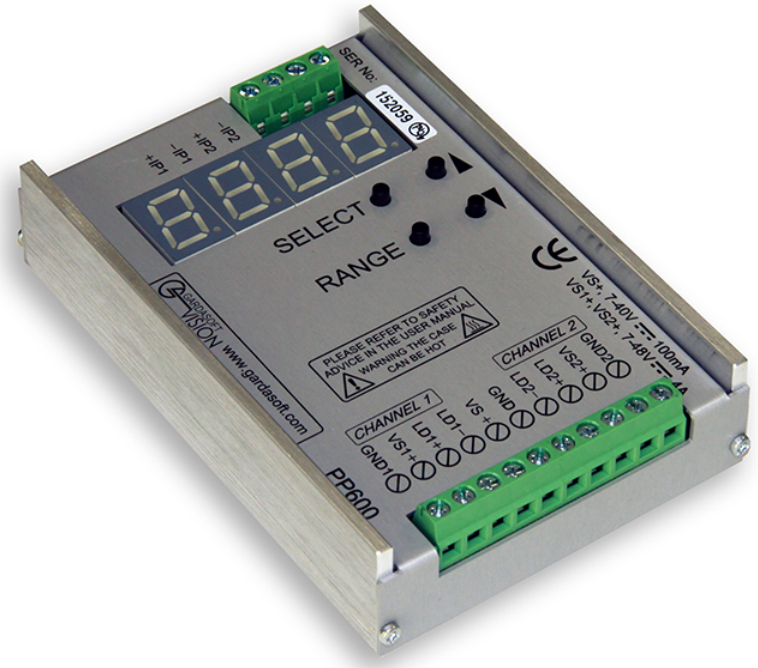
GARDASOFT
Industrial LED technology

PP600/602 LED

Lighting Controllers

Issue 015



User manual

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

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1 Getting started

This user manual describes the setting up and operation of the PP600 and PP602 lighting controllers.

The specific controller variant is referred to in this manual when necessary, otherwise the controllers are referred to as PP600.

Read Section 2, Safety (or Section 3, Sicherheit, or Section 4, Sécurité) and Section 10, Reference information, and check the PP600 fulfils your requirements.

Connect the PP600 up to a supply and an LED lighting unit as described in Section 8, Connections. Note that the supply voltage must be connected to three terminals. When the PP600 powers up, it should show two alternating lines on the display to indicate that it is operating properly.

Read Section 9, Operation and use the Simple Set Up to make the PP600 supply a small continuous current to the LED unit. Check that the LED unit illuminates.

Mount the PP600 as described in Section 6, Mechanical fixing, using a DIN rail or the mounting holes. In particular, read the notes on heatsinking in Section 7, PP600 heat output.

For additional information on the use of the PP600. Visit www.gardasoft.com to download a range of Application Notes.

2 Safety

Read this before using the PP600. Always observe the following safety precautions. If in doubt, contact your distributor or Gardasoft Vision. The following symbols mean:

Warning: Read instructions to understand possible hazard

Warning: Surface may get hot.

Warning: Possible hazardous voltage.

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

2.1 Heat

Ensure the PP600 is mounted correctly (see Section 6, Mechanical fixing), and that you do not exceed any of the ratings for the unit (see Section 10, Reference information).

At its maximum ratings, the PP600's enclosure can exceed 75°C which is sufficient to cause a burn if touched. Place in a position where personnel cannot accidentally touch it and ensure there is a free flow of air around the unit.

2.2 Electrical

The PP600 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 PP600 for about 15 seconds.

The PP600 does not have complete tracking isolation of inputs and outputs, therefore, please observe the following guidance:

- Computer equipment that is connected to the communication or trigger ports must be internally powered or separated from mains electricity by double insulation/reinforced isolation or be approved to IEC 60950-1 standard. All other equipment connected to the triggers or other ports must also have double insulation/reinforced isolation protection from the mains supply.
- The Power Supply Unit (PSU) used to energise the PP600 must provide double insulation/reinforced isolation from mains electricity and 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 should be approved to either IEC 60950-1, 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 Section 10, Reference information 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).
- 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 PP600.

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 PP600 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 PP600 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.

Warnung: Mögliche gefährliche Spannung.

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

3.1 Wärme

Stellen Sie sicher, dass der PP600 korrekt montiert ist (siehe Section 6, Mechanical fixing) und dass Sie die Grenzwerte für das Gerät nicht überschreiten (siehe Section 10, Reference information).

Bei den maximalen Grenzwerten kann das Gehäuse des PP600 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 PP600 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 PP600 gespeichert.

Das PP600 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 PP600 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 60950-1, 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 Section 10, Reference information.
- 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 angemessen 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 4 A 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.
- 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 PP600 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 PP600 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 Ltdkeine 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 PP600 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.

Attention: Risque d'électrocution.

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 PP600 soit monté correctement (voir Section 6, Mechanical fixing) et à ne dépasser aucune valeur nominale pour l'unité (voir Section 10, Reference information).

Lorsqu'il atteint ses valeurs nominales maximales, le boitier PP600 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 PP600 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 PP600 est éteint, de l'énergie résiduelle reste dans l'appareil pendant environ 15 secondes.

Le PP600 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 PP600 doit fournir une isolation double/renforcée pour isoler le PP600 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 60950-1, 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 extra-basse. Se reporter à la Section 10, Reference information pour les limites de tension autorisées.
- Lorsqu'il atteint ses valeurs nominales maximales, le boîtier du PP600 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).
- 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 PP600.

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 PP600 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 PP600 current controller is part of a group of products whose features are summarised below:

Controller	Interface	Fast	CCS connectors
PP600	Push button	-	-
PP600F	Push button	Y	-
PP602	Push button	-	Y
PP602F	Push button	Y	Y
PP610	Push button/RS232	-	-
PP610F	Push button/RS232	Y	-
PP612	Push button/RS232	-	Y
PP612F	Push button/RS232	Y	Y

The PP600 current controller provides repeatable intensity control of LED lighting for machine vision applications. It includes the power supply, 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 0.25mA steps below 1A and in 1mA steps above 1A.

Three modes of operation are provided separately for each channel:

- **Continuous:**

  In continuous mode the output is a continuous current.
- **Selected Continuous:**

  In selected continuous mode one or both inputs can be used to select an output current. For each state of the inputs, the output current is fixed.
- **Strobed:**

  In this mode output is pulsed once per trigger. One input is used as a trigger. The delay and pulse duration can range from 20µs to 1 second in 20µs or 2ms steps.

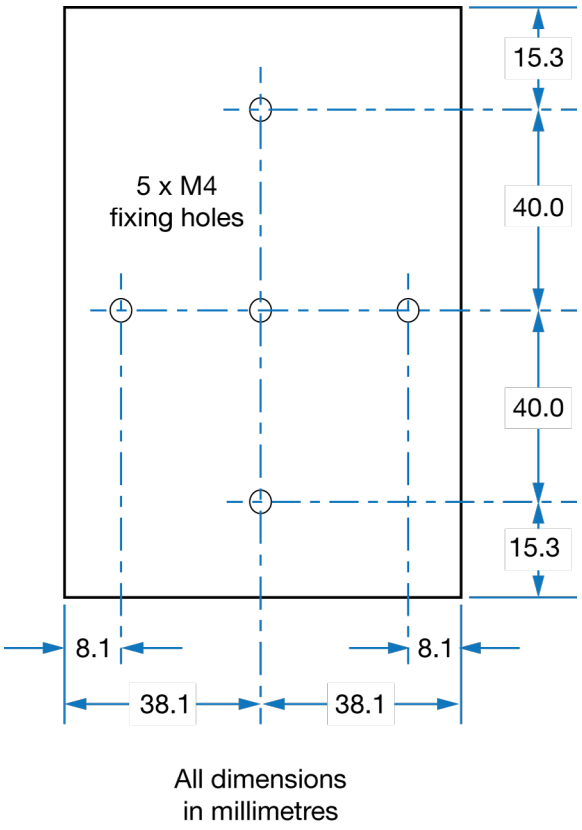
The PP600 is set up using four push buttons and a four digit seven-segment display (see Section 9, Operation).

Configurations are saved in non-volatile memory so that the PP600 will resume operation after a power cycle.

6 Mechanical fixing

The PP600 can be mounted onto a flat surface using the threaded holes in the base, see the diagram below. The PP600 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 PP600 and any parts which could be affected by high temperatures.

Note: The thickness of the base is 3.2mm. Fixing screws must not extend into the enclosure by more than 6mm.



The enclosure of the PP600 is used to dissipate power in the form of heat. For this reason the material to which the unit is attached must be suitable, preferably metallic with ability to dissipate the produced heat. This is particularly important if the power dissipation of the PP600 (as defined by P_D in Section 10, Reference information) exceeds 10 Watts.

The PP701 kit is available for mounting the PP600 on a DIN rail.

The PP600 does not have an IP rating and should be mounted so that moisture and dirt cannot enter the unit.

To avoid a fire hazard, consider the implications of overheating in the unlikely event of a fault in the PP600. The power dissipation in a fault

condition is approximately given by the sum of the following for the two channels:

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

Where: V_{PS} = Power supply voltage

V_L = Rated voltage for lighting

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

Either limit the power supply output current(s) so that not more than 30W can be dissipated in the PP600, or mount the unit in an enclosure.

For further information about heat output from the PP600, refer to Section 7, PP600 heat output.

To limit the power, set the power supply output voltages to the minimum value required by the LED light and the PP600 together. Chose a PSU that limits its output current by design, by setting the current limit on the supply (if this feature exists) or 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 PP600 when mounted. Cable entries below the PP600 should be through glands that also have a flammability rating of UL94-V1 or better. Observe the specified gap between the PP600 and any other part or side of the enclosure.

7 PP600 heat output

The PP600 controller has a linear circuit to produce constant current output. This section explains how to calculate the heat output from the PP600 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 GND (for output 1)

V_L = Voltage across the light LD1+ and LD1– (for output 1)

This is usually easy to calculate as the voltage across the light is normally the voltage rating of the light as declared in its specification. Alternatively you can measure it using a voltmeter.

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

$$\text{Heat output} = I_O \times \textit{duty cycle} \times (V_S - V_L)$$

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:

Duty cycle = WP x FT

Where: W_P = Pulse width in seconds

F_T = Trigger frequency in Hz

When overdriving, the voltage across the light is more difficult to identify. In most cases, you can use the voltage rating of the light.

7.2 Total heat output

The total heat output from the PP600 is given by adding the heat output for both channels as calculated above.

If the heat output is no greater than 10W, no heatsinking is required. If the heat output is between 10W and 24W, the PP600 needs to be mounted on a solid piece of metal to dissipate the heat. Above 24W, it is necessary to have a large heatsink with fan cooling.

There are several ways to reduce the heat output from the PP600. Refer to Application Note APP909 – PP600 Heat Output which is available from the PP600 product page at www.gardasoft.com.

8 Connections

All connections are made on screw terminals. The opto-isolated inputs require a voltage between 4.5v and 24v DC for a positive logic level. Open circuit or less than 1v gives a negative logic level.

Note: The case of the PP600 is not connected to the GND supply connection.

The input connector has the following connections:

Screw terminal ID	Function
IP1+	Input 1 positive
IP1–	Input 1 negative
IP2+	Input 2 positive
IP2–	Input 2 negative

The power connector has the following connections:

Screw terminal ID		Function
GND1	Channel 1	Power supply (–)
VS1+		Power supply (+)
LD1+		Load (+)
LD1–		Load (–)
VS+		Digital power supply (+)
GND		Digital power supply (GND)
LD2–	Channel 2	Load (–)
LD2+		Load (+)
VS2+		Power supply (+)
GND2		Power supply (–)

Note: GND, GND1, and GND2 must all be commoned, See Section 8.2, Power supply.

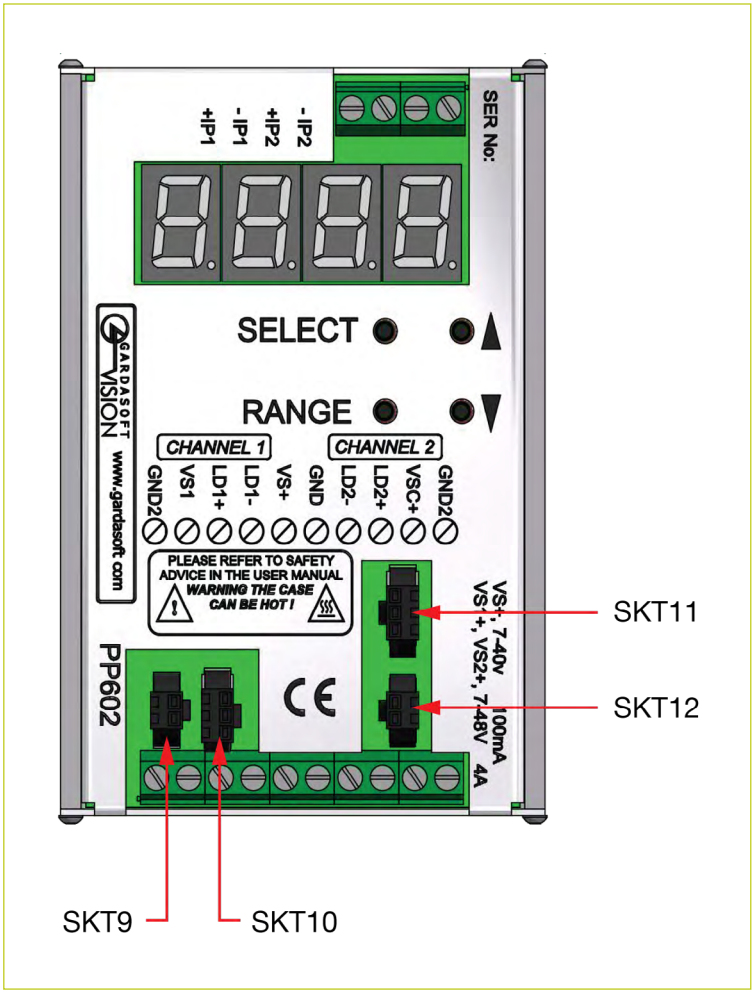
Ensure that the wire gauge used for these connections is appropriate for the current to be drawn. Ideally, wires should be double crimped or independently secured to ensure they cannot come loose. Route low voltage and mains wiring separately. If they must be loomed together ensure that low voltage insulation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

8.1 PP602 CCS connectors

PP602 controllers are additionally fitted with connectors for CCS lights. Note that the power input and digital inputs are only available on the screw terminals.

The connectors are not labelled on the case. Refer to the table and the diagram below for the layout.

Connector	Channel	Use
SKT9	1	CCS 12V lights
SKT10	1	CCS 24V and HLV lights
SKT12	2	CCS 12V lights
SKT11	2	CCS 24V and HLV lights



12V lights always have a 2 pin connector, 24V and HLV lights always have a 3 pin connector.

The CCS lights are labelled with a voltage and wattage rating, but PP602 controllers produce a constant current supply at their outputs. To

calculate the maximum continuous current that the lights can take apply the following formula:

$$I_{MAX} = I_R \div V_R$$

Where: I_{MAX} = Maximum continuous current in Amps

I_R = Rated wattage in Watts

V_R = Rated voltage in Volts

8.2 Power supply

The PP600 has split power input connectors for the control circuit and the two output channels. This is so that crosstalk between the outputs can be minimised when one channel has a high output current.

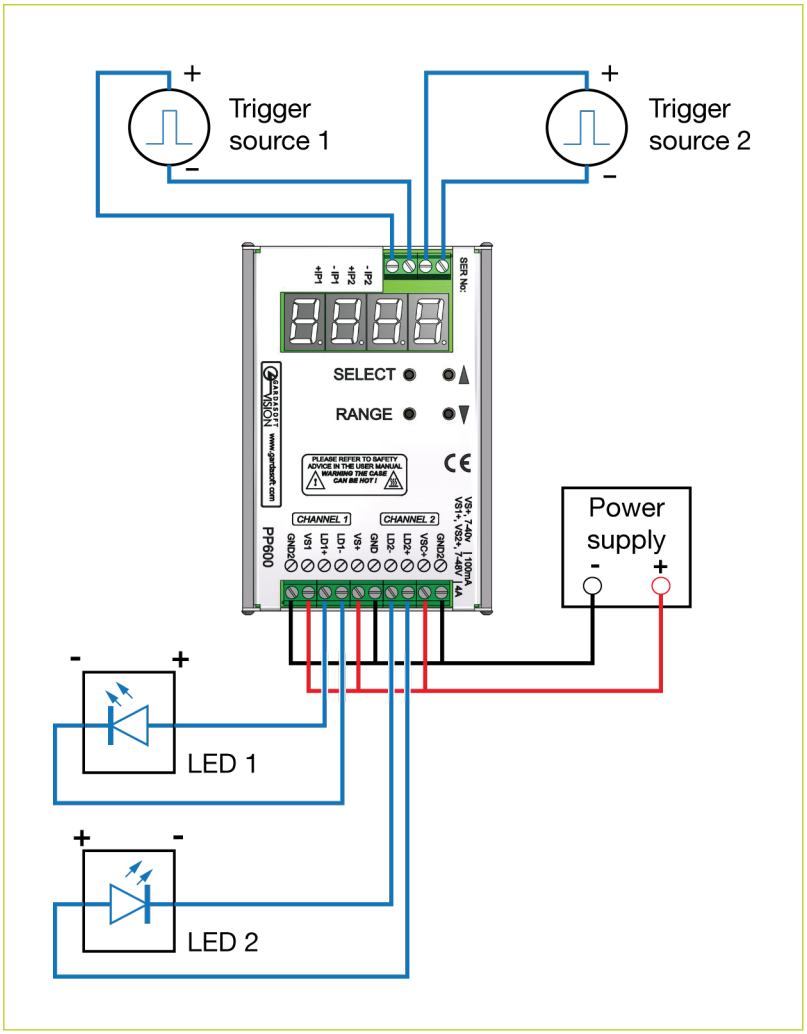
Start by wiring up the PP600 as described in Section 8.2.1, Single supply applications. It is possible to run the two channels and digital system from two or three separate supplies as shown in Section 8.2.2, Split supply applications, though this will rarely be necessary.

Power supplies should be regulated with SELV compliant outputs (fault tolerant). Consideration should be given to fusing VS1+ and VS2+. The fuse value can be based on the average current output.

Note: In Europe fuses are designed to pass at their rated current, while in the USA fuses are designed to blow at their rated current.

8.2.1 Single supply applications

The diagram overleaf shows the normal supply wiring scheme for the PP600. The three ground connections and VS connections are commoned.

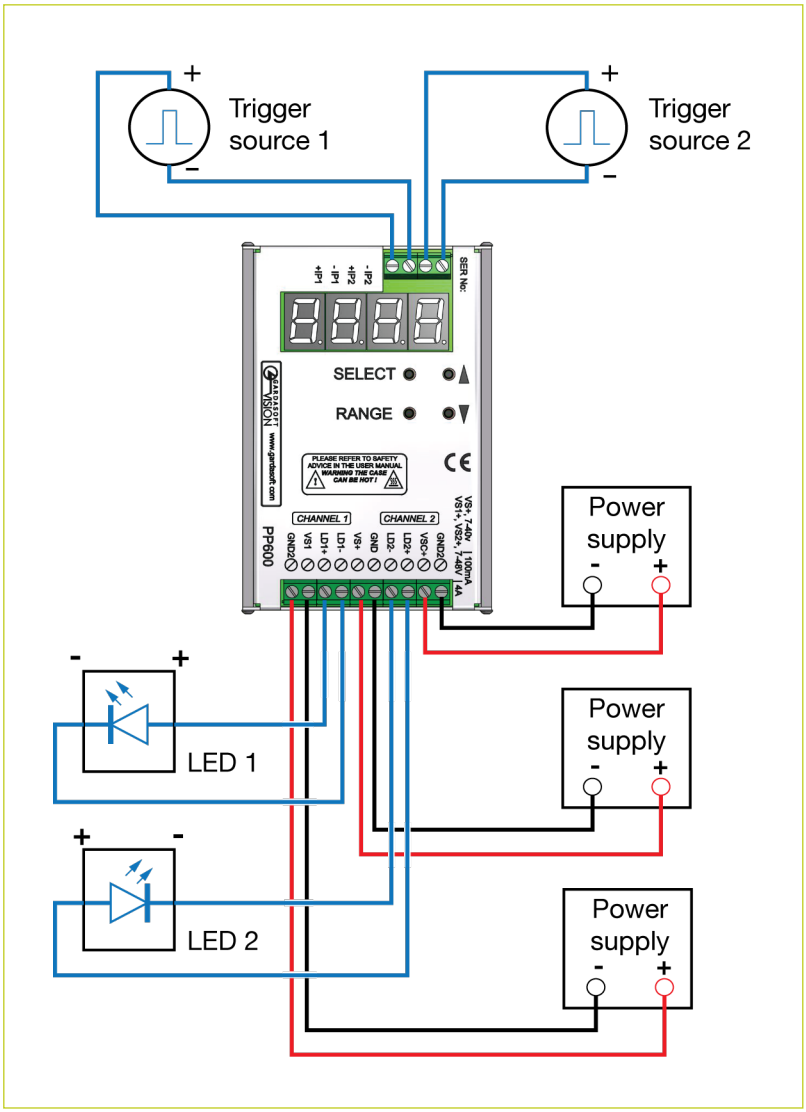


Note: A PP600 is shown in these illustrations. The same power connections apply for a PP602.

8.2.2 Split supply applications

It is possible to run the two channels and digital system from two or three separate supplies as shown below, though this will rarely be necessary.

Note: It is essential that the ground of the three supplies are commoned close to the PP600.



9 Operation

The PP600 is set up using the push buttons and display on the front of the unit. The setup is non-volatile, so the PP600 will resume the same operation after a power cycle.

9.1 Startup

On power up, the PP600 will display 8.8.8.8. to test the display is working, then PP6, followed by the version number, for example 0 17, and then the controller will be ready for operation. To show that the unit is operating normally, an alternating pattern is shown on the display.

9.2 Cold start

In the unlikely event that the non-volatile memory becomes corrupt the PP600 may not start up properly. In this case the memory can be cleared by powering up the PP600 while holding down the **SELECT** and **DOWN** buttons. The PP600 will display COLd for about 10 seconds while the memory is cleared.

9.3 Set up

Each channel of the PP600 can operate in three ways:

- Continuous output (Con): The output current is fixed.
- Selected continuous output (SE 1, SE 2, SE 12): One or both inputs can be used to select an output current. For each state of the inputs, the output current is fixed.
- Pulsed output (PU 1, PU 2): The output is normally off. When a trigger occurs, there is an optional delay, then the output is pulsed for a specified time. A trigger is a leading edge on an input signal; that is, a transition from 0V to 5V on the input.

  Each output operates asynchronously. For example, one output can be pulsing while the other has a different output current selected.

9.3.1 Continuous output and selected continuous output

In continuous output mode (Con), the output current is fixed and continuous.

For selected continuous output, the current is constant. The amount of current is selected using one or both digital inputs.

- Mode SE 1 uses INPUT1 to select between two current values. When INPUT1 changes state the output current changes.
- Mode SE 2 uses INPUT2 to select between two output currents.

- Mode SE 12 uses the four combinations of INPUT1 and INPUT2 to select between four different output currents.

The table below explains how the input conditions affect the output current settings according to what mode is selected:

Mode	Inputs	Output
Con	Don't care	Current setting 1
SE 1	INPUT1 = 0	Current setting 1
	INPUT1 = 1	Current setting 2
SE2	INPUT2 = 0	Current setting 1
	INPUT2 = 1	Current setting 2
SE 12	INPUT2 = 0, INPUT1 = 0	Current setting 1
	INPUT2 = 0, INPUT1 = 1	Current setting 2
	INPUT2 = 1, INPUT1 = 0	Current setting 3
	INPUT2 = 1, INPUT1 = 1	Current setting 4

9.3.2 Pulsed output

The output is off by default. When a trigger is received on one of the digital inputs, the PP600 will wait for a delay period and then pulse the output. The delay period, pulse width and pulse current are all configurable.

Mode PU 1 triggers from INPUT1, and Mode PU 2 triggers from INPUT2. Triggers occur on the leading edge of the input, that is, on the transition from 0V to (for example) 5V input.

9.3.3 Simple and Extended Set-Ups

There are two ways to set up the PP600 – simple and extended. Simple Set-Up can be used to set up:

- Continuous output in milliamps, and
- Pulsed output.

Simple Set-Up **cannot** be used to set up:

- Continuous output in steps of 0.25mA,
- Continuous output, selected by digital input, and
- Setting current protection.

Extended Set-Up can be used to set all features but is slightly more difficult to use (see Section 9.5, Extended Set -Up).

9.3.4 Current protection

Current protection can be used to provide the LED from being overdriven. This is not absolute protection but provides some safety when setting up the PP600.

Use Extended Set-Up to set the maximum current rating for each output channel. The PP600 will then ensure that the current to the LEDs, averaged over approximately 200ms, does not exceed the rating.

If the rating is exceeded, the output is turned off and the display shows EC 1 or EC 2 to show which channel has exceeded its rating. If one of these messages is displayed press the **SELECT** button to clear it.

Note that after a cold boot (and the factory default) the maximum rating is set to 4A.

9.3.5 Setting numeric values

When the PP600 displays numeric values for the user to change, the right hand digit flashes to indicate that the ▲ and ▼ buttons can be used to change the lowest digit. Pressing the **RANGE** button selects another digit which flashes, indicating that it can be changed by pressing the ▲ or ▼ buttons.

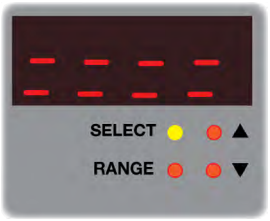
9.4 Simple Set-Up

Use Simple Set-Up to set continuous output and pulsed output.

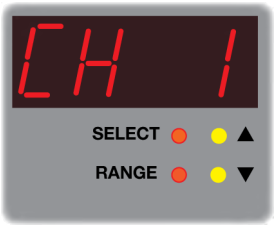
9.4.1 Setting continuous output

Continuous output on a PP600 controller can be set up using Simple Set-Up. Set up continuous mode as follows:

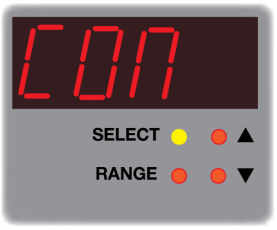
Note: Pressing and holding **SELECT** at any time will cancel the operation. Do not set the output current higher than the rating for the LEDs.



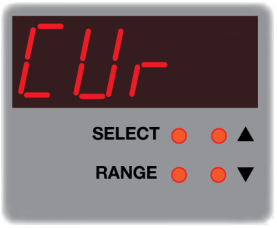
The PP600 is ready. Press and hold **SELECT** for one second.



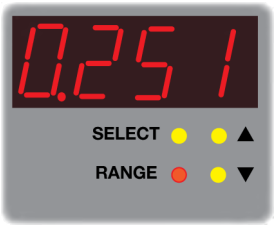
Use the ▲ and ▼ buttons to select which output channel to set up - **CH1** or **CH2**. Press **SELECT**.



Use the ▲ and ▼ buttons to select **CON**. (PU1 and PU2 are also displayed). Press **SELECT**.



CUR is displayed. Wait for one second...

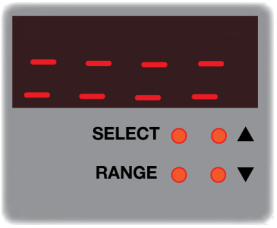


Use the ▲ and ▼ buttons to select the required current in Amps.

Note: Refer to: Section 9.3.5, Setting numeric values.

Press **SELECT**.

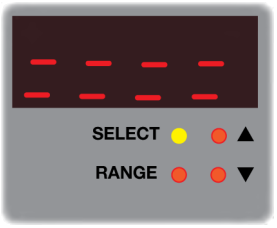
dONE is displayed for one second.



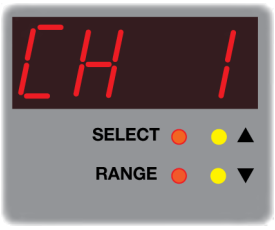
The PP600 sets the output current.

9.4.2 Setting pulsed operation

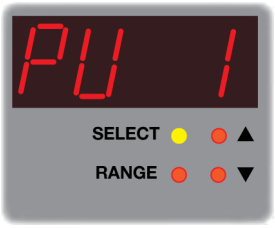
Pulsed output on a PP600 controller can be set up using Simple Set-Up. Set up pulsed mode as follows:



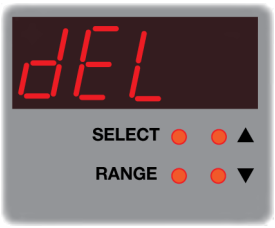
The PP600 is ready. Press and hold **SELECT** for one second.



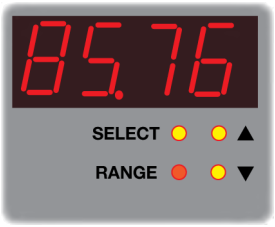
Use the ▲ and ▼ buttons to select which output channel to set up - **CH1** or **CH2**. Press **SELECT**.



Use the ▲ and ▼ buttons to select **PU1** to trigger from INPUT1 or **PU2** to trigger from INPUT2.



DEL is displayed. Wait for one second...

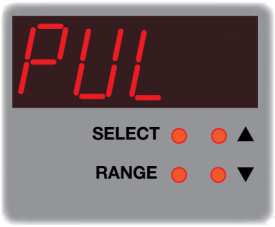


Use the ▲ and ▼ buttons to select the required delay in milliseconds

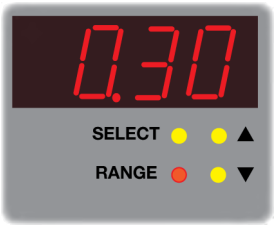
Note: The delay is set in multiples of 20ms.

Note: Refer to: Section 9.3.5, Setting numeric values.

Press **SELECT**.



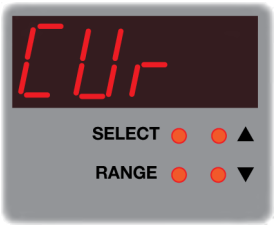
PUL is displayed. Wait one second...



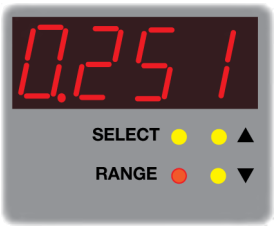
Use the ▲ and ▼ buttons to select the required pulse width in milliseconds.

Note: Refer to: Section 9.3.5, Setting numeric values.

Press **SELECT**.



CUR is displayed. Wait one second...

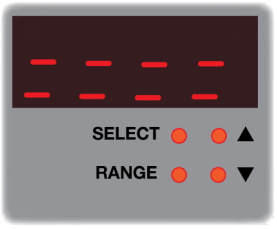


Use the ▲ and ▼ buttons to select the required current in Amps.

Note: Refer to: Section 9.3.5, Setting numeric values.

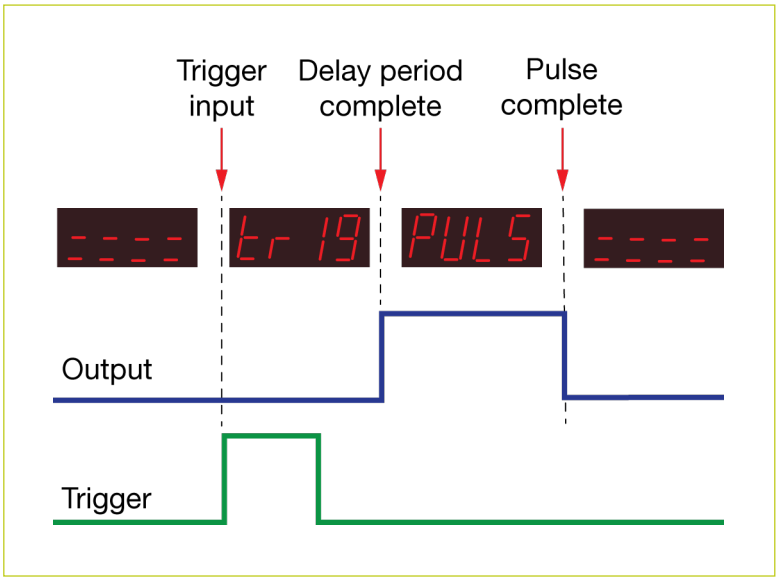
Press **SELECT**.

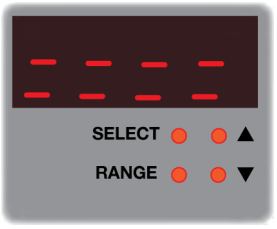
dONE is displayed for one second.



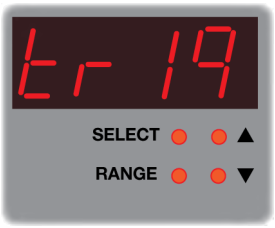
The PP600 is ready to pulse the output on a trigger.

When the lights are pulsed, the display shows that a trigger has occurred as follows:

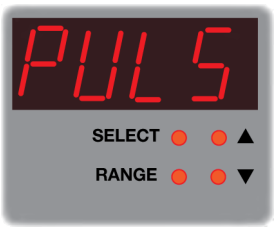




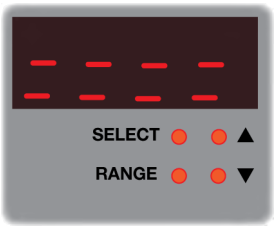
The PP600 is ready.



The PP600 shows that a trigger has been received for one of the channels and the delay period is running.



The PP600 shows that one of the channels is being pulsed.



The PP600 is ready.

9.5 Extended Set -Up

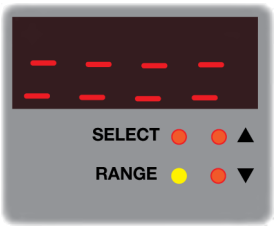
Extended Set-Up allows all features of the PP600 to be set up. It is entered by holding the **RANGE** button down for one second.

In order for the whole range of timing values to be entered, it is necessary to specify whether the delay is in seconds or milliseconds. This is done by selecting an exponent of **0** for seconds, or **–3** for milliseconds. The same applies for setting the current values. Refer to the steps overleaf for how this is set up.

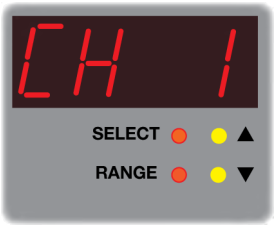
Extended Set-Up allows the current to be set up in steps of 0.25mA, whereas Simple Set-Up only allows 1mA steps.

9.5.1 Setting continuous output (extended)

Set continuous output on a PP600 as follows:

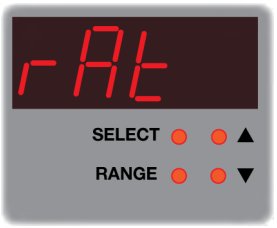


The PP600 is ready. Press and hold **RANGE** for one second.

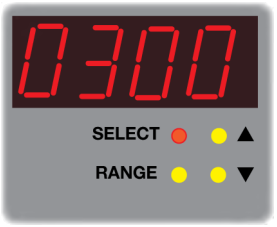


Use the ▲ and ▼ buttons to select which output channel to set up - **CH1** or **CH2**.

Press **SELECT**.

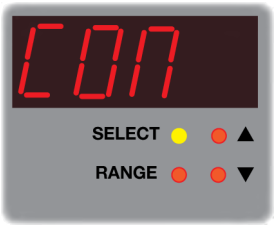


rAT is displayed. Wait one second...



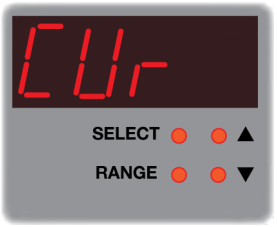
Use the ▲, ▼, and **RANGE** buttons to select the maximum current rating of the LED unit.

Press **SELECT**.

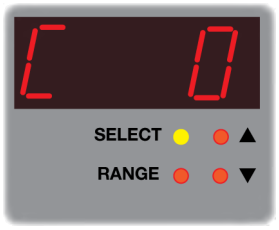


Use the ▲ and ▼ buttons to select **CON**. Select **SE1**, **SE2**, or **SE12** for slected output (see Section 9.3.1, Continuous output and selected continuous output). (PU1, PU2, and PU12 are also displayed).

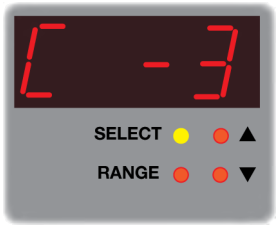
Press **SELECT**.



CUR is displayed. Wait one second...



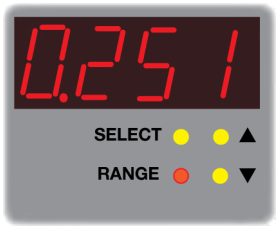
(a)



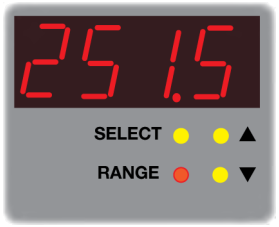
(b)

Use the ▲ and ▼ buttons to select **C0** to enter the current in Amps (a), or **C-3** to enter the current in milliamps (b).

Press **SELECT**.



(a)

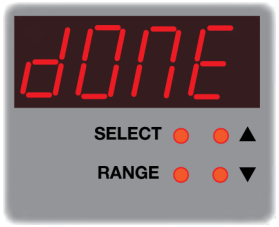


(b)

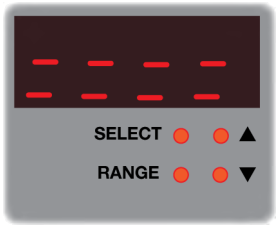
Use the ▲ and ▼ buttons to select the required current in Amps (a), or milliamps (b).

Note: Refer to: Section 9.3.5, Setting numeric values.

Press **SELECT**



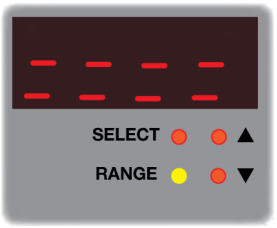
dONE is displayed for one second.



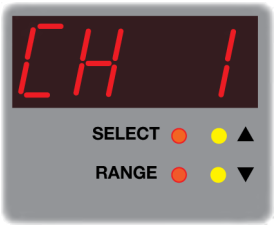
The PP600 sets the output current.

9.5.2 Setting pulsed output (extended)

Set pulsed operation on a PP600 as follows:

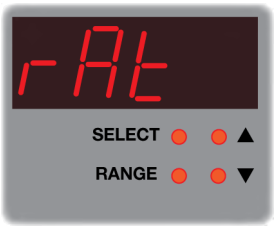


The PP600 is ready. Press and hold **RANGE** for one second.

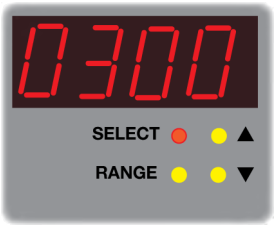


Use the ▲ and ▼ buttons to select which output channel to set up - **CH1** or **CH2**.

Press **SELECT**.



rAT is displayed. Wait one second...

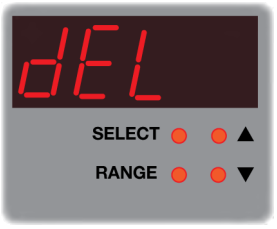


Use the ▲, ▼, and **RANGE** buttons to select the maximum current rating of the LED unit.

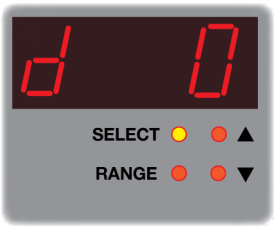
Press **SELECT**.

Use the ▲ and ▼ buttons to select **PU1**, **PU2**, or **PU12** according to which input you want to trigger from. (CON, SE1, SE2, and SE12 are also displayed).

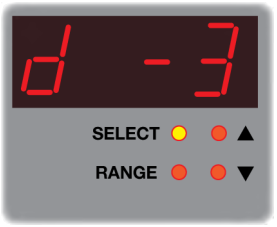
Press **SELECT**.



dEL is displayed. Wait one second...



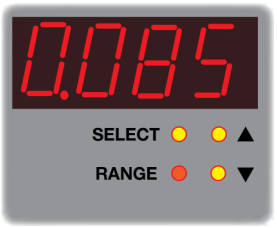
(a)



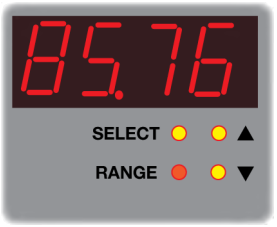
(b)

Use the ▲ and ▼ buttons to select **d0** to enter the delay in seconds (a), or **d-3** to enter the delay in milliseconds (b).

Press **SELECT**.



(a)

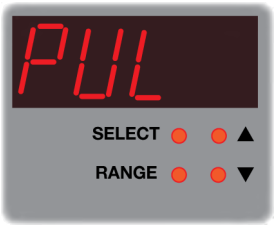


(b)

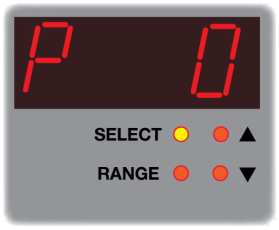
Use the ▲ and ▼ buttons to select the required delay in seconds (a), or milliseconds (b).

Note: Refer to: Section 9.3.5, Setting numeric values.

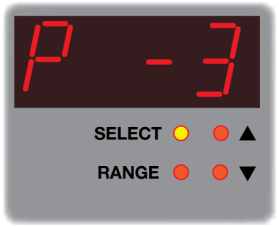
Press **SELECT**



PUL is displayed. Wait one second...



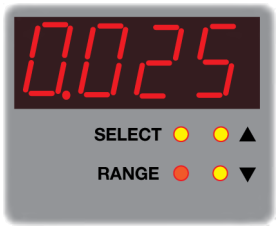
(a)



(b)

Use the ▲ and ▼ buttons to select **P0** to enter the pulse width in seconds (a), or **P-3** to enter the pulse width in milliseconds (b).

Press **SELECT**.



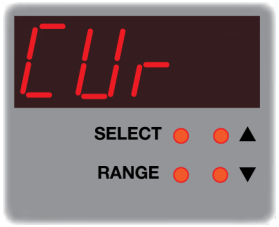
(a)

(b)

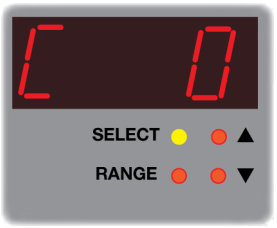
Use the ▲ and ▼ buttons to select the required pulse width in seconds (a), or milliseconds (b).

Note: Refer to: Section 9.3.5, Setting numeric values.

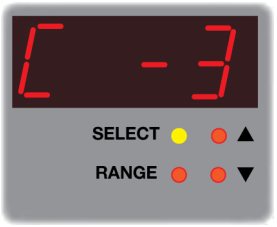
Press **SELECT**



CUr is displayed. Wait one second...



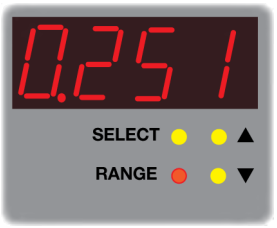
(a)



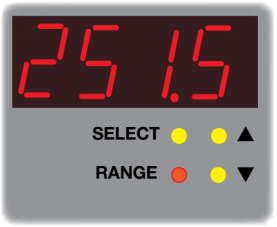
(b)

Use the ▲ and ▼ buttons to select **C0** to enter the current in amps (a), or **C-3** to enter the current in milliseconds (b).

Press **SELECT**.



(a)

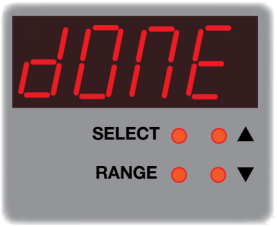


(b)

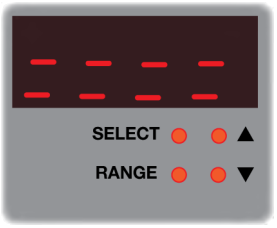
Use the ▲ and ▼ buttons to select the required current in amps (a), or milliamps (b).

Note: Refer to: Section 9.3.5, Setting numeric values.

Press **SELECT**.



dONE is displayed for one second.



The PP600 is ready to pulse the output on a trigger.

10 Reference information

Parameter	Value	Notes
Digital supply voltage (VS+)	7VDC (min) 40VDC (max) regulated	Ideally set this voltage as low as possible to reduce the total unit power dissipation.
Digital supply current	125mA (max)	
Load supply voltage (LD+)	48VDC (max) regulated	Must be at least 1V greater than the load potential difference at maximum required current.
Input enable level (IP_H) Input disable level (IP_L)	$24>IP_H>4.5V$ $IP_L<1V$	This is the voltage applied between the anode and cathode of each optically isolated input.
Output current per channel	4A continuous or10A pulsed	Maximum allowed current per channel. Average current when pulsing must not exceed the maximum allowed continuous output.
Ambient temperature during operation	5° to 40°C	
Maximum relative humidity during operation	90%rH non-condensing	
Total unit power dissipation without heatsinking	P_D=10 Watts (max)	This is the sum of $(V_S-V_F) \times I_L$ for each current output, where: I_L=Output current load (Amps) V_F=Load forward voltage

11 Timings

11.1 Selected continuous mode

When using selected continuous mode, the maximum delay from an input changing to the output current changing is 500µs.

11.2 Pulse mode

For short delays and pulse widths, the actual timings are repeatable but not exact. Timings are dependent on the output current as described in the table below.

The timings are given for channel 1 and assume a trigger input signal of 5V. The delays are approximately 8µs shorter for a 24V trigger input. The delays for channel 2 are greater. All timings are given in microseconds.

Programmed		Actual timing Output current: 100mA		Actual timing Output current: 1A	
Delay	Pulse width	Delay	Pulse width	Delay	Pulse width
20	20	41	11	29	23
20	40	41	30	29	41
40	20	58	14	48	22
40	40	58	32	48	40
60	60	72	52	61	62
100	100	112	92	101	102

Variations in the delay and pulse widths are caused when events happen on both channels simultaneously. Without simultaneous events, the variation is +/– 1µs.

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12 Error codes

Error codes may be displayed by the PP600. These are in the form **E *nn***, where ***nn*** gives the number of the error. To cancel the error message, press **SELECT**. The error codes are given in the table below:

Code	Meaning
EC 1, EC2	The current to one of the outputs has been turned off because the maximum output energy has been exceeded. To fix this, reduce the pulse width or increase the maximum output energy allowed.
Et	The PP600 has a thermal cut-out. If the internal temperature reaches 62°C, which corresponds to a case temperature of approximately 70°C, the output currents are turned off. This message persists until the PP600 has cooled down to below 62°C.
E 16	When the unit has powered up the non-volatile memory was corrupt and has been cleared. Set up the unit again.
E25, E26	The PP600 is calibrated during manufacture. This stored calibration has become invalid. Make a note of the number and contact your distributor.
E00, E01, E02, E03, E04, E05, E06, E07, E 18, E42, E43	A hardware error has occurred. Try power cycling the unit and see if the fault clears. If not, make a note of the number and contact your distributor.
E33, E44, E49, E51	A serial command has been received which is invalid. E33 is generated if the command format is wrong and the other messages if a parameter has an illegal value. Correct the command and re-send it. If these errors are intermittent then check the integrity of the serial link. ***Note:*** These error messages are also output on the serial port but the number is sent in hexadecimal, so the four errors are sent as **E21**, **E2C**, **E31**, and **E33** respectively.

Code	Meaning
E 17, E40, E41, E64, E65, E67, E74	An internal software error has occurred. Make a note of the number and contact your distributor.

This page is left blank for your notes:

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