HEX POWER SYSTEM

Solarlink H Series

Operation Manual

EN | Ver 0.0

Contents

1 Introduction

1.1 General Information

- The purpose of this operation manual is to provide users instructions on how to operate the inverter properly.
- This manual describes information needed to operate H series PV inverter.
- Please read operation manual before operating PV inverter for your safety.

1.2 Intended Use

- This operation manual covers H series products with HMI.
  [H3010S ~ H3060S, H3100S/L/LOD/SOD, H3250S/SOD/LOD, H3500LOD/SOD]
- PV inverter converts DC (Direct Current) generated in PV modules to AC (Alternating Current) to feed it into electrical grid. Converted AC's characteristics must comply with utility grid requirements based on locally applicable standards or directives to be used as power source.
- Use this product only in accordance with the information provided in the enclosed documentation.
- Any other application may cause personal injury or property damage.
- Modification of product is only permitted with written permission by Hex Power System Co.,Ltd. Unauthorized modifications will void guarantee of proper functions of components, operation of the inverter as well as warranty claims and in most cases terminate the operating license. Hex Power System Co., Ltd shall not be held liable for any damage caused by such changes.
- Improper use of the product rather than what it is intended to be used as described in **[Intended Use]** section will not be a qualified product as a PV inverter.
- This operation manual must be placed near the inverter to be available at all times.
- Unauthorized persons must not operate the product.
- The product must be operated with doors closed.
- The product must be operated without any technical issues or defective parts.

2 Terms and Definition

2.1 Terms used in the manual and definitions

Terms	Description
INPUT MCCB	Input molded case circuit breaker to turn on/off input source.
Cd	DC link capacitor
FAN	Cooling fan to cool off heat transferred from semiconductor components and blowing off heated air outside of inverter.
NTC	Measuring and detecting temperature from IGBT to shut down the inverter when temperature reaches a point where temperature range is outside of inverter's operating range
IGBT	Power semiconductors device for electronic switch to convert DC to AC.
LS	Filter Reactor to reduce output harmonic.
CP	Filter Capacitor to reduce output harmonic.
MC	Magnetic contactor to shut down the inverter operation and to disconnect it from grid.
OUTPUT MCCB	Output molded case circuit breaker to turn ON/OFF output source
SPD	Surge Protective Device to protect inverter from surge coming in from grid.
SPD MCCB	SPD circuit breaker to protect SPD circuit after surge protection.
I-PV1, I-PV2, I-PV3	Input DC current transducer
I-SU,SV,SW	Inverter control current transducer
I-OU,OV,OW	Inverter output current transducer
EMC FILTER	Reducing noise which could influence proper function of inverter.
MAIN BOARD	In charge of overall inverter control and operation.
AC SENSING BOARD	Receiving AC voltage signal and transfer it to mainboard
DC SENSING BOARD	Receiving DC voltage signal and transfer it to mainboard
SMPS	Power supply to PCBs
LCD Touch HMI	Displays operation status, yield and fault history. Enable users to operate inverter manually.

3 Safety Instruction

To minimize the hazards to people and equipment, follow the procedures and practices correctly. Otherwise it could result in death or serious injury to people or damage to part of or a whole PV inverter and/or other equipment connected to the inverter.

⚠ DANGER

Risk of electric shock by live components

High voltages are present during operation. Touching live components results in death or serious injury.

- Wear proper protective equipment and clothing for all work on a product.
- Do not touch or work on live parts of inverter.
- Observe all warning marks and symbols on the product and in user manual.
- Read and comply with safety information in user manual.
- Do not touch components of inverter immediately after the inverter has been shut-down.

⚠ WARNING

Danger, risk of electric shock when product is not locked

If Inverter's door is not locked, it can be accessed by unauthorized persons. Improper operation or touching live components of the inverter can result in death or serious injury.

- Keep the inverter closed at all times when it is not needed to be opened.
- Do not leave keys inserted in doors.
- Prevent access by unauthorized persons by placing inverter in closed area.

⚠ WARNING

Danger, risk of damages to the product.

Gain setup must be done only by an engineer recognized by Hex Power System Co., Ltd. When inaccurate values are entered to gain menu, it will result in shutdown of inverter or product malfunction which then may require service for partial or a whole product.

- Users' access to gain setup is restricted due to potential danger which could result in serious injury to operator and fatal damages to the product.
- Engineers specialized in PV inverters must conduct gain setting on PV inverter.

⚠ CAUTION

Risk of electric shock by damaged product

Operating a damaged product can be dangerous and can result in death or serious injury.

- Wear proper protective equipment and clothing for all works on a product.
- Maintain the product in safe condition to operate.
- Operate the product when it is in safe condition without any technical issues.

	⚠ CAUTION
	Risk of burn by heated component Components can get heated as the inverter operates. Touching these components can cause burns. ▪ Wear proper protective equipment and clothing for all work on a product. ▪ During operation, do not touch any components marked with warning symbols or markings. ▪ After turning-off the inverter, give it 10 to 15 minute to cool off.

	⚠ NOTICE
	Product malfunction or damage by dust intrusion and exceeded humidity. Dust intrusion and exceeded humidity can damage the product and impair its functions. ▪ Perform maintenance work only when the environment is dry and free of dust. ▪ Operate product when doors closed. ▪ Close and lock the enclosure. ▪ The product must be closed for storage at all times. ▪ Temperature for storage must be within specified range.

4 Markings

4.1 Safety symbols

Symbol	Description
 General danger	General danger symbol can be broken down to warning/danger symbols. Warning is a potentially hazardous situation that could result in minor injury. Danger is a potentially hazardous situation that could result in serious injury or death.
 High voltage	High voltage symbol indicates that in order to prevent risk of electric shock before maintenance or installation, it is necessary to ensure that all AC and DC terminals are disconnected as Alternating Current (AC) and Direct Current (DC) sources are directly connected to the terminals in the PV inverter. This symbol is also used to indicate that risk of electric shock from energy stored in capacitors.
 Risk of burns	This symbol indicates a hot surface during operation that could result in a burn injury.
 Information	Information symbol indicates important and useful information that the user should know about the system.

5 Product Overview

5.1 Major Components

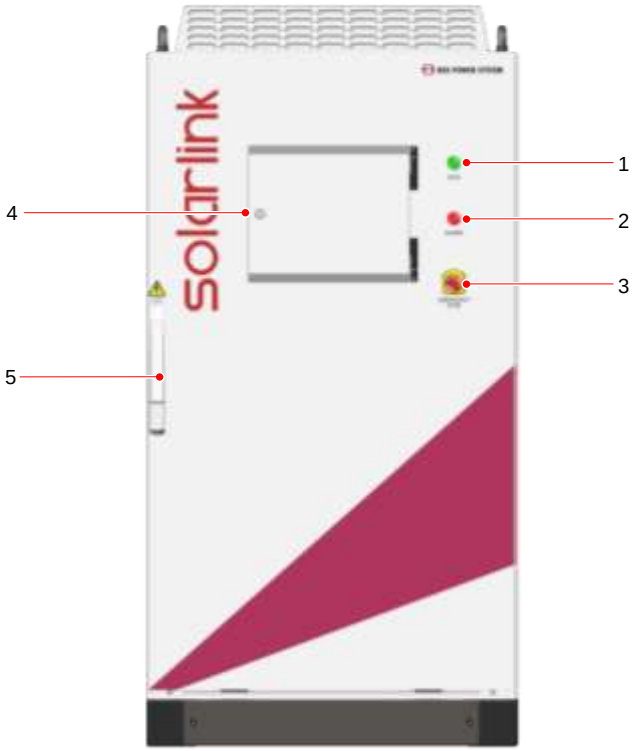


Figure 1: H3100SOD/LOD Front view door closed

No	Name	Description
1	Run lamp	Inverter operation indicator
2	Fault lamp	Inverter fault and shutdown indicator
3	Emergency stop	To shut down the inverter in case of emergency.
4	HMI protective cover	To protect HMI.
5	Door handle	To open and close the door

* All H series PV inverters manufactured by Hex Power System Co., Ltd share common external features which include single run lamp, fault lamp, emergency switch, HMI and/or HMI with its protective cover.

* Figure 1 is provided to help users understand where external components are located as well as their appearances.

Figure 2: H3100S Air flow overview

Figure 3: H3100S Air flow overview

FANS/AIR CIRCULATION

- It is recommended that users understand where PV inverters' fans are located and how air circulates in and out of the inverter.
- Users must consider the clearances that PV inverter need for installation and operation.
- Failure to comply the instruction can lead the inverter to shut down due to over-temperature fault that inverter is equipped as a protective function.

* As for information related to product's clearance can be found in products' **USER MANUAL.**

* Figures above are provided as an example. References related to fan location and air flow can be found in **USER MANUAL.**

6 Operation

6.1 Fault list

	Fault name	Cause	Measure
PV Fault	Solar Cell Over Voltage	PV voltage above standard voltage (H/W)	Automatic operation 5 min after recovery to normal inverter operable condition.
	Solar Cell Under Voltage	PV voltage below standard voltage (H/W)	Automatic operation 5 min after recovery to normal inverter operable condition.
Grid Fault	Line Over Voltage	Grid voltage above standard voltage	Automatic operation 5 min after recovery to normal inverter operable condition.
	Line Under Voltage	Grid voltage below standard voltage	Automatic operation 5 min after recovery to normal inverter operable condition.
	Line Over Frequency	Grid frequency above standard frequency	Automatic operation 5 min after recovery to normal inverter operable condition.
	Line Under Frequency	Grid frequency below standard frequency	Automatic operation 5 min after recovery to normal inverter operable condition.
	Line RST Phase Fault	Grid AC phases signals not received. One, two or all phases' signals not being read by mainboard.	Automatic operation 5 min after recovery to normal inverter operable condition.
	Line Phase Sequence Fault	Grid AC phases in wrong order	Automatic operation 5 min after recovery to normal inverter operable condition.
	Utility Line Failure	Grid blackout	Automatic operation 5 min after recovery to normal inverter operable condition.
Inverter Fault	Inverter Output Voltage Fault	Inverter voltage not correctly measured. voltage measured above or below limits	Measure actual voltage on inverter
	Inverter Over Current	Inverter current measured above limits	Measure actual voltage on inverter
	Inverter Ground Fault	Inverter ground failure	Inspect ground fault related parts and measure earth ground resistance before inverter operation.
	Inverter Overheating	Inverter temperature measured above limits	Inspect fan function then operate inverter when fan functions properly.
	Inverter MC Fault	When abnormal signals from magnetic contactor are received	Inspect MC or replace before inverter operation.
	Line-Inverter Async Fault	When inverter's frequency and grid frequency synchronization failed.	Automatic operation 5 min after recovery to normal inverter operable condition.

	Fault name	Cause	Measure
		IGBT failed to function	Reset inverter. Measure IGBT diodes if failure continues. Replace IGBT when IGBT is found to be defective.
		Emergency stop button pressed	Twist and pull out emergency stop button and turn **[ON]** output circuit breaker. Automatic operation after 5 min of recovery to normal inverter operable condition.
	Serial communication fault	When inverter failed to communicate with HMI	Inspect terminals and communication wires before operation.
	Multiple faults	Abnormal control power due to grid side fault	Inspect control power before operation.

6.2 Information on inverter failure

Information on primary factors leading inverter to operation failure

Inverter failure can occur due to grid instability and surrounding temperature. In order to operate inverter normally again, it is important to contact PV inverter installation agent or agency as soon as failure occurred. However, inspecting inverter on a daily basis for its abnormal noise or appearance is also crucial and can be greatly helpful in bringing inverter back to its normal operation quickly.

Factors	Description
Effects of grid instability	In case of grid blackout, power supply to PV power plant must be shut down within 0.5 second as it is stated in PV Inverter safety standards. Therefore, PV inverter shuts down automatically when blackout of grid is detected. When stable grid is supplied again, PV inverter will have 5 min of recovery time and operates again automatically. Besides blackouts, safety functions of PV inverter of which lead to its shutdown include grid over voltage +10%(permissible range ±2%) , grid under voltage -10%(permissible range ±2%), grid over frequency and grid under frequency below 60Hz +0.5Hz, -0.7Hz (permissible range ±0.05Hz). In these cases, PV inverter will automatically operate when grid is back to its normal range of values.
Effects of inverter installed environment	Inverter shutdown can be triggered due to temperature rise over normal operating temperature range from inverter operation in an isolated area to protect its system. In this case, circulating air around the inverter must be ventilated. When inverter shuts down by detecting overheated system or high temperature while surrounding temperature is relatively in normal operating range, fault due to cooling fan malfunction could be the cause of shutdown and must contact manufacturer for after sales service.
Effects of surrounding temperature of inverter	When surrounding temperature of inverter drops (below 20℃) PV module voltage can increase due to abnormal potential voltage on inverter. The inverter detects voltage as PV over voltage and shutdown the inverter to prevent it from possible damage to its system.
Effects of safety functions for securing safety	Due to certain factors, PV inverter can be shut down by its sensitive safety functions on grid connected terminals. In this case, contact manufacturer for after sales service.

How to take measures when inverter failure occurs

When inverter failure occurs, first initiative is to check fault alarms on HMI that caused inverter failure. Depend on alarm different measures can be applied.

After inverter is shutdown, go to alarm status located on bottom tab. Faults in red boxes indicate the cause of inverter shutdown.

When moved to event history located on bottom tab, it shows recorded faults along with time that fault was detected. When necessary information is acquired, note them and contact manufacturer.

Information on Inverter failure due to grid fault

Inverter failure due to grid instability can occur. As soon as grid is back in stable condition, the inverter will start operating automatically. However, if inverter is consistently shutting down due to such reason, contact manufacturer for further assistance on proper operation of the inverter.

Fault name	Description
Line phase sequence fault	When AC phases are in wrong order, line phase sequence fault occurs. This fault could come from wrong power cable connection to AC phases or from wrong power cable connection on transformer after transformer replacement service. Each AC power cable has to be connected to correct AC phase in order to prevent this fault.
Utility line failure	Utility line failure occurs when blackout from grid takes place. Even though blackout is not recognized by a person, inverter shuts down as soon as grid blackout occurs. When grid is back in stable condition, the inverter will begin operating automatically 5 min after.
Line over voltage fault	Fault occurs when grid voltage is raised to 10% or more over normal voltage. When grid voltage is back in normal range, the inverter will begin operating automatically 5 min after.
Line under voltage fault	Fault occurs when grid voltage is dropped to 12% or more under normal voltage. When grid voltage is back in normal range, the inverter will begin operating automatically 5 min after.
Line over frequency fault	Fault occurs when grid frequency is raised to 0.5Hz or more over normal frequency. When grid frequency is back in normal range, the inverter will begin operating automatically 5 min after.
Line under frequency fault	Fault occurs when grid frequency is dropped to 0.7Hz or more under normal frequency. When grid frequency is back in normal range, the inverter will begin operating automatically 5 min after.
Line R,S,T phase order fault	Fault occurs when one, two or all of AC phases are not measured correctly. When all three AC phases measured correctly, inverter begins operating automatically 5 min after.

6.3 Inverter set-up

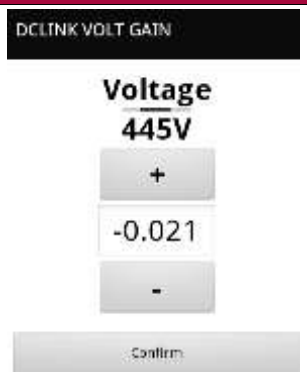
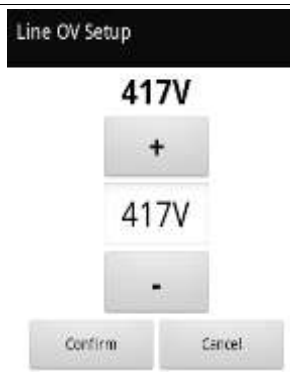
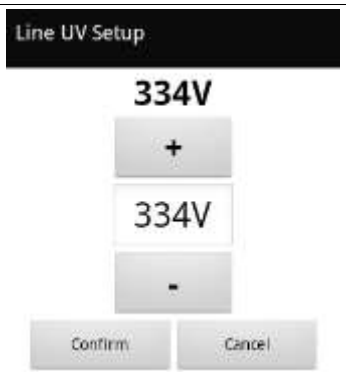
	**Information on inverter setup** Offset, gain setup, inverter ID, time setup, language setup, serial number, capacity and production date are set accordingly based on a purchase order before shipment to customers. The inverter setup section in operation manual is to provide users how to access to those setup when needed or to confirm all settings are made correctly before commissioning of the inverter.

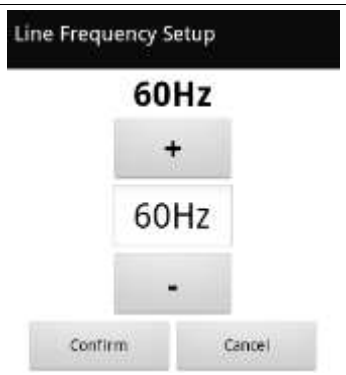
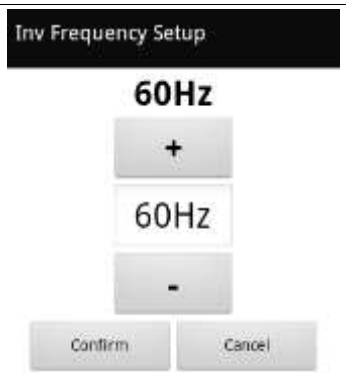
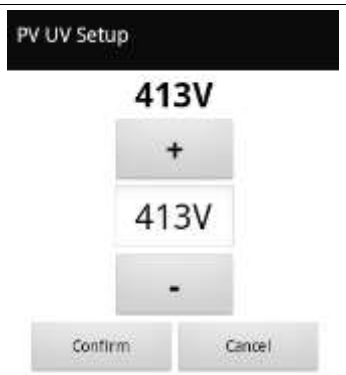
6.4 Gain setup

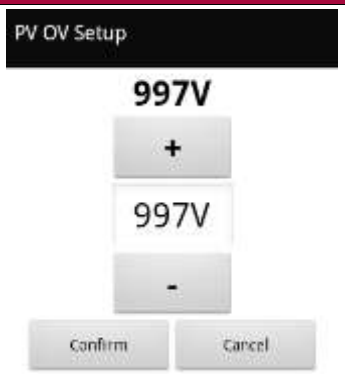
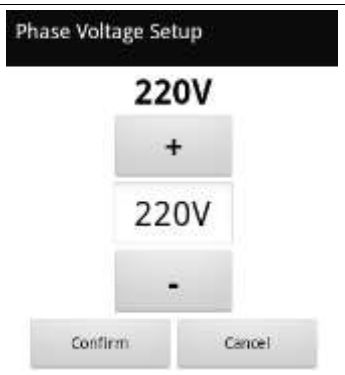
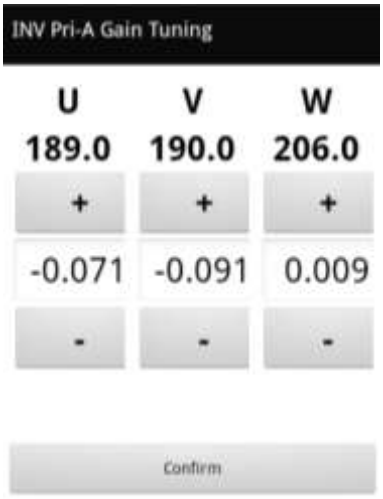
	**⚠ WARNING** Danger, risk of damages to the product. Gain setup must be done only by an engineer recognized by Hex Power System Co., Ltd. When inaccurate values are entered to gain menu, it will result in shutdown of inverter or product malfunction which then may require service for partial or a whole product. ▪ Users' access to gain setup is restricted due to potential danger which could result in serious injury to operator and fatal damages to the product. ▪ Engineers specialized in PV inverters must conduct gain setting on PV inverter.

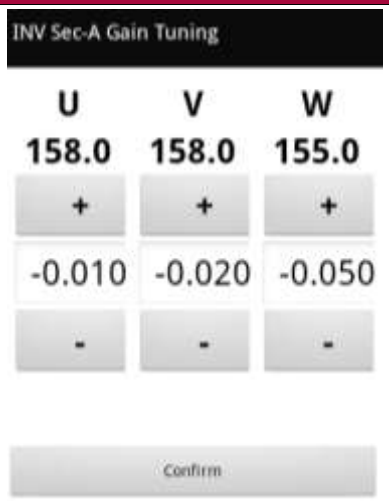
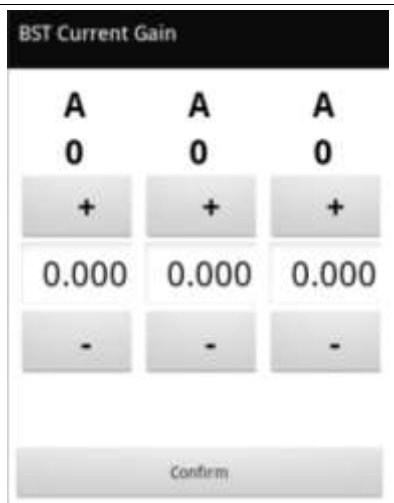
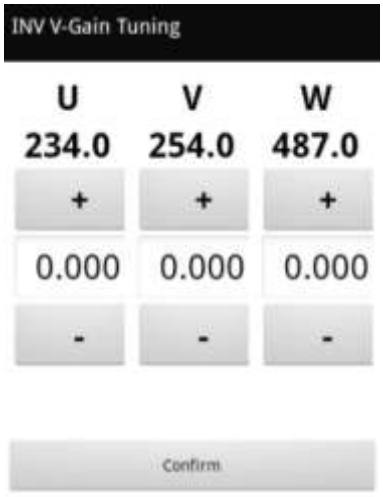
Window	Description
Line Gain Tuning	This line gain menu is to match R, S, T grid voltage measured by the inverter with actual three phase grid voltage. Line gain tuning will enable users to set R, S, T three phase voltage respectively.
PV Voltage Gain	This PV voltage gain menu is to match input DC voltage measured by the inverter with actual input DC voltage.
INV Offset Calibration	To set all values to zero to obtain precise measured data when input/output are supplied.
System Information	To request Inverter ID, serial number, produced date, mainboard version and HMI version from the inverter.
RTC Offset Calibration	To re-set the time set to PV inverter.
Total, Peak Clear	To clear the value of peak power and accumulated energy.
PV UV Setup	To set input (DC) under voltage range which triggers PV Under voltage fault when voltage drops below set range.
Line UF Setup	To set output (AC) under frequency range which triggers line under frequency fault when frequency drops below the set range.
Line OF Setup	To set output (AC) over frequency range which triggers line over frequency fault when frequency increases above the set range.

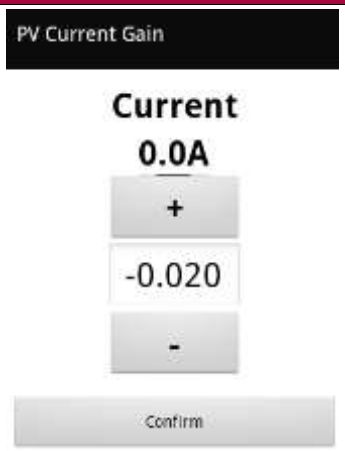
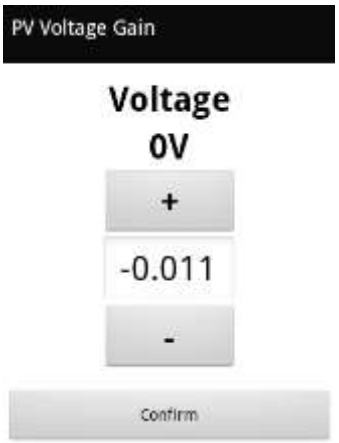
Window	Description
PV OV Setup	To set input (DC) over voltage range which triggers PV over voltage fault when voltage increases above set range.
Line UV Setup	To set output (AC) line under voltage set up which triggers line under voltage fault when line voltage drops below set range.
Line OV Setup	To set output (AC) line over voltage set up which triggers line over voltage fault when line voltage increase above set range.
Phase Voltage Setup	To set phase voltage of 220Vac.
Inv Frequency	To set inverter frequency of 50Hz/60Hz.
Line Frequency	To set line frequency of 50Hz/60Hz.
PV Current Gain	To set input (DC) current gain.
BST Current Gain	BST Current Gain is only used for H3100LOD model to set booster IGBT's DC current gain.
DCLINK VOLT GAIN	DC link voltage gain is only used for H3100LOD model. To set gain value of DC link capacitor voltage.
INV V-Gain Tuning	To set inverter R, S, T three phase voltage gain on stack.
INV Pri-A Gain Tuning	To set inverter's primary side current gain. Current can be measured on primary side of transformer.
INV Sec-A Gain Tuning	To set inverter's secondary side current gain. Current can be measured on secondary side of transformer.
Inv Async Range Setup	To set asynchronization range. This gain menu is used to match grid voltage wave form with an inverter voltage waveform. By setting the range in degree, the fault can be triggered when phase angle between grid voltage wave form and inverter voltage wave form does not match.

Gain menu	Description
	DC link voltage gain menu is used for H3100 LOD model to adjust DC link capacitor voltage. When adjusting gain for DC link voltage gain, + is to add values and – is to reduce the value. Bolded values indicate values currently measured by the inverter and values in a box between + and – button is the input gain value.
	Live OV setup is to set the over voltage range. When one of R, S, T phase's voltage goes beyond set voltage range, the inverter will trigger live OV fault to shut down the inverter to protect both inverter and grid. When adjusting gain for line OV setup, + is to add values and – is to reduce the value. Bolded values indicate values currently measured by the inverter and values in a box between + and – button is the input gain value.
	Live UV setup is to set the under voltage range. When of R, S, T phase's voltage drops below set voltage range, the inverter will trigger line under voltage fault to shut down the inverter to protect both inverter and grid. When adjusting gain for line UV setup, + is to add values and – is to reduce the value. Bolded values indicate values currently measured by the inverter and values in a box between + and – button is the input gain value.
	Line UF setup is to set the under frequency range. When grid frequency measured by the inverter drops below set frequency range, the inverter will trigger line under frequency fault to shut down the inverter. When adjusting gain for line UF setup, + is to add values and – is to reduce the value. Bolded values indicate values currently measured by the inverter and values in a box between + and – button is the input gain value.

Gain menu	Description
	Line OF setup is to set the over frequency range. When grid frequency measured by the inverter increases above set frequency range, the inverter will trigger line over frequency fault to shut down the inverter. When adjusting gain for line OF setup, + is to add values and – is to reduce the value. Bolded values indicate values currently measured by the inverter and values in a box between + and – button is the input gain value.
	Line frequency setup must be set to 50Hz or 60Hz to meet local directives or power standards requirement. Based on line frequency setup value, the inverter can trigger over/under frequency fault. When adjusting gain for line frequency setup, + is to add values and – is to reduce the value. Bolded values indicate values currently measured by the inverter and values in a box between + and – button is the input gain value.
	Inv frequency setup is to set output (AC) frequency of the inverter during operation. Inverter frequency must match grid frequency to supply generated power to grid. When adjusting gain for inverter frequency setup, + is to add values and – is to reduce the value. Bolded values indicate values currently measured by the inverter and values in a box between + and – button is the input gain value.
	PV UV setup is to set PV (DC input) under voltage range. The inverter will trigger PV UV fault when it detects the input voltage drops below set voltage range. When adjusting gain for PV UV setup, + is to add values and – is to reduce the value. Bolded values indicate values currently measured by the inverter and values in a box between + and – button is the input gain value.

Gain menu	Description
	PV OV setup is to set PV (DC input) over voltage range. The inverter will trigger PV OV fault when it detects the input voltage increases above set voltage range. When adjusting gain for PV OV setup, + is to add values and – is to reduce the value. Bolded values indicate values currently measured by the inverter and values in a box between + and – button is the input gain value.
	Phase voltage setup is the voltage to supply control power. SMPS with 220Vac input, phase voltage must be set to 220Vac. When adjusting gain for phase voltage setup, + is to add values and – is to reduce the value. Bolded values indicate values currently measured by the inverter and values in a box between + and – button is the input gain value.
	INV Pri-A gain tuning is a gain menu to set U, V, W three phase AC current on primary side of transformer. When adjusting gain for INV Pri-A gain tuning, + is to add values and – is to reduce the value. Gain value for U, V, W three phase can be entered respectively on boxes below each phase. Bolded values indicate values currently measured by the inverter and values in a box between + and – button is the input gain value.

Gain menu	Description
	INV Sec-A gain tuning is a gain menu to set R, S, T three phase AC current on secondary side of transformer. When adjusting gain for INV Sec-A gain tuning, + is to add values and – is to reduce the value. Gain value for U, V, W three phase can be entered respectively on boxes below each phase. Bolded values indicate values currently measured by the inverter and values in a box between + and – button is the input gain value.
	BST current gain menu is used for H3100LOD model to adjust booster IGBT current. When adjusting gain for BST current gain, + is to add values and – is to reduce the value. Booster IGBT's DC current gain value can be entered respectively on boxes below each phase. Bolded values indicate values currently measured by the inverter and values in a box between + and – button is the input gain value.
	INV V gain tuning is a gain menu to set R, S, T three phase voltage of inverter. When adjusting gain for INV-V-Gain tuning, + is to add values and – is to reduce the value. Gain value for U, V, W three phase can be entered respectively on boxes below each phase. Bolded values indicate values currently measured by the inverter and values in a box between + and – button is the input gain value.

Gain menu	Description
	PV Current gain is used to set PV (DC input) current gain. Failure to set PV current gain can affect measured input (DC) current. When adjusting gain for PV current gain, + is to add values and – is to reduce the value. Bolded values indicate values currently measured by the inverter and values in a box between + and – button is the input gain value.
	PV Voltage gain is used to set PV (DC input) current gain. Failure to set PV voltage gain can affect measured input (DC) voltage. When adjusting gain for PV voltage gain, + is to add values and – is to reduce the value. Bolded values indicate values currently measured by the inverter and values in a box between + and – button is the input gain value.

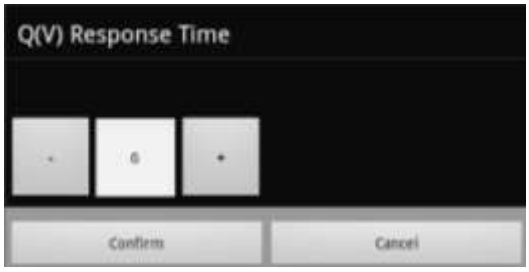
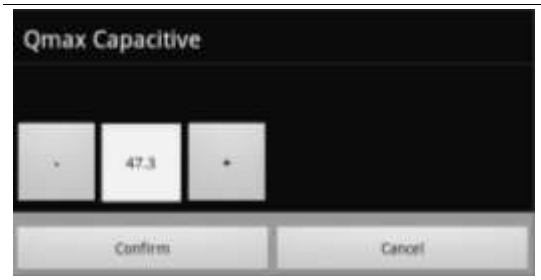
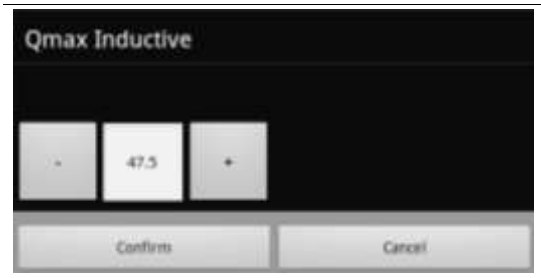
6.5 PF control

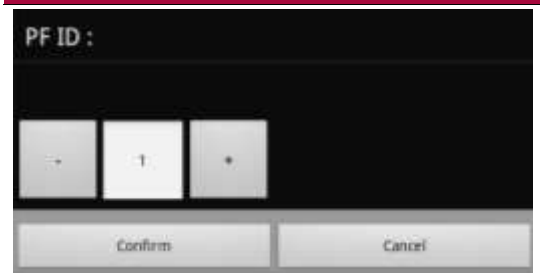
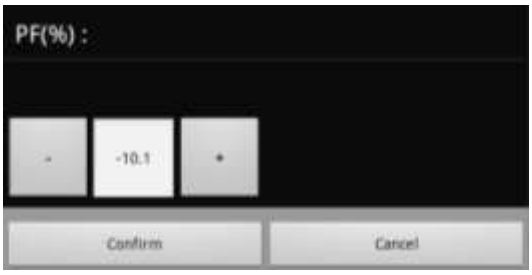
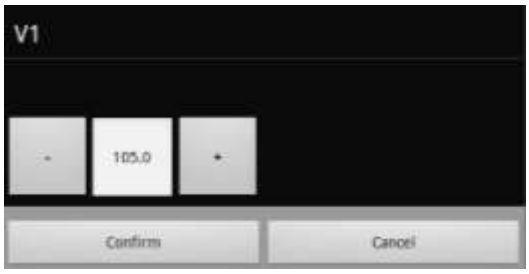
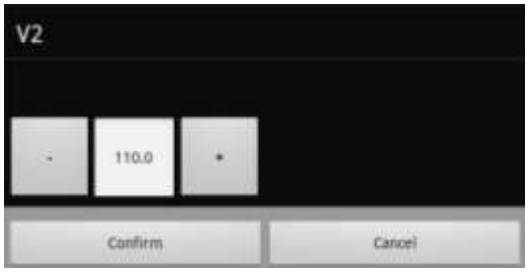
	Information on PF control
	Depend on public electricity power corporation of a country or government subsidized power corporates' requests or demands for power quality, power factor control function of PV inverter is subject to be tested to prove the power being generated from PV inverter is conforming the country's specific power quality standards.

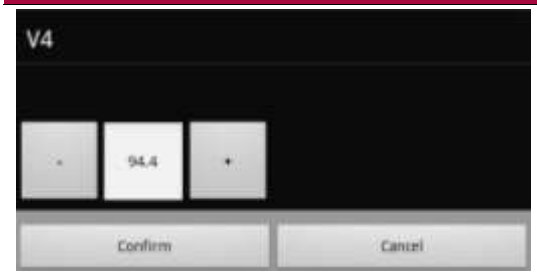
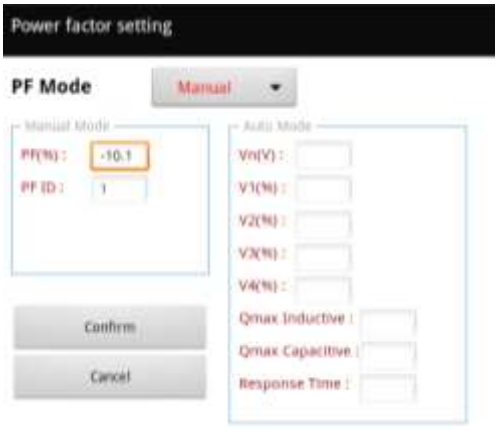
Menu

Description

To select Auto/Manual mode or to turn Off power factor control.

Window	Description
	Q(V) Response time is used for automatic power factor control. Power factor response time set up. Depend on specific demand or request on power factor control response time can be set.
	Qmax capacitive is used for automatic power factor control. Depend on specific demand or request on power factor control, values can be entered. The unit of this vale is percentage.
	Qmax inductive is used for automatic power factor control. Depend on specific demand or request on power factor control, values can be entered. The unit of this vale is percentage.

Window	Description
	PF ID is used only for manual power factor control. PF ID applies to the module type PV inverters. PF ID must be set to correspond to the PV inverter module.
	PF(%) is used only for manual power factor control. Depend on PF(%) value, it sets power factor either leading PF or lagging PF.
	Vn is used for automatic power factor control. Vn stands for nominal voltage and output rated voltage must be entered here.
	Depend on power factor test data or guideline, values can be entered. The unit used is percentage.
	Depend on power factor test instruction, provided values can be entered. The unit used is percentage.
	Depend on power factor test instruction, provided values can be entered. The unit used is percentage.

Window	Description
	Depend on power factor test instruction, provided values can be entered. The unit used is percentage.
	When PF setting is pressed, power factor setting page appears and users can choose either manual mode or auto mode.

6.6 Offset

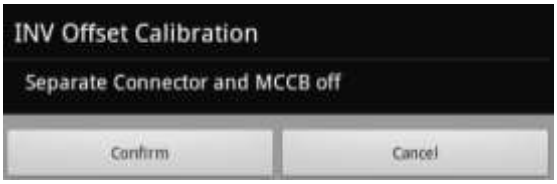
	Information on offset function
	Offset, gain setup, inverter ID, time setup, language setup, serial number, capacity and production date are set accordingly based on a purchase order before shipment to customers. The inverter setup section in operation manual is to provide users how to access to those setup when needed or to confirm all settings are made correctly before commissioning of the inverter.

Menu

Time setup is crucial in operation of PV inverter. In order to track precise data of a specific date, the time must be set or calibrated correctly to retrieve report and faults to take necessary actions when needed.

This function enable PV inverter to re-calibrate real-time of PV inverter.

Menu



Description

Inverter offset calibration function enable inverters to get rid of unnecessary values read by PV inverter. When offset is not done correctly, PV inverter will read incorrect data which then can lead to inverter failure.

Inverter offset function is to set all values to zero before reading input/output data to obtain as exact data as possible.

6.7 Commissioning PV inverter

Figure 4: PV inverter operation flow chart

⚠ DANGER

Risk of electric shock by live components

High voltages are present during operation. Touching live components results in death or serious injury.

- Wear proper protective equipment and clothing for all work on a product.
- Do not touch or work on live parts of inverter.
- Observe all warning marks and symbols on the product and in user manual.
- Read and comply with safety information in user manual.
- Do not touch components of inverter immediately after the inverter has been shut-down.

⚠ WARNING

Danger, risk of electric shock when product is not locked

If Inverter's door is not locked, it can be accessed by unauthorized persons. Improper operation or touching live components of the inverter can result in death or serious injury.

- Keep the inverter closed at all times when it is not needed to be opened.
- Do not leave keys inserted in doors.
- Prevent access by unauthorized persons by placing inverter in closed area.

Information on commissioning of PV inverter

- Before commissioning PV inverter, ensure all DC, AC power cables are connected properly and to correct phase and polarity.
- Unauthorized personnel must not operate PV inverter.
- When time setup to PV inverter is not precise, inaccurate data will be retrieved. Be sure to set correct time to obtain reports of specific date to view through HMI or remote monitoring tool.

6.7.1 Visual inspection

All circuit breakers or disconnectors on LV switchgear, combiner box or/and control cabinet must be turned [OFF] beforehand. In order to conduct thorough visual inspection, it is highly suggested all equipment connected in series with PV inverter are turned [OFF] for safety.

Procedures:

1. Ensure that emergency switch is turned [OFF]
2. Ensure that all cables are tightly connected to input/output MCCB.
3. Ensure all connectors on PCB are correctly plugged in.

6.7.2 Supplying voltage

For safety, it is highly suggested to use circuit breakers or disconnectors on LV switchgear or/and control cabinet to turn [ON] / [OFF] the PV inverter when commissioning PV inverter first time.

Location of control power circuit breaker, input MCCB and output MCCB may be different based on model and type of PV inverter. Please take references from user manual to locate these circuit breakers.

Procedures:

1. Turn **[ON]** AC (output) MCCB.
2. Turn **[ON]** AC circuit breaker or disconnector on LV switchgear or control cabinet.
3. Measure AC voltage on AC (output) MCCB of PV inverter.
4. Turn **[ON]** 220Vac control power circuit breaker.
5. Turn **[ON]** DC circuit breaker or disconnector on DC combiner box.
6. Measure DC voltage on DC (input) MCCB of PV inverter.
7. Turn **[ON]** DC (input) MCCB.

6.7.3 Inverter ID setup

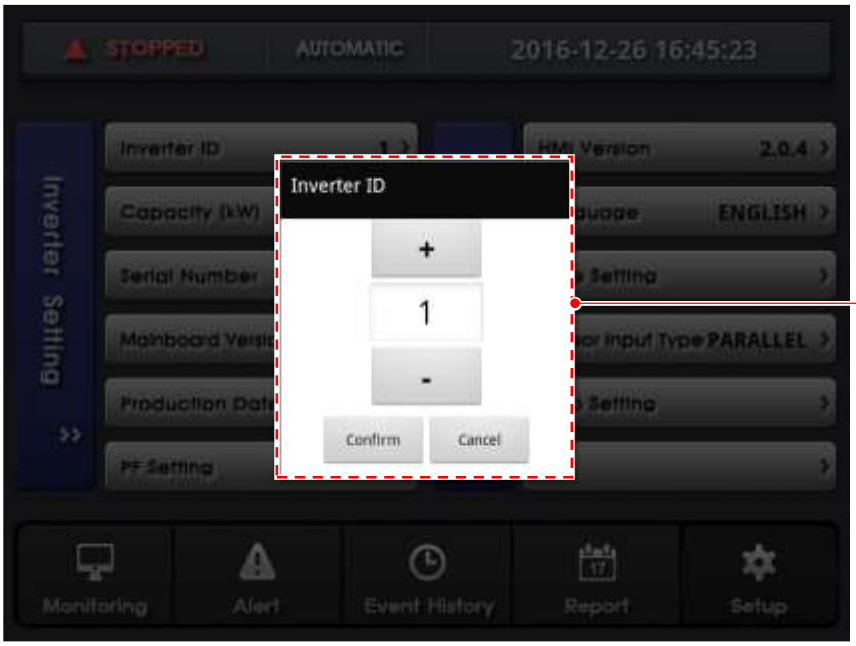


Figure 5: Inverter ID set up

No	Name	Description
1	Inverter ID	Inverter has its own inverter ID number. Users can select inverter ID number from Inverter ID menu located inside setup menu. When more than 1 inverter is installed in PV power plant, assign each inverter with different inverter ID number for monitoring. Inverter ID number goes from 1 to 15.

6.7.4 Language set up

Figure 6: Language setup

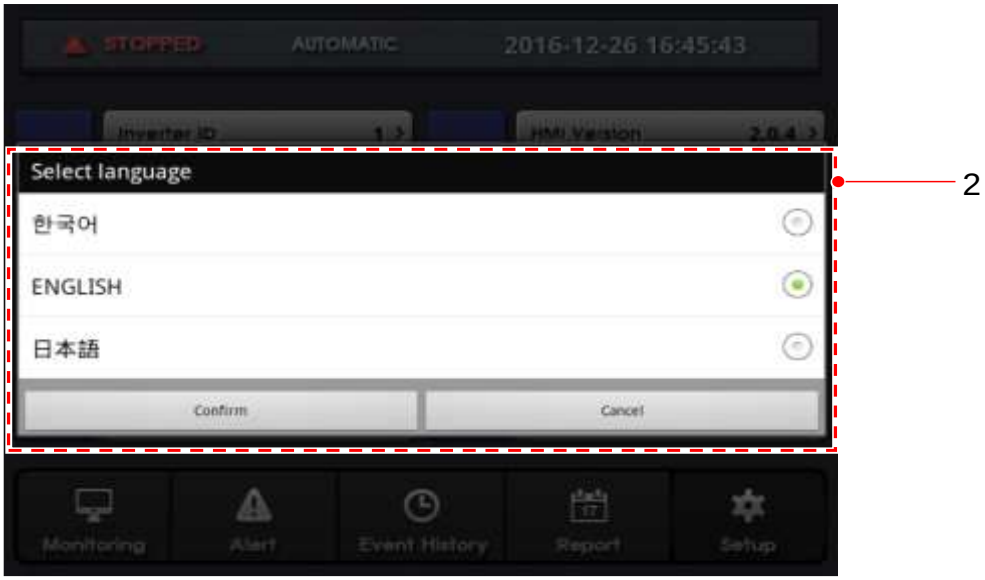


Figure 7: Language selection

No	Name	Description
1	Language setting menu	**[Language]** menu to choose the language to be displayed
2	Language selection	Korean, English and Japanese are available to choose from.

* Default language is set to Korean.

6.7.5 Time set up

Figure 8: Time setup

Figure 9: Time setting

No	Name	Description
1	Time setting menu	Time setup menu to set current time on inverter
2	Time setting	Choose the date and press **[Confirm]**. By pressing + or -, users can change the time. (Year, month, day from left to right)

* In order to track precise data, inverter must have correct time setup.

6.7.6 Inverter operation / shutdown

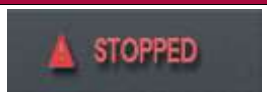
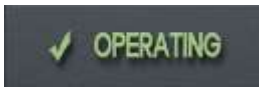
Menu	Description
	To halt inverter operation.
	To initiate inverter operation.
	To manually operate the inverter. When **[MANUAL]** mode is **[ON]**, the inverter will not restart operating even after 5min.
	To automatically operate the inverter. When **[AUTOMATIC]** mode is **[ON]**, the inverter restarts 5min later after shutdown.

Figure 10: Operating mode

Section 1

Figure 11: Operation / shutdown

OPERATING

Turned **[ON]** input, output and control power circuit breakers to view measured values of both input and output.

Figure 12: confirmation pop up

When **[STOPPED]** is pressed, it will generate a pop up message as figure 12 and pressing **[Confirm]** will proceed to operate the inverter.

Figure 13: STOPPED to OPERATING

[Section 1] in figure 11 will change to **[OPERATING]** from **[STOPPED]**.

* Even when **[OPERATING]** button is not pressed. Inverter will automatically operate 5 min later when **AUTOMATIC** mode is **[ON]**.

OPERATING MODE

* For information regarding **[AUTOMATIC]**, **[MANUAL]** mode, related references can be found from **HMI functions > Inverter manual/automatic mode**.

SHUTDOWN

Inverter shuts down when **[OPERATING]** is pressed while operating. **[Section 1]** will change to **[STOPPED]** when inverter shuts down.

* In case of emergency, inverter can be shut down by pressing **[Emergency Stop]** button located on outside of enclosure. Upon shutdown of PV inverter by **[Emergency Stop]** button, PV inverter's AC MCCB will trigger to be in tripped mode. (MCCB's hand lever will be placed in the center) Shutting down all AC power source including 220Vac control power.

Figure 14: operating to stopped

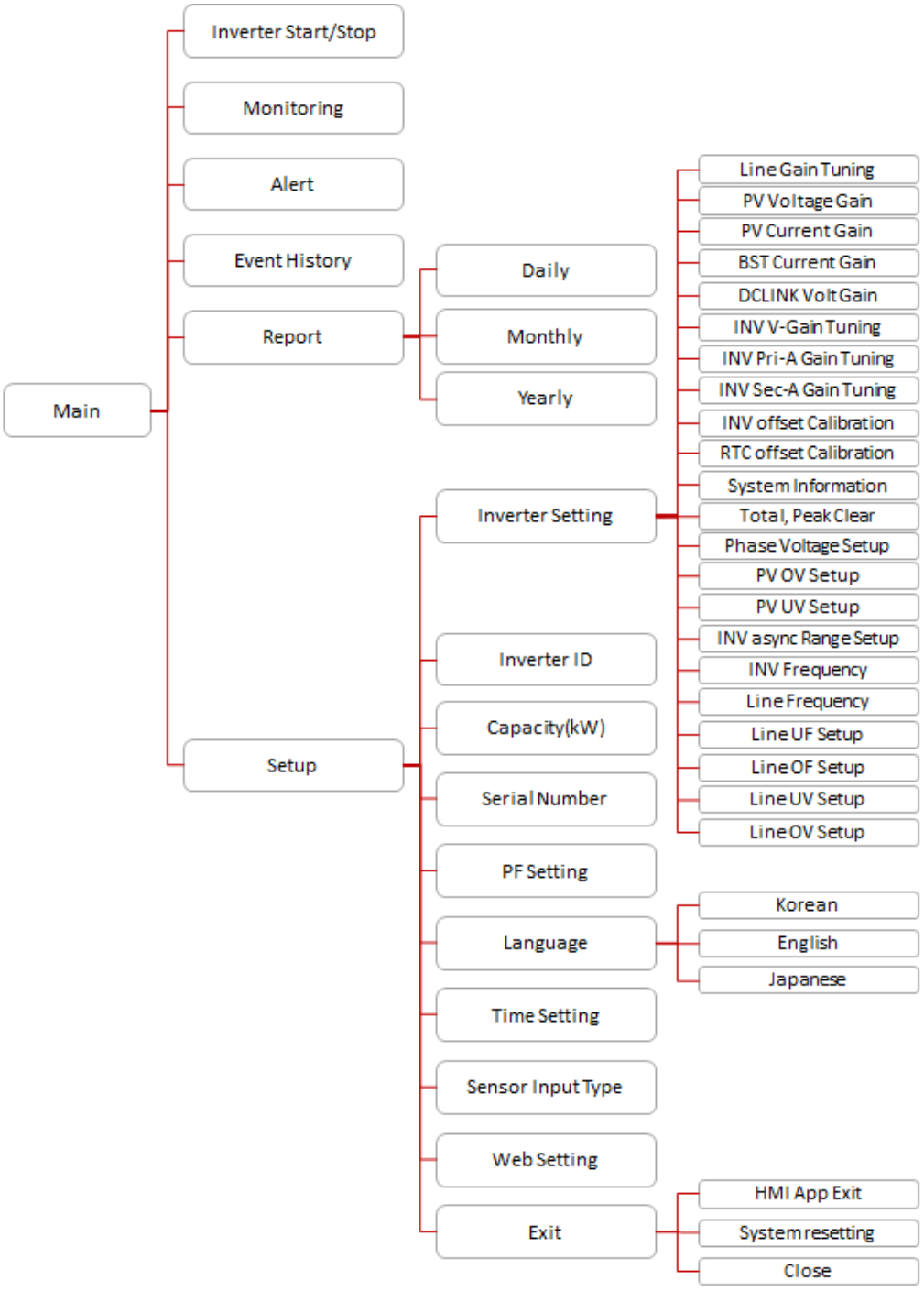
7 User Interface

7.1 HMI

7.2 HMI Tab menu

Window	Description
	To view operation status, input/output measured data, Power factor, AC frequency, Peak power, current power, today energy and accumulated energy.
	To view all recorded inverter operation related information. It displays time and type of faults occurred to the inverter.
	To view daily, monthly, yearly report in bar or table graph
	To change inverter settings. Inverter ID, Capacity, Serial number, PF setting, Language, Time setting, Web setting and sensor input type.
	To view faults that led inverter to shut down. Red boxes indicate the causes of inverter shut down.

7.3 HMI structure



7.4 HMI Screen Description

HMI displays inverter's current operation and grid status. Providing overview of operation status for inverter and enabling users to access to inverter operation and management.

- Inverter operation status (screen).
- PV array, grid, load, inverter voltage, current, frequency.
- Display normal, abnormal conditions of sections mentioned above.
- All operation related status, fault, and history.

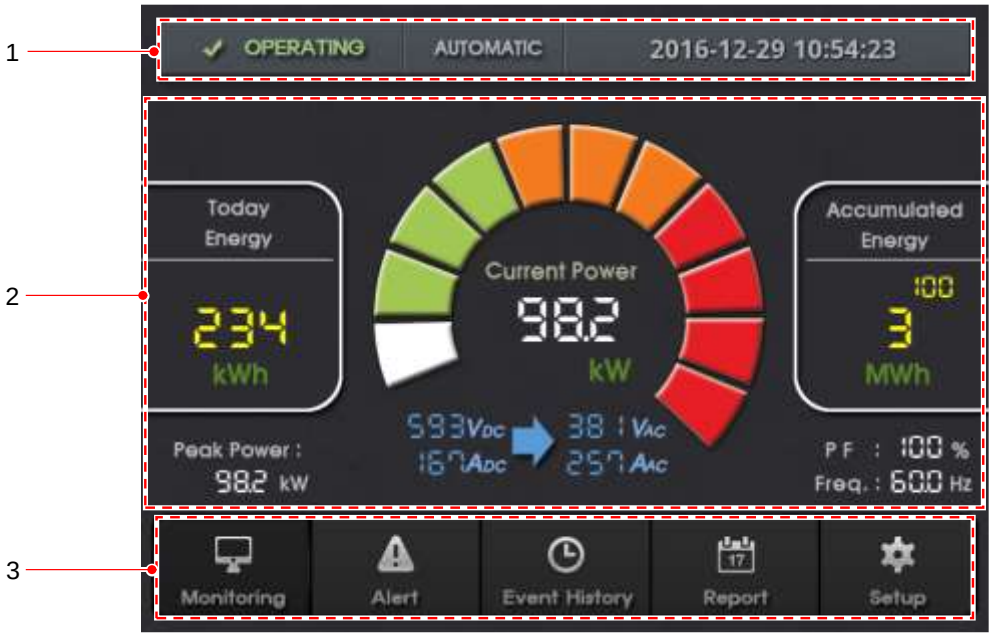


Figure 15: HMI main screen

No	Description
1	Inverter turn On/Off button(**[Operating]**, **[stopped]**), manual/automatic operation, current time
2	Current power, today/total yield, voltage/current, Power factor, frequency
3	Tabs to view different menu

* HMI menu comprises 5 (real-time monitoring, fault display, fault history, report, setup) tabs.

Not operating	Operating
	
When inverter is not operating, semicircular graph to indicate power being generated will appear as 0.0kW	The graph is indicating power being generated by 100kW inverter.

7.5 HMI functions

7.5.1 Self-diagnosis function

When fault occurs HMI runs self-diagnosis and saves all information affected inverter's operation. Self-diagnosis helps inverter to maintain optimized condition for proper operation by executing appropriate functions to protect the inverter from further damage.

- Diagnose 50 different data in the system in order to evaluate normality of the system to maintain proper operation of inverter.
- Saves all information related to inverter operation from fault name to time of fault occurrence. This information can be used later for analysis of inverter's performance assessment.

7.5.2 AC Input

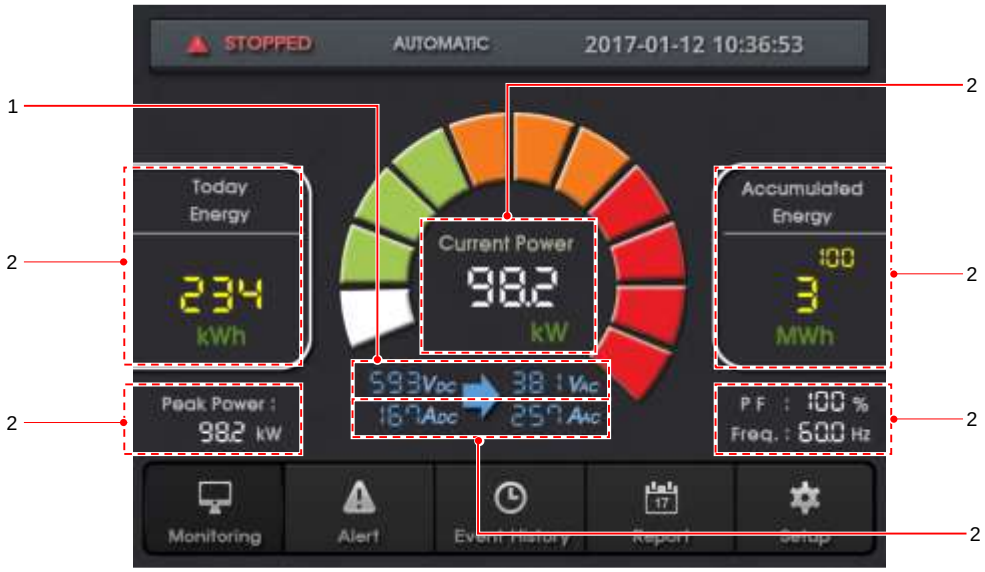


Figure 16: HMI input/output values

No	Description
1	**[Standby mode]** When input and output circuit breakers are all turned **[ON]** including control power circuit breaker, HMI displays grid AC voltage and DC voltage
2	**[Operation mode]** Current power, today yield, total yield, power factor, frequency, maximum power, DC current, AC current will be displayed as inverter operates.

7.5.3 Inverter manual/automatic operation

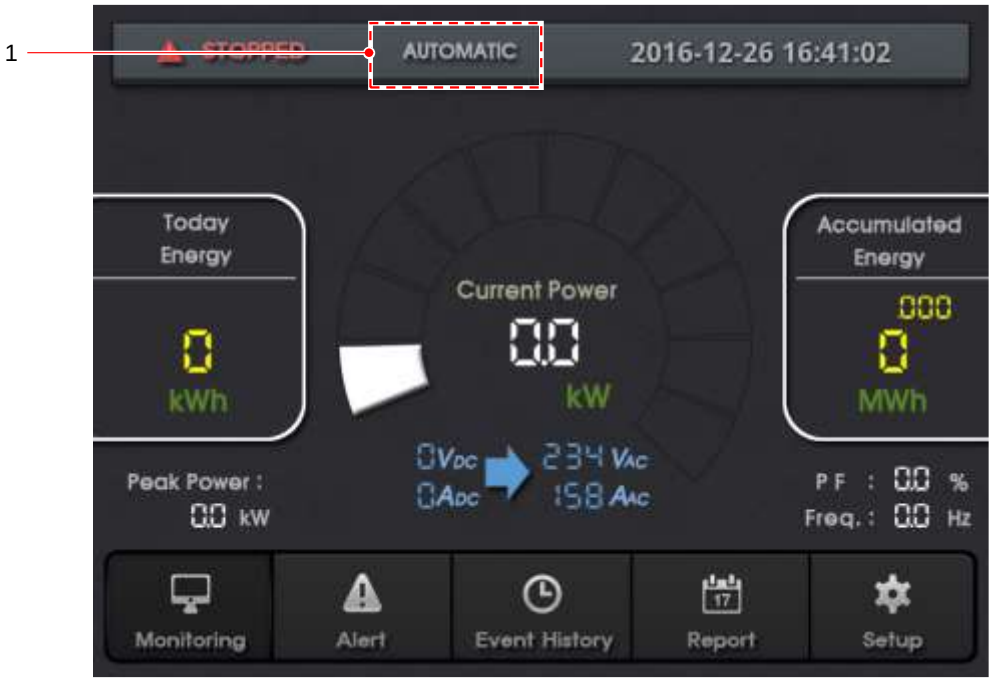


Figure 17: manual / automatic mode

No	Name	Description
1	Setting to manual/automatic mode	Two types of operating mode can be set. 1. AUTOMATIC MODE 2. MANUAL MODE

Activiatng [AUTOMATIC] mode:

A) When inverter was shut down by pressing **[STOPPED]** button while operating mode is set to **[AUTOMATIC]** mode, this mode will change to **[MANUAL]** mode. By pressing **[OPERATING]** button to operate the inverter again, operating mode of PV inverter will turn to **[AUTOMATIC]** mode from **[MANUAL]** mode.

B) Even after PV inverter was shut down by faults, the inverter will restart 5min later under **[AUTOMATIC]** mode upon removal of the faults.

Activating MANUAL mode:

A) When inverter was shut down manually by pressing **[STOPPED]** button. Operating mode will turn to **[MANUAL]** mode.

B) While operating mode is set to **[MANUAL]** mode, the inverter will not restart even after 5 min as opposed to **[AUTOMATIC]** mode.

7.5.4 Inverter real-time monitoring

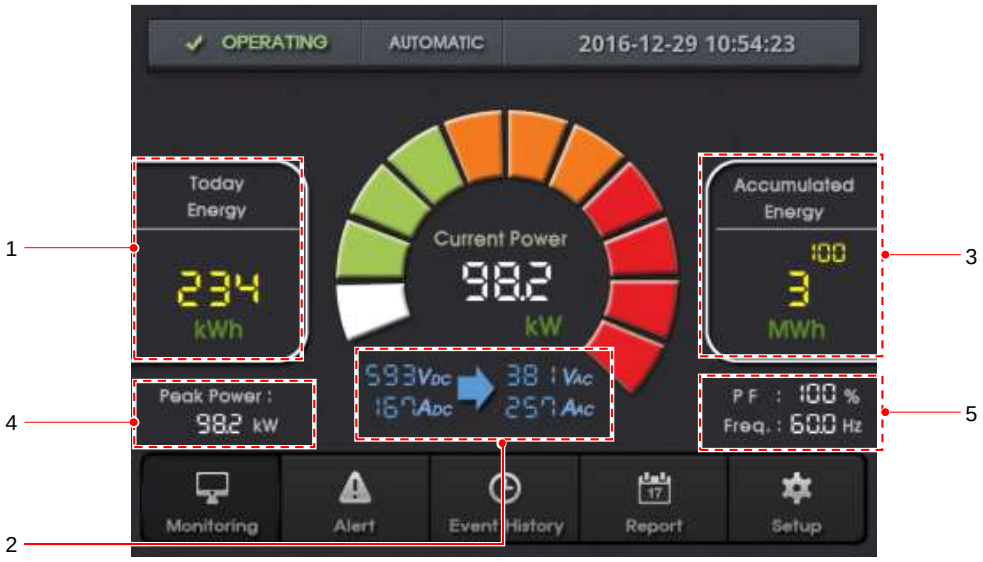


Figure 18: sectional description

No	Name	Description
1	Today Energy (Today yield)	Indicates power yielded today and yield value will be reset every night.
2	Current power, voltage, current	Indicates DC input voltage, current from PV array and AC output voltage, current and power. Color graph provide users an overview of how much power is being generated from inverter.
3	Accumulated Energy (Total yield)	Accumulated yield since first inverter operation. Unit used in total yield is MWh and display three digits below decimal point. (Example: 3.100MWh)
4	Peak Power	Maximum power yielded measured since initial inverter operation (kW).
5	Power factor, frequency	Display current power factor (PF) and frequency

7.5.5 Displaying AC Voltage and AC current

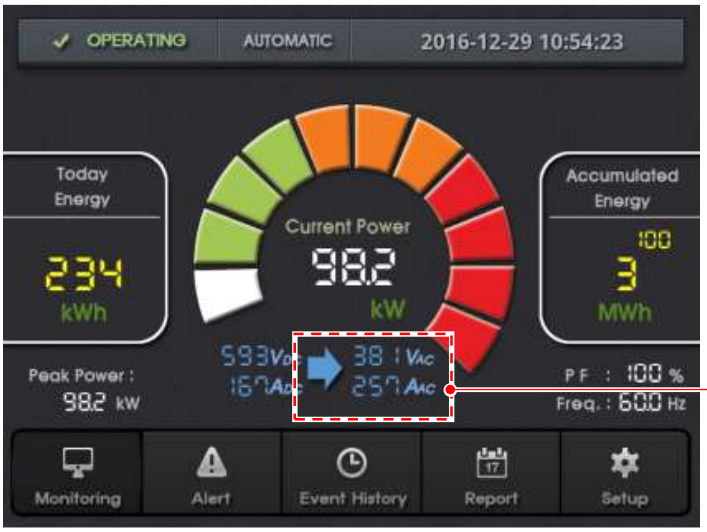


Figure 19: AC voltage, current display

No	Name	Description
1	Measured AC values	Indicates AC voltage and current by pressing the marked section

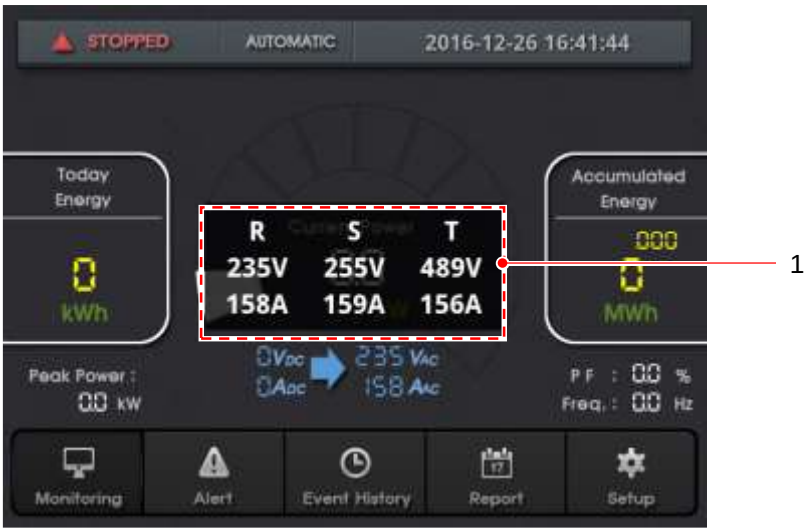


Figure 20: Back to main screen

No	Name	Description
1	Measured AC box	When marked section is pressed again, the message disappears.

7.5.6 Inverter fault display

Figure 21: Fault display

Function	Description
Self-diagnosis	Solarlink inverter is equipped with self-diagnosis function. Under any fault led shutdown circumstances, inverter will diagnose the cause of inverter failure and execute applicable functions. This function allows users to view the faults and receive quick repair service possible by providing faults information displayed on HMI. When abnormal operation or operational condition is detected, faults will be displayed on alarm tab.
Fault indication	When faults occur while operating, faults will be displayed in alarms tab. Active faults will be displayed in red and deactivated faults will be displayed in blue.

7.5.7 Communication fault

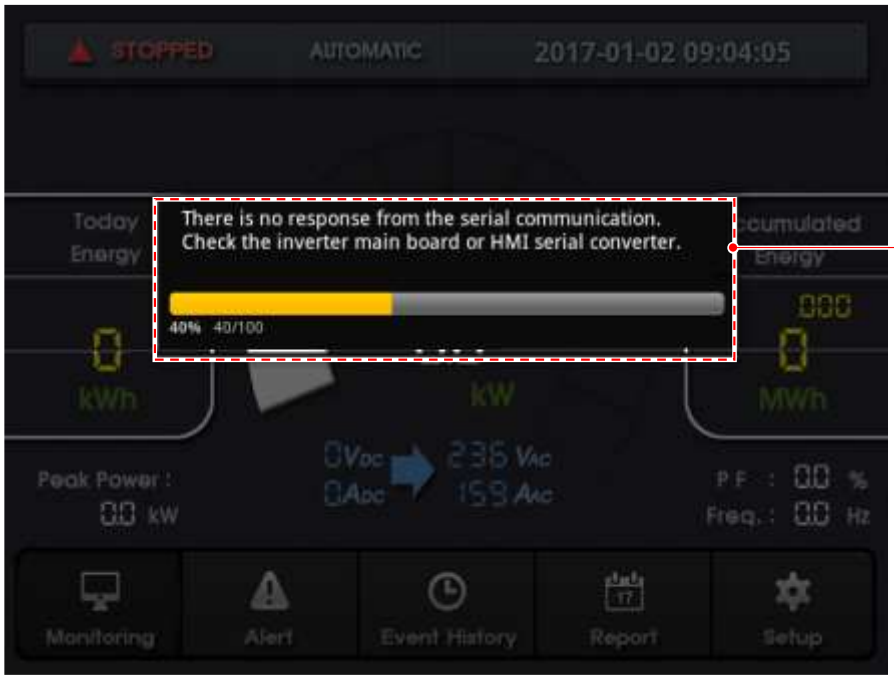


Figure 22: Communication error box

No	Name	Description
1	Error box	Indicating communication failure

7.5.8 Inverter fault history

Figure 23: Fault history

No	Name	Description
1	Fault history	In fault history, users can view all faults occurred during inverter operation from past to current. Texts in red indicate faults that have been displayed in alarm. Texts in blue indicate value changes in parameter manually.
2	Arrows	Users can use left or right arrow to view compiled data in fault history. Each page shows up to 5 items.

7.5.9 Report

Storage space of the memory enable PV inverters to save the data for approximately 20 years. This data can be retrieved as a daily, monthly or yearly report by entering specific date since first commissioned date of PV inverter.

Figure 24: Bar graph

Figure 25: Table graph

No	Name	Description
1	Bar graph **[Figure 24]**	When bar report type is selected.
2	Table graph **[Figure 25]**	When table report type is selected. Table report displays voltage, current of input and output with generated power.

* Daily, monthly, yearly reports can be viewed in a same manner.

7.5.10 Selecting date for reports

Figure 26: Date setting button location

Figure 27: Date setting button

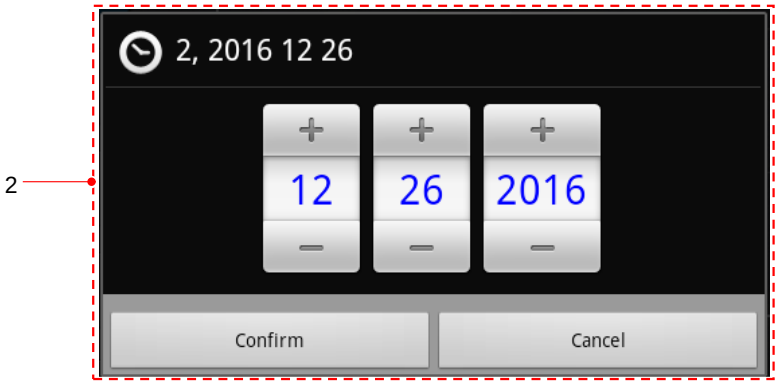


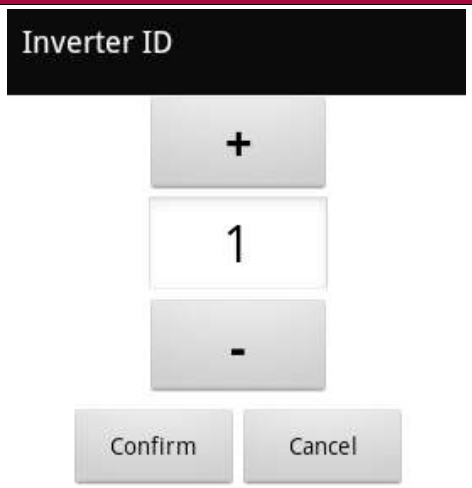
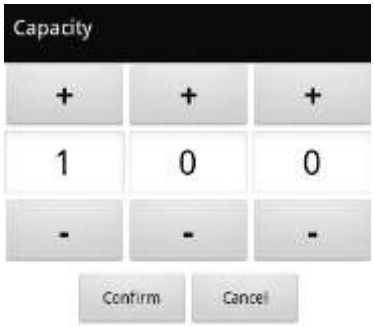
Figure 28: Date setting

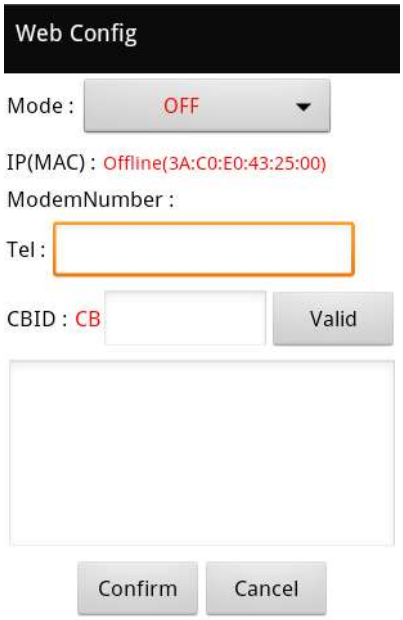
No	Name	Description
1	Button location	When pressed, it will show users a dial log for users to select the date.
2	Date setting	Choose the date and press **[Confirm]** to view the reports of selected date.

* Storage space of the memory enable PV inverters to save the data for approximately 20 years. This data can be retrieved as a daily, monthly or yearly report by entering the specific date since first commission of PV inverter.

7.5.11 Setup menu

Menu	Description
	Inverter ID can be set from 1 to 15. Inverter ID must be set in order to track the inverter when remotely monitoring inverter status, yield and fault alarm.
	Capacity setup is to indicate the power that PV inverter is generating. Depend on capacity set up inverter power will be displayed on semi-circular graph on HMI.
	Serial number helps manufacturer to identify which components are used on a product and when reliability tests are completed before shipment.
	Version to track hardware (PCB), software changes in mainboard.
	To control power factor.
	Date when product has passed reliability test and quality check.
	Version to track software changes in HMI.
	Time must be set correctly to track faults occurred to the inverter, accumulated yield, daily, monthly and yearly reports.
	To select sensor input type from sensor, T/D and parallel.
	To select language from Korea, English and Japanese.
	To receive daily yield and faults occurred to PV inverter during normal power generation hours of a day.
	To close HMI software.

Menu	Description
	To designate the inverter with a number to track the inverter through remote monitoring system when faults are occurred or to track daily, monthly, yearly yield of the inverter and to monitor operation status of the inverter.
	Capacity setup is to display the power being generated by PV inverter on HMI's semi-circular graph. When capacity is set less than the actual capacity of the inverter, graph on HMI will only indicate partial portion of the graph.
	Product serial number can be manually set when needed.
	In order to access inverter setting, password must be entered.

Menu	Description
	Product date is a date when a product is produced. First two digits indicate year and rest two digits indicate month.
	When Web setting is pressed, Web Config page appears and users can choose 3G or LAN mode. With telephone number entered to Tel section, users can receive fault alarm and daily yield. CBID is an identification number for an inverter to track data.
	When blank telephone section is pressed, number pad appears then users can enter the phone number to be notified of information related to inverter operation and yield through text messages. When inverter does not operate during normal hours of the day (6AM – 6PM) due to faults occurred to the inverter, users will receive fault notification from PV inverter.

Menu

Description

Web configuration mode has 3 options to choose from. To turn OFF the mode or to configure with 3G or LAN.

When 3G is selected, modem number will be given to the inverter automatically.

When LAN is selected, IP number will be given to the inverter automatically.

Description

When sensor input type is pressed, user can choose sensor(Irradiance,

Description

When EXIT button is pressed, system exit window appears.

HMI APP Exit is to close the HMI application.

System resetting is to retrieve inverter information of inverter ID, capacity, mainboard version, serial number and product produced date.

Close button will close the system exit window and goes back to previous page.

8 Remote monitoring

Weblink client bridge v2.5 is a firmware on weblink hardware(WLH). Primary function for this firmware is to collect inverter's input/output voltage, current, power, yield, alarm, yield trend and transmit collected data to weblink server for desktop v1.0.

- Weblink CS v1.0 connected by serial communication enables users to monitor inverter's collected yield information, operation and fault or alarm status remotely through internet.
- Weblink CS v1.0 comprises weblink client bridge v2.5, weblink server for desktop v1.0 and weblink server for mobile v1.0.

Users can access to weblink server for desktop v1.0 or weblink server for mobile v1.0 through web browser, smartphone, tablet PCs to monitor inverter's input/output voltage, current, power, yield, alarm, yield trend.

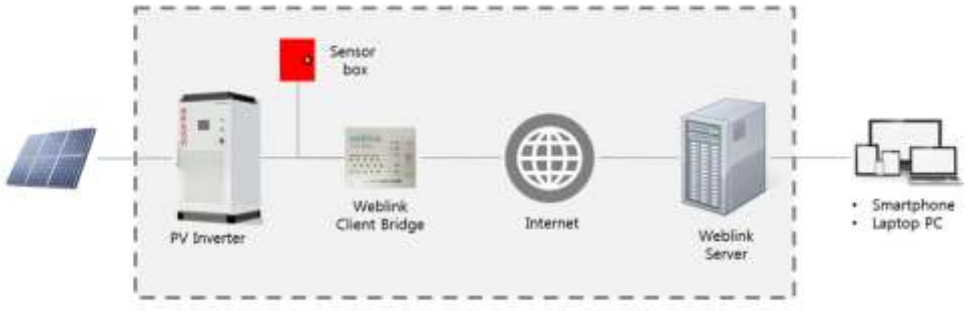


Figure 29: Weblink client bridge configuration

8.1 Weblink client bridge information

Product name	Weblink CS
Version	V1.0
Configuration	Weblink client bridge v2.5 Weblink server for desktop v1.0 Weblink server for mobile v1.0
Released date	April.2016
Manufacturer/supplier	Hex Power System Co., Ltd.

Figure 30: Weblink client bridge

8.1.1 Weblink client bridge external interface

No	Classification	Function	Description
1	Operation LED	Power	Power supplied (Red LED turns on when power is supplied)
		Ready	System functional (Green LED turns on when system is successfully booted)
		Server	Communication status between WLH and server (Green LED turns on when communication between WLH and server is stable)
		Inverter Link Status	Communication status between WLH and inverter ID from 1 to 15 (When traffic is normal, green LED turns on)
2	Port	Reset	RESET button (Reboot for 1 short press for 1 second. To set default value, 1 press for 5 seconds)
3		WAN	Internet port (RJ45) (Internet speed over 1MB is recommended)
4		RS422	Serial port to connect to inverter (RJ11)
5		DC 5V	Power supply port (DC 5Vdc) (Use provided power supply adapter only)

8.1.2 Weblink client bridge Functions

Function	Description
Time synchronization	Time retrieve function from weblink server for desktop when booted.
Data collection	Receiving data from inverter
Data analysis	Analyzing data received from inverter
Data transmission	Transmitting analyzed data to server
Status display	Displaying inverter's communication status in LED Displaying connection to server in LED

8.1.3 Menu configuration

Category	Division	Component
Main	Main	Main
	Notice	List
		Write
		Read
		Modify
Login	Login	Login
Monitoring	Monitoring	Monitoring
		Multi Display
Alarm	Alarm	Alarm
Trend	Trend	Trend
	Comparison	Comparison
Event History	Event History	Event History
Reports	Daily	Daily
	Monthly	Monthly
	Yearly	Yearly
System Info	System Info	System Info

8.1.4 Login

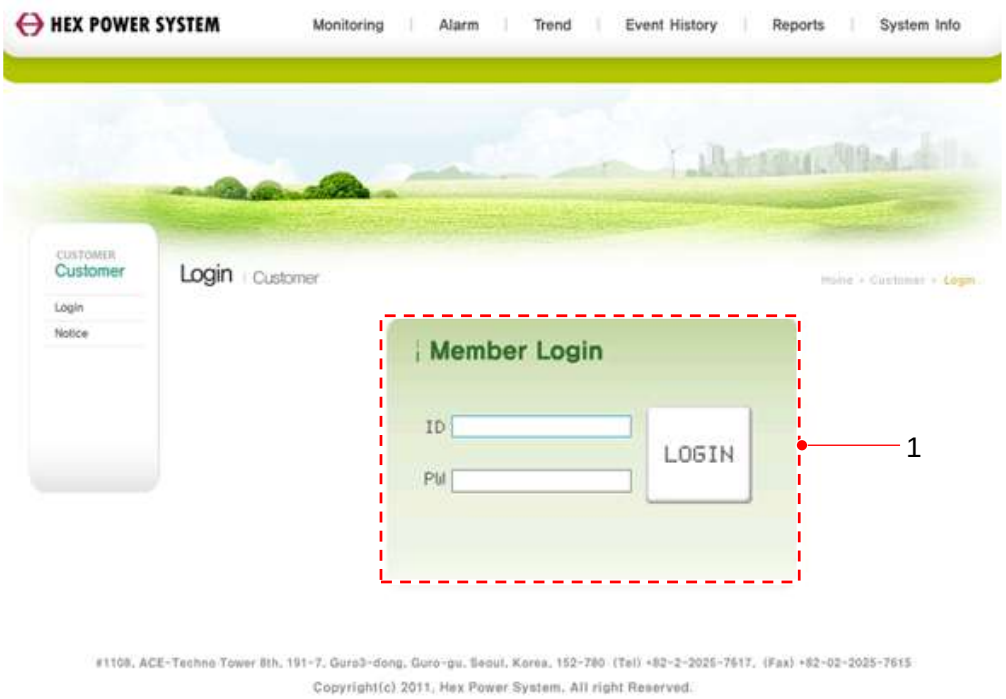


Figure 31: Login page

No	Name	Description
1	Login	Enter ID, password and click on login button

8.1.5 Web monitoring main page

Figure 32: Weblink server for desktop - monitoring

No	Description
1	Displaying values measured from sensor box (Slope irradiance, horizon irradiance, outside temperature, module temperature)
2	Displaying PV power plant photo (Uploading photo can be done on system information)
3	Displaying collected data (Peak power, CO2 reduction, accumulated yield)
4	Displaying today's data (Current power, daily yield, CO2 reduction)
5	Displaying inverter's input, output (voltage, current, power, frequency, power factor)

8.1.6 Terms and definition

Name	Description
Slope irradiance	Irradiance measured by a sensor on sloped surface.
Horizon irradiance	Irradiance measured by a sensor on horizontal surface
Outside temperature	Temperature measured by a sensor on outside environment
Module temperature	Temperature measured by a sensor on a module
Peak power	PV inverter's instantaneously reached peak power
Accumulated yield	PV inverter's total yield (energy generated)
CO2 reduction	CO2 reduction based on PV inverter's total yield
Revenue from total yield	Computed values only for electric utility business owner.
Current power	Current power being yielded (energy generated) by PV inverters
Daily yield	Daily yield from PV inverter
Revenue from today's yield	Computed values only for electric utility business owner.
Input voltage	DC voltage flowing in from PV array to PV inverter.
Input current	DC current flowing in from PV array to PV inverter.
Input power	Power flowing in from PV array to PV inverter.
Frequency	Output frequency
Power factor	Output power factor
Output voltage	AC voltage flowing in from inverter to grid
Output current	AC current flowing in from inverter to grid
Output power	AC power flowing in from inverter to grid
CBID[IP address]	CBID is a value generated in the server when installing monitoring program. [IP address] is the address for weblink client bridge.
Updated	Recent communication time from weblink client bridge's transmitted data

8.1.7 Trend

Figure 33: Weblink server for desktop - Trend

No	Description
1	Displaying a section where users can select inverter ID, report date, comparable data.
2	Displaying data in linear chart and graph (Chart and graph are displaying average values of yield by time, input voltage and output voltage.)
3	Displaying date in table graph (Received values from inverter in 3min interval)

8.1.8 Data comparison

Procedures:

1. Select inverter ID to search.
2. Select date to search.
3. Select the date to compare with.

Comparing sections	Description
Input/output voltage	Displaying input/output voltage
Input/output current	Displaying input/output current
Input/output power	Displaying input/output power
Frequency/power factor	Displaying frequency/power factor
Irradiance	Displaying sloped irradiance, horizontal irradiance when a sensor box is installed
Temperature	Displaying sloped irradiance, horizontal irradiance when a sensor box is installed

* Displayed yield, input voltage, output voltage are average values. They are actual measured figures retrieved from inverter in 3 min interval.

8.1.9 Yield comparison

Function to display compared output power data of inverters in linear charts.

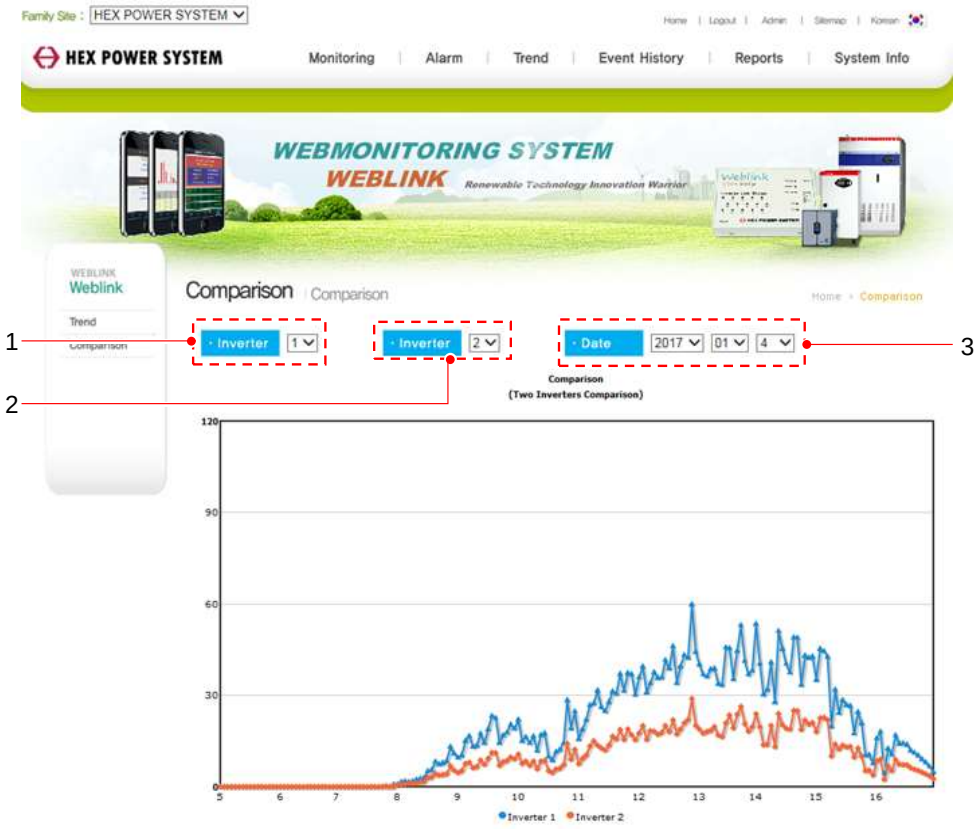


Figure 34: Weblink server for desktop - comparison

Procedures:

No	Description
1	Select inverter ID
2	Select another inverter ID to search to compare with
3	Select date to search.

8.1.10 Event history

Function to print fault, alarm lists occurred to inverter in charts

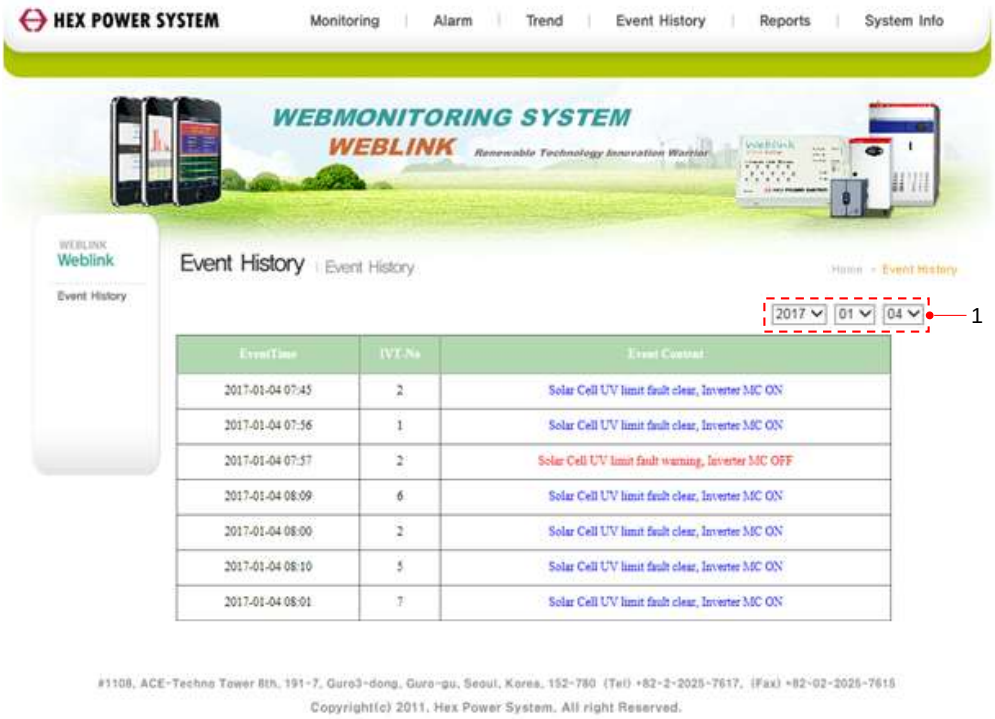


Figure 35: Weblink server for desktop – event history

Procedures:

No	Description
1	Select the date to search

8.1.11 Daily report

Function to display measured values from inverters transmitted by weblink client bridge in different time of the day.

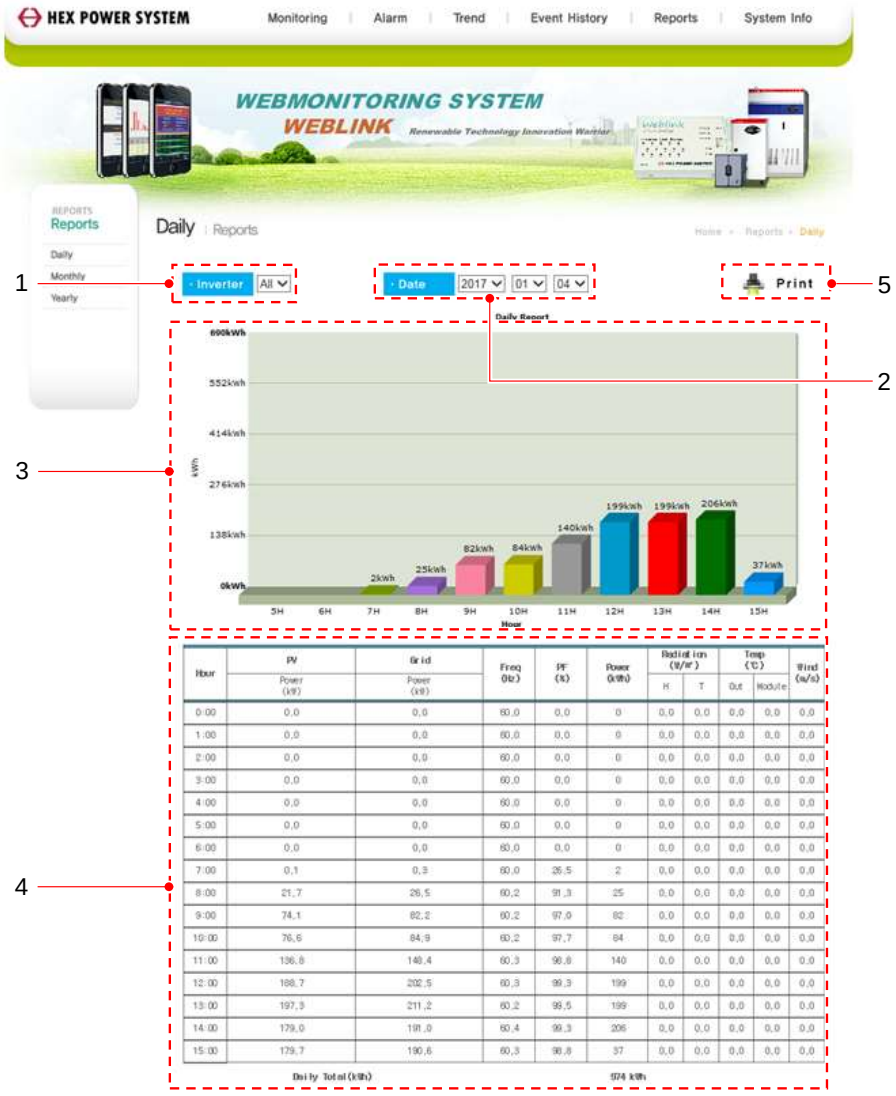


Figure 36: Weblink server for desktop – daily report

Procedures:

No	Description
1	Select inverter ID to search
2	Select date to search
3	Inverter's saved measured data of the day in graph
4	Inverter's saved measured data of the day in table graph
5	Printing daily report

* Besides yield and power factor, all data are average values of each hour.

* Data values are rounded off from second figure below decimal point.

8.1.12 Monthly report

Function to display measured values from inverters transmitted by weblink client bridge in different day of the month.

Figure 37: Weblink server for desktop – monthly report

Procedures:

No	Description
1	Select inverter to search
2	Select date to search
3	Inverter's saved measured data of the days in graph
4	Inverter's saved measured data of the days in table graph
5	Printing monthly report

* Besides yield and power factor, all data are average values of each day of the month.

* Data values are rounded off from second figure below decimal point.

8.1.13 Yearly report

Function to display measured values from inverters transmitted by weblink client bridge in different months of the year.

Figure 38: Weblink server for desktop – yearly report

Procedures:

No	Description
1	Select inverter to search
2	Select date to search
3	Inverter's saved measured data of the months in graph
4	Inverter's saved measured data of the months in table graph
5	Printing yearly report

* Besides yield and power factor, all data are average values of each month of the year.

* Data values are rounded off from second figure below decimal point.

8.1.14 System information

Figure 39: Weblink server for desktop – system information

No	Name	Description
1	Title	Name of PV Plant
2	Address	Address of PV Plant
3	Owner	Owner of PV plant
4	Tel	Phone number
5	Email	Email address
6	Sensor type	Sensor installed in PV Plant
7	User ID	User ID to use
8	Confirming ID	Checking whether or not entered ID is current being used
9	Password	Password
10	Expected revenue from PV Power yield	Expected amount of income from PV power generation
11	Picture	Picture of PV plant
12	Extended Information	Additional information
13	Confirm	Proceed to save entered information and creating user ID and password
14	Cancel	Cancel entered information

8.1.15 Weblink server access with smartphones

Regardless of operating system of smartphones (iOS and Android), users can monitor PV power plant's operation status through smartphones.

- Accessing time differs depend on wireless network (WiFi,3G,LTE)
- Additional fee could incur when Wi-Fi is not used to access the internet.

Weblink server for mobile devices' configuration

Category	Division	Component
Login	Login	Login
Monitoring	Monitoring	Monitoring
Alarm	Alarm	Alarm
Reports	Reports	Daily
		Monthly
		Yearly
A/S Center	A/S Center	A/S Center

8.1.15.1 IOS users

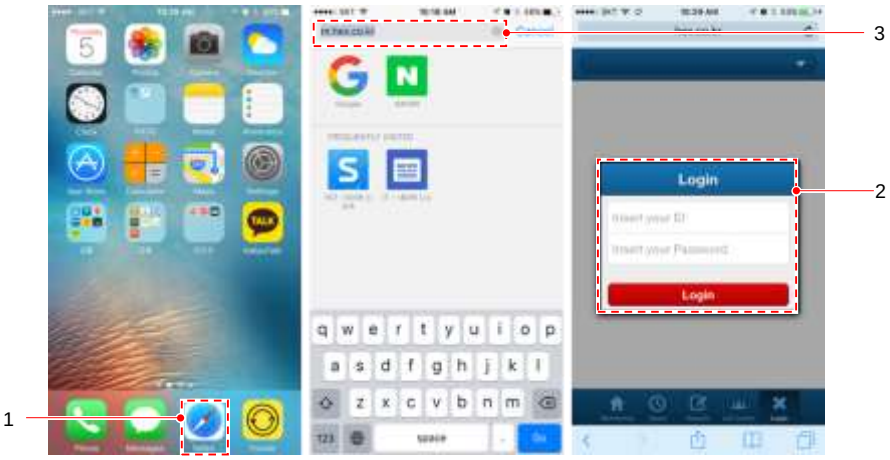


Figure 40: Weblink server for mobile – iOS

Procedures:

No	Description
1	Run **[Safari]** web browser
2	Enter web address as provided below and press "Go" button **[http://gsm.hex.co.kr]**
3	Enter ID and password to login

8.1.15.2 IOS creating shortcut to weblink server

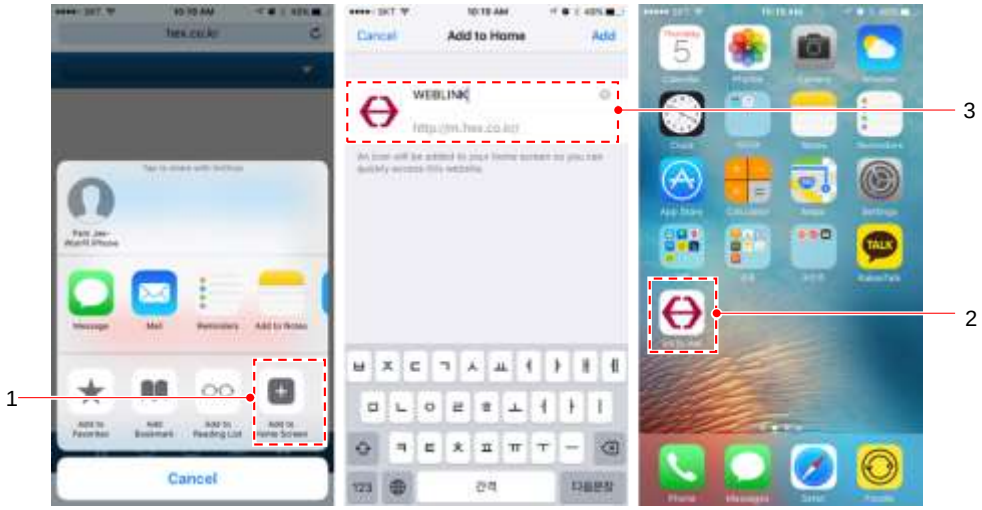


Figure 41: Creating shortcut on home screen

Procedures:

No	Description
1	Press **[Add to home screen]**
2	Enter name of shortcut and enter web address. **[http://gsm.hex.co.kr]**
3	When adding to home screen is complete, users can access to weblink server directly.

8.1.15.3 Android users

Figure 42: Weblink server for mobile – Android

Procedures:

No	Description
1	Run **[internet browser]**
2	Enter web address as provided below. **[http://gsm.hex.co.kr]**
3	Enter ID and password to login
4	Press **[MORE]** button to add to bookmarks.
5	Press **[Add to bookmark]** to create shortcut.
6	When adding to bookmark is complete, users can access to weblink server directly.

8.1.15.4 Weblink server for mobile – real time monitoring

Screen displaying measured data from inverters transmitted by weblink client bridge.

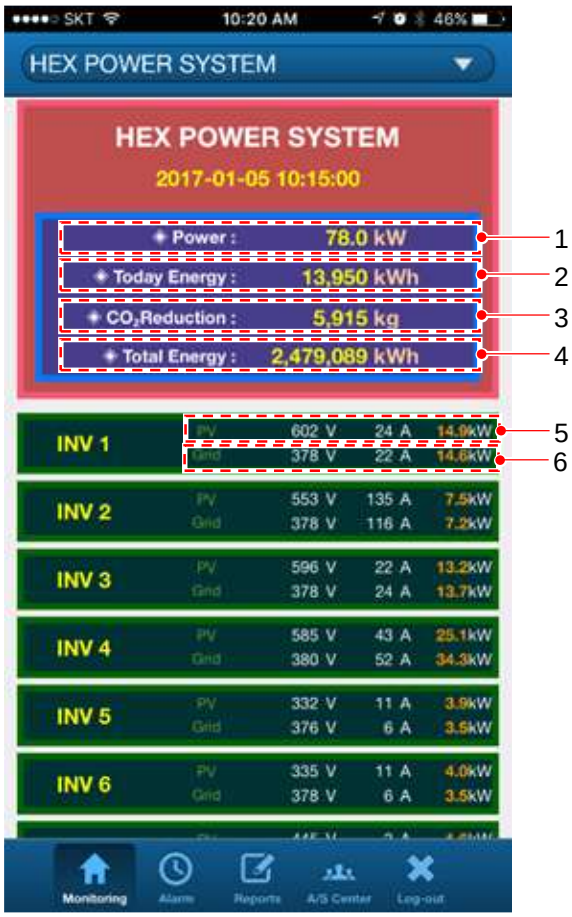


Figure 43: Real-time monitoring

No	Name	Description
1	Power	Current power being yielded (energy generated) by PV inverters
2	Today Energy	Power generated by an inverter per day.
3	CO2Reduction	Reduction of CO2 from power generated by PV inverter
4	Total Energy	Total power yielded from PV inverter
5	INV-PV	DC voltage, current, power flowing in from PV array to PV inverter
6	INV-Grid	AC voltage, current, power flowing in from grid to PV inverter.

8.1.15.5 Alarm

Screen displaying faults or alarm names, time of occurrence received from PV inverters.

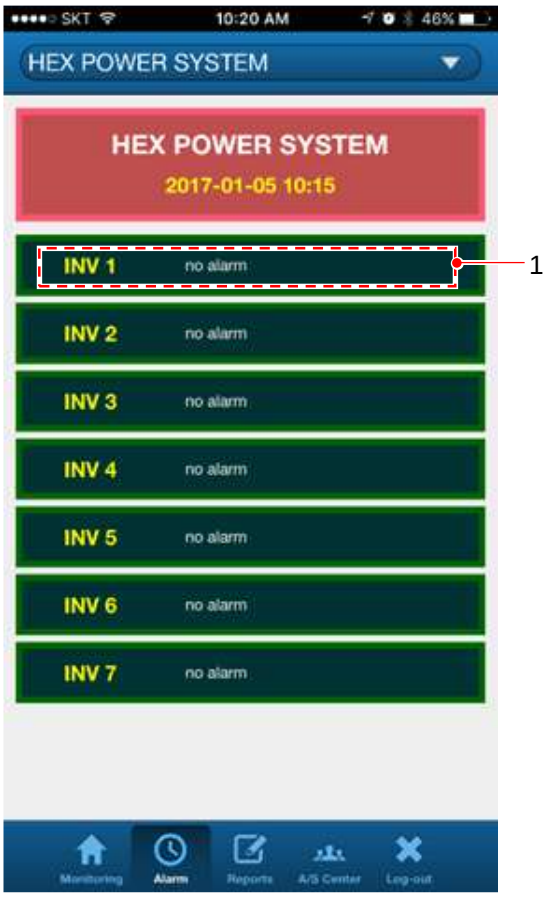


Figure 44: Alarm

No	Name	Description
1	Fault alarm	When faults or alarm occurs, they appear next to inverter ID

8.1.15.6 Weblink server for mobile - Reports

Figure 45: Reports

No	Name	Description
1	Daily report	Displaying selected day's yield by hours in table graph and chart.
2	Monthly report	Displaying selected month's yield by days in table graph and chart.
3	Yearly report	Displaying selected year's yield by months in table graph and chart.

HEX POWER SYSTEM

Headquarter

11, Digital ro 33 gil, Guro-gu, Seoul, 08380, Republic of Korea
Phone : +82-2-2025-7608 Fax : +82-2-2025-7615

Factory/R&D Center

108, Saneop-ro, Gwonseon-gu, Suwon-si, Gyeonggi-do, 16643, Republic of Korea
Fax : +82-2-855-0720

Service center

Phone : +82-502-760-7608

www.hex.co.kr

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