

TR-CL180 Lens Controller

Issue 003



User manual

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It is essential that the users ensure that the operation of the product is suitable for their application.

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

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4 Getting started

Before you use this product, make sure that you have read and understood [Section 5, Safety](#) (or [Section 6, Sicherheit](#), or [Section 7, Sécurité](#)) and [Section 15.1, Specifications and ratings](#), and that you have checked the TR-CL180 fulfils your requirements.

Mount the TR-CL180 (see [Section 8, Mounting the TR-CL180](#)) and **connect** it up (see [Section 9, Connecting the TR-CL180](#)), as required.

Set up the TR-CL180 for the desired operation as described in [Section 13, Webpage configuration](#) or [Section 14, Configuration commands](#).

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.

4.1 TR-CL180 features - a summary

The TR-CL180 product is a single channel lens controller for use in machine vision applications. It works with the following ranges of Optotune lenses:

EL-10-30

EL-16-40

4.2 GigE Vision™

The TR-CL180 is GigE Vision™ compatible. This means that any compatible GigE Vision client image processing software (for example, CVB, LabVIEW, Halcon) allows the user to view and change controller settings. GigE Vision is an industry standard protocol running on Ethernet which provides easy configuration and control of cameras and other devices.

The TR-CL180 is the first non-streaming device to become available (at the time of publishing this manual), so some packages may not support non-streaming devices yet. If your package does not work with the TR-CL180 then please inform the manufacturer or Gardasoft.

5 Safety

Read this before using the TR-CL180. 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: Possible hazardous voltage.

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

5.1 Electrical



The user must ensure that the potential difference between any combination of applied signals does not exceed the supply voltage.

The TR-CL180 does not have complete tracking isolation of inputs and outputs.

Transients caused by inductive loads must be suppressed externally to the TR-CL180.

5.2 General



The TR-CL180 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.

6 Sicherheit

Bitte lesen Sie dieses Dokument, bevor Sie die TR-CL180 verwenden. Beachten Sie immer die folgenden Sicherheitshinweise. Bei Fragen wenden Sie sich an Ihren Händler oder an Gardasoft Vision. Die folgenden Symbole bedeuten:



Warnung: Lesen Sie die Anleitung, um die mögliche Gefahrenquelle zu verstehen.



Warnung: Mögliche gefährliche Spannung.

Wenn diese Symbole in der Anleitung erscheinen, finden Sie im beistehenden Text die zu ergreifenden Vorsichtsmaßnahmen.

6.1 Elektrik



Der Benutzer muss sicherstellen, dass der Potenzialunterschied zwischen jeder beliebigen Kombination an angelegten Signalen die Versorgungsspannung nicht überschreitet.

Die TR-CL180 verfügt über keine vollständige Nachlauf-Isolierung der Ein- und Ausgänge.

Spannungsspitzen am TR-CL180 aufgrund von induktiven Ladungen müssen extern unterdrückt werden.

6.2 Allgemeines



Die TR-CL180 darf nicht in Bereichen verwendet werden, in denen bei Ausfall eine Gefahr von Personen- oder Sachschäden besteht.

Wenn das Gerät nicht entsprechend den Herstellerangaben eingesetzt wird, kann der durch das Gerät bereitgestellte Schutz beeinträchtigt werden.

7 Sécurité

Veillez lire la notice avant d'utiliser le TR-CL180 . Respectez toujours les mesures de sécurité qui suivent. En cas de doute, contactez votre distributeur ou Gardasoft Vision. Les symboles suivants signifient:



Attention: Lisez les consignes afin de bien comprendre les dangers encourus.



Attention: Risque d'électrocution.

Veillez vous référer aux consignes du manuel pour connaître les précautions à suivre au regard de ces symboles.

7.1 Électricité



L'utilisateur doit s'assurer que la différence de potentiel entre toute combinaison des signaux appliqués ne dépasse pas la tension de fourniture.

Le TR-CL180 ne dispose pas de système complet d'isolation des entrées et sorties.

Les transitoires causés par les charges inductives doivent être supprimés à l'extérieur du TR-CL180 .

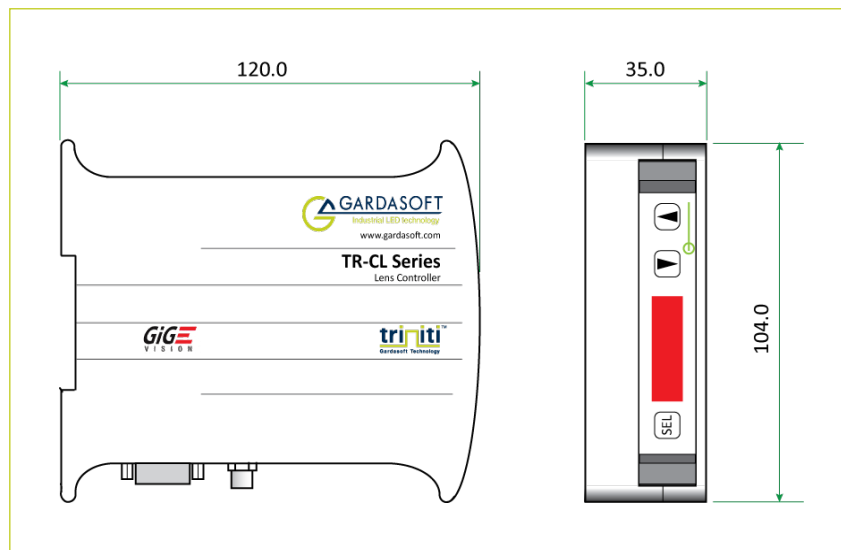
7.2 Général



Le TR-CL180 ne doit pas être utilisé dans une situation où toute panne de celui-ci mettrait en danger la santé des personnes ou risquerait d'endommager d'autres équipements.

Si l'appareil est utilisé d'une manière différente de celle recommandée par le fabricant, la protection offerte par l'appareil pourra en être altérée.

8 Mounting the TR-CL180



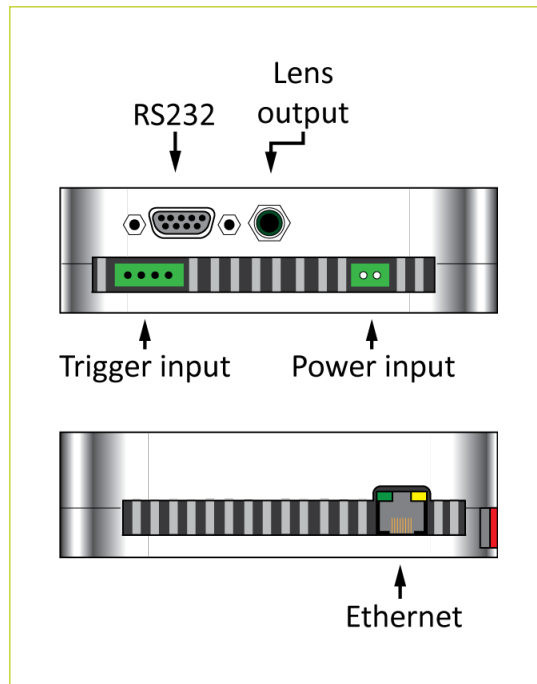
8.1 Environmental considerations

Mount the TR-CL180 unit vertically or horizontally on the DIN rail to allow the display to be read easily.

The TR-CL180 has an ingress rating of IP20 and it should be sited so that water or dirt cannot enter the unit.

9 Connecting the TR-CL180

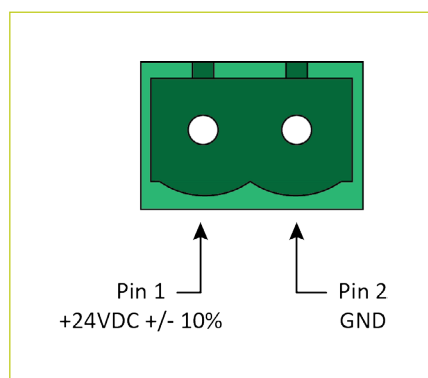
Refer to Section 15.1, Specifications and ratings for the ratings of the connections. The TR-CL180's connections are shown below:



9.1 Power

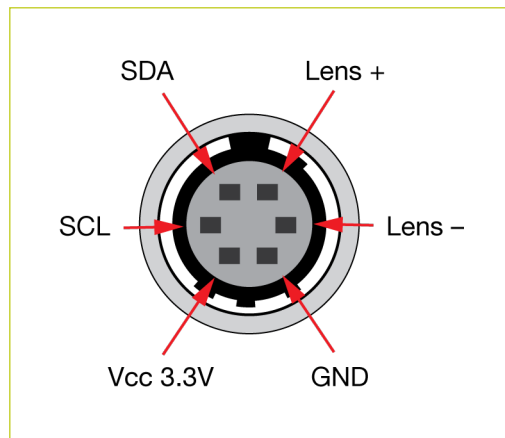
Any power supply derived from mains electricity must have a Safety Extra Low Voltage (SELV) output. Route low voltage wiring to the TR-CL180 controller separately from mains electricity wiring.

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:



9.2 Lens output

The lens output is the standard 6-way Hirose connector used on Optotune lenses. The connections are shown below:

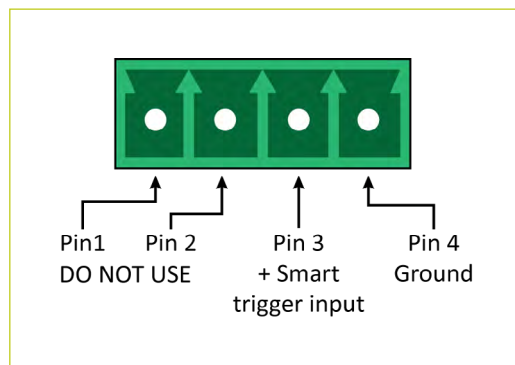


The **SCL** connection provides the clocking pulses to the lens, and the **SDA** connection is data.

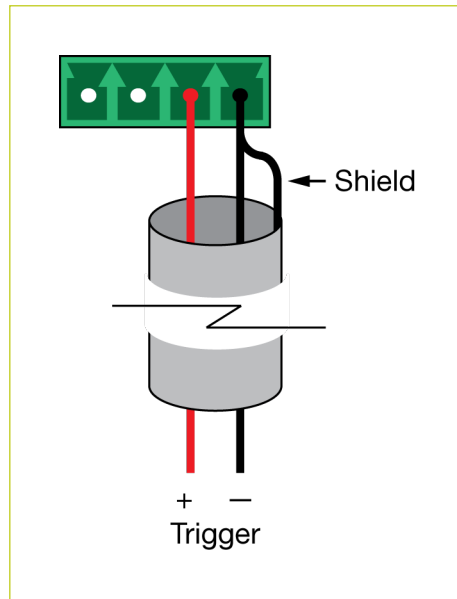
9.3 Trigger input

The trigger input is a Smart Input; it accepts a range of trigger sources with minimal extra circuitry. Refer to [Section 10, General description](#) for further information.

Note: The Smart Input is not isolated, it is ground referenced to the power supply negative connection.



In operating environments where there is a high level of radiated electrical noise, use a shielded cable for the trigger input as shown below:



9.4 Ethernet

The RJ45 connector fitted to the TR-CL180 requires a straight-through cable to connect to a network switch, hub or router. The connection is 10Base-T and operates at 10Mbits per second.

9.5 RS232

The RS232 connection fitted to the TR-CL180 is a standard female 9-way DSUB connector. The pin connections are as follows:

Pin	Function
2	Tx
3	Rx
5	Ground

9.6 Connectors (general)

The connectors required to mate with the TR-CL180 controller's connections are as follows:

Connector	Description	Supplier / Part number
Power input	Würth 351 series 2 way screw terminal free socket	Würth 691351500002 Farnell 164-1952 Newark 19P1467
Trigger input	Würth 361 series 4 way screw terminal free socket	Würth 691361100004 Farnell 184-1351 Newark 16T1571
Lens output*	Hirose HR10 6-way male plug	Hirose HR10-7P-6P(73) Farnell 107-7704 Newark 97K1594

***Note:** Where possible, use a standard Optotune lens cable.

10 General description

Three modes of operation are provided for the lens output:

Continuous – the output is constant, and can be set to any value between the minimum and maximum optical power of the lens.

Switch – the trigger input can be used to switch the output between an active optical power value and an idle optical power value.

Analog – the output is controlled by an analogue signal on the trigger input which can vary the optical power between the minimum and maximum power of the lens.

Additionally, using configuration commands, you can select a range of waveforms to output (see [Section 14.6, Waveform commands](#)), and program a timed sequence of optical power settings (see [Section 14.7, Programmable step commands](#)).

The set-up is non-volatile, so the TR-CL180 resumes the same operation after a power cycle.

10.1 Triggering

Trigger pulses should have a minimum pulse width of 2µs. You can set the sense of the TR-CL180 trigger input. Do this by setting the P flag from the front panel (see [Section 14, Configuration commands](#)), the web page (see [Section 13, Webpage configuration](#)) or the **RE** command (see [Section 14, Configuration commands](#)). The effect of setting the P flag is summarised below:

Mode	P Flag	Output
Continuous	Unused	Output is on.
Switched	P Flag = 1	Output is Idle when trigger is off, Output is Active when trigger is on.
	P Flag = 0	Output is Active when trigger is off, Output is Idle when trigger is on.
Analog	Unused	N/A.

Note: The P flag inverts the sense of the trigger.

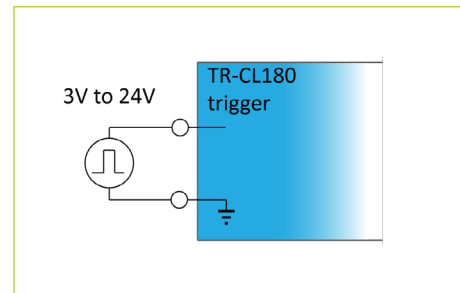
10.1.1 Trigger input options

You can connect the following types of trigger to the Smart Input:

3V to 24V voltage source

Any voltage between 0V and 0.9V is taken as logic 0.

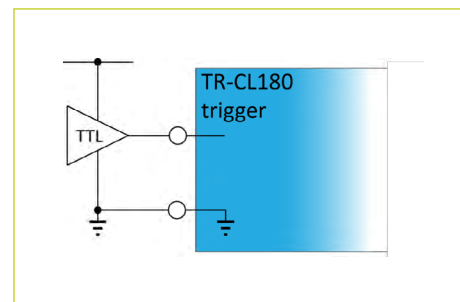
Any voltage between 3V and 24V is taken as logic 1.



TTL signal

You can connect a TTL signal to the TR-CL180 input. However, a 3.3V TTL signal only works if it can drive 8kohm without dropping below 2.7V.

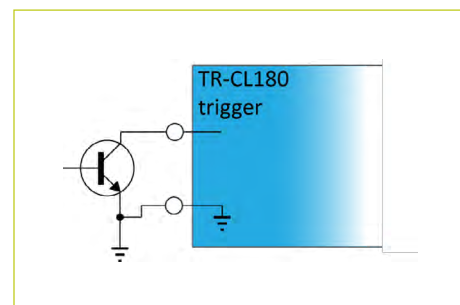
If the P flag is set to '1', the TR-CL180 output turns on when the TTL driver goes HIGH. To reverse this, set the P flag to '0' (see [Section 10.1, Triggering](#)).



NPN signal

You can connect an NPN open collector drive to the TR-CL180's input. Use the connections shown opposite.

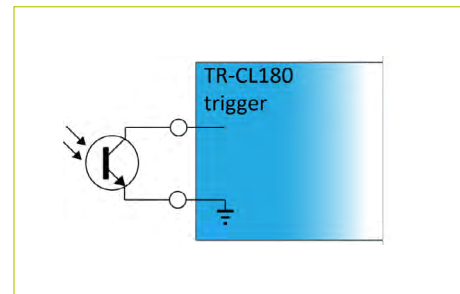
If the P flag is set to '1' the TR-CL180 output turns on when the driving transistor turns on. To reverse this, set the P flag to '0'. (see [Section 10.1, Triggering](#)).



Opto-coupler

You can connect an opto-coupler as an NPN drive to the TR-CL180's input. This prevents a 'ground loop' and reduces spurious triggering in high-interference environments.

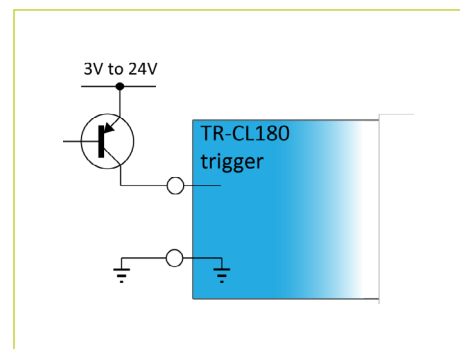
If the P flag is set to '1' the TR-CL180 output turns on when the driving transistor turns on. To reverse this, set the P flag to '0' (see [Section 10.1, Triggering](#)).



PNP signal

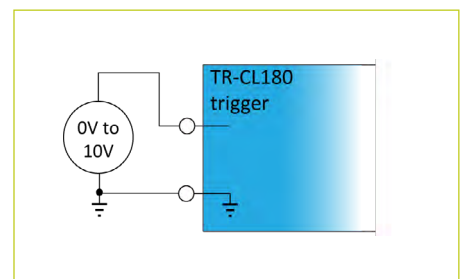
You can connect a PNP open collector drive to the TR-CL180's input. Use the connections shown opposite. The PNP transistor should not pull up to more than 24V.

If the P flag is set to '1' the TR-CL180 output turns on when the driving transistor turns on. To reverse this, set the P flag to '0' (see [Section 10.1, Triggering](#)).



Analog signal

A 0V to 10V analog signal is input to control the lens optical power when the controller is in Analog mode. This can be linear or non-linear (see [Section 14.5, Analog mode commands](#)).



10.2 Flags

You can set flags on the TR-CL180 controller to alter its operation. They can be set from the unit's front panel, the webpage or through the **RE** command (see [Section 14, Configuration commands](#)). The following configuration flags are available:

E Flag – Enables or disables fault detection. Error checking is enabled as the default setting.

P Flag – Sets the trigger input active high or active low. The default setting is active high. Refer to [Section 10.1.1, Trigger input options](#) for a detailed description of the settings.

10.3 Factory settings

You can clear the TR-CL180 configuration to return it to its factory settings.

Clear the configuration from the front panel by pressing and holding **SEL** and for about 5 seconds, until **COL** is displayed. You can also clear the configuration by using the **CL** command (see [Section 14, Configuration commands](#)).

You can start the TR-CL180 from a powered down state (cold boot) with the front panel keypad locked; this process removes the keypad lock.

11 Front panel commands

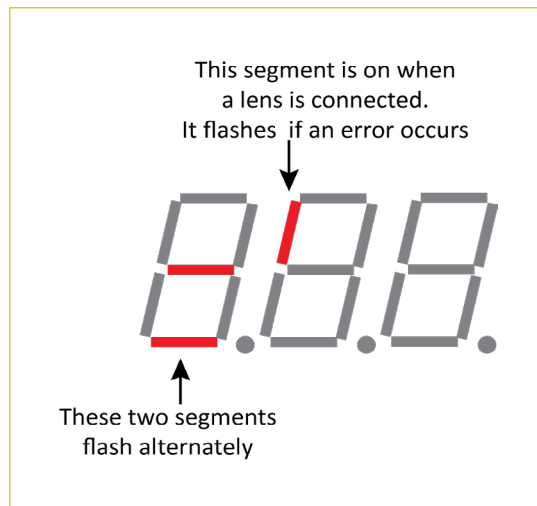
Using the front panel keypad, you can set the configuration, set a key lock code so unauthorised users cannot change any settings, set the internal trigger timer, view trigger status, and set the voltage or current rating.



The TR-CL180 features a protective clear plastic cover over the display and push-buttons (see above). You can open this cover by pressing in the tab on the right of the cover with a fingernail or screwdriver. With this cover open, the operation of the unit is unaffected by static discharges up to 2kV. With the protective cover closed, the EMC requirements of EN61326 are fully met. The unit is therefore suitable for initial setting up with the cover open. However, the cover should be closed when in use.

11.0.1 Startup

On power-up, the TR-CL180 displays **b** for 5 seconds, followed by **8.8.8.** to show the display is working correctly. The product name is then displayed; **tr-**, then **CL 1**, and **80**. The firmware version number is then displayed, for example **037**, and then the unit is ready for operation. When the TR-CL180 is not being configured, the display shows the status of the lens output as shown overleaf:



When a lens is connected the controller will read the properties and calibration for the lens from the memory in the lens. The controller will then allow the lens to be set to any optical power from its minimum to maximum. The controller will automatically compensate for temperature changes within the lens.

Lenses can be plugged and unplugged while the controller is turned on.

To configure the TR-CL180 from the front panel, press and hold **SEL** for 1 second. **CH1** is displayed. You can then use the ▲ and ▼ keys to scroll through the menu, pressing the **SEL** button to access the required set up as shown in the table overleaf:

Display	Select to:
CH1	Set up an output channel
Eth	Set up Ethernet access
LOC	Set up a key lock
UAL	View output optical power

11.0.2 Setting up continuous optical power

Press and hold **SEL** for 1 second and follow the keystrokes below:



CH1 is displayed. Press the **SEL** button.



Use the ▲ and ▼ buttons to select **SCo** (Other options displayed are **SAc** and **SA_n**). Press the **SEL** button.



Foc is displayed. Press the **SEL** button.



Use the ▲ and ▼ buttons to select the required brightness from 1% to 99%. Press the **SEL** button.



Use the ▲ and ▼ buttons to set the Error Detect flag: **F E** is enabled, **F-E** is disabled. Press the **SEL** button.



Continuous optical power is set up.

11.0.3 Setting up switched output

Press and hold **SEL** for 1 second and follow the keystrokes below:



CH1 is displayed. Press the **SEL** button.



Use the ▲ and ▼ buttons to select **SAc** (Other options displayed are **SA_n** and **SCo**). Press the **SEL** button.



Act is displayed. Press the **SEL** button.



Use the ▲ and ▼ buttons to select the required Active optical power for the lens. Press the **SEL** button.



Id1 is displayed. Press the **SEL** button.



Use the ▲ and ▼ buttons to select the required Idle optical power for the lens. Press the **SEL** button.



Use the ▲ and ▼ buttons to set the Trigger flag: **F P** is enabled, **F-P** is disabled. Press the **SEL** button.



Use the ▲ and ▼ buttons to set the Error Detect flag: **F E** is enabled, **F-E** is disabled. Press the **SEL** button.



Switched output is set up.

11.0.4 Setting up analog control

Press and hold **SEL** for 1 second and follow the keystrokes below:



CH1 is displayed. Press the **SEL** button.



Use the ▲ and ▼ buttons to select **SA n** (Other options displayed are **SAc** and **SCo**). Press the **SEL** button.



Use the ▲ and ▼ buttons to set the Error Detect flag: **F E** is enabled, **F-E** is disabled. Press the **SEL** button.



Analog control is set up.

11.0.5 Setting numerical values

When the TR-CL180 requires you to enter a numeric value, the right hand digit flashes to indicate you can use the ▲ and ▼ keys to change the value.

The optical power can be set from -99 to +99.9, but depending on the value, the resolution changes as follows:

Optical power value	Number format	Step value
-99 to -10	-99	1
-9.9 to -0.1	-9.9	0.1
0 to 9.99	9.9	0.01
10 to 99.9	99.9	0.1

11.0.6 Using the key lock

You can lock the TR-CL180 front panel keypad so unauthorised users cannot change the configuration. To do this you can set a numeric code from 0 to 255, which provides moderate protection.

To lock the keypad, press and hold **SEL** for 1 second and follow the keystrokes below:



CH1 is displayed. Press the **SEL** button.



Use the ▲ and ▼ buttons to scroll to **LOC** and press the **SEL** button.



To set up the lock code, use the ▲ and ▼ buttons to scroll to **Lc**. Press the **SEL** button.



Use the ▲ and ▼ buttons to set a lock code value from 0 to 255, and press the **SEL** button.



The TR-CL180 keypad is locked.

Note: Setting a lock code does not prevent a cold boot of the TR-CL180. A cold boot clears the lock code.

To unlock the keypad, press and hold **SEL** for 1 second and follow the keystrokes below:



LOC is displayed. Keep pressing the **SEL** button.



Un is displayed. Press the **SEL** button.



Use the ▲ and ▼ buttons to enter the lock code and press the **SEL** button.



CH1 is displayed and the TR-CL180 keypad is unlocked.

If the code entered is incorrect, **LOC** is displayed.

11.0.7 Viewing the output current

You can view an approximate measure of the output current from the TR-CL180 front panel. The current measurement is updated roughly once per second.

To view the output current, press and hold **SEL** for 1 second and follow the keystrokes below:



CH1 is displayed, Press the **SEL** button.



Use the ▲ and ▼ buttons to scroll to **UAL** and press the **SEL** button.



The measured output current is displayed. Press the **SEL** button.



Continue to use the TR-CL180 normally.

12 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 TR-CL180 is not affected by cold-booting the controller.

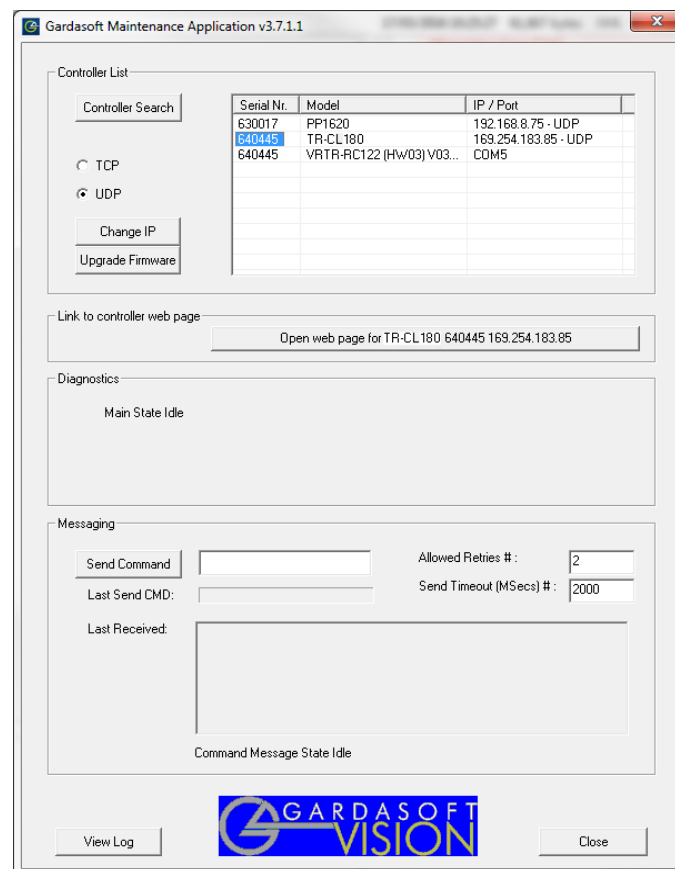
12.1 IP address

The TR-CL180 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 TR-CL180 acquired its IP address, subnet mask, and gateway address from the DHCP server. Otherwise the TR-CL180 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 14, Configuration commands](#). You can also open the selected controller's web pages at the click of a button. For more information about the TR-CL180's web pages, see [Section 13, Webpage configuration](#).

12.1.1 DHCP

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

- i. 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.

12.1.2 Fixed IP address

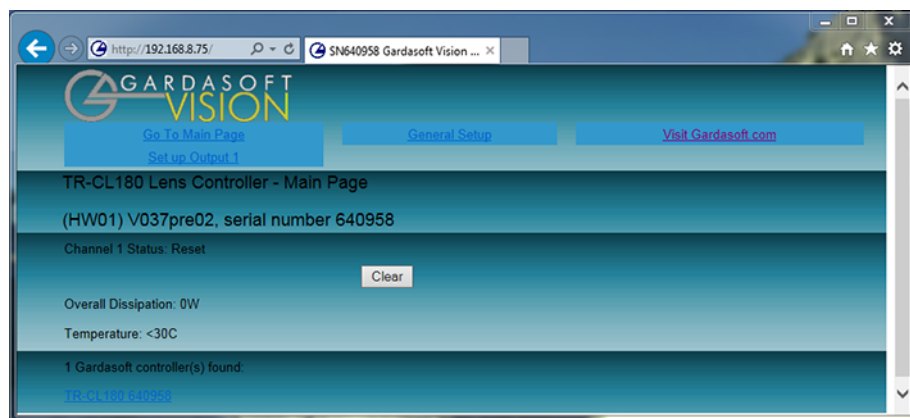
When using a fixed IP address, you must ensure that you use an IP address that is not being used by any other device on the network. It is usual to keep the first three numbers of the IP address the same as other devices and to change only the last number. For example, if you have a network consisting of a PC (IP address 192.168.1.35) and two TR-CL180s, they could be allocated addresses 192.168.1.201 and 192.168.1.202.

13 Webpage configuration

You can set up the TR-CL180 through its own internal web pages. Click the **Open webpage...** button in GardasoftMaint to take you directly to the TR-CL180's webpages. You can also type the controller's IP address (displayed in GardasoftMaint) into your web browser, which will display the Main screen. GardasoftMaint software is available from www.gardasoft.com/Downloads.

13.1 Main page

The main page (shown below) is the first to open when you access the TR-CL180's 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 TR-CL180's internal temperature.



13.2 Configuration page

The configuration page allows you to set up the lens parameters, view the lens data, and view the measurements the TR-CL180 makes during operation.

You can set the mode (continuous, switched, or analog), the Active optical power, and the Idle optical power. You must click the **Submit** button to effect any changes you make.

Click the **Refresh** button at the bottom of the screen to update the measurements being taken.

The configuration page is shown overleaf.

The screenshot shows the 'Channel 1 Configuration' page for the TR-CL180 Lens Controller. The browser address bar shows 'http://192.168.8.104/chan'. The page has a navigation bar with 'Go To Main Page', 'Set up Output 1', 'General Setup', and 'Visit Gardasoft.com'. The main content area is titled 'TR-CL180 Lens Controller - Channel 1 Configuration' and includes the hardware identifier '(HW01) V037pre02, serial number 640958'. A link 'Get help using this controller' is provided. The 'Configuration' section contains a 'Mode' dropdown set to 'Continuous', an 'Optical power range' of '-3.27dpt to 3.62dpt', and input fields for 'Active Power (dpt): 3.00' and 'Idle Power (dpt): 0.00'. A 'Click to update' button labeled 'Submit' is present. The 'Lens Data' section shows 'Lens Status: Connected', 'Lens Model: EL-16-40-TC', 'Lens Serial Number: ANAA0587', 'Lens Documentation: www.optotune.com', 'Lens Temperature: 23.75°C', and 'Lens Operating Range: -20.00°C to 65.00°C'. The 'Measurements' section displays 'State: Active', 'Dissipation: 3.3W', 'Set Current: 0.2396A', 'Measured Current: 0.2396A', 'Supply Voltage: 23.7V', 'SafePower(TM) Voltage: 17.0V', 'Lens Voltage: 3.1V', and 'Voltage Drop: 13.8V to 13.8V'. A 'Click to Refresh' button labeled 'Refresh' is at the bottom.

13.3 General setup page

On the general setup page, you can set a password for the TR-CL180 and send it commands. Refer to [Section 14, Configuration commands](#) for the commands you can use to operate the TR-CL180.

The screenshot shows the 'General' page for the TR-CL180 Lens Controller. The browser address bar shows 'http://192.168.8.75/general'. The page has a navigation bar with 'Go To Main Page', 'Set up Output 1', 'General Setup', and 'Visit Gardasoft.com'. The main content area is titled 'TR-CL180 Lens Controller - General' and includes the hardware identifier '(HW01) V037pre02, serial number 640958'. A link 'Get help using this controller' is provided. The 'Set Password' section contains input fields for 'Enter Password:' and 'Repeat Password:', followed by a 'Save' button. The 'Send Command' section contains an input field for 'Enter command:', a 'Previous output:' field showing '>', and a 'Click to send' button labeled 'Send'.

14 Configuration commands

In addition to configuring the TR-CL180 using its web page interface, you can configure it using the Ethernet or RS232 connections. Both of these methods are described in this section.

14.1 Ethernet configuration

You can configure the TR-CL180 through the Ethernet connection using UDP or TCP/IP. You can download GardasoftMaint from www.gardasoft.com/downloads, which allows you to send commands to configure your TR-CL180.

Commands sent in UDP or TCP/IP from a computer to the TR-CL180 must be sent to destination port 30313. Replies to the source port have the source port and destination port identities exchanged.

TCP/IP connections time out and close if they remain idle for more than 10 seconds. The host must send regular commands or 'keep alive' packets of data to keep the connection open.

A carriage return (ASCII 13) character must be sent to terminate the command line in case multiple TCP packets become joined.

14.2 RS232 configuration

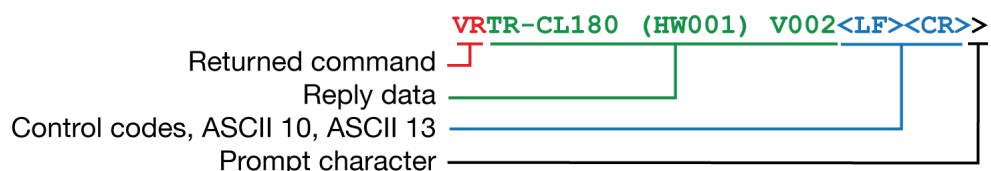
When using RS232 to configure the TR-CL180, the COM port should be set to 115200baud, 8 data bits, no parity, 1 stop bit, no handshaking.

A carriage return (ASCII 13) character should be sent to terminate the command line.

14.3 Command structure

Commands are sent by the host (a PC connected to the network). The command is returned by the TR-CL180, together with any reply generated by that command, in UDP or TCP/IP packets followed by <LF> <CR>. The last character sent is the > prompt. Once this has been received, the host knows the command has been completed.

For example, sending the **VR** command might get this reply:



Note: All parameters are specified in the 'USA/UK' format, where a half is written as '0.5' and not '0,5'

14.4 General commands

Any changes you make using Ethernet commands are not saved permanently until you send the **AW** command.

Report the TR-CL180 firmware version

This command returns the firmware version running on the TR-CL180. For example, typing:

VR returns

TR-CL180 (HW01) V037

Set continuous mode

This command sets the output to continuous mode and allows the brightness to be set:

RS1,s

Where:

s = optical power within the range of the lens

Set switched mode

This command sets the output to switched mode and allows the optical power to be set:

RU1,a,i

Where:

a = the Active optical power within the range of the connected lens.

i = the Idle optical power within the range of the connected lens.

Set the option flags

This command sets the flags for error detection, trigger sense, and SafeSense:

RE1,m

Where the following code applies:

m	Error detection	Trigger sense
0	Enabled	+
2	Disabled	+
4	Enabled	-
6	Disabled	-

Save the settings to memory

AW

This command saves the settings to non-volatile memory. If you power cycle the TR-CL180 before sending the **AW** command, all changes are lost and the unit returns to the values set before the last **AW** command.

Clear configuration

CL

This command clears the configuration and lighting ratings, and turns the output off. The results of any **VL**, **RS**, **RW**, **RU**, **RA**, **RE**, **RP**, and **AW** commands are cleared.

Show configuration

This command shows the configuration of the TR-CL180. Type in:

ST

A typical reply to this command might be:

```
CH1,MD0,AF 3.95, IF 0.00,  
IP1,FL0,Mn0.0,Mx0.
```

Where :

CH	Channel number; this is always 1 .
MD	Mode: 0 = continuous, 1 = switched, 2 = analog.
AF	Active optical power in the range of the connected lens.
IF	Idle optical power in the range of the connected lens.
IP	Always returns IP1
RT	Retrigger delay.
IP	Always returns IP1.
FL	Flags set using the RE1 command.
Mn	In Analog mode, the voltage corresponding to minimum focus.
Mx	In Analog mode, the voltage corresponding to maximum focus.

Enable Ethernet messages

This command enables or disables Ethernet messages. Type in:

GTm

Where:

m = 0 to disable Ethernet messages, and

m = 1 to enable Ethernet messages.

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

Evtc,e

Where:

c – 1 for events concerning the light output, otherwise 0

e – the event value (see [Section 15, TR-CL180 reference information](#))

Clear any errors

Use this command to read the last event or error code when Ethernet messaging has been disabled:

GR

Any error displayed on the TR-CL180 is cleared. If there are no outstanding events or errors, the '>' prompt is returned.

Set/Clear the webpage password

This command sets the webpage password. Up to six characters can be chosen. Type in:

EYasc1,asc2,asc3,asc4,asc5,asc6

Where:

asc1 to **asc6** are decimal ASCII values for the letters of your password

For example, a value of 65 is 'A', 66 is 'B' and so on up to 90 for 'Z'.

Note: When you use this password to access the TR-CL180 through the webpage, you must use the actual characters and not the ASCII values. Use upper case characters and do not enter commas or spaces. The keypad can be locked if required.

You may find it necessary to lock the front panel keypad to prevent any unauthorised changes to the settings to the TR-CL180. To disable the keypad, type in the following command:

KBd,c

Where:

- d = 0** to enable the keypad.
- d = 1** to disable the keypad, but allow the unlock code to be entered on the keypad
- d = 2** to disable the keypad and disallow the unlock code to be entered on the keypad.
- c =** the unlock code, which must be a number from 0 to 255.

You can still access the TR-CL180's settings using Ethernet commands and through its web page. The settings of this command are restored after a power cycle.

14.5 Analog mode commands

An analog input voltage from 0V to 10V can be used to set the focal power of the lens connected to the TR-CL180. The translation from input voltage to focal power can be linear or can be a non-linear profile. The non linearity is set up by the number of steps in a translation table and the value associated with each. The commands are described below:

Set analog mode

This command sets the output to analog mode so that the optical power is set by an analog input voltage. The translation from input voltage to focal power would normally be set before sending this command.

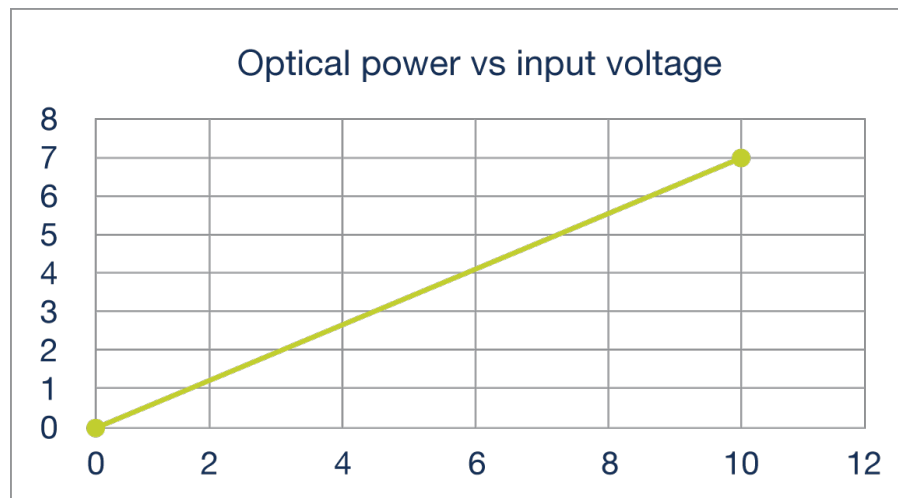
RA1,0

Turn off analog translation

This command turns off the non-linear translation (enables linear relationship), so that an input of 0V gives the minimum optical power of the lens and 10V gives the maximum optical power of the lens.

RA1,1,0

This gives the following relationship:



Set analog translation

Non-linear translation can be used to convert the analog voltages from a distance sensor to an optical power to focus at the given distance.

This command turns on non-linear translation and sets the number of steps in the non-linear translation.

RA1,1,n

Where:

n = the number of points in the profile (2 to 10)

This command sets a point within the non-linear translation:

RA1,d,f,a

Where:

d the point to be set (0 to [number of points] - 1)

a analog input voltage

f equivalent focal power for the input voltage

The translation points are assumed to be valid.

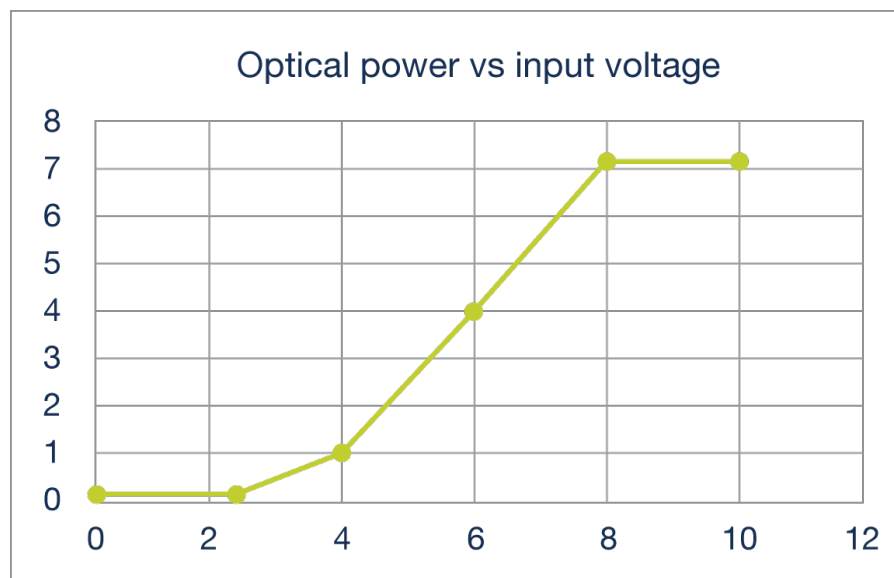
Voltages below the first voltage are set to the focal power of the first point. Voltages above the last voltage are set to the focal power of the last point. Voltages between the points are interpolated

The points do not need to be in order. The controller will internally sort them by analogue voltage.

For example:

RA1,1,4	Set 4 points
RA1,2,0,0.2,2.3	$\leq 2.3V$ gives 0.2 diopters
RA1,2,1,4.0,6	6V gives 4.0 diopters
RA1,2,2,7.2,8	$\geq 8V$ gives 7.2 diopters
RA1,2,3,1.0,4	4V gives 1.0 diopter

In this example, the point for 4V has been added after the 6V and 8V points. This gives the following relationship:



Note that in this example 5V will give 2.5 diopters.

14.6 Waveform commands

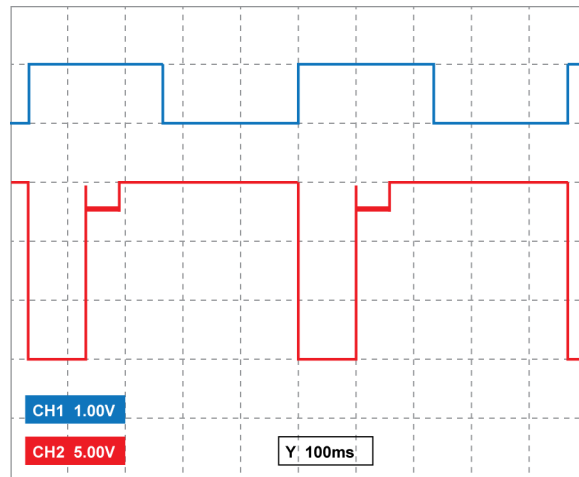
Waveform mode generates a signal with a value from the active focus to the idle focus.

Single shot waveforms run for one cycle when a trigger input signal is received. At the end of the cycle the focus is left as the last value of the waveform.

Continuous waveforms run independently of the trigger signal.

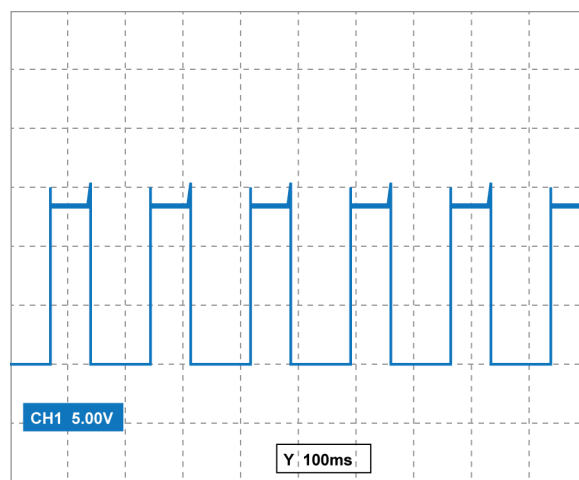
Sawtooth waves default to a slow rise and instant fall.

The waveforms are illustrated overleaf:



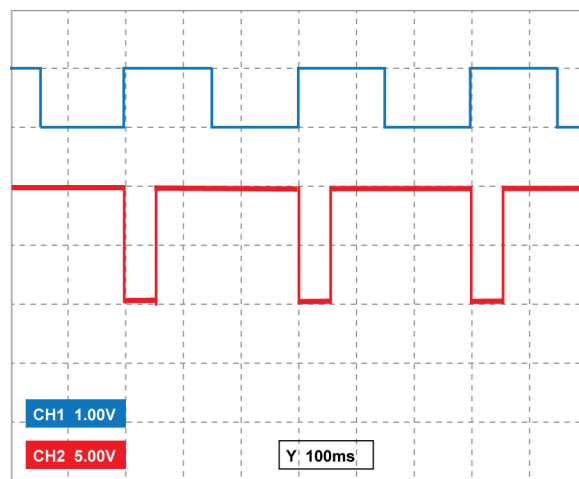
Mode 3

Single shot step points
(set using the RX
command).



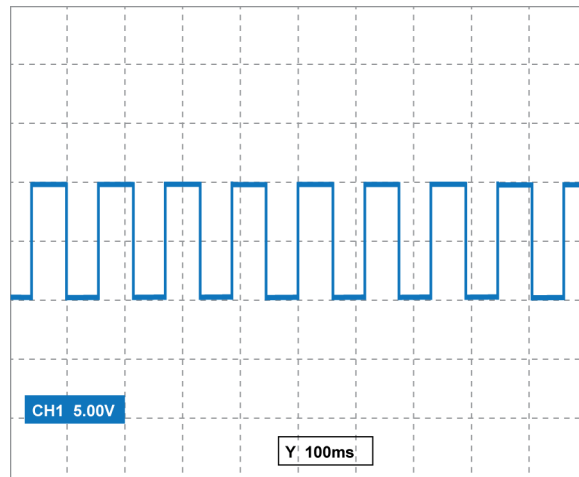
Mode 4

Step sequence run
continuously (trigger
ignored).



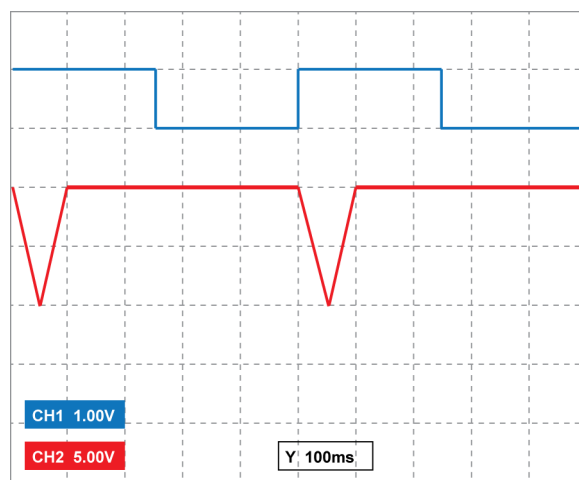
Mode 5

Square wave run once
per trigger pulse.



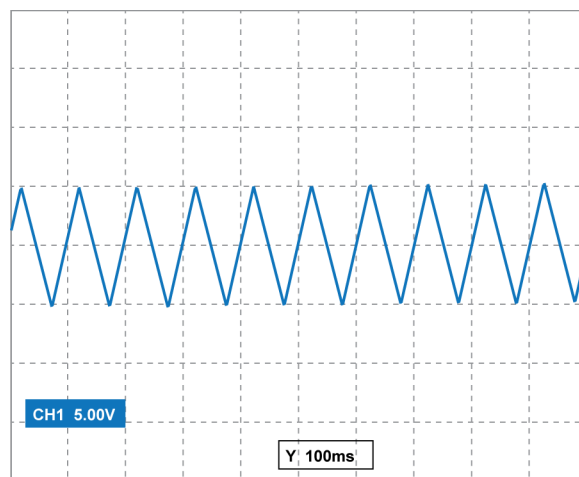
Mode 6

Square wave run continuously (trigger ignored).



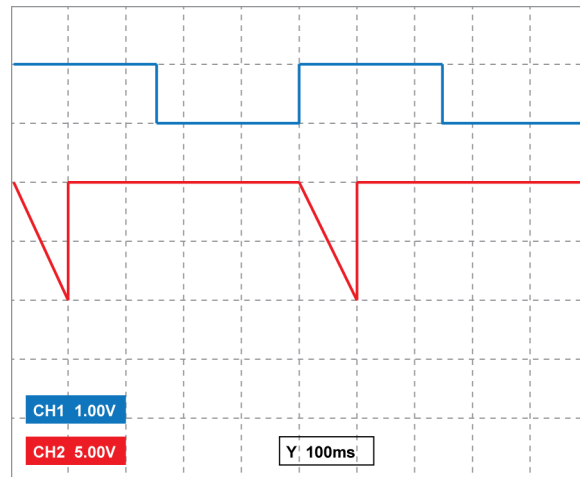
Mode 7

Triangle wave run once per trigger pulse.



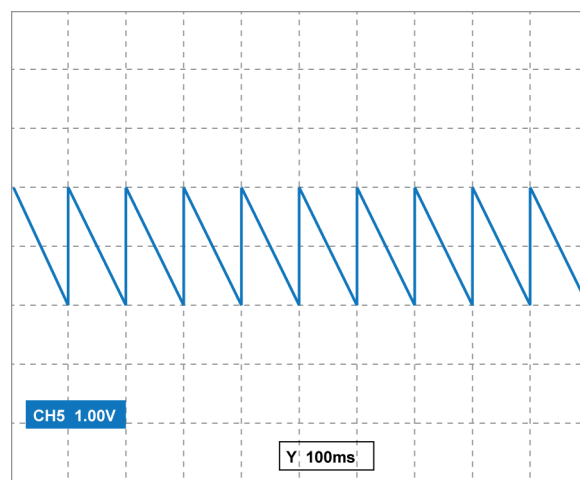
Mode 8

Triangle wave run continuously (trigger ignored).



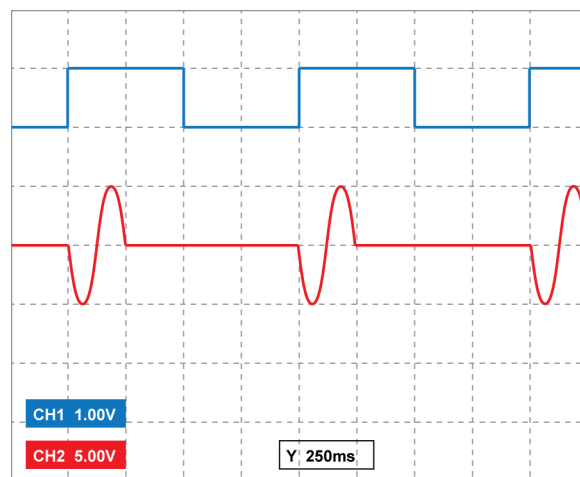
Mode 9

Sawtooth wave run once per trigger pulse.



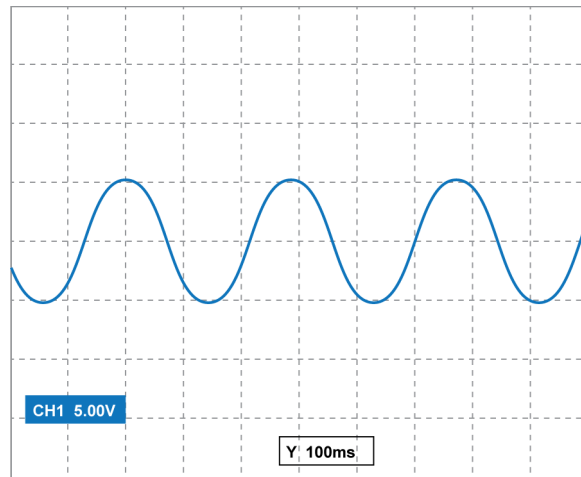
Mode 10

Sawtooth wave run continuously (trigger ignored).



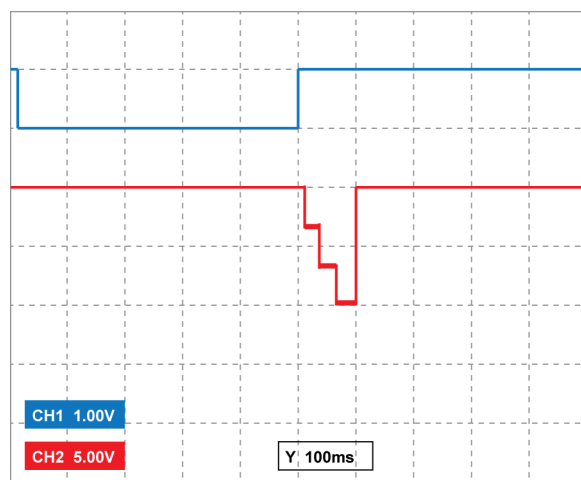
Mode 11

Sine wave run once per trigger pulse.



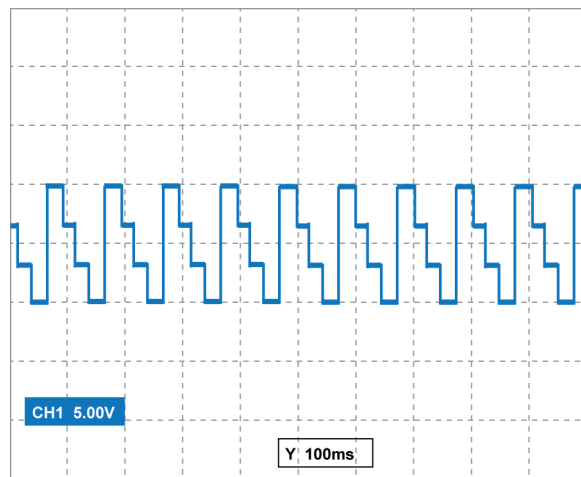
Mode 12

Sine wave run continuously (trigger ignored).



Mode 13

Staircase wave run once per trigger pulse.



Mode 14

Staircase wave run continuously (trigger ignored).

Waveform command

RN1,m,p,s

Where:

- m** mode (3 to 14; refer to the illustrations shown previously)
- p** period in milliseconds (50ms to 3s)
- s** number of steps for staircase mode only (3 to 50)

The following examples illustrate how this command is used:

- RN1,1,100 Set as continuous square wave at 10Hz.
- RN1,8,50 Set a continuous triangle wave at 20Hz.
- RN1,11,10s Set a triggered sine wave which runs once for 10 seconds.
- RU1,2,0 Set a continuous sawtooth wave at 5Hz from 0 to 2 diopters, with a slow fall and fast rise.
- RN1,10,200
- RU1,2,0 Set a continuous sawtooth wave at 5Hz from 0 to 2 diopters, with a slow rise and fast fall.
- RN1,10,200

14.7 Programmable step commands

Use this command to set up a sequence of steps where different optical powers can be set up for a programmed period of time.

Set the number of steps in a sequence

RX1,0,n

Where:

n = the number of steps (0 to 20)

Set a step point

RX1,1,e,f,t

Where:

- e** step number (0 to [number of steps] - 1)
- f** focal power in diopters
- t** time at this step in milliseconds

Add a step to the sequence

RX1,2,f,t

Where:

f focal power in diopters

t time at this step in milliseconds

Add a step to the sequence using the current focus

RX1,3,t

Where:

t = time at this step in milliseconds

Status command

ST

An example of the information that could be returned on receipt of an **ST** command is given below:

CH1,MD2, AF 0.00, IF 0.00,IP1,FL14

Analog profile: (1.00, -4.00), (1.90, -3.50),
(2.80, -3.20), (3.70, -2.00), (4.6

0, -1.50), (5.40, 1.50), (6.30, 2.00), (7.20,
3.20), (8.10, 3.50), (9.00, 4.00),

Waveform period 0.050s

No EEPROM range IF 0.00 XF 0.00, current IC
0.000 XC 0.000

Step sequence: (4.00, 0.10), (3.00, 0.20),
(2.00, 0.15), (1.00, 0.20), (0.00, 0.

30), (-1.00, 0.10), (-2.00, 0.20), (-3.00,
0.30), (-4.00, 0.15),

Note: The *analog profile* lists the points entered using the RA commands, and the *step sequence* lists the points entered using the RX commands.

14.8 Command summary

Command	Example	Effect
AW	AW	Save changes.
CL	CL	Clear configuration.
GT	GT1	Enable Ethernet messages.
GR	GR	Clear any error conditions.
EY	EY65,66	Set webpage password to 'AB'.
VR	VR	Read the firmware version.
RS	RS1,6.5	Set the lens to 6.5 diopters continuously.
RA	RA1,0	Set the lens to analog control mode.
	RA1,1,4	Set 4 points in the non-linear translation profile.
RN	RN1,1,100	Set a continuous square wave at 10Hz.
RX	RX1,0,5	Set the sequence to 5 steps.
RU	RU1,4.3,-1.8	Set the lens to switch between 4.3 diopters when Trigger input is High and -1.8 diopters when Trigger input is Low
KB	KB1,23	Disable the keypad buttons on the front panel. Set the unlock code to 23.
ST	ST	Show the unit's configuration details.

15 TR-CL180 reference information

This section of the user manual contains information about the TR-CL180's specification, ratings and restrictions, and event and error codes.

15.1 Specifications and ratings

TR-CL180	
Output channel	One channel, including constant current lens drive and lens EEPROM data communications. Automatically reads data from EEPROM inside lens which calibrates the controller response. The performance of the controller is therefore automatically tailored to each individual lens.
Lens compatibility	Compatible with Optotune EL-10-30, and EL-16-40 lens ranges. Full current calibration with lens temperature compensation.
Operating modes	Single configurable optical power. Two optical powers, selected by digital input Optical power set by analog input.
Digital input	Smart input 3V-24V, TTL, NPN, PNP compatible
Analog input	0V to 10V, 7K input impedance Nominal 12-bit resolution.
Refocus latency	1ms (not including communications delays).
Output current	-400mA to +400mA in 0.1mA steps, accuracy +/- 0.5mA.
Output voltage	-16V to +16V
User interface	Ethernet (easy to use GUI by means of in-built web server), RS232, and push button.
Lens connector	6-way Hirose HR 10 G lens connector
Power supply	24V +/-10%. An SELV power supply is required Input power 10W maximum
Operating temperature	5°C to 50°C

TR-CL180	
Humidity	Up to 95% non-condensing
Dimensions	120mm x 101mm x 35mm
Mounting	DIN rail mount
Weight	175g
Standards	CE, RoHS

15.2 Restrictions

The maximum continuous output current is -400mA to +400mA.

15.3 Event codes

On receipt of a GT1 command, event messages are sent by the TR-CL180 over its Ethernet link when a light is connected or an error occurs. The message format is:

Evt1,<event code>

Some event codes are displayed on the TR-CL180's front panel; these are shown in red.

Event number	Reason
1 to 127	An error has occurred. See Section 15.4, Error codes.
130 FAE	An over temperature error has occurred.
190	A lens has been connected.
191	A lens has been disconnected.
192	Configuration has been adjusted to be within the allowed range of values.

15.4 Error codes

Some error codes are displayed on the TR-CL180's front panel; these are shown in red.

Error number	Reason
Err 1	A parameter value is invalid.
Err 2	Command not recognised.
Err 3	A numeric value is in the wrong format.
Err 4	Wrong number of parameters.
Err 5	This is a warning, not an error. One of the parameters is out of range and the value of that parameter has been adjusted.
Err 8, 12	EEPROM corrupt. The configuration has been cleared.
Err 9, 20	Settings could not be saved to EEPROM.
Err 27	Ethernet settings cannot be read from EEPROM. They may be incorrect.
Err 44 FAL	Fatal error: The TR-CL180 is too hot. The unit has a thermal cut out which operates at approximately 65°C to 70°C depending on conditions.
Err 192	Unable to read EEPROM in lens.
Err 193, 194, 195	Lens EEPROM format is wrong.
Err 196	Current required for the optical power by the lens is more than the lens is rated for or more than the controller can supply.
Err 197	Lens temperature is outside its operating range.

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