

3-DRX Located at a typical digital transmitter complex

REMOTE TERMINAL

Before programming the 3-DRX press the fron panel AUTO switch until the LED goes out, putting the 3-DRX into MANUAL mode.

The 3-DRX can be programmed and controlled by two different serial interfaces. One is the remote PC attached to the DB-9 connector on the rear of the 3-DRX. Set up a remote PC to run hyperterm, teraterm, or equivalent.

When running the terminal emulation software, set it up to run 9600, 8, N, 1. Pressing "0" (zero) will cause the menu to be printed on the PC. Subsequently pressing the other menu items will change either the output of the 3-DRX or program its operating parameters

Another feature of the current 3-DRX is the inclusion of Bluetooth accessability. By using a cell phone you can control or program the 3-DRX by simply standing near it.

To use this feature, download one of the many applications on Google Play (we redommend "Bluetooth Terminal HC-05) or on Apple store. Once the application is running, make sure that there is no remote PC terminal connected to the rear panel DB-9 connector and the 3-DRX is nearby and plugged in. Simply look for the Bluetooth device named "Titus-3-DRX" and pair with it. The paring code is "1234".

Once the 3-DRX is paired with the cell phone and the 3-DRX is in MANUAL mode you can press "0" (zero) to access the menu. Now you can access the menu, program the 3-DRX or control it. For example entering "3" on the keypad on the cell phone will cause the 3-DRX to switch to Source 3.

If you are modifying the time delays (menu item 4) you have about 10 seconds to enter each number before the 3-DRX will exit the time delay setup routine. Enter the data one digit at a time, pressing SEND in the application after each number. For example, entering a 35 second time delay would be entered as " 3 SEND 5 SEND". If you want to exit the setting routine simply enter "X" at any point in the data entry and the main menu will re-appear.

When using the bluetooth connection and terminal emulation on your bluetooth device the device will show the current switching conditions.

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