NAME

kb – keyboard STREAMS module

SYNOPSIS

#include <sys/types.h>
#include <sys/stream.h>
#include <sys/stropts.h>
#include <sys/vuid_event.h>
#include <sys/kbio.h>
#include <sys/kbd.h>

ioctl(fd, I_PUSH, "kb");

AVAILABILITY

SPARC

DESCRIPTION

The **kb** STREAMS module processes byte streams generated by keyboard attached to a CPU serial port. Definitions for altering keyboard translation, and reading events from the keyboard, are in **<sys/kbio.h>** and **<sys/kbd.h>**.

kb recognizes which keys have been typed using a set of tables for each known type of keyboard. Each translation table is an array of 128 16-bit words (**unsigned short**s). If an entry in the table is less than 0x100, it is treated as an ISO 8859/1 character. Higher values indicate special characters that invoke more complicated actions.

Keyboard Translation Mode

The keyboard can be in one of the following translation modes:

TR_NONE	Keyboard translation is turned off and up/down key codes are reported.
TR_ASCII	ISO 8859/1 codes are reported.
TR_EVENT	**firm_events** are reported.
TR_UNTRANS_EVENT	**firm_events** containing unencoded keystation codes are reported for all input events within the window system.

Keyboard Translation-Table Entries

All instances of the **kb** module share seven translation tables used to convert raw keystation codes to event values. The tables are:

Unshifted	Used when a key is depressed and no shifts are in effect.
Shifted	Used when a key is depressed and a Shift key is being held down.
Caps Lock	Used when a key is depressed and Caps Lock is in effect.
Alt Graph	Used when a key is depressed and the Alt Graph key is being held down.
Num Lock	Used when a key is depressed and Num Lock is in effect.

Controlled	Used when a key is depressed and the Control key is being held down (regardless of whether a Shift key or the Alt Graph is being held down, or whether Caps Lock or Num Lock is in effect).
Key Up	Used when a key is released.

Each key on the keyboard has a “key station” code which is a number from 0 to 127. This number is used as an index into the translation table that is currently in effect. If the corresponding entry in that translation table is a value from 0 to 255, this value is treated as an ISO 8859/1 character, and that character is the result of the translation.

If the entry is a value above 255, it is a “special” entry. Special entry values are classified according to the value of the high-order bits. The high-order value for each class is defined as a constant, as shown in the list below. The value of the low-order bits, when added to this constant, distinguishes between keys within each class:

SHIFTKEYS 0x100 — A shift key. The value of the particular shift key is added to determine which shift mask to apply:

CAPSLOCK 0	“Caps Lock” key.
SHIFTLOCK 1	“Shift Lock” key.
LEFTSHIFT 2	Left-hand “Shift” key.
RIGHTSHIFT 3	Right-hand “Shift” key.
LEFTCTRL 4	Left-hand (or only) “Control” key.
RIGHTCTRL 5	Right-hand “Control” key.
ALTGRAPH 9	“Alt Graph” key.
ALT 10	“Alternate” or “Alt” key.
NUMLOCK 11	“Num Lock” key.

BUCKYBITS 0x200 — Used to toggle mode-key-up/down status without altering the value of an accompanying ISO 8859/1 character. The actual bit-position value, minus 7, is added.

METABIT 0	The “Meta” key was pressed along with the key. This is the only user-accessible bucky bit. It is ORed in as the 0x80 bit; since this bit is a legitimate bit in a character, the only way to distinguish between, for example, 0xA0 as META+0x20 and 0xA0 as an 8-bit character is to watch for “META key up” and “META key down” events and keep track of whether the META key was down.
SYSTEMBIT 1	The “System” key was pressed. This is a place holder to indicate which key is the system-abort key.

FUNNY 0x300 — Performs various functions depending on the value of the low 4 bits:

NOP 0x300	Does nothing.
OOPS 0x301	Exists, but is undefined.
HOLE 0x302	There is no key in this position on the keyboard, and the position-code should not be used.
RESET 0x306	Keyboard reset.
ERROR 0x307	The keyboard driver detected an internal error.
IDLE 0x308	The keyboard is idle (no keys down).
COMPOSE 0x309	This key is the COMPOSE key; the next two keys should comprise a two-character "COMPOSE key" sequence.
NONL 0x30A	Used only in the Num Lock table; indicates that this key is not affected by the Num Lock state, so that the translation table to use to translate this key should be the one that would have been used had Num Lock not been in effect.
0x30B — 0x30F	Reserved for nonparameterized functions.

FA_CLASS 0x400 — This key is a "floating accent" or "dead" key. When this key is pressed, the next key generates an event for an accented character; for example, "floating accent grave" followed by the "a" key generates an event with the ISO 8859/1 code for the "a with grave accent" character. The low-order bits indicate which accent; the codes for the individual "floating accents" are as follows:

FA_UMLAUT 0x400	umlaut
FA_CFLEX 0x401	circumflex
FA_TILDE 0x402	tilde
FA_CEDILLA 0x403	cedilla
FA_ACUTE 0x404	acute accent
FA_GRAVE 0x405	grave accent

STRING 0x500 — The low-order bits index a table of strings. When a key with a **STRING** entry is depressed, the characters in the null-terminated string for that key are sent, character by character. The maximum length is defined as:

KTAB_STRLEN 10

Individual string numbers are defined as:

HOMEARROW	0x00
UPARROW	0x01
DOWNARROW	0x02
LEFTARROW	0x03
RIGHTARROW	0x04

String numbers 0x05 — 0x0F are available for custom entries.

FUNCKEYS 0x600 Function keys. The next-to-lowest 4 bits indicate the group of function keys:

LEFTFUNC 0x600
RIGHTFUNC 0x610
TOPFUNC 0x620
BOTTOMFUNC 0x630

The low 4 bits indicate the function key number within the group:

LF(*n*)	(LEFTFUNC+(*n*)-1)
RF(*n*)	(RIGHTFUNC+(*n*)-1)
TF(*n*)	(TOPFUNC+(*n*)-1)
BF(*n*)	(BOTTOMFUNC+(*n*)-1)

There are 64 keys reserved for function keys. The actual positions may not be on left/right/top/bottom of the keyboard, although they usually are.

PADKEYS 0x700

This key is a "numeric keypad key." These entries should appear only in the Num Lock translation table; when Num Lock is in effect, these events will be generated by pressing keys on the right-hand keypad. The low-order bits indicate which key; the codes for the individual keys are as follows:

PADEQUAL 0x700	"=" key
PADSLASH 0x701	"/" key
PADSTAR 0x702	"*" key
PADMINUS 0x703	"-" key
PADSEP 0x704	"," key
PAD7 0x705	"7" key
PAD8 0x706	"8" key
PAD9 0x707	"9" key
PADPLUS 0x708	"+" key
PAD4 0x709	"4" key
PAD5 0x70A	"5" key
PAD6 0x70B	"6" key
PAD1 0x70C	"1" key
PAD2 0x70D	"2" key

PAD3	0x70E	"3" key
PAD0	0x70F	"0" key
PADDOT	0x710	"." key
PADENTER	0x711	"Enter" key

In **TR_ASCII** mode, when a function key is pressed, the following escape sequence is sent:

    ESC[0 . . . . 9z

where ESC is a single escape character and "0 . . . 9" indicates the decimal representation of the function-key value. For example, function key **R1** sends the sequence:

    ESC[208z

because the decimal value of RF(1) is 208. In **TR_EVENT** mode, if there is a VUID event code for the function key in question, an event with that event code is generated; otherwise, individual events for the characters of the escape sequence are generated.

Keyboard Compatibility Mode

kb is in "compatibility mode" when it starts up. In this mode, when the keyboard is in the **TR_EVENT** translation mode, ISO 8859/1 characters from the "upper half" of the character set (that is, characters with the 8th bit set) are presented as events with codes in the **ISO_FIRST** range (as defined in **<sys/vuid_event.h>**). The event code is **ISO_FIRST** plus the character value. This is for backwards compatibility with older versions of the keyboard driver. If compatibility mode is turned off, ISO 8859/1 characters are presented as events with codes equal to the character code.

IOCTLS

The following **ioctl( )** requests set and retrieve the current translation mode of a keyboard:

KIOCTRANS The argument is a pointer to an **int**. The translation mode is set to the value in the **int** pointed to by the argument.

KIOCGTRANS The argument is a pointer to an **int**. The current translation mode is stored in the **int** pointed to by the argument.

ioctl( ) requests for changing and retrieving entries from the keyboard translation table use the **kiockeymap** structure:

```
struct kiockeymap {
    int       kio_tablemask;  /* Translation table (one of: 0, CAPSMASK,
                               * SHIFTMASK, CTRLMASK, UPMASK,
                               * ALTGRAPHMASK, NUMLOCKMASK)
                               */
#define KIOCABORT1 −1         /* Special "mask": abort1 keystation */
#define KIOCABORT2 −2         /* Special "mask": abort2 keystation */
    u_char    kio_station;    /* Physical keyboard key station (0-127) */
    u_short   kio_entry;      /* Translation table station's entry */
    char      kio_string[10]; /* Value for STRING entries (null terminated) */
};
```

KIOCSKEY The argument is a pointer to a **kiockeymap** structure. The translation table entry referred to by the values in that structure is changed.

kio_tablemask specifies which of the five translation tables contains the entry to be modified:

UPMASK 0x0080	"Key Up" translation table.
NUMLOCKMASK 0x0800	"Num Lock" translation table.
CTRLMASK 0x0030	"Controlled" translation table.
ALTGRAPHMASK 0x0200	"Alt Graph" translation table.
SHIFTMASK 0x000E	"Shifted" translation table.
CAPSMASK 0x0001	"Caps Lock" translation table.
(No shift keys pressed or locked)	"Unshifted" translation table.

kio_station specifies the keystation code for the entry to be modified. The value of **kio_entry** is stored in the entry in question. If **kio_entry** is between STRING and STRING+15, the string contained in **kio_string** is copied to the appropriate string table entry. This call may return -**EINVAL** if there are invalid arguments.

There are a couple special values of **kio_tablemask** that affect the two step "break to the PROM monitor" sequence. The usual sequence is **L1**–**a** or **Stop**–**a .** If **kio_tablemask** is **KIOCABORT1** then the value of **kio_station** is set to be the first keystation in the sequence. If **kio_tablemask** is **KIOCABORT2** then the value of **kio_station** is set to be the second keystation in the sequence.

KIOCGKEY The argument is a pointer to a **kiockeymap** structure. The current value of the keyboard translation table entry specified by **kio_tablemask** and **kio_station** is stored in the structure pointed to by the argument. This call may return **EINVAL** if there are invalid arguments.

KIOCTYPE The argument is a pointer to an **int**. A code indicating the type of the keyboard is stored in the **int** pointed to by the argument:

KB_SUN3	Sun Type 3 keyboard
KB_SUN4	Sun Type 4 keyboard
KB_ASCII	ASCII terminal masquerading as keyboard

KB_DEFAULT is stored in the **int** pointed to by the argument, if the keyboard type is unknown. In case of error, -1 is stored in the **int** pointed to by the argument.

KIOCLAYOUT The argument is a pointer to an **int**. On a Sun Type 4 keyboard, the layout code specified by the keyboard's DIP switches is stored in the **int** pointed to by the argument.

KIOCCMD The argument is a pointer to an **int**. The command specified by the value of the **int** pointed to by the argument is sent to the keyboard. The commands that can be sent are:

Commands to the Sun Type 3 and Sun Type 4 keyboards:

KBD_CMD_RESET	Reset keyboard as if power-up.
KBD_CMD_BELL	Turn on the bell.
KBD_CMD_NOBELL	Turn off the bell.
KBD_CMD_CLICK	Turn on the click annunciator.
KBD_CMD_NOCLICK	Turn off the click annunciator.

Commands to the Sun Type 4 keyboard:

KBD_CMD_SETLED	Set keyboard LEDs.
KBD_CMD_GETLAYOUT	Request that keyboard indicate layout.

Inappropriate commands for particular keyboard types are ignored. Since there is no reliable way to get the state of the bell or click (because we cannot query the keyboard, and also because a process could do writes to the appropriate serial driver — thus going around this **ioctl()** request) we do not provide an equivalent **ioctl()** to query its state.

KIOCSLED The argument is a pointer to an **char**. On the Sun Type 4 keyboard, the LEDs are set to the value specified in that **char**. The values for the four LEDs are:

LED_CAPS_LOCK	"Caps Lock" light.
LED_COMPOSE	"Compose" light.
LED_SCROLL_LOCK	"Scroll Lock" light.
LED_NUM_LOCK	"Num Lock" light.

On some of the Japanese layouts, the value for the fifth LED is:

LED_KANA	"Kana" light.

KIOCGLED The argument is a pointer to a **char**. The current state of the LEDs is stored in the **char** pointed to by the argument.

KIOCSCOMPAT The argument is a pointer to an **int**. "Compatibility mode" is turned on if the **int** has a value of 1, and is turned off if the **int** has a value of 0.

KIOCGCOMPAT
The argument is a pointer to an **int**. The current state of "compatibility mode" is stored in the **int** pointed to by the argument.

These **ioctl( )** requests are supported for compatibility with the system keyboard device **/dev/kbd**.

KIOCSDIRECT Has no effect.

KIOCGDIRECT Always returns 1.

SEE ALSO

loadkeys(1), **keytables**(4), **termio**(7I)

NOTES

Many of the keyboards released after Sun Type 4 keyboard also report themselves as Sun Type 4 keyboard.