ping20Si

User and Installation Guide

UAV-1001626-001 Rev I

ECCN 7A994

uAvioni

1 Revision History

Revision	Date	Comments
A	12/9/2017	Initial release
B	4/4/2019	Input power requirements
C	6/18/2019	Including ambient temperature with battery pack
D	7/30/2019	
E	10/26/2019	Update product label compliant to RED RED conformity statement added
F	5/19/2020	Update Support Contact and minor formatting edits
G	4/19/2022	Update power input inconsistency, and diagram to match
H	8/2/2023	Updates to part numbers and MOPS references
I	11/16/2023	Updates to part numbers and errata

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 not received a FAA transmit license and is for development use only.**

The following required statement from the Federal Communications Commission (FCC) applies to United States based entities with the exception of direct sales to the U.S. Government and units directly exported by uAvionix:

This device has not been authorized as required by the rules of the Federal Communications Commission. This device is not, and may not be, offered for sale or lease, or sold or leased, until authorization is obtained.

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 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

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5 Introduction

5.1 Description

The ping20Si is a Mode S, 20W transponder with support for ADS-B extended squitter. The ping20Si has a nominal power output of 20W. The integrated GPS sensor meets the requirements of DO-229D.

Designed to meet the requirements of:

      RTCA DO-181E Level 2els (20W output power level)

      RTCA DO-260B Class B1S

      RTCA DO-229D Class Beta 1

      ICAO Annex 10, Volume IV

      EuroCAE ED-115 Class LcF

      EU-RED Annex VII

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.

5.2 RED conformity

Hereby, uAvionix Corporation declares that the radio equipment type ping20Si is in compliance with Directive 2014/53/EU. The full text of the EU declaration of conformity is available at the following internet address:

https://uavionix.store/info/red-conformity

5.3 Interfaces

The ping20Si has a SMA antenna connection, a 4-pin control interface and a 5-pin programming interface.

Control Interface

The control interface supports the MavLink protocol and can be directly connected to the TELEM port. Additionally, GDL90 Control and status is also supported. Protocol switching is automatic.

	Protocol	Message Type
CONTROL COM1 RX 1200-115200bps	GDL90 Appendix A	[^CS] Callsign [^MD] Mode
	SAGETECH	[0x02] Preflight [0x03] Operating [0x05] Data Request
	Protocol	Message Type
STATUS COM1 TX 1200-115200bps	GLD90 Appendix B	[0_{10}] Heartbeat [10_{10}] Ownship [11_{10}] Geo Altitude
	SAGETECH	[0x80] Acknowledge [0x81] Installation Response [0x82] Preflight Response [0x83] Status Response

The Interface Control Document (ICD) can be downloaded from:

www.uavioinix.com

5.4 Software and Airborne Electronic Hardware Configuration.

Part	Part Number/Version
Transponder Software	2.4.14
Airborne Electronic Hardware	UAV-1003275-()

5.5 Supplied Accessories

Part	Part Number
ping20Si	UAV-1003275-001
1090Mhz 120° Dipole Antenna	UAV-1004675-003
Microfit 20awg Power Pigtail	UAV-1000252-001
PingWifi Programmer	UAV-1004380-001
Programming Cable JST4p-5p	UAV-1000709-001
PixHawk 1 Cable	UAV-1000250-001
PixHawk 2 Cable	UAV-1000253-001
3M VHB Mounting Tape 18mm x 33mm	UAV-1000302-001

6 Technical Specifications

SPECIFICATION	
Operating Altitude	unrestricted
Max Cruising Speed	unrestricted
Transmit Power (Max)	45dBm, 32W
1030 Receive Sensitivity	-61±3 dBm
RF Impedance	50Ω
Host Serial Communications	SageTech, GDL90
Calibrated Pressure Altitude	85,000 ft
Export Compliance	ECCN 7A994
Supply Voltage	11-28V
Power Consumption (ON & ALT)	1W
Power Consumption (STBY)	0.5W
Transponder Performance Standard	RTCA DO-181E
Class	20W
Level	2els
ADS-B Performance Standard	RTCA DO-260B
Class	B1S
Pressure Altitude Standard	SAE AS8003
Compliance	RTCA DO-181E Class 2 Level 1els (20W output power level) RTCA DO-260B Class B1S (20W output power level) RTCA DO-229D Class Beta 1 ICAO Annex 10, Volume IV EuroCAE ED-115 Class Lc2 es V3 (20W output power level) EU-RED Annex VII
Operating Temperature	-45°C to +80°C/+55°C*
Storage Temperature	-55°C to +85°C
Transmitter Modulation	6M75 V1D
Weight	20 grams
Height	17mm
Length	40mm
Width	35mm
Host Interface Connector	4p JST
RF Connector	SMA

*based on max. operating temperature with battery pack.

6.1 Markings

Product Label

Importer Label

uAvionix Europe B.V.
www.uavionix.store
info@uavionix.store

Serial number / Identification

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
Output power is limited to 20W.

8 Equipment Installation

This section describes the installation of ping20Si 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 ping20Si 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 ping20Si 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 supplied mounting tape. It should be mounted on a flat surface.
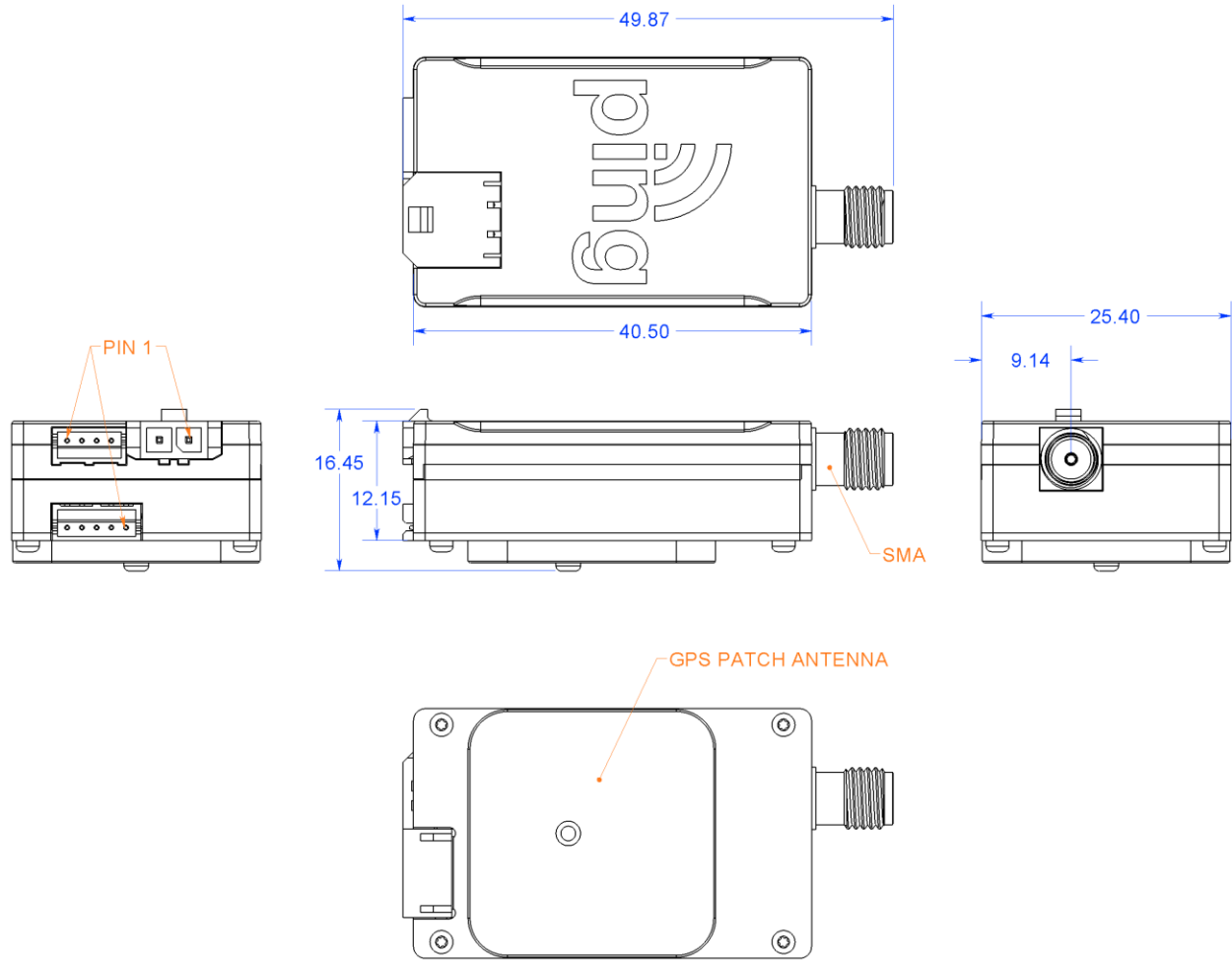
8.3 Connections

⚠ **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.**

PROGRAMMING
PORT

1 COM RX
2 COM TX
3 5V AUX POWER IN/OUT
4 AIRCRAFT GROUND

2 AIRCRAFT GROUND
1 AIRCRAFT POWER

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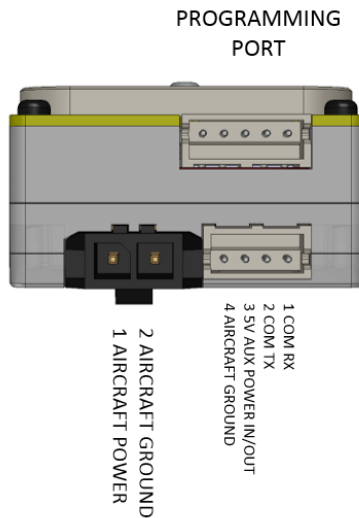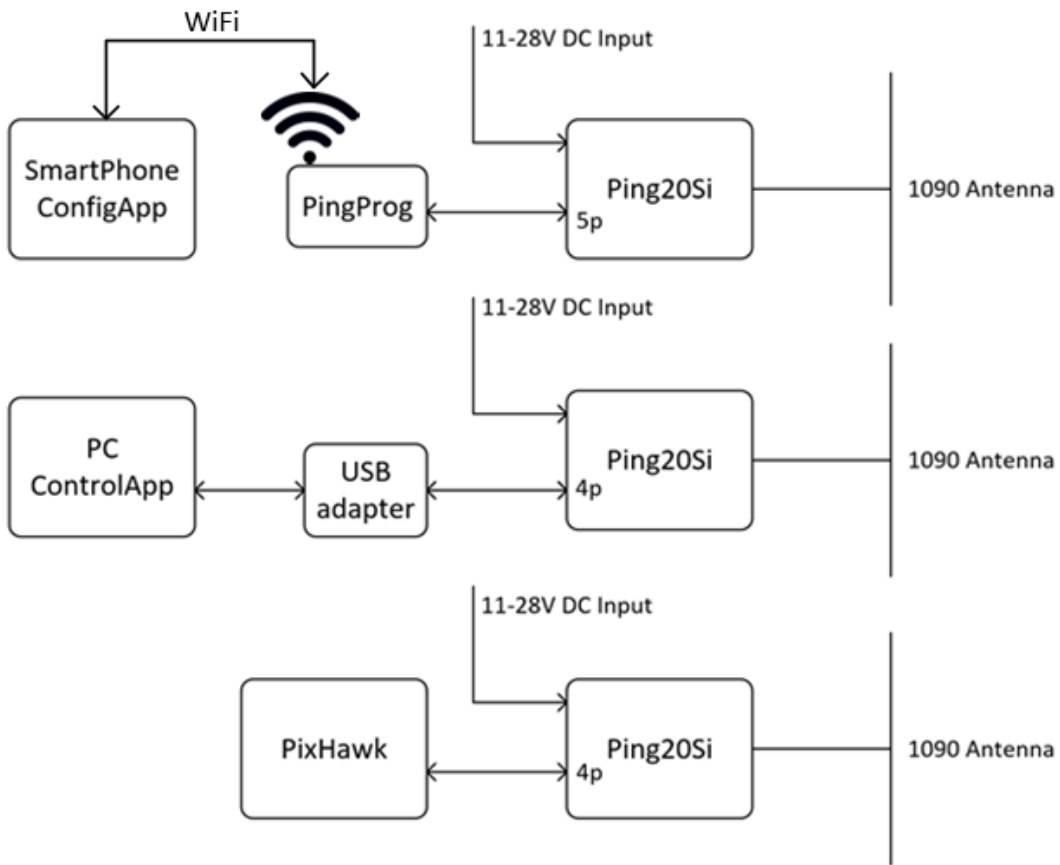
8.4 Wiring Diagram

Power Interface

Pin	Type	Physical
1	Aircraft Power	11-28V
2	Ground	
Mating Connector: Molex 0436450200		

Use a 1 Amp circuit breaker for power supply protection to the ping20Si.

Power to be provided by UAV battery or separate 3S LiPo battery.

Control Interface

Pin	Type	Physical	Rate	Link
1	RX In	3.3V Serial	57600bps	Control
2	TX Out	3.3V Serial	57600bps	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

8.5 Cooling Requirements

ping20Si 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 ping20Si 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.

8.6 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 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 Programming

These settings are stored in the ping20Si. To change these settings, the ping20Si is configured via the supplied pingUSB Wi-Fi adapter and mobile device application.
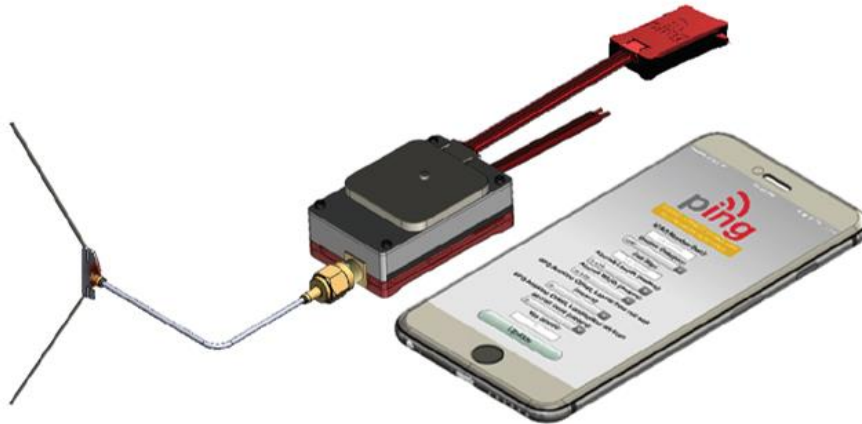
Please refer to the following documentation:

Ping App iOS quick start guide:

http://uavionix.com/downloads/pingapp/uavionix-ping-app-quick-start-guide.pdf

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	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

9.1 Default Control

Select the desired control type. This setting configures the ping20Si for Standby, On or Altitude reporting.

- Standby/Off: Disables both the transmit and receive functions.
- ON: Responds to all interrogations and transmits ADS-B Extended Squitter messages. Reports 0000 to altitude (Mode C) interrogations. ALT: Responds to all interrogations and transmits ADS-B Extended Squitter messages. Reports barometric altitude to Mode C interrogations.

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 echoUAT understands the

hexadecimal format, so you must first convert an octal number to hexadecimal 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.

9.3 Callsign

The CALL SIGN can be up to an 8 digit 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 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.

9.6 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.

9.7 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.

9.8 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.

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

9.9 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 at all, 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 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 60 Meters in 2 Meter increments
Left 2	
Left 4	
Left 6	
Right 2	
Right 4	
Right 6	

10 PC Control Application

A PC example control application is availiable to operate the control interface. Use of a USB/TTL adapter is recommended. Set the Port to the USB serial port and the App Baud to 57600.

Callsign, Mode and Squawk can be set in the application. The Ownship Display can monitor the programmed ICAO, Emitter category and GPS position.

The control app can be downloaded from: ww.uavionix.com
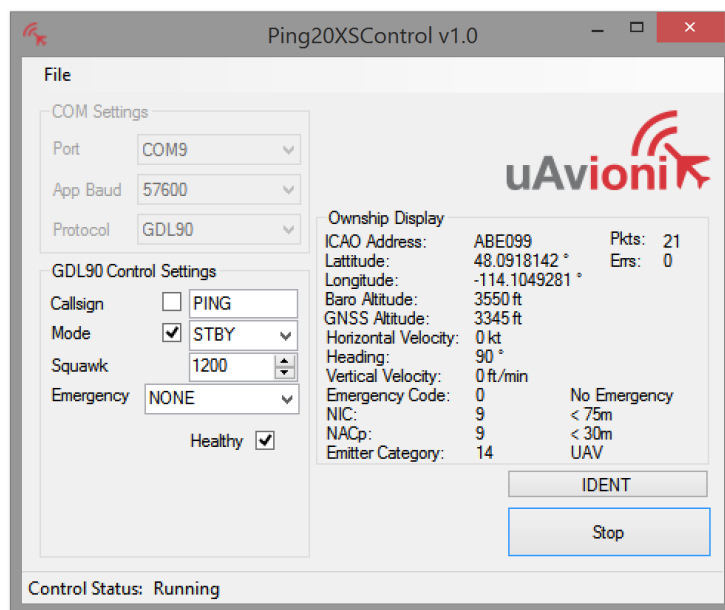
11 Post Installation Checklist

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 ping20Si	
Set the App Baud to 57600	
Set Protocol to GDL90	
Connect the Antenna	
Apply power from a minimum of a 12V, 3A 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	
Set 'Mode' to 'ALT' and check the 'Mode' box	
Observe the Red LED flashing about four times a second. This indicates 1090ES ADS-B transmissions	
If you are in range of 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 programmer needs to be at least 500ft	
The aircraft will appear as traffic on the EFB application	

12 Continued Airworthiness

Other than for periodic functional checks required by the regulations, ping20Si 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.

13 Environmental Qualification Forms

Nomenclature	ping20Si ADS-B Mode S transponder	
Part No: UAV-1003275-001		
Manufacturer	uAvionix Inc	
Address	300 Pine Needle Lane, Big Fork, MT 59911	
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	+80°C / +55°C*
High Temperature Short-Time Operating	4.5.3	+80°C / +55°C*
High Temperature Ground Survival	4.5.3	+85°C / +55°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

*based on max. operating temperature with battery pack.

Appendix A. GDL 90 Compatible Control Protocol Format
(Control RX - TTL 57600bps, 8N1)

The ping20Si 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 TTL 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 ping20Si 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 callsign.

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 Flight ID (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\r

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	OFF	0x4F
A	STBY	0x41
C	ON	0x43
S	ALT	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\r

> Mode STBY, Ident active, Squawk 2354, No Emergency, Healthy

Appendix B. GDL 90 Ownship Protocol Format.
(Control TX - TTL 57600bps, 8N1)

The GDL 90 Data Interface Specification can be found at:

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

ping20Si 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

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