

# ***V-PM1000 Series***



## ***VP-1405A User's Manual***

***Intelligent 48V Charger and Power Supply with  
Monitoring System for Automation Purpose***



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## **Chapter 1 - Introduction**

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### **1.1 General Information**

This is technical information and user's manual of V-PM1000 Product Series a product model of VP-1405A the intelligent battery charger and power supply device from the Veesta World Company. This document helps you to find about how V-PM1000 Series works and designed for your purpose.

V-PM1000 Series consist of many power system and module device from DC-DC converters, AC-DC converters, battery charger, power supply system and other related power application for the power electric system adopted for from very small function as like of power supply from that can be used in as conventional power systems up to very large function intelligent charger and supply system for unmanned substation and automation stations and distribution in electric or telecommunication and other facilities networks.

The VP-1405A power supply with battery backup system is an ideal device to supply power source for the SCADA and automation projects when continuous monitoring and control to system is required.

### **1.2 Features**

The VP-1405A provides not only power source in 48V system DC for the automation products but also metering for current, voltage of load as well as battery backup voltage and current value. Programmable set-points and optional assignable output relays allow to have monitoring device and your power supply and battery charger could be controlled and monitored remotely by other system like Remote Terminal Units or Programmable Logic Controller.

The provided measurement to DC load and battery load is a good thing that any control center could gathering data and save historical information and study over the main supply of power system remotely as well as providing more reliability to the automation applications.

All above monitored values are available via digital communication port RS485 running the ModBus® protocol. Also it is possible to define the 4 alarm output relay to be interconnecting hard wiring 4 alarms of power supply and battery charger to the other system or providing the alarm and indication annunciated.

The device has ability to be also configured some operation on relay out put with alarm mapping to which alarm and status indication of the intelligent power supply and battery charger.

The VP-1405A adopts connection realized by terminals that can be pulled out and inserted, thus facilitating on-site wiring and maintenance.

### **1.2.1 Characteristics**

- Metering of DC output load current and voltage
- Metering of Charger voltage charge and current charge
- Metering of Battery discharge current and voltage
- Commercial, industrial, utility
- Independent battery charger
- High Isolation between mains AC input and outputs
- Flexible control for demand battery deactivation and battery discharge activation
- 4 controlled relay outputs for alarm and indication
- Programmable alarm and status indication
- LED display on module within the 4 operation push button
- RS485 serial port
- ModBus® RTU protocol
- Smart and compact design

### **1.2.2 Standard features**

The VP-1405A is wall mount power supply for 48V DC system with battery backup as called as DC-UPS system.

The change of power source of mains AC input will switch to back-up battery connected to system in zero switching time.

The device can carry out 5.6A continues current and also 13A current in a time smaller than 30 seconds for driving any motor or actuator in the automation projects.

### **1.2.3 Metering Features**

The VP-1405A provide the metering of output load current, voltage and also the battery load and voltage in good accuracy which whelp users to maintain the operation of their system load and also the battery life. This information is available via the ModbusRTU protocol by RS485 communication network.

- Output load Voltage metering
- Output load Current metering
- Battery Voltage metering
- Battery Current metering
- Battery Charge/Discharge metering

A keyboard and light contrast LED display also provided to do some urgent case operation or status monitoring.

### **1.2.4 Setting and Set-points**

In VP-1405A there is a feature that you can provide some settings regarding the change default configuration or apply new setting for operation as like as any of the assignable output relays may be used to trigger and alarm for specific applications and status.

You can also assign and change some threshold like alarm of under voltage or change of shutdown output load regarding the current situation of battery voltage and etc.

### **1.2.5 Communications**

Integrate process, instrumentation and electrical requirements in a plant automation system by connecting VP-1405A power system together to a DCS or SCADA system. A PC running the VP-1405A can change system set-points, monitor values, status and alarms. Continuous monitoring minimizes process downtime by immediately identifying potential problems due to faults or changes from growth.

- RS485 ModBus® 2,400; 9600; 19,200; 38,400 bps
- RTU SCADA system component
- Measure actual values
- Read status
- Issue control commands
- Load all set-points
- Change individual set-points

### **1.3 VP-1405A Software Tools program**

The "VP-1000 Software Tool" is PC program in Windows based program for the VP-1405A. It can be used to enter set-points, read metered values, monitor status and evaluate power quality. All data continuously gathered by the VP-1405A can be transferred to a third party software program for display, control or analysis via the communications interface.

Once all set-points have been entered they can be downloaded into any VP-1405A or stored in a file with a tag name for later reference. Screens are available for monitoring all measured values such as current, voltage or power. Status of alarms and control settings can also be displayed.

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## **Chapter 2 - System Overview**

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### **2.1 Overview**

In places that need reliable power supply and also backup power via battery is important and is an important issue for any engineer or consultant or user, the unique design charger of the VP-1405A from V-PM1000 Product Series of Veesta World Company along with its quality construction will be a complete and convincing answer for everyone.

In this chapter you will find how this product has been designed and how it can help you.

### **2.2 Design Principals**

The VP-1405A can work after inputting AC power. The power supply will power the load, and at the same time, the battery is charged by constant current and constant voltage (CC/CV mode). When the battery is finished charging, the power supply automatically switches to the floating state. Meanwhile the power supply provides floating charging voltage and current to supplement the normal self-discharge of the battery.

When the AC is powered off, the battery is continuously providing the power to the load in zero switching time. When the battery is discharged to the under-voltage alarm point, the battery under-voltage warning signal is on. When the battery discharge is lower than the under-voltage protection point, the power is automatically turned off. These points are programmable and also can be set Modbus RTU. We do not recommend changing values of these points.

If it is need to turn off the battery output in advance, it can be done manually by press the battery OFF button for 5 seconds or remotely control the relay controlled by the CPU to short-circuit the battery remote control terminal or also by remote Modbus RTU command, then the battery will be shut down in advance.



Note: The battery early exit function is forbidden when the battery is activated; otherwise the load will be powered off for a short time. When the battery exits early and the load is cut off, the power can be restored only manually or when the AC is restored.

When the load requires a large inrush current and exceeds the maximum current supplied by the power supply, the power supply will be protected and turned off by itself. Then the load current is completely provided by the battery. When the load current is less than the maximum current supplied by the power supply, the power supply automatically starts working.

For more information please see the internal circuit of VP-1405A on the bellow picture:

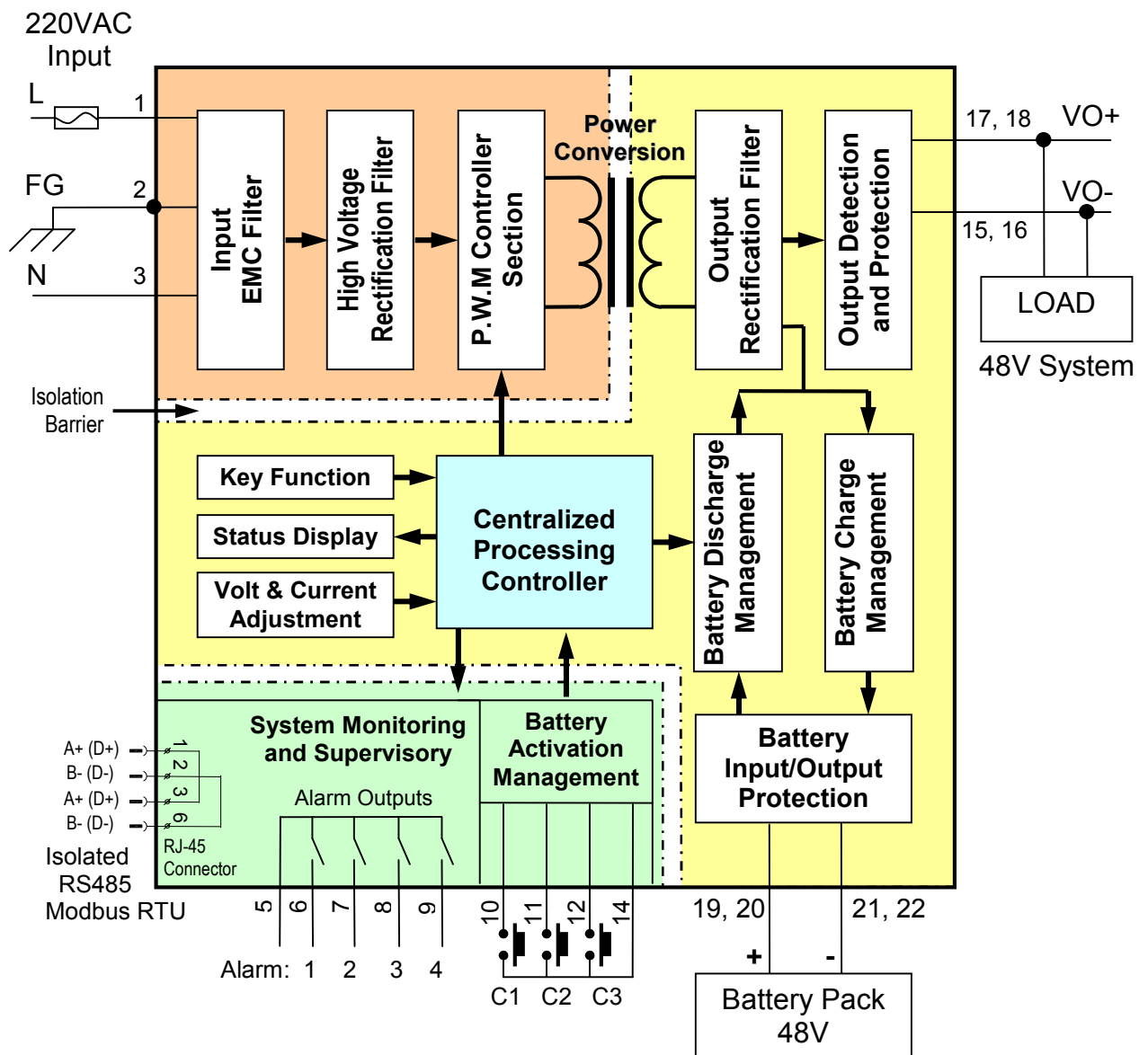


Figure 2-1: VP-1405A Design Principal

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## **Chapter 3 - Specifications**

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### **3.1 VP-1405A Specifications**

#### **3.1.1 Main AC Power input**

- 1. Phase & Wires** : 2 wires Line & Neutral
- 2. Input Voltage Range** : 165 to 265 VAC, Typical 220 VAC  
200 to 375 VDC, Typical 300 VDC
- 3. Frequency ( AC Input )** : 50 Hz ( 40 to 60 Hz)

#### **3.1.2 Output Specifications**

- 1. Output Voltage** : Typical: 53.5 V  
**Full AC Input range** : Minimum: 53.2 V  
Maximum: 53.8 V
- 2. Output Voltage** : Minimum: 42.0 V  
**(AC Fail, Battery Power)** : Maximum: 53.8 V
- 3. Typical Output Current** : Minimum: 0 A  
Typical: 5.6 A  
Full Input range exclude the charge current
- 4. Boost Output Current** : Maximum: 13.0 A  
Boost transient current applicable for time  $\leq$  30s  
seconds (when no battery connected)
- 5. Ripple & Noise** :  $\leq$  200 mV peak to peak in full output load and full  
input ranges

- 
6. **Source Effect** :  $\pm 0.1\%$  in full input range
  7. **Load Effect** :  $\pm 0.2\%$  in load range from 0.5A to 5.6A
  8. **Battery Float Voltage** : Typical: 53.5 V  
Minimum: 53.2 V  
Maximum: 53.8 V  
Full input range, Output load 5.6A, Charge 0.01A
  9. **Battery Constant Charge Current** : Typical: 1.3 A  
Minimum: 1.0 A  
Maximum: 1.4 A
  10. **Low Battery Power Warning** : Typical: 45.2 V  
Activation threshold minimum: 44.0 V  
Deactivation threshold maximum: 46.0 V
  11. **Battery Discharge Cut-off Power Point** : Typical: 43.0 V  
Activation threshold minimum: 42.0 V  
Deactivation threshold maximum: 44.0 V
  12. **Battery Discharge Resistance** : 50 milliohm
  13. **Maximum Output Current** : 15 Ampere

### 3.1.3 Protection Functions

1. **Output Over Current Protection** : 15.3 A  
Shutdown output
2. **Output Short Circuit Protection** : Turn off output, Cancel Auto-Restart
3. **Output Over Voltage Protection** : Activate on 60.5 V  
Threshold between 59 – 61 V
4. **Battery Reverse Connection Protection** : Activate Shutdown  
Return to work after normal wiring
5. **Input Over Current Protection** : Should be applied by External 4A/250VAC Fuse  
in series of input line connector.

### 3.1.4 Communication Port

1. **Rear Panel port** : RS-485 Network 2 wires for networking to master  
Baud-rate: 2400, 9600, 19200, 38400 bps  
Parity: None, Odd, Even  
Start/Stop: 1 bit, 2 bits
  
2. **Port Specifications** : RJ-45 Connection Port  
Isolated 2500V communication port
  
3. **Communication Protocol** : ModBus RTU Protocol  
Slave Address: 1~247  
Function Support: 03/04/06/16  
Factory Defaults: 9600 bps
  
4. **Factory Defaults** : Baud rate: 9600 bps  
Parity: None  
Start/Stop: 1 bit  
Slave Address ID: 200

### 3.1.5 Alarm outputs

1. **Relay Outputs** : 4x Configurable Alarm Output Relays  
Default Alarms:
  - Alarm Out 1: AC Input Power OK Status
  - Alarm Out 2: Any Failure Alarm
  - Alarm Out 3: Battery Fail/Under voltage Alarm
  - Alarm Out 4: Battery Disconnect Alarm
  
2. **Contact Switching Current:** 1.0 A
  
3. **Contact Rating Voltage** : 250 VAC
  
4. **Contact / Coil Isolation Voltage** : 3 kV
  
5. **Contact Short Circuit Protection** : Activate on maximum 1.1 A  
Auto-resettable Fuse

### 3.1.6 General Specifications

1. **Efficiency** : 84% in typical AC input, 5A output, full battery
2. **Temperature Coefficient** :  $\pm 0.02$  % per degree of centigrade ( $^{\circ}\text{C}$ )  
In typical input voltage, 5A output
3. **Indicators** : 6 LEDs  
4 Keys
4. **Insulation Resistance (Test Voltage 500 VDC)** : Input to Output: 80 M $\Omega$   
Input to Case: 80 M $\Omega$   
Output to Case: 80 M $\Omega$
5. **Isolation Voltage** : Input to Output: 2250 VAC / 5mA / 1 min  
Input to Case: 2250 VAC / 5mA / 1 min  
Output to Case: 500 VDC / 5mA / 1 min  
Alarm contact to coil: 3000 VAC / 5mA / 1 min  
RS485 port to system: 2500 VAC / 5mA / 1 min

### 3.1.7 Environment

1. **Operating Condition** : Temperature range: -25 to +60 $^{\circ}\text{C}$   
Ambient temperature over +55 $^{\circ}\text{C}$  should position module heat sink in air cooled position that case temperature should not exceed of +85 $^{\circ}\text{C}$
2. **Storage Condition** : Temperature range: -40 to +100 $^{\circ}\text{C}$
3. **Humidity Condition** : RH: 5-90% non-condensed

### 3.1.8 Dimension / Physical

1. **Dimension** : Width: 170mm  
Length: 120mm  
Height: 45mm
2. **Mounting** : Wall mount with flange holders
3. **Weight** : Approx. 1.4 kg.

## Chapter 4 - Unit Installation

### 4.1 Unit Observation

The VP-1405A is a wall mount device that install on the any place in cubicles, control cubicles and normally in the place that have good air-cooled conditions. It is recommended that assure the good air-cooled position for the VP-1405A module.

### 4.2 Terminal Definitions

The VP-1405A consists of attachable terminal block. It is recommended detach terminal block and do wiring based on the instructions on this manual. Afterwards attach terminal wires to the base unit.



The warranty of system is based on correct wiring of device, if any wrong wiring it may damage the device and it is out of scope of warranty.

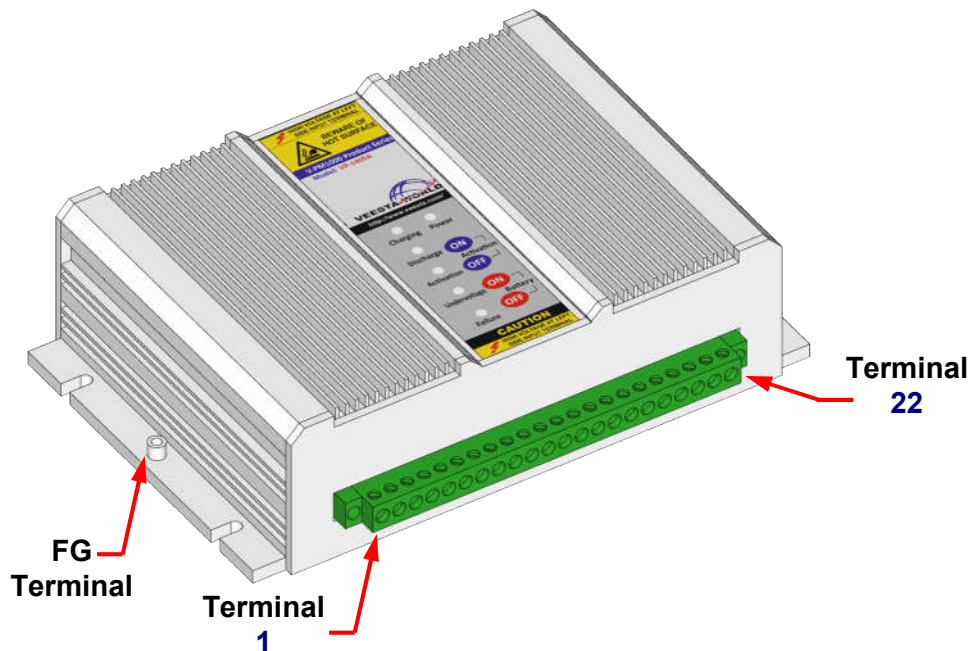


Figure 4-1: VP-1405A Terminal Definitions



In regarding the terminals numbered from 1 up to 22, please pay attention that terminal with code (--) tagged as NC (Not Connect), so you should leave this terminal float and disconnect to any wiring.

You can find in bellow table for 22 terminals which number from left to right on basis of front view of module:

*Table 4-1: VP-1405A Base Terminal Definitions*

No.	Code	Definition
1	L+	Line Input of power supply
2	PE	Earth protection Field Ground System
3	N-	Neutral input of power supply
4	--	No electrical connection leave open and not connected
5	AM	Common input of output contact alarms
6	A1	Alarm 1 Output (Default AC Input OK Status)
7	A2	Alarm 2 Output (Default Any Failure Alarm)
8	A3	Alarm 3 Output (Default Battery Under voltage Alarm)
9	A4	Alarm 4 Output (Default Battery Fail Alarm)
10	C1	Remote Activation Start Command
11	C2	Remote Activation Exit Command
12	C3	Remote Battery Exit Command
13	--	No electrical connection leave open and not connected
14	CM	Common return wire of C1,C2,C3 Command
15	VO-	Load Output Negative
16	VO-	Load Output Negative
17	VO+	Load Output Positive
18	VO+	Load Output Positive
19	B+	Battery Connection Positive
20	B+	Battery Connection Positive
21	B-	Battery Connection Negative
22	B-	Battery Connection Negative

**Note:**



Terminals of VO+ and VO- and B+ and B- consist of two pins that you should use for each pin connection of 25mm wire size that system able to drive enough output currents.

### 4.3 Mains Power Supply Connection

A power supply to the VP-1405A can be in two options which should be selected one of them during ordering the component.

The power supply input of VP-1405A is a universal AC / DC voltage with range 165~265VAC, 40~60Hz, and 200~375VDC. This should be connecting to the field mains power via 4A/250VAC fuse to protection.

Extensive filtering with transient protection is built into the V4-1405A to ensure reliable operation. Transient energy must be suppressed and conducted back to the source through filter ground terminal PE and also FG screw pins on the chassis.

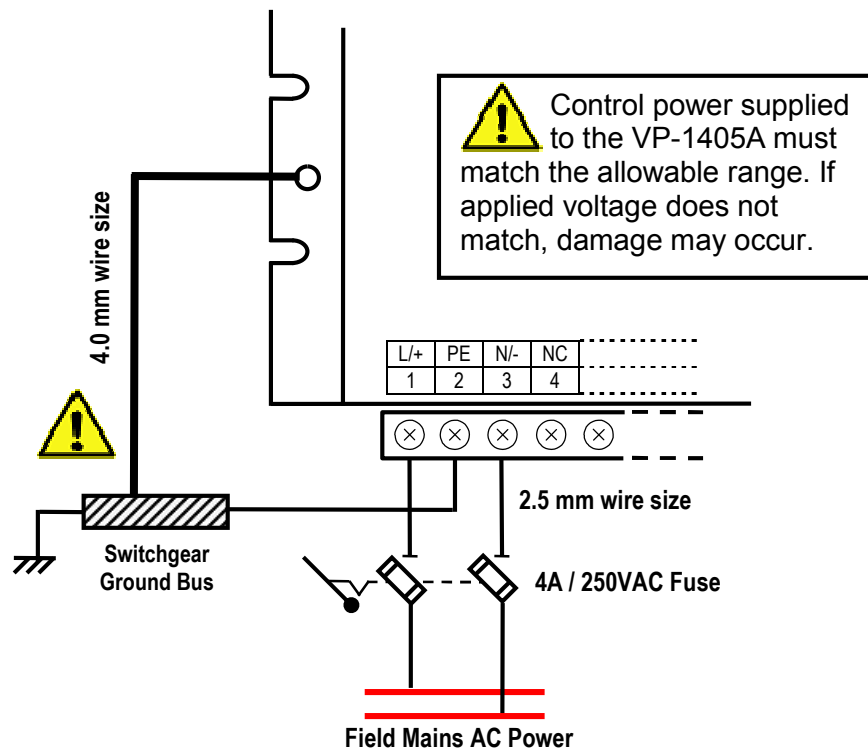


Figure 4-2: VP-1405A Power Supply & Field Ground

### 4.4 Field Ground

The PE terminal input and chassis FG terminal screw on the module VP-1405A are required to use ground cable and connect to the switchgear or your System Ground Bus.

## 4.5 Precautions in Installation



Bellow list are the precautions that you should follow during the installation of VR-1405A to achieve best performance. In some case if you do not follow these instructions your device may be damage, so it is important you follow these terms and conditions during the installation:

- Please select the wire with the cross-sectional area greater than 2.5 mm<sup>2</sup> for the output cable,
- Install miniature circuit breaker in 4A/250VAC fuse for the input mains.
- The terminal capacity is 15A, the output and battery terminals use two terminals wiring, so you should use from double wiring for load and battery connections; otherwise it is easy to burn the terminal and wire!
- The alarm terminal is forbidden to overload and short circuit, otherwise the electronic alarm contact will be burned.
- The product is not allowed to work in parallel without extra Parallel and Redundancy expansion module.
- The PE is connected to the shell inside, as well as FG screw. The PE and FG should be reliably connected to the earth to increase the anti-interference ability.
- The installation method is to face the identification and the terminal is installed in the vertical direction to ensure that the heat sink is perpendicular to the ground to facilitate heat dissipation.
- When the power supply is working, the outer casing is hot, up to 85°C. Please keep a certain gap (minimum 10 cm) around the power supply to keep the air flow to facilitate heat dissipation.
- Keep temperature-sensitive devices or heating components as far away as possible from the power supply.

## 4.6 RS485 Communication Wiring

A serial port provides communication capabilities between the power module of VP-1405A and remote computer, PLC or distributed control system (DCS) or any remote terminal unit (RTU) by the RS485 communication standard and it can be daisy chained together with 24 AWG stranded, shielded, twisted pair wire on a single communication channel.

Suitable wire should have a characteristic impedance of 120 ohms such as Belden #9841. These wires should be routed away from high power AC lines and other sources of electrical noise. The total length of communications wiring should not exceed 1200 meters for reliable operation.

Correct polarity is essential for the communications port to operate. The connector type of RJ-45 provided to easy communication wiring and short connection on the RS485 data bus. In this regards you should arrange the bus wiring based on RJ-45 socket. The pin 1 of RJ-45 socket has been arranged to the RS485 Data+ and pin 2 corresponds to the RS485 Data- (A+) bus wiring. Also pin 3 interconnected to the pin 1 and use for Data+ and pin 6 interconnects to the pin 2 for Data- (B-) wirings. This will help you use easy from standard RJ45 network connection wiring to be used on this system.

Therefore terminal pins of RJ-45 1&3 (485+ or D+) of every VP-1405A in a serial communication link must be connected together. Similarly, terminal pins of RJ-45 2&6 (485- or D-) of every VP-1405A must also be connected together. These polarities are specified for a "0" logic and should match the polarity of master device.

The last device in the chain and the master computer need a terminating resistor and terminating capacitor to prevent communication errors by ensuring proper electric matching of the loads. Using terminating resistors on all the devices on network would load down the communication network while omitting them at the ends could cause reflections resulting in communication errors. Install the 120Ω terminating resistor and 1nF capacitor externally.

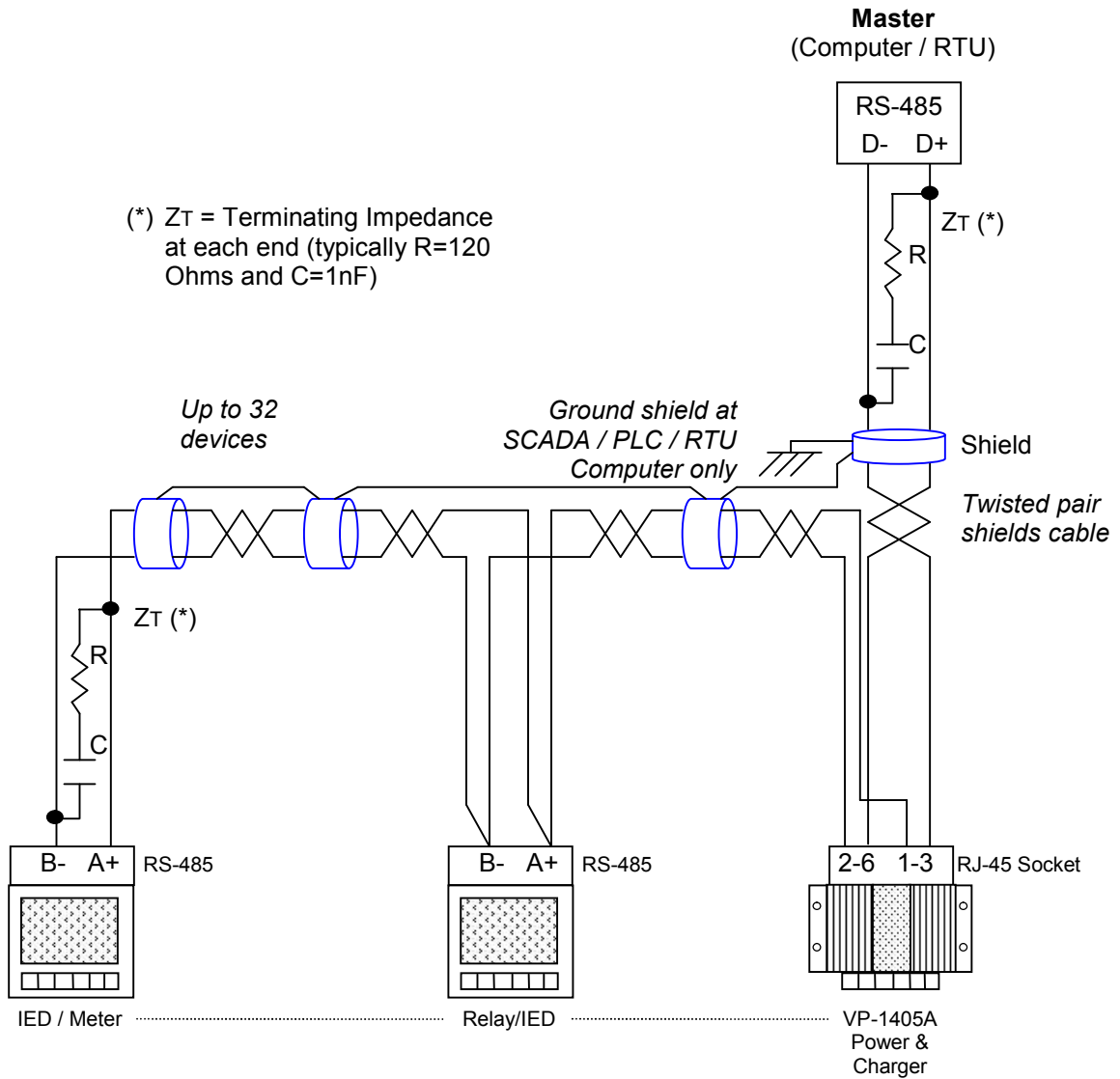


Figure 4-3: VP-1405A RS-485 Communication Wiring

## 4.7 Wiring Diagram

In the bellow diagram you can find the general wiring diagram of power supply and battery charger module VP-1405A.

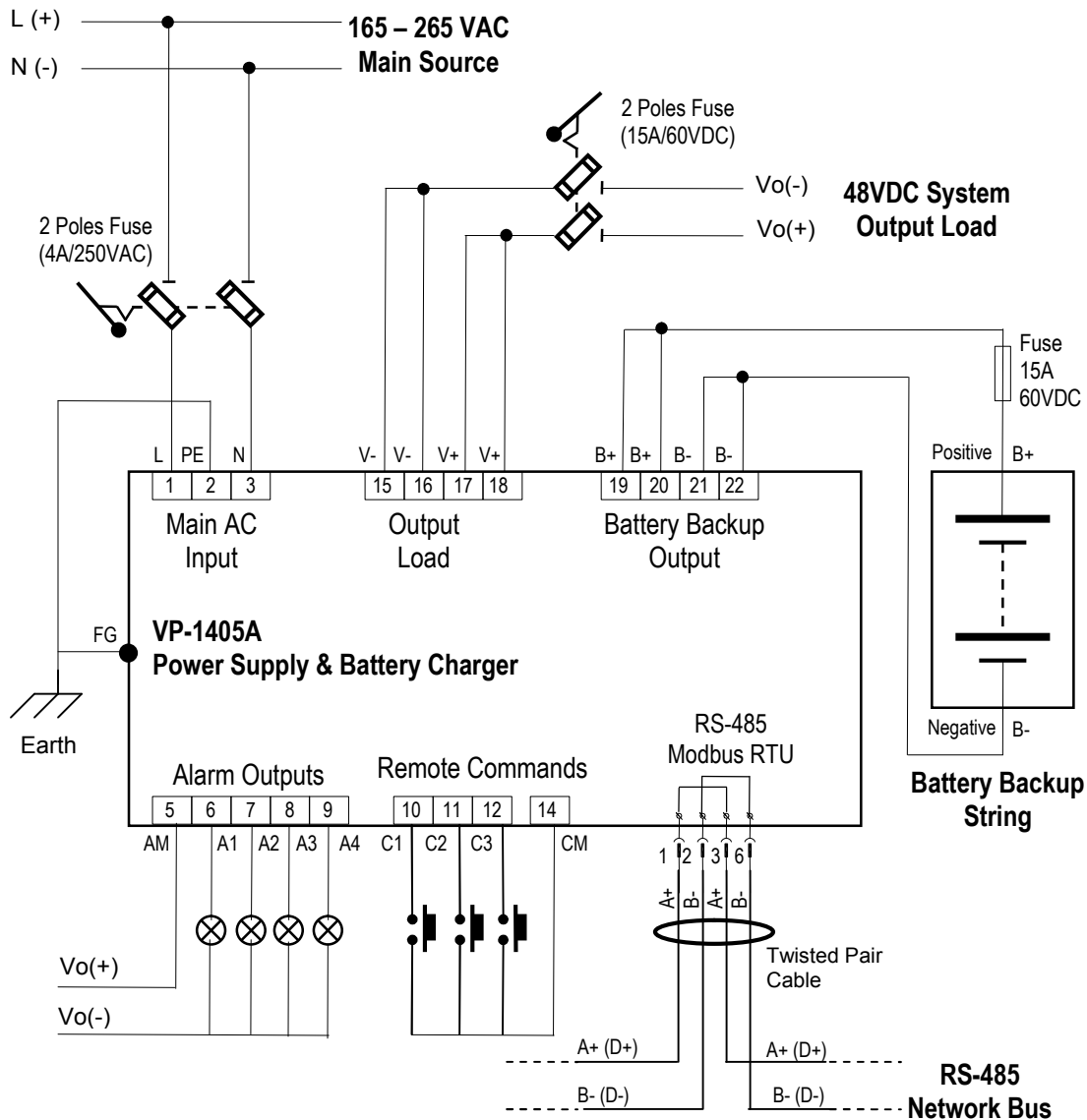


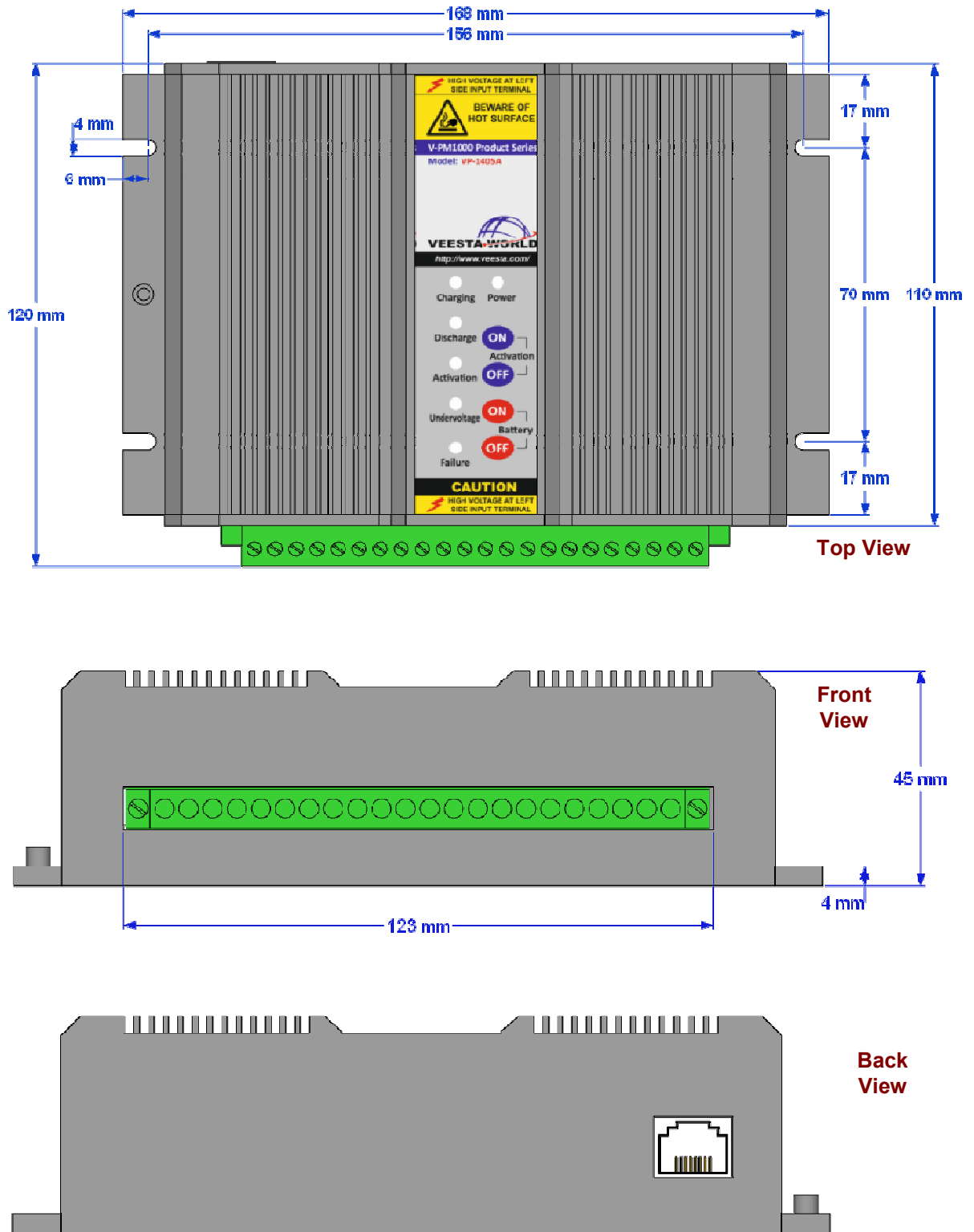
Figure 4-4: VP-1405A Wiring Diagram

### **WARNING:**



**If any wring wiring out side of above diagram applied to the power module device of VP-1405A the device may be damaged and it will be out from guarantee.**

**4.8 Dimensions and Positions**



**\* All Dimensions are in 'mm'**

Figure 4-5: VP-1405A Dimensions

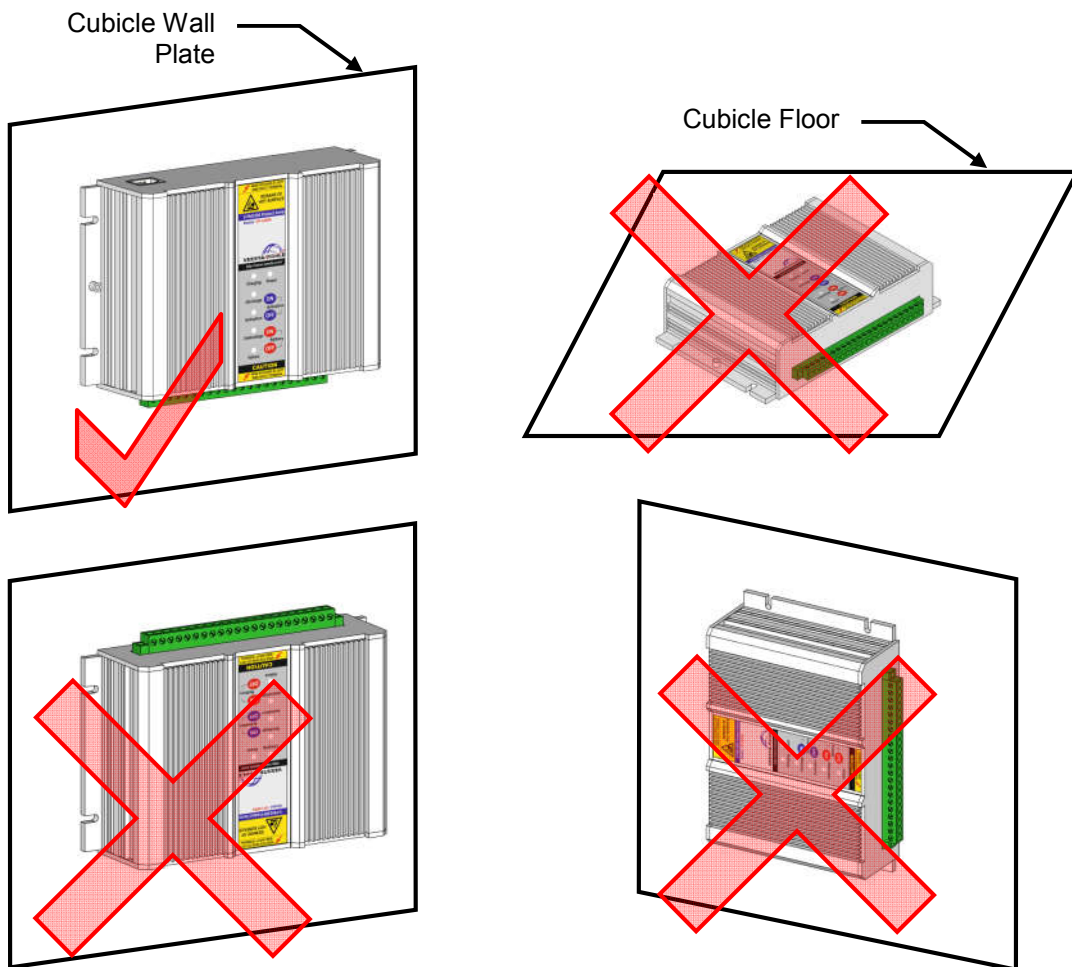
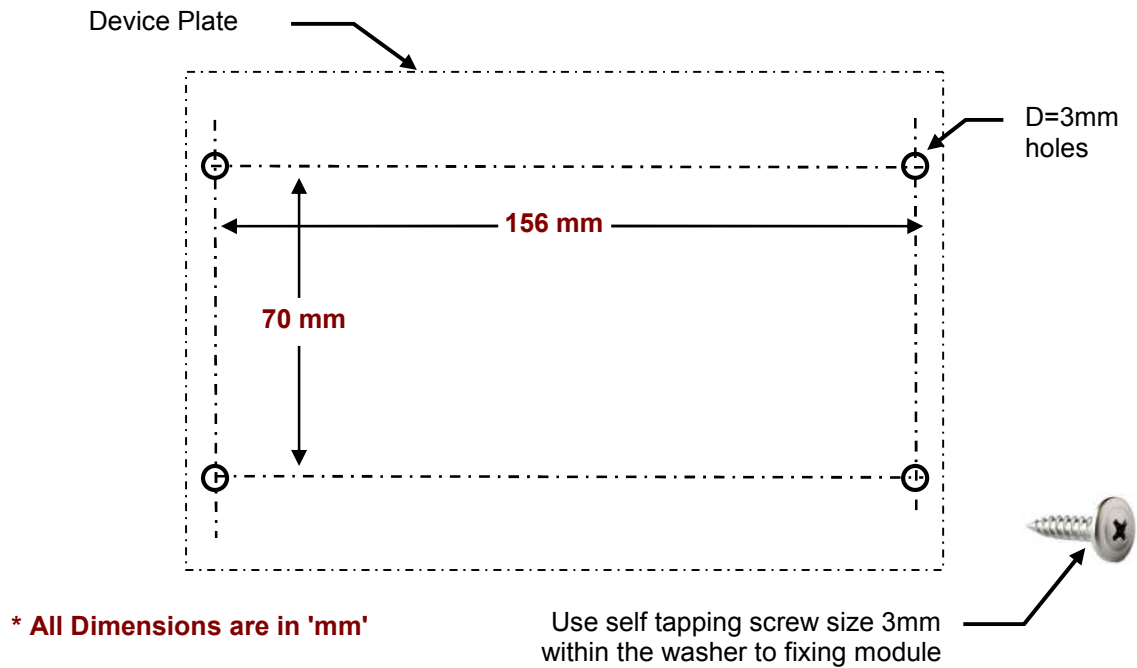


Figure 4-6: VP-1405A Mounting holes & places

## Chapter 5 - Panel Operation

### 5.1 Overview

The VP-1405A has a front panel LED and key-pad. From this panel you can do diagnostic and monitoring. In this Chapter we describe you how you can diagnostic device by this feature.

In the bellow figure you can see all details of unit observing and its instructions:

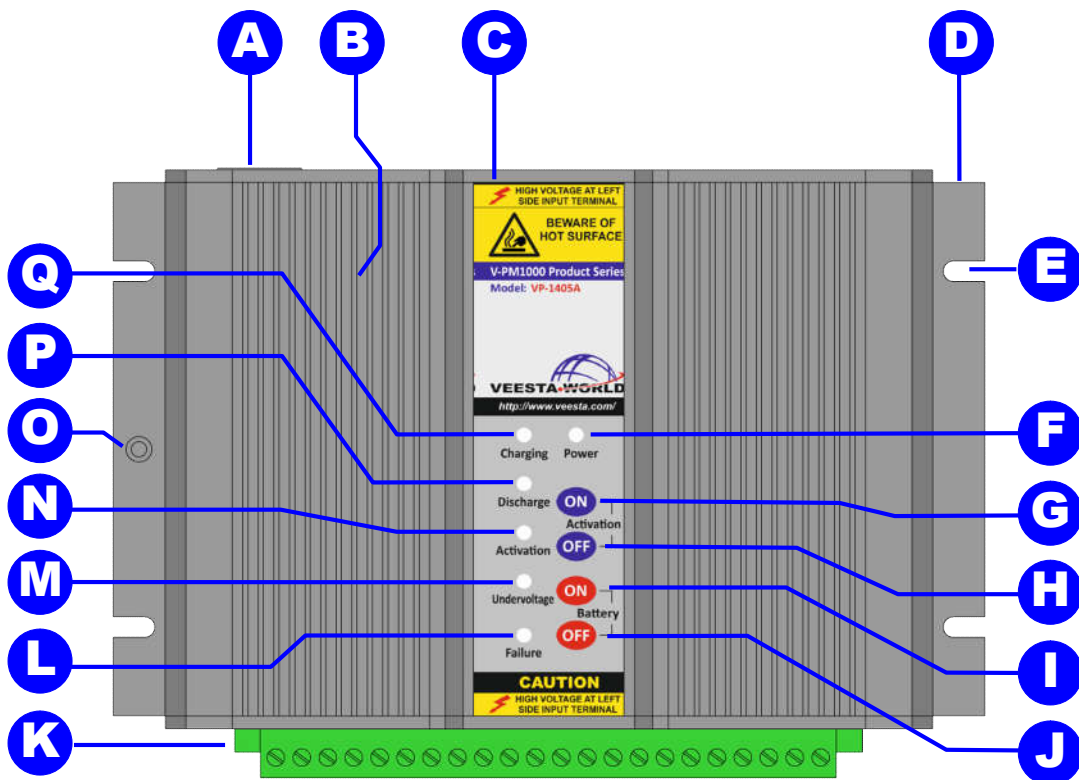


Figure 5-1: VP-1405A Front Panel Descriptions

- A** RJ-45 Socket for Modbus RTU on RS-485 network bus
- B** Aluminum heat-sink, Hot Area and should consider touching
- C** The Veesta-PM1000 Product Series Trade Mark and front panel
- D** Flange of enclosure for wall mount fixing
- E** The 4 place for fixing screw on the wall
- F** Power ON LED indicator
- G** Activation ON Command key
- H** Activation OFF Command key
- I** Battery ON Command key
- J** Battery OFF Command key
- K** 22x pins Terminal Block for external connection wiring
- L** Any failure Alarm LED indicator
- M** Battery Under-voltage Alarm LED indicator
- N** Activation of Battery Command Status indicator
- O** The FG terminal for Earthing of module
- P** Current Discharge Status LED indicator
- Q** Battery Charging Status LED indicator

## **5.2 Status Indications**

There are some LED in front panel, each of them show a special conditions:

### **5.2.1 Power LED**

The Power LED shows the condition of on stage of module. If this LED be off it means the device has lost input power or generally damaged.

### **5.2.2 Charging LED**

This green LED correspond to battery charging indication, when the battery is charging, it is on. When the battery is discharged or when the battery is activated, it is off.

### **5.2.3 Discharge LED**

This red LED correspond to battery discharge indication, when the battery is discharged or when the battery is activated, it is on. When the battery is charged and the battery is finished discharging, it is off.

### **5.2.4 Activation LED**

This is yellow color LED, when the battery is activated, it is on. Otherwise it is off.

### **5.2.5 Undervoltage LED**

This is red color LED, when the battery or power supply output is under-voltage, it is on. Otherwise it is off.

### **5.2.6 Failure LED**

This is red color LED, when the power output is overvoltage, the fault light is on. Otherwise it is off.

## **5.3 Key Button Functions**

### **5.3.1 Activation buttons**

By press the Activation ON button to enter the battery activation state. Meanwhile, the discharge indicator light is on and the battery discharges to the load. You can manually press the Activation OFF button to exit the battery activation; otherwise the power supply will automatically complete the battery activation.

### **5.3.2 Battery buttons**

The external battery input system of this product needs to have input voltage trigger, otherwise it can not be directly put into the system to supply power to the load. When the project is shakedown testing or battery first connected and no input power, press the Battery ON button, the load is powered by the battery. At this time, the discharge indicator is on.

You can manually press and hold the Battery OFF button for 5 seconds to cut off the battery, or the battery is automatically cut off after battery discharging to under-voltage shutdown point. Press and hold the Battery ON button to force the output of the battery to the load for the emergency when the battery voltage is lower than the under-voltage shutdown point.

**Note:** The battery button function does not work when there is AC power. The forced output time should not be too long to avoid damaging the battery.

## Chapter 6 - Protocol and Communication

### 6.1 PLC Modbus® Compatible

The Modbus® communications protocol allows information and data to be efficiently transferred between the VP-1405A and Modicon programmable logic controller (PLC) or other third party Modbus® compatible monitoring and control system. The VP-1405A also can establish a monitoring system simply to adopt an IPC-based centralized master running software.

### 6.2 Comprehensive System Integration

The VP-1405A provides the Modbus® compatible as a standard feature for comprehensive system integration. The PLC compatible RS485 Modbus® communication protocol allows information and data to be transferred efficiently between the VP-1405A and PLC, existing RTU Power SCADA system, DCS system, IPC running software.

### 6.3 Transmission Mode

The mode of transmission is the structure of the individual units of information within a message, and the numbering system used to transmit the data. The mode is defined in the following which is compatible with Modbus® protocol - RTU Mode.

Table 6-1: VP-1405A Modbus conventions table

Item	Convention
Coding System	8-bits binary
Start bits	1 (default), 2
Data bits	8
Parity	No parity (default), Odd, Even
Stop bit	1 (default), 2
Error Checking	CRC (Cyclical Redundancy Check)
Start of Frame	silence on line for time $\geq 4$ characters

Item	Convention
Slave Address	1 Character
Function Code	1 Character
Data field	N Characters
Error Check	16 bit CRC
End of Frame	silence on line for time $\geq 4$ characters

### 6.3.1 Slave Address

This is the first byte of every transmission. This byte response the user assigned address of the slave device that is to receive the message sent by the master. Each slave is started with its address. In a master request transmission the slave address represents the address of the slave that is sending the response.

In the VP-1405A the salve address can be from 1 to 247.

### 6.3.2 Function Code

This is a second byte of every transmission. Modbus® defines function codes of 1 to 127. The VP-1405A implements some of these functions. In a master request transmission the function code tells the slave what action to perform. In a slave response transmission, if the function code sent from the slave is 1 (i.e. if the function code > 127), then the slave did not perform the function as requested and is sending an error or exception response.

### 6.3.3 Data

This will be a variable number of bytes depending on the function code. This may be actual values, set-points, or addresses ... sent from the master to the slave or from the slave to the master.

### 6.3.4 CRC

This is a two-byte error checking code.

### 6.3.5 Protocol

When the master message sent to the assigned slave, it wire enter to the addressed device through a similar "port". The addressed device removes the envelope, reads the message, if no errors occurred and performs the requested task and then replaces the message into the slaved envelope and "returns to sender".

The information in the response message is the slave address, the action performed, data acquired as a result of the action, and a means of checking for errors. No response is transmitted if any error has occurred.

## 6.4 Modbus Framing

Modbus Message Format is as bellow:

Address	Function	Data	Check
8-Bits	8-Bits	N * 8-Bits	16-Bits

### 6.4.1 Address Field

The address is the beginning of the frame and consists of 8-bits (1-247). These bits indicate the user assigned address of the slave device that is to receive the message sent by the attached master. Each slave must be assigned a unique address and only the addressed slave will respond to query that contains its address. When the slave sends a response, the slave address informs the master which slave is communicating.

### 6.4.2 Function Field

The function code field tells the addressed slaves what function to perform. Table lists the function code, all measuring and action that initiated.

Table 6-2: VP-1405A Modbus Function Codes

Code	Meaning	Action
3 (03H)	Read holding data	Obtain current binary value in one or more registers
4 (04H)	Read input data	Obtain current binary input status in one or more registers
6 (06H)	Preset single - register	Place specific binary value into one
16 (10H)	Preset multiple - register	Place specific binary value into a series of consecutive multiple – registers

### 6.4.3 Data field

The data field contains information needed by the save to perform the specific function or contains data collected by the slave response to query. This information may be values, address references, or limits. For example, the function code tells the slave to read a register, and the data field is needed to indicated which register to start at and how many to read. The imbedded address and data

information varied with the type and capacity of slave associated with the slave.

In the VP-1405A maximum of  $N = 95$  bytes. You should observe this limitation when you are calling to read out data or setting data by different function codes.

#### **6.4.4 Error Check filed**

The field allows the master and slave devices to check a message for errors in transmission. Sometimes, because of electrical noise or other interference, a message may be changed slightly while it is on its way from one unit to another. The error checking assures that the slave or master does not react to messages that have changed during transmission. This increases the safety and the efficiency of the system. The error check uses a CRC – 16 check methods.

Note: The sending sequence is always the same - address, function code, data, and error check - relative to the direction

#### **6.4.5 Error Detection**

The RTU version of Modbus® includes a two byte CRC-16 (16 bit cyclic redundancy check) with every transmission. The CRC-16 algorithm essentially treats the entire data stream (data bits only; start, stop and parity ignored) as one continuous binary number.

This number is first shifted left 16 bits and then divided by a characteristic polynomial (1100000000000101B). The 16-bit remainder of the division is appended to the end of the transmission, MSB byte first. The resulting message including CRC, when divided by the same polynomial at the receiver will give a zero remainder if no transmission errors have occurred.

If a VP-1405A Modbus® slave device receives a transmission in which an error is indicated by the CRC-16 calculation, the slave device will not respond to the transmission.

A CRC-16 error indicates than one or more bytes of the transmission were received incorrectly and thus the entire transmission should be ignored in order to avoid the VP-1405A performing any incorrect operation.

The CRC-16 calculation is an industry standard methodized used for error detection. An algorithm is included here to assist programmers in situations where no standard CRC-16 calculation routines are available.

### 6.4.6 CRC-16 Algorithm

Once the following algorithm is complete, the working register "A" will contain the CRC value to be transmitted.

Note that this algorithm requires the characteristic polynomial to be reverse bit ordered. The MSbit of the characteristic polynomial is dropped since it does not affect the value of the remainder. The following symbols are used in the algorithm:

→	Data transfer
A	16 bit working register
AL	Low order byte of A
AH	High order byte of A
CRC	16 bit CRC-16 value
i, j	Loop counters
(+)	Logical exclusive or operator
Di	i-th data byte (i = 0 to N - 1)
G	16 bit characteristic polynomial equal 1010000000000001 with MSbit dropped and bit order reversed
shr(X)	Shift right (the LSbit of the low order byte of x shifts into a carry flag, a "0" is shifted into the MSbit of the high order byte of x, all other bits shift right one location.)

Algorithm:

1. FFFF hex → A
2. 0 → i
3. 0 → j
4. Di (+) AL → AL
5. j + 1 → j
6. shr (A)
7. is there a carry ?      No : go to 8.  
   Yes : G (+) A → A
8. is j = 8 ?                No : go to 5.  
   Yes : go to 9.
9. i + 1 → i
10. is i = N ?                No : go to 3.  
   Yes : go to 11.
11. A → CRC

## 6.5 Error responses

When VP-1405A detects an error other than a CRC error, a response will be sent to the master. The MSBit of the function code byte will be set to 1 (i.e. the function code sent from the slave will be equal to the function code sent from the master plus 128).

The following byte will be an exception code indicating the type of error that occurred.

Transmissions received from the master with CRC errors will be ignored by the VP-1405A.

The slave response to an error (other than CRC error) will be:

Slave Address	Function Code	Exception Code	CRC Check
8-Bits	8-Bits (With MSBit set to 1)	8-Bits	16-Bits

The VP-1405A implements the following exception response codes:

*Table 6-3: VP-1405A Modbus Exception Codes*

Exception Code	Meaning	Action
01	Illegal Function	The function code transmitted is not one of the functions supported by the VP-1405A.
02	Illegal Data Address	The address referenced in the data field transmitted by the master is not an allowable address for the VP-1405A or over-long data received.
03	Illegal Data Value	The values that send to write on the register address referenced in the data field is not an allowable for the register to written.

## Chapter 7 - Register Map Profile

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### 7.1 Introduction

This chapter describes about Modbus Register Map table and profile. To have better view on all of parameters of VP-1405A you must consider bellow items to communicating and translating data of registers.

- In this section all of references to the hexadecimal register number, byte number, word number and bit numbers all start from "Zero".

### 7.2 Summary of Data Conversion

The raw value of each memory register based on the unit value and data format and scale factor can be analyzed by master. For example, the calculation factor of the voltage register is 0.01. When the value read by the user via raw value of corresponding register as example like 5312, the Battery Voltage will be:  $5312 \times 0.01 = 53.12$  Volt.

It is called also Engineering Value conversion. In this section we listed summary for most common use of power parameters in VR-1405A. For the bellow table also review the bellow terms:

- **RAW:** RAW shows the raw value read from VR-1405A via corresponding register value.

### 7.3 Memory Map Data Format

Data format of each memory register value of VP-1405A based on its meaning is difference with other one. In the last column memory register map table in bellow of this section there is a column named as "FORMAT".

Each format type is described in memory map data format table as bellow.

Table 7-1: VP-1405A Data Format types

FORMAT	DESCRIPTION	CODING (HEX)
F1	<b>UNSIGNED INTEGER – NUMERICAL DATA (16 Bit )</b>	---
	Range From: 0	0000
	To: 65535	FFFF
F2	<b>SIGNED INTEGER – NUMERICAL DATA (16 Bit )</b>	---
	Range From: -32768	8000
	To: 32767	7FFF
F3	<b>UNSIGNED LONG INTEGER – NUMERICAL DATA (32 Bit )</b>	---
	Range From: 0	00000000
	To: 4,294,967,295	FFFFFFFF
F4	<b>SIGNED LONG INTEGER – NUMERICAL DATA (32 Bit )</b>	---
	Range From: -2,147,483,648	80000000
	To: 2,147,483,647	FFFFFFFF
F5	<b>STATUS INDICATION: ( 0 = OFF, 1 = ON )</b>	---
	0 = OFF	0000
	1 = ON	0001
F6	<b>OUTPUT RELAY STATUS: ( 0=DE-ENERGIZED, 1=ENERGIZED )</b>	---
	0 = Output Relay De-Energized	0000
	1 = Output Relay Energized	0001
F7	<b>ALARM STATUS</b>	---
	0 = NO ALARM	0000
	1 = ALARM CONDITION	0001
F8	<b>SLAVE ID ADDRESS</b>	FFFF
	The valid Range is 1 to 247	---
F9	<b>UNSIGNED INTEGER - MODBUS BAUD RATE</b>	---
	1 = 2400 bps	0001
	2 = 9600 bps	0002
	3 = 19200 bps	0003
	4 = 38400 bps	0004
F10	<b>UNSIGNED INTEGER - MODBUS PARITY</b>	---
	1 = None	0001
	2 = Odd	0002
	3 = Even	0003

<b>FORMAT</b>	<b>DESCRIPTION</b>	<b>CODING (HEX)</b>
<b>F11</b>	<b>UNSIGNED INTEGER - MODBUS STOP BIT</b>	---
	1 = 1 Stop bit	0001
	2 = 2 Stop bits	0002
<b>F12</b>	<b>UNSIGNED INTEGER – ALARM TYPE PARAMETER</b>	---
	1 = Input Power Failure Alarm	0001
	2 = Battery Activation Status	0002
	3 = Battery Under-voltage Alarm	0003
	4 = Failure Alarm	0004
	5 = Input Power ON Status	0005
	6 = Battery Deactivation Status	0006
	7 = Charge ON Status	0007
	8 = Float Charge Status	0008
	9 = Discharge Status	0009
	10 = Output Voltage On Status	000A
	11 = Battery Disconnect Alarm	000B
	12 = Discharge Activation Timeout	000C
13 = Hardware Error Alarm	000D	

## 7.4 Memory Map Register Table

In Memory Register map table in bellow of this chapter there are some columns which describe about register profile as bellow:

- **GROUP:** This column shows the meaning of group of register. You may have some register together to show a data like time or other structured data.
- **REG ADDR (HEX):** This column shows Register Address in format of hexadecimal number. Each Address in table represent address pointer to one register (word value) of Modbus. For values in 32 bits format two register addresses are allocated.
- **DESCRIPTION:** This column consists of full description of each register address and map. In some case in table you may find the one merged row that describe about following register functions such as READ or READ/WRITE or describe about kind of register as holding or set-point and etc.
- **REGISTER VALUE RANGE:** This column shows about the valid range of register. This is useful data for reading and analyzing read register value or to be used to check valid range for set-points. The format and range of value is described for each register separately.
- **UNIT VALUE:** This column shows about each count of RAW value read or set from or to register address means about which unit value. This column must be in purpose of other columns of SCALE FACTOR and FORMAT.
- **SCALE FACTOR:** This column shows scaling factor for each count of RAW value read or set from or to register address. Each count of RAW value of register must be multiply by SCALE FACTOR. The meaning of SCALE FACTOR of each register is described separately and if this column shows none or dashed means that there is no scaling factor.
- **FORMAT:** This column shows format type of RAW value of each register value. There are a lot of format types that has been coded in other table. Each register value based on its format type must be analyzed for reading or writing. For example the format type of "F1" represent that the register raw value must be typed cast to the "16 bit unsigned integer numerical value" and format type of "F2" represent that the register raw value must be typed cast to the "16 bit signed integer numerical value".

Table 7-2: VP-1405A Input Registers, Read Only Data

GROUP	REG ADDR (INDEX)	REG ADDR (HEX)	DESCRIPTION	REGISTER VALUE RANGE	UNIT VALUE	SCALE FACTOR	FORMAT
<b>Actual Values (Input Registers)</b>				<b>READ ONLY</b>			
MEASURING	40257	0100	Output Load Voltage	0 ~ 32767	V	RAW × 0.01	F1
SYSTEM	40258	0101	Output Load Current	0 ~ 32767	A	RAW × 0.01	F1
VOLTAGE	40259	0102	Battery Voltage	0 ~ 32767	V	RAW × 0.01	F1
&	40260	0103	Battery Current	-32768 ~ 32767	A	RAW × 0.01	F2
CURRENT	40261	0104	Reserved	---	---	---	---
SYSTEM	40262	0105	Firmware Version of Device	0 ~ 65535	---	---	F1
INFO	40263	0106	System Up time (low word)	0 ~ 4,294,967,295	Second	RAW × 1	F3
	40264	0107	System Up time (high word)	---	---	---	---
LED STATUS	40265	0108	Charge LED Status	0, 1	---	---	F5
	40266	0109	Discharge LED Status	0, 1	---	---	F5
	40267	010A	Activation LED Status	0, 1	---	---	F5
	40268	010B	Under-voltage LED Status	0, 1	---	---	F5
	40269	010C	Failure LED Status	0, 1	---	---	F5
ALARM	40270	010D	Alarm 1 Output Contact Status	0, 1	---	---	F6
OUTPUT STATUS	40271	010E	Alarm 2 Output Contact Status	0, 1	---	---	F6
	40272	010F	Alarm 3 Output Contact Status	0, 1	---	---	F6
	40273	0110	Alarm 4 Output Contact Status	0, 1	---	---	F6
ALARMS AND STATUSES	40274	0111	Input Power Failure Alarm (1)	0, 1	---	---	F7
	40275	0112	Battery Activation Status (2)	0, 1	---	---	F5
	40276	0113	Battery Under-voltage Alarm (3)	0, 1	---	---	F7
	40277	0114	Failure Alarm (4)	0, 1	---	---	F7
	40278	0115	Input Power ON Status (5)	0, 1	---	---	F5
	40279	0116	Battery Deactivation Status (6)	0, 1	---	---	F5
	40280	0117	Charge ON Status (7)	0, 1	---	---	F5
	40281	0118	Float Charge Status (8)	0, 1	---	---	F5
	40282	0119	Discharge Status (9)	0, 1	---	---	F5
	40283	011A	Output Voltage On Status (10)	0, 1	---	---	F5



Table 7-3: VP-1405A Holding Registers, Read/Write Data

GROUP	REG ADDR INDEX	REG ADDR (HEX)	DESCRIPTION	REGISTER VALUE RANGE	UNIT VALUE	SCALE FACTOR	FORMAT	FACTORY DEFAULT VALUE
<b>Programming Values (Holding Registers)</b>								<b>READ OR WRITE</b>
MODBUS	40513	0200	Communication Slave ID Address	1 ~ 247	Address	---	F8	200
SETTINGS	40514	0201	Communication Baud Rate	1 ~ 4	---	---	F9	2
	40515	0202	Communication Parity	1 ~ 3	---	---	F10	1
	40516	0203	Communication Stop Bit	1 ~ 2	---	---	F11	1
OUTPUT	40517	0204	Alarm 1 Output Contact Setting	1 ~ 13	---	---	F12	5
ALARM	40518	0205	Alarm 2 Output Contact Setting	1 ~ 13	---	---	F12	4
SETTINGS	40519	0206	Alarm 3 Output Contact Setting	1 ~ 13	---	---	F12	3
	40520	0207	Alarm 4 Output Contact Setting	1 ~ 13	---	---	F12	11
SET-POINTS	40521	0208	Set point of Under-voltage Alarm	0 ~ 32767	V	x 0.01	F1	4500
SETTINGS	40522	0209	Set point of Timeout of Discharge Activation OFF	1 ~ 60	Minute	1	F1	20
	40523	020A	Reserved	---	---	---	---	---
	40524	020B	Reserved	---	---	---	---	---
	40525	020C	Set point of Shutdown Voltage	0 ~ 32767	V	x 0.01	F1	4200
	40526	020D	Reserved	---	---	---	---	---
	40527	020E	Reserved	---	---	---	---	---
	40528	020F	Reserved	---	---	---	---	---
REMOTE	40529	0210	Activation ON/OFF Command	0, 1	---	---	F5	---
COMMANDS	40530	0211	Battery ON/OFF Command	0, 1	---	---	F5	---
	40531	0212	Reserved	---	---	---	---	---
	40532	0213	Reserved	---	---	---	---	---
	40533	0214	Reserved	---	---	---	---	---
	40534	0215	Reserved	---	---	---	---	---
	40535	0216	Reserved	---	---	---	---	---
	40536	0217	Reserved	---	---	---	---	---

## Chapter 8 - Troubleshooting

### 8.1 Introduction

Normally maintenance and installation of VP-1405A end without problem if engineer consider terms and conditions in this manual. But sometimes you may encounter to some trouble that normally caused device not operate or has malfunction.

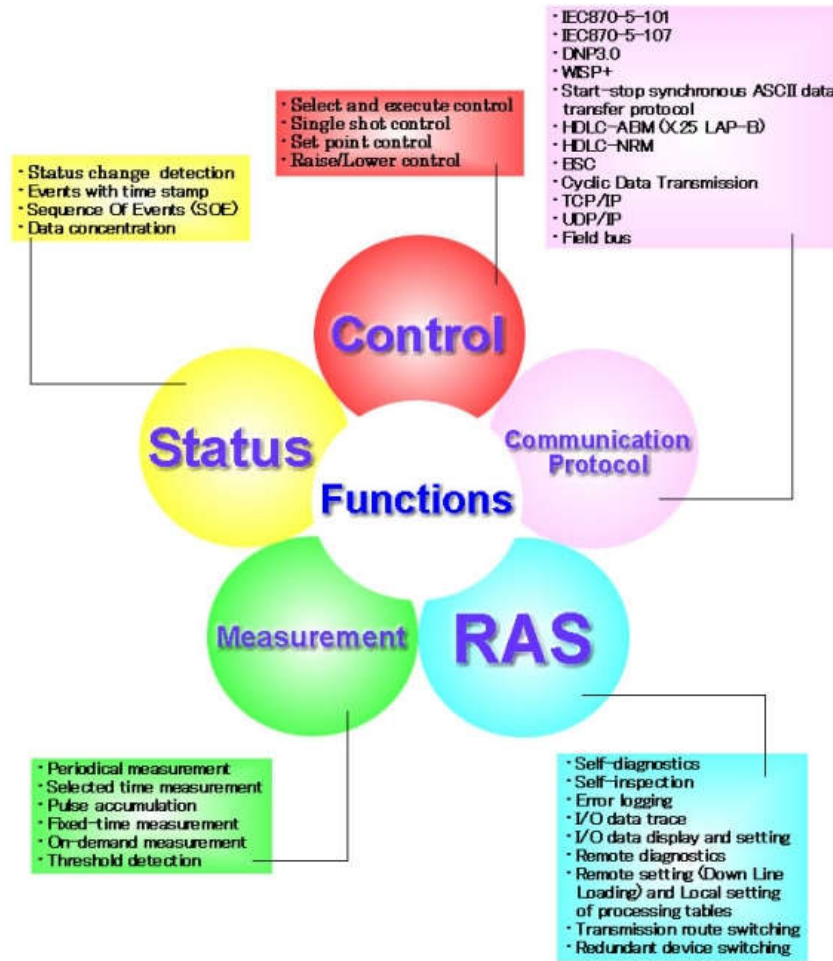
In this case before contact to Veesta World Company support center, review this chapter. You may found common problems that may encounter to them. These common problems normally are from your missed a condition mentioned in this manual. So this chapter not only helps you to find the problem, but also let you have a check list to installation of module VP-1405A.

Please pay attention that if you not follow terms and conditions in this manual any damage to product will not be in guarantee terms.

Table 8-1: VP-1405A Troubleshooting

Possible Problem	Possible Cause	Possible Solution
<i>The module has no indication after the control power supply is imposed.</i>	The mains supply fails to be imposed on the module.	Check if the correct working voltage has been imposed on the L/+ and N/- terminals of the module.
<i>Module dose not work no indicator lights turn on</i>	No AC power AC input socket fuse blown	Check AC connections are correct. Replace with correct AC fuse by qualified electrician
<i>No DC Output</i>	Output short circuit	Check DC connections between charger and battery
	Over temperature protection triggered	Check air intake vent at bottom of charger is blocked or not. Check charger ambient ventilation .
	Reverse battery polarity	Check for correct polarity,

Possible Problem	Possible Cause	Possible Solution
<i>Battery does not get full charge All indicator LED work normally and sequentially</i>	Bad battery connection	Check for loose contact, right cable size, cable integrity
	Battery capacity too large	Make sure charger rating matches battery capacity
	Ambient temperature too low	Move battery to a room temperature location
	Battery has damaged cell or battery is too old	Replace battery
<i>Long charging time , charge status LED light does not come off even after 24 hours charging time</i>	Total battery capacity is too high	Check battery capacity based on the charge current specifications
	Battery is defective	Replace battery
	Load current is more than nominal output load	Check the output load current not be more than continues load current
<i>There is no communication between the upper end device and the meter.</i>	The communication address ID of the module is not correct.	Check if the types of external nodes match the rated parameters of the meter.
	The communication speed, start, stop bit and parity bit of the module are not correct.	Check if the external connection is correct.
	The communication link has not been connected to the terminal resistor.	Check if the communication link is correct.
	The communication link suffers interference.	Check if the wiring is correct, pins of 4,5 & 7,8 should be leave and no connection



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