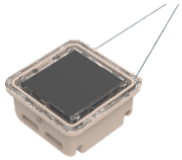
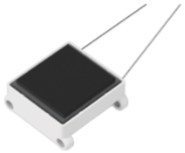
MINI

Debut MINI series represents a breakthrough in solar-powered GPS-ACC devices specifically crafted for attachment on the back. Weighing just 5 to 6 grams, this series offers a multitude of transmission options including 2G (GSM), 4G (CAT1), 5G (LTE-M & NB-IoT), LoRa, and Argos.

BASIC SPECIFICATIONS

MODEL	MINI standard / P1 / M1
	Standard/lite M1
Appearance	 
Dimensions (LWD, antennae excluded)	20.6mm × 20.6mm × 11.5 mm (standard) 18 mm × 19.5mm × 8~20mm (P1) 20.5mm × 27mm × 11mm (M1)
Battery Type	30mAh lithium polymer rechargeable battery with under/over-charge protection
Battery Life	Over 300 positions under optimal GNSS satellite view at 5-minute interval
Solar Type	GaAs solar unit (30% efficiency) with good performance under weak light
Housing	ABS & PC injection molding (standard), X-Glue (P1), or nylon 3D-printed (M1)
Color	Light brown for injection molding housing, white or customized for P1/M1
Antenna	External, 0.4mm titanium alloy with protective coating (by default)
GNSS Module	Precision: CEP (50%) 5m Maximum update rate: 10 Hz
Working Temperature	-20°C~60°C (enough for very cold winter if close to warm-blood animal body)
Waterproof	> IP 68 (2 ATM for injection molding)
Data Types	- GNSS: longitude, latitude, altitude, altitude (ellipsoid), course, satellite quantity - ENV: voltage, light intensity, temperature - ODBA (overall dynamic body acceleration) - ACC: x/y/z acceleration data (upon request) - Beacon: with Debut series gateway devices
Data Storage	Collected data will be stored in memory before transmission. - Flash memory: 16 MB - Regular data storage: 460 days at default setting (1h GNSS+1h ENV+10 min ODBA) - BOOST data storage: 280,000 pieces - ACC data storage: 28,700 pieces
Working Schedule	Programmable from 1 min, changeable via 2G/4G/5G network, or instantly via INTELINK (Bluetooth)
Firmware Upgrade	Remotely via 2G/4G/5G network, or instantly via INTELINK (Bluetooth)

MINI 2G/4G/5G

SUB-MODELS

Name	Weight	Antenna Length (GPS/Transmission)
MINI 2G [1]	6.3±0.1g	50 mm / 95 mm
MINI 2G lite [2]	5.8±0.1g	50 mm / 95 mm
MINI 2G M1 [3]	5.0±0.1g	50 mm / 95 mm
MINI 2G M2 [4]	5.3±0.1g	N/A
MINI 2G P1 [5]	5.0±0.1g	50 mm / 95 mm
MINI 2G P1 ECM20 [6]	5.5±0.2g	50 mm / 95 mm
MINI 4G	6.5±0.1g	46 mm / 114 mm
MINI 4G lite	5.8±0.1g	46 mm / 114 mm
MINI 4G M1	5.0±0.1g	46 mm / 114 mm
MINI 4G P1	5.0±0.1g	46 mm / 114 mm
MINI 4G P1 ECM20	5.5±0.2g	46 mm / 114 mm
MINI 5G	5.8±0.1g	61 mm / 95 mm
MINI 5G M1	5.0±0.1g	61 mm / 95 mm
MINI 5G P1	5.0±0.1g	61 mm / 95 mm
MINI 5G P1 ECM20	5.5±0.2g	61 mm / 95 mm

Note:

[1] This is standard version using injection molding housing. See the photo to the right for reference.

[2] “lite”signify the implementation of specialized craftsmanship aimed at reducing weight. Theoretically, these "lite" models may exhibit increased vulnerability to electromagnetic interference from the surrounding environment compared to their regular counterparts. However, field tests have demonstrated that despite this susceptibility, the "lite" models perform comparably to the regular ones when utilized in wilderness settings.

[3] M1 refers to a unique housing crafted from 3D-printed nylon material. This housing features a bottomless design, allowing users to customize it according to their preferences. Additionally, all components are waterproofed using our X-Coating technique to exceed the IP68 standard.

[4] M2 involves a unique treatment where the originally protruding antennas are coiled around the surface of the case. This design is specifically aimed at species prone to pulling or biting the antennas. However, this modification comes with trade-offs: increased power consumption, heightened susceptibility of GPS signals to environmental interference, and a higher likelihood of network transmission failures.

Nevertheless, our extensive field tests indicate satisfactory performance for shorebirds inhabiting well-lit and open environments. For other species, careful evaluation is advised.

[5] P1 refers to the X-Glue sealing technique primarily aimed at reducing weight.

[6] ECM20 denotes a customized version with the solar panel elevated to 20 mm (total device height). See photo to the right for reference.

TRANSMISSION MODULE

■ 2G:

Band	Uplink（MHz）	Downlink（MHz）	Output Power（dBm）
GSM850	824.2 ~ 848.8	869.2 ~ 893.8	33
EGSM900	880.2 ~ 914.8	925.2 ~ 959.8	33
DCS1800	1710.2 ~ 1784.8	1805.2 ~ 1879.8	30
PCS1900	1850.2 ~ 1909.8	1930.2	~ 1989.8

Maximum uplink/downlink data rate: 85.6 Kbps/85.6 Kbps

■ 4G:

Band	Uplink（MHz）	Downlink（MHz）	Output Power（dBm）
LTE-FDD B1	1920 ~1980	2110 ~2170	23 dBm±2.7 dB
LTE-FDD B3	1710 ~1785	1805 ~1880	23 dBm±2.8 dB
LTE-FDD B5	869 ~ 894	824 ~ 849	23 dBm±2.9 dB
LTE-FDD B8	880 ~915	925 ~960	23 dBm±2.1 dB

Maximum output power: 23 dBm

Maximum uplink/downlink data rate: 5 Mbps/10 Mbps

■ 5G

MINI 5G supports both NB-IoT and LTE-M (or called eMTC) frequency bands. You can activate selected bands for usage in different regions. Below lists all the bands that are supported.

NB-IoT bands

Band	Duplex mode	f (MHz)	Uplink (MHz)	Downlink (MHz)	UL/DL Bandwidth (MHz)	Duplex spacing (MHz)	Channel bandwidths (kHz)
B1	HD-FDD	2100	1920-1980	2110-2170	60	190	180(/200)
B2	HD-FDD	1900	1850-1910	1930-1990	60	80	180(/200)

B3	HD-FDD	1800	1710-1785	1805-1880	75	95	180(/200)
B4	HD-FDD	1700	1710 -1755	2110 -2155	45	400	180(/200)
B5	HD-FDD	850	824-849	869-894	25	45	180(/200)
B8	HD-FDD	900	880-915	925-960	25	45	180(/200)
B11	HD-FDD	1500	1427.9-1447.9	1475.9-1495.9	20	48	180(/200)
B12	HD-FDD	700	699-716	729-746	17	30	180(/200)
B13	HD-FDD	700	777-787	746-756	10	31	180(/200)
B14	HD-FDD	700	788-798	758-768	10	30	180(/200)
B17	HD-FDD	700	704-716	734-746	12	30	180(/200)
B18	HD-FDD	800	815-830	860-875	15	45	180(/200)
B19	HD-FDD	800	830-845	875-890	15	45	180(/200)
B20	HD-FDD	800	832-862	791-821	30	41	180(/200)
B25	HD-FDD	1900	1850-1915	1930-1995	65	80	180(/200)
B26	HD-FDD	850	814-849	859-894	35	45	180(/200)
B28	HD-FDD	700	703-748	758-803	45	55	180(/200)
B31	HD-FDD	450	452.5-457.5	462.5-467.5	5	10	180(/200)
B66	HD-FDD	1700	1710-1780	2110-2200	70/90	400	180(/200)

LTE-M (eMTC) bands

Band	Duplex mode	f(MHz)	Uplink (MHz)	Downlink (MHz)	UL/DL Bandwidth (MHz)	Duplex spacing (MHz)	Channel bandwidths (MHz)
B1	HD-FDD	2100	1920-1980	2110-2170	60	190	1.08(/1.4)
B2	HD-FDD	1900	1850-1910	1930-1990	60	80	1.08(/1.4)
B3	HD-FDD	1800	1710-1785	1805-1880	75	95	1.08(/1.4)
B4	HD-FDD	1700	1710 -1755	2110 -2155	45	400	1.08(/1.4)
B5	HD-FDD	850	824-849	869-894	25	45	1.08(/1.4)
B8	HD-FDD	900	880-915	925-960	25	45	1.08(/1.4)
B11	HD-FDD	1500	1427.9-1447.9	1475.9-1495.9	20	48	1.08(/1.4)
B12	HD-FDD	700	699-716	729-746	17	30	1.08(/1.4)
B13	HD-FDD	700	777-787	746-756	10	31	1.08(/1.4)
B14	HD-FDD	700	788-798	758-768	10	30	1.08(/1.4)
B17	HD-FDD	700	704-716	734-746	12	30	1.08(/1.4)
B18	HD-FDD	800	815-830	860-875	15	45	1.08(/1.4)
B19	HD-FDD	800	830-845	875-890	15	45	1.08(/1.4)
B20	HD-FDD	800	832-862	791-821	30	41	1.08(/1.4)

B25	HD-FDD	1900	1850-1915	1930-1995	65	80	1.08(/1.4)
B26	HD-FDD	850	814-849	859-894	35	45	1.08(/1.4)
B28	HD-FDD	700	703-748	758-803	45	55	1.08(/1.4)
B31	HD-FDD	450	452.5-457.5	462.5-467.5	5	10	1.08(/1.4)
B66	HD-FDD	1700	1710-1780	2110-2200	70/90	400	1.08(/1.4)

Maximum output power: 23 dBm

MINI ARGOS

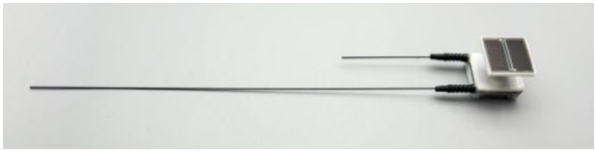
MINI Argos provides both GNSS data, and Doppler locations estimated by the Argos system. Additionally, it is equipped with multiple sensors capable of generating data that reflects ambient environmental conditions and animal activity and behaviors.

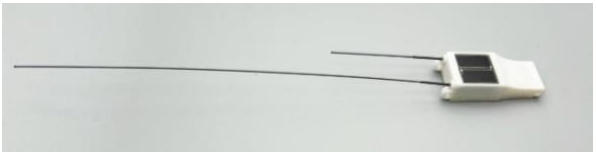
In addition to scheduled Argos transmission, MINI Argos utilizes patented INTELINK® technology to transmit data to smartphones or Debut series gateway devices. This facilitates ground search operations, retrieval of data stored onboard (often exceeding the capacity for Argos transmission), and enables real-time modeling based on raw acceleration data downloading and tagging using specialized tools.

SUB-MODELS

Name	Weight	Antenna Length
MINI Argos	5.8±0.1g	54 mm / 178 mm
MINI Argos M1	5.0±0.1g	54 mm / 178 mm
MINI Argos P1	4.8±0.1g	54 mm / 178 mm
MINI Argos P1 ECM20 [1]	5.2g±0.2g	54 mm / 178 mm
MINI Argos P1 ECM17	5.2g±0.2g	54 mm / 178 mm
MINI C2 Argos [2]	9.6±0.2g	54 mm / 178 mm

Note: [1] ECM20 and ECM 17 denote customized versions with the solar panel elevated to reach 20/17 mm total device height. See photo to the right for reference.
[2] MINI C2 Argos is a customized version for the purpose of using a bigger battery (210mAh). The dimensions are 46.6mm long, 16.2~19.5mm wide (top and bottom), and 6.7mm~11.2mm high (top and bottom). See photo to the right for reference.





TRANSMISSION BANDS

Duplex mode	f (MHz)	Uplink (MHz)	Duplex spacing (MHz)	Bandwidths (KHz)	Downlink (MHz)
Single frequency	400	399.99-401.690	1.79	10	466

TRANSMISSION STRATEGY

MINI Argos monitors Argos satellite pass and attempts transmission only when a satellite is over head. This mode is particularly recommended for long-distance migrating species, but it is also advisable for other species when you are unfamiliar with satellite pass schedules in the tracking region.

A crucial parameter is the "GNSS queue," which determines how many of the latest GNSS data points should enter the queue for Argos transmission attempts. Since Argos transmits one piece of GNSS data per time following a 90s/60s periodic pattern during satellite passes, and the device does not confirm whether the satellite has successfully received it, setting an appropriate GNSS queue value ensures that you receive the data as complete as possible.

The GNSS queue should be configured considering the GNSS interval you set, as well as the satellite pass duration of the region (the longer the pass, the more data can be transmitted). A successful example is at a north latitude of 43°, for birds with favorable solar charging conditions, where GNSS data was collected every 30 minutes, and the GNSS queue was set to 20. In this scenario, the researcher can receive 48 non-repetitive GNSS data points per day.

If another transmission strategy is required to suit the study's scenario and objectives, such as periodic or on-time transmission, please contact your sales manager for configuration assistance.

MINI LORA

MINI LoRa utilizes a proprietary LoRa protocol for data transmission. When paired with a professional gateway device like the HUB from Druid, MINI LoRa enables data downloading from distances of 8 to 10 kilometers in an ideal environment.

SUB-MODELS

Name	Weight	Antenna Length
MINI LoRa	5.8±0.1g	54 mm / 180 mm
MINI LoRa M1	5.0±0.1g	54 mm / 180 mm
MINI LoRa P1	4.8±0.1g	54 mm / 180 mm
MINI LoRa P1 ECM20	5.2g±0.2g	54 mm / 180 mm

TRANSMISSION BANDS

Specifications	LoRa	INTELINK
Frequency Bands	150~960 MHz	2.4 GHz
Maximum Output Power	22 dbm	8 dBm
Maximum Data Rate	62.5 kbps	1 Mbps
Transmission Distance (ideal condition in field)	10 km	50 m

TRANSMISSION STRATEGY

MINI LoRa employs either LoRa or INTELINK for data transmission, necessitating the configuration of signal broadcasting duty cycles for both transmission modes. When the device is within range of an INTELINK connection (and within range of LoRa connection as well), it adheres to the duty cycle configuration to determine which type of connection should be established.

By default, the duty ratio for LoRa is set lower than that for INTELINK due to its higher power consumption. This approach enhances data transmission efficiency while also managing energy consumption more effectively.

ANTENNA OPTIONS

ANTENNA MATERIAL OPTIONS

Type	Description	Weight Change
A	0.2mm titanium alloy wire with waterproof coating	- 0.1g for 2G/4G - 0.2g for Argos/LoRa
B	0.4mm titanium alloy wire with waterproof coating	Default [1]
C	0.8mm titanium alloy rope (7*7 wires braided)	+ 0.3g for 2G/4G + 0.6g for Argos/LoRa

ANTENNA ROOT PROTECTION OPTIONS

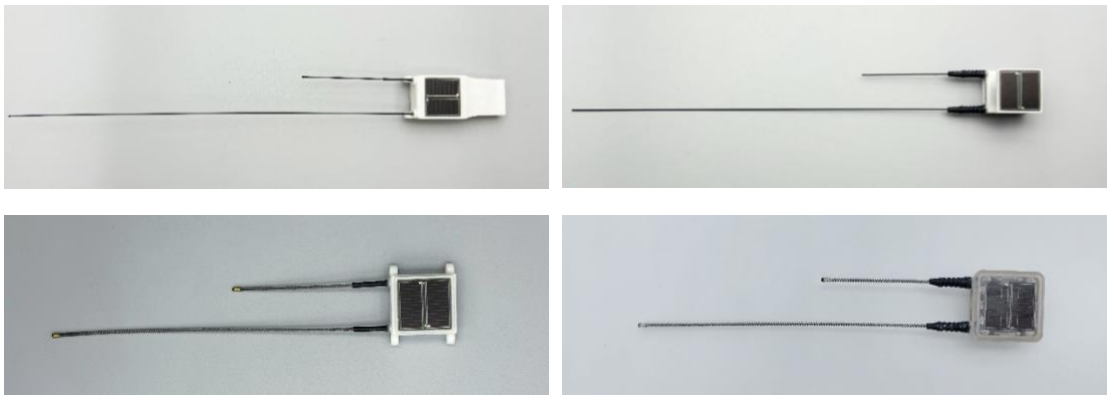
Type	Description	Weight Change
Default	Plastic tube	Default [2]
Extra strengthened	Spring with double-layer plastic tube	+ 0.3g

Note: [1] By default, 0.4 mm titanium alloy wire with waterproof coating is used, to achieve the balance between weight and toughness. The weight change of other options is calculated based on the default version. Generally, the thicker the antenna, the more resilient it is.

[2] By default, only plastic tube is used, to achieve the balance between weight and toughness. The weight change is calculated based on the default version.

In the below photos, from the left:

- the top-left shows default antenna (B)+ default antenna root protection;
- the top-right shows default antenna (B) + extra strengthened antenna root;
- the bottom-left t shows antenna material C + default antenna root protection;
- the bottom-right shows antenna material C + extra strengthened antenna root.



PRICING

Sub Model-Name	Device	(Feed Subscription)	Ecotopia Data Services [1]	Debut Renewal
	Retail	Promotion	(per unit per year)	Plan [2]
MINI 4G	1199	N/A	131.88	249
MINI 4G lite	1199	N/A	131.88	249
MINI 4G M1	1299	N/A	131.88	299
MINI 4G P1	1299	N/A	131.88	299
MINI 4G P1 ECM20	1299	N/A	131.88	299
MINI Argos	1199	N/A	59.88	249
MINI Argos M1	1299	N/A	59.88	299
MINI Argos P1	1299	N/A	59.88	299
MINI Argos P1 ECM20	1299	N/A	59.88	299
MINI Argos P1 ECM17	1299	N/A	59.88	299
MINI C2 Argos	1299	N/A	59.88	299

Note: The prices are in US dollar.

[1] To know more about Ecotopia Data Service, please click:
https://www.ecotopiago.com/help/en/#/essential/data_service/overview

[2] To know more about Debut Renewal Plan, please click:
https://www.youtube.com/watch?v=IM75JLGhsHU&t=6s

[3] The promotion period is 2023 Sep 1 ~2024 December 31.

ACCESSORIES

MINI series is designed with flexible holes to support harness attachment on back or waist.

BACK-MOUNT

Each device will be provided along with 1 meters of 1.5 mm wide UHMWPE tape (for harness use) and 6 aluminum rings (for binding the harness) for free.