

## User Manual

### VIBRATION SWITCH - VSW-160



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## 1. INTRODUCTION

VIBRATION SWITCH, Model VSW-160 is a real-time monitoring instrument for vibration. It accepts the vibration signal from an accelerometer which is measured and displayed using its Seven Segment LEDs. It has a dual Relay output for alarm and tripping purpose.

The single set point models contain one relay for alarm. The optional dual set point models contain two independent relay; one for alarm and one for trip. Trip and alarm limits are in engineering units of velocity. In addition, a 4-20 mA output (optional) proportional to vibration velocity is provided.

Any transient faults that happen during monitoring period may not be identified in case of some unattended critical application using conventional periodical monitoring methods. Whereas Continuous monitoring using VSW-160 will help to identify such transient faults to ensure corrective action to be developed and implemented at a schedule time, rather than disrupting operations for a failure.

## 2. OVERVIEW

- Trip and alarm settings are based on vibration severity. The internal sensor (unless the external sensor option has been specified) is a **Integrated circuit piezoelectric (ICP) accelerometers**. The output signal is electronically integrated to measure velocity.
- Set point trim port permits set point adjustment of vibration velocity levels up to full scale range. Two relay model switch have dual set points – one for alarm and one for Trip – that are independently adjustable.
- 4-20 mA output provides a convenient interface for trending and displaying vibration amplitude in a programmable logic controller (PLC), SCADA system, data logger, or other instrumentation. 4mA corresponds to no vibration, and allows the user to distinguish between no power to the switch (0mA) and a functional switch but with no vibration present (4mA). 20mA corresponds to full scale vibration amplitude.
- Electromechanical relays are used for alarm (relay-1) and Trip (relay-2). These outputs are independently configurable for normal (close on alarm) or Fail safe (open on alarm) mode.
- Adjustable 10-20 seconds time delay is given. This prevents false alarms/shutdowns on high startup vibrations and also from non-repetitive transient events.
- An LED adjacent to each set point control illuminates the instant the measured vibration level exceeds the set point.

### 3. ORDERING CODE

#### ORDERING CODE

Model	Sensor type		Vibration Range		Measurement		Power supply		Retransmission o/p		Sensor Cable length <sup>(4)</sup>	
VSW160	XX		XX		XX		XX		X		X	
	IN	Built in Sensor	1V	0-12.5 mm/sec	0R	RMS	U1	85-265VAC	Y	Yes	NA	Not applicable <sup>(3)</sup>
	RM	Remote Sensor <sup>(2)</sup>	2V	0-25 mm/sec	0P	Peak <sup>(1)</sup>	U2	18-36 VDC	N	No	L1	5 meters unarmoured cable
			3V	0-50 mm/sec	PP	Peak to Peak <sup>(1)</sup>					L2	10 meters unarmoured cable
			4V	0-100 mm/sec							L3	5 meters armoured cable
			1A	0-5 g							L4	10 meters armoured cable
			2A	0-10 g								
			3A	0-15 g								
			4A	0-20 g								
			5A	0-30 g								
		S	Special Range									

\* Consult factory  
 X Specify from table  
<sup>(1)</sup> Derived peak  
<sup>(2)</sup> To be ordered separately  
<sup>(3)</sup> Not applicable in case of Built in sensor  
<sup>(4)</sup> Applicable only if Remote Sensor ordered

**Table 1 : Product ordering code for VSW-160**

## 4. SPECIFICATIONS

### 4.1 Electrical Specification

- Input Type : Inbuilt ICP Accelerometer 100mV/g  
Option: Remote ICP piezoelectric Accelerometer  
Sensitivity: 100 mV/g  $\pm$ 10%  
Dynamic range: 80 g pk
- Sensor Excitation Current : 4 mA, Voltage: 21 VDC
- Cut-off frequency : 2.5Hz, 5 Hz or 10Hz (Internal Switch selectable) to  
1 KHz, 2.5 KHz or 10 KHz (Internal Switch selectable)
- Measuring parameter : Acceleration , Velocity , Displacement
- Measuring Range : Acceleration 0-30 g, RMS/peak(derived peak)  
Velocity 0-100 mm/s, RMS/peak/peak to peak (derived peak)  
Displacement 0-1000 micron, peak to peak (derived peak)
- Accuracy Input-display :  $\pm$  1% of full span

### 4.2 Power Supply Specification

- Rated Voltage : 85 - 265VAC 50/60 Hz / 100-300VDC Or 18-36VDC
- Power Consumption : Max 5VA (85-265VAC) and Max.5VA (18-36VDC)

### 4.3 Display Specification

- Display : 7.62mm(0.3"), - 3½ digit seven segment LED
- Status : Power On (Red Led), Relay1 On (Red Led), Relay2 On (Red Led).
- Keys : Touch sense keys: Reset, Set1, Set2

### 4.4 Mechanical Specification

- Type of Protections : Flameproof (Explosion Proof) EX-d
- Area Classification : Zone 1 & 2
- Gas Groups : I, IIA, IIB & IIC(Optional)
- IP Protection : IP 65
- Apparatus Standard : IS 2148
- Material : Cast Aluminum Alloy LM-6
- Cable entry size/no : ¾" ET – 2 NOS
- Weight : 1.2 kg (Approx)
- Mounting : Machine mounting with 4 NOS bolts of size M6.  
Stud / Pad mount in case of Remote Sensor
- Dimensions : 120 mm(W) x 120 mm (L ) x 102 mm (D )

### 4.5 Environmental Specification

- Ambient Temperature : 0 to 60 °C
- Humidity : 30 to 95% RH non-condensing
- Storage Temperature : 0-85°C

### 4.6 Output Relay Specification

- No of Relays : Two(2)
- Set point settings : via trim pot inside the instruments
- Delay for relay : 10 - 20 sec to avoid false tripping.
- Relay contact Rating : 5A @250VAC/30VDC.

### 4.7 Retransmission Output Specification (Optional)

- No. of Retransmission Output : One(1)
- Set Point Output : Process Output
- Output Signal : 4-20mA, 0-20mA
- Load Resistance : 500 ohms Max Or less for Current Output
- Output Accuracy : 0.25 % of Full Range(Display to output)

## 5. MECHANICAL INSTALLATION

- **Mounting Orientation**

The vibration switch can be mounted in the vertical or horizontal orientation (or anything in between) without a change in its sensitivity. Ideally, the mounting orientation will be chosen by measuring the vibration levels in both directions with a vibration meter and then selecting the direction in which the highest vibration occurs. This will typically be horizontal, since most machine structures are less rigid horizontally than vertically.

- **Mounting Surface**

Choose or fabricate a solid (rigid) surface (on the equipment being monitored) to mount the vibration switch or transducer. This will ensure transfer of the vibration to the vibration transducer, while not introducing spurious vibrations. In addition, the surface presented to the base of the unit should be flat. Fasten using sturdy hardware at all places provided.

- **Temperature Considerations**

The switch is designed to dissipate internal heat by conduction through its base. Hence, it is important to keep the mounting surface below the switch max temperature limit of 60°C. If the equipment being monitored is going to exceed this limit, consideration should be given to either using one of the remote transducers, or thermally isolating the switch. To ensure accurate switch performance, a warm-up time of 5 minutes is recommended.

- **Cable/Wiring**

The method chosen to electrically connect to the switch or transducer should be mechanically flexible, to eliminate the measurement of vibration of material not of interest (piping, etc.), and provide a moisture barrier as well.

Although seal tight and other flexible conduit have been used successfully, in areas of extreme humidity or moisture it is recommended that an "SO" type cable together with a suitable rain-tight CGB fitting be used.

No stress should be possible on the wiring to the terminal block. If such protection is not provided by the conduit system, some form of stress relief must be installed where the wiring exits the VSW160.

To reduce susceptibility to EMI/RFI, any signal-level wiring such as transducer, reset, lockout, or 4-20 mA loop should utilize shielded cable in EMI-proof conduit, separate from any power wiring. The signal-wiring conduit and power-wiring conduits can be connected at the switch entry via a "T" fitting.

## 6. OUTLINE & DIMENSIONAL DIAGRAM

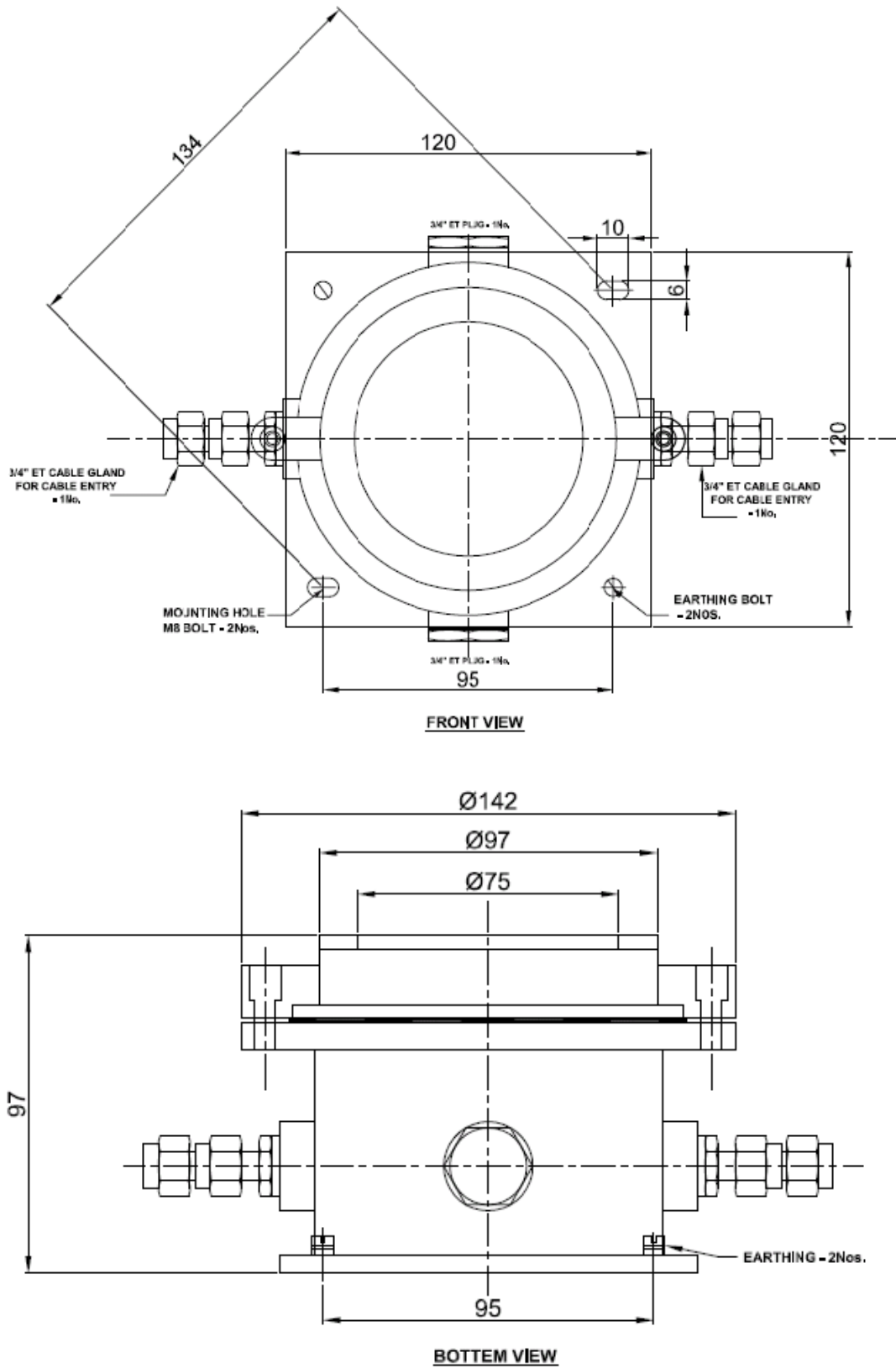
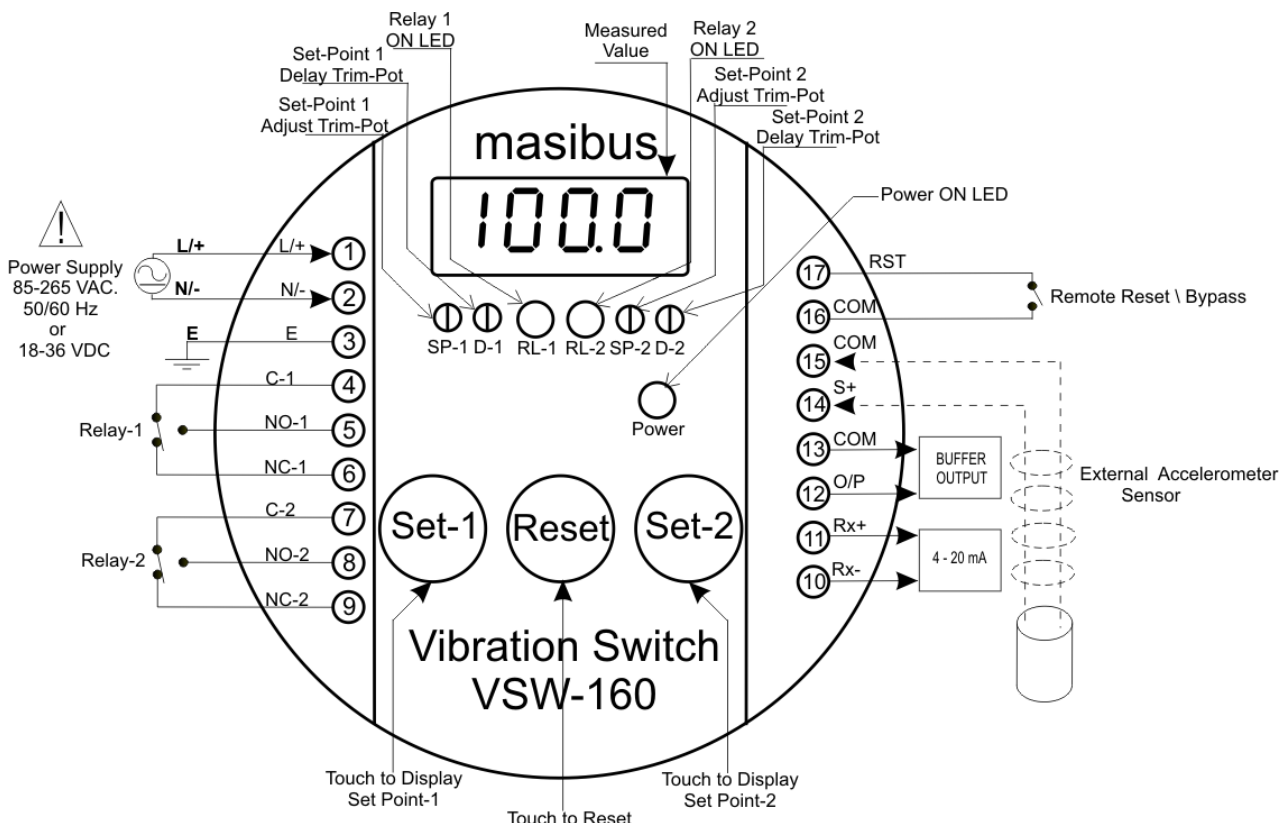


Figure 1: Front view and Side view of Enclosure



## 7. ELECTRICAL WIRING



**Figure 2 : Terminal connections**

- **Input Power**

Connect a grounding wire to the grounding screw provided in the switch. This is important for safety as well as noise. For AC powered units, power only with the voltage level indicated on the label. For DC powered units, connect +24V to Pin 1 and Ground to Pin 2.

- **Alarm/Trip Circuit**

The internal single pole solid state relay-1 between terminals 4, 5 and 6 is designed to be wired in series with the external alarm circuit i.e.; annunciator, lamp, relay, etc. The internal single pole solid state relay-2 between terminals 7,8 and 9 is used with external trip circuit

- **Remote Reset/bypass**

It must be connected with dry contact switch only (Relay).Shielded wire is required, to avoid creating ground loops, the N.C. remote switch contacts should be electrically isolated from other circuits or grounds.

- **4-20 mA Analog Output**

To avoid the possibility of ground loops, the 4-20 mA remote meter terminals should be electrically isolated from external grounds. Shielded wire is recommended to protect against damage due to long wire runs and the possibility of high induced voltage spikes from storms, etc. The 4-20 mA output is self-powered and therefore requires no external power source.

## 8. OPERATION GUIDELINES

- **Auto Reset / Latch Mode**

In auto reset, alarm and trip relay are automatically reset to the non-alarm condition when the vibration level falls below the set point. In Latch Mode, alarm and trip relay remain “latched” in alarm (trip) condition when the vibration level exceeds the set point. The unit is in this condition until reset key touched or when the reset terminal is connected to common.

- **Remote Reset Mode**

When wired in this mode, when vibration level exceeds the set point the alarm and trip relays latched, but can be reset to the “non-alarm” mode by momentarily interrupting the connection from terminal Reset to Common. This can be accomplished with a normally open momentary switch. The switch contacts should be isolated from other circuits, potentials or grounds.

- **Function of trim pots.**

- See the Pots SP-1 and SP-2 in **Figure 2**. To fix the set point-1/set point-2 trim the trim pot SP-1/SP-2 (To increase set point trim the trim pot in clock wise direction and to decrease set point trim the trim point in anti-clock wise ).By pressing switch SW1 display will show setpoint-1 and adjust setpoint-1. Similarly for setpoint-2.
- See the Pots RD-1 and RD-2 in **Figure-2**. To avoid the false tripping trim the trim pot RD-1/RD-2 (To increase delay trim the trim pot in clock wise direction and to decrease delay trim the trim pot in anti-clock wise).

- **Non Fail-safe / Fail-safe mode.**

- **In the non-fail-safe mode**, the relay coil being de-energized (that means without control voltage applied). If an alarm/trip takes place, the coil is energized and the contact 4/6 (terminal in figure-1) opens respectively 4/5 closes. Hence in the absence of control voltage, the state of the trip relay does not change. This method is chosen if a process should keep on running even in the absence of control voltage. A running motor/machine is not protected in absence of the control voltage.
- **In fail-safe mode**, the relay coil is energized (that means with control voltage applied). If an alarm/trip takes place, the coil is de-energized and the contacts 4/5 opens respectively 4/6 closes. In the absence of control voltage, the state of the relay changes. This method is chosen in most applications as in absence of control voltage the relay contact 4/5 opens, therewith the motor/machine is stopped and is protected

- **Function of different switches**

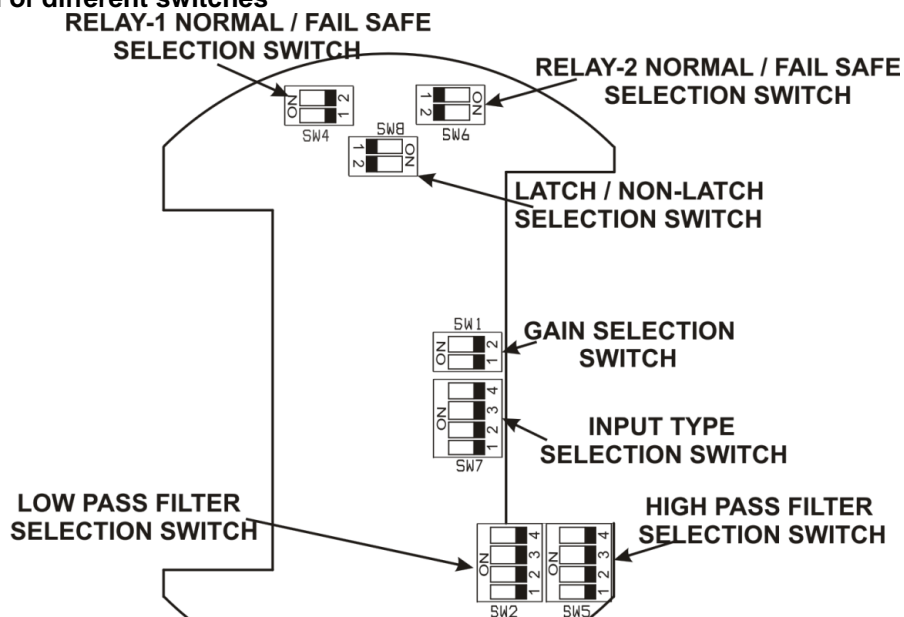


Figure 3: Different Switch Position

- For Select the Frequency Switch SW-2 is adjust. Below table is given for different frequency and switch position:-

LOW Pass Filter Selection Switch (SW2)		HIGH Pass Filter Selection Switch (SW5)	
1 KHz	Switch 1,2,3,4 OFF	2.5 Hz	Switch 1,2,3,4 OFF
2.5 KHz	Switch 1&3 ON , 2 &4 OFF	5 Hz	Switch 1 &4 ON , 2 &3 OFF
10 KHz	Switch 1,2,3,4 ON	10 Hz	Switch 1,2,3,4 ON

**Table 2 : LOW PASS (SW2) & HIGH PASS (SW5) Filter Selection Switch**

- For Select the Input type Switch SW7 is adjust. Below table is given for different input type and switch position:-

Input Type Selection Switch (SW7)	
Acceleration	Switch 1 ON , 2 & 3 OFF
Velocity	Switch 2 ON , 1 & 3 OFF
Displacement	Switch 3 ON , 1 & 2 OFF

**Table 3 : Input Type Filter Selection Switch (SW7)**

- For Select the Gain Switch SW1 is adjust .Below table is given for different gain and switch position:-

Gain Selection Switch (SW1)	
For Acceleration	Switch 1 & 2 ON
For Velocity	Switch 2 ON , 1 OFF
For Displacement	Switch 1 ON , 2 OFF

**Table 4 : Gain Selection Switch (SW1)**

- For Select the Normal / Fail Safe Function switch SW4 & SW6 is adjust. Below table is given for Both Relay and switch position:-

For Relay-1:-

Normal / Fail Safe Function For Relay-1 (SW4)	
For Normal Function	Switch 1 ON , 2 OFF
For Fail Safe Function	Switch 2 ON , 1 OFF

**Table 5 : Normal / Fail Safe Selection Switch For Relay-1 (SW4)**

For Relay-2:-

Normal / Fail Safe Function For Relay-2 (SW6)	
For Normal Function	Switch 1 ON , 2 OFF
For Fail Safe Function	Switch 2 ON , 1 OFF

**Table 6 : Normal / Fail Safe Selection Switch For Relay-2 (SW6)**

- For Select the Latch / Non Latch Function switch SW8 is adjust. Below table is given for Latch / Non Latch Function and switch position:-

Latch / Non Latch Function (SW8)	
For Non-Latch Function For Relay-1	Switch 1 ON , 2 OFF
For Non-Latch Function For Relay-2	Switch 2 ON , 1 OFF


**Table 7 : Latch / Non Latch Selection Switch (SW8)**

**Note:-** When Non Latch Function switch(SW8) is ON in any relay at that time Normal / Fail Safe Function switch(SW4 & SW6) is OFF position.

## 9. SAFETY AND WARNING PRECAUTIONS


 <b>WARNING</b>	<i>This indicates a danger that may result in death or serious injury if not avoided.</i>
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 <b>CAUTION</b>	<i>This indicates a danger that may result in minor or moderate injury or only a physical damage if not avoided.</i>
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 <b>WARNING</b>
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Ground the device. Otherwise, it may cause an electric shock or fire.  
The protective Ground is marked on the product, bearing the following symbol:



 <b>CAUTION</b>
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The terminal block inside the VSW160 is connected to 85-265 VAC power.

**Note:**

Information in this manual is subject to change without prior notice or permission due to continuous improvement.

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