V 1 3

Revised 10/11/17

# EZO-PMPTM

**Embedded Dosing Pump** 

Flow rate

0.5ml to 105ml/min

Accuracy

+/- 1%

Modes of operation

Volume dispensing
Constant flow rate
Dose over time mode

Calibration

Single point

Supplied tubing

61 cm

Tubing size

Any 5mm O.D. tubing

Data protocol

**UART & I<sup>2</sup>C** 

Default I<sup>2</sup>C address

103 (0x67)

Operating voltage

3.3V-5V (logic) 12V-24V (motor)

Pump head

2 meters

Data format

2 meters

**ASCII** 



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**Mounting the EZO-PMP™** 

**Datasheet change log** 

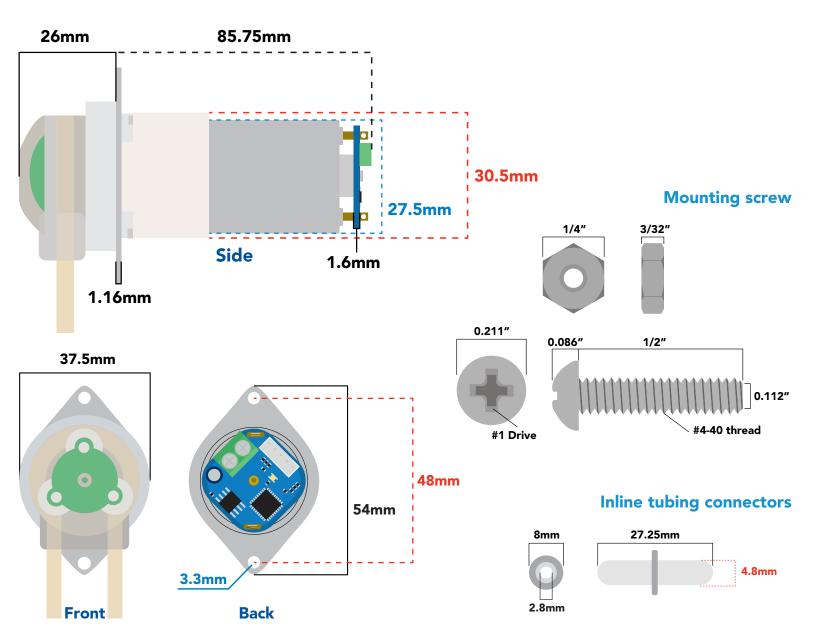
Warranty

**70** 

**71** 

**72** 

### **EZO-PMP**<sup>™</sup> dimensions



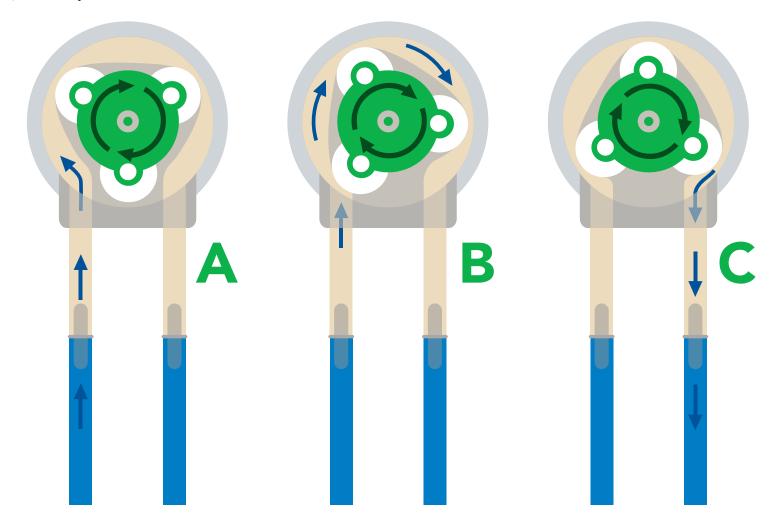
	LED	MAX	STANDBY	SLEEP
5V	ON	13.7 mA	13.4 mA	0.415 mA
	OFF	13.1 mA	12.8 mA	
3.3V	ON	12.5 mA	12.4 mA	0.13 mA
	OFF	12.3 mA	12.2 mA	
Motor	12V = -	~400mA	24V = ~200r	mA

### Power consumption Absolute max ratings

Parameter	MIN	TYP	MAX
Storage temperature (EZO-PMP™)	-65 °C		125 °C
Operational temperature (EZO-PMP™)	-40 °C	25 °C	85 °C
VCC	3.3V	5V	5.5V
Motor	10.8V	12V	24V

# Operating principle

- Self-priming
- ✓ Run dry



# **Operating modes**

The EZO-PMP  $^{\scriptscriptstyle\mathsf{TM}}$  can operate in four different modes.

#### **Continuous dispensing**

Run the pump continuously 105 ml/min ∞ (with supplied tubing)

#### **Volume dispensing**

Pump a specific volume (Smallest possible volume is 0.5 ml)

#### **Constant flow rate**

Pump a specific volume per minute

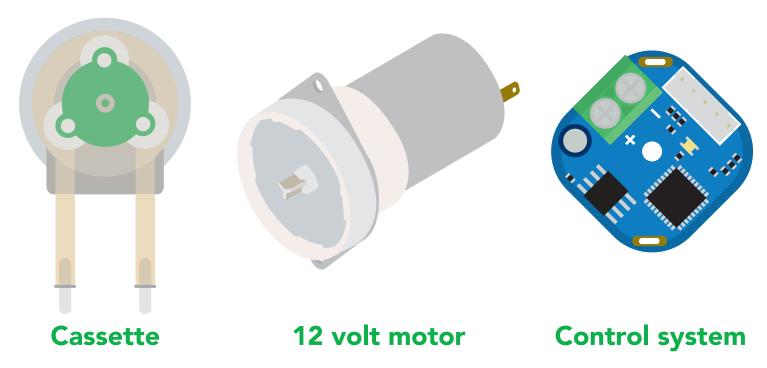
#### Dose over time mode

Pump a specific volume over a set time

Volume is always in ml.

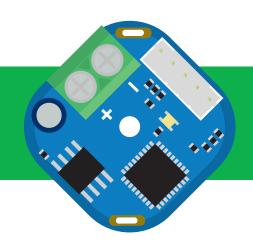


#### The Atlas Scientific EZO-PMP™ consists of three main components.



The actual peristaltic pumping is done within the cassette. It has been designed to be easily detached from the motor and disassembled.

The 12 volt motor and control system have been soldered together. Both components are designed to operate as one single unit.



#### The control system has three main components

Keyed data and power connector 12–24 volt power input Status indicator LED

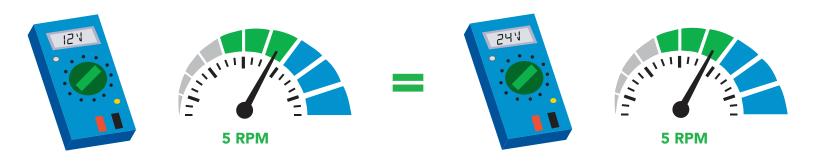
Data and power cable pinout

White - RX/SCL
Green - TX/SDA
Black - GND
Red - VCC
Blue - INT



### Pump speed vs. voltage

There is no change in pump speed at different voltages.

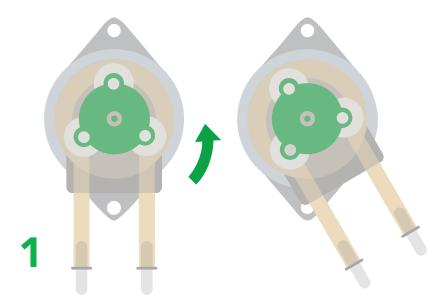


### Interupt pin

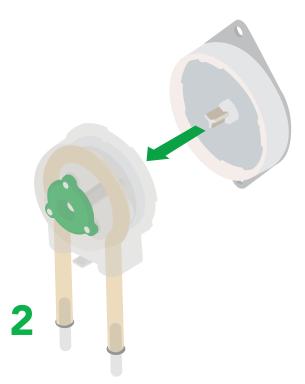
When the pump is dispensing the interupt pin goes high.



### Removing cassette



Turn cassette counterclockwise until it stops.

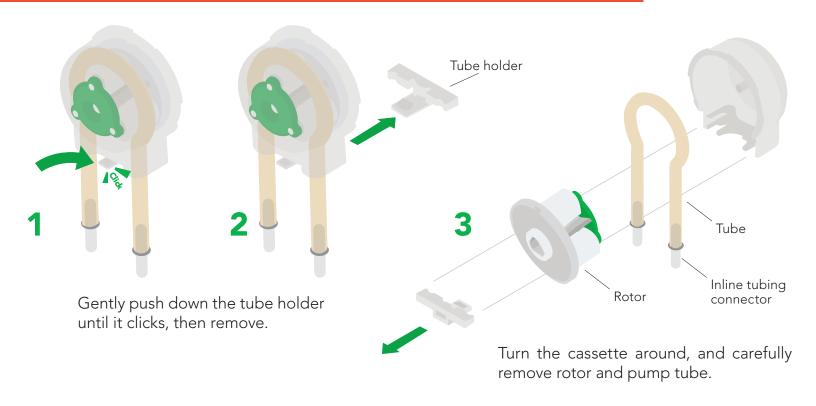


Pull cassette off the motor.



### Removing tube assembly

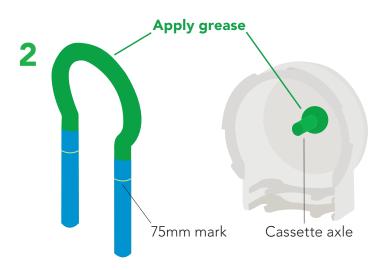
The inner workings of the cassette are fragile and must be dismantled by hand. Using tools can damage or break the cassette.



### Installing new tube assembly



Measure 75mm of pump tubing, and mark both ends with a soft-tip pen or marker.

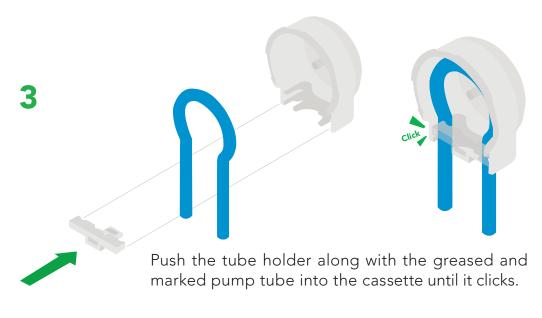


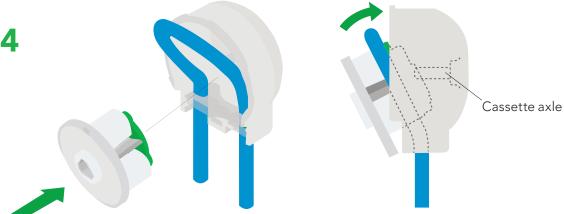
Apply silicone lubricating grease to the marked areas on both the tubing and cassette axle.

Do not operate this device without lubrication!

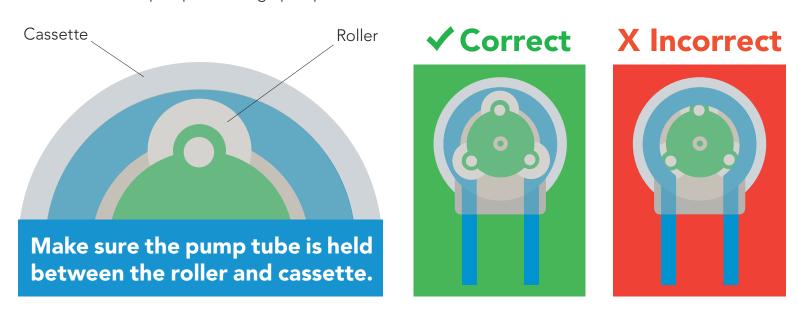
Atlas Scientific recommends using **Super Lube** silicone lubricating grease.







Gently pull out the pump tube, and insert the rotor into the pump tube. Align pump tube and rotor with the cassette axle.

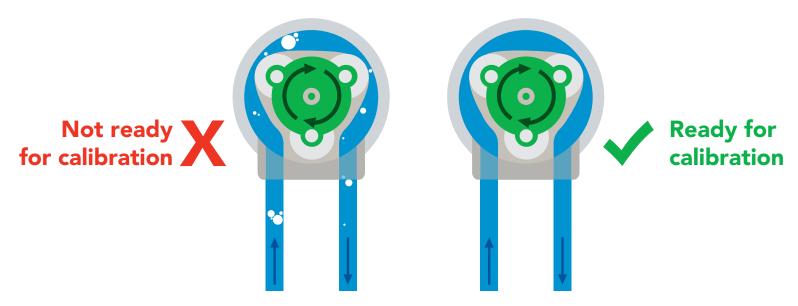


Once the tubing has been replaced, run the pump for 3–5 minutes to break in the new tubing. Remember, this pump can be run dry and does not need to pump liquid for the 3–5 minute break in period.

## **Calibration theory**

Uncalibrated accuracy +/- 5% Calibrated accuracy +/- 1%

**Before calibration is attempted** all the air bubbles should be removed from the tubing. This is done by running the pump while tapping the tubing. If air bubbles are not removed from the tubing they will slowly group together into larger air bubbles. Over time this will lead to accuracy issues.



### Calibration types

Volume calibration
Volume over time calibration

Calibration is optional. Both types of calibration are independent of each other and can be done at any time. Calibration can be done at any volume however; Atlas Scientific recommends using volumes above 5ml.

### **Equipment needed for calibration**



An accurate graduated cylinder of at least 10ml.



1 gram of water = 1ml 23.56 grams of water = 23.56ml

Or

An accurate scale with a resolution of at least 0.1 grams



### Calibration procedure

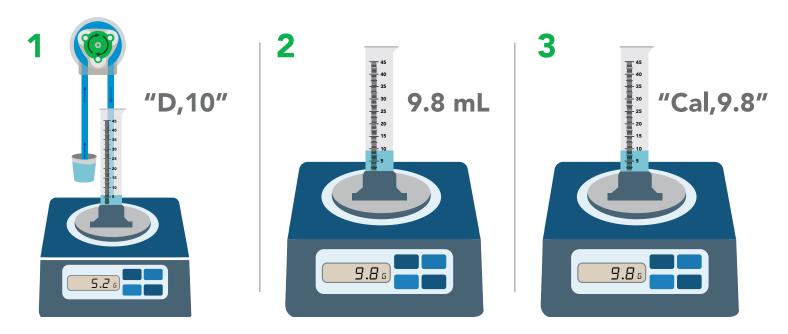
Calibration should be done with water and not a chemical

#### Make sure the tubing is full of water and has no bubbles before calibrating.

- 1. Instruct the pump to dispense a volume of water.
- 2. Measure the dispensed amount to determine how much water was actually dispensed.
- **3.** Calibrate the pump by sending it the volume of liquid you have measured.

#### **Example**

Calibrate the pump by dispensing 10ml



- 1. Instruct the pump to dispense 10ml into a graduated cylinder or beaker on a scale.
- 2. Measure the amount of liquid that was actually dispensed.
- 3. Inform the pump how much liquid was actually dispensed.
- 4. Calibration is now complete.

Once the pump has been calibrated it will accurately dispense any volume of liquid. It has not been calibrated specifically to the volume used during the calibration procedure (10 ml). It has now been calibrated to all volumes.

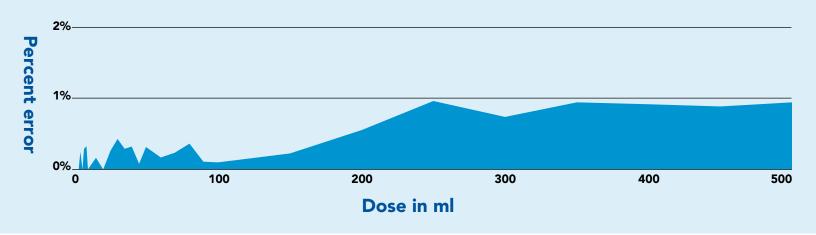
Use the same procedure to perform a volume over time calibration.



Uncalibrated accuracy +/- 5% Calibrated accuracy +/- 1%

#### Volume dispensing mode

calibrated at 10ml



#### Dose over time mode

calibrated at 10ml over 90 seconds



### Pump head

Pump head refers to the maximum vertical height a pump can dispense. The EZO-PMP $^{\text{m}}$  has a pump head of 2 meters (6.5').





## Available data protocols

# **UART**

**Default** 

# 1<sup>2</sup>C

# X Unavailable data protocols

SPI

**Analog** 

**RS-485** 

**Mod Bus** 

4-20mA



# UART mode

#### Settings that are retained if power is cut

Baud rate Calibration

Continuous mode

Device name

Enable/disable parameters

Enable/disable response codes

Hardware switch to I<sup>2</sup>C mode

LED control

Protocol lock

Software switch to I<sup>2</sup>C mode

#### Settings that are **NOT** retained if power is cut

Find Sleep mode



### **ART** mode

8 data bits 1 stop bit

no parity no flow control

Baud 300

1,200

2,400

9,600 default

19,200

38,400

57,600

115,200

Data in



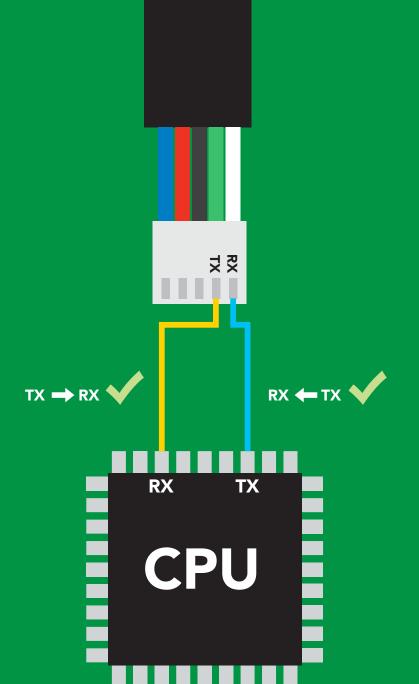
Data out



Vcc

3.3V - 5.5V





### **Data format**

volume Output

Units ml

**Encoding ASCII** 

**Format** string **Terminator** 

Data type

**Decimal places 3** 

**Smallest string 3 characters** 

Largest string

carriage return floating point

39 characters



# **Default state**

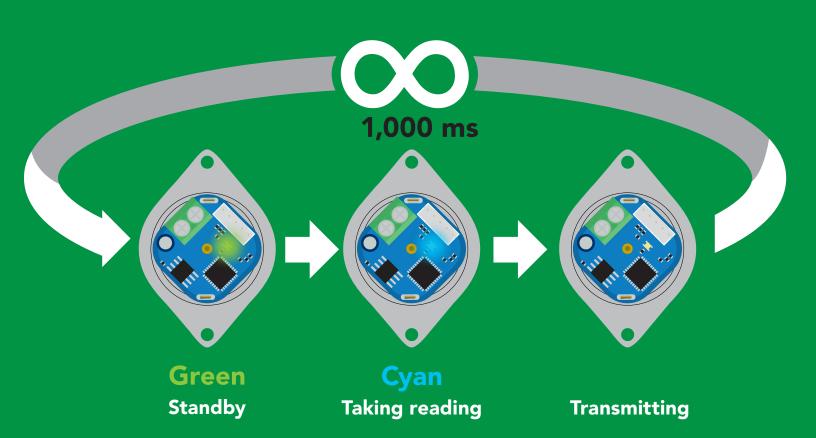
Mode **UART** 

9,600 **Baud** 

Readings continuous

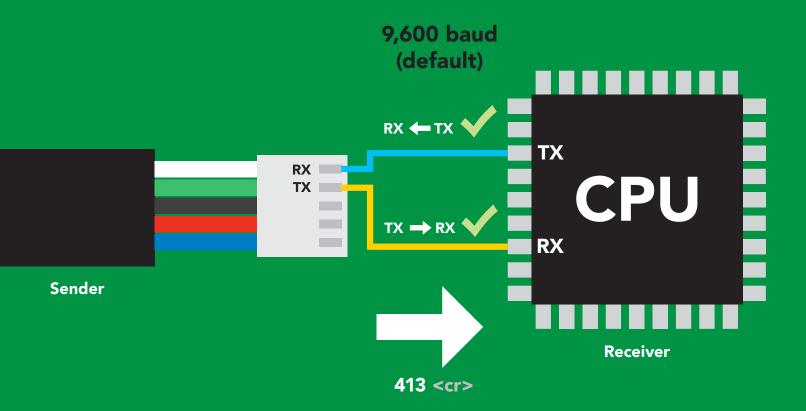
1 reading per second **Speed** 

**LED** on



# Receiving data from device





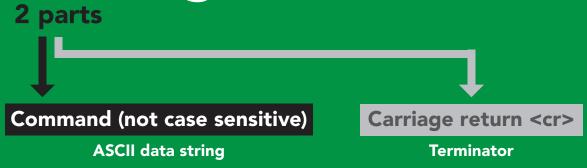
#### **Advanced**

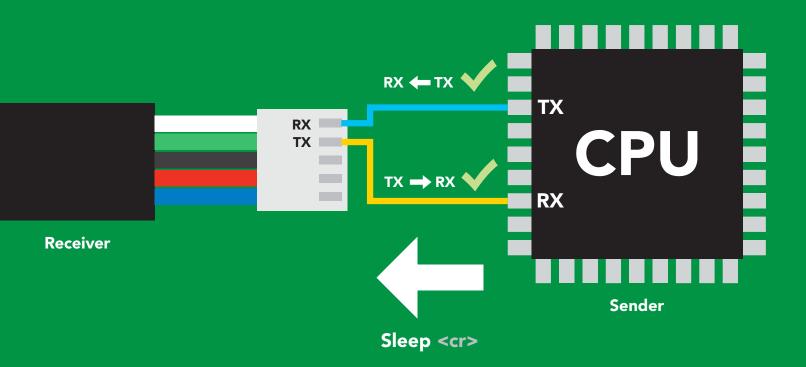
ASCII: 4 1

Hex: 34 31 33

Dec: 52 49 51 13

# Sending commands to device





#### **Advanced**

ASCII: s 53 6C 65 65 70 83 108 101 101 112 Dec:



### LED color definition











**Command** 

not understood



LED ON +2.5 mA +1 mA

# UART mode command quick reference

All commands are ASCII strings or single ASCII characters.

Command	Function	Default state
Baud	change baud rate	pg. 38 9,600
С	enable/disable continuous mode	pg. 21 enabled
Cal	performs calibration	pg. 30 n/a
D	dispense modes	pg. 23 – 26 n/a
Factory	enable factory reset	pg. 40 n/a
i	device information	pg. 34 n/a
I2C	change to I <sup>2</sup> C mode	pg. 41 not set
L	enable/disable LED	pg. 20 enabled
Name	set/show name of device	pg. 33 not set
0	enable/disable parameters	pg. 31 all enabled
Р	pause dispensing	pg. 27 n/a
Plock	enable/disable protocol lock	pg. 39 disabled
Pv	check pump voltage	pg. 32 n/a
R	returns a single reading	pg. 22 n/a
Sleep	enter sleep mode/low power	pg. 37 n/a
Status	retrieve status information	pg. 36 enable
Tv	total volume dispensed	pg. 29 n/a
Х	stop dispensing	pg. 28 n/a
*ОК	enable/disable response codes	pg. 35 enable

## LED contro

#### **Command syntax**

L,1 <cr> LED on default

L,0 <cr> LED off

L,? <cr> LED state on/off?

#### **Example**

#### Response

L,1 <cr>

\*OK <cr>

L,0 <cr>

\*OK <cr>>

L,? <cr>

?L,1 <cr> or ?L,0 <cr>

\*OK <cr>>



**L,1** 



**L,0** 

### Continuous mode

### **Command syntax**

C,\* <cr> continuously reports volume once per second default

C,1 <cr> continuously reports volume only when pumping

C,0 <cr> disable continuous reporting

C,? <cr> continuous reporting mode on/off?

#### **Example**

#### Response

#### dispense 3ml

**C**,\* <cr>

1.2 <cr>

3.0 <cr>

\*Done, 3.00 < cr>

3.0 <cr>

3.0 < cr >

1.2 <cr>

3.0 < cr >

\*Done, 3.00 < cr >

\*Done, 3.00 < cr >

?C,1 <cr> or ?C,0 <cr> or ?C,\* <cr>

\*OK <cr>

# Single reading mode

#### **Command syntax**

R <cr> returns a single value showing dispensed volume

Example	Response		
R <cr></cr>	2.50 <cr> *OK <cr></cr></cr>	(If issued half way through dispensing 5ml)	
	5.00 <cr> *OK <cr></cr></cr>	(If issued once dispensing has stopped)	

## Continuous dispensing

Pump on/pump off

#### **Command syntax**

After running in continuous mode for 20 days the EZO-PMP™ will reset.

- <cr> dispense until the stop command is given
- <cr> dispense in reverse until the stop command is given
- <cr> dispense status

Example	Response
<b>D,*</b> <cr></cr>	*OK <cr> pump will continuously run at ~105ml/min (with supplied tubing)</cr>
D,-* <cr></cr>	*OK <cr> pump will continuously run in reverse at ~105ml/min (with supplied tubing)</cr>
D,? <cr></cr>	?D,*,1 <cr> *OK <cr></cr></cr>

#### Response breakdown

?D,\*,1 last volume pump on requested

# Volume dispensing

Pump a specific volume

#### **Command syntax**

where [ml] is any volume in millimeters >= 0.5

<cr> dispense [this specific volume] D,[ml]

D,[-ml] <cr> dispense [in reverse this specific volume]

<cr> dispense status **D**,?

#### **Example**

#### Response

**D,15** <cr>

\*OK <cr> 15 ml will be dispensed

D,-405 <cr>

\*OK <cr> 405 ml will be dispensed in reverse

**D,?** <cr>

?D,22.50,0 <cr>

\*OK <cr>

#### Response breakdown

?D,22.50,0

last volu<u>me</u> dispensed

pump off

### Dose over time

Pump a fixed volume over a fixed time

#### **Command syntax**

D,[ml],[min] <cr> Dispense [this volume], [over this many minutes]

**Example** 

Response

D,85,10 <cr>

\*OK <cr> Dispense 85ml over 10 minutes



### Constant flow rate

Maintain a constant flow rate

#### **Command syntax**

After running in continuous mode for 20 days the EZO-PMP™ will reset.

DC,[ml/min],[min or \*] <cr> [maintain this rate],[for this much time] DC,? <cr> reports maximum possible flow rate

[ml/min] = a single number (int or float) representing the desired flow rate [min or \*] = the number of minutes to run or (\*) indefinitely A negative value for ml/min = reverse

#### Example

#### Response

DC,25,40 <cr>

**\*OK <cr> Dispense 25ml per minute for 40 minutes** 

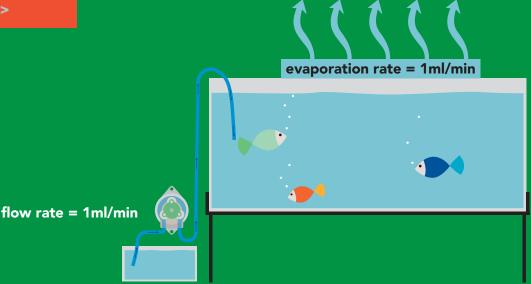
DC.? <cr>

?MAXRATE,58.5 <cr>

\*OK <cr>

The maximum flow rate is determinded after calibration. If the flowrate entered is to fast the EZO-PMP™ will send and error.

\*TOOFAST <cr> \*ER <cr>



## Pause dispensing

### **Command syntax**

Issue the command again to resume dispensing

pauses the pump during dispensing P <cr>

pause status **P,?** <cr>

#### **Example**

#### Response

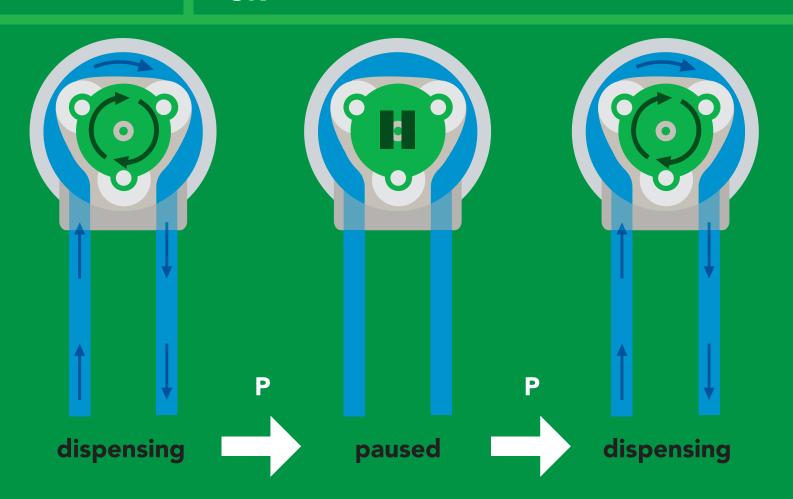
P <cr>

\*OK <cr>

P,? <cr>

?P,1 <cr> or ?P,0 <cr>

\*OK <cr>



# Stop dispensing

#### **Command syntax**

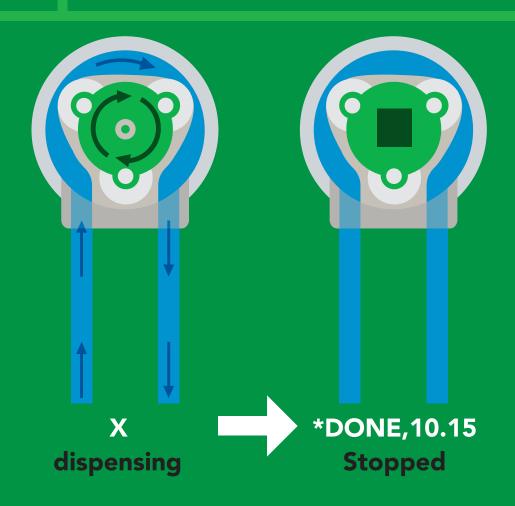
X <cr> stop dispensing

**Example** 

Response

**X** <cr>

\*DONE,v <cr> v = volume dispensed



# Total volume dispensed

#### **Command syntax**

TV,? <cr> shows total volume dispensed

ATV,? <cr> absolute value of the total volume dispensed

Clear <cr>> clears the total dispensed volume

Example	Response
TV,? <cr></cr>	?total,434.50 <cr></cr>
ATV,? <cr></cr>	?total,623.00 <cr></cr>
Clear <cr></cr>	*OK <cr> total now 0.00</cr>

### **Calibration**

#### **Command syntax**

Calibrate to the actual volume dispensed.

<cr> v = corrected volume Cal,v

Cal, clear <cr> delete all calibration data

<cr> device calibrated? Cal,?

This command is used for both, single dose and dose over time calibrations.

#### **Example**

#### Response

Cal,24.01 <cr>

\*OK <cr>

Cal, clear <cr>

\*OK <cr>

Cal,? <cr> ?Cal,1 <cr> or ?Cal,2 <cr> or ?Cal,3 <cr> or ?Cal,0 <cr>
both uncalibrated \*OK <cr>

# Enable/disable parameters from output string

#### **Command syntax**

O, [parameter],[1,0] <cr> enable or disable output parameter <cr> enabled parameter? 0,?

Example	Response
O,V,1 <cr></cr>	*OK <cr> enable volume being pumped</cr>
O,TV,0 <cr></cr>	*OK <cr> disable total volume pumped</cr>
O,ATV,1 <cr></cr>	*OK <cr> enable absolute volume pumped</cr>
O,? <cr></cr>	?,O,V,TV,ATV <cr> if all three are enabled</cr>

# Pump voltage

### **Command syntax**

PV,? <cr> check pump voltage

**Example** 

Response

**PV,?** <cr>

?PV,13.86 <cr> \*OK <cr>

### Response breakdown

?PV, 13.86

Pump input voltage

## Naming device

### **Command syntax**

Name,n <cr> set name

Name,? <cr> show name

n = 6 7 8 9 10 11 12 13 14 15 16

**Up to 16 ASCII characters** 

#### Example

Name,zzt <cr>

Name,? <cr>

#### Response

\*OK <cr>

?Name,zzt <cr>

\*OK <cr>

#### Name,zzt



\*OK <cr>

#### Name,?



Name,zzt <cr> \*OK <cr>

### **Device information**

#### **Command syntax**

i <cr> device information

<b>Examp</b>	le

Response

i <cr>

?i,PMP,1.1 <cr> \*OK <cr>

#### Response breakdown

?i, PMP, Device Firmware

### Response codes

#### **Command syntax**

\*OK,1 <cr> enable response

default

\*OK,0 <cr> disable response

\*OK,? <cr> response on/off?

#### Example

#### Response

R <cr>

413 <cr>

\*OK <cr>

\*OK,0 <cr>

no response, \*OK disabled

R <cr>

413 <cr> \*OK disabled

\*OK,? <cr>

?\*OK,1 <cr> or ?\*OK,0 <cr>

#### Other response codes

\*ER unknown command \*OV over volt (VCC>=5.5V)

under volt (VCC<=3.1V) \*UV

\*RS reset

\*RE boot up complete, ready

entering sleep mode \*SL

wake up \*WA

dispensing complete \*DONE

dispense amount too low \*MINVOL

\*TOOFAST ml/min set to fast These response codes cannot be disabled



### Reading device status

#### **Command syntax**

Status <cr> voltage at Vcc pin and reason for last restart

**Example** 

Response

Status <cr>

?Status, P, 5.038 < cr>

\*OK <cr>

#### Response breakdown

?Status,

5.038

Reason for restart

Voltage at Vcc

#### **Restart codes**

powered off

software reset

brown out

watchdog W

unknown

## Sleep mode/low power

## **Command syntax**

Send any character or command to awaken device.

Sleep <cr> enter sleep mode/low power

**Example** 

Response

Sleep <cr>

\*SL

**Any command** 

\*WA <cr> wakes up device

**5V** 

**STANDBY SLEEP** 

13.4 mA

0.415 mA

3.3V

12.4 mA  $0.13 \, \text{mA}$ 



Sleep <cr>



**Standby** 13.4 mA

Sleep 0.415 mA



## Change baud rate

## **Command syntax**

Baud,n <cr> change baud rate

### **Example**

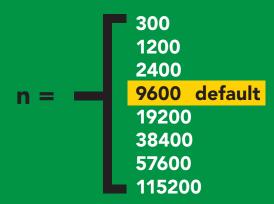
Response

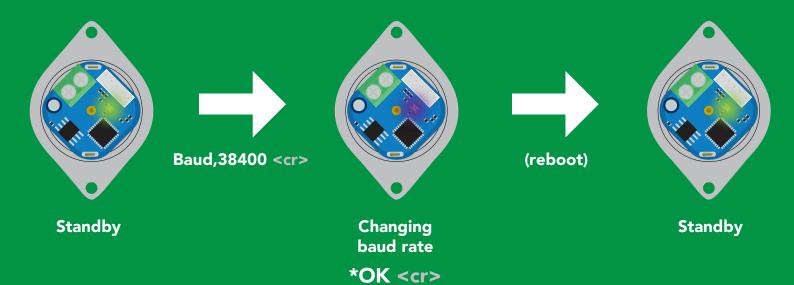
Baud, 38400 < cr>

\*OK <cr>

Baud,? <cr>

?Baud,38400 <cr> \*OK <cr>





## Protocol lock

## **Command syntax**

Locks device to UART mode.

Plock,1 <cr> enable Plock

default Plock,0 <cr> disable Plock

Plock,? <cr> Plock on/off?

### Example

### Response

Plock,1 <cr>

\*OK <cr>

Plock,0 <cr>

\*OK <cr>

Plock,? <cr>

?Plock,1 <cr> or ?Plock,0 <cr>

#### Plock.1

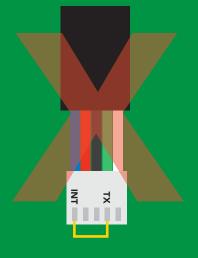
**I2C,100** 



\*OK <cr>



cannot change to I<sup>2</sup>C \*ER <cr>



cannot change to I<sup>2</sup>C

## **Factory reset**

## **Command syntax**

Clears calibration LED on "\*OK" enabled

Factory <cr> enable factory reset

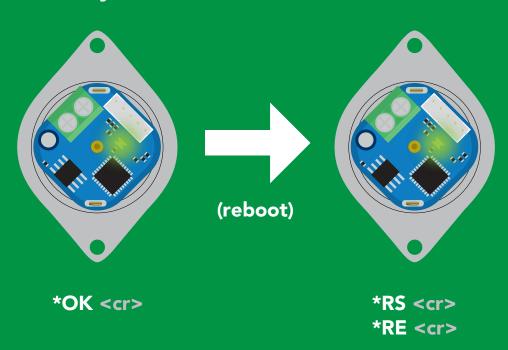
**Example** 

Response

Factory <cr>

\*OK <cr>

Factory <cr>



Baud rate will not change



## Change to I<sup>2</sup>C mode

## **Command syntax**

Default I<sup>2</sup>C address 103 (0x67)

I2C,n <cr> sets I2C address and reboots into I2C mode

n = any number 1 - 127

Example

Response

12C,100 <cr>

\*OK (reboot in I<sup>2</sup>C mode)

Wrong example

Response

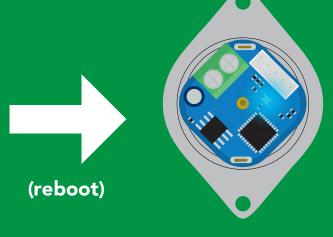
12C,139 <cr> n ≯ 127

\*ER <cr>

**I2C,100** 



Green \*OK <cr>



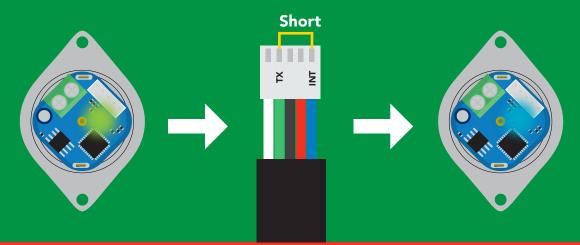
Blue now in I<sup>2</sup>C mode

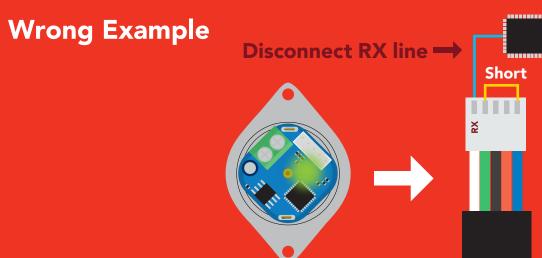
## Manual switching to I<sup>2</sup>C

- Make sure Plock is set to 0
- Disconnect ground (power off)
- Disconnect TX and RX
- Connect TX to INT
- Confirm RX is disconnected
- Connect ground (power on)
- Wait for LED to change from Green to Blue
- Disconnect ground (power off)
- Reconnect all data and power

Manually switching to I<sup>2</sup>C will set the I<sup>2</sup>C address to 103 (0x67)

### **Example**







# 12C mode

The I<sup>2</sup>C protocol is considerably more complex than the UART (RS-232) protocol. Atlas Scientific assumes the embedded systems engineer understands this protocol.

To set your EZO-PMP™ into I<sup>2</sup>C mode click here

#### Settings that are retained if power is cut

Calibration
Change I<sup>2</sup>C address
Enable/disable parameters
Hardware switch to UART mode
LED control
Protocol lock
Software switch to UART mode

Settings that are **NOT** retained if power is cut

Find Sleep mode



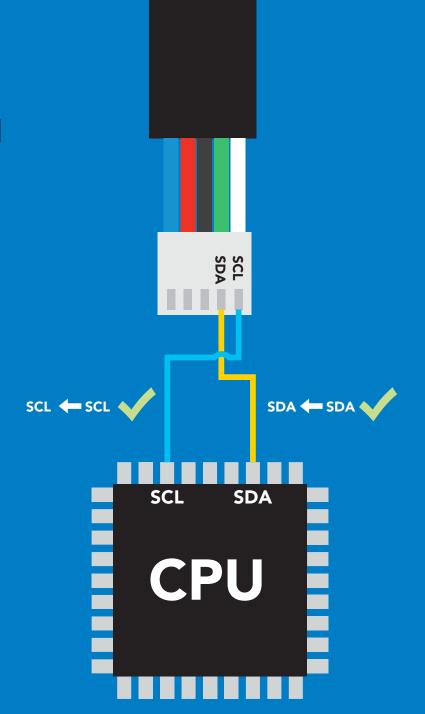
## I<sup>2</sup>C mode

I<sup>2</sup>C address (0x01 - 0x7F)

103 (0x67) default

Vcc 3.3V - 5.5V

Clock speed 100 - 400 kHz



## **Data format**

volume Reading

Units m

**ASCII** 

**Encoding Format** 

string

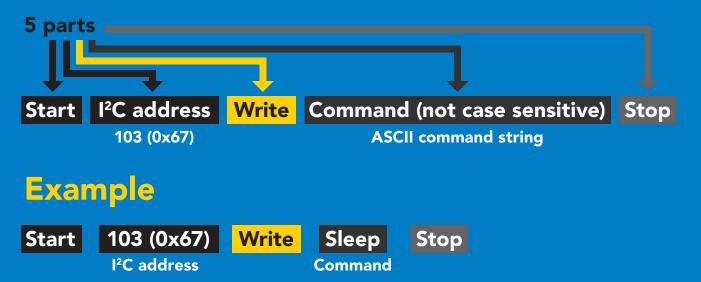
Data type **Decimal places Smallest string Largest string** 

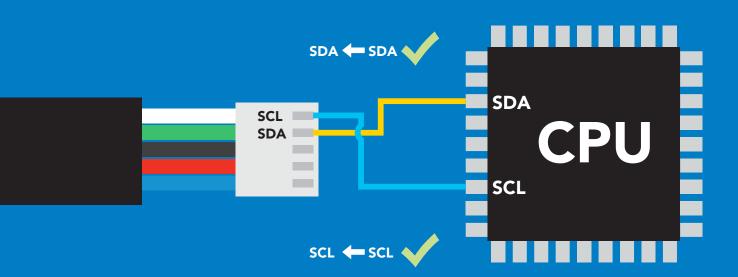
floating point

3 characters

39 characters

## Sending commands to device



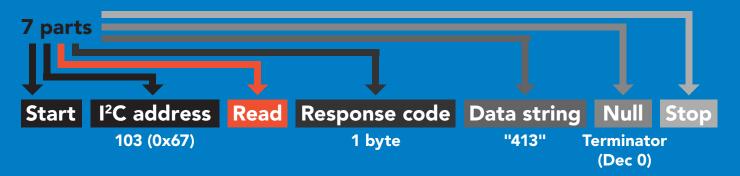


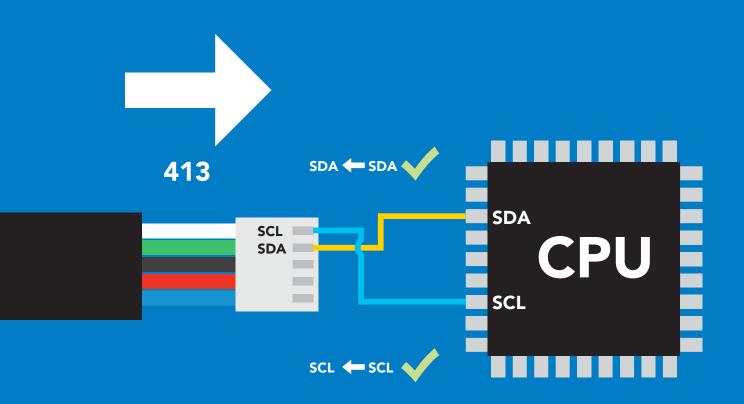
### Advanced



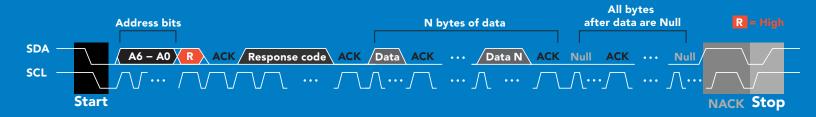


## Requesting data from device





### **Advanced**

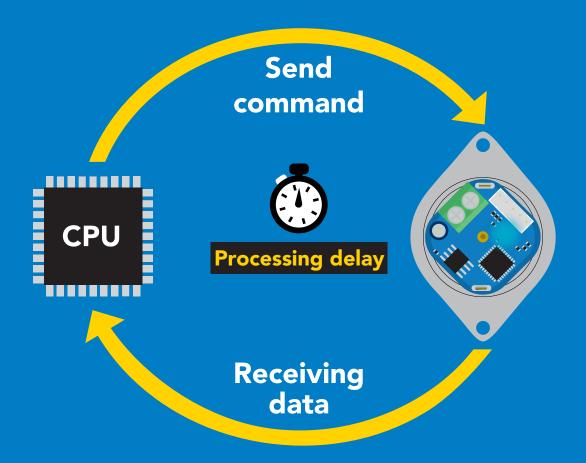




## Response codes

After a command has been issued, a 1 byte response code can be read in order to confirm that the command was processed successfully.

Reading back the response code is completely optional, and is not required for normal operation.



## **Example**

I2C\_start;

I2C address:

I2C\_write(EZO\_command);

I2C\_stop;

delay(300);



I2C start; I2C address; Char[] = I2C\_read; I2C\_stop;

If there is no processing delay or the processing delay is too short, the response code will always be 254.

Response codes

Single byte, not string

no data to send **255** 

254 still processing, not ready

2 error

successful request



## LED color definition



I<sup>2</sup>C standby



Green **Taking reading** 



Changing I<sup>2</sup>C ID#



Command not understood



White Find

LED ON **5V** +2.5 mA +1 mA

## I<sup>2</sup>C mode command quick reference

All commands are ASCII strings or single ASCII characters.

Command	Function	
Baud	switch back to UART mode	pg. 68
Cal	performs calibration	pg. 59
D	dispense modes	pg. 52 – 55
Factory	enable factory reset	pg. 67
i	device information	pg. 62
I2C	change I <sup>2</sup> C address	pg. 66
L	enable/disable LED	pg. 50
0	enable/disable parameters	pg. 60
Р	enable/disable protocol lock	pg. 56
Plock	enable/disable protocol lock	pg. 65
Pv	check pump voltage	pg. 61
R	returns a single reading	pg. 51
Sleep	enter sleep mode/low power	pg. 64
Status	retrieve status information	pg. 63
Tv	total volume dispensed	pg. 58
X	stop dispensing	pg. 57

## **LED** control

## **Command syntax**

300ms processing delay

**L,1** LED on default

L,0 **LED** off

LED state on/off? **L,?** 

## Example

### Response

L,1







**L,0** 



























## Single report mode

## **Command syntax**

300ms processing delay

returns a single value showing dispensed volume

### Example

### Response

R



2.50 **ASCII** 

(If issued half way through dispensing 5ml)



Dec

5.00 **ASCII** 

Null

(If issued once dispensing has stopped)



## Continuous dispensing

Pump on/pump off

300ms (processing delay

## **Command syntax**

After running in continuous mode for 20 days the EZO-PMP™ will reset.

- dispense until the stop command is given **D**,\*
- dispense in reverse until the stop command is given **D**,-\*
- dispense status **D**,?

## Example

### Response

**D**,\*







pump will continuously run at ~105ml/min (with supplied tubing)

D,-\*







pump will continuously run in reverse at ~105ml/min (with supplied tubing)

**D**,?





?D,10.00,1 **ASCII** 



## Response breakdown

?D,\*,1 last volume pump on requested

## Volume dispensing

Pump a specific volume

300ms (processing delay

## **Command syntax**

where [ml] is any volume in millimeters >= 0.5

D,[ml]dispense [this specific volume]

**D**,[-ml] dispense [in reverse this specific volume]

dispense status **D**,?

### Example

### Response

**D,15** 







15 ml will be dispensed

D,-405







405 ml will be dispensed in reverse

**D**,?



?D,22.50,0

**ASCII** 

## Response breakdown

?D,22.50,0

last volume dispensed

pump off



## Dose over time

Pump a fixed volume over a fixed time

## **Command syntax**

300ms processing delay

D,[ml],[min] Dispense [this volume], [over this many minutes]

Example

Response

D,85,10





Dispense 85ml over 10 mins





## **Constant flow rate**

Maintain a constant flow rate



## **Command syntax**

After running in continuous mode for 20 days the EZO-PMP™ will reset.

DC,[ml/min], [min or \*] DC,?

[maintain this rate], [for this much time] reports maximum possible flow rate

[ml/min] = a single number (int or float) representing the desired flow rate [min or \*] = the number of minutes to run or (\*) indefinitely A negative value for ml/min = reverse

## Example

### Response

DC,25,40







Dispense 25ml per minute for 40 minutes

DC,?





Dec

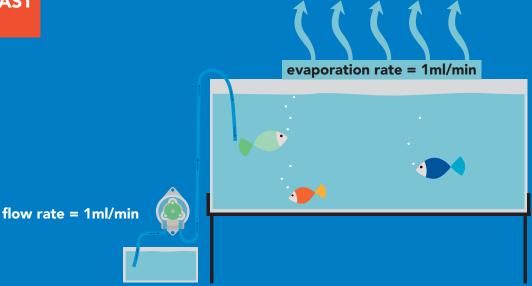
?maxrate,58.5

**ASCII** 



The maximum flow rate is determinded after calibration. If the flowrate entered is to fast the EZO-PMP™ will send and error.

\*TOOFAST \*ER



## Pause dispensing

## **Command syntax**

300ms processing delay

Issue the command again to resume dispensing

- pauses the pump during dispensing
- pause status

## Example

### Response

P













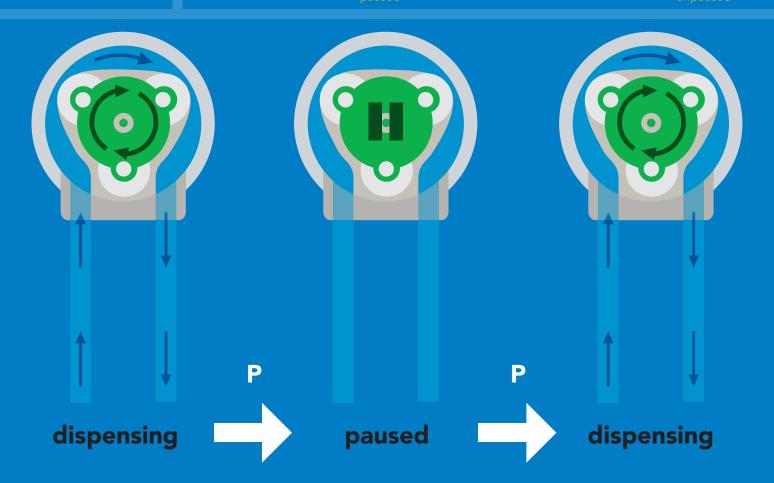












## Stop dispensing

## **Command syntax**

300ms processing delay

stop dispensing

Example

Response

X

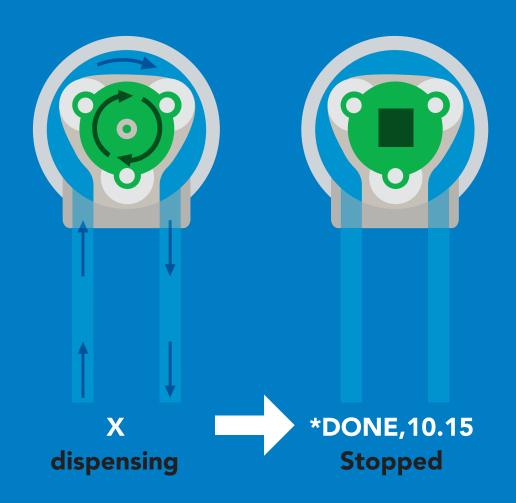








v = volume dispensed



## Total volume dispensed

## **Command syntax**

300ms processing delay

**TV**,? shows total volume dispensed

ATV,? absolute value of the total volume dispensed

Clear clears the total dispensed volume

Example	Response
TV,?	1 ?total,623.00 0 Wait 300ms Dec ASCII Null
ATV,?	1 ?total,434.50 0 Wait 300ms Dec ASCII Null
clear	Total now 0.00  Wait 300ms  Total now 0.00

## **Calibration**

## 300ms processing delay

## **Command syntax**

Calibrate to the actual volume dispensed.

v = corrected volume Cal,v

delete calibration data Cal, clear

Cal,? device calibrated?

## Example

Cal,24.01

Cal, clear

Cal,?

Response









































or







## Enable/disable parameters from output string

**Command syntax** 

300ms processing delay

O, [parameter],[1,0] enable or disable output parameter enabled parameter? 0,?

Example	Response
O,V,1	The state of the s
O,TV,0	The state of the s
O,ATV,1	enable absolute volume pumped
0,?	1 ?,O,V,TV,ATV 0 if all three are enabled

## Pump voltage

## **Command syntax**



PV,? check pump voltage

Example

Response

**PV**,?





?PV,13.86 ASCII



Dec

## Response breakdown

?PV, 13.86

Pump input voltage

## **Device information**

## **Command syntax**

300ms processing delay

device information



### Response

i









## Response breakdown

?i, PMP, Device **Firmware** 

## Reading device status

### Command syntax



voltage at Vcc pin and reason for last restart



### Response

**Status** 





?Status,P,5.038

**ASCII** 



## Response breakdown

?Status,

5.038

Reason for restart

Voltage at Vcc

#### **Restart codes**

powered off

software reset S

В brown out

watchdog W

unknown

U

## Sleep mode/low power

## Command syntax

enter sleep mode/low power Sleep

Send any character or command to awaken device.

Example

Response

Sleep

no response

Do not read status byte after issuing sleep command.

**Any command** 

wakes up device

**5V** 

**STANDBY SLEEP** 

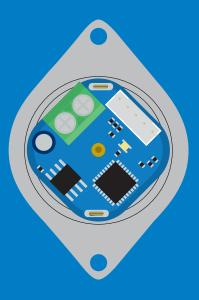
13.4 mA  $0.415 \, \text{mA}$ 

3.3V

12.4 mA  $0.13 \, \text{mA}$ 



Sleep



Sleep

**Standby** 

AtlasScient

## **Protocol lock**

## **Command syntax**

300ms processing delay

Plock,1 enable Plock

Plock,0 disable Plock default

Plock,? Plock on/off? Locks device to I<sup>2</sup>C mode.

## **Example**

### Response

Plock,1







Plock,0







Plock,?









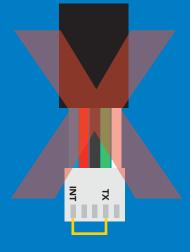
#### Plock,1



Serial, 9600



cannot change to UART



cannot change to UART



## I<sup>2</sup>C address change

## **Command syntax**

300ms processing delay

I2C,n sets I2C address and reboots into I2C mode

Example

Response

**I2C,101** 

device reboot

### Warning!

Changing the I<sup>2</sup>C address will prevent communication between the circuit and the CPU, until the CPU is updated with the new I<sup>2</sup>C address.

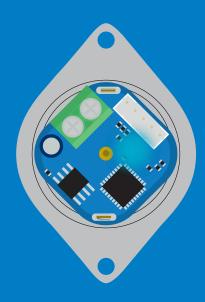
Default I<sup>2</sup>C address is 103 (0x67).

n = any number 1 - 127









## Factory reset

## **Command syntax**

Factory reset will not take the device out of I<sup>2</sup>C mode.

Factory enable factory reset

I<sup>2</sup>C address will not change

### Example

### Response

**Factory** 

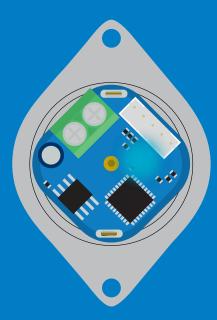
device reboot

Clears calibration LED on Response codes enabled

### **Factory**







## Change to UART mode

## **Command syntax**

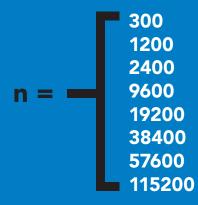
Baud, n switch from I<sup>2</sup>C to UART

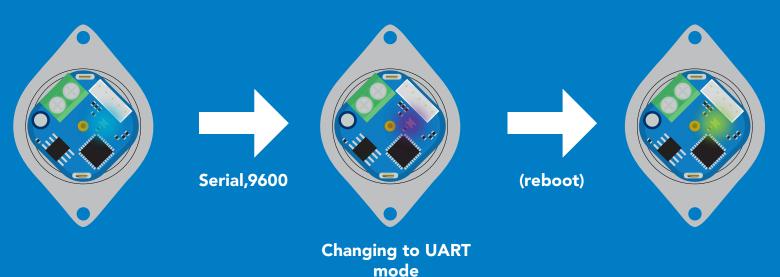
### Example

### Response

Baud, 9600

reboot in UART mode

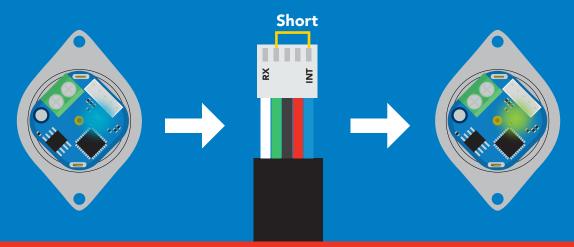


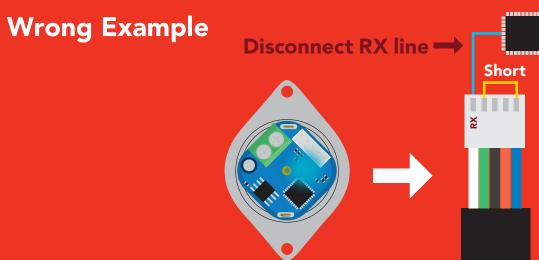


## Manual switching to UART

- Make sure Plock is set to 0
- **Disconnect ground (power off)**
- Disconnect TX and RX
- Connect TX to INT
- Confirm RX is disconnected
- Connect ground (power on)
- Wait for LED to change from Blue to Green
- Disconnect ground (power off)
- Reconnect all data and power

### **Example**

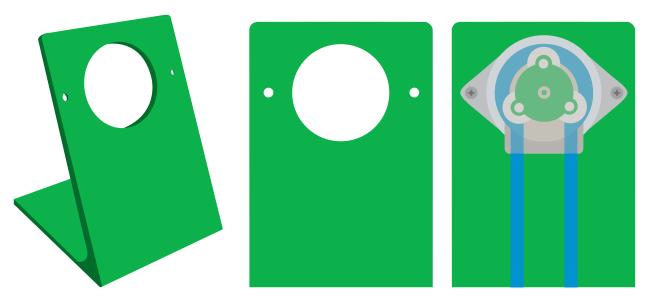




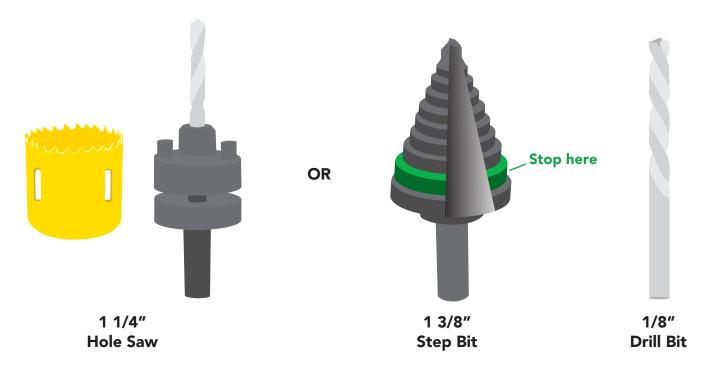


## Mounting the EZO-PMP™

There are a many different ways to mount the EZO-PMP™ Embedded Dosing Pump. If you have a 3D printer you can use the dosing pump stand we created, by clicking here. The dosing pump stand has been measured to perfectly fit the EZO-PMP™ and even has screw holes in place for you to help mount the dosing pump to the stand. Feel free to modify this stand design as needed.



However, if you would like to mount the EZO-PMP™ Embedded Dosing Pump into other materials, you will need the following tools:



Either are fine to make the larger hole.

Perfect for screw holes.



## Datasheet change log

#### **Datasheet V 1.3**

Revised art and added pump head information on pg 11.

#### Datasheet V 1.2

Revised Plock pages to show default value.

#### **Datasheet V 1.1**

Added mounting information on pg 70.

#### **EZO-PMP™** firmware changes

V1.0 - Initial release (April 28, 2017)

## Warranty

Atlas Scientific™ Warranties the EZO-PMP™ Embedded Dosing Pump to be free of defect during the debugging phase of device implementation, or 30 days after receiving the EZO-PMP<sup>™</sup> Embedded Dosing Pump(which ever comes first).

## The debugging phase

The debugging phase as defined by Atlas Scientific<sup>™</sup> is the time period when the EZO-PMP<sup>™</sup> Embedded Dosing Pump is inserted into a bread board, or shield. If the EZO-PMP<sup>™</sup> Embedded Dosing Pump is being debugged in a bread board, the bread board must be devoid of other components. If the EZO-PMP™ Embedded Dosing Pump is being connected to a microcontroller, the microcontroller must be running code that has been designed to drive the EZO-PMP™ Embedded Dosing Pump exclusively and output the EZO-PMP™ Embedded Dosing Pump data as a serial string.

It is important for the embedded systems engineer to keep in mind that the following activities will void the EZO-PMP™ Embedded Dosing Pump warranty:

- Soldering any part of the EZO-PMP™ Embedded Dosing Pump.
- Running any code, that does not exclusively drive the EZO-PMP™ Embedded Dosing Pump and output its data in a serial string.
- Embedding the EZO-PMP™ Embedded Dosing Pump into a custom made device.
- Removing any potting compound.

## Reasoning behind this warranty

Because Atlas Scientific™ does not sell consumer electronics; once the device has been embedded into a custom made system, Atlas Scientific<sup>™</sup> cannot possibly warranty the EZO-PMP™ Embedded Dosing Pump, against the thousands of possible variables that may cause the EZO-PMP™ Embedded Dosing Pump to no longer function properly.

### Please keep this in mind:

- 1. All Atlas Scientific™ devices have been designed to be embedded into a custom made system by you, the embedded systems engineer.
- 2. All Atlas Scientific™ devices have been designed to run indefinitely without failure in the field.
- 3. All Atlas Scientific™ devices can be soldered into place, however you do so at your own risk.

Atlas Scientific<sup>™</sup> is simply stating that once the device is being used in your application, Atlas Scientific can no longer take responsibility for the EZO-PMP™ Embedded Dosing Pumps continued operation. This is because that would be equivalent to Atlas Scientific™ taking responsibility over the correct operation of your entire device.

#### **ПОСТАВКА** ЭЛЕКТРОННЫХ КОМПОНЕНТОВ

многоканальный

Общество с ограниченной ответственностью «МосЧип» ИНН 7719860671 / КПП 771901001 Адрес: 105318, г.Москва, ул.Щербаковская д.3, офис 1107

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#### http://moschip.ru/get-element

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В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

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