
ULC-2

UNIVERSAL LED CONTROLLER

User's Manual

VERSION 1.1.07.02.2012

ULC-2

Revisions

DATE	REVISIONS MADE
3/5/2012	Inserted the DISABLE OUTPUT command & edited the ENABLE OUTPUT response category. Edited the text on page 18 Ethernet Command list.
3/8/2012	Inserted Maximum Pulse Frequency vs. Pulse Width & Current to document.
3/9/2012	Changed the amps on page 4 from 5amps to 6amps
3/14/12	Changed .1amps min to 4amps max & .5 amps min to 50amps max
3/16/12	Changed wording on 4 th page to read (CE) instead of UL Listed
3/30/12	Added legend titles on page 11 & 12 & hyperlink for windows framework
5/25/12	Updated MetaBoss Link to reflect link on www.Metaphase-tech.com
5/30/12	Added Checksum statement
6/01/12	Added information to the Trigger-Input Specs
07/02/12	Added IP Octet changes; Added IP recommended address; Added FAQ page; added Wire Gage Charts

ULC-2

Overview

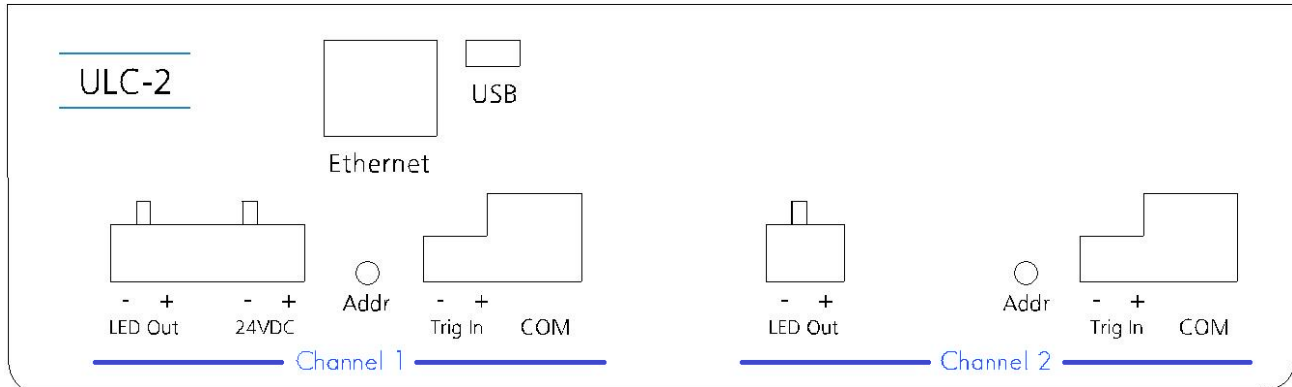
Metaphase Technologies' **ULC-2 LED Controller** provides independent; constant-current control of two LED loads at up to 4 amps continuous (DC) or a maximum output power of 60 Watts per channel. In Pulse (Strobe) Mode, the ULC-2 is capable of output currents up to 40 amps. The ULC-2 is capable of driving LED forward voltages between 4V and 20V. Pulsewidths are adjustable down to 2 microseconds and external trigger rates up to 50kHz.

The ULC-2 may be remotely controlled over Ethernet using the Metaphase Windows software MetaBOSS or by third party program using the ULC-2s Ethernet Commands. Additionally, user-adjustments of the ULC-2 are provided by way of a user-friendly LCD interface. Up to five preset configurations may be saved and recalled to meet the changing demands of today's applications.



Wiring Connections

Please refer to the diagram below for LED output and trigger input connections.



The ULC-2 is powered by a user-supplied power supply having the following ratings:

- 24VDC
- 6amp
- Switching topology (as opposed to linear)
- CE

ULC-2 LED Outputs

- With the ULC-2 un-powered, connect channel 1 & 2 LED loads to the positive and negative LED outputs.
**Note: Connecting or disconnecting LED loads while the ULC is powered may damage the ULC controller and/or the LED load.*
- To minimize rise-time distortion and guarantee pulsewidth values, keep all LED load wires as short as possible.

ULC-2 Trigger Inputs

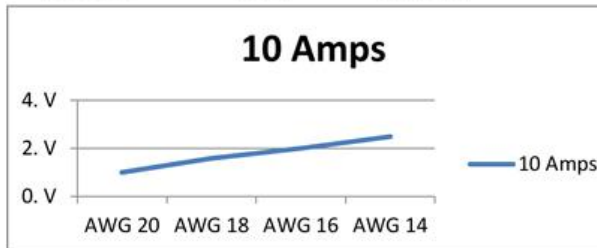
- For external trigger operation, each channel has its own separate trigger inputs. Trigger pulses enable the LED output for a period set by the Pulsewidth parameter.

Wiring Connections Cont'd

The Charts below show the output wire recommendations.

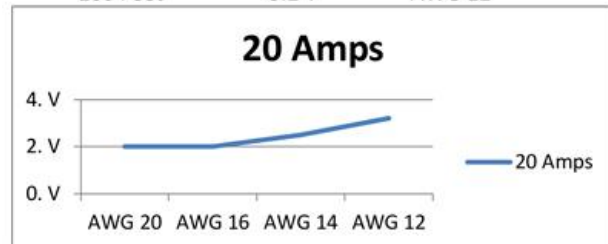
10 Amps

Distance	Voltage Drop	Recommended Wire Gauge
10 Feet	1. V	AWG 20
25 Feet	1.6 V	AWG 18
50 Feet	2. V	AWG 16
100 Feet	2.5 V	AWG 14



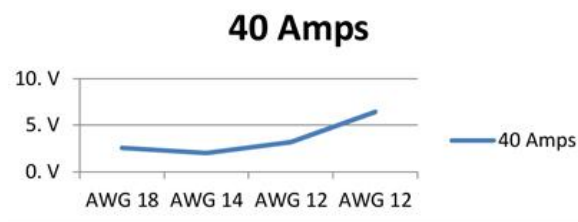
20 Amps

Distance	Voltage Drop	Recommended Wire Gauge
10 Feet	2. V	AWG 20
25 Feet	2. V	AWG 16
50 Feet	2.5 V	AWG 14
100 Feet	3.2 V	AWG 12



40 Amps

Distance	Voltage Drop	Recommended Wire Gauge
10 Feet	2.6 V	AWG 18
25 Feet	2. V	AWG 14
50 Feet	3.2 V	AWG 12
100 Feet	6.4 V	AWG 12



User-interface Menus

Setup Menu

The setup menus below appear only when the ULC-2 is powered on. Each menu described below applies to two channels independently. The menus include:

Trigger Type

This menu allows the setting of the type of trigger when in Strobe mode. In normal operation, External trigger is selected, but for setup and testing purposes, users may elect to use internal trigger in an effort to verify wiring connections and operation.

When set to External trigger, the ULC-2 will ignore external trigger inputs that received faster than what is set by Strobe Minimum Period.

For Internal trigger, the frequency of the strobing output is set by Strobe Minimum Period. For both types of trigger, the output Strobe Pulsewidth is determined by the Strobe Pulse width parameter.

Continuous (DC) Current Limit

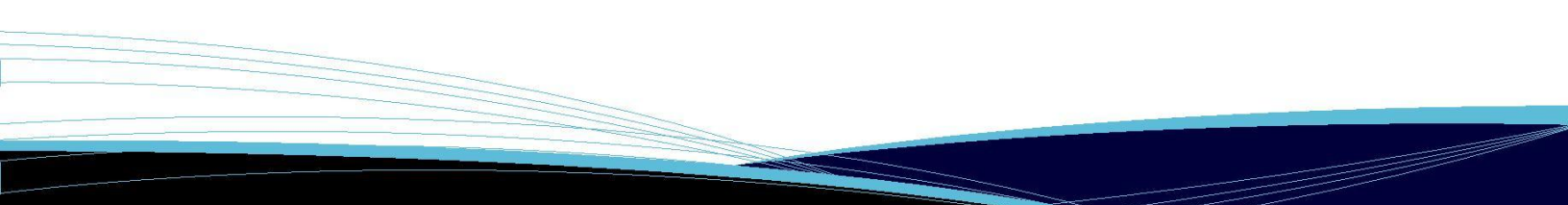
This “Limit” menu provides the user a way to set the upper bound of the LED output DC current found in the “Run time” menus. For example, if the DC Current Limit is set to 1.6 amps, the DC current can be adjusted from 0 to 1.6 amps. Such a limit assures adjustments never exceed the limits of the LED load.

Strobe (Pulse) Current Limit

This “Limit” menu provides the user a way to set the upper bound of the LED output Strobe current found in the “Run time” menus. For example, if the Strobe Current Limit is set to 9 amps, the Strobe current can be adjusted from 0 to 9 amps. Such a limit assures adjustments never exceed the limits of the LED load.

Strobe Pulsewidth Limit

This “Limit” menu provides the user a way to set the maximum LED output Strobe Pulse width found in the “Run time” menus. For example, if the Strobe Pulsewidth Limit is set to 100 microseconds, the Strobe Pulsewidth can be adjusted from 2 to 100 microseconds. Such a limit assures adjustments never exceed the limit of the LED load.



Strobe Minimum Period Limit

This “Limit” menu provides the user a way to set the Minimum Period of the external strobe triggers found in the “Run time” menus. For example, if the Minimum Period Limit is set to 100 microseconds, the Minimum Period can be adjusted from a maximum of 30 milliseconds down to a minimum of 100 microseconds. Such a limit assures adjustments never exceed the limits of the LED load.

Voltage Limit

This “Limit” menu provides the user a way to set the maximum voltage of the ULC-2 voltage. Typically, the rated voltage of the LED should be entered. The ULC-2 will automatically supply the voltage necessary to provide the specified current up to the Voltage limit specified.

Restore to Default

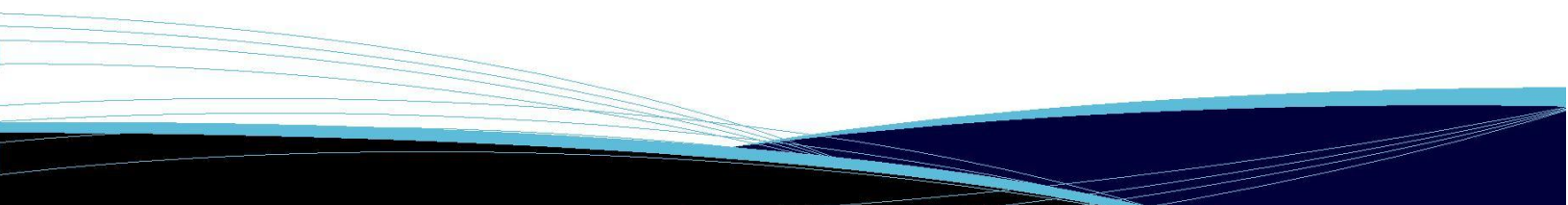
This allows for the device to be restored to original factory settings. First, reboot the device until the version menu is displayed.

Metaphase	ULC-2
Vx.x	Vx.x

When the above is displayed, hold the DOWN ARROW button to restore default settings.

Loading Defaults

The device should now be restored to the original settings and prompt you to enter setup mode.



Run-Time Menus

These menus are shown after the setup menus. Each menu described below applies to two channels independently. The menus include:

Mode

The Mode menu controls whether the ULC-2 output is continuous (DC) or is strobed each time the external trigger input is pulsed.

Current DC

The DC current menu controls the ULC-2 output from .1 amps to the DC Current Limit value set in the Setup menus.

Current Pulse

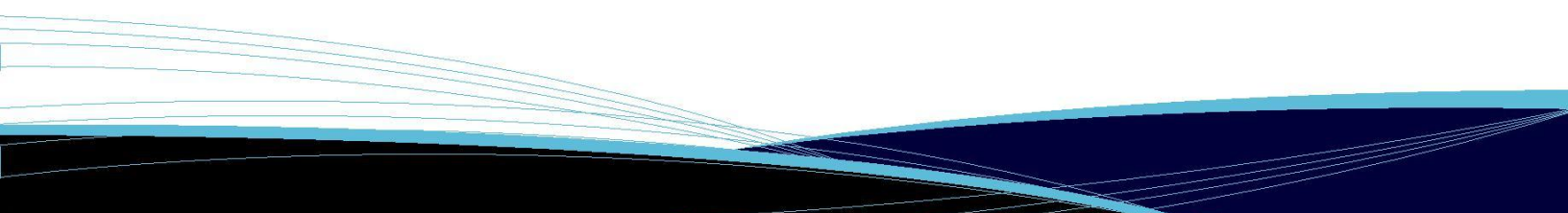
The Pulse current menu controls the ULC-2 output from .1 amps to the Pulse Current Limit value set in the Setup menus. This menu applies only to the output when the mode is set to Strobe.

Strobe Pulsewidth

The Strobe Pulsewidth menu controls the ULC-2 output from 2 microseconds to the Strobe Pulsewidth Limit value set in the Setup menus. This menu applies only to the output when the mode is set to Strobe.

Strobe Minimum Period

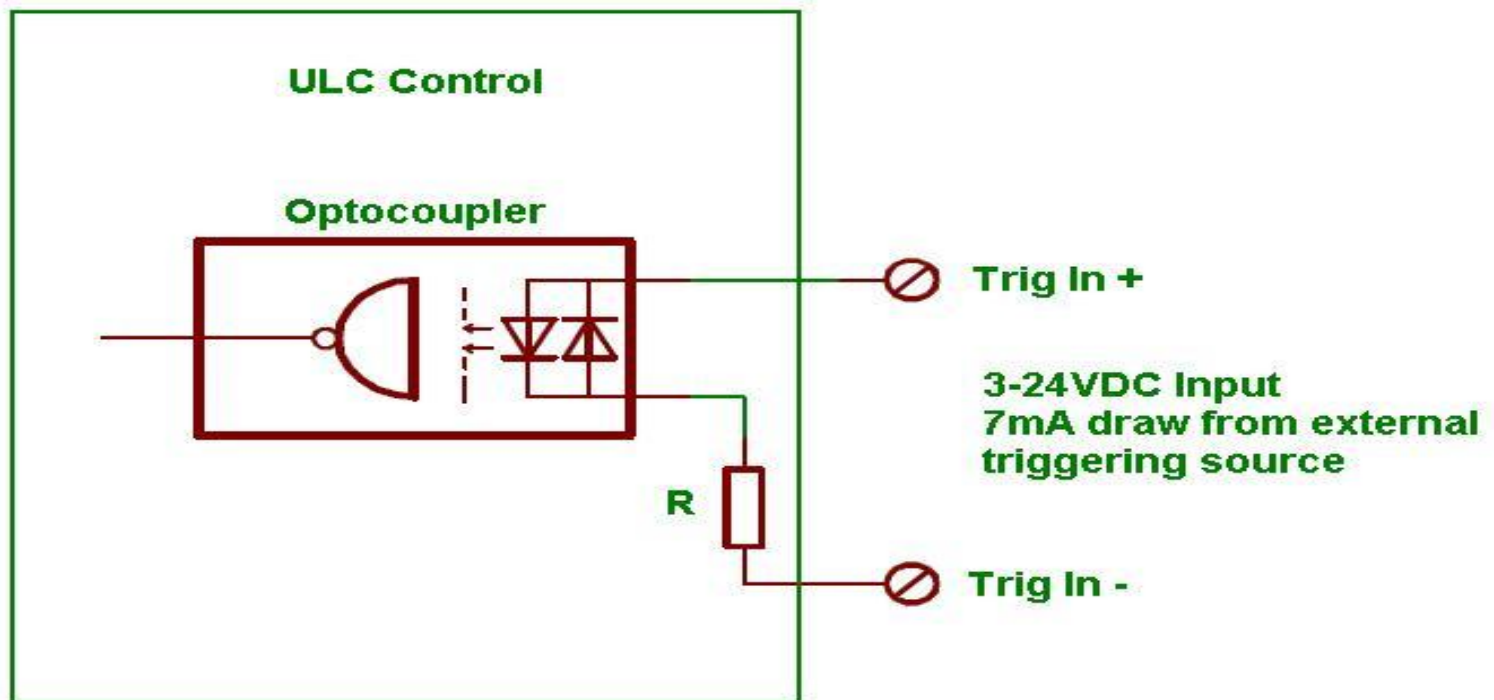
The Strobe Minimum Period menu controls the ULC-2 output from 30 msec down to the minimum value set by Strobe Minimum Period Limit value set in the Setup menus. This menu applies only to the output when the mode is set to Strobe. The ULC controller ignores trigger inputs faster than the Strobe Minimum Period.



One-shot Internal Trigger

This menu allows the user to simulate one cycle of strobe output triggered by the internal trigger. During setup, this feature helps the user determine the appropriate values of pulse width, period, and strobe current for their specific application.

ULC Trigger Input Equivalent Schematic



Save/Recall

This menu allows all Setup and Run Time settings to be stored in one of five presets. Saving to any preset saves all parameters for both Channels 1 & 2.

To use one of the save slots, select what mode the device will be operating under (strobe or DC) and change settings as desired. At the end of the options, The preset menu will display.

Preset #X
Save Recall

To save the options chosen select the preset number you would like with the C button

After choosing what slot to use, select the down arrow to save your preset.

Preset Setting X
Saved

To recall a saved setting, select the desired slot number and hit the up arrow
This should recall your personal settings as desired.

Channel Change

Both channels of the ULC-2 can have its address changed from the default settings of Channel 1 and Channel 2. Typically, this is only done when daisy chaining multiple ULC-2 controllers together. To change, use a paperclip and insert it into the address hole on the front panel. Every push of the button will increment the address setting.

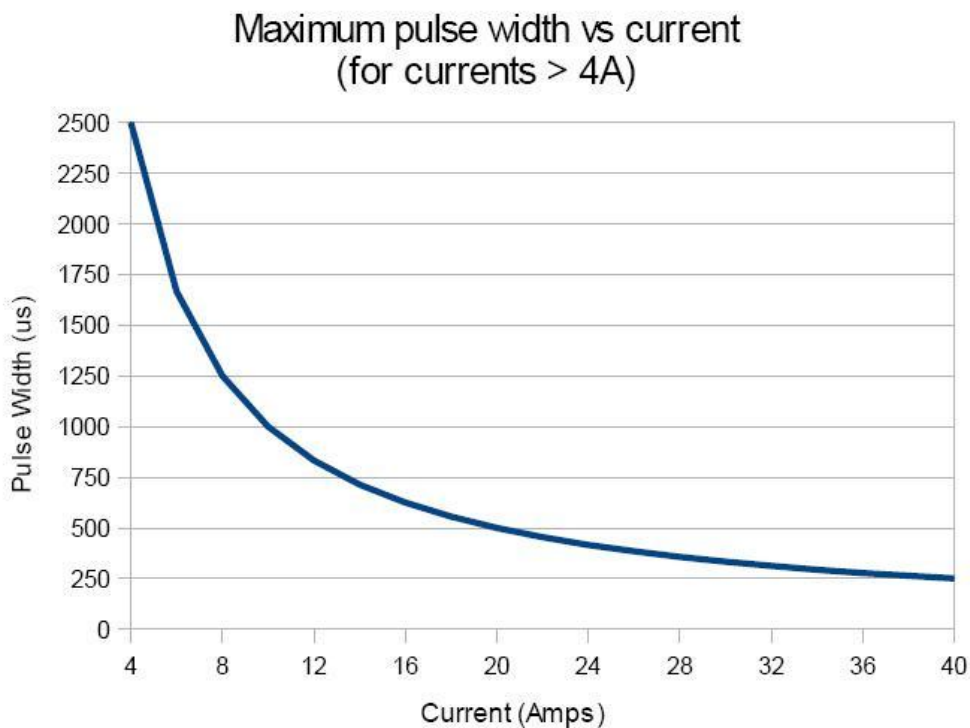
Example: Pushing it four times will set the Address to Address 4.

After reaching the desired address setting, push and hold the address button. The control will blink out the address setting (LED is on LCD side of the controller). Every time you start the sequence, it resets the address count to zero.

Pulsewidth Limit in Pulse (Strobe) Mode

Please refer to the diagram below to determine the allowable operating parameters while in Pulse Mode. The ULC-2 controller will automatically limit the peak output current and pulsewidth to the allowed maximum.

For example, the ULC-2 will not allow output pulsewidths greater than 500 microseconds if the out-put pulse current is set to 20A.



* Any pulse width is allowed with currents of 4A or less.

Formula: $(PW * A) \leq .01$

Where:

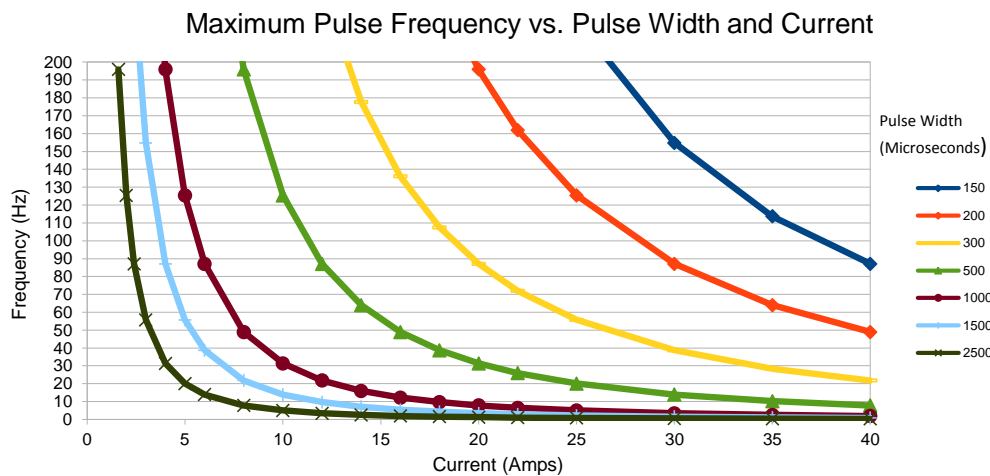
PW = pulse width in seconds

A = pulse current in Amps

Trigger Frequency Limit in Pulse (Strobe) Mode

Please refer to the diagram below to determine the allowable operating parameters while in Pulse Mode. The ULC-2 controller will automatically limit the peak output current and pulsewidth to the allowed maximum.

For example, the ULC-2 will not allow trigger inputs faster than 5000 Hz if the output pulsewidth is 50 microseconds and the output pulse current is set to 16A.



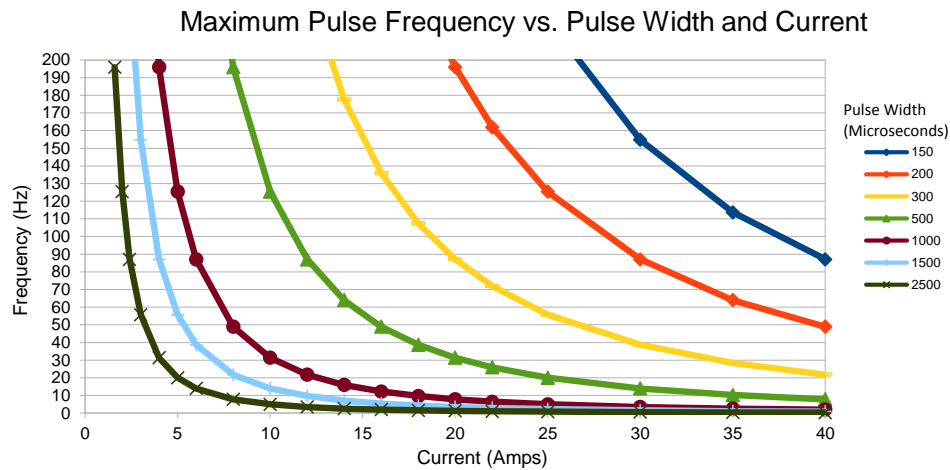
Formula: $T > 319 * PW^2 * I^2$

Where:

PW = pulse width in seconds

I = pulse current in Amps

T = pulse period in seconds



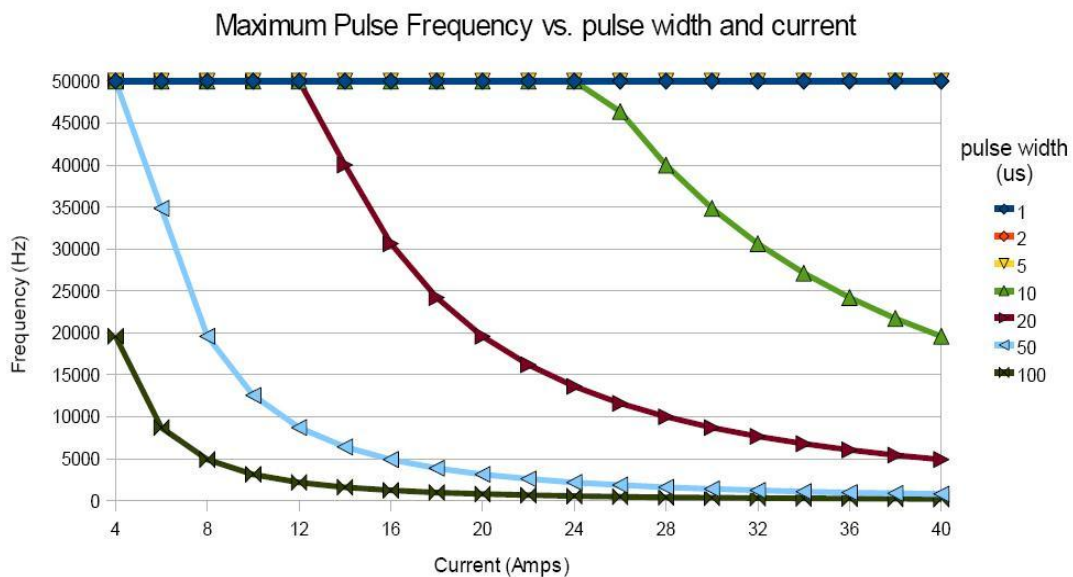
Formula: $T > 319 * PW^2 * I^2$

Where:

PW = pulse width in seconds

I = pulse current in Amps

T = pulse period in seconds



Formula: $T > 319 * PW^2 * I^2$

Where:

PW = pulse width in seconds

I = pulse current in Amps

T = pulse period in seconds

Specifications

Number of channels:	2
Voltage Input:	24V +/- 20%
Voltage Output:	4V to 70V
DC Current:	0.1A min to 4A max in .1 amp increments
Pulse Current:	0.5A min to 40A max in .1 amp increments
Pulsewidth Minimum:	2 microseconds
Pulsewidth Maximum:	30 milliseconds
Power Output:	60 Watts/channel
Trigger Inputs:	Opto-isolated, 3V to 24V DC (7ma min) Strobe Mode: Rising Edge Triggered DC Mode: Level Triggered *(LED Output is ON while trigger input is ON state)
Trigger Rate:	up to 50kHz
Ethernet Control:	UDP messaging over 172.16 sub-net
IP Address	Recommended IP Address 192.168.x.x. (Changeable 172.16.x.x – 172.31.x.x. and to 10.x.x.x.)
Operating Modes:	DC, Pulse (Strobe), constant-voltage
Compliance:	RoHS
Expected Lifetime:	80,000 hours
Mounting:	Din-rail
Dimensions:	7.40" x 4.72" x 2.27"

Appendix

Quick Start

Follow the steps below to quickly setup the Metaphase ULC-2 for basic operation using the ULC-2 keypad:

1. With external loads disconnected, apply 24V power to the unit.
2. After applying power to the device, the boot-up screen will flash and display the current software versions. The left is the Controller Version and the right is the current Driver 2.5 Version.

Metaphase	ULC-2
VX.X	VX.X

3. When prompted, choose Yes to enter the Setup Menus.

Enter Setup?
No Yes

Though the intended operation of the ULC may be only DC or only Strobe, the unit should be configured to safely operate in both modes in case the operation mode is set improperly at a later time. Scroll through the various menus using the M-button located on the ULC-2 front panel.

*If setup prompt is missed at startup, the unit can be prompted to enter the setup menu at any time by pressing M, UP ARROW, and DOWN ARROW simultaneously.

- Trigger Type – For the time being and quick verification of operation, choose Internal Trigger as the triggering source for Strobe Mode operation.

Trigger: Intern Chan 1

- DC Current Limit – set the maximum DC current for which the LED load is rated. A setting of .1 amps is the safest.

MaxDC Amps: x.xA
Chan 1

- Strobe Current Limit – set the maximum peak current for which the LED load is rated for its associated maximum pulse width. A setting of .1 amps is safest.

MaxPulse Amps: x.xA
Chan 1

- Pulsewidth Limit – set the maximum pulse width associated with the maximum peak current. A low value is safest, but may not be seen if set too low.

MaxPulsW: xxxxxus
Chan 1

- Strobe Minimum Period Limit – set the minimum period for which external trigger pulses will be allowed. A high value, such as 30,000 microseconds, is safest.

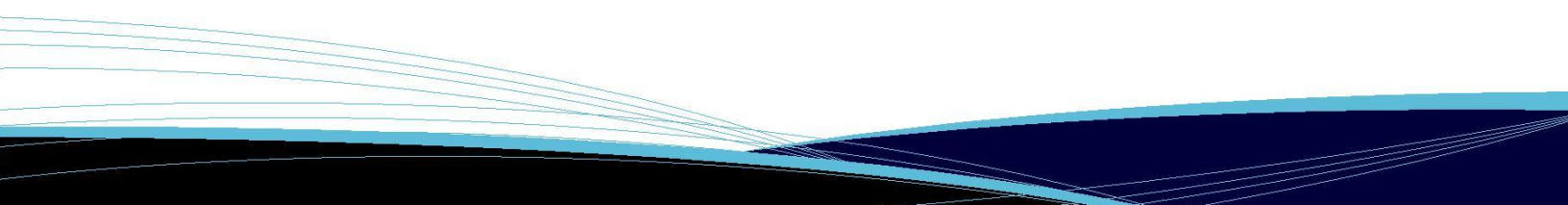
MinTPer: xxxxxus
Chan 1

- Voltage Limit – Not Implemented yet.

Rated Volts: 15V
Chan 1

- Trigger Controls- Used to disable LED output via trigger signal if set to YES; Default (Normal) is a setting of NO

Trig Controls DC
(Normal) NO



- IP Address- To change the IP Address select IP Addr Octet from the menu. Using the up and down arrow, scroll through each Octet 1-4 to change each segment of the IP address.

IP Addr Octet 1:
Chan XXX.16.1.1

IP Addr Octet 2:
Chan 172.XX.1.1

IP Addr Octet 3:
Chan 172.16.X.1

IP Addr Octet 4:
Chan 172.16.1.X

- Repeat the above steps for Channel 2. Scroll through the channels using the C-button located on the ULC-2 front panel.

2. Exit the Setup Menus to enter the Run-time Menus.

Exit Setup?
YES

3. In the Run-time Menus, scroll to the MODE Menu, select DC or strobe for BOTH Chan 1 and Chan 2 (press C button to change channel and use up/down arrow buttons to change Mode selection). Scroll to DC Current Menu and adjust the DC current to a low setting.

Mode: DC
Chan 2

DC Amps: x.xA
Chan 2

4. Scroll to the DC or Strobe Mode Menu and choose Strobe.

Mode: Strobe
Chan 1

5. Scroll to the Strobe Current Menu and adjust the strobe current to a low setting.

Pulse Amps: x.xA
Chan 1

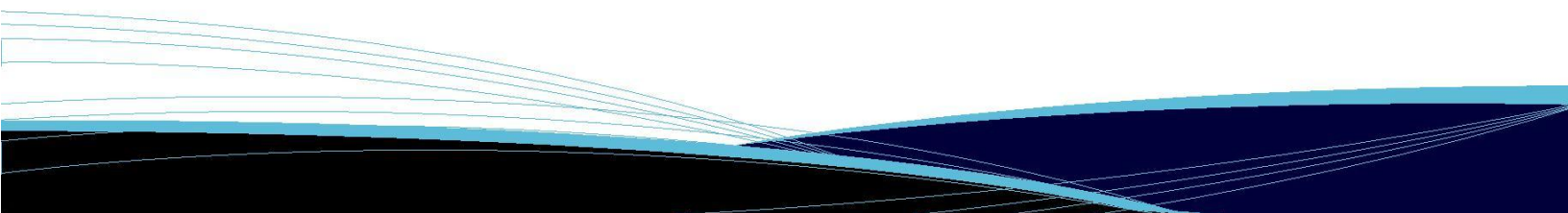
6. Scroll to the Strobe Pulsewidth Menu and adjust the pulsewidth to a low setting.

PulWidth: xxxxxus
Chan 1

7. Do the same with the Tperiod menu. Tperiod is the minimum time between triggers. All triggers received faster than this width will be ignored.

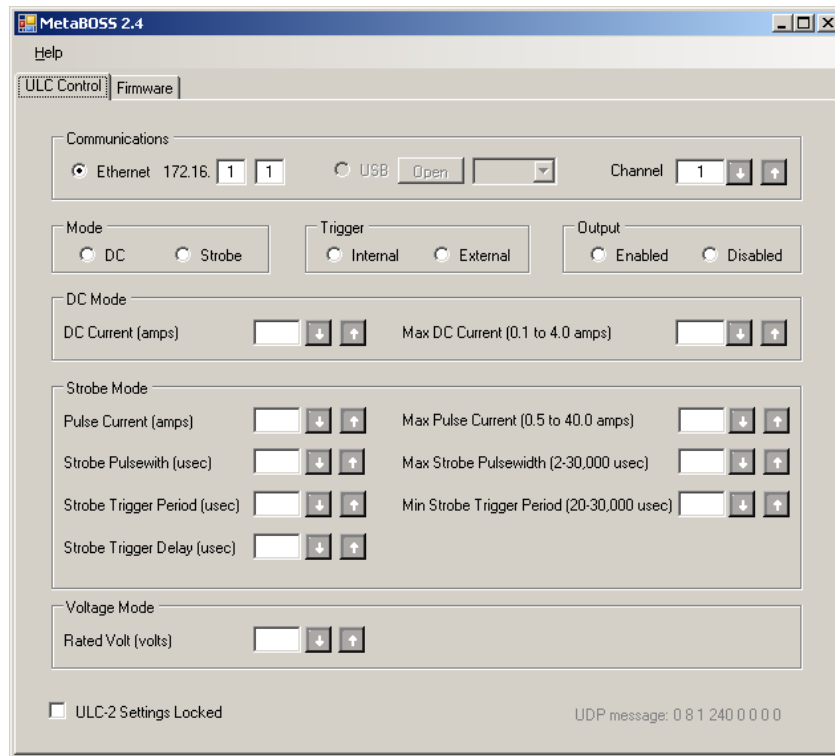
Tperiod : xxxxxus
Channel 1

8. Disconnect power to the ULC-2 device and connect an external load.
9. Re-apply power to the ULC-2. Upon initialization, the load should be operating at the designated settings. Within the Run-Time Menus, adjust the DC and strobe current while in the DC and Strobe Modes to verify operation.



MetaBOSS Windows Control Software

Metaphase provides Windows software to control ULC-2 controller from a remote PC. Please follow the instructions below for setting up the MetaBOSS software:



MetaBOSS Installation & Operation

- Go to <http://www.metaphase-tech.com/getfile.cfm?repositoryID=2626> to download a copy of the latest MetaBOSS software.
- Unzip the files into a folder of your choosing (typically c:\Metaboss)
- Microsoft .Net Framework 4.0 or later must be installed on the PC. The free upgrade may be found at <http://www.microsoft.com/download/en/details.aspx?id=17851>
- The ULC-2 Controller has a default IP address of 172.16.1.1. The PC running MetaBOSS must be on the same sub-net. i.e. – the PC must have an address beginning with 172.16. As required, set the IP address of the host PC to a 172.16 address (such as 172.16.0.100). The subnet mask should be set to 255.255.0.0.
- Connect the ULC-2 and host PC, using standard CAT-5 patch cables, to an Ethernet switch. Alternatively, connect the host PC directly to the ULC-2 using a “cross-over” CAT-5 cable.
- Double-click the MetaBOSS.exe application within the installed folder.
- ULC-2 parameters should be displayed automatically upon startup

ULC-2 Ethernet Command List

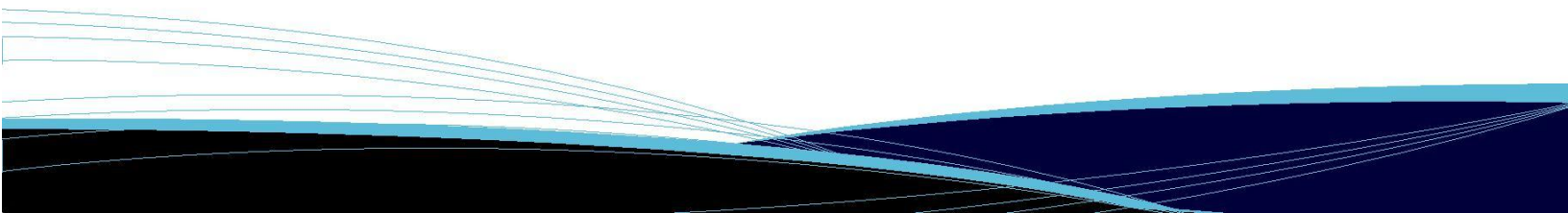
For users that do not want to use the Metaboss Software or the ULC-2 keypad, Metaphase provides an Ethernet command list that can be used embedded into user's custom program.

- The Ethernet commands are of the following format:
 <2-byte Length> <1-byte Channel number> <1-byte Command> < 1-byte reserved>
 <3-bytes of Data>
- All Commands are of 8-byte length. As such the first two bytes of all messages sent to the ULC should be 0x00 and 0x08
- The Channel byte "ch" tells the ULC which channel the command and data applies to. This byte should be either a 0x01 or 0x02 for a standard single-unit ULC-2 controller
- All Data fields must be 3 bytes. It is suggested that unused data fields be filled with zeroes, though not necessary, as the controller will simply ignore them
- Checksum – a Checksum is NOT included on the actual data and are relying on the checksum included in the UDP packet. With UDP protocol the data is "wrapped" in an IP and UDP datagram, both having checksums. This building of the checksum is transparent and is taken care of by the base UDP stack software.
- Examples:

Setting the DC current for channel 1 to 3.4 amps	00 08 01 B7 00 00 00 34
Setting the DC current for channel 2 to .3 amps	00 08 02 B7 00 00 00 03
Setting the Pulse current for channel 2 to 26 amps	00 08 02 BF 00 00 01 04
Reading the Pulse current for channel 1	00 08 01 BE 00 00 00 00
Enabling the output of channel 1	00 08 01 DC 00 00 00 00
Disabling the output of channel 1	00 08 01 DD 00 00 00 00

In the following command charts, CH is channel number (01 or 02 for single ULC-2).

Any commands that have the word "limit" in its description is for the Setup Values (as opposed to the Run-time values)



Description	Command	Response	Comment	Metaboss Command
Set Strobe Min Period	00 08 ch D3 00 XX XX XX	none	XX XX XX=Supplied data (Microseconds)	STROBE_MINIPERIOD_SET
Read Strobe Min Period Limit	00 08 ch D6 00 00 00 00	00 08 ch D6 00 XX XX XX	XX XX XX=Strobe Period (USEC)	STROBE_MINPERIOD_LIMIT_READ
Set Strobe Min Period Limit	00 08 ch D7 00 XX XX XX	none	XX XX XX=Supplied Data (Microseconds)	STROBE_MINPERIOD_LIMIT_SET
Read Voltage Limit	00 08 ch DA 00 00 00 00	00 08 ch DA 00 00 00 XX	XX=Rated Voltage (Volts)	VOLTAGE_LIMIT_READ
Set Voltage Limit	08 ch DB 00 00 xx xx	none	XXXX=Supplied Data (Volt)	VOLTAGE_LIMIT_SET
Enable Output	00 08 ch DC 00 00 00 00	none		OUTPUT_ENABLE
Disable Output	00 08 ch DD 00 00 00 00	none		OUTPUT_DISABLE
Read Output	00 08 ch DE 00 00 00 00	00 08 ch DE 00 00 00 XX	XX=Mode Status (0=off, 1=on)	OUTPUT_READ
Set DC Mode	00 08 ch DF 00 00 00 00	none		MODE_SET_DC
Set Pulse Mode	00 08 ch E0 00 00 00 00	none		MODE_SET_PULSE
Read Strobe/DC Mode	00 08 ch E1 00 00 00 00	00 08 ch E1 00 00 00 XX	XX=Mode Status (3=DC, 4=Pulse)	MODE_READ
Set Internal Trigger	00 08 ch E2 00 00 00 00	None		TRIGGER_SET_INTERNAL
Set External Trigger	00 08 ch E3 00 00 00 00	none		TRIGGER_SET_EXTERNAL
Read Trigger Mode	00 08 ch E4 00 00 00 00	00 08 ch E4 00 00 00 XX	XX=Trigger Status (0=Ext, 1=Int)	TRIGGER_READ
Enable ULC-2 Buttons	00 08 ch E5 00 00 00 00	none		BUTTONS_ENABLE
Disable Buttons	00 08 00 E6 00 00 00 00	none		BUTTONS_DISABLE
Enable Read Buttons	00 08 00 E7 00 00 00 00	00 08 00 E7 00 00 00 XX	XX=Button Status (0=locked, 1=unlocked)	BUTTONS_ENABLE_READ

Description	Command	Response	Comment	Metaboss Command
Read DC Current	00 08 ch B6 00 00 00 00	00 08 ch B6 00 00 00 XX	XX=DC Current (.1 Amp increments)	CURRENT_DC_READ
Set DC Current	00 08 ch B7 00 00 00 xx	none	XX=DC Current (.1 Amps increments)	CURRENT_DC_SET
Read DC Current <u>LIMIT</u>	00 08 ch BA 00 00 00 00	00 08 ch BA 00 00 00 XX	XX=DC Current (.1 Amps increments)	CURRENT_DC_LIMIT_READ
Set DC Current <u>LIMIT</u>	00 08 ch BB 00 00 00 xx	none	XX=DC Current (.1 Amps increments)	CURRENT_DC_LIMIT_SET
Read PULSE Current	00 08 ch BE 00 00 00 00	00 08 ch BE 00 00 XX XX	XX XX=Pulse Current (.1 Amps increments)	CURRENT_PULSE_READ
Set Pulse Current	00 08 ch BF 00 00 XX XX	none	XX XX=Pulse Current (.1 Amps increments)	CURRENT_PULSE_SET
Read PULSE Current <u>LIMIT</u>	00 08 ch C2 00 00 00 00	00 08 ch C2 00 00 XX XX	XX XX=Pulse Current (.1 Amps increments)	CURRENT_PULSE_LIMIT_READ
SET PULSE Current <u>LIMIT</u>	00 08 ch C3 00 00 XX XX	none	XX XX=Pulse Current (.1 Amps increments)	CURRENT_PULSE_LIMIT_SET
Pulse Width Read	00 08 ch C6 00 00 00 00	00 08 ch C6 00 XX XX XX	XX XX XX=Pulse Width (Microseconds)	STROBE_PULSE_WIDTH_READ
Set Strobe Pulse Width	00 08 ch C7 00 XX XX XX	none	XX XX XX=Supplied Data (Microseconds)	STROBE_PULSE_WIDTH_SET
Read Strobe Pulse Width Limit	00 08 ch CA 00 00 00 00	00 08 ch CA 00 XX XX XX	XX XX XX=Pulse Width (Microseconds)	STROBE_PULSE_WIDTH_LIMIT_READ
Set Strobe Pulse Width Limit	00 08 ch CB 00 XX XX XX	none	XX XX XX=Supplied Data (Microseconds)	STROBE_PULSE_WIDTH_LIMIT_SET
Read Strobe Pulse Width Delay	00 008 ch CE 00 00 00 00	00 008 ch CE 00 xx xx xx	xx xx xx = (Microseconds)	STROBE_PULSE_WIDTH_DELAY_READ
Set Strobe Pulse Width Delay	00 08 ch CF 00 XX XX XX	none	XX XX XX=Supplied Data (Microseconds)	STROBE_PULSE_WIDTH_DELAY_SET
Read Strobe Min Period	00 08 ch D2 00 00 00 00	00 08 CH D2 00 XX XX XX	XX XX XX= Strobe Period (Microseconds)	STROBE_MINPERIOD_READ

Frequently Asked Questions

Q: How to get into 'Set-up' menu from Running mode?

A: Press 1st(M), 3rd(DOWN) and 4th(UP) buttons simultaneously. 'Enter Setup?' will appear, click yes (UP button).

Q: How to reset to Manufacturing Settings?

A: Pressing the 1st (M) and the 4th (UP) buttons then powering the unit on will reset IP address.

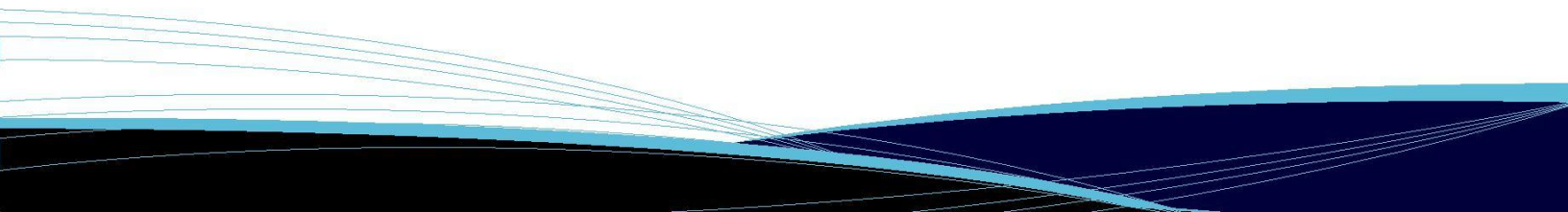
A: Holding the 3rd (DOWN) button during the Metaphase ULC-2 start-up screen will reset default settings.

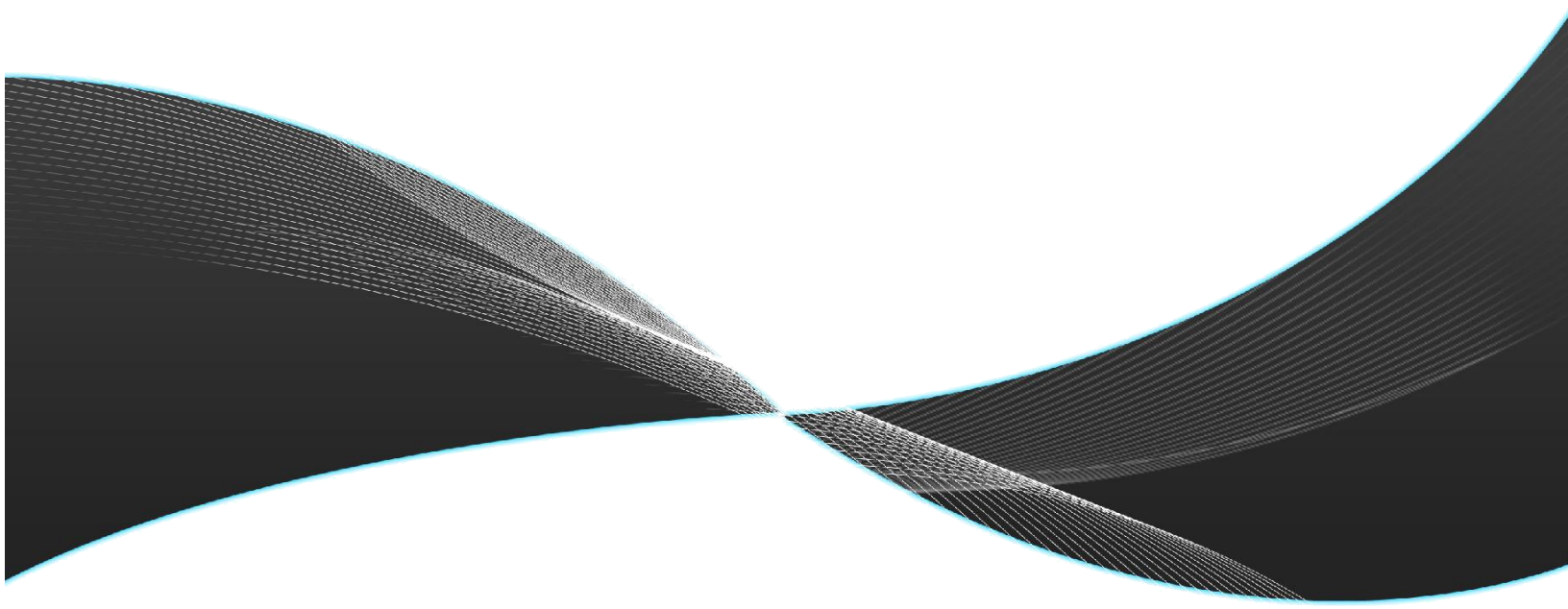
Q: Unit is on but LED Load not responding.

A: Make sure load is plugged into the ULC-2 before powering the unit.

A: With no Trigger connection, got to 'set-up' menu and change trigger setting to Internal (Intern) for the desired channel.

A: In running mode, cycle through the menu till 'LED Output' and change to 'ON'





ULC-2

Metaphase Technologies
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