NAME

terminfo - terminal capability data base

SYNOPSIS

/usr/share/misc/terminfo/*/*

DESCRIPTION

Terminfo is a data base describing terminals, used by screen-oriented programs such as **nvi**(1), **lynx**(1), **mutt**(1), and other curses applications, using high-level calls to libraries such as **curses**(3X). It is also used via low-level calls by non-curses applications which may be screen-oriented (such as **clear**(1)) or non-screen (such as **tabs**(1)).

Terminfo describes terminals by giving a set of capabilities which they have, by specifying how to perform screen operations, and by specifying padding requirements and initialization sequences.

This manual describes **ncurses** version 6.2 (patch 20210220).

Terminfo Entry Syntax

Entries in *terminfo* consist of a sequence of fields:

- Each field ends with a comma "," (embedded commas may be escaped with a backslash or written as "\054").
- White space between fields is ignored.
- The first field in a *terminfo* entry begins in the first column.
- Newlines and leading whitespace (spaces or tabs) may be used for formatting entries for readability. These are removed from parsed entries.

  The **infocmp -f** and **-W** options rely on this to format if-then-else expressions, or to enforce maximum line-width. The resulting formatted terminal description can be read by **tic**.
- The first field for each terminal gives the names which are known for the terminal, separated by "|" characters.

  The first name given is the most common abbreviation for the terminal (its primary name), the last name given should be a long name fully identifying the terminal (see **longname**(3X)), and all others are treated as synonyms (aliases) for the primary terminal name.

X/Open Curses advises that all names but the last should be in lower case and contain no blanks; the last name may well contain upper case and blanks for readability.

This implementation is not so strict; it allows mixed case in the primary name and aliases. If the last name has no embedded blanks, it allows that to be both an alias and a verbose name (but will warn about this ambiguity).

- Lines beginning with a "#" in the first column are treated as comments.

  While comment lines are legal at any point, the output of **captoinfo** and **infotocap** (aliases for **tic**) will move comments so they occur only between entries.

Terminal names (except for the last, verbose entry) should be chosen using the following conventions. The particular piece of hardware making up the terminal should have a root name, thus "hp2621". This name should not contain hyphens. Modes that the hardware can be in, or user preferences, should be indicated by appending a hyphen and a mode suffix. Thus, a vt100 in 132-column mode would be vt100-w. The following suffixes should be used where possible:

Suffix	Meaning	Example
-*nn*	Number of lines on the screen	aaa-60
-*n*p	Number of pages of memory	c100-4p
-am	With automargins (usually the default)	vt100-am
-m	Mono mode; suppress color	ansi-m
-mc	Magic cookie; spaces when highlighting	wy30-mc
-na	No arrow keys (leave them in local)	c100-na
-nam	Without automatic margins	vt100-nam
-nl	No status line	att4415-nl
-ns	No status line	hp2626-ns
-rv	Reverse video	c100-rv
-s	Enable status line	vt100-s
-vb	Use visible bell instead of beep	wy370-vb
-w	Wide mode (> 80 columns, usually 132)	vt100-w

For more on terminal naming conventions, see the **term**(7) manual page.

Terminfo Capabilities Syntax

The terminfo entry consists of several *capabilities*, i.e., features that the terminal has, or methods for exercising the terminal's features.

After the first field (giving the name(s) of the terminal entry), there should be one or more *capability* fields. These are boolean, numeric or string names with corresponding values:

- Boolean capabilities are true when present, false when absent. There is no explicit value for boolean capabilities.

- Numeric capabilities have a "#" following the name, then an unsigned decimal integer value.

- String capabilities have a "=" following the name, then an string of characters making up the capability value.

  String capabilities can be split into multiple lines, just as the fields comprising a terminal entry can be split into multiple lines. While blanks between fields are ignored, blanks embedded within a string value are retained, except for leading blanks on a line.

Any capability can be *canceled*, i.e., suppressed from the terminal entry, by following its name with "@" rather than a capability value.

Similar Terminals

If there are two very similar terminals, one (the variant) can be defined as being just like the other (the base) with certain exceptions. In the definition of the variant, the string capability **use** can be given with the name of the base terminal:

- The capabilities given before **use** override those in the base type named by **use**.

- If there are multiple **use** capabilities, they are merged in reverse order. That is, the rightmost **use** reference is processed first, then the one to its left, and so forth.

- Capabilities given explicitly in the entry override those brought in by **use** references.

A capability can be canceled by placing **xx@** to the left of the use reference that imports it, where *xx* is the capability. For example, the entry

```
2621-nl, smkx@, rmkx@, use=2621,
```

defines a 2621-nl that does not have the **smkx** or **rmkx** capabilities, and hence does not turn on the

function key labels when in visual mode. This is useful for different modes for a terminal, or for different user preferences.

An entry included via **use** can contain canceled capabilities, which have the same effect as if those cancels were inline in the using terminal entry.

Predefined Capabilities

The following is a complete table of the capabilities included in a terminfo description block and available to terminfo-using code. In each line of the table,

The **variable** is the name by which the programmer (at the terminfo level) accesses the capability.

The **capname** is the short name used in the text of the database, and is used by a person updating the database. Whenever possible, capnames are chosen to be the same as or similar to the ANSI X3.64-1979 standard (now superseded by ECMA-48, which uses identical or very similar names). Semantics are also intended to match those of the specification.

The termcap code is the old **termcap** capability name (some capabilities are new, and have names which termcap did not originate).

Capability names have no hard length limit, but an informal limit of 5 characters has been adopted to keep them short and to allow the tabs in the source file **Caps** to line up nicely.

Finally, the description field attempts to convey the semantics of the capability. You may find some codes in the description field:

(P) indicates that padding may be specified

#[1-9]
in the description field indicates that the string is passed through **tparm**(3X) with parameters as given (#*i*).

If no parameters are listed in the description, passing the string through **tparm**(3X) may give unexpected results, e.g., if it contains percent (%%) signs.

(P*)
indicates that padding may vary in proportion to the number of lines affected

(#*i*) indicates the *i*th parameter.

These are the boolean capabilities:

Variable Booleans	Cap-name	TCap Code	Description
auto_left_margin	bw	bw	cub1 wraps from column 0 to last column
auto_right_margin	am	am	terminal has automatic margins
back_color_erase	bce	ut	screen erased with background color
can_change	ccc	cc	terminal can re-define existing colors
ceol_standout_glitch	xhp	xs	standout not erased by overwriting (hp)
col_addr_glitch	xhpa	YA	only positive motion for hpa/mhpa caps
cpi_changes_res	cpix	YF	changing character pitch changes resolution
cr_cancels_micro_mode	crxm	YB	using cr turns off micro mode
dest_tabs_magic_smso	xt	xt	tabs destructive, magic so char (t1061)
eat_newline_glitch	xenl	xn	newline ignored after 80 cols (concept)
erase_overstrike	eo	eo	can erase overstrikes with a blank
generic_type	gn	gn	generic line type
hard_copy	hc	hc	hardcopy terminal
hard_cursor	chts	HC	cursor is hard to see
has_meta_key	km	km	Has a meta key (i.e., sets 8th-bit)
has_print_wheel	daisy	YC	printer needs operator to change character set
has_status_line	hs	hs	has extra status line
hue_lightness_saturation	hls	hl	terminal uses only HLS

			color notation (Tektronix)
insert_null_glitch	in	in	insert mode distinguishes nulls
lpi_changes_res	lpix	YG	changing line pitch changes resolution
memory_above	da	da	display may be retained above the screen
memory_below	db	db	display may be retained below the screen
move_insert_mode	mir	mi	safe to move while in insert mode
move_standout_mode	msgr	ms	safe to move while in standout mode
needs_xon_xoff	nxon	nx	padding will not work, xon/xoff required
no_esc_ctlc	xsb	xb	beehive (f1=escape, f2=ctrl C)
no_pad_char	npc	NP	pad character does not exist
non_dest_scroll_region	ndscr	ND	scrolling region is non-destructive
non_rev_rmcup	nrrmc	NR	smcup does not reverse rmcup
over_strike	os	os	terminal can overstrike
prtr_silent	mc5i	5i	printer will not echo on screen
row_addr_glitch	xvpa	YD	only positive motion for vpa/mvpa caps
semi_auto_right_margin	sam	YE	printing in last column causes cr
status_line_esc_ok	eslok	es	escape can be used on the status line
tilde_glitch	hz	hz	cannot print ~’s (Hazeltine)
transparent_underline	ul	ul	underline character overstrikes
xon_xoff	xon	xo	terminal uses xon/xoff handshaking

These are the numeric capabilities:

Variable Numeric	Cap-name	TCap Code	Description
columns	cols	co	number of columns in a line
init_tabs	it	it	tabs initially every # spaces
label_height	lh	lh	rows in each label
label_width	lw	lw	columns in each label
lines	lines	li	number of lines on screen or page
lines_of_memory	lm	lm	lines of memory if > line. 0 means varies
magic_cookie_glitch	xmc	sg	number of blank characters left by smso or rmso
max_attributes	ma	ma	maximum combined attributes terminal can handle
max_colors	colors	Co	maximum number of colors on screen
max_pairs	pairs	pa	maximum number of color-pairs on the screen
maximum_windows	wnum	MW	maximum number of definable windows
no_color_video	ncv	NC	video attributes that cannot be used with colors
num_labels	nlab	Nl	number of labels on screen
padding_baud_rate	pb	pb	lowest baud rate where padding needed
virtual_terminal	vt	vt	virtual terminal number (CB/unix)
width_status_line	wsl	ws	number of columns in status line

The following numeric capabilities are present in the SVr4.0 term structure, but are not yet documented in the man page. They came in with SVr4's printer support.

Variable Numeric	Cap-name	TCap Code	Description
bit_image_entwining	bitwin	Yo	number of passes for each bit-image row
bit_image_type	bitype	Yp	type of bit-image device
buffer_capacity	bufsz	Ya	numbers of bytes buffered before printing
buttons	btns	BT	number of buttons on mouse
dot_horz_spacing	spinh	Yc	spacing of dots horizontally in dots per inch
dot_vert_spacing	spinv	Yb	spacing of pins vertically in pins per inch
max_micro_address	maddr	Yd	maximum value in micro_..._address
max_micro_jump	mjump	Ye	maximum value in parm_..._micro
micro_col_size	mcs	Yf	character step size when in micro mode
micro_line_size	mls	Yg	line step size when in micro mode
number_of_pins	npins	Yh	numbers of pins in print-head
output_res_char	orc	Yi	horizontal resolution in units per line
output_res_horz_inch	orhi	Yk	horizontal resolution in units per inch
output_res_line	orl	Yj	vertical resolution in units per line
output_res_vert_inch	orvi	Yl	vertical resolution in units per inch
print_rate	cps	Ym	print rate in characters per second

wide_char_size	widcs	Yn	character step size when in double wide mode

These are the string capabilities:

Variable String	Cap-name	TCap Code	Description
acs_chars	acsc	ac	graphics charset pairs, based on vt100
back_tab	cbt	bt	back tab (P)
bell	bel	bl	audible signal (bell) (P)
carriage_return	cr	cr	carriage return (P*) (P*)
change_char_pitch	cpi	ZA	Change number of characters per inch to #1
change_line_pitch	lpi	ZB	Change number of lines per inch to #1
change_res_horz	chr	ZC	Change horizontal resolution to #1
change_res_vert	cvr	ZD	Change vertical resolution to #1
change_scroll_region	csr	cs	change region to line #1 to line #2 (P)
char_padding	rmp	rP	like ip but when in insert mode
clear_all_tabs	tbc	ct	clear all tab stops (P)
clear_margins	mgc	MC	clear right and left soft margins
clear_screen	clear	cl	clear screen and home cursor (P*)
clr_bol	el1	cb	Clear to beginning of line
clr_eol	el	ce	clear to end of line (P)
clr_eos	ed	cd	clear to end of screen (P*)

column_address	hpa	ch	horizontal position #1, absolute (P)
command_character	cmdch	CC	terminal settable cmd character in prototype !?
create_window	cwin	CW	define a window #1 from #2,#3 to #4,#5
cursor_address	cup	cm	move to row #1 columns #2
cursor_down	cud1	do	down one line
cursor_home	home	ho	home cursor (if no cup)
cursor_invisible	civis	vi	make cursor invisible
cursor_left	cub1	le	move left one space
cursor_mem_address	mrcup	CM	memory relative cursor addressing, move to row #1 columns #2
cursor_normal	cnorm	ve	make cursor appear normal (undo civis/cvvis)
cursor_right	cuf1	nd	non-destructive space (move right one space)
cursor_to_ll	ll	ll	last line, first column (if no cup)
cursor_up	cuu1	up	up one line
cursor_visible	cvvis	vs	make cursor very visible
define_char	defc	ZE	Define a character #1, #2 dots wide, descender #3
delete_character	dch1	dc	delete character (P*)
delete_line	dl1	dl	delete line (P*)
dial_phone	dial	DI	dial number #1
dis_status_line	dsl	ds	disable status

			line
display_clock	dclk	DK	display clock
down_half_line	hd	hd	half a line down
ena_acs	enacs	eA	enable alternate char set
enter_alt_charset_mode	smacs	as	start alternate character set (P)
enter_am_mode	smam	SA	turn on automatic margins
enter_blink_mode	blink	mb	turn on blinking
enter_bold_mode	bold	md	turn on bold (extra bright) mode
enter_ca_mode	smcup	ti	string to start programs using cup
enter_delete_mode	smdc	dm	enter delete mode
enter_dim_mode	dim	mh	turn on half-bright mode
enter_doublewide_mode	swidm	ZF	Enter double-wide mode
enter_draft_quality	sdrfq	ZG	Enter draft-quality mode
enter_insert_mode	smir	im	enter insert mode
enter_italics_mode	sitm	ZH	Enter italic mode
enter_leftward_mode	slm	ZI	Start leftward carriage motion
enter_micro_mode	smicm	ZJ	Start micro-motion mode
enter_near_letter_quality	snlq	ZK	Enter NLQ mode
enter_normal_quality	snrmq	ZL	Enter normal-quality mode
enter_protected_mode	prot	mp	turn on protected mode
enter_reverse_mode	rev	mr	turn on reverse video

			mode
enter_secure_mode	invis	mk	turn on blank mode (characters invisible)
enter_shadow_mode	sshm	ZM	Enter shadow-print mode
enter_standout_mode	smso	so	begin standout mode
enter_subscript_mode	ssubm	ZN	Enter subscript mode
enter_superscript_mode	ssupm	ZO	Enter superscript mode
enter_underline_mode	smul	us	begin underline mode
enter_upward_mode	sum	ZP	Start upward carriage motion
enter_xon_mode	smxon	SX	turn on xon/xoff handshaking
erase_chars	ech	ec	erase #1 characters (P)
exit_alt_charset_mode	rmacs	ae	end alternate character set (P)
exit_am_mode	rmam	RA	turn off automatic margins
exit_attribute_mode	sgr0	me	turn off all attributes
exit_ca_mode	rmcup	te	strings to end programs using cup
exit_delete_mode	rmdc	ed	end delete mode
exit_doublewide_mode	rwidm	ZQ	End double-wide mode
exit_insert_mode	rmir	ei	exit insert mode
exit_italics_mode	ritm	ZR	End italic mode
exit_leftward_mode	rlm	ZS	End left-motion mode
exit_micro_mode	rmicm	ZT	End micro-motion mode
exit_shadow_mode	rshm	ZU	End shadow-print

			mode
exit_standout_mode	rmso	se	exit standout mode
exit_subscript_mode	rsubm	ZV	End subscript mode
exit_superscript_mode	rsupm	ZW	End superscript mode
exit_underline_mode	rmul	ue	exit underline mode
exit_upward_mode	rum	ZX	End reverse character motion
exit_xon_mode	rmxon	RX	turn off xon/xoff handshaking
fixed_pause	pause	PA	pause for 2-3 seconds
flash_hook	hook	fh	flash switch hook
flash_screen	flash	vb	visible bell (may not move cursor)
form_feed	ff	ff	hardcopy terminal page eject (P*)
from_status_line	fsl	fs	return from status line
goto_window	wingo	WG	go to window #1
hangup	hup	HU	hang-up phone
init_1string	is1	i1	initialization string
init_2string	is2	is	initialization string
init_3string	is3	i3	initialization string
init_file	if	if	name of initialization file
init_prog	iprog	iP	path name of program for initialization
initialize_color	initc	Ic	initialize color #1 to (#2,#3,#4)
initialize_pair	initp	Ip	Initialize color pair #1 to fg=(#2,#3,#4),

			bg=(#5,#6,#7)
insert_character	ich1	ic	insert character (P)
insert_line	il1	al	insert line (P*)
insert_padding	ip	ip	insert padding after inserted character
key_a1	ka1	K1	upper left of keypad
key_a3	ka3	K3	upper right of keypad
key_b2	kb2	K2	center of keypad
key_backspace	kbs	kb	backspace key
key_beg	kbeg	@1	begin key
key_btab	kcbt	kB	back-tab key
key_c1	kc1	K4	lower left of keypad
key_c3	kc3	K5	lower right of keypad
key_cancel	kcan	@2	cancel key
key_catab	ktbc	ka	clear-all-tabs key
key_clear	kclr	kC	clear-screen or erase key
key_close	kclo	@3	close key
key_command	kcmd	@4	command key
key_copy	kcpy	@5	copy key
key_create	kcrt	@6	create key
key_ctab	kctab	kt	clear-tab key
key_dc	kdch1	kD	delete-character

			key
key_dl	kdl1	kL	delete-line key
key_down	kcud1	kd	down-arrow key
key_eic	krmir	kM	sent by rmir or smir in insert mode
key_end	kend	@7	end key
key_enter	kent	@8	enter/send key
key_eol	kel	kE	clear-to-end-of-line key
key_eos	ked	kS	clear-to-end-of-screen key
key_exit	kext	@9	exit key
key_f0	kf0	k0	F0 function key
key_f1	kf1	k1	F1 function key
key_f10	kf10	k;	F10 function key
key_f11	kf11	F1	F11 function key
key_f12	kf12	F2	F12 function key
key_f13	kf13	F3	F13 function key
key_f14	kf14	F4	F14 function key
key_f15	kf15	F5	F15 function key
key_f16	kf16	F6	F16 function key
key_f17	kf17	F7	F17 function key
key_f18	kf18	F8	F18 function key
key_f19	kf19	F9	F19 function

			key
key_f2	kf2	k2	F2 function key
key_f20	kf20	FA	F20 function key
key_f21	kf21	FB	F21 function key
key_f22	kf22	FC	F22 function key
key_f23	kf23	FD	F23 function key
key_f24	kf24	FE	F24 function key
key_f25	kf25	FF	F25 function key
key_f26	kf26	FG	F26 function key
key_f27	kf27	FH	F27 function key
key_f28	kf28	FI	F28 function key
key_f29	kf29	FJ	F29 function key
key_f3	kf3	k3	F3 function key
key_f30	kf30	FK	F30 function key
key_f31	kf31	FL	F31 function key
key_f32	kf32	FM	F32 function key
key_f33	kf33	FN	F33 function key
key_f34	kf34	FO	F34 function key
key_f35	kf35	FP	F35 function key
key_f36	kf36	FQ	F36 function key
key_f37	kf37	FR	F37 function

			key
key_f38	kf38	FS	F38 function key
key_f39	kf39	FT	F39 function key
key_f4	kf4	k4	F4 function key
key_f40	kf40	FU	F40 function key
key_f41	kf41	FV	F41 function key
key_f42	kf42	FW	F42 function key
key_f43	kf43	FX	F43 function key
key_f44	kf44	FY	F44 function key
key_f45	kf45	FZ	F45 function key
key_f46	kf46	Fa	F46 function key
key_f47	kf47	Fb	F47 function key
key_f48	kf48	Fc	F48 function key
key_f49	kf49	Fd	F49 function key
key_f5	kf5	k5	F5 function key
key_f50	kf50	Fe	F50 function key
key_f51	kf51	Ff	F51 function key
key_f52	kf52	Fg	F52 function key
key_f53	kf53	Fh	F53 function key
key_f54	kf54	Fi	F54 function key
key_f55	kf55	Fj	F55 function

			key
key_f56	kf56	Fk	F56 function key
key_f57	kf57	Fl	F57 function key
key_f58	kf58	Fm	F58 function key
key_f59	kf59	Fn	F59 function key
key_f6	kf6	k6	F6 function key
key_f60	kf60	Fo	F60 function key
key_f61	kf61	Fp	F61 function key
key_f62	kf62	Fq	F62 function key
key_f63	kf63	Fr	F63 function key
key_f7	kf7	k7	F7 function key
key_f8	kf8	k8	F8 function key
key_f9	kf9	k9	F9 function key
key_find	kfnd	@0	find key
key_help	khlp	%1	help key
key_home	khome	kh	home key
key_ic	kich1	kI	insert-character key
key_il	kil1	kA	insert-line key
key_left	kcub1	kl	left-arrow key
key_ll	kll	kH	lower-left key (home down)
key_mark	kmrk	%2	mark

			key
key_message	kmsg	%3	message key
key_move	kmov	%4	move key
key_next	knxt	%5	next key
key_npage	knp	kN	next-page key
key_open	kopn	%6	open key
key_options	kopt	%7	options key
key_ppage	kpp	kP	previous-page key
key_previous	kprv	%8	previous key
key_print	kprt	%9	print key
key_redo	krdo	%0	redo key
key_reference	kref	&1	reference key
key_refresh	krfr	&2	refresh key
key_replace	krpl	&3	replace key
key_restart	krst	&4	restart key
key_resume	kres	&5	resume key
key_right	kcuf1	kr	right-arrow key
key_save	ksav	&6	save key
key_sbeg	kBEG	&9	shifted begin key
key_scancel	kCAN	&0	shifted cancel key
key_scommand	kCMD	*1	shifted command

			key
key_scopy	kCPY	*2	shifted copy key
key_screate	kCRT	*3	shifted create key
key_sdc	kDC	*4	shifted delete-character key
key_sdl	kDL	*5	shifted delete-line key
key_select	kslt	*6	select key
key_send	kEND	*7	shifted end key
key_seol	kEOL	*8	shifted clear-to-end-of-line key
key_sexit	kEXT	*9	shifted exit key
key_sf	kind	kF	scroll-forward key
key_sfind	kFND	*0	shifted find key
key_shelp	kHLP	#1	shifted help key
key_shome	kHOM	#2	shifted home key
key_sic	kIC	#3	shifted insert-character key
key_sleft	kLFT	#4	shifted left-arrow key
key_smessage	kMSG	%a	shifted message key
key_smove	kMOV	%b	shifted move key
key_snext	kNXT	%c	shifted next key
key_soptions	kOPT	%d	shifted options key
key_sprevious	kPRV	%e	shifted previous key
key_sprint	kPRT	%f	shifted print

			key
key_sr	kri	kR	scroll-backward key
key_sredo	kRDO	%g	shifted redo key
key_sreplace	kRPL	%h	shifted replace key
key_sright	kRIT	%i	shifted right-arrow key
key_srsume	kRES	%j	shifted resume key
key_ssave	kSAV	!1	shifted save key
key_ssuspend	kSPD	!2	shifted suspend key
key_stab	khts	kT	set-tab key
key_sundo	kUND	!3	shifted undo key
key_suspend	kspd	&7	suspend key
key_undo	kund	&8	undo key
key_up	kcuu1	ku	up-arrow key
keypad_local	rmkx	ke	leave ’keyboard_transmit’ mode
keypad_xmit	smkx	ks	enter ’keyboard_transmit’ mode
lab_f0	lf0	l0	label on function key f0 if not f0
lab_f1	lf1	l1	label on function key f1 if not f1
lab_f10	lf10	la	label on function key f10 if not f10
lab_f2	lf2	l2	label on function key f2 if not f2
lab_f3	lf3	l3	label on function key f3

			if not f3
lab_f4	lf4	l4	label on function key f4 if not f4
lab_f5	lf5	l5	label on function key f5 if not f5
lab_f6	lf6	l6	label on function key f6 if not f6
lab_f7	lf7	l7	label on function key f7 if not f7
lab_f8	lf8	l8	label on function key f8 if not f8
lab_f9	lf9	l9	label on function key f9 if not f9
label_format	fln	Lf	label format
label_off	rmln	LF	turn off soft labels
label_on	smln	LO	turn on soft labels
meta_off	rmm	mo	turn off meta mode
meta_on	smm	mm	turn on meta mode (8th-bit on)
micro_column_address	mhpa	ZY	Like column_address in micro mode
micro_down	mcud1	ZZ	Like cursor_down in micro mode
micro_left	mcub1	Za	Like cursor_left in micro mode
micro_right	mcuf1	Zb	Like cursor_right in micro mode
micro_row_address	mvpa	Zc	Like row_address #1 in micro mode
micro_up	mcuu1	Zd	Like cursor_up in micro mode
newline	nel	nw	newline (behave like cr followed by lf)
order_of_pins	porder	Ze	Match software bits to print-head pins
orig_colors	oc	oc	Set all color pairs to the

			original ones
orig_pair	op	op	Set default pair to its original value
pad_char	pad	pc	padding char (instead of null)
parm_dch	dch	DC	delete #1 characters (P*)
parm_delete_line	dl	DL	delete #1 lines (P*)
parm_down_cursor	cud	DO	down #1 lines (P*)
parm_down_micro	mcud	Zf	Like parm_down_cursor in micro mode
parm_ich	ich	IC	insert #1 characters (P*)
parm_index	indn	SF	scroll forward #1 lines (P)
parm_insert_line	il	AL	insert #1 lines (P*)
parm_left_cursor	cub	LE	move #1 characters to the left (P)
parm_left_micro	mcub	Zg	Like parm_left_cursor in micro mode
parm_right_cursor	cuf	RI	move #1 characters to the right (P*)
parm_right_micro	mcuf	Zh	Like parm_right_cursor in micro mode
parm_rindex	rin	SR	scroll back #1 lines (P)
parm_up_cursor	cuu	UP	up #1 lines (P*)
parm_up_micro	mcuu	Zi	Like parm_up_cursor in micro mode
pkey_key	pfkey	pk	program function key #1 to type string #2
pkey_local	pfloc	pl	program function key #1 to execute string #2
pkey_xmit	pfx	px	program function key #1 to transmit string #2
plab_norm	pln	pn	program label #1 to

			show string #2
print_screen	mc0	ps	print contents of screen
prtr_non	mc5p	pO	turn on printer for #1 bytes
prtr_off	mc4	pf	turn off printer
prtr_on	mc5	po	turn on printer
pulse	pulse	PU	select pulse dialing
quick_dial	qdial	QD	dial number #1 without checking
remove_clock	rmclk	RC	remove clock
repeat_char	rep	rp	repeat char #1 #2 times (P*)
req_for_input	rfi	RF	send next input char (for ptys)
reset_1string	rs1	r1	reset string
reset_2string	rs2	r2	reset string
reset_3string	rs3	r3	reset string
reset_file	rf	rf	name of reset file
restore_cursor	rc	rc	restore cursor to position of last save_cursor
row_address	vpa	cv	vertical position #1 absolute (P)
save_cursor	sc	sc	save current cursor position (P)
scroll_forward	ind	sf	scroll text up (P)
scroll_reverse	ri	sr	scroll text down (P)
select_char_set	scs	Zj	Select character set, #1
set_attributes	sgr	sa	define video attributes

			#1-#9 (PG9)
set_background	setb	Sb	Set background color #1
set_bottom_margin	smgb	Zk	Set bottom margin at current line
set_bottom_margin_parm	smgbp	Zl	Set bottom margin at line #1 or (if smgtp is not given) #2 lines from bottom
set_clock	sclk	SC	set clock, #1 hrs #2 mins #3 secs
set_color_pair	scp	sp	Set current color pair to #1
set_foreground	setf	Sf	Set foreground color #1
set_left_margin	smgl	ML	set left soft margin at current column. See smgl. (ML is not in BSD termcap).
set_left_margin_parm	smglp	Zm	Set left (right) margin at column #1
set_right_margin	smgr	MR	set right soft margin at current column
set_right_margin_parm	smgrp	Zn	Set right margin at column #1
set_tab	hts	st	set a tab in every row, current columns
set_top_margin	smgt	Zo	Set top margin at current line
set_top_margin_parm	smgtp	Zp	Set top (bottom) margin at row #1
set_window	wind	wi	current window is lines #1-#2 cols #3-#4
start_bit_image	sbim	Zq	Start printing bit image graphics
start_char_set_def	scsd	Zr	Start character set definition #1, with #2 characters in the set
stop_bit_image	rbim	Zs	Stop printing bit image graphics

stop_char_set_def	rcsd	Zt	End definition of character set #1
subscript_characters	subcs	Zu	List of subscriptable characters
superscript_characters	supcs	Zv	List of superscriptable characters
tab	ht	ta	tab to next 8-space hardware tab stop
these_cause_cr	docr	Zw	Printing any of these characters causes CR
to_status_line	tsl	ts	move to status line, column #1
tone	tone	TO	select touch tone dialing
underline_char	uc	uc	underline char and move past it
up_half_line	hu	hu	half a line up
user0	u0	u0	User string #0
user1	u1	u1	User string #1
user2	u2	u2	User string #2
user3	u3	u3	User string #3
user4	u4	u4	User string #4
user5	u5	u5	User string #5
user6	u6	u6	User string #6
user7	u7	u7	User string #7
user8	u8	u8	User string #8
user9	u9	u9	User string #9
wait_tone	wait	WA	wait for dial-tone

xoff_character	xoffc	XF	XOFF character
xon_character	xonc	XN	XON character
zero_motion	zerom	Zx	No motion for subsequent character

The following string capabilities are present in the SVr4.0 term structure, but were originally not documented in the man page.

Variable String	Cap-name	TCap Code	Description
alt_scancode_esc	scesa	S8	Alternate escape for scancode emulation
bit_image_carriage_return	bicr	Yv	Move to beginning of same row
bit_image_newline	binel	Zz	Move to next row of the bit image
bit_image_repeat	birep	Xy	Repeat bit image cell #1 #2 times
char_set_names	csnm	Zy	Produce #1’th item from list of character set names
code_set_init	csin	ci	Init sequence for multiple codesets
color_names	colornm	Yw	Give name for color #1
define_bit_image_region	defbi	Yx	Define rectangular bit image region
device_type	devt	dv	Indicate language/codeset support
display_pc_char	dispc	S1	Display PC character #1
end_bit_image_region	endbi	Yy	End a bit-image region
enter_pc_charset_mode	smpch	S2	Enter PC character display mode
enter_scancode_mode	smsc	S4	Enter PC scancode

			mode
exit_pc_charset_mode	rmpch	S3	Exit PC character display mode
exit_scancode_mode	rmsc	S5	Exit PC scancode mode
get_mouse	getm	Gm	Curses should get button events, parameter #1 not documented.
key_mouse	kmous	Km	Mouse event has occurred
mouse_info	minfo	Mi	Mouse status information
pc_term_options	pctrm	S6	PC terminal options
pkey_plab	pfxl	xl	Program function key #1 to type string #2 and show string #3
req_mouse_pos	reqmp	RQ	Request mouse position
scancode_escape	scesc	S7	Escape for scancode emulation
set0_des_seq	s0ds	s0	Shift to codeset 0 (EUC set 0, ASCII)
set1_des_seq	s1ds	s1	Shift to codeset 1
set2_des_seq	s2ds	s2	Shift to codeset 2
set3_des_seq	s3ds	s3	Shift to codeset 3
set_a_background	setab	AB	Set background color to #1, using ANSI escape
set_a_foreground	setaf	AF	Set foreground color to #1, using ANSI escape
set_color_band	setcolor	Yz	Change to ribbon color #1
set_lr_margin	smglr	ML	Set both left and right margins to #1, #2.

			(ML is not in BSD termcap).
set_page_length	slines	YZ	Set page length to #1 lines
set_tb_margin	smgtb	MT	Sets both top and bottom margins to #1, #2

The XSI Curses standard added these hardcopy capabilities. They were used in some post-4.1 versions of System V curses, e.g., Solaris 2.5 and IRIX 6.x. Except for **YI**, the **ncurses** termcap names for them are invented. According to the XSI Curses standard, they have no termcap names. If your compiled terminfo entries use these, they may not be binary-compatible with System V terminfo entries after SVr4.1; beware!

Variable String	Cap-name	TCap Code	Description
enter_horizontal_hl_mode	ehhlm	Xh	Enter horizontal highlight mode
enter_left_hl_mode	elhlm	Xl	Enter left highlight mode
enter_low_hl_mode	elohlm	Xo	Enter low highlight mode
enter_right_hl_mode	erhlm	Xr	Enter right highlight mode
enter_top_hl_mode	ethlm	Xt	Enter top highlight mode
enter_vertical_hl_mode	evhlm	Xv	Enter vertical highlight mode
set_a_attributes	sgr1	sA	Define second set of video attributes #1-#6
set_pglen_inch	slength	YI	Set page length to #1 hundredth of an inch (some implementations use sL for termcap).

User-Defined Capabilities

The preceding section listed the *predefined* capabilities. They deal with some special features for terminals no longer (or possibly never) produced. Occasionally there are special features of newer terminals which are awkward or impossible to represent by reusing the predefined capabilities.

ncurses addresses this limitation by allowing user-defined capabilities. The **tic** and **infocmp** programs provide the **-x** option for this purpose. When **-x** is set, **tic** treats unknown capabilities as user-defined. That is, if **tic** encounters a capability name which it does not recognize, it infers its type (boolean, number or string) from the syntax and makes an extended table entry for that capability. The **use_extended_names**(3X) function makes this information conditionally available to applications. The ncurses library provides the data leaving most of the behavior to applications:

- User-defined capability strings whose name begins with "k" are treated as function keys.

- The types (boolean, number, string) determined by **tic** can be inferred by successful calls on **tigetflag**, etc.

- If the capability name happens to be two characters, the capability is also available through the termcap interface.

While termcap is said to be extensible because it does not use a predefined set of capabilities, in practice it has been limited to the capabilities defined by terminfo implementations. As a rule, user-defined capabilities intended for use by termcap applications should be limited to booleans and numbers to avoid running past the 1023 byte limit assumed by termcap implementations and their applications. In particular, providing extended sets of function keys (past the 60 numbered keys and the handful of special named keys) is best done using the longer names available using terminfo.

A Sample Entry

The following entry, describing an ANSI-standard terminal, is representative of what a **terminfo** entry for a modern terminal typically looks like.

```
ansi|ansi/pc-term compatible with color,
        am, mc5i, mir, msgr,
        colors#8, cols#80, it#8, lines#24, ncv#3, pairs#64,
        acsc=+\020\,\021-\030.^Y0\333‘\004a\261f\370g\361h\260
            j\331k\277l\332m\300n\305o~p\304q\304r\304s_t\303
            u\264v\301w\302x\263y\363z\362{\343|\330}\234~\376,
        bel=^G, blink=\E[5m, bold=\E[1m, cbt=\E[Z, clear=\E[H\E[J,
        cr=^M, cub=\E[%p1%dD, cub1=\E[D, cud=\E[%p1%dB, cud1=\E[B,
        cuf=\E[%p1%dC, cuf1=\E[C, cup=\E[%i%p1%d;%p2%dH,
        cuu=\E[%p1%dA, cuu1=\E[A, dch=\E[%p1%dP, dch1=\E[P,
        dl=\E[%p1%dM, dl1=\E[M, ech=\E[%p1%dX, ed=\E[J, el=\E[K,
        el1=\E[1K, home=\E[H, hpa=\E[%i%p1%dG, ht=\E[I, hts=\EH,
        ich=\E[%p1%d@, il=\E[%p1%dL, il1=\E[L, ind=^J,
        indn=\E[%p1%dS, invis=\E[8m, kbs=^H, kcbt=\E[Z, kcub1=\E[D,
```

```
kcud1=\E[B, kcuf1=\E[C, kcuu1=\E[A, khome=\E[H, kich1=\E[L,
mc4=\E[4i, mc5=\E[5i, nel=\r\E[S, op=\E[39;49m,
rep=%p1%c\E[%p2%{1}%-%db, rev=\E[7m, rin=\E[%p1%dT,
rmacs=\E[10m, rmpch=\E[10m, rmso=\E[m, rmul=\E[m,
s0ds=\E(B, s1ds=\E)B, s2ds=\E*B, s3ds=\E+B,
setab=\E[4%p1%dm, setaf=\E[3%p1%dm,
sgr=\E[0;10%?%p1%t;7%;
        %?%p2%t;4%;
        %?%p3%t;7%;
        %?%p4%t;5%;
        %?%p6%t;1%;
        %?%p7%t;8%;
        %?%p9%t;11%;m,
sgr0=\E[0;10m, smacs=\E[11m, smpch=\E[11m, smso=\E[7m,
smul=\E[4m, tbc=\E[3g, u6=\E[%i%d;%dR, u7=\E[6n,
u8=\E[?%[;0123456789]c, u9=\E[c, vpa=\E[%i%p1%dd,
```

Entries may continue onto multiple lines by placing white space at the beginning of each line except the first. Comments may be included on lines beginning with "#". Capabilities in *terminfo* are of three types:

- Boolean capabilities which indicate that the terminal has some particular feature,
- numeric capabilities giving the size of the terminal or the size of particular delays, and
- string capabilities, which give a sequence which can be used to perform particular terminal operations.

Types of Capabilities

All capabilities have names. For instance, the fact that ANSI-standard terminals have *automatic margins* (i.e., an automatic return and line-feed when the end of a line is reached) is indicated by the capability **am**. Hence the description of ansi includes **am**. Numeric capabilities are followed by the character "#" and then a positive value. Thus **cols**, which indicates the number of columns the terminal has, gives the value "80" for ansi. Values for numeric capabilities may be specified in decimal, octal or hexadecimal, using the C programming language conventions (e.g., 255, 0377 and 0xff or 0xFF).

Finally, string valued capabilities, such as **el** (clear to end of line sequence) are given by the two-character code, an "=", and then a string ending at the next following ",".

A number of escape sequences are provided in the string valued capabilities for easy encoding of

characters there:

- Both **\E** and **\e** map to an ESCAPE character,
- **^x** maps to a control-x for any appropriate *x*, and
- the sequences

  \n, **\l**, **\r**, **\t**, **\b**, **\f**, and **\s**

  produce

  newline, *line-feed*, *return*, *tab*, *backspace*, *form-feed*, and *space*,

  respectively.

X/Open Curses does not say what "appropriate *x*" might be. In practice, that is a printable ASCII graphic character. The special case "^?" is interpreted as DEL (127). In all other cases, the character value is AND'd with 0x1f, mapping to ASCII control codes in the range 0 through 31.

Other escapes include

- \^ for ^,
- \\ for \,
- \, for comma,
- **\:** for **:**,
- and **\0** for null.

  \0 will produce \200, which does not terminate a string but behaves as a null character on most terminals, providing CS7 is specified. See **stty**(1).

  The reason for this quirk is to maintain binary compatibility of the compiled terminfo files with other implementations, e.g., the SVr4 systems, which document this. Compiled terminfo files use null-terminated strings, with no lengths. Modifying this would require a new binary format, which would not work with other implementations.

Finally, characters may be given as three octal digits after a \.

A delay in milliseconds may appear anywhere in a string capability, enclosed in $<..> brackets, as in **el**=\EK$<5>, and padding characters are supplied by **tputs**(3X) to provide this delay.

- The delay must be a number with at most one decimal place of precision; it may be followed by suffixes "*" or "/" or both.

- A "*" indicates that the padding required is proportional to the number of lines affected by the operation, and the amount given is the per-affected-unit padding required. (In the case of insert character, the factor is still the number of *lines* affected.)

  Normally, padding is advisory if the device has the **xon** capability; it is used for cost computation but does not trigger delays.

- A "/" suffix indicates that the padding is mandatory and forces a delay of the given number of milliseconds even on devices for which **xon** is present to indicate flow control.

Sometimes individual capabilities must be commented out. To do this, put a period before the capability name. For example, see the second **ind** in the example above.

Fetching Compiled Descriptions

The **ncurses** library searches for terminal descriptions in several places. It uses only the first description found. The library has a compiled-in list of places to search which can be overridden by environment variables. Before starting to search, **ncurses** eliminates duplicates in its search list.

- If the environment variable TERMINFO is set, it is interpreted as the pathname of a directory containing the compiled description you are working on. Only that directory is searched.

- If TERMINFO is not set, **ncurses** will instead look in the directory **$HOME/.terminfo** for a compiled description.

- Next, if the environment variable TERMINFO_DIRS is set, **ncurses** will interpret the contents of that variable as a list of colon-separated directories (or database files) to be searched.

  An empty directory name (i.e., if the variable begins or ends with a colon, or contains adjacent colons) is interpreted as the system location */usr/share/misc/terminfo*.

- Finally, **ncurses** searches these compiled-in locations:

- a list of directories (@TERMINFO_DIRS@), and
- the system terminfo directory, */usr/share/misc/terminfo* (the compiled-in default).

Preparing Descriptions

We now outline how to prepare descriptions of terminals. The most effective way to prepare a terminal description is by imitating the description of a similar terminal in *terminfo* and to build up a description gradually, using partial descriptions with *vi* or some other screen-oriented program to check that they are correct. Be aware that a very unusual terminal may expose deficiencies in the ability of the *terminfo* file to describe it or bugs in the screen-handling code of the test program.

To get the padding for insert line right (if the terminal manufacturer did not document it) a severe test is to edit a large file at 9600 baud, delete 16 or so lines from the middle of the screen, then hit the "u" key several times quickly. If the terminal messes up, more padding is usually needed. A similar test can be used for insert character.

Basic Capabilities

The number of columns on each line for the terminal is given by the **cols** numeric capability. If the terminal is a CRT, then the number of lines on the screen is given by the **lines** capability. If the terminal wraps around to the beginning of the next line when it reaches the right margin, then it should have the **am** capability. If the terminal can clear its screen, leaving the cursor in the home position, then this is given by the **clear** string capability. If the terminal overstrikes (rather than clearing a position when a character is struck over) then it should have the **os** capability. If the terminal is a printing terminal, with no soft copy unit, give it both **hc** and **os**. (**os** applies to storage scope terminals, such as TEKTRONIX 4010 series, as well as hard copy and APL terminals.) If there is a code to move the cursor to the left edge of the current row, give this as **cr**. (Normally this will be carriage return, control/M.) If there is a code to produce an audible signal (bell, beep, etc) give this as **bel**.

If there is a code to move the cursor one position to the left (such as backspace) that capability should be given as **cub1**. Similarly, codes to move to the right, up, and down should be given as **cuf1**, **cuu1**, and **cud1**. These local cursor motions should not alter the text they pass over, for example, you would not normally use "**cuf1**= " because the space would erase the character moved over.

A very important point here is that the local cursor motions encoded in *terminfo* are undefined at the left and top edges of a CRT terminal. Programs should never attempt to backspace around the left edge, unless **bw** is given, and never attempt to go up locally off the top. In order to scroll text up, a program will go to the bottom left corner of the screen and send the **ind** (index) string.

To scroll text down, a program goes to the top left corner of the screen and sends the **ri** (reverse index) string. The strings **ind** and **ri** are undefined when not on their respective corners of the screen.

Parameterized versions of the scrolling sequences are **indn** and **rin** which have the same semantics as **ind** and **ri** except that they take one parameter, and scroll that many lines. They are also undefined except at the appropriate edge of the screen.

The **am** capability tells whether the cursor sticks at the right edge of the screen when text is output, but this does not necessarily apply to a **cuf1** from the last column. The only local motion which is defined from the left edge is if **bw** is given, then a **cub1** from the left edge will move to the right edge of the previous row. If **bw** is not given, the effect is undefined. This is useful for drawing a box around the edge of the screen, for example. If the terminal has switch selectable automatic margins, the *terminfo* file usually assumes that this is on; i.e., **am**. If the terminal has a command which moves to the first column of the next line, that command can be given as **nel** (newline). It does not matter if the command clears the remainder of the current line, so if the terminal has no **cr** and **lf** it may still be possible to craft a working **nel** out of one or both of them.

These capabilities suffice to describe hard-copy and "glass-tty" terminals. Thus the model 33 teletype is described as

```
33|tty33|tty|model 33 teletype,
        bel=^G, cols#72, cr=^M, cud1=^J, hc, ind=^J, os,
```

while the Lear Siegler ADM-3 is described as

```
adm3|3|lsi adm3,
        am, bel=^G, clear=^Z, cols#80, cr=^M, cub1=^H, cud1=^J,
        ind=^J, lines#24,
```

Parameterized Strings

Cursor addressing and other strings requiring parameters in the terminal are described by a parameterized string capability, with *printf*-like escapes such as *%x* in it. For example, to address the cursor, the **cup** capability is given, using two parameters: the row and column to address to. (Rows and columns are numbered from zero and refer to the physical screen visible to the user, not to any unseen memory.) If the terminal has memory relative cursor addressing, that can be indicated by **mrcup**.

The parameter mechanism uses a stack and special **%** codes to manipulate it. Typically a sequence will push one of the parameters onto the stack and then print it in some format. Print (e.g., "%d") is a special case. Other operations, including "%t" pop their operand from the stack. It is noted that more complex operations are often necessary, e.g., in the **sgr** string.

The **%** encodings have the following meanings:

%% outputs "%"

%*[[:]flags][width[.precision]][***doxXs***]*
as in **printf**(3), flags are *[-+#]* and *space*. Use a ":" to allow the next character to be a "-" flag, avoiding interpreting "%-" as an operator.

%c print *pop()* like %c in **printf**

%s print *pop()* like %s in **printf**

%p*[1-9]*
push *i*'th parameter

%P*[a-z]*
set dynamic variable *[a-z]* to *pop()*

%g*[a-z]/*
get dynamic variable *[a-z]* and push it

%P*[A-Z]*
set static variable *[a-z]* to *pop()*

%g*[A-Z]*
get static variable *[a-z]* and push it

The terms "static" and "dynamic" are misleading. Historically, these are simply two different sets of variables, whose values are not reset between calls to **tparm**(3X). However, that fact is not documented in other implementations. Relying on it will adversely impact portability to other implementations.

%'*c***'** char constant *c*

%{*nn***}**
integer constant *nn*

%l push strlen(pop)

%+, **%-**, **%***, **%/**, **%m**
arithmetic (%m is *mod*): *push(pop() op pop())*

%&, **%|**, **%^**
bit operations (AND, OR and exclusive-OR): *push(pop() op pop())*

%=, **%>**, **%<**
logical operations: *push(pop() op pop())*

%A, **%O**
logical AND and OR operations (for conditionals)

%!, **%~**
unary operations (logical and bit complement): *push(op pop())*

%i add 1 to first two parameters (for ANSI terminals)

%? *expr* **%t** *thenpart* **%e** *elsepart* **%;**
This forms an if-then-else. The **%e** *elsepart* is optional. Usually the **%?** *expr* part pushes a value onto the stack, and **%t** pops it from the stack, testing if it is nonzero (true). If it is zero (false), control passes to the **%e** (else) part.

It is possible to form else-if's a la Algol 68:
%? c1 **%t** b1 **%e** c2 **%t** b2 **%e** c3 **%t** b3 **%e** c4 **%t** b4 **%e %;**

where ci are conditions, bi are bodies.

Use the **-f** option of **tic** or **infocmp** to see the structure of if-then-else's. Some strings, e.g., **sgr** can be very complicated when written on one line. The **-f** option splits the string into lines with the parts indented.

Binary operations are in postfix form with the operands in the usual order. That is, to get x-5 one would use "%gx%{5}%-". **%P** and **%g** variables are persistent across escape-string evaluations.

Consider the HP2645, which, to get to row 3 and column 12, needs to be sent \E&a12c03Y padded for 6 milliseconds. Note that the order of the rows and columns is inverted here, and that the row and column are printed as two digits. Thus its **cup** capability is "cup=6\E&%p2%2dc%p1%2dY".

The Microterm ACT-IV needs the current row and column sent preceded by a **^T**, with the row and column simply encoded in binary, "cup=^T%p1%c%p2%c". Terminals which use "%c" need to be able to backspace the cursor (**cub1**), and to move the cursor up one line on the screen (**cuu1**). This is necessary because it is not always safe to transmit **\n ^D** and **\r**, as the system may change or discard them. (The library routines dealing with terminfo set tty modes so that tabs are never expanded, so \t is

safe to send. This turns out to be essential for the Ann Arbor 4080.)

A final example is the LSI ADM-3a, which uses row and column offset by a blank character, thus "cup=\E=%p1%' '%+%c%p2%' '%+%c". After sending "\E=", this pushes the first parameter, pushes the ASCII value for a space (32), adds them (pushing the sum on the stack in place of the two previous values) and outputs that value as a character. Then the same is done for the second parameter. More complex arithmetic is possible using the stack.

Cursor Motions

If the terminal has a fast way to home the cursor (to very upper left corner of screen) then this can be given as **home**; similarly a fast way of getting to the lower left-hand corner can be given as **ll**; this may involve going up with **cuu1** from the home position, but a program should never do this itself (unless **ll** does) because it can make no assumption about the effect of moving up from the home position. Note that the home position is the same as addressing to (0,0): to the top left corner of the screen, not of memory. (Thus, the \EH sequence on HP terminals cannot be used for **home**.)

If the terminal has row or column absolute cursor addressing, these can be given as single parameter capabilities **hpa** (horizontal position absolute) and **vpa** (vertical position absolute). Sometimes these are shorter than the more general two parameter sequence (as with the hp2645) and can be used in preference to **cup**. If there are parameterized local motions (e.g., move *n* spaces to the right) these can be given as **cud**, **cub**, **cuf**, and **cuu** with a single parameter indicating how many spaces to move. These are primarily useful if the terminal does not have **cup**, such as the TEKTRONIX 4025.

If the terminal needs to be in a special mode when running a program that uses these capabilities, the codes to enter and exit this mode can be given as **smcup** and **rmcup**. This arises, for example, from terminals like the Concept with more than one page of memory. If the terminal has only memory relative cursor addressing and not screen relative cursor addressing, a one screen-sized window must be fixed into the terminal for cursor addressing to work properly. This is also used for the TEKTRONIX 4025, where **smcup** sets the command character to be the one used by terminfo. If the **smcup** sequence will not restore the screen after an **rmcup** sequence is output (to the state prior to outputting **rmcup**), specify **nrrmc**.

Area Clears

If the terminal can clear from the current position to the end of the line, leaving the cursor where it is, this should be given as **el**. If the terminal can clear from the beginning of the line to the current position inclusive, leaving the cursor where it is, this should be given as **el1**. If the terminal can clear from the current position to the end of the display, then this should be given as **ed**. **Ed** is only defined from the first column of a line. (Thus, it can be simulated by a request to delete a large number of lines, if a true **ed** is not available.)

Insert/delete line and vertical motions

If the terminal can open a new blank line before the line where the cursor is, this should be given as **il1**; this is done only from the first position of a line. The cursor must then appear on the newly blank line. If the terminal can delete the line which the cursor is on, then this should be given as **dl1**; this is done only from the first position on the line to be deleted. Versions of **il1** and **dl1** which take a single parameter and insert or delete that many lines can be given as **il** and **dl**.

If the terminal has a settable scrolling region (like the vt100) the command to set this can be described with the **csr** capability, which takes two parameters: the top and bottom lines of the scrolling region. The cursor position is, alas, undefined after using this command.

It is possible to get the effect of insert or delete line using **csr** on a properly chosen region; the **sc** and **rc** (save and restore cursor) commands may be useful for ensuring that your synthesized insert/delete string does not move the cursor. (Note that the **ncurses**(3X) library does this synthesis automatically, so you need not compose insert/delete strings for an entry with **csr**).

Yet another way to construct insert and delete might be to use a combination of index with the memory-lock feature found on some terminals (like the HP-700/90 series, which however also has insert/delete).

Inserting lines at the top or bottom of the screen can also be done using **ri** or **ind** on many terminals without a true insert/delete line, and is often faster even on terminals with those features.

The boolean **non_dest_scroll_region** should be set if each scrolling window is effectively a view port on a screen-sized canvas. To test for this capability, create a scrolling region in the middle of the screen, write something to the bottom line, move the cursor to the top of the region, and do **ri** followed by **dl1** or **ind**. If the data scrolled off the bottom of the region by the **ri** re-appears, then scrolling is non-destructive. System V and XSI Curses expect that **ind**, **ri**, **indn**, and **rin** will simulate destructive scrolling; their documentation cautions you not to define **csr** unless this is true. This **curses** implementation is more liberal and will do explicit erases after scrolling if **ndsrc** is defined.

If the terminal has the ability to define a window as part of memory, which all commands affect, it should be given as the parameterized string **wind**. The four parameters are the starting and ending lines in memory and the starting and ending columns in memory, in that order.

If the terminal can retain display memory above, then the **da** capability should be given; if display memory can be retained below, then **db** should be given. These indicate that deleting a line or scrolling may bring non-blank lines up from below or that scrolling back with **ri** may bring down non-blank lines.

Insert/Delete Character

There are two basic kinds of intelligent terminals with respect to insert/delete character which can be described using *terminfo*. The most common insert/delete character operations affect only the characters on the current line and shift characters off the end of the line rigidly. Other terminals, such as the Concept 100 and the Perkin Elmer Owl, make a distinction between typed and untyped blanks on the screen, shifting upon an insert or delete only to an untyped blank on the screen which is either eliminated, or expanded to two untyped blanks.

You can determine the kind of terminal you have by clearing the screen and then typing text separated by cursor motions. Type "abc def" using local cursor motions (not spaces) between the "abc" and the "def". Then position the cursor before the "abc" and put the terminal in insert mode. If typing characters causes the rest of the line to shift rigidly and characters to fall off the end, then your terminal does not distinguish between blanks and untyped positions. If the "abc" shifts over to the "def" which then move together around the end of the current line and onto the next as you insert, you have the second type of terminal, and should give the capability **in**, which stands for "insert null".

While these are two logically separate attributes (one line versus multi-line insert mode, and special treatment of untyped spaces) we have seen no terminals whose insert mode cannot be described with the single attribute.

Terminfo can describe both terminals which have an insert mode, and terminals which send a simple sequence to open a blank position on the current line. Give as **smir** the sequence to get into insert mode. Give as **rmir** the sequence to leave insert mode. Now give as **ich1** any sequence needed to be sent just before sending the character to be inserted. Most terminals with a true insert mode will not give **ich1**; terminals which send a sequence to open a screen position should give it here.

If your terminal has both, insert mode is usually preferable to **ich1**. Technically, you should not give both unless the terminal actually requires both to be used in combination. Accordingly, some non-curses applications get confused if both are present; the symptom is doubled characters in an update using insert. This requirement is now rare; most **ich** sequences do not require previous smir, and most smir insert modes do not require **ich1** before each character. Therefore, the new **curses** actually assumes this is the case and uses either **rmir**/**smir** or **ich**/**ich1** as appropriate (but not both). If you have to write an entry to be used under new curses for a terminal old enough to need both, include the **rmir**/**smir** sequences in **ich1**.

If post insert padding is needed, give this as a number of milliseconds in **ip** (a string option). Any other sequence which may need to be sent after an insert of a single character may also be given in **ip**. If your terminal needs both to be placed into an "insert mode" and a special code to precede each inserted character, then both **smir**/**rmir** and **ich1** can be given, and both will be used. The **ich** capability, with one parameter, *n*, will repeat the effects of **ich1** *n* times.

If padding is necessary between characters typed while not in insert mode, give this as a number of milliseconds padding in **rmp**.

It is occasionally necessary to move around while in insert mode to delete characters on the same line (e.g., if there is a tab after the insertion position). If your terminal allows motion while in insert mode you can give the capability **mir** to speed up inserting in this case. Omitting **mir** will affect only speed. Some terminals (notably Datamedia's) must not have **mir** because of the way their insert mode works.

Finally, you can specify **dch1** to delete a single character, **dch** with one parameter, *n*, to delete *n characters*, and delete mode by giving **smdc** and **rmdc** to enter and exit delete mode (any mode the terminal needs to be placed in for **dch1** to work).

A command to erase *n* characters (equivalent to outputting *n* blanks without moving the cursor) can be given as **ech** with one parameter.

Highlighting, Underlining, and Visible Bells

If your terminal has one or more kinds of display attributes, these can be represented in a number of different ways. You should choose one display form as *standout mode*, representing a good, high contrast, easy-on-the-eyes, format for highlighting error messages and other attention getters. (If you have a choice, reverse video plus half-bright is good, or reverse video alone.) The sequences to enter and exit standout mode are given as **smso** and **rmso**, respectively. If the code to change into or out of standout mode leaves one or even two blank spaces on the screen, as the TVI 912 and Teleray 1061 do, then **xmc** should be given to tell how many spaces are left.

Codes to begin underlining and end underlining can be given as **smul** and **rmul** respectively. If the terminal has a code to underline the current character and move the cursor one space to the right, such as the Microterm Mime, this can be given as **uc**.

Other capabilities to enter various highlighting modes include **blink** (blinking) **bold** (bold or extra bright) **dim** (dim or half-bright) **invis** (blanking or invisible text) **prot** (protected) **rev** (reverse video) **sgr0** (turn off *all* attribute modes) **smacs** (enter alternate character set mode) and **rmacs** (exit alternate character set mode). Turning on any of these modes singly may or may not turn off other modes.

If there is a sequence to set arbitrary combinations of modes, this should be given as **sgr** (set attributes), taking 9 parameters. Each parameter is either 0 or nonzero, as the corresponding attribute is on or off. The 9 parameters are, in order: standout, underline, reverse, blink, dim, bold, blank, protect, alternate character set. Not all modes need be supported by **sgr**, only those for which corresponding separate attribute commands exist.

For example, the DEC vt220 supports most of the modes:

tparm parameter	attribute	escape sequence
none	none	\E[0m
p1	standout	\E[0;1;7m
p2	underline	\E[0;4m
p3	reverse	\E[0;7m
p4	blink	\E[0;5m
p5	dim	not available
p6	bold	\E[0;1m
p7	invis	\E[0;8m
p8	protect	not used
p9	altcharset	^O (off) ^N (on)

We begin each escape sequence by turning off any existing modes, since there is no quick way to determine whether they are active. Standout is set up to be the combination of reverse and bold. The vt220 terminal has a protect mode, though it is not commonly used in sgr because it protects characters on the screen from the host's erasures. The altcharset mode also is different in that it is either ^O or ^N, depending on whether it is off or on. If all modes are turned on, the resulting sequence is \E[0;1;4;5;7;8m^N.

Some sequences are common to different modes. For example, ;7 is output when either p1 or p3 is true, that is, if either standout or reverse modes are turned on.

Writing out the above sequences, along with their dependencies yields

sequence	when to output	terminfo translation
\E[0	always	\E[0
;1	if p1 or p6	%?%p1%p6%|%t;1%;
;4	if p2	%?%p2%|%t;4%;
;5	if p4	%?%p4%|%t;5%;
;7	if p1 or p3	%?%p1%p3%|%t;7%;

;8	if p7	%?%p7%|%t;8%;
m	always	m
^N or ^O	if p9 ^N, else ^O	%?%p9%t^N%e^O%;

Putting this all together into the sgr sequence gives:

```
sgr=\E[0%?%p1%p6%|%t;1%;%?%p2%t;4%;%?%p4%t;5%;
  %?%p1%p3%|%t;7%;%?%p7%t;8%;m%?%p9%t\016%e\017%;,
```

Remember that if you specify sgr, you must also specify sgr0. Also, some implementations rely on sgr being given if sgr0 is, Not all terminfo entries necessarily have an sgr string, however. Many terminfo entries are derived from termcap entries which have no sgr string. The only drawback to adding an sgr string is that termcap also assumes that sgr0 does not exit alternate character set mode.

Terminals with the "magic cookie" glitch (**xmc**) deposit special "cookies" when they receive mode-setting sequences, which affect the display algorithm rather than having extra bits for each character. Some terminals, such as the HP 2621, automatically leave standout mode when they move to a new line or the cursor is addressed. Programs using standout mode should exit standout mode before moving the cursor or sending a newline, unless the **msgr** capability, asserting that it is safe to move in standout mode, is present.

If the terminal has a way of flashing the screen to indicate an error quietly (a bell replacement) then this can be given as **flash**; it must not move the cursor.

If the cursor needs to be made more visible than normal when it is not on the bottom line (to make, for example, a non-blinking underline into an easier to find block or blinking underline) give this sequence as **cvvis**. If there is a way to make the cursor completely invisible, give that as **civis**. The capability **cnorm** should be given which undoes the effects of both of these modes.

If your terminal correctly generates underlined characters (with no special codes needed) even though it does not overstrike, then you should give the capability **ul**. If a character overstriking another leaves both characters on the screen, specify the capability **os**. If overstrikes are erasable with a blank, then this should be indicated by giving **eo**.

Keypad and Function Keys

If the terminal has a keypad that transmits codes when the keys are pressed, this information can be given. Note that it is not possible to handle terminals where the keypad only works in local (this applies, for example, to the unshifted HP 2621 keys). If the keypad can be set to transmit or not

transmit, give these codes as **smkx** and **rmkx**. Otherwise the keypad is assumed to always transmit.

The codes sent by the left arrow, right arrow, up arrow, down arrow, and home keys can be given as **kcub1, kcuf1, kcuu1, kcud1,** and **khome** respectively. If there are function keys such as f0, f1, ..., f10, the codes they send can be given as **kf0, kf1, ..., kf10**. If these keys have labels other than the default f0 through f10, the labels can be given as **lf0, lf1, ..., lf10**.

The codes transmitted by certain other special keys can be given:

- **kll** (home down),
- **kbs** (backspace),
- **ktbc** (clear all tabs),
- **kctab** (clear the tab stop in this column),
- **kclr** (clear screen or erase key),
- **kdch1** (delete character),
- **kdl1** (delete line),
- **krmir** (exit insert mode),
- **kel** (clear to end of line),
- **ked** (clear to end of screen),
- **kich1** (insert character or enter insert mode),
- **kil1** (insert line),
- **knp** (next page),
- **kpp** (previous page),
- **kind** (scroll forward/down),
- **kri** (scroll backward/up),

- **khts** (set a tab stop in this column).

In addition, if the keypad has a 3 by 3 array of keys including the four arrow keys, the other five keys can be given as **ka1**, **ka3**, **kb2**, **kc1**, and **kc3**. These keys are useful when the effects of a 3 by 3 directional pad are needed.

Strings to program function keys can be given as **pfkey**, **pfloc**, and **pfx**. A string to program screen labels should be specified as **pln**. Each of these strings takes two parameters: the function key number to program (from 0 to 10) and the string to program it with. Function key numbers out of this range may program undefined keys in a terminal dependent manner. The difference between the capabilities is that **pfkey** causes pressing the given key to be the same as the user typing the given string; **pfloc** causes the string to be executed by the terminal in local; and **pfx** causes the string to be transmitted to the computer.

The capabilities **nlab**, **lw** and **lh** define the number of programmable screen labels and their width and height. If there are commands to turn the labels on and off, give them in **smln** and **rmln**. **smln** is normally output after one or more pln sequences to make sure that the change becomes visible.

Tabs and Initialization

A few capabilities are used only for tabs:

- If the terminal has hardware tabs, the command to advance to the next tab stop can be given as **ht** (usually control/I).

- A "back-tab" command which moves leftward to the preceding tab stop can be given as **cbt**.

  By convention, if the teletype modes indicate that tabs are being expanded by the computer rather than being sent to the terminal, programs should not use **ht** or **cbt** even if they are present, since the user may not have the tab stops properly set.

- If the terminal has hardware tabs which are initially set every *n* spaces when the terminal is powered up, the numeric parameter **it** is given, showing the number of spaces the tabs are set to.

  The **it** capability is normally used by the **tset** command to determine whether to set the mode for hardware tab expansion, and whether to set the tab stops. If the terminal has tab stops that can be saved in non-volatile memory, the terminfo description can assume that they are properly set.

Other capabilities include

- **is1**, **is2**, and **is3**, initialization strings for the terminal,

- **iprog**, the path name of a program to be run to initialize the terminal,
- and **if**, the name of a file containing long initialization strings.

These strings are expected to set the terminal into modes consistent with the rest of the terminfo description. They are normally sent to the terminal, by the *init* option of the **tput** program, each time the user logs in. They will be printed in the following order:

run the program
iprog

output
is1 and
is2

set the margins using
mgc or
smglp and **smgrp** or
smgl and **smgr**

set tabs using
tbc and **hts**

print the file
if

and finally output
is3.

Most initialization is done with **is2**. Special terminal modes can be set up without duplicating strings by putting the common sequences in **is2** and special cases in **is1** and **is3**.

A set of sequences that does a harder reset from a totally unknown state can be given as **rs1**, **rs2**, **rf** and **rs3**, analogous to **is1 , is2 , if** and **is3** respectively. These strings are output by *reset* option of **tput**, or by the **reset** program (an alias of **tset**), which is used when the terminal gets into a wedged state. Commands are normally placed in **rs1**, **rs2 rs3** and **rf** only if they produce annoying effects on the screen and are not necessary when logging in. For example, the command to set the vt100 into 80-column mode would normally be part of **is2**, but it causes an annoying glitch of the screen and is not normally needed since the terminal is usually already in 80-column mode.

The **reset** program writes strings including **iprog**, etc., in the same order as the *init* program, using **rs1**, etc., instead of **is1**, etc. If any of **rs1**, **rs2**, **rs3**, or **rf** reset capability strings are missing, the **reset** program falls back upon the corresponding initialization capability string.

If there are commands to set and clear tab stops, they can be given as **tbc** (clear all tab stops) and **hts** (set a tab stop in the current column of every row). If a more complex sequence is needed to set the tabs than can be described by this, the sequence can be placed in **is2** or **if**.

The **tput reset** command uses the same capability strings as the **reset** command, although the two programs (**tput** and **reset**) provide different command-line options.

In practice, these terminfo capabilities are not often used in initialization of tabs (though they are required for the **tabs** program):

- Almost all hardware terminals (at least those which supported tabs) initialized those to every *eight* columns:

  The only exception was the AT&T 2300 series, which set tabs to every *five* columns.

- In particular, developers of the hardware terminals which are commonly used as models for modern terminal emulators provided documentation demonstrating that *eight* columns were the standard.

- Because of this, the terminal initialization programs **tput** and **tset** use the **tbc** (**clear_all_tabs**) and **hts** (**set_tab**) capabilities directly only when the **it** (**init_tabs**) capability is set to a value other than *eight*.

Delays and Padding

Many older and slower terminals do not support either XON/XOFF or DTR handshaking, including hard copy terminals and some very archaic CRTs (including, for example, DEC VT100s). These may require padding characters after certain cursor motions and screen changes.

If the terminal uses xon/xoff handshaking for flow control (that is, it automatically emits ^S back to the host when its input buffers are close to full), set **xon**. This capability suppresses the emission of padding. You can also set it for memory-mapped console devices effectively that do not have a speed limit. Padding information should still be included so that routines can make better decisions about relative costs, but actual pad characters will not be transmitted.

If **pb** (padding baud rate) is given, padding is suppressed at baud rates below the value of **pb**. If the entry has no padding baud rate, then whether padding is emitted or not is completely controlled by **xon**.

If the terminal requires other than a null (zero) character as a pad, then this can be given as **pad**. Only the first character of the **pad** string is used.

Status Lines

Some terminals have an extra "status line" which is not normally used by software (and thus not counted in the terminal's **lines** capability).

The simplest case is a status line which is cursor-addressable but not part of the main scrolling region on the screen; the Heathkit H19 has a status line of this kind, as would a 24-line VT100 with a 23-line scrolling region set up on initialization. This situation is indicated by the **hs** capability.

Some terminals with status lines need special sequences to access the status line. These may be expressed as a string with single parameter **tsl** which takes the cursor to a given zero-origin column on the status line. The capability **fsl** must return to the main-screen cursor positions before the last **tsl**. You may need to embed the string values of **sc** (save cursor) and **rc** (restore cursor) in **tsl** and **fsl** to accomplish this.

The status line is normally assumed to be the same width as the width of the terminal. If this is untrue, you can specify it with the numeric capability **wsl**.

A command to erase or blank the status line may be specified as **dsl**.

The boolean capability **eslok** specifies that escape sequences, tabs, etc., work ordinarily in the status line.

The **ncurses** implementation does not yet use any of these capabilities. They are documented here in case they ever become important.

Line Graphics

Many terminals have alternate character sets useful for forms-drawing. Terminfo and **curses** have built-in support for most of the drawing characters supported by the VT100, with some characters from the AT&T 4410v1 added. This alternate character set may be specified by the **acsc** capability.

Glyph Name	**ACS Name**	**Ascii Default**	**acsc Char**	**acsc Value**
arrow pointing right	ACS_RARROW	>	+	0x2b
arrow pointing left	ACS_LARROW	<	,	0x2c

arrow pointing up	ACS_UARROW	^	-	0x2d
arrow pointing down	ACS_DARROW	v	.	0x2e
solid square block	ACS_BLOCK	#	0	0x30
diamond	ACS_DIAMOND	+	‘	0x60
checker board (stipple)	ACS_CKBOARD	:	a	0x61
degree symbol	ACS_DEGREE	\	f	0x66
plus/minus	ACS_PLMINUS	#	g	0x67
board of squares	ACS_BOARD	#	h	0x68
lantern symbol	ACS_LANTERN	#	i	0x69
lower right corner	ACS_LRCORNER	+	j	0x6a
upper right corner	ACS_URCORNER	+	k	0x6b
upper left corner	ACS_ULCORNER	+	l	0x6c
lower left corner	ACS_LLCORNER	+	m	0x6d
large plus or crossover	ACS_PLUS	+	n	0x6e
scan line 1	ACS_S1	~	o	0x6f
scan line 3	ACS_S3	-	p	0x70
horizontal line	ACS_HLINE	-	q	0x71
scan line 7	ACS_S7	-	r	0x72
scan line 9	ACS_S9	_	s	0x73
tee pointing right	ACS_LTEE	+	t	0x74
tee pointing left	ACS_RTEE	+	u	0x75
tee pointing up	ACS_BTEE	+	v	0x76
tee pointing down	ACS_TTEE	+	w	0x77
vertical line	ACS_VLINE	|	x	0x78
less-than-or-equal-to	ACS_LEQUAL	<	y	0x79
greater-than-or-equal-to	ACS_GEQUAL	>	z	0x7a
greek pi	ACS_PI	*	{	0x7b

not-equal	ACS_NEQUAL	!	|	0x7c
UK pound sign	ACS_STERLING	f	}	0x7d
bullet	ACS_BULLET	o	~	0x7e

A few notes apply to the table itself:

- X/Open Curses incorrectly states that the mapping for *lantern* is uppercase "I" although Unix implementations use the lowercase "i" mapping.

- The DEC VT100 implemented graphics using the alternate character set feature, temporarily switching *modes* and sending characters in the range 0x60 (96) to 0x7e (126) (the **acsc Value** column in the table).

- The AT&T terminal added graphics characters outside that range.

  Some of the characters within the range do not match the VT100; presumably they were used in the AT&T terminal: *board of squares* replaces the VT100 *newline* symbol, while *lantern symbol* replaces the VT100 *vertical tab* symbol. The other VT100 symbols for control characters (*horizontal tab*, *carriage return* and *line-feed*) are not (re)used in curses.

The best way to define a new device's graphics set is to add a column to a copy of this table for your terminal, giving the character which (when emitted between **smacs**/**rmacs** switches) will be rendered as the corresponding graphic. Then read off the VT100/your terminal character pairs right to left in sequence; these become the ACSC string.

Color Handling

The curses library functions **init_pair** and **init_color** manipulate the *color pairs* and *color values* discussed in this section (see **curs_color**(3X) for details on these and related functions).

Most color terminals are either "Tektronix-like" or "HP-like":

- Tektronix-like terminals have a predefined set of *N* colors (where *N* is usually 8), and can set character-cell foreground and background characters independently, mixing them into *N* * *N* color-pairs.

- On HP-like terminals, the user must set each color pair up separately (foreground and background are not independently settable). Up to *M* color-pairs may be set up from 2**M* different colors. ANSI-compatible terminals are Tektronix-like.

Some basic color capabilities are independent of the color method. The numeric capabilities **colors** and

pairs specify the maximum numbers of colors and color-pairs that can be displayed simultaneously. The **op** (original pair) string resets foreground and background colors to their default values for the terminal. The **oc** string resets all colors or color-pairs to their default values for the terminal. Some terminals (including many PC terminal emulators) erase screen areas with the current background color rather than the power-up default background; these should have the boolean capability **bce**.

While the curses library works with *color pairs* (reflecting the inability of some devices to set foreground and background colors independently), there are separate capabilities for setting these features:

- To change the current foreground or background color on a Tektronix-type terminal, use **setaf** (set ANSI foreground) and **setab** (set ANSI background) or **setf** (set foreground) and **setb** (set background). These take one parameter, the color number. The SVr4 documentation describes only **setaf**/**setab**; the XPG4 draft says that "If the terminal supports ANSI escape sequences to set background and foreground, they should be coded as **setaf** and **setab**, respectively.

- If the terminal supports other escape sequences to set background and foreground, they should be coded as **setf** and **setb**, respectively. The **vidputs** and the **refresh**(3X) functions use the **setaf** and **setab** capabilities if they are defined.

The **setaf**/**setab** and **setf**/**setb** capabilities take a single numeric argument each. Argument values 0-7 of **setaf**/**setab** are portably defined as follows (the middle column is the symbolic #define available in the header for the **curses** or **ncurses** libraries). The terminal hardware is free to map these as it likes, but the RGB values indicate normal locations in color space.

Color	**#define**	**Value**	**RGB**
black	**COLOR_BLACK**	0	0, 0, 0
red	**COLOR_RED**	1	max,0,0
green	**COLOR_GREEN**	2	0,max,0
yellow	**COLOR_YELLOW**	3	max,max,0
blue	**COLOR_BLUE**	4	0,0,max
magenta	**COLOR_MAGENTA**	5	max,0,max
cyan	**COLOR_CYAN**	6	0,max,max
white	**COLOR_WHITE**	7	max,max,max

The argument values of **setf**/**setb** historically correspond to a different mapping, i.e.,

Color	**#define**	**Value**	**RGB**

black	**COLOR_BLACK**	0	0, 0, 0
blue	**COLOR_BLUE**	1	0,0,max
green	**COLOR_GREEN**	2	0,max,0
cyan	**COLOR_CYAN**	3	0,max,max
red	**COLOR_RED**	4	max,0,0
magenta	**COLOR_MAGENTA**	5	max,0,max
yellow	**COLOR_YELLOW**	6	max,max,0
white	**COLOR_WHITE**	7	max,max,max

It is important to not confuse the two sets of color capabilities; otherwise red/blue will be interchanged on the display.

On an HP-like terminal, use **scp** with a color-pair number parameter to set which color pair is current.

Some terminals allow the *color values* to be modified:

- On a Tektronix-like terminal, the capability **ccc** may be present to indicate that colors can be modified. If so, the **initc** capability will take a color number (0 to **colors** - 1)and three more parameters which describe the color. These three parameters default to being interpreted as RGB (Red, Green, Blue) values. If the boolean capability **hls** is present, they are instead as HLS (Hue, Lightness, Saturation) indices. The ranges are terminal-dependent.

- On an HP-like terminal, **initp** may give a capability for changing a color-pair value. It will take seven parameters; a color-pair number (0 to **max_pairs** - 1), and two triples describing first background and then foreground colors. These parameters must be (Red, Green, Blue) or (Hue, Lightness, Saturation) depending on **hls**.

On some color terminals, colors collide with highlights. You can register these collisions with the **ncv** capability. This is a bit-mask of attributes not to be used when colors are enabled. The correspondence with the attributes understood by **curses** is as follows:

Attribute	**Bit**	**Decimal**	**Set by**
A_STANDOUT	0	1	sgr
A_UNDERLINE	1	2	sgr
A_REVERSE	2	4	sgr
A_BLINK	3	8	sgr
A_DIM	4	16	sgr
A_BOLD	5	32	sgr
A_INVIS	6	64	sgr

A_PROTECT	7	128	sgr
A_ALTCHARSET	8	256	sgr
A_HORIZONTAL	9	512	sgr1
A_LEFT	10	1024	sgr1
A_LOW	11	2048	sgr1
A_RIGHT	12	4096	sgr1
A_TOP	13	8192	sgr1
A_VERTICAL	14	16384	sgr1
A_ITALIC	15	32768	sitm

For example, on many IBM PC consoles, the underline attribute collides with the foreground color blue and is not available in color mode. These should have an **ncv** capability of 2.

SVr4 curses does nothing with **ncv**, ncurses recognizes it and optimizes the output in favor of colors.

Miscellaneous

If the terminal requires other than a null (zero) character as a pad, then this can be given as pad. Only the first character of the pad string is used. If the terminal does not have a pad character, specify npc. Note that ncurses implements the termcap-compatible **PC** variable; though the application may set this value to something other than a null, ncurses will test **npc** first and use napms if the terminal has no pad character.

If the terminal can move up or down half a line, this can be indicated with **hu** (half-line up) and **hd** (half-line down). This is primarily useful for superscripts and subscripts on hard-copy terminals. If a hard-copy terminal can eject to the next page (form feed), give this as **ff** (usually control/L).

If there is a command to repeat a given character a given number of times (to save time transmitting a large number of identical characters) this can be indicated with the parameterized string **rep**. The first parameter is the character to be repeated and the second is the number of times to repeat it. Thus, tparm(repeat_char, 'x', 10) is the same as "xxxxxxxxxx".

If the terminal has a settable command character, such as the TEKTRONIX 4025, this can be indicated with **cmdch**. A prototype command character is chosen which is used in all capabilities. This character is given in the **cmdch** capability to identify it. The following convention is supported on some UNIX systems: The environment is to be searched for a **CC** variable, and if found, all occurrences of the prototype character are replaced with the character in the environment variable.

Terminal descriptions that do not represent a specific kind of known terminal, such as *switch*, *dialup*, *patch*, and *network*, should include the **gn** (generic) capability so that programs can complain that they do not know how to talk to the terminal. (This capability does not apply to *virtual* terminal descriptions

for which the escape sequences are known.)

If the terminal has a "meta key" which acts as a shift key, setting the 8th bit of any character transmitted, this fact can be indicated with **km**. Otherwise, software will assume that the 8th bit is parity and it will usually be cleared. If strings exist to turn this "meta mode" on and off, they can be given as **smm** and **rmm**.

If the terminal has more lines of memory than will fit on the screen at once, the number of lines of memory can be indicated with **lm**. A value of **lm**#0 indicates that the number of lines is not fixed, but that there is still more memory than fits on the screen.

If the terminal is one of those supported by the UNIX virtual terminal protocol, the terminal number can be given as **vt**.

Media copy strings which control an auxiliary printer connected to the terminal can be given as **mc0**: print the contents of the screen, **mc4**: turn off the printer, and **mc5**: turn on the printer. When the printer is on, all text sent to the terminal will be sent to the printer. It is undefined whether the text is also displayed on the terminal screen when the printer is on. A variation **mc5p** takes one parameter, and leaves the printer on for as many characters as the value of the parameter, then turns the printer off. The parameter should not exceed 255. All text, including **mc4**, is transparently passed to the printer while an **mc5p** is in effect.

Glitches and Braindamage

Hazeltine terminals, which do not allow "~" characters to be displayed should indicate **hz**.

Terminals which ignore a line-feed immediately after an **am** wrap, such as the Concept and vt100, should indicate **xenl**.

If **el** is required to get rid of standout (instead of merely writing normal text on top of it), **xhp** should be given.

Teleray terminals, where tabs turn all characters moved over to blanks, should indicate **xt** (destructive tabs). Note: the variable indicating this is now "dest_tabs_magic_smso"; in older versions, it was teleray_glitch. This glitch is also taken to mean that it is not possible to position the cursor on top of a "magic cookie", that to erase standout mode it is instead necessary to use delete and insert line. The ncurses implementation ignores this glitch.

The Beehive Superbee, which is unable to correctly transmit the escape or control/C characters, has **xsb**, indicating that the f1 key is used for escape and f2 for control/C. (Only certain Superbees have this problem, depending on the ROM.) Note that in older terminfo versions, this capability was called

"beehive_glitch"; it is now "no_esc_ctl_c".

Other specific terminal problems may be corrected by adding more capabilities of the form **x***x*.

Pitfalls of Long Entries

Long terminfo entries are unlikely to be a problem; to date, no entry has even approached terminfo's 4096-byte string-table maximum. Unfortunately, the termcap translations are much more strictly limited (to 1023 bytes), thus termcap translations of long terminfo entries can cause problems.

The man pages for 4.3BSD and older versions of **tgetent** instruct the user to allocate a 1024-byte buffer for the termcap entry. The entry gets null-terminated by the termcap library, so that makes the maximum safe length for a termcap entry 1k-1 (1023) bytes. Depending on what the application and the termcap library being used does, and where in the termcap file the terminal type that **tgetent** is searching for is, several bad things can happen.

Some termcap libraries print a warning message or exit if they find an entry that's longer than 1023 bytes; others do not; others truncate the entries to 1023 bytes. Some application programs allocate more than the recommended 1K for the termcap entry; others do not.

Each termcap entry has two important sizes associated with it: before "tc" expansion, and after "tc" expansion. "tc" is the capability that tacks on another termcap entry to the end of the current one, to add on its capabilities. If a termcap entry does not use the "tc" capability, then of course the two lengths are the same.

The "before tc expansion" length is the most important one, because it affects more than just users of that particular terminal. This is the length of the entry as it exists in /etc/termcap, minus the backslash-newline pairs, which **tgetent** strips out while reading it. Some termcap libraries strip off the final newline, too (GNU termcap does not). Now suppose:

- a termcap entry before expansion is more than 1023 bytes long,
- and the application has only allocated a 1k buffer,
- and the termcap library (like the one in BSD/OS 1.1 and GNU) reads the whole entry into the buffer, no matter what its length, to see if it is the entry it wants,
- and **tgetent** is searching for a terminal type that either is the long entry, appears in the termcap file after the long entry, or does not appear in the file at all (so that **tgetent** has to search the whole termcap file).

Then **tgetent** will overwrite memory, perhaps its stack, and probably core dump the program. Programs like telnet are particularly vulnerable; modern telnets pass along values like the terminal type automatically. The results are almost as undesirable with a termcap library, like SunOS 4.1.3 and Ultrix 4.4, that prints warning messages when it reads an overly long termcap entry. If a termcap library truncates long entries, like OSF/1 3.0, it is immune to dying here but will return incorrect data for the terminal.

The "after tc expansion" length will have a similar effect to the above, but only for people who actually set TERM to that terminal type, since **tgetent** only does "tc" expansion once it is found the terminal type it was looking for, not while searching.

In summary, a termcap entry that is longer than 1023 bytes can cause, on various combinations of termcap libraries and applications, a core dump, warnings, or incorrect operation. If it is too long even before "tc" expansion, it will have this effect even for users of some other terminal types and users whose TERM variable does not have a termcap entry.

When in -C (translate to termcap) mode, the **ncurses** implementation of **tic**(1M) issues warning messages when the pre-tc length of a termcap translation is too long. The -c (check) option also checks resolved (after tc expansion) lengths.

Binary Compatibility

It is not wise to count on portability of binary terminfo entries between commercial UNIX versions. The problem is that there are at least two versions of terminfo (under HP-UX and AIX) which diverged from System V terminfo after SVr1, and have added extension capabilities to the string table that (in the binary format) collide with System V and XSI Curses extensions.

EXTENSIONS

Searching for terminal descriptions in **$HOME/.terminfo** and TERMINFO_DIRS is not supported by older implementations.

Some SVr4 **curses** implementations, and all previous to SVr4, do not interpret the %A and %O operators in parameter strings.

SVr4/XPG4 do not specify whether **msgr** licenses movement while in an alternate-character-set mode (such modes may, among other things, map CR and NL to characters that do not trigger local motions). The **ncurses** implementation ignores **msgr** in **ALTCHARSET** mode. This raises the possibility that an XPG4 implementation making the opposite interpretation may need terminfo entries made for **ncurses** to have **msgr** turned off.

The **ncurses** library handles insert-character and insert-character modes in a slightly non-standard way

to get better update efficiency. See the **Insert/Delete Character** subsection above.

The parameter substitutions for **set_clock** and **display_clock** are not documented in SVr4 or the XSI Curses standard. They are deduced from the documentation for the AT&T 505 terminal.

Be careful assigning the **kmous** capability. The **ncurses** library wants to interpret it as **KEY_MOUSE**, for use by terminals and emulators like xterm that can return mouse-tracking information in the keyboard-input stream.

X/Open Curses does not mention italics. Portable applications must assume that numeric capabilities are signed 16-bit values. This includes the *no_color_video* (ncv) capability. The 32768 mask value used for italics with ncv can be confused with an absent or cancelled ncv. If italics should work with colors, then the ncv value must be specified, even if it is zero.

Different commercial ports of terminfo and curses support different subsets of the XSI Curses standard and (in some cases) different extension sets. Here is a summary, accurate as of October 1995:

- **SVR4, Solaris, ncurses** -- These support all SVr4 capabilities.
- **SGI** -- Supports the SVr4 set, adds one undocumented extended string capability (**set_pglen**).
- **SVr1, Ultrix** -- These support a restricted subset of terminfo capabilities. The booleans end with **xon_xoff**; the numerics with **width_status_line**; and the strings with **prtr_non**.
- **HP/UX** -- Supports the SVr1 subset, plus the SVr[234] numerics **num_labels**, **label_height**, **label_width**, plus function keys 11 through 63, plus **plab_norm**, **label_on**, and **label_off**, plus some incompatible extensions in the string table.
- **AIX** -- Supports the SVr1 subset, plus function keys 11 through 63, plus a number of incompatible string table extensions.
- **OSF** -- Supports both the SVr4 set and the AIX extensions.

FILES

/usr/share/misc/terminfo/?/* files containing terminal descriptions

SEE ALSO

infocmp(1M), **tabs**(1), **tic**(1M), **curses**(3X), **curs_color**(3X), **curs_variables**(3X), **printf**(3), **term_variables**(3X). **term**(5). **user_caps**(5).

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