

x100
Reference Guide

CONTENT

Declaration Of Conformity To Directive 2014/53/EU	3
Important Information	5
Safety information	5
Certified Installation	5
Product Disposal	6
IMO (International Maritime Organization) and SOLAS (Safety of Life at Sea)	6
About AIS (Automatic Identification System)	6
FCC	7
Compliance Statement (Part 15.19)	8
Innovation, Science and Economic Development Canada (ISED)	9
Innovation, Sciences et Développement économique Canada (Français)	9
Water Ingress	9
Disclaimer	9
Warranty Registration	9
Document And Product Information	10
Licensing	10
3rd party licenses	14
Specifications	21
Regulatory Bodies And Application Submissions	24

Declaration of conformity to Directive 2014/53/EU

Certificate Number: DK-RED003134 i01

We, em-Trak Marine Electronics of Wireless House Westfield Industrial Estate Midsomer Norton Bath, BA3 4BS United Kingdom. Hereby declare that the product known as X100AIS Class B SOTDMA DSC/VHF Radio (431-0002) to which this declaration relates, (Radio Equipment Directive 2014/53/EU) is in conformity with the relevant sections of the following standards and/or other normative documents:

For Article 3.1(a) [Health & Safety]:

Health:

EN 62311:2008

Safety:

EN 62368-1:2020

IEC 60945:2002-08

For Article 3.1(b) [EMC]:

EN 301 843-1 v2.1.1

IEC 60945:2002-08

EN 301 489-1 V2.2.3

EN 301 489-17 V3.2.4

EN 301 489-19 V2.1.1

EN 301 843-1 V2.2.1

EN 301 843-2 V2.2.1

For Article 3.2 [Spectrum usage]:

IEC 62287-2:2017

IEC 60945:2002-08

EN 300 328: v2.2.2

EN 303 413: v1.2.1

EN 301 025 V2.3.1

EN 300 698 V2.3.1

For Article 3.3(g) [Emergency access – R&TTE related]:

IEC 62287-2:2017

IEC 60945:2002-08

IEC 61108-1:2003

EN 301 025 V2.3.1

Declaration of conformity to Directive 2014/53/EU

We also declare that all essential radio test suites have been carried out and that the above-named product is in conformity with the essential requirements of Directive 2014/53/EU.

A power / data cable is provided to enable the product to operate as intended in line with optimum performance and EU directive 2014/53/EU. The NEXUS Base is pre-loaded with application software radio v220200.01 and software network v220400.01

The conformity assessment procedure for Directive 2014/53/EU Articles 3.2 and 3.3 has been followed with the involvement of the following Notified Body:

TÜV SÜD DANMARK ApS, Johanne Møllers Passage 1, 3. sal, 1799 Copenhagen V, Denmark [NB No. 2443]

Signed:



Name: Gary Evans

Position: Head of quality & supply chain

Date: 30th April 2025

Important Information

Copyright © 2025 em-trak Marine Electronics Limited. All rights reserved.

The information contained in this document is the copyright of em-trak Marine Electronics Limited. No part of this document may be disclosed, reproduced, or transmitted in any form, or by any means without the written permission of em-trak Marine Electronics Limited. The term document extends to all forms of media in which information may be embodied.

em-trak Marine Electronics Limited

Wireless House

Westfield Industrial Estate

Midsomer Norton

Bath BA3 4BS

England

Website: www.em-trak.com

Be aware that information in regards to this product can change without notice, this is not an installation or operation guide. Click [here](#) to make sure that you have the latest version of these manuals.

For support and online help click [here](#), alternatively email: Support@em-trak.com.

Safety information

Various symbols are used in this manual and on the product itself to ensure correct usage, to prevent danger to the user and others, and to prevent property damage. The meanings of these symbols are described below. It is important that you read these descriptions thoroughly and fully understand the contents.



WARNING

Indicates a hazardous situation that may result in death or serious injury if the appropriate safety precautions are not needed.



CAUTION

Indicates a hazardous situation that may result in minor or moderate injury if the appropriate safety precautions are not needed.



INFORMATION

Information, hints and advice for better understanding of the instructions to be observed in the operation of the device.

Labelling

The label can be found on the X100. If the label(s) become unstuck, contact em-trak Marine Electronics Limited for a replacement.



WARNING

Hot surface

Coming into contact with a hot surface may cause burning.

Certified Installation

em-trak Marine Electronics Limited recommends a certified installation by an em-trak Marine Electronics Limited approved installer. Certified installations qualify you for enhanced product

warranty benefits. Contact your em-trak Marine Electronics Limited dealer for further details, and refer to the separate warranty document packed with your product.

WARNING

 This product must be installed and operated in accordance with the instructions provided. Failure to do so could result in personal injury, damage to your vessel and poor product performance.

em-trak Marine Electronics Limited highly recommends a certified installation by an em-trak Marine Electronics Limited approved installer. A certified installation qualifies for enhanced product warranty benefits. Register your warranty on the em-trak Marine Electronics Limited website: em-trak.com.

WARNING

 This product is NOT designed for use in hazardous or flammable atmospheres. Do NOT install in a hazardous or flammable atmosphere (such as in an engine room or near fuel tanks).

WARNING

 Only connect the X100 to a 12 or 24V DC power source.

CAUTION

 Ground the X100 using the M3 tapped hole on the rear of the X100 during EVERY installation.

CAUTION

 Isolate the VHF antenna from any vessel metalwork using a suitable, insulated (i.e. plastic) mounting bracket to prevent galvanic corrosion.

CAUTION

 Switch OFF the vessel's power supply before installing this product. Do NOT connect or disconnect equipment with the power on unless otherwise instructed to do so in this document.

CAUTION

 Do NOT connect this unit to a system which has positive grounding.

Product Disposal

Dispose of this product in accordance with the WEEE (Waste Electrical and Electronic Equipment) Directive.

The WEEE Directive requires the recycling of waste electrical and electronic equipment, which contains materials, components, and other substances that may be hazardous and present a risk to human health and the environment when WEEE is not handled correctly.

IMO (International Maritime Organization) and SOLAS (Safety of Life at Sea)

The equipment described in this document is intended for use on leisure marine vessels and work boats NOT covered by the IMO and SOLAS Carriage Regulations.

About AIS (Automatic Identification System)

AIS is primarily used for collision-risk management and navigation safety. It can automatically transmit and receive vessel information, such as the vessel name, MMSI (Maritime Mobile Service Identity) number, vessel code, vessel type position data, speed, course, destination and

Important Information

more information depending on the transceiver class. Information exchanged among vessels and base stations on the VHF maritime mobile band. This information helps to identify other nearby vessel stations.

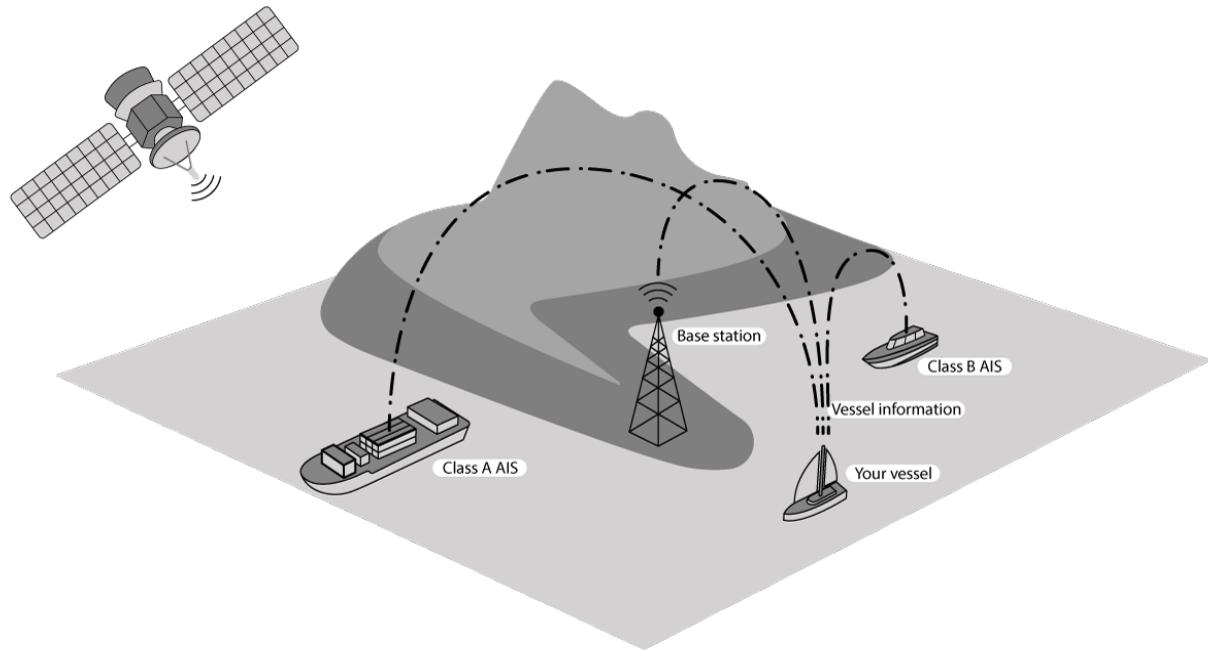


Figure 1 : AIS network

AIS classes

There are seven classes of AIS stations, vessels, base stations, Search and Rescue (SAR), Aids to Navigation (AtoN), Search and Rescue Transmitter (SART), Man Overboard (MOB), and Emergency Position Indicating Radio Beacon- AIS (EPIRB-AIS).

The X100 is a Class B device.

Under the Safety Of Life At Sea convention, all SOLAS vessels, as described below, are required to install a Class A AIS transponder:

- Upwards of 300 gross tonnage engaged on international voyages.
- Passenger vessels, irrespective of size, engaged on international voyages.
- Vessels upwards of 500 gross tonnage, not engaged on international voyages.

Class B AIS transponders are incompatible with Class A AIS transponders but do not impact the class A network.

Many commercial vessels and some leisure craft, not classified as requiring a Class A unit, choose to install Class B units to avoid accidents at sea.

FCC

WARNING

FCC Warning (Part 15.21)



Changes or modifications to this equipment not expressly approved in writing by em-trak Marine Electronics Limited Incorporated could violate compliance with FCC rules and void the user's authority to operate the equipment.

Compliance Statement (Part 15.19)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

FCC Interference Statement (Part 15.105 (b))

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

1. Reorient or relocate the receiving antenna.
2. Increase the separation between the equipment and receiver.
3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
4. Consult the dealer or an experienced radio / TV technician for help.

Maximum Permissible Exposure



WARNING

Perform regular radio checks when using your vessel, as recommended in radio training and certification schemes and radio equipment rules of use.



WARNING

Under no circumstances should a DSC distress alert be sent from your radio for test purposes. Such action is a violation of rules of use for radio equipment, and can result in heavy fines.

CAUTION

For optimal radio performance and minimal human exposure to Radio Frequency (RF) electromagnetic energy, you must ensure that the antenna is:

- connected to the radio before transmitting.
- located where it will be away from people.
- located at least 1.8 meters (5.9 feet) from the radio's main unit.



Failure to observe these guidelines may expose those within the Maximum Permissible Exposure (MPE) radius to RF radiation absorption that exceeds the FCC MPE limit. It is the radio operator's responsibility to ensure that no person comes within this radius.

Innovation, Science and Economic Development Canada (ISED)

This device complies with license-exempt RSS standard(s).

Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

This Class B digital apparatus complies with Canadian ICES-003.

Innovation, Sciences et Développement économique Canada (Français)

Cet appareil est conforme aux normes d'exemption de licence RSS.

Son fonctionnement est soumis aux deux conditions suivantes:

1. cet appareil ne doit pas causer d'interférence, et
2. cet appareil doit accepter toute interférence, notamment les interférences qui peuvent affecter son fonctionnement.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

Water Ingress

Water ingress disclaimer

Although the waterproof rating capacity of this product meets the stated water ingress protection standard (refer to the product's Technical Specification), water intrusion and subsequent equipment failure may occur if the product is subject to high-pressure washing. em-trak Marine Electronics Limited will not warrant products subjected to high-pressure washing.

Disclaimer

em-trak Marine Electronics Limited does not warrant that this product is error-free or is compatible with products manufactured by any person or entity other than em-trak Marine Electronics Limited.

em-trak Marine Electronics Limited is not responsible for damages or injuries caused by your use or inability to use the product, by the interaction of the product with products manufactured by others, or by errors in information utilised by the product supplied by third parties.

Warranty Registration

Register your product ownership to receive warranty benefits. Visit <https://em-trak.com/> to register online. Your product includes a barcode label indicating the units serial number. You will need this serial number when registering your product online. Retain the barcode label for future reference.

Document and Product Information

Licensing

Before using this product for the first time, check your national requirements for both the operator and equipment licensing.

IT IS YOUR RESPONSIBILITY TO DETERMINE WHETHER OR NOT YOU REQUIRE A LICENSE IN YOUR AREA BEFORE OPERATING THIS EQUIPMENT.

In many regions, the following authorisations are required from the relevant regulatory authority:

1. Ship Station VHF license;
2. Operator's license;
3. MMSI (Maritime Mobile Service Identity) number.

licenses are typically issued by the National Regulatory Authorities (NRAs) for each country.

Important:

It may also be necessary to obtain an Operator's license before an MMSI number for your vessel. The DSC and AIS functions of the radio will not work without a valid MMSI number.

USA Licensing Requirements

FCC station license requirement.

An FCC Ship Radio Station license and Call Sign are not required for most recreational vessels travelling in US waters. However, you must obtain a license if your vessel travels to foreign ports. Ships that use satellite communications or telegraphy must be licensed by the FCC.

For more information, refer to the FCC website (Licensing tab):
<https://www.fcc.gov/licensing-databases/licensing>.

Canada Licensing Requirement

You do not need a license to operate this product within the sovereign waters of Canada or the United States of America (USA).

You will need a license to operate this radio outside of Canada or the USA. To obtain licensing information, visit the Innovation, Science and Economic Development Canada (ISED) (previously known as Industry Canada) website: <https://tc.canada.ca/en>.

Europe Licensing Requirement

See the X100 Installation and Operation Guide for use on the inland waterways of contracting governments of the Regional Arrangement on the Radio Communication Service for Inland Waterways (RAINWAT).

Europe licensing requirements

Before the initial use of a VHF radio in Europe, obtain the following authorisations from the relevant regulatory authority.

- Ship Station VHF license — authorises two-way VHF communications with other vessels, aircraft, and shore stations. This license applies to a specific vessel and is usually valid for the vessel's lifetime. Transfer the Ship Station VHF license to the new owner if you sell your vessel.
- Operator's license — authorises an individual operator to conduct two-way VHF communications with other vessels, aircraft and shore stations. For most non-commercial

operators, this license is referred to as a "Restricted Radiotelephone Operator Permit" or "Restricted Certificate of Competence in Radiotelephone".

- Maritime Mobile Service Identities (MMSI) number — a nine-digit number sent over a radio frequency channel in order to identify the originating vessel/station.

Use the same MMSI number to program your radio if your vessel has one assigned. In Europe, the user can program the MMSI number. In some regions, you must obtain a radio operator's license before you are issued an MMSI number. In these areas, you can request an MMSI number from the same authority that issues the Operator's license or Ship Station VHF license.

It is also the radio operator's responsibility to be familiar with all relevant rules and regulations related to radio use. In regions in which a VHF transceiver is compulsory, a current copy of the applicable government rules and regulations must be accessible to the operator.

The following table lists the relevant issuing authority for licenses in each region, along with a link to the relevant website. Many authorities allow you to apply for a license online.

Country	Code	Regulatory Authority	Website
Austria	AT	Austrian Regulatory Authority for Broadcasting and Telecommunications	http://www.rtr.at
Belgium	BE	Belgian Institute for Postal services and Telecommunications (BIPT)	http://www.bipt.be
Bulgaria	BG	Communications Regulation Commission	http://www.crc.bg
Croatia	HR	Croatian Post and Electronic Communications Agency	https://www.hakom.hr/
Cyprus	CY	Office of Electronic Communications & Postal Regulation	http://www.ocecpr.org.cy/nqcontent
Czech Republic	CZ	The Czech Telecommunication Office	http://www.ctu.eu
Denmark	DK	Danish Energy Agency	https://ens.dk/en
Estonia	EE	Estonian Competition Authority	http://www.konkurentsiamet.ee
Finland	FI	Finnish Communications Regulatory Authority	http://www.ficora.fi/en

Country	Code	Regulatory Authority	Website
France	FR	Autorité de Régulation des Communications Électroniques et des Postes	http://www.arcep.fr
Germany	DE	Bundesnetzagentur	https://www.bundesnetzagentur.de/
Greece	EL	Hellenic Telecommunications and Post Commission	https://www.eett.gr/
Hungary	HU	National Media and Infocommunication Authority	http://www.nmhh.hu
Iceland	IS	Post and Telecom Administration	http://www.pfs.is/default.aspx?cat_id=101
Ireland	IE	Commission for Communications Regulation	http://www.comreg.ie
Italy	IT	Autorità per le Garanzie nelle Comunicazioni	http://www.agcom.it
Lichtenstein	LI	Office for Communications	https://www.llv.li
Lithuania	LT	Communications Regulatory Authority	http://www.rrt.lt/en/home.html
Luxembourg	LU	Institut luxembourgeois de régulation	https://web.ilr.lu
Latvia	LV	Elektronisko sakaru direkcija	https://www.vases.lv/lv/content/juras-sakaru-atlaujas
Malta	MT	Malta Communications Authority	http://www.mca.org.mt
Holland	NL	Autoriteit Consument & Markt	https://www.acm.nl/nl
Norway	NO	Norwegian Communications Authority	http://www.nkom.no
Poland	PL	Prezes Urzędu Komunikacji Elektronicznej	http://www.uke.gov.pl

Country	Code	Regulatory Authority	Website
Portugal	PT	Autoridade Nacional de Comunicações	https://www.anacom.pt
Romania	RO	National Authority for Management and Regulation in Communications of Romania	http://www.ancom.org.ro/en
Slovenia	SL	Agency for communication networks and services of the Republic of Slovenia	http://www.akos-rs.si
Slovakia	SK	Telecommunications Regulatory Authority of the Slovak Republic	http://www.teleoff.gov.sk/index.php?ID=9
Spain	ES	Comisión Nacional de los Mercados y la Competencia	https://www.cnmc.es/en
Sweden	SE	Swedish Post and Telecom Authority	http://www.pts.se
Switzerland	CH	Office fédéral de la communication	http://www.bakom.admin.ch
Turkey	TR	Information And Communication Technologies Authority	https://btk.gov.tr/
United Kingdom & Northern Ireland	UK (NI)	OFCOM	http://www.ofcom.org.uk

Rest of the world licensing requirements

In many regions, you will need to acquire the following authorisations from the relevant regulatory authority:

1. Ship Station VHF license;
2. Operator's license;
3. MMSI number.

Important: It is your responsibility to determine whether a license is required in your area before operating this equipment.

3rd party licenses

Roboto, Roboto_Mono, Manrope

Copyright 2011 The Roboto Project Authors (<https://github.com/googlefonts/roboto-classic>)

Copyright 2018 The Manrope Project Authors (<https://github.com/sharanda/manrope>)

This Font Software is licensed under the SIL Open Font License, Version 1.1 . This license is copied below, and is also available with a FAQ at: <https://openfontlicense.org>

SIL OPEN FONT LICENSE Version 1.1 - 26 February 2007

PREAMBLE

The goals of the Open Font License (OFL) are to stimulate worldwide development of collaborative font projects, to support the font creation efforts of academic and linguistic communities, and to provide a free and open framework in which fonts may be shared and improved in partnership with others.

The OFL allows the licensed fonts to be used, studied, modified and redistributed freely as long as they are not sold by themselves. The fonts, including any derivative works, can be bundled, embedded, redistributed and/or sold with any software provided that any reserved names are not used by derivative works. The fonts and derivatives, however, cannot be released under any other type of license. The requirement for fonts to remain under this license does not apply to any document created using the fonts or their derivatives.

DEFINITIONS

"Font Software" refers to the set of files released by the Copyright Holder(s) under this license and clearly marked as such. This may include source files, build scripts and documentation.

"Reserved Font Name" refers to any names specified as such after the copyright statement(s).

"Original Version" refers to the collection of Font Software components as distributed by the Copyright Holder(s).

"Modified Version" refers to any derivative made by adding to, deleting, or substituting -- in part or in whole -- any of the components of the Original Version, by changing formats or by porting the Font Software to a new environment.

"Author" refers to any designer, engineer, programmer, technical writer or other person who contributed to the Font Software.

PERMISSION & CONDITIONS

Permission is hereby granted, free of charge, to any person obtaining a copy of the Font Software, to use, study, copy, merge, embed, modify, redistribute, and sell modified and unmodified copies of the Font Software, subject to the following conditions:

- * Neither the Font Software nor any of its individual components, in Original or Modified Versions, may be sold by itself.
- * Original or Modified Versions of the Font Software may be bundled, redistributed and/or sold with any software, provided that each copy contains the above copyright notice and this license. These can be included either as stand-alone text files, human-readable headers or in the appropriate machine-readable metadata fields within text or binary files as long as those fields can be easily viewed by the user.
- * No Modified Version of the Font Software may use the Reserved Font Name(s) unless explicit written permission is granted by the corresponding Copyright Holder. This restriction only applies to the primary font name as presented to the users.
- * The name(s) of the Copyright Holder(s) or the Author(s) of the Font Software shall not be used to promote, endorse or advertise any Modified Version, except to acknowledge the contribution(s) of the Copyright Holder(s) and the Author(s) or with their explicit written permission.

* The Font Software, modified or unmodified, in part or in whole, must be distributed entirely under this license, and must not be distributed under any other license. The requirement for fonts to remain under this license does not apply to any document created using the Font Software.

TERMINATION

This license becomes null and void if any of the above conditions are not met.

DISCLAIMER

THE FONT SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT OF COPYRIGHT, PATENT, TRADEMARK, OR OTHER RIGHT. IN NO EVENT SHALL THE COPYRIGHT HOLDER BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, INCLUDING ANY GENERAL, SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF THE USE OR INABILITY TO USE THE FONT SOFTWARE OR FROM OTHER DEALINGS IN THE FONT SOFTWARE.

Fixedpoint, fixedpointmath

// Copyright 2007 Anthony Williams

// Copyright SRT 2010 by Clifford Slocombe

// Distributed under the Boost Software License, Version 1.0. (See

// accompanying file LICENSE_1_0.txt or copy at

// http://www.boost.org/LICENSE_1_0.txt)

LVGL

MIT licence

Copyright (c) 2021 LVGL Kft

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

Tinyprintf

Copyright (c) 2004,2012 Kustaa Nyholm / SpareTimeLabs

All rights reserved.

Redistribution and use in source and binary forms, with or without

modification, are permitted provided that the following conditions are met:

* Redistributions of source code must retain the above copyright

notice, this list of conditions and the following disclaimer.

* Redistributions in binary form must reproduce the above copyright

notice, this list of conditions and the following disclaimer in the

documentation and/or other materials provided with the distribution.

* Neither the name of Kustaa Nyholm or SpareTimeLabs nor the

names of its contributors may be used to endorse or promote products

derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS"
AND

ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED

WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE

DISCLAIMED. IN NO EVENT SHALL COPYRIGHT HOLDER BE LIABLE FOR ANY

DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES

(INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES;

LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND

ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT

(INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS

SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

adt_typedef_user.h

This file contains the Adaptive Digital Technologies, Inc. word length assignments based on processor type. This file is intended to be used in conjunction with Adaptive Digital's algorithms and is included by the algorithm public (user) header files.

This software is the property of Adaptive Digital Technologies, Inc.

Unauthorized use is prohibited.

Copyright (c) 2000-2011, Adaptive Digital Technologies, Inc.

www.adaptivedigital.com

610-825-0182

esp_littlefs

Copyright 2020 Brian Pugh

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

flatbuffers

Apache License

Version 2.0, January 2004

<http://www.apache.org/licenses/>

TERMS AND CONDITIONS FOR USE, REPRODUCTION, AND DISTRIBUTION

1. Definitions.

"License" shall mean the terms and conditions for use, reproduction, and distribution as defined by Sections 1 through 9 of this document.

"Licensor" shall mean the copyright owner or entity authorized by the copyright owner that is granting the License.

"Legal Entity" shall mean the union of the acting entity and all other entities that control, are controlled by, or are under common control with that entity. For the purposes of this definition,

"control" means (i) the power, direct or indirect, to cause the direction or management of such entity, whether by contract or otherwise, or (ii) ownership of fifty percent (50%) or more of the

outstanding shares, or (iii) beneficial ownership of such entity.

"You" (or "Your") shall mean an individual or Legal Entity exercising permissions granted by this License.

"Source" form shall mean the preferred form for making modifications, including but not limited to software source code, documentation source, and configuration files.

"Object" form shall mean any form resulting from mechanical transformation or translation of a Source form, including but not limited to compiled object code, generated documentation, and conversions to other media types.

"Work" shall mean the work of authorship, whether in Source or Object form, made available under the License, as indicated by a copyright notice that is included in or attached to the work

(an example is provided in the Appendix below).

"Derivative Works" shall mean any work, whether in Source or Object form, that is based on (or derived from) the Work and for which the editorial revisions, annotations, elaborations, or other modifications represent, as a whole, an original work of authorship. For the purposes of this License, Derivative Works shall not include works that remain separable from, or merely link (or bind by name) to the interfaces of, the Work and Derivative Works thereof.

"Contribution" shall mean any work of authorship, including the original version of the Work and any modifications or additions to that Work or Derivative Works thereof, that is intentionally

submitted to Licensor for inclusion in the Work by the copyright owner or by an individual or Legal Entity authorized to submit on behalf of the copyright owner. For the purposes of this definition, "submitted" means any form of electronic, verbal, or written communication sent

to the Licensor or its representatives, including but not limited to communication on electronic mailing lists, source code control systems, and issue tracking systems that are managed by, or on behalf of, the Licensor for the purpose of discussing and improving the Work, but excluding communication that is conspicuously marked or otherwise designated in writing by the copyright owner as "Not a Contribution."

"Contributor" shall mean Licensor and any individual or Legal Entity on behalf of whom a Contribution has been received by Licensor and subsequently incorporated within the Work.

2. Grant of Copyright License. Subject to the terms and conditions of this License, each Contributor hereby grants to You a perpetual, worldwide, non-exclusive, no-charge, royalty-free, irrevocable copyright license to reproduce, prepare Derivative Works of, publicly display, publicly perform, sublicense, and distribute the Work and such Derivative Works in Source or Object form.

3. Grant of Patent License. Subject to the terms and conditions of this License, each Contributor hereby grants to You a perpetual, worldwide, non-exclusive, no-charge, royalty-free, irrevocable (except as stated in this section) patent license to make, have made, use, offer to sell, sell, import, and otherwise transfer the Work, where such license applies only to those patent claims licensable by such Contributor that are necessarily infringed by their Contribution(s) alone or by combination of their Contribution(s) with the Work to which such Contribution(s) was submitted. If You institute patent litigation against any entity (including a cross-claim or counterclaim in a lawsuit) alleging that the Work or a Contribution incorporated within the Work constitutes direct or contributory patent infringement, then any patent licenses

granted to You under this License for that Work shall terminate as of the date such litigation is filed.

4. Redistribution. You may reproduce and distribute copies of the Work or Derivative Works thereof in any medium, with or without modifications, and in Source or Object form, provided that You meet the following conditions:

- (a) You must give any other recipients of the Work or Derivative Works a copy of this License; and
- (b) You must cause any modified files to carry prominent notices stating that You changed the files; and
- (c) You must retain, in the Source form of any Derivative Works that You distribute, all copyright, patent, trademark, and attribution notices from the Source form of the Work, excluding those notices that do not pertain to any part of the Derivative Works; and
- (d) If the Work includes a "NOTICE" text file as part of its distribution, then any Derivative Works that You distribute must include a readable copy of the attribution notices contained within such NOTICE file, excluding those notices that do not pertain to any part of the Derivative Works, in at least one of the following places: within a NOTICE text file distributed as part of the Derivative Works; within the Source form or documentation, if provided along with the Derivative Works; or, within a display generated by the Derivative Works, if and wherever such third-party notices normally appear. The contents of the NOTICE file are for informational purposes only and do not modify the License. You may add Your own attribution notices within Derivative Works that You distribute, alongside or as an addendum to the NOTICE text from the Work, provided that such additional attribution notices cannot be construed as modifying the License.

You may add Your own copyright statement to Your modifications and may provide additional or different license terms and conditions for use, reproduction, or distribution of Your modifications, or for any such Derivative Works as a whole, provided Your use,

reproduction, and distribution of the Work otherwise complies with the conditions stated in this License.

5. Submission of Contributions. Unless You explicitly state otherwise, any Contribution intentionally submitted for inclusion in the Work by You to the Licensor shall be under the terms and conditions of this License, without any additional terms or conditions. Notwithstanding the above, nothing herein shall supersede or modify the terms of any separate license agreement you may have executed with Licensor regarding such Contributions.

6. Trademarks. This License does not grant permission to use the trade names, trademarks, service marks, or product names of the Licensor, except as required for reasonable and customary use in describing the origin of the Work and reproducing the content of the NOTICE file.

7. Disclaimer of Warranty. Unless required by applicable law or agreed to in writing, Licensor provides the Work (and each Contributor provides its Contributions) on an "AS IS" BASIS,

WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied, including, without limitation, any warranties or conditions of TITLE, NON-INFRINGEMENT, MERCHANTABILITY, or FITNESS FOR A PARTICULAR PURPOSE. You are solely responsible for determining the appropriateness of using or redistributing the Work and assume any

risks associated with Your exercise of permissions under this License.

8. Limitation of Liability. In no event and under no legal theory, whether in tort (including negligence), contract, or otherwise, unless required by applicable law (such as deliberate and grossly negligent acts) or agreed to in writing, shall any Contributor be liable to You for damages, including any direct, indirect, special, incidental, or consequential damages of any character arising as a result of this License or out of the use or inability to use the Work (including but not limited to damages for loss of goodwill, work stoppage, computer failure or malfunction, or any and all other commercial damages or losses), even if such Contributor has been advised of the possibility of such damages.

9. Accepting Warranty or Additional Liability. While redistributing the Work or Derivative Works thereof, You may choose to offer, and charge a fee for, acceptance of support, warranty, indemnity, or other liability obligations and/or rights consistent with this License. However, in accepting such obligations, You may act only on Your own behalf and on Your sole responsibility, not on behalf of any other Contributor, and only if You agree to indemnify,

defend, and hold each Contributor harmless for any liability incurred by, or claims asserted against, such Contributor by reason of your accepting any such warranty or additional liability.

g711

Copyright (c) 2016-2024, Eleftherios (Lefteris) Zafiris

All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.

3. Neither the name of the copyright holder nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT HOLDER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

nlohmann

Copyright © 2013-2025 Niels Lohmann

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

The class contains the UTF-8 Decoder from Bjoern Hoehrmann which is licensed under the MIT License (see above). Copyright © 2008-2009 Björn Hoehrmann bjoern@hoehrmann.de

The class contains a slightly modified version of the Grisu2 algorithm from Florian Loitsch which is licensed under the MIT License (see above). Copyright © 2009 Florian Loitsch

The class contains a copy of Hedley from Evan Nemerson which is licensed as CC0-1.0.

Specifications

Dimensions and weight

Width	217 mm
Height	84 mm
Depth	152 mm +200 mm for cable routing
Weight	1.6 kg, 1.7 kg (with mounting bracket)

Environmental specification

Operating Temperature	-25°C (-13°F) to +55°C (131°F)
Storage Temperature	-25°C (-13°F) to +70°C (158°F)
Relative Humidity	95%
Water Proofing	IPx6 & IPx7
Connections	<ul style="list-style-type: none"> 2 x NMEA 0183 1 x NMEA 2000 LEN (Load equivalency number)=1 1 x Audio (Bare Wire) 1 x GPS antenna (TNC) 1 x VHF connection port 1 x Wi-Fi/Bluetooth antenna (antenna provided)

Power specification

Nominal Supply Voltage	12Vdc to 24Vdc (Reverse polarity and over voltage protected)
Operating voltage range	9.6Vdc to 31.2Vdc
Power consumption	<ul style="list-style-type: none"> Transmit 6A Standby: 0.6A Receive: 0.46A

Transmitter

Channels	All available US, International and Canadian VHF marine bands
Frequency Range	Tx 156.00 to 162.025 international including AIS Tx 155.500 to 162.425 private
Frequency stability	+/- 1.5 ppm
Channel spacing	25 kHz

Power output	<ul style="list-style-type: none"> Low power setting 1 W High power setting 25 W
Spurious emissions	Better than -36 dBm at 25 W (Less than 0.25 μ W)
Maximum deviation	+/- 5 kHz
Antenna impedance	50 Ohms (typical)

Receiver

Channels	All available US, International and Canadian VHF marine bands
Frequency range	Rx 156.205 to 162.025 International including AIS Rx 155.500 to 163.275 private and WX
Sensitivity	Better than 1 microvolt EMF @ 20dB SINAD
Squelch sensitivity	Less than 2 dB μ EMF
Hum and noise	Better than -40 dB
Audio distortion	Less than 10%
Receiver sensitivity	Distance: 119dBm (0.25 μ V) @ 12dB SINAD (typical) Local: 110dBm (0.7 μ V) @ 12dB S
Adjacent channel selectivity	More than 70 dB
Spurious response rejection	More than 70 dB
Inter modulation rejection	More than 68 dB
Fuse requirements	Fast Acting In-line Fuse = 5 x 20mm 12 A

Speakers

Base speaker power output	2W
Fist-mic speaker power	1W
External speaker power	15W (4 Ω)

GNSS

Channels	72
Cold Start	30s
Receiver IC Sensitivity	-167 dBm (Tracking) / -148 dBm (Acquisition)
GNSS compatibility	<ul style="list-style-type: none"> • GPS • GLONASS • Beidou • Galileo
SBAS compatibility	<ul style="list-style-type: none"> • WAAS • EGNOS • MSAS
Special features	Active Jamming and Interference Reduction
Operating frequency	<ul style="list-style-type: none"> • GPS L1 C/A • GLONASS L10F • Beidou EB1/C
Signal Acquisition	Automatic
Almanac Update	Automatic
Geodetic Datum	WGS-84
Refresh Rate	1 Hz
Antenna	<ul style="list-style-type: none"> • Internal: Ceramic chip mounted near top of unit • External: Passive antenna connection via TNC connector
Position Accuracy	<ul style="list-style-type: none"> • Without SBAS: <= 15 metres 95% of the time • With SBAS: <= 5 metres 95% of the time

Regulatory bodies and application submissions

Country	Regulatory Body	Website links
UK	OFCOM	http://www.ofcom.org.uk
USA	FCC (www.fcc.gov)	<ul style="list-style-type: none"> www.boatus.com www.seatow.com www.usps.org/lc/bare/mmsi.html
Canada	Industry Canada	www.ic.gc.ca
Australia	Australian Maritime Safety Authority (AMSA)	http://www.amsa.gov.au/mmsi/
Holland	Agentschap Telecom	www.agentschaptelecom.nl
Belgium	Belgisch Instituut voor Postdiensten en Telecommunicatie	www.bipt.be
Germany	Bundesnetzagentur	https://www.bundesnetzagentur.de/DE/Sachgebiete/Telekommunikation/Unternehmen_Institutionen/Frequenzen/SpezielleAnwendungen/Seefunk/Seefunk-node.html
Denmark	søfartsstyrelsen	www.søfartsstyrelsen.dk
France	Agence Nationale Des Fréquences	https://www.anfr.fr/accueil
Italy	Ministero dello sviluppo economico - Direzione generale per le attività territoriali	https://www.mimit.gov.it/it/
Spain	Ministerio De Fomento	https://www.fomento.gob.es/MFOM/LANG_CASTELLANO/DIRECCIONES_GENERALES/MARINA_MERCANTE/ RADIOCOMUNICACIONES/MMSI/
Sweden	PTS	www.pts.se
Finland	Viestintävirasto	https://www.viestintavirasto.fi/en/spectrum/radiolicences/Boatingandnavigation.html
Iceland	Post and telecom administration in Iceland	www.pfs.is
New Zealand	Radio Spectrum Management	https://www.rsm.govt.nz

Country	Regulatory Body	Website links
Chile	Directemar	www.nauticentro.cl
Panama	Autoridad Maritima de Panama	https://www.amp.gob.pa/

Head office:

em-trak Marine Electronics Ltd
Wireless House
Westfield Industrial Estate
Midsomer Norton
Bath, BA3 4BS
United Kingdom
T +44 (0)1761 409559 | F +44 (0)1761 410093
enquiries@em-trak.com

Regional Office:

em-trak Marine Electronics Limited
470 Atlantic Avenue
4th floor,
Boston MA 02210
USA
T +1 617 273 8395 | F +1 617 273 8001
enquiries@em-trak.com

Support: support@em-trak.com | Sales: enquires@em-trak.com | Website: www.em-trak.com