PPCC16xx LED Controller

Issue 014

User manual

Copyright and disclaimer notice

EC conformity declaration

The EC Certificate of Conformity is available from Gardasoft Vision Ltd on request

Issue status of this document: Issue 014 (March 2017)

Contents

1   Getting started

Before you use this product, make sure that you have read and understood Section 2, Safety, (or Section 3, Sicherheit, or Section 4, Sécurité) and , and that you have checked the PP16CCxx fulfils your requirements. Throughout this manual, all versions of the controller will be referred to as the PP16xx, unless specified otherwise.

Mount the PP16CCxx (see Section 5, Mounting the PPCC16xx) and **connect** it up as required (see Section 7, Connecting the PPCC16xx).

Set up the PP16CCxx for the desired operation as described in Section 9, Web page configuration or Section 10, Command configuration.

We recommend that you visit www.gardasoft.com for application notes on this product. There is also a support web page there, which has information on trouble-shooting problems.

1.1   PP16CCxx features - a summary

The PPCC16xx product is a sixteen channel LED lighting controller for use in machine vision applications that can deliver up to 20A per channel in pulse mode. Other variants of the product family are described in the table below.

Product	Max. Current	Resolution	Ethernet	RS232
PPCC1620	2A	7mA	Y	N
PPCC1621	5A	0.5mA	Y	N
PPCC1660	5A	7mA	N	Y
PPCC1661	2A	0.5mA	N	Y

Three modes of operation can be provided independently to each channel:

● **Continuous:** In continuous mode, the output is constant.

● **Pulsed:** Also referred to as 'strobed', this output mode produces one pulse on the receipt of a trigger input. The pulse width can range from 1µs to 300ms in 0.1µs steps. The delay can range from 4µs to 300ms in 0.1µs steps.

● **Switched:** In switched mode, a trigger input can be used to switch the output current on and off. The output is only enabled when the input has a voltage on it.

Configurations can be saved in non-volatile memory so that the PPCC16xx will resume operation after a power cycle.

1.2   Triggering

The PPCC16xx has 8 trigger in puts. Any trigger input can be used to trigger any output. Each channel can use a trigger input active high or active low.

You can set up the trigger input used through the webpage (see Section 9, Web page configuration) or with the **RP** command (see Section 10, Command configuration). The default settings are:

Channels	Triggered by:
CH0, CH1	TRIG0
CH2, CH3	TRIG1
CH3, CH4	TRIG2
CH5, CH6	TRIG3
CH7, CH8	TRIG4
CH10, CH11	TRIG5
CH12, CH13	TRIG6
CH14, CH15	TRIG7

You can set the P flag though the webpage or by using the **RE** command. This sets a channel to trigger active high or active low. Two channels can trigger from different edges of the same input.

Mode	P Flag	Output
Continuous	Unused	Output is on
Switched	P Flag = 1	Output is off when trigger is off Output is on when trigger is on
	P Flag = 0	Output is on when trigger is off Output is off when trigger is on
Pulsed	P Flag = 1	Pulse is triggered on rising edge
	P Flag = 0	Pulse is triggered on falling edge

Normally it is necessary to synchronise pulsing to an external camera signal. However, you can use the PPCC16xx's internal trigger to generate regular trigger pulses. You can set the period of the internal trigger in steps of 100μs from 200μs upwards.

You can use the **TR** command to trigger an individual channel.

1.3   Digital outputs

The PPCC16xx controllers have 8 TTL level digital outputs. You can use these as general purpose outputs or to synchronise camera triggers to lighting pulses.

These outputs and commands to configure them are described in Section 10.5, Trigger output commands.

2   Safety

Read this before using the PPCC16xx. 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 PPCC16xx is mounted correctly (see Section 5, Mounting the PPCC16xx), and that you do not exceed any of the ratings for the unit (see Section 11, PP16xx reference information).

At its maximum ratings, the PPCC16xx'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 PPCC16xx 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 PPCC16xx for about 15 seconds.

The PPCC16xx 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 PPCC16xx 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 11, PP16xx 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 12A.

- 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 12A using a slow blow fuse (T12AH, 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 PPCC16xx.

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 PPCC16xx 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 and Gardasoft LLC accept 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 PPCC16xx 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 PPCC16xx korrekt montiert ist (siehe Section 5, Mounting the PPCC16xx) und dass Sie die Grenzwerte für das Gerät nicht überschreiten (siehe Section 11, PP16xx reference information).

Bei den maximalen Grenzwerten kann das Gehäuse des PPCC16xx 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 PPCC16xx 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 PPCC16xx gespeichert.

Das PPCC16xx 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 PPCC16xx 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 11, PP16xx 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 12A 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 (T12AH, 50V) bis 12A 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 PPCC16xx 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 PPCC16xx 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, übernehmen Gardasoft Vision Ltd und Gardasoft LLC 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 PPCC16xx. 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 PPCC16xx soit monté correctement (voir Section 5, Mounting the PPCC16xx) et à ne dépasser aucune valeur nominale pour l'unité (voir Section 11, PP16xx reference information).

Lorsqu'il atteint ses valeurs nominales maximales, le boitier PPCC16xx 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 PPCC16xx 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 PPCC16xx est éteint, de l'énergie résiduelle reste dans l'appareil pendant environ 15 secondes.

Le PPCC16xx 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 PPCC16xx doit fournir une isolation double/renforcée pour isoler le PPCC16xx 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 11, PP16xx reference information pour les limites de tension autorisées.

- Lorsqu'il atteint ses valeurs nominales maximales, le boîtier du PPCC16xx 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 12A.

- 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 12A en externe, plus précisément un fusible à action retardée (T12AH, 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 PPCC16xx.

  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 PPCC16xx 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 et Gardasoft LLC 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 Mounting the PPCC16xx

The PPCC16xx can be mounted onto a flat surface using the M4 threaded holes in the base, see the diagram below.

Note: Mounting studs must not protrude any further than 6mm from the surface the PPCC16xx is to be fastened to.

The enclosure of the PPCC16xx 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 PPCC16xx (as defined in Section 11.1, Specifications and ratings) exceeds 16 Watts.
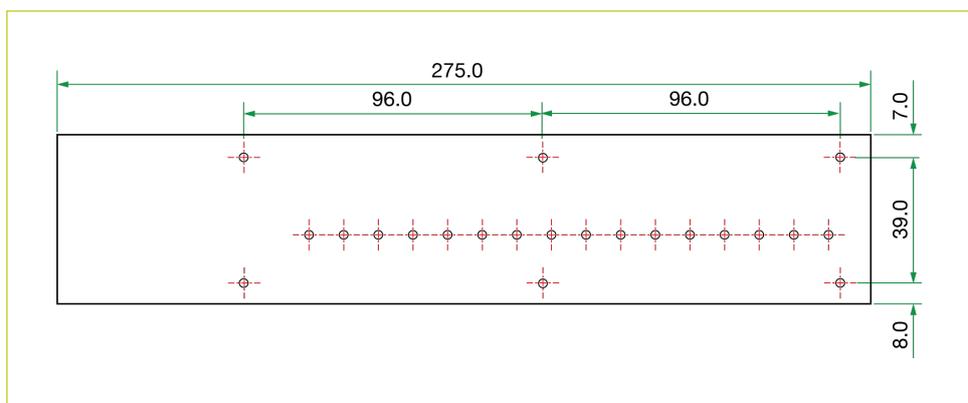
5.1 Environmental considerations

The PPCC16xx enclosure is a fire enclosure as long as the following conditions are met. The unit must be mounted either with the mounting face horizontal or downwards or with the large face of the base horizontal and downwards. All downwards facing holes must have a screw in them.

If a fire enclosure is used, the enclosure 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 PPCC16xx when mounted. Cable entries below the PPCC16xx should be through glands that also have a flammability rating of UL94V1. The PPCC16xx should be at least 10mm from any other part or side of the enclosure.

The PPCC16xx does not have an IP rating and should be mounted so that moisture and dirt cannot enter the unit.

Orientation of the controller as a fire enclosure is as shown above.

6 Heat dissipation and thermal guidance

The PPCC16xx has a linear circuit to produce the constant current output. This means that it generates heat which needs to be dissipated.

For more information on this and a spreadsheet to calculate the heat output, see application note APP941 at www.gardasoft.com.

6.1 Heat output per channel

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

$$D_H = I_O \times (V_S - V_L)$$

Where:

D_H	Heat dissipation in watts
I_O	Output current in amps
V_S	Supply voltage in volts
V_L	Voltage across the lighting in volts

This is usually easy to calculate as the voltage across the lighting is normally the voltage rating of the light given in its specification, or as measured using a voltmeter.

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

$$D_H = I_O \times Duty\ Cycle \times (V_S - V_L)$$

Where:

Duty Cycle = Pulse width (s) x *Trigger Frequency* (Hz)

When overdriving, the voltage across the lighting is more difficult to determine. In most cases it is reasonable to use the voltage rating of the light.

6.2 Total heat dissipation and heat sinking

The total heat dissipation for the PPCC16xx is given by adding together the heat output for all channels, as calculated above.

To maintain normal operation, please adhere to the following thermal guidance:

If the ambient temperature is below 40°C the maximum heat dissipation may be 8W without any heat sinking.

If the ambient temperature is less than 25°C, the total heat dissipation may be 16W without any heat sinking required.

If the controller is thermally bonded to a heat sink, then up to 24 watts may be dissipated at any ambient temperature. The heat sink must be of sufficient size to maintain a steady state internal temperature measurement of 60°C.

Sending the **AN** command to the controller reports the internal temperature measurement.

If the thermal guidance isn't followed the controller may over heat. There is a safety cut out, which will turn the output channels off when the internal temperature indicated by the **AN** command command exceeds 70°C.

## 6.3 Minimising thermal dissipation

There are several ways to reduce the heat output from the PPCC16xx:

- Use pulse mode. If the output is only on when you need it then you can dramatically reduce the heat output. Feed the camera trigger into the PPCC16xx and pulse the lights.

- Turn the light off when not needed. If you don't 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 remote 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 two PPCC16xx's and use less channels from each. For high power applications this may be the easiest solution.

7 Connecting the PPCC16xx

Refer to Section 11, PP16xx reference information for the ratings of the connections. To prevent overload of output wiring, all power and output cabling must be rated for a continuous load current of 6.3A minimum. However, this does not apply to the Ethernet, RS232 and trigger input connections.

The PPCC16xx's connections are shown below:
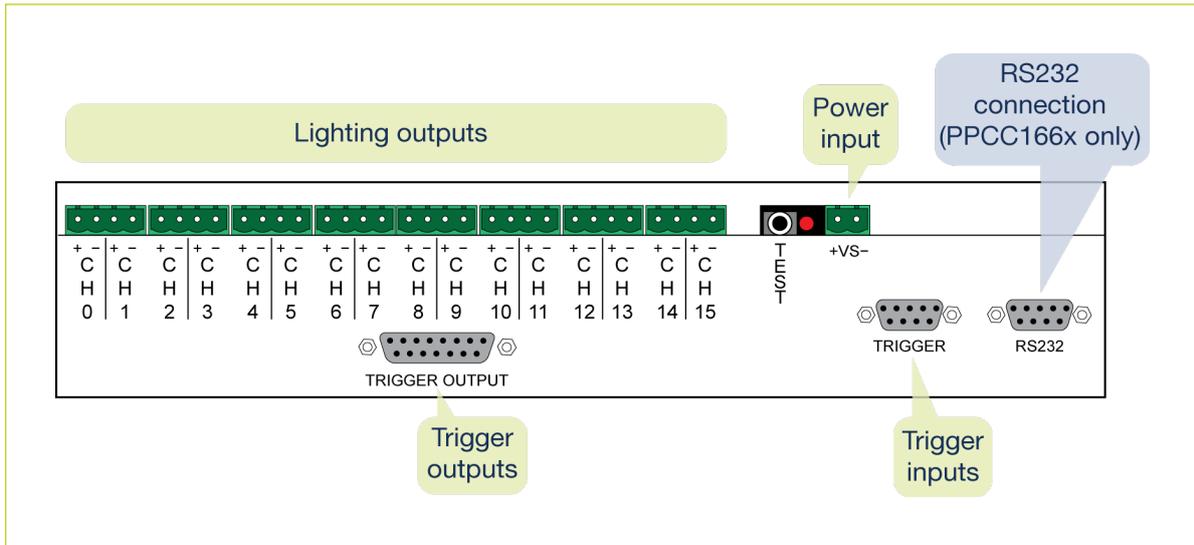
7.1 Power

Any power supply derived from mains electricity must have a Safety Extra Low Voltage (SELV) output. Route low voltage wiring to the PPCC16xx controller separately from mains electricity wiring, refer to Section 2, Safety

If this is not possible, make sure the low voltage wiring has an insulation rating that is appropriate or supplementary insulation is used. The connections are shown below:

Note: The case of the PPCC16xx is not connected to GND.
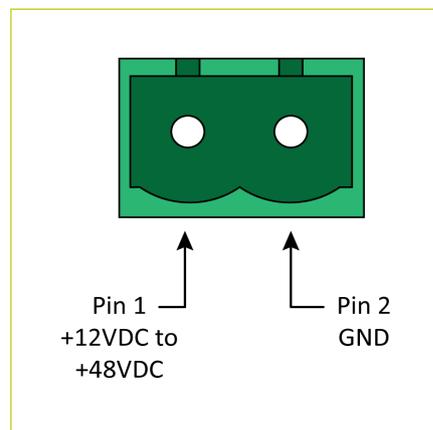
7.2 Lighting output

The lighting output connections must not be shorted together by any metallic object as the energy discharged generates heat within the PPCC16xx. The connections are shown below:
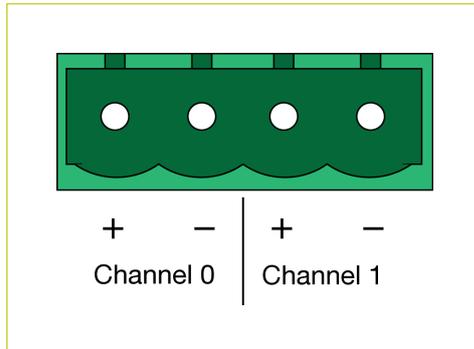
Each power output connector has connections for two output channels as follows:

Pin	Function
1	First channel positive
2	First channel negative
3	Second channel positive
4	Second channel negative

7.3 Trigger input

The PPCC16xx has an opto-coupled trigger input for each channel. The connection to the trigger inputs is through a 9-way male D-type connector as shown below:
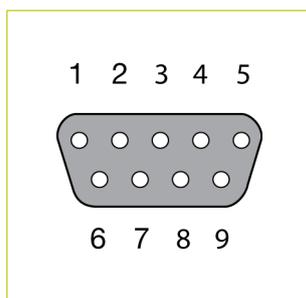
Pin	Function
1	Input 4 positive
2	Input 3 positive
3	Input 2 positive

Pin	Function
4	Input 1 positive
5	Input 0 positive
6	GND (connected to PSU GND)
7	Input 7 positive
8	Input 6 positive
9	Input 5 positive

The circuit for the trigger input is shown below:
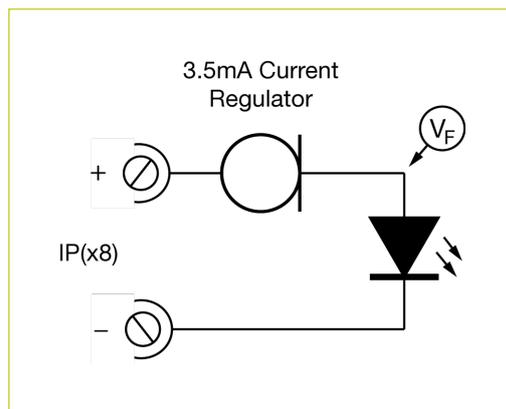
Referring to the diagram above, the operating conditions for the trigger inputs are:

Logic 1	$3V <= V_{TRIG} <= 24V$
Logic 0	$V_{TRIG} < 1V$
V_F	1.5V typically

7.4   Trigger output

The trigger output connector fitted to the PPCC16xx is a standard 15-way female D-type connected as shown in the table below.

It provides eight 5V TTL level outputs, a GND, and a 5V power output. Each output can provide up to 20mA.

Note: The total current from all outputs (including the 5V output) must not exceed 50mA.
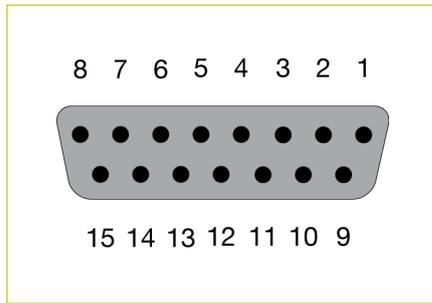
Pin	Function
1	Output 101
2	Output 103
3	Output 105
4	Output 107
5	GND
6	Not connected
7	Not connected
8	Not connected
9	Output 102
10	Output 104
11	Output 106
12	Output 108
13	+5V (unfused)
14	Not connected
15	Not connected

7.5 Ethernet (PPCC162x)

The RJ45 connector fitted to the PPCC162x controller requires a straight-through cable to connect to a network switch, hub or router. The connection is 100Base-T and operates at 100MBits per second.

7.6 RS232 (PPCC166x)

The RS232 connector fitted to the PPCC166x controller is a standard 9-way female D-type. A standard straight through cable can be used to connect the controller to a PC serial port. The communications port settings are 115Kbaud, no parity, 8 data bits and 1 stop bit.

The pin allocation for the serial connector is shown overleaf:

Pin3
Rx

Pin 5
GND

Pin 2
Tx

Rx = input to controller
TX = output from controller
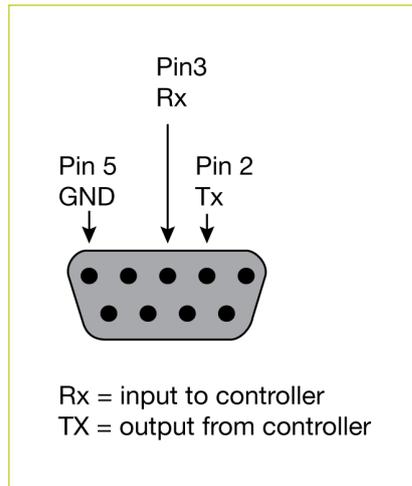
7.7   Connectors (general)

The connectors required to mate with the PPCC16xx's connections are as follows:

Connector	Description	Supplier/Part number
Power input	Würth 351 series 2- way screw terminal free socket	Würth 691 351 500 002 Farnell 164 1952
Lighting output	Würth 351 series 4-way screw terminal free socket	Würth 691 351 500 004 Farnell 164 1954

8   Ethernet address

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

The application note APP923 – Troubleshooting Ethernet problems is available from www.gardasoft.com/Downloads.

The Ethernet set up of the PPCC162x is not affected by cold-booting the controller.

8.1   IP address

The PPCC162x needs an Internet Protocol (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 PPCC162x acquires its IP address, subnet mask, and gateway address from the DHCP server. Otherwise the PPCC162x has a fixed IP address, subnet mask, and gateway address.

DHCP mode or the IP address can be set or read using the GardasoftMaint program available from www.gardasoft.com/Downloads. The GardasoftMaint window is shown below:
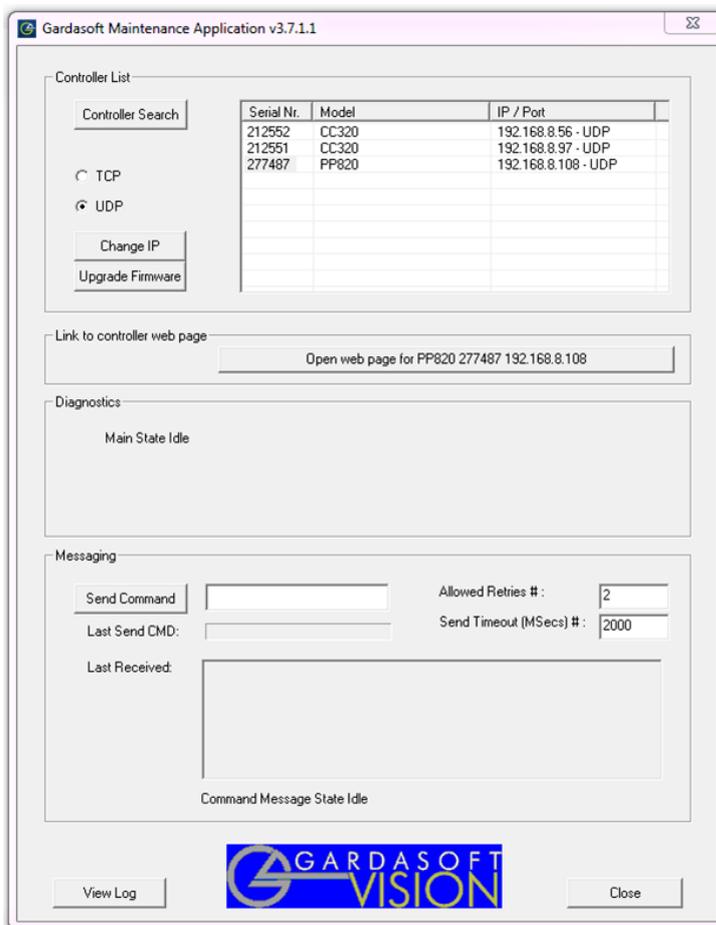
GardasoftMaint allows you to view the controllers on your network, change their IP addresses and upgrade their firmware if it becomes necessary. In the messaging section of GardasoftMaint, you can communicate with your controller using the commands explained in Section 10, Command configuration. You can also open the selected controller's web pages by clicking the **Link to controller webpage** button. For more information about the PPCC162x's web pages, see Section 9, Web page configuration.

8.1.1 MAC address

The PPCC162x's MAC address is in the form:

0x00.0x0B.0x75.0x01.0xNN.0xNN.

8.1.2 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 DCHP as follows:

i. Go to the Control Panel.
ii. Select **Network Connections**.
iii. Right click on **Local Area Connection**. Select **Properties**.
iv. From the list, select **Internet Protocol (TCP/IP)**, press **Properties**.

If 'Obtain an IP address automatically' is set, then DHCP is probably used. However, there may be an alternative fixed IP address on the **Alternative Configuration** tab.

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

i. Go to the Control Panel.
ii. Select **Network Connections**.
iii. Right click on **Local Area Connection**. Select **Status**.
iv. Select the **Support** tab. The IP address is displayed.

8.1.3 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 PPCC162x's, they could be allocated addresses 192.168.1.201 and 192.168.1.202.

8.2 Automatic sensing

The PPCC162x sends out a message on three events:

- On power up,

- When an IP address is received or renewed by DHCP, and

- When an enquiry message is received

On the first two events, the message is broadcast. On the third it is a reply to a single IP address.

An enquiry message is a UDP packet from source port 30310, destination port 30311 with the message body 'GardasoftSearch' (8-bit ASCII, 13 characters).

The message output by the PPCC162x is a UDP packet from source port 30311, destination port 30310. It is formatted as:

Gardasoft,PP82x,000000,111111111111,22222222

(8-bit ASCII, 44 characters), where

000000	is the serial number of the unit
111111111111	is the MAC address in 6 HEX bytes
22222222	is the IP address in 4 HEX bytes

For example for PP822 serial number 12345, IP address 192.168.1.103, MAC address 00.0B.75.01.80.99 the packet comprises:

`Gardasoft,PPCC1622,012345,000B75018099,C0A80167`

9 Web page configuration

You can set up the PPCC162x through its own internal web pages. Click the **Open webpage...** button in GardasoftMaint to take you directly to the PPCC162x's webpages. You can also type the controller's IP address (displayed in GardasoftMaint) into your web browser, which will display the Main page. GardasoftMaint software is available from www.gardasoft.com/Downloads.

9.1 Main page

The main page (shown below) is the first to open when you access the PPCC162x's web pages. This gives the controller's hardware and firmware revision levels and the serial number.
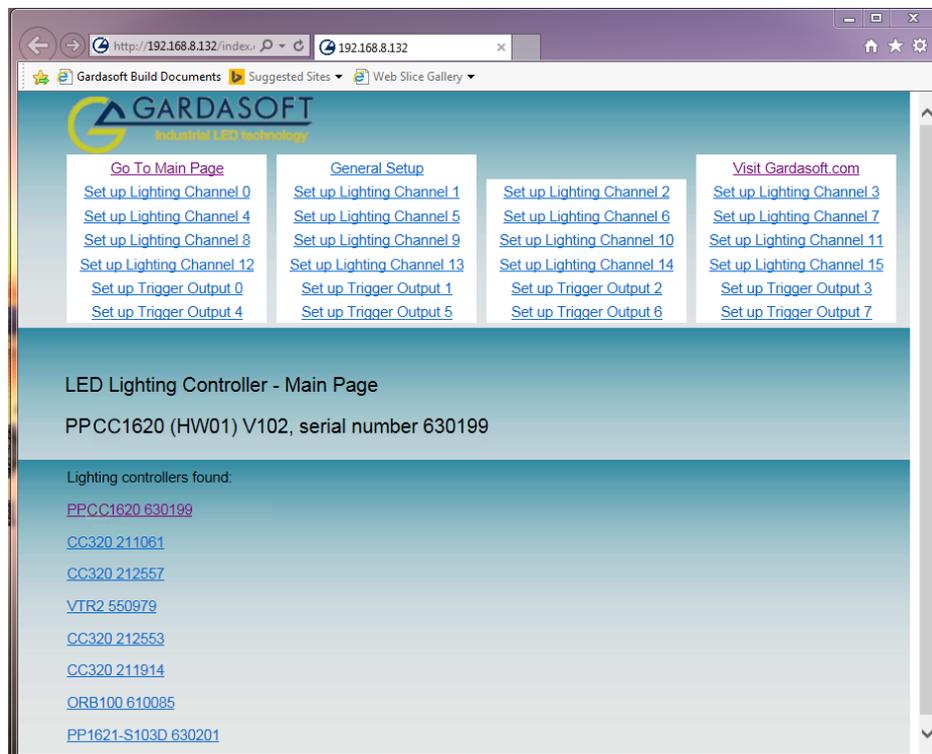
9.2 General setup page

On the general setup page (shown overleaf), you can set a password for the PPCC162x and send it commands. Refer to Section 10, Command configuration for the commands you can use to operate the PPCC162x. You can also set up the trigger mode and turn the internal trigger on or off.
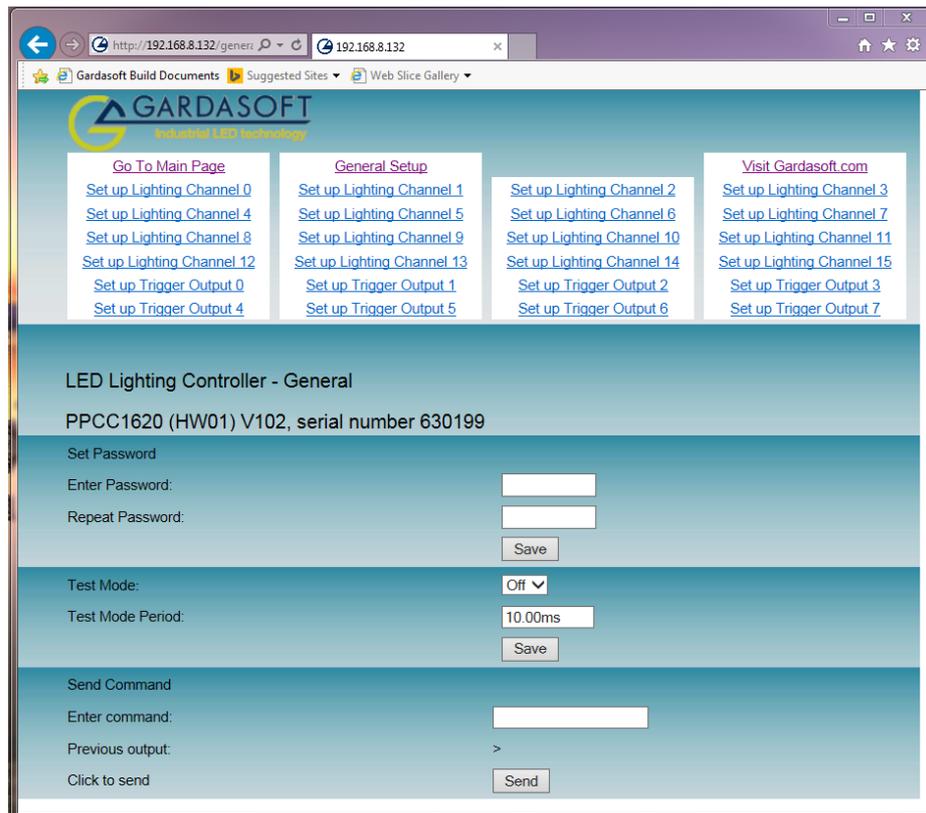
9.3   Configuration page

The configuration page allows you to set up the lighting parameters.

You can set the mode (continuous, pulsed, or switched), the light's brightness and pulse settings. You must click the **Submit** button to effect any changes you make.

The configuration page for Channel 0 is shown overleaf:
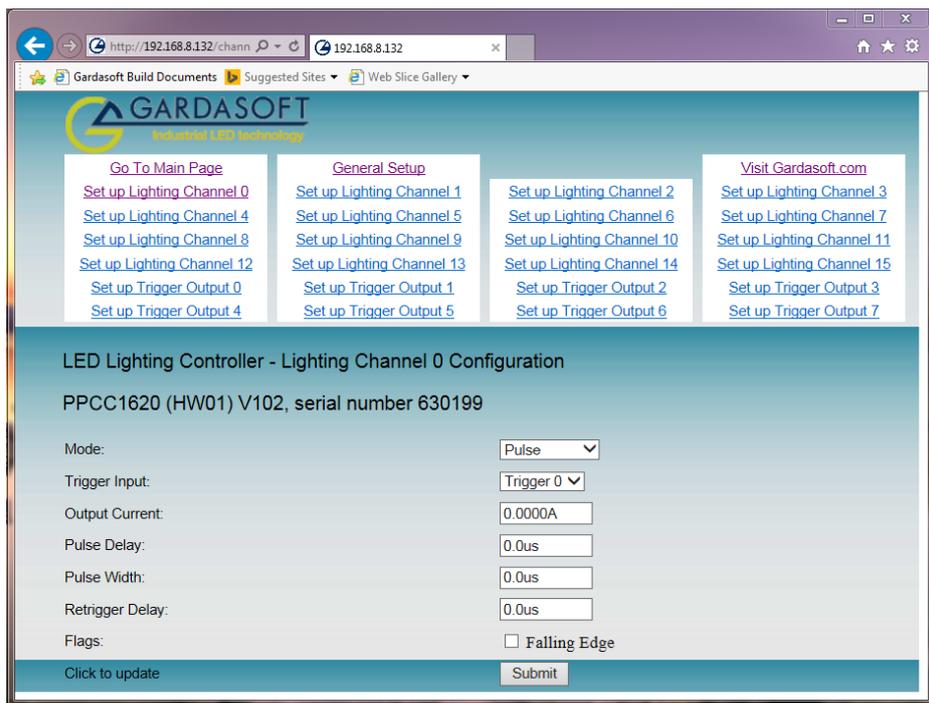
9.4   Trigger output page

The trigger output page (shown below) allows you to set up the eight digital outputs on the PPCC16xx to control other elements of your machine vision system. On this page you can turn the outputs on or off, set up the output pulse characteristics, and define whether a rising or falling edge triggers the output. Refer to Section 10.5, Trigger output commands for further information.
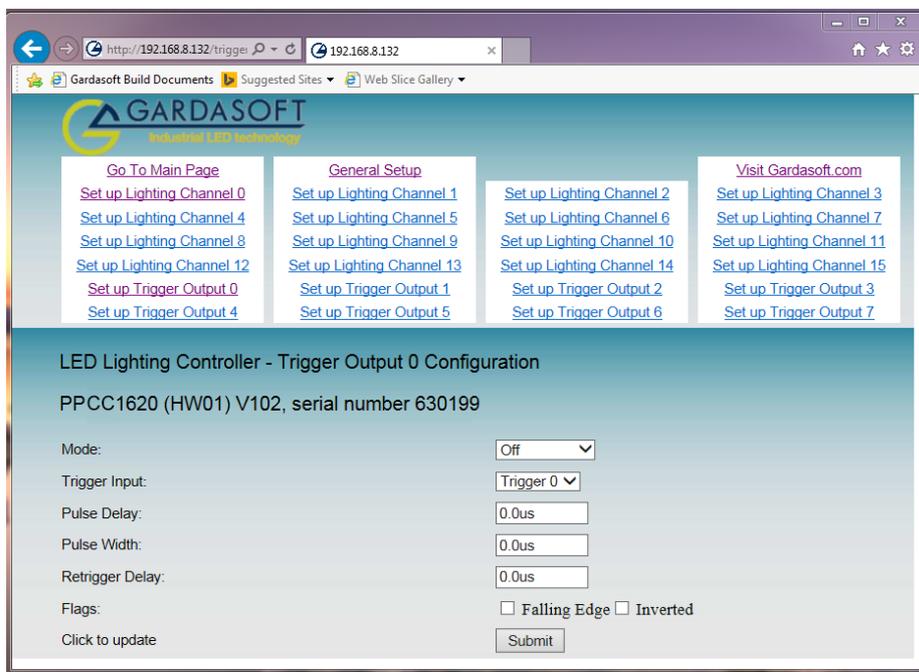
10 Command configuration

The commands in this section can be sent to the PPCC162x through its Ethernet connection, or to a PPCC166xx through its RS232 connection.

This section explains the communication protocols used with the PPCC16xx and goes on to list the commands you can use to operate the controller.

10.1 Communication

The PPCC16xx can be configured via the Ethernet connection using UDP or TCP/IP. You can use GardasoftMaint (available from www.gardasoft.com) to enter commands to the PPCC16xx.

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.

It is recommended 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.

For TCP, commands from a host should be sent to destination port 30313. Replies will be to destination port 30312. For UDP, commands from a host should be sent from source port 30312 to destination port 30313. Replies will be sent from source port 30313 to destination port 30312.

A TCP/IP connection will time out and close if it is idle for more than 10 seconds. The host must send regular 'heartbeat' commands (for example **VR**) to keep the link open.

10.2 Command structure

The PPCC16xx can be programmed using string commands. These commands can be sent by RS232 for the PPCC166x or by Ethernet for the PPCC162x. Configuration programs are available at www.gardasoft.com for both options.

The commands comprise a code of two letters followed by the parameters (several commands can be placed on a single command line by separating them with a semi-colon (**;**). Spaces in the commands are ignored. A carriage return character should be sent to terminate the command line. The PPCC16xx will send any replies to the commands followed by a **>** character to indicate that the command line has been completed.

Numeric parameters are separated by a comma (**,**). For a parameter which is a time period the default units are microseconds. '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 is amps. For example:

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

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

10.3   General commands

The general command codes and their meaning are described below. The upper case commands are shown, followed by lower case letters denoting the numeric argument.

Note: Any changes made using these commands are not saved permanently until the **AW** command has been issued as follows:

Save the settings to memory

AW

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

Report the firmware version

VR

This command returns the firmware version. For example:

```
PPCC1620 (HW0005) V059
```

Set trigger mode

FP0   All channels triggered individually

FP1   Two channels are triggered from one input as follows:

Input 0 triggers channels 0 and 1

Input 1 triggers channels 2 and 3

Input 2 triggers channels 4 and 5

Input 3 triggers channels 6 and 7

Input 4 triggers channels 8 and 9

Input 5 triggers channels 10 and 11

Input 6 triggers channels 12 and 13

Input 7 triggers channels 14 and 15

FP2   Input 0 triggers channels 0 to 3

Input 4 triggers channels 4 to 7

Input 1 triggers channels 8 to 11

Input 5 triggers channels 12 to 15

Note 1: When all channels are being triggered from input 0, the other triggers should not be pulsed.

Note 2: Delays are from 4µs to 10µs longer in FP1 and FP2 modes.

This setting can be saved to non-volatile memory using the **AW** command.

Internal trigger mode

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   Use external triggers

TT1   Use internal trigger (defaults to 25Hz)

TT1,p   Use internal trigger and set the period.

Where **p** is the period of the triggers in microseconds. For example:

TT1,200MS   Set the internal trigger to 200ms (5kHz)

TT1,100   Set the internal trigger to 100µs (10kHz).

Clear settings

Clear all output channel settings: All output channel and timer settings are cleared to a default value 0.0A continuous. This does not clear any Ethernet settings.

CL

Simulate an input trigger

This command sends a trigger pulse to the specified input channel.

TRc

Where **c** is the input channel (0 to 7)

Enable Ethernet messsages

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.

Read any error messages

GR

If Ethernet messages are disabled, the last error number can be read by this command.

The reply is of the form `ErrN` where `N` is the error code, for example:

`Err45`　　Error 45 was the last error.

If there are no outstanding errors ,then an empty reply is sent followed by the **>** character that normally terminates a reply message.

Set/clear the webpage password

EY

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

This command sets the password required to access the webpages. 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 which is 'Z'.

10.4　Lighting commands

You can use the commands listed below to set up the lighting parameters of the PPCC16xx.

Report the current settings for the outputs

ST

Reports the status of all channels.

Note: When using Ethernet communication, the output of the **ST** command will not fit in a reply packet, so the **STc** form of the command must be used (see below).

STc

Reports the status of one channel, where **c** is the output channel (0 to 15).

The status output is in the following format:

`CHcM1VaDdPpRr,Tt,Ff`   for pulsed output mode

`cM2Va`   for continuous mode

`cM3Va`   for switched mode

Where:

c	output channel
m	= 0 for not set up = 1 for pulsed output = 2 for continuous output = 3 for switched operation
a	output current in amps
p	pulse width in microseconds
d	delay before pulse in microseconds
r	retrigger delay
t	Trigger input (set by the **RP** command)
f	Flags (set by the **RE** command).

ST16

This command reports the internal trigger mode, period (**TT** command), and the trigger mode (**FP** command) settings.
A typical output might be:

`TT1 , TP 20.00ms FP 0`

Continuous output mode

This command sets the specified channel to continuous operation at the required current.

RSf,a

Where:

f	lighting output channel (0 to 15) or TTL output channel (101 to 108)

> **a**   lighting channel output current in amps.

For example: Set a continous current of 0.5A on lighting output channel 3.

> RS3,0.5

Set a continuous mode on TTL output channel 102.

> RS102, 1

Switched output mode

This command sets the specified channel to switched mode at the required current.

> **RWf,a**

Where:

> **f**   output channel (0 to 15). The TTL output channels have no switched mode.
>
> **a**   output current in amps.

For example: Set channel 4 to produce 1A whenever input 4 is active.

> RW4,1.0

Pulsed output mode

This command sets the pulse parameters for the specified channel.

Note: Output 1 can only be triggered by input 1, and output 2 can only be triggered by output 2, and so on.

The pulse delay can be from approximately 3µs to 1 second. The pulse width can be any value from 1µs to 1 second.

> **RTf,p,d,a**
>
> **RTf,p,d,a,r**

Where:

> **f**   output channel (0 to15) or
> TTL output channel (101 to 108)
>
> **p**   pulse width in microseconds
>
> **d**   delay from trigger to pulse in microseconds
>
> **a**   output current in amps
>
> **r**   retrigger delay in microseconds (optional).

For example: Set channel 2 to pulsed output at 4A, with a pulse width of 1ms after a delay of 500us:

> RT2,1000,500,4

Set the trigger input

This command sets the input to be used for pulsed and switched output modes:

RPc,p

Where:

c   lighting output channel (0 to 15)

p   input channel

The inputs used to trigger the lighting outputs using the
RP command depend on which trigger mode is set. Refer to Set
trigger mode in Section 10.3, General commands for further
information about this.

Set the trigger flag

REc,m

Where:

c   lighting output channel (0 to 15)

m   = **0**: P flag set (positive triggers)

               = **4**: P flag cleared (negative triggers)

10.5   Trigger output commands

The PPCC16xx has 8 digital outputs which can be used as general
outputs or camera triggers. The outputs are 5V TTL and are numbered
from 101 to 108.

Each output can be set 'on', 'off', or pulsed with precise timing
synchronised to lighting outputs.

The digital outputs can be used to synchronise lighting and cameras. The
controller can be set up to provide a fixed delay between the lighting pulse
and the camera exposure. On some cameras, the exposure time can be
controlled through the trigger pulse width.

When pulsing, each output can be triggered from any trigger input or from
the internal trigger timer.

Turn an output on or off

RSc,v

Where:

c   digital output channels (101 to 108)

v   value (0 or 1)

Trigger an output from a trigger input

RTc,p,d,v,r

Where:

	c	digital output channels (101 to 108)
	p	pulse width in microseconds
	d	delay from trigger in microseconds
	v	must be set to **1**
	r	retrigger time

Select which input triggers the output

RPc,i

Where:

	c	digital output channels (101 to 108)
	i	trigger input (0 to 7), or 255 for the internal timer

Select which edge triggers the output

REc,f

Where:

	c	digital output channels (101 to 108)
	f	= 0 to trigger from the rising edge of the trigger
		=4 to trigger from the falling edge of the trigger

10.6   Command summary

Command	Example	Effect
AW	AW	Save changes.
ST	ST2	Show configuration for channel 2.
VR	VR	Read the firmware version.
RS	RS2,0.7	Set channel 2 to 0.7A continuous.
RW	RW1,1.1	Set channel 1 to 1.1A, switched by input 1.
RT	RT2,3,4,1,9	Set channel 2 to 3ms pulses, delayed by 4ms, with an output pulse current of 1.9A.
FP	FP1	Trigger all channels from trigger 0 input.
TT	TT1,1ms	Set test mode with pulses every 1ms.
CL	CL	Clear all output settings.

Command	Example	Effect
TR	TR2	Trigger channel 2.
EY	EY65,66	Set webpage password to 'AB'.
GR	GR	Read any error messages.
GT	GT1	Enable Ethernet messages.

11   PP16xx reference information

This section contains information about the PPCC16xx's specification, ratings and error codes.

11.1   Specifications and ratings

	PPCC162x	PPCC166x
Configuration/ control	Ethernet using TCP/IP or UDP configured using a web browser, or from the user's application software	RS232 commands from a terminal, or from the user's application software
Output channel options	16 independent, constant current output channels 8 TTL digital outputs	
Output current options	PPCC1620/1660: 20A pulsed, 2A continuous, in steps of 7mA PPCC1621/1661: 2A pulsed, 2A continuous, in steps of 0.5mA	
Trigger inputs	8 opto-isolated digital inputs	
Pulse width timing	From 1ms to 300ms, in steps of 1µs Timing repeatability: 100ns for pulses up to 1ms	
Trigger to pulse delay	From 4µs to 300ms in steps of 1µs. Timing repeatability: 2µs	From 4µs to 300ms in steps of 1µs. Timing repeatability: 1µs
Supply voltage	Regulated or unregulated, 12V to 48V	
Quiescent supply current	100mA (typically)	
Total power dissipation	8W in free air, 24W heatsinked	
Operating temperature	5°C to 40°C	
Dimensions	215mm long x 54mm high x 162mm deep	
Weight	600g	
Mounting	Panel mounting: 6 x M4 tapped holes	
Standards	CE, RoHS	

11.2   Error codes

Error codes may be sent by Ethernet or RS232. These are shown as **Err*nn***, where ***nn*** gives the number of the error. The error codes are:

Error number	Reason
Err01	One of the parameters of a command has an illegal value.
Err02	Command not recognised.
Err03	Failed to save parameters to non-volatile memory.
Err04	The command has the wrong number of parameters.
Err05	This is a warning, not an error. A timing parameter is out of range and the value of that parameter has been adjusted.
Err18	On power-up, the stored configuration was invalid
Err40	When the unit has powered up the non-volatile memory was corrupt and has been cleared. Set up the unit again.
All other errors	A hardware error has occurred. Try power cycling the unit and see if the fault clears. If not, note the error number and contact your distributor.

— 44 —

Issue 014 - March 2017

© Copyright 2017 Gardasoft Vision Ltd

www.gardasoft.com