Fifth Framework Programme of the European Commission 1998-2002

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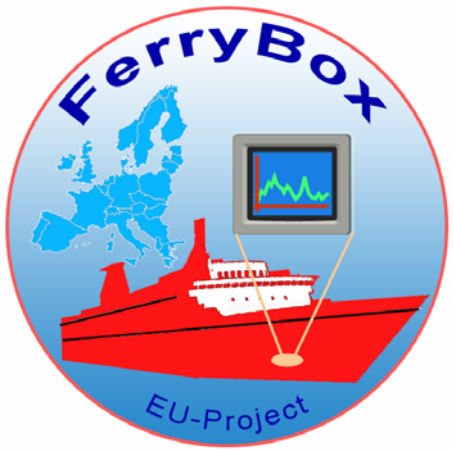
FerryBox

From On-line Oceanographic Observations to Environmental Information



Guidelines for Management, Assembly, Documentation and Exchange of Ferrybox Data

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Preface

This document provides guidelines for data assembly, documentation and meta data contents as well as for data archiving, final banking, dissemination and exchange of measured data acquired by the Ferrybox systems operated in the European FerryBox Project and subsequently processed and quality controlled by the FerryBox project partners concerned.

The document is unclassified and available to the interested public. It intends to inform interested parties, such as scientific institutions, agencies concerned with marine environmental monitoring, marine associations and initiatives (e.g. ICES, EuroGOOS) and other potential providers and/or users of Ferrybox data, how Ferrybox measurements are assembled, formatted and documented for project-internal exchange as well as how they are distributed or accessible to end users.

This document presents guidelines and approaches being mutually agreed among the FerryBox Consortium for application in the project. Resulting experiences will be accomplished and implemented in subsequent revisions whenever required.

Author: This document was compiled and edited by the leader of work package 3, K.D. Pfeiffer (HYDROMOD) following mutual agreement of the partners on proposed topics.

Contributors: All project partners operating Ferrybox systems as well as the Dutch National Oceanographic Data Centre and the British Oceanographic Data Centre (BODC – designated as custodian for the final sets of FerryBox project data) contributed ideas, suggestions and experiences to this guideline document.

Implementation

If necessary updated revisions of these guidelines can be implemented. They become valid after review by the project partners in charge of project data and information management issues. The review period will be specified by the project's data manager and review comments will be subsequently accomplished. Revised versions of this document entirely replace previous ones.

Document Reference Sheet

This document has been elaborated and issued by the European FerryBox Consortium.

P 1	GKSS	**GKSS Research Centre Institute for Coastal Research**	**Coordinator**
P 2	NERC.NOC	**NERC.NOC – National Oceanography Centre Southampton University and National Environment Res. Council** formerly NERC.SOC – Southampton Oceanography Centre	
P 3	NIOZ	**Royal Netherlands Institute of Sea Research**	
P 4	FIMR	**Finnish Institute of Marine Research**	
P 5	HCMR (formerly NCMR)	**Hellenic Centre for Marine Research** (formerly National Centre for Marine Research)	
P 6	NERC.POL	**Proudman Oceanographic Laboratory**	
P 7	NIVA	**Norwegian Institute of Water Research**	
P 8	HYDROMOD	**HYDROMOD Scientific Consulting**	
P 9	CTG (formerly CIL)	**Chelsea Technology Group (formerly Chelsea Instruments Ltd.)**	
P 10	IEO	**Spanish Institute of Oceanography**	
P 11	EMI	**Estonian Marine Institute** (in cooperation with the Estonian Maritime Academy)	

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Remarks:	Specific topics regarding project data and information management are not included in this report. These are provided in the Project Data and Information Management Plan (PDIMP – deliverable no. D-3-1/A & D-3.3/A) as a separate document. The FerryBox PDIMP is a confidential document restricted for the FerryBox Project Consortium. Revision 1.0 of this document was implemented for test purposes in August 2004. Revision 2.0 was prepared for publication on the FerryBox Report CD and website and for final integration of the FerryBox Project data into the Final FerryBox Data Set. Should a/m integration require a further update this will be announced and published on the FerryBox website.			
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Project website:	http://www.ferrybox.org			

Revision Control

Revision	Date (MM-YYYY)	Released by	Distribution	Purpose of release and remarks
0.1	05-2004	Project Data Manager	not applicable	Preliminary / working revisions
0.2	06-2004	Project Data Manager	WP-3 participants	For WP-3 internal review only
1.0	08-2004	Project Data Manager	WP-3 participants	Implemented as guideline for Ferry-box data processing in the project. Also designated for the interested public like Ferrybox operators, data users and institutions, associations and agencies concerned.
2.0	04-2006	Project Data Manager	WP-3 participants	For publication on the FerryBox Report CD and website and for assembly of the Final FerryBox Dataset.

Guidelines for Management, Assembly, Documentation and Exchange of Ferrybox Data

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1 Introduction

This document provides guidelines for data assembly, documentation and meta data contents as well as for data archiving, final banking, dissemination and exchange of measured data acquired by the Ferrybox systems operated in the European FerryBox Project and subsequently processed and quality controlled by the FerryBox project partners concerned.

It provides in particular:

Guidelines for Ferrybox data assembly

Recommendations for Ferrybox data documentation (meta data contents), and

Procedures for Ferrybox data assembly and long-term archiving

These guidelines and recommendations have been mutually agreed among the FerryBox Consortium and will be applied during the project. Resulting experiences will be accomplished and implemented in subsequent revisions whenever required.

The metrology related quality assurance measures applied by the Ferrybox operators are described in the “Report on the Experiences with the Ferrybox Systems during Operational Use” (deliverable No. D-2-3).

This document is unclassified and available to the interested public. Thereby it intends to inform interested parties such as scientific institutions, agencies concerned with marine environmental monitoring, marine associations and initiatives (e.g. ICES, EuroGOOS) and other potential providers and/or users of Ferrybox data how Ferrybox measurements are assembled, formatted and documented for project-internal exchange as well as how they are distributed or accessible to end users.

It intends to provide proven guidelines on management of Ferrybox data as well as an overview of possible uses and applications of Ferrybox data to the interested user communities.

The guidelines and descriptions intend to be as comprehensive and extensive as feasible in order to provide arbitrary users and other data providers and/or Ferrybox operators with a reference document which is as complete as possible. For experienced users and in particular project partners who contributed to this document a more condensed document – the so called **Quick Reference Guide and Checklist for Ferrybox Data Assembly** – will be compiled and distributed together with the Final FerryBox Data Set.

2 General Topics for the FerryBox Project Data

In the European FerryBox Project large amounts of oceanographic data are acquired operationally throughout a period of at least one year. Generally this data represents underway measurements conducted by automatic measurement systems installed on ferry boats on nine different routes. The data acquisition systems are operated jointly or individually by the project partners concerned in order to acquire a series of oceanographic parameters. For a detailed overview on the ferry routes, the measuring systems, principles and sensors, as well as the acquired parameters and applied methodologies of quality control please refer to the public document "Ferrybox System Description" (deliverable no. D-2.2) which can be downloaded from the project's website.

This chapter describes in short the general standards agreed by the FerryBox project partners on how Ferrybox data is efficiently assembled and documented for exchange and long-term use.

2.1 Ferrybox Data Categories

Ferrybox data can be categorised according to processing, quality control and integration stages. Simultaneously this classification reveals different intentions for use and applications.

In this respect we make the differences described in the following sections and discriminate the Ferrybox data into the following four data categories:

Operational Ferrybox data (Section 2.1.1)

Quality controlled Ferrybox data (Section 2.1.2)

Reference data applied for quality control measures (Section 2.1.3)

Further processed Ferrybox data (Section 2.1.4)

2.1.1 Operational Ferrybox Data

This data category incorporates data which are, after being acquired, automatically preprocessed and stored in the Ferrybox system. These data or parts thereof can also be transmitted in real or quasi-real time and in full or reduced resolution to the institution which operates the respective Ferrybox system. Other institutions may also have access and use this data in real or quasi-real time.

This data class incorporates for example raw data as well as quickly processed data for different applications and uses. They are typically used and required for applications for which in-time availability and access is of higher relevance than high data quality and validation. This is usually the case for online displays onboard, quick-views on the Internet or as input for hazard prediction and warning purposes.

Operational Ferrybox data sets are held in the institutes of the data providers under their sole responsibility and custody. They are treated and archived as per individual in-house procedures and are usually not available to Third Parties apart from specific agreements or individual requests when issued directly to the data producing institution.

Apart from some examples of applications of operational Ferrybox data depicted for illustration at the end of this document this data class is not considered further in these guidelines.

2.1.2 Quality Controlled Ferrybox Data

Quality controlled Ferrybox measurements are defined as data acquired by the Ferryboxes which underwent at least the minimum common quality control procedures defined in the project's work package no. 2 (WP-2). The Ferryboxes shall be maintained and their sensors shall be calibrated as described in brief in the "Ferrybox System Description" (deliverable no. D-2-1). The calibration and maintenance procedures are further refined and prescribed in deliverable number D-2-3 which was elaborated in WP-2. For further details one is referred to these documents.

2.1.2.1 Minimum Quality Control Procedures and Standard QC Flagging

Data values in quality controlled Ferrybox data files shall be flagged with one of the three quality control flags from the minimum and common quality flag definition for Ferrybox data as given in the table below.

The Standard Quality Flags (QCFS) for Ferrybox Data	
QC Flag Value	**QC Flag Description**
L	**Suspect data**
N	**No / absent / missing data**
BLANK	**Good data**

Table 2-1. Agreed minimum quality control flags (QCFS) applied to Ferrybox data.

The respective columns containing the quality flags are indicated in the header by the designator QCFS.

Quality flags appear for the following parameters in the data files:

One QC flag for both geographical position data (latitude and longitude)

One QC flag for the subsequent depth value

One QC flag for the subsequent parameter value

Date and time stamps are not individually associated with a quality control flag.

For the data assembly applied here which includes generally only one measured parameter per data file, the incorporation of missing values (QC flag “N”) is meaningless. However, it is indicated here for completeness and to make the data format more general (e.g. when applied for data series which include more than one parameter or for temporarily or spatially equidistant time series.)

It is recommended to generally remove records with missing values of the respective measured parameter from Ferrybox data files.

2.1.2.2 Extended Quality Control Procedures and Corresponding QC Flagging

Ferrybox operators are free to individually apply measures and methods of quality controlling in excess to the minimum and commonly agreed standards and procedures. The applied methods and the meaning of additional QC flags shall be accordingly documented in the meta data.

This applies for instance for some ferry routes where stationary precision instruments are deployed nearby. Another example are periods in which complementary monitoring cruises with station or sampling grids intersecting a ferry route are conducted. Such activities can provide better accuracy by more and better baseline data for post-calibration and identification of sensor drifts.

In such cases additional columns (indicated in the header and meta data by QCFE) shall be included directly after the respective mandatory column with the standard quality flags (QCFS). By this the additional QC flags are accordingly associated with the data or selected parameters which underwent quality control and flagging in excess. QC flags appearing in these extra columns can determine more precisely the data quality, in excess applied quality control measures and data checks.

All individual quality flags have to be accordingly referenced or documented in the meta data as well.

Note: The ICES QC flag definition and determination might be a good example therefore (refer to the website of ICES and thereon provided documentation).

2.1.3 Reference Data Applied for Quality Control Measures

The third data category which was relevant in the FerryBox Project were precision reference data either measured at sea or being analysed in the laboratory from collected water samples.

Some monitoring stations are positioned nearby of some ferry routes. As these are usually very carefully maintained and quality controlled by the operating agencies or institutions their data can also be used as precision references. Also data acquired during routine or targeted research or monitoring cruises with station grids intersecting a ferry route may provide good reference data.

Several Ferrybox systems incorporate water sampling devices and samples are later analysed in the laboratory to directly facilitate calibration and quality control for the underway measurements.

Generally the quality controlled Ferrybox data sets are not delivered together with other data which possibly have been used for sensor calibration and quality control measures.

However, if such reference measurements have been conducted as a direct project activity they have to be delivered together with other project data. For comprehensiveness of the Final FerryBox Data Set it is also recommended to deliver applied reference data although this is not mandatory. The general data format as documented here also supports this data category.

2.1.3.1 Optional Data Reference Flagging

Optionally data values in quality controlled Ferrybox data files can be flagged with one of the three data reference flags.

If applied these data reference flags shall be assembled in a separate column inserted after column(s) with the mandatory and, if applied, extended quality control flags.

A frequent problem in time series data is caused by re-calibration, exchange or replacement of a sensor. Even for carefully quality controlled and maintained systems thereby caused jumps or steps in data series are often impossible to avoid. It is therefore recommended to flag the first data value after re-calibration or exchange of a sensor accordingly and thereby provide respective indications to the users.

The designator of this column is DREF (shall mean data reference flags) and the flag values shall be one of the one byte characters given in the table below.

Data Reference Flags (DREF) for Ferrybox Data	
Flag Value	**Data Reference Flag Description**
W	**Water sample taken by the Ferrybox system and the data value is quality controlled according to results of subsequent laboratory analyses**
P	**Data value is quality controlled according to available other precision measurements or sample analyses**
C	**First data value after a sensor calibration or re-calibration was conducted**
E	**First data value after a sensor was exchanged or replaced**
BLANK	**No sample taken and no other reference data applied for quality control**

Table 2-2. Data reference flags (DREF) which can be optionally applied to Ferrybox data.

2.1.4 Further Processed Ferrybox Data

Ferrybox operators and/or data providers as well as users will likely apply further methods in data processing to match their individual needs and requirements. Such processing typically includes increased temporal or spatial averaging and other means of data reduction, event controlled processing, intensified plausibility checks and subsequent statistical evaluations.

As such further processing highly depends on the individual use and application of the data it cannot be generally determined in advance by the data providers. It should be also kept in mind that applying Ferrybox data for instance in operational oceanography (e.g. for now- and forecasting), in marine environmental monitoring or in specific research activities requires rather different means of data processing and treatment. Thus in general files in the Final FerryBox Data Set are not further processed by the individual data provider.

However, the FerryBox Project intends to post-process and provide some further processed sample data which are considered as typically usable for some sorts of more standard applications. Provision of such application and/or user tailored data sets is considered as beneficial for the users to demonstrate typical use and versatility of Ferrybox data both in operational oceanography and marine research.

The documentation standards and data formats described in detail below are certainly applicable for such kind of post-processed Ferrybox data as well.

3 The Final FerryBox Data Set

The FerryBox Project Consortium has decided to produce a final set of quality controlled data incorporating all Ferrybox measurements acquired during the operational phase of the project in high temporal and spatial resolution. We refer to this data set as the Final FerryBox Data Set.

These quality controlled Ferrybox data is a final project deliverable. The data set will be made available according to dedicated terms and conditions to interested Third Parties (users).

The Final FerryBox Data Set contains the quality controlled and identically assembled and documented data acquired and produced throughout the European FerryBox Project according to commonly agreed guidelines procedures. The data management, structuring, assembly and documentation related topics are provided in detail in this guideline document.

The complete content of the Final FerryBox Data Set is provided in a separate document accompanying the data,

3.1 Ownership, Copyrights, Dissemination and Rights of Use

The Final FerryBox Data Set is jointly owned by the FerryBox Project Consortium and can be used by Third Parties in compliance with applicable conditions, rules and regulation for project being co-funded in the European Commission's Fifth Framework Programme for Research and Technological Development (FP-5).

Generally the FerryBox project partners have agreed to make the data acquired in the project publicly available for research and non-commercial purposes. However, users shall allow to be registered for data transfers. The Final FerryBox Dataset shall be appropriately cited and referenced as the Final FerryBox Dataset (details are provided together with the data).

3.2 Final Banking and Data Custody

The Final FerryBox Data Set will be archived in the oceanographic data bases of the British Oceanographic Data Centre (BODC) who already volunteered to act as the data custodian in the long run.

The FerryBox Project Consortium and BODC will agree on procedures and terms on how to make the FerryBox project data available to interested Third Parties in the long term. Details will be provided together with the data.

Further to this, each FerryBox project partner holds a copy of the Final FerryBox Data Set and is allowed to disseminate it to interested users.

Subsets of these data can be made available to National Oceanographic Data Centres (NODCs) of the countries in which FerryBox partners are situated as well as to international organisations (e.g. ICES) as long as the aforementioned agreements on ownership, copyrights and rights of use are accordingly applied and maintained by these organisations.

3.3 Parameters Excluded from the Final FerryBox Data Set

One Ferrybox system already incorporates an Acoustic (Doppler) Current Profiler (ADP or ADCP) instrument and possibly more systems will be supplemented with such. These instruments acquire very large amounts of acoustic backscatter data. Special processing is required in order to gain profiles of current speed and direction. From this other derivable and aggregated parameters like water depth, seabed changes, sedimentation and erosion rates, sectional averaged water transports or sediment transport rates are possible to compute. Often, even the current profiles which are acquired in relatively high-frequency are not stored or archived in the data gathering institutions.

Thus the FerryBox Project Consortium has decided not to include ADP / ADCP current measurements in the Final FerryBox Data Set but to provide time / position referenced series of derived and aggregated data (e.g. water and/or sediment transport rates). Users which are interested in the original current measurements shall contact the data provider (NIOZ) directly.

In this conjunction it should be noted that the general data documentation and formats certainly support the provision of current profiles as well. These can be simply assembled as time series of their spatially integrated values (bins) for a dedicated depth value respectively interval. Consequently a separate column in the data file can be added in order to store either the two current vector components or the current's magnitude and direction. Current profiling data assembled in this way are in principle not different from current data acquired by conventional instruments being moored in different depth levels.

3.4 Quality Control Measures for the Final FerryBox Data Set

Each Ferrybox operator contributing data to the Final FerryBox Data Set has applied metrology methods of quality control to the delivered data (for details see deliverable D-2-3). The application of these QC procedures is documented by the standard quality flags (QCFS) associated to each data value (refer to Section 2.1.2 above).

The data providers have further assembled the data in the commonly agreed structure and format and have also compiled and assembled a corresponding meta data file to each of the data files.

These data and meta data files are delivered by the Ferrybox operators engaged in the project to the project's data management unit. There they are merged and final consistency, completeness and compliance checks are made. In case of necessary larger corrections resulting from these tests questionable data files can be returned to the data provider for revision. Smaller corrections and adds (especially in the meta data) can be applied by the data management unit in coordination with the data provider.

Some time after the end of the project this data set is delivered to BODC acting as data custodian for long-term archiving. BODC will perform applicable checks and may modify formats and/or meta data in order to match its overall database structure and design and to comply with import and merging routines. In case BODC detects vital errors in data or meta data these are reported to the project data management unit which will accordingly update the Final Ferry Box Data Set.

3.5 Common Principles for Final Assembly of Ferrybox Data

Measured data acquired by Ferrybox systems have common data characteristics. In general they consist of **time series of arbitrary parameters measured at different geographical positions** in almost constant depth ranges below the sea surface when load line deviations of the individual ships are neglected.

Thus each data value in a time series can and has to be uniquely referenced by a date- and time stamp and a geographical position.

Therefore the project consortium has mutually agreed upon that:

- All **date and time stamps** are in **Greenwich Mean Time** (GMT or UTC) in the specified date and time format, and
- All **geographical positions** are in decimal latitude and longitude degrees, with **positive values** for **northern latitudes** and **eastern longitudes** and, accordingly, **negative values** for **southern latitudes** and **western longitudes**. The position data must be given in **GPS/DGPS** coordinates (referring to the WGS 84 geoid).

As ferry or voluntary ship of opportunity services have temporal inhomogeneous operating times and periods at sea and/or because data acquisition by the Ferryboxes is subject to interruption by lay-time in ports, docking and maintenance periods, servicing of different routes or seasonal disrupts the provided data series are **not equally spaced in time**. However, this is usually the case during acquisition cycles except in cases of system or sensor breakdowns.

Due to the global character of geo-referenced time series the measured data can be assembled in a **simple column separated format.** A tabulator (TAB) is the common separator between each data column.

However, due to the different acquisition cycles of the various instruments and sensors installed in each individual Ferrybox system and, consequently, to avoid large gaps in specific data columns the data is usually provided **as per parameter**. **This means that each acquired parameter is assembled in a single data file.**

All data files are in plain ASCII format. These conventions facilitate efficient exchange of the data among the project partners as well as dissemination to interested users. It also eases data import by almost all suitable processing and application software and into data bases.

Each data set as well as individual data values are provided together with standard quality flags (refer to Section 2.1.2) assembled in subsequent columns. If necessary or applicable this basic set of quality control flags can be optionally supplemented by user defined extensions if accordingly documented in the accompanying meta data.

The project partners have further agreed that the measured data shall be provided in **highest feasible spatial and temporal resolution**. Strong arguments therefore are that any means of data averaging, reduction, exclusion through interpretation will result in unrecoverable data losses which disable individual processing and evaluation by other users of the data. As the applications or intentions of the data users cannot be determined globally this was considered as the best way to provide quality checked and reliable data for later interpretation.

This, however, does not restrict the Ferrybox operators or other project partners to assemble subsets of data which are more tailored to individual applications or specific requirements of end users.

The data formats and accompanying meta data documentation provided in these guidelines facilitates both approaches. In particular there is no need to change data formats and meta data contents as long as the general data structure regarding time- and geo-referencing is maintained.

Regarding the acquired parameters the FerryBox Project distinguishes between so called

(i) ***Ferrybox standard parameters*** comprising typically salinity[1] water temperature, chlorophyll-a fluorescence and turbidity and

(ii) ***Ferrybox non-standard parameters*** which include all other directly measured or derived parameters.

In order to make the data usable in the long-term as well as to provide clear information on ownership, data contents, methods of acquisition, quality control, pre- and post-processing and other versatile information together with the data **each individual data file** is accompanied by a **comprehensive and corresponding set of meta data** provided in a separate ASCII file with compliant file naming.

If data files are getting unreasonably large, they could be split in feasible periods. For practical reasons, such splitting should not occur within a leg or transit. We do not recommend to assemble the data in daily, weekly or monthly intervals as this will cause large numbers of files and correspondingly will increase efforts for merging or database import. Suitable periods of splitting Ferrybox data series are for instance service interruptions of ferry services or equipment changes.

To ensure proper uploading on typically configured FTP sites and servers we recommend file sizes of single data files to be in the range of 20 – maximum 40 megabytes.

For reasons of standardisation, and as already widely applied, the parameter dictionary used is a subset of the large oceanographic parameter dictionary of the British Oceanographic Data Centre (BODC) in its newest (2004) version. In the unlikely event, that for certain parameters matching dictionary entries are missing, BODC will compile consistent supplementary entries for this dictionary on request.

[1] The parameter “salinity” is actually not directly acquired by the measurement sensors as these generally measure conductivity, water temperature and pressure from which the salinity of seawater can be calculated according to internationally standardised formulae. The FerryBox partners have agreed to provide quality controlled salinity data.

4 Assembly of the Ferrybox Measurements

The FerryBox project partners have agreed on an easy to handle and simple data format for assembly of the underway measurements.

4.1 Data Preparation, Pre-processing and Quality Control

The measurements will be provided in **high resolution** as **quality controlled measurements** in **reasonably high temporal resolution**.

The raw data is pre-processed as per individual requirements which are determined by the instruments and sensors installed in the different Ferryboxes. If not already provided by the instruments themselves the raw data (e.g. voltages, counts) is accordingly pre-processed by the data acquisition and management unit being either already integrated into the Ferrybox or consisting of an interfaced data acquisition computer placed on the vessel. In rarer cases, specific pre-processing is conducted separately ashore after the read-out or transfer of the raw data.

The pre-processing results in data which provide the respective physical, chemical or biological parameters with high temporal and spatial resolution. Temporal (simultaneously spatial) averaging of the raw data is applied to such an extent only, that the values have the necessary and applicable confidence and accuracy.

Several data quality control measures (see related documentation, e.g. D-2-3) are applied to these data. Quality flagging associating each data value with one of the three standard quality flags as described above (QCFS – see Section 2.1.2) is mandatory. Data providers are free to provide individual extended quality control flags in addition. By this each data value will appear together with at least the standard QC flag and, optionally, with an extended QC flag as per definition of the individual data providers. QC flags and, if applicable, extended QC flags are documented in the accompanying meta data.

Application of the data reference flag (see Section 2.1.3) is optionally but strongly recommended for reasons of data consistency and comprehensiveness.

The parameters will be provided in standard units (MKSI Units) and in line with the respective entries of the BODC parameter dictionary. This might require additional unit conversion in some cases.

Frequently some further processing like averaging, data reduction, de-spiking, removal of sensor drifts and plausibility control were applied by the institutions as per individually considered necessities. Further details are described in deliverable D-2-3.

4.2 Unified File Naming Convention

The following general convention is applied to the naming of all FerryBox data files to ensure unique referencing.

<Project>_<Provider>_<Route>_<Start Date>_<Start Time>_<End Date>_<End_Time>_<Parameter>_<PSC>_DATA.dat

The separator between entries shall be generally the **underscore** ("_").

The textual parts of the file name shall include only standard letters / characters, numbers and, if applicable hyphens ("-").

Special characters and other signs must not appear in filenames.

The suffix is generally "**dat**" prefixed by a **dot** ("**.**").

4.2.1 Glossary of File Name Components

<Project> Stands for the acronym of the project (in capital letters) in which the respective data have been acquired.

This is usually **FERRYBOX** but data provider may decide to provide Ferrybox data from other or affiliated projects as well.

<Provider> Stands for the acronym of the data provider (in capital letters).

Acronyms of the data providers in the FerryBox Project are **FIMR**, **EMI** (or **FIMR-EMI**),**IEO** (or **NOC-IEO**), **GKSS**, **HCMR**, **NIOZ**, **NIVA**, **POL** and **NOC**.

If applicable, data providers may decide to include data from other ferry routes they operate in cooperation with other institutions into this data set as well.

<Route> Designates the calling ports of the ferry separated by a hyphen ("-"), [2] (e.g. **Cuxhaven-Harwich**, **Travemuende-Helsinki**, **Oslo-Hirtshals**).

<Start Date> Designates the date stamp of the first data value (**YYYYMMDD**).

<Start Time> Designates the time stamp of the first data value (**HHMMSS**).

<End Date> Designates the date stamp of the last data value (**YYYYMMDD**).

<End Time> Designates the time stamp of the last data value (**HHMMSS**).

<Parameter> Is the short name (abbreviation) of the parameter in the respective data file complying with the BODC parameter dictionary.

<PSC> Stands for the parameter serial counter (see the meta data tables for parameters in Section 6.2). Its value is usually **1** except for these Ferryboxes which measure exactly the **same parameter with two or more sensors**.

DATA Indicates that the file contains measured parameters.
For corresponding meta data file this identifier must be **METADATA** which is the only difference between the data and their corresponding documentation (header) file.

[2] For third parties this route indication is more convenient than using the abbreviations defined project internally.

4.2.2 File Naming Examples

4.2.2.1 Data Files

Some typical examples of data files are presented below

FERRYBOX_FIMR_Helsinki-Travemuende_20040322_1423_20041012_2235_PSALSG01_1_DATA.dat

FERRYBOX_FIMR-EMI_Helsinki-Tallinn_20040412_0813_20040703_0400_PSALSG01_1_DATA.dat

FERRYBOX_GKSS_Cuxhaven-Harwich_20040210_0710_20040915_2355_TEMPSG01_1_DATA.dat

FERRYBOX_HCMR_Athens-Herakliaon_20040612_1423_20041130_2209_TEMPSG01_1_DATA.dat

FERRYBOX_NIVA_Oslo-Hirtshals_20040111_0934_20040611_0832_PSALSG01_1_DATA.dat

FERRYBOX_NIOZ_DenHelder-Texel_20040822_1410_20040822_2118_TEMPSG01_1_DATA.dat

FERRYBOX_POL_Liverpool-Belfast_20040501_1117_20041111_1748_TEMPSG01_1_DATA.dat

FERRYBOX_NOC_Southampton-IsleofWight_20040822_1410_20040917_0503_TEMPSG01_1_DATA.dat

FERRYBOX_NOC-IEO_Southampton-Bilbao_20040521_1110_20041001_1812_TEMPSG01_1_DATA.dat

4.2.2.2 Meta Data Files

The names of the meta data files corresponding to the examples given above are accordingly:

FERRYBOX_FIMR_Helsinki-Travemuende_20040322_1423_20041012_2235_PSALSG01_1_METADATA.dat

FERRYBOX_FIMR-EMI_Helsinki-Tallinn_20040412_0813_20040703_0400_PSALSG01_1_METADATA.dat

FERRYBOX_GKSS_Cuxhaven-Harwich_20040210_0710_20040915_2355_TEMPSG01_1_METADATA.dat

FERRYBOX_HCMR_Athens-Herakliaon_20040612_1423_20041130_2209_TEMPSG01_1_METADATA.dat

FERRYBOX_NIVA_Oslo-Hirtshals_20040111_0934_20040611_0832_PSASG01L_1_METADATA.dat

FERRYBOX_NIOZ_DenHelder-Texel_20040822_1410_20040822_2118_TEMPSG01_1_METADATA.dat

FERRYBOX_POL_Liverpool-Belfast_20040501_1117_20041111_1748_TEMPSG01_1_METADATA.dat

FERRYBOX_NOC_Southampton-IsleofWight_20040822_1410_20040917_0503_TEMPSG01_1_METADATA.dat

FERRYBOX_NOC-IEO_Southampton-Bilbao_20040521_1110_20041001_1812_TEMPSG01_1_METADATA.dat

4.3 Filing of Ferrybox Measurements

All Ferrybox data are provided as flat files in ASCII coding with a common data structure and common application of logical file naming.

In general data for multiple legs (ferry transits) are merged into one data file. The amount of legs assembled in one data file (e.g. all, monthly or seasonal periods) is decided by the data provider and clearly indicated both in the standardised filename (see below) and in the meta data by unique date and timestamps of the start and end dates. File splitting should not occur within a leg.

Due to the different set-up and acquisition cycles of the instruments applied each parameter is provided in a single data file with common structure.[3]

All data files have identical data structures and format as described in detail below.

The general principals therefore are:

All data are assembled in columns with TAB used as column separator.

As decimal separator for real values the dot (".") is generally applied and no other separator shall appear in a data value.

All data are assembled as geo-referenced time series with

- Ordering as per date and time (oldest data record appears first),
- Date/time stamps are generally given in GMT / UTC time, and
- Position information is given with:
  - Horizontal positions generally given in GPS / DGPS coordinates (WGS 84)
  - Vertical positions (depth) generally given in metres below the sea surface.

At the beginning of each data file following references appear as comment lines each prefixed with a double cross ("##") followed by a BLANK to ease parsing:

- The data file name as an unique reference complying with the file naming convention
- The name of the corresponding meta data (header) file as an unique reference complying with the file naming convention
- A first informative caption line of the data columns (abbreviated parameter names complying with the BODC parameter dictionary) with TAB as column separator, and
- A second informative caption line with the units of the parameters in the data columns with TAB as column separator.

---

[3] The data format and documentation allows also assembly of more parameters in one file. The FerryBox partners have adhered to preferences of the data custodian (BODC) in this conjunction and will provide single files for each measured parameters as this eases import to BODC's databases and better facilitates subsequent archiving.

Address of BODC: British Oceanographic Data Centre Joseph Proudman Building
6 Brownlow Street Liverpool L3 5DA, UK
Tel: +44 151 795 4878 Fax: +44 151 7954912 Web site: www.bodc.ac.uk
Contact for Ferrybox data: Mary Mowat Email: mmow@bodc.ac.uk

Thereafter appear the Ferrybox data assembled as follows (described without columns for extended quality flags and data reference flags):

Column 1 Contains the date stamp as a 8-digit Integer value in common notation YYYYMMDD (year, month, day). No individual quality flagging is applied to the date stamp.

Column 2 Contains the time stamp as a 6-digit integer value in common notation (HHMMSS) (hours, minutes, seconds) in GMT / UTC time. No individual quality flagging is applied to the time stamp.

Column 3 Contains the latitude position as a Real Value with exactly 5 decimals – positive for northern and negative for southern latitudes.

Column 4 Contains the longitude position as a Real Value with exactly 5 decimals – positive for eastern and negative for western longitudes.

Column 5 Contains the standard quality flag (QCFS) for the geographical position.[4]

Column 6 Contains the vertical position of the sensor indicated by its depth in metres below the sea surface (this is usually the sensor depth but this may vary according to load line deviations of the platform (ferry).[5]

Column 7 Contains the standard quality flag (QCFS) for the depth value.

Column 8 Contains the provided parameter as a real value in compliant standard units and with decimal digits as appropriate for the parameter accuracy as determined by the technical sensor / instrumentation specifications.

Column 9 Contains the standard quality flag (QCFS) for the respective parameter.[6]

---

[4] Optionally, data providers may include a subsequent column with extended individual quality flagging (QCFE) for the geographical position.

[5] It is strongly recommended to include this parameter in all data sets even if no load line correction is applied (in this case the depth value is constant). This considerably supports data conversion to absolute depth values. Depth corrections shall be accordingly documented in the meta data. It is thereby easy to apply tidal / water level series (if available) along the ferry route and to perform corresponding depth corrections.

Optionally, data providers may include a subsequent column with extended individual quality (QCFE) flagging for the depth value.

[6] Optionally, data providers may include a column with extended individual quality flagging (QCFE) for the respective parameter after the column containing the standard quality flag values.

For compatibility reasons it is strongly recommended that the last ASCII sign of each data record is always **CARRIAGE RETURN LINE FEED – <CR><LF>**"[7].

The last line of each data file shall be always an **End of File Mark** – ("**EOF**" or "**^D**").[8]

In the corresponding meta data file the structure, column arrangement and contents of the data file is accordingly documented in a self-explaining manner which supports parsing by software and data base import tools.

4.3.1 Textual Example of a Final Ferrybox Data File

The text lines below provide an example of a Final Ferrybox Data file including the mandatory (standard) columns.

This example is compiled for the parameter "practical salinity" (PSAL) acquired on the Cuxhaven – Harwich ferry line operated by GKSS between 10 January 2004 – 08:00 GMT and 15 September 2004 – 23:55 GMT. Standard quality control and flagging (respective columns indicated by QCFS) as described above is included. No options as individual quality control and flagging (QCFE) and no data reference flagging (DREF) are included.

For illustration purposes BLANKS in the sample records are indicated by a rectangle ("□") and TABS by respective spaces between the columns.

Data are examples only and not referenced to track lines and data values in reality.

```
##□ FERRYBOX_GKSS_Cuxhaven-Harwich_20040110_0800_20040915_2355_PSAL_1_DATA.dat <CR><LF>

##□ FERRYBOX_GKSS_Cuxhaven-Harwich_20040110_0800_20040915_2355_PSAL_1_METADATA.dat <CR><LF>

##□ DATE          TIME     ALAT       ALON       QCFS  DEPTH  QCFS  PSAL     QCFS <CR><LF>

##□ YYYMMDD       HHMMSS   deg        deg        FLAG  M      FLAG  PSU      FLAG <CR><LF>

20040110         080000   52.12000   3.43000    □     3.50   N     35.253   □ <CR><LF>

20040110         080530   52.12127   3.41763    □     3.50   N     35.445   L <CR><LF>

.............

20040915         0235507  54,12000   3,43000    □     3,50   N     35,823   □ <CR><LF>

EOF
```

[7] On terminal input of the RETURN key DOS and Windows systems use "<CR><LF>" (ASCII character codes 13 and 10) as end of line mark. UNIX systems use "<LF>" (ASCII character code 10) and Macintosh systems use "<CR>" (ASCII character code 13) only. Many application programs can handle this automatically. In other cases common file conversion routines like dos2unix / unix2doc can be used for conversion. We recommend to generally apply the DOS / Windows coding "<CR><LF>".

[8] Most UNIX systems use "^D" "(<CTRL D>"as end of file mark but users change this frequently in their profile settings (.profile) with the stty command. As the "^D" signal may also terminate the shell we recommend to use the text string "EOF" in general.

4.3.2 Tabular Description of a Final Ferrybox Data File

Tabular Description of a Final Ferrybox Data File	
Line No.	**Contents Description**
1.	**Comment line** **## BLANK <Name of the data file> <CR><LF>**
2.	**Comment line** **## BLANK <Name of the corresponding meta data file> <CR><LF>**
3.	**Comment line** **## BLANK <Column content descriptors> <CR><LF>** **including:** - **short name of the column parameter as provided by the BODC parameter dictionary (use the parameter short names as provided in the tables in Chapter 6),** - **QCFS for data columns containing standard quality flags (see Table 2-1)** - **QCFE for optional data columns containing extended quality flags (refer to Section 2.1.2.2)** - **DREF for the optional data column containing reference flags (see Table 2-2)**
4.	**Comment line** **## BLANK <Column content unit descriptors> <CR><LF>** **including:** - **YYYYMMDD for date stamps** - **HHMMSS for time stamps** - **For data columns the unit of the column parameter (usually a standard MKSI-unit which has to comply with the parameter definition of the BODC parameter dictionary.** - **QCFS for columns containing data quality control flags (QCFS), and QCFE (if optionally applied)** - **DREF for the column containing the data reference flags (if optionally applied)**

Table 4-1. Mandatory contents of a Ferrybox data record.

Table 4-1 continued on next page.

Tabular Description of a Final Ferrybox Data File (continued)				
Line No.	**Contents Description**			
5.	**Data records**			
	1st value	**date stamp**	**YYYYMMDD**	**8-byte integer value**
	2nd value	**time stamp**	**HHMMSS**	**6-byte integer value**
	3rd value	**latitude**	**X.xxxxx**	**real value, 5 decimals**
	4th value	**longitude**	**X.xxxxx**	**real value, 5 decimals**
	5th value value	**position QCFS**	**BLANK or L**	**1-byte character**
	6th value	**depth**	**X.xx**	**real value, 2 decimals**
	7th value	**depth QCFS**	**BLANK or L**	**1-byte character**
	8th value	**parameter**	**X.xx.....**	**real value numbers of decimals as appropriate for the specific parameter**
	9th value	**param. QCFS**	**BLANK or L**	**1-byte character**
	carriage return line feed <CR><LF>			
	Optional columns for extended / individual quality control flags (QCFE) • **Extended quality control flags (QCFE) can be inserted in additional columns if and where appropriate.** • **If applied, a QCFE column has to be inserted directly after the corresponding mandatory one (QCFS).** **Optional column for data reference flags (DREF)** • **Data reference flags (DREF) can be optionally inserted in an additional column.** • **If applied, the DREF column has to be inserted after the last quality flag column of the parameter – i.e. after the QCFS, respectively, if applied after the QCFE column.**			
.....	**.....** **Further data records in identical format and assembly as above** **.....**			
Last	**EOF or <CTRL D> as end of file designator**			

Table 4-1 continued.

5 Documentation of Ferrybox Data

The FerryBox project partners have agreed on an easy to handle, simple and generally self-explaining meta data format with comprehensive contents to document the Ferrybox measurements.

The meta data format facilitates automated parsing by computer programs as well as import into data bases.

Completeness of each meta data file is an important demand and factor although this might imply that certain information is repeated in each file.

The big advantage of this approach is that computer programs being adapted and applied for viewing, editing, parsing, importing, handling or further evaluation of Ferrybox (and time series) data can always retrieve all the relevant and required information which belongs to an individual data file from one single meta data file. Thus such programs need to be adapted only once to the general format and contents.

As the meta data file also contains information which can be used for flexible and automated configuration of, for instance, data displays, dialogue panels or editing screens, the parsing programs to deal with Ferrybox data can be designed in a very flexible and self-adjusting manner.

A Ferrybox meta data file contains in general the following information:

- Contact details of the data provider, data owner and main contact for the data
- General information on the ferry line and the Ferrybox used
- Specific sensor data and information as well as details to the instrument and the acquisition methods used to measure the parameter provided in the data file
- Information on pre- and post-processing applied to the raw data
- Documentation of mandatory and (optionally) extended quality control procedures and flagging
- Information on the data contents (measured parameter) in compliance with the BODC parameter dictionary
- Information on measurement periods and acquisition cycles / frequencies
- Information on assembly and format of the data
- Information on data availability, terms of use, classification and archiving
- Any other versatile information for users regarding the corresponding data

The meta data contents provided is quite comprehensive and intends to facilitate both, project internal data documentation and referencing as well as use of the data by arbitrary project external users.

Some information is not essentially required for the specific approach applied for the Final FerryBox Data Set but these are included in order to support completeness and a more general application possibilities of the meta data documentation.[9]

This already is in view of the anticipated provision of a general guideline for documentation and meta data contents of almost arbitrary Ferrybox data and to support a wider community of Ferrybox operators and data users.

The Ferrybox meta data documentation provided below also supports elaboration of individual data models and/or design of relational or object oriented databases.

The Ferrybox meta data contents also incorporates and considers a series of typical changes which in part have been already encountered within the project along with the operation of the Ferryboxes, such as

- Change of the ferry
- Change of the route
- Change of the Ferrybox operator
- Changes of technical specifications, instrumentation and sensors of the individual Ferrybox systems
- Operation of more than one ferry with Ferrybox systems on the same route
- Operation of the same ferry and/or Ferrybox systems on different ferry routes

The meta data contents also supports data files which contain data of several measured parameters as well as inclusion of ADCP profiles when assembled as time series in different depths.

[9] The project partners intend to provide information on the FerryBox measurements for inclusion into the ***European Directory of the Initial Ocean Observing System*** **(EDIOS)** which is elaborated within another EU funded project. This would also be highly appreciated by EuroGOOS but requires provision of an extensive set of meta data.

It is also foreseen to compile forms for the ***European Directory of Marine Environmental Data*** **(EDMED)** for each ferry route and measurement series acquired in the European FerryBox Project and, correspondingly, to make this information available through the ***SeaSearch*** network and website.

5.1 General Topics for Ferrybox Meta Data Assembly

All Ferrybox meta data is provided as flat files in ASCII coding with common contents and data structure.

Each meta data file uniquely corresponds to a single data file. Also its file name is identical file name is identical with the associated data file, except for the textual supplement "**_METADATA**" (instead of "_DATA") which is inserted before the suffix (refer to Section 4.2 for file naming details).

Meta data contents is assembled simply by application of labels. Each label has a self-explanatory and unique name in relation to the meta data contents. Generally, all label names must be enclosed in brackets ("**[...]**") and stand at the beginning of each meta data record.

Although each meta data record can be uniquely identified by its associated label name unified and identical ordering of the meta data records in the sequence provided below is mandatory for consistency and for reasons of easier editing, quality control and parsing.

Meta data contents can be integer or real numbers as well as arbitrary text strings as predefined by the meta data contents itself (see the tables below for details).

Text strings can be of arbitrary contents, extent over multiple lines and could be also formatted as far as the ASCII coding permits.

The only exception comprises that such text strings must not include opening and closing brackets in order to clearly identify the label of the following meta data record.

However, we recommend that text strings are not too long (e.g. not to exceed a line length of 1,024) as this might cause problems with some databases, older application programs or operation systems. We recommend instead to refer to larger documentation with one or more links to files containing supplementary documentation. Such external documentation can also be referenced by web links (URLs)[10].

Data providers have to ensure that web links provided in the meta data are accordingly maintained and remain unchanged throughout the expected feasible lifetime (archiving period) of the Final FerryBox Data Set. As far as possible and feasible such material will be provided through the public section of the FerryBox web site which is maintained also for a considerable time after the project.

---

[10] The project partners intend to provide as much information as possible to disclose together with the data and meta data files and also refer to websites where such information is given or provided for downloading.

Both, file and web references have advantages and disadvantages. Once assembled files stored together with the data remain static, whereas documents accessible through the Internet may be updated when necessary. Controversy, referencing with web links bares the risk of invalid or changed URLs on the Internet.

To overcome related problems we intend to provide the information by both ways. Whenever possible, we will in addition duplicate and hold such information and external documents on the FerryBox project web site. As this website will stay alive and updated for a considerably long period after the completion of the project the risk of outdated or invalid URLs is considerably reduced.

5.1.1 Summary for Ferrybox Meta Data Preparation

- Accordingly each meta data record starts with a text string containing **the defined label name enclosed in brackets [LABEL NAME]**.
- A **TAB** follows as separator between the label and the meta data content.
- The meta data content follows as specified.
- Already pre-defined meta data contents (**the entries typed in red in the tables below**) should only be changed when explicitly needed.
- Each meta data record ends with **CARRIAGE RETURN LINE FEED <CR><LF>**.
- The last record of each meta data file contains an **End of File Mark** (text string **EOF** or **^Q**) only.

5.2 Ferrybox Parameter Meta Data References

The parameter definitions and parameter-related meta data in the Final FerryBox Data Set comply fully with the definitions of the new BODC parameter dictionary. Updates of the dictionary as applied by BODC are included up to the end of the project respectively up to the date when the Final FerryBox Data Set was delivered from the project's data management unit to BODC.

In this chapter the related references for the measured parameters are provided which simultaneously are the prescribed entries for the meta data table for each of the measured parameters. It also includes information on the parameters included the Final FerryBox Data Set and compliant definition of the associated meta data as follows:

- The discrimination or classification of parameters acquired in the FerryBox Project
- The compliant subset of the actual BODC parameter dictionary containing the measured parameters as provided in the Final FerryBox Data Set. These parameter dictionary entries are agreed as mandatory to apply for Ferrybox data and meta data.
- A tabular list in compliant sequence of the meta data labels which can be used as a reference table for individual data imports into databases of for automated conversion by replacement of individually defined labels or field names.
- A reference list linking the parameters of the Ferrybox data to the SeaSearch directory categories (delivered with the final data).

5.3 Discrimination of Parameters Acquired in the FerryBox Project

For the various parameters acquired by the different Ferryboxes or which are possible to derive from there the below described discrimination is made.

5.3.1 Independent Ferrybox Parameters

Five independent parameters are included in each data record, which are the

Temporal references consisting of

Calendar Date (Table 5-10 and Section 6.2.1), and

Time (Table 5-11 and Section 6.2.2)

and the position references consisting horizontally of

Geographical Latitude (Table 5-12 and Section 6.2.3),

Geographical Longitude (Table 5-13 and Section 6.2.4), and

vertically of the

Measurement (Sensor) Depth (Table 5-14 and Section 6.2.5).

The BODC compliant parameter definitions as well as predefined and proposals for individual entries are already included in the corresponding meta data tables.

Note: The meta data entry **Parameter Serial Counter** is required to uniquely identify a measured parameter in cases where two or more sensors acquire the same one (i.e. with identical dictionary definition) has to be always supplied in parameter related meta data.

It is mathematically meaningless for independent parameters. However, for reasons of compatibility this number is to be included. In data files with more than one measured dependent parameters this allows also the inclusion of one or more identical parameters as dependent ones in addition. This is typical for survey applications where usually two independent navigation systems log data in parallel but is also possible to apply to provide different depth data (for instance acquired by echosounder and ADCP or computed / corrected by different methods).

5.3.2 Dependent Ferrybox Parameters

For FerryBox data only one dependent parameter is included in each data file at the sixth position.

Dependent parameters can be further discriminated as indicated in the section below.

5.3.2.1 Standard Ferrybox Parameters

The FerryBox Consortium has selected the following parameters which are measured by almost identical principals and with comparable accuracy as the so called Ferrybox standard parameters:

Sea Temperature	(refer to Section 6.3.1)	measured on all Ferryboxes
Salinity	(refer to Section 6.3.2)	measured on all Ferryboxes
Turbidity	(refer to Section 6.3.3)	measured on all Ferryboxes except on the IEO research vessel RV "Jose Rioja"
Chlorophyll-a flourescence	(refer to Section 6.3.4)	measured on all Ferryboxes except on the Southampton – Cowes ferry

5.3.2.2 Non-standard Ferrybox Parameters

All other parameters, like nutrients, algae groups and others are denoted as so called Ferrybox Non-Standard Parameters.

Details on the corresponding parameter definitions and meta data are given in the tables in Chapters 5 and 6.

5.3.2.3 Optional Ferrybox Parameters

Each Ferrybox operator / data provider can include additional parameters (respectively data files) into the Final FerryBox Data Set.

These could be for instance:

- Additional navigation (e.g. ship speed, bearing, heading, vertical position) as routinely obtainable from a GPS or DGPS navigation system as well as navigation data acquired by a secondary or backup navigation system.
- Additional depth or sea pressure data.
- Any other oceanographic parameter of interest possible to derive from the Ferrybox measurements.
- Time series of reference data (e.g. from intersecting monitoring cruises, nearby fixed monitoring stations and/or tide gauges, or data from temporarily deployed moorings).
- Time series of laboratory analyses from water samples taken by Ferrybox systems which incorporate an automated sampling system or taken by separate monitoring cruises.
- Meteorological data from nearby stations or from the ship's weather station.
- Interesting housekeeping data supplied by the FerryBox systems.
- Time series of external documents (e.g. satellite images).

5.3.3 Flags

Flags are not considered as parameters but are directly associated to them with regard to quality or reference information. Thus related meta data and information on the flags is included in the same definition table as the dependent or independent parameter to which they are associated.

Two types of flags are defined for the FerryBox data.

5.3.3.1 Quality Control Flags

Quality control (QC) flags and data references are not considered as a separate parameter per se. Consequently they are included in the data files as separate columns. The respective column(s) containing flag values appears directly after the data column(s) of the parameter(s) which are associated to the flag value(s).

Standard quality control flags (QCFS) are defined in Section 2.1.2.1 and described in the corresponding parameter tables.

They are mandatory to apply for the horizontal position (one flag for both, longitude and latitude), the vertical spatial reference, and the measured parameter itself.

Extended quality control flags (QCFE) as outlined in Section 2.1.2.2 can be optionally applied to one or more parameters which are already associated with a standard quality flag.

5.3.3.2 Data Reference Flags (DREF)

Optionally, but highly recommended, is inclusion of a further column with **Data Reference Flags** which follows directly after the QC flag column(s) of the measured parameter.

For further information on the Ferrybox Data Reference Flags one is referred to Section 2.1.3 above.

5.4 Assembly of the Ferrybox Meta Data

5.4.1 General Topics

The tables below provide a complete description of the contents of the Ferrybox meta data files plus associated information.

This structure may be also useful for individual definition of data base tables. For a better structuring of the information each table has an informative header which does not appear in the meta data file.

For convenient meta data referencing, preparation and editing a colour coding of text entries and table fields was applied.

5.4.1.1 Coloured Typing in Tables with Meta Data Entries

For better visual discrimination the following coloured typing is applied for meta data table fields:

Bold red typed meta data entries	Are generic and already predefined labels and meta data entries.. Labels must not changed and red-typed meta data entries shall be kept unchanged if ever possible.
Bold dark green typed entries	Shall be inserted, supplemented or adapted by the data provider.
Dark blue typed entries	Contain comments and descriptions of the field contents which should be regarded by the data provider.

5.4.1.2 Colour Shaping of Table Fields with Meta Data Entries

For better visual discrimination the following colour shaping is applied for meta data table fields:

Grey shaded fields with bold red typed meta data entries must remain unchanged
Yellow shaded fields are filled by the project data management unit
Blue shaded fields are filled by the project data custodian

5.4.2 Data Types of Meta Data Entries

Data typed used in the Ferrybox meta data files are kept simple and reduced to a feasible minimum.

Apart from control (**<CR><LF>**, **EOF**) and separator (**TAB**) signs the Ferrybox meta data contain the following data types:

5.4.2.1 Text Entries

A text entry is denoted by **TEXT** and can include any character from the extended ASCII (ISO-8859 (Latin-1) character set except for rectangular brackets which are reserved to embrace labels . The following subtypes are defined:

Text String A single line of arbitrary text

YES/NO is a subtype of a text string which contains **YES** or **NO** only.

Block Text Several lines of text which may also include line feeds **but no brackets**.

Text strings and block text can also contain following sub-types:

Filename [11] Valid filename which refers to the meta data file itself, to the corresponding data file or to an arbitrary external document which is an integrated part of the Final FerryBox Data Set (i.e. delivered together with the data and meta data files).

URL Valid web link (ftp://..., http://..., https://..., etc.) or e-mail address without relative paths) which point to an external document provided through the Internet (if ever available, on the FerryBox project website).

[11] Filenames shall only include capital (ASCII decimal codes (ASDC) 65 – 90) and small standard letters (ASDC 97 – 122), numbers (ASDC 48 – 57), hyphen / minus sign (ASDC 45) and underscore (ASDC 95). Period (ASDC 46) is only used as separator of the suffix. No special characters are and BLANKS are allowed in filenames.

5.4.2.2 Numbers

Integer A numeric value without decimal point.

Two subtypes of integer values are defined and must be provided in the prescribed format:

Date stamp A calendar date in the notation **YYYYMMDD** which is always an eight-digit integer

Time stamp A time in 24 hour notation **HHMMSS** which is always an six-digit integer

Counter Usually a one-digit integer

Real A decimal number with period as decimal point (field length and format as applicable or required to appropriately resolve the number).

5.5 Structuring of Ferrybox Meta Data

The Ferrybox meta data intend to provide an as much as feasible and possible complete and comprehensive documentation of measured and/or processed Ferrybox data.

The meta data entries and contents have been selected and structured in order to match the data documentation requirements and expectations of the European FerryBox Project as well as to be compatible or at least comparable with meta data contents of other organisations or oceanographic or marine environmental databases or data sets.

5.5.1 Standardisation

Wherever feasible and possible the meta data associated to the Ferrybox measurements conducted in the project use standardised entries.

In particular the BODC Parameter Dictionary (see below) is applied. This has the advantage of using a very comprehensive, professionally and constantly maintained and updated parameter dictionary including associated definitions of parameter groups and units. This dictionary is widely applied in oceanographic research and environmental monitoring throughout Europe and is already used outside the United Kingdom by a large number of research institutions and in a variety of European Commission funded research projects. It is also increasingly used by agencies in charge of marine environmental monitoring. Its application is also considered as a contribution to further standardisation of oceanographic parameter definitions in Europe which is also beneficial for the implementation of the Global Ocean observing System in Europe.

Related cross-links are also made to EuroGOOS project activities and in particular to the EDIOS project which presently builds a comprehensive database for marine environmental monitoring activities across Europe as well as to the SeaSearch initiative.

For the data itself a certain degree of standardisation is achieved by common

- Date and time referencing (GMT only) as independent parameters
- Geographical referencing (horizontally GPS WGS 84 coordinates in decimal degrees, vertically as per application) as independent parameters
- Parameter definitions (BODC Parameter Dictionary)
- Quality control procedures (as defined on the project level for Ferrybox data)
- Quality control flags (BODC notation, optionally supplemented by individual ones, associated to each numeric data)
- Formatting (tab-separated ASCII data) and data assembly (one dependent parameter only in each data file)
- Meta data contents

5.5.2 Flexibility

The Ferrybox meta data and data structures are flexibly designed.

This means in particular that both the data and meta data structures and formats can be used for almost every kind of time and geo-spatially referenced data.

The number of parameters possible to include into a data file is limited by a feasible record length of the data record only.

The format supports both scalar and component-wise organised vector data.

The meta data contents allows self-configuration of readers, viewers or parsers as well as integration into databases.

All typical oceanographic (and, more generally, environmental) measurement procedures and instruments are supported (e.g. stationary time series, track data, vertical or horizontal profiles. It is also possible to include non-numeric data (e.g. textual notes, photos, graphs, documents) by simply associating external file names instead of numeric values in the data series.

5.5.3 Stand-Alone Capability

Each data file is uniquely associated to a corresponding meta data file.

This, however, determines repetition of a considerable number of fields and entries when (as in the FerryBox Project) a lot of data files are provided (for instance by the same organisation, for the same Ferrybox or identical ferry routes). The big advantages of this approach are a unified data and meta data structure as well as a, comprehensive and complete documentation for each pair of data and meta data files. This eases in particular data parsing and further use in applications regardless whether single or multiple pair of files are treated. It also eases merging of identically structured data regardless whether originating from a Ferrybox (respectively the FerryBox Project) or from other data sources / providers.

5.5.4 Compatibility

Contents and structure of data and meta data files are compatible or possible to easily adapt to import routines of common application software and databases.

The meta data contents is compatible to requirements of most of typical oceanographic and environmental applications and needs as well as matching with related requirements and guidelines.

5.5.5 Internal Identity

Data and meta data are identical in terms of structure, contents and degree of documentation. This regardless of the included parameters, used instrumentation and sensor arrangements, and applied metrology, evaluation, analysis methods or quality control procedures.

5.5.6 Relational and Hierarchical Background

The meta data are logically structured although this is not explicitly necessary as each meta data field is identified by a uniquely named label. The applied meta data structure eases definition of data tables for relational databases either as a whole or as a subset.

Basically the relational and hierarchical philosophy of the meta data structure is as follows:

- Each meta data file is associated to exactly one data file uniquely identified by its filename.
- Each data file is a result of one or more associated projects or, more generally, activities (e.g. a temporal or permanent marine environmental monitoring programme). These usually incorporate data management work and final archiving. which is accordingly documented as well.
- Each data file originates from one or more providing institutions (data provider or data publisher).
- Ferrybox data was acquired on one or more a ferry (ship) routes or tracks. This meta data table is specific for Ferrybox data (more generally for underway measurements conducted with moving instrument platforms).
- Data in each Ferrybox data file was acquired on a single ferry (ship). This meta data table is specific for Ferrybox data but very similar contents appears for other instrumentation and sensor carriers like buoys, moorings, deployed stations or even aeroplanes and satellites.
- Each Ferrybox data file was acquired by a specific Ferrybox system which is usually installed on a single ferry. Identical or at least very similar contents can be applied for any other measuring instrument or system.
- Each Ferrybox data file has a specific data structure which is documented in an associated table allowing self-configuration of parsers and other software. This documentation supports both single and multiple contents of dependent parameters in a data file.
- Each Ferrybox data file has a specific data contents in particular in terms of the included parameters, associated quality control flags and (optionally) references. All parameter related information is documented in a associated parameter-specific table (one for each parameter). The parameter name together with the parameter counter provides unique referencing. In other applications or in merged Ferrybox data files more than one dependent parameter can be included in data files with identical data structure

5.5.7 The BODC Parameter Dictionary in Brief

The BODC Parameter Dictionary is likely the most comprehensive and best maintained assembly of definitions of parameters acquired in marine environmental research and monitoring. The dictionary consists of three tables which are briefly described in the sections below. Each dictionary entry (record) consists of a unique code, a short and a full name, and, where applicable descriptions plus supplementary information (entry history and references).

The dictionary, its philosophy, contents and application is comprehensively documented (refer to BODC for further details) and available as MS.Access database and as comma separated ASCII data. From time to time the parameter definitions are revised to improve consistency.

5.5.7.1 Parameter Groups

Parameters are clustered in parameter groups which define usually the measured entity (e.g. date and time, horizontal and vertical space coordinates, sea temperature, salinity, silicate, turbidity, etc.).

At present (2004) about 750 different parameter groups are defined.

At present the dictionary includes more than 15,000 parameter definitions. From time to time the parameter definitions are revised to improve consistency.

5.5.7.2 Parameters

Each parameter group holds usually several parameters which further refine in terms of specific

- Data contents (e.g. date, time, date+time), or
- Data acquisition, analysis and/or quality control methods, or
- Instruments or sensors applied.

In addition and where applicable, one or more unspecified parameter definitions are associated to the corresponding parameter group which covers other methods or instrumentation not explicitly specified.

The parameter groups and definitions are open for new inserts to adhere to new parameters delivered to BODC's databases and archives as well as to new sensor and instrument developments, standards and evaluation methods.

At present the dictionary includes more than 15,000 parameter definitions.

5.5.7.3 Parameter Units

Each parameter is uniquely associated with a corresponding unit which, whenever possible, complies with international (UNESCO / IOC) oceanographic standard units.

The present the unit table holds nearly 147 entries.

5.6 Contents of the Ferrybox Meta Data

The contents of the Ferrybox meta data is considered to be as complete and as comprehensive as feasible in order to provide the required information to arbitrary users.

Following the above mentioned considerations and relations the Ferrybox meta data are assorted in tables as follows:

Three meta data tables with general and revision keeping information on the data set

General information on the measured (Table 5-1), and

Project internal data management and history information (Table 5-2)

Data custodian information (Table 5-3)

Six meta data tables with project, carrier (platform), measurement location, instrumentation and general data information regarding the

European FerryBox Project (Table Table 5-4), and

Ferrybox operator (Table 5-5)

Ferry route (Table 5-6), and

Ferry (Table 5-7)

Ferrybox system (Table 5-8)

General data file contents information (Table 5-9)

Six parameter meta data tables – one for each parameter –

incorporating parameter definitions, descriptions, quality control and reference information

Five parameter meta data tables for the **Independent Ferrybox Parameters**

Calendar Date (Table 5-10)

Time (Table 5-11)

Geographical Latitude (Table 5-12),

Geographical Longitude (Table 5-13), and

Measurement Depth (Table 5-14)

One parameter meta data table for each **Dependent Ferrybox Parameter**

given as example in Table 5-15 and being further refined as per applicable parameter by a series of separate tables in Chapter 6.

5.6.1 Data File Summary Information

Data File Summary Information (uniquely identifies the meta data and measurement data files and contains a few core information on the data)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Meta data file name]	**Text String**	File name of this meta data file
[Data file name]	**Text String**	File name of the corresponding data file
[Data and time zone]	**Text String**	**UTC**
[Time difference to UTC in minutes]	**Integer**	**0**
[Data series start date]	**Date Stamp**	Date stamp of the first data record
[Data series start time]	**Time Stamp**	Time stamp of the first data record
[Data series end date]	**Date Stamp**	Date stamp of the last data record
[Data series end time]	**Time Stamp**	Time stamp of the last data record.
[Measured parameter short names]	**Text String**	Abbreviation (short names) of the measured parameter provided in the data file in compliance with the BODC parameter dictionary (see the reference table below).
[Measured parameter full names]	**Text String**	Full names of the measured parameter provided in the data file in compliance with the BODC parameter dictionary (see the reference table below).
[Data set general comments]	**Block Text**	Comments with overall applicability for the data set.

Table 5-1. Mandatory Ferrybox meta data contents identifying the data and meta data files, the beginning and end of the corresponding data series and the corresponding measured parameter provided in the data file.

5.6.2 Project Data Management and Final Assembly Information

Project Data Management and Final Assembly Information (uniquely identifies the meta data and measurement data files and contains a few core information on the data)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Date of delivery from data provider]	Date Stamp	Inserted by the project data management unit
[Date of last project internal modification]	Date Stamp	Inserted by the project data management unit
[Date of delivery to data custodian]	Date Stamp	Inserted by the project data management unit
[Comments on applied corrections and modifications]	Block Text	Inserted by the project data management unit p
[Data management comments and references]	Block Text	Inserted by the project data management unit

Table 5-2. Ferrybox meta data contents providing information on data history and changes applied within the project by the data management unit.

5.6.3 Data Custodian and Final Archiving Information

Data Custodian and Final Archiving Information (uniquely identifies the meta data and measurement data files and contains a few core information on the data)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Data custodian comments and references]	Block Text	Inserted by the project data custodian
[Applied corrections and modifications by data custodian]	Block Text	Inserted by the project data custodian
[Data custodian and references]	Block Text	Inserted by the project data custodian
[Date of last modification by data custodian]	Block Text	Inserted by the project data custodian
[Date of final archiving]	Block text	Inserted by the project data custodian

Table 5-3. Ferrybox meta data contents providing information on data history and changes applied after the project by the data custodian and organisation responsible for final archiving.

5.6.4 General Project and Data Management Information

General Project and Data Management Information (identical for all meta data files produced in the European FerryBox Project)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Project acronym]	Text String	FerryBox
[Project full name]	Text String	The European FerryBox Project – From online oceanographic observations to environmental information
[Project contract number]	Text	EVK2-CT-2002-00144
[Project website]	URL	http://www.ferrybox.de, http://www.ferrybox.org, http://www.ferrybox.net, http://www.ferrybox.com
[Project main contact]	Block Text	Prof. Dr. Franciscus Colijn GKSS Research Centre Institute of Coastal Research and Operational Systems Max-Planck-Strasse D-21502 Geesthacht, Germany Tel.: +49 4152 87 42 00 Fax.: +49 4152 87 42 99 E-mail: franciscus.colijn@gkss.de Website: http://www.gkss.de
[Project data management contact]	Block Text	Klaus D. Pfeiffer HYDROMOD Scientific Consulting Bahnhofstr. 52 D-22880 Wedel, Germany Tel.: +49 4103 9 12 23 0 Fax.: +49 4103 9 12 23 23 E-mail: pfeiffer@hydromod.de Website: http://www.hydromod.de
[Project data custodian contact]	Block Text	Mary Mowat Joseph Proudman Building 6 Brownlow Street Liverpool L3 5DA, UK Tel.: +44 151 6 63 15 10 Fax.: +44 151 6 62 29 50 E-mail: mmowat@bodc.ac.uk Website: http://www.bodc.ac.uk
[Short project description]	Block Text	The European FerryBox Project was a multi-disciplinary research and development project to qualify and foster routine underway measurements from ferries to better monitor the environmental conditions of European Seas. The project was co-funded by the European Commission under Energy, Environment and Sustainable Development (EESD) Programme. For further information please visit the project website http://www.ferrybox.org.
[Further project information]	Block Text	Will contain URLs and filenames with further project information on the FerryBox Project. Final contents to be agreed at the end of the project and included within final QC of the Ferrybox data by the PDIM.

Table 5-4. Mandatory Ferrybox meta data contents providing general project information and contacts.

5.6.5 Information on the Data Providing Institution (Ferrybox Operator)

Information on the Data Providing Institution (Ferrybox Operator) (identical for all meta data files of the same Ferrybox operating institution or Ferrybox data provider)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Institution acronym]	**Text String**	Acronym of the data providing institution
[Institution full name]	**Text String**	Full name of the data providing institution
[Institution department]	**Text String**	Full name of the institution's department concerned with the provided Ferrybox data.
[Institution website]	**URL**	**http://...** Website(s) of the institution
[Institution main contact]	**Block Text**	**<Name>** **<Organisation>** **<Address>** **<ZIP> <City>, <Country>** **Tel.:** **+<country code>-<area code>-<number>** **Fax.:** **+<country code>-<area code>-<number>** **E-mail:** **<name>@ <domain>** **Website:** **http://www.<website/domain>** Contact details of the main contact at the data providing institution (assembled and contents as above for project contacts)
[Institution data management contact]	**Block Text**	**<Name>** **<Organisation>** **<Address>** **<ZIP> <City>, <Country>** **Tel.:** **+<country code>-<area code>-<number>** **Fax.:** **+<country code>-<area code>-<number>** **E-mail:** **<name>@ <domain>** **Website:** **http://www.<website/domain>** Contact details of the Ferrybox data management contact at the data providing institution. (assembled and contents as above for project contacts)
[Short institution description]	**Block Text**	A short description of the data providing institution.
[Further institution information]	**Block Text**	May contain URLs and filenames of relevant documents with further information on the data providing institution.

Table 5-5. Mandatory Ferrybox meta data contents providing information and contacts of the data provider (Ferrybox operator) and the institution.

5.6.6 Information on the Ferry Route

Information on the Ferry Route (identical for all meta data files of the same ferry route)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Ferry route designator]	**Text String**	**R....** The designator used in the FerryBox Project for the respective ferry route (R1a/b – R8)
[Ferry route name]	**Text String**	Name of the ferry route (usually start and end port)
[Ferry route start port]	**Text String**	Name of the start port of the ferry route
[Ferry route start latitude]	**Real**	**X.xxxxx** Latitude of the start port of the ferry route provided in standard latitude notation.
[Ferry route start longitude]	**Real**	**X.xxxxx** Longitude of the start port of the ferry route
[Ferry route end port]	**Text String**	Name of the end port of the ferry route
[Ferry route end latitude]	**Real**	**X.xxxxx** Latitude of the end port of the ferry route provided in standard latitude notation.
[Ferry route end longitude]	**Real**	**X.xxxxx** Longitude of the end port of the ferry route
[Ferry route schedule]	**Block Text**	Information on the schedule of the ferry route (e.g. service periods, interruptions)
[Ferry route average transit time in decimal hours]	**Real**	**XX.xx** Average transit time for the respective ferry route provided in decimal hours
[Ferry route website]	**URL**	Website(s) / page(s) of the ferry route on the FerryBox website, if applicable also at the institute's web site
[Further ferry route information]	**Block Text**	Contains URLs and filenames of relevant documents with further information on the ferry route.

Table 5-6. Mandatory Ferrybox meta data contents providing information on the ferry route.

Note: As more than one ferry may service more than a single ferry route the ferry and Ferrybox specific information is not included in the table above but in two separate ones provided below.

5.6.7 Information on the Ferry (SOOP / Instrument Carrier / Platform)

Information on the Ferry (Instrument Carrier / Platform) (identical for all meta data files of the same ferry)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Ferry name]	**Text string**	Name of the Ferry.
[Ferry flag country]	**Text string**	Flag (registration) country of the ferry provided as IOC country code (e.g. FI, EE, DE, GR, NO, UK)
[Ferry international call sign]	**Text string**	International call sign of the ferry
[Ferry operator]	**Block Text**	**<Name>** **<Organisation>** **<Address>** **<ZIP> <City>, <Country>** **Tel.: +<country code>-<area code>-<number>** **Fax.: +<country code>-<area code>-<number>** **E-mail: <name>@ <domain>** **Website: http://www.<website/domain>** Operator of the ferry (ferry company) – if applicable with URL to company website
[Ferry average transit time]	**Real**	**X.xx** Average transit time in decimal hours of the particular ferry.
[Ferry schedule]	**Block Text**	Contains information on the service schedule of the ferry route (e.g. service periods, interruptions)
[Further ferry information]	**Block Text**	Contains URLs and filenames of relevant documents with further information on the platform / ferry (e.g. documents, master plan or photos of the ship).

Table 5-7. Mandatory Ferrybox meta data contents providing information on the ferry.

Notes: As design and configuration of Ferryboxes installed on a particular ferry may vary with elapsing time a separate table for information regarding the Ferrybox system is provided below.

The international call sign together with the ship name and flag country provides an unique identifier of the ferry at the time of operation (e.g. by ship directories).

5.6.8 Information on the Ferrybox System

Information on the Ferrybox System (identical for all meta data files of the same Ferrybox as long as its configuration is unchanged)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Ferrybox name]	**Text string**	A designating name of the Ferrybox
[Ferrybox manufacturer]	**Block Text**	**<Name>** **<Organisation>** **<Address>** **<ZIP> <City>, <Country>** **Tel.:** **+<country code>-<area code>-<number>** **Fax.:** **+<country code>-<area code>-<number>** **E-mail:** **<name>@ <domain>** **Website:** **http://www.<website/domain>** Contact details of the Ferrybox system manufacturer
[Ferrybox description]	**Block Text**	Brief description of the Ferrybox system – where applicable supplemented with file names and/or URLs to more comprehensive external documentation
[Ferrybox sensors]	**Block Text**	Brief description of the sensors installed on the particular Ferrybox – where applicable supplemented with filenames and/or URLs linking to more comprehensive external documentation
[Ferrybox maintenance]	**Block Text**	Brief description of the maintenance procedures of the Ferrybox systems and sensors installed on the particular ferry – where applicable supplemented with file names and/or URLs linking to more comprehensive external documentation
[Further Ferrybox information]	**Block Text**	URLs and filenames of relevant external documents with further information on the particular Ferrybox system

Table 5-8. Mandatory Ferrybox meta data contents providing information on the Ferrybox system.

5.6.9 Information on the General Contents of the Corresponding Data File

Information on the General Contents of the Corresponding Data File (except for the format of the measured or derived parameter identical for all meta data files when standard quality control (QCFS) is applied only and no data reference flags are given)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Number of parameters] **For other data assemblies with more measured or derived parameters this value increases accordingly.**	**Integer**	**6** This is the number of (independent and dependent) parameters provided in each data record. For data deliveries to the Final FerryBox Data Set this value is always 6 (i.e. one each for the date stamp, the time stamp, the geographical latitude, the geographical longitude, the depth and the single measured or derived parameter.
[Number of data records]	**Integer**	**XXXXXXX** This value is a control counter for the data records included in the corresponding data file without the preceding header records and the last EOF record.
[Number of columns per data record] If data reference flagging is applied this value increases by one. In case extended QC flags provided for specific data columns this value increases accordingly by the number of applied extended QC flag columns. **For other data assemblies with more measured / dependent parameters this value increases accordingly.**	**Integer**	**9** (if standard QC flagging is applied only) **10** (if data reference flagging is applied in addition) **9 or 10 plus number of extended QC flag columns supplied** This value is counted as the number of independent parameters (5 for date, time, latitude, longitude, depth) plus the number of dependent parameters (1 per file only for the Ferrybox data) plus the number of standard QC flags (3 – one for the horizontal position, one for the vertical position and one for the measured / dependent parameter).
[Data column separator]	**Text string**	**TAB**
[Comment line indicator]	**Text string**	**##**
[Further general data information]	**Block Text**	**Refer to the public guideline document for management of Ferrybox data (deliverable no. D-3.1/A & D-3.1/B) for a comprehensive documentation. The document is available for downloading at URL included by PDIM.**

Table 5-9. Mandatory Ferrybox meta data contents for general parameter / data contents.

5.6.10 Measured Parameter No. 1 – Calendar Date

Information on the Measured / Provided Parameters Part 1 – Parameter No. 001 – Independent Parameter: Calendar Date (almost identical for all meta data files when standard quality control flagging (QCFS) is applied)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter column number]	Integer	1
[Parameter 001 serial counter]	Integer	1
[Parameter 001 group code]	Text string	AYMD
[Parameter 001 group short name]	Text string	Date + Time
[Parameter 001 group full name]	Text string	All date and time parameters
[Parameter 001 code]	Text string	ADATAA01
[Parameter 001 short name]	Text string	Date (yyyymmdd)
[Parameter 001 full name]	Text string	Date in format yyyymmdd
[Parameter 001 unit code]	Text string	UYMD
[Parameter 001 unit short name]	Text string	yyyymmdd
[Parameter 001 unit full name]	Text string	Years Months Days (yyyymmdd)
[Parameter 001 missing value]	Integer	-1
[Parameter 001 short description]	Text string	Computed date from GPS time signal Only necessary to change in case date and time are obtained by other means.
[Parameter 001 full description] The field's last paragraph may require some individual adaptation to match the provision of date and time information by the respective Ferrybox system. Any supplementary information and references to provided external documentation (e.g. on corresponding sensors and instrumentation) are appreciated for insertion in this field.	Block Text	The calendar date of each data record is an independent temporal reference parameter and provided in the notation year-month-day (YYYYMMDD) as an 8-byte integer value. Calendar dates are generally given in UTC / GMT time. Recordings were accordingly converted in case the original data have been logged in local time. Data records with missing or questionable calendar date are meaningless as proper temporal referencing is impossible. Consequently they are generally excluded from the final Ferrybox data files The calendar date is usually provided by the GPS of the Ferrybox system. Normally no further processing is applied except in cases when date and time data had to be obtained by other means .
[Parameter 001 mean sensor depth]	Real	- XX.xx Here the height of the GPS antenna above the sea surface / load line.

Table 5-10. Mandatory Ferrybox meta data contents describing the date stamp (first parameter data column in the data record).

Table 5-10 continued on next page.

Information on the Measured / Provided Parameters **Part 1 – Parameter No. 001 – Independent Parameter: Calendar Date (continued)** (almost identical for all meta data files when standard quality control flagging (QCFS) is applied)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter 001 references]	**Block Text**	**Reference is made to the new (2004) BODC parameter dictionary (documentation available at http://www.bodc.ac.uk).**
[Parameter 001 standard QC flagging applied]	**YES/NO**	**NO**
[Parameter 001 standard QC description]	**Block Text**	**Calendar dates are not associated with a QC flag but checked according to theapplied QC procedures for date and time.** **Missing or wrong (bad quality) calendar dates are meaningless and consequently such records are not included in the data file.**
[Parameter 001 extended QC applied]	**YES/NO**	**NO**
[Parameter 001 extended QC description]	**Block Text**	**Not applicable**
[Parameter 001 further QC information] The common text of the first paragraph of this field will be finally agreed as per results from WP-2 work on quality assurance of Ferrybox data. Any supplementing information and references to provided external QC documentation are appreciated for insertion in this field.	**Block Text**	**GPS and computer clock tests were done as part of the routine maintenance of the Ferrybox system. These are not necessary to document with an associated quality flags.** **Refer to the FerryBox System Description (D-2-1) for public topics on quality control of Ferrybox data and maintenance of Ferrybox systems available for downloading at <URL by PDIM> and to the public guidelines on management of Ferrybox data for details of data contents and QC flagging available for downloading at <URL by PDIM>.** **For specific topics regarding pre- and post-processing of measured data one is referred to documents elaborated within work package no. 2 of the FerryBox Project with restricted classification. Refer to the project coordinator for further details on these non-public documentation.**

Table 5-10 continued.

Refer to Section 6.2.1 for further information.

An alternative to merge calendar date and time is given in Section 6.2.2.1.

5.6.11 Measured Parameter No. 2 – Time

Information on the Measured / Provided Parameters Part 2 – Parameter No. 002 – Independent Parameter: Time (almost identical for all meta data files when standard quality control flagging (QCFS) is applied)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter column number]	Integer	2
[Parameter 002 serial counter]	Integer	1
[Parameter 002 group code]	Text string	AYMD
[Parameter 002 group short name]	Text string	Date + Time
[Parameter 002 group full name]	Text string	All date and time parameters
[Parameter 002 code]	Text string	AHMSAA01
[Parameter 002 short name]	Text string	Time (hh24miss)
[Parameter 002 full name]	Text string	Time in format hh24miss
[Parameter 002 unit code]	Text string	UHMS
[Parameter 002 unit short name]	Text string	hh24miss
[Parameter 002 unit full name]	Text string	Hours Minutes Seconds
[Parameter 002 missing value]	Integer	-1
[Parameter 002 short description]	Text string	Computed time from GPS time signal Only necessary to change in case date and time are obtained by other means.
[Parameter 002 full description] The two paragraphs above may require some individual adaptation to match the provision of date and time information by the respective Ferrybox system. Any supplementary information and references to provided external documentation (e.g. on corresponding sensors and instrumentation) are appreciated for insertion in this field.	Block Text	The time stamp of each data record is an independent temporal reference parameter and provided in the notation 24-hours-minutes-seconds (HHMMSS) as an 6-byte integer number. Time stamps are generally given UTC / GMT time. No records with missing time stamps are included in the final Ferrybox data files. For temporally averaged raw data the time stamp corresponds to the mean value of the raw data sampling times. Time data was usually taken directly from the GPS of the Ferrybox system. Whenever available they are used without further processing, except for conversion from local time to UTC / GMT if necessary. Missing GPS time was interpolated between good ones or time data was obtained from the clock of the data acquisition computer.

Table 5-11. Mandatory Ferrybox meta data contents describing the time stamp (second parameter data column in the data record).

Table 5-11 continued on next page.

Information on the Measured / Provided Parameters Part 2 – Parameter No. 002 – Independent Parameter: Time (continued) (almost identical for all meta data files when standard quality control flagging (QCFS) is applied)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter 002 mean sensor depth]	**Real**	**-XX.xx** Usually height (negative) of the GPS antenna relative to mean loadline of the vessel (not relevant for time)
[Parameter 002 references]	**Block Text**	**Reference is made to the new (2004) BODC parameter dictionary (documentation available at http://www.bodc.ac.uk).**
[Parameter 002 standard QC flagging applied]	**YES/NO**	**NO**
[Parameter 002 standard QC description]	**Block Text**	**Time data is not associated with a QC flag but checked according to the applied QC procedures for date and time.** **Missing or wrong (bad quality) time data is meaningless and consequently such records are not included in the data file.**
[Parameter 002 extended QC applied]	**YES/NO**	**NO**
[Parameter 002 extended QC description]	**Block Text**	**Not applicable**
[Parameter 002 further QC information] An as much as possible common text of this field will be finally agreed as per results from WP-2 work on quality assurance of Ferrybox data. Any supplementing information and references to provided external QC documentation are appreciated for insertion in this field.	**Block Text**	**GPS and computer clock tests were done as part of the routine maintenance of the Ferrybox system. These are not necessary to document with an associated quality flags.** **Refer to the FerryBox System Description (D-2.1) for public topics on quality control of Ferrybox data and maintenance of Ferrybox systems available for downloading at <URL by PDIM> and to the public guidelines on management of Ferrybox data for details of data contents and QC flagging available for downloading at <URL by PDIM>.** **For specific topics regarding pre- and post-processing of measured data one is referred to documents elaborated within work package no. 2 of the FerryBox Project with restricted classification. Refer to the project coordinator for further details on these non-public documentation.**

Table 5-11 continued.

Refer to Section 6.2.2 for further information.

An alternative to merge calendar date and time is given in Section 6.2.2.1.

5.6.12 Parameter No. 003 – Independent Parameter: Geographical Latitude North

Information on the Measured / Provided Parameters Part 3 – Parameter No. 003 – Independent Parameter: Geographical Latitude North (almost identical for all meta data files when standard quality control flagging (QCFS) is applied)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter column number]	Integer	3
[Parameter 003 serial counter]	Integer	1
[Parameter 003 group code]	Text string	ALAT
[Parameter 003 group short name]	Text string	Horiz_spat_coord
[Parameter 003 group long name]	Text string	Horizontal spatial coordinates
[Parameter 003 code]	Text string	ALATGP01
[Parameter 003 short name]	Text string	GPS
[Parameter 003 full name]	Text string	Latitude north (GPS)
[Parameter 003 unit code]	Text string	UAAA
[Parameter 003 unit short name]	Text string	deg
[Parameter 003 unit full name]	Text string	Degrees
[Parameter 003 missing value]	Real	-99.
[Parameter 003 short description]	Text string	Global Positioning System (receiver type unspecified)
[Parameter 003 full description] The last two paragraphs to the right may require some individual adaptation to match provision of geographical position data by the respective Ferrybox system and as per WP-2 results. Any supplementary information and references to provided external documentation (e.g. on corresponding sensors and instrumentation) are appreciated for insertion in this field.	Block Text	The geographical latitude is an independent spatial reference parameter and provided in decimal degrees with 5 decimals. Northern latitudes have positive and southern latitudes ones negative values. Position data is generally provided in geographical GPS/DGPS coordinates for the WGS 84 geoid. No records with missing latitudes are included in the final Ferrybox data files. Missing or bad GPS fixes were interpolated between good ones. If this was impossible geographical positions were obtained from the vessel's GPS, or its backup navigation, or logging systems. Position accuracy depends on local GPS / DGPS coverage, receiving conditions and other parameters and may strongly vary in time along the ferry route.

Table 5-12. Mandatory Ferrybox meta data contents describing the geographical latitude (third parameter data column in the data record).

Table 5-12 continued on next page.

Information on the Measured / Provided Parameters **Part 3 – Parameter No. 003 – Independent Parameter: Geographical Latitude North (continued)** (almost identical for all meta data files when standard quality control flagging (QCFS) is applied)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter 003 mean sensor depth]	**Real**	**-XX.xx** Height (negative) of the GPS antenna relative to mean loadline of the vessel
[Parameter 003 references]	**Block Text**	**Reference is made to the new (2004) BODC parameter dictionary (documentation available at http://www.bodc.ac.uk).**
[Parameter 003 standard QC flagging applied]	**YES/NO**	**NO**
[Parameter 003 standard QC description]	**Block Text**	**Not applicable here. Refer to the QC description for the geographical longitude which was identically applied for both parameters, the geographical latitude and longitude.**
[Parameter 003 extended QC applied]	**YES/NO**	**NO**
[Parameter 003 extended QC description]	**Block Text**	**Not applicable**
[Parameter 003 further QC information]	**Block Text**	**Not applicable here. Refer to the corresponding entry of QC description for the geographical longitude which is also valid for the geographical latitude and applied for both values.**

Table 5-12 continued.

Note: Refer to Section 6.2.3 for options and alternatives.

5.6.13 Parameter No. 004 – Independent Parameter: Geographical Longitude East

Information on the Measured / Provided Parameters Part 4 – Parameter No. 004 – Independent Parameter: Geographical Longitude East (almost identical for all meta data files when standard quality control flagging (QCFS) is applied)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter column number]	Integer	4
[Parameter 004 serial counter]	Integer	1
[Parameter 004 group code]	Text string	ALAT
[Parameter 004 group short name]	Text string	Horiz_spat_coord
[Parameter 004 group long name]	Text string	Horizontal spatial coordinates
[Parameter 004 code]	Text string	ALONGP01
[Parameter 004 short name]	Text string	GPS
[Parameter 004 full name]	Text string	Longitude east (GPS)
[Parameter 004 unit code]	Text string	UAAA
[Parameter 004 unit short name]	Text string	deg
[Parameter 004 unit full name]	Text string	Degrees
[Parameter 004 missing value]	Real	-999.
[Parameter 004 short description]	Text string	Global Positioning System (receiver type unspecified)
[Parameter 004 full description] The last three paragraphs to the right may require some individual adaptation to match provision of geographical position data by the respective Ferrybox system and as per WP-2 results. Any supplementary information and references to provided external documentation (e.g. on corresponding sensors and instrumentation) are appreciated for insertion in this field.	Block Text	The geographical longitude is an independent spatial reference parameter and provided in decimal degrees with an accuracy of 5 decimals. Eastern longitudes have positive and western ones negative values. Position data is generally provided in geographical GPS coordinates for the WGS 84 geoid. No records with missing longitudes are included in the final Ferrybox data files. Missing or bad GPS fixes were interpolated between good ones. If this was impossible, geographical positions were obtained from the vessel's GPS or its backup navigation or logging systems. Position accuracy depends on local GPS coverage, receiving conditions and other parameters and may strongly vary in time along the ferry route.

Table 5-13. Mandatory Ferrybox meta data contents describing the geographical longitude (fourth parameter data column in the data record).

Table 5-13 continued on next page.

Information on the Measured / Provided Parameters **Part 4 – Parameter No. 004 – Independent Parameter: Geographical Longitude East (continued)** (almost identical for all meta data files when standard quality control flagging (QCFS) is applied)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter 004 mean sensor depth]	**Real**	**-XX.xx** Height (negative) of the GPS antenna relative to mean loadline of the vessel
[Parameter 004 references]	**Block Text**	**Reference is made to the new (2004) BODC parameter dictionary (documentation available at http://www.bodc.ac.uk).**
[Parameter 004 standard QC flagging applied]	**YES/NO**	**YES**
[Parameter 004 standard QC description]	**Block Text**	**The applied Ferrybox quality control and flagging procedure is applied together for both data columns containing the geographical position data based on additional data on GPS quality provided by the GPS system of the Ferrybox system.** **Good data (standard QC flag BLANK) is applied for geographical positions with accuracy of 50 metres or better.** **Questionable data (standard QC flag L) is applied for geographical positions with accuracy of less than 50 metres as well as for all position data (when included) filled-in by interpolation due to missing or spurious values in the raw data.** **Usually data records with missing (if not possible to properly interpolate) geographical positions (whether longitude or latitude) are excluded from the data file. Consequently the standard QC flag M does usually not appear.**
[Parameter 004 extended QC applied]	**YES/NO**	**NO**
[Parameter 004 extended QC description]	**Block Text**	**Not applicable**
[Parameter 004 further QC information] An as much as possible common text of the text of this field will be finally agreed as per results from WP-2 work on quality assurance of Ferrybox data. Any supplementing information and references to provided external QC documentation are appreciated for insertion in this field.	**Block Text**	**Refer to the FerryBox System Description (D-2-1) for public topics on quality control of Ferrybox data and maintenance of Ferrybox systems available for downloading at <URL by PDIM> and to the public guidelines on management of Ferrybox data for details of data contents and QC flagging available for downloading at <URL by PDIM>.** **For specific topics regarding pre- and post-processing of measured data one is referred to documents elaborated within work package no. 2 of the FerryBox Project with restricted classification. Refer to the project coordinator for further details on these non-public documentation.**

Table 5-13 continued.

Notes:

- Above given parameter definitions are valid if position data is acquired by an unspecified GPS system (according to longitude for specified GPS systems in the BODC parameter dictionary).
- In other cases one is referred to Section 6.2.4 for further information and alternatives.

5.6.14 Parameter No. 005 – Independent Parameter: Vertical Space Coordinate

Information on the Measured / Provided Parameters Part 5 – Parameter No. 005 – Independent Parameter: Vertical Space Coordinate (almost identical for all meta data files for identical sensors or water intake depths when standard quality control flagging (QCFS) is applied)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter column number]	Integer	5
[Parameter 005 serial counter]	Integer	1
[Parameter 005 group code]	Text string	AHGT
[Parameter 005 group short name]	Text string	Vert_spac_coord
[Parameter 005 group full name]	Text string	Vertical spatial coordinates
[Parameter 005 code]	Text string	DEPHPM01
[Parameter 005 short name]	Text string	PhysMeasDep
[Parameter 005 full name]	Text string	Depth below sea surface (used here as an independent variable)
[Parameter 005 unit code]	Text string	ULAA
[Parameter 005 unit short name]	Text string	m
[Parameter 005 unit full name]	Text string	Metres
[Parameter 005 missing value]	Real	-99.
[Parameter 005 short description]	Text string	Depth below sea surface
[Parameter 005 full description] The paragraphs to the right might need some adaptations or supplements to match the determination of the vertical space coordinate (if any). Any supplementary information and references to provided external documentation (e.g. on corresponding sensors and instrumentation) are appreciated for insertion in this field.	Block Text	The vertical space coordinate is an independent spatial reference parameter and provided in metres below the sea surface as a positive value with an accuracy of 2 decimals. It is the depth below the water surface where the water intake of the Ferrybox system is placed at the ship's hull. For hull mounted sensors replace the text "water intake of" in the paragraph above with "hull mounted <NNNN> sensor belonging to the Ferrybox system" where <NNNN> is the name of the hull mounted sensor or instrument (e.g. ADCP). If uncorrected this value is given relative to the mean load line of the vessel. The parameter is not an absolute (geographical) vertical position reference as long as no tide / sea level and/or load line corrections are applied. Without any of these corrections the value is constant for the entire data file.

Table 5-14. Mandatory Ferrybox meta data contents describing the sensor depth below the sea surface (fifth parameter column in the data record).

Table 5-14 continued on next page.

Information on the Measured / Provided Parameters **Part 5 – Parameter No. 005 – Independent Parameter: Vertical Space Coordinate (continued)** (almost identical for all meta data files for identical sensors or water intake depths when standard quality control flagging (QCFS) is applied)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter 005 mean sensor depth]	**Real**	**XX.xx** Height (negative – e.g. for the GPS antenna) or mean depth (positive) of the sensor which determines the vertical space coordinate for this parameter relative to mean loadline of the vessel
[Parameter 005 references]	**Block Text**	**Reference is made to the new (2004) BODC parameter dictionary (documentation available at http://www.bodc.ac.uk).**
[Parameter 005 standard QC flagging applied]	**YES/NO**	**YES**
[Parameter 005 standard QC description]	**Block Text**	**A quality control and flagging procedure is applied for the vertical space coordinate.** **Good data (standard QC flag BLANK) is applied for depth data for which an appropriate tide and sea level correction as well as correction with regard to the ferry's actual load line was applied.** **Questionable data (standard QC flag L) is applied for uncorrected or only partially corrected data.** **Usually data records with missing (if not possible to properly interpolate) geographical positions (whether longitude or latitude) are excluded from the data file. Consequently the standard QC flag M does usually not appear.**
[Parameter 005 extended QC applied]	**YES/NO**	**NO**
[Parameter 005 extended QC description]	**Block Text**	**Not applicable**
[Parameter 005 further QC information] An as much as possible common text of this field will be finally agreed as per results from WP-2 work on quality assurance of Ferrybox data. Any supplementing information and references to provided external QC documentation are appreciated for insertion in this field.	**Block Text**	**Refer to the FerryBox System Description (D-2.1) for public topics on quality control of Ferrybox data and maintenance of Ferrybox systems available for downloading at <URL by PDIM> and to the public guidelines on management of Ferrybox data for details of data contents and QC flagging available for downloading at <URL by PDIM>.** **For specific topics regarding pre- and post-processing of measured data one is referred to documents elaborated within work package no. 2 of the FerryBox Project with restricted classification. Refer to the project coordinator for further details on these non-public documentation.**

Table 5-14 continued.

Note: If the vertical space coordinate is determined by other means (e.g. with a pressure sensor) the parameter definitions given in Part 1 of this table have to be changed.

Refer to Section 6.2.5 for further details.

5.6.15 Parameter No. 006 – Dependent Parameter: Measured Parameter

Information on the Measured / Provided Parameters Part 6 – Parameter no. 006 – Dependent Parameter: Measured Parameter		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter column number]	Integer	Prescribed entry
[Parameter 006 serial counter]	Integer	Prescribed entry with individual modifications as applicable
[Parameter 006 group code]	Text string	Prescribed BODC dictionary entry
[Parameter 006 group short name]	Text string	Prescribed BODC dictionary entry
[Parameter 006 group full name]	Text string	Prescribed BODC dictionary entry
[Parameter 006 code]	Text string	Prescribed BODC dictionary entry
[Parameter 006 short name]	Text string	Prescribed BODC dictionary entry
[Parameter 006 full name]	Text string	Prescribed BODC dictionary entry
[Parameter 006 unit code]	Text string	Prescribed BODC dictionary entry
[Parameter 006 unit short name]	Text string	Prescribed BODC dictionary entry
[Parameter 006 unit full name]	Text string	Prescribed BODC dictionary entry
[Parameter 006 missing value]	Real or Integer as parameter	Prescribed BODC dictionary entry
[Parameter 006 short description]	Text string	Prescribed entry
[Parameter 006 full description]	Block Text	Prescribed entry with individual modifications as applicable
[Parameter 006 mean sensor depth]	Real	As for system
[Parameter 006 references]	Block Text	Prescribed entry
[Parameter 006 standard QC applied]	YES/NO	Prescribed entry
[Parameter 006 standard QC description]	Block Text	Prescribed entry with individual modifications as applicable
[Parameter 006 extended QC applied]	YES/NO	Prescribed entry with individual modifications as applicable
[Parameter 006 extended QC description]	Block Text	Prescribed entry with individual modifications as applicable
[Parameter 006 further QC information]	Block Text	Prescribed entry with individual modifications as applicable

Table 5-15. General Ferrybox meta data contents for measured oceanographic parameters (sixth parameter column in the data record).

Table 5-15 continued on next page.

Information on the Measured / Provided Parameters Part 6 – Parameter no. 006 – Dependent Parameter: Measured Parameter (continued)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter 006 data reference applied]	YES/NO	Prescribed entry
[Parameter 006 reference description]	Block Text	Prescribed entry
[Parameter 006 further data reference description]	Block Text	Prescribed entry
[Parameter 006 references]	Block Text	Reference is made to the new (2004) BODC parameter dictionary (documentation available at http://www.bodc.ac.uk).
[Parameter 006 standard QC flagging applied]	YES/NO	YES
[Parameter 006 standard QC description]	Block Text	The applied Ferrybox quality control and flagging procedure is applied for the parameter <.. parameter full name ...>. Good data (standard QC flag BLANK) is applied for ...completed as per parameter. Questionable data (standard QC flag L) is applied for ...completed as per parameter. Missing values (standard QC flag M) are usually not included.
[Parameter 006 extended QC applied]	YES/NO	NO
[Parameter 006 extended QC description]	Block Text	Not applicable
[Parameter 006 further QC information] The common text of the first paragraph of this field will be finally agreed as per results from WP-2 work on quality assurance of Ferrybox data. Any supplementing information and references to provided external QC documentation are appreciated for insertion in this field.	Block Text	Refer to the FerryBox System Description (D-2.1) for public topics on quality control of Ferrybox data and maintenance of Ferrybox systems available for downloading at <URL to be provided by the PDIMP>. Refer to the public guidelines on management of Ferrybox data for details of data contents and QC flagging available for downloading at <URL to be provided by the PDIM>. For specific topics regarding pre- and post-processing of measured data one is referred to documents elaborated within work package no. 2 of the FerryBox Project with restricted classification. Please refer to the project coordinator for further details. Any supplementing information and references to provided external QC documentation are appreciated for insertion in this field.
[Parameter 006 data reference applied]	YES/NO	NO
[Parameter 006 reference description]	Block Text	Not applicable
[Parameter 006 further data reference description]	Block Text	Not applicable

Table 5-15 continued.

Refer to the table and notes in Section 2.1.3 **for the typical meta data of the data reference flags (DREF) when applied to Ferrybox data.**

Tables containing the predefined and/or optional insertions for the dependent parameters measured in the FerryBox Project are provided in

- **Section** 6.3 **for the Ferrybox standard parameters**
- **Section** 6.4 **for the Ferrybox Non-standard parameters**

5.6.16 Notes Concerning the Parameter Related Meta Data

- The above documentation also allows integration of more measured parameters by simply adopting the parameter numbers and adding a column in the data file and accordingly assembled entries in the meta data.

- For reasons of compatibility, consistency and easier handling the FerryBox Project Consortium has decided to provide only one single measured oceanographic parameter in a data file.

- Ferrybox data produced by other activities / projects being conducted by a specific Ferrybox system or by an individual data provider as well as extended processed Ferrybox data sets may include such assemblies as aggregated or averaged or by other means reduced data files. This is fully supported by the above given data and meta data template and contents.

6 Parameter Meta Data Definitions

6.1 Introduction Comments

The following sections provide the individual entries of the parameters which are included in the Final FerryBox Data Set (refer to the grey shaded lines in Table 5-15).

We recommend that the parameter related full descriptions are to a certain extent harmonised in order to demonstrate the common principles of the measuring systems, the data acquisition methods, the automated system internal pre-processing, common system and sensor maintenance procedures, as well as the subsequently applied methods for quality control and, where carried out, for post-processing or analyses.

We have therefore in the corresponding meta data fields already included a series of suggestions **(typed in bold red colour)** which we consider that they need to be adapted and supplemented by a few insertions (respectively by modifications of the entries which are set in brackets **"<...> and typed in bold dark green colour**) only.

Where applicable and necessary extended individual descriptions should follow below in the same meta data text field or in other fields by overwriting the related comments.

6.2 Alternative Meta Data Definitions for Independent Ferrybox Parameters

The following subsections refer to already defined entries of the independent parameters. Thus repetition of the table lines as given in Table 5-10 to Table 5-15 is not required for the first five independent parameters which provide the time and space references.

6.2.1 Ferrybox Independent Parameter No. 1: Calendar Date

The BODC Parameter dictionary entries as well as the other meta data contents for this parameter are already provided and, except for individual instrument or sensor specifics, completely defined in Table 5-10.

Note: The FerryBox Consortium has intermediately considered to merge data and time into one parameter (Date+Time – see Paragraph 6.2.2.1 below) but this variant was discarded again later in the project as it "disturbs" the almost unified meta data structure on the parameter level.

6.2.2 Ferrybox Independent Parameter No. 2: Time

The BODC Parameter dictionary entries as well as the other meta data contents for this parameter are already provided and, except for individual instrument or sensor specifics, completely defined in Table 5-11.

6.2.2.1 Option to Merge Calendar Date and Time to a Single Independent Parameter

Merging of the presently separated independent parameters date and time is proposed as an options. This better matches with the general and overall class of Ferrybox data as geo- (spatial) and time-referenced environment data which usually require four independent parameters only for consistent and unique referencing. This is also the date and time format applied by large oceanography projects (e.g. WOCE). Mathematically it also fits much better to the functional description of Ferrybox data

$f(x',y',z',t)$ respectively $f(x'(t), y'(t), z'(t), t)$

where ***x'*** stands for the geographical latitude, ***y'*** for the geographical longitude, and ***z'*** for the depth/height below/above mean sea level (alternative for the sea pressure) and ***t*** for the time.

In this case Table 5-10 and Table 5-11 will be merged. A new data type DATETIME will be defined as a 14-digit Integer number in format YYYYMMDDHHMMSS.

The associated BODC parameter dictionary entries are:

Classification	Code	Missing value	Short Name	Full Name
Parameter Group	AYMDAA01		yyyymmddhh24miss.dd	Date and Time in format yyy-ymmddhh24miss.dd (WOCE)
Parameter	AYMD	-1	Date + Time	Date and Time
Unit	UDTM		Date+Time	yyyymmddhh24miss.dd

Table 6-1. BODC Parameter Dictionary definitions for the parameter “Date + Time” (merged).

Accordingly the first two columns (ref. Section 4.3) of the data file will be merged.

Note: We do not recommend to use specific time logging formats although the NMEA format is a standard in mariners applications. The BODC Parameter Dictionary supports instrument specific logging formats for two DGPS clocks (of the Seapath DGPS with parameter code AHMSSP01 and the Trimble DGPS with parameter code AHMTRP01). For reasons of compatibility the GPS time logs should be converted in the time format specified for application for the FerryBox project data.

6.2.3 Ferrybox Independent Parameter No. 3: Geographical Latitude North

The BODC Parameter dictionary entries are already completely specified in Table 5-12 for the geographical latitude is acquired by an unspecified GPS system.

6.2.3.1 Alternative Parameter Definitions

If the geographical position is obtained by another navigation system the BODC parameter dictionary provides the following alternatives which have to be applied instead:

Parameter code	Short Name	Full Name	Short Parameter description
ALATAS01	Ashtech_lat	Latitude north (Ashtech GPS)	Ashtech GPS positioning system
ALATTR01	Trimble_lat	Latitude north (Trimble GPS)	Trimble GPS positioning system
ALATSA01	SatNav	Latitude north (Sat-Nav)	Satellite Navigation (pre-GPS)
ALATAG01	LatARGOS	Latitude north (ARGOS)	ARGOS satellite positioning system
ALATGL01	GLONASS_lat	Latitude north (GLONASS)	GLONASS satellite navigation system
ALATLO01	LORAN	Latitude north (LORAN)	LORAN
ALATDE01	DECCA	Latitude north (DECCA)	Decca Navigation
ALATZZ01	Unspec	Latitude north (unspecified)	Unspecified method

Table 6-2. Alternative BODC Parameter Dictionary entries for the parameter “Latitude (North)” if not determined with an unspecified GPS.

The entries provided in Table 5-12 for missing values, parameter group and the parameter unit remain unchanged.

6.2.4 Ferrybox Independent Parameter No. 4: Geographical Longitude East

The BODC Parameter dictionary entries are already completely specified in Table 5-13 for the geographical longitude is acquired by a GPS system.

6.2.4.1 Alternative Parameter Definitions

If the geographical position is obtained by another navigation system the BODC parameter dictionary provides the following alternatives which have to be applied instead:

Parameter code	Short Name	Full Name	Short Parameter description
ALONAS01	Ashtech_lon	Longitude east (Ashtech GPS)	Ashtech GPS positioning system
ALONTR01	Trimble_lon	Longitude east (Trimble GPS)	Trimble GPS positioning system
ALONSA01	SatNav	Longitude east (Sat-Nav)	Satellite Navigation (pre-GPS)
ALONAG01	LatARGOS	Longitude east (ARGOS)	ARGOS satellite positioning system
ALONGL01	GLONASS_lon	Longitude east (GLONASS)	GLONASS satellite navigation system
ALONLO01	LORAN	Longitude east (LORAN)	LORAN
ALONDE01	DECCA	Longitude east (DECCA)	Decca Navigation
ALONZZ01	Unspec	Longitude east (unspecified)	Unspecified method

Table 6-3. Alternative BODC Parameter Dictionary entries for the parameter “Longitude (East)” if not determined with an unspecified GPS.

The entries already provided in Table 5-13 for missing values, parameter group and the parameter unit remain unchanged.

6.2.5 Ferrybox Independent Parameter No. 5: Vertical Spatial Coordinate

BODC parameter dictionary entries are already completely specified in Table 5-14 when the sensor depth below mean sea level is not specifically calculated or measured. Alternative BODC parameter dictionary entries are provided below.

6.2.5.1 Depth below Sea Level Calculated from Direct Sea Pressure Measurements

The vertical position of the instrument or sensor can be obtained by direct sea pressure measurements and the therefrom calculated depth below sea level. This is a typical procedure for towed instruments with a pressure sensor. Although not classically a Ferrybox, but closely affiliated (and also a major product line of one of the project partners), we specifically mention this option also for reasons of generality in application of these guidelines.

For such cases the following parameter definition is applicable in Table 5-14:

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter	DEPHPR01	-99.	CmpDep	Depth (computed from pressure) Pressure converted using UNESCO PTODEP

Table 6-4. Applicable BODC Parameter Dictionary entries for depth below sea surface when applied as vertical space coordinate and computed with UNESCO standard formula from in-situ pressure measurements (code and unit definitions remain unchanged).

6.2.5.2 Depth Below Sea Level Calculated from Tow-Wire Pay-Out and Ship Speed

The depth of towed vehicles or instruments which are not equipped with a pressure sensor is frequently and roughly obtained by calculation of empirical formulae which relate the pay-out length of the tow-wire or umbilical with the ship's speed.

For such cases the BODC parameter dictionary provides the following parameter definition:

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter Group	AHGT		Vert_spac_coord	Vertical spatial coordinates All vertical spatial parameters including depth, height and pressure when used as an independent variable.
Parameter	DEPHWO01	-99.	Depth	Depth Measurement determined from an in-situ pressure sensor data averaged over a sampling event
Unit	ULAA		m	Metres

Table 6-5. Applicable BODC Parameter Dictionary entries for the depth below sea surface when applied as vertical space coordinate when computed with UNESCO standard formula from in-situ pressure measurements.

6.2.5.3 Application of Measured Sea Pressure as Vertical Space Coordinate

If for profiling (undulating) instruments or vehicles the pressure is applied as independent parameter and vertical coordinate the BODC parameter dictionary provides the following definitions to be applied in Table 5-14:

Classification	Code	Missing value	Short Name	Full Name and Description
Group	AHGT		Vert_spac_coord	Vertical spatial coordinates All vertical spatial parameters including depth, height and pressure when used as an independent variable.
Parameter	PRESPR01	-99.	Press	Sea pressure (spatial coordinate) Profiling pressure sensor (e.g. CTD) spatial coordinate
Unit	UPDB		dBar	Decibars

Table 6-6. BODC Parameter Dictionary entries for the vertical space coordinate in case sea pressure is applied instead of depth.

6.2.5.4 Bin Height Above Seafloor for ADCP Current Measurements

This reference is included for completeness as the data format also supports the provision of acoustically profiled current measurements, which, however, are not provided in the Final FerryBox Data Set.

Classification	Code	Missing value	Short Name	Full Name and Description
Group	AHGT		Vert_spac_coord	Vertical spatial coordinates All vertical spatial parameters including depth, height and pressure when used as an independent variable.
Parameter	HBINAA01	-9999.	BinHeight	Bin height above seafloor Computation
Unit	ULAA		m	Metres

Table 6-7. BODC Parameter Dictionary entries for the vertical space coordinate when applied to ADCP data with bottom track.

This for instance with (grey-shaded one might be of particular interest for present Ferrybox systems):

DepthLLU	Uncorrected hull-mounted sensor / instrument depth below sea surface	Uncorrected sensor depth below actual sea level relative to the mean load line of the vessel
DepthLLCm	Hull-mounted sensor / instrument depth corrected to mean vessel loadline	Sensor depth corrected to actual mean loadline Computed from mounted / deployed sensor depth and the vessel's mean loadline for a specific period obtained from ship's logbook or other methods (constant for a longer period, e.g. duration of a ferry leg / transit).
DepthLLCh	Hull-mounted sensor / instrument depth corrected to mean vessel loadline	Sensor depth corrected to actual loadline Computed from mounted / deployed sensor depth and the vessel's actual loadline (obtained e.g. from higher frequent averaging of vertical position fixes (e.g. DGPS) or higher frequent ship log data.
DepthPos	Sensor / instrument depth computed from vertical position fixes (GPS, DGPS, others)	Computed directly from vertical position fixes relative and distance between receiver antenna and sensor. (Maybe necessary to introduce / discriminate between none and applied tide corrections.)
Not yet defined	Directly measured vertical space coordinate.	Various (unspecified methods). Could be depth, height or absolute position in a selected / given coordinate system. Related topics not further discussed here.
DepthATr	Sensor / instrument depth obtained by acoustic tracking (pinger and array)	Computed from acoustic tracking data.

Note: In reference to towed instruments and in particular to capabilities and applications of acoustic tracking systems it might be reasonable to supplement also longitude and latitude of the sensor accordingly – i.e. calculated by ship's position and instrument / platform tracking / positioning relative to the vessel by means of acoustic tracking

Maybe also feasible to include an entry for a more simple horizontal positioning through ship's speed, tow-wire payout and wire fleet angle) as already included for the vertical.

General Remarks to Missing Values

- Some missing value definitions for depth parameters have –1 whereas others have –99. We assume that depths are generally positive downward (below sea surface). Does application of depth related space coordinates generally exclude negative depth (positive height) values?

- Applies also vice versa for height data (assuming these are generally positive above sea level or sea bottom) – why is than the missing value for ADCP Bin Depth –9999?

General Remarks to ADCP Applications

(also relevant for Ferryboxes) if ADCP data is supplied):

- There is an entry for BIN height above for ADCP / ADP measurements. We assume that this is typically applied for seafloor mounted profilers.

- It is also possible to calculate if the ADCP / ADP system acquires bottom track data.

- How about other ADCP applications like:

  - ADCP / ADP with Ferryboxes and on other ships (research vessels or VOLS) when no bottom track is possible to measure due to range exceeding water depth.

  - Upward looking ADCP in moorings.

  - ADCP / ADP systems without bottom track capability.

- Would it be feasible to supplement by an entry for ADCP bin depth below sea surface?

Final Remark:

We are certainly aware that all the proposed refinements could be respectively are covered when applying the general parameter definition for DEPHPM01 / PhysMeasDep.

However, the dictionary provides lots of nice and useful discriminations and details for the vertical space coordinate (as for other parameters).

Thus refinement might be reasonable to propose and consider in the one or other case.

6.3 Meta Data Tables for the Ferrybox Standard Parameters

The tables in this section provide fixed, partly pre-defined entries and suggested of the meta data for the dependent Ferrybox standard parameters water temperature, salinity, turbidity and chlorophyll-a.

Where feasible, options are given for each parameter which include the respective parameter definitions.

Thereafter follow some temporary comments to data providers and BODC.

6.3.1 Ferrybox Standard Parameter No. 1: Sea Water Temperature

The water temperature is measured by all Ferrybox systems inside the flow through systems and on some ferries also with hull mounted sensors in addition. The pipe systems through which the water is transported from the water intake to the Ferrybox are usually insulated.

A variety of temperature sensors and associated measurement principles are included in the different Ferrybox systems:

- With the Ferrybox systems on the Helsinki – Travemünde route operated by FIMR and on the Helsinki – Tallinn ferry route jointly operated by FIMR and EMI sea water temperature is measured by a Pt 2000 resistance temperature sensor (T3444 – manufacturer Aanderaa Instruments, Norway). The sensor has a resolution and an accuracy of 0.1 K.

- NIVA applies a *Seabird 45* micro-thermosalinograph system on the Oslo – Hirtshals ferry route (Micro TSG sensor, manufacturer Seabird Electronics Inc., USA, resolution 0.001 K and accuracy of 0.002 Kelvin).

- On the Cuxhaven – Harwich ferry route GKSS uses a Pt 100 resistance temperature probe (manufacturer not specified) with 0.01 K resolution and an accuracy of 0.1 Kelvin. The sea water temperature is also measured inside the Ferrybox system with integrated temperature sensors of unspecified types of the pH probe and the Turner fluorometer (resolution and accuracy data not available yet).

- On the Den Helder – Texel ferry NIOZ uses a hull-mounted temperature sensor (Pt 100 / *SBE 38* digital oceanographic thermometer) and one inside the flow-through system incorporated in a *SBE 21* thermosalinograph (both manufactured by Seabird Electronics Inc., USA) having a resolution 0.001 K and an accuracy of 0.002 Kelvin.

- NERC.POL applies on the Liverpool – Belfast ferry route an aged thermistor as an integrated part of the *SBE 16plus SeaCat* thermosalinograph (manufactured by Seabird Electronics Inc., USA) with a resolution 0.001 K and an accuracy of 0.002 Kelvin.

- NERC.NOC applies thermometer on the Cowes – Isle of Wright ferry route a *CTG Minipack system* with a Pt-resistance (manufacturer Chelsea Technology Group, UK) with a resolution 0.003 K and an accuracy of 0.005 Kelvin.

- On the Southampton – Bilbao ferry route the Ferrybox operated jointly by NERC.NOC and IEO in addition to the CTG Minipack (as above for the Cowes – Isle of Wright Ferrybox) a hull mounted SBE-38 digital oceanographic thermometer (as above for the Den Helder – Texel Ferrybox).

- The Ferrybox system of HCMR operating on the ferry route Athens – Heraklion uses a Pt-100 resistance temperature probe (manufacturer 4H-Jena Engineering GmbH, Germany) with a resolution 0.01 K and an accuracy of 0.1 Kelvin.

6.3.1.1 Meta Data Description for Sea Water Temperature

Information on the Measured / Provided Parameters Part 6 – Parameter no. 006 – Dependent Parameter: Sea Water Temperature		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter column number]	Integer	6
[Parameter 006 serial counter]	Integer	1 (change only if the same parameter is measured by more than one sensor and if the respective data files are included in the data set)
[Parameter 006 group code]	Text string	TEMP
[Parameter 006 group short name]	Text string	SeaTemp
[Parameter 006 group full name]	Text string	Sea temperature
[Parameter 006 code]	Text string	TEMPSG01 Refer to notes, options and suggestions below.
[Parameter 006 short name]	Text string	CalTSGTmp
[Parameter 006 full name]	Text string	Temperature of the water column by thermosalinograph and verification against independent measurement
[Parameter 006 unit code]	Text string	UPAA
[Parameter 006 unit short name]	Text string	DegC
[Parameter 006 unit full name]	Text string	Degrees Centigrade
[Parameter 006 missing value]	Real	-9.
[Parameter 006 short description]	Text string	Thermosalinograph measurement with in-situ calibration (e.g. surface CTD data) A thermosalinograph is not really a Ferrybox but this parameter definition appears the best match in relation to the measurement principle of Ferryboxes as per the presently available entries in the BODC parameter dictionary (refer to suggestions below).

Table 6-8. Ferrybox meta data contents for the standard parameter sea water temperature.

Table 6-8 continued on next page.

Information on the Measured / Provided Parameters Part 6 – Parameter no. 006 – Dependent Parameter: Sea Water Temperature		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter 006 full description]	Block Text	The water temperature is measured by a precision temperature sensor of type <insert> which is an integrated part of the Ferrybox flow through system. The measurement principle of the temperature sensor is <insert> <... supplemented and adapted as applicable ...> The absolute accuracy of the temperature sensor is <x.xx> and the relative one <x.xx> degree centigrade. The mean response time of the sensor is <x.xx> seconds. <.. supplemented and adapted as applicable ...> The water sample is continuously pumped from the water intake mounted at the hull of the ferry through a pipe arrangement to the Ferrybox. The mean temperature difference between in-situ water temperature at the intake and the measured value is <... negligible ... / ... determined by ambient system temperature correction .... / .... in average x.x degree centigrade ..>. <.. supplemented and adapted as applicable ...> The system measures water temperature with a frequency of <x.xx> Hertz and averages internally over <x> measurement cycles. The mean values are stored as raw data and are subsequently corrected as per the applied quality control procedure. <.. supplemented and adapted as applicable ...> Due to stirring and mixing caused by the movement of ship the measured in-situ temperature can be considered as an integrated value for a depth interval in the range of <1 to 1.5> times of the mean draught of the vessel which is <x.x> metres. Records with missing values of sea water temperature are usually not included in the Final FerryBox Data Set. To be supplemented and adapted as per the individual water temperature sensor of the Ferrybox.
[Parameter 006 mean sensor depth]	Real	XX.xx Usually mean depth (positive) of the water intake (or a hull mounted temperature sensor) relative to the mean loadline of the vessel. For platforms with varying depths (e.g. towed vehicles) this should be the mean depth below the sea surface of the temperature measurements in the corresponding data file.
[Parameter 006 references]	Block Text	Reference is made to the new (2004) BODC parameter dictionary (documentation available at http://www.bodc.ac.uk).

Table 6-8 continued.

Table 6-8 continued on next page.

Information on the Measured / Provided Parameters Part 6 – Parameter no. 006 – Dependent Parameter: Sea Water Temperature (continued)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter 006 standard QC flagging applied]	**YES/NO**	**YES**
[Parameter 006 standard QC description]	**Block Text**	**The applied Ferrybox quality control and flagging is applied for sea water temperature.** **A common description of the applied QC procedure for sea temperature is included when agreed in WP-2.** **Good data (standard QC flag BLANK) is applied for <...completed as per agreed procedure for sea temperature...>.** **Questionable data (standard QC flag L) is applied for <...completed as per agreed procedure for sea temperature...>.** **Records with missing values (standard QC flag M) are not included.**
[Parameter 006 extended QC flagging applied]	**YES/NO**	**NO**
[Parameter 006 extended QC description]	**Block Text**	**Not applicable**
[Parameter 006 further QC information] The common text of the first paragraph of this field will be finally agreed as per results from WP-2 work on quality assurance of Ferrybox data. Any supplementing information and references to provided external QC documentation are appreciated for insertion in this field.	**Block Text**	**Refer to the FerryBox System Description (D-2.1) for public topics on quality control of Ferrybox data and maintenance of Ferrybox systems available for downloading at <URL to be provided by the PDIMP>.** **Refer to the public guidelines on management of Ferrybox data for details of data contents and QC flagging available for downloading at <URL to be provided by the PDIM>.** **For specific topics regarding pre- and post-processing of measured data one is referred to documents elaborated within work package no. 2 of the FerryBox Project with restricted classification. Please refer to the project coordinator for further details.** Any supplementing information and references to provided external QC documentation are appreciated for insertion in this field.
[Parameter 006 data reference applied]	**YES/NO**	**NO**
[Parameter 006 reference description]	**Block Text**	**Not applicable**
[Parameter 006 further data reference description]	**Block Text**	**Not applicable**

Table 6-8 continued.

6.3.1.2 Alternative and Optional Parameter Definitions for Sea Water Temperature

As a general note we consider that the increasing application of Ferrybox systems in oceanographic research and ocean monitoring as well as the standardisation in data acquisition methods and metrology, common quality control procedures, and data pre- and post-processing which will be a core result of the European FerryBox Project justifies individual parameter definition for sea water temperature measurements with Ferryboxes. Presently available entries in the BODC Parameter Dictionary match either very generally and unspecified or, if more specified definitions are applied, these doe not match with the overall metrology (e.g. for a multi-sensor flow-through system) and the FerryBox approach.

Some of the Ferryboxes have two sensors for water temperature – one hull-mounted and one inside the flow-through system. Due to the different methods and sensors as well as to possible differences the temperature data acquired by these sensors should not be merged but two data series with corresponding meta data shall be provided for each.

6.3.1.2.1 Options for Sea Water Temperature Acquired by Thermosalinograph

As depicted above this parameter definition possibly matches at best the metrology of Ferryboxes. However, a Ferrybox is not a thermosalinograph although some Ferryboxes use respective sensors or components. Actually out of the FerryBox Project proposals have been launched to replace presently installed thermosalinographs on research and survey vessels by Ferryboxes.

When installed on oceanographic research vessels thermosalinograph as well as Ferrybox temperature registrations can be well independently verified by precision measurements with other sensors (CTD, in-situ thermometers). When installed on a ferry or VOLS the situation is different and verification measurements might range from none to certain basic standards and procedures as applied in the European FerryBox Project. In supplement to the calibrated temperature measurements by thermosalinographs the BODC Parameter Dictionary provides to options which take into account this bandwidth of verification possibilities and applications.

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter	TEMPSU01	-9.	UncalTSGTmp	Temperature of the water column by thermosalinograph and **no** verification against independent measurements Thermosalinograph measurement **with no in-situ calibration**
Parameter	TEMPSZ01	-9.	TSGTmp	Temperature of the water column by thermosalinograph Thermosalinograph measurement**. Not known whether in-situ calibration has been applied**

Table 6-9. BODC Parameter Dictionary entries for sea temperature measurements by thermosalinographs without and with unknown verification against independent measurements (parameter group and unit definitions remain unchanged).

Note: The BODC Parameter Dictionary provides also a parameter definition "Temperature of the water column by bucket sample or thermosalinograph" described as "Bucket sample or ship intake measurement" (code PSSTBK01). Although quite matching for the water provision, we consider application of this as too much of honour for Ferryboxes.

6.3.1.2.2 Sea Water Temperature Acquired by Unspecified Methods

The BODC parameter dictionary provides a general parameter definition for sea temperature which does not discriminate further regarding instrumentation or acquisition method. This could be another alternative to apply in Table 6-8:

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter	TEMPPR01	-9.	UspTmp	Temperature of the water column Unspecified method

Table 6-10. BODC Parameter Dictionary entries for sea temperature measured with unspecified instruments / methods (associated definitions for parameter group and unit remain unchanged).

Note: Due to its general character this is a matching parameter definition for water temperature measurements with Ferryboxes. However, we consider this definition as too general to apply.

6.3.1.2.3 Sea Water Temperature Acquired by Moving Vessel Profilers

The BODC Parameter Dictionary provides a parameter definition for sea temperature which refers to a moving vessel profiler without further specifications. For such applications it could be an alternative to apply in Table 6-8.

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter	TEMPMV01	-9.	MVP_Temp	Temperature of the water column by moving vessel profiler Not specified

Table 6-11. BODC Parameter Dictionary entries for sea temperature measurements by unspecified moving vessel profilers (associated definitions for parameter group and unit remain unchanged).

Note: This could be a somehow matching parameter definition for water temperature measurements with a Ferrybox as well. Although the method is not further specified in the BODC Parameter Dictionary we assume that this definition typically matches for temperature measurements with AUVs, surface floats and subsurface floats or profilers and other unspecified vessels / instrumentation carriers.

6.3.1.2.4 Sea Water Temperature Acquired by a CTD probe

Flow-through systems as applied for Ferryboxes and especially towed vehicles often hoist a standard CTD or multi-parameter probe. The BODC Parameter Dictionary provides the following definitions.

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter	TEMPST01	-9	CTDTmp	Temperature of the water column by CTD of STD This is the preferred term for this definition. Alternative term TEMPST02 is included to cover cases where there are two sensors of the same type contributing to the data set and referential integrity considerations prevent a usage of a single code.

Table 6-12. Applicable BODC Parameter Dictionary definitions for the sea temperature when acquired in-situ by a CTD or STD probe (associated definitions for parameter group and unit remain unchanged).

Note: Application of this parameter definition could be recommendable when a CTD system is installed outside on the hull or on a towed vehicle measuring the in-situ temperature in the water column together with sea pressure and salinity (conductivity). For reasons of consistency this definition should not be applied when standard CTD sensors or a standard CTD probe is integrated into the Ferrybox respectively its flow through system.

Notes to BODC

In reference to the presently applied parameter definition and the alternatives discussed above it might be reasonable to consider one or two supplementary parameter definitions which better match sea temperature measurements by Ferrybox systems in particular regarding to the general approach and the commonly defined basic QC standards.

These could be for instance:

FBX_Temp_Unspec	Temperature of the upper water column from a Ferrybox (unspec)	Temperature of the upper water column measured by precision temperature sensors installed inside a ship with probe water supplied by a flow-through system (Ferrybox) without corrections or applied corrections unknown.
FBX_Temp_Corr	Temperature of the upper water column (corrected) from Ferrybox	Temperature of the upper water column measured by precision temperature sensors installed inside a ship with probe water supplied by a flow-through system (Ferrybox) with corrections considering system temperature adaptation effects applied.
FBX_Temp_Cal	Temperature of the upper water column from a Ferrybox (verified)	Temperature of the upper water column measured by precision temperature sensors installed inside a ship with probe water supplied by a flow-through system (Ferrybox) referenced against in-situ temperature measurements.

One may consider more options which also better match other Ferrybox-like applications (e.g. hull mounted temperature sensors and/or a installation on a towed vehicle) but above definitions would match the measurements in the project and likely in future Ferrybox applications quite well.

Hull mounted temperature and conductivity sensors are part of NIOZ Ferrybox system.

6.3.2 Ferrybox Standard Parameter No. 2: Salinity

The conductivity is measured by all Ferrybox systems inside the flow through systems and on some ferries also with hull mounted sensors in addition. the pipe systems through which the water is transported from the water intake to the Ferrybox are usually insulated and temperature compensation is applied for computation of salinity from the conductivity and temperature measurements which is done generally by using the UNESCO 82 standard formula.

A variety of conductivity sensors and associated measurement principles are included in the different Ferrybox systems:

- For the Ferrybox systems on the Helsinki – Travemünde route operated by FIMR and on the Helsinki – Tallinn ferry route jointly operated by FIMR and EMI conductivity is measured with an inductive method by a salinity-temperature sensor (STS 3210 – manufacturer Aanderaa Instruments, Norway). The sensor has a resolution 0.2 and an accuracy of 0.04 mS/cm and compensates internally temperature effects on salinity.

- NIVA applies a *Seabird 45* micro-thermosalinograph system on the Oslo – Hirtshals ferry route (Micro TSG sensor, manufacturer Seabird Electronics Inc., USA, resolution 0.00001 ms/cm and accuracy of 0.0003 mS/cm).

- On the Cuxhaven – Harwich ferry route GKSS uses a EXCELL TSG conductivity sensor (manufacturer Falmouth Scientific Inc., USA) with 0.001 mS/cm resolution and an accuracy of 0.02 mS/cm.

- On the Den Helder – Texel ferry (ferries) NIOZ uses a hull-mounted conductivity sensor (inductivity / *OCM-8000 conductivity probe* manufactured by Falmouth Scientific Inc., USA) with a resolution 0.001 ms/cm and an accuracy of 0.01 mS/cm and inside the flow-through system the *SBE 21* thermosalinograph (*SBE 21 conductivity probe* manufactured by Seabird Electronics Inc., USA) which has a resolution of 0,001 psu and an accuracy of 0.05 psu.

- NERC.POL applies on the Liverpool – Belfast ferry route a cell resistance conductivity probe as an integrated part of the *SBE 16plus SeaCat* thermosalinograph (manufactured by Seabird Electronics Inc., USA) with a resolution 0.00005 S/m and an accuracy of 0.0005 S/m.

- NERC.SOC applies on the Cowes – Isle of Wright ferry route a *CTG Minipack system* (manufacturer Chelsea Technology Group, UK) which has an induction cell to determine the conductivity with a resolution 0.001 mmho/cm and an accuracy of 0.005 mmho/cm.

- On the Southampton – Bilbao ferry route the Ferrybox operated jointly by NERC.SOC and IEO the *CTG Minipack* (as above for the Cowes – Isle of Wright Ferrybox) is used for the salinity (conductivity) measurements.

- The Ferrybox system of HCMR operating on the ferry route Athens – Heraklion uses a the same type of conductivity sensor (EXCELL TSG) as the GKSS Ferrybox above.

6.3.2.1 Meta Data Description for Salinity

Information on the Measured / Provided Parameters Part 6 – Parameter no. 006 – Dependent Parameter: Salinity		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter column number]	Integer	6
[Parameter 006 serial counter]	Integer	1 (change only if the same parameter is measured by more than one sensor and if the respective data files are included in the data set)
[Parameter 006 group code]	Text string	PSAL
[Parameter 006 group short name]	Text string	PrSal
[Parameter 006 group full name]	Text string	Practical Salinity
[Parameter 006 code]	Text string	PSALSG01 Refer to notes, options and suggestions below.
[Parameter 006 short name]	Text string	CalTSGSal
[Parameter 006 full name]	Text string	Temperature of the water column by thermosalinograph and verification against independent measurement
[Parameter 006 unit code]	Text string	UPSU
[Parameter 006 unit short name]	Text string	PSU
[Parameter 006 unit full name]	Text string	Practical Salinity Units
[Parameter 006 missing value]	Real	-1.
[Parameter 006 short description]	Text string	Practical salinity of the water column by thermosalinograph and computation using UNESCO 1982 algorithm and calibration against independent measurements A thermosalinograph is not really a Ferrybox but this parameter definition appears the best match in relation to the measurement principle of Ferryboxes as per the presently available entries in the BODC parameter dictionary (refer to suggestions below).

Table 6-13. Meta data contents for the Ferrybox standard parameter salinity.

Table 6-13 continued on next page.

Information on the Measured / Provided Parameters Part 6 – Parameter no. 006 – Dependent Parameter: Salinity (continued)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter 006 full description]	Block Text	The conductivity of seawater is measured by a precision sensor of type <insert> which is an integrated part of the Ferrybox flow through system. The measurement principle of the conductivity sensor is <insert> <... supplemented and adapted as applicable ...> The absolute accuracy of the conductivity sensor is <x.xx> and the relative one <x.xx> PSU. The mean response time of the sensor is <x.xx> seconds. <.. supplemented and adapted as applicable ...> The water sample is continuously pumped from the water intake mounted at the hull of the ferry through a pipe arrangement to the Ferrybox. The effect of temperature difference between in-situ water at the intake and the measured one on conductivity respectively computed salinity is <... negligible ... / ... determined by ambient system temperature correction .... / .... in average x.x degree centigrade causing average conductivity / salinity differences of x.xxx mS/cm respectively x.xxx PSU>. <.. supplemented and adapted as applicable ...> The system measures the conductivity with a frequency of <x.xx> Hertz and averages internally over <x> measurement cycles. The salinity is computed from the measured conductivity values and temperature with the UNESCO 1982 algorithm. The effect of sea pressure is neglected <.. taken into account ...>. The mean values are stored as raw data and are subsequently corrected as per the applied quality control procedure. <.. supplemented and adapted as applicable ...> Due to stirring and mixing caused by the movement of ship the measured in-situ salinity can be considered as an integrated value for a depth interval in the range of <1 to 1.5> times of the mean draught of the vessel which is <x.x> metres. Records with missing values of salinity are usually not included in the Final FerryBox Data Set. To be supplemented and adapted as per the individual water conductivity sensor of the Ferrybox.
[Parameter 006 mean sensor depth]	Real	XX.xx Usually mean depth (positive) of the water intake (or a hull mounted temperature sensor) relative to the mean loadline of the vessel. For platforms with varying depths (e.g. towed vehicles) this should be the mean depth below the sea surface of the temperature measurements in the corresponding data file.
[Parameter 006 references]	Block Text	Reference is made to the new (2004) BODC parameter dictionary (documentation available at http://www.bodc.ac.uk).

Table 6-13 continued.

Table 6-13 continued on next page.

Information on the Measured / Provided Parameters Part 6 – Parameter no. 006 – Dependent Parameter: Salinity (continued)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter 006 standard QC flagging applied]	**YES/NO**	**YES**
[Parameter 006 standard QC description]	**Block Text**	**The quality control and flagging as applied for salinity.** **A common description of the QC procedure applied for salinity to be included.** **Good data (standard QC flag BLANK) is applied for <...completed as per agreed procedure for sea temperature...>.** **Questionable data (standard QC flag L) is applied for <...completed as per agreed procedure for sea temperature...>.** **Records with missing values (standard QC flag M) are not included.**
[Parameter 006 extended QC flagging applied]	**YES/NO**	**NO**
[Parameter 006 extended QC description]	**Block Text**	**Not applicable**
[Parameter 006 further QC information] The common text of the first paragraph of this field will be finally agreed as per results from WP-2 work on quality assurance of Ferrybox data. Any supplementing information and references to provided external QC documentation are appreciated for insertion in this field.	**Block Text**	**Refer to the FerryBox System Description (D-2.1) for public topics on quality control of Ferrybox data and maintenance of Ferrybox systems available for downloading at <URL to be provided by the PDIMP>.** **Refer to the public guidelines on management of Ferrybox data for details of data contents and QC flagging available for downloading at <URL to be provided by the PDIM>.** **For specific topics regarding pre- and post-processing of measured data one is referred to documents elaborated within work package no. 2 of the FerryBox Project with restricted classification. Please refer to the project coordinator for further details.** Any supplementing information and references to provided external QC documentation are appreciated for insertion in this field.
[Parameter 006 data reference applied]	**YES/NO**	**NO**
[Parameter 006 reference description]	**Block Text**	**Not applicable**
[Parameter 006 further data reference description]	**Block Text**	**Not applicable**

Table 6-13 continued.

6.3.2.2 Alternative and Optional Parameter Definitions for Salinity

As for sea water temperature the increasing application of Ferrybox systems may justify some supplements of the BODC Parameter Dictionary regarding the parameter salinity.

The practical salinity shall be computed from conductivity and temperature (if applicable also sea pressure) according to the UNESCO 82 standard formula.

Some of the Ferryboxes have two sensors to measure conductivity – one hull-mounted and one inside the flow-through system. Due to the different methods and sensors as well as to possible differences the conductivity and temperature data acquired by these sensors should not be merged but two data series with corresponding meta data shall be provided for each. If ever, possible, salinity shall be computed from the corresponding sensor arrangements.

6.3.2.2.1 Options for Salinity Acquired by Thermosalinograph

As depicted above this parameter definition possibly matches at best the metrology of Ferryboxes. However, a Ferrybox is not a thermosalinograph (refer to the comments for sea water temperature which correspondingly apply here as well).

In supplement to the calibrated conductivity measurements by thermosalinographs and subsequent computation of practical salinity with the UNESCO-82 formula the BODC Parameter Dictionary provides to options which take into account this bandwidth of verification possibilities and applications.

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter	PASLSU01	-1.	UncalTSGSal	Practical salinity of the water column by thermosalinograph and computation using UNESCO 1982 algorithm and **no** verification against independent measurements Thermosalinograph measurement **with no in-situ calibration**
Parameter	PSALSZ01	-1.	TSGSal	Practical salinity of the water column by thermosalinograph and computation using UNESCO 1982 algorithm Thermosalinograph measurement**. Not known whether in-situ calibration has been applied**

Table 6-14. BODC Parameter Dictionary entries for salinity (conductivity) measurements by thermosalinographs without and with unknown verification against independent measurements (parameter group and unit definitions remain unchanged).

6.3.2.2.2 Salinity Acquired by Unspecified Methods

The BODC parameter dictionary provides a general parameter definition for practical salinity which does not discriminate further regarding instrumentation or acquisition method. This could be another alternative to apply in Table 6-13.

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter	PSALZZXX	-1.	Salinity (unspec.)	Practical salinity of the water column by computation using UNESCO 1982 algorithm Unspecified method

Table 6-15. BODC Parameter Dictionary entries for salinity (conductivity) measurements by unspecified instruments / methods (associated definitions for parameter group and unit remain unchanged).

Note: Due to its general character this is a matching parameter definition for practical salinity measurements with Ferryboxes. However, we consider this definition as too general to apply.

6.3.2.2.3 Salinity Acquired by Moving Vessel Profilers

The BODC Parameter Dictionary provides a parameter definition for practical salinity which refers to a moving vessel profiler without further specifications. For such applications it would be one alternative to apply in Table 6-13.

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter	PSALMV01	-1.	Pr_Sal	Practical salinity of the water column by moving vessel profiler and computation using UNESCO 1982 algorithm Not specified

Table 6-16. BODC Parameter Dictionary entries for practical salinity measured with unspecified moving vessel profilers (associated definitions for parameter group and unit remain unchanged).

Note: Refer to the corresponding note for sea temperature which applies here accordingly.

6.3.2.2.4 Salinity Acquired by a CTD probe

Flow-through systems as applied for Ferryboxes and especially towed vehicles often hoist a standard CTD or multi-parameter probe. Therefore the BODC Parameter Dictionary provides the following definitions for salinity (conductivity) measurements.

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter	PSALST01	-1.	CTDPSI	Practical salinity of the water column by CTD and computation using UNESCO 1982 algorithm This is the preferred term for this definition. Alternative term PSALST02 is included to cover cases where there are two sensors of the same type contributing to the data set and referential integrity considerations prevent a usage of a single code.
Parameter	PSALST02	-1.	CTDPS2	Practical salinity of the water column by CTD and computation using UNESCO 1982 algorithm This is the alternative term for this definition. Only use to cover cases where there are **two sensors of the same type contributing to the data set and referential integrity considerations prevent a usage of a single code**.
Parameter	PSALCU01	-1.	Uncal_CTD_Sal	Practical salinity of the water column by CTD and computation using UNESCO 1982 algorithm and **no calibration** against independent measurements CTD measurement of salinity that is known not to have been calibrated against independent salinity measurements such as salinometer determinations on bottle samples.

Table 6-17. Applicable BODC Parameter Dictionary definitions for practical salinity when acquired in-situ by a CTD or STD probe (associated definitions for parameter group and unit remain unchanged).

Notes: Application of one of these parameter definitions could be recommendable when a CTD system is installed outside on the hull or on a towed vehicle measuring the in-situ conductivity in the water column together with sea pressure and water temperature. For reasons of consistency this definition should not be applied when standard CTD sensors or a standard CTD probe is integrated into the Ferrybox respectively its flow through system.

Notes to BODC

In reference to the presently applied parameter definition and the alternatives discussed above it might be reasonable to consider one or two supplementary parameter definitions which better match sea temperature measurements by Ferrybox systems in particular regarding to the general approach and the commonly defined basic QC standards.

These could be for instance:

FBX_PSal_Unspec	Practical salinity of the water column measured by Ferrybox and computation using UNESCO 1982 algorithm	Practical salinity of the water column by CTD and computation using UNESCO 1982 algorithm measured by precision conductivity sensors installed inside a ship with probe water supplied by a flow-through system (Ferrybox) without corrections or applied corrections unknown.
FBX_PSal_Corr	Practical salinity of the water column measured by a Ferrybox and computation using UNESCO 1982 algorithm	Practical salinity of the water column by CTD and computation using UNESCO 1982 algorithm measured by precision conductivity sensors installed inside a ship with probe water supplied by a flow-through system (FerryBox) with sporadic corrections against independent water samples.
FBX_Psal_Cal	Practical salinity of the water column measured by a FerryBox and computation using UNESCO 1982 algorithm	Practical salinity of the water column by CTD and computation using UNESCO 1982 algorithm measured by precision conductivity sensors installed inside a ship with probe water supplied by a flow-through system (FerryBox) with frequent corrections against independent water samples (gathered routinely on each leg).

One may consider more options which also better match other Ferrybox-like applications (e.g. hull mounted conductivity sensors or a installation on a towed vehicle) but above definitions would match the measurements in the project and likely in future Ferrybox applications quite well.

6.3.3 Ferrybox Standard Parameter No. 3: Turbidity

Turbidity is measured by almost all (except for the Cowes – Isle of Wight ferry route) Ferrybox systems inside the flow through system. The pipe arrangement through which the water is transported from the water intake to the Ferrybox are usually insulated to minimise temperature changes. Some system have an integrated temperature sensor in the turbidity measuring sub-system.

Five different turbidity sensors and associated measurement principles are included in the applied Ferrybox systems:

- For the Ferrybox systems on the Helsinki – Travemünde route operated by FIMR and on the Helsinki – Tallinn ferry route jointly operated by FIMR and EMI turbidity is measured with a blue light scattering method by a submersible fluorometer (*SCUFA® II "Self-Contained Underwater Fluorescence Apparatus"* – manufactured by Turner Designs Inc., USA). This self controlled fluorometer has a resolution 0.05 NTU (accuracy not specified) and compensates internally temperature effects on turbidity (the sea water temperature is measured internally with an integrated temperature probe and can be read-out as well).

- NIVA applies a *SeaPoint* turbidity meter on the Oslo – Hirtshals ferry route (manufacturer SeaPoint Sensors Inc., USA) which determines turbidity values by light scattering at 880 nm wavelength. The instrument sensitivity and range depends on the measurement frequency an has in the desired operation mode of NIVA a resolution of 0.05 NTU with an accuracy approximately of 2%.

- On the Cuxhaven – Harwich ferry route GKSS uses a two turbidity sensors. The first one is a SCUFA® II submersible fluorometer (as above for FIMR and EMI) and the second one a CUS 31-W2A turbidity sensor (manufacturer Endress & Hauser GmbH, Germany) using a nephelometric 90° NIR scattered light measuring method according to EN 27027 (red light, 880 nm scattering, measuring under pressure to avoid degassing). The sensor has a resolution of 0.001 FTU and an accuracy of about 10%.

- On the Den Helder – Texel ferry (ferries) NIOZ uses a SeaPoint turbidity meter (as above for NIVA) providing a resolution of 0.001 FTU and an accuracy of approximately 10% in the desired operation mode.

- NERC.POL uses on the Liverpool – Belfast ferry route a SeaPoint turbidity meter (as above for NIVA and NIOZ) to measure turbidity with an anticipated accuracy of approximately 2% in the desired operation mode.

- NERC.NOC does not measure turbidity on the Cowes – Isle of Wright ferry route.

- On the Southampton – Bilbao ferry route the Ferrybox operated jointly by NERC.NOC and IEO uses a *CTG Minipack* (manufacturer Chelsea Technology Group, UK) which incorporates a turbidity sensor applying light scattering measuring principle at 470 nm wavelength with of 0.01 FTU resolution (accuracy unspecified).

- The Ferrybox system of HCMR measures turbidity with the SCUFA® II submersible fluorometer (as above for FIMR, EMI and GKSS) with 0.05 NTU resolution.

6.3.3.1 Meta Data Description for Turbidity

Information on the Measured / Provided Parameters Part 6 – Parameter no. 006 – Dependent Parameter: Turbidity		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter column number]	Integer	6
[Parameter 006 serial counter]	Integer	1 (change only if the same parameter is measured by more than one sensor and if the respective data files are included in the data set)
[Parameter 006 group code]	Text string	TURB
[Parameter 006 group short name]	Text string	Turb
[Parameter 006 group full name]	Text string	Turbidity
[Parameter 006 code]	Text string	<Applicable BODC parameter code as provided below>
[Parameter 006 short name]	Text string	<Applicable BODC short name as provided below>
[Parameter 006 full name]	Text string	<Applicable BODC full name as provided below>
[Parameter 006 unit code]	Text string	USTU
[Parameter 006 unit short name]	Text string	STU
[Parameter 006 unit full name]	Text string	Standard Turbidity Units
[Parameter 006 missing value]	Real	-1.
[Parameter 006 short description]	Text string	<Applicable BODC short parameter description as provided below – if necessary supplement by individual ones> Check whether BODC parameter definitions cover applied turbidity sensors of the individual Ferryboxes. If not, supplementary parameter definitions are required.

Table 6-18. Meta data contents for the Ferrybox standard parameter turbidity.

Table 6-18 continued on next page.

Information on the Measured / Provided Parameters Part 6 – Parameter no. 006 – Dependent Parameter: Turbidity (continued)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter 006 full description]	Block Text	The turbidity of seawater is measured by a <sensor> of <Turner / Chelsea Instruments Aquatracka / OBS backscatter / SCUFA II / SeaPoint <other> ... type / design> which is an integrated part of the Ferrybox flow through system. The measurement principle of the turbidity sensor is <insert> <... supplemented and adapted as applicable ...> The absolute accuracy of the turbidity sensor is <x.xx> and the relative one <x.xx> STU. The mean response time of the sensor is <x.xx> seconds. <.. supplemented and adapted as applicable ...> The water sample is continuously pumped from the water intake mounted at the hull of the ferry through a pipe arrangement to the Ferrybox. The effect of residence time in the flow through system is <... negligible ... / ... determined by ambient system temperature correction .... / .... in average x.x degree centigrade causing average turbidity differences of x.xxx STU>. <.. supplemented and adapted as applicable ...> The system measures the turbidity with a frequency of <x.xx> Hertz and averages internally over <x> measurement cycles. The mean values are stored as raw data and are subsequently corrected as per the applied quality control procedure. <.. supplemented and adapted as applicable ...> Due to stirring and mixing caused by the movement of ship the measured in-situ turbidity can be considered as an integrated value for a depth interval in the range of <1 to 1.5> times of the mean draught of the vessel which is <x.x> metres. Records with missing values of turbidity are usually not included in the Final FerryBox Data Set. To be supplemented and adapted as per the individual water turbidity sensor of the Ferrybox.
[Parameter 006 mean sensor depth]	Real	XX.xx Usually mean depth (positive) of the water intake (or a hull mounted temperature sensor) relative to the mean loadline of the vessel. For platforms with varying depths (e.g. towed vehicles) this should be the mean depth below the sea surface of the temperature measurements in the corresponding data file.
[Parameter 006 references]	Block Text	Reference is made to the new (2004) BODC parameter dictionary (documentation available at http://www.bodc.ac.uk).

Table 6-18 continued.

Table 6-18 continued on next page.

Information on the Measured / Provided Parameters Part 6 – Parameter no. 006 – Dependent Parameter: Turbidity (continued)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter 006 standard QC flagging applied]	**YES/NO**	**YES**
[Parameter 006 standard QC description]	**Block Text**	**The quality control and flagging as applied for turbidity.** **The turbidity sensors of the FerryBox is are routinely calibrated against a standard Formazine solution.** **A common description of the applied QC procedure for turbidity is to be included.** **Good data (standard QC flag BLANK) is applied for <...completed as per agreed procedure for sea temperature...>.** **Questionable data (standard QC flag L) is applied for <...completed as per agreed procedure for sea temperature...>.** **Records with missing values (standard QC flag M) are not included.**
[Parameter 006 extended QC flagging applied]	**YES/NO**	**NO**
[Parameter 006 extended QC description]	**Block Text**	**Not applicable**
[Parameter 006 further QC information] The common text of the first paragraph of this field will be finally agreed as per results from WP-2 work on quality assurance of Ferrybox data. Any supplementing information and references to provided external QC documentation are appreciated for insertion in this field.	**Block Text**	**Refer to the FerryBox System Description (D-2.1) for public topics on quality control of Ferrybox data and maintenance of Ferrybox systems available for downloading at <URL to be provided by the PDIMP>.** **Refer to the public guidelines on management of Ferrybox data for details of data contents and QC flagging available for downloading at <URL to be provided by the PDIM>.** **For specific topics regarding pre- and post-processing of measured data one is referred to documents elaborated within work package no. 2 of the FerryBox Project with restricted classification. Please refer to the project coordinator for further details.** Any supplementing information and references to provided external QC documentation are appreciated for insertion in this field.
[Parameter 006 data reference applied]	**YES/NO**	**NO**
[Parameter 006 reference description]	**Block Text**	**Not applicable**
[Parameter 006 further data reference description]	**Block Text**	**Not applicable**

Table 6-18 continued.

6.3.3.2 Parameter Definitions for Turbidity

The parameter definitions for turbidity in the BODC Parameter Dictionary are instrument / method dependent.

The definitions match with the sensors applied in the European FerryBox Project but other or future types of Ferryboxes might require respective supplements.

Some of the Ferryboxes have two different sensors for turbidity. Due to the different methods and sensors as well as to possible differences the data acquired by these sensors should not be merged but two data series with corresponding meta data shall be provided for each.

The following parameter definitions are presently included in the BODC Parameter Dictionary.

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter	TURBAQ01	-1.	Aquatracka turbidity	In-situ CI Aquatracka configured as a nephelometer calibrated against Formazin
Parameter	TURBPR01	-1.	OBS turbidity	In-situ optical backscatter nephelometer calibrated against Formazin
Parameter	TURBPR02	-1.	OBS turbidity (sensor 2)	In-situ optical backscatter nephelometer calibrated against Formazin
Parameter	TURBSP01	-1.	Seapoint turbidity	In-situ SeaPoint turbidity meter calibrated against Formazin
Parameter	TURBTNTX	-1.	Nephelometer turbidity (Turner Designs)	Through-flow nephelometer

Table 6-19. BODC Parameter Dictionary entries for turbidity measurements by different instruments / sensors (parameter group and unit definitions remain as provided in the table above).

6.3.4 Ferrybox Standard Parameter No. 4: Chlorophyll-a Fluorescence

Chlorophyll-a fluorescence was measured by all Ferrybox systems inside the flow through system. Pipe systems through which the water is transported from the water intake to the Ferrybox are usually insulated and temperature compensated. Some system have an integrated temperature sensor in the chlorophyll-a fluorescence measuring subsystem.

Four different chlorophyll-a fluorescence sensors / fluorimeters and associated fluorescence measurement principles are included in the applied Ferrybox systems:

- On the Ferrybox systems on the Helsinki – Travemünde route operated by FIMR and on the Helsinki – Tallinn ferry route jointly operated by FIMR and EMI chlorophyll-a fluorescence was measured with two sensors / instruments both using fluorescence measurements. The first one is the *SCUFA® II* submersible fluorometer (as above for turbidity). The second one is a *10-AU-005 CE* portable field fluorometer (manufactured by Turner Designs Inc., USA). Resolution of both instruments is given with 0.01 µg/l (accuracy not specified).

- NIVA applied a *SeaPoint Chlorophyll Fluorometer* (*SCF* – manufacturer SeaPoint Sensors Inc., USA) on the Oslo – Hirtshals ferry route which determines chlorophyll-a fluorescence with a fluorescence method (extinction wavelength 685 nm, emission wavelength 470 nm). The instrument sensitivity and range depends on the measurement frequency an has in the desired operation mode of NIVA a resolution of 0.02 µg/l with an accuracy of approximately 2%.

- On the Cuxhaven – Harwich ferry route GKSS used a the *SCUFA® II* submersible fluorometer (as above for FIMR and EMI) with a resolution of 0.5 µg/l (accuracy not determined yet).

- On the Den Helder – Texel ferry (ferries) NIOZ uses a *SeaPoint Chlorophyll Fluorometer* (as above for NIVA) to measure chlorophyll-a fluorescence with a resolution of 0.02 µg/l and an accuracy of approximately 10%.

- NERC.POL used on the Liverpool – Belfast ferry route a *CTG Minitracka II* (manufacturer Chelsea Technology Group, UK) system to determine chlorophyll-a fluorescence by fluorescence at about 470 (+/- 30) nm emission wave length (blue light LED). The instrument has a resolution of 0.01 µg/l (accuracy unspecified).

- NERC.NOC applief on the Cowes – Isle of Wright ferry route *CTG Minipack* (manufacturer Chelsea Technology Group, UK) system to conduct chlorophyll-a fluorescence measurements. The instrument has a resolution of 0,01 µg/l (accuracy unspecified).

- The same instrument (*CTG Minipack*) was used to determine chlorophyll-a fluorescence on the Southampton – Bilbao ferry route the Ferrybox operated jointly by NERC.NOC and IEO.

- The Ferrybox system of HCMR measured chlorophyll-a fluorescence with the SCUFA® II submersible fluorometer (as above for FIMR, EMI and GKSS) with 0.5 µg/l resolution.

6.3.4.1 Meta Data Description for Chlorophyll-a Fluorescence

Information on the Measured / Provided Parameters Part 6 – Parameter no. 006 – Dependent Parameter: Chlorophyll-a Fluorescence		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter column number]	Integer	6
[Parameter 006 serial counter]	Integer	1 (change only if the same parameter is measured by more than one sensor and if the respective data files are included in the data set)
[Parameter 006 group code]	Text string	CPWC
[Parameter 006 group short name]	Text string	Cphl_WC
[Parameter 006 group full name]	Text string	Chlorophyll pigment concentrations in the water column (Includes all variants of chlorophyll expressed in terms of per unit volume or unit area of the water column. Does not include data expressed per unit mass of SPM).
[Parameter 006 code]	Text string	<Applicable BODC parameter code as provided below>
[Parameter 006 short name]	Text string	<Applicable BODC parameter short name as provided below>
[Parameter 006 full name]	Text string	<Applicable BODC parameter full name as provided below>
[Parameter 006 unit code]	Text string	UMMC
[Parameter 006 unit short name]	Text string	mg/m^3
[Parameter 006 unit full name]	Text string	Milligrams per cubic metre
[Parameter 006 missing value]	Real	-1.
[Parameter 006 short description]	Text string	<Depending on method and sensor pack – insert matching parameter short description from the parameter tables below> Check whether BODC parameter definitions cover applied turbidity sensors of the individual Ferryboxes. If not, supplementary parameter definitions are required.

Table 6-20. Meta data contents for the standard parameter chlorophyll-a fluorescence.

Table 6-20 continued on next page.

Information on the Measured / Provided Parameters Part 6 – Parameter no. 006 – Dependent Parameter: Chlorophyll-a Fluorescence (continued)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter 006 full description]	Block Text	The chlorophyll-a fluorescence in seawater is measured by a <sensor> of <SCUFA II / Chelsea Instruments Minipack / Chelsea Instruments Minitracka II / OBS backscatter / <other> ... type / design> which is an integrated part of the Ferrybox flow through system. The measurement principle of the chlorophyll-a fluorescence sensor is <insert> <... supplemented and adapted as applicable ...> The absolute accuracy of the chlorophyll-a fluorescence sensor is <x.xx> and the relative one <x.xx> milligrams per cubic metre. The mean response time of the sensor is <x.xx> seconds. <.. supplemented and adapted as applicable ...> The water sample is continuously pumped from the water intake mounted at the hull of the ferry through a pipe arrangement to the Ferrybox. The effect of residence time in the flow through system is <... negligible ... / ... determined by ambient system temperature correction .... / .... in average x.x degree centigrade causing average chlorophyll-a fluorescence differences of x.xxx milligrams per cubic metre>. <.. supplemented and adapted as applicable ...> The system measures chlorophyll-a fluorescence with a frequency of <x.xx> Hertz and averages internally over <x> measurement cycles. The mean values are stored as raw data and are subsequently corrected as per the applied quality control procedure. <.. supplemented and adapted as applicable ...> Due to stirring and mixing caused by the movement of ship the measured in-situ chlorophyll-a fluorescence can be considered as an integrated value for a depth interval in the range of <1 to 1.5> times of the mean draught of the vessel which is <x.x> metres. Records with missing values of chlorophyll-a fluorescence are usually not included in the Final FerryBox Data Set. To be supplemented and adapted as per the individual water turbidity sensor of the Ferrybox.
[Parameter 006 mean sensor depth]	Real	XX.xx Usually mean depth (positive) of the water intake (or a hull mounted temperature sensor) relative to the mean loadline of the vessel. For platforms with varying depths (e.g. towed vehicles) this should be the mean depth below the sea surface of the temperature measurements in the corresponding data file.
[Parameter 006 references]	Block Text	Reference is made to the new (2004) BODC parameter dictionary (documentation available at http://www.bodc.ac.uk).

Table 6-20 continued.

Table 6-20 continued on next page.

Information on the Measured / Provided Parameters Part 6 – Parameter no. 006 – Dependent Parameter: Chlorophyll-a Fluorescence (continued)		
Label Name	**Data Type**	**Contents and Meta Data Description**
[Parameter 006 standard QC flagging applied]	**YES/NO**	**YES**
[Parameter 006 standard QC description]	**Block Text**	**The quality control and flagging as applied for chlorophyll-a.** **The chlorophyll-a sensors of the Ferrybox is are routinely calibrated against water samples analysed in the laboratory..** **A common description of the QC procedure applied for turbidity is to be included.** **Good data (standard QC flag BLANK) is applied for <...completed as per agreed procedure for sea temperature...>.** **Questionable data (standard QC flag L) is applied for <...completed as per agreed procedure for sea temperature...>.** **Records with missing values (standard QC flag M) are not included.**
[Parameter 006 extended QC flagging applied]	**YES/NO**	**NO**
[Parameter 006 extended QC description]	**Block Text**	**Not applicable**
[Parameter 006 further QC information] The common text of the first paragraph of this field will be finally agreed as per results from WP-2 work on quality assurance of Ferrybox data. Any supplementing information and references to provided external QC documentation are appreciated for insertion in this field.	**Block Text**	**Refer to the FerryBox reports D-2-1 and D-2-3 for public topics on quality control of Ferrybox data and maintenance of Ferrybox systems available for downloading at <URL to be provided by the PDIMP>.** **Refer to the public guidelines on management of Ferrybox data for details of data contents and QC flagging available for downloading at <URL to be provided by the PDIM>.** **For specific topics regarding pre- and post-processing of measured data one is referred to documents elaborated within work package no. 2 of the FerryBox Project with restricted classification. Please refer to the project coordinator for further details.** Any supplementing information and references to provided external QC documentation are appreciated for insertion in this field.
[Parameter 006 data reference applied]	**YES/NO**	**NO**
[Parameter 006 reference description]	**Block Text**	**Not applicable**
[Parameter 006 further data reference description]	**Block Text**	**Not applicable**

Table 6-20 continued.

6.3.4.2 Parameter Definitions for Chlorophyll-a Fluorescence

The parameter definitions for turbidity in the BODC Parameter Dictionary are instrument / method dependent.

The definitions match with the sensors applied in the European FerryBox Project but other or future types of Ferryboxes might require respective supplements.

Some of the Ferryboxes have two different sensors to measure chlorophyll-a fluorescence. Due to the different methods and sensors as well as to possible differences the data acquired by these sensors should not be merged but two data series with corresponding meta data shall be provided for each.

The following parameter definitions are presently included in the BODC Parameter Dictionary.

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter	CPHLULAQ	-1.	UwayFluor_Chl-a_Aq	Concentration of chlorophyll-a {chl-a} per unit volume of the water column [particulate phase] by Aquatracka fluorometer immersed in non-toxic supply and laboratory calibration applied Aquatracka fluorometer immersed in pumped surface water supply with laboratory calibration applied.
Parameter	CPHLULTF	-1.	UwayFluor_Chl-a_TF	Concentration of chlorophyll-a {chl-a} per unit volume of the water column [particulate phase] by through-flow fluorometer plumbed into non-toxic supply and laboratory calibration applied Through-flow fluorometer plumbed into pumped surface water supply with laboratory calibration applied.
Parameter	CPHLUMAQ	-1.	UwayFluor_Chl-a_Aq	Concentration of chlorophyll-a {chl-a} per unit volume of the water column [particulate phase] by Aquatracka fluorometer immersed in non-toxic supply and manufacturer's calibration applied Aquatracka fluorometer immersed in pumped surface water supply with manufacturer calibration applied.
Parameter	CPHLUMTF	-1.	UwayFluor_Chl-a_TF	Concentration of chlorophyll-a {chl-a} per unit volume of the water column [particulate phase] by through-flow fluorometer plumbed into non-toxic supply and manufacturer's calibration applied Through-flow fluorometer plumbed into pumped surface water supply with manufacturer calibration applied.

Table 6-21. BODC Parameter Dictionary entries for chlorophyll-a measurements by different instruments / sensors and methods (parameter group and unit definitions remain as provided in the table above).

Table 6-21 continued on next page.

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter	CPHLUT01	-1.	UwayFluor_Chl-a_TF	Concentration of chlorophyll-a {chl-a} per unit volume of the water column [particulate phase] by through-flow fluorometer plumbed into non-toxic supply and calibrated using extracted chlorophyll data from field samples Through-flow fluorometer plumbed into pumped surface water supply and calibrated using extracted chlorophyll data from samples collected during the cruise.
Parameter	CPHLUW01	-1.	UwayFluor_Chl-a_Aq	Concentration of chlorophyll-a {chl-a} per unit volume of the water column [particulate phase] by Aquatracka fluorometer immersed in non-toxic supply and calibrated using extracted chlorophyll data from field samples Aquatracka fluorometer immersed in pumped surface water supply and calibrated using extracted chlorophyll data from samples collected during the cruise.
Parameter	CPHLZZXX	-1.	Chl-a (unspec)	Concentration of chlorophyll-a {chl-a} per unit volume of the water column [particulate phase] Unspecified methodology.

Table 6-21 continued.

6.4 Meta Data Tables for the Ferrybox Non-Standard Parameters

The tables in this section provide the BODC Parameter Dictionary definitions (parameter groups, parameters and corresponding units) for the Ferrybox non-standard parameters to for application in the template provided with Table 5-15 (respectively compliant to the Ferrybox standard parameter tables in the previous section).

1. Dissolved oxygen
2. pH
3. Nitrate
4. Phosphate (ortho-phosphate)
5. Ammonia
6. Silicate
7. Algae groups
8. Yellow substance
9. PAR (photosynthetic available radiance)
10. Sediment transport rate derived from long-term ADCP measurements
11. Acoustic backscatter from

Note: Underway current measurements by ADCP / ADP as well as acoustic backscatter data are not included in the Final FerryBox Data Set. Interested parties should contact institutions operating ADCPs on ferries directly.

If reasonable, alternatives for the parameter definitions are provided as well.

Other Ferrybox operators who might apply other methods or sensors to determine above parameters should consult the BODC Parameter Dictionary if necessary.

Full parameter description as well as applicable descriptions of the quality assurance procedures shall be included as depicted in the previous section for the Ferrybox standard parameters using Table 5-15 as template.

New and better instrumentation and sensors to measure hydrobiogeochemical parameters in-situ has become available in the last years to a great extent. More are expected to be developed in future of which several are likely applicable for Ferryboxes. Sensor arrangements and metrology vary considerably among different Ferrybox systems and operators.

It is therefore important that the Ferrybox non-standard parameters are comprehensively described and referenced in the meta data fields for full parameter description and quality assurance. This has to include individually applied methodologies of data acquisition, measuring and instrument principles, sensor types and characteristics, determination of raw data, temperature compensation, filtration, quality control and verification procedures, etc.. Wherever possible external documentation should be provided together with the meta data.

6.4.1 Ferrybox Non-standard Parameter No. 1: Dissolved Oxygen

Dissolved Oxygen is measured on the GKSS Ferrybox on the route Cuxhaven – Harwich only with a Clark Electrode (sensor *COS-42*, manufacturer Endress & Hauser, Germany) built into the flow through system.

The BODC Parameter dictionary provides as most general parameter definition:

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter group	DOXY		DissO2	Oxygen at in-situ temperature
Parameter	DOXYUZ01	-1.	DissO2	Concentration of oxygen {O2} per unit volume of the water column [dissolved phase] by in-situ sensor and no calibration against sample data **Unspecified** type of oxygen sensor with **no field calibration** against sample data
Parameter unit	UPOX		umol/l	Micromoles per litre

Table 6-22. General BODC Parameter Dictionary definition for dissolved oxygen.

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter	DOXYPE01	-1.	PEO2	Concentration of oxygen {O2} per unit volume of the water column [dissolved phase] by in-situ pulsed electrode Pulsed electrode oxygen probe

Table 6-23. Alternative BODC Parameter Dictionary definition for dissolved oxygen (parameter group and unit definitions as above).

Notes: The alternative definition may provide a better match of the measurement principle.

No information is available yet on verification method (if any).

The temperature dependence of dissolved oxygen as well as possible oxygen concentration during pass of the flow-through system may require correction (refer to QC procedures defined in WP-2). The dissolved oxygen sensor is routinely calibrated outside the flow through system.

The BODC Parameter dictionary provides some more definitions for dissolved oxygen. Future or other Ferrybox systems may use a Seabird SBE 43 oxygen sensor for which specific entries (calibrated against sample data and uncalibrated) are provided.

All parameter definitions eventually applicable for Ferrybox systems in the BODC Parameter Dictionary refer to in-situ displacements of sensors.

A parameter definition for dissolved oxygen measurements with flow-through systems is not yet included in the parameter dictionary.

6.4.2 Ferrybox Non-standard parameter No. 2: pH

The pH is measured on the GKSS Ferrybox on the route Cuxhaven – Harwich only with a pH Electrode (sensor type and manufacturer not specified) built into the flow through system. The sensor has a resolution of 0.01 and an accuracy of 0.05.

The BODC Parameter dictionary provides as most general parameter definition:

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter group	PHXX		pH	pH
Parameter	PHXXPR01	-1.	pH	pH electrode
Parameter unit	UPHX		pH units	pH units

Table 6-24: BODC Parameter Dictionary definition for pH measured with an electrode.

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter	PHXXSP01	-1.	pH	Spectrophotometric absorption
Parameter	PHXXZZXX	-1.	pH (unspecified)	Unspecified methodology

Table 6-25. Alternative BODC Parameter Dictionary definitions for pH (parameter group and unit definitions as above).

Notes: Temperature effects are corrected by a temperature sensor which is built into the pH electrode.

A parameter definition for pH measurements with flow-through systems is not yet included in the parameter dictionary.

6.4.3 Ferrybox Non-standard Parameter No. 3: Nitrate

Nitrate is measured on the GKSS Ferrybox on the route Cuxhaven – Harwich only with two types of analysers which are interfaced with the flow through system.

The first instrument (manufacturer TRIOS, Germany) uses UV detection by ultra-violet spectrometry of unfiltered water. The system has a resolution of 0.1 µmol/l and an accuracy of 50 µmol/l.

The second one is an automated pump photometer (APP – manufacturer ME GmbH, Germany). The APP measuring principle is colorometric autoanalysis. Water fed into the APP has passed an unspecified band filter in advance. The instrument has a resolution of 0.01 µmol/l and an accuracy of 15%.

The BODC Parameter dictionary provides one parameter definition:

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter group	NTRA		NO3	Nitrate concentration parameters in the water column. Nitrate concentration parameters (including statistical parameters such as standard deviation) in the water column. **NB:** Before using parameters from this group ensure that the data are not nitrate+nitrite, which are often loosely referred to as nitrate.
Parameter	ODSDM014	-1.	ODSDM014	Concentration of nitrate {NO3} per unit volume of the water column (dissolved plus reactive particulate <unknown> phase) by filtration and colorometric autoanalysis and corrected for nitrite Not specified
Parameter unit	UPOX		umol/l	Micromoles per litre

Table 6-26. BODC Parameter Dictionary definition for nitrate (only one available).

Notes: Nitrate data are inter-calibrated with filtrated samples (at present trial phase for TRIOS sensor) and routinely against monthly taken samples for the APP.

The parameter definition matches the APP measuring principle but not the UV-detection method by the TRIOS analyser.

Note to BODC

We suggest to provide a parameter dictionary entry for unfiltered samples matching the measurement principle of the TRIOS sensor.

6.4.4 Ferrybox Non-standard Parameter No. 4: Ortho-Phosphate

Dissolved phosphate (ortho-phosphate) is measured on the GKSS Ferrybox on the route Cuxhaven – Harwich only with an automated pump photometer (APP – manufacturer ME GmbH, Germany) interfaced with the flow through system. Water fed to the APP is filtered with a band-filter of unspecified type. The analyser has a resolution of 0.05 µmol/l and an accuracy of 15%.

The BODC Parameter dictionary provides as most general parameter definition:

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter group	PHOS		PO4	Phosphate concentration parameters in the water column Phosphate concentration parameters (including statistical parameters such as standard deviation) in the water column
Parameter	PHOSAAD1	-1.	PO4D_unspec	Concentration of phosphate (PO4) per unit volume of the water column (dissolved plus reactive particulate (unknown phase) by filtration and colorometric autoanalysis Colorometric autoanalysis of filtrate after filtration through an unspecified filter type
Parameter unit	UPOX		umol/l	Micromoles per litre

Table 6-27. Applicable BODC Parameter Dictionary definition for phosphate.

Notes: Phosphate data are inter-calibrated with filtrated samples taken in monthly intervals.

The BODC Parameter Dictionary provides a series of other parameter definitions for phosphate measurements by autoanalysing instruments possibly suitable for Ferrybox systems. The definitions discriminate between filter types and filtering method (different types and sizes of filters, unknown filters and unfiltered samples). A series of parameter definitions for laboratory analyses is provided as well.

If nitrate measurements are done in future Ferrybox applications matching parameters should be looked up in the BODC Parameter Dictionary. New types of sensors or analysers might require supplementing of the dictionary.

Note to BODC

The parameter definition does not discriminate between sample verification against water samples and uncalibrated data.

6.4.5 Ferrybox Non-standard Parameter No. 5: Ammonia

Ammonia is measured on the GKSS Ferrybox on the route Cuxhaven – Harwich with an automated pump photometer (APP – manufacturer ME GmbH, Germany) interfaced with the flow through system. Water fed to the APP is filtered with a bandfilter of unspecified type. The analyser has a resolution of 0.01 µmol/l and an accuracy of 15%.

The BODC Parameter dictionary provides as most general parameter definition:

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter group	AMON		NH4	Ammonium concentration parameters in the water column Ammonium concentration parameters (including statistical parameters such as standard deviation) in the water column
Parameter	AMONAADZ	-1.	NH4D	Concentration of ammonium (NH4) per unit volume of the water column (dissolved plus reactive particulate (unknown phase) by filtration and colorometric autoanalysis Colorometric autoanalysis (unspecified filter type)
Parameter unit	UPOX		umol/l	Micromoles per litre

Table 6-28. Applicable BODC Parameter Dictionary definition for ammonia.

Notes: Ammonia data are inter-calibrated with filtrated samples taken in monthly intervals.

The BODC Parameter Dictionary provides a series of other parameter definitions for ammonia measurements by autoanalysing instruments possibly suitable for Ferrybox systems. The definitions discriminate between filter types and filtering method (different types and sizes of filters, unknown filters and unfiltered samples). A series of parameter definitions for laboratory analyses is provided as well.

If ammonia measurements are done in future Ferrybox applications matching parameters should be looked up in the BODC Parameter Dictionary. New types of sensors or analysers might require supplementing of the dictionary.

Notes to BODC

The parameter definition does not discriminate between sample verification against water samples and uncalibrated data.

Use of “NH4D_unspec” as parameter short name would be more consistent with other parameters determined by the same measurement principle (see above for phosphate – PO4D_unspec and below for silicate – Dsi_unspec).

6.4.6 Ferrybox Non-standard Parameter No. 6: Silicate

Silicate is measured on the GKSS Ferrybox on the route Cuxhaven – Harwich with an automated pump photometer (APP – manufacturer ME GmbH, Germany) interfaced with the flow through system. Water fed to the APP is filtered with a bandfilter of unspecified type. The analyser has a resolution of 0.01 µmol/l and an accuracy of 15%.

The BODC Parameter dictionary provides as most general parameter definition:

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter group	SLCA		SiO4	Silicate concentration parameters in the water column Silicate concentration parameters (including statistical parameters such as standard deviation) in the water column
Parameter	SLCAAADZ	-1.	Dsi_unspec	Concentration of silicate (SiO4) per unit volume of the water column (dissolved plus reactive particulate (unknown phase) by filtration and colorometric autoanalysis Colorometric autoanalysis of filtrate after filtration through an unspecified filter type.
Parameter unit	UPOX		umol/l	Micromoles per litre

Table 6-29. Applicable BODC Parameter Dictionary definition for silicate.

Notes: Silicate data are inter-calibrated with filtrated samples taken in monthly intervals.

The BODC Parameter Dictionary provides a series of other parameter definitions for silicate measurements by autoanalysing instruments possibly suitable for Ferrybox systems. The definitions discriminate between filter types and filtering method (different types and sizes of filters, unknown filters and unfiltered samples). A series of parameter definitions for laboratory analyses is provided as well.

If silicate measurements are done in future Ferrybox applications matching parameters should be looked up in the BODC Parameter Dictionary. New types of sensors or analysers might require supplementing of the dictionary.

Note to BODC

The parameter definition does not discriminate between sample verification against water samples and uncalibrated data.

6.4.7 Ferrybox Non-standard Parameter No. 7: Algae Groups

Algae groups are determined measured on the GKSS Ferrybox on the route Cuxhaven – Harwich with a multi-spectral fluorometer (manufacturer bbe Moldaenke GmbH, Germany) and fluorescence extinction at different wave lengths using unfiltered water samples. By this method four algae groups can be discriminated – blue algae, green algae, Diatoms and others (miscellaneous algae). The instrument requires a base calibration as per area of application respectively the typical species abundance within the four groups. Data are provided in µg/l.

The BODC Parameter dictionary provides a matching parameter group but at present no suitable parameter definition:

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter group	PNTX		Phyto_nontax_abund	Phytoplankton non taxonomy-related abundance per unit volume of the water column. Basically, any phytoplankton abundance measurement that isn't included in parameter group PATX. May include data integrations such as 'total phytoplankton'.
Parameter	Not available	-1.	Not available yet	Not available yet
Parameter unit	UMMC		mg/m^3	Milligrams per cubic metre

Table 6-30. Applicable BODC Parameter Dictionary definition for algae groups.

Notes: Algae group data are inter-calibrated with HPLC measurements and cell counting from preserved water samples analysed in two-monthly intervals.

We could not identify matching parameter definitions in the BODC Parameter Dictionary.

Parameter group PNTX would match well (may be feasible to supplement the full description of the parameter group by "... May include ... such as ... and phytoplankton or algae group classification".

Notes to BODC

There appears to be no matching parameter group and parameter definition in the BODC Parameter Dictionary for this new type of measurements.

We suggest to define parameter definitions for the each of four algae groups determined by this and similar detection methods.

6.4.8 Ferrybox Non-Standard parameter No. 8: Yellow Substance

Yellow substance is determined on the NIVA Ferrybox on the route Oslo – Hirtshals. A hyper-spectral radiance sensor (*VIS-Absorber* – manufacturer TriOS Mess- und Datentechnik GmbH, Germany) is applied (details of method, resolution and accuracy to follow).

Presently the BODC Parameter dictionary does not provide matching parameter definitions.

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter group	Not available		Not available yet	Not available yet
Parameter	Not available	-1.	Not available yet	Not available yet
Parameter unit	To be defined		To be defined	To be defined

Table 6-31. Applicable BODC Parameter Dictionary definition for yellow substance (Gelbstoff).

Notes: Determination of yellow substance (Gelbstoff) concentration is presently a test application and details of metrology and evaluation will be defined at a later stage.

We could not identify matching parameter group and parameter definitions in the BODC Parameter Dictionary.

Notes to BODC

There appears to be no matching parameter group and parameter definition in the BODC Parameter Dictionary for this parameter and measuring method.

We suggest to define a matching parameter group and definition for yellow substance.

6.4.9 Ferrybox Non-standard Parameter No. 9: PAR

PAR (photo-synthetic available radiance) is determined on the NIVA Ferrybox on the route Oslo – Hirtshals. An irradiance detector (*PAR Cosines sensor* – manufacturer LiCor Environmental, USA) is applied. the sensor is installed on the deck of the ferry and PAR in 3 metres of water depth is calculated from measurement data (details of method, resolution and accuracy to follow).

The BODC Parameter dictionary provides the two parameter definitions (to be selected once the method is finally determined by NIVA):

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter group	IRRD		Dwir	Downwelling irradiance (photons)
Parameter	IRRDSV01	-1.	SurfVPAR	Downwelling vector irradiance as photons (PAR wavelength) in the atmosphere by cosine-collector spectral radiometer
Parameter (alternative)	IRRDUV01	-1.	SubsurVPAR	Downwelling vector irradiance as photons (PAR wavelength) in the water column by cosine-collector spectral radiometer
Parameter unit	UMES		uE/m^2/s	MicroEinsteins per square metre per second

Table 6-32. Applicable BODC Parameter Dictionary definition for PAR.

Remarks: Determination of PAR is presently a test application and details of metrology and evaluation will be defined at a later stage.

Selection of the parameter definition will be when the metrology and validation method has been proved further.

6.4.10 Ferrybox Non-standard Parameter No. 10: Sediment Transport Rate "ADCP"

On the ferry route Den Helder – Texel NIOZ applies a specific evaluation method to derive the sediment transport rate from the long-term acoustic current measurements, bottom-track and backscatter data acquired with a hull-mounted acoustic current Doppler profiler (1 MHz – manufacturer Nortek A/S, Norway).

At present the BODC Parameter dictionary does not provide matching parameter definitions:

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter group	Not available		Not available yet	Not available yet
Parameter	Not available	-1.	Not available yet	Not available yet
Parameter unit	To be defined		To be defined	To be defined

Table 6-33. Applicable BODC Parameter Dictionary definition for the sediment transport rate.

Note to BODC

There appears to be no matching parameter group and parameter definition in the BODC Parameter Dictionary for this parameter and determination method.

6.4.11 Ferrybox Non-standard Parameter No. 11: Acoustic Backscatter "ADCP"

On the ferry route Den Helder – Texel NIOZ logs acoustic backscatter data acquired with a hull-mounted acoustic current Doppler profiler (1 MHz – manufacturer Nortek A/S, Norway).

The BODC Parameter provides the following parameter definition:

Classification	Code	Missing value	Short Name	Full Name and Description
Parameter group	ASAM		Acc_bksctr	Acoustic backscatter Includes all parameters covering the strength of acoustic signal return, including absolute measurements of returning signal strength as well as parameters expressed as backscatter (the proportion of transmitted signal returned)
Parameter	ASAMAS01	-1.	ADCPSA	ADCP signal return amplitude Shipborne acoustic Doppler current profiler
Parameter unit	UDBL		dbel	Decibels

Table 6-34. Applicable BODC Parameter Dictionary definition for acoustic backscatter data.

Remark: Acoustic backscatter data are not included into the Final FerryBox Data Set.