



ping200X

User and Installation Guide

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1 Revision History


Revision	Date	Comments
A	2/3/2019	Initial release


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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 unmanned aircraft operating above 500ft AGL.**

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

This equipment is classified by the United States Department of Commerce's Bureau of Industry and Security (BIS) as Export Control Classification Number (ECCN) 7A994.

These items are controlled by the U.S. government and authorized for export only to the country of ultimate destination for use by the ultimate consignee or end-user(s) herein identified. They may not be resold, transferred, or otherwise disposed of, to any other country or to any person other than the authorized ultimate consignee or end-user(s), either in their original form or after being incorporated into other items, without first obtaining approval from the U.S. government or as otherwise authorized by U.S. law and regulations.

3 Limited Warranty

uAvionix products are warranted to be free from defects in material and workmanship for one year from purchase. 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.

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5 TSO and System Information

5.1 Certification

This installation manual provides mechanical and electrical information necessary to install ping200X. It is not equivalent to an approved airframe-specific maintenance manual, installation design drawing, or installation data package. The content of this manual assumes use by competent and qualified personnel using standard maintenance procedures in accordance with Title 14 of the Code of Federal Regulation and other related accepted procedures. The conditions and tests required for approval of this article are minimum performance standards. Those installing this article either on or within a specific type or class of aircraft must determine that the aircraft installation conditions are within the standards which include any accepted integrated functions not specified by the standards. TSO articles, articles approved with 14 CFR Part 21.8(d), and any accepted integrated function(s) not specified in the standard must have separate approval for installation in an aircraft. The article may be installed only according to 14 CFR Part 43 or the applicable airworthiness requirements. This is an incomplete system intended to provide the functions identified in, and when installed according to this installation manual.

5.2 TSO Authorization

Function	TSO/RTCA	Class
AIR TRAFFIC CONTROL RADAR BEACON SYSTEM/MODE SELECT (ATCRBS / MODE S) AIRBORNE EQUIPMENT	TSO-C112e INCOMP RTCA/DO-181E	Level 2els Class 1
1090MHz EXTENDED SQUITTER AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B)	TSO-C166b RTCA/DO-260B	Class B1S
AUTOMATIC PRESSURE ALTITUDE CODE-GENERATING EQUIPMENT	TSO-C88b	

5.3 Applicable P/Ns

Description	P/Ns
skyBeacon PF007 Boot Program Firmware	UAV-1001758-()
ping200X PF007 Operating Program Firmware	UAV-100xxxx-()
Ping200X FPGA	UAV-100xxxx-()

5.4 System Functions

System Function	DO-178C DAL	DO-254 DAL
Mode S Transponder	C	C

5.5 TSO Deviations and Incomplete

TSO	Deviation
C112e	uAvionix was granted a deviation from TSO-C112e paragraphs 3.e and 6.f to use DO-178C instead of DO-178B.
C112e	Incomplete System. Does not include a control head for pilot input.
C166b	uAvionix was granted a deviation from TSO-C166b paragraph 3.e to use DO-178C instead of DO-178B.
C88b	uAvionix was granted a deviation from TSO-C88b paragraph 3.e to use DO-178C instead of DO-178B.

5.6 FCC ID

Model	FCC ID
ping200X	2AFFTP200S

5.7 Device Marking

uAvionix Corporation
 Ping200X UAV-10xxxx-001 Mod 0
 TSO-C112e Level 2els Class 1
 TSO-C166b Class B1S
 See IM for Configuration and Deviations
 14/28 VDC DO-160G / DO-178C / DO-254 Level C
 FCC ID: 2AFFTP200S

5.8 Environmental Qualification Form

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 (+55°C operating without cooling)
Altitude	4.6.1	25,000feet
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 B
Humidity	6.0	Equipment tested to Category A
Operation Shock and Crash Safety	7.0	Equipment tested to Category X – no test
Vibration	8.0	Aircraft zone 2: type 5 Category S level M
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 BX
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 XXXXXX – 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 X – no test

5.9 Continued Airworthiness

Maintenance of the ping200X is "on condition" only. For regulatory periodic functional checks, refer to the approved aircraft maintenance manuals or manual supplements. The aircraft must be returned to service in a means acceptable to the appropriate aviation authority.

5.10 System Limitations

This article meets the minimum performance and quality control standards required by a technical standard order (TSO). If you are installing this article on or in a specific type or class of aircraft, you must obtain separate approval for installation.

6 System Specifications

ping200X is a Mode S, Level 2els, Class 1 transponder with support for ADS-B extended squitter, elementary surveillance and SI codes. The ping200X 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.

6.1 Specifications

Specification	Value
Operating Altitude	unrestricted
Max Cruising Speed	unrestricted
Transmit Power (Max)	54dBm, 250W
1030 Receive Sensitivity	-74±3 dBm
RF Impedance	50Ω
Host Serial Communications	GDL90+
Calibrated Pressure Altitude	-1,000ft to 60,000ft
Export Compliance	ECCN 7A994
Supply Voltage	9-30.3V
Inrush Current Limit	1A
TX Peak Current Limit	See Below
Power Consumption (ON & ALT)	1.5W
Power Consumption (STBY)	0.5W
Transponder Performance Standard	RTCA DO-181E
Class	Class 1
Level	2els
ADS-B Performance Standard	RTCA DO-260B
Class	B1S
Granted Certifications	TSO-C112e TSO-C166b TSO-C88b
Environmental	RTCA DO-160G
FCC ID	2AFFTP200S
FAA Transmit License	Manned aircraft. Unmanned operating above 500ft AGL.
Software	RTCA DO-178C Level C
Hardware	RTCA DO-254 Level C
Operating Temperature	-45°C to +70°C
Storage Temperature	-55°C to +85°C
Transmitter Modulation	6M75V1D
Weight	50grams
Height	13mm
Length	61mm
Width	50mm
RF Connector	SMA

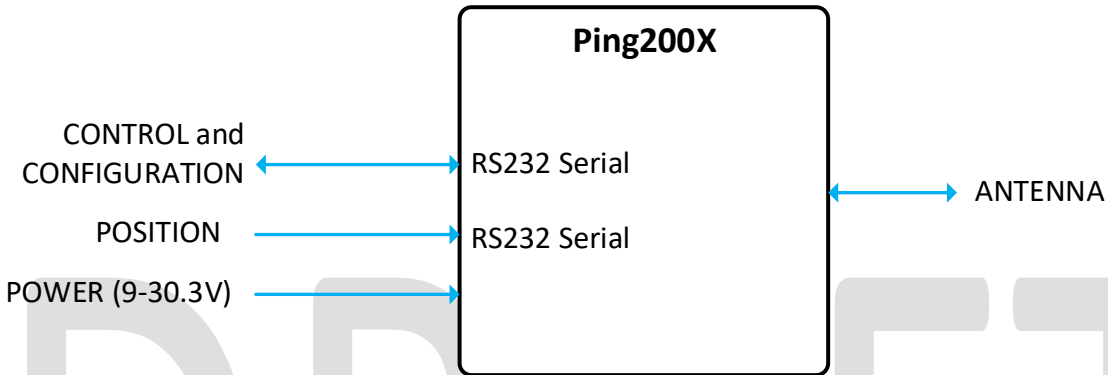
Reply Transmission Peak Current

Mode	Incremental Peak Current @ 14V	Recovery
ATCRBS "7777" Reply	70mA	65us
Mode S Short	312mA	5.7ms
Mode S Long	312mA	9.4ms
1090ES DF17	312mA	9.4ms

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7.1 Interfaces

The ping200X has a single SMA antenna connection and a 5-wire power and data interface.



Serial Data Interfaces

	Protocol	Message Type
CONTROL and CONFIGURATION 1200 – 115200bps	GDL90+ RX	[0x2B] Configuration [0x2C] Config Request [0x2D] Control [0x2E] GPS Data
	GDL90+ TX	Configuration Ownship Identification
POSITION 115200 bps	Navigation Data Message	[0x2B] Configuration [0x0A] Ownship [0x25] Identification [0x2F] Status

Note:

Details of the GDL90+ packets can be found in UAV-1002375-001 uAvionix GDL90 Plus Transponder ICD.

Details of the Navigation Data Message can be found in UAV-1001912-001 uAvionix OEM Protocol Specification

8 Equipment Installation

This section describes the installation of Ping200X and related accessories in the aircraft, including mounting, wiring, and connections.

8.1 Part Numbers

Part	Part Number	Revision
ping200X	UAV-1002723-001	
RS232-USB adapter	UAV-100xxxx-001	
ping200X Installation Manual	UAV-1002721-001	

8.2 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.

8.3 Mounting

The ping200X is designed to be mounted in any convenient location in the cockpit, the cabin, or an avionics bay.

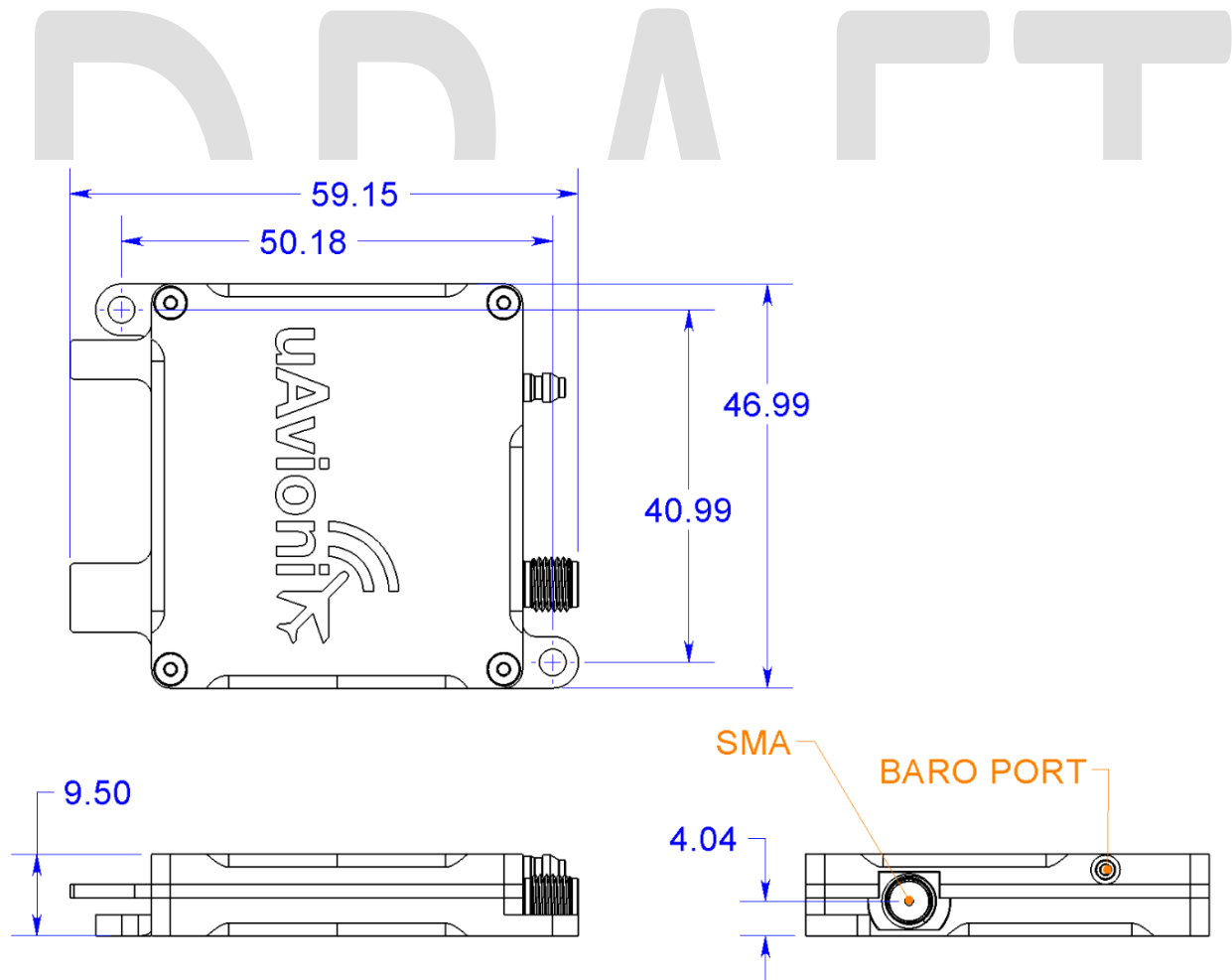
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ECCN 7A994



The following installation procedure should be followed, taking care 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 ping200X 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 two (2) mounting holes. It should be mounted on a flat surface.



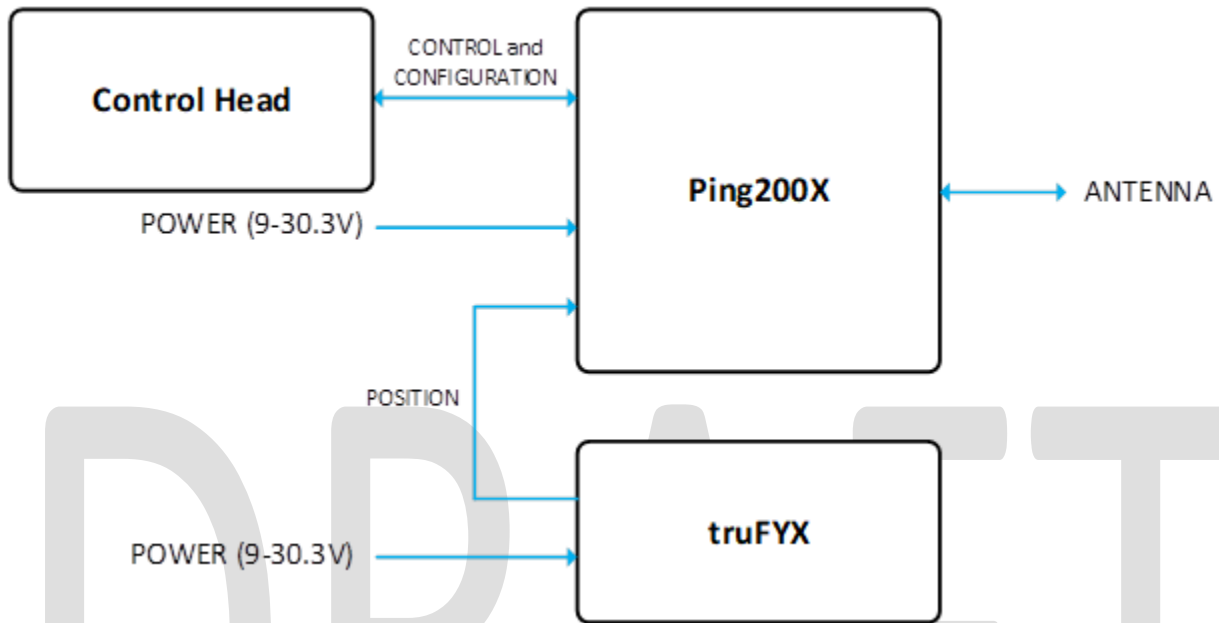
8.4 Connections

- ⓘ **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.**

Powering the transponder without an attached load will result in damage to the device not covered under warranty.

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8.5 Wiring Diagram



Interfaces

Pin	Type	Physical	Rate
Black	Ground		
Red	Aircraft Power	9-30.3V	
Grey	COM TX	RS-232 Out	Programmable
Orange	COM RX	RS-232 In	Programmable
White	GPS RX	RS-232 In	115200bps

8.6 Cooling Requirements

ping200X 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 ping200X 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.

8.7 Antenna Installation

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

- The antenna should be mounted in a vertical position when the aircraft is in level flight.
- 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 Voltage Standing Wave Ratio (VSWR).

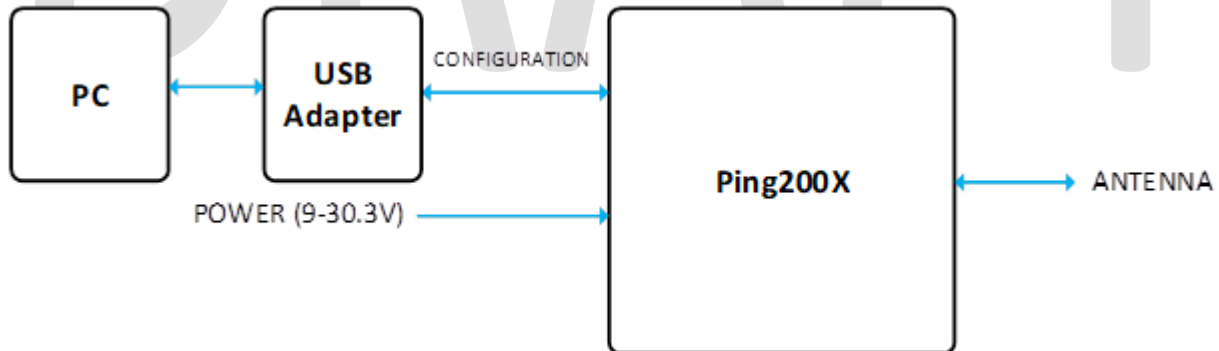
Electrical connection to the antenna should be protected to avoid loss of efficiency due to exposure to liquids and moisture. All antenna feeders shall be installed in such a way that a minimum of RF energy is radiated inside the aircraft.

9 Configuration

The transponder system should be configured during initial system installation. The Configuration Items List below should be used to document the system installation for future reference.

Configuration Item		Default	Control Priority
Default Control		Standby/Off	YES
ICAO Number		0x000000	
Callsign		“ “	YES
Aircraft Category		UAV (14)	
VFR Squawk Code		1200	YES
Aircraft Maximum Speed		Not Available	
ADS-B RX Capability	UAT RX	NO	
	ES1090 RX	NO	
Aircraft Length (Meters)		0	
Aircraft Width (Meters)		0	
GPS Offset Lateral (Meters)		0	
GP Offset Longitudinal (Meters)		0	

Configuration Items List



Connect the ping200X to a PC running the Configuration and Control application. The following parameters are permanently stored in the ping200X.

Make sure that the COM settings on the control tab match the serial port assigned to the USB adapter.

Ping20XS Control & Config v2.0

File

Control Configuration

	Device	Config
ICAO Address:	ABE099	ABE099
Maximum Aircraft Speed:	< 75 knots	< 75 knots
Aircraft Stall Speed:	20	20 knots
Aircraft Length + Width	L <= 15m + W <= 23m	L <= 15m + W <= 23m
Aircraft Registration	N8644B	N8644B
GPS Antenna Lateral Offset	0m	0m
GPS Antenna Longitudinal Offset	Applied By Sensor	Applied By Sensor
Aircraft Emitter Type	Light(ICAO) < 15500 lbs	Light(ICAO) < 15500 lbs
ADS-B In Capability	<input checked="" type="checkbox"/> 1090 <input checked="" type="checkbox"/> UAT	<input checked="" type="checkbox"/> 1090 <input checked="" type="checkbox"/> UAT
Baro Altitude Source	External	External
Serial Port Baud Rate	57600bps	57600bps
SIL	<= 1E-7(3)	<= 1E-7 (3)
SDA	<= 1E-5 (2)	<= 1E-5 (2)

Get Configuration Send Configuration

- ← GDL90+ GPS Data Message
- ← GDL90+ Transponder Control Message
- ← GDL90+ GPS Data Message
- ← GDL90+ GPS Data Message
- ← GDL90+ GPS Data Message
- ← GDL90+ GPS Data Message
- GDL90 Heartbeat Message
- GDL90+ Identification
- ← GDL90+ GPS Data Message
- GDL90 Ownship Report
- GDL90 Ownship Geometric Altitude

Control Status: Running

9.1 Default Control

Select the desired control type. This setting configures the ping200X for Mode A, Mode C, Mode S and ADS-B Extended Squitter transmissions.

- None selected disables both the transmit and receive functions.
- Mode A - Squawk
- Mode C – Altitude
- Mode S – Addressed Identification and Altitude
- Mode ES – ADS-B Identification and Position reporting.

9.2 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 ping200X understands the hexadecimal format. An octal number must be converted to hexadecimal format before entering.

Tip: By using the N-Number Look Up function on <https://www.faa.gov>, locate and use the “Mode S Code (base 16 / hex)” value. Applies to U.S. registered aircraft only.

9.3 Aircraft Registration

The Aircraft Registration can be up to an 8 alpha-numeric code that corresponds to the tail number of the aircraft. (0-9, A-F).

Note: This is typically your aircraft N-number, unless otherwise advised by the FAA or ATC.

9.4 Aircraft Category

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

9.5 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.

9.6 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.

9.7 Aircraft Length / Width

When 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.

Aircraft Length in Meters	Aircraft Width (wing span) in Meters
$L \leq 15$	$W \leq 23$
$15 < L \leq 25$	$28.5 < W \leq 34$
$25 < L \leq 35$	$33 < W \leq 38$
$35 < L \leq 45$	$39.5 < W \leq 45$
$45 < L \leq 55$	$45 < W \leq 52$
$55 < L \leq 65$	$59.5 < W \leq 67$
$65 < L \leq 75$	$72.5 < W \leq 80$
$75 < L \leq 85$	$W > 80$
$L > 85$	Any

9.8 GPS Antenna Offset Lateral / Longitudinal

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 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 and larger UAVs 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.

GPS Antenna Lateral Offset from roll axis (Meters)	GPS Antenna Longitudinal Offset from aircraft nose (Meters)
0	0 to 60meters in 2meter increments
Left 2	
Left 4	
Left 6	
Right 2	
Right 4	
Right 6	

9.9 Baro Altitude Source

If the autopilot provides the barometric altitude, set the Baro Altitude Source to external. The ping200X will use the Baro Altitude reported in the Control Message.

9.10 Serial Port Baud Rate

This setting configures the speed of the AutoPilot serial interface in bps.

9.11 SIL/SDA

Set according to the system and design integrity of the GPS source.

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9.12 Control

The Control tab allows the developer to exercise the transponder.

The screenshot shows the 'Ping20XS Control & Config v2.0' application window. It features a 'File' menu and two tabs: 'Control' and 'Configuration'. The 'Control' tab is active and contains several sections:

- Serial Port Setup:** Located in the top left, it includes 'COM Settings' with a 'Port' dropdown set to 'COM8', 'App Baud' set to '57600', and 'Protocol' set to 'GDL90+'.
- Control:** Located in the middle left, it includes 'GDL90+ Control Settings' with a 'Callsign' field set to 'PING', 'Mode' options (A, C, S, ES), 'Squawk' set to '1200', 'Emergency' set to 'NONE', and 'Baro Alt (ft)' set to '3200'.
- GPS simulator:** Located in the bottom left, it includes 'GPS Location Data' with fields for 'Lat' (48.012306490), 'Lon' (-114), 'Alt' (3200), 'Hdg' (360), and 'Vel' (100). It also has 'Rate' (0) and 'En' (checked) options, and 'IDENT' and 'Stop' buttons.
- Packet Viewer:** Located in the bottom left, it displays a list of messages: '--> GDL90 Ownship Report', '--> GDL90 Ownship Geometric Altitude', '<- GDL90+ GPS Data Message', '<- GDL90+ GPS Data Message', '<- GDL90+ GPS Data Message', '<- GDL90+ Transponder Control Message', '<- GDL90+ GPS Data Message', '<- GDL90+ GPS Data Message', '--> GDL90 Heartbeat Message', '<- GDL90+ GPS Data Message', and '--> GDL90+ Identification'.
- Transponder Ownship Display:** Located in the middle right, it displays the 'uAvioni' logo and a table of transponder data:

Ownship Display		
ICAO Address:	ABE099	Pkts: 283
Latitude:	48.0117342 °	Erns: 0
Longitude:	-114.0000215 °	
Baro Altitude:	3175 ft	
GNSS Altitude:	3200 ft	
Horizontal Velocity:	99 kt	
Heading:	0 °	
Vertical Velocity:	0 ft/min	
Emergency Code:	0	No Emergency
NIC:	8	< 185.2m
NACp:	8	< 92.6m
Emitter Category:	1	Light

The 'Control Status' at the bottom of the window is 'Running'.

10 Post Installation Checks

Connect the system as shown in the Post Installation configuration diagram.

STEP	CHECK
Launch the PC Ping20XSControl application	
Set Port to the USB or serial port connected to the ping200X	
Set the App Baud to 57600	
Set Protocol to GDL90+	
Connect the Antenna	
Apply power from a minimum of a 11V, 1A power source	
Confirm that the Green LED comes on after power-up	
'Pkts:' should start counting confirming that the app is talking to the transponder	
Confirm 'ICAO Address' is correctly programmed and not 000000	
Confirm 'Baro Altitude' is correct for your field elevation	
After the GPS has had time to lock, confirm that 'Latitude' and 'Longitude' are correct	
Check the A, C, S and ES Mode boxes	
Observe the Red LED flashing about four times a second. This indicates 1090ES ADS-B transmissions	
If you are in range of Secondary Surveillance Radar, the Green LED will flash during interrogations	
Using an EFB App such as ForeFlight mobile, connect via WiFi to PingUSB powered by a portable USB 5V power supply.	
The separation between the transponder and PingUSB needs to be at least 500ft	
The aircraft will appear as traffic on the EFB application	

11 Support

For additional questions or support please visit:

<https://www.uavionix.com/support/>

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