



ON Semiconductor®

STR-DMS-NCV7694-GEVK Driver Monitoring System

Strata Enabled STR-DMS-NCV7694-GEVK Driver Monitoring System User Guide



STR-DMS-NCV7694-GEVK Driver Monitoring System

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STR-DMS-NCV7694-GEVK Driver Monitoring System

1. Introduction

STR-DMS-NCV7694-GEVK provides an easy to use evaluation platform within the Strata Development Environment for the NCV7694 Safety Controller for Infra-Red LED Illumination to Complement the Image Sensor for Automotive Applications from ON Semiconductor. Strata gives the developer access to any collateral one may need, including datasheets, BOMs and schematics, as well as providing a user interface for testing the performance of the NCV7694. This document will provide instructions on how to use the evaluation board.

Features

Parameter	Description
Vin	9.5 V – 28 V (minimum Vin depends on the current through LEDs)
Size	Size: 21 mm x 21 mm x 12.7mm
Energy	40 mJ energy in SOA (more details in the following text) Tank capacitor: 4 x T598D157M016ATE065 automotive grade (optimized for 21 x 21 mm form factor)
Illumination	1250mW/sr (IR LED: Osram SFH4725S)
Frequency	60 Hz (aligned with the 60fps from image sensor), FW of RSL10 & GUI set to 62Hz
Voltage LEDs	8.6 V max. (2 LEDs in series @ 5 A). Adjustable at DC-DC output. 4.8 V – 10 V
Current pulses	Short: 5 A peak for 500us / Long: 1 A for 4ms. Adjustable current: 0.7 - 5 A
Adjustable parameters	On Strata: IR LED current, DC-DC output voltage, PWM signal (FLASH emulator for evaluation w/o camera) On Hardware: Input for FLASH (from camera or from Strata (PWM)) On Image sensor (DevWare): FLASH signal (freq. and TON)
Strata	Adjustable parameters. Monitor ILED and DC/DC VOUT (calibrated). Diagnostic pin from NCV7694 LED driver.
Compatible Image Sensor Modules	AR0144, IVEC-0144 primarily (optimized LED FOV DMS). Possible with other image sensors AR0234, AR0239, AR0820,... that use same FLASH mechanism.

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2. USER GUIDE

This section provides step-by-step manual on how to use the STR-DMS-NCV7694-GEVK. In general it consist of three boards:

- STR-DMS-NCV7694-GEVB (GazeT housing IR LED board)
- STR-DMS-CONTROL-GEVB (Control board to adjust Voltage and current on IR LEDs)
- STR-ASSISTED-RSL10-GEVB (RSL10 SoC based Strata interface module)

Connection of the modules when PWM flash taken from STR-ASSISTED-RSL10-GEV B

The STR-DMS-NCV7694-GEVK is delivered as platform that can operate as standalone evaluation kit. Using the Strata interface and control board, one can adjust:

- the Ton time (PWM flash) with fixed frequency 62Hz
- Output voltage of DCDC converter NCV890204
- LED current amplitude I_{LED}

Note: When operating from PWM flash out of Strata module, make sure that jumper CON4 is plugged

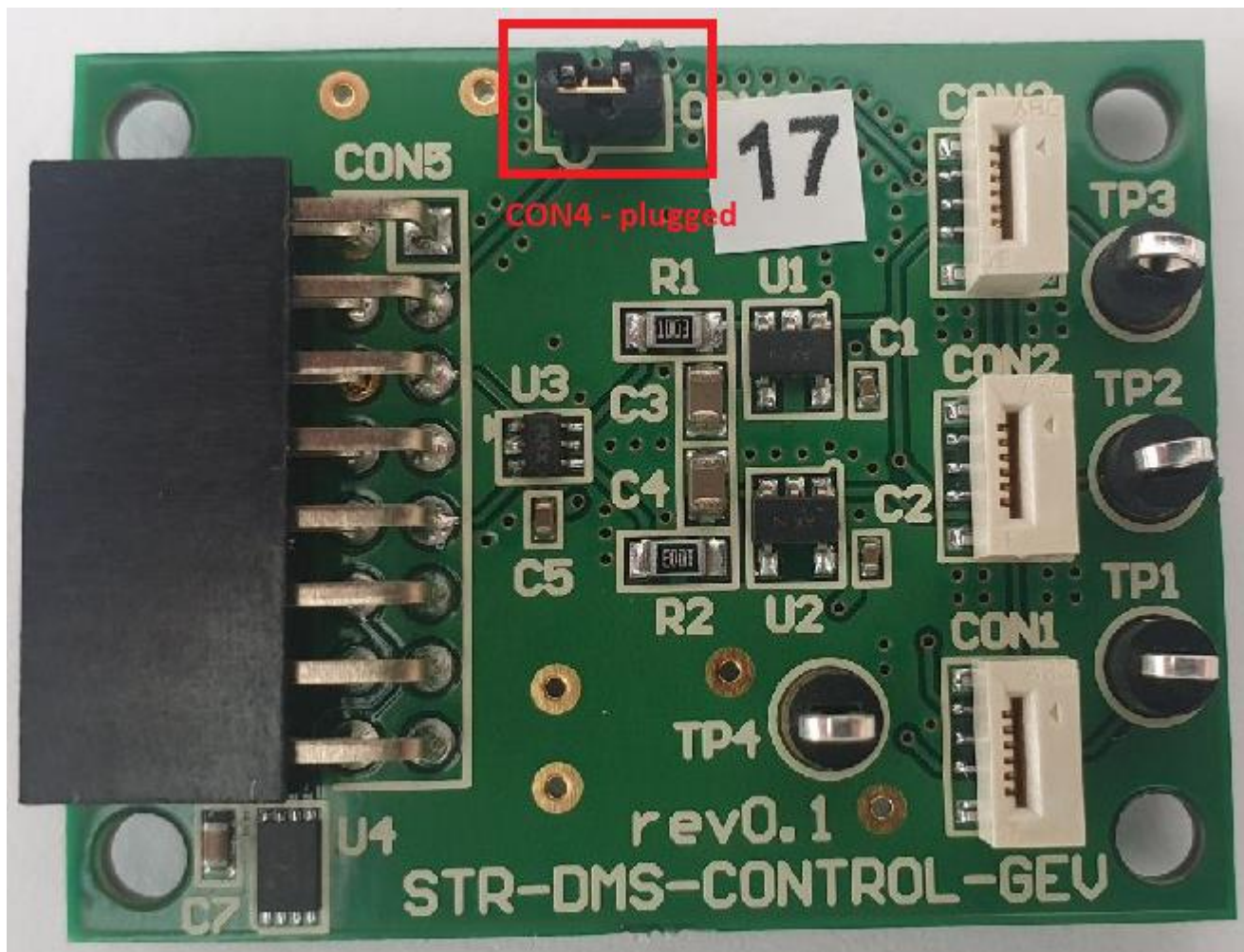


Fig. 1 CON4 jumper to be plugged when PWM flash signal taken from Strata Control board

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STR-DMS-NCV7694-GEVK consists of two connectors:

- i. Three – pin connector for Supply Voltage, Ground and PWM flash signal from Image Sensor
- ii. Six – pin connector for flat FPC cable that provides control voltage for I_LED and Vout_DCDC adjustment, PWM from Strata together with Diagnostic pin output of NCV7694.

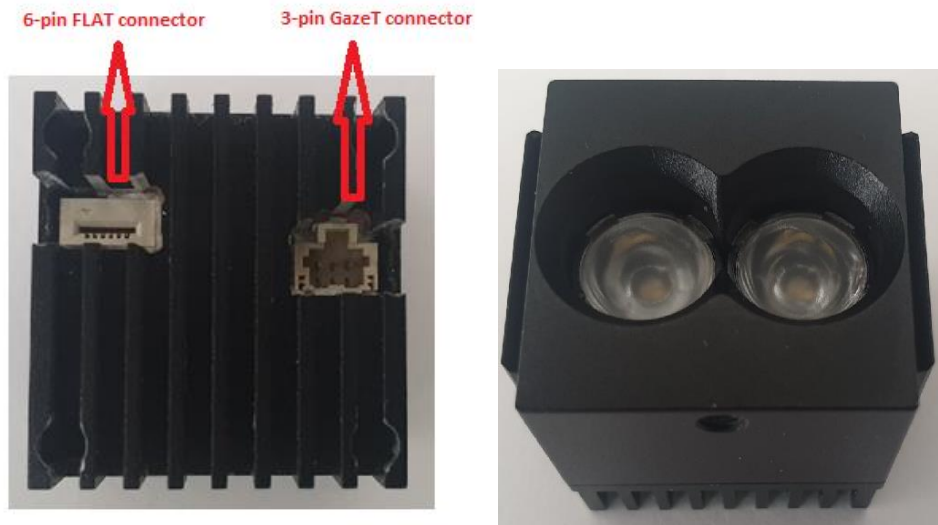


Fig. 2: 3-pin and 6-pin connectors on the back side of STR-DMS-NCV7694-GEVB LED module

Single Control board STR-DMS-CONTROL-GEVB can service up to three STR-DMS-NCV7694-GEVB GazeT IR LED modules. Here is the procedure on hardware connections of the system:

1. Connect the bundled 3-pin connector and 6-pin FPC connector to STR-DMS-NCV7694-GEVB per Fig.3. Please make sure that Blue part of the 6-pin FPC is looking upwards as depicted and LED module's hole for standoff/tripod is from housing's bottom side.

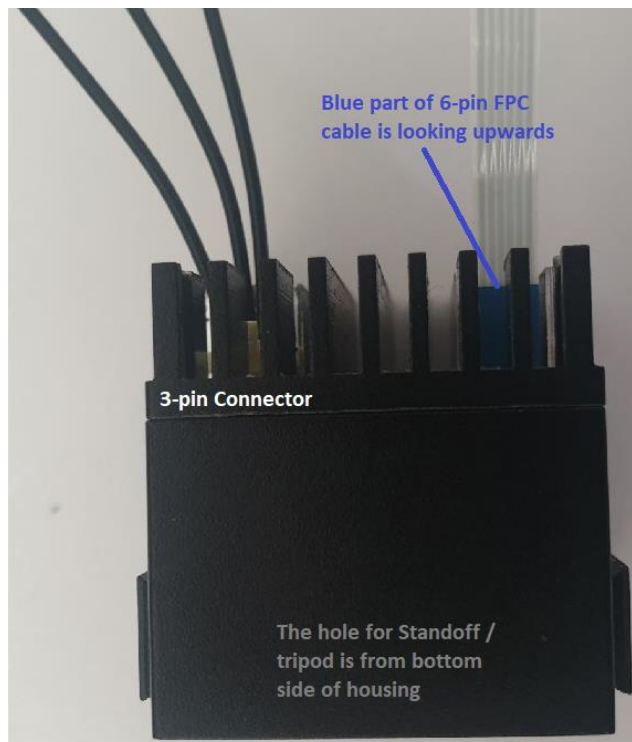


Fig. 3: 3-pin and 6-pin cable connections to IR LED module (STR-DMS-NCV7694-GEVB)

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2. Connect the other part of 6-pin FPC cable into controlboard STR-DMS-CONTROL-GEVB as shown in Fig.4. Blue part of the FPC cable must go outside of the control board. User can control up to three GazeT IR LED driver modules over 6-pin FPC cables. Each module will have the same V_{out} DCDC and I_{LED} current and PWM flash signal.

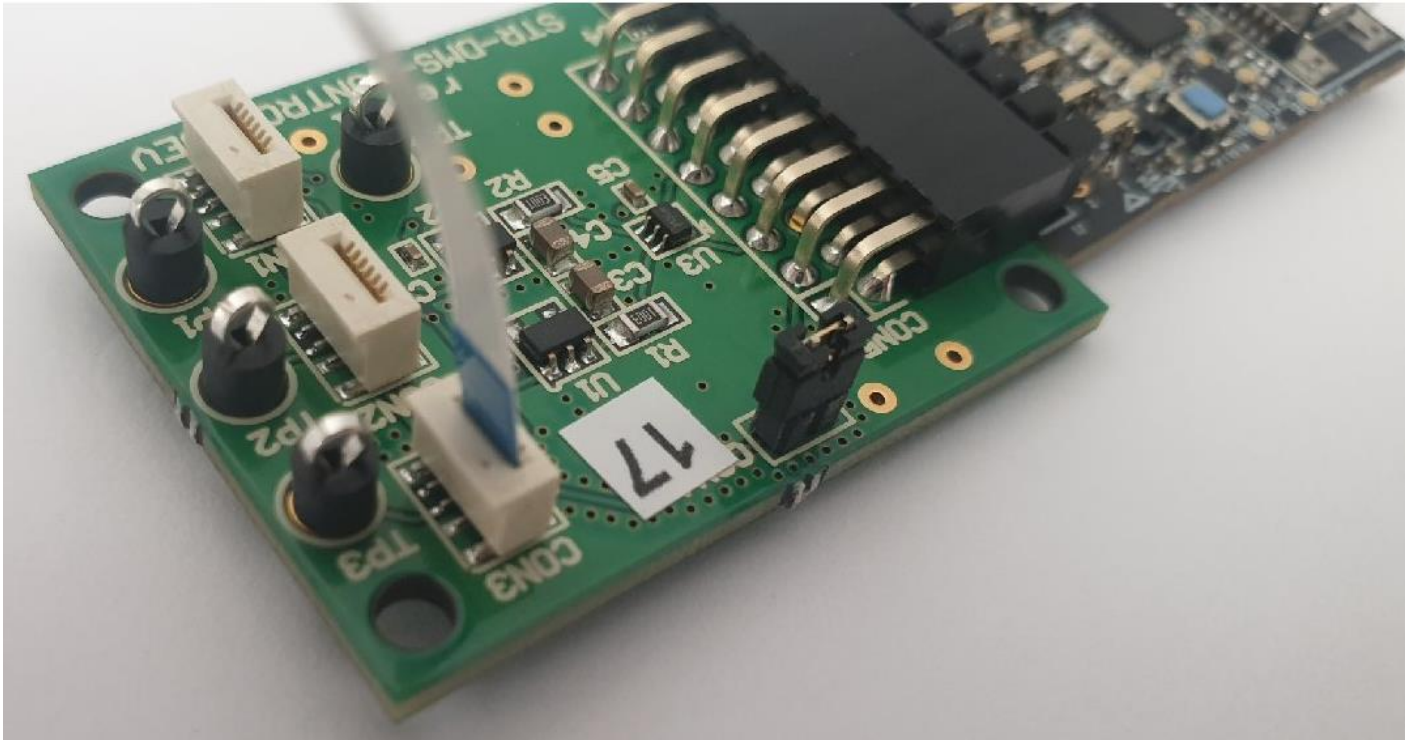


Fig. 4: connection of the 6-pin FPC cable from GazeT LED driver module (STR-DMS-NCV7694-GEVB) into Controlboard (STR-DMS-CONTROL-GEVB)

3. Make sure you have available Regulated Constant Voltage Power supply with current capability up to 5A. Connect the external power supply and polarity per Fig.5 and set voltage to 13V (current limitation 5A min). Turn the power supply ON. With PWM generated by Strata interface, leave PWM cable from 3-pin connector open (unconnected). You can connect and simultaneously control up to three STR-DMS-NCV7694-GEVB over FPC cable to single STR-DMS-CONTROL-GEVB board. Supply wires should be connected together to Regulated Voltage Source (all minus poles and all plus poles).

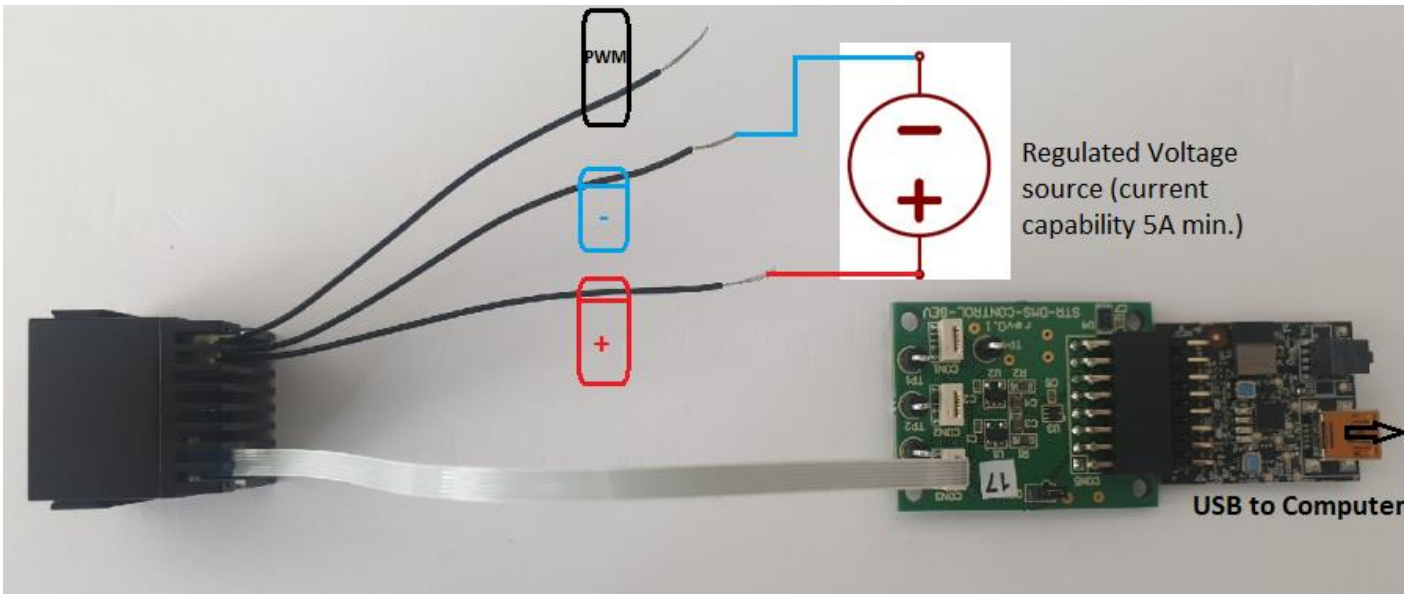


Fig. 5: Connection of the external power supply

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4. After the power supply is ON, connect the Mini USB cable to STR-DMS-CONTROL-GEVB and to computer
5. Once the system is fully powered, user can manipulate and test the performance of the system from Strata / Serial Console Interface (SCI).

The current DMS allows variation (i.e. variables) of LED current, NCV890204 output voltage and T_ON period (i.e. ON time of PWM flash pulse) by means of the STR-DMS-CONTROL-GEVB and STR-ASSIST-RS10-GEVB. There are two SW tools (available within Strata SW tools) for adjusting the above mentioned parameters: i) Serial Control Interface (SCI); ii) Strata Developer Studio GUI.

SCI:

- Commands sent via command line
- Accept any “floating value” for particular variable from command line, thus easy to bring the DMS into malfunction if user does not know what he/she is doing
- Allows user to work with variable values outside the SOA area in the Strata GUI
- Intended rather for development and/or “skilled” users
- Takes more time (sending commands) to change variables compared to Strata GUI tool
- Cannot run simultaneously with Strata GUI (to operate via GUI, close the SCI first)
- Command examples:

I_LED (LED DRIVER NCV7694)

```
{
  "cmd": "set_pwm1",
  "payload": {
    "status": "bool",
    "current": "double"
  }
}
```

VOUT (DCDC CONVERTER NCV890204)

```
{
  "cmd": "set_pwm2",
  "payload": {
    "status": "bool",
    "voltage": "double"
  }
}
```

FLASH_PWM (62Hz)

```
{
  "cmd": "set_pwm3",
  "payload": {
    "status": "bool",
    "on_time": "double"
  }
}
```

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Examples:

1. turn ON I_LED to 0.7A

```
{  
  "cmd": "set_pwm1",  
  "payload": {  
    "status": true,  
    "current": 0.7  
  }  
}
```

2. turn OFF I_LED

```
{  
  "cmd": "set_pwm1",  
  "payload": {  
    "status": false,  
    "current": 0.7  
  }  
}
```

Strata GUI:

- Available within Strata Development Studio
- Developed to make the DMS more stable, user friendly to control and operate within safety limits
- Operation restricted to “Safety Operation Area (SOA)” to reduce potential risk of damage or the DMS malfunction. LED current levels below 0.7A are removed from operation area.
- Initial variables: LED current=0.7A; T_ON PWM FLASH time=0ms; NCV890204 output voltage=10.0V
- Cannot run simultaneously with the SCI

The screenshot displays the Strata Developer Studio interface. At the top, the title bar reads "ON Semiconductor: Strata Developer Studio". Below the title bar, there is a navigation menu with "Strata", "Platform Selector", and "ams-led". The main area is divided into two sections. On the left, a graph titled "T_ON = f (I_LED)" shows the relationship between LED current (I_LED [A]) on the x-axis (0 to 6) and T_ON time (ms) on the y-axis (0 to 6). The graph shows a curve that starts at approximately 5.5 ms for 0.7 A and decreases to about 0.5 ms for 5.5 A. The area under the curve is shaded green and labeled "SOA". Conditions listed are VOUT = 10V and Flash PWM = 62Hz. On the right, a PCB diagram of the STR-DMS-NCV7694-GEVK is shown with various components labeled (T1-T4, R1-R3, L1, D1, D2, C1-C6, U1). Below the graph and PCB diagram is a "Simple Command Handler" section with three sliders: "I_LED (LED driver NCV7694)" with a current of 0.7 A, "VOUT (DCDC converter NCV890204)" with a voltage of 10 V, and "Flash PWM (62Hz)" with a T_ON time of 6 ms. The T_ON duty cycle is shown as 0%.

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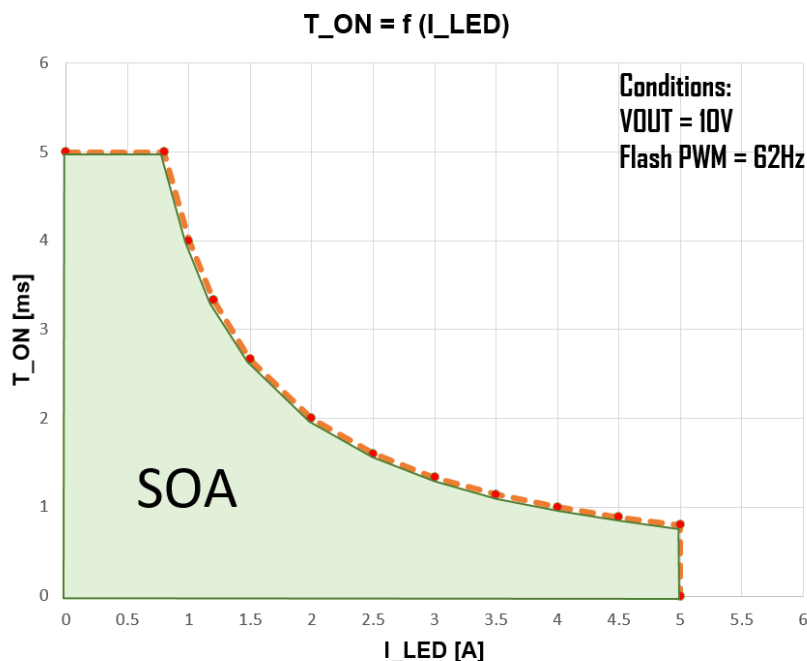


Fig. 6: Control panel for Flash PWM, VOUT (DCDC converter) and I_{LED} . Safety operating area included.

SOA area is implemented in the Strata GUI. Accepted at the conditions: NCV890204 VOUT=10.0V; f_{PWM_flash} =62Hz. LED current levels below 0.7A are unavailable.

Thresholds:

- the IRLED (MPN: SFH4725S) maximum specified LED current: 5A
- R_{ETL} value: 15kOhm -> maximum T_{ON} time 6ms per the NCV7694 specs -> thus 5ms maximum T_{ON} time accepted

Power law: $P=E/t=U*I$

- SOA is accepted: 40mJ
- $40mJ=10V*I*t$
- t involves duty cycle (i.e. T_{ON} time)
- thus: $40mC=I_{LED}*T_{ON}$ -> SOA envelope

How to start the DMS (example1): 1. set the LED current and turn the LED current button on. 2. Set the T_{ON} time and turn the PWM FLASH (T_{ON} time) on.

How to start the DMS (example2): 1. set the T_{ON} time and turn the T_{ON} time button on (i.e. PWM FLASH). 2. set the LED current and turn the LED current button on.

The NCV890204 output voltage variable can be adjusted afterwards the DMS runs (T_{ON} time is ON) with default value 10.0V. This precaution is done to prevent the DMS malfunction just after it starts due to insufficient voltage is applied at the particular working point.

If the working point is out of the SOA area that is the T_{ON} time is set too high in the example 1, the GUI automatically adjust the previous variable (i.e. LED current in the example 1 above) to stay within the SOA. In such case the working point sits onto the dashed orange curve (the SOA envelope). Consequently any change of the T_{ON} time or the LED current exceeding the SOA adjusts the working point position onto the SOA envelope.

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Connection of the modules when PWM flash taken from Image Sensor

The STR-DMS-NCV7694-GEVK as platform can operate with Image sensor. Using the Strata interface and control board, one can adjust:

- i. Output voltage of DCDC converter NCV890204
- ii. LED current amplitude I_LED

Image Sensor will serve for PWM Flash generation set out of the DevWare system.

Note: When operating with Image sensor, PWMflash out of Strata module is not used, make sure that jumper CON4 is unplugged

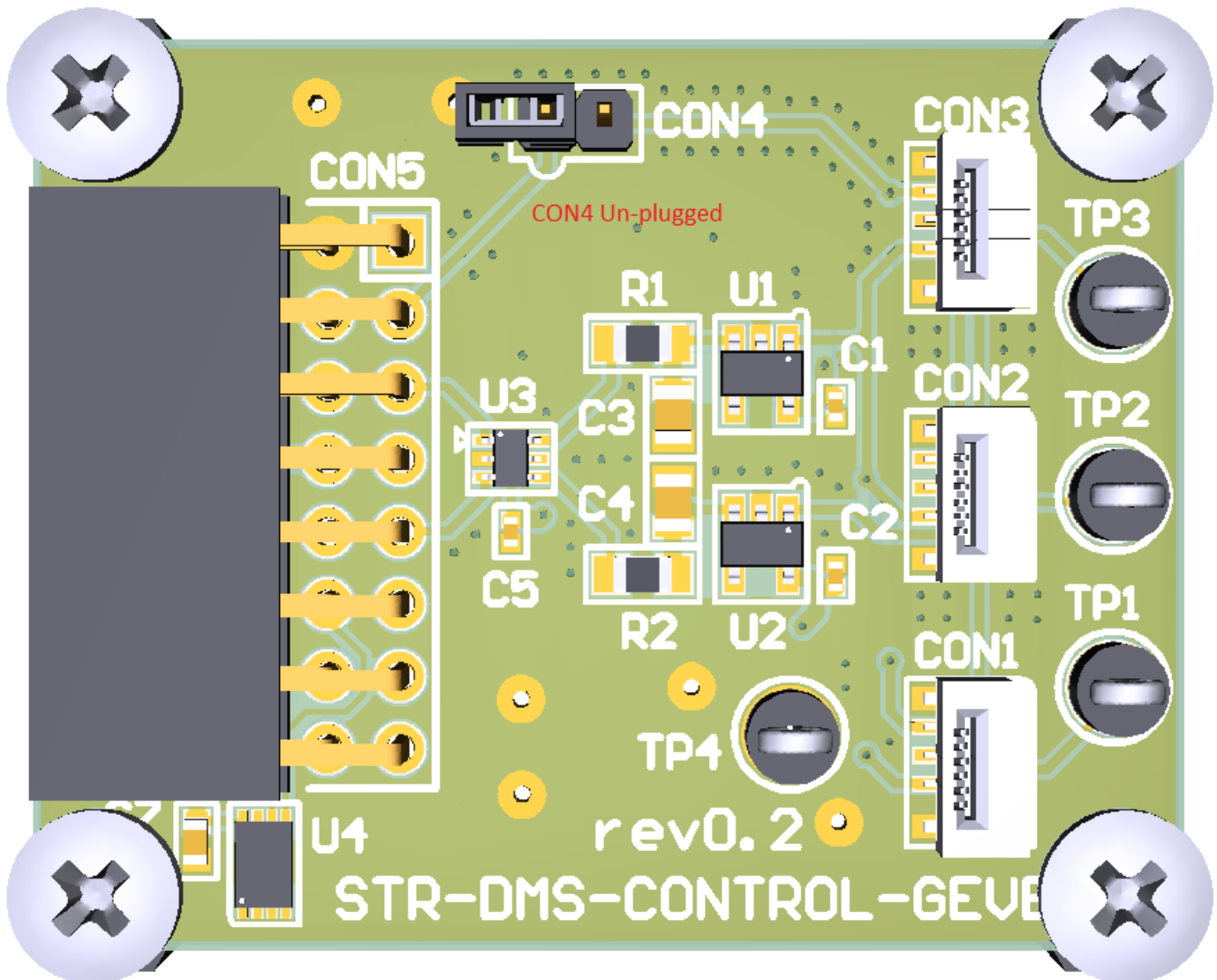


Fig. 7 CON4 jumper to be un-plugged when PWM flash signal taken from Image Sensor

Please follow the connection steps as outlined in previous chapter. For PWM_Flash signal – this is generated directly from camera module (and not from Strata control board, hence CON4 jumper not assembled).

Make sure you have available Regulated Constant Voltage Power supply with current capability up to 10A (in case you connect more modules). Connect up to two or three STR-DMS-NCV7694-GEVB GazeT modules to the GazeT image sensor module over

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three pin cabling as shown on Fig. 8. Image sensor module consists of supply connector that user hooks up to the external power supply. Set the voltage to 13V (current limitation 5A). Make sure you have the setup completed per below with 6-pin FPC cables interconnection between GazeT LED modules and Control board, IS to Deserializer – Demo3. Turn the power supply ON.

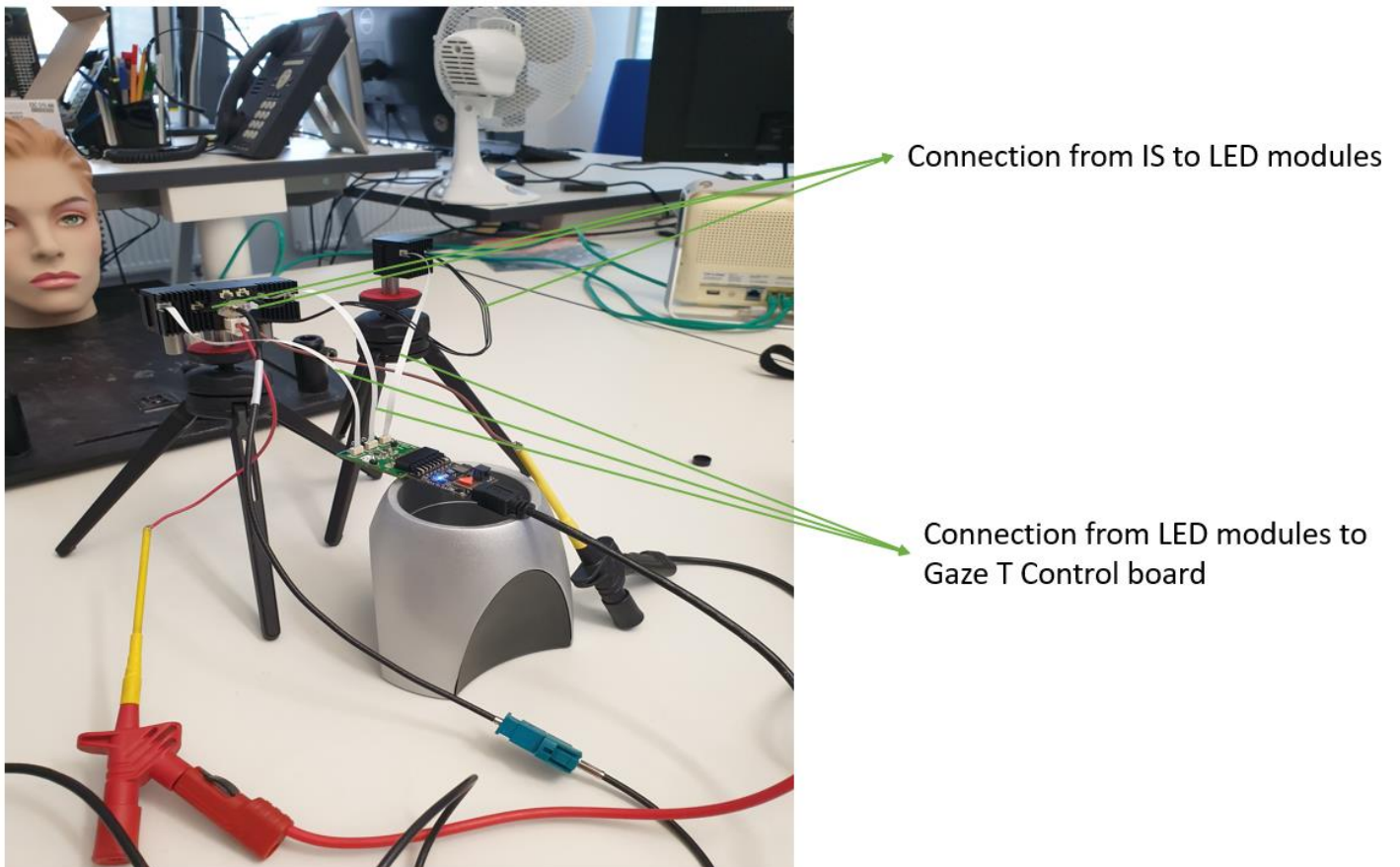
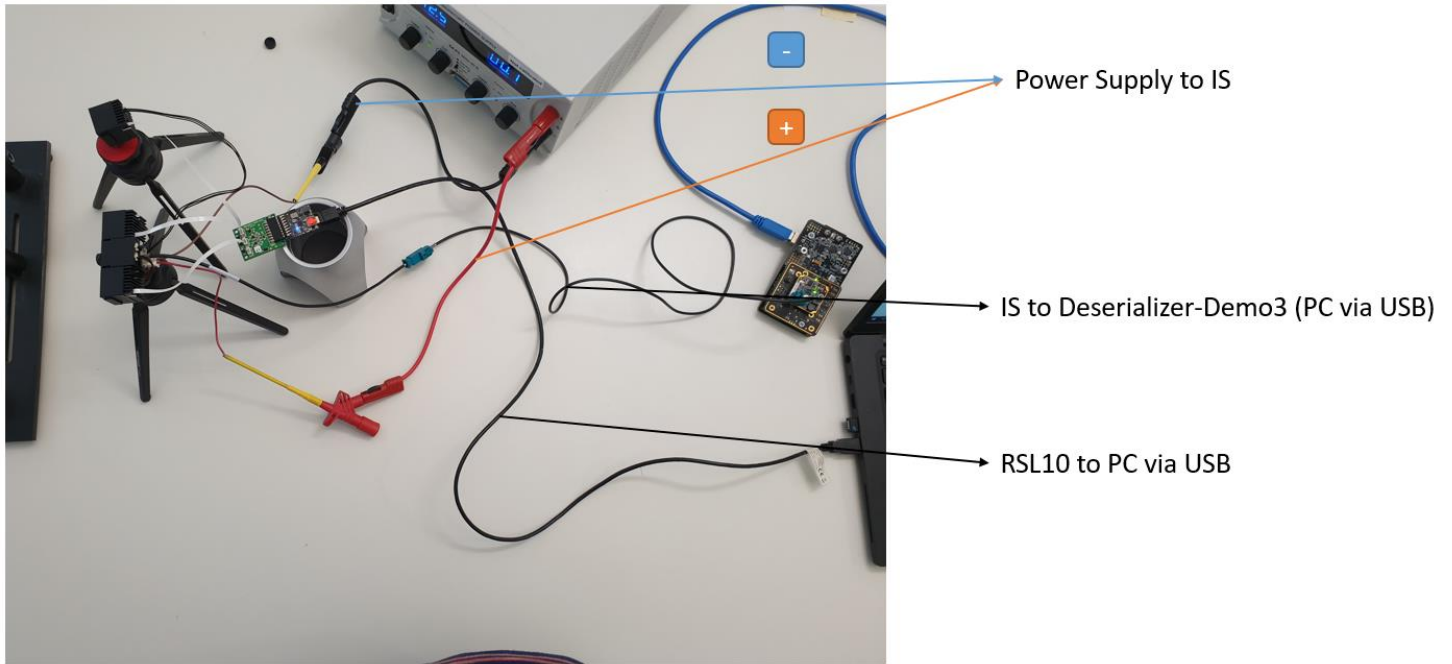


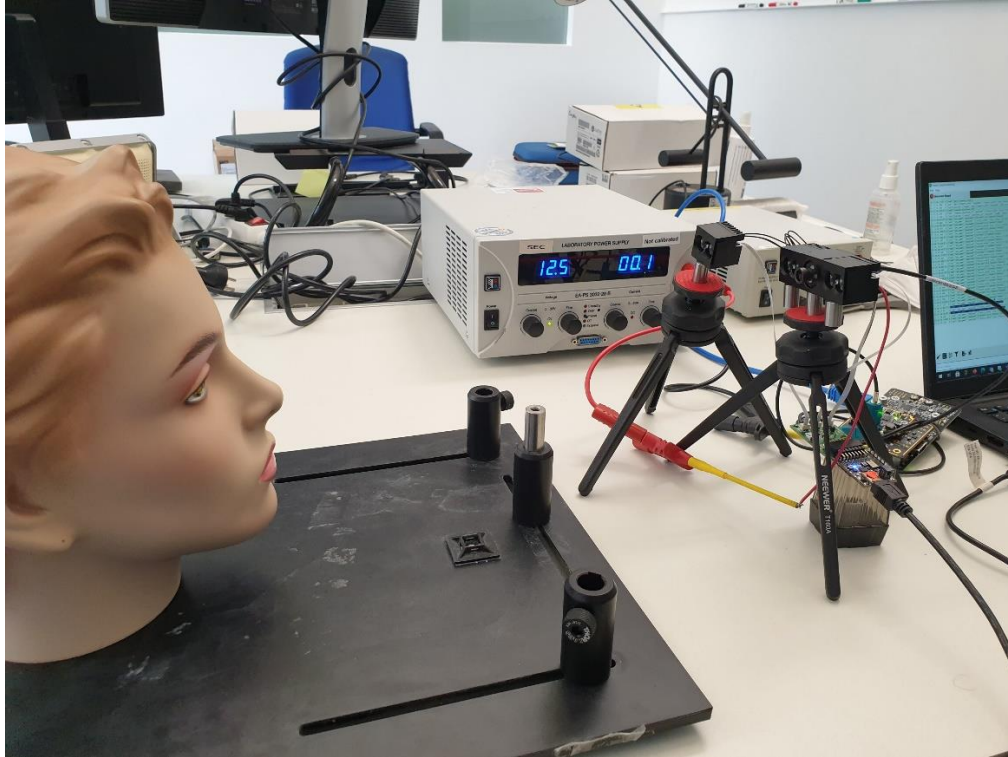
Fig. 8: Connection of the external power supply and Control board to GazeT LED and IS modules together with control board and Strata interface board

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After the power supply is ON, connect the Mini USB cable to STR-DMS-CONTROL-GEVB and to computer

Once the system is fully powered, user can manipulate and test the performance of the system from Strata / Serial Console Interface (SCI) together with DevWare. The interface is the same except PWM_flash Signal generated out of the Image Sensor over three pin connector.

Important note: DevWare generates PWMflash signal directly from Image Sensor. Strata Control GUI / SCI serves only for DCDC converter Voltage and I_LED current settings. Don't use Flash PWM Signal.



Gaze T NCV7694 LED driver modules

Gaze T AR0144 Image Sensor

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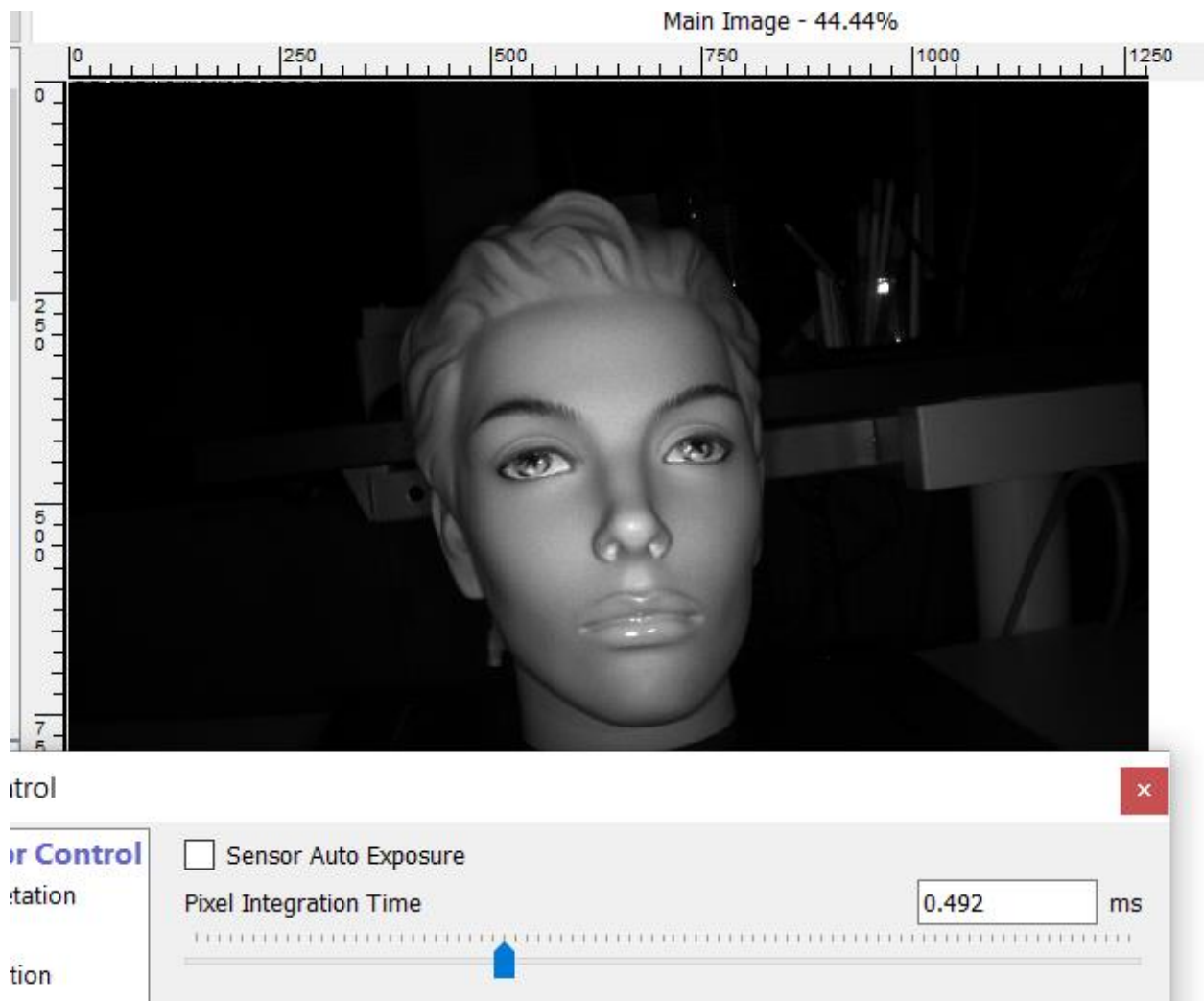


Fig. 9: Example of well exposed image, 3 LEDs connected, $T_{on} \approx 500\mu s$, $I_{LED} = 4.5 A$
Background objects also illuminated apart from the subject

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