Analog Output Smart Brick

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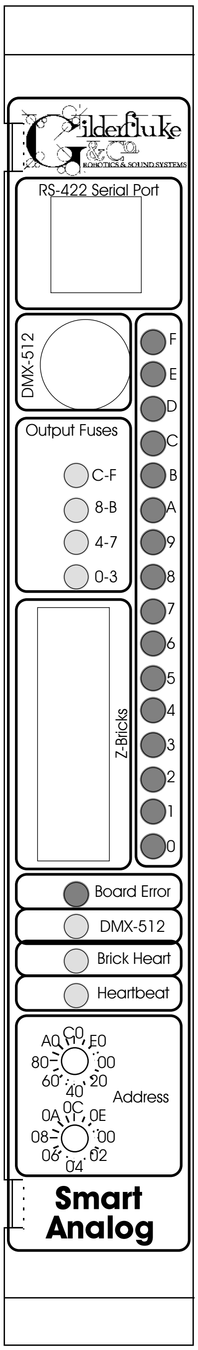

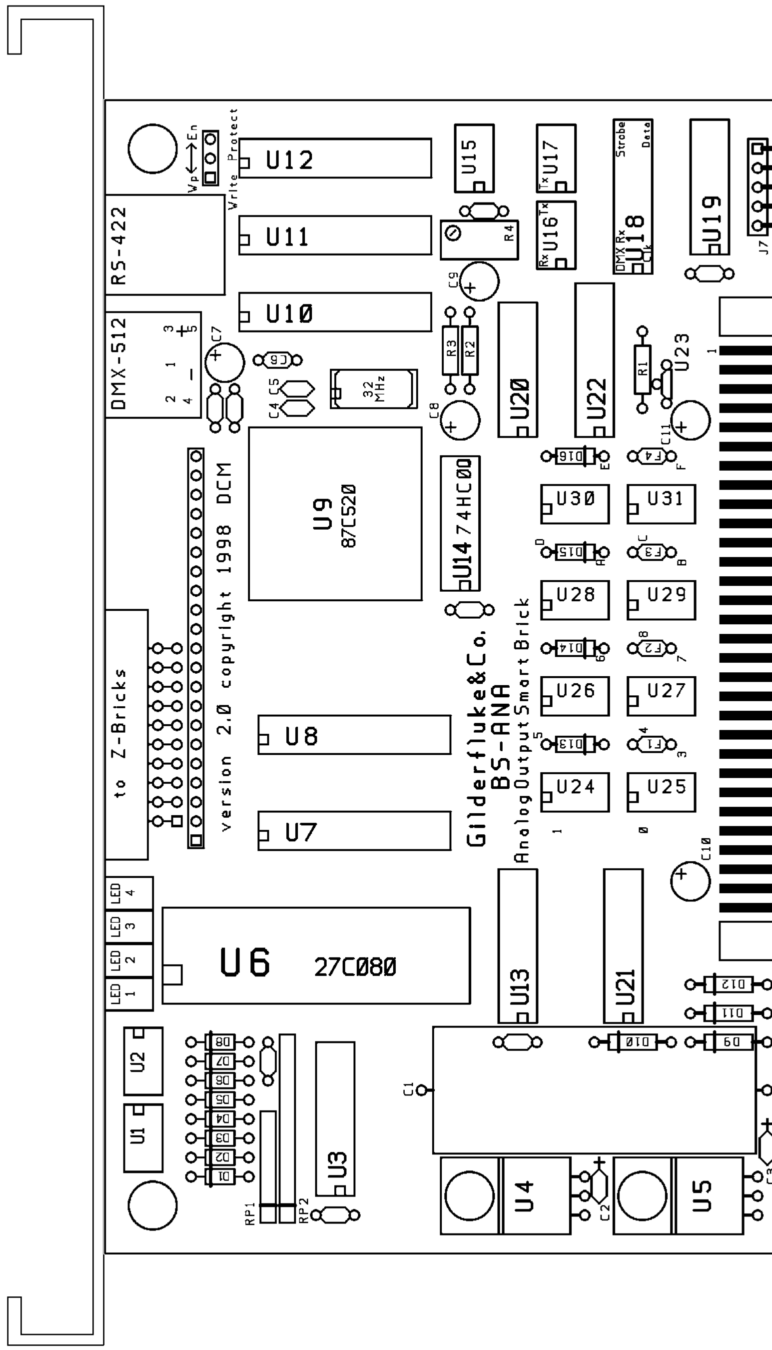

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Overview:

This is an output card which has sixteen 0-10 volt analog outputs, a single DMX-512 output and a port for attaching Z-Bricks. The analog outputs can be set to use either eight or twelve bits of resolution. It is designed to be used as an output card for use in a PC·MACs system, or as a playback only Smart Brick in a Smart Brick installation. It can be used in two different ways:

1) **BS-ANA as a Remote Terminal Unit (RTU):** In this mode the card receives up to 256 channels of DMX-512 data transmitted by a PC·MACs Animation Control System, or any other source of DMX-512 data, and uses this to update its outputs. The BS-ANA can be addressed to use any DMX-512 address from 0 to 255. The DMX-512 input allows the BS-ANA to be used as a permanent output device for a PC·MACs or other Animation or Lighting Control System, or the DMX-512 input can be used temporarily until an Eprom is programmed so the card can be used as a Smart Brick.
2) **BS-ANA as a Smart Brick:** This card acts just like any other Playback-Only Smart Brick, playing animation data from an on-board Eprom. As a Smart Brick, it requires a Smart Brick Brain to run. The Smart Brick Brain tells all of the Smart bricks attached to it (including the BS-ANA) where in the show it is. The BS-ANA then uses this information to access the appropriate data in the Eprom and update its outputs. The animation sequence which is to be is used on the Analog Output Smart Brick is usually generated on a PC·MACs Animation Control System. While it is being generated, the DMX-512 input mode is used so that you can see the animation data.

In either of the above modes, the first sixteen channels of data addressed are converted to individual 0-10 volt analog outputs. If twelve bit resolution has been selected for the outputs, then the first 24 channels of data are converted to individual 0-10 volt analog values. If the Z-Brick and/or DMX-512 outputs are enabled, all 256 channels of DMX-512 or Eprom data are also retransmitted through the Z-Brick and/or DMX-512 data outputs. The Z-Brick output can be used for additional digital outputs through one or more Z-Bricks. The DMX-512 output can be used to control light dimmers, automated spotlights, color changers, fog and wind machines, or any other pieces of equipment which will accept standard DMX-512 inputs.

The BS-ANA can be mounted in one 1" wide slot in any of our Brick Card cages. The BS-ANA can be used in conjunction with any selection of Smart Bricks, Smart Brick Brains, Electronic FeedBack (EFB) Smart Bricks and Z-Bricks in the same card cage. Card cages with one, two or sixteen slots are available. The card cages provide all of the connections for power supply, control signals and outputs that any Brick card will need. Several different styles of output connectors are available on the one and two slot card cages. The sixteen slot card cage mounts in seven inches of standard 19" rack space (4-1/2 " of space behind the panel). In some applications you may need to mount a single Smart Brick. This can be done by mounting the Brick on standoffs, and connecting to the card's edge connector with a mating connector. We usually recommend a sixty position insulation displacement connector for this type of installation.

Power requirements for each BS-ANA are 18 to 24 VDC. The actual current requirements are determined by the loads attached to the unit (up to 20 ma. per output). The Smart Analog Brick itself draws approximately 200 ma..

On the Front of the Analog Smart Brick:

A) RS-422 Serial Port: This is used to configure the BS-ANA. It is compatible with all of the RS-422 Serial Ports used on Gilderfluke & Company products.

As a convenience, the four active lines on this connector are bussed to the backplane of the card cage. This allows you to communicate to a whole card cage full of BS-ANAs, Smart Brick Brains, Electronic FeedBack (EFB) Smart Bricks and other cards through the connector on any single card. They just need to be set to different addresses. If desired, permanent connections can be made on the back of a card cage.

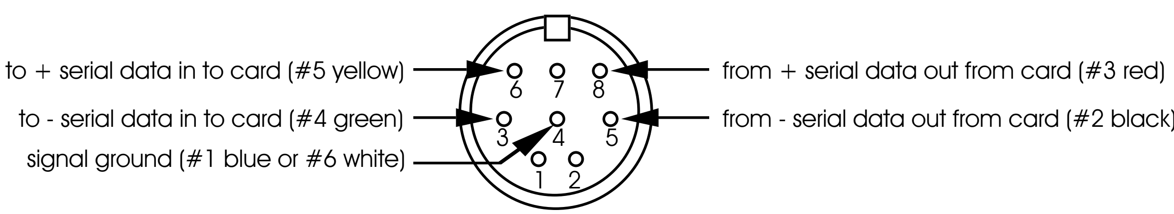
The serial data signals from the BS-ANA are brought out on a six position RJ-11 (modular telephone style connector). Facing the end of the cable with the release latch upwards, its pin out is as follows:

	COLOR	SIGNAL NAME:
LEFT	#1 white	Signal Ground
	#2 black	- Serial data out from card
	#3 red	+ Serial data out from card
	#4 green	- Serial data in to card
	#5 yellow	+ Serial data in to card
RIGHT	#6 blue	Signal Ground

PC and Compatible Connections: If you are only talking to a single BS-ANA and your wire length is short, you may be able to simply cross wire the RS-232 serial port on your PC to talk to the BS-ANA. This does not work on all PCs, as some don't swing their RS-232 outputs as far as they should. If it does not work with your PC, you may need to get a RS-232 to RS-422 converter to talk to the BS-ANA. To cross wire the RS-422 / RS-485 signals from the BS-ANA to the RS-232 serial port of an IBM compatible, cross connect the signals as follows:

DB-25	DE-9	Signal	Signal from/to BS-ANA
2	3	DATA OUT	- Serial data into card (#4 green)
3	2	DATA IN	- Serial data out from card (#2 black)
7	5	GROUND	Signal Ground (#1 white or #6 blue)

Apple Macintosh Connections: Apple Macintosh computers have true RS-422 serial ports built in. To connect to the BS-ANA, the pin out is as follows (view is of male connector facing the end of the cable):



The BS-ANA expects to see the serial data in the following format:

ONE START BIT
EIGHT DATA BITS
ONE STOP BIT

Unlike many of the products manufactured by Gilderfluke & Company, the BS-ANA responds only to the command to enter the configuration mode, download/upload configuration and status enquiries. It will ignore all other commands, which allows it to share the same RS-422 serial line with additional BS-ANAs, Digital Audio Repeaters, Smart Brick Brains and other serially controlled devices. The only requirement is that each unit be addressed to a different location.

B) DMX-512 Data In/Out: Five pin MiniDIN connector. The BS-ANA will stop listening to the Smart Brick network whenever there is a DMX-512 signal present on this input. If JP-1 is in the 'DMX' position, then the two received data lines on this connector will be attached to pins 11 and

12 on the backplane. This allows the DMX-512 signals to be bussed between cards within a card cage. The default position for JP-1 is 'neither'.

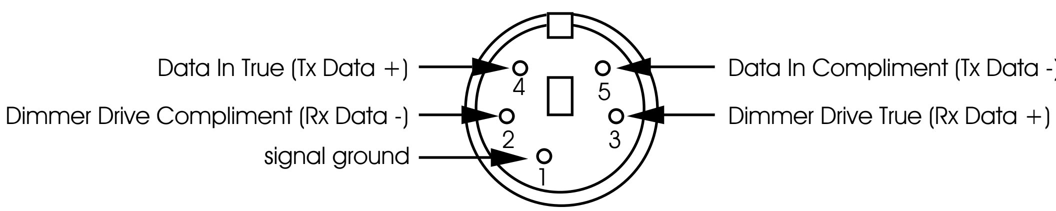
The DMX-512 standard was developed by the United States Institute for Theatrical Technology (USITT) for a high speed (250 KBaud) asynchronous serial data link. Although it was originally designed for controlling light dimmers, it is now supported by hundreds of suppliers throughout the world for controlling 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 your DMX-512 compatible output devices to respond to any address between 00 and 255. Addresses above the 256th are used in PC·MACs for transmitting a checksum. The BS-ANA can use this to verify that the data received from PC·MACs has no transmission errors in it. If you address a light dimmer 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 forty FPS, not all 256 channels can be transmitted through the DMX-512 output.

The DMX-512 standard calls out a 5 pin XLR connector for all cabling. Unfortunately these connectors won't fit on a 1" wide card. For this reason we chose a 5 pin MiniDIN connector for this signal. the pinout is as follows:

MiniDIN pin #	**SIGNAL**[1]
1	Signal Common (shield)
2	Dimmer Drive compliment (Rx Data -)
3	Dimmer Drive True (Rx Data +)
4	Data In True (Tx Data +)
5	Data In compliment (Tx Data -)

Facing the end of the male end of a cable, the pins are located as shown:



Data from a PC·MACs should be fed into pins #2 (-RxD) and #3 (+RxD). The shield should be connected to pin #1.

Only 256 channels of data are transmitted from the BS-ANA. Since the 256th and 257th bytes are not transmitted, the checksum is not sent. The transmitted data will also pause when the BS-ANA is busy as it redraws the screen in configuration mode. For this reason it should only be used to control lighting and other equipment that doesn't mind an occasional pause or data error.

C) Output Fuse Indicators: These four LEDs are lit unless one of the four PTC fuses has been tripped by an overload on the J6/A output cable.

D) Output Level Indicators: These sixteen red LEDs show the current output level on all of the 0-10 volt outputs. You will see these LEDs fade in and out as the signals on the outputs change.

E) Z-Brick: This twenty pin IDS connector is used to connect to one or more Z-Bricks. When enabled, the BS-ANA puts out data from the DMX-512 input or onboard Eprom to this connector. The format of the data is as follows:

[1] Don't blame us for these names. These are directly from the USITT.

IDS pin #	SIGNAL
1	Data bit 0
2	Data bit 1
3	Data bit 2
4	Data bit 3
5	Data bit 4
6	Data bit 5
7	Data bit 6
8	Data bit 7
9	Address bit 0
10	Address bit 1
11	Address bit 2
12	Address bit 3
13	Address bit 4
14	Address bit 5
15	Address bit 6
16	Address bit 7
17	ground
18	ground
19	Strobe/
20	Reset/

When the address and data lines are valid, the rising edge of the Strobe line will latch the data into the addressed outputs.

F) Board Error LED: This LED will flash when:

1) Smart Analog Card just booted
2) An error is found in the DMX-512 data checksum
3) An error is found in the Smart Brick Network checksum

G) DMX-512 LED: This LED will be lit when the BS-ANA is receiving DMX-512 data.

H) Brick Heart: The heartbeat from the Smart Brick Brain is transmitted throughout the system over the Smart Brick Network. The presence of a healthy heartbeat means that the data on the Smart Brick Network is getting through cleanly. If it ever stutters or flashes erratically (or not at all), then there is a problem with the Smart Brick Brain, the Smart Brick Network, or the BS-ANA. As the DMX-512 takes precedence over the Smart Brick Network, this LED will go dark whenever a DMX-512 signal is present.

I) Heartbeat: This LED Flashes continuously while the CPU is running. If it ever stops for more than a fraction of a second, the 'Deadman' circuit in the BS-ANA will automatically reset the CPU. While performing an Ease-In, the heart rate will double.

J) Address: Two HEXadecimal switches that are used to set the base address for the card. This address is always used to access the BS-ANA through the serial port. It is also normally the first DMX-512 address used (data at this DMX-512 address will be output through output #0). The DMX-512 address can also be set through the configuration screen. This will override the DMX-512 address set by these switches.

BackPlane Connections:

The BackPlane connection is through a sixty position double sided edge connector (thirty connections on each side on .1" centers). This normally is plugged into a card cage, but can also be used with an IDS or other discrete edge connector. We recommend an Insulation Displacement (IDE) connector for the latter.

The first ten positions are used for the Smart Brick network and RS-422 Serial Port. They are normally bussed between all of the cards in the card cage (although they can be separated by cutting the lines if desired).

The next forty positions are used to connect the J6/A signals to the output cabling.

The last ten positions are used to provide power to the BS-ANA. These wires are ganged to provide a higher current carrying capacity. The pinout of this connector is as follows:

output wire #	Edge pin #	color	wire function
Smart Brick net #2	1	black	Smart Brick Network Data/ into BS-ANA
Smart Brick net #1	2	white	Smart Brick Network Data into BS-ANA
Smart Brick net #3	3	red	Smart Brick Network Clock into BS-ANA
Serial Port #3	4	red	TxD + out from BS-ANA
Smart Brick net #4	5	green	Smart Brick Network Clock/ into BS-ANA
Serial Port #2	6	black	TxD - out from BS-ANA
Smart Brick net #5	7	yellow	Smart Brick Network Strobe into BS-ANA
Serial Port #5	8	yellow	Rx + into BS-ANA
Smart Brick net #6	9	blue	Smart Brick Network Strobe into BS-ANA
Serial Port #4	10	green	Rx -into BS-ANA
J6/A #1	11	brown	circuit ground
J6/A #2	12	red	+ unregulated power output (protected to 1 amp)
J6/A #3	13	orange	Output 15 (0Fh) Positive Analog Output
J6/A #4	14	yellow	Output 15 (0Fh) Negative Reference
J6/A #5	15	green	Output 14 (0Eh) Positive Analog Output
J6/A #6	16	blue	Output 14 (0Eh) Negative Reference
J6/A #7	17	violet	Output 13 (0Dh) Positive Analog Output
J6/A #8	18	gray	Output 13 (0Dh) Negative Reference
J6/A #9	19	white	Output 12 (0Ch) Positive Analog Output
J6/A #10	20	black	Output 12 (0Ch) Negative Reference
J6/A #11	21	brown	circuit ground
J6/A #12	22	red	+ unregulated power output (protected to 1 amp)
J6/A #13	23	orange	Output 11 (0Bh) Positive Analog Output
J6/A #14	24	yellow	Output 11 (0Bh) Negative Reference
J6/A #15	25	green	Output 10 (0Ah) Positive Analog Output
J6/A #16	26	blue	Output 10 (0Ah) Negative Reference
J6/A #17	27	violet	Output 9 (09h) Positive Analog Output
J6/A #18	28	gray	Output 9 (09h) Negative Reference
J6/A #19	29	white	Output 8 (08h) Positive Analog Output
J6/A #20	30	black	Output 8 (08h) Negative Reference
J6/A #21	31	brown	circuit ground
J6/A #22	32	red	+ unregulated power output (protected to 1 amp)
J6/A #23	33	orange	Output 7 (07h) Positive Analog Output
J6/A #24	34	yellow	Output 7 (07h) Negative Reference
J6/A #25	35	green	Output 6 (06h) Positive Analog Output
J6/A #26	36	blue	Output 6 (06h) Negative Reference
J6/A #27	37	violet	Output 5 (05h) Positive Analog Output
J6/A #28	38	gray	Output 5 (05h) Negative Reference
J6/A #29	39	white	Output 4 (04h) Positive Analog Output
J6/A #30	40	black	Output 4 (04h) Negative Reference

J6/A #31	41	brown	circuit ground
J6/A #32	42	red	+ unregulated power output (protected to 1 amp)
J6/A #33	43	orange	Output 3 (03h) Positive Analog Output
J6/A #34	44	yellow	Output 3 (03h) Negative Reference
J6/A #35	45	green	Output 2 (02h) Positive Analog Output
J6/A #36	46	blue	Output 2 (02h) Negative Reference
J6/A #37	47	violet	Output 1 (01h) Positive Analog Output
J6/A #38	48	gray	Output 1 (01h) Negative Reference
J6/A #39	49	white	Output 0 (00h) Positive Analog Output
J6/A #40	50	black	Output 0 (00h) Negative Reference
n/a	51	black	power supply ground
n/a	52	black	power supply ground
n/a	53	black	power supply ground
n/a	54	black	power supply ground
n/a	55	black	power supply ground
n/a	56	red	+ power supply input
n/a	57	red	+ power supply input
n/a	58	red	+ power supply input
n/a	59	red	+ power supply input
n/a	60	red	+ power supply input

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 forty 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 Sixteen Channel Servo Controllers (both of these cards require a power supply of 18 volts be used for the BS-ANA).

To simplify wiring to any MACs Animation Control 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 forty wire cable can be terminated in seconds. All connectors are polarized, to keep them from being plugged in backwards.

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 BS-ANA 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 BS-ANA, but **there must be no direct connections made between any of the negative references and the circuit grounds anywhere in the animation system**.

The '+ unregulated power output' 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 power output 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. The 'Output Fuse' LEDs on the front of the BS-ANA show the condition of each of the PTC fuses. Each of these is a LED and resistor between the ground (pin #1 brown) wire and power output (pin #2 red) wire. Each of these will be lit if the corresponding circuit breaker is OK. The resistor is 4.7 Kohms.

R4 is the one adjustment on the BS-ANA. It 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 R4. The adjustments for the endpoints on each of the sixteen outputs are individually set through the setup screen.

Animation Data Eproms:

The Eproms used for all all of the 'Brick' products manufactured by Gilderfluke & Company have traditionally each contained one channel (eight bits) worth of data. The Eproms used on the BS-ANA, EFB Smart Brick and RTU/FSK Units for storing animation data each carry a number of channel's worth of data. The first four bytes also contain the frame rate, number of channels and the length of the first show in the Eprom.

These are generated on a PC·MACs system by:

1) Selecting the 'Save as Eprom...' command from the 'File' pulldown.
2) Check on the 'Multi Channel' checkbox
3) Set the 'start' and 'end' boxes to set the number channels you want to go into this multiple Eprom file. A BS-ANA with all sixteen channels set to eight bit resolution, this will be sixteen channels. A BS-ANA with all sixteen channels set to twelve bit resolution, this will be twenty-four channels. If you are saving a twelve bit resolution Eprom, you must set the 'start' address (and the BS-ANA address) to a multiple of three (or zero). Be sure to allow for enough extra channels for any Z-Bricks that might be attached to the BS-ANA.
4) Use the 'Add' button to select any additional show you would like to be saved into this Eprom file set.
5) Use the 'Promote' and 'Demote' buttons to move selected show(s) into the order you would like to save them in the Eprom.
6) Normally you will want to select the 'Calculate Brick Start Frames' checkbox to allow PC·MACs to automatically calculate the offset into the Eproms needed for the shows you are saving. If you would like to preserve the 'Start frame' values in the show files, also check the 'Save Brick Starts' checkbox.
7) If you are not using the PC·MACs calculated 'Brick Starts', you will have had to set these individually for each show under its File/Show Information dialog. If they are set improperly, PC·MACs will tell you if any of the shows are overlapping during the build. When using 'Brick Starts' that you have entered, PC·MACs can pad the space between the shows with the default values for the movements if you have checked the 'Pad With Default Values' checkbox.
8) Press the 'Build' button to begin the saving process. A standard file save dialog will open. Name the file as desired. (it defaults to the name of the first show in the list). PC·MACs will warn you if a file already exists with this name. Hit OK to save the data to a file.

Once the shows have been saved to the multiple show file, you can burn them into an Eprom using any Eprom programmer that supports 27C010 through 27C080 Eproms.

If you press the 'Report' button, PC·MACs will display the information about the Eprom set you just saved. This information is also saved in a text file with the same name as the Eproms, but with the extension of '.set'. You can open this file with any text editor like Notepad or Wordpad. The numbers shown for 'Brick start' and 'Brick end' are what you need to enter into the Smart Brick Brain to set the start and end of each show. The 'Eprom start' and 'Eprom end' are the actual locations of the shows in the Eprom set. The number shown for the 'Eprom End' for the last show in this file set is the last byte which will be saved into the Eprom. If your Eprom is smaller than this number, you will need to use more than a single Eprom and a memory expansion board for the BS-ANA. The capacities of all of the large Eproms are as follows:

Eprom type	Total number of bytes
27C010	131,072
27C020	262,144
27C040	524,288
27C080	1,048,576

If additional capacity is needed, then a memory expansion board can increase the capacity of the BS-ANA to eight 27C080's (8,388,608 byte capacity).

Note that at least one show must be loaded starting at a 'Brick Start' of 0, even if it is only a frame or two long. PC·MACs will use this first show to set the frame rate and number of channels stored in the multiple channel Eprom. The BS-ANAs need this information to index into the Eprom.

The Eprom file that PC·MACs generates will have the extension of filename.Mnn. The 'M' in the extension flags it as a 'multiple channel' Eprom file. The 'nn' is the HEXadecimal address of the first channel in the Eprom set. Once saved, this file can be burnt into any Eprom from 1 Mbit (27C010) to 8 Mbits (27C080). The BS-ANA supports all four standard thirty-two pin Eproms.

The address of the data sent out from an Eprom may be different from what you saw when programming through the DMX-512 input. This is a question of the address selected for the BS-ANA and whether it is addressed via the front panel switches or the software. Data sent out from the Eprom will be sent out starting at DMX-512 and Z-Brick outputs 00h. The BS-ANA DMX-512 address should be addressed at 00h (either using the front panel dipswitch or software address setting) to make sure the addresses are the same when running from DMX or the on-board Eprom.

Serial Port Commands:

The following commands are used to communicate with BS-ANAs and just about any other piece of equipment manufactured by Gilderfluke & Company. Just by attaching the serial port of your PC, PLC or terminal to the serial port of the Smart Brick, you can access these commands.

To enter the configuration mode: Type the following. The (address) is replaced by the HEX value set when the BS-ANA is configured.

m5AA5(address)

If any other card is in configuration mode (or even if it just thinks another card is in configuration), the BS-ANA won't be able to enter configuration mode. To exit any other card from configuration type 'XN'. You can then try entering configuration again.

To display the status of this card: Send the card an '**i(address)**'. The (address) is replaced by the HEX value set when the BS-ANA is configured.

To download the configuration of this card: Prepare your computer to receive and save a stream of ascii characters. Send the card a '**r(address)**'. The (address) is replaced by the HEX value set when the BS-ANA is configured. The card will respond with a stream of 1043 bytes of ascii data. Any number of additional cards (either more BS-ANAs or any other card made by Gilderfluke & Company) can also have their configuration downloaded into the same file by giving them the same command with the appropriate addresses appended on. When you are done downloading configurations, you can tell your computer to stop saving received ascii to a file.

To reload saved configuration: All you need to do is send this file back to the cards through your computer's serial port. All cards that were addressed will hear their address in the data stream and load in the configuration data.

Analog Smart Brick Configuration:

To communicate with the BS-ANA 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 BS-ANA 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 BS-ANA through the serial port. Every copy of Windows comes with HyperTerm or Terminal.EXE, which are just such programs. Z-Term is available as shareware (free) from most Bulletin Board Systems and users groups for Macintosh computers. 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 BS-ANA at a later date. The BS-ANA uses no screen control codes or ESCape sequences (unless VT-52 compatible mode has been enabled), so it should work on any machine with an eighty column by twenty-four 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. You should set handshaking to 'Xon/Xoff'. Hardware handshaking must be turned off. If your terminal emulation program supports VT-52 terminal emulation (they all do!), you should enable it. This will allow faster screen redraws if 'VT-52 compatible' mode is enabled on the BS-ANA. You should set your program NOT to insert an extra LineFeed (LF) character after each Carriage Return (CR) it receives. You should also tell it NOT to scroll automatically after the eightieth column is filled. If either of these are on, the screen will be displayed 'double spaced'. This won't cause any problem, but will make it hard to see the whole screen at one time.

If you have hooked up the BS-ANA 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 BS-ANA 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 piece of wire, 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 BS-ANA. 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.

To enter the configuration mode you need to type the following. The (address) is replaced by the HEX value set on the ADDRESS switches on the front of the BS-ANA:

m5AA5(address)

If any other card is in configuration mode (or even if it just thinks another card is in configuration), the BS-ANA won't be able to enter configuration mode. To exit any other card from configuration type 'XN'. You can then try entering configuration again.

To redraw the screen at any time, just press the <ESC>ape key or <SPACE> bar. The BS-ANA will display the following screen:

Configuration Screen:

For eight bit resolution outputs, the menu will appear as follows. Percentage values have been selected for the numbers. At the top of the screen the size of the Animation Data Eprom installed (if any) is shown. If the Animation Data Eprom isn't found, then 'not found' will appear in this space.

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-Gilderfluke & Company - Analog Smart Brick - version 2.02 - copyright 1998 DCM-

         EPROM: _16 channels @ 30 FPS / first show is 06450 frames long

a) use front panel address- yes      MSB      E minimum maximum forced  PowerOn
b) first output addressed at __0   address    I  scale   scale  output  default
c) DMX Rx checksum enabled- yes        0 (0) |Y|___0%__|__100__|_______|___0%__|
d) OverSampling enabled- yes           1 (1) |Y|___0%__|__100__|_______|___0%__|
e) sequencer enabled- yes              2 (2) |Y|___0%__|__100__|_______|___0%__|
f) sequencer frame rate /2- no     ->  3 (3) |Y|___0%__|__100__|_______|___0%__|
g) numbering system- HEX               4 (4) |Y|___0%__|__100__|_______|___0%__|
h) VT-52 compatible display- yes       5 (5) |Y|___0%__|__100__|_______|___0%__|
i) twelve bit resolution-  no          6 (6) |Y|___0%__|__100__|_______|___0%__|
j) address to test & adjust- _03       7 (7) |Y|___0%__|__100__|_______|___0%__|
k) test output- none                   8 (8) |Y|___0%__|__100__|_______|___0%__|
l) auto Ease-In- 5 seconds             9 (9) |Y|___0%__|__100__|_______|___0%__|
p) set analog endpoints               10 (A) |Y|___0%__|__100__|_______|___0%__|
q) force Output to a value            11 (B) |Y|___0%__|__100__|_______|___0%__|
r) set Min/Max/forced using keypad    12 (C) |Y|___0%__|__100__|_______|___0%__|
t) set PowerOn defaults               13 (D) |Y|___0%__|__100__|_______|___0%__|
u) download configuration             14 (E) |Y|___0%__|__100__|_______|___0%__|
o) reload defaults                    15 (F) |Y|___0%__|__100__|_______|___0%__|
x) eXit and save
                                Enter Command-
```

If you have selected twelve bits resolution for the outputs, then the values will be displayed as follows. Note that addresses that can't be used for twelve bit vales are skipped in the 'MSB address' column. In this case the value scale being used is Hex:

```
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         EPROM: 10h channels @ 30 FPS / first show is 0F96h frames long

a) use front panel address- yes      MSB      E minimum maximum forced  PowerOn
b) first output addressed at 00h   address    I  scale   scale  output  default
c) DMX Rx checksum enabled- yes      01h (0) |Y|__00h__|__FFh__|_______|__000h_|
d) OverSampling enabled- yes         02h (1) |Y|__00h__|__FFh__|_______|__000h_|
e) sequencer enabled- yes            04h (2) |Y|__00h__|__FFh__|_______|__000h_|
f) sequencer frame rate /2- no     ->05h (3) |Y|__08h__|__F3h__|__070h_|__070h_|
g) numbering system- HEX             07h (4) |Y|__00h__|__FFh__|_______|__000h_|
h) VT-52 compatible display- yes     08h (5) |Y|__00h__|__FFh__|_______|__000h_|
i) twelve bit resolution- yes        0Ah (6) |Y|__00h__|__FFh__|_______|__123h_|
j) address to test & adjust- 05h     0Bh (7) |Y|__00h__|__FFh__|_______|__456h_|
k) test output- none                 0Dh (8) |Y|__00h__|__FFh__|_______|__000h_|
l) auto Ease-In- 5 seconds           0Eh (9) |Y|__00h__|__FFh__|_______|__000h_|
p) set analog endpoints              10h (A) |Y|__00h__|__FFh__|_______|__000h_|
q) force Output to a value           11h (B) |Y|__00h__|__FFh__|_______|__000h_|
r) set Min/Max/forced using keypad   13h (C) |Y|__00h__|__FFh__|_______|__000h_|
t) set PowerOn defaults              14h (D) |Y|__00h__|__FFh__|_______|__000h_|
u) download configuration            16h (E) |Y|__00h__|__FFh__|_______|__000h_|
o) reload defaults                   17h (F) |Y|__00h__|__FFh__|_______|__000h_|
x) eXit and save
                                Enter Command-
```

All numeric values are entered in HEXadecimal (0-9, A through F)or Decimal numbers (0-9), as selected on the menu. Each number consist of one or more ASCII characters followed by a <RETURN>

(<ENTER> on some keyboards). If more characters have been entered before the <RETURN> than are allowed, then the characters already entered will scroll to the left to make room for the new entries. Once a command has been invoked, characters can be erased one-by-one by using the <DELETE> key (<BACKSPACE> on some keyboards). An entire entry can be erased by hitting the <ESC>ape key. A command can be canceled altogether by hitting the <RETURN> key (<ENTER> on some keyboards) or <ESC>ape key after all of the characters have been erased or before any have been entered.

Once you have configured a BS-ANA, you can 'lock' the configuration by moving the 'Write Protect' jumper to the 'Wp' (Write Protect) position from the 'En' (Enable) position. This should protect your configuration from anything short of a lightning hit. The menu will change to show that the Eprom has been protected and warn you that you can no longer make any changes. Configuration changes can be re-enabled at any time by moving the jumper back to the 'Enabled' position.

If you want to keep a hard copy printout of the current configuration of the BS-ANA, 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) **Use Front Panel Address:** The front panel switches are always used for the RS-422 Serial Port Address. This toggle selects whether the DMX-512 address is set from the front panel switches or from the address set by the '**First Output Addressed At**' command. No matter which is source for the address is selected, the address for each individual output is shown in the '**Output Address**' column. If twelve bit resolution has been selected, then any 'illegal' [2] twelve bit address will be skipped.

b) **First Output Addressed At:** The front panel switches are always used for the RS-422 Serial Port Address. This command is used to set the BS-ANA to a DMX-512 address other than the one from the front panel address switches. Entering an address here will force the command above to 'NO'. The address for each individual output is shown in the 'output address' column. If twelve bit resolution has been selected, the BS-ANA won't allow you to address it at any 'illegal' [3] twelve bit address.

c) **DMX Rx Checksum:** This toggle is used to enable and disable the error checking in data received through the DMX-512 data input. Without it, the BS-ANA won't be able to recognize errors in the incoming data, and may update the outputs with this bad data. It should be left ON whenever running from a PC·MACs or other DMX-512 source that supports this checksum.

d) **Over Sampling enabled:** This toggle enables and disables the automatic Over Sampling feature of 2.0+ BS-ANA cards. With this feature off, the outputs will be updated at the same rate and resolution as the card is receiving data from the on-board Eprom and SmartBrickNet or through the DMX-512 connection. With this feature ON, the outputs will always be updated at 120 Hz and twelve bit resolution, no matter what the incoming data frame rate and resolution. What this means is that instead of the outputs doing one big step at each incoming frame, the BS-ANA divides this big step into two, four or eight smaller steps. With higher performance servo loops, this feature means that the outputs will be smoother with this feature ON. The default condition for this toggle is ON. In most cases there is no reason to ever turn this feature OFF.

e) **Sequencer Enabled:** This toggle enables and disables the BS-ANA to use the Animation Data Eprom. When it is OFF, nothing will be output even when the Smart Brick Network is active. If it is ON, then the data from the Animation Data Eprom will be sent out when the Smart Brick Network is active.

f) **sequencer frame rate /2:** This toggle is used to drop the frame rate of the data being played back from the Eproms by half. This allows the same sized Eprom to hold twice the time as it otherwise could. This is typically used when the main part of the show is running at 30 FPS and the lighting which is coming from this BS-ANA (from the DMX-512 or analog outputs) doesn't need to be run at such a high frame rate. The show that is used to generate the Eprom data for this BS-ANA should be programmed at half the rate of the rest of the show.

g) **Numbering System:** This toggle is used to select between HEXadecimal, Decimal, or

[2] A twelve bit value can not be addressed at any address that can evenly be divided by three.

[3] A twelve bit value can not be addressed at any address that can evenly be divided by three.

Percentage numbering systems for display and entries. When percentage is selected, all entries are still made in Decimal numbers.

h) VT-52 Compatible Display: When this toggle is enabled, the BS-ANA will use special escape sequences to clear the screen (<ESC>ape 'E'), clear the current line (<ESC>ape 'l'), or position the cursor (<ESC>ape 'Y' ROW COLUMN). When disabled, the BS-ANA has to redraw the entire screen to change any value, so it can save a good deal of screen redraw time if you have a compatible display.

i) twelve bit resolution: When toggled ON, the output resolution will be twelve bits. This works out to a resolution of one part in 4096. With a 0-10 volt output, each step will be .00244 volts. If you are using 12 bit resolution analogs, you must carefully account for the locations and number of output channels you are using. Each 12 bit resolution input takes 1-1/2 eight bit channels. The **BS-ANA** won't let you set the first address for a 12 bit analog to any address that can be evenly divided by three (0, 3, 6, 9, etc.). This is because it uses these bytes for storing the least significant four bits of the next two 12 bit resolution channels. Any 12 bit resolution channel that is addressed at an address that can be divided evenly by three plus one (addresses 1, 4, 7, 10, etc.) will need to have the previous address sent (or burnt into the Eprom) so that its lowest four bit nibble isn't lobbed off. Any 12 bit resolution channel that is addressed at an address that can be divided evenly by three plus two (addresses 2, 5, 8, 11, etc.) will need to have the previous two addresses sent (or burnt into the Eprom) so that its lowest four bit nibble isn't lobbed off.

j) Output to Test & Adjust: This command is used to set the output address that will be used by the '**Test Output**', '**Set Analog Endpoints**', '**Force output to a Value**', '**set Min/Max/forced using keypad',** and '**set PowerOn Defaults**' commands. If the output address selected is one of the sixteen on the BS-ANA, then an arrow will appear next to it on the screen. In the example screen above you can see this arrow pointing to output #7, which happens to be addressed at address 8. Since some of the adjustments can affect channels that are only transmitted through the DMX-512 and Z-Brick outputs, the address can be set to anywhere between 0 and 255.

k) Test Output: When toggled to '**Test One Output**', the single output selected by the '**Output to Test & Adjust**' command will be ramped up and down. The ramp time is about 5 seconds. The time the output stays at each extreme is set by the '**Test Dwell Time**' command. When toggled to '**Test All Outputs**', all of the outputs will be ramped between their two extremes. The ramp time is still about 5 seconds. The time the output stays at each extreme is set by the '**Test Dwell Time**' command.

l) auto Ease-In: When enabled, this feature will keep all of the selected channels from jumping at a high rate of speed if:

a) Incoming frame number received through the SmartBrickNet jumps more than five frames. (This is typically caused by discontinuous time code being received by the Smart Brick Brain, or when the Smart Brick Brain jumps to a different show.)
b) The DMX-512 data starts being received.
c) The DMX-512 signal drops out for more than a second.
d) An output is forced to a specific value.
e) One or more outputs are put into or taken out of the internal test mode.
f) At boot up as the outputs assume their default values.

This command allows you to select the amount of time any output will take to ramp from one extreme to the other and which outputs will be using the Ease-In feature. The range of time available is:

0) Ease-In is disabled
1) 1/4 second
2) 1/2 second
3) 1 second
4) 1-1/2 seconds
5) 2 seconds
6) 2-1/2 seconds

7) 5 seconds
8) 7.5 seconds
9) 10 seconds

If any output crosses or reaches the level it is being commanded to, it will drop out of Ease-In mode and begin following the command normally. You can tell when an Ease-In is being performed by the Heartbeat jumping to a speed twice normal. Once all outputs have dropped out of Ease-In mode, the heartbeat will return to its regular rate.

Which outputs have been set to use the Ease-In Feature is shown under the column labeled 'EI'. Outputs which will be Eased In are shown by the letter 'Y'. All other channels will be unaffected by the Ease-In.

The Ease-In only affects the sixteen on-board analog outputs from the BS-ANA. Any outputs on the DMX-512 output or from Z-Bricks that are attached to the BS-ANA are unaffected.

p) Set Analog Endpoints: This command is used to adjust the endpoints of the sixteen analog outputs. The '**Set Min/Max/Forced using Keypad**' is actually a much easier way of setting these values. Use it if you can.

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. The endpoints for all sixteen outputs is displayed in the '**Analog Endpoints**' columns on the display.

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 64 (40h) and 192 (C0h).

To set the endpoints, first clear the endpoints to the two extremes (0%/0/00h). Then use a Togglodyte, Programming Console, or the '**Force Output to a Value**' command to find what values set the proper endpoints for the output. You can then enter these numbers into the endpoints for this output.

The endpoints can only be set for the on-board 0-10 volt analog outputs. A new output address will be requested if the currently selected '**Output to Test & Adjust**' is not one of the on-board ones.

q) Force Output to a Value: This command is used to force an output to any value. This value can be written into EEprom so that the output will never leave this value, even after the card is reset. It can be used to 'lock down' a movement that has malfunctioned or needs to be positioned for servicing or adjustment. Any outputs which have been forced will be displayed in the '**Forced Output**' column on the display.

Only the on-board 0-10 volt analog outputs can be forced. A new output address will be requested if the currently selected '**Output to Test & Adjust**' is not one of the on-board ones.

r) set Min/Max/forced using keypad: This command is used to set the three main variables used for each analog output. These are the two endpoints and forced values. This is the quickest way to set and adjust the outputs. Once this command is invoked, the currently selected output can be adjusted using the numeric keypad on your computer:

a) The 'Minimum Scale' endpoint is set using the '7' (increase the value), '4' (set the value to 50%), and '1' (decrease the value) keys.
b) The 'Maximum Scale' endpoint is set using the '8' (increase the value), '5' (set the value to 50%), and '2' (decrease the value) keys.
c) The 'Forced Outputs' is set using the '9' (increase the value), '6' (set the value to 50%), and '3' (decrease the value) keys. When this value has been disabled, it will appear as a 'n/a' on the command line. The 'Forced Outputs' can be used to move a figure when a Togglodyte or other source of DMX-512 data is not available.

The current values for these variables are displayed on the command line as they are changed. When you have finished making the adjustments, hitting the <space bar>, <Enter key> or <Return Key> will save write these variables to the table on the main part of the screen.

To set the endpoints for any output, just follow these simple steps:

1) **Select the output you want to adjust:** You can do this using the '**j) Output to Test & Adjust**', '**n) Next**' or '**l) Last**' commands. The output must be one of the on-board ones. The arrow will now be pointing at the output you are going to adjust.

2) **Select this command by typing 'u':** The current values will now appear on the command line.

3) **Set the output to either one of the extremes of position:**

   a) If you have a programming system or Togglodyte attached: Just set the output to either the minimum position (0%/0/00h) or maximum position (100%/255/0FFh). [4]

   b) If you only have the computer: Use the '3', '6' and '9' keys on your keypad to force the movement to either the minimum position (0%/0/00h) or maximum position (100%/255/0FFh). [5]

4) **Adjust the first endpoint:**

   a) If you set the movement to the minimum position: Use the '1', '4' and '7' keys on your keypad to adjust this endpoint. The movement will follow as you adjust these settings.

   b) If you set the movement to the maximum position: Use the '2', '5' and '8' keys on your keypad to adjust this endpoint. The movement will follow as you adjust these settings.

5) **Set the output to opposite extreme position:**

   a) If you have a programming system or Togglodyte attached: Just set the output to either the minimum position (0%/0/00h) or maximum position (100%/255/0FFh).[6]

   b) If you only have the computer: Use the '3', '6' and '9' keys on your keypad to force the movement to either the minimum position (0%/0/00h) or maximum position (100%/255/0FFh).[7]

6) **Adjust the second endpoint:**

   a) If you set the movement to the minimum position: Use the '1', '4' and '7' keys on your keypad to adjust this endpoint. The movement will follow as you adjust these settings.

   b) If you set the movement to the maximum position: Use the '2', '5' and '8' keys on your keypad to adjust this endpoint. The movement will follow as you adjust these settings.

7) **Clear out any forced outputs:** If you used the '3', '6' and '9' keys on your keypad to force an output, you will need to use these keys to 'un-force' it as well. If you don't, the output will remain 'stuck' at this one position. Just hold down the '3' key until the value reaches the minimum (0%/0/00h). One more press

[4] These are the eight bit resolution values. Substitute the twelve bit equivalents of 100%/4095/FFFh if you are using twelve bit resolutions.

[5] These are the eight bit resolution values. Substitute the twelve bit equivalents of 100%/4095/FFFh if you are using twelve bit resolutions.

[6] These are the eight bit resolution values. Substitute the twelve bit equivalents of 100%/4095/FFFh if you are using twelve bit resolutions.

[7] These are the eight bit resolution values. Substitute the twelve bit equivalents of 100%/4095/FFFh if you are using twelve bit resolutions.

and it will then change to 'n/a'.

8) **Save your changes:** Hitting the <Return>, <Space Bar> or '0' key on your keyboard will exit this mode and write the changes to the BS-ANA's EEprom. These new values will also now appear on the upper part of the screen on the line next to the arrow.

If you have outputs that you don't want to swing full scale before they are adjusted, set both the minimum and maximum scales to 50%/128/80h before applying power to the ServoMotors. This will force them to the 50% of stroke position before they can do any damage.

t) Set PowerOn Defaults: This command allows you to set the value that will be output on any one of the 256 possible output addresses. This value will be sent out when the BS-ANA is first powered up. This command give you the option of:

a) Capturing the current value as the default value for the currently selected output.
b) Capturing the current values as the default value for all outputs.
c) Entering a value as the default value for the currently selected output.

The PowerOn value for all outputs is displayed in the '**PowerOn Default**' column on the display.

u) Download configuration: This command is used to save the current configuration of the BS-ANA through the serial port to a file on your computer. This file can then be reloaded into this, or any other BS-ANA. To use this command, you first invoke it, then following the instructions, you set your computer to receive a string of ASCII characters.

```
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 Set your computer to save a stream of text to a file. The file should be 1043
   bytes long. To reload this card, just send this file back to this screen.

                           Hit any key when ready.

          Stop saving text and hit any key when the data has finished.






                           hit <ESC>ape key to cancel-

                                 Enter Command-
```

You then press any key to tell the BS-ANA 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 BS-ANA to redraw the screen.

o) Reload Default Configuration: This command reloads the default configuration to the BS-ANA.

x) eXit: This exits the configuration mode and returns the BS-ANA to the command mode. When exiting you must enter a 'y' or 'n', to preserve compatibility with some other Gilderfluke & Company cards.

s) **Upload configuration:** This command (which doesn't appear on the menu) is the compliment of the **Download Configuration** command. To invoke it, all you need to do is tell your modem program to send the file saved by the 'download' command back to the BS-ANA. This will automatically invoke the upload command and store the incoming data.

+) **Data Dump:** This command (which doesn't appear on the menu) dumps out the DMX output buffer and the configuration memory onto the screen. This started as some developmental routines, and there was plenty of space available, so what the hell.

Using Z-Bricks with a BS-ANA:

A Z-Brick is a card that can be used with any BS-ANA to add thirty-two digital outputs to it. The data for the Z-Brick comes either from the DMX-512 that is being received by the BS-ANA or from the Eprom on-board the BS-ANA. With proper buffering, any number of Z-Bricks can be added to a BS-ANA. Each adds another thirty-two digital outputs to the BS-ANA.

The Z-Brick's thirty-two outputs are addressed on four consecutive eight bit channels. This means that each Z-Brick needs four eight bit channels worth of data. The Z-Bricks can be addressed on any address that is a multiple of four. The two HEXadecimal switches on the front of the Z-Brick are used to set the address. The address is set using HEXadecimal numbers (a chart which shows both numbering systems is at the rear of this manual). The upper switch is used to set the upper nibble's address. The lower switch is used to set the lower nibble's address. Because the address has to be set on a four byte boundary, the lower switch has only four usable ranges. These are labeled on the silkscreen as '0-3', '4-7', '8-B', and 'C-F'. Setting this switch to any of the four positions in these ranges are acceptable. i.e.: there are four detents at 0, 1, 2 and 3 on this switch. Setting the switch to ANY of these positions counts as the position '0-3' on the Z-Brick.

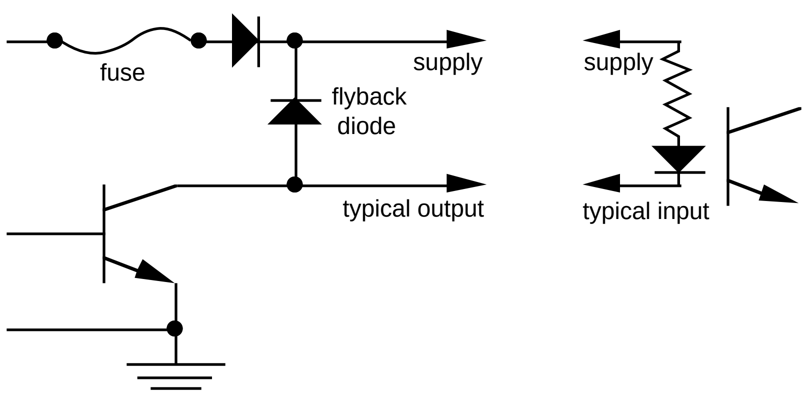
As an example, a typical address for a Z-Brick is right after the sixteen eight bit resolution analog outputs on a BS-ANA. If they are addressed at address 0, then the last analog channel is in address 15. This translates to 0Fh, so the first address which is available to the Z-Brick is 16 (decimal), or 10h. To set this address on a Z-Brick, the upper address switch would be set to '1', and the lower switch set to '0-3'.

Another common address is right after sixteen analog outputs which are set to twelve bits of resolution. These sixteen twelve bit resolution outputs occupy twenty-four channels worth of data. If they are addressed at address 0, then the last analog channel is in address 23. This translates to 17h, so the first address which is available to the Z-Brick is 24 (decimal), or 18h. The upper address switch needs to be set to '1', and the lower switch set to '8-B'.

The Z-Brick must be connected to the BS-ANA by a twenty position ribbon cable. When the Z-Brick is being scanned, the LED on its front will flash at 1/4 the frame rate.

In all animation systems made by Gilderfluke & Company all output cabling on the Z-Brick is through what we call 'J-6' standard output cables. These are 40 wire cables which are made up of four identical eight bit wide 'channels'. A J-6 cable is often split up into four individual channels. As each channel also includes a common power supply and ground wire, each '1/4 J-6' 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.

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

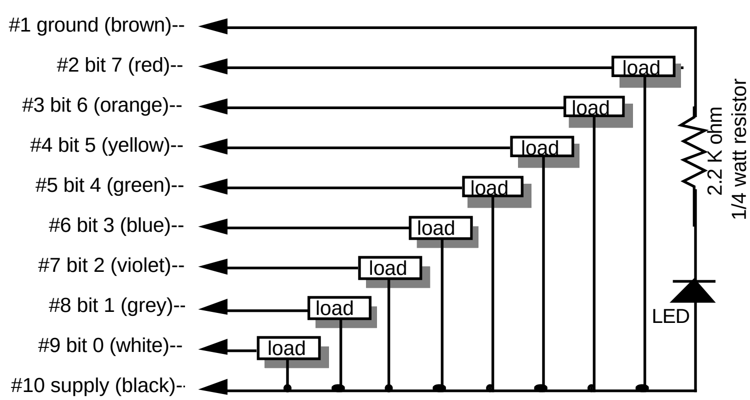


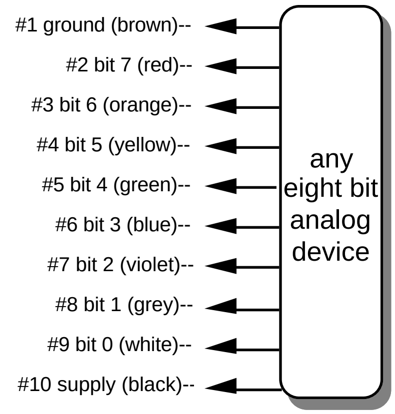
To simplify wiring to any MACs animation system, the connectors used on the J-6 cables are what are called 'insulation displacement connectors'. These simply snap on to an entire cable, automatically 'displacing' the wire insulation and making contact with the wires within. This means that an entire 40 wire cable can be terminated in seconds. All connectors are polarized, to keep them from being plugged in backwards. Although there are tools made specifically for installing these connectors, the tool we find works best is a small bench vise.

Each J-6 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	+15 VDC unregulated power supply (fused for 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
17	violet	channel 1 data bit 2
18	gray	channel 1 data bit 1
19	white	channel 1 data bit 0
20	black	+15 VDC unregulated power supply (fused for 1 amp)
21	brown	circuit ground
22	red	channel 2 data bit 7
23	orange	channel 2 data bit 6
24	yellow	channel 2 data bit 5
25	green	channel 2 data bit 4
26	blue	channel 2 data bit 3
27	violet	channel 2 data bit 2
28	gray	channel 2 data bit 1
29	white	channel 2 data bit 0
30	black	+15 VDC unregulated power supply (fused for 1 amp)
31	brown	circuit ground
32	red	channel 3 data bit 7
33	orange	channel 3 data bit 6
34	yellow	channel 3 data bit 5
35	green	channel 3 data bit 4
36	blue	channel 3 data bit 3
37	violet	channel 3 data bit 2
38	gray	channel 3 data bit 1
39	white	channel 3 data bit 0
40	black	+15 VDC unregulated power supply (fused for 1 amp)

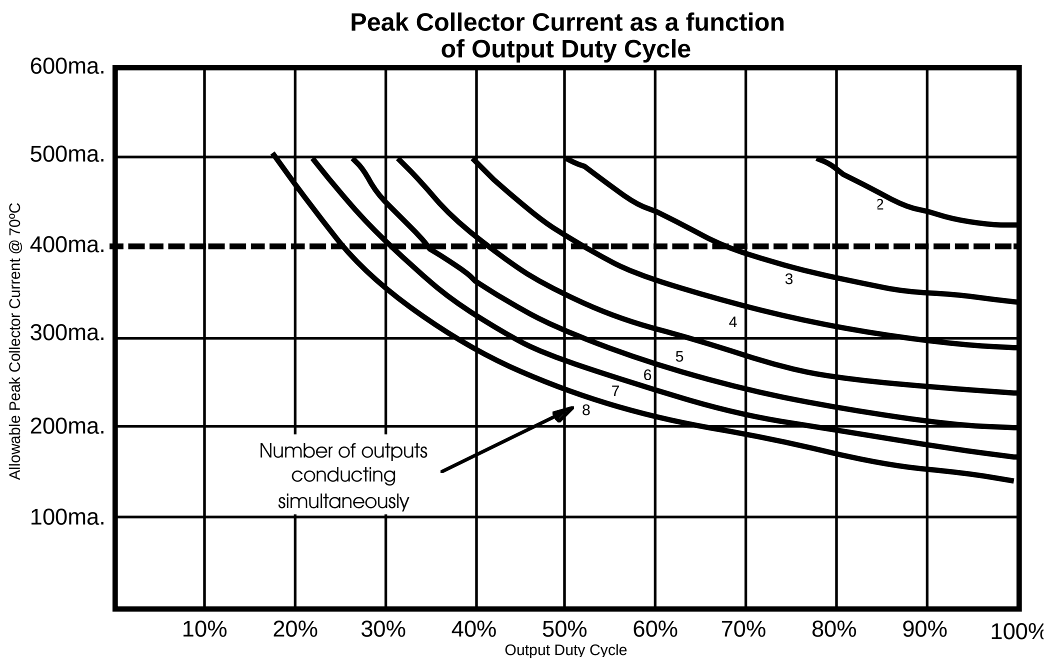
Any eight digital devices or one eight bit analog device can be connected to any 1/4 J-6 cable as shown. The LED between the ground (pin #1 brown) wire and supply (pin #10 black) wire acts as an indicator which is lit if the fuse for that channel is OK:





The supply line for each 1/4 J-6 is fused for 1 amp. You should treat each 1/4 J-6 as an individual, and not cross the outputs or supply lines from one channel to the lines from any other channel. Doing this won't cause any damage, but can reduce the protection for the outputs that the fuses normally provide.

The current Output Capacity of a 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 which will be directly connected to the outputs of the animation system. 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:

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.

Edge Connector: All of the connections to and from Z-Brick Cards are available on the 60 position edge connector. You can use an Insulation Displacement Edge (IDE) connector if you aren't going to be using one of our card cages:

output wire #	Edge pin #	color	wire function
n/a	1	brown	not used
n/a	2	red	not used
n/a	3	orange	not used
n/a	4	yellow	not used
n/a	5	green	not used
n/a	6	blue	not used
n/a	7	violet	not used
n/a	8	gray	not used
n/a	9	white	not used
n/a	10	black	not used
#1	11	brown	J6 out channel 0 Ground
#2	12	red	J6 out channel 0 bit 7
#3	13	orange	J6 out channel 0 bit 6
#4	14	yellow	J6 out channel 0 bit 5
#5	15	green	J6 out channel 0 bit 4
#6	16	blue	J6 out channel 0 bit 3
#7	17	violet	J6 out channel 0 bit 2
#8	18	gray	J6 out channel 0 bit 1
#9	19	white	J6 out channel 0 bit 0
#10	20	black	J6 out channel 0 + Supply
#11	21	brown	J6 out channel 1 Ground
#12	22	red	J6 out channel 1 bit 7
#13	23	orange	J6 out channel 1 bit 6
#14	24	yellow	J6 out channel 1 bit 5
#15	25	green	J6 out channel 1 bit 4
#16	26	blue	J6 out channel 1 bit 3
#17	27	violet	J6 out channel 1 bit 2
#18	28	gray	J6 out channel 1 bit 1
#19	29	white	J6 out channel 1 bit 0
#20	30	black	J6 out channel 1 + Supply
#21	31	brown	J6 out channel 2 Ground
#22	32	red	J6 out channel 2 bit 7
#23	33	orange	J6 out channel 2 bit 6
#24	34	yellow	J6 out channel 2 bit 5
#25	35	green	J6 out channel 2 bit 4
#26	36	blue	J6 out channel 2 bit 3
#27	37	violet	J6 out channel 2 bit 2
#28	38	gray	J6 out channel 2 bit 1
#29	39	white	J6 out channel 2 bit 0
#30	40	black	J6 out channel 2 + Supply
#31	41	brown	J6 out channel 3 Ground
#32	42	red	J6 out channel 3 bit 7
#33	43	orange	J6 out channel 3 bit 6
#34	44	yellow	J6 out channel 3 bit 5
#35	45	green	J6 out channel 3 bit 4
#36	46	blue	J6 out channel 3 bit 3
#37	47	violet	J6 out channel 3 bit 2
#38	48	gray	J6 out channel 3 bit 1
#39	49	white	J6 out channel 3 bit 0
#40	50	black	J6 out channel 3 + Supply
black	51	brown	power supply ground
black	52	red	power supply ground
black	53	orange	power supply ground
black	54	yellow	power supply ground
black	55	green	power supply ground
red	56	blue	+ power supply input
red	57	violet	+ power supply input
red	58	gray	+ power supply input
red	59	white	+ power supply input
red	60	black	+ power supply input

- 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 and Smart Brick Animation Control Systems and RTU/FSK units. ASCII values that have their uppermost bit set (bit 7) are shown in parenthesis:

decimal	HEX	ASCII	%	decimal	HEX	ASCII	%	decimal	HEX	ASCII	%	decimal	HEX	ASCII	%
00	00h	null	0	64	40h	@	25%	128	80h	(null)	50%	192	C0h	(@)	75%
1	01h	soh/^A	LaserSearch	65	41h	A		129	81h	(soh)		193	C1h	(A)	
2	02h	stx/^B	PB Input wait	66	42h	B		130	82h	(stx)		194	C2h	(B)	
3	03h	etx/^C	BLUE in wait	67	43h	C		131	83h	(etx/)		195	C3h	(C)	
4	04h	eot/^D	GREEN in wait	68	44h	D		132	84h	(eot)		196	C4h	(D)	
5	05h	eng/^E	STOP Relay	69	45h	E		133	85h	(eng)		197	C5h	(E)	
6	06h	ack/^F	PLAY Relay	70	46h	F		134	86h	(ack)		198	C6h	(F)	
7	07h	bell/^G	REWIND Relay	71	47h	G		135	87h	(bell)		199	C7h	(G)	
8	08h	bs/^H	HDTV Mode	72	48h	H		136	88h	(bs)		200	C8h	(H)	
9	09h	ht/^I	Hour = '01'	73	49h	I		137	89h	(ht)		201	C9h	(I)	
10	0Ah	lf/^J		74	4Ah	J		138	8Ah	(lf)		202	CAh	(J)	
11	0Bh	vt/^K		75	4Bh	K		139	8Bh	(vt)		203	CBh	(K)	
12	0Ch	ff/^L		76	4Ch	L		140	8Ch	(ff)		204	CCh	(L)	
13	0Dh	cr/^M		77	4Dh	M		141	8Dh	(cr)		205	CDh	(M)	
14	0Eh	so/^N		78	4Eh	N		142	8Eh	(so)		206	CEh	(N)	
15	0Fh	si/^O		79	4Fh	O		143	8Fh	(si)		207	CFh	(O)	
16	10h	dle/^P		80	50h	P		144	90h	(dls)		208	D0h	(P)	
17	11h	dc1/^Q		81	51h	Q		145	91h	(dc1)		209	D1h	(Q)	
18	12h	dc2/^R		82	52h	R		146	92h	(dc2)		210	D2h	(R)	
19	13h	dc3/^S		83	53h	S		147	93h	(dc3)		211	D3h	(S)	
20	14h	dc4/^T		84	54h	T		148	94h	(dc4)		212	D4h	(T)	
21	15h	nak/^U		85	55h	U		149	95h	(nak)		213	D5h	(U)	
22	16h	syn/^V		86	56h	V		150	96h	(syn)		214	D6h	(V)	
23	17h	etb/^W		87	57h	W		151	97h	(etb)		215	D7h	(W)	
24	18h	can/^X		88	58h	X		152	98h	(can)		216	D8h	(X)	
25	19h	em/^Y		89	59h	Y		153	99h	(em)		217	D9h	(Y)	
26	1Ah	sub/^Z		90	5Ah	Z		154	9Ah	(sub)		218	DAh	(Z)	
27	1Bh	ESC		91	5Bh	[		155	9Bh	(ESC)		219	DBh	([)	
28	1Ch	FS		92	5Ch	\		156	9Ch	(FS)		220	DCh	(\)	
29	1Dh	GS		93	5Dh	]		157	9Dh	(GS)		221	DDh	(])	
30	1Eh	RS		94	5Eh	^		158	9Eh	(RS)		222	DEh	(^)	
31	1Fh	VS		95	5Fh			159	9Fh	(VS)		223	DFh	( )	
32	20h	SP	12.5%	96	60h	`	37.5%	160	A0h	(SP)	62.5%	224	E0h	(`)	87.5%
33	21h	!		97	61h	a		161	A1h	(!)		225	E1h	(a)	
34	22h	"		98	62h	b		162	A2h	(")		226	E2h	(b)	
35	23h	#		99	63h	c		163	A3h	(#)		227	E3h	(c)	
36	24h	$		100	64h	d		164	A4h	($)		228	E4h	(d)	
37	25h	%		101	65h	e		165	A5h	(%)		229	E5h	(e)	
38	26h	&		102	66h	f		166	A6h	(&)		230	E6h	(f)	
39	27h	'		103	67h	g		167	A7h	(')		231	E7h	(g)	
40	28h	(		104	68h	h		168	A8h	(()		232	E8h	(h)	
41	29h	)		105	69h	i		169	A9h	())		233	E9h	(i)	
42	2Ah	*		106	6Ah	j		170	AAh	(*)		234	EAh	(j)	
43	2Bh	+		107	6Bh	k		171	ABh	(+)		235	EBh	(k)	
44	2Ch	'		108	6Ch	l		172	ACh	(')		236	ECh	(l)	
45	2Dh	-		109	6Dh	m		173	ADh	(-)		237	EDh	(m)	
46	2Eh	·		110	6Eh	n		174	AEh	(·)		238	EEh	(n)	
47	2Fh	/		111	6Fh	o		175	AFh	(/)		239	EFh	(o)	
48	30h	0		112	70h	p		176	B0h	(0)		240	F0h	(p)	
49	31h	1		113	71h	q		177	B1h	(1)		241	F1h	(q)	
50	32h	2		114	72h	r		178	B2h	(2)		242	F2h	(r)	
51	33h	3		115	73h	s		179	B3h	(3)		243	F3h	(s)	
52	34h	4		116	74h	t		180	B4h	(4)		244	F4h	(t)	
53	35h	5		117	75h	u		181	B5h	(5)		245	F5h	(u)	
54	36h	6		118	76h	v		182	B6h	(6)		246	F6h	(v)	
55	37h	7		119	77h	w		183	B7h	(7)		247	F7h	(w)	
56	38h	8		120	78h	x		184	B8h	(8)		248	F8h	(x)	
57	39h	9		121	79h	y		185	B9h	(9)		249	F9h	(y)	
58	3Ah	:		122	7Ah	z		186	BAh	(:)		250	FAh	(z)	
59	3Bh	;		123	7Bh			187	BBh	(;)		251	FBh	( )	
60	3Ch	<		124	7Ch			188	BCh	(<)		252	FCh	( )	
61	3Dh	=		125	7Dh	|		189	BDh	(=)		253	FDh	(|)	
62	3Eh	>		126	7Eh	~		190	BEh	(>)		254	FEh	(~)	
63	3Fh	?		127	7Fh	del		191	BFh	(/)		255	FFh	(del)	100%