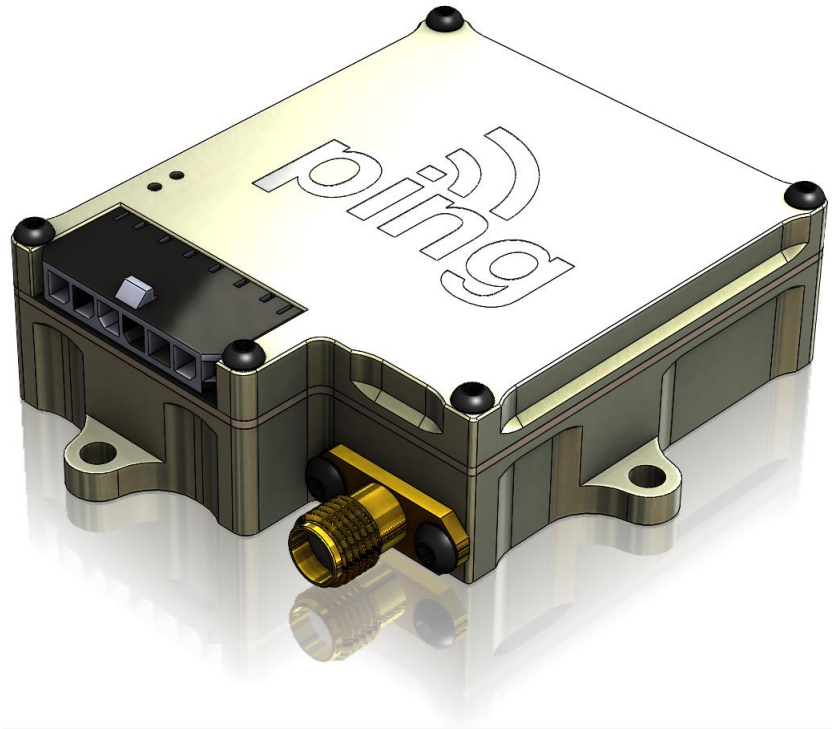
Ping200S

User and Installation Guide



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1 Revision History

Revision	Date	Comments
A	10/21/16	Initial release

2 Warnings / Disclaimers

All device operational procedures must be learned on the ground.

uAvionix is not liable for damages arising from the use or misuse of this product.

This equipment has received a FAA transmit license for manned aircraft and a license for un-manned aircraft operating above 500ft AGL

This antenna used for this transmitter must installed to provide a separation distance of at least 20cm from all persons.

3 Limited Warranty

uAvionix products are warranted to be free from defects in material and workmanship for one year from the installation in the aircraft. For the duration of the warranty period, uAvionix, at its sole option, will repair or replace any product which fails under normal use. Such repairs or replacement will be made at no charge to the customer for parts or labor, provided that the customer shall be responsible for any transportation cost.

This warranty does not apply to cosmetic damage, consumable parts, damage caused by accident, abuse, misuse, water, fire or flood, damage caused by unauthorized servicing, or product that has been modified or altered.

IN NO EVENT, SHALL UAVIONIX BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM THE USE, MISUSE OR INABILITY TO USE THE PRODUCT OR FROM DEFECTS IN THE PRODUCT. SOME STATES DO NOT ALLOW THE EXCLUSION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU.

Warranty Service

Warranty repair service shall be provided directly by uAvionix.

4 Contents

5 Introduction

5.1 Description

The Ping200S is a TSO-C199 Class A, Mode S, level 2e transponder with support for ADS-B extended squitter. The Ping200S has a nominal power output of 250W and meets the power output requirements for Class 1. The ADS-B function meets DO-260B class B1S.

This transponder replies to both legacy Mode A/C interrogations and to Mode S interrogations from both ground radar and airborne collision avoidance systems. In all cases, the interrogations are received by the transponder on 1030MHz and replies are transmitted on 1090MHz.

This system will enable the aircraft to be visible to ATC and other aircraft equipped with:

- Traffic Advisory System (TAS) as defined in TSO-C174()
- Traffic Alert and Collision Avoidance System I (TCAS I) as defined in TSO-C188()
- Traffic Alert and Collision Avoidance System II (TCAS II) as defined in TSO-C119d
- ADS-B In capability as defined in TSO-C154c, TSO-C166b and TSO-C195b

This equipment has received a FAA transmit license for manned aircraft and a license for un-manned aircraft operating above 500ft AGL

5.2 Interfaces

The Ping200S has a single SMA antenna connection, a 6-pin Host interface and a 4-pin FYXnav GPS interface.

Host Interface

Interface	Specification	Protocol
Power Input	46 – 52V	
COM1 RX 57600bps	VFR Squawk Code Call sign Squawk Code IDENT Transponder Mode	GDL 90 Compatible Control Protocol (See Appendix A)
COM1 TX 57600bps	Heartbeat Ownship Geometric Altitude	GDL 90 (See Appendix B)
COM2 RX 115200bps	Reserved for future use.	
Mutual Suppression Input	Commonly used between transponders and DME systems, and between transponders and collision avoidance systems.	

FYXnav Interface

Interface	Specification	Protocol
FYXnav 115200bps	GPS Altitude Encoder ICAO number VFR Squawk Code Callsign Aircraft Maximum Speed Aircraft Category Aircraft Vso	uAvionix

	Aircraft Length and Width GPS Antenna Offset ADS-B Rx Capability	

5.3 TABS

The intent of a Traffic Awareness Beacon System (TABS) is to increase safety within the National Airspace System (NAS) by encouraging the voluntary equipage of a low cost, compact, easy to install device that will allow other aircraft equipped with collision avoidance systems and traffic advisory systems to track and display the TABS aircraft. TABS are intended to be used on aircraft that are exempt from carrying a transponder or ADS-B equipment such as gliders, balloons and aircraft without electrical systems.

A TABS will allow these exempted aircraft to be visible to other aircraft equipped with:

- Traffic Advisory System (TAS) as defined in TSO-C147().
- Traffic Alert and Collision Avoidance System I (TCAS I) as defined in TSO-C188().
- Traffic Alert and Collision Avoidance System II (TCAS II) as defined in TSO-C199d.
- Aircraft with ADS-B In capability as defined in TSO-C154c, TSO-C166b and TSO-195b.

5.4 Software and Airborne Electronic Hardware Configuration.

Part	Part Number	Revision	SDA
Software	UAV-1000704-001	A	1
Airborne Electronic Hardware	UAV-1000706-001	A	1

5.5 Supplied Accessories

Part	Part Number	Revision
Ping200S	UAV-1000706-001	A
Power Adapter	UAV-1000707-001	A
Ping200S – Power Adapter Cable		
Power Adapter – Battery Cable		A
FYXnav TSO GPS/Baro	UAV-1000568-001	A
Ping200S - FYXnav Cable	UAV-1000595-001	A
PingBuddy	UAV-1000525-001	A
Programmer		
USB Micro Cable		
Dipole Antenna	UAV-1000653-001	A
4S 800mAHr LiPo Battery		
AC Charger		
Fastener Set		
FYXnav Mounting Tape		
Ping200S User Manual	UAV-1000711-001	A
FYXnav Programming Manual		
Case		

6 Technical Specifications

Specification	Characteristics
Compliance	TSO-C199 Class A Level 2e Class 1 DO-181E Class B1S DO-260B
FCC ID	2AFFTP200S
FAA Transmit License	Manned aircraft. Un-manned operating above 500ft AGL.
Software	RTCA DO-178B Level C
Hardware	RTCA DO-254 Level C
Power Requirements	11 – 33VDC. Typical 2W.
Altitude	35,000ft
Operating Temperature	-45°C to +70°C
Humidity	Tested to Category DO-160G Category B2
Transmit Frequency	1090MHz ±1MHz
Transmit Power	250W nominal; 125W minimum at antenna after allowing for 0.5dB connector losses and 1.5dB cable losses.
Transmitter Modulation	6M75 V1D
Receiver Frequency	1030MHz
Receiver Sensitivity	-74dBm ±3dB
Weight	50grams
Height	17mm
Length	59mm
Width	57mm

6.1 Markings

Ping200S, uAvionix Inc. TSO-C199 Class A
P/N: UAV-1000xxx-001 S/N: 10000001
DO-181E Class 2e Level 1 FCC ID: 2AFFTP200S

7 Equipment Limitations

7.1 Installation

7.1.1 Modifications and Use Outside of Intended Scope

This device has been designed and tested to conform to all applicable standards in the original form and when configured with the components shipped with the device. It is not permissible to modify the device, use the device for any use outside of the intended scope, or use the device with any antenna other than the one shipped with the device.

7.1.2 Deviations

There are no deviations from the MPS of TSO-C199 Class A Device.

7.1.3 Configurable Options

Accessing or altering configurable options not intended to be operated may cause pilot distraction.

7.1.4 Approvals

Approvals do not cover adaptations to the aircraft necessary to accommodate ancillary equipment such as power provisions, mounting devices or external antennas; such items must still be approved under existing minor modification/change processes applicable to the aircraft.

This device meets the minimum performance and quality control standards required by a technical standard order (TSO). Installation of this device requires separate approval.

This device does not meet requirements for use in transponder rule airspace as defined in 14 CFR § 91.215 and ADS-B rule airspace as defined in 14 CFR § 91.225.

7.1.5 FAA Transmitter License and FCC Grant of Equipment Authorization

This equipment has received a FAA transmit license for manned aircraft, and for un-manned aircraft operating above 500ft AGL.

This equipment has been issued an FCC Grant of Equipment Authorization.

The equipment contains FCC ID 2AFFTP200S and is marked on the equipment nameplate.

8 Equipment Installation

This section describes the installation of Ping200S and related accessories in the aircraft, including mounting, wiring, and connections.

8.1 Unpacking and Inspecting

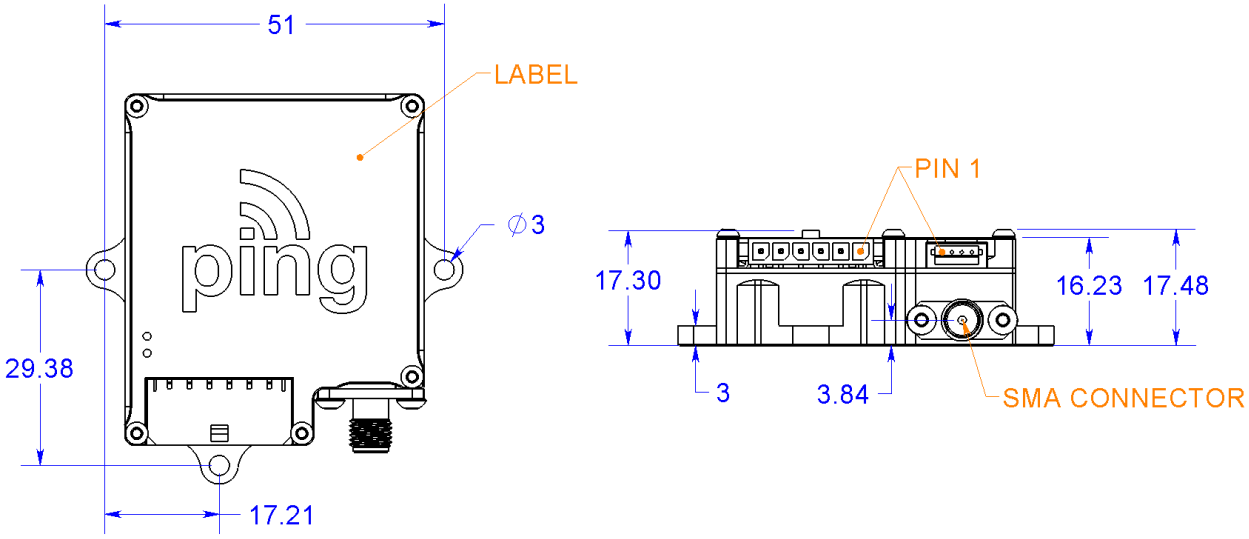
Carefully unpack the device and make a visual inspection of the unit for evidence of any damage incurred during shipment. If the unit is damaged, notify the shipping company to file a claim for the damage. To justify your claim, save the original shipping container and all packing materials.

8.2 Mounting

The Ping200S is designed to be mounted in any convenient location in the cockpit, the cabin, or an avionics bay.

The following installation procedure should be followed, remembering to allow adequate space for installation of cables and connectors.

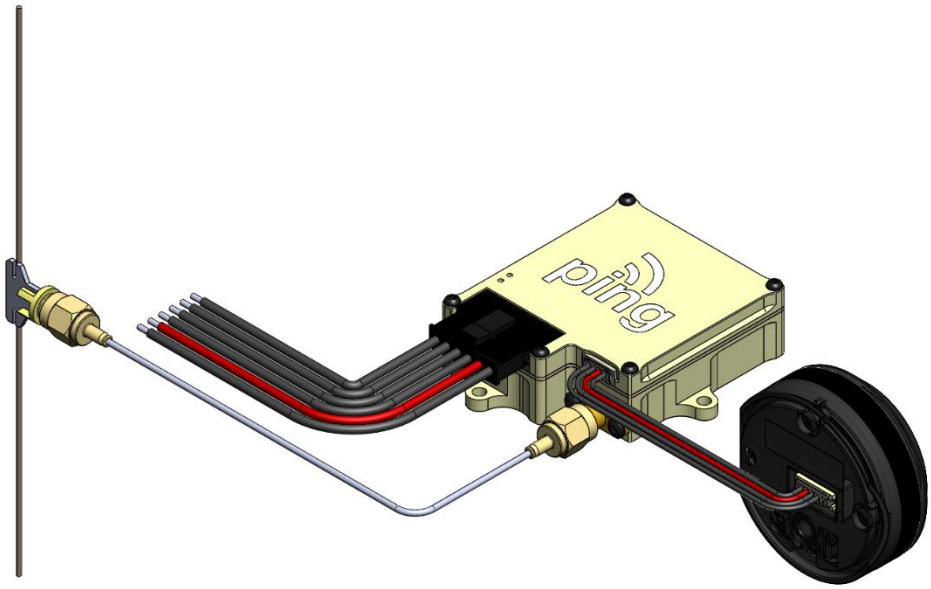
- Select a position in the aircraft that is not too close to any high external heat source. The Ping200S is not a significant heat source itself and does not need to be kept away from other devices for this reason.
- Avoid sharp bends and placing the cables too near to the aircraft control cables.
- Secure the transponder to the aircraft via the three (3) mounting holes. It should be mounted on a flat surface.



8.3 Connections

Whenever power is supplied to the transponder, a 50ohm load must be provided to the SMA connection. You can use the supplied antenna or a commercially available 50ohm load.

The following diagrams illustrate the setups using 48V and 14/28V Aircraft power. Note that a power adapter will be required when installing with 14/28V Aircraft power.



48V (46-52V) Aircraft Power

Host Interface

Pin	Type	Physical	Rate	Link
1	Ground			
2	Aircraft Power	46-52V		
3	COM1 TX	RS-232 Out	57600bps	GDL 90
4	COM1 RX	RS-232 In	57600bps	Control
5	COM2 RX	RS-232 In	115200bps	RFU
6	SURPRESS	3.3V IO		
Mating Connector: Molex 0436450600, Pins: 0462350001				

FYXnav Interface

Pin	Type	Physical	Rate	Link
1	RX In	3.3V Serial	115200bps	uAvionix
2	TX Out	3.3V Serial	115200bps	GDL 90
3	Power	5V Out		
4	Ground			
Mating Connector: JST ZHR-4, Pins: SZH-002T-P0.5				

LEDs

LED	SOLID	FLASHING
RED	FAULT	Reply / Transmit
GREEN	Powered	Receiving Interrogation

8.4 Cooling Requirements

Ping200S is designed to meet all applicable TSO requirements without forced-air cooling.

Attention should, however, be given to the incorporation of cooling provisions to limit the maximum operating temperature if Ping200S is installed in close proximity to other Avionics. The reliability of equipment operating in close proximity in an avionics bay can be degraded if adequate cooling is not provided.

8.5 Wiring Considerations

The Ping200S was designed and tested using unshielded, untwisted wiring. There may, however, be technical benefits of improved electromagnetic emissions and susceptibility to and from the transponder system. Use of twisted wire can reduce interference and break-through on adjacent audio wiring if it is not possible to route them separately.

The distance between the Ping200S and the power adapter is limited by the impedance of the wire between them. The Ping200S is powered from the power adapter, not directly from aircraft power, and, therefore, the acceptable voltage drop in the power line is what limits the distance.

The Ping200S needs an impedance of less than 0.5ohm in the power line for satisfactory operation. The following table gives guidance for typical aircraft hook-up wire. Note that different brands may vary – check your supplier for details.

Gauge	ohm/km	Length for 0.5ohm
20 AWG	35	14.2m
22 AWG	64	7.8m
24 AWG	99	5.0m

An alternative to a harness built from individual wires, particularly for a long cable run, is to use a multi-core cable. Aviation grade cables with 6 or more cores are often more expensive than individual wires, and, therefore, are not generally a good choice. For aircraft where those situations do not

apply, an attractive alternative solution may be to use 3 or 4 pair data cable.

Please note that not all data cable is suitable for this application. Cables with solid cores should not be used. Cables should be selected based on the wear characteristics of their insulation material, including temperature rating, resistance to solvents and oils, and flammability. Most inexpensive commercial data cables have poor flammability properties.

8.6 Antenna Installation

8.6.1 Supplied Dipole Antenna

The following considerations should be taken into account when siting the antenna.

- The antenna should be well removed from any projections, the engine(s) and propeller(s). It should also be well removed from landing gear doors, access doors or other openings which will break the ground plane for the antenna.
- The antenna should be mounted in a vertical position when the aircraft is in level flight.
- Avoid mounting the antenna within 1 meter of the ADF sense antenna or any COMM antenna and 2 meters from the transponder to the DME antenna.
- Where practical, plan the antenna location to keep the cable lengths as short as possible and avoid sharp bends in the cable to minimize the VSWR.

Electrical connection to the antenna should be protected to avoid loss of efficiency due to exposure to liquids and moisture. All Antenna feeders shall be installed in such a way that a minimum of RF energy is radiated inside the aircraft.

8.6.2 Conventional OEM Monopole Antenna

The antenna should be installed according to the manufacturer’s instructions.

The following considerations should be taken into account when siting the antenna.

- The antenna should be well removed from any projections, the engine(s) and propeller(s). It should also be well removed from landing gear doors, access doors or other openings which will break the ground plane for the antenna.
- The antenna should be mounted on the bottom surface of the aircraft and in a vertical position when the aircraft is in level flight.
- Avoid mounting the antenna within 1 meter of the ADF sense antenna or any COMM antenna and 2 meters from the transponder to the DME antenna.
- Where practical, plan the antenna location to keep the cable lengths as short as possible and avoid sharp bends in the cable to minimize the VSWR.

Electrical connection to the antenna should be protected to avoid loss of efficiency due to exposure to liquids and moisture. All antenna feeders shall be installed in such a way that a minimum of RF energy is radiated inside the aircraft.

When a conventional aircraft monopole antenna is used it relies on a ground plane for correct behavior. For ideal performance, the ground plane should be large relative to the wavelength of the transmission, which is 275mm. In a metal, skinned aircraft this is usually easily accomplish, but is more difficult in a composite or fabric skinned aircraft. In these cases, a metallic ground plane should be fabricated and fitted under the antenna.

The ground plane should be as large as you can sensibly make it. Because it is a function of the wavelength of the transmission, the smallest practical ground plane for a transponder is a approx. 120mm per side; as the size increases, the performance improves, until the ground plane is approx. 700mm on each side. Anything much larger than that size is unlikely to result in significant further improvement.

The thickness of the material used to construct the ground plane is not critical, providing it is sufficiently conductive. A variety of proprietary mesh and grid solutions are available. Heavyweight cooking foil meets the technical requirement, but obviously needs to be properly supported.

8.6.3 Antenna Cable

The Ping200S is designed to meet Class 1 requirements with an allowance of 2dB for loss in connectors and cable used to connect it to the antenna. Excessive loss will degrade both transmitter output power and receiver sensitivity.

Allowing for 0.25dB loss for the connector at each end of the antenna cable assembly leaves an allowance of 1.5dB maximum loss for the cable itself.

An acceptable cable:

- has less than 1.5dB loss for the run length needed,
- has a characteristic impedance of 50ohms,
- has double braid screens or has foil and braid screen.

Once the cable run length is known, a cable type with low enough loss per meter that meets the above requirements can be chosen. Longer runs require lower loss cable.

The following table is a guide to the maximum usable lengths of some common cable types. Actual cable loss varies between manufacturers. There are many variants, and the table is based on typical data. Use it as a guide only and refer to the manufacturer's data sheet for your specific chosen cable for accurate values.

Length (meters)	Insertion Loss (dB/m)	MIL-C 17	Specialists	SSB Electronic
2.54	0.59	M17/128		
2.54	0.59	RG400		
3.16	0.47		3C142B	
3.81	0.39	RG304		
4.5	0.33			Aircell 5
5.25	0.29	RG393	311601	
6.42	0.23		311501	
6.81	0.18			Aircell 7
8.22	0.18		311201	
12.59	0.12		3108801	

When routing the cable:

- Route the cable away from sources of heat
- Route the cable wiring away from potential interference sources such as ignition wiring, 400Hz generators, fluorescent lighting and electric motors
- Allow a minimum separation of 300mm from an ADF antenna cable
- Keep the cable run as short as possible
- Avoid routing the cable around tight bends
- Avoid kinking the cable, even temporarily, during installation
- Secure the cable so that it cannot interfere with other systems

9 Configuration

The transponder system should be configured during initial system installation by a qualified technician. The configuration items list below should be used to document the system installation for future reference.

Configuration Item		Default	Setting
ICAO Number		0x000000	
VFR Squawk Code		1200	
Callsign		NONE	
Aircraft Maximum Speed		0	
Aircraft Category		0	
Aircraft V_{SO}		0kts	
Aircraft Size	Length	0	
	Width	0	
GPS Antenna Offset	Longitudinal	0	
	Lateral	0	
ADS-B RX Capability	UAT RX	NO	
	ES1090 RX	NO	

Configuration Items List

9.1 ICAO Number

The ICAO address is a 24-bit number issued to the aircraft by the registration authority of the aircraft. These addresses are usually written as a 6-digit hexadecimal number, although you may also encounter one written as an 8-digit octal number. The FYXnav understands the hexadecimal format. An octal number must be converted to hexadecimal format before entering.

9.2 VFR Squawk Code

VFR squawk (Mode 3/A) code is a pre-programmed default code when the pilot is flying VFR and not in contact with ATC. In the USA, the VFR squawk code is 1200 and in most parts of Europe the VFR squawk code is 7000.

9.3 Callsign

The callsign (aka VFR Flight ID) is an 8 character code that corresponds to the tail number of the aircraft. (0-9, A-Z).

9.4 Aircraft Maximum Speed

Mode S transponders can transmit their maximum airspeed characteristics to aircraft equipped with TCAS. This information is used to identify threats and to plan avoiding action by the TCAS equipped aircraft. The airspeeds are grouped in ranges.

9.5 Aircraft Category

To assist ATC tracking of aircraft, an aircraft category can be transmitted.

9.6 Aircraft V_{SO}

Groundspeed threshold can be used to help determine and verify the ON GROUND condition for transmitting ON GROUND message types for “Light Fixed Wing” aircraft types only.

9.7 Aircraft Size

On the ground, ADS-B transmits encoded aircraft size information which is used by ATC to identify taxiing routes and potential conflicts. Enter the length and width (wingspan) fields and the appropriate size codes will be calculated for transmission.

9.8 GPS Antenna Offset

The GPS antenna offset is used in conjunction with the length and width to manage taxiway conflicts. A typical GPS does not report the geographic position of the center of the aircraft, or even the tip of the nose of the aircraft; instead, it usually reports the location of the actual GPS antenna (not the GPS receiver). In normal flight operation, this distinction is of no importance, but if ADS-B is used to manage taxiway conflicts, a significant offset in antenna position could mean that the aircraft footprint is not in the same place as the ADS-B reported position. Although the GPS Antenna Offset is primarily intended for position correction on large transport aircraft, General Aviation aircraft can also have a significant offset. For example, if the aircraft has a long tail boom and the GPS antenna is on top of the tail, the GPS position could be 4 meters or more from the nose of the aircraft.

9.9 ADS-B RX Capability

The ADS-B transmissions include an indication to the ground stations of whether the aircraft includes a 1090MHz ADS-B receiver, a UAT ADS-B receiver, or both.

9.10 Programming

These settings are stored in the FYXnav GPS device and transferred to the transponder at power-up. To change these settings, the FYXnav is configured via the supplied Wi-Fi adapter and mobile device application.

Please refer to the following documentation:

FYXnav datasheet:

http://uavionix.com/downloads/pingnav/docs/uAvionix-PingNav-Data-Sheet-AP4.pdf

FYXnav quick start guide:

http://uavionix.com/downloads/pingnav/docs/uAvionix-Ping-Nav-Quick-Start-Guide.pdf

Ping App iOS quick start guide:

http://uavionix.com/downloads/pingapp/uAvionix-ping-app-Quick-Start-Guide.pdf

Download on the App Store

10 Post Installation Checks

Post installation checks should be carried out in accordance with your certification requirements.

- Mode S interrogations to verify correct address programming.
- Verification of the reported altitude using a static tester.
- Interrogations to verify the receiver sensitivity. A mode S transponder should have a minimum triggering level (MTL) of between -77dBm and -71dBm. Failure to meet this requirement usually indicates an antenna or coaxial cable problem.
- Interrogations to verify the transmitted power. A Class 1 installation should have no less than 125watts at the antenna (and no more than 500watts). Failure to meet this requirement is also generally due to antenna or wiring issues.
- Verification of the GPS position source and ADS-B outputs. Whenever a valid position is received by the transponder and the transponder is in any mode other than standby, ADS-B Extended Squitter messages should be observed on the transponder test set.

11 Continued Airworthiness

Other than for periodic functional checks required by the regulations, Ping200S has been designed and manufactured to allow “on condition maintenance”. This means that there are no periodic service requirements necessary to maintain continued airworthiness, and no maintenance is required until the equipment does not properly perform its intended function. When service is required, a complete performance test should be accomplished following any repair action. Repairs should only be carried out in accordance with uAvionix service procedures.

12 Environmental Qualification Forms

Nomenclature	Ping200SADS-B Mode S transponder	
Part No: UAV-1000706-001	TSO-C199 Class A Device	
Manufacturer	uAvionix Inc	
Address	380 Portage Ave, Palo Alto, CA 94306	
Conditions	**DO-160G Section**	**Description of Conducted Tests**
Temperature and Altitude	4.0	Equipment tested to Category B2
Low temperature ground survival	4.5.1	-55°C
Low Temperature Short-Time Operating	4.5.1	-45°C
Low Temperature Operating	4.5.2	-45°C
High Temperature Operating	4.5.4	+70°C
High Temperature Short-Time Operating	4.5.3	+70°C
High Temperature Ground Survival	4.5.3	+85°C
Loss of Cooling	4.5.5	Cooling air not required (+70°C operating without cooling)
Altitude	4.6.1	35,000feet
Decompression	4.6.2	Equipment identified as Category B2 – no test
Overpressure	4.6.3	Equipment identified as Category B2 – no test
Temperature Variation	5.0	Equipment tested to Category B2
Humidity	6.0	Equipment tested to Category B2
Operation Shocks	7.2	Equipment tested to Category B
Crash Safety	7.3	Equipment tested to Category B type 5
Vibration	8.0	Aircraft zone 2: type 3, 4, 5 to Category S level M, type 1 (Helicopters) to Category U level G
Explosion	9.0	Equipment identified as Category X – no test
Waterproofness	10.0	Equipment identified as Category X – no test
Fluids Susceptibility	11.0	Equipment identified as Category X – no test
Sand and Dust	12.0	Equipment identified as Category X – no test
Fungus	13.0	Equipment identified as Category X – no test
Salt Spray	14.0	Equipment identified as Category X – no test
Magnetic Field	15.0	Equipment identified as Category Z
Power Input	16.0	Equipment identified as Category ZX
Voltage Spike	17.0	Equipment identified as Category B
AF Conducted Susceptibility	18.0	Equipment identified as Category B
Induced Signal Susceptibility	19.0	Equipment identified as Category AC
RF Susceptibility	20.0	Equipment identified as Category TT
RF Emissions	21.0	Equipment identified as Category B
Lightening Induced Transient Susceptibility	22.0	Equipment identified as Category XXXX – no test
Lightening Direct Effects	23.0	Equipment identified as Category X – no test
Icing	24.0	Equipment identified as Category X – no test
Electrostatic Discharge	25.0	Equipment identified as Category X – no test
Fire, Flammability	26.0	Equipment identified as Category C

Appendix A. GDL 90 Compatible Control Protocol Format

(COM1 RX - RS-232 57600bps, N81)

The Ping200S receives control messages over the Control interface. The interface uses an ASCII-text basis, with an ASCII-encoded hexadecimal checksum. The checksum is algebraic sum of the message byte values. Messages are delimited with a carriage return character.

A1. Physical Interface.

The Control interface uses RS-232 signaling levels. The port is configured for the following characteristics:

- Baud Rate: 57600 baud
- Start Bits: 1
- Data Length: 8
- Stop Bits: 1
- Parity: None
- Flow Control: None

A2. Control Messages.

The following table summarizes the Control messages that the Ping200S receives.

Msg ID	Description	Notes	Ref
^CS	Call Sign	1 min interval or on change	A2.1
^MD	Operating Mode Message	1 second interval (nominal)	A2.2
^VC	VFR Code	1 min interval or on change	A2.3

A2.1 Call Sign Message

The call sign message provides for a user selectable call sign.

Rate: Every 1 minute or when a change occurs
Message Length: 15 bytes

Byte	Contents	Description
1	'^'	ASCII '^' (0x5E)
2	'C'	ASCII 'C' (0x43)
3	'S'	ASCII 'S' (0x53)
4	' '	ASCII space (0x20)
5-12	dddddddd	ASCII call sign (all 8 characters are mandatory, right pad with space)
13-14	dd	Checksum of bytes 1 through 12. In hex ASCII i.e. "FA"
15	'\r'	ASCII carriage return (0x0D)

Example: ^CS UAVIONIX87

A2.2 Mode Message

The mode message indicates the current operating mode. It includes the current mode, the Ident status, current squawk code setting and emergency code.

Rate: 1 sec (nominal)
Message Length: 17 bytes

Byte	Contents	Description
1	'^'	ASCII '^' (0x5E)
2	'M'	ASCII 'M' (0x4D)
3	'D'	ASCII 'D' (0x44)
4	' '	ASCII space (0x20)
5	m	See mode field table below
6	','	ASCII comma (0x2C)
7	'I'	See ident field table below
8	','	ASCII comma (0x2C)
9-12	dddd	ASCII squawk code
13	e	See emergency field table below
14	h	Health bit in hex ASCII "1"
15-16	dd	Checksum of bytes 1 through 14. In hex ASCII i.e. "FA"
17	'\r'	ASCII carriage return (0x0D)

Mode Field

m	Definition	ASCII
O	Standby Mode	0x4F
A	Mode A	0x41
C	Mode C	0x43
S	Mode S	0x53

Ident Field

i	Definition	ASCII
I	Ident Enabled	0x49
-	Ident is Inactive	0x2D

Emergency Field

e	Definition	ASCII
0	None	0x00
1	General	0x01
2	Medical	0x02
3	Fuel	0x03
4	Com	0x04
5	Hijack	0x05
6	Downed	0x06
7	UAS Lost Link	0x07

The health indication is set to '1 to indicate that everything is operating normally.

Example: ^MD A,I,23540120

Mode A, Ident active, Squawk 2354, No Emergency, Healthy

A2.3 VFR Code Message

The VFR code message informs the Ping200S of the squawk code that is used to indicate the VFR operating condition.

Rate: Every 1 minute or when a change occurs
Message Length: 11 bytes

Byte	Contents	Description
1	'^'	ASCII '^' (0x5E)
2	'V'	ASCII 'V' (0x56)
3	'C'	ASCII 'C' (0x43)
4	' '	ASCII space (0x20)
5-8	dddd	ASCII VFR code ASCII characters
9-10	dd	Checksum of bytes 1 through 10. In hex ASCII i.e. "FA"
11	'\r'	ASCII carriage return (0x0D)

Example: ^VC 1200DA

VFR code is 1200

Appendix B. GDL 90 Ownship Protocol Format.

(COM1 TX RS-232 57600bps, 81N)

The GDL 90 Data Interface Specification can be found at:

https://www.faa.gov/nextgen/programs/adsb/wsa/media/GDL90_Public_ICD_RevA.PDF

Ping200S transmits the following messages:

Msg ID	Description	Notes	Ref
0_{10}	Heartbeat	1 second interval	§3.1
10_{10}	Ownship Report	1 second interval	§3.4
11_{10}	Ownship Geometric Report	1 second interval	§3.8