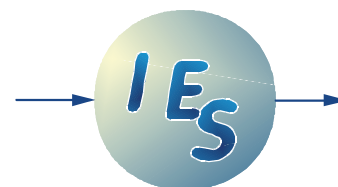


IES 4415 Onbord LED - Controller



SYSTEM DESCRIPTION

Mobile ruggedized supply and control unit for up to 8 LED illumination heads.



Revision RB16

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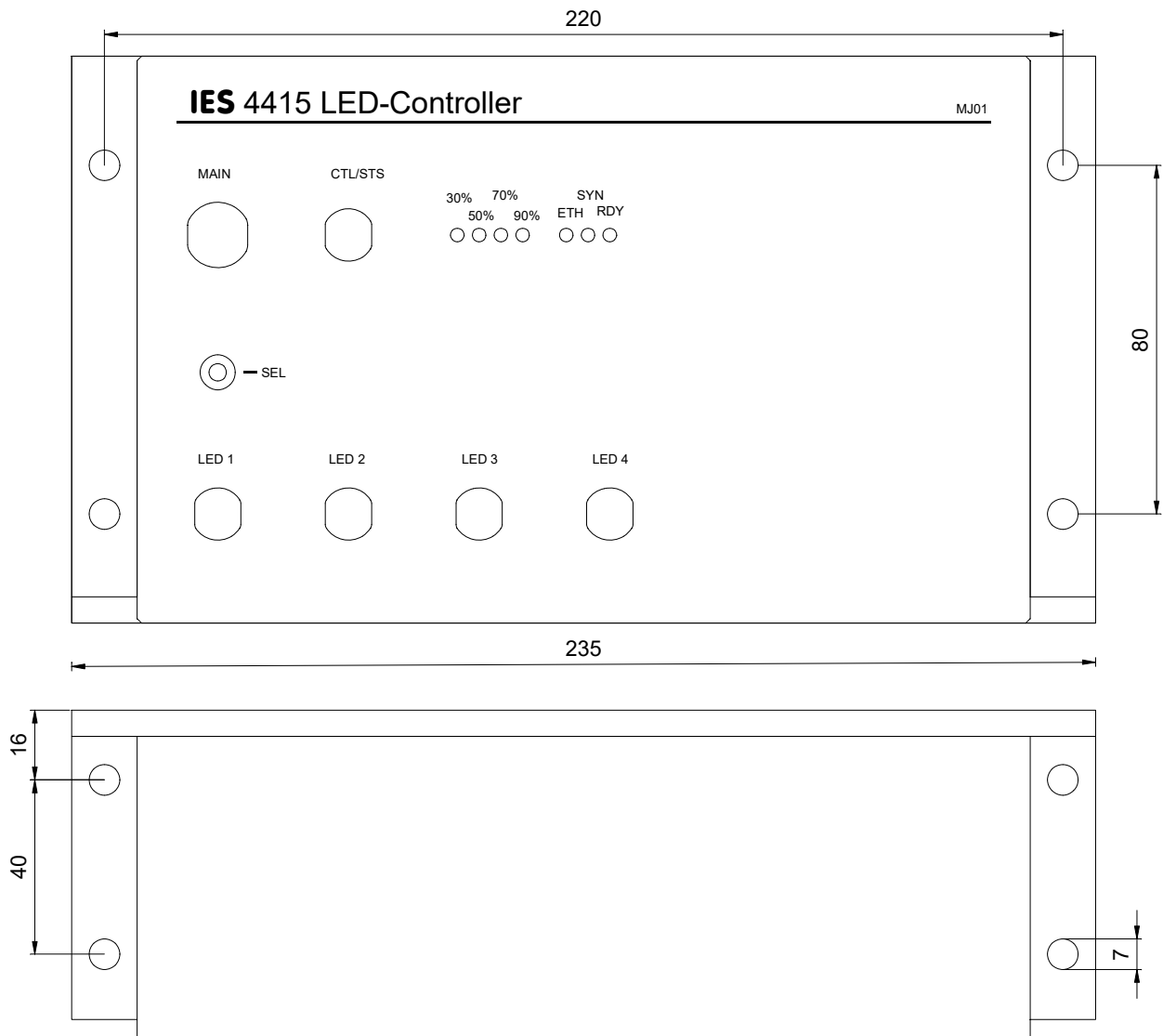
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1 Overview

This onboard LED controller can supply energy and can control up to 8 LED illumination heads. It is made for installation on board of a vehicle and may be used in crash testing scenarios. It contains internal rechargeable batteries.

1.1 Mounting information

The drawing below shows the main measures. We recommend the good practise of having a stopping edge on the users mounting plate, which can take the acceleration force.



2 Connectors and Front Panel elements

All connectors and user interface elements are located on the front panel.

2.1 MAIN connector

The MAIN connector is used to connect this device to the user's existing infrastructure. Connections are:

- Power supply to internal charger
- Ethernet for communication
- Trigger input
- Sync input

The pinout is given in the table below.

Connector type in front panel: Lemo EGA.2B.318
Connector type for user cable: Lemo FGA.2B.318

Pin	Signal	Remark
1	Ethernet A-	
2	Ethernet D-	
3	Ethernet B-	
4	Ethernet B+	
5	Ethernet C+	
6		
7	+CHGSUP	Charger-Input 40-48 V, 1 A
8	+CHGSUP	as above
9	SYNC+	
10	SYNC-	
11	-CHGSUP	Device-GND and Charger-GND
12	-CHGSUP	as above
13	Ethernet A+	
14	Ethernet D+	
15	Ethernet C-	
16		
17	+T0	
18	-T0	
Case		

The input signals SYNC and T0 are of type RS-485. They are pulled to their respective quiet voltage levels by internal pullup resistors and therefore may be left open, if unused.

These inputs also accept TTL input signals. These must be referenced to GND. This table shows, how to connect a **TTL sync signal** to the MAIN connector:

TTL sync out from user's equipment	MAIN Pin 9
TTL GND from user's equipment	MAIN Pin 11

It would be possible to signal T0 with a closing contact between pins 17 and pin 11 - however this is not recommended, because it is an RS-485 input and not an explicit contact input. But it's ok for testing purposes.

2.2 CTL/STS connector

The CTL/STS connector has control and status signals for exchange with external equipment. The signals are optoisolated and the couplers have internal current limiting circuitry, so they can be driven from sources between 5 V and 24 V without additional resistors. Functions provided:

- START signal input to start the light
- READY output to signal ready status
- Remote front panel button control input

There is also an isolated 5 V voltage source provided on this connector. It makes it easy to use the optoisolated inputs from closing contacts.

The pinout is given in the table below.

Connector type in front panel: Lemo EGG.1B.308
Connector type for user cable: Lemo FGG.1B.308

Pin	Signal
1	Opto-Start K
2	ISO 0V
3	Opto RDY C
4	Opto RDY E
5	ISO +5 V
6	Opto Start A
7	Opto Setup light A
8	Opto Setup light K

2.3 LED head connector

The LED illumination heads are connected to the LED 1, LED 2 , ... output connectors. Each output connector can supply two LED heads, or one double LED head. Each output connector has one temperature supervising input channel.

If (downgraded) devices are not fully equipped with LED ports, then the lower connector numbers

ar functional (starting at LED1) and the higher numbers are not functional.

The pinout is given in the table below.

Connector type in front panel: Lemo EGG.1B.306

Connector type for user cable: Lemo FGG.1B.306

Pin	Signal
1	LED A1
2	LED K1
3	LED A2
4	LED K2
5	NTC a
6	NTC b
Case	Screen

2.4 LED status markers

The status markers indicate

- Charge level of internal batteries
- Ethernet communication activity
- Sync input signal present
- Controller ready status

During charge (when external power supply is attached to MAIN connector) the highest charge level LED blinks. This indicates, charging takes place. The charging is complete, if all charge indication LED's are ON.

Ethernet indicator is normally ON, and is blanked for a moment, if a command is received and processed.

Sync LED is ON, if a valid external sync signal is recognized.

Controller ready status is signalled, if battery is in good condition and no temperature is higher than the "ready level". See operating instructions for more on ready signalling.

2.5 Front panel button

The front panel button provides these functions:

- Switch ON the device (press short)
- Switch ON or OFF the light (press 1/2 second)
- Switch OFF the device

Switching ON is simple, just press shortly.

Switching the light is done by pressing the button a bit longer, then release. Light is switched on at the lowest level on the first press (called setup light), then switched to full level on the second press, then switched off on the third press.

Switching OFF the device is done by pressing the button long, approx 8 seconds (or more). The LED's give feedback: All turned off.

3 Functional Description

3.1 Unknown IP

If the devices IP is unknown, these are the possibilities:

- use SRCH cmd from Diag4400 with ethernet broadcast in a small network
- use SRCH cmd from Diag4400 with device address "0000", e.g. together with broadcast

If still lost, device must be sent in to factory.

3.2 Setup light

High speed filming typically goes in parallel with a short term lighting demand. But for the set up of cameras and lenses more time is required. To prevent excessive heating up of LED heads, drawing energy out of batteries and heating up test objects it is wise to use a lower light level, called setup light. This can be switched ON by command or by pressing the front panel button, and the percent level of light can be set using Diag4400 software.

A **better concept** for setting up cameras and lenses is to use the **full light level**, but a **reduced frame rate** like 100 fps. It means only a tenth of energy and heating, and also very convenient light level for the human eye. And, as the pictures are illuminated with the final parameters (shutter time, light level) **you see what you get** during the set up. No post-adjustment of lenses is to be done then.

The low frequency setup can be done by feeding in an external sync signal (e.g. from a camera), or by setting the internal frequency generator to 100 fps.

3.3 Starting the light

The light can be started by

- pressing the front panel button (once or twice)
- software command
- electrical signal or closing contact at CTL/STS connector (OPTO Start function)
- electrical signal or closing contact at same connector (RMT function)

The OPTO start function switches ON full light immediately. The RMT (remote) function is internally wired in parallel with the front panel button and thus all functions of this button can be done with an external signal. For example it would be possible to use a small user built operator panel with 6 meters cable as a remote control.

The duration of light ON can be selected between two possibilities. If "Start is signal controlled" is checked in Diag4400 software, then the light is ON as long as the external signal is active. The external signal directly controls on/off of the light. If this is unchecked, then the external signal acts as a start timer trigger and light is switched ON for a duration set by the timer value.

3.4 SYNC and CONT modes

The LED controllers may operate in SYNC mode or in CONT mode. The actual mode can be read with the command GMOD ("get mode"), which is answered with a string like "0000". These are two hex numbers 00 and 00 which reflect the settings für mode and sync edge.

To change the operating mode use command "SMODxxxx" (set mode"), where xxxx is the number from this table:

Mode	xxxx
Sync	0000
Cont	0101

For example send SMOD0000 to set sync mode.

3.5 External sync input

The LED controllers detect the external signal automatically. If detected, the yellow LED is switched on and the rising edge of the external signal is used to trigger an output pulse to the lights. It means, that for every rising edge one sync pulse with the configured width (see Diag4400) is output. For example, if setting up 250 µs pulse width and applying an external signal of 1000 Hz, then the lights will see one pulse 250 µs every 1 ms. If lowering the external frequency to 100 Hz, the pulse width remains unchanged, so lights will see a pulse with 250 µs every 10 ms.

3.6 Special Functions

Some special functions are implemented into the LED controllers. These functions can be switched on or off using the Diag4400 software, see below. The bits are combined to form a number value. An example: If TLH function and ET0 function are wanted, this gives a value $1+4 = 5$ to be stored into the device.

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
-	-	-	-	-	ET0	SYM	TLH

TLH Set Temperature limit high

Setting may be used for climate chamber operation. LED heads will NOT be switched off at elevated temperatures, when set. It is then a responsibility of user to ensure switching off before damages to LED head or illuminated objects can occur.

SYM Sync multiplexer

If set, the external sync signal is taken from CAM1 connector. If not set, the external sync signal is taken from MAIN (or 5B) connectors.

ET0 Emergency T0

When set, controller switches ON the light if a T0 signal is received. This provides some additional "feel well" in scenarios where long delays between start light and T0 may occur and thus a timer could unhappily may be timed out. A disadvantage of ET0 is, that light is switched ON repeatedly during T0 test in preparation phase of a vehicle. This can potentially be harmful for working personell, if they are close to the LED heads. Administrative rules should be set up for working people, if using this function.

Remark: The small controller 4415 does not support SYM and ET0.

3.7 Device shutdown timer

The LED controllers have an internal shutdown timer with a user settable value (see Diag4400). Devices will be ON as long as external power is applied. If no external power is present, timer counts down and finally switches off the device. This prevents (forgotten) devices from drawing the battery empty. A **special value 255** can be used for the timer: In this case the **shutdown is disabled** and it is in users responsibility to switch off device before the battery is empty!

4 Diag4400-Software

IES provides a free PC software named "Diag4400", which is primary intended for diagnostic purposes related to the LED controllers. It can also be used as a lightweight front end for controlling the light function (switch on/off). To obtain the latest revision, or report bugs and wishes, please contact [office\(at\)ies-elektronikentwicklung.de](mailto:office(at)ies-elektronikentwicklung.de).

The description is based on LED controller model IES 4416 with firmware QL16 or later and Diag4400 revision RB11 or later.

The software has one EXE file (Diag4400.exe) and one INI file (IES4400.ini). These both should be placed in a free to choose directory on a Windows PC. Microsofts DotNet 2.0 framework must be installed on that PC.

4.1 Finding and connecting LED-Controllers

At first, a proper INI file should be prepared (text editor). See an example below. The port setting (UDP) tells the software with what type of interface it should communicate with the controller. UDP is the default setting for ethernet communications.

The [IPSEARCHLIST] provides a set of IP numbers and controller serial numbers. It should contain at least one entry.

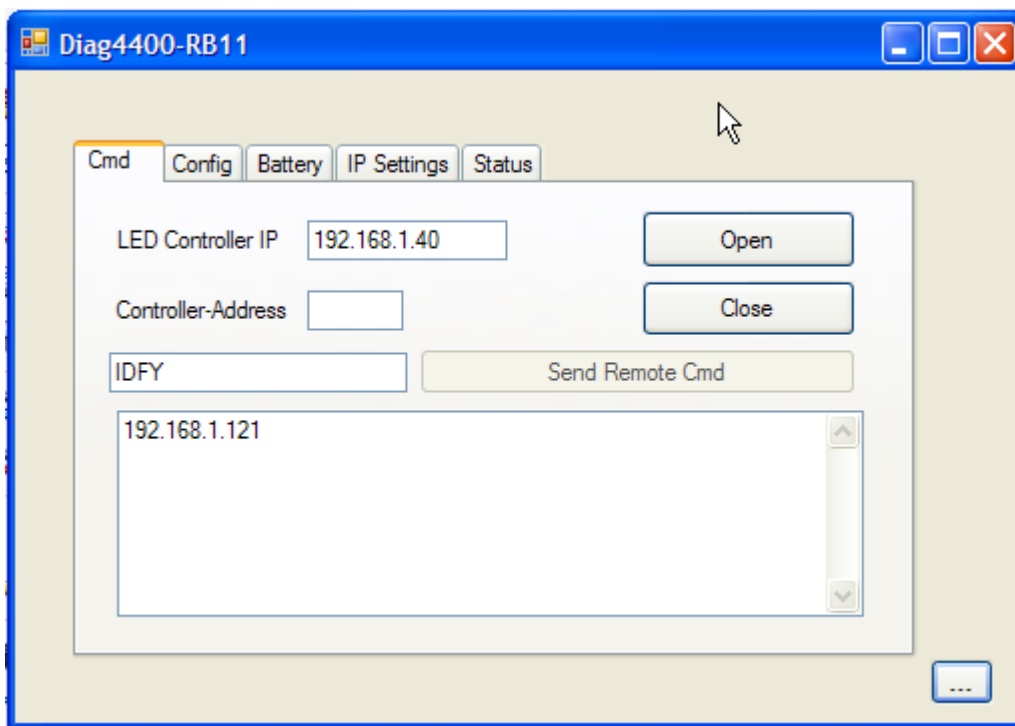
```
[REMOTEPORT]
PORT=UDP

[IPSEARCHLIST]
DEVICE1=172.22.102.81 PK03
DEVICE2=192.168.1.40 PK40
DEVICE3=192.168.40.37 PK08
```

After program start, devices are searched according to this list. If **no controller is found** in the network, this error message is displayed:



In this case, after clicking OK, the software shows a CMD tab, where a manual connection can be established. Enter the IP address of an LED controller and the controllers serial number (like PK09) into the text field "Controller address"), then press "open".



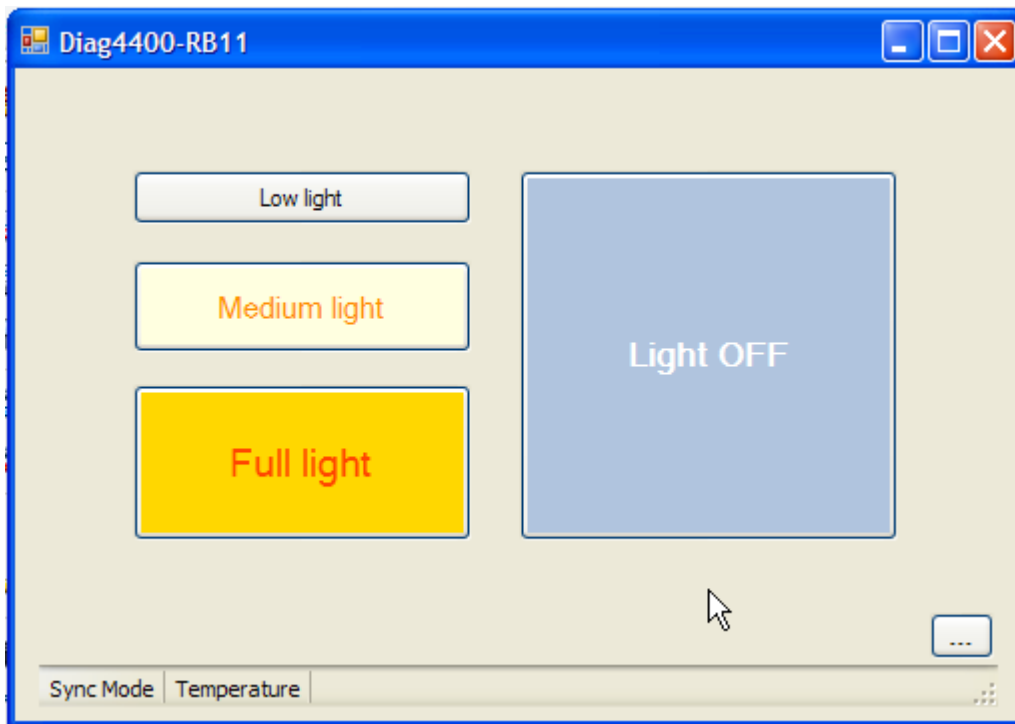
To check, if the device responds to commands, send a remote command like IDFY (identify), using the button "send remote cmd". The answers from the controller are displayed in the textfield at the bottom.

If the controllers serial number is not known, the special address "0000" can be used. Then, only one command, "SRCH", will give an answer, if a controller hears it. It sends its serial number, and from then on communication can be made with the proper address.

If the IP is not known, a **broadcast** into the network can be done (255.255.255.255). This may be rejected from your network. In smaller networks, or peer to peer cabling, you may use the broadcast plus the "0000" to find a device with absolutely no preliminary information of it. Only, the PC must be in the same network as the controller (a general requirement of ethernet networking).

If connection to an LED controller is finally established, press the button named "..." in the lower right edge of the form. This brings you to the normal start screen.

In the **normal case** (finding controller from INI list) after program start, the screen looks like this:



It is an operator panel for switching on/off the light.

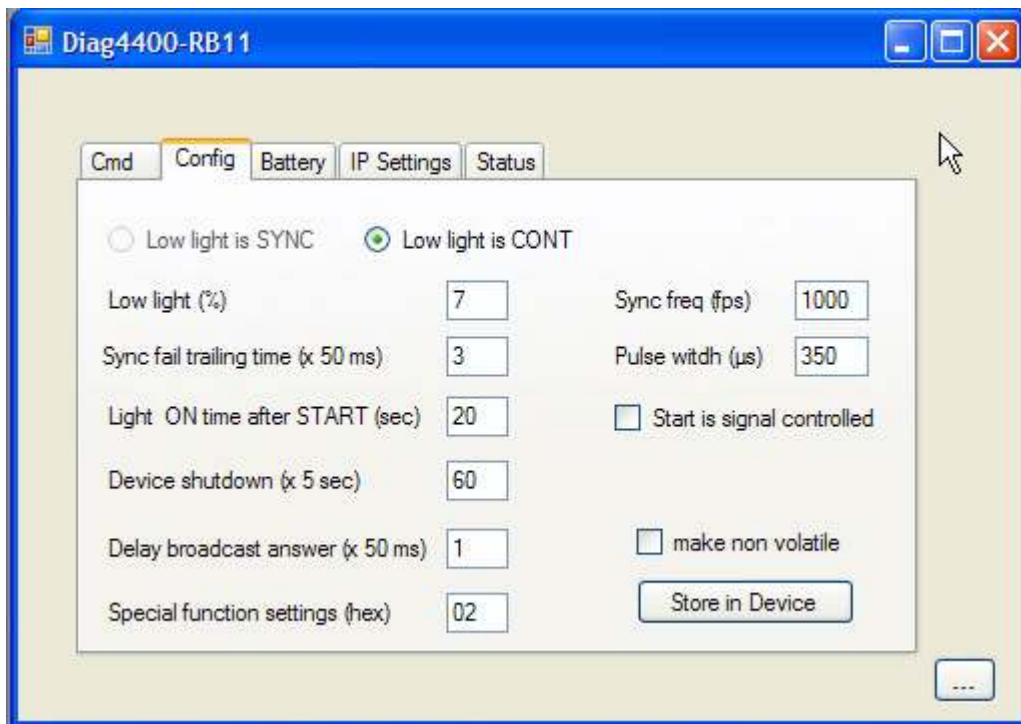
Access to the diagnostic functions is reached by pressing the "... " button in the lower right edge of the form.

4.2 CMD-Tab

The CMD tab was already mentioned. Experienced users may send commands to the controller from here and see the answers. Also, all buttons from all tabs of the software do the same, sending commands and processing the answers. The commands are always four big letters, like "IDFY", which is a mnemonic for the word "identify". The answers are shown in the big text box for manual evaluation. Text here can be marked and deleted ("delete all" from the mouse context menu), to clean up the area from time to time.

4.3 Config-Tab

This tab enables a lot of settings to be made.



Low light % sets up the intensity of the lowest light level, also called setup light.

Sync fail trailing time (depracted) will keep the light switched on for some time after an external sync signal stops (potentially fails). It is a good feature for crash test scenarios, but it is unwanted at test stands, where a camera controls the light on/off by its sync output. Therefore it was made configurable by the user. This value is depracted now and controllers will ignore the setting. Use SyncMode instead.

Light ON time after START sets the duration of an internal timer. Light will be switched off after this duration. START light can be done from an ethernet command or from a contact signal.

Device shutdown controls that the device will shut down (switch itself off) after some time of inactivity and when disconnected from external power supply. It prevents a forgotten device to draw the battery empty. A special value 255 can be used, if the device should never switch off. It is a responsibility of the user, to switch it off manually, after work is done.

Delay broadcast answer is a setting for helping to find devices with the SRCH command. All devices in an RS-485 network should be set to different delays, so after a broadcast they will respond one after another, making it likely to be found. If all devices would respond simultaneously, only garbage answers will be produced and finding is difficult.

Special function settings is a bitmask for special functions. These are device specific and explained in the hardware chapters.

Sync freq is a setting for the internal sync generator.

Pulse width is a setting for the output pulse width of sync signal, that is given to the cameras and the LED light. Preferably use a pulse width lower than 50% of the frame period to have maximum power output from LED heads. If using more than 50% duty cycle, power is automatically reduced.

Start is signal controlled is a selection between timer control of LED light or direct control from a hardware signal. If not checked, the external START signal starts the internal timer, which controls the light on duration. If checked, the external START signal controls the light output directly, so the duration of the signal is used for switching on the light (as opposed to the timer duration).

Make non volatile, if checked, makes the settings nonvolatile after the **Store in Device** button is clicked. If not checked, the **Store in Device** button sends the new settings to the device, and device uses them, but will forget the changes at power off. This volatility is good for experimenting, for temporary setups or when a controlling software sets up the LED controllers prior to each test. The non volatile storage option is good for stand alone applications.

4.4 Battery-Tab

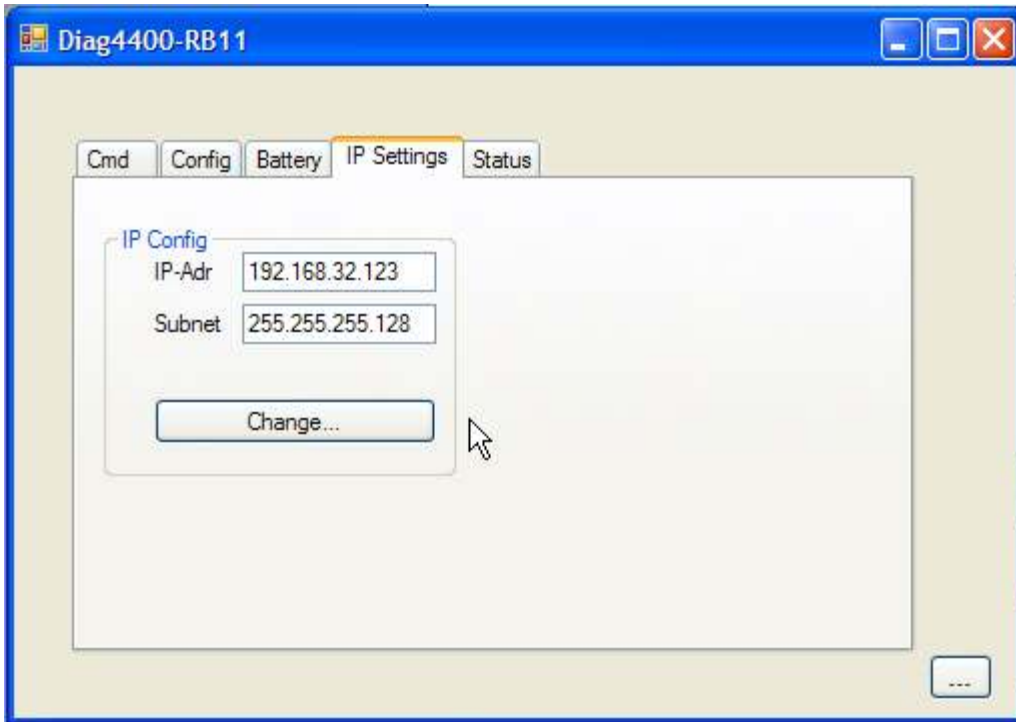
This tab shows the state of charge in percent, the load current and the individual cell voltages. Cell voltages are colored green, if they are in a normal range, and colored orange, if abnormal. The values are only updated on entering the tab, not polled automatically.



4.5 IP-Settings -Tab

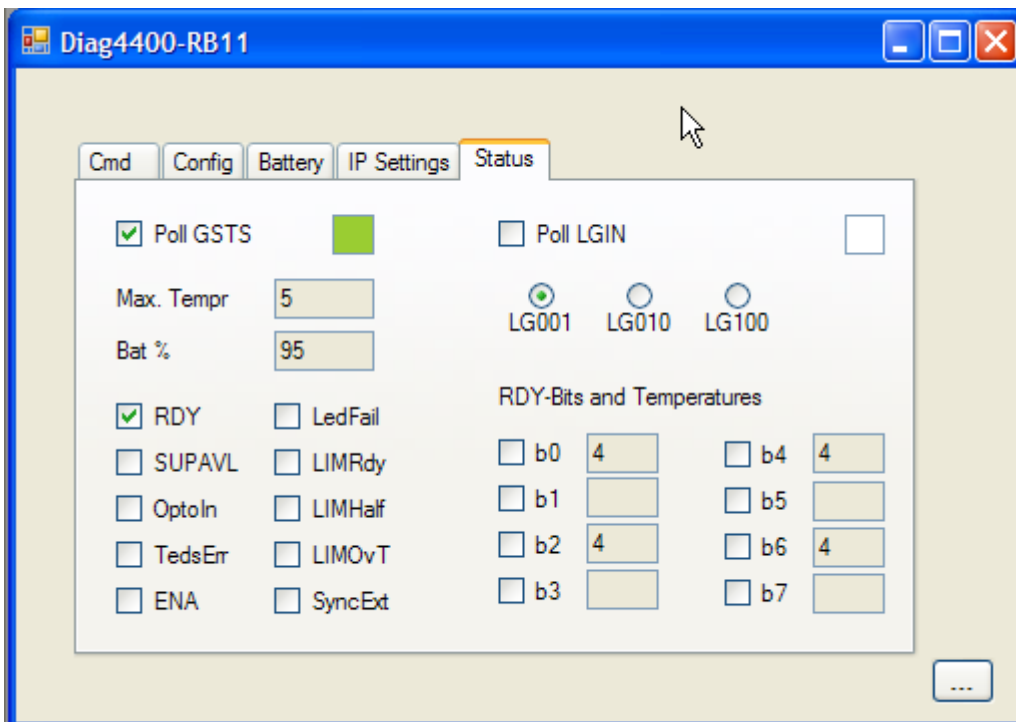
This tab displays the IP setting of the device. It may be changed and written into the device using the "change..." button. A password dialog comes up. The password is currently empty.

After a change and write into the device, the device keeps using its old IP until a fresh power up is done.



4.6 Status -Tab

This tab provides status information about the LED controller. The status is read from the device on entering the tab (when displayed first). It is also possible to periodically update the status by checking the Poll GSTS and/or Poll LGIN boxes. The periodical refresh causes communication traffic every second and fills the "answer" textbox (on CMD tab) quickly. It is not a general problem, but may not be wanted for diagnostic purposes. This is why polling can/must be checked yes/no.



Polling GSTS (GSTS is the command used for this poll, it is a mnemonic for "get status") delivers

- the maximum temperature of all connected LED heads
- the state of charge of the battery
- the ready state of the device
- a SUPAVL flag indicating external power supply is present
- status of OPTO IN input (signal from CTL/STS connector), used for switching on the light
- error indication for config memory (Teds)
- ENA flag, if set, the light is logically ON, but may be dark, if waiting for sync signal
- LED fail flag, indicating an LED head failed to illuminate (requires proper setup SLJB)
- temperature limit flags (see functional description)
- SYNCEXT flag indicating an external sync signal

Polling LGIN (lamp group information) delivers the temperatures for every LED head and the so called "ready bits" for every LED head. This bit is set, if the light is illuminated.

The LED controller 4416 has three lamp groups, LG001, LG010 and LG100. The diag software polls all three (if polling is checked), but displays only the one selected to keep the display compact.

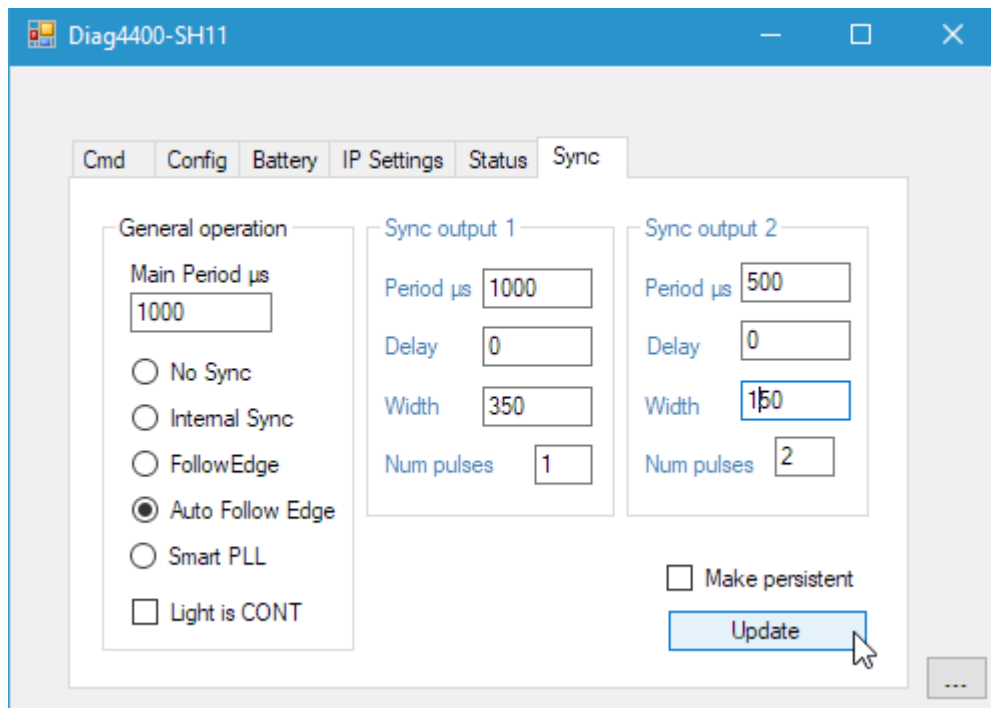
4.7 SYNC -Tab

In "General operation" the main period is set. The main period determines all timing of the device. In PLL mode it should match the external frequency (1/x). One of five different sync modes can be chosen with the radio knobs. A tool tip text is available for each to explain the behaviour.

Normally, light output is synchronized to the camera signal. If the checkbox is checked, light output will be continuous, not synced. It would, for example, be possible to select "no sync" (then no sync supplied to cameras) and checkmark CONT to have continuous light.

The device has two sync channels. They can be set to different parameters. It is a very flexible way to address different, but still synchronized sync frequencies, or anti-phase illuminations.

But 3rd party software (like popular Falcon) may not be able to use the so called extended sync functions. The dialog gives a feedback about the extended or simple functions by the color of text, as can be seen in the screenshot. If text is blue, the settings are "extended functions". These can be handled with the Diag4400 software, but if 3rd party software touches the controller, the settings may be reset to simple parameters (one channel, no delay, one pulse per period).



Remark: The small controller 4415 supports only one sync phase and has no internal sync generator (no PLL). It is always operated in FollowEdge mode.

5 CE Conformity

We,

IES Ingenieurbüro für Elektronikentwicklung und Spezialgerätebau Dr.-Ing. U. Bahr
In den Waashainen 2
38108 Braunschweig
Germany

hereby declare in sole responsibility, that our product

IES 4415 LED Controller

complies in conception and production with the following EU standards

2014/30/EG (EMC)

Applied standards:

EN 61000-6-2

EN 61000-6-4

If any modifications are applied from the end user, this declaration is invalid.

2016-06-01
(Date)



(Dr.-Ing. U. Bahr, company owner)