

The S-Lang C Library Reference

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1 Functions dealing with UTF-8 encoded strings

1.1 SLutf8_skip_char

Synopsis

Skip past a UTF-8 encoded character

Usage

```
SLuchar_Type *SLutf8_skip_char (SLuchar_Type *u, SLuchar_Type *umax)
```

Description

The `SLutf8_skip_char` function returns a pointer to the character immediately following the UTF-8 encoded character at `u`. It will make no attempt to examine the bytes at the position `umax` and beyond. If the bytes at `u` do not represent a valid or legal UTF-8 encoded sequence, a pointer to the byte following `u` will be returned.

Notes

Unicode combining characters are treated as distinct characters by this function.

See Also

`SLutf8_skip_chars`, `SLutf8_bskip_char`, `SLutf8_strlen`

1.2 SLutf8_skip_chars

Synopsis

Skip past a specified number of characters in a UTF-8 encoded string

Usage

```
SLuchar_Type *SLutf8_skip_chars (u, umax, num, dnum, ignore_combining)
```

```
SLuchar_Type *u, *umax;  
unsigned int num;  
unsigned int *dnum;  
int ignore_combining;
```

Description

This functions attempts to skip forward past `num` UTF-8 encoded characters at `u` returning the actual number skipped via the parameter `dnum`. It will make no attempt to examine bytes at `umax` and beyond. Unicode combining characters will not be counted if `ignore_combining` is non-zero, otherwise they will be treated as distinct characters. If the input contains an invalid or illegal UTF-8 sequence, then each byte in the sequence will be treated as a single character.

See Also

`SLutf8_skip_char`, `SLutf8_bskip_chars`

1.3 SLutf8_bskip_char

Synopsis

Skip backward past a UTF-8 encoded character

Usage

```
SLuchar_Type *SLutf8_bskip_char (SLuchar_Type *umin, SLuchar_Type *u)
```

Description

The `SLutf8_bskip_char` skips backward to the start of the UTF-8 encoded character immediately before the position `u`. The function will make no attempt to examine characters before the position `umin`. UTF-8 combining characters are treated as distinct characters.

See Also

SLutf8_bskip_chars, SLutf8_skip_char

1.4 SLutf8_bskip_chars

Synopsis

Skip backward past a specified number of UTF-8 encoded characters

Usage

```
SLuchar_Type *SLutf8_bskip_chars (umin, u, num, dnum, ignore_combining)
```

```
SLuchar_Type *umin, *u;  
unsigned int num;  
unsigned int *dnum;  
int ignore_combining;
```

Description

This functions attempts to skip backward past `num` UTF-8 encoded characters occurring immediately before `u`. It returns the the actual number skipped via the parameter `dnum`. No attempt will be made to examine the bytes occurring before `umin`. Unicode combining characters will not be counted if `ignore_combining` is non-zero, otherwise they will be treated as distinct characters. If the input contains an invalid or illegal UTF-8 sequence, then each byte in the sequence will be treated as a single character.

See Also

SLutf8_skip_char, SLutf8_bskip_chars

1.5 SLutf8_decode

Synopsis

Decode a UTF-8 encoded character sequence

Usage

```
SLuchar_Type *SLutf8_decode (u, umax, w, nconsumedp
```

```
SLuchar_Type *u, *umax;  
SLwchar_Type *w;  
unsigned int *nconsumedp;
```

Description

The `SLutf8_decode` function decodes the UTF-8 encoded character occurring at `u` and returns the decoded character via the parameter `w`. No attempt will be made to examine the bytes at `umax` and beyond. If the parameter `nconsumedp` is non-NULL, then the number of bytes consumed by the function will be returned to it. If the sequence at `u` is invalid or illegal, the function will return NULL and with the number of bytes consumed by the function equal to the size of the invalid sequence. Otherwise the function will return a pointer to byte following encoded sequence.

See Also

SLutf8_decode, SLutf8_strlen, SLutf8_skip_char

1.6 SLutf8_encode

Synopsis

UTF-8 encode a character

Usage

```
SLuchar_Type *SLutf8_encode (w, u, ulen)
```

```
    SLwchar_Type w;  
    SLuchar_Type *u;  
    unsigned int ulen;
```

Description

This function UTF-8 encodes the Unicode character represented by `w` and stored the encoded representation in the buffer of size `ulen` bytes at `u`. The function will return `NULL` if the size of the buffer is too small to represent the UTF-8 encoded character, otherwise it will return a pointer to the byte following encoded representation.

Notes

This function does not null terminate the resulting byte sequence. The function `SLutf8_encode_null_terminate` may be used for that purpose.

To guarantee that the buffer is large enough to hold the encoded bytes, its size should be at least `SLUTF8_MAX_BLEN` bytes.

The function will encode illegal Unicode characters, i.e., characters in the range `0xD800-0xFFFF` (the UTF-16 surrogates) and `0xFFFE-0xFFFF`.

See Also

`SLutf8_decode`, `SLutf8_encode_bytes`, `SLutf8_encode_null_terminate`

1.7 SLutf8_strlen

Synopsis

Determine the number of characters in a UTF-8 sequence

Usage

```
unsigned int SLutf8_strlen (SLuchar_Type *s, int ignore_combining)
```

Description

This function may be used to determine the number of characters represented by the null-terminated UTF-8 byte sequence. If the `ignore_combining` parameter is non-zero, then Unicode combining characters will not be counted.

See Also

`SLutf8_skip_chars`, `SLutf8_decode`

1.8 SLutf8_extract_utf8_char

Synopsis

Extract a UTF-8 encoded character

Usage

```
SLuchar_Type *SLutf8_extract_utf8_char (u, umax, buf)

SLuchar_Type *u, *umax, *buf;
```

Description

This function extracts the bytes representing UTF-8 encoded character at `u` and places them in the buffer `buf`, and then null terminates the result. The buffer is assumed to consist of at least `SLUTF8_MAX_BLEN+1` bytes, where the extra byte may be necessary for null termination. No attempt will be made to examine the characters at `umax` and beyond. If the byte-sequence at `u` is an illegal or invalid UTF-8 sequence, then the byte at `u` will be copied to the buffer. The function returns a pointer to the byte following copied bytes.

Notes

One may think of this function as the single byte analogue of

```
if (u < umax)
{
    buf[0] = *u++;
    buf[1] = 0;
}
```

See Also

`SLutf8_decode`, `SLutf8_skip_char`

1.9 SLutf8_encode_null_terminate

Synopsis

UTF-8 encode a character and null terminate the result

Usage

```
SLuchar_Type *SLutf8_encode_null_terminate (w, buf)

SLwchar_Type w;
SLuchar_Type *buf;
```

Description

This function has the same functionality as `SLutf8_encode`, except that it also null terminates the encoded sequences. The buffer `buf`, where the encoded sequence is placed, is assumed to consist of at least `SLUTF8_MAX_BLEN+1` bytes.

See Also

`SLutf8_encode`

1.10 SLutf8_strup

Synopsis

Uppercase a UTF-8 encoded string

Usage

```
SLuchar_Type *SLutf8_strup (SLuchar_Type *u, SLuchar_Type *umax)
```

Description

The `SLutf8_strup` function returns the uppercase equivalent of UTF-8 encoded sequence of `umax-u` bytes at `u`. The result will be returned as a null-terminated `SLstring` and should be freed with `SLang_free_slstring` when it is no longer needed. If the function encounters an invalid or illegal byte sequence, then the byte-sequence will be copied as as-is.

See Also

`SLutf8_strlow`, `SLwchar_toupper`

1.11 SLutf8_strlo

Synopsis

Lowercase a UTF-8 encoded string

Usage

```
SLuchar_Type *SLutf8_strlo (SLuchar_Type *u, SLuchar_Type *umax)
```

Description

The `SLutf8_strlo` function returns the lowercase equivalent of UTF-8 encoded sequence of `umax-u` bytes at `u`. The result will be returned as a null-terminated `SLstring` and should be freed with `SLang_free_slstring` when it is no longer needed. If the function encounters an invalid or illegal byte sequence, then the byte-sequence will be copied as as-is.

See Also

`SLutf8_strlow`, `SLwchar_toupper`

1.12 SLutf8_subst_wchar

Synopsis

Replace a character in a UTF-8 encoded string

Usage

```
SLstr_Type *SLutf8_subst_wchar (u, umax, wch, nth, ignore_combining)
```

```
SLuchar_Type *u, *umax;  
SLwchar_Type wch;  
unsigned int nth;  
int ignore_combining;
```

Description

The `SLutf8_subst_wchar` function replaces the UTF-8 sequence representing the `n`th character of `u` by the UTF-8 representation of the character `wch`. If the value of the `ignore_combining` parameter is non-zero, then combining characters will not be counted when computing the position of the `n`th character. In addition, if the `n`th character contains any combining characters, then the byte-sequence associated with those characters will also be replaced.

Since the byte sequence representing `wch` could be longer than the sequence of the `n`th character, the function returns a new copy of the resulting string as an `SLSTRING`. Hence, the calling function should call `SLang_free_slstring` when the result is no longer needed.

See Also

`SLutf8_strup`, `SLutf8_strlow`, `SLutf8_skip_chars`, `SLutf8_strlen`

1.13 SLutf8_compare**Synopsis**

Compare two UTF-8 encoded sequences

Usage

```
int SLutf8_compare (a, amax, b, bmax, nchars, case_sensitive)

    SLuchar_Type *a, *amax;
    SLuchar_Type *b, *bmax;
    unsigned int nchars;
    int case_sensitive;
```

Description

This function compares `nchars` of one UTF-8 encoded character sequence to another by performing a character by character comparison. The function returns 0, +1, or -1 according to whether the string `a` is equal to, greater than, or less than the string `b`. At most `nchars` characters will be tested. The parameters `amax` and `bmax` serve as upper boundaries of the strings `a` and `b`, resp.

If the value of the `case_sensitive` parameter is non-zero, then a case-sensitive comparison will be performed, otherwise characters will be compared in a case-insensitive manner.

Notes

For case-sensitive comparisons, this function is analogous to the standard C library's `strncmp` function. However, `SLutf8_compare` can also cope with invalid or illegal UTF-8 sequences.

See Also

`SLutf8_strup`, `SLutf8_strlen`, `SLutf8_strlen`

2 Character classification functions**2.1 SLwchar_toupper****Synopsis**

Uppercase a Unicode character

Usage

```
SLwchar_Type SLwchar_toupper (SLwchar_Type wc)
```

Description

SLwchar_toupper returns the uppercase equivalent of the specified character.

Notes

If the library is not in UTF-8 mode, then the current locale will be used.

See Also

SLwchar_tolower, SLwchar_isupper, SLutf8_strup

2.2 SLwchar_tolower

Synopsis

Lowercase a Unicode character

Usage

```
SLwchar_Type SLwchar_tolower (SLwchar_Type wc)
```

Description

SLwchar_tolower returns the lowercase equivalent of the specified character.

Notes

If the library is not in UTF-8 mode, then the current locale will be used.

See Also

SLwchar_toupper, SLwchar_islower, SLutf8_strlow

2.3 SLwchar_wcwidth

Synopsis

Determine the displayable width of a wide character

Usage

```
int SLwchar_wcwidth (SLwchar_Type wc)
```

Description

This function returns the number of columns necessary to display the specified Unicode character. Combining characters are meant to be combined with other characters and, as such, have 0 width.

Notes

If the library is not in UTF-8 mode, then the current locale will be used.

See Also

SLwchar_isspace, SLwchar_iscntrl

2.4 SLwchar_isalnum

Synopsis

Determine if a Unicode character is alphanumeric

Usage

```
int SLwchar_isalnum (SLwchar_Type wc)
```

Description

SLwchar_isalnum returns a non-zero value if the Unicode character is alphanumeric, otherwise it returns 0.

Notes

If the library is not in UTF-8 mode, then the current locale will be used.

See Also

SLwchar_isalpha, SLwchar_isdigit, SLwchar_iscntrl

2.5 SLwchar_isalpha

Synopsis

Determine if a Unicode character is an alphabetic character

Usage

```
int SLwchar_isalpha (SLwchar_Type wc)
```

Description

SLwchar_isalpha returns a non-zero value if the Unicode character is alphabetic, otherwise it returns 0.

Notes

If the library is not in UTF-8 mode, then the current locale will be used.

See Also

SLwchar_isalnum, SLwchar_isalpha, SLwchar_isdigit, SLwchar_iscntrl

2.6 SLwchar_isblank

Synopsis

Determine if a Unicode character is a blank

Usage

```
int SLwchar_isblank (SLwchar_Type wc)
```

Description

SLwchar_isblank returns a non-zero value if the Unicode character is a blank one (space or tab), otherwise it returns 0.

Notes

If the library is not in UTF-8 mode, then the current locale will be used.

See Also

SLwchar_isspace, SLwchar_isalpha, SLwchar_isdigit, SLwchar_iscntrl

2.7 SLwchar_iscntrl**Synopsis**

Determine if a Unicode character is a control character

Usage

```
int SLwchar_iscntrl (SLwchar_Type wc)
```

Description

SLwchar_isblank returns a non-zero value if the Unicode character is a control character, otherwise it returns 0.

Notes

If the library is not in UTF-8 mode, then the current locale will be used.

See Also

SLwchar_isspace, SLwchar_isalpha, SLwchar_isdigit, SLwchar_isprint

2.8 SLwchar_isdigit**Synopsis**

Determine if a Unicode character is a digit

Usage

```
int SLwchar_isdigit (SLwchar_Type wc)
```

Description

This function returns a non-zero value if the specified Unicode character is a digit, otherwise it returns 0.

Notes

If the library is not in UTF-8 mode, then the current locale will be used.

See Also

SLwchar_isspace, SLwchar_isalpha, SLwchar_isxdigit, SLwchar_isprint

2.9 SLwchar_isgraph

Synopsis

Determine if a non-space Unicode character is printable

Usage

```
int SLwchar_isgraph (SLwchar_Type wc)
```

Description

This function returns a non-zero value if the specified Unicode character is a non-space printable character, otherwise it returns 0.

Notes

If the library is not in UTF-8 mode, then the current locale will be used.

See Also

SLwchar_isspace, SLwchar_isalpha, SLwchar_isdigit, SLwchar_isprint

2.10 SLwchar_islower

Synopsis

Determine if a Unicode character is alphanumeric

Usage

```
int SLwchar_islower (SLwchar_Type wc)
```

Description

This function returns a non-zero value if the specified Unicode character is a lowercase one, otherwise it returns 0.

Notes

If the library is not in UTF-8 mode, then the current locale will be used.

See Also

SLwchar_isupper, SLwchar_isspace, SLwchar_isalpha, SLwchar_isdigit, SLwchar_iscntrl

2.11 SLwchar_isprint

Synopsis

Determine if a Unicode character is printable

Usage

```
int SLwchar_isprint (SLwchar_Type wc)
```

Description

This function returns a non-zero value if the specified Unicode character is a printable one (includes space), otherwise it returns 0.

Notes

If the library is not in UTF-8 mode, then the current locale will be used.

See Also

`SLwchar_isgraph`, `SLwchar_isspace`, `SLwchar_isalpha`, `SLwchar_isdigit`

2.12 `SLwchar_ispunct`

Synopsis

Determine if a Unicode character is a punctuation character

Usage

```
int SLwchar_ispunct (SLwchar_Type wc)
```

Description

This function returns a non-zero value if the specified Unicode character is a punctuation character, otherwise it returns 0.

Notes

If the library is not in UTF-8 mode, then the current locale will be used.

See Also

`SLwchar_isspace`, `SLwchar_isalpha`, `SLwchar_isdigit`, `SLwchar_isprint`

2.13 `SLwchar_isspace`

Synopsis

Determine if a Unicode character is a whitespace character

Usage

```
int SLwchar_isspace (SLwchar_Type wc)
```

Description

This function returns a non-zero value if the specified Unicode character is a whitespace character, otherwise it returns 0.

Notes

If the library is not in UTF-8 mode, then the current locale will be used.

See Also

`SLwchar_isblank`, `SLwchar_isalpha`, `SLwchar_isdigit`, `SLwchar_ispunct`

2.14 SLwchar_isupper

Synopsis

Determine if a Unicode character is uppercase

Usage

```
int SLwchar_isupper (SLwchar_Type wc)
```

Description

This function returns a non-zero value if the specified Unicode character is an uppercase character, otherwise it returns 0.

Notes

If the library is not in UTF-8 mode, then the current locale will be used.

See Also

SLwchar_islower, SLwchar_isspace, SLwchar_isalpha, SLwchar_isdigit

2.15 SLwchar_isxdigit

Synopsis

Determine if a Unicode character is a hexadecimal digit

Usage

```
int SLwchar_isxdigit (SLwchar_Type wc)
```

Description

This function returns a non-zero value if the specified Unicode character is a hexadecimal digit character, otherwise it returns 0.

Notes

If the library is not in UTF-8 mode, then the current locale will be used.

See Also

SLwchar_isdigit, SLwchar_isspace, SLwchar_isalpha, SLwchar_ispunct

3 SLsearch interface Functions

3.1 SLsearch_new

Synopsis

Create an SLsearch_Type object

Usage

```
SLsearch_Type *SLsearch_new (SLuchar_Type *key, int search_flags)
```

Description

The `SLsearch_new` function instantiates an `SLsearch_Type` object for use in ordinary searches (non-regular expression) by the functions in the `SLsearch` interface. The first argument `key` is a pointer to a null terminated string that specifies the character string to be searched. This character string may not contain any embedded null characters.

The second argument `search_flags` is used to specify how the search is to be performed. It is a bit-mapped integer whose value is constructed by the bitwise-or of zero or more of the following:

`SLSEARCH_CASELESS`

The search shall be performed in a case-insensitive manner.

`SLSEARCH_UTF8`

Both the search string and the text to be searched is UTF-8 encoded.

Upon success, the function returns the newly created object, and `NULL` otherwise. When the search object is no longer needed, it should be freed via the `SLsearch_delete` function.

See Also

`SLsearch_delete`, `SLsearch_forward`, `SLsearch_backward`

3.2 SLsearch_delete**Synopsis**

Free the memory associated with a `SLsearch_Type` object

Usage

`SLsearch_delete (SLsearch_Type *)`

Description

This function should be called to free the memory associated with a `SLsearch_Type` object created by the `SLsearch_new` function. Failure to do so will result in a memory leak.

See Also

`SLsearch_new`, `SLsearch_forward`, `SLsearch_backward`

3.3 SLsearch_forward**Synopsis**

Search forward in a buffer

Usage

`SLuchar_Type SLsearch_forward (st, pmin, pmax)`

`SLsearch_Type *st;`

`SLuchar_Type *pmin, *pmax;`

Description

The `SLsearch_forward` function searches forward in the buffer defined by the pointers `pmin` and `pmax`. The starting point for the search is at the beginning of the buffer at `pmin`. At no point will the bytes at `pmax` and beyond be examined. The first parameter `st`, obtained by a prior call to `SLsearch_new`, specifies the object to found. be found from a previous call to `SLsearch_new`.

If the object was found, the pointer to the beginning of it will be returned. Otherwise, `SLsearch_forward` will return `NULL`. The length of the object may be obtained via the `SLsearch_match_len` function.

Notes

This function uses the Boyer-Moore search algorithm when possible.

See Also

`SLsearch_new`, `SLsearch_backward`, `SLsearch_delete`, `SLsearch_match_len`

3.4 SLsearch_backward

Synopsis

Search backward in a buffer

Usage

```
SLuchar_Type SLsearch_forward (st, pmin, pstart, pmax)
```

```
SLsearch_Type *st;  
SLuchar_Type *pmin, *pstart, *pmax;
```

Description

The `SLsearch_forward` function searches backward in the buffer defined by the pointers `pmin` and `pmax`. The starting point for the search is at the position `pstart`. At no point will the bytes at `pmax` and beyond be examined. The first parameter `st`, obtained by a prior call to `SLsearch_new`, specifies the object to found.

If the object was found, the pointer to the beginning of it will be returned. Otherwise, `SLsearch_forward` will return `NULL`. The length of the object may be obtained via the `SLsearch_match_len` function.

Notes

This function uses the Boyer-Moore search algorithm when possible.

It is possible for the end of match to appear after the point where the search began (`pstart`).

See Also

`SLsearch_new`, `SLsearch_forward`, `SLsearch_delete`, `SLsearch_match_len`

3.5 SLsearch_match_len

Synopsis

Get the length of the previous match

Usage

```
unsigned int SLsearch_match_len (SLsearch_Type *st)
```

Description

The `SLsearch_match_len` function returns the length of the match from the most recent search involving the specified `SLsearch_Type` object. If the most recent search was unsuccessful, the function will return 0.

See Also

`SLsearch_forward`, `SLsearch_backward`, `SLsearch_new`, `SLsearch_delete`

4 Screen Management (SLsmg) functions

4.1 SLsmg_fill_region

Synopsis

Fill a rectangular region with a character

Usage

```
void SLsmg_fill_region (r, c, nr, nc, ch)
```

```
    int r  
    int c  
    unsigned int nr  
    unsigned int nc  
    unsigned char ch
```

Description

The `SLsmg_fill_region` function may be used to a rectangular region with the character `ch` in the current color. The rectangle's upper left corner is at row `r` and column `c`, and spans `nr` rows and `nc` columns. The position of the virtual cursor will be left at `(r, c)`.

See Also

`SLsmg_write_char`, `SLsmg_set_color`

4.2 SLsmg_set_char_set

Synopsis

Turn on or off line drawing characters

Usage

```
void SLsmg_set_char_set (int a);
```


Description

SLsmg_set_char_set may be used to select or deselect the line drawing character set as the current character set. If `a` is non-zero, the line drawing character set will be selected. Otherwise, the standard character set will be selected.

Notes

There is no guarantee that this function will actually enable the use of line drawing characters. All it does is cause subsequent characters to be rendered using the terminal's alternate character set. Such character sets usually contain line drawing characters.

See Also

SLsmg_write_char, SLtt_get_terminfo

4.3 int SLsmg_Scroll_Hash_Border;**Synopsis**

Set the size of the border for the scroll hash

Usage

```
int SLsmg_Scroll_Hash_Border = 0;
```

Description

This variable may be used to ignore the characters that occur at the beginning and the end of a row when performing the hash calculation to determine whether or not a line has scrolled. The default value is zero which means that all the characters on a line will be used.

See Also

SLsmg_refresh

4.4 SLsmg_suspend_smg**Synopsis**

Suspend screen management

Usage

```
int SLsmg_suspend_smg (void)
```

Description

SLsmg_suspend_smg can be used to suspend the state of the screen management facility during suspension of the program. Use of this function will reset the display back to its default state. The function SLsmg_resume_smg should be called after suspension.

It returns zero upon success, or -1 upon error.

This function is similar to SLsmg_reset_smg except that the state of the display prior to calling SLsmg_suspend_smg is saved.

See Also

SLsmg_resume_smg, SLsmg_reset_smg

4.5 SLsmg_resume_smg

Synopsis

Resume screen management

Usage

```
int SLsmg_resume_smg (void)
```

Description

SLsmg_resume_smg should be called after SLsmg_suspend_smg to redraw the display exactly like it was before SLsmg_suspend_smg was called. It returns zero upon success, or -1 upon error.

See Also

SLsmg_suspend_smg

4.6 SLsmg_erase_eol

Synopsis

Erase to the end of the row

Usage

```
void SLsmg_erase_eol (void);
```

Description

SLsmg_erase_eol erases all characters from the current position to the end of the line. The newly created space is given the color of the current color. This function has no effect on the position of the virtual cursor.

See Also

SLsmg_gotoirc, SLsmg_erase_eos, SLsmg_fill_region

4.7 SLsmg_gotoirc

Synopsis

Move the virtual cursor

Usage

```
void SLsmg_gotoirc (int r, int c)
```

Description

The SLsmg_gotoirc function moves the virtual cursor to the row `r` and column `c`. The first row and first column is specified by `r = 0` and `c = 0`.

See Also

SLsmg_refresh

4.8 SLsmg_erase_eos

Synopsis

Erase to the end of the screen

Usage

```
void SLsmg_erase_eos (void);
```

Description

The `SLsmg_erase_eos` is like `SLsmg_erase_eol` except that it erases all text from the current position to the end of the display. The current color will be used to set the background of the erased area.

See Also

`SLsmg_erase_eol`

4.9 SLsmg_reverse_video

Synopsis

Set the current color to 1

Usage

```
void SLsmg_reverse_video (void);
```

Description

This function is nothing more than `SLsmg_set_color(1)`.

See Also

`SLsmg_set_color`

4.10 SLsmg_set_color (int)

Synopsis

Set the current color

Usage

```
void SLsmg_set_color (int c);
```

Description

`SLsmg_set_color` is used to set the current color. The parameter `c` is really a color object descriptor. Actual foreground and background colors as well as other visual attributes may be associated with a color descriptor via the `SLtt_set_color` function.

Example

This example defines color 7 to be green foreground on black background and then displays some text in this color:

```
SLtt_set_color (7, NULL, "green", "black");
SLsmg_set_color (7);
SLsmg_write_string ("Hello");
SLsmg_refresh ();
```

Notes

It is important to understand that the screen management routines know nothing about the actual colors associated with a color descriptor. Only the descriptor itself is used by the SLsmg routines. The lower level SLtt interface converts the color descriptors to actual colors. Thus

```
SLtt_set_color (7, NULL, "green", "black");
SLsmg_set_color (7);
SLsmg_write_string ("Hello");
SLtt_set_color (7, NULL, "red", "blue");
SLsmg_write_string ("World");
SLsmg_refresh ();
```

will result in "hello" displayed in red on blue and *not* green on black.

See Also

SLtt_set_color, SLtt_set_color_object

4.11 SLsmg_normal_video

Synopsis

Set the current color to 0

Usage

```
void SLsmg_normal_video (void);
```

Description

SLsmg_normal_video sets the current color descriptor to 0.

See Also

SLsmg_set_color

4.12 SLsmg_printf

Synopsis

Format a string on the virtual display

Usage

```
void SLsmg_printf (char *fmt, ...)
```

Description

SLsmg_printf format a printf style variable argument list and writes it on the virtual display. The virtual cursor will be moved to the end of the string.

See Also

SLsmg_write_string, SLsmg_vprintf

4.13 SLsmg_vprintf

Synopsis

Format a string on the virtual display

Usage

```
void SLsmg_vprintf (char *fmt, va_list ap)
```

Description

SLsmg_vprintf formats a string in the manner of *vprintf* and writes the result to the display. The virtual cursor is advanced to the end of the string.

See Also

SLsmg_write_string, SLsmg_printf

4.14 SLsmg_write_string

Synopsis

Write a character string on the display

Usage

```
void SLsmg_write_string (char *s)
```

Description

The function SLsmg_write_string displays the string *s* on the virtual display at the current position and moves the position to the end of the string.

See Also

SLsmg_printf, SLsmg_write_nstring

4.15 SLsmg_write_nstring

Synopsis

Write the first *n* characters of a string on the display

Usage

```
void SLsmg_write_nstring (char *s, unsigned int n);
```

Description

SLsmg_write_nstring writes the first *n* characters of *s* to this virtual display. If the length of the string *s* is less than *n*, the spaces will be used until *n* characters have been written. *s* can be NULL, in which case *n* spaces will be written.

See Also

SLsmg_write_string, SLsmg_write_nchars

4.16 SLsmg_write_char

Synopsis

Write a character to the virtual display

Usage

```
void SLsmg_write_char (char ch);
```

Description

SLsmg_write_char writes the character `ch` to the virtual display.

See Also

SLsmg_write_nchars, SLsmg_write_string

4.17 SLsmg_write_nchars

Synopsis

Write `n` characters to the virtual display

Usage

```
void SLsmg_write_nchars (char *s, unsigned int n);
```

Description

SLsmg_write_nchars writes at most `n` characters from the string `s` to the display. If the length of `s` is less than `n`, the whole length of the string will get written.

This function differs from SLsmg_write_nstring in that SLsmg_write_nstring will pad the string to write exactly `n` characters. SLsmg_write_nchars does not perform any padding.

See Also

SLsmg_write_nchars, SLsmg_write_nstring

4.18 SLsmg_write_wrapped_string

Synopsis

Write a string to the display with wrapping

Usage

```
void SLsmg_write_wrapped_string (s, r, c, nr, nc, fill)
```

```
    char *s  
    int r, c  
    unsigned int nr, nc  
    int fill
```

Description

SLsmg_write_wrapped_string writes the string `s` to the virtual display. The string will be confined to the rectangular region whose upper right corner is at row `r` and column `c`, and consists of `nr` rows and `nc` columns. The string will be wrapped at the boundaries of the box. If `fill` is non-zero, the last line to which characters have been written will get padded with spaces.

Notes

This function does not wrap on word boundaries. However, it will wrap when a newline character is encountered.

See Also

`SLsmg_write_string`

4.19 SLsmg_cls**Synopsis**

Clear the virtual display

Usage

```
void SLsmg_cls (void)
```

Description

`SLsmg_cls` erases the virtual display using the current color. This will cause the physical display to get cleared the next time `SLsmg_refresh` is called.

Notes

This function is not the same as

```
SLsmg_gotoxc (0,0); SLsmg_erase_eos ();
```

since these statements do not guarantee that the physical screen will get cleared.

See Also

`SLsmg_refresh`, `SLsmg_erase_eos`

4.20 SLsmg_refresh**Synopsis**

Update physical screen

Usage

```
void SLsmg_refresh (void)
```

Description

The `SLsmg_refresh` function updates the physical display to look like the virtual display.

See Also

`SLsmg_suspend_smg`, `SLsmg_init_smg`, `SLsmg_reset_smg`

4.21 SLsmg_touch_lines

Synopsis

Mark lines on the virtual display for redisplay

Usage

```
void SLsmg_touch_lines (int r, unsigned int nr)
```

Description

SLsmg_touch_lines marks the nr lines on the virtual display starting at row r for redisplay upon the next call to SLsmg_refresh.

Notes

This function should rarely be called, if ever. If you find that you need to call this function, then your application should be modified to properly use the SLsmg screen management routines. This function is provided only for curses compatibility.

See Also

SLsmg_refresh

4.22 SLsmg_init_smg

Synopsis

Initialize the SLsmg routines

Usage

```
int SLsmg_init_smg (void)
```

Description

The SLsmg_init_smg function initializes the SLsmg screen management routines. Specifically, this function allocates space for the virtual display and calls SLtt_init_video to put the terminal's physical display in the proper state. It is up to the caller to make sure that the SLtt routines are initialized via SLtt_get_terminfo before calling SLsmg_init_smg.

This function should also be called any time the size of the physical display has changed so that it can reallocate a new virtual display to match the physical display.

It returns zero upon success, or -1 upon failure.

See Also

SLsmg_reset_smg

4.23 SLsmg_reset_smg

Synopsis

Reset the SLsmg routines

Usage

```
int SLsmg_reset_smg (void);
```


Description

SLsmg_reset_smg resets the SLsmg screen management routines by freeing all memory allocated while it was active. It also calls SLtt_reset_video to put the terminal's display in its default state.

See Also

SLsmg_init_smg

4.24 SLsmg_char_at**Synopsis**

Get the character at the current position on the virtual display

Usage

```
unsigned short SLsmg_char_at(void)
```

Description

The SLsmg_char_at function returns the character and its color at the current position on the virtual display.

See Also

SLsmg_read_raw, SLsmg_write_char

4.25 SLsmg_set_screen_start**Synopsis**

Set the origin of the virtual display

Usage

```
void SLsmg_set_screen_start (int *r, int *c)
```

Description

SLsmg_set_screen_start sets the origin of the virtual display to the row *r and the column *c. If either r or c is NULL, then the corresponding value will be set to 0. Otherwise, the location specified by the pointers will be updated to reflect the old origin.

See slang/demo/pager.c for how this function may be used to scroll horizontally.

See Also

SLsmg_init_smg

4.26 SLsmg_draw_hline**Synopsis**

Draw a horizontal line

Usage

```
void SLsmg_draw_hline (unsigned int len)
```

Description

The `SLsmg_draw_hline` function draws a horizontal line of length `len` on the virtual display. The position of the virtual cursor is left at the end of the line.

See Also

`SLsmg_draw_vline`

4.27 SLsmg_draw_vline**Synopsis**

Draw a vertical line

Usage

```
void SLsmg_draw_vline (unsigned int len);
```

Description

The `SLsmg_draw_vline` function draws a vertical line of length `len` on the virtual display. The position of the virtual cursor is left at the end of the line.

See Also

??

4.28 SLsmg_draw_object**Synopsis**

Draw an object from the alternate character set

Usage

```
void SLsmg_draw_object (int r, int c, unsigned char obj)
```

Description

The `SLsmg_draw_object` function may be used to place the object specified by `obj` at row `r` and column `c`. The object is really a character from the alternate character set and may be specified using one of the following constants:

<code>SLSMG_HLINE_CHAR</code>	Horizontal line
<code>SLSMG_VLINE_CHAR</code>	Vertical line
<code>SLSMG_ULCORN_CHAR</code>	Upper left corner
<code>SLSMG_URCORN_CHAR</code>	Upper right corner
<code>SLSMG_LLCORN_CHAR</code>	Lower left corner
<code>SLSMG_LRCORN_CHAR</code>	Lower right corner
<code>SLSMG_CKBRD_CHAR</code>	Checkboard character
<code>SLSMG_RTEE_CHAR</code>	Right Tee
<code>SLSMG_LTEE_CHAR</code>	Left Tee
<code>SLSMG_UTEES_CHAR</code>	Up Tee
<code>SLSMG_DTEES_CHAR</code>	Down Tee
<code>SLSMG_PLUS_CHAR</code>	Plus or Cross character

See Also

SLsmg_draw_vline, SLsmg_draw_hline, SLsmg_draw_box

4.29 SLsmg_draw_box**Synopsis**

Draw a box on the virtual display

Usage

```
void SLsmg_draw_box (int r, int c, unsigned int dr, unsigned int dc)
```

Description

SLsmg_draw_box uses the SLsmg_draw_hline and SLsmg_draw_vline functions to draw a rectangular box on the virtual display. The box's upper left corner is placed at row `r` and column `c`. The width and length of the box is specified by `dc` and `dr`, respectively.

See Also

SLsmg_draw_vline, SLsmg_draw_hline, SLsmg_draw_object

4.30 SLsmg_set_color_in_region**Synopsis**

Change the color of a specified region

Usage

```
void SLsmg_set_color_in_region (color, r, c, dr, dc)
```

```
int color;  
int r, c;  
unsigned int dr, dc;
```

Description

SLsmg_set_color_in_region may be used to change the color of a rectangular region whose upper left corner is given by `(r,c)`, and whose width and height is given by `dc` and `dr`, respectively. The color of the region is given by the `color` parameter.

See Also

SLsmg_draw_box, SLsmg_set_color

4.31 SLsmg_get_column**Synopsis**

Get the column of the virtual cursor

Usage

```
int SLsmg_get_column(void);
```

Description

The `SLsmg_get_column` function returns the current column of the virtual cursor on the virtual display.

See Also

`SLsmg_get_row`, `SLsmg_gotorc`

4.32 SLsmg_get_row**Synopsis**

Get the row of the virtual cursor

Usage

```
int SLsmg_get_row(void);
```

Description

The `SLsmg_get_row` function returns the current row of the virtual cursor on the virtual display.

See Also

`SLsmg_get_column`, `SLsmg_gotorc`

4.33 SLsmg_forward**Synopsis**

Move the virtual cursor forward `n` columns

Usage

```
void SLsmg_forward (int n);
```

Description

The `SLsmg_forward` function moves the virtual cursor forward `n` columns.

See Also

`SLsmg_gotorc`

4.34 SLsmg_write_color_chars**Synopsis**

Write characters with color descriptors to virtual display

Usage

```
void SLsmg_write_color_chars (unsigned short *s, unsigned int len)
```

Description

The `SLsmg_write_color_chars` function may be used to write `len` characters, each with a different color descriptor to the virtual display. Each character and its associated color are encoded as an `unsigned short` such that the lower eight bits form the character and the next eight bits form the color.

See Also

SLsmg_char_at, SLsmg_write_raw

4.35 SLsmg_read_raw**Synopsis**

Read characters from the virtual display

Usage

```
unsigned int SLsmg_read_raw (SLsmg_Char_Type *buf, unsigned int len)
```

Description

SLsmg_read_raw attempts to read `len` characters from the current position on the virtual display into the buffer specified by `buf`. It returns the number of characters actually read. This number will be less than `len` if an attempt is made to read past the right margin of the display.

Notes

The purpose of the pair of functions, SLsmg_read_raw and SLsmg_write_raw, is to permit one to copy the contents of one region of the virtual display to another region.

See Also

SLsmg_char_at, SLsmg_write_raw

4.36 SLsmg_write_raw**Synopsis**

Write characters directly to the virtual display

Usage

```
unsigned int SLsmg_write_raw (unsigned short *buf, unsigned int len)
```

Description

The SLsmg_write_raw function attempts to write `len` characters specified by `buf` to the display at the current position. It returns the number of characters successfully written, which will be less than `len` if an attempt is made to write past the right margin.

Notes

The purpose of the pair of functions, SLsmg_read_raw and SLsmg_write_raw, is to permit one to copy the contents of one region of the virtual display to another region.

See Also

SLsmg_read_raw

5 Functions that deal with the interpreter

5.1 SLallocate_load_type

Synopsis

Allocate a SLang_Load_Type object

Usage

```
SLang_Load_Type *SLallocate_load_type (char *name)
```

Description

The `SLallocate_load_type` function allocates and initializes space for a `SLang_Load_Type` object and returns it. Upon failure, the function returns `NULL`. The parameter `name` must uniquely identify the object. For example, if the object represents a file, then `name` could be the absolute path name of the file.

See Also

`SLdeallocate_load_type`, `SLang_load_object`

5.2 SLdeallocate_load_type

Synopsis

Free a SLang_Load_Type object

Usage

```
void SLdeallocate_load_type (SLang_Load_Type *slt)
```

Description

This function frees the memory associated with a `SLang_Load_Type` object that was acquired from a call to the `SLallocate_load_type` function.

See Also

`SLallocate_load_type`, `SLang_load_object`

5.3 SLang_load_object

Synopsis

Load an object into the interpreter

Usage

```
int SLang_load_object (SLang_Load_Type *obj)
```

Description

The function `SLang_load_object` is a generic function that may be used to load an object of type `SLang_Load_Type` into the interpreter. For example, the functions `SLang_load_file` and `SLang_load_string` are wrappers around this function to load a file and a string, respectively.

See Also

`SLang_load_file`, `SLang_load_string`, `SLallocate_load_type`

5.4 SLclass_allocate_class

Synopsis

Allocate a class for a new data type

Usage

```
SLang_Class_Type *SLclass_allocate_class (char *name)
```

Description

The purpose of this function is to allocate and initialize space that defines a new data type or class called **name**. If successful, a pointer to the class is returned, or upon failure the function returns NULL.

This function does not automatically create the new data type. Callback functions must first be associated with the data type via functions such as `SLclass_set_push_function`, and the data type must be registered with the interpreter via `SLclass_register_class`. See the **S-Lang** library programmer's guide for more information.

See Also

`SLclass_register_class`, `SLclass_set_push_function`

5.5 SLclass_register_class

Synopsis

Register a new data type with the interpreter

Usage

```
int SLclass_register_class (c1, type, sizeof_type, class_type)
```

```
    SLang_Class_Type *c1
    SLtype type
    unsigned int sizeof_type
    SLclass_Type class_type
```

Description

The `SLclass_register_class` function is used to register a new class or data type with the interpreter. If successful, the function returns 0, or upon failure, it returns -1.

The first parameter, `c1`, must have been previously obtained via the `SLclass_allocate_class` function.

The second parameter, `type` specifies the data type of the new class. If set to `SLANG_VOID_TYPE` then the library will automatically allocate an unused value for the class (the allocated value can then be found using the `SLclass_get_class_id` function), otherwise a value greater than 255 should be used. The values in the range 0-255 are reserved for internal use by the library.

The size that the data type represents in bytes is specified by the third parameter, `sizeof_type`. This value should not be confused with the sizeof the structure that represents the data type, unless the data type is of class `SLANG_CLASS_TYPE_VECTOR` or `SLANG_CLASS_TYPE_SCALAR`. For pointer objects, the value of this parameter is just `sizeof(void *)`.

The final parameter specifies the class type of the data type. It must be one of the values:

```
SLANG_CLASS_TYPE_SCALAR
SLANG_CLASS_TYPE_VECTOR
SLANG_CLASS_TYPE_PTR
SLANG_CLASS_TYPE_MMT
```

The `SLANG_CLASS_TYPE_SCALAR` indicates that the new data type is a scalar. Examples of scalars in `SLANG_INT_TYPE` and `SLANG_DOUBLE_TYPE`.

Setting `class_type` to `SLANG_CLASS_TYPE_VECTOR` implies that the new data type is a vector, or a 1-d array of scalar types. An example of a data type of this class is the `SLANG_COMPLEX_TYPE`, which represents complex numbers.

`SLANG_CLASS_TYPE_PTR` specifies the data type is of a pointer type. Examples of data types of this class include `SLANG_STRING_TYPE` and `SLANG_ARRAY_TYPE`. Such types must provide for their own memory management.

Data types of class `SLANG_CLASS_TYPE_MMT` are pointer types except that the memory management, i.e., creation and destruction of the type, is handled by the interpreter. Such a type is called a *memory managed type*. An example of this data type is the `SLANG_FILEPTR_TYPE`.

Notes

See the S-Lang Library C Programmer's Guide for more information.

See Also

`SLclass_allocate_class`, `SLclass_get_class_id`

5.6 SLclass_set_string_function

Synopsis

Set a data type's string representation callback

Usage

```
int SLclass_set_string_function (cl, sfun)
```

```
SLang_Class_Type *cl
char *(*sfun) (SLtype, VOID_STAR);
```

Description

The `SLclass_set_string_function` routine is used to define a callback function, `sfun`, that will be used when a string representation of an object of the data type represented by `cl` is needed. `cl` must have already been obtained via a call to `SLclass_allocate_class`. When called, `sfun` will be passed two arguments: an `SLtype` which represents the data type, and the address of the object for which a string representation is required. The callback function must return a *malloced* string.

Upon success, `SLclass_set_string_function` returns zero, or upon error it returns -1.

Example

A callback function that handles both `SLANG_STRING_TYPE` and `SLANG_INT_TYPE` variables looks like:


```

char *string_and_int_callback (SLtype type, VOID_STAR addr)
{
    char buf[64];

    switch (type)
    {
        case SLANG_STRING_TYPE:
            return SMake_string (*(char **)addr);

        case SLANG_INTEGER_TYPE:
            sprintf (buf, "%d", *(int *)addr);
            return SMake_string (buf);
    }
    return NULL;
}

```

Notes

The default string callback simply returns the name of the data type.

See Also

SLclass_allocate_class, SLclass_register_class

5.7 SLclass_set_destroy_function**Synopsis**

Set the destroy method callback for a data type

Usage

```

int SLclass_set_destroy_function (cl, destroy_fun)

    SLang_Class_Type *cl
    void (*destroy_fun) (SLtype, VOID_STAR);

```

Description

SLclass_set_destroy_function is used to set the destroy callback for a data type. The data type's class `cl` must have been previously obtained via a call to `SLclass_allocate_class`. When called, `destroy_fun` will be passed two arguments: an `SLtype` which represents the data type, and the address of the object to be destroyed.

SLclass_set_destroy_function returns zero upon success, and -1 upon failure.

Example

The destroy method for `SLANG_STRING_TYPE` looks like:

```

static void string_destroy (SLtype type, VOID_STAR ptr)
{
    char *s = *(char **) ptr;
    if (s != NULL) SLang_free_slstring (*(char **) s);
}

```

Notes

Data types of class `SLANG_CLASS_TYPE_SCALAR` do not require a destroy callback. However, other classes do.

See Also

`SLclass_allocate_class`, `SLclass_register_class`

5.8 `SLclass_set_push_function`

Synopsis

Set the push callback for a new data type

Usage

```
int SLclass_set_push_function (cl, push_fun)

    SLang_Class_Type *cl
    int (*push_fun) (SLtype, VOID_STAR);
```

Description

`SLclass_set_push_function` is used to set the push callback for a new data type specified by `cl`, which must have been previously obtained via `SLclass_allocate_class`.

The parameter `push_fun` is a pointer to the push callback. It is required to take two arguments: an `SLtype` representing the data type, and the address of the object to be pushed. It must return zero upon success, or `-1` upon failure.

`SLclass_set_push_function` returns zero upon success, or `-1` upon failure.

Example

The push callback for `SLANG_COMPLEX_TYPE` looks like:

```
static int complex_push (SLtype type, VOID_STAR ptr)
{
    double *z = *(double **) ptr;
    return SLang_push_complex (z[0], z[1]);
}
```

See Also

`SLclass_allocate_class`, `SLclass_register_class`

5.9 `SLclass_set_pop_function`

Synopsis

Set the pop callback for a new data type

Usage

```
int SLclass_set_pop_function (cl, pop_fun)

    SLang_Class_Type *cl
    int (*pop_fun) (SLtype, VOID_STAR);
```

Description

`SLclass_set_pop_function` is used to set the callback for popping an object from the stack for a new data type specified by `cl`, which must have been previously obtained via `SLclass_allocate_class`.

The parameter `pop_fun` is a pointer to the pop callback function, which is required to take two arguments: an unsigned character representing the data type, and the address of the object to be popped. It must return zero upon success, or -1 upon failure.

`SLclass_set_pop_function` returns zero upon success, or -1 upon failure.

Example

The pop callback for `SLANG_COMPLEX_TYPE` looks like:

```
static int complex_push (SLtype type, VOID_STAR ptr)
{
    double *z = *(double **) ptr;
    return SLang_pop_complex (&z[0], &z[1]);
}
```

See Also

`SLclass_allocate_class`, `SLclass_register_class`

5.10 `SLclass_get_datatype_name`

Synopsis

Get the name of a data type

Usage

```
char *SLclass_get_datatype_name (SLtype type)
```

Description

The `SLclass_get_datatype_name` function returns the name of the data type specified by `type`. For example, if `type` is `SLANG_INT_TYPE`, the string "Integer_Type" will be returned.

This function returns a pointer that should not be modified or freed.

See Also

`SLclass_allocate_class`, `SLclass_register_class`

5.11 `SLang_free_mmt`

Synopsis

Free a memory managed type

Usage

```
void SLang_free_mmt (SLang_MMT_Type *mmt)
```

Description

The `SLang_MMT_Type` function is used to free a memory managed data type.

See Also

`SLang_object_from_mmt`, `SLang_create_mmt`

5.12 SLang_object_from_mmt

Synopsis

Get a pointer to the value of a memory managed type

Usage

```
VOID_STAR SLang_object_from_mmt (SLang_MMT_Type *mmt)
```

Description

The `SLang_object_from_mmt` function returns a pointer to the actual object whose memory is being managed by the interpreter.

See Also

`SLang_free_mmt`, `SLang_create_mmt`

5.13 SLang_create_mmt

Synopsis

Create a memory managed data type

Usage

```
SLang_MMT_Type *SLang_create_mmt (SLtype t, VOID_STAR ptr)
```

Description

The `SLang_create_mmt` function returns a pointer to a new memory managed object. This object contains information necessary to manage the memory associated with the pointer `ptr` which represents the application defined data type of type `t`.

See Also

`SLang_object_from_mmt`, `SLang_push_mmt`, `SLang_free_mmt`

5.14 SLang_push_mmt

Synopsis

Push a memory managed type

Usage

```
int SLang_push_mmt (SLang_MMT_Type *mmt)
```

Description

This function is used to push a memory managed type onto the interpreter stack. It returns zero upon success, or -1 upon failure.

See Also

`SLang_create_mmt`, `SLang_pop_mmt`

5.15 SLang_pop_mmt

Synopsis

Pop a memory managed data type

Usage

```
SLang_MMT_Type *SLang_pop_mmt (SLtype t)
```

Description

The `SLang_pop_mmt` function may be used to pop a memory managed type of type `t` from the stack. It returns a pointer to the memory managed object upon success, or `NULL` upon failure. The function `SLang_object_from_mmt` should be used to access the actual pointer to the data type.

See Also

`SLang_object_from_mmt`, `SLang_push_mmt`

5.16 SLang_inc_mmt

Synopsis

Increment a memory managed type reference count

Usage

```
void SLang_inc_mmt (SLang_MMT_Type *mmt);
```

Description

The `SLang_inc_mmt` function may be used to increment the reference count associated with the memory managed data type given by `mmt`.

See Also

`SLang_free_mmt`, `SLang_create_mmt`, `SLang_pop_mmt`, `SLang_pop_mmt`

5.17 SLadd_intrin_fun_table

Synopsis

Add a table of intrinsic functions to the interpreter

Usage

```
int SLadd_intrin_fun_table(SLang_Intrin_Fun_Type *tbl, char *pp_name);
```

Description

The `SLadd_intrin_fun_table` function adds an array, or table, of `SLang_Intrin_Fun_Type` objects to the interpreter. The first parameter, `tbl` specifies the table to be added. The second parameter `pp_name`, if non-`NULL` will be added to the list of preprocessor symbols.

This function returns `-1` upon failure or zero upon success.

Notes

A table should only be loaded one time and it is considered to be an error on the part of the application if it loads a table more than once.

See Also

`SLadd_intrin_var_table`, `SLadd_intrinsic_function`, `SLdefine_for_ifdef`

5.18 `SLadd_intrin_var_table`

Synopsis

Add a table of intrinsic variables to the interpreter

Usage

```
int SLadd_intrin_var_table (SLang_Intrin_Var_Type *tbl, char *pp_name);
```

Description

The `SLadd_intrin_var_table` function adds an array, or table, of `SLang_Intrin_Var_Type` objects to the interpreter. The first parameter, `tbl` specifies the table to be added. The second parameter `pp_name`, if non-NULL will be added to the list of preprocessor symbols.

This function returns -1 upon failure or zero upon success.

Notes

A table should only be loaded one time and it is considered to be an error on the part of the application if it loads a table more than once.

See Also

`SLadd_intrin_var_table`, `SLadd_intrinsic_function`, `SLdefine_for_ifdef`

5.19 `SLang_load_file`

Synopsis

Load a file into the interpreter

Usage

```
int SLang_load_file (char *fn)
```

Description

The `SLang_load_file` function opens the file whose name is specified by `fn` and feeds it to the interpreter, line by line, for execution. If `fn` is NULL, the function will take input from `stdin`.

If no error occurs, it returns 0; otherwise, it returns -1, and sets `SLang_Error` accordingly. For example, if it fails to open the file, it will return -1 with `SLang_Error` set to `SL_OBJ_NOPEN`.

Notes

If the hook `SLang_Load_File_Hook` declared as

```
int (*SLang_Load_File_Hook)(char *);
```

is non-NULL, the function point to by it will be used to load the file. For example, the **jed** editor uses this hook to load files via its own routines.

See Also

`SLang_load_object`, `SLang_load_string`

5.20 `SLang_restart`

Synopsis

Reset the interpreter after an error

Usage

```
void SLang_restart (int full)
```

Description

The `SLang_restart` function should be called by the application at top level if an error occurs. If the parameter `full` is non-zero, any objects on the **S-Lang** run time stack will be removed from the stack; otherwise, the stack will be left intact. Any time the stack is believed to be trashed, this routine should be called with a non-zero argument (e.g., if `setjmp/longjmp` is called).

Calling `SLang_restart` does not reset the global variable `SLang_Error` to zero. It is up to the application to reset that variable to zero after calling `SLang_restart`.

Example

```
while (1)
{
    if (SLang_Error)
    {
        SLang_restart (1);
        SLang_Error = 0;
    }
    (void) SLang_load_file (NULL);
}
```

See Also

`SLang_init_slang`, `SLang_load_file`

5.21 `SLang_byte_compile_file`

Synopsis

Byte-compile a file for faster loading

Usage

```
int SLang_byte_compile_file(char *fn, int reserved)
```

Description

The `SLang_byte_compile_file` function “byte-compiles” the file `fn` for faster loading by the interpreter. This produces a new file whose filename is equivalent to the one specified by `fn`, except that a `'c'` is appended to the name. For example, if `fn` is set to `init.sl`, then the new file will have the name `init.slc`. The meaning of the second parameter, `reserved`, is reserved for future use. For now, set it to 0.

The function returns zero upon success, or -1 upon error and sets `SLang_Error` accordingly.

See Also

`SLang_load_file`, `SLang_init_slang`

5.22 SLang_autoload

Synopsis

Autoload a function from a file

Usage

```
int SLang_autoload(char *funct, char *filename)
```

Description

The `SLang_autoload` function may be used to associate a `slang` function name `funct` with the file `filename` such that if `funct` has not already been defined when needed, it will be loaded from `filename`.

`SLang_autoload` has no effect if `funct` has already been defined. Otherwise it declares `funct` as a user-defined **S-Lang** function. It returns 0 upon success, or -1 upon error.

See Also

`SLang_load_file`, `SLang_is_defined`

5.23 SLang_load_string

Synopsis

Interpret a string

Usage

```
int SLang_load_string(char *str)
```

Description

The `SLang_load_string` function feeds the string specified by `str` to the interpreter for execution. It returns zero upon success, or -1 upon failure.

See Also

`SLang_load_file`, `SLang_load_object`

5.24 SLdo_pop

Synopsis

Delete an object from the stack

Usage

```
int SLdo_pop(void)
```

Description

This function removes an object from the top of the interpreter's run-time stack and frees any memory associated with it. It returns zero upon success, or -1 upon error (most likely due to a stack-underflow).

See Also

SLdo_pop_n, SLang_pop_integer, SLang_pop_string

5.25 SLdo_pop_n

Synopsis

Delete n objects from the stack

Usage

```
int SLdo_pop_n (unsigned int n)
```

Description

The SLdo_pop_n function removes the top n objects from the interpreter's run-time stack and frees all memory associated with the objects. It returns zero upon success, or -1 upon error (most likely due to a stack-underflow).

See Also

SLdo_pop, SLang_pop_integer, SLang_pop_string

5.26 SLang_pop_integer

Synopsis

Pop an integer off the stack

Usage

```
int SLang_pop_integer (int *i)
```

Description

The SLang_pop_integer function removes an integer from the top of the interpreter's run-time stack and returns its value via the pointer i. If successful, it returns zero. However, if the top stack item is not of type SLANG_INT_TYPE, or the stack is empty, the function will return -1 and set SLang_Error accordingly.

See Also

SLang_push_integer, SLang_pop_double

5.27 SLpop_string

Synopsis

Pop a string from the stack

Usage

```
int SLpop_string (char **strptr);
```

Description

The `SLpop_string` function pops a string from the stack and returns it as a malloced pointer. It is up to the calling routine to free this string via a call to `free` or `SLfree`. If successful, `SLpop_string` returns zero. However, if the top stack item is not of type `SLANG_STRING_TYPE`, or the stack is empty, the function will return -1 and set `SLang_Error` accordingly.

Example

```
define print_string (void)
{
    char *s;
    if (-1 == SLpop_string (&s))
        return;
    fputs (s, stdout);
    SLfree (s);
}
```

Notes

This function should not be confused with `SLang_pop_slstring`, which pops a *hashed* string from the stack.

See Also

`SLang_pop_slstring`. `SLfree`

5.28 SLang_pop_string

Synopsis

Pop a string from the stack

Usage

```
int SLang_pop_string(char **strptr, int *do_free)
```

Description

The `SLpop_string` function pops a string from the stack and returns it as a malloced pointer via `strptr`. After the function returns, the integer pointed to by the second parameter will be set to a non-zero value if `*strptr` should be freed via `free` or `SLfree`. If successful, `SLpop_string` returns zero. However, if the top stack item is not of type `SLANG_STRING_TYPE`, or the stack is empty, the function will return -1 and set `SLang_Error` accordingly.

Notes

This function is considered obsolete and should not be used by applications. If one requires a malloced string for modification, `SLpop_string` should be used. If one requires a constant string that will not be modified by the application, `SLang_pop_slstring` should be used.

See Also

`SLang_pop_slstring`, `SLpop_string`

5.29 SLang_pop_slstring

Synopsis

Pop a hashed string from the stack

Usage

```
int SLang_pop_slstring (char **s_ptr)
```

Description

The `SLang_pop_slstring` function pops a hashed string from the **S-Lang** run-time stack and returns it via `s_ptr`. It returns zero if successful, or -1 upon failure. The resulting string should be freed via a call to `SLang_free_slstring` after use.

Example

```
void print_string (void)
{
    char *s;
    if (-1 == SLang_pop_slstring (&s))
        return;
    fprintf (stdout, "%s\n", s);
    SLang_free_slstring (s);
}
```

Notes

`SLang_free_slstring` is the preferred function for popping strings. This is a result of the fact that the interpreter uses hashed strings as the native representation for string data.

One must *never* free a hashed string using `free` or `SLfree`. In addition, one must never make any attempt to modify a hashed string and doing so will result in memory corruption.

See Also

`SLang_free_slstring`, `SLpop_string`

5.30 SLang_pop_double

Synopsis

Pop a double from the stack

Usage

```
int SLang_pop_double (double *dptr)
```

Description

The `SLang_pop_double` function pops a double precision number from the stack and returns it via `dptr`. This function returns 0 upon success, otherwise it returns -1 and sets `SLang_Error` accordingly.

See Also

`SLang_pop_integer`, `SLang_push_double`

5.31 SLang_pop_complex**Synopsis**

Pop a complex number from the stack

Usage

```
int SLang_pop_complex (double *re, double *im)
```

Description

`SLang_pop_complex` pops a complex number from the stack and returns it via the parameters `re` and `im` as the real and imaginary parts of the complex number, respectively. This function automatically converts objects of type `SLANG_DOUBLE_TYPE` and `SLANG_INT_TYPE` to `SLANG_COMPLEX_TYPE`, if necessary. It returns zero upon success, or -1 upon error setting `SLang_Error` accordingly.

See Also

`SLang_pop_integer`, `SLang_pop_double`, `SLang_push_complex`

5.32 SLang_push_complex**Synopsis**

Push a complex number onto the stack

Usage

```
int SLang_push_complex (double re, double im)
```

Description

`SLang_push_complex` may be used to push the complex number whose real and imaginary parts are given by `re` and `im`, respectively. It returns zero upon success, or -1 upon error setting `SLang_Error` accordingly.

See Also

`SLang_pop_complex`, `SLang_push_double`

5.33 SLang_push_double**Synopsis**

Push a double onto the stack

Usage

```
int SLang_push_double(double d)
```

Description

SLang_push_double may be used to push the double precision floating point number `d` onto the interpreter's run-time stack. It returns zero upon success, or -1 upon error setting `SLang_Error` accordingly.

See Also

SLang_pop_double, SLang_push_integer

5.34 SLang_push_string

Synopsis

Push a string onto the stack

Usage

```
int SLang_push_string (char *s)
```

Description

SLang_push_string pushes a copy of the string specified by `s` onto the interpreter's run-time stack. It returns zero upon success, or -1 upon error setting `SLang_Error` accordingly.

Notes

If `s` is NULL, this function pushes NULL (`SLANG_NULL_TYPE`) onto the stack.

See Also

SLang_push_malloced_string

5.35 SLang_push_integer

Synopsis

Push an integer onto the stack

Usage

```
int SLang_push_integer (int i)
```

Description

SLang_push_integer the integer `i` onto the interpreter's run-time stack. It returns zero upon success, or -1 upon error setting `SLang_Error` accordingly.

See Also

SLang_pop_integer, SLang_push_double, SLang_push_string

5.36 SLang_push_malloced_string

Synopsis

Push a malloced string onto the stack

Usage

```
int SLang_push_malloced_string (char *s);
```

Description

SLang_push_malloced_string may be used to push a malloced string onto the interpreter's run-time stack. It returns zero upon success, or -1 upon error setting `SLang_Error` accordingly.

Example

The following example illustrates that it is up to the calling routine to free the string if `SLang_push_malloced_string` fails:

```
int push_hello (void)
{
    char *s = malloc (6);
    if (s == NULL) return -1;
    strcpy (s, "hello");
    if (-1 == SLang_push_malloced_string (s))
    {
        free (s);
        return -1;
    }
    return 0;
}
```

Example

The function `SLang_create_slstring` returns a hashed string. Such a string may not be malloced and should not be passed to `SLang_push_malloced_string`.

Notes

If `s` is `NULL`, this function pushes `NULL` (`SLANG_NULL_TYPE`) onto the stack.

See Also

`SLang_push_string`, `SLmake_string`

5.37 SLang_is_defined

Synopsis

Check to see if the interpreter defines an object

Usage

```
int SLang_is_defined (char *nm)
```

Description

The `SLang_is_defined` function may be used to determine whether or not a variable or function whose name is given by `em` has been defined. It returns zero if no such object has been defined. Otherwise it returns a non-zero value according to the following table:

1	intrinsic function
2	user-defined slang function
-1	intrinsic variable
-2	user-defined global variable

Note that variables correspond to negative numbers and functions are represented by positive numbers.

See Also

`SLadd_intrinsic_function`, `SLang_run_hooks`, `SLang_execute_function`

5.38 SLang_run_hooks**Synopsis**

Run a user-defined hook with arguments

Usage

```
int SLang_run_hooks (char *fname, unsigned int n, ...)
```

Description

The `SLang_run_hooks` function may be used to execute a user-defined function named `fname`. Before execution of the function, the `n` string arguments specified by the variable parameter list are pushed onto the stack. If the function `fname` does not exist, `SLang_run_hooks` returns zero; otherwise, it returns 1 upon successful execution of the function, or -1 if an error occurred.

Example

The `jed` editor uses `SLang_run_hooks` to setup the mode of a buffer based on the filename extension of the file associated with the buffer:

```
char *ext = get_filename_extension (filename);
if (ext == NULL) return -1;
if (-1 == SLang_run_hooks ("mode_hook", 1, ext))
    return -1;
return 0;
```

See Also

`SLang_is_defined`, `SLang_execute_function`

5.39 SLang_execute_function**Synopsis**

Execute a user or intrinsic function

Usage

```
int SLang_execute_function (char *fname)
```

Description

This function may be used to execute either a user-defined function or an intrinsic function. The name of the function is specified by `fname`. It returns zero if `fname` is not defined, or 1 if the function was successfully executed, or -1 upon error.

Notes

The function `Slexecute_function` may be a better alternative for some uses.

See Also

`SLang_run_hooks`, `Slexecute_function`, `SLang_is_defined`

5.40 SLang_get_function**Synopsis**

Get a pointer to a **S-Lang** function

Usage

```
SLang_Name_Type *SLang_get_function (char *fname)
```

Description

This function returns a pointer to the internal **S-Lang** table entry of a function whose name is given by `fname`. It returns `NULL` upon failure. The value returned by this function can be used `Slexecute_function` to call the function directly from C.

See Also

`Slexecute_function`

5.41 Slexecute_function**Synopsis**

Execute a **S-Lang** or intrinsic function

Usage

```
int Slexecute_function (SLang_Name_Type *nt)
```

Description

The `Slexecute_function` allows an application to call the **S-Lang** function specified by the `SLang_Name_Type` pointer `nt`. This parameter must be non `NULL` and must have been previously obtained by a call to `SLang_get_function`.

Example

Consider the **S-Lang** function:

```
define my_fun (x)
{
    return x^2 - 2;
}
```


Suppose that it is desired to call this function many times with different values of `x`. There are at least two ways to do this. The easiest way is to use `SLang_execute_function` by passing the string `"my_fun"`. A better way that is much faster is to use `SLEXecute_function`:

```
int sum_a_function (char *fname, double *result)
{
    double sum, x, y;
    SLang_Name_Type *nt;

    if (NULL == (nt = SLang_get_function (fname)))
        return -1;

    sum = 0;
    for (x = 0; x < 10.0; x += 0.1)
    {
        SLang_start_arg_list ();
        if (-1 == SLang_push_double (x))
            return -1;
        SLang_end_arg_list ();
        if (-1 == SLEXecute_function (nt))
            return -1;
        if (-1 == SLang_pop_double (&y))
            return -1;

        sum += y;
    }
    return sum;
}
```

Although not necessary in this case, `SLang_start_arg_list` and `SLang_end_arg_list` were used to provide the function with information about the number of parameters passed to it.

See Also

`SLang_get_function`, `SLang_start_arg_list`, `SLang_end_arg_list`

5.42 SLang_peek_at_stack

Synopsis

Find the type of object on the top of the stack

Usage

```
int SLang_peek_at_stack (void)
```

Description

The `SLang_peek_at_stack` function is useful for determining the data type of the object at the top of the stack. It returns the data type, or -1 upon a stack-underflow error. It does not remove anything from the stack.

See Also

`SLang_pop_string`, `SLang_pop_integer`

5.43 SLang_pop_fileptr

Synopsis

Pop a file pointer

Usage

```
int SLang_pop_fileptr (SLang_MMT_Type **mmt, FILE **fp)
```

Description

SLang_pop_fileptr pops a file pointer from the **S-Lang** run-time stack. It returns zero upon success, or -1 upon failure.

A **S-Lang** file pointer (SLANG_FILEPTR_TYPE) is actually a memory managed object. For this reason, SLang_pop_fileptr also returns the memory managed object via the argument list. It is up to the calling routine to call SLang_free_mmt to free the object.

Example

The following example illustrates an application defined intrinsic function that writes a user defined double precision number to a file. Note the use of SLang_free_mmt:

```
int write_double (void)
{
    double t;
    SLang_MMT_Type *mmt;
    FILE *fp;
    int status;

    if (-1 == SLang_pop_double (&d, NULL, NULL))
        return -1;
    if (-1 == SLang_pop_fileptr (&mmt, &fp))
        return -1;

    status = fwrite (&d, sizeof (double), 1, fp);
    SLang_free_mmt (mmt);
    return status;
}
```

This function can be used by a **S-Lang** function as follows:

```
define write_some_values ()
{
    variable fp, d;

    fp = fopen ("myfile.dat", "wb");
    if (fp == NULL)
        error ("file failed to open");
    for (d = 0; d < 10.0; d += 0.1)
    {
        if (-1 == write_double (fp, d))
            error ("write failed");
    }
    if (-1 == fclose (fp))
```

```

        error ("fclose failed");
    }

```

See Also

SLang_free_mmt, SLang_pop_double

5.44 SLadd_intrinsic_function

Synopsis

Add a new intrinsic function to the interpreter

Usage

```
int SLadd_intrinsic_function (name, f, type, nargs, ...)
```

```

    char *name
    FVOID_STAR f
    SLtype type
    unsigned int nargs

```

Description

The `SLadd_intrinsic_function` function may be used to add a new intrinsic function. The **S-Lang** name of the function is specified by `name` and the actual function pointer is given by `f`, cast to `FVOID_STAR`. The third parameter, `type` specifies the return type of the function and must be one of the following values:

```

    SLANG_VOID_TYPE   (returns nothing)
    SLANG_INT_TYPE    (returns int)
    SLANG_DOUBLE_TYPE (returns double)
    SLANG_STRING_TYPE (returns char *)

```

The `nargs` parameter specifies the number of parameters to pass to the function. The variable argument list following `nargs` must consists of `nargs` integers which specify the data type of each argument.

The function returns zero upon success or -1 upon failure.

Example

The `jed` editor uses this function to change the `system` intrinsic function to the following:

```

static int jed_system (char *cmd)
{
    if (Jed_Secure_Mode)
    {
        msg_error ("Access denied.");
        return -1;
    }
    return SLsystem (cmd);
}

```

After initializing the interpreter with `SLang_init_slang`, `jed` calls `SLadd_intrinsic_function` to substitute the above definition for the default **S-Lang** definition:

```

    if (-1 == SLadd_intrinsic_function ("system", (FVOID_STAR)jed_system,
                                        SLANG_INT_TYPE, 1,
                                        SLANG_STRING_TYPE))

        return -1;

```

See Also

SLadd_intrinsic_variable, SLadd_intrinsic_array

5.45 SLadd_intrinsic_variable**Synopsis**

Add an intrinsic variable to the interpreter

Usage

```

int SLadd_intrinsic_variable (name, addr, type, rdonly)

    char *name
    VOID_STAR addr
    SLtype type
    int rdonly

```

Description

The `SLadd_intrinsic_variable` function adds an intrinsic variable called `name` to the interpreter. The second parameter `addr` specifies the address of the variable (cast to `VOID_STAR`). The third parameter, `type`, specifies the data type of the variable. If the fourth parameter, `rdonly`, is non-zero, the variable will be interpreted by the interpreter as read-only.

If successful, `SLadd_intrinsic_variable` returns zero, otherwise it returns -1.

Example

Suppose that `My_Global_Int` is a global variable (at least not a local one):

```
int My_Global_Int;
```

It can be added to the interpreter via the function call

```

if (-1 == SLadd_intrinsic_variable ("MyGlobalInt",
                                    (VOID_STAR)&My_Global_Int,
                                    SLANG_INT_TYPE, 0))

    exit (1);

```

Notes

The current implementation requires all pointer type intrinsic variables to be read-only. For example,

```
char *My_Global_String;
```

is of type `SLANG_STRING_TYPE`, and must be declared as read-only. Finally, not that

```
char My_Global_Char_Buf[256];
```

is *not* a `SLANG_STRING_TYPE` object. This difference is very important because internally the interpreter dereferences the address passed to it to get to the value of the variable.

See Also

SLadd_intrinsic_function, SLadd_intrinsic_array

5.46 SLclass_add_unary_op

Synopsis

??

Usage

```
int SLclass_add_unary_op (SLtype,int (*) (int, SLtype, VOID_STAR, unsigned int,
VOID_STAR), int (*) (int, SLtype, SLtype *));
```

Description

??

See Also

??

5.47 SLclass_add_app_unary_op

Synopsis

??

Usage

```
int SLclass_add_app_unary_op (SLtype, int (*) (int,SLtype, VOID_STAR, unsigned
int,VOID_STAR),int (*) (int, SLtype, SLtype *));
```

Description

??

See Also

??

5.48 SLclass_add_binary_op

Synopsis

??

Usage

```
int SLclass_add_binary_op (SLtype, SLtype,int (*) (int, SLtype, VOID_STAR, unsigned
int,SLtype, VOID_STAR, unsigned int,VOID_STAR),int (*) (int, SLtype, SLtype, SLtype
*));
```

Description

??

See Also

??

5.49 SLclass_add_math_op

Synopsis

??

Usage

```
int SLclass_add_math_op (SLtype,int (*)(int,SLtype, VOID_STAR, unsigned
int,VOID_STAR),int (*)(int, SLtype, SLtype *));
```

Description

??

See Also

??

5.50 SLclass_add_typecast

Synopsis

??

Usage

```
int SLclass_add_typecast (SLtype, SLtype int (*)(*)_PROTO((SLtype, VOID_STAR, unsigned
int,SLtype, VOID_STAR)),int);
```

Description

??

See Also

??

6 Library Initialization Functions

6.1 SLang_init_slang

Synopsis

Initialize the interpreter

Usage

```
int SLang_init_slang (void)
```

Description

The `SLang_init_slang` function must be called by all applications that use the **S-Lang** interpreter. It initializes the interpreter, defines the built-in data types, and adds a set of core intrinsic functions.

The function returns 0 upon success, or -1 upon failure.

See Also

`SLang_init_slfile`, `SLang_init_slmath`, `SLang_init_slunix`

6.2 SLang_init_slfile

Synopsis

Initialize the interpreter file I/O intrinsics

Usage

```
int SLang_init_slfile (void)
```

Description

This function initializes the interpreters file I/O intrinsic functions. This function adds intrinsic functions such as `fopen`, `fclose`, and `fputs` to the interpreter. It returns 0 if successful, or -1 upon error.

Notes

Before this function can be called, it is first necessary to call `SLang_init_slang`. It also adds the preprocessor symbol `__SLFILE__` to the interpreter.

See Also

`SLang_init_slang`, `SLang_init_slunix`, `SLang_init_slmath`

6.3 SLang_init_slmath

Synopsis

Initialize the interpreter math intrinsics

Usage

```
int SLang_init_slmath (void)
```

Description

The `SLang_init_slmath` function initializes the interpreter's mathematical intrinsic functions and makes them available to the language. The intrinsic functions include `sin`, `cos`, `tan`, etc... It returns 0 if successful, or -1 upon failure.

Notes

This function must be called after `SLang_init_slang`. It adds the preprocessor symbol `__SLMATH__` to the interpreter.

See Also

`SLang_init_slang`, `SLang_init_slfile`, `SLang_init_slunix`

6.4 SLang_init_slunix

Synopsis

Make available some unix system calls to the interpreter

Usage

```
int SLang_init_slunix (void)
```

Description

The `SLang_init_slunix` function initializes the interpreter's unix system call intrinsic functions and makes them available to the language. Examples of functions made available by `SLang_init_slunix` include `chmod`, `chown`, and `stat_file`. It returns 0 if successful, or -1 upon failure.

Notes

This function must be called after `SLang_init_slang`. It adds the preprocessor symbol `__SLUNIX__` to the interpreter.

See Also

`SLang_init_slang`, `SLang_init_slfile`, `SLang_init_slmath`

7 Miscellaneous Functions

7.1 SLcurrent_time_string

Synopsis

Get the current time as a string

Usage

```
char *SLcurrent_time_string (void)
```

Description

The `SLcurrent_time_string` function uses the C library function `ctime` to obtain a string representation of the current date and time in the form

```
"Wed Dec 10 12:50:28 1997"
```

However, unlike the `ctime` function, a newline character is not present in the string.

The returned value points to a statically allocated memory block which may get overwritten on subsequent function calls.

See Also

`SLmake_string`

7.2 SLatoi

Synopsis

Convert a text string to an integer

Usage

```
int SLatoi(unsigned char *str
```

Description

`SLatoi` parses the string `str` to interpret it as an integer value. Unlike `atoi`, `SLatoi` can also parse strings containing integers expressed in hexadecimal (e.g., "0x7F") and octal (e.g., "012".) notation.

See Also

`SLang_guess_type`

7.3 SExtract_list_element

Synopsis

Extract a substring of a delimited string

Usage

```
int SExtract_list_element (dlist, nth, delim, buf, buflen)

    char *dlist;
    unsigned int nth;
    char delim;
    char *buf;
    unsigned int buflen;
```

Description

SExtract_list_element may be used to obtain the `nth` element of a list of strings, `dlist`, that are delimited by the character `delim`. The routine copies the `nth` element of `dlist` to the buffer `buf` whose size is `buflen` characters. It returns zero upon success, or -1 if `dlist` does not contain an `nth` element.

Example

A delimited list of strings may be turned into an array of strings as follows. For conciseness, all malloc error checking has been omitted.

```
int list_to_array (char *list, char delim, char ***ap)
{
    unsigned int nth;
    char **a;
    char buf[1024];

    /* Determine the size of the array */
    nth = 0;
    while (0 == SExtract_list_element (list, nth, delim, buf, sizeof(buf)))
        nth++;

    ap = (char **) SMalloc ((nth + 1) * sizeof (char **));
    nth = 0;
    while (0 == SExtract_list_element (list, nth, delim, buf, sizeof(buf)))
    {
        a[nth] = SMake_string (buf);
        nth++;
    }
    a[nth] = NULL;
    *ap = a;
    return 0;
}
```

See Also

SMalloc, SMake_string

8 Error and Messaging Functions

8.1 SLang_verror

Synopsis

Signal an error with a message

Usage

```
void SLang_verror (int code, char *fmt, ...);
```

Description

The `SLang_verror` function sets `SLang_Error` to `code` if `SLang_Error` is 0. It also displays the error message implied by the `printf` variable argument list using `fmt` as the format.

Example

```
FILE *open_file (char *file)
{
    char *file = "my_file.dat";
    if (NULL == (fp = fopen (file, "w")))
        SLang_verror (SL_INTRINSIC_ERROR, "Unable to open %s", file);
    return fp;
}
```

See Also

`SLang_vmessage`, `SLang_exit_error`

8.2 SLang_doerror

Synopsis

Signal an error

Usage

```
void SLang_doerror (char *err_str)
```

Description

The `SLang_doerror` function displays the string `err_str` to the error device and signals a **S-Lang** error.

Notes

`SLang_doerror` is considered to be obsolete. Applications should use the `SLang_verror` function instead.

See Also

`SLang_verror`, `SLang_exit_error`

8.3 SLang_vmessage

Synopsis

Display a message to the message device

Usage

```
void SLang_vmessage (char *fmt, ...)
```

Description

This function prints a `printf` style formatted variable argument list to the message device. The default message device is `stdout`.

See Also

`SLang_verror`

8.4 SLang_exit_error

Synopsis

Exit the program and display an error message

Usage

```
void SLang_exit_error (char *fmt, ...)
```

Description

The `SLang_exit_error` function terminates the program and displays an error message using a `printf` type variable argument list. The default behavior to this function is to write the message to `stderr` and exit with the `exit` system call.

If the function pointer `SLang_Exit_Error_Hook` is non-NULL, the function to which it points will be called. This permits an application to perform whatever cleanup is necessary. This hook has the prototype:

```
void (*SLang_Exit_Error_Hook)(char *, va_list);
```

See Also

`SLang_verror`, `exit`

9 String and Memory Allocation Functions

9.1 SMake_string

Synopsis

Duplicate a string

Usage

```
char *SMake_string (char *s)
```

Description

The `SLmake_string` function creates a new copy of the string `s`, via `malloc`, and returns it. Upon failure it returns `NULL`. Since the resulting string is malloced, it should be freed when no longer needed via a call to either `free` or `SLfree`.

Notes

`SLmake_string` should not be confused with the function `SLang_create_slstring`, which performs a similar function.

See Also

`SLmake_nstring`, `SLfree`, `SLmalloc`, `SLang_create_slstring`

9.2 `SLmake_nstring`

Synopsis

Duplicate a substring

Usage

```
char *SLmake_nstring (char *s, unsigned int n)
```

Description

This function is like `SLmake_string` except that it creates a null terminated string formed from the first `n` characters of `s`. Upon failure, it returns `NULL`, otherwise it returns the new string. When no longer needed, the returned string should be freed with `SLfree`.

See Also

`SLmake_string`, `SLfree`, `SLang_create_nslstring`

9.3 `SLang_create_nslstring`

Synopsis

Created a hashed substring

Usage

```
char *SLang_create_nslstring (char *s, unsigned int n)
```

Description

`SLang_create_nslstring` is like `SLang_create_slstring` except that only the first `n` characters of `s` are used to create the hashed string. Upon error, it returns `NULL`, otherwise it returns the hashed substring. Such a string must be freed by the function `SLang_free_slstring`.

Notes

Do not use `free` or `SLfree` to free the string returned by `SLang_create_slstring` or `SLang_create_nslstring`. Also it is important that no attempt is made to modify the hashed string returned by either of these functions. If one needs to modify a string, the functions `SLmake_string` or `SLmake_nstring` should be used instead.

See Also

`SLang_free_slstring`, `SLang_create_slstring`, `SLmake_nstring`

9.4 SLang_create_slstring

Synopsis

Create a hashed string

Usage

```
char *SLang_create_slstring (char *s)
```

Description

The `SLang_create_slstring` creates a copy of `s` and returns it as a hashed string. Upon error, the function returns `NULL`, otherwise it returns the hashed string. Such a string must only be freed via the `SLang_free_slstring` function.

Notes

Do not use `free` or `SLfree` to free the string returned by `SLang_create_slstring` or `SLang_create_nslstring`. Also it is important that no attempt is made to modify the hashed string returned by either of these functions. If one needs to modify a string, the functions `SLmake_string` or `SLmake_nstring` should be used instead.

See Also

`SLang_free_slstring`, `SLang_create_nslstring`, `SLmake_string`

9.5 SLang_free_slstring

Synopsis

Free a hashed string

Usage

```
void SLang_free_slstring (char *s)
```

Description

The `SLang_free_slstring` function is used to free a hashed string such as one returned by `SLang_create_slstring`, `SLang_create_nslstring`, or `SLang_create_static_slstring`. If `s` is `NULL`, the routine does nothing.

See Also

`SLang_create_slstring`, `SLang_create_nslstring`, `SLang_create_static_slstring`

9.6 SLang_concat_slstrings

Synopsis

Concatenate two strings to produce a hashed string

Usage

```
char *SLang_concat_slstrings (char *a, char *b)
```

Description

The `SLang_concat_slstrings` function concatenates two strings, `a` and `b`, and returns the result as a hashed string. Upon failure, `NULL` is returned.

Notes

A hashed string can only be freed using `SLang_free_slstring`. Never use `free` or `SLfree` to free a hashed string, otherwise memory corruption will result.

See Also

`SLang_free_slstring`, `SLang_create_slstring`

9.7 `SLang_create_static_slstring`

Synopsis

Create a hashed string

Usage

```
char *SLang_create_static_slstring (char *s_literal)
```

Description

The `SLang_create_static_slstring` creates a hashed string from the string literal `s_literal` and returns the result. Upon failure it returns `NULL`.

Example

```
char *create_hello (void)
{
    return SLang_create_static_slstring ("hello");
}
```

Notes

This function should only be used with string literals.

See Also

`SLang_create_slstring`, `SLang_create_nslstring`

9.8 `SLmalloc`

Synopsis

Allocate some memory

Usage

```
char *SLmalloc (unsigned int nbytes)
```

Description

This function uses `malloc` to allocate `nbytes` of memory. Upon error it returns `NULL`; otherwise it returns a pointer to the allocated memory. One should use `SLfree` to free the memory after use.

See Also

`SLfree`, `SLrealloc`, `SLcalloc`

9.9 SLcalloc

Synopsis

Allocate some memory

Usage

```
char *SLcalloc (unsigned int num_elem, unsigned int elem_size)
```

Description

This function uses `calloc` to allocate memory for `num_elem` objects with each of size `elem_size` and returns the result. In addition, the newly allocated memory is zeroed. Upon error it returns `NULL`; otherwise it returns a pointer to the allocated memory. One should use `SLfree` to free the memory after use.

See Also

`SLmalloc`, `SLrealloc`, `SLfree`

9.10 SLfree

Synopsis

Free some allocated memory

Usage

```
void SLfree (char *ptr)
```

Description

The `SLfree` function deallocates the memory specified by `ptr`, which may be `NULL` in which case the function does nothing.

Notes

Never use this function to free a hashed string returned by one of the family of `slstring` functions, e.g., `SLang_pop_slstring`.

See Also

`SLmalloc`, `SLcalloc`, `SLrealloc`, `SLmake_string`

9.11 SLrealloc

Synopsis

Resize a dynamic memory block

Usage

```
char *SLrealloc (char *ptr, unsigned int new_size)
```

Description

The `SLrealloc` uses the `realloc` function to resize the memory block specified by `ptr` to the new size `new_size`. If `ptr` is `NULL`, the function call is equivalent to `SLmalloc(new_size)`. Similarly, if `new_size` is zero, the function call is equivalent to `SLfree(ptr)`.

If the function fails, or if `new_size` is zero, `NULL` is returned. Otherwise a pointer is returned to the (possibly moved) new block of memory.

See Also

`SLfree`, `SLmalloc`, `SLcalloc`

10 Keyboard Input Functions

10.1 `SLang_init_tty`

Synopsis

Initialize the terminal keyboard interface

Usage

```
int SLang_init_tty (int intr_ch, int no_flow_ctrl, int opost)
```

Description

`SLang_init_tty` initializes the terminal for single character input. If the first parameter `intr_ch` is in the range 0-255, it will be used as the interrupt character, e.g., under Unix this character will generate a `SIGINT` signal. Otherwise, if it is `-1`, the interrupt character will be left unchanged.

If the second parameter `no_flow_ctrl` is non-zero, flow control (`XON/XOFF`) processing will be enabled.

If the last parameter `opost` is non-zero, output processing by the terminal will be enabled. If one intends to use this function in conjunction with the **S-Lang** screen management routines (`SLsmg`), this parameter should be set to zero.

`SLang_init_tty` returns zero upon success, or `-1` upon error.

Notes

Terminal I/O is a complex subject. The **S-Lang** interface presents a simplification that the author has found useful in practice. For example, the only special character processing that `SLang_init_tty` enables is that of the `SIGINT` character, and the generation of other signals via the keyboard is disabled. However, generation of the job control signal `SIGTSTP` is possible via the `SLtty_set_suspend_state` function.

Under Unix, the integer variable `SLang_TT_Read_FD` is used to specify the input descriptor for the terminal. If `SLang_TT_Read_FD` represents a terminal device as determined via the `isatty` system call, then it will be used as the terminal file descriptor. Otherwise, the terminal device `/dev/tty` will be used as the input device. The default value of `SLang_TT_Read_FD` is `-1` which causes `/dev/tty` to be used. So, if you prefer to use `stdin` for input, then set `SLang_TT_Read_FD` to `fileno(stdin)` *before* calling `SLang_init_tty`.

If the variable `SLang_TT_Baud_Rate` is zero when this function is called, the function will attempt to determine the baud rate by querying the terminal driver and set `SLang_TT_Baud_Rate` to that value.

See Also

`SLang_reset_tty`, `SLang_getkey`, `SLtty_set_suspend_state`

10.2 `SLang_reset_tty`

Synopsis

Reset the terminal

Usage

```
void SLang_reset_tty (void)
```

Description

`SLang_reset_tty` resets the terminal interface back to the state it was in before `SLang_init_tty` was called.

See Also

`SLang_init_tty`

10.3 `SLtty_set_suspend_state`

Synopsis

Enable or disable keyboard suspension

Usage

```
void SLtty_set_suspend_state (int s)
```

Description

The `SLtty_set_suspend_state` function may be used to enable or disable keyboard generation of the `SIGTSTP` job control signal. If `s` is non-zero, generation of this signal via the terminal interface will be enabled, otherwise it will be disabled.

This function should only be called after the terminal driver has been initialized via `SLang_init_tty`. The `SLang_init_tty` always disables the generation of `SIGTSTP` via the keyboard.

See Also

`SLang_init_tty`

10.4 `SLang_getkey`

Synopsis

Read a character from the keyboard

Usage

```
unsigned int SLang_getkey (void);
```

Description

The `SLang_getkey` reads a single character from the terminal and returns it. The terminal must first be initialized via a call to `SLang_init_tty` before this function can be called. Upon success, `SLang_getkey` returns the character read from the terminal, otherwise it returns `SLANG_GETKEY_ERROR`.

See Also

`SLang_init_tty`, `SLang_input_pending`, `SLang_ungetkey`

10.5 `SLang_ungetkey_string`

Synopsis

Unget a key string

Usage

```
int SLang_ungetkey_string (unsigned char *buf, unsigned int n)
```

Description

The `SLang_ungetkey_string` function may be used to push the `n` characters pointed to by `buf` onto the buffered input stream that `SLgetkey` uses. If there is not enough room for the characters, `-1` is returned and none are buffered. Otherwise, it returns zero.

Notes

The difference between `SLang_buffer_keystring` and `SLang_ungetkey_string` is that the `SLang_buffer_keystring` appends the characters to the end of the `getkey` buffer, whereas `SLang_ungetkey_string` inserts the characters at the beginning of the input buffer.

See Also

`SLang_ungetkey`, `SLang_getkey`

10.6 `SLang_buffer_keystring`

Synopsis

Append a keystring to the input buffer

Usage

```
int SLang_buffer_keystring (unsigned char *b, unsigned int len)
```

Description

`SLang_buffer_keystring` places the `len` characters specified by `b` at the *end* of the buffer that `SLang_getkey` uses. Upon success it returns 0; otherwise, no characters are buffered and it returns `-1`.

Notes

The difference between `SLang_buffer_keystring` and `SLang_ungetkey_string` is that the `SLang_buffer_keystring` appends the characters to the end of the `getkey` buffer, whereas `SLang_ungetkey_string` inserts the characters at the beginning of the input buffer.

See Also

`SLang_getkey`, `SLang_ungetkey`, `SLang_ungetkey_string`

10.7 SLang_ungetkey

Synopsis

Push a character back onto the input buffer

Usage

```
int SLang_ungetkey (unsigned char ch)
```

Description

SLang_ungetkey pushes the character `ch` back onto the `SLgetkey` input stream. Upon success, it returns zero, otherwise it returns 1.

Example

This function is implemented as:

```
int SLang_ungetkey (unsigned char ch)
{
    return SLang_ungetkey_string(&ch, 1);
}
```

See Also

SLang_getkey, SLang_ungetkey_string

10.8 SLang_flush_input

Synopsis

Discard all keyboard input waiting to be read

Usage

```
void SLang_flush_input (void)
```

Description

SLang_flush_input discards all input characters waiting to be read by the `SLang_getkey` function.

See Also

SLang_getkey

10.9 SLang_input_pending

Synopsis

Check to see if input is pending

Usage

```
int SLang_input_pending (int tsecs)
```

Description

`SLang_input_pending` may be used to see if an input character is available to be read without causing `SLang_getkey` to block. It will wait up to `tsecs` tenths of a second if no characters are immediately available for reading. If `tsecs` is less than zero, then `SLang_input_pending` will wait `-tsecs` milliseconds for input, otherwise `tsecs` represents 1/10 of a second intervals.

Notes

Not all systems support millisecond resolution.

See Also

`SLang_getkey`

10.10 SLang_set_abort_signal**Synopsis**

Set the signal to trap SIGINT

Usage

```
void SLang_set_abort_signal (void (*f)(int));
```

Description

`SLang_set_abort_signal` sets the function that gets triggered when the user presses the interrupt key (SIGINT) to the function `f`. If `f` is NULL the default handler will get installed.

Example

The default interrupt handler on a Unix system is:

```
static void default_sigint (int sig)
{
    SLKeyboard_Quit = 1;
    if (SLang_Ignore_User_Abort == 0) SLang_Error = SL_USER_BREAK;
    SLsignal_intr (SIGINT, default_sigint);
}
```

Notes

For Unix programmers, the name of this function may appear misleading since it is associated with SIGINT and not SIGABRT. The origin of the name stems from the original intent of the function: to allow the user to abort the running of a **S-Lang** interpreter function.

See Also

`SLang_init_tty`, `SLsignal_intr`

11 Keymap Functions**11.1 SLkm_define_key****Synopsis**

Define a key in a keymap

Usage

```
int SLkm_define_key (char *seq, FVOID_STAR f, SLKeyMap_List_Type *km)
```

Description

SLkm_define_key associates the key sequence `seq` with the function pointer `f` in the keymap specified by `km`. Upon success, it returns zero, otherwise it returns a negative integer upon error.

See Also

SLkm_define_keysym, SLang_define_key

11.2 SLang_define_key

Synopsis

Define a key in a keymap

Usage

```
int SLang_define_key(char *seq, char *fun, SLKeyMap_List_Type *km)
```

Description

SLang_define_key associates the key sequence `seq` with the function whose name is `fun` in the keymap specified by `km`.

See Also

SLkm_define_keysym, SLkm_define_key

11.3 SLkm_define_keysym

Synopsis

Define a keysym in a keymap

Usage

```
int SLkm_define_keysym (seq, ks, km)
```

```
    char *seq;  
    unsigned int ks;  
    SLKeyMap_List_Type *km;
```

Description

SLkm_define_keysym associates the key sequence `seq` with the keysym `ks` in the keymap `km`. Keysyms whose value is less than or equal to 0x1000 is reserved by the library and should not be used.

See Also

SLkm_define_key, SLang_define_key

11.4 SLang_undefine_key

Synopsis

Undefined a key from a keymap

Usage

```
void SLang_undefine_key(char *seq, SLKeyMap_List_Type *km);
```

Description

SLang_undefine_key removes the key sequence `seq` from the keymap `km`.

See Also

SLang_define_key

11.5 SLang_create_keymap

Synopsis

Create a new keymap

Usage

```
SLKeyMap_List_Type *SLang_create_keymap (name, km)
```

```
char *name;  
SLKeyMap_List_Type *km;
```

Description

SLang_create_keymap creates a new keymap called `name` by copying the key definitions from the keymap `km`. If `km` is `NULL`, the newly created keymap will be empty and it is up to the calling routine to initialize it via the `SLang_define_key` and `SLkm_define_keysym` functions. `SLang_create_keymap` returns a pointer to the new keymap, or `NULL` upon failure.

See Also

SLang_define_key, SLkm_define_keysym

11.6 SLang_do_key

Synopsis

Read a keysequence and return its keymap entry

Usage

```
SLang_Key_Type *SLang_do_key (kml, getkey)
```

```
SLKeyMap_List_Type *kml;  
int (*getkey)(void);
```

Description

The `SLang_do_key` function reads characters using the function specified by the `getKey` function pointer and uses the key sequence to return the appropriate entry in the keymap specified by `km1`.

`SLang_do_key` returns `NULL` if the key sequence is not defined by the keymap, otherwise it returns a pointer to an object of type `SLang_Key_Type`, which is defined in `slang.h` as

```
#define SLANG_MAX_KEYMAP_KEY_SEQ 14
typedef struct SLang_Key_Type
{
    struct SLang_Key_Type *next;
    union
    {
        char *s;
        FVOID_STAR f;
        unsigned int keysym;
    }
    f;
    unsigned char type;          /* type of function */
#define SLKEY_F_INTERPRET  0x01
#define SLKEY_F_INTRINSIC 0x02
#define SLKEY_F_KEYSYM    0x03
    unsigned char str[SLANG_MAX_KEYMAP_KEY_SEQ + 1]; /* key sequence */
}
SLang_Key_Type;
```

The `type` field specifies which field of the union `f` should be used. If `type` is `SLKEY_F_INTERPRET`, then `f.s` is a string that should be passed to the interpreter for evaluation. If `type` is `SLKEY_F_INTRINSIC`, then `f.f` refers to function that should be called. Otherwise, `type` is `SLKEY_F_KEYSYM` and `f.keysym` represents the value of the `keysym` that is associated with the key sequence.

See Also

`SLkm_define_keysym`, `SLkm_define_key`

11.7 SLang_find_key_function

Synopsis

Obtain a function pointer associated with a keymap

Usage

```
FVOID_STAR SLang_find_key_function (fname, km);
```

```
char *fname;
SLKeyMap_List_Type *km;
```

Description

The `SLang_find_key_function` routine searches through the `SLKeymap_Function_Type` list of functions associated with the keymap `km` for the function with name `fname`. If a matching function is found, a pointer to the function will be returned, otherwise `SLang_find_key_function` will return `NULL`.

See Also

`SLang_create_keymap`, `SLang_find_keymap`

11.8 SLang_find_keymap**Synopsis**

Find a keymap

Usage

```
SLKeyMap_List_Type *SLang_find_keymap (char *keymap_name);
```

Description

The `SLang_find_keymap` function searches through the list of keymaps looking for one whose name is `keymap_name`. If a matching keymap is found, the function returns a pointer to the keymap. It returns `NULL` if no such keymap exists.

See Also

`SLang_create_keymap`, `SLang_find_key_function`

11.9 SLang_process_keystring**Synopsis**

Un-escape a key-sequence

Usage

```
char *SLang_process_keystring (char *kseq);
```

Description

The `SLang_process_keystring` function converts an escaped key sequence to its raw form by converting two-character combinations such as `^A` to the *single* character `Ctrl-A` (ASCII 1). In addition, if the key sequence contains constructs such as `^(XX)`, where `XX` represents a two-character termcap specifier, the termcap escape sequence will be looked up and substituted.

Upon success, `SLang_process_keystring` returns a raw key-sequence whose first character represents the total length of the key-sequence, including the length specifier itself. It returns `NULL` upon failure.

Example

Consider the following examples:

```
SLang_process_keystring ("^XC");
SLang_process_keystring ("^[A");
```

The first example will return a pointer to a buffer of three characters whose ASCII values are given by `{3,24,3}`. Similarly, the second example will return a pointer to the four characters `{4,27,91,65}`. Finally, the result of

```
SLang_process_keystring ("^[^ (ku)");
```


will depend upon the termcap/terminfo capability "ku", which represents the escape sequence associated with the terminal's UP arrow key. For an ANSI terminal whose UP arrow produces "ESC [A", the result will be 5,27,27,91,65.

Notes

`SLang_process_keyststring` returns a pointer to a static area that will be overwritten on subsequent calls.

See Also

`SLang_define_key`, `SLang_make_keyststring`

11.10 `SLang_make_keyststring`

Synopsis

Make a printable key sequence

Usage

```
char *SLang_make_keyststring (unsigned char *ks);
```

Description

The `SLang_make_keyststring` function takes a raw key sequence `ks` and converts it to a printable form by converting characters such as ASCII 1 (ctrl-A) to `^A`. That is, it performs the opposite function of `SLang_process_keyststring`.

Notes

This function returns a pointer to a static area that will be overwritten on the next call to `SLang_make_keyststring`.

See Also

`SLang_process_keyststring`

12 Undocumented Functions

The following functions are not yet documented:

12.1 `SLprep_open_prep`

Synopsis

??

Usage

```
int SLprep_open_prep (SLPreprocess_Type *);
```

Description

??

See Also

??

12.2 SLprep_close_prep

Synopsis

??

Usage

```
void SLprep_close_prep (SLPreprocess_Type *);
```

Description

??

See Also

??

12.3 SLprep_line_ok

Synopsis

??

Usage

```
int SLprep_line_ok (char *, SLPreprocess_Type *);
```

Description

??

See Also

??

12.4 SLdefine_for_ifdef

Synopsis

??

Usage

```
int SLdefine_for_ifdef (char *);
```

Description

??

See Also

??

12.5 `SLang_Read_Line_Type` * `SLang_rline_save_line`
(`SLang_RLine_Info_Type` *);

Synopsis

??

Usage

```
SLang_Read_Line_Type * SLang_rline_save_line (SLang_RLine_Info_Type *);
```

Description

??

See Also

??

12.6 `int SLang_init_readline` (`SLang_RLine_Info_Type` *);

Synopsis

??

Usage

```
int SLang_init_readline (SLang_RLine_Info_Type *);
```

Description

??

See Also

??

12.7 `int SLang_read_line` (`SLang_RLine_Info_Type` *);

Synopsis

??

Usage

```
int SLang_read_line (SLang_RLine_Info_Type *);
```

Description

??

See Also

??

12.8 int SLang_rline_insert (char *);**Synopsis**

??

Usage

```
int SLang_rline_insert (char *);
```

Description

??

See Also

??

12.9 void SLrline_redraw (SLang_RLine_Info_Type *);**Synopsis**

??

Usage

```
void SLrline_redraw (SLang_RLine_Info_Type *);
```

Description

??

See Also

??

12.10 int SLtt_flush_output (void);**Synopsis**

??

Usage

```
int SLtt_flush_output (void);
```

Description

??

See Also

??

12.11 void SLtt_set_scroll_region(int, int);**Synopsis**

??

Usage

```
void SLtt_set_scroll_region(int, int);
```

Description

??

See Also

??

12.12 void SLtt_reset_scroll_region(void);**Synopsis**

??

Usage

```
void SLtt_reset_scroll_region(void);
```

Description

??

See Also

??

12.13 void SLtt_reverse_video (int);**Synopsis**

??

Usage

```
void SLtt_reverse_video (int);
```

Description

??

See Also

??

12.14 void SLtt_bold_video (void);**Synopsis**

??

Usage

void SLtt_bold_video (void);

Description

??

See Also

??

12.15 void SLtt_begin_insert(void);**Synopsis**

??

Usage

void SLtt_begin_insert(void);

Description

??

See Also

??

12.16 void SLtt_end_insert(void);**Synopsis**

??

Usage

void SLtt_end_insert(void);

Description

??

See Also

??

12.17 void SLtt_del_eol(void);**Synopsis**

??

Usage

```
void SLtt_del_eol(void);
```

Description

??

See Also

??

12.18 void SLtt_goto_rc (int, int);**Synopsis**

??

Usage

```
void SLtt_goto_rc (int, int);
```

Description

??

See Also

??

12.19 void SLtt_delete_nlines(int);**Synopsis**

??

Usage

```
void SLtt_delete_nlines(int);
```

Description

??

See Also

??

12.20 void SLtt_delete_char(void);**Synopsis**

??

Usage

```
void SLtt_delete_char(void);
```

Description

??

See Also

??

12.21 void SLtt_erase_line(void);**Synopsis**

??

Usage

```
void SLtt_erase_line(void);
```

Description

??

See Also

??

12.22 void SLtt_normal_video(void);**Synopsis**

??

Usage

```
void SLtt_normal_video(void);
```

Description

??

See Also

??

12.23 void SLtt_cls(void);**Synopsis**

??

Usage

```
void SLtt_cls(void);
```

Description

??

See Also

??

12.24 void SLtt_beep(void);**Synopsis**

??

Usage

```
void SLtt_beep(void);
```

Description

??

See Also

??

12.25 void SLtt_reverse_index(int);**Synopsis**

??

Usage

```
void SLtt_reverse_index(int);
```

Description

??

See Also

??

12.26 `void SLtt_smart_puts(unsigned short *, unsigned short *, int, int);`

Synopsis

??

Usage

```
void SLtt_smart_puts(unsigned short *, unsigned short *, int, int);
```

Description

??

See Also

??

12.27 `void SLtt_write_string (char *);`

Synopsis

??

Usage

```
void SLtt_write_string (char *);
```

Description

??

See Also

??

12.28 `void SLtt_putchar(char);`

Synopsis

??

Usage

```
void SLtt_putchar(char);
```

Description

??

See Also

??

12.29 int SLtt_init_video (void);**Synopsis**

??

Usage

```
int SLtt_init_video (void);
```

Description

??

See Also

??

12.30 int SLtt_reset_video (void);**Synopsis**

??

Usage

```
int SLtt_reset_video (void);
```

Description

??

See Also

??

12.31 void SLtt_get_terminfo(void);**Synopsis**

??

Usage

```
void SLtt_get_terminfo(void);
```

Description

??

See Also

??

12.32 void SLtt_get_screen_size (void);**Synopsis**

??

Usage

```
void SLtt_get_screen_size (void);
```

Description

??

See Also

??

12.33 int SLtt_set_cursor_visibility (int);**Synopsis**

??

Usage

```
int SLtt_set_cursor_visibility (int);
```

Description

??

See Also

??

12.34 int SLtt_initialize (char *);**Synopsis**

??

Usage

```
int SLtt_initialize (char *);
```

Description

??

See Also

??

12.35 void SLtt_enable_cursor_keys(void);**Synopsis**

??

Usage

```
void SLtt_enable_cursor_keys(void);
```

Description

??

See Also

??

12.36 void SLtt_set_term_vtxxx(int *);**Synopsis**

??

Usage

```
void SLtt_set_term_vtxxx(int *);
```

Description

??

See Also

??

12.37 void SLtt_set_color_esc (int, char *);**Synopsis**

??

Usage

```
void SLtt_set_color_esc (int, char *);
```

Description

??

See Also

??

12.38 void SLtt_wide_width(void);**Synopsis**

??

Usage

```
void SLtt_wide_width(void);
```

Description

??

See Also

??

12.39 void SLtt_narrow_width(void);**Synopsis**

??

Usage

```
void SLtt_narrow_width(void);
```

Description

??

See Also

??

12.40 int SLtt_set_mouse_mode (int, int);**Synopsis**

??

Usage

```
int SLtt_set_mouse_mode (int, int);
```

Description

??

See Also

??

12.41 void SLtt_set_alt_char_set (int);**Synopsis**

??

Usage

```
void SLtt_set_alt_char_set (int);
```

Description

??

See Also

??

12.42 int SLtt_write_to_status_line (char *, int);**Synopsis**

??

Usage

```
int SLtt_write_to_status_line (char *, int);
```

Description

??

See Also

??

12.43 void SLtt_disable_status_line (void);**Synopsis**

??

Usage

```
void SLtt_disable_status_line (void);
```

Description

??

See Also

??

12.44 char *SLtt_tgetstr (char *);**Synopsis**

??

Usage

```
char *SLtt_tgetstr (char *);
```

Description

??

See Also

??

12.45 int SLtt_tgetnum (char *);**Synopsis**

??

Usage

```
int SLtt_tgetnum (char *);
```

Description

??

See Also

??

12.46 int SLtt_tgetflag (char *);**Synopsis**

??

Usage

```
int SLtt_tgetflag (char *);
```

Description

??

See Also

??

12.47 char *SLtt_tigetent (char *);**Synopsis**

??

Usage

```
char *SLtt_tigetent (char *);
```

Description

??

See Also

??

12.48 char *SLtt_tigetstr (char *, char **);**Synopsis**

??

Usage

```
char *SLtt_tigetstr (char *, char **);
```

Description

??

See Also

??

12.49 int SLtt_tigetnum (char *, char **);**Synopsis**

??

Usage

```
int SLtt_tigetnum (char *, char **);
```

Description

??

See Also

??

12.50 SLtt_Char_Type SLtt_get_color_object (int);**Synopsis**

??

Usage

```
SLtt_Char_Type SLtt_get_color_object (int);
```

Description

??

See Also

??

12.51 void SLtt_set_color_object (int, SLtt_Char_Type);**Synopsis**

??

Usage

```
void SLtt_set_color_object (int, SLtt_Char_Type);
```

Description

??

See Also

??

12.52 void SLtt_set_color (int, char *, char *, char *);**Synopsis**

??

Usage

```
void SLtt_set_color (int, char *, char *, char *);
```

Description

??

See Also

??

12.53 `void SLtt_set_mono (int, char *, SLtt_Char_Type);`

Synopsis

??

Usage

```
void SLtt_set_mono (int, char *, SLtt_Char_Type);
```

Description

??

See Also

??

12.54 `void SLtt_add_color_attribute (int, SLtt_Char_Type);`

Synopsis

??

Usage

```
void SLtt_add_color_attribute (int, SLtt_Char_Type);
```

Description

??

See Also

??

12.55 `void SLtt_set_color_fgbg (int, SLtt_Char_Type, SLtt_Char_Type);`

Synopsis

??

Usage

```
void SLtt_set_color_fgbg (int, SLtt_Char_Type, SLtt_Char_Type);
```

Description

??

See Also

??

12.56 int SLkp_define_keysym (char *, unsigned int);**Synopsis**

??

Usage

```
int SLkp_define_keysym (char *, unsigned int);
```

Description

??

See Also

??

12.57 int SLkp_init (void);**Synopsis**

??

Usage

```
int SLkp_init (void);
```

Description

??

See Also

??

12.58 int SLkp_getkey (void);**Synopsis**

??

Usage

```
int SLkp_getkey (void);
```

Description

??

See Also

??

12.59 `int SLscroll_find_top (SLscroll_Window_Type *);`

Synopsis

??

Usage

```
int SLscroll_find_top (SLscroll_Window_Type *);
```

Description

??

See Also

??

12.60 `int SLscroll_find_line_num (SLscroll_Window_Type *);`

Synopsis

??

Usage

```
int SLscroll_find_line_num (SLscroll_Window_Type *);
```

Description

??

See Also

??

12.61 `unsigned int SLscroll_next_n (SLscroll_Window_Type *, unsigned int);`

Synopsis

??

Usage

```
unsigned int SLscroll_next_n (SLscroll_Window_Type *, unsigned int);
```

Description

??

See Also

??

12.62 `unsigned int SLscroll_prev_n (SLscroll_Window_Type *, unsigned int);`

Synopsis

??

Usage

```
unsigned int SLscroll_prev_n (SLscroll_Window_Type *, unsigned int);
```

Description

??

See Also

??

12.63 `int SLscroll_pageup (SLscroll_Window_Type *);`

Synopsis

??

Usage

```
int SLscroll_pageup (SLscroll_Window_Type *);
```

Description

??

See Also

??

12.64 `int SLscroll_pagedown (SLscroll_Window_Type *);`

Synopsis

??

Usage

```
int SLscroll_pagedown (SLscroll_Window_Type *);
```

Description

??

See Also

??

12.65 `SLSig_Fun_Type *SLsignal (int, SLSig_Fun_Type *)`;

Synopsis

??

Usage

```
SLSig_Fun_Type *SLsignal (int, SLSig_Fun_Type *)
```

Description

??

See Also

??

12.66 `SLSig_Fun_Type *SLsignal_intr (int, SLSig_Fun_Type *)`;

Synopsis

??

Usage

```
SLSig_Fun_Type *SLsignal_intr (int, SLSig_Fun_Type *)
```

Description

??

See Also

??

12.67 `int SLsig_block_signals (void)`;

Synopsis

??

Usage

```
int SLsig_block_signals (void)
```

Description

??

See Also

??

12.68 `int SLsig_unblock_signals (void);`**Synopsis**

??

Usage`int SLsig_unblock_signals (void);`**Description**

??

See Also

??

12.69 `int SLsystem (char *);`**Synopsis**

??

Usage`int SLsystem (char *);`**Description**

??

See Also

??

12.70 `void SLadd_at_handler (long *, char *);`**Synopsis**

??

Usage`void SLadd_at_handler (long *, char *);`**Description**

??

See Also

??

12.71 void SLang_define_case(int *, int *);**Synopsis**

??

Usage

```
void SLang_define_case(int *, int *);
```

Description

??

See Also

??

12.72 void SLang_init_case_tables (void);**Synopsis**

??

Usage

```
void SLang_init_case_tables (void);
```

Description

??

See Also

??

12.73 unsigned char *SLang_regexp_match(unsigned char *, unsigned int, SLRegexp_Type *);**Synopsis**

??

Usage

```
unsigned char *SLang_regexp_match(unsigned char *, unsigned int, SLRegexp_Type *);
```

Description

??

See Also

??

12.74 int SLang_regex_compile (SLRegexp_Type *);**Synopsis**

??

Usage

```
int SLang_regex_compile (SLRegexp_Type *);
```

Description

??

See Also

??

12.75 char *SLregex_quote_string (char *, char *, unsigned int);**Synopsis**

??

Usage

```
char *SLregex_quote_string (char *, char *, unsigned int);
```

Description

??

See Also

??

12.76 int SLcmd_execute_string (char *, SLcmd_Cmd_Table_Type *);**Synopsis**

??

Usage

```
int SLcmd_execute_string (char *, SLcmd_Cmd_Table_Type *);
```

Description

??

See Also

??

12.77 SLcomplex_abs

Synopsis

Returns the norm of a complex number

Usage

```
double SLcomplex_abs (double *z)}
```

Description

The SLcomplex_abs function returns the absolute value or the norm of the complex number given by z.

See Also

SLcomplex_times

12.78 double *SLcomplex_times (double *, double *, double *);

Synopsis

??

Usage

```
double *SLcomplex_times (double *, double *, double *);
```

Description

??

See Also

??

12.79 double *SLcomplex_divide (double *, double *, double *);

Synopsis

??

Usage

```
double *SLcomplex_divide (double *, double *, double *);
```

Description

??

See Also

??

12.80 `double *SLcomplex_sin (double *, double *);`**Synopsis**

??

Usage`double *SLcomplex_sin (double *, double *);`**Description**

??

See Also

??

12.81 `double *SLcomplex_cos (double *, double *);`**Synopsis**

??

Usage`double *SLcomplex_cos (double *, double *);`**Description**

??

See Also

??

12.82 `double *SLcomplex_tan (double *, double *);`**Synopsis**

??

Usage`double *SLcomplex_tan (double *, double *);`**Description**

??

See Also

??

12.83 `double *SLcomplex_asin (double *, double *);`**Synopsis**

??

Usage`double *SLcomplex_asin (double *, double *);`**Description**

??

See Also

??

12.84 `double *SLcomplex_acos (double *, double *);`**Synopsis**

??

Usage`double *SLcomplex_acos (double *, double *);`**Description**

??

See Also

??

12.85 `double *SLcomplex_atan (double *, double *);`**Synopsis**

??

Usage`double *SLcomplex_atan (double *, double *);`**Description**

??

See Also

??

12.86 `double *SLcomplex_exp (double *, double *);`

Synopsis

??

Usage

```
double *SLcomplex_exp (double *, double *);
```

Description

??

See Also

??

12.87 `double *SLcomplex_log (double *, double *);`

Synopsis

??

Usage

```
double *SLcomplex_log (double *, double *);
```

Description

??

See Also

??

12.88 `double *SLcomplex_log10 (double *, double *);`

Synopsis

??

Usage

```
double *SLcomplex_log10 (double *, double *);
```

Description

??

See Also

??

12.89 `double *SLcomplex_sqrt (double *, double *);`

Synopsis

??

Usage

```
double *SLcomplex_sqrt (double *, double *);
```

Description

??

See Also

??

12.90 `double *SLcomplex_sinh (double *, double *);`

Synopsis

??

Usage

```
double *SLcomplex_sinh (double *, double *);
```

Description

??

See Also

??

12.91 `double *SLcomplex_cosh (double *, double *);`

Synopsis

??

Usage

```
double *SLcomplex_cosh (double *, double *);
```

Description

??

See Also

??

12.92 `double *SLcomplex_tanh (double *, double *);`

Synopsis

??

Usage

```
double *SLcomplex_tanh (double *, double *);
```

Description

??

See Also

??

12.93 `double *SLcomplex_pow (double *, double *, double *);`

Synopsis

??

Usage

```
double *SLcomplex_pow (double *, double *, double *);
```

Description

??

See Also

??

12.94 `double SLmath_hypot (double x, double y);`

Synopsis

??

Usage

```
double SLmath_hypot (double x, double y);
```

Description

??

See Also

??

`extern double *SLcomplex_asinh (double *, double *);`

12.95 `double *SLcomplex_acosh (double *, double *);`

Synopsis

??

Usage

```
double *SLcomplex_acosh (double *, double *);
```

Description

??

See Also

??

12.96 `double *SLcomplex_atanh (double *, double *);`

Synopsis

??

Usage

```
double *SLcomplex_atanh (double *, double *);
```

Description

??

See Also

??

12.97 `char *SLdebug_malloc (unsigned long);`

Synopsis

??

Usage

```
char *SLdebug_malloc (unsigned long);
```

Description

??

See Also

??

12.98 char *SLdebug_calloc (unsigned long, unsigned long);**Synopsis**

??

Usage

```
char *SLdebug_calloc (unsigned long, unsigned long);
```

Description

??

See Also

??

12.99 char *SLdebug_realloc (char *, unsigned long);**Synopsis**

??

Usage

```
char *SLdebug_realloc (char *, unsigned long);
```

Description

??

See Also

??

12.100 void SLdebug_free (char *);**Synopsis**

??

Usage

```
void SLdebug_free (char *);
```

Description

??

See Also

??

12.101 void SLmalloc_dump_statistics (void);**Synopsis**

??

Usage

```
void SLmalloc_dump_statistics (void);
```

Description

??

See Also

??

12.102 char *SLstrcpy(register char *, register char *);**Synopsis**

??

Usage

```
char *SLstrcpy(register char *, register char *);
```

Description

??

See Also

??

12.103 int SLstrcmp(register char *, register char *);**Synopsis**

??

Usage

```
int SLstrcmp(register char *, register char *);
```

Description

??

See Also

??

12.104 `char *SLstrncpy(char *, register char *, register int);`

Synopsis

??

Usage

```
char *SLstrncpy(char *, register char *, register int);
```

Description

??

See Also

??

12.105 `void SLMemset (char *, char, int);`

Synopsis

??

Usage

```
void SLMemset (char *, char, int);
```

Description

??

See Also

??

12.106 `void SLExpand_escaped_string (register char *, register char *, register char *);`

Synopsis

??

Usage

```
void SLExpand_escaped_string (register char *, register char *, register char *);
```

Description

??

See Also

??

12.107 `void SLmake_lut (unsigned char *, unsigned char *, unsigned char);`

Synopsis

??

Usage

```
void SLmake_lut (unsigned char *, unsigned char *, unsigned char);
```

Description

??

See Also

??

12.108 `int SLang_guess_type (char *);`

Synopsis

??

Usage

```
int SLang_guess_type (char *);
```

Description

??

See Also

??