

FEASA LED ANALYSER RGB FUNCTIONAL VERSION



User Manual for RGB LED Analyser



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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



About this Manual

Feasa operates a policy of continuous development. Feasa reserves the right to make changes and improvements to any of the products described in this document without prior notice.

Feasa reserves the right to revise this document or withdraw it at any time without prior notice.

This manual is written for models Feasa RGB LED Analysers. The model numbers are Feasa 3RGB, 5RGB, 6RGB and 10RGB.

The Feasa 10RGB model is a 10 channel unit which will test up to 10 LEDs while the Feasa 3RGB is a 3 channel unit testing up to 3 LEDs.

The interface on these units is USB or Serial.

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Introduction

The **Feasa RGB Analyser** is an instrument that tests the Color and Intensity of Light Emitting Diodes (LEDs) in a Test Process. It has been specifically designed to test LEDs in RGB situations such as backlit Switches and Panels. The Analyser has up to 10* flexible 2.2mm Fiber-Optic Light Guides which are mounted individually over the LEDs to be tested.

Emitted Light from the LEDs is guided through these Fiber-Optic Light Guides to the Analyser where the raw data is stored. The raw data can then be read out of the Analyser through the Serial or USB Interfaces. Fiber is polished both ends for optimum performance.

The USB Interface is 2.0 compatible.

The Serial Interface is a 3-Pin Connector with a 3 pin to 9 pin dtype cable (supplied) compatible with the RS-232C ports on machines.

All colors are derived from the three primary colors, Red, Green and Blue (RGB). The RGB values are used to identify different color LEDs.

The raw data from the Led under test is stored on the Led Analyser and output in different formats as required through the Serial and ICT interfaces.

* Other options include 3,5 & 6

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IMPORTANT INFORMATION for Programmers

set / put Commands

The *Set* / *Put* commands are used to adjust various settings in the LED Analyser such as Intensity, Exposure and offsets.

The *Set* commands are written to the on-board Flash.

These settings remain programmed in the Analyser even when the power is removed. The Led Analyser has a capacity limit of approximately 100,000 writes to the flash.

Use the *Set* command only to store relevant information on the Led Analyser. Please refrain from using *Set* commands in your high volume production programs as this constant writing to the Flash will eventually corrupt the Led Analyser. Use the *Put* command instead.

The *Put* commands are written to the on-board RAM.

These settings will NOT remain programmed in the Analyser after the power is removed.

Use the *Put* command as often as you need in your program. This will prolong the life of the Led Analyser particularly in high volume testing environment.

Commands are transmitted and received using ASCII characters and are **case-insensitive**. All commands must be terminated with a **<CR>** or **<LF>** character.

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Colour and Saturation

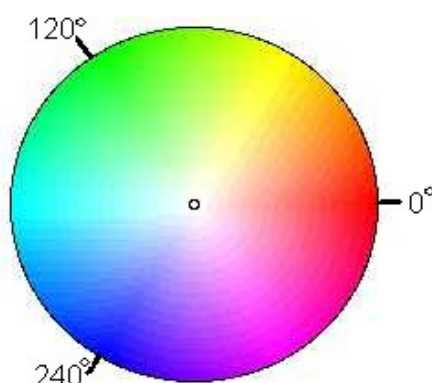


Figure 1: Hue (Color) Wheel

RED	=	0°
GREEN	=	120°
BLUE	=	240°

Colours can be represented by a 360° degree circular Colour wheel. The three Primary RGB values can also be represented as a single value called **Hue**. Hue is a measured location on a Colour wheel and is expressed in degrees. For example, Red will have a Hue value near 0°, Green will have a Hue value near 120° and Blue will have a value near 240°.

A pure Colour will be represented on the Colour wheel as a point near the outer edge. White will be represented by a point near the center of the wheel. The degree of whiteness in a LED will affect its position on the wheel – the greater the amount of white the closer it will be to the center.

The Feasa Led Analyser output of **Saturation** is NOT part of the International System of Units. and is not an absolute or traceable unit of colour measurement. It is part of the Hue Saturation and Relative intensity (HSI) system of describing colour. The degree of whiteness emitted by the LED is represented by the term **Saturation**. A Saturation value of 0% represents pure White. A Saturation value of 95 - 100% represents a pure Colour such as Red, Blue, Green, etc. It is a relative output much the same as the Relative Intensity output, and is used to compare similarly coloured LEDs under test. The Saturation values are calculated within the Feasa Led Analyser for each channel of the LED Analyser, relative to the LED under test.

There is a consistency in the Saturation readings between all Feasa Led Analysers, for LEDs of a similar colour, in a similarly constructed fixture.

Usually the user must determine the Hue and Saturation values by testing a number of LED's and recording the results.

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The RGB and Hue values in *Figure 2* show how different Colour LEDs can be identified.

<i>LED</i>	<i>R</i>	<i>G</i>	<i>B</i>	<i>HUE</i>	<i>SATURATION</i>
Red	236	17	2	3.71	99%
Green	13	187	55	135	99%
Blue	3	12	240	238	99%
Yellow	123	130	2	64	98%
White	75	92	82	See Page 10	17%

Figure 2.

The RGB or Hue values are used to identify different Colour LEDs.

Every LED tested by the LED Analyser will have a set of RGB values generated for analysis. These values are converted automatically to Hue and Saturation (whiteness) and can be read out through the Serial or USB ports.

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Intensity

Intensity is a measure of the amount of light being emitted by the LED. The Analyser tests the Intensity of each LED and outputs this value to the Test System. The value is output as a number in the range 0-99,999. The Analyser is calibrated to a fixed standard and all measurements are relative.

The RGB Analyser measures Intensity of the LED on a Linear scale.

Factors that influence Intensity Measurement:

- The position of the Fiber in relation to the LED.
- Offset from the Optical Centre of the LED.
- The Gap between the end of the Fiber Light Guide and LED to be measured.
- The condition of the Fiber end. Fiber has a 90° Cleave and is polished both ends for optimum performance. It must be kept clean.
- Is the LED Static or Flashing ?
- External Influences – Other LEDs in close proximity, Ambient Lighting.
- Is an Optical Head being used.

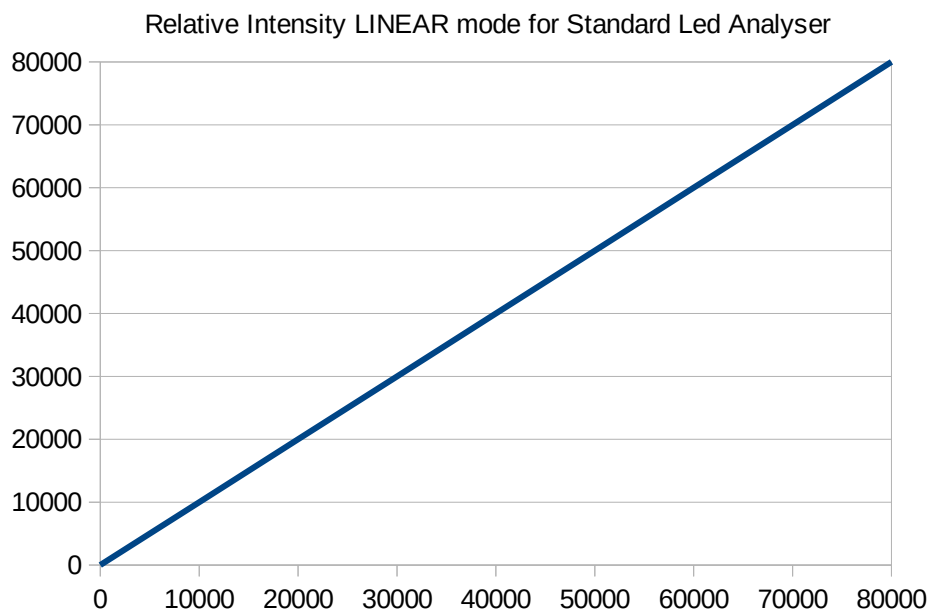


Figure 3. Relative Intensity for the LED Analyser in LINEAR mode

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White LED's

White LED's must be treated differently to coloured LED's when being tested. White is not a colour – it is a mix of all other colours. The three Primary colours Red, Green and Blue will be mixed in approximately equal proportions to display a White colour. The Saturation values must be used when testing White LED's. The Saturation is a value between 0% and 100%. A value of 0% indicates a pure white and a value of 100% indicates a pure Colour.

In reality, the Saturation value of white LED's vary significantly with values of 30% being typical. Remember, the Saturation value is an indication of how white the LED is. The correct values must be determined experimentally with the particular LED's to be tested.

Most LED manufacturers will specify their White LED's using Chromaticity co-ordinates xy . This is a two-dimensional Chart with x on the horizontal axis and y on the vertical axis. The range of x and y lies between 0 and 1.

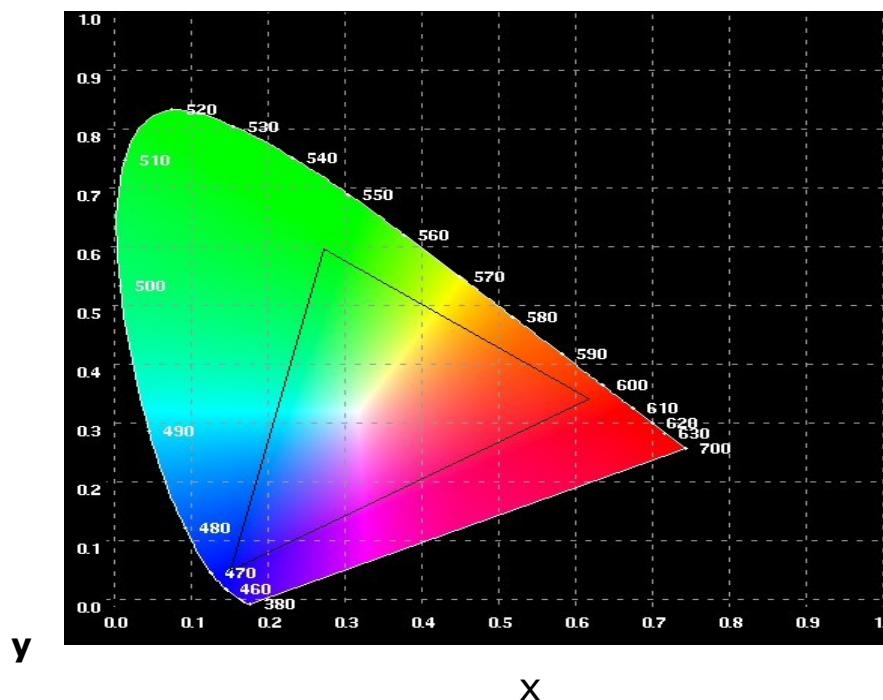


Figure 4. CIE 1931 Chromaticity Co-Ordinates

White LED's will have approximate co-ordinates of 0.33, 0.33. This may vary depending on the manufacturer of the LED where some LED's will have a Blue tint (cool white) and the other LED's will have a Red tint (Warm White).

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Setting Tolerance Limits for Color and Intensity

The test procedure requires the user to set the Pass/Fail limits for Colour and Intensity for each LED which then becomes the standard against which LEDs to be tested are compared.

The Pass/Fail limits for Colour are chosen, in conjunction with manufacturer's specifications, from measurements taken from a sample number of typical LEDs.

Because Hue is expressed as a single number it is more convenient to set the limits for the colour in terms of their Hue value.

Sample Hue Pass/Fail Limits

LED	Minimum	Maximum
Red	0	10
Green	110	130
Blue	220	250
Amber	10	15
Yellow	60	80
Orange	10	20

Figure 5a.

The Saturation value must be taken into account when testing White LED's. The Saturation is a value between 0% and 100%. A pure white will have a value close to 0% while a pure colour will have a value close to 100%.

The Pass/Fail limits for intensity are chosen from the average intensity values from a number of sample LEDs.

Sample Intensity Pass/Fail Limits

Intensity Value	Upper Limit	Lower Limit	Comments
1250	1500	1000	
25000	28000	22000	
60000	64000	56000	

Figure 5b.

Note:- the Relative Intensity Value will depend on the Range selected.

Note:- Feasa recommends selecting a Capture Range to achieve Relative Intensity Reading of 55K to 85K for the best results. However this is not always possible.

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Physical Layout 3, 5, 6-RGB

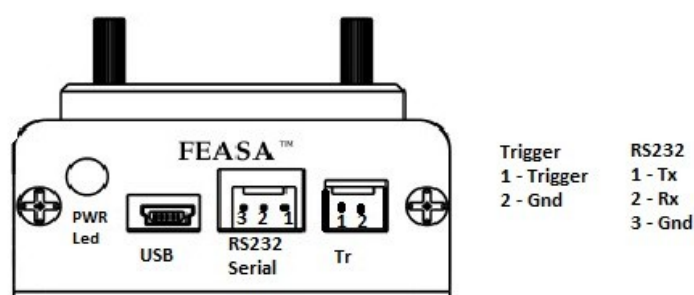


Figure 6a (Front Panel)

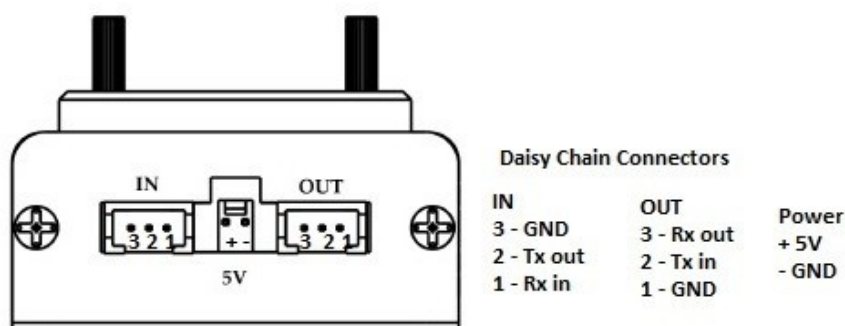


Figure 6b (Rear Panel).

Figure 6a shows the physical layout of the Feasa 3,5,6-RGB Low Light Analyser Front Panels.
Figure 6b shows the physical layout of the Feasa 3,5,6-RGB Low Light Analyser Rear Panels.

These units are enclosed in a Gold colour Aluminium case. The Serial port is a 3 pin connector with the Serial and Power cables supplied and the USB connector is the mini USB 2.0, again the cable is supplied with the unit.

Please refer to the fixturing Guidelines Manual for connector pin out details.

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Physical Layout 10-RGB

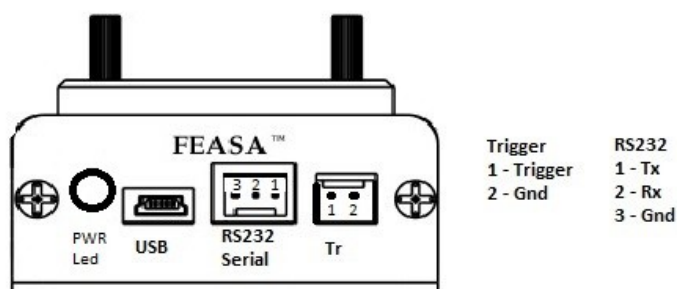


Figure 6c (Front Panel)

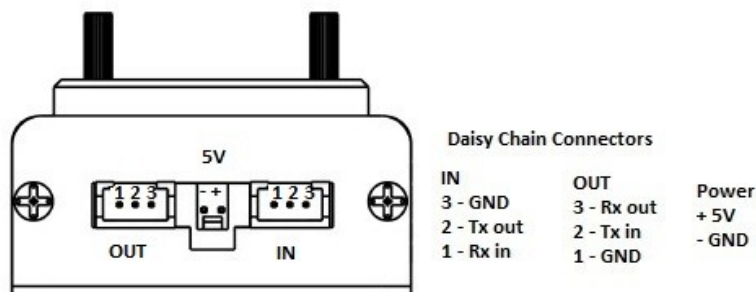


Figure 6d (Rear Panel)

Figure 6c shows the physical layout of the Feasa 10-RGB Low Light Analyser Front Panels.
Figure 6d shows the physical layout of the Feasa 10-RGB Low Light Analyser Rear Panels.

These units are enclosed in a Gold colour Aluminium case. The Serial port is a 3 pin connector with the Serial and Power cables supplied and the USB connector is the mini USB 2.0, again the cable is supplied with the unit.

Please refer to the fixturing Guidelines Manual for connector pin out details.

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Led Analyser Fiber

Fiber Length 0.6m
Fiber Diameter 2.2mm incl. Cladding
Fiber is polished both ends for optimum performance
Minimum Bend Radius: 35mm
Fiber Core Diameter 1.5mm
Number of Fibers 3, 5, 6, 10
Operating Temperature Range 0°C to +50°C

USB Port Control

Connect the LED Analyser to the PC using the supplied USB cable.

Power is supplied through the USB Cable so there is no need to plug in the Power cable.

The installed Software Driver will configure the USB Port automatically.

The USB Port is configured as a Virtual Com Port and will be designated a name such as COM5, COM6, etc.

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Serial Port Control

For serial communications the LED Analyser must be connected from the 3-pin Serial Connector to the PC or Controller using the supplied serial cable.

5V DC @ 100mA must be supplied to the 2-pin Power Connector using the Power Cable provided. (LA-PWR-01). See figure 7. **Prolonged Voltages > 7V can damage the Analyser.**

The Green LED should turn on to indicate the Analyser is ready for use.

The default serial communications settings are **57,600 Baud, 8 Data bits, 1 Stop bit and No Parity.**

The baud rate can be changed to any of the following:- 9600, 19200, 38400, 57600, 115200. These can be selected using the [setbaud](#) command.

Serial Connector (RS232C)

Pin	Signal	Pin on 9-Pin D-type
1	Tx from LED Analyser	2 / RXD
2	Rx from LED Analyser	3 / TXD
3	GND	5 / GND

Power Connector

Pin No	Signal
1	Power (5V 100mA DC)
2	GND

Figure 7.

Please Ensure the RS232 GND (pin3) and the PSU GND are connected together.

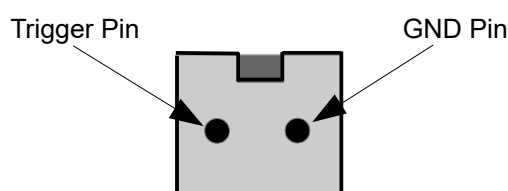
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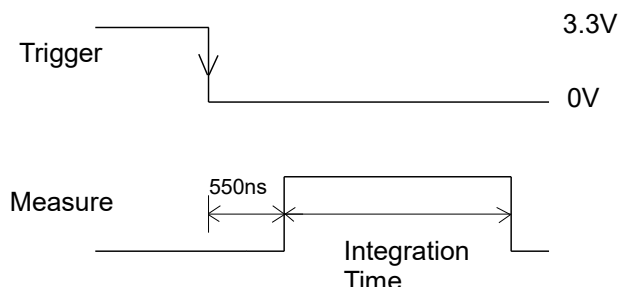


Trigger Port Control

The Feasa Led Analyser includes a Trigger function that allows an external signal to trigger a capture. For Trigger Function to operate the LED Analyser must be connected from the 2-pin Trigger Connector to the PC or Controller using the supplied serial cable (LA-TR-01). The Trigger function must first be enabled by sending commands to the Led Analyser. The capture is triggered by a high-to-low transition on the Trigger Pin. See the **External Trigger Mode** section of this manual for the programming details.



The layout of the Trigger Connector is shown above. The trigger is activated on the Trigger Pin. This pin has an internal pull-up resistor to 3.3V. The Trigger is activated by driving this pin to GND. The Trigger timing sequence is shown below.



When the Trigger is activated there is a 550ns +/- 50ns delay before the light capture begins. The commands must be transmitted through the USB or Serial Port of the Led Analyser. The Feasa Terminal program can be used to perform this task.

Trigger Connector

<i>Pin</i>	<i>Signal</i>
1	Trigger Pin
2	GND

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Capture Commands

The Capture commands are used to capture the parameters (color, intensity, xy, uv, wavelength, cct) of the LED's to be tested and store the results in the memory of the Analyser.

These results can be read out later using the **GET DATA** commands.

Commands are transmitted and received using ASCII characters and are **NOT case-sensitive**. All commands must be terminated with a **<CR>** or **<LF>** character. All responses from the Led Analyser are also terminated with **<CR>** **<LF>**

The **Terminal Program** supplied by Feasa is used to send/receive commands to/from the Analyser. This program is also available as a drop down function of the **USER** and **Test** Software programs.

The **Feasa LED Analyser User** Program is a graphical tool that can be used to send commands and receive results from the Analyser. It allows one LED to be tested at a time. This Program also allows a Terminal Window to be opened so that the User can type the commands directly and send them to the Analyser. The responses from the Analyser can be observed in the Window.

The **Feasa LED Analyser Test** Program allows the User to test all the LED's together. Pass and Fail limits can be set and results can be printed and logged.

Alternately, the User may generate a customised Program that sends commands and receives data through the virtual USB Com Port.

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Capture Mode

AUTO CAPTURE - Store LED Data

Transmit	Receive
Capture c	OK OK

Description

This Auto Range Capture instructs the LED Analyser to capture and store the data of all the LED's positioned under the fibers. The Analyser automatically determines the correct settings to capture the LED data based on the Intensity. In the case of a 10 channel unit the data for all 10 LED's are captured simultaneously and stored in internal memory of the LED Analyser. The data is stored until the power is removed or another **capture** command is issued. When completed the Analyser will transmit the character **OK** on the receive line to the transmitting device (i.e. the PC).

This command uses a wide Intensity range to be able to test dim and bright LED's simultaneously. However, if the LED's to be tested are of similar Intensity then better results will be obtained by using the [Capture#](#) command described on the next page.

This command uses the auto-ranging feature and an end-user averaging factor to capture the LED data. The averaging factor is in the range 01-99 and can be set by using the [setAverage](#) or [putAverage](#) command. The factory default is 01. A larger Averaging factor will lead to more stable results but will increase the Test Times.

Example:

The PC transmits **capture** to the LED Analyser and the LED Analyser sends **OK** to the PC to acknowledge that the command is completed.

Capture

or

c

OK

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Capture Mode

MANUAL CAPTURE - Store LED Data for a specific range

Transmit	Receive
Capture# c#	OK OK

Where:

represents the ranges 1, 2, 3, 4, 5, 6.

The LED brightness level for each range is as follows:-

Range 1 = Ultra Low
Range 2 = Super Low
Range 3 = Low
Range 4 = Medium
Range 5 = High
Range 6 = Super

Description

This command uses a pre-selected exposure time designated Range1, Range2 etc. For RGB or dim LED's use Range 1 and for brighter LED's use higher ranges. The higher ranges lead to faster test times because the exposure time is shorter. This command instructs the LED Analyser to read and store the Color and Intensity of all the LED's positioned under the fibers using a fixed range.

The range setting must be specified. The data is stored until the power is removed or another **capture** command is issued. When completed the Analyser will transmit the character **OK** on the receive line to the transmitting device (i.e. the PC).

This command can be further controlled by the end-user averaging factor to capture the LED data. The averaging factor is in the range 01-99 and can be set by using the [setAverage](#) [putAverage](#) command. The factory default is 01. A larger Averaging factor will lead to more stable results but will increase the Test Times.

Example:

The PC transmits **capture** to the LED Analyser and the LED Analyser sends **OK** to the PC to acknowledge that the command is completed.

Capture2 or C2
OK

There are 6 manual capture ranges each with an intensity output range of 0 to 99,999. Feasa recommends that the UUT readings should be in the 55K to 85K range for the best stability.

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Capture Mode

AUTO CAPTUREPWM - Store PWM LED Data

Transmit	Receive
capturepwm cpwm	OK OK

Description

Pulse-Width-Modulated(PWM) LED's are switched on and off rapidly to save power and to control Intensity. The Auto PWM Capture Range Capture instructs the LED Analyser to capture and store the data of all the LED's positioned under the fibers. The Analyser automatically determines the correct settings to capture the LED data based on the Intensity. In the case of a 10 channel unit the data for all 10 LED's are captured simultaneously and stored in internal memory of the LED Analyser. The data is stored until the power is removed or another **capture** command is issued. When completed the Analyser will transmit the character **OK** on the receive line to the transmitting device (i.e. the PC).

This command uses a wide Intensity range to be able to test dim and bright LED's simultaneously. However, if the LED's to be tested are of similar Intensity then better results will be obtained by using the [C#pwm](#) command described on the next page.

This command can be further controlled by the end-user averaging factor to capture the LED data. The averaging factor is in the range 01-99 and can be set by using the [setAverage or putAverage](#) command. The factory default is 01. A larger Averaging factor will lead to more stable results but will increase the Test Times.

Example:

The PC transmits **capturepwm** to the LED Analyser and the LED Analyser sends **OK** to the PC to acknowledge that the command is completed. Use an average of 7 to capture data.

putaverage07
capturepwm
or
putaverage07
cpwm

OK

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Capture Mode

MANUAL CAPTURE PWM - Store PWM LED Data for a specific Range

Transmit	Receive
c#pwm	OK

Where:

represents the ranges 1 - 6.

Note: The Averaging factor has a default setting of 01 set at the factory.

The LED brightness level for each range is as follows:-

Range 1 = Ultra Low
Range 2 = Super Low
Range 3 = Low
Range 4 = Medium
Range 5 = High
Range 6 = Super

Description

This command uses a pre-selected exposure time designated Range1, Range2 etc. For RGB or dim LED's use Range 1 and for brighter LED's use higher ranges. The higher ranges lead to faster test times because the exposure time is shorter. This command instructs the LED Analyser to read and store the Color and Intensity of all the LED's positioned under the fibers using a fixed range.

The range setting must be specified. The data is stored until the power is removed or another **capture** command is issued. When completed the Analyser will transmit the character **OK** on the receive line to the transmitting device (i.e. the PC).

This command can be further controlled by the end-user averaging factor to capture the LED data. The averaging factor is in the range 01-99 and can be set by using the [setAverage or putAverage](#) command. The factory default is 01. A larger Averaging factor will lead to more stable results but will increase the Test Times.

Example:

The PC transmits **c1pwm** to the LED Analyser and the LED Analyser sends **OK** to the PC to acknowledge that the command is completed. Use an average of 7 to capture the data

```
putaverage07
c1pwm
OK
```

There are 6 manual capture ranges each with an intensity output range of 0 to 99,999. Feasa recommends that the UUT readings should be in the 55K to 85K range for the best stability.

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Capture Mode

Get Data Commands

The *get data* commands are used to read out the Color, Saturation and Intensity data stored by the *capture* commands.

The data from the last *capture* command remains in memory until a new *capture* command is issued or the power is removed from the Analyser.

Commands are transmitted and received using ASCII characters and are **NOT case-sensitive**. All commands must be terminated with a **<CR>** or **<LF>** character.

Under Range Condition

An under range condition will occur when insufficient light from the LED reaches the sensor for the range selected. This will be indicated by **999.99 999 00000** for **HSI**, **000 000 000 00000** for **RGBI** and **0.0000 0.0000** for xy and uv.

If this condition occurs select the next **lower** range and test again.

Over Range Condition

An over range condition will occur when too much light from the LED reaches the sensor for the range selected by the switch. This will be indicated by **999.99 999 99999** for **HSI**, **255 255 255 99999** for **RGBI** and **0.0000 0.0000** for xy and uv.

If this condition occurs select the next **higher** range and test again.

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Get Data Mode

getRGBI## - Get RGB and Intensity for a LED

Transmit	Receive
getrgbi## getrbgi all	Rrr ggg bbb iiii

Where:

represents the Fiber Number and is a number in the range 01 – 10.

rrr , **ggg** and **bbb** are the **red**, **green** and **blue** components of the LED color. These values are normalized and are in the range 0 – 255.

iiii represents the intensity value of the LED under Fiber xx. This 5-digit number is in the range 0000 – 99999. 0000 represents no Intensity or under range(i.e. the LED is off) and 99999 will represent over range or the LED is too bright.

Description

This command instructs the LED Analyser to return RGB and Intensity data for fiber ## (01-10) in format **rrr ggg bbb iiii** where **rrr**, **ggg** and **bbb** are the **red**, **green** and **blue** components of the color. The **iiii** value indicates the intensity value.

This command should be preceded by a **capture** command to ensure valid LED data is stored in the memory of the LED Analyser. The data for each LED can only be read out one-at-the-time, in any order. Note: it is important for the PC to use 01, 02, 03, etc to indicate Fibers 1, 2 and 3, etc.

Alternatively use the *getrbgi*all command to read back the LED data for all 10 LEDs in one command.

Example:

The PC transmits **getrgbi05** to the LED Analyser to instruct it to send the stored Color and Intensity data for the LED positioned under Fiber No 5. The LED Analyser will return a string **rrr ggg bbb iiii** to the PC.

getrgbi05
006 230 018 06383

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Get Data Mode

getHSI## - Get Hue, Saturation and Intensity

Transmit	Receive
gethsi## gethsiall	Hhh.hh sss iiii

Where:

represents the Fiber Number and is a number in the range 01 – 10.

all represents the 10 Fibers in a Feasa 10-RGB, or 3 Fibers in a 3-RGB

hhh.hh represents the Hue (color) and is a number in the range 0.00 – 360.00.

sss represents the Saturation (whiteness) and is a number in the range 0–100.

iiii represents the intensity value of the LED under fiber **##**. This 5-digit number is in the range 0000 – 99999. 0000 represents no Intensity or under range(i.e. the LED is off) and 99999 will represent over range or the LED is too bright.

Description

This command instructs the LED Analyser to return Hue, Saturation and Intensity data for fiber **##** (01-10) in format **hhh.hh sss iiii** where **hhh.hh** represents the Hue(Color), **sss** represents the Saturation(whiteness) of the LED under Fiber **##**. The **iiii** value indicates the intensity value.

This command should be preceded by a **capture** command to ensure valid LED data is stored in the memory of the LED Analyser. The data for each LED can only be read out one-at-the-time, in any order. Note: it is important for the PC to use 01, 02, 03, etc to indicate Fibers 1, 2 and 3, etc.

Alternatively use the *gethsiall* command to read back the LED data for all 10 LEDs in one command.

Example:

The PC transmits **gethsi05** to the LED Analyser to instruct it to send the stored Color and Intensity data for the LED positioned under Fiber No 5. The LED Analyser will return a string **hhh.hh sss iiii** to the PC.

**gethsi05
123.47 098 06383**

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Get Data Mode

getxy## - Return the xy Chromaticity values

Transmit	Receive
getxy## getxyall	0.xxxx 0.yyyy

Where:

represents the Fiber Number and is a number in the range 01 – 10.

all represents the 10 Fibers in a Feasa 10-RGB, or 3 Fibers in a 3-RGB.

0.xxxx represents the x Chromaticity value

0.yyyy represents the y Chromaticity value

Description

This command is used to return the xy Chromaticity value for the LED under the Fiber number **##**. This command is used for testing White LED's.

This command should be preceded by a **capture** command to ensure valid LED data is stored in the memory of the LED Analyser. The data for each LED can only be read out one-at-the-time, in any order. Note: it is important for the PC to use 01, 02, 03, etc to indicate Fibers 1, 2 and 3, etc.

Alternatively use the *getxyall* command to read back the LED data for all 10 LEDs in one command.

Example:

The PC transmits **getxy01** to the LED Analyser to instruct it to send the stored xy Chromaticity data for the LED positioned under Fiber No 1. The LED Analyser will return a string **0.xxxx 0.yyyy** to the PC.

getxy01
0.6461 0.3436

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Get Data Mode

getxyi## - Return the xy Chromaticity & Relative Intensity values

Transmit	Receive
getxyi## getxyiall	0.xxxx 0.yyyy IIIII

Where:

represents the Fiber Number and is a number in the range 01 – 20.

all represents the 10 Fibers in a Feasa 10-RGB, or 3 Fibers in a 3-RGB.

0.xxxx represents the x Chromaticity value

0.yyyy represents the y Chromaticity value

IIIII represents the Relative Intensity value

Description

This command is used to return the xy Chromaticity and Relative Intensity values for the LED under the Fiber number **##**. This command is used for testing White LED's.

This command should be preceded by a **capture** command to ensure valid LED data is stored in the memory of the LED Analyser. The data for each LED can be read out one-at-the-time, in any order. Note: it is important for the PC to use 01, 02, 03, etc to indicate Fibers 1, 2 and 3, etc.

Alternatively use the *getxyiall* command to read back the LED data for all 20 LEDs in one command.

Example:

The PC transmits **getxyi01** to the LED Analyser to instruct it to send the stored xy Chromaticity and Relative Intensity data for the LED positioned under Fiber No 1. The LED Analyser will return a string **0.xxxx 0.yyyy 12345** to the PC.

getxyi01
0.6461 0.3436 03456

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Get Data Mode

getXYZ## - Return the CIE 1931 XYZ Colour values

Transmit	Receive
GetXYZ##	0.0000e+00 0.0000e+00 0.0000e+00
GetXYZall	0.0000e+00 0.0000e+00 0.0000e+00

Where:

represents the Fiber Number and is a number in the range 01 – 10.

all represents the 10 Fibers in a Feasa 10-RGB, or 3 Fibers in a 3-RGB.

0.0000e+00 represents the X value

0.0000e+00 represents the Y value (Absolute Intensity *)

0.0000e+00 represents the Z value

Description

The Led Analyser is capable of measuring the CIE 1931 XYZ components. The **Y component** is the photometric magnitude corresponding to the brightness of the source and corresponds to the photometric quantity that was used to calibrate the LED Analyser with the Feasa Spectrometer and:

- the Integrating Sphere (SPxx) was used then the Photometric Quantity is - Luminous flux (in lm)
- or the Millicandela Head (CDxx) was used then the Photometric Quantity is - Luminous intensity (in cd)
- or the Luminance Head (LUxx) was used then the Photometric Quantity is - Luminance (in cd/m²)

This can also be referred to as the Absolute Intensity. The commands **getxyz##** is used to return the CIE XYZ Colour value for the LED under the Fiber number **##** after a Capture.

To achieve the XYZ values from the Led Analyser there are a couple of steps to follow:

- * Calibrate each Channel/Fiber of the Led Analyser for **Absolute Intensity**.
- * When Calibration is complete, do a **Capture** to ensure valid Data is stored in the memory of the LED Analyser
- * The data for each LED can be read out one-at-the-time, in any order using the command **getxyz##**. Note: it is important for the PC to use 01, 02, 03, etc to indicate Fibers 1, 2 and 3, etc.

The data for multiple LEDs can be read out simultaneously using the command **Getxyzall**

Example:

The PC transmits **getxyz01** to the LED Analyser to instruct it to send the stored CIE XYZ Colour data for the LED positioned under Fiber No 1. The LED Analyser will return a string in the format **0.0000e+00 0.0000e+00 0.0000e+00** to the PC.

getxyz01

1.2345e+04 9.8765e-01 5.6789e+03

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Get Data Mode

getuv## - Return the u'v' Chromaticity values

Transmit	Receive
getuv## getuvall	0.0000 0.0000

Where:

represents the Fiber Number and is a number in the range 01 – 10.

all represents the 10 Fibers in a Feasa 10-RGB, or 3 Fibers in a 3-RGB.

0.0000 represents the u Chromaticity value

0.0000 represents the v Chromaticity value

Description

This command is used to return the u'v' Chromaticity value for the LED under the Fiber number **##**. This command is used for testing White LED's. The u'v' values are derived from the xy Chromaticity co-ordinates including any xy offsets that may be applied.

This command should be preceded by a **capture** command to ensure valid LED data is stored in the memory of the LED Analyser. The data for each LED can only be read out one-at-the-time, in any order. Note: it is important for the PC to use 01, 02, 03, etc to indicate Fibers 1, 2 and 3, etc.

Alternatively use the *getuvall* command to read back the LED data for all 10 LEDs in one command.

Example:

The PC transmits **getuv01** to the LED Analyser to instruct it to send the stored XY Chromaticity data for the LED positioned under Fiber No 1. The LED Analyser will return a string **0.1809 0.4414** to the PC.

**getuv01
0.1809 0.4414**

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Get Data Mode

getwavelength## - Get the Dominant Wavelength

Transmit	Receive
getwavelength## getwavelengthall	xxx

Where:

represents the Fiber Number and is a number in the range 1 – 10.

all represents the 10 Fibers in a Feasa 10-RGB, or 3 Fibers in a 3-RGB.

xxx represents the dominant wavelength of the LED in nanometers.

Description

This command is used to get the value of the Dominant Wavelength for the LED under the Fiber number **##**.

This command should be preceded by the **capture C** command to ensure valid LED data is stored in the memory of the LED Analyser. The **C1-C5** commands are available but are not as accurate. The data for each LED can only be read out one-at-the-time, in any order.

Alternatively use the *getwavelengthall* command to read back the LED data for all 10 LEDs in one command.

Example:

The PC transmits **getwavelength01** to the LED Analyser to instruct it to send the stored dominant wavelength for the LED positioned under Fiber No 1. The LED Analyser will return a string **xxx** to the PC.

getwavelength01
513

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Get Data Mode

getWI## - Get the Dominant Wavelength & Intensity

Transmit	Receive
getwi## getwiall	XXX YYYYY

Where:

represents the Fiber Number and is a number in the range 1 – 10.

all represents the 10 Fibers in a Feasa 10-RGB, or 3 Fibers in a 3-RGB.

XXX represents the dominant wavelength of the LED in nanometers.

YYYYY represents the intensity of the LED.

Description

This command is used to get the value of the Dominant Wavelength for the LED under the Fiber number **##**. This command should be preceded by the **capture C** command to ensure valid LED data is stored in the memory of the LED Analyser. The **C1-C5** commands are available but are not as accurate. The data for each LED can be read out one-at-the-time, in any order.

Alternatively use the *getwiall* command to read back the LED data for all 10 LEDs in one command.

Example:

The PC transmits **getwi01** to the LED Analyser to instruct it to send the stored dominant wavelength & Intensity for the LED positioned under Fiber No 1. The LED Analyser will return a string **xxx yyyyy** to the PC.

getwi01
513 12345

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Get Data Mode

getWSI## - Get the Dominant Wavelength, Saturation & Intensity

Transmit	Receive
getwsii## getwsiall	XXX SSS YYYYY

Where:

represents the Fiber Number and is a number in the range 1 – 10.

all represents the 10 Fibers in a Feasa 10-RGB, or 3 Fibers in a 3-RGB.

XXX represents the dominant wavelength of the LED in nanometers.

SSS represents the Saturation (whiteness) and is a number in the range 0–100.

YYYYY represents the intensity of the LED.

Description

This command is used to get the value of the Dominant Wavelength for the LED under the Fiber number **##**. This command should be preceded by the **capture C** command to ensure valid LED data is stored in the memory of the LED Analyser. The **C1-C5** commands are available but are not as accurate. The data for each LED can be read out one-at-the-time, in any order.

Alternatively use the *getwsiall* command to read back the LED data for all 20 LEDs in one command.

Example:

The PC transmits **getwsii01** to the LED Analyser to instruct it to send the stored dominant wavelength & Intensity for the LED positioned under Fiber No 1. The LED Analyser will return a string **xxx yyyyy** to the PC.

getwsii01
513 100 12345

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Get Data Mode

getcct## - Get the Correlated Colour Temperature

Transmit	Receive
getcct# # getcctall	cccc +/ -d.dddd

Where:

represents the Fiber Number and is a number in the range 1 – 10.
all represents the 10 Fibers in a Feasa 10-RGB, or 3 Fibers in a 3-RGB.

cccc represents the Correlated Colour Temperature of the LED.
d.dddd represents the perpendicular distance the LED is from the Plankian locus (*Delta E*). This result can be + or-

Description

This command is used to get the value of the Correlated Colour Temperature (CCT) for the LED under the Fiber number #.

This command should be preceded by the **capture** command to ensure valid LED data is stored in the memory of the LED Analyser. The data for each LED can only be read out one-at-the-time, in any order.

Alternatively use the *getcctall* command to read back the LED data for all 10 LEDs in one command.

Example:

The PC transmits **getcct01** to the LED Analyser to instruct it to send the stored Correlated Colour Temperature for the LED positioned under Fiber No 1. The LED Analyser will return a string **cccc d.dddd** to the PC.

getcct1
04621 +0.0340

getCCT is NOT Valid when measuring pure color LEDs (Red, Green, Blue). The output from the Analyser will report 0 for CCT and +0.5555 for delta uv.

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Get Data Mode

getintensity## - Get the Intensity

Transmit	Receive
Getintensity## getintensityall	IIIII

Where:

represents the Fiber Number and is a number in the range 01 – 10.

all represents the 10 Fibers in a Feasa 10-RGB, or 3 Fibers in a 3-RGB.

IIIII represents the Intensity value.

Description

This command is used to get the Intensity value for the LED under the Fiber number **##**. This command should be preceded by a **capture** command to ensure valid LED data is stored in the memory of the LED Analyser. The data for each LED can only be read out one-at-the-time, in any order using the **getintensity##** command or all data can be read simultaneously using the **getintensityall** command. Note: it is important for the PC to use 01, 02, 03, etc to indicate Fibers 1, 2 and 3, etc.

Alternatively use the *getintensityall* command to read back the LED data for all 10 LEDs in one command.

The Intensity and signal level values are independent of each other.

The signal level indicates how close (in percentage) to the Full Scale the light sensor reading is The Intensity is a factory adjusted value so all the channel provide similar levels of intensity when measuring the same light source.

Example:

The PC transmits **getintensity01** to the LED Analyser to instruct it to send the stored XY Chromaticity data for the LED positioned under Fiber No 1. The LED Analyser will return a string **IIIII** to the PC.

getintensity01
06734

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Get Data Mode

getABSINT@@ Get the Absolute Intensity Value of the Led under test.

Transmit	Receive
getabsint@@	#####e±##

Where:

@@ represents the Fiber Number and is a number in the range 01 – 10.

all represents the 10 Fibers in a Feasa 10-RGB, or 3 Fibers in a 3-RGB.

#####e±## represents the Intensity reading

Description:

This command will allow the user to interrogate the Led Analyser to return the absolute Intensity Value for the Led under test at Fiber@@.

This command should only be used in conjunction with the Feasa LED Spectrometer. Absolute Intensity values must first be measured with the Spectrometer. The LED Analyser must then be calibrated with these values using the **usercal** program supplied with the Analyser.

Alternatively use the *getabsintall* command to read back the LED data for all 10 LEDs in one command.

Example:

Place fiber 01 over the Led to be tested. Using any of the **Capture** commands, capture the data for that Led. Type the command **getabsint01** and the analyser will respond with the intensity reading in the format **#####e±##**

getabsint01
2.5000e-02

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Get Data Mode

getSIGNALLEVEL## - Get the Relative Intensity in a percentage of the Range

Transmit	Receive
getsignallevel## getsignallevelall	iii%

Where:

represents the Fiber Number and is a number in the range 01 – 10.

all represents the 10 Fibers in a Feasa 10-RGB, or 3 Fibers in a 3-RGB.

iii% represents the intensity value in percentage terms of the LED under fiber ##. This 3-digit number is in the range 001 – 100. 000% represents no Intensity or under range(i.e. the LED is off) and 999% will represent over range or the LED is too bright.

Description

This command is used to get the level of Intensity in percentage terms for each range for the LED under the Fiber number ##. This command should be preceded by a **capture** command to ensure valid LED data is stored in the memory of the LED Analyser. The data for each LED can be read out one-at-the-time, in any order.

Note: it is important for the PC to use 01, 02, 03, etc to indicate Fibers 1, 2 and 3, etc.

Alternatively use the *getsignallevelall* command to read back the LED data for all 10 LEDs in one command.

The Intensity and signal level values are independent of each other.

The signal level indicates how close (in percentage) to the Full Scale the light sensor reading is The Intensity is a factory adjusted value so all the channel provide similar levels of intensity when measuring the same light source.

Example:

The PC transmits **getsignallevel01** to the LED Analyser to instruct it to send the stored Intensity data for the LED positioned under Fiber No 1. The LED Analyser will return **iii%** to the PC.

getsignallevel01
050%

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Get Data Mode

get7SEG# - Get the value of a 7 Segment Display

Transmit	Receive
get7seg#	x

Where:

represents the Number 1 or 2
x represents the value of the display 0 - 9

Description

The LED Analyser can be used to test LED-based 7-Segment displays. To set up the LED Analyser to interrogate a single 7-Segment display, fit fibers labelled 1 to 7 over segments a-g on the 7-Segment display. See *Figure 8*.

To set up the LED Analyser to interrogate an additional 7-Segment display, fit fibers labelled 11 to 17 over segments a-g on the additional display.

To interrogate the digit displayed on the first 7-Segment Display send the command [get7seg1](#) to the LED Analyser. The LED Analyser will return the digit displayed. The LED Analyser will return the character **X** when the displayed value is not recognized (**0 to 9**).

To interrogate the digit displayed on the second 7-Segment display send the command [get7seg2](#) to the LED Analyser. The LED Analyser will return the digit displayed. Again, the LED Analyser will return the character **X** when the displayed value is not recognized (**0 to 9**).

Note:- it is not necessary to send any **capture** commands prior to using the [get7seg1](#) or [get7seg2](#) commands.

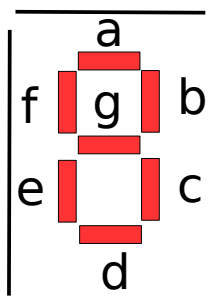


Figure 8.

Example:

The PC transmits [get7seg1](#) to the LED Analyser and the Analyser will return the value of the display. In this example the Digit 6 is displayed.

get7seg1
6

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Get Data Mode

getfactor - Get the exposure Factor

Transmit	Receive
getfactor	xx

Where:

xx represents the exposure factor value 01 to 15. The default value is 01.

Description

This command is used to get the exposure factor value for all Fibers.
The default value set at the factory are 01. The values can be adjusted by the [SetFactor](#) command.

Example:

The PC transmits **getfactor** to the LED Analyser to instruct it to send the stored exposure factor for all Fibers. The default value is 01.

getfactor
01

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Get Data Mode

getaverage - Get the number of Captures to Average

Transmit	Receive
getaverage	##

Where:

represents the number of Captures that can be averaged and is in the range 01 – 99.

Description

This command returns the number of Captures that are averaged. The minimum value is 01 and the maximum value is 99. A Capture command must be executed after the Average value has been changed.

These values are stored permanently in memory and can only be changed by using the [setAverage or putAverage](#) command.

Example:

Get the number of Captures that are averaged.

getaverage
05

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General Commands

getBAUD- Get the Baud Rate

Transmit	Receive
getBAUD	X bps

Where: **X** = 9600, 19200, 38400, 57600, 115200 for **Serial RS232 Port**

Where: **X** = 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600 for **USB Port**

Description

This command will get the baud rate of the Serial and USB Port's that the Analyser is communication through.

The default Port settings of the Analyser are 57,600, 8 Data bits, 1 Stop bit and No Parity.

It can also be seen on the comment section of the Feasa terminal window.

Example:

To get the baud rate of the Analyser transmit the command **getbaud** to the Analyser.

getbaud
57600 bps

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General Commands

getHW - *Get the Hardware Version*

Transmit	Receive
getHW	Feasa XXYY

Where: XX-YY is an alphanumeric value.

Description

This command will return the hardware version the Analyser.

Example:

The PC transmits **gethw** to the LED Analyser and it will return **Feasa XX-YY** to the PC.

gethw
Feasa 10-RGB

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



General Commands

getSTATUS - *Get a summary of the Led Analyser details*

Transmit	Receive
getstatus	See details below

Information Received back from the Analyser:

Hardware: Feasa xx-y
Serial number : Xyyy
Bus ID: Xyyy
Firmware Version : Iyyyyy
Exposure Factor : 01
Number of Averages ##
Capture : Manuel 04
Number of Fibers : 05
Selected calibration set: 00
user calibration date: dd/mm/yyyy
Factory calibration date: dd/mm/yyyy

Description

This command will return a summary of the Led Analyser details.

Example:

The PC transmits **getstatus** to the LED Analyser and it will return to the PC.

Feasa RGB Analyser

Hardware: Feasa 03-RGB
Serial number: M308
Bus ID: M308
Firmware version: A21201
Exposure factor: 05
Number of averages: 01
Capture: auto
Number of fibers: 03
Selected calibration set: 00
User calibration date: 29/08/2017
Factory calibration date: 18/09/2018

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General Commands

getSERIAL Get the Serial Number of the Analyser

Transmit	Receive
getSerial	xxxx

Where: xxxx is an alphanumeric value. (Always 4 characters)

Description

This command will return the Serial Number of the Analyser. This is a unique number and is useful if multiple LED Analysers are used in a System. The Controlling Software can query each LED Analyser for it's Serial Number to ensure the correct Analyser is being controlled.

Example:

The PC transmits **getserial** to the LED Analyser an it will return **xxxx** to the PC.

getserial
75A6

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General Commands

getVERSION - Get the Firmware Version

Transmit	Receive
getVersion	xxxxxxx

Where: xxxx is an alphanumeric value. (Up to 6 characters)

Description

This command will return the Version Number of the firmware in the Analyser.

Example:

The PC transmits **getversion** to the LED Analyser and it will return **xxxxxxx** to the PC.

getversion
A21212

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General Commands

getNFIB - Get the the Number of Channels on the Analyser

Transmit	Receive
getNFIB	xx

Where: XX is an alphanumeric value in the range 01 to 10. (Always 2 characters)

Description

This command will return the Nunber of Channels on the Analyser.

Example:

The PC transmits [getnfib](#) to the LED Analyser an it will return **xx** to the PC.

getnfib
06

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Set Data Mode

General Set Commands

IMPORTANT INFORMATION for Programmers

set / put Commands

The *Set* / *Put* commands are used to adjust various settings in the LED Analyser such as Intensity, Exposure and offsets.

The *Set* commands are written to the on-board Flash.

These settings remain programmed in the Analyser even when the power is removed. The Led Analyser has a capacity limit of approximately 100,000 writes to the flash.

Use the *Set* command only to store relevant information on the Led Analyser. Please refrain from using *Set* commands in your high volume production programs as this constant writing to the Flash will eventually corrupt the Led Analyser. Use the *Put* command instead.

The *Put* commands are written to the on-board RAM.

These settings will NOT remain programmed in the Analyser after the power is removed.

Use the *Put* command as often as you need in your program. This will prolong the life of the Led Analyser particularly in high volume testing environment.

Commands are transmitted and received using ASCII characters and are **case-insensitive**. All commands must be terminated with a **<CR>** or **<LF>** character.

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Set Data Mode

setBAUD - Change the baud rate

Transmit	Receive
Setbaudxxxxx	OK

Where: **X** = 9600, 19200, 38400, 57600, 115200 for **Serial RS232 Port**

Where: **X** = 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600 for **USB Port**

Description

This command will change the baud rate of the Serial and USB Port's in the Analyser.

The default Port settings of the Analyser are 57,600, 8 Data bits, 1 Stop bit and No Parity. If an incompatible baud rate is selected the Analyser will not respond. Please disconnect and reconnect the Analyser to return the Analyser to the default 57600 bps. A correct baud rate selected will remain stored in memory even after power off. The command getbaud will return the set baud rate. It can also be seen on the comment section of the Feasa terminal window.

Test times are improved by increasing the baudrate from the default to higher values and this can be further enhanced by decreasing the latency (windows default 16) to latency of 1. Refer to the App Note in the documentation folder of the website download page to carry out this.

Example:

To change the baud rate to 19,200 transmit the command **setbaud19200** to the Analyser .

setbaud19200
OK

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Set Data Mode

set / putAVERAGE - Set the number of Captures to Average

Transmit	Receive
Setaverage## putaverage	OK OK

Where:

represents the number of Captures to average and is a number in the range 01 – 99.

Description

This command allows the user set the number of Captures to execute and calculate the Average value. The minimum value is 01 and the maximum value is 99. A Capture command must be executed after the Average value has been changed. The Factory default is 01.

These set values are stored permanently in memory and can only be changed by using the *setaverage* command again, power on/off will NOT effect the set Factor.

The put values are stored in RAM memory and must be changed by using the *putaverage* command each time after Power On/Off.

The command [getAverage](#) will display the current stored setting.

Example:

Set the number of Captures to Average to 05.

setaverage05
OK

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Set Data Mode

set / putFACTOR## - Set the Exposure Factor

Transmit	Receive
setfactor## putfactor##	OK OK

Where:

represents the Factor Number and is in the range 01 – 15 (default 01).

Description

This command allows the user to adjust the *Exposure Factor* for **all** Fibers. This is useful when it is required to test very dim LED's. The Factory default setting is 01. The value can be adjusted from 01 to 15. The exposure time will be increased when the factor is increased which will lead to longer test times i.e. Factor 02 will double the test time, factor 03 will treble the test time etc.

Try the low range(*capture1*) first before adjusting the Exposure Factor.

These set values are stored permanently in memory and can only be changed by using the *setfactor* command again, power on/off will NOT effect the set Factor.

The put values are stored in RAM memory and must be changed by using the *putfactor* command each time after Power On/Off.

The current value can be read out using the [getfactor](#) command.

Example:

Set the Factor Number for all Fibers to 05.

setfactor05
OK

Example:

Set the Factor Number for all Fibers to 05.

putfactor05
OK

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



External Trigger Mode

External Trigger Method:

RGB Led Analysers have a 2 pin input port (Tr) to activate an external trigger capture. Prior to activation the programmer must set the **External Trigger Capture mode** and the **External Trigger Output mode**. When set to the correct modes **connecting** pin 1 to pin 2 will activate a capture and output the relevant readings as selected. No External Voltages are required.

Transmit	Receive
Setexternalcapture## Putexternalcapture## getexternalcapture	See details below

Where **##** is as follows:

- 00 Disable Trigger
- 01 Capture1 or C1 (Range Ultra Low)
- 02 Capture2 or C2 (Range Super Low)
- 03 Capture3 or C3 (Range Low)
- 04 Capture4 or C4 (Range Medium)
- 05 Capture5 or C5 (Range High)
- 06 Capture or C (Range Auto)

- 10 Capturepwm or CPWM (Range Auto)
- 11 C1PWM
- 12 C2PWM
- 13 C3PWM
- 14 C4PWM
- 15 C5PWM

- 50 Sequencecapture mode

Transmit	Receive
Setexternaloutput#### Putexternaloutput#### getexternaloutput	See details below

Where **####** is as follows:

- No output **setexternaloutputnone**
- HSI **setexternaloutputhsi**
- XYI **setexternaloutputxyi**
- RGBI **setexternaloutputrgbi**
- CCTI **setexternaloutputcct**
- ABSINT **setexternaloutputabsint**
- WSI **setexternaloutputwsi**

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



User Calibration Mode

Introduction:

The user calibration mode function allows up to 50 (01 to 50) different calibration sets to be simultaneously stored on the Led Analyser. The Analyser is shipped from the factory in set calibration mode 01. [setcalibration##](#) (## is 01 to 50) will enable which set you want to work in. While in this mode you can vary the Relevant Intensity, Absolute Intensity, xy offset, wavelength offset, and RGB gains and then save them in that *version* or *set*. The date of this user calibration can also be saved using the command [setcalibrationdateddmmYYYY](#). Using the [getstatus](#) or [getcalibration](#) commands the Led Analyser will display which user calibration set you are enabled in and also the date you set it up.

For example if you are testing a board which has 2 different led Colour options you could setcalibration01, adjust your gains or offsets as necessary and proceed to test your version 01 board. setcalibration02 and now adjust you gains or offsets as necessary for your other version of the board and proceed to test your version 02 of the board. The user calibration date for each set can be saved also.

Before doing the Calibration, we recommend you select the proper capture mode and range for the Leds you are testing. **Standard Capture** (C, C1, C2....) mode is recommended for static Leds whereas **Capture PWM** (eg c2pwm) is recommended for RGB Leds that are pulsing.

Select the relevant **Range** (UltraLow, SuperLow, Low, Medium, High) by measuring the Led color to be measured in the production. Ensure the **signal level is > 30 %** in order to maximize the repeatability.

For PWM Leds you will also need to set the best average factor (01-99) by doing a repeatability analysis on the final colour. The higher the average number the more repeatable the result. However the higher the average number the longer the capture time will be. The Feasa User software has a repeatability test analysis to help with this task.

When this data is accumulated then proceed with the calibration. Feasa provide a program called UserCal on the website download page to accomplish this process. However should you wish to undertake the process manually please refer to the procedure below.

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



User Calibration Mode

RGB Led Calibration Notes:

The RGB user calibration mode function allows up to 50 (01 to 50) different calibration sets to be simultaneously stored on the Led Analyser. The Analyser is shipped from the factory in set calibration mode 01. setcalibration## (## is 01 to 50) will enable which set you want to work in. While in this mode you can vary the RGB gains and then save them in that version or set. The date of this user calibration can also be saved using the command setcalibrationdatedd/mm/yyyy.

Using the getstatus or getcalibrationset commands the Led Analyser will display which user calibration set you are enabled in and also the date you set it up.

For example if you are testing a board which has 2 different led Colour options you could setcalibration01, adjust your gains or offsets as necessary and proceed to test your version 01 board. setcalibration02 and now adjust you gains or offsets as necessary for your other version of the board and proceed to test your version 02 of the board. The user calibration date for each set can be saved also.

Feasa provide a program called UserCal on the website downloads page to accomplish this process. Before doing the RGB calibration, we recommend you select the proper capture mode and range for the Leds you are testing. Feasa recommends Capture PWM Auto mode for calibrating RGB LEDs. The LED components should be at 100% of duty Cycle, and Capture PWM is recommended for standard measurements, since RGB LEDs are typically driven by a pulsing/PWM signal.

Select the relevant Range (UltraLow, SuperLow, Low, Medium High) by measuring the final color combination that is going to be measured in the production and also the Blue Led segment (Normally the Blue segment will have the highest Intensity) from the Led under test. Ensure the signal level is > 30 % in order to maximize the repeatability. Use the range which captures these Intensity levels best.

For PWM mode you also need to select the best average factor (01-99) by doing a repeatability analysis on the final colour. The higher the average number, the more repeatable the results will be, However the higher the average the longer the capture time will be required. The Feasa User software has a repeatability test analysis to help you on this task. When this data is accumulated then proceed to the UserCal Program provided to set the RGB gains.

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



User Calibration Mode

This is a manual procedure to calibrate the Led Analyser. However we recommend to use the Feasa UserCal program provided on the website download page. Each command is detailed in the section below.

UserCal Manual Procedure:

1. Select Calibration set
 - setcalibration## (01-50)
2. Reset Analyser to factory defaults:
 - resetusercal (Reset all parameters to Factory default)
3. Capture (auto, manual, pwm)
 - capture
4. Dominant Wavelength reading
 - getwavelength@@Dominant Wavelength Correction Offset
 - setwavelengthoffset@@##
5. Relative Intensity Reading for Fiber @@
 - getintensity@@Relative Intensity Correction Factor
 - setintgain@@###
6. CIE xy Reading for Fiber@@
 - getxy@@CIE Correction Offsets
 - setxoffset@@± 0.###
 - setyoffset@@± 0.###
7. Absolute Intensity Reading for Fiber@@
 - getabsint@@Absolute Intensity Correction Factor
 - setabsintmult@@1.00000e+00 (set the multiplier to 1)
 - capture (auto, manual, pwm)
 - getabsint@@ (get the absolute intensity using a multiplier of 1)
 - i.iiiie±00 (absolute intensity based on a multiplier of 1)
 - Divide the **Desired Intensity** by i.iiiie±00 (result will be new multiplier m.mmmmmE±ee)
 - setabsintmult@@m.mmmmmE±ee (set the new multiplier to o/p the desired Absolute Int.)
 - getabsint@@ (get the absolute intensity using new multiplier)
 - #.####e±## (Absolute Intensity in Engineering Format)
8. Set the user calibration date:
 - setcalibrationdateddmmyyyy

Note1: you can skip the adjustment of a particular parameter if you don't need it.

Note2: if you require dominant wavelength and absolute intensity, make sure the wavelength correction is done first as it affects the absolute intensity readings.

FEASA LED ANALYSER RGB FUNCTIONAL VERSION



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User Calibration Mode

setCALIBRATION## - Select the Calibration Set to use

Transmit	Receive
setcalibration## putcalibration##	OK OK

Where:

represents the set value (# can be 01 to 50).

Description

This command will select which calibration set you are accessing. The Led analyser is capable of storing fifty (50) separate user Calibration sets on the board.

The command **SETCALIBRATION##** stores the Calibration sets both on RAM and on EEPROM (stays after power cycle but limits the number of *set* command operations to ~ 100K).

The command **PUTCALIBRATION##** only stores them on RAM and the analyser will default back to what values were stored in the EEPROM after a power cycle.

The default calibration set is 01

Example:

If you want to select set No.3

setcalibration03
OK

Example:

If you want to select set No.3

putcalibration03
OK

The command **GETCALIBRATION** will return the number of which stored Calibration set of values are currently selected.

Example:

03

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User Calibration Mode

getCALIBRATION - Select the Calibration Set to use

Transmit	Receive
getcalibration	##

Where:

represents the set value (## can be 01 to 50).

Description

This command will retrieve which calibration set you are accessing. The Led analyser is capable of storing fifty (50) separate user Calibration sets on the board.

The command **SETCALIBRATION##** stores the Calibration sets both on RAM and on EEPROM (stays after power cycle but limits the number of set command operations to ~ 100K).

The command **PUTCALIBRATION##** only stores them on RAM and the analyser will default back to what values were stored in the EEPROM after a power cycle.

The factory default calibration set is 00. The Analyser is shipped at setcalibration 01

Example:

If you want to know what set is active

getcalibration

03

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



User Calibration Mode

set/putINTGAIN - Set the Intensity GainFactor

Transmit	Receive
Setintgain##xxx	OK
putintgain##xxx	OK

Where:

represents the Fiber Number and is a number in the range 01 – 10.
xxx represents a 3 digit gain factor, default 100.

Description

This command allows the user to adjust the Intensity Gain Factor for each Fiber. This is useful when it is required to balance all or some of the Fibers to give the same Intensity when testing similar LED's. The Factory default setting is 100 and the value for each Fiber can be adjusted from 050 – 200.

These set values are stored permanently in memory and can only be changed by using the *setIntGain* command again.

The put values are stored in RAM memory and must be changed by using the *putIntGain* command each time after Power On/Off.

The command [getIntGain](#) will display the current stored gain setting.

Example:

Set the Intensity gain for Fiber 1 to 095.

setintgain01095
OK

Example:

Set the Intensity gain for Fiber 1 to 095.

putintgain01095
OK

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



User Calibration Mode

getINTGAIN## - Get the Intensity Gain Factor

Transmit	Receive
getIntGain##	xxx

Where:

represents the Fiber Number and is a number in the range 01 – 10.
xxx represents the Intensity gain value. Default 100.

Description

This command is used to get the Intensity gain value for each Fiber.
The default values set at the factory are 100 i.e. 100% of nominal. The values can be adjusted by the [SetIntGain](#) command.

Example:

The PC transmits **getintgain01** to the LED Analyser to instruct it to send the stored intensity gain data for Fiber No 1.

getintgain01
100

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



User Calibration Mode

set/putXOFFSET##0.xxx - Set the x Chromaticity Offset

Transmit	Receive
setxoffset##±0.xxx putxoffset##±0.xxx	OK OK

Where:

represents the Fiber Number and is a number in the range 01 – 10.
0.xxx represents the x Chromaticity offset value (±0.000 – 0.300).

Description

This set command is used to set an offset to the displayed x Chromaticity value. The limit of the offset is ±0.300 which means values must be in the range ±0.000 – 0.300. This command is useful when the user wishes to set the x Chromaticity to be the same as that specified by the LED Manufacturer. The default value of the offset is 0.000. The offset is stored in non-volatile memory and will remain at the programmed setting until changed by a new *Setxoffset* command.

This put command is used to set an offset to the displayed x Chromaticity value. The limit of the offset is ±0.300 which means values must be in the range ±0.000 – 0.300. This command is useful when the user wishes to set the x Chromaticity to be the same as that specified by the LED Manufacturer. The default value of the offset is 0.000. The offset is stored in RAM memory and will remain at the programmed setting until changed by a new *Setxoffset* command or power OFF.

Example:

The PC transmits **setxoffset01+0.050** to the LED Analyser to instruct it to set the x offset on Fiber 01 to +0.050.

setxoffset01+0.050
OK

Example:

The PC transmits **setxoffset01+0.050** to the LED Analyser to instruct it to set the x offset on Fiber 01 to +0.050.

putxoffset01+0.050
OK

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



User Calibration Mode

set/putYOFFSET##0.xxx - Set the x Chromaticity Offset

Transmit	Receive
setyoffset##$\pm$0.xxx putyoffset##$\pm$0.xxx	OK OK

Where:

represents the Fiber Number and is a number in the range 01 – 10.
0.xxx represents the x Chromaticity offset value (± 0.000 – 0.300).

Description

This set command is used to set an offset to the displayed y Chromaticity value. The limit of the offset is ± 0.300 which means values must be in the range ± 0.000 – 0.300. This command is useful when the user wishes to set the y Chromaticity to be the same as that specified by the LED Manufacturer. The default value of the offset is 0.000. The offset is stored in non-volatile memory and will remain at the programmed setting until changed by a new *Setyoffset* command.

This put command is used to set an offset to the displayed y Chromaticity value. The limit of the offset is ± 0.300 which means values must be in the range ± 0.000 – 0.300. This command is useful when the user wishes to set the y Chromaticity to be the same as that specified by the LED Manufacturer. The default value of the offset is 0.000. The offset is stored in RAM memory and will remain at the programmed setting until changed by a new *Setyoffset* command or power OFF.

Example:

The PC transmits **setyoffset01+0.050** to the LED Analyser to instruct it to set the y offset on Fiber 01 to +0.050.

setyoffset01+0.050
OK

Example:

The PC transmits **putyoffset01+0.050** to the LED Analyser to instruct it to set the y offset on Fiber 01 to +0.050.

putyoffset01+0.050
OK

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



User Calibration Mode

getXOFFSET## - Return the x Chromaticity offset

Transmit	Receive
getxoffset##	±0.xxx

Where:

represents the Fiber Number and is a number in the range 01 – 10.
±0.xxx represents the x Chromaticity offset

Description

This command is used to return the x Chromaticity offset for the LED under the Fiber number ##. The value of this offset must be set by the [setxoffset##](#) command. The default value is 0.000.

Example:

The PC transmits **getxoffset01** to the LED Analyser to instruct it to send the stored x Chromaticity offset for the LED positioned under Fiber No 1. The LED Analyser will return a string **±0.xxx** to the PC.

getxoffset01
+0.155

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



User Calibration Mode

getYOFFSET## - Return the y Chromaticity offset

Transmit	Receive
getyoffset##	±0.yyy

Where:

represents the Fiber Number and is a number in the range 01 – 10.
±0.yyy represents the y Chromaticity offset

Description

This command is used to return the y Chromaticity offset for the LED under the Fiber number ##. The value of this offset must be set by the [setyoffset##](#) command. The default value is 0.000.

Example:

The PC transmits **getyoffset01** to the LED Analyser to instruct it to send the stored y Chromaticity offset for the LED positioned under Fiber No 1. The LED Analyser will return a string **±0.yyy** to the PC.

getyoffset01
-0.025

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



User Calibration Mode

set/putWAVELENGTHOFFSET@@±## - Set the wavelength Offset

Transmit	Receive
setwavelengthoffset##±xx putwavelengthoffset##±xx	OK OK

Where:

@@ represents the Fiber Number and is a number in the range 01 – 10.
xx represents the wavelength offset value (±99).

Description

This set command is used to set an offset to the wavelength value. The limit of the offset is ±99. This command is useful when the user wishes to set the wavelength to be the same as that specified by the LED Manufacturer. The default value of the offset is 00. The offset is stored in non-volatile memory and will remain at the programmed setting until changed by a new *setwavelengthoffset* command.

This put command is used to set an offset to the wavelength value. The limit of the offset is ±99. This command is useful when the user wishes to set the wavelength to be the same as that specified by the LED Manufacturer. The default value of the offset is 00. The offset is stored in RAM memory and will remain at the programmed setting until changed by a new *setwavelengthoffset* command or power OFF.

Example:

The PC transmits **setwavelengthoffset01-05** to the LED Analyser to instruct it to set the wavelength offset on Fiber 01 to -05.

setwavelengthoffset01-05

OK

Example:

The PC transmits **putwavelengthoffset01-05** to the LED Analyser to instruct it to set the wavelength offset on Fiber 01 to -05.

putwavelengthoffset01-05

OK

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



User Calibration Mode

getWAVELENGTHOFFSET@@ - Get the Dominant Wavelength Offset

Transmit	Receive
getwavelengthoffset@@	+/-XX

Where:

@@ represents the Fiber Number and is a number in the range 1 – 10.

+/- xx represents the wavelength offset set of the LED in nanometers.

Description

This command is used to get the value of the Dominant Wavelength Offset set for Fiber number @@.

The range of value that can be programmed is +/-99, however setting a value of greater than +/-10 would probably indicate an error in your measurement setup

Example:

The PC transmits **getwavelengthoffset01** to the LED Analyser to instruct it to send the programmed dominant wavelength offset for the LED positioned under Fiber No 1. The LED Analyser will return a string **+/- xx** to the PC.

getwavelengthoffset01
+07

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



User Calibration Mode

set/putABSINTMULT@@ - Set the x Chromaticity Offset

Transmit	Receive
setabsintmult@@m.mmmme+mm	OK
putabsintmult@@m.mmmme+mm	OK

Where:

@@ represents the Fiber Number and is a number in the range 01 – 10.
m.mmmme+mm represents the Absolute Intensity Multiplier Factor

Description

This set command is used to set an offset to the displayed y Chromaticity value. The limit of the offset is ± 0.300 which means values must be in the range $\pm 0.000 - 0.300$. This command is useful when the user wishes to set the y Chromaticity to be the same as that specified by the LED Manufacturer. The default value of the offset is 0.000. The offset is stored in non-volatile memory and will remain at the programmed setting until changed by a new *Setyoffset* command.

This put command is used to set an offset to the displayed y Chromaticity value. The limit of the offset is ± 0.300 which means values must be in the range $\pm 0.000 - 0.300$. This command is useful when the user wishes to set the y Chromaticity to be the same as that specified by the LED Manufacturer. The default value of the offset is 0.000. The offset is stored in RAM memory and will remain at the programmed setting until changed by a new *Setyoffset* command or power OFF.

Example:

send the command **setabsintmult@@m.mmmme+mm** to the LED Analyser to instruct it to set the Absolute Intensity Multiplier Factor on Fiber 3 to 1

setabsintmult031.00000e+00
OK

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



User Calibration Mode

getABSINTMULT@@ Get Absolute Intensity Correction Factor of the Led under test.

Transmit	Receive
getabsintmult@@	#.####e±##

Where:

@@ represents the Fiber Number and is a number in the range 01 – 10.
#.####e±## represents the Absolute Intensity Correction Factor

Description:

This command will allow the user to interrogate the Led Analyser to return the absolute Intensity Correction Factor or Multiplier Value for the Led under test at Fiber@@.

Example:

Type the command **getabsintmult01** and the analyser will respond with with the Multiplier in the format **0.00000e+00**

getabsintmult01
0.00000e+00

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



User Calibration Mode

ResetUserCal- Reset the active calset usercal settings to factory default

Transmit	Receive
resetusercal	OK

Description

This command will reset the active calibrationset back to factory default values. The Led analyser is capable of storing fifty (01-50) separate user Calibration sets on the board. Each one must be reset separately.

The command [resetusercal](#) resets the active Calibration set to factory default.

The command resets:

- Absolute intensity factors to 0
- Relative intensity gains to 100
- xy and dominant wavelength offsets to 0
- User calibration date to 00/00/0000
- Reset RGB mode if selected and come back to standard mode
- Exposure factor to 1
- Log mode

of all the fibers in the user calibration set selected.

The command [GETCALIBRATION](#) or [GETCALIBRATIONSET](#) will return the number of which stored Calibration set of values are currently selected.

Example:

If you want to reset the user calibration set No.03

setcalibration03

OK

resetusercal

OK

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



User Calibration Mode

ResetRGBM - Reset the RGB usercal setting to factory default

Transmit	Receive
resetrgbm@@ resetrgmall	OK

Where: @@ is the individual fiber number to be reset from 01-20
 ALL will reset all 10 fibers in a specific calibration set

Description:

This command will reset the RGB calibration values (of the RGB calibration mode) to 0 for a particular fiber or for all fibers in a Calibration set. The Led analyser is capable of storing fifty (01-50) separate user Calibration sets on the board. Each one must be reset separately.

Example:

If you want to reset RGB values for all fibers in calibration set No.25

setcalibration25

OK

resetrgmall

OK

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



User Calibration Mode

SetCalibrationDateddmmyyyy - Set the user Cal Date

Transmit	Receive
Setcalibrationdateddmmyyyy	OK

Where:

dd represents the 2 digit Day (01, 02....21, 30)
mm represents the 2 digit Month (01, 02...12)
yyyy represents a 4 digit Year. (2019)

Description

This command allows the user to input the Calibration Date for the Led Analyser. This command is used in conjunction with the user calibration set mode.

These dates are stored permanently in memory and can only be changed by using the *setcalibrationdate* command again.

The command [getcalibrationdate](#) will display the current stored Calibration Date setting and calibration mode settings.

Example:

Set the user Calibration Date for August 1st 2015.

setcalibrationdate01082015
OK

The commands [getcalibrationdate](#) or [getstatus](#) will display the current stored user Calibration Date and calibration set mode.

Example:

01/08/2015

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User Calibration Mode

getcalibrationdate *Get the Calibration Date set by the user.*

Description:

This command will allow the user to interrogate the Led Analyser to return the actual USER Calibration Date in the format dd/mm/yyyy. This is the date set by the user for a specific cal version.

Example:

Connect the Analyser to the Terminal Window and using the getcalibrationdate command, read the data for that Led. Type the command **getcalibrationdate** and the analyser will respond with with the user calibration date in the format **dd/mm/yyyy**

getcalibrationdate
21/01/2015

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Daisy Chain Mode

There are two options when connecting the Daisy Chain Function USB and Serial RS232 :

Daisy Chain USB Wiring Method:

The Daisy chain is a method used to communicate with multiple Led Analyser units to save connections and simplify the wiring.

The 1st Led analyser in the chain is connected to the computer using the USB cable supplied. The remaining LED Analysers are interconnected in a Daisy Chain Bus using the cables provided. The Daisy Chain OUT connector on Led Analyser No1 is connected to the Daisy Chain IN Connector on Led Analyser No2 and so on.(See Fig 9a below). Each Analyser except for No1 must be powered to 5V @100mA. This completes your wiring requirements.

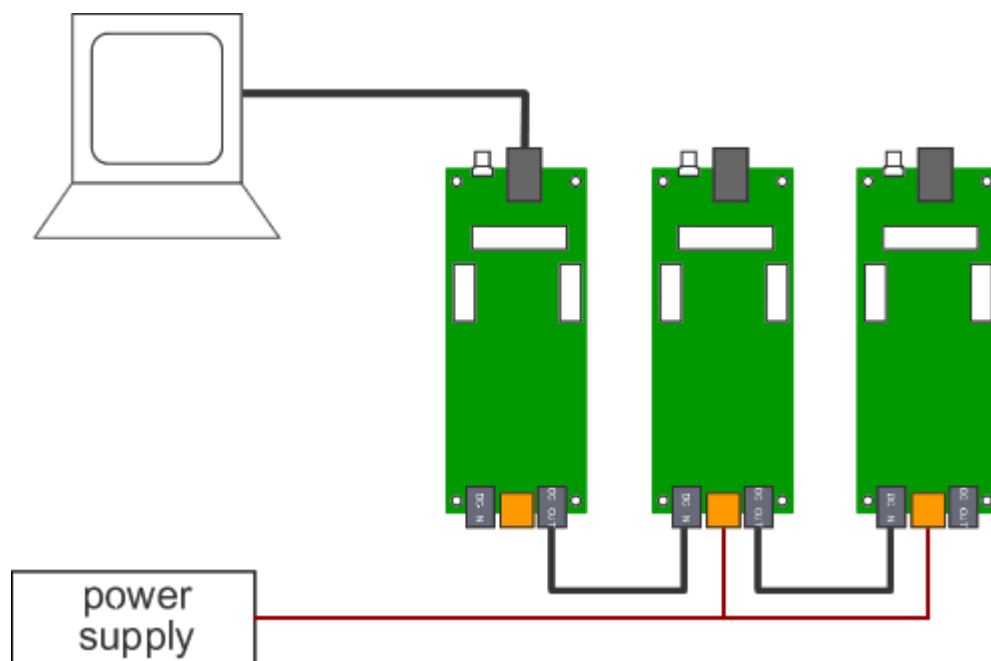


Figure 9a USB Setup

FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Daisy Chain Mode

Daisy Chain Serial Method:

The Daisy chain is a method used to communicate with multiple Led Analyser units to save connections and simplify the wiring.

The 1st Led analyser in the chain is connected to the computer using the Serial cable supplied. The remaining LED Analysers are interconnected in a Daisy Chain Bus using the cables provided. The Daisy Chain OUT connector on Led Analyser No1 is connected to the Daisy Chain IN Connector on Led Analyser No2 and so on.(See Fig 9b below). Each Analyser must be powered to 5V @100mA. This completes your wiring requirements.

Please Ensure the RS232 GND (pin3) and the PSU GND are connected together.

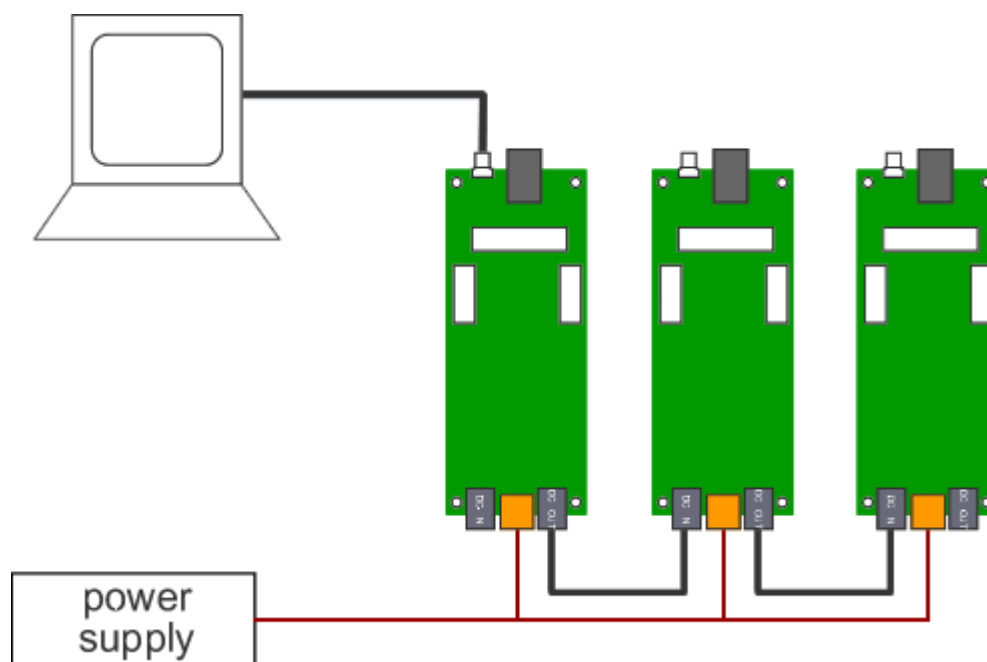


Figure 9b Serial Setup

Daisy Chain Communication

Daisy Chain Baudrate:

The default Port settings of the Analysers are 57,600, 8 Data bits, 1 Stop bit and No Parity. If an incompatible baud rates are selected the Analyser will not respond. Please disconnect the Analysers from the Daisy Chain and reconnect each Analyser in turn using USB or Serial RS232 port and set the required baudrate. All baudrates must be the same for communication purposes. A correct baud rate selected will remain stored in memory even after power off. The command `getbaud` will return the set baud rate. It can also be seen on the comment section of the Feasa terminal window.

Test times are improved by increasing the baudrate from the default to higher values and this can be further enhanced by decreasing the latency (windows default 16) to latency of 1. Refer to the App Note in the documentation folder of the website download page to carry out this.

The LED Analyser connected to the computer receives a command and this command is received by all the other LED Analysers through the Daisy Chain Bus. All Analysers in the chain are active but only the selected LED Analyser is active to give result Data. All responses received by the Computer will be from this active LED Analyser.

Daisy Chain Identification:

Each LED Analyser is identified using a unique 4-character *Serial Number*. This *Serial Number* is fixed to each Analyser or can be read out using the [getSerial](#) command.

There is an option to create a unique user name called BusID. This, like the Serial Number is a 4 -character ID Number. It can be entered using the command `setbusid####`. It can be verified by using the command `getbusid` or `getstatus`.

Feasa provides a **Terminal Program** on the website download page for the customers use. When you connect your 1st analyser the terminal program will detect which port you are connected to. At this time you have the option of connecting to the Standalone option or the Daisy Chain option from the drop down box. If you select the Daisy Chain option you will be asked for the serial Number of the 1st analyser in your chain.

There are a number of commands which are used to control the Analysers in the Daisy Chain. These commands are described on the following pages.

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Daisy Chain Mode

setBUSID Set the Unique ID Number of the Analyser

Transmit	Receive
setBUSID####	

Where: #### is an alphanumeric value. (Always 4 characters)

Description

This command will enter the BUSID Number of the Analyser. This is a customer controlled unique number to identify a n Analyser in a Daisy Chain. The Controlling Software can query each LED Analyser for it's ID Number to ensure the correct Analyser is being controlled. As a factory default BUSID=Serial Number.

Example:

The PC transmits `setbusid####` to the LED Analyser an it will store the new Bus ID.

setbusid1234

getBUSID Get the Unique ID Number of the Analyser

Transmit	Receive
getBUSID	xxxx

Where: xxxx is an alphanumeric value. (Always 4 characters)

By default the BUS ID = the Factory Serial Number

Description

This command will return the BUSID of the Analyser. This is a unique number controlled by the End User which is a way to use a custom identifier, instead of the SN for the Daisy-chain-related commands. The Controlling Software can query each LED Analyser for it's BUSID Number to ensure the correct Analyser is being controlled. As a factory default BUSID=Serial Number.

Example:

The PC transmits `getbusid` to the LED Analyser an it will return the new Bus ID.

**Getbusid
1234**

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Daisy Chain Mode

BusFree - Deactivate any active Analysers

Transmit	Receive
busfree	OK

Description

This command is used to deactivate any active Analysers on the Daisy Chain Bus. This will free the Bus to allow an Analyser to be made active. This command should be issued at the start of a sequence. It is the responsibility of the Controlling Computer to issue commands and monitor the responses. If an Analyser does not respond within 500mSec then the Controlling Computer should issue a new BusFree command and report an error.

The Analyser connected to the computer will operate as a standalone unit after the command is issued.

Example:

The PC transmits **busfree** to free up the Daisy Chain Bus.

busfree
OK

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Daisy Chain Mode

BusGet#### - Activate a LED Analyser

Transmit	Receive
busget####	OK

Where:

represents the Serial Number of the Analyser.

Description

This command will activate the LED Analyser with the specified Serial Number. This command should be preceded by a *BusFree* command. All the *Capture*, *Set*, *Get*, etc commands can now be used with the active Analyser in the chain.

It is the responsibility of the Controlling Computer to issue commands and monitor the responses. If an Analyser does not respond within 500mSec then the Controlling Computer should issue a new *BusFree* command and report an error.

Example:

The PC transmits **BusGet####** to the Master LED Analyser to instruct it to activate the LED Analyser with Serial Number ####.

busgetF044
OK

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Daisy Chain Mode

BusC - Initiate Capture for all LED Analyser's

Transmit	Receive
busc	OK

Description

This command will cause all LED Analysers in the Daisy Chain to initiate a capture sequence using the Automatic Range Mode. To specify a Range manually see the command *BusC#* on the next page.

After the capture cycle use the the command [BusGet####](#) to activate a specific LED Analyser. All the standard commands can then be used to read back the LED Test data.

Example:

The PC transmits **busc** to instruct all LED Analysers in the Daisy Chain to initiate a Capture cycle.

busc
OK

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Daisy Chain Mode

BusC# - Initiate Capture for all LED Analyser's

Transmit	Receive
busc#	OK

Where:

represents the ranges 1, 2, 3, 4, 5, 6.

The LED brightness level for each range is as follows:-

Range 1 = Ultra Low
Range 2 = Super Low
Range 3 = Low
Range 4 = Medium
Range 5 = High
Range 6 = Super

Description

This command uses a pre-selected exposure time designated Range1, Range2 etc. For RGB or dim LED's use Range 1 and for brighter LED's use higher ranges. The higher ranges lead to faster test times because the exposure time is shorter.

This command should be preceded by a [BusFree](#) command.

This command instructs all LED Analyser's in the Daisy Chain to capture and store the Colour and Intensity of all the LED's positioned under the fibers using a fixed range.

The range setting must be specified. The data is stored until the power is removed or another capture command is issued. When completed the Analyser will transmit the character OK on the receive line to the transmitting device (i.e. the PC). Example:

The PC transmits **busc#** to instruct all LED Analysers in the Daisy Chain to initiate a Capture cycle.

busc2
OK

There are 6 manual capture ranges each with an intensity output range of 0 to 99,999. Feasa recommends that the UUT readings should be in the 55K to 85K range for the best stability.

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Daisy Chain Mode

BusC#pwm - Store PWM LED Data for a specific Range

Transmit	Receive
Busc#pwm	OK

Where:

represents the ranges 1 – 6.

Note: The Averaging factor has a default setting of 01 set at the factory.

The LED brightness level for each range is as follows:-

Range 1 = Ultra Low
Range 2 = Super Low
Range 3 = Low
Range 4 = Medium
Range 5 = High
Range 6 = Super

Note: The Averaging factor has a default setting of 01 set at the factory.

Description

This command uses a pre-selected exposure time designated Range1, Range2 etc. For low light or dim LED's use Range 1 and for brighter LED's use higher ranges. The higher ranges lead to faster test times because the exposure time is shorter. This command instructs the LED Analyser to read and store the Color and Intensity of all the LED's positioned under the fibers using a fixed range.

The range setting must be specified. The data is stored until the power is removed or another **capture** command is issued. When completed the Analyser will transmit the character **OK** on the receive line to the transmitting device (i.e. the PC).

This command can be further controlled by the end-user averaging factor to capture the LED data. The averaging factor is in the range 01-99 and can be set by using the [setAverage or putAverage](#) command. The factory default is 01. A larger Averaging factor will lead to more stable results but will increase the Test Times.

Example:

The PC transmits **busc1pwm** to the LED Analyser and the LED Analyser sends **OK** to the PC to acknowledge that the command is completed. Use an average of 7 to capture the data

Busc1pwm
OK

There are 6 manual capture ranges each with an intensity output range of 0 to 99,999. Feasa recommends that the UUT readings should be in the 55K to 85K range for the best stability.

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Daisy Chain Mode

BusCE#### - Poll each LED Analyser to verify a capture is complete

Transmit	Receive
busce####	0 or 1

Where:

represents the Serial Number of the Led Analyser.

If reply is 1 Then Capture is complete

If reply is 0 No Capture

No reply Led Analyser is busy - Timeout 10mS

Description

This command is used to verify that after a [busc](#) (global capture) each Analyser in the chain has complete its capture.

The PC transmits **busce####** to chech each LED Analysers in the Daisy Chain has complete a Capture cycle.

BusceF123 (Where F123 is the s/n of the Analyser)
1

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Daisy Chain Mode

Ports Description and Wiring.



Figure 10

The Daisy Chain Connectors are shown on the right-hand side of figure 10.
The D_OUT connector is connected to the D_IN connector of the next Analyser in the chain.

The Power Connector is used to supply +5V DC to each Analyser in the chain.
Allow 100mA @5V for each Analyser and ensure the wiring is adequate to supply the current without incurring large voltage drops. **For reliable operation it is necessary to have 5V at the Power Connector of each Analyser.** Do not exceed 6V for a prolonged period as this will damage the Analyser.

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Daisy Chain Mode

Daisy Chain Pinout

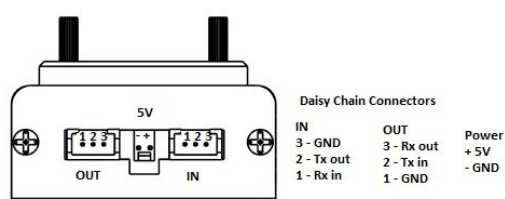


Figure 11 Rear Panel 10-RGB

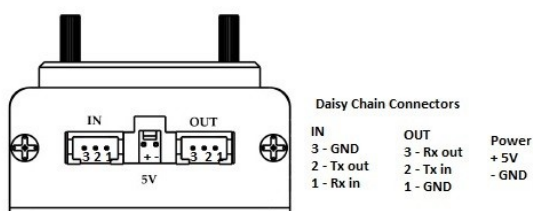


Figure 12 Rear Panel 3,5,6-RGB

PIN	D_IN	D_OUT
1	RX_in	RX_out
2	TX_out	TX_in
3	GND	GND

Table shows the layout of the Connectors viewed from the edge of the board. The *GND* line of *D_OUT* is connected with the *GND* line of *D_IN*, the *RX_out* of *D_OUT* is connected to *RX_in* of *D_IN* and the line *TX_in* of *D_OUT* is connected to the line *TX_out* of *D_IN*.

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Daisy Chain Mode

Step-by-Step method for Daisy Chaining

To successfully implement Daisy chaining the following steps are recommended:-

1. Decide how many Analysers are to be daisy chained.
2. Make a list of the Serial Numbers of the Analysers and note the order in which they will be interconnected. For example we have 4 analysers as follows:

Chain Order	Serial No	Comments
1	A304	Tests D40 – D59 Connected to PC
2	A461	Tests D60 - D69
3	A201	Tests LED01 – LED10 All White
4	A006	Tests LED11 – LED20 All Red

3. Set the required baud rate on each Analyser (All baudrates must be the same).
4. Locate the Daisy Chain cables and connect the Daisy_Out of s/n A304 to the Daisy_In of s/n A461. Connect Daisy_Out of s/n A461 to Daisy_In of s/n A201. Connect Daisy_Out of s/n A201 to Daisy_In of s/n A006.
5. Next locate the 2-pin Power cable supplied to s/n A461, s/n A201 and s/n A006 Analysers. It is necessary to apply 5V @100mA to each of these Analysers in the chain. The green power Led should be visible on these 3 analysers.
6. Connect s/n A304 to the PC using the usb cable. The green power led should come on. If you don't have a usb port available and only a Serial port please connect the s/n A304 to the PC using the Serial Cable provided **AND** connect the 2 pin power connector to the 5V 100mA supply.
7. The supplied Terminal Program can be used to verify the operation of the Daisy Chain. Connect to the port on which the 1st Analyser is installed. See [USB Port Control](#)
8. Send **capture** to verify the communications with the 1st Analyser. The response should be **OK**.
9. Send **getserial** and the response should be **A304**.

Daisy Chain Mode

10. To connect to Analyser 2 (s/n F461) send:-

busfree

OK

Response from the Analyser

busgetA461

OK

Response from the Analyser

The host computer is now connected to Analyser 2 (s/n A461).
This can be verified by requesting the Serial Number:-

getserial

FA61

Response from the Analyser

All the LED Analyser commands can now be directed to Analyser 2.

11. To connect to Analyser 3 (s/n A201) send the following:-

busfree

OK

Response from the Analyser

busgetA201

OK

Response from the Analyser

12. It is possible to instruct all Analysers in the chain to capture LED data simultaneously. This makes programming easier and saves time. There are six capture commands in total but only one can be used at a time. The commands are **busc**, **busc1**, **busc2**, **busc3**, **busc4** and **busc5**. **Busc** uses the automatic capture range whereas **busc1** – **busc5** use pre-selected manual ranges.
13. If you are have difficulty reading from Analysers at the end of your chain please verify your voltage to each of these units is 5V.

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Daisy Chain Mode

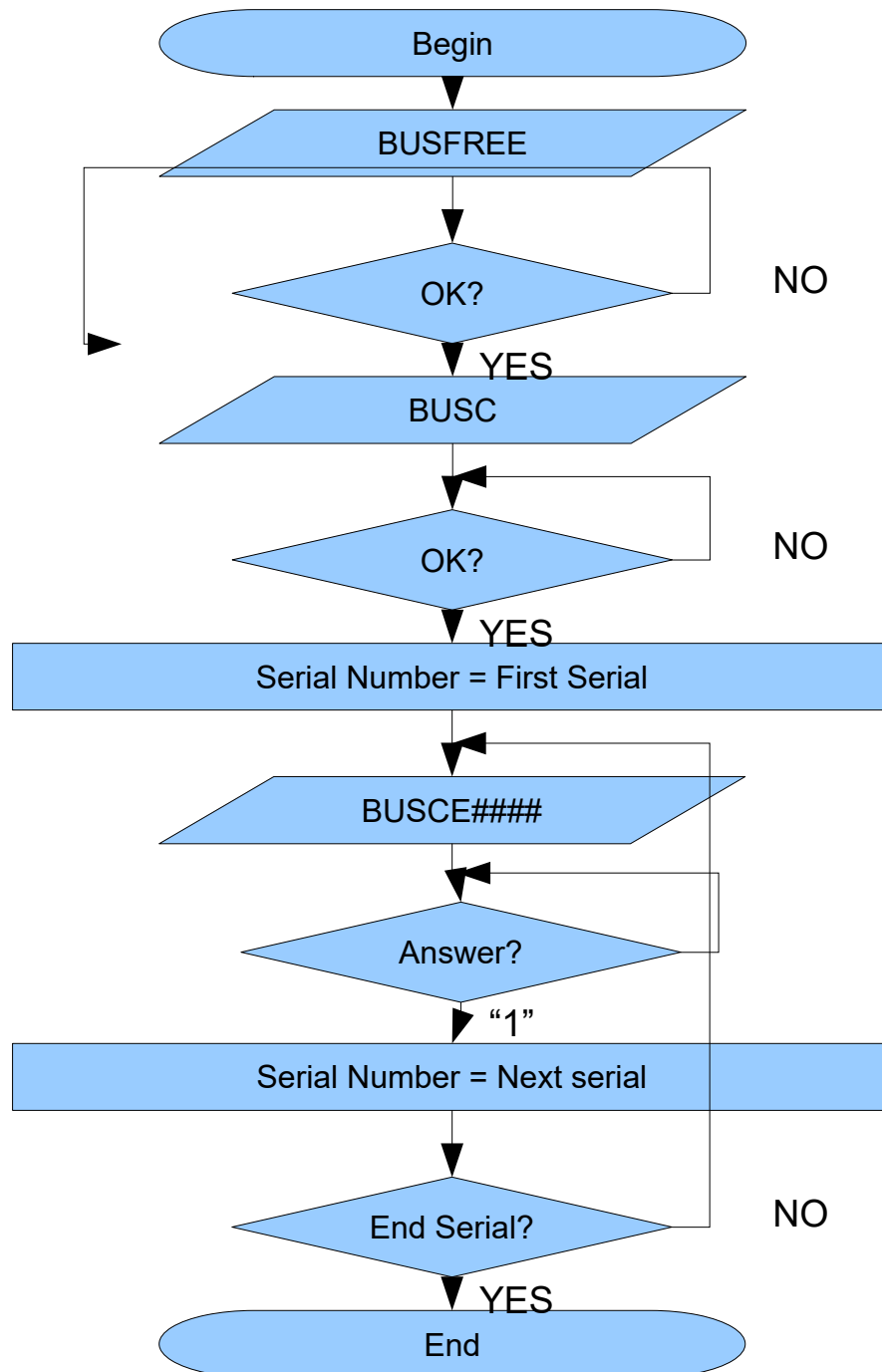
Example

Busfree	'free the bus
OK	
busc3	'All Analysers capture using range 3 High
OK	
busceA304	'poll the analyser A304
1	
busgetA304	'Connect to the Analyser F304
OK	
getserial	'Confirm s/n of the Analyser
A304	
gethsi01	'Get the Data for Fiber 1
000.51 100 36491	
gethsi02	
.	
.	
gethsi10	
120.51 100 66542	'Data for Fiber 10
busfree	
OK	
busceA461	
1	
busgetA461	'Connect to the next Analyser F461
OK	
getserial	'Confirm to Analyser
A461	
gethsi01	'Get the Data for Fiber 1
000.51 100 36491	
gethsi02	
gethsi10	'Get the Data for Fiber 10

.
Repeat this sequence for all Analysers in the chain.

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Step-by-Step approach to Testing a LED

Standard Capture Mode

To Test the Color and Intensity of up to 10 LEDs simultaneously carry out the following:

1. Ensure that the LEDs to be Tested are turned on and that the fibers are centered over the LEDs.
2. To Test the Color and Intensity in **RGB** first send the command **capture** to the LED Analyser. The LED Analyser will return the characters **OK** indicating that the Color and Intensity data for the LEDs has been stored in the internal memory.
1. Transmit the command **getrgbi01** to retrieve the results for Fiber 1. Any fiber can be queried by sending the command **getrgbi##** to the LED Analyser, where **##** is the fiber number in the range **01 to 10**. The LED Analyser will return the results in the format **rrr ggg bbb iiiiiE** where **rrr**, **ggg** and **bbb** are the **red**, **green** and **blue** components of the light in decimal format in the range **000 to 255**. The **iiii** value indicates the intensity value of the light in the range **00000 to 99999**.
2. Alternatively, the Led Analyser may also be queried to retrieve the Hue, Saturation and Intensity results for the LEDs under test. After step 2 send the command **gethsi##** to the LED Analyser where **##** is the fiber number. The LED Analyser will return the results for that fiber in the format **hhh.hh sss iiiiiE** where **hhh.hh** is the Hue, **sss** is the Saturation(whiteness) and **iiii** are the Intensity results for that Fiber.
3. When using the Capture or C command an Intensity value of 0000 will indicate that the LED under test is not bright enough. An Intensity value of 99999 will indicate that the LED is too bright and the LED Analyser has an over-range condition. Either increase the or decrease the distance of the LED to the Fiber or increase/decrease the LED Intensity.
1. In general, try to keep the Intensity less than 80,000 and greater than 20,000.

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Command Summary:

Capture Commands	Page	DESCRIPTION
capture or c	18	Measure Static LED Data - Auto Range
capture# or c#	19	Measure Static LED Data - Manual Range(1-5)
capturepwm or cpwm	20	Measure PWM LED Data - Auto Range
c#pwm	21	Measure PWM LED - Manual Range(1-5)

Get Led Data Commands	Page	DESCRIPTION
getrgbi## or getrgbiall	23	Get RGB, Saturation and Intensity for LED/LEDS
gethsi## or gethsiall	24	Get Hue, Saturation and Intensity for LED/LEDS
getxy## or getxyall	25	Get the xy Chromaticity values for LED/LEDS
getxyi## or getxyiall	26	Get the xy Chromaticity and Intensity values for LED/LEDS
Getxyz## or getxyzall	27	Get the XYZ data for LED/LEDS
getuv## or getuval	28	Get the u'v' Chromaticity values for LED/LEDS
getwavelength## or getwavelengthall	29	Get Dominant Wavelength for LED/LEDS
getwi## or getwiall	30	Get Wavelength & Intensity for LED/LEDS
getwsi## or getwsiall	31	Get Wavelength, Saturation & Intensity for LED/LEDS
getcct## or getcctall	32	Get Colour Temperature for LED/LEDS
getintensity## or getintensityall	33	Get the Intensity for LED/LEDS
getabsint@@ or getabsintall	34	Get the Absolute Intensity for a LED / LEDS
getsignallevel## or getsignallevelall	35	Get the Intensity of the LED/LEDS in % mode
get7seg#	36	Get the value of a 7segment display

General Control Commands	Page	DESCRIPTION
setfactor / getfactor	48/37	Set / Get the Sensitivity Level (Exposure Factor) of the Analyser
Setaverage / getaverage	47/38	Set / Get the Number of Averages used for PWM measurements
setbaud / getbaud	46/39	Set / Get the Baud Rate the Analyser is set to

System Commands	Page	DESCRIPTION
gethw	40	Get the Hardware Version of the Analyser
getstatus	41	Get the summary details of a Led Analyser
getserial	42	Get the Serial Number of the Analyser
getversion	43	Get the Firmware Revision of the Analyser
getnfib	44	Get the Number of Channels on a Led Analyser

External Trigger Commands	Page	DESCRIPTION
setexternalcapture####	49	Set the External Trigger Capture mode
getexternalcapture	49	Verify what capture mode the external trigger is set at.
setexternaloutput####	49	Set the External Trigger Output mode
getexternaloutput	49	Verify what capture mode the external trigger output is set at.

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Daisy Chain Mode Commands	Page	DESCRIPTION
setbusid /getbusid	72	Set / Get the customer unique ID of an Analyser in the Dasiy Chain
busfree	73	deactivate any active Analysers on the Daisy Chain Bus
busget####	74	activate the LED Analyser with the specified BUSID (default BUSID-SN)
busc	75	Auto Capture range all led data from the Analysers on the bus
busc#	76	Manual Capture range all led data from the Analysers on the bus
busc#pwm	77	pwm Manual Capture all led data from the Analysers on the bus
busce####	78	Returns a 1 if capture has complete in with BUSID ####

UserCal Commands	Page	DESCRIPTION
set / getINTGAIN	55/56	Set / Get the Intensity Gain of the Led Analyser
set / getXOFFSET	57/59	Set / Get the X Chromaticity Offset of the Led Analyser
set / getYOFFSET	58/60	Set / Get the Y Chromaticity Offset of the Led Analyser
Set / getwavelengthOFFSET##	61/62	Set / Get the Wavelength Offset of the Led Analyser
Set / getabsintmult@@m.mmmme+mm	63/64	Set / Get the Absolute Intensity Correction Factor of the Led under test.
setcalibration##	53	Set the Calibration version of the USER
getcalibration	54	Return the set number of the activated calibration
resetusercal	65	Reset the active calset usercal parameters to the factory defaults
resetrgbm	66	Reset the RGBM usercal to factory settings
setCalibrationDateddmmYYYY	67	Set the Calibration Date of the USER
getcalibrationdate	68	Get the Calibration Date set by the user

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Specifications

Part Number(s)

Feasa 10-RGB	LED Analyser with 10 Fibers
Feasa 6-RGB	LED Analyser with 6 Fibers
Feasa 5-RGB	LED Analyser with 5 Fibers
Feasa 3-RGB	LED Analyser with 3 Fibers

Physical

Dimensions: 144mm x 54mm x 55mm (L x W x H) - Feasa 10-RGB
Dimensions: 104mm x 54mm x 55mm (L x W x H) - Feasa 6-RGB, 5-RGB, 3-RGB
Fiber Length 0.6m
Fiber Diameter 2.2mm incl. Cladding
Fiber is polished both ends for optimum performance
Minimum Bend Radius: 35mm
Fiber Core Diameter 1.5mm
Number of Fibers 3, 5, 6, 10
Operating Temperature Range 0°C to +50°C

Electrical

Supply Voltage 5.0V
Supply Current 200 mA
USB 2.0 Interface, Serial RS232 Interface
Output Data Format RGB, HSI, XY, UV, Wavelength, CCT

Optical

Total Operating Wavelength Range 450 nm to 650 nm

Accuracy

White $X = \pm 0.01$, $Y = \pm 0.01$ @ $x=0.33$, $y=0.33$ using OH-16 Optical Head

Capture Test Times

Auto Range	1900ms
Range 1 (Ultra Low Intensity)	850ms
Range 2 (Super Low Intensity)	350ms
Range 3 (Low Intensity)	280ms
Range 4 (Medium Intensity)	240ms
Range 5 (High Intensity)	190ms

Typical Values obtained using non-PWM captures @ 57600 baud. These values can be effected by the exposure factor, averaging factor, baudrate, port latency, USB cables, hubs, programming languages, compiler settings etc..

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FEASA LED ANALYSER RGB FUNCTIONAL VERSION



Warranty

1. Feasa Enterprises Limited (herein referred to as Feasa) warrants Feasa hardware, accessories and supplies against defects in materials and workmanship for the period of one year. If Feasa receives notice of such defects during the warranty period, Feasa will, at its option, either repair or replace products which prove to be defective. Replacement products may be either new or like-new.
2. Feasa warrants that Feasa software will not fail to execute its programming instructions, for the period of one year, due to defects in material or workmanship when properly installed and used. If Feasa receives notice of defects during the warranty period, Feasa will replace software media which does not execute its programming instructions due to such defects.
3. Feasa does not warrant that the operation of Feasa products will be uninterrupted or error free. If Feasa is unable, within a reasonable time, to repair or replace any product to a condition as warranted, customer will be entitled to a refund of the purchase price upon prompt return of the product to Feasa.
4. Feasa products may contain re-manufactured parts equivalent to new in performance or may have been subject to incidental use
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6. Warranty does not apply to defects resulting from:
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 - (c) unauthorized modification or misuse,
 - (d) operation outside the published environmental specifications for the product, or
 - (e) improper site preparation or maintenance.
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