

Contents

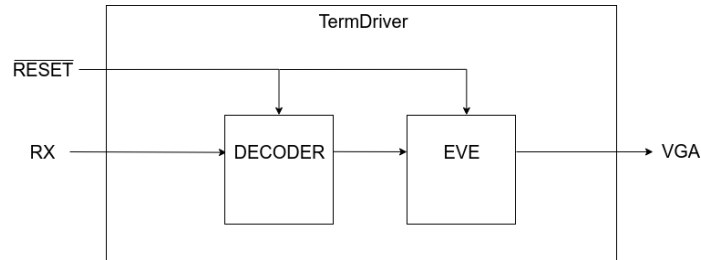
1 Overview	2
2 Features	2
3 Installation with Arduino	3
4 Operation	4
4.1 ANSI escape codes	5
4.2 High-resolution modes	6
5 Hardware	9
6 Specifications	10
6.1 DC characteristics	10
6.2 AC characteristics	10
7 Support information	10

List of Figures

1 sample output at 80x25	4
2 Counter example output	5
3 mode 1 (128x48)	7
4 mode 2 (96x64)	8
5 Arduino Uno	9

1 Overview

TermDriver listens on a serial line and emulates a text terminal, producing output on a standard VGA connector. It gives embedded microcontrollers a real console.



2 Features

- serial input at 115200 bps
- connects to the Arduino serial output pin, no libraries required
- supports standard ANSI terminal control codes
- VGA 16-color output at 1024x768
- standard 80x25 and high-resolution 128x48 modes
- rotated-screen 96x64 mode
- screen-saver under CPU control
- input signals 3.3V and 5V compatible

3 Installation with Arduino

1. Disconnect power from the Arduino
2. Attach the TermDriver to the Arduino
3. Connect the VGA plug to the TermDriver and turn on the monitor
4. Apply power to the Arduino. You should see a blank screen with a blinking cursor at top-left
5. Load a sketch on the Arduino that prints text at 115200 baud, like the one below

```
void setup()
{
  Serial.begin(115200);
}

void loop()
{
  Serial.println("Hello world");
}
```

4 Operation

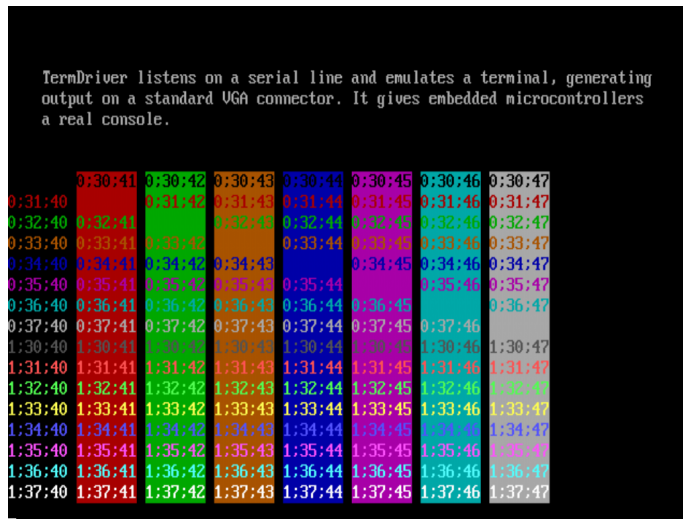


Figure 1: sample output at 80x25

TermDriver monitors the serial line at 115200 baud, and draws any text on the VGA. There's nothing to set up or load. For example this Arduino sketch

```
void setup() {
  Serial.begin(115200);
}

int counter;
void loop() {
  Serial.print("Counter is ");
  Serial.println(counter++);
}
```

Or this code in plain C

```
for (;;)
  printf("Counter is %d\n", counter++);
```

Gives this output on the VGA:

```

Counter is 11
Counter is 12
Counter is 13
Counter is 14
Counter is 15
Counter is 16
Counter is 17
Counter is 18
Counter is 19
Counter is 20
Counter is 21
Counter is 22
Counter is 23
Counter is 24
Counter is 25
Counter is 26
Counter is 27
Counter is 28
Counter is 29
Counter is 30
Counter is 31
Counter is 32
Counter is 33
Counter is 34

```

Figure 2: Counter example output

4.1 ANSI escape codes

The following standard **CSI codes** are supported:

Code	Effect
ESC [n A	Cursor up
ESC [n B	Cursor down
ESC [n C	Cursor forward
ESC [n D	Cursor back
ESC [r;c H	Cursor position
ESC [n J	Erase display
ESC [n m	Select graphic rendition
ESC [s	Save cursor position
ESC [u	Restore cursor position

In addition the following sequences are specific to TermDriver:

Code	Effect
ESC [n h	Set display mode. 0 is 80x25, 1 is 128x48, 2 is 96x64 (rotated)
ESC [n S	Screen-saver. 0 stops video output, 1 restarts video output

For example this C program displays all available foreground and background

colors.

```
#include <stdio.h>

int main()
{
    int attr, fg, bg;

    printf(
        "TermDriver listens on a serial line and emulates a "
        "terminal, generating\noutput on a standard VGA connector."
        "It gives embedded microcontrollers\na real console.\n\n");
    for (attr = 0; attr <= 1; attr++) {
        for (fg = 30; fg <= 37; fg++) {
            for (bg = 40; bg <= 47; bg++) {
                printf("\e[%d;%d;%dm%d;%d;%d\e[m",
                    attr, bg, fg, attr, bg, fg);
            }
            printf("\n");
        }
    }

    return 0;
}
```

4.2 High-resolution modes

In addition to standard 80x25 text mode, TermDriver supports a higher density 128x48 mode, and a portrait orientation 96x64 mode. Both are very readable because they match TermDriver's native 1024x768 @ 60 Hz VGA output.

CHAPTER I. Loomings.

Call me Ishmael. Some years ago—never mind how long precisely—having little or no money in my purse, and nothing particular to interest me on shore, I thought I would sail about a little and see the wotery part of the world. It is a way I have of driving off the spleen and regulating the circulation, whenever I find myself growing grim about the mouth; whenever it is a damp, drizzly November in my soul; whenever I find myself involuntarily pausing before coffin warehouses, and bringing up the rear of every funeral I meet; and especially whenever my hypos get such an upper hand of me, that it requires a strong moral principle to prevent me from deliberately stepping into the street, and methodically knocking people's hats off—then, I account it high time to get to sea as soon as I can. This is my substitute for pistol and ball. With a philosophical flourish Cato throws himself upon his sword; I quietly take to the ship. There is nothing surprising in this. If they but knew it, almost all men in their degree, some time or other, cherish very nearly the same feelings towards the ocean with me.

There now is your insular city of the Manhattans, belted round by wharves as Indian Isles by coral reefs—commerce surrounds it with her surf. Right and left, the streets take you waterward. Its extreme downtown is the Battery, where that noble mole is washed by waves, and cooled by breezes, which a few hours previous were out of sight of land. Look at the crowds of water-jazzers there.

Circumnavigate the city of a dreamy Sabbath afternoon. Go from Corlears Hook to Coenties Slip, and from thence, by Whitehall, northward. What do you see?—Posted like silent sentinels all around the town, stand thousands upon thousands of mortal men of wood in ocean reweries. Some leaning against the spiles; some seated upon the pier-heads; some looking over the bulwarks of ships from China; some high aloft in the rigging, as if striving to get a still better seaward peep. But these are all landmen; of weak days pent up in leth and plaster-tied to counters, nailed to benches, clinched to desks. How then is this?—Are the green fields gone? What do they here?

But look! here come more crowds, pacing straight for the water, and seemingly bound for a dice. Strangest! Nothing will content them but the extreme limit of the land; loitering under the shady lee of yonder warehouses will not suffice. No, they must get just as nigh the water as they possibly can without falling in. And there they stand—miles of them—leagues. Inlanders all, they come from lanes and alleys, streets and avenues—north, east, south, and west. Yet here they all unite. Tell me, does the magnetic virtue of the needles of the compasses of all those ships attract them thither?

Once more. Say you are in the country. In some high land of lakes. Take almost any path you please, and ten to one it carries you down in a dale, and leaves you there by a pool. There is magic in it, let the most absent-minded of men be plunged in his deepest reveries—stand that man on his legs, set his feet a-going, and he will infallibly lead you to water, if water there be in all that region. Should you ever be athirst in the great American desert, try this experiment, if your caravan happen to be supplied with a metaphysical professor. Yes, as every one knows, meditation and water are wedded for ever.

But here is an artist. He desires to paint you the dreamiest, shadiest, quietest, most enchanting bit of romantic landscape in all the valley of the sacre. What is the chief element he employs? There stand his trees, each with a hollow trunk, as if a hermit and a crucifix were within; and here sleeps his meadow, and there sleep his cattle; and up from yonder cottage goes a sleepy smoke. Deep into distant woodlands winds a mazy way, reaching to overlapping spurs of mountains bathed in their hill-side blue. But though the picture lies thus traced, and though his pine-tree shakes down its sighs like leaves upon this shepherd's head, get all were vain, unless the shepherd's eye were fixed upon the magic stream before him. Go visit the Prairies in June, when for scores on scores of miles you wade knee-deep among Tiger-lilies—what is the one charm wanting?—Water—there is not a drop of water there!—There Niagara but a contract of sand, would you travel your thousand miles to see it? Why did the poor poet of Tennessee, upon suddenly receiving two handfuls of silver, deliberate whether to buy him a coat, which he sadly needed, or invest his money in a pedestrian trip to Rockaway Beach? Why is almost every robust healthy boy with a robust healthy soul in him, at some time or other ready to go to sea? Why upon your first voyage as a passenger, did you yourself feel such a mystical vibration, when first told that you and your ship were now out of sight of land? Why did the old

Figure 3: mode 1 (128x48)

CHAPTER I. Loomings.

Call me Ishmael. Some years ago—never mind how long precisely—having little or no money in my purse, and nothing particular to interest me on shore, I thought I would sail about a little and see the watery part of the world. It is a way I have of driving off the spleen and regulating the circulation. Whenever I find myself growing grim about the mouth; whenever it is a damp, drizzly November in my soul; whenever I find myself involuntarily pausing before coffin warehouses, and bringing up the rear of every funeral I meet; and especially whenever my hypos get such an upper hand of me, that it requires a strong moral principle to prevent me from deliberately stepping into the street, and methodically knocking people's hats off—then, I account it high time to get to sea as soon as I can. This is my substitute for pistol and ball. With a philosophical flourish Cato throws himself upon his sword; I quietly take to the ship. There is nothing surprising in this. If they but knew it, almost all men in their degree, some time or other, cherish very nearly the same feelings towards the ocean with me.

There now is your insular city of the Manhattoes, belted round by wharves as Indian isles by coral reefs—commerce surrounds it with her surf. Right and left, the streets take you waterward. Its extreme downtown is the battery, where that noble mole is washed by waves, and cooled by breezes, which a few hours previous were out of sight of land. Look at the crowds of water-gazers there.

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But look! here come more crowds, pacing straight for the water, and seemingly bound for a dive. Strange! Nothing will content them but the extremest limit of the land; loitering under the shady lee of yonder warehouses will not suffice. No, they must get just as nigh the water as they possibly can without falling in. And there they stand—miles of them—leagues. Inlanders all, they come from lanes and alleys, streets and avenues—north, east, south, and west. Yet here they all unite. Tell me, does the magnetic virtue of the needles of the compasses of all those ships attract them thither?

Once more. Say you are in the country; in some high land of lakes. Take almost any path you please, and ten to one it carries you down in a dale; and leaves you there by a pool in the stream. There is magic in it. Let the most absent-minded of men be plunged in his deepest reveries—stand that man on his legs, set his feet a-going, and he will infallibly lead you to water, if water there be in all that region. Should you ever be athirst in the great American desert, try this experiment, if your caravan happen to be supplied with a metaphysical professor. Yes, as every one knows, meditation and water are wedded for ever.

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Figure 4: mode 2 (96x64)

5 Hardware



Figure 5: Arduino Uno

TermDriver connects directly to any Arduino or Arduino-compatible. It requires four connections:

- GND
- 5V
- RESET
- TX

To use another MCU, make the above four connections. Note that RESET is active-low. The serial protocol on TX is 115200 bps, 8 bits, no parity, 1 stop bit. This is frequently described as 115200-8N1. All signaling is 3.3V, but 5V tolerant.

6 Specifications

6.1 DC characteristics

	min	typ	max	units
Supply voltage	4.0	5.0	9.0	V
Supply current				
operation		25		mA
screen saver		10		mA
RESET,RX low voltage			0.6	V
RESET,RX high voltage	2.7		5.8	V

6.2 AC characteristics

	min	typ	max	units
Serial input line speed		115200		bps
VGA				
resolution		1024x768		pixels
vertical sync		60.004		Hz
horizontal sync		48.363		kHz
pixel clock		65.000		MHz
Cursor blink rate		1.875		Hz
Startup time			300	ms

7 Support information

Technical and product support is available at support@excamera.com