



# **pytermor**

***Release 2.6.1-dev2***

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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*).

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**Todo:** This is how you **should** format examples:

---

We put these pieces together to create a SGR command. Thus, `ESC[3m` 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.

Diagram illustrating the components of an ANSI SGR command sequence for rendering the word "text" in red with a single underline:

- CSI** (Control Sequence Introducer) is represented by `\x1b`.
- Parameters** are the numbers `31` and `4` inside the brackets, specifying red foreground and single underline.
- Final Byte** is the `m` character that terminates the sequence.
- The full sequence is `\x1b[31;4mtext`.

#### Notes

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

A L	Module	Class(es)	Purpose
Hi	<i>text</i>	<i>Text</i>	Container consisting of text pieces each with attached <i>Style</i> . Renders into specified format keeping all the formatting.
		<i>Style</i> <i>Styles</i>	Reusable abstractions defining colors and text attributes (text color, bg color, <i>bold</i> attribute, <i>underlined</i> attribute etc).
		<i>SgrRenderer</i> <i>HtmlRenderer</i> <i>TmuxRenderer</i> etc.	<i>SgrRenderer</i> transforms <i>Style</i> instances into <i>Color</i> , <i>Span</i> and <i>SequenceSGR</i> instances and assembles it all up. There are several other implementations depending on what output format is required.
	<i>color</i>	<i>Color16</i> <i>Color256</i> <i>ColorRGB</i>	Abstractions for color operations in different color modes (default 16-color, 256-color, RGB). Tools for color approximation and transformations.
		<i>pytermor</i>	Color registry.
Lo	<i>ansi</i>	<i>Span</i>	Abstraction consisting of “opening” SGR sequence defined by the developer (or taken from preset list) and complementary “closing” SGR sequence that is built automatically.
		<i>Spans</i>	Registry of predefined instances in case the developer doesn’t need dynamic output formatting and just wants to colorize an error message.
		<i>SequenceSGR</i> <i>SeqIndex</i>	Abstractions for manipulating ANSI control sequences and classes-factories, plus a registry of preset SGRs.
		<i>IntCodes</i>	Registry of escape control sequence parameters.
	<i>util</i>	*	Additional formatters and common methods for manipulating strings with SGRs inside.

### 1.1.3 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 Spans
2
3 print(Spans.RED('Feat') + Spans.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* using default constructor, 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 SeqIndex, SequenceSGR
2
3 seq1 = SequenceSGR('hi_blue', 1) # keys or integer codes
4 seq2 = SequenceSGR(seq1, SeqIndex.ITALIC) # existing SGRs
5 seq3 = SequenceSGR('underlined', 'YELLOW') # case-insensitive
6
7 msg = f'{seq1}Flexible{SeqIndex.RESET} ' + \
8       f'{seq2}sequence{SeqIndex.RESET} ' + \
9       str(seq3) + 'builder' + str(SeqIndex.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 SequenceSGR, SeqIndex
2
3 start_color = 41
4 for idx, c in enumerate(range(start_color, start_color+(36*6), 36)):
5     print(f'{SequenceSGR.init_color_256(c)}{SeqIndex.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'{SequenceSGR.init_color_rgb(r, g, b)}{SeqIndex.COLOR_OFF}', end='')

```



## Customizable output formats

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**Todo:** @TODOTODO

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## String and number formatters

---

**Todo:** @TODOTODO

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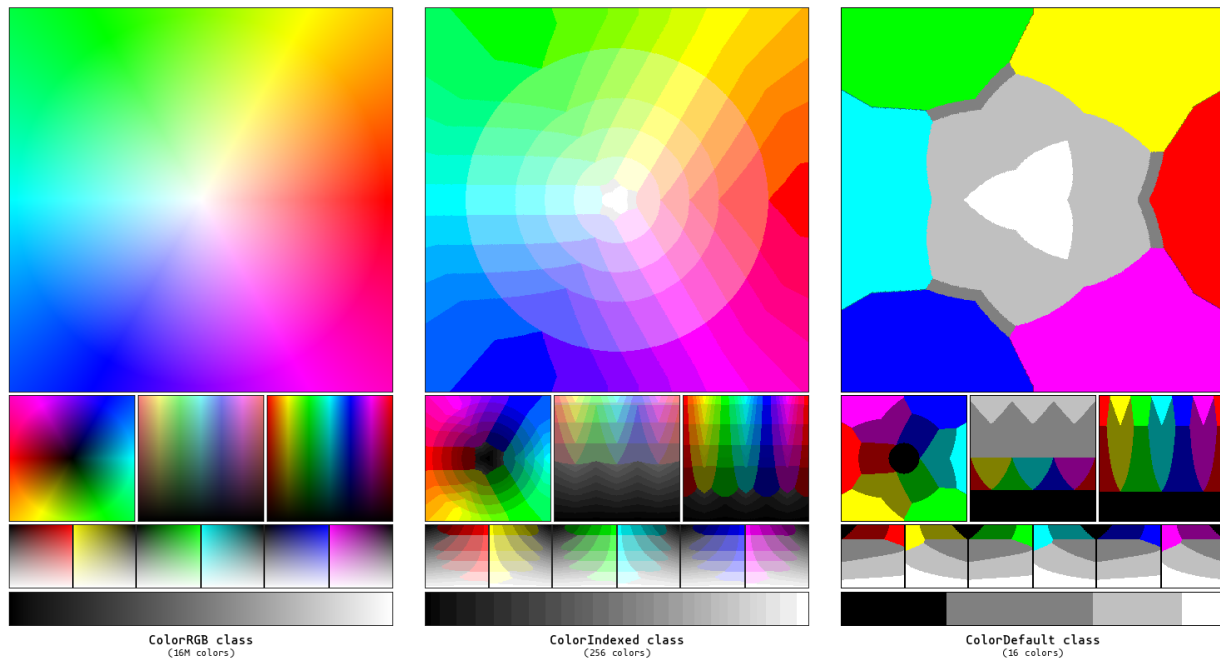


Fig. 1: Color approximations for indexed modes

## 1.2 High-level abstractions

### 1.2.1 ColorIndex and Styles

### 1.2.2 Output format control

### 1.2.3 Color mode fallbacks

### 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 ESC[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 ESC[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 Span, Spans, SeqIndex
2
3 # implicitly:
```

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```

4 span_warn = Span(93, 4)
5 # or explicitly:
6 span_warn = Span.init_explicit(
7     SeqIndex.HI_YELLOW + SeqIndex.UNDERLINED, # sequences can be summed up, remember?
8     SeqIndex.COLOR_OFF + SeqIndex.UNDERLINED_OFF, # "counteractive" sequences
9     hard_reset_after=False
10 )
11
12 orig_text = Spans.BOLD(f'this is {SeqIndex.BG_GRAY}the original{SeqIndex.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 `SeqIndex.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.init_explicit()`.

### 1.3.3 Creating and applying SGRs

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

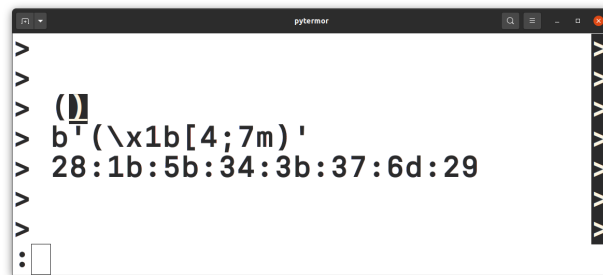
**Important:** SequenceSGR with zero params was specifically implemented to translate into an empty string and not into ESC[m, which would make sense, but also could be very entangling, as terminal emulators interpret that sequence as ESC[0m, which is *hard* reset sequence.

There is also a set of methods for dynamic SequenceSGR creation:

- `init_color_indexed()` will produce sequence operating in 256-colors mode (for a complete list see [Preset list](#));
- `init_color_rgb()` will create a sequence capable of setting the colors in True Color 16M mode (however, some terminal emulators doesn't support it).

To get the resulting sequence chars use `assemble()` method or cast instance to `str`.

```
1 from pytermor import SequenceSGR
2
3 seq = SequenceSGR(4, 7)
4 msg = f'({seq})'
5
6 print(msg + f'{SequenceSGR(0).assemble()}')
7 print(str(msg.assemble()))
8 print(msg.assemble().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. ESC is escape *control character*, which opens a control sequence (can also be written as `\e` or `\x1b`).
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 SequenceSGR, SeqIndex
2
3 combined = SequenceSGR(1, 31) + SequenceSGR(4)
4 print(f'{combined}{combined}{SeqIndex.RESET}', str(combined).assemble())
```

### 1.3.6 Core API

---

**Todo:**

- *SequenceSGR* constructor
  - *SequenceSGR*.init\_color\_indexed()
  - *SequenceSGR*.init\_color\_rgb()
  - *Span* constructor
  - *Span*.init\_explicit()
- 

## 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 (*Color16*), and second one consisting of 256 colors (*Color256*). 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 assembled 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</i> mode]; use <code>init_color_indexed</code> and <code>init_color_rgb</code> instead
	BG_COLOR_EXTENDED	48					Set background color [ <i>indexed/RGB</i> mode]; use <code>init_color_indexed</code> and <code>init_color_rgb</code> 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 inverting
	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
	XTERM_BLACK <sup>3</sup>	0			V		#000000	
	XTERM_MAROON	1			V		#800000	
	XTERM_GREEN	2			V		#008000	
	XTERM_OLIVE	3			V		#808000	
	XTERM_NAVY	4			V		#000080	
	XTERM_PURPLE_5	5			V		#800080	Purple <sup>4</sup>
	XTERM_TEAL	6			V		#008080	
	XTERM_SILVER	7			V		#c0c0c0	
	XTERM_GREY	8			V		#808080	
	XTERM_RED	9			V		#ff0000	
	XTERM_LIME	10			V		#00ff00	
	XTERM_YELLOW	11			V		#ffff00	
	XTERM_BLUE	12			V		#0000ff	
	XTERM_FUCHSIA	13			V		#ff00ff	
	XTERM_AQUA	14			V		#00ffff	
	XTERM_WHITE	15			V		#ffffff	
	XTERM_GREY_0	16			V		#000000	
	XTERM_NAVY_BLUE	17			V		#00005f	
	XTERM_DARK_BLUE	18			V		#000087	
	XTERM_BLUE_3	19			V		#0000af	
	XTERM_BLUE_2	20			V		#0000d7	Blue3
	XTERM_BLUE_1	21			V		#0000ff	
	XTERM_DARK_GREEN	22			V		#005f00	
	XTERM_DEEP_SKY_BLUE_7	23			V		#005f5f	DeepSkyBlue4
	XTERM_DEEP_SKY_BLUE_6	24			V		#005f87	DeepSkyBlue4
	XTERM_DEEP_SKY_BLUE_5	25			V		#005faf	DeepSkyBlue4
	XTERM_DODGER_BLUE_3	26			V		#005fd7	
	XTERM_DODGER_BLUE_2	27			V		#005fff	
	XTERM_GREEN_5	28			V		#008700	Green4
	XTERM_SPRING_GREEN_4	29			V		#00875f	
	XTERM_TURQUOISE_4	30			V		#008787	
	XTERM_DEEP_SKY_BLUE_4	31			V		#0087af	DeepSkyBlue3
	XTERM_DEEP_SKY_BLUE_3	32			V		#0087d7	
	XTERM_DODGER_BLUE_1	33			V		#0087ff	
	XTERM_GREEN_4	34			V		#00af00	Green3
	XTERM_SPRING_GREEN_5	35			V		#00af5f	SpringGreen3
	XTERM_DARK_CYAN	36			V		#00af87	
	XTERM_LIGHT_SEA_GREEN	37			V		#00afaf	
	XTERM_DEEP_SKY_BLUE_2	38			V		#00afd7	
	XTERM_DEEP_SKY_BLUE_1	39			V		#00afff	
	XTERM_GREEN_3	40			V		#00d700	
	XTERM_SPRING_GREEN_3	41			V		#00d75f	
	XTERM_SPRING_GREEN_6	42			V		#00d787	SpringGreen2
	XTERM_CYAN_3	43			V		#00d7af	
	XTERM_DARK_TURQUOISE	44			V		#00d7d7	
	XTERM_TURQUOISE_2	45			V		#00d7ff	
	XTERM_GREEN_2	46			V		#00ff00	Green1
















continues on next page

Table 2 – continued from previous page

	Name	INT	SEQ	SPN	CLR	STY	RGB code	XTerm name
	XTERM_SPRING_GREEN_2	47			V		#00ff5f	
	XTERM_SPRING_GREEN_1	48			V		#00ff87	
	XTERM_MEDIUM_SPRING_GREEN	49			V		#00ffa5	
	XTERM_CYAN_2	50			V		#00ffd7	
	XTERM_CYAN_1	51			V		#00ffff	
	XTERM_DARK_RED_2	52			V		#5f0000	DarkRed
	XTERM_DEEP_PINK_8	53			V		#5f005f	DeepPink4
	XTERM_PURPLE_6	54			V		#5f0087	Purple4
	XTERM_PURPLE_4	55			V		#5f00af	
	XTERM_PURPLE_3	56			V		#5f00d7	
	XTERM_BLUE_VIOLET	57			V		#5f00ff	
	XTERM_ORANGE_4	58			V		#5f5f00	
	XTERM_GREY_37	59			V		#5f5f5f	
	XTERM_MEDIUM_PURPLE_7	60			V		#5f5f87	MediumPurple4
	XTERM_SLATE_BLUE_3	61			V		#5f5faf	
	XTERM_SLATE_BLUE_2	62			V		#5f5fd7	SlateBlue3
	XTERM_ROYAL_BLUE_1	63			V		#5f5fff	
	XTERM_CHARTREUSE_6	64			V		#5f8700	Chartreuse4
	XTERM_DARK_SEA_GREEN_9	65			V		#5f875f	DarkSeaGreen4
	XTERM_PALE_TURQUOISE_4	66			V		#5f8787	
	XTERM_STEEL_BLUE	67			V		#5f87af	
	XTERM_STEEL_BLUE_3	68			V		#5f87d7	
	XTERM_CORNFLOWER_BLUE	69			V		#5f87ff	
	XTERM_CHARTREUSE_5	70			V		#5faf00	Chartreuse3
	XTERM_DARK_SEA_GREEN_8	71			V		#5faf5f	DarkSeaGreen4
	XTERM_CADET_BLUE_2	72			V		#5faf87	CadetBlue
	XTERM_CADET_BLUE	73			V		#5fafaf	
	XTERM_SKY_BLUE_3	74			V		#5fafd7	
	XTERM_STEEL_BLUE_2	75			V		#5fafff	SteelBlue1
	XTERM_CHARTREUSE_4	76			V		#5fd700	Chartreuse3
	XTERM_PALE_GREEN_4	77			V		#5fd75f	PaleGreen3
	XTERM_SEA_GREEN_3	78			V		#5fd787	
	XTERM_AQUAMARINE_3	79			V		#5fd7af	
	XTERM_MEDIUM_TURQUOISE	80			V		#5fd7d7	
	XTERM_STEEL_BLUE_1	81			V		#5fd7ff	
	XTERM_CHARTREUSE_2	82			V		#5fff00	
	XTERM_SEA_GREEN_4	83			V		#5fff5f	SeaGreen2
	XTERM_SEA_GREEN_2	84			V		#5fff87	SeaGreen1
	XTERM_SEA_GREEN_1	85			V		#5fffaf	
	XTERM_AQUAMARINE_2	86			V		#5fffd7	Aquamarine1
	XTERM_DARK_SLATE_GRAY_2	87			V		#5ffffff	
	XTERM_DARK_RED	88			V		#870000	
	XTERM_DEEP_PINK_7	89			V		#87005f	DeepPink4
	XTERM_DARK_MAGENTA_2	90			V		#870087	DarkMagenta
	XTERM_DARK_MAGENTA	91			V		#8700af	
	XTERM_DARK_VIOLET_2	92			V		#8700d7	DarkViolet
	XTERM_PURPLE_2	93			V		#8700ff	Purple
	XTERM_ORANGE_3	94			V		#875f00	Orange4
	XTERM_LIGHT_PINK_3	95			V		#875f5f	LightPink4


















































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Table 2 – continued from previous page

	Name	INT	SEQ	SPN	CLR	STY	RGB code	XTerm name
	XTERM_PLUM_4	96			V		#875f87	
	XTERM_MEDIUM_PURPLE_6	97			V		#875faf	MediumPurple3
	XTERM_MEDIUM_PURPLE_5	98			V		#875fd7	MediumPurple3
	XTERM_SLATE_BLUE_1	99			V		#875fff	
	XTERM_YELLOW_6	100			V		#878700	Yellow4
	XTERM_WHEAT_4	101			V		#87875f	
	XTERM_GREY_53	102			V		#878787	
	XTERM_LIGHT_SLATE_GREY	103			V		#8787af	
	XTERM_MEDIUM_PURPLE_4	104			V		#8787d7	MediumPurple
	XTERM_LIGHT_SLATE_BLUE	105			V		#8787ff	
	XTERM_YELLOW_4	106			V		#87af00	
	XTERM_DARK_OLIVE_GREEN_6	107			V		#87af5f	DarkOliveGreen3
	XTERM_DARK_SEA_GREEN_7	108			V		#87af87	DarkSeaGreen
	XTERM_LIGHT_SKY_BLUE_3	109			V		#87afaf	
	XTERM_LIGHT_SKY_BLUE_2	110			V		#87afd7	LightSkyBlue3
	XTERM_SKY_BLUE_2	111			V		#87afff	
	XTERM_CHARTREUSE_3	112			V		#87d700	Chartreuse2
	XTERM_DARK_OLIVE_GREEN_4	113			V		#87d75f	DarkOliveGreen3
	XTERM_PALE_GREEN_3	114			V		#87d787	
	XTERM_DARK_SEA_GREEN_5	115			V		#87d7af	DarkSeaGreen3
	XTERM_DARK_SLATE_GRAY_3	116			V		#87d7d7	
	XTERM_SKY_BLUE_1	117			V		#87d7ff	
	XTERM_CHARTREUSE_1	118			V		#87ff00	
	XTERM_LIGHT_GREEN_2	119			V		#87ff5f	LightGreen
	XTERM_LIGHT_GREEN	120			V		#87ff87	
	XTERM_PALE_GREEN_1	121			V		#87ffaf	
	XTERM_AQUAMARINE_1	122			V		#87ffd7	
	XTERM_DARK_SLATE_GRAY_1	123			V		#87ffff	
	XTERM_RED_4	124			V		#af0000	Red3
	XTERM_DEEP_PINK_6	125			V		#af005f	DeepPink4
	XTERM_MEDIUM_VIOLET_RED	126			V		#af0087	
	XTERM_MAGENTA_6	127			V		#af00af	Magenta3
	XTERM_DARK_VIOLET	128			V		#af00d7	
	XTERM_PURPLE	129			V		#af00ff	
	XTERM_DARK_ORANGE_3	130			V		#af5f00	
	XTERM_INDIAN_RED_4	131			V		#af5f5f	IndianRed
	XTERM_HOT_PINK_5	132			V		#af5f87	HotPink3
	XTERM_MEDIUM_ORCHID_4	133			V		#af5faf	MediumOrchid3
	XTERM_MEDIUM_ORCHID_3	134			V		#af5fd7	MediumOrchid
	XTERM_MEDIUM_PURPLE_2	135			V		#af5fff	
	XTERM_DARK_GOLDENROD	136			V		#af8700	
	XTERM_LIGHT_SALMON_3	137			V		#af875f	
	XTERM_ROSY_BROWN	138			V		#af8787	
	XTERM_GREY_63	139			V		#af87af	
	XTERM_MEDIUM_PURPLE_3	140			V		#af87d7	MediumPurple2
	XTERM_MEDIUM_PURPLE_1	141			V		#af87ff	
	XTERM_GOLD_3	142			V		#afaf00	
	XTERM_DARK_KHAKI	143			V		#afaf5f	
	XTERM_NAVAJO_WHITE_3	144			V		#afaf87	





















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Table 2 – continued from previous page

	Name	INT	SEQ	SPN	CLR	STY	RGB code	XTerm name
	XTERM_GREY_69	145			V		#afafaf	
	XTERM_LIGHT_STEEL_BLUE_3	146			V		#afafd7	
	XTERM_LIGHT_STEEL_BLUE_2	147			V		#afafff	LightSteelBlue
	XTERM_YELLOW_5	148			V		#afd700	Yellow3
	XTERM_DARK_OLIVE_GREEN_5	149			V		#afd75f	DarkOliveGreen3
	XTERM_DARK_SEA_GREEN_6	150			V		#afd787	DarkSeaGreen3
	XTERM_DARK_SEA_GREEN_4	151			V		#afd7af	DarkSeaGreen2
	XTERM_LIGHT_CYAN_3	152			V		#afd7d7	
	XTERM_LIGHT_SKY_BLUE_1	153			V		#afd7ff	
	XTERM_GREEN_YELLOW	154			V		#afff00	
	XTERM_DARK_OLIVE_GREEN_3	155			V		#afff5f	DarkOliveGreen2
	XTERM_PALE_GREEN_2	156			V		#afff87	PaleGreen1
	XTERM_DARK_SEA_GREEN_3	157			V		#afffaf	DarkSeaGreen2
	XTERM_DARK_SEA_GREEN_1	158			V		#afffd7	
	XTERM_PALE_TURQUOISE_1	159			V		#afffff	
	XTERM_RED_3	160			V		#d70000	
	XTERM_DEEP_PINK_5	161			V		#d7005f	DeepPink3
	XTERM_DEEP_PINK_3	162			V		#d70087	
	XTERM_MAGENTA_3	163			V		#d700af	
	XTERM_MAGENTA_5	164			V		#d700d7	Magenta3
	XTERM_MAGENTA_4	165			V		#d700ff	Magenta2
	XTERM_DARK_ORANGE_2	166			V		#d75f00	DarkOrange3
	XTERM_INDIAN_RED_3	167			V		#d75f5f	IndianRed
	XTERM_HOT_PINK_4	168			V		#d75f87	HotPink3
	XTERM_HOT_PINK_3	169			V		#d75faf	HotPink2
	XTERM_ORCHID_3	170			V		#d75fd7	Orchid
	XTERM_MEDIUM_ORCHID_2	171			V		#d75fff	MediumOrchid1
	XTERM_ORANGE_2	172			V		#d78700	Orange3
	XTERM_LIGHT_SALMON_2	173			V		#d7875f	LightSalmon3
	XTERM_LIGHT_PINK_2	174			V		#d78787	LightPink3
	XTERM_PINK_3	175			V		#d787af	
	XTERM_PLUM_3	176			V		#d787d7	
	XTERM_VIOLET	177			V		#d787ff	
	XTERM_GOLD_2	178			V		#d7af00	Gold3
	XTERM_LIGHT_GOLDENROD_5	179			V		#d7af5f	LightGoldenrod3
	XTERM_TAN	180			V		#d7af87	
	XTERM_MISTY_ROSE_3	181			V		#d7afaf	
	XTERM_THISTLE_3	182			V		#d7afd7	
	XTERM_PLUM_2	183			V		#d7afff	
	XTERM_YELLOW_3	184			V		#d7d700	
	XTERM_KHAKI_3	185			V		#d7d75f	
	XTERM_LIGHT_GOLDENROD_3	186			V		#d7d787	LightGoldenrod2
	XTERM_LIGHT_YELLOW_3	187			V		#d7d7af	
	XTERM_GREY_84	188			V		#d7d7d7	
	XTERM_LIGHT_STEEL_BLUE_1	189			V		#d7d7ff	
	XTERM_YELLOW_2	190			V		#d7ff00	
	XTERM_DARK_OLIVE_GREEN_2	191			V		#d7ff5f	DarkOliveGreen1
	XTERM_DARK_OLIVE_GREEN_1	192			V		#d7ff87	
	XTERM_DARK_SEA_GREEN_2	193			V		#d7ffaf	DarkSeaGreen1

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Table 2 – continued from previous page

	Name	INT	SEQ	SPN	CLR	STY	RGB code	XTerm name
	XTERM_HONEYDEW_2	194			V		#d7ffd7	
	XTERM_LIGHT_CYAN_1	195			V		#d7ffff	
	XTERM_RED_1	196			V		#ff0000	
	XTERM_DEEP_PINK_4	197			V		#ff005f	DeepPink2
	XTERM_DEEP_PINK_2	198			V		#ff0087	DeepPink1
	XTERM_DEEP_PINK_1	199			V		#ff00af	
	XTERM_MAGENTA_2	200			V		#ff00d7	
	XTERM_MAGENTA_1	201			V		#ff00ff	
	XTERM_ORANGE_RED_1	202			V		#ff5f00	
	XTERM_INDIAN_RED_1	203			V		#ff5f5f	
	XTERM_INDIAN_RED_2	204			V		#ff5f87	IndianRed1
	XTERM_HOT_PINK_2	205			V		#ff5faf	HotPink
	XTERM_HOT_PINK	206			V		#ff5fd7	
	XTERM_MEDIUM_ORCHID_1	207			V		#ff5fff	
	XTERM_DARK_ORANGE	208			V		#ff8700	
	XTERM_SALMON_1	209			V		#ff875f	
	XTERM_LIGHT_CORAL	210			V		#ff8787	
	XTERM_PALE_VIOLET_RED_1	211			V		#ff87af	
	XTERM_ORCHID_2	212			V		#ff87d7	
	XTERM_ORCHID_1	213			V		#ff87ff	
	XTERM_ORANGE_1	214			V		#ffaf00	
	XTERM_SANDY_BROWN	215			V		#ffaf5f	
	XTERM_LIGHT_SALMON_1	216			V		#ffaf87	
	XTERM_LIGHT_PINK_1	217			V		#ffafaf	
	XTERM_PINK_1	218			V		#ffafd7	
	XTERM_PLUM_1	219			V		#ffaaff	
	XTERM_GOLD_1	220			V		#ffd700	
	XTERM_LIGHT_GOLDENROD_4	221			V		#ffd75f	LightGoldenrod2
	XTERM_LIGHT_GOLDENROD_2	222			V		#ffd787	
	XTERM_NAVAJO_WHITE_1	223			V		#ffd7af	
	XTERM_MISTY_ROSE_1	224			V		#ffd7d7	
	XTERM_THISTLE_1	225			V		#ffd7ff	
	XTERM_YELLOW_1	226			V		#ffff00	
	XTERM_LIGHT_GOLDENROD_1	227			V		#ffff5f	
	XTERM_KHAKI_1	228			V		#ffff87	
	XTERM_WHEAT_1	229			V		#ffffaf	
	XTERM_CORNSILK_1	230			V		#ffffd7	
	XTERM_GREY_100	231			V		#ffffff	
	XTERM_GREY_3	232			V		#080808	
	XTERM_GREY_7	233			V		#121212	
	XTERM_GREY_11	234			V		#1c1c1c	
	XTERM_GREY_15	235			V		#262626	
	XTERM_GREY_19	236			V		#303030	
	XTERM_GREY_23	237			V		#3a3a3a	
	XTERM_GREY_27	238			V		#444444	
	XTERM_GREY_30	239			V		#4e4e4e	
	XTERM_GREY_35	240			V		#585858	
	XTERM_GREY_39	241			V		#626262	
	XTERM_GREY_42	242			V		#6c6c6c	

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Table 2 – continued from previous page

	Name	INT	SEQ	SPN	CLR	STY	RGB code	XTerm name
■	XTERM_GREY_46	243			V		#767676	
■	XTERM_GREY_50	244			V		#808080	
■	XTERM_GREY_54	245			V		#8a8a8a	
■	XTERM_GREY_58	246			V		#949494	
■	XTERM_GREY_62	247			V		#9e9e9e	
■	XTERM_GREY_66	248			V		#a8a8a8	
■	XTERM_GREY_70	249			V		#b2b2b2	
■	XTERM_GREY_74	250			V		#bcbcbc	
■	XTERM_GREY_78	251			V		#c6c6c6	
■	XTERM_GREY_82	252			V		#d0d0d0	
■	XTERM_GREY_85	253			V		#dadada	
■	XTERM_GREY_89	254			V		#e4e4e4	
■	XTERM_GREY_93	255			V		#eeeeee	

## 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 *Color16* 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).

**Todo: (Verify)** 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 *Color16* 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.

**Todo:** Approximation algorithm is as simple as iterating through all colors in the *lookup table* (which contains all possible ...

<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. Every changed name is displayed with **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> #5ffd7	<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> #ffaf00	<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> #ffaf5f	<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> #ffaf87	<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> #ffafaf	<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> #ffaf7d7	<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> #ffafff	<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

---

**Todo:** The library contains @TODO

---

### 1.6.1 Auto-float formatter

### 1.6.2 Prefixed-unit formatter

### 1.6.3 Time delta formatter

```
1 import pytermor.utilnum
2 from pytermor import RendererManager, SgrRenderer
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 for max_len in max_len_list:
9     formatter = pytermor.utilnum.registry.find_matching(max_len)
10
11 RendererManager.set_default(SgrRenderer)
12 for seconds in seconds_list:
13     for max_len in max_len_list:
14         formatter = pytermor.utilnum.registry.get_by_max_len(max_len)
15         print(formatter.format(seconds, True), end=' ')
16     print()
```





### 1.6.4 String filters

### 1.6.5 Standard Library extensions

---

**Todo:** @TODO

---



## API REFERENCE

### 2.1 ansi

Module contains definitions for low-level ANSI escape sequences building. Can be used for creating a variety of sequences including:

- SGR sequences (text coloring, background coloring, text styling);
- CSI sequences (cursor management, selective screen clearing);
- OSC (Operating System Command) sequences (various system commands).

The module doesn't distinguish "single-instruction" sequences from several ones merged together, e.g. `Style(fg='red', bold=True)` produces only one opening `SequenceSGR` instance:

```
>>> SequenceSGR(IntCode.BOLD, IntCode.RED).assemble()  
'\x1b[1;31m'
```

...although generally speaking it is two of them (`ESC[1m` and `ESC[31m`). However, the module can automatically match terminating sequences for any form of input SGRs and translate it to specified format.

#### XTerm Control Sequences

<https://invisible-island.net/xterm/ctlseqs/ctlseqs.html>

#### ECMA-48 specification

<https://www.ecma-international.org/publications-and-standards/standards/ecma-48/>

#### class `pytermor.ansi.Sequence`

Bases: `Sized`, `ABC`

Abstract ancestor of all escape sequences.

`__init__(*params)`

##### Parameters

`params (int | str) –`

`assemble()`

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

##### Return type

`str`

**property** `params: t.List[int | str]`

Return internal params as array.

**class** `pytermor.ansi.SequenceFe`

Bases: [Sequence](#), ABC

Wide range of sequence types that includes CSI, OSC and more.

All subtypes of this sequence start with ESC plus ASCII byte from 0x40 to 0x5F (@[\]\_^ and capital letters A-Z).

**class** `pytermor.ansi.SequenceST`

Bases: [SequenceFe](#)

String Terminator sequence (ST). Terminates strings in other control sequences. Encoded as ESC\ (0x1B 0x5C).

**assemble()**

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

**Return type**

str

**class** `pytermor.ansi.SequenceOSC`

Bases: [SequenceFe](#)

Operating System Command sequence (OSC). Starts a control string for the operating system to use. Encoded as ESC] plus params separated by ;, and terminated with [SequenceST](#).

**class** `pytermor.ansi.SequenceCSI`

Bases: [SequenceFe](#)

Class representing CSI-type ANSI escape sequence. All subtypes of this sequence start with ESC[.

Sequences of this type are used to control text formatting, change cursor position, erase screen and more.

**\_\_init\_\_**(*terminator*, *\*params*)

**Parameters**

- **terminator** (*str*) –
- **params** (*int*) –

**classmethod** **init\_cursor\_horizontal\_absolute**(*column=1*)

Set cursor x-coordinate to column.

**Parameters**

**column** (*int*) –

**Return type**

[SequenceCSI](#)

**classmethod** **init\_erase\_in\_line**(*mode=0*)

Erase part of the line. If *mode* is 0, clear from cursor to the end of the line. If *mode* is 1, clear from cursor to beginning of the line. If *mode* is 2, clear the entire line. Cursor position does not change.

**Parameters**

**mode** (*int*) –

**Return type**

[SequenceCSI](#)

**assemble()**

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

**Return type**

str

**class** pytermor.ansi.SequenceSGR

Bases: [SequenceCSI](#)

Class representing SGR-type escape sequence with varying amount of parameters. SGR sequences allow to change the color of text or/and terminal background (in 3 different color spaces) as well as set decorate text with italic style, underlining, overlining, cross-lining, making it bold or blinking etc.

[SequenceSGR](#) with zero params was specifically implemented to translate into empty string and not into ESC[m, which would have made sense, but also would be entangling, as this sequence is the equivalent of ESC[0m – hard reset sequence. The empty-string-sequence is predefined at module level as [NOOP\\_SEQ](#).

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

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

**\_\_init\_\_**(\*args)

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 (any of [IntCode](#) names, case-insensitive)
- integer param value ([IntCode](#) values)
- existing SequenceSGR instance (params will be extracted).

```
>>> SequenceSGR(91, 7)
SGR[91;7]
>>> SequenceSGR(IntCode.HI_CYAN, IntCode.UNDERLINED)
SGR[96;4]
>>> SequenceSGR(1, SequenceSGR(33))
SGR[1;33]
```

**Parameters**

**args** (str | int | [SequenceSGR](#)) –

**classmethod** init\_color\_256(idx, bg=False)

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

**Parameters**

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

**Returns**

[SequenceSGR](#) with required params.

**Return type**

[SequenceSGR](#)

**classmethod** `init_color_rgb(r, g, b, bg=False)`

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:

```
SequenceSGR.init_color_rgb(255, 51, 0)
```

#### Parameters

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

#### Returns

[SequenceSGR](#) with required params.

#### Return type

[SequenceSGR](#)

**assemble()**

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

#### Return type

str

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

Return internal params as array.

`pytermor.ansi.NOOP_SEQ = SGR[NOP]`

Special sequence in case you *have to* provide one or another SGR, but do not want any control sequences to be actually included in the output. `NOOP_SEQ.assemble()` returns empty string, `NOOP_SEQ.params` returns empty list.

```
>>> pt.NOOP_SEQ.assemble()
''
>>> pt.NOOP_SEQ.params
[]
```

**class** `pytermor.ansi.IntCode`

Bases: `int`, `Enum`

Complete or almost complete list of reliably working SGR param integer codes.

Suitable for [SequenceSGR](#) default constructor.

**class** `pytermor.ansi.SeqIndex`

Registry of sequence presets.

**RESET** = `SGR[0]`

Hard reset sequence.

## 2.2 color

Yare-yare daze

Iterate the registered colors table and compute the euclidean distance from argument to each color of the palette. Sort the results and return them.

### sRGB euclidean distance

[https://en.wikipedia.org/wiki/Color\\_difference#sRGB](https://en.wikipedia.org/wiki/Color_difference#sRGB) <https://stackoverflow.com/a/35114586/5834973>

`pytermor.color.ColorType`

alias of `TypeVar('ColorType', bound=Union[Color16, Color256, ColorRGB])`

**class** `pytermor.color.Index`

**classmethod** `register(color, aliases=None)`

#### Parameters

- **color** (*Color*) –
- **aliases** (*Optional[List[str]]*) –

#### Returns

**classmethod** `resolve(name)`

Case-insensitive search through registry contents.

#### Parameters

**name** (*str*) – name of the color to look up for.

#### Raises

**KeyError** – if no color with specified name is registered.

#### Returns

*Color* instance.

#### Return type

*Color*

**class** `pytermor.color.Color`

Abstract superclass for other Colors.

**\_\_init\_\_**(*hex\_value*, *name=None*)

#### Parameters

- **hex\_value** (*int*) –
- **name** (*Optional[str]*) –

**to\_hsv**()

#### Return type

*Tuple*[float, float, float]

**to\_rgb**()

#### Return type

*Tuple*[int, int, int]

**format\_value**(*prefix*='0x')

**Parameters**

**prefix** (*str*) –

**Return type**

*str*

**property hex\_value:** *int*

**property name:** *str* | *None*

**abstract to\_sgr**(*bg*, *bound*=*None*)

**Parameters**

- **bg** (*bool*) –
- **bound** (*Optional*[*Type*[*Color*]]) –

**Return type**

*SequenceSGR*

**abstract to\_tmux**(*bg*)

**Parameters**

**bg** (*bool*) –

**Return type**

*str*

**classmethod find\_closest**(*hex\_value*)

Search and return the nearest color to **hex\_value**. Depending on the desired result type and current color mode you might use either of:

- *Color16*.find\_closest(..) -> *Color16*
- *Color256*.find\_closest(..) -> *Color256*
- *ColorRGB*.find\_closest(..) -> *ColorRGB*

---

**Note:** Invoking the method of *Color* itself will result in a *RuntimeError*, as it is an abstract class and therefore the color map for this type will always be empty.

---

Method is useful for finding applicable color alternatives if user's terminal is incapable of operating in more advanced mode.

This method caches the results, i.e., the same search query will from then onward result in the same return value without the necessity of iterating through the color index. If that's not applicable, use similar method *approximate*, which is unaware of caching mechanism altogether.

**Parameters**

**hex\_value** (*int*) – Target color RGB value.

**Returns**

Nearest to **hex\_value** instance of *Color* found. Type will be the same as the class of called method.

**Return type**

*ColorType*



**classmethod** `approximate(hex_value, max_results=1)`

Search for nearest colors to `hex_value` and return the first `max_results` of them. This method is similar to the `find_closest`, although they differ in some aspects:

- `approximate` can return more than one result;
- `approximate` returns not just `Color` instances, but also a number equal to the distance to the target color for each of them;
- `find_closest` caches the results, while `approximate` ignores the cache completely.

Invoking the method is the same as for its sibling – do not use abstract class method `Color.approximate`, choose one of the concrete class methods instead:

- `Color16.approximate(..) -> [(Color16, float)...]`
- `Color256.approximate(..) -> [(Color256, float)...]`
- `ColorRGB.approximate(..) -> [(ColorRGB, float)...]`

The type of the result will be the type of the `Color` class the called method is originating from.

#### Parameters

- **hex\_value** (*int*) – Target color RGB value.
- **max\_results** (*int*) – Return no more than `max_results` pairs.

#### Returns

Tuples of closest `Color` instance(s) found with their distances to the target color, sorted by distance descending, i.e., element at index 0 is the closest color found, paired with its distance to the target; element with index 1 is second-closest color (if any) and corresponding distance value, etc.

#### Return type

`List[Tuple[ColorType, float]]`

**classmethod** `find_by_code(code)`

#### Parameters

**code** (*int*) –

#### Return type

`ColorType`

**static** `hex_to_hsv(hex_value)`

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** (*int*) –

#### Return type

`Tuple[float, float, float]`

**static** `hex_to_rgb(hex_value)`

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

**Parameters**

**hex\_value** (*int*) –

**Return type**

*Tuple*[int, int, int]

**static** **rgb\_to\_hex**(*r*, *g*, *b*)

**Parameters**

- **r** (*int*) –
- **g** (*int*) –
- **b** (*int*) –

**Return type**

int

**class** pytermor.color.Color16

Bases: [Color](#)

**\_\_init\_\_**(*hex\_value*, *code\_fg*, *code\_bg*, *name=None*, *aliases=None*, *add\_to\_map=False*)

**Parameters**

- **hex\_value** (*int*) –
- **code\_fg** (*int*) –
- **code\_bg** (*int*) –
- **name** (*Optional*[*str*]) –
- **aliases** (*Optional*[*List*[*str*]]) –
- **add\_to\_map** (*bool*) –

**to\_sgr**(*bg*, *bound=None*)

**Parameters**

- **bg** (*bool*) –
- **bound** (*Optional*[*Type*[[Color](#)]]) –

**Return type**

[SequenceSGR](#)

**to\_tmux**(*bg*)

**Parameters**

**bg** (*bool*) –

**Return type**

str

**class** pytermor.color.Color256

Bases: [Color](#)

**\_\_init\_\_**(*hex\_value*, *code*, *name*=None, *add\_to\_map*=False, *color16\_equiv*=None)

**Parameters**

- **hex\_value** (*int*) –
- **code** (*int*) –
- **name** (*Optional[str]*) –
- **add\_to\_map** (*bool*) –
- **color16\_equiv** (*Optional[int]*) –

**to\_sgr**(*bg*, *bound*=None)

**Parameters**

- **bg** (*bool*) –
- **bound** (*Optional[Type[Color]]*) –

**Return type**

[SequenceSGR](#)

**to\_tmux**(*bg*)

**Parameters**

- bg** (*bool*) –

**Return type**

str

**property code:** int

**class** pytermor.color.ColorRGB

Bases: [Color](#)

**\_\_init\_\_**(*hex\_value*, *name*=None, *add\_to\_map*=False)

**Parameters**

- **hex\_value** (*int*) –
- **name** (*Optional[str]*) –
- **add\_to\_map** (*bool*) –

**to\_sgr**(*bg*, *bound*=None)

**Parameters**

- **bg** (*bool*) –
- **bound** (*Optional[Type[Color]]*) –

**Return type**

[SequenceSGR](#)

`to_tmux(bg)`

**Parameters**

**bg** (*bool*) –

**Return type**

*str*

`pytermor.color.NOOP_COLOR = Color[NOP]`

Special *Color* instance always rendering into empty string.

## 2.3 renderer

Module with output formatters. By default *SgrRenderer* is used. It also contains compatibility settings, see *SgrRenderer()* constructor.

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

- Method *RendererManager.set\_default()* sets the default renderer globally. After that calling *text.render()* will automatically invoke a said renderer and all formatting will be applied.
- Alternatively, you can use renderer's own instance method *render()* directly and avoid messing up with the manager: *HtmlRenderer.render()*

### TL;DR

To unconditionally print formatted message to output terminal, do something like this:

```
>>> from pytermor import render, RendererManager
>>> RendererManager.set_default_to_force_formatting()
>>> render('Warning: AAAA', Styles.WARNING)
'\x1b[33mWarning: AAAA\x1b[39m'
```

`class pytermor.renderer.RendererManager`

`classmethod set_default(renderer=None)`

Set up renderer preferences.

**Parameters**

**renderer** (*AbstractRenderer* / *t.Type[AbstractRenderer]*) – Default renderer to use globally. Passing *None* will result in library default setting restored (*SgrRenderer*).

Default renderer is used when no other is specified, e.g. in *text.render()* method.

**Returns**

Renderer instance set as default.

**Return type**

*AbstractRenderer*

```
>>> DebugRenderer().render('text', Style(fg='red'))
'|31|text|39|'
>>> NoOpRenderer().render('text', Style(fg='red'))
'text'
```

**classmethod** `get_default()`

Get global default renderer instance (*SgrRenderer*, or the one provided with setup).

**Return type**

*AbstractRenderer*

**classmethod** `set_default_to_disable_formatting()`

Shortcut for forcing all control sequences to be omitted when using a default renderer (i.e., doesn't specifying it).

**classmethod** `set_default_to_force_formatting()`

Shortcut for forcing all control sequences to be present in the output when using a default renderer (i.e., doesn't specifying it).

**class** `pytermor.renderer.AbstractRenderer`

Renderer interface.

**abstract** `render(string, style=Style[NOP])`

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

**Parameters**

- **string** (*Any*) –
- **style** (*Style*) –

**Return type**

str

**class** `pytermor.renderer.OutputMode`

Bases: `IntEnum`

Determines what types of SGR sequences are allowed to use in the output. See *SgrRenderer* documentation for exact color mappings.

**NO\_ANSI** = 1

Disable all formatting

**XTERM\_16** = 2

16-colors mode

**XTERM\_256** = 3

256-colors mode

**TRUE\_COLOR** = 4

RGB mode

**AUTO** = 5

The renderer decide

**class** `pytermor.renderer.SgrRenderer`

Bases: *AbstractRenderer*

---

**Todo:** make `render()` protected (?)

---

Default renderer invoked by `Text._render()`. Transforms *Color* instances defined in `style` into ANSI control sequence bytes and merges them with input string. Type of output `SequenceSGR` depends on type of *Color* instances in `style` argument and current output mode of the renderer.

1. `ColorRGB` can be rendered as True Color sequence, 256-color sequence or 16-color sequence depending on compatibility settings (see below).
2. `Color256` can be rendered as 256-color sequence or 16-color sequence.
3. `Color16` will be rendered as 16-color sequence.
4. Nothing of the above will happen and all Colors will be discarded completely if output is not a terminal emulator or if the developer explicitly set up the renderer to do so (`force_styles = False`).

Compatibility preferences (see `SgrRenderer.setup()`) determine exact type of output SGRs. Renderer approximates 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 16-color palette and picks closest samples again the same way. Color mode to color type mapping:

1. `OutputMode.TRUE_COLOR` does not apply restrictions to color rendering.
2. `OutputMode.XTERM_256` allows the renderer to use either `Color16` or `Color256` (but RGB will be approximated to 256-color palette).
3. `OutputMode.XTERM_16` enforces the renderer to approximate all color types to `Color16` and render them as basic mode selection SGR sequences (e.g., `ESC[31m`, `ESC[42m` etc).
4. `OutputMode.NO_ANSI` discards all color information completely.

```
>>> SgrRenderer(OutputMode.XTERM_256).render('text', Styles.WARNING_LABEL)
'\x1b[1;33mtext\x1b[22;39m'
>>> SgrRenderer(OutputMode.NO_ANSI).render('text', Styles.WARNING_LABEL)
'text'
```

**\_\_init\_\_**(*output\_mode=OutputMode.AUTO*)

Set up renderer preferences.

#### Parameters

**output\_mode** (`OutputMode`) – SGR output mode to use. Valid values are listed in `OutputMode` enum.

With `OutputMode.AUTO` the renderer will first check if the output device is a terminal emulator, and use `OutputMode.NO_ANSI` when it is not. Otherwise, the renderer will read `TERM` environment variable and follow these rules:

- `OutputMode.NO_ANSI` if `TERM` is set to `xterm`.
- `OutputMode.XTERM_16` if `TERM` is set to `xterm-color`.
- `OutputMode.XTERM_256` in all other cases.

Special case is when `TERM` equals to `xterm-256color` **and** `COLORTERM` is either `truecolor` or `24bit`, then `OutputMode.TRUE_COLOR` will be used.

#### Returns

self

**render**(*string, style=Style[NOP]*)

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

#### Parameters

- **string** (*Any*) –
- **style** (`Style`) –

`is_sgr_usage_allowed()`

**Return type**

bool

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

Bases: `AbstractRenderer`

tmux

```
>>> TmuxRenderer().render('text', Style(fg='blue', bold=True))
'#[fg=blue bold]text#[fg=default nobold]'
```

```
STYLE_ATTR_TO_TMUX_MAP = {'bg': 'bg', 'blink': 'blink', 'bold': 'bold',
'crosslined': 'strikethrough', 'dim': 'dim', 'double_underlined':
'double-underscore', 'fg': 'fg', 'inversed': 'reverse', 'italic': 'italics',
'overlined': 'overline', 'underlined': 'underscore'}
```

**render**(*string*, *style*=`Style[NOP]`)

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

**Parameters**

- **string** (*Any*) –
- **style** (`Style`) –

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

Bases: `AbstractRenderer`

Special renderer type that does nothing with the input string and just returns it as is. That's true only when it `_is_` a str beforehand; otherwise argument will be casted to str and then returned.

```
>>> NoOpRenderer().render('text', Style(fg='green', bold=True))
'text'
```

**render**(*string*, *style*=`Style[NOP]`)

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

**Parameters**

- **string** (*Any*) –
- **style** (`Style`) –

**Return type**

str

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

Bases: `AbstractRenderer`

html

```
>>> HtmlRenderer().render('text', Style(fg='red', bold=True))
'<span style="color: #800000; font-weight: 700">text</span>'
```

```
DEFAULT_ATTRS = ['color', 'background-color', 'font-weight', 'font-style',
'text-decoration', 'border', 'filter']
```

**render**(*string*, *style*=Style[NOP])

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

**Parameters**

- **string** (*Any*) –
- **style** (Style) –

**Return type**

str

**class** pytermor.renderer.DebugRenderer

Bases: [SgrRenderer](#)

DebugRenderer

```
>>> DebugRenderer().render('text', Style(fg='red', bold=True))
'|1;31|text|22;39|'
```

**render**(*string*, *style*=Style[NOP])

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

**Parameters**

- **string** (*Any*) –
- **style** (Style) –

**Return type**

str

**is\_sgr\_usage\_allowed**()

**Return type**

bool

## 2.4 style

**class** pytermor.style.Style

**renderable\_attributes** = frozenset({'bg', 'blink', 'bold', 'crosslined', 'dim', 'double\_underlined', 'fg', 'inversed', 'italic', 'overlined', 'underlined'})

**\_\_init\_\_**(*parent*=None, *fg*=None, *bg*=None, *blink*=None, *bold*=None, *crosslined*=None, *dim*=None, *double\_underlined*=None, *inversed*=None, *italic*=None, *overlined*=None, *underlined*=None, *class\_name*=None)

Create a new Style(). Both fg and bg can be specified as:

1. [Color](#) instance or library preset;
2. str – name of any of these presets, case-insensitive;
3. int – color value in hexademical RGB format;
4. None – the color will be unset.

Inheritance parent -> child works this way:



- If an argument in child's constructor is empty (`None`), take value from parent's corresponding attribute.
- If an argument in child's constructor is *not* empty (`True`, `False`, `Color` etc.), use it as child's attribute.

---

**Note:** Both empty (i.e., `None`) attributes of type `Color` after initialization will be replaced with special constant `NOOP_COLOR`, which behaves like there was no color defined, and at the same time makes it safer to work with nullable color-type variables.

---

### Parameters

- **parent** (`Style`) – Style to copy attributes without value from.
- **fg** (`Color` | `int` | `str`) – Foreground (i.e., text) color.
- **bg** (`Color` | `int` | `str`) – Background color.
- **blink** (`bool`) – Blinking effect; *supported by limited amount of Renderers*.
- **bold** (`bool`) – Bold or increased intensity.
- **crosslined** (`bool`) – Strikethrough.
- **dim** (`bool`) – Faint, decreased intensity.
- **double\_underlined** (`bool`) – Faint, decreased intensity.
- **inversed** (`bool`) – Swap foreground and background colors.
- **italic** (`bool`) – Italic.
- **overlined** (`bool`) – Overline.
- **underlined** (`bool`) – Underline.
- **class\_name** (`str`) – Arbitrary string used by some renderers, e.g. by `HtmlRenderer`.

```
>>> Style(fg='green', bold=True)
Style[fg=008000, bg=NOP, bold]
>>> Style(bg=0x0000ff)
Style[fg=NOP, bg=0000ff]
>>> Style(fg='DeepSkyBlue1', bg='gray3')
Style[fg=00afff, bg=080808]
```

### autopick\_fg()

Pick `fg_color` depending on `bg_color`. Set `fg_color` to either 3% gray (almost black) if background is bright, or to 80% gray (bright gray) if it is dark. If background is `None`, do nothing.

---

**Todo:** check if there is a better algorithm, because current thinks text on `#000080` should be black

---

### Returns

`self`

### Return type

`Style`

**flip()**

Swap foreground color and background color. :return: self

**Return type**

Style

**clone()****Return type**

Style

**property fg:** *Color***property bg:** *Color***pytermor.style.NOOP\_STYLE = Style[NOP]**

Special style passing the text through without any modifications.

**class pytermor.style.Styles**

Some ready-to-use styles. Can be used as examples.

**WARNING = Style[fg=808000, bg=NOP]****WARNING\_LABEL = Style[fg=808000, bg=NOP, bold]****WARNING\_ACCENT = Style[fg=ffff00, bg=NOP]****ERROR = Style[fg=800000, bg=NOP]****ERROR\_LABEL = Style[fg=800000, bg=NOP, bold]****ERROR\_ACCENT = Style[fg=ff0000, bg=NOP]****CRITICAL = Style[fg=ffffff, bg=ff0000]****CRITICAL\_LABEL = Style[fg=ffffff, bg=ff0000, bold]****CRITICAL\_ACCENT = Style[fg=ffffff, bg=ff0000, bold, blink]**

## 2.5 text

**class pytermor.text.Renderable**

Bases: Sized

Renderable abstract class. Can be inherited when the default style overlaps resolution mechanism implemented in *Text* is not good enough.**abstract render**(*renderer=None*)**Return type**

str

**abstract raw()****Return type**

str

**class** pytermor.text.Text

Bases: *Renderable*

**\_\_init\_\_**(string="", style=Style[NOP], close\_this=True, close\_prev=False)

Parameters

- **string** (*str*) –
- **style** (*Style*) –
- **close\_this** (*bool*) –
- **close\_prev** (*bool*) –

**render**(renderer=None)

Parameters

**renderer** (*AbstractRenderer* / *t.Type[AbstractRenderer]*) –

Return type

*str*

**raw**()

Return type

*str*

**append**(string, style=Style[NOP], close\_this=True, close\_prev=False)

Parameters

- **string** (*str* / *Text*) –
- **style** (*Style*) –
- **close\_this** (*bool*) –
- **close\_prev** (*bool*) –

Return type

*Text*

**prepend**(string, style=Style[NOP], close\_this=True, close\_prev=False)

Parameters

- **string** (*str* / *Text*) –
- **style** (*Style*) –
- **close\_this** (*bool*) –
- **close\_prev** (*bool*) –

Return type

*Text*

**class** pytermor.text.TemplateEngine

**\_\_init\_\_**(custom\_styles=None)

Parameters

**custom\_styles** (*Optional[Dict[str, Style]]*) –

`parse(tpl)`

**Parameters**

`tpl` (*str*) –

**Return type**

[Text](#)

`pytermor.text.render(string, style=Style[NOP], renderer=None)`

**Parameters**

- `string` (*Any*) –
- `style` ([Style](#)) –
- `renderer` (*Optional* [[AbstractRenderer](#)]) –

`pytermor.text.echo(string, style=Style[NOP], renderer=None, nl=True, file=<_io.TextIOWrapper  
name='<stdout>' mode='w' encoding='utf-8'>, flush=True)`

**Parameters**

- `string` (*Any*) –
- `style` ([Style](#)) –
- `renderer` (*Optional* [[AbstractRenderer](#)]) –
- `nl` (*bool*) –
- `file` (*IO*) –
- `flush` (*bool*) –

## 2.6 common

`pytermor.common.T`

`t.Any`

alias of `TypeVar('T')`

`pytermor.common.StrType`

[StrType](#) in a method signature usually means that regular strings as well as [Renderable](#) implementations are supported, can be intermixed, and:

- return type will be *str* if and only if type of all arguments is *str*;
- otherwise return type will be [Renderable](#) – *str* arguments, if any, will be transformed into [Renderable](#) and concatenated.

alias of `TypeVar('StrType', bound=Union[str, Renderable])`

**exception** `pytermor.common.LogicError`

Bases: `Exception`

**exception** `pytermor.common.ConflictError`

Bases: `Exception`

**exception** `pytermor.common.EmptyColorMapError`

Bases: `RuntimeError`

`__init__(is_rgb)`

**Parameters**

**is\_rgb** (*bool*) –

**Return type**

None

## 2.7 utilnum

`pytermor.utilnum.format_auto_float(value, req_len, allow_exponent_notation=True)`

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** (*float*) – Value to format
- **req\_len** (*int*) – Required output string length
- **allow\_exponent\_notation** (*bool*) – Enable/disable exponent form.

**Returns**

Formatted string of required length

**Raises**

**ValueError** –

**Return type**

str

New in version 1.7.

`pytermor.utilnum.format_si_metric(value, unit='m')`

Format value as meters with SI-prefixes, max result length is 7 chars: 4 for value plus 3 for default unit, prefix and separator. Base is 1000. Unit can be customized.

```
>>> format_si_metric(1010, 'm²')
'1.01 km²'
>>> format_si_metric(0.0319, 'g')
'31.9 mg'
>>> format_si_metric(1213531546, 'W') # great scott
'1.21 GW'
>>> format_si_metric(1.26e-9, 'eV')
'1.26 neV'
```

#### Parameters

- **value** (*float*) – Input value (unitless).
- **unit** (*str*) – Value unit, printed right after the prefix.

#### Returns

Formatted string with SI-prefix if necessary.

#### Return type

str

New in version 2.0.

`pytermor.utilnum.format_si_binary(value, unit='b')`

Format value as binary size (bytes, kbytes, Mbytes), max result length is 8 chars: 5 for value plus 3 for default unit, prefix and separator. Base is 1024. Unit can be customized.

```
>>> format_si_binary(1010) # 1010 b < 1 kb
'1010 b'
>>> format_si_binary(1080)
'1.055 kb'
>>> format_si_binary(45200)
'44.14 kb'
>>> format_si_binary(1.258 * pow(10, 6), 'bps')
'1.200 Mbps'
```

#### Parameters

- **value** (*float*) – Input value in bytes.
- **unit** (*str*) – Value unit, printed right after the prefix.

#### Returns

Formatted string with SI-prefix if necessary.

#### Return type

str

New in version 2.0.

**class** `pytermor.utilnum.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, truncate_frac=False, unit=None, unit_separator=None, mcoef=1000.0,
          prefixes=None, prefix_zero_idx=None)
```

#### Parameters

- **max\_value\_len**(*int*) –
- **truncate\_frac**(*bool*) –
- **unit**(*str*) –
- **unit\_separator**(*str*) –
- **mcoef**(*float*) –
- **prefixes**(*List[str | None]*) –
- **prefix\_zero\_idx**(*int*) –

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

#### Returns

Maximum length of the result. Note that constructor argument is `max_value_len`, which is different parameter.

**format**(*value*, *unit=None*)

#### Parameters

- **value**(*float*) – Input value
- **unit**(*Optional[str]*) – Unit override

#### Returns

Formatted value

#### Return type

`str`

```
pytermor.utilnum.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.utilnum.PREFIX_ZERO_SI = 8
```

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

`pytermor.utilnum.format_time_delta(seconds, max_len=None)`

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** (*float*) – Value to format
- **max\_len** (*Optional[int]*) – Maximum output string length (total)

#### Returns

Formatted string

#### Return type

str

**class** `pytermor.utilnum.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, allow\_negative, unit\_separator=None, plural\_suffix=None, overflow\_msg='OVERFLOW'*)

#### Parameters

- **units** (*List[TimeUnit]*) –
- **allow\_negative** (*bool*) –
- **unit\_separator** (*Optional[str]*) –
- **plural\_suffix** (*Optional[str]*) –
- **overflow\_msg** (*str*) –

**property** `max_len`: int

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

#### Returns

Maximum possible output string length.



**format**(*seconds*, *always\_max\_len=False*)

Pretty-print difference between two moments in time.

**Parameters**

- **seconds** (*float*) – Input value.
- **always\_max\_len** (*bool*) – 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.

**Return type**

str

**format\_raw**(*seconds*)

Pretty-print difference between two moments in time, do not replace the output with “OVERFLOW” warning message.

**Parameters**

**seconds** (*float*) – Input value.

**Returns**

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

**Return type**

str | None

**class** pytermor.utilnum.**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*, *in\_next=None*, *custom\_short=None*, *collapsible\_after=None*, *overflow\_afer=None*)

**Parameters**

- **name** (*str*) –
- **in\_next** (*Optional[int]*) –
- **custom\_short** (*Optional[str]*) –
- **collapsible\_after** (*Optional[int]*) –
- **overflow\_afer** (*Optional[int]*) –

**Return type**

None

## 2.8 utilstr

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.utilstr.format_thousand_sep(value, separator='')`

Returns input value with integer part split 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'
```

### Parameters

- **value** (*int* | *float*) –
- **separator** (*str*) –

### Return type

*str*

`pytermor.utilstr.distribute_padded(values, max_len, pad_before=False, pad_after=False)`

---

**Todo:** todo

---

### Parameters

- **values** (*List[StrType]*) –
- **max\_len** (*int*) –
- **pad\_before** (*bool*) –
- **pad\_after** (*bool*) –

### Returns

### Return type

*StrType*

`pytermor.utilstr.ljust_sgr(s, width, fillchar=' ', actual_len=None)`

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).

### Parameters

- **s** (*str*) –
- **width** (*int*) –
- **fillchar** (*str*) –
- **actual\_len** (*Optional[int]*) –

### Return type

*str*

`pytermor.utilstr.rjust_sgr(s, width, fillchar=' ', actual_len=None)`

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).

#### Parameters

- **s** (*str*) –
- **width** (*int*) –
- **fillchar** (*str*) –
- **actual\_len** (*Optional[int]*) –

#### Return type

`str`

`pytermor.utilstr.center_sgr(s, width, fillchar=' ', actual_len=None)`

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).

---

**Todo:**     (.)    – f-

---

#### Parameters

- **s** (*str*) –
- **width** (*int*) –
- **fillchar** (*str*) –
- **actual\_len** (*Optional[int]*) –

#### Return type

`str`

`pytermor.utilstr.apply_filters(s, *args)`

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(f'{SeqIndex.RED}test{SeqIndex.COLOR_OFF}', ReplaceSGR(r'E\2\3\4'))
'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* / *Type[StringFilter]*) – `StringFilter` instance(s) or `StringFilter` class(es).

#### Returns

Filtered `s`.

#### Return type

`ST`

**class** pytermor.utilstr.StringFilter

Bases: Generic[ST]

Common string modifier interface.

**\_\_init\_\_**(*pattern, repl*)**Parameters**

- **pattern** (*ST | Pattern[ST]*) –
- **repl** (*ST | Callable[[ST | Match], ST]*) –

**\_\_call\_\_**(*s*)Can be used instead of [apply\(\)](#)**Parameters****s** (*ST*) –**Return type***ST***apply**(*s*)Apply filter to *s* string (or bytes).**Parameters****s** (*ST*) –**Return type***ST***class** pytermor.utilstr.VisualuzeWhitespaceBases: [StringFilter](#)[str]Replace every invisible character with **repl** (default is `.`), except newlines. Newlines are kept and `get_by_code` 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='.'*)**Parameters****repl** (*str*) –**class** pytermor.utilstr.ReplaceSGRBases: [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=""*)**Parameters****repl** (*str*) –

**class** pytermor.utilstr.ReplaceCSI

Bases: [StringFilter](#)[str]

Find all CSI seqs (i.e. starting with 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="")

**Parameters**

**repl** (str) –

**class** pytermor.utilstr.ReplaceNonAsciiBytes

Bases: [StringFilter](#)[bytes]

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

**Parameters**

**repl** – Replacement byte-string.

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

**Parameters**

**repl** (bytes) –

## 2.9 utilsys

pytermor.utilsys.get\_terminal\_width(default=80, padding=2)

**Returns**

terminal\_width

**Parameters**

- **default** (int) –
- **padding** (int) –

**Return type**

int

pytermor.utilsys.wait\_key()

Wait for a key press on the console and return it.

**Return type**

t.AnyStr | None

pytermor.utilsys.total\_size(o, handlers=None, verbose=False)

Returns the approximate memory footprint an object and all of its contents.

Automatically finds the contents of the following builtin containers and their subclasses: tuple, list, deque, dict, set and frozenset. To search other containers, add handlers to iterate over their contents:

**handlers** = {**SomeContainerClass**: iter,  
OtherContainerClass: OtherContainerClass.get\_elements }

**Parameters**

- **o** (*Any*) –
- **handlers** (*Optional[Dict[Any, Iterator]]*) –
- **verbose** (*bool*) –

**Return type**

int

## 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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