

# AcSense-Mini-OEM

## User Manual

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## System Overview

The AcSense-Mini-OEM is the OEM version of single-channel hydrophone, IMU, internal pressure/temperature, and RTC recorder for use in underwater sensing application. Based on the AcSense-Digital board, this system provides comes with one or two endcap-integrated hydrophones for collection of acoustic data sampled at up to 100 kHz with 12 bit resolution, as well as an arducam that can sample at up to 20 frames/s (camera resolution automatically adjusts based on sample rate; lower sample rate = higher resolution). Standard features include one HTI-96-MIN broadband hydrophone, internal IMU, and RTC.

Expected battery life is 9 hours with a 9V lithium primary battery, 5 hours with a 9V lithium rechargeable or 9V alkaline battery.

### Input Voltage:

Connector Number	Cable End Description	Voltage (VDC_
J1	USBC	5 V
J22	Molex Microfit 3.0 1x2 M shell F pins	3.7 to 17 V

**Console:** A console cable is provided; see console section below.

**SD Card:** The system is configured via a file called DefaultConfig.cfg on the SD card. We provide a micro SD card with a default configuration, with that same config available in the customer share google drive.

# System Overview

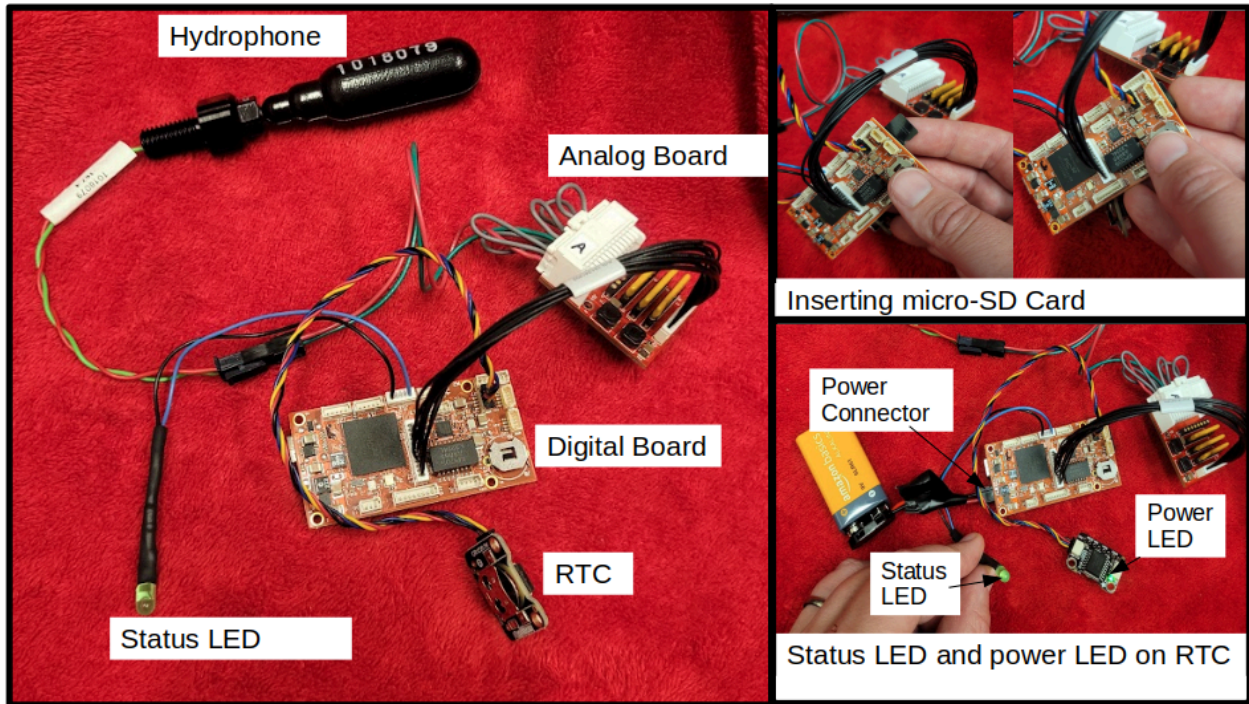


FIG 1: Key components of the AcSense-Mini-OEM with hydrophone recorder

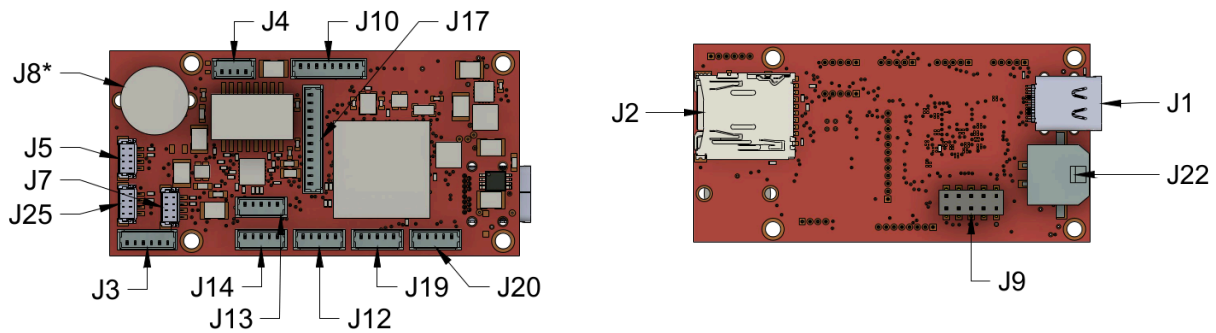


FIG 2: Connector Labels. For this build, important connectors are J17 -> Analog board, J20 -> Console Cable, J12 -> Status LED, J7 -> RTC, J1 (USBC) or J22 can be used to power the system with 5-17 V, Micro SD card slots into J2.

# Typical Use

The typical use of this system includes turning the system on, configuring the system, confirming system state, and data offload. The system on startup will begin logging to an SD card automatically.

## Powering On

To power the system on, power via one of the power connectors:

Connector Number	Cable End Description	Voltage (VDC_
J1	USBC	5 V
J22	Molex Microfit 3.0 1x2 M shell F pins	3.7 to 17 V

## Observing Logging State

There are two LEDs, one on the RTC and the other a free status LED. The green RTC LED will be on so long as the system is powered; the green status LED on the hydrophone board has three states:

- OFF: AcSense system is not running/logging data
- AcSense is logging but not logging: solid blue LED
- Recording: flashing blue LED, 2 s on, blink off, 2 s on

If the light is ON but not blinking, that indicates the system is configured but the SD card is missing. If the light is OFF it indicates the AcSense is not running. Check that the SD card is full inserted; this can also indicate that the config file contains an error. Open the config file in ghex and ensure each config line starts at the beginning of the line.

## Offloading Data

The AcSense firmware creates a series of folders; every time the system turns on, it writes to the next sequential folder. The most recent folder with data in it contains the most recent run; occasionally a file system refresh is required to have the new files show up. Note that if files are initially created before the GPS RTC is set, the dates of creation on the folders will reflect that rather than the correct time.

1. Open the housing as described above
2. Locate SD card on end of the electronics rack away from the sensor endcap under the Digital board.
3. Press the SD card to “pop” out, remove SD card
4. Put SD card into reader, connected to a computer, copy data to known location
5. Run parser as described below, in “Data Parsing”.

NOTE: a pair of tweezers can be useful for inserting/removing the SD card if you are struggling with it.

Note: The last directory will contain the latest data; in general, data should be contained within a single directory but it sometimes gets split either due to too many files being created in a single

directory or due to system reset due to an overflow state. We suggest you use the timestamps and expected duration to check, and clear the SD card of D\* directories prior to each use.

## Data Parsing

Data may now be parsed into .csv files using a gui that runs in python. When you are ready to parse data, we can provide either source code, a .exe for windows, or a linux bash script.

To parse an individual file, select the “Internal ADC” Radio button, then File -> Open -> Open File. Next, select Parse -> Parse Loaded File or Directory. Finally, select Export -> Export Data to CSV.

To parse an entire directory, select the “Internal ADC” Radio button, then File -> Open -> Open, parse, and export directory ; select the desired directory path. Another file menu will open to ask where you want to output the data, you can put it in the same place. Once you click “Open” on the second directory selection, it will begin parsing the files within the directory. This may take a LONG time depending on how many files are in the directory; it is parsing all the .dat files to .csv.

You can then plot your .csv files. Note that the time data will be saved as a separate csv from the sensor data; to plot on the same time base, use an interpolation function on the time csv and apply it to the sample points in the sensor data file.

## Data Plotting (Example Code)

Example plotting code is provided in the customer share in python file generic\_plotter\_script\_folderexport.py

Run as follows:

```
> python3 generic_plotter_script_folderexport.py --dir <outdir for folder export> --cam <0 or 1> --ac <0 or 1>
```

Example on my computer:

```
>python3 generic_plotter_script_folderexport.py --dir /home/efischell/Desktop/SDcard/CFF_turtle2024/Benchtest/CFF2/D2/parsed1/ --cam 0 --ac 1
```

This will plot all SENS data in the folder, as well as each AC file with associated SENS data and the camera images as frames for export to a movie. If --cam 1, it will export .jpg files with the camera images and snaps of the other data to a directory; if --ac 1 it will plot and save acoustic data along with associated other sensor data.

NOTE: the script assumes camera images are back a directory from the directory you specify with --dir: it is configured so that you copy your data to, e.g. myfolder/D4/, then export it to myfolder/D4/ which will create the directory myfolder/D4/parsed1/ with the .csv files then it would look for image files in myfolder/D4/IMG4\_1/ etc.

## microSD Card Config

The provided microSD card should have a file called "DefaultConfig.cfg". This file sets which data streams are turned on and off, what is logged, and what is used as the clock for the system.

An example configuration file is below, with annotations:

```

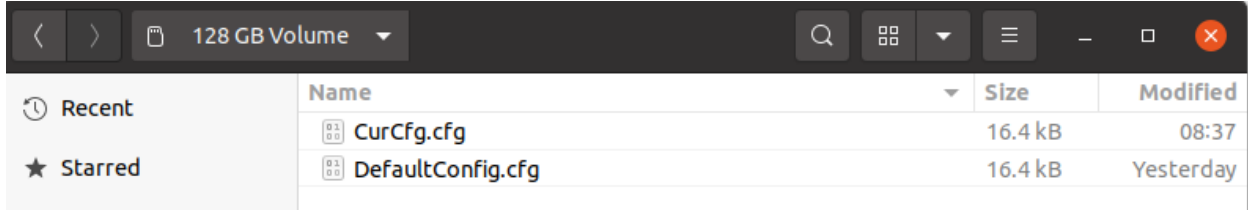
1 ACBOTICS CONFIG ON
2 CONSCFG ON
3 SDCFG ON
4 CONS OFF
5 SDCARD ON HB_STAT=ON WDT_STAT=ON WDT_AC=ON
6 ENET OFF
7 IMU ON READINT=10
8 PTS ON
9 PTS READINT=100
10 ADC OFF
11 PING OFF
12 INTADC ON CH=1 DIFF=1 SIGNED=1 FS=50000 RBELEMS=400 RBSIZE=400
13 EPT_30 ON READINT=100 DNAME=J25
14 RTC OFF
15 TIMEMGR SRC=GPS
16 MAG ON NAME=J25 DTYPE=MM56x3 READINT=100
17 GPS ON NAME=J7
18 SDCARD ACH=INTADC1 CH=GPS CH=EPT CH=IMU CH=PTS CH=MAG CCH=IMG
19 SDCARD CH=IMG_MD
20 STAT ON SD_GPIO=B10 WDT=ON
21 CAM ON RES=VGA FR=5
  
```

Line no	Line	Description
1	ACBOTICS CONFIG ON	Config on (do not change)
2	CONSCFG ON	(do not change)
3	SDCFG ON	Config via sd card (do not change)
4	CONS OFF	Console on/off (can turn on console from here)
5	SDCARD ON HB_STAT=ON WDT_STAT=ON WDT_AC=ON	SD Card logging ON, heartbeat based on stat on, watchdog based on stat on, watchdog based on ac files on
6	ENET OFF	Ethernet off
7	IMU ON READINT=10	IMU on at a rate of 10

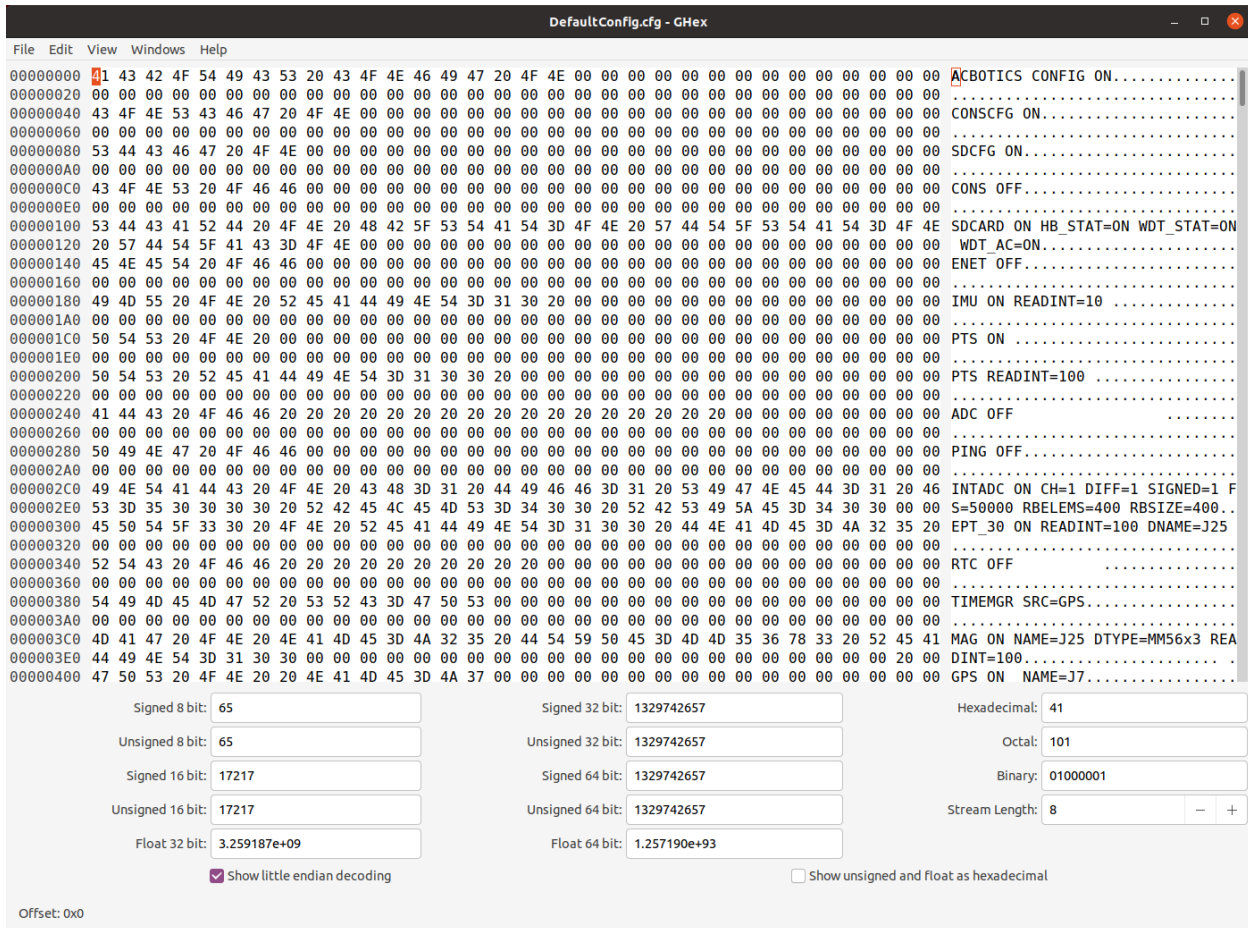
		ms/sample
8	PTS ON	Internal pressure/temperature sensor on
9	PTS READINT=100	Internal pressure/temperature rate of 100 ms/sample
10	ADC OFF	External ADC off
11	PING OFF	Ping echosounder off
12	INTADC ON CH=1 DIFF=1 SIGNED=1 FS=50000 RBELEMS=400 RBSIZE=400	Internal ADC on, 1 channel, differential, signed, sample rate 50000, ring buffer elements 400, ring buffer size/elem 400 (probably do not change for now)
13	EPT_30 ON READINT=100 DNAME=J25	External pressure/temperature on, 100 ms/sample, read on I2C port J25
14	RTC OFF	RTC off
15	TIMEMGR SRC=GPS	Time manager time source is the GPS
16	MAG ON DNAME=J25 DTYPE=MM56x3 READINT=100	Manetometer on, read on port J25, type of mag MM56x3, read at 100 ms/sample
17	GPS ON DNAME=J7	GPS ON, read on port J7
18	SDCARD ACH=INTADC1 CH=GPS CH=EPT CH=IMU CH=PTS CH=MAG CCH=IMG	SD card log acoustics from INTADC1, log sensor data from GPS, EPT, IMU, PTS, Mag; camera channel IMG
19	SDCARD CH=IMG_MD	SD card log IMG metadata
20	STAT ON SD_GPIO=B10 WDT=ON	Status on with GPIO B10 (LED on Hydrophone board), watchdog timer on
21	CAM ON RES=VGA FR=4	Camera on, Resolution VGA (640x480), framerate 5 frames/s

To change the default config, do the following:

1. Locate and remove SD card. Plug into computer.
2. Find binary .cfg file on SD card, DefaultConfig.cfg



3. Open file in ghex or other binary file editor. (instructions below are for ghex) (for ghex, it is really helpful to stretch the screen horizontally until the lines all start where the hex ends as shown below before attempting to edit)



4. Edit as needed
5. Save file
6. Eject card, put back into AcSense-Digital board

Install ghex on linux:

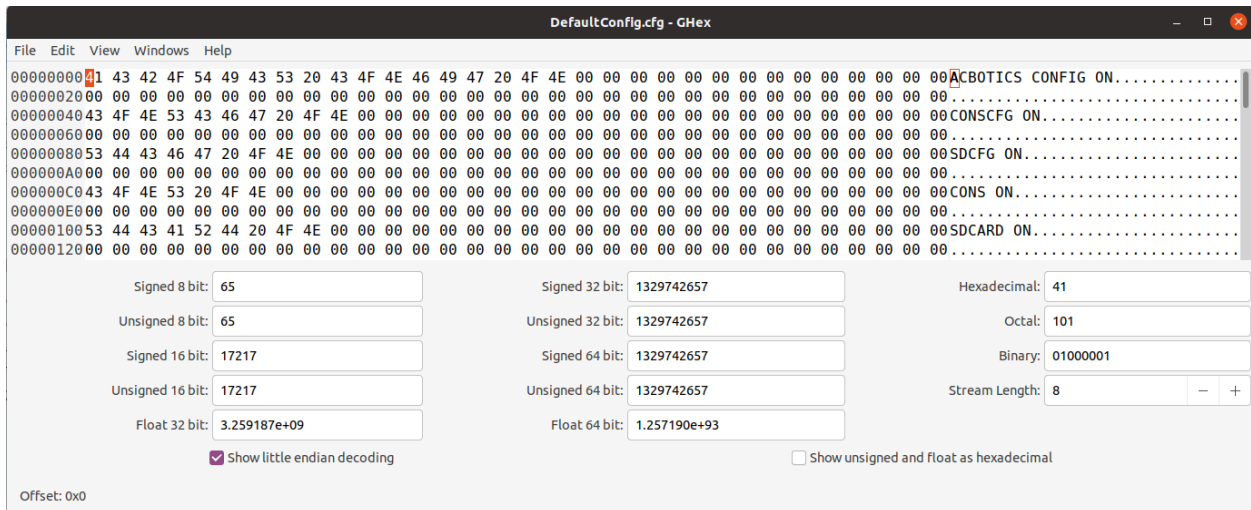
> sudo apt-get install ghex

For more information on config file customization, see **Configuration Setup** below.

## Configuration Setup

The AcSense onboard software may be configured via a binary file with configuration data; if the file DefaultConfig.cfg is on root of the SD card, the AcSense will automatically load it as the initial configuration on boot. To create a new configuration file: use a hex editor such as ghex, open a new file. This will allow you to edit human-readable text, then export to a file called DefaultConfig.cfg.

**NOTE: Ensure there is a line break between each line, and each new line starts at the beginning of the line with no spaces ahead of it. If there is something wrong with your DefaultConfig.cfg, the AcSense blue record LED will not blink on startup, which is always a clue to go look again. If you are having trouble getting this to work, contact [support@acbotics.com](mailto:support@acbotics.com) with the config file you are trying to run and we can help you figure out where something is misaligned.**



If you name your file FactoryOverwrite.cfg it will load that into the non-volatile RAM as the config, and then if you later boot without the SD card that will be stored.

**The configuration is run once at startup. It is possible to define configs that allocate more memory than are available on the device, in which case it will fail. Unless you need something different, it is highly recommended you use Acbotics provided config files.**

Required configuration variables:



Required on line	Text	Description
1	ACBOTICS CONFIG ON	Turns it on; this line must be present
2	CONSCFG ON	Can be configured; this line must be present
3	SDCFG ON	Can be configured by the SD card; this line must be present

General configuration variables:  
MODULENAME PASSEDDVALS

**NOTE: All bool type variables can take ON, OFF, TRUE, FALSE, 0 or 1.**

## Config Names

Module	Config Name
Console module	CONS
SD logging	SDCARD
Ethernet streaming/eth parameters	ENET
Internal IMU	IMU
Internal pressure/temp sensor	PTS
Ac-ADM	ADC
DS RTC	RTC
Bar 100 pressure sensor	EPT_100
Bar 30 pressure sensor	EPT_30
Ping Echosounder	PING
Internal ADCs	INTADC
Time manager	TIMEMGR

GPS (currently that specific module)	GPS
Status process	STAT
NAU driver	NAU7802
Magnetometer driver	MAG
Watchdog driver	ACW
Heartbeat	HB_STAT=ON
Camera	CAM

## CONS

Options: ON/OFF

Command	Result	Notes
CONS ON	Turns on console	
CONS OFF	Turns off console	Default

Default: OFF

## SDCARD

Options:

ON, OFF

CH=<str> [adds a channel to be logged][can be run as many times as you want]

ACH=<str> [ring buffer name for primary ADC][only set to one thing]

**Note: new channels to record must be added here and also turned ON. E.g to add a magnetometer, you would need a “MAG ON” line and also to add CH=MAG on this line. If you only do one or the other, your sensor will not log.**

Command	Result	Notes
SDCARD ON	Turn on	
SDCARD OFF	Turn off	Default
CH=<str>	Add a channel to log on SD Card, e.g. CH=GPS	Can have as many as will fit in the 32 byte line, space

		delimited
ACH=<str>	Ring buffer name for primary ADC (name needs to match what your ADC is outputting on) E.g ACH=SPIADC ACH=INTADC	
HB_STAT=ON	Turn on heartbeat based on STAT variable	
HB_AC=ON	Turn on heartbeat based on acoustic file creation	
WDT_STAT=ON	Watchdog on STAT variable; reset if it stops	
WDT_AC=ON	Watchdog on AC files; reset if they stop being written	

## ENET

Command	Result	Notes
ENET ON	On	
ENET OFF	Off	Default
ENET IP=<str>	Set target IP address for main data stream. E.g. if you are sending data to IP 195.168.1.5, you would put: ENET IP=195.168.1.5	Default 224.1.1.1
ENET PORT=<str>	Set target port	Default 9760
ENET DAQ_IP=<str>	Set own IP address	Default 192.168.1.56
ENET DAQ_SM=<str>	Set own netmask	Default 255.255.255.0
ENET SEN_ON	Turn on sending sensor (i.e. non-ADC) data (e.g. GPS, IMU, PTS etc.)	

ENET SEN_OFF	Turn off sending sensor (i.e. non-ADC) data (e.g. GPS, IMU, PTS etc.)	Default
ENET SEN_IP=<str> ENET SEN_PORT=<str>	IP address and port to send the sensor (non-ADC) data to. Let you send sensor and ADC data to different places	Default SEN_IP=224.1.1.2 Default SEN_PORT=9770
CH=<str>	Add a channel to Ethernet stream, e.g. CH=GPS	Can have as many as will fit in the 32 byte line, space delimited e.g. ENET CH=GPS CH=PTS CH=ADC CH=IMU Or as as many lines as you want  Default none
ACH=<str>	Ring buffer name for primary ADC (name needs to match what your ADC is outputting on)	Sets once  Default ACH=SPIADC
SER_ON	Turn on serial stream	
SER_OFF	Turn off serial stream	Default
SER_IP=<str>	IP address to send serial data to	Default 192.168.1.115
SER_TX_PORT	Port send serial data to over ethernet	Default 9780
SER_RX_PORT	Port to listen to for ethernet data to send to the serial port (gives you a ability to control a serial device via ethernet)	Default 9781
SER_BAUD	Baud rate for eth-modulated serial connection	Default 15200
SER_INV True SER_INV False	Configures whether the serial port inverts its logic (needed for some TTL level w/ RS232 logic serial devices)	Default False
SER_CON=<str> SER_CON=J20	Connector for serial device referencing the UART	Default J19

SER_CON=J19 SER_CON=J14 SER_CON=J13 SER_CON=J12	connectors on the AcSense-Digital board	
NTP_IP=<str>	Configure where to get NTP data from	Default 192.168.1.115

## IMU

Command	Result	Notes
IMU ON IMU OFF	Turn on/off	Default OFF
IMU READINT=100 IMU READINT=1000	Sample interval in IMU in ms	Default 100

## PTS

Command	Result	Notes
PTS ON PTS OFF	Turn on/off	Default OFF
PTS READINT=10000 PTS READINT=1000	Sample interval in ms	Default 10000 (.1 Hz)

## ADC

Command	Result	Notes
ADC ON ADC OFF	On/off	
ADC CANON	Turn fake input on/off	Not generally used except by

ADC CANOFF		Sam
ADC CHAN=<str>	Configure number of channels for ADC, e.g. ADC CHAN=8 ADC CHAN=16	Default ADC CHAN=16 Match to 8x number of ADM boards
ADC FS=<str>	Set desired sample rate	Currently placeholder
ADC RBELEMS=<number>	How many elements are going to be in the ADC ring buffer (memory trade-off) (most users won't need to mess with this)	Default 48, if doing something requiring lots of memory may need to drop down

## RTC

Command	Result	Notes
RTC ON RTC OFF	On/off	
RTC DNAME=<str>	Port name, e.g. J25, J7, J9 etc. that I2C RTC is plugged into	Must be explicitly defined if ON

## EPT\_100

Command	Result	Notes
EPT_100 ON EPT_100 OFF	On/off	
EPT_100 DNAME=<str>	Port name, e.g. J25, J7, J9 etc. that I2C RTC is plugged into	Must be explicitly defined if ON
EPT_100 READINT=<ms>	Read interval in milliseconds for EPT	Default 100

## EPT\_30

Command	Result	Notes
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EPT-30 ON EPT-30 OFF	On/off	
EPT_30 DNAME=<str>	Port name, e.g. J25, J7, J9 etc. that I2C RTC is plugged into	Must be explicitly defined if ON
EPT_30 READINT=<ms>	Read interval in milliseconds for EPT	Default 100

## PING

Command	Result	Notes
PING ON PING OFF	On/off	
		* below from rev.
PING SER_BAUD=<baud rate>	Baud rate for the ping	(probably don't need to change this) Default 115200
PING SER_CON=<UART Port>	Port argument for which serial port (J14, J21, J19, J20) that the ping is plugged into	
PING MODE_AUTO=ON PING MODE_AUTO=OFF	Set auto mode ping echosounder (see BlueRobotics Ping documentation)	Default OFF
PING SCAN_START=<mm> PING SCAN_LENGTH=<mm>	Range scan start distance and scan length settings for ping if not using AUTO mode, set in mm (see BlueRobotics Ping Documentation).	Minimum scan start value 0, SCAN_LENGTH must be at least 1 m (1000 mm) Default SCAN_START=1000 Default SCAN_LENGTH=25000
PING INTERVAL=<ms>	Time interval between transmissions; INTERVAL=0 as fast as possible given scan start and scan length. Interval set in ms.	Default INTERVAL=0
PING GAIN=<number>	Gain for PING system, see	Default GAIN=3

	<p>Ping documentation for details; 0: 0.6, 1: 1.8, 2: 5.5, 3: 12.9, 4: 30.2, 5: 66.1, 6: 144</p> <p>Higher gain = more sensitivity to water column, may saturate; lower gain = may not detect smaller scatterers in the water column</p>	
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## INTADC

Command	Result	Notes
INTADC ON INTADC OFF	On/off	
INTADC CH=<number from 0 to 4>	Turns on indicated channel (0 to 4)	May appear more than once, e.g. to run CH 0 and CH 1 you would have: INTADC CH=0 INTADC CH=1
INTADC FS=<sample rate in HZ)	Integer in Hz for desired sample rate	Exact sample rate may differ slightly from setting, will pick nearest the clock can do. We recommend verifying using a function generator as input at a known frequency, or ask us for validation.
INTADC DIFF=ON INTADC DIFF=OFF	On/off of differential mode or single-ended input mode	Default ON
INTADC SIGN=ON INTADC SIGN=OFF	Signed or unsigned ADC data	Default ON (signed)
INTADC RBELEMS	Ring Buffer lines	(if you are having issues with dropped acoustic data, try adding RBELEMS=400 to your INTADC config) Rec: RBSIZE=400
INTADC RBSIZE	Length for each line in ring buffer	Rec: RBSIZE=400



## TIMEMGR

Command	Result	Notes
TIMEMGR SRC=<str>	Channel name of a source it can get the time from, e.g. GPS or RTC to get timestamps for files	Currently only supports GPS or RTC
		Future: add NTP as option

## GPS

Command	Result	Notes
GPS ON GPS OFF	ON/OFF	
GPS DNAME=<port>	Port for GPS	NOTE: DO NOT PUT THE GPS ON J8 as the IMU is on J8 and they REALLY don't play nicely together. I typically put the GPS on J7 and chain other I2C devices on J25

## STAT

Command	Result	Notes
STAT SD_GPIO=<str> STAT SD_GPIO	Sets which GPIO pin blinks an LED when running <A to H><number> E.g. STAT SD_GPIO=A5	Default None
		Future: set blink rate etc.
STAT WDT=ON STAT WDT=OFF	Turn watchdog timer on/off; watchdog resets if it doesn't get fed.	
STAT ON STAT OFF	Control whether STATUS process runs (turn off to save	

	memory)	
--	---------	--

## NAU7802

Command	Result	Notes
NAU7802 ON NAU7802 OFF	ON/OFF	Typ used for load cell interface
NAU7802 DNAME=<port>	Port for NAU7802	
NAU7802 GAIN=<number>	Gain values 1,2,4,8,... 128 (powers of 2 up to 128)	Default 1
NAU7802 READINT=<ms>	READINT is how fast it will attempt to read from the ADC.	The ADC clocks itself, so there is also a SR=?? Which sets the ADC's internal sample rate, if READINT is faster it will default to internal sample rate
NAU7802 SR=<sample/s>	Options: 10, 20, 40, 80, 320	Default 10

## ACW (AcWatchdog interface)

Command	Result	Notes
ACW ON ACW OFF	ON/OFF	
ACW ALARM=MM/DD/YY HH:MM:SS	Alarm wake time for watchdog timer to wake the system back up	E.g. ACW ALARM=04/30/24 10:58:00
		LATER: will add duty cycle, initial wake interval, dname

## MAG

Command	Result	Notes
MAG ON MAG OFF	ON/OFF	
MAG DNAME=<port>	Port for Magnetometer	
MAG READINT=<ms>	Millisecond read interval	

## CAM

Command	Result	Notes
CAM ON CAM OFF	ON/OFF	
CAM RES=<resolution>	Set resolution for the Arducam; resolution options in resolution table below	The frame rate will adjust DOWN if it can't write fast enough for a given selected frame rate. If you go above HD, do a trial run to ensure you are getting sufficient frame rate for your application. (HD w/ frame rate 1 verified)
FR=<Hz>	Framerate in Hz	The frame rate will adjust DOWN if it can't write fast enough for a given selected frame rate. If you go above VGA FR=4 or HD FR=1, do a trial run to ensure you are getting sufficient frame rate for your application.

Camera Resolution Options:

<resolution>	Suggested Line in DefaultConfig.cfg	Resolution (pixels)
QVGA	CAM ON RES=QVGA FR=16	320x240
VGA	CAM ON RES=VGA FR=4	640x480

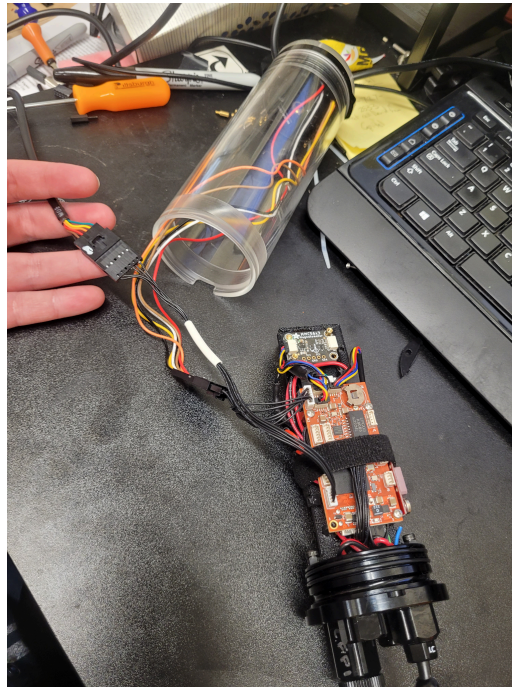
HD	CAM ON RES=HD FR=1	1280x720
FHD	CAM ON RES=FHD FR=0.25	1920x1080
WXGA2	CAM ON RES=WXGA2 FR=0.1	2592x1944

NOTE: You can set a higher frame rate, but you are not guaranteed to get that frame rate. Above is a best guess at the fastest it will run, but exact performance will depend on how fast the SD card you choose can write data.

## Serial Console

### Serial console

The cable kit includes a console cable to plug into J20; this cable mates to a USB to serial converter (avail on digikey: <https://www.digikey.com/en/products/detail/ftdi-future-technology-devices-international-ltd/TTL-232R-3V3/1836393>). Using a console is useful if you need to debug the system, but may not be required during general use.



*Plugging in the console cable to the AcSense-Mini-Cam system*

1. Connect console cable to USB to serial converter cable (provided)
2. Power on
3. Log in via Minicom or other terminal (Baud rate 115200, flow control off):  
> minicom -D /dev/ttyUSB0

(Navigate menus to adjust baud rate, flow control)

4. Activate serial console and heartbeat:

→ ?

→ LOG+

(The system should begin giving you heartbeats)

*NOTE: if you query too soon after startup, you will get a message "Password?". If that happens, unpower/power the unit and try again with a longer wait.*

5. Query the GPS:

→ GPS

6. If the RTC on the GPS is correct, continue to step **8**

7. To manually set the RTC:

→ > ?

→ > CFG

→ >> RTC

→ >> RTC MM/DD/YY HH:MM:SS

→ >> EXIT

→ To confirm: (it may take a few seconds to update)

→ > RTC

8. Verify sensor values using serial console:

→ ?

→ LOG+

The system will begin giving you heartbeats. To view IMU data:

→ IMU+

To observe IMU settings:

→ IMU PRT

To get IMU at a rate of 1 sample every 10 ms:

→ IMU READINT=10

To slow back down to every second:

→ IMU READINT=1000

(READINT is set in ms)

To stop streaming IMU over serial console or to get a single data entry:

→ IMU

9. Verify data is logging:

→ ?

→ SDCARD

SDCARD Space: 29.711GB, Free: 29.677GB, Ovfl: 0, Next: D2/AC2\_2.dat

SDCARD Sensor File: D2/SENS\_2\_1.dat, size: 0.582MB

Repeat the command, and observe if the file size is growing (it should be, indicating logging is indeed taking place).

In general, a command and + will stream; a command without plus will give a single return and stop. Examples for data queries are:

```
LOG STS CFG PING RTC
PTS IMU SDCARD EPT GPS MAG
```

## Console Service

(Version 0.99.1, June 16, 2023)

### 1. Configuration

The Console Service is currently defined as Uart 1, baudrate 115200, data bits 8, parity none, stop bits 1.

<CRLF> refers to the line ending character(s) generated when the Return or Enter key is pressed.

### 2. General Operation

The Console Service comes up in Logging Mode, looking for a request to enter Command Mode.

? ? enters Command Mode and pauses Logging Mode for 30 seconds. This is to make it easier to enter commands in the face of streaming log data. When Command Mode is entered, the Command Menu is displayed, followed by the Command Prompt (> ), for example:

```
LOG STS CFG GEO ADC ECHO EPT RTC
PTS IMU SDCARD NAU7802
>
```

The list of Commands may be different, depending on the device configuration. Most Commands will be described in Section 3, below, but CFG (Configuration Mode) is special:

> CFG<CRLF> - this enters Configuration Mode, the Configuration Command Menu is displayed, followed by the Configuration Prompt (>> ), for example:

```
EXIT RTC
>>
```

The list of Configuration Commands may be different, depending on the device configuration. Most Configuration Commands will be described in Section 4, below, but EXIT (Configuration Mode) is special:

>> EXIT<CRLF> - this Command exits Configuration Mode and returns to Command Mode. When Command Mode is re-entered, the Command Menu is displayed, followed by the Command Prompt (> ).

When in Command or Configuration Mode, ? may be entered, to pause Logging Mode for 30 seconds, redisplay the current Menu (Command or Configuration), and redisplay the current prompt (> or >>).

Commands and Configuration Commands (except for ?) must be followed by <CRLF>. To make corrections, backspace is allowed until the <CRLF> is entered.

### 3. Commands

The current list of Commands and parameters are listed in Table 1, below.

Table 1, Command Description

Command	Parameters	Operation
LOG	none	Displays LOG Help
LOG	+	Restarts Logging mode
LOG	-	Pauses Logging mode indefinitely
STS	none	Requests devices to output their Status
STS	Device	Requests a particular device (GEO, ADC, ECO, etc. to output its Status)
CFG	none	Enter Configuration mode
GEO	none	Request Geophone device to output one sample for each channel in xx,xxx,xxxx format, comma separated hex values (no 0x prefix)
GEO	#	Request Geophone device to output 1024 samples for channel # (0,1,2) in xx,xxx,xxx,... format comma separated hex values (no 0x prefix)
ADC	none	Request External ADC device to output one sample for each channel in xx,xxx,xxxx format, comma separated hex values (no 0x prefix)
ADC	#	Request External ADC device to output max samples for channel # (0,1,2,3,4,5,6,7) channel in xx,xxx,xxxx format, comma separated hex values (no 0x prefix). max samples currently 5120
ECHO	none	Request Echo Sounder device to output latest PING_PROFILE in xxXXxxXXxx... format, unseparated 2 digit hex values (no 0x prefix) PING_PROFILE currently 226 bytes.
EPT	none	Displays EPT Help message
EPT	#	Displays periodic External Pressure / Temperature data # times
EPT	+	Displays periodic EPT data forever, or until a new EPT command is entered (use EPT 1 to turn periodic data display off after next period).
RTC	none	
PTS	none	Displays PTS Help message
PTS	#	Displays periodic internal Pressure / Temperature Sensor data # times
PTS	+	Displays periodic PTS data forever, or until a new PTS command is entered (use PTS 1 to turn periodic data display off after next period).
PTS	FAST	Set PTS periodic rate to fast value (currently every 1 second)
PTS	SLOW	Set PTS periodic rate to slow value (currently every 10 seconds)
IMU	none	Displays IMU Help message
IMU	#	Displays periodic IMU data # times
IMU	+	Displays periodic IMU data forever, or until a new IMU command is entered (use IMU 1 to turn periodic data display off after next period).
IMU	FAST	Set IMU periodic rate to fast value (currently every 10 times per second)
IMU	SLOW	Set PTS periodic rate to slow value (currently every 1 second)
SDCARD	none	Displays current SDCARD information

## 4. Configuration Commands

The current list of Configuration Commands and parameters are listed in Table 1, below.

*Table 2, Configuration Command Descriptions*

Command	Parameters	Operation
EXIT	none	Exit Configuration Mode, return to Command Mode
RTC	DD/MM/YY HH:MM:SS	Set Real Time Clock to time specified in Parameters, numbers only

## 5. Paused Log Nuances

(In the next release)

The output of these commands will be displayed even when LOG is paused.

RTC and IMU PTS EPT (with # parameter set to 1)

These commands will restart the log

IMU PTS EPT (with + or # parameter set to > 1)

These "Dump" commands will pause the log until done then return it to its previous state

ADC, ADC #, GEO, GEO #, ECHO

Data output as a result of STS commands will be displayed even when LOG is paused.