



# **pytermor**

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(yet another) Python library designed for formatting terminal output using ANSI escape codes. Implements automatic "soft" format termination. Provides a registry of low-level SGR (Select Graphic Rendition) *sequences* and formatting *spans* (or combined sequences). Also includes a set of formatters for pretty output.

Key feature of this library is providing necessary abstractions for building complex text sections with lots of formatting, while keeping the application code clear and readable.

No dependencies besides Python Standard Library are required (*there are some for testing and docs building, though*).

@TODO This is how you **should** format examples:

We put these pieces together to create a SGR command. Thus, `ESC[1m` specifies bold (or bright) text, and `ESC[31m` specifies red foreground text. We can chain together parameters; for example, `ESC[32;47m` specifies green foreground text on a white background.

The following diagram shows a complete example for rendering the word "text" in red with a single underline.



#### Notes

- For terminals that support bright foreground colors, `ESC[1;3Xm` is usually equivalent to `ESC[9Xm` (where `X` is a digit in 0-7). However, the reverse does not seem to hold, at least anecdotally: `ESC[2;9Xm` usually does not render the same as `ESC[3Xm`.
- Not all terminals support every effect.

Fig. 1: <https://chrisyeh96.github.io/2020/03/28/terminal-colors.html#color-schemes>



## 1.1 Getting started

### 1.1.1 Installation

```
pip install pytermor
```

### 1.1.2 Features

One of the core concepts of the library is *Span* class. *Span* is a combination of two control sequences; it wraps specified string with pre-defined leading and trailing SGR definitions.

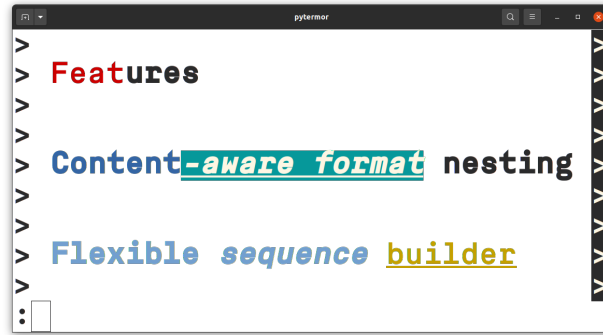
Example code:

```
1 from pytermor import span
2
3 print(span.RED('Feat') + span.BOLD('ures'))
```

### Content-aware format nesting

Compose text spans with automatic content-aware span termination. Preset spans can safely overlap with each other (as long as they require different *breaker* sequences to reset).

```
1 from pytermor import Span
2
3 span1 = Span('blue', 'bold')
4 span2 = Span('cyan', 'inversed', 'underlined', 'italic')
5
6 msg = span1(f'Content{span2("-aware format")} nesting')
7 print(msg)
```



### Flexible sequence builder

Create your own *SGR sequences* with `build()` method, which accepts color/attribute keys, integer codes and even existing *SGRs*, in any amount and in any order. Key resolving is case-insensitive.

```
1 from pytermor import sequence, build
2
3 seq1 = build('hi_blue', 1) # keys or integer codes
4 seq2 = build(seq1, sequence.ITALIC) # existing SGRs
5 seq3 = build('underlined', 'YELLOW') # case-insensitive
6
7 msg = f'{seq1}Flexible{sequence.RESET} ' + \
8       f'{seq2}sequence{sequence.RESET} ' + \
9       str(seq3) + 'builder' + str(sequence.RESET)
10 print(msg)
```

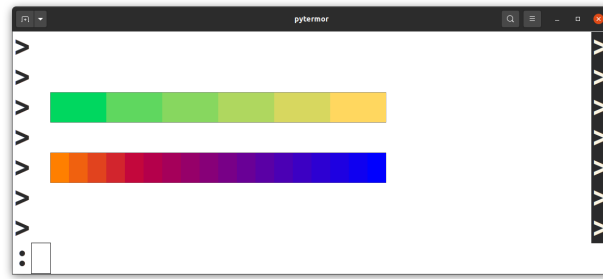
### 256 colors / True Color support

The library supports extended color modes:

- XTerm 256 colors indexed mode (see [Preset list](#));
- True Color RGB mode (16M colors).

```
1 from pytermor import color_indexed, color_rgb, sequence
2
3 start_color = 41
4 for idx, c in enumerate(range(start_color, start_color+(36*6), 36)):
5     print(f'{color_indexed(c)}{sequence.COLOR_OFF}', end='')
6
7 print('\n')
8 for idx, c in enumerate(range(0, 256, 256//17)):
9     r = max(0, 255-c)
10    g = max(0, min(255, 127-(c*2)))
11    b = c
12    print(f'{color_rgb(r, g, b)}{sequence.COLOR_OFF}', end='')
```





## Customizable output formats

@TODO

## String and number formatters

@TODO

# 1.2 High-level abstractions

## 1.2.1 Colors and Styles

## 1.2.2 Output format control

## 1.2.3 Color mode fallbacks

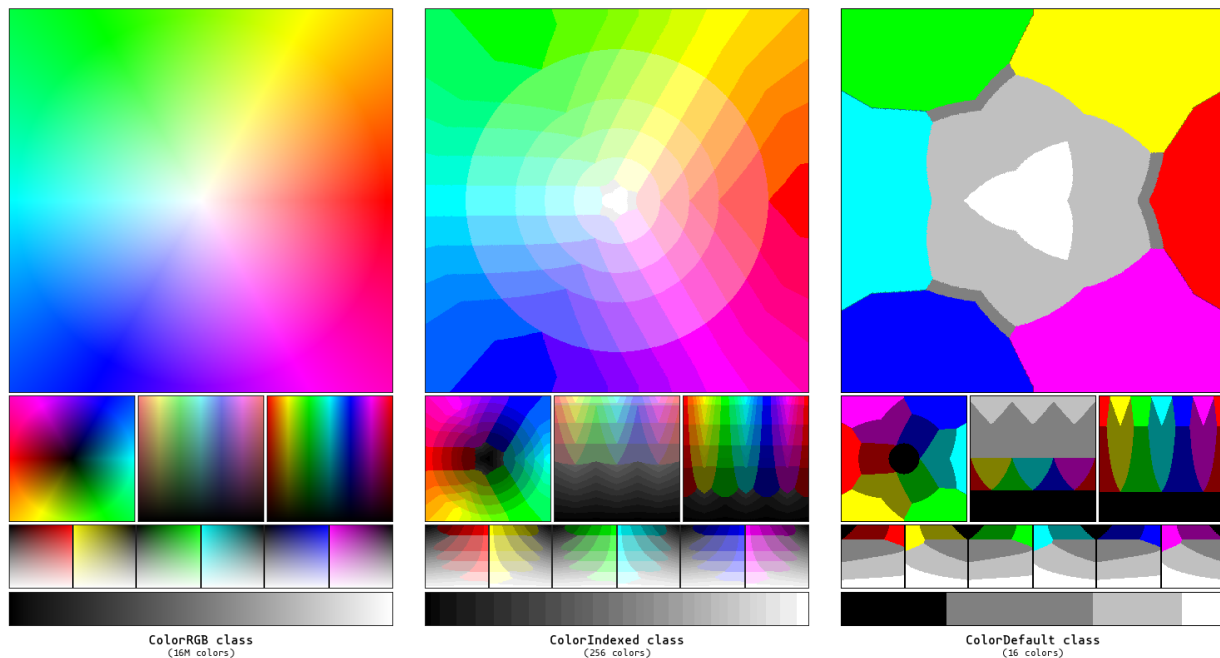


Fig. 1: Color approximations for indexed modes

## 1.2.4 Core API

@EXAMPLES

## 1.3 Low-level abstractions

So, what's happening under the hood?

### 1.3.1 Format soft reset

There are two ways to manage color and attribute termination:

- hard reset (SGR-0 or `e[0m`)
- soft reset (SGR-22, 23, 24 etc.)

The main difference between them is that *hard* reset disables all formatting after itself, while *soft* reset disables only actually necessary attributes (i.e. used as opening sequence in `Span` instance's context) and keeps the other.

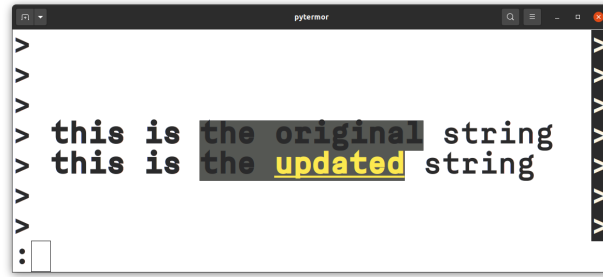
That's what `Span` class is designed for: to simplify creation of soft-resetting text spans, so that developer doesn't have to restore all previously applied formats after every closing sequence.

### Example

We are given a text span which is initially *bold* and *underlined*. We want to recolor a few words inside of this span. By default this will result in losing all the formatting to the right of updated text span (because `RESET`, or `e[0m`, clears all text attributes).

However, there is an option to specify what attributes should be disabled or let the library do that for you:

```
1 from pytermor import sequence, span, Span
2
3 # implicitly:
4 span_warn = Span(93, 4)
5 # or explicitly:
6 span_warn = Span.from_seq(
7     sequence.HI_YELLOW + sequence.UNDERLINED, # sequences can be summed up, remember?
8     sequence.COLOR_OFF + sequence.UNDERLINED_OFF, # "counteractive" sequences
9     hard_reset_after=False
10 )
11
12 orig_text = span.BOLD(f'this is {sequence.BG_GRAY}the original{sequence.RESET} string')
13 updated_text = orig_text.replace('original', span_warn('updated'), 1)
14 print(orig_text, '\n', updated_text)
```



As you can see, the update went well – we kept all the previously applied formatting. Of course, this method cannot be 100% applicable; for example, imagine that original text was colored blue. After the update “string” word won’t be blue anymore, as we used `sequence.COLOR_OFF` escape sequence to neutralize our own yellow color. But it still can be helpful for a majority of cases (especially when text is generated and formatted by the same program and in one go).

### 1.3.2 Working with Spans

Use [Span](#) constructor to create new instance with specified control sequence(s) as a opening/starter sequence and **automatically composed** closing sequence that will terminate attributes defined in opening sequence while keeping the others (soft reset).

Resulting sequence params’ order is the same as argument’s order.

Each sequence param can be specified as:

- string key (see [Preset list](#));
- integer param value;
- existing [SequenceSGR](#) instance (params will be extracted).

It’s also possible to avoid auto-composing mechanism and create [Span](#) with explicitly set parameters using [Span.from\\_seq\(\)](#).

### 1.3.3 Creating and applying SGRs

You can use any of predefined sequences from [sequence](#) or create your own via standard constructor. Valid argument values as well as preset constants are described in [Preset list](#) page.

There is also a set of methods for dynamic [SequenceSGR](#) creation:

- [build\(\)](#) for non-specific sequences;

---

**Important:** [SequenceSGR](#) with zero params was specifically implemented to translate into an empty string and not into `e[m`, which would make sense, but also could be very entangling, as terminal emulators interpret that sequence as `e[Om`, which is *hard* reset sequence.

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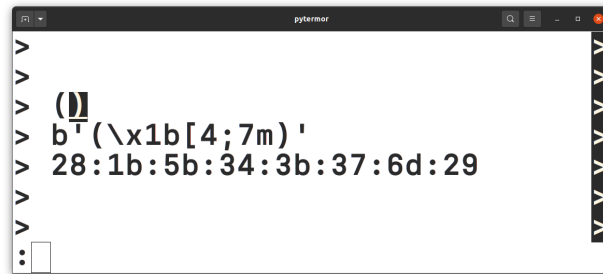
- [color\\_indexed\(\)](#) for complex color selection sequences operating in 256-colors mode (for a complete list see [Preset list](#));
- [color\\_rgb\(\)](#) for setting the colors in True Color 16M mode (however, some terminal emulators doesn’t support it).

To get the resulting sequence chars use [encode\(\)](#) method or cast instance to `str`.

```

1 from pytermor.sequence import SequenceSGR
2
3 seq = SequenceSGR(4, 7)
4 msg = f'({seq})'
5
6 print(msg + f'{SequenceSGR(0).encode()}')
7 print(str(msg.encode()))
8 print(msg.encode().hex(':'))

```



- First line is the string with encoded escape sequence;
- Second line shows up the string in raw mode, as if sequences were ignored by the terminal;
- Third line is hexademical string representation.

### 1.3.4 SGR sequence structure

1. `\x1b` is ESC *control character*, which opens a control sequence.
2. `[` is sequence *introducer*; it determines the type of control sequence (in this case it's CSI (Control Sequence Introducer)).
3. 4 and 7 are *parameters* of the escape sequence; they mean “underlined” and “inversed” attributes respectively. Those parameters must be separated by `;`.
4. `m` is sequence *terminator*; it also determines the sub-type of sequence, in our case SGR. Sequences of this kind are most commonly encountered.

### 1.3.5 Combining SGRs

One instance of `SequenceSGR` can be added to another. This will result in a new `SequenceSGR` with combined params.

```

1 from pytermor import sequence
2 from pytermor.sequence import SequenceSGR
3
4 combined = SequenceSGR(1, 31) + SequenceSGR(4)
5 print(f'{combined}{combined}{sequence.RESET}', str(combined).encode())

```

### 1.3.6 Core API

- @TODO
- *Span* constructor
- *Span.from\_seq()*

## 1.4 Preset list

Preset lists are omitted from API docs to avoid unnecessary duplication; summary list of all presets defined in the library (not including *util.\**) is displayed here.

@TODO USAGE - list all memthods that accept string keys of those prsets.

There are two types of color palettes used in modern terminals – first one containing 16 colors (library references that palette as *default*, see *ColorDefault*), and second one consisting of 256 colors (referenced as *indexed*, e.g. *ColorIndexed*). There is also True Color mode (referenced as *RGB* mode), but it is not palette-based.

### Legend

- INT (intcode module -- 1st or 3rd SGR param value)
- SEQ (sequence module)
- SPN (span module)
- CLR (color module)
- STY (style module)

































### 1.4.1 Meta, attributes, breakers

	Name	INT	SEQ	SPN	CLR	STY	Description
<b>Meta</b>							
	NOOP		V	V	V	V	No-operation; always encoded as empty string
	RESET	0	V				Reset all attributes and colors
<b>Attributes</b>							
	BOLD	1	V	V		V <sup>1</sup>	Bold or increased intensity
	DIM	2	V	V		V	Faint, decreased intensity
	ITALIC	3	V	V		V	Italic; <i>not widely supported</i>
	UNDERLINED	4	V	V		V	Underline
	BLINK_SLOW	5	V			V <sup>2</sup>	Set blinking to < 150 cpm
	BLINK_FAST	6	V				Set blinking to 150+ cpm; <i>not widely supported</i>
	INVERSED	7	V	V		V	Swap foreground and background colors
	HIDDEN	8	V				Conceal characters; <i>not widely supported</i>
	CROSSLINED	9	V			V	Strikethrough
	DOUBLE_UNDERLINED	21	V				Double-underline; <i>on several terminals disables BOLD instead</i>
	COLOR_EXTENDED	38					Set foreground color [ <i>indexed/RGB mode</i> ]; use <a href="#">color_indexed</a> and <a href="#">color_rgb</a> instead
	BG_COLOR_EXTENDED	48					Set background color [ <i>indexed/RGB mode</i> ]; use <a href="#">color_indexed</a> and <a href="#">color_rgb</a> instead
	OVERLINED	53	V	V		V	Overline; <i>not widely supported</i>
<b>Breakers</b>							
	BOLD_DIM_OFF	22	V				Disable BOLD and DIM attributes. <i>Special aspects... It's impossible to reliably disable them on a separate basis.</i>
	ITALIC_OFF	23	V				Disable italic
	UNDERLINED_OFF	24	V				Disable underlining
	BLINK_OFF	25	V				Disable blinking
	INVERSED_OFF	27	V				Disable inversing
	HIDDEN_OFF	28	V				Disable concealing
	CROSSLINED_OFF	29	V				Disable strikethrough
	COLOR_OFF	39	V				Reset foreground color
	BG_COLOR_OFF	49	V				Reset background color
	OVERLINED_OFF	55	V				Disable overlining

<sup>1</sup> for this and subsequent items in “Attributes” section: as boolean flags.

<sup>2</sup> as `blink`.

## 1.4.2 Default colors

	Name	INT	SEQ	SPN	CLR	STY	RGB code	XTerm name
<b>Foreground default colors</b>								
	BLACK	30	V	V	V		#000000	Black
	RED	31	V	V	V		#800000	Maroon
	GREEN	32	V	V	V		#008000	Green
	YELLOW	33	V	V	V		#808000	Olive
	BLUE	34	V	V	V		#000080	Navy
	MAGENTA	35	V	V	V		#800080	Purple
	CYAN	36	V	V	V		#008080	Teal
	WHITE	37	V	V	V		#c0c0c0	Silver
<b>Background default colors</b>								
	BG_BLACK	40	V	V	V		#000000	Black
	BG_RED	41	V	V	V		#800000	Maroon
	BG_GREEN	42	V	V	V		#008000	Green
	BG_YELLOW	43	V	V	V		#808000	Olive
	BG_BLUE	44	V	V	V		#000080	Navy
	BG_MAGENTA	45	V	V	V		#800080	Purple
	BG_CYAN	46	V	V	V		#008080	Teal
	BG_WHITE	47	V	V	V		#c0c0c0	Silver
<b>High-intensity foreground default colors</b>								
	GRAY	90	V	V	V		#808080	Grey
	HI_RED	91	V	V	V		#ff0000	Red
	HI_GREEN	92	V	V	V		#00ff00	Lime
	HI_YELLOW	93	V	V	V		#ffff00	Yellow
	HI_BLUE	94	V	V	V		#0000ff	Blue
	HI_MAGENTA	95	V	V	V		#ff00ff	Fuchsia
	HI_CYAN	96	V	V	V		#00ffff	Aqua
	HI_WHITE	97	V	V	V		#ffffff	White
<b>High-intensity background default colors</b>								
	BG_GRAY	100	V	V	V		#808080	Grey
	BG_HI_RED	101	V	V	V		#ff0000	Red
	BG_HI_GREEN	102	V	V	V		#00ff00	Lime
	BG_HI_YELLOW	103	V	V	V		#ffff00	Yellow
	BG_HI_BLUE	104	V	V	V		#0000ff	Blue
	BG_HI_MAGENTA	105	V	V	V		#ff00ff	Fuchsia
	BG_HI_CYAN	106	V	V	V		#00ffff	Aqua
	BG_HI_WHITE	107	V	V	V		#ffffff	White


















































### 1.4.3 Indexed colors

	Name	INT	SEQ	SPN	CLR	STY	RGB code	XTerm name
	IDX_BLACK <sup>3</sup>	0			V		#000000	Black
	IDX_MAROON	1			V		#800000	Maroon
	IDX_GREEN	2			V		#008000	Green
	IDX_OLIVE	3			V		#808000	Olive
	IDX_NAVY	4			V		#000080	Navy
	IDX_PURPLE	5			V		#800080	Purple
	IDX_TEAL	6			V		#008080	Teal
	IDX_SILVER	7			V		#c0c0c0	Silver
	IDX_GRAY	8			V		#808080	Grey
	IDX_RED	9			V		#ff0000	Red
	IDX_LIME	10			V		#00ff00	Lime
	IDX_YELLOW	11			V		#ffff00	Yellow
	IDX_BLUE	12			V		#0000ff	Blue
	IDX_FUCHSIA	13			V		#ff00ff	Fuchsia
	IDX_AQUA	14			V		#00ffff	Aqua
	IDX_WHITE	15			V		#ffffff	White
	IDX_GREY_0	16			V		#000000	Grey0
	IDX_NAVY_BLUE	17			V		#00005f	NavyBlue
	IDX_DARK_BLUE	18			V		#000087	DarkBlue
	IDX_BLUE_3	19			V		#0000af	Blue3
	IDX_BLUE_2	20			V		#0000d7	Blue3 <sup>4</sup>
	IDX_BLUE_1	21			V		#0000ff	Blue1
	IDX_DARK_GREEN	22			V		#005f00	DarkGreen
	IDX_DEEP_SKY_BLUE_4	23			V		#005f5f	DeepSkyBlue4
	IDX_DEEP_SKY_BLUE_4	24			V		#005f87	DeepSkyBlue4
	IDX_DEEP_SKY_BLUE_4	25			V		#005faf	DeepSkyBlue4
	IDX_DODGER_BLUE_3	26			V		#005fd7	DodgerBlue3
	IDX_DODGER_BLUE_2	27			V		#005fff	DodgerBlue2
	IDX_GREEN_4	28			V		#008700	Green4
	IDX_SPRING_GREEN_4	29			V		#00875f	SpringGreen4
	IDX_TURQUOISE_4	30			V		#008787	Turquoise4
	IDX_DEEP_SKY_BLUE_3	31			V		#0087af	DeepSkyBlue3
	IDX_DEEP_SKY_BLUE_3	32			V		#0087d7	DeepSkyBlue3
	IDX_DODGER_BLUE_1	33			V		#0087ff	DodgerBlue1
	IDX_GREEN_3	34			V		#00af00	Green3
	IDX_SPRING_GREEN_3	35			V		#00af5f	SpringGreen3
	IDX_DARK_CYAN	36			V		#00af87	DarkCyan
	IDX_LIGHT_SEA_GREEN	37			V		#00afaf	LightSeaGreen
	IDX_DEEP_SKY_BLUE_2	38			V		#00afd7	DeepSkyBlue2
	IDX_DEEP_SKY_BLUE_1	39			V		#00afff	DeepSkyBlue1
	IDX_GREEN_3	40			V		#00d700	Green3
	IDX_SPRING_GREEN_3	41			V		#00d75f	SpringGreen3
	IDX_SPRING_GREEN_2	42			V		#00d787	SpringGreen2
	IDX_CYAN_3	43			V		#00d7af	Cyan3
	IDX_DARK_TURQUOISE	44			V		#00d7d7	DarkTurquoise
	IDX_TURQUOISE_2	45			V		#00d7ff	Turquoise2
	IDX_GREEN_1	46			V		#00ff00	Green1

continues on next page















































Table 2 – continued from previous page

	Name	INT	SEQ	SPN	CLR	STY	RGB code	XTerm name
	IDX_SPRING_GREEN_2	47			V		#00ff5f	SpringGreen2
	IDX_SPRING_GREEN_1	48			V		#00ff87	SpringGreen1
	IDX_MEDIUM_SPRING_GREEN	49			V		#00ffa7	MediumSpringGreen
	IDX_CYAN_2	50			V		#00ffd7	Cyan2
	IDX_CYAN_1	51			V		#00ffff	Cyan1
	IDX_DARK_RED	52			V		#5f0000	DarkRed
	IDX_DEEP_PINK_4	53			V		#5f005f	DeepPink4
	IDX_PURPLE_4	54			V		#5f0087	Purple4
	IDX_PURPLE_4	55			V		#5f00af	Purple4
	IDX_PURPLE_3	56			V		#5f00d7	Purple3
	IDX_BLUE_VIOLET	57			V		#5f00ff	BlueViolet
	IDX_ORANGE_4	58			V		#5f5f00	Orange4
	IDX_GREY_37	59			V		#5f5f5f	Grey37
	IDX_MEDIUM_PURPLE_4	60			V		#5f5f87	MediumPurple4
	IDX_SLATE_BLUE_3	61			V		#5f5faf	SlateBlue3
	IDX_SLATE_BLUE_3	62			V		#5f5fd7	SlateBlue3
	IDX_ROYAL_BLUE_1	63			V		#5f5fff	RoyalBlue1
	IDX_CHARTREUSE_4	64			V		#5f8700	Chartreuse4
	IDX_DARK_SEA_GREEN_4	65			V		#5f875f	DarkSeaGreen4
	IDX_PALE_TURQUOISE_4	66			V		#5f8787	PaleTurquoise4
	IDX_STEEL_BLUE	67			V		#5f87af	SteelBlue
	IDX_STEEL_BLUE_3	68			V		#5f87d7	SteelBlue3
	IDX_CORNFLOWER_BLUE	69			V		#5f87ff	CornflowerBlue
	IDX_CHARTREUSE_3	70			V		#5faf00	Chartreuse3
	IDX_DARK_SEA_GREEN_4	71			V		#5faf5f	DarkSeaGreen4
	IDX_CADET_BLUE	72			V		#5faf87	CadetBlue
	IDX_CADET_BLUE	73			V		#5fafaf	CadetBlue
	IDX_SKY_BLUE_3	74			V		#5fafd7	SkyBlue3
	IDX_STEEL_BLUE_1	75			V		#5fafff	SteelBlue1
	IDX_CHARTREUSE_3	76			V		#5fd700	Chartreuse3
	IDX_PALE_GREEN_3	77			V		#5fd75f	PaleGreen3
	IDX_SEA_GREEN_3	78			V		#5fd787	SeaGreen3
	IDX_AQUAMARINE_3	79			V		#5fd7af	Aquamarine3
	IDX_MEDIUM_TURQUOISE	80			V		#5fd7d7	MediumTurquoise
	IDX_STEEL_BLUE_1	81			V		#5fd7ff	SteelBlue1
	IDX_CHARTREUSE_2	82			V		#5fff00	Chartreuse2
	IDX_SEA_GREEN_2	83			V		#5fff5f	SeaGreen2
	IDX_SEA_GREEN_1	84			V		#5fff87	SeaGreen1
	IDX_SEA_GREEN_1	85			V		#5fffaf	SeaGreen1
	IDX_AQUAMARINE_2	86			V		#5fffd7	<b>Aquamarine1</b>
	IDX_DARK_SLATE_GRAY_2	87			V		#5ffffff	DarkSlateGray2
	IDX_DARK_RED	88			V		#870000	DarkRed
	IDX_DEEP_PINK_4	89			V		#87005f	DeepPink4
	IDX_DARK_MAGENTA	90			V		#870087	DarkMagenta
	IDX_DARK_MAGENTA	91			V		#8700af	DarkMagenta
	IDX_DARK_VIOLET	92			V		#8700d7	DarkViolet
	IDX_PURPLE	93			V		#8700ff	Purple
	IDX_ORANGE_4	94			V		#875f00	Orange4
	IDX_LIGHT_PINK_4	95			V		#875f5f	LightPink4

















































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Table 2 – continued from previous page

	Name	INT	SEQ	SPN	CLR	STY	RGB code	XTerm name
	IDX_PLUM_4	96			V		#875f87	Plum4
	IDX_MEDIUM_PURPLE_3	97			V		#875faf	MediumPurple3
	IDX_MEDIUM_PURPLE_3	98			V		#875fd7	MediumPurple3
	IDX_SLATE_BLUE_1	99			V		#875fff	SlateBlue1
	IDX_YELLOW_4	100			V		#878700	Yellow4
	IDX_WHEAT_4	101			V		#87875f	Wheat4
	IDX_GREY_53	102			V		#878787	Grey53
	IDX_LIGHT_SLATE_GREY	103			V		#8787af	LightSlateGrey
	IDX_MEDIUM_PURPLE	104			V		#8787d7	MediumPurple
	IDX_LIGHT_SLATE_BLUE	105			V		#8787ff	LightSlateBlue
	IDX_YELLOW_4	106			V		#87af00	Yellow4
	IDX_DARK_OLIVE_GREEN_3	107			V		#87af5f	DarkOliveGreen3
	IDX_DARK_SEA_GREEN	108			V		#87af87	DarkSeaGreen
	IDX_LIGHT_SKY_BLUE_3	109			V		#87afaf	LightSkyBlue3
	IDX_LIGHT_SKY_BLUE_3	110			V		#87afd7	LightSkyBlue3
	IDX_SKY_BLUE_2	111			V		#87afff	SkyBlue2
	IDX_CHARTREUSE_2	112			V		#87d700	Chartreuse2
	IDX_DARK_OLIVE_GREEN_3	113			V		#87d75f	DarkOliveGreen3
	IDX_PALE_GREEN_3	114			V		#87d787	PaleGreen3
	IDX_DARK_SEA_GREEN_3	115			V		#87d7af	DarkSeaGreen3
	IDX_DARK_SLATE_GRAY_3	116			V		#87d7d7	DarkSlateGray3
	IDX_SKY_BLUE_1	117			V		#87d7ff	SkyBlue1
	IDX_CHARTREUSE_1	118			V		#87ff00	Chartreuse1
	IDX_LIGHT_GREEN	119			V		#87ff5f	LightGreen
	IDX_LIGHT_GREEN	120			V		#87ff87	LightGreen
	IDX_PALE_GREEN_1	121			V		#87ffaf	PaleGreen1
	IDX_AQUAMARINE_1	122			V		#87ffd7	Aquamarine1
	IDX_DARK_SLATE_GRAY_1	123			V		#87ffff	DarkSlateGray1
	IDX_RED_3	124			V		#af0000	Red3
	IDX_DEEP_PINK_4	125			V		#af005f	DeepPink4
	IDX_MEDIUM_VIOLET_RED	126			V		#af0087	MediumVioletRed
	IDX_MAGENTA_3	127			V		#af00af	Magenta3
	IDX_DARK_VIOLET	128			V		#af00d7	DarkViolet
	IDX_PURPLE	129			V		#af00ff	Purple
	IDX_DARK_ORANGE_3	130			V		#af5f00	DarkOrange3
	IDX_INDIAN_RED	131			V		#af5f5f	IndianRed
	IDX_HOT_PINK_3	132			V		#af5f87	HotPink3
	IDX_MEDIUM_ORCHID_3	133			V		#af5faf	MediumOrchid3
	IDX_MEDIUM_ORCHID	134			V		#af5fd7	MediumOrchid
	IDX_MEDIUM_PURPLE_2	135			V		#af5fff	MediumPurple2
	IDX_DARK_GOLDENROD	136			V		#af8700	DarkGoldenrod
	IDX_LIGHT_SALMON_3	137			V		#af875f	LightSalmon3
	IDX_ROSY_BROWN	138			V		#af8787	RosyBrown
	IDX_GREY_63	139			V		#af87af	Grey63
	IDX_MEDIUM_PURPLE_2	140			V		#af87d7	MediumPurple2
	IDX_MEDIUM_PURPLE_1	141			V		#af87ff	MediumPurple1
	IDX_GOLD_3	142			V		#afaf00	Gold3
	IDX_DARK_KHAKI	143			V		#afaf5f	DarkKhaki
	IDX_NAVAJO_WHITE_3	144			V		#afaf87	NavajoWhite3















































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Table 2 – continued from previous page

	Name	INT	SEQ	SPN	CLR	STY	RGB code	XTerm name
	IDX_GREY_69	145			V		#afafaf	Grey69
	IDX_LIGHT_STEEL_BLUE_3	146			V		#afafd7	LightSteelBlue3
	IDX_LIGHT_STEEL_BLUE	147			V		#afafff	LightSteelBlue
	IDX_YELLOW_3	148			V		#afd700	Yellow3
	IDX_DARK_OLIVE_GREEN_3	149			V		#afd75f	DarkOliveGreen3
	IDX_DARK_SEA_GREEN_3	150			V		#afd787	DarkSeaGreen3
	IDX_DARK_SEA_GREEN_2	151			V		#afd7af	DarkSeaGreen2
	IDX_LIGHT_CYAN_3	152			V		#afd7d7	LightCyan3
	IDX_LIGHT_SKY_BLUE_1	153			V		#afd7ff	LightSkyBlue1
	IDX_GREEN_YELLOW	154			V		#afff00	GreenYellow
	IDX_DARK_OLIVE_GREEN_2	155			V		#afff5f	DarkOliveGreen2
	IDX_PALE_GREEN_1	156			V		#afff87	PaleGreen1
	IDX_DARK_SEA_GREEN_2	157			V		#afffaf	DarkSeaGreen2
	IDX_DARK_SEA_GREEN_1	158			V		#afffd7	DarkSeaGreen1
	IDX_PALE_TURQUOISE_1	159			V		#afffff	PaleTurquoise1
	IDX_RED_3	160			V		#d70000	Red3
	IDX_DEEP_PINK_3	161			V		#d7005f	DeepPink3
	IDX_DEEP_PINK_3	162			V		#d70087	DeepPink3
	IDX_MAGENTA_3	163			V		#d700af	Magenta3
	IDX_MAGENTA_3	164			V		#d700d7	Magenta3
	IDX_MAGENTA_2	165			V		#d700ff	Magenta2
	IDX_DARK_ORANGE_3	166			V		#d75f00	DarkOrange3
	IDX_INDIAN_RED	167			V		#d75f5f	IndianRed
	IDX_HOT_PINK_3	168			V		#d75f87	HotPink3
	IDX_HOT_PINK_2	169			V		#d75faf	HotPink2
	IDX_ORCHID	170			V		#d75fd7	Orchid
	IDX_MEDIUM_ORCHID_1	171			V		#d75fff	MediumOrchid1
	IDX_ORANGE_3	172			V		#d78700	Orange3
	IDX_LIGHT_SALMON_3	173			V		#d7875f	LightSalmon3
	IDX_LIGHT_PINK_3	174			V		#d78787	LightPink3
	IDX_PINK_3	175			V		#d787af	Pink3
	IDX_PLUM_3	176			V		#d787d7	Plum3
	IDX_VIOLET	177			V		#d787ff	Violet
	IDX_GOLD_3	178			V		#d7af00	Gold3
	IDX_LIGHT_GOLDENROD_3	179			V		#d7af5f	LightGoldenrod3
	IDX_TAN	180			V		#d7af87	Tan
	IDX_MISTY_ROSE_3	181			V		#d7afaf	MistyRose3
	IDX_THISTLE_3	182			V		#d7afd7	Thistle3
	IDX_PLUM_2	183			V		#d7afff	Plum2
	IDX_YELLOW_3	184			V		#d7d700	Yellow3
	IDX_KHAKI_3	185			V		#d7d75f	Khaki3
	IDX_LIGHT_GOLDENROD_2	186			V		#d7d787	LightGoldenrod2
	IDX_LIGHT_YELLOW_3	187			V		#d7d7af	LightYellow3
	IDX_GREY_84	188			V		#d7d7d7	Grey84
	IDX_LIGHT_STEEL_BLUE_1	189			V		#d7d7ff	LightSteelBlue1
	IDX_YELLOW_2	190			V		#d7ff00	Yellow2
	IDX_DARK_OLIVE_GREEN_1	191			V		#d7ff5f	DarkOliveGreen1
	IDX_DARK_OLIVE_GREEN_1	192			V		#d7ff87	DarkOliveGreen1
	IDX_DARK_SEA_GREEN_1	193			V		#d7ffaf	DarkSeaGreen1

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Table 2 – continued from previous page

	Name	INT	SEQ	SPN	CLR	STY	RGB code	XTerm name
	IDX_HONEYDEW_2	194			V		#d7ffd7	Honeydew2
	IDX_LIGHT_CYAN_1	195			V		#d7ffff	LightCyan1
	IDX_RED_1	196			V		#ff0000	Red1
	IDX_DEEP_PINK_2	197			V		#ff005f	DeepPink2
	IDX_DEEP_PINK_1	198			V		#ff0087	DeepPink1
	IDX_DEEP_PINK_1	199			V		#ff00af	DeepPink1
	IDX_MAGENTA_2	200			V		#ff00d7	Magenta2
	IDX_MAGENTA_1	201			V		#ff00ff	Magenta1
	IDX_ORANGE_RED_1	202			V		#ff5f00	OrangeRed1
	IDX_INDIAN_RED_1	203			V		#ff5f5f	IndianRed1
	IDX_INDIAN_RED_1	204			V		#ff5f87	IndianRed1
	IDX_HOT_PINK	205			V		#ff5faf	HotPink
	IDX_HOT_PINK	206			V		#ff5fd7	HotPink
	IDX_MEDIUM_ORCHID_1	207			V		#ff5fff	MediumOrchid1
	IDX_DARK_ORANGE	208			V		#ff8700	DarkOrange
	IDX_SALMON_1	209			V		#ff875f	Salmon1
	IDX_LIGHT_CORAL	210			V		#ff8787	LightCoral
	IDX_PALE_VIOLET_RED_1	211			V		#ff87af	PaleVioletRed1
	IDX_ORCHID_2	212			V		#ff87d7	Orchid2
	IDX_ORCHID_1	213			V		#ff87ff	Orchid1
	IDX_ORANGE_1	214			V		#ffaaf00	Orange1
	IDX_SANDY_BROWN	215			V		#ffaaf5f	SandyBrown
	IDX_LIGHT_SALMON_1	216			V		#ffaaf87	LightSalmon1
	IDX_LIGHT_PINK_1	217			V		#ffaafaf	LightPink1
	IDX_PINK_1	218			V		#ffaafd7	Pink1
	IDX_PLUM_1	219			V		#ffaafff	Plum1
	IDX_GOLD_1	220			V		#ffd700	Gold1
	IDX_LIGHT_GOLDENROD_2	221			V		#ffd75f	LightGoldenrod2
	IDX_LIGHT_GOLDENROD_2	222			V		#ffd787	LightGoldenrod2
	IDX_NAVAJO_WHITE_1	223			V		#ffd7af	NavajoWhite1
	IDX_MISTY_ROSE_1	224			V		#ffd7d7	MistyRose1
	IDX_THISTLE_1	225			V		#ffd7ff	Thistle1
	IDX_YELLOW_1	226			V		#ffff00	Yellow1
	IDX_LIGHT_GOLDENROD_1	227			V		#ffff5f	LightGoldenrod1
	IDX_KHAKI_1	228			V		#ffff87	Khaki1
	IDX_WHEAT_1	229			V		#ffffaf	Wheat1
	IDX_CORNSILK_1	230			V		#ffffd7	Cornsilk1
	IDX_GREY_100	231			V		#ffffff	Grey100
	IDX_GREY_3	232			V		#080808	Grey3
	IDX_GREY_7	233			V		#121212	Grey7
	IDX_GREY_11	234			V		#1c1c1c	Grey11
	IDX_GREY_15	235			V		#262626	Grey15
	IDX_GREY_19	236			V		#303030	Grey19
	IDX_GREY_23	237			V		#3a3a3a	Grey23
	IDX_GREY_27	238			V		#444444	Grey27
	IDX_GREY_30	239			V		#4e4e4e	Grey30
	IDX_GREY_35	240			V		#585858	Grey35
	IDX_GREY_39	241			V		#626262	Grey39
	IDX_GREY_42	242			V		#6c6c6c	Grey42

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Table 2 – continued from previous page

	Name	INT	SEQ	SPN	CLR	STY	RGB code	XTerm name
■	IDX_GREY_46	243			V		#767676	Grey46
■	IDX_GREY_50	244			V		#808080	Grey50
■	IDX_GREY_54	245			V		#8a8a8a	Grey54
■	IDX_GREY_58	246			V		#949494	Grey58
■	IDX_GREY_62	247			V		#9e9e9e	Grey62
■	IDX_GREY_66	248			V		#a8a8a8	Grey66
■	IDX_GREY_70	249			V		#b2b2b2	Grey70
■	IDX_GREY_74	250			V		#bcbcbc	Grey74
■	IDX_GREY_78	251			V		#c6c6c6	Grey78
■	IDX_GREY_82	252			V		#d0d0d0	Grey82
■	IDX_GREY_85	253			V		#dadada	Grey85
■	IDX_GREY_89	254			V		#e4e4e4	Grey89
■	IDX_GREY_93	255			V		#eeeeee	Grey93

## Sources

1. [https://en.wikipedia.org/wiki/ANSI\\_escape\\_code](https://en.wikipedia.org/wiki/ANSI_escape_code)
2. <https://www.ditig.com/256-colors-cheat-sheet>

## 1.5 Color palette

Actual colors of *default* palette depend on user's terminal settings, i.e. the result color of `ColorDefault` is not guaranteed to exactly match the corresponding color listed below. What's more, note that *default* palette is actually a part of *indexed* one (first 16 colors of 256-color table).

**Important:** @TODO The approximation algorithm was explicitly made to ignore these colors because otherwise the results of transforming *RGB* values into *indexed* ones would be unpredictable, in addition to different results for different users, depending on their terminal emulator setup.

However, it doesn't mean that `ColorDefault` is useless. Just the opposite – it's ideal for situations when you don't actually **have to** set exact values and it's easier to specify estimation of desired color. I.e. setting color to 'red' is usually more than enough for displaying an error message – we don't really care of precise hue or brightness values for it.

Approximation algorithm is as simple as iterating through all colors in the *lookup table* (which contains all possible ... @TODO finish

<sup>3</sup> First 16 colors are effectively the same as colors in *default* 16-color mode and share with them the same color values (and depend on terminal color scheme as well).

<sup>4</sup> XTerm name list contains duplicates; variable names for these were slightly modified (different numbers at the end) to avoid namespace conflicts. All non-matching names are displayed using **bold** font.

	<b>000</b> #000000	<b>001</b> #800000	<b>002</b> #008000	<b>003</b> #808000	<b>004</b> #000080	<b>005</b> #800080	<b>006</b> #008080	<b>007</b> #c0c0c0			
	<b>008</b> #808080	<b>009</b> #ff0000	<b>010</b> #00ff00	<b>011</b> #ffff00	<b>012</b> #0000ff	<b>013</b> #ff00ff	<b>014</b> #00ffff	<b>015</b> #ffffff			
<b>016</b> #000000	<b>022</b> #005f00	<b>028</b> #008700	<b>034</b> #00af00	<b>040</b> #00d700	<b>046</b> #00ff00	<b>082</b> #5fff00	<b>076</b> #5fd700	<b>070</b> #5faf00	<b>064</b> #5f8700	<b>058</b> #5f5f00	<b>052</b> #5f0000
<b>017</b> #00005f	<b>023</b> #005f5f	<b>029</b> #00875f	<b>035</b> #00af5f	<b>041</b> #00d75f	<b>047</b> #00ff5f	<b>083</b> #5fff5f	<b>077</b> #5fd75f	<b>071</b> #5faf5f	<b>065</b> #5f875f	<b>059</b> #5f5f5f	<b>053</b> #5f005f
<b>018</b> #000087	<b>024</b> #005f87	<b>030</b> #008787	<b>036</b> #00af87	<b>042</b> #00d787	<b>048</b> #00ff87	<b>084</b> #5fff87	<b>078</b> #5fd787	<b>072</b> #5faf87	<b>066</b> #5f8787	<b>060</b> #5f5f87	<b>054</b> #5f0087
<b>019</b> #0000af	<b>025</b> #005faf	<b>031</b> #0087af	<b>037</b> #00afaf	<b>043</b> #00d7af	<b>049</b> #00ffaf	<b>085</b> #5fffaf	<b>079</b> #5fd7af	<b>073</b> #5fafaf	<b>067</b> #5f87af	<b>061</b> #5f5faf	<b>055</b> #5f00af
<b>020</b> #0000d7	<b>026</b> #005fd7	<b>032</b> #0087d7	<b>038</b> #00afd7	<b>044</b> #00dd7	<b>050</b> #00ffd7	<b>086</b> #5fffd7	<b>080</b> #5fd7d7	<b>074</b> #5fadd7	<b>068</b> #5f87d7	<b>062</b> #5f5fd7	<b>056</b> #5f00d7
<b>021</b> #0000ff	<b>027</b> #005fff	<b>033</b> #0087ff	<b>039</b> #00afff	<b>045</b> #00d7ff	<b>051</b> #00ffff	<b>087</b> #5fffff	<b>081</b> #5fd7ff	<b>075</b> #5fafff	<b>069</b> #5f87ff	<b>063</b> #5f5fff	<b>057</b> #5f00ff
<b>093</b> #8700ff	<b>099</b> #875fff	<b>105</b> #8787ff	<b>111</b> #87afff	<b>117</b> #87d7ff	<b>123</b> #87ffff	<b>159</b> #afffff	<b>153</b> #afd7ff	<b>147</b> #afafff	<b>141</b> #af87ff	<b>135</b> #af5fff	<b>129</b> #af00ff
<b>092</b> #8700d7	<b>098</b> #875fd7	<b>104</b> #8787d7	<b>110</b> #87afd7	<b>116</b> #87dd7	<b>122</b> #87ffd7	<b>158</b> #afffd7	<b>152</b> #afd7d7	<b>146</b> #afadd7	<b>140</b> #af87d7	<b>134</b> #af5fd7	<b>128</b> #af00d7
<b>091</b> #8700af	<b>097</b> #875faf	<b>103</b> #8787af	<b>109</b> #87afaf	<b>115</b> #87d7af	<b>121</b> #87ffaf	<b>157</b> #afffaf	<b>151</b> #afd7af	<b>145</b> #afafaf	<b>139</b> #af87af	<b>133</b> #af5faf	<b>127</b> #af00af
<b>090</b> #870087	<b>096</b> #875f87	<b>102</b> #878787	<b>108</b> #87af87	<b>114</b> #87d787	<b>120</b> #87ff87	<b>156</b> #afff87	<b>150</b> #afd787	<b>144</b> #afaf87	<b>138</b> #af8787	<b>132</b> #af5f87	<b>126</b> #af0087
<b>089</b> #87005f	<b>095</b> #875f5f	<b>101</b> #87875f	<b>107</b> #87af5f	<b>113</b> #87d75f	<b>119</b> #87ff5f	<b>155</b> #afff5f	<b>149</b> #afd75f	<b>143</b> #afaf5f	<b>137</b> #af875f	<b>131</b> #af5f5f	<b>125</b> #af005f
<b>088</b> #870000	<b>094</b> #875f00	<b>100</b> #878700	<b>106</b> #87af00	<b>112</b> #87d700	<b>118</b> #87ff00	<b>154</b> #afff00	<b>148</b> #afd700	<b>142</b> #afaf00	<b>136</b> #af8700	<b>130</b> #af5f00	<b>124</b> #af0000
<b>160</b> #d70000	<b>166</b> #d75f00	<b>172</b> #d78700	<b>178</b> #dfa00	<b>184</b> #dfd00	<b>190</b> #dff00	<b>226</b> #ffff00	<b>220</b> #ffd00	<b>214</b> #ffa00	<b>208</b> #ff8700	<b>202</b> #ff5f00	<b>196</b> #ff0000
<b>161</b> #d7005f	<b>167</b> #d75f5f	<b>173</b> #d7875f	<b>179</b> #dfa5f	<b>185</b> #dfd5f	<b>191</b> #dff5f	<b>227</b> #ffff5f	<b>221</b> #ffd5f	<b>215</b> #ffa5f	<b>209</b> #ff875f	<b>203</b> #ff5f5f	<b>197</b> #ff005f
<b>162</b> #d70087	<b>168</b> #d75f87	<b>174</b> #d78787	<b>180</b> #dfa87	<b>186</b> #dfd87	<b>192</b> #dff87	<b>228</b> #ffff87	<b>222</b> #ffd87	<b>216</b> #ffa87	<b>210</b> #ff8787	<b>204</b> #ff5f87	<b>198</b> #ff0087
<b>163</b> #d700af	<b>169</b> #d75faf	<b>175</b> #d787af	<b>181</b> #dfaaf	<b>187</b> #dfdaf	<b>193</b> #dffaf	<b>229</b> #ffffaf	<b>223</b> #ffdaf	<b>217</b> #ffaaf	<b>211</b> #ff87af	<b>205</b> #ff5faf	<b>199</b> #ff00af
<b>164</b> #d700d7	<b>170</b> #d75fd7	<b>176</b> #d787d7	<b>182</b> #dafdf	<b>188</b> #dfd7d7	<b>194</b> #dff7d7	<b>230</b> #ffffd7	<b>224</b> #ffd7d7	<b>218</b> #ffd7d7	<b>212</b> #ff87d7	<b>206</b> #ff5fd7	<b>200</b> #ff00d7
<b>165</b> #d700ff	<b>171</b> #d75fff	<b>177</b> #d787ff	<b>183</b> #dafff	<b>189</b> #dff7ff	<b>195</b> #dff7ff	<b>231</b> #ffffff	<b>225</b> #ffd7ff	<b>219</b> #ffa7ff	<b>213</b> #ff87ff	<b>207</b> #ff5fff	<b>201</b> #ff00ff
<b>232</b> #080808	<b>233</b> #121212	<b>234</b> #1c1c1c	<b>235</b> #262626	<b>236</b> #303030	<b>237</b> #3a3a3a	<b>238</b> #444444	<b>239</b> #4e4e4e	<b>240</b> #585858	<b>241</b> #626262	<b>242</b> #6c6c6c	<b>243</b> #767676
<b>244</b> #808080	<b>245</b> #8a8a8a	<b>246</b> #949494	<b>247</b> #9e9e9e	<b>248</b> #a8a8a8	<b>249</b> #b2b2b2	<b>250</b> #bcbcbc	<b>251</b> #c6c6c6	<b>252</b> #d0d0d0	<b>253</b> #dadada	<b>254</b> #e4e4e4	<b>255</b> #eeeeee

Fig. 2: Indexed mode palette



## Sources

1. <https://www.tweaking4all.com/software/linux-software/xterm-color-cheat-sheet/>

## 1.6 Formatters and Filters

The library contains @TODO

### 1.6.1 Auto-float formatter

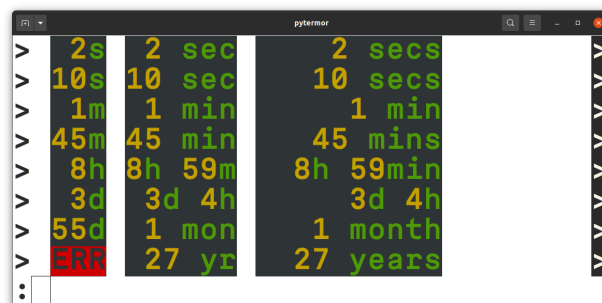
### 1.6.2 Prefixed-unit formatter

### 1.6.3 Time delta formatter

```

1 from pytermor import Style, color, ColorRGB
2 from pytermor import renderer
3 from pytermor.util import time_delta
4
5 seconds_list = [2, 10, 60, 2700, 32340, 273600, 4752000, 864000000]
6 max_len_list = [3, 6, 10]
7
8 custom_stylesheet = time_delta.TimeDeltaStylesheet(
9     default=Style(bg_color=0x202028),
10    digit=Style(0x3333000, 'yellow'),
11    unit=Style(fg_color='green', bg_color=0x202028, underlined=True),
12    overflow=Style(fg_color=color.BLACK, bg_color='hi_red', bold=True),
13 )
14 for max_len in max_len_list:
15     formatter = time_delta.registry.find_matching(max_len)
16     formatter.stylesheet = custom_stylesheet
17
18 renderer.SGRRenderer.set_as_default()
19 for seconds in seconds_list:
20     for max_len in max_len_list:
21         formatter = time_delta.registry.get_by_max_len(max_len)
22         print(formatter.format(seconds, True), end=' ')
23 print()

```



### 1.6.4 String filters

### 1.6.5 Standard Library extensions

@TODO



## 2.1 color

@TODO

@TODO black/white text selection depending on bg

**class** pytermor.color.Color

Abstract superclass for other Colors.

**\_\_init\_\_**(*hex\_value: Optional[int] = None*)

**static hex\_value\_to\_rgb\_channels**(*hex\_value: int*) → Tuple[int, int, int]

Transforms *hex\_value* in 0xffffffff format into tuple of three integers corresponding to *red*, *blue* and *green* channel value respectively. Values are within [0; 255] range.

```
>>> Color.hex_value_to_rgb_channels(0x80ff80)
(128, 255, 128)
>>> Color.hex_value_to_rgb_channels(0x000001)
(0, 0, 1)
```

**static hex\_value\_to\_hsv\_channels**(*hex\_value: int*) → Tuple[int, float, float]

Transforms *hex\_value* in 0xffffffff format into tuple of three numbers corresponding to *hue*, *saturation* and *value* channel values respectively. *Hue* is within [0, 359] range, *saturation* and *value* are within [0; 1] range.

**Parameters**

**hex\_value** –

**Returns**

**abstract classmethod get\_default**() → *Color*

**Returns**

Fallback instance of *Color* inheritor (if registries are empty).

**abstract classmethod find\_closest**(*hex\_value: int*) → *Color*

Wrapper for *\_ColorMap.find\_closest()*.

**Parameters**

**hex\_value** – Integer color value in 0xffffffff format.

**Returns**

Nearest found color of specified type.

**abstract** `to_sgr(bg: bool = False) → SequenceSGR`

**property** `hex_value: int | None`

**format\_value**(*prefix: str | None = '0x'*) → str

**class** `pytermor.color.ColorDefault`

Bases: `Color`

**\_\_init\_\_**(*hex\_value: int, code\_fg: int, code\_bg: int*)

**classmethod** `get_default() → ColorDefault`

**Returns**

Fallback instance of `Color` inheritor (if registries are empty).

**classmethod** `find_closest(hex_value: int) → ColorDefault`

Wrapper for `_ColorMap.find_closest()`.

**Attention:** Use this method only if you know what you are doing. *Default* mode colors may vary in a huge range depending on user terminal setup (colors even can have exactly the opposite value of what's listed in preset list). Much more reliable and predictable approach is to use `ColorIndexed.find_closest` instead.

**Parameters**

**hex\_value** – Integer color value in 0xffffff format.

**Returns**

Nearest found `ColorDefault` instance.

```
>>> ColorDefault.find_closest(0x660000)
ColorDefault[fg=31, bg=41, 0x800000]
```

**to\_sgr**(*bg: bool = False*) → `SequenceSGR`

**format\_value**(*prefix: str | None = '0x'*) → str

**property** `hex_value: int | None`

**static** `hex_value_to_hsv_channels(hex_value: int) → Tuple[int, float, float]`

Transforms `hex_value` in 0xffffff format into tuple of three numbers corresponding to *hue*, *saturation* and *value* channel values respectively. *Hue* is within [0, 359] range, *saturation* and *value* are within [0; 1] range.

**Parameters**

**hex\_value** –

**Returns**

**static** `hex_value_to_rgb_channels(hex_value: int) → Tuple[int, int, int]`

Transforms `hex_value` in 0xffffff format into tuple of three integers corresponding to *red*, *blue* and *green* channel value respectively. Values are within [0; 255] range.

```
>>> Color.hex_value_to_rgb_channels(0x80ff80)
(128, 255, 128)
>>> Color.hex_value_to_rgb_channels(0x000001)
(0, 0, 1)
```

**class** pytermor.color.ColorIndexed

Bases: *Color*

**\_\_init\_\_**(*hex\_value: int, code: int*)

**classmethod** **get\_default**() → *ColorIndexed*

**Returns**

Fallback instance of *Color* inheritor (if registries are empty).

**classmethod** **find\_closest**(*hex\_value: int*) → *ColorIndexed*

Wrapper for *\_ColorMap.find\_closest()*.

---

**Note:** Approximation algorithm ignores colors 000-015 from the *indexed* palette and will return colors with int codes in 016-255 range only. The reason for this is the same as for discouraging the usage of *ColorDefault* method version – because aforementioned colors actually depend on end-user terminal settings and the final result can be differ drastically from what's the developer imagined.

---

**Parameters**

**hex\_value** – Integer color value in 0xffffffff format.

**Returns**

Nearest found *ColorIndexed* instance.

```
>>> ColorIndexed.find_closest(0xd9dbdb)
ColorIndexed[code=253, 0xdadada]
```

**to\_sgr**(*bg: bool = False*) → *SequenceSGR*

**format\_value**(*prefix: str | None = '0x'*) → str

**property** **hex\_value**: int | None

**static** **hex\_value\_to\_hsv\_channels**(*hex\_value: int*) → Tuple[int, float, float]

Transforms *hex\_value* in 0xffffffff format into tuple of three numbers corresponding to *hue*, *saturation* and *value* channel values respectively. *Hue* is within [0, 359] range, *saturation* and *value* are within [0; 1] range.

**Parameters**

**hex\_value** –

**Returns**

**static** **hex\_value\_to\_rgb\_channels**(*hex\_value: int*) → Tuple[int, int, int]

Transforms *hex\_value* in 0xffffffff format into tuple of three integers corresponding to *red*, *blue* and *green* channel value respectively. Values are within [0; 255] range.

```
>>> Color.hex_value_to_rgb_channels(0x80ff80)
(128, 255, 128)
>>> Color.hex_value_to_rgb_channels(0x0000001)
(0, 0, 1)
```

**class** pytermor.color.ColorRGB

Bases: *Color*

**classmethod** `get_default()` → *ColorRGB*

**Returns**

Fallback instance of *Color* inheritor (if registries are empty).

**classmethod** `find_closest(hex_value: int)` → *ColorRGB*

In case of *ColorRGB* we suppose that user's terminal is not limited to a palette, therefore RGB-type color map works by simplified algorithm – it just checks if instance with same hex value was already created and returns it if that's the case, or returns a brand new instance with specified color value otherwise.

**Parameters**

**hex\_value** – Integer color value in 0xffffffff format.

**Returns**

Existing *ColorRGB* instance or newly created one.

```
>>> existing_color1 = ColorRGB(0x660000)
>>> existing_color2 = ColorRGB(0x660000)
>>> existing_color1 == existing_color2
True
>>> existing_color1 is existing_color2 # different instances
False
>>> existing_color1 == ColorRGB.find_closest(0x660000)
True
>>> existing_color1 is ColorRGB.find_closest(0x660000) # same instance
True
```

**to\_sgr**(bg: bool = False) → *SequenceSGR*

**\_\_init\_\_**(hex\_value: Optional[int] = None)

**format\_value**(prefix: str | None = '0x') → str

**property** `hex_value`: int | None

**static** `hex_value_to_hsv_channels(hex_value: int)` → Tuple[int, float, float]

Transforms `hex_value` in 0xffffffff format into tuple of three numbers corresponding to *hue*, *saturation* and *value* channel values respectively. *Hue* is within [0, 359] range, *saturation* and *value* are within [0; 1] range.

**Parameters**

**hex\_value** –

**Returns**

**static** `hex_value_to_rgb_channels(hex_value: int)` → Tuple[int, int, int]

Transforms `hex_value` in 0xffffffff format into tuple of three integers corresponding to *red*, *blue* and *green* channel value respectively. Values are within [0; 255] range.

```
>>> Color.hex_value_to_rgb_channels(0x80ff80)
(128, 255, 128)
>>> Color.hex_value_to_rgb_channels(0x000001)
(0, 0, 1)
```

`pytermor.color.TypeColor`

Any non-abstract *Color* type.

alias of `TypeVar('TypeColor', ColorDefault, ColorIndexed, ColorRGB)`

**class** pytermor.color.\_ColorMap

Bases: Generic[TypeColor]

Class contains a dictionary of registered *Colors* indexed by hex code along with cached nearest color search results to avoid unnecessary instance copies and search repeating.

**\_\_init\_\_**(parent\_type: TypeColor)

Called in *Color*-type class constructors. Each *Color* type should have class variable with instance of *\_ColorMap* and create it by itself if it's not present.

**Parameters**

**parent\_type** – Parent *Color* type.

**add\_to\_map**(color: TypeColor)

Called in *Color*-type class constructors. Add a new element in color lookup table if it wasn't there, and then drop cached search results as they are most probably useless after registering a new color (i.e. now there will be better result for at least one cached value).

**Parameters**

**color** – *Color* instance being created.

**get\_exact**(hex\_value: int) → TypeColor | None

Public interface for searching exact values in the *lookup table*, or global registry of created instances of specified Color class.

**Parameters**

**hex\_value** – Color value in RGB format.

**Returns**

Color with specified value. Type is equal to type of the parent of selected color map.

**find\_closest**(hex\_value: int) → TypeColor

Search for nearest to *hex\_value* registered color. Is used by *SGRRenderer* to find supported color alternatives in case user's terminal is incapable of operating in better mode.

**Parameters**

**hex\_value** – Color value in RGB format.

**Returns**

Nearest to *hex\_value* registered Color. Type is equal to type of the parent of selected color map. If no colors of required type were created (table and cache are empty), invokes *get\_default()* Color method.

**approximate**(hex\_value: int, max\_results: int = 1) → List[TypeColor]

Core color approximation method. Iterate the registered SGRs table, or *lookup table*, containing parents' instances, and compute the euclidean distance from argument to each color of the palette. Sort the results and return the first <max\_results> of them.

---

**Note:** It's not guaranteed that this method will **always** succeed in searching (the result list can be empty). Consider using *find\_closest* instead, if you really want to be sure that at least some color will be returned. Another option is to use special "color" named *NOOP*.

---

**Parameters**

- **hex\_value** – Color RGB value.
- **max\_results** – Maximum amount of values to return.

**Returns**

Closest [Color](#) instances found, sorted by color distance descending (i.e. 0th element is always the closest to the input value).

```
static __new__(cls, *args, **kws)
```

```
pytermor.color.NOOP = ColorRGB[]
```

Special instance of [Color](#) class always rendering into empty string.

**Attention:** Preset constants are omitted from API doc pages to improve readability and avoid duplication. Summary list of all presets can be found in [Preset list](#) section of the guide.

## 2.2 intcode

Module with SGR param integer codes, contains a complete or almost complete list of reliably working ones.

Suitable for [Span](#) and [SequenceSGR](#) default constructors.

**Attention:** Preset constants are omitted from API doc pages to improve readability and avoid duplication. Summary list of all presets can be found in [Preset list](#) section of the guide.

## 2.3 renderer

Module with output formatters. By default [SGRRenderer](#) is used.

Abstract parent class [Renderer](#) contains global (library-wide) compatibility settings. See [Renderer.set\\_up\(\)](#).

Working with non-default renderer can be accomplished in two ways:

1. There is a module-level variable [DefaultRenderer](#) determining what renderer [Style.render\(\)](#) method will be using. Default renderer can be swapped with another one using [Renderer.set\\_as\\_default\(\)](#) class method of the latter.
2. Alternatively, you can use renderer's own class method [Renderer.render\(\)](#) directly and avoid calling [Style.render\(\)](#) method whatsoever.

```
>>> Renderer.set_up(True)
>>> DebugRenderer.set_as_default()
>>> Style('red').render('_text_')
'[31m_text_[39m'
>>> NoOpRenderer.render(Style('red'), 'text')
'text'
```

```
class pytermor.renderer.Renderer
```

Abstract parent of all other renderers. Among other things also contains settings shared between all renderer types that can be customized by developer at runtime.

```
static set_up(force_styles: bool | None = False, compatibility_indexed: bool = False,
              compatibility_default: bool = False)
```

Set up renderer preferences. Affects all renderer types.

### Parameters

- **force\_styles** –
  - If set to *None*, all renderers will pass input text through themselves without any changes (i.e. no colors and attributes will be applied).
  - If set to *True*, renderers will always apply the formatting regardless of other internal rules and algorithms.
  - If set to *False* [default], the final decision will be made by every renderer independently, based on their own algorithms.
- **compatibility\_indexed** – Disable *RGB* (or True Color) output mode. 256-color (*indexed*) sequences will be printed out instead of disabled ones. Useful when combined with *curses* – that way you can check the terminal capabilities from the inside of that terminal and switch to different output mode at once.
- **compatibility\_default** – Disable *indexed* output mode and use *default* 16-color sequences instead. If this setting is set to *True*, the value of *compatibility\_indexed* will be ignored completely. Useful when combined with *curses* – that way you can check the terminal capabilities from the inside of that terminal and switch to different output mode at once.

#### classmethod `set_as_default()`

Set renderer as default for `Style.render()` invocations.

#### abstract classmethod `render(style: Style, text: str) → str`

Apply colors and attributes described in `style` argument to `text` and return the result. Output format depends on renderer's class (which defines the implementation).

#### class `pytermor.renderer.SGRRenderer`

Bases: `Renderer`

Default renderer that `Style.render()` invokes. Transforms `Color` instances defined in `style` argument into ANSI control sequence characters and merges them with input string.

#### classmethod `render(style: Style, text: str)`

Render `text` with `style` applied as ANSI control sequences.

Respects compatibility preferences (see `set_up()`) and maps RGB colors to closest *indexed* colors if terminal doesn't support RGB output. In case terminal doesn't support even 256 colors, falls back to *default* colors, searching for closest counterparts in 16-color table.

Type of output `SequenceSGR` depends on type of `Color` variables in `style` argument. Keeping all that in mind, let's summarize:

1. `ColorRGB` can be rendered as True Color sequence, indexed sequence and default (16-color) sequence depending on terminal capabilities.
2. `ColorIndexed` can be rendered as indexed sequence or default sequence.
3. `ColorDefault` will be rendered as default-color sequence.

### Parameters

- **style** – Style to apply.
- **text** – Input string.

### Returns

Input string enclosed in SGR sequences.

**classmethod** `set_as_default()`

Set renderer as default for `Style.render()` invocations.

**static** `set_up(force_styles: bool | None = False, compatibility_indexed: bool = False, compatibility_default: bool = False)`

Set up renderer preferences. Affects all renderer types.

#### Parameters

- **force\_styles** –
  - If set to *None*, all renderers will pass input text through themselves without any changes (i.e. no colors and attributes will be applied).
  - If set to *True*, renderers will always apply the formatting regardless of other internal rules and algorithms.
  - If set to *False* [default], the final decision will be made by every renderer independently, based on their own algorithms.
- **compatibility\_indexed** – Disable *RGB* (or True Color) output mode. 256-color (*indexed*) sequences will be printed out instead of disabled ones. Useful when combined with *curses* – that way you can check the terminal capabilities from the inside of that terminal and switch to different output mode at once.
- **compatibility\_default** – Disable *indexed* output mode and use *default* 16-color sequences instead. If this setting is set to *True*, the value of `compatibility_indexed` will be ignored completely. Useful when combined with *curses* – that way you can check the terminal capabilities from the inside of that terminal and switch to different output mode at once.

**class** `pytermor.renderer.TmuxRenderer`

Bases: `Renderer`

**abstract classmethod** `render(style: Style, text: str) → str`

Apply colors and attributes described in `style` argument to `text` and return the result. Output format depends on renderer's class (which defines the implementation).

**classmethod** `set_as_default()`

Set renderer as default for `Style.render()` invocations.

**static** `set_up(force_styles: bool | None = False, compatibility_indexed: bool = False, compatibility_default: bool = False)`

Set up renderer preferences. Affects all renderer types.

#### Parameters

- **force\_styles** –
  - If set to *None*, all renderers will pass input text through themselves without any changes (i.e. no colors and attributes will be applied).
  - If set to *True*, renderers will always apply the formatting regardless of other internal rules and algorithms.
  - If set to *False* [default], the final decision will be made by every renderer independently, based on their own algorithms.
- **compatibility\_indexed** – Disable *RGB* (or True Color) output mode. 256-color (*indexed*) sequences will be printed out instead of disabled ones. Useful when combined with *curses* – that way you can check the terminal capabilities from the inside of that terminal and switch to different output mode at once.



- **compatibility\_default** – Disable *indexed* output mode and use *default* 16-color sequences instead. If this setting is set to *True*, the value of `compatibility_indexed` will be ignored completely. Useful when combined with `curses` – that way you can check the terminal capabilities from the inside of that terminal and switch to different output mode at once.

**class** `pytermor.renderer.NoOpRenderer`

Bases: `Renderer`

**classmethod** `render(style: Style, text: str) → str`

Special renderer type that does nothing with the input string and just returns it as is.

```
>>> NoOpRenderer.render(Style(0xff00ff), 'text')
'text'
```

#### Parameters

- **style** – Style to ignore.
- **text** – Input string.

#### Returns

Input string without changes.

**classmethod** `set_as_default()`

Set renderer as default for `Style.render()` invocations.

**static** `set_up(force_styles: bool | None = False, compatibility_indexed: bool = False, compatibility_default: bool = False)`

Set up renderer preferences. Affects all renderer types.

#### Parameters

- **force\_styles** –
  - If set to *None*, all renderers will pass input text through themselves without any changes (i.e. no colors and attributes will be applied).
  - If set to *True*, renderers will always apply the formatting regardless of other internal rules and algorithms.
  - If set to *False* [default], the final decision will be made by every renderer independently, based on their own algorithms.
- **compatibility\_indexed** – Disable *RGB* (or True Color) output mode. 256-color (*indexed*) sequences will be printed out instead of disabled ones. Useful when combined with `curses` – that way you can check the terminal capabilities from the inside of that terminal and switch to different output mode at once.
- **compatibility\_default** – Disable *indexed* output mode and use *default* 16-color sequences instead. If this setting is set to *True*, the value of `compatibility_indexed` will be ignored completely. Useful when combined with `curses` – that way you can check the terminal capabilities from the inside of that terminal and switch to different output mode at once.

**class** `pytermor.renderer.HtmlRenderer`

Bases: `Renderer`

**classmethod** `render(style: Style, text: str) → str`

Apply colors and attributes described in `style` argument to `text` and return the result. Output format depends on renderer's class (which defines the implementation).

**classmethod** `set_as_default()`

Set renderer as default for [Style.render\(\)](#) invocations.

**static** `set_up(force_styles: bool | None = False, compatibility_indexed: bool = False, compatibility_default: bool = False)`

Set up renderer preferences. Affects all renderer types.

#### Parameters

- **force\_styles** –
  - If set to *None*, all renderers will pass input text through themselves without any changes (i.e. no colors and attributes will be applied).
  - If set to *True*, renderers will always apply the formatting regardless of other internal rules and algorithms.
  - If set to *False* [default], the final decision will be made by every renderer independently, based on their own algorithms.
- **compatibility\_indexed** – Disable *RGB* (or True Color) output mode. 256-color (*indexed*) sequences will be printed out instead of disabled ones. Useful when combined with `curses` – that way you can check the terminal capabilities from the inside of that terminal and switch to different output mode at once.
- **compatibility\_default** – Disable *indexed* output mode and use *default* 16-color sequences instead. If this setting is set to *True*, the value of `compatibility_indexed` will be ignored completely. Useful when combined with `curses` – that way you can check the terminal capabilities from the inside of that terminal and switch to different output mode at once.

**class** `pytermor.renderer.DebugRenderer`

Bases: [Renderer](#)

**classmethod** `render(style: Style, text: str) → str`

Apply colors and attributes described in `style` argument to `text` and return the result. Output format depends on renderer's class (which defines the implementation).

**classmethod** `set_as_default()`

Set renderer as default for [Style.render\(\)](#) invocations.

**static** `set_up(force_styles: bool | None = False, compatibility_indexed: bool = False, compatibility_default: bool = False)`

Set up renderer preferences. Affects all renderer types.

#### Parameters

- **force\_styles** –
  - If set to *None*, all renderers will pass input text through themselves without any changes (i.e. no colors and attributes will be applied).
  - If set to *True*, renderers will always apply the formatting regardless of other internal rules and algorithms.
  - If set to *False* [default], the final decision will be made by every renderer independently, based on their own algorithms.

- **compatibility\_indexed** – Disable *RGB* (or True Color) output mode. 256-color (*indexed*) sequences will be printed out instead of disabled ones. Useful when combined with *curses* – that way you can check the terminal capabilities from the inside of that terminal and switch to different output mode at once.
- **compatibility\_default** – Disable *indexed* output mode and use *default* 16-color sequences instead. If this setting is set to *True*, the value of *compatibility\_indexed* will be ignored completely. Useful when combined with *curses* – that way you can check the terminal capabilities from the inside of that terminal and switch to different output mode at once.

`pytermor.renderer.DefaultRenderer`

alias of *SGRRenderer*

## 2.4 sequence

Module contains definitions for low-level ANSI escape sequences handling.

Each preset defined below is a valid argument for *Span* and *SequenceSGR* default constructors (case-insensitive):

```
Span(sequence.BG_GREEN, sequence.UNDERLINED)
```

`pytermor.sequence.build(*args: str | int | SequenceSGR) → SequenceSGR`

Create new *SequenceSGR* with specified *args* as params.

Resulting sequence param order is same as an argument order.

**Each sequence param can be specified as:**

- string key (see *span*)
- integer param value (from *intcode*)
- existing *SequenceSGR* instance (params will be extracted).

Deprecated since version 2.0: @TODO ,

Examples:

```
>>> build('yellow', 'bold')
SGR[33;1]
>>> build(91, 7)
SGR[91;7]
>>> build(HI_CYAN, UNDERLINED)
SGR[96;4]
```

`pytermor.sequence.color_indexed(color: int, bg: bool = False) → SequenceSGR`

Wrapper for creation of *SequenceSGR* that sets foreground (or background) to one of 256-color palette value.

Deprecated since version 2.0: @TODO

### Parameters

- **color** – Index of the color in the palette, 0 – 255.
- **bg** – Set to *True* to change the background color (default is foreground).

### Returns

*SequenceSGR* with required params.

`pytermor.sequence.color_rgb(r: int, g: int, b: int, bg: bool = False) → SequenceSGR`

Wrapper for creation of `SequenceSGR` operating in True Color mode (16M). Valid values for *r*, *g* and *b* are in range [0; 255]. This range linearly translates into [0x00; 0xFF] for each channel. The result value is composed as #RRGGBB. For example, sequence with color of #FF3300 can be created with:

```
color_rgb(255, 51, 0)
```

Deprecated since version 2.0: @TODO

#### Parameters

- **r** – Red channel value, 0 – 255.
- **g** – Blue channel value, 0 – 255.
- **b** – Green channel value, 0 – 255.
- **bg** – Set to *True* to change the background color (default is foreground).

#### Returns

`SequenceSGR` with required params.

**class** `pytermor.sequence.SequenceSGR`

Bases: `_SequenceCSI`

Class representing SGR-type escape sequence with varying amount of parameters.

`SequenceSGR` with zero params was specifically implemented to translate into empty string and not into `e[m`, which would have made sense, but also would be very entangling, as this sequence is equivalent of `e[0m` – hard reset sequence. The empty-string-sequence is predefined as `NOOP`.

It's possible to add of one SGR sequence to another:

```
>>> SequenceSGR(31) + SequenceSGR(1) == SequenceSGR(31, 1)
True
```

**encode()** → str

Build up actual byte sequence and return as an ASCII-encoded string.

**\_\_init\_\_**(\*params: int)

**property** `params: List[int]`

Return internal params as array.

**classmethod** `regex()` → str

`pytermor.sequence.NOOP = SGR[]`

Special sequence in case where you *have to* provide one or another SGR, but do not want any control sequence to be actually included.

- `NOOP.encode()` returns empty string.
- `NOOP.params` returns empty list.

```
>>> NOOP.encode()
''
>>> NOOP.params
[]
```

New in version 1.8.

```
pytermor.sequence.RESET = SGR[0]
```

Resets all attributes and colors.

**Attention:** Preset constants are omitted from API doc pages to improve readability and avoid duplication. Summary list of all presets can be found in [Preset list](#) section of the guide.

## 2.5 span

Module introducing [Span](#) low-level abstractions. The key difference between them and Sequences is that sequence can *open* text style and also *close*, or terminate it. As for Spans – they always do both; typical use-case of [Span](#) is to wrap some text in opening SGR and closing one.

**class** `pytermor.span.Span`

Create a [Span](#) with specified control sequence(s) as an opening sequence and **automatically compose** second (closing) sequence that will terminate attributes defined in the first one while keeping the others (*soft* reset).

Resulting sequence param order is same as an argument order.

**Each argument can be specified as:**

- string key (name of any constant defined in [intcode](#), case-insensitive)
- integer param value (defined in [intcode](#))
- existing [SequenceSGR](#) instance (params will be extracted).

```
>>> Span('red', 'bold')
Span[SGR[31;1], SGR[39;22]]
>>> Span(intcode.GREEN)
Span[SGR[32], SGR[39]]
>>> Span(93, 4)
Span[SGR[93;4], SGR[39;24]]
>>> Span(sequence.BG_BLACK + sequence.RED)
Span[SGR[40;31], SGR[49;39]]
```

### Parameters

**opening\_params** – string keys, integer codes or existing [SequenceSGR](#) instances to build [Span](#) from.

**\_\_init\_\_** (\**opening\_params*: str | int | [SequenceSGR](#))

**classmethod** **from\_seq**(*opening\_seq*: Optional[[SequenceSGR](#)] = None, *closing\_seq*: Optional[[SequenceSGR](#)] = None, *hard\_reset\_after*: bool = False) → [Span](#)

Create new [Span](#) with explicitly specified opening and closing sequences.

---

**Note:** [closing\\_seq](#) gets overwritten with [sequence.RESET](#) if *hard\_reset\_after* is *True*.

---

### Parameters

- **opening\_seq** – Starter sequence, in general determining how [Span](#) will actually look like.
- **closing\_seq** – Finisher SGR sequence.

- **hard\_reset\_after** – Terminate *all* formatting after this span.

**wrap**(text: Optional[Any] = None) → str

Wrap given text string with SGRs defined on initialization – *opening\_seq* on the left, *closing\_seq* on the right. `str(text)` will be invoked for all argument types with the exception of *None*, which will be replaced with an empty string.

**Parameters**

**text** – String to wrap.

**Returns**

text enclosed in instance's SGRs, if any.

**property opening\_str: str**

Return opening SGR sequence encoded.

**property opening\_seq: SequenceSGR**

Return opening SGR sequence instance.

**property closing\_str: str**

Return closing SGR sequence encoded.

**property closing\_seq: SequenceSGR**

Return closing SGR sequence instance.

**\_\_call\_\_**(text: Optional[Any] = None) → str

Can be used instead of *wrap()* method.

```
>>> RED('text') == RED.wrap('text')
True
```

`pytermor.span.NOOB = Span[SGR[], SGR[]]`

Special *Span* in cases where you *have to* select one or another *Span*, but do not want any control sequence to be actually included.

- `NOOB(string)` or `NOOB.wrap(string)` returns string without any modifications;
- `NOOB.opening_str` and `NOOB.closing_str` are empty strings;
- `NOOB.opening_seq` and `NOOB.closing_seq` both returns *sequence.NOOB*.

```
>>> NOOB('text')
'text'
>>> NOOB.opening_str
''
>>> NOOB.opening_seq
SGR[]
```

**Attention:** Preset constants are omitted from API doc pages to improve readability and avoid duplication. Summary list of all presets can be found in *Preset list* section of the guide.

## 2.6 style

High-level abstraction defining text colors and attributes.

### `class pytermor.style.Style`

Create a new `Style()`.

Key difference between `Styles` and `Spans` or `SGRs` is that `Styles` describe colors in RGB format and therefore support output rendering in several different formats (see [renderer](#)).

Both `fg_color` and `bg_color` can be specified as:

1. [Color](#) instance or library preset;
2. key code – name of any of aforementioned presets, case-insensitive;
3. integer color value in hexademical RGB format.

```
>>> Style('green', bold=True)
Style[fg=008000, no bg, bold]
>>> Style(bg_color=0x0000ff)
Style[no fg, bg=0000ff]
>>> Style(color.IDX_DEEP_SKY_BLUE_1, color.IDX_GREY_93)
Style[fg=00aaff, bg=eeeeee]
```

#### Parameters

- **fg\_color** – Foreground (i.e., text) color.
- **bg\_color** – Background color.
- **auto\_fg** – Automatically select `fg_color` based on `bg_color` (black or white depending on background brightness, if `bg_color` is defined).
- **blink** – Blinking effect; *supported by limited amount of Renderers*.
- **bold** – Bold or increased intensity.
- **crosslined** – Strikethrough.
- **dim** – Faint, decreased intensity.
- **double\_underlined** – Faint, decreased intensity.
- **inversed** – Swap foreground and background colors.
- **italic** – Italic.
- **overlined** – Overline.
- **underlined** – Underline.

```
__init__(fg_color: str | int | Color = None, bg_color: str | int | Color = None, auto_fg: bool = False, blink:
bool = False, bold: bool = False, crosslined: bool = False, dim: bool = False, double_underlined:
bool = False, inversed: bool = False, italic: bool = False, overlined: bool = False, underlined:
bool = False)
```

**render**(text: Optional[Any] = None) → str

Returns text with all attributes and colors applied.

By default uses [SequenceSGR](#) renderer, that means that output will contain ANSI escape sequences.

```
class pytermor.style.Stylesheet
```

```
    __init__(default: Optional[Style] = None)
```

## 2.7 util

Package containing a set of formatters for prettier output, as well as utility classes for removing some of the boilerplate code when dealing with escape sequences.

```
pytermor.util.format_thousand_sep(value: int | float, separator=' ')
```

Returns input value with integer part splitted into groups of three digits, joined then with `separator` string.

```
>>> format_thousand_sep(260341)
'260 341'
>>> format_thousand_sep(-9123123123.55, ',')
'-9,123,123,123.55'
```

### 2.7.1 auto\_float

```
pytermor.util.auto_float.format_auto_float(value: float, req_len: int, allow_exponent_notation: bool =
                                             True) → str
```

Dynamically adjust decimal digit amount and format to fill up the output string with as many significant digits as possible, and keep the output length strictly equal to `req_len` at the same time.

```
>>> format_auto_float(0.016789, 5)
'0.017'
>>> format_auto_float(0.167891, 5)
'0.168'
>>> format_auto_float(1.567891, 5)
'1.568'
>>> format_auto_float(12.56789, 5)
'12.57'
>>> format_auto_float(123.5678, 5)
'123.6'
>>> format_auto_float(1234.567, 5)
'1235'
>>> format_auto_float(12345.67, 5)
'12346'
```

For cases when it's impossible to fit a number in the required length and rounding doesn't help (e.g. 12 500 000 and 5 chars) algorithm switches to scientific notation and the result looks like '1.2e7'.

When exponent form is disabled, there are two options for value that cannot fit into required length:

- 1) if absolute value is less than 1, zeros will be displayed ('0.0000');
- 2) in case of big numbers (like  $10^9$ ) `ValueError` will be raised instead.

#### Parameters

- **value** – Value to format
- **req\_len** – Required output string length



- **allow\_exponent\_notation** – Enable/disable exponent form.

**Returns**

Formatted string of required length

**Raises**

**ValueError** –

New in version 1.7.

## 2.7.2 prefixed\_unit

`pytermor.util.prefixed_unit.format_si_metric(value: float) → str`

Format value as unitless value with SI-prefixes, max result length is 6 chars. Base is 1000.

```
>>> format_si_metric(123.456)
'123'
>>> format_si_metric(1080)
'1.08 k'
>>> format_si_metric(45200)
'45.2 k'
>>> format_si_metric(1257800)
'1.26 M'
```

**Parameters**

**value** – Input value (unitless).

**Returns**

Formatted string with SI-prefix if necessary.

New in version 2.0.

`pytermor.util.prefixed_unit.format_si_binary(value: float) → str`

Format value as binary size (bytes, kbytes, Mbytes), max result length is 8 chars. Base is 1024.

```
>>> format_si_binary(631)
'631 b'
>>> format_si_binary(1080)
'1.055 kb'
>>> format_si_binary(45200)
'44.14 kb'
>>> format_si_binary(1257800)
'1.200 Mb'
```

**Parameters**

**value** – Input value in bytes.

**Returns**

Formatted string with SI-prefix if necessary.

New in version 2.0.

**class** pytermor.util.prefixed\_unit.PrefixedUnitFormatter

Formats value using settings passed to constructor. The main idea of this class is to fit into specified string length as much significant digits as it's theoretically possible by using multipliers and unit prefixes to indicate them.

You can create your own formatters if you need fine tuning of the output and customization. If that's not the case, there are facade methods `format_si_metric()` and `format_si_binary()`, which will invoke predefined formatters and doesn't require setting up.

@TODO params

**Parameters**

**prefix\_zero\_idx** – Index of prefix which will be used as default, i.e. without multiplying coefficients.

New in version 1.7.

**\_\_init\_\_**(*max\_value\_len: int, integer\_input: bool = False, unit: str = None, unit\_separator: str = None, mcoef: float = 1000.0, prefixes: List[str | None] = None, prefix\_zero\_idx: int = None*)

**property** max\_len: int

**Returns**

Maximum length of the result. Note that constructor argument is *max\_value\_len*, which is different parameter.

**format**(*value: float*) → str

**Parameters**

**value** – Input value

**Returns**

Formatted value

pytermor.util.prefixed\_unit.PREFIXES\_SI = ['y', 'z', 'a', 'f', 'p', 'n', '', 'm', None, 'k', 'M', 'G', 'T', 'P', 'E', 'Z', 'Y']

Prefix presets used by default module formatters. Can be useful if you are building your own formatter.

pytermor.util.prefixed\_unit.PREFIX\_ZERO\_SI = 8

Index of prefix which will be used as default, i.e. without multiplying coefficients.

## 2.7.3 time\_delta

Module for time difference formatting (e.g. “4 days 15 hours”, “8h 59m”).

Supports several output lengths and can be customized even more.

pytermor.util.time\_delta.format\_time\_delta(*seconds: float, max\_len: Optional[int] = None*) → str

Format time delta using suitable format (which depends on *max\_len* argument). Key feature of this formatter is ability to combine two units and display them simultaneously, e.g. return “3h 48min” instead of “228 mins” or “3 hours”,

There are predefined formatters with output length of 3, 4, 6 and 10 characters. Therefore, you can pass in any value from 3 inclusive and it's guaranteed that result's length will be less or equal to required length. If *max\_len* is omitted, longest registered formatter will be used.

```
>>> format_time_delta(10, 3)
'10s'
>>> format_time_delta(10, 6)
'10 sec'
>>> format_time_delta(15350, 4)
'4 h'
>>> format_time_delta(15350)
'4h 15min'
```

**Parameters**

- **seconds** – Value to format
- **max\_len** – Maximum output string length (total)

**Returns**

Formatted string

**class pytermor.util.time\_delta.TimeDeltaFormatter**

Formatter for time intervals. Key feature of this formatter is ability to combine two units and display them simultaneously, e.g. return “3h 48min” instead of “228 mins” or “3 hours”, etc.

You can create your own formatters if you need fine tuning of the output and customization. If that’s not the case, there is a facade method `format_time_delta()` which will select appropriate formatter automatically.

Example output:

```
"10 secs", "5 mins", "4h 15min", "5d 22h"
```

```
__init__(units: List[TimeUnit], allow_negative: bool, unit_separator: Optional[str] = None, plural_suffix:
Optional[str] = None, stylesheet: Optional[TimeDeltaStylesheet] = None, overflow_msg: str =
'OVERFLOW')
```

**property stylesheet:** *TimeDeltaStylesheet*

**property max\_len:** `int`

This property cannot be set manually, it is computed on initialization automatically.

**Returns**

Maximum possible output string length.

**format**(seconds: float, always\_max\_len: bool = False) → str

Format the requested amount of seconds and apply styles to the result as defined in current formatter’s *stylesheet*. Default stylesheet contains “noop” spans only and thus no styles will be applied.

**Parameters**

- **seconds** – Input value.
- **always\_max\_len** – If result string is less than *max\_len* it will be returned as is, unless this flag is set to *True*. In that case output string will be padded with spaces on the left side so that resulting length would be always equal to maximum length.

**Returns**

Formatted string with applied styles if they are defined, raw string otherwise.

**format\_raw**(seconds: float) → str | None

Format the requested amount of seconds as raw string without styling.

**Parameters**

**seconds** – Input value.

**Returns**

Formatted string or *None* on overflow (if input value is too big for the current formatter to handle).

**class** pytermor.util.time\_delta.**TimeUnit**

TimeUnit(name: 'str', in\_next: 'int' = None, custom\_short: 'str' = None, collapsible\_after: 'int' = None, overflow\_afer: 'int' = None)

**name:** str

**in\_next:** int = None

**custom\_short:** str = None

**collapsible\_after:** int = None

**overflow\_afer:** int = None

**\_\_init\_\_**(name: str, in\_next: Optional[int] = None, custom\_short: Optional[str] = None, collapsible\_after: Optional[int] = None, overflow\_afer: Optional[int] = None) → None

**class** pytermor.util.time\_delta.**TimeDeltaStylesheet**

Bases: [Stylesheet](#)

**\_\_init\_\_**(default: Optional[Style] = None, digit: Optional[Style] = None, unit: Optional[Style] = None, overflow: Optional[Style] = None)

## 2.7.4 stdlib\_ext

Some of the Python Standard Library methods rewritten for correct work with strings containing control sequences.

pytermor.util.stdlib\_ext.**ljust\_sgr**(s: str, width: int, fillchar: str = ' ') → str

SGR-formatting-aware implementation of `str.ljust`.

Return a left-justified string of length `width`. Padding is done using the specified fill character (default is a space).

pytermor.util.stdlib\_ext.**rjust\_sgr**(s: str, width: int, fillchar: str = ' ') → str

SGR-formatting-aware implementation of `str.rjust`.

Return a right-justified string of length `width`. Padding is done using the specified fill character (default is a space).

pytermor.util.stdlib\_ext.**center\_sgr**(s: str, width: int, fillchar: str = ' ') → str

SGR-formatting-aware implementation of `str.center`.

Return a centered string of length `width`. Padding is done using the specified fill character (default is a space).

## 2.7.5 string\_filter

String filtering module.

Main idea is to provide a common interface for string filtering, that can make possible working with filters like with objects rather than with functions/lambda's.

```
pytermor.util.string_filter.apply_filters(s: AnyStr, *args: StringFilter[AnyStr] |
                                         Type[StringFilter[AnyStr]]) → AnyStr
```

Method for applying dynamic filter list to a target string/bytes. Example (will replace all ESC control characters to E and thus make SGR params visible):

```
>>> apply_filters(span.RED('test'), ReplaceSGR(r'E\2\3\5'))
'E[31mtestE[39m'
```

Note that type of *s* argument must be same as `StringFilter` parameterized type, i.e. `ReplaceNonAsciiBytes` is `StringFilter[bytes]` type, so you can apply it only to bytes-type strings.

### Parameters

- *s* (*AnyStr*) – String to filter.
- *args* – *StringFilter* instance(s) or *StringFilter* class(es).

### Returns

Filtered *s*.

```
class pytermor.util.string_filter.StringFilter
```

Bases: `Generic`

Common string modifier interface.

```
__init__(pattern: AnyStr, repl: AnyStr | Callable[[AnyStr | Match], AnyStr])
```

```
__call__(s: AnyStr) → AnyStr
```

Can be used instead of *apply()*

```
apply(s: AnyStr) → AnyStr
```

Apply filter to *s* string (or bytes).

```
static __new__(cls, *args, **kwargs)
```

```
class pytermor.util.string_filter.VisualuzeWhitespace
```

Bases: `StringFilter[str]`

Replace every invisible character with *repl* (default is `.`), except newlines. Newlines are kept and get prepended with same string.

```
>>> VisualuzeWhitespace().apply('A B C')
'A·B·C'
>>> apply_filters('1. D\n2. L ', VisualuzeWhitespace)
'1·D·\n2·L·'
```

```
__init__(repl: AnyStr = '.')
```

```
__call__(s: AnyStr) → AnyStr
```

Can be used instead of *apply()*

```
static __new__(cls, *args, **kwargs)
```

**apply**(*s: AnyStr*) → AnyStr

Apply filter to *s* string (or bytes).

**class** pytermor.util.string\_filter.**ReplaceSGR**

Bases: [StringFilter](#)[str]

Find all SGR seqs (e.g. ESC[1;4m) and replace with given string. More specific version of [ReplaceCSI](#).

**Parameters**

**repl** – Replacement, can contain regexp groups (see [apply\\_filters\(\)](#)).

**\_\_init\_\_**(*repl: AnyStr* = "")

**\_\_call\_\_**(*s: AnyStr*) → AnyStr

Can be used instead of *apply()*

**static** **\_\_new\_\_**(*cls, \*args, \*\*kws*)

**apply**(*s: AnyStr*) → AnyStr

Apply filter to *s* string (or bytes).

**class** pytermor.util.string\_filter.**ReplaceCSI**

Bases: [StringFilter](#)[str]

Find all CSI seqs (i.e. ESC[\*]) and replace with given string. Less specific version of [ReplaceSGR](#), as CSI consists of SGR and many other sequence subtypes.

**Parameters**

**repl** – Replacement, can contain regexp groups (see [apply\\_filters\(\)](#)).

**\_\_init\_\_**(*repl: AnyStr* = "")

**\_\_call\_\_**(*s: AnyStr*) → AnyStr

Can be used instead of *apply()*

**static** **\_\_new\_\_**(*cls, \*args, \*\*kws*)

**apply**(*s: AnyStr*) → AnyStr

Apply filter to *s* string (or bytes).

**class** pytermor.util.string\_filter.**ReplaceNonAsciiBytes**

Bases: [StringFilter](#)[bytes]

Keep 7-bit ASCII bytes [0x00 - 0x7f], replace other to ?.

**Parameters**

**repl** – Replacement byte-string.

**\_\_init\_\_**(*repl: AnyStr* = b'?')

**\_\_call\_\_**(*s: AnyStr*) → AnyStr

Can be used instead of *apply()*

**static** **\_\_new\_\_**(*cls, \*args, \*\*kws*)

**apply**(*s: AnyStr*) → AnyStr

Apply filter to *s* string (or bytes).

## CHANGELOG

### 3.1 v2.0.0

- Complete library rewrite.
- High-level abstractions *Color*, *Renderer* and *Style*.
- Unit tests for formatters and new modules.
- pytest and coverage integration.
- sphinx and readthedocs integraton.

### 3.2 v1.8.0

- `format_prefixed_unit` extended for working with decimal and binary metric prefixes.
- `format_time_delta` extended with new settings.
- Value rounding transferred from `format_auto_float` to `format_prefixed_unit`.
- Utility classes reorganization.
- Unit tests output formatting.
- `sequence.NOOP` SGR sequence and `span.NOOP` format.
- Max decimal points for `auto_float` extended from (2) to (max-2).

### 3.3 v1.7.4

- Added 3 formatters: `format_prefixed_unit`, `format_time_delta`, `format_auto_float`.

### 3.4 v1.7.3

- Added `span.BG_BLACK` format.

### 3.5 v1.7.2

- Added `ljust_sgr`, `rjust_sgr`, `center_sgr` util functions to align strings with SGRs correctly.

### 3.6 v1.7.1

- Print reset sequence as `\e[m` instead of `\e[0m`.

### 3.7 v1.7.0

- `Span` constructor can be called without arguments.
- Added SGR code lists.

### 3.8 v1.6.2

- Excluded `tests` dir from distribution package.

### 3.9 v1.6.1

- Ridded of `EmptyFormat` and `AbstractFormat` classes.
- Renamed code module to `sgr` because of conflicts in PyCharm debugger (`pydevd_console_integration.py`).

### 3.10 v1.5.0

- Removed excessive `EmptySequenceSGR` – default SGR class was specifically implemented to print out as empty string instead of `\e[m` if constructed without params.



### 3.11 v1.4.0

- `Span.wrap()` now accepts any type of argument, not only `str`.
- Rebuilt Sequence inheritance tree.
- Added equality methods for `SequenceSGR` and `Span` classes/subclasses.
- Added some tests for `fmt.*` and `seq.*` classes.

### 3.12 v1.3.2

- Added `span.GRAY` and `span.BG_GRAY` format presets.

### 3.13 v1.3.1

- Interface revisioning.

### 3.14 v1.2.1

- `opening_seq` and `closing_seq` properties for `Span` class.

### 3.15 v1.2.0

- `EmptySequenceSGR` and `EmptyFormat` classes.

### 3.16 v1.1.0

- Autoformat feature.

### 3.17 v1.0.0

- First public version.

---

This project uses Semantic Versioning – <https://semver.org> (*starting from 2.0.0*)



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