

PP480 LED Lighting Controller



User Manual

Except as prohibited by law:

All hardware, software and documentation are provided on an 'as is' basis. This information is for guidance only. Installers must perform their own risk assessment specific to each installation.

It is essential that the user ensures that the operation of the product is suitable for their application.

The user must ensure that incorrect functioning of this equipment cannot cause any dangerous situation or significant financial loss to occur.

Deliberate acts of endangerment and vandalism are not covered by this document and must be considered by the installer.

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1 Getting Started

This user manual describes the setting up and operation of the PP480 lighting controller for machine vision applications. The PP480 is a four channel lighting controller that provides 2 Amps continuously or 10 Amps pulsed from each channel up to a maximum of 8W in total. Higher power can be dissipated with heat-sinking (see Section 7.2 "Total heat output"). Communication with the PP480 is by Ethernet or RS232.

Read Section 2, "Safety" (or Abschnitt 3, "Sicherheit", or Section 4, "Sécurité"), and check the PP480 fulfils your requirements.

Mount the PP480 as described in Section 6, "Mechanical fixing", using a DIN rail fixing kit (PP701) or the mounting holes. In particular, read the notes on heat-sinking in Section 7, "PP480 heat output".

Connect the PP480 up to a power supply and an LED lighting unit as described in Section 8, "Connections".

Refer to Section 10, "Webpage Configuration" to set the PP480 up from its web pages. The commands that may be used with the Ethernet connection are described in Section 11, "Command configuration".

For additional information on the use of the PP480, visit www.gardasoft.com to download a range of Application Notes.

2 Safety

Read this before using the PP480. Always observe the following safety precautions. If in doubt, contact your distributor or Gardasoft Vision. The following symbols mean:



Warning: Read the instructions to understand the possible hazards.



Warning: Surface may get hot.

Where these symbols appear in the manual, refer to the text for precautions to be taken.

2.1 Heat



Ensure the PP480 is mounted correctly (see Section 6, “Mechanical fixing”), and that you do not exceed any of the ratings for the unit (see Section 12.2, “Specifications”).

At its maximum ratings, the PP480’s enclosure can get quite hot to touch. Place in a position where personnel cannot accidentally touch it and ensure there is a free flow of air around the unit. See Section 6, “Mechanical fixing” for information about mounting the unit.

2.2 Electrical



The PP480 produces high energy pulses. Take care to connect the outputs correctly and protect the output wiring and load from any short circuits. When switched off, energy remains stored in the PP480 for about 15 seconds.

The PP480 does not have complete tracking isolation of inputs and outputs, therefore, please observe the following guidance:

The Power Supply Unit (PSU) used to energise the PP480 must provide double insulation/reinforced isolation from mains electricity and be protected against short circuits and overloads. We recommend using a PSU that limits its output current to the appropriate rating of the controller by design, by setting the current limit on the supply (if possible), or through over current protection. The PSU shall be approved to either IEC 62368-1, IEC 60335-1, IEC 61010-1, IEC61558-1,-2,-16. The PSU may also be approved to equivalent or superior safety standards.

Any energised conductors derived from mains electricity must also have Safety Extra Low Voltage (SELV) output. Refer to for allowable voltage limits.

At maximum ratings the temperature of the enclosure can exceed 75°C. Therefore, either all cabling must be rated to at least 100°C, or all cabling must be additionally insulated by an appropriately rated heat resistant

sleeve or prevented from touching the metal enclosure of the controller, or its heatsink where fitted.

Power supply cabling to the controller must be rated to at least 4A. The cabling from the channel output to the load must be rated higher than the maximum channel output current.

If the controller is setup incorrectly, or in the event of failure, the energy provided by the power supply to the controller may become directly connected to any or all output channels. You must consider this during installation, and if necessary, provide adequate protection.

The DC power supply to controller must be externally fused to 4A using a slow blow fuse (T4AH, 50V).

For 48V PSU operation, the power supply must be capable of delivering 140A peak current for 50us. For 24V PSU operation, the power supply must be capable of 70A peak current for 50us.

To deliver the stated pulsing operation performance, the power supply must also be capable of delivering 40A of peak current for a duration of 1ms.

The PSU surge operation must be capable of the sum of each LED channels' continuous current rating multiplied by 2

The installer must provide a clearly marked, nearby and easily accessible switch as part of the installation to allow the controller to be disconnected from its energy source on both power conductors.

Transients caused by inductive loads must be suppressed externally to the PP480.

Warning: This is a Class A product. Its use in residential areas may cause radio interference, and such use should be avoided unless special measures are taken by the user to restrict emissions to a level that allows the reception of broadcast transmissions.

2.3 General



The PP480 must not be used in an application where its failure could cause a danger to personal health or damage to other equipment. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

2.4 Installation guidance (disclaimer)

This information is for guidance only. Installers must perform their own risk assessment specific to each installation. While Gardasoft Vision Ltd has taken every care in the preparation of this advice, Gardasoft Vision Ltd accepts no liability for damages of any kind except those required by law. Deliberate acts of endangerment and vandalism are not covered by this document and must be considered by the installer.

3 Sicherheit

Bitte lesen Sie vor Verwendung des PP480 diese Informationen. Beachten Sie immer die folgenden Sicherheitshinweise. Wenden Sie sich im Zweifelsfall an Ihren Händler oder Gardasoft Vision. Die folgenden Symbole haben die folgende Bedeutung:



Warnung: Lesen Sie die Hinweise, um eine mögliche Gefahr zu verstehen.



Warnung: Oberfläche kann heiß werden.

Wenn diese Symbole in der Anleitung auftauchen, enthält der Text Hinweise zu den zu ergreifenden Vorsichtsmaßnahmen.

3.1 Wärme



Stellen Sie sicher, dass der PP480 korrekt montiert ist (siehe Abschnitt 6, "Mechanical fixing") und dass Sie die Grenzwerte für das Gerät nicht überschreiten (siehe Abschnitt 12.2, "Specifications").

Bei den maximalen Grenzwerten kann das Gehäuse des PP480 75°C überschreiten, was ausreichend ist um bei einer Berührung zu Verbrennungen zu führen. Positionieren Sie das Gerät so, dass eine versehentliche Berührung durch das Personal ausgeschlossen ist und stellen Sie sicher, dass Luft frei um das Gerät zirkulieren kann.

3.2 Elektrik



Das PP480 erzeugt Impulse mit hoher Energie. Achten Sie darauf, die Ausgänge korrekt anzuschließen und schützen Sie die Ausgangsverkabelung und Last gegen Kurzschlüsse. Beim Ausschalten bleibt Energie für etwa 15 Sekunden im PP480 gespeichert.

Das PP480 verfügt über keine vollständige Nachlaufisolierung der Eingänge (einschließlich Trigger- und Kommunikationsports) und Ausgänge.

Beachten Sie daher unbedingt die folgenden Hinweise:

Computergeräte, die an die Kommunikations- oder Trigger-Ports angeschlossen sind, müssen über eine interne Stromversorgung verfügen oder vom Stromnetz durch eine doppelte Isolierung/verstärkte Isolierung getrennt sein oder nach dem Standard IEC 60950-1 zugelassen sein. Alle anderen Geräte, die an die Trigger- oder andere Ports angeschlossen sind, müssen ebenfalls durch eine doppelte Isolierung/verstärkte Isolierung vom Stromnetz getrennt sein.

Das Netzgerät, das zur Stromversorgung des PP480 dient, muss durch eine doppelte Isolierung/verstärkte Isolierung von der Stromversorgung getrennt sein und gegen Kurzschlüsse und Überlastungen geschützt sein. Wir empfehlen die Verwendung eines Netzgeräts, das den Ausgangsstrom durch konstruktive Maßnahmen, durch Einstellen der Stromgrenze an der Versorgung (wenn möglich) oder durch einen Überstromschutz auf den

geeigneten Nennstrom der Steuerung begrenzt. Das Netzgerät muss nach IEC 62368-1, IEC 60335-1, IEC 61010-1 oder IEC61558-1,-2,-16 zugelassen sein. Das Netzgerät kann auch nach gleichwertigen oder höheren Standards zugelassen sein.

Alle stromführenden Leiter, die vom Stromnetz abgeleitet sind, müssen ebenfalls Sicherheitskleinspannung (SELV) am Ausgang erzeugen. Hinweise zu den zulässigen Spannungsgrenzwerten finden Sie im .

Bei den maximalen Grenzwerten kann die Temperatur des Gehäuses 75°C überschreiten. Daher muss entweder die gesamte Verkabelung für mindestens 100°C bemessen sein oder die gesamte Verkabelung muss zusätzlich mit einer angemessenen dimensionierten wärmebeständigen Tülle isoliert sein oder gegen Kontakt mit dem Metallgehäuse der Steuerung oder deren Kühlkörper, sofern angebracht, geschützt sein.

Die Verkabelung der Stromversorgung zur Steuerung muss für mindestens 4A bemessen sein.

Die Verkabelung vom Kanalausgang zur Last muss höher als der maximale Kanalausgangsstrom dimensioniert sein.

Wenn die Steuerung falsch eingerichtet ist oder im Fall eines Fehlers, kann es vorkommen, dass die von der Stromversorgung an die Steuerung abgegebene Energie direkt mit einem oder allen Ausgangskanälen verbunden wird. Sie müssen dies bei der Installation berücksichtigen und gegebenenfalls für einen geeigneten Schutz sorgen.

Die Gleichstromversorgung der Steuerung muss extern durch eine träge Sicherung (T4AH, 50V) bis 4A gesichert sein.

Für den Betrieb mit einem 48-V-Netzteil muss das Netzteil aufgrund der Eingangskapazität des Controllers in der Lage sein, bei 48 V einen Spitzenstrom von 140 A für eine Zeitdauer von 50 µs zu liefern. Dies muss aufrechterhalten werden, ohne dass die Spannung des Netzteils unter 30 V abfällt.

Um die angegebene Leistung im Pulsbetrieb zu erreichen, muss das Netzteil auch in der Lage sein, 40 A Spitzenstrom für eine Dauer von 1 ms zu liefern

Der Installationstechniker muss einen deutlich gekennzeichneten, leicht zugänglichen Schalter als Teil der Installation in der Nähe vorsehen, mit dem die Steuerung an beiden Stromleitern von ihrer Stromquelle getrennt werden kann.

Durch induktive Lasten verursachte Einschaltstöße zum PP480 müssen extern unterdrückt werden.

Warnung: Es handelt sich hierbei um ein Produkt der Klasse A. Die Verwendung in Wohngebieten kann zu Funkstörungen führen und eine solche Verwendung sollte vermieden werden, es sei denn besondere Maßnahmen werden vom Anwender ergriffen, um die Emissionen auf ein

Niveau zu begrenzen, das den Empfang von Rundfunkübertragungen ermöglicht.

3.3 Allgemein



Das PP480 darf nicht in Anwendungen eingesetzt werden, bei denen es durch einen Ausfall des Geräts zu einer Gefahr für die Gesundheit von Personen oder zur Beschädigung anderer Geräte kommen könnte.

Wenn das Gerät in einer anderen als der vom Hersteller vorgesehenen Weise verwendet wird, kann die Schutzvorrichtung des Geräts beeinträchtigt werden.

3.4 Installationsanleitung (Haftungsausschluss)

Diese Informationen dienen nur zur Orientierung. Installationstechniker müssen ihre eigene spezifische Risikobewertung für die jeweilige Installation durchführen. Auch wenn Gardasoft Vision Ltd diese Empfehlung mit größter Sorgfalt erstellt hat, übernimmt Gardasoft Vision Ltd keine Haftung für Schäden jeglicher Art, außer in dem gesetzlich erforderlichen Maße. Vorsätzliche Gefährdungs- oder Zerstörungshandlungen werden in diesem Dokument nicht behandelt und müssen vom Installationstechniker berücksichtigt werden.

4 Sécurité

Lisez ce document avant d'utiliser le PP480. Respectez les mesures de sécurité suivantes en toutes circonstances. En cas de doute, contactez votre distributeur ou Gardasoft Vision. Les symboles ci-dessous auront la signification suivante:



Attention: Lisez les instructions pour comprendre quels sont les risques éventuels.



Attention: La surface peut devenir chaude.

Lorsque ces symboles apparaissent dans le manuel, reportez-vous aux consignes pour connaître les précautions à prendre.

4.1 Chaleur



Veillez à ce que le PP480 soit monté correctement (voir Section 6, "Mechanical fixing") et à ne dépasser aucune valeur nominale pour l'unité (voir Section 12.2, "Specifications").

Lorsqu'il atteint ses valeurs nominales maximales, le boîtier PP480 peut dépasser les 75°C, ce qui est suffisant pour provoquer des brûlures en cas de contact. Placez l'appareil à un endroit où le personnel ne risque pas de le toucher par accident et veillez à ce que l'air circule librement autour de l'unité.

4.2 Électricité



Le PP480 produit des impulsions d'énergie élevées. Veillez à bien raccorder les sorties et à ce que les câbles de sortie et la charge soient à l'abri de tout court-circuit. Lorsque le PP480 est éteint, de l'énergie résiduelle reste dans l'appareil pendant environ 15 secondes.

Le PP480 ne possède pas de système d'isolation complet des entrées (notamment des ports de déclenchement et de communication) et des sorties. Par conséquent, respectez les consignes suivantes :

L'équipement informatique connecté aux ports de communication et de déclenchement doit être alimenté en interne ou séparé de l'alimentation secteur par une isolation double/renforcée, ou être approuvé selon la norme CEI 60950-1. Tous les autres équipements branchés aux déclencheurs ou à d'autres ports doivent aussi posséder une isolation double/renforcée pour être protégés de l'alimentation secteur.

Le boîtier d'alimentation utilisé pour mettre sous tension le PP480 doit fournir une isolation double/renforcée pour isoler le PP480 de l'alimentation secteur, et le protéger des courts-circuits et des surcharges. Nous recommandons d'utiliser un boîtier d'alimentation qui limite le courant de sortie de l'appareil à la valeur nominale appropriée du contrôleur, en réglant la limite de courant sur l'alimentation (si possible) ou via la protection contre les surcharges. Le boîtier d'alimentation doit être

approuvé selon la norme CEI 62368-1, CEI 60335-1, CEI 61010-1 ou CEI61558-1,-2,-16. Le boîtier d'alimentation peut aussi être approuvé selon des normes de sécurité équivalentes ou supérieures.

Tous les conducteurs sous tension dérivés depuis l'alimentation secteur doivent aussi posséder une sortie à tension de sécurité extrabasse. Se reporter à la pour les limites de tension autorisées.

Lorsqu'il atteint ses valeurs nominales maximales, le boîtier du PP480 peut dépasser les 75°C. Par conséquent, tout le câblage doit soit avoir une capacité minimale de 100°C, soit être en plus isolé par une gaine suffisamment résistante à la chaleur, soit ne pas toucher le boîtier en métal du contrôleur ou son dissipateur thermique s'il est installé.

Le câblage d'alimentation vers le contrôleur doit avoir une capacité minimale de 4A.

Le câblage reliant la sortie de la chaîne à la charge doit avoir une capacité supérieure au courant de sortie maximal de la chaîne.

Si le contrôleur est mal réglé ou en cas de panne, l'énergie fournie par l'alimentation au contrôleur peut devenir directement connectée à n'importe quelle chaîne de sortie ou à toutes les chaînes de sortie. Vous devez prendre en compte ce paramètre durant l'installation et si nécessaire, fournir une protection adéquate.

L'alimentation en courant continu vers le contrôleur doit être protégée par un fusible 4A en externe, plus précisément un fusible à action retardée (T4AH, 50V).

Pour le fonctionnement avec une alimentation de 48 V, le bloc d'alimentation doit être capable de fournir plus de 140 A de courant de pointe à 48 V pendant une durée de 50 us, en raison de la capacité d'entrée du contrôleur.

Pour fournir les performances de fonctionnement pulsé indiquées, l'alimentation doit également être capable de fournir 40 A de courant de crête pendant une durée de 1 ms.

Dans le cadre de l'installation, l'installateur doit fournir un interrupteur clairement marqué, qui soit à proximité et facilement accessible, pour permettre au contrôleur d'être déconnecté de sa source d'énergie sur les conducteurs d'alimentation.

Les coupures causées par des charges inductives doivent être supprimées de manière externe vers le PP480.

Attention: Il s'agit d'un produit de classe A. Son utilisation en zone résidentielle peut causer des interférences radio. Ce type d'utilisation doit être évité, sauf si des mesures particulières sont prises par l'utilisateur pour restreindre les émissions à un niveau qui permet la réception des transmissions diffusées.

4.3 Généralités



Le PP480 ne doit pas être utilisé dans une application où la santé des personnes et l'intégrité des équipements seraient mises en danger s'il venait à tomber en panne.

Si l'équipement est utilisé autrement qu'aux fins prévues par le fabricant, la protection offerte par l'équipement pourrait en être altérée.

4.4 Guide d'installation (clause de non-responsabilité)

Ces informations sont seulement à titre indicatif. Les installateurs doivent effectuer leur propre évaluation des risques, pour chaque installation. Même si Gardasoft Vision Ltd a préparé minutieusement ces conseils, Gardasoft Vision Ltd décline toute responsabilité pour tout dommage, quel qu'il soit, à l'exception de ceux requis par la loi. La mise en péril volontaire ainsi que les actes de vandalisme ne sont pas couverts par le présent document et doivent être pris en compte par l'installateur.

5 General description

The PP480 current controller provides repeatable intensity control of LED lighting for machine vision applications. It does intensity control, timing and triggering functions required for machine vision systems.

LED lighting needs a constant current supply as small variations in voltage can cause large variations in light output. Currents can be specified in 2.5mA steps to give very fine control of intensity.

You can set the PP480 up through its web pages (see Section 10, "Webpage Configuration"), or by using Ethernet commands (see Section 11, "Command configuration").

Configurations are saved in non-volatile memory so that the PP480 will resume operation after a power cycle.

5.1 Triggers

There are four trigger inputs, as summarised in the table below. The sense of these can be either active high or active low depending on how the 'P' flag is set. The 'P' flag inverts the sense of the trigger (see Section 5.3, "Flags"). Output in table below is described for positive edge triggering.

Mode	Trigger Input	Output
Continuous	N/A	Output is on
Switched	Trigger < 1V	Output is off
	Trigger = 3V to 24V	Output is on
Pulsed	Trigger goes from 0V to 3V	Pulse is triggered
	Trigger goes from 3V to 0V	No action

5.2 Output Modes

Three modes of operation are provided separately for each channel.

5.2.1 Continuous

In continuous mode the output is a fixed and continuous current. The brightness can be set from 0% to 100%.

5.2.2 Pulsed

In this mode, the output is pulsed once per trigger. One trigger input is used to trigger the output. The delay, pulse width and light intensity are all configurable. In pulse mode, the brightness can be set up to 999% of its rating, but only for short periods and low duty cycles so the lighting does not overheat and get damaged. The default limits are as shown in the table below:

Brightness	Max pulse width	Max duty cycle
0 to 100%	999ms	100%
101% to 200%	30ms	30%
201% to 300%	10ms	20%
301% to 500%	2ms	10%
501% to 999%	1ms	5%

5.2.3 Switched

In switched mode, you can use a trigger input to switch the output current on and off. The output is enabled only when the input has a voltage (above 3V) on it.

In switched mode, you can use a trigger input to switch the output current on and off. The output will action the pulse width, subject to the overdrive limit tables. If the timing of the external trigger transitions with the overdrive limits, the LED output will also transition.

5.3 Flags

Flags can be set on each channel as follows:

S flag: This flag enables or disables autosensing (see Section 5.4, “Automatic light sensing”). When set, the PP480 senses a light when it is first connected to it for the first time and will wait for the current rating to be set. If the flag is not set, the PP480 will revert to the last current rating set.

E flag: This flag enables or disables error checking. If the flag is set the PP480 will detect lighting errors.

P flag: This flag inverts the trigger sense. In pulse mode with the P flag set, the PP480 triggered on the rising edge of the trigger. If the flag is not set, it

triggers on the falling edge. In switched mode with the P flag set, the output is on when the input is on. Clearing the P flag inverts this operation.

5.4 Automatic light sensing (Autosense)

When a channel does not have a light connected, the PP480 continually tries to output a small sensing current. When a light is connected, it flashes for a short time (the light is not damaged by this). The PP480 will detect that it is connected. You will then need to set up the current rating of the light (see Section 10, "Webpage Configuration" or Section 11, "Command configuration").

5.5 Status LEDs

The PP480 has LED indicators for each channel to display its status:

Red indicates a channel error or hardware failure.

Amber indicates a configuration issue such as light rating setup, connection, or settings.

Green indicates the channel is working and healthy.

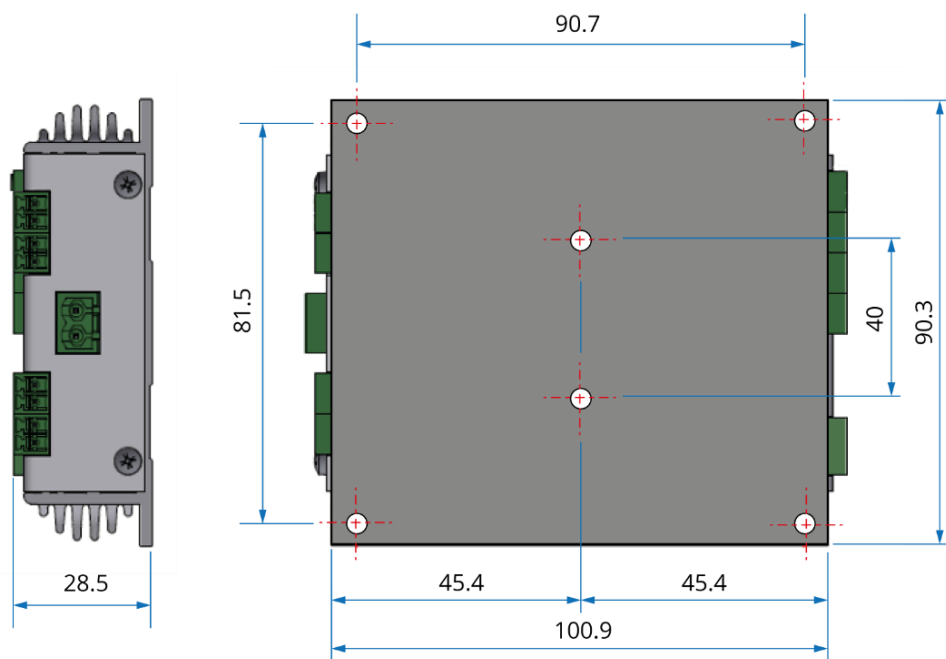
Blue flashing indicates the channel is booting up.

6 Mechanical fixing

The PP480 can be mounted onto a flat surface using the M4 clearance mounting holes in the corners of the base or the M4 threaded holes in the centre, see the diagram overleaf.

Note: If you choose to mount the PP480 using the threaded holes, ensure no more than 6mm of thread can be screwed in to prevent damage to internal components.

The PP480 should only be mounted either vertically or with its base horizontal. It should be mounted at least 15mm away from the sides of plastic enclosures. Likewise leave a similar space between the PP480 and any parts which could be affected by high temperatures.





The enclosure of the PP480 is used to dissipate heat. For this reason, the material to which the unit is attached must be suitable, preferably metallic with ability to dissipate this heat. This is particularly important if the power dissipation of the PP480 (as defined Section 7.2, "Total heat output") exceeds 8 Watts at 21°C or 4W at 40°C.

The PP701 kit is available for mounting the PP480 on a DIN rail. The PP480 does not have an IP rating and should be mounted so that moisture and dirt cannot enter the unit. Alternatively, the 4 mm holes can be used to mount the PP480.



To avoid a fire hazard, consider the implications of overheating in the unlikely event of a fault in the PP480. The power dissipation in a fault condition is approximately given by the sum of the following for the four channels:

$$(V_{PS} - V_L) \times I_{PS}$$

Where: V_{PS} = Power supply voltage

V_L = Rated voltage for lighting

I_{PS} = Maximum current delivered by the power supply.

For further information about heat output from the PP480, refer to Section 7, "PP480 heat output".

To limit the power, set the power supply output voltages to the minimum value required by the LED light and the PP480 together. Choose a PSU that limits its output current by design, by setting the current limit on the supply (if this feature exists). Use fuses. Remember to de-rate the fuse if mounted in an enclosure, as the temperature will be higher than ambient.

An enclosure may also be required for other parts of the system such as power supplies and should provide mechanical and environmental protection in industrial applications.

If an enclosure is used, it should be metal or plastic (with a flammability rating of UL94-V1 or better) and with no holes below or to the sides of the PP480 when mounted. Cable entries below the PP480 should be through glands that also have a flammability rating of UL94-V1 or better. Observe the specified gap between the PP480 and any other part or side of the enclosure.

Whichever way it is mounted, ensure that the PP480 is electrically connected to a ground plane for optimum ESD (electrostatic discharge) protection. When DIN rail mounted or to a plastic enclosure, this can be achieved using the corner mounting holes that is connected to a metal surface.

7 PP480 heat output

The PP480 controller has a linear circuit to produce constant current output. This section explains how to calculate the heat output from the PP480 and what measures you can take to manage it.

7.1 Heat output per channel

For a continuous output current, the heat output is given by:

$$\text{Heat output} = I_o \times (V_s - V_L)$$

Where: I_o = Output current set by the user

V_s = Supply voltage across VS1+ and VS-

V_L = Voltage across the light LED1+ and LED1- (for output 1)

For a pulsed output, the heat output is given by:

$$\text{Heat output} = I_o \times \text{duty cycle} \times (V_s - V_L)$$

Where: I_o = Output current set by the user

V_s = Supply voltage

V_L = Voltage across the light

And duty cycle is defined as:

$$\text{Duty cycle} = \text{Pulse width} \times \text{Trigger frequency}$$

When overdriving, the voltage across the light is more difficult to identify.

7.2 Total heat output

The total heat output from the PP480 is given by adding the heat output for all channels as calculated above.

There are several ways to reduce the heat output from the PP480:

Use pulse mode. If the output is only on when you need it, you can significantly reduce the heat output. Feed the camera trigger into the PP480 and pulse the lights.

Turn the light off when not needed. If you do not have precise timing of when the camera will trigger, you can use switched mode to switch the output off or on depending on the trigger input (or use the PP480 Ethernet/Serial Port commands to turn the output on and off).

Reduce the output current if possible.

Reduce the supply voltage. Most PSUs have some adjustment in their output voltage.

Connect lights in series instead of parallel. If you have an array of lights or LEDs in parallel, then changing the arrangement to serial will increase the voltage across them but reduce the overall current.

Use a higher power controller from the Gardasoft range, for example a PP820 can dissipate much more heat.

With no heatsinking and no forced airflow, the PP480 can dissipate the following:

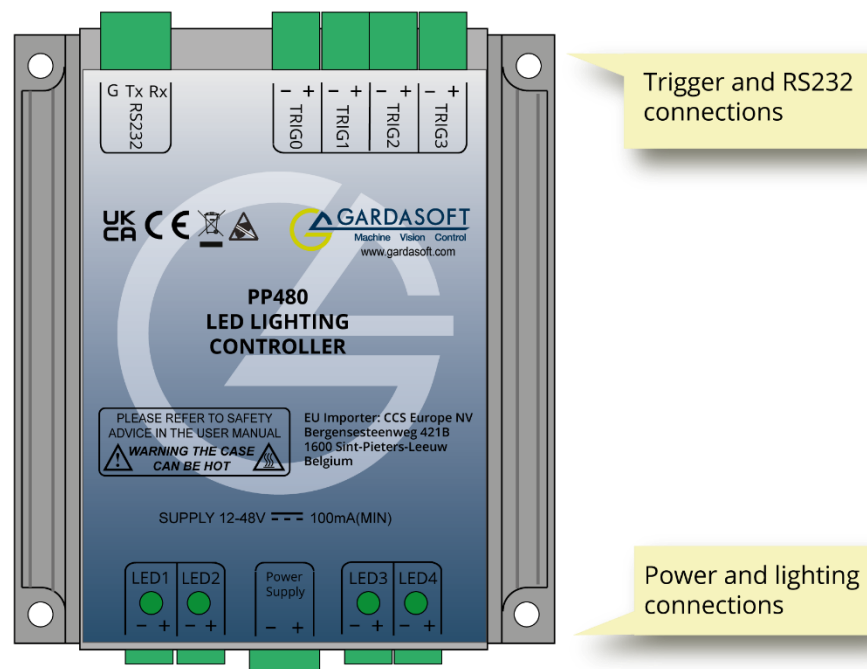
8W at 25°C ambient

4W at 40°C ambient

If the heat output is between 8W and 24W, the PP480 needs to be mounted on heatsink.

8 Connections

All connections to the PP480 are made on multi-way plugs and sockets. The mating connectors are described in Section 8.6, "Connectors".

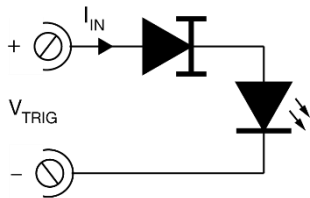


The power and load connections are as follows:

Terminal ID	Function
LED1-	Channel 1 lighting output
LED1+	
LED2-	Channel 2 lighting output
LED2+	
PSU-	Power supply -
PSU+	Power supply +
LED3-	Channel 3 lighting output
LED3+	
LED4-	Channel 4 lighting output
LED4+	

The RS232 and trigger connections are as follows:

Terminal ID	Function
RS232 G	RS232 Ground
RS232 Tx	RS232 Transmit
RS232 Rx	RS232 Receive
TRIG1-	Trigger input 1
TRIG1+	



Terminal ID	Function
TRIG2-	Trigger input 2
TRIG2+	
TRIG3-	Trigger input 3

TRIG3+	
TRIG4-	
TRIG4+	Trigger input 4

8.1 Triggers

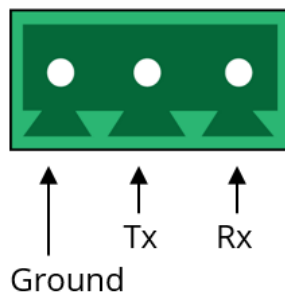
The PP480 triggers are opto-coupled as shown in the circuit below. Trigger voltage between 3V and 24V provides a logic 1 and any voltage below 1V, a logic 0. A logic 1 signal will sink approximately 3mA at any voltage from 3V to 24V.

8.2 Ethernet

The RJ45 connector fitted to the PP480 is for ethernet connection which runs at 10Mbits per second.

8.3 RS232

RS232 communications are electrically isolated and made through a three-way male connector as shown below:



8.4 Power supply



Refer to Section 2.2, “Electrical” (or Abschnitt 3.2, “Elektrik” , or Section 4.2, “Électricité”) for important guidance on selecting a power supply for your PP480.

Power supplies should be regulated with SELV compliant outputs (fault tolerant). Consideration should be given to fusing. The fuse value can be based on the sum of all the average current output.

8.5 Wiring

Refer to Section 2.2, “Electrical” (or Abschnitt 3.2, “Elektrik”, or Section 4.2, “Électricité”) for important guidance on wiring up your PP480.

Ensure that the wire gauge used for these connections is appropriate for the current to be drawn. Ideally, wires should be double crimped or independently secured to ensure they cannot come loose. Route low voltage and mains wiring separately. If they must be loomed together ensure that low voltage insulation rating is sufficient or that supplementary insulation is used.

Note: The case of the PP480 is not connected to the GND supply connection.

8.6 Connectors

The following table shows the connectors necessary to mate with the PP480’s connections. The model numbers relate to Würth connectors.

Connector	Type	Mating connector
LED	3.5mm, 2-way	691 304 100 002 (screwless)
Power	5.08mm, 2-way	691 361 100 002 (screw terminal)
RS232	2.5mm, 3-way	691 353 500 002 (screwless)
Trigger	2.5mm, 2-way	691 351 500 002 (screw terminal)

9 Ethernet communication

You may need to ask your network administrator for advice about setting up the Ethernet connection.

Ethernet set up is not affected by cold booting the PP480.

See Application note APP923 (available from www.gardasoft.com) for troubleshooting Ethernet problems.

9.1 Connection

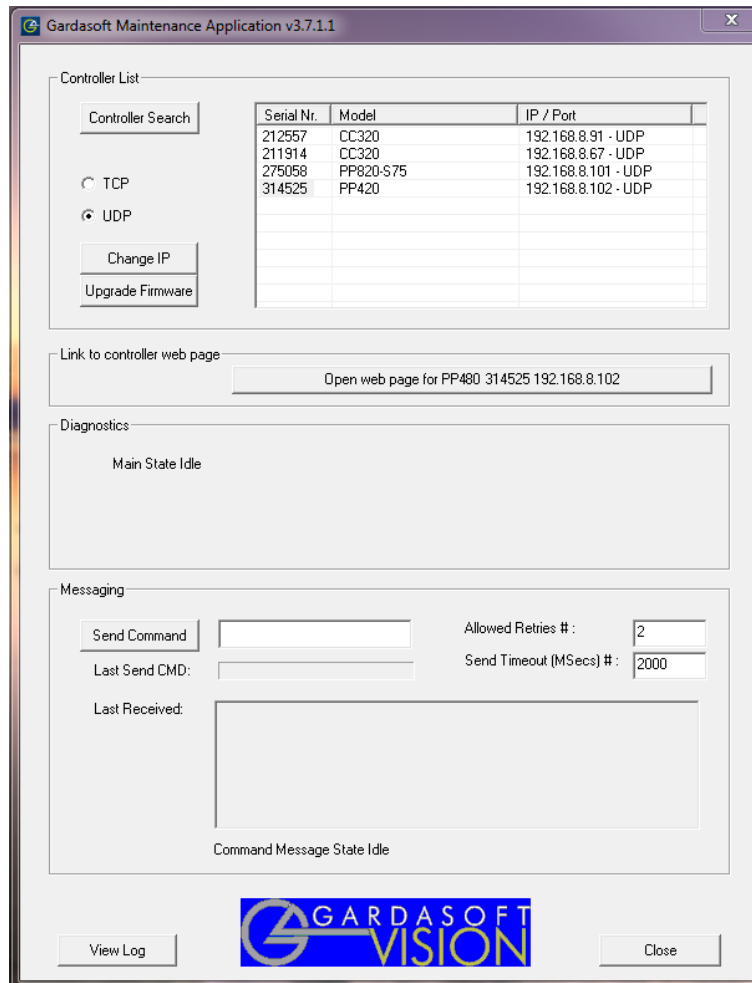
The Ethernet link uses a 10Base-T connection on an RJ45 connector. The PP480 is usually connected to a network switch, hub or directly into the network port on a PC.

9.2 IP address

The PP480 needs an IP address to communicate over Ethernet. There are two ways to get an IP address; either programmed into the unit or using DHCP.

For DHCP mode, the PP480 acquires its IP address, subnet mask and gateway address from a DHCP server. Otherwise, the PP480 has a fixed IP address, subnet mask and gateway address.

DHCP mode or the IP address can be set and read using the GardasoftMaint program available at www.gardasoft.com. The GardasoftMaint window is shown below:



GardasoftMaint allows you to view the controllers on your network, change their IP addresses and upgrade their firmware if it becomes necessary. In the messaging section of GardasoftMaint, you can communicate with your controller using the commands explained in Section 11, “Command configuration”. You can also open the selected controller’s web pages at the click of a button. For more information about the PP480’s web pages, refer to Section 10, “Webpage Configuration”.

9.2.1 DHCP

Most networks use a DHCP server. If there is a PC on the network, you may be able to find out whether a PC on the same network uses DHCP as follows:

- (i) Right-click the Windows 11™ Start icon on your PC's task bar.
- (ii) Select **Network Connections**.
- (iii) Click the **Ethernet** tab.
- (iv) The IP assignment will be shown as Automatic (DHCP).

You can find out what IP address is being used by the PC at any time by following the steps overleaf:

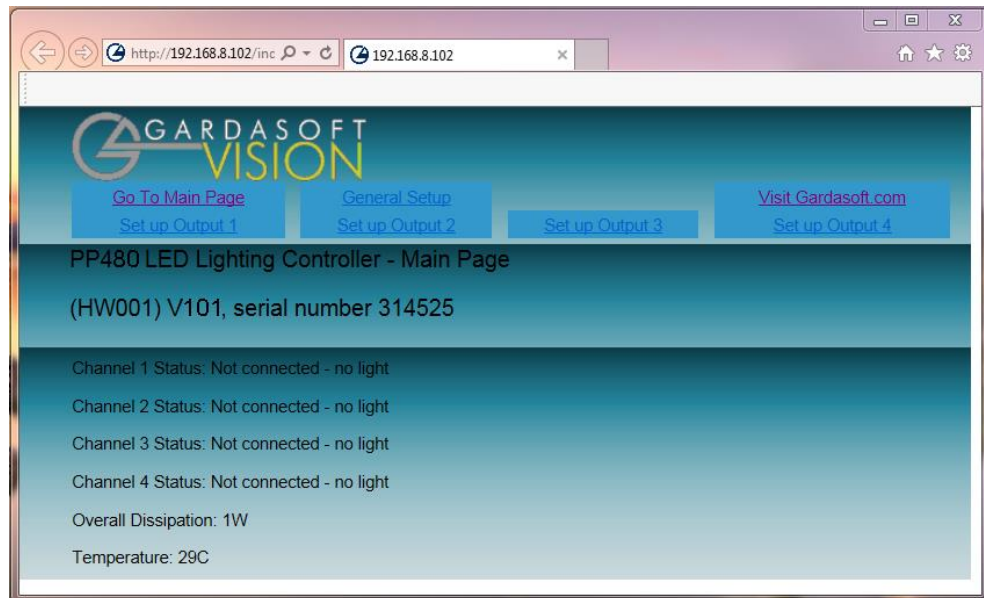
- (i) Right-click the Windows 11™ Start icon on your PC's task bar.
- (ii) Select **Network Connections**.
- (iii) Click the **Ethernet** tab.
- (iv) Under Properties, your IP address will be given as the 'IPv4 address'.

9.2.2 Fixed IP Address

When using a fixed IP address, you must ensure that you use an IP address that is not being used by any other device on the network. It is usual to keep the first three numbers of the IP address the same as other devices and to change only the last number. For example, if you have a network consisting of a PC (IP address 192.168.1.35) and two PP480s, they could be allocated addresses 192.168.1.201 and 192.168.1.202.

10 Webpage Configuration

You can set up the PP480 through its own internal web pages. Click the **Open webpage...** button in GardasoftMaint to take you directly to the PP480's web pages. You can also type the controller's IP address (displayed in GardasoftMaint) into your web browser, which will display the Main screen. GardasoftMaint software is available from www.gardasoft.com.

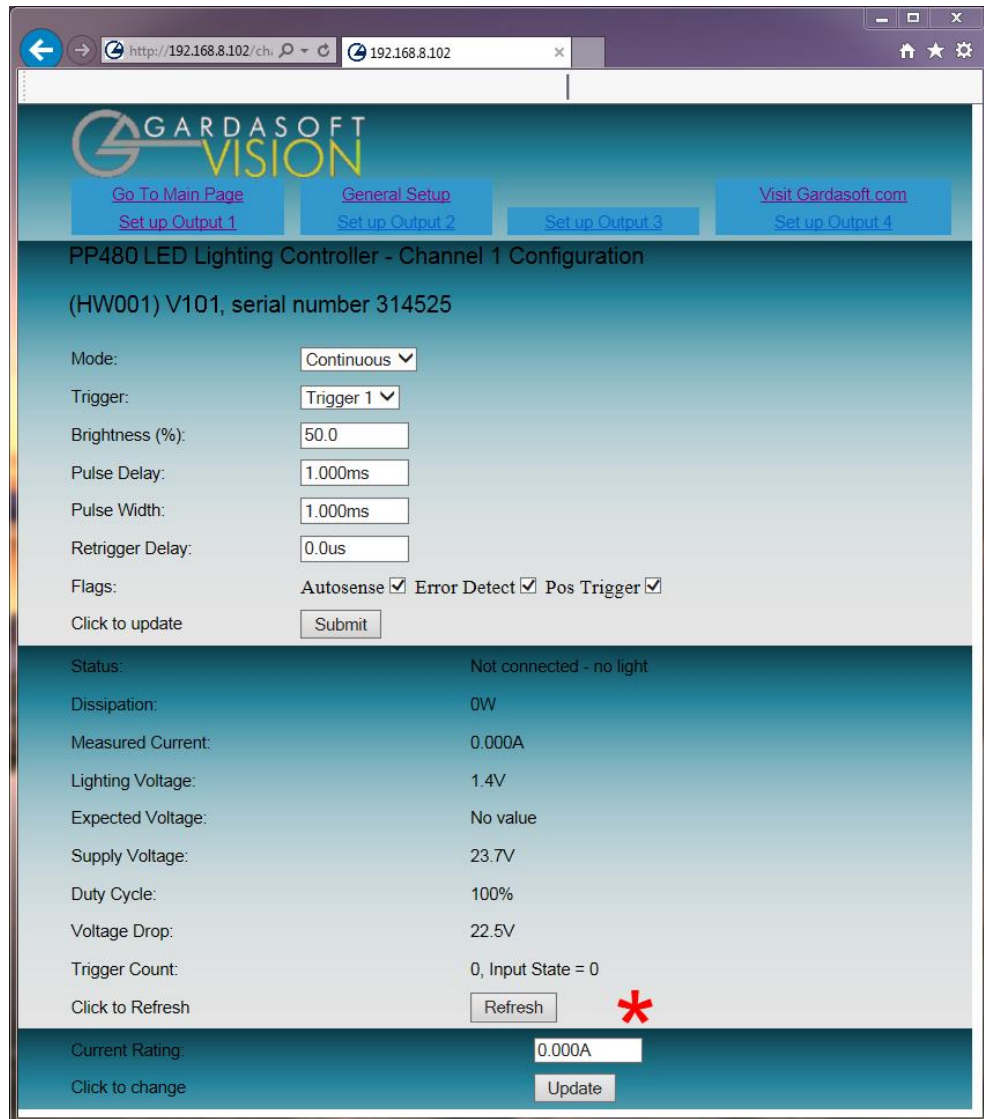


10.1 Main Page

The main page (shown overleaf) is the first to open when you access the PP480's web pages. This gives the controller's hardware and firmware revision levels and the serial number. It also tells you the power being dissipated and the PP480's internal temperature.

10.2 Configuration page

There is one configuration page for each output channel as shown below. To refresh this page it is important that you click the Refresh button on the web page (*) rather than on your browser. When configuration changes are submitted, the URL includes the new configuration, so refreshing the page re-submits the URL.

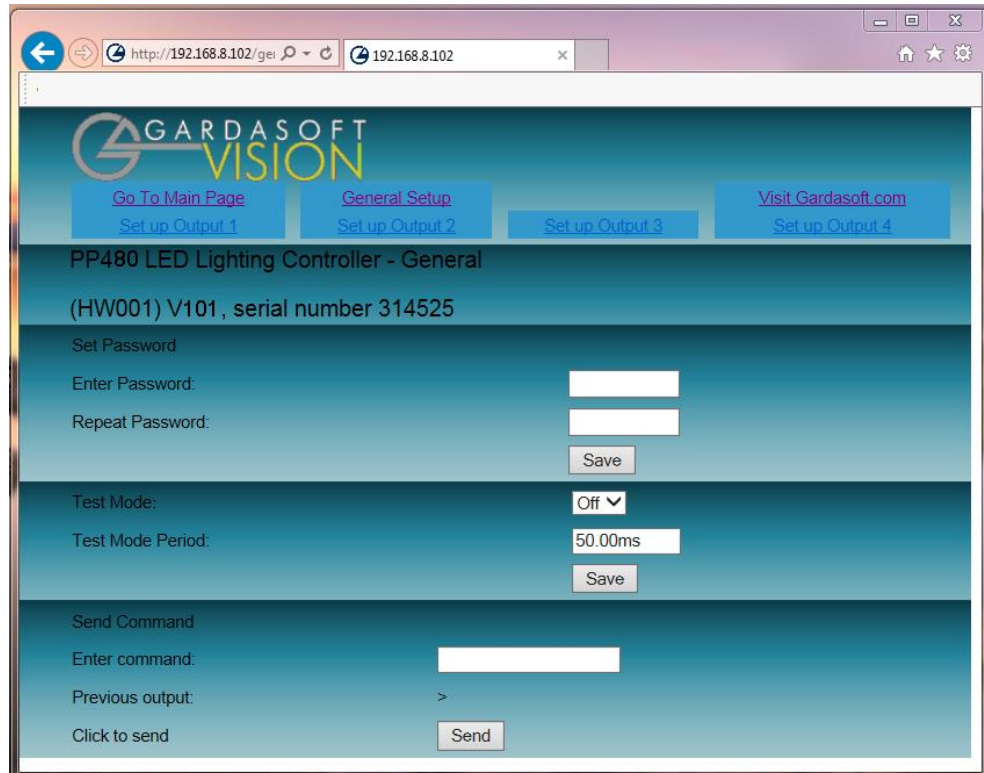


You can set up all the parameters for each output channel. Pressing the Submit button updates the PP480 configuration and saves the changes to non-volatile memory. On this page you can:

- Change the current rating and brightness of the light.
- View some measured voltages and the actual output current.
- Set the output mode: continuous, pulsed, or switched.
- Set the pulse parameters.

10.3 General setup page

The general setup page (shown below) allows you to set up or clear the web page's password and set up the internal trigger. You can also enter any Ethernet command from Section 11, "Command configuration".



11 Command configuration

Command lines can be sent from a client using TCP or UDP packets. They should be sent to destination port 30313. The source port can be set to anything, but 30312 is recommended.

Only one TCP connection can be active at any time. A carriage return (ASCII 13) character should be sent to terminate the command line, in case multiple packets get joined together.

Commands can also be sent through the RS232 interface.

11.1 Command structure

Communication consists of commands sent by the host (controlling PC). All output generated by the command is returned in reply UDP or TCP/IP packets. The last character sent is > ('greater than' symbol). Once this is received, the host knows that the command has been completed.

We recommend that the host waits for the > symbol before sending the next command. UDP communications are not guaranteed to arrive, so the host software must be able to cope with lost messages.

Using the GT command, a host can request that a message is sent to it whenever an error occurs.

Several commands can be put into one command line by separating them by a semi-colon (;). The PP480 sends any replies to the commands followed by a > character to show that the command line has completed.

All commands comprise a code of two letters followed by any optional parameters. All spaces in the commands are ignored.

Numeric parameters are separated by a comma (,). For a parameter which is a time period, the default units are milliseconds. 's', 'ms' or 'us' can be added to the end of the number to indicate seconds, milliseconds or microseconds. For currents, 'A' or 'mA' can be added to indicate amps or milliamps. The default unit is amps.

Note: parameters are in 'USA/UK' format so that a half is written '0.5' not '0,5'. For example:

Parameter	Meaning
0.1	0.1 milliseconds
200µs	200 microseconds
0.1s	0.1 seconds
100mA	100 milliamps
2.45A	2.45 amps
2.3	2300 milliamps or 2.3 amps

The command codes and their meaning are described in the remainder of this section. The upper case commands are shown, followed by lower case letters denoting the numeric argument.

11.2 General commands

Save the settings to memory

AW

Once the settings are saved to memory, they are retained when the unit is switched off. If this is not done, the changes to the settings are volatile, and if the unit is switched off they revert to the settings in force when the last AW command was issued.

Report the configuration

ST1

The typical output is:

CH 1, MD 1, CS 2.000A, SE 500.0, DL 2.0us, PU 2.0us, PW 0, ST 1, EV 0.0V, IP 1, FL 14, RT 20.0us

Where:

CH	Channel number
MD	Mode: 0 = continuous, 1 = pulse, 2 = switched
CS	Current rating of the light
SE	Brightness percentage setting
DL	Pulse delay
PU	Pulse width
IP	Trigger input: 1, 2, 3, 4
RT	Re-trigger delay
PW, EV, ST	Fields are for internal use.
FL	See table below, any other values are invalid

	Error Detect	Pos Trigger	Auto Sense Enabled
FL Value	RKc,m	RJc,m	RQc,m
FL0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
FL2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
FL4	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
FL6	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
FL8	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
FL10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
FL12	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
FL14	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

ST0

Reports internal timer settings, The typical output is:

TM 1, TP 20.00m

Where:

TM	= 1 - internal timer enabled
	= 0 - internal timer disabled
	= internal timer repetition period

This command reports the settings for a single channel.

STc

Where:

c = Channel number (1 to 4)

Enable Ethernet messages**GTm**

Where:

m = 0 to disable Ethernet messages

= 1 to enable Ethernet messages.

When Ethernet messages are enabled, any error reports are sent to the most recent UDP or TCP address from which a command has been received.

Messages are of the form:

Evtc,e

Where:

c the channel number, or 0 for no channel

e event value:

32 to 47 are lighting error codes

128 = light detected and waiting for current rating

129 = light detected and not waiting for current rating.

Clear any errors**GR**

If Ethernet messages are not enabled, the last event or error number can be read by this command. Any error displayed on the unit is cleared, so if there was a lighting error, the PP480 resumes auto-sensing on that channel.

The reply is in the same form as the GT command above. If there are no outstanding events or errors, only the prompt '>' is returned.

Clear settings**CL**

Clears the output channel configuration. This excludes the Ethernet settings. If the auto sense flag is set on any channel, then the flag and the current rating are preserved.

Set/clear the webpage password**EY**

EY asc1, asc2, asc3, asc4, asc5, asc6

This command sets the password required to access the web pages. If EY is entered on its own then the password is cleared. There are six optional parameters, which are ASCII values for a password from one to six letters. A value of 65 is 'A', 66 is 'B', and so on to 90 is 'Z'.

Report the version of firmware running in the PP480

VR

This command returns the firmware version. For example:

101 (HW01)

11.3 Lighting commands

Set the output current rating

This command changes the current rating for a light:

RRc,v

Where:

c output channel (1 to 4)

v rated current (10mA to 2A)

Set continuous mode

The output is set to continuous mode at a percentage of full brightness:

RSc,s

Where:

c output channel (1 to 4)

s setting in percent (0 to 100)

Set switched mode

The output is set to continuous mode at a percentage of full brightness:

RWc,s

Where:

c output channel (1 to 4)

s setting in percent (0 to 999)

The output is only active if the trigger input selected for the channel is active.

Set pulse mode

The output can be set up to pulse on a trigger input. You can configure the delay from the trigger to the start of the pulse, the length of the pulse and the brightness.

An error is generated if the brightness setting requires a current greater than 10A or if the combination of pulse width and setting is not allowed.

RTc,p,d,s

RTc,p,d,s,r

Where:

- c** output channel (1 to 4)
- p** pulse width in milliseconds (0.001 to 999)
- d** delay from trigger to pulse in milliseconds (0.03 to 2999)
- s** brightness setting in percent (0 to 999)
- r** re-trigger delay in milliseconds (0 to 999). This parameter is optional.

If the re-trigger parameter is not given, then the re-trigger delay is set to the minimum allowed for the configuration.

Disable error detection mode

RKc,m

Where:

- c** output channel (1 to 4)
- m** = 1: Error detection disabled
= 0: Error detection enabled

Set Autosense mode

RQc,m

Where:

- c** output channel (1 to 4)
- m** = 1: No Autosense (controller assumes light is connected).
= 0: Autosense set (controller waits for light to be connected).

Set the trigger mode

RJc,m

Where:

- c** output channel (1 to 4)
- m** = 1: Triggered on negative edges
= 0: Triggered on positive edges

Set the trigger input

This command sets which input is used for pulse and switched output modes.

RPc,p

Where:

- c** output channel (1 to 4)
- p** trigger input (1 to 4)

Simulate an input trigger

This command simulates a trigger pulse. If the channel is in pulse mode, it will pulse.

TRc

Where

- c** = the input channel to be pulsed (1 to 4)

Set an internal trigger

This command enables or disables the internal trigger. When enabled, all outputs are triggered simultaneously using an internal trigger signal. This setting can be saved to non-volatile memory using the **AW** command.

- TT0** Disable the internal trigger
- TT1** Enable the internal trigger and use the previously set period
- TT1,p** Enable the internal trigger and set the period.

Where:

- p** = period of the trigger in milliseconds

For example:

- TT1,200 Set the internal trigger to 200ms (5Hz)
- TT1,500US Set the internal trigger to 500µs (2kHz)

11.4 Command summary

Command	Example	Effect
AW	AW	Save changes.
ST	ST	Show configuration.
GT	GT1	Enable Ethernet messages.
GR	GR	Get any error codes.
CL	CL	Clear all settings except Ethernet.
EY	EY65,66	Set web page password to 'AB'.
VR	VR	Read the firmware version.
RJ	RJ2,0	Set channel 2 to trigger on a positive trigger edge.
RK	RK1,1	Disable the error detection on channel 1.
RR	RR1,0.2	Set the rating of channel 1 to 0.2A.
RS	RS2,65	Set channel 2 to 65% brightness continuous.
RW	RW1,50	Set channel 1 to 50% = switched by trigger 1.
RT	RT2,3,4,50	Set channel 2 to 3ms pulses, delayed by 4ms, at 50% brightness.
RP	RP1,2	Use trigger input 3 for channel 2.
RQ	RQ3,1	Set channel 3 to have no Autosense.
TR	TR2	Simulate a trigger on channel 2.
TT	TT1,1ms	Set internal triggers every 1ms.
RE	RE1,4	Historic commands to set flags. It is better to use the individual flag set command (RK, RJ, RQ)
RK	RK1,1	Set error detection for channel 1
RJ	RJ2,0	Trigger on positive edge for channel 2
RQ	RQ3,1	Disable Autosense for channel 3

12 Specifications

12.1 Limitations

Switched mode: The maximum delay from a trigger input changing to the output current being turned on or off is 10 μ s.

Pulse Mode: The minimum pulse delay is about 4 μ s.

For 1ms and above pulse width, the driver power should not be greater than 30W.

For pulse width below 1ms, the driver power should not be greater than 100W.

Where:

driver power = pulse current x (power supply voltage – lighting voltage)

12.2 Specifications

Parameter	Value	Notes
User interface	Ethernet and Isolated serial (RS232)	
Output channels	4 independent constant current output with SafeSense™	
Trigger Inputs	4 opto-isolated digital inputs	
Power supply voltage (PSU+)	12 - 48V DC regulated	Must be at least 1V greater than the lighting voltage at maximum current.
Maximum input current (PSU)	4A	
Trigger input HIGH level	From 3V to 24V	This is the voltage applied between + and – of each trigger input.
Trigger input LOW level	From 0V to 1V	Trigger voltages between 1V and 3V are undefined
Typical trigger input current	3mA	Independent of trigger voltage
Max output current per channel	2A continuous, 10A pulsed	
Output voltage	46V maximum	
Average controller current	2A maximum	The average output current for all channels added

Parameter	Value	Notes
		together must not exceed this.
Pulse Frequency		Test conditions:
1 Channel	50 kHz	2 us pulse width
2 Channels	15 kHz	2A light rating at 24V
3 or 4 Channels	4 kHz	
Ambient temperature during operation	5°C to 40°C	
Maximum power dissipation without heat sinking	8W at 20°C 4W at 40°C	
Pulse width timing	2µs to 2999ms	In steps of 0.1 us Repeatability 0.1us
Pulse Delay timing	7µs to 2999ms	In steps of 1 us Repeatability 1us
Unit Usage	Indoor	
Pollution degree	2	As defined in BS EN 61010-1:2010+A1:2019
Altitude	Up to 2000m	
Relative Humidity	80% up to 31degC ambient. Decreasing linearly to 50% at 40degC	
PSU Voltage fluctuations	Up to +/- 10% of nominal voltage	Line regulation tolerance
Transient Overvoltage	Up to levels of Overvoltage category II. Temporary overvoltage on mains supply	For mains power supply used to power the PP480 (according to BS EN 61010-1:2010+A1:2019)
Dimension	118 mm long by 90.5 mm wide by 28.5 mm deep (excluding DIN fixings)	
Weight	240 g excluding DIN fixings	

Parameter	Value	Notes
Mounting	DIN rail or panel mounting	

12.3 Error codes

Error number	Reason
Err 1	A parameter value is invalid.
Err 2	Command is not recognised.
Err 3	Numeric value in wrong format.
Err 4	Wrong number of parameters.
Err 5	One of the parameters is out of range. The value of the parameter has been adjusted. For example, sending an RT command with a delay of 0 will return 'Err 5'. When the settings are viewed, the delay will have been set to 4 μ s.
Err 8, 12	EEPROM corrupt. The configuration has been cleared.
Err 20	Settings could not be saved to the EEPROM.
Err 27	Cannot read Ethernet settings from EEPROM; they may be incorrect.
Err 33	Temperature error. The PP480 is too hot and has switched off to protect itself.
Err 34	Internal power dissipation too high. Output turned off.
Err 35	Output current to lighting is too low.
Err 36	The output is short circuit.
Err 37	The voltage required for the lighting has increased too much. Check for ageing of the lighting or a failed LED.
Err 38	The voltage required for the lighting has decreased too much. Check for ageing of the lighting or a failed LED.
Err 39	There is not enough supply voltage for the requested output current.
Err, 40, 41, 45	More current is being output than should be, so the PP480 has turned off the outputs. This may be caused by a hardware error. Check with your distributor.

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