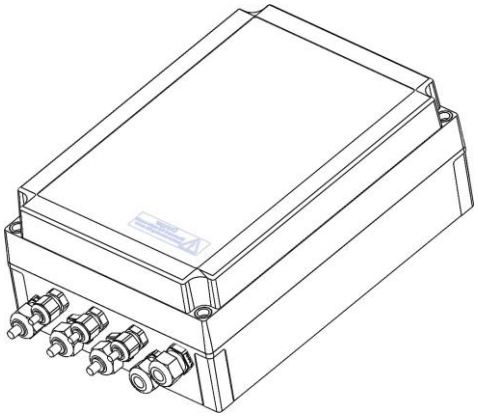
PULSESTAR PSTR Lighting Controllers Engineering Guide



1140-D-00007-Rev 3

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1.0 Getting Started

This user manual describes the setting up and operation of the PULSESTAR PSTR series of pulsed illuminators.

The PSTR series is a range of pulsed illuminators suitable for use in transport or machine vision applications.

For **basic users**, PULSESTAR PSTR is factory set to work from a trigger to pulse the illuminators. All lighting parameters are fixed and should not be adjusted. For factory defaults see section 10, 'Factory Defaults'.

For **experienced users**, an ethernet connection can be made to the PSTR controller to adjust lighting parameters. Raytec advises **extreme caution** to avoid any damage and loss of warranty. The PSTR controller has an embedded web interface (GUI) to allow troubleshooting, diagnostics, and changes to operating parameters.

For **expert users**, in addition to the GUI, direct commands can be sent using UDP or TCP/IP.

2.0 Safety

The following symbols are used in this guide:

WARNING*:* Read the instructions to understand the possible hazards.

WARNING: Possible hazardous voltage.

Always observe these safety precautions. If in doubt, contact Raytec.

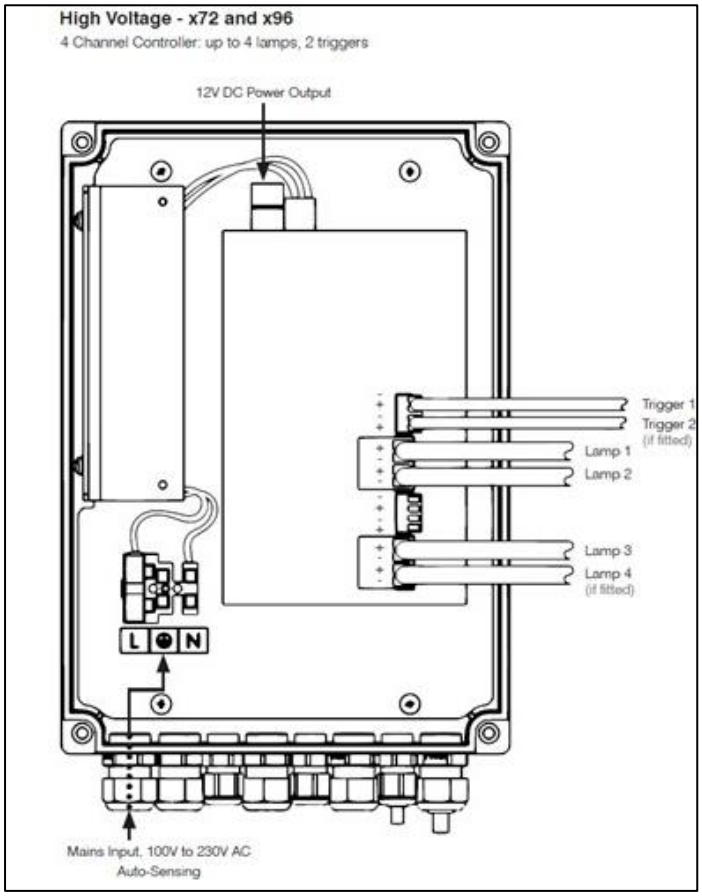
2.1 Electrical

The PSTR controller 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 PSTR controller for about 15 seconds.

WARNING*: This is a Class A product certified for use in Industrial type applications. For Class B (residential use) applications, care should be taken and special measures to ensure the product operates within the required limits*

3.0 Connections

The PSTR is designed to be integrated with a camera, or an external trigger, which can be used to control the pulse functionality of the illuminator. For a detailed guide on integrating the PSTR with a camera or external trigger, refer to the 'PULSESTAR Connectivity Guide' which is available from www.raytecled.com



Note: Trigger Input - 3.3V to 24V DC. Rising edge + = pulse on

3.1 Power Input

There are two versions of input voltage ranges for the controller:

- The PSTR HV Controller accepts a universal mains input of 110-230V AC 50/60 Hz
- The PSTR LV Controller requires an external 24V -48V DC input. We recommend that the PSU is rated at 200% of the ratings shown below.

Part Number	Average Power *
PSTR-i24-xx	13W
PSTR-i32-xx	17W
PSTR-i48-xx	25W
PSTR-i72-xx	37W
PSTR-i96-xx	49W
**1ms pulse, 50hz,600%*	
Part Number	Average Power**
PSTR-w24-xx	11W
PSTR-w32-xx	15W
PSTR-w48-xx	22W
PSTR-w72-xx,	33W
PSTR-w96-xx	44W
*** 2ms pulse, 50hz, 275%*	
Part Number	Average Power***
PSTR-i24-xx-730	6W
PSTR-i32-xx-730	8W
PSTR-i48-xx-730	12W
PSTR-i72-xx-730	18W
PSTR-i96-xx-730	24W
***2 ms pulse,50hz 150%	

xx = HV (High Voltage) or LV (Low Voltage)

3.2 Lighting Output

The lighting connections can exceed 46.7V but should not exceed 70V DC. Pulse peak voltages above 72V are considered hazardous. The lighting connections must be shielded so they cannot be touched both within the light and along the whole length of the cable.

3.3 Trigger Inputs

The trigger inputs are opto-isolated 3V to 24V input, drawing a minimum of 3mA.

3.4 12V Power output [Optional]

The PSTR controllers have a single 12V DC power supply output. This can supply up to 1A at 12V for powering cameras and other devices. Do not connect inductive loads or devices that take large peak currents. Do not exceed the current rating as these outputs are not fused.

3.5 Ethernet connection [Optional]

Ethernet connectivity is available on PSTR controllers - we would recommend this is only used by experienced or expert users. Contact Raytec for advice. This connection can be used for troubleshooting or to amend performance of the unit. The RJ45 ethernet connector requires a straight through cable to connect into a network switch, hub, or router. It operates at 10Mbits per second (10Base-T).

3.6 Connectors

The PSTR controller includes mating connectors for the power supply input, trigger inputs, 12V power output and lighting output.

Should spare parts be required, Würth part numbers are shown below:

Connector	Description	Wurth Part Number
Power Input	2W screw terminal free socket	691 351 500 002
Trigger Input	4W screw terminal free socket	691 361 100 004
12V Output	2W screw terminal free socket	691 348 500 004
Illuminator	4W screw terminal free plug	691 348 500 002

Note: For more detailed information please refer to the 'PULSESTAR Connectivity Guide' at www.raytecled.com

4.0 General Description of Operating Modes and Features

The PSTR series controllers are designed to provide repeatable intensity control of LED lighting for pulsed lighting applications. This includes the intensity control, timing and triggering functions required for these applications.

LED lighting needs a constant current supply as small variations in voltage can cause large variations in light output. The PSTR series of controllers can set currents in steps of 0.1% (with a lower limit of 2.5mA steps) to give very fine control of intensity.

4.1 Operating Modes

The PSTR series has the following operating modes;

4.1.1 Pulse (Strobe) Mode

In pulse mode, the output is pulsed once per trigger. The delay from trigger to pulse, the pulse duration and the brightness can be set. This is the default mode.

*Note: We would **not** recommend changing the operation mode or other configuration parameters by anyone other than Experienced or Expert uses. Please contact Raytec for advice.*

4.1.2 Switched Mode

In switched mode a trigger input is used to switch the output current on and off. The output is only enabled when the trigger input has a voltage on it.

4.1.3 Selected Mode

In selected mode a trigger input is used to select between two different intensities. Selected mode uses a trigger input to select between the two different brightness settings. Brightness 1 must be greater than Brightness 2.

4.1.4 Continuous Mode

In continuous mode the output is constantly on. This is restricted to a maximum of 30W per channel. If this is exceeded, the controller will shut down and show an error. In continuous mode the output current is fixed and continuous.
We do not recommend using the PSTR in continuous mode.

4.2 Standard Setup

The PSTR unit is configured in the following way:

x24, x48, x72 variants
LED outputs 1, 2 and 3 (where applicable) are simultaneously triggered by a positive going input on "trig 1".

X96 variants
LED outputs 1 and 2 are triggered simultaneously by a positive going input on "trig 1".

LED outputs 3 and 4 are triggered simultaneously by a positive going input on "trig 2"

Infra-Red variants are configured with a 1ms pulse width and a 20ms retrigger delay. This configuration is suitable for connection to a camera with a shutter speed of 1/1000s or shorter and a maximum frame rate of 50fps.

White light and 730nm variants are configured with a 2ms pulse width and a 20ms retrigger delay. This configuration is suitable for connection to a camera with a shutter speed of 1/500s or shorter and a maximum frame rate of 50fps.
For other configurations please contact Raytec.

4.3 Summary of Output Modes

The different types of trigger inputs are as follows:

Note: The POS trigger flag inverts the sense of the trigger input

Mode	Trigger Input	Output
Pulsed	Trigger rising edge	Pulse is triggered if POS Trigger flag =1
		Pulse is triggered if POS Trigger flag = 0
Switched	Trigger = off	Output is off
	Trigger = on	Output is on
Selected	Trigger = off	Output is continuous brightness 2
	Trigger = on	Output is continuous brightness 1
Continuous	Unused	Output is on

4.4 Pulsed Output – Default Setting

The output is off by default. When the PSTR is triggered it pulses the output after a defined delay. The delay, pulse width, retrigger delay and pulse intensity are all configurable.

Retrigger delay is the minimum allowed time from one trigger to the next. Any triggers that happen too soon after the previous trigger are ignored. The retrigger delay is set in multiples of 100µs.

The duty cycle is limited by the controller by ignoring triggers which occur too quickly after the previous trigger to avoid the unit exceeding its maximum duty cycle.

For example, if the brightness is set to 250%, then the PSTR controller does not allow pulses greater than 10ms long. With 10ms pulses, if a trigger occurs within 50ms of a previous trigger (such that the duty cycle would be greater than the 20% max allowed) then that trigger is ignored.

The brightness of the lamp can be set to a percentage of its rating. The actual power emitted is dependent on the brightness setting, on the pulse width and on the duty cycle. The tables below show the operating limits. Setting outside of these limits may cause errors or damage to the lamp or controller.

Infrared		
Brightness	Maximum Pulse Width	Maximum Duty Cycle
101%-200%	30ms	30%
201%-300%	10ms	10%
301%-450%	2ms	10%
451%-600%	1ms	5%

White Light		
Brightness	Maximum Pulse Width	Maximum Duty Cycle
100%-200%	30ms	30%
201%-275%	10ms	10%

730nm		
Brightness	Maximum Pulse Width	Maximum Duty Cycle
100%-150%	30ms	30%

WARNING: *When changing the configuration, the average power output of should not exceed the following.*

Part Number	Power Restriction	
	Per Channel Average	Overall Average
PSTR-x24-xx	30W	40W
PSTR-x32-xx	30W	40W
PSTR-x48-xx	30W	40W
PSTR-x72-xx	30W	50W
PSTR-x96-xx	30W	50W

The average power per channel can be calculated using the follow.

(((Light rating * brightness %) * Lighting Voltage[1]))*(pulse duration/retrigger delay))

The light rating, brightness % (max) and light voltage are shown in the table below.

WARNING: *The light rating must not be changed. The maximum brightness must not be exceeded.*

Part no.	Light Rating	Brightness % (max)	Light voltage
PSTR-i24-xx	1.5A	600%	27V
PSTR i32-xx	1.0A	600%	27V
PSTR-i48-xx	1.5A	600%	27V
PSTR-i72-xx	1.5A	600%	27V
PSTR-i96-xx	1.5A	600%	27V
Part no.	Rating Per channel	Max Brightness	Light voltage per panel
PSTR-w24-xx	1.5A	275%	27V
PSTR w32-xx	1.0A	275%	27V
PSTR-w48-xx	1.5A	275%	27V
PSTR-w72-xx	1.5A	275%	27V
PSTR-w96-xx	1.5A	275%	27V
Part no.	Rating Per channel	Max Brightness	Light voltage per panel
PSTR-i24-730-xx	2.0A	150%	18V
PSTR i32-730-xx	1.3A	150%	18V
PSTR-i48-730-xx	2.0A	150%	18V
PSTR-i72-730-xx	2.0A	150%	18V
PSTR-i96-730-xx	2.0A	150%	18V

4.5 Fault Detection

The controller detects the following errors, shown in the table below.

Note: The error code is shown on the webpage of the controller (see section 7, 'Webpage Configuration'). When the output current is less than 100mA, some fault detection is disabled.

Note: You can issue a GR command to cancel the error (see section 8, 'Command Configuration'). The PSTR controller re-senses the light.

Error	Reason
34,37	Internal power dissipated is too high. Output turned off.
35,43	Output current to lighting is too low. The light is open circuit or there is not enough supply voltage for the requested output current.
36	If the output voltage is too low, the controller detects that the output is short circuited.
37	The voltage required for the lighting has increased too much. Check for ageing of the lighting or a failed LED.
38	The voltage required for the lighting has decreased too much. Check for ageing of the lighting or a failed LED.
46	The output of the controller is >30W average.

4.6 Light Autosensing

When a channel does not have a light connected, the PSTR controller continually tries to supply a very small current.

When a light is connected, it flashes for a short time (the light is not damaged by this) until the PSTR controller detects that it is connected.

4.7 Light Characterisation

When a light is detected, the characteristics of the light are measured up to the brightness set for the characterisation limit. It is not essential to set this value and it can be left at 200 (meaning 200% brightness). For further detail of this function contact Raytec

4.8 Current Adjust

The current adjust feature provides a more accurate and repeatable output current. After setting an output current, the controller continually measures the actual current and adjusts the output to maintain the target current. This will compensate for any inaccuracies such as temperature drift in the controller.

4.9 Clear Configuration

You can clear the PSTR configuration settings - this clears the lighting ratings and sets all channels to 50% brightness continuous operation. You can do this by sending the CL command. After the configuration is cleared the controller should be re-configured using the factory defaults listed in section 10.

5.0 Lighting Setup

The light rating of the controller is set to match the lights supplied. This rating is the supply to the lighting that should be used to get 100% continuous brightness from the illuminator.

The type of light must match the rating of the controller. If a different illuminator is connected damage may be caused to the illuminator and controller.

Refer to section 10, 'Factory Defaults' for the default setting of the PSTR controller.

To change the rating of a light of the PSTR controller, Experienced users could consider using the internal webpages (see section 7, 'Webpage Configuration') or Expert users may use the VL command.

WARNING: *Changing the rating may damage the illuminator or controller and may void the warranty.*

6.0 Ethernet Communication

When setting up ethernet versions of the PSTR, you may need to ask your network administrator for advice about making the ethernet connection.

Ethernet set-up is not affected by power cycling the PSTR.

The ethernet link uses a 10-base T connection and runs at 10Mbits per second. The PSTR is usually connected to a network switch, or hub router but you can also connect it directly into a network port on a PC using a standard Ethernet cable.

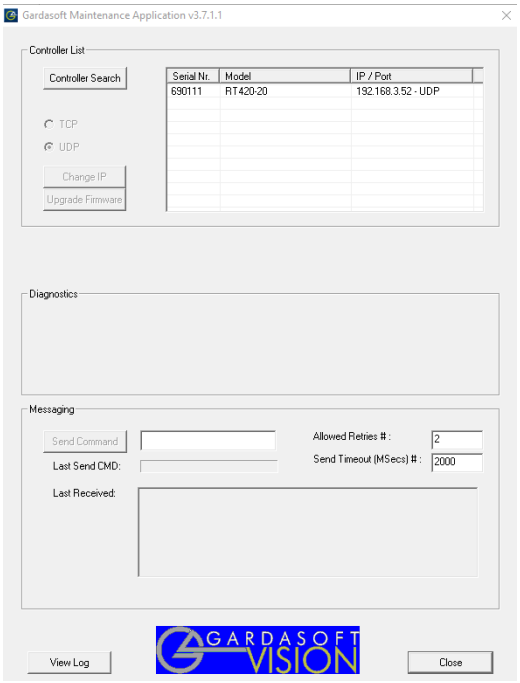
6.1 IP Address

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

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

DHCP mode or the IP address can be set/read using the GardasoftMaint program available to download from www.raytecled.com. This program has been developed in-conjunction with Gardasoft Vision and is compatible with all Raytec PULSESTAR products.

The GardasoftMaint program is shown overleaf:



Note: By default, the PSTR controller is configured as DHCP enabled. If the controller is connected to a non-DHCP network, an address in the range of 169.254.0.0-169.254.255.255 will be assigned automatically.

This is a temporary address and a static address should be assigned to ensure correct connection with the controller

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 GaradsoftMaint, you can communicate with your PSTR using the commands explained in section 8, 'Command Configuration'. You can also open the PSTR's web pages by clicking the **Link to controller** webpage button. For more information about the PSTR's web pages, see section 7, 'Webpage Configuration'.

6.2 Programmed IP Address and DHCP

This section explains the use of DHCP and fixed IP addressing.

6.2.1 DHCP

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

Right-click on the Windows 11™ icon on your PC's task bar.

*Select **Network Connections**.*

*Click the **Ethernet** tab.*

The IP assignment will be shown as Automatic (DHCP)

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

Right-click on the Windows 11™ start icon on your PC's task bar.

*Select **Network Connections***

*Click the **Ethernet*** tab.

*Under **Properties**, your IP address will be given as the 'IPV4 address'.*

Note: The steps set out above are for a PC using Windows® 11; if your operating system is different, the steps may not be the same.

6.2.2 Fixed IP address

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

6.2.3 Automatic sensing

The PSTR controller sends a message on three events:

1. On power up
2. When an IP address is received or renewed by DHCP
3. 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 ‘Gardasoft Search’ (8-bit ASCII, 13 characters).

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

Raytec ,RT220-20,000000,111111111111,22222222

(8-bit ASCII, 44 characters) Where:

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

For example, for RT220-20, serial number 12345, IP address 192.168.1.103, MAC address 00.0B.75.01.80.99 the packet is formatted:

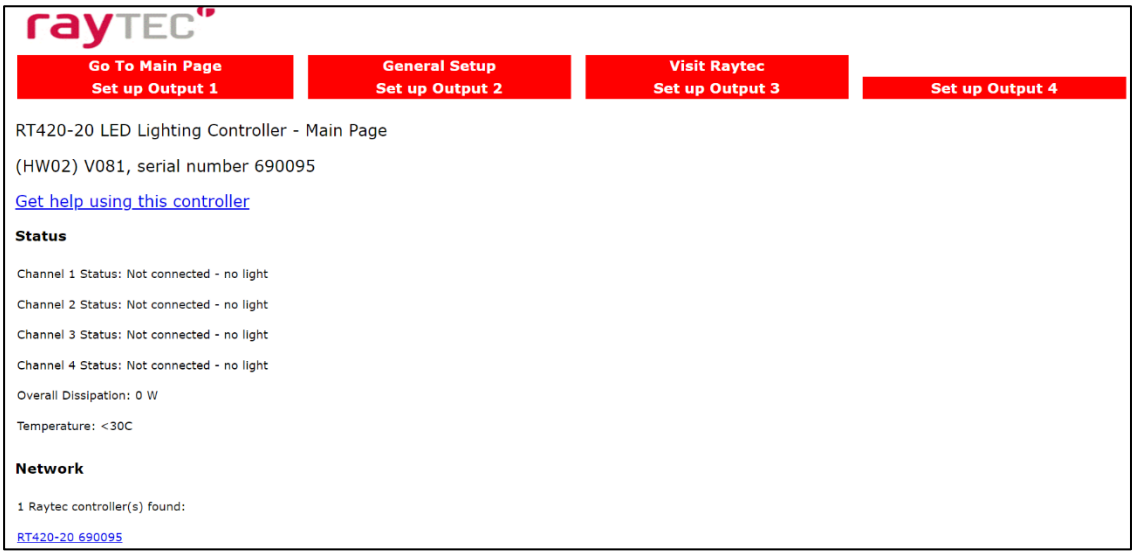
Raytec ,RT220-20,012345,000B75018099,C0A8016

7.0 Webpage Configuration (for experienced or expert users)

You can set up the PSTR controller through its own internal web pages. Click the Open webpage... button in GardasoftMaint to take you directly to the PSTR webpages. These webpages will show the Raytec branding at the top of the page. You can also type the controller's IP address (displayed in GardasoftMaint) into your web browser, which will display the Main screen.

7.1 Main Page

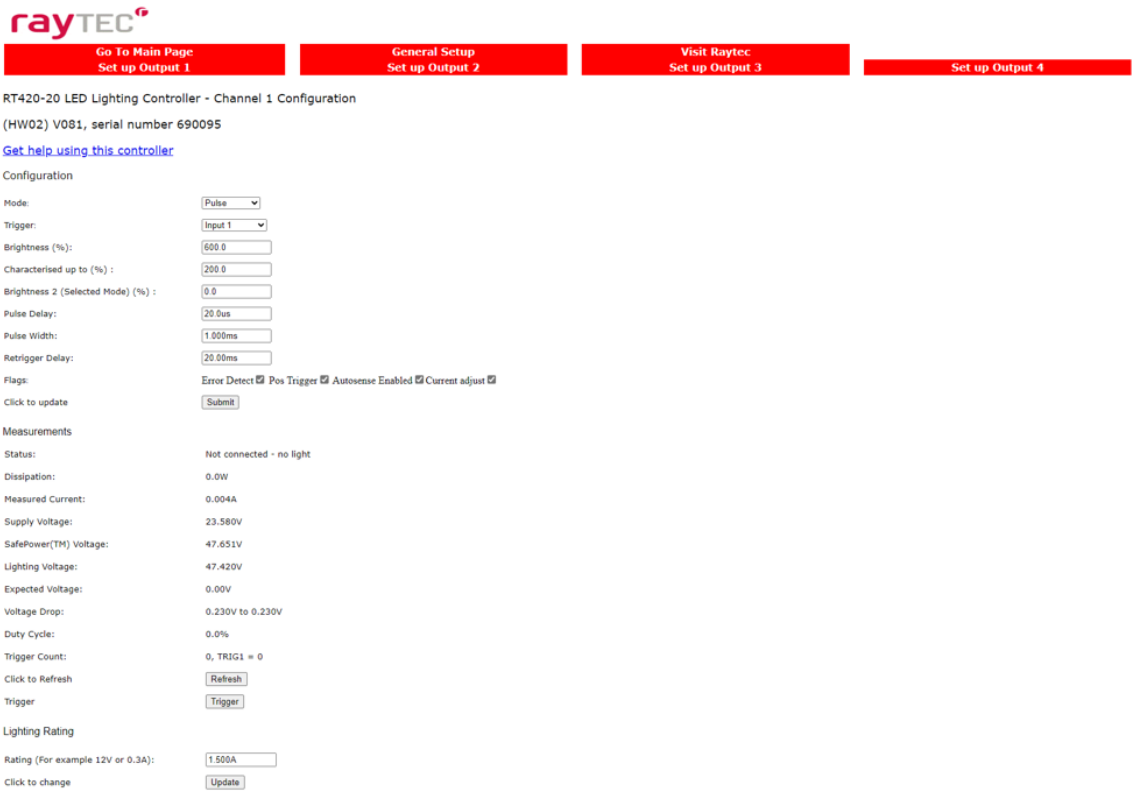
The main page (shown below) is the first to open when you access the PSTR webpages. This gives the controller's hardware and firmware revision levels and the serial number. It also tells you the power being dissipated and the PSTR's internal temperature.



7.2 Configuration Page

There is one configuration page for each output channel, as shown below:

To refresh this page it is important to click the Refresh button on the web page rather than that on your browser. When configuration changes are submited, the URL includes the new configuration, so refreshing the page re-submits the URL.



Note: This is an example only. Refer to section 10, 'Factory Defaults' for default settings.

You can set up all the parameters for each output channel. Pressing the Submit button updates the PSTR's configuration and saves the changes to non-volatile memory.

7.2.1 Mode

This setting defines the operation of the lamp when a trigger input is received. In most cases this should be set to Pulse. Refer to section 4.1, 'Operating Modes' for further details.

7.2.2 Trigger

This selects which trigger input is associated with the illuminator. Any input can be selected to trigger any illuminator. Multiple illuminators can also be triggered from the same input. Internal can also be selected to use the internal trigger signal.

7.2.3 Brightness %

This is the pulse brightness of the illuminator as a percentage of the continuous lighting rating.

7.2.4 Characterised up to (%)

This setting allows the controller to make accurate measurements at a specific brightness. These measurents are stored and allows the controller to respond rapidly to changes in the overdrive parameters. It is not normally necessary to adjust this setting.

7.2.5 Brightness 2 (Selected Mode) (%)

This setting is only used when the controller is in selected mode. Selected mode allows the illuminator to switch between two brightness levels when a trigger is

received. The maximum output current is limited to 0.5A when Selected mode is chosen.

7.2.6 Pulse Delay

The pulse delay sets the time between trigger input being received and the illuminator being turned on.

7.2.7 Pulse Width

The time the illuminator is turned on from when a triggering input is received. Refer to section 4.2, 'Standard Setup' for further details.

7.2.8 Re-trigger Delay

The re-trigger delay is the minimum time allowed between one trigger and another. Refer to section 4.2, 'Standard Setup' for further details. This varies depending on Brightness Level set and Pulse Width to maintain the unit within its required duty cycle.

7.2.9 Flags

The Error detect auto sense and current adjust Enabled flags should always be ticked.

The Pos Trigger flag selects if the illuminator is triggered by a rising or falling edge signal. When ticked, the illuminator is triggered by a rising edge signal.

7.2.10 Measurements

The measurement section gives detail about the status of the connected illuminator. This information can be used for advanced diagnostics and trouble shooting.

Note: This information is NOT constantly updated or refreshed automatically. To refresh this page, click the refresh button or press the Function key F5.

7.2.10 Trigger

The trigger button allows the illuminator to be trigger manually.

7.2.11 Light Rating

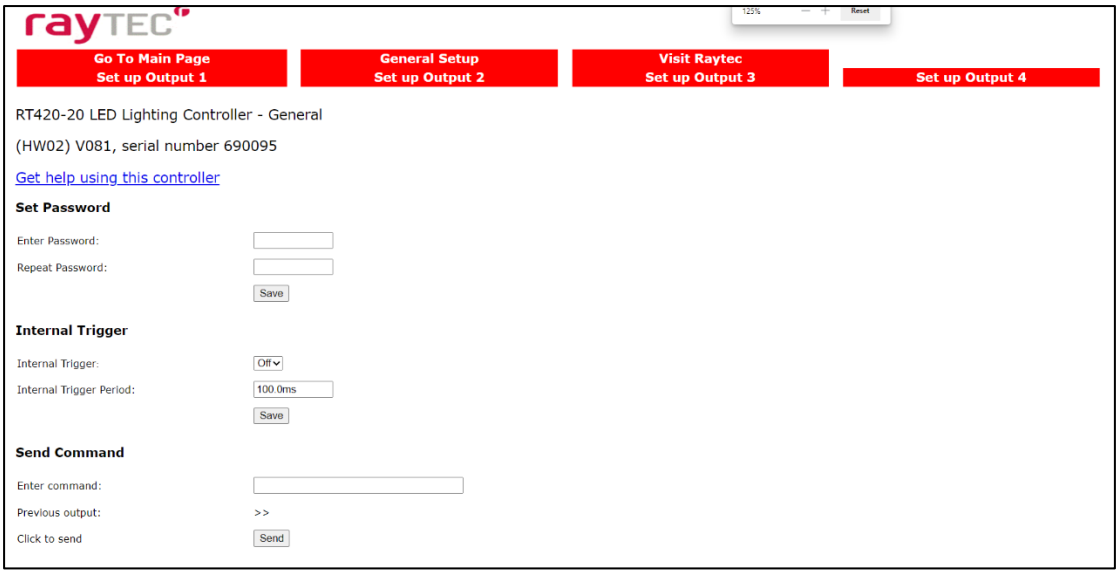
This sets the standard constant rating for the illuminator.

WARNING: *This setting must not be adjusted.*

To store any changes to the set up the Submit button must be pressed. This will save the configuration into the controllers' non-volatile memory.

7.3 General Setup Page

The General Setup page allows you to set up or clear the webpage's password and set up the internal trigger. You can also enter any ethernet command from section 8, 'Command Configuration'.



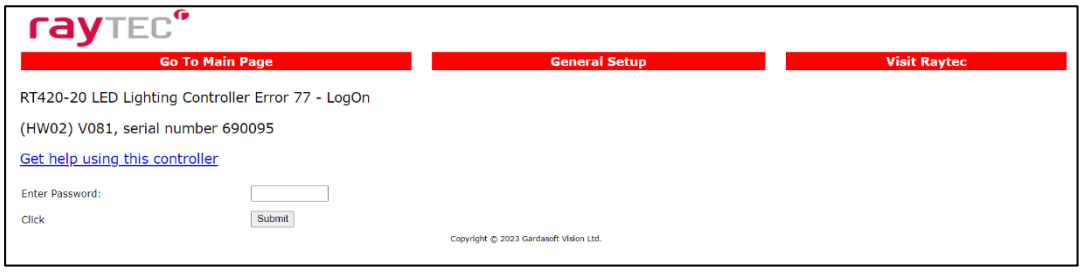
7.3.1 Set Password

A password can be set to restrict access to the setting pages of the web interface. This is set by entering a password in Set Password fields and clicking the "Save" button.

The password will take effect when the power to the controller is cycled or after 5 minutes of inactivity.

When a password is set, only the Main page of the web interface is available. Access to other pages is only possible by entering the password.

The password will be reapplied after 5 minutes of inactivity.



7.3.2 Clear Password

Go the enter General Setup page and enter the current password.

Leave both Set Password fields blank and click the **Save** button.

The password will be cleared when the power is cycled or after 5 minutes of inactivity.

It is also possible to set and remove password by sending ethernet commands to the unit. Refer to section 8, 'Command Configuration'.

7.3.3 Internal Trigger

The internal trigger can be used for testing the illuminators when a triggering device is not available or for applications requiring a none synchronised pulsed lighting.

When using the internal trigger function, the trigger sector should be set to internal for the channels that are required to use the internal trigger signal. This may be selected for multiple channels if required.

7.3.4 Send Commands

The send command functional allows single or strings of command to be sent to the controller. The previous output field shows the last command sent to the controller. This will be blank when no commands have been sent.

Refer to section 8, 'Command Configuration' for details.

8.0 Command Configuration (expert users only)

WARNING: *The following sections contain advanced configurations. We would only recommend these configurations are used by Expert users.*

The PSTR can be configured through the ethernet connection using UDP or TCP/IP.

8.1 Command Summary

Command	Example	Effect
AW	AW	Save changes
CL	CL	Clear configuration
GT	GT1	Enable Ethernet messages
GR	GR	Clear any error condition
EY	EY65,66	Set webpage password to "AB"
VR	VR	Read the firmware version
VL	VL1,0,0.5	Set the rating of channel 1 to 0.5A
PQ	PQ,1,200	Set automatic sensing for channel 1 to 200%
RS	RS2,65	Set channel 2 to 65% brightness continuous
RW	RW1,50	Set channel 1 to 50% switch mode
RU	RU1,75,25	Set channel 1 to selected mode at 75% and 25%
RT	RT2,3,4,50	Set channel 2 to 3ms pulse, delayed by 4ms at 50% brightness
RP	RP1,2	Output channel 1 is triggered using output 2
RE	RE1,3	Set channel 1 to ignore lighting errors and not prompt for the current rating when a light is connected
TT	TT1,1ms	Set internal triggers every 1ms
TR	TR2	Trigger channel 2
ST	ST2	Show configuration for channel 2

8.2 Ethernet Configuration

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

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

A carriage return (ASCII 13) character should be sent to terminate the command line in case multiple packets get joined together.

8.3 Command Structure

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

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

Using the **GT** command, a host can request that a message is sent to it whenever an error occurs. Several commands can be put into one command line by separating them by a semi-colon (;).The PSTR sends any replies to the commands followed by a > character to show that the command line has completed.

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

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

For example:

Parameter	Meaning
0.1	0.1 milliseconds
200us	200 microseconds
0.1s	0.1 seconds

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

The command codes and their meanings are summarised below (that is, in the table on the next page). The upper-case commands are shown, followed by lower case letters denoting the numeric argument.

Note: Any changes made using ethernet commands are not saved permanently until the AW command has been issued.

8.4 General Commands

8.4.1 Report the Firmware Version

VR

This command returns the firmware version currently running in your PSTR

For example:

8.4.2 Set Rating of a Light

WARNING: *This setting should not be changed*

This command sets the current or voltage rating for a light. If a current rating is being set, then the voltage rating value should be 0.

VLo,v,c

Where:

o = output channel (1 to 2 or 4, depending on model)

v = voltage rating (0 or 12 to 36)

c = current rating (0 or 10mA to 3A)

8.4.3 Set automatic sensing of lighting characteristics

This command sets the maximum brightness to be used when automatically sensing the characteristics of the light connected.

PQc,0

PQc,m

PQ

Where:

c = output channel (1 to 2, 4, or 8, depending on model)

m = maximum expected brightness (50% to 999%)

Setting **m** = 0 turns off automatic sensing. The **PQ** command returns the current maximum brightness for automatic sensing.

8.4.4 Set Continuous Mode

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

RSc,s

Where:

c = output channel (1 to 2 or 4, depending on model)

s = setting in percent (s = 0 to 100)

8.4.4 Set Switched Mode

The output is set to switched mode at a percentage of full brightness.

RWc,s

Where:

c = output channel (1 to 2 or 4, depending on model)

s = setting in percent (s = 0 to 100)

8.4.5 Set Selected Mode

The output is set to selected mode with two brightness settings.

RUc,s,t

Where:

c = output channel (1 to 2 or 4, depending on model)

s = brightness 1 setting in percent (s = 0 to 100)

t = brightness 2 setting in percent (t = 0 to s)

8.4.6 Set Pulse Mode

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

An error is generated if the brightness setting requires a current greater than 20A or if the combination of pulse width and setting is not allowed.

RTc,p,d,s

RTc,p,d,s,r

Where:

c = output channel (1 to 2 or 4, depending on model)

p = pulse width in milliseconds (0.02 to 999)

d = delay from trigger to pulse in milliseconds (0.02 to 999)

s = setting in percent (s = 0 to 999)

r = retrigger delay. This parameter is optional.

8.4.7 Set Option Flags

REc,m

Where:

c = output channel (1 to 2 or 4, depending on model)

m = flags:

bit 1 =	0	0 E flag set (error detection enabled)
	1	E flag cleared (error detection disabled)
bit 2 =	0	P flag set (positive triggers)
	1	P flag cleared (negative triggers)
bit 3 =	0	Autosense set (controller waits for light to be connected)
	1	No autosense (controller assumes light is connected)
bit 4=	0	Enable current adjust
	1	Disable current adjust

8.4.8 Set Trigger Input

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

RPc,p

Where:

c = output channel (1 to 4, depending on model)

p = trigger input (1 to 4 depending on model)

To use the internal trigger, the trigger input is “p” is set to the total number of channels plus 1.

PSTR-x24,x32,x48	p = 3
PSTR-x72,x96	p = 5

8.4.9 Set Internal Trigger

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

TT0 Disable internal trigger

TT1 Enable internal trigger (uses previously set period)

TT1,p Enable internal trigger and set the period

Where:

P = period of the triggers in milliseconds

For example:

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

8.4.10 Save Settings to Memory

AW

Once the settings are saved to memory they are retained when the unit is switched off. If this is not done, 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.

8.4.11 Clear Configuration

CL

Clears the channel configuration and lighting ratings and sets all channels to 50% continuous operation. The results of the VL, RS, RW, RU, RT, RE, RP, TT, and AW commands are all cleared.

8.4.12 Show Configuration

ST

This command shows the operational parameters for all channels in the controller. A typical output for a PSTR controller is:

CH1,MD0,S 50.0,
0.0,DL1.000ms,PU1.000ms,RT
0.0us,IP1,FL0,CS0.000A,RA0.000A

CH2,MD0,S 50.0, 0.0,DL1.000ms,PU1.000ms,RT
0.0us,IP2,FL0,CS0.000A,RA0.000A

Where:

CH	Channel number
MD	Mode: 0 = continuous, 1 = pulse, 2 = switched, 3 = select
S	Brightness percentage settings: 1st setting used in all modes 2nd setting only used for select mode
DL	Pulse delay
PU	Pulse width
RT	Retrigger delay
IP	Input trigger (set using the RP command)
FL	Flags (set using the RE command)
CS	Rating of the light (after SafeSense has successfully completed sensing the light)
RA	Rating of the light (set using the VL command).

When using ethernet, use the following forms of the **ST** command:

ST0

Reports the general settings. A typical output is:

TM 1, TP 20.00ms

STc

This reports the settings for a single channel.

Where:

c = the input channel (1 to 2, 4, or 8 depending on model).

8.4.13 Simulate Input Trigger

TRc

This simulates a trigger pulse. If the channel is in pulse mode it pulses the output once.

Where:

c = the input channel (1 to 2 or 4, depending on model).

8.4.14 Enable Ethernet Messages

GTm

Where:

m = 0 to disable ethernet messages, or
m = 1 to enable ethernet messages.

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

Evtc,e

Where:

c = the channel number (1 to 2, 4 or 8), or 0 for no channel
e = event value (see section 9.5, 'Event Codes').

8.4.15 Clear Any Errors

GR

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

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

8.4.16 Set/Clear 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 decimal ASCII values for a password from one to six letters. A value of 65 is 'A', 66 is 'B', and so on, to 90 is 'Z'.

You can set an unlock code. Ethernet commands and the web pages still work.

9.0 Reference Information

This section contains the specification for the PSTR controller and any restrictions on its use. Error and event codes are also listed.

9.1 Specification

The information in the table below is the maximum rating of the controller. Refer to section 10, 'Factory Defaults' for default configurations.

Each output channel	3A maximum continuous/20A pulsed, 46V output and 30W average output power*
Light rating	100mA to 3A in step of 5mA
Operating modes	Continuous, strobe, switch and selected
Trigger input	Opto-isolate, standard or inverted operation 3V to 24V
Pulse Width	20 microseconds to 1 second. Repeatable to 0.1 microsecond
Trigger delay	20 microseconds to 1 second. Repeatable 2 to microseconds.
Internal trigger timer	0.2Hz to 1kHz
Supply Voltage:	
HV Version	100 V AC to 230V AV
LV Version	24V DC to 48V DC

9.2 Restrictions

The following timings and restrictions are applied whenever settings are saved using the **AW** command:

B.1 Continuous Mode The maximum output current is 3A

B.2 Switched Mode The maximum delay from a trigger input changing to the output current being turned on or off is 10us. The maximum output current is 20A

B.3 Selected Mode The maximum delay from a trigger input changing to the output current being turned on or off is 5ms. The maximum output current is0.5A.

B.4 Pulse Mode The maximum output current is 20A. The table below show the limits that should no be exceeded for each channel.

The overall combined average output power of 40W for 2 channel controllers (PSTR-x24, PSTR-x32,PSTR-x48) and 50W for 4 channel controller (PSTR-x72 & PSTR-x96) must not be exceed. Refer to section 4.2 for details.

Infrared		
Brightness	Maximum Pulse Width	Maximum Duty Cycle
101%-200%	30ms	30%
201%-300%	10ms	10%
301%-450%	2ms	10%
451%-600%	1ms	5%

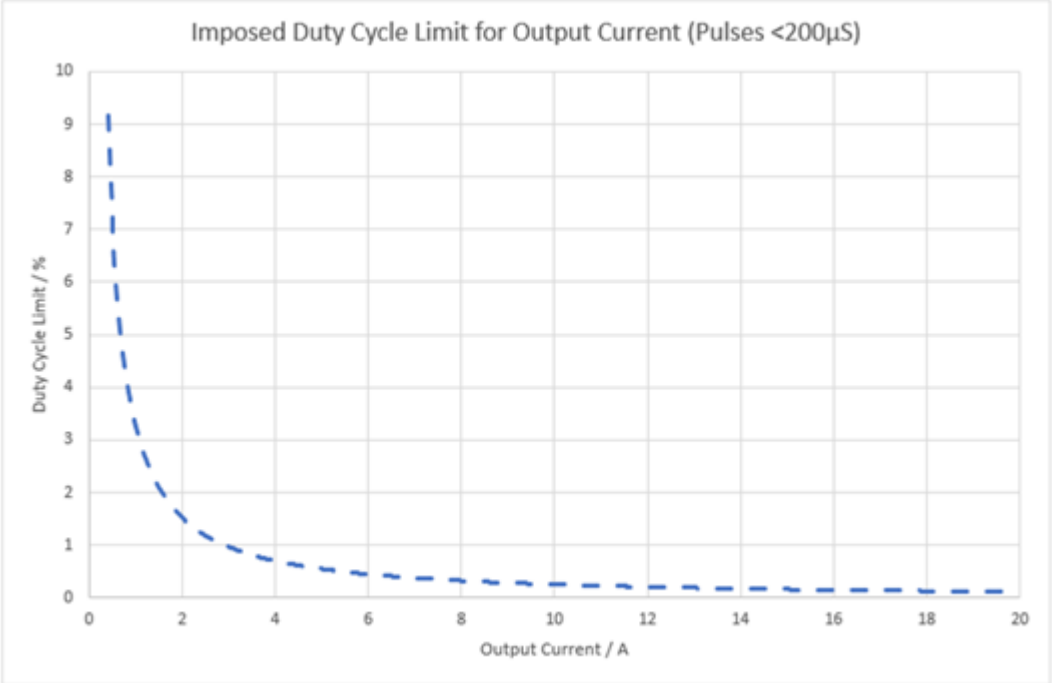
White Light		
Brightness	Maximum Pulse Width	Maximum Duty Cycle
100%-200%	30ms	30%
201%-275%	10ms	10%

730nm		
Brightness	Maximum Pulse Width	Maximum Duty Cycle
100%-150%	30ms	30%

Pulses of 2A or more for pulse widths longer than 2ms may cause an error or have a lower current towards the end of the pulse.

The minimum pulse delay is about 2µs. When overdriving or using the retrigger delay, the minimum delay is around 5µs.

For a pulse width less than approximately 200 µs, the lighting voltage cannot be measured for ant given output current setting. Therefore, the controller is unable to determine the instantaneous power dissipation within its control circuit. To prevent damage to the controller, the following duty cycle restrictions apply, depending on the output current of pulse below 200 µs



9.3 Error Codes

Error number	Reason
Err 1	A parameter value is invalid
Err2	Command not recognised
Errr3	Numeric value is the wrong format
Err 4	Wrong number of parameters
Err 5	This warning is not an error. One of the parameters is out of range. The value of the parameter has been adjusted. For example, sending an RT command with a delay of 0 gets a reply of 'Err 5'. The command is accepted but the delay is set to the minimum of allowed value
Err 19	A light has been connected to a channel, but no rating has been set
Err 8,12	EEprom corrupt. The configuration has been cleared
Err 9,20	Could not save to EEPROM
Err 21,22,23	Sensing error. Refer to light auto- sensing
Err 27	Can't read the Ethernet setting from EEPROM, so these may be incorrect
Err 34	Internal power dissipation is too high. Output turned off.
Err 35	Output current to lighting is too low
Err 43	The requested output current required is too high a voltage
Err 36	The output is short circuit
Err 42	The output current is too high
Err 37	The voltage required for the lighting has increased too much. Check for a failed LED
Err 38	The voltage required for the lighting has decreased too much. Check fir a failed LED
Err 39	Internal protection has prevented SafePower voltage going too high
Err 46	Controller output – 30W average

9.4 Fatal Error Codes

The following codes can only be cleared by cycling the power or sending the **GR** command.

Error number	Reason
Err 44	The pulsestar controller is too hot. The pulsestar controller has a thermal cutout that operates at 65° to 70°C
Err 40,41,45	One channel is outputting more current than expected
Err 47	Internal protection has prevented too much heat in output driver

9.5 Event Codes

Event messages are sent when a light is connected, or an error occurs. The format of these is:

Evt<channel>,<event code>;

These event messages are only sent after the **GT1** command has been sent.

Event number	Reason
1 to 127	An error has occurred. The error code is given by the event number.
128	A light has been connected and is working.
129	A light has been connected but doesn't have a current or voltage rating.
130	An over temperature error occurred.
131	An over current error occurred.
132	An error has occurred while autosensing the rating of a light.
138	Safepower trainup has completed.
139	Safepower trainup has failed or been cancelled.
140	In switch output mode, the light has been turned off because the duty cycle is too high.

10.0 Factory Defaults

The use of settings other than the ones shown below may result in damage to the controller or illuminators.

Setting a lower Brightness and shorter Pulse Width is OK.

Setting a longer Pulse Delay and a longer Retrigger delay is OK.

For all products the Brigntness% should not exceeded that shown in the tables below. Exceeding this may result in damage to the controller or illuminators and may invalidate the warranty.

10.1 Infra-Red

Part number	Output	Mode	Trigger	Brightness %	Characterised	Brightness 2 %	Pulse Delay	Pulse Width	Retrigger Delay	Flags	Rating
PSTR-i24-xx	1	Pulse	Input 1	600%		0%	20us	1ms	20ms	All on	1.5A
PSTR-i32-xx	1,2	Pulse	Input 1	600%		0%	20us	1ms	20ms	All on	1.0A
PSTR-i48-xx	1,2	Pulse	Input 1	600%		0%	20us	1ms	20ms	All on	1.5A
PSTR-i72-xx	1,2,3	Pulse	Input 1	600%		0%	20us	1ms	20ms	All on	1.5A
PSTR-i96-xx	1,2	Pulse	Input 1	600%		0%	20us	1ms	20ms	All on	1.5A
	3,4	Pulse	Input 2	600%		0%	20us	1ms	20ms	All on	1.5A

10.2 White-Light

Part number	Output	Mode	Trigger	Brightness %	Characterised	Brightness 2 %	Pulse Delay	Pulse Width	Retrigger Delay	Flags	Rating
PSTR-w24-xx	1	Pulse	Input 1	275%		0%	20us	2ms	20ms	All on	1.5A
PSTR-w32-xx	1,2	Pulse	Input 1	275%		0%	20us	2ms	20ms	All on	1.0A
PSTR-w48-xx	1,2	Pulse	Input 1	275%		0%	20us	2ms	20ms	All on	1.5A
PSTR-w72-xx	1,2,3	Pulse	Input 1	275%		0%	20us	2ms	20ms	All on	1.5A
PSTR-w96-xx	1,2	Pulse	Input 1	275%		0%	20us	2ms	20ms	All on	1.5A
	3,4	Pulse	Input 2	275%		0%	20us	2ms	20ms	All on	1.5A

10.3 730nm

Part number	Output	Mode	Trigger	Brightness %	Characterised	Brightness 2 %	Pulse Delay	Pulse Width	Retrigger Delay	Flags	Rating
PSTR-i24-730-xx	1	Pulse	Input 1	150%		0%	20us	2ms	20ms	All on	2.0A
PSTR-i32-730-xx	1,2	Pulse	Input 1	150%		0%	20us	2ms	20ms	All on	1.3A
PSTR-i48-730-xx	1,2	Pulse	Input 1	150%		0%	20us	2ms	20ms	All on	2.0A
PSTR-i72-730-xx	1,2,3	Pulse	Input 1	150%		0%	20us	2ms	20ms	All on	2.0A
PSTR-i96-730-xx	1,2	Pulse	Input 1	150%		0%	20us	2ms	20ms	All on	2.0A
	3,4	Pulse	Input 2	150%		0%	20us	2ms	20ms	All on	2.0A