Crylogger MGV

1.0 Introduction

The Cryologger MGV (Milne Glacier Velocity) system is intended to measure daily movement and velocity of the Milne Glacier on Ellesmere Island, Nunavut.

2.0 Contents

Each Cryologger MGV consists of the following components:

- Cryologger (1)
- ComNav K706 GNSS receiver board (1)
- ComNav AT330 GNSS antenna (1)
- Nanuk 945 enclosure (1)
- 10W solar panel (2)
- Genasun GV-4 MPPT charge controller (1)
- Fullriver DC105-12 sealed lead acid (SLA) battery (1)
- 45 cm TNC male antenna cable (1)
- 3 m TNC male antenna cable (1)
- TNC female bulkhead adapter (1)

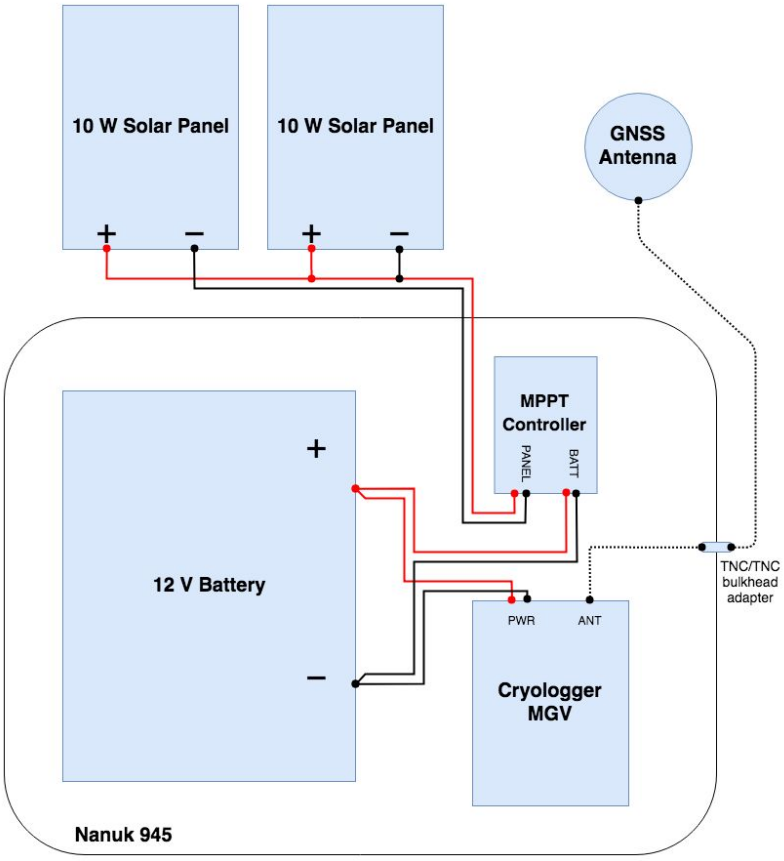


Figure 1. Simplified diagram of the Cryologger MGV system.

2.1 Cryologger MGV Components

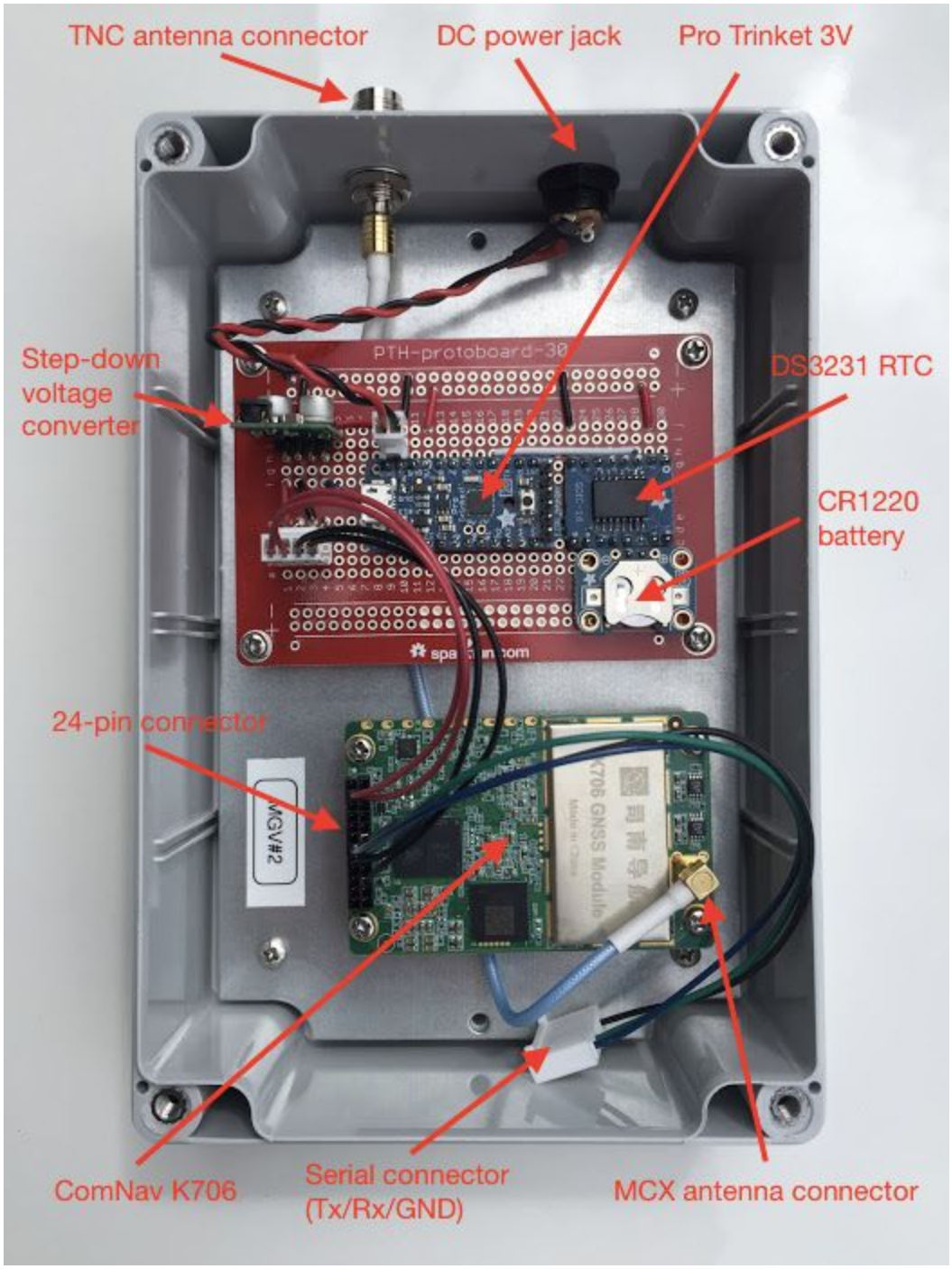


Figure 2. Components of the Cryologger MGV.

3.0 Deployment Guidelines

3.1 Pre-Deployment Tasks:

3.1.1 Cryologger

1) Drill holes in Nanuk 945 enclosure for 1) antenna TNC bulkhead adapter and 2) cable gland(s) for solar panel power wires.
2) Connect power wires between Fullriver DC105-12 battery and Genasun GV-4 MPPT charge controller.
3) Connect solar panel power wires in parallel and then pass through cable glands to Genasun GV-4 MPPT charge controller.
4) Apply marine silicone around enclosure holes as necessary.

3.1.2 Panasonic Toughbook

1) Install Arduino Software IDE (https://www.arduino.cc/en/Main/Software?)
2) Install FTDI drivers (https://learn.adafruit.com/ftdi-friend/installing-ftdi-drivers)
3) Install Adafruit Pro Trinket driver (https://learn.adafruit.com/introducing-pro-trinket/windows-setup)
4) Setup the Arduino IDE to support the Adafruit Pro Trinket board (https://learn.adafruit.com/introducing-pro-trinket/setting-up-arduino-ide)
5) Download and install the following Arduino library (https://github.com/JChristensen/DS3232RTC)
6) Install ComNav Compass Receiver Utility (CRU) software (http://www.comnavtech.com/go.asp?id=56)

3.2 Setup & Testing

1) Do **not** connect power to Cryologger until all other connections are made.
2) Connect 3 m TNC antenna cable between ComNav AT330 antenna and external TNC bulkhead adapter connection.
5) Connect 45 cm TNC antenna cable between internal TNC bulkhead adapter and Cryologger ANT-GNSS connector.
6) Connect ring terminals to battery and DC power adapter terminal block connectors.
7) Connect DC power adapter to Cryologger DC barrel jack.
8) Observe LED blink pattern.

3.3 Deployment

1) Follow same steps as in 3.2.

LED Descriptions

The Cryologger's onboard LED (see Figure 2.) provides information on the overall status and operation of the system. Note: Each time the Adafruit Pro Trinket 3V is reset, the bootloader will produce a default LED blinking pattern. It is following this pattern that the LED indicator should be observed. The following table defines the LED indications.

Table 2. Cryologger LED blink patterns and descriptions.

LED Blink Pattern	Description
Observed when power turned on or reset	
Quickly blinks twice (2), four times in a row	- Bootloader blink pattern
Observed at startup (after bootloader pattern)	
Quickly blinks four (4) times	- Minimum voltage threshold met.
Slowly blinks four (4) times	- Minimum voltage threshold not met.
Observed during sleep cycles every 8 seconds	
Quickly blinks once (1)	- Cryologger is in sleep mode. - Minimum voltage threshold was met at last measurement. - Not recording GNSS observations.
Quickly blinks two (2) times	- Cryologger is in sleep mode. - Minimum voltage threshold was not met at last measurement. - Not recording GNSS observations.
Quickly blinks three (3) times	- Cryologger is in sleep mode. - Currently recording GNSS observations.

4.0 Programming the Cryologger

1) Connect the FTDI-friend to the Pro Trinket's header (shown below)
2) Open the Arduino IDE.
3) Ensure the correct board port are selected.
4) Connect the Adafruit FTDI-friend connector to the Adafruit Pro Trinket 3V header pins.
5) Upload the appropriate code to the board.

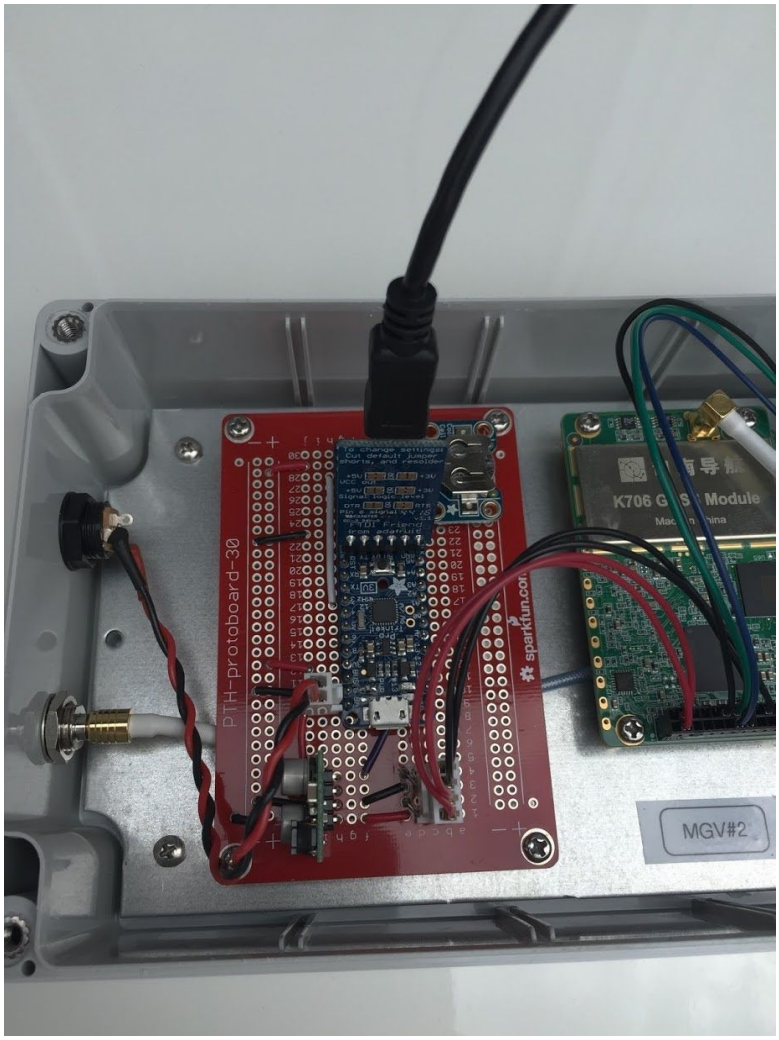


Figure 3. Proper orientation of Adafruit FTDI-friend connection to Pro Trinket 3V header

For additional information on how to upload code to the Arduino see:

- https://www.arduino.cc/en/main/howto
- https://learn.adafruit.com/ladyadas-learn-arduino-lesson-number-1/upload-your-first-sketch

5.0 Accessing ComNav K706 Onboard Memory (Also see: ComNav documentation)

1) Ensure proper grounding and that there are no sources of electrostatic discharge (ESD).
2) Carefully disconnect the MCX antenna cable and 24-pin header connectors from the K706 receiver board.
3) Remove the 4 PCB standoff mounting screws.
4) Remove the K706 receiver board from Cryologger and carefully insert it into the ComNav K708 dev-board.
    a) The 24-pin connector should be inserted first into the dev-board, followed by the MCX antenna connector.
    b) Be when applying pressure to the board

5) Connect DC power to the dev-board
6) Connect the USB Type B cable between the dev-board and computer
7) Turn on power to the dev-board
8) The K706's onboard memory should automatically mount as an external drive and the observation data can then be downloaded

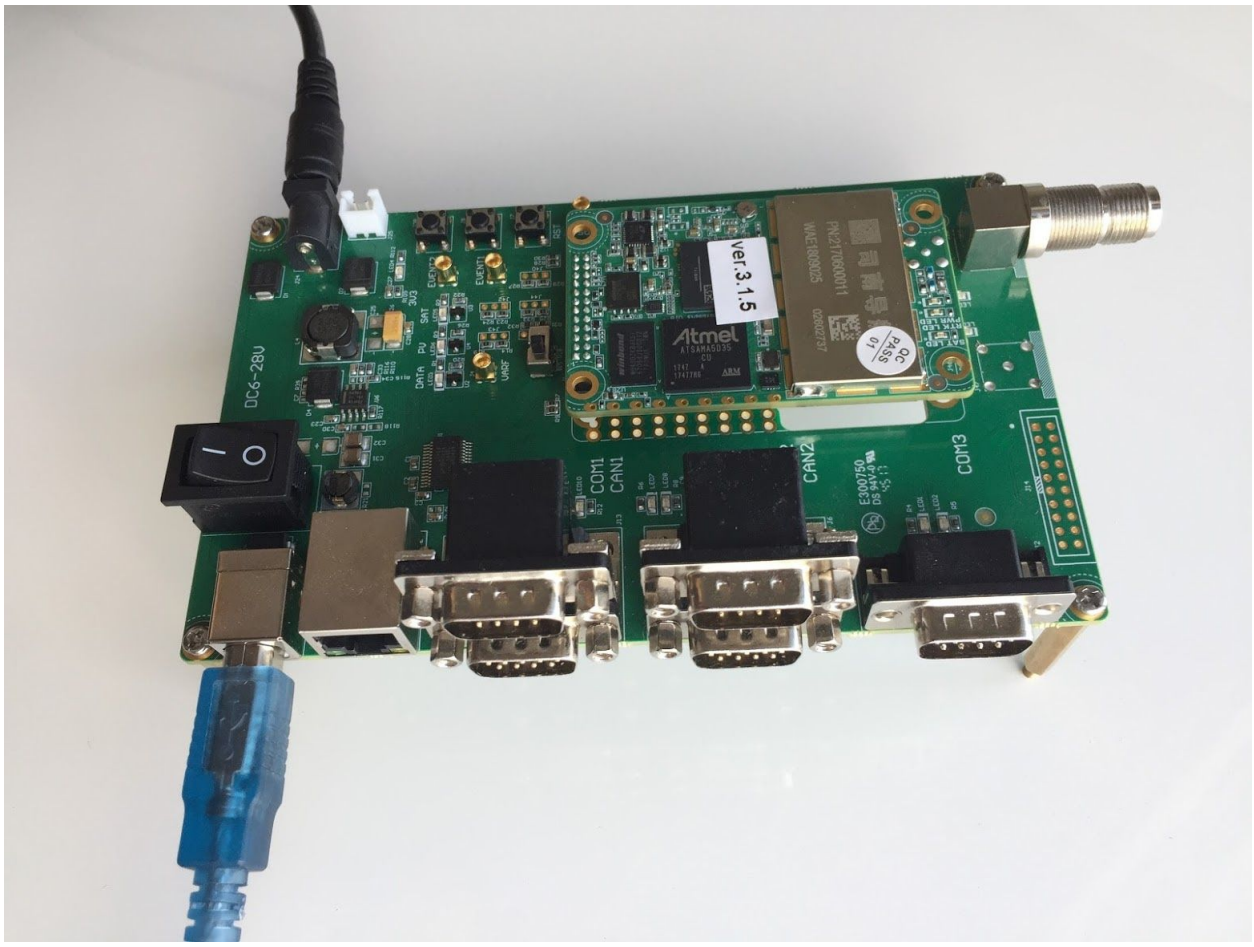


Figure 4. Connection for accessing K706 onboard 8 GB memory

6.0 ComNav Dev-Board

The image below illustrates the proper connection to make use of the K706 dev-board. It requires an antenna connection, DC power, serial cable, and serial to USB adapter. Additional information can be found in the ComNav Quick Guide V1.0.2.

Figure 5. Connection required for operating the K706 with the dev-board.

7.0 Fieldwork Connection

It is possible to confirm the operation of the ComNav K706 receiver using the Compass Receiver Utility program and the connection displayed below.

- Connect the FTDI-friend connector with the male header pins to the white KK254 connector inside the case
- Open the CRU software
- Select the appropriate COM port and click "Connect"
- Click on the "Tracking" tab and wait for live receiver data to populate the screen

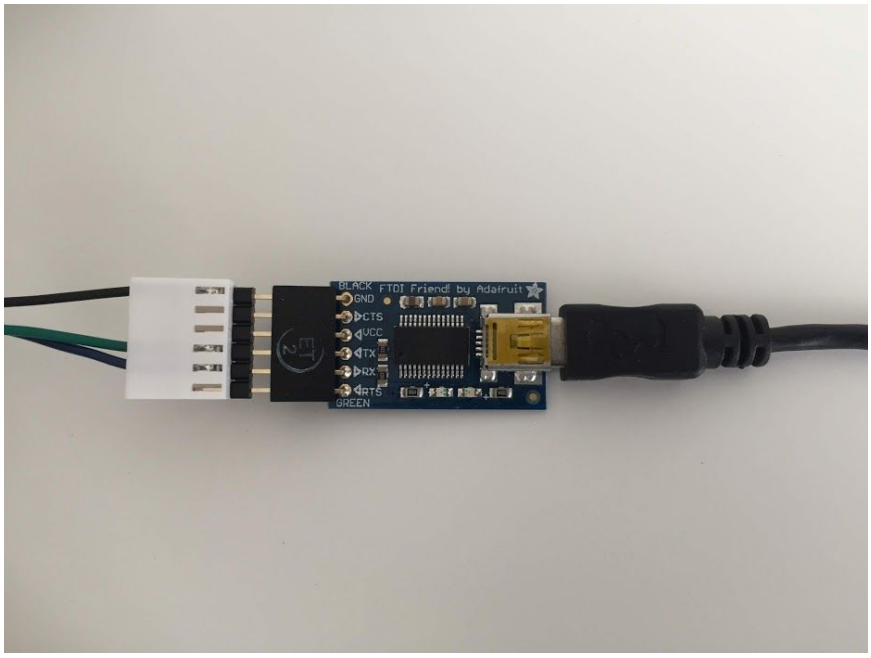


Figure 6. Direct Tx/Rx/GND connection to K706 board

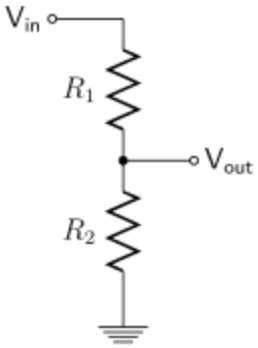
8.0 Converting to RINEX

See ComNav Quick Guide V1.0.2 documentation.

9.0 Specifications

9.1 Electrical

- Voltage input ranges:
  - Pro Trinket: 3-18V
  - Step-down voltage regulator: 6-48V
- Quiescent draw: ~147 uA
- Active draw: ~ 250 mA



9.2 Voltage divider resistor values

- MGV #1
  - R1: 10.03 MOhm
  - R2: 996 kOhm
  - ADC voltage divider calculation constant:
    - 996000 / (996000 + 10030000) * 1024 =
    - 92.50
- MGV #2
  - R1: 10.03 MOhm
  - R2: 994 kOhm
  - ADC voltage divider calculation constant:

        - 994000 / (994000 + 10030000) * 1024 =
        - 92.33

9.3 Panel Mount Connectors

- MCX to TNC
    - Diameter: 9.6 mm (0.38 inch)
    - Drill bit: 3/8"
- TNC female to TNC female
    - Diameter:
    - Drill bit:
- DC barrel jack:
    - Diameter: 12.5 mm (0.49 inch)
    - Drill bit: 1/2"

Appendix A. ComNav K706 OEM Receiver Board

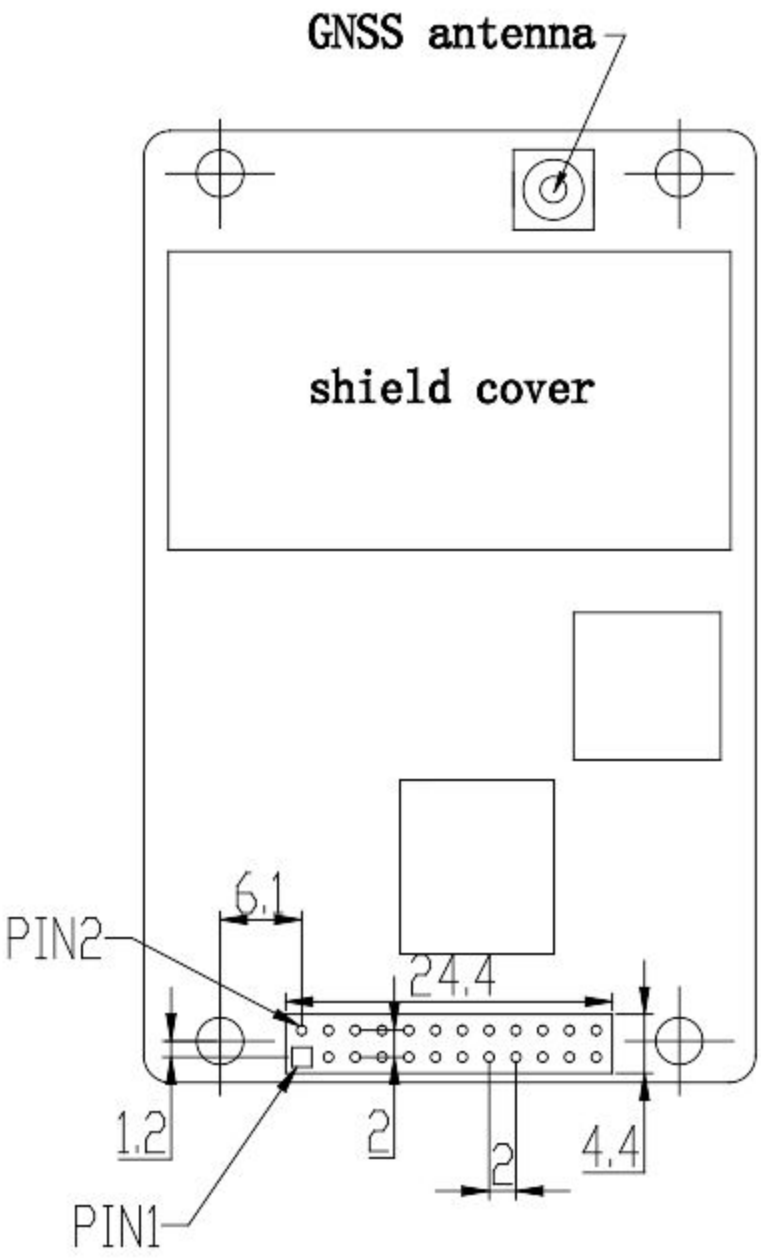


Figure 6. ComNav K706 top view denoting numbering of 24-pin connector.

Table x. ComNav K706 24-pin connector. Utilized pins highlighted in colour.

2	4	6	8	10	12	14	16	18	20	22	24
1	3	5	7	9	11	13	15	17	19	21	23

Table x. Descriptions of ComNav K706 24-pin connector. Utilized pins highlighted in colour.

Pin	Signal	Type	Description
1	SPI_CLK / ETH_RD-	MUL	multiplexed pin: SPI clock signal / ethernet receive signal (-) default: ETH_RD-
2	SPI_CS0 / ETH_RD+	MUL	multiplexed pin: SPI1 CS0 signal / ethernet receive signal (+) default: ETH_RD+
3	LNA_PWR	PWR	antenna power supply
4	3V3 / 5V	PWR	DC power supply for board
5	USBN	IO	USB device interface data (-)
6	USBP / COM3_RX	MUL	multiplexed pin: USB device interface data (+) / UART received data for COM3 input default: USBP
7	RST_SYS	I	system reset
8	VARF / CAN1_RX	MUL	multiplexed pin: 10MHz square wave output / CAN1 input default: CAN1_RX
9	EVENT2 / CAN1_TX	MUL	multiplexed pin: CAN2 input / RTK data LED indicator default: LED_RTK
10	CAN2_RX / LED_RTK	MUL	multiplexed pin: CAN2 input / RTK data LED indicator default: LED_RTK
11	EVENT1 / COM3_TX	MUL	multiplexed pin: external event input / UART transmitted data for COM3 default: EVENT1
12	GND	PWR	ground reference
13	COM1_TX	O	transmitted data for COM1 output
14	COM1_RX	I	received data for COM1 input
15	GND	PWR	ground reference
16	COM2_TX	O	transmitted data for COM2 output
17	COM2_RX	I	received data for COM2 input

18	GND	PWR	ground reference
19	PV	O	'good solution' or valid GPS position indicator
20	GND	PWR	ground reference
21	PPS	O	pulse per second
22	CAN2_TX / LED_SAT	MUL	multiplexed pin: CAN2 output / tracked satellite number indicator default: LED_SAT
23	SPI_MISO / ETH_TD+	MUL	multiplexed pin: SPI master in slave out signal / Ethernet transmit signal (+) default: ETH_TD+
24	SPI_MOSI / ETH_TD-	MUL	multiplexed pin: SPI1 master out slave in signal / Ethernet transmit signal (-) default: ETH_TD-

Appendix B. Adafruit Pro Trinket

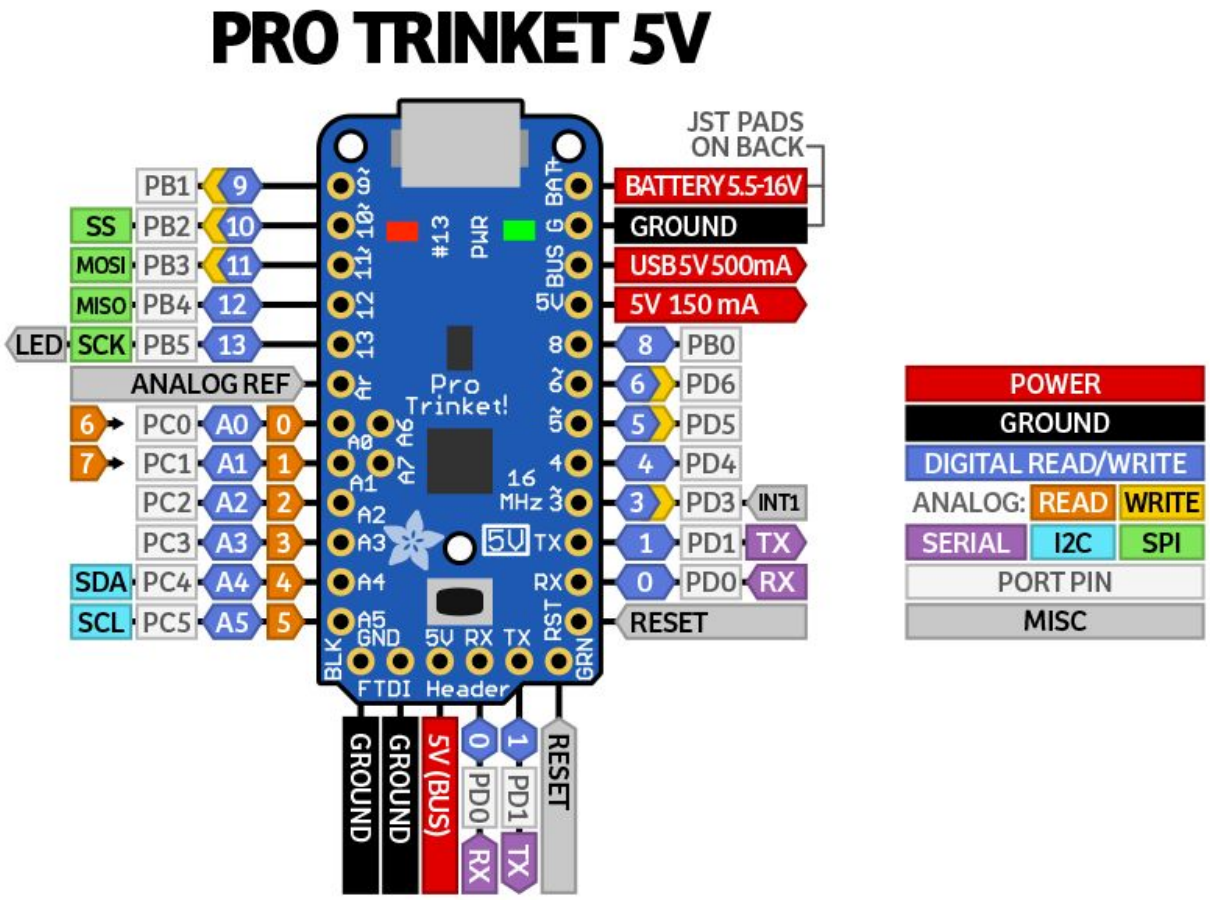


Figure 7. Note that the Cryologger MGV utilizes the Adafruit Pro Trinket 3V version.

Table x. Adafruit Pro Trinket 3V pinouts and descriptions. Utilized pins highlighted in colour.

Pin	Connection	Description
Rx	Unused	
Tx	Unused	
D3	RTC SQW/INT	DS3231SN SQW/INT pin external interrupt
D4	Unused	
D5	Unused	
D6	Unused	
D8	Unused	

D9	Step-down Enable	Step-down voltage converter EN (enable) pin
D10	Unused	
D11	Unused	
D12	Unused	
D13	LED	
A0	Voltage Divider	Battery voltage divider measurement (analog)
A1	Unused	
A2	Unused	
A3	Unused	
A4	SDA	I2C bus (RTC)
A5	SCL	I2C bus (RTC)
A6	Unused	
A7	Unused	
BAT	BAT	Connected to battery, voltage divider and step-down
GND	GND	Ground
BUS	Unused	
3V	3.3V	3.3V power rail (RTC)