WFS Technologies
3 Michaelson Square, Kirkton Campus,
Livingston, EH54 7DP, Scotland, UK
Tel : +44 (0)845-862-6600 Fax : +44 (0)845-862-6601
www.wfs-tech.com

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Seatext®

User Manual

Revision History

Rev	Date	Comment
1.0	Jan 2009	Initial release
1.1	May 2009	Intermediate changes
1.2	Jul 2009	Intermediate changes
1.3	9-Nov-2009	Template and structure revised, branding updated
3.0	18-Nov-2009	Updated to reflect V3 modem technology, in particular: • Change to external battery • Major software revision • Major DSP revision The content is based on interim revision V2.0

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1 Introduction

The Seatext® modem is designed to transmit data from underwater to above the surface, thus crossing the water/air interface, from water-to-water and air-to-air. It also communicates through solid structures such as rock and walls in both water and in air.

1.1 Definitions

The following definitions might be used in this document.

Term	Description
Antenna	A transducer designed to transmit or receive electromagnetic waves
Modem	A modem (modulator-demodulator) is a device that modulates an analogue carrier signal to encode digital information, and also demodulates such a carrier signal to decode the transmitted information
RF	Radio Frequency radiation is a subset of electromagnetic radiation with a range of wavelengths from 1 mm to 100 km

1.2 Symbols Used

The following symbols might be used in this document.

Symbol	Meaning
	Warning symbol denoting a device's susceptibility to electrostatic discharge

Table 1: Symbols Used in this Document

1.3 Nomenclature

The following acronyms and abbreviations might be used in this document.

Term	Meaning
ADC	Analogue-to-digital converter
CRC	Cyclic redundancy check
EMI	Electromagnetic interference
ESD	Electrostatic sensitive device
RF	Radio Frequency
FEC	Forward Error Correction

Term	Meaning
ASCII	American Standard Code for Information Interchange

Table 2: Acronyms and Abbreviations in this Document

1.4 Safety

General

All installation, operation, maintenance and repair works must be carried out by competent personnel.

It is the responsibility of the installer to ensure Seatext® modems and associated components are installed in suitable locations and in a safe manner.

Seatext® should be installed, commissioned, operated and maintained in accordance with this manual. In particular, it should be used within the maximum operating conditions stipulated. Failure to do so may lead to safety hazards or equipment failure.

Before starting installation, commissioning, operation or maintenance of the Seatext®, personnel should read and understand all relevant sections of this manual.

Enclosure Electrics
There are no user serviceable parts inside the Seatext® subsea enclosure.

Electrostatic Sensitive Devices
Certain semiconductor devices used in the equipment are liable to damage due to static voltages.

The following precautions should be observed when handling these devices in their un-terminated state, or sub-units containing these devices:

- Persons working on the modem must be earthed by a wrist strap via a 1 MΩ resistor to a suitable discharge reference point within the equipment
- Outer clothing must be unable to generate static charges

1.5 Tools Required

In addition to common workshop tools, the following tools and equipment will be required to install, configure, test, operate, maintain, de-commission or store this unit.

This unit does not require special tools.

2 Equipment

This section describes the purpose and function of the equipment, as well as the actual equipment.

2.1 Purpose

The transmission and reception of data through water, through air, across the water/air boundary and through solid structures in both water and air.

2.2 Function

The system comprises a pair of Seatext® modems housed in waterproof enclosures. Each modem is attached to an antenna, the standard antenna has a square transmit element approximately 0.5m size. The antenna contains X, Y and Z axis antennas located in “fins” attached to the body of the antenna. Antennae of larger and smaller dimensions can be provided on a custom basis.

The units require a power source, typically a rechargeable or primary cell battery in a suitable enclosure meeting the electrical requirements detailed in the specification table in this document.

2.3 .Description

A Seatext® modem in a subsea enclosure is shown in **Error! Reference source not found. Error! Reference source not found.** with the standard antenna.

Table 3: Seatext Modem and Antenna

The modem electronics are contained in the cylindrical enclosure shown. The enclosure is supplied filled with air at one atmosphere. The antenna shown is the

standard 0.5m square unit. The fins containing the receive elements are clearly visible.

Seatext® modems provide half duplex communication between two locations, with data integrity protected by FEC if required. Industry standard serial communication protocols are provided to facilitate interface to data sources and terminals. Full duplex communication is provided between the modems and data sources and terminals.

3 Product Lifecycle

3.1 Installation

The following guidelines should be followed when installing the equipment.

When deciding where to mount the Seatext® unit consideration should be given to:

- The unit's location relative to magnetically active materials on the host system
- The rigidity of the mounting arrangement
- Collision protection
- Positioning the flask outside the loop of the antenna

Antenna Installation

As with all radio systems, antenna location and orientation is very important for correct function of Seatext® units. The appropriate receive element must be selected, bearing in mind the orientation of the transmit element of the other modem. Typically, both of the transmit elements are held horizontal so that field is generated at equal magnitude in each direction in the plane of the square. In this case, the default receive element (X) is usually appropriate for operation. However, nearby structures and surfaces can distort the field patterns and sources of interference often have directional properties so in many applications the signal strength should be measured on each axis to determine the best signal strength and signal to noise ratio available. Signal Strength and Signal to Noise Ratio measurements are provided by the Seatext® modem for this purpose.

EMI (Electromagnetic Interference)

To reduce the effects of fixed magnetic disturbances on the Seatext® output, the antenna should be mounted as far as is practically possible from the following:

- Ferrous or other magnetically active materials and conductive materials (including fasteners or brackets used to mount the Seatext® unit).
- Sources of electrically induced magnetic fields such as motors and transformers.
- Moving equipment, e.g. manipulator arms, pan & tilt units

Rigidity

The Seatext® unit and antenna should be rigidly mounted so that flexibility and / or system vibration does not affect the outputs.

Collision Protection

To protect against accidental damage, the Seatext® should be mounted in a protected location. The protection around the Seatext® should not be manufactured from a ferrous material.

General

While the standard antenna is self-supporting, it is constructed from plastic materials. Continued reliability of the antennas is reliant on the joints not being bent or forced in such a way that would result in distorting the antenna shape. The antenna must be protected from impacts, including the “fins”.

Connector Handling Procedure

The connector should be made up in accordance with Subconn guidelines, as detailed below (taken from MacArtney Subconn standard literature):

- The connector should not be exposed to long-term heat or sunshine. If this occurs, and the connectors are very dry, soak in fresh water before use.
- Ensure the connectors are lubricated - the recommended lubricant is Molykote 44 Medium – which should be used sparingly. Half a match head dose per contact is adequate.
- Any accumulation of sand or mud in the female contact should be removed with fresh water. Failure to do so could result in the splaying of the female contact and damage to the O-ring seals.
- Do not disconnect by pulling on the cable and avoid sharp bends at cable entry.
- When using bulkhead connectors ensure that angular loads are not applied as this will damage the connector.
- When disconnecting, pull straight, not at an angle
- The mated connector should be retained using the locking sleeve supplied. This ensures that the connector does not become inadvertently partially or fully disconnected.

3.2 Getting Started

A system comprises a pair of modems and antennas, typically connected to a data source at one end and a data terminal at the other.

The units require an external power source meeting the requirements of the specification. Power can conveniently be provided by rechargeable or primary cell batteries or from a mains powered D.C. voltage converter. Please ensure that the Data connector and the Antenna are connected to the modem before the supply is activated.

To verify operation of the modems you will need a personal computer with an RS-232 serial port, together with a remote device to generate data. For testing purposes, this could consist of a single personal computer with two serial ports. A USB to Serial port adaptor can be used to provide either or both RS232 interfaces. Follow the manufacturer's instructions for installing drivers before fitting such devices and note the port number allocated to each serial port. A terminal emulation application such as HyperTerminal or TeraTerm is required to allow data to be sent to and received from the serial ports. These are freely available to download for use with the Windows operating system.

Parameter	Setting
Data Rate	Default 9600 baud Programmable to 300, 1200, 2400, 4800, 9600 and 19200 baud
Data Bits	8
Stop Bits	1
Parity	None
Hardware Flow Control	On
Return or Enter key	<CR>+<LF>
Local echo	On

Table 4: RS232 Settings for Terminal Emulator Applications

Once the terminal emulation application has been configured, the modems should be connected as described in chapter 133.3 “Connections” below.

3.3 Connections

The electrical connections to the modem are identified below:

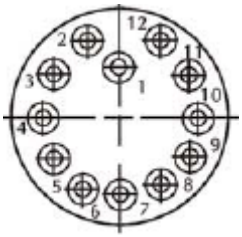
Connector Type	MCBH-12F-SC		
Mating Part	MCIL-12M		
	Pin	Designation	9-Pin RS-232 Port Pin #
	1	RS232 DCD	1
	2	RS232 Receive Data	2
	3	RS232 Transmit Data	3
	4	RS232 DTR	4
	5	RS232 GND	5
	6	RS232 DSR	6
	7	RS232 RTS	7
	8	RS232 CTS	8
	9	NC	NC
	10	NC	NC
	11	NC	NC
	12	NC	NC

Table 5: Data Communications Connector

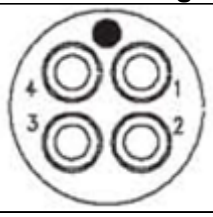
Connector Type	MCBH-4M-SS-SC		
Mating Part	MCIL-4F		
	1	Power	+24V
	2	Ground	0V
	3	NC	NC
	4	NC	NC

Table 6: Power Connector

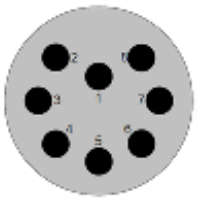
Connector Type	BH-8-FSX		
Mating Part	IL8M		
	1	TX Coil	Transmitter
	2	TX Coil	Transmitter
	3	SOLENOID 0	X Axis Receiver
	4	SOLENOID 0	X Axis Receiver
	5	SOLENOID 1	Y Axis Receiver
	6	SOLENOID 1	Y Axis Receiver
	7	SOLENOID 2	Z Axis Receiver
	8	SOLENOID 2	Z Axis Receiver

Table 7: Antenna Connector

Table 8: Seatext Cap Showing Connectors

3.4 Operation

Seatext® operates as a transparent modem that is, it will transfer data presented at the interface through the transmission medium to the data interface of the second modem without modifying or re-ordering the data. However, due to the low data transmission rate through the medium and the option to use FEC, delays are inevitably introduced into the data path. Modem flow control is used to manage data arriving at the interface to prevent buffer overflow when large quantities of data are being carried.

If the data is in the ASCII format, there are two exceptions to modem data transparency:

- If the software flow control feature of the Seatext® modem is enabled,the <XON> and <XOFF> ASCII control characters are used to manage data flow and are added to the data as required.
- If the modem receives four "%" characters together, the following data is interpreted as a modem command, part of the Seatext® user interface, provided it is terminated correctly. See chapter 3.5 "Seatext® User Interface." below.

If random non-ASCII data is being transferred there is a possibility that a command sequence will occur by accident. Such an occurrence is unlikely but if the consequential loss of data would be critical, and binary to ASCII encoding algorithm such as "uuencode" should be used.

Software flow control **must not** be enabled when non-ASCII data is being transferred. To do so would cause uncontrolled interruptions to data flow.

3.5 Seatext® User Interface.

Seatext® modems are controlled using the Seatext® user interface. This provides a number of commands which, when received at the data interface, cause the modem to take some action such as change configuration or measure a parameter of operation such as signal power.

All data input to the Seatext® interface must be terminated by a <CR> (Carriage Return) and <LF> (Line Feed) pair if it is to be correctly interpreted as a command. Please ensure that the Return key is configured for <CR>+<LF> in your terminal setup.

All commands to the Seatext® user interface begin with four ASCII % characters. Any command-like data that is not pre-fixed by %%%% will be interpreted as data and transmitted to the other modem. There are three categories of commands, and these are listed Table 9 below.

Full details of the Seatext® user interface are contained in the Seatext® Modem Command Reference, WFS Document Number 600GD002.

Introduction to Modem Commands.

Most commands consist of %%%% and seven digits followed by a <CR><LF> pair.

If you make a mistake while typing a command there is no facility to edit in-line using the delete or backspace keys, so the best option is to type seven random characters or digits. The system will respond by repeating the characters you typed and adding a negative acknowledge (NCK). Then you can start again.

For example, if you type the command %%%%0800000, the system will respond with %%%%0800000NCK. Alternatively, if you type only %%%%0344 the system will wait for the rest of the digits as it expects a command to have at least seven characters. It is also worth noting that if you type %%%0100000 this will be interpreted as data and sent out via the RF link as it is not terminated in <CR><LF> .

Command	Module	Command types
%%%%00xxxxx	Data Modules	Enable or Disable FEC etc
%%%%01xxxxx	DSP Module	Read SNR/VRMS set TX power etc
%%%%02xxxxx	System Module	Set power Mode, Serial number etc.

Table 9: Basic Command Types

Command Example

This example shows how to determine the software revision of the modem.

At the prompt, in the terminal emulation application type:

%%%%0200000<RETURN>

The modem will respond with

%%%%02000040nnnACK indicating a software revision of n.nn

3.6 Modem Operating Modes

Seatext® can operate in three different modes:

- **Always On** (AO)
  When the unit is in AO mode it is continually active. Power requirements are as indicated in the specification section.
- **Timed Transmit** (TT)
  This mode is data-driven; the unit is normally in the Standby state, but whenever a message is ready for transmission, the unit goes into the AO mode for a minimum period of 30 seconds, which includes the time to transmit a maximum-length message plus a margin. If another message comes in during this period, the transmit window is extended for 30 seconds from receipt of the second message. When the unit is in the Standby state the power requirement is only ~120mW.
- **Synchronised Receive** (SR)
  This mode is useful for a modem located at a central node in a mesh network. The modem is normally in the Standby state, but opens a receive window approximately 10 seconds before a message is due, and closes it 45 seconds later. This window timing permits a string longer than 80 bytes to be used, or provide a window after the message is received for potential transmission to the far end. Acquisition of synchronism is performed on power-up or after an interruption. If no messages are heard within 12 minutes, the modem goes into low-power the Standby state for 108 minutes.

Modem operating modes are controlled through the user interface. Details of the appropriate commands are contained in the Seatext® Modem Command Reference, WFS Document Number 600GD002.

State Diagrams

Key:

- Green states = Standby state
- Red states = Active state

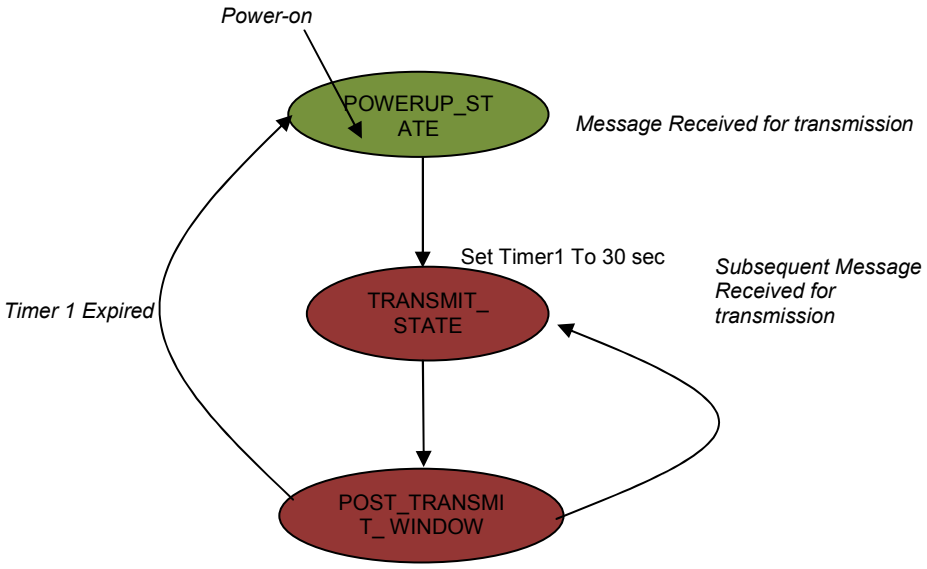


Figure 1: Timed Transmit State Diagram

Figure 2: Synchronised Receive State Diagram

3.7 Maintenance

The Seatext® unit is designed for low maintenance operation using corrosion resistant materials and does not require preventative maintenance.

NOTE: There are no user serviceable parts inside the Seatext® unit.

3.8 Decommissioning

When removing the equipment from service, all necessary safety precautions should be taken and then the outside of the equipment should be washed thoroughly with fresh water.

3.9 Storage

If the Seatext® units are taken out of service, connectors should be cleaned and blanked off and the units washed thoroughly with fresh water.

4 Troubleshooting

The following should assist in troubleshooting communications issues.

Symptom	Cause	Remedy
Garbled data transfer in one direction only	Inadequate power supply	Check voltage is within the specified range even while transmitting.
	Faulty transmitter or receiver on one modem.	Identify and replace modem.
Garbled data transfer in both directions	Inadequate power supply	Check voltage is within the specified range even while transmitting.
	Antennae misaligned	Re-orientate antennae
	Range too great	Check signal quality using the user interface commands. Reposition antennae to achieve good signal quality.
No communications	Faulty Modem(s)	Check power to each modem
		Check that modems respond to user interface commands such as the software revision query.

5 Product Specification

Feature	Detail
Performance	Data rate 100 bits/sec with optional FEC
RS-232 Serial port	Data Communication Equipment (DCE) configuration.
	Programmable baud rate, parity and stop bit configuration.
	Programmable hardware and software flow control
Standard Antenna	0.5m square transmit element with 3-axis solenoid receive elements.
Power requirements	24v DC at 500mA nominal. Active State: 12W transmission, 3W receive. Standby State: 120mW Acceptable voltage range 18 to 36V.
Environmental	50 m depth in water
	Operating temp -30°C - +35°C
Other capabilities • Power management based on events and timers • Linear and mesh networking	

6 General Arrangement Drawings

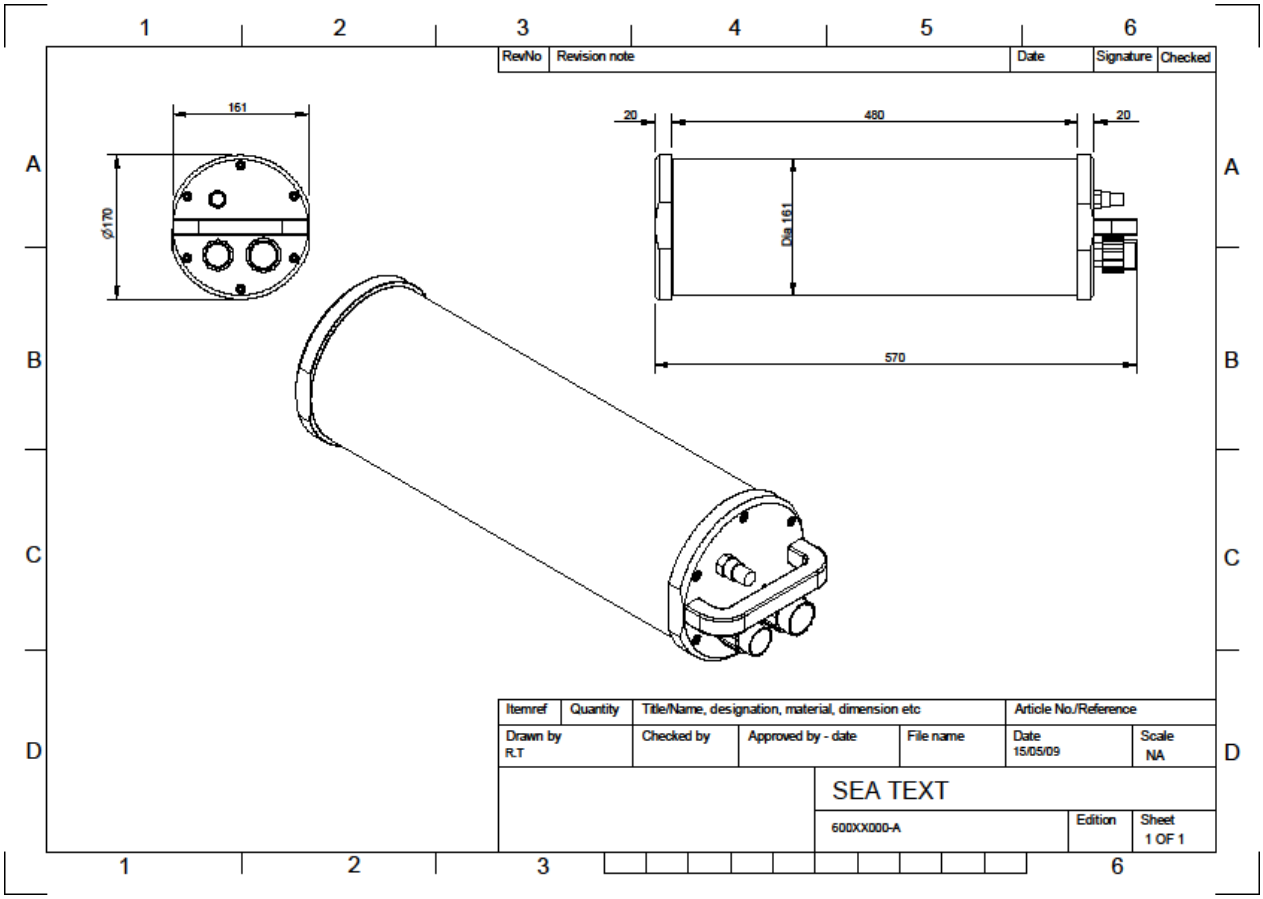


Figure 3: Seatext Enclosure Dimensions

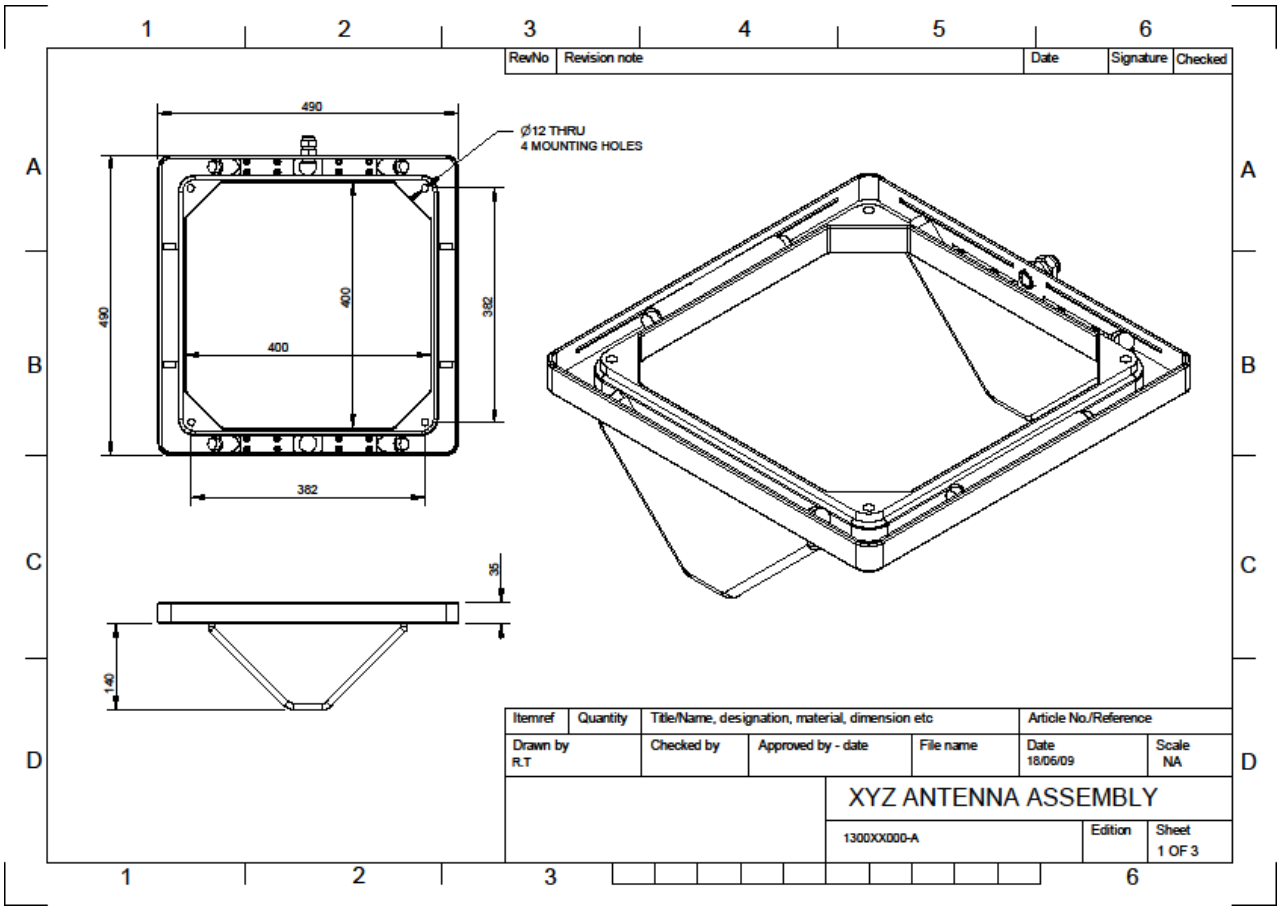


Figure 4: Standard Antenna Dimensions