

Keyboard Technologies, Inc.
GZ-1000 Performance Keyboard
User Manual

First Edition - November 1988

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This document covers GZ-1000 units with operating system firmware version number 1.00.

CAUTION:

To prevent fire or shock hazard, do not expose this device to rain or moisture. Do not remove cover. No user serviceable parts inside. Refer servicing and internal adjustments to qualified service personnel.

WARNING:

This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

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Chapter 1 – General Description	7
Keyboard.....	7
Performance controls	7
Control routing	7
Global Setups.....	8
Disk drive	8
Displays and Data Entry.....	8
Typical setup	8
Chapter 2 - Description of Controls	11
Mechanical adjustments	11
Front panel controls and displays	11
Operator switches	11
Operator LEDs.....	11
Global display	11
Write switch, Write LED.....	12
Function display	12
PAL switch, PAL LED	12
Edit switch, Edit LED.....	12
Page 1 LED, Page 2 LED	13
Data entry switches (NO, YES)	13
Rear panel	13
Power ON/OFF switch, AC power receptacle, Line voltage selector.....	13
Fuse holder	13
Front panel dimmer.....	13
MIDI inputs	13
MIDI outputs	13
Footswitch inputs.....	13
Pedal inputs.....	13
External disk drive connector	13
Editing parameters.....	15
Front panel data entry	16
Modulation wheel data entry	16
Keyboard data entry.....	16
Status entry	17
Alphanumeric data entry	17
Hexadecimal data entry	18
Using functions	18
Chapter 3 – Performance Mode Features.....	19
Wake-up.....	19
Operator Switching	19
Program Advance Library (PAL)	20
Changing Global Setups	20

MIDI Input Processing	21
Chapter 4 - Global Setup Parameters (Edit Page 1)	23
Global transpose	23
Global name	23
MIDI output enables	24
Operator wake-up status	24
Key action thresholds	25
Memory protect.....	25
Operator MIDI transmit channel display	26
Operator local mode switching	26
MIDI input routing modes.....	26
MIDI input assignment mode	27
MIDI input filtering	27
Operator Sustain-Hold option.....	28
Global MIDI controller enable	28
Chapter 5 - Operator Parameters (Edit Page 2)	29
What is an operator?	29
Selecting an operator	29
Operator compare mode	29
Operator name.....	30
Name Finder	30
Operator wake-up options	31
Synthesizer patch select	31
MIDI control message	31
User defined wake-up messages	31
MIDI transmit channel.....	32
Transmitter enables	33
Keyboard limits.....	33
Operator transpose	34
Keyboard pitch enable	34
Velocity scale & limits	34
Velocity window.....	35
Pressure enables.....	35
Pressure scale and limits	36
Controller assignment	36
Pedal polarity	38

Pedal routing	38
Wheel polarity	39
Wheel routing	39
Footswitch polarity	39
Footswitch routing	40
MIDI Input processing	40
Chapter 6 - System Functions (Edit Page 0)	41
Page 0 function 0	41
Global select function	41
Momentary edit footswitch feature	41
Transmit MIDI Tune command	42
PAL Editing	42
PAL looping	42
PAL Insert/Delete functions	43
Copying global setups	43
Swapping global setups	44
Copying a single operator	44
Recall last edited global	44
Front Panel Switch Sensitivity	45
Footswitch Polarity	45
User defined Pressure/Velocity scales	46
User Defined MIDI Messages	49
User defined MIDI control message	51
MIDI to Disk Request message	51
MIDI Transfer of global setups	52
GZ-1000 MIDI Inputs	52
MIDI Input channels and omni mode	52
MIDI input enables	52
MIDI input program change handling	53
MIDI input system exclusive enable	53
MIDI utility output enables	53
Disk Functions	54
Protecting Disk Data	54
Disk Files	54
Selecting Primary Disk Drive	55
Save All (System Save)	55

Random file name selection	56
Save miscellaneous files	56
Record Incoming MIDI to Disk (MIDI-to-Disk)	57
Load file	58
Erase file from disk	60
Copy File	60
Formatting disks	61
Keyboard lock	61
Test mode	63
Power-up reset to default values	64
Global setup request:	69
Global setup data dump:	69
8 bit Data Block request:	72
7 bit Data Block dump:	73
User MIDI message requests:	74
User MIDI message dump:	74
System ID request:	74
"Press" Front Panel Switch	75
Universal device inquiry message (recognized)	75
Universal device inquiry message response	75
<i>Appendix 3 - G2-1000 Error messages</i>	<i>77</i>
Disk error messages	77
Test mode error messages	78
Other error messages	78
<i>Appendix 5 – Conversion Tables</i>	<i>83</i>
Hexadecimal to Decimal conversion table	83
Data Entry Character Codes	84
GZ-1000 Setup Sheets	85

Chapter 1 – General Description

The GZ-1000 is a versatile Performance Keyboard designed as a central MIDI controller for a system of electronic musical instruments. It combines an adjustable mechanical keyboard action with a powerful microcomputer for state of the art MIDI control.

Keyboard

The keyboard has 88 wooden keys with weighted hammer action for a piano-like feel. A single lever adjusts the overall mechanical response of the keyboard to suit the user. Also, internal adjustments can be made at any KTI service center to custom tailor the response of individual keys by setting the position of a sliding weight on each key's hammer.

The GZ-1000 has an extensive MIDI implementation and the keyboard can generate Key-On and Key-Release Velocity with adjustable response curves (velocity scales) and adjustable sensitivity. Global aftertouch (channel pressure) and polyphonic pressure are also supported.

Performance controls

Performance controls include two modulation wheels on the left side of the keyboard, which can be used for pitch bending, modulation or any other type of MIDI continuous controller. One of these wheels has a return-to-center spring and is normally used for pitch bending. Rear panel inputs are provided for up to four continuously variable pedal controls and three momentary foot switches all of which may be assigned to any MIDI controller number.

Control routing

The keyboard and all these controls are routed to eight independent MIDI operators - a unique concept in MIDI control. Each operator has a definable keyboard range, transpose value, MIDI transmit channel, velocity scale, pressure scale, and controller assignments. MIDI program changes may be transmitted by each operator at wake-up, along with a choice of 32 user definable MIDI messages. The output of each of these operators may be directed to any combination of four MIDI transmitters which in turn drive up to two MIDI outputs each, for a total of eight GZ-1000 MIDI outputs. The operators may be switched on and off at any time from the front panel. This allows very flexible control of the system in a performance situation.

Global Setups

The GZ-1000 has the capacity to hold 100 global setups in memory. A global setup is a group of setup parameters that defines the way the GZ-1000 will respond to inputs from the keyboard, wheels and external controls, and how these inputs will control the MIDI devices connected to it. A global setup consists of eight operators, and parameters common to all operators. These other parameters include a sixteen character setup name, a global transpose value, MIDI output enables, key action thresholds, MIDI input mode, a master controller disable switch, and a sustain-hold option. Each of the eight operators in a setup can control patch selection, keyboard range, transpose, controller assignments, and many other parameters.

Disk drive

A floppy disk drive is built into the GZ-1000 for storing global setups and other GZ-1000 data as well as synthesizer patches or any other information that can be transmitted over MIDI in system exclusive format. Convenient 3.5 inch microfloppy disks are used that can store up to 640k bytes of data - more than 20 groups of 100 global setups may be saved on a single disk.

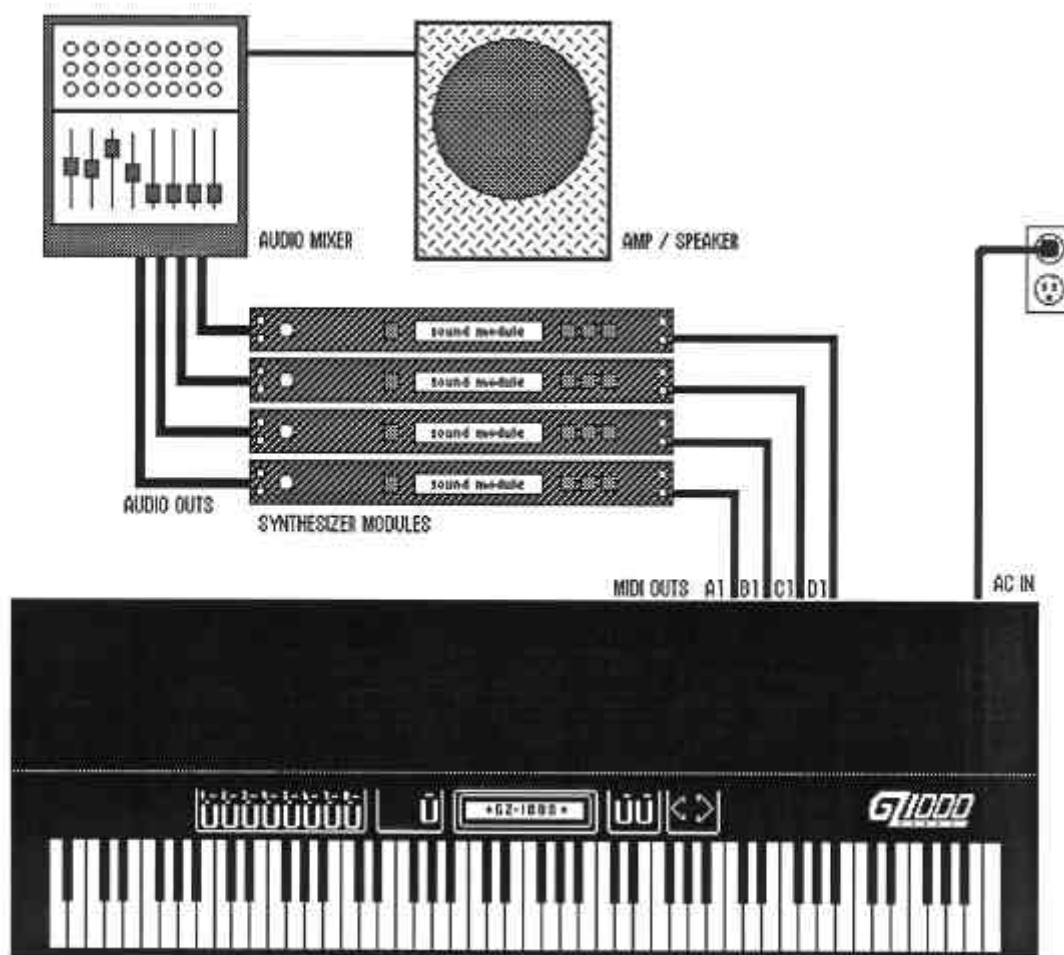
Displays and Data Entry

Interaction between the user and the GZ-1000 is simplified through the use of an 80 character Liquid Crystal Display (LCD) that provides detailed displays for editing parameters, and the keyboard itself which is used for data entry and cursor control. Alternate methods of data entry are the modulation wheel and front panel switches.

Typical setup

A typical GZ-1000 system is depicted on the next page. Four synthesizer modules are connected to four GZ-1000 MIDI outputs. Control of the four modules can be divided in many different ways. Each synthesizer could be assigned to a different range of the keyboard, or all four could play in parallel. With each module assigned to a different operator, individual sounds can be added or removed while playing by switching operators on and off.

This setup is just one of a practically infinite number of possible arrangements; the GZ-1000 can handle just about any setup you can think of.



Chapter 2 - Description of Controls

Mechanical adjustments

The lever at the right side of the GZ-1000 keyboard is used to set the physical playing action. The lever is pushed towards the front panel for a light action, pulled back for a heavier response, or set anywhere in between to suit the user's preference. Other internal adjustments that can be made by a qualified service technician include a sliding weight on each key's hammer, and variable action rail pivot point. The combination of all these adjustments provide for a wide range of keyboard feels.

Front panel controls and displays

The GZ-1000 has 13 pressure sensitive touch switches on its front panel. Switches are activated by finger pressure in the 'U' shaped areas indicated, or in the triangle areas of the data entry switches. The controls and displays are described here in order from left to right:

Operator switches

The numbered switches are used to turn operators on or off in Performance mode, and to select operators in Edit mode. These switches are also used to turn operator compare mode on and off for any operator which has been edited.

Operator LEDs

There are two LEDs (Light Emitting Diodes) located by each operator switch; the large rectangular LED is the operator ON/OFF indicator which is lighted when the corresponding operator is "awake" and active. The triangular LED is the operator edit/compare indicator. One of the eight edit/compare LEDs will light steadily if Page 2 Edit mode is selected for that operator. The edit/compare LEDs for any operators that are in compare mode will blink on and off continuously. If more than one operator is in compare mode, and one of them is also the selected operator in Edit mode, the selected operator edit/compare LED will flash out of phase with the others.

Global display

The large two digit numeric display is used to show the number of the currently selected global setup. This display is also used to display certain types of system errors. The decimal points in the global display will light when incoming MIDI data is present at either of the two GZ-1000 MIDI inputs - the left hand decimal point represents MIDI input number 1 and the right hand point shows MIDI input number 2 activity.

Write switch, Write LED

The write switch is used to save the data in the current edit buffer to setup memory. With a few exceptions, the write switch has no effect in page 0 Edit mode, but in page 1 and in Performance mode, pressing "write" will save the entire edited global setup including all eight operators. In operator Edit mode (page 2) pressing the write switch will only save the selected operator edit buffer. In Performance mode, if the current global setup has not been edited, pressing the write switch will cause the GZ-1000 to "wake up" again and recall the programmed operator on/off status. The LED over the write switch will blink momentarily when a global setup or operator is saved.

Function display

In Performance mode this backlit 80 character LCD (Liquid Crystal Display) is used to display the name of the selected global setup. Also, when an operator switch is pressed, the name of the operator is momentarily displayed on the function display. In Edit mode, the function display presents various parameters for editing and interactive displays for performing functions. There are two areas of the display which are used consistently in Edit mode - the current function number is always shown in the upper left hand corner and the current edit page number (P0, P1 or P2) is displayed in the upper right hand part of the display. Individual edit functions will be described in later chapters.

PAL switch, PAL LED

The PAL switch turns the Program Advance Library mode on or off. The PAL is a list of global setup numbers that can be programmed in any sequence. When PAL mode is on, the two data entry switches on the front panel become PAL step switches and will allow stepping through the PAL chain forwards or backwards, and the edit footswitch becomes a PAL advance switch. When the PAL is advanced, the current global setup changes immediately to the next setup in the list. The PAL LED will light when PAL mode is on.

Edit switch, Edit LED

The edit switch is used to turn Edit mode on or off. Pressing the switch once will turn Edit mode on. Pressing the switch again will turn Edit mode off. The edit switch is also used during certain Page zero functions to cancel an operation in progress. The Edit LED lights when Edit mode is selected.

Page 1 LED, Page 2 LED

The page 1 LED will light when editing on page 1. The page 2 LED will light when editing on page 2. Both the page 1 and page 2 LEDs will be off in Performance mode and page 0 Edit mode.

Data entry switches (NO, YES)

These switches are used for incrementing or decrementing data values in Edit mode, or moving through the PAL chain when PAL mode is on. They are also used to reply to GZ-1000 inquiries in certain Edit mode functions where a "yes" or "no" response is required. Pressing the red NO switch will subtract 1 from edit values selected with the cursor. The green YES switch will add 1 to selected values. When either of these switches is depressed for longer than one second, it will begin to repeat automatically, allowing scanning through a range of values quickly.

Rear panel

The following items are located on the rear panel of the GZ-1000:

Power ON/OFF switch, AC power receptacle, Line voltage selector

Select correct operating line voltage - 115 or 230 volts at 50-60Hz.

Fuse holder

If the fuse is blown, replace with the same type to prevent damage to the GZ-1000.

Front panel dimmer

A screwdriver adjustment is provided to set the brightness of the lighting behind the switches on the front panel. To avoid excessive heat buildup, don't set the lamp brightness any higher than necessary.

MIDI inputs

MIDI inputs 1 and 2 can be used for merging MIDI data or for system exclusive data input.

MIDI outputs

The eight MIDI outputs are programmable as a part of each global setup.

Footswitch inputs

Footswitch inputs 1 - 3 and the edit switch input are designed for either normally open or normally closed momentary contact switches.

Pedal inputs

The pedal inputs 1-4 are designed for a pedal with a 50K potentiometer, or a control voltage of 0 to +2.5 volts.

External disk drive connector

This connector is provided for the optional KTI GZ-D disk drive. Do not connect any other type of device to this port.

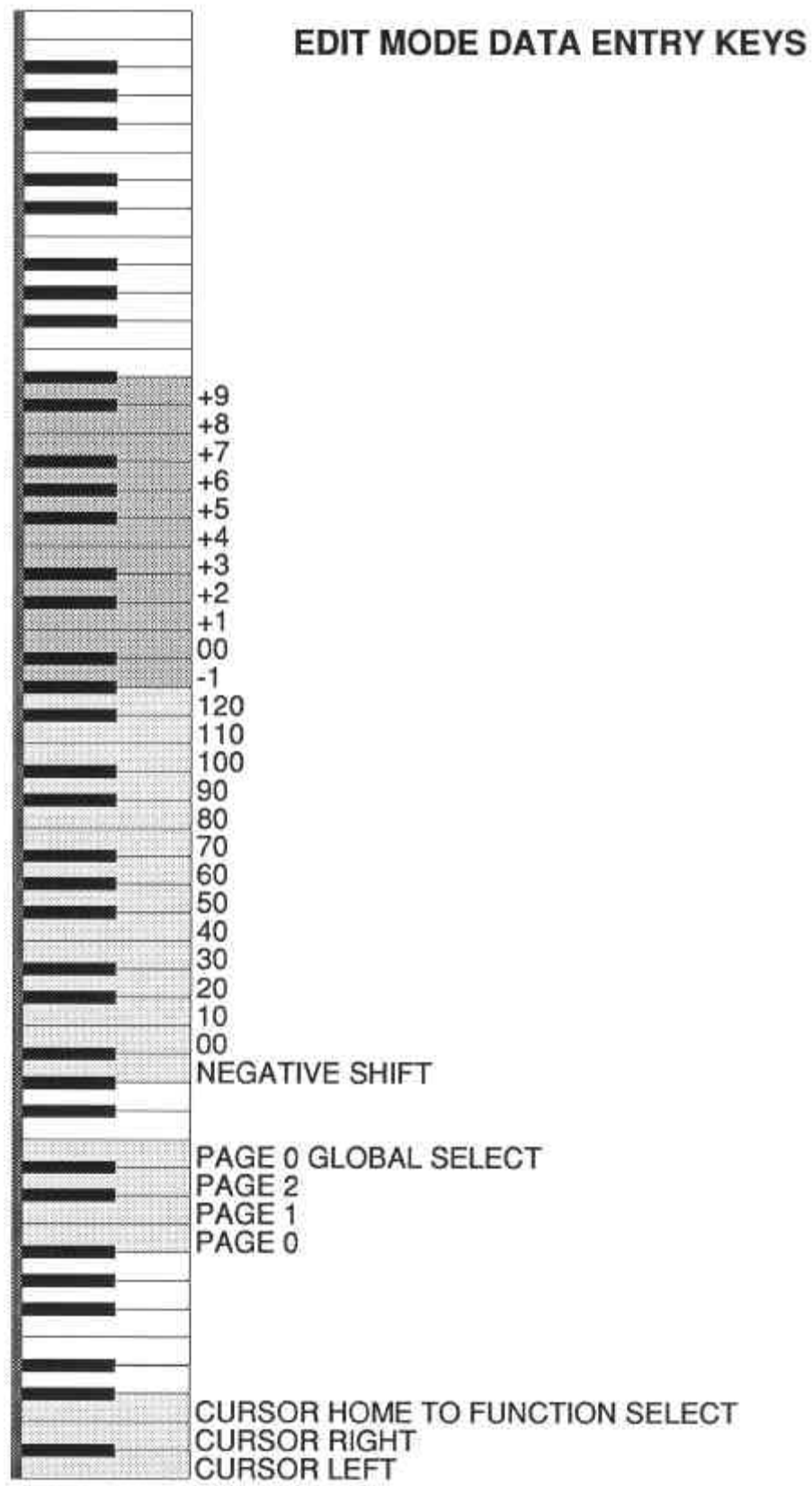


Figure 1 – Keyboard data entry key assignments

Editing parameters

The GZ-1000 has two basic modes of operation - Performance mode (or play mode) and Edit mode. The edit switch on the front panel and the edit footswitch are used to switch between these two modes. When the GZ-1000 is in Edit mode, the keyboard takes on a new function as a data entry and display cursor control device. The modulation wheel and front panel data entry switches may also be used for entering parameters, but with a little practice the user should soon become comfortable using the keyboard as a swift and convenient input device.

A flashing cursor appears on the function display in Edit mode to indicate the active data entry field - the parameter which will be affected by the next data entry. The first character of the selected field is also marked by an underline. The cursor may be moved from one field to the next by pressing the appropriate cursor control keys (see figure 1). The cursor home key will always move the cursor back to the function select field in a single jump.

There are three basic groups of edit functions called pages. The function display always shows the current page number in the upper right hand corner.

Page zero (P0) contains miscellaneous functions for manipulating and saving global setups, and defining system level parameters common to all global setups.

Page one (P1) is used to edit global setup parameters (and some operator parameters).

Page two (P2) is the operator edit page. There are actually eight page twos – one for each operator. The operator selected in page two edit mode is always shown by a number on the function display as well as by the operator edit/compare LEDs.

Each page has several functions that are identified by a number - this function number is always displayed in the upper left corner of the function display. The current function can be changed by placing the cursor on the function select field and changing the value.

While in Edit mode, different edit pages can be accessed using the white keys one octave up from the cursor control keys (see figure 1). When these page access keys are used, the display jumps directly to the last function that was accessed on the selected page. The global select key is a special key that will jump directly to Edit page zero function 0 and place the cursor on the global setup selection field. After pressing the global select key, pressing the page zero access key will return to the function display on page zero that was last used prior to jumping to the global select function. Note - if the global select key is pressed twice in succession, this will not work.

When the cursor has been positioned on a parameter field, the value displayed in that field may be modified using any of three methods; with the data entry switches on the front panel, the keyboard or the modulation wheel (the wheel that is not spring loaded).

There are three basic types of data that can be edited; numbers, alphanumeric characters, and status values that are either on or off.

Front panel data entry

The data entry switches on the front panel are used to increment or decrement values, or to select on/off status. The "Yes" switch will increment the selected value by one if it is a number or alphanumeric character, and set status values to "on". The "No" switch will decrement numbers and alphanumeric characters and set status values to "off".

Modulation wheel data entry

The modulation wheel is used to enter values by turning it until the desired value is displayed. There are two modes of data entry when using the modulation wheel. When the parameter being edited has a small range of values (less than 32), the absolute position of the wheel sets the value. On parameters with a larger range, the wheel behaves incrementally, adding to or subtracting from the displayed value by an amount from 1 to 127 corresponding to the amount and direction of wheel movement. Turning the wheel forward will add to the displayed value, and pulling it back will subtract from it.

In some cases, it is necessary to enter values greater than 127. One way to do this is by setting the wheel to its minimum position and then entering a large number using the keyboard. The wheel can then be turned to add to the value, increasing it beyond 127 - up to 255 maximum.

Keyboard data entry

Numeric values between 00 and 129 may be entered in one or two keystrokes using the keyboard in the following manner (see figure 1): White keys starting with the C one octave below middle C are numbered representing tens digits (B=0, C=10, D=20, E=30, ... D=90). Pressing any of these 'tens' keys will *reset* the current value selected by the cursor to a whole number multiple of ten. The white keys beginning at the C one octave above middle C represent 'ones' *increments* to the selected value (with a special case where the A above middle C represents a value of negative one). Pressing any of these 'ones' keys will add its value to the currently selected value highlighted by the cursor. Pressing either of the B 'zero' keys (B2 or B4) will reset the selected numeric value to zero. The A key just below the 'tens' zero key functions as a negative shift key. Any values entered while this key is depressed will have a negative value.

Example: To enter a value of 23, press the keys D2 (20) and E4 (+3) in that order. Notice that each of the 'ones' keys will continue to add their respective values each time they are pressed. This allows another method of entering numbers greater than 129; just continue pressing one of these keys to reach the desired value.

The keys A4 (-1) and C4 (+1) have the same effect as the two data entry switches on the front panel.

The mode of data entry may vary slightly depending on the type of data in the field. Most numeric data entry is straightforward. Some displays fields have numbers that may be positive or negative. In this case, an additional cursor field is provided to change the sign of the displayed number without changing the magnitude of the number itself. The negative shift key may also be used to enter negative numbers - while it is being pressed, all other numeric entry will be negative. If the negative shift key is used when the cursor field is expecting only positive values, either a value of zero or the maximum will result. Or, if the range of values is 0 to 255, the result will be $(256 - V)$, where V is the entered value. For example, if entering a controller number while editing a footswitch assignment; entering a value of 50 while holding the negative shift key will result in the number $206 = (256 - 50)$.

Status entry

In cases where the value in the selected field is either ON or OFF, a negative (decrement) value or a value of zero entered will set the status to OFF. Any positive increment will set the value to ON. If the cursor field is on the sign of a number that can be positive or negative, any non-zero entry will toggle the sign between plus and minus.

Alphanumeric data entry

Alphanumeric data (alphabet symbols, punctuation, numbers, etc.) is entered numerically also, with numbers representing characters. A table of characters corresponding to number codes 0 through 95 is included in appendix of this manual. In most displays where alphanumeric entry is required, a small 'helper' display is also provided at the lower right of the LCD indicating the numeric equivalent of the selected character. This will help the user to enter characters directly by number as he becomes familiar with the codes. The modulation wheel also makes it easy to quickly scroll through the character set.

Hexadecimal data entry

Entering hexadecimal (hex) numbers for MIDI messages is a little more complicated. The keyboard is a decimal data entry device, but hexadecimal is a base 16 numbering system. As we all know, the decimal numbering system uses the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. Hex digits include 0 through 9, and then continue with letters A, B, C, D, E, and F, representing the values ten through fifteen. For example, the decimal number 36 ($3 \times 10 + 6 \times 1$) would be represented by 24 (hex) ($2 \times 16 + 4 \times 1$). To enter a hex value of 24 into a MIDI message, use the keyboard to enter 36 decimal by pressing the 30 key and then the +6 key. The display will show 24. The hex to decimal conversion table in the appendix can be used to make conversions easier.

Using functions

Many functions require a command from the user in order to begin execution of a process. Such functions have a "GO" display in the lower right corner of the display. When viewing a Edit page function, no action will be taken until the cursor is moved to the <GO> field and a non-zero data entry is made (pressing the YES switch for instance). Some functions will finish and display a message that include, "PRESS 'YES' TO CONTINUE". Again, any non-zero data entry will restore the proper Edit page display

Chapter 3 – Performance Mode Features

As the name implies, Performance mode is used for playing music. In this mode, the keyboard, wheels, pedals and footswitches will generate MIDI commands as programmed by the currently selected global setup. In Performance mode all the switches on the front panel are active: The operator switches will turn operators on and off, the write switch will save any edits to setup memory and also reset all operators to their programmed wake-up status. The PAL switch turns PAL mode on and off and the data entry switches will step through the PAL sequence (the data entry switches have no effect unless PAL mode is on). And finally, the edit switch will turn Edit mode on and Performance mode off. If any MIDI notes are still on when Edit mode is turned on, all those notes will be turned off before going into Edit mode.

The GZ-1000 will always “wake up” in Performance mode when first powered on unless it is locked (see the description of Lock mode which appears later in this manual).

Wake-up

The term wake-up is used to describe what happens to the GZ-1000 when a global setup is changed, or when switching from Edit mode to Performance mode.

Depending on the way the global setup is programmed, a MIDI program change command for each operator may be transmitted along with other user defined MIDI messages. All assigned controllers transmit their current position at this time.

Operator Switching

A very useful feature of the GZ-1000 is the ability to turn operators on and off without leaving Performance mode. This allows great flexibility and ease of changing and mixing sounds without stopping to turn volume controls or change MIDI cables.

Whenever an operator is turned off, all of the MIDI notes that originated from within that operator that are still on will be automatically turned off. Also when changing globals using the PAL, or when switching from Performance mode to Edit mode, all operators are turned off to prevent any MIDI notes from getting “stuck” on.

Program Advance Library (PAL)

The *Program Advance Library* is a list of 100 global setup numbers programmed in the GZ-1000. The user may edit this list and set the current PAL position (0-99) within the list. In Performance mode, when PAL mode is on, the data entry switches will increment or decrement the current PAL position, changing the global setup as it steps forward or backward through the PAL list. Also, when PAL mode is on, the edit footswitch becomes a PAL advance footswitch instead of switching the GZ-1000 into Edit mode. If the PAL position is advanced repeatedly, it will stop when it reaches the end (position 99). Any number of special loop markers may be inserted anywhere in the PAL. When one of these markers is encountered while stepping forward through the PAL, the PAL position will go back to the beginning of the list (PAL position 0). When stepping backwards through the PAL, the current position will stop and go down no further when a marker is found one position below the current position.

The PAL is useful for live performances where a predetermined set of global setups are to be used in a certain order – one global setup for each different song in a set, for example. The player can change globals very quickly without ever going into Edit mode. Also, having the ability to go backwards through the PAL (using the front panel switches only), the player is not locked into an unchanging sequence of setups.

Changing Global Setups

The current global setup can be changed in several different ways. The normal method is to go into Edit mode and change the global number on Page 0 or 1, function 0. As described earlier, stepping through the PAL will also change the current global setup. MIDI program change commands transmitted by an external controller or sequencer and received by the GZ-1000 can also change the current global if this option is enabled.

In a performance situation, it is sometimes necessary to change setups very quickly. This can be done easily without lifting hands from the keyboard using a combination of the edit footswitch and the keyboard for data entry. To do this, before going into Performance mode, set the cursor on global select (function 0 in either page 0 or page 1). In these two special cases, the GZ-1000 will go into Edit mode when the footswitch is pressed down, and then return to Performance mode as soon as the footswitch is released. While the edit footswitch is depressed, the keyboard is in data entry mode and can be used to select a new global setup number. Releasing the edit footswitch then will return the keyboard immediately to Performance mode.

When a setup is changed, by any means, if any edits have been made to the global setup or any of its operators, the data in the current edit buffer (including any operators that are in compare mode) will be written into the *recall edit buffer*. The recall edit buffer is not modified if the current setup has NOT been edited. This buffer can be recalled by using a special Page 0 function.

MIDI Input Processing

There are two MIDI inputs on the GZ-1000, input 1 and input 2. In Edit mode, either input (but not both) may be used for transferring system exclusive data into the GZ-1000; for receiving GZ-1000 format system exclusive data, using a Name-Finder to load a synthesizer patch name, or for saving synthesizer system exclusive patch dumps to the GZ-1000 disk.

In Performance mode, MIDI data from the two inputs can be merged and routed through any operators that are not in local mode. The current global setup can process the MIDI data in several ways. MIDI system exclusive messages are ignored, and notes, controllers, pressure and sequencer control commands may be selectively filtered. Program change commands can be handled in three ways – they can pass through to the operators, change the current global setup number without passing through, or be ignored completely.

In each non-local operator, note-on and note-off velocities are modified by the selected operator velocity scale and limits, and keyboard range and velocity window parameters also apply to incoming MIDI notes. The original channel number of all incoming MIDI channel messages is stripped off and replaced with the operator transmit channel if *channelize* mode is selected.

Two GZ-1000 input assignment modes are available. The first, called mode P, routes all qualified incoming MIDI messages to all non-local operators. In this case, “qualified” means that GZ-1000 MIDI input is ON and the input channel number matches the incoming MIDI message (if omni mode is off). If omni mode is on, messages on all MIDI channels will be accepted.

The other mode, mode M, also known as ‘guitar controller mode’, routes MIDI messages on sequential MIDI channels to sequentially numbered operators – each operator only listening to one MIDI channel. Operators must be in non-local mode to process incoming MIDI, and the input should be in omni ON mode. Foreexample, messages coming in on MIDI channel 1 can go through operator 1, message on channel 2 go through operator 2 and so on. If a MIDI input is not set for omni mode, messages can only be accepted on that inputs MIDI channel and will go through operator 1 only. In mode M, operator 1 only looks at MIDI messages on the basic MIDI input channel, operator 2 looks at the basic channel +1, operator 3 looks at basic channel +2, and so on, wrapping around to operator 1 again for channels higher than 16.

Chapter 4 - Global Setup Parameters (Edit Page 1)

The following is a description of parameters that may be defined by the user for each global setup, and explanations of how these parameters work. Typical edit displays are included to show the cursor fields for each display. Each possible cursor field is indicated by bold lettering and an underline below the first character position.

The LCD display shows the parameter 'GLOBAL TRANSPOSE=' with a cursor under the first character of '01'. The value '+ 12' is displayed below the parameter name. The label 'P1' is in the top right corner.

Global transpose

The pitch of all notes played on the keyboard may be transposed up or down in semitone steps. The global transpose value applies to all operators except those with keyboard pitch disabled. With both global and operator transpose equal to zero, middle C on the GZ-1000 keyboard corresponds to MIDI note number 60 (3C hex). Global transpose range is from -48 to +48.

The LCD display shows the parameter 'GLOBAL NAME=' with a cursor under the first character of '02'. The value 'GLOBAL 00 = GRAND_PIANO' is displayed below the parameter name. The label 'P1' is in the top right corner.

Global name

Global setups may have a sixteen character name consisting of letters, numbers and/or other ASCII characters. The global name, along with the global number, is displayed on the lower line of the LCD in performance mode. When editing alphanumeric data, a "helper" display appears in the lower right corner of the LCD, with the numerical equivalent of the selected character, as shown below.

The LCD display shows the parameter 'GLOBAL NAME=' with a cursor under the first character of '02'. The value 'GLOBAL 00 = GRAND_PIANO' is displayed below the parameter name. The label 'P1' is in the top right corner. A helper display in the bottom right corner shows '39 = "G"'. The character 'G' is underlined.

03	MIDI OUT	A1	A2	B1	B2	C1	C2	D1	D2	P1
	ENABLES:	ON	ON	ON	ON	--	--	--	--	

MIDI output enables

The GZ-1000 has four MIDI transmitters which each drive two MIDI output jacks. The two jacks connected to any transmitter may be enabled or disabled independently, but when both are enabled, they will always transmit identical information.

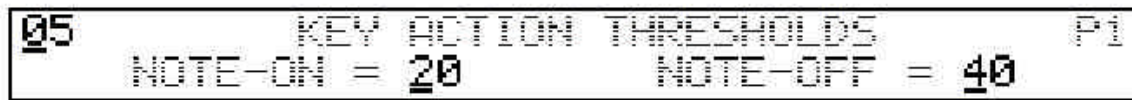
The MIDI output jacks are enabled at the global level independent of the transmitter programming which is done at the operator level. Each output jack is labeled with a letter (A, B, C or D) corresponding to its transmitter and a number, 1 or 2 for the upper or lower jack. On the MIDI output enable function display, either "ON" or "--" is displayed beneath each output name to show the output status. Turning off both outputs for a particular transmitter will disable the transmitter completely, overriding the operator transmitter enable status for that transmitter.

04	OPERATOR	1	2	3	4	5	6	7	8	P1
	WAKE UP	ON	ON	--	--	--	--	--	--	

Operator wake-up status

When a global setup is first selected, it goes through a process called "wake-up". At this time, all operators transmit any program change commands and other MIDI messages that may be programmed. These things will happen even if an operator is programmed to wake-up in the OFF state. The times when a setup will wake up are; when the global setup is changed by a received MIDI program change command, when going from Edit mode to Performance mode, or when the write switch is pressed while in Performance mode.

Each operator may be programmed to wake up ON or OFF. Not every global program needs to use all eight operators, so the unused ones may be set to OFF. Operators that wake-up OFF will not transmit any notes, pressure or controllers, but will transmit any wake-up program changes or MIDI messages that are programmed. This is done in order to transmit all setup information for the synthesizers only at wake-up time, and not while turning operators on and off individually. Sometimes a global setup might have different sounds on each operator, but wake up with only one of them on. The others sounds can then be added at any time in Performance mode by turning on the other operators, and the synthesizer programs will be ready to play immediately.



Key action thresholds

In addition to the mechanical adjustments possible with the GZ-1000 keyboard, each global setup can be programmed with a different keyboard velocity response and physical note-on and note-off points. The GZ-1000 calculates velocity based on the small time period in which a key passes between two programmable key action threshold levels. These are the note-on and the note-off thresholds and they control the physical level at which a key causes a note to turn on or off.

The feel of the keyboard can be programmed to be light or heavy depending on where the note-on threshold is placed. A high number for the note-on threshold will mean that a key must be pressed far down before the note will turn on. A lower number will make the keys more sensitive.

Warning:

Do not set the note-on threshold too low, or the keys may start to play by themselves under their own weight. An exclamation point (!) is displayed next to the note-on threshold if it is in a range that might be too sensitive.

The difference between the two threshold values affects the keyboard feel also. The two thresholds can be placed close together to get a "staccato" action, but when the thresholds are programmed too close to each other, notes will play with nearly maximum velocity no matter how hard they are played. This happens because the time it takes for the key to pass through the closely spaced thresholds is extremely short. By setting the two levels far apart, the dynamic range of velocity response is improved.

The range of key action threshold values is from 0 to 99. The note-off threshold must always be lower than the note-on threshold and is automatically limited to be in the proper range.



Memory protect

Global setups may be protected by turning global memory protect ON. This will prevent saving any edits, copying, or loading individual globals from disk to the protected global location. It will not protect against loading all programs from disk, however. Memory protect also prevents receiving GZ-1000 global setups via MIDI system exclusive messages.

07 OPERATOR	1	2	3	4	5	6	7	8	P1
MIDI CHANNEL	01	01	01	01	02	02	15	16	

Operator MIDI transmit channel display

This function display allows viewing and editing all eight operator MIDI transmit channels together. If an operator is in compare mode, editing the MIDI channel is not allowed.

08 OPERATOR	1	2	3	4	5	6	7	8	P1
LOCAL MODE	ON	ON	ON	ON	ON	ON	ON	--	

Operator local mode switching

Local mode refers to the source of data that goes through an operator. An operator with Local mode ON normally processes commands from the GZ-1000 keyboard, wheels, pedals and footswitches. If Local mode is OFF, all of these local controls are disabled and the operator then processes MIDI commands received at either or both of the two GZ-1000 MIDI inputs. Local mode may be enabled individually for each operator.

MIDI input routing modes

The GZ-1000 has two MIDI inputs. The MIDI commands and information that are received at these inputs may merged, routed and processed through selected operators and retransmitted over GZ-1000 outputs. This routing happens in three stages:

The first stage is the system level (P0), where each MIDI input has its own enable switch, input channel (basic channel), omni mode switch, program change options, and system exclusive switch. These are system parameters and are not a part of the global setup.

The second stage is the global setup level (P1), where operator Local mode, operator input assignment mode and input filtering determine the destination of received MIDI data.

The final stage is the operator level (P2), where channelization, and program change filtering are decided. MIDI data that makes it through all three of these stages can be transmitted through selected MIDI outputs.

```

09 SELECT MIDI INPUT 1 2 P
OPERATOR ASSIGNMENT MODE: P M P

```

MIDI input assignment mode

There are two input modes available for assigning MIDI to operators. Both MIDI inputs may be assigned to either mode. Mode "P" is similar to MIDI Poly mode, in that information received on all MIDI channels can go to all non-Local operators if omni mode (a system level parameter) is ON. If omni mode is OFF, MIDI data only on the basic input channel will go to all non-local operators.

Mode "M" is similar to MIDI Mono mode. Incoming MIDI on the basic input channel can only go to operator 1, MIDI on the basic channel + 1 only goes to operator 2, and so on. If the basic channel is greater than 8, channels will "wrap around" and start at 1 again after number 16. Mode "M" only works this way if omni mode is ON. If omni mode is OFF, only MIDI commands on the basic input channel will pass through and will go only through operator 1 and then only if operator 1 is not in Local mode.

```

10 MIDI INPUT 1 ENABLES: NOTES = ON P1
CTRLS = ON PRESSURE = ON FA-FC = OFF

```

```

11 MIDI INPUT 2 ENABLES: NOTES = ON P1
CTRLS = ON PRESSURE = ON FA-FC = ON

```

MIDI input filtering

Certain types of MIDI commands may be enabled or disabled at the global level in order to prevent them from passing through an operator. There are separate enable function displays for each of the two GZ-1000 MIDI inputs. The types of messages that can be enabled are: Notes (on and off), Controllers (including pitch bend), Pressure (poly and channel pressure), and the sequencer commands 'start', 'stop' and 'continue' (FA-FC). There are additional controls for filtering MIDI data at the system level and at the operator level.



Operator Sustain-Hold option

This is a special function that applies to global setups that use a footswitch or pedal assigned to *sustain* (MIDI controller number 64 - also called *damper pedal*) in any operator. When an operator is turned off by pressing its front panel switch, note-off commands are always transmitted for every note that is still on in that operator.

If the sustain-hold option is OFF, a MIDI sustain-off command is also transmitted, regardless of the current state of the switch that is assigned to controller 64. This is intended to shut o. any sustaining notes on synthesizer modules controlled by that operator.

Sometimes it is useful to let notes deliberately sustain when an operator is switched off. In this case, the sustain-hold option may be turned ON, thereby suppressing the transmission of sustain-off commands when an operator is turned off. To finally shut off any sustaining notes, the operator must be turned back on and the sustain switch released.



Global MIDI controller enable

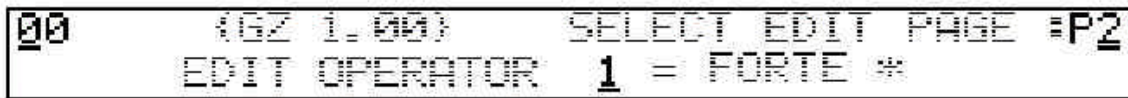
When this switch is OFF, all local MIDI controller outputs for all operators are disabled. This switch allows disabling controllers temporarily without reprogramming each operator.

Chapter 5 - Operator Parameters (Edit Page 2)

What is an operator?

A GZ-1000 MIDI operator is one of eight parallel data processing paths that takes keyboard actions and controller movements and translates them into MIDI commands that are transmitted over selected MIDI outputs. When an operator is OFF, this path is inactive and will not generate any output.

The inputs to an operator include the keyboard, wheels and pedal inputs, the footswitch inputs, and two MIDI inputs. The outputs are MIDI commands that are routed to any combination of the four MIDI transmitters. A GZ-1000 global setup has eight operators and all MIDI commands are merged correctly into the selected transmitters. In Performance mode, operators may be turned on and off at any time using the front panel switches.



Selecting an operator

There are two ways to select an operator to edit. One way is by selecting edit page 2 function 0, placing the display cursor on the operator number and changing its value. The simplest way, is to just press one of the operator switches on the front panel while in Edit mode (any page). This will select page 2 Edit mode for the selected operator at the function that was previously selected the last time page 2 was accessed.

Operator compare mode

When any number of operator parameters in the current global setup have been edited, all the original operator parameters may be recalled to the operator edit buffer by selecting compare mode. Compare mode will restore the entire operator to its original condition (before editing), and will transmit the original program change command if the program change value has been edited. An operator will switch between compare mode and edited mode when the front panel operator switch is pressed repeatedly. Compare mode is indicated by a flashing edit/compare LED. As an operator switch is pressed repeatedly in Performance mode, it will rotate between off, compare mode and edited mode.

Editing an operator in compare mode is not allowed, and the edit cursor will not move from the function number field if compare mode is on.

Compare mode can be used to revert to the unedited version of an operator. Just press the write switch while in operator edit compare mode and the compare version of the operator will be written back into the edit buffer.

```

01 OPERATOR 1 NAME      =  FORTE_*____ P2
   SYNTH PATCH SELECT  =  32          <NF>

```

Operator name

A ten-character operator name can be entered for each operator in a global setup. This name is included on certain function displays, and is also displayed momentarily when pressing and holding an operator switch in Performance mode. Operator names could be the name of a synthesizer, a synth patch name, or anything else that will fit in ten characters.

```

01 OPERATOR 1 NAME      =  FORTE_*____ P2
GET FROM SYNTH: Yamaha DX-7          32 <GO>

```

Name Finder

It is possible for the GZ-1000 to extract a patch name directly from certain types of synthesizers to use as an operator name. This is done by requesting a system exclusive MIDI patch dump and locating the patch name within the resulting received MIDI data. The GZ-1000 does this automatically on command by using a special "Name Finder" program. KTI can provide many different Name Finder programs that are loaded from a GZ-1000 disk. Once a Name Finder has been loaded, it will stay in memory until another Name Finder or a null file has been loaded.

On the operator program change/name function display, the symbol <NF> will appear on the bottom line of the LCD if a valid Name Finder is loaded. If there is a Name Finder in memory, when the cursor is moved between the program change parameter and the first character of the operator name, the lower display line will change, displaying the type of Name Finder that is in memory and a <GO> display. Entering a +1 or YES at this point will start the process by transmitting a system exclusive patch dump request and then waiting for a response from the synthesizer. In order to work properly, the synthesizer must have a MIDI cable from its MIDI output to one of the GZ-1000 MIDI inputs, which must be ON and must have System Exclusive enabled (Page 0 parameters). If everything is set up correctly, the GZ-1000 will receive the patch dump and then locate the patch name within the received data and copy this name to the selected operator name field. A Name Finder can only work with synthesizers that have named programs, of course.

Operator wake-up options

There are three types of MIDI messages that can be transmitted by an operator at the time the global setup wakes up. These are *program select*, *MIDI control message*, and *user wake-up message*. All three may be enabled or disabled independently and the order of their transmission can be changed by placing the user wake-up message either before or after the other two which are transmitted program select first.

```
01 OPERATOR 1 NAME = FORTE *--- P2  
SYNTH PATCH SELECT = 32 <NF>
```

Synthesizer patch select

Each operator may be programmed to transmit a MIDI program change (patch select) command during wake-up. Any program number from 0 to 127 may be selected. Program change can be disabled by selecting a value of -1 for the program number.

```
02 OPERATOR 1 MIDI CONTROL MESSAGE P2  
OFF
```

MIDI control message

One long user defined MIDI control message is provided for the purpose of transmitting commonly used controller messages to reset all controllers to their standard default values at operator wake-up. This MIDI message, which is defined at the system (P0) level, may be enabled or disabled for each operator in a global setup. If enabled, the message will be transmitted immediately after the operator synth patch select.

```
03 OPERATOR 1 USER WAKE-UP MESSAGE 01 P2  
SET VOLUME (X) = 127 (Y) = 00 (AFTER )
```

User defined wake-up messages

In addition to the MIDI control message, 32 short MIDI messages may be defined at the system (P0) level. Any one of these messages can be transmitted by each operator during wake-up, either before or after the synth patch select and MIDI control message. Up to two parameters may be inserted into a user MIDI message at the operator level. These parameters, which can range from 0 to 127, are labeled X and Y and correspond to the (X) and (Y) symbols displayed on the user MIDI message edit function (see Page 0 descriptions).


```
03 OPERATOR 1 USER WAKE-UP MESSAGE 01 P2  
TRANSMIT MESSAGE AFTER PATCH SELECT
```

After moving the cursor past the Y parameter field, the before/after status will be displayed on the bottom line and the transmission order of the MIDI messages can be selected.

Some useful examples of possible user wake-up messages are:

Volume controller change - by using an operator parameter to select a volume level in a volume controller MIDI message, the initial volume of a synthesizer may be set at wake-up. However, if there is also a pedal or wheel assigned to volume, its current position will override any wake-up volume message.

Bank select - some synthesizers or samplers have multiple banks of patches to select from. By transmitting a special system exclusive bank select message before the patch select, you can address more than 128 programs.

For more information on defining user MIDI messages, see chapter 6.

```
04 OPERATOR 1 FORTE * P2  
MIDI TRANSMIT CHANNEL = 01
```

MIDI transmit channel

Each GZ-1000 operator has its own MIDI transmit channel number. The transmit channel can be programmed to any number from 1 to 16 and becomes a part of all MIDI channel mode messages that are transmitted by the operator.

Notice that there is a distinction between the MIDI channel and the physically numbered MIDI output jacks on the GZ-1000. The MIDI channel number is part of the MIDI data itself, while the transmitters and output jacks of the GZ-1000 are the physical devices that route the data. It is entirely possible to transmit data on eight different MIDI channels through a single MIDI output jack.

05	OP 1	TRANSMITTER	A	B	C	D	P2
		ENABLES	ON	--	--	--	

Transmitter enables

You can select any combination of four MIDI transmitters (A, B, C and D) for each operator. There are sixteen possible combinations including all OFF (in case the operator is not being used). Many different operators may use the same transmitter at the same time. The transmitter outputs are routed to a globally selected combination of MIDI output jacks. It is important to remember that a single transmitter can't send different data out of its two MIDI jacks - it can put identical data through both jacks, or it can have one jack turned off, while data goes out the other, or both jacks can be turned off if they are not needed.

If the GZ-1000 is controlling two or more synthesizers through multiple operators it is a good practice to connect them to separate MIDI transmitters if possible. This is especially important if MIDI delays are a consideration. When a single output is used to control two or more synths on different MIDI channels, all simultaneous note-ons and note-offs must be transmitted serially, introducing a one millisecond delay for every note-on or note-off message. By using separate transmitters, delays between MIDI commands can be reduced to a few microseconds (about 100 times less delay).

06	OPERATOR 1	SET KEYBOARD LIMITS	P2
		LOW = 01	HIGH = 88

Keyboard limits

Each operator may be programmed to use only a part of the GZ-1000 keyboard. An operator will ignore any key pressed above the upper keyboard limit and below the lower keyboard limit. By setting the keyboard limits properly for each operator, the keyboard can be split or layered up to eight ways. The key limits are displayed as key numbers from 1 to 88. Key number 52 corresponds to middle C.

06	OPERATOR 1	SET KEYBOARD LIMITS	P2
	(PRESS 2 KEYS)	LOW = 01	HIGH = 88

To set the limits, move the cursor one space away from the function number on the keyboard limit function display. The next two keys that are pressed become the new lower and upper limits to the keyboard range.

The keyboard limits also apply to any incoming MIDI note-on and note-off commands in operators where Local mode is off.

```

07 OPERATOR 1 TRANSPOSE = P2
      ± 00

```

Operator transpose

The pitch of all notes in an operator may be transposed in pitch up or down in semi-tone steps as much as four octaves. The amount of transpose is shown as a decimal value from -48 to +48. The operator transpose value is added to the global transpose value to get the overall operator transpose.

```

08 OPERATOR 1 KEYBOARD PITCH = ON P2

```

Keyboard pitch enable

When keyboard pitch enable is ON, the keyboard plays notes normally. When keyboard pitch is OFF, all keys within the operator's programmed keyboard range will play the same note value: middle C, plus or minus the operator transpose value (not including global transpose). This feature can be used to mix a fixed pitch sound, from a sampler for example, with another sound in order to simulate an attack transient, or for triggering drum machine sounds with the keyboard.

Velocity scale & limits

Whenever a key on the GZ-1000 keyboard is pressed or released, an instantaneous velocity value which corresponds to how hard the key was struck or how fast it was released is generated by the keyboard electronics. This velocity value is a number between 1 and 127, and each operator may deal with this key velocity in a different way. Each active operator that recognizes the key will generate a MIDI note-on or note-off command containing a note number and a velocity value. Transmitting the velocity value generated by the hardware does not give a very good expressive response, however. A more natural feel results when the velocity response is mapped or scaled exponentially. The GZ-1000 has several different types of velocity scales available including three which may be user defined. Each operator may have a different scale assigned to modify the velocity coming from the keyboard. To select a normal velocity scale, choose a scale number from 0 to 7.

```

09 OP 1 VEL.SCALE = 00 NORM EXPO-1 P2
LO VEL LIMIT = 01 HI VEL LIMIT = 127

```

An operator may have its selected velocity scale *inverted*. This allows a note to play loudly when a key is pressed softly and vice versa. To select an inverted scale, choose a scale number from 8 to 15.

A typical use for inverted velocity scales is cross-fading sounds between two different synthesizers. By inverting the velocity scale of one of two operators covering the same keyboard range, controlling two different synthesizer sounds, you can cross-fade between the two sounds by playing harder or softer. (This is assuming that velocity is controlling loudness in both sounds).

In addition to selecting one of sixteen velocity scales (eight normal and eight inverted), upper and lower velocity limits may be set. Normally, the limits are set to 1 and 127, covering the complete velocity range. Setting these limits to any other values will modify the selected velocity scale, changing the maximum and minimum output values. For a fixed velocity value on all notes played, set both the upper and lower limits to the same desired value.

For more information on velocity scales, see chapter 6.

```
10 OP 1 VELOCITY WINDOW    LOW  HIGH  P2
PLAY NOTES W/VEL. BETWEEN 00   127
```

Velocity window

Another operator function concerning key velocity is the velocity window. This is a range of velocity that can be programmed where only those notes played between the window limits will be played. The velocity window only applies to key-on events. (The velocity window limits are tested against scaled velocity).

```
11 OPERATOR 1    AFTERTOUCH ENABLE    P2
CHAN PRESSURE = 0N    POLY PRESSURE = 0FF
```

Pressure enables

In addition to sensing the speed at which keys are pressed and released (velocity), the GZ-1000 can also sense the continuous pressure on the keys. This pressure is converted into a numerical value which can be used to control certain parameters on some synthesizers. When so enabled, the GZ-1000 will continuously transmit changes in pressure information over MIDI as long as any notes are on.

MIDI has two different methods of transmitting pressure (also known as aftertouch). The most common way is global aftertouch, or *channel pressure*. The GZ-1000 generates channel pressure by continuously scanning each 'on' key in the keyboard range of an operator and taking the highest measured pressure value as the channel pressure for that operator. The other method is known as *polyphonic pressure*. In this case each key transmits its own pressure value, which is linked to the key number. The GZ-1000 can transmit either or both types of pressure as selected on the pressure enable function display.

12	OP 1	PRS.SCALE = 04	NORM LINEAR	P2
LO	PRS LIMIT = 01	HI	PRS LIMIT = 127	

Pressure scale and limits

Like velocity, the pressure response also usually needs to be scaled in order to be musically useful. The same set of scales that are used for velocity are also available for scaling pressure. Pressure scales also have programmable upper and lower limits and may be inverted. Each operator may process pressure with a different scale, but if polyphonic and channel pressure are both used in one operator, the pressure scaling and limits are the same for both.

Controller assignment

Each operator allows assignment of the GZ-1000 wheel, pedal and footswitch controls to any MIDI controller number or to one of a few special GZ-1000 functions. This allows the possibility of, for example, one foot pedal changing eight different synthesizer parameters at the same time. The control direction or polarity of each control can also be programmed at the operator level. The two wheels, four foot pedals and three footswitches can be assigned through the eight operators generating as many as 72 different MIDI controller messages in one global setup. Typical uses for these controls are pitch bend, modulation, volume, sustain, etc.

The MIDI specification allows only controllers numbers 0 through 127. The GZ-1000 uses additional "controller assignments" 128 through 255 for assigning pedals, wheels and switches to other functions that are not standard MIDI *controller* messages (such as pitch bend or sequence start, which are separate types of MIDI messages).

Table 1 shows the controller assignments that are available.

Table 1 - Standard MIDI controller assignments

Note: Controllers 0 - 31 are MSB (most significant byte) control for listed assignments, 32 - 63 are LSB (least significant byte) control for the same assignments (add 32 to MSB controller to get LSB controller). Unlisted controllers in the range of 0 to 127 are not currently defined by the MIDI specification.

Controller	Standard <i>continuous</i> controller destination	MIDI hex data
1	Modulation depth	Bc 01 nn
2	Breath controller	Bc 02 nn
4	Foot controller	Bc 04 nn
5	Portamento time	Bc 05 nn
6	Data entry	Bc 06 nn
7	Main volume	Bc 07 nn
8	Balance	Bc 08 nn
10	Pan	Bc 0A nn
11	Expression	Bc 0B nn
16 – 19	General purpose 1 - 4	Bc 10-13 nn
80 – 83	General purpose 5 - 8	Bc 50-53 nn
91	External effects depth	Bc 5B nn
92	Tremolo depth	Bc 5C nn
93	Chorus depth	Bc 5D nn
94	Celeste depth	Bc 5E nn
95	Phaser depth	Bc 5F nn
98	Non-registered parameter MSB	Bc 62 nn
99	Non-registered parameter LSB	Bc 63 nn
100	Registered parameter MSB	Bc 64 nn
101	Registered parameter LSB	Bc 65 nn
Controller	Standard <i>switch</i> controller destination	
64	Damper pedal (sustain)	Bc 40 nn
65	Portamento	Bc 41 nn
66	Sostenuto	Bc 42 nn
67	Soft pedal	Bc 43 nn
69	Hold 2	Bc 45 nn
96	Data increment	Bc 60 nn
97	Data decrement	Bc 61 nn
121	Reset all controllers	Bc 79 00
122	Local control switch	Bc 7A nn
123	All notes off	Bc 7B 00
124	Omni mode off / all notes off	Bc 7C 00
125	Omni mode on / all notes off	Bc 7D 00
126	Mono mode on / all notes off	Bc 7E 00
127	Poly mode on / all notes off	Bc 7F 00
GZ control	Special GZ controller assignment	
128	Pitch bend -continuous	Ec nn nn
129	Sequence start -switch	FA
130	Sequence continue -switch	FB
131	Sequence stop -switch	FC
132	Set MIDI message parameter (X) -cont.	none
133	Set MIDI message parameter (Y) -cont.	none
200 – 231	MIDI message number 0 - 31 -switch	-user defined

13	OP 1	PEDAL	PED1	PED2	PED3	PED4	P2
		POLARITY	+	+	=	+	

Pedal polarity

The control direction or *polarity* of each pedal input may be programmed into each operator. Polarity in this case does not refer to the actual electrical polarity of the inputs, but to the way the inputs are treated in software. Pedals are normally assumed to increase their resistance (or voltage) as they are moved forward. In that case if "+" polarity is selected, the controller value will increase as the pedal is moved forward. Pedals for the GZ-1000 can be passive types, using a 50k ohm potentiometer, or a control voltage source with a 0 to +2.5 volt dc output range (the tip connector of the 1/4 inch input jack is positive and the sleeve connector is common).

The control direction of pedals may be programmed differently in each operator. This allows a single pedal controlling volume, for example, to cross-fade between two synthesizers, increasing the volume of one synthesizer as the pedal moves forward at the same time it lowers the volume of the other.

14	OPERATOR 1	PEDAL 1 ROUTING:	P2
	PED 1 = CTRL 07	= MAIN VOLUME	

15	OPERATOR 1	PEDAL 2 ROUTING:	P2
	PED 2 = CTRL 11	= EXPRESSION	

16	OPERATOR 1	PEDAL 3 ROUTING:	P2
	PED 3 = CTRL 04	= FOOT CONTROLLER	

17	OPERATOR 1	PEDAL 4 ROUTING:	P2
	PED 4 = CTRL 255	= - NOT ASSIGNED -	

Pedal routing

Continuous foot controls (pedals) may be routed to any of the 128 possible MIDI controller numbers, to MIDI pitch bend, or to (X) or (Y) MIDI message parameters. To select a standard MIDI controller number, just enter a controller number from 0 to 127. To select pitch bend, enter 128. To select a parameter (X or Y), enter 132 or 133. To de-select a foot pedal, so it will be inactive, enter a value of 255 (or 0 minus 1).

When any controller in any operator is assigned to control a parameter, the current value of both X and Y will be displayed on the lower right part of the LCD when Performance mode is active.

18	OP 1	WHEEL	WHEEL1	WHEEL2	P2
		POLARITY	+	+	

Wheel polarity

The control direction of the wheels at the left of the keyboard may be programmed in each operator, as with the pedal inputs.

19	OPERATOR 1	WHEEL 1 ROUTING:	P2
	WHL 1 = CTRL 01	= MODULATION DEPTH	

20	OPERATOR 1	WHEEL 2 ROUTING:	P2
	WHL 2 = CTRL 128	= PITCH BEND	

Wheel routing

Wheel routing options are identical to pedal routing options. The standard default value for wheel 1 is MIDI controller 1 (modulation) and the default for wheel 2 is GZ control number 128 (MIDI pitch bend). Wheel 2 is the wheel with the return-to-center action.

21	OP 1	FOOTSWITCH 1	2	3	P2
		POLARITY	+(OFF)	+(OFF)	+(OFF)

Footswitch polarity

Footswitch polarity is set at two different levels. The system level (P0 edit function 9) is used to set the basic switch response for normally-open or normally closed switches. Footswitch polarity is also programmed in each individual operator. The operator footswitch polarity function display shows the current status of each footswitch based on the selected system and operator switch polarities.


```
22 OPERATOR 1 FOOTSWITCH 1 ROUTING: P2
FSW 1 = CTRL 64 = DAMPER PEDAL
```

```
23 OPERATOR 1 FOOTSWITCH 2 ROUTING: P2
FSW 2 = CTRL 66 = SOSTENUTO
```

```
24 OPERATOR 1 FOOTSWITCH 3 ROUTING: P2
FSW 3 = CTRL 129 = SEQUENCE START
```

Footswitch routing

Footswitches can be assigned to most of the same controllers as the pedals and wheels. A switch OFF transition transmits a controller value of 0, and a switch ON transition produces a value of 127. Controllers 121 and 123 through 127 are transmitted only after switch-on transitions. GZ-1000 control numbers 129, 130 and 131 can be used to transmit MIDI sequence start, continue and stop commands, and GZ-1000 control numbers 200 through 231 correspond to GZ-1000 User defined MIDI messages 0 through 31. These additional switch messages are only transmitted at switch-on transitions.

If any continuous controllers are assigned to control X or Y parameters, any MIDI messages assigned to footswitches are transmitted with these parameters set to the current value for the controller as displayed on the LCD. Any X or Y parameter in a footswitch controlled MIDI message that has no corresponding pedal or wheel assigned to it will take on the value defined in the operator wake-up MIDI message function display.

```
25 OPERATOR 1 MIDI INPUT PROCESSING P2
CHANNELIZE = ON PROGRAM CHANGE = OFF
```

MIDI Input processing

Two options are available to handle MIDI inputs when an operator is not in Local mode. The *channelize* option allows MIDI messages passing through a non-local operator to keep their original channel number, or be "channelized" and take on the operator transmit channel. The channelize option has no effect on MIDI commands originating in *local* operators.

A program change enable option allows program changes to pass through an operator if program changes are enabled THRU at the system level. This program change enable is *not* related to the wake-up synth patch select.

Chapter 6 - System Functions (Edit Page 0)



```
00 (GZ 1.00) SELECT EDIT PAGE : P0
SELECT GLOBAL 00 = GRAND PIANO
```

Page 0 function 0

Page 0 function 0 is used to select the current global setup or to switch to a different edit page. Position the cursor on the page number (P0) in the upper right hand corner, and enter a value of 1 or 2 to go to another edit page. When the edit page is changed, control will go to the new page and the last function number previously used on that page.

Global select function

This function is used to change the current global setup. When the cursor is positioned on the global number in this display, any data entry will change the currently selected global setup. Going into Performance mode, the GZ-1000 will then wake up with the new setup.

If any edits have been made to the current setup without being saved (by pressing the write switch) and the global setup number is changed, the edited setup will be saved in the recall edit buffer before the new program wakes up. When this happens, any setup already in the recall edit buffer will be lost. To recover an edited setup that is saved in the recall edit buffer, use Page 0 function 7 (recall last edited global).

Momentary edit footswitch feature

When the cursor is on the global number select field of page 0 function 0 (or Page 1 function 0), the edit footswitch becomes a momentary action switch. On all other edit functions the edit footswitch operates in parallel with the edit switch on the front panel (pressing and releasing it once will turn Edit mode ON and pressing and releasing it a second time will turn Edit mode OFF). But in this special case, the GZ-1000 will go into Edit mode when the edit footswitch is depressed and go back to Performance mode immediately upon releasing the footswitch. This allows fast program changing using keyboard data entry while stepping on the edit footswitch.

```

01 TRANSMIT MASTER TUNE COMMAND ON    P0
   ALL ACTIVE MIDI OUTPUTS...         <GO>

```

Transmit MIDI Tune command

This function can be used to transmit the MIDI "tune" command (F6 hex) over all active GZ-1000 MIDI utility outputs. Place the cursor on <GO> and enter +1 or YES to transmit.

Synthesizers with analog oscillators tend to drift out of tune and will respond to this command by going through their auto-tune process to calibrate the oscillators.

```

02 Program Advance Library EDIT    P0
PAL 21 = GLOBAL 00 = GRAND PIANO

```

PAL Editing

The Program Advance Library (PAL) has 100 memory locations that can each hold the number of any one of the 100 global setups in GZ-1000 memory, or a special loop marker that controls PAL step operation. The PAL is used to set up a sequence of global setups for use in a performance situation.

Editing the PAL and setting the current PAL position can be accomplished using Page 0 function 2. The current PAL position is displayed at the lower left of the LCD along with the global setup number and name at that PAL location. Editing the PAL position will set the current PAL position that will be active the next time PAL is activated in Performance mode. Placing the cursor at the global number field will allow selecting the global at the current PAL position.

PAL looping

```

02 Program Advance Library EDIT    P0
PAL 26 = MARKER 100 LOOP BACK TO PAL 12

```

Entering a value of 100 or greater here will place a loop marker in the PAL, setting the end of a particular segment of the PAL. When a loop marker is displayed, the PAL position of the beginning of the loop is displayed at the lower right. The beginning of a loop is either PAL position 0 or the position just after the preceding loop marker in the PAL.

```

03 Program Advance Library INSERT P0
GLOBAL 00 AT PAL POSITION 20 <GO>

```

```

03 Program Advance Library DELETE P0
GLOBAL 00 AT PAL POSITION 21 <GO>

```

PAL Insert/Delete functions

Globals or loop markers may be inserted into or deleted from any given PAL position without disturbing the order of the rest of the list. On Page 0 function 3, moving the cursor one space to the right allows selection of the INSERT or DELETE mode by entering a value of +1 or zero.

In insert mode, the number of the program that is to be inserted is selected, and then the PAL position where the insertion is to be made is selected. When the selections have been made, move the cursor to <GO> and enter +1 or YES to perform the insertion. The <GO> display changes to <OK> after the insertion has been made. When a new global is inserted at a PAL position, the previous contents of that location and all following locations are moved up by 1 space too make room for the new entry. This means that the entry at PAL position 99 will be lost when an insertion is made.

Delete mode allows editing the contents of PAL locations as well as selecting the position to delete. The current global value is displayed at the left with the PAL location and the <GO> display at the right. When the position that is to be deleted has been selected, the cursor is moved to <GO> and +1 or YES is entered. All PAL entries following the selected position are then moved down by one (leaving the last entry at PAL 99 duplicated at PAL position 98).

```

04 COPY CURRENT GLOBAL (00) P0
TO GLOBAL 72 <GO>

```

Copying global setups

Any global setup may be copied to another global setup location. Page 0 function 4 allows selection of the current global and selection of a destination for the copy command. To copy, move the cursor to <GO> and enter +1 or YES. If the destination memory is protected, an error message will appear and the global setup will not be copied.

05	SWAP CURRENT GLOBAL (00) WITH GLOBAL 72	P0 <GO>
----	--	------------

Swapping global setups

The current global setup may be exchanged with another global setup location. Page 0 function 5 is used to select the current global and a secondary global for the swap command. To swap, move the cursor to <GO> and enter +1 or YES. If either of the globals are protected, an error message will appear and the setups will not be exchanged.

06	COPY OPERATOR 1 "FORTE *" TO GLOBAL 12 OPERATOR 3	P0 <GO>
----	--	------------

Copying a single operator

A single operator in the current global setup may be copied to another operator position in the same setup, or to any other unprotected setup in memory. The source and destination operators are selected using normal data entry or by pressing one of the operator switches on the front panel.

07	RECALL LAST EDITED GLOBAL (08) AND WRITE TO CURRENT GLOBAL 00	P0 <GO>
----	--	------------

Recall last edited global

This function is used to retrieve the last global setup that was edited without being saved. When a global setup has been edited in any way, it is automatically written into a recall edit buffer if the current global is changed before the edited global has been written into permanent memory. To write the contents of this recall edit buffer to the current global location, move the cursor to <GO> and enter +1 or YES. This will erase the global setup at the current location, replacing it with the contents of the recall edit buffer.

This feature can be useful for creating a new global setup by editing an existing global without changing the original. This is done in the following manner: Select the global to be edited and make the desired edits. Don't press the write switch yet! Select an unused location to store the new (edited) global. Change the current global to this new location (the edited version is automatically stored in the recall edit buffer). Use the "recall last edited global" function to write the program in the recall edit buffer into the new location.

08	SET FRONT PANEL SWITCH SENSITIVITY = 25	P0
----	--	----

Front Panel Switch Sensitivity

The response of the pressure sensitive front panel switches may be set according to user preference. The range of sensitivity is from 0 to 99 with low numbers being the most sensitive. The value entered becomes effective immediately.

Note: Due to variations in batches of the pressure sensitive material used in the switches, in some units the lower sensitivity levels will be so sensitive that switches may start triggering without even being pressed, causing the keyboard to go crazy. If this happens and the switch sensitivity cannot be reset to a less sensitive value, switch the unit off and back on again. If the value still cannot be edited, the power-up reset sequence will have to be used (hold the edit switch while turning the power on). This will set the sensitivity value to 25 as well as resetting global number 0 and all system parameters to default values.



09 SWITCH: FSW 1 FSW 2 FSW 3 EDIT P0
POLARITY: +(OFF) +(OFF) +(OFF) +(OFF)

Footswitch Polarity

The polarity of the four footswitch inputs (including the edit footswitch) may be programmed at the system level for normally open or normally closed switch types. Footswitches used for the GZ-1000 should be of the momentary contact type. Normally open switches should be programmed for (+) polarity and normally closed switches should be (-). Footswitches 1 - 3 can additionally be programmed for polarity at the operator level. The following chart shows the resulting behavior of different combinations of system and operator polarities.

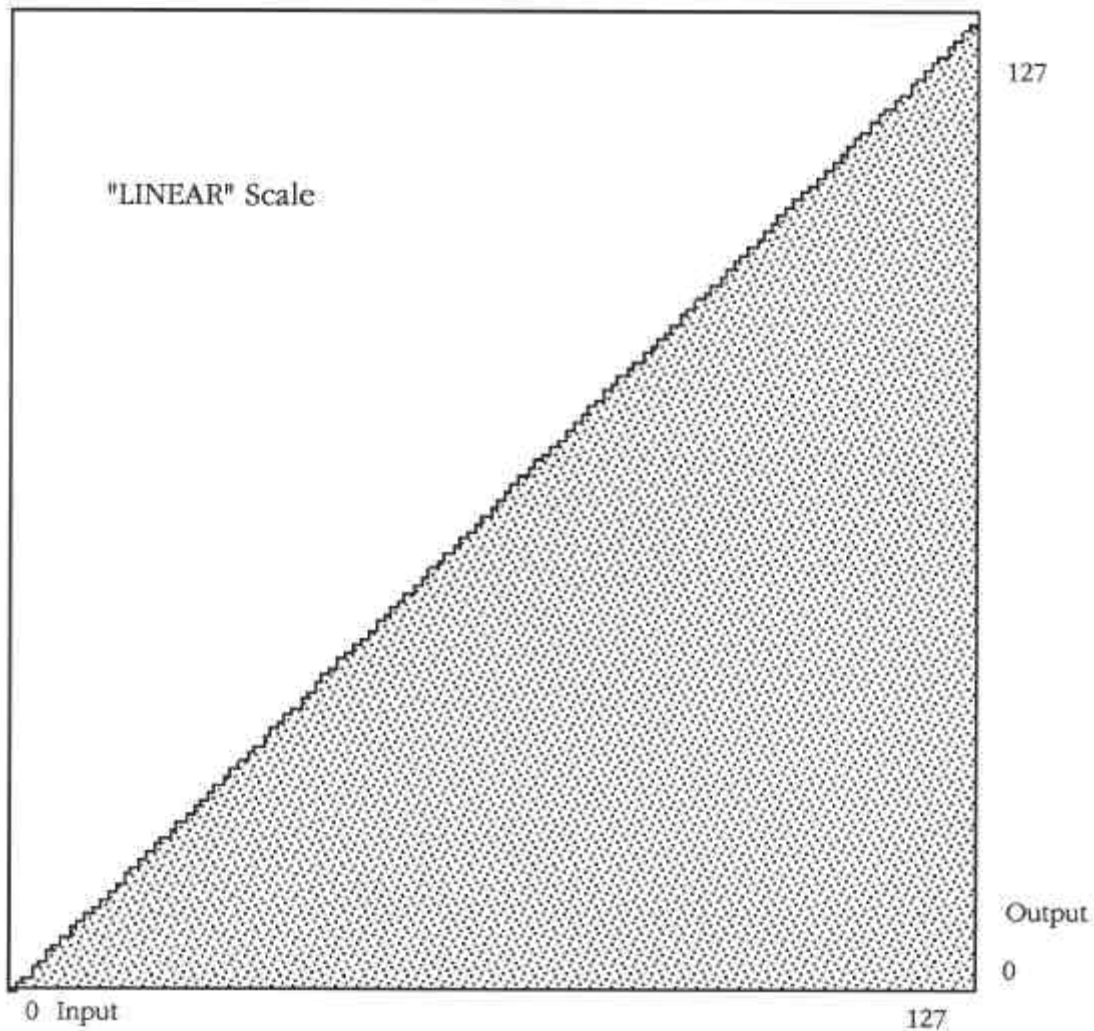
System Polarity	Operator polarity	Switch Closed:	Switch Open:
+	+	ON	OFF
+	-	OFF	ON
-	+	OFF	ON
-	-	ON	OFF

User defined Pressure/Velocity scales

The GZ-1000 has five different pre-defined velocity/pressure scale curves. There are also three scales which may be customized by the user. Page 0 function 10 is used to edit these three custom scales.

But, first a little background on scales. A scale is a "mapping" function with an input range of 0 to 127 (velocity or pressure generated by the GZ-1000 hardware) and 128 possible output values (from 0 to 127). A simple example is the linear scale where the output of the function exactly equals the input (OUT = IN).

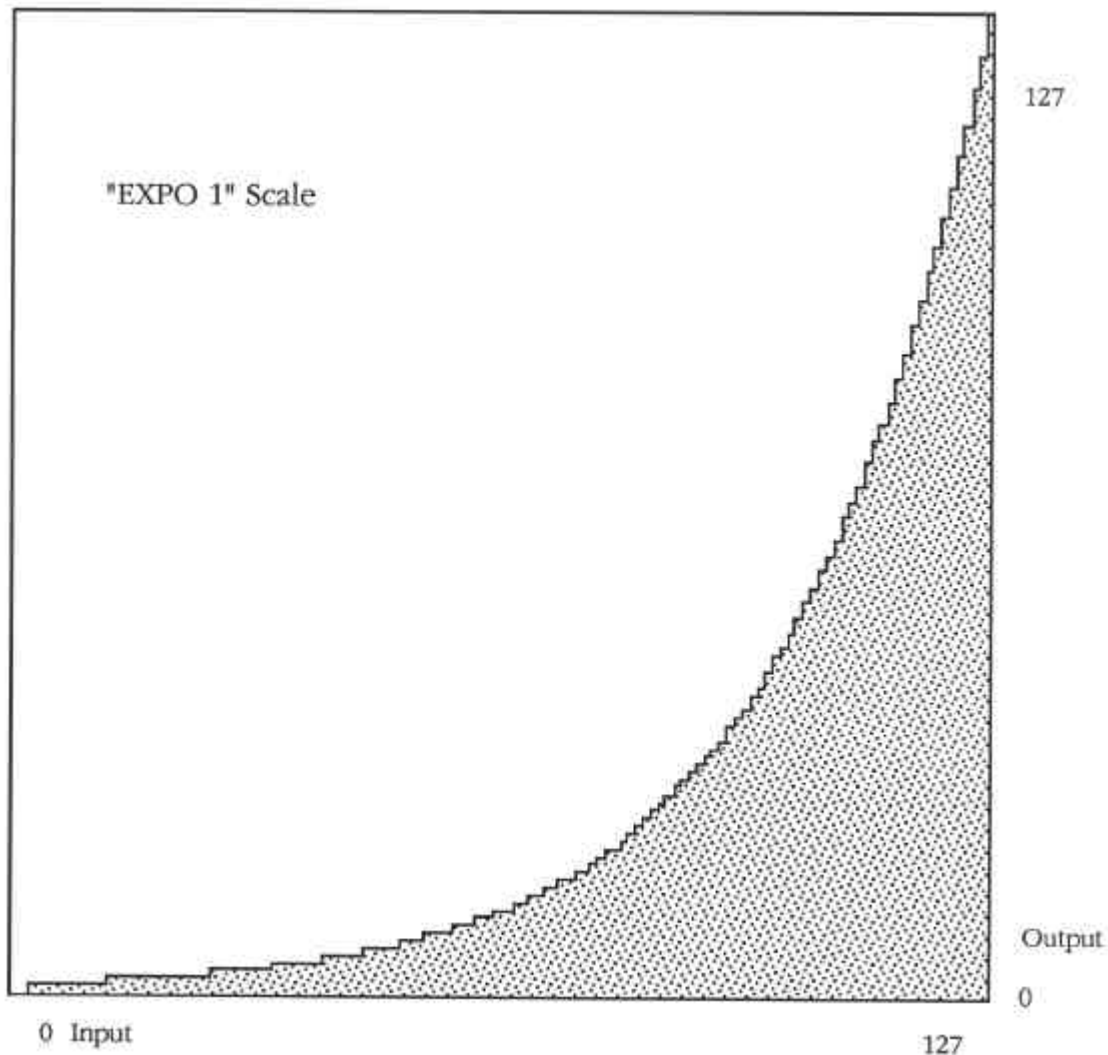
One of the GZ-1000's built-in scales (EXPO 1) is an exponential scale which follows the formula $OUT = e^{(IN/26.2)}$. This type of scale, when used for shaping velocity, gives a more useable response than a linear scale due to the non-linear nature of the interaction of fingers and keys.



Scales used for shaping the pressure response of the GZ-1000 typically will have a large "dead area" in the lower end of the scale (see "LO LEVEL" scale) where the pressure stays at zero level until the key is pressed harder than normal, when the pressure then rises steeply to maximum value at maximum key pressure.

Some synthesizers use internal pressure scaling and don't need any additional shaping. In this case the linear scale can be used for the pressure scale.

Custom user designed scales can be minor variations on these types of scales, or can be wildly different. The only limitation on user defined scales is that the output value for zero input should also be zero, and the minimum and maximum output values are 0 and 127.



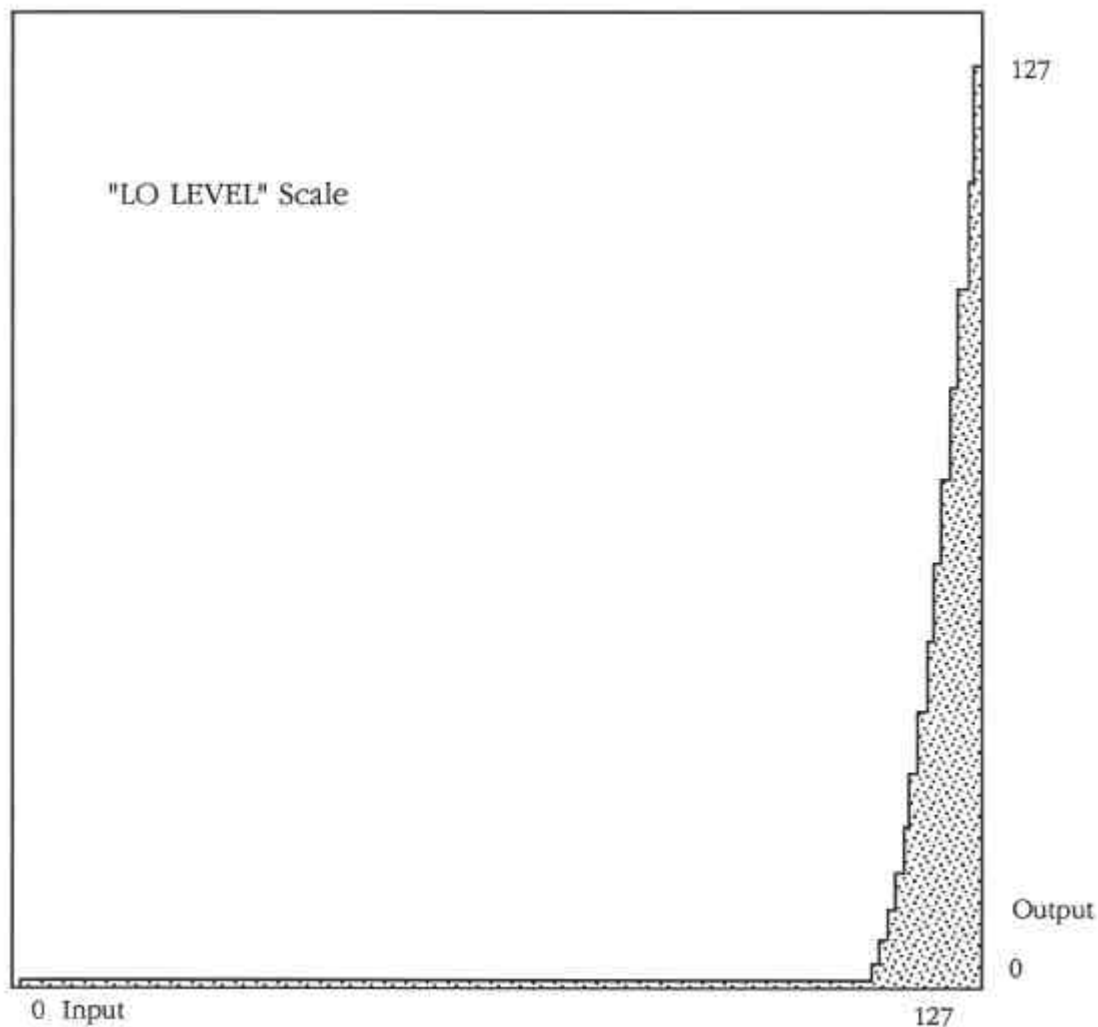
```

10 EDIT CUSTOM SCALE 2 = [SHALLOW1] P0
00 00 00 00 00 10 31 127 <GO>

```

Editing scales from the front panel is fairly simple. One of the three user defined scales is selected by placing the cursor on the scale selection number which may be 1, 2 or 3. The next ten cursor positions are used for editing the name of the selected scale.

Eight numbers are displayed on the lower line of the LCD representing scale output values at eight evenly spaced points in the range of 128 possible input values. The scale output values displayed correspond to the inputs: 15, 31, 47, 63, 79, 95, 111, and 127 (from left to right). The values for these eight points may be edited by placing the cursor on the appropriate field and entering the new value. When the cursor is moved to <GO>, and +1 or YES is entered, the process is completed by interpolating all data points between those displayed in straight lines between the nine selected points (including the zero point, which is not displayed).



If <GO> is not executed, the intermediate scale values will not be changed from their previous values, which may be unknown.

For more precise editing of scales, a computer may be used to generate a scale graphically or mathematically and then dump the scale into the GZ-1000 via a MIDI system exclusive message. (See the appendix for GZ-1000 MIDI system exclusive data formats).

One note about scales used to contour velocity: A MIDI note-on command with a velocity value of zero is a special case which synthesizers treat as a note-off command. For this reason, the GZ-1000 will automatically replace any scale output value of zero with a 1 when the scale is used for velocity.



11 USER MIDI MESSAGE 03 [SET_VOLUME] P0
(→) Bc 07 (X) _

User Defined MIDI Messages

There are 32 user definable MIDI messages that can be created at the system level. These messages are used by global setups for transmission at wake-up time, or as footswitch commands. Each message has a ten character name, and can have up to 14 MIDI data bytes and flag bytes.

Warning: Properly defining MIDI messages requires a thorough understanding of the MIDI specification and hexadecimal (hex) notation. Hexadecimal notation is used in displaying MIDI messages on the GZ-1000 because most MIDI documentation uses hex or binary notation, and it makes identification of MIDI channels within status bytes as simple as looking at the least significant digit. Hex to decimal conversion tables and a brief description of the MIDI specification are included in the appendix of this manual.

The GZ-1000 doesn't allow transmission of certain MIDI bytes which are reserved for use as special flags. These special bytes are FF (MIDI System Reset), FE (MIDI Active Sensing), and FD. All other bytes are OK to use. The only other restriction on MIDI messages is that the first byte of a message must be a status byte (80H or greater). The three special flag bytes are used as follows.

FF is entered when a parameter is to be inserted in the message at the operator level. An entry of FF is displayed as (X) or (Y). If there is more than one parameter flag in a user defined MIDI message, the (X) and (Y) parameter markers will alternate.

The first occurrence of FF is always an (X). When the message is transmitted by an operator, the FF(s) are replaced by values defined within that operator.

The FE marker is used to indicate the end of a message. This is not the same as a MIDI system exclusive EOX byte (F7). Entering an FE will blank the edit display to the right of the last byte in the message and the cursor will go no further to the right. An end of message marker is not required if the MIDI message uses all 14 available bytes.

The FD byte is used to channelize the *following* byte (to insert the MIDI transmit channel of the operator that uses the message). Entering FD will place an arrow on the display pointing to the right (->). The next byte in the message will then be displayed with a lower case "c" in the least significant digit position. This indicates that the low order four bits of this byte will be ignored and replaced with (operator channel -1).

To edit one of the 32 user defined MIDI messages, select the message number by placing the display cursor one space to the right of the function number on Page 0 function 11. After the message number the cursor will go through the ten characters in the message name. The actual message is displayed on the lower line of the LCD. Only ten bytes are displayed, but as the cursor reaches the right side of the display, the message display will scroll to the left, revealing the rest of the message as scrolling continues. The MIDI message bytes are always displayed in hexadecimal, but must be edited in decimal using the keyboard or the mod wheel to select the approximate range for the desired value, and using the +1 and -1 keys to set the value precisely.

Here are a few examples of MIDI messages that can be defined in the GZ-1000:

Controller changes:

(->) Bc 07 7F	Set volume to 7F (maximum volume) - channelized to operator MIDI transmit channel.
B3 07 7F	Set volume to 7F on MIDI channel 4.
(->) Bc 07 (X)	Set volume on operator MIDI channel to a level to be determined by the operator parameter.
(->) Ec 00 40	Set pitch bend to center on operator MIDI channel.
B0 07 (X) 01 (Y)	MIDI channel 1; set main volume to value to be set by . rst operator parameter, set modulation to value set by second parameter. (Note use of running status to conserve status bytes.)
C0 01 C6 14	Send program change 1 on MIDI Channel 1, send program change 14 on MIDI channel 7.

```

12 MIDI CONTROL MESSAGE [STD. RESET] PG
(+) Bc 79 00 07 7F (+) Ec 00 40

```

User defined MIDI control message

A single message used to reset commonly used MIDI controllers to default values may be defined. This is the message that is transmitted when the MIDI CONTROL MESSAGE option (Page 2 function 2) is ON. The format of the message follows the same rules described for the 32 user defined MIDI messages described above, with the exception that this message can be up to 90 bytes long. A typical MIDI control message used to reset controller positions might look something like this:

(->) Bc 01 00 07 7F (->) Ec 00 40

This message sets modulation (controller 1) to zero, sets volume (07) to 7F (using running status), and sets pitch bend to center. Only one message is required for any number of MIDI channels if the channelize option is used to insert the operator MIDI channel into all channel status bytes. Parameters should not be included in the MIDI control message, as they will always be set to zero upon transmission of the message.

```

13 MIDI REQUEST MESSAGE [M12_SINGLE] PG
E0 10 02 00 00 (X) E7 _

```

MIDI to Disk Request message

A system exclusive Data Request (DRQ) message may be transmitted when using the "MIDI to Disk" function (Page 0 function 23). This is a MIDI message similar to the user defined MIDI messages just described. The DRQ message may be up to 100 bytes long. One other difference between the DRQ message and other GZ-1000 MIDI messages is in the handling of channelize and parameter bytes. Since there is no operator and thus no MIDI transmit channel associated with "MIDI to Disk", when a channelization byte is encountered in a DRQ message, the lower four bits of the parameter defined on the MIDI-to-Disk edit page is substituted for any channelization data field. The same parameter is substituted for any (X) parameters in the DRQ message. (Y) parameters in a DRQ message are replaced by a value of zero.

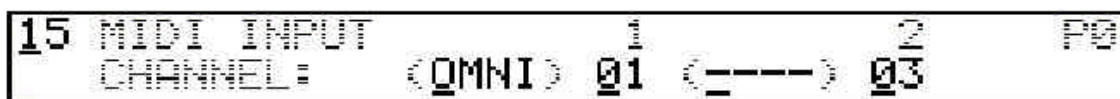


MIDI Transfer of global setups

Global setups may be transferred over MIDI to another GZ-1000 or to a computer. These system exclusive transfers or data dumps are initiated from the GZ-1000 front panel, or by means of a dump request message generated by the computer that will receive the data. See the appendix for a complete list of the different types of system exclusive data dumps that the GZ-1000 supports. From the page 0 function 14 display, the user may select any single individual global setup, or ALL. Selecting ALL will transfer all 100 global setups, the PAL, 32 user MIDI messages, three user scales, and the MIDI control message. All other types of data dumps may only be initiated by receipt of a GZ-1000 system exclusive dump request message.

GZ-1000 MIDI Inputs

The GZ-1000 has two MIDI inputs (input 1 and input 2) that may be used in a variety of different ways. They may be used to accept GZ-1000 system exclusive data and program changes or for recording incoming MIDI data directly to disk. They may also be used in Performance mode to accept (and merge) MIDI commands from an external MIDI controller or sequencer. Such MIDI commands can then be processed by the operators in the current global setup and retransmitted through the GZ-1000 MIDI outputs.



MIDI Input channels and omni mode

The basic MIDI channel and omni mode for each input may be selected on Page 0 function 15. When an input is in omni mode (or "omni on" mode) it will accept MIDI commands on all sixteen MIDI channels. When omni mode is OFF, the input will only accept channel messages on the GZ-1000 basic MIDI channel.



MIDI input enables

An overriding MIDI input enable is located on edit Page 0 function 16 for each input. If this option is ON, the specified input will operate normally. If it is OFF, the input will ignore ALL incoming data.

17	MIDI INPUT	1	2	PG
PROGRAM CHANGES:		OFF	THRU	

MIDI input program change handling

On the system level, incoming MIDI program (patch) select messages can be handled in one of three ways for each of the two inputs. They can be ignored entirely (OFF), they can be used to change the current GZ-1000 global setup (ON), or they can be passed on to any operators that are not in local mode (THRU). The operator program change enable option on Page 2 function 25 applies in the latter case. In any given non-local operator if the program change enable is ON, patch changes coming from a GZ-1000 MIDI input in THRU mode will be retransmitted through that operator.

18	MIDI INPUT	1	2	PG
SYSTEM EXCLUSIVE:		ON	OFF	

MIDI input system exclusive enable

Only one of the two MIDI inputs may have system exclusive enabled at any one time. An input that has system exclusive enabled must also have its MIDI input enabled on Page 0 function 16 in order to receive data. System exclusive must be enabled in order to properly use the Name Finder and MIDI-to-Disk functions, and to receive GZ-1000 system exclusive data transfers. If neither input is to be used for receiving system exclusive data, both may be turned off.

19	UTILITY	A1	A2	B1	B2	C1	C2	D1	D2	PG
MIDI OUTS:		ON	ON	ON	ON	ON	ON	ON	ON	

MIDI utility output enables

Edit mode functions that send MIDI data use all four MIDI transmitters. Individual outputs may be selected for these utility functions by enabling only those outputs needed.

Disk Functions

The GZ-1000 has the capability of storing several different types of data on 3.5 inch double-sided microfloppy disks (Maxell MF2-DD, Sony MFD-2DD or equivalent). Each disk is formatted by the GZ-1000 to hold up to 640K bytes of data. Standard disks are used but the GZ-1000 has its own special disk format which is not compatible with disks formatted on other computers.

The disk drive is located on the right side panel of the GZ-1000. A 25 pin connector for an optional GZ-D external disk drive is located on the rear panel. Insert disks into the drive with the label side up, metal shutter end first.

Cautions

Floppy disks are very delicate devices. Even though they are protected by a sliding metal shutter, they can be damaged by exposure to dust, liquid, heat and magnetic fields. Always treat disks with care and avoid these hazards. Before shutting off power to the GZ-1000, disks should be ejected from the disk drive mechanism by pressing the button on the face of the drive. An indicator light on the face of the drive shows that the disk is in use. Always wait for this light to go out before turning the power off or ejecting the disk.

Protecting Disk Data

Data on a disk may be protected from accidental erasure or modification by sliding the write-protect tab into the protect position (the little window is open in the protect position). Write-protect must be disabled in order to save files on the disk.

Disk Files

When the GZ-1000 saves some data on a disk, it puts it in an area on the disk called a file. There are several types of files for the different kinds of data that can be saved by the GZ-1000. Every file on a disk has a file name of up to sixteen characters. All files of the same type on any particular disk must have unique file names. Files on the same disk may have identical names only if they are different file types.

```

20 SELECT PRIMARY DISK DRIVE : A          P0
<GET DISK INFO>                          <GO>

```

Selecting Primary Disk Drive

The GZ-1000 may use one or two disk drives for saving and loading data. The basic GZ-1000 comes with one internal disk drive (Drive A). An optional external disk drive (Drive B) may also be used. One of these drives must be selected as the primary disk drive. If there are two disk drives, the other one becomes the secondary drive.

If you only have the internal disk drive, drive A should always be selected. With two disk drives, you can switch between them to have more data available without ejecting disks, and you can also copy files from the primary drive to the secondary drive.

```

20 SELECT PRIMARY DISK DRIVE : A          P0
09 FILES ON DISK: 76 % OF SPACE USED

```

Edit page 0 function 20 is where the primary disk drive is selected. This function display also has a utility called GET DISK INFO. Move the cursor to <GO> and enter +1 or YES. The GZ-1000 will then scan the disk in the selected drive and display the number of files on the disk and the amount of unused disk space available.

```

21 SAVE SYSTEM (ALL GLOBALS & PAL)       P0
TO DISK FILE: [CONCERT_SETUPS-A]        <GO>

```

Save All (System Save)

The *save all* function will save the current GZ-1000 system settings to disk including all 100 global setups as well as the PAL, all user defined MIDI messages, all user velocity scales, and the user defined MIDI control message. Moving the cursor one position away from the function field will select the <GO> cursor field. Moving it further will select the characters in the disk file name, which may be edited before saving the file. Once a file name has been selected, move the cursor back to <GO> and enter +1 or YES. The GZ-1000 will then allocate space on the disk and then save the file. When finished, a message indicating the result will be displayed. Press any data entry or cursor key to return to the normal edit display.

When allocating space for a new disk file, if the GZ-1000 finds a file of the same type and name as the new file on the disk, a warning message will be displayed. Entering +1 or YES at this point will erase the existing disk file before attempting to save the new file. To halt the process and leave the existing file intact, enter (negative 1) or NO. The cursor will then automatically advance to the first character of the file name so that it may be changed before saving the file.

Random file name selection

Since it is somewhat time consuming to enter disk file names, a special function has been included for all functions in which a disk file name can be edited. By entering a space character (0) for the first character in a file name, a semi-random file name will automatically be generated in the form "NO NAME XX123" where "XX" is a random sequence of alphabet characters and "123" is a two or three digit random number. Since a space in the first character position will erase any existing file name in the display and replace it with a random one, normal file names cannot have a space as the first name character. All other combinations of alphanumeric characters are legal.

Note: When entering a file name for saving a Name Finder or data request message, a " * " (10) entered in the first character position will automatically replace the file name that is displayed with the name of the Name Finder or the name of the DRQ message.

```
22 SAVE: ?                                PG
TO DISK FILE: [NO NAME AB123] 1          <GO>
```

```
22 SAVE: CUSTOM SCALES:                   PG
TO DISK FILE: [NO NAME AB123] 1          <GO>
```

```
22 SAVE: MIDI MESSAGES:                   PG
TO DISK FILE: [NO NAME AB123] 1          <GO>
```

```
22 SAVE: MIDI CTRL MSG: STD. RESET        PG
TO DISK FILE: [STD. RESET #5] 1          <GO>
```

```
22 SAVE: DATA REQUEST : M12 SINGLE       PG
TO DISK FILE: [M12 SYSEX. REQ.] 1        <GO>
```

Save miscellaneous files

Certain types of system data may be saved in separate disk files. The types of files supported are: Name Finder, user scales, user MIDI messages, MIDI control message, and data request message. The first cursor position after the function number is used to select the file type that will be saved. Use the mod wheel or incremental data entry to scan the available file types. The next cursor position is <GO>, followed by the file name data entry fields.


```
23 RECORD INCOMING MIDI DATA          P0  
TO DISK FILE=IM12_PATCHES_____1    <GO>
```

```
RECORD MIDI TO DISK: DATA LENGTH = 65 K  
DATA REQUEST MESSAGE=IM12 SINGLE1    <GO>
```

```
RECORD MIDI TO DISK: DATA LENGTH = 65 K  
PARAMETER (X) = 04                    <GO>
```

Record Incoming MIDI to Disk (MIDI-to-Disk)

A special feature of the GZ-1000 is the ability to record MIDI data directly from one of the two GZ-1000 MIDI inputs directly to a disk file. This is especially useful for saving synthesizer patches (voices, programs, sounds, etc.) to go with a particular GZ-1000 global setup. Any synthesizer that can dump and receive patches via a system exclusive MIDI message can save its patches on a GZ-1000 disk, and they can be transferred back to the synthesizer later.

In general there are two ways to get a synthesizer to transmit a patch over MIDI. The first way is by pressing the proper button or sequence of buttons on the synthesizer's front panel. The second way is with a specific MIDI system exclusive data request (DRQ) message transmitted from the GZ-1000 to the synthesizer. Many synthesizer manufacturers will print their system exclusive dump request format in the synthesizer owner's manual. If this is the case, you can use this information to create a DRQ message (see Page 0 function 13) so you can initiate a patch dump from the GZ-1000.

To start the MIDI-to-Disk process, you must first do the following things:

1. Check the MIDI cable connections and make sure the correct MIDI input is enabled, and check the utility MIDI output enables if you are using a DRQ message.
2. Enter the name of the disk file that will receive the data.
3. Enter the amount of data to be received. If there is enough empty space on the disk, just enter the maximum size of 255K if you don't know how many bytes the patch dump will contain. The file size is automatically corrected to the actual number of bytes received after the dump is complete.
4. Enter a parameter for DRQ message if required. Sometimes a single patch number may be inserted into the DRQ message.
5. GO!

The GZ-1000 will start by scanning the disk directory and allocating space for the amount of data you indicated. If there is room on the disk, it will then transmit the DRQ message (if one exists) and display "WAITING FOR MIDI DATA". At this point you can press the buttons required to start a patch dump on the synthesizer if not using a DRQ message.

The lower part of the LCD will display an arrow scanning quickly from left to right. You should see the arrow slow down or jump around randomly as MIDI data starts to come in. When the synthesizer is finished sending data, press the EDIT button (on the GZ-1000) to terminate the operation. If the operation was successful, the disk directory will be updated and a status message will be displayed including a hexadecimal number showing the exact number of bytes received.

If no data was received, or if the amount of MIDI data exceeded the allocated space, an error message will be displayed and the operation will be cancelled without saving the file. If MIDI data stops coming in and you do not press the EDIT button, the operation will end automatically after 30 seconds. The long time limit allows the possibility of dumping several different patches if the synthesizer front panel controls are used for initiating patch dumps.

```
24 LOAD FROM DISK: FILE ? : P0  
                                <GO>
```

```
24 LOAD FROM DISK: FILE 02 : ALL P0  
CONCERT SETUPS-A: GZ SYSTEM <GO>
```

```
24 LOAD FROM DISK: FILE 02 : 00 TO 09 P0  
CONCERT SETUPS-A: GZ SYSTEM <GO>
```

Load file

Page 0 function 24 is used for loading all types of disk files. When the cursor is moved from the function field, the primary disk drive is scanned and the first 64 entries in the directory are loaded into memory. Each file in the directory is assigned a file number based on its position on the disk. The cursor will be on this file number on the top line of the display. A particular file is chosen using data entry to change the file number. The file name and .le type that go with the selected file number will be displayed on the bottom display line. To load the entire selected file, move the cursor to <GO> and enter +1 or YES.

Some file types (GZ SYSTEM, MIDI MESSAGES, USER SCALES) may be loaded entirely or in sections. The following table lists the possible options:

File type	Load options
SYSTEM	ALL (entire file) Any global in file to any un-protected global location PAL All user scales All user MIDI messages MIDI control message
MIDI MESSAGES	ALL Any message in file to any message location
USER SCALES	ALL Any scale in file to any user scale location

Move the cursor beyond <GO> and use data entry to select the source and destination locations for the data. For example, when loading from a MIDI message file, selecting '03 TO 12' on the top line of the display will load MIDI message number 3 from disk and place it in memory at MIDI message location 12. User scales and global setups may similarly be individually loaded into different destinations from their original source locations.

When loading a MIDI file (a file that was created using the MIDI to Disk function), the MIDI data will be transmitted over all active MIDI utility outputs as it is read from the disk. A delay of 20 milliseconds is automatically inserted after each MIDI EOX (F7) byte in the file. This is required by some synthesizers to allow time to store individual patches properly without losing any MIDI data.

```

25 ERASE FILE FROM DISK: ?                                PG
                                                         <GO>

```

```

25 ERASE FILE FROM DISK: 02                                PG
CONCERT SETUPS-A: GZ SYSTEM                               <GO>

```

Erase file from disk

Files may be erased from a disk to make room for other data. On page 0 function 25, the file numbers, names and file types are displayed in the same manner as the disk load function display. After selecting the file to erase, move the cursor to <GO> and enter +1 or YES. The file will then be erased from the disk.

When a file is erased, it is also erased from the disk directory, and that directory location becomes free for use the next time a file is saved. When a file is saved, it always uses the first available directory location. For this reason, the order of files on a disk is not always the order in which they were saved.

```

26 COPY FILE TO DRIVE  = ? :                               PG
                                                         <GO>

```

```

26 COPY FILE TO DRIVE B: 02 :                               PG
CONCERT SETUPS-A: GZ SYSTEM                               <GO>

```

Copy File

When two disk drives are available, a disk file may be copied from one drive to the other. Select the file name on the primary disk drive to be copied to the secondary disk drive, move the cursor to <GO> and enter +1 or YES. The two disk drives will alternately go on and off, switching back and forth as blocks of data are copied. Do not eject either disk while a copy operation is in progress. To cancel a copy command, press the EDIT switch on the front panel until the CANCEL message appears on the display. Transfer time is approximately 1K bytes of data every 2 seconds.

```
27 FORMAT DISK - WILL ERASE DISK (A0) P8
ENTER VERIFICATION CODE R : ? <GO>
```

Formatting disks

Before a blank disk can be used by the GZ-1000, it must be formatted. Formatting creates empty spaces on the disk and sets up a directory that tells the disk controller where to put files. Formatting a disk takes about 1 minute and 40 seconds. During the formatting process, blank sectors are written onto the disk and then read back. If an error occurs while trying to read a sector, it is marked bad and the formatting process will continue. At the end of the formatting process, if any errors have occurred, a message will appear, showing the number of bad sectors. In an emergency, it may be OK to use a disk with bad sectors, but if there are more than a few faulty sectors, the disk should be discarded. If a bad sector is found in the area of the disk used for the directory, an error message will be displayed and formatting will stop immediately.

Warning! - Formatting a disk with data on it will erase the entire disk!

The verification code is a way to prevent accidental erasure of disks. Just move the cursor to the verification field and enter an "R" (50). The cursor can then advance to the <GO> field and the disk can be formatted.

```
28 KEYBOARD LOCK = OFF P8
```

Keyboard lock

A special feature of the GZ-1000 is the ability to "lock" the keyboard to prevent unauthorized use. When the keyboard lock is turned ON (Page 0 function 28), the unit will continue to operate normally until the power is turned off. Then the next time the power is switched on, the GZ-1000 will not go into Performance mode until the correct six digit code word is entered using standard data entry methods. After the last correct code letter is entered, the cursor is moved one more time to unlock the keyboard. Lock mode is then automatically turned OFF when the GZ-1000 goes into Performance mode.

Warning! - Do not turn the keyboard lock ON unless you know the secret code that will unlock it again!

```

28  KEYBOARD LOCK = OFF  P0
ENTER CODE:  [SECRET]  51 = "S"

```

If you don't know or aren't sure what the secret code word is, DO NOT TURN LOCK MODE ON! Instead, go to Page 0 function 28 and move the cursor past the ON/OFF select field. A data entry field will appear. Enter the secret code here, using the normal methods of alphanumeric data entry.

```

SELECT SECRET ACCESS CODE - REMEMBER IT
ENTER CODE:  [SECRET]  51 = "S"

```

If you have entered the code correctly, a special edit page will appear that will allow you to change the secret code word. To change the code, enter the new code word in the space indicated. Code words can be shorter than six characters, to make them easier to remember. Just fill any unused spaces with the asterisk character "*" (character code 10). Any asterisks in the code will match any character that is entered for that character position. When the new code word has been selected, write it down someplace safe and then press the write switch. A reminder message will appear. Press the write switch a second time to return to normal Edit mode.

If you don't plan to use the lock feature and want to be safe in case lock mode is turned on accidentally, just set the code to "*****". Then if the GZ-1000 powers up in lock mode, any cursor movement will immediately unlock it.

Each GZ-1000 is shipped from the factory with the code word set to "SECRET". The code will also reset to "SECRET" if the GZ-1000 internal memory is corrupted or if the backup battery fails. Removing memory chip U124 (inside the GZ-1000) momentarily will also cause the code to reset, although this should only be attempted by an authorized service center technician.



Test mode

Several test functions are included to aid service centers in calibration and testing the GZ-1000. To enter test mode, move the cursor to <GO> and enter +1 or YES. Different tests are selected by pressing the appropriate operator switch.

Test 1: Keyboard test. Displays note number, note-on velocity and note-off velocity of the last key event. If operator 1 of the current global has channel pressure enabled, peak pressure will be displayed along with a bar graph of the current pressure value.

Test 2: Pedal and wheel calibration. Each pedal input's current value is displayed (0 to 127) as are the two wheels. Pitch bend is also displayed on the top line graphically. Press PAL to un-center the pitch bender (removing the software offset that was calculated at power-up). Press WRITE to recalculate the pitch bender center offset.

Test 3: Front panel switch test.

Test 4: LCD test / All LEDs ON. LCD runs through three phases repeatedly, while all LEDs are turned on. LCD goes through all segments off, all segments on, and descriptive message.

Test 5: Rotating LEDs. Each LED is turned on, one at a time.

Test 6: RAM test. Memory is tested continuously. Any failures will be displayed on the bottom line of display.

Test 7: EPROM test. EPROM integrity is tested by comparing calculated checksum with value stored on EPROM. Result is GOOD or BAD.

Power-up reset to default values

A special function is available to initialize all system parameters and global setup 0 to default values. To activate the power-up reset, switch off the GZ-1000 power switch, press the edit switch on the front panel firmly, and then switch the power back on. After a moment, the LCD display will read "KEYSCANNER NOT RESPONDING". This is normal and the GZ-1000 will go into Performance mode when the edit switch is released. At this time, global setup 0 will have been erased, replaced by a simple default setup. Many system parameters will also have been reset to default values as shown below:

Current global setup = 0

Current edit page = 0

All edit pages: Function number = 0, cursor position = home

Primary disk drive = A

Name Finder = OFF

Both MIDI inputs: ON, OMNI mode ON, input channel 1, program change = OFF

MIDI input 1: System exclusive = ON

All MIDI utility outputs = ON

All footswitch polarity = (+)

Front panel switch sensitivity = 25

Appendix 1 - What is MIDI?

The initials "MIDI" stand for *Musical Instrument Digital Interface*. This is a system originally introduced around 1983 designed to control electronic musical instruments. Almost all synthesizers built since then are equipped with MIDI.

There are many synthesizers with a built-in keyboard that can both send and receive MIDI commands. Some MIDI devices like the G2-1000 only transmit MIDI commands and don't make any sound on their own. Many synthesizers, such as rack mounted expanders or sound modules, have no keyboard and must rely on MIDI for control.

MIDI is the system used to connect these various devices together with MIDI cables. A simple example of a MIDI setup is where the keyboard on one synthesizer is used to play notes on another. The audio outputs of the two synthesizers can be mixed together to give a rich, layered sound.

MIDI consists of a physical specification that defines special hardware to transmit and receive digital commands serially over a simple cable, and a logical definition of commands which is generally agreed upon by all manufacturers of synthesizers and other MIDI equipment. The heart of the physical interface is a special integrated circuit called a Universal Asynchronous Receiver / Transmitter (UART) which is connected to the microprocessor that controls the other functions of the instrument. The UART can take eight-bit binary words or bytes from the microprocessor and send them out over the MIDI cable serially (one bit at a time).

The receiving UART in the instrument on the other end of the MIDI cable then accepts those bits and reconstructs them into eight-bit words for its own microprocessor to use.

MIDI commands are made up of *status* and *data bytes*. Some MIDI commands are a single status byte, but most consist of a status byte and one or two data bytes. Status bytes can include a channel number ranging from 1 to 16. This channel number can be used to specify a single instrument in a system where many devices are "listening" to the same controller.

MIDI connections are made through five pin MIDI connectors on the instruments, with special MIDI cables that can be up to about 50 feet in length. MIDI connectors are usually labeled in one of the three following ways; MIDI out, MIDI in or MIDI thru (through). MIDI is a unidirectional system, that is, information can only be transmitted in one direction over a single MIDI cable; a MIDI output may connect to one and only one MIDI input. In order for a MIDI controller to control more than one other instrument at a time, MIDI thru connectors are often provided. MIDI thru is a MIDI output that duplicates the data from a device's MIDI input. So, to control two or more synthesizers from a keyboard with only one MIDI output, a MIDI cable is run from MIDI out on the controller to MIDI in on the first synthesizer. Then another MIDI cable is run from the MIDI thru on the first synthesizer to the MIDI input on the second synthesizer, and so on.

In theory it is possible to chain together an infinite number of instruments this way, but in reality with each MIDI thru there is a slight degradation of the MIDI. Eventually when too many devices are connected together, the last ones in the chain will start to have errors in the data received, operating erratically, possibly not playing notes when they should, or having notes get stuck on. It should be practical to connect about four MIDI devices in series without any problem. Since the G2-1000 has eight MIDI outputs, it is possible to control 32 synthesizers or more, if four are linked to each output.

All MIDI inputs are electrically isolated from the circuitry in the instrument to eliminate the chance of hum or noise being induced through ground loops formed through MIDI connections. The device used to pass a signal while remaining electrically isolated is called an opto-isolator. The quality of this device is what determines the amount of signal degradation that takes place in chaining MIDI devices together. Some manufacturers use better quality (higher speed) opto-isolators than others. If a synthesizer uses a high speed opto-isolator, the MIDI thru signal will be degraded less and allow more devices to be connected in a chain.

A list of MIDI commands and messages is included on page 65. There are some commands which indicate an event such as turning a note on or off, or changing a program, or changing a switch type controller. There are also "continuous" control commands which are usually sent several times a second, or as often as the values change, to approximate continuous control. Such controllers include pitch bend, channel aftertouch, and polyphonic pressure which includes a note number along with each pressure value.

The MIDI specification states that a status byte needs to be transmitted only if the current status has changed or is unknown. This process of using *running status* allows transmitting long groups of controller messages or note-on messages without sending a status byte for each one. The following is an example of a group of note-ons, first with a status byte for each message, and then using running status.

90 3C 7F 90 3D 65 90 36 7F (normal)

90 3C 7F 3D 65 36 7F (running status)

Summary of MIDI commands

Status (Hex)	Data byte 1	Data byte 2	Description
8c	Note number	Velocity	Note off
9c	Note number	Velocity	Note on
Ac	Note number	Pressure	Polyphonic pressure
Bc	Controller number	Value	Controllers 0 – 120
Bc	Message number	N	Channel mode message
Cc	Program number	-	Program change
Dc	Pressure	-	Channel pressure
Ec	LSB	MSB	Pitch bend
F0	?		System exclusive status
F1	N	-	MIDI time code quarter frame
F2	LSB	MSB	Song position pointer
F3	Song number	-	Song select
F4	?		Undefined
F5	?		Undefined
F6	-	-	Tune request
F7	-	-	EOX (End system exclusive)
F8	-	-	Timing clock
F9	-	-	Undefined
FA	-	-	Sequence start
FB	-	-	Sequence continue
FC	-	-	Sequence stop
FD	-	-	Undefined
FE	-	-	Active sensing
FF	-	-	System reset

Notes: c = MIDI channel – 1

N = defined by message type

Appendix 2 - G2-1000 MIDI system exclusive format

Notes: Byte descriptions are in hexadecimal, byte counts are in decimal. Binary numbers are eight digits followed by the letter B. The basic structure of all system exclusive messages generated by and recognized by the GZ-1000 is as follows:

FO 00 00 24 01 <data> F7

Where:

<i>FO</i>	= system exclusive status byte
<i>00 00 24</i>	= KTI Manufacturer ID (three byte code)
<i>01</i>	= GZ-1000 Device ID
<i><data></i>	= any number of data bytes specific to type of message
<i>F7</i>	= EOX (End of system exclusive message)

Some data formats use split byte transmission to put eight bit data into two seven bit MIDI data bytes (bit 7 = 0). The method used by the G2-1000 to split bytes is as follows; the least significant four bits of the original eight bit data are transmitted first as one byte with bits 4 - 7 set to zero. The original high order four bits are shifted right by one bit position and bits 0-2 and bit 7 are zeroed before transmission of this second byte. In other words, to transmit a byte represented by GHIJKLMN it is transformed into two bytes - 0000KLMN followed by 0GHIJ000.

For example, to transmit the byte F3 (11110011B), the first byte would be sent as 03 and the second byte would be transmitted as 78 (00000011B followed by 01111000B). When a split byte is received, the first byte is saved, the second byte is shifted one position left and then OR'ed with the saved byte to reconstruct the original data.

Using the front panel controls, the GZ-1000 user can initiate data dumps of individual global setups or a bulk dump including all globals, PAL, user scales, MIDI control message and user MIDI messages. The other types of dumps can only be initiated externally using a dump request message.

A complete description of currently implemented system exclusive messages follows.

Global setup request:

FO 00 00 24 01 00 nn F7

Global setup data dump:

FO 00 00 24 01 01 nn <576 split data bytes> <checksum> F7

nn = global setup number

<checksum> = Exclusive OR of device ID through last data byte

After recombining split data bytes, there are 288 8-bit bytes arranged in the following way. The first 24 bytes are global parameters:

```

Byte 0 = <P01>< Program name ASCII character 1 >
Byte 1 = <C01>< Program name ASCII character 2 >
Byte 2 = <P02>< Program name ASCII character 3 >
Byte 3 = <C02>< Program name ASCII character 4 >
Byte 4 = <P03>< Program name ASCII character 5 >
Byte 5 = <C03>< Program name ASCII character 6 >
Byte 6 = <P04>< Program name ASCII character 7 >
Byte 7 = <C04>< Program name ASCII character 8 >
Byte 8 = <P05>< Program name ASCII character 9 >
Byte 9 = <C05>< Program name ASCII character 10 >
Byte 10 = <P06>< Program name ASCII character 11 >
Byte 11 = <C06>< Program name ASCII character 12 >
Byte 12 = <P07>< Program name ASCII character 13 >
Byte 13 = <C07>< Program name ASCII character 14 >
Byte 14 = <P08>< Program name ASCII character 15 >
Byte 15 = <C08>< Program name ASCII character 16 >
Byte 16 = < Global transpose -48 to +48 >
Byte 17 = < Key Action Threshold 1 >
Byte 18 = < Key Action Threshold 2 >
Byte 19 = <WU8> <WU7> <WU6> <WU5> <WU4> <WU3> <WU2> <WU1>
Byte 20 = <M4B> <M4A> <M3B> <M3A> <M2B> <M2A> <M1B> <M1A>
Byte 21 = <LM8> <LM7> <LM6> <LM5> <LM4> <LM3> <LM2> <LM1>
Byte 22 = <F2P> <F2B> <F2C> <F2N> <F1P> <F1B> <F1C> <F1N>
Byte 23 = <PRO> <SUS> <CTL> <IM2> <IM1> <X><X><X>

```

Where:

<COx> =	Channel pressure enable for operator x.
<POx> =	Polyphonic pressure enable for operator x.
<WUx> =	Wake-up ON status for operator x.
<MxB> =	MIDI output enable for output xB.
<MxA> =	MIDI output enable for output xA.
<LMx> =	Local mode on flag for operator x.
<F2P> =	MIDI input 2 pressure disable
<F2B> =	MIDI input 2 FA - FC disable
<F2C> =	MIDI input 2 controller disable
<F2N> =	MIDI input 2 notes disable
<F1P> =	MIDI input 1 pressure disable
<F1B> =	MIDI input 1 FA - FC disable
<F1C> =	MIDI input 1 controller disable
<F1N> =	MIDI input 1 notes disable
<PRO> =	Global setup protect flag
<SUS> =	Sustain-hold option on flag
<CTL> =	Controllers on flag
<IM2> =	MIDI Input 2 mode (0=P, 1=M)
<IM1> =	MIDI Input 1 mode (0=P, 1=M)
<X> =	unused bit

Next are eight groups of 29 bytes for each of the eight operators, in sequential order starting with operator 1:

Byte n + 0 = <UW6> < Operator name ASCII character 1 >
 Byte n + 1 = <UW5> < Operator name ASCII character 2 >
 Byte n + 2 = <UW4> < Operator name ASCII character 3 >
 Byte n + 3 = <UW3> < Operator name ASCII character 4 >
 Byte n + 4 = <UW2> < Operator name ASCII character 5 >
 Byte n + 5 = <UW1> < Operator name ASCII character 6 >
 Byte n + 6 = <UW0> < Operator name ASCII character 7 >
 Byte n + 7 = <PRV> < Operator name ASCII character 8 >
 Byte n + 8 = <LW6> < Operator name ASCII character 9 >
 Byte n + 9 = <LW5> < Operator name ASCII character 10>
 Byte n + 10 = <LW4> <F3P> <F2P> <F1P> <UED> <UEC> <UEB> <UEA>
 Byte n + 11 = <LW3> < Keyboard range upper limit >
 Byte n + 12 = <LW2> < Keyboard range lower limit >
 Byte n + 13 = <LW1> <PS2> <PS1> <PS0> <MIDI xmit channel-1 >
 Byte n + 14 = <LWO> < Pressure scale upper limit >
 Byte n + 15 = <VRS> < Pressure scale lower limit >
 Byte n + 16 = <VS2> < Velocity scale upper limit >
 Byte n + 17 = <VS1> < Velocity scale lower limit >
 Byte n + 18 = <VSO> < Operator pitch transpose >
 Byte n + 19 = <PCD> < Wake-up Synth program number >
 Byte n + 20 = < Footswitch 1 destination >
 Byte n + 21 = < Footswitch 2 destination >
 Byte n + 22 = < Footswitch 3 destination >
 Byte n + 23 = < Footpedal 1 destination >
 Byte n + 24 = < Footpedal 2 destination >
 Byte n + 25 = < Footpedal 3 destination >
 Byte n + 26 = < Footpedal 4 destination >
 Byte n + 27 = < Wheel 1 destination >
 Byte n + 28 = < Wheel 2 destination >

Where: n = 24 + (29 * (operator number - 1))
 <UW6-UW0> = Upper velocity window limit (bit 7 = 0)
 <PRV> = Pressure scale reverse flag
 <LW6-LW0> = Lower velocity window limit (bit 7 = 0)
 < PxP > = Polarity of footswitch x.
 <UED> = UART D enable
 <UEC> = UART C enable
 <UEB> = UART B enable
 <UEA> = UART A enable
 <PS2-PS0> = Pressure scale select (0 - 7)
 <VRS> = Velocity scale reverse flag
 <VS2-VS0> = Velocity scale select (0 - 7)
 <PCD> = Wake-up program change disable

And last are 8 groups of 4 bytes of additional operator parameters:

Byte m + 0 = <KPD> < X > <IW1> <IW2> <IP4> <IP3> <IP2> <IP1>
 Byte m + 1 = <CHZ> <PCT> <UMD> < User MIDI message number >
 Byte m + 2 = < AFT > < User MIDI message parameter 2 >

Byte $m + 3 = \langle \text{MCM} \rangle \langle \text{User MIDI message parameter 1} \rangle$

Where: $m = 256 + (4 * (\text{operator number} - 1))$

$\langle X \rangle =$ Unused bit
 $\langle \text{KPD} \rangle =$ Keyboard Pitch Disable
 $\langle \text{IW1} \rangle =$ Invert Wheel 1 flag
 $\langle \text{IW2} \rangle =$ Invert Wheel 2 flag
 $\langle \text{IP4} \rangle =$ Invert Pedal 4 flag
 $\langle \text{IP3} \rangle =$ Invert Pedal 3 flag
 $\langle \text{IP2} \rangle =$ Invert Pedal 2 flag
 $\langle \text{IP1} \rangle =$ Invert Pedal 1 flag
 $\langle \text{CHZ} \rangle =$ Channelize incoming MIDI (flag)
 $\langle \text{PCT} \rangle =$ Allow incoming MIDI Program changes through (flag)
 $\langle \text{UMD} \rangle =$ Wake-up User MIDI message disable flag
 $\langle \text{AFT} \rangle =$ Wake-up message transmitted after/(before)
 synth program change. (1 = after)
 $\langle \text{MCM} \rangle =$ Transmit MIDI control message after prog. Change

8 bit Data Block request:

FO 00 00 24 01 02 ss F7

8 bit Data Block dump:

FO 00 00 24 01 03 ss <tt split data bytes> <checksum> F7

ss = Block number (see table 1)

tt = number of data bytes (see table 1 for value and multiply by 2)

<checksum> = XOR of device ID through last data byte

Table 1:

Block number (hex)	Data length before splitting	Description of data
00	3 bytes	PAL info: First two bytes are 16 bit PAL position address (msb first), third byte is PAL mode (0 = off, 1 = on).
01	256 bytes	Name Finder program
02	24 bytes	Global parameter edit buffer
03	256 bytes	Operator 1 edit buffer
04	256 bytes	Operator 2 edit buffer
05	256 bytes	Operator 3 edit buffer
06	256 bytes	Operator 4 edit buffer
07	256 bytes	Operator 5 edit buffer
08	256 bytes	Operator 6 edit buffer
09	256 bytes	Operator 7 edit buffer
0A	256 bytes	Operator 8 edit buffer
0B	110 bytes	System data request MIDI message
0C	100 bytes	System MIDI Control message
0D	80 bytes	Display Flash buffer - non-zero entries correspond to flashing display positions

0E	5 bytes	LED buffers: Operator LEDs Edit LEDs Misc. LEDs and switch column enables 7 segment LED msb 7 segment LED lsb
0F	6 bytes	MIDI input parameters: Input 1 channel/Omni Input 2 channel/Omni (bit 7 = omni, bits 0-3 = channel) Input 1 enable/program change enable Input 2 enable/program change enable (bit 7 = on, bits 0-1: 0=off, 1=on, 2=thru) System Exclusive enable (0=off, 1=input 1, 2=input 2) Utility MIDI output enables
10	24 bytes	Disk file information Erased flag (always 0) File type (2 - 8) System type - 3 bytes: always = 1,0,0 File size in bytes (3 bytes) File Name (16 ASCII bytes)
11	256 bytes	Software file part 1 Byte 0,1 = Checksum of bytes 2-511 (2 bytes) Byte 2 = Edit page location (0 - 2) Byte 3 = Normal program entry point Byte 5 = Display update entry point
12	256 bytes	Software file part 2

7 bit Data Block request:

FO 00 00 24 01 04 ss F7

7 bit Data Block dump:

FO 00 00 24 01 05 ss <uu data bytes> <checksum> F7

ss = Block number (see table 2)
 uu = number of data bytes (see table 2 for value)
 <checksum> = XOR of device ID through last data byte

Table 2:

Block number (hex)	Data length	Description of data
00	100 bytes	PAL
01	8 bytes	User scale 1 name
02	8 bytes	User scale 2 name
03	8 bytes	User scale 3 name
04	128 bytes	User scale 1

05	128 bytes	User scale 2
06	128 bytes	User scale 3
07	80 bytes	Display buffer
08	7 bytes	Edit pointers: page 0 function number page 0 cursor position page 1 function number page 1 cursor position page 2 function number page 2 cursor position page 2 operator number (0 - 7)
09	1 byte	New Global program -- any change to this number will cause the current global setup to change immediately
0A	1 byte	Display update flag -- non-zero entry will cause LCD refresh.

User MIDI message requests:

F0 00 00 24 01 06 vv F7

vv = User message number desired (0 – 31)

User MIDI message dump

F0 00 00 24 01 07 vv < 48 split data bytes > < checksum > F7

vv = User message number

<checksum> = XOR of device ID through last data byte

After split data bytes are reconstructed into 24 bytes, the first ten are the message name (ASCII). The next byte greater than 7F is the first byte of the actual message. A value of FE will mark the end of the message. Bytes after the end are ignored. Names longer or shorter than ten characters may be used, but the editing page of the GZ-1000 will assume a length of ten. The first byte with a value greater than 7F is assumed to be the start of the message.

System ID request:

F0 00 00 24 01 09 < 40 data bytes > < checksum > F7

<checksum> = XOR of device ID through last data byte

The 40 data bytes are ASCII in a form similar to the following:

"GZ-1000 FIRMWARE VERSION 1.00 © 1988"

Any unused trailing characters are filled with blanks to make the data count equal to 40.

“Press” Front Panel Switch

F0 00 00 24 01 0A <s1> <s2> <s3> F7

Simulate button pushing by remote control: Place a 1 in bit position(s) indicated to “press” button. All three bytes must be transmitted – unused bits are set to zero.

Where:	msb	lsb
s1 = operator buttons	0 0 0 0 4 3 2 1	
s2 = operator buttons	0 8 7 6 5 0 0 0	
s3 = buttons	0 0 0	WR NO YES PAL ED

Universal device inquiry message (recognized)

F0 7E <ch> 06 01 F7

<ch> = “Channel” number – ignored by GZ-1000

Universal device inquiry message response

F0 7E <ch> 06 02 00 00 24 01 00 01 00 <rev id> F7

Where:

<ch> = Channel number – always equal to zero.

<rev id> = 4 byte revision identification message (ASCII)

GZ-1000 MIDI Implementation Chart

Function...	Transmitted	Recognized	Remarks
Basic Channel Default Channel	1-16 1-16	1-16 1-16	Assignments are held in memory until changed
Mode Default Messages Altered	Mode 3 1-4	X X	
Note Number True Voice	1-127	1-127	
Note ON Velocity Note OFF Velocity	O O	X X	
Aftertouch Keys Chans.	O O	X X	
Pitch Bender	O	X	
Control Change	0-127	X	Pedals, wheels and footswitches are assignable to any controller
Prog Change True #	O 0-127	O 0-99	
System Exclusive	O	O	
System : Song Pos Common : Song Sel : Tune	O O O	X X X	
System : Clock Real Time : Commands	X X	X X	
Aux : Local ON/OFF Mes- : All Notes Off sages : Active Sense : Reset	O O X X	X X X X	

Notes: Channel messages and system messages FA, FB and FC may be re-directed from either MIDI input to any output.

Mode 1: OMNI ON, POLY Mode 2: OMNI ON, MONO O : Yes
Mode 3: OMNI OFF, POLY Mode 3: OMNI OFF, MONO X : No

Appendix 3 - G2-1000 Error messages

LED display error messages

These messages are displayed on the two digit LED global display.

- E1 Hardware error - LCD module not responding.
- E2 Hardware error - Keyscanner not responding (normally flashes briefly during power-up).
- E3 System exclusive checksum error - Appears momentarily if a GZ-1000 system exclusive message is received incorrectly.
- E4 Battery checkword error - displayed at power up if memory integrity test fails.

Other types of error messages are displayed on the LCD display:

Disk error messages

BAD DATA ON DISK

This message is displayed when a cyclic redundancy check (CRC) error happens while reading data from the disk.

DISK DRIVE NOT READY

This message is displayed when a disk is ejected from the drive unexpectedly.

DISK IS FULL

The selected file cannot be saved because there is not sufficient space available on the disk.

DISK IS NOT GZ FORMAT

Disk is unformatted or formatted incorrectly for the GZ-1000.

DISK IS WRITE-PROTECTED

File cannot be saved or disk cannot be formatted because the write protect tab on the disk is set.

FILE NOT FOUND

Selected file can't be found - disk may have been changed without reloading directory.

FILE OVERLOAD - TOO MUCH DATA

When recording MIDI data directly to disk, file size was exceeded (too much MIDI data was received). File is not saved.

FILE REQUIRES TOO MANY SEGMENTS

Disk files may be segmented on the disk into as many as 12 sections. It is possible for a disk to be fragmented from having small files erased at random in such a way that a large file would require more segments than are allowed.

FORMAT COMPLETE - n BAD SECTORS

A number (n) of bad sectors were encountered during formatting. These sectors will not be used for saving data, so the disk may still be used.

INTERNAL LOGIC ERROR

Directory entry is in error. If this error happens, try to note the exact circumstances leading to the error and report to KTI.

LOST DATA

Possible wrong sector length on non-GZ-1000 format disk, or processor overload during MIDI to disk operation.

MIDI INPUT SYSTEM EXCLUSIVE NOT ENABLED

MIDI to disk - at least one MIDI input must be enabled and also have system exclusive enabled.

MIDI RECEIVE CANCELLED

MIDI to disk - disk error occurred while attempting to write data to disk.

NO DATA RECEIVED

MIDI to disk operation cancelled or timed out without receiving any MIDI Data.

NO DISK IN DRIVE

Disk is not properly inserted in correct drive.

NOT A GZ-DISK !

Disk is formatted and has correct sector size, but the identification field on the disk failed to match the GZ-1000 test pattern.

ROTATION SPEED

Hardware error - disk drive motor not rotating at correct speed.

RECORD NOT FOUND

Disk sector address could not be found due to bad data on disk.

TOO MANY FILES ON DISK

248 is the maximum number of files that will fit on one disk due to the fixed size of the directory.

UNABLE TO FORMAT DISK

Disk could not be formatted due to a bad sector in the directory area.

UNABLE TO UPDATE DIRECTORY

Disk error occurred while attempting to update disk directory after writing file.

UNKNOWN FILE TYPE

File has illegal file type - cannot be loaded.

Test mode error messages

EPROM CHECKSUM TEST xxxx BAD

If the EPROM checksum calculated does not match the checksum stored in the EPROM, the calculated hexadecimal value will be displayed.

ERROR IN U124 [U125]

During RAM test, any errors will be displayed showing the part number of the memory chip where the error occurred.

Other error messages

CANCELLED

Operation was cancelled with EDIT switch.

UNABLE TO WRITE GLOBAL - DESTINATION MEMORY IS PROTECTED

Memory protect must be off in order to write, copy to or swap with a global location, load a single global setup from disk to memory, or accept a MIDI system exclusive global data dump.

Appendix 4 - Glossary

Action adjust lever: Lever at the right side of the GZ-1000 keyboard that is used to adjust the tension on the keys to set the playing action.

Aftertouch: Parameter that varies with pressure on the keyboard.

ASCII: American Standard Code for Information Interchange.

Binary: Base 2 numbering system.

Bit: Binary digit

Buffer: Computer memory location reserved for a specific use.

Byte: Eight bit binary data value.

Channel, basic: MIDI channel that a GZ-1000 input listens to.

Channel, MIDI: number from 1 to 16 that is part of MIDI channel messages - specifies the message destination.

Channel pressure: Pressure value taken from the highest pressure on any key within an operator's keyboard range.

Channel, transmit: MIDI channel used by messages originating in a GZ-1000 operator.

Channelize: Add specified MIDI channel to status byte.

Compare mode: See edit compare mode.

Controller: MIDI messages that change continuous or switch parameters.

Data entry: Process of changing values of numbers, characters or status parameters.

Data entry switches: Switches on the GZ-1000 front panel used to enter values of -1 (NO) or +1 (YES). Holding one of these switches for longer than one second will allow automatic repetition.

Data request message (DRQ): User defined system exclusive message used for requesting patch dump when using the MIDI to Disk function.

Default settings: Parameter settings that the GZ-1000 will reset to when powered up while EDIT switch is depressed.

Disk, microfloppy: Magnetic data storage medium in a hard, flat plastic shell. GZ-1000 uses double-sided, double density 3.5 inch disks such as Maxell MF 2-DD, Sony MFD-2DD or equivalent.

Disk drive: The physical mechanism that is used to read from and write to microfloppy disks. Drive A is built into the right end panel of the GZ-1000. Drive B is the optional GZ-D external disk drive.

Edit buffer: When a global setup is first selected, a copy of the global is put into a part of memory called the edit buffer. Any parameter edits are made to the data in this buffer. When the write switch is pressed, the edit buffer is copied back into the current global setup location.

Edit compare mode: Allows individual edited operators to be swapped out of the edit buffer and replaced with their original settings.

Edit mode: This mode must be selected to edit GZ-1000 parameters and access utility functions. The edit switch or edit footswitch is used to turn Edit mode on and off.

Edit recall buffer: The edit buffer is copied into a second buffer called the edit recall buffer when a new global setup is selected (if the edit buffer had been modified in any way). A function is provided for retrieving the contents of the recall edit buffer.

File, disk: Section of disk containing a group of data.

Footswitch: Momentary foot control which is either normally ON or normally OFF.

Global: See global setup.

Global setup: Keyboard configuration consisting of eight operators and other parameter settings. The GZ-1000 can store 100 global setups in its internal memory.

Hexadecimal: Base 16 numbering system used to represent MIDI data.

Interface: Connection between two devices

'K': 1024. (1Kbyte = 1024 bytes)

Key action threshold: Programmable point at which keys turn on or off.

LCD: Liquid Crystal Display - the large 40 character by 2 line display on the front panel of the G2-1000

LED: Light Emitting Diode

Load (from disk): Copy data on disk into the GZ-1000's memory.

Local mode: Operator mode where MIDI inputs are ignored and local controls (wheels, foot controls, keyboard) are active.

'M' mode: GZ-1000 input mode where only one channel is routed to each operator.

MIDI: Musical Instrument Digital Interface

MIDI control message: User defined reset message that can be transmitted at wake-up.

MIDI message: One of 32 user defined messages that can be transmitted at wake-up, or under footswitch control, with up to two parameters defined at the operator level.

Modulation wheel: Variable control located at the left of the G2-1000 keyboard

Name Finder: Device specific program to extract patch names from a synthesizer and use for operator name.

Operator: An operator is a set of parameters that act on input information from the keyboard, footpedals, footswitches, modulation wheels and MIDI inputs to generate MIDI output commands.

'P' mode: GZ-1000 input mode where only all MIDI channels are routed to each operator.

PAL: Program Advance Library - List of global setups that can be stepped through.

Page: Group of related edit displays.

Patch select: See program change.

Pedal: Foot controller with continuous response.

Pitch bend wheel: Spring loaded wheel normally assigned to MIDI pitch bend.

Polyphonic pressure: Pressure generated by individual keys - transmitted with corresponding note number.

Pressure: Downward force on keyboard.

Pressure scale: Function which translates raw keyboard pressure value into transmitted MIDI pressure.

Program change: MIDI message to change synthesizer patch or program.

Sampler: Musical instrument that generates sound by playing digital sound samples.

Save (to disk): Copy data from the GZ-1000's memory to a disk file.

Sound module: Sound generation device without a built-in keyboard.

Sustain: MIDI switch controller (see also Damper pedal)

Synthesizer: Musical instrument that generates sound by processing various waveforms through envelopes and filters.

Tone module: See sound module.

Transmitter (MIDI): On the GZ-1000, a transmitter converts data from parallel to serial and drives either or both of two MIDI outputs.

Utility outputs: GZ-1000 MIDI outputs that are active in Edit mode.

Velocity scale: Function which translates raw keyboard note velocity to transmitted MIDI velocity.

Velocity window: Upper and lower velocity limits that note-ons must fall between to be transmitted by an operator.

Wake-up: Process that the GZ-1000 goes through when switching into Performance mode.

Appendix 5 – Conversion Tables

Hexadecimal to Decimal conversion table

Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec
00	0	20	32	40	64	60	96	80	128	A0	160	C0	192	E0	224
01	1	21	33	41	65	61	97	81	129	A1	161	C1	193	E1	225
02	2	22	34	42	66	62	98	82	130	A2	162	C2	194	E2	226
03	3	23	35	43	67	63	99	83	131	A3	163	C3	195	E3	227
04	4	24	36	44	68	64	100	84	132	A4	164	C4	196	E4	228
05	5	25	37	45	69	65	101	85	133	A5	165	C5	197	E5	229
06	6	26	38	46	70	66	102	86	134	A6	166	C6	198	E6	230
07	7	27	39	47	71	67	103	87	135	A7	167	C7	199	E7	231
08	8	28	40	48	72	68	104	88	136	A8	168	C8	200	E8	232
09	9	29	41	49	73	69	105	89	137	A9	169	C9	201	E9	233
0A	10	2A	42	4A	74	6A	106	8A	138	AA	170	CA	202	EA	234
0B	11	2B	43	4B	75	6B	107	8B	139	AB	171	CB	203	EB	235
0C	12	2C	44	4C	76	6C	108	8C	140	AC	172	CC	204	EC	236
0D	13	2D	45	4D	77	6D	109	8D	141	AD	173	CD	205	ED	237
0E	14	2E	46	4E	78	6E	110	8E	142	AE	174	CE	206	EE	238
0F	15	2F	47	4F	79	6F	111	8F	143	AF	175	CF	207	EF	239
10	16	30	48	50	80	70	112	90	144	B0	176	D0	208	F0	240
11	17	31	49	51	81	71	113	91	145	B1	177	D1	209	F1	241
12	18	32	50	52	82	72	114	92	146	B2	178	D2	210	F2	242
13	19	33	51	53	83	73	115	93	147	B3	179	D3	211	F3	243
14	20	34	52	54	84	74	116	94	148	B4	180	D4	212	F4	244
15	21	35	53	55	85	75	117	95	149	B5	181	D5	213	F5	245
16	22	36	54	56	86	76	118	96	150	B6	182	D6	214	F6	246
17	23	37	55	57	87	77	119	97	151	B7	183	D7	215	F7	247
18	24	38	56	58	88	78	120	98	152	B8	184	D8	216	F8	248
19	25	39	57	59	89	79	121	99	153	B9	185	D9	217	F9	249
1A	26	3A	58	5A	90	7A	122	9A	154	BA	186	DA	218	FA	250
1B	27	3B	59	5B	91	7B	123	9B	155	BB	187	DB	219	FB	251
1C	28	3C	60	5C	92	7C	124	9C	156	BC	188	DC	220	FC	252
1D	29	3D	61	5D	93	7D	125	9D	157	BD	189	DD	221	FD	253
1E	30	3E	62	5E	94	7E	126	9E	158	BE	190	DE	222	FE	254
1F	31	3F	63	5F	95	7F	127	9F	159	BF	191	DF	223	FF	255

Data Entry Character Codes

00 =		25 =	9	50 =	R	75 =	k
01 =	!	26 =	:	51 =	S	76 =	l
02 =	"	27 =	;	52 =	T	77 =	m
03 =	#	28 =	<	53 =	U	78 =	n
04 =	\$	29 =	=	54 =	V	79 =	o
05 =	%	30 =	>	55 =	W	80 =	p
06 =	&	31 =	?	56 =	X	81 =	q
07 =	'	32 =	@	57 =	Y	82 =	r
08 =	(	33 =	A	58 =	Z	83 =	s
09 =	)	34 =	B	59 =	[	84 =	t
10 =	*	35 =	C	60 =	¥	85 =	u
11 =	+	36 =	D	61 =	]	86 =	v
12 =	,	37 =	E	62 =	^	87 =	w
13 =	-	38 =	F	63 =	_	88 =	x
14 =	.	39 =	G	64 =	`	89 =	y
15 =	/	40 =	H	65 =	a	90 =	z
16 =	0	41 =	I	66 =	b	91 =	{
17 =	1	42 =	J	67 =	c	92 =	|
18 =	2	43 =	K	68 =	d	93 =	}
19 =	3	44 =	L	69 =	e	94 =	~
20 =	4	45 =	M	70 =	f	95 =	←
21 =	5	46 =	N	71 =	g		
22 =	6	47 =	O	72 =	h		
23 =	7	48 =	P	73 =	i		
24 =	8	49 =	Q	74 =	j		

GZ-1000 Setup

Name

Transpose

MIDI output enables

A1 A2 B1 B2 C1 C2 D1 D2

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Key action
thresholds

MIDI input 1 assignment mode:

Notes CTRLS Pressure FA-FC

MIDI input 2 assignment mode:

Notes CTRLS Pressure FA-FC

Sustain-hold ON ☐

Controllers ON ☐

Operators 1 2 3 4 5 6 7 8

Local mode:	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF
Wake-up:								
Name:								
MIDI channel:								
Transmitters:								
Patch no.								
MIDI msgs								
Ctrl msg								
Transpose								
Key Pitch	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF
Keyboard limits:								
Velocity Scale								
Limits								
Velocity Window								
Pressure	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono
Scale								
Limits								
Pedal 1								
Pedal 2								
Pedal 3								
Pedal 4								
Wheel 1								
Wheel 2								
Footsw. 1								
Footsw. 2								
Footsw. 3								
MIDI input processing								

GZ-1000 Setup

Name

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MIDI output enables

A1 A2 B1 B2 C1 C2 D1 D2

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Name:								
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Transmitters:								
Patch no.								
MIDI msgs								
Ctrl msg								
Transpose								
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Keyboard limits:								
Velocity								
Scale								
Limits								
Velocity Window								
Pressure	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono
Scale								
Limits								
Pedal 1								
Pedal 2								
Pedal 3								
Pedal 4								
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Wheel 2								
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Footsw. 2								
Footsw. 3								
MIDI input processing								

GZ-1000 Setup

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Wake-up:								
Name:								
MIDI channel:								
Transmitters:								
Patch no.								
MIDI msgs								
Ctrl msg								
Transpose								
Key Pitch	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF
Keyboard limits:								
Velocity								
Scale								
Limits								
Velocity Window								
Pressure	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono
Scale								
Limits								
Pedal 1								
Pedal 2								
Pedal 3								
Pedal 4								
Wheel 1								
Wheel 2								
Footsw. 1								
Footsw. 2								
Footsw. 3								
MIDI input processing								

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MIDI output enables

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Wake-up:								
Name:								
MIDI channel:								
Transmitters:								
Patch no.								
MIDI msgs								
Ctrl msg								
Transpose								
Key Pitch	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF	<input type="radio"/> OFF
Keyboard limits:								
Velocity Scale								
Limits								
Velocity Window								
Pressure	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono	<input type="radio"/> poly <input type="radio"/> mono
Scale								
Limits								
Pedal 1								
Pedal 2								
Pedal 3								
Pedal 4								
Wheel 1								
Wheel 2								
Footsw. 1								
Footsw. 2								
Footsw. 3								
MIDI input processing								

