

VTAP

Application Note - External LED control with VTAP50

Firmware from v2.1.12.3

VTAP50

Revised September 2023 v1.0

If you need help to set up or use your VTAP reader, beyond what is contained in this Application Note, then please contact our support team.

Email: vtap-support@dotorigin.com

Download the latest documentation and firmware from <https://vtapnfc.com>

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If you have any feedback on setting up or using your VTAP reader or this documentation, then please contact our support team. The product is constantly being reviewed and improved and we value feedback about your experience.

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1 External LED control with VTAP50

VTAP50 readers support connection with external LEDs, either RGB or serial type. This Application Note discusses how to use external LEDs with those VTAP50 readers.

Note: External serial LED support is available on VTAP50 v2 boards with firmware from 2.1.11.2 onwards.

External LEDs (RGB or serial) can be configured to show a default colour, then automatically change colour (or flash) in response to events, such as a successful pass read, successful card/tag read or certain error conditions. (See Section [3 Configuration settings](#) for setting different LED responses). External LEDs can alternatively be driven to flash or change colour over a command interface, using programs such as TeraTerm or PuTTY, or your own custom software or script. (Examples are included in Section [5 Example LED animation sequences](#)).

External LED output can be used in VTAP reader applications which require LED feedback, such as:

- Kiosks (using serial LEDs);
- Turnstiles or other public access control (with RGB or serial LEDs);
- Where a VTAP reader is using an external antenna (with RGB or Serial LEDs). (There is a separate Application Note that addresses use of external NFC antennas).

Note: The VTAP50-OEM module has been EMC tested with on-board serial LEDs installed on the PCB. The VTAP50-OEM module is designed so that you can connect external LEDs. If external LEDs are attached to the VTAP50, that new arrangement will require corresponding LED driver circuits and EMC approvals. Contact vtap-support@dotorigin.com for details about LED driver circuits and EMC approvals for tested external LED arrangements.

2 Connect external LEDs

To connect external LEDs with the VTAP50, the 10/12 pin expansion header (not fitted as standard) needs to be soldered in place. Connect your external LED to the expansion header:

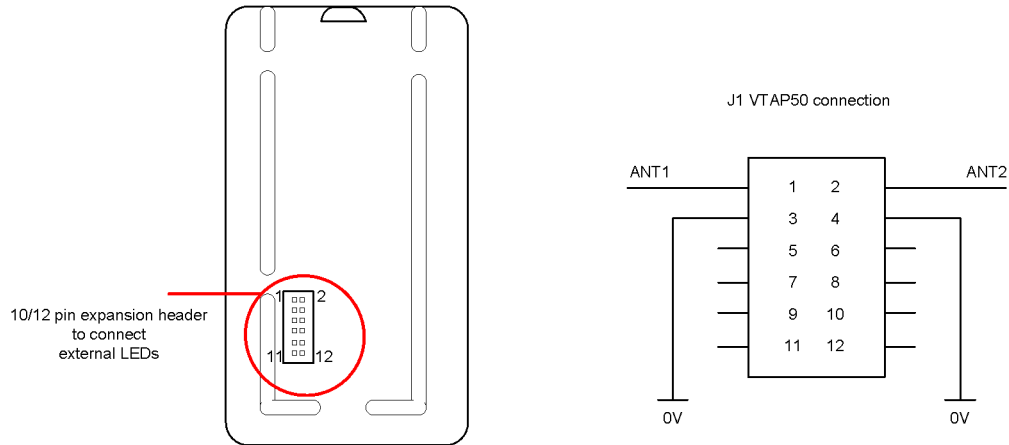


Figure 2-1 Expansion header to connect external LEDs

Pin	Function
1	Remote antenna
2	Remote antenna
3	GND
4	GND
5	+3V3 (out)
6	+5V (in/out)
7	LED (red) / LED serial 5V logic
8	LED (green)
9	LED serial 3V3 logic
10	LED (blue)
11 (v2 boards only)	Rx (serial comms 3V3)
12 (v2 boards only)	Tx (serial comms 3V3)

For external RGB LEDs: Pins 7, 8, 10 are used, pin 6 for 5V output and either pin 3 or 4 for ground. The VTAP50 supports both common anode and common cathode LEDs, configurable in `config.txt`. See Section [3.1 LED configuration in Config.txt](#) for further details.

For external Serial LEDs: VTAP50 supports 5V and 3V3 logic on different pins. Use pin 7 for 5V logic or pin 9 for 3V3 logic output, pin 6 for 5V output and either pin 3 or 4 for ground.

The external LED outputs are buffered 5V, without any current limiting resistors. You should attach an external LED board or module that includes built-in current limiting resistors. External LEDs should be decoupled, if the LEDs are rated at 5V, and 10 μ F bulk capacitance per LED along the LED path should be used.

The maximum current that can be drawn through the VTAP50 for external LEDs is 350mA. If your application requires additional current, you should connect an external power source for the LEDs and use only the RGB pins (for RGB LEDs) or logic pins (for serial LEDs) from the VTAP reader, together with ground.

It is recommended you have a common ground between the VTAP reader and the external LED(s). If the LED circuit uses much higher voltages, adequate protection will be needed on the LED circuit, to avoid damage on either side. You could use an opto-isolator on the LED logic output (5V/3V3), for complete isolation between the VTAP reader and LED circuit.

3 Configuration settings

The main settings for LED output from the VTAP reader are set in `config.txt`. Definition of complex sequences or animations, which can run to many lines, are best defined in a separate text file, called `leds.ini` for example. Both `config.txt` and `leds.ini` can either be:

- opened and edited on the VTAP reader mass storage drive, or
- retrieved from the VTAP reader, edited, then transferred back using Zmodem over a serial interface.

3.1 LED configuration in Config.txt

Following are the main settings in `config.txt` you need to define, with their specific use on a VTAP50 reader.

Setting	Definition	Default value	Example value	Options
LEDSelect	Selects which type of LED output to use, both for a default colour or in response to pass or card reads.	=1	=2	=0 External RGB (common cathode), =1 External RGB (common anode), =2 External RGB (common anode) =3 External or on-board serial LEDs (where fitted).
LEDDefaultRGB	Chooses the default colour for the RGB LED, or default sequence if using serial LEDs.	N/A	=FF8000 =FFFFFF:seq.comet@leds.ini	=FF8000 sets the LED to a specific hex colour, here #FF8000, as its default state. Use any hex RGB value, where each byte represents the strength of that colour component RRGGBB, so #FF0000 is red. =FFFFFF:seq.comet@leds.ini sets a default LED sequence of timed toggling or animation of serial LEDs (if fitted), in this case following the seq.comet sequence you have defined in a text file called leds.ini
PassLED	Chooses LED colour to flash on successful presentation of mobile NFC pass	N/A	=FF8000,100,50,2	LED colour (use any hex RGB colour value), LED on time in ms, LED off time in ms, number of repeats Example sets two 100ms orange LED flashes, spaced by 50ms, on presentation of mobile NFC pass
TagLED	Chooses LED colour to flash on presentation of a card/tag	N/A	=00FF00,500	LED colour (use any hex RGB colour value), LED on time in ms, LED off time in ms, number of repeats Example sets 1 500ms green LED flash on presentation of card/tag
LEDMaxSerial	Limits the maximum number of LEDs in a serial LED chain or matrix. [VTAP50 v2 only] Not required for external RGB LEDs.	=24	=24	The VTAP50 v2 has a limit of 1 to 255 serial LEDs in a chain. If future versions permit longer chains, there may be a need to limit the number used, for backward compatibility.

Note: Where status LEDs are fitted alongside a chain or matrix of serial LEDs, they duplicate the behaviour of the first two LEDs in the chain.

3.2 LED pattern and sequence definition

A chain or matrix of serial LEDs supports more complex LED feedback options. This is best managed using a text file called `leds.ini` which will:

- define the colours of LEDs that make up named patterns, and
- define timed sequences of these patterns.

Any pattern or sequence defined in the `leds.ini` text file can then be called from `config.txt` when needed.

1. Create an LED pattern section to define the colour of one or more serial LEDs. It starts with a section name in square brackets, such as `[leds.xxxxxx]` where `xxxxxx` is your own name for this pattern. The section sets a colour output value in hexadecimal, and gives the specific address of the LED or LEDs in the chain which should show that colour when this pattern is called.

Example: 10 red LEDs pattern definition in a text file called `leds.ini`

```
[leds.red]
FF0000=1-10
```

Serially connected LEDs 1 to 10 are required to show colour #FF0000 (red) when this pattern is called.

For sequences you may need to define several different patterns in this way.

2. Create a sequence by calling different pattern sections (such as the one above) as a sequence of frames. It starts with a section name in square brackets, such as `[seq.yyyyyy]` where `yyyyyy` is your own name for this sequence. Each frame will specify a duration in milliseconds to display a particular LED pattern. The frames run in the order they are listed. If a pattern section called does not exist in the file, the LEDs will be switched off for the duration of that frame. The number of frames is only limited by the available RAM.

Each sequence can repeat 1 to 255 times. If a repeat is not specified, the sequence is only shown once. If a repeat is set to `forever` or `0`, then sequence will run continuously until another sequence or individual pattern is called, which can be done using dynamic commands.

Example: Red-Green-Blue sequence definition in a text file called `leds.ini`

```
[leds.red]
FF0000=1-10

[leds.green]
00FF00=1-10

[leds.blue]
0000FF=1-10

[seq.rgb]
repeat=forever
frame=400,leds.red
frame=500,leds.green
frame=600,leds.blue
```

The sequence section `[seq.rgb]` requires a repeat 'forever' loop which first calls the `[leds.red]` pattern for 400ms, then the `[leds.green]` pattern for 500ms, then the `[leds.blue]` pattern for 600ms.

You can define several different sequences in the same file.

3. After saving a text file called `leds.ini` with the above example lines, open the `config.txt` file and add the following setting to make this the default LED sequence.

Example: Setting in `config.txt` which requires default LEDs to follow the `[seq.rgb]` sequence defined in the text file `leds.ini`

```
LEDDefaultRGB=FFFFFF:seq.rgb@leds.ini
```

When you save the `config.txt` file the new LED default setting will take effect immediately.

4 LED dynamic commands

You can send dynamic commands to change the LED response of the VTAP reader, without having to save the setting in the `config.txt` file. Dynamic commands are sent over any Command Interface, either a virtual COM port or serial port, using a program such as TeraTerm or PuTTY or your own custom software or script.

Dynamic commands can be used for applications where you have multiple LED sequences or patterns required, in response to different types of passes or cards, or any other pass payload criteria defined in your custom software.

Dynamic commands for LED control all take the form `?<setting>`.

Example: Dynamic command to make LED settings follow the LED sequence `seq.abc` defined in a text file called `leds.ini`

```
?LED FFFFFFF:seq.abc@leds.ini
```

Note: A value set using a dynamic command will be used by the VTAP reader only until it reboots or refreshes. After any reboot, which could follow a power cycle, using a `command.txt` file or sending `?x` through a serial interface, the VTAP reader will return to the settings defined in the `config.txt` file.

5 Example LED animation sequences

Example: 24 serial LED board where all LEDs fade in/out white colour, flashes green for successful tag/pass read.

In the text file `leds.ini`:

```
[leds.fade0]

[leds.fade1]
222222=1-24

[leds.fade2]
444444=1-24

[leds.fade3]
555555=1-24

[leds.fade4]
666666=1-24

[leds.fade5]
777777=1-24

[leds.fade6]
888888=1-24

[leds.fade7]
999999=1-24

[leds.fade8]
AAAAAA=1-24

[leds.fade9]
BBBBBB=1-24

[leds.fade10]
CCCCCC=1-24

[leds.fade11]
DDDDDD=1-24

[leds.fade12]
EEEEEE=1-24

[leds.fade13]
FFFFFF=1-24

[seq.fade]
repeat=forever
frame=150,leds.fade0
```

```
frame=150,leds.fade1
frame=150,leds.fade2
frame=70,leds.fade3
frame=70,leds.fade4
frame=70,leds.fade5
frame=70,leds.fade6
frame=70,leds.fade7
frame=100,leds.fade8
frame=150,leds.fade9
frame=150,leds.fade10
frame=150,leds.fade11
frame=150,leds.fade12
frame=250,leds.fade13
frame=50,leds.fade12
frame=50,leds.fade11
frame=50,leds.fade10
frame=50,leds.fade9
frame=50,leds.fade8
frame=50,leds.fade7
frame=50,leds.fade6
frame=50,leds.fade5
frame=50,leds.fade4
frame=50,leds.fade3
frame=120,leds.fade2
frame=120,leds.fade1
```

In the text file `Config.txt`:

Set the default LED colour to the show the sequence, as defined in the `leds.ini` file.

```
LEDDefaultRGB=FFFFFF:seq.fade@leds.ini
```

Flash green colour 100ms on, 50ms off, twice on successful pass read.

```
PassLED=00FF00,100,50,2
```

Flash green colour 200ms on, 50ms off, twice on successful card/tag read.

```
TagLED=00FF00,200,50,2
```

Example: Signal a tick or cross on an 8x8 serial LED matrix Defining everything in `config.txt`

In the text file `Config.txt`:

Define the location of each LED that must light to make a tick sign, by flashing green when this section is called.

```
[leds.tick]
006600=16,18,30,36,40,42,44,54
[end.leds]
```

Define the location of each LED that must light to make a cross sign, by flashing red when this section is called.

```
[leds.cross]
660000=1,8,10,15,19,22,28,29,36,37,43,46,50,55,57,64
[end.leds]
```

Set the default LED colour to Dot Origin standard blue.

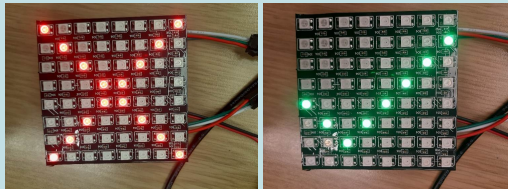
```
LEDDefaultRGB=1EBBCF
```

Call the tick animation, as defined in the `config.txt` file, on successful pass read.

```
PassLED=FFFFFF:leds.tick@config.txt
```

Call the cross animation, as defined in the `config.txt` file, on unsuccessful pass read.

```
PassErrorLED=FFFFFF:leds.cross@config.txt
```



6 About Application Notes

Application Notes address topics of interest to small groups of customers, or topics around the use of a VTAP reader with third-party systems.

The main documents available to support your use of the VTAP50 are the Installation Guide for your VTAP reader model and the VTAP Configuration Guide. You will find the latest versions of these, and other useful information at <https://vtapnfc.com>.

If you need further help do contact us by email to vtap-support@dotorigin.com, or by phone +44 (0) 1428 685861 from Europe and Asia, or +1 (562) 262-9642 from Northern and Latin America.