



**Micro Pulse LiDAR**  
EST. 1997

# MiniMPL-532-C Operations Manual

Version: June 2020



**Micro Pulse LiDAR**  
EST. 1997



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MEASUREMENT TECHNOLOGIES

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### **Warranty**

The seller warrants the equipment supplied will be free from defects in material and workmanship for a period of eighteen (18) months from date of shipment, or twelve (12) months from date of installation / first use, whichever comes first. When returning the equipment to Droplet for warranty or service procedures, the equipment owner will pay for shipping to Droplet, while Droplet may pay the return shipping expense. The exceptions to this warranty are the laser, for which the original manufacturer’s warranty shall apply, and the detector for which the manufacturer’s expressed warranty will be extended to the equipment owner. Any repairs or service related to the laser and detector within the warranty period may incur additional costs as assessed by Droplet, after evaluating any defect or performance deviations. The equipment owner is deemed liable for these charges.



**Mini Micro Pulse LiDAR (MiniMPL) System: Record of Purchase**

Fill in the following system information for your records.

Customer Name	
Organization	
Date of Purchase	

	Model Number	Serial Number
MiniMPL		
Configuration Notes		



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## **Precautions**

### **Electrical Safety**

E1. Always adhere to the specified operating voltage for the MiniMPL electronics. The MiniMPL has a power consumption of 100 W, and the default operating voltage is 110-240V AC, 50/60 Hz. The voltage specification on custom configured units is labeled accordingly.

E2. Use grounded plugs and receptacles for power. It is recommended to use receptacles or power strips equipped with surge suppressors to protect the electronics from damage.

E3. All electrical connections should be verified by qualified personnel prior to operating the instrument. Incorrect or poor connections may cause damage to the equipment.

E4. Ground straps are recommended for handling connection cables of the MiniMPL to avoid damage due to electrostatic discharge.

E5. Startup and shutdown procedures must be followed as described in Section 4 of this Operations Manual. Do not attempt to open or move the MiniMPL while the instrument is in operation.

E6. The user should review all procedures listed in this Operations Manual.

E7. The MiniMPL does not have any user serviceable components. Refer any service requirements directly to Droplet Measurement Technologies personnel or an authorized representative.

### **Mechanical, Optical, and Environmental Safety**

M1. The MiniMPL is not weatherproof and must not be exposed to rain or excessive humidity levels above 80%. The operating and storage temperature of the instrument should always be between 10°C (50°F) and 35°C (95°F).

M2. The surface of the MiniMPL aperture should not be touched by hand or cleaned in a manner that is outside of standard optical cleaning practices (gloves, acetone, lint free cotton wipes). The aperture must remain covered when not in use to protect against dust and accidental damage. Any dust accumulating on the aperture during normal operations should be periodically cleaned using filtered, pressurized air. Care should be taken to avoid contact with the optical surfaces.

M3. Always use the attached handle to gently move the MiniMPL. Dropping or bumping the MiniMPL may cause serious damage to the components inside.

M4. The MiniMPL is certified to the EN61010-1 'Electrical Equipment for Measurement, Control and Laboratory Use' safety standard for operation up to elevations of 2,000m (6,562 ft.).



**Laser Safety**

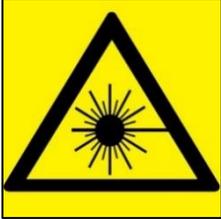
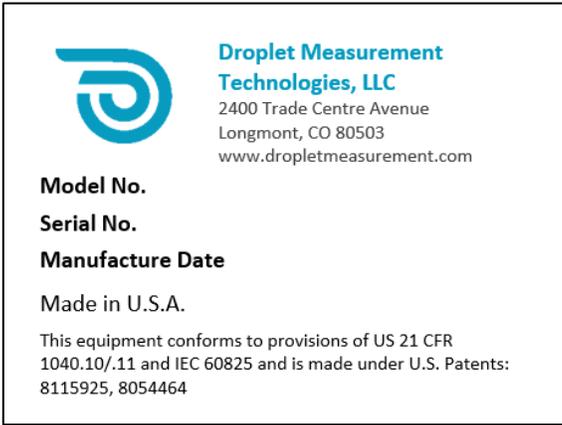
L1. **Caution – Laser Radiation exposure may occur if the user modifies the controls or performance of the instrument with procedures other than those specified herein.**

L2. The MiniMPL System is a Class II Laser Product as defined by the US CDRH 21CFR1040.10/.11; Class II Laser Product as defined by EN60825-1/2; and ANSI Z136.1 2000.

L3. All operators of the MiniMPL should be trained in Laser Safety prior to operating the MiniMPL. Laser warnings should be observed at all times and direct viewing of the beam should be avoided.

L4. If the transmitted beam quality or shape changes during use, shut down the instrument and contact us for service.

L5. Location of FDA/CDRH Laser labels:

Label Type	Label Description and Location
	<p>Laser caution symbol. One next to the emission aperture on top of the MiniMPL</p>
	<p>MiniMPL unit information label. One on top of the MiniMPL</p>



	<p>Laser aperture warning label. One next to the emission aperture on top of the MiniMPL</p>
	<p>Laser caution label. One on the front panel opposite the LEDs, and one next to the emission aperture on top of the MiniMPL</p>



## 1. Introduction

Micro Pulse LiDAR (MPL) instruments from Droplet Measurement Technologies, LLC, help scientists, meteorologists and air quality professionals monitor clouds and aerosols to better understand our atmospheric structure. Using eye safe lasers, and originally designed for NASA, MPL's long-range capabilities and high-quality signal deliver a rich source of atmospheric feature information. The MiniMPL is comprised of an optical transceiver unit and a laptop computer (Figure 1: MiniMPL System). The optical transceiver houses the laser transmitter (operating at a 532 nm wavelength) and the photon counting detection system. The signal is transmitted and received using the same built-in athermal telescope. The range resolved signal is collected and displayed in real time on the data acquisition computer. The optical transceiver is integrated with the electronic system in a single box to maximize the portability of the unit. The data acquisition software provided can also be used to playback previously recorded data files.



**Figure 1: MiniMPL System**



The MiniMPL is a precision optical instrument and should be handled with extreme care during transportation and use. It should not be operated or stored in extreme humidity or temperature conditions. Although the laser output energy from the unit is designed to meet the ANSI Z136.1–2000 standard for eye safety, direct viewing of the laser beam for extended periods of time may damage the retina. This manual assumes that the user has fundamental working knowledge of lasers and laser safety. *All MiniMPL operators must read through this Operations Manual prior to operating the instrument.*

## 2. Unpacking and Installation

Table 1 shows a packing list of components included with the MiniMPL shipment. Inspect these items for any visible damage upon receiving the instrument and report any discrepancies to us as soon as possible.

**Table 1: MiniMPL Packing List**

Item	Description	Quantity
1	MiniMPL Unit	1
2	Power Cable <sup>+1</sup>	1
3	Shielded USB-A/USB-A Cable <sup>2</sup>	1
4	Data Acquisition Computer and Charger	1
5	Documentation Package and <i>SigmaMPL</i> Software	1
6	Shipping Case	1

+ Power cable supplied for deliveries in the United States only

1. User-supplied power cables should be certified to IEC60227, IEC 60245, or approved by a recognized testing authority. All power cables should be rated to at least 250V, 0.75mm<sup>2</sup>, contain green and yellow ground wires, and have a certified, country-appropriate plug adaptor.

2. User-supplied USB cables or extenders greater than 2.0 m in length are not recommended as they could create disruptions in data transmission.

Since the MiniMPL is a delicate instrument, extreme care must be exercised while unpacking from the shipping case. Dropping or bumping the MiniMPL may cause serious damage to the components inside. Operating the MiniMPL outside the recommended use and operating procedures listed in this manual may cause harm to the instrument and/or operators.

The MiniMPL may be stored in its original shipping container when not in use between 10°C (50°F) and 35°C (95°F) in a location with low humidity.

### 2.1 Power Requirements at MiniMPL Site

The MiniMPL system requires a 110-240V AC, 50/60 Hz supply with a grounded connection for proper operation, and has a power consumption of approximately 100 W. For improved protection, a surge protected power supply is recommended.

## 2.2 MiniMPL Site Environment

The MiniMPL system is designed to operate in a controlled environment. To ensure accurate performance over an extended period of time, the location of the MiniMPL must adhere to the following criteria:

- Operating temperature: 10°C to 35°C (50°F to 95°F)
- Relative humidity: <80%
- Well ventilated
- Dust free
- Vibration isolated
- Free from strong sources of EMI radiation

## 3. Hardware Setup

This section describes the systematic installation of the MiniMPL system. Figure 2 shows the connectors and controls located on the front and rear panel views of the MiniMPL instrument.

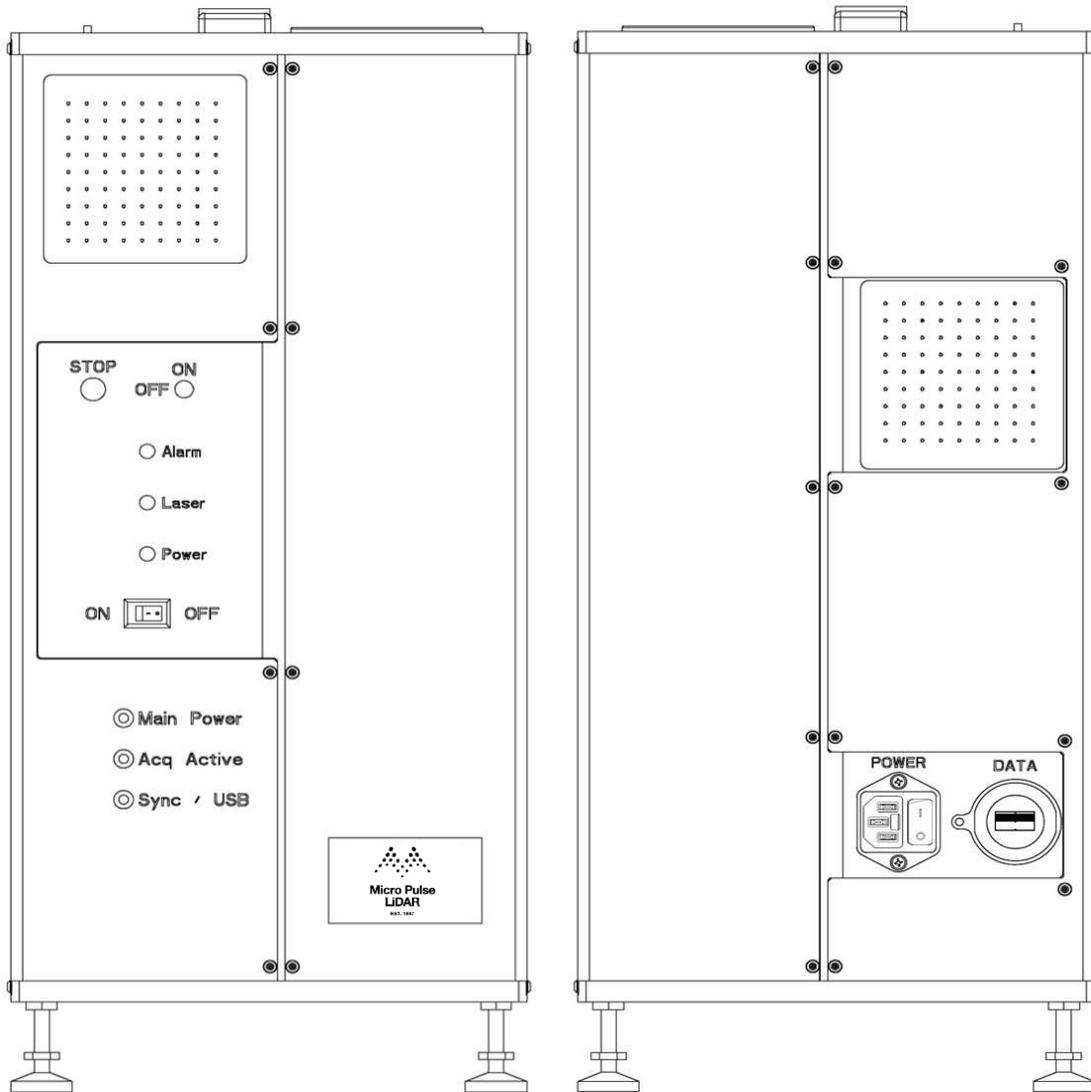


Figure 2: MiniMPL Front (Left) and Rear (Right) Panel Views

### 3.1 MiniMPL Placement

1. Always use the attached handle when moving the MiniMPL.
2. Place the MiniMPL on a firm, horizontal surface that is free from vibrations.
3. The MiniMPL is pre-leveled at the factory before delivery and all feet are locked in place. If additional adjustments are needed, refer to the following guidelines to avoid damaging the instrument.
  1. Use a 7/16" open-ended wrench to loosen and secure the lock nuts.
  2. Adjust each foot by *hand*. Use the BUBBLE LEVEL on the top of the MiniMPL as a guide.



3. The foot located below the USB data port on the rear of the MiniMPL (the far right foot in Figure 2) can only be threaded in so far before coming to a hard stop. **DO NOT** force the foot past this stop by excessive tightening. Damage to the MiniMPL chassis and cover may result.
  4. After the MiniMPL has been leveled, secure each foot using the lock nut. Do not over tighten the lock nut. When securing the lock nuts, hold the bottom of the foot by *hand* and tighten the lock nut with the 7/16" open-ended wrench.
4. If the MiniMPL needs to be anchored in place, it is recommended to use the MiniMPL Mobility Kit. Contact your Droplet Measurement Technologies representative for more information.
    1. Excessive force caused by strapping down the MiniMPL directly can cause damage to the feet, chassis and/or cover.
  5. The power rocker switch and the key switch on the front of the unit should be set to the **OFF** position. The INPUT POWER switch on the back of the unit should also be set to **OFF**.
  6. Connect the included power cord from the INPUT POWER inlet of the MiniMPL unit to a grounded outlet.
  7. Check for adequate air circulation around the MiniMPL fan located on the rear panel of the unit.
  8. Position the MiniMPL so that the power cable is always easily accessible.

### 3.2 Data Acquisition Computer Connections

The MiniMPL system includes a laptop computer with the *SigmaMPL* software installed on the hard drive. An alternate computer (desktop, rack-mounted etc.) may be used with the software programs and drivers configured for MiniMPL operation using the supplied *SigmaMPL* software.

1. Using the provided laptop charger, plug in the laptop to a grounded outlet.
2. Using the shielded USB-A/USB-A cable provided, connect the USB port of the computer to the DATA port of the MiniMPL. **NOTE:** User-supplied USB cables or extenders greater than 2.0 m in length are not recommended as they could create disruptions in data transmission.

## 4. MiniMPL Operation Procedures

The MiniMPL should be located with an unobstructed view of the atmosphere and the aperture lid should be opened carefully to avoid touching the lens.

**NOTE:** All personnel in the vicinity of the MiniMPL should be clear of the beam path before the laser is turned on.

### 4.1 Power up Sequence

1. Turn on the INPUT POWER switch located on the rear panel. The red **Main Power** LED on the front panel will turn on.



2. Turn on the RED ROCKER SWITCH and KEY SWITCH located on the front panel. The red **Main Power** LED for the laser will turn on. The green **Laser** LED will be illuminated, even though there is no visible laser emission. The red **Alarm** LED will be illuminated if there is a laser fault. Contact us if the **Alarm** LED continues to be illuminated.
3. The red STOP button can be used to quickly turn off the laser in an emergency. Press the STOP button again to start laser emission.
4. Remove the protective lens cap from the top of the MiniMPL.
5. Turn on the laptop. The default username and password are as follows:  
Username: **mpluser**  
Password: **mpluser**
6. Locate the *SigmaMPL* shortcut on the desktop and launch the program by double clicking on the icon.

## 4.2 *SigmaMPL*: MiniMPL Control and Data Acquisition Software

The *SigmaMPL* data acquisition software allows for real time operation of the instrument and data playback of previously stored data. This section describes the *Real Time Hardware Control* mode. For *File Playback* mode and other software and data processing features, refer to the *SigmaMPL Software Manual*.

### 4.2.1 Real Time Hardware Control

1. From the opening screen of *SigmaMPL*, press **Ctrl+R** or select **File→Real Time Hardware Control** (Figure 3).

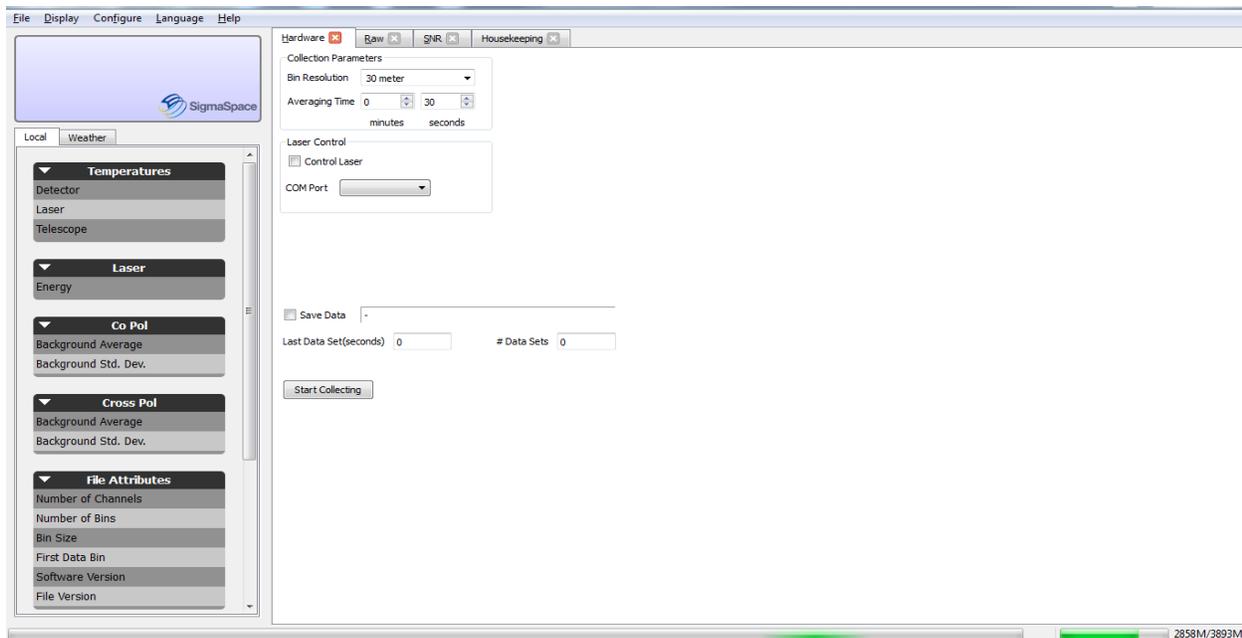


Figure 3: SigmaMPL Real Time Hardware Control Window

2. Tabs for Hardware, Raw Data, R<sup>2</sup> Corrected, SNR, and Housekeeping will appear in the plot area to the right of the left sidebar. A tab for NRB will be displayed only if the three configuration files for the MiniMPL are loaded. See the *SigmaMPL Software Manual* for more information.
3. The software must be configured for the MiniMPL before collecting data. To access configuration options, press **Ctrl+K+L**. This will enable the Collection Parameters to be adjusted in the Hardware tab. To configure the software for MiniMPL, select **Configure→Algorithm Setup** and select **Default MiniMPL Parameters**. Click **Apply** followed by **OK** to save the changes.
4. Select the desired **Bin Resolution** and **Averaging Time**.
5. Check the **Save Data** box to record the data. Data does not have to be saved. The saved files are automatically named using an YYYYMMDDHHmm.mpl format and can be found in **C:\Program Files (x86)\SigmaMPL\DATA**.
6. Toggle the **Start Collecting** button to begin collection.
  - a. Laser emission will occur within 10 seconds of collection.
7. The yellow **Acq Active** LED and green **Sync/USB** LED's will both be illuminated. The **Sync/USB** LED will flash while data is being collected.
8. To stop collecting data toggle the **Stop Collecting** button.



The MiniMPL displays signal and other instrument data as shown in Figure 4. For a more detailed explanation, refer to the *SigmaMPL Software Manual*.

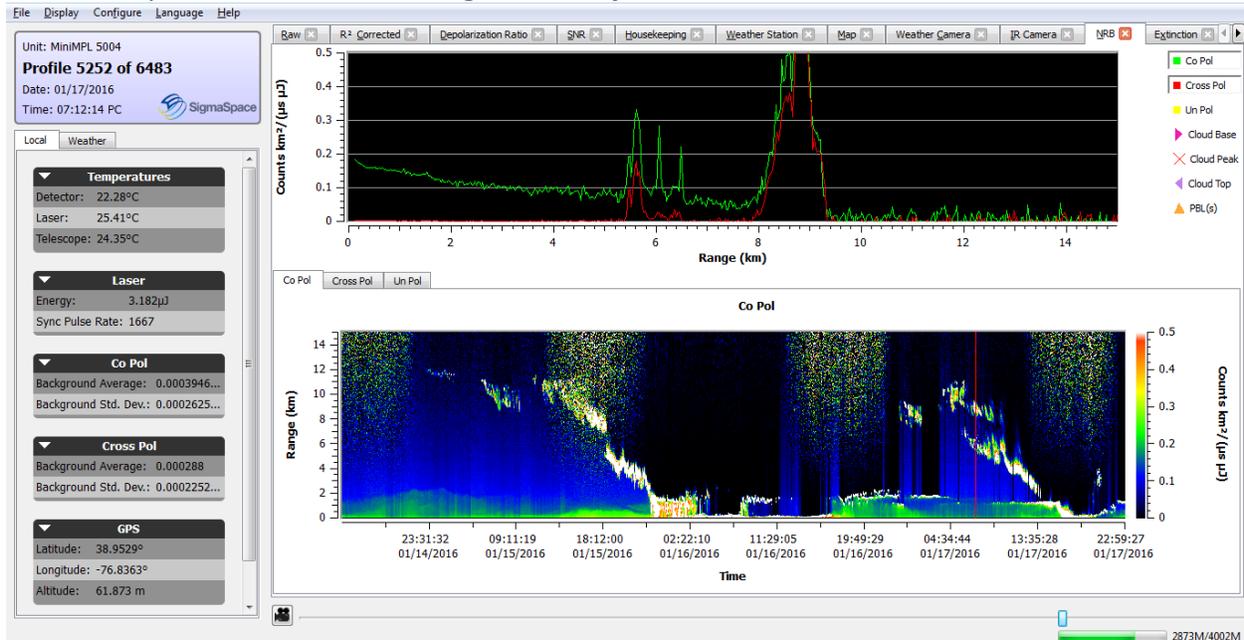


Figure 4: *SigmaMPL* Plot Display

## 5. System Shutdown

The MiniMPL system should be shut down in the following sequence:

1. Click the Stop Collecting button in the SigmaMPL program to stop data acquisition.
2. Exit the SigmaMPL program.
3. Turn off the KEY SWITCH on the laser power supply (Front Panel).
4. Turn off the RED ROCKER SWITCH on the laser power supply (Front Panel).
5. Turn off the LiDAR/MAIN POWER SWITCH (Rear Panel).
6. Shut down the laptop computer.
7. Carefully replace the lid on the MiniMPL without touching the optics.



## 6. MiniMPL Specifications

**Table 2: Nominal MiniMPL Specifications**

<b>Dimensions</b>	
Size	318 mm x 216 mm x 495 mm (12.52" x 8.50" x 19.49")
Weight	13 kg (29 lbs.)
<b>Power</b>	
Supply	110-240V AC, 50/60 Hz
Consumption	100 W
<b>Transmitter</b>	
Laser Wavelength	532 nm Nd: YAG
Pulse Repetition Frequency	2,500 Hz
Pulse Energy	3-4 $\mu$ J
Laser Product Compliance	ANSI: Z136.1-2000 IEC: EN60825 USFDA/CDRH: 21 CFR 1040.10/.11
<b>Receiver</b>	
Telescope Type	Galilean Telescope
Diameter	80 mm
<b>Data</b>	
Detector	Avalanche Photodiode, Photon Counting Mode
Range Resolution	5m, 15m, 30m, 75m (Programmable)
Detection Range	Up to 15 km
Multichannel Scaler	Two-channel photon counting, A/D converters for temperature and energy monitors, USB interface to computer

**For all MiniMPL service, please contact:**

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