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Technical Note
D5.6 – Operations Validation Results

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D5.6 – Operations Validation Results

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Document Change Log:

Version	Date	Author name(s)	Description of Change
1.0	2019-01-15	Antonio Ceriello	First Issue of the document
1.1	2019-04-04	Antonio Ceriello	Procedure 2.610 ready. Following that, the tables in chapter 2.2 and chapter 3 have been updated accordingly, and the procedure itself included in the Annex.

Executive summary

The Operation Validation Results document, describes how the final version of the EDEN ISS procedures have been obtained from the preliminary version delivered before the start of the EDEN ISS Antarctica mission. These last have been provided as both annex of the document D4.6 Operations Procedures Test Report and as a standalone product for the EDEN ISS operators, accessible in electronic format on the computers used for the EDEN ISS operations.

As stated in other documents, the EDEN ISS test campaign has been used, among other things, as final validation step of the procedures. During the operations, the Antarctica operator has collected several notes and comments to the procedures, underlining all the technical and/or sequence mistakes and/or discrepancies. His feedback has been used to finally upgrade/update the procedures, or even to develop new ones as per identified new need.

This document describes the feedbacks provided by the Antarctica operator, and provides in annex the final version of the procedures (for those procedures whose inputs are available).

Finally, those procedure that cannot be updated (because the inputs are not yet available) and are still in draft or preliminary status, will be tracked as open points, and provided in other annexes of this document.

Contents

Acronyms

Acronym	Explanation	Acronym	Explanation
AIT	Assembly, Integration and Test	MTF	Mobile Test Facility
CDR	Critical Design Review	PODF	Payload Operations Data File
CNR	Consiglio Nazionale delle Ricerche	SW	Software
FRR	Final Readiness Review	TPZ	Telespazio
HW	Hardware	UoG	University of Guelph
ISPR	International Standard Payload Rack	WUR	Wageningen University and Research
ISS	International Space Station		
LIT	Limerick Institute of Technology		

1 Introduction

As already described in other documents, the procedures development has been managed following an approach similar to the one used for the development of the procedures for the ISS operations. That because:

- EDEN ISS is close to a space system. It is a complex system to be operated in a harsh environment by a trained, but not expert, operator.
- The EDEN ISS operations deals not only with the system operations (i.e. set a light intensity, a temperature, etc.), but also with procedures for plants management (seedling, pruning, harvesting, etc.), and for the assessment of the quality and safety of the food produced.

For that reason, to minimize the EDEN ISS operator effort, in terms of analysis of different operations manuals, user guides, and even different document authoring styles, it has been decided to follow an ISS-like approach. That approach led to the preparation of detailed procedures, written using one single standard (PODF-Like) and following a process similar to the one in place for the ISS procedure preparation. As part of the process, a validation step is foreseen, having the objective to collect the EDEN ISS operator feedbacks, comments and suggestions on the procedures, and then to update these last for further operations phases.

One remark: the validation activity deals with the only EDEN ISS procedures. The ISPR rack procedures have been excluded from this activity, since the ISPR rack operations are over.

1.1Applicable and Reference Document

1.1.1 Applicable Document

[AD1] - D2.7 Ops Mode and Test Plan v1.4

[AD2 – D4.6 Operations Procedures Test Report

1.1.2 Reference Document

N/A

2 Procedures Development Process (as-defined vs as-implemented)

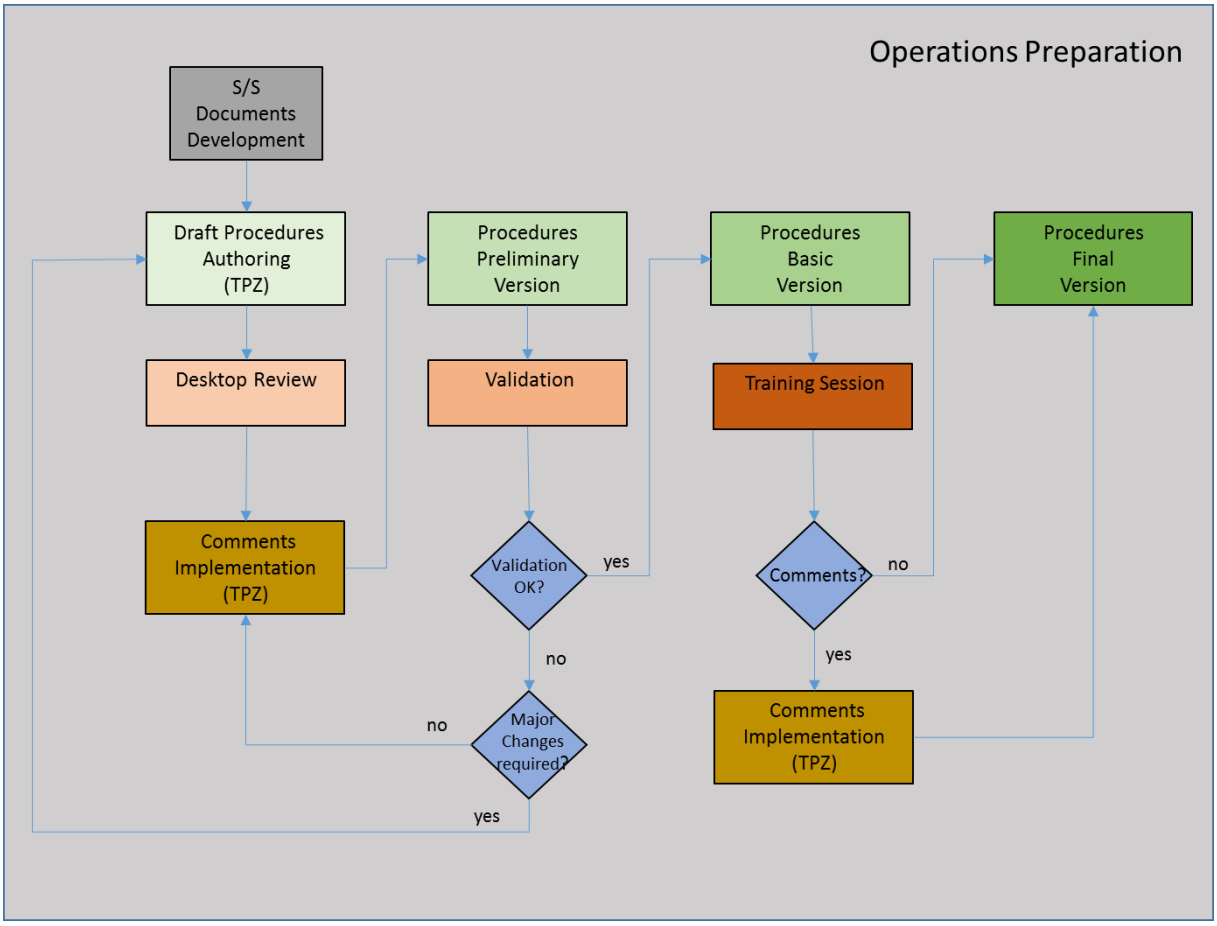


Figure 1: Procedure Development Process – as defined

The above figure 1 shows the procedures development process as defined in the early phase of the EDEN ISS project. The process was based on several cornerstones:

- **Desktop Review**, aimed at the revision of the draft procedures by a panel of experts and to the implementation of the received comments and recommendation in an new version of the procedures (Preliminary)
- **Procedures Validation,** aimed at the testing of the procedures using the HW/SW developed for the mission, or an alternate model having the same functionalities (Engineering Model)
- **Training Session,** aimed one hand at operators training, and on the other hand in collecting and implementing all the comments (if any) coming from it.

The process has been defined in order to have all the procedures ready in their final status, before the start of the Antarctica operations. However, for several reasons it was not possible to follow it as planned.

In fact, the delay in the hardware development, in documentation availability and in inputs provision, have affected the possibility to have the procedures ready as necessary. Because the misalignment of the procedures development timeline with the MTF availability, it was not possible to validate the procedures and promote them to the final status as planned, resulting in the need to change the development process and adapt it to this situation as shown in the Figure 2.

Following this new process, a preliminary set of procedures have been delivered prior the start of the EDEN ISS campaign, and the EDEN ISS operations themselves have been used as final validation step of the procedures themselves. Therefore, the Antarctica operator has been requested to identify the

area of improvements in the procedures, and even to collect all the discrepancies found, and made them available to the Procedures Engineer for further procedures update.

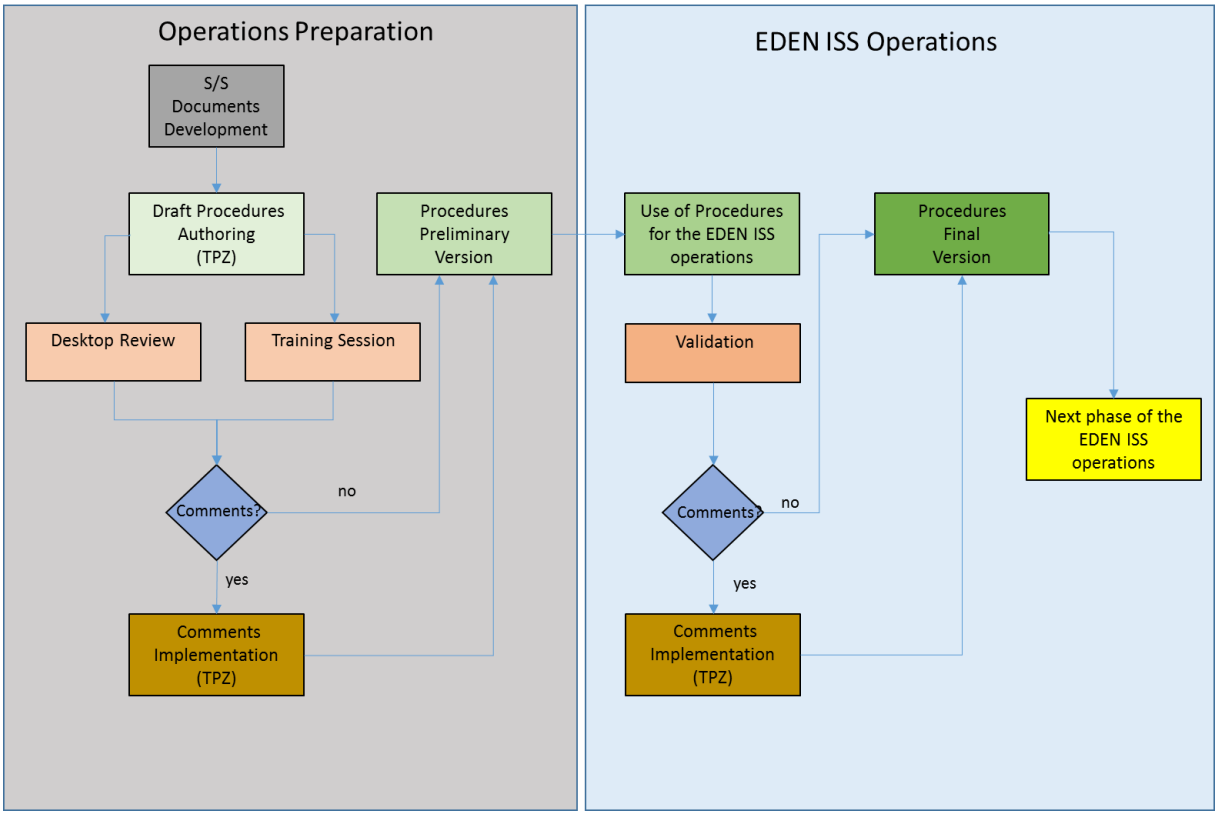


Figure 2: Procedure Development Process – as implemented

2.1 EDEN ISS operator feedback

The following tables collects the first Antarctica operator feedback on the procedures used during the EDEN ISS operations.

Table 1: MTF Nominal and Maintenance operation procedures

Identifier	Name	Type	Comments
EDEN 2000	Daily system check	MTF Nominal	The list at it is now is more like a checklist for mission control. Daily system and plant check on-site requires going to the MTF to check things.
EDEN 2100	Plant sowing	MTF Nominal	Minor changes.
EDEN 2105	Plant thinning	MTF Nominal	Minor changes.
EDEN 2110	Plant transfer	MTF Nominal	Minor changes.
EDEN 2120	Crop management	MTF Nominal	Major rework.
EDEN 2130	Plant harvesting	MTF Nominal	Update required. Especially images. See conversation with Esther.

EDEN 2200	FEG configuration for plant growth	MTF Nominal	Good to go final I think. I would however define it as Maintenance procedure and not nominal.
EDEN 2500	Camera configuration	MTF Nominal	I would define it as Maintenance procedure and not nominal. Requires update after installation of new cameras?
EDEN 2510	Datalog and images automatic transfer to MCC	MTF Nominal	I would define it as Maintenance procedure and not nominal.
EDEN 4200	NDS tank refill	MTF Maintenance	Minor changes and several additional points. (e.g. sump pump cleaning)
EDEN 4220	NDS sensors calibration	MTF Maintenance	Good to go final.
XXX	Pre- storm preparations and post-storm check	MTF Nominal	
XXX	Fresh and waste water tank filling and emptying	MTF Nominal	
XXX	CO2 bottle exchange	MTF Maintenance	
XXX	Cleaning of trays, tray lids and rock wool holders	MTF Nominal	
XXX	Snow and ice removal from platform and external doors	MTF Nominal	
XXX	Preparation of nutrient stock solution, diluted acid, diluted base for NDS	MTF Nominal	
XXX	Transportation of material to/from MTF to/from Neumayer	MTF Nominal	

Remark: the xxx represents new procedures as deemed necessary by the Antarctica operator. They were not foreseen in the operations preparation phase, and therefore not developed.

Table 2: MTF Science operation procedures

Identifier	Name	Type	Comments
EDEN 3210	Growth media preparation for safety analysis	MTF Science - Food safety	Not required on-site, due to availability of preconditioned petri dishes.
EDEN 3211	Sample preparation for safety analysis	MTF Science - Food safety	Complicated. Not yet used.
EDEN 3212	Safety analysis MDS method	MTF Science - Food safety	Minor changes.

EDEN 3220	Sample collection and storage for quality analysis	MTF Science - Food quality	Minor changes.
EDEN 3230	On-site quality measurements refractometer	MTF Science - Food quality	Remove 'On-site' from title to follow format of the other handheld procedures. Good to go final.
EDEN 3231	Quality measurements penetrometer	MTF Science - Food quality	Good to go final.
EDEN 3232	Quality measurements colourimeter	MTF Science - Food quality	Good to go final. Could not be tested because of broken device.
EDEN 3233	Quality measurements chlorophylmeter	MTF Science - Food quality	Good to go final.
EDEN 3234	Quality measurements nitrate meter	MTF Science - Food quality	Good to go final.
EDEN 3300	E-Nose	MTF Science - Microbial environment	Not yet used.
EDEN 3310	Microbial sampling micro	MTF Science - Microbial environment	Micro and molecular should be combined to one procedure named 'microbial sampling surface'. Both tasks are always performed together.
EDEN 3311	Microbial sampling molecular	MTF Science - Microbial environment	See above.
EDEN 3312	Microbial sampling plant	MTF Science - Microbial environment	Good to go final.
EDEN 3313	Microbial sampling liquid	MTF Science - Microbial environment	Good to go final.
EDEN 3320	TransMADD decontamination	MTF Science - Microbial environment	Good to go final.

Following this preliminary feedback, received at the end of September 2018, several interactions occurred between the procedures engineer and the Antarctica operators, to better detail the comments and the inputs for procedures upgrade. When necessary the matter expert have been included in the loop, as for example for the procedures related to the crop cultivation. All the information's have been exchanged via email.

2.2Validation result

As validation results, updated procedures are provided, as well as the new procedures as proposed by the Antarctica operator. Both are available as annex to this document and will be delivered as standalone product to be used in electronic format. In this chapter a matrix provides the evidence of what done and what remains open.

#	Nr	Title	Note	Comments from Antarctica Operator	Answer from procedure Engineer	Upgrade Status
1	2.000	EDEN ISS Daily System Check	The most part of the parameters to be checked have been indicated "as required" because missing inputs. That issue has to be solved in the next release. In the meantime MCC has to provide the list with the refrence parameters or range to the Antarctica Operator	The list at it is now is more like a checklist for mission control. Daily system and plant check on-site requires going to the MTF to check things.	The procedures hast to be used for telemetry check. Any visual check requiring the operator to go to the MTF has to be added. But **I need inputs for that. Inputs are also needed** to finalise the Telemetry Check, by providing the precise values and or the range for all the parameters to be verified.	Done! 2December
2	2.100	Plant Sowing		Minor Changes	Inputs needed	Done!22 November
3	2.105	Plant Thinning		Minor Changes	Inputs needed	Done!22 November
4	2.110	Plant Transfer to Growth Trays		Minor Changes	Inputs needed	Done!22 November
5	2.120	Crop Management	picture 1 and 2 to be replaced with new ones showing early disease signals. Inputs required	Major Rework	Inputs needed	Done! FIN1 on 12 December
6	2.130	Plant Harvesting		Update required. Especially images. See conversation with Esther.	Inputs needed	Done! 5 December. Nevertheless when other pictures will be available, we will update it to FIN1

7	2.200	FEG Configuration for Plant Growth	Step 2.18 still TBW. It will be finalised with inputs coming from the early operations days	Good to go final I think. I would however define it as Maintenance procedure and not nominal. Update on 14/01/2019 Mail from Paul: I probably missed that one. I am already back in Germany. The others should arrive in Antarctica this week and can look up the timing values we currently have in the system. This might even change a bit, depending on how many pumps are setup for the next season. @Conrad/Daniel: please communicate the values to Antonio once the system is setup	I checked the definition of Nominal procedures in the NASA PODF standard. They are "Nominal operations procedures – Procedures used to carry out day-to-day operations of the systems or individual subsystem components. Preventative maintenance procedures and periodic maintenance procedures are included as nominal operations procedures to ensure continued satisfactory performance of these systems" . From this perspective, **I did a mistake** in considering a Maintenance Category. On the other hand, since the PODF standard is a simply guideline for us, we can decide to have the daily operations procedures classified as Nominal, all the other system procedures classified as maintenance.	15/01/2019: Tracked as open point to be closed later
8	2.500	Videocameras Configuration For Plant Monitoring		I would define it as Maintenance procedure and not nominal. Requires update after installation of new cameras?		Mantained Nominal and promoted to FIN. No update required. Nevertheless a new procedures will be written for Camera system upgrade (21/11/2018)

9	2.510	EDEN ISS datalog and Images Automatic Transfer to MCC	Title changed. Old : Remote videocamera configuration for plant monitoring Title changed once again and fixed	I would define it as Maintenance procedure and not nominal.		Mantained Nominal and promoted to FIN (21/11/2018)
	2.400	Pre-storm Preparations and post-storm check	New! As per Paul input	New procedure to be added to the list	Inputs available 29/11/2018	Done! FIN on 12/12/2018 previously 04/12/2018 - PRE1
	2.600	Cleaning of trays, tray lids and rock wool holders	New! As per Paul input	New procedure to be added to the list	Inputs available 29/11/2018	Done! FIN on 12/12/2018 previously 04/12/2018 - PRE1
	~~xxx~~	~~Snow and ice removal from platform and external doors~~	~~New! As per Paul input~~	~~new procedure to be added to the list~~	~~Is a procedure really needed for that?~~	removed from the list after further iteration with Paul (mail 29/11)
	2.610	Preparation of nutrient stock solution, diluted acid, diluted base for NDS	New! As per Paul input	New procedure to be added to the list Update on 14/01/2019 Mail from Paul Zabel: Markus is working on that. The NDS is going to be changed in the next	15/01/2019 Could be part of the procedure "4.200 Nutrient Distribution System Bulk Solution Tank Refill" ? In any case Inputs are required. 26/03/2019 The procedure is self standing	15/01/2019: Tracked as open point to be closed later 04/04/2019 Done!

				four weeks so I cannot write that procedure. 26/03/2019 Inputs available		
	2.410	Transportation of material to/from MTF to/from Neumayer	New! As per Paul input	New procedure to be added to the list	Is a procedure really needed for that? Inputs available 29/11/2018	Done! FIN on 12/12/2018 previously 04/12/2018 - PRE1
	2.620	Fresh and waste water tank filling and emptying	New! As per Paul input	New procedure to be added to the list	Two procedures were already foreseen for that: - 4.300 Fresh Water Tank Filling - 4.310 Waste Water Tank Emptying Whatever format we want to use, I need inputs to develop them. Iputs available 29/11/2018	Done! FIN on 12/12/2018 previously 04/12/2018 - PRE1
10	3.210	Growth Media Preparation for Safety Analysis	Evolution of the following procedures: - 3.200 Safety Sample Collection and Storage - 3.210 Sample Safety Analysis Remark: Procedure 3.212 refers to a NMIII procedure for	Not required on-site, due to availability of preconditioned petri dishes.	I would not delete it from the list. It could be useful in the future. Let mantain it even if in PRE status	Let promote it to FIN and manage possible update with a FIN1 version Done on 12/12/2018
11	3.211	Samples Collection and Storage for Safety Analysis		Complicated. Not yet used.	I would not delete it from the list. It could be useful in the future. Let mantain it even if in PRE status	Let promote it to FIN and manage possible update with a FIN1 version Done on 12/12/2018

12	3.212	Safety Analysis Using the Micro Biological Survey Method	laboratory waste management. Check with NMII people if this procedure exist.	Minor changes. **Update on 14/01/2019** Mail form Paul: Modifications are not required for the next year, that's why I wrote earlier that this procedure is of low priority. I can work on them in March when I am back in the office. You can leave the procedure like it is for now.	Inputs needed	15/01/2019: Tracked as open point to be closed later
13	3.220	Sample Collection and Storage for Quality Analysis		Minor changes Update on 14/01/2019 Mail form Paul: Modifications are not required for the next year, that's why I wrote earlier that this procedure is of low priority. I can work on them in March when I am back in the office. You can leave the procedure like it is for now..	Inputs needed	15/01/2019: Tracked as open point to be closed later
14	3.230	Quality Measurement_Refractometer Operations	Evolution of the procedures: - 3.230 Sample Quality Analysis - 3.230 On Site Quality Measurement	Remove 'On-site' from title to follow format of the other handheld procedures. Good to go final.	Ok. Then I will promote it to final	Done! 21/11/2018
15	3.231	Quality Measurement_Penetrometer Operations		Good to go final.	OK. Good!	Done! 21/11/2018
16	3.232	Quality Measurement_Colourimeter Operations		Remove 'On-site' from title to follow format of the other handheld procedures. Good to go final.	Ok. Then I will promote it to final	Done! 21/11/2018
17	3.233	Quality Measurement_Clorophylmeter Operations		Good to go final.	OK. Good!	Done! 21/11/2018

18	3.234	Quality Measurement_Nitrate Ion Meter Operations		Good to go final.	OK. Good!	Done! 21/11/2018
19	3.300	E-Nose Operations	Some TBD to be solved	Not yet used.	it could be used in the future, therefore I will resolve the TBD's and update it to FIN.	Done on 13/12/2018
20	3.310	Microbial Sampling _micro		Micro and molecular should be combined to one procedure named 'microbial sampling surface'. Both tasks are always performed together.	Procedures can be combined but accepting the risk of clarity loss. The update will give the possibility to solve another issue. In particular I've detected that no preparatory steps are foreseen apart the collection of the tools required for the activity. But for example how do you fill the Eppendorf tubes (2ml) and the centrifuge tubes (15ml) with the sterile water? Is another tool required for that? Please let me know.	Done! 21/11/2018. Procedures merged in one single procedure having the title "3.310 Sampling for Microbial and Molecular Analysis"
21	3.311	Microbial Sampling _molecular		See Above		
22	3.312	Microbial Sampling _plants		Good to go final	OK, Good!	Done! 21/11/2018
27	3.313	Microbial Sampling _liquid		Good to go final	OK, Good!	Done! 21/11/2018
28	3.320	TransMADD Decontamination		Good to go final	OK, Good!	Done! 21/11/2018
29	4.100	AMS Filters Replacement			Inputs still missing	Draft developed on 20/12/2018 Update on 15/01/2019: Tracked as open point to be closed later

30	4.150	Thermal Cooling Lines refill			Inputs still missing	Update on 15/01/2019: Tracked as open point to be closed later
31	4.200	Nutrient Distribution System Bulk Solution Tank Refill	Title changed from "NDS tanks water refill"	Minor changes and several additional points. (e.g. sump pump cleaning)	Inputs needed	Done 13/12/2018
~~32~~	~~4.210~~	~~NDS waste water tank emptying~~	-	-	~~Inputs still missing~~	Not needed. There is not a dedicate tank for NDS waste water, but rather the wasted water flows to the waste water tank placed underneath of the Cold Porch floor. And the emptying of this last is managed via the procedure "2.620 Fresh and waste water tank filling and emptying"
33	4.220	NDS Sensors Calibration		Good to go final	OK, Good!	Done! 21/11/2018
~~34~~	~~4.300~~	~~Fresh Water Tank Filling~~	-	~~Considered nominal from Antarctica Operator. See new procedures to bdeveloped as per Crew Request~~	~~Agreed on categorize this procedure as Nominal. Inputs needed for development~~	Moved to procedure 2.620 Fresh and waste water tank filling and emptying
~~35~~	~~4.310~~	~~Waste water tank emptying~~	-	~~Considered nominal from Antarctica Operator. See new procedures to bdeveloped as per Crew Request~~	~~Agreed on categorize this procedue as Nominal. Inputs needed for development~~	
~~36~~	~~4.400~~	~~LED Panel Maintenance~~	-	-	~~Inputs still missing~~	No maintenance activities foreseen

37	4.500	Camera System Upgrade	New for Camera Upgrade to 8MP			Done! 21/11/2018
38	5.100	Overtemperature/Undertemperature Management			Inputs still missing	To be developed on event occurrence
39	5.200	AMS Failure Management and Repair			Inputs still missing	To be developed on event occurrence
40	5.300	NDS Pump Failure Management And Repair			Inputs still missing	To be developed on event occurrence
41	5.400	Sensor Failure Management and Repair			Inputs still missing	To be developed on event occurrence
42	5.500	Building System Failure Management and Repair (doors, lighting, electrical)			Inputs still missing	To be developed on event occurrence
43	5.600	NDS pH and EC setting failure	New (09/11/2017)		Inputs still missing	To be developed on event occurrence

The matrix has been developed using the following color coding:

	Done
	Deemed not necessary or moved to another procedure
	Minor changes needed
	Not developed or requiring major changes

3 Remarks and Open Points

Three remarks are reported as follow:

- the matrix in Chapter 2.2 clearly show that not all the procedures, as defined in the early stage of the project, have been developed. Some have been deleted from the list, others have been added, other have changed their name or number, or combined with other procedures. That is normal in a long process that is running in parallel to the hardware and software development.
- the matrix shows that all the procedures for nominal, science and maintenance activities have been developed and available for the EDEN ISS operations, that therefore are well covered. Nevertheless some of them still miss the upgrade to the final version since the inputs to do that are not yet available. That represent an open point to be closed as soon as the inputs will be available
- The procedures for anomalies management have not been developed for lack of information's. That represents an **open point**, to be closed at anomaly occurrence, with troubleshooting and recovery actions defined ad-hoc with the support of the subsystem experts.

Open point list

#	Procedure	Category	Status
1	2.200 FEG Configuration for Plant Growth	Nominal	PRE version available. Step 2.18 still TBW. To be finalised with inputs coming from Antarctica
3	3.212 Safety Analysis Using the Micro Biological Survey Method	Science	PRE version available Minor changes required.
4	3.220 Sample Collection and Storage for Quality Analysis	Science	PRE version available Minor changes required.
5	4.100 AMS Filters Replacement	Maintenance	Draft Version available Inputs requested.
6	4.150 Thermal Cooling Lines refill	Maintenance	Not developed yet. Inputs missing
7	5.100 Overtemperature/Undertemperature Management	Corrective	To be developed on event occurrence
8	5.200 AMS Failure Management and Repair	Corrective	To be developed on event occurrence
9	5.300 NDS Pump Failure Management And Repair	Corrective	To be developed on event occurrence
10	5.400 Sensor Failure Management and Repair	Corrective	To be developed on event occurrence
11	5.500 Building System Failure Management and Repair (doors, lighting, electrical)	Corrective	To be developed on event occurrence
12	5.600 NDS pH and EC setting failure	Corrective	To be developed on event occurrence

4 Lessons Learned

As expected, since the beginning, the procedure development has resulted in a very complex task, with several difficulties to be faced probably coming from a not common understanding of the role and responsibilities, and of the timing of the procedure development process.

Therefore, as final part of the procedures development job, it is worth to report some aspects not foreseen in the EDEN ISS project, and to be taken into account for future evolution of the project in the space field. Of course, any lesson learned reported shall not be considered as a criticism, but rather as feedbacks and recommendations to correctly export what done in the EDEN ISS project to a future space project.

LL#1: Roles and responsibilities.

The procedure development effort cannot be charged on a single person and/or entity, but rather it has to be shared among all the participants to the project. In particular, any subsystem developer has to consider the operability of his equipment since the beginning of the project, and detail that in dedicated documents. On the other hands, the task and the role of the procedure engineer is to harmonize all the inputs using a common language (or standard) and looking at the integrated system operations in the final environment. Starting from that, he manages a process whose final goal is the availability of procedure at the right time, and the correct involvement of the needed persons/experts.

LL#2: Availability of Technical Documentation

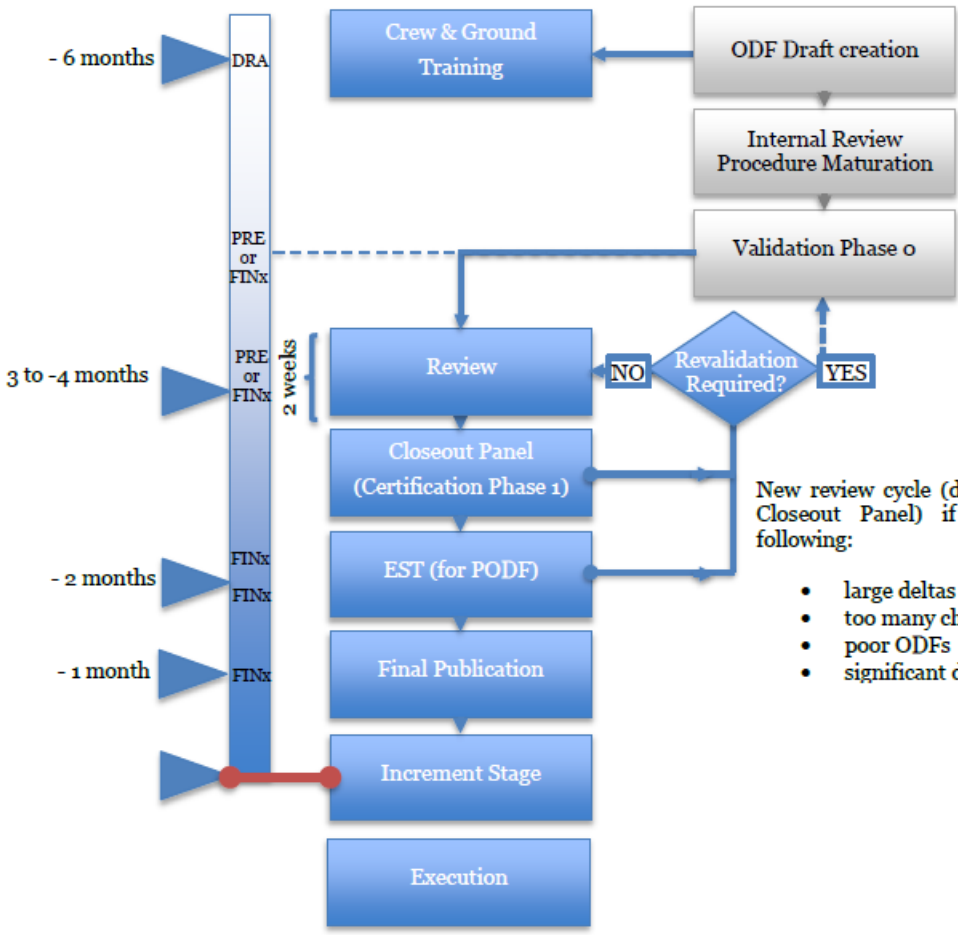
The procedure authoring starts from the analysis of the technical documentation of the system and of the subsystems. Poor or incomplete documentation results in poor or incomplete procedures. On the contrary, any available information can be useful to deepen a particular aspect or to find the best way to operate a system. That results in the needs to report what done in documents. A future project should produce as minimum as minimum the following documents:

- Requirements Documents (Mission/System/Subsystems)
- Interface Control Document (external/Internal)
- Design reports (System/Subsystem)
- User Guide (including step-by-step procedures)
- Test Plan (System/Subsystem)
- Test Procedures (System/Subsystem)
- Test Report(System/Subsystem)

LL#3: Procedure Development Timeline

For space project, the procedure development process is strongly interlaced with other project activities. On one hand, the procedure development rely on a timely availability of inputs, but on the other hand the procedures shall be ready in time to support other activities, like for example Crew and Ground Operators training and simulations, Flight Readiness Review (FRR) and Operations Readiness Review. Unavailability of operational products could prevent the start of the mission.

The following picture gives an idea of the development process as implemented for the ESA procedure to be used for the ISS operations.



In the planning of the procedures development activities and definition of the project timeline, the above described dependencies shall be considered.

LL#4: Anomalies Management procedures

The most famous Murphy Law state the following: "If anything can go wrong, it will", and one of the most important corollary says that "If you perceive that there are four possible ways in which something can go wrong, and circumvent these, then a fifth way, unprepared for, will promptly develop". Space activities are not excluded by these theorems, however all the possible efforts to minimize the occurrence of problems and to be well prepared to solve them shall be done before the mission starts. That includes a Fault Tree Analysis and the preparation of a What-If Scenario having as results the description (as much as possible) of failure cases with the related recovery actions. Having that it is possible to minimize the effort for real time troubleshooting analysis and prepare in advance as much as possible Malfunction and Corrective Procedures.

LL#5: Operations Safety

Safety is playing a very important role in a space project, up to representing a real obstacle to overcome to get to operations and a showstopper in case the safety requirements are not satisfied. Along the project, three levels of safety reviews have to be passed, demonstrating that all the hazards have been identified and are controlled in some way. The hazards shall be controlled as per design, but it is not possible to do that for all of them. Should be this the case, it is necessary to insert in the procedures special steps for hazards control, and provide to the crew dedicated training on the safety aspect. From

this point of view, EDEN ISS represent a big challenge, since its operations can led to several hazards from structural to chemical, from electrical to microbial contamination, etc.

For procedure development (but more in general for the entire project), a safety analysis shall be considered having as output the so- called Safety Data Package. Dedicated persons, with a well-defined skill in safety matter, shall be involved in the program since the beginning, and sufficient time and budget shall be allocated to this task.

ANNEX A: EDEN ISS Procedures in FIN Status

This Annex contains all the available procedures in their Final status.

Remark: the number pages reported in the index, is related to this annex and not to the whole document.

2.000 EDEN ISS Daily System Check

(EDEN ISS/CREW/NOMINAL/FIN)

OBJECTIVE

Daily check of the EDEN ISS status in terms of both S/S Telemetries and Plant Health Status of the MTF/FEG and the ISPR Rack.

DURATION

30 min for check inside FEG, 15 min for telemetry check

TOOLS

N/A

ITEMS

N/A

NOTE
THIS PROCEDURE DEFINES A CHECKLIST FOR THE ON SITE OPERATOR FOR THE DAILY VERIFICATION OF THE HEALTH AND STATUS OF EDEN ISS S/S, AND FOR PLANT GROWTH MONITORING. SUCH A VERIFICATION CAN BE DONE WITHOUT GOING TO THE MTF BUT RATHER USING THE TOOLS AND DISPLAYS AVAILABLE AT NMIII

MCC 1 Daily EDEN ISS S/S STATUS CHECK

NOTE
THE ANALYSIS OF THE TELEMETRIES IN THE MAIN PANEL PROVIDES A HIGH LEVEL VIEW OF THE STATUS OF THE MAIN SUBSYSTEMS OF THE MTF AND THE CONFIRMATION THAT SOME S/S (IN PARTICULAR THE **AMS** AND THE **TCS)** ARE COORRECTLY WORKING. FOR OTHERS LIKE THE **NDS** AND THE **ILS** FURTHER VERIFICATION ARE DAILY REQUIRED, TO ASSESS FOR EXAMPLE THE CORRECTNESS OF THE PH AND EC, OR THAT THE LED PANELS UNITS ARE ACTIVE AS REQUIRED.

MCC 1.1 High Level Telemetries Verification

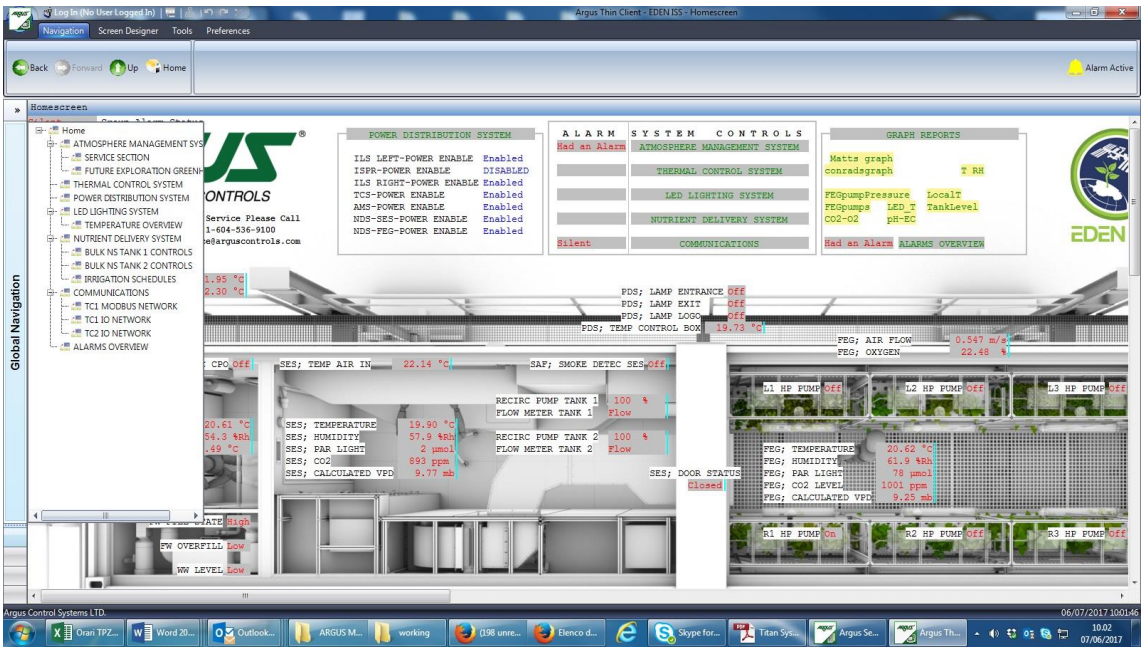


Figure 1: Argus Main Screen

On the EDEN ISS Homescreen Display

In the **ALARM/SYSTEM CONTROL** box

Verify ATMOSPHERE MANAGEMENT SYSTEM = no alarm
Verify THERMAL CONTROL SYSTEM = no alarm
Verify LED LIGHITING SYSTEM = no alarm
Verify NUTRIENT DELIVERY SYSTEM = no alarm
Verify COMMUNICATION = no alarm

In the **MTF Picture** Part

Verify CPO; Temperature > 10 °C
Verify CPO; Humidity = > 30%

Verify SES; TEMPERATURE > 15°C
Verify SES; HUMIDITY > 50%
Verify SES; CO2 >= 1000 ppm

Verify FEG; TEMPERATURE = 21°C
Verify FEG; HUMIDITY = 65%
Verify FEG; CO2 >= 1000 ppm

Verify FEG; AIR FLOW > 0
Verify FEG; OXYGEN >= 20%

MCC 1.2 Nutrient Bulk Solution Tank Status

NOTE
THIS ACTION IS AIMED AT VERIFYING IF THE NDS TANKS ARE FILLED AS REQUIRED AND IF THE NUTRIENT SOLUTION COMPOSITION IS IN LINE WITH THE OPERATION PHASE REQUIREMENT

Figure 3: NDS Main Displays – Dilute tanks part

1.2.1 On the **NUTRIENT DELIVERY SYSTEM/DILUTE TANKS** Display

In the **SENSORS TANK 1** Box

Verify EC 1 TANK 1 = EC setpoint in the **Tank 1 equipment control** box
Verify EC 2 TANK 1 = EC setpoint in the **Tank 1 equipment control** box
Verify pH 1TANK 1 = pH setpoint in the **Tank 1 equipment control** box
Verify pH 2 TANK 1 = pH setpoint in the **Tank 1 equipment control** box
Verify TEMP 1 TANK 1 > 18 °C
Verify TEMP 2 TANK 1 > 18 °C
Verify FLOW METER TANK 1 = Flow
Verify LEVEL SENSOR TANK 1 > 30 cm

In the **SENSORS TANK 2** Box

Verify EC 1 TANK 2 = EC setpoint in the **Tank 2 equipment control** box
Verify EC 2 TANK 2 = EC setpoint in the **Tank 2 equipment control** box
Verify pH 1TANK 2 = pH setpoint in the **Tank 2 equipment control** box
Verify pH 2 TANK 2 = pH setpoint in the **Tank 2 equipment control** box
Verify TEMP 1 TANK 2 > 18 °C
Verify TEMP 2 TANK 2 > 18 °C
Verify FLOW METER TANK 2 = Flow
Verify LEVEL SENSOR TANK 2 > 30 cm

1.2.2 If one or more parameters and/or status is not as expected
Call **MCC** for action definition

MCC	**1.3**	**Thermal Control System System Status**
	1.3.1	On the **THERMAL CONTROL SYSTEM** Display In the **SENSOR READINGS** Box **Verify** COOL 1:EXT HS IN <0 °C **Verify** COOL2:INT HSOUT < 5°C **Verify** COOL3:I&L HS IN <5°C **Verify** COOL4:AMS HS IN <3°C **Verify** COOL5:AMS OUT <10°C **Verify** COOL6:AMS IN <5°C **Verify** COOL7:ISPR OUT <20°C **Verify** COOL8: ISPR IN < 20°C **Verify** COOL9:LED OUT <30°C **Verify** COOL10:LED IN <=23°C **Verify** COOL11:FREE IN <0°C **Verify** COOL12:FREE OUT <0°C **Verify** Pressure 1:FREE = 1.5 bar **Verify** Pressure 2:ISPR = 1.2 bar **Verify** Pressure 3:LED = 1.2 bar **Verify** Pressure 4:AMS = 1.2 bar

MCC 1.4 Plants Images Check

NOTE

NOMINALLY TWO DIFFERENT KIND OF IMAGES ARE TAKEN DURING THE DAY:

- 32 HD IMAGES (1 FOR EACH CAMERA)
- 8 MULTIWAVE IMAGES (2 FOR EACH CAMERA)

THESE IMAGES ARE STORED ON THE CAMERA-PC IN THE MTF AND AUTOMATICALLY TRANSFERRED ON THE CAMERA-PC IN THE NMIII AND HAVE TO BE DAILY CHECKED FOR PLANT HEALTH ASSESSMENT. NEVERTHELESS, DEPENDING ON THE AVAILABILITY OF CAMERA'S OR ON CHANGES OF THE PICTURES ACQUISITION STRATEGY, THE NUMBER OF IMAGES COULD BE LOWER OR HIGHER.

1.4.1 On the Camera PC (NMIII) open the crop images stored in the following folders:

HD Images (top and side view)
Camera-PC (NM-III)
D:\FTP_EDEN-ISS\CropImages\HDTOPVIEW\<camera position1>

Where *<camera position1>* is:

- L1-2C, L1-4C
- L2-1C, L2-2C, L2-3C, L2-4C
- L3-1C, L3-2C, L3-3C, L3-4C
- L4-1L, L4-2L, L4-3L
- L4-1R, L4-2R, L4-3R, L4-4C
- R1-2C, R1-4C
- R2-2C, R2-4C
- R3-4C
- R4-2C, R4-4C

D:\FTP_EDEN-ISS\CropImages\HDSIDEVIEW\<camera position2>

Where *<camera position2>* is:

- L12-1S, L12-3S, L34-1S, L34-3S
- R12-1S, R12-3S, R34-1S, R34-3S

Multiwave Images
Camera-PC (NM-III)
D:\FTP_EDEN-ISS\CropImages\UFIMAGERS\<ufimager camera position>

Where *<ufimager camera position>* is:

- UFImager1, UFImager2, UFImager3, UFImager4

1.4.2 If anomalies are detected
Call **MCC** for action definition

MTF 2 System and Plant Check

NOTE
THE FOLLOWING TASKS NEED TO BE PERFORMED INSIDE THE MTF, IF POSSIBLE ON A DAILY BASIS.

2.1 System Check

NOTE
IF ISSUES WITH THE HARDWARE ARE DISCOVERED DURING THE SYSTEM CHECK, CONTACT MCC.

Verify the amount of nutrient stock solution, acid and base connected to the NDS lasts until next system check. Otherwise connect new supply bottles.
Verify all fuses inside the power box are in the required position
Verify if ice is on the door frame of the main entrance, remove when necessary
Verify FEG subfloor heater is running
Verify TCS pumps are running
Visual inspection of NDS nutrient solution in NDS tank 1 and tank 2
Verify that the values displayed on the EC and pH sensors inside the NDS rack do not deviate too much
Check on leakage in TCS rack
Verify that all circulation fans inside the FEG are running

2.2 Plant Check

NOTE
IF ISSUES WITH THE CROPS ARE DISCOVERED DURING THE PLANT CHECK, CONTACT MCC.

Visual Inspection of all plants
Visual Inspection of 2 random trays (open box and check roots)

2.100 Plant Sowing

(EDEN ISS/CREW/NOMINAL/FIN)

OBJECTIVE

Plant seeds for germination and preparation of plant cultivation

DURATION

5-10 min per crop

TOOLS

Tweezers

Scissors

ITEMS

Plastic Plugs Holder Tray
Rock-wool plugs
Seeds
Nutrient solution (3 liters per tray)
Water (0.5 liters)

NOTE

THIS PROCEDURE IS APPLICABLE TO TOMATO, PEPPER, CUCUMBER, LETTUCE, SPINACH, RADISH, BASIL. ALL THE OTHER PLANTS WILL BE PLANTED DIRECTLY IN THE TRAY

SS-WB 1. ROCK-WOOL PLUGS PREPARATION FOR SOWING

CAUTION

TO AVOID SEED CONTAMINATION AND POSSIBLE FUTURE PLANTS DISEASE, CAREFULLY WASH YOUR HAND BEFORE THE OPERATIONS

Fig. 1 Plastic Rockwool Plugs Holder Tray as delivered

1.1 Using the scissors, cut the Plastic Plugs Holder Tray (fig. 1) down to the number of rock wool blocks needed

1.2 Water the rock wool blocks in the sink with cool water

1.3 Place a towel or paper tissue on the working desk and position the watered rock wool tray on it

2. SOWING

NOTE
THE NUMBER OF SEEDS TO BE SOWED DEPENDS ON THE PLANT TO BE CULTIVATED. THE OPERATOR WILL BE INSTRUCTED FROM THE MCC BEFORE THE ACTIVITY TAKES PLACE

2.1 Sow one or more seeds per plug as per plant requirement. Use tweezers for handling the seeds. Make sure that the seeds are pushed deep into the rock wool block.

FEG **3. TRANFERRING THE TRAY TO THE NURSERY**

3.1 Clean the grey plastic box located in L4-2L (nursery position)

3.2 Insert the rock wool tray inside the grey plastic box

3.3 Put white plastic labels on the rock wool tray to identify where which plants are sown

3.4 Fill around 3 liters of nutrient solution from NDS tank 1 in the grey plastic box of the nursery.

SS-WB **4 CLOSEOUT**

4.1 Clean and stow all objects and items used for the sowing activity.

4.2 Carefully wash your hands

FEG **5 GERMINATION MONITORING**

5.1 Check the plugs status every day. Make sure that it stay moist. Refill nursery tray with nutrient solution when necessary

2.105 Plant Thinning

(EDEN ISS/CREW/NOMINAL/FIN)

OBJECTIVE

Plant thinning (or spacing) to increase the light interception

DURATION

5-15 min per tray

TOOLS

None

ITEMS

3D Printed Plastic Plug Holders (number as needed)
Plug Holders Boxes (number as needed)

NOTE

1. THINNING IS A PROCESS NECESSARY TO INCREASE THE SPACE BETWEEN THE GERMINATED PLANTS IN ORDER TO IMPROVE THE LIGHT INTERCEPTION. CREW IS REQUESTED TO SELECT THE BEST-GERMINATED PLANTS FOR THE NEXT GROWTH PHASE AND TO DISPOSE THE WEAK PLANTS AND THE UNGERMINATED SEEDS.
2. THIS WORK STEP IS ONLY NECESSARY FOR PLANTS THAT UNDERGO A PERIOD OF GROWTH IN THE WATERED NURSERY (e.g. TOMATO, PEPPER, CUCUMBER, KOHLRABI; STRAWBERRY).

FEG 1. TRANSFER OF SEEDLINGS FROM THE NURSERY TO THE WATERED NURSERY

CAUTION

TO AVOID SEED CONTAMINATION AND POSSIBLE FUTURE PLANTS DISEASE THE HANDS HAVE TO BE CAREFULLY WASHED BEFORE THE OPERATIONS START

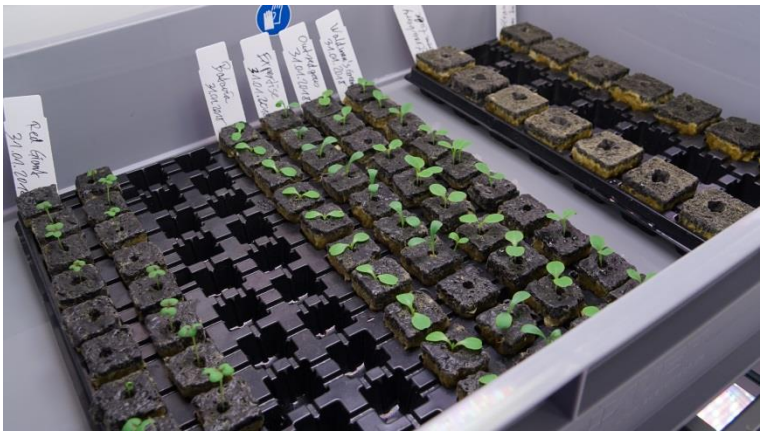


Fig. 1 Nursery with rock wool block tray and germinated plants

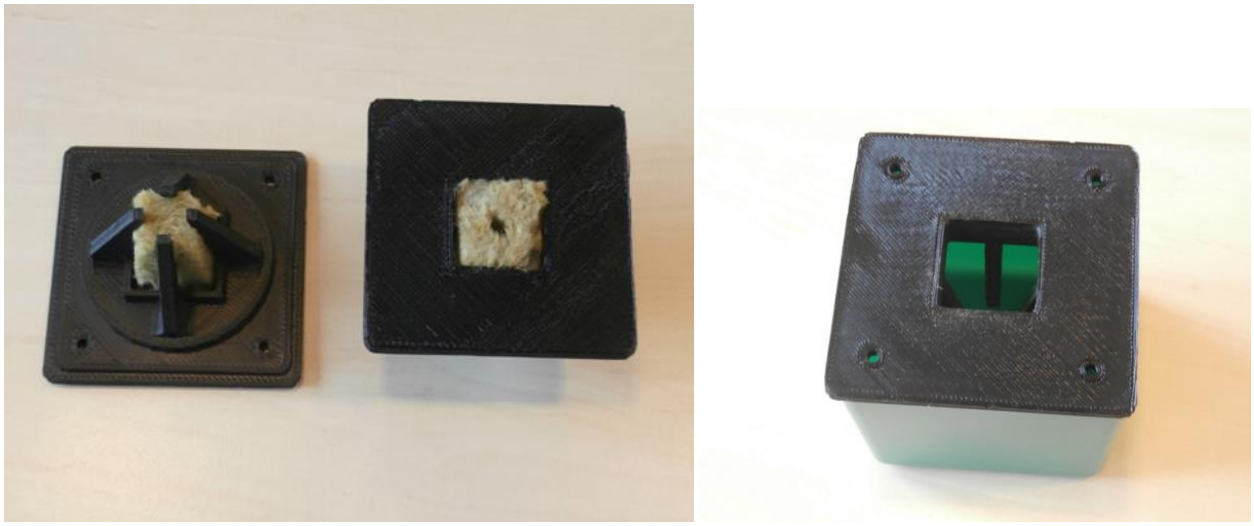


Fig. 2: 3D Printed Plastic Plug Holders (Left) and Holders Green Plastic Box (Right)

Fig. 3: Watered nursery containing Basil seedlings. Green plastic boxes are under the metal cover.

1.1 Remove the rockwool plug with the germinated plant from the Plastic Rockwool Plugs Holder Tray in the nursery (fig.1). Pay attention to not damage the shoot or the roots!

1.2 Insert the rockwool plug into the 3D printed plastic plug holder (fig. 2)

1.3 Insert the 3D Printed Plastic Plug Holder in a free Plastic Box in the tray of the watered nursery (L4-2R, L4-1L, L4-1R) (fig. 3)

1.4 Repeat for ALL the germinated plants selected for cultivation

NOTE
THE POLYPROPYLENE TRAY(S), WHERE THE 3D-PRINTED PLASTIC BOX ARE INSERTED, IS(ARE) CONNECTED TO THE NUTRIENT DELIVER SYSTEM. NEVERTHELESS THE INTERNAL TUBING IS NOT EQUIPPED WITH NOZZLES, SINCE THE OBJECTIVE IS TO ONLY FILL THE TRAY WITH THE RIGHT QUANTITY OF WATER/NUTRIENT SOLUTION IN ORDER TO MAKE THEM AVAILABLE TO THE ROCKWOOL PLANT HOLDER (FIG.4)

3 CLOSEOUT

Discard the used black rock wool holder tray.

3.2 Carefully wash your hands

3.3 Stow all the tools as necessary

2.110 Plant transplant to the aeroponic system

(EDEN ISS/CREW/NOMINAL/FIN)

OBJECTIVE

Transplant the germinated plants from the nursery or watered nursery to the final position inside the cultivation trays

DURATION

5-10 minutes

TOOLS

None

ITEMS

Tray Lid
Plugs Holder

NOTE
THIS PROCEDURE IS VALID FOR ALL PLANTS THAT REACHED THE DEFINED MATURATION STAGE IN THE NURSERY OR WATERED NURSERY**.**

SS-WB **1.** **PLANT TRANSFER TO FINAL CULTIVATION POSITION**

CAUTION
TO AVOID CONTAMINATION AND POSSIBLE FUTURE PLANTS DISEASE, THE HANDS HAVE TO BE CAREFULLY WASHED BEFORE STARTING THE OPERATIONS

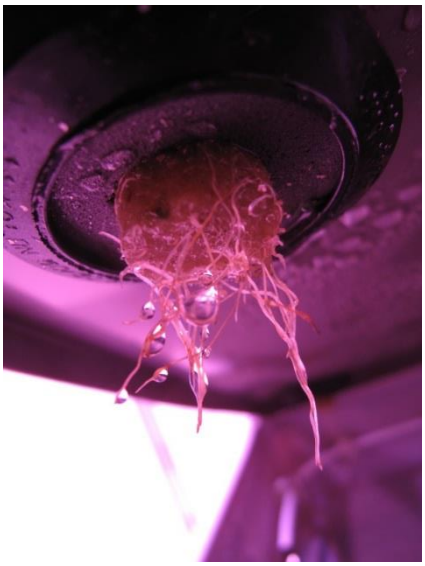


Fig.1: Germinated seeds with roots ready for the aeroponic system

Fig. 2: Four of the six tray lids used for EDEN ISS cultivation project

NOTE

1. SIX DIFFERENT TRAY LIDS HAVE BEEN DESIGNED FOR SPACING OF TARGETS PLANTS (FIG.2). THE TRAY LIDS OUTLINE THE MAXIMAL SPACING FOR PLANT POSITIONING.

2. FOR SEEDLINGS COMING FROM THE WATERED NURSERY, STEPS 1.1 TO 1.3 ARE TO BE SKIPPED!

	1.1	Verify that the roots of the germinated seeds have grown through the plug (fig.1)
	1.2	Remove the rockwool plug with the germinated plant from the Plastic Rockwool Plugs Holder Tray in the nursery (fig.1). Pay attention to not damage the shoot or the roots!
	1.3	Insert the rockwool plug into the 3D printed plastic plug holder
	1.4	Transfer the seedling and its plug holder in the tray lid hole (fig. 2). Continue until the tray lid contains the desired amount of plants.
	1.5	Take the tray lid and position it on the required tray inside the FEG (check with MCC if necessary).
SS-WB	**3**	**CLOSEOUT**
	3.1	Carefully wash your hands
	3.2	Clean the workbench

2.120 Crop Management

(EDEN ISS/CREW/NOMINAL/FIN1)

OBJECTIVE

Monitor the crop development and the take the actions for steering plant growth, like pruning, training, pollination and early disease recognition

DURATION

Crop dependent

TOOLS

Pruning Shears or knife
String for supporting Tomato (indeterminate) and cucumber from upper shelf
Plastic plant clips
Brush

ITEMS

N/A

NOTE

CROP DEVELOPMENT SHALL BE REGULARLY MONITORED FOR THREE MAIN REASONS:

1. EARLY DISEASE DETECTION.
2. PLANT PRUNING/TRAINING (crop dependent)
3. HARVESTING (IF POSSIBLE)

THE GREENHOSUE OPERATOR SHALL HAVE A VISUAL CHECK WITHIN THE FEG AND MONITOR THE PLANT IMAGES AS ACQUIRED BY THE PLANT HEALTH MONITORING SYSTEM.

FEG 1. PLANTS HEALTH STATUS CHECK

CAUTION

TO AVOID CONTAMINATION AND POSSIBLE FUTURE PLANT DISEASES, THE HANDS HAVE TO BE CAREFULLY WASHED BEFORE THE START OF THE OPERATIONS. USING A HAND SANITIZING AGENT IS ALSO REQUIRED.

1.1 Check that plants are not affected by any anomaly like spots on leaves (fig. 1) or on the stems (fig. 2) and wilting signals (fig.3)

1.2 If abnormal appearance is recognized take additional pictures of the plants affected and send them to MCC

1.3 Wait for instructions and coordinate with MCC any corrective action.

Fig. 1: Example of brown spot on leaf (leaf lesion of Alternaria Solani)

Fig. 2: Example of sunken spots on stem (stem lesion of Alternaria Solani)

Fig.3: Example of a wilted tomato plant

2 PLANTS TRAINING

NOTE

1. TRAINING IS THE TERM FOR THE PROCEDURE OF SHAPING THE PLANT INTO A DESIRED OPTIMAL GROWTH ARCHITECTURE IN ORDER TO PROVIDE A SUPPORT TO THE PLANT THEMSELVES AND TO IMPROVE LIGHT INTERCEPTION AND AIR MOVEMENT. TRAINING IS NEEDED FOR TALL PLANTS, THEREFORE FOR INDETERMINATE TOMATOES, PEPPERS AND CUCUMBERS.
2. TOMATO, PEPPER AND CUCUMBER PLANTS TRAINING IS MANAGED USING BY MEANS OF ROPES THAT ARE ATTACHED AT THE PLANT MAIN STEM SUPPORT AND TO HOOKS FIXED TO THE RACK STRUCTURE CLOSE TO THE LED LAMPS.

Fig. 4: Cucumber Training

Fig. 5: Tomato training

2.1 Cucumbers Training

2.1.1 When plants have reached an approximate length of 20-30 cm, attach string to the stem or the rock wool holder, wind it around the stem and attach the string to the hook close to the LED lamp. Leave it slack enough so that the plant can hang in it as it grows. As the plant continues to grow, keep wrapping the string around the stem to support the whole plant. Once the plants are 20-30 cm from the LED lamp, use the hooks to reposition the plants. Roll some 40 cm of rope from the hook and hang the hook on the next position in counter clockwise direction. The plant should now be further away from the LED lamp. Make sure to position the vine around the cultivation trays.

2.2 Tomatoes Training

NOTE
THIS ACTIVITY IS ONLY NECESSARY FOR TALL TOMATO PLANTS. DWARF TOMATO PLANTS DO NOT REQUIRE A ROPE.

2.2.1 When plants have reached an approximate length of 20-30 cm, attach string to the stem or the rock wool holder, wind it around the stem and attach the string to the hook close to the LED lamp. Leave it slack enough so that the plant can hang in it as it grows. As the plant continues to grow, keep wrapping the string around the stem to support the whole plant.

3 PLANTS PRUNING

NOTE

1. PLANT PRUNING IS AIMED AT THE REMOVAL OF LEAVES AND/OR LATERAL SHOOTS IN ORDER TO ALLOCATE ASSIMILATES TO THE FRUITS INSTEAD OF LEAVES. A SECONDARY AIM IS TO INCREASE THE AIR CIRCULATION AND/OR LIGHT INTERCEPTION. THIS METHODOLOGY APPLIES TO THE FRUITING CROPS (TOMATO, CUCUMBER AND PEPPER).

3.1 Pruning Tomato Plants

NOTE

1. THIS PROCEDURES APPLIES TO INDETERMINATE TOMATO ONLY. A COMPACT 'INDETERMINATE' TOMATO WILL GROW CONTINUOUSLY IN HEIGHT AND SHOULD BE CULTIVATED WITH 2 STEMS. IN THE JUVENILE STAGE, THE MAIN STEM IS CUT JUST ABOVE THE THIRD LEAF; TWO TO THREE SIDE SHOOTS WILL APPEAR. AFTER 10 TO 12 DAYS RETAIN THE 2 BEST SIDE SHOOTS AND REMOVE THE THIRD. TWO STEMS WILL CONTINUE TO DEVELOP AND OTHER SIDE SHOOTS SHOULD BE REMOVED DURING CULTIVATION.
2. HERE ARE SOME KEY TOMATO PRUNING TERMS:

- LEADERS: THE LEADER IS THE PRIMARY STEM. WHEN A SECOND LEADER IS ALLOWED TO DEVELOP, BOTH GROW IN A Y-SHAPED PATTERN (FIG.4).
- COMPETITORS GROW AT A 45-DEGREES ANGLE FROM WHERE LATERAL GROWTH MEETS THE STALK (FIG.6)

3. LEAVES USUALLY GROWS AT A 90-DEGREE ANGLE FROM THE STALK. THIS GROWTH IS THE PHOTOSYNTHESIZING POWERHOUSE OF THE PLANT

Fig. 6: Y shaped pattern, with clearly identified the leaders stems

Fig.7: Lateral (Leaf) growth and emerging competitor

Fig. 8 Leaders vs competitors

Fig. 9: Competitor life cycle

3.1.1 Break young competitors (ca. 2 cm) off with your fingers. Do NOT use a knife (Fig. 6)

3.1.2 Collect and remove any discarded plant material from the area to reduce the risk of infection or pathogen growth

3.2 Pruning cucumber plants

NOTE

1. ONCE CUCUMBER PLANTS HAVE BEGUN TO SET FRUIT, THE GROWTH RATE INCREASES BOTH IN THE PLANT AND THE FRUIT. PRUNING THE PLANT TO REMOVE LATERAL, OR SIDE SHOOTS, REDIRECTS THIS PLANT ENERGY INTO THE CUCUMBERS THEMSELVES, OFTEN PRODUCING GREATER YIELDS AND HEALTHIER FRUIT.
2. CUCUMBER PLANTS SHOULD BE GROWN WITH TWO STEMS.

Fig.10: Main Stem and lateral growths

3.2.1 Make sure your pruning shears, or knife are SHARP and CLEAN to avoid any rough cuts, and any transfer of disease.

3.2.2 Locate the cucumber plant's main stem. You should be able to isolate it easily by going to the base of the plant at soil level and following the single largest stem that hasn't branched out (Fig. 7)

3.2.3 Look for any lateral growth in the form of small shoots growing out of the sides of the main stem and cut them off (Fig. 6). If left on the plant, they will grow into competitors and result in smaller yields. Leave one competitor to develop into a second stem. Remove all other competitors.

3.2.4 Repeat this process for all individual cucumber plants and tie the remaining stem loosely to the support. Be careful not to crush blossoms or bend stem too sharply, as this will cut off water and nutrients to the cucumbers forming on them

3.2.5 Prune all lateral shoots as they appear, which can be as often as once a day once the plants' roots are established and the plant enter their rapid growth stage

3.2.6 Remove undersized or damaged cucumbers as well as any that appear diseased

3.3 Pruning Pepper Plants

NOTE

1. THIS PROCEDURE APPLIES ONLY TO **BELL PEPPER**. INFACT BELL PEPPER PLANTS ARE INDETERMINATE PLANTS, THAT IS, THEY CONTINUALLY GROW NEW STEMS AND LEAVES. **MINIPEPPER (BUSHY PEPPER)** SHALL NOT BE PRUNED. .
2. HEREINAFTER SOME KEY WORDS FOR BELL PEPPER PRUNING

- NODE: A NODE IS DEFINED AS A POINT ON THE STEM FROM WHICH LEAVES ARISE AND THE LENGTH OF STEM BETWEEN NODES IS CALLED AN INTERNODE.
- THE TERM "AXIL" REFERS TO THE UPPER ANGLE FORMED BY THE JUNCTION OF A LEAF (OR LATERAL) WITH THE STEM

3. PLANTS ARE GENERALLY PRUNED EVERY TWO WEEKS. AS NEW LEAVES AND LATERAL SIDE SHOOTS DEVELOP FROM THE AXILS OF THE NEW NODES ON THE GROWING STEMS, THEY HAVE TO BE PRUNED TO MAINTAIN THE TWO MAIN-STEM ARCHITECTURE OF THE PLANT

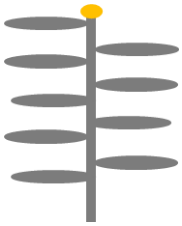


Fig. 11: juvenile pepper: 9 leaves followed by a flower (yellow)

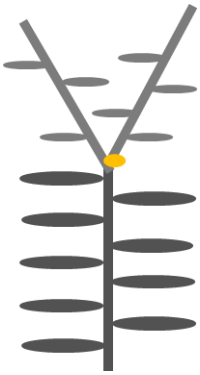


Fig. 12: pepper with 2 stems and 1 flower (yellow)

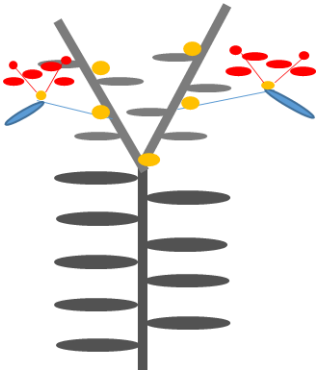


Fig. 13: : example of a plant with 2 stems with developing side shoots at both stems

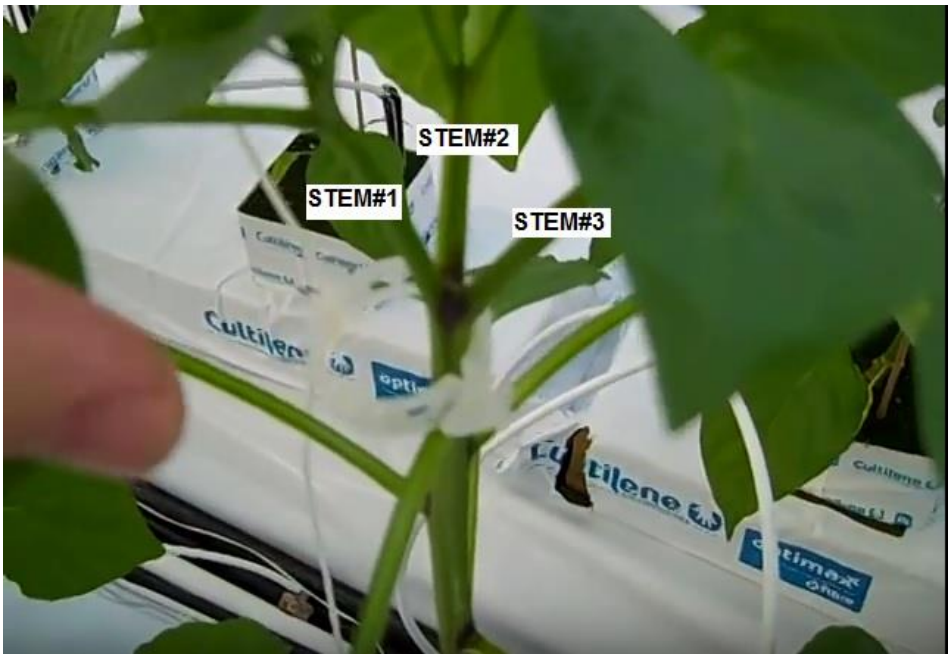


Fig. 14: Pepper plants – selecting the stem to be grown

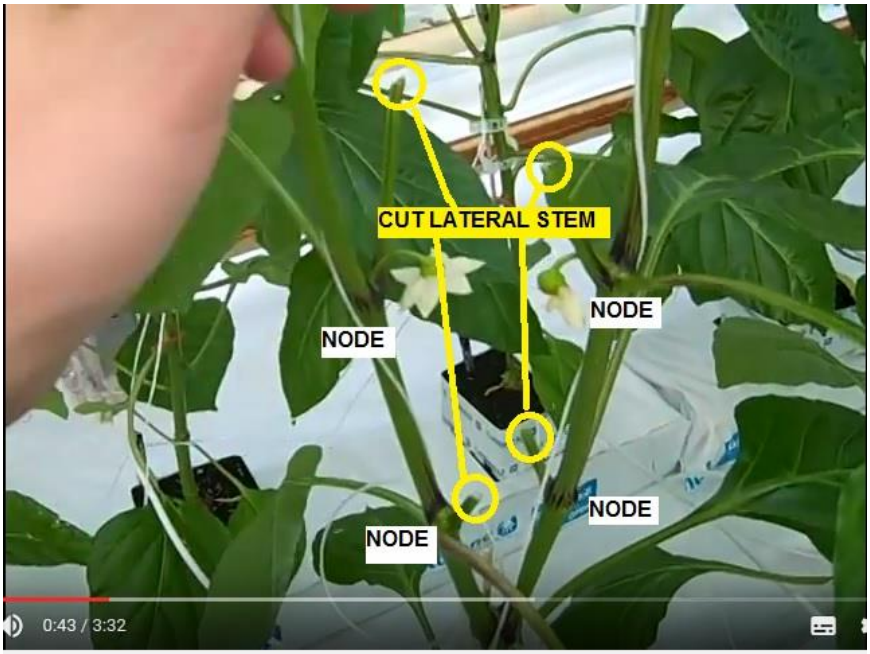


Fig.15: Further Pepper Plants: Stem Pruning

3.3.1 After sowing, the juvenile plant develops and makes around 8-10 leaves and then a flower will appear (Figure 11). In this phase, no pruning is necessary.

3.3.2 When more than 1 stem will develop (after the first flower), keep the 2 best stems and remove the third or even more stems that appear at this position in the crop (Fig. 12 and Fig. 14).

Remark. These 2 stems will split again. New side shoots will develop on them, in this way a compact bushy plant will appear like described above.

3.3.3 When a new side shoot appears on the two main stem, always keep the best shoot, and from the other shoot keep one leaf and one flower and remove the rest. See fig. 13 and Fig. 15 (the “to be pruned parts” of these side shoots are marked in red. Keep the blue and yellow parts of the sideshoot maintaining 1 leaf and 1 flower, and remove the rest. So one fruit will develop at the shoots that is partly pruned).

Remark: Continue this pruning during cultivation, because side shoots will appear continuously

4 HAND POLLINATION

NOTE

HAND POLLINATION (ALSO CALLED "MECHANICAL POLLINATION") IS A TECHNIQUE USED WHEN WIND OR SELF-POLLINATION IS INSUFFICIENT, AND HAS THE OBJECTIVE TO PROMOTE THE TRANSFER OF POLLEN FROM THE ANTHERS TO THE STIGMA OF FLOWERS. THAT APPLIES TO CLOSED ENVIRONMENT LIKE THAT OF THE EDEN ISS OPERATIONS. TWO CROPS IN THE FEG IN EDEN ISS ARE AFFECTED: TOMATOES AND PEPPERS. TOMATO AND PEPPER PLANTS ARE MANAGED IN THE SAME WAY.

4.1 **Tomato/Pepper hand pollination**

NOTE

1. TOMATO AND PEPPER HAND POLLINATION REQUIRES THE ONLY SHAKING OF THE FLOWERS IN ORDER THAT THE POLLEN IS DISTRIBUTED AROUND. THAT CAN BE ACHIEVED IN DIFFERENT WAYS:
   - GENTLE SHAKING OF THE FLOWERS OR EVEN OF THE ENTIRE PLANT (DAILY)
   - USING A PLANT VIBRATOR
2. THE POLLINATION ACTIVITY HAS TO BE DONE EVERY DAY AS EACH INDIVIDUAL FLOWER OPENS

Fig. 16: Example of a plant vibrator

Fig. 17: Shaking Flowers by means of a plant vibrator (4-5 intensity) every day

4.1 Gently shake the flowers by means of the plant vibrator. (Gently shake the flowers by hand or using a brush if the plant vibrator is not available)

4.2 Repeat until all the flowers have been shaken

2.130 Plant Harvesting

(EDEN ISS/CREW/NOMINAL/FIN)

OBJECTIVE

Plant harvesting during and/or at the end of the growth cycle

DURATION

Crop dependent

TOOLS

Pruning Shears or Scissors

ITEMS

Plastic containers (as necessary)
Latex Gloves
Hydrogen peroxide or Virkon-S.

NOTE

TWO DIFFERENT APPROACHES ARE CONSIDERED FOR HARVESTING:

- SINGLE POINT HARVESTING EVENT (LETTUCE AND RADISH)
- MULTIPLE HARVESTING EVENTS (LEAFY GREENS, LETTUCE, HERBS, TOMATOES, PEPPER AND CUCUMBER)

FEG 1 PREPARATION

CAUTION

1. **TO AVOID CONTAMINATION THE HANDS HAVE TO BE CAREFULLY WASHED BEFORE THE OPERATIONS**
2. **THE PRUNING SHEARS OR CUTTERS SHALL BE STERILISED BEFORE STARTING THE OPERATIONS**

1.1 Wash your hand

1.2 Sterilize the pruning shears or the scissors

1.3 GOTO step 2.1 for Lettuce single harvesting
GOTO step 2.2 for Radish harvesting
GOTO step 3.1 for Chives harvesting
GOTO step 3.2 for Parsely harvesting
GOTO step 3.3 for Basil harvesting
GOTO step 3.4 for Lettuce and leafy greens spread harvesting
GOTO step 3.5 for Tomato harvesting
GOTO step 3.6 for Pepper harvesting
GOTO step 3.7 for Cucumber harvesting

2. SINGLE POINT HARVESTING EVENTS

2.1 Lettuce Single Harvesting

NOTE

LETTUCE CAN BE HARVESTED AROUND 38 DAYS AFTER PLANT SOWING.

2.1.1 Cut each plant at the base by means of the pruning shears
2.1.2 Collect the cut edible biomass in the plastic container or Styrofoam box

2.1.3 Collect the inedible biomass (roots) and the rock wool substrate in a plastic bag. Squeeze out excess fluid from the roots and the rock wool. The fluid can be put in the cultivation tray.

2.1.4 GOTO step 4

2.2 Radish Harvesting

NOTE
1. RADISH CAN BE HARVESTED AROUND 25 DAYS AFTER SOWING. AT THIS STAGE THE EXPECTED TAPROOT DIAMETER SHOULD BE IN THE RANGE 20-35 MM 2. BOTH THE TAP ROOT AND THE LEAVES ARE EDIBLE

2.2.1 Gently pull the radish plants from the plug

2.2.2 Separate edible biomass (tap root), leaves, roots and rock wool into three different containers.

2.2.3 GOTO step 4

3 MULTIPLE POINT HARVESTING EVENTS

3.1 Chives harvesting

NOTE
1. CHIVES CAN BE FIRST HARVESTED AROUND 8 WEEKS AFTER SOWING. CHIVES CAN BE TOTALLY HARVESTED; PLANTS WILL REGROW VERY EASILY AND CAN BE HARVESTED AGAIN EVERY 2 WEEKS. THIS CAN BE REPEATED FOR SEVERAL MONTHS (UP TO 9 MONTHS). 2. DON'T CLIP TOO CLOSE TO THE BULB OR THEY WON'T REGROW – LEAVE AT LEAST 4 CM ATTACHED TO THE BULB ABOVE THE SOIL. CUT FROM THE OUTSIDE OF THE BUNCH FIRST.

3.1.1 Gather leaves into a bunch and cut with a scissors Put an elastic cord at the base of the bunch if necessary

3.1.2 Collect the cut edible biomass in the plastic container

3.1.3 GOTO step 4

3.2 Parsley Harvesting

NOTE
1. PARSLEY CAN BE FIRST HARVESTED AROUND 8 WEEKS AFTER SOWING. PARSLEY CAN BE TOTALLY HARVESTED; PLANTS WILL REGROW VERY EASILY AND CAN BE HARVESTED AGAIN EVERY 1.5 WEEKS. THIS CAN BE REPEATED FOR SEVERAL MONTHS (UP TO 9 MONTHS). **2.** WHEN HARVESTING PARSLEY; MAKE SURE THAT THE YOUNGEST LEAF IS NOT CUT OFF. THIS GROWING POINT WILL GROW VERY EASILY AND CAN BE HARVESTED AGAIN AFTER 1-2 WEEKS.

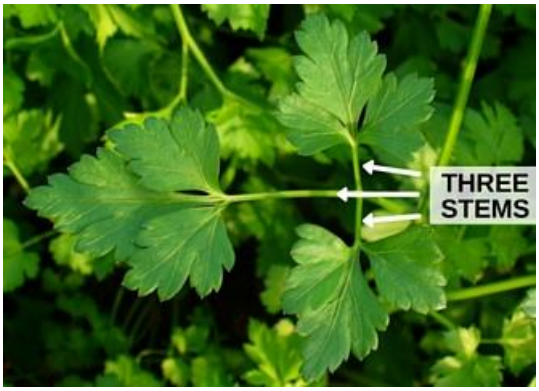


Fig.4: Parsley – Three Stems

3.2.1 Gather stem and leaves in a bunch and cut it using a scissors. Snip your harvest from the base of the plant to encourage more growth. Cut leaves from the outer portions first so your parsley can focus on growing new leaves from the center of the plant

3.2.2 Put an elastic cord at the base of the bunch if necessary

3.2.3 Collect the edible biomass in the plastic container

3.2.4 GOTO step 4

3.3 Basil Harvesting

NOTE
BASIL CAN BE HARVESTED AROUND 5-6 WEEKS AFTER SOWING, AND IN ANY CASE BEFORE THE PLANTS START TO BUD AND THE FLOWERS START TO BLOOM (ALSO KNOWN AS “BOLTING”).

3.3.1 Pinch or cut a pair of large leaves from the stem. Make sure not to damage the small new leaves or the side shoots, which will start growing after the first harvests. Do not remove the first pair of leaves lowest to the ground. These leaves stay with the plant.

3.3.2 Collect the basil leaves in the plastic container

3.3.3 GOTO Step 4

3.4 Lettuce and leafy Greens Spread Harvesting

NOTE
LETTUCE AND LEAFY GREENS SPREAD HARVEST CAN COMMENCE 4 WEEKS (LETTUCE), 5 WEEKS (RED MUSTARD) and 6 WEEKS (SWISS CHARD) AFTER SOWING AT THE MOMENT THAT THE PLANTS TOUCH EACH OTHER. THE OUTER (3-8) LEAVES CAN BE HARVESTED FROM EACH PLANT AND BE EATEN. SPREAD HARVEST CAN BE CARRIED OUT ONCE WEEKLY UNTIL PLANTS START TO FORM FLOWERS

Fig. 7: Lettuce crispy Green Expertise (left), 1 plant (right)

Fig. 8: Cutting the lettuce leaves

3.4.1 Harvest the outer (3-8) leaves from each plant. Pinch them off with your fingers at the base of the plant (fig. 8)

3.4.2 Collect the leaves in the plastic container

3.4.3 GOTO Step 4

3.5 Tomato Harvesting

NOTE
DWARF TOMATO CAN BE HARVESTED STARTING FROM 12-14 WEEKS AFTER SOWING . THE PERFECT TOMATO FOR PICKING WILL BE FIRM AND RED/ORANGE (DEPENDING ON VARIETY) REGARDLESS OF SIZE, WITH PERHAPS SOME YELLOW REMAINING AROUND THE STEM. A RIPE TOMATO WILL BE ONLY SLIGHTLY SOFT.

Fig.9 Tomato grapes ready for harvesting

3.5.1 Twist the tomato from the the stem with your fingers

3.5.2 Collect the tomatoes in the plastic containers

3.5.3 GOTO step 4

3.6 Pepper Harvesting

NOTE
1. PEPPER GROWS VERY SLOWLY AND IT TAKES ABOUT 4 MONTHS TO HARVEST THE FIRST FRUITS 2. BELL PEPPERS GROW IN A RANGE OF COLORS, INCLUDING GREEN, RED, DARK PURPLE, YELLOW AND ORANGE. IN GENERAL, THEY ARE READY TO HARVEST WHEN THEY ARE THE FULL COLOR OF THE VARIETY PLANTED 3. PICKING PEPPERS BEFORE THEY ARE FULLY MATURE WILL ENCOURAGE THE PLANT TO PRODUCE MORE FLOWERS AND, THUS, MORE PEPPERS.

Fig.11: Clipping Pepper using scissors

Fig. 12 Harvested Pepper

3.6.1 Clip the pepper off at the stem using the pruning shears (fig. 11). Cut as close to the branch as possible. Alternatively, ripe peppers may detach easily from the plant stem with a gentle twist.

3.6.2 Collect the Peppers in the plastic container

3.6.3 GOTO Step 4

3.7 Cucumber Harvesting

NOTE
CUCUMBERS NEED A LONG GROWING SEASON AND ARE READY FOR HARVEST AFTER AROUND 8-9 WEEKS. THE FRUITS RIPEN AT DIFFERENT TIMES ON THE VINE, SO IT IS ESSENTIAL TO PICK THEM AS THEY ARE READY. CUCUMBER SHOULD BE HARVESTED WHEN THE FINAL SIZE HAS BEEN REACHED, WHICH IS AROUND 10 CM LONG (AROUND 60 GRAM). CUCUMBERS MUST BE PICKED BEFORE THEY SHOW THE FIRST SIGNS OF YELLOWING, WHICH INDICATE THE FRUITS ARE PAST THEIR PRIME.

Fig. 12: Cucumber Harvesting

3.7.1 Remove fruits that are stunted and not growing, have rotten ends or are past their prime. This prevents the plant from focusing energy on fruits that are a waste anyway.

3.7.2 Use pruning shears or scissors when harvesting ripe cucumbers cut the stem 1 cm above the fruit (using the garden shears will prevent injury to the vine by twisting or pulling)

3.7.3 Lay gently the cucumber in the plastic container (the cucumbers are sensitive to bruising)

4 CLOSEOUT

4.1 If. no other harvesting are possible

Remove the drawer from the rack for plant disposal and drawer preparation for new plant cultivation

4.2 Clean the scissors and/or the pruning shears and stow it/them

NMIII 4.3 Weight collected plant mass, both edible and inedible and document data in the related Excel file

2.400 Pre- and Post-storm check

(EDEN ISS/CREW/NOMINAL/FIN)

OBJECTIVE

Check-up of the MTF and its supplies prior and after a storm. A storm in this case means weather conditions of more than 30 knots for more than 2 days and/or heavy snow fall.

DURATION

30 min

TOOLS

N/A

ITEMS

As necessary

		NOTE THIS PROCEDURE IS NECESSARY, BECAUSE THE CONDITIONS DURING A STORM MAY PREVENT THE ON-SITE OPERATOR FROM TRANSPORTING SUPPLIES TO AND FROM THE MTF.
MTF	**1.**	**Pre-storm check**
	1.1	Check the nutrient stock solution, acid and base solutions within the NDS tanks are sufficient for the operations until the end of the storm. If they are not sufficient, prepare new solutions and refill the NDS tanks. Use procedure 2.610 Preparation of nutrient stock solution, diluted acid, diluted base for NDS
	1.2	Take note of the remaining stock nutrient stock, acid and base in the stowage cabinet
	1.3	Check supply of rock wool and grow mats to last until the end of the storm. Take note of remaining rock wool and grow mats in the stowage cabinet.
	1.4	Check pressure on CO_2 bottles to be >5 bar. If the pressure is < 5 bar, replace the CO_2 bottles with new ones.
	1.5	Inspect FEG and harvest plants when necessary.
	1.6	Secure shovel outside behind ladder to the roof.
	1.7	Test FEG emergency exit door
MTF	**2.**	**Post-storm check**
	2.1	Inspect the exterior equipment (ladder, CO_2 bottles, lamps, freecooler, etc.)
	2.2	Test FEG emergency exit door, remove snow accumulation when necessary

2.3 Remove snow from platform in front of the entrance door, and from the ladder

2.4 Check nutrient stock solution, acid and base bottles connected to the NDS

2.410 Transportation of material between NM and MTF

(EDEN ISS/CREW/NOMINAL/FIN)

OBJECTIVE

This procedure contains guidelines for transporting material between NM and MTF under different weather conditions.

DURATION

n.a.

TOOLS

N/A

ITEMS

See Note for Transportation Equipment List

NOTE

1. AVAILABLE VEHICLE:
   a. HAND-PULLED SLED
   b. SKIDOO
   c. PISTENBULLY
2. AVAILABLE TRANSPORTATION EQUIPMENT:
   a. BACKPACK
   b. ZARGES BOX
   c. LARGE STYROFOAM BOX
   d. PLASTIC BAGS
   e. DUFFLE BAG
3. HARVEST CONTAINER
   a. TUPPERWARE BOX
4. DEPENDING ON THE WEATHER CONDITION, DIFFERENT MEANS OF TRANSPORTATION HAVE TO BE USED (SEE FOLLOWING TABLE AND PICTURE)

Means of transportation	Hand-pulled sled	Skidoo	Pistenbully
Equipment	Styrofoam box, Zarges box	Canisters	All
Weather	<30 knots	<15-20 knots Good sight	<40 knots Medium sight

Figure 1: Overview means of transportation and weather conditions (from left to right: Zarges Box, Sled, Skidoo, Pistenbully)

5. THE AIR CHEMIST ÜWI SHALL BE INFORMED WHEN DRIVING WITH A ENGINE-POWERED VEHICLE TO THE MTF

2. Normal transportation (good weather)

2.1 Use Hand Pulled Sled for light items using Styrofoam or Zarges Box attached to it with straps. In particular:

- Use Styrofoam box for Lettuce Harvest (it requires a lot of insulation)
- Use Zarges Box for the other harvested plants, or other items, like the nutrient stock solution tanks.

Remark: In any case, the harvested plants have to be put inside a Tupperware Box. These last are then put inside the Styrofoam or Zarges Box. This is true for all plants except lettuce, which gets too much compressed inside the Tupperware boxes. Therefore lettuce harvest is put into the Styrofoam box without Tupperware.

2.2 Use Skidoo coupled with the sled for heavy items, like for example canisters with fresh water and/or waste water.

If, for whatever reason, the Skidoo cannot be used (e.g. ramp closed due a drift), use a Pistenbully for transport

3. Transportation during bad weather (wind > 25-30 knots)

Do not use the hand-pulled sled!

Light items, as small quantities of harvest (in any case put in the Tupperware boxes) can be put into a backpack or into a duffel bag.

During long periods of very bad weather a Pistenbully can be used to transport harvest and/or water between NM and MTFHeavy Items have to be put in the Zarges Box or Styrofoam box in the rear cabine.

2.500 HD Cameras Configuration for Plant Monitoring

(EDEN ISS/CREW/NOMINAL/FIN)

OBJECTIVE

To configure the HD camera's system in terms of:

- network parameter's definition
- camera's parameters

DURATION

120 minutes

TOOLS

N/A

ITEMS

N/A

NOTE
1) PREREQUISITES TO START THIS ACTIVITY ARE: • THE CAMERA'S ARE INSTALLED IN THE MTF AND THE PHYSICAL CONNECTIONS HAVE BEEN DONE • THE EDEN ISS NETWORK IS CONFIGURED AND FULLY WORKING • THE HIKVISION SADP AND IVMS-4200 SW HAVE BEEN ALREADY INSTALLED ON THE TWO CAMERAS PC' IN THE MTF AND IN NMIII 2) THE CONFIGURATION CAN BE DONE ON THE PC CAMERA'S IN BOTH THE MTF AND NMIII

Camera PC

1. CAMERA ACTIVATION

NOTE
1) FOR CAMERA ACTIVATION IT IS **NOT** INTENDED THE PROVISION OF THE POWER, BUT RATHER THE CONFIGURATION OF THE NETWORK PARAMETERS AND THE LOAD OF TEH CAMERAS TO THE IVMS-4200 SERVER SW. AS MATTER OF FACT THE PROVISION OF THE ELECTRICAL POWER TO THE CAMERAS IS DONE AS SOON AS THEY ARE CONNECTED TO AN ACTIVE SWITCH. 2) THE CONFIGURATION OF THE CAMERA NETWORK PARAMETERS IS DONE USING THE SADP SW

1.1 Run the SADP SW. Click on the SADP SW icon on the CameraPC and wait until the SADP main page opens (fig. 1)

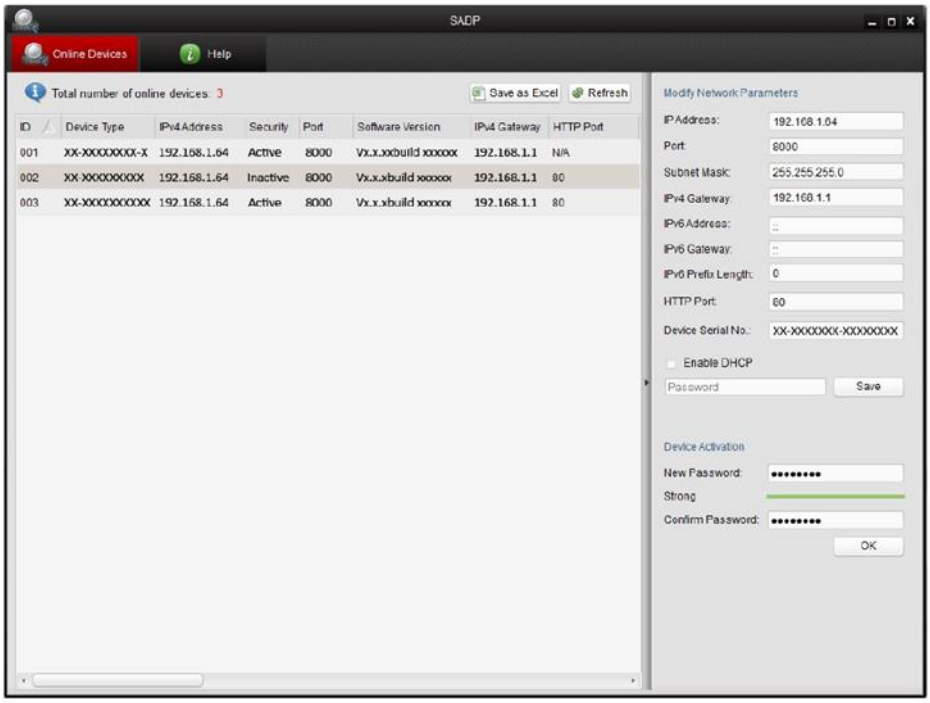


Figure 1: SADP Main Page

Table 1: Cameras network parameters

Item	Position	IP Address	Server Port	Subnet Mask	Gateway	HTTP Port
Top View Cam	L1-2C	192.168.39.111	8000	255.255.255.0	192.168.39.254	80
Top View Cam	L1-4C	192.168.39.112	8000	255.255.255.0	192.168.39.254	80
Top View Cam	L2-1C	192.168.39.113	8000	255.255.255.0	192.168.39.254	80
Top View Cam	L2-2C	192.168.39.114	8000	255.255.255.0	192.168.39.254	80
Top View Cam	L2-3C	192.168.39.115	8000	255.255.255.0	192.168.39.254	80
Top View Cam	L2-4C	192.168.39.116	8000	255.255.255.0	192.168.39.254	80
Top View Cam	L3-1C	192.168.39.117	8000	255.255.255.0	192.168.39.254	80
Top View Cam	L3-2C	192.168.39.118	8000	255.255.255.0	192.168.39.254	80
Top View Cam	L3-3C	192.168.39.119	8000	255.255.255.0	192.168.39.254	80
Top View Cam	L3-4C	192.168.39.120	8000	255.255.255.0	192.168.39.254	80
Top View Cam	L4-1L	192.168.39.121	8000	255.255.255.0	192.168.39.254	80
Top View Cam	L4-2L	192.168.39.122	8000	255.255.255.0	192.168.39.254	80
Top View Cam	L4-3L	192.168.39.123	8000	255.255.255.0	192.168.39.254	80
Top View Cam	L4-1R	192.168.39.125	8000	255.255.255.0	192.168.39.254	80
Top View Cam	L4-2R	192.168.39.126	8000	255.255.255.0	192.168.39.254	80

Top View Cam	L4-3R	192.168.39.127	8000	255.255.255.0	192.168.39.254	80
Top View Cam	L4-4C	192.168.39.128	8000	255.255.255.0	192.168.39.254	80
Top View Cam	R1-2C	192.168.39.129	8000	255.255.255.0	192.168.39.254	80
Top View Cam	R1-4C	192.168.39.130	8000	255.255.255.0	192.168.39.254	80
Top View Cam	R2-2C	192.168.39.131	8000	255.255.255.0	192.168.39.254	80
Top View Cam	R2-4C	192.168.39.132	8000	255.255.255.0	192.168.39.254	80
Top View Cam	R3-4C	192.168.39.133	8000	255.255.255.0	192.168.39.254	80
Top View Cam	R4-2C	192.168.39.134	8000	255.255.255.0	192.168.39.254	80
Top View Cam	R4-4C	192.168.39.135	8000	255.255.255.0	192.168.39.254	80
Side View Cam	L1-S	192.168.39.141	8000	255.255.255.0	192.168.39.254	80
Side View Cam	L2-S	192.168.39.142	8000	255.255.255.0	192.168.39.254	80
Side View Cam	L3-S	192.168.39.143	8000	255.255.255.0	192.168.39.254	80
Side View Cam	L4-S	192.168.39.144	8000	255.255.255.0	192.168.39.254	80
Side View Cam	R1-S	192.168.39.145	8000	255.255.255.0	192.168.39.254	80
Side View Cam	R2-S	192.168.39.146	8000	255.255.255.0	192.168.39.254	80
Side View Cam	R3-S	192.168.39.147	8000	255.255.255.0	192.168.39.254	80
Side View Cam	R4-S	192.168.39.148	8000	255.255.255.0	192.168.39.254	80
External Cam.	EAST	192.168.39.171	8000	255.255.255.0	192.168.39.254	80
External Cam.	WEST	192.168.39.172	8000	255.255.255.0	192.168.39.254	80
Observ. Cam.	MTF/CP	192.168.39.181	8000	255.255.255.0	192.168.39.254	80
Observ. Cam.	MTF/SS	192.168.39.182	8000	255.255.255.0	192.168.39.254	80
Observ. Cam.	MTF/SS	192.168.39.183	8000	255.255.255.0	192.168.39.254	80
Observ. Cam.	MTF/FEG	192.168.39.184	8000	255.255.255.0	192.168.39.254	80

1.2 **Verify** that all the camera's are listed in the main page

1.3 **Select** the device to be modified in the device list and the network parameters of the device will be displayed in the Modify Network Parameters panel on the right side

1.4 **Modify** the newtork camera parameters in the "Modify Network Parameters" field as per the table 1

1.5 **Enter** the password of the admin account of the device in the Password field and click to save the changes.

1.6 Repeat for all the other cameras.

2 ADDING THE ONLINE CAMERAS TO THE iVMS CLIENT

2.1 **Run** the iVMS-4200 SW. Double click on the iVMS icon on the desktop and wait until the iVMS-4200 main page opens (fig. 2)

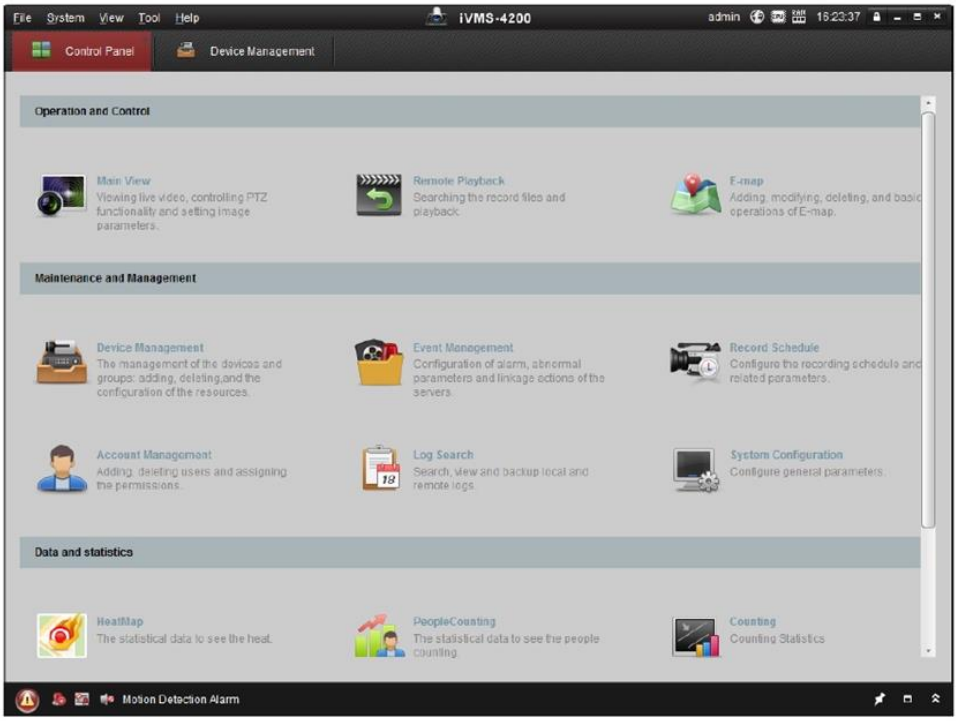


Figure 2: iVMS-4200 Main Page

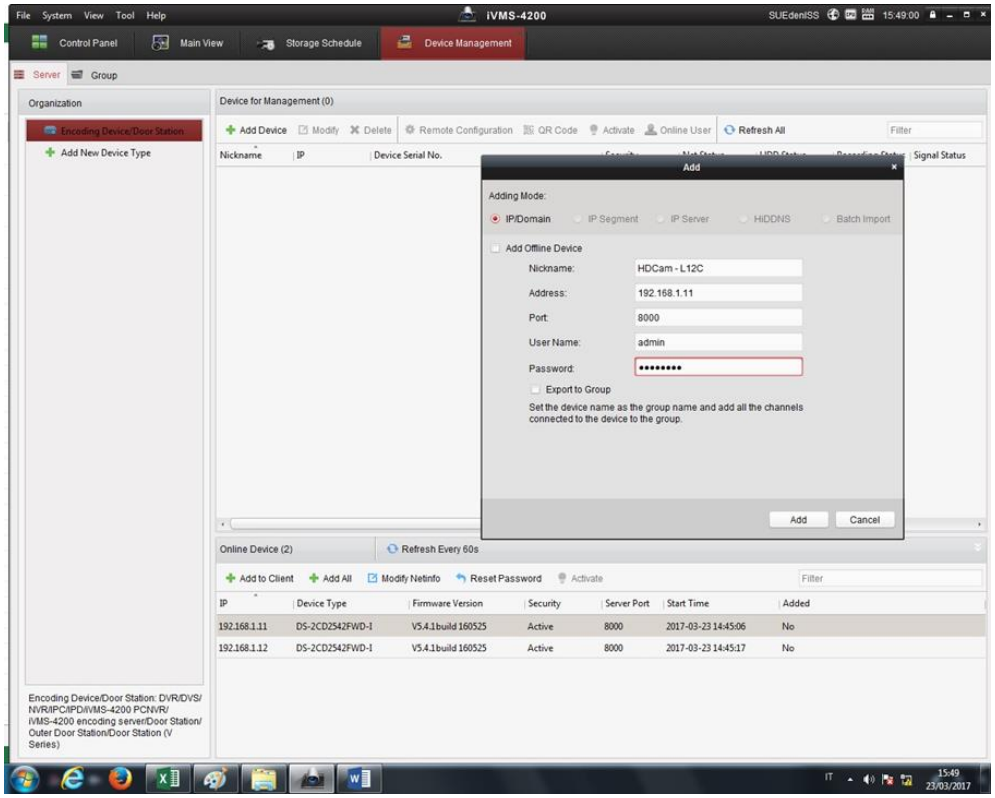


Figure 3: Device Management Main Page

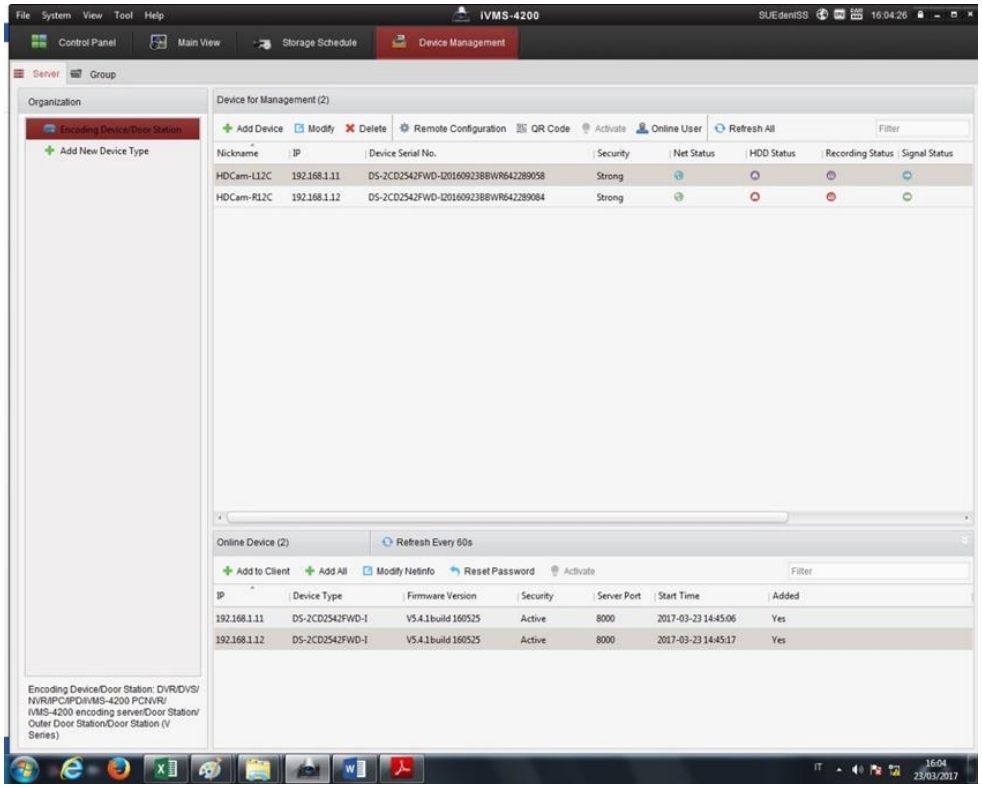


Figure 4: Cameras added to Client

2.2 In the Online Device Field Select the devices to be added from the list

2.3 Click **Add to Client** to open the device adding dialog box

2.4 **Input** the required information.

Nickname: Edit a name for the device as you want (it is recommended to have a name that is recalling the position or the function of the camera).
Address: Input the device's IP address. The IP address of the device is obtained automatically in this adding mode.
Port: Input the device port No. The default value is *8000*.
User Name: Input the device user name. By default, the user name is *admin*.
Password: Input the device password.

2.5 **Record** the above defined parameters in the log

2.6 **Repeat** for all the other cameras.

3 CREATING GROUPS OF CAMERAS

NOTE
AN IMPORTANT FEATURES OF THE DEVICE MANAGEMENT IS THE POSSIBILITY TO CREATES GROUPS OF CAMERAS. THAT IS VERY IMPORTANT FOR THE EDEN ISS PROJECT WERE WE HAVE A LOT OF CAMERA'S THAT CAN BE ORGANISED BY THEIR

POSITION (RIGHT OR LEFT SIDE OF THE FEG CORRIDOR FOR EXAMPLE), OR BY THEIR DESTINATION (PLANT HEALTH MONITORING OR AMBIENT MONITORING).

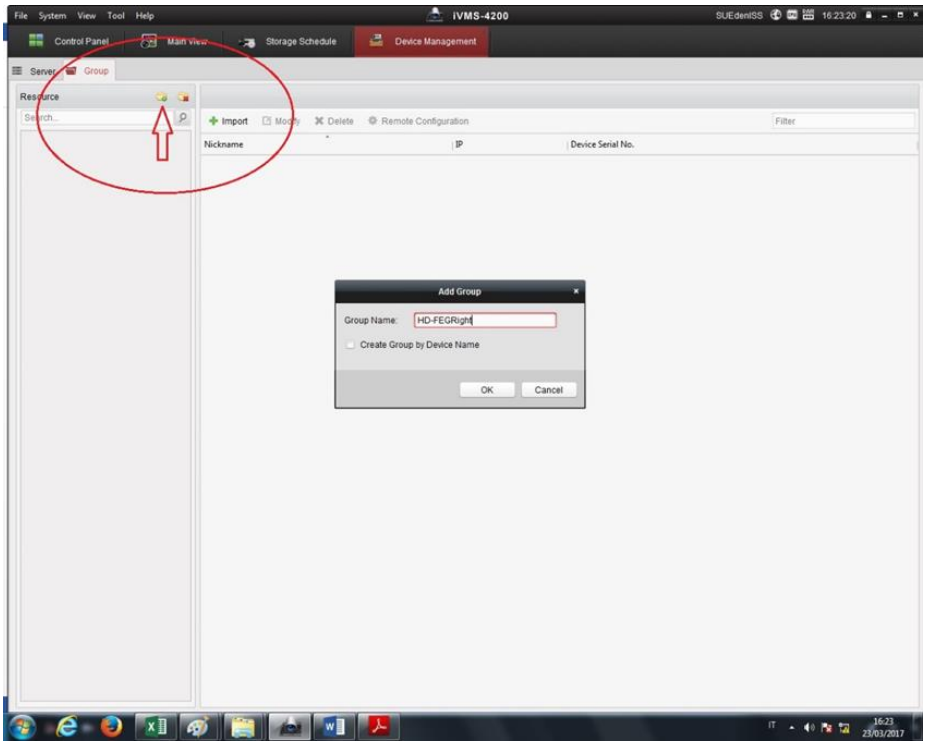


Figure 5: Creating a group

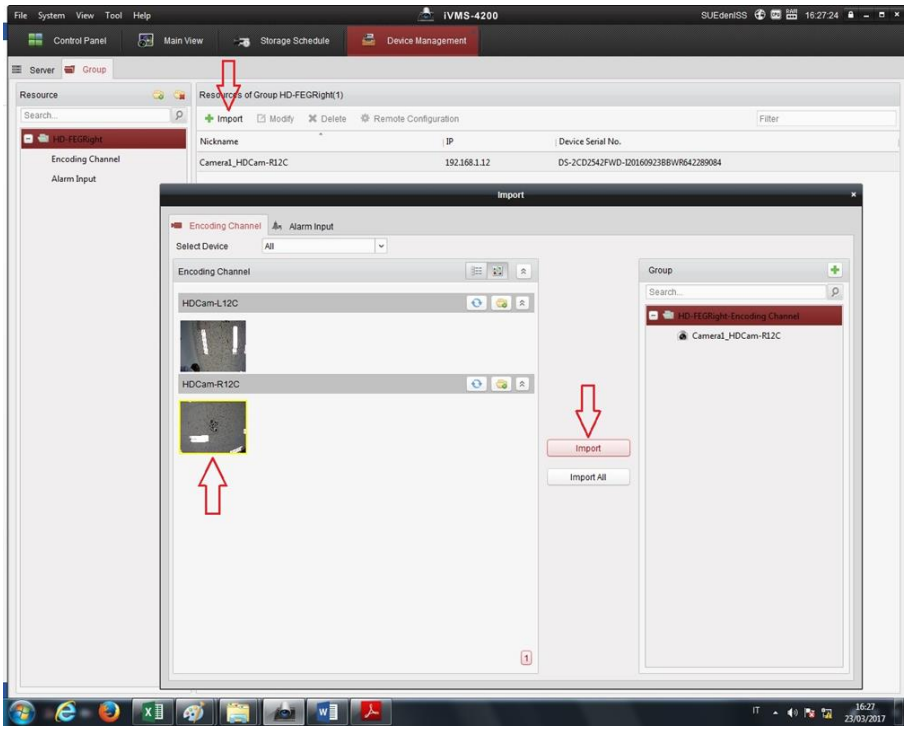


Figure 6: Camera importing to group

3.1 **Click** "**Group"** in the Device Management page to open the group page

3.2 **Click** "**Add Group"** to create a new group

3.3 **Insert** the "**Group Name",** click OK

3.4 **Verify** that the group has been created in the Resource Field

3.5 **Click** "**Import"** on the tool bar of the Device Management to open the import page

3.6 **Select** the Image (it is possible to click on the image)

3.7 **Click** Import

3.8 Repeat for the other groups and camera's as desired

4 CAMERA CONFIGURATION

NOTE

TWO ACTIONS ARE NECESSARY BEFORE STARTING WITH THE IMAGES/VIDEO ACQUISITION:

- THE CONFIGURATION OF THE CAMERA'S PARAMETERS (LIKE RESOLUTION, FRAME RATE, ETC)
- THE CONFIGURATION OF THE VIDEO PARAMETERS (LIKE THE BRIGHTNESS, THE CONTRAST, ETC)
- THE CONFIGURATION OF THE DISPLAYS PARAMETERS (LIKE CAMERA NAME, TIME FORMAT, ETC.)

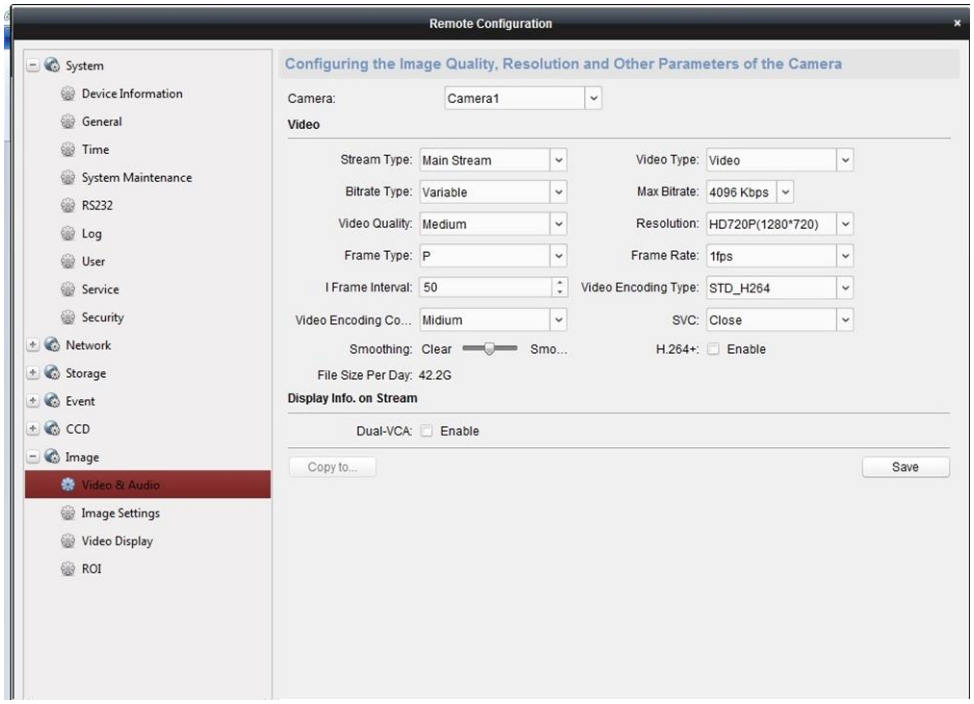


Figure 7: Remote Configuration page- Video and Audio Configuration

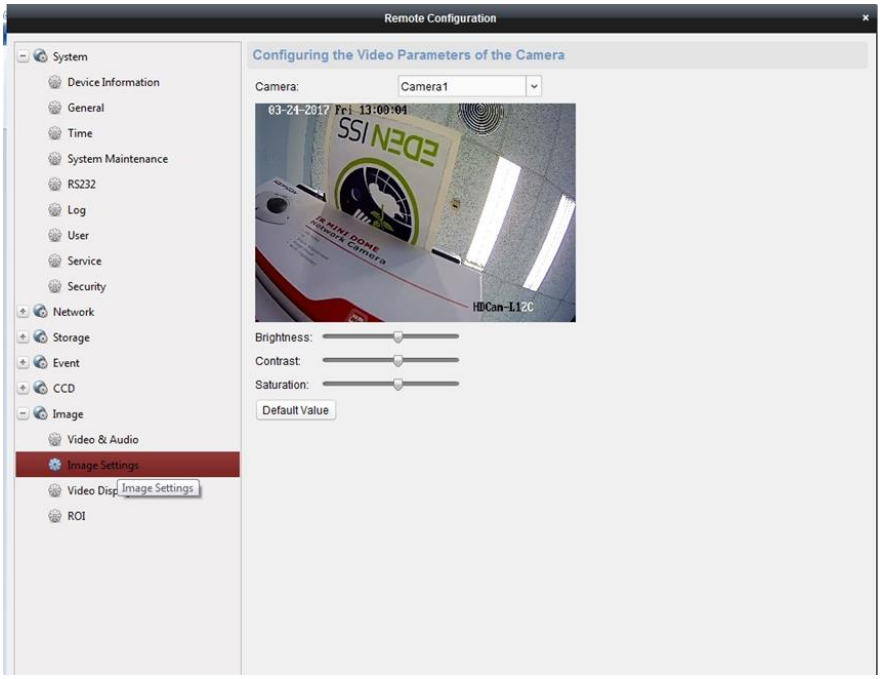


Figure 8: Remote Configuration page- Image Configuration

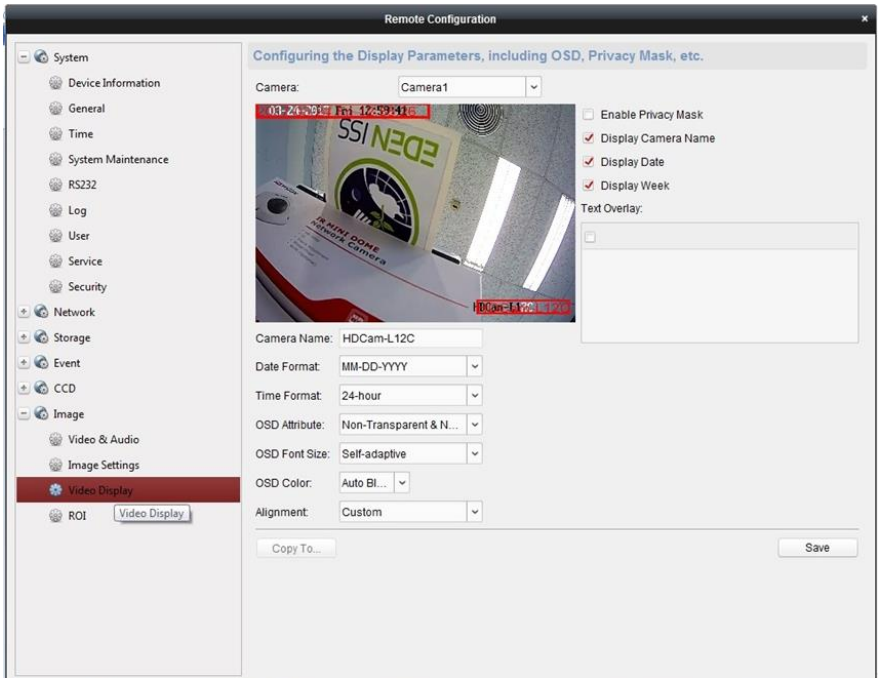


Figure 9: Remote Configuration page- Video Display Configuration

4.1 Select the camera to be configured in the Device Management Main page

4.2 **Click "Remote Configuration"** in the Device Management page. The Remote Configuration page will be opened (Fig. 7)

Click Image to open popup menu

4.4 **Select** "**Video & Audio"** in the Popup Menu for Camera parameters configuration. The "*Configuring the Image Quality, Resolution and other parameters of the camera*" window will open (Fig.7).

Input the desired value

4.5 **Select** the "**Image Setting"** in the popup Menu to define the video parameters of the cameras. The "*Configuring the video Parameters of the camera*" window will open (Fig. 8).
Input the desired value

4.6 **Select** the "**Video Display"** in the Popup menu to define how the video/images will be displayed and saved. The "*Configuring the Display Parameters, including the OSD, privacy mask, etc*" will open (Fig. 9).

Input the desired value

5 LIVE VIEW

NOTE
THE LIVE VIEW WILL ALLOW THE USER TO VERIFY IF THE SYSTEM IS SENDING THE IMAGES ON THE CAMERA PC AS VERIFICATION OF THE ABOVE STEPS

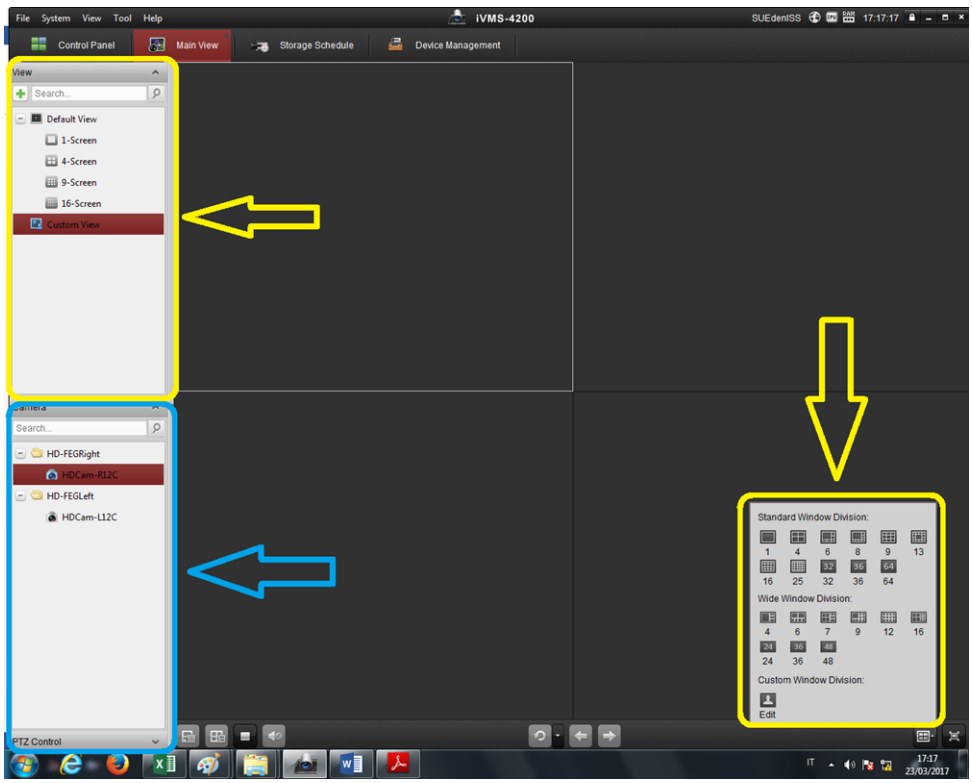


Figure 10: Main View Window with four screen

5.1 On the toolbar, **Select** "**Main View".** The main View Window will open (Fig. 10) with four screen as default

5.2 **Open** the Standard Window Division and select 32 (See fig. 10). 32 screens will be associated to the Main View Window

5.3 In the camera field **Verify** that each camera is online  and that all the cameras are divided as per defined groups.

5.4 Associate each camera to a window. Select the window, by simply clicking on it, and then the camera with a double click. A small green arrow  close to the camera name indicate that the camera is sending a video to the window.

5.5 On the screen **Verify** that the camera's name is correct

2.510 EDEN ISS Datalog and Images Automatic Transfer to MCC

(EDEN ISS/CREW/NOMINAL/FIN)

OBJECTIVE

Configure the C&DH system in order to automatically transfer the datalog and the images generated during the EDEN ISS operations to the NMIII Station and to the EDEN ISS MCC @DLR Bremen.

DURATION

120 minutes (TBC)

TOOLS

N/A

ITEMS

N/A

NOTE

1. SEVERAL DATE ARE GENERATED DURING THE EDEN ISS OPERATIONS:

   - FEG/MTF DATA LOG
   - MTF/FEG HD IMAGES
   - MULTIWAVE IMAGES
   - ISPR DATA LOG
   - ISPR IMAGES

   THESE DATA HAVE TO BE TRANSFERRED FORM THE MTF TO THE NMIII CONSOLES AND TO THE EDEN ISS MCC@DLR BREMEN, AND THEN DISTRIBUTED TO THE UHB'S (SUPPORT CENTERS) FOR OFFLINE ANALYSIS. THE TRANSFER IS AUTOMATICALLY MANAGED BY AD-HOC DEVELOPED SW APPLICATIONS. THESE APPLICATIONS, WITH THE EXCEPTION OF THE HD IMAGES, ARE NOT RESPONSIBLE FOR THE ACQUISITION AND STORAGE OF THE DATA THAT ARE MANAGED BY THE OTHER SYSTEMS IMPLEMENTED AS PART OF THE C&DH AS FOLLOW:

   - ARGUS FOR THE MTF/FEG
   - GOPRO SW FOR THE MULTIWAVE IMAGES
   - LABVIEW FOR THE ISPR DATA/IMAGES

2. THESE PROCEDURE MANAGES THE ONLY NOMINAL ACTIVITIES. FOR FURTHER INSTRUCTIONS AND/OR VERIFICATION REFER TO THE DOCUMENT "INPUT TO D3.11 – PHM DESIGN REPORT: HD CAMERA SYSTEM DESIGN REPORT AND USER GUIDE"

1 PREREQUISITES CHECK

1.1 Verify that the following files/scripts have been copied on the ***Camera-PC (MTF)*** - C:\File_AcquisitionTransfer\TPZ_SW:

- *edeniss_mkdir.bat*
- *hikvision.py*
- *camera_snapshot_robot.py*
- *camera_ftp_robot_DLR.py*

- *edeniss_camera_scheduler_DLR.bat*
- *camera_ftp_robot_NMIII.py*
- *edeniss_camera_scheduler_NMIII.bat*

MTF 1.2 Verify that the following scripts have been copied on the the ***Argus-PC (MTF)*** C:\File_AcquisitionTransfer\TPZ_SW:

- *edeniss_mkdir.bat*
- *hikvision.py*
- *data_ftp_robot_DLR.py*
- *edeniss_data_scheduler_DLR.bat*
- *data_ftp_robot_NMIII.py*
- *edeniss_data_scheduler_NMIII.bat*

1.3 Verify that the following files/scripts have been copied to the ***ISPR-PC (MTF) -*** C:\File_AcquisitionTransfer\TPZ_SW:

- *edeniss_mkdir.bat*
- *hikvision.py*
- *isprcamera_ftp_robot_DLR.py*
- *edeniss_isprcamera_scheduler_DLR.bat*
- *isprcamera_ftp_robot_NMIII.py*
- *edeniss_isprcamera_scheduler_NMIII.bat*
- *isprdata_ftp_robot_DLR.py*
- *edeniss_isprdata_scheduler_DLR.bat*
- *isprdata_ftp_robot_NMIII.py*
- *edeniss_isprdata_scheduler_NMIII.bat*

NMIII 1.4 Verify that the following file has been installed on the ***Camera-PC (NM-III)*** and ***Argus-PC (NM-III)*** - C:\File_AcquisitionTransfer\TPZ_SW:

- *edeniss_remote_mkdir.bat*
- *FTP Server* (for example ***filezilla server***)

*Remark: The FTP user account should be **ftp_edeniss_dlr**, the password "12345", the home directory should be **'D:/FTP_EDEN-ISS/'**.*

MCC 1.5 Verify that the following file has been installed on the ***DLR OPS PC -*** C:\File_AcquisitionTransfer\TPZ_SW:

- *edeniss_remote_mkdir.bat*
- *FTP Server* (for example ***filezilla server***)

*Remark: The FTP user account should be **ftp_edeniss_dlr**, the password "12345", the home directory should be **'D:/FTP_EDEN-ISS/'**.*

1.6 If the above steps are not accomplished, copy all the listed applications as described above. Call **MCC** in case the SW Applications are not available.

2 DIRECTORIES CREATION FOR DATA LOG/IMAGES STORAGE ON THE MTF PC'S

MTF 2.1 Creating Folder Structure on the MTF Camera-PC for Images Storage

NOTE

1. THE OBJECTIVE OF THIS STEP IS THE CREATION OF THE DIRECTORIES FOR THE STORAGE OF THE FOLLOWING IMAGES TIPOLOGY:
   - HDTOPVIEW
   - HDSIDEVIEW
   - UFIMAGERS (MULTIWAVE) IMAGES
2. IF THE FOLDER STRUCTURE ALREADY EXISTS, THE COMMANDS FOR DIRECTORES CREATION ARE NOT EXECUTED AND A MESSAGE WILL APPEAR IN THE COMMAND WINDOW STATING THAT THE FOLDERS ALREADY EXIST.

2.1.1 On **Camera-PC (MTF)** Launch the ***edeniss_mkdir.bat*** batch file in a *Windows CMD command line*

enter *[CAM]*

2.1.2 **Verify** the following folders have been created:

D:\FTP_EDEN-ISS\CropImages\HDTOPVIEW\<camera position1>

Where *<camera position1>* is:

- L1-2C, L1-4C
- L2-1C, L2-2C, L2-3C, L2-4C
- L3-1C, L3-2C, L3-3C, L3-4C
- L4-1L, L4-2L, L4-3L
- L4-1R, L4-2R, L4-3R, L4-4C
- R1-2C, R1-4C
- R2-2C, R2-4C
- R3-4C
- R4-2C, R4-4C

D:\FTP_EDEN-ISS\CropImages\HDSIDEVIEW\<camera position2>

Where *<camera position2>* is:

- L12-1S, L12-3S, L34-1S, L34-3S
- R12-1S, R12-3S, R34-1S, R34-3S

- *D:\FTP_EDEN-ISS\CropImages\UFIMAGERS\<ufimager camera position>*

  Where *<ufimager camera position>* is:
  - UFImager1, UFImager2, UFImager3, UFImager4

2.2 Creating Folder Structure on the Argus PC (MTF) for Argus Data Logs Storage

2.2.1 On **Argus-PC (MTF)** Launch the ***edeniss_mkdir.bat*** batch file in a *Windows CMD command line*

enter *[CSVDATA]*

2.2.2 **Verify** the following folders have been created:

D:\FTP_EDEN-ISS\DataFiles

2.3 Creating Folder Structure on the ISPR PC (MTF) for ISPR Data Logs and Images Storage

2.3.1 On **ISPR-PC (MTF)** Launch the ***edeniss_mkdir.bat*** batch file in a *Windows CMD command line*

enter *[ISPRFILES]*

2.3.2 **Verify** the following folders have been created:

D:\FTP_EDEN-ISS\CropImages\<ispr camera position>

Where *<ispr camera position>* is:

- GCScam, GCSUFIcam, GCTcam

D:\FTP_EDEN-ISS\DataFiles\<ispr datafile dir>

Where *<ispr datafile dir>* is:

- LOG, VALUES, ERROR

NMIII/ MCC **3 CONFIGURING THE FTP SERVER ON DLR OPS-PC, CAMERA-PC (NM-III) AND ARGUS-PC (NM-III)**

NOTE
THE OBJECTIVE OF THIS STEP IS THE CONFIGURATION OF THE FTP SERVER (FILEZILLA) FOR DATALOG AND IMAGES TRANSFER FROM THE MTF TO NMIII TO THE MCC. IT IS DESCRIBED FOR ONE GENERIC PC.

3.1 On the **NMIII Camera-PC, NMIII Argus-PC and on the DLR OPS_PC**

- Open Filezilla Server Interface
- In the Menu Bar/Edit → Users
- In the Users Page/Users → Click on Add Button
- In the Add User Account window → type the name of the ftp user Account: ***ftp_edeniss_dlr***
- In the account settings → Click on Password and then enter: ***12345*** (if another is desired the scheduler batch file has to be updated)
- In Page Select Shared Folders → Click Add and then select '***D:\FTP_EDEN-ISS\'*** → Click OK

- Select the **privileges** (in Files select Read, Write, Delete, Append; in Directories select Create, Delete, List, Subdirs) → Click on **set as home dir** → Click OK

3.2 In FileZilla Server Interface **verify** the operation has succeeded

NMIII/ MCC

4 DIRECTORIES CREATION FOR DATA LOG/IMAGES STORAGE ON THE NMIII/MCC PC'S

NOTE

1. THE OBJECTIVE OF THIS STEP IS THE CREATION OF THE DIRECTORIES ON THE COMPUTERS AT THE NMIII AND AT THE MCC WHERE THE IMAGES/DATA WILL BE AUTOMATICALLY TRANSFERRED FROM THE MTF.
2. ONLY TWO PC'S ARE AVAILABLE AT NMIII
   - NMIII CAMERA-PC (FOR ARGUS/ISPR DATALOG STORAGE)
   - NMIII ARGUS PC (FOR MTF/FEG AND ISPR IMAGES STORAGE)
3. ONLY ONE PC IS AVAILABLE AT MCC. ALL THE DATA/IMAGES COMING FROM THE MTF WILL BE STORED ON IT.
4. IF THE FOLDER STRUCTURE ALREADY EXISTS, THE COMMANDS FOR DIRECTORES CREATION ARE NOT EXECUTED AND A MESSAGE WILL APPEAR IN THE COMMAND WINDOW STATING THAT THE FOLDERS ALREADY EXIST

4.1 Creating Folder Structure on the NMIII Camera-PC and on the DLR OPS-PC for Images Storage

4.1.1 On the Camera-PC (NM-III) and on the DLR OPS-PC **Launch** the ***edeniss_remote_mkdir.bat*** batch file in a *Windows CMD command line*

enter *[CAM]*

4.1.2 **Verify** the following folders have been created:

- *D:\FTP_EDEN-ISS\CropImages\HDTOPVIEW\<camera position1>*

  Where *<camera position1>* is:
  - L1-2C, L1-4C
  - L2-1C, L2-2C, L2-3C, L2-4C
  - L3-1C, L3-2C, L3-3C, L3-4C
  - L4-1L, L4-2L, L4-3L
  - L4-1R, L4-2R, L4-3R, L4-4C
  - R1-2C, R1-4C
  - R2-2C, R2-4C
  - R3-4C
  - R4-2C, R4-4C

- *D:\FTP_EDEN-ISS\CropImages\HDSIDEVIEW\<camera position2>*

  Where *<camera position2>* is:
  - L12-1S, L12-3S, L34-1S, L34-3S

- R12-1S, R12-3S, R34-1S, R34-3S

- *D:\FTP_EDEN-ISS\CropImages\UFIMAGERS\<ufimager camera position>*

  Where *<ufimager camera position>* is:
  - UFImager1, UFImager2, UFImager3, UFImager4

- *D:\FTP_EDEN-ISS\CropImages\ISPR\<ispr camera position>*

  Where *<ispr camera position>* is:
  - GCScam, GCSUFIcam, GCTcam

4.2 Creating Folder Structure on the NMIII Argus-PC and on the DLR OPS-PC for Data Log Storage

4.2.1 On the Argus-PC (NM-III) and on the DLR OPS-PC **Launch** the ***edeniss_remote_mkdir.bat*** batch file in a *Windows CMD command line*

enter *[DATA]*

4.2.2 **Verify** the following folders have been created, for Argus and ISPR data files:

- *D:\FTP_EDEN-ISS\DataFiles\Argus*
- *D:\FTP_EDEN-ISS\DataFiles\ISPR\<ispr datafile dir>*

  Where *<ispr datafile dir>* is:
  - LOG, VALUES, ERROR

5 HD IMAGES AUTOMATIC ACQUISITION SCHEDULING

NOTE

EVEN IF THE HD CAMERA'S INSTALLED IN THE MTF FOR BOTH AMBIENT AND PLANT MONITORING CAN BE MANAGED BY THE SW FACTORY, IT IS PREFERRED TO USE AN AD-HOC DEVELOPED SW APPLICATION FOR THE AUTOMATIC ACQUISITION OF PLANT IMAGES. THIS APPLICATION ACQUIRES ONE PICTURE PER CAMERA PER DAY.

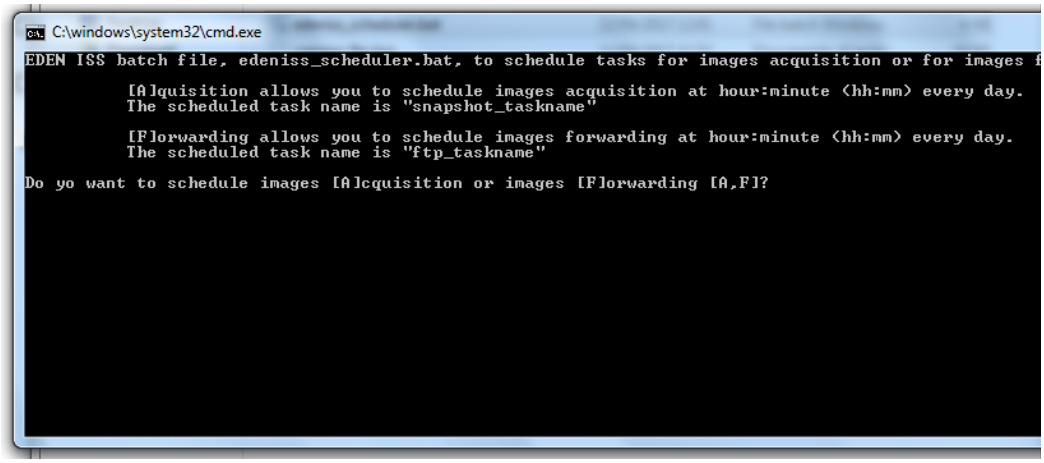


Fig. 1: Cmd Prompt

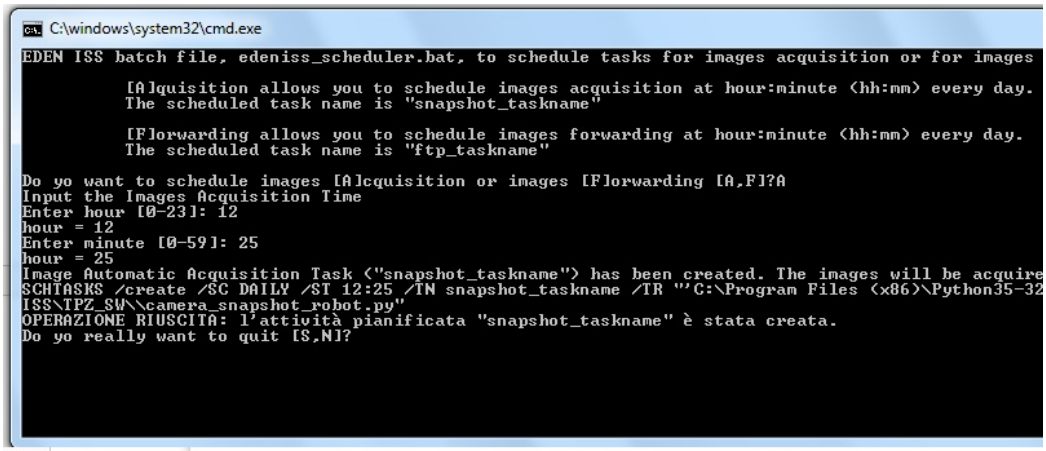


Fig. 2: Confirmation Message

5.1 On **Camera-PC (MTF)**, In a *Windows CMD command line*,

Launch edeniss_camera_scheduler_DLR.bat batch file

Verify the Cmd prompt appears on the screen as per Fig. 1

To schedule the image acquisition **Input** in sequence:

- A
- Hour (in the format 0-23)
- Minutes (in the format 0-59)

Verify that the snapshot_taskname has been created (a confirmation message will appear)

Verify the images have been acquired and saved on the MTF camera PC

6 HD AND MULTIWAVE FEG PLANT IMAGES AUTOMATIC TRANSFER

NOTE

1. THIS STEP REFERS TO THE AUTOMATIC TRANSFER FROM THE MTF TO NMIII AND TO THE MCC OF ALL THE PLANTS IMAGES GENERATED WITHIN THE FEG:
   - HD IMAGES
   - MULTIWAVE IMAGES

2. TRANSFER SHALL OCCUR AFTER THE IMAGE ACQUISITION HAS BEEN COMPLETED

6.1 Automatic Transfer of the Plant Images to the MCC (DLR OPS –PC)

6.1.1 On the **Camera-PC (MTF)**, In a *Windows CMD command line*,

If the cmd prompt is still active **enter** N, otherwise **launch** edeniss_camera_scheduler_DLR.bat

6.1.2 **Verify** the Cmd prompt appears on the screen as per Fig. 1

6.1.3 **Input** in sequence:
- B
- Hour (in the format 0-23)
- Minutes (in the format 0-59)

6.1.4 **Verify** that the ftp_taskname has been created.

A confirmation message will appear saying that the *ftp_taskname_camera_DLR has been created*

6.1.5 **@DLR**, Verify that the images have been transferred on the DLR OPS PC (path as per step 4.1.2)

6.2 Automatic Transfer of the Plant Images to NMIII Camera PC

On the **Camera-PC (MTF)**, In a *Windows CMD command line*,

launch edeniss_camera_scheduler_NMIII.bat batch file

Input in sequence
- Hour (in the format 0-23)
- Minutes (in the format 0-59)

Verify that the ftp_taskname has been created.

A confirmation message will appear saying that the *ftp_taskname_camera_NMIII has been created*

@NMIII, Verify that the images have been transferred on the NMIII Camera PC (path as per step 4.1.2)

7 SCHEDULING ARGUS DATA TRANSFER FROM MTF TO NMIII AND TO DLR

NOTE
ARGUS GENERATES DATA LOG WITH A PREDEFINED TIMING. THESE DATA HAVE TO BE DAILY AND AUTOMATICALLY TRANSFERRED TO THE NMIII AND THE MCC.

7.1 Scheduling Argus Datalog Transfer to DLR

7.1.1 On **Argus-PC (MTF), IN THE** *Windows CMD command line*

Launch edeniss_data_scheduler_DLR.bat batch file

7.1.2 **Input** in sequence:

- Hour (in the format 0-23)
- Minutes (in the format 0-59)

7.1.3 **Verify** that the ftp_taskname has been created.

A confirmation message will appear saying that the *ftp_taskname_data_DLR has been created*

7.1.4 **@DLR**, Verify that the data have been transferred on the DLR OPS PC
Path as per step 4.2.2

7.2 Scheduling Argus Datalog Transfer to NMIII

On **Argus-PC (MTF),** in the *Windows CMD command line*

Launch edeniss_data_scheduler_NMIII.bat batch file

Input in sequence:

- Hour (in the format 0-23)
- Minutes (in the format 0-59)

Verify that the ftp_taskname has been created.

A confirmation message will appear saying that the *ftp_taskname_data_DLR has been created*

@NMIII, Verify that the data have been transferred on the NMIII Argus PC
Path as per step 4.2.2

8 Scheduling the ISPR Datalogs and Images Automatic Transfer

NOTE
THE ISPR GENERATES DATALOGS AND IMAGES WITH A PREDEFINED TIMING. THESE DATA HAVE TO BE DAILY AND AUTOMATICALLY TRANSFERRED TO NMIII AND THE MCC.

8.1 Scheduling ISPR Datalog Transfer to DLR

8.1.1 On the **ISPR PC (MTF), i**n a *Windows CMD command line*,

launch edeniss_isprdata_scheduler_DLR.bat batch file

8.1.2 **Input** in sequence:

- Hour (in the format 0-23)
- Minutes (in the format 0-59)

8.1.3 **Verify** that the ftp_taskname has been created.

A confirmation message will appear saying that the *ftp_taskname_isprdata_DLR has been created*

8.1.4 **@DLR**, Verify that the data have been transferred on the DLR OPS PC
Path as per step 4.2.2

8.2 Scheduling ISPR Datalog Transfer to NMIII

8.2.1 On the **ISPR PC (MTF), i**n a *Windows CMD command line*,

launch edeniss_isprdata_scheduler_NMIII.bat batch file

8.2.2 **Input** in sequence:

- Hour (in the format 0-23)
- Minutes (in the format 0-59)

8.2.3 **Verify** that the ftp_taskname has been created.

A confirmation message will appear saying that the *ftp_taskname_isprdata_NMIII has been created*

8.2.4 **@NMIII**, Verify that the data have been transferred on the NMIII Argus PC
Path as per step 4.2.2

8.3 Scheduling ISPR Images Transfer to DLR

On the **ISPR PC (MTF), i**n a *Windows CMD command line*,

launch edeniss_isprcamera_scheduler_DLR.bat batch file

Input in sequence:

- Hour (in the format 0-23)
- Minutes (in the format 0-59)

Verify that the ftp_taskname has been created.

A confirmation message will appear saying that the *ftp_taskname_isprcamera_DLR* has been created

@DLR, Verify that the images have been transferred on the DLR OPS PC (path as per step 4.1.2)

8.4 Scheduling ISPR Images Transfer to NMIII

On the **ISPR PC (MTF), i**n a *Windows CMD command line*,

launch edeniss_isprcamera_scheduler_NMIII.bat batch file

Input in sequence:

- Hour (in the format 0-23)
- Minutes (in the format 0-59)

Verify that the ftp_taskname has been created.

A confirmation message will appear saying that the *ftp_taskname_isprcamera_NMIII* has been created

@NMIII, Verify that the images have been transferred on the NMIII Camera PC (path as per step 4.1.2)

2.600 Cleaning of trays, tray lids and rock wool holders

(EDEN ISS/CREW/NOMINAL/FIN)

OBJECTIVE

After removing/harvesting plants inside the FEG, the tray, tray lid and rock wool holders need to be cleaned.

DURATION

5-10 min per tray

TOOLS

Sponge
Towel

ITEMS

Cleaning agent/soap
Paper tissue
Closed tray lid

NOTE
IT IS RECOMMENDED TO CLEAN SEVERAL TRAY LIDS AND ROCK WOOL HOLDERS IN ONE SINGLE CLEANING SESSION TO OPTIMIZE AND MINIMIZE THE USAGE OF WATER.

MTF	**1.**	**Cleaning tray lid and rock wool holders**
	1.1	Remove tray lid including the rock wool holders from the tray and put all in the sink in the Service Section.
	1.2	Put a closed tray lid in place of the removed one to close the tray.
	1.3	Place 2-3 layers of paper tissue on the workbench in front of the CDH box
	1.4	Remove the rock wool holders from tray lid
	1.5	Fill sink half full with hot water, add a drop of soap
	1.6	Submerse the rock wool holders and clean them with the sponge
	1.7	Put the rock wool holders on the paper tissue for drying
	1.8	Clean the tray lid using the sponge
	1.9	Dry the tray lid with the towel
	1.10	Store the tray lid and the rock wool holders in the storage cabinet in the Cold Porch
MTF	**2.**	**Cleaning tray**

NOTE

2.600 Cleaning of trays, tray lids and rock wool holders

(EDEN ISS/CREW/NOMINAL/FIN)

DO NOT USE ANY CHEMICALS OR CLEANING AGENTS!

2.1 Check in the control software that the high-pressure pump for the tray to be cleaned is not going to be activated in the next 5 minutes.

2.2 Remove tray lid from tray

2.3 Using a paper tissue, remove any residual roots and biofilm from the tray

2.4 Using a small pipe cleaning brush, clean the drain outlet of the tray

2.5 Take a paper tissue, lift the tray and clean the tray outlet hose

2.6 Reinstall the tray lid

2.610 Preparation of nutrient stock solution, diluted acid and diluted base for NDS

(EDEN ISS/CREW/NOMINAL/FIN)

OBJECTIVE

Prepare stock solutions, diluted acid and diluted base for NDS

DURATION

70 min for preparing DI water
40 min for mixing and dissolving fresh nutrients
10 min for filling acid and base tanks
20 min for transport fresh stock solution containers from NM III MPL to EDEN ISS - SS
30 min for exchange of stock solution containers inside MTF
Total duration: 2h 30min to 3 h

TOOLS

Nano circulation pump (Voyager Nano)
Stock solution container A,B,C,D
Acid tank
Base tank
Osmosis water-/ Osmosis machine
Measuring jug

ITEMS

Premixed nutrient salt Set # 1-4 for tank A, B, C, D
Nitric acid (HNO_3) with 25 % concentration
Potassium hydroxide (KOH) with 38 % concentration

NOTE

PARTS OF THIS PROCEDURE (3.1 to 3.4) CAN ONLY BE DONE UNDER GOOD WEATHER CONDITIONS**.**

NM III / MPL **1. PREPARATION OF DI WATER FOR STOCK SOLUTION PREPARATION (20 L for each tank)**

1.1 Collect 4 x 20 Liter canisters, marked with ‘Stock solution A,B,C,D and 2 x 5L containers marked with acid and base and bring them to the multipurpose laboratory in NM III

Figure 1: Stock Solution Tanks

1.2 Turn ON the reverse osmosis machine located below the left sink in the multipurpose laboratory. Make sure the outlets of the RO water tube and the waste water tube are inside the sink. Wait until the machine has flushed the filters (~30 seconds).

1.3 Open one canister and place it next to the sink on the floor

1.4 Insert the RO water tube (marked with a green label) into the empty canister.

1.5 Wait until stock solution canister A is filled to the 20 Liter mark (takes 11-13 min per canister)

1.6 Repeat steps 1.2 to 1.5 until 4 stock solution tanks are filled.

1.7 Turn off the reverse osmosis machine

1.8 Put filled containers on the table

NM III / MPL **2. PREPARATION OF ACID AND BASE**

NOTE

1. TARGET CONCENTRATION OF DILUTED ACID IS 1,25 %.
2. TARGET CONCENTRATION OF DILUTED BASE IS 1 %.

CAUTION

TO PREVENT INJURIES AND SKIN IRRITATIONS MAKE SURE TO WEAR HANDGLOVES AND SAFETY GOOGLES**.**

2.1 Fill acid container with 4750ml of RO water.

2.2 Fill measuring jug with 250 ml of concentrated acid and add it to the acid container.

2.4 Fill base container with 4868 ml of concentrated base

2.5 Fill measuring jug with 132 ml of concentrated base and add it to the base container.

2.6 Close the lids and bring it together with ready prepared stock solution containers to MTF.

NM III / MPL **3. PREPARATION OF NUTRIENT STOCK SOLUTION**

CAUTION

TO PREVENT INJURIES AND SKIN IRRITATIONS PLEASE AVOID DIRECT CONTACT WITH CONCENTRATED PREMIXED SALTS. MAKE SURE TO WEAR HANDGLOVES AND SAFETY GOOGLES.

Figure 2: Voyager Nano circulation pump

3.1 Open lid from stock solution tank A and unpack the nano circulation pump 'Voyager Nano' (fig. 2)

3.2 Insert the pump into the tank and mount it with the provided magnet on one tank side (Fig. 3)

Figure 3: pump installation into the tank

3.3 Turn on the circulation pump.

3.4 Collect a stock solution set out of the stock solution storage in the MPL.
For leafy crops (A+B) take salt containers from upper shelf level.
For fruity crops (C+D) take salt containers from lower shelf level.

Figure 4: Stock Solution Storage

3.5 Place the set marked with tank A in front of the stock solution tank

Figure 5: Stock Solution

3.6 Open salt portion number # 1 and release it slowly into the stock solution tank.

CAUTION

BY DISSOLVING CALCIUM CHLORIDE HEAT IS RELEASED DURING THIS PROCESS. SALTS OF THIS TYPE SHOULD BE ADDED TO THE STOCK SOL. TANK VERY SLOWLY AND TEMPERATURE SHOULD BE CHECKED FREQUENTLY. IN CASE OF HEAT FORMATION LET IT COOL DOWN AND ADD AFTERWARDS.

3.7 Repeat this for all remaining numbers.

3.8 Let the nano pump stir the solution for another 10 min and make sure all salts dissolved in the water.

3.9 Get the pump out of the stock solution tank, clean it with tab water and place it into stock solution tank B

3.10 Get salt portions ready for tank B and repeat steps 2.6 to 2.9

	3.11	Repeat steps 2.5 to 2.9 for tank C and D
NM III / MTF SS	**4.**	**REPLACE STOCK SOLUTION TANKS**
NMIII	4.1	Collect readymade stock solution tanks A, B, C, D plus acid and base tank and bring it down to NM III outside entrance
	4.2	Get skidoo with yellow sled (or Pistenbully with rear cabin)
	4.3	Load the tanks on the yellow sled (or Pistenbully)
	4.4	Drive to the MTF and park in front of the stairs
MTF SS	4.5	Bring the stock solution tanks and the base and acid tanks up the stairs, enter the cold porch and place stock sol. tanks in front of the stock solution rack in the service section and the acid and base tanks in front of the NDS rack.
	4.6	Unplug the NDS nano circulation pumps.
	4.7	Remove mounting magnet of the nano circulation pump from outside the stock sol tank
	4.8	Unscrew the lid from the empty stock sol tanks and hang it onto the free ring hook above.

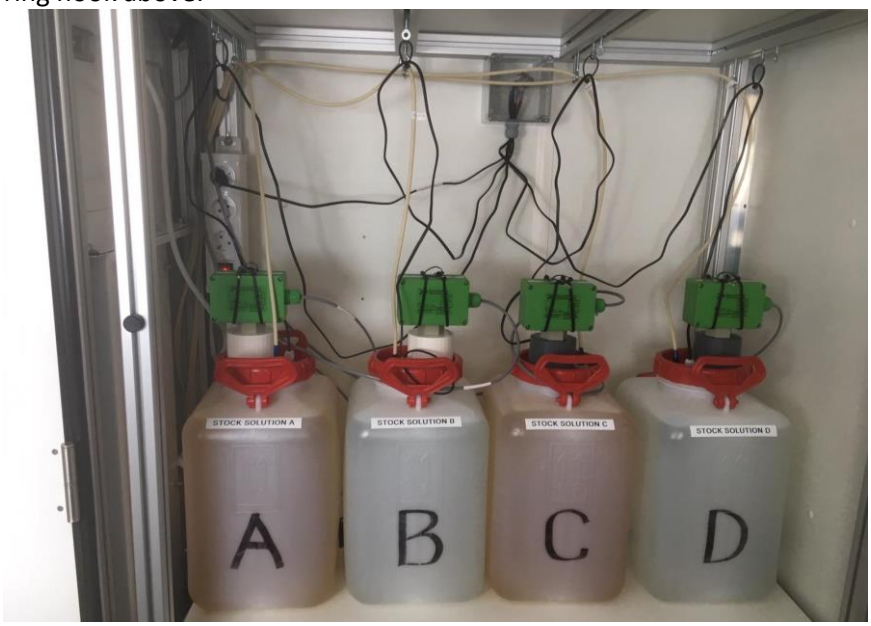


Figure 6: Stock Solution Tanks in the NDS

	4.9	Remove empty stock sol tanks A, B, C, D
	4.10	Place the fresh stock sol tanks underneath the lid with level sensor

4.11 Insert nano circulation pump on the tank side by placing the magnet on the outside

4.12 Close the lid of the fresh stock sol. tanks carefully. Make sure the power cable of the nano circulation pump is not turned around the level sensor

4.13 Close lids of the empty/ waste stock solution tanks and bring it down the stairs to the transport sledge.

5 REPLACE DILUTED ACID AND BASE TANKS.

Figure 7: Acid and Base Tanks within the NDS

5.1 Remove lid with connecting tube from acid tank.

5.2 Put freshly diluted acid tank underneath the lid and close it.

5.3 Remove lid with connecting tube from base tank.

5.4 Put freshly diluted base tank underneath the lid and close it.

5.5 Close lid of empty acid and base tanks and bring it down the stairs to the transport sledge.

NMIII /MPL 5.6 Transport empty tanks to NM III MPL, clean it with fresh water and detergent and let it dry

5.7 Store all containers at the designated storage area.

2.620 Fresh and Waste Water Tank Filling and Emptying

(EDEN ISS/CREW/NOMINAL/FIN)

OBJECTIVE

Filling of the fresh water (FW) tank and emptying of the waste water (WW) tank in the subfloor of the Cold Porch.

DURATION

180 min for FW tank filling
90 min for WW tank emptying

TOOLS

ITEMS

20 Liter FW canisters (8)
20 Liter WW canisters (10)
Waste water transfer pump
Waste water transfer tubes (2)
DI water
Suction Cap Handle

NOTE
THIS PROCEDURE CAN ONLY BE EXECUTED UNDER GOOD WEATHER CONDITIONS.

NMIII **1. DI water preparation for FW tank filling**

1.1 Collect 8x 20 Liter canisters marked with 'FW' and bring them to the multipurpose laboratory in NM III

1.2 Turn ON the reverse osmosis machine located below the left sink in the multipurpose laboratory. Make sure the outlets of the RO water tube and the waste water tube are inside the sink. Wait until the machine has flushed the filters (~30 seconds).

1.3 Open one canister place it next to the sink on the floor.

1.4 Insert the RO water tube (marked with a green label) into the empty canister.

1.5 Wait until canister is filled to the 20 Liter mark (takes 11-13 minutes per canister).

1.6 Repeat steps 1.3-1.5 until 8 canisters are filled.

1.7 Turn OFF the reverse osmosis machine

NMIII/MTF Cold Porch **2. FW tank filling**

NOTE
WHEN THE 'FW TANK LOW LEVEL' ALARM IS ON, THE FW TANK CAN TAKE UP AROUND 160 LITERS OF WATER.

NMIII 2.1 Get Skidoo with yellow sled (or Pistenbully with rear cabin)

2.2 Load the 8 canisters prepared in step 1 into the yellow sled (or Pistenbully rear cabin)

2.3 Drive to the MTF and park in front of the stairs

MTF Cold Porch

2.4 Enter the Cold Porch and turn off FW tank UV lamps by using the green switch on the power control box on the right side when entering the Cold Porch from the outside. Verify that the light illuminating the switch is off. (FIGURE1)

Figure 1: Cold porch with fresh and waste water tanks, and the lamp switch, position

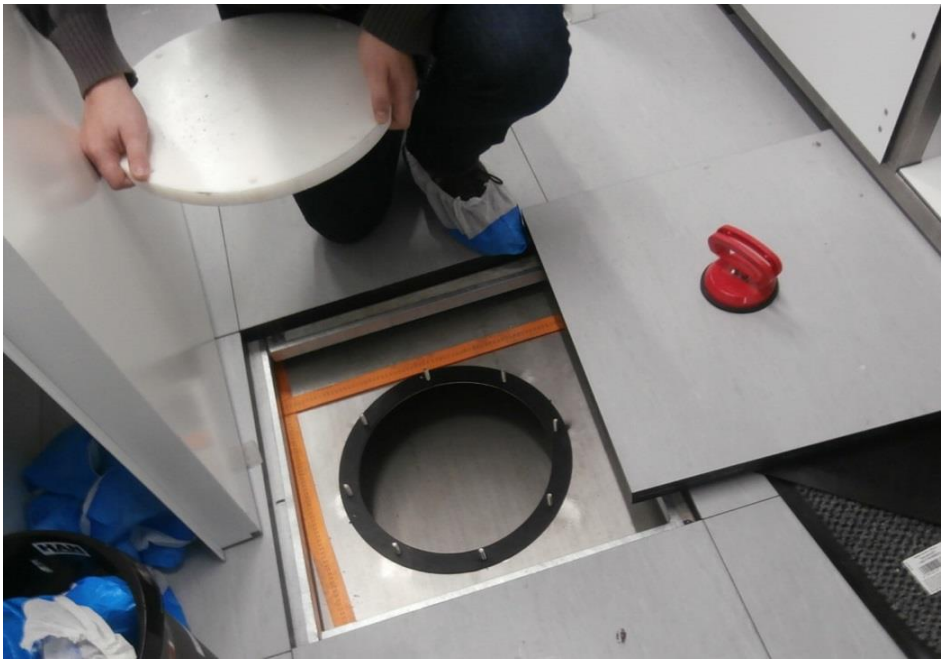


Figure 2: Waste Water Tank Open (Same for Fresh Water Tank)

2.5 Remove the floor panel for Fresh Water tank access (Fig. 1 and Fig. 2), using the suction cap handle

2.6 Remove the FW tank lid using the suction cap handle

2.7 Get one canister from the sled, bring it into the Cold Porch and gently empty it into the FW tank without spilling water.

2.8 Bring empty canister to the sled.

2.9 Repeat steps 2.7 to 2.8 for all 8 canisters
.

2.10 Close the tank lid and the put the floor panel in place
.

2.11 Turn on the UV lamp inside the FW tank.

2.12 Drive empty canisters back to NM III.

NMIII/MTF Cold Porch **3. WW tank emptying**

NMIII 3.1 Collect 10 x 20 Liter canisters marked with 'WW', the Zarges box containing the waste water transfer pump and the two waste water transfer tubes.

3.2 Get Skidoo with yellow sled (or Pistenbully with rear cabin)

3.3 Load the canisters, the Zarges box and the tubes into the yellow sled (or Pistenbully rear cabin)

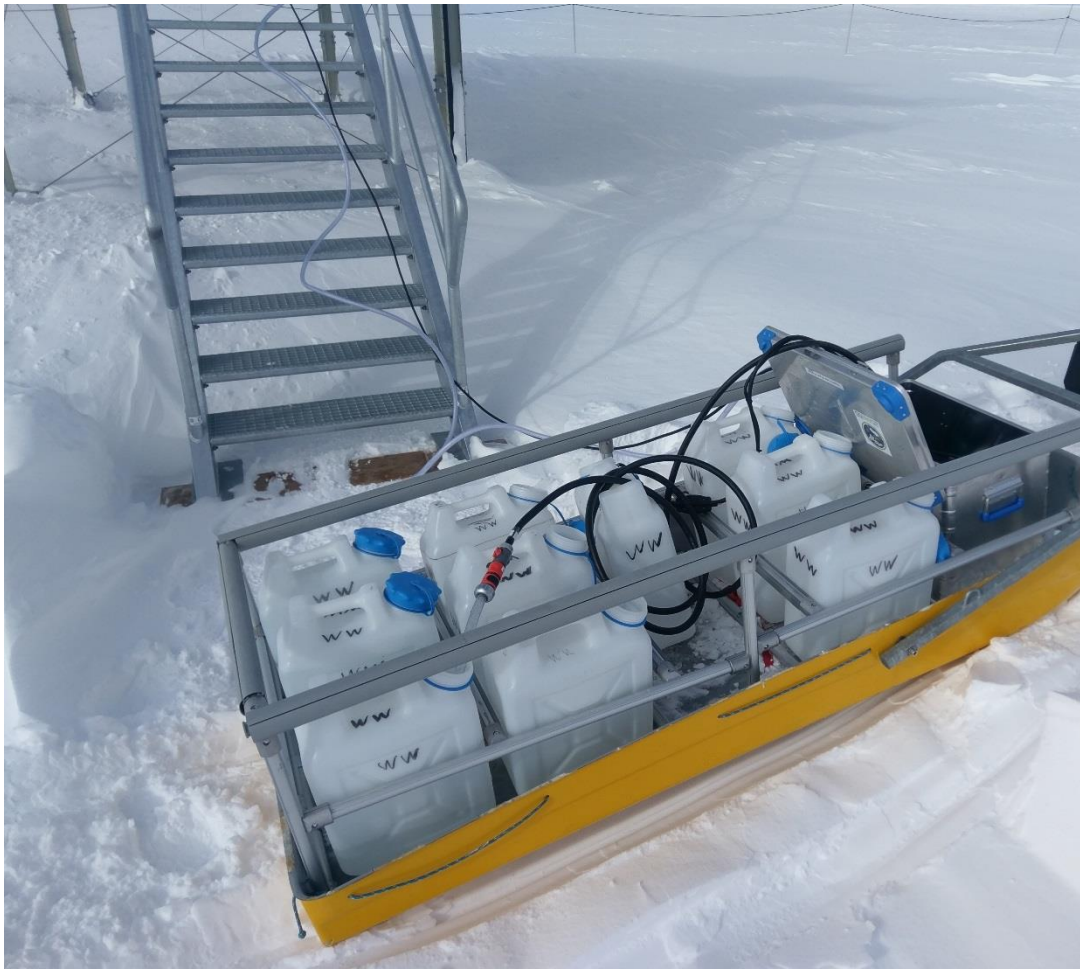


Fig.3: Skidoo with the sled parked in front of the MTF stairs

3.4 Drive to the MTF and park in front of the stairs (Fig. 3)

MTF Cold Porch

3.5 Enter the Cold Porch and remove the floor panel for Waste Water tank access (Fig. 1 and Fig. 2) using suction cap handle

3.6 Remove the WW tank lid using the suction cap handle (Fig. 2)

3.7 Connect the short waste water tube to the outlet of the waste water transfer pump

3.8 Hang the open end of the short waste water tube into an open canister located inside the yellow sled

3.9 Connect the long waste water tube to the waste water transfer pump inlet

3.10 Hang the open end of the long waste water tube into the waste water tank inside the Cold Porch. Make sure the tube is below the water level. Make sure that the tube cannot move.

	3.11	Connect the power cable of the waste water transfer pump to the power socket inside the Cold Porch.
	3.12	Activate pump and fill canister
	3.13	When the canister is full, use the valve located on the short waste water tube to close the tube.
	3.14	Open an empty canister and hang open end of short waste water tube into the canister
	3.15	Open valve located on the short waste water tube to fill canister
	3.16	Repeat steps 3.13 to 3.15 until all canisters are full or the WW tank is empty
	3.17	Remove waste and pack waste water tubes, disconnect power cable
	3.18	Close tank lid and floor panels
	3.19	Drive to NM III
NMIII	3.20	Empty canisters into sink or toilet
	3.21	Remove fluid from waste water tubes
	3.22	Store canisters, tubes and waste water transfer pump

3.210 Growth Media Preparation for Safety Analysis

(EDEN ISS/CREW/SCIENCE/FIN)

OBJECTIVE

Preparation of media for the growth, isolation and detection of microorganisms potentially present in fruit and vegetables cultivated in the FEG

DURATION

30 minutes + (time needed for solution solidification)

TOOLS

Pipets
Pipetter
Adjustable Volume Pipetter
Pipetter Tips
Microbial Plates
Scale
Pressure Cooker
Heating stirring plate
Bunsen Burner

ITEMS

Glass Jar with cover lid
Autoclave tape
Deionized and Sterile Water (TBD volume)
Growth Media Powder

NOTE

1. THE SAFETY ANALYSIS AIMS AT THE VERIFICATION OF THE ABSENCE OF DANGEROUS MICROORGANISMS (AS LISTED BELOW) ON THE PLANTS CULTIVATED TO BE EATEN BY THE NMIII CREW:
   - COMMON PATHOGENS
   - TOTAL MICROBIAL COUNT
   - YEASTS AND MOULDS
   - TOTAL COLIFORM
   - *ESCHERICHIA COLI*
   - *SALMONELLE SPP.*
   - *STAPHYLOCOCCUS AUREUS*
   - *BACILLUS CEREUS*
   - *EMERGING PATHOGENS*
   - *ENTEROBACTER SAKAZAKII*
   - *LISTERIA INNOCUA*
   - *CLOSTRIDIUM SPP*

   THOSE ANALYSES REQUIRES, AMONG THE OTHERS, THE AVAILABILITY OF MEDIA FOR THE GROWTH, ISOLATION AND DETECTION OF MICROORGANISMS POTENTIALLY PRESENT IN FRUIT AND VEGETABLES CULTIVATED IN THE FEG. THESE MEDIA CAN BE PROVIDED READY TO USE, OR ALTERNATIVELY CAN BE PREPARED STARTING FROM DRIED POWDER. THIS PROCEDURE DESCRIBE THIS LAST CASE.
2. THE GROWTH MEDIA PREPARATION REQUIRES SEVERAL HOURS TO HAVE THE PLATES READY TO USE. FOR THAT REASON IT CAN BE DONE THE DAY BEFORE THE PREPARATION OF THE SAMPLES

NMIII 1 ACTIVITY PREPARATION

NOTE

1. CREW SHALL BE INSTRUCTED ON THE MEDIA TO BE PREPARED BY MCC. IN ANY CASE THEY WILL BE SELECTED BETWEEN THOSE LISTED BELOW:

- HI CHROME EC0157: H7 SELECTIVE AGAR BASE
- HI CHROME COLIFORM AGAR
- HI CHROME RAJHANS MEDIUM, MODIFIED
- VIOLET RED BILE AGAR
- NUTRIENT BROTH N.2
- HI CHROME BACILLUS AGAR
- LISTERIA SELECTIVE AGAR
- BACTERIOLOGICAL AGAR
- TRYPTONE YEAST EXTRACT AGAR
- YEAST EXTRACT
- SLANETZ BARTLEY MEDIUM
- LAB LEMCO AGAR

2. TO NOT CONTAMINATE THE SAMPLES, CREW IS REQUESTED TO CAREFULLY WASH THE HANDS BEFORE STARTING THE OPERATIONS AND WEAR LATEX GLOVES

1.1 Prepare and/or collect the required tools and items

1.2 Call **MCC** to be instructed on the media to be prepared

1.3 Carefully wash the hands

1.4 Wear the gloves

2 CULTURE MEDIA PREPARATION

Figure 1: Powder preparation

2.1 Take the selected growth media (the weight is depending on the number of sample to be prepared) and put it in a transparent glass jar. Add Agar in proportion 1.2 – 1.6%. Then add distilled water as necessary (Fig. 1)

Figure 2: Heating/Stirring Plate

2.2 Put the jar on the heating/stirring plate and activate the stirrer for TBD minutes (Alternatively a spoon can be used) (Fig. 2)

Figure 3: Labelling with autoclave tape

2.3 Close the Jar with its lid cover and put on the lid the autoclave tape. Write on the Autoclave tape the type of culture media under preparation. (Fig. 3)

Figure 4: Pressure Cooker

2.4 Put the jar in the pressure cooker and close the cooker lid. Be sure that some water is in the cooker. Put the cooker on the heating/stirring plate and activate the heater at 270 degC for 30 minutes

Figure 5: Solution Ready to use

2.5 The solution is ready for use. Remove the autoclave tape from the cover to the jar side or to add a new label.

2.6 Repeat for the other growth media as required

3 PLATES PREPARATION

NOTE

1. THREE PLATES HAVE TO BE PREPARED FOR EACH MICROORGANISM CULTURE, TO ENSURE THE RELIABILITY OF THE MEASUREMENT
2. THE PLATES PREPARATION HAS TO BE DONE CLOSE TO THE BUNSEN BURNER FLAME TO PREVENT CONTAMINATION (THE PICTURES IN THE FOLLOWING SHOW THE PLATES DONE UNDER A LAMINAR FLOW HOOD THAT IS NOT AVAILABLE IN THE NMIII LAB)

Figure6: Plates labelling

3.1 Label the plates. Do that on the on the bottom of the plates and not on the cover to avoid mistakes when the covers are removed (could be reinstalled on the wrong plate)

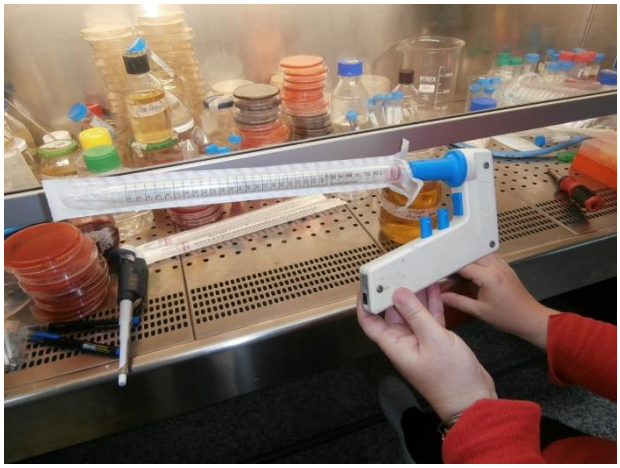


Figure7: Preparation of the pipetter

3.2 Open the pipette package and engage the pipette with the pipetter. Pay attention to not touch the pipette with your hand.

Figure 8: Sucking the culture media

3.3 Suck 20 ml of solution from the jar

Figure 9: Injection of the solution in the plate

3.4 Inject the solution in the plate (fig. 9)

3.5 Repeat for the other two plates

3.6 Repeat for the other growth media if any

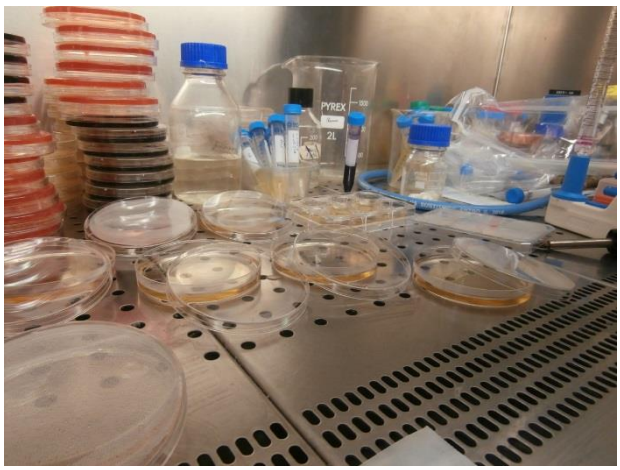


Figure 10: Solution Solidification

3.7 Leaving the cover open, wait TBD time until the solution solidifies

3.8 Close the plates. They are ready to be used (Perform procedure 3.211 Sample Preparation for Safety Analyisis, All steps).

3.211 Sample Preparation for Safety Analysis

(EDEN ISS/CREW/SCIENCE/FIN)

OBJECTIVE

Preparation of samples for the growth, isolation and detection of microorganisms potentially present in fruit and vegetables cultivated in the FEG

DURATION

TOOLS

Pipets
Pipetter
Adjustable Volume Pipetter
Pipetter Tips
Microbial Plates (ready to use)
Scale
Bunsen Burner
Microbiological Incubator

ITEMS

Spatulas
Falcon Conical Tubes (50 ml)
Falcon Conical Tubes (15 ml)
Filter Bags
Deionized and Sterile Water (TBD volume)

NOTE

THE SAFETY ANALYSIS AIMS AT THE VERIFICATION OF THE ABSENCE OF DANGEROUS MICROORGANISMS (AS LISTED BELOW) ON THE PLANTS CULTIVATED TO BE EATEN BY THE NMIII CREW:

- COMMON PATHOGENS
- TOTAL MICROBIAL COUNT
- YEASTS AND MOULDS
- TOTAL COLIFORM
- *ESCHERICHIA COLI*
- *SALMONELLE SPP.*
- *STAPHYLOCOCCUS AUREUS*
- *BACILLUS CEREUS*
- *EMERGING PATHOGENS*
- *ENTEROBACTER SAKAZAKII*
- *LISTERIA INNOCUA*
- *CLOSTRIDIUM SPP*

THOSE ANALYSES REQUIRES, AMONG THE OTHERS, THE AVAILABILITY OF MEDIA FOR THE GROWTH, ISOLATION AND DETECTION OF MICROORGANISMS POTENTIALLY PRESENT IN FRUIT AND VEGETABLES CULTIVATED IN THE FEG. AT THIS STAGE THESE MEDIA ARE PROVIDED READY TO USE.

NMIII 1 ACTIVITY PREPARATION

1.1 Call **MCC** to be instructed on the samples to be prepared (growth media to be used and plants to be tested)

1.2 Prepare and/or collect the required tools and items

1.3 Carefully wash the hands

1.4 Don the gloves

2 SAMPLE PREPARATION

NOTE
THE SEQUENCE IS SHOWN FOR LEAFY GREENS. NEVERTHELESS THE SAME SEQUENCE APPLIES TO THE FRUIT AND RADISH PLANTS.

Figure 1: Weigh the sample

2.1 Prepare, weigh the selected vegetable (from 10 to 50 g, depending on the vegetable) and wash it with abundant fresh water

Figure2: solution of water and hypochlorite (2%)

2.2 Immerse the vegetable in a solution of water and hypochlorite (2%) for 15 minutes. Then wash with fresh water until the hypochlorite is completely removed

2.3 Immerse the vegetable in a solution of water and sodium bicarbonate (50g/l) for 15 minutes. Then wash with fresh water

Figure 3: Mortar

2.4 Put the vegetable in a mortar ad crush it by means of the pestle until it is reduced in a fine paste. Then add distilled water or physiological solution and stir the solution

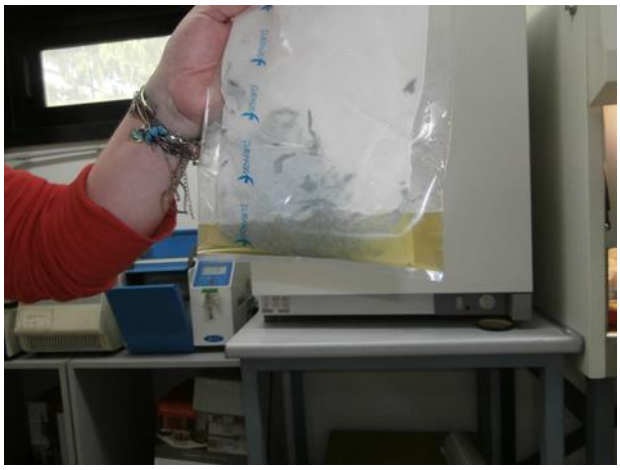


Figure 4: Filter Bags

2.5 Put the solution in a filter bag

Figure 5: Preparing the Falcon Tubes

2.6 Prepare and label an Eppendorf Conical Tube (50 ml)

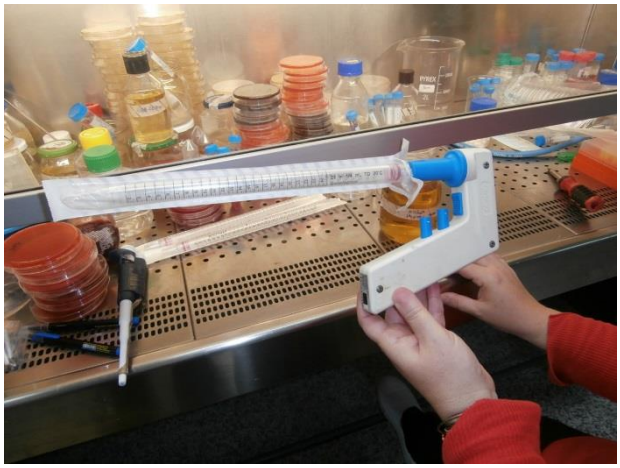


Figure 6: Pipetter Preparation

2.7 Prepare the pipetter. Open the pipette package and with the pipetter engage the pipette.

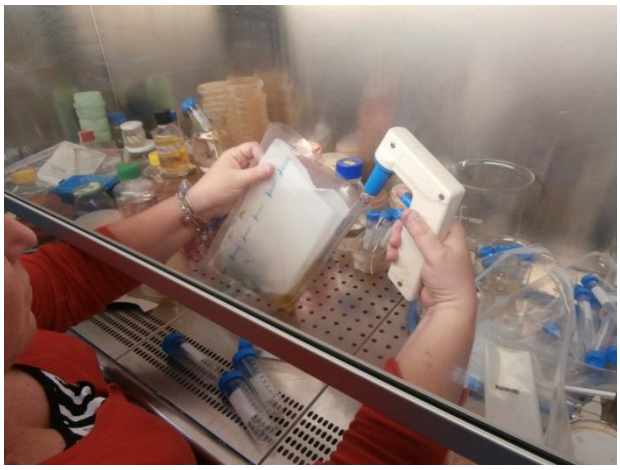


Figure 7: Solution transfer to the Eppendorf Tube

2.8 Using the pipetter, transfer the liquid part form the filter bag to the Eppendorf conical tube

Figure 8: Engaging a pipetter tips

2.9 Engage the Pipetter Tips with the Adjustable Volume Pipetter and the Pipetter Tips

Figure 9: Plate preparation

2.10 Using the adjustable volume pipetter, take 100 microliters of the solution from the Eppendorf conical tube and inject it in the plate. Repeat for other two plates.

Figure 10: Solution distribution on the growth media

2.11 Using the spatulas, distribute gently the solution in the plates. Proceed until all the liquid part has been absorbed by the culture media. Repeat for the other two plates.

Figure 11: Incubator

2.12 Put the plates in the incubator for 24 hours (Fig. 11)

2.13 Repeat step 2 for other plants and/or growth media as necessry.

3 CLOSEOUT

3.1 Take off the gloves

3.2 Waste the consumable items

3.3 Stow the tools and the unused items

3.4 Log the activity in the log Journal

3.230 Quality Measurement: Refractometer Operations

(EDEN ISS/CREW/SCIENCE/FIN)

OBJECTIVE

Measurement of refractive index to determine the % Brix of sugar in aqueous solutions

DURATION

5 minutes per measurement

TOOLS

HANNA HI 96801Refractometer

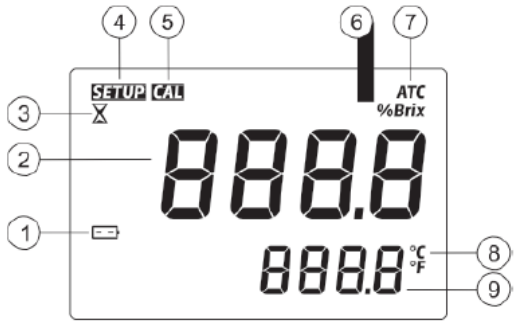
ITEMS

Plastic pipette
Garlic Squeezer
Deionized or distilled water (100 ml)
Soft tissue

NOTE

THE REFRACTOMETER IS A TOOL THAT MEASURE THE PERCENT SOLIDS (TSS) IN A GIVEN WEIGHT OF PLANT JUICE (ALSO CALLED BRIX). THE BRIX IS ACTUALLY A SUMMATION OF THE POUNDS OF SUCROSE, FRUCTOSE, VITAMINS, MINERALS, AMINO ACIDS, PROTEINS, HORMONES, AND OTHER SOLIDS IN ONE HUNDRED POUNDS OF ANY PARTICULAR PLANT JUICE. BRIX VARIES DIRECTLY WITH PLANT **QUALITY**, FOR THIS REASON THE REFRACTOMETER WILL BE USED IN THE EDEN ISS OPERATIONS.

Figure 1: HANNA HI 96801 Refractometer



1. **Battery** (blinks when low battery condition detected)
2. **Primary Display** (displays measurement and error messages)
3. **Measurement in Progress Tag**
4. **SETUP:** Factory Calibration Tag
5. **CAL:** Calibration Tag
6. **Measurement Unit**
7. **Automatic Temperature Compensation** (blinks when temperature exceeds 10-40 °C range)
8. **Temperature Units**
9. **Secondary Display** (displays temperature measurements; when blinking, temperature has exceeded operation range: 0-80 °C)

Figure 2: Displays Elements

1 ACTIVITY PREPARATION

1.1 Collect all the required items and tools

1.2 Carefully wash your hands

2 INSTRUMENT CALIBRATION

NOTE
CALIBRATION HAS TO BE DONE EVERY DAY BEFORE STARTING WITH THE MEASUREMENTS, OR AFTER A LONG SERIES OF MEASUREMENTS.

Figure 3: Calibration

2.1 Using a plastic pipette, fill the sample well with distilled or deionized water. Make sure the prism is completely covered

2.2 Cover the sample well with your hand or other shading plate during the calibration

2.3 Press the zero key. If no error messages appears, the unit is calibrated. The zero will be set on the display and will remain until the unit is deactivated

2.4 Using a soft tissue, remove the water and dry the surface

3 TAKING MEASUREMENT

Figure 4: Taking measurements

Produce	Avg %Brix
Rocket	4.57
Lettuce	1.47
Pepper (Green) (3gFW)	4.63
Pepper (Red) (3gFW)	4.83
Salad Tomato	4
Small Cherry	7.6
large Cherry	5.8

Fig. 5: Expected values for plant species

3.1 Place approximately 2g of sample (could be fruit or leaf) in garlic press and squeeze juice out in the sample well (this operations can also be done by hand). Make sure the prism is completely covered.

NOTE

1. IF THE TEMPERATURE OF THE SAMPLE DIFFERS SIGNIFICANTLY FROM THE TEMPERATURE OF THE INSTRUMENT, WAIT APPROXIMATELY 1 MINUTE TO ALLOW THERMAL EQUILIBRATION.
2. THE LAST MEASUREMENT VALUE WILL BE DISPLAYED UNTIL THE NEXT SAMPLE IS MEASURED OR THE INSTRUMENT IS TURNED OFF. TEMPERATURE WILL BE CONTINUOUSLY UPDATED.
3. THE ATC TAG BLINKS AND AUTOMATIC TEMPERATURE COMPENSATION IS DISABLED IF THE TEMPERATURE EXCEEDS THE 10-40 °C RANGE.

3.2 Press the **READ** key

3.3 Take the reading and log it in the log journal

4 SAMPLE WELL CLEANING

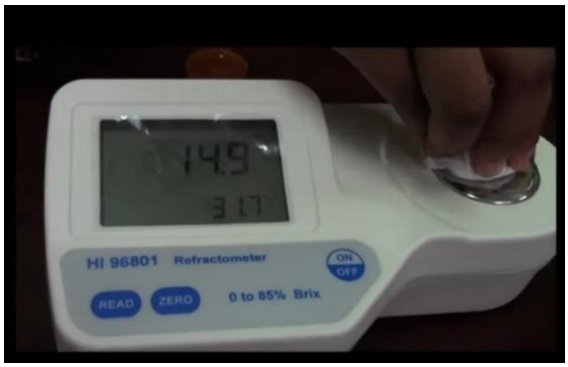


Figure 6: Sample well cleaning

4.1 Remove sample from the sample well by absorbing with a soft tissue.
Use care not to scratch the prism surface. Dry the surface completely

4.2 Using a plastic pipette, rinse prism and sample well with distilled or deionized water. Wipe dry.

5 CLOSEOUT

5.1 If a new measurement is required GOTO step 3

5.2 Shutdown the instrument and stow it

5.3 Carefully wash the garlic squeezer and stow it

3.231 Quality Measurement: Penetrometer Operations

(EDEN ISS/CREW/SCIENCE/FIN)

OBJECTIVE

Indicative measurement of fruit firmness for ripening.

DURATION

5 minutes per measurement

TOOLS

PCE Instruments Force Gauge PCE-FM 200

ITEMS

Soft Tissue

NOTE

1. THE PENETROMETER IS AND HAND-HELD DEVICE USED TO MEASURE THE FIRMNESS OF RELATIVELY HOMOGENOUS FRUIT AND/OR VEGETABLES. IN THE EDEN ISS OPERATIONS IT WILL BE USED FOR THE QUALITY ANALYSIS OF THE CUCUMBERS, TOMATOES AND PEPPERS
2. SEVERAL SENSING HEAD CAN BE MOUNTED ON THE INSTRUMENT (THE PICTURE SHOWS THE HOOK HEAD MOUNTED ON THE INSTRUMENT FOR TENSION MEASUREMENT). FOR THE EDEN ISS THE ONLY CONIC HEAD HAS TO be CONSIDERED
3. NO SAMPLE PREPARATION IS NECESSARY AS THE INSTRUMENT CAN BE USED DIRECTLY ON THE FRUIT *IN SITU*.

Figure 1: PCE Instruments Force Gauge PCE-FM 200

SS 1 ACTIVITY PREPARATION

1.1 Retrieve the Penetrometer from the stowage

1.2 Slide the ***Power Off/On/Peak Hold button*** to the “On” position.

1.3 Select the measurement by pressing the ***g/oz/N Unit Switch***

1.4 Carefully wash your hands

1.5 Attach the cone adapter provided for measurement of tomato, bell pepper cucumber, and strawberry

1.6 Zero the instrument by pressing the ***Zero Button***.

FEG 2 SAMPLE MEASUREMENT

NOTE

1. THE COMPRESSION MEASURING FUNCTION IS EXECUTED AUTOMATICALLY
2. THE OBJECT BEING MEASURE SHOULD BE DIRECTLY IN LINE WITH THE SENSING HEAD

Figure 2: Taking measurement

Produce	Avg *g/oz/N*	Std Dev	95% CI
Baby Vine Tomatoes, N=12 x 2 reps	0.74	0.12	0.002
Baby Vine Plum Tomatoes, N=14 x 2 reps	0.89	0.07	0.001
Large Vine Tomatoes, N=5 x 3 reps	1.15	0.12	0.003
Salad Tomatoes, N=4 x 3 reps	1.82	0.05	0.001
Green Bell Pepper, N=3 x 4 reps	2.18	0.25	0.009
Yellow Bell Pepper, N=3 x 4 reps	2.02	0.05	0.002
Red Bell Pepper, N=3 x 4 reps	1.56	0.10	0.004
Cucumber, N=3 x 6 reps	2.17	0.08	0.003
Strawberries, N=18 x 2 reps	0.24	0.05	0.001

Figure 3: Example of expected values

2.1 Start the measurement by applying force (pushing the sensing adapter to the sample). Ensure that the motion used is constant and that the action is terminated once the end of the cone portion of the probe has been inserted into the sample. The LCD display will display the average value

2.2 Take the reading and log it in the log journal

2.3 Repeat for the other sample as required

FEG **3 CLOSEOUT**

3.1 Shutdown the instrument

3.2 Dismount the Conic Head and clean it with a soft tissue and with water

3.3 Stow the tool

3.232 Quality Measurement: Colourimeter Operations

(EDEN ISS/CREW/SCIENCE/FIN)

OBJECTIVE

Measurement the colour co-ordinates of food samples

DURATION

5 minutes per measurement

TOOLS

PCE Instruments Colourimeter PCE-CSM 1

ITEMS

White Calibration Plate (if calibration is required)

NOTE

1. THE HAND-HELD COLORIMETER IS A TOOL FOR THE MEASUREMENT OF THE COLOUR COORDINATES OF FOOD SAMPLES AS AN INDICATION OF THE BIOACTIVE CONTENT. IN THE EDEN ISS PROGRAM THIS INSTRUMENT WILL ONLY BE USED ON LARGER FRUITS AND VEGETABLES SUCH AS TOMATOES (INCLUDING BABY TOMATOES), BELL PEPPER, CUCUMBERS. THE INSTRUMENTS READS THREE PARAMETERS, THE SO CALLED CIE SYSTEM COORDINATES (L*, A*, B*):
   - A* TAKES POSITIVE VALUES FOR REDDISH COLOURS AND NEGATIVE VALUES FOR THE GREENISH ONES
   - B* TAKES POSITIVE VALUES FOR YELLOWISH COLOURS AND NEGATIVE VALUES FOR THE BLUISH ONES
   - L* IS AN APPROXIMATE MEASUREMENT OF LUMINOSITY.
2. NO SAMPLE PREPARATION IS NECESSARY AS THE INSTRUMENT CAN BE USED DIRECTLY ON THE COLOURED FRUIT / VEGETABLE *IN SITU*.

Figure 1: PCE Instruments Colourimeter PCE-CSM 1

- Mains adaptor: Only use the mains adaptor included in the package. If it breaks down, only use substitutions with the following characteristics: output 5 V DC, 2 A.
- USB interface: By using the USB interface, you can transfer data from the colorimeter to a PC. The baud rate is 115,200 bps.

Figure 2: Instrument Overview

SS 1 ACTIVITY PREPARATION

1.1 Retrieve the Colourimeter from stowage

1.2 Make sure the battery is installed or the device is connected to an external power source.

1.3 Remove the dust protective black cover

1.4 Turn on the device by switching the On/Off button to “1”. After a few seconds, you are automatically directed to the “Standard Measurement” screen. The default setting for this measuring mode is L*a*b*C*H.

1.5 If calibration is not required GOTO step 3

1.6 If standard measurement is not necessary GOTO step 5

2 INSTRUMENT CALIBRATION

> **NOTE**
> A CALIBRATION IS ONLY REASONABLE IN THE FOLLOWING CASES: WHEN FIRST USING THE DEVICE, AFTER STRONG CHANGES IN THE ENVIRONMENTAL CONDITIONS, WHEN THE DEVICE HAS NOT BEEN USED FOR A SIGNIFICANT PERIOD OF TIME OR WHEN THE MEASUREMENT RESULTS ARE INACCURATE.

2.1 Press the Menu button, select “Calibrate “and press Enter

2.2 Use the arrow keys to select **white calibration** or **black calibration** and press Enter to confirm. A confirmation display with instructions will appear

2.3 Perform White Calibration

> **NOTE**
> WHITE CALIBRATION IS USED TO CONFIRM LUMINOSITY INTENSITY. IT IS RECOMMENDED FOR ALL FRUIT AND VEGETABLE ANALYSIS

2.3.1 Use the arrow keys to select **white calibration** and press Enter to confirm. A confirmation display with instructions will appear

2.3.2 Retrieve the calibration plate

2.3.3 Turn the device upside down and place the white calibration plate on the measuring aperture

2.3.4 Press the Testing button to start the calibration

2.3.5 Wait until the following message appears on the screen: White Calibration Success

2.4 Perform Black Calibration

> **NOTE**
> BLACK CALIBRATION IS USED TO DEEP COLOUR INTENSITY

2.4.1 Using the arrows keys, select **black calibration** and press enter to confirm. A confirmation display with instructions will appear

2.4.2 Point the instrument towards the air. Keep the device away at least 1 meter from reflecting objects like walls, tables or other objects

2.4.3 Press the Testing button to start the calibration

2.4.4 Wait until the following message appears on the screen: Black Calibration Success

FEG 3 TAKING A STANDARD MEASUREMENT

NOTE

1. THE STANDARD MEASUREMENT ALLOWS FOR CLEAR IDENTIFICATION OF STRONG RED, YELLOW AND GREEN COLOURS.
2. THE STANDARD MEASUREMENT IS RECORDED AND SAVED ON THE INTERNAL MEMORY OF THE COLOURIMETER. IT CAN THEN BE USED AS REFERENCE TO DETERMINE COLOUR CHANGE IN FRUITS AND VEGETABLES AS THEY GROW.

3.1 Prepare the RED colour reference items

3.2 Press and hold the testing button – located on the back panel of the device. Four (4) light cones appear to aid with selecting the measuring point.

3.3 Move the device as close to the measuring point as possible.

3.4 Release the testing button. The colorimeter now takes a measurement (Fig. 3)

3.5 Log the reading in the log journal (including date and time)

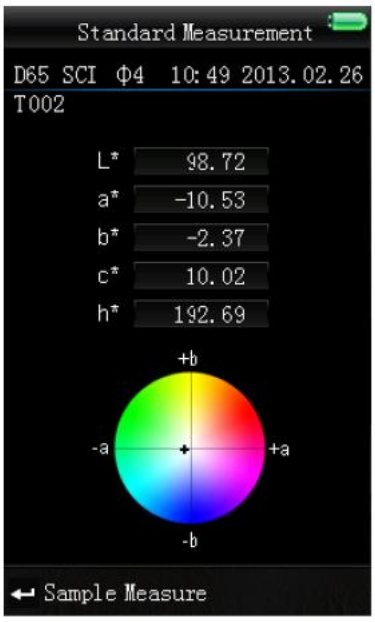


Figure 3: Standard Measurement Result

3.5 Repeat step from 3.1. to 3.5 for YELLOW and GREEN colour standard measurements

4 SAMPLE MEASUREMENT

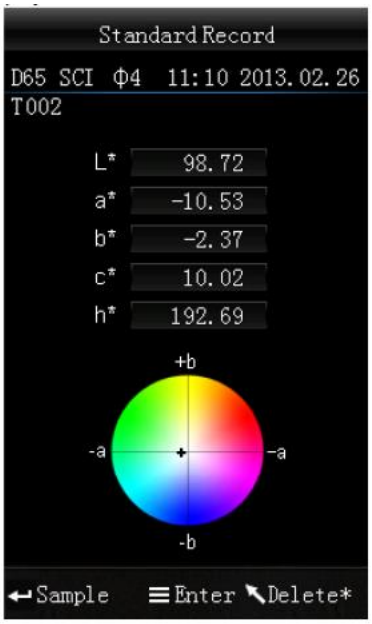


Fig. 4: Standard Record Display

4.1 Press the **Menu** button , select “Record” and press **Enter** to confirm. The standard record displays (fig.4) is displayed

4.2 Using the **key arrows** select the Standard Measurement to be used as refrence for sample measurment (RED, YELLOW or GREEN)

Figure 4: Taking measurement of sample

4.3 Press **Enter** to get to the sample measurement display

4.4 Press and hold the testing button – located on the back panel of the device. Four (4) light cones appear to aid with selecting the measuring point.

4.5 Move the device as close to the measuring point as possible (fig. 4)

4.6 Release the testing button. The colourimeter now takes a measurement

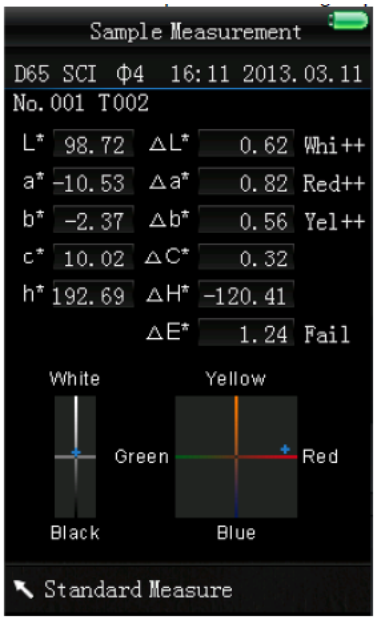


Figure 5: Sample Measurement Results

4.7 Read the deviations of the sample in the display (Fig. 5) and log them in the log journal

4.8 If another measurement is required with the same color reference press the **Back** button. The sample measurement display is displayed back. Repeat steps from 4.3 to 4.7

4.9 If other measurements for different colours have to be taken, press the **Back** button. Repeat step from 4.1 to 4.7 selecting the relevant Sample Measurement Displays.

SS 4 CLOSEOUT

3.1 Shutdown the instrument ans stow it

3.232 Quality Measurement: Clorophyll Meter Operations

(EDEN ISS/CREW/SCIENCE/FIN)

OBJECTIVE

Measurement of chlorophyll content in plant leaves

DURATION

5 minutes per measurement

TOOLS

MINOLTA Chlorophyll Meter SPAD-502

ITEMS

None

NOTE

1. THE AMOUNT OF CHLOROPHYLL PRESENT IN PLANT LEAVES CAN SERVE AS AN INDICATOR OF THE OVERALL CONDITION OF PLANT HEALTH. IN GENERAL, HEALTHIER PLANTS CONTAIN MORE CHLOROPHYLL THAN LESS HEALTHY PLANTS.
2. THE SPAD VALUE DETERMINED BY THE SPAD-502 PROVIDES AN INDICATION OF THE RELATIVE AMOUNT OF CHLOROPHYLL PRESENT IN PLANT LEAVES. THIS SPAD VALUE CAN BE USED TO DETERMINE WHEN AND IF ADDITIONAL NUTRIENTS ARE REQUIRED.
3. NO PREPARATION IS NECESSARY AS THE CHLOROPHYLL METER SPAD-502 CAN BE USED ON PLANT LEAVES DIRECTLY *IN SITU*

Figure 1: MINOLTA Chlorophyll Meter SPAD-502

SS 1 ACTIVITY PREPARATION

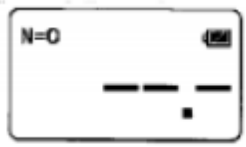
1.1 Retrieve the Chlorophyll Meter from stowage

2 INSTRUMENT CALIBRATION

NOTE
CALIBRATION IS NECESSARY WHENEVER THE METER IS SWITCHED ON AFTER HAVING BEEN SWITCHED OFF

2.1 Turn the power switch to ON

2.2 When the word “Calibration” appears on the screen press close and hold the measuring head until a beep sounds and the following screen appears



Calibration is now complete

2.3 If a series of beeps sound and “Error” appears in the display, calibration was not preformed correctly. Repeat Step 2.1 and 2.2

2.4 If a series of beeps sound and “Error” and “E-U” appear in the display, then the measuring head may be dirty. Clean the windows and repeat steps 1 and 2.

FEG 3 CHLOROPHYLL CONTENT MEASUREMENTS

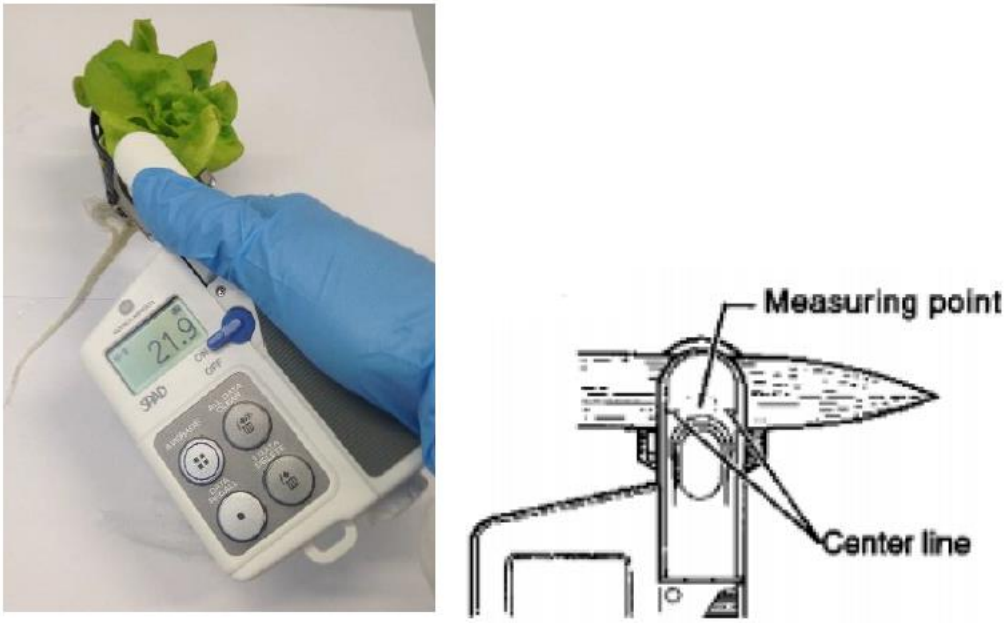


Figure 2: taking measurements

Produce	Avg Reading	Std Dev	95% CI
Red Lettuce (Outrageous) Inner Green Leaf N=12	5.98	1.99	0.04
Red Lettuce (Outrageous) Outer Red Leaf N=12	29.33	7.25	0.13
Butterleaf Lettuce (Red Variety) Inner Green Leaf, N=10	3.79	2.50	0.05
Butterleaf Lettuce (Red Variety) Outer Red Leaf, N=10	36.08	10.52	0.21
Chives (leaf Bottom), N=6	34.13	8.77	0.22
Chives (leaf Middle), N=6	39.48	9.86	0.25
Chives (leaf Top), N=6	31.18	8.55	0.11
Parsley (Leaf), N=7	29.80	19.22	0.46
Parsley (Top of Stalk), N=7	15.43	7.79	0.18
Parsley (Bottom of Stalk), N=7	11.36	4.86	0.05

Figure 3: Expected Values

3.1 Insert the plant sample to be measured into the sample slot of the measuring head. Ensure the sample completely covers the receiving window.

3.2 Press and close the measuring head. Hold until a beep sounds. The measurement will appear on the display and will automatically be stored in the memory.

3.3 Log the measuremnt in the log journal

3.4 If a series of beeps sound and error is displayed on the screen measuring was not preformed correctly. This may be due to the sample being too thick, the measuring head not being closed tightly enough or opened too soon. Repeat steps 3.1 and 3.2

3.5 If a series of beeps sounds and the word Calibration appears on the screen, then the temperature has changed by more than 10°C since calibration and needs recalibrating. Stored data will be deleted. GOTO step 2

SS 4 CLOSEOUT

3.1 Shutdown the instrument and stow it

3.234 Quality Measurement: Nitrate Ion Meter Operations

(EDEN ISS/CREW/SCIENCE/FIN)

OBJECTIVE

Measurement of the nitrate ion level of fruit and vegetables

DURATION

5 minutes per measurement + 30 minutes for sample preparation

TOOLS

Horiba Nitrate Ion Meter B-741
Pipetter
High Concentation Standard Solution
Low concentration Standard solution

ITEMS

Beaker
Laboratory Spatula
Deionised Water
Dry Wipes

NOTE

1. LEAFY VEGETABLES OCCUPY A VERY IMPORTANT PLACE IN THE HUMAN DIET, BUT UNFORTUNATELY CONSTITUTE A GROUP OF FOODS WHICH CONTRIBUTES MAXIMALLY TO NITRATE CONSUMPTION BY LIVING BEINGS. UNDER EXCESSIVE APPLICATION OF NITROGEN FERTILIZER, THESE VEGETABLES CAN ACCUMULATE HIGHLEVELS OF NITRATE AND, UPON BEING CONSUMED BY LIVING BEINGS, POSE SERIOUS HEALTH HAZARDS. THEREFORE, EFFORTS ARE WARRANTED TO CHECK IF THE NITRATE CONCENTRATION IN HARVESTED VEGETABLES ARE WITHIN THE ALLOWED RANGE FOR INGESTION BY HUMAN BEINGS.
2. SAMPLE PREPARATION IS REQUIRED BEFORE USING THE IN METER, AND THIS OPERATIONS IS VERY SIMILAR TO THE ONE DESCRIBED FOR THE ON-SITE SAFETY ANALYSIS. THEREFORE THE MEASUREMENT WITH THE NITRATE ION METER COULD BE COMBINED WITH THE SAFETY MEASUREMENT

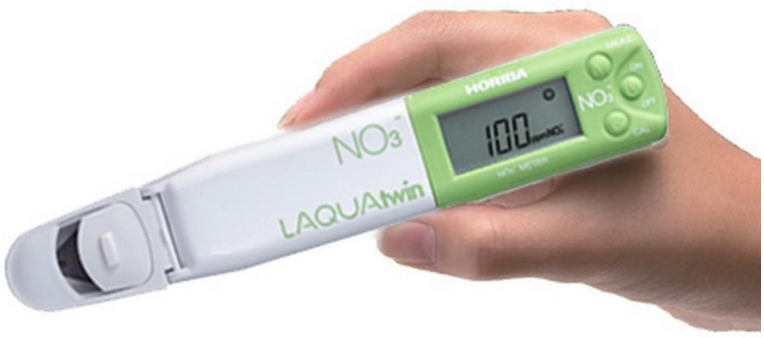


Figure 1: Horiba Nitrate Ion Meter B-741

SS 1 ACTIVITY PREPARATION

1.1 Retrieve the Nitrate Ion Meter and the other tools and items from stowage

2 SAMPLE PREPARATION

> **NOTE**
> 1. ONE SMALL PIECE (1 GRAMS) OF VEGETABLES ARE SUFFICIENT FOR THE ANALYSIS
> 2. THIS STEP CAN BE SKIPPED IF SAMPLES HAVE ALREADY BEEN PREPARED FOR SAFETY ANALYSIS (REF. 3.211 SAMPLE PREPARATION FOR SAFETY ANALYSIS)

2.1 Collect the vegetable (leaves and/or fruit) to be analyzed, and cut them in small pieces

2.2 Put one or more piece in a beaker and reduce them in even smaller pieces by means of a laboratory spatula

2.3 Add 5 ml of deionised water in the beaker. Wait not less then 10 minutes before using the sample for measurements

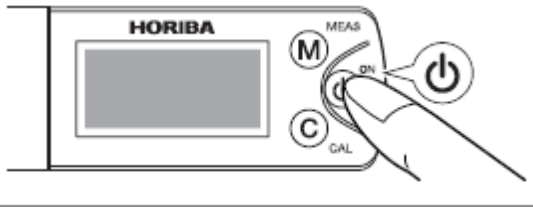
2.4 Repeat for other species to be analyzed

3 INSTRUMENT CALIBRATION

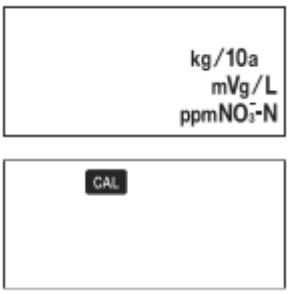
> **NOTE**
> 1. CALIBRATION IS NECESSARY WHENEVER THE METER IS SWITCHED ON AFTER HAVING BEEN SWITCHED OFF
> 2. WASHING THE SENSOR WITH THE STANDARD SOLUTION BEFOREHAND MAY PROVIDE MORE ACCURATE CALIBRATION

3.1 Wash the sensor with water

3.2 Turn On the Instrument. Press the ON/OFF button over 2 seconds to turn on the instrument



3.2 Press and hold the MEAS switch for over 3 seconds in the measurement mode to enter the special setting mode. All items appear on the LCD, and then the display changes as shown below.



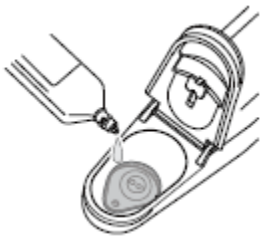
3.3 Press the **CAL** switch until the **CAL** symbol appears.

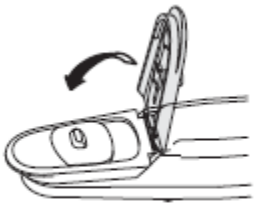
3.4 Press the MEAS switch for 0.5 seconds. This will display the current calibration setting

3.5 Press the **CAL** switch for 0.5 seconds to change the calibration setting. Change the setting to Two Point Calibration, this will be indicated by the number 2 as displayed below

3.6 Press the **MEAS** switch to apply the setting. The measurement mode is returned

3.7 Open the light shield cover and put some drops of the low-concentration standard solution on the flat sensor to cover the entire flat sensor





3.8 Close the light shield cover and press the **CAL** switch over 2 seconds

3.9 The **CAL** and ☺ symbols will blink and the calibration value will be displayed

3.10 Once calibration is complete the **CAL** and ☺ symbols stop blinking and remain steady

3.11 After the calibration for low concentration is completed, open the light shield cover to remove the low-concentration standard solution and wipe off moisture on the sensor

3.12 Wash the sensor with tap water. Dry with dry wipes

3.13 Put some drops of the high-concentration standard solution on the flat sensor to cover the entire flat sensor

3.14 Close the light shield cover and press the **CAL** switch for over 2 seconds

3.15 The **CAL** and ☺ symbols will blink and the calibration value will be displayed

3.16 Once calibration is complete the **CAL** and ☺ symbols stop blinking and remain steady.

3.17 Clean the sensor with tap water. Dry with dry wipes

3.18 Press the **MEAS** switch for 0.5 seconds to enter the measurement mode and prepare for measurement

4 TAKING MEASUREMENT

Figure 2: Taking Measurement

4.1 Verify the instrument is in measurement mode

4.2 Open the light shield cover and, by means of the pipetter, put some drops of sample on the flat sensor until it is completely covered

4.3 Close the light shield cover

4.4 When the ☺ symbol lights up the measurement is completed

4.5 To lock the measured value, press the **MEAS** switch for 0.5 seconds

4.6 When the **MEAS** and ☺ symbols stop blinking and remain steady the measurement is locked

4.7 Clean the sensor with tap water. Dry with dry wipes

4.8 If other measurements are required repeat step 4 using other species samples

SS 5 CLOSEOUT

5.1 Shutdown the instrument

5.2 Clean the beakers, the pipetter and the spatula with tap water

5.3 Stow all the items and tools

5.4 Waste the unused vegetables samples.

3.300 E-Nose Operations

(EDEN ISS/CREW/SCIENCE/FIN)

OBJECTIVE

Measurement of microbial contamination using the E-Nose

DURATION

90 minutes (+ 15 minutes for any additional measurement and data downoad)

TOOLS

E-Nose
1 Plant Sampler
1 Air Sampler 2 Evolution (modular part of the plant sampler)
1 Transfer Line
1 Stowage Container
6 Filter F1 (Particle Filter)
12 Filter F2 (Humidifier)
Power supply
USB-Cable
WinMuster S/W

ITEMS

Nitrile Gloves

NOTE

1. THE E-NOSE OFFERS TWO DIFFERENT OPERATING OPTIONS (AND THEREFORE TWO DIFFERENT CONFIGURATIONS):
- THE FIRST OPTION FORESEES THE MEASUREMENT OF CONTAMINANTS ON DIFFERENT SURFACES INSIDE THE FEG.
- THE SECOND OPTION FORESEES THE MEASUREMENTS OF CONTAMINANTS ON THE PLANTS LEAVES. IN THIS CASE THE AIRSAMPLER HAS TO BE MOUNTED ON THE PLANT SAMPLER

2. E-NOSE OPERATIONS IS COMPOSED OF THREE STEPS
- DATA ACQUISITION ON THE E-NOSE DEVICE
- DATA DOWNLOAD VIA USB TO THE CREW LAPTOP (THE **WINMUSTER** S/W SHALL BE PREVIOUSLY INSTALLED ON THE LAPTOP)
- DATA TRANSFER TO MCC

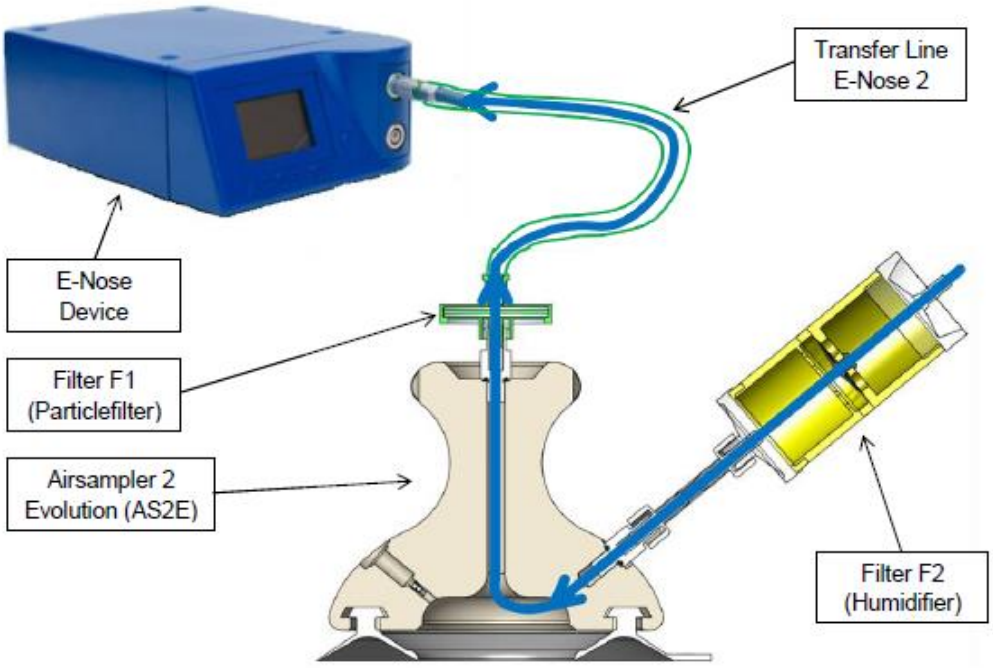


Figure 1: E-NOSE configured for surface measurement

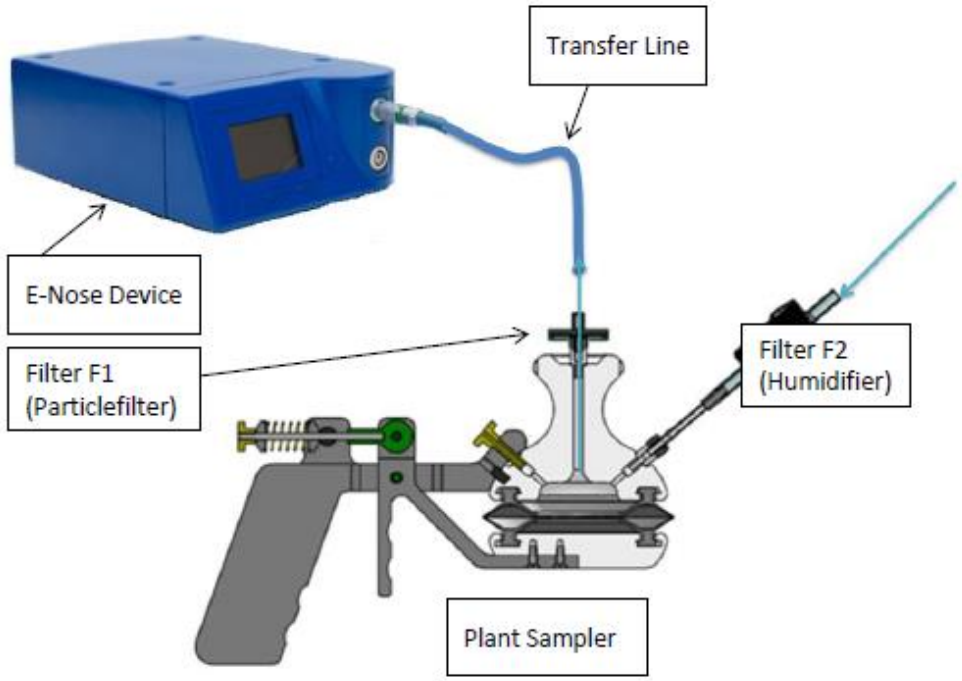


Figure 2: E-NOSE configured for measurement on plant leaves

MTF **1** **SYSTEM SETUP**

1.1 Retrieve all the items and tools from stowage

1.2 Withdraw the “E-NOSE” Device from the Container

1.3 Withdraw Power Cable from the Container and connect it to the 230V power socket on the E-NOSE Device

Figure 3: Transfer Line Connection to E-NOSE Device

1.4 Withdraw the Transfer Line from the Container and connect it to the E-Nose

Figure 4: Filter F1 (Particle Filter – Left) and Filter F2 (Humidifier – Right)

1.5 Withdraw the filter kit from the container and take one bag with filters from it

1.6 Remove both cover caps of the Filter- F2

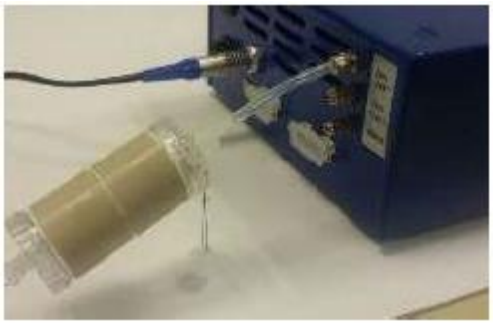


Figure 5: Fliter F2 Connected to the E-NOSE Device

1.7 Connect Filter F2 to connector Zero Gas 1 at the rear side of the “E-NOSE” Device

1.8 Connect Filter F1 with Transfer line

If measurements on plants are required

Figure 6: Configuration of the Air Sampler for Measurement on Plants

1.9 Mount the Air Sampler on the handle of the Plant Sampler as per Fig. 6

Figure 7: Air Sampler Connected to the Filter 1

1.10 Connect the Air Sampler with Filter F1

Figure 8: Air Sampler Connected to the Filter 2 (for surface measurement on the left and for leaves measurement on the right)

1.11 Connect Filter F2 to the Air Sampler

2 TAKING MEASUREMENTS

NOTE

E-NOSE MEASUREMENT IS DONE OF THREE PHASES :

- SYSTEM INITIALIZATION: AFTER THE ACTIVATION THE E-NOSE IS MANTAINED IN STAND BY FOR 40 MINUTES. DURING THIS TIME THE SYSTEM IS FLUSHED UNTIL IT REACHES A STEADY STATE STATUS
- ENVIRONMENTAL AIR MEASUREMENT. THE AIR SAMPLER IS NOT CONNECTED TO THE SURFACE/PLANT TO BE ANALYSED
- SAMPLE MEASUREMENT. THE AIR SAMPLER IS CONNECTED TO THE SURFACE/PLANT TO BE ANALYSED. DURING THE SAMPLE MEASURMENT A SHORT CONNECTIVITY TEST IS DONE TO VERIFY IF THE FILTER F2 IS CORRECTLY INSTALLED ON THE AIR SAMPLER. IN PARTICULAR AT THE BEGINNING OF THE MEASUREMENT THE INLET OF THE FILTER F2 IS CLOSED WITH A FINGER FOR 2/3 SECONDS. A CHANGE IN THE SIGNAL IS THE PROOF OF A CORRECT CONNECTION. TO AVOID CONTAMINATION GLOVES SHALL BE USED.

2.1 Don Nitrile gloves

2.2 System Initialization

2.2.1 Activate the E-NOSE Device (On the rear part of the device push the switch “POWER” to ON)

2.2.2 Wait until the inizialization is completed (the system goes to Standby)

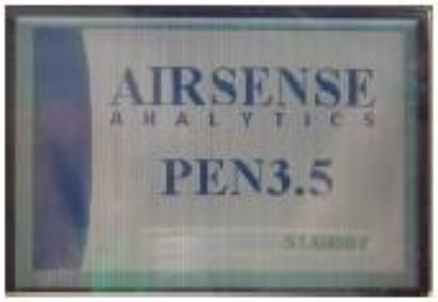


Fig. 9: System in STANDBY

2.2.3 On the LCD screen of the E-Nose Device, verify the system is in STANDBY

2.2.4 Wait for 40 minutes

2.3 Environmental Air Measurement

2.3.1 Without connecting the Air Sampler to the surface to be analysed push the button "MEASUREMENT

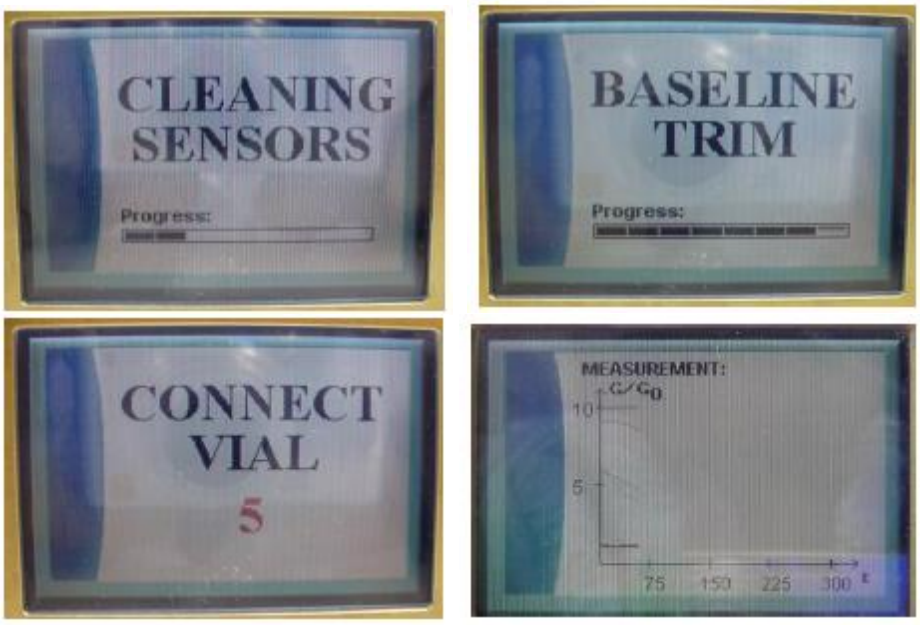


Figure 10: Measurement Sequence as shown on the Display

2.3.2 On the E-NOSE Device verify that the sequence Shown in Figure 10 is executed:

- CLEANING SENSORS
- BASELINE TRIM
- CONNECTING VIAL COUNTDOWN
- MEASUREMENT PLOTS APPEARANCE
-

2.3.3 After measurement starts (from plot appearance), wait for approx.5 minutes

2.3.4 Verify the E-Nose come back to Stand-By

2.4 Sample Measurement

2.4.1 Push the button “MEASUREMENT” and wait for the appearance of the message “CLEANING SENSOR” on the E-NOSE Device Display

Figure 11: Sample Measurement (Surface on the left, plant on the right)

2.4.2 Place the Air Sampler on the dedicated surface or plant

2.4.3 Verify the sequence of fig.10 is executed. When the “MEASUREMENT” plots appears, wait 10 seconds, close for 2-3 seconds the Filter 2 on the Air Sampler with a finger, verify that the measurement changes and then remove the finger.

2.4.4 Wait approx. 5 minutes

2.4.5 Verify the E-Nose come back to Stand-By

3 MEASUREMENT DATA DOWNLOAD

3.1 Connect the USB cable to the E-Nose connector and to the Crew-Notebook

3.2 Turn on the Crew-Notebook and start the WinMuster S/W.

(Double Click on 

)

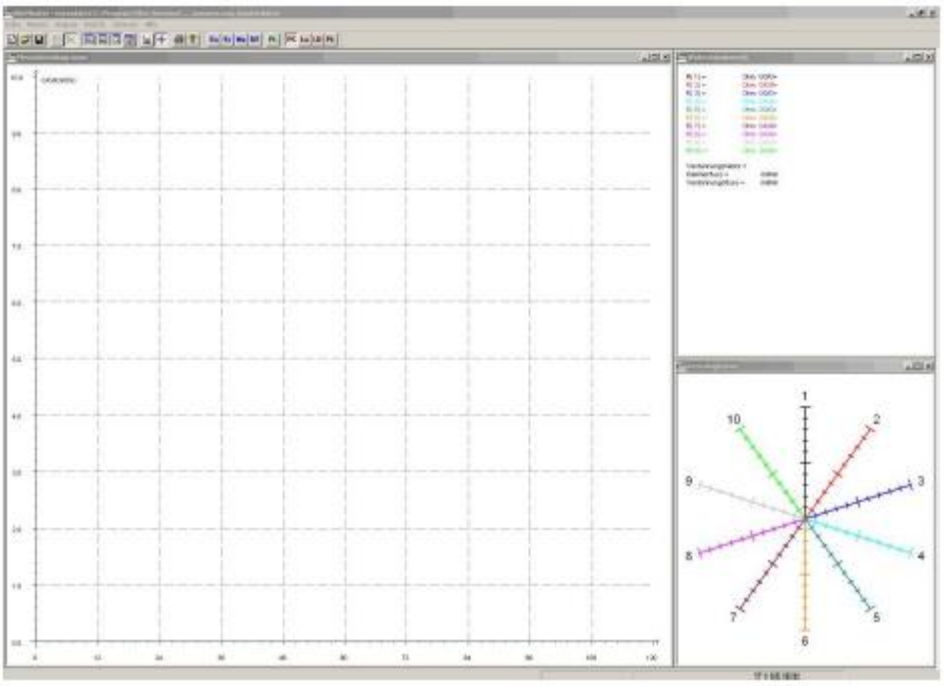


Figure 12: WinMuster SW Main Display

3.3 After the S/W has been started, check the following windows appears

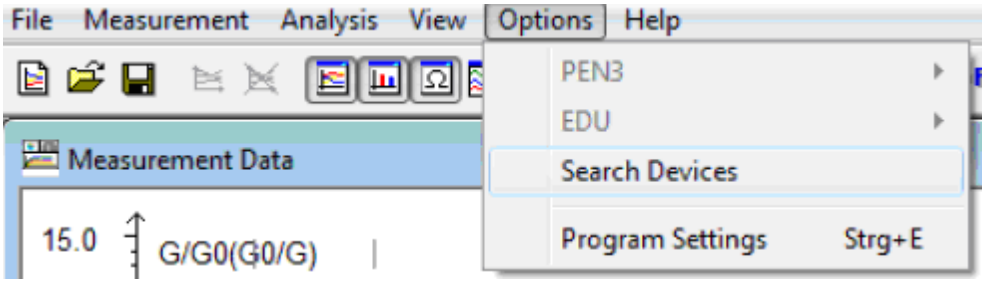


Figure 13: Options popup menu – Search Device Option

3.4 Press "Options" and "Search Devices"

Figure 14: Select Device Display

3.5 Select the device "PEN3" and confirm with "OK". A dialog Window appears

Figure 15: PEN3 Data Window

3.6 Press "Yes"

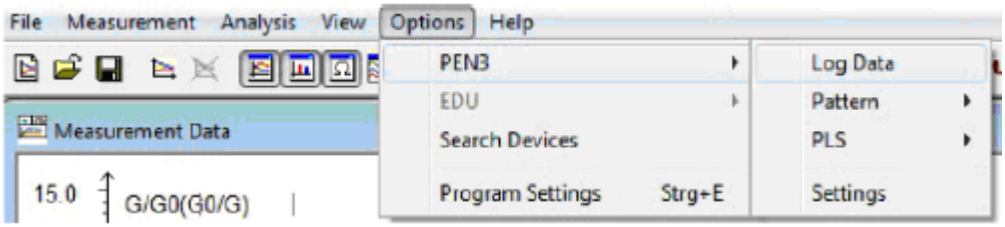


Figure 16: Options popup menu – PEN 3 option

3.7 Press "Options", "PEN3" and Logdata

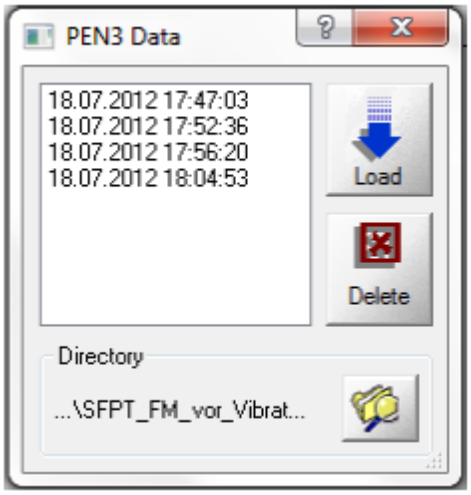


Figure 17: PEN3 Data Window

3.8 Find the measurement data in the list

3.9 Choose a folder where the data has to be stored and indicate the measurement files to be downloaded. Press "Load"

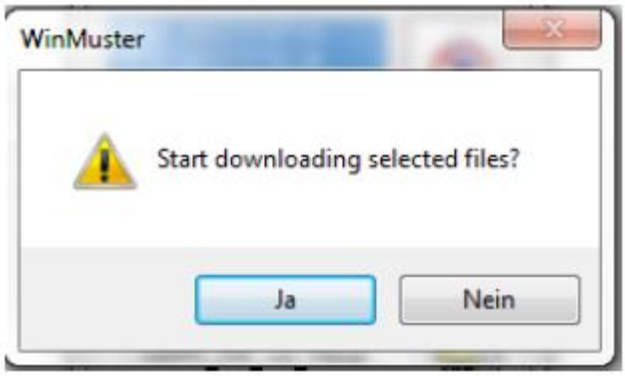


Figure 18: Dialog Window

3.10 Confirm the Start of the Download by pressing "Yes"

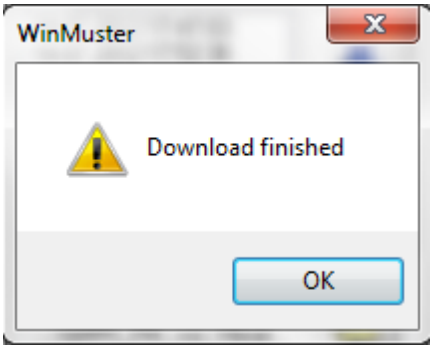


Figure 19: Confirmation Window

3.11 Verify the download is finished

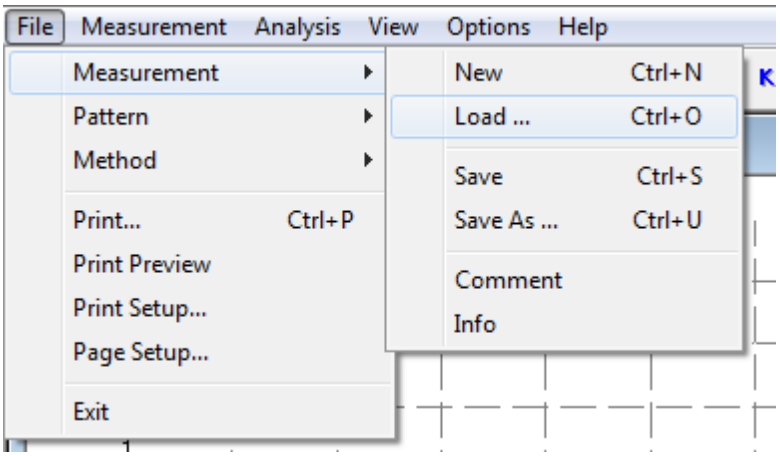


Figure 20: Navigation path

3.12 Press "File", "Measurement" and "Load" to open the downloaded files

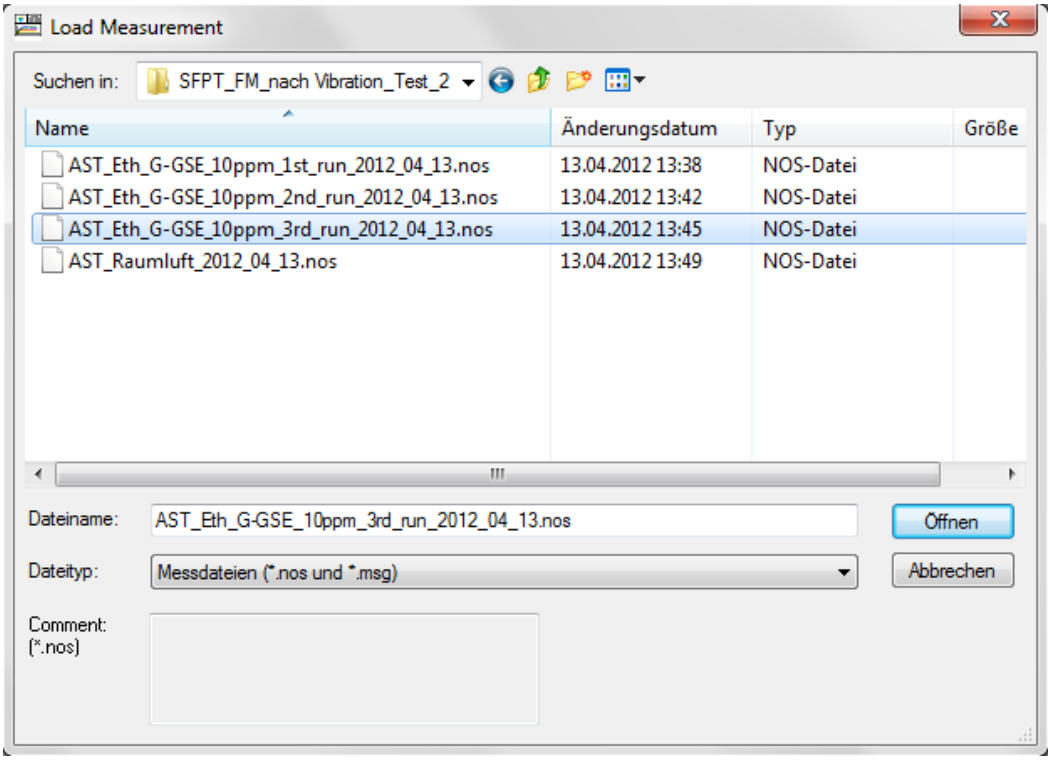


Figure 21: Record Selection

3.13 Choose one measurement file and press "Open"

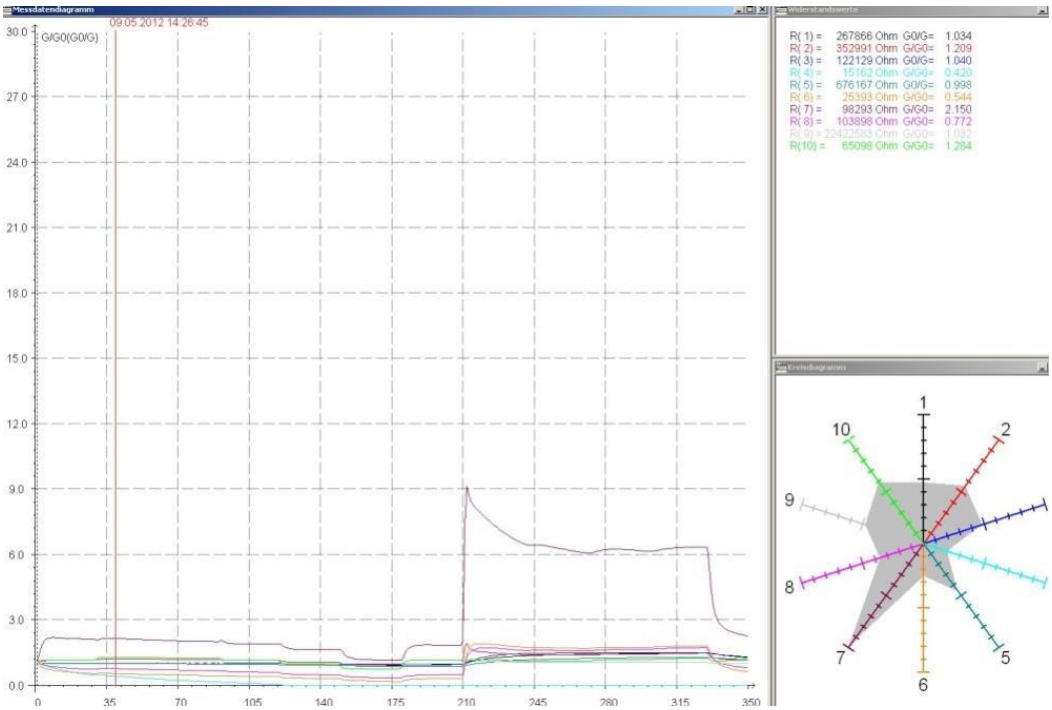


Figure 22: Data Analysis Plot

3.14 Check the appearance of the measurement plot (Fig. 22)

3.15 Repeat from step 3.7 for other measurements

4 CLOSEOUT

4.1 Power off the E-NOSE Device (On the rear part of the device push the switch "POWER" to OFF)

4.2 Disconnect the Fliter F2 from the Air Sampler and install the cover caps (2) on it

4.3 Disconnect the Fliter F1 from the Air Sampler

If the E-NOSE has been used for PLANT Measurement

4.4 Dismount the Air Sampler from the Plant Sampler Handle

4.5 Disconnect the Filter F1 from the Transfer Line

4.6 Disconnect the Filter F2 from the E-NOSE Device and install the cover caps(2) on it

4.7 Disconnect the Transfer Line from the E-NOSE Device

4.8 Disconnect the Power Cable from the E-NOSE Device

4.9 Waste the Filters 1and the Filters 2

4.10 Stow the E-Nose device, the power cable and the transfer line

3.310 Sampling for Microbial and Molecular Analysis

(EDEN ISS/CREW/SCIENCE/FIN)

OBJECTIVE

Collection of samples and storage for off-line microbial and molecular analysis.

DURATION

TBD

TOOLS

N/A

ITEMS

84 Eppendorf Tubes (2ml)
84 Centrifuge Tubes (15ml)
84 Nylon flocked swab with containers
Markers
3 Sterile Nitrile Gloves

NOTE

1. SEVERAL SAMPLES HAVE TO BE COLLECTED BY CREW AS PER THE FOLLOWING SCHEMA:

- 10 LOCATION WITHIN THE FEG
- 6 LOCATION WITHIN THE SERVICE MODULE
- 4 LOCATIONS OF THE ISPR RACK

FOUR SAMPLES HAVE TO BE COLLECTED FOR EACH LOCATION, TWO FOR MICROBIAL ANALYSIS AND TWO FOR MOLECULAR ANALYSIS.

IN ADDITION FOUR OTHER FIELD NEGATIVE CONTROL SAMPLES HAVE TO BE COLLECTED FOR EACH SAMPLING EVENT, TWO FOR MICROBIAL ANALYSIS AND TWO FOR MOLECULAR ANALYSIS.

2. BOTH THE EPPENDORF AND THE CENTRIFUGE TUBES ARE PREFILLED WITH STERILE WATER

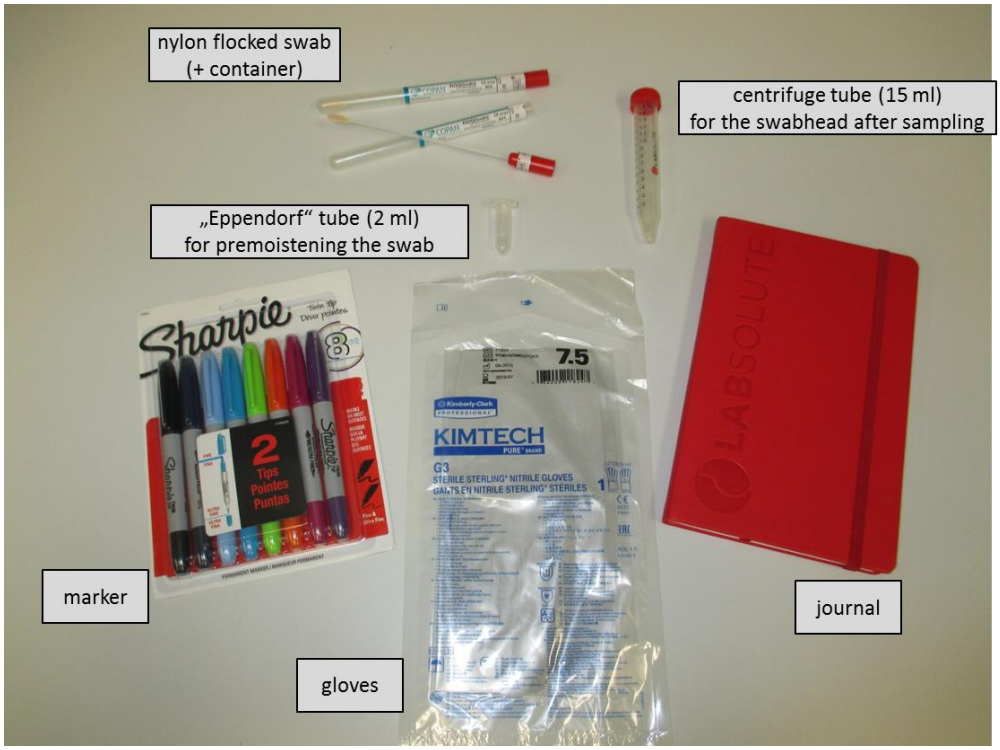


Figure 1: Items to be used

1 ACTIVITY PREPARATION

1.1 Collect all the required items and tools

1.2 Carefully wash your hands

1.2 Wear Nitrile Gloves

2 SURFACE SAMPLING

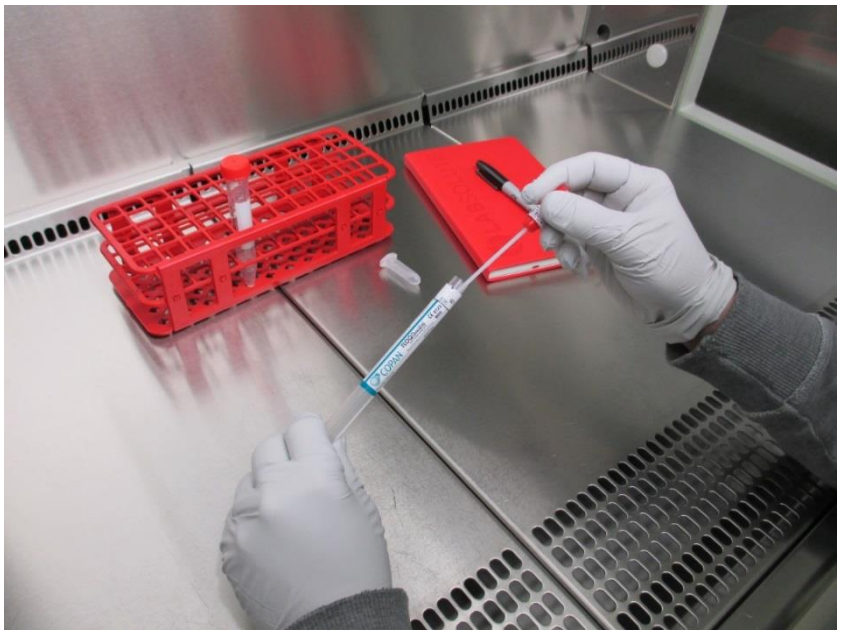


Figure 2: swab preparation

2.1 Remove a sterile swab from its container (Fig.2)

Fig. 3: Swab moisten

NOTE
A NEW STERILE EPPENDORF TUBE SHALL BE USED FOR A NEW SAMPLING

2.2 Moisten the head of the swab using the sterile water in the sterile Eppendorf tube (2 ml) (Fig. 3)

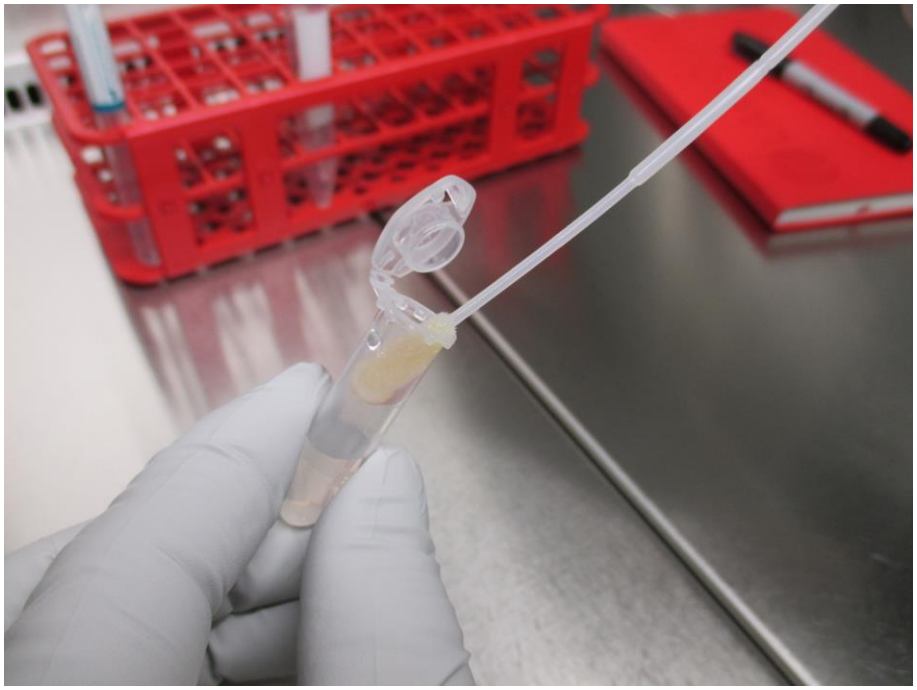


Figure 4: Water Excess removal

2.3 Express excess moisture from the swab against the interior wall of the tube (fig. 4)

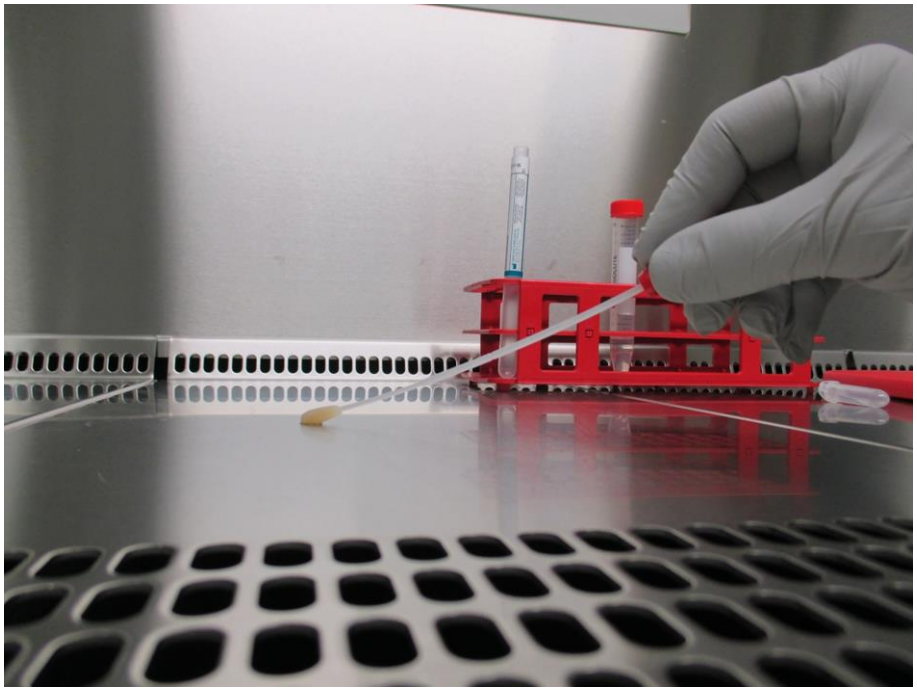


Figure 5: First swab position

2.4 Hold the swab so that the handle makes about a 30° angle with the surface to be sampled (fig. 5)

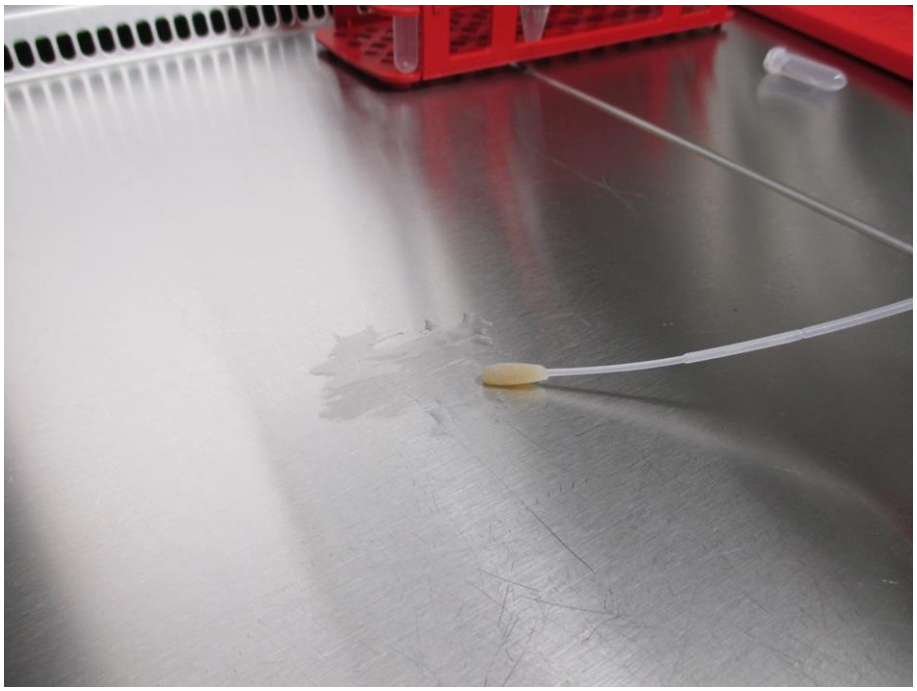


Figure 6: Swabbing – step 1

2.5 While moving the swab in one direction, rotate the head of the swab slowly and thoroughly over a measured 25 cm^2 surface area (Fig. 6)

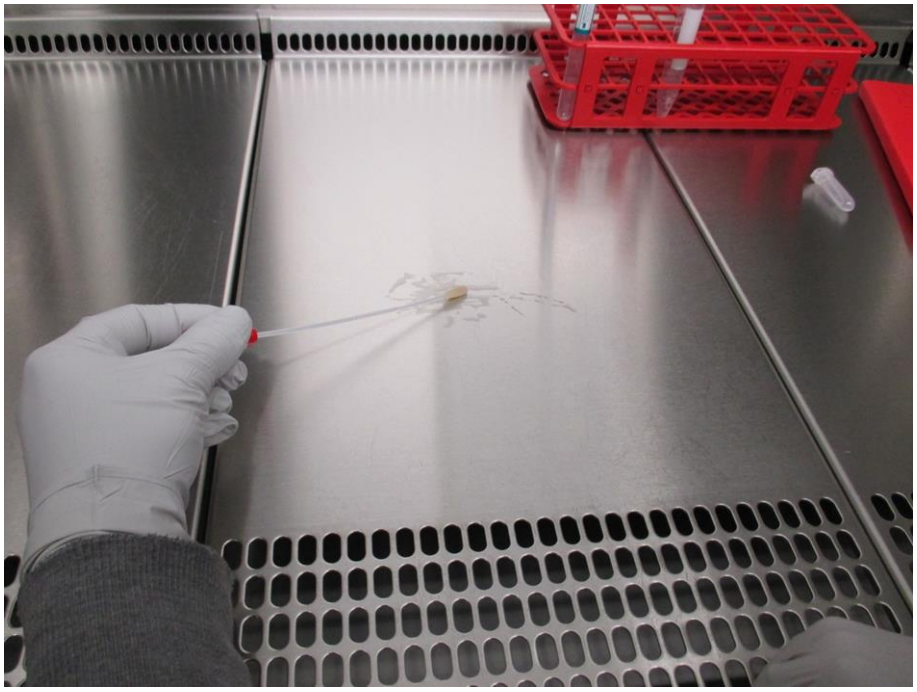


Figure 7: Swabbing – Step2

2.6 Change the linear direction of the swabbing motion 90° and again swab the surface thoroughly

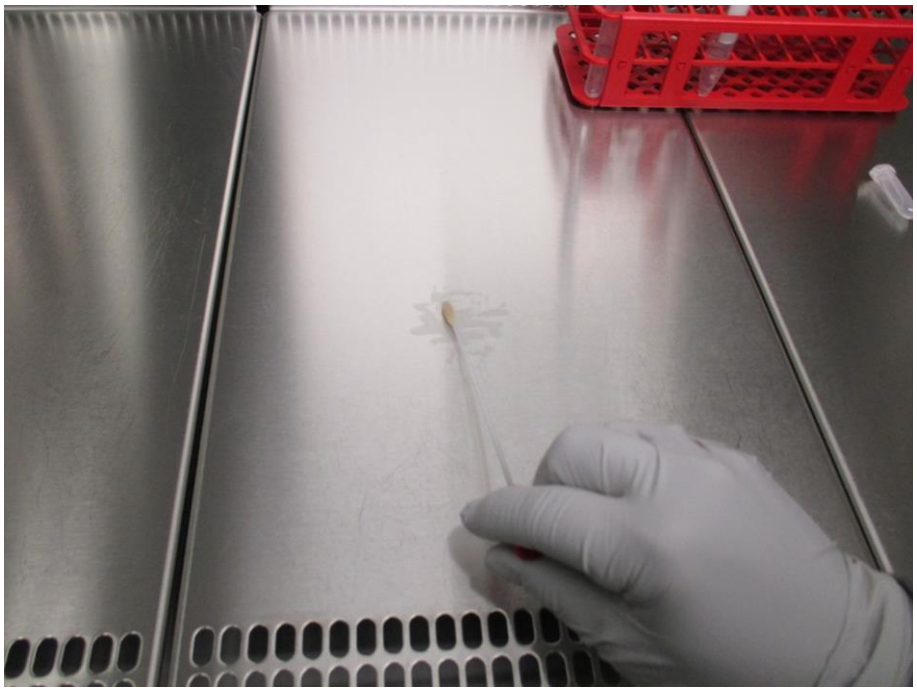


Figure 8: Swabbing – Step 3

2.7 Complete a third coverage of the surface by again changing the direction of the swabbing motion by 135°

2.8 IF sampling id done for Microbial Analysis

Figure 9: Swab preparation for storage

2.8.1 Put the swab in a sterile centrifuge tube (15 ml) containing 2,5 ml sterile water, and break the swab shaft at the breakpoint (Fig. 9)

2.8.2 Close the tube for storage and label the tube (location/date/time/microbial)

2.9 IF sampling is done for Molecular Analysis

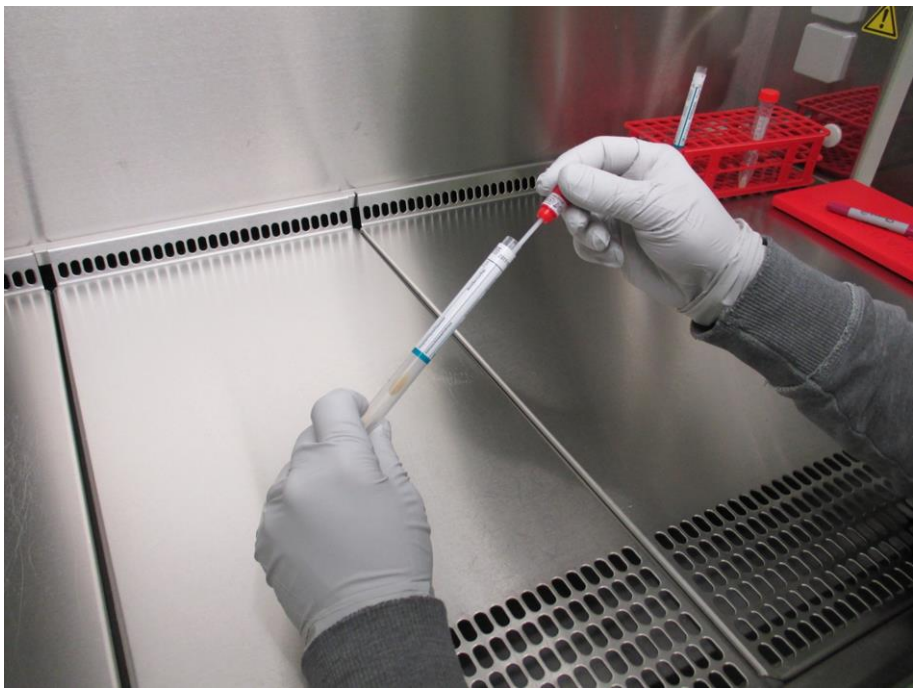


Figure 10: Swab preparation for storage

2.9.1 Put the swab back in its container

2.9.2 Close the tube for storage and label the tube (location/date/time/molecular)

2.10 Repeat step 2 for the same location, and then twice for all the locations of the FEG, Service Module and the ISPR Rack

3 FIELD NEGATIVE CONTROL SAMPLE COLLECTION

NOTE

1. FOUR FIELD NEGATIVE CONTROL SAMPLES HAVE TO BE COLLECTED FOR COMPARISON PURPOSE, TWO IN THE FEG AND TWO IN THE SERVICE SECTION.
2. THE ACTIVITY IS VERY SIMILAR TO WHAT DONE FOR THE MICROBIAL AND MOLECULAR SAMPLING AS DESCRIBED IN STEP 2, WITH THE ONLY DIFFERENCE THAT THE SWAB WILL BE MOVED TROUGH THE AIR RATHER THAN ON A SOLID SURFACE

3.1 Perform step 2.1, 2.1 and 2.3

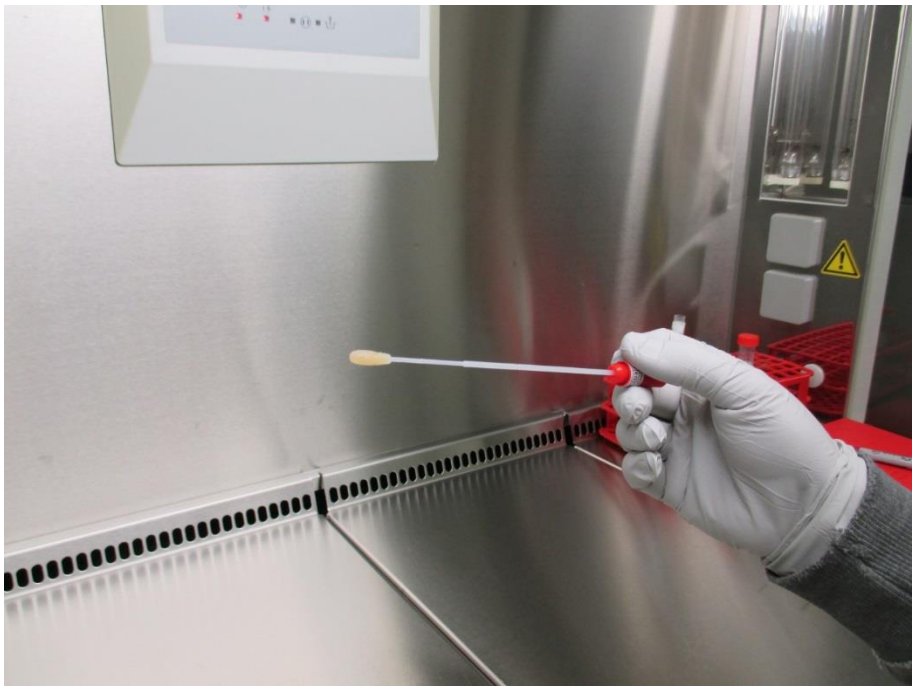


Figure 11: Swabbing through the air

3.2 Wave the moistened swab through the air for 2 to 4 seconds

3.3 IF Sampling is done for Microbial Analysis

3.3.1 Put the swab in a sterile centrifuge tube (15 ml) containing 2,5 ml sterile water, and break the swab shaft at the breakpoint (Fig. 9)

3.3.2 Close the tube for storage and label the tube (Field Negative Control location/date/time/microbial)

3.4 IF Sampling is done for Molecular Analysis

3.4.1 Put the swab back in its container

3.4.2 Close the tube for storage and label the tube (Field Negative Control /location/date/time/molecular)

3.5 Repeat the step 3 until the 4 samples (two for FEG, two for the Service Module) have been collected

4 **CLOSEOUT**

4.1 Take off the gloves

4.1 Store the tube at -18degC)

4.2 Document the activity in the log journal

4.3 Waste the gloves and the swab sticks

3.312 Plant Sampling For Microbial and Molecular Analysis

(EDEN ISS/CREW/SCIENCE/FIN)

OBJECTIVE

Collection of plant samples and storage for off-line microbial and molecular analysis.

DURATION

TBD

TOOLS

N/A

ITEMS

40 Centrifuge Tubes (50ml) for sample
4 Centrifuge Tubes (50ml) for control (with tissue)
44 Tweezers
44 Scalpel
Markers
3 Sterile Nitrile Gloves

NOTE
1. FOUR SAMPLES PER PLANT (10 PLANTS IN TOTAL) HAVE TO BE COLLECTED BY CREW. TWO SAMPLES WILL BE USED FOR MICROBIAL AND 2 SAMPLES FOR MOLECULAR ANALYSIS.
2. FOR EACH SAMPLING EVENT 4 OTHER FIELD NEGATIVE CONTROL SAMPLES HAVE TO BE COLLECTED
3. EACH SAMPLING REQUIRES THE USE OF A NEW TWEEZER AND A NEW SCALPEL

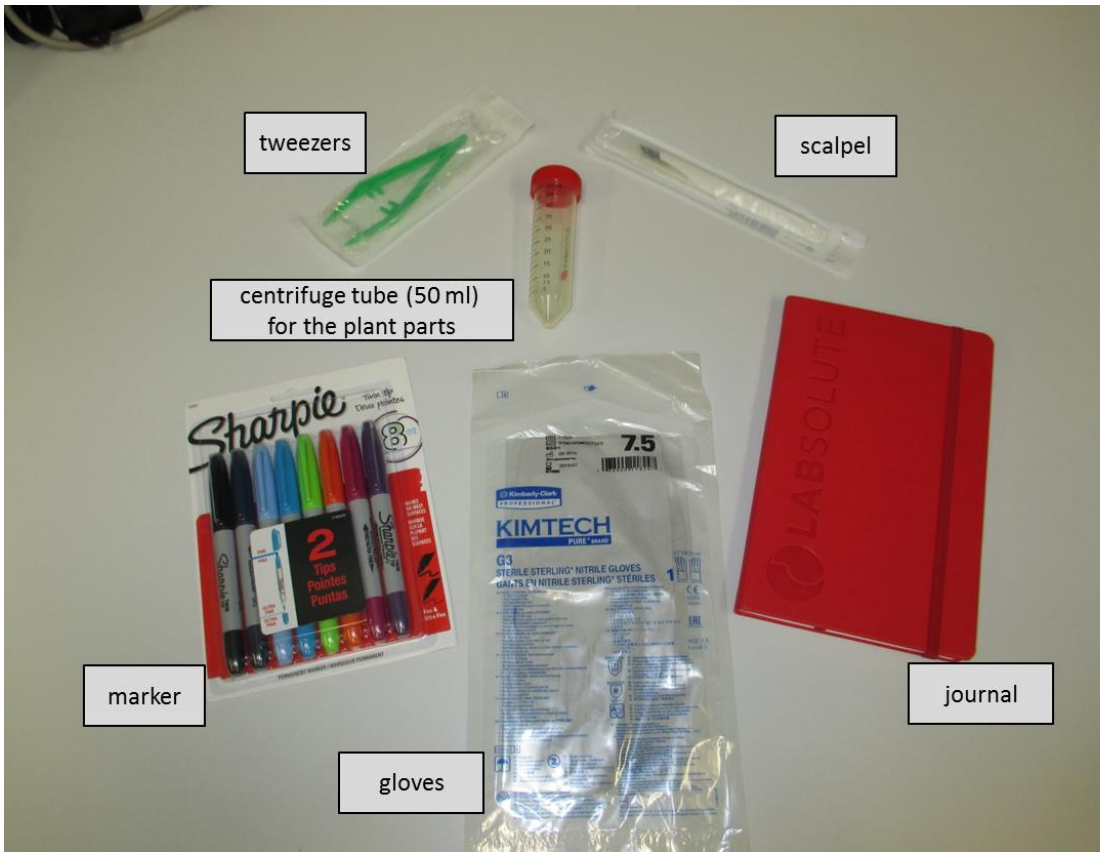


Figure 1: Items to be used

SS **1** **ACTIVITY PREPARATION**

1.1 Collect all the required items and tools

1.2 Carefully wash your hands

1.3 Wear Nitrile Gloves

FEG **2** **PLANT SAMPLING**

2.1 Remove a sterile scalpel from its pouch

2.2 Remove sterile tweezers from its pouch

Fig.2: Plant Sample Cutting

Figure 3: Plant Sample Insertion in the Tube

2.3 Grab a leaf (or another plant part) with tweezers (Fig. 2)

2.4 Cut the plant part with the scalpel (Fig. 2)

2.5 Put the plant part into a centrifuge tubes (50 ml) (Fig. 3)

2.6 Close the tube for storage

2.7 Label the tube unambiguously

2.8 Repeat step 2 for another sample (same plant)

2.9 Repeat step 2 for another plant until all the plants samples have been collected.

3 FIELD NEGATIVE CONTROL SAMPLE COLLECTION

3.1 Remove a sterile scalpel from its pouch

3.2 Remove sterile tweezers from its pouch

Figure 4: Tissue removal from its tube

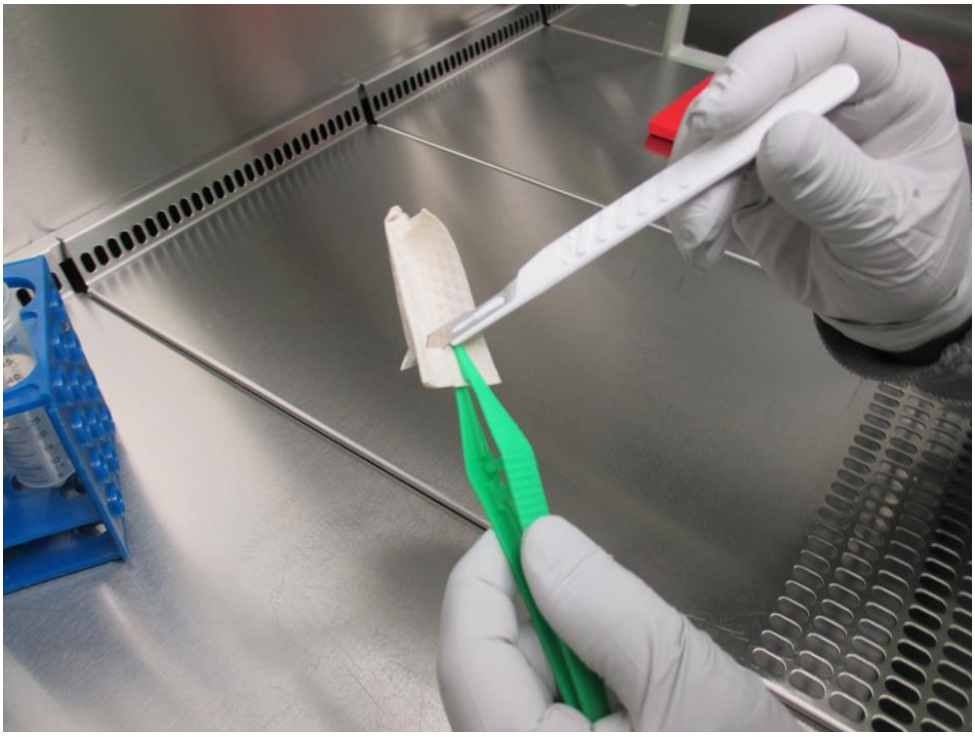


Figure 5: Piece of tissue cutting

3.3 Remove the piece of tissue with tweezers from its tube (50 ml) (fig. 4)

3.4 Cut the piece of tissue with the scalpel (fig. 5)

3.5 Put the piece of tissue back to its tube

3.6 Close the tube for storage

3.7 Label the tube unambiguously

3.8 Repeat step 3 other three times (four samples to be collected in total)

4 CLOSEOUT

4.1 Take off the gloves and waste them

4.1 Document the activity in the log journal (date location sample number, etc.)

4.2 Store the tube at -18degC

3.313 Liquid Sampling For Microbial and Molecular Analysis

(EDEN ISS/CREW/SCIENCE/FIN)

OBJECTIVE

Collection of nutrient solution samples and storage for off-line microbial and molecular analysis

DURATION

TBD

TOOLS

N/A

ITEMS

4 Centrifuge Tubes (50ml)
Sterile Nitrile Gloves

NOTE
TWO SAMPLES PER THANK (2 THANKS) HAVE TO BE COLLECTED BY CREW. TWO SAMPLES WILL BE USED FOR MICROBIAL AND 2 SAMPLES FOR MOLECULAR ANALYSIS.

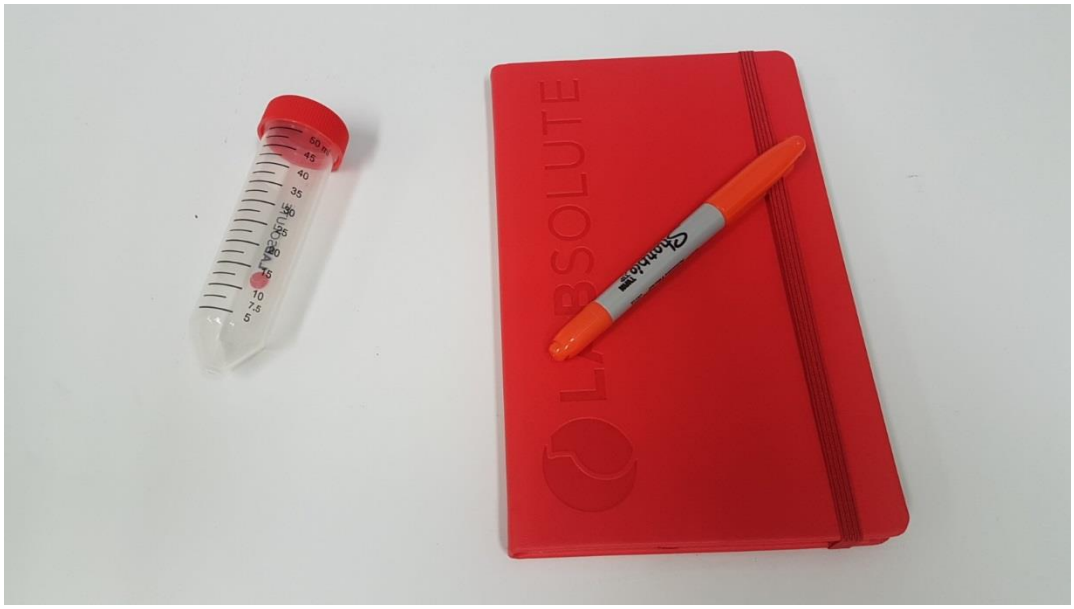


Figure 1: Items to be used

SS 1 ACTIVITY PREPARATION

NOTE
TO PREVENT CONTAMINATION THE HANDS HAVE TO BE CLEAN AND STERILE GLOVES SHALL BE WEARED BEFORE THE START OF THE OPERATIONS

1.1 Collect all the required items and tools

1.2 Carefully wash your hands

1.3 Don Nitrile Gloves

3 LIQUID SAMPLING

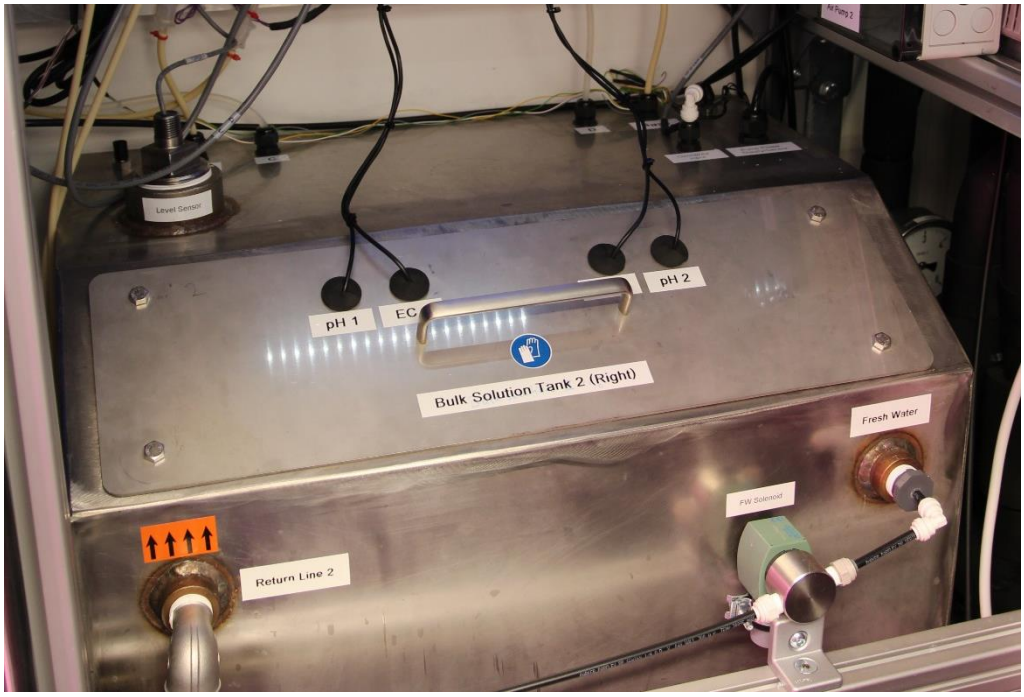


Figure 2: Bulk Solution Tank Cover

3.1 Remove the Bulk Solution Tank Panel.
Remark. It is not necessary to unscrew the bolts. They are just used to align the Tank Panel.

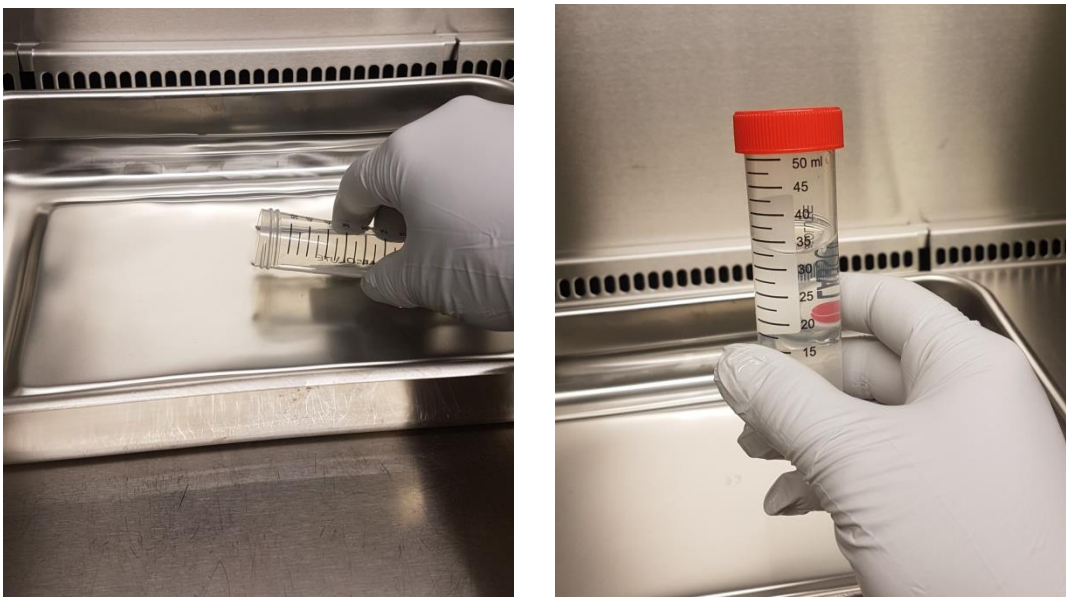


Figure 2: Liquid Sampling

3.2 Fill the centrifuge tubes (50 ml) with 30 - 40 ml of the nutrient solution

3.2 Close the tube for storage and label it with the following information:

- Tank Number (1 or 2)
- Type of analysis (microbial or molecular)
- Date (yyyy.mm.dd)

3.3 Document date, location, sample number etc. in the journal

3.4 Store the tube at -18degC

4 CLOSEOUT

4.1 Reinstall the Bulk Solution Tank Panel.

4.2 Restow the tools and the items

3.312 TransMADD Decontamination

(EDEN ISS/CREW/SCIENCE/FIN/HC)

OBJECTIVE

Decontaminate the FEG and/or the entire MTF in case microbial contaminations is detected

DURATION

120 minutes

TOOLS

Diop Generator
Nozzle

ITEMS

Bottle holder
Bottle for the agent
Tube adapter (2)
Tube (3 meter)
Power cable
Decontamination Agent

NOTE

THE TRANSMADD OFFERS TWO DIFFERENT OPERATING OPTIONS (AND THEREFORE TWO DIFFERENT CONFIGURATIONS):

- THE FIRST OPTION IS STORING THE DECONTAMINATION AGENT INSIDE THE GENERATOR, AND THE NOZZLE IS MOUNTED ON THE DIOP GENERATOR AND THE DECONTAMINATION AGENT IS DIRECTLY VAPORIZED BY THE NOZZLE. IN THIS CASE THE ENTIRE SYSTEM IS PLACED IN THE ROOM TO BE DECONTAMINATED,
- THE SECOND OPTION IS STORING THE DISINFECTION AGENT IN A SMALLER BOTTLE FIXED IN A FLASK HOLDER. THE DECONTAMINATION AGENT IS CONDUCTED BY A TUBE TO THE NOZZLE. IN THIS SECOND CASE THE ONLY BOTTLE AND THE NOZZLE ARE PLACED IN THE ROOM TO BE DECONTAMINATED.

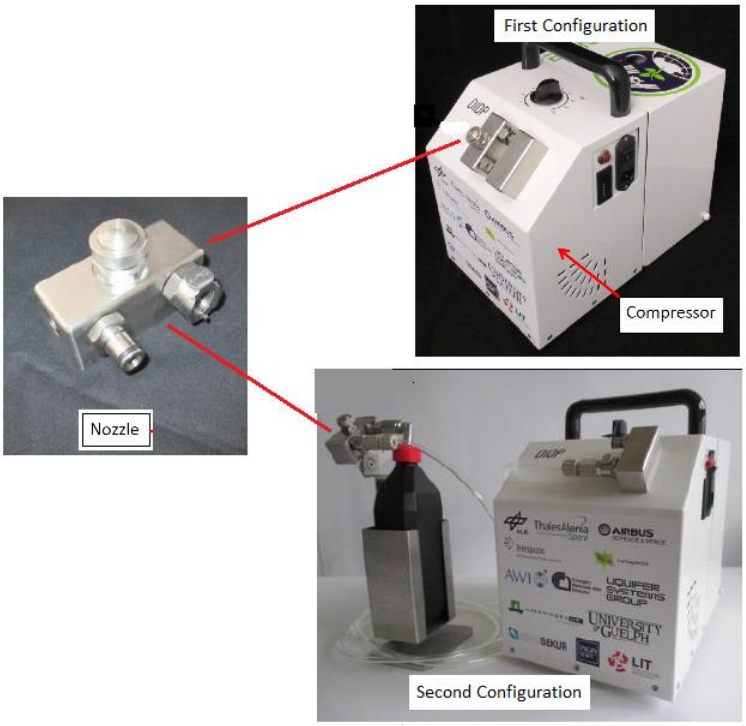


Figure 1: Decontamination Items: two configurations

1 SYSTEM SETUP – CONFIGURATION 1

NOTE
THE BOTTLE HOLDER AND THE BOTTLE FOR THE AGENT ARE NOT REQUIRED FOR THIS CONFIGURATION

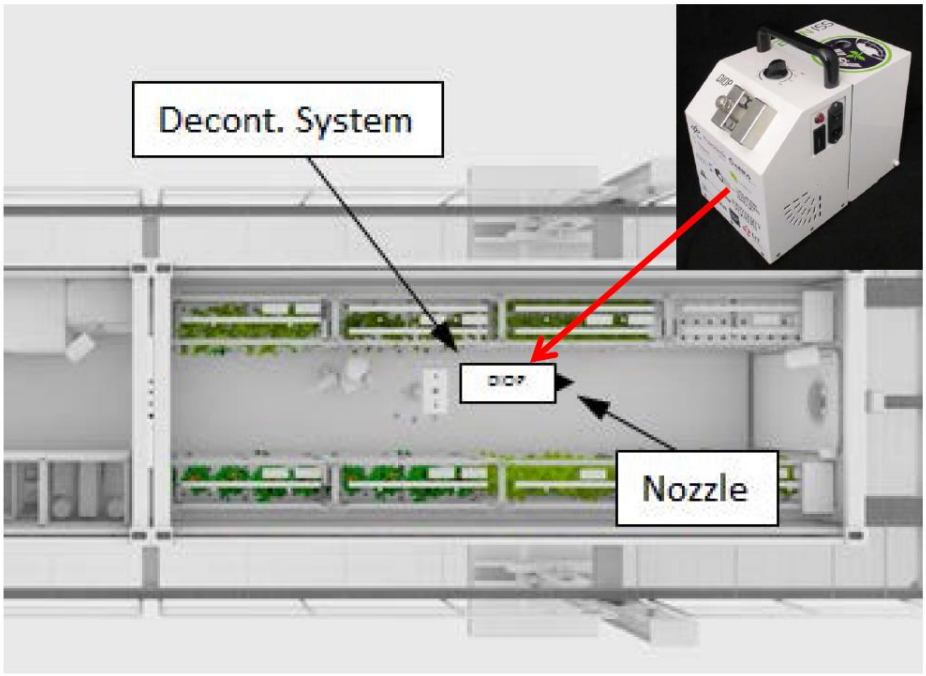


Figure 2: Configuration 1: System placed inside the FEG

1.1 Destow the tools and items from their stowage location

1.2 Install the nozzle on the Diop generator

1.3 Fill the Diop generator tank with the selected decontaminant agent

1.4 Place the system in the middle of the FEG in an elevated position (could be on a chair or on the trolley)

1.5 Attach the power cable to the Diop Generator

1.6 GOTO step 3

2 **SYSTEM SETUP – CONFIGURATION 2**

NOTE
ALL THE ITEMS AND TOOLS ARE REQUIRED FOR THIS CONFIGURATION

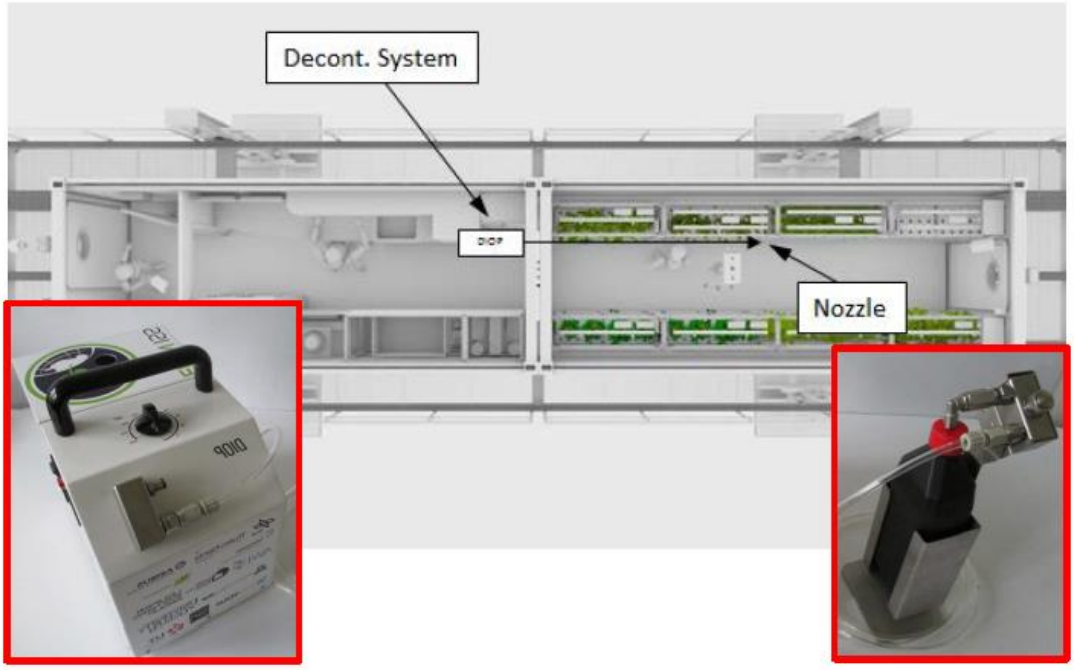


Figure 3: Configuration 2 – Nozzle in the FEG and Diop in the SS

2.1 Destow the tools and items from their stowage location

Figure 4: Suction Valve Installed on the bottle

2.2 Fill the bottle with the selected decontaminant agent

2.3 Install the bottle into the bottle holder and install the suction valve (Fig.4)

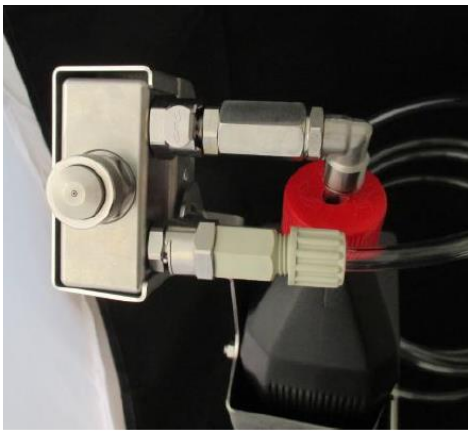


Fig. 5: Nozzle connected to the suction valve

2.4 Connect the suction valve to the nozzle and place the nozzle in the bottle holder

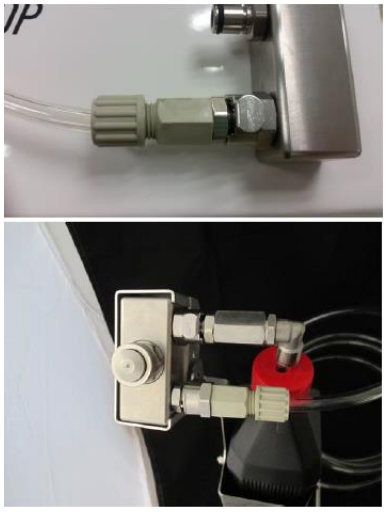


Fig. 6: Tube connected

2.5 Install the tube adapter on the nozzle and on the Diop generator

2.6 Install the tube

2.7 Place the system nozzle/bottle in the middle of the FEG in an elevated position (could be on a chair or on the trolley). The Diop has to be left in the SS

2.8 Exit from the FEG and close the door

3 DECONTAMINATION EXECUTION

WARNING
NO PERSONS SHALL STAY INSIDE THE ROOM TO BE DECONTAMINATED DURING THE TRANSMADD OPERATIONS.

3.1 Check that no persons are inside the FEG

3.2 Adjust the Diosol Generator to the appropriate volume (for the FEG 70 m^3 tbc)

3.3 Turn off the Air Management System and the Air Circulation Fan inside the FEG

3.4 Activate the Diop. Push the power switch to position “I”. (If you are in the FEG, leave it within 30 sec. and close the door)

3.5 Put on the door a security sign with the following words: “DO NOT OPEN, DECONTAMINATION IN PROGRESS”

3.6 Wait 90 minutes until the end of the decontamination operations. Deactivate the Diop (Push the power switch to position “O”.

3.7 Turn On the Air Management System and the Air Circulation Fan inside the FEG

3.8 Open the door and assure air circulation for the following 30 minutes. Do not enter in the FEG during this time.

3.9 When the 30 minutes have expired, enter in the FEG and retriev the system nozzle/bottle.

4 **CLOSEOUT**

4.1 Deconfigure the system as required

4.2 Stow all the items and tools

4200 Nutrient Distribution System Bulk Solution Tank Refill

(EDEN ISS/CREW/MAINTENANCE/FIN/HC)

OBJECTIVE

Changing the Hydroponic Nutrient Solution in Tank X (where tank X implies NDS bulk solution rack tank 1 or 2)

DURATION

240 min

TOOLS

N/A

ITEMS

Fresh Water Canisters (20 litre tank)
Waste Water Canisters (20 litre tank)
Stock Solution A (4 litre bottle)
Stock Solution B (4 litre bottle)
Acid Solution (4 litre bottle)
Base Solution (4 litre bottle)
Protective Glasses
Protective Gloves
Lab Coat/Coveralls
Paper Tissue
Waste water transfer pump
Waste water transfer tubes
Skidoo + sled (or Pistenbully)
Vacuum cleaner

NOTE

THIS PROCEDURE APPLIES TO BOTH THE BULK SOLUTION TANK #1 AND THE BULK SOLUTION TANK #2. IN FACT, EVEN IF THEY COULD BE FILLED WITH TWO DIFFERENT NUTRIENT SOLUTIONS, THE OPERATION TO DO THAT IS THE SAME FOR THE TWO TANKS.

SS 1 ACTIVITY PREPARATION

1.1 Retrieve the items and tools

WARNING

1. POTENTIAL ELECTRICAL SHOCK HAZARD: THE ACTIVITIES HAVE TO BE DONE WITH THE NDS COMPONENT OFF
2. POTENTIAL CHEMICAL HAZARD: THE OPERATOR MUST WEAR INDIVIDUAL PROTECTIVE ITEMS (LAB COAT/COVERALLS, GLOVES, GLASSES AND MASK) DURING THE OPERATIONS

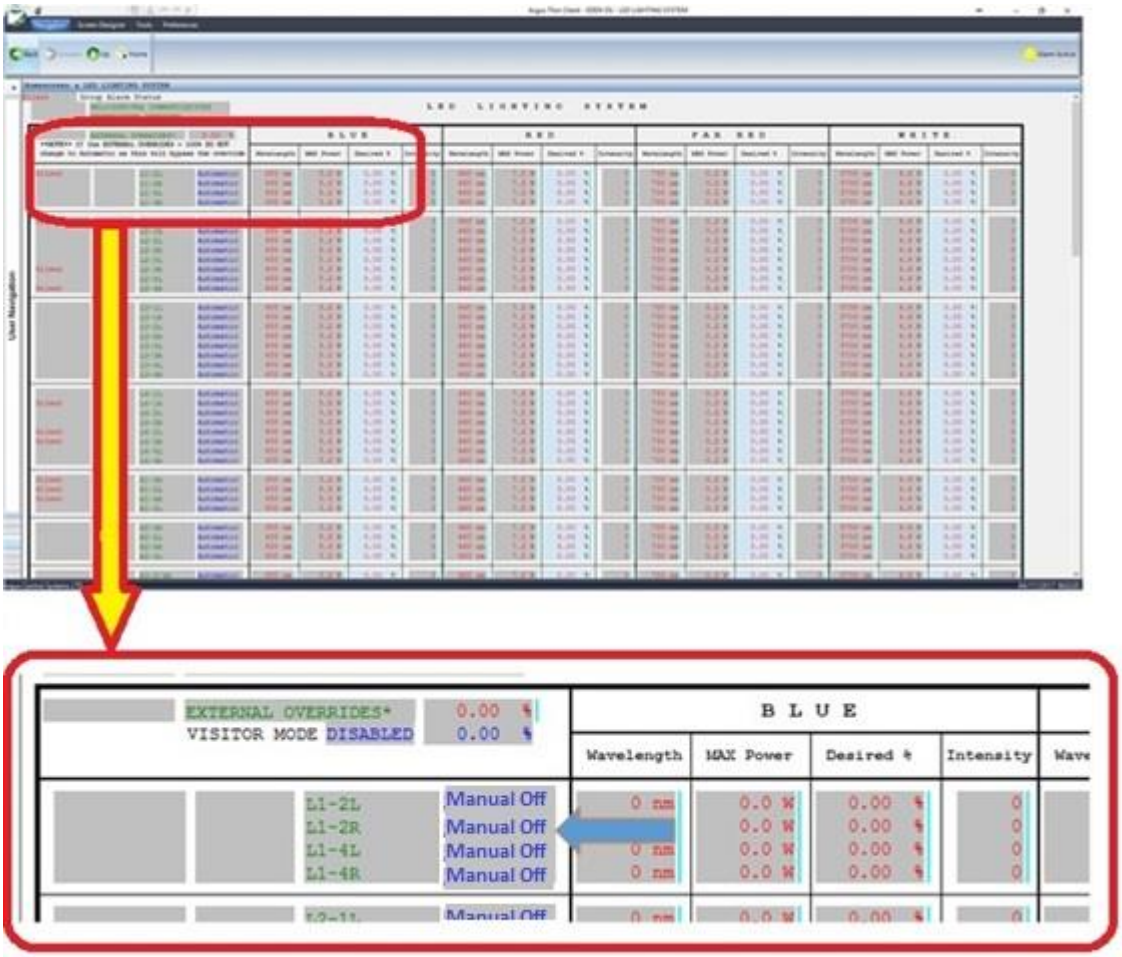


Figure 1: LED Lighting System Display – Main Page

1.2 On the LED Lighting System Display (Fig. 1)

Cmd the LED Panel Units (All) to Manual Off

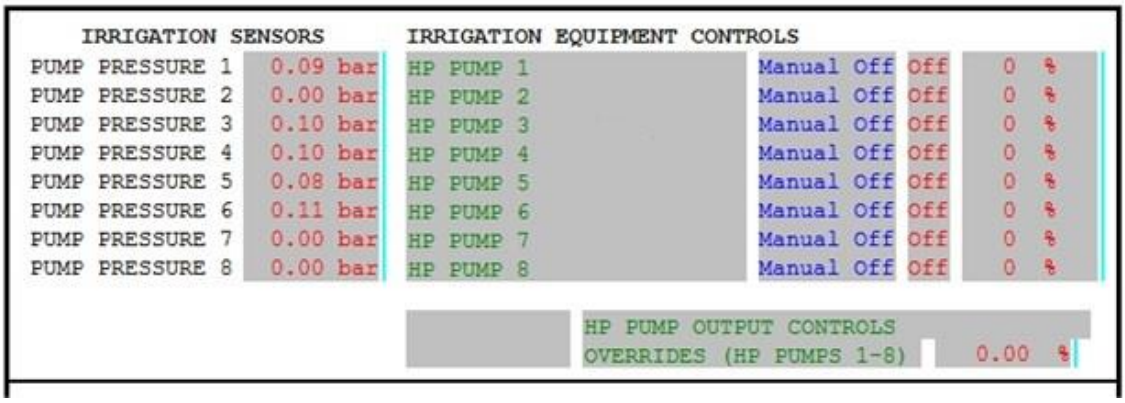


Figure 2: Nutrient Delivery System Display – Irrigation Equipment Control

1.3 In the Irrigation Equipment Control Display

Turn **OFF** all high pressure aeroponic *pumps fed from* Tank 1(2) (Fig. 2):

Cmd HP1 Pump to **Manual Off**
Cmd HP2 Pump to **Manual Off**
Cmd HP3 Pump to **Manual Off**
Cmd HP4 Pump to **Manual Off**
Cmd HP5 Pump to **Manual Off**
Cmd HP6 Pump to **Manual Off**
Cmd HP7 Pump to **Manual Off**
Cmd HP8 Pump to **Manual Off**

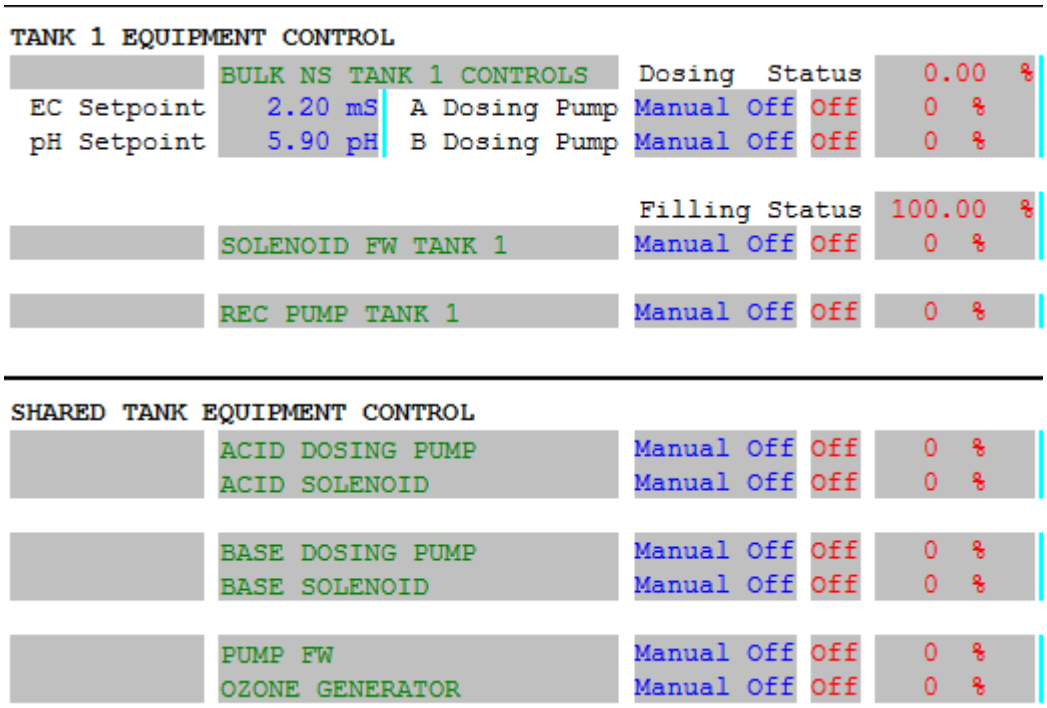


Figure 3: Nutrient Delivery System Display – Tanks Equipment Control

1.4 Turn OFF the Tanks Actuators (fig. 3):

In Tank 1(2) Equipment Control Display

Cmd A Dosing Pump to **Manual Off**
Cmd B Dosing Pump to **Manual Off**
Cmd Solenoid FW Tank 1(2) **to Manual Off**
Cmd Rec Pump Tank 1(2) **to Manual Off**

In Shared Tank Equipment Control box

Cmd Acid Dosing Pump to **Manual Off**
Cmd Acid Solenoid to **Manual Off**
Cmd Base Dosing Pump to **Manual Off**
Cmd Base Solenoid to **Manual Off**
Cmd Pump FW to **Manual Off**
Cmd Ozone Generator to **Manual Off**

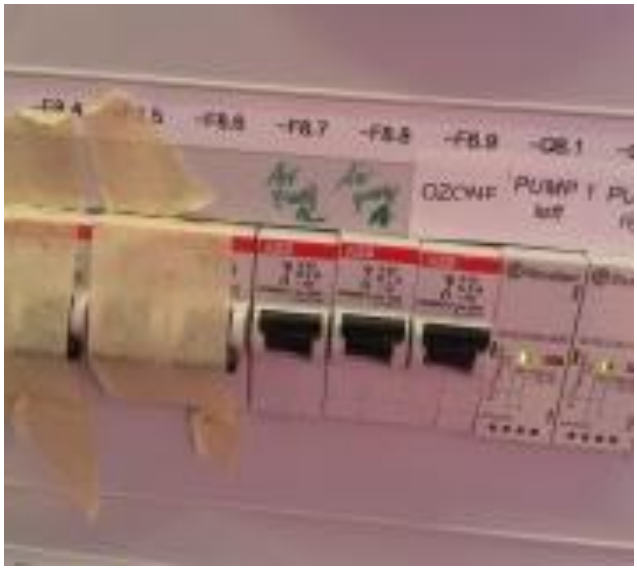


Figure 4: Power Rack Interface – NDS Service Section Line

1.5 On the Power Rack Interface – NDS Service Section Line (Fig. 4)

Switch OFF the Air Pump 1
Swicth OFF the Air Pump 2
Switch OFF the Circ Pump 1
Switch OFF the Circ Pump 2

NM/ SS **2 OLD BULK SOLUTION REMOVAL**

Figure5: Skidoo with yellow sled filled with canisters in front of MTF

NM 2.1 Collect at least 8x 20 Liter canisters marked with 'WW' (for waste water) and the Zarges box containing the waste water transfer pump

2.2 Load the canisters and the Zarges box onto the yellow Skidoo sled (or in the rear cabin of a Pistenbully)

2.3 Drive to the MTF and park in front of the stairs (Fig. 5)

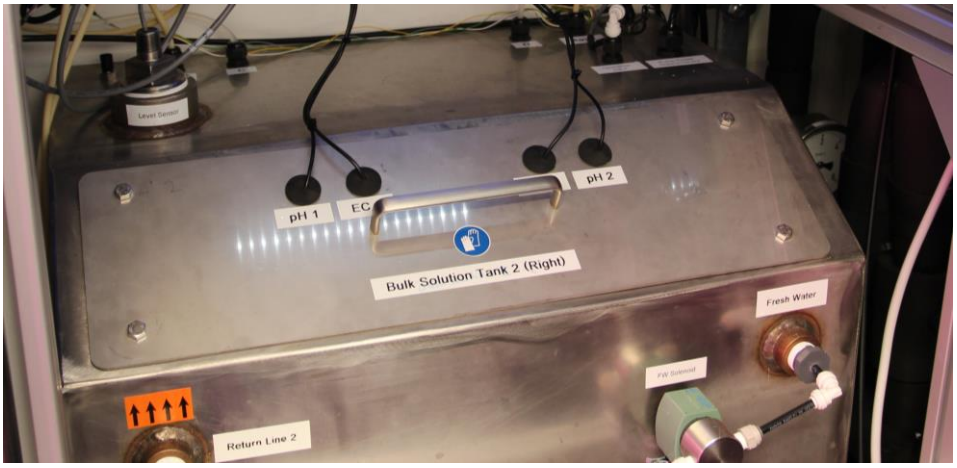


Figure 6: NDS Rack – Bulk Solution Tank 2

NOTE
THE WASTE WATER TUBE ONCE CONNECTED RUNS FROM THE SERVICE SECTION THROUGH THE COLD PORCH TO THE SLED. PLEASE KEEP THE ENTRACE DOOR AND THE DOOR BETWEEN THE SERVICE SECTION AND THE COLD PORCH AS CLOSED AS POSSIBLE TO REDUCE THE AMOUNT OF COLD AIR ENTERING THE MTF.

SS 2.4 Remove the Lid Panel from the Bulk Solution Tank 1(2) (Fig. 6)

2.5 Pull out the EC and pH sensors from the Bulk Solution Tank and lay them on the top of the Bulk Solution Tank with the Lid Panel.
Remark: There is no need to feed the sensor and sensor cables out from the Lid Panel

2.6 Wash the sensors with fresh water and then place them in clean beaker with water to clean and prevent drying of sensors
Remark: The bolts are used to align the cover - no need to unscrew them

Figure 7: Drain Pipeline under floor panel in the left corner of the Service Section (as seen from the Cold Porch) under the table

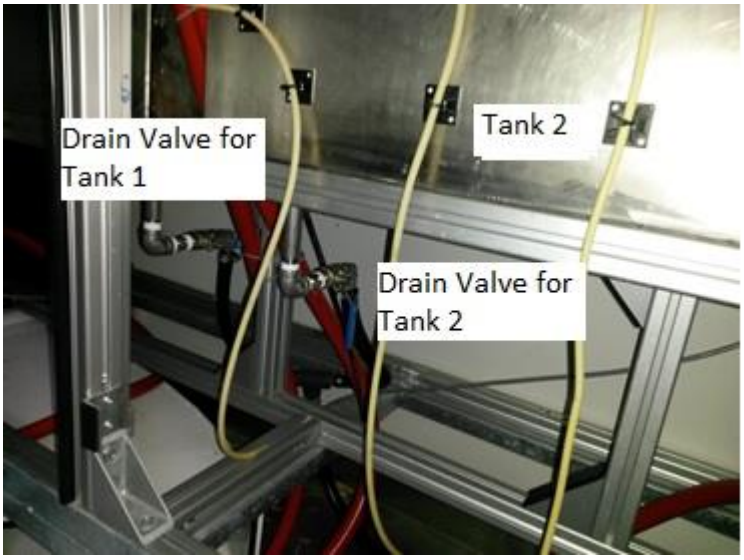


Figure 8: Drain Valve position

2.7 Lift the left floor panel in front of the ISPR Rack to access the Drain Pipeline (Fig. 7)

2.8 Wear appropriate Personal Protective Equipment (Gloves and Glasses)

2.9 Connect the long waste water tube to the outlet under the floor panel

2.10 Connect the other end of the long waste water tube to the input port of the waste water transfer pump in the sled

2.11 Connect the short waste water tube to the outlet port of the waste water transfer pump. Insert the free end of the short waste water tube in the first waste water canister in the sled

2.12 Open Tank 1(2) Drain Valve (Fig. 8)

2.13 Open valve under floor panel

2.14 Wait until the 20 L waste water canister is almost filled.

2.15 Remove the free end of the drain tube from the waste water canister and close the canister lid.

2.16 Repeat the process filling subsequent waste water canisters (i.e. from step AA until step BB) until the respective NDS tank is empty.

2.17 Close valve of the interface tube under the floor panel
.

2.18 Close drain valve of NDS tank 1(2)

2.19 Disconnect waste water tubes from the waste water transfer pump and from the interface below the floor panel.

2.20 Drive the waste water canisters to the station and dispose waste nutrient solution according to station regulations.

NOTE
DO NOT DRAIN THE WASTE NUTRIENT SOLUTION INTO THE TOILETTE OR THE SINKS INSIDE THE STATION. THAT HIGH CONTENT OF MINERALS CAUSES TROUBLE WITH THE WASTE WATER RECYCLING SYSTEM OF THE STATION. DRAIN THE WASTE NUTRIENT SOLUTION IN THE 'CAVERN' BELOW THE STATION. ASK THE STATION ENGINEER FOR ASSISTANCE.

SS 3 BULK SOLUTION TANK 1(2) CLEANING

3.1 **Close** Tank 1(2) outlet valve at Filter (Figure 8)

3.2 Take the 3 Liter plastic beaker and fill it with hot water from the tap. Insert the beaker into the tank and poor hot water over the surfaces and equipment inside the tank. Repeat until every equipment/surface was watered once.

3.3 Clean all inside surfaces (including recirculation pump, thermal coil, and pipes) by hand with a brush.

3.4 Repeat step 3.1.

Figure 9: Mesh Filters Valve (located below the NDS Tank)

3.5 Use the vacuum cleaner to remove all water and biofilm material from the tank. Empty vacuum cleaner into sink.

3.6 Carefully remove Mesh Filter (Fig. 9), using a beaker or bowl to capture leaked water
3.7 Wash it and reinstall in its position

4 FEED LINES CLEANING

CAUTION
FEED LINES CLEANING SHALL NOT BE DONE WHILE PLANTS ARE PRESENT IN THE FEG

4.1 Carefully remove Mesh Filter (Fig. 8), using a beaker or bowl to capture leaked water

4.2 Wash it and reinstall in its position

4.3 Fill Tank 1(2) with a little bit of Water

4.4 **Open** Outlet valve of Tank 1(2) at Filter

4.5 In the Irrigation Equipment Control Display

Turn **ON** all high pressure aeroponic pumps fed from Tank 1(2) (Fig. 2):

Cmd HP1 Pump to **Manual On**
Cmd HP2 Pump to **Manual On**
Cmd HP3 Pump to **Manual On**
Cmd HP4 Pump to **Manual On**
Cmd HP5 Pump to **Manual On**
Cmd HP6 Pump to **Manual On**
Cmd HP7 Pump to **Manual On**
Cmd HP8 Pump to **Manual On**

4.6 Wait for 1 spray from Return Line to clean feed and return lines.

if Return pump not sprays for a while

add more water to return lines to active Return Pump

4.7 In the Irrigation Equipment Control Display

Turn **OFF** all high pressure aeroponic pumps fed from Tank 1(2) (Fig. 2)

Cmd HP1 Pump to **Manual Off**
Cmd HP2 Pump to **Manual Off**

Cmd HP3 Pump to **Manual Off**
Cmd HP4 Pump to **Manual Off**
Cmd HP5 Pump to **Manual Off**
Cmd HP6 Pump to **Manual Off**
Cmd HP7 Pump to **Manual Off**
Cmd HP8 Pump to **Manual Off**

NM/SS **6** **NUTRIENT SOLUTION REFILL**

NM 6.1 Prepare 7x 20 L canisters of DI water. Use the canisters marked with 'FW' (for fresh water)

6.2 Prepare/have ready 2x 4 L nutrient stock solution bottles A/B for NDS tank 1(2)

6.3 Collect filled canisters and nutrient stock solution and drive the material to the MTF using a Skidoo with the yellow sled (or a Pistenbully with rear cabin).

SS 6.4 Verify the fresh water tank is filled at least to 50 %

If the tank is empty than fill it. **PERFORM** Procedure "4.300 Fresh Water Tank Filling"

6.5 Empty the 7 FW canisters into the Bulk Solution Tank 1(2)

6.6 Slowly dump into the Bulk Solution Tank 1(2) 1.5 bottles pre-made 4 L Stock solution A and 1.5 bottles B

6.7 Connect the half empty stock solution bottles to the feed lines of the NDS tank 1(2)

NOTE

1. **ELECTRICAL CONDUCTIVITY SETUP.** EC TARGET VALID PARAMETERS ARE:
   a. Leafy Crops: 2.3 +/- 0.2 mS/cm2
   b. Fruit Crops: 3.5 +/- 0.2 mS/cm2
2. **pH Setup.** pH TARGET VALID PARAMETERS ARE FROM 5.5 TO 6.2

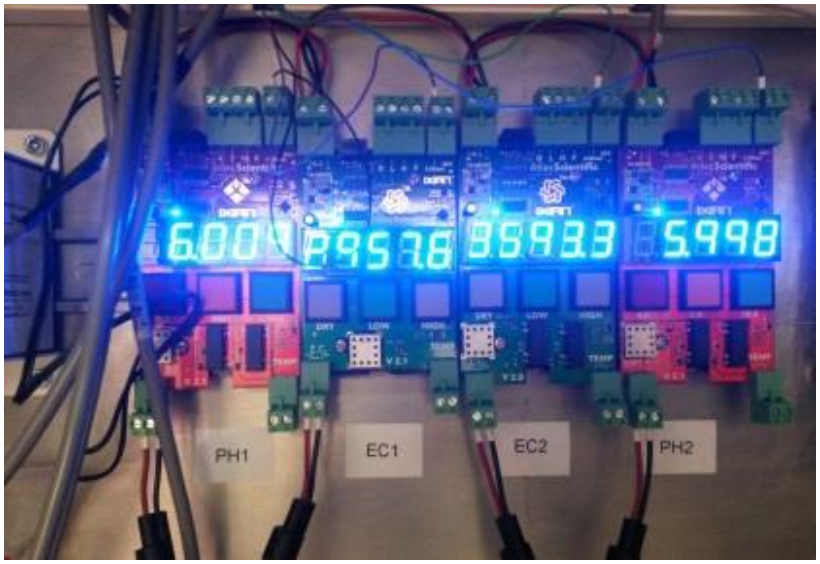


Fig. 10: pH and EC transmitters

6.8 Reinstall the lid panel on the Bulk Solution Tank 1(2)

6.9 Reinstall the EC sensor in the Bulk Solution Tank 1(2) lid panel

6.10 Take off the protective gloves, mask and glasses

6.11 **OPEN** Tank 1(2) outlet valve at Filter (Figure 8)

6.12 On the Power Rack Interface – NDS Service Section Line (Fig. 3)

Switch ON the Air Pump 1
Swicth ON the Air Pump 2

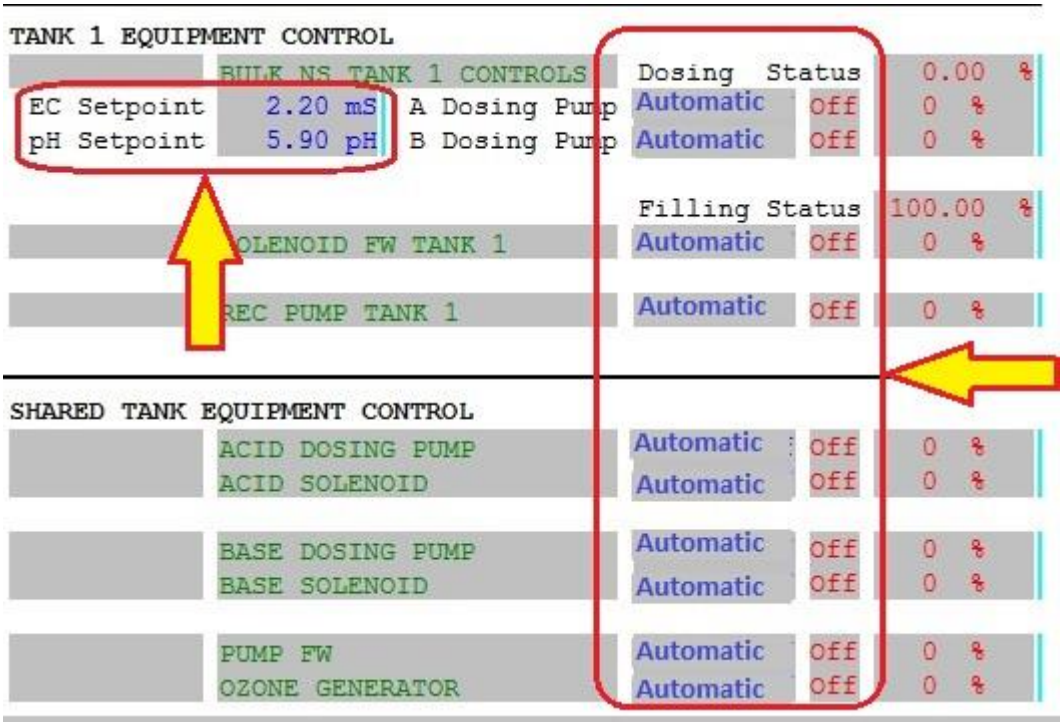


Figure 11: Nutrient Delivery System Display – Tanks Equipment Control. NDS Configuration

6.13 Turn ON the Tanks Actuators and input the EC and pH Setpoints (Fig. 11):

In Tank 1(2) Equipment Control Control box

Input EC Setpoint = as required
Input pH Setpoint = as required

Cmd A Dosing Pump to **Automatic**
Cmd B Dosing Pump to **Automatic**
Cmd Solenoid FW Tank 1(2) **to Automatic**
Cmd Rec Pump Tank 1(2) **to Automatic**

In Shared Tank Equipment Control box

Cmd Acid Dosing Pump to **Automatic**
Cmd Acid Solenoid to **Automatic**
Cmd Base Dosing Pump to **Automatic**
Cmd Base Solenoid to **Automatic**
Cmd Pump FW to **Automatic**
Cmd Ozone Generator to **Automatic**

6.14 After 30 minutes, verify on the pH and EC transmitters that the pH and the EC have been adjusted to the defined target

If the EC and/or the pH are out of range
PERFORM procedure 5.600 NDS pH and EC Setting Failure

NOTE

1. EACH OF THE EIGHT NDS RACKS CAN BE SET TO RECEIVE NUTRIENT SOLUTION FROM EITHER TANK 1 OR TANK 2. TO CHANGE THE SOURCE SOLUTION, BOTH THE FEED VALVE AND THE RETURN VALVE MUST BE SWITCHED TO THE APPROPRIATE TANK. TO CHANGE THE FEED VALVE FOR ANY RACK, REFER TO THE DIAGRAM OF VALVE POSITION (FIG. 9)

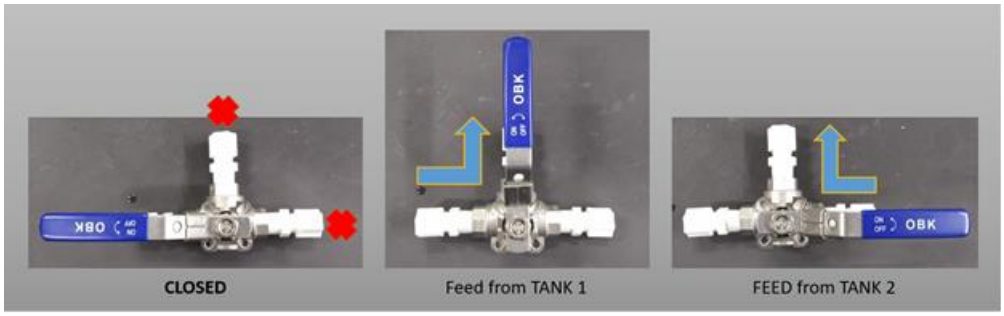


Figure 12: NDS feed tank valve positions

THE CORRESPONDING WASTE VALVE MUST ALSO BE CHANGED. REFER TO THE VALVE DIAGRAM BELOW FOR THE CORRECT POSITIONING OF THE VALVE HANDLE.

Figure 13: NDS waste valve position

2. CREW WILL BE INSTRUCTED BY **MCC** ON THE VALVE CONFIGURATION BEFORE THE ACTIVITY STARTS
3. THE VALVES ARE UNDER THE FEG FLOOR. THE FEG FLOOR HAS TO BE REMOVED TO ACCESS THEM

6.15 Configure the NDS feed tank valve position as required (example in fig. 12)

6.16 Configure the Waste valve position as required (example in fig. 13)

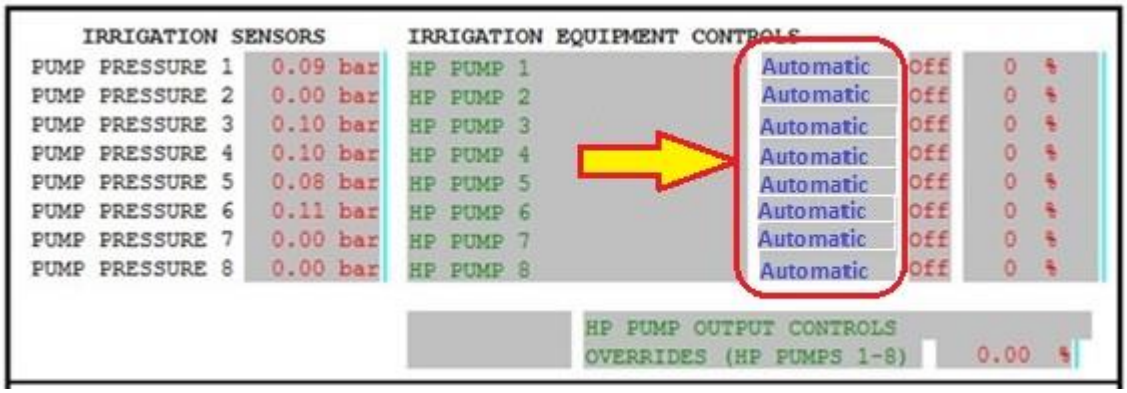


Figure 14: Nutrient Delivery System Display – Irrigation Equipment Control Configuration

6.17 Turn **ON** all high pressure aeroponic *pumps fed from* Tank 1(2) (Fig. 14):

In the Irrigation Equipment Control box

Cmd L1 HP Pump to **Automatic**
Cmd L2 HP Pump to **Automatic**
Cmd L3 HP Pump to **Automatic**
Cmd L4 HP Pump to **Automatic**
Cmd R1 HP Pump to **Automatic**
Cmd R2 HP Pump to **Automatic**
Cmd R3 HP Pump to **Automatic**
Cmd R4 HP Pump to **Automatic**

7 CLOSEOUT

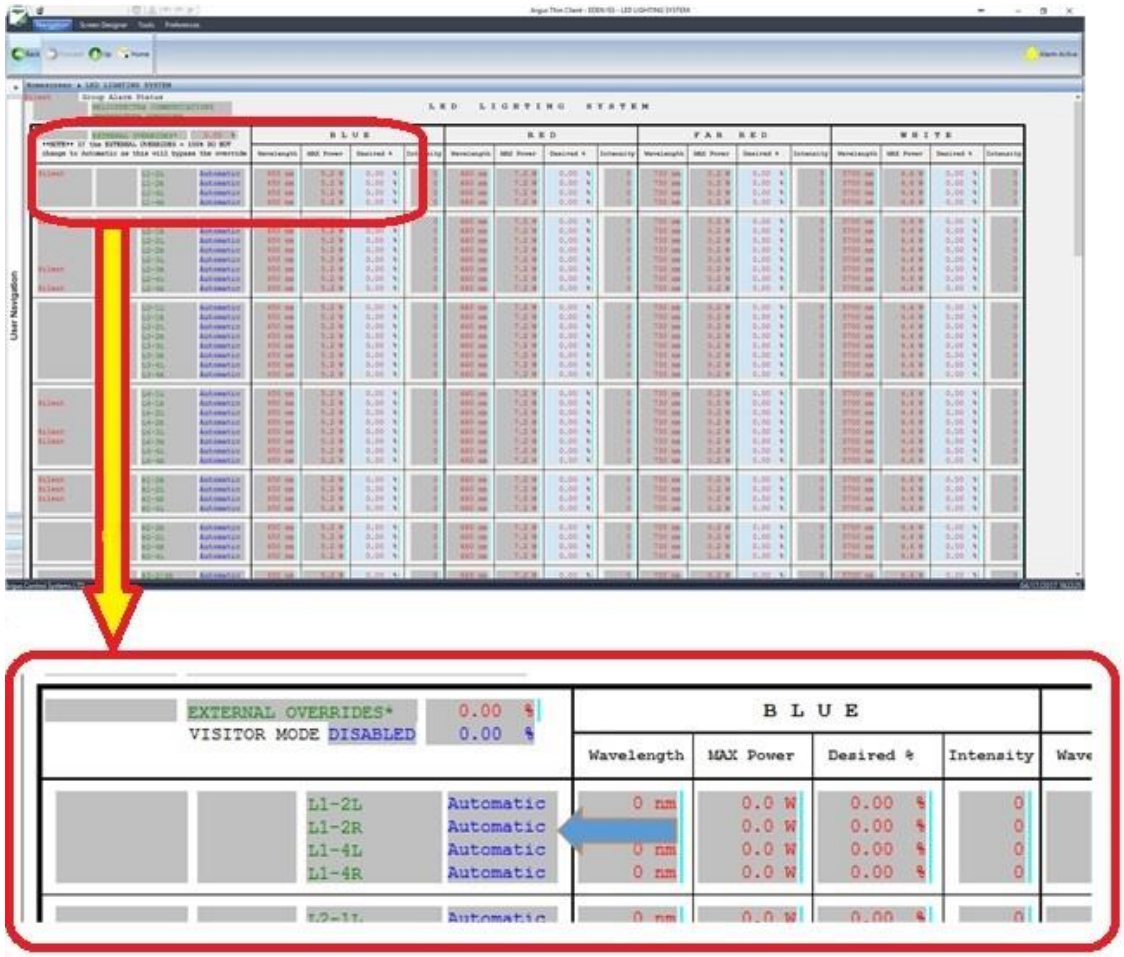


Fig. 15: LED Lighting System Display – Main Page

7.1 On the LED Lighting System Display

Cmd LED Panel Unit (All) to Automatic (Fig. 15)

7.2 Stow items and tools

4.220 NDS Sensors Calibration

(EDEN ISS/CREW/MAINTENANCE/FIN)

OBJECTIVE

Calibrate the pH and the EC probes.

DURATION

120 min (TBC)

TOOLS

N/A

ITEMS

250 ml beakers (5)
Large rinse bucket
Deionised Water
pH 4.0 solution
pH 7.0 solution
pH 10.0 solution
1,413 µs solution
12,880 µs solution
Dry wipe

NOTE

1. TWO PH SENSORS AND TWO EC SENSORS ARE INSTALLED FOR EACH BULK SOLUTION TANK, FOR A TOTAL OF 4 pH SENSORS AND 4 EC SENSORS TO BE CALIBRATED
2. THE SENSORS ARE DIRECTLY CONNECTED TO THEIR TRANSMITTERS BOARD WHOSE SETUP IN THE NDS SYSTEM, I.E. CONNECTION TO ARGUS AND TO SENSORS, HAS BEEN DONE AS PART OF SYSTEM INTEGRATION
3. SENSORS CALIBRATION IS DONE VIA TRANSMITTER BOARD INTERFACES.

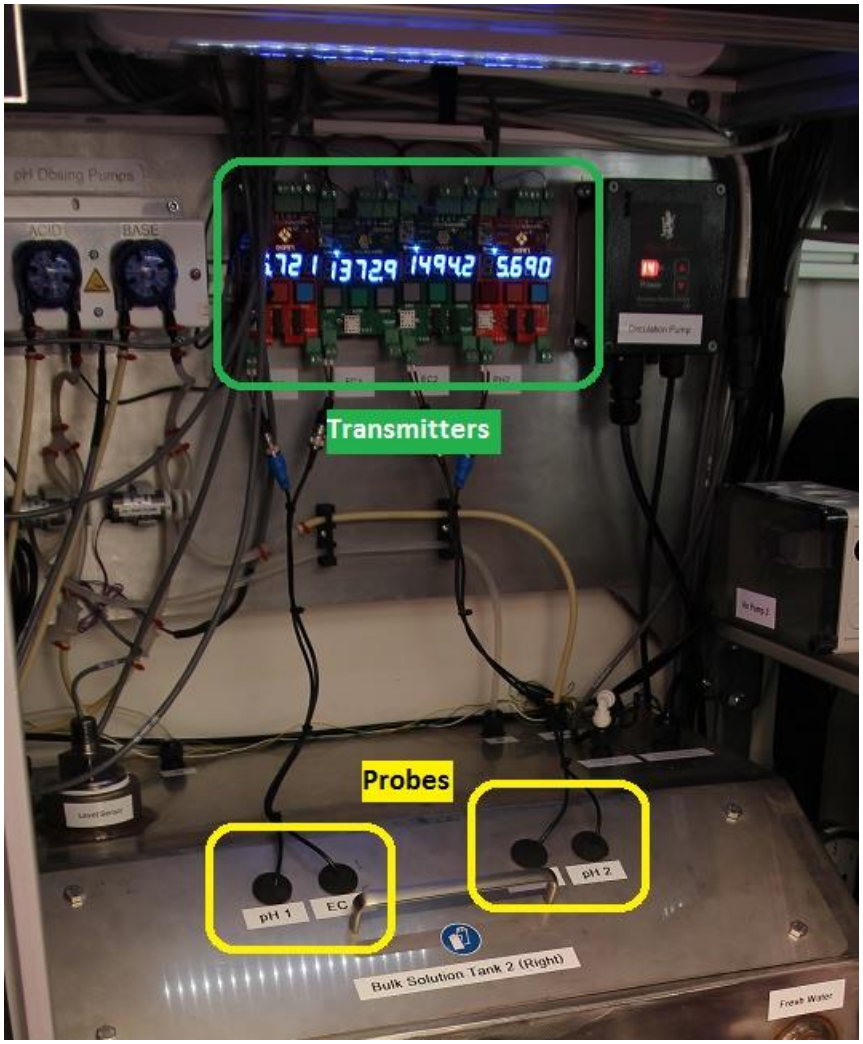


Figure 1: pH and EC sensors in the Bulk Solution Tank 2 (Right)

SS 1 ACTIVITY PREPARATION

1.1 Retrieve the items and tools

1.2 Deactivate the pH and EC Control

In Tank 1(2) Equipment Control box

Cmd A Dosing Pump to **Manual Off**
Cmd B Dosing Pump to **Manual Off**
Cmd Solenoid FW Tank 1(2) **to Manual Off**
Cmd Rec Pump Tank 1(2) **to Manual Off**

In Shared Tank Equipment Control box

Cmd Acid Dosing Pump to **Manual Off**
Cmd Acid Solenoid to **Manual Off**
Cmd Base Dosing Pump to **Manual Off**
Cmd Base Solenoid to **Manual Off**
Cmd Pump FW to **Manual Off**
Cmd Ozone Generator to **Manual Off**

SS 2 pH PROBES CALIBRATION

NOTE
1. The pH SENSOR USES A THREE POINT CALIBRATION. THREE STANDARDS ARE REQUIRED FOR PROPER CALIBRATION OF THE pH UNITS AND CONSIST OF pH 4.0, 7.0 AND 10.0 SOLUTIONS **2.** THE PROCEDURE IS WRITTEN FOR A GENERIC TANK X, BUT OF COURSE IS APPLICABLE TO BOTH THE TANKS

2.1 Remove the probe to be calibrated from the Bulk Solution Tank X and rinse with deionized (or equivalent

2.2 Place the probe in pH 7.0 calibration solution and ensure the end of the probe is completely submerged

Figure 2: pH Calibration Buttons on the pH Transmitter Boards

2.3 On the pH Transmitter Board

1. Press and hold the button marked “7.0” for 1.5 seconds. The display will flash: CAL 7.0

2.4 Wait until the display will flash: done

2.5 Remove the probe from the calibration solution and rinse with deionized water (or equivalent)

2.6 If required
repeat step 2.3 to 2.5 for pH 4.0 and pH 10.0

2.7 Reinstall the pH Sensors in the Bulk Solution Tank X

2.8 If required
repeat step 2.1 to 2.6 for the other Bulk Solution Tank

3 EC PROBE CALIBRATION

NOTE
1. THE CONDUCTIVITY SENSOR USES A 3 POINT CALIBRATION: DRY, LOW AND HIGH. THE FIRST CALIBRATION POINT IS “DRY” AND THIS IS ONLY PERFORMED WHEN A NEW PROBE

IS CONNECTED TO THE TRANSMITTER FOR THE FIRST TIME. THE OTHER TWO CALIBRATION POINTS ARE PRESET TO SPECIFIC INDUSTRY STANDARD CALIBRATION VALUES. TO ACCOUNT FOR POSSIBLY HIGHER EC LEVELS, THE PROBES USED IN THE EDEN SYSTEM ARE MIDRANGE WITH A CALIBRATION CONSTANT OF K=1.

2. THE STANDARDS REQUIRED FOR CALIBRATION ARE 1,413µS AND 12,880µS.

3.1 Dry Calibration

NOTE

DRY PROBE CALIBRATION IS ANALOGOUS TO THE TARE FUNCTION ON A SCALE. AFTER DRY CALIBRATION THE DISPLAYED CONDUCTIVITY SHOULD BE 0.

3.1.1 Remove the probe from the nutrient tank, rinse with deionized water (or equivalent) and then dry it off

Figure 3: EC Calibration Buttons on the EC Transmitter Boards

3.1.2 On the EC Transmitter Board

Press and hold the dry calibration button for 1.5 seconds. The screen will display “dry” during the calibration

3.1.3 Wait until the screen will display "DONE"

3.2 Low and High Calibration

3.2.1 If not already done

Remove the probe from the nutrient tank and rinse with deionized water (or equivalent)

3.2.2 Place the probe in the 1,413µs solution. Ensure that the bottom of the probe is completely submersed)

3.2.3 Wait until the conductivity readings stabilize

3.2.4 Press and hold the low calibration button for 1.5 seconds. The screen will display “Low” during calibration

3.2.5 Wait until the screen will display "DONE"

3.2.6 Remove the probe from the calibration solution and rinse with deionized water (or equivalent)

3.2.7 If required
repeat from step 3.2.2 to step 3.2.5 for the 12,880 µs solution

3.2.8 Reinstall the EC Sensors in the Bulk Solution Tank X

3.2.9 If required
repeat step 3.1 and then from step 3.2.2 to step 3.2.5 for the other Bulk Solution Tank

4 CLOSEOUT

4.1 Re-activate the pH and EC Control

In Tank 1(2) Equipment Control box

Cmd A Dosing Pump to **Automatic**
Cmd B Dosing Pump to **Automatic**
Cmd Solenoid FW Tank 1(2) **to Automatic**
Cmd Rec Pump Tank 1(2) **to Automatic**

In Shared Tank Equipment Control box

Cmd Acid Dosing Pump to **Automatic**
Cmd Acid Solenoid to **Automatic**
Cmd Base Dosing Pump to **Automatic**
Cmd Base Solenoid to **Automatic**
Cmd Pump FW to **Automatic**
Cmd Ozone Generator to **Automatic**

4.2 Stow the tools and items

4.500 Camera System Upgrade to 8MP

(EDEN ISS/CREW/NOMINAL/FIN)

OBJECTIVE

To replace one or more 4MP camera's with 8MP camera's within the FEG

DURATION

Depends on the number of camera's to be replaced

TOOLS

N/A

ITEMS

N/A

NOTE

1. THIS PROCEDURE WORKS ONLY WITH HIKVISION CAMERA'S. THE REPLACEMENT OF THE HIKVISION CAMERA'S WITH OTHERS OF A DIFFERENT BRAND REQUIRE A MORE COMPLEX ACTIVITY AND PROCEDURE
2. THE PROCEDURE IS WRITTEN FOR THE REPLACEMENT OF ONE SINGLE CAMERA. THE REPLACEMENT OF MORE CAMERA'S REQUIRE A MULTIPLE EXECUTION OF EACH STEP

1. 4MP CAMERA REMOVAL FROM THE FEG NETWORKS

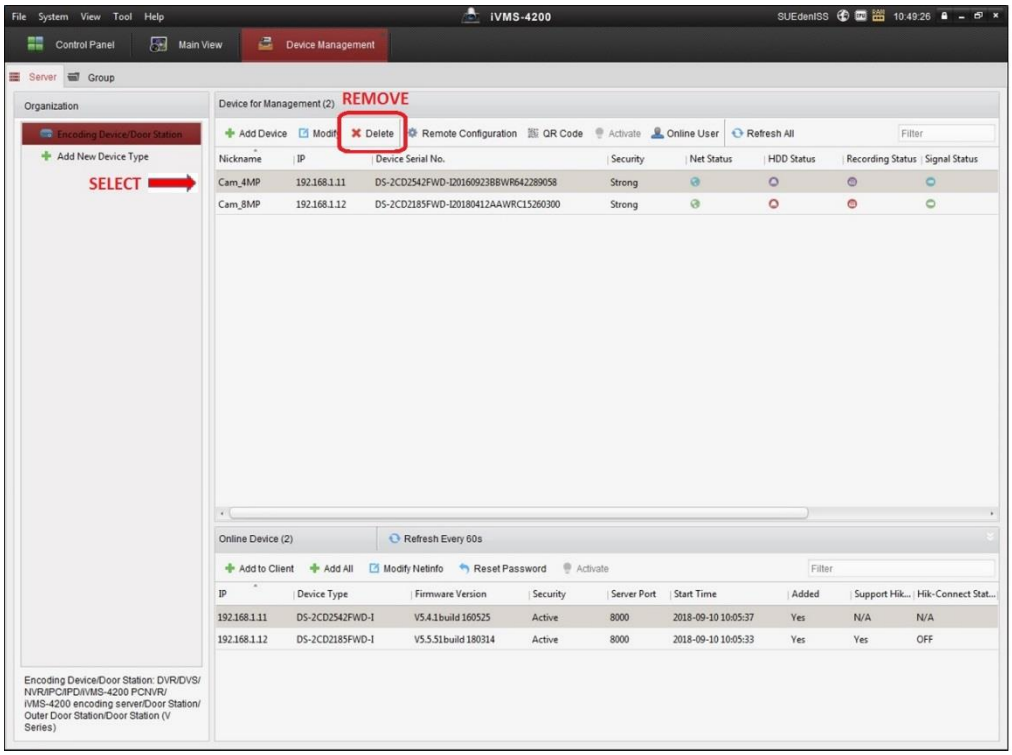


Fig.1: Camera removal from the FEG network

1.1 Remove the 2MP camera's from the iVMS-4200 client

Navigate to Device Management→ Server
Select the camera to be removed
Click on delete

Repeat for all the other camera's to be removed

1.2 Deinstall and stow the 4MP camera's (ANY detailed step required?)

2 8MP CAMERA INSTALLATION

NOTE

LOGGING THE CAMERA'S S/N VS THE POSITION IN THE FEG IS VERY IMPORTANT FOR THE CORRECT NETWORK PARAMETERS ASSIGNMENT)

2.1 Install the 8MP camera's (log the camera name and S/N vs the position in the FEG) (Any detailed step required?)

2.2 Upgrade the iVMS-4200 with the latest version available (it is provided with the 8MP camera – CD available in the camera package)

2.6 Perform the procedure 2.500 HD Cameras Configuration for Plant Monitoring (All)

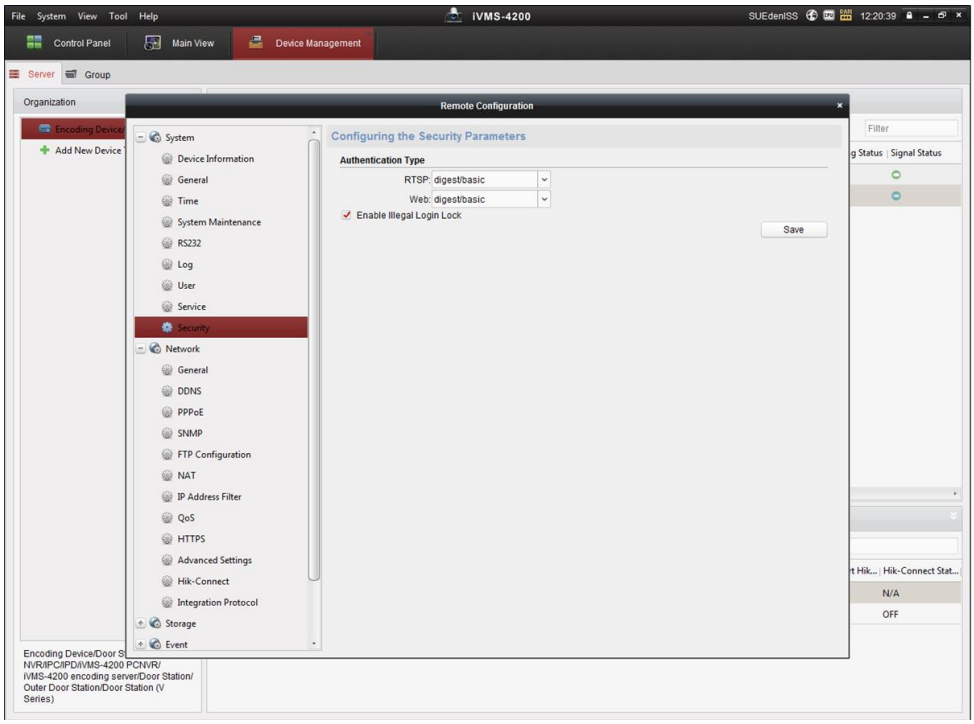


Figure 2: Configuring the Security Parameters

2.7 Configure the Security Parameters

Navigate to Remote Configuration
Select Security
In the Autentication Type Field
Select RTSP = digest/basic
Select Web = digest/basic
Click on Save

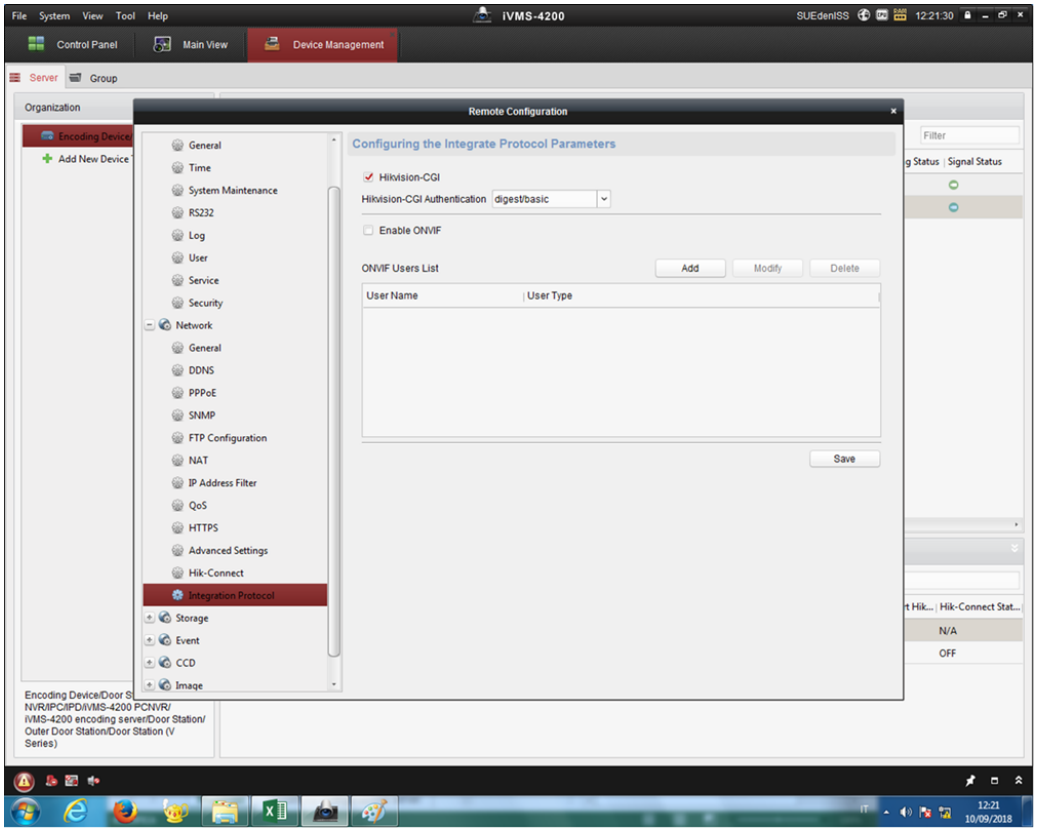


Figure 3: Configuring the Integrate Protocol Parameters

2.8 Configure the Integrate Protocol Parameters

Select Integration Protocol

In the Configuring the Integration Protocol Field
Check Hikvision CGI
Select HIKVISION-CGI Authentication = digest/basic
Click on Save

3 CLOSEOUT

Stow Items and tools
Resume the Imaging System Operations

ANNEX B: EDEN ISS Procedures in PRE Status

This Annex contains all the procedures that are still in Preliminary status.

Remark: the number pages reported in the index, is related to this annex and not to the whole document.

2.200 FEG Configuration for Plant Growth

(EDEN ISS/CREW/NOMINAL/PRE/HC)

OBJECTIVE

Configure the Future Exploration Greenhouse in preparation of Antarctica Operations.

DURATION

120 min

TOOLS

N/A

ITEMS

Fresh Water (20 litre tank)
Stock Solution A (4 litres bottle)
Stock Solution B (4 litre bottle)
Acid Solution (4 litre bottle)
Base Solution (4 litre bottle)
Protective Glasses
Protective Mask
Protective Gloves

NOTE

1. AT THIS STAGE IT IS SUPPOSED THAT:
    a. THE MTF IS CONFIGURED AND OPERATIVE, I.E. ALL THE ASSEMBLING ACTIVITIES HAVE BEEN COMPLETED, THE S/S TEST HAVE BEEN DONE WITH SUCCESS, AND THE MTF ENVIRONMENTAL PARAMETERS (TEMPERATURE, HUMIDITY, LIGHTING) ARE UNDER ARGUS CONTROL ALLOWING FOR MTF ABITABILITY
    b. THE SETUP OF THE TRAYS FOR HAS BEEN DONE AS PER THE FOLLOWING PROCEDURES:
        i. 2.100 PLANT SOWING
        ii. 2.110 PLANT TRANSFER TO GROWTH TRAYS

2. THIS PROCEDURE MANAGES TWO MAIN ASPECTS:
    a. THE PREPARATION OF THE NUTRIENT SOLUTION FOR THE CULTIVATION CYCLE
    b. THE SETUP OF THE FEG IN TERMS OF:
        i. ATMOSPERE MANAGEMENT SYSTEM (T, RH AND CO2, DAY/NIGHT CYCLE)
        ii. NUTRIENT DELIVERY SYSTEM SETUP (pH AND EC OF THE NUTRIENT SOLUTION, IRRIGATION CYCLE)
        iii. ILLUMINATION SYSTEM (LIGHT INTENSITY AND COMPOSITION, ILLUMINATION CYCLE)

3. THE INSTRUCTION FOR THE CAMERA SYSTEM SETUP ARE PROVIDED IN THE FOLLOWING TWO PROCEDURES:
    a. 2.500 VIDEOCAMERAS CONFIGURATION FOR PLANT MONITORING
    b. 2.510 EDEN ISS DATA AND IMAGES ACQUISITION AND TRANSFER

SS 1 ACTIVITY PREPARATION

1.1 Retrieve the items and tools

1.2 Verify the fresh water tank is filled

If the tank is empty than fill it. **PERFORM** Procedure "4.300 Fresh Water Tank Filling"

1.3 Verify the waste water is empty

If the tank is filled than empty it. **PERFORM** Procedure "4.310 Waste Water Tank Emptying"

SS 2 NUTRIENT SOLUTION PREPARATION

NOTE

THIS PART OF THE PROCEDURE APPLIES TO BOTH THE BULK SOLUTION TANK #1 AND THE BULK SOLUTION TANK #2. IN FACT, EVEN IF THEY COULD BE FILLED WITH TWO DIFFERENT NUTRIENT SOLUTIONS, THE OPERATION TO DO THAT IS THE SAME FOR THE TWO TANKS.

WARNING

1. POTENTIAL ELECTRICAL SHOCK HAZARD: THE ACTIVITIES HAVE TO BE DONE WITH THE NDS COMPONENT OFF
2. POTENTIAL CHEMICAL HAZARD: THE OPERATOR MUST WEAR INDIVIDUAL PROTECTIVE ITEMS (GLOVES, GLASSES AND MASK) DURING THE OPERATIONS

2.1 If the NDS components are active

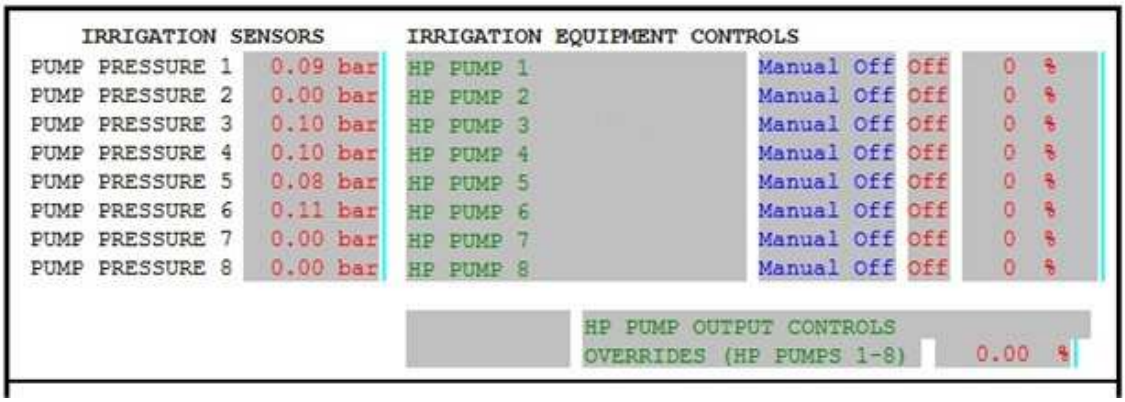


Figure 1: Nutrient Delivery System Display – Irrigation Equipment Control

2.1.1 In the Irrigation Equipment Control box

Turn **OFF** all high pressure aeroponic *pumps fed from* Tank 1(2) (Fig. 1):

Cmd HP1 Pump to **Manual Off**
Cmd HP2 Pump to **Manual Off**
Cmd HP3 Pump to **Manual Off**
Cmd HP4 Pump to **Manual Off**
Cmd HP5 Pump to **Manual Off**
Cmd HP6 Pump to **Manual Off**
Cmd HP7 Pump to **Manual Off**
Cmd HP8 Pump to **Manual Off**

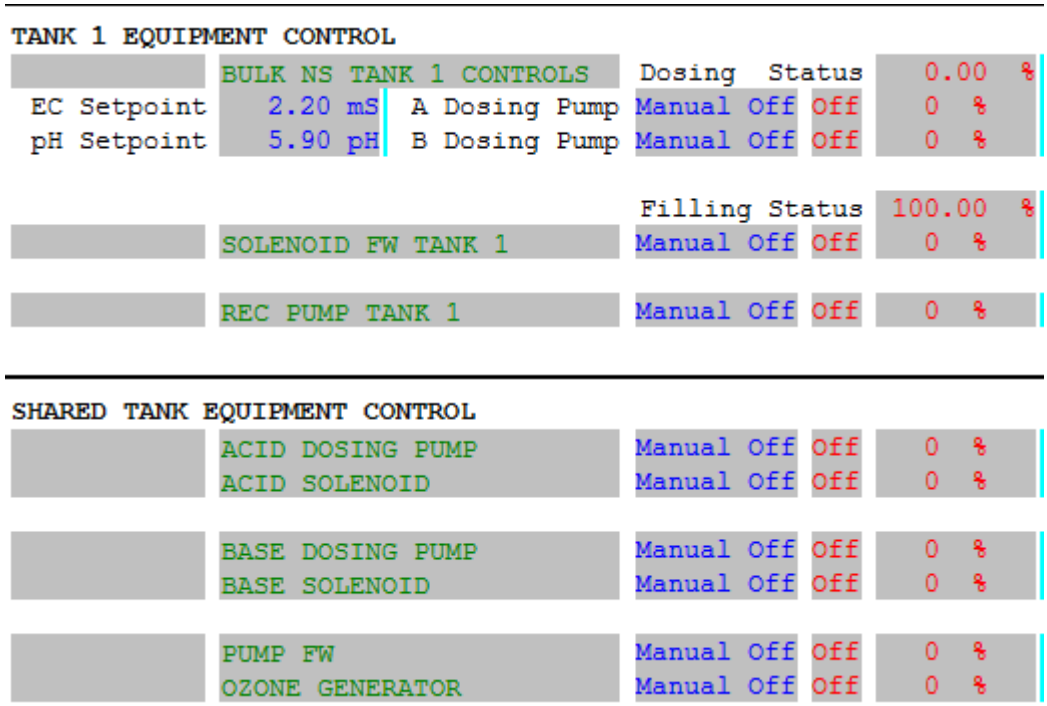


Figure 2: Nutrient Delivery System Display – Tanks Equipment Control

2.1.2 Turn OFF the Tanks Actuators (fig. 2):

In Tank 1(2) Equipment Control box

Cmd A Dosing Pump to **Manual Off**
Cmd B Dosing Pump to **Manual Off**
Cmd Solenoid FW Tank 1(2) **to Manual Off**
Cmd Rec Pump Tank 1(2) **to Manual Off**

In Shared Tank Equipment Control box

Cmd Acid Dosing Pump to **Manual Off**
Cmd Acid Solenoid to **Manual Off**
Cmd Base Dosing Pump to **Manual Off**
Cmd Base Solenoid to **Manual Off**
Cmd Pump FW to **Manual Off**
Cmd Ozone Generator to **Manual Off**

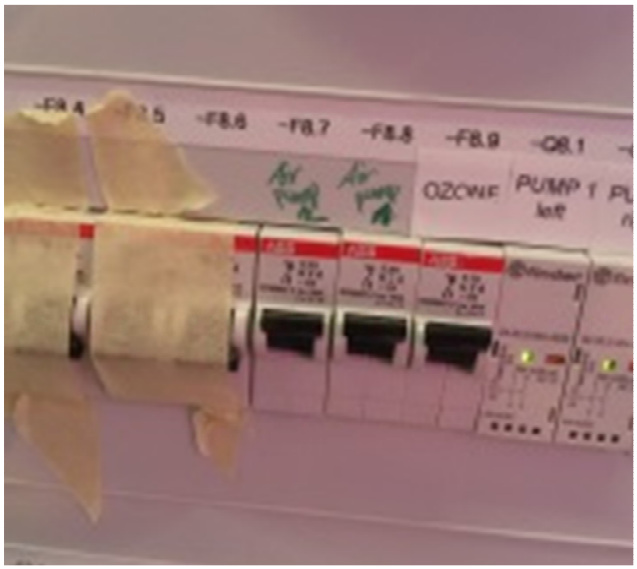


Figure 3: Power Rack Interface – NDS Service Section Line

2.1.3 On the Power Rack Interface – NDS Service Section Line (Fig. 3)

Switch OFF the Air Pump 1
Swicth OFF the Air Pump 2
Switch OFF the Circ Pump 1
Swicth OFF the Circ Pump 2

2.2 Wear appropriate Personal Protective Equipment (Gloves, Mask and Glasses)

Figure 4: NDS Rack – Stock, Acid and Base Solution Tank 2

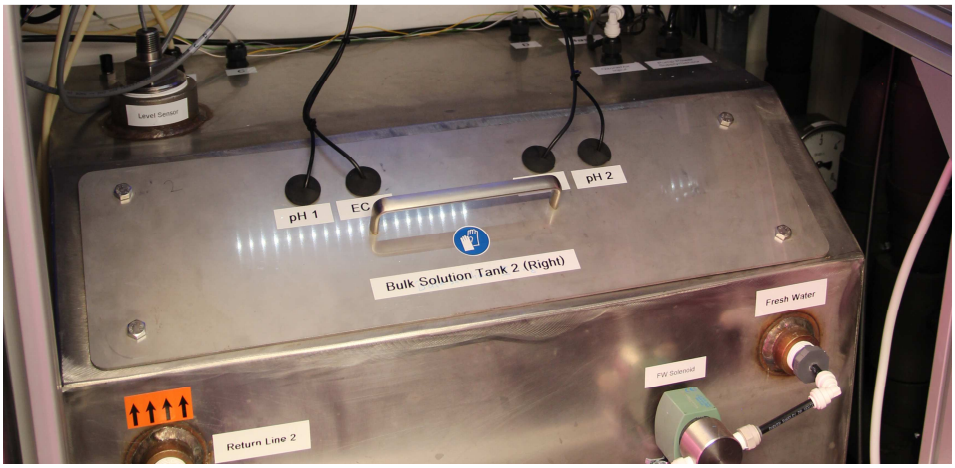


Figure 5: NDS Rack – Bulk Solution Tank 2

2.3 Fill the Stock, Acid And Basic tanks (Fig. 4)

2.4 Remove the Lid Panel from the Bulk Solution Tank 1(2) (Fig. 5)

Remark: The bolts are used to align the cover - no need to unscrew them

2.5 Take out one of the two EC sensors from the Bulk Solution Tank 1(2) lid panel

2.6 Fill Bulk Solution Tank 1(2) to about half way up with fresh water

2.7 Slowly dump into the Bulk Solution Tank 1(2) the pre-made 4 L Stock solution A (B)

NOTE

1. **<u>ELECTRICAL CONDUCTIVITY SETUP</u>.** EC TARGET VALID PARAMETERS ARE:
   a. Leafy Crops: 2.3 +/- 0.2 mS/cm2
   b. Fruit Crops: 3.5 +/- 0.2 mS/cm2
2. **<u>pH Setup.</u>** pH TARGET VALID PARAMETERS ARE FROM 5.2 TO 6.5

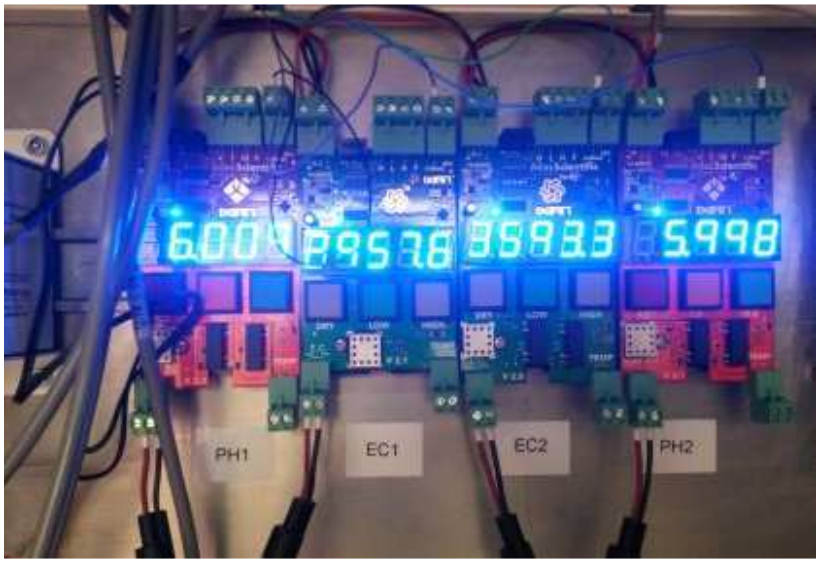


Fig. 6: pH and EC transmitters

2.8 While watching the EC values (Fig. 6) acquired by means of the removed EC sensor, slowly add fresh water into the NDS tank (1/2) until the EC value is close to the required range

2.9 Reinstall the lid panel on the Bulk Solution Tank 1(2)

2.10 Reinstall the EC sensor in the Bulk Solution Tank 1(2) lid panel

2.11 Take off the protective gloves, mask and glasses

2.12 On the Power Rack Interface – NDS Service Section Line (Fig. 3)

Switch ON the Air Pump 1
Swicth ON the Air Pump 2
Switch ON the Circ Pump 1
Swicth ON the Circ Pump 2

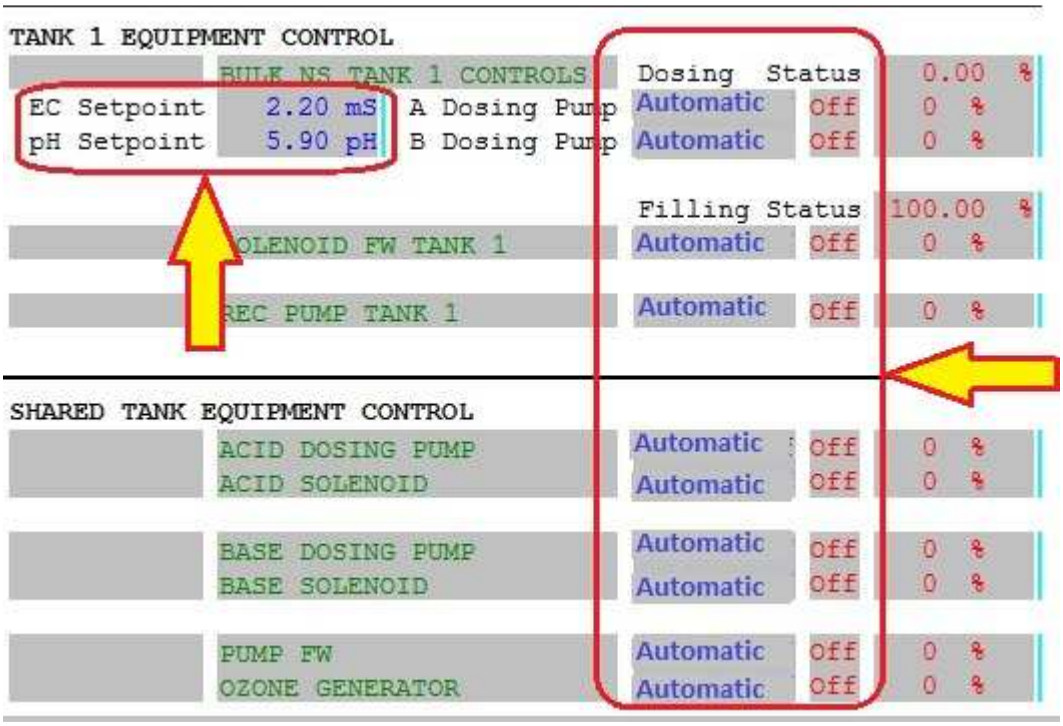


Figure 7: Nutrient Delivery System Display – Tanks Equipment Control. NDS Configuration

2.13 Turn ON the Tanks Actuators and input the EC and pH Setpoints (Fig. 7):

In Tank 1(2) Equipment Control Control box

Input EC Setpoint = as required
Input pH Setpoint = as required

Cmd A Dosing Pump to **Automatic**
Cmd B Dosing Pump to **Automatic**
Cmd Solenoid FW Tank 1(2) **to Automatic**

Cmd Rec Pump Tank 1(2) **to Automatic**

In Shared Tank Equipment Control box

Cmd Acid Dosing Pump to **Automatic**
Cmd Acid Solenoid to **Automatic**
Cmd Base Dosing Pump to **Automatic**
Cmd Base Solenoid to **Automatic**
Cmd Pump FW to **Automatic**
Cmd Ozone Generator to **Automatic**

2.14 After 30 minutes, verify on the pH and EC transmitters that the pH and the EC have been adjusted to the defined target

If the EC and/or the pH are out of range
PERFORM procedure 5.600 NDS pH and EC Setting Failure

NOTE

1. EACH OF THE EIGHT NDS RACKS CAN BE SET TO RECEIVE NUTRIENT SOLUTION FROM EITHER TANK 1 OR TANK 2. TO CHANGE THE SOURCE SOLUTION, BOTH THE FEED VALVE AND THE RETURN VALVE MUST BE SWITCHED TO THE APPROPRIATE TANK. TO CHANGE THE FEED VALVE FOR ANY RACK, REFER TO THE DIAGRAM OF VALVE POSITION (FIG. 9)

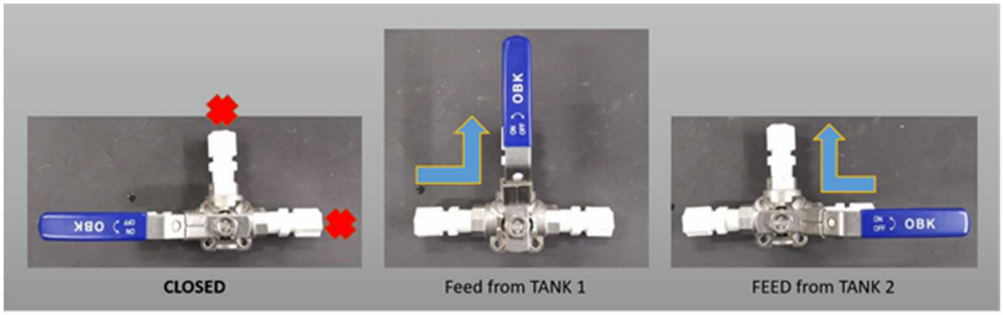


Figure 8: NDS feed tank valve positions

THE CORRESPONDING WASTE VALVE MUST ALSO BE CHANGED. REFER TO THE VALVE DIAGRAM BELOW FOR THE CORRECT POSITIONING OF THE VALVE HANDLE.

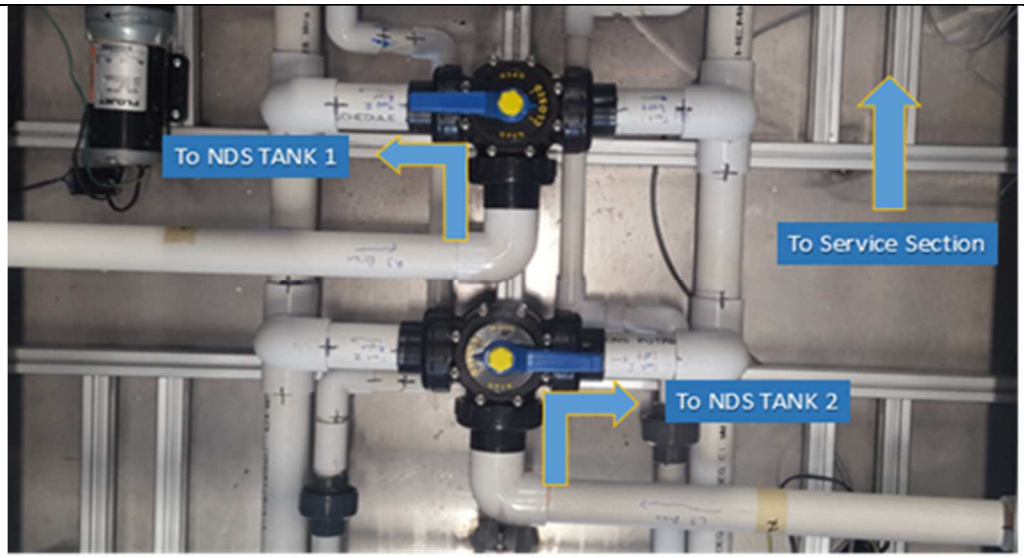


Figure 9: NDS waste valve position

2. CREW WILL BE INSTRUCTED BY **MCC** ON THE VALVE CONFIGURATION BEFORE THE ACTIVITY STARTS
3. THE VALVES ARE UNDER THE FEG FLOOR. THE FEG FLOOR HAS TO BE REMOVED TO ACCESS THEM

2.15 Configure the NDS feed tank valve position as required (example in fig. 8)

2.16 Configure the Waste valve position as required (example in fig. 9)

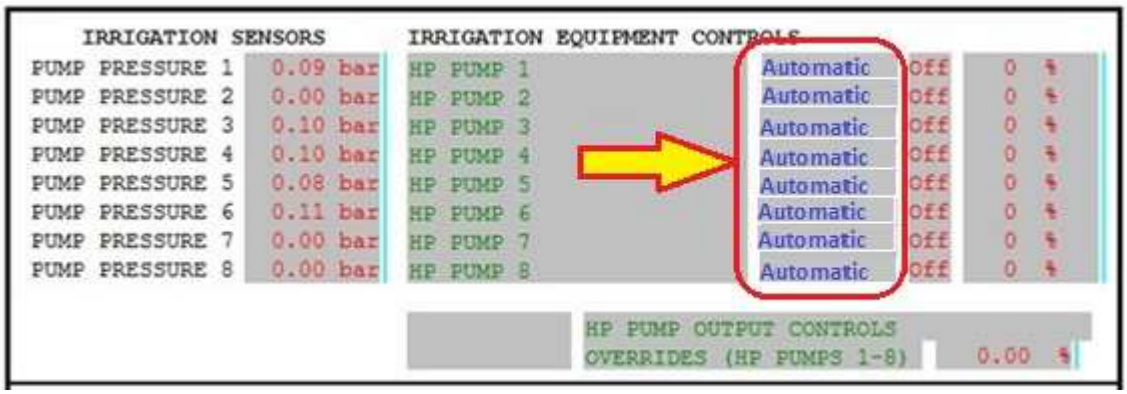


Figure 10: Nutrient Delivery System Display – Irrigation Equipment Control Configuration

2.17 Turn **ON** all high pressure aeroponic *pumps fed from* Tank 1(2) (Fig. 10):

In the Irrigation Equipment Control box

Cmd L1 HP Pump to **Automatic**
Cmd L2 HP Pump to **Automatic**
Cmd L3 HP Pump to **Automatic**
Cmd L4 HP Pump to **Automatic**
Cmd R1 HP Pump to **Automatic**

Cmd R2 HP Pump to **Automatic**
Cmd R3 HP Pump to **Automatic**
Cmd R4 HP Pump to **Automatic**

2.18 **Irrigation pump timing (TBW – input missing)**

3 FEG ATMOSPHERE PARAMETERS SETUP FOR PLANT CULTIVATION

NOTE

1. **TEMPERATURE, RELATIVE HUMIDITY AND CO2** CONTROL IS DIVIDED INTO DAY AND NIGHT PERIODS. FOR CONSTANT PARAMETERS OPERATION, DAY CONTROL SHOULD BE SET TO ENABLED AND NIGHT CONTROL TO DISABLED. FOR DAY/NIGHT TEMPERATURE DIFFERENCES, BOTH ARE SET TO ENABLE WITH AT LEAST ONE DIFFERENT SETPOINT. SCHEDULE TIMES SHOULD NOT OVERLAP. AN ALARM WILL SOUND IF THIS IS THE CASE.
2. **TEMPERATURE SETUP.** FOR EACH PERIOD THERE IS A COOLING TARGET AND A HEATING TARGET. THE MINIMUM SEPARATION BETWEEN THE TWO VALUES SHOULD BE NO LESS THAN 1.0 C. IF CONTROL IS SET TOO TIGHT, HEATING AND COOLING CONTROL WILL OSCILLATE. FOR EXAMPLE, IF A DAY TIME TEMPERATURE OF 22.0 C IS DESIRED, THE HEATING TARGET SHOULD BE SET TO 21.5 C AND THE COOLING TARGET SET TO 22.5 C
3. **RELATIVE HUMIDITY SETUP**. FOR EACH PERIOD THERE IS A DEHUMIDIFY TARGET AND A HUMIDIFY TARGET. THE MINIMUM SEPARATION BETWEEN THE TWO VALUES SHOULD BE NO LESS THAN 5%. FOR EXAMPLE, IF A DAY TIME HUMIDITY OF 65% IS DESIRED, THE DEHUMID TARGET SHOULD BE SET TO 67.5% AND THE HUMIDIFY TARGET SET TO 62.5%.
4. **CO_2 SETUP.** CO_2 TARGET VALID PARAMETERS ARE FROM 0 TO 2000 PPM. TO ENABLE CO_2 CONTROL, THE CO_2 INJECTION VALVE AUTOMATIC CONTROL HAS TO BE ENABLED IN THE AMS DISPLAY

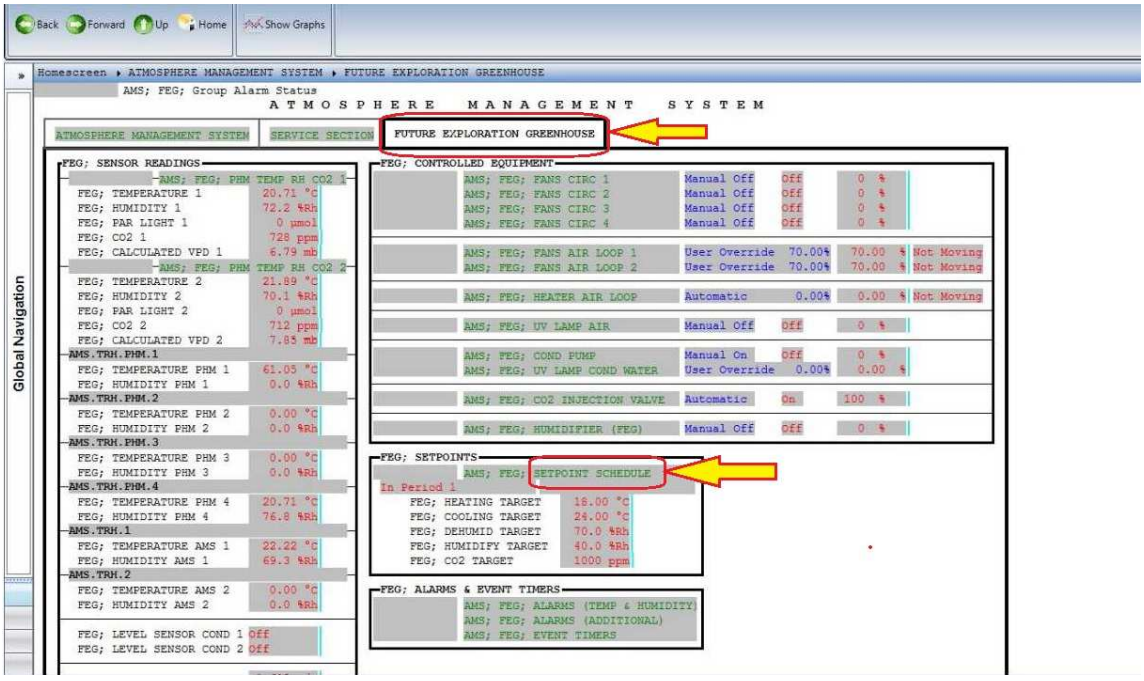


Figure 11: Atmosphere Management System Display – Navigation to SETPOINT SCHEDULE

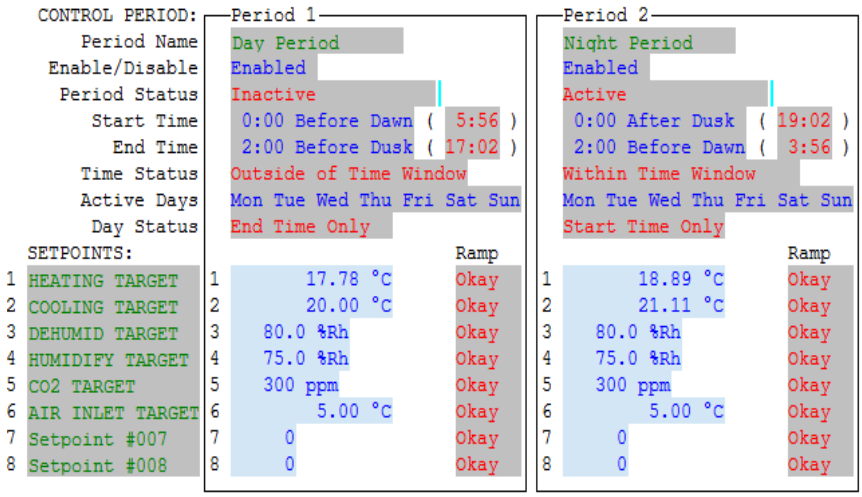


Fig. 12: SETPOINT SCHEDULE page.

3.1 In the **ATMOSPHERE MANAGEMENT SYSTEM** Display, open the **FUTURE EXPLORATION GREENHOUSE** Page and then click to the **SETPOINT SCHEDULE** tab (Fig. 11). The SETPOINT SCHEDULE page will open (Fig. 12)

3.2 In the SETPOINT SCHEDULE page input the **CONTROL PERIOD** parameters, in **both** the fields **Period 1** and **Period 2,** as required

Input Enable/Disable = as required
Input Start time = as required
Input End Time = as required
Input Active Days = as required
Input HEATING TARGET = as required
Input COOLING TARGET = as required
Input DEHUMID TARGET = as required
Input HUMIDIFY TARGET = as required
Input CO2 TARGET = as required
Input AIR INLET TARGET = as required
Input Setpoint #007 = 0
Input Setpoint #008 = 0

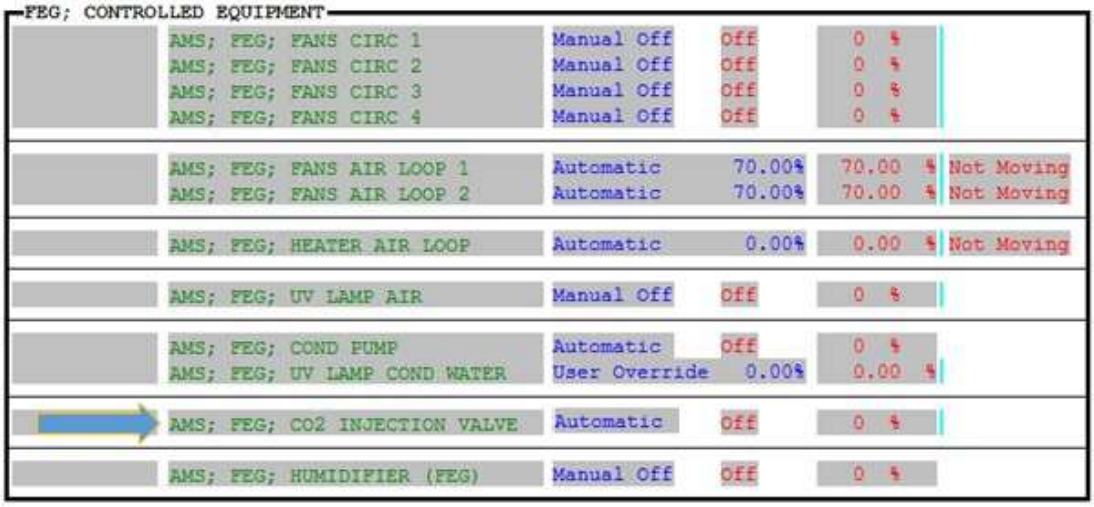


Figure 13: FEG Controlled Equipment Box – Enable the automatic Control of the CO2 Injection Valve

3.3 In the FEG; CONTROLLED EQUIPMENT BOX

Cmd AMS; FEG; FANS CIRC 1 to **Automatic**
Cmd AMS; FEG; FANS CIRC 2 to **Automatic**
Cmd AMS; FEG; FANS CIRC 3 to **Automatic**
Cmd AMS; FEG; FANS CIRC 4 to **Automatic**
Cmd FANS AIR LOOP 1 to **Automatic 70%**
Cmd FANS AIR LOOP 2 to **Automatic 70%**
Cmd HEATER AIR LOOP to **Automatic**
Cmd UV LAMP AIR to **Automatic**
Cmd COND PUMP to **Automatic**
Cmd UV LAMP COND WATER to **Automatic**
Cmd AMS; FEG; CO2 INJECTION VALVE to **Automatic**
Cmd FEG HUMIDIFER: **Manual Off**

4 ILLUMINATION SYSTEM SETUP

NOTE

1. THE ILLUMINATION SYSTEM IS OPERATED BY ARGUS PROVIDED THAT IT IS CONFIGURED AND THAT THE AUTOMATIC MODE IS SELECTED. EACH LED LAMP UNIT CAN BE CONFIGURED INDEPENDENTLY IN TERMS OF LED INTENSITY, LIGHT COMPOSITION AND ILLUMINATION CYCLES DEFINITION
2. THE CONFIGURATION PARAMETERS OF THE LED LAMPS UNIT WILL BE PROVIDED BY MCC BEFORE THE OPERATIONS STARTS
3. THE FOLLOWING FIGURES REFERS TO THE LED LAMP UNIT NAMED “L1-2R”. THE PROCEDURE STEPS REFERS TO A GENERIC LED LAMP UNIT

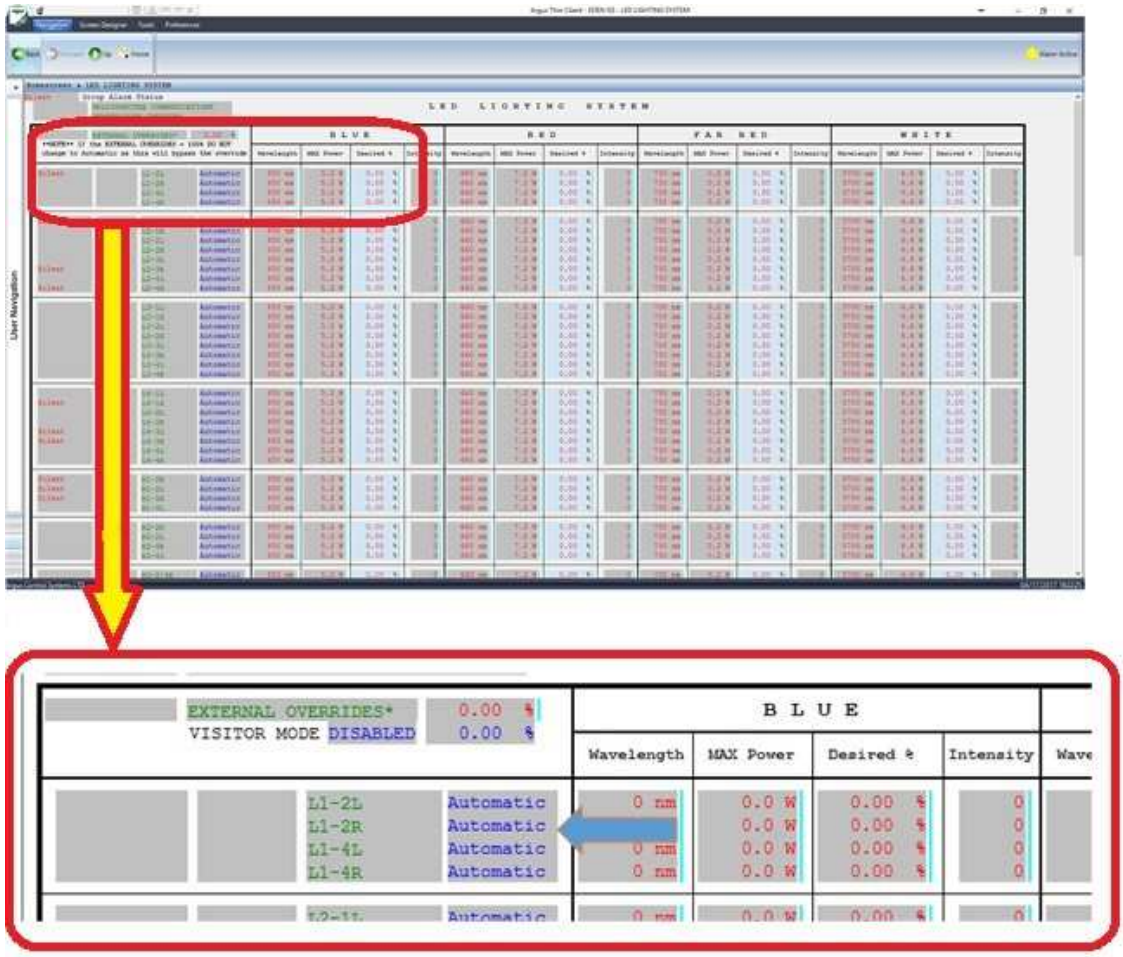


Fig. 14: LED Lighting System Display – Main Page

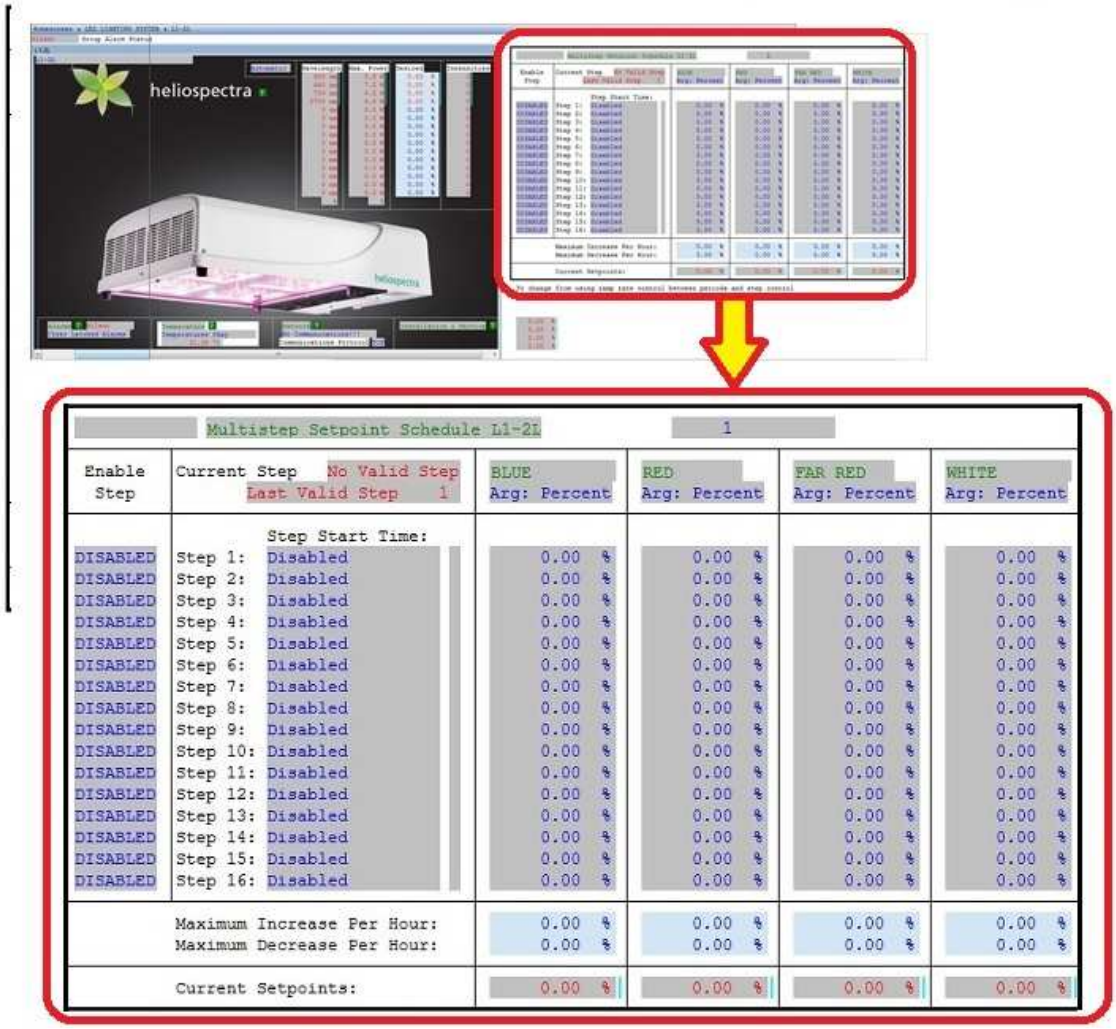


Fig. 15: LED Lighting System Display – LED Lamp Unit Configuration

4.1 Configure the LED Lamp Units as per MCC instructions (Fig. 15).

On the LED Lighting System Display

Click on the desired LED Lamp Unit. The LED Lamp Unit Window will open

In the LED Lamp Unit Window

For **i** = 1 to 16
Input Enable Step = as required
Input Step Start Time = as required
Input BLUE (Arg. Percent) = as required
Input RED (Arg. Percent) = as required
Input FAR RED (Arg. Percent) = as required
Input WHITE (Arg. Percent) = as required
Input Maximum Increase per hours **=** as required
Input Maximum Decrease per hours = as required

4.2 On the LED Lighting System Display

Cmd LED Panel Unit to Automatic

4.3 Repeat Steps 4.1 and 4.2 for the other LED Lamp Units as required

5 CLOSEOUT

5.1 Stow items and tools

3.212 Safety Analysis Using the Micro Biological Survey Method

(EDEN ISS/CREW/SCIENCE/PRE/HC)

OBJECTIVE

Perform the Safety analysis using the rapid Micro Biological Survey (MBS) Method

DURATION

Sample preparation (30 minutes)
Results (sample dependent 3 to 67 hours))

TOOLS

Sterile twezers

ITEMS

MBS Kit (containing the reaction vial and a vial of distilled water)
Protective Glass
Nitrile Gloves
Protective Respirator Mask

NOTE

1. THE MICRO BIOLOGICAL SURVEY (MBS) METHOD IS AN INNOVATIVE RAPID COLORIMETRIC SYSTEM TO PERFORM MICROBIOLOGICAL TESTS ON FOOD, WATER AND SURFACES. THE METHOD OF ANALYSIS IS BASED ON THE OBSERVATION OF THE CHANGE OF COLOR IN THE SUSPENSION FORMED IN THE ANALYSIS VIAL USED WHEN THE TEST SAMPLE IS ADDED: THE SUSPENSION CHANGES COLOR IF THERE ARE MICROORGANISMS, THE GREATER THE AMOUNT OF MICROORGANISMS, THE MORE RAPID THE CHANGE OF COLOR
2. SELECTED REAGENTS FOR THE SELECTIVE SEARCH OF THE FOLLOWING MICROORGANISMS ARE:
   - CBT-A01 (TOTAL VIABLE COUNT)
   - CO-A02 (COLIFORMS)
   - EC –A22 (ESCHERICHIA COLI)
   - SL-A06 (SALMONELLA SPP.)
   - LY-A07 (LISTERIA SPP.)

   OTHER REAGENTS ARE AVAILABLE, BUT THEY ARE NOT APPLICABLE TO VEGETABLES

1 ACTIVITY PREPARATION

WARNING

THE OPERATIONS WITH THE IDENTIFIED REAGENTS ARE CORRELATED WITH SEVERAL HAZARDS AS DESCRIBED IN THE REAGENTS SAFETY DATA SHEETS. THE MITIGATION OF SUCH HAZARDS REQUIRES THE ADOPTION OF SEVERAL PRECAUTIONS AS LISTED BELOW:

- REAGENTS SHALL BE USED/STORED AWAY FROM HEAT, HOT SURFACES, SPARKS, OPEN FLAMES AND OTHER IGNITION SOURCES
- SMOKING IS FORBIDDEN DURING THE HANDLING OF REAGENTS
- CREW SHALL WEAR WEAR PROTECTIVE GLOVES/ PROTECTIVE CLOTHING/ EYE PROTECTION/ FACE PROTECTION DURING THE OPERATIONS

- REAGENT SHALL NOT BE RELEASED TO THE ENVIRONMENT.

NOTE
BEFORE HANDLING THE VIALS AND PROCEEDING WITH THE ANALYSIS A THOROUGH HAND WASHING IS RECOMMENDED.

1.1 Retrieve the MBS kit from storage with the selected reagent

1.2 Carefully wash your hand

1.3 Don Gloves

1.4 Don Protective Glass

1.5 Don Protective Mask

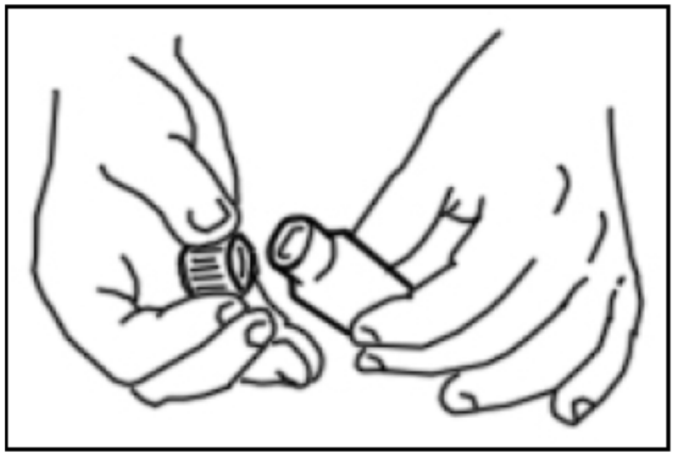


Figure 1: Reagent Vial Opening

1.6 Open the vial, taking care to flip the cap so that the inner surface does not come into contact with the surface to avoid contamination.

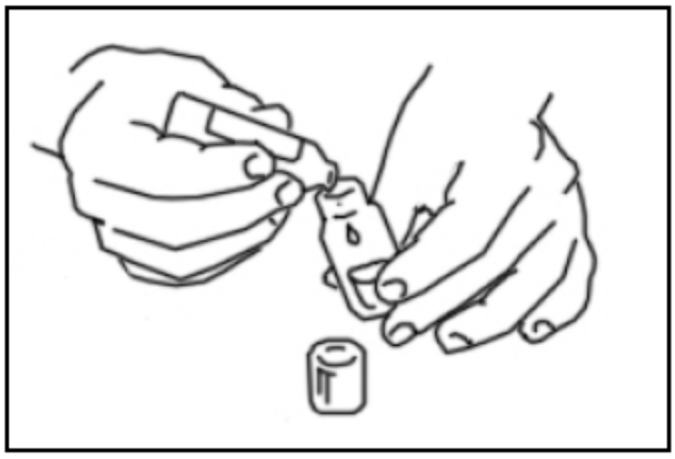


Figure 2: Reagent preparation

1.7 Open the vial of water supplied with the reaction vial, and insert the entire contents of the vial itself. Mix by shake the vial until the reagent is completely dissolved and no solid powder is present (20 seconds using a vortex)

1.8 Wait 10 minutes. After that the reagent is ready for use.

2 ANALYSIS EXECUTION

NOTE

1. THE SIZE OR THE EXACT WEIGHT OF THE SAMPLE TO BE EXAMINED IS NOT SO IMPORTANT. HOWEVER, THE SAMPLE MUST BE REDUCED TO A VERY SMALL PARTS (MAXIMUM SIZE 2-3 MM)
2. FOR INSERTING THE SAMPLE INTO THE VIAL, WE RECOMMEND USING A TOOL USED DURING THE PROCESSING OF THE FOOD ITSELF, SINCE BY SO DOING, YOU WILL BE ABLE TO DETECT ANY CONTAMINATION OF THE FOOD DUE TO EXTRINSIC CAUSES.

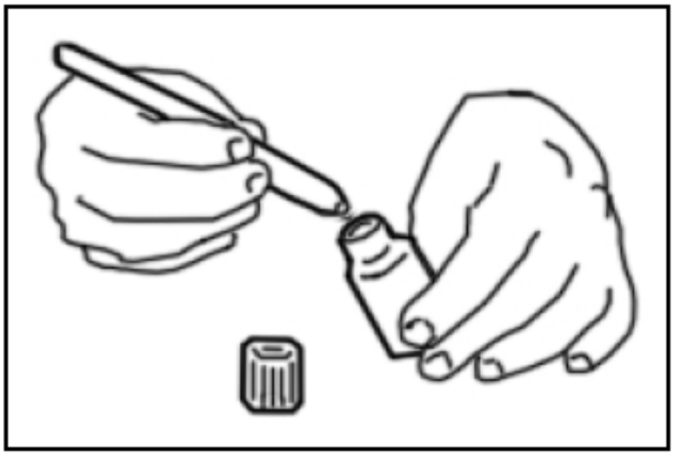


Figure 3: Inserting the sample in the vial

2.1 Take a small part of the vegetable (about the volume of a grain of corn, approximately corresponding to 1 g) with a tool used during the processing of the food itself and insert it into the vial (alternatively you can use sterile tweezers)

2.2 Accurately mix the sample with the solution contained into the vial by inverting the vial several times.

NOTE

THE INCUBATOR TEMPERATURE AND THE INCUBATION DURATION ARE DEFINED AS FOLLOW:

REAGENT	U.M	Limit of Acceptability	TEMP. (degC)	TIME OF OBSERVATION (hh.min)
TOTAL VIABLE COUNT	CFG/g	10^7	30	03:00
COLIFORMS	CFU/g	10^3	37	16:35
ESCHERICHIA COLI	CFU/g	10^3	44	26:00
SALMONELLA SPP	CFU/g	0	37	67:00

LISTERIA SPP	CFU/25g	0	37	36:00

ANY CHANGE IN THE COLOUR OF THE SOLUTION BEFORE THIS TIME REPRESENT A LEVEL OF CONTAMINATION HIGHER THAN THE ACCEPTABLE LIMITS. SHORTER IS THE TIME, HIGHER IS THE LEVEL OF CONTAMINATION.

2.3 Place the vial in the incubator thermostat and setup the temperature as per reagent requirement

2.4 Log the activity in the log journal

2.5 Wait the needed time as defined per reagent

3 RESULTS EVALUATION

NOTE

1. FOR LONG TIME OF OBSERVATION IT IS RECOMMENDED TO HAVE INTERMEDIATE CHECK'S.
2. THE ANALYSIS RESULT IS POSITIVE IF, AND ONLY IF, OCCURS A COMPLETE COLOR CHANGE OF THE VIAL CONTENT
3. THE COLOR PALETTE, AS WELL OTHER RELEVENT INFORMATIONS ARE PROVIDED AS ANNEX TO THIS PROCEDURE.

3.1 Check periodically for color status. Log on the log journal the time and the results of the observation. Report to MCC at the end.

4 POST-ANALYSIS STERILIZATION

NOTE

1. STERILIZATION OF THE VIALS IS REQUIRED BEFORE THE DISPOSAL
2. THE ADDITION OF THE STERILIZING AGENT CAN CAUSE A FURTHER COLOR CHANGE

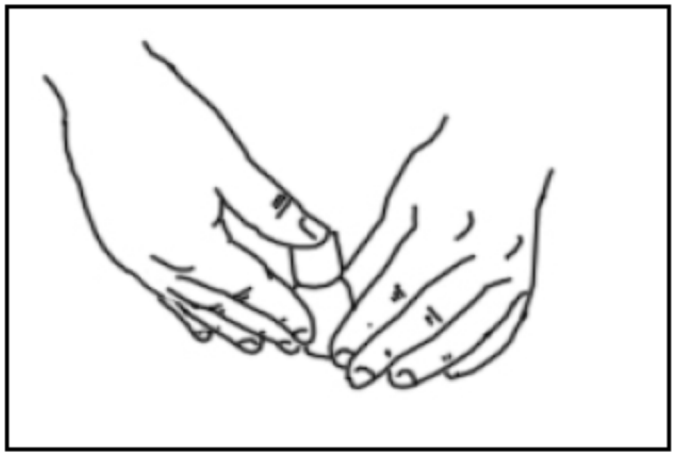


Figure 4: Sterilization

4.1 After analysis, without opening the vial, firmly press the top of the cap and shake for about 10 seconds. After 5-10 minutes the contents of the vial is completely sterilized

4.2 Waste the vials according to the NMIII disposal procedures

ANNEX 1: CBT-A01 - TOTAL VIABLE COUNT CONTROL SHEET

MBS
MICRO BIOLOGICAL SURVEY

TOTAL VIABLE COUNT CONTROL SHEET

CBT-A01

SCQ CBT-A01 (30) 16.01

ANALYTICAL METHOD	Detection of aerobic or microaerophilic mesophilic microorganisms which are able to grow on complete media.
MBS - MICRO BIOLOGICAL SURVEY	

INCUBATION TEMPERATURE	COLOR OF ANALYSIS AT START			COLOR OF ANALYSIS AT END		POSITIVE			NEGATIVE		
30 °C											

	CONTAMINATION [CFU/g] [CFU/ml] [CFU/100cm²]	10^8	10^7	10^6	10^5	10^4	10^3	10^2	10	1	0
TIME OF COLOR CHANGE [hour. minutes]	Water	-	-	-	-	-	-	-	-	-	-
	Meat	< 2.30	2.30	7.00	11.20	16.00	20.50	25.00	30.00	34.00	36.00
	Fish	< 2.00	5.00	8.30	12.15	16.00	19.30	23.20	27.00	31.00	36.00
	Dairy product	< 2.30	2.30	6.00	9.40	13.15	16.45	20.20	24.00	27.30	36.00
	Vegetables	< 3.00	3.00	6.30	10.00	13.30	17.00	20.20	23.50	27.15	36.00
	Other	< 3.00	6.50	10.00	14.00	17.20	20.50	24.30	28.00	32.00	36.00
	Surfaces	< 3.00	6.50	10.00	14.00	17.20	20.50	24.30	28.00	32.00	36.00

QUANTITATIVE ANLAYSIS

According to main standards and EU Regulations.

TYPE OF SAMPLE	U.M.	LIMIT OF ACCEPTABILITY	TIME OF OBSERVATION [hours.minutes]
FOOD			
Raw meat and preparations of meat	CFU/g	10^6	7.00
Milk and dairy products	CFU/ml	10^6	6.00
Fresh vegetables; precut vegetables (ready to eat)	CFU/g	10^7	3.00
Egg prooducts	CFU/g	10^5	14.00
Ice-cream; bakery products	CFU/g	10^5	14.00
Cooked and stewed products	CFU/g	10^4	17.20
First and second courses cooked, served hot and cold	CFU/g	10^6	10.00
Frozen fishery products	CFU/g	10^6	8.30
Frozen meat and preparations of meat	CFU/g	10^6	7.00
Pre-cooked frozen dishes	CFU/g	10^5	14.00
Frozen vegetables	CFU/g	10^6	6.30
SURFACES			
Worktops; tools	CFU/cm²	10^2	17.20
Hands	CFU/cm²	10^3	14.00

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ANNEX 2: CO-A02 - COLIFORMS CONTROL SHEET

MBS
MICRO BIOLOGICAL SURVEY

COLIFORMS CONTROL SHEET

SCQ CO-A02 (37) 17.01

CO-A02

ANALYTICAL METHOD	Rod-shaped aerobic, Gram-negative, non spore-forming, cytochrome oxidase negative microorganism; fermenting lactose with production of acids in the presence of bile salts or other surfactants.
MBS - MICRO BIOLOGICAL SURVEY	

INCUBATION TEMPERATURE	COLOR OF ANALYSIS AT START			COLOR OF ANALYSIS AT END		POSITIVE			NEGATIVE		
37 °C											
CONTAMINATION [CFU/g] [CFU/ml] [CFU/100cm²]	10^8	10^7		10^6	10^5	10^4	10^3	10^2	10	1	0
TIME OF COLOR CHANGE [hours.minutes] Water	< 3.00	< 3.00		< 3.00	< 3.00	3.10	9.25	15.35	21.50	28.15	36.00
Meat	< 4.00	< 4.00		4.10	8.20	12.30	16.35	20.50	25.00	29.10	36.00
Fish	< 4.00	< 4.00		4.10	8.20	12.30	16.35	20.50	25.00	29.10	36.00
Dairy product	< 4.00	< 4.00		4.10	8.20	12.30	16.35	20.50	25.00	29.10	36.00
Vegetables	< 4.00	< 4.00		4.10	8.20	12.30	16.35	20.50	25.00	29.10	36.00
Other	< 4.00	< 4.00		4.10	8.20	12.30	16.35	20.50	25.00	29.10	36.00
Surfaces	< 4.00	< 4.00		4.10	8.20	12.30	16.35	20.50	25.00	29.10	36.00

QUANTITATIVE ANALYSIS

According to main standards and EU Regulations

TYPE OF SAMPLE	U.M.	LIMIT OF ACCEPTABILITY	TIME OF OBSERVATION [hours.minutes]
FOOD			
Raw meat	CFU/g	10^3	9.25
Raw milk and products made from raw milk	CFU/ml	10^5	8.20
Milk and products made from milk	CFU/ml	10^3	16.35
Egg products	CFU/g	10^3	16.35
Fresh vegetables	CFU/g	10^3	16.35
Preparations of mixed ingredients (ready to eat)	CFU/g	10^2	20.50
First and second courses cooked, served hot and cold	CFU/g	10	25.00
Frozen precooked dishes	CFU/g	10^5	8.20
SURFACES			
Worktops; tools	CFU/cm²	10	16.35
Hands	CFU/cm²	10^2	12.30

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ANNEX 3: EC-A22 – ESCHERECHIA COLI CONTROL SHEET

MBS
MICRO BIOLOGICAL SURVEY

Escherichia coli CONTROL SHEET

EC-A22

SCQ EC-A22 (44) 17.01

ANALYTICAL METHOD	Rod-shaped aerobic, Gram-negative, non spore-forming, cytochrome oxidase negative microorganism; fermenting lactose with production of acids in the presence of bile salts or other surfactants; at a temperature of 44 °C produce indole from tryptophan.
MBS - MICRO BIOLOGICAL SURVEY	

INCUBATION TEMPERATURE	COLOR OF ANALYSIS AT START			COLOR OF ANALYSIS AT END		POSITIVE			NEGATIVE		
44 °C											
CONTAMINATION [CFU/g] [CFU/ml] [CFU/100cm²]	10^8	10^7		10^6	10^5	10^4	10^3	10^2	10	1	0
TIME OF COLOR CHANGE [hours.minutes]											
Water	< 3.00	< 3.00		< 3.00	3.10	9.40	15.40	21.50	28.10	34.20	40.00
Meat	< 3.00	< 3.00		7.15	13.30	19.45	26.00	35.15	38.30	44.50	48.00
Fish	< 3.00	< 3.00		7.15	13.30	19.45	26.00	35.15	38.30	44.50	48.00
Dairy product	< 3.00	< 3.00		7.15	13.30	19.45	26.00	35.15	38.30	44.50	48.00
Vegetables	< 3.00	< 3.00		7.15	13.30	19.45	26.00	35.15	38.30	44.50	48.00
Other	< 3.00	< 3.00		7.15	13.30	19.45	26.00	35.15	38.30	44.50	48.00
Surfaces	< 3.00	< 3.00		7.15	13.30	19.45	26.00	35.15	38.30	44.50	48.00

QUANTITATIVE ANALYSIS

According to main standards and EU Regulations

TYPE OF SAMPLE	U.M.	LIMIT OF ACCEPTABILITY	TIME OF OBSERVATION [hours.minutes]
FOOD			
Fresh pastry and backery products	CFU/g	10	38.30
Raw meat; minced meat; preparations of meat	CFU/g	10^2	35.15
Fishery products, seafood, shellfish	CFU/g	10	38.30
Egg products	CFU/g	10^2	35.15
Milk and products made from milk	CFU/g	10^2	35.15
Precut vegetables (ready to eat); fruit juice	CFU/g	10^3	26.00
Preparations of mixed ingredients cooked (ready to eat)	CFU/g	10	38.30
Preparations of mixed ingredients not cooked (ready to eat)	CFU/g	10^2	35.15
SURFACES			
Worktops; tools	CFU/cm²	10	26.00
Hands	CFU/cm²	10	26.00
WATER			
Water for human consumption	CFU/100ml	0	40.00
Water for human consumption placed in bottles or containers	CFU/250ml	0	40.00

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ANNEX 4: SL-A06 – SALMONELLA SLL CONTROL SHEET

MBS
MICRO BIOLOGICAL SURVEY

Salmonella spp. CONTROL SHEET

SL-A06

SCQ SL-A06 (37) 16.01

ANALYTICAL METHOD	Gram-negative, aerobic-anaerobic facultative enterobacteria, able to ferment mannitol. Catalase positive, produce hydrogen sulfide, reduce nitrate to nitrite.
MBS - MICRO BIOLOGICAL SURVEY	

INCUBATION TEMPERATURE	COLOR OF ANALYSIS AT START			COLOR OF ANALYSIS AT END		POSITIVE			NEGATIVE		
37 °C											
CONTAMINATION [CFU/g] [CFU/ml] [CFU/100cm²]	10^0	10^7		10^6	10^5	10^4	10^3	10^2	10	1	0
TIME OF COLOR CHANGE [hours.minutes] Water	< 10.00	< 10.00		< 10.00	11.00	22.10	33.15	44.20	55.30	66.30	67.00
Meat	< 10.00	< 10.00		< 10.00	11.00	22.10	33.15	44.20	55.30	66.30	67.00
Fish	< 10.00	< 10.00		< 10.00	11.00	22.10	33.15	44.20	55.30	66.30	67.00
Dairy product	< 10.00	< 10.00		< 10.00	11.00	22.10	33.15	44.20	55.30	66.30	67.00
Vegetables	< 10.00	< 10.00		< 10.00	11.00	22.10	33.15	44.20	55.30	66.30	67.00
Other	< 10.00	< 10.00		< 10.00	11.00	22.10	33.15	44.20	55.30	66.30	67.00
Surfaces	< 10.00	< 10.00		< 10.00	11.00	22.10	33.15	44.20	55.30	66.30	67.00

QUANTITATIVE ANALYSIS

According to main standards and EU Regulations

TYPE OF SAMPLE	U.M.	LIMIT OF ACCEPTABILITY	TIME OF OBSERVATION [hours.minutes]
FOOD			
Raw meat; minced meat and preparations of meat	CFU/25g	0	67.00
Yogurt; pasteurized milk; chheses	CFU/25g	0	67.00
Washed fresh vegetables; precut vegetables (ready to eat)	CFU/25g	0	67.00
Fresh whole eggs (shell) and egg products	CFU/25g	0	67.00
Milk powder and whey powder	CFU/25g	0	67.00
Shelled crustaceans products and cooked molluscs	CFU/25g	0	67.00
Live bivalve molluscs, echinoderms, tunicates and gastropods	CFU/25g	0	67.00
Powdered infant products and dried dietary for special medical purposes products	CFU/25g	0	67.00
Frozen fishery products	CFU/25g	0	67.00
Frozen pre-cooked dishes	CFU/25g	0	67.00
SURFACES			
Worktops; tools	CFU/cm²	0	67.00
Hands	CFU/cm²	0	67.00

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ANNEX 5: LY-A07 – LYSTERIA CONTROL SHEET

MBS
MICRO BIOLOGICAL SURVEY

Listeria spp. CONTROL SHEET

LY-A07

SCQ LY-A07 (37) 16.01

ANALYTICAL METHOD	Gram-positive, non spore-forming, facultative anaerobic microorganisms, resistant to many antibiotics. Grow at pH between 5 and 9 and in the presence of NaCl to 10%. Catalase positive, oxidase negative, do not hydrolyze urea, gelatin and casein. Do not reduce nitrates and do not produce indole nor hydrogen sulfide.
MBS - MICRO BIOLOGICAL SURVEY	

INCUBATION TEMPERATURE	COLOR OF ANALYSIS AT START			COLOR OF ANALYSIS AT END		POSITIVE			NEGATIVE		
37 °C											
CONTAMINATION [CFU/g] [CFU/ml] [CFU/100cm²]	10^6	10^7		10^6	10^5	10^4	10^3	10^2	10	1	0
TIME OF COLOR CHANGE [hours.minutes] – Water	< 4.00	4.00		8.00	12.00	16.00	20.00	24.00	28.00	23.00	36.00
Meat	< 4.00	4.00		8.00	12.00	16.00	20.00	24.00	28.00	23.00	36.00
Fish	< 4.00	4.00		8.00	12.00	16.00	20.00	24.00	28.00	23.00	36.00
Dairy product	< 4.00	4.00		8.00	12.00	16.00	20.00	24.00	28.00	23.00	36.00
Vegetables	< 4.00	4.00		8.00	12.00	16.00	20.00	24.00	28.00	23.00	36.00
Other	< 4.00	4.00		8.00	12.00	16.00	20.00	24.00	28.00	23.00	36.00
Surfaces	< 4.00	4.00		8.00	12.00	16.00	20.00	24.00	28.00	23.00	36.00

QUANTITATIVE ANALYSIS

According to main standards and EU Regulations

TYPE OF SAMPLE	U.M.	LIMIT OF ACCEPTABILITY	TIME OF OBSERVATION [hours.minutes]
FOOD			
Foods for infants and for special medical purposes (according to Reg.to CE 2073/05)	CFU/25g	0	36.00
Other foods than those intended for infants and for special medical purposes who are able to support growth of *Listeria monocytogenes*	CFU/25g	0	36.00
Meat and preparations of meat	CFU/25g	0	36.00
Washed vegetables; precut vegetables (ready to eat)	CFU/25g	0	36.00
Preparations of mixed ingredients (ready to eat)	CFU/25g	0	36.00
Pasteurized milk	CFU/25g	0	36.00
Soft cheeses (made from heat-treated milk); cheeses made from raw milk	CFU/25g	0	36.00
First, second courses and vegetables cooked	CFU/25g	0	36.00
Frozen fishery products	CFU/g	10^2	24.00
Frozen vegetables and fruits	CFU/g	10^2	24.00
SURFACES			
Worktops; tools	CFU/cm²	0	36.00
Hands	CFU/cm²	0	36.00

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3.220 Sample Collection and Storage for Quality Analysis

(EDEN ISS/CREW/SCIENCE/PRE)

OBJECTIVE

Collection and storage of samples for the quality analysis to be performed at the CNR and LIT laboratory

DURATION

TBD

TOOLS (per sampling event)

FreeZone® 6 Liter Benchtop Freeze Dry System
Vacuum Pump
Weight scale
1 Scalpel
1 Scissor
1 Kitchen knife
1 Pruning Shears

ITEMS (per sampling event)

1 pair of gloves
1 plastic bowl
12 sealable aluminum foil bags
1 laboratory book
1 permanent black marker
absorbent paper

NOTE

1. FOR THE ANALYSIS TO BE PERFORMED AT CNR AND LIT LABORATORIES, A CRUCIAL ACTIVITY TO BE PERFORMED BY THE ANTARCTICA OPERATOR IS THE SAMPLE PREPARATION AND STORAGE. DEPENDING ON THE ANALYSIS TO BE DONE TWO KIND OF TREATMENTS ARE FORESEEN, A SIMPLE FREEZING AT -20°C OR THE SAMPLE LIOPHYLIZATION. IN PREPARATION OF THIS LAST A PRELIMINARY FREEZING AT -80°C HAS TO DONE.
2. AS A PRELIMINARY ESTIMATE, IT IS ASSUMED THAT 100 G OF FRESH MATERIAL SHOULD BE SUFFICIENT TO PERFORM ALL ANALYSIS, TAKING INTO CONSIDERATION THAT THE DRY MATTER CONTENT OF THE TISSUES IS NORMALLY CLOSE TO 5%. COLLECTING 100G OF FRESH MATERIAL SHOULD PROVIDE APPROXIMATELY 5G OF DRY MATTER.

SS 1 ACTIVITY PREPARATION

1.1 Prepare and/or collect the required tools and items

1.2 Carefully wash the hands

1.3 Wear the gloves

Figure 1: Bag labelling

Figure 2: Taking the weight of the bag and of the plastic bowl

1.4 Using the permanent black marker, labels each bag with the following information: DATE, SPECIES, LOCATION, SUB1 or SUB2, REP. #

1.5 Weigh the bag and log the weight on the log journal to have the tare value for each bag

1.6 Weigh the plastic bowl and log the weight on a log journal to have the tare

2 PLANT SAMPLING

FEG 2.1 SAMPLING OF EDIBLE FRUITS

NOTE
1. TWELVE (12) SAMPLES PER SPECIES HAVE TO BE COLLECTED BY CREW AS PER THE FOLLOWING SCHEMA: • THREE (3) PLANTS IN THREE DIFFERENT LOCATIONS • FOUR (4) FRUITS PER PLANT THE FRUITS SHALL BE UNIFORM WITH RESPECT TO THEIR POSITION ON THE PLANT, THE RIPENING STATE AND THE DIMENSION 2. THE SAMPLING ACTIVITY SHALL BE QUICKLY COMPLETED IN ORDER TO PRESERVE THE DIFFERENT QUALITATIVE METHABOLITES

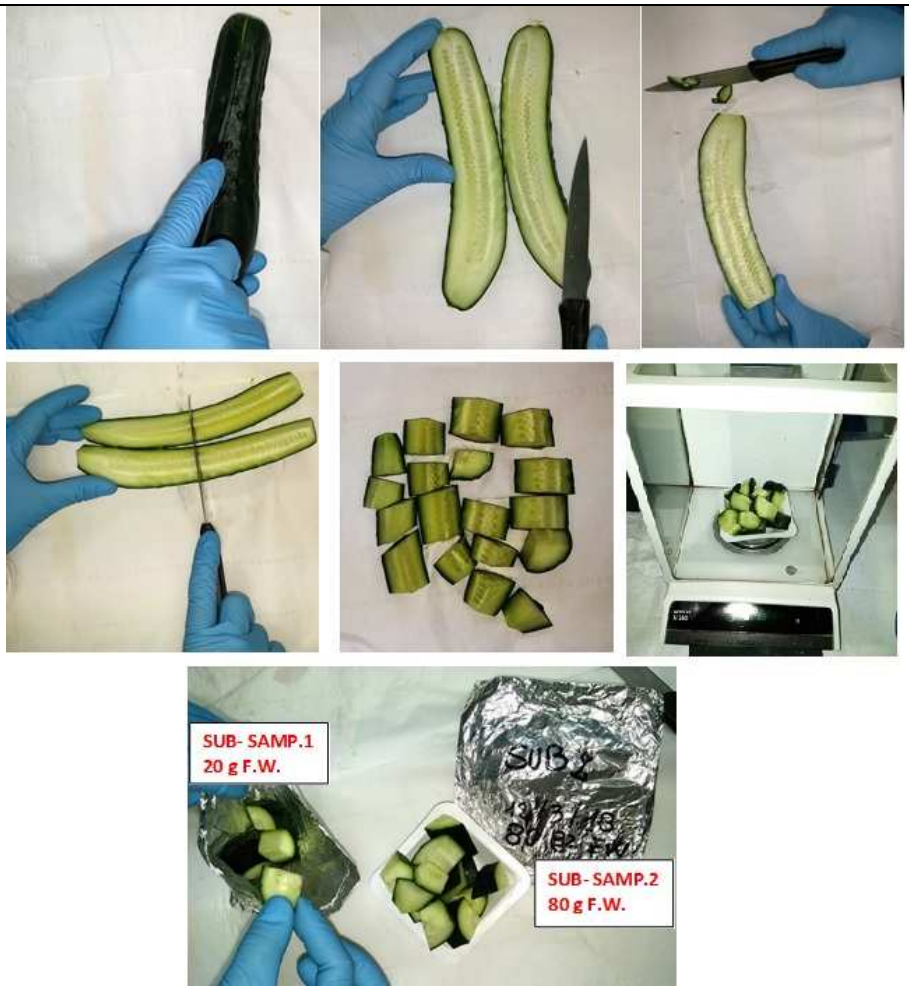

Figure 3: Cucumber sampling

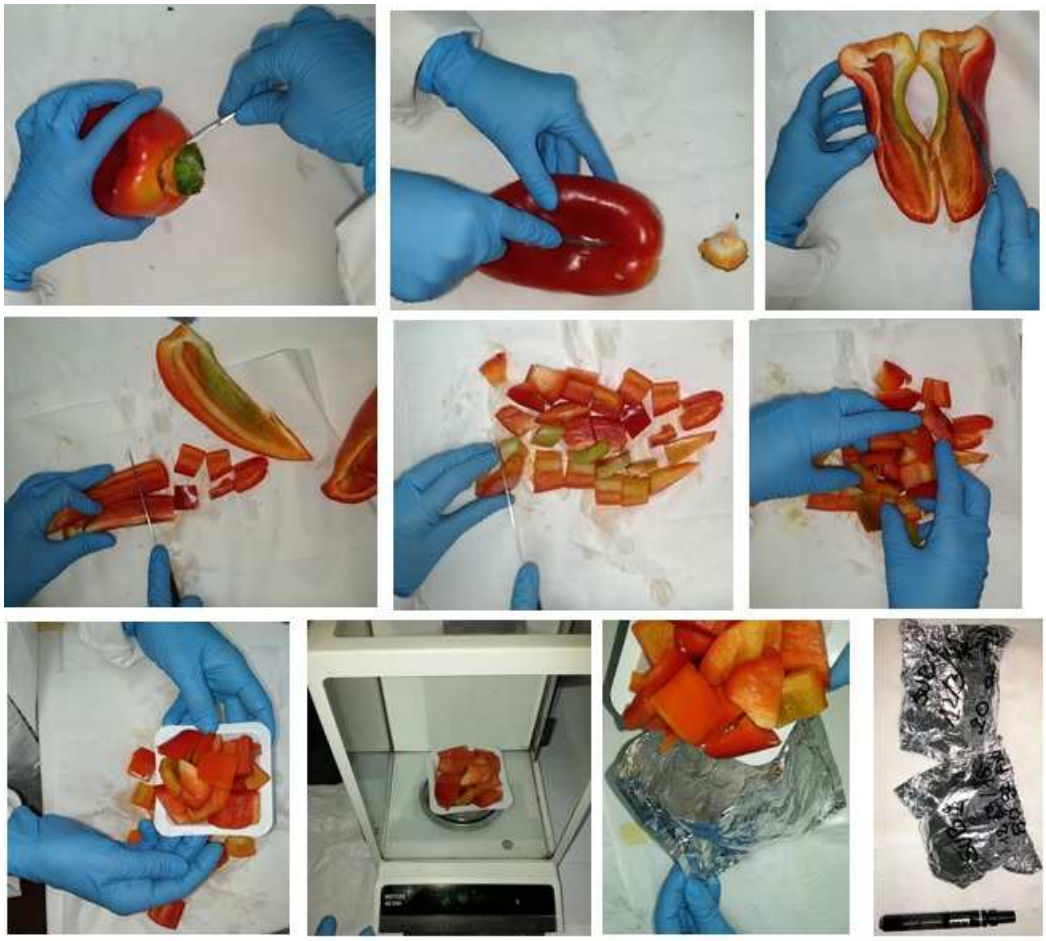

Figure 4: Pepper sampling

Figure 5: Tomatoes sampling

2.1.1 Collect the required fruits for sampling

2.1.2 Using the kitchen knife, cut the fruit in small pieces as per the sequence shown in Fig. 3,4 and 5. Remove the non-edible parts.

2.1.3 Go to step 2.4

2.2 SAMPLING OF EDIBLE LEAVES

NOTE

1. TWELVE (12) SAMPLES PER SPECIES HAVE TO BE COLLECTED BY CREW AS PER THE FOLLOWING SCHEMA:
   - THREE (3) PLANTS IN THREE DIFFERENT LOCATIONS
   - FOUR (4) SAMPLING PER PLANT

   LEAFY VEGETABLE SAMPLED MUST BE UNIFORM IN RELATION TO THE NUMBER OF LEAVES, HEIGHT, LIGHT EXPOSITION, AND ALL TYPES OF TISSUES MUST BE PRESENT IN THE SAMPLE (FOR EXAMPLE LEAF LAMINA AND PETIOLES)
2. THE SAMPLING ACTIVITY SHALL BE QUICKLY COMPLETED IN ORDER TO PRESERVE THE DIFFERENT QUALITATIVE METHABOLITES

Figure 6: Lettuce Sampling

2.2.1 Collect the required leafy vegetables for sampling

2.2.2 If the leafy vegetable is a Lettuce, using the kitchen knife, cut the fruit in small pieces as per the sequence shown in Fig. 6.

Figure 7: Swiss Chard, Rockets and Red Mustard Samples

2.2.3 If the leafy vegetables are Swiss Chard, Rockets or Red Mustard cut the plant at the base by means of a pruning shears

2.2.4 GOTO step 2.4

2.3 SAMPLING OF EDIBLE TAP ROOTS

NOTE

1. TWELVE (12) SAMPLES PER SPECIES HAVE TO BE COLLECTED BY CREW AS PER THE FOLLOWING SCHEMA:
   - THREE (3) PLANTS IN THREE DIFFERENT LOCATIONS
   - FOUR (4) SAMPLING PER PLANT

   THE TAP ROOTS SHOULD BE ROUND (THE DIAMETER USUALLY IS ABOUT 8-15MM) AND WITH A RED COLOR
2. THE SAMPLING ACTIVITY SHALL BE QUICKLY COMPLETED IN ORDER TO PRESERVE THE DIFFERENT QUALITATIVE METHABOLITES

2.3.1 Collect the required fruits for sampling

2.3.2 Using the kitchen knife, cut the taproot in four small part (as for tomatoes , see Fig 5)

2.4 SAMPLE PREPARATION

2.4.1 Collect 100 g of material

2.4.2 Put 20 g of material in the bag labelled SUB1 and 80 g in the bag labelled SUB2. Close them

2.4.3 Store the SUB1 bags in the freezer at -20degC

2.4.4 Store the SUB2 bags in the freezer at -80degC

NMIII 5 SUB2 SAMPLES LYOPHILISATION

NOTE

1. LYOPHILISATION (OR FREEZE DRYING) IS A PROCESS WHEREBY WATER, OR ANOTHER SOLVENT, IS REMOVED FROM FROZEN MATERIAL BY CONVERTING THE FROZEN WATER DIRECTLY INTO VAPOUR WITHOUT THE INTERMEDIATE FORMATION OF LIQUID WATER. IT IS AN IMPORTANT PROCESS IN SAMPLE PREPARATION AND FOR THE PRESERVATION AND STORAGE OF BIOLOGICALS, PHARMACEUTICALS AND FOODS

2. LYOPHILISATION IS REQUIRED FOR THE ONLY SAMPLES MARKED AS SUB2
3. **TBD** TIME AT -80°C IS NECESSARY TO HAVE THE SAMPLE READY FOR LIOPHYLIZATION

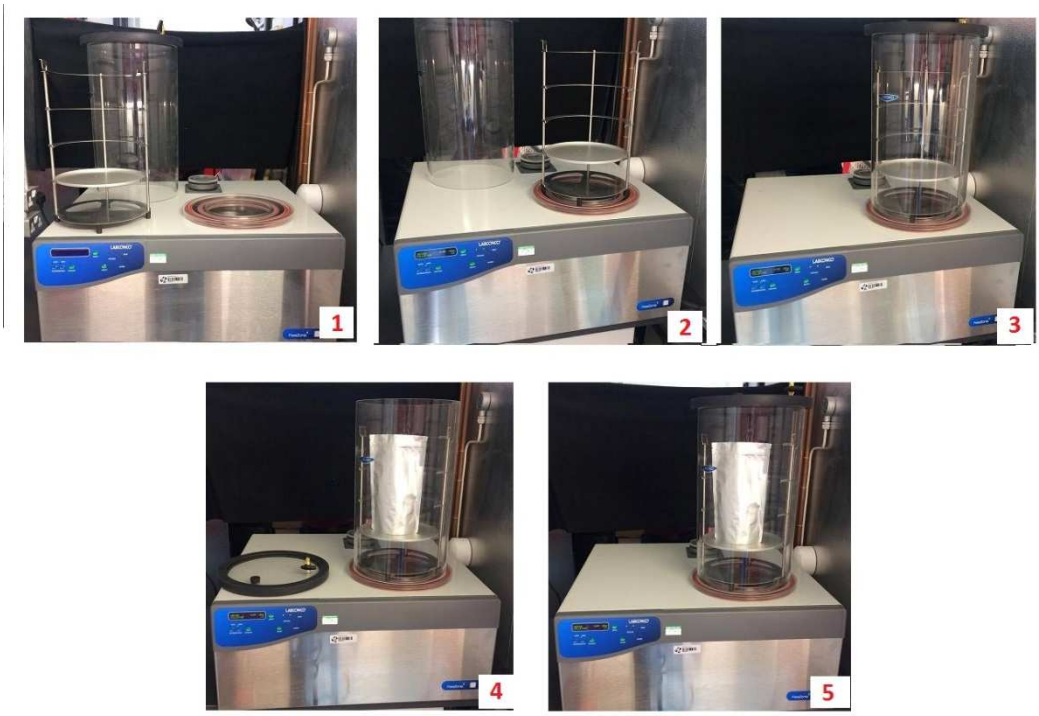

Figure 8: Sample insertion sequence

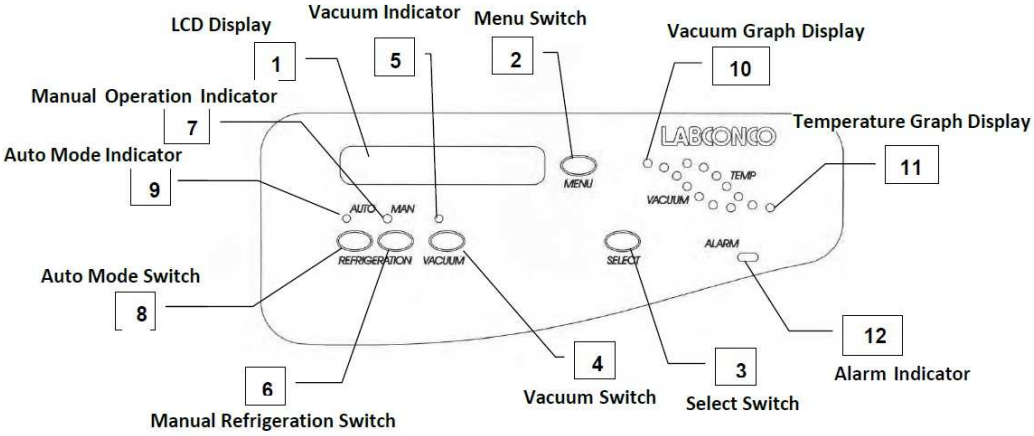

Figure 9: Freeze drier Control Panel

5.1 When the sample is ready start the liophylisation process.

5.2 INSTRUMENT INIZIALITION

5.2.1 Ensure the dryer manifold and collector are dry. Remove any moisture before continuing with operation

5.2.2 Turn ON the **Main Power Switch** – located on the left side of the cabinet

5.2.3 Place the drying manifold on top of the collector, ensuring the rubber seals are aligned

5.2.4 Press the **Manual Refrigeration Switch**. The freezer dryer will begin cooling to -50C

5.3 SAMPLE ADDITION AND DRYING

5.3.1 Once the **Collector Temperature Graph Display** indicates that the temperature has adequately reduced, retrieve the bags labelled SUB2 from the freezer, and place them, upright where possible, into the drying manifold. Ensure that the bags are only partially sealed

5.3.2 Place the lid onto the drying manifold, ensuring it is secure, close the valve

5.3.3 Press the **Auto Mode Switch**. This will switch off the manual function

5.3.4 Press the **Auto Mode Switch** a second time to initiate the vacuum

5.3.5 Monitor the **Vacuum Graph Display** until the lower green LED light is steadily illuminated

5.3.6 Once the **Collector Temperature Graph Display** and **Vacuum Graph Display** both have the lower green LED lights steadily illuminating, the sample have begun lyophilising

5.4 SAMPLE REMOVAL

CAUTION
Return from vacuum to ambient pressure has to be done with caution. Opening the valve too quickly or completely at first will cause the vacuum to be released too soon resulting the samples being destroyed or ejected from the sample bags

5.4.1 Once the samples have been adequately dried for between 24 and 36 hours, depending on the tissue quantity, press the **Auto Mode Switch** to turn off the vacuum

5.4.2 Relieve the vacuum by opening the drying manifold valve slightly and very gently.

5.4.3 Once the vacuum has completely dissipated, as indicated by the **Vacuum Graph Display**, the drying manifold can be carefully taken off the drying chamber using an upwards motion.

5.4.4 Remove the samples and shut the bags in order to have them fully sealed

5.4.5 Store the bags at 4°C

5.5 Instrument Shut-off

5.5.1 Defrost the ice build-up inside the drying chamber by either exposing the chamber to ambient temperatures and allow to melt naturally, or by adding warm water to aid the process.

5.5.2 Open the hose on the right of the chamber to drain the waste water

5.5.3 Once drained reseal the hose and dry the inside of the chamber with some paper towels or a cloth.

5.5.4 Switch the **Main Power Switch** to the OFF position

6 **CLOSEOUT**

6.1 Take Off the gloves and wash your hand

6.2 Clean the tools and stow them

6.3 Waste the not used plants part.

ANNEX C: EDEN ISS Procedures in DRAFT Status

This Annex contains all the procedures that are still in DRAFT status.

Remark: the number pages reported in the index, is related to this annex and not to the whole document.

4100 AMS Filters Replacement

(EDEN ISS/CREW/MAINTENANCE/DRAFT)

OBJECTIVE

AMS Filters Replacement when they are clogged

DURATION

30 min

TOOLS

N/A

ITEMS

Pre-filter
HEPA Filter
VOC's Filter

NOTE
1. THREE FILTERS ARE INSTALLED IN THE AMS UNIT: A PREFILTER, AN ABSOLUTE HEPA FILTER AND A VOC (ETHYLENE) FILTER. 2. THE STATUS OF THE PREFILTER AND OF THE ABSOLUTE FILTER CAN BE ASSESSED LOOKING AT THE PRESSURE STATUS MEASURED BY A PRESSURE DIFFERENTIAL GAUGE, AND PROVIDED TO THE OPERATOR VIA A GAUGE DISPLAYS ON THE FRONT PANEL OF THE AMS FILTERS UNIT SECTION. BOTH FILTERS HAVE TO BE REPLACED WHEN THE PRESSURE REACHES THE VALUE OF 600 PA (FILTER CLOGGED). 3. A VISUAL INSPECTION IS REQUIRED TO ASSESS THE VOC'S FILTER STATUS. FILTER COLOUR CHANGES WHEN THE FILTER IS CLOGGED. **4.** HOWEVER, AS SOON AS THE MAXIMUM FILTER LIFETIME IS REACHED THEY HAVE TO BE TREPLACED INDEPENDENTLY OF THE MEASURED PRESSURE OR COLOR STATUS. THE MAXIMUM LIFETIME OF THE FILTERS IS 3 MONTHS (PREFILTER), 6 MONTHS (ABSOLUTE FILTERS) AND 1 YEAR (VOC'S FILTER).

1 FILTERS STATUS CHECK

Figure1: AMS Filters Unit Front Panel

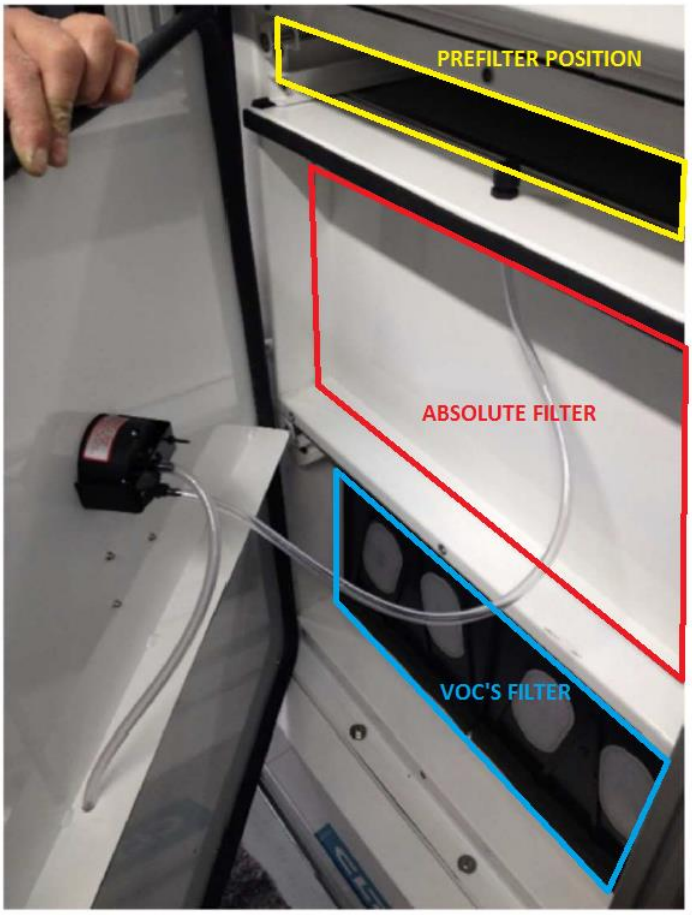

Figure 2: Filters position

1.1 Prefilter and Absolute Filter check

1.1.1 On the pressure gauge display, check the pressure level.

If the pressure level is ≥600 Pa, filters have to be replaced.

If the pressure level is < 600 Pa, check the installation date and calculate the time in operations.
If the time of operations has exceeded the lifetime of the filter(s), filter (s) has (have) to be replaced

1.2 Filters Unit Front Panel Removal

CAUTION

1. THE PANEL CANNOT BE REMOVED COMPLETELY WITHOUT REMOVING THE SUPPORT OF THE PRESSURE PROBE (TBC).
2. DAMAGE OF THE PRESSURE GAUGE, THE PROBE OR THE HOSE CAN OCCUR IN CASE OF "VIOLENT" REMOVAL OF THE FRONT PANEL

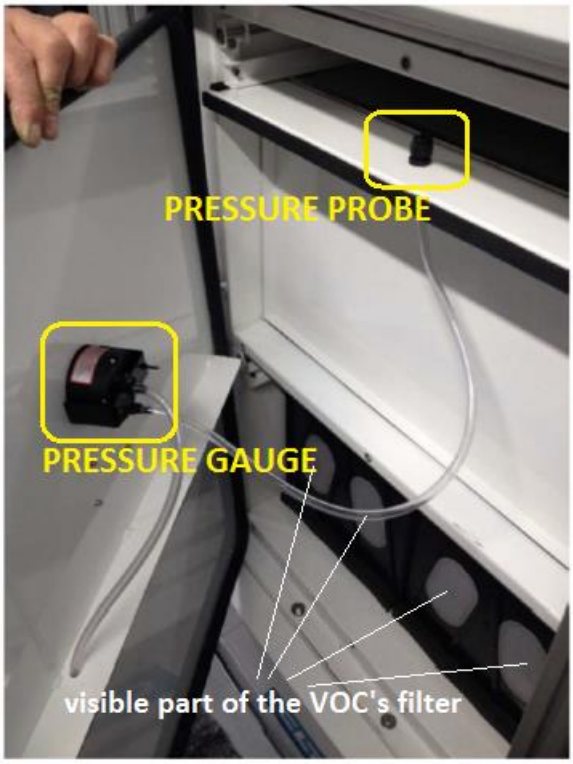

Figure 3: AMS Filters Unit Front Panel partially removed

1.2.1 Unscrew the knobs (9) on the front panel until the panel itself is released. Do the operation from the lower to the higher row.

1.2.2 Partially remove the panel as per Fig. 3. Gently pull the panel paying attention to not stretch the pressure probe tube.

1.2.3 Slide out the support of the pressure probe.

1.2.4 Temp stow the assembly Front Panel/Pressure probe panel

1.3 VOC's Filters Check

1.3.1 Check the filter colour **(How?)**
If the colour is turned from **Purple to TBD,** replace the VOC's filter as per step 2.2

2 FILTERS REPLACEMENT

NOTE
NO TOOLS ARE REQUIRED FOR FILTERS REPLACEMENT

2.1 Prefilter and Absolute Filter Replacement

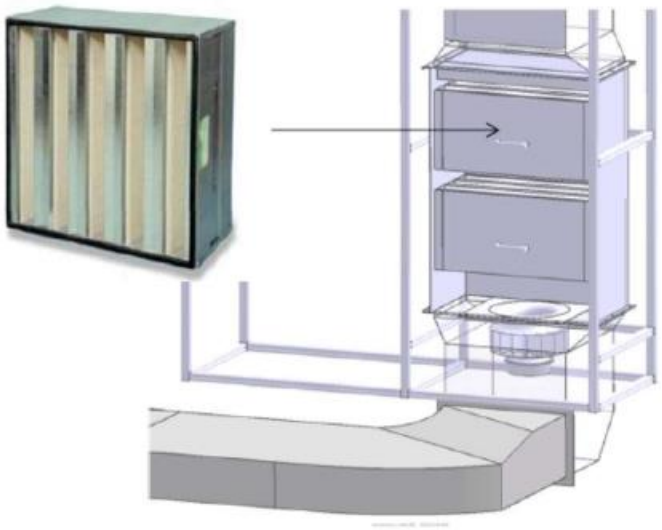

Figure 4: Absolute Filter Replacement

2.1.1 Pull the prefilter out and temp stow

2.1.2 Install the new Prefilter

2.1.3 Pull the Absolute Filter out and temp stow (no tools required)

2.1.4 Install the new Absolute Filter

2.1.5 If the replacement of the VOC's Filter is not required
GOTO step 3

2.2 VOC's Filters Replacement

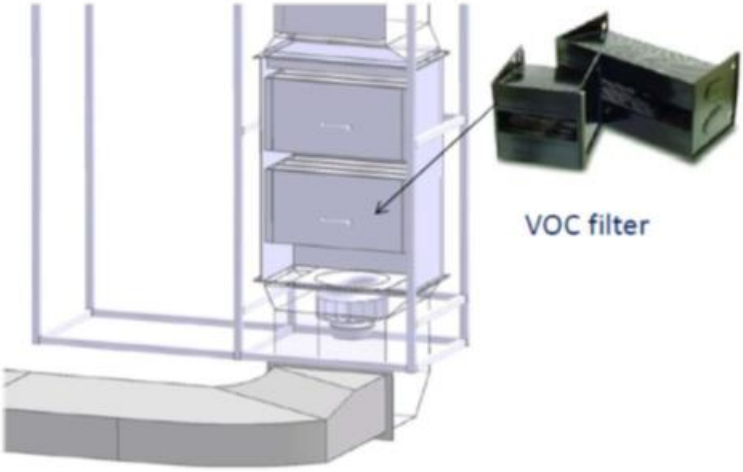

Figure 5: VOC's Filters Replacement

2.2.1 Pull the VOC's filters (2) out and temp stow

2.2.2 Install the new VOC's Filters (2)

3 FILTERS UNIT FRONT PANEL REINSTALLATION

3.1 While maintaining the Front Panel, insert the support where the pressure probe is installed in its location

Install the Front Panel. Completely screw the knobs

4 CLOSEOUT

4.1 Check the pressure gauge reading is < 600Pa

4.2 Pack the removed Filters and waste them as per NMIII procedure