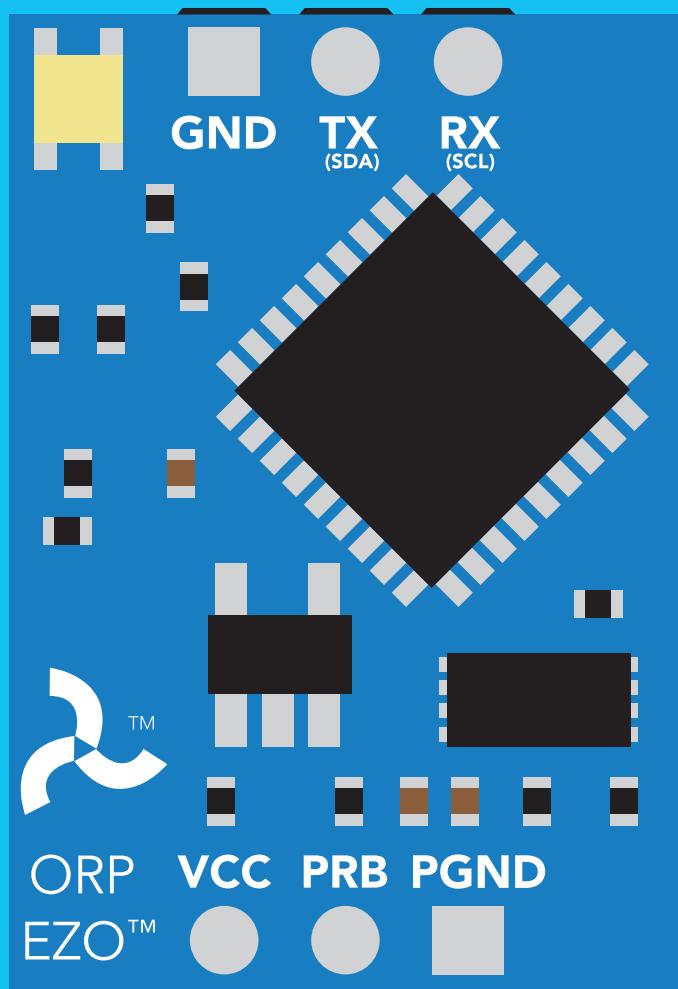


EZO-ORP™

Embedded ORP Circuit

Reads	ORP
Range	-1019.9mV – 1019.9mV
Accuracy	+/- 1mV
Response time	1 reading per sec
Supported probes	Any type & brand
Calibration	Single point
Temp compensation	N/A
Data protocol	UART & I²C
Default I ² C address	98 (0x62)
Operating voltage	3.3V – 5V
Data format	ASCII



PATENT PROTECTED



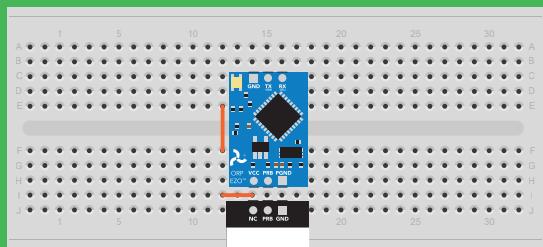
STOP

SOLDERING THIS DEVICE VOIDS YOUR WARRANTY.

This is sensitive electronic equipment. Get this device working in a solderless breadboard first. Once this device has been soldered it is no longer covered by our warranty.

This device has been designed to be soldered and can be soldered at any time. Once that decision has been made, Atlas Scientific no longer assumes responsibility for the device's continued operation. The embedded systems engineer is now the responsible party.

Get this device working in a solderless breadboard first!



Do not embed this device without testing it in a solderless breadboard!

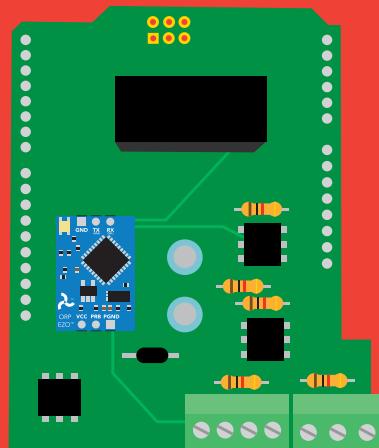


Table of contents

Circuit dimensions	4	Power and data isolation	7
Power consumption	4	Correct wiring	9
Absolute max ratings	4	Calibration theory	12
Operating principle	5	Default state	14
		Available data protocols	15

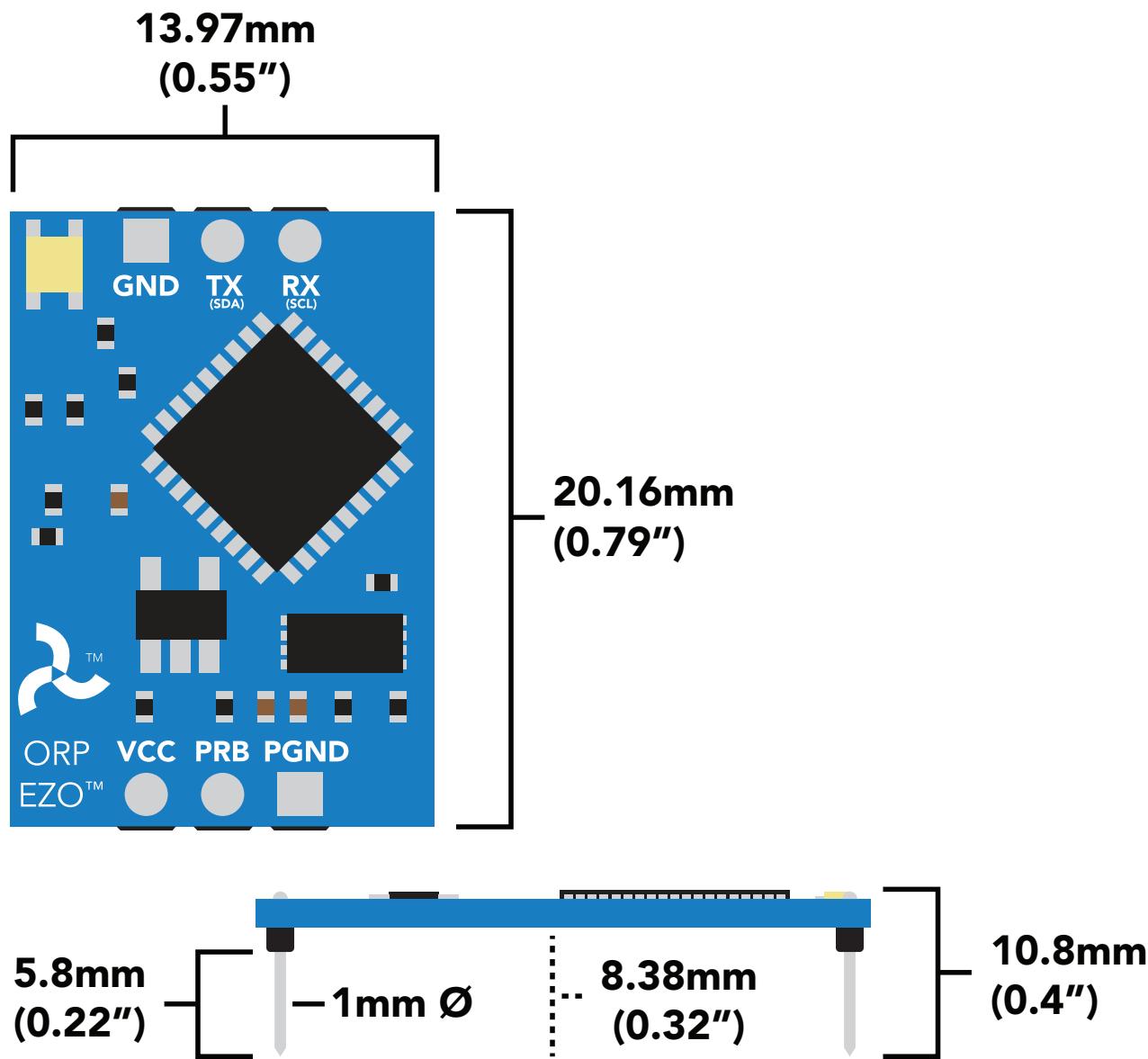
UART

UART mode	17
Receiving data from device	18
Sending commands to device	19
LED color definition	20
UART quick command page	21
LED control	22
Find	23
Continuous reading mode	24
Single reading mode	25
Calibration	26
Export calibration	27
Import calibration	28
Naming device	29
Device information	30
Response codes	31
Reading device status	32
Sleep mode/low power	33
Change baud rate	34
Protocol lock	35
Factory reset	36
Change to I ² C mode	37
Manual switching to I ² C	38

I²C

I ² C mode	40
Sending commands	41
Requesting data	42
Response codes	43
LED color definition	44
I ² C quick command page	45
LED control	46
Find	47
Taking reading	48
Calibration	49
Export calibration	50
Import calibration	51
Naming device	52
Device information	53
Reading device status	54
Sleep mode/low power	55
Protocol lock	56
I ² C address change	57
Factory reset	58
Change to UART mode	59
Manual switching to UART	60
Circuit footprint	61
Datasheet change log	62
Warranty	65

EZO™ circuit dimensions



Power consumption

Absolute max ratings

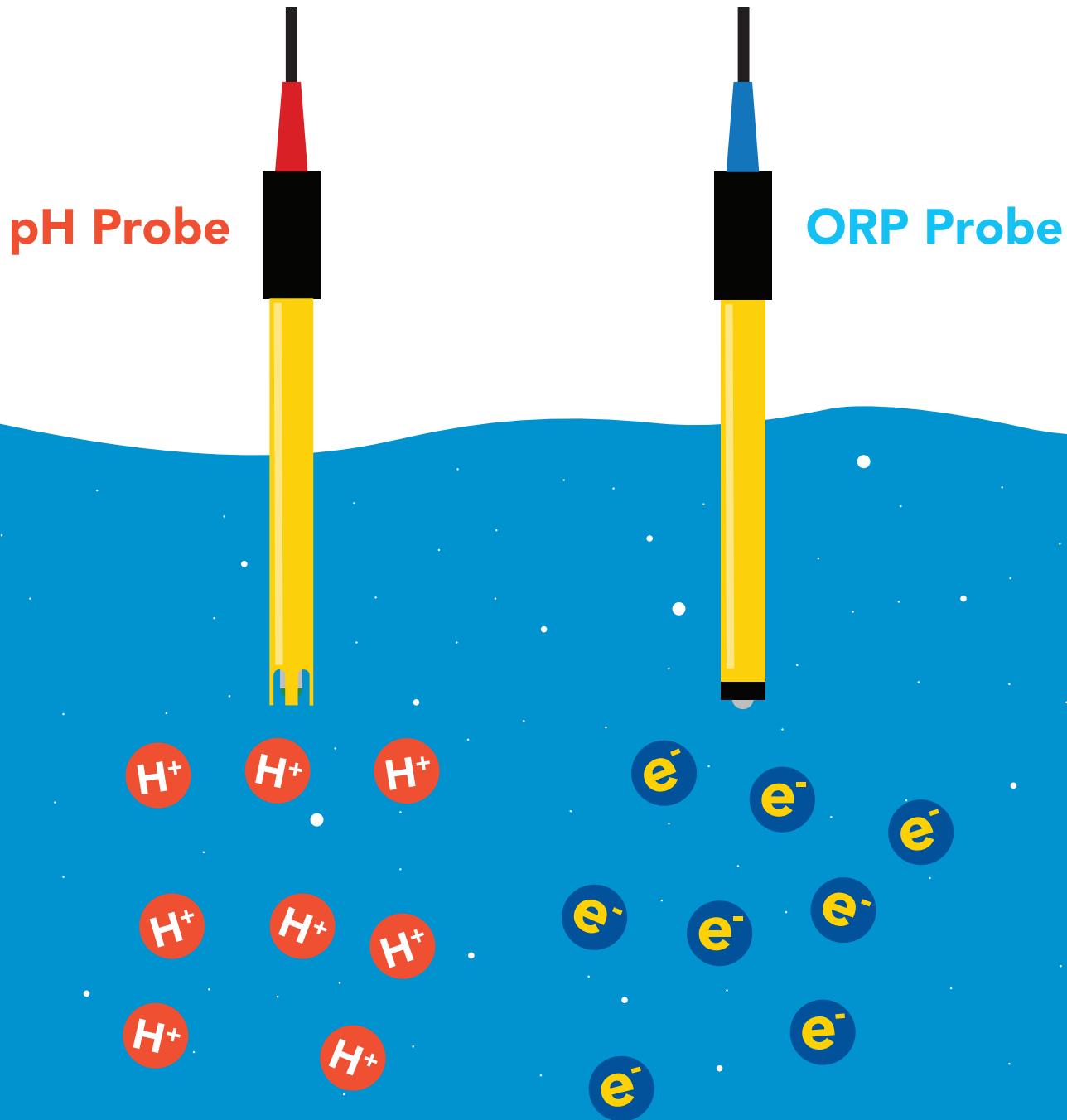
	LED	MAX	STANDBY	SLEEP
5V	ON	18.3 mA	16 mA	1.16 mA
	OFF	13.8 mA	13.8 mA	
3.3V	ON	14.5 mA	13.9 mA	0.995 mA
	OFF	13.3 mA	13.3 mA	

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

Operating principle

ORP stands for **oxidation/reduction potential**. Oxidation is the loss of electrons and reduction is the gain of electrons. The output of the probe is represented in millivolts and can be positive or negative.

Just like a pH probe measures hydrogen ion activity in a liquid; an ORP probe measures electron activity in a liquid. The ORP readings represents how strongly electrons are transferred to or from substances in a liquid. Keeping in mind that the readings do not indicate the amount of electrons available for transfer.

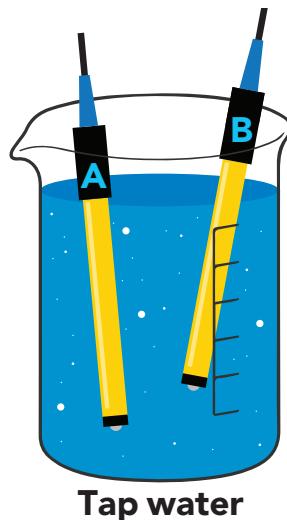


When reading the ORP of a liquid that has very few electrons available for transfer ORP readings can appear to be inconsistent.

The water is unreactive and has only trace amounts of electron movement. These readings are equivalent to the readings you see with an unconnected multimeter.

-234.6

Reading A

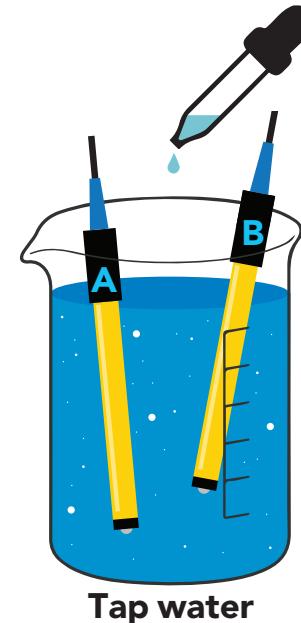


24.2

Reading B

606.9

Reading A

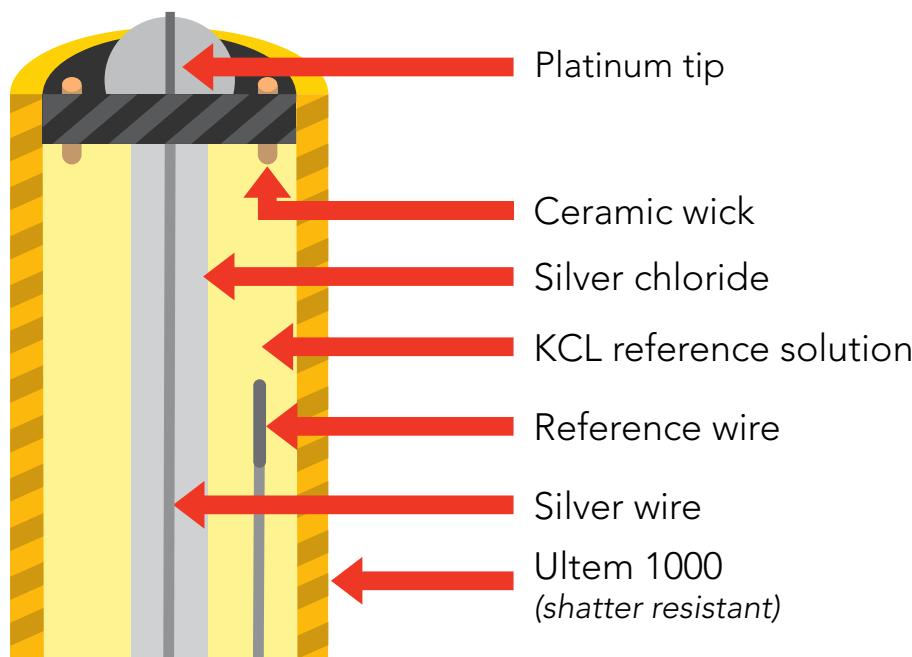


605.3

Reading B

Add just a drop of bleach
(which is an oxidizing agent)

An ORP probe has a platinum tip that is connected to a silver wire, surrounded by silver chloride. That silver wire is then connected to a KCL reference solution. Because platinum is an unreactive metal it can “silently observe” the electron activity of the liquid without becoming apart of whatever reaction is occurring in the liquid.



Power and data isolation

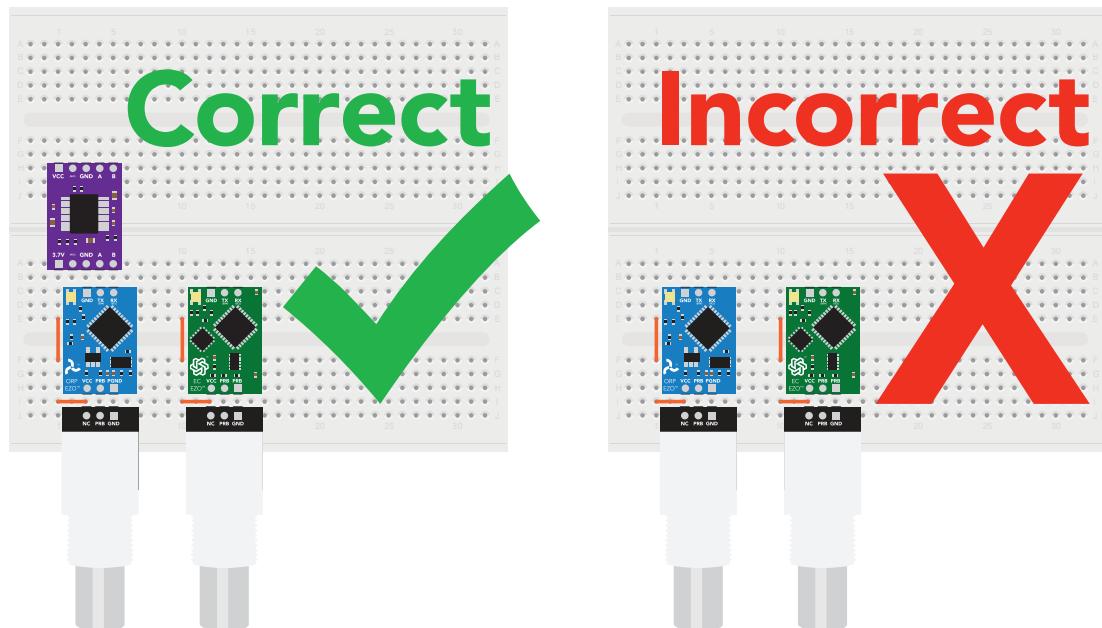
The Atlas Scientific EZO™ ORP circuit is a very sensitive device. This sensitivity is what gives the ORP circuit its accuracy. This also means that the ORP circuit is capable of reading micro-voltages that are bleeding into the water from unnatural sources such as pumps, solenoid valves or other probes/sensors.

When electrical noise is interfering with the ORP readings it is common to see rapidly fluctuating readings or readings that are consistently off. To verify that electrical noise is causing inaccurate readings, place the ORP probe in a cup of water by itself. The readings should stabilize quickly, confirming that electrical noise was the issue.



When reading ORP and Conductivity or Dissolved Oxygen together, it is **strongly recommended** that the EZO™ ORP circuit is electrically isolated from the EZO™ Conductivity or Dissolved Oxygen circuit.

Basic EZO™
Inline Voltage Isolator



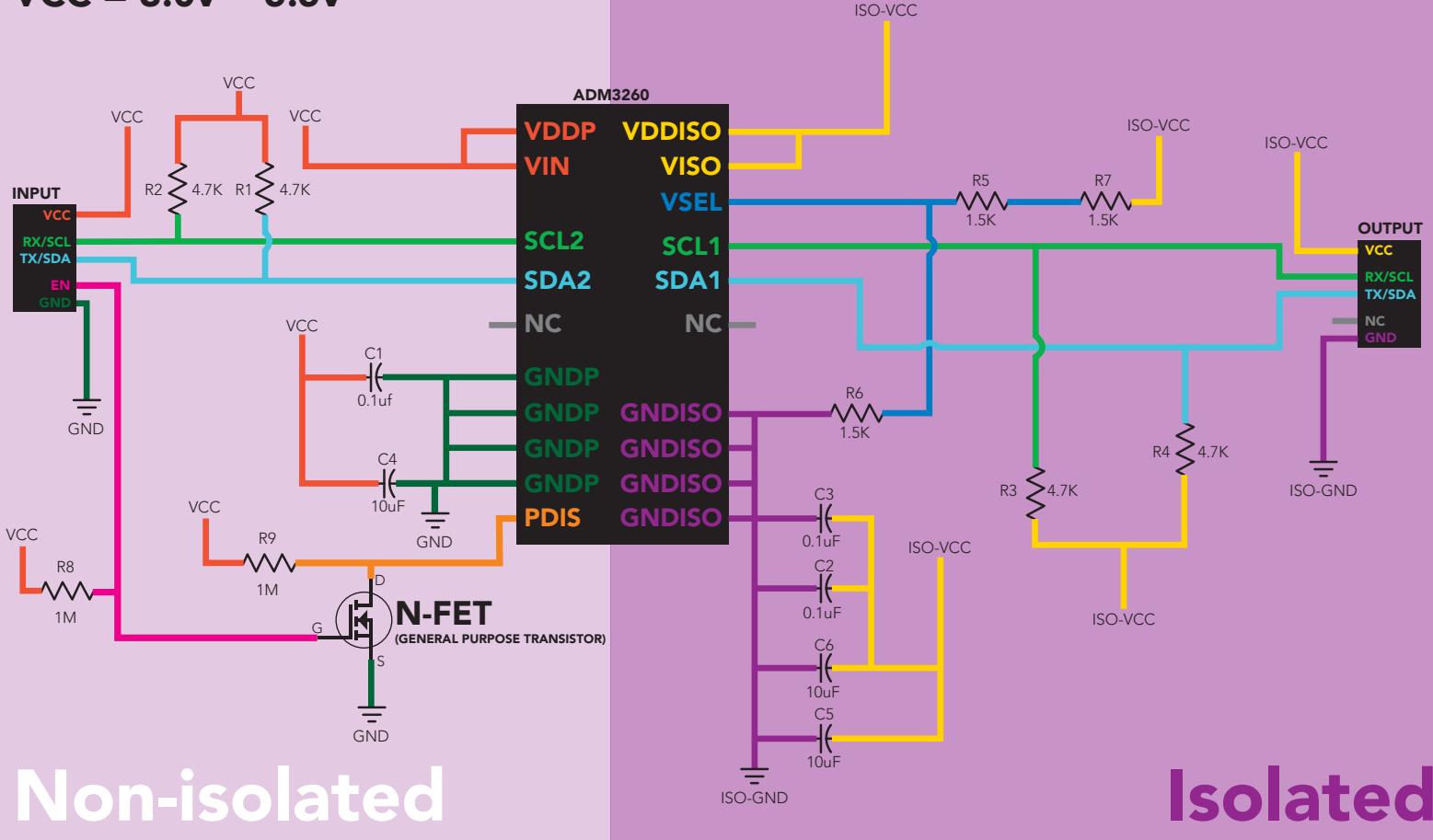
**Without isolation, Conductivity and Dissolved Oxygen
readings will effect ORP accuracy.**

This schematic shows exactly how we isolate data and power using the and a few passive components. The ADM3260 can output isolated power up to 150 mW and incorporates two bidirectional data channels.

This technology works by using tiny transformers to induce the voltage across an air gap. PCB layout requires special attention for EMI/EMC and RF Control, having proper ground planes and keeping the capacitors as close to the chip as possible are crucial for proper performance. The two data channels have a $4.7\text{k}\Omega$ pull up resistor on both the isolated and non-isolated lines (R1, R2, R3, and R4) The output voltage is set using a voltage divider (R5, R6, and R7) this produces a voltage of 3.9V regardless of your input voltage.

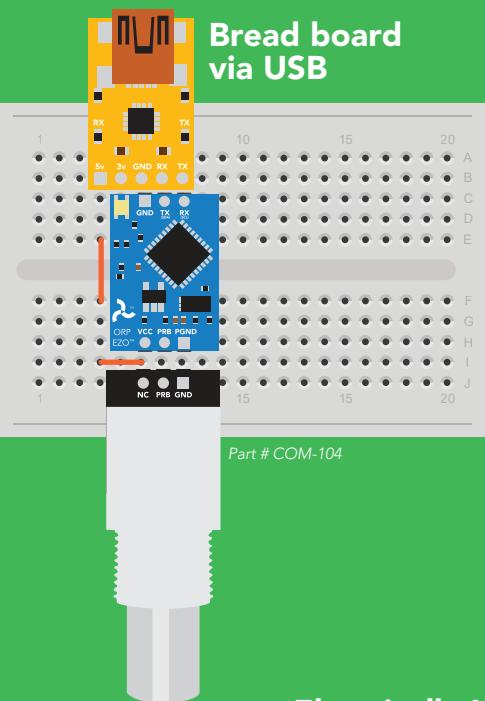
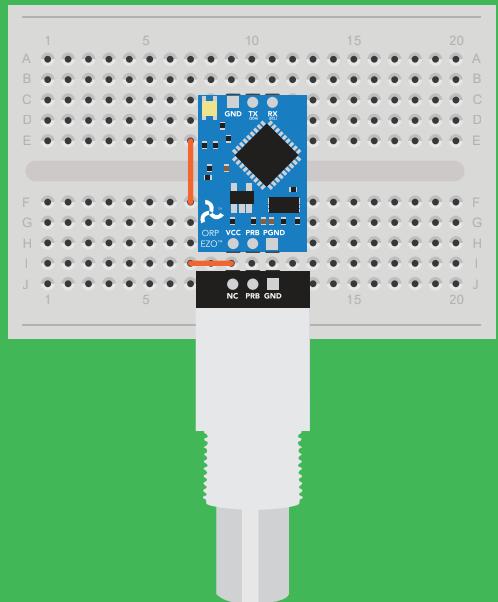
Isolated ground is different from non-isolated ground, these two lines should not be connected together.

VCC = 3.0v – 5.5v

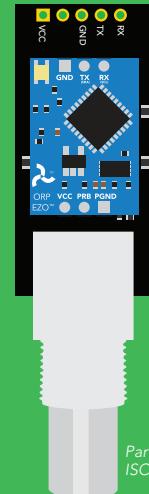


✓ Correct wiring

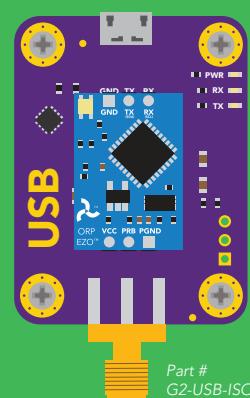
Bread board



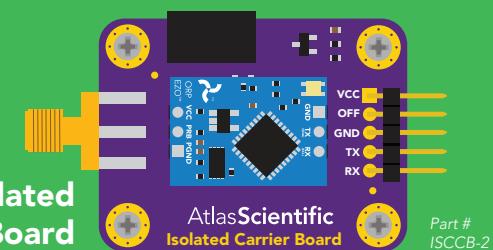
Carrier board



USB carrier board



Electrically Isolated EZO™ Carrier Board

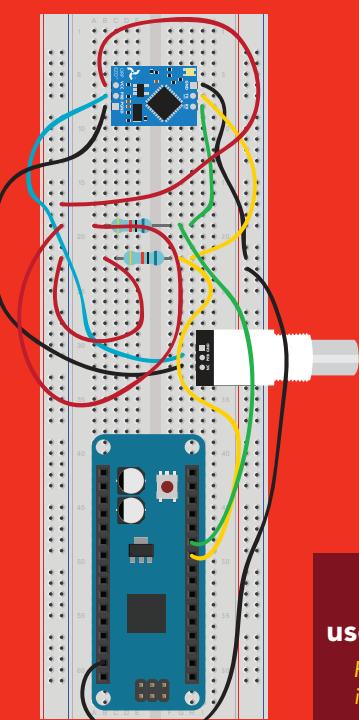


✗ Incorrect wiring

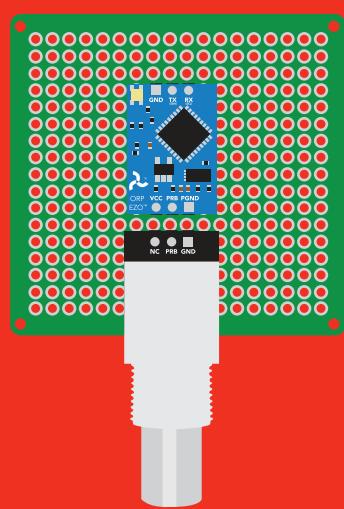
Extended leads



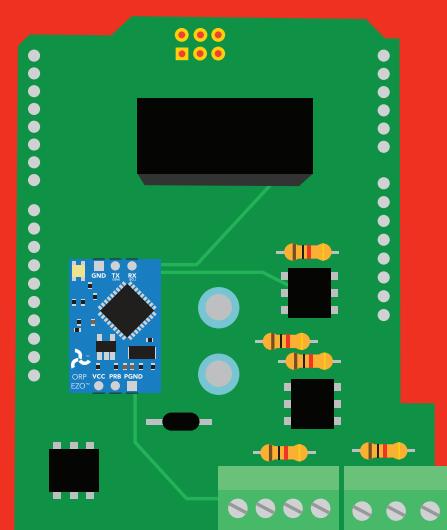
Sloppy setup



Perfboards or Protoboards



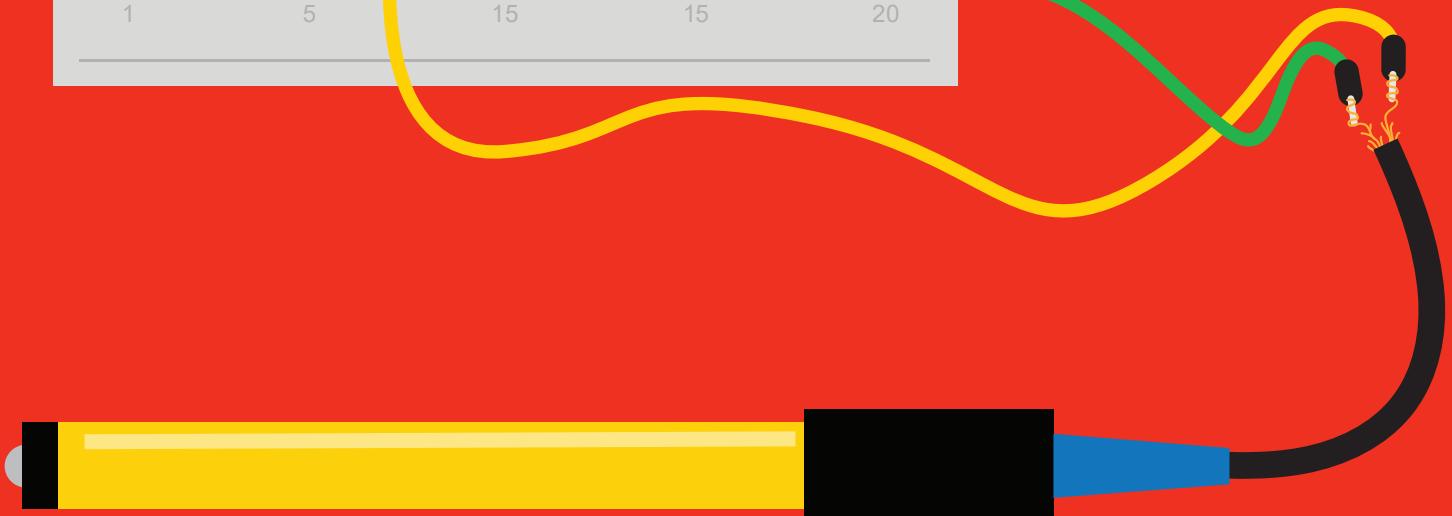
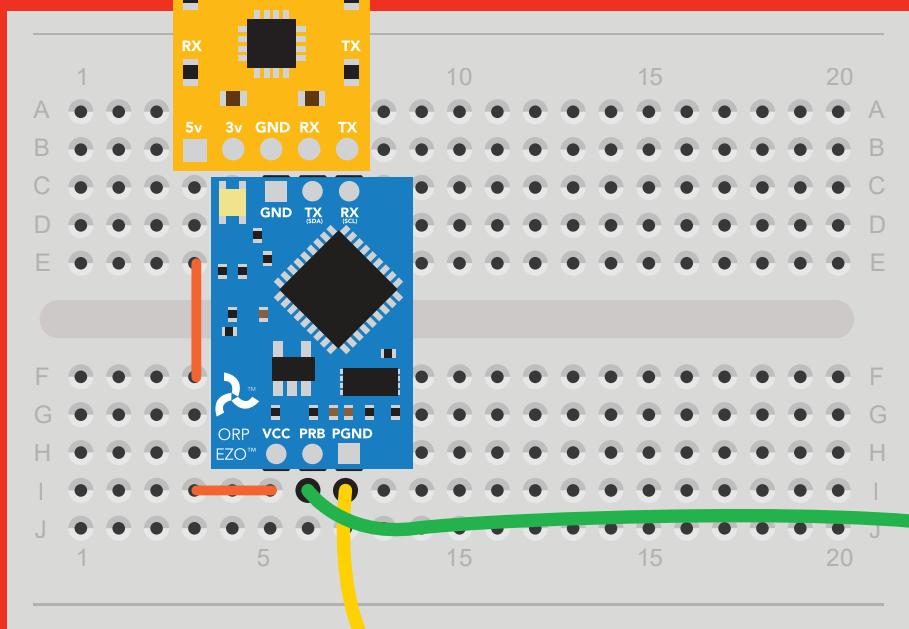
*Embedded into your device



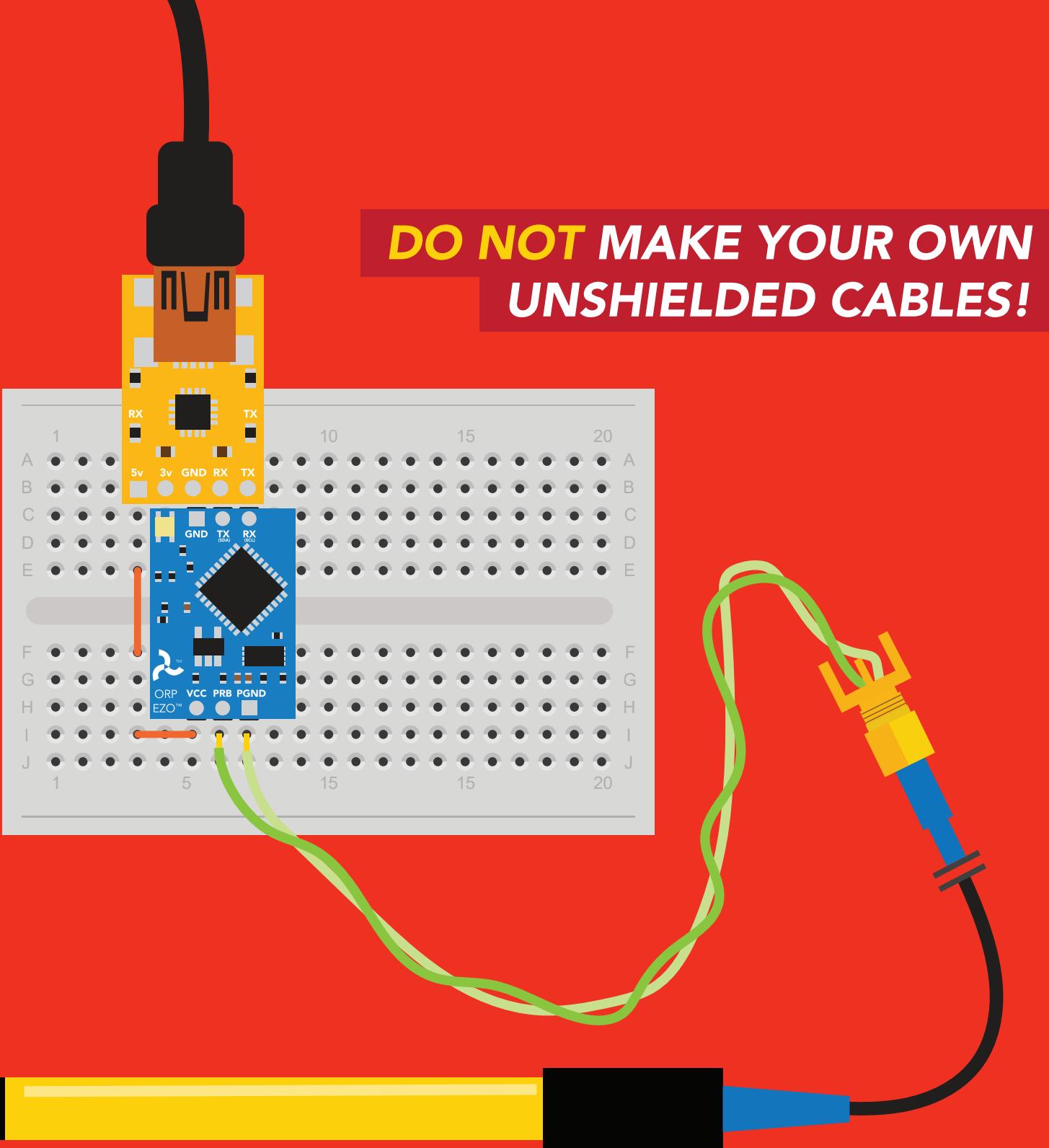
NEVER
use Perfboards or Protoboards
Flux residue and shorting wires make it very hard to get accurate readings.

*Only after you are familiar with EZO™ circuits operation

**NEVER EXTEND THE CABLE
WITH CHEAP JUMPER WIRES!**



**DO NOT CUT THE PROBE CABLE
WITHOUT REFERING TO **THIS DOCUMENT!****



Calibration theory

Simple calibration

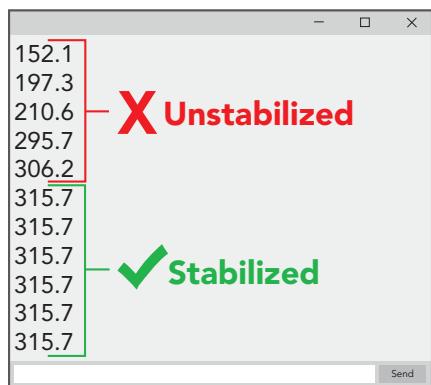
UART
mode

Continuous readings

Advanced calibration

I²C
mode

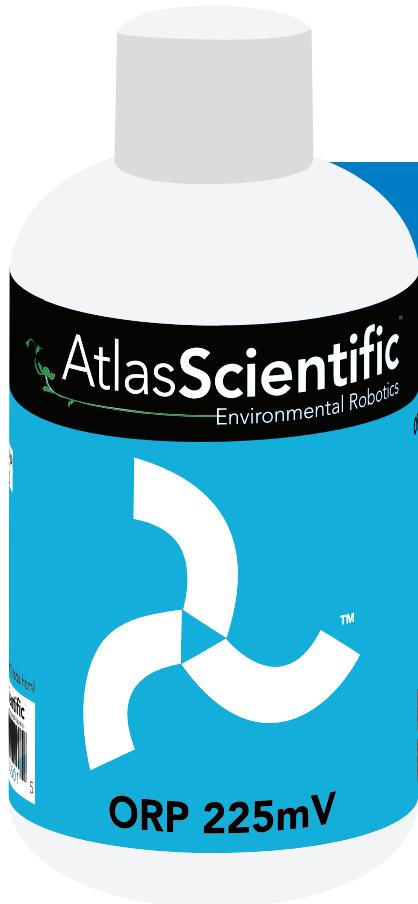
Continuously request readings



The most important part of calibration is watching the readings during the calibration process.

It's easiest to calibrate the device in its default state (UART mode, with continuous readings enabled).

Switching the device to I²C mode after calibration **will not** affect the stored calibration. If the device must be calibrated in I²C mode be sure to **continuously request readings** so you can see the output from the probe.



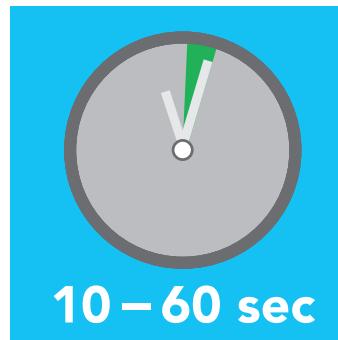
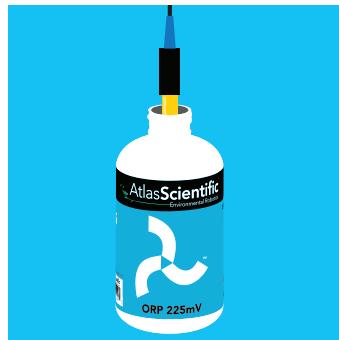
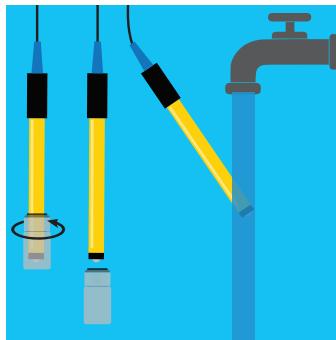
The Atlas Scientific EZO™ ORP circuit has a flexible calibration protocol, allowing single point calibration to **any off the shelf calibration solution**.

However, If this is your first time calibrating the EZO™ ORP circuit, Atlas Scientific recommends using the 225mv calibration solution.



Single point calibration

Remove the soaker bottle and rinse off the ORP probe. Insert the ORP probe directly into the **225mV** calibration solution bottle, and let the probe sit in the calibration solution until the readings stabilize (small movement from one reading to the next is normal).



```
342.0
315.2
268.7
X Unstabilized
240.1
240.1
240.1
240.1
✓ Stabilized
cal,225
*OK
225.0
225.0
```

Once the readings have stabilized,
issue the calibration command.
In this case "**cal,225**"

Calibration should be done at least once per year

If the ORP that's being read is continuously on the extremes of the scale (~ -900mV or +900mV) calibration may have to be done more often. The exact frequency of calibration will have to be determined by your engineering team.

Default state

UART mode

Baud

9,600

Readings

continuous

Speed

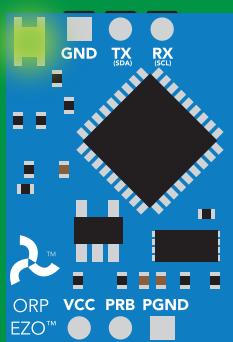
1 reading per second

LED

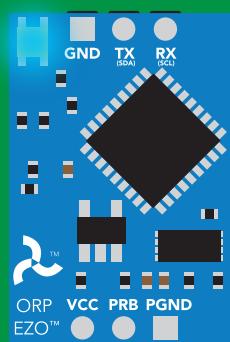
on



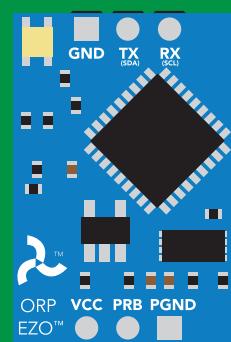
1,000 ms



Green
Standby



Cyan
Taking reading



Transmitting

 Available data protocols

UART

Default

I²C

 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 response codes
Hardware switch to I²C mode
LED control
Protocol lock
Software switch to I²C mode

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

Find
Sleep mode

UART mode

8 data bits no parity
1 stop bit no flow control

Baud 300
1,200
2,400
9,600 default
19,200
38,400
57,600
115,200

RX Data in

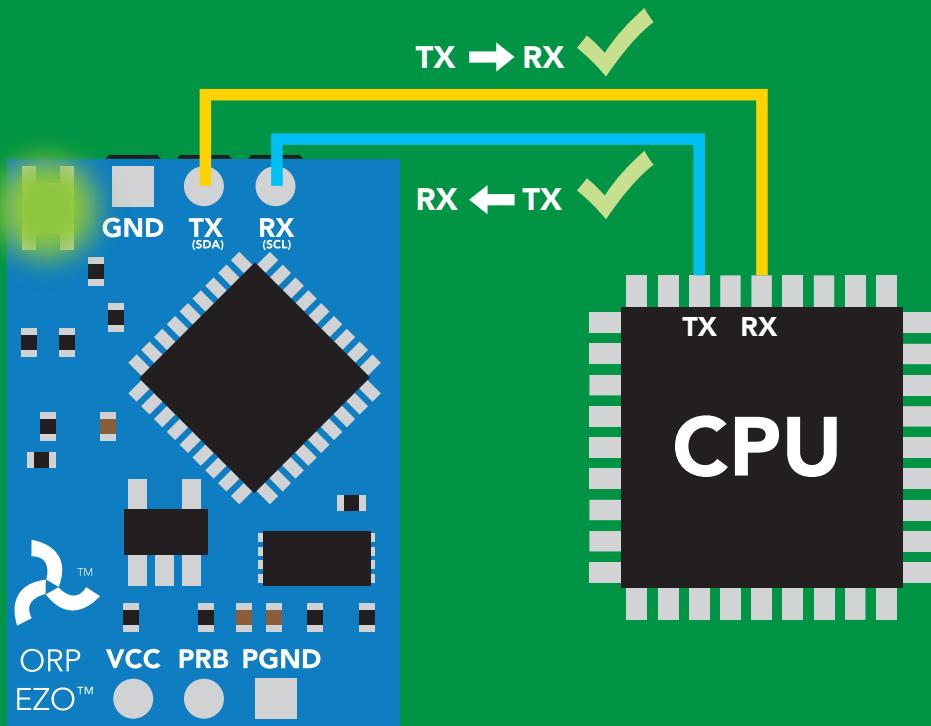


TX Data out



Vcc 3.3V – 5.5V

0V VCC 0V



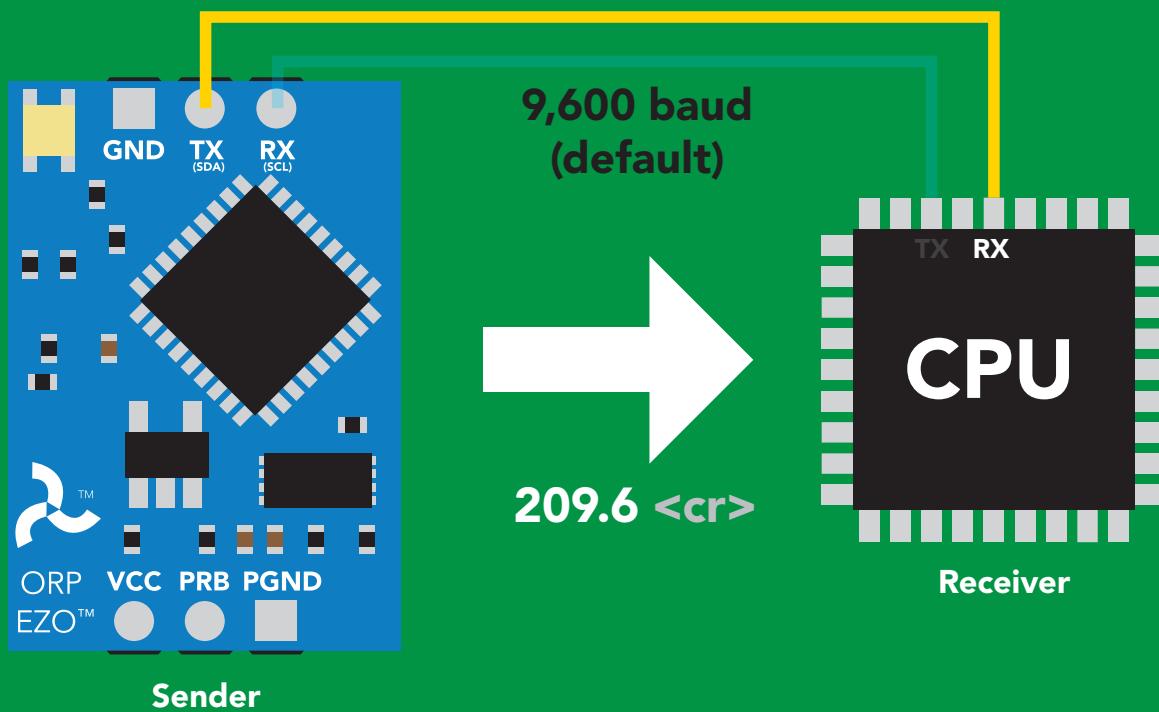
Data format

Reading	ORP
Units	mV
Encoding	ASCII
Format	string
Terminator	carriage return

Data type	floating point
Decimal places	1
Smallest string	2 characters
Largest string	40 characters

Receiving data from device

2 parts



Advanced

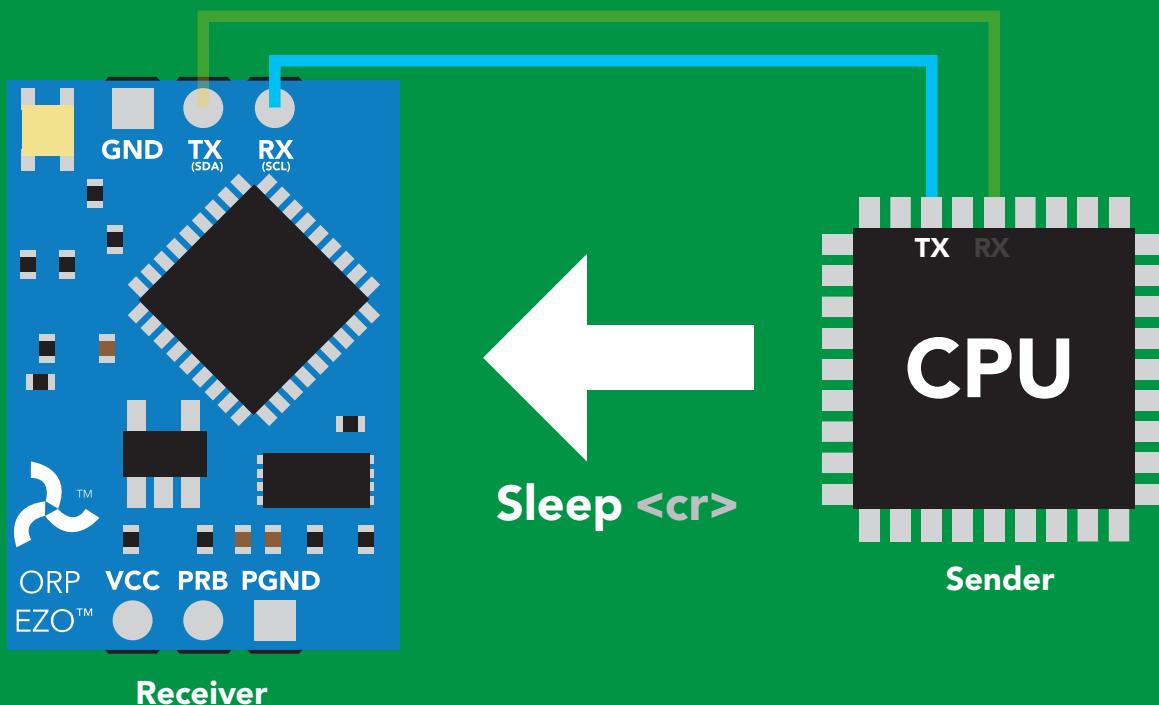
ASCII: 2 0 9 . 6 <cr>

Hex: 32 30 39 2E 36 0D

Dec: 50 48 57 46 54 13

Sending commands to device

2 parts



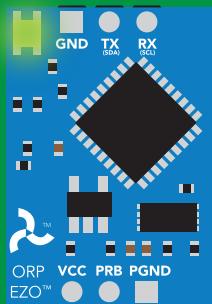
Advanced

ASCII: S I e e p <cr>

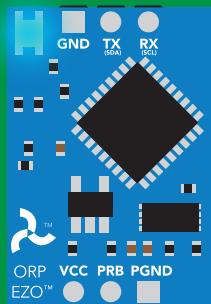
Hex: 53 6C 65 65 70 0D

Dec: 83 108 101 101 112 13

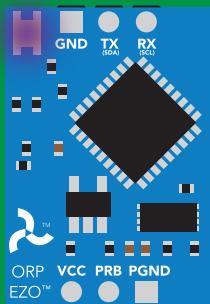
LED color definition



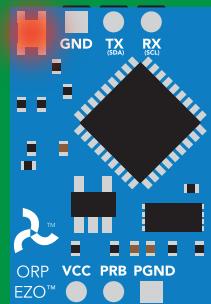
Green
UART standby



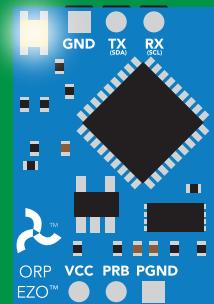
Cyan
Taking reading



Purple
Changing baud rate



Red
Command not understood



White
Find

5V	LED ON +2.2 mA
3.3V	+0.6 mA

UART mode

command quick reference

All commands are ASCII strings or single ASCII characters.

Command	Function	Default state
Baud	change baud rate	pg. 34 9,600
C	enable/disable continuous reading	pg. 24 enabled
Cal	performs calibration	pg. 26 n/a
Export	export calibration	pg. 27 n/a
Factory	enable factory reset	pg. 36 n/a
Find	finds device with blinking white LED	pg. 23 n/a
i	device information	pg. 30 n/a
I2C	change to I ² C mode	pg. 37 not set
Import	import calibration	pg. 28 n/a
L	enable/disable LED	pg. 22 enabled
Name	set/show name of device	pg. 29 not set
Plock	enable/disable protocol lock	pg. 35 disabled
R	returns a single reading	pg. 25 n/a
Sleep	enter sleep mode/low power	pg. 33 n/a
Status	retrieve status information	pg. 32 n/a
*OK	enable/disable response codes	pg. 31 enable

LED control

Command syntax

L,1 <cr> LED on **default**

L,0 <cr> LED off

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

Example

L,1 <cr>

*OK <cr>

L,0 <cr>

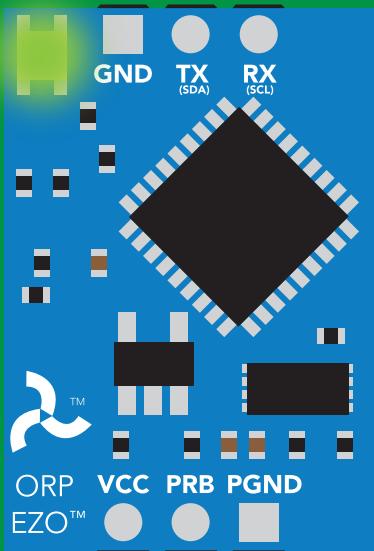
*OK <cr>

L,? <cr>

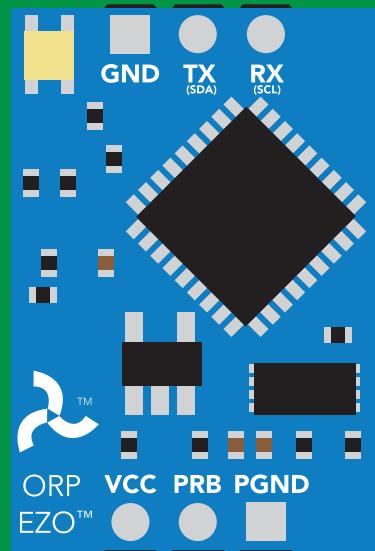
?L,1 <cr> or ?L,0 <cr>

*OK <cr>

L,1



L,0



Find

Command syntax

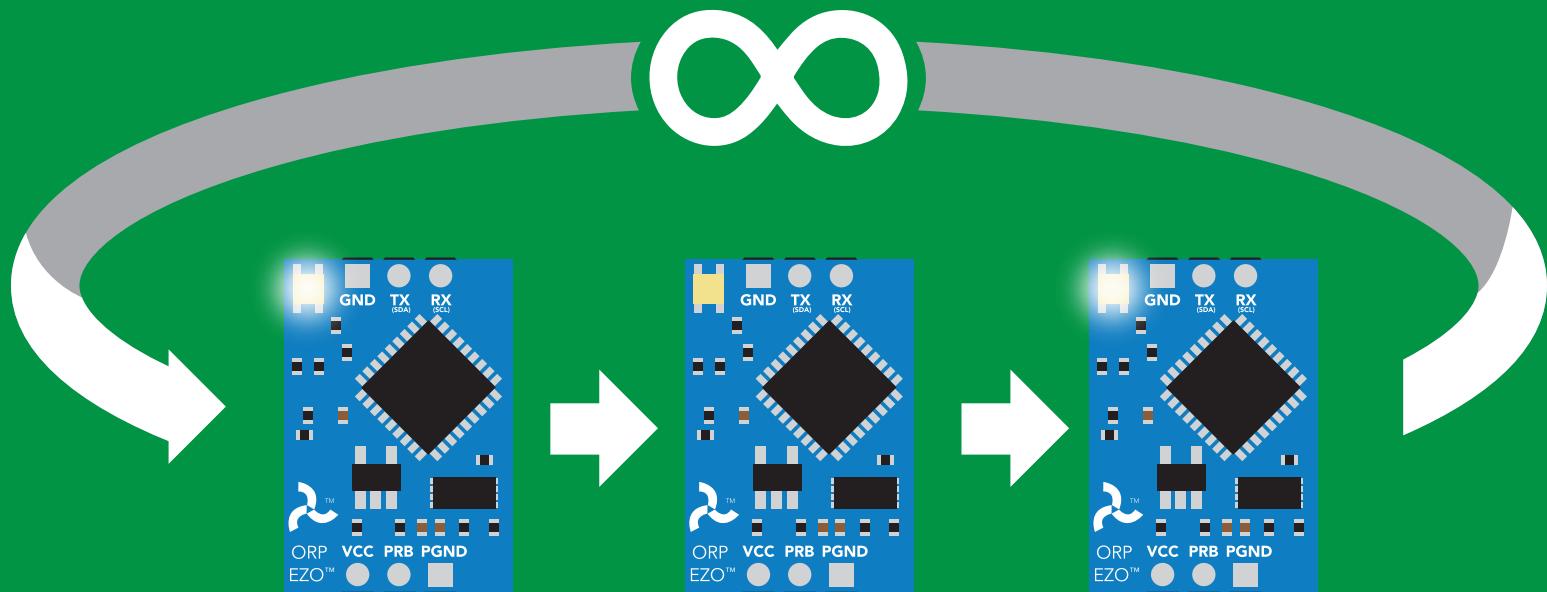
This command will disable continuous mode
Send any character or command to terminate find.

Find <cr> LED rapidly blinks white, used to help find device

Example Response

Find <cr>

*OK <cr>



Continuous reading mode

Command syntax

- C,1 <cr> enable continuous readings once per second **default**
- C,n <cr> continuous readings every n seconds (n = 2 to 99 sec)
- C,0 <cr> disable continuous readings
- C,? <cr> continuous reading mode on/off?

Example Response

C,1 <cr>

*OK <cr>
ORP (1 sec) <cr>
ORP (2 sec) <cr>
ORP (n sec) <cr>

C,30 <cr>

*OK <cr>
ORP (30 sec) <cr>
ORP (60 sec) <cr>
ORP (90 sec) <cr>

C,0 <cr>

*OK <cr>

C,? <cr>

?C,1 <cr> or ?C,0 <cr> or ?C,30 <cr>
*OK <cr>

Single reading mode

Command syntax

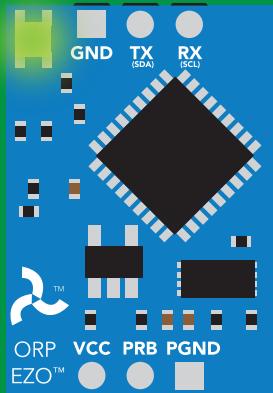
R <cr> takes single reading

Example Response

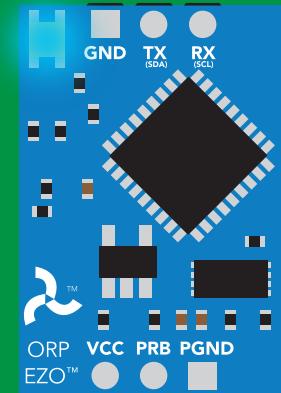
R <cr>

209.6 <cr>

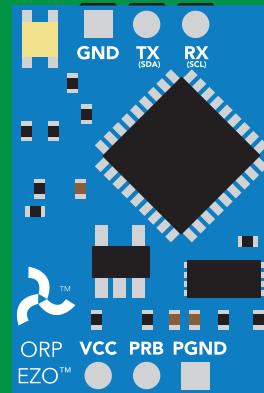
*OK <cr>



Green
Standby



Cyan
Taking reading



Transmitting



Calibration

Command syntax

The EZO™ ORP circuit can be calibrated to any known ORP value

- Cal,n <cr>** calibrates the ORP circuit to a set value
- Cal,clear <cr>** delete calibration data
- Cal,? <cr>** device calibrated?

Example

Cal,225 <cr>

*OK <cr>

Cal,clear <cr>

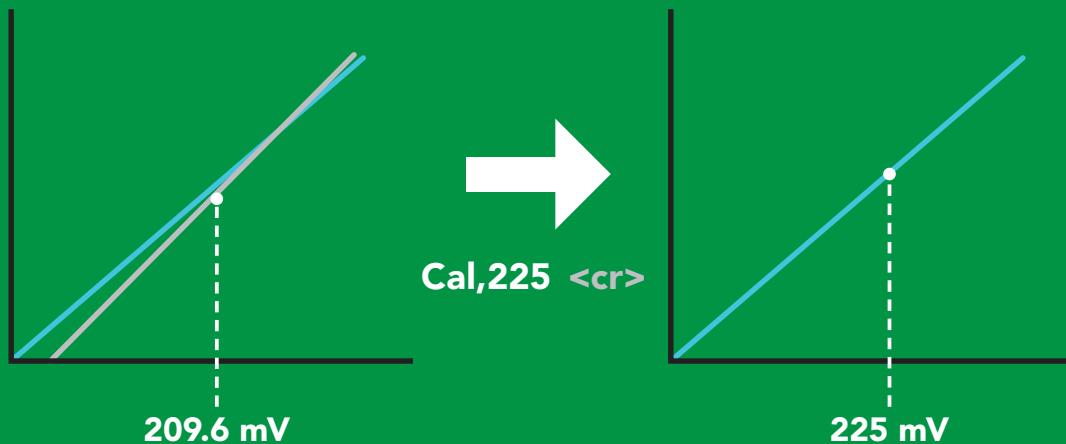
*OK <cr>

Cal,? <cr>

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

*OK <cr>

Response



Export calibration

Command syntax

Export: Use this command to download calibration settings

Export,? <cr> calibration string info

Export <cr> export calibration string from calibrated device

Example

Export,? <cr>

Response

10,120 <cr>

Response breakdown

10, 120

of strings to export

of bytes to export

Export strings can be up to 12 characters long,
and is always followed by <cr>

Export <cr>

59 6F 75 20 61 72 <cr> (1 of 10)

Export <cr>

65 20 61 20 63 6F <cr> (2 of 10)

(7 more)

⋮

Export <cr>

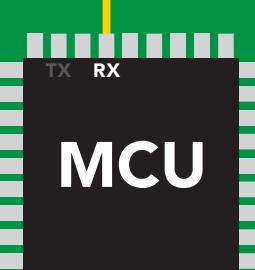
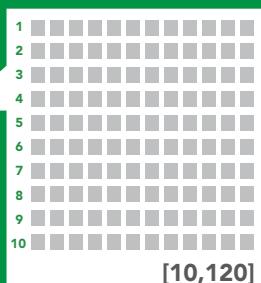
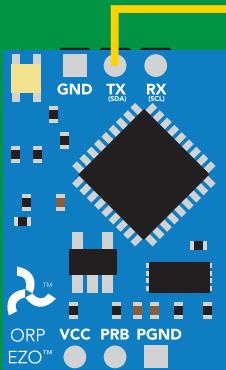
6F 6C 20 67 75 79 <cr> (10 of 10)

Export <cr>

*DONE

Disabling *OK simplifies this process

Export <cr>



*DONE

Import calibration

Command syntax

Import: Use this command to upload calibration settings to one or more devices.

Import,n <cr> import calibration string to new device

Example

Import, 59 6F 75 20 61 72 <cr> (1 of 10)

Import, 65 20 61 20 63 6F <cr> (2 of 10)

⋮

Import, 6F 6C 20 67 75 79 <cr> (10 of 10)

Response

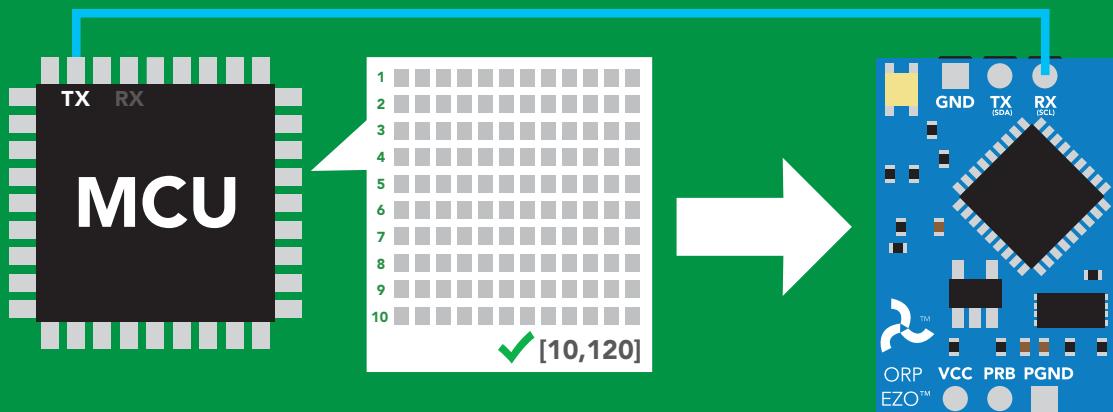
*OK <cr>

*OK <cr>

⋮

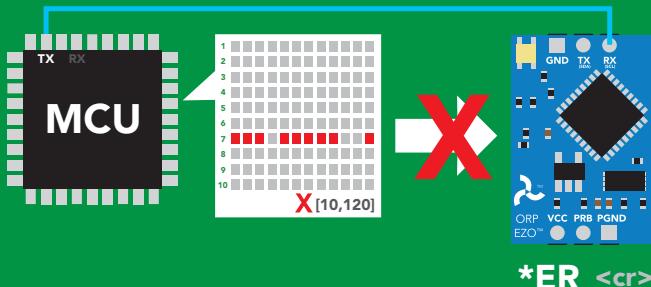
*OK <cr>

Import,n <cr>



*OK <cr>

system will reboot



* If one of the imported strings is not correctly entered, the device will not accept the import, respond with *ER and reboot.

Naming device

Command syntax

Name,n <cr> set name

n = 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Name,? <cr> show name

Do not use spaces in the name

Up to 16 ASCII characters

Example

Name,zzt <cr>

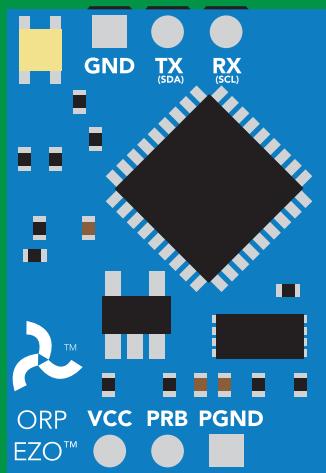
*OK <cr>

Name,? <cr>

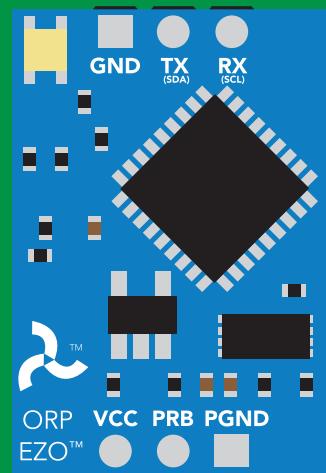
?Name,zzt <cr>

*OK <cr>

Name,zzt



Name,?



*OK <cr>

Name,zzt <cr>
*OK <cr>

Device information

Command syntax

i <cr> device information

Example Response

i <cr>

**?i,ORP,1.97 <cr>
*OK <cr>**

Response breakdown

?i, ORP, 1.97

↑ ↑
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>

209.6 <cr>

***OK <cr>**

*OK,0 <cr>

no response, *OK disabled

R <cr>

209.6 <cr> *OK disabled

*OK,? <cr>

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

Other response codes

*ER unknown command
*OV over volt (VCC>=5.5V)
*UV under volt (VCC<=3.1V)
*RS reset
*RE boot up complete, ready
*SL entering sleep mode
*WA wake up

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, P, 5.038
↑ ↑
Reason for restart Voltage at Vcc

Restart codes

P	powered off
S	software reset
B	brown out
W	watchdog
U	unknown

Sleep mode/low power

Command syntax

Send any character or command to awaken device.

Sleep <cr> enter sleep mode/low power

Example

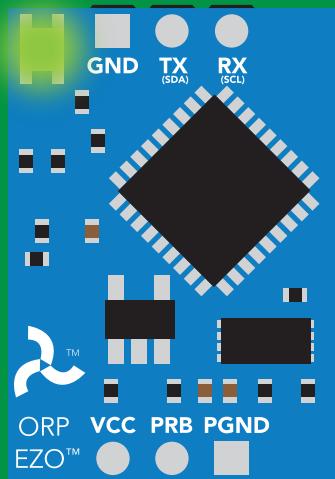
Sleep <cr>

*OK <cr>
*SL <cr>

Any command

*WA <cr> wakes up device

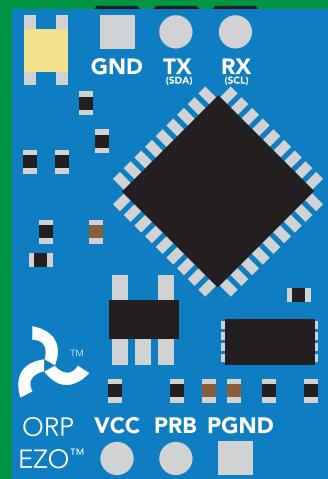
	STANDBY	SLEEP
5V	16 mA	1.16 mA
3.3V	13.9 mA	0.995 mA



**Standby
16 mA**



Sleep <cr>



**Sleep
1.16 mA**

Change baud rate

Command syntax

Baud,n <cr> change baud rate

Example

Baud,38400 <cr>

Response

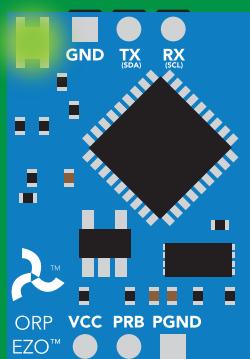
*OK <cr>

Baud,? <cr>

?Baud,38400 <cr>

*OK <cr>

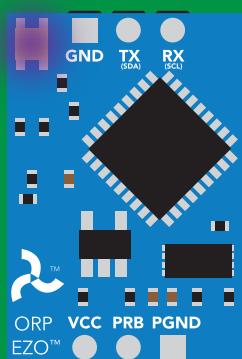
n = [300
1200
2400
9600 default
19200
38400
57600
115200]



Standby



Baud,38400 <cr>

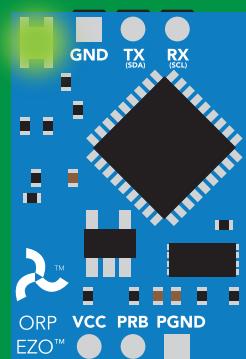


Changing
baud rate

*OK <cr>



(reboot)



Standby

Protocol lock

Command syntax

Locks device to UART mode.

Plock,1 <cr> enable Plock

Plock,0 <cr> disable Plock **default**

Plock,? <cr> Plock on/off?

Example

Plock,1 <cr>

*OK <cr>

Plock,0 <cr>

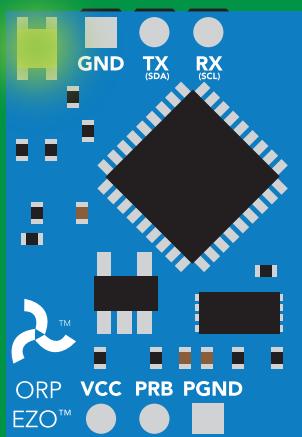
*OK <cr>

Plock,? <cr>

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

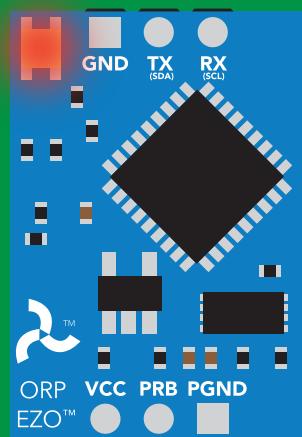
Response

Plock,1



*OK <cr>

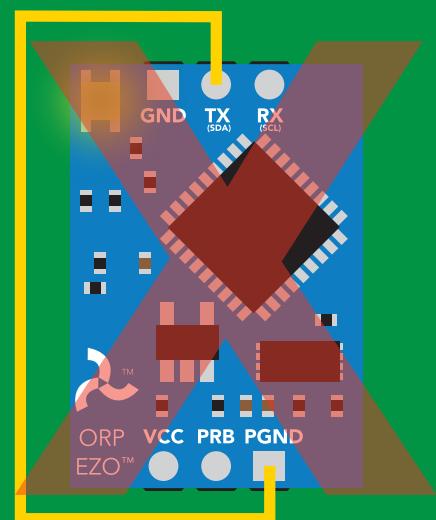
I2C,100



cannot change to I²C

*ER <cr>

Short



cannot change to I²C

Factory reset

Command syntax

Clears calibration
LED on
"*OK" enabled

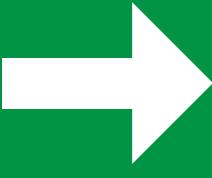
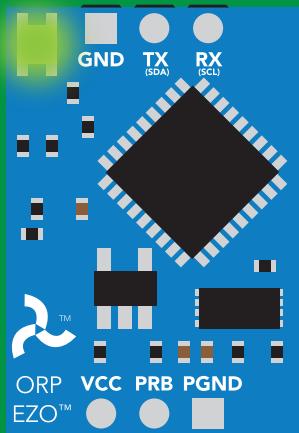
Factory <cr> enable factory reset

Example Response

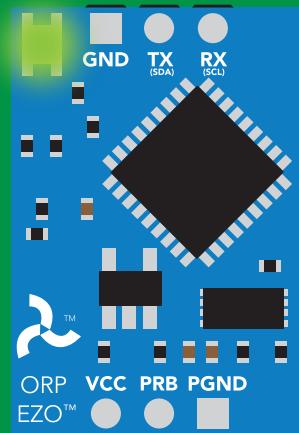
Factory <cr>

*OK <cr>

Factory <cr>



(reboot)



*OK <cr>

*RS <cr>

*RE <cr>

Baud rate will not change

Change to I²C mode

Command syntax

Default I²C address 98 (0x62)

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

n = any number 1 – 127

Example Response

I²C,100 <cr>

*OK (reboot in I²C mode)

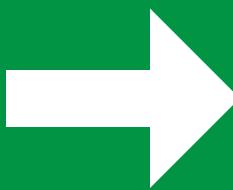
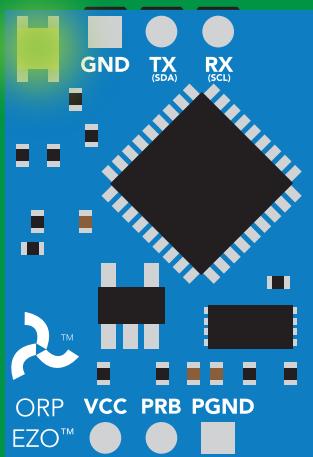
Wrong example

I²C,139 <cr> n ≠ 127

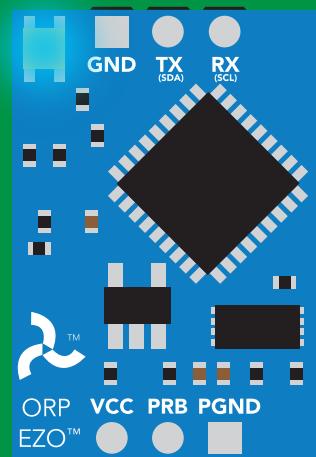
Response

*ER <cr>

I²C,100



(reboot)



Green
*OK <cr>

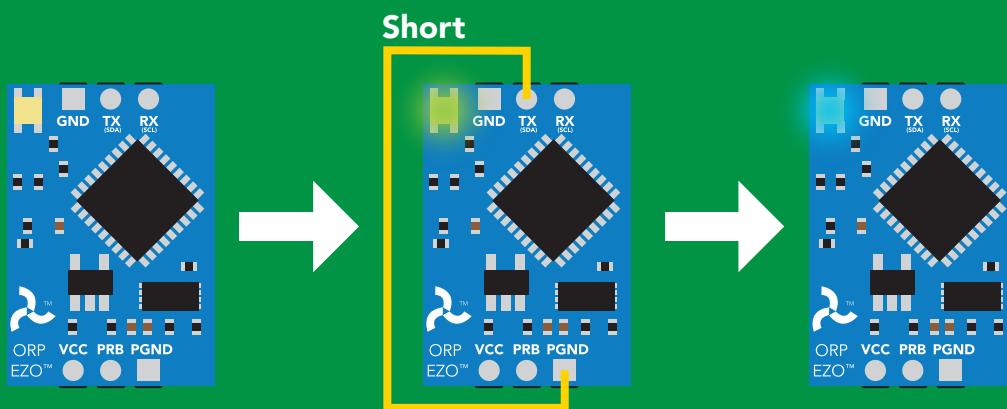
Blue
now in I²C mode

Manual switching to I²C

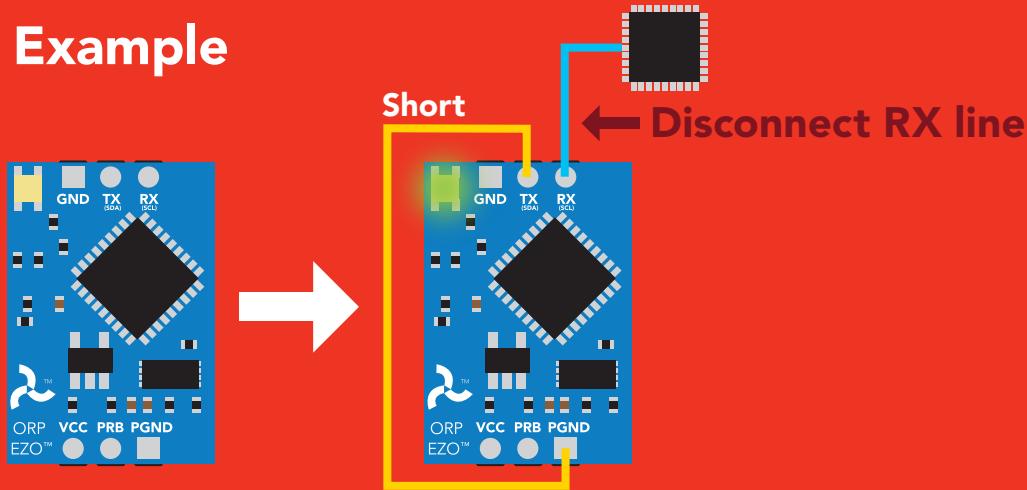
- Disconnect ground (power off)
- Disconnect TX and RX
- Connect TX to PGND
- Confirm RX is disconnected
- Connect ground (power on)
- Wait for LED to change from Green to Blue
- Disconnect ground (power off)
- Reconnect all data and power

Manually switching to I²C will set the I²C address to 98 (0x62)

Example



Wrong Example



I²C mode

The I²C 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™ device into I²C mode [click here](#)

Settings that are retained if power is cut

Calibration
Change I²C address
Hardware switch to UART mode
LED control
Protocol lock
Software switch to UART mode

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

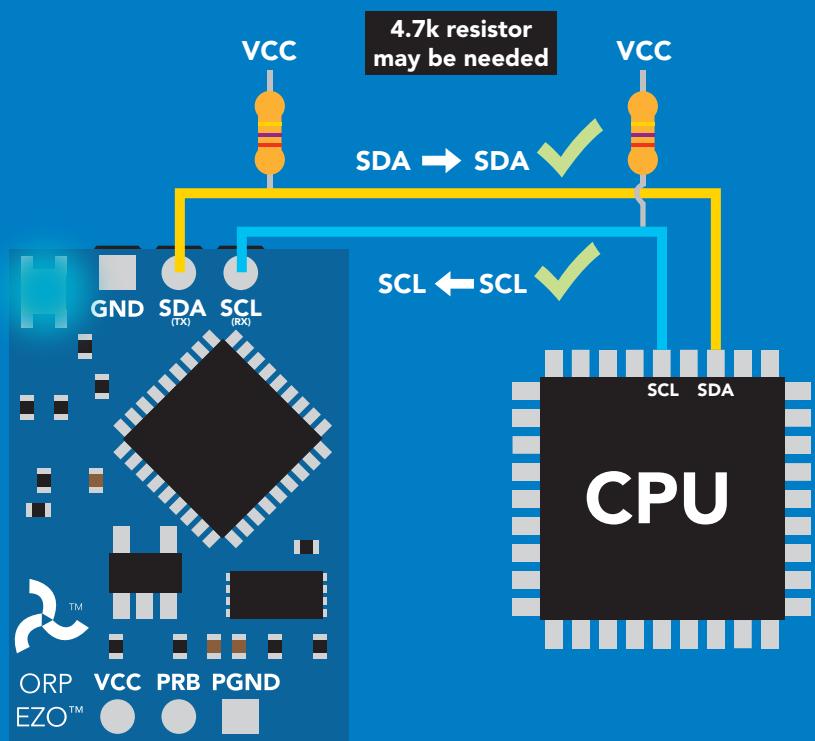
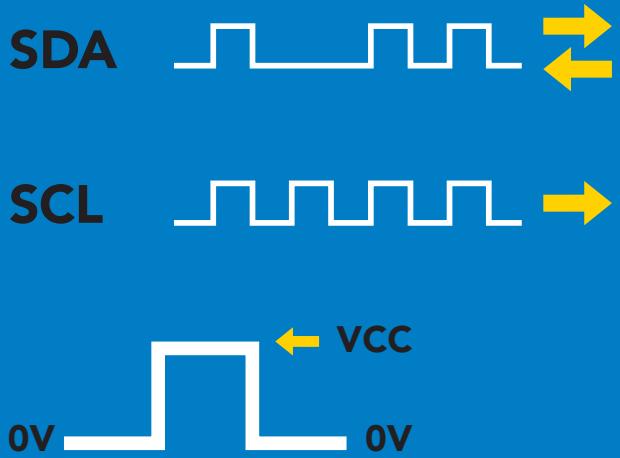
Find
Sleep mode

I²C mode

I²C address (0x01 – 0x7F)
98 (0x62) default

V_{cc} 3.3V – 5.5V

Clock speed 100 – 400 kHz



Data format

Reading ORP
Units mV
Encoding ASCII
Format string

Data type floating point
Decimal places 1
Smallest string 2 characters
Largest string 40 characters

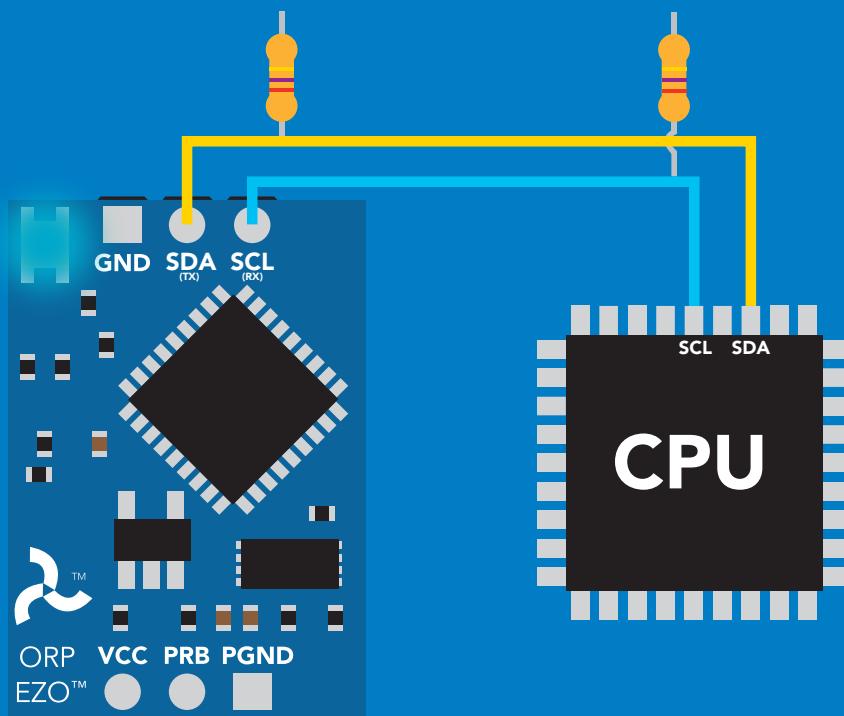
Sending commands to device

5 parts

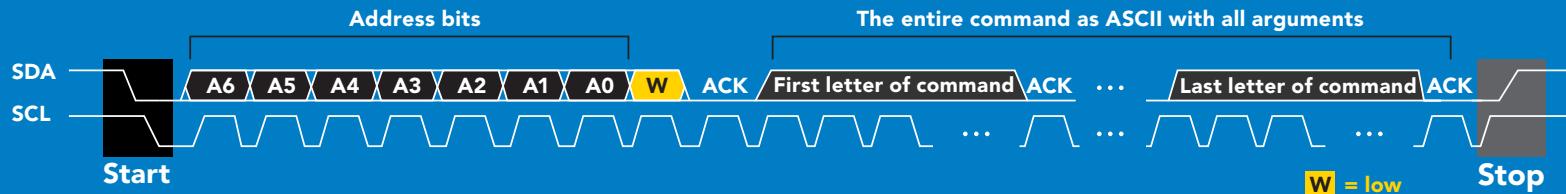


Example

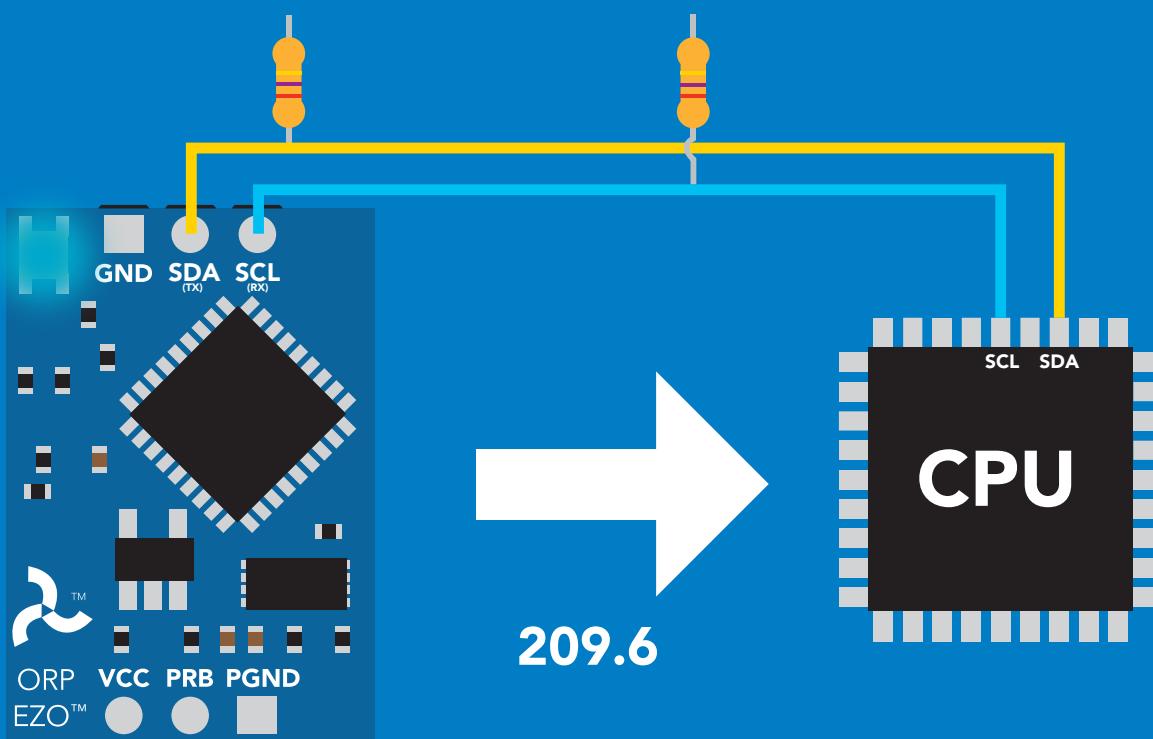
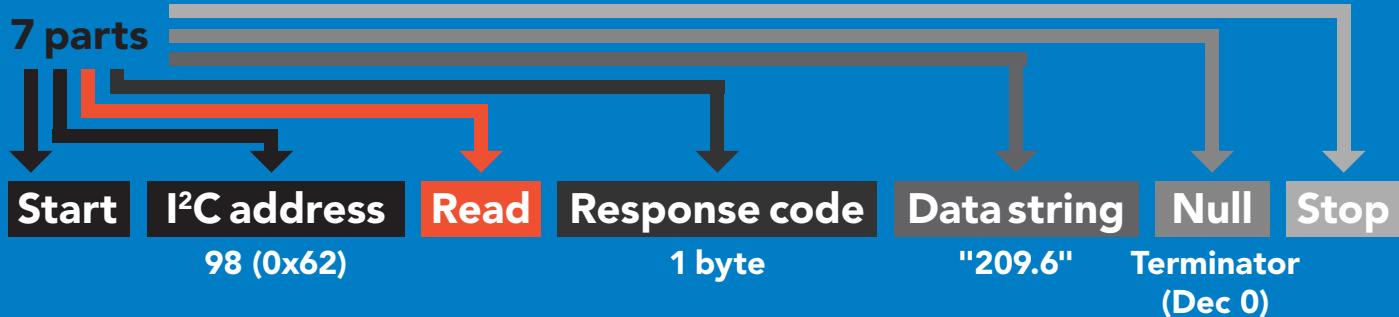
Start 98 (0x62) Write Sleep Stop
I²C address Command



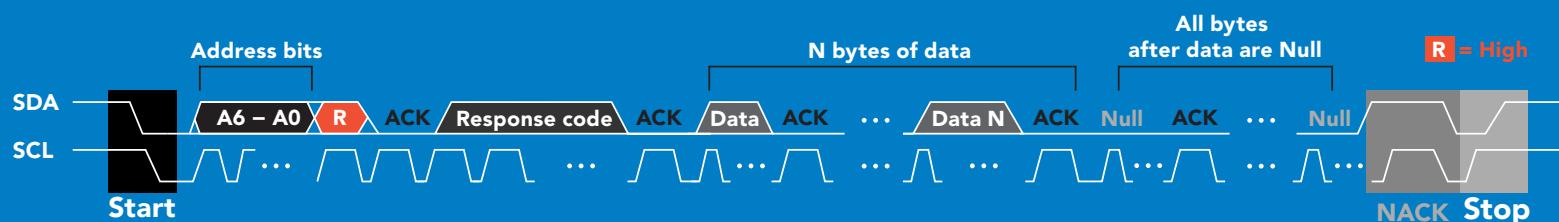
Advanced



Requesting data from device



Advanced



1 50 48 57 46 54 0 = 209.6

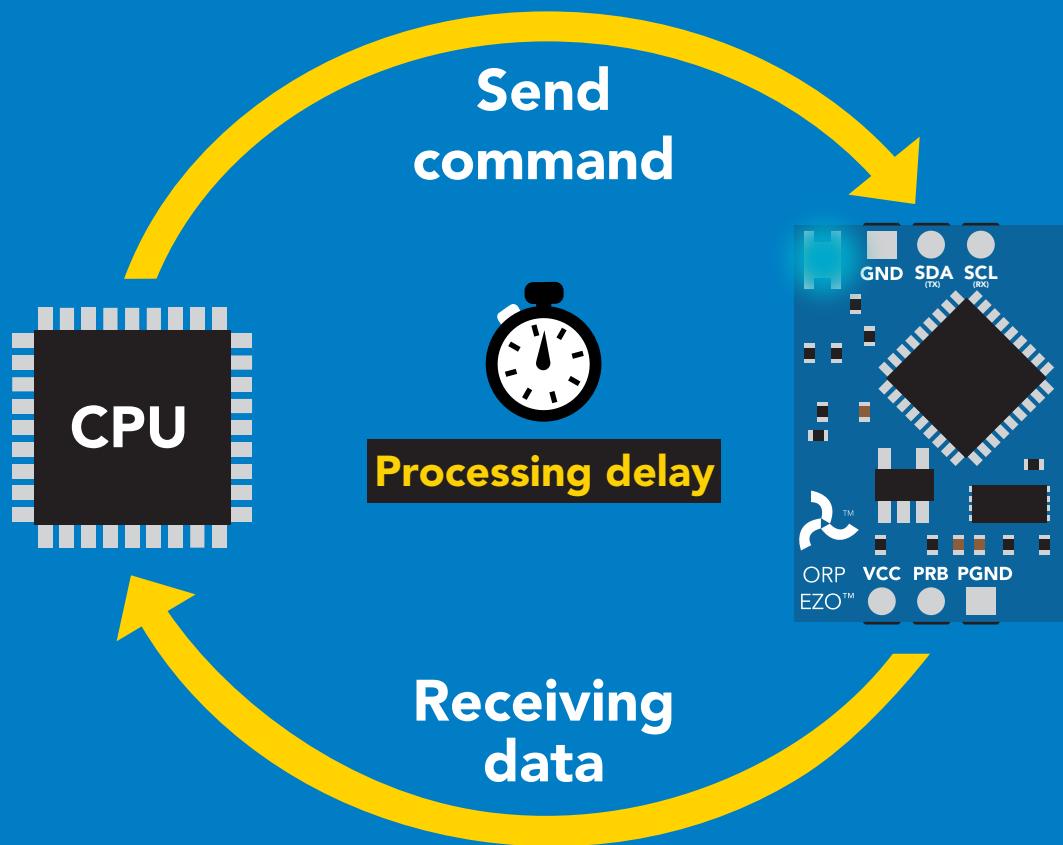
Dec Dec

ASCII

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); →  Processing delay
```

```
I2C_start;  
I2C_address;  
Char[ ] = I2C_read;  
I2C_stop;
```

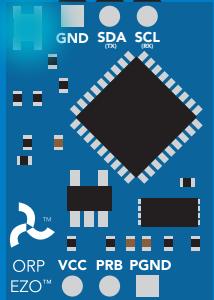
If there is no processing delay or the processing delay is too short, the response code will always be 254.

Response codes

Single byte, not string

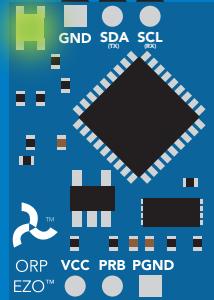
- | | |
|-----|-----------------------------|
| 255 | no data to send |
| 254 | still processing, not ready |
| 2 | syntax error |
| 1 | successful request |

LED color definition



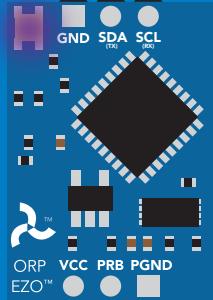
Blue

I²C standby



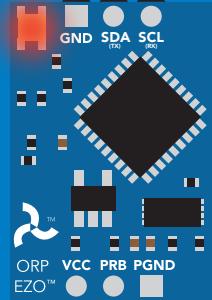
Green

Taking reading



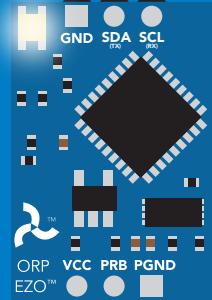
Purple

Changing I²C address



Red

Command not understood



White

Find

5V	LED ON +2.2 mA
3.3V	+0.6 mA

I²C mode

command quick reference

All commands are ASCII strings or single ASCII characters.

Command	Function	
Baud	switch back to UART mode	pg. 59
Cal	performs calibration	pg. 49
Export	export calibration	pg. 50
Factory	enable factory reset	pg. 58
Find	finds device with blinking white LED	pg. 47
i	device information	pg. 53
I2C	change I ² C address	pg. 57
Import	import calibration	pg. 51
L	enable/disable LED	pg. 46
Name	set/show name of device	pg. 52
Plock	enable/disable protocol lock	pg. 56
R	returns a single reading	pg. 48
Sleep	enter sleep mode/low power	pg. 55
Status	retrieve status information	pg. 54

LED control

Command syntax

300ms  processing delay

L,1 LED on **default**

L,0 LED off

L,? LED state on/off?

Example

L,1


Wait 300ms

1
Dec
0
Null

L,0


Wait 300ms

1
Dec
0
Null

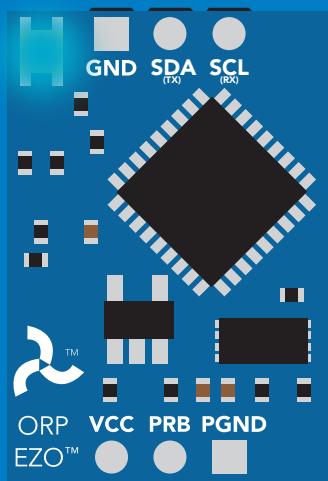
L,?


Wait 300ms

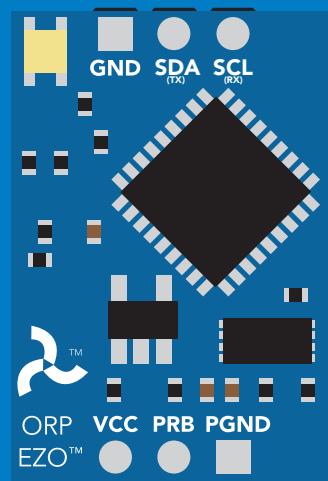
1
Dec
?L,1
ASCII
0
Null

or

1
Dec
?L,0
ASCII
0
Null



L,1



L,0

Find

300ms  processing delay

Command syntax

This command will disable continuous mode
Send any character or command to terminate find.

Find LED rapidly blinks white, used to help find device

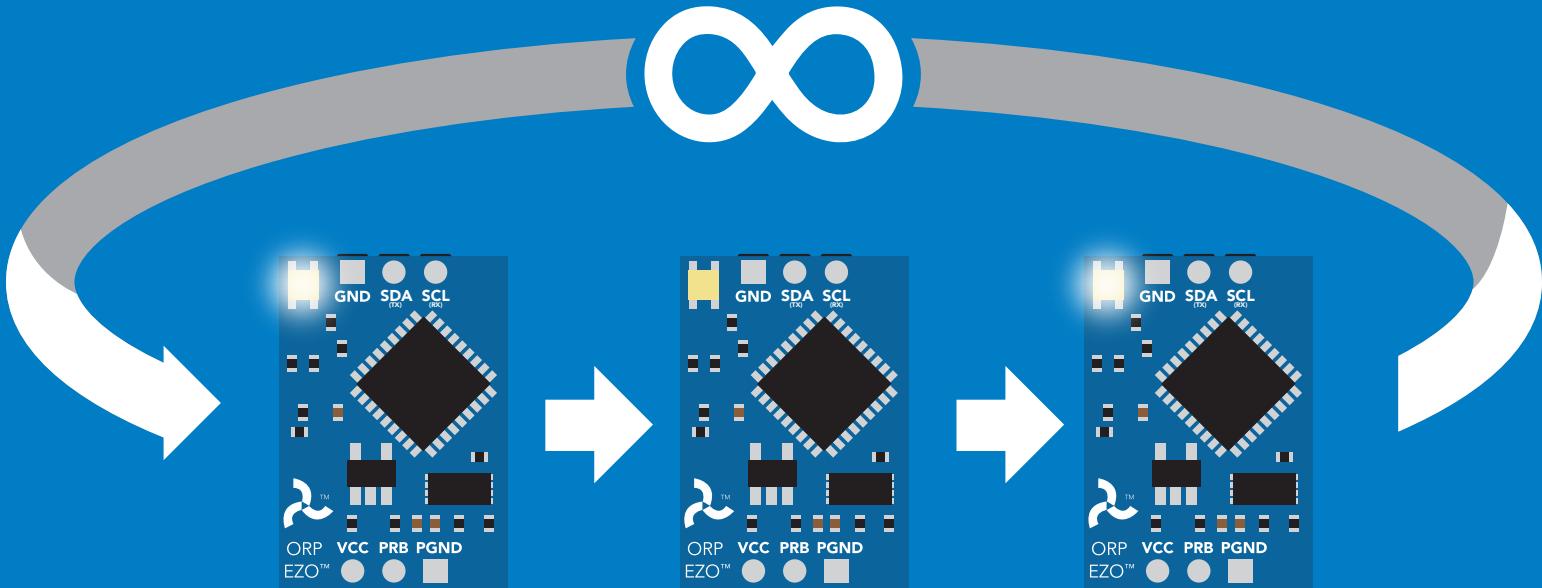
Example

Response

Find


Wait 300ms

1
Dec
Null



Taking reading

Command syntax

900ms  processing delay

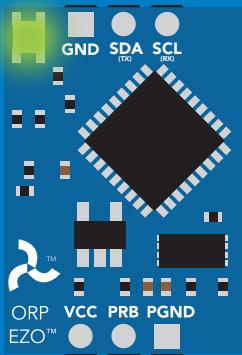
R return 1 reading

Example Response

R

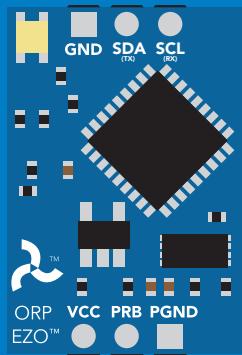

Wait 900ms

1 Dec 209.6 ASCII 0 Null

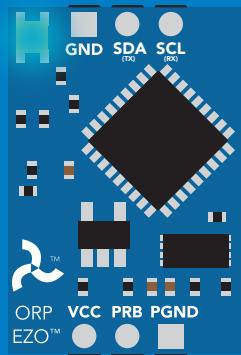


Green

Taking reading



Transmitting



Blue

Standby

Calibration

Command syntax

900ms  processing delay

Cal,n calibrates the ORP circuit to a set value

Cal,clear delete calibration data

Cal,? device calibrated?

The EZO™ ORP circuit can be calibrated to any known ORP value

Example

Response

Cal,225

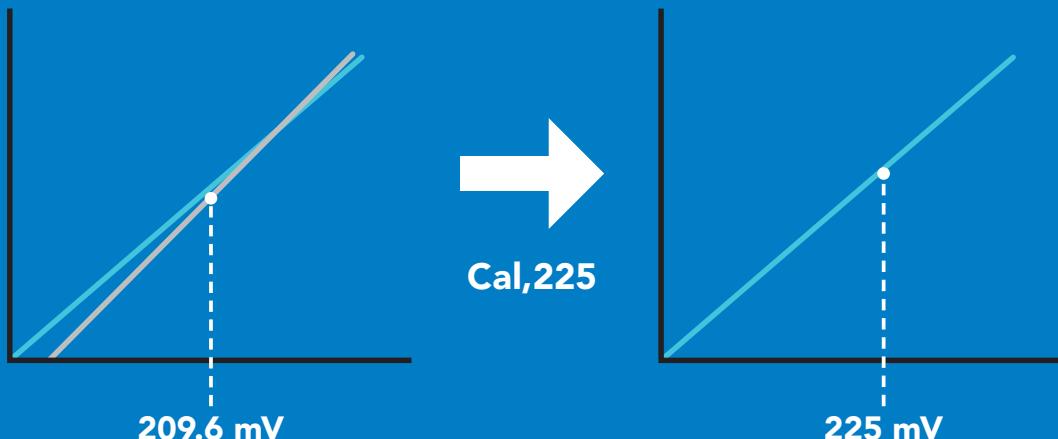
 Wait 900ms
1 Dec 0 Null

Cal,clear

 Wait 300ms
1 Dec 0 Null

Cal,?

 Wait 300ms
1 Dec ?Cal,0 0 or 1 Dec ?Cal,1 0 ASCII Null Null



Export calibration

300ms  processing delay

Command syntax

Export: Use this command to download calibration settings

Export,? calibration string info

Export export calibration string from calibrated device

Example

(optional)

Export,?

Response



Wait 300ms

1 Dec 10,120 ASCII 0 Null

Response breakdown

10, 120
↑ ↑
of strings to export # of bytes to export

Export strings can be up to 12 characters long

Export



Wait 300ms

1 Dec 59 6F 75 20 61 72 0 Null

(1 of 10)

Export



Wait 300ms

1 Dec 65 20 61 20 63 6F 0 Null

(2 of 10)

(7 more)



Export



Wait 300ms

1 Dec 6F 6C 20 67 75 79 0 Null

(10 of 10)

Export



Wait 300ms

1 Dec *DONE 0 Null

Import calibration

300ms  processing delay

Command syntax

Import: Use this command to upload calibration settings to one or more devices.

Import,n import calibration string to new device

Example

Import, 59 6F 75 20 61 72 (1 of 10)

Import, 65 20 61 20 63 6F (2 of 10)

⋮

Import, 6F 6C 20 67 75 79 (10 of 10)

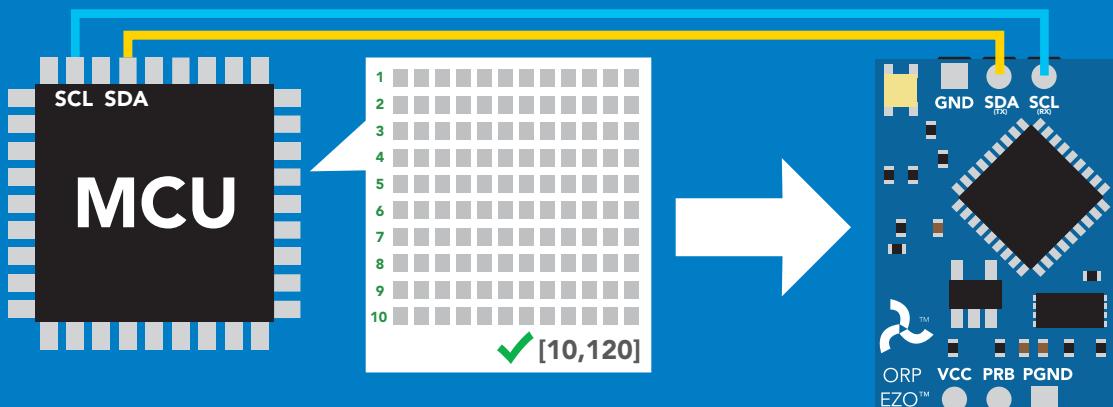
Response

 1 0 Null
Wait 300ms

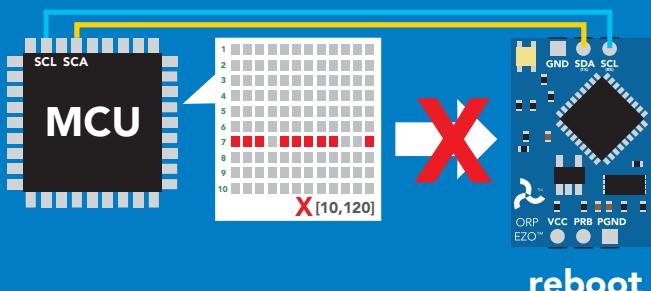
 1 0 Null
Wait 300ms

⋮
 1 0 Null
Wait 300ms

Import,n



system will reboot



* If one of the imported strings is not correctly entered, the device will not accept the import and reboot.

Naming device

300ms  processing delay

Command syntax

Do not use spaces in the name

Name,n set name n =

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Name,? show name

Up to 16 ASCII characters

Example

Name,zzt

 Wait 300ms

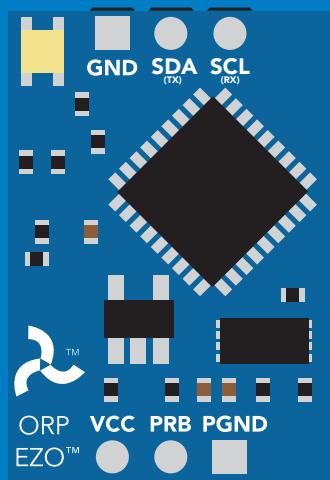
1 Dec 0 Null

 Wait 300ms

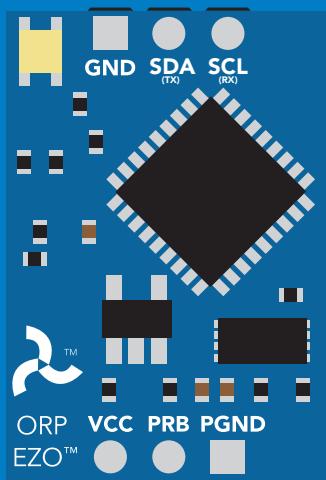
1 Dec ?Name,zzt 0 Null

Response

Name,zzt



Name,?



1 0

1 ?Name,zzt 0

Device information

Command syntax

300ms  processing delay

i device information

Example Response

i



Wait 300ms

1
Dec

?i,ORP,19.7
ASCII

0
Null

Response breakdown

?i, ORP, 1.97
↑ ↑
Device Firmware

Reading device status

Command syntax

300ms  processing delay

Status voltage at Vcc pin and reason for last restart

Example Response

Status



Wait 300ms

1

?Status,P,5.038

Dec

ASCII

0

Null

Response breakdown

?Status, P, 5.038

Reason for restart

Voltage at Vcc

Restart codes

P	powered off
S	software reset
B	brown out
W	watchdog
U	unknown

Sleep mode/low power

Command syntax

Sleep enter sleep mode/low power

Send any character or command to awaken device.

Example

Response

Sleep

no response

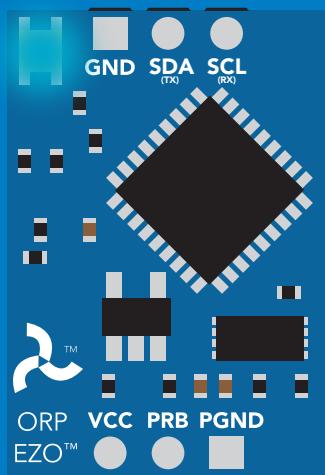
Do not read status byte after issuing sleep command.

Any command

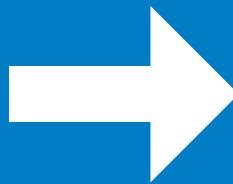
wakes up device

	STANDBY	SLEEP
5V	16 mA	1.16 mA

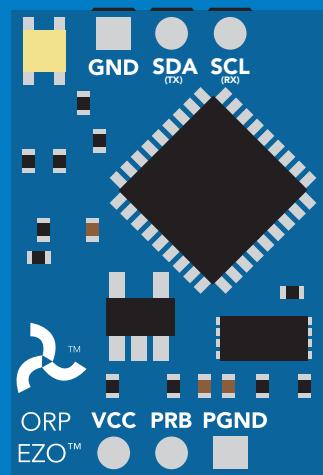
3.3V	13.9 mA	0.995 mA
-------------	----------------	-----------------



Standby



Sleep



Sleep

Protocol lock

Command syntax

300ms  processing delay

Plock,1 enable Plock

Locks device to I²C mode.

Plock,0 disable Plock

default

Plock,? Plock on/off?

Example

Plock,1

 Wait 300ms

1
Dec
0
Null

Plock,0

 Wait 300ms

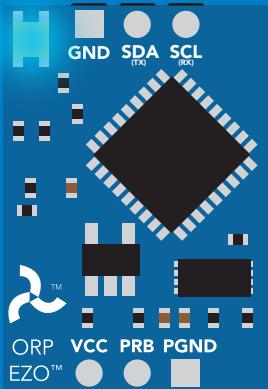
1
Dec
0
Null

Plock,?

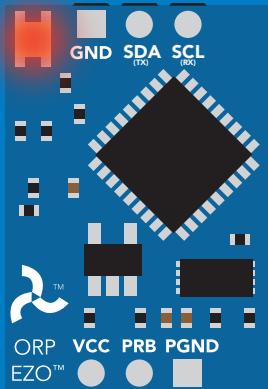
 Wait 300ms

1
Dec
?Plock,1
ASCII
0
Null

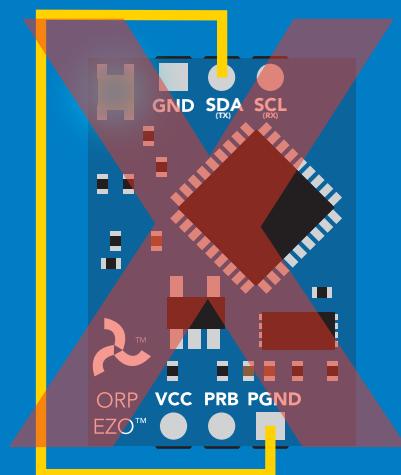
Plock,1



Baud, 9600



cannot change to UART



cannot change to UART

I²C address change

Command syntax

300ms  processing delay

I²C,n sets I²C address and reboots into I²C mode

Example Response

I²C,100

device reboot

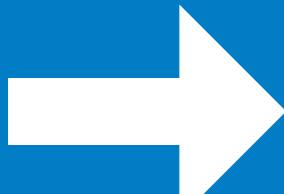
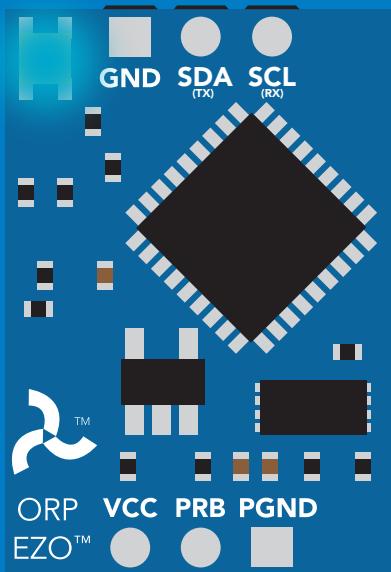
Warning!

Changing the I²C address will prevent communication between the circuit and the CPU until the CPU is updated with the new I²C address.

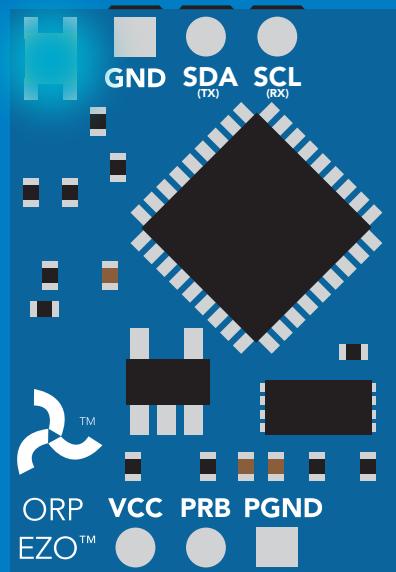
Default I²C address is 98 (0x62).

n = any number 1 – 127

I²C,100



(reboot)



Factory reset

Command syntax

Factory reset will not take the device out of I²C mode.

Factory enable factory reset

I²C address will not change

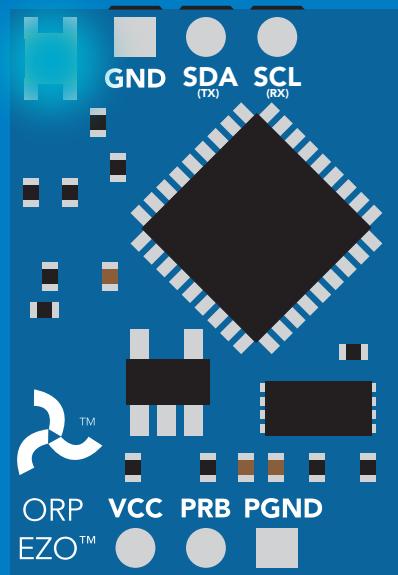
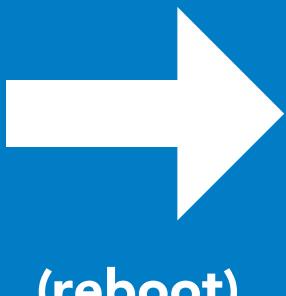
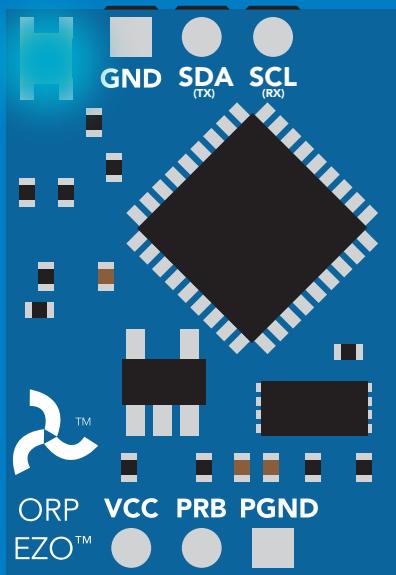
Example Response

Factory

device reboot

Clears calibration
LED on
Response codes enabled

Factory



Change to UART mode

Command syntax

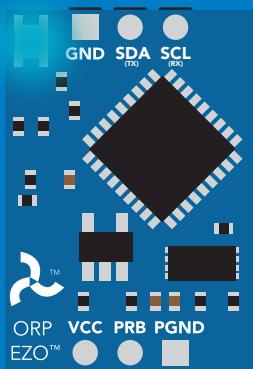
Baud,n switch from I²C to UART

Example Response

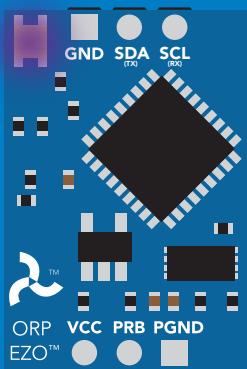
Baud,9600

reboot in UART mode

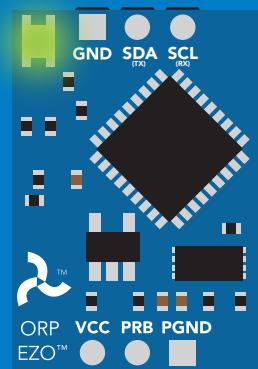
n = [300
1200
2400
9600
19200
38400
57600
115200]



→
Baud,9600



→
(reboot)

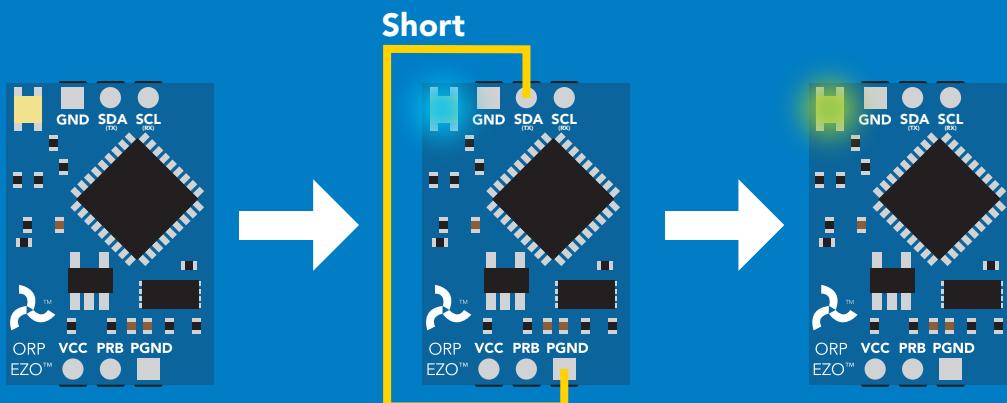


Changing to
UART mode

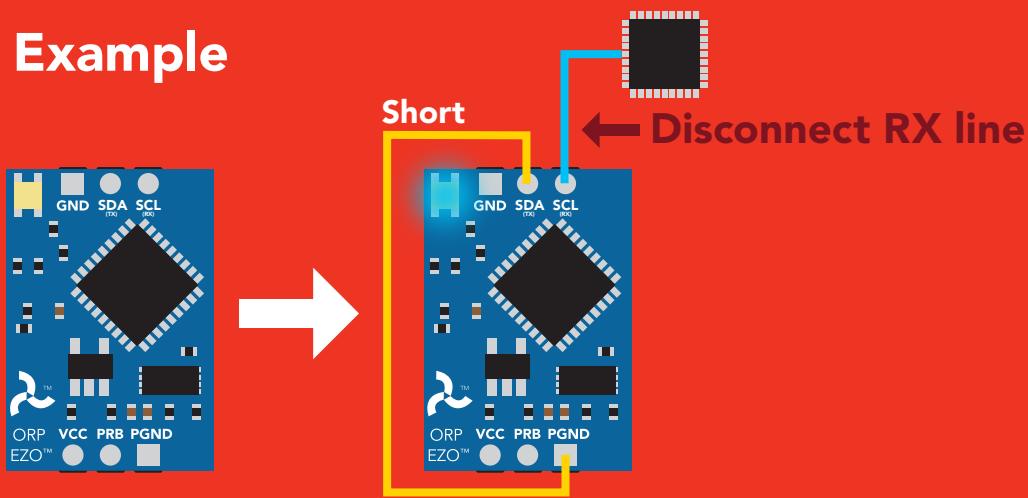
Manual switching to UART

- Disconnect ground (power off)
- Disconnect TX and RX
- Connect TX to PGND
- 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

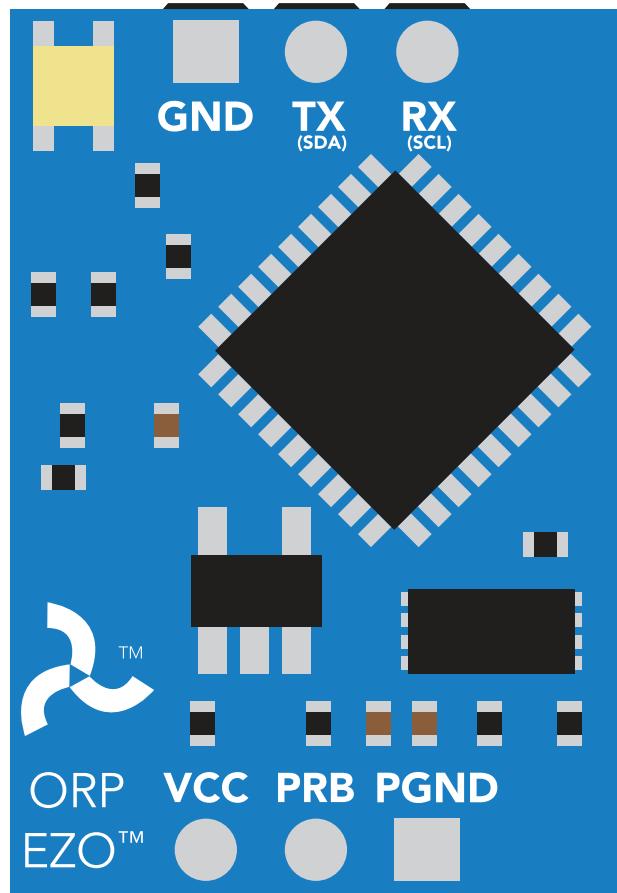
Example



Wrong Example



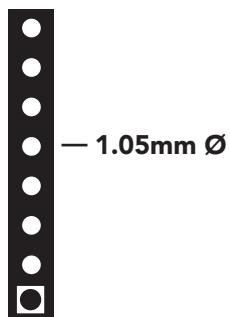
EZO™ circuit footprint



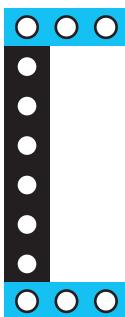
17.78mm
(0.7")

2.54mm
(0.1")

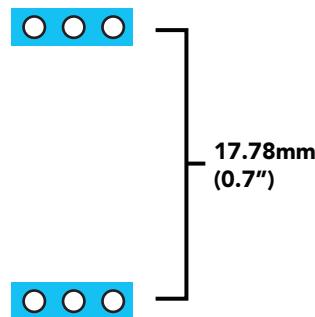
1 In your CAD software place a 8 position header.



2 Place a 3 position header at both top and bottom of the 8 position.



3 Delete the 8 position header. The two 3 position headers are now 17.78mm (0.7") apart from each other.



Datasheet change log

Datasheet V 4.8

Moved Default state to pg 14.

Datasheet V 4.7

Updated firmware to V2.11 on pg 63.

Datasheet V 4.6

Revised response for the sleep command in UART mode on pg 33.

Datasheet V 4.5

Revised calibration theory on page 12, and added more information on the Export calibration and Import calibration commands.

Datasheet V 4.4

Revised isolation schematic on pg. 10

Datasheet V 4.3

Changed "Max rate" to "Response time" on cover page.

Datasheet V 4.2

Removed note from certain commands about firmware version.

Datasheet V 4.1

Added information to calibration theory on pg 8.

Datasheet V 4.0

Revised definition of response codes on pg 42.

Datasheet V 3.9

Revised isolation information on pg 9.

Datasheet V 3.8

Revised Plock pages to show default value.

Datasheet V 3.7

Added new commands:

"Find" pages 23 (UART) & 46 (I²C).

"Export/Import calibration" pages 27 (UART) & 49 (I²C).

Added new feature to continuous mode "C,n" pg 24.

Datasheet V 3.6

Revised circuit illustrations throughout datasheet.

Datasheet V 3.5

Added accuracy range on cover page, and revised isolation info on pg 10.

Datasheet V 3.4

Revised entire datasheet.

Firmware updates

V1.5 – Baud rate change (Nov 6, 2014)

- Change default baud rate to 9600

V1.6 – I²C bug (Dec 1, 2014)

- Fixed I²C bug where the circuit may inappropriately respond when other I²C devices are connected.

V1.7 – Factory (April 14, 2015)

- Changed "X" command to "Factory"

V1.95 – Plock (March 31, 2016)

- Added protocol lock feature "Plock"

V1.96 – EEPROM (April 26, 2016)

- Fixed bug where EEPROM would get erased if the circuit lost power 900ms into startup

V1.97 – EEPROM (Oct 10, 2016)

- Fixed bug in the cal clear command, improves how it calculates the ORP
- Added calibration saving and loading

V2.10 – (May 9, 2017)

- Added "Find" command.
- Added "Export/import" command.
- Modified continuous mode to be able to send readings every "n" seconds.

V2.11 – (July 17, 2017)

- Fixed bug where calibration would restore itself after restart, despite being cleared.

Warranty

Atlas Scientific™ Warranties the EZO™ class ORP circuit to be free of defect during the debugging phase of device implementation, or 30 days after receiving the EZO™ class ORP circuit (which ever comes first).

The debugging phase

The debugging phase as defined by Atlas Scientific™ is the time period when the EZO™ class ORP circuit is inserted into a bread board, or shield. If the EZO™ class ORP circuit is being debugged in a bread board, the bread board must be devoid of other components. If the EZO™ class ORP circuit is being connected to a microcontroller, the microcontroller must be running code that has been designed to drive the EZO™ class ORP circuit exclusively and output the EZO™ class ORP circuit 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™ class ORP circuit warranty:

- **Soldering any part of the EZO™ class ORP circuit.**
- **Running any code, that does not exclusively drive the EZO™ class ORP circuit and output its data in a serial string.**
- **Embedding the EZO™ class ORP circuit 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™ cannot possibly warranty the EZO™ class ORP circuit, against the thousands of possible variables that may cause the EZO™ class ORP circuit 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™ is simply stating that once the device is being used in your application, Atlas Scientific™ can no longer take responsibility for the EZO™ class ORP circuits continued operation. This is because that would be equivalent to Atlas Scientific™ taking responsibility over the correct operation of your entire device.