Intergovernmental Oceanographic Commission
(of UNESCO)

World Meteorological Organization

DATA BUOY COOPERATION PANEL

REFERENCE GUIDE TO THE GTS-SUB-SYSTEM OF THE ARGOS PROCESSING SYSTEM

REVISION 1.4

DBCP Technical Document No.2
2004

NOTE

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariats of the Intergovernmental Oceanographic Commission (of UNESCO), and of the World Meteorological Organization concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

FOREWORD

The original Argos processing system was designed and implemented primarily to support the Global Weather Experiment in 1978/79. The processing requirement for the Global Telecommunication System (GTS) of WMO was intended to facilitate rapid global dissemination of data in standard format from the observation platforms (initially drifting buoys and constant level balloons) to the responsible research centres evaluating the observing systems. By the end of the 1980's, however, the diversity of users had expanded dramatically and it was apparent that the overall processing system was not well matched to the needs of either operational or research users of the Argos system. The DBCP and CLS/Service Argos together decided, therefore, to undertake the design and implementation of a new sub-system within the overall Argos processing system, specifically for the management of data destined for operational distribution over the GTS.

Specification for the Argos GTS Sub-system were subsequently prepared by the DBCP Technical Coordinator, Mr. Etienne Charpentier, and development of the sub-system was undertaken by a commercial company. Funding for the work was provided jointly by CLS/Service Argos, as an Argos development project, and by the DBCP. The sub-system finally became fully operational in 1993.

A Reference Guide to the Argos GTS Processing Sub-system was prepared and issued at that time (DBCP Technical Document No. 2) to assist Principal Investigators (PIs) running Argos programmes and wishing their data to be distributed on the GTS; PIs and manufacturers intending to design Argos platforms and messages for GTS distribution; and GTS users who receive data from the Argos centres. This guide has recently been updated to reflect various changes that have been made in the last few years and to clarify certain issues. The guide should be read in conjunction with the Guide to Data Collection and Services Using Service Argos (DBCP Technical Document No. 3), which provides details of the structure of the sub-system, and provides background on the system's various applications.

The Argos system has now become a very widely used and integral part of many worldwide programmes, and it is hoped this guide will assist further in extending the usage of the system. I am confident that the guide will continue and build on the good work of the previous issue. It is after all in the best interests of all involved in the marine meteorology and oceanography community, to have a reliable, timely and standardized method for exchanging data. I feel sure that this guide will assist PIs to distribute their buoy data on the GTS, and thus continue to increase the quantity and quality of such data available to support operational meteorology and oceanography.

In closing, I would like to thank Mr. Charpentier for his efforts in updating this guide, and commend its use to all users of the Argos system.

Graeme Brough
(Chairman, DBCP)

Contents

1 - Who this guide is for 1

2 - The GTS sub-system at the Argos centres 2

2.1 - What it is for 2
2.2 - The Global Telecommunication System 2
2.3 - Advantages of the GTS sub-system for Argos users 4
2.4 - No additional cost to Argos users 4
2.5 - How to stop data from being sent onto the GTS 4
2.6 - How to get help 4

3 - How to have Argos data sent onto the GTS 5

3.1 - Have your programme approved 5
3.2 - Check that your data fits into a WMO format 5
3.3 - Obtain WMO numbers for your platforms 6
3.4 - Designate a Principal GTS Coordinator for your programme 6
3.5 - Decide how you want your data processed 6
3.6 - Test some processing options 6

4 - Argos messages and message processing 7

4.1 - Types of sensor 7
4.2 - Producing GTS bulletins from platform messages 7

5 - Defining your data and processing requirements 10

5.1 - Platform 11
5.2 - Binary format 12
5.3 - Transfer functions 13
5.4 - Corrections 28
5.5 - Associated sensors 29
5.6 - Using more than one format 30
5.7 - Reporting observation time 34
5.8 - Message multiplexing 40
5.9 - Processing blocks (e.g. sub-surface floats) 41

6 - Location 43

7 - Quality control 43

7.1 - Tests made for the whole observation 43
7.2 – Tests made for each individual sensor 46

8 - GTS distribution 52

8.1 -Deferred GTS distribution 52
8.2- GTS Bulletins 52

8.3 - GTS bulletin headers 57

9 - Direct distribution to Argos users 61

9.1 -STD format 61
9.2 -SIMPLE format 63

10 - Automatic modification of GTS technical file via email 64

10.1 - Read Access 64
10.2 -Write access 64
10.3 - Security issues 73
10.4 - Information to provide to the User Office 74

Annex A - Allocation of WMO numbers to Argos platforms 77

QA1bwnbnbnbnbnb 78

Annex B - Addresses 82

Annex C - GTS code forms in use with the Argos system 83

C.1) BUOY code (WMO code form FM 18-XII BUOY) 84
C.2) SYNOP code (WMO code forms FM 12-XI Ext. SYNOP): 86
C.3) SHIP code (WMO code form FM 13-XI Ext. SHIP): 88
C.4) BATHY code (WMO code form FM 63-XI Ext. BATHY): 90
C.5) TESAC code (WMO code form FM 64-XI Ext. TESAC): 91
C.6) HYDRA code (WMO code form FM 67-VI HYDRA): 92
C.7) BUFR code (WMO code form FM 94-XI Ext. BUFR): 93

Annex D - Glossary 99

Annex E - References 103

1 - Who this guide is for

This guide is for:
• Principal Investigators (PIs) running Argos programmes and wishing the Argos processing centres to send data onto the Global Telecommunication System (GTS),
• PIs and manufacturers intending to design Argos platforms and messages for transmission onto the GTS,
• GTS users who receive data from the Argos centres.

We assume you are already familiar with the basic operation of the Argos system. For example, the guide does not discuss the type of transmitter you need to use Argos, or the daily number of satellite passes you can expect at your latitude. For information of this type, please contact an Argos User Office (see addresses in Annex B.1).

* * *

§ 2 and 3 of this guide summarize the purpose of the GTS sub-system and how to use it.

§ 4 describes the three types of Argos messages and how they are processed, from reception by the satellite through to distribution on the GTS.

§ 5 describes how to define your requirements, essentially by filling in a Technical File.

§ 6 explains how the GTS sub-system deals with localizations.

§ 7 explains how the GTS sub-system compresses and quality-controls your message data.

§ 8 summarizes how Argos data are grouped into “observations”, which are formatted as “reports” for assembly into “bulletins”.

2 - The GTS sub-system at the Argos centres

2.1 - What it is for

Operational meteorologists rely on real-time data to run their numerical prediction models. The ground station network is dense and the data of good quality, but there is not enough data from the oceans, particularly in data-sparse areas not covered by commercial ships reporting weather data.

Many Argos platforms such as drifting and moored buoys, and even racing yachts, carry sensors to measure the geophysical variables needed, such as atmospheric pressure, air temperature, sea surface temperature, wind speed and direction. Principal Investigators of Argos programmes are therefore regularly asked for permission to send their data onto the GTS.

These data need decoding, processing into geophysical units, and quality-controlling. This is what the Argos GTS sub-system does. It also encodes the data according to World Meteorological Organization (WMO) formats for distribution onto the GTS. It is increasing both the quantity and the quality of Argos data sent onto the GTS.

The GTS sub-system operates at the Argos Global Processing Centres:
- Largo, Maryland in the United States,
- Toulouse, France.

You can both receive raw data on line from an Argos centre and have geophysical units sent through the GTS sub-system for GTS distribution (see Figure 1, below)

Before sending results onto the GTS the sub-system automatically traps data from failed sensors, and other bad data, by:
1. comparing data with limits you supply,
2. checking for gross errors,
3. compressing identical platform messages or sensor data from the same satellite pass,
4. using checksums to check message integrity, if you wish and if your platform message is compatible with this technique.

2.2 - The Global Telecommunication System

The GTS is a public international communication network for weather centres to exchange data gathered by their observation networks. It is coordinated by the World Meteorological Organization (WMO) World Weather Watch (WWW). The data are formatted using WMO GTS code formats such as BUOY for drifting buoys (see Annex C.1) and disseminated using formal WMO protocols.

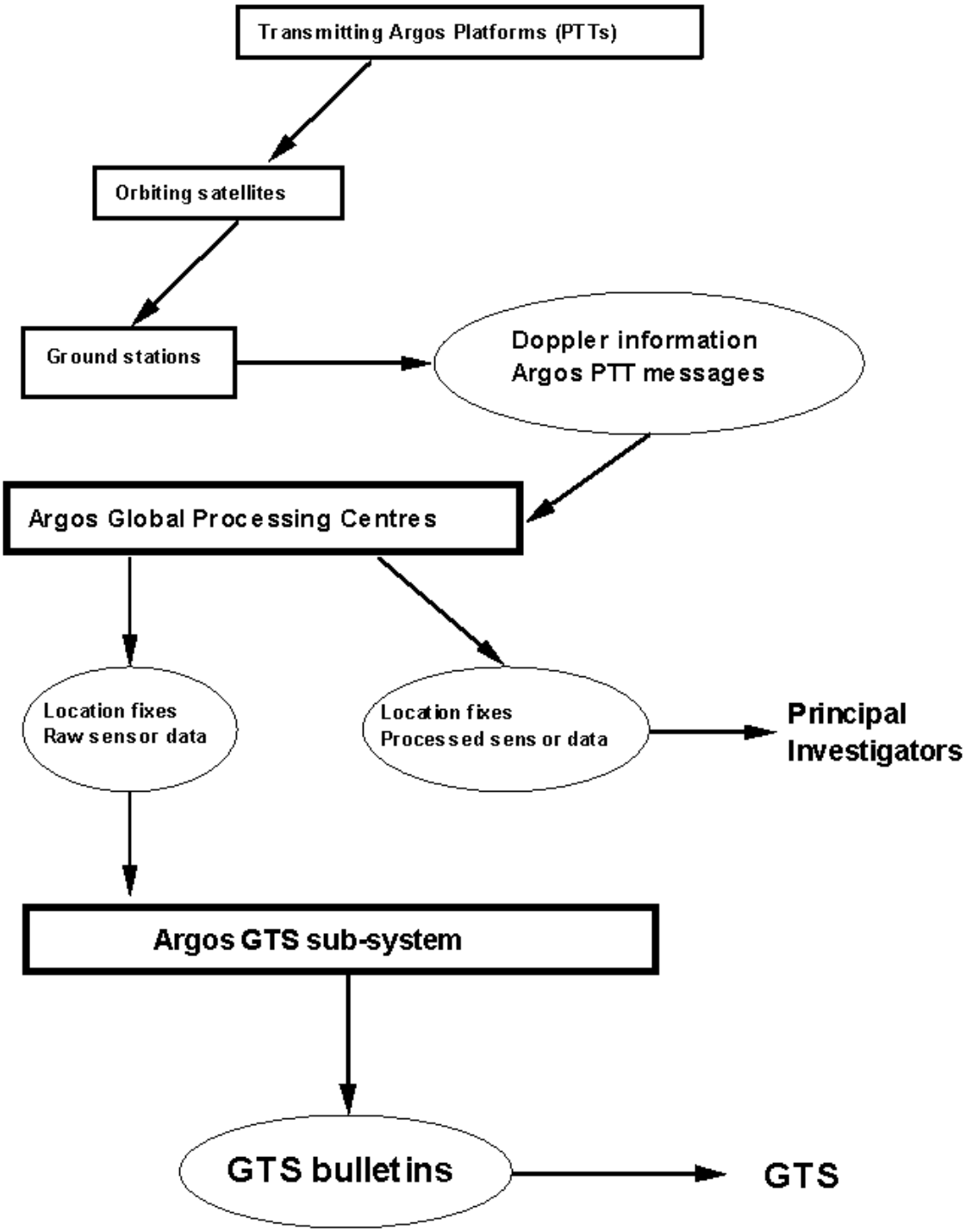


Figure 1: sending Argos data onto the GTS

2.3 - Advantages of the GTS sub-system for Argos users

The weather centres quality-control GTS data in delayed time. You are therefore informed if a sensor fails or needs recalibrating. Since the GTS sub-system is separate from the main Argos system, it does not affect the data delivered to Principal Investigators. For example, quality control and recalibrations have no impact on Argos data. The separation between the two systems also means you can receive the raw data while the processed data are distributed onto the GTS.

2.4 - No additional cost to Argos users

Argos recognizes the need for more cooperation in the environmental data user community. You pay no extra charges for the Argos centres to:
- handle your platforms for transmission of the data onto the GTS, e.g. declare your requirements in the system,
- send your data onto the GTS,
- provide help and advice.

2.5 - How to stop data from being sent onto the GTS

You can contact your Argos User Office at any time and request that GTS transmission of data from any of your platforms or programmes be stopped. If you intend to recover a platform please ask the Argos User Office in advance to remove it from the GTS. Please also let us know as soon as you know a platform is dying.

2.6 - How to get help

Feel free to contact your User Office or the Technical Coordinator of the DBCP[1] (TC-DBCP) at any time. An easy way to contact the User Office is Argos e-mail, using the MESS command. See Annex B, for TC-DBCP and User Office references.

[1] The Data Buoy Cooperation Panel (DBCP) is an official joint body set up by the World Meteorological Organization (WMO) and the Intergovernmental Oceanographic Commission (IOC). It was formally established in 1985. The DBCP's most important task is to internationally coordinate drifting buoy programmes. Substantial increases are expected in the number of buoys deployed on the global oceans and in the amount of good quality operational oceanic and atmospheric data available for the meteorological and oceanographic community. The DBCP is served by a full-time Technical Coordinator.

3 - How to have Argos data sent onto the GTS

3.1 - Have your programme approved

Your Argos programme must be approved in the regular way (if you are new to the Argos system please contact your Argos User Office, (addresses: Annex B.1). If you are starting a new programme, fill out a Programme Application Form and send it to your User Office for submission to the Argos Operations Committee. This takes about a month.

3.2 - Check that your data fits into a WMO format

The sensor data must be meteorological or oceanographic. The Argos GTS sub-system must also be able to convert the raw data into one of these GTS formats, sometimes known as code forms (see Annex C):

Type of data	**GTS format**	
	Name	**Code**
Buoy observations	BUOY	FM 18-X
Land observations	SYNOP	FM 12-XI Ext.
Marine station observations	SHIP	FM 13-XI Ext.
Bathythermal observations	BATHY	FM 63-XI Ext.
Sub-surface temperature, salinity and current observations from a sea station	TESAC	FM 64-XI Ext.
Report from a hydrological stations	HYDRA	FM 67-VI
Binary Universal Form for the Representation of meteorological data	BUFR	FM 94-XI Ext.

Note: BUFR is not available yet.

3.3 - Obtain WMO numbers for your platforms

Contact your National Weather Service or National Focal Point for Drifting Buoy Programmes (see Annex B.2) to request WMO identifier numbers for each platform (see Annex A). Your National Focal Point will also tell you if your country has any other procedures to follow for inserting data onto the GTS.

3.4 - Designate a Principal GTS Coordinator for your programme

We recommend you to designate a PGC, such as yourself if you are the Principal Investigator. The PGC will be the only person who can ask the Argos User Office to make changes impacting the data delivered onto the GTS, such as removing a platform from GTS distribution, removing or recalibrating a sensor, etc. The Technical Coordinator of the Data Buoy Cooperation Panel (TC-DBCP) will gladly be your PGC if you wish.

3.5 - Decide how you want your data processed

The GTS sub-system offers a wide variety of processing options, described in § 5 below. The way to define how you want us to process your data is by filling out a GTS Technical File, available from your User Office. Feel free to contact the TC-DBCP for any help you need.

The other information to provide to your User Office is:
- Quality Control: which of the available options you wish to use. The six QC checks described in § 7 can be turned on or off on request,
- information you wish us to include in your GTS bulletins: see § 8.2.

3.6 - Test some processing options

To see which options give the best results, it is often possible to simulate an Argos/GTS programme with raw data telemetry. If you are interested, please contact the TC-DBCP. Requests are examined on a case-by-case basis.

4 - Argos messages and message processing

4.1 - Types of sensor

The Argos message (also known as the PTT message, for Platform Transmitter Terminal) contains the data your platform sends to the satellite, either instantaneously or from memory. The data is split into words, often called "sensors". The Argos message can contain 32 to 256 data bits. Bits are numbered 0 to 255.

Data words can be:

-a- "Regular sensor": geophysical measurements (e.g. Air Pressure).

-b- "Timer": words containing information related to the observation time of regular sensors.

-c- "Checksum": words containing information calculated by the platform for validating data transmission and message integrity.

-d- "Block": Number of times a block of information is repeated in the Argos message (e.g. repeating Temp/Depth for a temperature profile).

4.2 - Producing GTS bulletins from platform messages

Whenever one of the satellites in the Argos system passes within range of a transmitting Argos platform, it collects messages. It stores these on board and transmits them to the Argos processing centres via ground stations in real or delayed time.

The processing centres compute the platform locations (if your platform is location-type) and compress identical messages. If you do not specify otherwise, only the message received identically most often during the satellite pass (known as the message with the highest compression index) is processed. The compressed message is decoded according to information you provide in your Technical File.

GTS bulletins containing GTS reports coded according to WMO regulations are then produced and sent in real time to operational meteorological and oceanographic centres.

Data from one platform and one satellite pass can produce more than one report in the following situations:

- You requested more than one GTS code form (e.g. BUOY and BATHY)

- The satellite received more than one observation during the same satellite pass (an observation is the set of sensor information available from a transmitter at a given time).

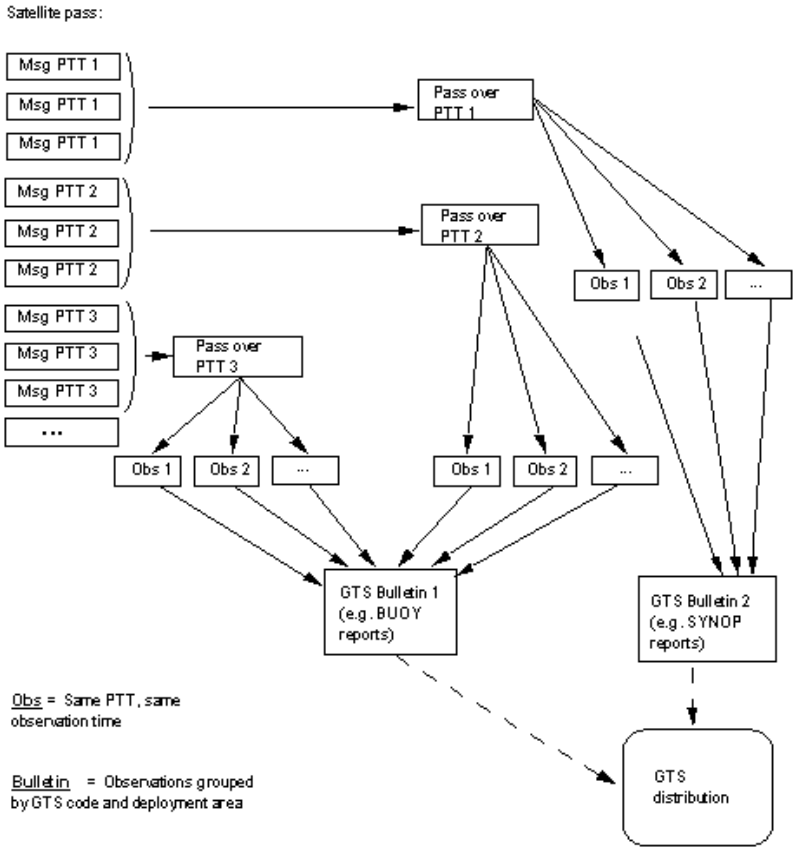


Figure 2: how GTS bulletins are generated from transmitter (PTT) messages

5 - Defining your data and processing requirements

To have your sensor data processed into physical units by the GTS sub-system and sent onto the GTS, you can define the following:

Definition	See below	Where to specify it
Platform: type, initial position, etc.	§ 5.1	GTS Technical File
Binary format: e.g. pure binary	§ 5.2	Contact an Argos User Office or the TC-DBCP[1]
Transfer function: how you want your raw data converted, e.g. using a polynomial function.	§ 5.3	GTS Technical File
Corrections: e.g. for geomagnetic variation	§ 5.4	Contact an Argos User Office or the TC-DBCP[1]
Associated sensors, e.g. to provide the depth of a temperature measurement, timers, etc.	§ 5.5	Contact an Argos User Office or the TC-DBCP[1]
Extra GTS format: e.g. use both SHIP and BATHY (not recommended)	§ 5.6	Contact an Argos User Office or the TC-DBCP [1]
Observation time: e.g. report your measurements according to UTC time	§ 5.7	GTS Technical File
Multiplexing: if 256 bits are not enough, you can spread data over several Argos messages	§ 5.8	Contact an Argos User Office or the TC-DBCP [1]
Repeating blocks of information in Argos messages (e.g. temp/depth profiles)	§ 5.9	Contact an Argos User Office or the TC-DBCP [1]

[1]If the technical specifications of your Argos transmitter do not match the information requested in GTS Technical File, they may still be compatible with the GTS sub-system. Please contact your User Office or the TC-DBCP and submit the specifications in your own format. Requests are examined on a case-by-case basis.

5.1 - Platform

Enter the following information in your Technical File. Again, if the technical specifications of your Argos transmitter do not match the information requested in the GTS Technical File, please contact your Argos User Office or the TC-DBCP and submit the specifications in your own format:

- Type of platform (e.g. drifting buoy, moored buoy, fixed platform, ship). Quality control procedures depend upon the type of platform. For example very old locations can be used for fixed platforms or moored buoys, but drifter locations older than a couple of days are not sent onto the GTS.

- Initial position of platform and date of deployment.

- Name of international experiment to which platform belongs (e.g. WOCE, TOGA), if any.

- WMO number (see Annex A).

- Number of bits in Argos message.

- Any multiplexing methods used, with format (see § 5.8).

- For drifting buoys, whether it is a Lagrangian drifter, whether a drogue is present, and if any the depth and shape of the drogue (e.g. holey sock). If requested, drogue information can be coded in BUOY messages (see Annex C.1). If the drogue detaches tell the Argos User Office so that the drogue information can be updated in your GTS messages.

- List of sensors to be sent onto the GTS, with a description of each sensor status.

- List of requested GTS code forms needed for GTS distribution, plus GTS bulletin header information.

5.2 - Binary format

The processing centre obtains the binary value of each word from its position in the Argos message, the number of bits, and the binary format. Bits are numbered from 0 (first, most significant bit) to 255 (last, least significant bit). The number of bits in a word can vary from 1 to 31.

You can define the following binary formats:

No	Format	Example	
		Decimal	**Binary coding**
1	**Pure binary**, e.g. 4 bits:	+15	1111
2	**Pure binary in twos-complement**, e.g. 4 bits:	-1 +7	1111 0111
3	**Signed binary**, e.g. 4 bits:	-7 +7	1111 0111
4	**Binary-Coded Decimal (BCD)**, 4 bits per digit e.g. 2 digits, 8 bits:	87	10000111
5	**ASCII**, e.g. 8-bit characters:	31	00110011 and 00110001
6	**Gray code**		
8	**Point number within block** (see paragraph 5.9). By convention, first point in block has value 1. Remark: this is not strictly speaking a binary format since point number will be taken in place of a specific data word in the Argos message.	Not applicable	Not applicable
9	**Campbell binary format.** Always 16 bits, including 1 bit for the sign (sgn, 0=+1, 1=-1), 2 bits for the magnitude (exp), and 13 bits for the digits (digits). Final value "v" is computed as following: v=sgn * digits * 10^{-exp}	0.03 -3	0100000000000011 1000000000000011

In addition, **binary words can be permuted**, i.e. binary word in cut in two halves and then those halves are permutted, e.g. 00001111 => 11110000 (if number of bits are odd, permutation is done as on the following example: 0001111 => 1111000).

When decoding binary words, the GTS sub-system first extracts the bits and then permutes the half words if permutation was requested by the users. Then binary formats as described above are applied.

5.3 - Transfer functions

The processing centres will use your transfer function to convert the binary data into physical units as indicated in Table 1 after paragraph 5.6 (e.g. Air Pressure data converted to hectoPascals (hPa)).

Transfer functions available:

B1: Calibration table (up to 20 points), linear interpolation between points. See § 5.3.1.

B2: Calibration table with compensating sensor, linear interpolation between points. See § 5.3.2.

B3: Polynomial function with break point and compensating sensor. See § 5.3.3.

B4: Polynomial function with compensating sensor up to degree 5. See § 5.3.4.

SM: Software Module: a dedicated module (e.g. FORTRAN program) can be implemented to convert raw data into physical units. Example: Laplace module for reducing air pressure to sea level. See § 5.3.5.

5.3.1 - B1 (calibration table, linear interpolation)

	Sensor output	Physical output		Sensor output	Physical output
1	0		11		
2			12		
3			13		
4			14		
5			15		
6			16		
7			17		
8			18		
9			19		
10			20		

- The first entry in the table must correspond to a sensor output with all bits set to zero.
- The last entry in the table must correspond to a sensor output with all bits set to 1 (e.g. 24 for an 8-bit sensor).
- Entries must be arranged in order of increasing sensor output.
- There must be 2 to 20 physical values.

5.3.2 - B2 (calibration table with compensating sensor, linear interpolation)

MS / CS	Main sensor output							
	0							
Compensating sensor output								
0								

Comments:

- The table consists of physical values and may contain a maximum of 11 columns and 9 rows.
- Sensor output corresponds to raw decimal values extracted from platform message, according to your defined binary format.
- The first entry in the table must correspond to a sensor output with all bits zero.
- The last entry in the table must correspond to a sensor output with all bits set to 1 (e.g. 24 if an 8-bit sensor).
- Entries must be arranged in order of increasing sensor output.

5.3.3 - B3 (polynomial function with break point and compensating sensor)

- Algorithm:

IF X_j<TC THEN $X_j=X_j+2^{n_j}$
$X_j=A*X_j+B$
IF X_i<PC THEN $X_i=X_i+2^{n_i}$
$R=C_1+C_2*X_j+C_3*X_i+C_4*X_i^2$

where:
R is the result of B3 processing, i.e. the computed physical value.
TC is the compensating sensor break point
X_i and X_j are the main and compensating sensor outputs respectively, i.e. raw decimal values extracted from PTT message, using your defined binary format,
n_i and n_j are the number of bits output by the main and compensating sensors, respectively,
PC is the main sensor break point.

5.3.4 - B4 (polynomial function with compensating sensor)

- Function:

$$R=A_0 + A_1*X_i+A_2*X_i^2+A_3*X_i^3+A_4*X_i^4+A_5*X_i^5 + B_1*X_j+B_2*X_j^2+B_3*X_j^3+B_4*X_j^4+B_5*X_j^5$$

where:
R is the result of B4 processing, i.e. the computed physical value,
X_i and Xj are the main and compensating sensor outputs respectively, i.e. raw decimal values extracted from the platform message, using your defined binary format.

5.3.5 - SM (software module)

For transfer functions which B1, B2, B3, or B4 processing cannot approximate accurately enough, you can have a dedicated FORTRAN subroutine (SM) implemented in the GTS processing sub-system. It can be assigned to any defined sensor on any PTT, with 20 coefficients per sensor.

Please submit your specifications to the Argos User Office. Do not exceed 25 lines of FORTRAN. Based on the complexity of the task, the Argos system operator CLS may or may not agree. Software modules are for converting raw sensor data into geophysical values, and may not be used for, say, time computation.

Notation:

Count: Main sensor raw value as encoded in Argos message

Count_Comp: Compensating sensor raw value

Phys: Processed physical value of main sensor

Phys_Comp: Processed physical value of compensating sensor (if any)

Phys_Comp2: Processed physical value of second compensating sensor (if any)

c_1 .. c_{20}: Calibration coefficients (each sensor of any platform is assigned a dedicated coefficient)

General form:

```
SUBROUTINE SOFTWARE_MODULE (  Input:Count,
                              Input:Count_Comp,
                              Input:Phys_Comp,
                              Output:Phys )
```

The software modules available at the time of writing (September 2001) are:

*5.3.5.1 - **IDENTITY** module*

Simply copies raw sensor value into sensor geophysical value without converting, i.e.:

Phys = Count

*5.3.5.2 - **TEMP_LOGA** module*

For temperature sensors with transfer functions in the following form:

IF there is a compensating sensor #1 then
  X = Physical value of compensating sensor # 1
Else
  X = Binary decimal value of main sensor (Count)
Endif

Resistance = $(c_1 * X + c_2) / (c_3 * X + c_4)$
Y = $LOG(Resistance)/LOG(c_5)$
Phys = $c_6 / (c_7 + c_8*Y + c_9*Y^2 + C_{10}*Y^3) - c_{11}$

*5.3.5.3 - **POLYN_XY** module*

For sensors with transfer functions in the following form:

X = Count (or Phys_Comp2 in case a 2nd compensating sensor is used)

Y = Phys_Comp

$$Phys = c_1 + c_2*X + c_3*X^2 + c_4*X^3 + c_5*X^4 + c_6*Y + c_7*Y^2 + c_8*Y^3 + c_9*Y^4 + c_{10}*X*Y + c_{11}*X*Y^2 + c_{12}*X*Y^3 + c_{13}*X^2*Y + c_{14}*X^2*Y^2 + c_{15}*X^3*Y$$

This makes it possible to encode incremental values of a sensor relative to another sensor (e.g. Phys = Phys_Comp + c_2*Count).

Attention: There is now the possibility to have a second compensating sensor declared for each main sensor. If this is the case, then value X is not the binary value of the main sensor (count) but the physical value of the second compensating sensor.

*5.3.5.4 - **POLYN_XZY** module*

For sensors with transfer functions in the following form:

X = Binary decimal value of main sensor
If (c_1=0) or Compensating sensor #1 found (by real time)
    Y = Physical value of compensating sensor # 1
Else
    Y = Physical value of compensating sensor # 2
Endif
Z = Physical value of compensating sensor # 2

$$\begin{aligned}\text{Phys} = \quad & c_2 + c_3*X + c_4*Y + c_5*Z + c_6*X*Y + c_7*X*Z + c_8*Y*Z + \\ & c_9*X*Y*Z + c_{10}*X^2 + c_{11}*Y^2 + c_{12}*Z^2 + \\ & c_{13}*X^3 + c_{14}*Y^3 + c_{15}*Z^3\end{aligned}$$

Remark: When using blocks, this makes it possible to encode incremental values of a sensor relative to (i) an initial value outside the block, or (ii) the preceeding value withing block, e.g.

Phys=Preceeding_Phys+Delta_Phys

Where

Phys: main sensor (declared using bits for delta value)
Delta_Phys: delta value as encoded in block (X)
Preceeding_Phys: Preceeding physical value of sensor (Y), i.e. $Phys_0$ (outside the block declared as 2nd compensating sensor) or preceeding value within block of the main sensor (previous Phys declared as 1st compensating sensor).

*5.3.5.5 - **ATLAS** module*

For TOGA TAO array ATLAS moored buoys (in the Equatorial Pacific Ocean). May also be useful for platforms using the types of sensor data processing shown below, according to the value of c_1.

If c_1 = 1 then (Temperature)

$Z = 768000000 / (2.525*Count - 7680)$
$X = LOG10 (c_5 + c_6*Z)$
$Phys = 1/(c_2 + c_3*X + c_4*X^3) - 273.15$

Else If c_1 = 2 then (Water Pressure)

$Phys = 0.68947*(c_2 + (76800*c_3/Count))$

Else If c_1 = 3 then (Wind)

(Wind is encoded in the Argos message using U and V vector components. The Main sensor represents V (before processing) and wind direction (after processing); the Compensating sensor represents U (before processing) and wind speed (after processing))

```
U=Count_Comp
V=Count
If U >= 128 then U = U - 256 Endif
If V >= 128 then V = V - 256 Endif
U = c2*U
V = c2*V
SPEED = c5 + c6*SQRT (U^2+V^2)
If V=0 Then
    If U = 0 then DIR = 0 Endif
    If U < 0 then DIR = 270 Endif
    If U > 0 then DIR = 90 Endif
Else
    If (U>=0) and (V>0) then DIR = ArcTan(ABS(U/V)) Endif
    If (U>=0) and (V<0) then DIR = 180-ArcTan(ABS(U/V)) Endif
    If (U<0) and (V<0) then DIR = 180+ArcTan(ABS(U/V)) Endif
    If (U<0) and (V<0) then DIR = 360-ArcTan(ABS(U/V)) Endif
Endif
DIR = 180 + c4*DIR
If (Automatic Geo-Magnetic Correction Not Requested) then
    DIR = DIR + c3
Endif
If (DIR < 0) then DIR = DIR + 360 Endif
If (DIR >= 360) then DIR = DIR - 360 Endif
Phys_Comp = SPEED
Phys = DIR
```

Else If c_1 = 5 then (Temperature)

$Z = 307200000 / Count$

$X = LOG10 (c_5 + c_6*Z)$

$Phys = 1/(c_2 + c_3*X + c_4*X^3) - 273.15$

Else If c_1 = 6 then (Temperature)

$Y = c_5 + c_6*(5*Count/1024)$

$Phys = c_2 + c_3*Y$

Else If c_1 = 7 then (Temperature)

$Z = 400000000 / Count$

$X = LOG10 (c_5 + c_6*Z)$

$Phys = 1/(c_2 + c_3*X + c_4*X^3) - 273.15$

Else If c_1 = 8 then (Humidity)

$Phys = c_2 + c_3*(Count/2.56)$

End if

*5.3.5.6 - **MARISONDE** module*

For temperature sensors on buoys with thermistor strings (Météo-France).

If Phys_Comp is out of limits then
  Phys forced to an out of limits value
Else
  $U = c_1 * Count + c_2$
  $V = INT((Phys_Comp-U+1)/(256*c_1))$
  $Phys = U + V*256*c_1$
Endif

*5.3.5.7 - **LAPLACE** module: Reduction to Sea Level, Geopotential*

Reduces air pressure to sea level or computes geopotential of an isobaric surface at a standard pressure level (i.e. 1000, 500, 700, or 850 hPa).

For land meteorological stations making air pressure measurements at station level when sea level pressure or geopotential is required for GTS distribution.

Assumptions:
- air relative humidity is constant throughout the year for the air layer considered,
- air temperature varies with a vertical gradient of -0.65 Celsius per 100 meters of elevation,
- main sensor measures air pressure at station level,
- If there is no 2nd compensating sensor, then transfer function for main sensor is assumed linear: station level pressure = $c_1+c_2*Count$.
- If there is a 2nd compensating sensor, then physical value of that sensor (Phys_Comp2) is assumed to be air pressure at station level in hPa and Count value of main sensor is ignored.
- compensating sensor measures air temperature (if applicable). If not measured, air temperature is assumed constant throughout the year.

The processed physical value of the main sensor will be pressure reduced to sea level or geopotential as required.

Module coefficients:

c_1: **Offset** for computation of air pressure (hPa) at station level (Pressure = c1 + c2*Count). Used only if there is no 2nd compensating sensor which returns air pressure at station level directly (Phys_Comp2).

c2: **Slope** for computation of air pressure (hPa) at station level (Pressure = c1 + c2*Count). Used only if there is no 2nd compensating sensor which returns air pressure at station level directly (Phys_Comp2).

c3: **Mean annual air temperature** (°C) at station location if no air temperature sensor is available.

c4: **Mean air relative humidity** (%) of air layer considered at station location.

c5: 1 if **Sea Level Pressure** is required
0 if **geopotential** is required (PI defines isobaric surface to be used for all platform sensors).

*5.3.5.8 - **AWI (Alfred Wegener Institute)** module*

Computes air pressure using algorithm below.

Main sensor: Air Pressure.
Compensating sensor: internal temperature.

$X = Count$
$Y = Phys_Comp$

$P_0 = \mathbf{c_1} - X * (\mathbf{c_2} + X * \mathbf{c_3})$
$P_1 = \mathbf{c_4} - X * (\mathbf{c_5} + X * \mathbf{c_6})$
$P_2 = \mathbf{c_7} - X * (\mathbf{c_8} + X * \mathbf{c_9})$
$Q_0 = P_1$
$Q_1 = (P_0 - P_2) / \mathbf{c_{10}}$
$Q_2 = ((P_0 + P_2) / \mathbf{c_{11}}) - Q_0$
$R = (Y + \mathbf{c_{12}}) / \mathbf{c_{13}}$
$Phys = Q_0 + (R * (Q_1 + R * Q_2))$

*5.3.5.9- **DEWPOINT** module: Air Dew Point Temperature based on Relative Humidity and Air Temperature.*

Computes the Air Dew Point Temperature based on values of Relative Humidity (main sensor or 2nd compensating sensor), and Air Temperature (compensating sensor).

Assumptions:
- main sensor measures air Relative Humidity,
- If there is no 2nd compensating sensor, then transfer function for main sensor is assumed linear: Humidity = c_1+c_2*Count.
- If there is a 2nd compensating sensor, then physical value of that sensor (Phys_Comp2) is assumed to be air relative humidity in % and Count value of main sensor is ignored.
- compensating sensor measures Air Temperature. If Air Temperature is not measured, or not valid, Dew Point Temperature is forced out of limits.

The processed physical value of the main sensor will be the Air Dew Point Temperature. Module coefficients are:

c_1: **Offset** for computation of air Relative Humidity (%) at station level (Offset = c1 coefficient, Humidity = c1 + c2*Count). Used only if there is no 2nd compensating sensor which returns air relative humidity directly (Phys_Comp2).

c_2: **Slope** (c2 coefficient) for computation of air Relative Humidity (%) . Used only if there is no 2nd compensating sensor which returns air relative humidity directly (Phys_Comp2).

*5.3.5.10- **SAL78** module: Computation of water salinity based upon conductivity, temperature, depth:*

Main sensor: Conductivity sensor

Compensating sensor: Temperature sensor in Celsius (physical value of compesating sensor is used here for temperature).

2nd Compensating sensor: Optional, water pressure in Deci-Bars (Phys_Comp2). If there is no 2nd compensating sensor, value of coefficient c3 is taken for constant average water pressure (in Deci-Bars).

SAL78 computes salinity based on conductivity and temperature. Conductivity is obtained as a linear function of main sensor count: Conductivty = c1 + c2*Count

Conductivity is expressed here in MilliSiemens/cM. Obtained salinity is expressed in psu (Practical Salinity Units,part per thousand).

c1: Offset for computing conductivity
c2: Slope for computing conductivity
c3: Average water pressure

Remark: For the computation, the algorithms uses and computes so called Conductivity Ratio defined as Conductivity divided by Conductivity of standard seawater of 35 psu salinity, 15C temperature, and standard surface atmospheric pressure.

*5.3.5.11- **SIGNATURE** module: Computation of the signature of an Argos message.*

Signature of an Argos message is a real number (32 bits) computed based

$$\sum_{i=1}^{32} Octet_i \Rightarrow 13 \text{ bits} \qquad \sum_{i=2}^{32} Abs(Octet_i - Octet_{i-1}) \Rightarrow 13 \text{ bits}$$

upon the value of a whole Argos message. The 32 bits of the Argos message signature are computed as follows (13+13+6 bits):

$$\left(\sum_{i=1}^{32} Octet_i^2\right) \text{modulo } 64 \Rightarrow 6 \text{ bits}$$

Obtained 32 bits (I) are transformed into a real number using following formula: Phys=I+(10000*(I modulo 10000)).

*5.3.5.12- **TABLE** module: extraction of physical value from a table*

IF there is a compensating sensor #2 then
    X = Physical value of compensating sensor # 2
Else
    X = Binary decimal value of main sensor (Count)
Endif
Y = Corrected Physical Value of 1st Compensating Sensor

$Phys = c_4 + c_5 * TABLE\ (c_1 * X + c_2 * Y + c_3)$

TABLE is given in the lines of text of module for the considered sensor: Values separated by comas (,), e.g.

950.1,900.0,850
750.1,700,654.55,500.77
…

*5.3.5.13- **PRESDEDUC** module: extraction of physical value from a table*

A table TABLE is provided by the principal investigator. Table is sorted by increasing geo-physical values (first value has index 1), values are sperated by comas (e.g. 1000,950.1,800,750 ...).

Y = Corrected Physical Value of 1st Compensating Sensor
Y_Index = Index in the table of Y or of value immediately preceeding Y in the table

$Phys = TABLE(c_1 + Y_Index + 1)$

This module is used when an approximate value for Phys is known and correct value can only be found from closest value in a table.

5.4 - Corrections

5.4.1 - Geomagnetic variation correction

For buoys measuring wind direction using compass, data can be automatically corrected for takinf geomagnetic variations into account. The correction depends upon the observation time and the platform position. The GTS sub-system computes a geomagnetic variation for that time and the platform position using the World Chart 2000 global field Geomagnetic variation model (IGRF 2000) which was obtained from the Geomagnetic Data Group of the NOAA National Geophysical Data Center (http://www.ngdc.noaa.gov/seg/potfld/geomag.shtml). Version is valid for the period 2000-2005. It then automatically adds the correction (modulo 360) to the wind direction measurements before GTS distribution.

5.4.2 - Linear correction

Instead of modifying a complete calibration curve, the GTS sub-system can slightly modify any sensor data sent onto the GTS by applying linear corrections to all physical values for the sensor (i.e. phys=phys.a+b, where a and b are provided by the PI).

This linear correction is independent of the transfer function.

a is initialized at 1 and b at 0.

For example, a Air Pressure sensor might need recalibrating by adding 3.4 hPa (a=1, b=3.4) or a wind speed sensor by applying a rate factor of 1.24 (a=1.24, b=0).

5.5 - Associated sensors

Extra sensor words can help to interpret the output of, or report on the status of, a main sensor:

5.5.1 - Compensating sensors

The final result from a geophysical measurement is computed from the binary output of a main sensor and from another sensor word called the compensating sensor. For example a main Air Pressure Sensor can be compensated by an Internal Temperature sensor whose binary values are also coded into the Argos message. Compensating sensors can only be used with B2, B3, B4 and SM processing.

Certain SM modules do accept a 2nd compensating sensor.

5.5.2 - Level sensors

If a sensor makes measurements at different levels or depths, e.g. XBT water temperature measurements, a sensor can encode the levels into the Argos message. A level sensor must be defined with a B1, B2, B3, B4 or SM calibration curve and be associated with one or more sensors.

If the level is constant and defined, e.g. Salinity at 50 meters, a level sensor is unnecessary.

5.5.3 - Duplicated sensors

If a platform has two or more similar sensors (e.g. two Air Pressure sensors), its data can be sent onto the GTS according to the priorities you define. Hence, if Quality Control rejects the first sensor value in the list, the GTS sub-system will process the next sensor value in the list.

5.5.4 - Time sensor

A timer can provide the measurement time. See § 5.7 for details.

5.5.5 - Checksum sensors

Checksums validate sensor data on reception at the processing centres to prevent bad data going onto the GTS. (Degradation can occur in the platform-to-satellite link or satellite-to-ground link, or at the processing centre). See § 7.3.2 for details.

5.6 - Using more than one format

Platform sensors can each use different code forms to report onto the GTS. For example, if a platform has Air Pressure, Air Temperature, Sea Surface Temperature, and Sub-Surface Temperature sensors, it can report onto the GTS using SHIP code for surface measurements (Air Pressure, Air Temperature, Sea Surface Temperature) and BATHY for Surface and Sub-Surface Water Temperature. However, we recommend that you use only one code form per sensor. See Annex C for details.

Table 1: Geophysical variables, with units and formats.

Mnemo	*Code*	*Variable*	*Units*	*Buoy*	*Synop*	*Ship*	*Bathy*	*Tesac*	*Hydra*	*Bufr*
AI_GEOP	33	Geopotential	M		*	*				*
AI_HUM	31	Air Relative Humidity	%	*	*	*				*
AI_P	3	Atmospheric Pressure	hPa	*	*	*				*
AI_PT	4	Air Press Tendency (>0)	hPa/3H	*	*	*	*			*
AI_PTC	5	Charact of Pr. Tend.	Table	*	*	*				*
AI_PTS	16	Sign of pressure tendency	/							*
AI_PV	50	Air Press Variation	hPa/3H	*	*	*	*			*
AI_SLP	32	Sea Level Pressure	hPa	*	*	*				*
AI_T	2	Air Temperature	C	*	*	*	*	*	*	*
AI_TD	30	Air Dew Point	C	*	*	*			*	*
AI_TN06	39	Air Temp (Min.) in 6 hrs	C		*	*				*
AI_TN12	38	Air Temp (Min.) in 12 hrs	C		*	*				*
AI_TN24	37	Air Temp (Min.) in 24 hrs	C		*	*			*	*
AI_TX06	42	Air Temp (Max.) in 6 hrs	C		*	*				*
AI_TX12	41	Air Temp (Max.) in 12 hrs	C		*	*				*
AI_TX24	40	Air Temp (Max.) in 24 hrs	C		*	*			*	*
ALTITUDE	57	Altitude of station	m							*
CU_DI, l<0	11	Current direction	Deg	*				*		*
CU_DI, l=0	11	Surface Current Dir.	Deg	*			*	*		*
CU_SP, l<0	10	Current Speed	cm/s	*				*		*
CU_SP, l=0	10	Surface Current Speed	cm/s	*			*	*		*
DEFAULT	1000	Default type of sensor	/							*
DEPTH	100001	Depth of probe	m	*			*	*		*
DISCHARGE	44	Discharge hydro sta.	dm^3/s						*	*
HK#1	12	Housekeeping Param.	Free	*						*
HK#2	13	Housekeeping Param.	Free	*						*
HK#3	14	Housekeeping Param.	Free	*						*
H_VISI	34	Horizontal Visibility	m		*	*				*
ICE_THICK	48	Ice Thickness	cm						*	*
INT_T	100000	Internal platform temp.	C							*
LATITUDE	58	Latitude of station	Deg.	*		*	*	*		*
LONGITUDE	59	Longitude of station	Deg.	*		*	*	*		*
NB_TMP	17	Number of temperatures	/							*
PF_POINTS	90	Required nb. of points	/	*			*	*		*
PRECIP01	21	Precipitations in 1 hr.	mm		*	*			*	*
PRECIP02	22	Precip. in 2 hours	mm		*	*			*	*
PRECIP03	23	Precip. in 3 hours	mm		*	*			*	*
PRECIP06	24	Precip. in 6 hours	mm		*	*			*	*
PRECIP09	25	Precip. in 9 hours	mm		*	*				*
PRECIP12	26	Precip. in 12 hours	mm		*	*			*	*
PRECIP15	27	Precip. in 15 hours	mm		*	*				*
PRECIP18	28	Precip. in 18 hours	mm		*	*				*
PRECIP24	29	Precip. in 24 hours	mm		*	*			*	*
SNOW_DEPTH	45	Depth of Snow Layer	cm		*					*
SNOW_ICE	49	Layer of snow on ice depth	cm						*	*
SNOW_WAT24	47	Snow in 24h Wat Equiv	mm						*	*
SNOW_WATER	46	Snow Layer Wat Equiv	mm						*	*
STAGE	43	Stage hydro. station.	cm						*	*
TIDE_GAUGE		Sea Level	m							*
WA_HT	8	Wave height	m	*	*	*				*
WA_PE	7	Wave period	s	*	*	*				*
WIWA_HT	36	Wind wave height	m		*	*				*
WIWA_PE	35	Wind wave period	s		*	*				*
WI_DI	15	Wind direction	Deg	*	*	*	*	*		*
WI_GU	56	Wind gust at the obs.	m/s		*	*				*
WI_GU01	51	Wind gust in prev. hour	m/s		*	*				*
WI_GU03	52	Wind gust in prev. 3 hours	m/s		*	*				*
WI_SP	1	Wind Speed	m/s	*	*	*	*	*		*
WT_SA, l<0	9	Water Salinity	psu	*				*		*
WT_SA, l=0	9	Mixed Layer Salinity	psu	*				*		*
WT_T, l<0	6	Water Temperature (probe)	C	*			*	*		*
WT_T, l=0	6	SST (hull contact)	C	*	*	*	*	*	*	*
WT_T_BUCK	54	Water temp. (bucket)	C		*	*				*
WT_T_INTK	53	Water temp. (intake)	C		*	*				*
WT_T_OTHER	55	Water temp. other than T,T-INTK,T-BUCK	C	*	*				*	

_SE#01	65537	Sensor number 1	/	*

Comments on Table 1

1: "l=0" means measurement at sea surface, and "l<0" means measurement below surface.

2: If an Air Pressure Tendency (AI_PT, always positive) sensor is used, it should be in conjunction with a Characteristic of Pressure Tendency (AI_PTC) sensor (see group **appp** in Annex C.1, C.2, and C.3). If no Characteristic of Pressure Tendency sensor is used, then an Air Pressure Variation Sensor (AI_PV) should be used instead (positive or negative).

3: BUOY code replaced DRIFTER in November 1994. BUFR is not available at the time of writing (June 2000).

5.7 - Reporting observation time

Most measurements are averaged over a few minutes, just before being encoded into the Argos message, then sent to the satellite every 90 seconds or so until another set of averaged data is available. The default observation time, also sometimes called measurement time, is when the satellite collects the message (satellite time). However the GTS sub-system also offers other options, described below.

The Argos GTS sub-system computes the observation time for each sensor according to the algorithm below (terms described in § 5.7.1 to 5.7.15). Different sensors can be initialized differently:

```
If WAAP_Correction Then
  If [Timer Val1] Modulo WAAP_MODULO = 0 Then
    Time is not valid
    [UTC Time]:= NIL
    Exit
  Else
    If WAAP_TEST_VALUE<>0 Then
      If [Timer Val1] < WAAP_TEST_VALUE Then
        [Computed Time]:= [Timer Val1]*[N] + WAAP_OFFSET*60
      Else
        [Computed Time]:= [Timer Val1]*[N]
      Endif
    Else
      [Computed Time]:= ([Timer Val1] Modulo WAAP_MODULO)*[N]
    Endif
  Endif
Else
  If timer in the form of Date/Time then
    [Computed Time]:= [Date/Time Value]
  Else
    [Computed Time]:= [Timer Val1]*[N] + [Timer Val2]*[M]
  Endif
Endif

[UTC Time]:= [Reference Time] + [A]*[Computed Time]

If [Special Correction]="Offset After Correction" Then
  If [UTC Time]>[Data collection time] Then
    [UTC Time]:= [UTC Time] - [Reference Period]
  Endif
Endif

[UTC Time]:= [UTC Time] + [Offset]

If [Special Correction]="Offset Before Correction" Then
  If [UTC Time]>[Data collection time] Then
    [UTC Time]:= [UTC Time] - [Reference Period]
  Endif
Endif
```

If you wish, [UTC Time] can then be rounded to the nearest hour, minute or second, etc. according to the following code:

Code	Rounding times to the nearest
0	Not rounded
1	Second
2	Minute
3	Hour
4	3 hours
5	30 minutes
6	15 minutes
7	10 minutes
8	5 minutes

5.7.1 - [UTC Time]

The final observation time sent onto the GTS.

5.7.2 - [Special Correction]

Values can be:

"N"	No Special Correction
"A"	Offset After Correction
"B"	Offset Before Correction

5.7.3 - [Data collection time]

Time at which platform sends Argos message to satellite.

5.7.4 - [Reference Time]

Baseline for assigning a time to your observations. Each sensor can have a different reference time, as defined using one of the following codes:

Algorithm	Reference Time	Example	
		Data collection time	Reference time
0	Specific date submitted by PI		
1	Jan. 1 of current year (year in which data was collected)	08:57:03 on Aug. 12, 2001	00:00:00 on Jan.1, 2001
2	First day in current month (month in which data was collected)	08:57:03 on Aug. 12, 2001	00:00:00 on Aug.1, 2001
3	Exact data collection time	08:57:03 on Aug. 12, 2001	08:57:03 on Aug.12, 2001
4	Data collection time rounded to hour immediately below	08:57:03 on Aug. 12, 2001	08:00:00 on Aug.12, 2001
5	Data collection time rounded to closest hour	08:57:03 on Aug. 12, 2001	09:00:00 on Aug.12, 2001
6	Data collection time rounded to synoptic time (00:00:00, 03:00:00, 06:00:00, etc.) immediately below	08:57:03 on Aug. 12, 2001	06:00:00 on Aug.12, 2001
7	Data collection time rounded to closest synoptic hour	08:57:03 on Aug. 12, 2001	09:00:00 on Aug.12, 2001
8	00:00:00 UTC on data collection day	08:57:03 on Aug. 12, 2001	00:00:00 on Aug.12, 2001
9	00:00 solar time on data collection day, i.e. depends on platform longitude: e.g. 90° East e.g. 90° West e.g. 165° East	14:09:43 on Aug. 12 2001	18:00:00 on Aug. 11, 2001 06:00:00 on Aug. 12, 2001 11:00:00 on Aug. 12, 2001
10	00:00 UTC or 12:00 on data collection day (immediately prior to data collection)	18:57:03 on Aug. 12, 2001	12:00:00 on Aug. 12, 2001
11	Time of last message in satellite pass that collected the message	08:57:03 on Aug. 12, 2001	09:12:27 on Aug. 12, 2001 (satellite pass time)
12	Multiple of N minutes preceding data collection time. PI provides. E.g. n=20:	08:57:03 on Aug. 12, 2001	08:40:00 on Aug. 12, 2001
13	No reference time if a Time sensor provides it.		
14	Uses as observation time a previous observation time when one exists for the same platform in the period [satellite pass time - N minutes] to [Satellite pass]. If such a time was not found then [satellite pass] time is used as observation time. Value of N is given by the user for every sensor.	08:57:03 on Aug. 12, 2001	02:12:22 on Aug. 12, 2001 (because this obs. Time was found in database in the last 12 hours (e.g. N=720))

5.7.5 - [Reference Period]

[Reference Period] depends upon [Reference Time] as follows:

Code	[Reference Period]
4:	1 hour
6:	3 hours
8:	24 hours
9:	24 hours
10:	12 hours
12:	N minutes as defined by PI for [Reference Time]
other:	0.

5.7.6 - Coefficient [A]

Define [A] (+1 or -1) for the associated "Time sensor", if any.

5.7.7 - [Offset]

Constant, in minutes. Each sensor on each platform can have a different offset, in accordance with your requirements.

5.7.8 - [Computed Time]

Value of "Time sensor", if any. If there is no "Time sensor" [Computed Time] is forced to 0. Time sensors can be dedicated to any sensor on any platform.

[Computed Time] can be coded into the Argos message as [Date] and/or [Time] word(s). [Date] and [Time] words can be encoded in the following binary formats provided that all elements of a given date and/or time have the same binary format:

- Pure binary
- Two's complement binary
- Signed binary
- BCD

Each binary word can be binary permuted. See paragraph 5.2 for details regarding binary formats.

[Date] and/or [Time] word(s) can be defined as follows:

(1) Define [Date] by either of the following options:

- **Julian day**
- **Year** or **Year in Millennium** or **Year in Century** or **Year in Decade** and either
  - **Calendar day in year** or
  - **Month and Day in month**

(2) Define [Time] by either of the following options:

- **Number of N-second periods** (please provide N). Time is coded as P_1 x N
- **Number of N-second periods plus number of M-second periods** (provide N and M) Time is coded as (P_1 x N) + (P_2 x M)
- **Hour, Minutes** and **Seconds**
- **Hour** and **Minutes**
- **Hour**

Note: with the WAAP algorithm, introduced for NOAA's National Data Buoy Center WAAP type buoys, only timers in the form of **Number of N-second periods** are used for [Computed Time].

5.7.9 - [Date/Time Value]

Value of time sensor expressed as Date and/or Time. You must provide values of the bit positions and number of bits for the Date and/or Time components in the Argos message.

5.7.10 - [Timer Val1]

Raw value of timer expressed as **Number of N-second periods**. You must provide the value of **[N]** and the bit positions and number of bits for the timer value in the Argos message.

5.7.11 - [Timer Val2]

Raw value of second timer (i.e. **Number of M-second periods**) when an N-second and M-second period are used. You must provide the value of **[N]** and **[M]** and the bit positions and number of bits for the timer values in the Argos message.

5.7.12 - WAAP_correction

'Y' or 'N'. Says whether WAAP algorithm should be used or not. Defined in conjunction with the time sensor.

5.7.13 - WAAP_modulo

Modulo value defined in conjunction with time sensor if WAAP algorithm is used.

5.7.14 - WAAP_test value

Test value defined in conjunction with time sensor if WAAP algorithm is used.

5.7.15 - WAAP_offset

Offset value defined in conjunction with time sensor if WAAP algorithm is used.

5.8 - Message multiplexing

If you have too much data for a single 256-bit Argos message, you can spread observations across several messages, i.e. multiplex the data.

The multiplexing method you use must be compatible with the standard method used for the GTS sub-system. This is based on the method used by ATLAS TOGA-TAO Array moored buoys in the equatorial Pacific Ocean.

The different Argos messages can be coded using different formats. For example a platform could transmit surface data using format #1, then sub-surface data using format #2, etc. However, the data from messages in different formats and the information needed to identify the format must be independent of other messages.

Consider a set of Argos messages during a given satellite pass. As a first step, for each compressed Argos message, the system tries to identify the message format from the list you defined for that platform. Once it identifies the format, it processes the messages as if they were non-multiplexed. If it does not identify a format, it assumes a transmission error and flags this in the GTS database.

The message lengths may be different (e.g. format #1: 32 bits, format #2: 256 bits). They are assumed to be independent so that the data can be processed even if a transmission error occurs in another message, containing the same observation but in a different format.

For a given format define which of the following options you require to identify the format:

(1) $A*X + B*Y + C > 0$
(2) $A*X + B*Y + C = 0$
(3) $A*X + B*Y + C \# 0$

where:

X and Y are two summation values (logical bit-by-bit 'xor' summation or arithmetic '+' summation modulo M) of contiguous data words from the Argos message, e.g. N words of n bits starting from position P,

A, B, C are figures you provide:
C is an integer.
For arithmetic summation: A and B are integers.
For logical summation: A and B can only be 0, 1 or -1.

You must therefore provide:

- Number of different formats used for each platform (1 if messages are not multiplexed).

- For each format:

  - format number,
  - number of bits in platform message for that format,
  - how to recognize format: option (1), (2) or (3),
  - summation operator (logical 'xor' or arithmetic '+'),
  - modulo value (M) if arithmetic summation is used,
  - definition of X as a summation: state N, n and P,
  - definition of Y as a summation: state N, n and P,
  - values of A, B and C.

5.9 - Processing blocks (e.g. sub-surface floats)

Blocks are contiguous blocks of sensor values which are repeated in the Argos message. Although only 64 sensors can be defined for each PTT in the data-base of the GTS sub-system, using blocks it is possible to process more than 64 sensor values within an Argos message.

For example, depth (Z), temperature (T), and salinity (S) values can be repated in the Argos message to code a number of (Z,T,S) data points (i.e. a T/S profile). If all temperature sensors have the same declaration, except for the bits, blocks permit to only declare one T sensor in the GTS sub-system data base (technical files).

GTS sub-system can basically process 120 points of 4 sensors that way. Following rules apply:

- A block can contain up to 10 sensors knowing that memory allocated for blocks is allocated for 120 points of 4 sensors.
- A block only contains geo-phyical sensors (i.e. no timers, no checksums). If timers or checksums are used, they must be declared outside a block.
- A block can be defined as static (number of points is constant and must be provided) or dynamic (number of points is encoded in the Argos message). If block is dynamic, number of points can be encoded in the Argos message in Pure binary, two's complement, signed binary, or BCD (see paragraph 5.2)
- All sensor data from a block (plus block size, if any) belong to the same Argos message.
- Bit positions are given with reference to the first bit of the first data point of the block (other sensors refer to the first bit of Argos message). By convention, first bit of first data point of the block has position 0.

- A sensor within a block can have compensating sensors, outside or inside the block but not from another block. By convention, if compensating sensor is declared as "itself", then the value of the compensating sensor being considered when processing the data will be the value of the considered sensor when processing the previous data point. Otherwise, if compensating sensor is another sensor from the block, then the value considered will be the value of the considered sensor when processing the current data point.
- All sensors within a block must have an associated level sensor which can be "itself" (e.g. sensor Depth would have itself for level sensor).

6 - Location

When an observation is compted by the systrem, a location must be associated to it. Since buoys or stations are capable of recording observations onboard and later transmitting the data through the satellites, there is not necessarily a location available for a given time of observation. The system therefore looks for the closest (in time) location available in the data base for the considered platform and associates that location to the observation.

It is also possible to ask the system to find two close locations and to make an interpolation (or extrapolation) in order to have an estimated location at the exact time of observations. This method is only effective for platforms with relatively straight trajectories such as ships.

Certains platforms are equipped with GPS receivers. GTS sub-system can decode latitudes, longitudes, time of location and use this information for the location.

For buoys, Argos location class is encoded in BUOY reports.

7 - Quality control

The GTS sub-system does automatic Quality Control to prevent bad data going onto the GTS. You can select different tests for different platforms or sensors. They are listed below.

7.1 - Tests made for the whole observation

These tests are defined at the platform level.

7.1.1 – Location index

Location index (values 0 to 4 in GTS sub-system) must be greater or equal to a minimal value to be provided by the platform operator for the location to be accepted.

7.1.2 – Multiplexing error

This test rejects data when no of the defined format has been recognized (see paragraph 5.8).

7.1.3 – Lan/Sea test

This test was introduced for the Argo programme initially. Checks whether the platform is at sea using a 1°x1° resolution file. If station is on land then observation is rejected. This test only works for marine observing stations.

7.1.4 – Not used

This test is not defined yet and is reserved for future use.

7.1.5 – Not used

This test is not defined yet and is reserved for future use.

7.1.6 – Temperature and/or Salinity profile Spike test

This test was introduced for the Argo programme initially. Test rejects a data point (Depth, Temp., Sal.) in case a value departs too much from nearby points after the profile was sorted out by decreasing depth (i.e. towards surface). Test is only applied to WT_T and WT_SA types of sensor.

For a temperature value T2, result is bad if:

- For pressure < 500db
  $|T2–(T3+T1)/2| - |(T3-T1)/2| > 6.0$ Celsius.
- For pressure >= 500db
  $|T2–(T3+T1)/2| - |(T3-T1)/2| > 2.0$ Celsius.

For a salinity value S2, result is bad if :

- For pressure < 500db
  $|S2–(S3+S1)/2| - |(S3-S1)/2| > 0.9$ PSU.
- For pressure >= 500db
  $|S2–(S3+S1)/2| - |(S3-S1)/2| > 0.3$ PSU.

In case either temperature and salinity sensor values are rejected then whole data point (Depth, Temp., Sal.) is rejected.

The first and the last data point from the profile do not go through this test.

7.1.7 – Temperature and/or Salinity profile Gradient test

This test was introduced for the Argo programme initially.
Result is bad in case temperature or salinity gradient is too high once the profile is sorted out by decreasing values of depth (i.e. towards sea surface). This test is made only for WT_T and WT_SA types of sensor.

For a temperature value T2, result is bad if:

- For pressure < 500db

|T2–(T3+T1)/2| > 9.0 Celsius.

- For pressure >= 500db
  |T2–(T3+T1)/2| > 3.0 Celsius.

For a salinity value S2, result is bad if :

- For pressure < 500db
  |S2–(S3+S1)/2| > 1.5 PSU.
- For pressure >= 500db
  |S2–(S3+S1)/2| > 0.5 PSU.

In case either temperature and salinity sensor values are rejected then whole data point (Depth, Temp., Sal.) is rejected.

The first and the last data point from the profile do not go through this test.

7.1.8 – Temperature and/or Salinity profile Stuck value test

This test was introduced for the Argo programme initially.
Result is bad in case all values for the same type of sensor are identical along the profile. Test is only applied to WT_T and WT_SA types of sensor.

In case either temperature and salinity sensor values are rejected then whole data point (Depth, Temp., Sal.) is rejected.

7.1.9 – Temperature and/or Salinity profile Density test

This test was introduced for the Argo programme initially.
Test result is bad in case water density decreases when depth increases. In order to compute test result, potential temperature and density anomaly must be computed first for all profile data points after the points have been sorted out by decreasing depth (i.e. towards sea surface). Test is only applied to WT_T and WT_SA types of sensor.

All profile data points (Depth, Temp., Sal.) are rejected in case this test fails. First and last data points do not go through this test.

7.1.10 – Computation of salinity based upon conductivity, temperature, and depth

This test was introduced for the TAO moored buoy array. It computes salinity based upon water conductivity (C), temperature (T), and depth (D) values as computed by the system according to technical file definition. A dedicated sub-programme (UNESCO formula SAL78, http://ioc.unesco.org/oceanteacher/resourcekit/M3/Classroom/Tutorials/Processin

g/CTDDataProcess.htm) uses computed values of C, T, and D, to compute salinity prior to GTS encoding and distribution.

7.2 – Tests made for each individual sensor

These tests are defined at the sensor level.

7.2.1 - Gross Error Check

For each kind of geophysical variable, sensor data are compared with constant limits. Out-of-range data are not sent onto the GTS. Note that limit values are considered as valid.

7.2.2 - User Limit check

Each sensor measurement is compared with limits you provide. Each sensor can have its own limits. Out-of-range data are not sent onto the GTS. Note that limit values are considered as valid.

7.2.3 - Compression Index, Checksum

Sensor data for which the Compression Index by Sensor (CIS) is lower than a minimum acceptable value (entered for each individual platform sensor, usually 2) are automatically rejected from GTS distribution, unless a checksum sensor returns 'OK'.

7.2.3.1 - Compression index

Compression means grouping identical values from a given satellite pass and platform.

7.2.3.1.1 - Compression by message

Identical Argos messages from a given satellite pass and platform are grouped together. The number of identical Argos messages received during the same satellite pass is called the Compression Index by Message (CIM). You can choose between the following options:

(1) Keep the message with the highest compression index. CIS as described in § 7.3.1.2 is forced to the value of CIM.

or

(2) Keep all the messages so that full sensor compression can be applied (see § 7.3.1.2).

7.2.3.1.2 - Compression by sensor

Identical sensor measurements from all messages collected in a given satellite pass from the same platform are grouped together, provided the sensor is in the same position in the Argos message, the sensor level is the same, and the computed observation time the same. The number of identical sensor measurements is called the Compression Index by Sensor (CIS). The sensor measurements with the highest CIS are stored and sent onto the GTS.

7.2.3.2 - Checksums

Checksum "sensors" validate the transmission link between the platform, the satellite and the ground station. A bad checksum usually indicates that one or more bits in a string of contiguous bits from the Argos message is bad.

The platform computes the sum of some of the words in the message and encodes it into the message. When the GTS sub-system receives and processes the messages, it recalculates the sum and compares it with the sum in the platform message. If the sums don't match, the part of the message in which the sum was computed is rejected: there were apparently one or more bit errors during transmission. The system does not send the data onto the GTS.

Note: If the checksum is unavailable or if the platform's message format does not provide one, the GTS sub-system only sends the data onto the GTS if it receives at least two identical messages.

The PTT message contains the value (MC) of a checksum computed on-board, and then recalculated by the system (CC) for comparison. In order to be considered as correct, a checksum from the message must agree with the following formula:

Classical checksum: (K1*CC + K2*MC + K3) modulo M = 0
CC ("Computed Checksum") is the summation of contiguous data words of the same length.

Hamming codes: (CC + K1*MC + K3) modulo M = 0
CC ("Computed Checksum") is computed according to Hamming algorithm which uses a constant polynom value.
K2 is the number of zero bits to add at the end of the bit stream before starting computation.

Webb checksum: (K1*CC + K2*MC + K3) modulo M = 0

CC ("Computed Checksum")is computed according to Webb algorithm which uses a constant polynom value.

Where:

CC is "Computed Checksum" (computed by system),

MC is "Message Checksum" (computed by platform and encoded into message),

K1, K2 and K3 are constants,

M is a constant modulo value.

Summation can be either an arithmetic "+" or a logical "xor" exclusive or "bit by bit" summation (i.e. parity, in which case no Modulo operation is done). It means N contiguous data words of n bits starting at position P in the Argos message.

Information to provide:

- name of algorithm to use (Default, Hamming, Webb)
- summation operator (logical 'xor' or arithmetic '+'),
- Modulo value (M) if arithmetic summation is used (convention: if M=0 then no Modulo operation is done),
- definition of MC as a data word from the Argos message, i.e. first bit position and number of bits,
- definition of CC as a summation of data words from the Argos message (i.e. values of N, n and P),
- values of integer constants K1, K2 and K3.
- Value of the polynom, a 32 bit number which value is provided in hexadecimal.

7.2.4 - Level rejected by QC

If a level sensor (stating the depth at which a main sensor makes measurements) is is rejected by QC, then the main sensor is also rejected.

7.2.5 - All bits identical test

If requested, data can be automatically removed from GTS distribution if all the bits in the sensor word are ones or zeros.

7.2.6 - Sensor blockage test

If the reported sensor data are always identical during a user-definable period or number of identical values, then data will be automatically removed from GTS distribution.

7.2.7 - Bad associated compensating sensor

Main sensor value is rejected if the compensation sensor (or 2nd compensating sensor) was rejected by the QC tests.

7.2.8 - Same value transmitted X minutes before

Sensor value (measured at H) is rejected if the same sensor value observed at H minus X minutes has already be distributed on GTS. Value of X is given by the user for each sensor. X corresponds to the value of [Reference period] as detailed in paragrpah 5.7.5.

7.2.9 – Climatological test

This test was introduced for the Argo programme initially.
Test is only applied to WT_T and WT_SA types of sensor.

Test result is bad in case sensor value is out of climatological limits. Limits are obtained from a climatological file (1° resolution) which provides minimum and maximum values for the platform location. Sensor level (or depth) is not taken into account at this point.

In case either temperature and salinity sensor values are rejected then whole data point (Depth, Temp., Sal.) is rejected.

7.2.10 - Managing duplicate times of observation

Because of the nature of the Argos system and the way data are processed, GTS sub-system can produce duplicates, and quasi duplicates (very close observation times). To deal with this problem, several solutions are offered:

- Rounding times of observation (See paragraph 5.7)
- Setting a duplicate tolerance, a number of seconds. If two observations for one PTT are within indicated value for "duplicate tolerance", then only the first processed observation is distributed on GTS. By default, duplicate tolerance is set to zero which means that all observations are accepted.

8 - GTS distribution

8.1 -Deferred GTS distribution

System is capable of deferred GTS distribution. By default, GTS reports are sent immediately. Deferred time GTS distribution can be useful when:

- User can easily accepts additional delays (e.g. sub-surface oceanographic data)
- All neccessary information to compile an observation is obtained through several satellite passes.

Deferred distribution for profile data:

A specific algorithm was developped to make profile data more timely: profile data can include large number of data points within a profile (e.g. about 200 for an Argo profiling float profile) which require encoding in several Argos messages for the satellite data transmission. Hence when a satellite pass is being processed, not all the points of the profile might have been received preventing the corresponding observation from being transmitted on GTS as it is incomplete. This obliges to delay GTS distribution until sufficient number of points is received and validated for GTS distribution. The acceptable number of points for the profile is a variable that can be defined (i) at the platform level (i.e. a constant), or (ii) dynamically as a sensor of type “PF_POINTS”. GTS distribution happens as soon as the actual profile number of points exceeds or equals either of these two numbers. In case the expected number of points is never achieved, then GTS distribution happens anyway after a given maximum delay which is defined at the platform level.

8.2- GTS Bulletins

Validated sensor data from platforms and satellite passes are grouped if their observation times are identical. The WMO Identification Number, Location, Time of Observation, and sensor data set is called an "observation". An observation coded into a GTS code form is called a GTS Report.

Observations are sent onto the GTS using requested GTS code forms on the following basis:

Recommended:

One observation ==> One GTS message if only one GTS code is requested,

or as follows (not recommended):

One observation ==> As many GTS messages as GTS codes requested (e.g. BATHY and SHIP).

or as follows (not recommended):

One observation ==> For each geophysical variable, as many GTS messages as GTS codes requested (e.g. Air Pressure distributed in SHIP format, Sub-Surface Temperatures distributed in BATHY and TESAC).

GTS Reports are grouped according to whether their GTS code forms are identical and, depending on the GTS code form, additional criteria such as identical observation time and area of deployment. A set of grouped GTS Reports using a single GTS code form is called a GTS bulletin. Bulletins are distributed onto the GTS.

Table 2: **A_1A_2** for GTS bulletin Headers of SYNOP and HYDRA reports (from Table C1, Part II of WMO Manual on the Global Telecommunication System, Volume I, Global Aspects, WMO No 386):

Table 2, part I: Countries or territories

AB Albania	AG Argentina	AH Afghanistan
AI Ascension Island	AK Alaska	AL Algeria
AN Angola	AT Antigua, St. Kitts and other British islands in the vicinity	
AU Australia	AZ Azores	BA Bahamas
BC Botswana	BD Brunei Darussalam	BE Bermuda
BH Belize	BI Burundi	BJ Benin
BK Banks Islands	BM Myanmar	BN Barhain
BO Bolivia	BQ Baltic Sea Area	BR Barbados
BU Bulgaria	BV Bouvet Island	BW Bangladesh
BX Belgium, Luxembourg	BY Belarus	BZ Brazil
CA Caribbean area and Central America		CD Chad
CE Central African Republic	CG Congo	CH Chile
CI China	CM Cameroon	CN Canada
CO Colombia	CR Spain (Canary Islands)	CS Costa Rica
CT Canton Island	CU Cuba	CV Cape Vert
CY Cyprus	CZ Czechoslovakia	DJ Djibouti
DL Germany	DN Denmark	DO Dominica
DR Dominican Republic	EG Egypt	EQ Ecuador
ER United Arab Emirates	ES El Salvador	ET Ethiopia
FA Faeroes	FG French Guiana	FI Finland
FJ Fiji	FK Falklands (Malvinas)	FP St. Pierre et Miquelon
FR France	FW Wallis and Futuna Islands	
GB Gambia	GC Cayman Islands	GD Grenada
GE Gough Island	GH Ghana	GI Gibraltar
GL Greenland	GM Guam	GN Guinea
GO Gabon	GQ Equatorial Guinea	GR Greece
GU Guatemala	GW Guinea-Bissau	GY Guyana
HA Haiti	HE St. Helena	HK Hong Kong
HO Honduras	HU Hungary	HV Burkina Faso
HW Hawaiian Islands	IC Comoros	ID Indonesia
IE Ireland	IL Iceland	IN India
IQ Iraq	IR Iran, Islamic Republic of	IS Israel
IV Cote d'Ivoire	IY Italy	JD Jordan
JM Jamaica	JP Japan	KA Caroline Islands
KB Kiribati	KI Christmas Island	KK Cocos Islands
KN Kenya	KO Korea, Republic of	KP Cambodia
KR Democratic People's Republic of Korea		KU Cook Islands
KW Kuwait	LA Lao People's Democratic Republic	
LB Lebanon	LC Saint Lucia	LI Liberia
LN southern Line Islands	LS Lesotho	LU Aleutian Islands
LY Libyan Arab Jamahiriya	MA Mauritius	MB Marion Island
MC Morocco	MD Madeira	
MF Saint-Martin, Saint-Bartholomew, Guadeloupe and other French islands in the vicinity		

MG Madagascar	MH Marshall Islands	MI Mali
MK Macquarie Island	ML Malta	
MN St. Maarten, St. Eustasius and Saba		MO Mongolia
MR Martinique	MS Malaysia	MT Mauritania
MU Macao	MV Maldives	MW Malawi
MX Mexico	MY Mariana Islands	MZ Mozambique
NC New Caledonia	NF Norfolk Island	NG Papua New Guinea
NI Nigeria	NK Nicaragua	NL Netherlands
NM Namibia	NO Norway	NP Nepal
NR Niger	NU Netherlands Antilles (Aruba, Bonaire, Curacao)	
NV Vanuatu	NW Nauru	
NZ New Zealand	OM Oman	OR South Orkney Islands
OS Austria	PF French Polynesia	PH Philippines
PI Phoenix Islands	PK Pakistan	PL Poland
PM Panama	PO Portugal	PR Peru
PT Pitcairn Island	PU Puerto Rico	PY Paraguay
QT Qatar	RA Russian Federation (Asia)	
RE Reunion and associated islands		RO Romania
RS Russian Federation (Europe)		RW Rwanda
SB Sri Lanka	SC Seychelles	SD Saudi Arabia
SG Senegal	SI Somalia	SK Sarawak
SL Sierra Leone	SM Suriname	SN Sweden
SO Solomon Islands	SP Spain	SR Singapore
SU Sudan	SV Swaziland	SW Switzerland
SX Santa Cruz Islands	SY Syrian Arab Republic	SZ Spitzbergen
TC Tristan da Cunha	TD Trinidad and Tobago	TG Togo
TH Thailand	TI Turk Islands	TK Tokelau Islands
TM Timor	TN Tanzania, United Republic of	
TO Tonga	TP Sao Tome and Principe	TS Tunisia
TU Turkey	TV Tuvalu	UG Uganda
UK United Kingdom of Great Britain and Northern Ireland		UR Ukrain
US United States of America	UY Uruguay	VI Virgin Islands
VN Venezuela	VS Viet Nam	WK Wake Island
YE Yemen	YG Yugoslavia	ZA South Africa
ZB Zambia	ZM Western Samoa	ZR Zaire
ZW Zimbabwe		

Table 2, part II: Vast areas such as continents, hemispheres

AA Antarctic	AC Arctic	AE South-East Asia
AF Africa	AM Central Africa	AO West Africa
AP Southern Africa	AR Arabian Sea area	AS Asia
AW Near East	EA East Africa	EC East China Sea area
EE Eastern Europe	EM Middle Europe	EN Northern Europe
EU Europe	EW Western Europe	FE Far East
GA Gulf of Alaska area	GX Gulf of Mexico area	IO Indian Ocean Area
ME Eastern Mediterranean area		MM Mediterranean area

MP Central Mediterranean area		MQ Western Mediterranean
NA North America	NT North Atlantic area	OC Oceania
OH Sea of Okhotsk	PA Pacific area	PE Persian Gulf area
PN North Pacific area	PQ Western North Pacific	PS South Pacific area
PW Western Pacific area	PZ Eastern Pacific area	SA South America
SE Southern Ocean area	SJ Sea of Japan area	SS South China Sea area
ST South Atlantic area	XE Eastern Hemisphere	XN Northern Hemisphere
XS Southern Hemisphere	XT Tropical belt	XW Western hemisphere
XX for use when other designators are not appropriate		

8.3 - GTS bulletin headers

8.3.1 - General form

GTS bulletins are identified by headers to make sure they reach the right operational centres as detailed below. The general form for a GTS bulletin header is:

$T_1T_2A_1A_2$ii CCCC YYGGgg [RR_x]

Where:

T_1T_2	Data Type Designator,
A_1A_2	Geographical Designator,
ii	Level or Deployment area,
CCCC	Originating Centre (LFPW=Toulouse, KARS=Largo),
YYGGgg	Time of bulletin: Day in the month (YY), Hour (GG) and Minutes (gg),
RR_x	For Delayed Routine Meteorological Reports (optional).

The system automatically initiazes part of the bulletin header, i.e.
CCCC YYGGgg [RR_x] for all types of reports plus :

-T_1T_2 for BATHY, HYDRA, SHIP, SYNOP, TESAC reports

- $T_1T_2A_1A_2$ for BUOY reports

8.3.2 - Information you need to provide

BUOY and BUFR Reports (containing buoy data):

ii, depending on upon the Argos Processing Centre (Toulouse or Largo) and the deployment area. See tables 3 and 4 below:

Table 3: Data distributed from the US Argos Global Processing Centre, Largo, USA

Bull. header (BUOY) TTAAii CCCC	Bull. header (BUFR) TTAAii CCCC	Deployment area	Remark
SSVX02 KARS	IOZX02 KARS	GDP	New
SSVX04 KARS	IOZX 04 KARS	North Atlantic and EGOS	Same
SSVX06 KARS	IOZX 06 KARS	Northern Hemisphere	Same
SSVX08 KARS	IOZX 08 KARS	TAO, PIRATA	Was SSVX40 for TAO
SSVX10 KARS	IOZX 10 KARS	Southern Hemisphere	Same

		and ISABP	
SSVX12 KARS	IOZX 12 KARS	Arctic, Antarctic, sea ice	Arctic, Antarctic merged
SSVX14 KARS	IOZX 14 KARS	Indian Ocean and IBPIO	New
SSVX16 KARS	IOZX16 KARS	Navoceano	Same
SSVX18 KARS	IOZX 18 KARS	Pacific Ocean	New
SSVX20 KARS	IOZX 20 KARS	Navoceano	Same
SSVX22 KARS	IOZX 22 KARS	Mediterranean sea	New
SSVX42 KARS	IOZX 42 KARS	NOAA/NDBC, Southern Hemisphere	Was SSVX02
SSVX44 KARS	IOZX 44 KARS	NE Pacific Ocean (USA, and Canada)	Was SSVX18
SSVX48 KARS	IOZX 48 KARS	NOAA/NDBC, Northern Hemisphere	Was SSVX08
SSVX96 KARS	IOZX 96 KARS	NDBC	Same

Table 4: Data distributed from the French Argos Global Processing Centre, Toulouse, France

Bull. header (BUOY) TTAAii CCCC	Bull. header (BUFR) TTAAII CCCC	Deployment area	Remark
SSVX01 LFPW	IOZX01 LFPW	North Atlantic and EGOS	Same
SSVX03 LFPW	IOZX 03 LFPW	Southern Hemisphere and ISABP	Same
SSVX05 LFPW	IOZX 05 LFPW	Northern Hemisphere	Same
SSVX07 LFPW	IOZX 07 LFPW	Arctic, Antarctic, and sea ice	Arctic, Antarctic merged
SSVX09 LFPW	IOZX 09 LFPW	Indian Ocean and IBPIO	New
SSVX11 LFPW	IOZX 11 LFPW	TRITON	New
SSVX13 LFPW	IOZX 13 LFPW	GDP	New
SSVX15 LFPW	IOZX 15 LFPW	Pacific	New
SSVX21 LFPW	IOZX 21 LFPW	Mediterranean Sea	New
SSVX39 LFPW	IOZX 39 LFPW	French West Indies	Was SSVX19

SYNOP, HYDRA Reports:

A_1A_2, depending upon station deployment position
Refer to table 2.

ii, coded from 01 to 19, means these values are normally distributed to all weather centres worldwide.

SHIP, BATHY, TESAC Reports:

A_1A_2 depends upon the type of station and the geographical area where the platform is reporting from:

A_1: W for Ocean Weather Stations
V for Mobile Ships and other Marine Stations

A_2: A area between 30N-60S, 35W-70E
B area between 90N-05N, 70E-180E
C area between 05N-60S, 120W-35W
D area between 90N-05N, 180W-35W
E area between 05N-60S, 70E-120W
F area between 90N-30N, 35W-70E
J area south of 60S
X more than one area

ii, generally coded from 01 to 19, means these values are normally distributed to all weather centres worldwide.

BUFR reports (not distributed yet).

9 - Direct distribution to Argos users

In addition to GTS distribution of the data, the Argos GTS sub-system is capable of distributing processed data directly to the Argos users. This can be done either only to an Argos user or both to an Argos user and to the GTS. This distribution mode can be useful for principal investogators to check that the data are being correctly decoded, processed and QC'ed by the system before effectively asking for GTS distribution of the data.

Data can be received by the users either in GTS format or in two specific formats called STD and SIMPLE.

9.1 -STD format

Each observation is coded as following (coded fields indicated in bold below are separated by commas):

STD,Argos_ID,WMO,YYYYMMDDHHmm,
Latitude,Longitude,YYYYMMDDHHmm,QCLoc,Nb_Sensor
Repeat Nb_Sensor times
    If Option=1 then
        Sensor_name,Level,Sensor_value
    Sinon
        Sensor_type,Level,Sensor_value
    Finsi

With:

Field	Coding
STD	3 characters coded "STD"
Argos_ID	5 characters, Argos number
WMO	7 characters, WMO number (first 7 digits)
YYYYMMDDHHm	12 characters, observation date & time
Latitude	8 characters, F8.4, Latitude
Longitude	9 characters, F9.4, Longitude
YYYYMMDDHHm	12 characters, date de la localisation
QCLoc	2 characters, Localization class
Nb_Sensor	2 characters, number of sensor values to follow for the observation
Sensor_name	6 characters, sensor name as declared in the system (first 6 characters, e.g. SEATEMP)
Sensor_type	6 characters, sensor type (first 6 characters, e.g. WT_T)
Level	5 characters, probe level in meters (<0 for probes below sea surface)

Sensor_value	8 characters, F8.3, sensor value

Example:

Option 1 (sensor names):

```
STD,17193,XBTTEST,199909300500, 40.0000,  20.0000,19990930052955,03, 4
BUOY_N,    0,   6.000
WINDIR,    0, 170.385
WINDSP,    0,   2.000
AIRTEM,    0,  29.100
```

Option 2 (sensor types):

```
STD,20392,52083  ,200109192100,  7.9910, 156.0068,200109191826,03,18
AI_T  ,    0,  29.200
AI_P  ,    0,1009.500
AI_HUM,    0,  69.200
WT_T  ,    0,  29.820
WI_DI ,    0, 158.000
WI_SP ,    0,   1.000
WT_T  ,   -2,  29.820
WT_T  ,  -25,  29.750
WT_T  ,  -50,  29.050
WT_T  ,  -75,  27.750
WT_T  , -100,  25.240
WT_T  , -125,  23.330
WT_T  , -150,  18.020
WT_T  , -200,  13.480
WT_T  , -250,  10.600
WT_T  , -300,   9.700
WT_T  , -500,   7.770
WT_T  , -750,   5.760
AI_T  ,    0,  29.100
```

9.2 -SIMPLE format

Each observation is coded as following (coded fields indicated in bold below are separated by commas, records can have varying length):

BEGIN
Argos_ID,WMO,YYYYMMDDHHmmss,Nb_Capt
Latitude,Longitude,YYYYMMDDHHmmss,QCLoc
Repeat Nb_sensor times:
Sensor_name,Sensor_type,Level,Sensor_value,QC_Flags
END

With:

Field	Coding
BEGIN	5 characters coded "BEGIN"
Argos_ID	5 characters, Argos number
WMO	5 to 7 characters, WMO number (first 7 digits)
YYYYMMDDHHmmss	14 characters, observation date & time
Latitude	8 characters, F8.4, Latitude
Longitude	9 characters, F9.4, Longitude
YYYYMMDDHHmmss	14 characters, date de la localisation
QCLoc	2 characters, Localization class
Nb_Sensor	2 characters, number of sensor values to follow for the observation
Sensor_name	16 characters, sensor name as declared in the system (e.g. SEATEMP)
Sensor_type	10 characters, sensor type (e.g. WT_T)
Level	8 characters, F8.1, probe level in meters (<0 for probes below sea surface)
Sensor_value	8 characters, F15.6, sensor value
QC_Flags	6 characters, QC flag results, 1 character for each QC test (0=OK, 1=not tested, 2:dubious, 3=bad). 6 flags coded here. See list of QC tests in paragraph 7.
END	3 characters coded "END"

Example:

```
BEGIN
17193,PTFM1,20001120110400,02
 40.0000,  20.0000,20001120105917,03
AIRTEMP          ,AI_T      ,     0.0,      14.261176,000110
ATMPRES          ,AI_P      ,     0.0,    1011.291373,000110
END
```

10 - Automatic modification of GTS technical file via email

Argos GTS users can access (read or write) technical files of GTS platforms via Email. The system reads received messages on an hourly basis,processes the messages and replies to the users

10.1 - Read Access

Technical file access request is done via Email according to the following rules:

- User provides the Argos User Office with Email address he will use to send messages.This address is inserted into a list updated by the Argos User Office. This list permits to check identity of the user and to send results back to him.
- User sends one message per platform for which he wants to read GTS TechnicalFile.
- Based upon what Argos centre the platform belongs to, the message is sent to an Internet address in SAI (Largo, USA) or CLS (Toulouse, France):
- Toulouse: gts_tf@diane.cls.fr
- Largo: gts_tf@argosinc.com
- Subject line follows the syntax below:
    - To get technical file in SHORT format:
      TF:READ; USER=UserName; PTT=Argos_ID
    - To get technical file in LONG format:
      TF:READ; USER=UserName; PTT=Argos_ID; FORMAT=LONG

As seen above, FORMAT keyword is optional. Its default value is SHORT (see examples of SHORT and LONG formats below).

Text of the message is free. It will not be processed by the system but will be archived.
The system recognises the UserName and the Internet origin of the message.It checks that the two match via the list of Email addresses maintainedby the User Office. If they don't the message is ignored and no error message is sent back to the originator (but one is sent to the Argos user). If they do match, Technical File data are read and returned to the user in less than 1 hour to the address given to theUser Office. If an error occures (e.g. syntax error in the subject line,or inexisting PTT numbers, or unauthorized access) then an error message is returned to the originator.

10.2 -Write access

Write access follows similar rules as above except for the following ones. Writing unit is still the platform. User sends a message per platform for which he wants to modify the GTS TechnicalFile.

Subject line follows the syntax below:

TF:WRITE;USER=UserName

Message text includes instructions for modification of a platform TechnicalFile according to the so called GTSMOD language (see description of language and example below for LONG format). Hence a user will be able to re-use a reading file (FORMAT=LONG), to modify it and to submit it via Email.
The system recognises the UserName and the Internet origin of the message.System checks email address as for the read option. If email addresses match, Technical File data are modified and confirmation returned to the user in less than 1 hour to the address given to the User Office. If an error occures (e.g. syntax error in theGTSMOD text submitted, or inexisting PTT numbers) then an error message is returned to the originator.
User must be aware that the operational system will not be able to take the modification into account before a delay of 1 minute to one hour.

10.2.1) GTSMOD:

The purpose of the GTSMOD facility is changing calibration coefficients and other platform status information automatically by submitting a file which follows GTSMOD syntax.

Input file contains description information of GTS platforms already existing in the GTS Sub-System and already properly defined (sensors, etc..). The basic advantages are:

(i) to implement calibration coefficients automatically in the system with no risk of typographical error, and,

(ii) to modify very quickly the values of fields which can change after the platform started reporting on GTS: change the WMO number, remove the platform or one of its sensor from GTS, change the limits or the coefficient values, etc...

Certain fields or operations (e.g. remove or add a sensor, change calibration type, ...) cannot be handled by GTSMOD interpreter and must therefore be done manually through the Argos Users' Guidance Office.

Syntax and other types of errors can happen, e.g.

- Non existing keyword or Syntax error,
- Inconsistent sequence of keywords,

- Reference to a non existing platform,
- Reference to a non existing sensor for the platform,
- Wrong calibration type,
- Inconsistent calibration coefficients,
- Wrong values for the fields,
- Etc...

10.2.2) GTSMOD Syntax (pseudo-language instructions)

The source file is supposed to include blocks of PTT description information (one block per PTT). A block is comprised of two or more instructions , the first instruction of a block must always be the keyword "PTT,Argos_Id" to indicate the platform number. Hence the first keyword of a file must be PTT to indicate the platform number of the first platform of the source file.

When compiling the file, the compiler will save the previous block and create a new one automatically each time a new keyword PTT is found. When all the blocks are processed, and if no error occurred, the blocks saved are automatically transferred to the GTS sub-system description data base. In case an error occurred all informations processed are disregarded and the compiler stops immediately processing the source file.The Argos Users' Guidance Office will inform you in case such errors occur.

The compiler reads instructions from the input file sequentially.

Many instructions per line are possible. In that case instructions on a single line but must be separated using the character ';' (e.g. "PTT=05566; WMO=64643")

Empty lines or instructions are ignored.

Comments can be included using the character '!'. All the characters following the '!' character will be ignored by the compiler. (ex "WMO=64514 ! WMO Number").

Instructions can begin or end with an unlimited number of Space or Tab characters which will be ignored by the compiler.

All instructions are automatically converted into Uppercases before being interpreted.

The general format of an instruction is :

KEYWORD[,ARGUMENT1[,ARGUMENT2]]

(',' is the separator, and [] are used to indicate optional arguments).

All arguments in excess of required ones will be ignored
(e.g "PTT 05566 (Argos ID Number)")

Arguments are separated by a separator which can be one of the following characters: ,:=()[]{} Spaces or Tabs (e.g."PTT:05566" or "PTT=05566" or "PTT 05566" are valid instructions)

Arguments can be included in quotes "" or " in order for the compiler to ignore possible separators or spaces
(e.g. ARGUMENT1 = "TEMP:AIR"). Quotes are not necessary when no ambiguity is possible (e.g. ARGUMENT1 = SST).

ARGUMENTi can take the form "ARGUMENT1 | ARGUMENT2" which stands for ARGUMENT1 or ARGUMENT2.

Important:

In the Argos GTS sub-system, sensors are referenced by names. Normally these names are defined by the programme manager at the time he fills out his GTS Technical File. It is however possible (e.g. the programme manager did not fill out a GTS Technical File and submitted the information in a free format) that the programme manager is not aware of the sensor names used for these of his platforms which are reporting on GTS. In that case he can request the Argos Users' Guidance Office to provide him with the list of sensor names used for every kind of GTS platform he is using. Also for consistency purposes, it is recommended that the following names be used in the GTS Technical File:

Sensor name	Sensor
ATMPRES	Atmospheric pressure
SEATEMP	Sea surface temperature
AIRTEMP	Air temperature
WINDSP	Wind speed
WINDIR	Wind direction
TEND	Air pressure tendency
TENDCHAR	Characteristic of the air pressure tendency
ATMPRES_SY	Synoptic atmospheric pressure
ATMPRES_H-1	Previous hour atmospheric pressure
T1	First sub-surface water temperature
T2	Second sub-surface water temperature

10.2.3) List of possible instructions and keywords for GTSMOD:

Keywords are indicated in Uppercases, Arguments in lowercases, optional elements are inside brackets []:

10.2.3.1) General

Remark: These commands are for the moment only available to the Argos Users' Guidance Office.

QUIT

Quits the program and disregard any information entered so far.

EXIT

Quits the program and save any information entered so far.

HELP[,command]

HELP : List all the possible commands possible at this point.

HELP,command : Explains command in argument.

10.2.3.2) PTT description

CURRENT

Types the informations entered so far for the current PTT.This command is only available to the Argos Users' Guidance Office.

PTT,argos_id

To indicate (select) the Argos Number

WMO,wmo_id

To change the WMO Number

GTS,yes_no

GTS,Y : GTS Distribution of the platform is authorized

GTS,N : The Platform is removed from GTS distribution

DEPLOYMENT,latitude,longitude

To indicate the platform deployment position in degrees.The deployment date is then forced to the current date.

ALTITUDE,altitude

To indicate the platform altitude in meters.

DROGUE,yes_no

DROGUE,Y : The Drogue is attached

DROGUE,N : The Drogue is detached

10.2.3.3) Sensor description:

SENSOR,[#ii | ALL] Sensor_Name[*]

- Beginning of a sensor(s) block for the current PTT. Sensor_Name is the name (or beginning of name) of one or more geo-physical sensor(s) as defined in the GTS sub-on data base.

- If the wild card asterisk "*" option is used, then all the geo-physical sensor(s) of the platform with names beginning with Sensor_Name will be modified (the first for each different name if option ALL is not used, and in case many sensors have the same name).

- If the asterisk "*" option is not used, then only the geo-physical sensor(s) of the platform with the name matching exactly Sensor_Name will be modified.

- If option #ii is specified (e.g. #02) then only the iith (e.g. second) sensor with name Sensor_Name will be modified. Usage of keyword ALL and option #ii is exclusive.

- If keyword "ALL" is specified then all the sensors with the name Sensor_Name will be modified

- If keyword "ALL" is omitted then only the first sensor with the name Sensor_Name of will be modified.

Example:

- **SENSOR** ATMPRES .. First ATMPRES sensor found

- **SENSOR** #02 ATMPRES .. Second ATMPRES sensor found

- **SENSOR** ALL ATMPRES .. All ATMPRES sensors found

- **SENSOR** AIR* .. For every possible sensor name beginning with AIR, only the first of each is used (e.g. first AIRPRES, and first AIRTEMP)

- **SENSOR** ALL AIR* .. All sensors with names beginning with AIR

- **SENSOR** * .. First sensor for each possible name

- **SENSOR** ALL * .. All the sensors

DISSEM,yes_no

DISSEM,Y : The current sensor is authorized for GTS distribution

DISSEM,N : The current sensor is removed from GTS distribution

LEVEL,probe_level

To define the elevation or depth (i.e. level) of the probe compared to the station level (<0 if below station level, >0 if above station level, e.g. depths are negative numbers).

BITS,pos,nb_bits

Change bit position (pos) and number of bits (nb_bits) of sensor in Argos message. Argos message starts with position zero.

TIME_OFFSET,offset_value

To indicate the time offset for the sensor in minutes.

MAGVAR,yes_no

MAGVAR,Y : To ask for automatic Geo-Magnetic Variation.

MAGVAR,N : To ask for no automatic Geo-Magnetic Variation.

RECALIBRATE,RESET

The coefficients for the linear correction are initialized to a=1 and b=0

RECALIBRATE,a,b

Sensor is recalibrated : PHYS = a*PHYS + b
Previous values of a and b are therefore corrected accordingly.

LIMITS,low,high

Change the lower and upper limits for the user limits QC test.

10.2.3.4) Calibration coefficients

CALIBRATION_FROM_SENSOR,Sensor_Name

Coefficients of the sensor which name is Sensor_Name are copied to the current sensor. Sensor_Name must exist in a preceding sensor block for the current PTT.

CALIBRATION_TYPE,process_type

Processing Type used (cannot be changed, must match with what is declared in the GTS sub-system description data base). Processing_type can be only 'B1', 'B4' or 'SM'.

[**VALUES**,]binary,physical

Keyword "**VALUES**" is optional. To define coefficient values of a B1 calibration curve. This instruction must follow a "**CALIBRATION_TYPE**,B1" instruction or another "**VALUES**" instruction. Many instructions can be used to define as many tabulations as needed (up to a maximum of 20).

A0,value

To define the value of coefficient A0 of a B4 calibration curve. this instruction must be preceded by a "**CALIBRATION_TYPE**,B4" instruction.

A1,value

To define the value of coefficient A1 of a B4 calibration curve. this instruction must be preceded by a "**CALIBRATION_TYPE**,B4" instruction or a A0,value instruction.

A2 A5, **B1**.. **B5**

Same as for the other B4 coefficients. Coefficients not listed are forced to zero.

C01,value

To define the value of coefficient **C1** of a SM calibration curve. this instruction must be preceded by a "**CALIBRATION_TYPE**,B4" instruction.

C02,value

To define the value of coefficient **C2** of a SM calibration curve. this instruction must be preceded by a "**CALIBRATION_TYPE**,B4" instruction or a **C1**,value instruction.

C03 .. C20

Same as for the other SM coefficients. Coefficients not listed are forced to zero.

10.3 - Security issues

Authentication

Authentication is realized through the email address of originating message.

Authorisation

For a given Argos Programme, the PrincipalGTS Co-ordinator (PGC) is the only person allowed by the Argos programme manager to make modifications to GTS technical files (manually via the User Office and remotely). However, a programme manager is not obliged to designate a PGC. In this case, only the programme manager himself plus authorised users will be in a position to do so. Users can be authorised to access to all programmes of a given programme manager, or to one or more programmes, or to one or more platforms of the programme manager.Above aspects of security are already taken into account in the GTS subsystem.

Access restriction

If a user has reservations regarding the level of security offered, he can ask that all of his platforms of all of his programmes be removed from remote access mode. For a programme, he can also forbid remote access or limit it to read access only. By default, remote reading as well as writing access is forbidden. A user will therefore have to explicitly ask for read or read/write access for each of his programmmes if he wants to use these facilities.

10.4 - Information to provide to the User Office

If a user wants to remotely access to his GTS Technical Files, he must:

- For each of his programmes, provide the User Office with either the name of the Principal GTS Coordinator (PGC) who will be authorised to access technicalfile data remotely, or with the list of users who will have authorisation.
- For each programme, for the designated PGC or for each authorised user, provide the User Office with the Email address he will use to access the system. The User Office will then provide the user with User Names for the PGC or authorised users.
- For each programme ask for read or read/write access.

SHORT Format in read access

Example:

GTS Technical file information for an Argos platform (SHORT)

```
PTT:18646 WMO=73502    GTS=N Program:01155 User:MORRISSY     DROGUE=N
CODE BUOY,  Bulletin Header = SSVX03

## SENSOR NAME      KIND       G LEVEL    A        B        PR POS BIT RF OFFST
01 HOUR             TIME
02 SEATEMP          WT_T       Y 0.00     1.000    0.000    B1  16 10   8     0
03 ATMPRES          AI_P       Y 1.00     1.000    0.000    B1   0 11   4     0
04 BATTERY          DEFAULT    Y 0.00     1.000    0.000    B1  26  6   4     0
05 AIRTEMP          AI_T       Y 0.00     1.000    0.000    B1  32 10   4     0
06 TENDCHAR         AI_PTC     Y 0.00     1.000    0.000    B1  42  6  11     0
07 TEND             AI_PT      Y 0.00     1.000    0.000    B1  48  8   4     0
08 HOUR_H-1         TIME
09 SEATEMP_H-1      WT_T       Y -1.00    1.000    0.000    B1  72 10   4   -60
10 ATMPRES_H-1      AI_P       Y 0.00     1.000    0.000    B1  56 11   4   -60
11 BATTERY_H-1      DEFAULT    Y 0.00     1.000    0.000    B1  82  6   4   -60
12 AIRTEMP_H-1      AI_T       Y 0.00     1.000    0.000    B1  88 10   4   -60
13 TENDCHAR_H-1     AI_PTC     Y 0.00     1.000    0.000    B1 104  6  11     0
14 TEND_H-1         AI_PT      Y 0.00     1.000    0.000    B1 104  8   4   -60
15 HOUR_H-2         TIME
16 ATMPRES_H-2      AI_P       Y 0.00     1.000    0.000    B1 112 11   4  -120
17 SEATEMP_H-2      WT_T       Y 0.00     1.000    0.000    B1 128 10   4  -120
18 BATTERY_H-2      DEFAULT    Y 0.00     1.000    0.000    B1 138  6   4  -120
19 AIRTEMP_H-2      AI_T       Y 0.00     1.000    0.000    B1 144 10   4  -120
20 TENDCHAR_H-2     AI_PTC     Y 0.00     1.000    0.000    B1 154  6  11     0
21 TEND_H-2         AI_PT      Y 0.00     1.000    0.000    B1 160  8   4  -120
22 HOUR_H-3         TIME
23 ATMPRES_H-3      AI_P       Y 0.00     1.000    0.000    B1 168 11   4  -180
24 SEATEMP_H-3      WT_T       Y 0.00     1.000    0.000    B1 184 10   4  -180
25 BATTERY_H-3      DEFAULT    Y 0.00     1.000    0.000    B1 194  6   4  -180
26 AIRTEMP_H-3      AI_T       Y 0.00     1.000    0.000    B1 200 10   4  -180
27 TENDCHAR_H-3     AI_PTC     Y 0.00     1.000    0.000    B1 210  6  11     0
28 TEND_H-3         AI_PT      Y 0.00     1.000    0.000    B1 216  8   4  -180
```

Columns:

##	Sensor order in the declaration
SENSOR NAME	Sensor name
KIND	Type of geo-physical measurementG
GTS	distribution on/off for the sensor
LEVEL	Hight/Depth of probe
A	Coefficient A for linear correction (Y=A*Y+B)
B	Coefficient B for linear correction (Y=A*Y+B)
PR	Processing type for the calibration curve
POS	Bit position in the Argos essage (first message bit = 0)
BIT	Number of bits in the Argos message
RF	Reference time used for computation of observation time
OFFST	Time offset for computation of observation time

LONG format (compatible with GTSMOD language)

Example:

```
This program is to read calibration information from the GTS
Data Base for a given PTT and  to convert  this  information
into  a  file  using  the CALIBRATION compiler instructions.
PTT:22121
WMO=55574
! Program=00476 User=HICKMAN
GTS=Y
DROGUE=N
DEPLOYMENT= -36.000, 161.200
ALTITUDE=          0
! CODE BUOY Header code =SSVX    Header PTT=03
SENSOR  ATMPRES
   ! Sensor kind:AI_P
   DISSEM=Y
   LEVEL= 0.0000000000E+00
   TIME_OFFSET=          0
   ! Linear Correction: a= 0.1000000000E+01, b= 0.0000000000E+00
   LIMITS= 0.9010000000E+03, 0.1050000000E+04
   CALIBRATION_TYPE B1
         0: 0.9000000000E+03
      1023: 0.1053449951E+04
SENSOR  SEATEMP
   ! Sensor kind:WT_T
   DISSEM=Y
   LEVEL= 0.0000000000E+00
   TIME_OFFSET=          0
   ! Linear Correction: a= 0.1000000000E+01, b= 0.0000000000E+00
   LIMITS=-0.3000000000E+01, 0.3490000153E+02
   CALIBRATION_TYPE B1
         0:-0.3250000000E+01
       255: 0.3500000000E+02
SENSOR  ATMPRES_H-1
   ! Sensor kind:AI_P
   DISSEM=Y
   LEVEL= 0.0000000000E+00
   TIME_OFFSET=          0
   ! Linear Correction: a= 0.1000000000E+01, b= 0.0000000000E+00
   LIMITS= 0.9010000000E+03, 0.1050000000E+04
   CALIBRATION_TYPE B1
         0: 0.9000000000E+03
      1023: 0.1053449951E+04
```

Annex A - Allocation of WMO numbers to Argos platforms

When data from Argos platforms are intended for transmission through the GTS, an identifier called the WMO identification number or WMO number is used in place of the Argos identifier. This provides stations with identifying numbers similar to the station index numbers assigned to land meteorological stations for operational, storage and retrieval purposes at national Meteorological Centres.

The WMO identification number is allocated depending upon which GTS code form is used, the type of the platform, and its deployment position.

BUOY: $A_1b_wn_bn_bn_b$, (commonly called "WMO numner")

A_1	WMO Regional Association area in which platform is deployed (see figure 3)
b_w	Sub area belonging to area A_1 (see figure 3). Note that sub-surface floats are allocated value 9 for b_w
$n_bn_bn_b$	Buoy type and serial number. 500 is added to the original value of this number to indicate a drifting buoy. The number is left as is for moored buoys. Hence in distributed GTS reports, it is always between 0 and 499 for moored buoys, and between 500 and 999 for drifting buoys.

BATHY, TESAC, SHIP: $A_1b_wn_bn_bn_b$ ("WMO number") or D....D ("Ship's Call Sign"):

A_1	WMO Regional Association area in which the platform is deployed (see figure 3)
b_w	Sub area belonging to area A_1 (see figure 3)
$n_bn_bn_b$	Type and serial number of the platform
or	
D....D	Ship's Call Sign

Platform identifier in TESAC for profiling floats

Observational data from profiling sub-surface floats deployed under Argo and similar projects are distributed on the GTS in TESAC code. The Data Buoy Cooperation Panel (DBCP) has developed an extension of the existing buoy identifier system to facilitate easy identification of the reports from these floats, as well as retain a unique ID number for all floats deployed (without recycling). The new identifier is to be **used in place of the ship's call sign, D….D, not the buoy identifier**. It extends the existing buoy ID structure from five to eight characters for floats,

but retains the same format, with the addition of the letter Q as the first character:

$QA_1b_wn_bn_bn_bn_bn_b$

where:

Q = a letter not currently used as the first letter of a ship's call sign, to indicate that the report is from an Argo float
A_1 = WMO region of float deployment, with 7 used for the Southern Ocean south of 60°S
b_w = 9 to signify a float
$n_bn_bn_bn_bn_b$ = a unique number for each float deployed in area A_1, allocated serially

This identifier is used in Section 5 of TESAC only, when the report is from a profiling float, and **is used in place of the ship call sign D….D**, not the buoy identifier. The existing five-digit buoy identifier group will be retained for TESAC reports originating from drifting and moored surface buoys.

The seven-digit float identifier in TESAC was implemented for all floats deployed on and after 1 June 2001.

SYNOP IIiii (commonly called "WMO Station Index Number"):
- II WMO block Number (see Volume A of WMO publication No. 9)
- iii Station Number within WMO block II.

HYDRA AC_i and $BBi_Hi_Hi_H$:
- A WMO Regional Association area,
- C_i Indicator for country of Hydrological Basin,
- BB Hydrological Basin in the WMO Region (See Vol. II of WMO Manual on Codes for the list of basins),
- $i_Hi_Hi_H$ National Hydrological Observing Station Identifier within the basin.

BUFR *Once BUFR is implemented, the type of identification number may differ depending on the type of platform, and may take the form of one of the identification number detailed above for BUOY, BATHY, TESAC, SYNOP, SHIP or HYDRA code forms.*

For the allocation of these identifiers, programme managers must receive:
- platform numbers from CLS/Service Argos,

- WMO numbers from their national Meteorological Service or from their National Focal Point for Drifting Buoy Programmes (NFP) for drifting or moored buoys (see Annex B.2 for the list of NFPs). NFPs in turn obtain national allocations of buoy identification numbers from the WMO Secretariat, which maintains a master list. The following rules only apply to buoys.

When submitting requests, the geographical positions and nature of platforms should be specified (the position of initial deployment for drifting buoys). Requests for WMO numbers can also be made via the Technical Coordinator of the Data Buoy Cooperation Panel (TC-DBCP). See Annex B for address and telephone number.

The symbolic form $A_1b_wn_bn_bn_b$ of the identifier is used in FM 13-X SHIP, FM 63-X Ext. BATHY, FM 64-IX TESAC, and FM 18-X BUOY. Specifications of symbolic letters are as follows:

A_1	WMO Regional Association area in which buoy has been deployed (see figure 3). 1: Region I, Africa 2: Region II, Asia 3: Region III, South America 4: Region IV, North and Central America 5: Region V, South-West Pacific 6: Region VI, Europe 7: Antarctic
b_w	Sub-area belonging to the area indicated by A_1 (see figure 3).
$n_bn_bn_b$	Type and serial number of buoy.

<u>Important</u>: Serial numbers for buoys in each maritime sub-area identified by A_1 and b_w shall be allocated from the series 000 up to 499 but in the case of drifting buoys and other mobile platforms, 500 shall be added to the original $n_bn_bn_b$ number. A number allocated to a particular programme may effectively be used twice for that programme only, directly as allocated for a fixed platform and with the addition of 500 for a mobile platform. After the operational life-time of a given platform that reported onto the GTS, its WMO number may be re-used for another similar platform once, provided the rules above are still met, e.g. the platform is deployed in the same area. Non re-used WMO numbers may be released after 3 months of non-transmission.

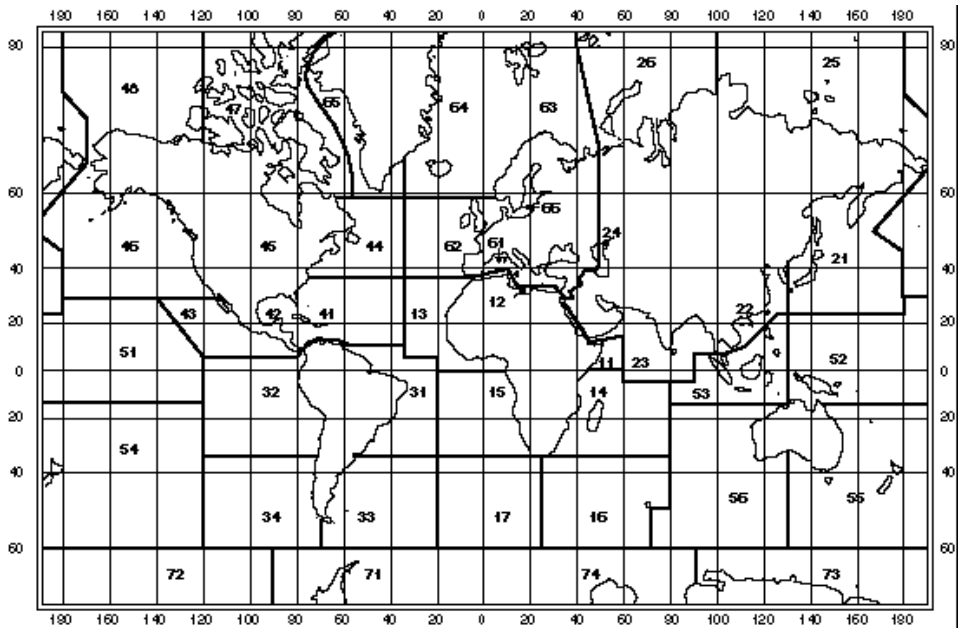
Examples

14015 = No. 15 buoy, deployed in sub-area 4 in region I, stationary.
46673 = No. 173 buoy, deployed in sub-area 6 in region IV, drifting.

The identifier may be allocated to fixed as well as drifting buoy stations, mobile ship stations and, in some cases, land-based remote stations. Drifting buoys (and similarly other mobile platforms) retain the original identifier applicable to the WMO region

and sub-area in which they were set adrift. As adopted by Recommendation 5 (CBS-Ext. (85)), stations at sea located on a drilling rig or oil-gas-production platform shall also carry an identifier number. In the case of such "semi-mobile" platforms, a new number will be required if the platform changes its geographical location from one area to another, e.g. from region III, South America, to region 1, Africa.

Figure 3: Chart of sea areas ($\mathbf{A_1b_W}$) for use in assigning buoy identifiers. $\mathbf{A_1}$: WMO Regional Association area in which the buoy is deployed (1-Region I, 2-Region II, etc.). $\mathbf{b_W}$: Sub-area belonging to the area indicated by $\mathbf{A_1}$.



Annex B - Addresses

Annex B.1 - Argos User Offices

See addresses at http://www.cls.fr/html/cls/activite/adresses_en.html

Annex B.2 - DBCP technical coordinator

See references at http://www.dbcp.noaa.gov/dbcp/1d.html#TC

Annex B.3 - National Focal Points for drifting buoy programmes

See up to date list on the DBCP web site at : http://www.dbcp.noaa.gov/dbcp/1nfpfbp.html

Annex C - GTS code forms in use with the Argos system

Note: This is neither an official description of WMO GTS code forms, nor a detailed one; it is rather written taking into consideration how these code forms can be generated from the Argos GTS sub-system. For formal WMO regulations and details, see the WMO Manual on Codes, Volume 1, International Codes, WMO N° 306. Particularly, groups not used with the Argos system do not appear in the code descriptions below.

In the following code descriptions,

(i) Code fields are indicated in **bold**
(ii) Optional fields are indicated in parentheses ()
(iii) Underlined fields are constant fields or constant part of the message (e.g. 888)
(iv) Fields in brackets {} are exclusive

C.1) BUOY code (WMO code form FM 18-XII BUOY)

Report of a drifting or moored buoy observation.
Replaced DRIFTER in November 1994.

Section 0 is mandatory, all other sections are optional.

Section 0:	ZZYY	$A_1b_wn_bn_bn_b$	YYMMJ	$GGggi_w$
		$Q_cL_aL_aL_aL_aL_a$	$L_oL_oL_oL_oL_oL_o$	$(6Q_1Q_tQ_A/)$
Section 1:	$111Q_dQ_x$	0ddff	$(1s_nTTT)$	
		$\{(2s_nT_dT_dT_d)$ or	$(29UUU)\}$	
		$(3P_oP_oP_oP_o)$	$(4PPPP)$	(5appp)
Section 2:	$222Q_dQ_x$	$(0S_nT_wT_wT_w)$	$(1P_{wa}P_{wa}H_{wa}H_{wa})$	
		$(20P_{wa}P_{wa}P_{wa})$	$(21H_{wa}H_{wa}H_{wa})$	
Section 3:	$333Q_{d1}Q_{d2}$			
	$8887k_2$	$(2z_oz_oz_oz_o)$	$(3T_oT_oT_oT_o)$	$(4S_oS_oS_oS_o)$
		. . . . .		
		$(2z_nz_nz_nz_n)$	$(3T_nT_nT_nT_n)$	$(4S_nS_nS_nS_n)$
	$66k_69k_3$	$(2z_oz_oz_oz_o)$	$(d_od_oc_oc_oc_o)$	
		. . . . .		
		$(2z_nz_nz_nz_n)$	$(d_nd_nc_nc_nc_n)$	

Section 4: 444 $(1Q_pQ_2Q_{TW}Q_4)$ $(2Q_NQ_LQ_AQ_Z)$
$\{(Q_cL_aL_aL_aL_aL_a$ $L_oL_oL_oL_oL_oL_o)$ or (YYMMJ GGgg/)$\}$
$(3Z_hZ_hZ_hZ_h$ $4Z_cZ_cZ_cZ_c)$ $(5B_tB_tX_tX_t)$
$(6A_hA_hA_hA_N)$ $(7V_BV_Bd_Bd_B)$ $(8V_iV_iV_iV_i)$ $(9/Z_dZ_dZ_d)$

Brief description of the groups for BUOY:

$A_1b_wn_bn_bn_b$	WMO Identification number
YYMMJ	Day in the month, Month, Year
$GGggi_w$	Hour, Minutes, Indicator for wind units (1=m/s, 4=knots)
$Q_cL_aL_aL_aL_aL_a$	Quadrant of the globe (1:NE,3:SE,5:SW,7:NW, Latitude (1/1000 degrees)
$L_oL_oL_oL_oL_oL_o$	Longitude (1/1000 degrees)
Q_1	Quality control indicator for the location fix. 0=not checked, 1=good, 2=inconsistent, 3=doubtful, 4=wrong, 5=data changed.
Q_t	Quality control indicator for the time of observation. 0=not checked, 1=good, 2=inconsistent, 3=doubtful, 4=wrong, 5=data changed.
Q_A	Location quality class (range of radius of 66% confidence) 0: >=1500m, 1: 500..1500m, 2: 250..500m, 3:<250m, /: not available
Q_d	Quality control indicator for the section. 0=not checked, 1=good, 2=inconsistent, 3=doubtful, 4=wrong, 5=data changed.
Q_x	Number of the only group of the section whose Quality Control indicator is not 1. Otherwise this group is coded 9.
ddff	Wind Direction (10 degrees), Wind Speed (m/s or Knots depending upon iw)
s_nTTT	Air Temperature (1/10 C), sn=1 if <0, sn=0 if >0
$s_nT_dT_dT_d$	Dew-Point Temperature (1/10 C), sn=1 if <0, sn=0 if >0
UUU	Air Humidity (%)
$P_oP_oP_oP_o$	Air Pressure at station level (1/10 hPa)
PPPP	Air Pressure reduced at sea level (1/10 hPa)
appp	Characteristic of air pressure tendency, air pressure tendency in the last 3 hours (1/10 hPa/3H). **a** is coded as follows: 2=pressure is increasing; 4=pressure is steady; 7=pressure is decreasing.
$S_nT_wT_wT_w$	Sea Surface Temperature (1/10 C), sn=1 if <0, sn=0 if >0

$P_{wa}P_{wa}$	Period of waves
$H_{wa}H_{wa}$	Height of waves
$P_{wa}P_{wa}P_{wa}$	Period of waves (1/10 s, accurate)
$H_{wa}H_{wa}H_{wa}$	Height of waves (1/10 m, accurate)
Q_{d1}	Quality control indicator for temperature salinity profile. 0=not checked, 1=good, 2=inconsistent, 3=doubtful, 4=wrong, 5=data changed.
Q_{d2}	Quality control indicator for current speed and direction profile. 0=not checked, 1=good, 2=inconsistent, 3=doubtful, 4=wrong, 5=data changed.
k_2	Indicator for salinity
$z_nz_nz_nz_n$	Depth (m)
$T_nT_nT_nT_n$	Water Temperature at depth (C, +5000 if <0)
$S_nS_nS_nS_n$	Water Salinity at Depth (1/100 of psu)
k_6	Method for removing ship's velocity and motion from current measurement
k_3	Duration and time of current measurement
$z_nz_nz_nz_n$	Depth (m)
$d_nd_nc_nc_nc_n$	Direction (10 Deg), and Speed (cm/s) of Marine Currents at Depth
Q_p	Quality control indicator for Air Pressure. 0=good, 1=bad.
Q_2	Quality control indicator for the first housekeeping parameter. 0=good, 1=bad.
Q_{TW}	Quality control indicator for the water-surface temperature measurement. 0=good, 1=bad.
Q_4	Quality control indicator of the air temperature. 0=good, 1=bad.
Q_N	Quality of the satellite transmission. 0=good, 1=doubtful.
Q_L	Quality of Location (0=OK, 1=Latest known location). If the value is 1, then the date and time of the location fix is given by the groups YYMMJ GGgg of section 4.
Q_A	Location quality class (range of radius of 66% confidence) 0: >=1500m, 1: 500..1500m, 2: 250..500m, 3:<250m, /: not available
Q_z:	Depth correction indicator. Indication whether probe depths as reported in Section 3 are corrected using hydrostatic pressure or not (0: not corrected, 1:corrected, /: missing). Code talbe 3318.
$Z_hZ_hZ_hZ_h$	Hydrostatic pressure of lower end of cable. Pressure is expressed in units of 1000 Pa (i.e. centibars). If group $\underline{3}Z_hZ_hZ_hZ_h$ is present, then group $\underline{4}Z_cZ_cZ_cZ_c$ is mandatory.
$Z_cZ_cZ_cZ_c$	Length of cable in meters (thermistor strings).
B_tB_t	Buoy type: code table 0370 «Type of data-buoy» (BUFR table 0-02-150). e.g. 00:unspecified drifting buoy, 01=Lagrangian drifter, 02: FGGE, 03: Wind FGGE, 04: Ice float, 08: sub-surface float, 16: unspecified moored buoy, 17: NOMAD, 18: 3-meter discus, 19: 10-12 meter discus, 20: ODAS 30 series, 21:ATLAS, 22:TRITON, 24: Omnidirectional wave rider, 25: Directional wave rider, //:missing.
X_tX_t	Drogue type: code table 4880 « Drogue Type » (BUFR table 0 02 034) (e.g. 01=Holey sock, 00:unspecified, //:missing)
$A_hA_hA_h$	Anemometer height above station level (decimeters. A value of 999 shall be used to say that anemometer height is artificially corrected to 10 meters by applying a formula. ///: Unknown value. Group omitted if wind is not measured.
A_N	Anemometer type (0:Cup, 1: propeller rotor, 2:WOTAN, /:missing). Group ommitted if wind is not measured. Code table 0114.
$V_BV_Bd_Bd_B$	Speed and direction of the buoy at the last known position. Speed V_BV_B is given in cm/s, and Direction d_Bd_B is given in tens of degrees.
$V_iV_iV_iV_i$	Housekeeping Parameter number i (up to 3 parameters)
$Z_dZ_dZ_d$	Depth of the drogue (m) coded if requested by the Principal Investigator.

Example of BUOY message:

```
ZZYY
12345 29013 0756/ 761567 022345 611//
11119 0//// 40145=
```

Platform WMO 12345 on 29 January 1993 at 7:56 UTC, 61.567N, 22.345W (good time and good location), Good Air Pressure=1014.5 hPa.

C.2) SYNOP code (WMO code forms FM 12-XI Ext. SYNOP):

Report of surface observation from a land station. Used for reporting synoptic surface observations from a land station, manned or automatic.

Section 0 and 1 are mandatory, Sections 2 and 3 are optional.

Section 0:

AAXX YYGGi_w
IIiii

Section 1:

$i_R i_x$/VV /ddff (00fff) (1s_nTTT) { (2$s_n T_d T_d T_d$) or (29UUU) }

(3$P_o P_o P_o P_o$) { (4PPPP) or (4$a_3$hhh) } (5appp) (6RRRt_R)

(9GGgg)

Section 2:

22200 (0$s_s T_w T_w T_w$) (1$P_{wa} P_{wa} H_{wa} H_{wa}$) (2$P_w P_w H_w H_w$) (70$H_{wa} H_{wa} H_{wa}$)
(8$s_w T_b T_b T_b$)

Section 3:

333 (1$s_n T_x T_x T_x$) (2$s_n T_n T_n T_n$) (4/sss)

(907tt 911ff (00fff))

Brief description of groups for SYNOP:

$YYGGi_w$	Day in the month, Hour, Indicator for wind units (1=m/s, 4=knots)
IIiii	WMO Identification number
i_R	Indicator for precipitation data
i_x	Type of station (3:Manned, 6:Automatic)
VV	Horizontal visibility
ddff	Wind Direction (10 degrees), Wind Speed (m/s or Knots depending upon iw)
fff	Wind speed in units indicated by iw
s_nTTT	Air Temperature (1/10 C), sn=1 if <0, sn=0 if >0
$s_nT_dT_dT_d$	Dew-Point Temperature (1/10 C), sn=1 if <0, sn=0 if >0
UUU	Air Humidity (%)
PPPP	Air Pressure at mean sea level (1/10 hPa)
$P_oP_oP_oP_o$	Air Pressure at station level (1/10 hPa)
appp	Characteristic of air pressure tendency, air pressure tendency in the last 3 hours (1/10 hPa/3H). Refer to table number 200 of the WMO Manual on Codes, Volume I, WMO No 306, Part D, for the possible values of **a**.
$RRRt_R$	Precipitations, period for precipitations. Refer to WMO Manual on Codes for details.
a_3hhh	Isobaric surface (1:1000 hPa, 5:500, 7:700, 8:850), Geopotential (M Modulo 1000)
GGgg	Hour and minutes of time of observation if asynoptic time.
s_s	Sign and Type of Sea Surface Temperature measurement :

Code figure	Sign	Type of measurement
0	SST>0	Intake
1	SST<0	Intake
2	SST>0	Bucket
3	SST<0	Bucket
4	SST>0	Hull Contact Sensor
5	SST<0	Hull Contact Sensor
6	SST>0	Other
7	SST<0	Other

$T_wT_wT_w$	Sea Surface Temperature (1/10 C), sign is given by **s_s**
$P_{wa}P_{wa}$	Period of waves
$H_{wa}H_{wa}$	Height of waves
P_wP_w	Period of wind waves
H_wH_w	Height of wind waves
$H_{wa}H_{wa}H_{wa}$	Height of waves (1/10 m, accurate)
$s_wT_bT_bT_b$	Wet bulb or ice bulb temperature. **s_w**: Indicator fo the sign and type (web/ice bulb) of web bulb temp. **$T_bT_bT_b$**:Wet bulb or ice bulb temperature in 1/10 of Celsius.
$s_nT_xT_xT_x$	Maximal Temperature in the last 24 hours (1/10 C), sn=1 if <0, sn=0 if >0
$s_nT_nT_nT_n$	Minimal Temperature in the last 24 hours (1/10 C), sn=1 if <0, sn=0 if >0
sss	Total depth of snow (cm)
tt	Period of reference for wind gust ending at the time of observation (WMO Table 4077): 00= at the observation, 10=1 hour, 30=3 hours, 69=unknown.
ff	Wind Gust (m/s or Knots depending upon **i_w**)
fff	Wind Gust in units indicated by **i_w** if > 99 units.

Example of SYNOP message:

AAXX 29061
07510 46/// /0723 10125=

Automatic Station WMO 07510 on 29 January 1993 at 06:00 UTC, Wind Direction = 70 Degrees, Wind Speed = 23 m/s, Air Temperature = 12.5 Celsius.

C.3) SHIP code (WMO code form FM 13-XI Ext. SHIP):

Report of surface observation from a sea station. Used for reporting synoptic surface observations from a sea station, manned or automatic.

Section 0 and 1 are mandatory, Sections 2 and 3 are optional.

Section 0:

BBXX
{ **D . . . D** }
{ or } **YYGGi$_w$** **99L$_a$L$_a$L$_a$** **Q$_c$L$_o$L$_o$L$_o$L$_o$**
{ **A$_1$b$_w$n$_b$n$_b$n$_b$** }

Section 1:

i$_R$i$_x$/VV **/ddff** **(00fff)** **(1s$_n$TTT)** { **(2s$_n$T$_d$T$_d$T$_d$)** or **(29UUU)** }

(3P$_o$P$_o$P$_o$P$_o$) { **(4PPPP)** or **(4a$_3$hhh)** } **(5appp)** **(6RRRt$_R$)**

(9GGgg)

Section 2:

222// **(0s$_s$T$_w$T$_w$T$_w$)** **(1P$_{wa}$P$_{wa}$H$_{wa}$H$_{wa}$)** **(2P$_w$P$_w$H$_w$H$_w$)** **(70H$_{wa}$H$_{wa}$H$_{wa}$)**

(8s$_w$T$_b$T$_b$T$_b$)

Section 3:

333 **(1s$_n$T$_x$T$_x$T$_x$)** **(2s$_n$T$_n$T$_n$T$_n$)**

(907tt 911ff (00fff))

Brief description of the groups for SHIP:

D ... D	Ship's call sign
$A_1b_wn_bn_bn_b$	WMO Identification number
$YYGGi_w$	Day in the month, Hour, Indicator for wind units (1=m/s, 4=knots)
$L_aL_aL_a$	Latitude (1/10 degrees)
$Q_cL_oL_oL_oL_o$	Quadrant of the globe (1:NE,3:SE,5:SW,7:NW, Longitude (1/10 degrees)
IIiii	WMO Identification number
i_R	Indicator for precipitation data
i_x	Type of station (3:Manned, 6:Automatic)
VV	Horizontal visibility
ddff	Wind Direction (10 degrees), Wind Speed (m/s or Knots depending upon iw)
fff	Wind speed in units indicated by iw
s_nTTT	Air Temperature (1/10 C), sn=1 if <0, sn=0 if >0
$s_nT_dT_dT_d$	Dew-Point Temperature (1/10 C), sn=1 if <0, sn=0 if >0
UUU	Air Humidity (%)
PPPP	Air Pressure at mean sea level (1/10 hPa)
$P_oP_oP_oP_o$	Air Pressure at station level (1/10 hPa)
appp	Characteristic of air pressure tendency, and air pressure tendency in the last 3 hours (1/10 hPa/3H). Refer to the table number 200 of the WMO Manual on Codes, Volume I, WMO No 306, Part D, for the possible values of **a**.
$RRRt_R$	Precipitations, period for precipitations. refer to the WMO Manual on Codes for details.
a_3hhh	Isobaric surface (1:1000 hPa, 5:500, 7:700, 8:850), Geopotential (M Modulo 1000)
GGgg	Hour and minutes of time of observation if asynoptic time.
s_s	Sign and Type of Sea Surface Temperature measurement :

Code figure	Sign	Type of measurement
0	SST>0	Intake
1	SST<0	Intake
2	SST>0	Bucket
3	SST<0	Bucket
4	SST>0	Hull Contact Sensor
5	SST<0	Hull Contact Sensor
6	SST>0	Other
7	SST<0	Other

$T_wT_wT_w$	Absolute value of Sea Surface Temperature (1/10 C)
$P_{wa}P_{wa}$	Period of waves
$H_{wa}H_{wa}$	Height of waves
P_wP_w	Period of wind waves
H_wH_w	Height of wind waves
$H_{wa}H_{wa}H_{wa}$	Height of waves (1/10 m, accurate)
S_w	Sign and Type of Wet Bulb Temperature measurement

Code figure	Sign	Type of measurement
0	SST>=0	Measured wet bulb temperature
1	SST<0	Measured wet bulb temperature
2	/	Ice bulb measured wet bulb temperature
3-4	/	Not used
5	SST>=0	Computed wet bulb temperature
6	SST<0	Computed wet bulb temperature
7	/	Ice bulb computed wet bulb temperature

$T_bT_bT_b$	Absolute value of Wet Bulb Temperature Measurement in 1/10 of Celsius
$s_nT_xT_xT_x$	Maximal Temperature in the last 24 hours (1/10 C), sn=1 if <0, sn=0 if >0
$s_nT_nT_nT_n$	Minimal Temperature in the last 24 hours (1/10 C), sn=1 if <0, sn=0 if >0
tt	Period of reference for wind gust ending at the time of observation (WMO Table 4077): 00=at the observation, 10=1 hour, 30=3 hours, 69=unknown.
ff	Wind Gust (M/S or Knots depending upon i_w)
fff	Wind Gust in units indicated by i_w if > 99 units.

Example of SHIP message:

```
BBXX
12345 29061 99213 70432
46/// /0723 10125=
```

Automatic Marine station WMO 12345 on 29 January 1993 at 06:00 UTC, Latitude = 21.3N, Longitude = 43.2W, Wind Direction = 70 Degrees, Wind Speed = 23 m/s, Air Temperature = 12.5 Celsius.

C.4) BATHY code (WMO code form FM 63-XI Ext. BATHY):

Report of bathythermal observation.

Section 1 and 4 are mandatory, Sections 2 and 3 are optional.

Section 1: **JJVV**
YYMMJ **GGgg/** $Q_cL_aL_aL_aL_aL_a$ $L_oL_oL_oL_oL_oL_o$
($i_u$ddff) **(4s_nTTT)**

Section 2: **8888k_1** $I_xI_xI_xX_RX_R$
($z_oz_oT_oT_oT_o$) **($z_1z_1T_1T_1T_1$)** ... **($z_nz_nT_nT_nT_n$)**
(999zz **($z_1z_1T_1T_1T_1$)** ... **($z_nz_nT_nT_nT_n$))**

Section 3: **66666** **($k_5D_cD_cV_cV_c$)**

Section 4: { **D .... D** }
{ or }
{**99999** **$A_1b_wn_bn_bn_b$** }

Brief description of the groups for BATHY:

YYMMJ	Day in the month, month, year
GGgg	Hour, Minutes
$Q_cL_aL_aL_aL_aL_a$	Quadrant of the globe (1:NE,3:SE,5:SW,7:NW, Latitude (1/1000 degrees)
$L_oL_oL_oL_oL_oL_o$	Longitude (1/1000 degrees)
$i_u$ddff	Units used for wind speed, wind direction (10 Deg), wind speed
s_nTTT	Air temperature (1/10 C), sn=1 if <0, sn=0 if >0
k_1	Indicator for digitization
$I_xI_xI_x$	Instrument type for XBT with fall rate equation coefficients (see table 1770 from WMO Manual on codes (No. 306), Volume-I, part A)
X_RX_R	Recorder types (see table 4770 from WMO Manual on codes (No. 306), Volume-I, part A)
$z_nz_nT_nT_nT_n$	Depth (m modulo 100), Water Temperature
zz	Depth (100 m)
k_5	Indicator for the method of current measurements
$D_cD_cV_cV_c$	Direction of Surface Currents (10 Deg), Speed of Surface Currents (Knots)
D ... D	Ship's call sign
$A_1b_wn_bn_bn_b$	WMO Identification Number

Example of BATHY message:

```
JJVV
29013 0600/ 721222 043522
00723 40125
88887 04222 00124 10082
99901 50022
99999 12345=
```

Marine station WMO 12345 on 29 January 1993 at 06:00 UTC, Latitude = 21.222 North, Longitude = 43.522 West, Wind Direction = 70 Degrees, Wind Speed = 23 m/s, Air Temperature = 12.5 Celsius, Temperatures at selected depths: Surface:12.4 C, 10 meters: 8.2 C, 150 meters: 2.2 C.

C.5) TESAC code (WMO code form FM 64-XI Ext. TESAC):

Temperature, salinity and current report from a sea station. Section 1 and 5 are mandatory, sections 2, 3, and 4 are optional.

Section 1: **KKYY**
YYMMJ **GGgg/** **$Q_cL_aL_aL_aL_aL_a$** **$L_oL_oL_oL_oL_oL_o$**
($i_u$ddff) **(4s_nTTT)**

Section 2: **888k_1k_2** **$I_xI_xI_xX_RX_R$**
(2$z_oz_oz_oz_o$) **(3$T_oT_oT_oT_o$)** **(4$S_oS_oS_oS_o$)**
(2$z_1z_1z_1z_1$) **(3$T_1T_1T_1T_1$)** **(4$S_1S_1S_1S_1$)**
. . . . . .
(2$z_nz_nz_nz_n$) **(3$T_nT_nT_nT_n$)** **(4$S_nS_nS_nS_n$)** **(00000)**

Section 3: **(66$k_6k_4k_3$** **(2$z_oz_oz_oz_o$)** **($d_od_oc_oc_oc_o$)**
(2$z_1z_1z_1z_1$) **($d_1d_1c_1c_1c_1$)**
. . . . . .
(2$z_nz_nz_nz_n$) **($d_nd_nc_nc_nc_n$)**

Section 4: (This section is not used with the Argos system)

Section 5: **{ D .... D }**
or
{ 99999 $A_1b_wn_bn_bn_b$ }

Brief description of the groups:

YYMMJ	Day in the month, Month, Year
GGgg	Hour, Minutes
$Q_cL_aL_aL_aL_aL_a$	Quadrant of the globe (1:NE,3:SE,5:SW,7:NW, Latitude (1/1000 Degrees)
$L_oL_oL_oL_oL_oL_o$	Longitude (1/1000 Degrees)
$i_u$ddff	Units used for wind speed, wind direction (10 Deg), wind speed
s_nTTT	Air Temperature (1/10 C), sn=1 if <0, sn=0 if >0
k_1	Indicator for digitization
k_2	Indicator for salinity
$I_xI_xI_x$	Instrument type for XBT with fall rate equation coefficients (see table 1770 from WMO Manual on codes (No. 306), Volume-I, part A)
X_RX_R	Recorder types (see table 4770 from WMO Manual on codes (No. 306), Volume-I, part A)
$z_nz_nz_nz_n$	Depth (m)
$T_nT_nT_nT_n$	Water Temperature at depth (C, +5000 if <0)
$S_nS_nS_nS_n$	Water Salinity at Depth (1/100 of psu)
k_3	Duration and time of current measurement
k_4	Period of current measurement
k_6	Method for removing ship's velocity and motion from current measurement
$d_nd_nc_nc_nc_n$	Direction (10 Deg), and Speed (cm/s) of Marine Currents at Depth
D ... D	Ship's call sign
$A_1b_wn_bn_bn_b$	WMO Identification number

Example of TESAC message:

```
KKYY
29013 0600/ 721223 043523 00723 40125
88871  04222 20000 30124 20010 30082 40035 20150 30022
99999 12345=
```

Marine station WMO 12345 on 29 January 1993 at 06:00 UTC, Latitude = 21.223 North, Longitude = 43.523 West, Wind Direction = 70 Degrees, Wind Speed = 23 m/s, Air Temperature = 12.5 Celsius, Temperatures at selected depths: Surface:12.4 C, 10 meters: 8.2 C, 150 meters: 2.2 C. Salinity at 10 meters: 35 psu.

C.6) HYDRA code (WMO code form FM 67-VI HYDRA):

Report of hydrological observation from a hydrological station.

Section 1 is mandatory, other sections are optional.

Section 1:	**HHXX**	**YYGG**	**(000AC_i)**	**$BBi_Hi_Hi_H$**
Section 2:	**22**	**(/$H_sH_sH_sH_s$)**		
Section 3:	**33**	**(/$QQQe_Q$)**		
Section 4:	**44**	**(t_pRRRR)**	**(. . .)**	**(. . .)**
Section 5:	**55**	**($ts_nT_tT_tT_t$)**	**(. . .)**	**(. . .)**
Section 6:	**66**	**(DDDss)**		

Brief description of the groups:

YYGG	Day in the month, Synoptic hours
AC_i	WMO Regional association area, Country
$BBi_Hi_Hi_H$	Basin, National hydrological observing station identifier
$H_sH_sH_sH_s$	Stage (cm)
$QQQe_Q$	Discharge (first 3 digits of discharge in dm^3/s, exponent for QQQ)
t_pRRRR	Period for precipitations, Total amount of precipitations
$ts_nT_tT_tT_t$	Nature of the Temperature reading, Temperature of the element indicated by t (1/10 C), sn=1 if <0, sn=0 if >0
DDDss	Ice thickness (cm), Depth of snow on ice (cm)

Example of HYDRA message:

```
HHXX
2906 00019 17001
22 /0040
33 /1251
55 10123 3152
```

Hydrological station 17001 on 29 January 1993 at 06h00 UTC. Stage 40 cm; discharge 1250 dm^3/s; Air Temperature 12.3 C; Maximum Temperature in the last 24 hours 15.2 C.

C.7) BUFR code (WMO code form FM 94-XI Ext. BUFR):

Binary Universal Form for the Representation of meteorological data:

BUFR

Identification section

(Optional section)

Data description section

Data section

7777

BUFR is basically a self defining binary code for exchanging meteorological data. A BUFR "message" is a contiguous binary stream composed of 6 sections. Section 0 contains the coded characters "BUFR" and Section 5 the coded characters "7777" indicating the beginning and the end of a BUFR message. Section 1, Identification Section, contains information about the contents of the data, such as type of data, time of data, and whether or not the optional Section 2 is included in the message. Section 3 contains the description of the data that is represented in Section 4. Standard BUFR descriptors defined in BUFR tables B, C, and D are used for that purpose. Refer to the WMO Manual on Codes, Volume 1, International Codes, WMO N° 306, Part B - Binary codes - for details.

BUFR templates which can be used for GTS distribution of platform data collected via Argos are listed below.

BUFR Template for SHIP

0301036 - Ship's call sign and motion, type of station, date/time, position (coarse accuracy)
0007030 - Height of station ground above mean sea level
0007031 - Height of barometer above mean sea level
0302001 - Low altitude station, pressure (at station level & RSLP), tendency
0007032 - Height of sensor above local ground (or deck of marine platform)
0007033 - Height of sensor above water surface
0012101 - Temperature/dry-bulb temperature
0012103 - Dew-point temperature
0013003 - Relative humidity
0007032 - Height of sensor above local ground (or deck of marine platform)
0007033 - Height of sensor above water surface
0020001 - Horizontal visibility
0007033 - Height of sensor above water surface
0007032 - Height of sensor above local ground (or deck of marine platform)
0013023 - Total precipitation past 24 hours
0007032 - Height of sensor above local ground (or deck of marine platform)
0302004 - General cloud information
0302005 - Vertical significance, cloud
0020031 - Ice deposit (thickness)
0020032 - Rate of ice accretion
0020033 - Cause of ice accretion
0020034 - Sea ice concentration
0020035 - Amount and type of ice

0020036 - Ice situation
0020037 - Ice development
0020038 - Bearing of ice edge (see note 3)
0002038 - Method of sea-surface temperature measurement
0022043 - Sea/water temperature
0302021 - Waves (direction, period, height)
0302024 - Wind waves & 2 systems of swell waves
0020003 - Present weather (see note 1)
0004024 - Time period or displacement
0020004 - Past weather (1) (see note 2)
0020005 - Past weather (2) (see note 2)
0007032 - Height of sensor above local ground (or deck of marine platform)
0004024 - Time period or displacement
0013011 - Total precipitation/total water equivalent
0007032 - Height of sensor above local ground (or deck of marine platform)
0007033 - Height of sensor above water surface
0004024 - Time period or displacement
0012111 - Maximum temperature, at height and over period specified
0004024 - Time period or displacement
0012112 - Minimum temperature, at height and over period specified
0007032 - Height of sensor above local ground (or deck of marine platform)
0007033 - Height of sensor above water surface
0002002 - Type of instrumentation for wind measurement
0008021 - Time significance
0004025 - Time period or displacement
0011001 - Wind direction
0011002 - Wind speed
0008021 - Time significance
0004025 - Time period or displacement
0011043 - Maximum wind gust direction
0011041 - Maximum wind speed (gusts)

Notes:

1. Within RA-IV, the maximum temperature at 1200 UTC is reported for the previous calendar day (i.e. the ending time of the period is not equal to the nominal time of the report). Thus, in these cases, a delayed replication factor of 2 may be used to construct a time range. Conversely, in all other cases, a delayed replication factor of 1 is sufficient.
2. If "plain language" text is reported within Section 2, this information can be conveyed in BUFR via the use of an appropriate 205YYY field as an extra descriptor following the above basic template.

BUFR Template for XBT/XCTD

0001003 - WMO Region number/geographical area
0001020 - WMO Region sub-area
0001005 - Buoy/platform identifier
0001011 - Ship or mobile land station identifier
0001019 - Long Station or site name
0001080 - Ship line number according to SOOP
0005036 - Ship transect number according to SOOP
0001036 - Agency in charge of operating the Observing platform
0301011 - Year, month, day
0301012 - Hour, minute
0301021 - Position (lat, lon) (high accuracy)
0007030 - Height of station ground above mean sea level
0002040 - Method of removing velocity and motion of platform from current
0022067 - Instrument type for water temperature profile measurement
0022068 - Water temperature profile recorder types
0008080 - Qualifier for GTSPP quality flag
0033050 - Global GTSPP quality flag
0008080 - Qualifier for GTSPP quality flag
0033050 - Global GTSPP quality flag
0008080 - Qualifier for GTSPP quality flag
0033050 - Global GTSPP quality flag
0008080 - Qualifier for GTSPP quality flag
0033050 - Global GTSPP quality flag
0025100 - XBT/XCTD fall rate equation coefficient a
0025101 - XBT/XCTD fall rate equation coefficient b
0022063 - Total water depth
0302021 - Waves (direction, period, height)
0306004 - Sub-surface water temperature & salinity profile
0002030 - Method of current measurement
0306005 - Sub-surface current speed & direction profile
0007032 - Height of sensor above local ground (or deck of marine platform)
0012101 - Temperature/dry-bulb temperature
0012103 - Dew-point temperature
0007032 - Height of sensor above local ground (or deck of marine platform)
0011001 - Wind direction
0011002 - Wind speed

Note: a unique observation identifier will be defined later by SOOP.

BUFR Template for subsurface profiling floats

0001003 - WMO Region number/geographical area
0001020 - WMO Region sub-area
0001005 - Buoy/platform identifier
0001085 - Observing platform manufacturer's model
0001086 - Observing platform manufacturer's serial number
0002036 - Buoy type
0002149 - Type of data buoy
0301011 - Year, month, day
0301012 - Hour, minute
0301021 - Position (lat, lon) (high accuracy)
0007030 - Height of station ground above mean sea level
0002040 - Method of removing velocity and motion of platform from current
0022067 - Instrument type for water temperature profile measurement
0022068 - Water temperature profile recorder types
0008080 - Qualifier for GTSPP quality flag
0033050 - Global GTSPP quality flag
0008080 - Qualifier for GTSPP quality flag
0033050 - Global GTSPP quality flag
0008080 - Qualifier for GTSPP quality flag
0033050 - Global GTSPP quality flag
0008080 - Qualifier for GTSPP quality flag
0033050 - Global GTSPP quality flag
0022055 - Float cycle number
0022056 - Direction of profile
0022063 - Total water depth
0302021 - Waves (direction, period, height)
0002032 - Indicator for digitization
0002033 - Method of salinity/depth measurement
0031001 - Delayed descriptor replication factor
0007062 - Depth below sea/water surface
0022045 - Sea/water temperature
0022064 - Salinity
0002030 - Method of current measurement
0306005 - Sub-surface current speed & direction profile

Remark: Above 6 descriptors were deleted because floats do not measure such variables.
Note: a unique observation identifier will be defined later by SOOP.

BUFR Template for BUOY

0001003 - WMO Region number/geographical area
0001020 - WMO Region sub-area
0001005 - Buoy/platform identifier
0002001 - Type of station
0002036 - Buoy type
0002149 - Type of data buoy
0301011 - Year, month, day
0301012 - Hour, minute
0008021 - Time significance
0301011 - Year, month, day
0301012 - Hour, minute
0008021 - Time significance
0301021 - Position (lat, lon) (high accuracy)
0027004 - Alternate latitude (high accuracy)
0028004 - Alternate longitude (high accuracy)
0007030 - Height of station ground above mean sea level
0001051 - Platform transmitter ID number
0002148 - Data collection and/or location system
0001012 - Direction of motion of moving observing platform
0001014 - Platform drift speed (high precision)
0002040 - Method of removing velocity and motion of platform from current
0033022 - Quality of buoy satellite transmission
0033023 - Quality of buoy location
0033027 - Location quality class (range of radius of 66 % confidence)
0022063 - Total water depth
0302021 - Waves (direction, period, height)
0302022 - Wind Waves (direction, period, height)
0302023 - Swell waves (direction, period, height)
0008081 - Type of equipment
0025026 - Battery voltage (large range)
0008081 - Type of equipment
0025026 - Battery voltage (large range)
0008081 - Type of equipment
0025026 - Battery voltage (large range)
0008081 - Type of equipment
0002034 - Drogue type
0022060 - Lagrangian drifter drogue status
0007070 - Drogue depth
0002190 - Lagrangian drifter submergence (% time submerged)
0025086 - Depth correction indicator
0002035 - Cable length
0002168 - Hydrostatic pressure of lower end of cable (thermistor string)
0020031 - Ice deposit (thickness)
0002038 - Method of sea-surface temperature measurement
0306004 - Sub-surface water temperature & salinity profile
0002030 - Method of current measurement
0306005 - Sub-surface current speed & direction profile
0007031 - Height of barometer above mean sea level
0008081 - Type of equipment
0012064 - Instrument temperature
0302001 - Low altitude station, pressure (at station level & RSLP), tendency

0008081 - Type of equipment
0007032 - Height of sensor above local ground (or deck of marine platform)
0007033 - Height of sensor above water surface
0012101 - Temperature/dry-bulb temperature
0012103 - Dew-point temperature
0013003 - Relative humidity
0007032 - Height of sensor above local ground (or deck of marine platform)
0007033 - Height of sensor above water surface
0008082 - Artificial correction of sensor height to another value
0007033 - Height of sensor above water surface
0002169 - Anemometer type
0002002 - Type of instrumentation for wind measurement
0008021 - Time significance
0004025 - Time period or displacement
0011001 - Wind direction
0011002 - Wind speed
0008021 - Time significance
0004025 - Time period or displacement
0011043 - Maximum wind gust direction
0011041 - Maximum wind speed (gusts)
0008082 - Artificial correction of sensor height to another value
0007033 - Height of sensor above water surface
0007032 - Height of sensor above local ground (or deck of marine platform)
0004024 - Time period or displacement
0013011 - Total precipitation/total water equivalent
0007032 - Height of sensor above local ground (or deck of marine platform)
0008021 - Time significance
0004024 - Time period or displacement
0014021 - Global radiation, integrated over period specified
0008021 - Time significance
0025028 - Operator or manufacturer defined parameter
0025028 - Operator or manufacturer defined parameter
0025028 - Operator or manufacturer defined parameter
0031001 - Delayed descriptor replication factor
0004024 - Time period or displacement
0007062 - Depth below sea/water surface
0012111 - Maximum temperature, at height and over period specified

Annex D - Glossary

ATLAS	Autonomous Temperature Line Acquisition System. TAO Array moored buoys deployed in the equatorial Pacific Ocean initially for TOGA.
BATHY	GTS code form used for bathythermal observations.
BCD	Binary Coded Decimal.
Bit	The smallest possible quantity of information, 0 or 1.
BUFR	Binary Universal Form for the Representation of meteorological data.
Bulletin	GTS Bulletin: set of GTS reports coded using the same GTS code form and grouped for GTS distribution.
Buoy	Drifting and moored buoys are automatic observing systems deployed in the oceans to gather geophysical data.
Calendar Day	The day of the year, e.g. 31 December is calendar day 365 in a non-leap year.
Checksum	The platform computes the sum of consecutive words from the platform message and inserts it in the message. When the GTS sub-system receives the sum, it re-calculates it and compares it with the sum in the message. If the numbers do not match, a transmission error has occurred: one or several bits are wrong.
CIM	Compression Index by platform Message, i.e. number of consecutive identical original platform messages from a platform during a satellite pass.
CIS	Compression Index by Sensor, i.e. number of identical data fields for a given sensor on a given platform, during a satellite pass. Identical fields are not necessarily consecutive.
Compensating sensor	Sensor used in conjunction with the transfer function of another sensor to calculate its geophysical value. For example an Air Pressure sensor can be compensated (corrected) by an internal temperature sensor because the temperature of the pressure sensor modifies its reading.

Data base	Organized data structure.
DBCP	Data Buoy Cooperation Panel. Joint body of the World Meteorological Organization (WMO) and of the Intergovernmental Oceanographic Commission (IOC).
Drifting Buoy	See buoy.
Drogue	Device attached to a drifting buoy either for the drifter to stay a long time in a given ocean area or for it to follow the water motion.
Flag	Binary descriptor (0/1, yes/no, good/bad, etc.).
FORTRAN	Programming Language.
FRGPC	French Argos Global Processing Centre (Toulouse).
Geomagnetic Variation	Difference between true North and Magnetic North, high in polar areas. Can be used to correct wind direction data when these are measured with reference to magnetic North.
Gray Codes	Sequence of binary words of N bits; successive words differ one from another in only one bit position.
GTS	Global Telecommunication System of the World Meteorological Organization, used by the meteorological centres to exchange data in real time all over the world.
Header	GTS Bulletin Header: identification section of a GTS bulletin used to route bulletin to a weather centre.
HYDRA	GTS code form used for hydrological observations from a hydrological station.
IOC	Intergovernmental Oceanographic Commission.
Julian day	Integer for a given date. Julian day 1 is 1 January 1950. The 26 November 1990 is the 14939th day after 1 January 1950; its Julian day is therefore 14939.
Lagrangian drifter	Drifting buoy designed to follow water motion. Used to measure sea surface current.

MEDS	Marine Environment Data Service, Canada.
Modulo	Modulo operator on integer numbers: remainder of the Euclidian division of two integer numbers, i.e. (R = A mod B) <==> (A=B*Q + R with R<B).
Moored buoy	See buoy.
NDBC	National Data Buoy Center of NOAA, Stennis Space Center, Mississippi, USA.
NOAA	National Oceanic and Atmospheric Administration, USA.
NFP	National Focal Point for Drifting Buoy Programmes.
Observation	Set of geophysical measurements from a transmitter at a given time.
PGC	Principal GTS Coordinator. Designated by the Principal Investigator of an Argos programme as point of contact to request any status changes the Argos User Office is to do on platforms reporting onto the GTS.
PI	Principal Investigator (e.g. in drifting buoy programs, usually the platform owner).
PTT	Argos Platform Transmitter Terminal or Argos platform.
PTT message	Coded set of informations sent by a PTT to the satellite. Argos message.
QC	Quality Control.
Raw data	Original binary values of sensors as coded in the Argos messages.
Report	GTS Report: platform observation coded in a GTS message using a GTS code form.
RMS	Root Mean Square.
SHIP	GTS code form used for surface observations from a sea station.

SYNOP	GTS code form used for surface observations from a land station.
Synoptic observation	Observation done at a specific synoptic time. Synoptic times are 00:00, 03:00, 06:00, 09:00, 12:00, 15:00, 18:00, 21:00 UTC.
TAO	Tropical Atmosphere-Ocean.
TC DBCP	Technical Coordinator of the Data Buoy Cooperation Panel.
TOGA	Tropical Ocean and Global Atmosphere Programme.
USGPC	US Argos Global Processing Centre (in Largo).
UTC	Universal Time Coordinated.
WMO	World Meteorological Organization.
WMO number	Platform Identification Number used for international exchange of data on the GTS.
WOCE	World Ocean Circulation Experiment.
Word	A set of contiguous bits from a given regular sensor, timer or checksum.
Xor	Exclusive logical bit by bit or operator (0+0=0, 0+1=1, 1+0=1, 1+1=0).

Annex E - References

Argos User Manual.

WMO Manual on Codes, Volume 1, International codes, WMO No. 306, Part A - Character Codes.

WMO Manual on Codes, Volume 1, International codes, WMO No. 306, Part B - Binary Codes.

WMO Manual on the Global Telecommunication System, No. 386.

DBCP Guide to data collection and location services using Service Argos, DBCP document series.

TECHNICAL DOCUMENTS ISSUED WITHIN THE DATA BUOY COOPERAYION PANEL SERIES

No.	Title	Year of issue
1	Annual report for 1994	1995
2	Referenbce Guide to the GTS Sub-system of the Argos Processing System - Revision 1.3	2003
3	Guide to Data Collection and Location Services using Service Argos	1995
4	WOCE Surface Velocity Programme Barometer Drifter Construction Manual - Revision 1.2	2002
5	Surface Velocity Programme - Joint Workshop on SVP Barometer Drifter Evaluation	1996
6	Annual report for 1995	1996
7	Developments in Buoy Technology and Enabling Methods - Technical Presentations Made at the Eleventh Session of the DBCP	1996
8	Guide to Moored Buoys and Other Ocean Data Acquisition Systems	1997
9	Annual Report for 1996	1997
10	Developments in Buoy Technology and Communication Technologies	1997
11	Annual report for 1997	1998
12	Developments in Buoy Technology and Data Applications	1998
13	Annual report for 1998	1999
14	Variety in Buoy Technology and Data Applications	1999
15	Global Drifting Buoy Observations - A DBCP Implementation Strategy	1999
16	Annual Report for 1999	2000
17	Developments in Moored and Drifting Buoy Design, Programmes, Sensors, and Communications - Presentations at the DBCP Technical Workshop	2000
18	Annual report for 2000	2001
19	Developments in Buoy Technology, Communications and Data Applications - Presentations at the DBCP Scientific and Technical Workshop	2001
20	DBCP Annual report for 2001	2002
21	Dev. in buoy technology, communications, science and data applications Presentations at the DBCP Workshop, Perth, Oct. 2001	2002
22	Research, applications and developments involving data buoys - Presentations at the DBCP Workshop, Martinique, Oct. 2002	2003
23	DBCP Annual report for 2002	2003

These publications can be ordered from: Etienne charpentier, Technical Coordinator of DBCP and SOOP, JCOMMOPS, Parc Technologique du Canal, 8-10 rue Hermes, F-31526 Ramonville Saint-Agne, France - *Internet mail*: charpentier@jcommops.org - *Telefax:* +33-5 61 75 10 14 - *Telephone:* +33-5 61 39 47 82