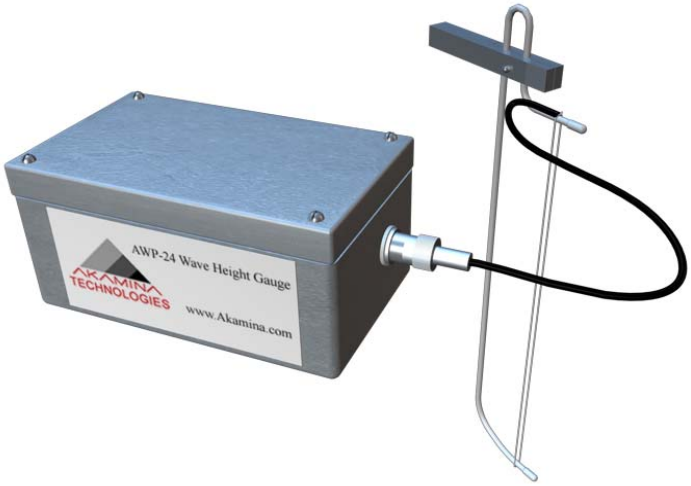
AWP-24
Wave Height Gauge
User's Guide



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1. INTRODUCTION

The AWP-24 from Akamina Technologies is a capacitance-type precision wave height measurement gauge. For accurate measurements and continued reliable operation please read this manual carefully. We also recommend reading the application note: Acquiring Minimum Noise Data, in order to acquire minimum noise and accurate measurements. The document can be downloaded at http://www.akamina.com/Reports/MinNoiseData.pdf

The AWP-24 is the only wave height gauge on the market that measures capacitance using purely digital techniques, providing high accuracy measurements of wave heights or water levels. The measured capacitance is converted to an analogue voltage that can be measured with a voltmeter or a data acquisition system depending on your specific needs. The AWP-24 provides an output voltage that is proportional to the level of water. A simple calibration procedure allows the highly linear relationship between the water level and the voltage to be determined. This relationship is then used to convert the measured voltage to wave heights or water levels.

1.1 Wave Height Gauge Overview

The Akamina wave height gauge system consists of two main components. These are:

- AWP-24 electronics mounted in an enclosure
- wave probe head and mounting clamp. The probe is partially submerged in water during measurements

The AWP-24, the wave probe head, and a typical tripod for laboratory use are shown in Figure 1-1.

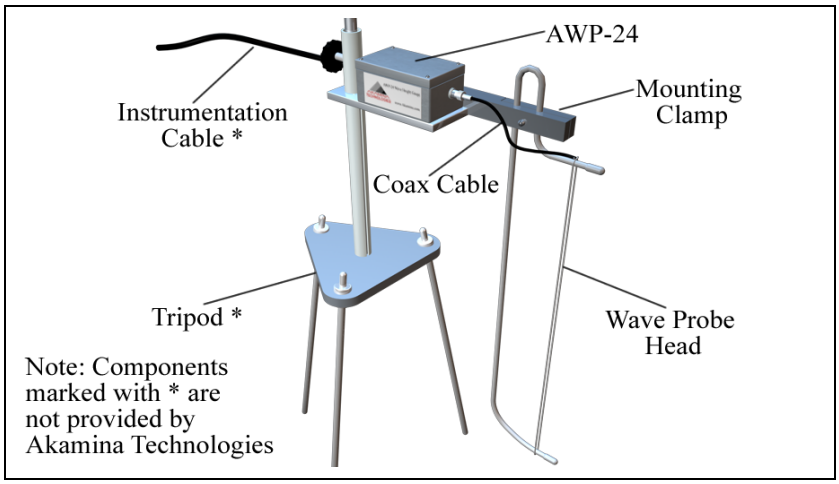

Figure 1-1: AWP-24 Wave Height Gauge and tripod

The enclosure and electronics mounted inside the enclosure are shown in Figure 1-2.

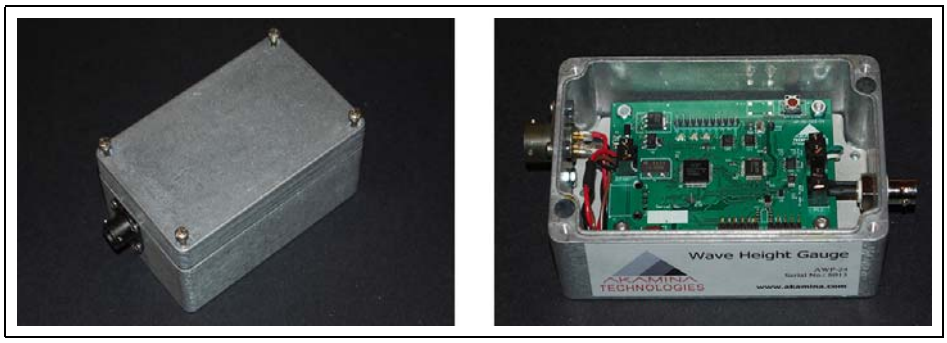

Figure 1-2: Wave Height Gauge Enclosure and Electronics

2. AWP-24 MAIN COMPONENTS

2.1 Enclosure

The AWP-24 uses a heavy duty, rugged, watertight, diecast aluminium alloy enclosure that is suitable for indoor or outdoor use. The enclosure can be mounted to a structure using the through-box holes that are located outside of the gasket protection. The enclosure itself is designed to meet the IP65 waterproof standard, however, the connectors mounted to the enclosure do not meet the standard.

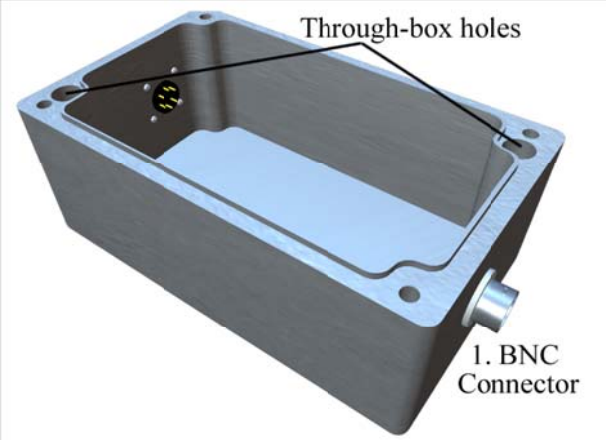

Figure 2-1: Enclosure & BNC Connector

2.2 Connectors and Cables

There are two connectors on the enclosure.

1. A BNC connector (Figure 2-1) is used to attach the wave probe head coax cable to the AWP-24 electronics.

2. A 6-pin circular male bayonet connector (Figure 2-2) is used to attach the instrumentation cable to the AWP-24. The instrumentation cable carries power to the electronics and carries the high-level output signal from the electronics to a remote data acquisition system or data recording device. The pin-out information for the connector and the instrumentation cable is shown in Table 2-1 below.

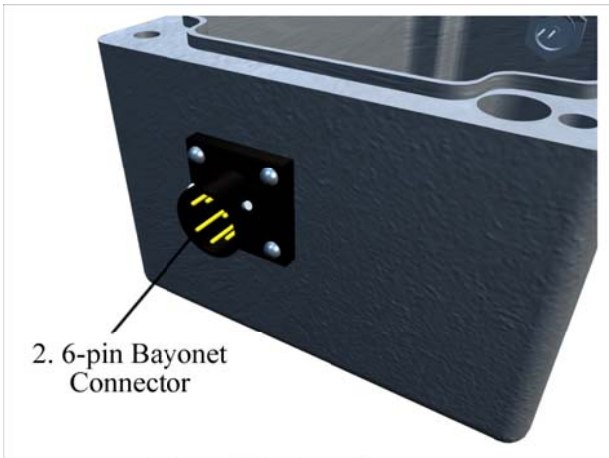

Figure 2-2: 6-pin Connector

The instrumentation cable and female mating connector is not included with the AWP-24. We recommend using a high quality instrumentation cable with two shielded twisted pairs and a separate inner shield drain. One example of a suitable cable is Belden Cable part number 8723. The recommended 6-pin female cable connector is Amphenol part number PT06E-10-6S (SR).

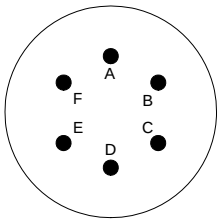	• Pin A – N/C • Pin B – Output Signal High • Pin C – Output Signal Low • Pin D – Shield • Pin E – Power Low • Pin F – Power High

Table 2-1: 6-pin Instrumentation Cable Connector

2.3 AWP-24 Electronics

The AWP-24 electronics measures capacitance and presents this as an analogue signal at the output. This signal is offset adjusted, amplified and filtered before being presented at the output connector. The output signal range is -5 volts to +5 volts.

The modest input power requirements must be provided by an external power supply. The voltage should be between 8 and 12 volts but voltages as high as 20 volts are acceptable. The current draw of the board is approximately 20 to 22 mA at 10 volts. The circuit board is shown in Figure 2-3 below.

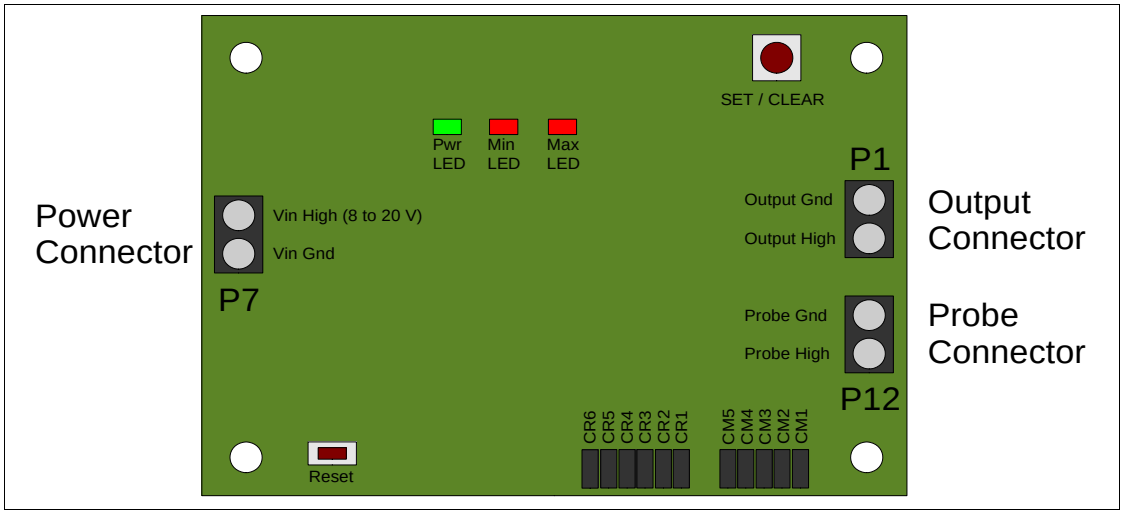

Figure 2-3: Wave Height Gauge Circuit Board AWP-24

The key components involved in the set up and configuration of the circuit board are:

- Pwr LED – is illuminated green when the board is powered
- Min LED – flashes red when the minimum water level has not been set
- Max LED – flashes red when the maximum water level has not been set
- SET/CLEAR – a push button that allows the user to set and clear the minimum and maximum water levels.
- CM1 to CM5 – these jumpers are used to set the measurement adjustment capacitance value. The set up of these jumpers is explained in Chapter 3 Set Up & Configuration
- CR1 to CR6 – these jumpers are used to set the reference capacitance value. The set up of these jumpers is explained in Chapter 3 Set Up & Configuration
- Reset switch – used to reset the on-board electronics

The remaining components on the circuit board are not user configurable.

CAUTION ! AWP-24 is a high precision instrument. When the enclosure lid is open, please follow safe ESD (Electrostatic Discharge) procedures in order to ensure problem free operation and to avoid damaging your instrument.

2.4 Wave Probe Head Attachment

The wave probe head provided with the AWP-24 is a high precision sensor and must be handled with care. Please avoid damaging the probe by following these instructions.

CAUTION ! Please ensure that the sensing wire, shown in Figure 2-4, does not come into contact with sharp objects. When not in use, please do not put any weight on the sensing wire or let the wave probe head rest on the sensing wire. Avoid exposing the probe to extreme hot and cold temperatures.

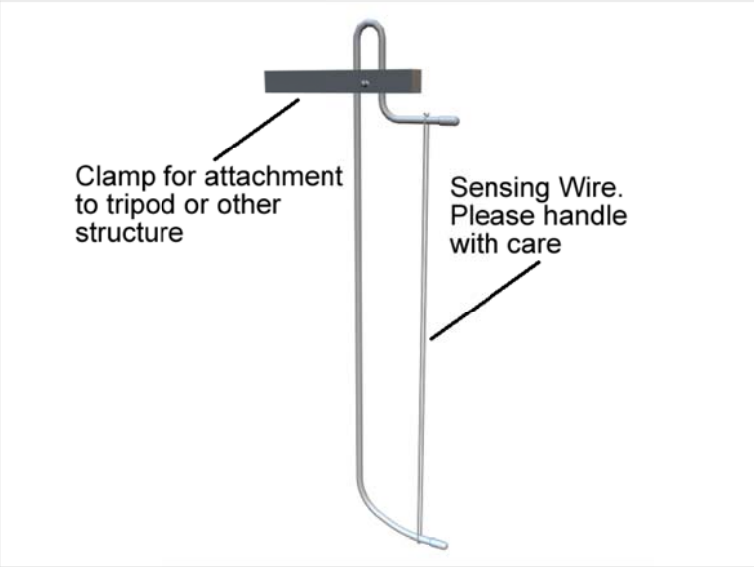

Figure 2-4: Wave Probe Head

The AWP-24 does not include a stand or tripod. You will require a stand or tripod in order to place the wave probe head in water. The Akamina wave probe head comes with a clamp, shown in Figure 2-4. The clamp can be attached to a tripod or your specific support structure.

3. Set Up & Configuration

The AWP-24 wave height gauge must be set up and configured before it can be used. The configuration procedure requires measuring the output voltage. A digital voltmeter, oscilloscope or a data acquisition system are all suitable for this purpose as high precision measurements are not required during configuration. To view an interactive demo of Set Up and Configuration please visit http://www.akamina.com/AWP-24_Demo.htm

NOTE

In the Set up and Configuration steps described below you are asked to immerse the wave probe head in water. For accurate results please keep the water level constant and ensure that the water surface is steady, without any waves or ripples.

For maximum measurement accuracy please use the maximum and minimum depth limit recommendations shown in Figure 3-1.

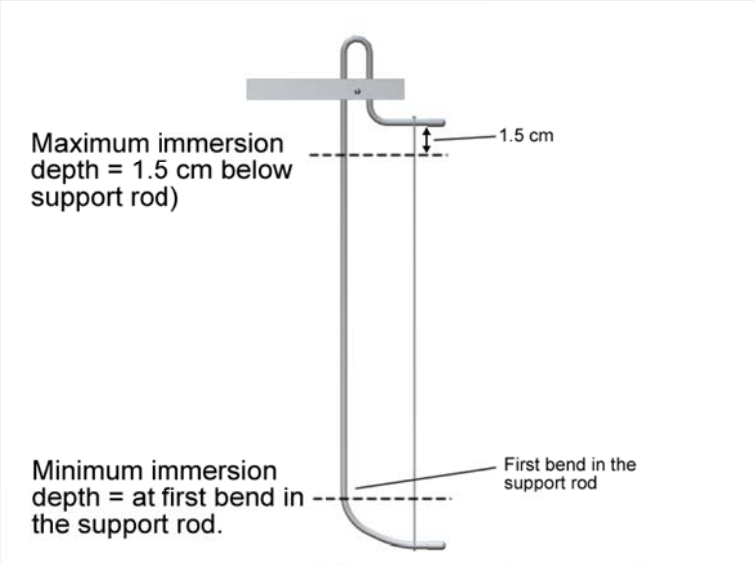

Figure 3-1: Recommended Maximum and Minimum depths

3.1 Set Up

To set up the AWP-24 please follow these steps:

1. Open the enclosure top cover by unscrewing the 4 screws.
2. Connect the signal output wires of the instrumentation cable to your voltmeter or data acquisition system.
3. Connect the power wires of the instrumentation cable to a suitable power supply. (8V – 20V)
4. Connect the bayonet connector of the instrumentation cable to the 6-pin circular connector on AWP-24. The green Pwr LED should be illuminated when the board is powered.
5. Connect the wave probe to the BNC connector using the coaxial cable and the BNC connector.

6. Ensure that both the red Min LED and the red Max LED are continuously flashing at a 0.5 Hz rate (1 second on followed by 1 second off). If the Max LED is not flashing, press and hold the SET/CLEAR push button for 3 seconds or more. When the push button is released, the Max LED will begin to flash. If the Min LED is not flashing, press and hold the SET/CLEAR push button again. When the push button is released, the Min LED will begin to flash.
7. Remove jumpers CR1 to CR5 in the Reference Jumper section and ensure that jumper CR6 is installed.
8. Remove jumpers CM1 to CM4 in the Measurement Jumper section and ensure that jumper CM5 is installed.
9. Immerse the probe in water to the maximum level that it will be used to measure. This is typically the full depth of the probe rather than the expected immersion for a specific set of measurements.

You are now ready to to configure the AWP-24.

3.2 Configuration

The AWP-24 wave height gauge must be configured for the maximum capacitance of the wave probe head being used. The configuration is a simple procedure in which the reference capacitance is increased in 15 steps using jumpers CR1, CR2, CR3 and CR4 with the output voltage measured at each step.

On the next page, Table 3-1 shows the jumper pattern that is to be used in this procedure. An X in a column indicates that the jumper is installed whereas a _ indicates that the jumper is removed.

To configure the AWP-24 please follow these steps:

1. Immerse the wave probe head in water to its maximum. Do not move it until step 4 is completed
2. Beginning with Reference Capacitance Configuration 1 in Table 3-1, measure the output voltage and record the value.
3. Move through the remaining jumper configurations and measure the output voltage and record the voltage.
4. Identify the jumper configuration where the output voltage is closest to 0 volts.

As can be seen in Table 3-1, jumper CR6 is always installed and jumper CR5 is always removed. The last column in Table 3-1 shows an example of voltages measured for a 2-wire, 55 cm wave probe. As can be seen in the example, configuration 7 results in the output voltage closest to 0 volts for the 2-wire probe example. In the example note how the measured voltages decrease from larger positive voltages towards larger negative voltages. You should observe the same trend in your measurements.

NOTE

The last column in Table 3-1 is an example. Your measured voltages will be different.

NOTE

If the voltage for two Reference Capacitance Configurations are equally close to 0 volts or nearly equal (a difference less than 0.05 volts), use the larger of the voltages.

You are now ready to install the proper jumper pattern on the AWP-24 electronics. The jumper set up table for the standard length wave probe is shown in Table 3-2 and the jumper set up table for extended length wave probe is shown in Table 3-3 on page 10. Use the jumper configuration in the row that matches the row number identified in step 4 above.

Reference Capacitance Configuration	*Probe Range Jumper pattern*						*Measured Voltages*	*Example Voltages (2-wire 55 cm probe)*
	CR6	CR5	CR4	CR3	CR2	CR1		
1	X	_	_	_	_	X		1.24
2	X	_	_	_	X	_		0.91
3	X	_	_	_	X	X		0.64
4	X	_	_	X	_	_		0.5
5	X	_	_	X	_	X		0.28
6	X	_	_	X	X	_		0.2
7	X	_	_	X	X	X		**-0.04**
8	X	_	X	_	_	_		-0.89
9	X	_	X	_	_	X		-1.08
10	X	_	X	_	X	_		-1.24
11	X	_	X	_	X	X		-1.41
12	X	_	X	X	_	_		-1.45
13	X	_	X	X	_	X		-1.58
14	X	_	X	X	X	_		-1.72
15	X	_	X	X	X	X		-1.86

Table 3-1: Capacitance Configuration

For the example measurement shown in the last column of Table 3-1, the jumper pattern in row 7 of Table 3-2 is used for the 2-wire probe. According to Table 3-2, row 7, the recommended Reference Jumper Pattern for the 2-wire probe is _ X _ X X X (jumpers CR5, CR3, CR2 and CR1 installed) and the recommended Measurement Jumper Pattern is _ X _ X X (jumpers CM4, CM2 and CM1 installed). See Figure 3-2.

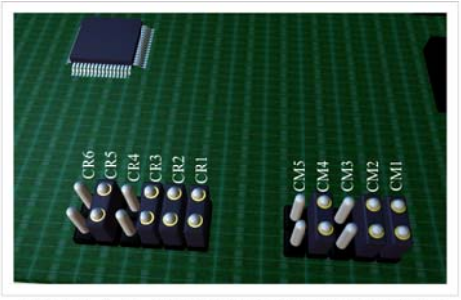

Figure 3-2: Example for jumper setting

NOTE

If the first voltage measured in Table 3-1 is a negative value, please use jumper configuration 2 in Table 3-2.

NOTE

Please note that Reference Capacitance Configuration 1 in Table 3-2 is not a valid option (Not Used). While performing the steps to determine the correct jumper configuration, if the voltage values result in Reference Capacitance Configuration 1 in Table 3-2, choose configuration 2 instead.

Reference Capacitance Configuration	*Probe Range Jumper pattern*						*Reference Jumper Pattern*						*Measurement Jumper pattern*				
	CR6	CR5	CR4	CR3	CR2	CR1	CR6	CR5	CR4	CR3	CR2	CR1	CM5	CM4	CM3	CM2	CM1
1	X	_	_	_	_	X	Not Used						Not Used				
2	X	_	_	_	X	_	_	_	_	X	_	_	_	_	_	X	_
3	X	_	_	_	X	X	_	_	_	X	X	X	_	_	_	X	X
4	X	_	_	X	_	_	_	_	X	_	X	X	_	_	X	_	X
5	X	_	_	X	_	X	_	_	X	X	X	X	_	X	_	_	_
6	X	_	_	X	X	_	_	X	_	X	_	_	_	X	_	X	_
7	X	_	_	X	X	X	_	X	_	X	X	X	_	X	_	X	X
8	X	_	X	_	_	_	_	X	X	X	X	_	_	X	X	X	X
9	X	_	X	_	_	X	X	_	_	X	X	_	X	_	_	_	_
10	X	_	X	_	X	_	X	_	X	_	X	_	X	_	_	X	X
11	X	_	X	_	X	X	X	_	X	X	_	X	X	_	X	_	_
12	X	_	X	X	_	_	X	X	_	_	X	X	X	_	X	X	X
13	X	_	X	X	_	X	X	X	_	X	X	_	X	X	_	_	X
14	X	_	X	X	X	_	X	X	X	_	X	_	X	X	_	X	X
15	X	_	X	X	X	X	X	X	X	X	_	X	X	X	X	_	X

Table 3-2: Set up Table for Standard Length Wave Probes (<=1.2 m)

Reference Capacitance Configuration	*Probe Range Jumper pattern*						*Reference Jumper Pattern*						*Measurement Jumper pattern*				
	CR6	CR5	CR4	CR3	CR2	CR1	CR6	CR5	CR4	CR3	CR2	CR1	CM1	CM4	CM3	CM2	CM1
1	X	_	_	_	_	X	_	_	_	_	X	_	_	_	_	X	_
2	X	_	_	_	X	_	_	_	_	X	X	_	_	_	X	_	X
3	X	_	_	_	X	X	_	_	X	X	_	_	_	X	_	_	X
4	X	_	_	X	_	_	_	_	X	X	X	_	_	X	_	X	X
5	X	_	_	X	_	X	_	X	_	X	_	X	_	X	X	X	X
6	X	_	_	X	X	_	_	X	X	_	X	_	X	_	_	_	_
7	X	_	_	X	X	X	X	_	_	X	_	_	X	_	_	_	_
8	X	_	X	_	_	_	_	X	X	X	X	_	X	_	_	_	_
9	X	_	X	_	_	X	X	_	X	_	_	X	X	_	X	_	_
10	X	_	X	_	X	_	X	_	X	X	_	X	X	_	X	X	X
11	X	_	X	_	X	X	X	X	_	X	_	_	X	X	_	X	X
12	X	_	X	X	_	_	X	X	_	X	X	_	X	X	X	_	X
13	X	_	X	X	_	X	X	X	X	_	X	X	X	X	X	X	X
14	X	_	X	X	X	_	X	X	X	X	X	X	X	X	X	X	X
15	X	_	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 3-3: Set up Table for Extended Length Wave Probes (>1.2 m)

4. Output Range Adjustment

The output range adjustment procedure described below maximizes the output voltage range to approximately +/- 4.5 volts. The internal gain and offset used by the firmware to increase the output range are stored in non-volatile memory so that they are retained across resets and across power interruptions.

Please follow these steps to adjust the output range:

1. Ensure that both the red Min LED and the red Max LED are continuously flashing at a 0.5 Hz rate (1 second on followed by 1 second off). If the Max LED is not flashing, press and hold the SET/CLEAR push button for 3 seconds or more. When the push button is released, the Max LED will begin to flash. If the Min LED is not flashing, press and hold the SET/CLEAR push button again. When the push button is released, the Min LED will begin to flash.
2. Set the probe to the minimum immersion point for the wave probe. This is typically the lowest immersion point of the probe.
3. Press the SET/CLEAR push button. You will see the minimum LED flash quickly a number of times and then the flashing will stop. The minimum LED will then stay off.
4. Set the probe to the maximum immersion point. This will typically be the same immersion point as used during the wave probe capacitance determination procedure.
5. Press the SET/CLEAR push button. You will see the maximum LED flash quickly a number of times and then the flashing will stop.
6. Next the minimum and maximum LEDs will alternate on and off. The wave probe should not be disturbed until the flashing stops and both LEDs remain off. Once both LEDs have turned off the output range adjustment is complete.

You are now ready to begin using the AWP-24 for your measurements. The first step before proceeding with actual measurements is to perform a calibration. This is necessary in order to determine the relationship between water level and the output voltage from AWP-24.

NOTE

To ensure accurate results, it is recommended that calibrations on AWP-24 are performed in steady water with no waves or ripples.

The firmware can be returned to factory default values by pressing and holding the SET/CLEAR for 3 seconds once to reset the maximum and then pressing and holding SET/CLEAR for 3 seconds again to reset the minimum – as described above.

5. Akamina Product Warranty

5.1 Limited Warranty

Akamina Technologies Inc. ("Akamina") manufactures (or has manufactured by a third party) its hardware products from parts and components that are new or equivalent to new in accordance with industry-standard practices. Akamina warrants that hardware products supplied by Akamina will be free from defects in materials and workmanship under normal use for a period of one (1) year from the date of shipment to the original purchaser.

This warranty does not cover consumables, normal wear and tear, damage due to external events, including accident, acts of God, abuse, misuse, problems with electrical power, attempted modifications or servicing not authorized by Akamina, negligent use or mishandling, and problems caused by use with non-Akamina products, external devices, accessories or parts added to the system.

5.2 Remedies

During the limited warranty period Akamina will, at its option, repair, replace or refund the purchase price of products that are determined to be defective. Replacement may constitute, at Akamina's option, a new, refurbished or functionally equivalent item. A replacement product or part assumes the remaining warranty of the original product or ninety (90) days from the date of replacement or repair, whichever provides longest coverage.

To request limited warranty service, the purchaser must contact Akamina within the limited warranty period. If warranty service is required pursuant to the limited warranty the purchaser will pay for and ship the defective product(s) item to Akamina. Akamina will ship the repaired or replacement product(s) to the purchaser or refund the purchase price of the defective product(s).