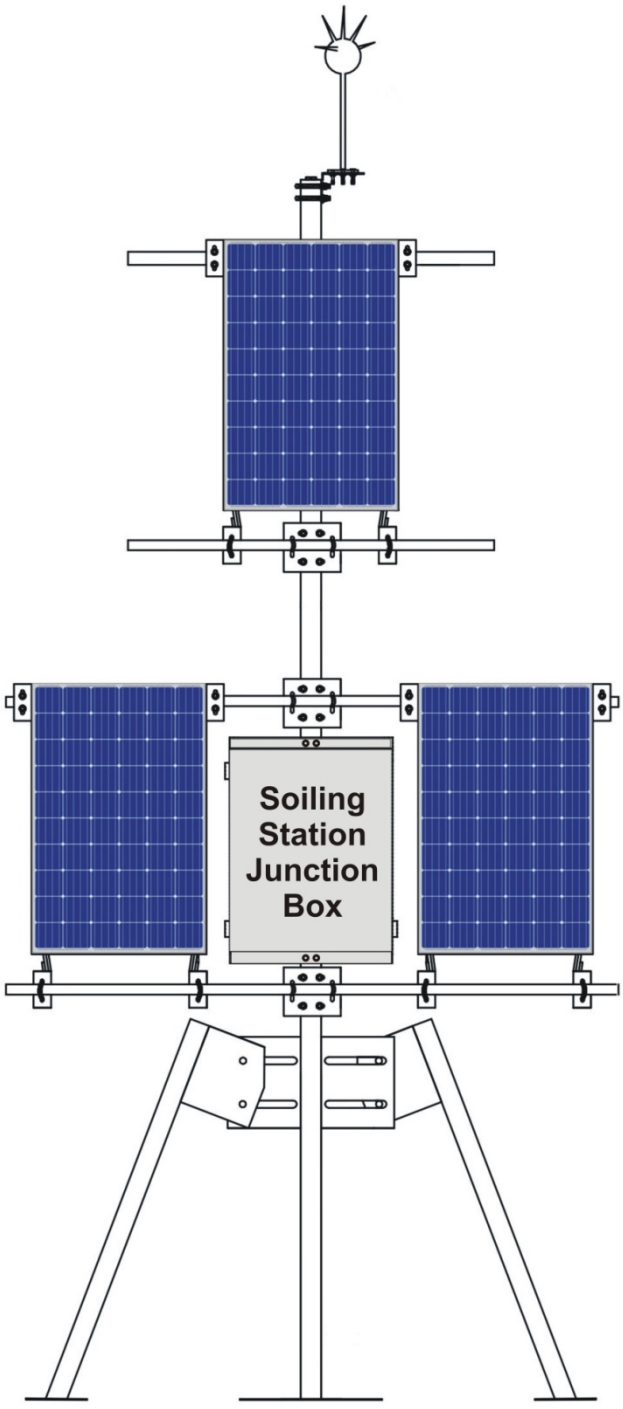
MBSoiling Station– 700 Series

Advanced Soiling Station Series



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SW 3.10

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1. Warnings

- Installation at site should be done by skilled and qualified personal after taking required approvals.
- Use proper protection gear and tool while installing the device.
- Be aware of your surroundings while doing the installation work.
- Serious injury can occur if proper safety norms are not followed.
- Compliance with all utility and electrical safety codes regulations are mandatory.
- Read the manual and get acquainted with the datalogger connections and terminals before commencing installation activity.
- Before connecting the datalogger, read its label to confirm power supply requirements.
- All connections should be done only when power to device is switched off.
- Improper installation and connections may damage the device and sensors connected to the same.
- Protect from overvoltage and static electricity.
- To prevent potential fire or shock hazard, do not expose the datalogger to rain or moisture.
- Physically damaged equipment should not be used or connected to main power.
- Use proper earth connection.

2. MBSoiling Station

MBSoiling Station series-700 is advanced range of soiling station. The soiling station provides following advanced functions:

3. Uses latest ARM 32 bits processor.
4. Real time monitoring of clean and soiled PV panels.
5. Regular monitoring and filtering of soiling parameters.
6. All measurements are available via serial RS485 (MODBUS RTU) and ETH (MODBUS TCP) ports.
7. Modem 4G (optional) for communication of logged files to remote servers.
8. IOT communication with remote diagnostics and control.
9. MODBUS TCP (master and slave), SNTP, FTP, MQTT and DNS.
10. All parameters are available as MODBUS (RTU or TCP) slave parameters.
11. External SD memory card (16GB) for data logging.
12. Programmable data logging interval.
13. Embedded webserver for configuration of soling functions and diagnostics (real time view of measured parameters). No programming is required.
14. MyPage – to display user selected parameters in one webserver page.
15. Internal battery backed up real time clock (RTC).
16. Data file transfer to two file servers.
17. Internal memory of 32MB and expandable SD card memory up-to 16GB.
18. Log for user activity and device messages/ faults.
19. Calibrate soiled panel with respect to clean panel.
20. Powered via solar charge PV panel or AC power supply.
21. Optional – automatic cleaning of soiled and clean panels. With monitoring of cleaning liquid level in the tank.
22. **Excellent on-site diagnostic support with soiling station status and value reports.**

2.1 MBSoiling Station Applications

The soling station is used to measure power generation losses due to soiling of panels in of photovoltaic plant. Number of soiling stations to be installed in a plant will depend on its topology and size. Guidelines provided in IEC-61724-1 should be followed.

Soiling station can be used in various applications:

- Site resource and generation capacity assessment.
- Scheduling of PV panel cleaning.
- Plant performance evaluation.

2.2 Soiling Parameters

Following soiling parameters are measured and calculated:

Sl. No.	Parameter	Description
1	Reference Panel Voltage	Reference Panel open circuit voltage
2	Reference Panel Current	Reference Panel short circuit current
3	Reference Panel Temperature	Reference Panel temperature
4	Soiled Panel Voltage	Soiled Panel open circuit voltage
5	Soiled Panel Current	Soiled Panel short circuit current
6	Soiled Panel Temperature	Soiled Panel temperature
7	Reference panel Effective Irradiation - EffRadClean	Calculated based on panel short circuit current and panel temperature for reference panel. This calculation also compensates for the panel temperature and the panel temperature coefficient.
8	Soiled panel Effective Irradiation - EffRadSoil	Calculated based panel short circuit current and panel temperature for soiled panel. This calculation also compensates for the panel temperature and the panel temperature coefficient.
9	Soiling Ratio	EffRadSoil/ EffRadClean
10	Soiling Index (%) (SLI)	(1- EffRadSoil/ EffRadClean)*100. This calculation is also compensated for calibration constant of soiled panel.

Table -2.2: Soiling parameters

2.3 MBSoiling Station Models

Various options and models available are shown in table 2.3 below:

Sl. No.	Features	700XXH	700XMH	700CXH	700CMH
1	**Port Serial Port -1** RS-485 (MODBUS RTU Slave)	●	●	●	●
2	**Port ETH** (MODBUS TCP Slave, Web Server, FTP and SNTP)	●	●	●	●
3	**Cellular Modem**	-	●	-	●
4	**MMC SD Card (16GB)**	●	●	●	●
5	**Maximum number of MODBUS TCP Slave clients**	4	4	4	4
6	**SNTP Client**	1	1	1	1

7	**File Transfer Clients**	2	2	2	2
8	**RTC (battery backed up)**	●	●	●	●
9	**Solar PV Power supply**	●	●	-	-
10	**AC Power supply**	●	●	●	●
11	**Auto Panel cleaning**	-	-	●	●

Table-2.3: Soiling Station models

Note: C: Soiling station with cleaning option.
M: Soiling station with modem
H: Soiling station with high wattage solar panel

3 MBSoiling Station Installation

MBSoiling Station connections are described in this section. All connections described here may not be available in your soiling station. Features and connections available will depend on the model selected.

3.1 MBSoiling Station With Solar Charger:

Soiling station can be powered via solar PV panel or AC power supply.
Diagram for soiling station is shown in figure 3.1 below.

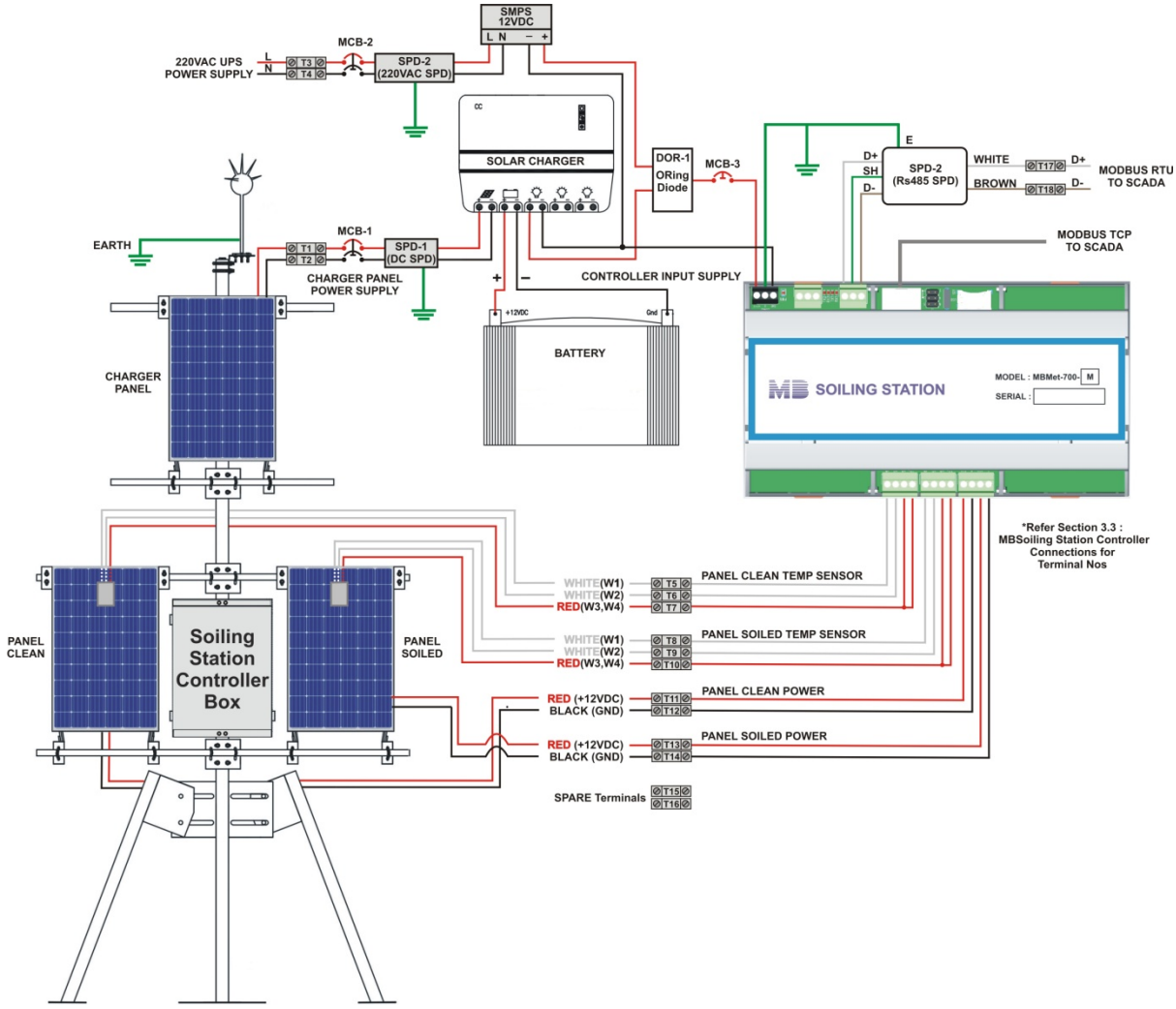


Fig - 3.1Soiling station with solar charger

Parts of soling station with solar charger are listed in table-3.1 below.

Sl. No.	Part	Model	Description
Soiling Station			
1	Pole	MS Pole- three meters	Galvanized pole with tripod and accessories.
	Measurement panels boom Pipes		Galvanised- for installing measurement solar panels

			along with mounting accessories.
2	Panel Reference	50W	Reference solar panel
3	Panel Soiled	50W	Soiled solar panel
4	Temperature sensor – reference panel	MBMet-801B-3000	PT1000 with three meters cable
5	Temperature sensor – soiled panel	MBMet-801B-3000	PT1000 with three meters cable
7	Lightning Arrester		Copper
8	Copper strip	25x2.5mm – Five meters	For earthing lightening arrestor
9	Solar charging panel	50W	Solar charging panel
10	Charging panel boom Pipes		Galvanised- for installing charging solar panel along with mounting accessories.
11	Cables		Required interconnecting cables
Soiling Station Control Box			
1	Soiling station controller	MBMet-700X	Soiling station controller as per selected model
2	Battery charger		Battery charger
3	Battery	16AH	Battery to power soiling station
4	AC Power supply	12V/ 3A	Backup power supply
5	Enclosure		IP65
6	Enclosure mounting accessories		
7	Power supply and serial port protection devices		

Table- 3.1: Parts of soiling station with charger

3.2 MBSoiling Station – Without Solar Charger:

Diagram for soiling station without solar charger is shown in figure 3.2 below.

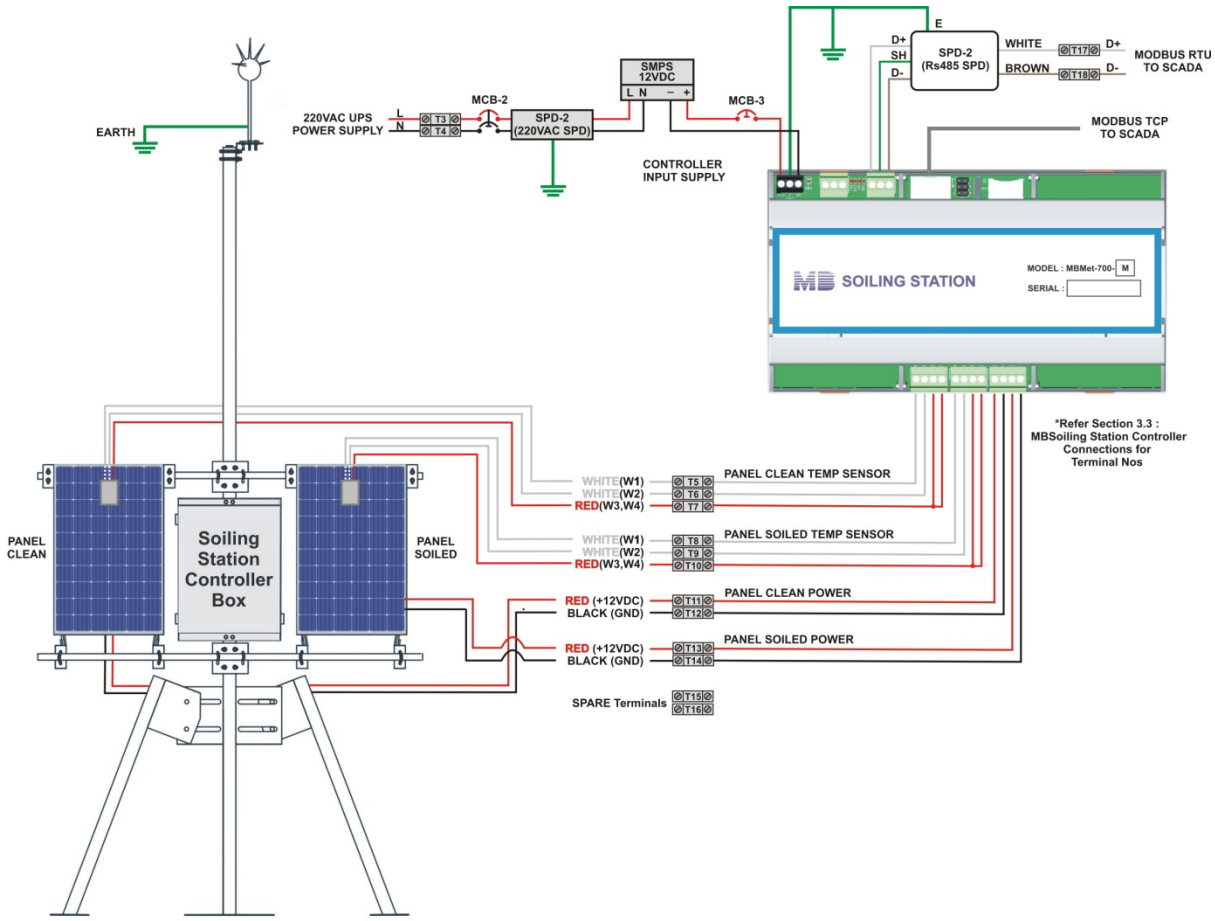


Fig - 3.2 Soiling station without solar charger

Parts of soling station without solar charger are listed in table-3.2 below.

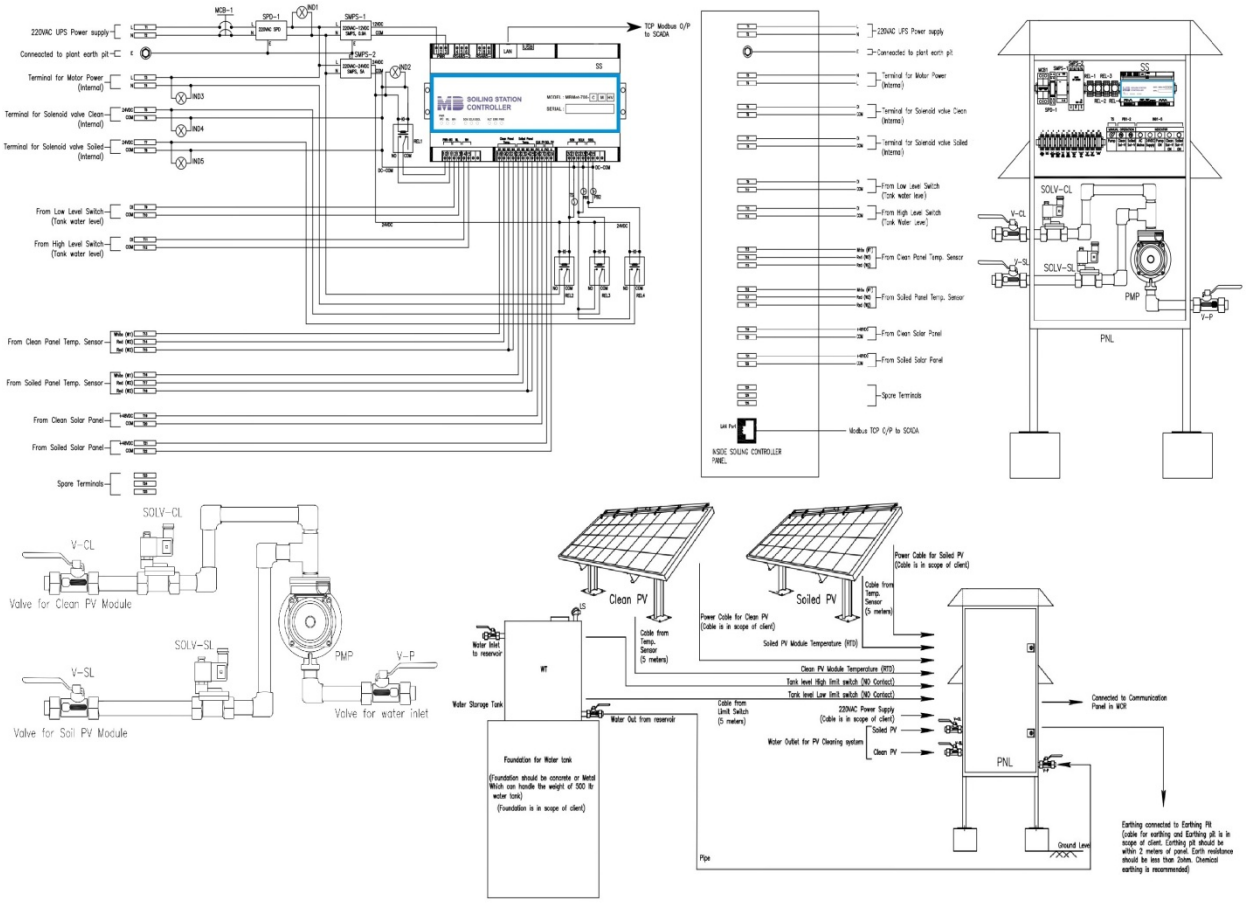
Sl. No.	Part	Model	Description
	Soiling Station		
1	Pole	MS Pole- three meters	Galvanized pole with tripod and accessories.
	Measurement panels boom Pipes		Galvanised- for installing measurement solar panels along with mounting accessories.
2	Panel Reference	50W	Reference solar panel
3	Panel Soiled	50W	Soiled solar panel
4	Temperature sensor – clean panel	MBMet-801B-3000	PT1000 with three meters cable
5	Temperature sensor – soiled panel	MBMet-801B-3000	PT1000 with three meters cable
7	Lightning Arrester		Copper

8	Copper strip	25x2.5mm – Five meters	For earthing lightening arrestor
9	Cables		Required interconnecting cables
Soiling Station Control Box			
1	Soiling station controller	MBMet-700X	Soiling station controller as per selected model
2	Enclosure		IP65
3	Enclosure mounting accessories		
4	Power supply and serial port protection devices		

Table- 3.2: Soiling station without solar charger

3.3 MBSoiling Station - Cleaning:

Reference clean panel of the soiling station should be cleaned periodically depending on local dust conditions. This should be done at least once in a day.
Soiled panel should be cleaned as per cleaning schedule of the generation PV panels.



3.4 MBSoiling Station Controller Connections

Soling station controller connections are explained here.

3.4.1 PV Panel Interface

Connections for clean and soiled solar panels are shown in figure -3.4.1 below.

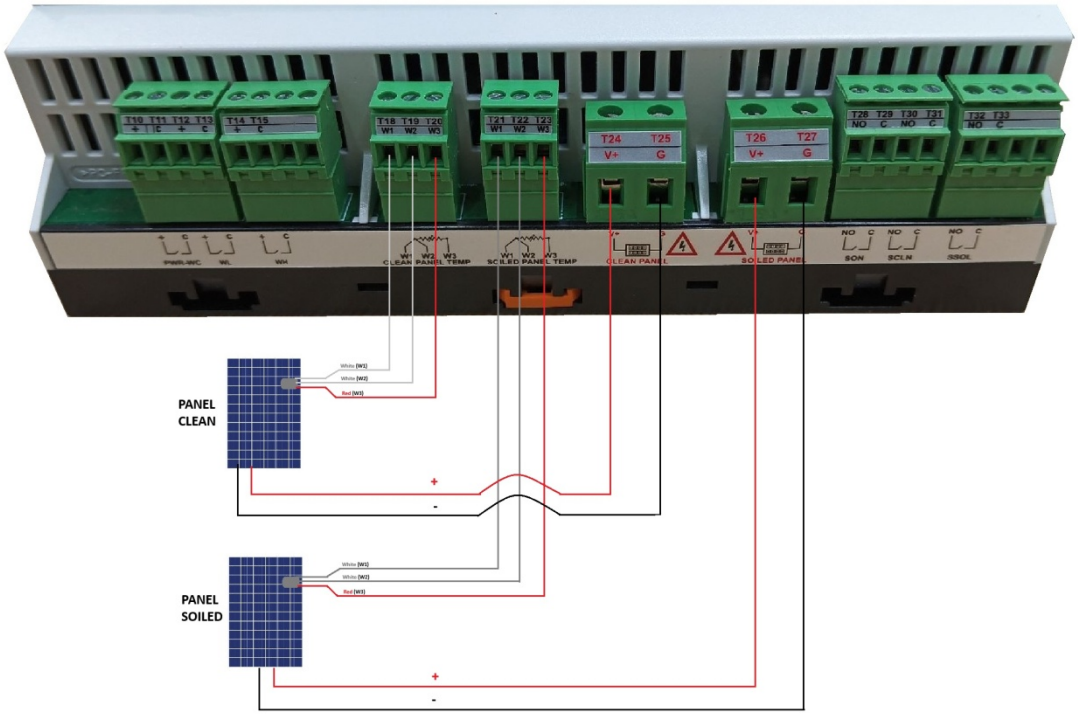


Figure-3.4.1: Clean and soiled panel connections

Details of measurement PV panels connections are provided below in table 3.4.1.

Terminal	Wire Colour	Description	Remarks
T18	White	W1	Clean panel temperature measurement using 3-wire RTD Connection.
T19	White	W2	
T20	Red	W3	
T21	Red	W4	
T22	White	W1	Soiled panel temperature measurement using 3-wire RTD Connection.
T23	White	W2	
T24	Red	W3	
T25	Red	W4	
T26	Red	Clean Panel +	Clean panel measurement
T27	Black	Clean Panel -	
T28	Red	Soiled Panel +	Soiled panel measurement
T29	Black	Soiled Panel -	

Table-3.4.1: Measurement solar panel connections

3.4.2 MBSoiling Station Power Supply Connections

Soiling station controller power supply connections are shown in figure 3.4.2 below.
These terminals are not plugin type.

Figure-3.4.2: Soiling station controller power supply connections.

Power supply connections details are listed in table-3.4.2 below.

Terminal	Wire Colour	Function	Remarks
T1	Red	V+	Voltage Range: DC 9 to 32VDC Power Consumption (Without modem) – 4W Power Consumption (With modem)- 10W Use proper MCB.
T2	Green	Earth	
T3	Black	V-	

Table-3.4.2: Soiling station controller connections

3.4.3 Serial Port -RS485

Soiling station serial port - RS485 are shown in figure 3.4.3 below. This port can be used only as MODBUS slave to read soling parameters.

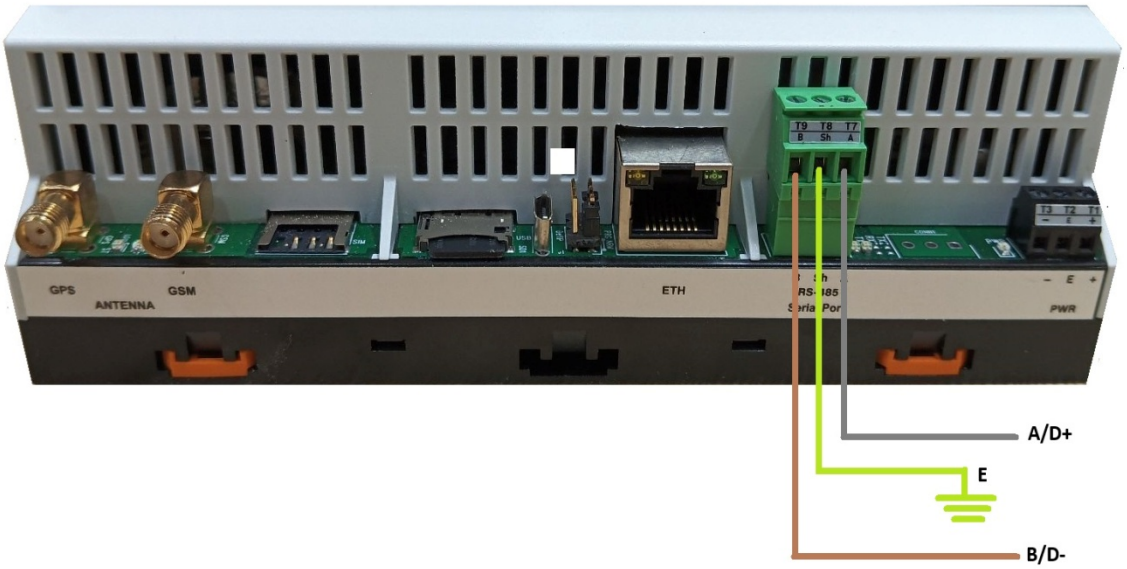


Figure-3.4.3: Soiling station serial port-1 (RS485) connections.

Note: Serial port-2 is not used.

Connection details for the serial port are listed in table-3.4.3.1 below.

Terminal	Wire Colour	Function	Remarks
T7	White	A	Isolated RS485 port. LED Rx and Tx provide indication for port activity. Can operate only as MODBUS RTU Slave. Use low capacitance, twisted pair and shielded cable for connecting devices to the port.
T8	Green	Shield	
T9	Brown	B	

Table-3.4.3.1: Soiling station serial port-RS485 connections

Default configuration for the serial RS485 port is provided in table 3.4.3.2 below.

S. No.	Description	Value
1	Baud rate	9600
2	Data bits	8
3	Parity	None
4	Stop bits	1
5	MODBUS Slave address	1

Table-3.4.3.2: Default port configuration parameters

These parameters can be changed via the embedded web server.

3.4.4 Port ETH

This ETH port (base 10MHz) is multi- function port.

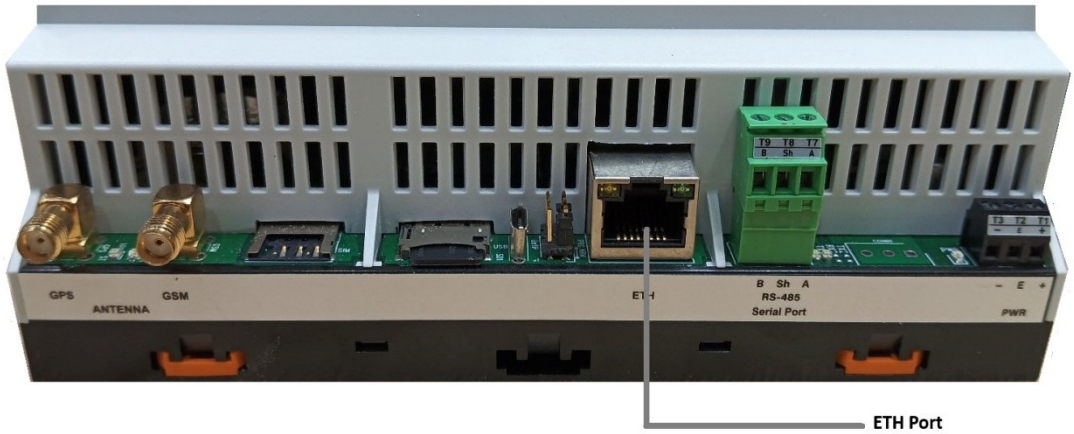


Figure-3.4.4.1: Soiling station ETH Port.

Use standard LAN cable with RJ 45 connector for connecting to the port.
Port activity LED are provided on the connector.

This port is used for following operations:

i) Configuration of soiling station via embedded web server.
ii) Downloading logged file.
iii) MODBUS TCP slave (multiple masters) to provide measured and collected parameters to other devices and SCADA.
iv) SNTP Client for time synchronization.
v) File transfer client (ftp).

Configuration details for ETH port are provided here.

Default network configuration for the ETH port is provided in table 3.4.4 below.

S. No.	Description	Value
1	Device IP	192.168.100.222
2	Network Mask	255.255.255.0
3	Network Gateway IP	0.0.0.0
4	Primary DNP IP	8.8.8.8
5	Secondary DNS IP	8.8.4.4

Table-3.4.4: Default ETH port network configuration

These parameters can be changed via the embedded web server.

Procedure for setting default IP address in the soiling station is provided below. This procedure should be followed only if IP address of the soiling station is not known. If soiling station IP address is known, use webserver in the soiling station to set the required IP address.

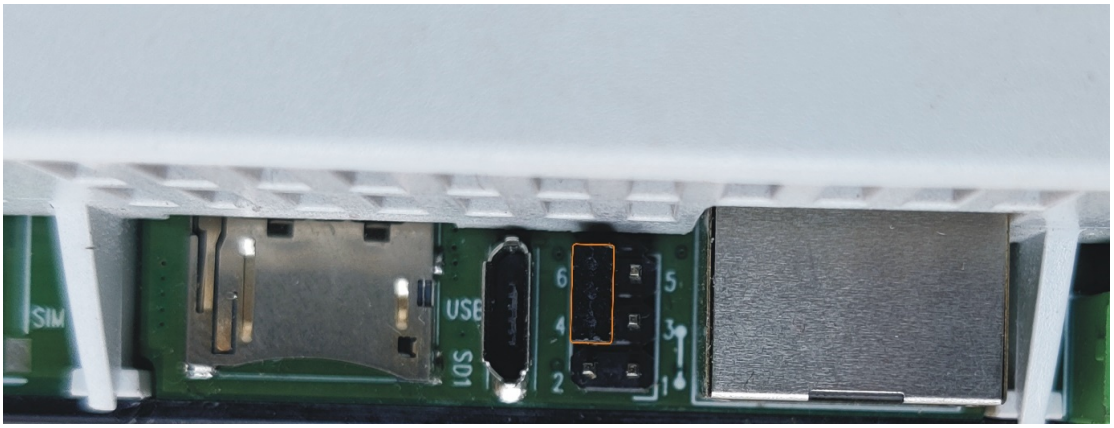


Figure -3.4.4.2: Jumpers for setting default IP address in the soiling station.

1. For normal operation jumper 6 and 4 shall be in open condition.
2. For setting default IP address short jumper 6 and 4 for about two seconds.
3. Remove the jumper between 6 and 4.
4. Wait for about five seconds.
5. Soiling station will restart with default IP address. Only default IP address and Subnet shall be set to default values.
6. Verify default IP address by using ping and / or logging in the soiling station webserver.

3.4.5 SD Memory Card

Soiling station supports microSD memory card up-to 16GB.

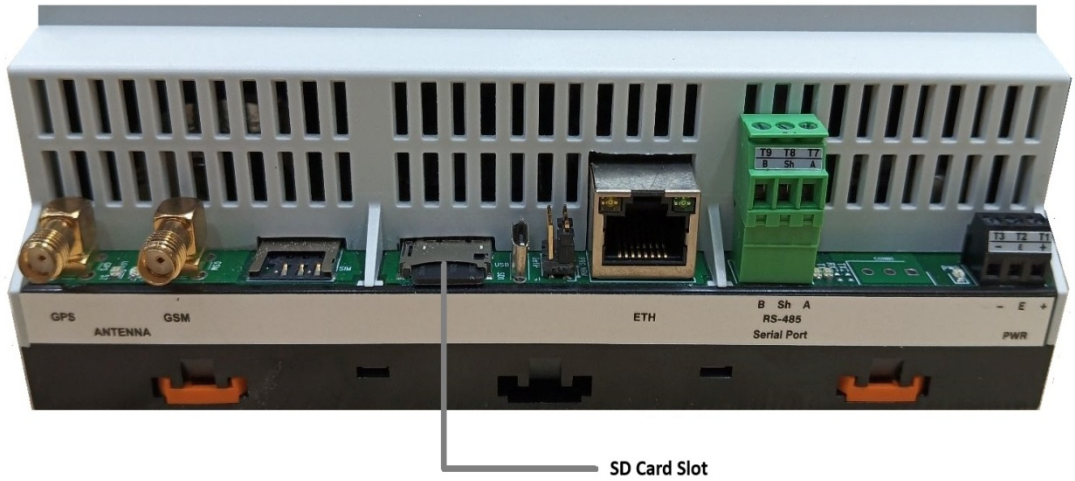


Figure-3.4.5: Soiling station SD card slot.

MicroSD card is used for data logging.
Configuration of data logging operations can be done via webserver.

3.4.6 Internal Modem (Optional)

Availability of internal modem is based on selected model.
High speed 4G modem (CAT-1) is provided.

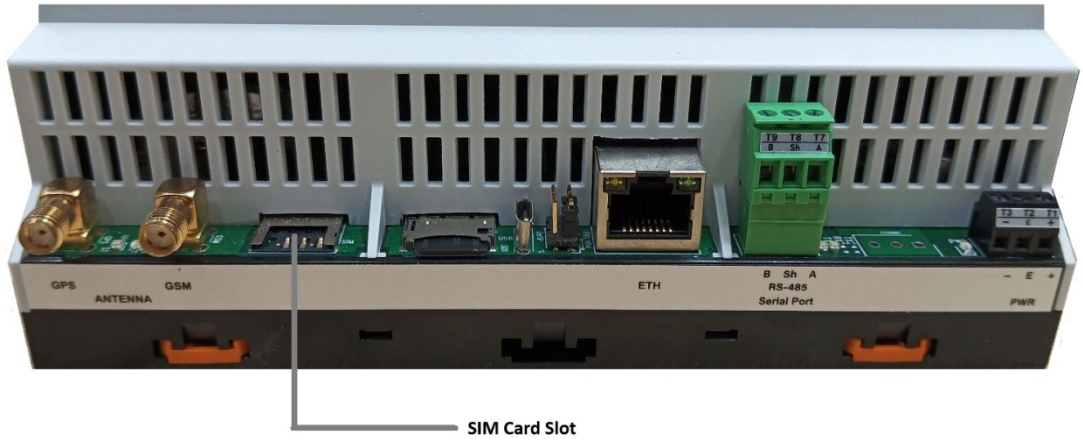


Figure-3.4.5: Soiling station internal modem.

Micro SIM slot is provided. Push the SIM inside to lock or un-lock the same.
Use the antenna provided along with the modem.
Contact our sales team if high gain antenna is required.

Modem configuration details are provided here.

Details of modem status LEDs are provided in table-3.4.6 below.

LED	Colour	Remarks
Modem Status	Green	Always OFF: Modem not ready. Always ON: Modem ready for operation.
Net Status	Blue	Always OFF: Power OFF. Always ON: Searching for network. ON 200mSec and OFF 200mSec: 4G registered. ON 800mSec and OFF 800mSec: 2G/ 3G registered.

Table-3.4.6: Modem status LED.

The modem can be used for following operations:

i) SNTP Client for time synchronization.
ii) File transfer client (ftp).
iii) IOT communication
iv) GPS operation

4 Embedded Webserver

MBSoiling station provides embedded webserver for configuration and diagnostics.

Following functionality is provided via the embedded webserver.

i) Soling Station configuration.
ii) Monitor measured parameters.
iii) Download and delete logged files
iv) User configuration.
v) Soiling Station diagnostic messages
vi) Dropdown list for section of pre-selected options.
vii) Limit validation for configured parameter values.
viii) Hoover (take cursor) over the parameter to get further details on the same.
ix) Details of not all parameters have been provided in this manual (to reduce the size). Further details can be obtained by using hoover over the parameter.
x) Auto configured parameters will not have editable configuration field.
xi) Configuration of parameters not applicable will be disabled.
xii) Limits are displayed for parameters with limits (allowed minimum and maximum values). Default values are provided for most of the parameters.
xiii) After editing any parameter click the cursor on any part of the screen. The parameter valued checked for errors and will be saved if there no error. If any error is found, same will be indicated on right hand top corner of the screen. Wrong values will not be saved and menu option for the parameter will turn red till the wrong value is corrected.
xiv) All edited parameters will be marked till the same has not been committed.
xv) Page menu option for the parameter will be marked with 'E'. This mark will be provided at all hierarchy levels (up wards) till "MBLogger Configuration'.
xvi) All configuration of parameters will be saved on 'Commit' operation. Edit marks will also be removed from all edited parameters on 'Commit' operation being successful.

4.1 User Login

Use ‘Chrome’ to login to soiling station embedded web server.

Use soiling station IP (for first login – use soiling station default IP) to login.
Following login screen shall be displayed as shown in figure-4.1 below.

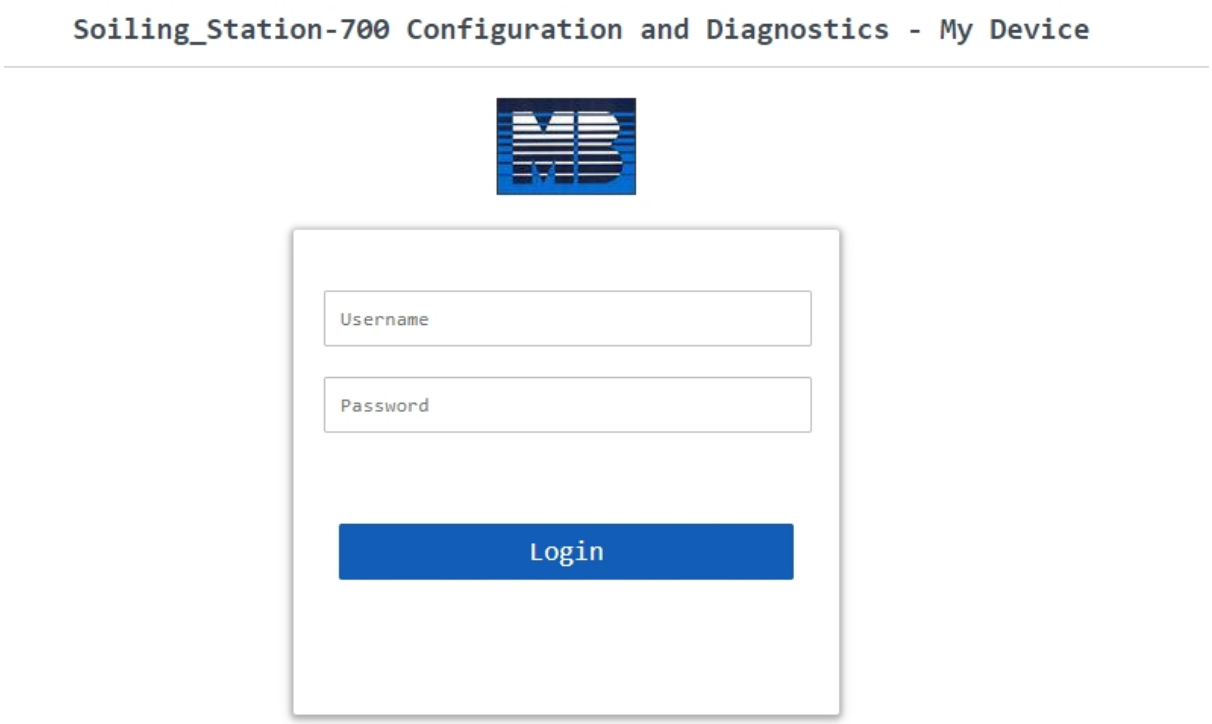


Figure-4.1: Soiling station login screen.

User login details are provided in table 4.1 below.

User Type	Default Password	User Rights
Viewer	‘Viewer’	Rights to view configuration and view diagnostic information.
Operator	‘Operator’	All rights for configuration, operation, and diagnostics.
Admin	‘Admin’	All rights for configuration, operation, diagnostics, and user configuration.
Maint	Not allowed	Maintenance user is used during manufacturing only.

Table-4.1: User login details

It advisable that first login should be done by ‘Admin’ and then other users and their passwords should be configured.

4.2 Welcome Page

Upon successful user login, welcome page as shown in figure-4.2 is displayed.

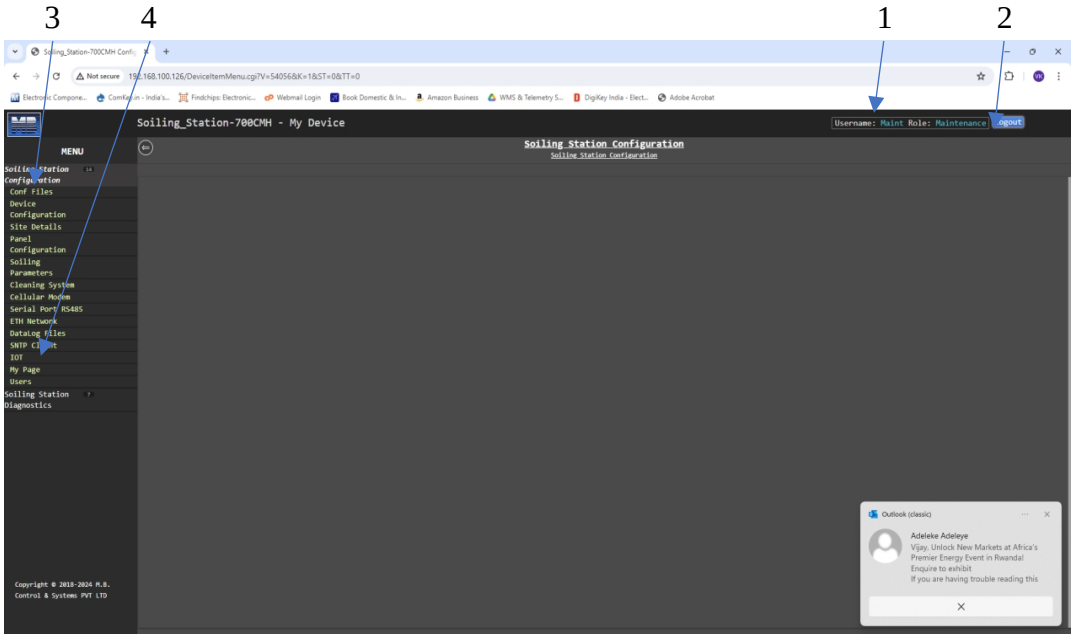


Figure-4.2: User login welcome page.

The welcome page is self-explanatory, all the information required for configuration of the datalogger is provided on the page.

Details of welcome page are provided in table 4.2 below.

Object No	Description	Remarks
1	Username and role	Displays logged username and role.
2	'Logout'	Button for user logout. User will be automatically logged out if there is no keyboard or mouse activity for three minutes. User will be warned about this by warning sign on right hand top corner of the page. User can do any keyboard or mouse activity to reset the logout timer.
3	MBSoiling Station Configuration	Left klick on this menu option to configure the soiling station. Menu options below will enable configuration all features of the datalogger. Left click on any menu option to configure the same.
4	Soiling station Diagnostics	Left klick on this menu option to view soiling station diagnostics menu.

Table-4.2: Soiling station welcome page

Note:
If the user closes the webpage without logging out, user will have to wait for about three minutes prior to next login.

4.3 Soiling Station Configuration Files

Soiling station configuration files can be saved in the soiling station SD card. Left click on menu option ‘Configuration Files’ to view the soiling station configuration files saved in the SD card shown in figure-4.3 below.

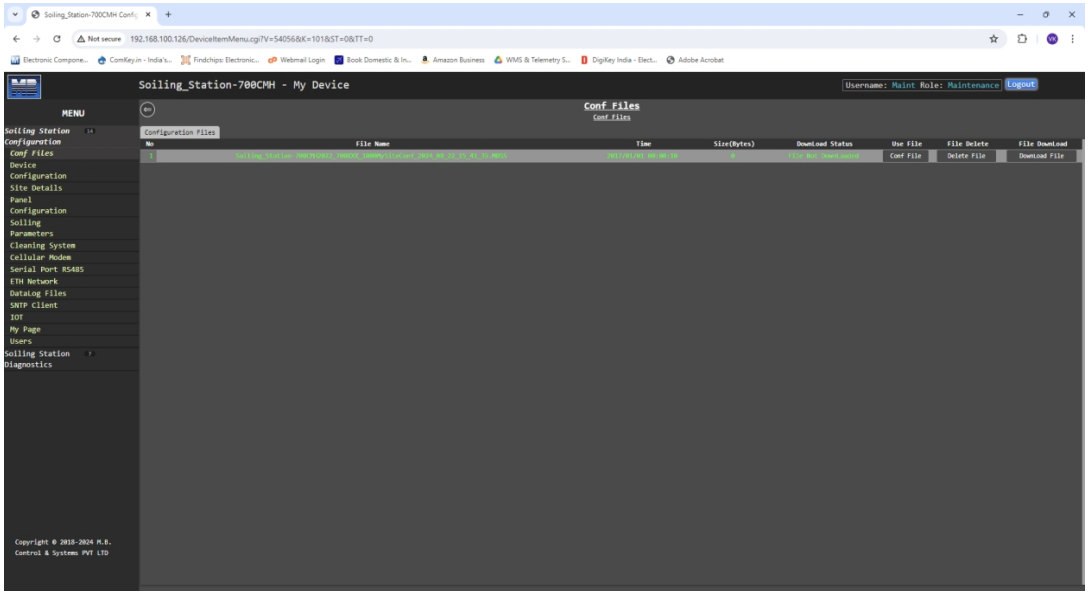


Figure-4.3: Soiling station configuration files.

Selected menu option shall be highlighted.

Operations available for soiling station configuration files are shown in table 4.3.1 below.

Sr. No	Operation	Action	Remarks
1	Save present soiling station configuration file	Right Click menu “Configuration Files” and select option “Save Present Configuration File” by left clicking on the option.	Soiling station configuration file will be saved in the SD Card and will be displayed in the list of configuration files saved. File name will model and serial number details.
2	Restore configuration	Right Click menu “Configuration Files” and select option “Restore Configuration” by left clicking on the option.	Soiling station configuration shall be restored in webserver. All edited ‘E’ parameters will be reverted to values and status as per current configuration of datalogger. This will be confirmed by removal of ‘E’ mark from all edited parameters.

3	Upload Configuration File	Right Click menu “Configuration Files” and select option “Upload Configuration File” by left clicking on the option.	Soiling station configuration file shall be uploaded from the selected directory in PC. Selected file shall be verified and will be uploaded only if the file all verification procedures.

Table-4.3.1: Soiling station configuration file operations

Options available for saved soiling station configuration files are shown in table 4.3.2 below.

Sr. No	Operation	Action	Remarks
1	Download File	Click on button “Download File” for the file to be downloaded.	Selected file will be downloaded on connect PC/ Laptop. File “Download Status” will show “File Downloaded”
2	Delete File	Click on button “Delete File” for the file to be deleted.	The file will be deleted and removed from the list. Deleted files cannot be restored.
3	Use file for configuration	Click on button “Conf File” for using the file for configuration.	The file will be validated. If validation is OK, soiling station configuration parameters will be displayed as edited parameters. Parameters which do not match with present configuration shall be marked with ‘E’. Use ‘Device Commit’ operation to configure the datalogger with the selected file.

Table-4.3.2: Operations for saved configuration files

4.4 Device Configuration

Left click on menu option ‘Device Configuration’ to configure soiling station parameters as shown in figure-4.4 below.

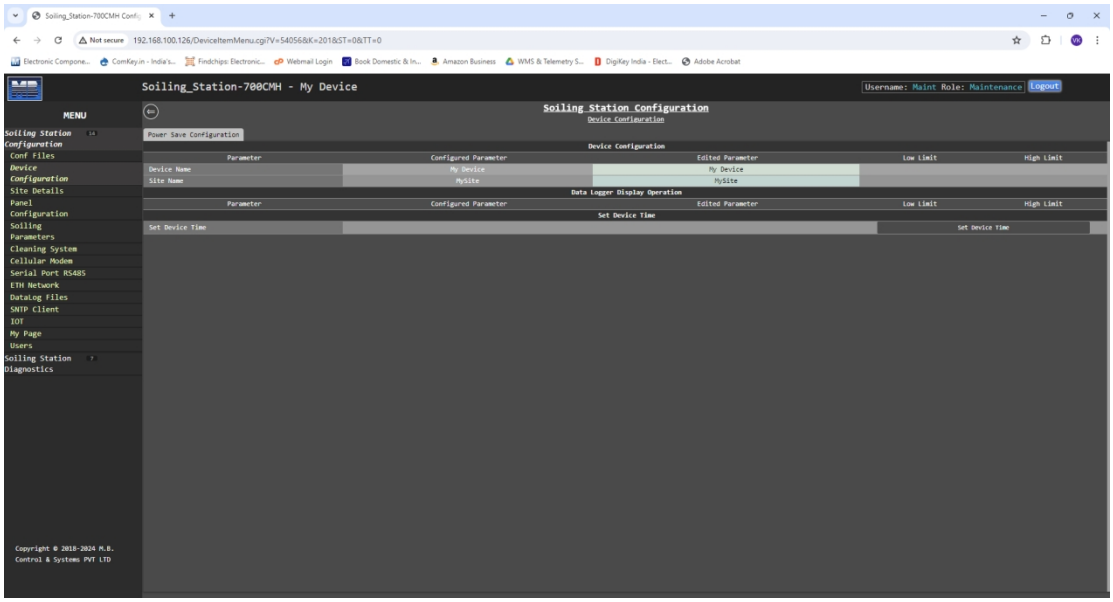


Figure-4.4: Configuration of soling station parameters.

Selected menu option shall be highlighted.
Select the required tab to configure the tab parameters. Selected tab shall be highlighted.

Details of the page are provided in table 4.4 below.

Sr. No	Parameter	Description	Remarks
1	Device Name	Device Name.	Device name. – Default is ‘MyDevice’.
2	Site Name	Site Name	Site name – Default is ‘MySite’.
3	Set Device Time	Left click on the button ‘Set Device Time’ to synchronize the datalogger time with PC time	On successful operation, current time will be displayed.

Table-4.4: Configuration – soling station

4.5 Site Details

Left click on menu option ‘Site Details’ to configure site details and sun times of the soiling station.

4.5.1 Soiling Station Site Details

Select tab ‘Site Details’ to configure soiling station site details as shown in figure 4.5.1 below.

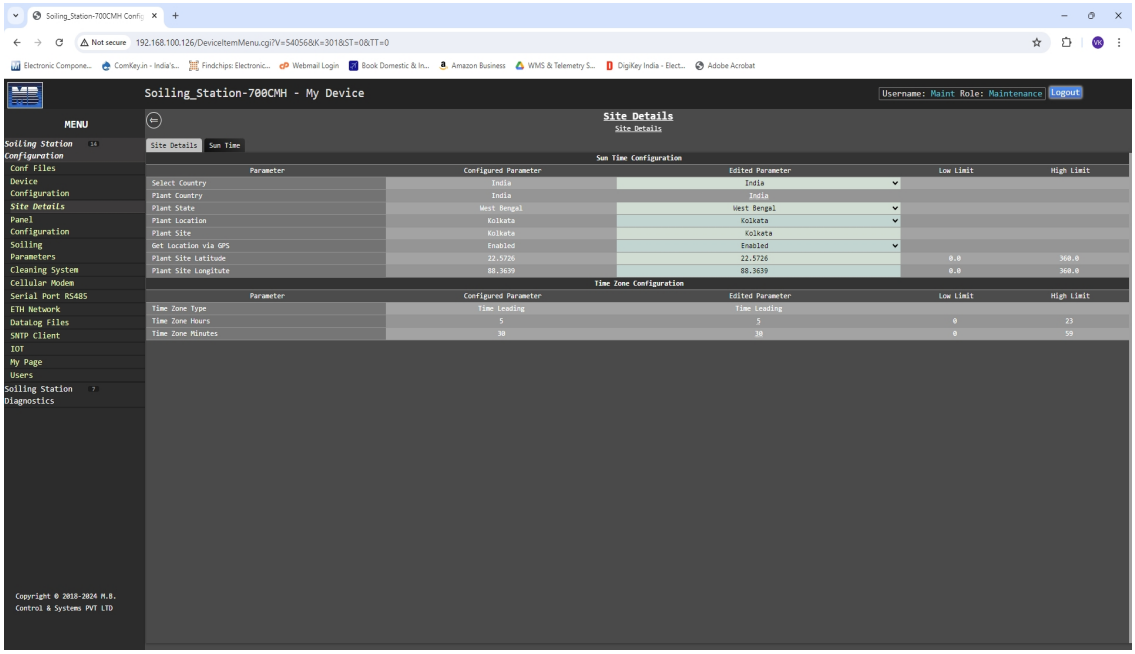


Figure-4.5.1: Configure site details of soiling station.

Configuration parameters of site details are provided in table 4.5.1 below. These parameters are used to calculate sun rise, sun set and solar noon times.

Sr. No	Parameter	Description	Remarks
	Plant Site Configuration		
1	Select Country	Configure soiling station site location	Select and configure site location parameters
2	Selected Plant Country		
3	Plant State		
4	Plant Location		
5	Plant Site		
6	Plant Site Latitude		
7	Plant Site Longitude		
	Time Zone Configuration		
1	Time Zone Type	Select ‘Time Leading’ or ‘Time Lagging’	Select time zone of the site
2	Time Zone hours		Enter time zone
3	Time Zone Minutes		

Table-4.5.1: Configuration – site details

4.5.2 Sun Time

Select tab ‘Sun Time’ to configure sun parameters as shown in figure 4.5.2 below.

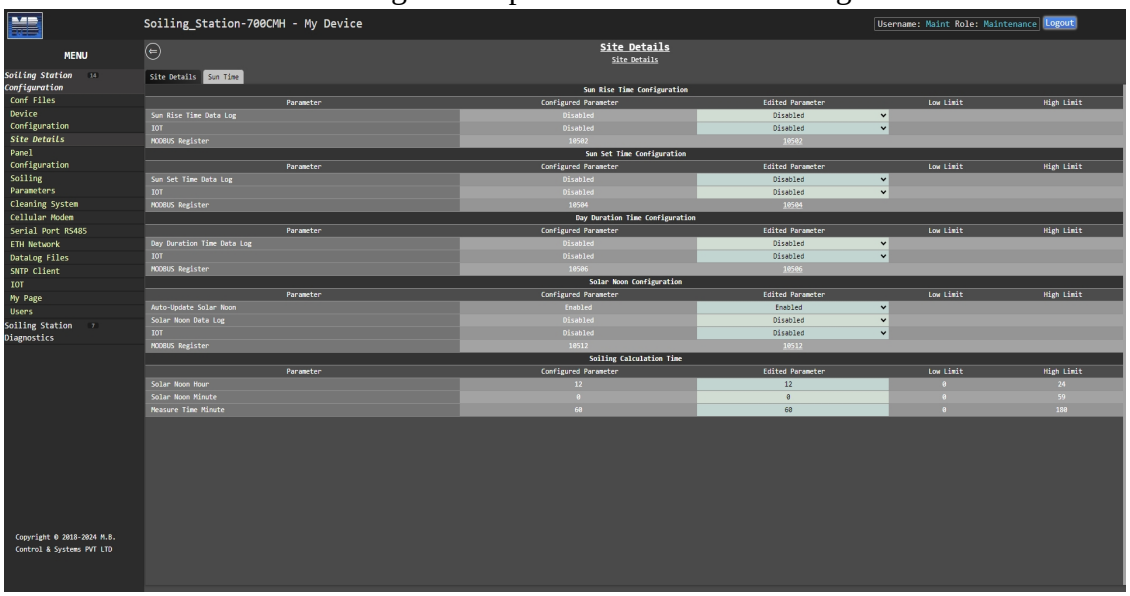


Figure-4.5.2: Configuration of ‘Sun Time’ parameters.

Configure logging and IOT communication of parameters as required.
Configuration parameters of sun time parameters are provided in table 4.5.2 below.
Details of configuration of soling measurement time are provided in table 4.5.2 below.

Sr. No	Parameter	Description	Remarks
	Solar Noon Configuration		
1	Auto Update Solar Noon	Solar noon time shall be updated automatically.	The device RTC should be synchronised via GPS or SNTP.
2	Solar Noon Data Log	‘Enabled’ or ‘Disabled’	
3	IOT	‘Enabled’ or ‘Disabled’	
	Soiling Calculation Time		
1	Solar Noon Hour	Solar noon hours	
2	Solar Noon Minutes	Solar noon minutes	
3	Measure Time - Minutes	Time in minutes during which soling parameters will be measured.	This time together with solar noon time will be used to measure soiling.

Table-4.5.2: Configuration – soling measurement time

Note: Measurement of soling:

i) Example: Solar noon is configured as 11 Hours and 30 minutes and measurement time is set as 60 minutes.
Soiling measurement will start at 10.30AM and stop at 12.30PM.

ii) As per IEC standard soiling should be calculated between sixty minutes before solar noon and sixty minutes after solar noon.

4.6 Measurement Panels Configuration:

Soling station panel configuration can be seen by clicking on menu “Panel Configuration” as shown in figure – 4.6 below:

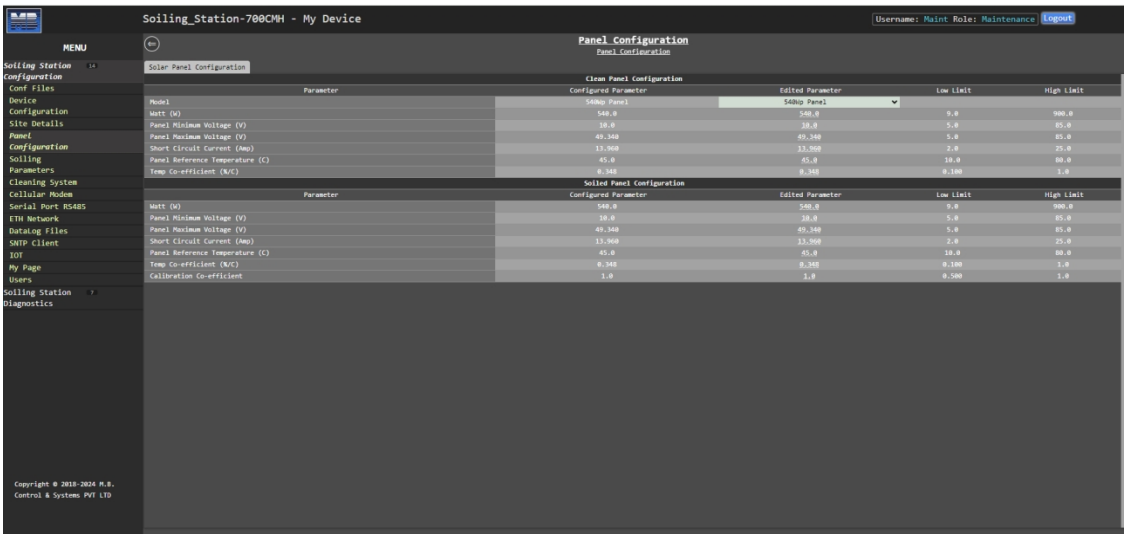


Figure-4.6: Soiling station panel parameters

Details of the page are provided in table 4.6 below. Soiled panel parameters should be same as reference panel.

Sr. No	Parameter	Description	Remarks
1	**Reference Panel Parameters**		
1.1	Model	Panel model	Installed panel model. Select from the dropdown list. Custom panel can also be configured.
1.2	Watt	Panel Wp	Wp for the installed panel
1.3	Panel Minimum voltage (V)	Panel minimum voltage	Selected panel parameters.
1.4	Panel Maximum voltage (V)	Panel maximum voltage	
1.5	Short Circuit Current	Panel short circuit current	
1.6	Panel Reference Temperature (C)	Panel reference temperature	
1.7	Panel Coefficient (%/ºC)	Panel temperature coefficient	Will be as per as the panel being used.
	Soiled Panel Parameters – will be same as reference panel parameters		

Table-4.6: Configuration – soling station panel parameters

4.7 Soiling Parameters

Soling parameters configuration can be seen by clicking on menu “soiling Parameters”.

4.7.1 Soiling Calculation

Soling Calculations can be configured by clicking on tab “Soiling Calculation” as shown in figure – 4.7.1 below:

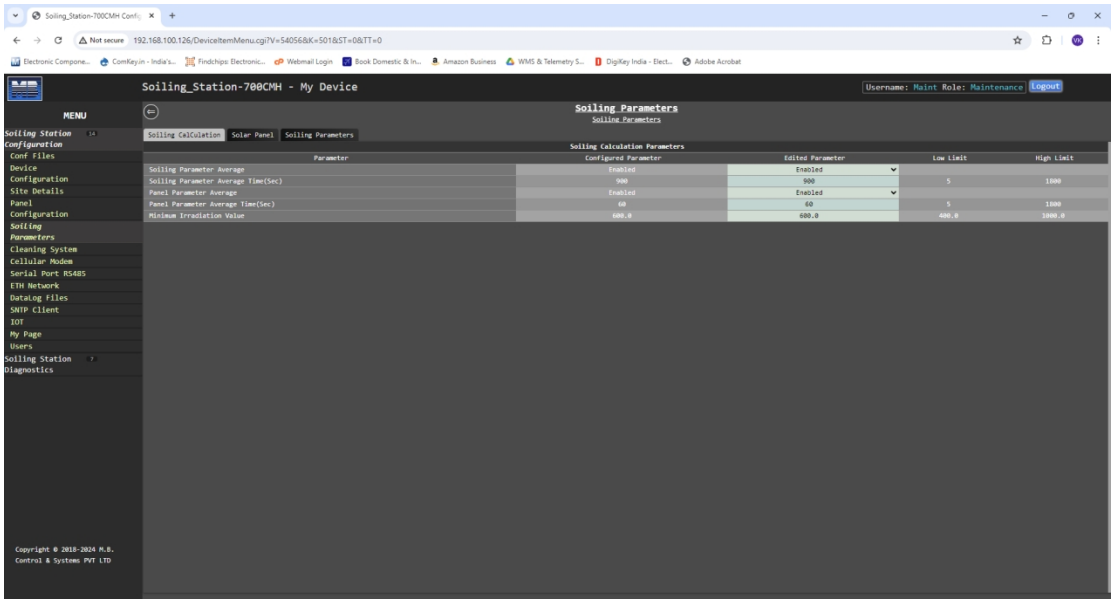


Figure-4.7.1: Configuration Soiling calculation

Details of soling calculation configuration are provided in table 4.7.1 below.

Sr. No	Parameter	Description	Remarks
1	Soling Parameter Average	Averaging of soiling parameters	Default – Enable
2	Soling Parameter Average Time (sec)	Soiling parameters average time (seconds)	Default – 900 second
3	Panel Parameter Average	Averaging of solar panel parameters	Default – Enable
4	Parameter Average Time (sec)	Solar panel parameters average time (seconds)	Default – 60 second
5	Minimum Irradiation Value	Soiling calculation will be done only if solar irradiation exceeds this minimum value.	Default 400 W/mtr2

Table-4.7.1: Configuration – soling parameters

4.7.2 Logging Solar Panel Parameters

Datalogging and IOT communication of soling panels parameter can be configured clicking on tab “Solar Panel” as shown in figure – 4.7.2 below:

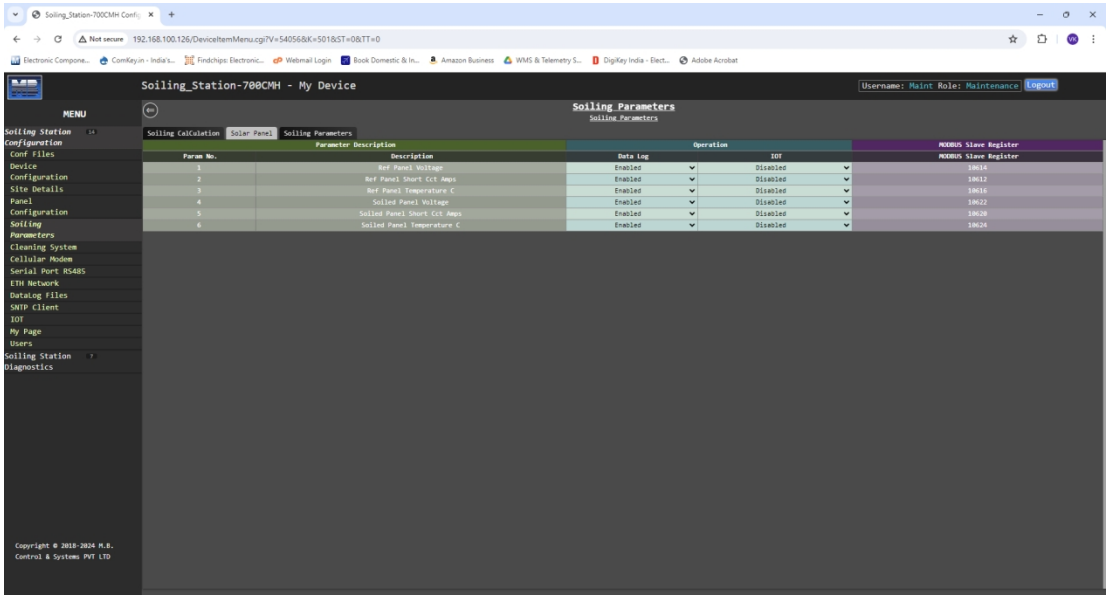


Figure-4.7.2: Datalogging of panel parameters

Datalogging and IOT communication of panel parameter can be enabled/ disabled as required.

4.7.3 Logging Soiling Parameters

Datalogging and IOT communication of soling parameters can be configured clicking on tab “Soiling Parameters” as shown in figure – 4.7.3 below:

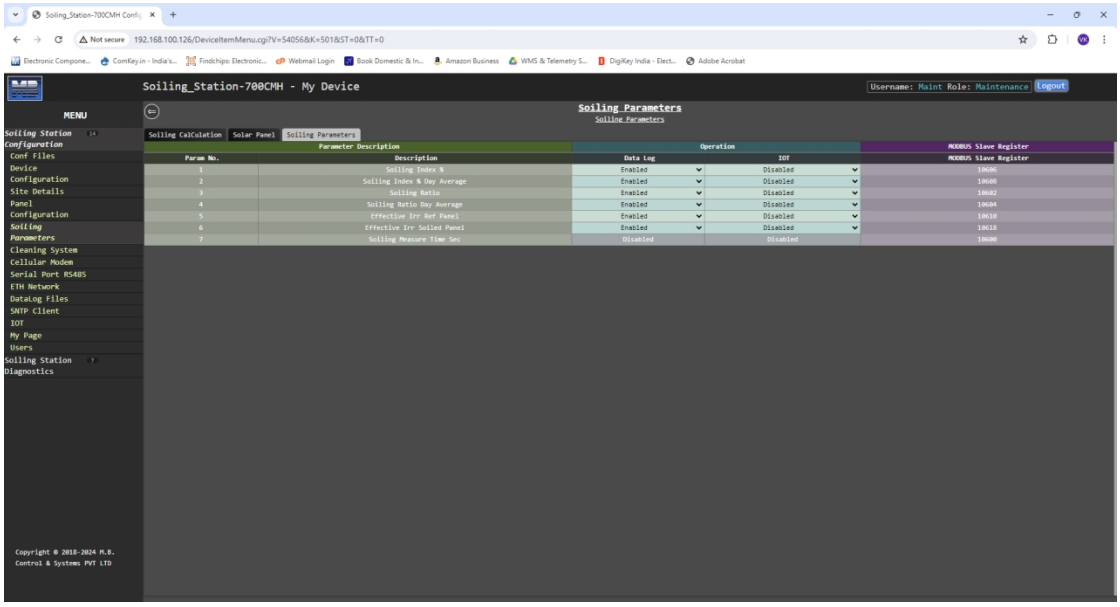


Figure-4.7.3: Logging of Soiling parameters

Datalogging and IOT communication of soiling parameter can be enabled/ disabled as required.

4.8 Cleaning System

Cleaning system (if provided) can be configured by clicking on menu “Cleaning System”. Cleaning system is used for periodical cleaning of reference panel. Soiled panel can be cleaned by manual commands.

4.8.1 Cleaning System Configuration

Cleaning System can be configured by clicking on tab “Cleaning System Configuration” as shown in figure – 4.8.1 below:

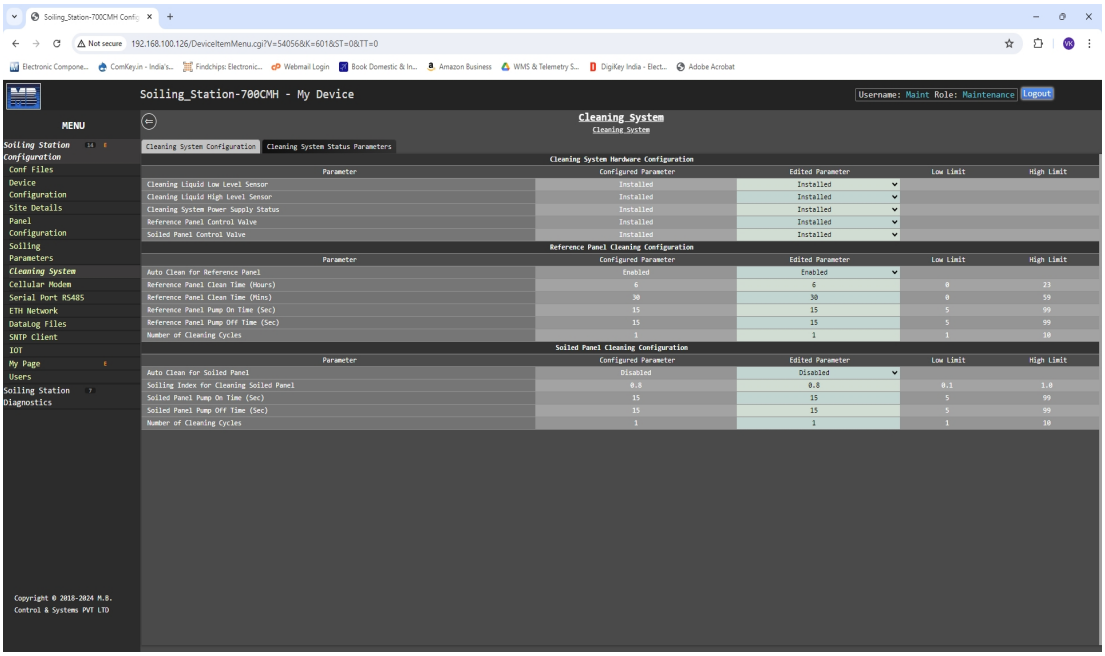


Figure-4.8.1: Configuration of cleaning system

Details of soiling station cleaning configuration are provided in table 4.8.1 below.

Reference panel and soiled panel cleaning shall be done as per this configuration.

Sr. No	Parameter	Description	Remarks
	Cleaning System Hardware Configuration		
1	Cleaning Liquid Low Level Sensor	Cleaning system hardware details	Cleaning system hardware
2	Cleaning Liquid High Level Sensor		
3	Cleaning System Power Supply Status		
4	Reference Panel Control Valve		
5	Soiled Panel Control Valve		
	Reference Panel Cleaning Configuration		
1	Auto Clean for Reference Panel	‘Enable’ or ‘Disable’	If enabled, the reference panel shall be cleaned as per set

			configuration.
2	Reference Panel Cleaning Time (Hours)	Reference Panel shall be cleaned at this set time each day.	
3	Reference Panel Cleaning Time (Minutes)		
4	Reference Panel Pump On time (Sec)	Pump on time for cleaning the panel	Reference panel shall be cleaned at set time as per the configured pump on and off times. Number of cleaning cycles shall be repeated as the set number of cycles.
5	Reference Panel Pump Off time (Sec)	Pump off time before stating the next cleaning cycle.	
6	Number of cleaning cycles	Number of cycles for the cleaning operation.	
	Soiled Panel Cleaning Configuration		
1	Auto Clean for Soiled Panel	'Enable' or 'Disable'	If enabled, the panel shall be cleaned as per the set soiling conditions.
2	Soiling Index for cleaning the soiled panel	Set the soiling index at which the soiled panel will be cleaned automatically.	This should coincide with cleaning of other solar panels in the plant.
3	Soiled Panel Pump On time (Sec)	Pump on time for cleaning the panel	Soiled panel shall be cleaned at set soiling index. Number of cleaning cycles shall be repeated as the set number of cycles.
4	Soiled Panel Pump Off time (Sec)	Pump off time before stating the next cleaning cycle.	
6	Number of cleaning cycles	Number of cycles for the cleaning operation.	

Table-4.8.1: Configuration – cleaning system

4.8.2 Cleaning System Status Parameters

Cleaning System status parameters can be configured for logging and IOT communication by clicking on tab "Cleaning System Status Parameters" as shown in figure – 4.8.2 below:

Figure-4.8.2: Configuration of cleaning system status parameters

Configuration of cleaning system parameters are provided in table 4.8.2 below.

Sr. No	Parameter	Description	Remarks
1	Data Log	Enable to log the status	If enabled, the parameter shall be logged.
2	IOT	Enable and select status parameter for IOT communication	If enabled, the status parameter will be sent via IOT communication

Table-4.8.2: Configuration – cleaning system status parameters

4.9 Configure – Cellular Modem and GPS

This option will be displayed only if the modem is installed.
Use micro-SIM with 4G service.
The modem will operate in PPP mode if any file transmit is enabled or IOT is enabled or SNTP is enabled via modem. In this case GPS operation shall be disabled.

Left click on menu option ‘Cellular Modem’ to configure internal modem and GPS operation as shown in figure-4.9 below.

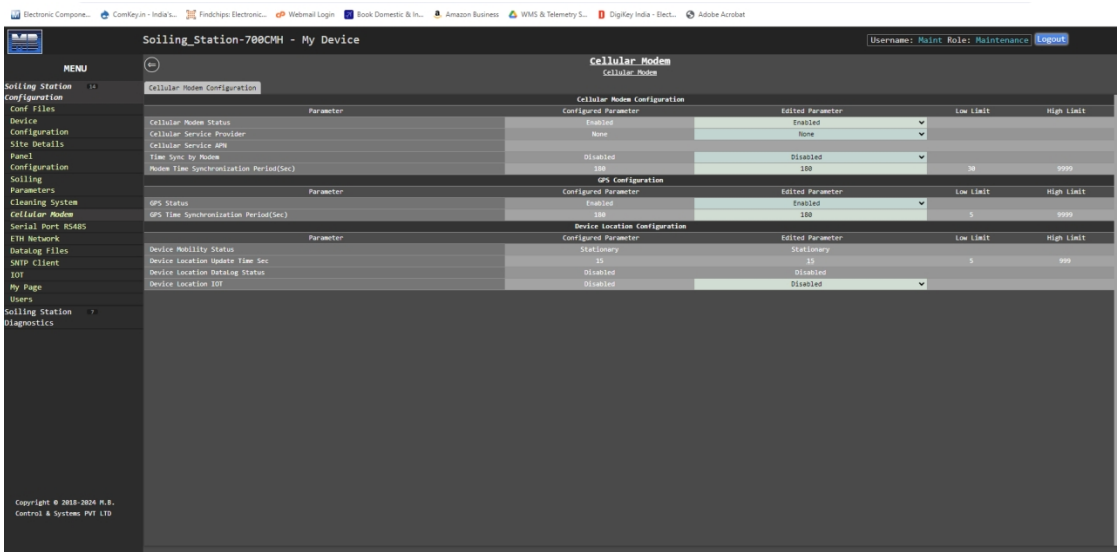


Figure-4.9: Configuration of internal cellular modem and GPS.

Configuration details of modem and GPS parameters on the page are provided in table 4.9 below.

Sr. No	Parameter	Description	Remarks
	Cellular Modem Configuration		
1	Cellular Modem Status	'Enable' to avail modem services.	
2	Cellular Service Provider	Select cellular service provider	Select the service provider from the dropdown list. If 'None' is selected, modem operation will be disabled.
3	Cellular service APN	APN for the service provider	APN will be auto configured based on the selected service provider.
4	Time Sync by modem	'Enable' if time synchronisation is required the service provider.	Modem service will update the device time at set periods.
5	Modem Time Synchronisation Period (Sec)	Set period for synchronization of the device.	
	GPS Configuration		
1	GPS Status	Enable if device time has to be synchronised via GPS.	Make sure that the supplied GPS antenna is exposed to direct sky.
2	GPS Time Synchronisation Period (Sec)	Set period for synchronization of the device.	Device time will be synchronised via GPS commands at the set time period.
	Device Location Configuration		
1	Device Mobility Status	Configured as stationary	
2	Device Location Update time Sec	Disabled	
3	Device Location data log status	Disabled	
4	Device Location IOT	Enable to communicate device location	

Table-4.9: Configuration – device modem and GPS

4.10 Configure – Serial Port (RS485)

Serial port –RS485 can be used as MODBUS RTU Slave.
Use low capacitance, twisted pair and shielded cable for connection to this port.
Left click on menu option ‘Serial Port RS485’ to configure this port as shown in figure-4.10 below.

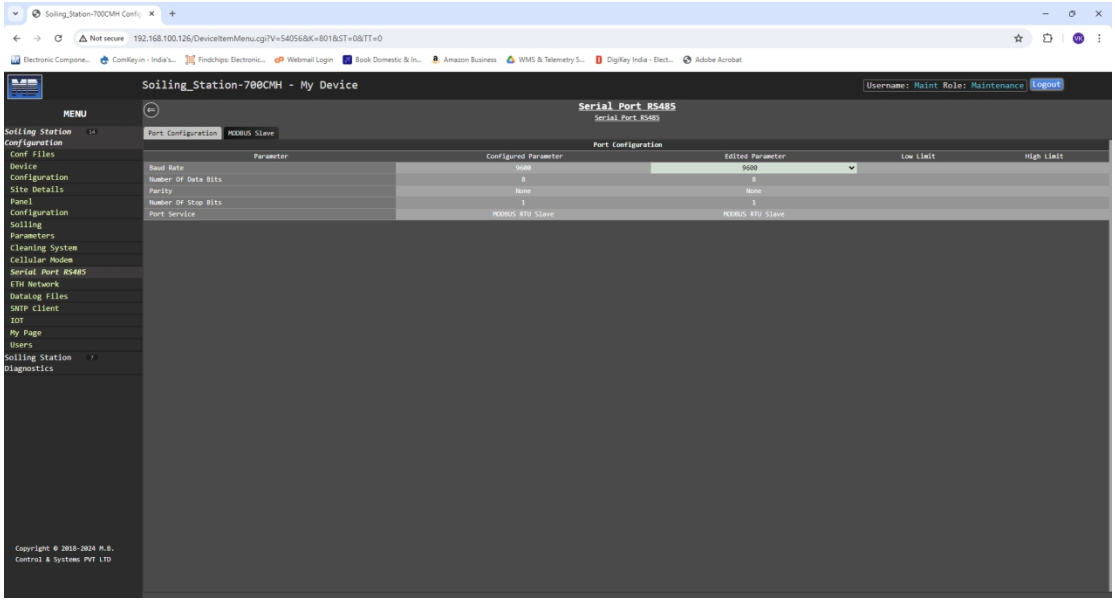


Figure-4.10.1: Configuration of serial port RS485.

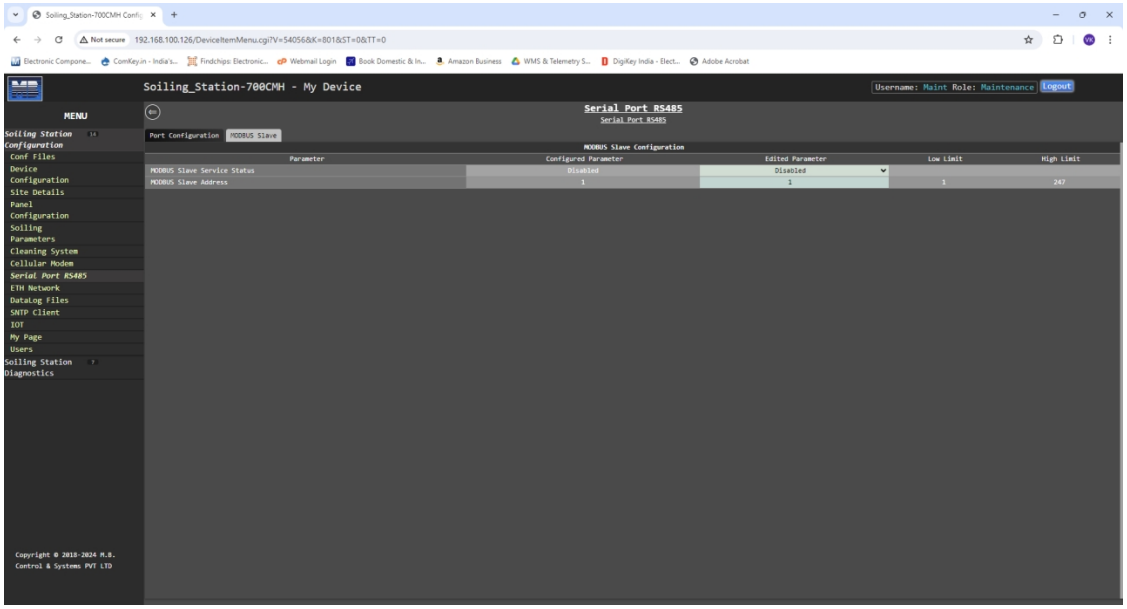


Figure-4.10.2: Configuration of serial port RS485 – MODBUS Slave parameters.

Configuration details of communication parameters for serial port RS485 are provided in table 4.10 below.

Sr. No	Parameter	Description	Remarks
1	Port Service	Select service for the port	Only MODBUS Slave service is allowed.

Table-4.10: Configuration – serial port RS485

4.11 Configure – ETH Network

Left click on menu option ‘ETH Network’ to configure soiling station ETH network and its services as shown in figure-4.11 below.

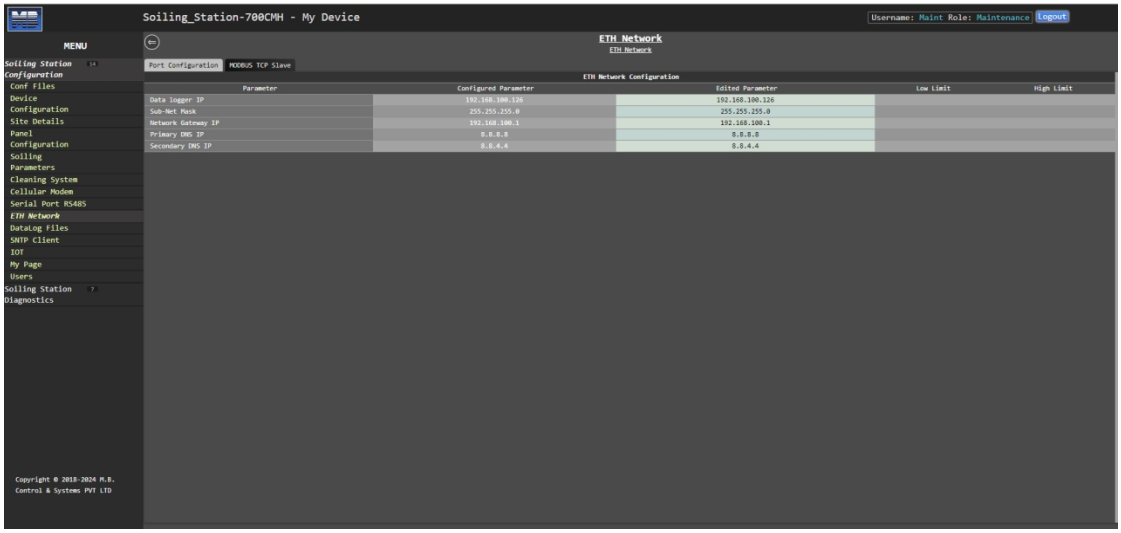


Figure-4.11.1: Configuration of soiling station ETH network.

Configuration details for ETH port are provided in table 4.11.1 below.

Sr. No	Parameter	Description	Remarks
1	Data Logger IP	Data logger IP	
2	Data Logger Subnet mask	Data Logger Subnet mask	
3	Network Gateway IP	Network Gateway IP	This IP shall be used for internet access via ETH port
4	Primary DNS IP		Set primary DNS
5	Secondary DNS IP		Set secondary DNS

Table-4.11.1: Configuration – ETH Port parameters

The configuration of MODBUS slave service on ETH port is shown in figure 4.11.2 below.

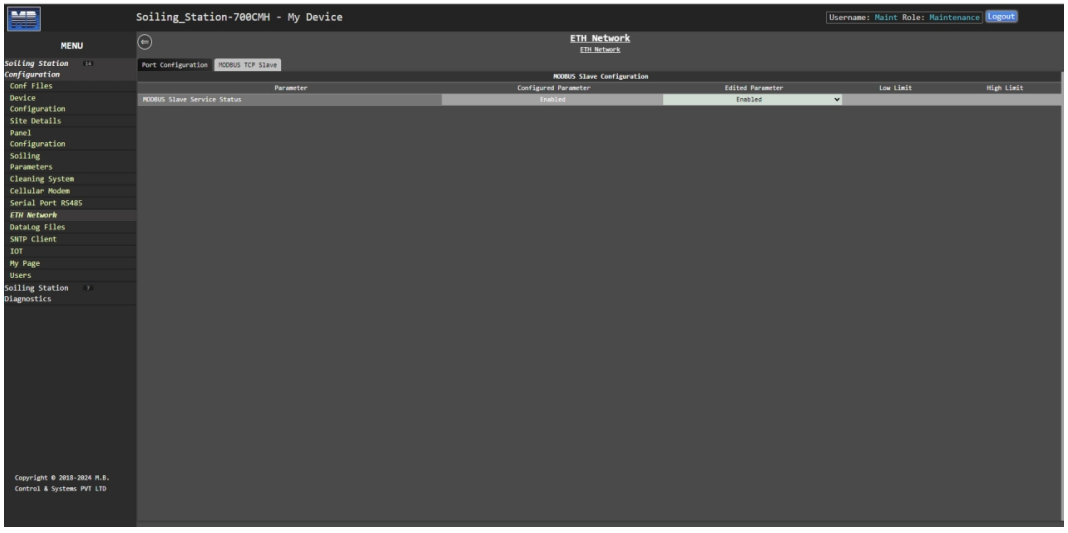


Figure-4.11.2: Configuration of soiling station ETH service.

Details for tabs for configuration of services on ETH port are provided in table 4.11.2 below.

Sr. No	Tab	Description	Remarks
1	MODBUS TCP Slave	Configure MODBUS TCP slave service	

Table-4.11.2: Configuration – ETH port service

4.12 Configure – Datalogging Files

All logged files are saved in SD memory card. The card should be formatted with 'FAT32' format before being inserted in SD card holder.
SD card should not be removed or inserted while the soiling station is powered On and in operation. Disconnect power to soiling station prior to inserting or removing the SD card.
Files are saved with .csv extension with date and time.

Details of data log directories are provided in table 4.12 below:

Sr. No	Directory Name	Description	Remarks
1	'DirDataLogDay'	Stores day log files	Configure operation of day log files.
2	'DirDataLogRFT1'	Stores files for remote file server 1	Configure operation of files for remote file server 1.
3	'DirDataLogRFT2'	Stores files for remote file server 2	Configure operation of files for remote file server 2.

Table-4.12: Data log file directories

Soiling station will automatically create missing directories on the SD card.

Parameter values and its attributes will be saved in the data log files if the parameter is configured for datalogging (refer to configuration of individual parameter for more details).

Left click on menu option 'Datalog Files' to configure file operation as shown in figure-4.12 below.

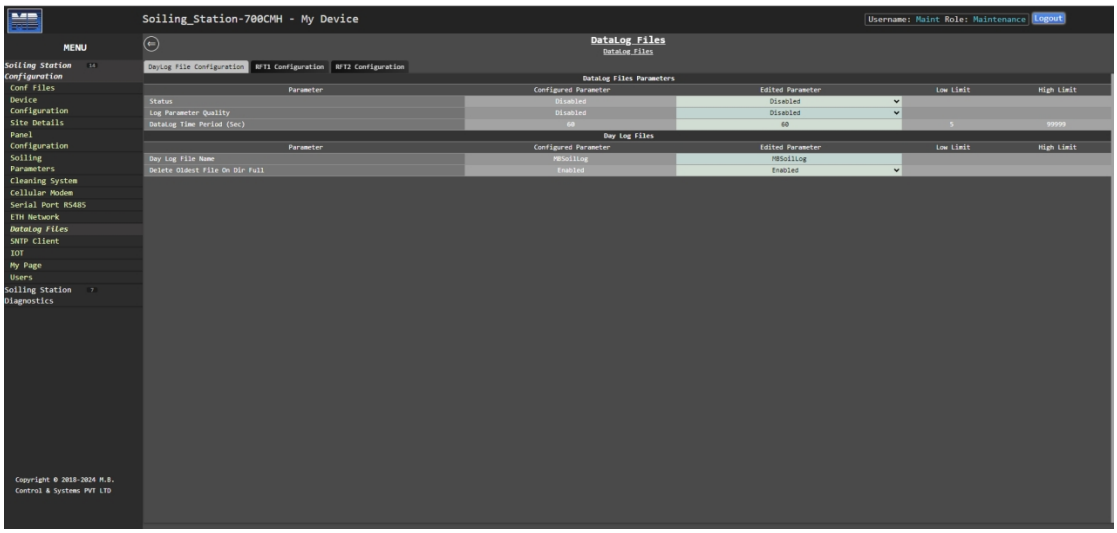


Figure-4.12: Configuration of data log file operations.

For parameters having pre-selected options, available options are provided as drop-down list.

Following log files can be configured:

i) ‘Day Log File Configuration’: Day data log file.

ii) ‘RFT1 Configuration’: Remote file transfer-1 configuration

iii) ‘RFT2 Configuration’: Remote file transfer-2 configuration

4.12.1 Day Log File Configuration:

Configuration of day log file is shown in figure 4.12.1 below.

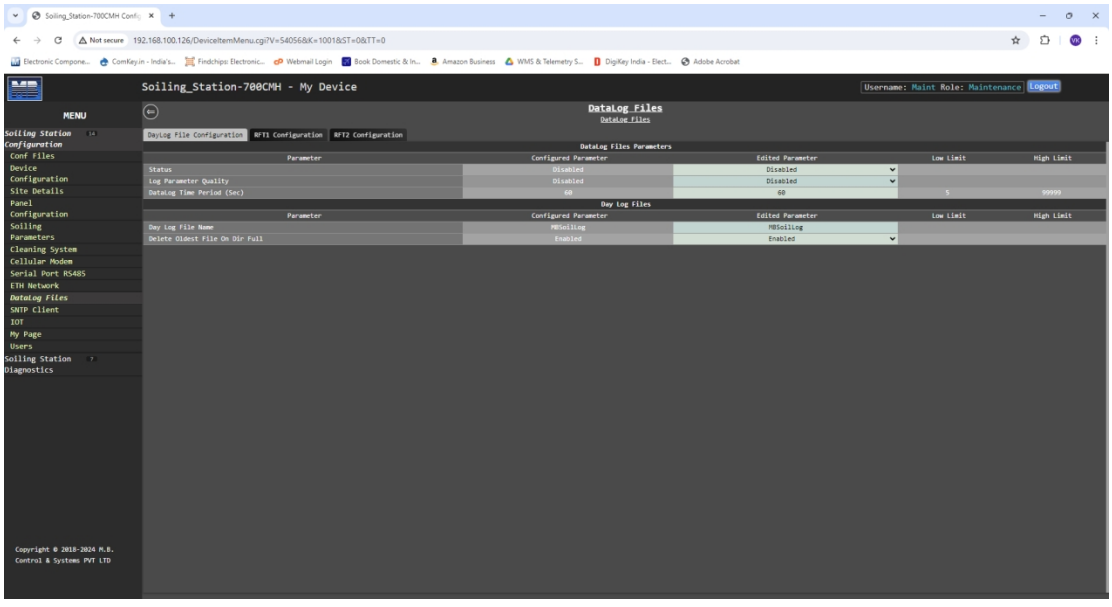


Figure-4.12.1: Day log file Configuration

Details of the parameters on the page are provided in table 4.12.1 below. For details on other parameters use hoover feature of the webpage. Take cursor on the parameter object on the page and further information will be provided for the parameter.

Sr. No	Parameter	Description	Remarks
1	Status	Enable / Disable data log operation	If disabled, data log operation will be disabled
2	Log Parameter Quality	Enable/ Disable logging of parameter value quality.	Parameter value quality will be logged if enabled.
3	Data Log Time Period (sec)	Time period for logging data in seconds	
4	Day Log File Name	Provide required data log file name	Day data log files will be saved with this name suffixed by '_Day'. Time in 'YYY_MM_DD' format will be added to the file name. e.g. 'MBDataLog_Day_2020_12_06'
5	Delete Oldest File on Directory Full	If the directory is full – oldest file is deleted so that new file can be added.	**Disabled:** Data logging will stop if the directory is full. **Enabled:** Data logging will continue after deleting the oldest file in the directory.

Table-4.12.1: Configuration – day data log file operation

4.12.2 Remote File Transfer Configuration:

Remote file transfer can be configured via tabs – 'RFT1 Configuration' and 'RFT2 Configuration'. Configuration page is shown in figure 4.12.2 below.

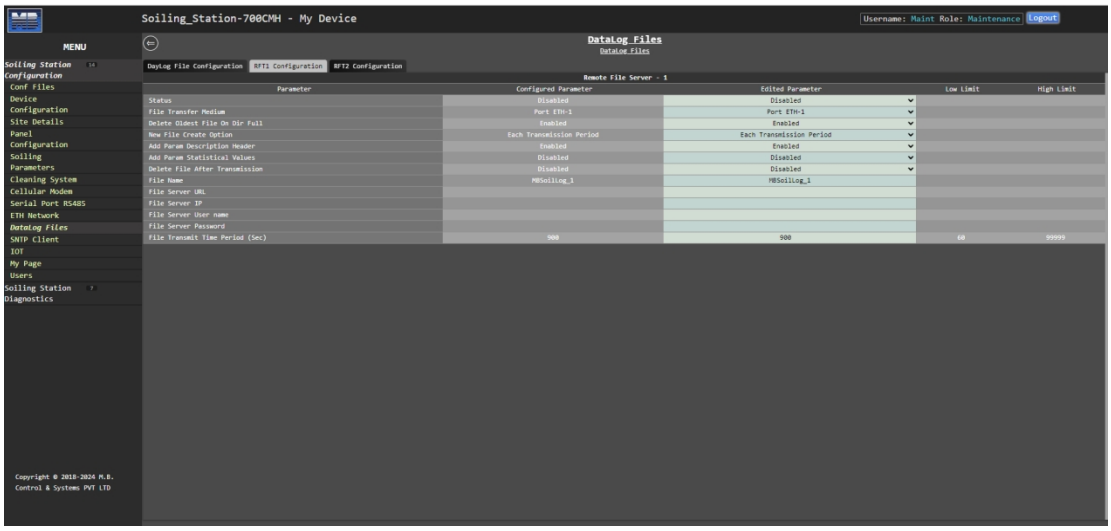


Table-4.12.2: Configuration – remote file transfer operation

Details on file parameters on the are provided in table 4.12.2.1 below.

Sr. No	Parameter	Description	Remarks
1	Status	Enabled / Disabled data log operation	If disabled, data log operation will be disabled
2	File Transfer Medium	Select Port ETH or Cellular Modem	Logged files will be transmitted via the selected medium. Note: If cellular modem is selected as medium and the modem operation fails – file transfer will be attempted via ETH port (if the port is connected and the gateway connection is OK).
3	Delete Oldest File on Directory Full	If the directory is full – oldest file is deleted so that new file can be added.	**Disabled:** Data logging will stop if the directory is full. **Enabled:** Data logging will continue after deleting the oldest file in the directory.
4	New File Create Option	Select from 'Each Day' or 'Each Transmission Period'	**Each Day**: New data log file will be created as start of each day. **Each Transmission Period**: New data log file will be created at start of each file transmission time period.
5	Add Param Description Header	Enabled or disabled	If enabled, parameter description header will be added to the file
6	Add Param Statistical Values	Enabled or disabled	**Enabled**: Calculated statistical values – minimum, maximum, average, standard deviation, and integrated value shall be added to the log (as per parameter configuration). **Disabled**: Only parameter value shall be added to the log.
7	Delete File after Transmission	Enabled or disabled	**Enabled**: Data log file shall be deleted after successful transmission. **Disabled**: Data log file will not be deleted after transmission.
8	File Name	Provide required data log file name	Data log files will be saved with this name. Time in 'YYYY_MM_DD_HH_MM' format will be added to the file name.

			e.g. ‘MBDataLog_2020_03_15_15_45’
9	File Server URL	URL for the file server	Data logger shall resolve the URL to get the file server IP address.
10	File server IP	IP address for the file server	
11	File server Username	Username for the client	
12	File server Password	Password for the client	FTP client will use the configured username and password to connect to the file server.
13	File Transmit Time Period (sec)	Files transmit time in seconds	Logged file will be transmitted after this time.

Table-4.12.2.1: Configuration – remote file transfer operation

Notes:

i) If ‘Modem; is selected media for file transfer, and it fails, file transfer shall be tried via ETH port (if the link to configured gateway is OK).

Details for parameter descriptor header with statistical values are provided in table 4.12.2.2 below.

Sr. No	Column	Description	Remarks
1	Date	Date of logging	YYYY.MM.DD
2	Time	Time of logging	HH.MM.SS
3	Parameter Quality	Parameter Description_Qua	=’0’ for bad quality =’1’ for good quality
4	Parameter Value	Parameter Description_Val.	Value in float
5	Parameter minimum Value	Parameter Description_Min	Minimum value in float
6	Parameter maximum Value	Parameter Description_Max	Maximum value in float
7	Parameter average Value	Parameter Description_Avg	Average value in float
8	Parameter standard deviation Value	Parameter Description_SD	Standard Deviation value in float. This value shall be provided if its calculation is enabled.
9	Parameter Integrated Value	Parameter Description_Int	Integrated value in float. This value shall be provided if its calculation is enabled.
10	Next parameter quality		

Table-4.12.2.2: Parameter descriptor header with statistical values

Details for parameter descriptor header without statistical values are provided in table 4.12.2.3 below.

Sr. No	Column	Description	Remarks
1	Date	Date of logging	YYYY.MM.DD
2	Time	Time of logging	HH.MM.SS
3	Parameter Value	Parameter Description_Val.	Value in float
4	Next parameter value		

Table-4.12.2.3: Parameter descriptor header without statistical values

4.13 Configure – SNTP Client

SNTP client can be used to synchronize internal clock of the soiling station. The client can be used to operate via datalogger network or internal modem.
Up-to NTP time servers can be configured. SNTP client will switch over to next time server if any server fails to respond.
Left click on menu option ‘SNTP Client’ for configuration as shown in figure-4.13 below.

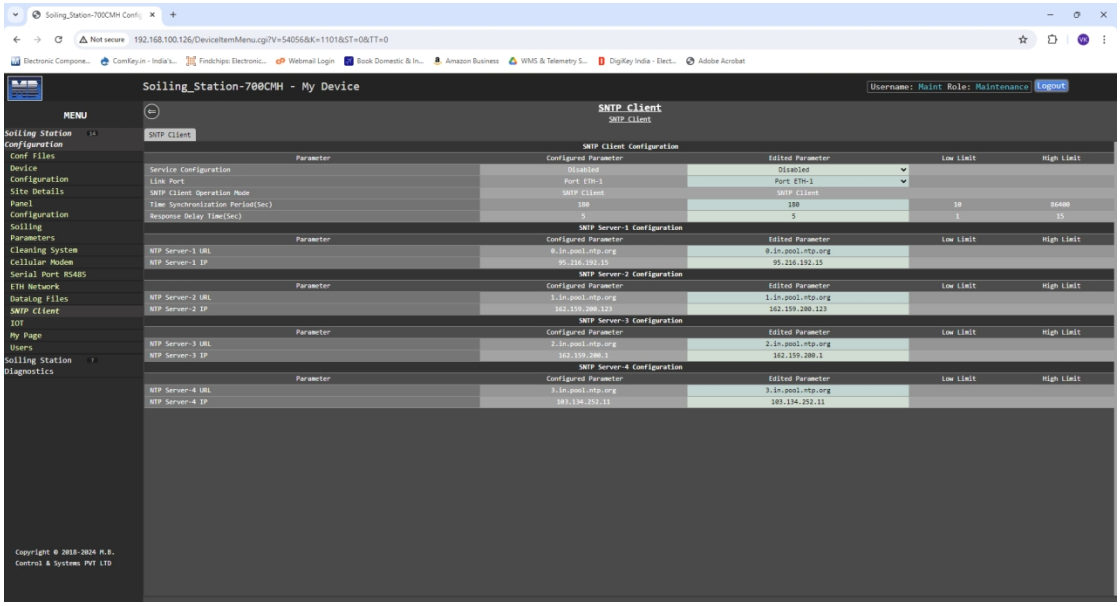


Figure-4.13: Configuration of SNTP client.

SNTP client will operate in ‘Client Mode’ only.

Configuration details of SNTP clients are provided in table 4.13 below.

Sr. No	Parameter	Description	Remarks
1	NTP Server IP and URL	Configure NTP server IP or URL. Either of the two can be configured.	SNTP client will get time from any of the configured and working NTP servers. URL will be resolved if DNS are configured.

Table-4.13: Configuration – SNTP Client

Notes:

i) If SNTP client fails to get time via the configured media. It will try to change the media (if alternate media is available) and get time.

4.14 IOT Parameters (MQTT)

IOT (MQTT) communication parameters can be configured via this page.
IOT communication can be used for transmitting real time parameter values to MBCS or other compatible cloud services.
This service is also used for remote diagnostic and monitoring of the data logger status. This helps in remote diagnostic and reducing downtime of the datalogger.
IOT communication can be done ETH port or device modem. If ETH port is used, proper internet service and gateway configuration is required.
Left click on menu option 'IOT' for configuration as shown in figure-4.14 below.

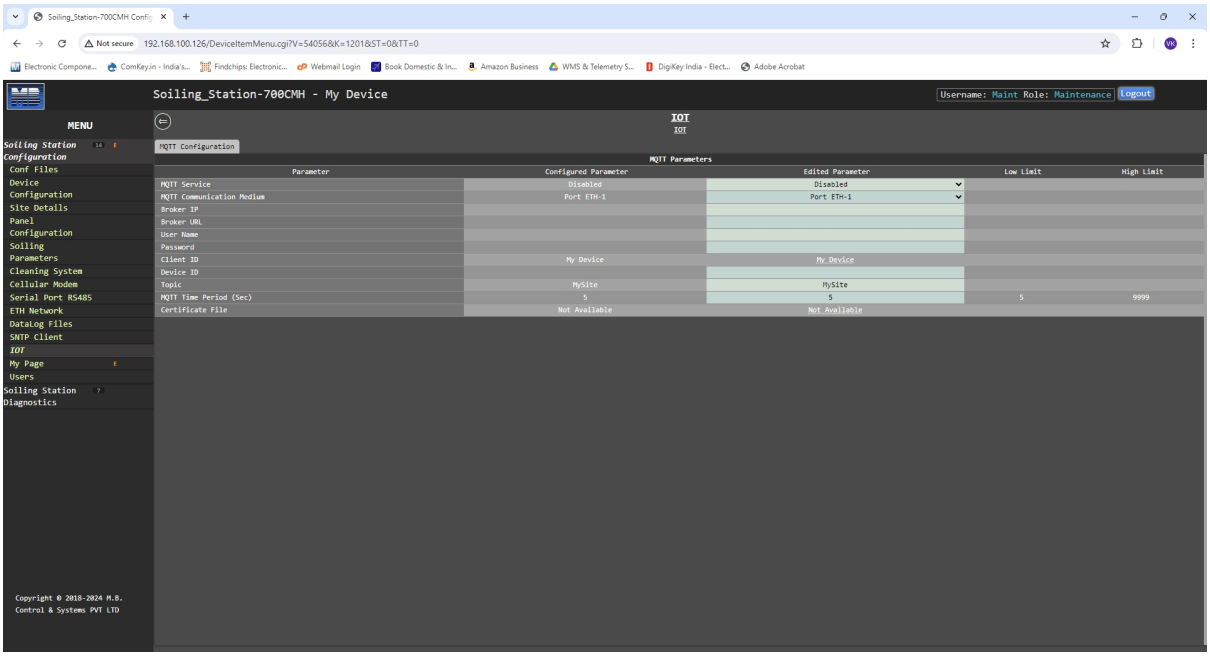


Figure-4.14: Configuration of IOT services.

Configuration details of IOT parameters are provided in table 6.15 below.

Sr. No	Parameter	Description	Remarks
1	MQTT service		Enabled or Disabled.
2	MQTT Communication Media	Select communication port	ETH or Modem can be used.
3	Broker IP		Set MQTT Broker IP
4	Broker URL		Set MQTT Broker URL – if broker IP is not known.
5	User Name		Username and password for

6	Password		communication with broker
7	Client ID		This is datalogger name
8	Device ID		Unique device ID to be provided by MBCS cloud team.
9	Topic		Configurable, usually site name.
10	MQTT Time Period (Sec)		Time period in seconds for data communication. *This time should set as per actual application requirements. Too fast communication may choke communication channel bandwidth.*
11	TLS Certificate File		TLS certificate file

Table-4.14: Configuration – IOT

Following remote diagnostic functionality is provided:

i) Device status log
ii) Device value log
iii) MODBUS Communications logs
iv) Modem operation log
v) Remote device reset.

4.15 MyPage Parameters

This unique feature allows users to configure required parameters of interest on one page for viewing on webserver. Maximum of 24 parameters can be configured. These parameters can also be accessed on MODBUS Slave port in sequential register addresses.

Left click on menu option ‘MyPage’ to configure analog input channels as shown in figure-4.15 below.

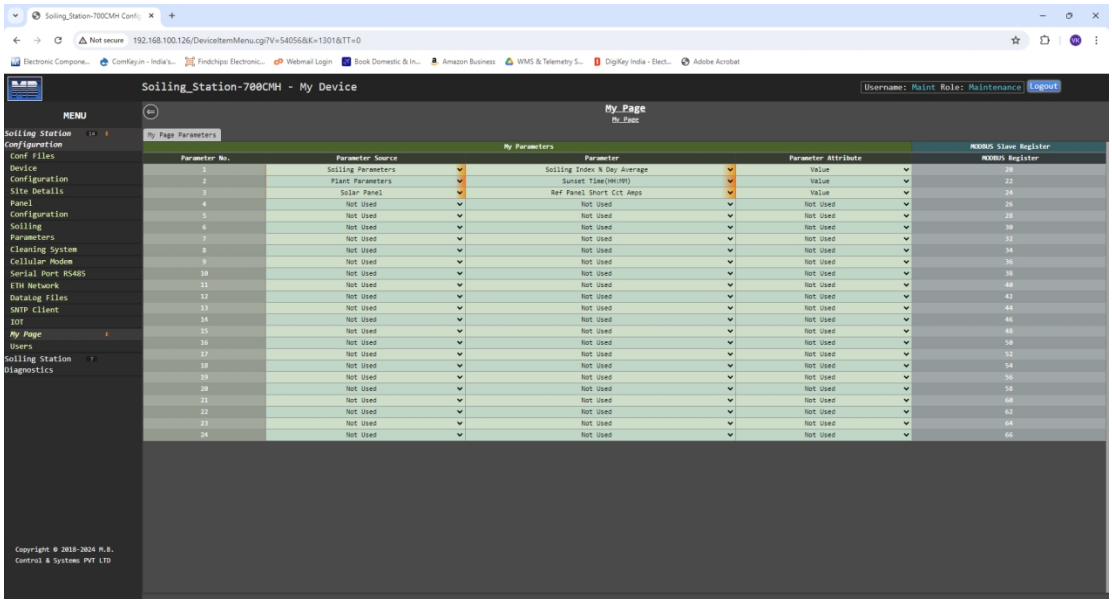


Figure-4.15: Configuration of MyPage.

Configuration details for MyPage parameters are provided in table 4.15 below.

Sr. No	Parameter	Description	Remarks
1	Parameter Source	Select source for the parameter. Dropdown list of available parameter sources.	Select ‘Not Used’ if parameter configuration is not required.
2	Parameter	Select the parameter of interest. Dropdown list of parameters configured in the selected source shall be provided.	Select ‘Not Used’ if parameter configuration is not required.
3	Parameter Attribute	Select the parameter attribute of interest. Dropdown list of available parameter attributes for the selected parameter shall be provided.	
4	MODBUS	MODBUS register	Selected parameter attribute

	Register	address is provided for external device or SCADA to read value of the parameter.	value is provided as 32 bits float registers. This field in not editable.

Table-4.15: MyPage parameters configuration

4.16 User Configuration

Following types of users can be configured for soiling station operation:

i) Administrator
ii) Operator
iii) Viewer

Left click on menu option ‘User Configuration’ to configure users shown in figure-4.16 below. Only ‘Administrator’ can configure usernames and their passwords.

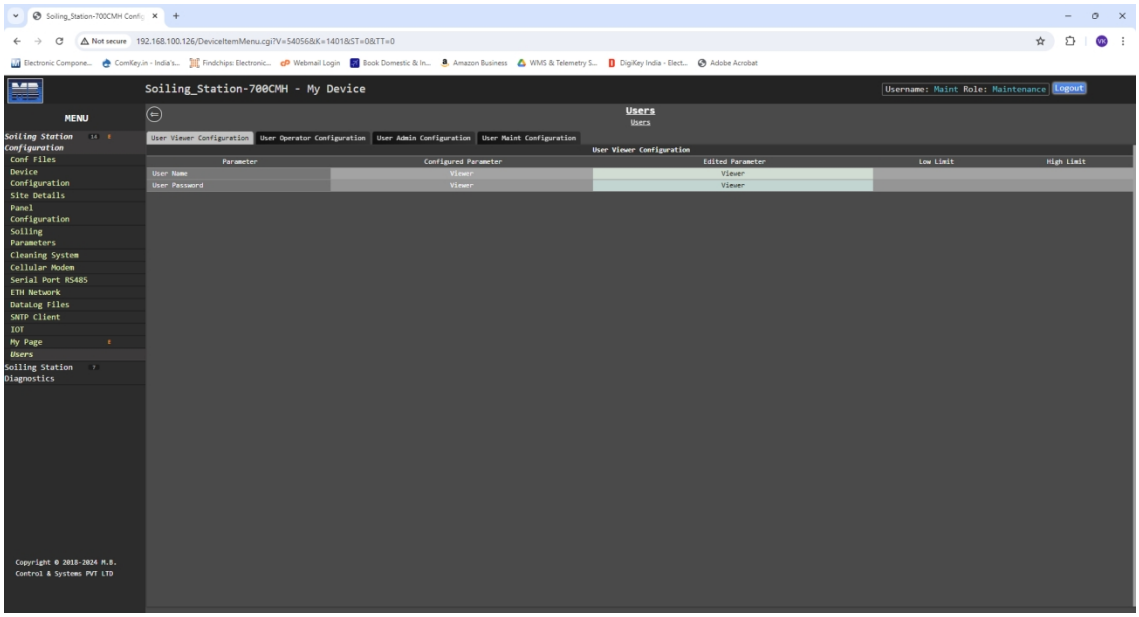


Figure-4.16: User configuration.

Use tabs provided to configure the required user.

Configuration details of user configuration are provided in table 4.16 below.

Sr. No	Parameter	Description	Remarks
1	Username	Set username	Users with configured username and passwords will be allowed to operate the datalogger
2	User Password	Set user password	

Table-4.16: User configuration

4.17 Commit Configuration

All edited parameter values must be saved in the soiling station non-volatile memory– this is called ‘Commit Operation’.This will be allowed only if configuration of any parameter has been edited (marked by ‘E’).

Following actions will happen (in the listed sequence) once ‘Commit’ is initiated.

i) All logged in users will be logged out.

ii) All operations of the soiling station will be stopped. This may take some time.

iii) New configured valued will be saved in internal non-volatile memory of the soiling station.

iv) All operations of soiling station will resume with new configuration. This may take some time.

v) User can login again (if required) with assigned credentials.

Left click on menu option ‘MBSoiling Station Configuration’ to select the same. Right click on MBSoiling Station Configuration’ to see the submenu option to commit the configuration as shown in figure-4.17 below.

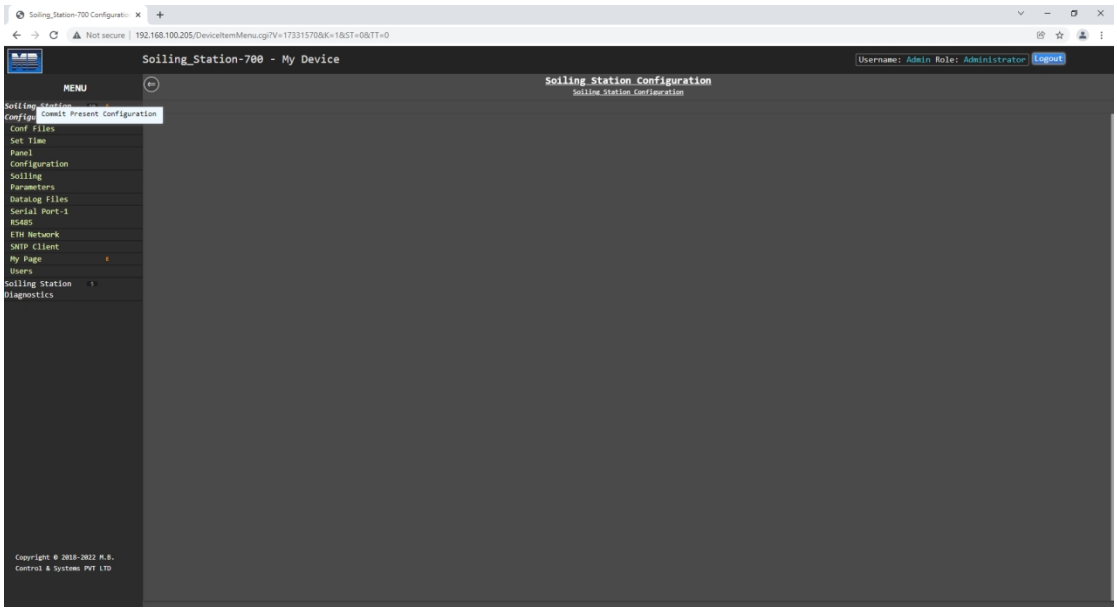


Figure-4.17: Commit operation.

Note:

i) Once committed, the configuration cannot be reverted. It is irreversible operation. The soiling station must be re-configured if any change is required.

ii) User will be logged out on commit operation. User can login again once the soiling station re-starts.

iii) Soiling station will take few seconds to re-start its operation.

5 Embedded Webserver– Diagnostics

MBSoiling Station provides extensive diagnostics and monitoring functionality via webserver.

Following diagnostic features are provided:

i) Monitor real time values from all inputs.
ii) Monitor MyPage parameters
iii) Status of datalogger resources
iv) Messages from datalogger for user login history, operations, and hardware faults.
v) All parameter values, their calculated statistical values and status will be updated in real time (at preset time interval). Animation is provided when the values are updated.
vi) Parameter values will be updated with their quality. Bad quality values will be shown in red.

Left click on the menu option ‘MBSoiling Station Diagnostic’ to open the diagnostic menu as shown in figure -5 below.

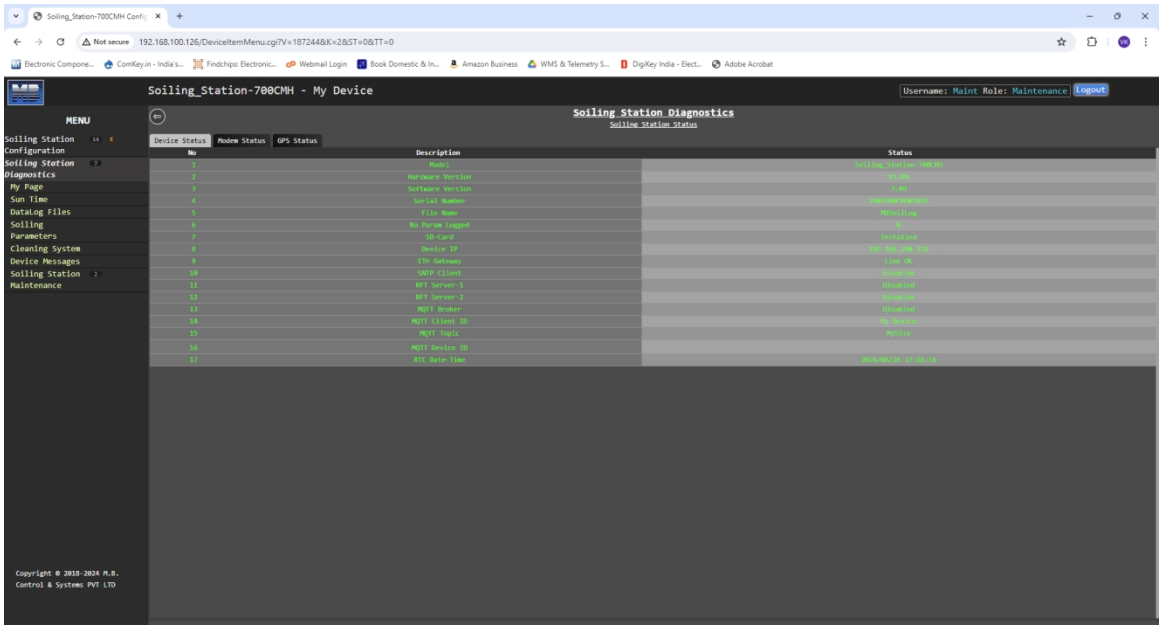


Figure-5: MBSoiling Station diagnostic page.

5.1 MBSoiling Station Status

This status page displays status of datalogger services and modem status:

5.1.1 MBSoiling Station Status

Select tab ‘MBSoiling Station Status’ to view details of the soiling Stationand status of services as shown in figure-5.1.1 below.

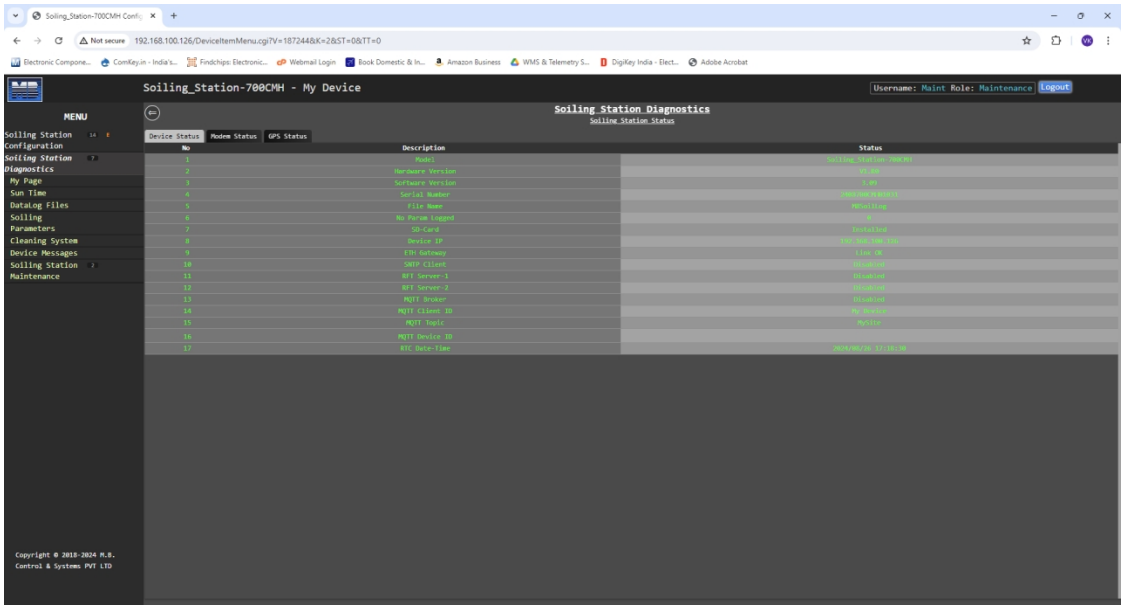


Figure-5.1.1: Soiling Station status.

Details for soiling Station status are provided in table 5.1.1 below.

Sr. No	Parameter	Description	Remarks
1	Model	Model details of the data logger	
2	Hardware Version	Hardware version for the model	
3	Software Version	Software version for the model	
4	Serial Number	Unique alphanumeric serial number for the datalogger	
5	File Name	Names of data log files	Data log files will be created with this name and will be suffixed by date and time
6	No Param Logged		Number of parameters configured for logging
7	SD Card	Status of SD card	Display –‘Installed’ or ‘Not Installed’
8	Device IP	IP address for the datalogger	
9	ETH Gateway	Status of network gateway	Display ‘Link Fail’ if link to gateway fails.

			Display ‘Link OK’ if link to gateway is OK.
10	SNTP Client	Status of SNTP client	Display status of SNTP client.
11	RFT Server-1	Status of remote file transfer server -1	
12	RFT Server-2	Status of remote file transfer server- 1	
13	MQTT Broker	IOT MQTT communication status	
14	MQTT Client ID		
15	MQTT Topic		
16	MQTT Device ID		
17	RTC Date - Time		

Table-5.1.1: Soiling Station status

5.1.2 Soiling Station Modem Status

This tab will be displayed on if the modem is installed. Select tab ‘Modem Status’ to view status of soling station internal modem as shown in figure-5.1.2 below.

Figure-5.1.2: Soiling station modem status.

Details for soiling station modem are provided in table 5.1.2 below.

Sr. No	Parameter	Description	Remarks
1	Modem status time		Time at which the modem status was updated
2	Modem SIM status		Modem SIM status
3	Initialisation Status	Modem initialisation status	
4	Registration	Modem registration	

	status	status	
5	Service Provider		Service provider details
6	Operating mode	Modem operation mode	Modem network operation mode – ‘None’, ‘GSM’, ‘GPRS’, ‘EDGE, or ‘LTE’
7	Signal Strength	Cellular signal strength	Signal strength in dBm
8	Bit error rate (BER)	Bit error rate	
9	Modem PPP link status		Modem PPP link status

Table-5.1.2: Datalogger modem status

5.1.3 GPS Status

Select tab ‘GPS Status’ to view status of device GPS as shown in figure-5.1.3 below.

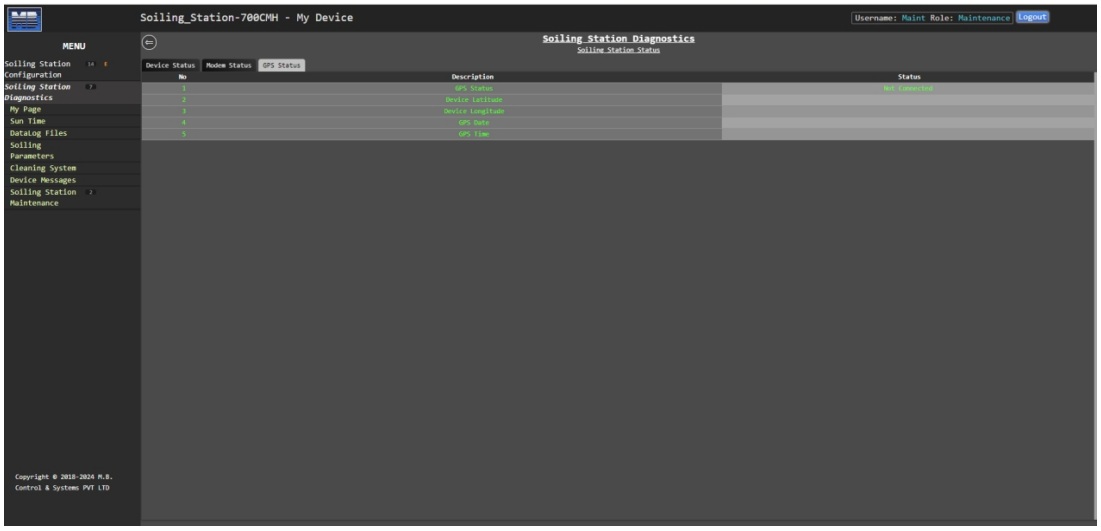


Figure-5.1.3: Datalogger GPS status.

Details for datalogger GPS status are provided in table 5.1.3 below.

Sr. No	Parameter	Description	Remarks
1	GPS Status	GPS status	
2	Device Latitude	Device coordinates obtained from GPS	
3	Device Longitude		
4	GPS Date	Date and Time obtained via GPS	Signal strength in dBm
5	GPS Time		

Table-5.1.3: Datalogger modem status

5.2 MyPage Parameters

Left click on diagnostic menu option ‘MyPage Parameters’ to view MyPage parameters as shown in figure 5.2 below.

Figure-5.2: MyPage parameters.

The values of all parameters configured as MyPage Parameters will be displayed on the page.

5.3 Data Log Files

Status of all data log files can be viewed via this page. Files can also be deleted or downloaded via click buttons provided.
Left click on diagnostic menu option ‘Datalog Files’ to view details of logged files.

Three tabs are provided for data log files:

i) ‘Data log Files Day’: Day data log files.
ii) ‘Data log Files RFT-1’: Data log files for remote file server-1.
iii) ‘Data log Files RFT-2’: Data log files for remote file server-2.

5.3.1 Data Log Files –Day

Day log file status is shown in figure 5.3.1 below.

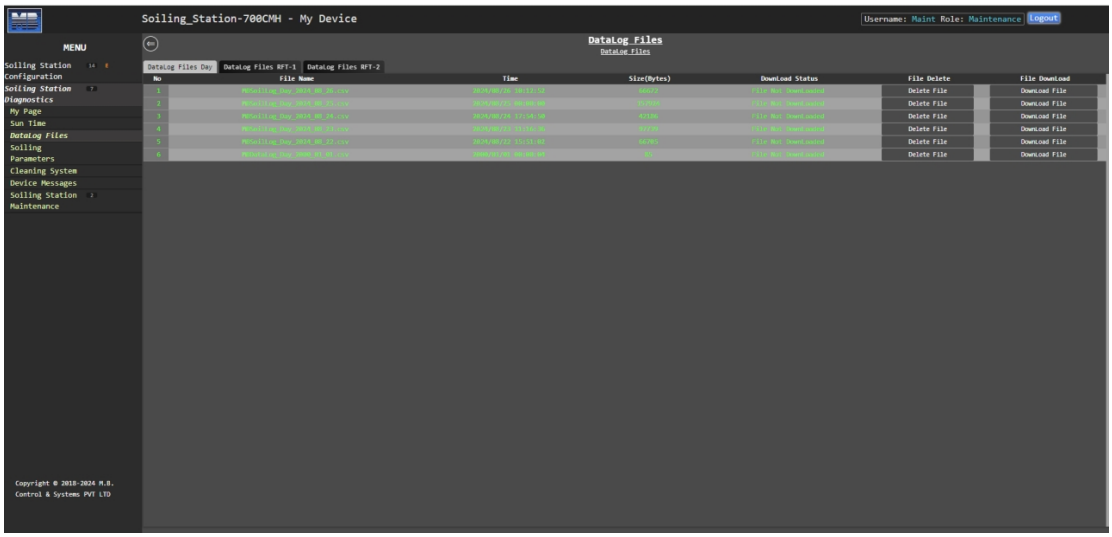


Figure-5.3.1: Day Data log files

Details file status and operation are provided in table 5.3.1 below.

Sr. No	Parameter	Description	Remarks
1	File name	Logged file name	
2	Time	File log time	
3	Size	File size in Bytes	
4	Download Status	Download status of the file	File not downloaded – 'File Not Downloaded' File downloaded – 'Downloaded'
4	Delete File button	Left click on the button to delete the file.	Files delete operation is irreversible. Active file – file that is being logged cannot be deleted. 'Delete Button' shall be disabled for this file.
5	Download File button	Left click on the button to download the file.	The file will be downloaded to PC or Laptop. Status of the file will be changed to 'Downloaded'. This button will not be available if the file is being logged.

Table-5.3.1: Day data log files

5.3.2 Data Log Files –RFT-1 and RFT-2

Select the required tab for viewing status of remote file transfer operation.
Remote Transfer log file status is shown in figure 5.3.2 below.

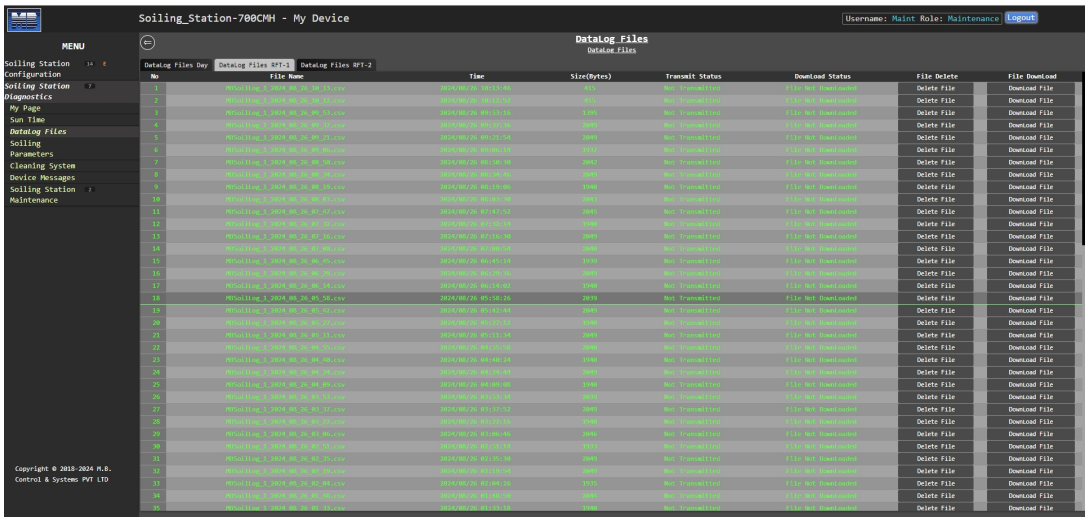


Figure-5.3.2: Remote transfer data log file status

Details of file status and operation are provided in table 5.3.2 below.

Sr. No	Parameter	Description	Remarks
1	File name	Logged file name	
2	Time	File log time	
3	Size	File size in Bytes	
4	Transmit status	Transmit status of the file	File not transmitted – 'Not Transmitted' File not transmitted – 'Transmitted'
5	Download Status	Download status of the file	File not downloaded – 'File Not Downloaded' File downloaded – 'Downloaded'
6	Delete File button	Left click on the button to delete the file.	File delete operation is irreversible. Active file – file that is being logged cannot be deleted. 'Delete Button' shall be disabled for this file.
7	Download File– button	Left click on the button to download the file.	The file will be downloaded to PC or Laptop. Status of the file will be changed to 'Downloaded'. This button will not be available if the file is being transmitted or being logged.

Table-5.3.2: Remote transfer data log files

5.4 Soling Parameters

Soiling parameters can be viewed in real time clicking on ‘Soiling Parameters’.

Select tab ‘Solar Panel’ to view panel parameters as shown in figure-5.4.1 below.

Figure-5.4.1: Solar panel parameters

Select tab ‘Soling Parameters’ to view soiling parameters as shown in figure-5.4.2 below.

Figure-5.4.2: Soiling parameters

5.5 Cleaning System – Status and Operation

Status of cleaning system can be viewed in real time clicking on ‘Cleaning System’. Status and operation of cleaning system can also be done from here.

Select tab ‘Cleaning System Status’ to view status of cleaning system as shown in figure-5.5 below.

Figure-5.5: Panel cleaning status

Details of cleaning system status and operation are provided in table 5.5 below.

Sr. No	Parameter	Description	Remarks
1	Cleaning System Power Status	Status of power supply system for cleaning system	This power supply should be healthy for operation of the cleaning system
2	Switch Level Low	Status of cleaning fluid level	Cleaning fluid should be with limits for the cleaning system t operate.
3	Switch Level High		
4	Reference Panel Clean Oper	‘On’ or ‘Off’	Status of reference panel cleaning operation. Button ‘Start’ is provided to manually start cleaning of reference panel. Reference panel shall be cleaned as per the configured time and number of cycles. This button will be disabled if the cleaning fluid is not within limits, or any cleaning operation is active.
5	Soiled Panel Clean Oper	‘On’ or ‘Off’	Status of soiled panel cleaning operation. Button ‘Start’ is provided to manually start cleaning of soiled panel.

			Soiled panel shall be cleaned as per the configured time and number of cycles. This button will be disabled if the cleaning fluid is not within limits, or any cleaning operation is active.
6	Cleaning Pump Status	‘On’ or ‘Off’	Status of cleaning pump operation. Button ‘On’ / ‘Off’ is provided to manually start/ stop the pump. This pump can only be operated if any of the valves are is ‘On’ and if the cleaning fluid is within limits. This button is also used to test operation of the cleaning pump.
7	Valve – Reference Panel	‘On’ or ‘Off’	Status of reference panel valve. Button ‘On’ / ‘Off’ is provided to manually start/ stop the valve. This valve can only be operated if any panel cleaning operation is not active and if the cleaning fluid is within limits. This button is also used to test operation of the valve.
8	Valve – Soiled Panel	‘On’ or ‘Off’	Status of soiled panel valve. Button ‘On’ / ‘Off’ is provided to manually start/ stop the valve. This valve can only be operated if any panel cleaning operation is not active and if the cleaning fluid is within limits. This button is also used to test operation of the valve.
9	Cleaning cycle number		Cleaning cycle number for the running cleaning cycle.
10	Pump ‘On’ remaining time (sec)		Remaining time in seconds for the pump ‘On’ operation.
11	Pump ‘Off’ remaining time (sec)		Remaining time in seconds for the pump ‘Off’ operation

12	Cleaning System Status (Hex)		Status of cleaning system parts in Hex. Details of status bits are provided below: b0: Cleaning System Power Status b1: Water Level Low b2: Water Level High b3: Pump Status b4: Valve Clean Panel b5: Valve Soiled Panel b6: Reference Panel clean ON b7: Soiled Panel clean ON

Table-5.5: Cleaning system status and manual operation

5.6 Soling Station Messages

Left click on diagnostic menu option ‘Device Messages’ to view messages from soling station as shown in figure 5.6 below.

Logged messages shall be displayed on the page. Soiling station message details are provided in this chapter.

Figure-5.6: Soiling Station messages

Details of soiling station messages are provided in table 5.6 below.

Sr. No	Parameter	Description	Remarks
1	Description	Message description	Hardware faults will be displayed in red.
2	Message Code	Message code	

Table-5.6: Soiling Station messages

5.7 Soling Station Diagnostic Logs

Comprehensive diagnostic logs are available in the soiling station to enable diagnosis of various errors during operation.

Left click on ‘Device Messages’ and right on the same to view diagnostic logs available as shown in figure 5.7 below.

Figure-5.7: Soiling Station diagnostic logs

Following diagnostic logs are available:

i) Download Device Status Report
ii) Download Device Value Report
iii) Delete Device Messages
iv) Download Modem Comm Log
v) Download MODBUS Comm Log
vi) Download MQTT Log
vii) Delete MQTT Save Msg Log

Left click on the option required.

5.7.1 Download Device Status Report

Click on this option to download status of soiling station status file. It will also download logged messages.

Downloaded file will have following information:

i) Date and time of report
ii) Model and serial number details.
iii) Status of services on the soiling station.
iv) Status of sensors connected.
v) List of all the messages logged.

5.7.2 Download Device Value Report

Click on this option to download values of all parameters from all inputs in .txt file.

Downloaded file will have following information:

i) Model and serial number details.
ii) All measured values and quality.

Following information is provided in this report:

i) Date and time of report
ii) Description of parameters.
iii) **'Qual'**: quality of parameter value. Good quality values will be marked as 'GD'.Bad quality values will be marked as 'IV'.
iv) **'Value'**: parameter value in float format.
v) **'Value_Min'**: minimum value of the parameter for the block time.
vi) **'Value_Man'**: maximum value of the parameter for the block time.
vii) **'Value_Avg'**: average value of the parameter for the block time.
viii) **'Value_SD'**: Standard deviation for the parameter. It will be displayed only if the same is enabled in parameter configuration.
ix) **'Value_Int'**: Integrated value for the parameter. It will be displayed only if integration is enabled in parameter configuration.

5.7.3 Delete MBLogger Messages

This option is not available.

5.7.4 Download Modem Comm Log

Download modem communication log.

5.7.5 Download MODBUS Comm Log

Download MODBUS communication log. This is useful in finding problems with MODBUS communication over serial or ETH ports.

5.7.6 Download MQTT Log

Download MQTT communication log via Modem PPP or ETH ports.

5.7.7 Delete MQTT Save Msg File

This deletes MQTT messages saved in backup file.

5.8 Soiling Station Test and Calibration

These operations can be done by only “Maint’ user.
Select left click option ‘Configuration’ under ‘Soiling Station Maintenance’.

Various tests and calibrations can be performed for the soiling station.
Refer to the screen shown in figure 5.8 below.

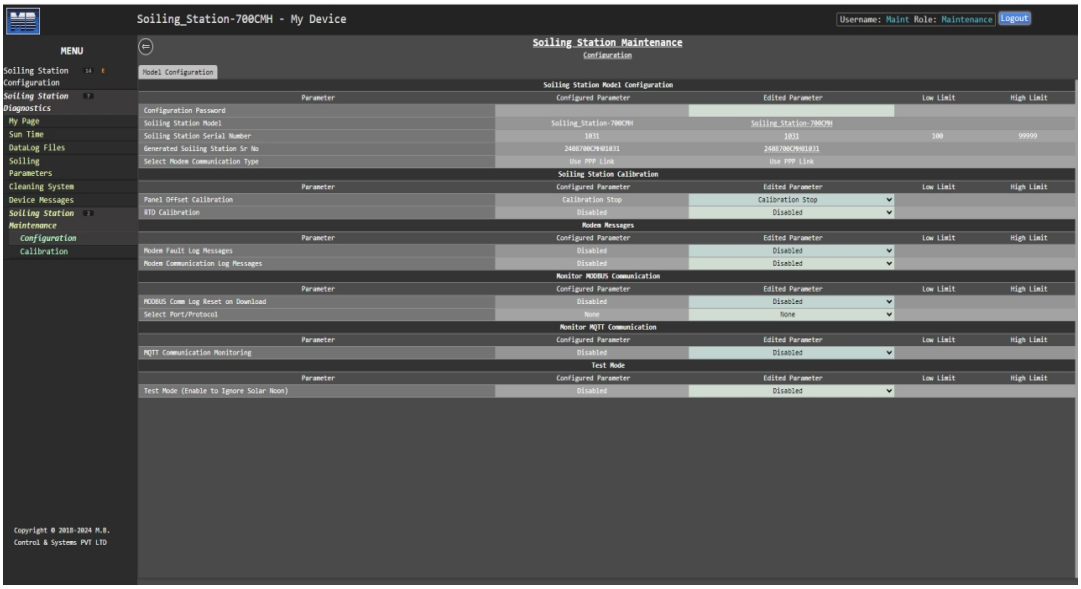


Figure-5.8: Soiling station test and calibration

Details of soiling station test and calibration operation are provided in table 5.8 below.

Sr. No	Parameter	Description	Remarks
	Soiling Station Calibration		
1	Panel Offset Calibration		‘Start’ or ‘Stop’ panel calibration
2	RTD Calibration		Enable calibration of panel RTD sensors. Disable when RTD calibration is over.
	Modem Messages		
1	Modem Fault log messages	‘Enable’ or ‘Disable’	If enabled modem operation messages will be logged.
2	Modem Communication Log Messages	‘Enable’ or ‘Disable’	If enabled modem communication messages will be logged in modem communication log file.
	Monitor MODBUS Communication		
1	MODBUS Comm Log Reset on Download	‘Enable’ or ‘Disable’	

2	Select Port/ Protocol		Select port and protocol to log the communication.
	Monitor MQTT Communication		
1	MQTT Communication monitoring		If ‘Enabled’ MQTT messages will be logged.
	Test Mode		
1	Test Mode (Enable to ignore Solar Noon)		This is used to test the soiling station. If ‘Enabled’ settings of solar noon shall be disabled for calculation of soiling parameters.

Table-5.8: Soiling station test and calibration

5.8.1 Panel Calibration

This feature is used to remove any error in soiling calculation due to difference reference and soiled panel characteristics.
Select “Calibration Start’ in row ‘Panel Offset Calibration’ (refer figure 5.7 above).
Panel offset calibration will be done automatically and will be over in about 30 seconds.
Select “Calibration Stop’ in row ‘Panel Offset Calibration’ and logout.

This operation calibrates parameters of soiled panel with clean panel. The operation should be done under the following conditions only.

i) Clear sunny day with no clouds.
ii) At solar noon.
iii) Solar irradiation should be more than 0.8 sun.

5.8.2 Panel RTD Calibration

This operation calibrates solar panel temperature measurement RTD sensors. Use precision RTD sources for this calibration.

Refer to the screen shown in figure 5.8 above to ‘Enable’ the RTD calibration process.
Left click on ‘Calibration’ to see the RTD calibration screen below in figure -5.8.2.

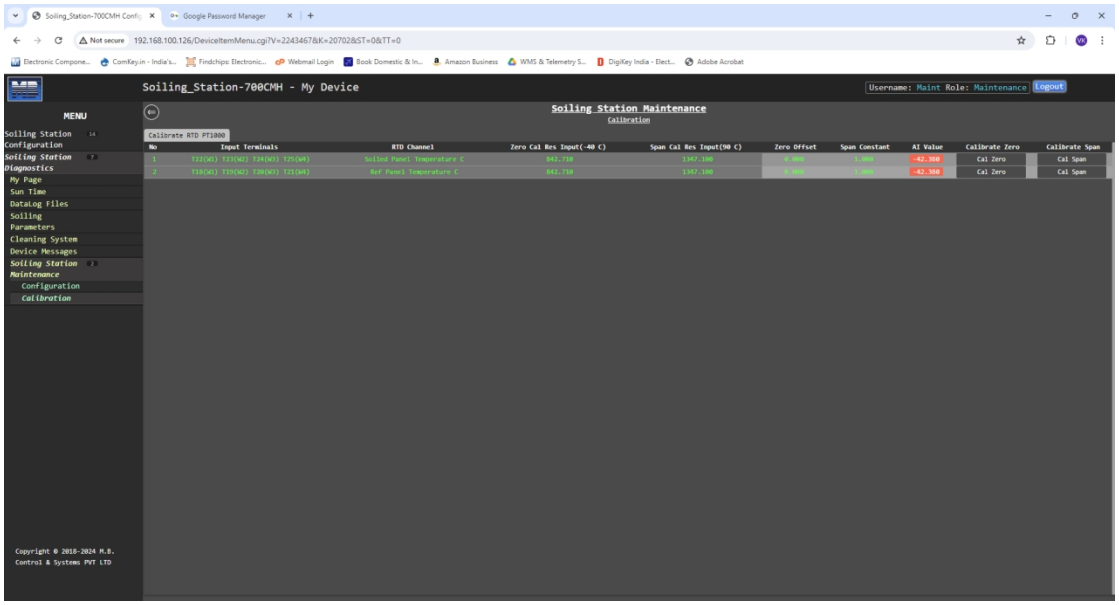


Figure-5.8.2: Panel RTD calibration

RTD calibration – resistance values and temperatures are provided on the calibration screen.

Details of RTD calibration operation are provided in table 5.8.2 below.

Sr. No	Parameter	Description	Remarks
1	Connect ‘Zero’ calibration input resistance to the RTD input terminals		Click on button ‘Cal Zero’ to update the offset value.
2	Connect ‘Span’ calibration input resistance to the RTD input terminals		Click on button ‘Cal Span’ to update the span constant.
3			Repeat the above cycles few times to reach steady values of ‘Zero Offset’ and ‘Span Constant’.

Table-5.8.2: Panel RTD calibration

6 Soiling Station Messages

Soiling station provides messages for the following events:

i) User login and logout
ii) Datalogger re-configuration
iii) Hardware faults

Details of message types are provided in table-6 below.

Sr. No	Message Type	Remarks	Action Required
1	Information	Information message. No effect on operation of the datalogger.	None
2	Fault	Hardware fault. Operation of the datalogger will be affected. Red Led 'ER' on front panel will flash.	Contact service@mbcontrol.com

Table-6: Datalogger message types

6.1 Soiling Station Information Messages

MBLogger operation information messages are listed in table-8.1 below.

Sr. No	Code	Message	Message Type	Remarks
1	1000	Power On	Information	
2	1001	Re-Conf	Information	Datalogger has been re-configured
3	1002	Adm Login	Information	Administrator login and logout
4	1003	Adm Logout	Information	
5	1004	Opr Login	Information	Operator login and logout
6	1005	Opr Logout	Information	
7	1006	Viw Login	Information	Viewer login and logout
8	1007	Viw Logout	Information	
9	1008	Login Fail	Information	Invalid login attempt
10	1010	Time SyOK	Information	Time synchronisation OK after fail
11	1011	Time SyFail	Information	Time synchronisations fail
12	1012	DL Msg Deleted	Information	Data logger messages have been deleted.
13	1014	RFT1 Comm Media Fail	Information	Communication media for remote file transfer -1 has failed
14	1015	RFT1 Comm Media OK	Information	Communication media for remote file transfer -1 is OK
15	1016	RFT1 Connect	Information	Connection to remote file

		ETH Fail		server -1 has failed via ETH port
16	1017	RFT1 Connect ETH OK	Information	Connection to remote file server -1 is OK via ETH port
17	1018	RFT1 File Write Fail	Information	File write operation for remote file server -1 has failed
18	1019	RFT1 File Write OK	Information	File write operation for remote file server -1 is OK
19	1020	RFT1 File Open Fail	Information	File open operation for remote file server -1 has failed
20	1021	RFT1 File Open OK	Information	File open operation for remote file server -1 is OK
21	1022	RFT1 File Close Fail	Information	File close operation for remote file server -1 has failed
22	1023	RFT1 File Close OK	Information	File close operation for remote file server -1 is OK
23	1024	RFT1 File Transmit Fail	Information	File transmit operation for remote file server -1 has failed
24	1025	RFT1 File Transmit OK	Information	File transmit operation for remote file server -1 is OK
25	1026	RFT2 Comm Media Fail	Information	Communication media for remote file transfer -2 has failed
26	1027	RFT2 Comm Media OK	Information	Communication media for remote file transfer -2 is OK
27	1028	RFT2 Connect ETH Fail	Information	Connection to remote file server -2 has failed via ETH port
28	1029	RFT2 Connect ETH OK	Information	Connection to remote file server -2 is OK via ETH port
29	1030	RFT2 File Write Fail	Information	File write operation for remote file server -2 has failed
30	1031	RFT2 File Write OK	Information	File write operation for remote file server -2 is OK
31	1032	RFT2 File Open Fail	Information	File open operation for remote file server -2 has failed
32	1033	RFT2 File Open	Information	File open operation for

		OK		remote file server -2 is OK
33	1034	RFT2 File Close Fail	Information	File close operation for remote file server -2 has failed
34	1035	RFT21 File Close OK	Information	File close operation for remote file server -2 is OK
35	1036	RFT2 File Transmit Fail	Information	File transmit operation for remote file server -2 has failed
36	1037	RFT2 File Transmit OK	Information	File transmit operation for remote file server -2 is OK
37	1038	Modem PPP Link Up	Information	Modem PP Link is OK
38	1039	Modem PPP Link Down	Information	Modem PP Link has failed. All communication via modem will be stopped.
39	1040	RTC OK	Information	RTC is operating OK
40	1041	Modem File Transfer ETH	Information	File is being transmitted via ETH port instead of Modem. This can happen if the modem has failed and file transfer via ETH port is possible.
41	1042	Modem File Transfer Modem	Information	File transmission via Modem has been restored.
42	1043	Modem Fail Recovery	Information	Modem failure has been recovered
43	1044	ETH Port Not Connected	Information	ETH port is not connected to any network
44	1045	ETH Port Connected	Information	ETH port is connected to network
45	1046	Maint Login	Information	Maintenance user login and logout
46	1047	Maint Logout	Information	
47	1048	Calibration Mode Start	Information	Datalogger is in calibration mode
48	1049	Calibration Mode End	Information	Datalogger is in normal mode of operation
49	1050	Device Restart	Information	Device has re-started itself.
50	1051	Task Termination Fail	Information	System message for tasks operation
51	1052	Messages Deleted	Information	Logged messages have been deleted.
52	1053	RFT1 Connect Modem Fail	Information	Connection to remote file server -1 has failed via Modem

53	1054	RFT1 Connect Modem OK	Information	Connection to remote file server -1 is OK via Modem
54	1055	RFT2 Connect Modem Fail	Information	Connection to remote file server -2 has failed via Modem
55	1056	RFT2 Connect Modem OK	Information	Connection to remote file server -2 is OK via Modem
56	1057	SNTP Media Change Modem	Information	SNTP client media has been changed from ETH to Modem. This will happen if SNTP client fails to connect to time server via ETH network and modem is working OK.
57	1058	SNTP Media Change ETH	Information	SNTP client media has been changed from Modem to ETH. This will happen if SNTP client fails to connect to time server via modem and ETH network is working OK.
58	1061	Serial Port2 Re Conf	Information	Serial port port-2 has been re-configured
59	1062	ADC-1 Fail	Information	ADC-1 operation failed
60	1063	ADC-1 Error	Information	ADC-1 error
61	1064	ADC-1 Reg Error	Information	ADC-1 register read error
62	1065	ADC-1 ReInit OK	Information	ADC-1 re-initialisation is OK
63	1066	DayLog File Write fail	Information	Error in writing to data log file
64	1967	RFT1Log File Write Fail	Information	Error in writing to remote file server-1 data log file
65	1068	RFT2Log File Write Fail	Information	Error in writing to remote file server-2 data log file
66	1069	Config File Write Fail	Information	Error in writing to device configuration file
67	1070	File Write size mismatch	Information	Mismatch in size of file being written
68	1071	Ref Panel Temp Sensor OK	Information	Reference panel temperature sensor is OK
69	1072	Panel soiled Temp Sensor OK	Information	Soiled panel temperature sensor is OK
70	1073	Ref Panel Param Read Ok	Information	Reference panel parameters read OK.

71	1074	Soiled Panel Param Read Ok	Information	Soiled panel parameters read OK.
72	1075	MBSlave Socket Not Free	Information	
73	1076	Device IP set to Default	Information	Default IP has been set
74	1077	PPP link Restore Command	Information	
75	1078	PPP link Restore Failed	Information	
76	1079	Modem Registered	Information	Modem Registration OK
77	1080	Modem Registration Failed	Information	
78	1081	Cellular Signal Low	Information	Place the modem antenna to location with better signal strength
79	1082	Cellular Signal OK	Information	
80	1083	Device Task Close	Information	All device tasks have been closed
81	1084	Cleaning Fluid Level Low	Information	Fill the cleaning fluid tank
82	1085	Cleaning Fluid Level High	Information	
83	1086	Cleaning Fluid Level in limits	Information	
84	1087	Cleaning System Power OK	Information	
85	1088	Cleaning System Power Fail	Information	Check the cleaning system power supply
86	1089	Cleaning Pump On	Information	
87	1090	Cleaning Pump Off	Information	
88	1091	Valve Reference Panel On	Information	
89	1092	Valve Reference Panel Off	Information	
90	1093	Valve Soiled Panel On	Information	
91	1094	Valve Soiled Panel Off	Information	
92	1095	Reference Panel Cleaning Start	Information	

93	1096	Reference Panel Cleaning Over	Information	
94	1097	Panels Calibrated	Information	Soiling station panels have been calibrated
95	1098	Soiled Panel Cleaning Start	Information	
96	1099	Soiled Panel Cleaning Over	Information	
97	1100	Modem FTP Start Fail	Information	
98	1101	Modem FTP Stop Fail	Information	
99	1102	Modem FTP CD Fail	Information	
100	1103	Modem FTP Del Fail	Information	
101	1104	Modem FTP Logout Fail	Information	
102	1105	Modem FTP Abort Fail	Information	
103	1106	Modem Comm Restore Fail	Information	
104	1107	Modem FTP Stop Ok	Information	
105	1108	Modem FTP Start Ok	Information	
106	1109	Modem FTP Abort Ok	Information	
107	1110	Modem SyFail Log Stop	Information	
108	1111	GPS Connected	Information	
109	1112	GPS Fail	Information	
110	1113	GPS Not Connected	Information	
111	1114	Modem FTO LogIn Fail	Information	
112	1115	Modem Message Log Enabled	Information	
113	1116	Modem Message Log Disabled	Information	
114	1117	RFT1 Disconnect Modem Fail	Information	
115	1118	RFT1 Disconnect Modem OK	Information	
116	1119	RFT2 Disconnect Modem Fail	Information	

117	1120	RFT2 Disconnect Modem OK	Information	
118	1121	RFT1 Disconnect ETH Fail	Information	
119	1122	RFT1 Disconnect ETH OK	Information	
120	1123	RFT2 Disconnect ETH Fail	Information	
121	1124	RFT2 Disconnect ETH OK	Information	
122	1127	Modem Reset Success	Information	
123	1128	Modem Reset Fail	Information	
124	1129	MMC Media Init OK	Information	
125	1130	Modem SIM Present	Information	
126	1131	Modem SIM Not Present	Information	Install SIM in the device
127	1132	Device Restarted	Information	Device restarted by the user
128	1133	Day Log Dir Full	Information	Delete few files in day log directory
129	1134	RFT-1 Dir Full	Information	Delete few files in RFT-1 log directory
130	1135	RFT-2 Dir Full	Information	Delete few files in RFT-2 log directory
131	1136	Config Dir Full	Information	Delete few files in Config directory
132	1137	MBSlave Pool Deplete	Information	
133	1138	MBSlave Pool Alloc Fail	Information	
134	1139	Modem Reg Home Network	Information	
135	1140	Modem Reg Roaming Network	Information	
136	1141	IP0 Pool Depleteed	Information	
137	1142	IP Pool Reset	Information	
138	1143	IP Inv Listner	Information	Invalid listner on IP port
139	1144	Media Restore	Information	
140	1145	RFT1 Server Space Full	Information	RFT -1 destination server has no more space for files
141	1146	RFT1 Server Space Available	Information	

142	1147	RFT2 Server Space Full	Information	RFT -2 destination server has no more space for files
143	1148	RFT2 Server Space Available	Information	
144	1149	Invalid Day Log File name	Information	
145	1150	Invalid RFT-1 File name	Information	
146	1151	Invalid RFT-2 File name	Information	
147	1152	Day File Corrupt	Information	
148	1153	RFT-1 File Corrupt	Information	
149	1154	RFT-2 File Corrupt	Information	
150	1155	MBSlave Comm Stopped	Information	
151	1156	IOT Connect Fail	Information	Check IOT Broker credentials or internet connection
152	1157	IOT Connect OK	Information	
153	1158	MQTT StFail Log Stop	Information	
154	1159	MQTT Start Fail	Information	
155	1160	MQTT Start Ok	Information	
156	1161	MQTT Stop Fail	Information	
157	1162	MQTT Stop OK	Information	
158	1163	MQTT Connect Fail	Information	
159	1164	MQTT Connect OK	Information	
160	1165	MQTT Fail	Information	
161	1166	MQTT OK	Information	
162	1167	MQTT Auth Fail	Information	IOT Authorisation has failed. Check MQTT publisher credentials.
163	1168	PPP Google Restore	Information	
164	1169	Modem Reg Denied	Information	Install proper SIM
165	1170	Sensor Cal Disable	Information	
166	1171	Sensor Cal Enable	Information	
167	1172	Sensor Cal Const Input	Information	Sensor calibration constants have been input manually

168	1173	File Create Error	Information	
169	1174	DayLog Open Fail	Information	
170	1175	RFT1 Log Open Fail	Information	
171	1176	RFT2 Log Open Fail	Information	
172	1177	RFT1 File Create Fail	Information	
173	1178	RFT2 File Create Fail	Information	

Table-6.1: Soiling Station operation information messages

6.2 Soiling Station Fault Messages

Soling station peration fault messages are listed in table-6.2 below.

Sr. No	Code	Message	Message Type	Remarks
1	2000	QSPI Fail	Fault	Internal non-volatile memory fail. Datalogger will not function.
2	2001	SDRAM Fail	Fault	Internal memory fail. Datalogger will not function.
3	2002	ADC-1 Fail	Fault	Analog input channels – PT1000 will not operate.
4	2004	Modem Fail	Fault	Internal modem will not function. This will affect functions working via modem.
5	2006	RTC Fail	Fault	RTC operation has failed. It will affect all time-based operations
6	2007	RTCbackupFail	Fault	RTC time was not backed up. Change the RTC backup battery
7	2008	ADC-1 SPI initialisation Fail	Fault	Fault in ADC-1
8	2022	Data Flash Fail	Fault	Fault in controller data flash memory
9	2024	Serial Port 2 Fail	Fault	Fault in datalogger serial port- 2
10	2025	ADC-1 ReInit Fail	Fault	Re-initialisation of ADC-1 failed
11	2026	Ref panel Temp	Fault	Reference panel RTD sensor has failed

		SensorFault		
12	2027	Soiled panel Temp Sensor Fault	Fault	Soiled panel RTD sensor has failed
13	2028	Ref panel Param Read Fault	Fault	Reference panel parameter read has failed
14	2029	Soiled panel Param Read Fault	Fault	Soiled panel parameter read has failed
15	2030	MMC Media Init Fail	Fault	Check by restarting the device
16	2031	SD Card Fail	Fault	Change the SD card

Table-6.2: Soiling station operation fault messages

7 Technical Specifications

7.1 General Specifications:

Sr. No	Parameter	Specification
1	Micro-Processor	32 bits ARM Processor
2	RTC	Temperature compensated. RTC

Table-7.1: Soiling Station controller general specifications

7.2 Measurement Parameters:

Sr. No	Parameter	Range	Resolution
1	Measurement Panel clean – voltage	65V	0.01V
2	Measurement Panel clean – short circuit current	18A	0.01A
3	Measurement Panel clean – Temperature	-40 to 90ºC	0.1ºC
4	Measurement Panel soiled – voltage	65V	0.01V
5	Measurement Panel soiled – short circuit current	18A	0.01A
6	Measurement Panel soiled – Temperature	-40 to 90ºC	0.1ºC
7	Accuracy		0.2%
8	Noise filter		Notch at 50Hz and 60Hz

Table-7.2: Measured Parameters

7.3 Communication Serial Port(RS485):

Sr. No	Parameter	Specification
1	Baud rate	4,800, 9,600 and 19,200 bps
2	Isolation	2.5KV
3	Protocols	MODBUS RTU Slave

Table-7.3: Serial Port(RS485)

7.4 Communication Port ETH

Sr. No	Parameter	Specification
1	Speed	100MHz
2	Protocols	MODBUS TCP Slave SNTP client, FTP, HTTP, MQTT, Embedded web server

Table-7.4: Port ETH

7.5 Internal Modem and GPS

Sr. No	Parameter	Specification
1	Modem Type	Quad band 4G (CAT-1) modem with antenna.
2	Frequency band	TDD LTE: B40/B41 GSM: 900/1800Mhz

Table-7.5: Internal Modem

7.6 Datalogging

Sr. No	Parameter	Specification
1	Datalogging time (periodical time)	Site configurable
2	SD Card	Up-to 16GB (FAT32)
3	Protocol	FTP via ETH port or inbuilt Modem

Table-7.6: Datalogging operation

7.7 Electrical

Sr. No	Parameter	Specification
1	Power supply voltage input	9-32 VDC
2	Power Consumption	With cellular modem: 6 W
		Without cellular modem: 4 W

Table-7.7: Electrical specifications

7.8 Environmental

Sr. No	Parameter	Specification
1	Operating Temperature range	-5ºC to +60ºC
2	Storage Temperature	-20ºC to +80ºC
3	Operating Humidity	Maximum 95% - noncondensing

Table-7.8: Environmental specifications

7.9 Physical

Sr. No	Parameter	Specification
1	Protection	IP20
2	Dimensions (W x H x L)	90 x 62 x 162 mm
3	Weight	0.5 Kg (74pprox..)
4	Mounting	DIN Rail
5	Housing material	Polycarbonate

Table-7.9: Physical specifications

8 Soiling Station MODBUS Slave Registers

All soiling station parameters are available via MODBUS slave registers.

Details of these registers are provided in this section.

8.1 Soiling Station Time

Sr. No	Parameter	Register Address	Type	Read/ Write
1	Soiling station epoch second	10	32 bits un-signed integer	Read/ Write

Table-8.1: Soiling station RTC time

Note: For writing time to datalogger – 32 bits should be written with write command.

8.2 My Parameters

Sr. No	Parameter	Attribute	Register Address	Type	Read/ Write
1	My Parameter-1	Value	20	32 bits float	Read only
2	My Parameter-2	Value	22	32 bits float	Read only
3	My Parameter-3	Value	24	32 bits float	Read only
4	My Parameter-4	Value	26	32 bits float	Read only
5	My Parameter-5	Value	28	32 bits float	Read only
6	My Parameter-6	Value	30	32 bits float	Read only
7	My Parameter-7	Value	32	32 bits float	Read only
8	My Parameter-8	Value	34	32 bits float	Read only
9	My Parameter-9	Value	36	32 bits float	Read only
10	My Parameter-10	Value	38	32 bits float	Read only
11	My Parameter-11	Value	40	32 bits float	Read only
12	My Parameter-12	Value	42	32 bits float	Read only
13	My Parameter-13	Value	44	32 bits float	Read only
14	My Parameter-14	Value	46	32 bits float	Read only
15	My Parameter-15	Value	48	32 bits float	Read only
16	My Parameter-16	Value	50	32 bits float	Read only
17	My Parameter-17	Value	52	32 bits float	Read only
18	My Parameter-18	Value	54	32 bits float	Read only
19	My Parameter-19	Value	56	32 bits float	Read only
20	My Parameter-20	Value	58	32 bits float	Read only
21	My Parameter-21	Value	60	32 bits float	Read only
22	My Parameter-22	Value	62	32 bits float	Read only
23	My Parameter-23	Value	64	32 bits float	Read only
24	My Parameter-24	Value	66	32 bits float	Read only

Table-8.2: My Parameters

8.3 Soiling Parameters

Sr. No	Parameter	Register Address	Type	Read/ Write
1	Soling Ratio	10602	32 bits float	Read only
2	Soling Ration – Day average	10604	32 bits float	Read only
3	Soling Index (%)	10606	32 bits float	Read only
4	Soling Index (%) – Day average	10608	32 bits float	Read only
5	Soiling measurement time	10600	32 bits – unsigned	Read only

Table-8.3: Soiling parameters

8.4 Measurement Panel Parameters

Sr. No	Parameter	Register Address	Type	Read/ Write
1	**Panel Clean Parameters**			
1.1	Effective Irradiation (W/mtr2)	10610	32 bits float	Read only
1.2	Short Circuit Currents (Amps)	10612	32 bits float	Read only
1.3	Voltage (V)	10614	32 bits float	Read only
1.4	Panel Temperature (ºC)	10616	32 bits float	Read only
2	**Panel Soiled Parameters**			
2.1	Effective Irradiation (W/mtr2)	10618	32 bits float	Read only
2.2	Short Circuit Currents (Amps)	10620	32 bits float	Read only
2.3	Voltage (V)	10622	32 bits float	Read only
2.4	Panel Temperature (ºC)	10624	32 bits float	Read only

Table-8.4: Measurement panels parameters

8.5 Cleaning System Configuration Parameters

Applicable only for soiling stations with auto cleaning system.
Cleaning system configuration parameter registers.

Sr. No	Parameter	Register Address	Type	Read/ Write
1	Auto clean enable b0: =1 for auto clean enable =0: for auto clean disable	10650	16 bits Unsigned Integer	Read / Write
23	Reference panel cleaning time – Hours (0-23)	10651	16 bits Unsigned Integer	Read / Write

3	Reference panel cleaning time – Minutes (0-59)	10652	16 bits Unsigned Integer	Read / Write
4	Reference panel number of cleaning cycles (1-10)	10653	16 bits Unsigned Integer	Read / Write
5	Reference panel clean ON Time (sec) (5-99)	10654	16 bits Unsigned Integer	Read / Write
6	Reference panel clean OFF Time (sec) (5-99)	10655	16 bits Unsigned Integer	Read / Write
7	Soiled panel number of cleaning cycles (1-10)	10656	16 bits Unsigned Integer	Read / Write
8	Soiled panel clean ON Time (sec) (5-99)	10657	16 bits Unsigned Integer	Read / Write
9	Soiled panel clean OFF Time (sec) (5-99)	10658	16 bits Unsigned Integer	Read / Write

Table-8.5: Cleaning system configuration parameters

8.6 Cleaning System Control Parameters

Cleaning system command registers.

Sr. No	Parameter	Register Address	Type	Read/ Write
1	Reference Panel Cleaning control (i) b0: Start b1: Stop	10660	16 bits Unsigned Integer	Write only
2	Soiled Panel Cleaning control (ii) b0: Start b1: Stop	10661	16 bits Unsigned Integer	Write only
3	Cleaning Hardware b0: Pump On b1: Valve Clean b2: Valve Soiled	10662	16 bits Unsigned Integer	Write only

Table-8.6: Cleaning system control parameters

Note:

i) Reference panel cleaning control: ‘Start’ will start the cleaning operation of reference panel. It will stop after completing the cleaning cycles as configured via the webserver. ‘Stop’ will terminate cleaning operation of the reference panel.

ii) Soiled panel cleaning control: ‘Start’ will start the cleaning operation of the soiled panel. It will stop after completing the cleaning cycles as configured via the webserver. ‘Stop’ will terminate cleaning operation of the soiled panel.

iii) The pump and valves will be on for the time configured via the web server if Power Supply is available and water level is above the low level.

8.7 Cleaning System Status Parameters

Cleaning system status registers.

Sr. No	Parameter	Register Address	Type	Read/ Write
1	Cleaning System Status b0: Cleaning System Power Status b1: Water Level Low b2: Water Level High b3: Pump Status b4: Valve Clean Panel b5: Valve Soiled Panel b6: Reference Panel clean ON b7: Soiled Panel clean ON	10663	16 bits Unsigned Integer	Read only
2	Cleaning Cycle Number	10664	16 bits Unsigned Integer	Read only
3	Pump ON Remain Time	10665	16 bits Unsigned Integer	Read only
4	Pump OFF Remain Time (sec)	10666	16 bits Unsigned Integer	Read only

Table-8.7: Cleaning system status parameters

10 Soiling StationDiagnostics

Configuration and operation of MBSoiling Station is quite simple. It can be easily configured using the default settings.

Some of the probable problems and solutions are listed below.

10.1 Download Device Status and Values Report:

These reports will enable better understanding of the problem.

10.2 Embedded Webserver

Sr. No.	Problem	Solutions
1	Unable to login to Device	i) Check that proper IP set in the device is being used. ii) Try default device IP. iii) Confirm that there is no IP clash in the network. iv) Check that IP set is as per network class. v) If user has closed the webpage without logout – wait for **about three minutes** before attempting next login.
2	Unbale to login. Message 'Soiling Station is being configured. Login after some time'.	This message is generated if user tries to login while the device is being configured. Try to login after 10 to 15 seconds.

Table-10.2: Embedded webserver problems

10.3 ETH Network

Sr. No.	Problem	Solutions
1	SNTP client not able to update time.	i) Check that network gateway has been configured properly and connected to the LAN. Check gateway status on webserver diagnostics. ii) Check availability of internet. iii) Verify NTP server IP set in the Device. vi) Verify operation of the NTP server via ping.

Table-10.3: ETH Network problems

10.4 Soiling Station Modem

Sr. No.	Problem	Solutions
1	Modem is unable to register to network.	i) Check cellular signal strength via webserver diagnostic. ii) Connect the antenna securely and place the antenna to get best signal strength. iii) Verify that SIM is inserted properly.

		iv) v)	Verify correct selection of cellular service provider. Check that there is enough balance in the SIM for data communication

Table-10.4: Soiling station Modem

10.5 Soiling Parameters

Sr. No.	Problem	Solutions
1	Panel temperature	i) Check proper connection of the panel temperature sensor.
2	Panel voltage and current	i) Verify that panel has been connected properly.
3	Soiling calculations not done	i) Check for solar noon settings. ii) Check proper soiling station location parameters. iii) Check soiling station time synchronisation.

Table-10.5: Soiling parameters

10.6 Cleaning System

Sr. No.	Problem	Solutions
1	Cleaning System not operating	i) Check cleaning system power supply ii) Check cleaning system configuration iii) Check that cleaning fluid is within limits. iv) Check proper operation of pump. v) Check proper operation of solenoid valves. vi) Check and clean the incoming water filter.
2	Water leakage even when the valve is ‘Off’	i) Open and clean the respective solenoid valve.

Table-10.6: Cleaning system

10.7 File Transfer Operation

Sr. No.	Problem	Solutions
1	File transfer not OK.	i) Check the media for file transfer Modem of ETH. ii) If modem is selected – check that no problem exists with modem. iii) If ETH is selected – check problems with ETH network. iv) Verify configuration of IP, username and passwords for remote file servers.

		v)	Check file servers with ping

Table-10.7: File transfer Operation

10.8 Datalogging Operation

Sr. No.	Problem	Solutions
1	SD Card problem	i) Check SD Card status on OLED or webserver. ii) Check that SD card is inserted properly. iii) Put Off the datalogger, remove the SD card. Verify operation of SD card on PC or laptop. iv) If required format the SD card. Remember to save the logger files prior to formatting the SD card.
2	Parameter values are not being logged	i) Verify that datalogging operation is enabled for the remote server. ii) Check if the data log file directory is full. iii) Check configuration for file directory. iv) Verify that the parameter has been configured for logging.

Table-10.8: Datalogging Operation

For other problems please contact service@mbcontrol.com .

11 Soiling Station Library

List of libraries provided in MBSoiling Station is provided below.

Option of ‘Input Not Used’ is provided for all inputs, if the same is not used.

11.1. Library for Solar Panels

List of solar panels is provided in table-10.1 below. This selection can be done at MBCS works only.

Sr. No.	Panel Wp	Comment
1	10Wp	To be selected during system configuration.
2	35Wp	
3	40Wp	
4	50Wp	
5	540Wp	
6	Other	

Table-11.1: Library of solar panels

12 Revision History

Revision	Date	Description
1.01	2022-01-01	Document created
1.02	22-03-18	Procedure for setting default IP is added.
1.03	24-08-27	Cleaning system added Solar noon configuration added MQTT added Operating Messages updated RTD Calibration procedure added Panel Library added

Table-11: Revision History