INSTRUCTION MANUAL

1250 KW RESISTIVE LOAD BANK

MODEL NO. ULB-R1250H-480-240-OT/TR

Published by:
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Date of Original: 2024 May

LIST OF EFFECTIVE PAGES

Insert latest changed pages and dispose of superseded pages in accordance with applicable regulations. The total number of pages in this manual is approximately 52 consisting of the following:

Page No.	Change	Date
1 - 52	Original	Nov 2024
1 - 52	REV.1	Jun 2025

ABBREVIATIONS AND ACRONYMS

The following is a list of abbreviations and acronyms used throughout this manual.

A	Amperes (Amps)
AC	Alternating current
AI	Analog Input
AO	Analog Output
CMM	Component Maintenance Manual
DC	Direct Current
Deg	Degree
DI	Digital Input
DMM	Digital Multimeter
DO	Digital Output
F	Fahrenheit
F.S.	Full scale
Ft-lbs	Foot pounds
GND	Ground
HMI	Human Machine Interface
Hz	Hertz
In-lbs	Inch pounds
KVA	Kilovolt amps
kW	Kilowatt
LCD	Liquid Crystal Display
LED	Light Emitting Diode
L-L	Line to Line
L-N	Line to Neutral
mA	Milliampere
MSDS	Material Safety Data Sheet
mV	Millivolt
NEC	National Electric Code
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
UL	Underwriters Laboratory
VAC	Volts AC

Table of Contents

Safety Points

Safety Precautions

The following instructions are general safety precautions that are not necessarily related to any specific part or procedure, and do not necessarily appear elsewhere in this publication. These precautions must be thoroughly understood and applied to all phases of operation and maintenance.

This manual contains various **Warning** and **Caution** statements. Personal injury or death may occur to an operator and/or technician if a warning statement is ignored. Equipment damage or hazardous conditions for personnel could result if caution or warning statements are ignored. Carefully read and review this instruction manual, supplemental manuals, and all electrical schematic/interconnection drawings provided with the Load Bank prior to installation and operation.

Keep Away from Live Circuits

Operating and Maintenance personnel must at all times observe normal safety regulations. Do not replace components or make adjustments to equipment with power turned on. To avoid casualties, always remove power to the entire system. Turn off and disconnect the main-power source under test. Disconnect all sources of power to the Load Bank (Main input Cam-lok, blower motor circuit, and 120 VAC control circuits).

Shock Hazard

Load Banks contain lethal voltages when connected to the power source. Power to the load resistors (main input Cam-Lok), power to fan motor circuits, and power to 120 VAC control circuits must be removed before servicing. Allow adequate time after removing power before servicing or touching any components.

Do Not Service or Adjust Alone

Under no circumstances should any person reach into an enclosure for the purpose of service or adjustment of equipment except in the presence of someone who is capable of rendering aid.

Safety Earth Ground

An uninterruptible and approved earth ground must be supplied from the main power source. Serious injury or death can occur if this grounding is not properly supplied. The grounding of this equipment should be done by qualified personnel only and must be installed in accordance with all applicable national and local electrical codes and regulations.

Chemical Hazard

No chemicals are included in the manufacturing or operation of this unit. There are no chemical hazards to consider.

Emergency Aid

Personnel working with or near high voltages should be familiar with modern methods of resuscitation.

Potentially Hazardous Operator Conditions

- Read this manual prior to operation.
- Always run an approved ground conductor from the load bank frame to the power source under test which in turn must be properly earth grounded.
- Do not operate the unit unattended. Access to an approved electrical fire extinguisher should always be on hand.
- Do not operate the Load Bank with access panels removed or doors open. Doing so would expose personnel to potential injury from electrical shock or from a moving fan blade.
- Careful consideration needs to be taken during installation and equipment location during operation.
- Hot exhaust air can cause damage to other installed equipment.
- Do not direct hot exhaust air in the direction of other installed equipment.
- Do not allow hot-air exhaust to recirculate through the cold-air intake.
- Do not allow objects to enter or block the cold-air intake or hot-air exhaust.
- Do not install any external cold-air intake or hot-air exhaust duct work to the Load Bank for ventilation.
- The Load Bank must be installed and operated in a cool, well-ventilated area with adequate clearance for both intake and exhaust air. Do not allow hot air exhaust to recirculate into the cold-air intake.
- The unit should always be operated outdoors in a clean, cool, well-ventilated area free of dust and debris.
- Operating personnel should avoid and never come in contact with the hot-air exhaust and/or surrounding covers during operation and for some time after operation as these surfaces become hot and may result in a serious burn injury.
- Never bypass any blown fuse.
- Replace any indicator lamps on the operator control panel as required. Each indicator is important to the protection of the unit and safety of the operator and is an indication of proper system operation or failure.
- Do not bypass any safety circuit including but not limited to; air-safety switch, fan motor overload, exhaust over-temperature switch.
- Always short/shunt current transformer secondary circuits when troubleshooting metering and instrumentation circuits.
- Operating personnel should not meet hot air exhaust opening, outside panels, system components, and load resistors for some time after operation.
- A recommended 5-minute cool down period of the blower motor circuit, with no load applied, is recommended as best practice and will protect operating personnel from possible burn injuries. A 5-minute cooldown should adequately remove any residual heat from the Load Bank and system components.

Emergency ShutDown

The Emergency STOP pushbutton will immediately turn off control power to the load step application circuits, blower motor circuits.
In a controlled emergency stop condition, click <LOAD DROP> button on display allowing fan motor to run while all load steps are disconnected. Turning the “Power On” switch to the “OFF” position will then turn off all control and blower circuits. Turn off and disconnect the

main-power source under the test. Disconnect all sources of power to the Load Bank (Main input Cam-lok), blower motor circuit, and 120 VAC control circuits).

- Maintenance should always be done only by qualified personnel and with all sources of power disconnected from the unit (main input Cam-lok power, power to all blower fan and control circuits). Always follow The National Electric Code (NEC), local electrical safety codes, and the Occupational Safety and Health Act (OSHA) when handling, installing and operating equipment to reduce hazards, personal injury and property damage.

Safety Symbols

WARNING Statements
Warning notes call attention to a procedure, which if not correctly performed could result in personal injury.

WARNING
Disconnect unit from all power sources before any disassembly or service. Main input Cam-lok, Blower Motor circuits, 120 VAC control circuits.

WARNING
Do not position the exhaust to blow on other equipment or material susceptible to excessive heat. Never direct exhaust air towards flammable materials.

WARNING
Do not remove the enclosure covers while the unit is in operation or operate with covers removed. Units will not properly cool without all covers in place and pose a shock hazard to personnel.

WARNING
Do not touch the enclosure surfaces while the unit is in operation. Enclosure surfaces are hot and exhaust temperatures can reach in excess of 500ºF when unit is under load and in operation.

WARNING
Operation of the unit with any covers removed will pose a shock hazard and danger to personnel.

WARNING
Do not look into the exhaustion of the enclosure while in operation. Exhaust temperatures can reach temperatures in excess of 500ºF when a unit is under load and in operation. Dust and our debris may also be present.

WARNING
Do not insert a screwdriver or any thin metal objects through the perforated cooling air grilles while the load bank is in operation. The fan blade and power within the unit could cause serious injury to personnel and damage to the unit.

CAUTION Statements
Caution notes call attention to a procedure, which if not correctly performed could result in damage to the unit. This symbol indicates that a shock hazard exists if the precautions in the instruction manual are not followed. The caution symbol appears on the equipment indicating there is important information in the instruction manual regarding that particular area.

CAUTION
This load bank is not suited for shipboard applications and not designed/configured for Marine/shore-based applications.

CAUTION
Air enters through the right (looking from HMI Control Panel) cold-air intake of the enclosure and exhausts at the left side hot-air exhaust end of the enclosure. Blocking these openings will cause overheating and unit failure.

CAUTION
Do not apply more than the rated Voltage or exceed the power rating of the Load Bank. Excessive power will damage the internal resistor banks.

CAUTION
Confirm all control voltages before operation. Improper Voltage or Over-Voltage will damage load resistors, fan motors, and control components.

CAUTION
Confirm that all load, control, and blower connections are securely attached, turned, and tightened, and that the unit is properly grounded prior to operation. Failure to do so may result in equipment damage and harm to personnel.

CAUTION
Check for fan directions before applying the load. Air flow should be coming out of heater screen at the side of the load bank.

CAUTION
Do not operate under load without fan blower in motion. Immediate equipment damage may result.

CAUTION
Air intake opening should not be obstructed, and consideration should be given to provide combustibles free air at the air intake.

CAUTION
Avoid Blocking the air intake and ensure the area around the load bank is clear from debris. The Load bank must be positioned and installed to allow for a 4 feet intake clearance as well as a 20 feet exhaust clearance.

CAUTION
Operation of the unit with any covers removed will disrupt air flow and allow debris to pass through resistors, possibly damaging equipment.

Inspection and Unpacking

As part of your safety program, an initial inspection of all equipment should occur after receiving the unit. Periodic preventative maintenance and inspections should be performed to ensure system reliability. Upon receipt of your Load Bank, be sure to carefully unpack the unit and inspect the unit carefully for any shipping damage. Check for loose, broken or otherwise damaged parts due to shipping. If damage is noticed, do not unpack the unit. Immediately notify ULB LLC and report any shipping damage to the freight carrier. Be sure to verify that the part number and ratings listed on the nameplate match the order specification. **The ratings listed on the nameplate are critical – installing, operating, and energizing the incorrect part number could damage the unit and load resistors.**

If the unit is not damaged, unpack the equipment and remove protective stretch wrap. Remove all covers and inspect all the components for visual signs of damage. Immediately notify the freight carrier and ULB LLC of equipment damage or missing parts. Reinstall packing materials for storage with the exception of stretch wrap. **Do not store the unit with the protective plastic in place.**

NOTE: Do not reinstall or reapply protective stretch wrap. This material is meant for shipping protection only. Prolonged storage in stretch wrap may cause condensation damage to powder coat, painted, or mill galvanized finishes.

Product Overview

ULB-R1250H-480-240-OT/TR Series of Outdoor Trailor Mounted Resistive Load Banks are designed for installation and operations Outdoor. The Load Bank is an industrial power test unit specifically designed for Outdoor operation and will absorb a balanced resistive load at unity power factor. The Load Bank is a self-contained unit that includes an Operator Control Panel which allows the user to control and monitor individual-discrete load steps, blower motor circuits, control circuits, and safety circuits. Electrical energy from the power source under the test is absorbed by the load bank resistors and converted into heat. The blower motor provides the necessary cooling airflow to cool the resistor load elements. The Load Bank Unit contains all the necessary principal system components for control and operation.

- **Load Circuits**: Including load power resistors, load step switching and main input CAM-LOK.
- **Cooling System**: Including integrally powered blower motor and controls.
- **Control Circuits**: Including 120 VAC controls, load application circuits, blower circuits, and indicators.
- **Load Dump Circuit**: Provides user interface provisions to disconnect and disable all load steps by Manual load dump switch.
- **Safety Circuits**: Including branch circuit protection for load power resistor circuits, protection for blower and control circuits, motor overload protection, exhaust over temperature protection, cooling air-loss protection, wrong voltage protection, load dump indication, and E-Stop.
- **Overload Relay**: Overload relay current range is 4 to 6 Amp. Overload Relay set at 5 Amp for 240/480VAC Operation of Load Bank.

CAUTION
The Load Bank should never be used without the Fan Blower Motor operating. Inadequate cooling airflow will result in resistor load elements overheating, fire hazard, and danger to personnel.

Operating Instructions

General

- All installation should be reviewed and checked by a qualified technician with all local and National Electric codes observed.
- Ensure all connections are properly tightened and all covers are installed.
- Never operate the unit unattended.
- All wiring from external power sources to the Load Bank Unit should be verified and checked by a qualified technician with all local and National Electric codes observed.
- The Load bank must be positioned and installed to allow for a 4 feet intake clearance as well as a 20 feet exhaust clearance.

The following Cautions should be strictly enforced:

CAUTION
To avoid damage, set Switches E5B/E7A (on control panel) & E5A in the correct position before applying power & starting the load bank.

CAUTION
Load bank operates at either 240VAC(L-L) OR 480VAC (L-L), 3PH, 60Hz AC Power. Input power circuit breaker/Disconnect switch must be turned on only when Input Volage are stabilized nearby 240VAC (L-L) or 480VAC (L-L)

Keeping Input Power circuit breaker/disconnect switch on while bringing generator online may damage the load bank or cause malfunction.

CAUTION
Input power connection guidelines.
Use CAM Type Plug for main power & ground connection (rating 350A each. Total 4 wire & plug assembly for each phase, each module on input power.

To utilize the full current capacity of load bank, all power cables must be connected to respective connectors on load bank.

CAUTION
Main disconnect to be provided by installer rated 600V maximum, sized 150% maximum of rated current.

Operation

Load Power Connection

Connect the power source under test to CAM-Type connectors provided on the load bank using suitable mating CAM-Type plugs and cables sized per the NEC (National Electric Code) or any local codes.

The Load Bank provides a DBX box with color coded qty.08 CAM-Type connectors (350A Max.) for each phase (L1/L2/L3) and qty.04 Connector for Ground Cable connection. (See Figure-1)

To utilize the full current capacity of load bank, all power cables must be connected to respective connectors on load bank.

Load cable conductors from the power source to the load bank and mating CAM-Type cable plugs should be adequately sized and protected to handle the maximum rated load and in accordance with the National Electric Code and any local codes.

Load bank can be operated in following option for control/blower power source and voltage level. Selector switches on the front/side of the load bank should be positioned as per the following table.

Figure-1 Load power connection

Blower Power Connection (External/Internal)

1) For External blower power keep E5B switch in “External” side.

2) Connect 480/240VAC,3PH,60Hz,60A Power to E10R, E11R, E12R and E13J(GND) CAM-LOK Connectors. (See Figure-1)

3) For Internal blower power keep E5B switch in “Internal” side.

Control Power (External/Internal)

For External control Power keep E7A & E5A switch in EXT. Side. connect 120VAC,1PH,20A,60Hz Control power to E16A Connector (See figure 1).

For internal control power Keep E7A & E5A In INT. Side.
Keeping E7A at OFF position will keep load bank control circuit OFF.

CAUTION: Position of E5A, E5B & E7A switches must be in correct position prior to connecting load power to the load bank. Failure to put E5A, E5B and E7A switches in the correct position may damage the load bank components.

Removable Sliding Cover

- Please see below picture of sliding cover for inlets & exhaust (see figure-2,2a).
- Remove sliding cover of inlets & exhaust before applying power.

Figure-2 Sliding cover inlets

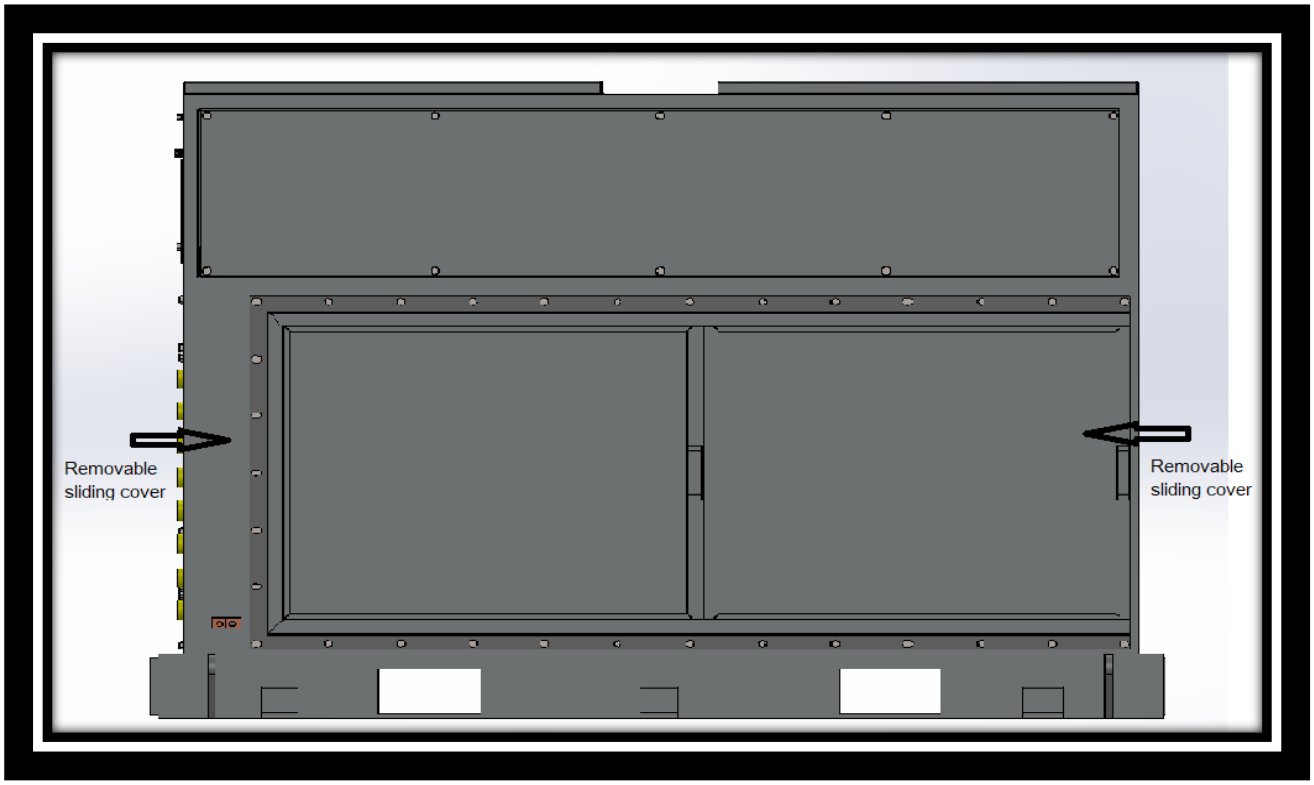

Figure-2a Sliding cover exhaust

Turn on the power source under test and make sure load power is ON and applied to the load bank.

- Display (E1A) will turn on.
- Verify Check Emergency Stop Button (E2A) is in the “Released (Depressed)” operating position.
- Press the green button on Power On/Off Switch (E3A) and orange lamp will illuminate to show that control power is on.
- Verify that Load Dump switch (E4A) is in OFF (Downward) Position.
- Use the main screen on HMI display (See Figure.3 as below) to apply require kW.

Load bank can be operated as per SET KW, Hrs, Minutes and <Load Apply> button on the main screen.

Use HMI display touch screen to apply the required kW. Minimum kW resolution that can be selected is 5/10/25 OR 50 KW as applicable to selected model number of load bank.

Make sure that ‘Safety OK’ message appears in green color indicating all safety parameters are ok.

Soft push buttons are provided for.

1. Loads apply 2. Load drop 3. Load steps Increase/Decrease

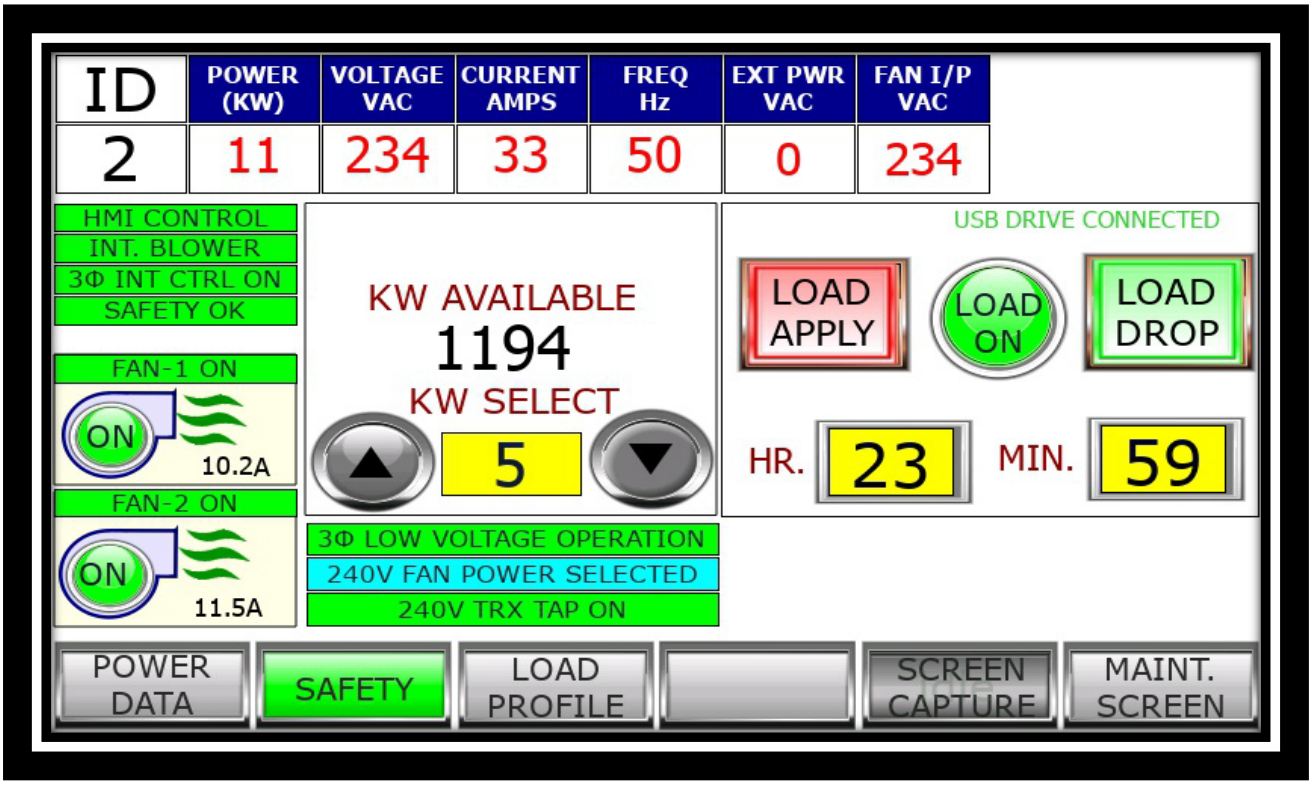

Figure-3 Main Screen.

Use HMI display touch screen to set require KW. Minimum KW resolution that can be selected is 5KW. Set desired time duration in Hours (HR.) and Minutes (MIN.) for which selected KW is to be applied.

Click <LOAD APPLY> button on Main Screen. This action will start with a blower motor, and the preselected amount of load KW will be applied to the power source under test.

fan ON status is indicated by fan status indicator with ‘ON’ text in green background color. Fan Off Status indicator with ‘OFF’ text in red background color.
Also, when the set time duration is over, load will automatically disconnect, and the cooling fan will continue to run for pre-set cooling time of 5 minutes (300sec) OR as set in the Maintenance screen.

Load bank Id can be seen and changed by clicking on <ID> button located on Left Top screen of main screen.

Safety (Alarms)

Any alarm condition existing in the load bank is indicated by load bank 'SAFETY NOT OK' indication on the top left corner of the main screen on HMI. To investigate safety NOT OK status, click <SAFETY> button on Main screen to see following screen (See figure 4).

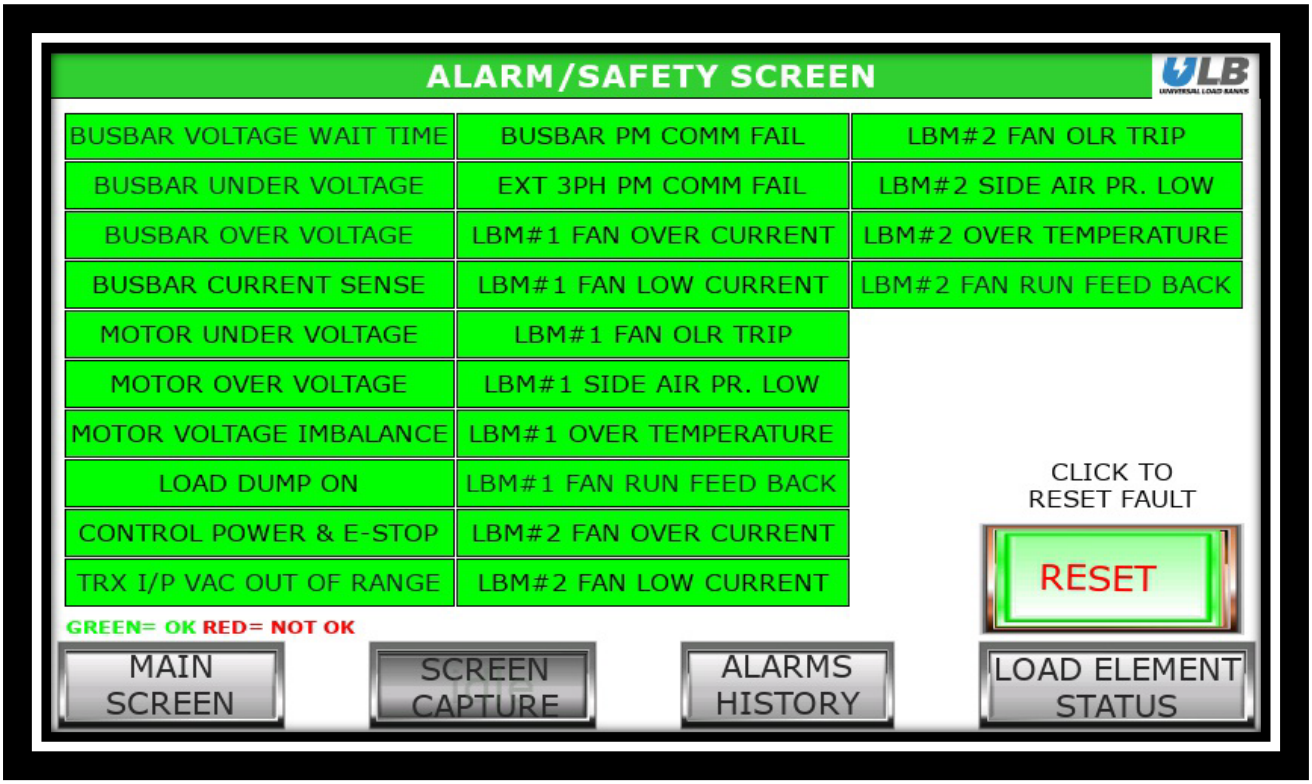

Figure-4 Safety Parameter

Following table explains various conditions and their settings (see Table 1),

Sr no	Alarm Conditions	Settings	Note
1	Over voltage at 480VAC	505VAC	Settable in fault setting screen in Maint. Mode
2	Over voltage at 240VAC/120VAC	260VAC	Settable in fault setting screen in Maint. Mode
3	Under voltage at 480VAC	375VAC	Settable in fault setting screen in Maint. Mode
4	Under voltage at 240VAC/120VAC	185VAC	Settable in fault setting screen in Maint. Mode
5	Current Imbalance at 480VAC	20 AMP	Settable in fault setting screen in Maint. Mode
6	Current Imbalance at 240VAC	40 AMP	Settable in fault setting screen in Maint. Mode

7	Over Temperature	High Exhaust Temperature in Heater element section	
8	Air Pressure Loss (Fault is detected only when fan is on)	Loss of cooling air in Heater section.	
9	Control Power / E-stop	Loss of control power or E-stop is operated.	
10	Motor Voltage imbalance	10 VAC	Settable in fault setting screen in Maint. Mode
11	Motor Over voltage	505 at 480VAC 260 at 240 VAC	Settable in fault setting screen in Maint. Mode
12	Motor under voltage	375 at 480VAC 185 at 240 VAC	Settable in fault setting screen in Maint. Mode
13	Motor over current trip factor	1	Settable in fault setting screen in Maint. Mode
14	Fan run fail (Check OLR)	OLR SET 5A	Settable in fault setting screen in Maint. Mode

Table-1

All load steps are disabled, and load cannot be applied unless all above parameters in OK status (Green Color).

Safety and Shut-Down Indicators
Pressing “Emergency Stop” Pushbutton (E2A – E-stop on control panel), turns off all active load steps and blower motor. Use this button during emergencies only. When the situation becomes normal, turn on blower motor for duration and cooldown load bank.

Note: Fault detection values for Over Voltage / Under Voltage / Current Sense are set in Voltage / Current Faults setting screen described somewhere in the Maintenance Section in this manual.

Note: Ensure and check for proper phasing of blower motor and direction of airflow from cold-air intake to hot-air exhaust. If airflow is exhausted from cold-air intake, shut down the unit, disconnect all sources of load power, blower power, control power.
Set correct blower direction by setting the BLOWER ROTATION switch ‘E6A’ (On front control panel) to ‘FWD’ or ‘REV’ position.

CAUTION
DO NOT attempt to bypass the air switch or over temperature switch as this will cause catastrophic damage to the unit.

Clicking on the ULB logo in alarm/safety screen will bring up load bank information (See figure 4a).

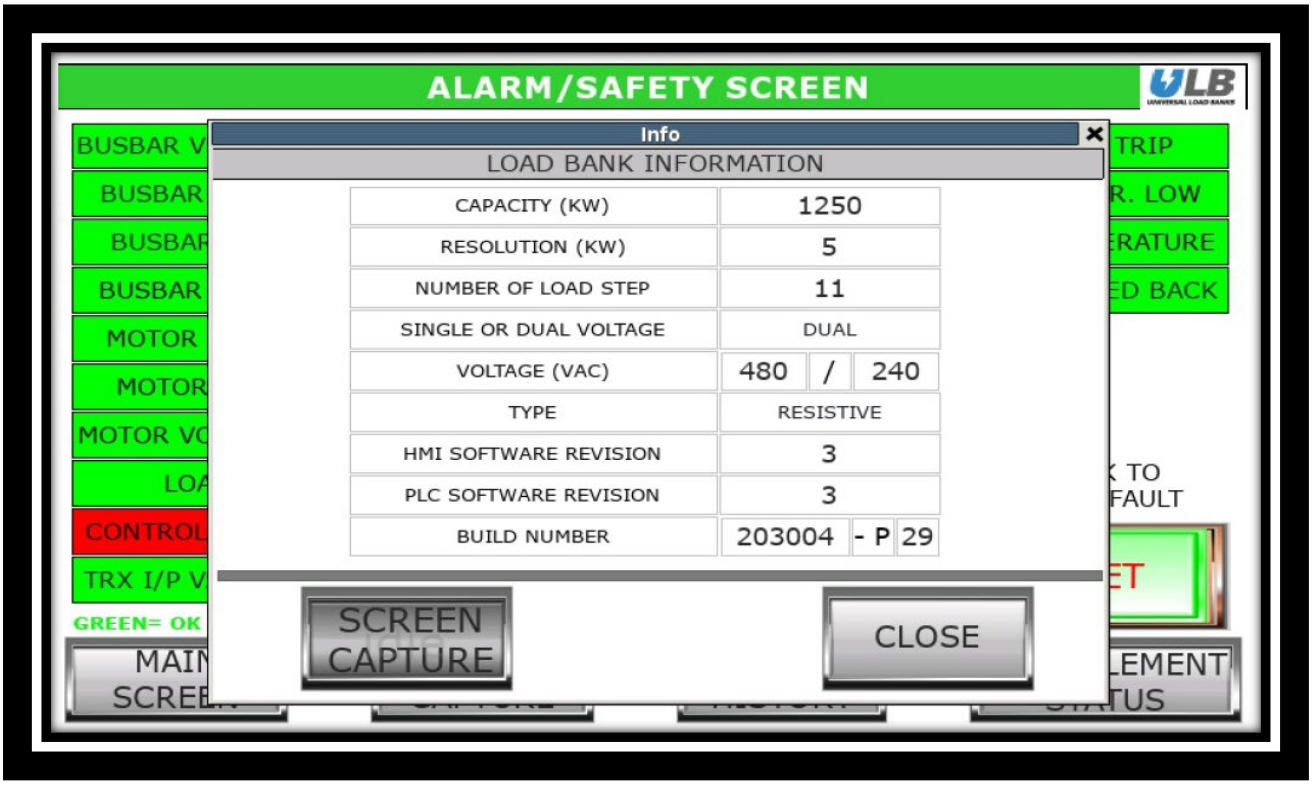

Figure-4a Load bank information

NOTE: Load bank information screen details will change as per selected model number and resolution of load bank.

Alarm History screen

Click <ALARMS HISTORY> button located in alarm screen on HMI. This Screen show history of alarms or Faults (See Figure-5)

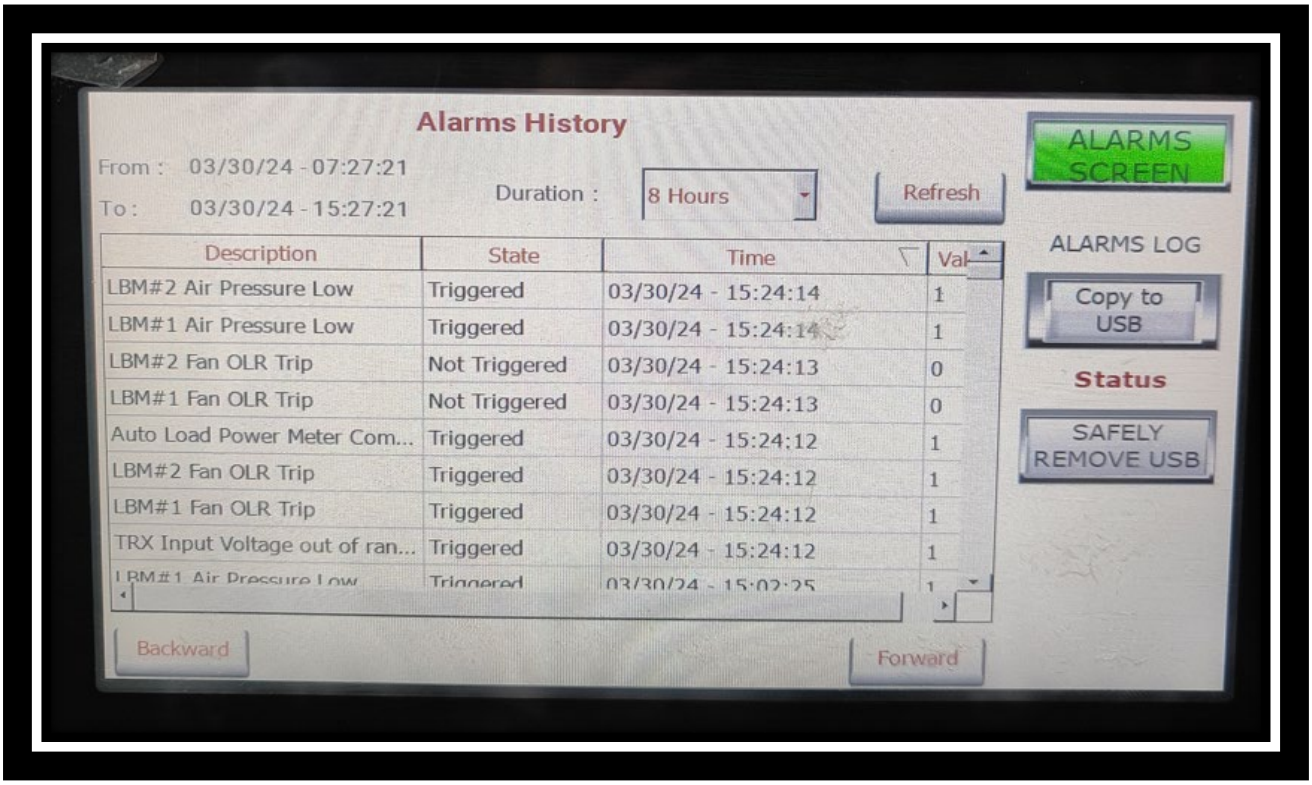

Figure-5 Alarm History screen

- Alarms history duration by default set at 8Hours (can be changed as required using scroll down arrow button).
- Click< Copy to USB> button to copy alarms history data to USB drive.
- Click <SAFELY REMOVE USB> to remove USB stick from HMI USB port.
- Data recording in csv file on USB stick.
- Click< ALARMS SCRREN> button to go back to Alarms Screen.
- Click< GO BACK> button to back Power& Diag Screen.

Load element status

Click <LOAD ELEMENT STATUS> button on Alarm/safety parameter screen and following load element screen will appear (See figure 6)

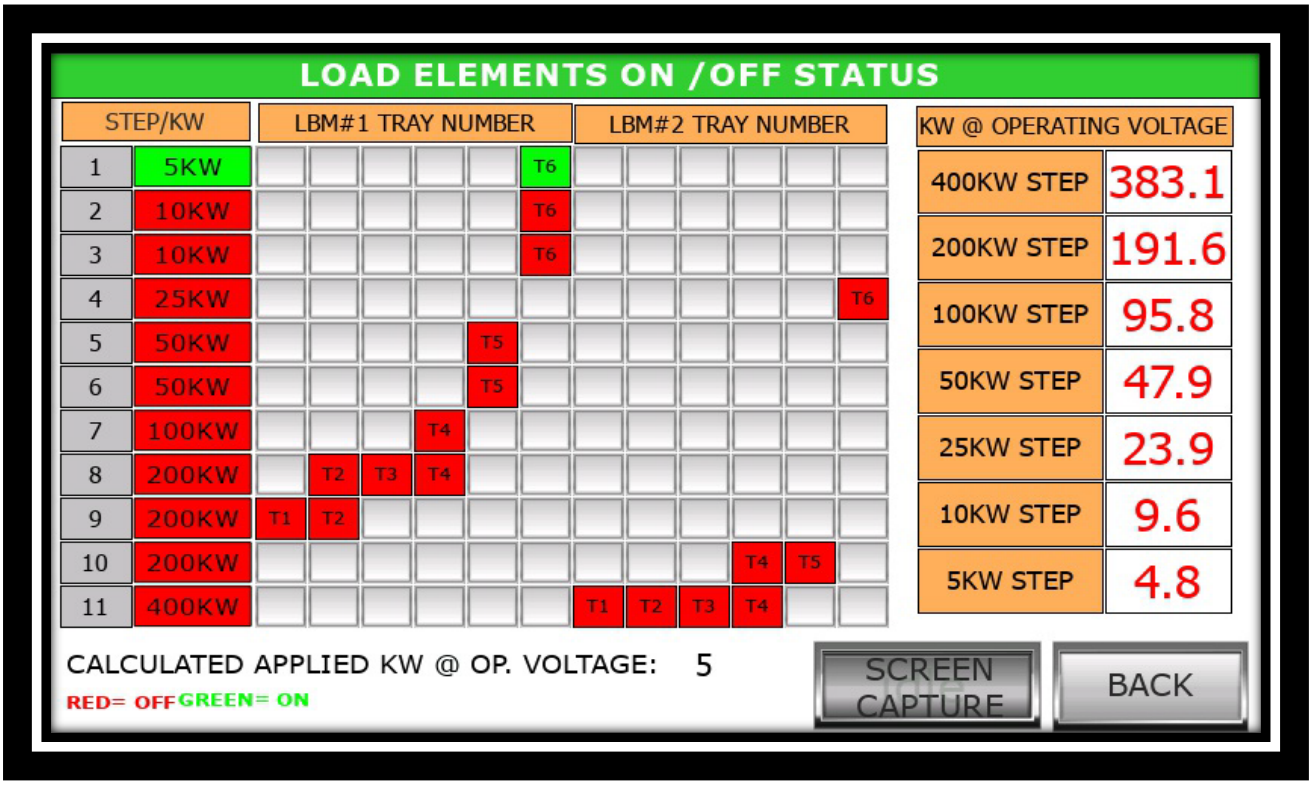

Figure-6 Load element status.

This screen also shows KW value at operating voltage for induvial load step.

Power data

1) Power data display: Click <Power Meter> button on Main screen and following power data screen will appear (See figure 7),

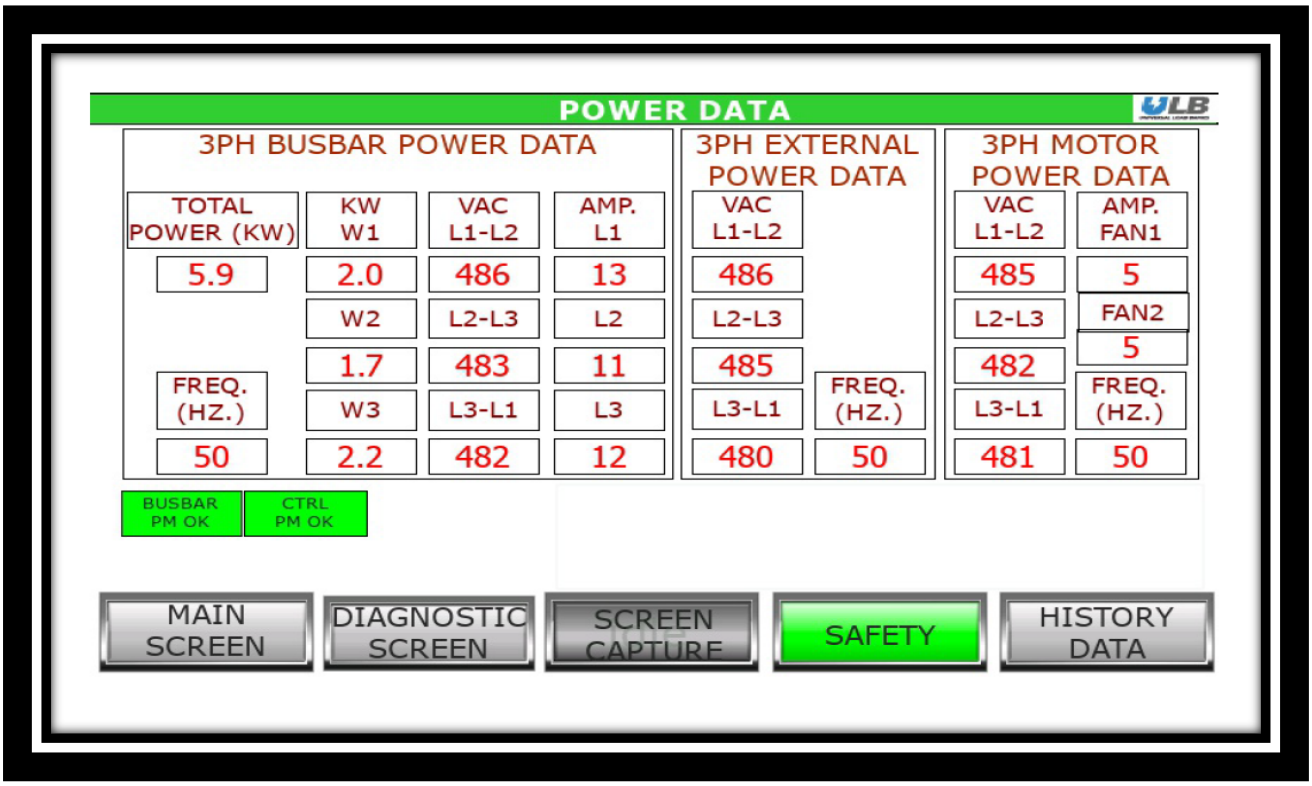

Figure-7 Power Data screen

HISTORY DATA

History Data for Power / Voltage
Click <HISTORY DATA> button on Power meter Screen and history data screen showing history of KW/Voltage loading (See figure 8).

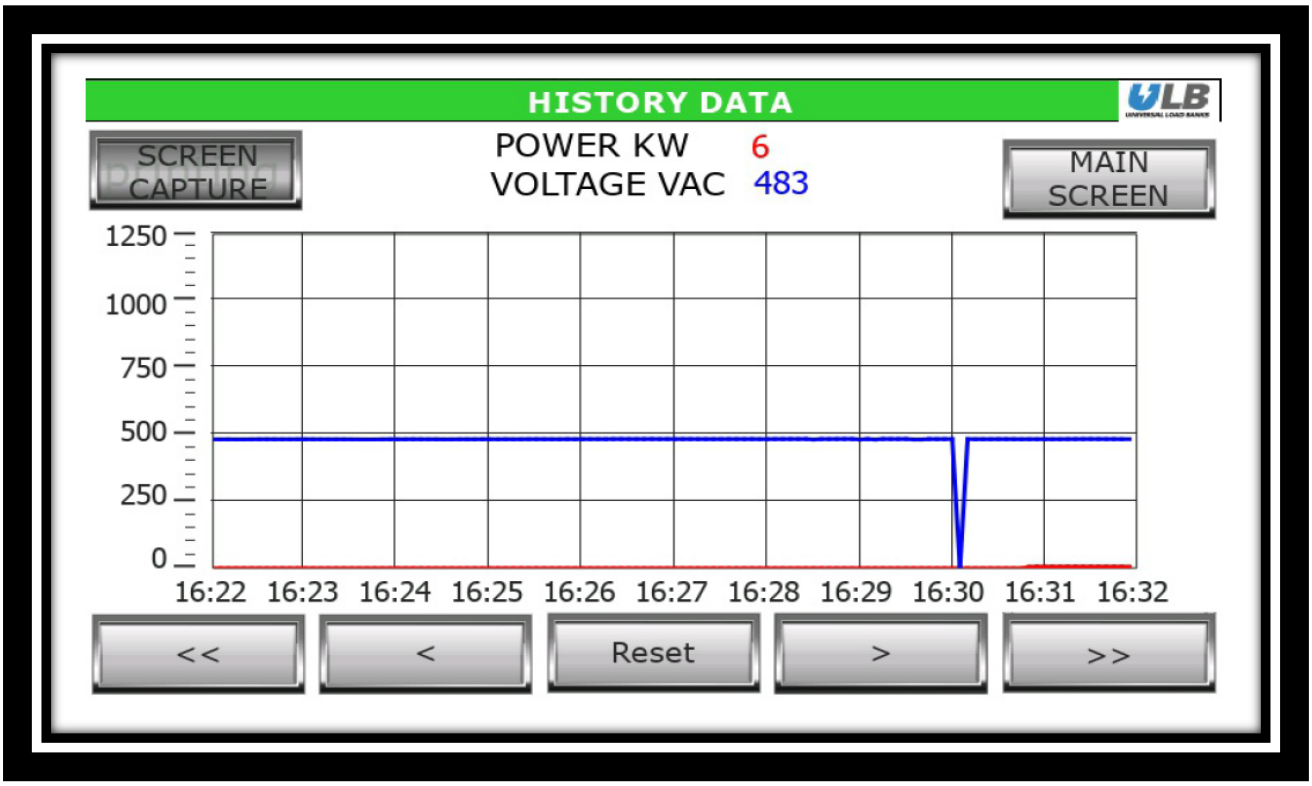

Figure-8 History data

Click <Main Screen> button to switch back to Main Screen.

DIAGNOSTICS SCREEN

Click <DIAGNOSTICS SCREEN> button located in power data screen on HMI (See Figure-9).

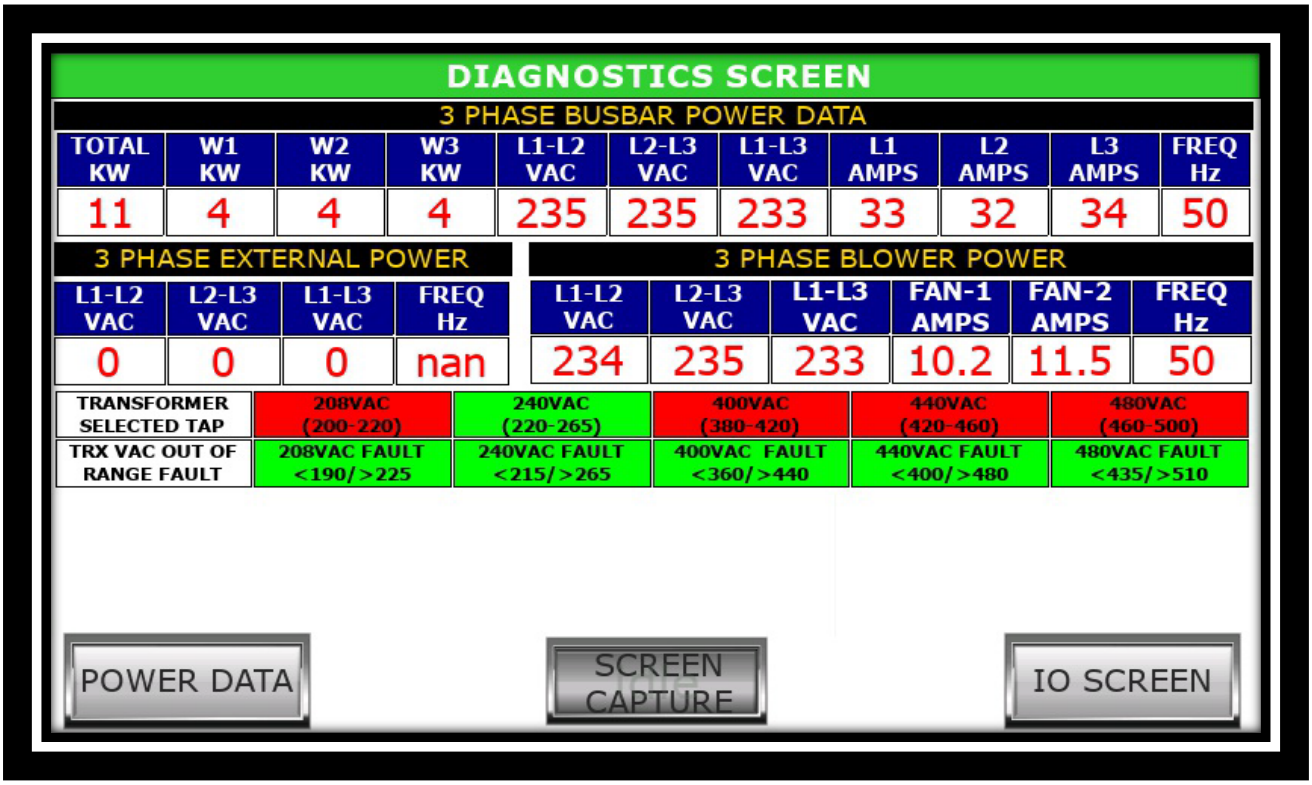

Figure-9 Diagnostics Screen.

1. Diagnostics screen shows 3 Phase Bus bar Power data (KW, Voltage, Amp).
2. Diagnostics screen shows 3 Phase External Power (Voltage, Freq).
3. Diagnostics screen shows 3 Phase Blower Power (Voltage, Fan(L1) Amp, Freq).
4.Transformer selected tap details.

INPUT/OUTPUT SCREEN

Click <IO SCREEN> button on <DIAG SCREEN> and Input/Output Status screen will appear. (See Figure-10)

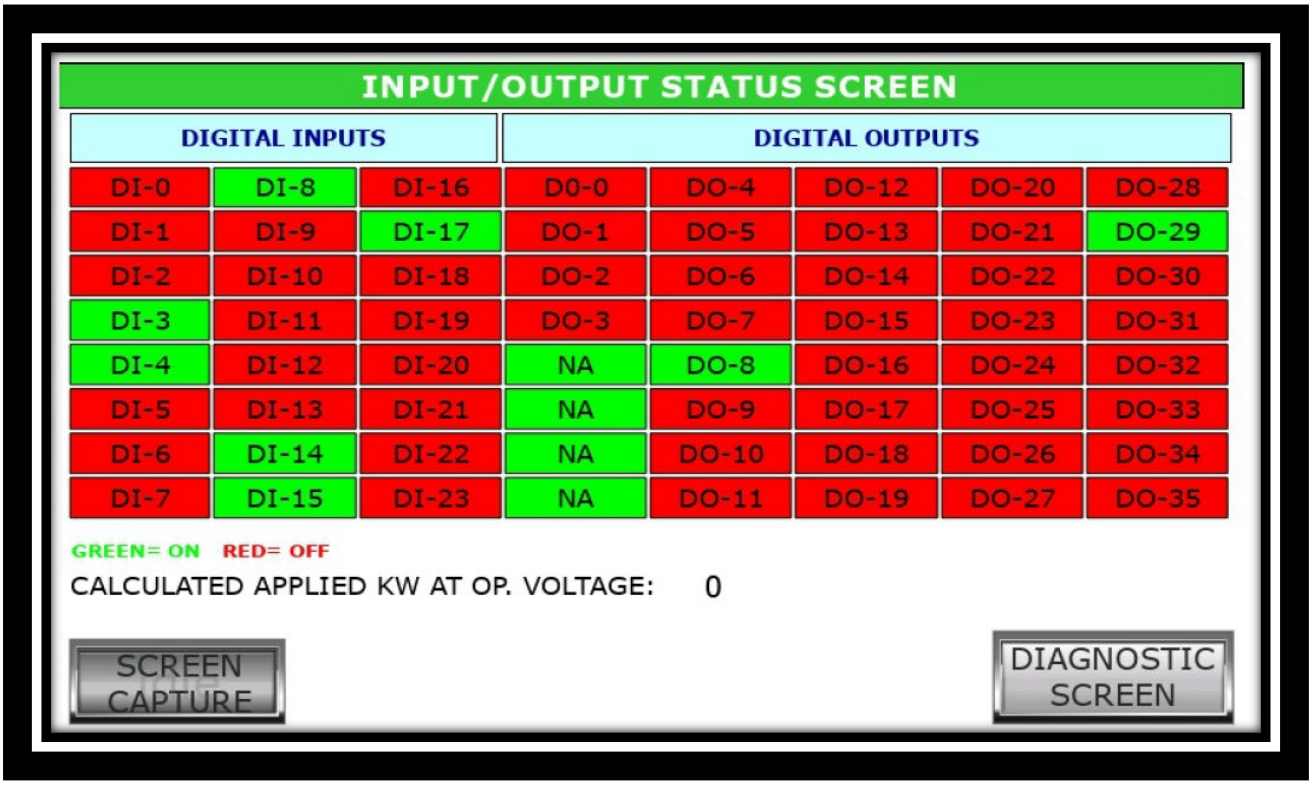

Figure-10 Input/output Status screen.

1. This screen shows Digital Input/Output Status of Load Bank
2. Red color shows ‘OFF’ condition (Digital Input/Digital Output) and green color shows ‘ON’ (Digital Input/Digital Output) condition.

Data logging

1) Insert USB stick into USB port (E307A) on the front control panel box.
2) Click <DATA LOGGING> button, will show following screen (see figure 11),

Figure-11 Data logging

1) Click <START LOGGING> will also start recording the following values of load bank in which USB stick is inserted at every 10 seconds.

   Total kW, Average Voltage, Average Current, Frequency, Phase wise kW, Line Voltage, Line current

   All values are stored in ‘csv’ format file having followed naming convention,

   1250KW_MMDDYY_HHMMSS.csv e.g., 1250KW_111824_094827.csv

Click <CLOSE> to close the above dialog box.

Click < STOP LOGGING> will stop date recording in csv file on USB stick.

Click <SAFELY REMOVE USB> to remove USB stick from HMI USB port.

Note:
If a USB stick is inserted into USB port (E307A) on the front control panel box, then "SCREEN CAPTURE" button will appear on various screens.

Click <SCREEN CAPTURE> button to copy screen image to USB Stick.

WARNING
While Load bank is running (with load applied condition) setting Load Dump Switch to ON (upward) position will cut off all applied load immediately. However, the cooling fan will continue to run until pre-set cooling time is over.

A recommended 5-minute cool down period of the blower motor circuit, with no load applied, should adequately remove any residual heat from the Load Bank and system components.

WARNING
Click <LOAD DROP> button any time will cut of all applied load. However, the cooling fan will continue to run until pre-set cooling time is over.

Shut-Down

- Click <Load DROP> button on Main Screen (see figure-3) will drop load.
- Set requires KW to '0' KW.
- Press the red button on Power On/Off Switch (E3A) and orange lamp will turn off to show that control power to contactors and blower motor is off.
- Turn off and disconnect the main-power source under the test. Disconnect all sources of power to the Load Bank (Main input Cam-Lok).

WARNING
DO NOT touch the exhaust louver during operation. Hot-Air exhaust will cause serious burns.
DO NOT operate the Load Bank overrated nameplate Voltage as this will cause catastrophic.
Failure and danger to personnel. DO NOT apply DC voltages to main input Cam-Lok.

Load Profile

Using this feature, the load bank can be configured to operate at various load conditions for predetermined time. The following are the steps to configure load profile.

1) While load bank is not running, click <Load Profile> button on main screen, and the following screen will appear (see figure-12),

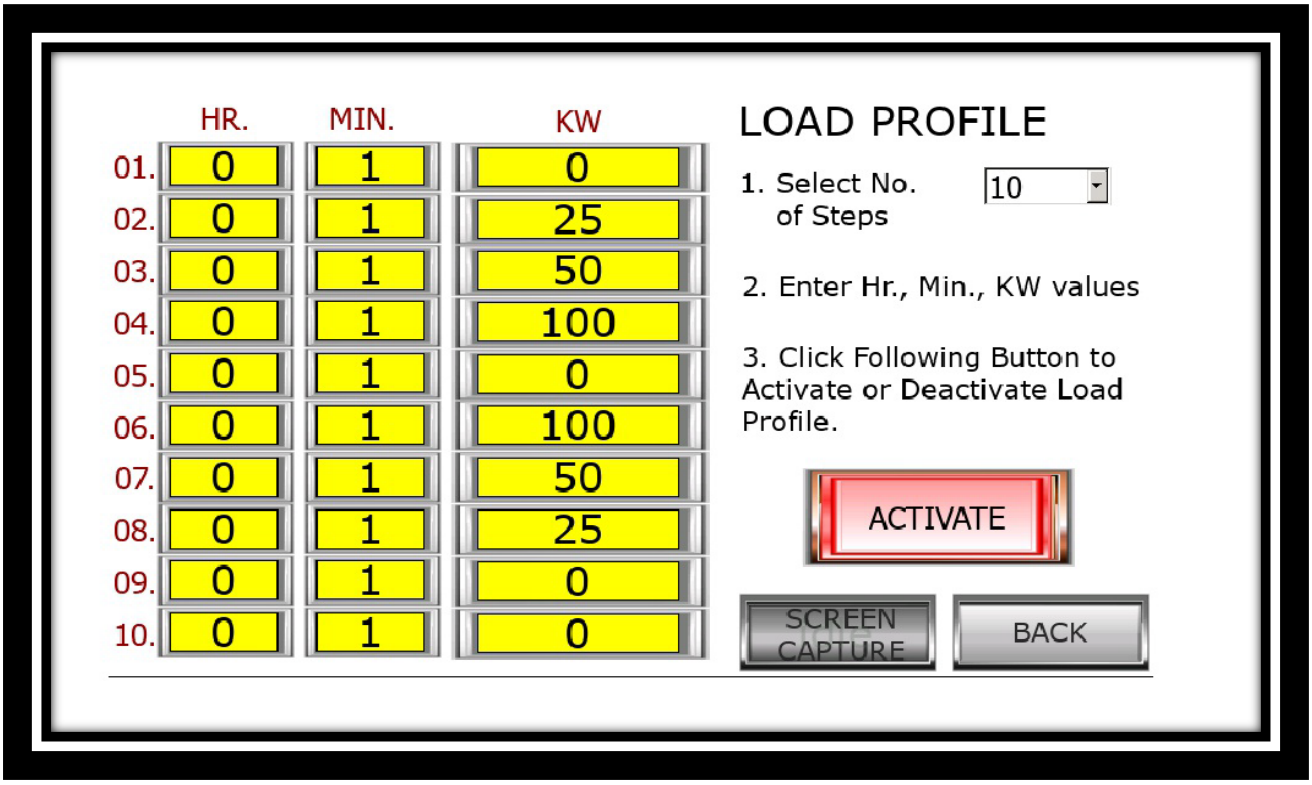

Figure-12 Load profile

2) Select no. of load steps from 1 to 10 using drop down menu. Screen will start showing entry fields for Hours, minutes and KW values depending on number of steps selected in drop down menu. Following is the example screen if number of steps selected are 10.

3) Enter require Hr., Min, and KW values for each step and click <ACTIVATE> button.

    a. Now Load bank will start operating with Hr., Min. and KW values selected for step#1. This will be indicated by flashing step 1 entry fields.
    b. ACTIVATE button will now change to DEACTIVATE, meaning load profile run of load bank can be deactivated and hence applied load can be disconnected anytime by click on this button (see figure-13).

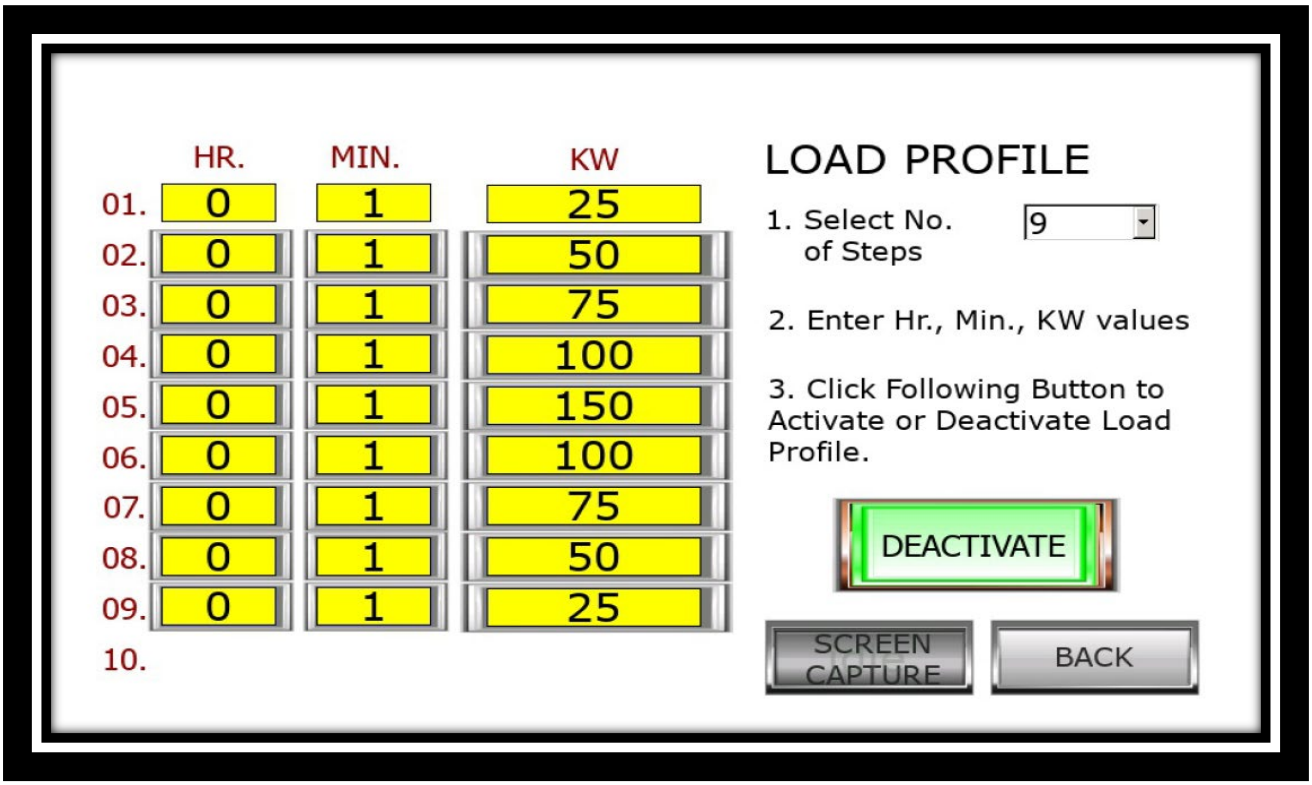

Figure-13 Load profile

c. Click <BACK> button to display main screen.
d. Flashing <LOAD PROFILE> button on main screen indicates that load bank is operating with activated load profile.
   Note: Following buttons / entries on main screen are disabled when load profile is active,
   i. KW SELECT entry
   ii. Load Increase button,
   iii. Load Decrease button,
   iv. LOAD APPLY button,
   v. HR. entry,
   vi. MIN. entry,
e. Load bank will continue to operate at KW values, Hr and Min selected for step#1, then after step#2 will be activated and load bank will operate at the values selected for step#2. This will be indicated by flashing values under that step.
f. In this way, load bank will continue to operate until the last step is reached. Then after the entire load will be disconnected. However, cooling fan will continue to run until pre-set cooling time is over.

WARNING

Click <Load Drop> button any time will cut of all applied load and deactivate LOAD PROFILE. However, cooling fan will continue to run until pre-set cooling time is over.

Operating Multiple Load banks

Multiple load banks (Max.12) can be operated in 'Master – Slave' mode by connecting load banks in daisy chain networking as shown below (See Fig.14)

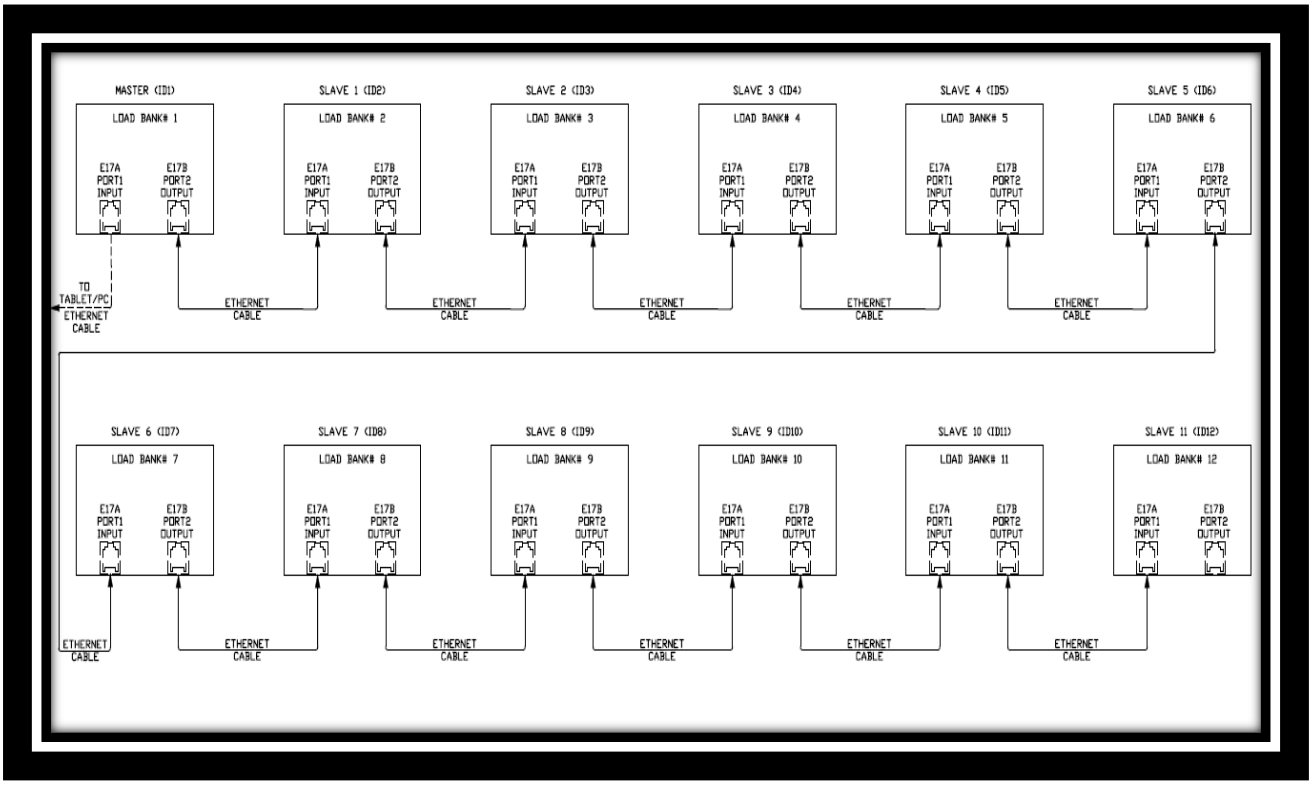

Figure-14 Multiple load banks connections

Note:

1) Maximum 12 Load banks can be connected in Master – Slave mode. So, for load bank with 110KW each capacity, multiple load bank operation will provide maximum 12 x 1250KW = 15000 KW capacity.

Software set up

Each load bank must be correct configured using load bank Main screen ID settings screen shown below. Refer maintenance section below to know how to access this screen on the display.

1) Each Load bank should have unique ID assigned.
2) The "First load bank in the network (designated as Master load) bank should have the lowest ID e.g. ID=1 if other slave load banks in network have ID = 2,3,4,5…12
3) See "ID" field located in top of main screen to know/set ID for the load bank(see figure-15).

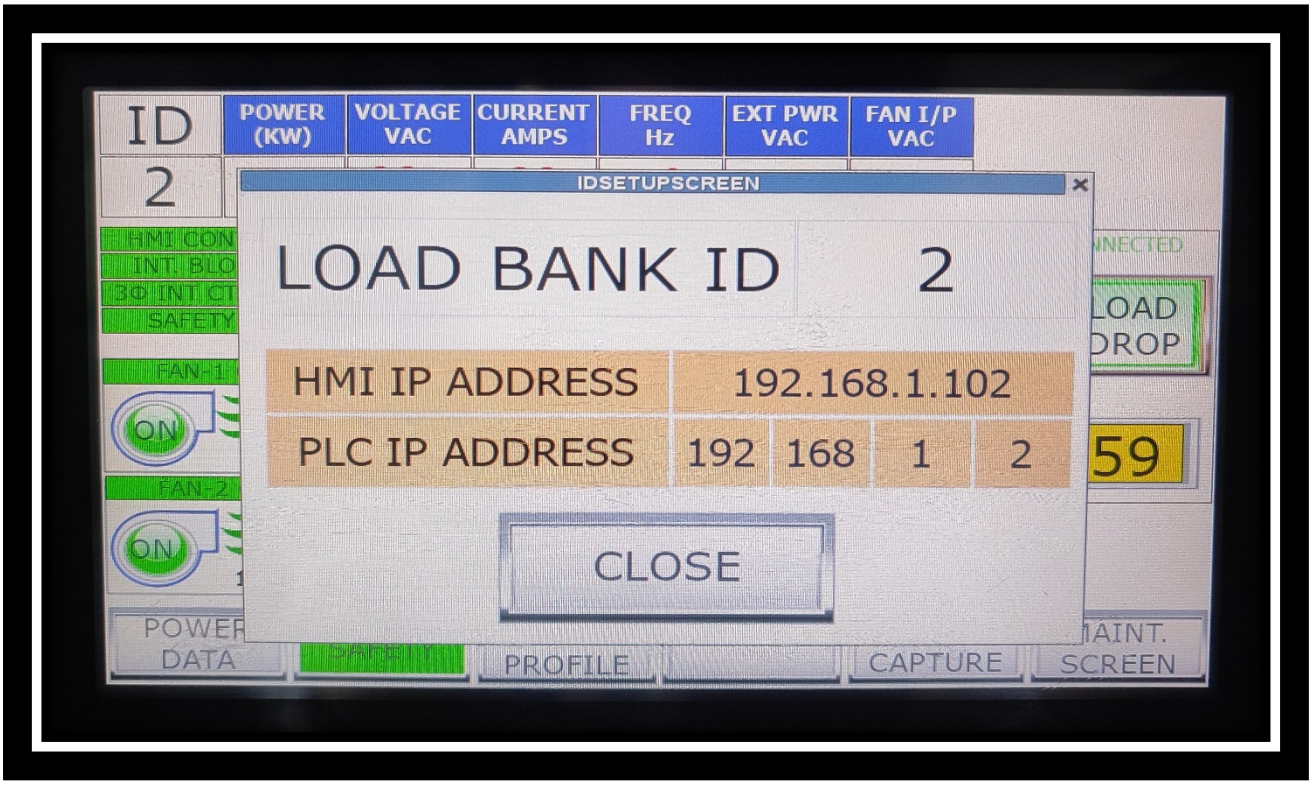

Figure-15 ID Setup screen

Physical connection

1) Each load bank has one input port (PORT-1, E17A) and one output port (PORT-2, E17B) located on the load bank.
2) Connect Ethernet cable from output port of Master load bank to the input port of next load bank (Slave-1). Similarly, connect networking cable from the out port of Slave-1 load bank to input port of Slave-2 Load bank. Connect Slave-3, Slave-4 to Slave-12 in a similar way.

Powering up Master – Slave Load banks

If steps of physical connection, settings and powered up are done correctly then "**MULTIPLE LB DETECTED**" appears in main Screen (See figure 16).

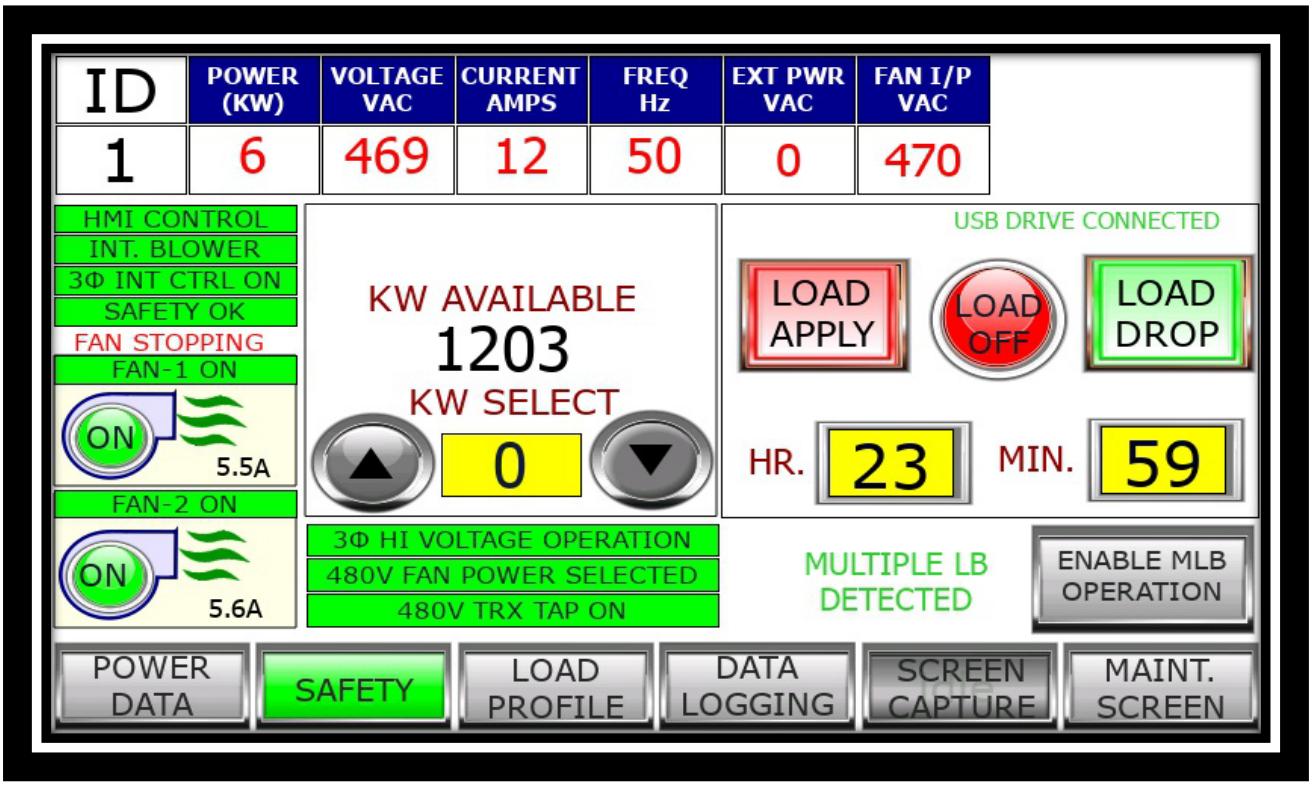

Figure-16 Single Load Bank OR Multiple load Banks operation

Click <ENABLE MLB OPERATION> button will display following screen (See figure 17). Click on <YES> button.

Figure-17 Enable multiple load bank option

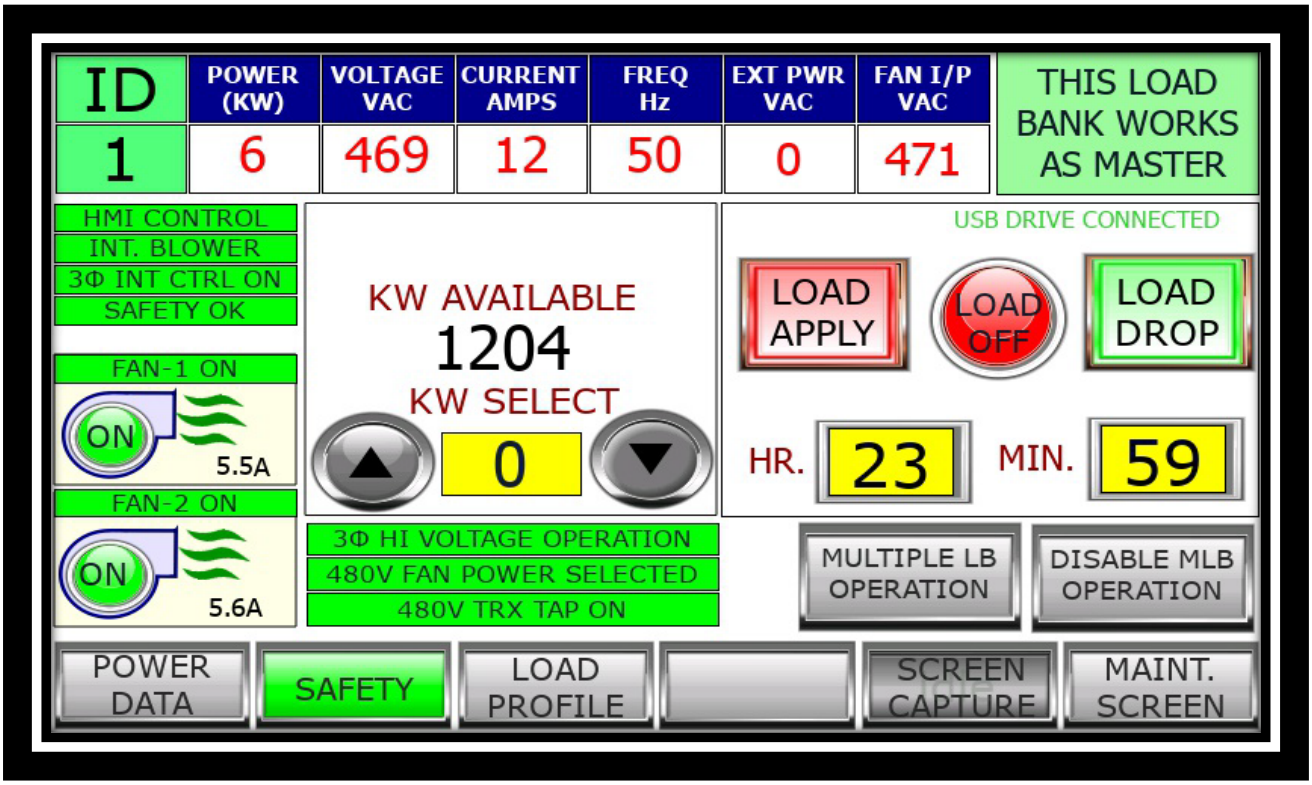

Figure-18 Multiple LB operation

- Click on<MULTIPLE LB OPERTAION> button (Figure-18) will display flowing screen. (see figure 19)

Figure-19 Multiple LB operation

- Load can be shared by Sequence load share or Equal load distribution. Select require option from above screen.
- Set Require KW and Click <SEQ LOAD APPLY> button on above screen if Sequence load share selected.
- Set desired time duration in Hours (HR.) and Minutes (MIN.) for which selected KW is to be applied.
- This action will start cooling fan and the preselected amount of load KW will be applied to the power source under test.
- Click on <MLB SAFETY> button. Any alarm condition existing in the load bank is indicated in red color shown as per in figure 20.
- Click Load drop button to drop Applied load.

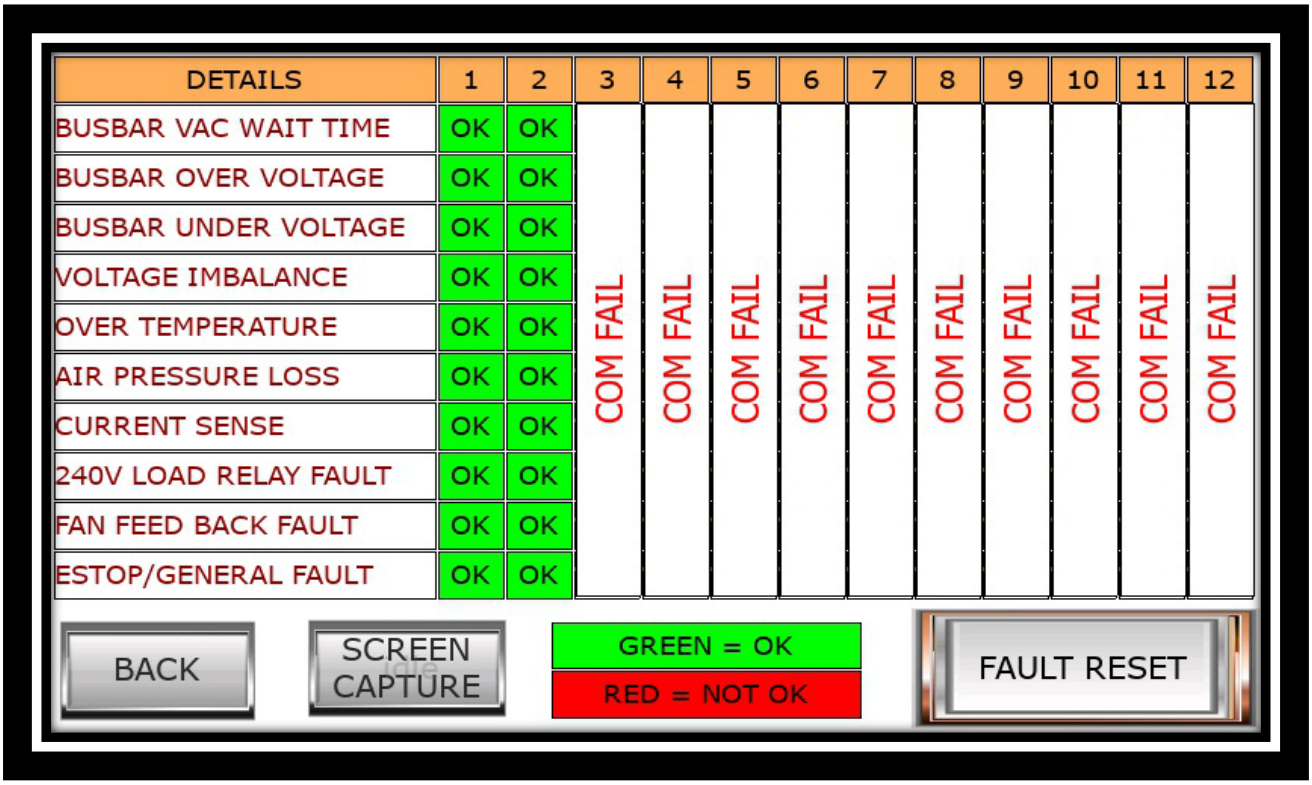

Figure-20 Multiple Load bank Safety screen

- Click <BACK> button to go into the previous screen.
- Click on <MLB detail screen> button to see Status, Voltage, KW, AMPS details. See figure 21.

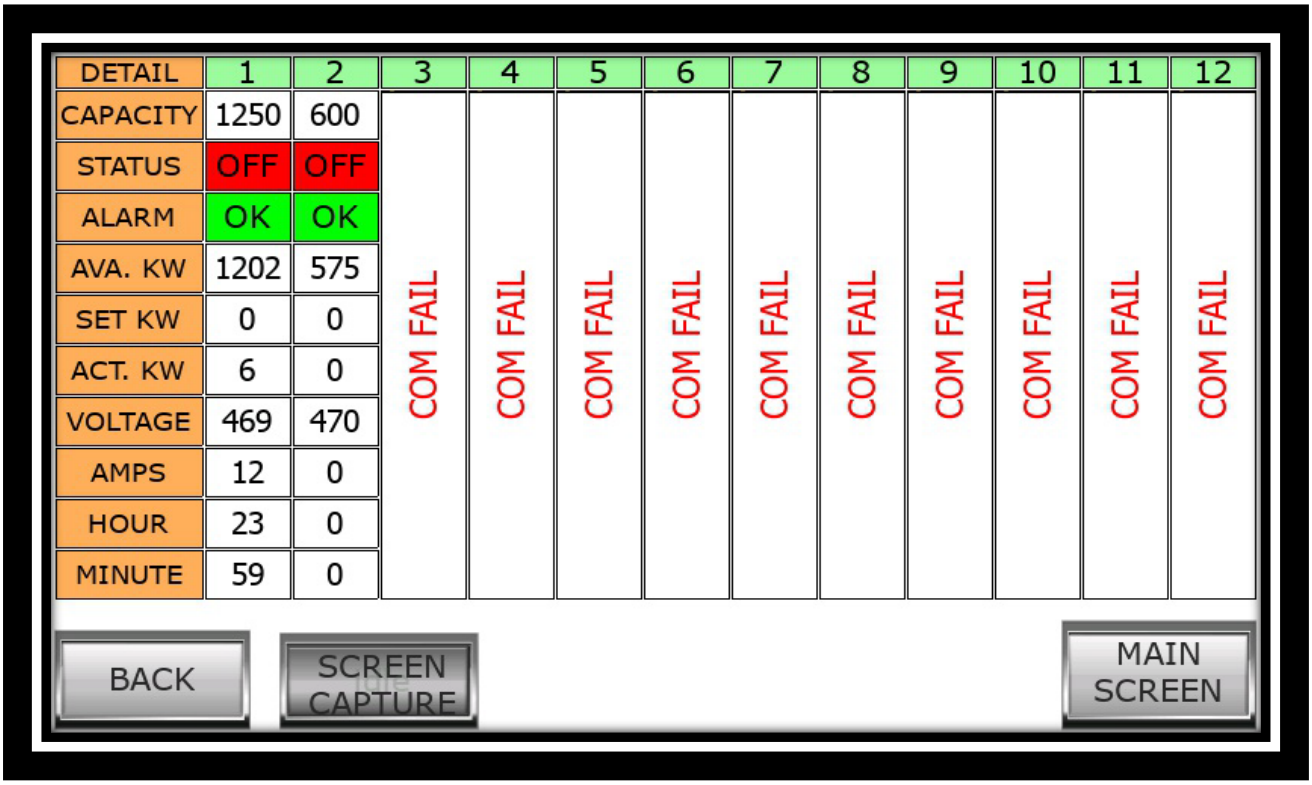

Figure-21 Multiple load bank details screen

Auto Load Level Controller (option available on purchase only)

Automatic Load Level Controller will add/subtract load bank load in response to dynamic power fluctuations of the connected building load. It utilizes the load bank as a "supplemental load" for maintaining a minimum load on the power source (generator). Customer "transfer of control" contact closure initiates the load bank and time delay load application circuit. A separately supplied current transformer provides the necessary feedback signal for sensing building load or generator output current.
In other words, the load bank "monitors" the connected building load or generator current output (via external CT) and automatically adds or subtracts load steps to maintain the total load (building load plus load bank load) to a predetermined KW level - as defined by the user. Example: User desires 30% minimum gen-set loading (0.30 x 2000 = 600 KW). Under the Automatic Loading option, he sets the Minimum Gen-Set loading selection to 30%. The actual building load is saying 400 KW but is 200 KW short of the desired 600 KW level. The load bank then applies 200 KW load automatically. The load bank continuously monitors the building load and adjusts accordingly (by increments of the minimum load step resolution).

Auto Load Control Setup

In order to operate load bank in ‘AUTO” mode following settings must be done using set up / maintenance screen as shown below,

Note:

1. External Current Transformer (CT) must be installed (in customer facility) to measure either building current or Generator output current,
2. External CT must be connected to power meter (installed inside landbank) and power meter must be configured for correct CT Ratio e.g. 2000:5A.
3. External CT location must be configured in “Auto Load Level Setup” screen.
   Upon entering correct username / password login information while clicking <MAINT SCREEN> button on main screen, used will see following setup screen (see figure-22),

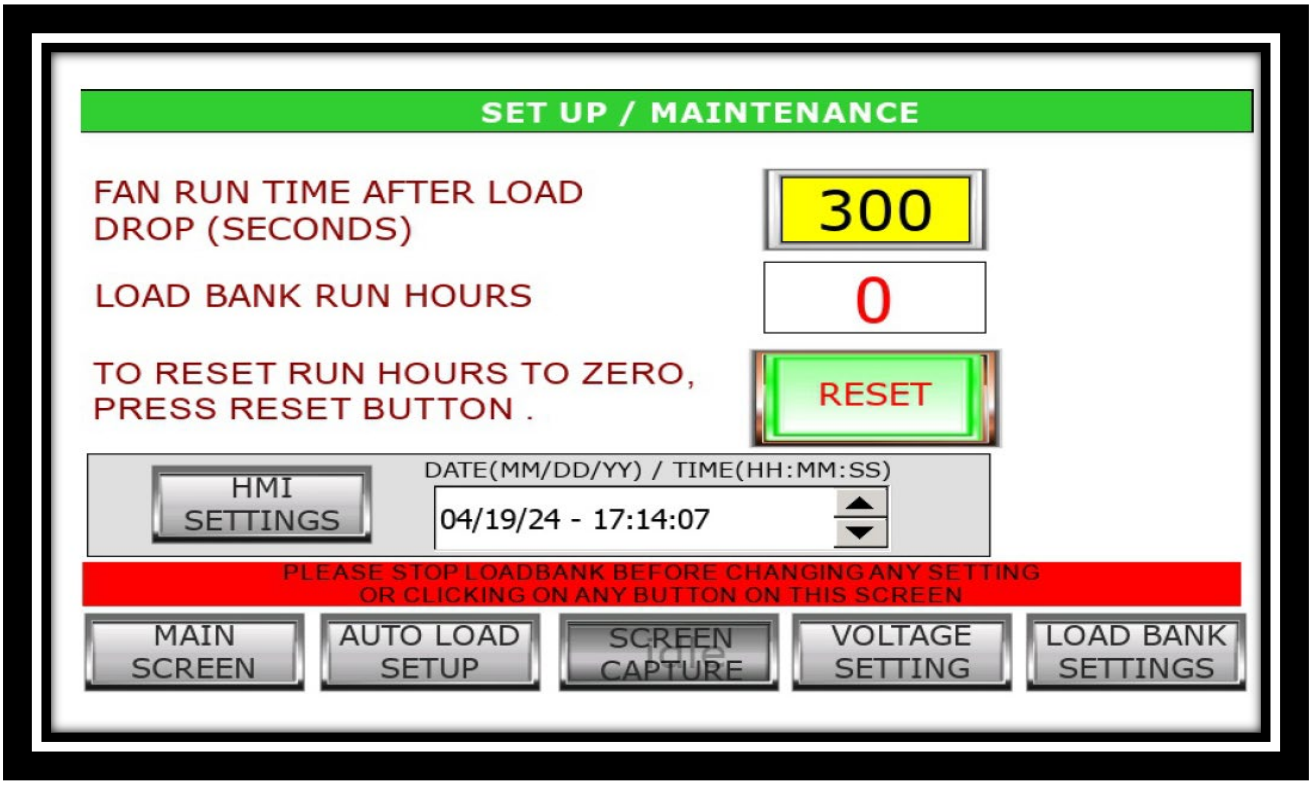

Figure-22 Maintenance screen

Click <Auto Load Setup> Button to open set up screen as shown below (see figure-23),

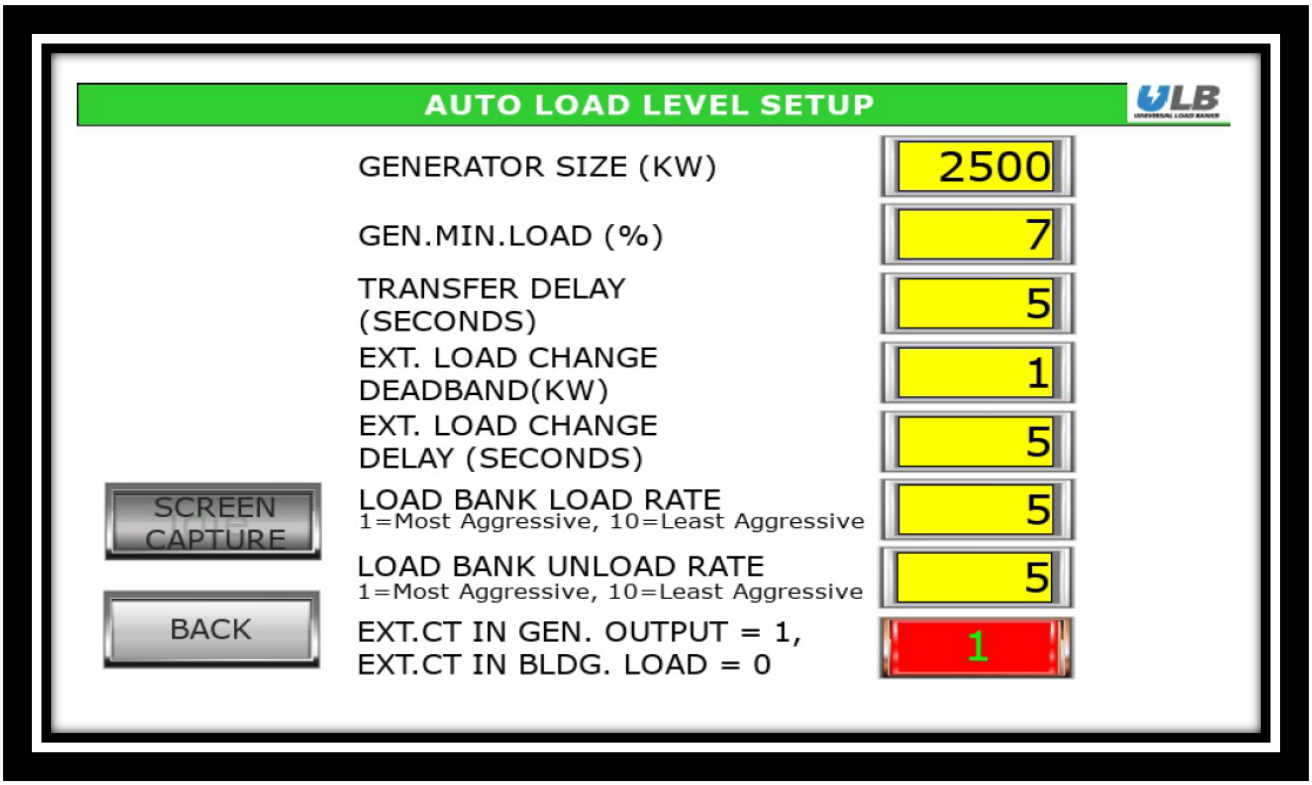

Figure-23 Auto load level set up

Set various parameters as below,

Generator Size:

Generator maximum KW capacity e.g. 2500KW.

Gen. Min. Load (%):

Desired minimum (%) loading on Generator when Auto Load Control is active.

For example, If the Generator size is set to 2500KW and Load (%) is set to 7% then Auto Load Control will try to maintain 175KW load on Generator.

Transfer Delay (Sec.):

Time delay between Transfer of Control (TOC) / Load Bank Run contact actuation from Customer facility until load is actually applied by Auto Load Control on Load bank.

Ext. Load Change Dead band (KW) or Load Resolution:

Minimum change (Load Resolution) in the connected building load (KW) required to Activate auto load control action.

When auto load control is active the system will adjust the load whenever the Difference in building load is more than the configured value.

Ext. Load Change Delay (Sec):

Time delay after Minimum KW change in building load (KW) and Auto load control to start Taking action.

Load Bank Load Rate and Unload Rate: 1 to 10

These parameters are used to adjust the rate in which load is added (Load Rate) or removed (Unload Rate) from the generator when the Auto Load Control mode is active. The values range from 1 to 10. A value of 1 provides the most aggressive rate and a value of 10 is the least aggressive rate. In most cases, the Unload Rate will be set to a more aggressive setting than the Load Rate. This will cause the Load Bank to unload more quickly than it loads.

Current Transformer Location:

This parameter is used to set the location of External Current transformer (CT) used for sensing connected building load.

1 = CT is located in Generator set and is sensing total current (Building + Load bank current)

0 = CT is located in building circuit and is sensing only Building Current.

Click <Back> to go back to Setup / Maintenance Screen.

Auto Load Control Operation

Load bank can be operated in two modes using <AUTO/NORMAL > selection button (on top right corner of main screen) as described below,

NORMAL: Load bank can be operated as per SET KW, Hrs., Minutes and <Load Apply> button on the main screen shown below.

AUTO: In addition to NORMAL mode operation as above, load bank is sensing Actuation of “Transfer of Control or Load bank Run” contact from customer facility.

When this contact is activated, following sequence of events will happen on load bank screens,

1) screen will flash “TOC ACTIVATED” message above <AUTO/NORMAL> button for few seconds and then message will change to “Auto Load Active” (see figure-24),

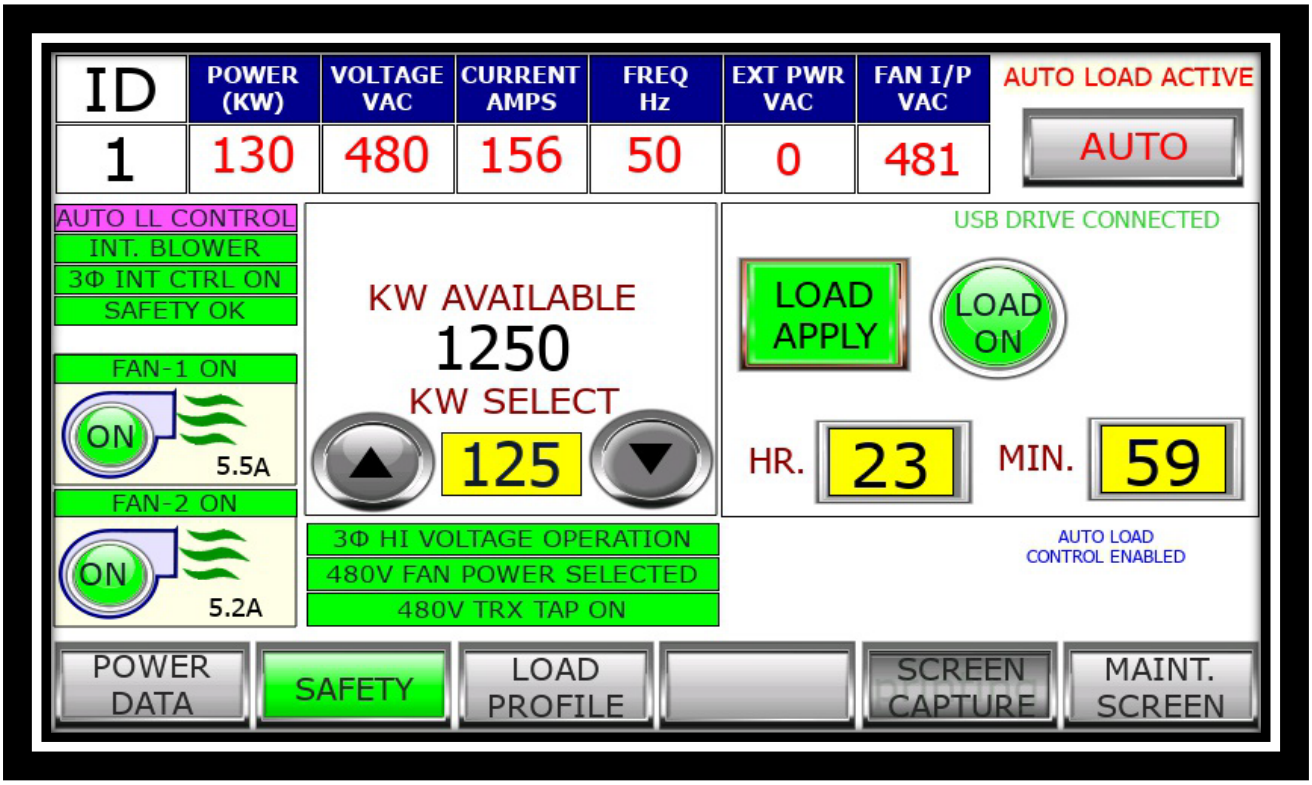

Figure-24 Main Screen

2) Hrs and min values will automatically change to 23hrs and 59 min respectively.
3) KW Select value will change automatically depending on Building Load (As sensed by External CT) to maintain minimum KW load on Generator. However, Set KW will never be higher than available KW on Load bank.
4) KW select 'increase rate' will depend on "Load Bank Load Rate" and 'decrease. rate' will depend on "Load Bank Unload Rate" set in the set-up screen. Further, KW Select value will change only if External load change is more than the EXT. Load change Dead band (KW) value set in the set-up screen.
5) <Load Apply> button will flash at regular interval of 1 sec indicating that load bank is applying load as required as per Auto Load Control corrective actions.
6) <Load Drop> button will disappear to disable any manual intervention of dropping load when load bank's Auto Load Control is active.
7) <KW Select>, KW increase, KW decrease, <Load Profile>, <Master-Slave> buttons are disabled.

Note: In case of emergency, operator can use <Load DUMP > switch on control console to drop the load or can press <Emergency stop> Push button to stop the load bank.
External CT current and calculated Building Load are shown in Power Data screen as below (see figure-25),

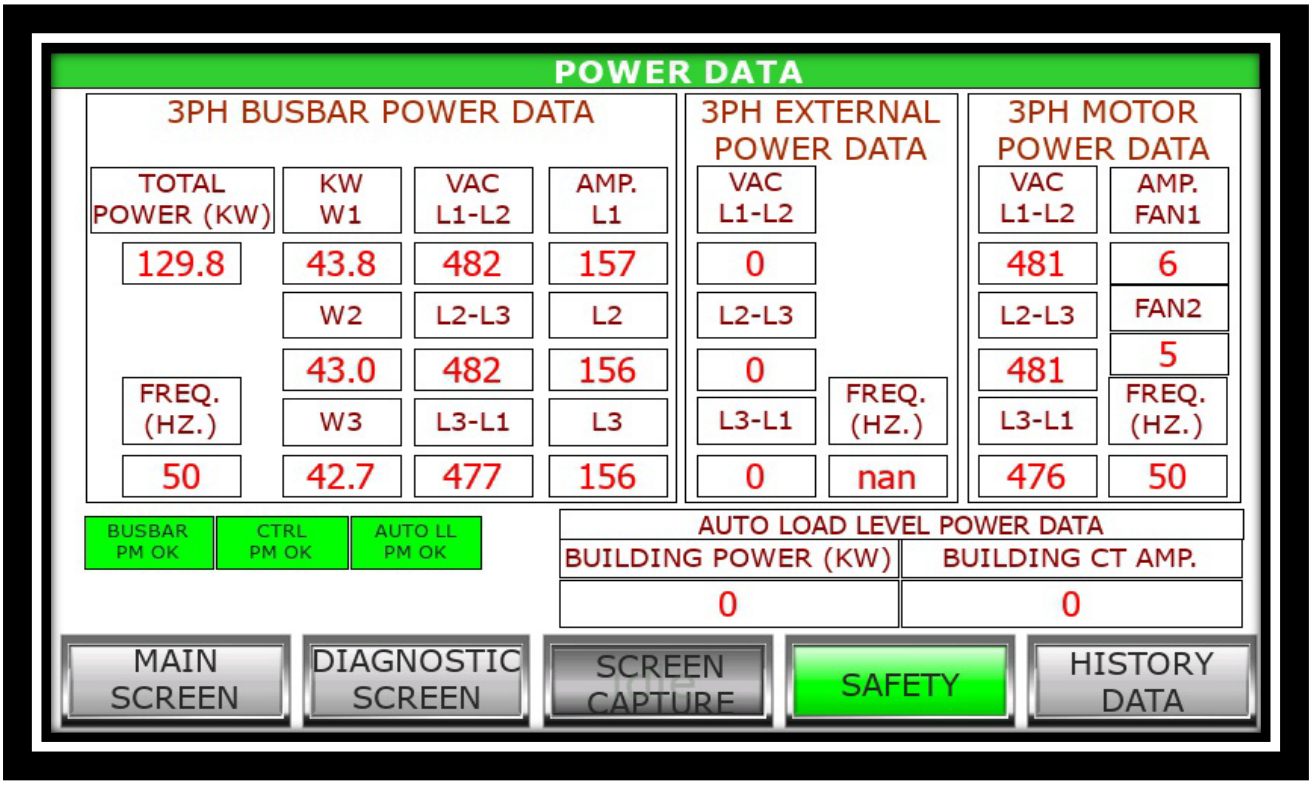

Figure-25 Power data.

While load bank running with “Auto Load Control” active as above, if Transfer of control (TOC) contact is deactivated from customer facility then TOC Deactivated message will flash on Main screen. Load bank will unload to 0 KW (as per set unload rate), all loads will be disconnected and finally blower fan will stop.

MAINTENANCE

Click <MAINT. SCREEN> Button and enter correct username, password to see below screen.

A pop-up window will ask the user to enter password. Upon correct password entry following Set up / Maintenance screen will appear (See figure 26)

WARNING
Stop Load Test / blower motor before entering this set up screen. Settings should be changed by only qualified person who clearly understands implication of changing each setting.

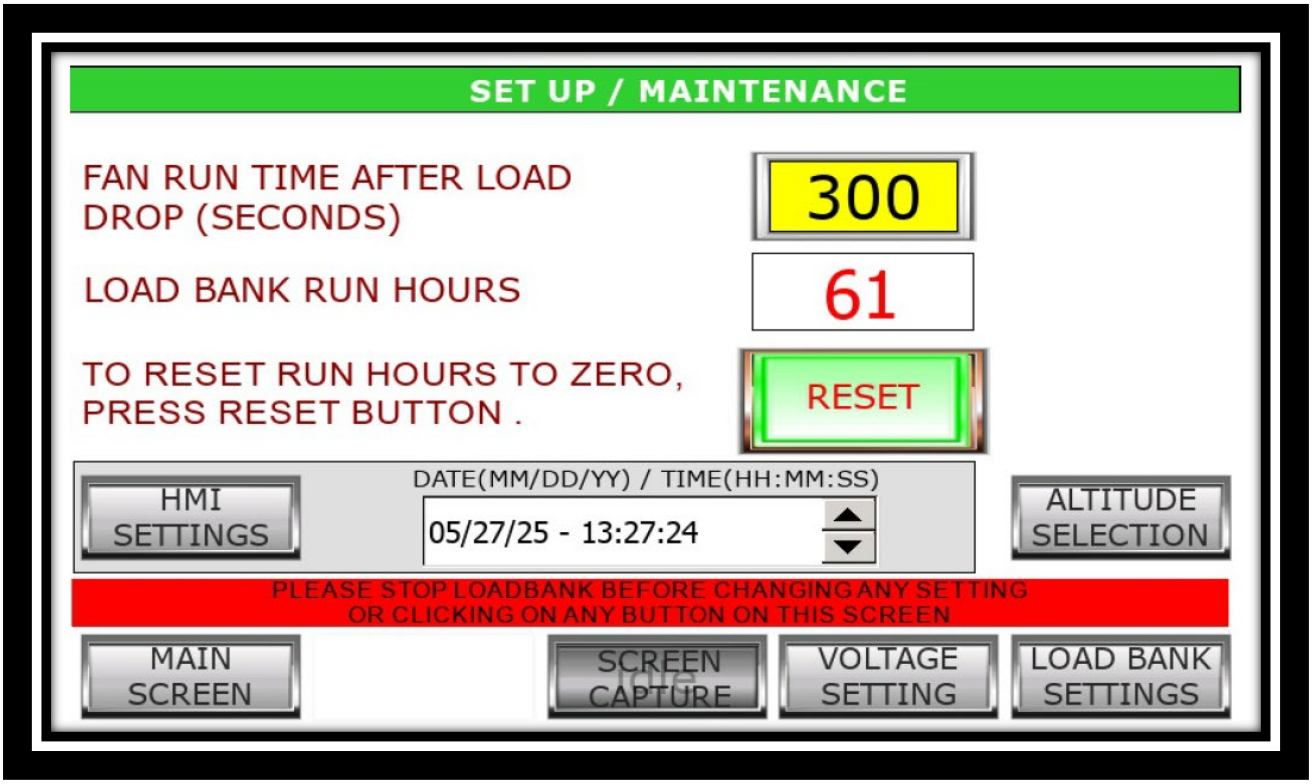

Figure-26 Set up/Maintenance.

On this screen the following settings can be done,

1) Fan Run Time after Load Drop (Seconds): Cooling time, Typically, 300 Seconds (5 Minutes)
2) HMI Setting: Click on this button to change various settings as per HMI Display manufacturer manual.
3) HMI Date/Time: Set date / time to current date / time. Used for time stamping in data logging on USB stick.

This screen also shows Load Bank running hours based on the run time of blower motor since last reset. In case of major maintenance or replacement of blower motor, run hours can be reset to zero by pressing <RESET> button.

Altitude Selection

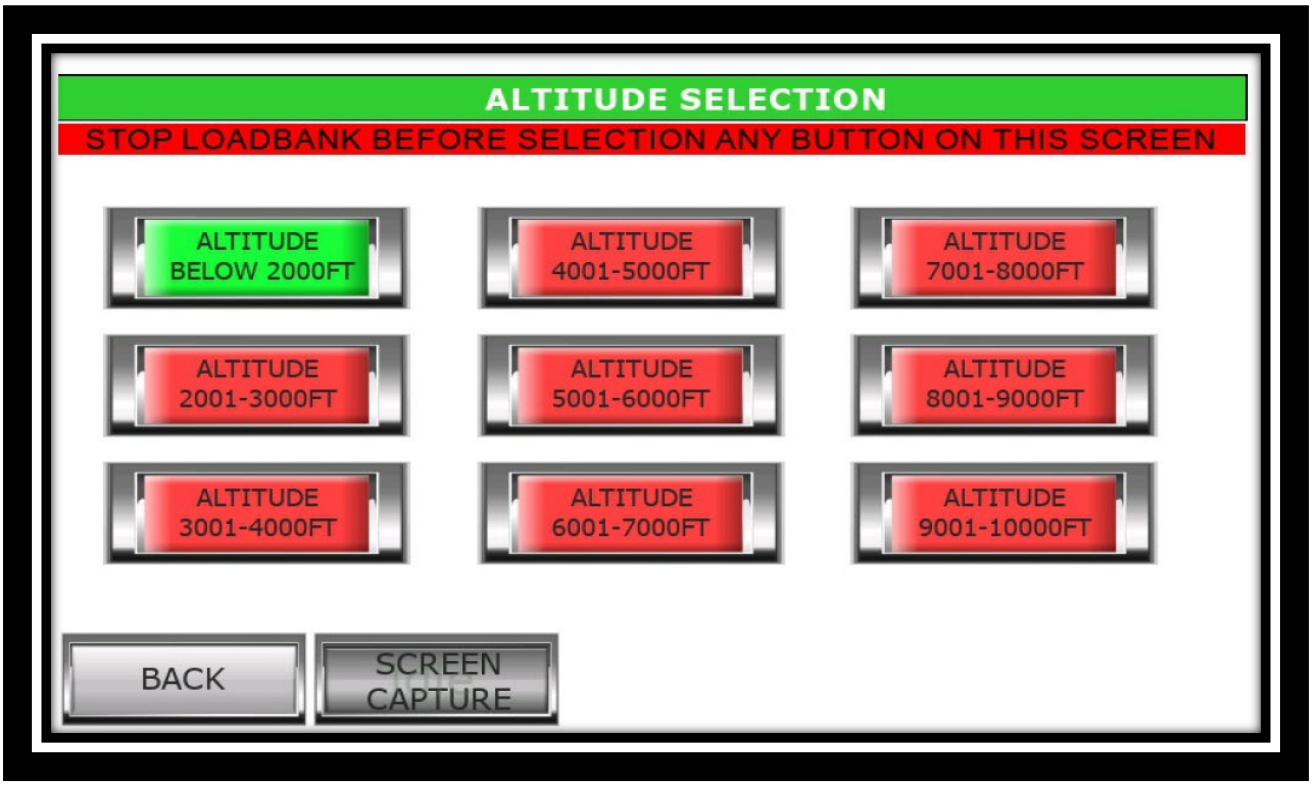

Figure-27 Altitude Selection.

Load bank can be operated at higher altitude with de-rated KW capacity as per button selection given on Altitude Selection Screen accessible through maintenance mode (see figure-27),

Operator has to select particular altitude by clicking respective button as per below table-2 selected altitude is shown in green color.

HMI Button	De-Rated KW Capacity
BELOW 2000 FT	1250 KW
2001 - 3000 FT	1050 KW
3001 - 4000 FT	950 KW
4001 - 5000 FT	850 KW
5001 - 6000 FT	775 KW
6001 - 7000 FT	725 KW
7001 - 8000 FT	550 KW
8001 - 9000 FT	425 KW
9001 - 10000 FT	350 KW

Table-2

Click on <Back> button to go back in to set up / maintenance screen.

Bus bar voltage and Current faults settings

Click <VOLTAGE SETTINGS> button to display the following screen. (See figure 28).

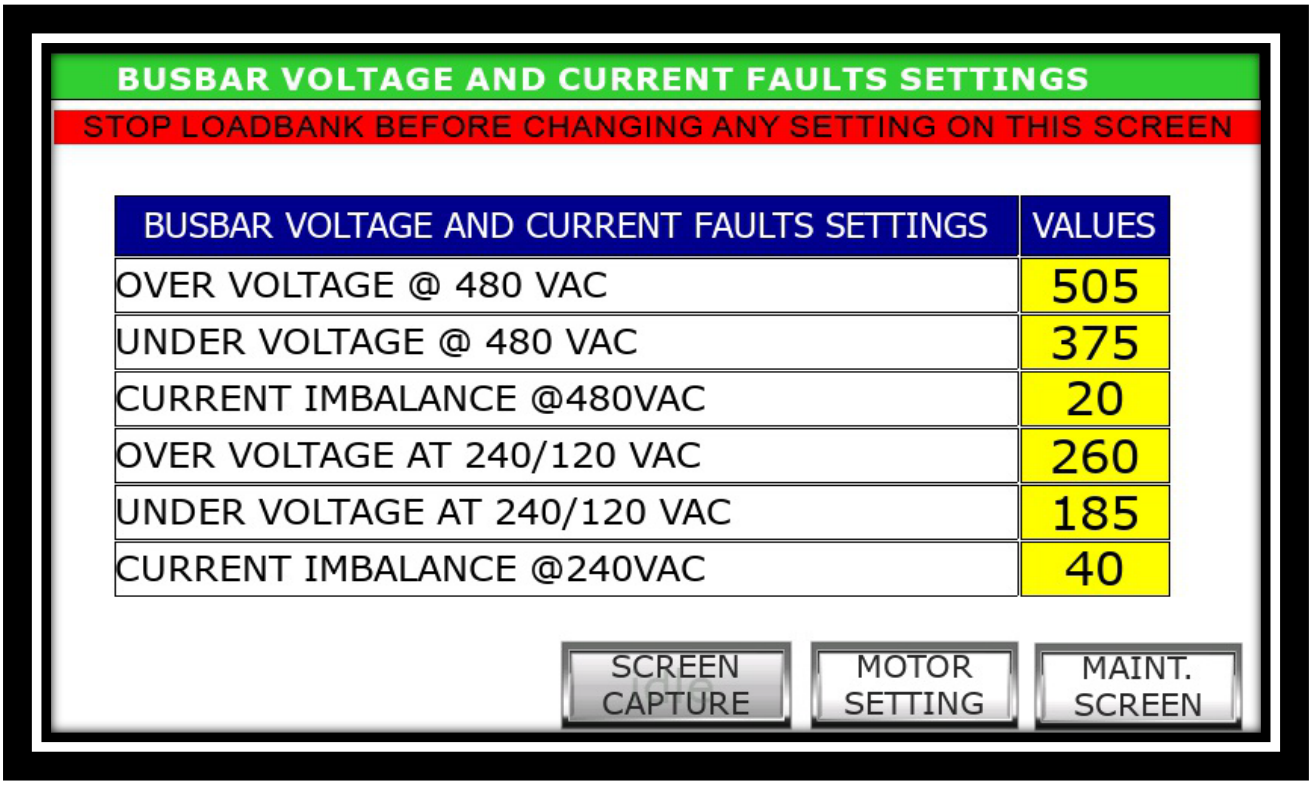

Figure-28 Busbar Voltage and current settings

Faults are sensed based on Main Input power voltage applied at the CAM-LOK connectors.

Motor setting

Click <MOTOR SETTING > button to display the Fan Motor voltage and current Faults settings screen will appear. (See figure 29)

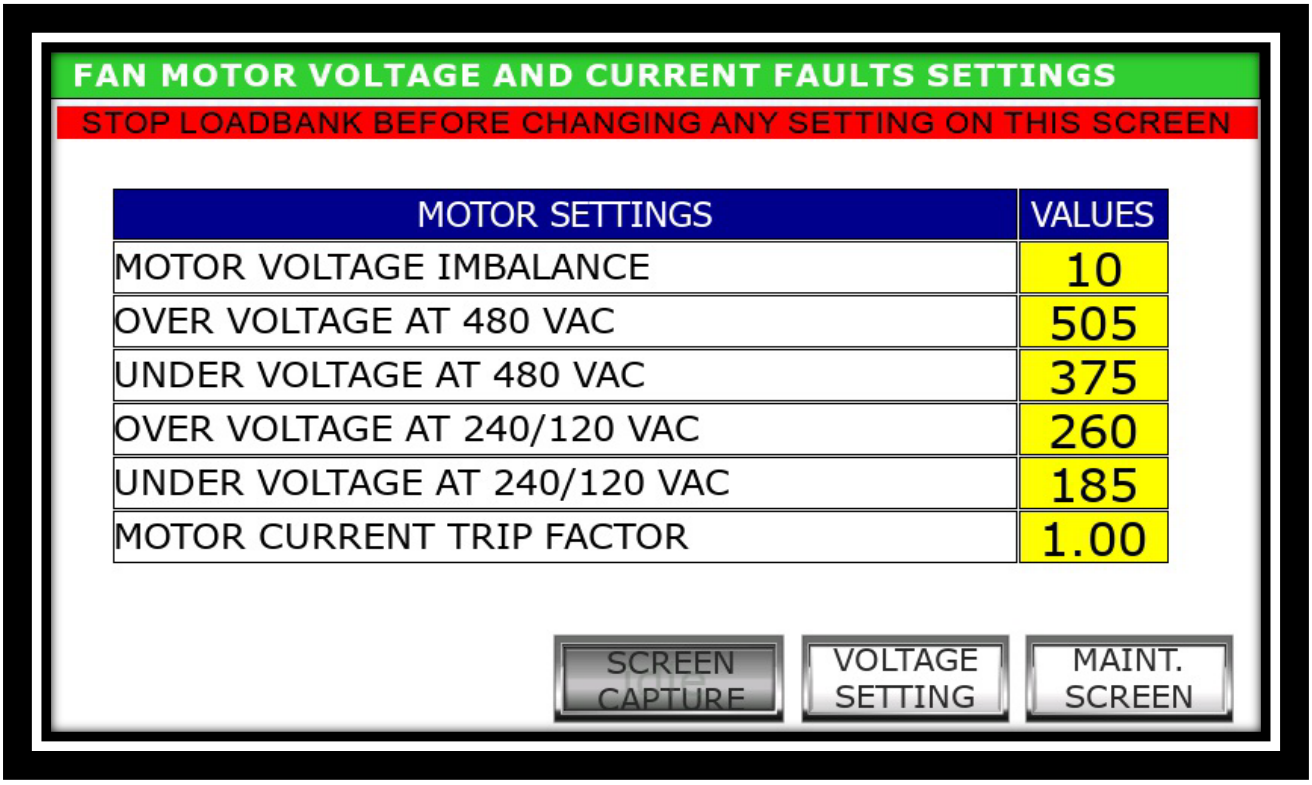

Figure-29 Motor settings

Load bank settings

Click <Load Bank Settings> button to display following screen (See figure 30),

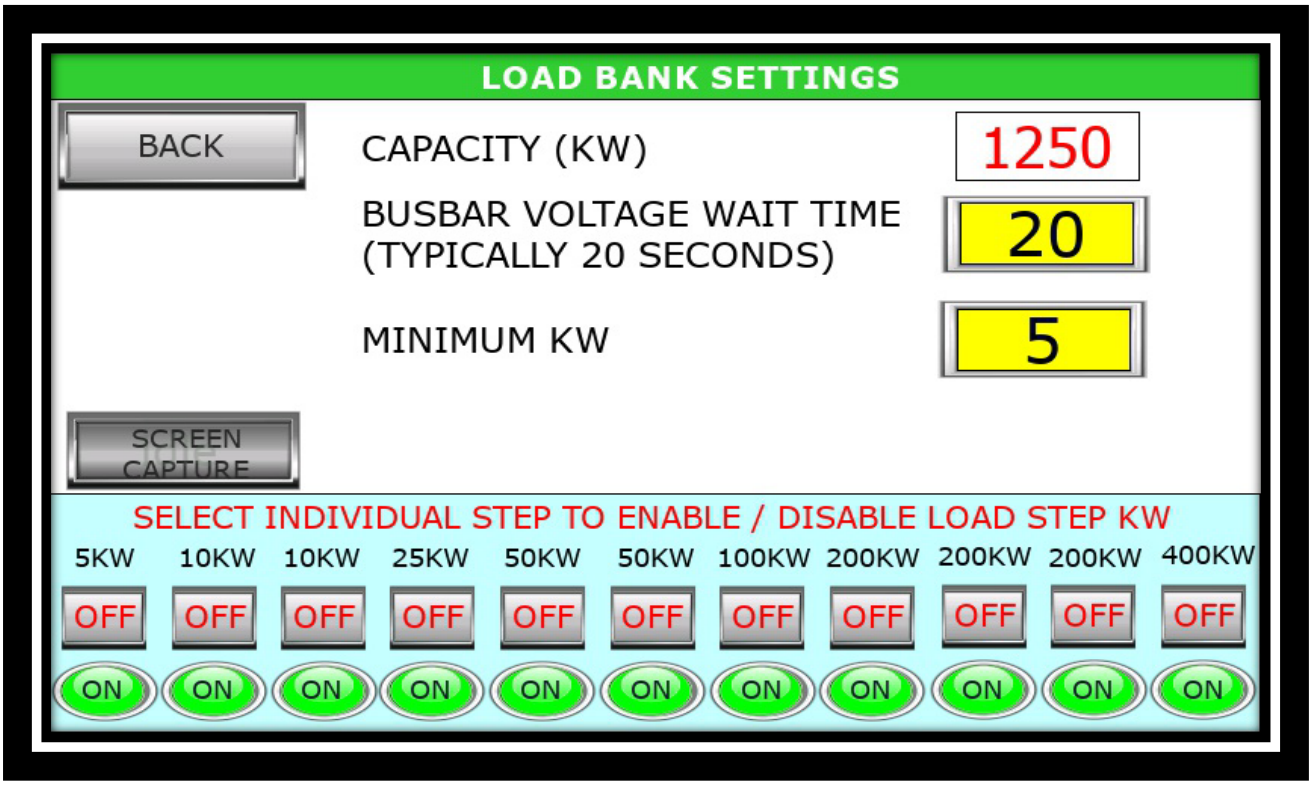

Figure-30 Load bank settings

Maintenance Guidelines:

Maintenance personnel must always exercise caution when access panels are removed. Personal injury from electrical shock or from moving fan blades could result unless all sources of power are completely disconnected before servicing.
Maintenance must always be done by a qualified technician.
Maintenance procedures must be followed to provide longevity of equipment life, and to reduce the probability of electric shock hazard, fire, personal injury, or property damage. Before servicing this equipment, completely review the "**Safety Points**" and "**Potentially Hazardous Operator Conditions**" sections of this manual.
Maintenance must always be done by a qualified and certified technician. Proper protective arch-flash clothing, eye protection, ear protection, gloves, and hard-hat should be worn when servicing or maintaining the unit.

WARNING
Disconnect from all sources of power to the unit (Main input Cam-lok, external Blower Power, External Control Power) prior to any inspection, service, or cleaning. Electric Shock Hazard exists while connected. For optimum performance and service life, preventative maintenance is a key factor. It is recommended that during scheduled inactiveness, reactivation from storage, or unit relocation the following maintenance steps are performed:

Daily Maintenance Prior to Operation

1. Inspect and remove any restrictions and/or obstructions to cold-air intake and hot-air exhaust of the Load Bank unit.
2. Check screens to make sure objects have not blocked/entered openings.
3. Verify the direction of the airflow is in the proper direction from cold-air intake to hot-air exhaust.
4. Verify that there is no possibility of re-circulation of hot-air exhaust to cold-air intake.

Quarterly Maintenance (every three months)

1. Remove all exterior access panels to Load Bank enclosure (including air intake and exhaust covers).
2. Inspect the intake and exhaust covers. Blow or brush away any noticeable dirt or debris from air intake and exhaust openings. Ensure covers are functional and free of debris. Replace any respective panel that is compromised or damaged.
3. Clean all dirt and/or debris from the interior of the entire Load Bank. Do not exceed 40 PSI when using clean, dry, compressed air for blowing and removing dust and debris.
4. Inspect the blower motor and fan blade, clearing any debris or removing any obstruction. Check the fan blade for balance and all the respective fan blades and motor mounting hardware for tightness. Torque to proper values of tightness as required.
5. Inspect all resistor elements ensuring all hardware is tightened and elements are clear and free of debris.
6. Inspect all resistors for mechanical and structural integrity and location. Replace any excessive sagging resistor elements, ceramics and support rods. Replace any and all broken or cracked termination ceramics, and ceramics on resistor support rods as required.
7. Inspect all termination ceramic insulators at resistor case ends (both sides) for breaks or cracks and replace as necessary.
8. Inspect all support rod ceramic insulators for breaks or cracks and replace them as necessary.
9. Inspect the entire inside of the enclosure for loose hardware or loose connections and tighten to proper torque values as required.
10. Inspect all load and control wiring for signs of insulation failure or breakdown.
11. Inspect for any signs of heat stress on connections and terminals. This could be a sign of losing hardware or corroded/oxidized connections. Repair and replace connection hardware as required.
12. Inspect all electrical connections to terminal blocks, main input Cam-lok bars, fuses mounted to bus bars, all resistor connections for corrosion and oxidation. Clean connections and replace hardware as required. Tighten as necessary.
13. Inspect all load step contactors. Inspect magnetic contactor coils for oxidation and rust. Inspect contacts that carry loads if pitted, rusted, or corroded. Contacts must all move freely and properly seal when closed. Replace as necessary.
14. When replacing current transformers, mark all leads before removing them to ensure proper phasing of new current transformer. Never leave the secondary of a current transformer un-shunted.
15. Reinstall all covers ensuring all materials are well in place and all hardware is properly tightened.
16. Verify Airflow protection circuit. This can be done when the unit is powered up for operation with all access panels closed and in place and blocking off the cold-air intake and/or hot-air exhaust.

17. Check all indicator lamps on the Operator Control unit (replace as necessary).
18. The blower motor should be lubricated per manufacturer's requirements as noted on motor nameplate.

CAUTION
Do not pressure wash the inside component terminal compartment (relay panel) as damage may occur to electro-mechanical load step relays, motor and control circuits, safety circuits, and terminal strip wiring. If splashed, ensure the entire compartment is dry before covering.

WARNING
Pressure washing terminal compartment (relay panel) may lead to condensation and promote internal arching.

Additional Preventative Maintenance Measures (as required)

1. The outside surface of the unit should be wiped or blown free of dust and dirt. Careful consideration to controls, metering and relay compartment must be taken into account when pressure washing the exterior of the enclosure. Ensure air intake and exhaust areas are clean and debris free. Blast or sand any noticeable corrosion areas and cover with a suitable paint or coating.
2. Remove both side access panels and ensure all resistor terminal connections including wire, bus jumper are tightened to 15 in-lb and ceramic tubes spring bushings are tightened to 9 in-lb. Inspect all ceramic bushings and insulators for cracks. Replace all broken or cracked ceramic insulators. Ensure all fan and safety component connections are tight. If required, it is safe to blow any dust from this compartment using 40 PSI or less of clean, dry, compressed air. Replace any broken or failed components. Reinstall access panel cover before proceeding with any enclosure maintenance.
3. If resistor elements are extremely dirty, elements can be pressure washed. Pressures up to 40 PSI at a distance of two feet or greater may be used when cleaning the resistor elements. Pressure should be reduced for the connection points and the distance from the nozzle to any insulator should not be closer than four feet to prevent damage.

WARNING
- Disconnect all sources of power to the unit (Main input Cam-lok, external Blower Power, External Control Power) prior to any inspection, service, or cleaning. Electric Shock Hazard exists while connected.
- For corrections requiring repair or replacement of components, contact the factory immediately for further instruction.
- Only those functions within the scope of normal maintenance are listed. This manual cannot list all malfunctions that may occur, or corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify the factory.

Note: When checking fuses for continuity, remove all fuses from fuse blocks, bus bars, fuse holders, and disconnect switch. Test each fuse individually and out of circuit. A blown fuse left in the circuit may check out OK with false reading of continuity due to feedback and return paths within the circuit.

Troubleshooting

1) No Main Power to 120 VAC Control Circuits.
- Emergency Stop / “E-STOP” push button is in the pressed position.
- Terminals were damaged during shipment.
- External Control Power Main Switch or circuit breaker is not closed.
- Control Power Transformer failure primary or secondary control power fuse is blown (check and replace as required).
- Control Circuit Fuse is blown (check and replace as required).
- Dirty or loose connections or faulty Main Power Switch.

2) Blower Motor Not Operating.
- No External Power to Motor Circuits.
- Main Power switch is in the off position.
- Emergency Stop / “E-STOP” push button is in the pressed position.
- External Blower/Control Power Main Switch or circuit breaker is not closed, or power source is disconnected.
- Blower Motor is internally wired to main input Cam-lok with no main input Cam-lok voltage applied.
- Check blower motor power selection switch is in correct position.
- External power sources are inadequate.
- Loose or broken connection at terminal block, motor starter, motor starting coil or on operator control unit (main power, blower start/stop pushbuttons)
- Blower Motor fuse is blown (check and replace as required).
- Motor Over-Load relay is tripped.
- Motor starting relay failed.
- Fan blade obstruction, motor winding failure, or shaft does not turn to improper lubrication.

3) Blower Motor Circuit energized but Fan Blade is not turning.
- Fan blade motion is obstructed or broken.
- Fan blade is loose at hub or is not keyed properly.

4) Air Failure fault indication on HMI display.
- Obstruction or restriction of air flow at Load Bank cold-air intake or hot-air exhaust.
- Blower motor phasing is incorrect, causing rotation of fan blades and wrong direction of cooling air flow. Check motor power connections for proper phase sequence.
- Exhaust over-temperature switch is activated. Sign of resistor over temperature. Verify and ensure air intake and exhaust openings are clear of any debris, blockage, or obstruction. Check for proper -blower operation and proper direction of airflow.
- Air switch or Air failure auxiliary relay is malfunctioning or not operating correctly.
- Air switch high pressure intake tubing obstruction. Remove, clean, and replace tubing as necessary.

5) Over-Temp fault indication on HMI Display.
- Obstruction or restriction of air flow at Load Bank cold-air intake or hot-air exhaust.
- Blower motor phasing is incorrect causing rotation of fan blades and wrong direction of cooling air flow. Check motor power connections for proper phase sequence.

- Airflow switch is activated, indicating a loss of cooling airflow. Sign of resistor over-temperature.
- Verify and ensure air intake and exhaust openings are clear of any debris, blockage, or obstruction.
- Check for proper blower operation and proper direction of airflow.
- Over-Temp switch or Over-Temp auxiliary relay is malfunctioning or not operating correctly.
- Air switch high pressure intake tubing obstruction. Remove, clean, and replace tubing as necessary.

6) Wrong Voltage Lamp Illuminated (dual voltage units).
- Over voltage fault indication on HMI screen: Input power voltage is higher than allowed tolerances.
- Under Voltage fault indication on HMI display: Input power voltage is lower than allowed tolerances or one phase is missing, or input phase is reversed.

7) Load Dump On indication on HMI screen.
- Indicates that all load steps are removed because load dump toggle switch is operated.

8) Resistor Open or Phase Imbalance.
- Blown load step fuse in branch load circuit (check and replace as necessary).
- Loose bus bar or loose connection at resistor terminal or fuse (tighten all bus bar and connection points as required).
- Resistor element failure and burned open (replace as necessary).

9) Load Step or Load Step application circuit cannot be energized.
- Blower Failure, Air failure, Over-Temp, Wrong Voltage, Motor Overload, Load Dump, (see item 2 to 8 above).
- Load Dump switch is operated. One or more of the branch circuit load step fuses for the load step in question is blown (check and replace as necessary).
- One or more of the load step resistors for the load step in question has failed or burned open (check and replace as necessary).
- Load step contactor has failed or is inoperative due to losing connection or failed-open coil.

10) Load Step energized without a rated load, or un-balanced load.
- Applied main input bus voltage from power source under test is de-rated, low, imbalanced, or inadequate.
- Contactor failure or not closing properly. Loose connection.
- One or more of the branch circuit load step fuses for the load step in question is blown (check and replace as necessary).
- One or more of the load step resistors for the load step in question has failed or burned open (check and replace as necessary).

11) Load Step contactor or relay chattering.
- Contacts are pitted or oxidized.
- Magnetic core and coil are dirty or corroded.
- Coil connections to the contactor are loose.
- 120 VAC control circuit line voltage is low and/or inadequate.

12) Switchgear Circuit Breaker trips or Main Disconnect fuses are blown.

- Fuses and/or circuit breaker trip settings are undersized.
- A short circuit exists at the Load Bank Resistor (main input Cam-lok or blower circuit).
- A short exists in the power conductors feeding the Load Bank Resistor. Note: When checking fuses for continuity, remove all fuses from fuse blocks, bus bars, fuse holders, and disconnect switch. Test each fuse individually and out of circuit. A blown fuse left in the circuit may check out OK with false reading of continuity due to feedback and return paths within the circuit.

LOAD BANK LIFTING

- Weight of load bank is 1450KG (3197 Pound).
- Use forklift which has capacity of 2 ton with fork length of 42'' (minimum).
- Slide the fork to the desired location on the crossbar. Lift the fork slightly until it drops into the slots on the load bank.
- Now move forklift to forward side to position fork inside slots on the load bank. Make sure load banks doors do not get touch to the forklift.
- Now, lift load bank @ 1 ft distance above floor and move forklift to the desired location.
- Below Picture for reference only (See figure 31),

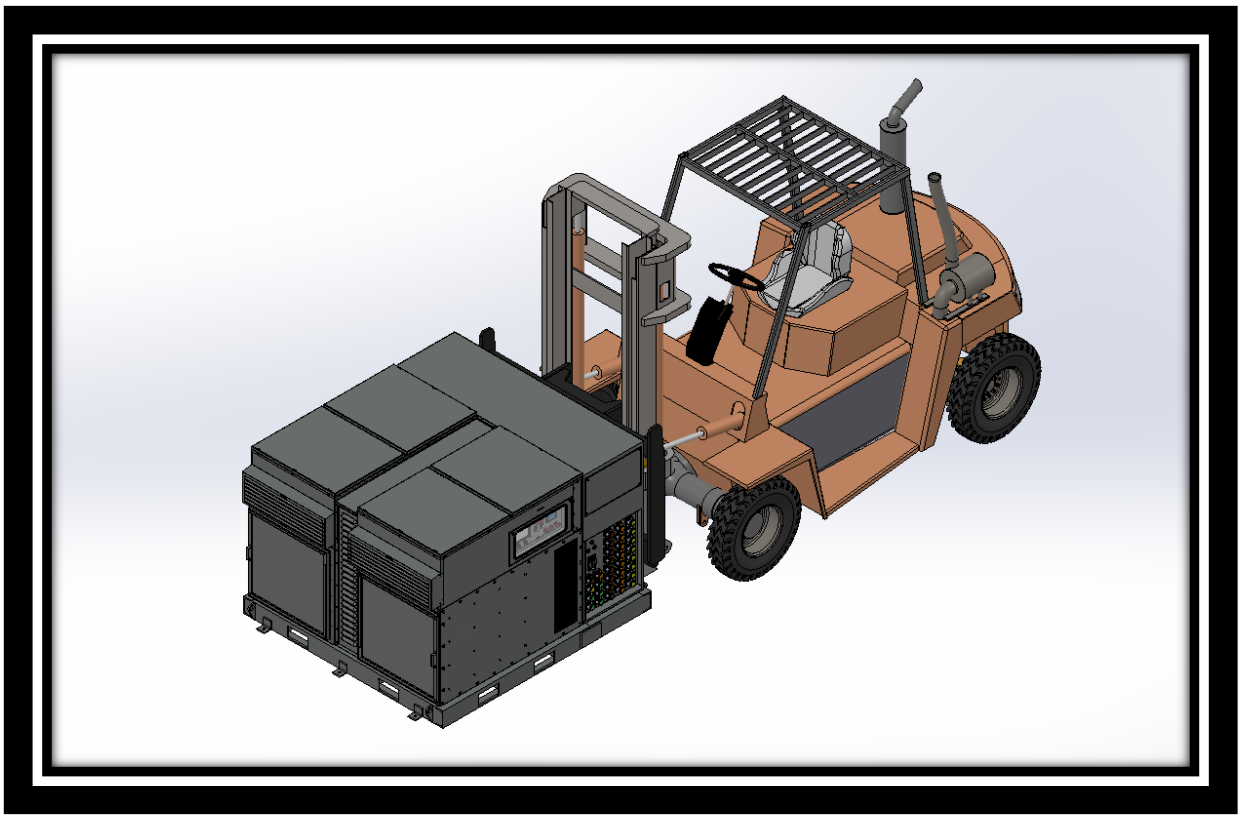

Figure-31 Load bank lifting with Forklift.

Storage

- It is recommended that the unit be stored Indoor/Outdoor in a dry enclosed area. There is no special preparation required.
- If the unit is to be unused or stored for any length of time Indoor/Outdoors, cover the unit to prevent any accumulation or buildup of dust or dirt. If stored outdoors, do not cover with plastic that may create condensation and enclosure corrosion or staining (keep exhaust hood in place).
- Storage temperatures should remain -4°F to +122°F [- 20°C to +50°C].

Shipping

- Attach the enclosure to a skid constructed with minimum board thickness of two inches (2") to properly support the unit's weight. Use (4) or more lag bolts in the mounting base holes provided at the entrance to the integrated forklift tine receptacles and properly secure the load bank to the mounting skid.
- Secure all loose parts in the bottom of the enclosure and reinstall cover.
- Pack, seal securely in a sturdy wooden crate or equivalent, with sufficient padding to avoid shock damage.
- Ship Operator Control Unit separately.
- If returning to the factory, a factory Return Merchandise Authorization (RMA) Number will be required prior to shipment or may be refused at the dock.

Customer Service

Any maintenance or service procedure beyond the scope of those provided in this manual should be referred to a factory engineer. All units returned for service must be shipped prepaid and to the attention of the factory engineer in which return, and service were discussed with RMA number noted.

Contact Information

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APPENDIX A: ELECTRICAL SCHEMATICS

See PDF file provided separately.

APPENDIX B: BILL OF MATERIAL

Provided upon request.

APPENDIX C: DIMENSIONAL DRAWINGS

See PDF file provided separately.