



FIRMSuite®

**BATTERY MANAGEMENT
USER MANUAL**

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CONTROL SHEET

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Technical Support

support@multitel.com

1. CONFIGURATION RIGHTS

Table 1 - Credentials

Rights	Description
Basic Access	Give access to the maintenance dashboard
Technician	Allow user to submit a maintenance and temporarily adjust the inventory
Inventory Manager	Allow user to approve or reject temporarily inventory update
Manager	Allow user to create and assign period; approve, resolve and submit maintenance

To configure a group:

1. In the Settings-System Parameters page, click on *Security*
2. Right click on a group and click on *Assign Rights*
3. Select rights
4. Confirm

2. MAINTENANCE STATES AND STATUS

2.1. MAINTENANCE STATES

Table 2 – Maintenance States

States	Description
Active	The maintenance can be modified.
Reserved	This maintenance is assigned to a data entry user.
Submitted	The maintenance has been submitted and still can be edited.
Standby	The maintenance is not required.
Approved	The maintenance has been submitted with success or has been approved by a manager. Maintenance values cannot be modified, but notes and attachment can be added.
Locked	The period associated with the maintenance is closed and the maintenance cannot be modified.

2.1.1. Maintenance Never Required

Site can be put on hold by selected the option *Maintenance Never Required* in the General Information page of the site.

To change the state of the site you must go in FIRMSuite Legacy:

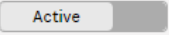
1. In the site, click on *Site Detail* in the menu
2. Click on *Edit a Site*
3. Select an option in the field *Prioritization Type*

Table 3 – Site Prioritization Type

Option	Description
Maintenance Never Required	The site will not be available to be assigned to a period.
Maintenance Required	The site will be available to be assigned to a period.

2.1.2. Standby Maintenance

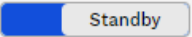
To put on hold a maintenance:

1. In the line-drawing of the site, click on the battery to open the right panel
2. Click *Active* 

NOTE:

For a *fixed* period, when the current period close, the maintenance will automatically revert to an active state. For a *dynamic* period, you must reactive the maintenance manually.

To active a maintenance:

1. In the line-drawing of the site, click on the battery to open the right panel
2. Click *Standby* 

2.2. MAINTENANCE STATUS

Table 4 – Maintenance Status

Status	Description
Pending	This maintenance has been started.
Rejected	This maintenance has been rejected by the manager.
Error	This maintenance has been submitted but, there is an exception. (this status is only for maintenance migrated from FIRMSuite - Battery Management 4.5)
Warning	This maintenance has been submitted but, there is at least one validation warning.
Success	This maintenance was submitted and the validation was successful.


An approved maintenance with a warning status indicates that the warnings were approved by a manager.

2.3. MAINTENANCE INTERVAL STATE

Table 5 – Maintenance Interval Status

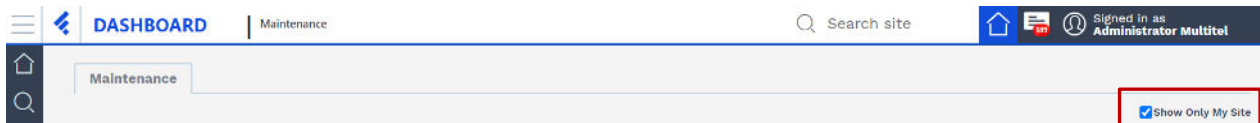
Maintenance Interval State	Description
Overdue	Maintenance are in <i>overdue</i> if the difference between the current date and the date of the last approved maintenance is greater than the duration of the associated period.
On Time	Maintenances are in <i>on time</i> if the difference between the current date and the date of the last approved maintenance is less than the duration of the associated period.
N/A	Indicate maintenances without an associated period, maintenance never required or maintenance on standby.

3. MAINTENANCE DASHBOARD

To access the maintenance dashboard, you must click on the dashboard icon  in the menu.

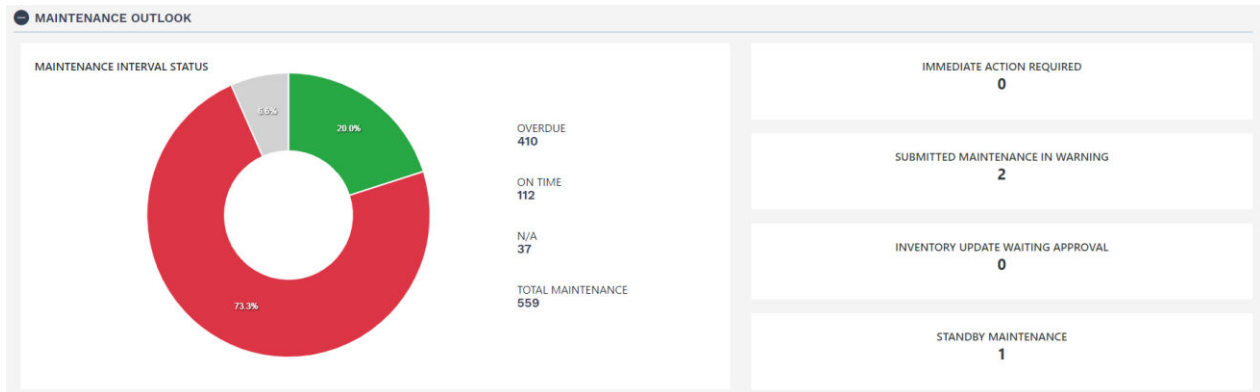
The maintenance dashboard displays an overview of the maintenance's progress and a list of all power plants available for maintenance according to site assignment of the user. Uncheck "Show only my site" will display the complete network on the page.

Figure 1 – Maintenance Dashboard – Show only my site



3.1. STATUS MAINTENANCE

Figure 2 – Maintenance Dashboard – Status Maintenance



The pie chart shows the current maintenance interval status of all sites. The right side of the pie chart shows how many maintenances are in each state.

3.1.1. Immediate Action Required

Indicates the number of maintenances requiring immediate action. To view the corresponding maintenances, you must scroll below and click on the Immediate Action Required tab.

3.1.2. Submitted Maintenance in Warning

Indicates the number of maintenances needed approval. To see the corresponding maintenances, you must go below and click on the Maintenance in warning tab.

3.1.3. Inventory Update waiting Approval

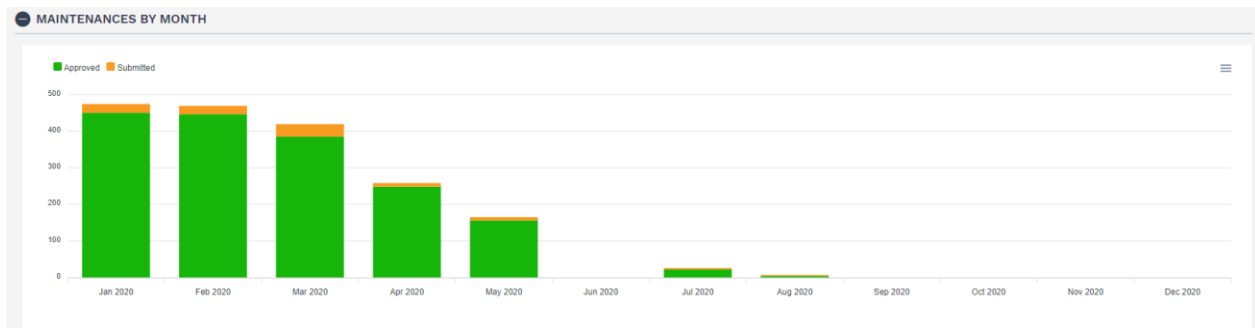
Indicates the number of inventory updates needed approval. To see the corresponding inventory update, you must scroll below and click on the Inventory Update Waiting Approval tab.

3.1.4. Standby Maintenance

Indicates the number of maintenances in standby and sites where maintenance is never required. To see the corresponding maintenance, you must go below and click on the Standby Maintenance tab.

3.2. MAINTENANCE BY MONTH

Figure 3 – Maintenance Dashboard – Maintenance by Month




The Maintenances by Month graph indicates the number of maintenances submitted and approved during the current year.

3.3. MAINTENANCE LIST

The list displays all power plant available to have a maintenance.

Figure 4 – Maintenance Dashboard – Power Plant List

All Immediate Action Required Maintenance in warning Inventory Update Waiting Approval Standby Maintenance									
Export All Maintenance Template Export All									
	Site Name	CLLI	Powerplant Name	Supervisor	State	Status	Months Since Last Approved Maintenance	Maintenance Interval Status	Site Prioritization Type
	<input type="text" value="Search"/>	<input type="text" value="Search"/>	<input type="text" value="Search"/>	<input type="text" value="Search"/>	All	All	<input type="text" value="Search"/>	On time	All
...	Multitel	MLT2265	PF01		Active	Pending	23	On time	Maintenance Required

You can go to the site by clicking on the Action icon  and then on Go to Site. For sites with an active maintenance, the Go to the Maintenance option will be displayed in the menu.

3.3.1. Immediate Action Required

Listed all maintenance with an active immediate action requested.

3.3.2. Maintenance in Warning

Listed all submitted, approved and locked maintenance in warning.

3.3.3. Inventory Update waiting Approval

Listed all power plant who have an inventory update.

3.3.4. Standby Maintenance

Listed all power plant in standby.

ASSET MANAGEMENT

4.1. POWER PLANT

4.1.1. Create a Template

A power plant template must be created in FIRMSuite Legacy interface.



1. Select the *Administration* tab
2. Click on *Equipment templates* quick link
3. Click on the appropriate equipment type
4. Click on *Add Template*
5. Fill all fields in General Information, Specifications and Other Information section.
 All fields in bold characters are mandatory.
6. Click on *Save*

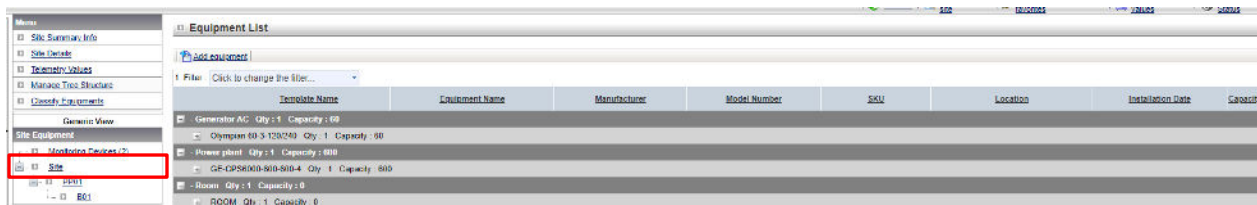
NOTE:

It is extremely important that the reserve and the end voltage value is set correctly during the selection of the template. All of the battery capacities are calculated in the Capacity Management module according to: the end voltage and battery reserve setting in the power plant in combination with the Manufacturers Battery Capacity values in the Adjusted Battery Capacity Table in the associated battery template.

4.1.2. Add a Power Plant

A Power Plant must be added from the FIRMSuite Legacy interface.



1. In the Site Details page, click on *Site* in the site equipment section



2. Click on *Add equipment* and select *Power plant*

1.7.2. Delete a Power Plant

A Power Plant must be deleted from the FIRMSuite Legacy interface. Equipment is permanently deleted in the inventory.

1. In the Site Details page, click on *Site* in the site equipment section
2. Click on *Plus* icon  of the power plant
3. Click on *Delete* icon 

4.2. RECTIFIER

4.2.1. Create a Template

A rectifier template must be created in FIRMSuite Legacy interface.

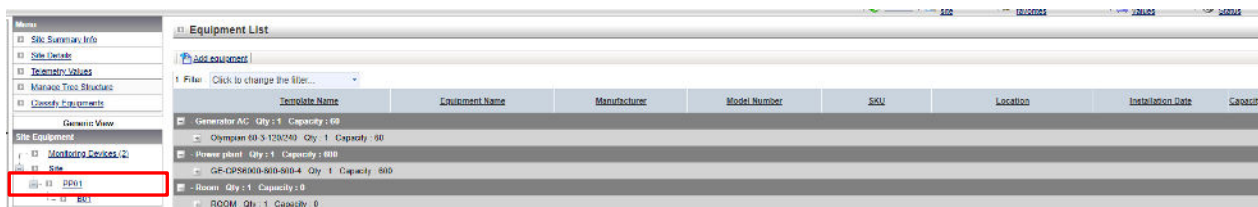


1. Select the *Administration* tab
2. Click on *Equipment templates* quick link
3. Click on the appropriate equipment type
4. Click on *Add Template*
5. Fill all fields in General Information, Specifications and Other Information section.
 All fields in bold characters are mandatory.
6. Click on *Save*

4.2.2. Add a Rectifier

A Rectifier must be added from the FIRMSuite Legacy interface.


1. In the Site Details page, click on a Power Plant in the site equipment section



2. Click on *Add equipment* and select *Rectifiers*

4.2.3. Delete a Rectifier

A Rectifier must be deleted from the FIRMSuite Legacy interface. Equipment is permanently deleted in the inventory.

1. In the Site Details page, click on *Site* in the site equipment section
2. Click on *Plus* icon  of the rectifier

3. Click on *Delete* icon 

4.3. CELL

4.3.1. Create a template

A Cell template must be created in FIRMSuite Legacy interface.



1. Select the *Administration* tab
2. Click on *Equipment templates* quick link
3. Click on *Cell equipment type*
4. Click on *Add Template*
5. Fill all fields in General Information, Specifications and Other Information section.
The conductance and impedance reference values correspond the manufacturer baseline for that model.
6. Click on *Save*

4.4. BATTERY

4.4.1. Create a template

A battery template must be created in FIRMSuite Legacy interface.



7. Select the *Administration* tab
8. Click on *Equipment templates* quick link
9. Click on *Battery equipment type*
10. Click on *Add Template*
11. Fill all fields in General Information, Specifications and Other Information section.
All fields in bold characters are mandatory.

NOTE: Adjusted Battery Capacity Table

This table is used to customize the battery capacity at different end voltages (left) and at different times (top). Time must be entered as "1:25" that means 1hour 25 minutes. The table must contain at least 3 values to give the appropriate results when calculating the battery

reserve time. These values must be consistent. i.e. they must decrease as the number of hours increase.

If a discharge table is not required or not applicable, you need to put de the following minimal information:

Vpc/Time	1:00	2:00	3:00
1:75	3	2	1

12. Click on *Save*
13. Select the Grouping of Templates tab of the new battery template
14. Select the desired battery cell template
15. Name the cell as the naming convention for your business


When the battery will be added in a site inventory, cells names will automatically be generated by adding one (1) to the name provided up to “name(x)”, where “(x)” is the number of cell provided. Example: If you entered the name “C”. In this case cell are going to be named “C1” to “C24”.

16. Insert the number of cells you want to group together as a battery.
17. Click on *Add*

4.4.2. Add a Battery

NOTE:

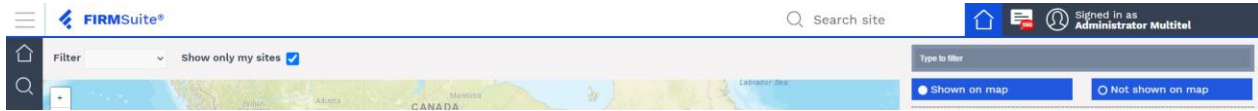
Battery must be added from FIRMSuite 5.3 interface.

According to the user’s rights, the battery can be added immediately in the inventory or temporarily. The temporary battery added must be approved by the inventory manager. To indicate the temporary status of the new battery, in the tree structure, the  icon will be displayed until approval.

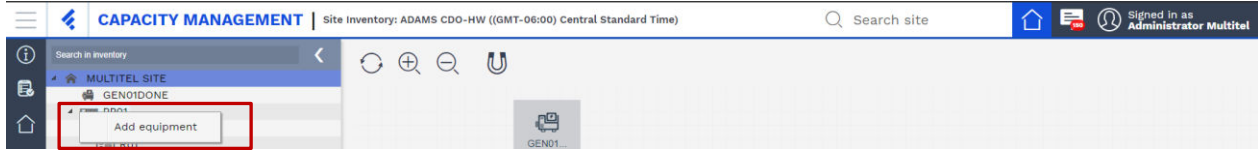
To add a battery:

1. Type your Site Name or CLLI in the search bar to access to the site





2. Right click on the power plant in the tree structure and click *Add Equipment*



3. Select the equipment type and the equipment model

NEW EQUIPMENT

Type *
Select an Option

Equipment model *
Select an Option

Confirm

4. Fill the form and confirm

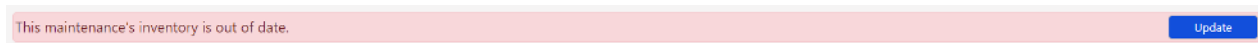
NOTE:

Battery equipment added in Skynet is uploaded in real time in FIRMSuite Legacy.

Battery temporarily added is not uploaded in FIRMSuite Legacy until approval.

5. If the maintenance has not yet started, new batteries will be displayed automatically in the maintenance form.

If the maintenance has been started or submitted, it's possible to update the inventory by clicking on the *Update* button in the maintenance form.



To cancel a temporarily addition:

Only the technician who added the battery can cancel it.

1. Go to the general information page of the new battery.
2. Click on *Cancel*

You removed this battery. (2020-07-23)

Cancel


NOTE:

If the maintenance has been active or submitted, you must update the inventory of the maintenance by clicking on the *Update* button in the maintenance form. After the inventory update, the battery added will not be displayed anymore in the maintenance form.

4.3.2. Delete a Battery

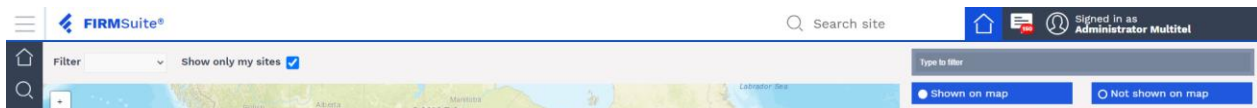
NOTE:

Battery must be deleted from FIRMSuite 5.3 interface.

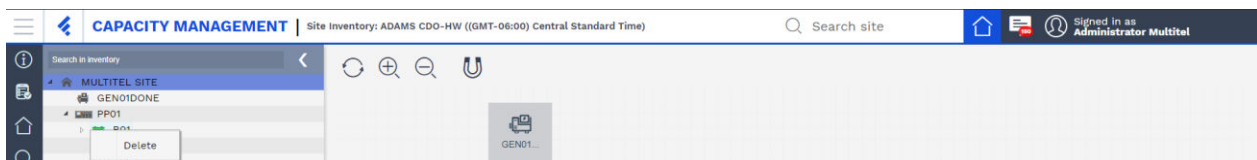
According to the user's right, the battery can be deleted immediately in the inventory or temporarily. Battery temporarily deleted must be approved by the inventory manager. To indicate the temporary status of the deleted battery, in the tree structure, the  icon will be displayed until approval.

To delete a battery:

1. Type your Site Name or CLLI in the search bar to access to the site



2. Right click on the battery and click *Delete*



3. Confirm the deletion

- If the maintenance is active, the deleted battery will be automatically displayed as inactive.

If the maintenance has been reserved or submitted, it's possible to update the inventory of the maintenance by clicking on the *Update* button in the maintenance form. After the refresh, the battery deleted will be displayed inactive in the maintenance form.

Figure 5 – Maintenance Battery Temporarily Deleted

B01 - SBS-190F

This Battery was removed by Technician Multitel. To cancel the modification go to the general information about the equipment.

Import

Float Current (A)	Float Voltage (V)	Battery Terminal Connection (Ohms)	Battery Continuity
			Yes No

Tested Online Offline Grips Picks Posts Intercell Connector

Modify References Yes No

Conductance Impedance

# Jar	Serial Number	Manufacturing Date	Uploads Readings (Posts by Cell : 2)						Posts by Cell								
			Conductance (Mhos)	Ref.	%	Intercell Resistance (ohms)	Ref.	%	Voltage (V)	Temp (F)	A	B	C	D			
1		01/05/2016		1900	%		%										

To cancel a temporarily deletion:

Only the technician who deleted the battery can cancel it.

- Go to the General Information page of the new battery
- Click on *Cancel*

You removed this battery. (2020-07-27)

Cancel

NOTE:

If the maintenance has been reserved or submitted, you must update the inventory of the maintenance by clicking on the *Update* button in the maintenance. After the inventory update, the deleted battery will be displayed as active.

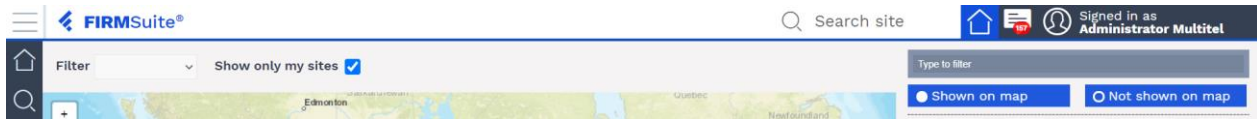
4.3.3. Cell Replacement

Only manager can replace a cell.

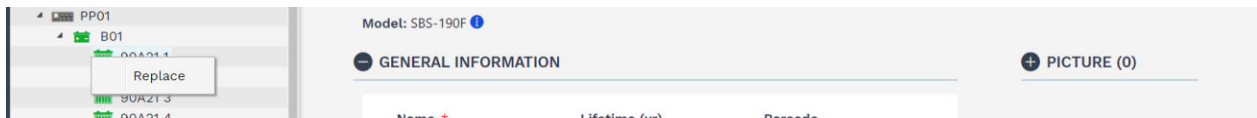
Replacing a cell allows you to maintain data history of the old cell in the Historical Reading page.

To replace a cell/jar:


1. Type your Site Name or CLLI in the search bar to access the site



2. Right click on the cell/jar that you want to replace



3. Fill the form and confirm


To notify cell/jar replaced, the  icon will be displayed in the right corner of the General Information page of the equipment.

5. INVENTORY APPROVAL

The inventory must be approved before the manager approves the warning.

To approve an inventory update:

Equipment waiting for an approval is listed in the Inventory tab in the Maintenance dashboard.

Clicking on the action icon  will bring you to the approval page of the equipment.

For each inventory update, the inventory manager associated with the site will receive a message in the Message Center. Clicking on the message brings you directly on the approval page of the equipment.

5.1. APPROVING ADDITIONS AND DELETIONS

If the inventory change is approved, the equipment will be permanently added to or deleted from the inventory.

NOTE:

If a maintenance has been submitted with a temporarily equipment, the maintenance form must be updated after inventory approval to be validated.

5.2. REJECTING ADDITIONS

If the addition is rejected, the equipment will be deleted in the tree structure and the maintenance form.

NOTE:

If a maintenance has been submitted with a temporarily equipment, the maintenance form must be updated after inventory approval to be validated.

5.3. REJECTING DELETIONS

If the deletion is rejected, the equipment will stay in the inventory. To inform the technician, a message will be sent in their message center. The technician must adjust the maintenance form and submit it again.

6. MAINTENANCE PERIOD

6.1. TYPE OF PERIOD

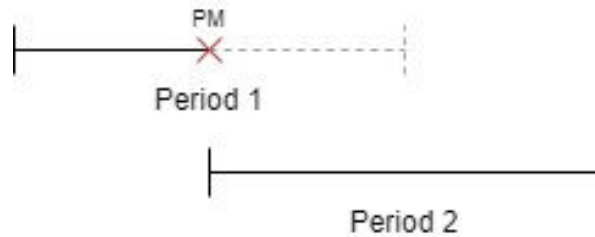
Table 6 – Type of Period

Period	Description
One Time	This period does not have recurrence.
Fixed	Start date upon the expiry of the period duration.
Dynamic	Start date upon the approval of maintenance. Assigned site periods are independent of each other.

Figure 6 – Fixed Period Schema



Figure 7 – Dynamic Period Schema



6.2. TYPE OF ASSIGNMENT

Table 7 – Type of Assignment

Assignment	Description
Site	All batteries in the site will be assigned to the period
Equipment model-Site	Only the battery model selected in the site will be assigned to the period

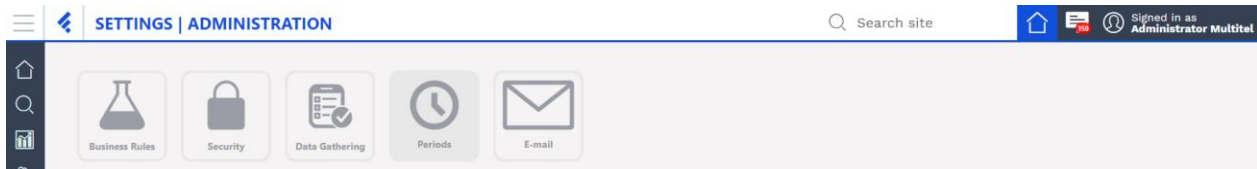
NOTE:

You must assign all periods with the same type of assignment.

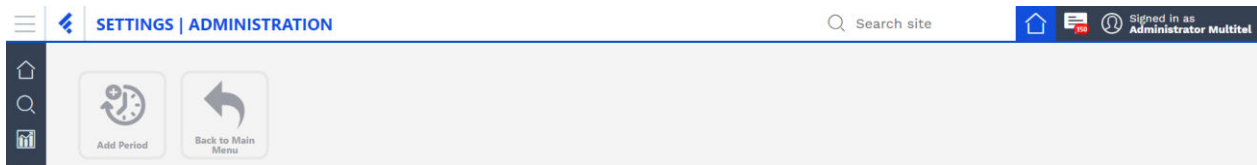
6.3. CREATE A PERIOD

Only user with manager rights can manage a period.

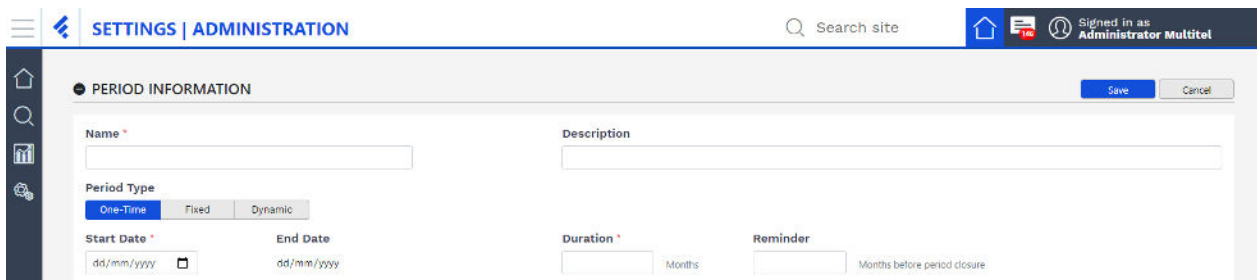
1. In the Settings page, click *Period*



2. Click on *Add period*



3. Enter a name and a description (*a description is not mandatory*)



4. Choose a type of period
5. Enter the start date and the duration of the period
6. Enter a reminder (*a reminder is not mandatory*)

When a reminder is set, a notification will be sent to the Message Center when or if the due date set for a site is within the reminder timeframe. This will be visible to any user assigned to the site, so that actions can be taken to visit and submit the data prior to the due date.

7. Click on *Save*
8. Choose a type of assignment

● PERIOD ASSIGNMENT

Assign to *

Sites Submit

Select All Deselect All

	Site Name	CLLI	Category	Type	Address	City	Province/State
All	Search	Search	Search	Search	Search	Search	Search
<input type="checkbox"/>	HOLLYWOOD CENTER OFFICE	HOLWIRY61	TBD	TBD	213 S BROAD ST	HOLLYWOOD	California

NOTE:

You must assign all periods with the same type of assignment (site or model-site).

9. Select site or equipment model-site
10. Click on *Submit*

6.4. EDIT A PERIOD

If the period is assigned, you can only modify the name, description and reminder. At any time, you can assign a new site or new equipment model-site to a period.

To delete a period, modify the duration or remove a site or an equipment model-site assigned, you must contact Multitel professional services.

NOTE:

If you added a new site in the network, you must assign it to a period. The next maintenance date will be calculated according to the date in the period.

7. BATTERY RIGHT-PANEL INFORMATION

To access to the right panel:

1. Go to a site
2. On the line-drawing, click on the battery

Clicking on the  icon leads to the specific information of the strings and the cells.

7.1. MANUAL ENTRIES BUTTON

This page allows you to enter and submit manual entries.

To submit a manual entry:

1. Click on *Manual Entries* in the battery right panel
2. Enter value and as needed and change the reading date
3. Click on *Submit* (you can click on *Submit All* to push all value entered together)

Historical Data

You have access to the five (5) previous historical values by clicking on the clock  icon.

7.2. MAINTENANCE INFORMATION

Maintenance

State: displayed the state of the current maintenance

Status: displayed the status of the current maintenance

Last Maintenance

Submitted Date: The last submitted date is the date on which the maintenance is submitted by the technician.

Approved Date: The last approved date is the date on which the maintenance is approved by the maintenance service agent or an user.

Period Information

Next Maintenance Due Date:

One time and Fixed period:

The next maintenance is the end date of the period.

Dynamic period:

The next maintenance is determined by adding the duration of the period to the last approved maintenance date. If there has never approved maintenance, the next maintenance due date will be calculated with the oldest battery installation date.

Maintenance Interval State: The state of the period according to the time between the current date and the date of the last approved maintenance. If there has never approved maintenance, the interval state will be calculated with the oldest battery installation date.

Months Since Last Approved Maintenance: The number of months since a maintenance has been approved.

Associated Period: The name of the associated period.

7.3. MAINTENANCE HISTORY BUTTON

The maintenance history allows you to view all maintenances and actions performed according to the maintenance selected.

To access to the maintenance history:

1. In a site, click on a battery in the line-drawing to open the right panel
2. Click on *Maintenance History*
3. Select a maintenance and click on *View* to consult it

7.4. HISTORICAL READING BUTTON

The value displayed in this page are all values available in FIRMSuite; they are from telemetry, maintenance and manual entries.

To access the historical reading:

1. In a site, click on a battery in the line-drawing to open the right panel

2. Click on *Historical Reading*

7.5. BATTERY INFORMATION

Adjusted Capacity (SOH):

Sum of the adjusted capacities of all batteries without SOH and taking into account the SOH. The battery adjusted capacity calculation is based on the battery manufacturer's table according to the battery required reserve time and the battery end voltage defined for the power plant. If this table does not cover the required reserve time and/or the end voltage specified in FIRM Suite, "N/A" will be displayed. (SOH Equation: Adjusted capacity x SOH)

Required Reserve Time:

This value has been specified by the administrator in the Power Plant General Information page of the equipment.

Estimated Reserve Time:

Battery current remaining time without SOH. This value is calculated according to the information specified in the manufacturer's table.

Estimated Reserve Time with SOH:

Battery current remaining time with SOH. This value is calculated according to the information specified in the manufacturer's table.

8. MAINTENANCE FORM

1.1. TYPE OF MAINTENANCE FORM

Table 8 – Type of Maintenance Form

Maintenance type	Description
Maintenance	Submitted maintenances will affect the active period. Data entered will be processed and the date of the next maintenance will be calculated accordingly.
Unplanned Maintenance	Submitted unplanned maintenances will not affect the active period. Data entered will be processed, but the date of the next maintenance will not be modified.

To access to the maintenance form:

1. In a site, click on a battery in the line-drawing to open the right panel
2. Click *Maintenance* or *Unplanned Maintenance*

1.2. RESERVE / UNRESERVE MAINTENANCE

To reserve a maintenance:

Anyone can reserve a maintenance.

1. In a maintenance, open the *Not Reserved Yet* section
2. Click on *Reserve*

User who reserved a maintenance can unreserve it by clicking *Unreserve*.


Clicking on *Save* or *Submitted* automatically reserve the maintenance.




A reserved maintenance can be submitted by anyone. Submitting maintenance reserved by another technician will automatically change their name to yours.

1.3. IMMEDIATE ACTION REQUIRED

1.3.1. Flag a site that needs immediate action

1. In the maintenance, enter a note and press *add*

2. Click on the *Require Action* icon  to flag it “Needs immediate action”
3. Confirm the request

NOTE: The grey icon  means that the message is not flagged as “Needs Immediate Action”; the red icon  means the flag is “ON”; the green icon  means the immediate action is resolved.

When an action is required, a message is automatically sent to the managers assigned to the site.

8.3.2. Resolve an immediate action

1. In the maintenance, click on *Resolve*




2. Enter a note and confirm

To notify the requester that the maintenance has been resolved, a message will be sent in their Message Center.


8.4. PUBLISH A NOTE

To publish a note:

1. In the maintenance, enter a note and press *Add*
2. Click on the *Publish* icon 
3. Confirm the post

When a note is published, a message is automatically sent to the managers and technicians assigned to the site.

To unpublish a note:

You can click on the *Unpublish* icon  in the maintenance form or in the View All Message page.

Unpublish a note will delete the message for everyone who received it.

8.5. ATTACHMENTS

The following file types are accepted for attachments: .CSV files, .JPG, .GIF image files, .TXT, .DOC or .XLS files. At any time, you can download a file by clicking on the file name.

8.6. IMPORT A MAINTENANCE

Use the *Import* button to upload data from various battery test sets. Voltage, Temperature, Ohmic value (Conductance or Impedance) and intercell resistance (strap) can be imported from .CSV or .C60 file generated by the battery test sets. Currently, we support the following makes and models: Vertiv (Alber) Cellcorder CRT-400, Franklin (Midtronics) Advantage and Ultra.

The file must contain exactly the same number of cells as the battery and the conductance values of a downloaded file may contain 1, 2, 3, or 4 readings per cell depending on the number of poles defined in the battery.

Files imported will be automatically attached to the maintenance.

NOTE:

The posts by cell values will be displayed in the form the first time that a file is imported. If the maintenance has a warning, the posts by cell section will switch for the warning messages. If a file is imported again, FIRM Suite will automatically display the right values in the conductance fields and keep displaying warning messages.

Here are the files accepted for downloading values as well as the validations made before displaying the values in the maintenance:

8.6.1. .C60 files

- Files with the extension .C60.
- Values that can be downloaded: maintenance date, and cells conductance and voltage.
- 4 or 6 poles battery management.
- Only the "Reference Date" tags (or "Date de Référence"), "Battery Model" (or "Modele de la Bac"), "Jar Index" (or "Index de la bac"), "Jar G" (or "Bac-G") and "Jar Volts" (or "Tension de la bac") are used when downloading values.
- If the "Reference Date" tag (or "Date de Référence") is present but does not have a date in a recognized format, an error will be displayed and the values will not be downloaded. The date formats accepted are checked in the following order: DD/MM/YY, MM/DD/YYYY, MM/DD/YY, MM/DD/YYYY, M/DD/YY, M/DD/YYYY, DD/M/YY, DD/M/YYYY, MM/D/YY, MM/D/YYYY, D/M/YY, D/M/YYYY, M/D/YY, and M/D/YYYY. If the date is in the future, the date displayed in the maintenance form will be the current date.
- The "Jar Index" tag (or "Index de la bac") is used for counting the number of cells and indicate the case of the 4, or 6-poles battery. In the case of 4 or 6-pole batteries, 2 or 3 readings are taken for each cell and only the lowest value (conductance or voltage) must be reported for the cell in the maintenance form. For this, the third section of the "Jar Index" tag is only used if it contains exactly 4 characters to address the batteries with 4 or 6 poles. In this case, the last character indicates the pole and the other 3 are used to identify the cell in order to take the minimum value of conductance and / or voltage for each cell. However, no link is made between the identification of the cell in the file and the number of the cell in the maintenance form. Cells are processed in the order of the file.
- If the conductance or voltage is not set for one of the cells, no value will be displayed in the box in the maintenance form.

8.6.2. Advantage type .CSV files

- Files with the extension .CSV and where the first box of the first line contains "Site."
- Values that can be downloaded: cell conductance and voltage.
- 4 or 6-pole battery management
- When a download is performed for a single battery, the file must contain a header row and a single row for each of the battery cells.
- When a download is performed for a power plant, the file must contain a header row and a single row for each cell of each battery. A single blank row must be used to separate the next battery cell rows. The number of cells for each battery of the maintenance must exactly match the number of cells set in the file and in the same order.

- The conductance values are read in columns with a header that contains "Cond," but not "Ref". In the case of the 4 or 6 pole batteries, many "Cond" columns ("Cond A", "Cond B", and "Cond C") will have values for each line.
- The voltage values are read in the column whose header contains "Volts". In the case of the 4 or 6 pole batteries, many "Volts" columns ("Volts A", "Volts B", and "Volts C") will have values for each line.
- For 4 or 6-pole batteries, 2 or 3 readings are taken for each cell and only the lowest value (conductance or voltage) must be reported for the cell in the maintenance. No link is made between the identification of the cell in the file and the number of the cell in the maintenance. Cells are processed in the order of the file.

8.6.3. Alber type .CSV files

- Files with the extension .CSV and where the first box of the first row contains "Location Name".
- Values that can be downloaded: impedance and cell voltage.
- No management for 4 or 6-pole battery.
- The values of the cells are specified in rows following the row where the first box reads "Low SG". Each row must match a single cell. The last row of the file is never taken into account, since the boxes specifying the voltage and the impedance are usually 0. For example, in a file that defines 5 cell rows, only the voltage and impedance of the first four rows will be downloaded into the maintenance, for 4 cells.
- The voltage values are read from the fourth column.
- The impedance values are read from the sixth column. The impedance values are divided by 1000 before being displayed in the maintenance.
- When a download is done for the power plant, the file must contain values for all cells of all the power plant batteries, without separation between the different batteries. For example, if a file contains the values of 24 cells, the values can be displayed in a single 24-cell battery or in six 4-cell batteries.

8.6.4. Ultra type .CSV files

- Files with the .CSV extension, which is neither of Advantage type nor Alber type and with a first row that has only the first box with a value.
- Values that can be downloaded: cell conductance and voltage.
- 4 or 6-pole battery management.
- The values of the cells are specified in the rows where the text of the 1st box starts with the letter J.

- Cell indexes are specified in the first column.
- Conductance values are read from the second column.
- The voltage values are read from the third column.
- The cell index is used to indicate if the last character is a letter for 4 or 6-pole batteries. In the case of 4 or 6-pole batteries, 2 or 3 readings are taken for each cell and only the lowest value (conductance or voltage) must be reported for the cell in the maintenance. No link is made between the identification of the cell in the file and the number of the cell in the maintenance. Cells are processed in the order of the file.
- If the download is done for the power plant, the file must contain values for all cells of all the power plant batteries, without separation between the different batteries. For example, if a file contains the values of 24 cells, the values can be displayed in a single 24-cell battery or in six 4-cell batteries.

8.7. BATTERY INFORMATION

8.7.1. Tested

Use the tested buttons to document the context of the tests:

The battery was: Online or Offline.

You were using: Grips or Picks.

The measures were taken from: Posts, Intercell or Connector.


8.7.2. Reference Values

Reference values come from the template and are specific to the battery model. The percentage color (measured value/reference value) is based on the defined business rules.

8.7.3. Modify Reference - Optional

The user can decide if the reference values will come from the first reading or the manufacturer. At the 6 months milestone (for example) the technician might want to replace the theoretical values to replace them with the measured values. If this option is selected (can only be selected once in battery lifetime), the theoretical values will be replaced with the measured values; the next maintenance will show these values in the reference values columns.

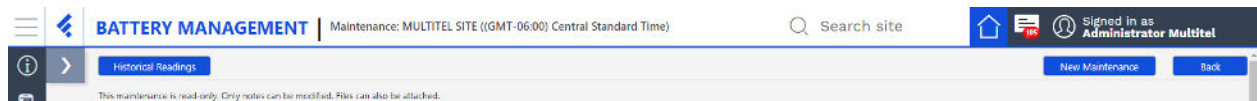
8.7.4. Manufacturing Date Field

Clicking on the icon  apply the date entered for all cell.

8.8. NEW MAINTENANCE BUTTON

The *New Maintenance* button is available only for a fixed period. The button is displayed when the maintenance is approved and the current period is not closed yet.

Clicking on the *New maintenance* button allows the user to perform other maintenance in the current period. The next maintenance date will be calculated with the date of the last approved maintenance done.




9. MAINTENANCE APPROVAL

NOTE:

The inventory update must be approved before the manager approves the warnings.

If the data submitted by the technician does not meet the pre-set business rules once the validation is complete, the maintenance will feature a warning status. The manager can approve or reject the warnings.

To approve maintenance:

Maintenance waiting for an approval are listed in the warning tab in the maintenance dashboard. Clicking on the action icon  will bring you to the maintenance.

To each warning maintenance, the manager associated with the site will receive a message in the message center. Clicking on the message brings you directly to the maintenance.

9.1. APPROVED

If the warnings are approved, the maintenance will turn into approved state with a warning status. The data will be processed and the next due date will be updated accordingly.

9.2. REJECTED

If warnings are rejected, the status of the maintenance will be rejected. The maintenance will need new data or further approval before its state changes to having been approved. It will not change the due date as the maintenance will be considered as incomplete.

9.3. VALIDATIONS

When submitted, the mandatory data entered in the maintenance is validated.

If the validation raises a warning, a message appearing beside the value to explain the warning.

The validation will create warnings in the following cases: (customizable)

- A power plant voltage has no value.
- A power plant voltage is at least X% lower than the previous value recorded.
- A power plant voltage is at least X% higher than the previous value recorded.
- A power plant load current is at least X% lower than the previous value recorded.
- A power plant load current is at least X% higher than the previous value recorded.
- A power plant temperature is at least X% lower than the previous value recorded.
- A power plant temperature is at least X% higher than the previous value recorded.
- A battery float current value is at least X% lower than the previous value recorded.
- A battery float current value is at least X% higher than the previous value recorded.
- A battery float voltage value is at least X% lower than the previous value recorded.
- A battery float voltage value is at least X% higher than the previous value recorded.
- A battery terminal connection resistance value is at least X% lower than the previous value recorded.
- A battery terminal connection resistance value is at least X% higher than the previous value recorded.
- A cell conductance value is at least X% lower than the previous value recorded.
- A cell conductance value is at least X% higher than the previous value recorded.
- A cell impedance value is at least X% lower than the previous value recorded.
- A cell impedance value is at least X% higher than the previous value recorded.
- A cell intercell resistance value is at least X% lower than the previous value recorded.
- A cell intercell resistance value is at least X% higher than the previous value recorded.
- A cell voltage value is at least X% lower than the previous value recorded.
- A cell voltage value is at least X% higher than the previous value recorded.
- A cell temperature value is at least X% lower than the previous value recorded.
- A cell temperature value is at least X% higher than the previous value recorded.
- A temporarily battery added is not approve yet.
- A temporarily battery added or deleted is not approve yet.

NOTE:

Value entered in none mandatory fields will not be validated.

If cell serial number and manufacturing date are mandatory, fields are validated.

- Cell serial number stored in FIRM Suite differs from the cell serial number in the maintenance form.
- Cell manufacturing date stored in FIRM Suite differs from the cell manufacturing date in the maintenance form.

If there are no cell serial or manufacturing date stored in FIRM Suite and values are entered in the maintenance form, the values are automatically updated in the General Information page of the equipment after approval regardless of the configuration.

10. MESSAGE CENTER

There are two (2) different types of information that can be found in the Message Center:

1. Action messages: Message required an action
2. Notification messages: Message to inform about an event

10.1. ACTION MESSAGE

10.1.1. Manager

Table 9 – Message Manager

Message Name	Trigger	Removal	Action
Immediate Action Required	When someone flags a note for immediate action required in the maintenance form	The message is displayed until the immediate action is resolved	Leads to the maintenance interface
Warning Maintenance	When a maintenance failing validation	The message is displayed until the maintenance is approved or warning are resolved.	Leads to the maintenance interface

10.1.2. Inventory Manager

Table 10 – Inventory Message Manager

Message Name	Trigger	Removal	Action
Inventory Update	When a temporarily inventory update has been done	The message is displayed until the inventory update has been approved	Leads to the general information of the equipment

10.1.3. Technician

Table 11 – Technician Message

Message Name	Trigger	Removal	Action
Maintenance Rejected	When a maintenance is rejected by the manager	The message is displayed until the maintenance is resubmitted	Leads to the maintenance interface
Inventory Rejected	When an equipment temporarily deleted is rejected	Technician must delete the message in the View all Messages page	Leads to the general information of the equipment

10.2. NOTIFICATION

10.2.1. Manager & Technician

Table 12 – Manager & Technician Message

Message Name	Trigger	Removal	Action
Maintenance Reminder	When a maintenance due date is within the reminder timeframe of the period *Email are sent every night to subscribers	The message is displayed until the maintenance has been submitted	Leads to the maintenance interface
Maintenance Note	When someone publishes a note in the maintenance form	The message is displayed until someone unpublishes it	Leads to the maintenance interface
Maintenance Resolved	When manager resolved a maintenance	The message is displayed until someone deletes it in the view all message page	Leads to the maintenance interface

Battery Fail	According to battery replacement business rules	The message is displayed until someone deletes it in the view all message page	Leads to the equipment failed
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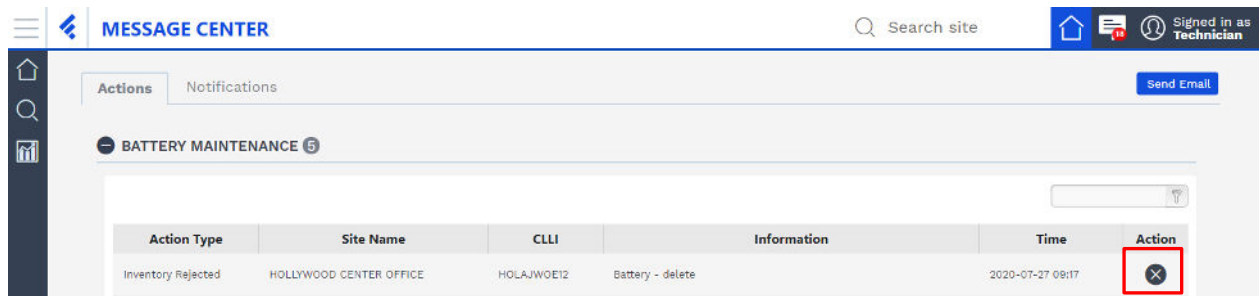
10.3. VIEW ALL MESSAGES

If you click *View all messages*, the Message Center will open on the entire page. Clicking on a message will lead you to the action page associated with the message.

10.3.1. Action Button

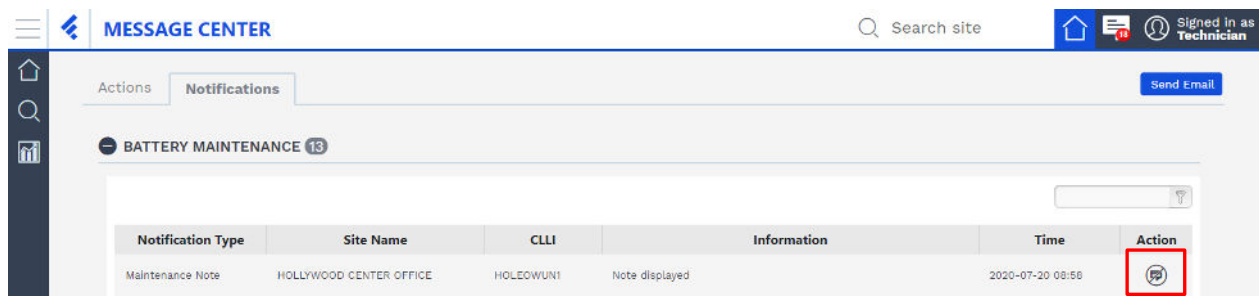
On this page, you can delete an inventory rejected message by clicking on the delete  icon.

Figure 8 – View all Messages - Delete



On this page you can unpublish a maintenance without going to the maintenance form.

Figure 9 – View all Messages - Unpublish



11. E-MAIL ASSIGNMENT

11.1. SUBSCRIBE

The email address use to send e-mail is the one set in the user profile.

1. In the Settings-System Parameters page, click *E-mail*
2. Click *Subscriber*
3. Assign group and/or user for each message

NOTE:

The groups and users displayed are only those with battery management rights.

4. Save the assignment by clicking on the red floppy disk 

11.2. CONFIGURATION

1. In the Settings-System Parameters page, click *E-mail*
2. Click *Configuration*
3. Turns SMTP Server on
4. Fill the form

SMTP Server Name/IP

NOTE:

If you enter a wrong SMTP Server Port, you will not be able to send emails. We recommend you send a test email after configuring the SMTP Server. You can send a test email by clicking on the send email button to the Subscriber page.

SMTP Server Port

The outgoing mail server port uses normally is 25.

Email address in the “FROM” text box

5. Save by clicking on the red floppy disk 