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CAWA-SSP-FMT-GFZ-006

Remotely Operated Multi-Parameter Stations

System Software Output Format Specification

CRD

Scientific Technical Report STR - Data 20/08

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Preparation/Review	Name
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Change Control Sheet

Date	Version	Author	Items
31.10.2010	0.1	Tilo Schöne	Initial Document
03.01.2011	0.2	Tilo Schöne	Parameter added
20.09.2011	0.3	Tilo Schöne	Parameter for SPA added
08.12.2011	0.4	Tilo Schöne	Parameter for river monitoring added
04.07.2012	0.5	Tilo Schöne	Unit for Pressure is changed from mmHg to mBar
15.12.2015	0.6	Cornelia Zech	Parameters for SPA added and spited SPA and RQ in new sub sections
03.11.2017	0.7	Tilo Schöne	New parameters added (snow scale & soil sensors)
13.05.2019	0.8	Cornelia Zech	New parameters added (Water level & CTD)
12.02.2020	0.9	Cornelia Zech	Measurement range for AirTC changed (from HMP45 to HMP155)
07.05.2020	1.0	Cornelia Zech	Update of introduction and file naming convention

1. INTRODUCTION AND SCOPE

An extensive network of Remotely Operated Multi-Parameter Stations (ROMPS) has been installed in the last years providing meteorological and hydrological data. Most of the stations are part of the Regional Research Network "Water in Central Asia" (CAWA) funded by the German Federal Foreign Office but additional funding was provided by GFZ through the "Global Change Observatory – Central Asia" (GCO) and the "Advanced Remote Sensing – Ground-truth Demo and Test Facilities" (ACROSS) projects of the Helmholtz Association. In spite of various projects, the technical setup of the stations is largely identical. There are minor differences in the selection of the sensors due to different applications. This means that all measurement parameters do not necessarily have to be available at each station. Usually, a standard set of meteorological sensors such as air temperature, relative humidity, air pressure, wind speed and direction, precipitation, solar radiation, soil moisture, and soil temperature are installed but this can be expanded to include other sensors like a snow measuring system or river discharge system.

All data from the hydrometeorological system are sampled by a Campbell datalogger on each station according to a pre-selected sampling rate and written to files. The software requesting the data from the datalogger and writing them to files is called **crd**. The files are transmitted to a central data storage unit using file-oriented TCP/IP services (scp, ncftp) at GFZ and to the open access web-based Sensor Data Storage System (SDSS).

The scope of this document is to describe the data format coming from the ROMPS. Additionally, this document is the basis for processing of data within the SDSS.

2. DEFINITIONS, ACRONYMS, ABBREVIATIONS

Abbreviation	Description
CAWa	Project "Water in Central Asia"
GCO	Project "Global Change Observatory – Central Asia"
ACROSS	Project "Advanced Remote Sensing – Ground-truth Demo and Test Facilities"
crd	hymet data daemon (Software module for communicating with Campbell® data recorder peripherals)
SW	Software
TBD	to be defined
SDSS	Sensor Data Storage System
UTC	Universal Time Coordinated

3. DOCUMENTS

All relevant information about data structures for the design and procurement of the Hymet station software is contained in this specification. The following documents are provided as additional information and reference. In case of incompatibilities between the document at hand and one of the following documents, this shall be brought to the attention of the customer for resolution.

4. FILE NAMING CONVENTION

The data is stored in files following a unique file name convention. The file name consists of a 4-letter leading identifier, type of data, intermediate information, and a file name extension.

The file name is defined as follows

<div align="center">

`XXXX-<type-of-data>-<timestamp>.EXT`

</div>

with

`XXXX`:	as 4-letter leading identifier for station code,
`type-of-data`:	for the type of observed parameters,
`timestamp`:	Unix time at the moment of file closure (seconds since 01.01.1970), and
`EXT`:	extension for type of file (e.g. *.log).

The type of observed parameters can be:

- hymetd: for meteorological data requested by the `crd` software
- snow: for snow data (requested by the `crd` software)
- RQ24: for river discharge data (requested by the `crd` software)

The time consistency is achieved by synchronizing the system with a GPS time signal once a day. Therefore, all time information is based on this time scale. Exceptions are stated in the text.

5. GENERAL DESCRIPTION OF *CRD* SOFTWARE RECORD FOR CAWA HYMET STATIONS

5.1. Overview

The standard Hymet station is equipped with hydrometerological sensors and a Campbell® data recorder. While the standard set of meteorological data is stored in one file, additional data, e.g. discharge or snow data will be stored in an extra file. Each file consists of header information and the measured data. All header records are enclosed by speech marks and separated by a comma.

The header record can be divided into four parts containing each line as follows:
1.   General station information
2.   Types of measured parameters listed with their abbreviation
3.   Units of measured parameters
4.   Quantity representation (type of sampling) of measured parameters.

After this header section, the data section follows starting with date and time. All values corresponding to the same time are written in one line and are comma-separated. The following table shows an example of the header sections and one data line:

Header	`"TOA5","CR1000","22872","CR1000.Std.15","CPU:TARA_20100905.CR1","45970","Table1"`	**I**
	`"TIMESTAMP","RECORD","BattV_Min","VW_1","PA_1","VW_2","PA_2","VW_3","PA_3","VW_4","PA_4","VW_5","PA_5","VW_6","PA_6","VW_7","PA_7","VW_8","PA_8","T107_1","T107_2","T107_3","T107_4","T107_5","T107_6","T107_7","T107_8","AirTC","RH","Baro","RadSW_Up_Avg","RadSW_Dn_Avg","RadLW_Up_Avg","RadLW_Dn_Avg","NR01TC_Avg","NR01TK_Avg","NetRs_Avg","NetRl_Avg","Albedo_Avg","UpTot_Avg","DnTot_Avg","NetTot_Avg","RadLW_UpCo_Avg","RadLW_DnCo_Avg","WindSp_Avg","WindSp_Max","WindSp_TMx","WindDir","Rain_Tot","R_vel","R_WL","R_Q"`	**II**
	`"TS","RN","Volts","","uSec","","uSec","","uSec","","uSec","","uSec","","uSec","","uSec","","uSec","Deg C","Deg C","Deg C","Deg C","Deg C","Deg C","Deg C","Deg C","%","mmHg","W/m^2","W/m^2","W/m^2","W/m^2","Deg C","K","W/m^2","W/m^2","W/m^2","W/m^2","W/m^2","W/m^2","W/m^2","W/m^2","meters/second","meters/second","meters/second","Degrees","mm","mm/s","mm","m^3/s"`	**III**
	`"","","Min","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Avg","Avg","Avg","Avg","Avg","Avg","Avg","Avg","Avg","Avg","Avg","Avg","Avg","Avg","Avg","Avg","Max","TMx","Smp","Tot","Smp","Smp","Smp"`	**IV**
Data	`"2018-09-25 09:30:00",237794,12.36,0.075,19.38,0.114,21.16,0.098,20.47,0.133,21.96,0.143,22.35,0.143,22.35,"NaN","NaN","NaN","NaN",13.60,10.93,11.73,12.58,12.39,12.35,"NaN","NaN",15.35,31.42,776.354980,664.760559,141.117157,-213.116013,47.300652,23.64,296.8,523.643433,-260.416687,0.212283,451.644531,188.417816,263.226746,227.016693,487.433350,0.533,0.975,"2018-09-25 09:29:00",25.49,0.000000,3.454`	**One data line**

5.2. Header Record Definition Type I

General information about the station and the Campbell® data recorder:

`"TOA5","CR1000","22872","CR1000.Std.15","CPU:TARA_20100905.CR1","45970","Table1"`

Field	Data representation	Description
"TOA5"	Character	Table Oriented ASCII (refers to the output format, here ASCII)
"CR1000"	Character	Campbell® Data Recorder Type
"22872"	Character	Operating System Signature
"CR1000.Std.15"	Character	Campbell® Data Recorder Firmware Version
"CPU:TARA_20100905.CR1"	Character	Campbell® Data Recorder Configuration file
"45970"	Character	Program Signature Number
"Table1"	Character	Internal Table for measured values

5.3. Header Record Definition Type II

Types of the measured parameters:

```
"TIMESTAMP","RECORD","BattV_Min","VW_1","PA_1","VW_2","PA_2","VW_3","PA_3","V
W_4","PA_4","VW_5","PA_5","VW_6","PA_6","VW_7","PA_7","VW_8","PA_8","T107_1",
"T107_2","T107_3","T107_4","T107_5","T107_6","T107_7","T107_8","AirTC","RH","
Baro","RadSW_Up_Avg","RadSW_Dn_Avg","RadLW_Up_Avg","RadLW_Dn_Avg","NR01TC_Avg
","NR01TK_Avg","NetRs_Avg","NetRl_Avg","Albedo_Avg","UpTot_Avg","DnTot_Avg","
Net-
Tot_Avg","RadLW_UpCo_Avg","RadLW_DnCo_Avg","WindSp_Avg","WindSp_Max","WindSp_
TMx","WindDir","Rain_Tot","R_vel","R_WL","R_Q"
```

For details refer to "Field" entries in Section 6.

5.4. Header Record Definition Type III

Units of the measured parameters:

```
"TS","RN","Volts","","uSec","","uSec","","uSec","","uSec","","uSec","","uSec"
,"","uSec","","uSec","Deg C","Deg C","Deg C","Deg C","Deg C","Deg C","Deg
C","Deg C","Deg C","%","mmHg","W/m^2","W/m^2","W/m^2","W/m^2","Deg
C","K","W/m^2","W/m^2","W/m^2","W/m^2","W/m^2","W/m^2","W/m^2","W/m^2","meter
s/second","meters/second","meters/second","Degrees","mm","mm/s","mm","m^3/s"
```

For details refer to "Unit" entries in Section 6. The entries are related to the same field entries as Type II.

5.5. Header Record Definition Type IV

Quantity representation (type of sampling) of measured parameters:

```
"","","Min","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp"
,"Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp","Smp
","Smp","Smp","Smp","Avg","Avg","Avg","Avg","Avg","Avg","Avg","Avg","Avg","Av
g","Avg","Avg","Avg","Avg","Avg","Max","TMx","Smp","Tot","Smp","Smp","Smp"
```

The fields describe the data description for the measured quantity representation. The entries are related to the same field entries as Type II.

Field	Data representation	Description
""	Empty	Empty fields are for e.g., time or record number
"Smp"	Character	Sample: Spot or instantaneous value
"Min"	Character	Minimum value within the past sampling period
"Max"	Character	Maximum value within the past sampling period
"Avg"	Character	Average over the past sampling period
"Tot"	Character	Total value, e.g. for Rain in the past sampling period

Depending on the type of sampling (min, max, avg, tot), the Type II data entry may be appended by the Type IV, e.g. totalisation of Rain would be "Rain_Tot", averaged Wind Speed would be "WindSP_Avg".

5.6. Record Description of CRD

5.6.1. Meteorological parameters

Field	TIMESTAMP
Description	Gives the time of the measurements
Character Length	19
Data representation	Character
Unit	YYYY-MM-DD HH:MI:SS
	TS
Minimum	n/a
Maximum	n/a
Error Code	No error code available
Notes	Time is enclosed in speech marks
	The time system is originated from the Campbell® data recorder and cannot be adjusted during run time. The time is set by the operator prior to deployment

Field	RECORD
Description	Internal record number
Data representation	Integer
Unit	RN
Minimum	1
Maximum	111360
Notes	The record number is increased every measurement. Measurement is defined as the internal sampling rate of the data logger.

Field	BattV	
Description	Battery voltage of power supply	
Data representation	Float	
Unit	Volts	
Minimum		
Maximum		
ErrorCode	NaN	Enclosed in speech marks
Notes		

Field	VW_# (# = [0,9])	
Description	Volumetric soil water content at local position #	
Data representation		
Unit	n/a	
Minimum		
Maximum		
Error Code	NaN	Enclosed in speech marks
Notes	Values equal & above 800 may be truncated to integer. A value of 799.99 would be float "799.99", while 800.01 would be integer "800". This is firmware dependent and must not be true for all files.	

Field	PA_# (# = [0,9])	
Description	Measured travel time of the EM-wave along the probe CS616	
Data representation		
Unit	μSec (displayed as uSec)	
Minimum		
Maximum		
Error Code	NaN	Enclosed in speech marks
Notes	Values equal & above 800 may be truncated to integer. A value of 799.99 would be float "799.99", while 800.01 would be integer "800". This is firmware dependent and must not be true for all files.	

Field	T107_# (# = [0,9])	
Description	Soil temperature at local position #	
Data representation	Float	
Unit	°C	
Minimum	-35	
Maximum	50	
Error Code	NaN	Enclosed in speech marks
Notes		

Field	AirTC	
Description	Air Temperature	
Data representation	Float	
Unit	°C	
Minimum	-80	
Maximum	60	

Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III HMP45 range: -40 to +60°C	

Field	RH
Description	Relative Humidity
Data representation	Float
Unit	%
Minimum	0
Maximum	100
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III

Field	Baro
Description	Barometric Pressure
Data representation	Float or Integer
Unit	mBar (hPa)
Minimum	500 mbar (hPa)
Maximum	1100 mbar (hPa)
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III Values equal & above 800 may be truncated to integer. A value of 799.99 would be float "799.99", while 800.01 would be integer "800". This is firmware dependent and must not be true for all files.

Field	RadSW_Up
Description	Incoming short-wave solar radiation
Data representation	Float or Integer
Unit	W/m^2
Minimum	0
Maximum	2000
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III Values equal & above 800 may be truncated to integer. A value of 799.99 would be float "799.99", while 800.01 would be integer "800". This is firmware dependent and must not be true for all files.

Field	RadSW_Dn
Description	Outgoing (reflected) short wave solar radiation
Data representation	Float or Integer
Unit	W/m^2
Minimum	0
Maximum	2000
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III Values equal & above 800 may be truncated to integer. A value of 799.99 would be float "799.99", while 800.01 would be integer "800". This is firm-ware dependent and must not be true for all files.

Field	RadLW_Up
Description	Incoming long wave solar radiation
Data representation	Float or Integer
Unit	W/m^2
Minimum	-1000
Maximum	1000
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III Values equal & above 800 may be truncated to integer. A value of 799.99 would be float "799.99", while 800.01 would be integer "800". This is firm-ware dependent and must not be true for all files.

Field	RadLW_Dn
Description	Outgoing (reflected) long wave solar radiation
Data representation	Float or Integer
Unit	W/m^2
Minimum	-1000
Maximum	1000
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III Values equal & above 800 may be truncated to integer. A value of 799.99 would be float "799.99", while 800.01 would be integer "800". This is firm-ware dependent and must not be true for all files.

Field	NR01TC
Description	Temperature at the solar radiation sensor in degrees Celsius
Data representation	Float
Unit	Deg C
Minimum	-10
Maximum	40
Error Code	NaN · Enclosed in speech marks
Notes	For the Unit see Header Record Type III

Field	NR01TK
Description	Temperature at the solar radiation sensor in Kelvin
Data representation	Float
Unit	K
Minimum	263.15
Maximum	313.15
Error Code	NaN · Enclosed in speech marks
Notes	For the Unit see Header Record Type III

Field	NetRs
Description	Net short-wave solar radiation
Data representation	Float or Integer
Unit	W/m^2
Minimum	
Maximum	
Error Code	NaN · Enclosed in speech marks
Notes	For the Unit see Header Record Type III Values equal & above 800 may be truncated to integer. A value of 799.99 would be float "799.99", while 800.01 would be integer "800". This is firmware dependent and must not be true for all files.

Field	NetRl
Description	Net long wave solar radiation
Data representation	Float or Integer
Unit	W/m^2
Minimum	
Maximum	

Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III	
	Values equal & above 800 may be truncated to integer. A value of 799.99 would be float "799.99", while 800.01 would be integer "800". This is firmware dependent and must not be true for all files.	

Field	Albedo	
Description	Proportion of the incident light or radiation that is reflected by a surface	
Data representation	Float or Integer	
Unit	W/m^2	
Minimum		
Maximum		
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III	
	This quantity is internally computed	

Field	UpTot	
Description	Total incoming solar radiation	
Data representation	Float or Integer	
Unit	W/m^2	
Minimum	0	
Maximum		
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III	
	Values equal & above 800 may be truncated to integer. A value of 799.99 would be float "799.99", while 800.01 would be integer "800". This is firmware dependent and must not be true for all files.	

Field	DnTot	
Description	Total outgoing solar radiation	
Data representation	Float or Integer	
Unit	W/m^2	
Minimum		
Maximum		
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III	

Field	NetTot
Description	Total Net solar radiation
Data representation	Float or Integer
Unit	W/m^2
Minimum	
Maximum	
Error Code	NaN — Enclosed in speech marks
Notes	For the Unit see Header Record Type III
	Values equal & above 800 may be truncated to integer. A value of 799.99 would be float "799.99", while 800.01 would be integer "800". This is firm-ware dependent and must not be true for all files.

Field	RadLW_UpCo
Description	Temperature corrected incoming solar radiation 'RadLW_UpCo=RadLW_Up+5.67*10^-8*NR01TK^4'
Data representation	Float or Integer
Unit	W/m^2
Minimum	
Maximum	
Error Code	NaN — Enclosed in speech marks
Notes	For the Unit see Header Record Type III
	Values equal & above 800 may be truncated to integer. A value of 799.99 would be float "799.99", while 800.01 would be integer "800". This is firm-ware dependent and must not be true for all files.

Field	RadLW_DnCo
Description	Temperature corrected outgoing solar radiation 'RadLW_DnCo=RadLW_Dn+5.67*10^-8*NR01TK^4'
Data representation	Float or Integer
Unit	W/m^2
Minimum	
Maximum	
Error Code	NaN — Enclosed in speech marks
Notes	For the Unit see Header Record Type III
	Values equal & above 800 may be truncated to integer. A value of 799.99 would be float "799.99", while 800.01 would be integer "800". This is firm-ware dependent and must not be true for all files.

Field	WindSp	
Description	Wind speed	
Data representation	Float	
Unit	meters/seconds	
Minimum	0	
Maximum	60	
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III	
Field	WindSp_Max	
Description	Wind speed maximum (Gust)	
Data representation	Float	
Unit	meters/seconds	
Minimum	0	
Maximum	60	
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III	

Field	WindDir	
Description	Wind direction	
Data representation	Float	
Unit	Degrees	
Minimum	0	
Maximum	355 (electrical) (360 mechanical)	
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III	

Field	WindSp_TMx	
Description	Gives the time of the maximum wind speed (Gust)	
Record length	19	
Data representation	Character	
Unit	YYYY-MM-DD HH:MI:SS TS	
Minimum	n/a	
Maximum	n/a	
Error Code	n/a	
Notes	For the Unit see Header Record Type III	

Field	Rain
Description	Amount of Precipitation within the sampling interval
Data representation	Float or Integer
Unit	mm
Minimum	0
Maximum	
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III
	Values equal & above 800 may be truncated to integer. A value of 799.99 would be float "799.99", while 800.01 would be integer "800". This is firm-ware dependent and must not be true for all files.

Field	Soil_temperature_## (## = [01,30])
Description	Soil temperature at local position ##
Data representation	Float
Unit	°C
Minimum	-20°C
Maximum	+80°C
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III
	Due to an earlier programming, the Field may be named as "Temp#", "Temp##" or "Soil_temperature_#" (for positions between [1,9])

Field	Water_content_## (## = [01,30])
Description	Soil water content at local position ##
Data representation	Float
Unit	%
Minimum	0
Maximum	TBD (100?), sensor dependence
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III
	Depending on the cross-profile section, the value may have decimal digits, while still a 4digit (integer) value is distributed. This needs clarification in SDSS.
	Due to an earlier programming, the Field may be named as "Wasserg#" or "Wasserg##' or "Water_content_#"(for positions between [1,9])

5.6.2. Snow parameters

Field	SnowH
Description	Snow Height
Data representation	Float
Unit	mV (will be converted to mm)
Minimum	TBD
Maximum	TBD
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III
	Till January, 4th, 2011, unit in mV, for conversion contact thoss@gfz-potsdam.de
	Values equal & above 800 are truncated to integer. A value of 799.99 would be float "799.99", while 800.01 would be integer "800"

Field	S#_ice (# = [1,4])
Description	Ice Content in snow by the SPA
Data representation	Float
Unit	%
Minimum	0
Maximum	100
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III

Field	S#_water (# = [1,4])
Description	Water Content in snow by the SPA sensor
Data representation	Float
Unit	%
Minimum	100
Maximum	100
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III

Field	S#_dens (# = [1,4])
Description	Snow Density by the SPA sensor (calculated)
Data representation	Float
Unit	kg/m^3
Minimum	0

Maximum	1000	
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III	

Field	S#_SWE (# = [1,4])	
Description	Snow water equivalent by the SPA sensor (calculated)	
Data representation	Float	
Unit	Mm WS	
Minimum	0	
Maximum	1000 (3000) factory configured	
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III	
	The SWE corresponds to the water column in mm resulting from the melting of the complete snow cover on a defined area. It is calculated from the snow density of sloping sensors with respect to the snow depth.	

Field	SH	
Description	Snow Depth by Ultrasonic of the SPA	
Data representation	Float	
Unit	m	
Minimum	0	
Maximum	2.5 (5) factory configured	
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III	
	The snow depth sensor output is zeroed during installations	

Field	Potmtr	
Description	Correction Length Sensor of the SPA sensor (Potentiometer measuring the variation of the length of the cross band)	
Data representation	Float	
Unit	mm	
Minimum	TBD	
Maximum	TBD	
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III	
	The deforming of sloping sensors due to the snow pack can be corrected by measuring the additional length of the sensor rope at the suspension.The sensor measures the rotation of the suspension roll and converts the values into length. The correction is automatically included in the calculation.	

Field	S#_C§ ((#=(1,4), §=(1,2))	
Description	Capacitance of the SPA sensor	
Data representation	Float	
Unit	pF	
Minimum	TBD	
Maximum	TBD	
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III	
	The capacitance of the SPA-sensor is measured at a low frequency of 10 kHz and a high frequency of 150 kHz. The capacitance of one meter sensor in the air is 16,7 pF at both frequencies and consequently about 84 pF for a 5 m long SPA-sensor. The values may vary with humidity and water on the sensor.	

Field	SnowScale	
Description	Snow weight	
Data representation	Float	
Unit	kg/m^2	
Minimum	0	
Maximum	TBD (XXX), sensor dependence (Sensors exist for 200 to 3000 mm Snow water equivalent)	
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III	

5.6.3. Water parameters

Field	R_vel	
Description	RQ24 Water / River surface velocity	
Data representation	Float	
Unit	mm/s	
Minimum	0,3 m/s	
Maximum	8 m/s	
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III	

Field	R_WL
Description	RQ24 Water Level
Data representation	Float
Unit	mm or cm

Minimum	0 m	
Maximum	30 m	
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III	
	Depending on the cross-profile section, the value may come as (static) mm/cm, while still a 4-digit (integer) value is distributed. This needs clarification in SDSS.	

Field	R_Q	
Description	RQ24 river flow volume	
Data representation	Float	
Unit	m^3/s	
Minimum	0	
Maximum	TBD (9999?)	
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III	
	Depending on the cross-profile section, the value may have decimal digits, while still a 4digit (integer) value is distributed. This needs clarification in SDSS.	

Field	Radar	
Description	Water level from Radar sensor	
Data representation	Float	
Unit	mm	
Minimum	0	
Maximum	15000	
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III	

Field	CTDPressure	
Description	Water pressure above CTD sensor	
Data representation	Float	
Unit	mbar	
Minimum	0	
Maximum	980	
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III	

Field	CTDTemp	
Description	Water temperature from CTD Sensor	
Data representation	Float	
Unit	°C	
Minimum	0	
Maximum	60	
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III	

Field	CTDConduct	
Description	Water Conductivity	
Data representation	Float	
Unit	S/m	
Minimum	0	
Maximum	10	
Error Code	NaN	Enclosed in speech marks
Notes	For the Unit see Header Record Type III	