Integrating Activities for Advanced Communities

D3.6- SMF 6 minutes

Project No.730938– INTERACT

H2020-INFRAIA-2016-2017/H2020-INFRAIA-2016-1

Start date of project: 2016/10/01 Duration: 48 months
Due date of deliverable: 2020/07/31 (46) Actual Submission date: 2020/08/11

Lead partner for deliverable: UCPH
Author: Morten Rasch

Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the Consortium (including the Commission Services)	
CO	Confidential, only for members of the Consortium (including the Commission Services)	

Station Managers' Forum V Minutes - publishable executive summary

The 6th Station Managers' Forum (SMF) meeting in INTERACT II was held Bäckaskog Castle, Sweden. 42 INTERACT stations were represented at the meeting along with representatives from a number of external partners and collaborators, e.g. AMAP, Iridium, ECMWF, T-MOSAiC, APECS, AECO, etc., 69 participants altogether.

The INTERACT SMF is a platform for dialogue for internal knowledge exchange between station managers, and SMF tasks and other workpackages. The meeting included sessions on ongoing SMF work package tasks and included:

A SMF Seminar: best practices of organizing and financing research stations. Prospects and consequences of different administration and leadership models.

A Safety Course: Means of communication and positioning systems (by Sara Mollie Cohen, UNIS).

Open floor sessions where station managers share experiences. Following stations gave updates:
Arctic Research Station by Aleksandr Sokolov
- Update on station facilities and instrumentation,

Oulanka Research Station – short movie, By Riku Pavola.
- Video of Oulanka Research Station and it's 'EcoClimate' programme, which is a long-term manipulative natural experimental platform

Kluane Lake – Energy supply system and hydroponics, by Harry Penn
- Presenting experiences with sustainable energy solution and hydroponic growing system recently installed at Kluane Lake Research Station.

Sonnblick Observatory by Christian Maier
- Update on station facilities and instrumentation.

SakhaFluxNet by Trofim Maximov (Spasskaya Pad, Elgeei and Chokurdakh research stations)
- Global, continental and regional observational networks of heat, water and carbon dioxide fluxes.

Research Station Samoylov Island by Sofia Antonova
- Update on station facilities and instrumentation, and showing the importance of high frequency Lena River water sampling based at the Research Station Samoylov Island using non-expert sample collectors.

Sessions where other INTERACT WPs requested input from station managers was also part of the agenda.

Generally, WP3 tasks are developing according to the time plan and all deliverables of the second reporting period has been met.

Minutes of INTERACT II

Station Managers' Forum VI

Photo: Marie Frost Arndal

5-6 February 2020 Bäckaskog Castle, Sweden

List of Contents

Minutes

Wednesday, February 5

1. Welcome and introduction

By Morten Rasch, Chair of INTERACT Station Managers' Forum, University of Copenhagen

The chair of INTERACT Station Managers' Forum, Morten Rasch, welcomed all participants to the meeting at Bäckaskog Castle in Sweden. After a short introduction to the agenda, all participants introduced themselves.

42 INTERACT stations were represented at the meeting along with representatives from a number of external partners and collaborators, e.g. AMAP, Iridium, ECMWF, T-MOSAiC, APECS, AECO, etc., 69 participants altogether.

All presentations from INTERACT II can be found online at https://eu-interact.org/presentations-from-station-managers-forum-vi/

2. Status of SMF in INTERACT II, by Elmer Topp-Jørgensen

Generally, tasks are developing according to the time plan and almost all deliverables and milestones have been met. The planned safety courses are a bit delayed due to change of staff at UNIS, but the deliverable (course materials for four courses) is expected to be submitted before the deadline (June 2020). In addition to the two remaining courses (one at this meeting, one at the last consortium meeting in September 2020) and course materials, the SMF WP have another deliverable – the INTERACT Research and Monitoring Report with a deadline in June 2020. For this report, station managers need to register or update monitored parameter groups, studied disciplines, and upload project metadata from 2000 until today through the INTERACT GIS system. By updating in the GIS system, it will be easy to extract the information needed for the report.

3. T- MOSAiC by Diogo Folhas

The T-MOSAiC secretary, Diogo Folhas, introduced the T-MOSAiC programme. T-MOSAiC is the "Terrestrial Multidisciplinary distributed Observatories for the Study of Arctic Connections" that will study the terrestrial consequences of Arctic sea ice reduction and climate change. This will be done simultaneously with the MOSAIC expedition (2019-2020) that will study arctic oceanographic and climate change issues.

A T-MOSAiC/INTERACT call will be advertised by end of February 2020, to enable T-MOSAiC researchers/thematic groups to request access to data from Arctic field stations during 2020. It has been

agreed that the T-MOSAiC Secretariat will receive, organize, and manage the applications, and act as a bridge between the applicants and INTERACT station managers. Requests to INTERACT Station Managers will be for specific data, observations or samples. Station Managers reserve the right to reject any application and the submission of an application does not guarantee the acceptance of the request. The data archives will be published as individual station records that will have DOI's assigned and will be cited where used (only new DOI for those data that do not have it already).

In addition to providing data/samples (as described above), T-MOSAiC has specific requests for INTERACT stations contributions to a T-MOSAiC/INTERACT catalogue of Automated Weather Station (AWS), and air temperature data plus photographic landscape images (spring and summer). This goes for the T-MOSAiC / MOSAiC period 1 January 2019 to 31 December 2020, and for data from AWS stations that are currently 'invisible' in the WMO network.

It is also still possible for stations and their scientists to join thematic groups under T-MOSAiC, please visit the T-MOSAiC website to explore these groups.

Action > Basic metadata for all stations (station catalogue information) will be sent to Diogo.

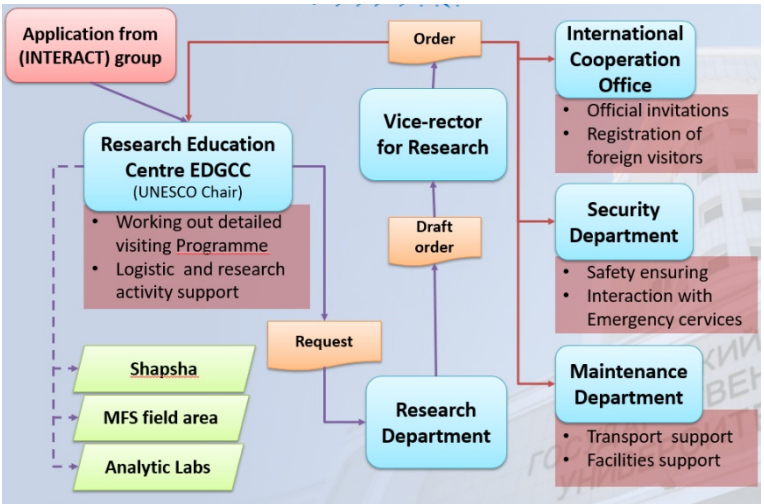
4. SMF Seminar

5. Best practices of organizing and financing research stations. Prospects and consequences of different administration and leadership models.

This seminar was brought up as a wish from station managers, and some stations were asked to give a presentation of their organisation and funding mechanisms for inspiration.

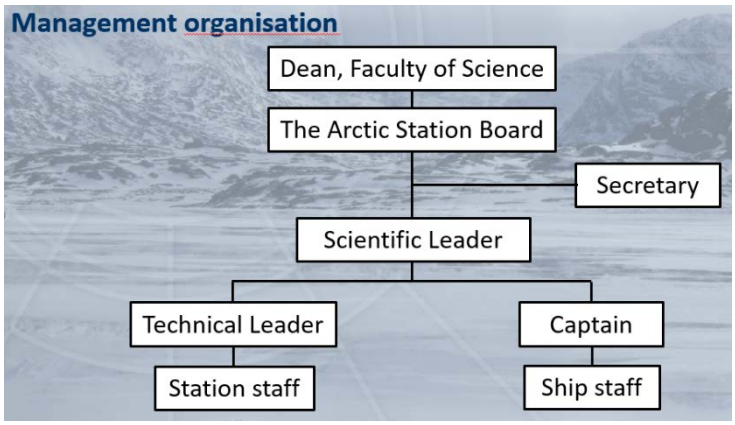
1. Mukhrino by Elena Lapshina

Mukhrino Field Station is owned and run by the Research Education Centre "EDGCC" (UNESCO Chair) of Yugra State University, Russia. The station was established in 2009 and has 6 employees. Funding: 90% of the money from INTERACT goes to visitors (flight tickets etc.). 5% is used for the run of the station. Government funds the rest. The university has no money to support the station. Indirect cost from grants can be used for technical support to the station.



This diagram demonstrates the sequence of steps in the administrative management process and the University structures involved in decision-making about visiting event.

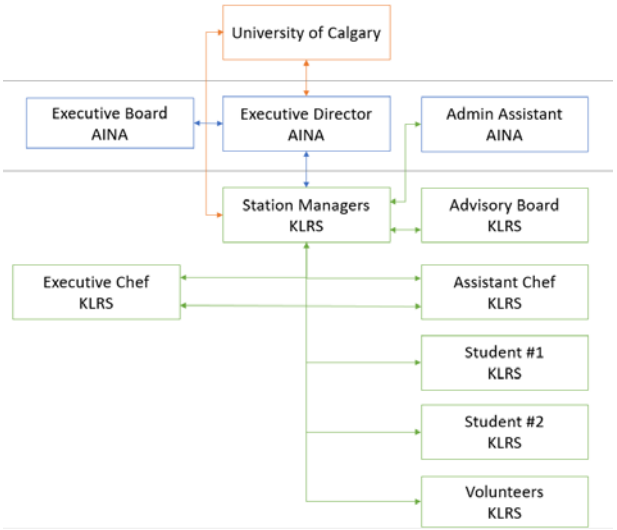
Arctic Station by Morten Rasch



The scientific leader of Arctic Station, Greenland, is in general an education position, i.e. a young scientific leader in a time limited position for example Ph.D or Post doc., ideally employed for 3 years. The station is owned by University of Copenhagen and has room for up to 26 scientists. Staff: 1 Scientific leader, 1 Technical leader, 1 Captain, 2-3 Logistics assistants. The Board is involved in the daily run of the station. The station receives an operating grant of 2.7 mio DKK from University of Copenhagen, and get income from user fees.

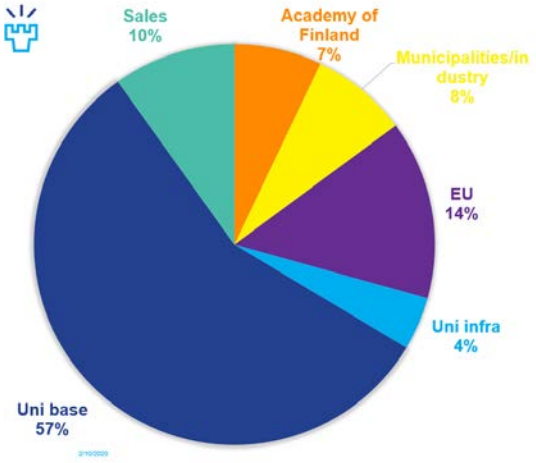
Kluane Lake by Harry Penn

Kluane Lake Research Station, Canada, is owned and managed by the Arctic Institute of North America (AINA), and can accommodate up to 42 persons. Two persons are sharing the Station manager position and spends 40% on research, 60% as station manager and vice versa (equals one full time position researcher). Costs are paid by users, governmental funds and scientific grants as well as paying field schools. Executive board consists of six people from industry and academia.



Oulanka by Rico Pavola

Oulanka Research Station in Finland is part of an Infrastructure unit at University of Oulo. As an infrastructure unit, staff are not expected to conduct research as PI.
Staff: 6 (technical staff). Number of beds: 72.
Organisation: Part of the Infrastructure unit – board only advisory. Directly under the vice-rector of research.
See diagram for funding:



Notes from the discussion in breakout groups:

1. Management of stations

Station head needs autonomy (as well as accountability). Short decision paths are important, otherwise it can be slow. If paths are long, people need to communicate and work together well. Very important for station manager to have control over his or her own budget and change expenditures to address things that come up.

Some kind of executive director is common, but can be challenging.

Advisory boards vary with some being more involved than others. Often they have some scientific advice functions.

Funding – stable, long term is advisable. Most stations are partly government or university funded. Important to have long term planning for infrastructure.

2. Financing models

All stations are different – some have 24/7 support while other stations are un-manned. Scientists need a safe platform to work from, and it is important to support science. Discussion on how to find the balance: How should technical and scientific issues be prioritised?

Concluding remarks: Could we make a comprehensive mapping of station management?

Action > Send out a questionnaire to all station managers. Make few slides to show policy makers and decision makers. Synthesize the discussion on financing by doing a survey.

6. Breather presentation – CIAO

China Iceland Arctic research Observatory by Halldór Johannsson

The presentation is available on the INTERACT website https://eu-interact.org/presentations-from-station-managers-forum-vi/

7. INTERACT GIS management organization by Morten Rasch

The INTERACT GIS system now includes the following modules:

- A station catalogue module
- A research project database
- A publication database
- An application module (for application for access to research stations)

Currently, apparently only two stations use the INTERACT GIS application module, and a major challenge is to get more stations to use the application module in the future.

Workpackage 2, Subtask 2.0.4 consists of the following tasks:

1) Develop INTERACT GIS to make it a leading international platform, 2) Consolidate the INTERACT GIS Management Organisation, and 3) Ensure an effective operation with an increasing number of stations involved (i.e. stations using the application module). 4) Integrate standard station descriptions and science metadata and data in formats developed in cooperation with relevant organisations/networks, and 5) Integrate thematic maps (climate zones, vegetation, permafrost etc.) in cooperation with relevant organisations/networks.

It was suggested that the possible establishment of a more permanent INTERACT GIS Management Organisation is postponed to the last few months of INTERACT III (i.e. the autumn of 2023). An interim management organization consisting of two representatives from SMF coordination (to represent the station managers and the INTERACT GIS Station Manager Forum perspectives) and two representatives from Umeå IT (representing the technical perspectives) was suggested and approved. A more detailed description of the new management organization can be found in the document 'suggestions concerning the formal framework for the run and development of INTERACT GIS during INTERACT III, by Morten Rasch (See Appendix 1)

8. INTERACT Station Managers Forum Website by Morten Rasch

The SMF website has not been updated for a long time and needs some re-structuring and new content. It will be placed under INTERACT main website under 'Managing stations' and new sub categories could be: 1) Station management, 2) INTERACT GIS, 3) Publications, 4) SMF meetings. A suggested sub-structure was presented to accommodate the need for making smart online versions of previous publications and new materials, and all agreed on the suggested new draft structure.

Action > The SMF secretariat will make a draft of a new website structure and send around to all station managers for input and comments. Will be ready for next Station Managers Forum in September 2020.

DAY 2, Thursday February 6

9. Breather presentation

North-East Scientific Station (NESS) by Nikita Zimov.

NESS is located in North-East Siberia. Originally, the station was founded in 1980 as the part of the Soviet Academy of Sciences, but since the 1990 NESS has been a private scientific organization. The presentation is available on the INTERACT website.

10. Open floor

Open floor is a session where station managers are encouraged to inform about recent developments at the station, new facilities/technologies, new outreach initiatives, etc. At this meeting six stations offered to present new developments. Presentations can be found on the INTERACT website https://eu-interact.org/presentations-from-station-managers-forum-vi/ (item 20-24).

11. *Arctic Research Station* – Update on station facilities and instrumentation, *by Aleksandr Sokolov*

The station started in 1954 and is situated in the Yamal-Nenets Autonomous District in Russia. The presentation is available on the INTERACT website.

12. Oulanka Research Station – short movie, By Riku Pavola.

Video of Oulanka Research Station and it's 'EcoClimate' programme, which is a long-term manipulative natural experimental platform studying combined and separate effects of climate change and reindeer grazing. The video is available online at https://youtu.be/vN3o3z1zwrU.

13. *Kluane Lake* – Energy supply system and hydroponics, by Harry Penn

Kluane Lake Research Station recently installed a new energy supply system: 25 KW solar array and 80 kW carbon nano lead batteries for energy storage. In December-January, the diesel generators run at max to charge the batteries and are then turned off again for 3-4 days. Avoid the sound of generators during summer. The price for all this: around 200.000 Canadian dollars. Harry will send out information on the batteries, see appendix 2.

A hydroponic growing system will be installed to grow leafy greens, roots crops, etc. A 40 feet container with 18,000 LED lamps (production equal to 1 acre land), is planned to be up and running by June 2020. System has a water scrubber, to remove nutrients from wastewater. Crop box cost around 100.000 CA dollars. The presentation is available on the INTERACT website.

14. Sonnblick Observatory by Christian Maier

Update on station facilities and instrumentation.

Sonnblick Observatory is situated in the Austrian Alps. The presentation is available on the INTERACT website.

15. SakhaFluxNet by Trofim Maximov

Global, continental and regional observational networks of heat, water and carbon dioxide fluxes. The presentation is available on the INTERACT website.

16. Research Station Samoylov Island by Sofia Antonova

Update on station facilities and instrumentation.

High frequency Lena River water sampling based at the Research Station Samoylov Island. The station uses permanent staff, that lives at the station year-round and operates and supports the station, but are not scientifically trained. The presentation is available on the INTERACT website.

17. Safety Course by Sara Mollie Cohen

Sara gave a lecture on means of communication and positioning systems:
Pros and cons of different Satellite phones, Emergency Beacons, VHF radios, InReach, Maps and compasses, GPS, etc. The presentation is available on the INTERACT website and can be used as a guide, see https://eu-interact.org/presentations-from-station-managers-forum-vi/.

18. INTERACT photo contest and Coffee table book by Morten Rasch

A coffee table book with pictures from a photo competition in the INTERACT community is planned for publication by the end of INTERACT II. Each chapter will be supplemented with a short text (one page) telling, in easy words, about the subject of the chapter. The primary purpose of this book is to illustrate the more adventurous aspects of arctic research stations and arctic research to attract an audience that is not being attracted by other INTERACT publications / outreach products. The photos will be evaluated by an

evaluation committee. The winner under each theme will have a diploma and a small present. A number of pictures will be selected for the book by the evaluation panel.

Possible themes:

- The research Station
- Arctic Fieldwork
- Remote Field Camps
- Landscapes
- Wildlife and plants
- People
- Local communities

Photo competition: February – April 2020, and expected Publication in September 2020.

Action > send out info about the competition (requirements, photo resolution etc.) and timelines for the photo contest. Any suggestions for female photographers for the evaluation committee will be appreciated.

19. Closing of SMF

By Morten Rasch (University of Copenhagen) and Elmer Topp-Jørgensen (Aarhus University)

Station managers were reminded that:

- A number of 360-degree cameras are circulated to interested stations. The SMF keeps track of cameras and ensure these are circulated. Stations were reminded to use the equipment and to report to the SMF once done, to discuss where to send the kit.

- New research and Monitoring report will soon be made. Important that all station managers upload their project metadata in INTERACT GIS. Guidelines for uploading excel files with project metadata will be circulated.

Action > Elmer will send out a template to all station managers to ease the uploading of metadata.

Action > Station managers remember to sign up for INTERACT GIS (register on website and use 'Contact' on the website to write note on which station you will be managing and if others need to have access to the station in INTERACT GIS)

Action > Next SMF meeting will be held back to back with the Annual meeting of INTERACT III, September 21-25 in North America.

20. Appendices 1- 2

Appendix 1

INTERACT GIS – Management Organisation

Status of INTERACT GIS: INTERACT GIS has been developed during INTERACT I and INTERACT II. It now includes the following modules:

- A station catalogue module
- A research project database
- A publication database
- An application module (for application for access to research stations)

Currently, only two stations use the INTERACT GIS application module.

Development plans during INTERACT III: Further development of the system will take place during INTERACT III. According to the INTERACT III Description of Work we have promised to do the following (Subtask 2.0.4 in Workpackage 2):

- Develop INTERACT GIS to make it a leading international platform
- Consolidate the INTERACT GIS Management Organisation
- Ensure an effective operation with an increasing number of stations involved (i.e. stations using the application module)
- Integrate standard station descriptions and science metadata and data in formats developed in cooperation with relevant organisations/networks.
- Integrate thematic maps (climate zones, vegetation, permafrost etc.) in cooperation with relevant organisations/networks

Major challenge during INTERACT III:

- To make the system application module attractive to research stations

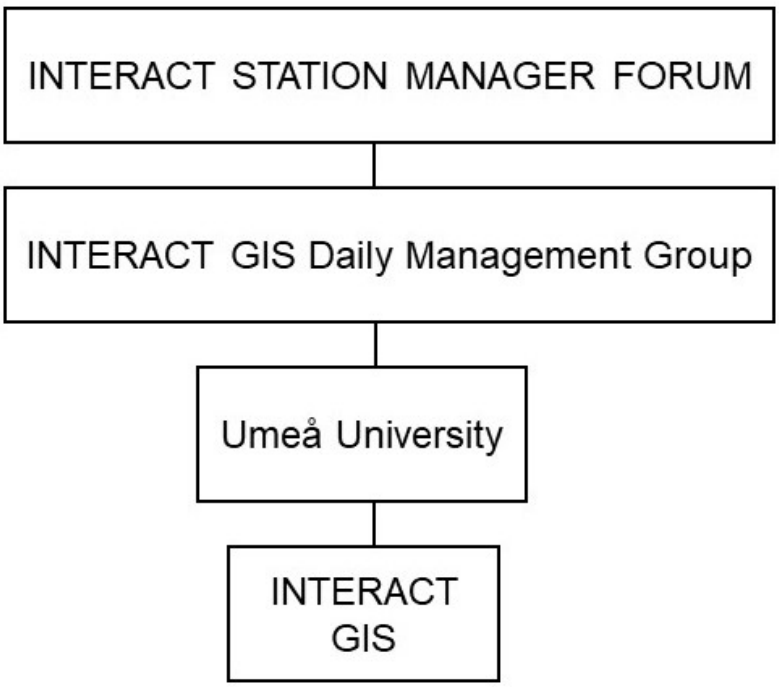
Thoughts about the need for a management organization:

- It is part of the INTERACT II Description of Work to establish an INTERACT GIS management organization with the purpose of securing a continued run of INTERACT GIS after funding from the EU Commission runs out.
- We have not been good enough in making the use of the system application module attractive to stations involved in INTERACT. The application module is a very important part of INTERACT GIS - also because it is one of the feeding systems for the INTERACT GIS project database.
- We now have the chance in INTERACT III to increase the number of stations using the application module and thereby securing that INTERACT GIS will become a leading arctic research project database.
- If we do not succeed with this, it is not considered very probable that INTERACT GIS will have a legacy/life beyond INTERACT III.
- It is therefore suggested that the possible establishment of a more permanent INTERACT GIS Management Organisation is postponed to the last few months of INTERACT III (i.e. the autumn of 2023), when we know whether or not it is probable that INTERACT GIS will have a life after INTERACT.

Suggestions concerning the formal framework for the run and development of INTERACT GIS during INTERACT III:

- INTERACT GIS will be run and further developed in close cooperation between the Station Manager Forum and Umeå University.
- An INTERACT GIS Daily Management Group with Skype meetings once every month and on ad hoc basis (when needed) will be established with participation of two representatives of the Station Manager Forum Secretariat and two representatives of Umeå University.
- Suggestions concerning larger developments of the system will be made by the INTERACT GIS Daily Management Group to be discussed at a Station Manager Forum before system developments are being initiated.
- The Station Manager Forum Secretariat will pay all expenses concerning hosting of the INTERACT GIS during entire INTERACT III.
- The further development of the INTERACT GIS during INTERACT III will take place via funding from INTERACT III to Umeå University.
- The Station Manager Forum Secretariat is obliged to suggest, no later than 30 September 2023, a more permanent management organization to be established when the funding for INTERACT III runs out.
- The Station Manager Forum Secretariat takes responsibility for promoting the system internally in INTERACT to secure that much more stations will find it interesting to use the system in general and specifically the application module.

Suggested management organization:



Discover®
Innovative Battery Solutions

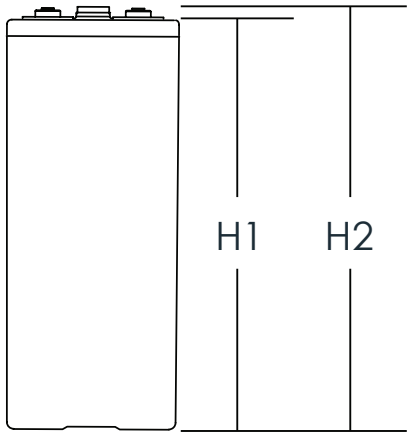
Appendix 2

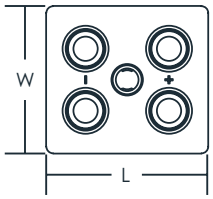
2VRE-4400TG
DATASHEET

Tubular Gel OPzV Cell

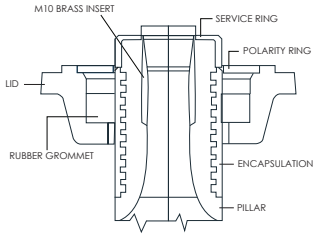
Discover® Tubular Gel OPzV batteries are maintenance-free and provide superior deep cycling performance and reliability for demanding commercial, industrial and residential applications. Providing reliable energy storage for Stationary Backup and Telecom Networks, and Renewable Energy applications with its Advanced Tubular Plate Technology to deliver long service life. Discover® Tubular Gel OPzV batteries provide maximum efficiency per discharge-charge cycle, and proven reliability in remote, high temperature, or unstable power network installations.

MECHANICAL DRAWINGS





Terminal (M10)



MECHANICAL SPECIFICATIONS

Voltage	2	
Industry Reference	Tubular Gel OPzV	
Length (A)	8.3 in	212 mm
Width (B)	10.9 in	277 mm
Height (C)	31.4 in	797 mm
Total Height (D)	32.5 in	825 mm
Weight	247 lbs	112 kgs
Terminal	M10	
Poles	4	
Cell(s)	1	
Container	ABS	

ELECTRICAL SPECIFICATIONS

Reference LVD / I10	**20% DOD**	2.05V
	50% DOD	1.97V
	80% DOD	1.91V
Cycle Life	**20% DOD**	7000 cycles
	50% DOD	2950 cycles
	80% DOD	1900 cycles
Internal Resistance		0.25 mΩ
Short Circuit		8500 A
Self Discharge		2-3% per month
Maximum Operating Temperature		-35°C / -31°F | 50°C / 122°F
Electrolyte		Gel

ELECTRICAL SPECIFICATIONS

240 HR	120 HR	100 HR	20 HR	10 HR	5 HR	3 HR	1 HR
1.85 Volts Per Cell (VPC)			1.75 Volts Per Cell (VPC)				
2238 AH	2227 AH	2197 AH	1782 AH	1620 AH	1470 AH	1275 AH	784 AH

NOTE: All Electrical Specifications are based on 20°C / 68°F temperature.

BENEFITS & FEATURES

Long Service Life
Tubular positive plates with non-woven polyester gauntlets are designed to prevent active material plate shedding and provide the highest cycling expectancy amongst lead acid technologies, particularly in PSoC (Partial State of Charge) operation.

High energy density tubular plates in combination with lead calcium alloy reduces self discharge and charge current requirements during float operation and extends battery service life.

Performance and Reliability
Special sliding pole terminals are designed to accommodate natural grid growth occurrence throughout battery lifetime. Battery containers are made of Acrylonitrile Butadiene Styrene(ABS) and Styrene Acrylonitrile (SAN) to endure high impact and heat environments.

Maintenance and Optimization
OPzV Gel batteries are valve-regulated, non-spillable and completely maintenance-free and available with the option to be horizontally mounted.

Safety
All products are tested and certified to multiple international safety standards for use in Photovoltaic and Stationary applications. Flame retardant containers are available upon request.

Lowest Total Cost of Ownership
OPzV Tubular batteries provide the Lowest Total Cost of Ownership (TCO) amongst lead acid technologies. Further savings can be achieved in Hybrid systems through diesel abatement and peak shaving.

CERTIFIED QUALITY

Discover and its manufacturing facilities are fully certified to ISO 9001/14001 and OSHA 18001 standards. OPzS and OPzV Tubular products are also tested in compliance to multiple international standards:

- Eurobat "Long Life" classification
- IEC 60896-21/22 (OPzV) and IEC60896-11 (OPzS) test standard for stationary applications
- IEC 61427 test standard for photovoltaic energy systems
- EN50272-1 and EN50272-2 safety requirements
- DIN 40742 (OPzV) and DIN 40736 (OPzS) standard for stationary tubular plate cells
- UN 2800 (US DOT Compliance)

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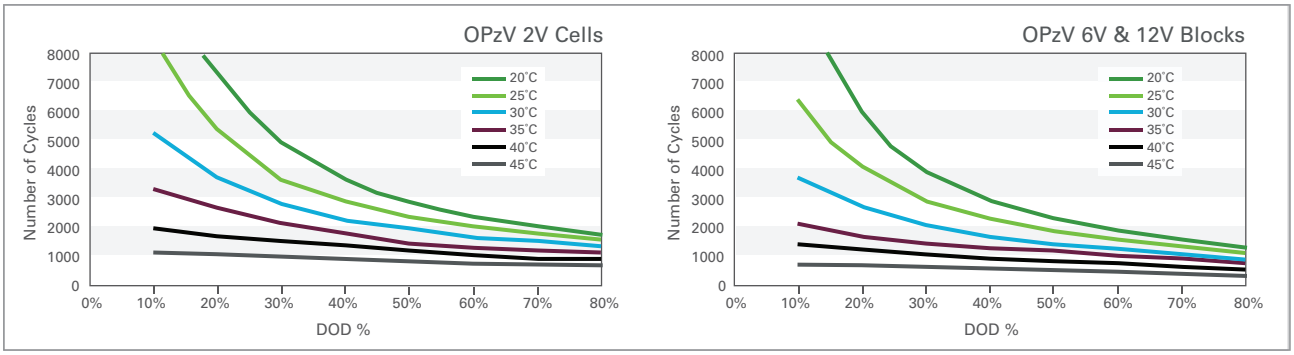
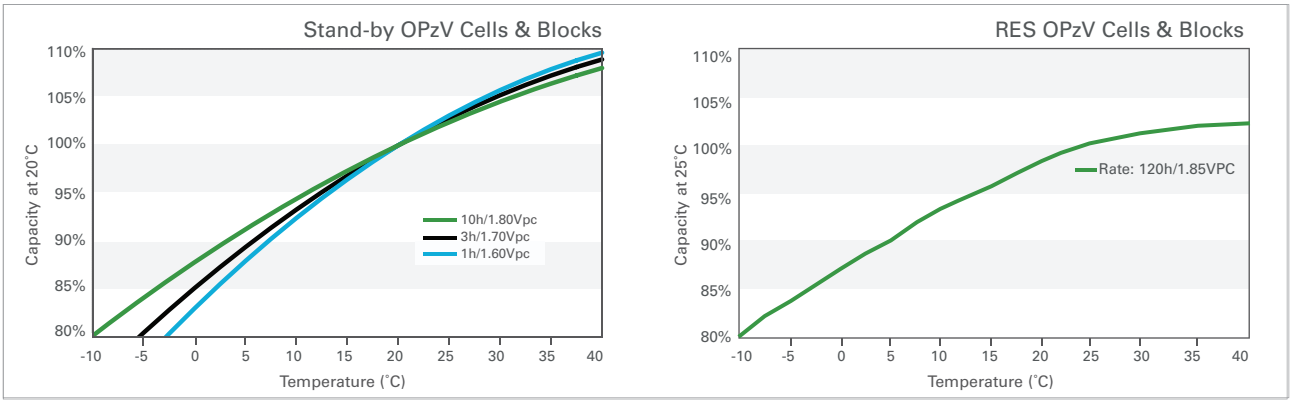
+ 1.778.776.3288
info@discoverbattery.com

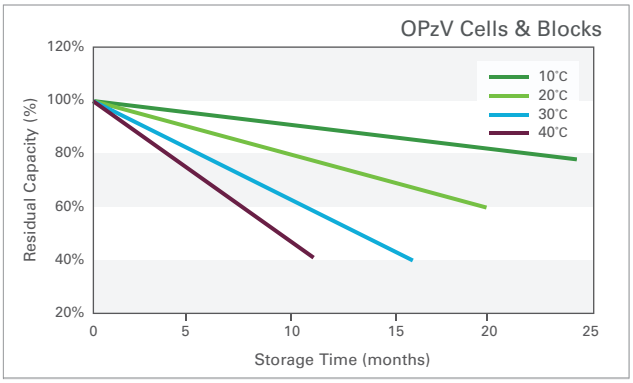
EXPECTED NUMBER OF CYCLES IN RELATION TO THE DEPTH OF DISCHARGE



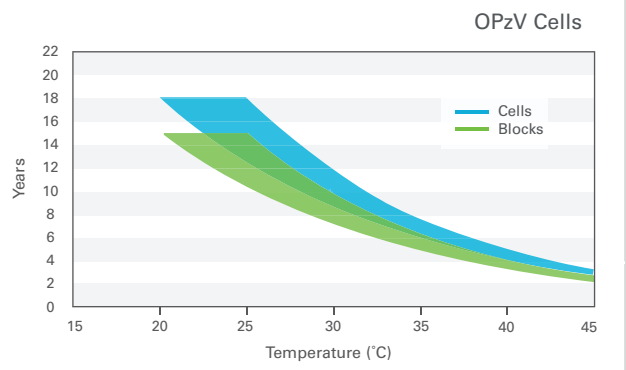
CAPACITY IN RELATION TO THE TEMPERATURE



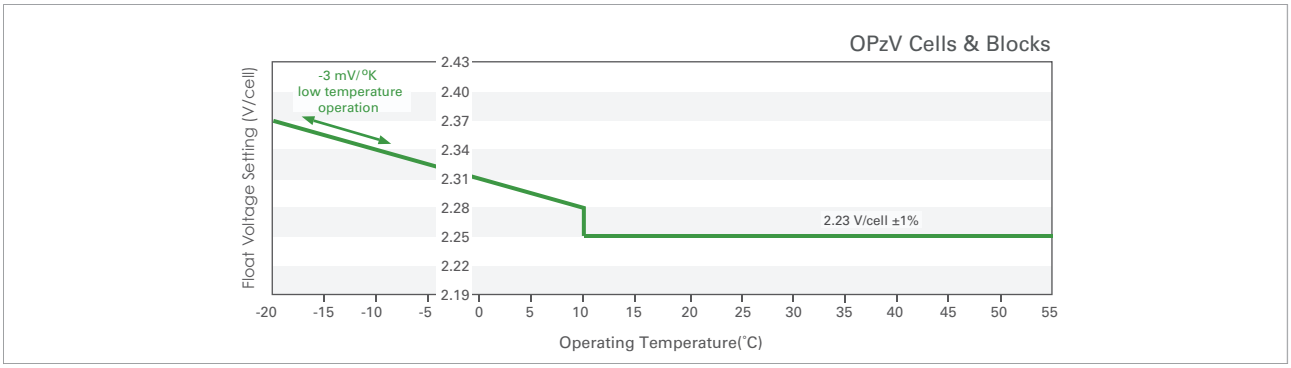
SELF-DISCHARGE CHARACTERISTICS



EXPECTED SERVICE LIFE IN RELATION TO OPERATING TEMPERATURE



Float Voltage Setting in Relation to Operating Temperature



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User Guide

Discover RE Gel Tubular Battery (SOPzV)

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Contents

Tubular Gel Battery

1. BATTERY CHARGING

The most common type of charging method can be grouped into three phases: bulk, absorption, and float charge. An additional equalization phase can be performed on a routine maintenance-as-required basis.

The Bulk charge accounts for charging the battery from anywhere between 0% up to 80% state of charge. The absorption phase charges the battery from 80% to nearly 100% state of charge. Lastly, a float charge supplies a controlled voltage and amperage to bring the battery to a complete full charge.

For specific charge programming instructions, please refer to the documents provided by the charger manufacturer.

1.1 CHARGE PARAMETERS

Regular Cycling /PSOC Recovery

Regular Cycling / PSOC Recovery		0°C (32°F)	10°C (50°F)	20°C (68°F)	25°C (77°F)	30°C (86°F)	40°C (104°F)
2V	Bulk & Absorption Charge Voltage	2.49 V	2.44 V	2.39 V	2.37 V	2.34 V	2.29 V
	Float Voltage	2.43 – 2.46 V	2.38 – 2.41 V	2.33 – 2.36 V	2.30 - 2.33 V	2.28 – 2.31 V	2.23 – 2.26 V
12V	Bulk & Absorption Charge Voltage	14.95 V	14.65 V	14.35 V	14.20 V	14.05 V	13.75 V
	Float Voltage	14.55–14.75V	14.25 – 14.45 V	13.95 – 14.15 V	13.80 - 14.00 V	13.65 – 13.85 V	13.35 – 13.55 V
24V	Bulk & Absorption Charge Voltage	29.90 V	29.30 V	28.70 V	28.40 V	28.10 V	27.50 V
	Float Voltage	29.10 – 29.50 V	28.50 – 28.90 V	27.90 – 28.30 V	27.60 - 28.00 V	27.30 – 27.70 V	26.70 – 27.10 V
48V	Bulk & Absorption Charge Voltage	59.80 V	58.60 V	57.40 V	56.80 V	56.20 V	55.00 V
	Float Voltage	58.20 – 59.00 V	57.00 – 57.80 V	55.80 – 56.60 V	55.20 - 56.00 V	54.60 – 55.40 V	53.40 – 54.20 V

TABLE 1 (a): Regular Cycling/Partial State of Charge (PSOC) Recovery

1.2 END AMPS (RETURN AMPS)

End Amps or Return Amps is the current when the battery is fully charged and no longer accepts a charge. When the current reaches the End Amps set point, the charger will turn off. The recommended setting is 2% of the C20 Ah rating. For example, if the battery is 220 Ah at the C20 rate, then the recommended End Amps setting is 4.4 Amps.

2. DEPTH OF DISCHARGE

It is recommended for a system to be sized for no greater than 50% Depth of Discharge (DOD). A deep discharge will provide more capacity to operate loads but exposes the battery to sulphation and reduces the service life. After a deep discharge, it is recommended to charge a battery back to full State of Charge (SOC) as soon as possible to preserve capacity life.

The longer the battery stays at a low Depth of Discharge, the greater the exposure to sulphation and capacity loss. If the battery is left at a low Depth of Discharge for extended periods of time, sulphation damages may become unrecoverable through equalization charges.

2.1 LOW VOLTAGE DISCONNECT

An electromagnetic device may be included into many charging systems which automatically disconnects and reconnects loads to the battery to preserve life based on the Low Voltage Disconnect (LVD) or Low Voltage Cut Off (LVCO) setting. The default setting may be set by the charger manufacturer at 1.8 volts per cell (VPC). To prolong battery cycle life, the recommended LVD setting is between 1.8 VPC to 1.85 VPC.

3. BATTERY MAINTENANCE

3.1 TERMINALS

The battery terminal connections should be regularly inspected, cleaned, and tightened properly with a torque wrench. Loose connections may cause arcing and shorts which will generate excessive heat and damage to the terminals.

Over time, dirt or corrosion may accumulate on the terminals. To clean, the connections should be removed. Using a neutralizing solution such as baking soda and water (100g per litre), wipe the terminals and connections to remove debris and any corrosion. Rinse the terminals and connections with distilled water to remove any remnants of the neutralizing solution. Allow sufficient time to dry, then apply a conductive coating agent such as petroleum jelly which acts as a safeguard against corrosion. Lastly, reconnect the battery terminals using a torque wrench.

3.2 STATE OF CHARGE

12V Block [Volt]	Percentage Charge
13.10V	100%
12.45V	75%
12.15V	50%
11.80V	25%
10.50V	0%

TABLE 2: State of Charge as a Measure Open-Circuit Voltage

3.3 TEMPERATURE

Temperature is important to monitor as it affects the voltage readings. Depending on the battery temperature, the voltage set points may require adjustment. For an accurate temperature measurement, the temperature sensor, if included with the charge equipment, must be properly mounted to the side of the cell casing below the electrolyte. Attaching the sensor to other parts of the battery may provide an inaccurate representation of the battery temperature. Failure to monitor the temperature accurately may cause overcharging or undercharging. The operating temperature should not exceed 50°C. As a precaution, there should be a charge cut-off to prevent the battery bank from operating at temperatures greater than 50°C (122°F).

3.4 STORAGE AND MAINTENANCE

When storing the batteries for a longer period, ensure to check the charge levels periodically as a low state of charge will cause sulphation. At ambient temperature conditions, the self-discharge is 5% per month. To maintain the battery at a high state of charge, the batteries should be recharged every 3 months to prevent sulphation.

If possible, the batteries should be stored at room temperature and in a controlled humidity environment (ie. indoors or sheltered). Depending on the temperature, the electrolyte levels may decrease in a colder environment and increase in a warmer environment. As a result, caution should be taken to monitor and maintain the electrolyte between the indicated minimum and maximum levels as plate exposure will have negative effects towards battery life.

3.5 WINTER STORAGE

The battery should be monitored closely in cold climates. If the electrolyte freezes, it may cause unrepairable damage such as case cracking. A discharged battery is more likely to freeze than a fully charged battery.

A higher specific gravity freezes at a much lower freezing temperature. For example, at a low state of charge, the battery may freeze when stored below -7°C (20°F). When the battery is at a higher state of charge and a higher specific gravity such as at 1.280, the freezing temperature is at -69°C (-92°F).

4. COMMISSIONING AND MAINTENANCE CHECKLIST

4.1 COMMISSIONING

Within the first week of operation, the following parameters should be recorded at full charge (baseline readings):

- Charger voltage and amperage output
- Absorption voltage at battery system terminals
- Measure and record the resting/loaded individual battery voltage
- Ambient temperature

Allow the battery system to discharge until it reaches the Low Voltage Disconnect and record the following parameters:

- Runtime
- Capacity delivered (amp-hours)
- Average DC load (amperes)
- Endpoint voltage at battery system terminals

After discharging, the battery should be fully charged as soon as possible to prevent sulphation.

4.2 SCHEDULED MAINTENANCE

The following should be monitored for the first 6-12 months:

MONTHLY

- Measure and record the resting/loaded individual battery voltage.
- Record ambient temperature where the batteries are installed.
- Inspect cell integrity for corrosion at terminal, connection, racks or cabinets.
- Check battery monitoring equipment to verify operation.

QUARTERLY

- Test Ventilation.
- Check for high resistive connections.
- Check cabling for broken or frayed cables.
- Verify Charge Output, Bulk/Absorption voltage of Inverter/Charge Controller.
- Check Ground connections.

Deep cycle batteries will increase in capacity during the initial break-in period. Adjustments to charging parameters may be necessary during this time. Following these recommendations will ensure the batteries to reach their rated capacity and be maintained in good working order.

5. TROUBLESHOOTING & FREQUENTLY ASKED QUESTIONS

The following is a list of common concerns and questions regarding system setup, battery charging and maintenance procedures. Please refer to these as general guidelines. For further assistance with your specific system setup, please contact your installer.

What causes the Battery Terminal to melt?

Battery terminals melting is most common because of improper connections causing high resistance and heat generation.

- Loose connections
- Over-tightened connections
- Improper sized cables (too small).
- Corroded connections
- Improper use of washers/lock washers.
- Too many connections on the same terminal

Why do the batteries bulge?

Some case bulging is normal from the weight of electrolyte. New battery cases tend to “relax” after filling with electrolyte.

- If case bulging is a concern upon receipt of a new product, please notify your Distributor immediately
- In the case of excessive bulging- your batteries may have been exposed to temperatures of over 50°C (122°F). The high temperature may cause the plates/chassis to swell and expand. If this occurs, the batteries may fail prematurely
- The batteries may have frozen due to excessive exposure to cold temperatures.

What causes a battery to lose capacity?

The capacity loss may be due to sulphation, overheating, or over-discharging. If there is capacity loss, the battery bank may no longer support an increase in load.

- A balance charge may be necessary
- Verify the temperature sensors are properly mounted and the operation settings are adjusted to the appropriate battery temperature

Why is the charging current to the battery bank so low?

The charging current will decrease as the batteries become fully charged. If the charge current is low, the end of charge cycle may have been reached. Verify that the charger is near the end of the Absorption phase or in Float voltage phase. If so, low current is normal at this stage of charging.

- The battery bank self-regulates charge current. The voltage can be controlled and adjusted to a high or low setting, however the amp output to the battery bank cannot be controlled and will drop as the batteries reach a full state of charge.

- When the charge current decreases to 2% of the battery capacity, the charge is essentially complete. (ex. 220 AH battery bank. Charge current is reduced to 4.4 Amps). Check the specific gravity with a hydrometer to confirm.

Why does the voltage rise very quickly causing the charger to shut off when I begin to charge my battery bank?

This is often an indication of sulphated batteries which can be confirmed by completing a load test.
- An increase in Absorption time may be necessary to sufficiently charge the battery to full SOC.
- If the battery bank is heavily sulphated, an equalization charge may be necessary.

Why does the battery bank not reach the Bulk voltage setting when charging?

If the system is not reaching the Bulk voltage, the charger voltage and/or Amp output to the battery bank may be too low. To ensure sufficient charge, the output should be approximately 10%-15% of the Amp Hour capacity of the battery bank. Another cause may be from DC loads running on the system during the charge cycle and reducing the current supplied to the battery bank.
- Verify that the charging settings meet the recommended charging parameters and that the charger output (Amps) is sufficient to meet the capacity requirements of the battery bank.

What do I do if the battery temperatures are very high?

- If at or nearing 50˚C (122˚F), shut off the charger and allow the batteries to cool.
- If a single battery or cell in a string is hot, this may indicate a cell failure or short. Verify the specific gravity for all cells, take the voltage readings from each battery, and perform a load test to identity any cell failures.

What causes the battery cover to crack, shatter and/or dislodge from the case? (Not affecting the positive and negative terminals or connections)

The ignition of hydrogen gas may have caused the battery cover to crack. This sometimes occurs during a charge where a loose connection at the terminal creates a spark and ignites hydrogen gas produced from the cell. If the battery case has split or cracked along the sides, the battery may have frozen in the past.