

Frequency Shift Keyed (FSK) / Remote Terminal Unit (RTU)

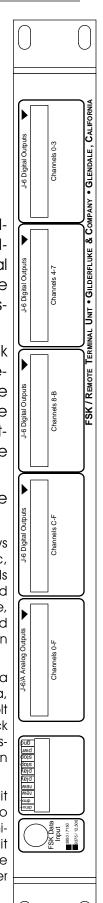
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This is an Animation system with 128 digital outputs and (optionally) sixteen 0-10 VDC analog outputs. It can be used in standalone applications using its on-board EPROM or an external source of FSK data for program storage. This unit can also be used as an output device attached to a PC·MACs animation system, receiving data sent to it through the DMX-512 or FSK inputs.

The FSK/RTU can be mounted in 1-3/4" of standard 19" rack space. It requires 4-1/2 " of space behind the panel. Power requirements are between 12 and 24 VDC (18 VDC or greater if the analog output option is installed). The current requirements are determined by the loads attached to the unit. The FSK/RTU unit itself draws between 350 ma. and 1 amp, depending on the number of front panel LEDs on at any one time.

This Animation System is used in one or more of the following three modes:

- 1) Frequency Shift Keyed (FSK) Data Playback: To play animated shows which have been recorded on any standard audio tape, Compact Disc, LaserDisk, or other source of audio data. Sixteen to thirty-two 8 bit channels of data can be played back using this unit. FSK data is normally generated using a PC·MACs Animation Control System. When operating in this mode, three relay outputs and/or the serial port can be used to start, stop and rewind a tape deck, LaserDisk or Compact Disc players. Delays between shows can be set for up to 9,999 seconds.
- **2) Remote Terminal Unit (RTU):** Receive DMX-512 data transmitted by a PC·MACs animation Control System, or any other source of DMX-512 data, and convert it to individual digital outputs and (optionally) sixteen 0-10 volt analog outputs. FSK/RTUs can be used to temporarily take the place of Brick Animation Control Systems when programming a show from a PC·MACs system. A single DMX-512 twisted pair is often more convenient to handle than a multitude of temporary J6 ribbon cables.
- **3) Stand-Alone Animation Playback:** A sequencer feature allows the unit to play a show from an on-board EPROM memory. The FSK/RTU can be set to play whenever either of the two data sources above stops. This allows an animated show to continue running in an 'attract' or 'keep alive' mode when it isn't playing any of the regular shows. This mode of operation can also be used if you just need to run a single show continuously. The sequencer EPROM is programmed using a PC·MACs Animation Control System.



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On the Front of the FSK/RTU are:

A) Eight Position Dipswitch which is used as follows:

- 1) Initiate output test #1 when ON. Chases one digital output on at a time.
- 2) Initiate output test #2 when ON. Chases all digital outputs in a sweeping pattern.
- 3) Initiate output test #3 when ON. Spells out a difficult to read message on the digital outputs.
- 4) When ON, data sent to the sixteen digital output channels is also mirrored to the optional analog outputs.
- 5) Use DMX-512 input rather than FSK input when ON. The Sixteen Position Rotary Switch must be used to select the channels which the FSK/RTU will decode.
- 6) Depending on condition of switch #5:
 - a) If using FSK data input (switch #5 OFF): If ON, this switch is used to select the higher frequency set. These allow up to 32 channels of data at 15 Frames per Second or up to 16 channels of data at 30 Frames Per Second in the FSK data stream. The FSK input section must be modified at the factory to support this mode of operation. To generate FSK data in the proper format for this higher speed, you must set the FSK data options for the 9375 Hz/12500 Hz option with 16/32 channels set as appropriate (16 channels if the frame rate is 30 FPS / 32 channels if the frame rate is set to 15 FPS).
 - b) If using DMX-512 data input (switch #5 ON): If ON, tells FSK/RTU unit to use checksum found in bytes 256 and 257 to verify DMX-512 data is valid before updating outputs. This option is recommended for all DMX applications
- 7) If using higher frequency FSK data (switch #5 is OFF and switch #6 is ON), expect 32 channels at a 15 Frames Per Second rate when ON. When OFF, expect 16 channels of data at a 30 Frames per Second rate. To generate FSK data in the proper format for 32 channels of data, you must set the FSK data options for the 9375 Hz/12500 Hz option with 32 channels of data. The show must be set for a frame rate of 15 Frames Per Second.
- 8) Depending on condition of switch #5:
 - a¹) When using high speed FSK data (switch #5 OFF, AND switch #6 ON), this tells the RTU/FSK to look for a BREAK character to synchronize with the FSK data (instead of a value of 0A5h). To use this option, the PC·MACs SMPTE card must be set to generate data in the same format. To do this, turn on dipswitch #6 on the SMPTE card² and set the FSK data options for the 9375 Hz/12500 Hz option with 16/32 channels set as appropriate (16 channels if the frame rate is 30 FPS / 32 channels if the frame rate is set to 15 FPS).
 - b) When using DMX-512 data input (switch #5 is ON), this option offsets the outputs by 256 channels into the data received. This is used to access DMX-512 channels 256 through 512.

B) Sixteen Position Rotary Switch. Depending on condition of switch #5:

- a) If using DMX-512 data input (switch #5 ON): This switch is used to select which channels of DMX-512 data will be used by the FSK/RTU Unit. DMX-512 addresses are set in HEX numbers, using this switch to select the upper digit. Normally channels 0 through 255 are selected (00h through FFh). If Dipswitch #8 is turned on, then DMX-addresses 256 through 511 can be selected (100h through 1FFh).
- b) If using FSK data input (switch #5 OFF): This switch selects which delay between shows is to be used. Sixteen different delay values can be set through the serial port, any of which can be any length of time ranging from none to 9,999 seconds.

¹ This option is available on RTU/FSK firmware revision 2.10 and later only.

² This option is availible on SMPTE card firmware revision 1.9 and later only.

C) Six LEDs Indicate:

- 1) Heartbeat: Flashes continuously while the CPU is running. If it ever stops for more than a second or so, the 'Deadman' circuit in the FSK/RTU unit will automatically reset the CPU.
- 2) Data received: Turns on when valid data is received from the FSK or DMX-512 input as appropriate).
- 3) Data errors: Flashes for a moment whenever an error is detected in the FSK or DMX-512 input (as appropriate). When operating in the FSK mode, excessive data errors indicate that the tape is getting too worn to reliably play back a show. When sending a string to a serially controlled device, it will flash when an unexpected character is received.
- 4) Stop relay output activated: Lights when this tape deck control output is activated.
- 5) Play relay output activated: Lights when this tape deck control output is activated.
- 6) Rewind relay output activated: Lights when this tape deck control output is activated.
- **D) RS-422 Port** used for accessing and modifying configuration of the FSK/DMX unit and for sending commands to serially controlled devices like LaserDisk and Compact Disc players.
- E) LED Indicators for all Digital, Analog and Fuse outputs (Optional).

On the back side of the FSK/RTU are connectors for:

A) Power Supply: The power supply input is used to feed a voltage between 12 and 24 Volts Direct Current (VDC) to the FSK/DMX Unit. The voltage input must be 18 volts or greater if the analog output option is installed.

The size and voltage of the power supply is determined by the load you are connecting to it. In most cases a power supply in the 100 to 200 Watt range will be sufficient to drive most shows. The polarity of these connections is plainly marked. The RTU/FSK unit itself draws about 350 ma. at 24 volts. With all of the indicator LEDs on the front of the unit, this can get as high as 1 amp.

B) Tape Deck Control: These provide three normally open contact closures which can be connected to the remote control inputs on a tape deck (or Compact Disc, LaserDisk player or other audio source if you aren't going to control it through its serial port).

The 'Play', 'Rewind' and 'Stop' outputs normally go the the 'Play', 'Rewind' and 'Stop' inputs on a tape deck. As the system doesn't support a foil sensor input, the tape deck must be able to take care of itself when it is given a rewind command. Since a cassette tape can't ever come off the end of the reel, any cassette deck with remote control inputs will work. An open reel tape deck can be used if it has a 'Home' function which can be attached to the 'Rewind' output on the FSK/RTU. This will tell the tape deck to rewind and stop at the zero point set on the tape counter.

- C) Frequency Shift Keyed (FSK) Data Input: If FSK data is used, the FSK Data input is attached to wherever it is coming from. This is usually the output of the data track on a tape deck, Compact Disc or LaserDisk player. The FSK/RTU decodes the FSK data input and sends it to the outputs. The standard FSK data rate sends out sixteen channels of data at fifteen frames per second. At the higher FSK data rate (FSK/RTU must be factory modified to support this option), data is limited to fifteen frames per second if transmitting thirty-two channels of data, or thirty frames per second if transmitting sixteen channels of data.
- **D) DMX-512 Data Input:** The DMX-512 standard was developed by the United States Institute for Theatrical Technology (USITT) for a high speed (250 KBaud asynchronous) serial link. Although it was originally designed for controlling light dimmers, it is now supported by hundreds of suppliers throughout the world for controlling all kinds of theatrical equipment.

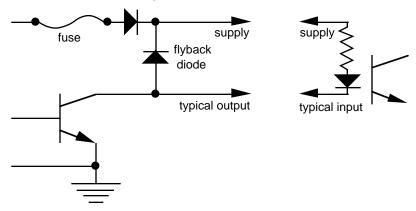
Even though the DMX-512 standard calls for 512 channels of data, the DMX transmission from PC·MACs is limited to 256 eight bit wide channels. You can address the FSK/RTU to respond to any address between 00 and 512. Addresses above the 256th are used in PC·MACs

for transmitting a checksum. The FSK/RTU can use this to verify that the data received from PC·MACs has no transmission errors in it. If you address a FSK/RTU or other DMX-512 device to addresses 256 or 257, you will see this verification data displayed as a flickering pattern. Note that at frame rates higher than 40 FPS, not all 256 channels will be transmitted through the DMX-512 output.

The positive and negative DMX-512 wires are attached to the FSK/RTU through the screw terminals marked on its back. The shield (if any) can be attached to the ground side of the power supply terminal.

E) Four J-6 connectors for Digital Data Output: In all the animation systems made by Gilderfluke & Company, all digital input and output cabling is through what we call 'J6' standard output cables. These are 40 wire cables which are made up of four identical eight bit wide 'channels'. A J6 cable is often split up into four individual channels. Each '1/4 J6' cable is made up of 10 wires, and can be used to control eight individual 'digital' (off/on) devices, or one eight bit wide 'analog' device. The remaining two wires in each 1/4 J6 are used for ground and a power connection.

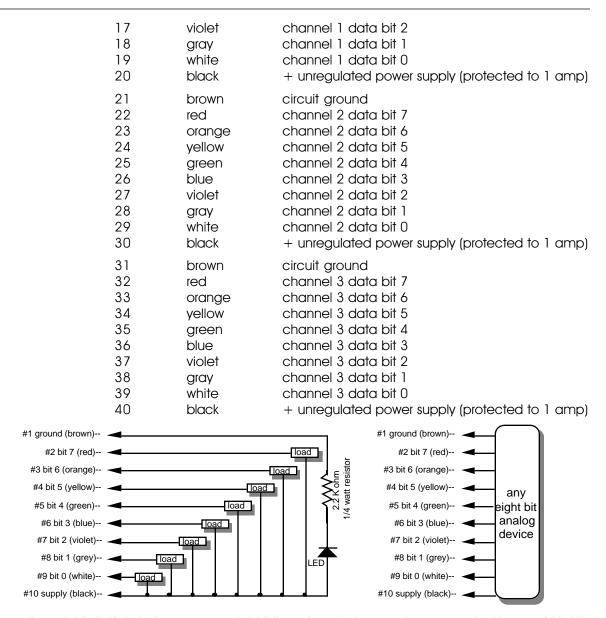
In all the animation systems made by Gilderfluke & Company, all digital outputs are open collector switches to ground, and all digital inputs are through optoisolators. Flyback diodes are included in the outputs for driving inductive loads:



To simplify wiring to any of our animation systems, the connectors used on the J6 cables are what are called 'insulation displacement connectors'. These simply snap on to an entire cable, automatically 'displacing' the wire insulation and making contact with the wires within. This means that an entire 40 wire cable can be terminated in seconds. All connectors are polarized, to keep them from being plugged in backwards.

Each J6 cable is arranged in the following order:

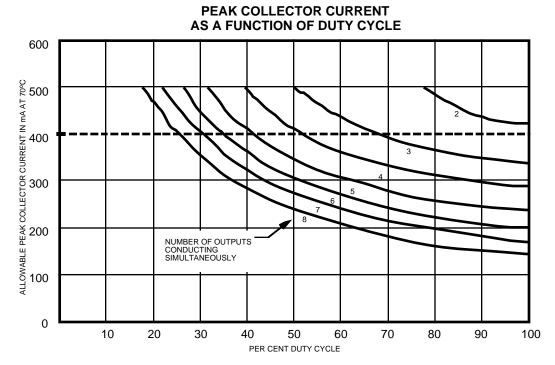
wire number	color	wire function
1	brown	circuit ground
2	red	channel 0 data bit 7
3	orange	channel 0 data bit 6
4	yellow	channel 0 data bit 5
5	green	channel 0 data bit 4
6	blue	channel 0 data bit 3
7	violet	channel 0 data bit 2
8	gray	channel 0 data bit 1
9	white	channel 0 data bit 0
10	black	+ unregulated power supply (protected to 1 amp)
11	brown	circuit ground
12	red	channel 1 data bit 7
13	orange	channel 1 data bit 6
14	yellow	channel 1 data bit 5
15	green	channel 1 data bit 4
16	blue	channel 1 data bit 3



Any eight digital devices or one eight bit analog device can be connected to any 1/4 J6 cable as shown. The LED between the ground (pin #1 brown) wire and supply (pin #10 black) wire acts as an indicator which is lit if the fuse for that channel is OK.

The supply line for each 1/4 J6 is protected by a solid state circuit breaker (PTC Fuse) for 1 amp. You should treat each 1/4 J6 as an individual, and not cross the outputs or supply lines from one 1/4 J6 to the lines from another. Doing this won't cause any damage, but can reduce the protection for the outputs that the circuit breakers normally provide.

The current output capacity of each output is as shown in the following chart:



Since it is unusual to have more than 50% of the outputs on at any one time, you can usually assume the system has a 250 ma output current capacity. If you are going to be turning on lots of heavy loads at the same time, you should derate this to 150 ma.. This is sufficient to drive the majority of loads that will be directly connected to the outputs of the animation system. FSK/RTUs use a Micrel MIC58P01CN output driver chip. These chips add output protection to each individual output which acts much like an electronic circuit breaker. When the rated output of a chip is exceeded, it will turn 'OFF'. To reset the output, just temporarily power down the FSK/RTU.

If additional current capacity is needed, or if you need to drive higher voltage loads, you can connect relays as needed to the outputs of the animation system. Coincidentally, boards for doing this are available from Gilderfluke & Company. These include:

Solid State Output Drivers: These snap track mounted cards each have eight optoisolated outputs. Current capacities available range from 700 ma. up to 3.5 amps. The lower current models are internally protected.

DPDT relay board: A set of eight electromechanical relays with double pole/double throw contacts rated at 5 amps each.

Reed relay board: A set of eight small electromechanical relays with normally open contacts rated at 150 ma each.

I/O module: A set of eight small solid state relays with normally open contacts rated at 3.5 amps each (AC and DC relays available).

Solid State Relay Fanning Strip: For connecting up to eight popular 'hockey puck' style relays to a 1/4 J-6 output cable. These are available with capacities of up to 75 amps each.

F) One J6/A Analog Data Output (optional): In all the animation systems made by Gilderfluke & Company, all Analog input and output cabling is through what we call 'J6/A' standard output cables. These are 40 wire cables which are made up of four identical four channel wide cables. A J6/A cable is often split up into four individual cables called a 1/4 J6/A. Each 1/4 J6/A also includes a common power supply and ground wire which allow it to provide power for analog output accessories like Electronic FeedBack (EFB) controllers and 16 Channel Servo Controllers.

To simplify wiring to any MACs animation system, the connectors used on the J6/A cables

are what are called 'insulation displacement connectors'. These simply snap on to an entire cable, automatically 'displacing' the wire insulation and making contact with the wires within. This means that an entire 40 wire cable can be terminated in seconds. All connectors are polarized, to keep them from being plugged in backwards.

Each J6/A cable is arranged in the following order:

wire number	color	wire function
1 2	brown red	circuit ground + unregulated power supply (protected to 1 amp)
3	orange	Output 15 (0Fh) Positive Analog Output
4	yellow	Output 15 (0Fh) Negative Reference
5	green	Output 14 (0Eh) Positive Analog Output
6	blue	Output 14 (0Eh) Negative Reference
7	violet	Output 13 (ODh) Positive Analog Output
8 9	gray white	Output 13 (0Dh) Negative Reference Output 12 (0Ch) Positive Analog Output
10	black	Output 12 (OCh) Negative Reference
11	brown	circuit ground
12	red	+ unregulated power supply (protected to 1 amp)
13 14	orange yellow	Output 11 (OBh) Positive Analog Output Output 11 (OBh) Negative Reference
15	green	Output 10 (0Ah) Positive Analog Output
16	blue	Output 10 (0Ah) Negative Reference
17	violet	Output 9 (09h) Positive Analog Output
18	gray	Output 9 (09h) Negative Reference
19	white	Output 8 (08h) Positive Analog Output
20 21	black brown	Output 8 (08h) Negative Reference circuit ground
22	red	+ unregulated power supply (protected to 1 amp)
23 24	orange yellow	Output 7 (07h) Positive Analog Output Output 7 (07h) Negative Reference
25	green	Output 6 (06h) Positive Analog Output
26	blue	Output 6 (06h) Negative Reference
27	violet	Output 5 (05h) Positive Analog Output
28	gray	Output 5 (05h) Negative Reference
29 30	white black	Output 4 (04h) Positive Analog Output
31	brown	Output 4 (04h) Negative Reference circuit ground
32	red	+ unregulated power supply (protected to 1 amp)
33	orange	Output 3 (03h) Positive Analog Output
34	yellow	Output 3 (03h) Negative Reference
35 36	green blue	Output 2 (02h) Positive Analog Output
30 37	violet	Output 2 (02h) Negative Reference Output 1 (01h) Positive Analog Output
38	gray	Output 1 (01h) Negative Reference
39	white	Output 0 (00h) Positive Analog Output
40	black	Output 0 (00h) Negative Reference

Analog loads are connected between each of the Positive outputs and its associated Negative reference. The output capacity of each output is 20 ma. The output voltage range can be adjusted from the FSK/RTU to anywhere between 0 and 10 volts. Current amplifiers are available if additional current capacity is required for your application.

The negative reference is at a voltage of approximately 1.6 volts above the circuit ground. The negative references are all connected on the FSK/RTU, but there must be no direct connections made between any of the negative references and the circuit grounds anywhere in the animation system.

The supply line for each 1/4 J6/A is protected by a solid state circuit breaker (PTC Fuse) rated for 1 amp. You should treat each 1/4 J6/A as an individual, and not cross the outputs or supply lines from one 1/4 J6/A to the lines from another. Doing this won't cause any damage, but can reduce the protection for the outputs that the circuit breakers normally provide. A LED and resistor on each 1/4 J6/A between the ground (pin #1 brown) wire and supply (pin #2 red) wire can act as an indicator which is lit if the circuit breaker is OK. The resistor should be a value between 2.2 Kohms and 4.7 Kohms.

There is one adjustment on the FSK/RTU for setting the maximum analog voltage to be output. This sets the gain for the Digital to Analog (D/A) converters on the board. To set it, pick any output and set the minimum and maximum scaling to their minimums and maximums through the configuration screen. When you send a full scale output command to this output, you should then be able to adjust it for 10.00 volts using R11. The adjustments for the endpoints on each of the 16 outputs are normally individually set through the setup screen software.

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Frequency Shift Keyed (FSK) Tape (or Disk) Organization:

When operating in FSK mode, the system is constantly listening for data on the FSK input. Whenever it hears valid data, it will start decoding it and sending it to the outputs. This means that a show can be started at any time by simply pressing the 'Play' button on the tape deck (or LaserDisk or Compact Disc player) that supplies the FSK data.

Since it will play whenever it hears FSK data, a show which is run from a loop deck or other continuous source of FSK data will play continuously.

The FSK/RTU doesn't use any codes embedded in the FSK data or sensors on the FSK source to find where it is. When it sends a PLAY string (usually starting the tape deck, Compact Disc or LaserDisk player), it starts the 'FSK startup' timer. If it finds FSK data before the 'FSK startup' timer expires, then it is off and running. If it doesn't hear any FSK data before the 'FSK startup' time, then it assumes that the tape is positioned incorrectly and so starts a rewind sequence and a new delay between shows.

Once the system has started playing, it ignores any gap in the data of less than what has been set for the 'FSK/DMX dropout' time. If it finds a gap of more than this time, then it assumes that it has just found the end of a show. It won't send the STOP string yet, but instead will start looking for the FSK data to pick back up at the start of the next show. If it receives FSK data again before the 'FSK Intershow' timer expires, it will send the STOP string (usually stopping the tape deck or other source of FSK data), and start the countdown delay for the next show. If no next show is found within the time set for the 'FSK Intershow' timer, then it assumes that this was the last show on the tape (or disk) and will initiate a rewind sequence.

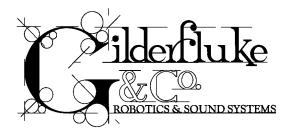
The format for the tape or disk) must be as follows:

- 1) Start of tape (or disk).
- 2) Gap of less than the time set for the 'startup timer' before first show's FSK data starts (the shorter the better).
- 3) Show number 1.
- 4) Gap in the FSK data between shows which is longer than the time set for the 'FSK/DMX dropout' timer, but shorter than the length set for the 'FSK Intershow' timer. The FSK/RTU will send out the STOP string and start a new countdown between shows when the FSK data starts again.
- 5) Repeat numbers 3 and 4 above for each show on tape (or disk).
- 6) Last show on tape (or disk).
- 7) Gap in the FSK data which is longer than the time set for the 'FSK Intershow' timer. This will initiate a tape rewind sequence.

When operating from a Compact Disc or LaserDisk, the REWIND string is used to position the disk to the start of the first show. This makes it the most complex of the three possible strings.

If you would like a show to play continuously from a Compact Disc or LaserDisk, the PLAY string can send a string to the player which tells it to play the same show over and over again.

On systems that use tape decks, the delay between shows can be shorter than the time it takes to fully rewind the tape. If the delay time is not longer, then the system can try to start playing at wherever the tape happens to be when the countdown ends. If the 'normal' delay is shorter than the 'minimum rewind' time, the 'minimum rewind' timer will automatically be used instead.



FSK/RTU CONFIGURATION:

All commands sent to the FSK/RTU Unit through its serial interface take the following format. All characters are sent in ASCII. All numeric values are sent in HEXadecimal (HEX for short), and consist of one or more ASCII characters (0-9, A through F). The case (as in upper and lower) of all input is important. A lower case 'a' signifies a command, while an 'A' is a numeric value. If the FSK/RTU Unit receives another command while it is waiting for additional input needed to complete the previous command, it will abandon the previous command and start working on the new one.

To communicate with the FSK/RTU Unit through the serial port, you can use just about any computer or terminal which has a serial port on it. Some newer computer designs, like the Apple Macintosh, come with serial ports which are directly compatible with the RS-422 / RS-485 signal levels the FSK/RTU Unit wants to see. These signal levels are close enough to be used with the RS-232 signal levels found on most older computers (like most IBMs and compatibles) with only a simple adapter cable, so long as the wire isn't too long. To gain the full advantage of the RS-422 / RS-485 signal levels you will need to use a signal level adapter like our 232conv-09.

If you are using a computer as a terminal you will need to run a modem or terminal emulation program. These will send everything you type on the keyboard out the serial port on your computer while printing on the screen anything which comes in from the FSK/RTU Unit through the serial port. Every copy of Windows comes with TERM.EXE, which is just such a program. A modem program will usually have the advantage over a terminal emulation program in that it will allow you to save data to your computer's disk drives and then send it back to the FSK/RTU Unit at a later date. The FSK/RTU Unit uses no screen control codes or ESCape sequences, so it should work on any machine with an 80 column by 24 line display. Machines with other display formats will work, but may not look so neat on the screen.

When configuring your modem program, you should set it for 9600 baud, 8 data bits, one stop bit, and no parity. Higher or lower baud rates can be used if you configure the FSK/RTU Units' serial port to run at a different speed. You should set your program not to insert an extra LineFeed (LF) character after each Carriage Return (CR) it receives. If you are going to be downloading configuration strings to the system (command 's'), you will also need to tell the modem program to put a slight delay between each character sent in order to not over run the FSK/RTU Unit's incoming data buffer.

If you have hooked up the FSK/RTU Unit to your computer and it still doesn't seem to respond to the keyboard, the first thing to check is that you are attached to the right serial port. The easiest way to do this is to disconnect the FSK/RTU Unit and short between the Tx data out and Rx data in pins on the serial port connector on the back of your computer. On all IBMs and compatibles this means sticking a paper clip or similar tool between pins 2 and 3 on the 'Com.' connector. While still running the modem program, anything you type should be shown on the screen while this paper clip is in place, while nothing will appear when you remove it. If your computer passes this test, then you are using the right serial port and the problem is most likely the baud rate setting or in your wiring to the FSK/RTU Unit. If you get characters on the screen even with the paper clip removed from the serial port, it means you probably need to set the 'echo' mode to 'none' or 'full duplex' and try this test again.

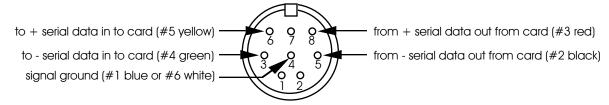
The serial data signals from the FSK/RTU Unit are brought out on a 6 position RJ-11 (modular telephone style connector). Facing the end of the cable with the release latch upwards, its pin out is as follows:

COLOR **SIGNAL NAME: LEFT** WHITE SIGNAL GROUND BLACK - SERIAL DATA OUT FROM FSK/RTU Unit + SERIAL DATA OUT FROM FSK/RTU Unit RED - SERIAL DATA IN TO REPEATERS GREEN + SERIAL DATA IN TO REPEATERS YELLOW **RIGHT BLUE** SIGNAL GROUND

PC and Compatible Connections: To cross wire the RS-422 / RS-485 signals from the FSK/RTU Unit to the RS-232 serial port of an IBM compatible, cross connect the signals as follows:

DB-25	<u>DE-9</u>	<u>SIGNAL</u>	SIGNAL FROM/TO FSK/RTU Unit
2	3	DATA OUT	- SERIAL DATA IN TO FSK/RTU Unit (GREEN)
3	2	DATA IN	- SERIAL DATA OUT FROM FSK/RTU Unit (BLACK)
7	5	GROUND	SIGNAL GROUND (BLUE or WHITE)

Apple Macintosh computers have true RS-422 serial ports built in. To connect to the Smart Brick System, the pin out is as follows for a Macintosh mini-DIN-8:



The FSK/RTU Unit expects to see the serial data in the following format:

ONE START BIT EIGHT DATA BITS ONE or TWO STOP BITS

Unlike many of the products manufactured by Gilderfluke & Company, the FSK/RTU can not share the serial port with other devices at the same time. The screen is displayed when you enter:

m5AA5

To redraw the screen at any time, just press the <ESC>ape key. If the FSK/RTU is set for FSK data, then the following screen will be displayed:

Main Configuration Screens:

-Gilderfluke & Company - RTU/FSK	Controlle	r - ver	sion 2.0)0 - co <u>r</u>	pyright	1994 DCM-
sequencer = 20h x 06450 frames	forced	forced	forced		analog	
	ON	OFF	analog	min.	max.	seconds
a) tape deck pulse- 0.5 seconds	0:			00	FF	0000
b) FSK/DMX dropout- 1.0 seconds	1:			00	FF	0015
c) FSK intershow- 10 seconds	2:		İİ	00	FF	0030
d) FSK startup- 20 seconds	3:		Í	00	FF	0045
e) minimum rewind- 0030 seconds	4:	İ	İ	00	FF	0060
f) set FSK time delays	5:	İ	İi	00	FF	0090
g) enter strings	6:	İ	İi	00	FF	0120
h) sequencer enabled- yes	7:	İ	İİ	00	FF	0180
i) countdown displayed- yes	8:	İ	İİ	00	FF	0240
j) force digital outputs off	9:	İ	İi	00	FF	0300
k) force digital outputs on	A:	İ	İİ	00	FF	0450
1) force analog to a value	в:	İ	İİ	00	FF	0600
n) set analog endpoints	C:	İ	İi	00	FF	0900
r) download configuration	D:			00	FF_	1200
s) upload configuration	E:			00	FF_	1500
t) default configuration	F:		ii	00	FF_	1800
u) Read configuration from EEPROM					. – –	
w) Write configuration to EEPROM		x) eX:	it			
countdown- 0000 dropout timer- 00 intershow timer- 00 startup timer- 00						

If the FSK/RTU is set for receiving DMX-512 data, the following menu will be displayed instead. It differs from the first only in that several of the commands and settings which are specific to the FSK data have been disabled.

-Gilderfluke & Company - RTU/FSK Controller - version 2.00 - copyright 1994 DCM-						
sequencer = 20h x 06450 frames	forced ON	forced OFF		analog min.		
	0:			00	FF	
b) FSK/DMX dropout- 1.0 seconds	1:			00	FF_	
_	2:	İ	İ	00	FF	
	3:	İ	İ	00	FF	
	4:	İ	İ	00	FF	
	5:	İ	İ	00	FF	
	6:	<u> </u>		00	FF	
h) sequencer enabled- yes	7:			00	FF	
	8:	Ì		00	FF	
j) force digital outputs off	9:			00	FF	
k) force digital outputs on	A:			00	FF	
1) force analog to a value	B:			00	FF	
n) set analog endpoints	C:			00	FF	
r) download configuration	D:			00	FF	
s) upload configuration	E:			00	FF	
t) default configuration	F:			00	FF	
u) Read configuration from EEPRON	ľ					
w) Write configuration to EEPROM		x) eX:	it			
	command-					

On either of these menus, the size of the sequencer EPROM installed (if any)is also shown near the top of the screen. If the sequencer EPROM isn't found, then this area will not appear on the screen.

If another command is entered while the last command is waiting for additional input, the new command will be started. If at any point you enter a command in error and it is waiting for additional input, you can leave the command by entering an <ESC>ape key. You can also bail from the string entry com-

mands without having to enter all 80 characters. Doing so will conclude (not abort) the string entry commands. All other commands are aborted by entering an <ESC>ape key.

If you want to keep a hard copy printout of the current configuration of the RTU/FSK, you should use the <ESC>ape key to redraw the screen while saving the print in the modem program running on your computer. This file can then be printed out at any time.

- **a) Tape deck pulse-** This command is used to set how long (in 10ths of seconds) the relay closures sent to tape deck will remain closed. This command is used only in FSK mode.
- b) FSK/DMX dropout- This command is used to set how long of a gap (in 10ths of seconds) is allowed before the FSK/RTU assumes that the data has been well and truly lost. If running from FSK data, this will start the 'FSK Intershow' timer when it runs out. If it is installed and enabled, both FSK and DMX-512 controlled units will start outputting data from their on-board sequencer EPROM after this timer has expired.
- c) FSK intershow- This command is used to set how long of a gap (in seconds) to allow between shows on a tape. If FSK data from the next show on the tape is found before this timer expires, the FSK/RTU will send out its STOP string and start the countdown to the next show. If this timer does expire, then the FSK/RTU will send out its REWIND string and start the countdown to the next show. This command is used only in FSK mode.
- **d) FSK startup-** This command is used to set how long of a gap (in seconds)after sending a START sequence to wait before receiving FSK data. If this timer expires, then a REWIND sequence will be started and a new countdown to the next show will be initiated. This command is used only in FSK mode.
- e) Minimum rewind- Because the delay between shows can be shorter than the time the tape deck requires to rewind the tape, this value (in seconds) will automatically be used for the delay between shows after a rewind if it is larger than the currently selected delay. This command is used only in FSK mode.
- f) Set FSK time delays- This command is used to set the sixteen possible different delays the users can select from the rotary switch on the front of the FSK/RTU for the delays between shows. Any delay between 0000 (none) and 9999 seconds can be used. This command is used only in FSK mode.
- g) Enter strings- STRINGS are the ASCII characters and commands which you can tell the FSK/RTU to send at the start or end of any show through its serial port. The Strings used in the FSK/RTU are similar to those used in PC·MACs or the Smart Brick Animation Control Systems. They are used primarily to talk to LaserDisk and Compact Disc players or just to tell the FSK/RTU to close the contacts on its tape deck control outputs. They can also be used to send commands through the serial port to any other piece of show equipment that needs a serial input to start or stop it, or even just to print on a monitoring screen that a show has started or ended.

When using the FSK/RTU with a LaserDisk or Compact Disc, you will typically use the STOP string to pause the player, the PLAY string to tell the player to start playing, and the REWIND string to spin up the disk and position the player to the beginning of the first show.

Please see the section on this manual on STRING SETUP for more details on their care and feeding.

- h) Sequencer enabled- This toggle is used to enable the sequencer EPROM, if it has been installed. When enabled, the show data stored in the sequencer EPROM will be played back as long as there is no FSK or DMX-512 data being received. Valid frame rates are 15 or 30 frames per second. The sequencer EPROM is programed using a PC·MACs Animation Control system to program an appropriate animation sequence, which is then downloaded to a 'multi' EPROM file using the 'Save as EPROM....' command under the file pulldown menu.
- i) Countdown displayed- When this toggle is 'ON', the countdowns used when running FSK based shows will be displayed on the bottom of the screen. This is useful for seeing how these counters are working. As long as you are not using the serial port for controlling a LaserDisk or Compact Disc player, you can go ahead and leave this toggle 'ON'.

- j) Force digital outputs on- This command is used to force any of the 128 digital outputs 'ON'. No matter where the data comes from, an output that has been forced on can not be turned off
- **k)** Force digital outputs off- This command is used to force any of the 128 digital outputs 'OFF'. No matter where the data comes from, an output that has been forced off can not be turned back on.
- **I)** Force analog to a value- This command is used to force any of the analog outputs (if installed) to a set value. Once an analog output has been forced to a to a level, no matter where data comes from it will not change.
- n) Set analog endpoints- This command is used to adjust the endpoints of the 16 analog outputs (if installed). The analog outputs normally sweep between 0 and 10 Volts DC. By using these commands you can set either endpoint to anywhere between 0 and 10 volts for a reduced or reversed analog output swing. If you want to invert the voltage swing of any output, all you need to do is set the lower limit to a higher level than the upper limit.

As an example of the use of the analog endpoint adjustments, if you wanted to set the voltages on a channel to sweep from 2.5 volts to 7.5 volts: Looking at the chart at the end of this manual, you can see that this would be from approximately 25% to 75% of full scale. From the chart you would see that the values that should be entered would be 40h and C0h.

- r) Download configuration- This command is used to save the current configuration of the FSK/RTU through the serial port to a file on your computer. This file can then be reloaded into this, or any other FSK/RTU. To use this command, you first invoke it, then following the instructions, you set your computer to receive a string of ASCII characters. You then press any key to tell the FSK/RTU to send out it's configuration. When it has finished, you then tell your computer to stop saving characters, and then hit any key to tell the FSK/RTU to redraw the screen.
- s) Upload configuration- This command is the compliment of the previous command. To invoke it, all you need to do is tell your modern program to send the file saved by the 'download' command to the FSK/RTU. This will automatically invoke the upload command and store the incoming data. The data won't be saved permanently until you invoke the 'Write configuration to EEPROM'.
- t) Default configuration- This command reloads the default configuration to the FSK/RTU.
- u) Read configuration from EEPROM- This reads the permanently stored configuration into the FSK/RTU's memory from the EPROM. This configuration is normally loaded by the FSK/RTU only at boot up. This command can be used if you have made some changes in the configuration that you now want the FSK/RTU to forget.
- w) Write configuration to EEPROM- This command is used to write any changes you have made in the configuration to the permanent EEPROM memory in the FSK/RTU.
- x) eXit- This exits the configuration mode and returns the FSK/RTU to the command mode.

Summary of Setup Commands:

	-
a)	tape deck pulse
b)	FSK/DMX dropout
c)	FSK intershow
d)	FSK startup
e)	Minimum rewind
f)	Set FSK time delays
g)	Enter strings
h)	Sequencer enabled
i)	Countdown displayed
j)	Force digital outputs off
k)	Force digital outputs on
l)	Force analog to a value
n)	Set analog endpoints
r)	Download configuration
s)	Upload configuration
t)	Default configuration
u)	Read configuration from EEPROM
w)	Write configuration to EEPROM
x)	eXit

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- String Setup -

STRINGS are the ASCII characters and commands which you can tell the FSK/RTU send at the start or end of any show through its serial port. The Strings used in the FSK/RTU are similar to those used in PC·MACs or the Smart Brick Animation Control Systems. They are used primarily to talk to LaserDisk and Compact Disc players or just to tell the FSK/RTU to close the contacts on its tape deck control outputs. They can also be used to send commands through the serial port to any other piece of show equipment that needs a serial input to start or stop it, or even just to print on a monitoring screen that a show has started or ended.

When using the FSK/RTU with a LaserDisk or Compact Disc, you will typically use the STOP string to pause the player, the PLAY string to tell the player to start playing, and the REWIND string to spin up the disk position the player to the beginning of the first show.

The 'enter string' command leads to the following String Setup Screen (the default configuration is shown):

```
-Gilderfluke & Company - RTU/FSK Controller - version 2.00 - copyright 1994 DCM-
a) Stop String:
c) Rewind String:
x) eXit
    command-
```

Characters are entered into the strings as HEXadecimal ASCII characters. As an example of using ASCII:

To send a letter "a", you enter the HEXadecimal value of 61.

If bit seven of any ASCII character is set to =1, then instead of sending the character out the serial port, the FSK/RTU will wait until it receives this character through the serial port. As an example of using ASCII to receive a character:

To wait until the FSK/RTU receives a letter "a", you enter a value of E1.

If the FSK/RTU receives a different character than it was expecting, then the DATA ERROR LED will flash momentarily. Use the 'Special Character' 80h if you don't care what character is to be received.

The strings are up to 80 characters long. They are sent as part of a start, stop or rewind sequence. The default strings simply close the Stop, Play and rewind relays, respectively. All the characters in a string will be sent until a '00' is encountered or the end of the string is reached.

When entering any of the strings, you can stop at any time by just pressing the <ESC>ape key. You don't need to enter in all 80 characters in each string. This will conclude (not abort) the string entry command.

Special String Characters:

Within the strings there are nine 'special characters' which can be used. They are defined as follows:

END-o-STRING: (00): This special character tells the FSK/RTU that it has reached the end of the current string it is sending.

LaserSearch: (01): Not used by the FSK/RTU.

PB: (02): Not used by the FSK/RTU.

BLUE: (03): Not used by the FSK/RTU.

GREEN:(04): Not used by the FSK/RTU.

STOP: (05): When found in a string, this character causes the FSK/RTU to close the STOP relay output. It will then reopen at a later time as set by the TAPE DECK PULSE setting. When running a tape deck from the FSK/RTU, this would normally be used to stop the tape deck at the end of each show.

PLAY: (06): When found in a string, this character causes the FSK/RTU to close the PLAY relay output. It will then reopen at a later time as set by the TAPE DECK PULSE setting. When running a tape deck from the FSK/RTU, this would normally be used to start the tape deck at the beginning of each show.

REWIND: (07): When found in a string, this character causes the FSK/RTU to close the REWIND relay output. It will then reopen at a later time as set by the TAPE DECK PULSE setting. When running a tape deck from the FSK/RTU, this would normally be used to rewind the tape deck at the end of the last show on the tape.

DON'T CARE: (80): This character is used when you need to get a character returned from the serial port, but just don't give a damn what it is that you receive. The FSK/RTU will simply wait until it gets <u>any</u> character through the serial port. This is the only one of the 'special characters' which is used when receiving characters from the serial port.

ASCII Characters to be Sent Out:

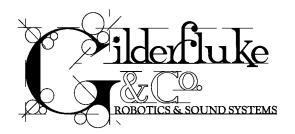
When sending ASCII characters to the serial port, they translate into HEXadecimal as follows. The first eight characters are special characters unique to the FSK/RTU:

SENT ASCII	HEX	SENT ASCII	HEX	SENT ASCII	<u>HEX</u>	SENT ASCII	<u>HEX</u>
end-o-strin		DLE	10	SPACE	20	0	30
LaserSearc		DC1	11	!	21	1	31
pb	02	DC2 DC3	12 13		22 23	2 3	32 33
blue	03 04	DC3 DC4	13	# \$	23 24	3 4	33 34
green stop	05	NAK	15	\$ %	24 25	5	35
play	06	SYN	16	% &	26	6	36
rewind	07	ETB	17	α,	20 27	7	37
BS	08	CAN	18	(28	8	38
HT	09	EM	19	(29	9	39
LF	0 <i>7</i>	SUB	1A) *	2A	,	3A
VT	OB	ESC	1B	+	2B		3B
FF	0C	FS	1C	,	2C	, <	3C
CR	0D	GS	1D	-	2D	=	3D
SO	0E	RS	1E		2E	>	3E
SI	OF	VS	1F	,	2F	?	3F
<u>SENT</u>		<u>SENT</u>		SENT		<u>SENT</u>	
ASCII	<u>HEX</u>	ASCII	<u>HEX</u>	SENT ASCII	<u>HEX</u>	SENT ASCII	<u>HEX</u>
<u>ASCII</u> @	40	ASCII P	50		60	· · · · · · · · · · · · · · · · · · ·	70
ASCII	40 41	ASCII P Q	50 51	<u>ASCII</u>	60 61	ASCII	70 71
ASCII @ A B	40 41 42	ASCII P Q R	50 51 52	ASCII a b	60 61 62	ASCII p q r	70 71 72
ASCII @ A B C	40 41 42 43	ASCII P Q R S	50 51 52 53	a b c	60 61 62 63	ASCII p q r s	70 71 72 73
ASCII @ A B C D	40 41 42 43 44	ASCII P Q R S T	50 51 52 53 54	a b c d	60 61 62 63 64	ASCII p q r s t	70 71 72 73 74
ASCII @ A B C D E	40 41 42 43 44 45	ASCII P Q R S T U	50 51 52 53 54 55	a b c d e	60 61 62 63 64 65	ASCII p q r s t	70 71 72 73 74 75
ASCII @ A B C D E	40 41 42 43 44 45 46	ASCII P Q R S T U V	50 51 52 53 54 55 56	a b c d e f	60 61 62 63 64 65 66	ASCII p q r s t u	70 71 72 73 74 75 76
ASCII @ A B C D E F G	40 41 42 43 44 45 46 47	ASCII P Q R S T U V W	50 51 52 53 54 55 56 57	a b c d e f g	60 61 62 63 64 65 66	P q r s t u v w	70 71 72 73 74 75 76 77
ASCII @ A B C D E F G H	40 41 42 43 44 45 46 47 48	ASCII P Q R S T U V W X	50 51 52 53 54 55 56 57 58	a b c d e f g h	60 61 62 63 64 65 66 67 68	P q r s t u v w x	70 71 72 73 74 75 76 77 78
ASCII @ A B C D E F G H I	40 41 42 43 44 45 46 47 48 49	ASCII P Q R S T U V W X Y	50 51 52 53 54 55 56 57 58 59	a b c d e f g	60 61 62 63 64 65 66 67 68 69	ASCII	70 71 72 73 74 75 76 77 78 79
ASCII	40 41 42 43 44 45 46 47 48 49 4A	P Q R S T U V W X Y Z	50 51 52 53 54 55 56 57 58 59 5A	a b c d e f g h i j	60 61 62 63 64 65 66 67 68 69 6A	P Q r S † U V W X Y Z	70 71 72 73 74 75 76 77 78 79 7A
ASCII @ A B C D E F G H I J K	40 41 42 43 44 45 46 47 48 49 4A 4B	ASCII P Q R S T U V W X Y Z	50 51 52 53 54 55 56 57 58 59 5A 5B	a b c d e f g h i j k	60 61 62 63 64 65 66 67 68 69 6A 6B	ASCII	70 71 72 73 74 75 76 77 78 79 7A 7B
ASCII @ A B C D E F G H I J K L	40 41 42 43 44 45 46 47 48 49 4A 4B 4C	ASCII P Q R S T U V W X Y Z [50 51 52 53 54 55 56 57 58 59 5A 5B 5C	a b c d e f g h i j k l	60 61 62 63 64 65 66 67 68 69 6A 6B 6C	P P P P P P P P P P	70 71 72 73 74 75 76 77 78 79 7A 7B 7C
ASCII @ A B C D E F G H I J K L M	40 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D	P Q R S T U V W X Y Z [\ \ \]	50 51 52 53 54 55 56 57 58 59 5A 5B 5C 5D	a b c d e f g h i j k l m	60 61 62 63 64 65 66 67 68 69 6A 6B 6C 6D	P P P P P P P P P P	70 71 72 73 74 75 76 77 78 79 7A 7B 7C
ASCII @ A B C D E F G H I J K L	40 41 42 43 44 45 46 47 48 49 4A 4B 4C	ASCII P Q R S T U V W X Y Z [50 51 52 53 54 55 56 57 58 59 5A 5B 5C	a b c d e f g h i j k l	60 61 62 63 64 65 66 67 68 69 6A 6B 6C	P Q r S † U V W X Y Z	70 71 72 73 74 75 76 77 78 79 7A 7B 7C

ASCII Characters to be Recieved:

If you need to get a response from the serial port, you simply enter the character with bit seven set. The first character is a special character unique to the RTU/FSK. Response ASCII characters translate into HEX as follows:

RESPO	NSE	RESPO	NSE	RESP	ONSE	RESPO	NSE
<u>ASCII</u>	HEX	<u>ASCII</u>	HEX	<u>ASCII</u>	HEX	<u>ASCII</u>	HEX
don't care	9 80	DLE	90	SPACE	A0	0	ВО
SOH	81	DC1	91	!	A1	1	В1
STX	82	DC2	92	w	A2	2	B2
ETX	83	DC3	93	#	А3	3	В3
EOT	84	DC4	94	\$	A4	4	B4
ENG	85	NAK	95	%	A5	5	В5
ACK	86	SYN	96	&	A6	6	В6
BELL	87	ETB	97	`	Α7	7	В7
BS	88	CAN	98	(A8	8	В8
HT	89	EM	99)	Α9	9	В9
LF	A8	SUB	9A	*	AA	:	BA
VT	8B	ESC	9B	+	AB	;	BB
FF	8C	FS	9C	,	AC	<	BC
CR	8D	GS	9D	-	AD	=	BD
SO	8E	RS	9E		ΑE	>	BE
SI	8F	VS	9F	/	AF	?	BF
DESDO	NSF	DESDO	NSF	DESD	ONSE	DESDO	NSE
RESPO		RESPO		RESP(RESPO ASCII	
ASCII	HEX	ASCII	HEX	RESPO ASCII	HEX	ASCII	HEX
ASCII @	HEX C0	ASCII P	HEX D0	ASCII	HEX EO	ASCII	HEX FO
ASCII @ A	HEX C0 C1	ASCII P Q	HEX D0 D1	ASCII a	HEX E0 E1	ASCII p q	HEX FO F1
ASCII @ A B	HEX C0 C1 C2	ASCII P Q R	HEX D0 D1 D2	ASCII a b	HEX E0 E1 E2	ASCII p q r	HEX F0 F1 F2
ASCII @ A B C	HEX C0 C1 C2 C3	ASCII P Q R S	D0 D1 D2 D3	ASCII a b c	HEX E0 E1 E2 E3	ASCII p q r s	F0 F1 F2 F3
ASCII @ A B C D	HEX C0 C1 C2 C3 C4	ASCII P Q R S T	D0 D1 D2 D3 D4	ASCII a b c d	HEX E0 E1 E2 E3 E4	ASCII p q r s t	F0 F1 F2 F3 F4
ASCII @ A B C D E	HEX C0 C1 C2 C3 C4 C5	ASCII P Q R S T	D0 D1 D2 D3 D4 D5	ASCII a b c d e	HEX E0 E1 E2 E3 E4 E5	ASCII p q r s t	F0 F1 F2 F3 F4 F5
ASCII @ A B C D E	HEX C0 C1 C2 C3 C4 C5 C6	ASCII P Q R S T U	D0 D1 D2 D3 D4 D5 D6	ASCII a b c d e f	HEX E0 E1 E2 E3 E4 E5 E6	ASCII p q r s t u	F0 F1 F2 F3 F4 F5 F6
ASCII @ A B C D E F G	HEX C0 C1 C2 C3 C4 C5 C6	ASCII P Q R S U V W	D0 D1 D2 D3 D4 D5 D6 D7	ASCII a b c d e f g	E0 E1 E2 E3 E4 E5 E6 E7	ASCII p q r s t u v	F0 F1 F2 F3 F4 F5 F6 F7
ASCII @ A B C D E	HEX C0 C1 C2 C3 C4 C5 C6 C7	ASCII P Q R S T U	D0 D1 D2 D3 D4 D5 D6 D7 D8	ASCII a b c d e f	E0 E1 E2 E3 E4 E5 E6 E7 E8	ASCII p q r s t u v w x	F0 F1 F2 F3 F4 F5 F6 F7 F8
ASCII @ A B C D E F G H	HEX C0 C1 C2 C3 C4 C5 C6 C7 C8	ASCII P Q R S U V W X	D0 D1 D2 D3 D4 D5 D6 D7	ASCII a b c d e f g	E0 E1 E2 E3 E4 E5 E6 E7 E8 E9	ASCII p q r s t u v w x y	F0 F1 F2 F3 F4 F5 F6 F7 F8 F9
ASCII @ A B C D E F G H	HEX C0 C1 C2 C3 C4 C5 C6 C7	ASCII P Q R S T U V W X Y	D0 D1 D2 D3 D4 D5 D6 D7 D8	ASCII a b c d e f g	E0 E1 E2 E3 E4 E5 E6 E7 E8	ASCII p q r s t u v w x y z	F0 F1 F2 F3 F4 F5 F6 F7 F8
ASCII @ A B C D E F G H I J	HEX C0 C1 C2 C3 C4 C5 C6 C7 C8 C9	ASCII P Q R S T U V W X Y	D0 D1 D2 D3 D4 D5 D6 D7 D8 D9 DA	ASCII a b c d e f g h i	E0 E1 E2 E3 E4 E5 E6 E7 E8 E9 EA	ASCII p q r s t u v w x y	FO F1 F2 F3 F4 F5 F6 F7 F8 F9 FA
ASCII	HEX C0 C1 C2 C3 C4 C5 C6 C7 C8 C9 CA	ASCII P Q R S U V W X Y Z [D0 D1 D2 D3 D4 D5 D6 D7 D8 D9 DA DB	ASCII a b c d e f g h i	E0 E1 E2 E3 E4 E5 E6 E7 E8 E9 EA EB	ASCII p q r s t u v w x y z {	FO F1 F2 F3 F4 F5 F6 F7 F8 F9 FA FB
ASCII	HEX C0 C1 C2 C3 C4 C5 C6 C7 C8 C9 CA CB	ASCII P Q R S T U V W X Y	D0 D1 D2 D3 D4 D5 D6 D7 D8 D9 DA DB DC	ASCII a b c d e f g h i j k l	E0 E1 E2 E3 E4 E5 E6 E7 E8 E9 EA EB EC	ASCII p q r s t u v w x y z	FO F1 F2 F3 F4 F5 F6 F7 F8 F9 FA FB FC



- PIONEER LaserDisk COMMANDS -

The Pioneer LaserDisk players all share a common command format. A full description of the commands can be found in the technical publications available from Pioneer Communications of America. They can be reached at (408) 988-1702.

LaserDisks used with the FSK/RTU may be recorded in the CAV or CLV format. This allows up to 1 hour per side. The FSK data must be recorded on one of the audio tracks much as they would be on any audio tape FSK installation. The gaps in the FSK data between shows is used by the FSK/RTU to recognize the ends of shows and decide when to send each of the strings.

The LaserDisk player must be configured for 9600 baud, 8 bit data, and 1 stop bit. On the LD-V8000, you also must set the 'TxD Terminator' to '<C/R>'. Connections are made as follows:

Pioneer LaserDisk		
DB-15	<u>SIGNAL</u>	SIGNAL FROM/TO FSK/RTU
2	DATA OUT	- serial data in to FSK/RTU (GREEN)
3	DATA IN	- serial data out from FSK/RTU (BLACK)
1, 11 or 15	GROUND	signal ground (BLUE or WHITE)

The electrical output from the FSK/RTU is at RS-422 voltage levels rather than the RS-232 that these LaserDisk players really want to see. If this causes a problem, or it the wire runs between FSK/RTU and the LaserDisk player are long, then you may want to add a RS-232 to RS-422 converter to the LaserDisk player.

In general, you send a command to the LaserDisk player as two ASCII characters (with occasional variables), followed by a <carriage return> character (0D). The LaserDisk player will then respond when it has completed the task with a upper case 'R' followed by a <carriage return> character (0D). A number of different commands can be stacked together and then followed by a single <carriage return> character (0D) to get them all rolling. The LaserDisk player will go through all of these commands in the order they were entered and then return a 'R' followed by a <carriage return> character (0D) when it has finished the last command. This can save a lot of string space if you are sending complicated strings to the LaserDisk player.

The majority of commands which you might need to use are all pretty simple two or three character ones. A typical PLAY string for a LaserDisk show is:

PL <CR> (R) (<CR>) end-o-string

Translated into HEX ASCII, this string becomes (this is what you would enter)

50 4C 0D D2 8D 00

Notice that we have to tell the LaserDisk to start playing, and that this command is followed by one <carriage return> character to be sent out. Following this we tell the FSK/RTU to wait until it gets first an 'R', and then a <CR> back from the LaserDisk player. After this we have a '00' to tell the FSK/RTU that it has found the end of the string.

A typical end string for a LaserDisk show is:

ST < CR > (R) (< CR >) end-o-string

Translated into HEX ASCII, this string becomes (this is what you would enter):

53 54 0D D2 8D 00

The format of this string is pretty much like that of the startup string, except the PL command has been replaced by a ST (still frame) command for the LaserDisk player. This freezes the image to whatever the last image on the video disk was. Other commands are available for blanking out the video, ejecting the disk,

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or a variety of other things. You can even build up a string which will tell the LaserDisk player to search for another frame on the disk and freeze or start playing from that frame. If no command is given to the LaserDisk player at the end of a LaserDisk show, then the player will continue playing along until the end of the disk is reached or another command is received.

The REWIND string is the most complex one when operating a LaserDisk or CD player. This is because this is the string which is used to spin up and locate the disk to the start of all of the shows. An example of a typical REWIND string would be:

SA 12345 SE <CR> (R) (<CR>) end-o-string

Translated into HEX ASCII, this string becomes (this is what you would enter):

53 41 31 32 33 34 35 53 45 0D D2 8D 00

The 'SA' in this string is the 'spin up' command for a Pioneer LaserDisk player. This is followed by a five digit frame number to search for, and the search command 'SE'. The rest of the string consists of a <CR> that tells the LaserDisk player to start working on these commands, and acknowledgment that the LaserDisk will return at the end of the successful completion of the commands.

As an example of how you combine more than a single LaserDisk command in the same string, we will now show a sample of a string which sends two commands at the same time to the LaserDisk player.

A typical combined start string for a LaserDisk show is:

PL 1KP <CR> (R) (<CR>) end-o-string

Translated into HEX ASCII, this string becomes (this is what you would enter):

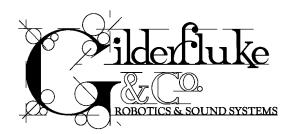
50 4C 30 4B 4C 0D D2 8D 00

This string is just like the start string shown above, except that it sends a command to disable the front panel keypad on the LaserDisk player after it sends the command to start the show playing, but before it sends the <carriage return> that tells the LaserDisk player to start acting upon all the commands it has just received.

The following is a partial listing of the commands supported by Pioneer LaserDisk players. It is by no means a complete list of all of the commands available to you, but includes those common commands which you may actually need. Remember that you only need to send the <carriage return> (0D) (shown as the last character of all the commands) only if you aren't following the current command with any other command. The <carriage return> tells the LaserDisk player to start working on all of the commands it has received since the last <carriage return> was received.

COMMAND	MNEMONIC	<u>1st</u>	<u>2nd</u>	3rd	4th	RESPONSE	2ND
SEARCH	SE	53	45	0D		D2	8D
	or the five digit frame	number wh		nediatel	y preced	les this commai	nd.
CLEAR Clears the o	CL current entry or mode	43 Ə.	4C	0D		D2	8D
START Closes the o	SA door (if it was open) c	53 and spins u	41 p the di	OD sk.		D2	8D
OPEN DOOR Stops the p	OP layer if it is running ar	4F and opens the	50 ne door.	0D		D2	8D
REJECT	RJ layer motor if it is runi	52	4A	0D		D2	8D
PLAY	PL aserDisk playing from	50	4C	OD	e disk	D2	8D
PAUSE	PA aserDisk player and a	50	41	0D		D2	8D
STILL	ST output of the LaserD	53	54	0D		D2	8D
STEP FORWARD	SF urrent video frame fo	53	46	0D	arrie.	D2	8D
STEP BACKWARI	SB urrent video frame bo	53 ackwards b	42 y one fro	OD ame		D2	8D
VIDEO CONTRO Turns off the	OVD e video output.	30	56	44	0D	D2	8D
VIDEO CONTRO Turns on the	L 1VD e video output (defau	31 ult conditio	56 n).	44	0D	D2	8D
CLOSE DOOR Closes the	CO olayer's door if it was	43 open.	4F	0D		D2	8D
KEY LOCK	OKL buttons on the front	30	4B ne Laser	4C Disk pla	OD yer.	D2	8D
KEY LOCK	1KL e buttons on the front	31	4B	4C	0D	D2	8D
BEEP CONTROL	OBP ns long 880 Hz beep	30	42	50	0D	D2	8D
BEEP CONTROL	1BP ns long 880 Hz beep	31	42	50	0D	D2	8D
BEEP CONTROL	2BP ns long 880 Hz beep	32	42	50	0D	D2	8D
BEEP CONTROL	3BP ns long 880 Hz beep	33	42	50	0D	D2	8D

Please note that in many ways a LaserDisk player isn't very bright. If you send it a command to do something that is already done, it will return an error message. As an example, if you ask it to close the door with a CLOSE DOOR command and the door is already closed, it will return an error message 'E04 <CR>' instead of the 'R <CR>' you are expecting. This will cause the FSK/RTU to display an error message on the Heads Up Display and stop sending the current string.



- SONY LaserDisk COMMANDS -

The Sony LaserDisk players all share a more or less common command format. A full description of the commands can be found in the technical publications available from Sony or your Sony dealer. You should confirm the the usage of these commands for the specific player you are using.

LaserDisks used with the FSK/RTU may be recorded in the CAV or CLV format. This allows up to 1 hour per side. The FSK data must be recorded on one of the audio tracks much as they would be on any audio tape FSK installation. The gaps in the FSK data between shows is used by the FSK/RTU to recognize the ends of shows and decide when to send each of the strings.

The LaserDisk player must be configured for 9600 baud, 8 bit data, and 1 stop bit. Connections are made as follows:

Sony LaserDisk		
DB-25	<u>SIGNAL</u>	SIGNAL FROM/TO FSK/RTU
2	DATA OUT	 serial data in to FSK/RTU (GREEN)
3	Data in	 serial data out from FSK/RTU (BLACK)
7	GROUND	signal ground (BLUE or WHITE)
4 to 5	RTS/CTS	connect these two lines
6 to 20	DSR/DTR	connect these two lines

The electrical output from PC·MACs is at RS-422 voltage levels rather than the RS-232 that these LaserDisk players really want to see. If this causes a problem, or it the wire runs between PC·MACs and the LaserDisk player are long, then you may want to add a RS-232 to RS-422 converter to the LaserDisk player.

In general, you send a command to the LaserDisk player as a single ASCII character. The LaserDisk player will then respond that it has received the command with a 'ACK' (0A). When it has completed the task it will sometimes respond with a 'COMPLETION CODE' (01 usually). Each command must be transmitted one at a time, after which you must wait for a return code(s) before you can send any additional commands.

The majority of commands which you might need to use are all pretty simple ones. The one complicated 'search' command is handled transparently to you when you insert a LaserSearch (01) character in the string being sent to the LaserDisk player (the FSK/RTU must be told it is running a Sony player in the configuration screen). This string only performs a search for the starting frame of the show on the LaserDisk player. For this reason it is normally followed by a 'F-PLAY' (3A) command in the same string.

A typical start string for a LaserDisk show is:

'F-PLAY' <ACK> end-o-string

Translated into HEX ASCII, this string becomes (this is what you would enter):

3A 8A 00

Notice that we have to then tell the LaserDisk to start playing, and then we tell the FSK/RTU to wait until it gets an 'ACK' (0A) back from the LaserDisk player so we know that the command has been accepted. After this we have a '00' to tell the FSK/RTU that it has found the end of the string.

A typical end string for a Sony LaserDisk show is:

'STILL' <ACK> end-o-string

Translated into HEX ASCII, this string becomes (this is what you would enter):

4F 8A 00

The format of this string is pretty much like that of the startup string, except the F-PLAY command has been replaced by a STILL command for the LaserDisk player. This freezes the image to whatever the last image on the video disk was. Other commands are available for blanking out the video, ejecting the disk, or a variety of other things. You can even build up a string which will tell the LaserDisk player to search for another frame on the disk and freeze or start playing from that frame. If no command is given to the LaserDisk player at the end of a LaserDisk show, then the player will continue playing along until the end of

The REWIND string is the most complex one when operating a LaserDisks or CD player. This is because this is the string which is used to spin up and locate the disk to the start of all of the shows. An example of a typical REWIND string to search for frame number 12,345 would be:

'CLEAR ALL' <ACK> 'SEARCH' <ACK> '1' <ACK> '2' <ACK> '3' <ACK> '4' <ACK> '5' <ACK> 'ENTER' <ACK> <Completion> end-o-string

Translated into HEX ASCII, this string becomes (this is what you would enter):

56 8A 43 8A 31 8A 32 8A 33 8A 34 8A 35 8A 40 8A 81 00

the disk is reached or another command is received.

The 'Clear All' this string starts with is to stop the LaserDisk from processing any other commands it might already be working on. This is followed by the 'Motor On' which will close the door (if needed) and spin up the disk. The 'Search' command is followed by a five digit frame number to search for, and a 'Enter' which tells the LaserDisk player to start its search. It returns a Completion acknowledgment that the LaserDisk will return at the end of the successful completion of the commands.

The following is a partial listing of the commands supported by Sony LaserDisk players. It is by no means a complete list of all of the commands available to you, but includes those common commands which you may actually need. Not all Sony players support this full range of commands or respond in the same way to the commands sent to them. These particular commands are from a LDP-1500's manual, and so may not be applicable to all Sony players. The values shown are what you would actually enter into the strings.

COMMAND	HEX CHARACTER SENT	POSITIVE RESPONSE
	43 (ADDRESS) 40 rame number that follows the commo turns 8A immediately, 81 when task is co	
CLEAR ALL Clears out any curr	56 rently digesting command.	8A
AUDIO MUTE ON ³ Stops the audio ou	24 tput from the player.	8A
AUDIO MUTE OFF ¹ Enables the audio	25 output from the player.	8A
CH-1 ON Turns on Audio out	46 out from Channel 1 to 'LEFT' audio outp	8A out connector.
CH-1 OFF Turns off Audio out abled.	47 put from CH 1 audio. CH 2 audio will (8A go to both outputs if it is still en-
CH-2 ON Turns on Audio out	48 out from Channel 2 to 'Right' audio out	8A tput connector.
CH-2 OFF Turns off Audio out abled.	49 put from CH 2 audio. CH 1 audio will e	8A go to both outputs if it is still en-
CLEAR ALL	56	

Stops any ongoing command and puts player into STILL mode.

³ Command not available on all Sony models

EJECT⁴	2 A	8A 83
Opens the disk compartme	nt. Returns 8A immediately,	83 when task is completed.
EJECT ENABLE ²	74	8A
	n the front of the LaserDisk p	olayer.
EJECT DISABLE ² Disables the 'Eject' button o	75 on the front of the LaserDisk p	8A player.
F-PLAY	3 A	8A
Puts the player in normal pla	ay mode.	
F-STEP and STILL ²	2B	8A
Steps the LaserDisk forward I	by one frame and display st	ill frame.
R-STEP and STILL ² Steps the LaserDisk backwar	2C rds by one frame and displa	8A y still frame.
FRAME # MODE	55	8A
Sets the player to 'frame' me	ode.	
	62 opped. Returns the first 8A d. Returns one NAK if the ma	8A 8A immediately, and the second after otor was already on.
MOTOR OFF	63	8A 8A
	unning. Returns the first 8A i lown. Returns one NAK if the	immediately, and the second after motor was already off.
NAK		8B
Code returned when the pla	ayer doesn't like the commo	and, as in the above two examples.
STILL	4F	8A
Sets the player to display a	·	
Stops all video and audio o	3F utput.	88
VIDEO OFF ²	26	8A
Turns off video output.		
VIDEO ON ²	27	8A
Turns on video output.		

⁴ Command not available on all Sony models

- DECIMAL to HEXadecimal to ASCII to PERCENTAGE -

The following chart shows decimal, HEXadecimal, ASCII and a few percentage equivalents to aid you when you need to convert between numbering bases. Also shown are the 'special' characters used by PC·MACs, Smart Brick and FSK/RTU Animation Control Systems. ASCII values that have their uppermost bit set (bit 7) are shown in parenthesis:

decimal	<u>HEX</u>	<u>ASCII</u>	<u>%</u>	decimal	<u>HEX</u>	<u>ASCII</u>	<u>%</u>	<u>decimal</u>	<u>HEX</u>	<u>ASCII</u>	<u>%</u>	decima	<u>HEX</u>	ASCII %
00 1 2 3 4 5 6	02 03 04 05 06	stx/^B etx/^C eot/^D eng/^E ack/^F	O LaserSearch PB Input wait BLUE in wait GREEN in wa STOP Relay PLAY Relay REWIND Rela	66 67 it 68 69 70	40 41 42 43 44 45 46 47	@ A B C D E F G	25%	128 129 130 131 132 133 134	80 81 82 83 84 85 86 87	(soh) (stx) (etx/) (eot) (eng) (ack)	% (don't (care)192 193 194 195 196 197 198	C0 C1 C2 C3 C4 C5 C6 C7	(@) 75% (A) (B) (C) (D) (E) (F)
9 10 11 12 13 14	08 09 0A 0B 0C 0D	bs/^H	HDTV Mode Hour = '01'	72 73 74 75 76 77 78 79	47 48 49 4A 4B 4C 4D 4E 4F	9 H		136 137 138 139 140 141 142	88 89 8A 8B 8C 8D 8E 8F	(bell) (bs) (ht) (ff) (yt) (ff) (cr) (so) (si)		200 201 202 203 204 205 206 207	C7 C8 C9 CA CB CC CD CE CF	(G) (H) (J) (X) (M) (N) (O)
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	11 d 12 13 14 15 16 17 18	dle/^P dc1/^Q dc2/^R dc3/^S dc4/^T nak/^U syn/^V etb/^W can/^X sub/^Z ESC FS GS RS VS		80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95	50 51 52 53 54 55 57 58 59 58 50 55 55 55 55 55 55 55 55 55 55 55 55	P Q R S T U V W X Y Z [\]		144 145 146 147 148 149 150 151 152 153 154 155 156 157 158	90 91 92 93 94 95 96 97 98 90 9D 9F	(dls) (dc1) (dc2) (dc3) (dc4) (nak) (syn) (etb) (can) (sub) (ESC) (FS) (GS) (RS) (VS)		208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223	DO D1 D2 D3 D4 D5 D6 D7 D8 D9 DA DB DC DD DE DF	(^)
32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51	20 21 22 23 24 25 26 27 28 29 20 22 31 32 33 33	SP ! # \$ % & ` () * + ` - · / O 1 2 3 4	12.5%	96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111	60 61 62 63 64 65 66 67 68 69 6A 6B 6C 6D 6E 71 72 73	abcdefghijk-Enopars	37.5%	160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175	A0 A1 A2 A3 A4 A5 A6 A7 A8 AAA AAA AAAAAAAAAAAAAAAAAAAAAA	(SP) 62 (!) (#) (\$) (%) (%) ((!) (!) (!) (!) (!) (!) (!) (!) (!) (2.5%	224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243	E0 E1 E2 E3 E4 E5 E6 E7 E8 E9 EA EB EC ED EE EF F0 F1 F2 F3	(*) 87.5% (a) (b) (c) (d) (e) (f) (g) (h) (ii) (iii) (
52 53 54 55 56 57 58 59 60 61 62 63	34 35 36 37 38 39 3A 3B 3C 3D 3E 3F	4 5 6 7 8 9 :;< = ?		116 117 118 119 120 121 122 123 124 125 126 127	74 75 76 77 78 79 7A 7B 7C 7D 7E 7F	t u v w x y z		180 181 182 183 184 185 186 187 188 189 190	B4 B5 B6 B7 B8 B9 BA BB BC BD BE BF	(4) (5) (6) (7) (8) (9) (;) (<) (=) (>)		244 245 246 247 248 249 250 251 252 253 254 255	F4 F5 F6 F7 F8 F9 FA FB FC FD FE	(f) (u) (v) (w) (x) (y) (z) () () () () (del)100%