



AJL-3000 Water Leakage Detector

Operation Manual



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Operation Manual of AJL-3000 Water Leakage Detector

1. Detector description

1.1 Function overview

AJL-3000 detector is a specialized device for use to locate leakage point on water supply pipeline, and is also applicable to leakage detection with other pressure pipeline systems. When fluid leaks out from the pipeline, the noise produced spreads along the pipeline or the burying layer to the ground. AJL-3000 leakage detector can locate the leakage position along the pipeline or road surface. AJL-3000 is a leakage detector that adopts low-power microprocessor and advanced dedicated filters in digital processing. It adopts specifically designed broadband high-sensitivity vibration sensor (vibration pick-up) to pick up ground (or at pipeline end) noise and converts such signal to electric signals. The electric signals are then amplified and processed by digital filtration, and the results are displayed on the monitor in two graphical forms. Since the water leakage noise is continuous, six column bars are produced by repeated detection at the six frequency bands, while sporadic impact and interference signals are restrained (not displayed). Besides, the external interference may be overlying together, the detector captures and presents the minimum values within a corresponding time period, in order to minimize the external interference.

AJL-3000 adopts dot matrix backlit LCD display to meet the needs of horizontal lengths and 6 vertical light bars and is easily readable during nighttime.

AJL-3000 provides three bands of bandwidths, which has taken into account the vibration energy distribution during monitoring process and is more accurate in frequency based analysis.

AJL-3000 provides 6 channel memories, which can store the signals at 6 frequency bands or measurement results at 6 detection spots.

The special engineering plastic case and corresponding operation panels for AJL-3000 are very simple to use and to get extensive information easily.

1.2 Structure

AJL-3000 leakage detector is stored in a dedicated die-cast PVC and aluminum alloy case, which is 230*95*108 (L*W*H) in size. The case is in a two layer structure, with the upper layer (80mm high) as the main case of circuits and the lower layer (28mm high) as the case of battery and bottom cover. When they are assembled together, they are 108mm high. When viewed from the front side of the case, the left part of the upper layer is the LCD display with protection glass, while the right part is the operation panel.

On the right side of the operation panel, there is an approximately 3.6cm wide skewed slot. Above the skewed slot, there is the vibration pick-up socket and the headphone jack, and between the upper and lower case on the skewed slot side, there is the battery charging port. The bottom cover of the case is fixed to the upper part by bolts. There is a dedicated case for rechargeable battery. The special battery set is stored in the case and connected to the electric circuit via a special plug. There is a cover with hidden latch. When the battery is removed or inserted, the operator can open the cover from the hidden latch. The battery set adopts 6 NI-MH battery cells. When energy saving measures are taken, a full battery (1900mAh) can power the detector for at least 35 hours, or

at least 10 hours when the backlight is enabled. In case the user may fail to charge the battery in time, another battery set of the same specification is provided with the detector. The battery may be charged in the case by using a special charger, or charged separately outside the device. It is advised to charge the battery for continuously 10 hours, when the battery power has been completely consumed.

1.3 Technical Specification

- a. Amplification ratio, adjustable within 100dB
- b. Frequency analysis span: 70~4000HZ, approximately 5 frequency intervals and three bandwidths.
 - c. Frequency bands: 1: 100HZ
(Central frequency): 2: 200HZ
3: 400HZ
4: 800HZ
5: 1500HZ
6: 3000HZ
- d. Bandwidth 1: Narrowband symbols |||
2: Middle-width band symbols |||||
3: Broadband: symbols |||||
- e. Two display modes:
 - 1) Horizontal bars
 - 2) 6 vertical bars
- f. Digital display: The corresponding minimum value is displayed in a range of 0~100.
- g. LCD display: 70*40mm
- h. The backlight is controlled by an On/Off switch and may be

automatically shut down 3 minutes after the last operation.

i. Power supply: 6*1.2V rechargeable battery set.

j. when battery is full

Continuous work time ≥ 35 hours (backlight off)

k. 6 measurement values are stored in 6 channels and can be viewed separately.

l. Silent mode button: Attached on the handle

m. Working temperature: $-10^{\circ}\text{C} \sim +50^{\circ}\text{C}$

n. Storage temperature: $-10^{\circ}\text{C} \sim +70^{\circ}\text{C}$

o. Detector case dimensions (L×W×D): 450×310×142 mm

p. Weight: Internal components of JT—3000 (including battery) 1.2kg

JT—3000 vibration pick-up (with socket connecting wire) 0.6kg

Gross weight of portable case 5.2kg

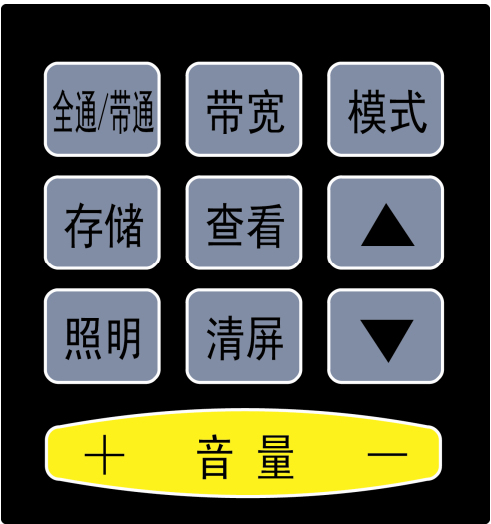
1.4 Supply list

Main body	1 (with internal NI-MH battery set)
Vibration pick-up	1
Sound monitoring rod	1 pair
Headphone	1pair
Charger	1
User Manual	1
Warranty Card	1
Portable aluminum alloy case	1
Backup battery set	1

2. Introduction to components of AJL-3000

2.1 AJL-3000 operation panel: Fig. 2.1

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All keys except the On/Off switch are touch keys.

The detector provides detailed description of the functions and operation of all keys.

全通/带通	All-pass/Band-pass	带宽	Bandwidth
模式	Mode	存储	Save
查看	View	照明	Light
清屏	Clear	音量	Volume

2.2 AJL-3000 side ports

Fig.2.2



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2.3 Vibration pick-up and connection



隔音球	Vibration absorbing ball	手柄开关	Handle switch
传感器	Sensor		

2.4 LCD display



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The LCD display is a dot matrix monitor. All information, except the headphone, is displayed on the LCD display. Backlight is also available during nighttime. All graphical and values are easily readable.

2.5 Headphone

The headphone of this detector is a headset with ear protection and has high sensitivity. The ear protection can eliminate external noise interference, and the operator can adjust the elastic handle length accordingly. The operator may also adjust the attenuation knob according to his own hearing.



2.6 Battery set chamber and cover



The battery set includes 6 1900mAh NI-MH battery cells.

The battery cells are connected to internal circuit via special plugs.

2.7 Charger



2.8 Special outer package

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The package is a portable case made from aluminum alloy with special protective cushion structure.

3. Detector operation

Any operation on the detector must be done after the operator has read this Operation Manual carefully and understood the basic functions of each component, to avoid improper operation or even damages to the detector. The operation procedures are generally in the following steps:

3.1 Connect the headphone and vibration pick-up

Figure 2.2 shows the positions of connection holes on the side of the main unit.

Firstly, the operator should plug the wire from the vibration pick-up handle into the corresponding socket (an align slot is provided in the middle of the 4-core socket) on the cant side of the main unit, and then insert the headphone plug to the headphone jack. There is an On/Off switch on the control handle and the plug of this cable should be connected to the socket on the vibration pick-up. Similarly, special care should be taken to align and tighten the plug properly.

3.2. Switch on the detector by the On/Off switch

The On/Off switch is a rocker switch located on the lower right corner on the front side of the detector.

When “ON” is pressed, the detector is powered on.

After it is powered on, a welcoming message of “Welcome to use Yangzhou Jietong Detector”. Several seconds later, the detector will enter the standby status.

The LCD display will be in one of the two modes available.

3.3 Display mode selection:

Mode I includes horizontal bars with corresponding value 0 on its left and 100 on its right. Mode II includes 6 vertical light bars, with 0 on the bottom and 100 on the top. If the LCD display is already in the mode selected, then no further operation will be required. To switch to the other mode, the operator may press the “Mode” key on the touch panel.

LCD display information when Mode I [single horizontal bar] is selected.

Fig. 3.1



The horizontal bar display and corresponding minimum value

In Mode II [6 vertical bars], the corresponding images and values of detection signals will be displayed. Fig. 3.2



The horizontal bar display and corresponding minimum value

This image corresponds to the intensity distribution of signals at various central frequencies in all-pass state.

3.4 Headphone volume and amplification adjustment

Operator should put on the headphone and place the vibration pick-up on a desk or on the ground, to listen to the environment noise, or he may scratch the ground surface gently with a foot and observe the bar dynamics while listening to the friction noise. To increase the sensitivity, the operator may press the “+” button to the right of the volume button, or otherwise press the “-” button, until he can find the best comfortable level and the light bar can move from one end to the other.

In field detection process, the operator may also use the volume “+” or “—” buttons to adjust the headphone volume level.

3.5 Frequency band selection and frequency analysis

Frequency band selection and frequency analysis are key operations on AJL-3000 leakage detector and an important check point for operators to master the leakage detection techniques. Therefore special attentions should be paid.

3.5.1 “All-pass” and “Band-pass”

There is an “All-pass” and “Band-pass” switch key on the operation panel.

When the detector is in “All-pass” state, all vibration signals captured by the vibration pick-up within the range from 70 to 4000 Hz will pass and be amplified by the AJL-3000 leakage detector. The operator can heard various noise from the headphone, covering all bands from low frequency to high frequency, which is to say that all environment noises at an extensive frequency range will be received (via ground vibration). To an operator with sufficient capability of hearing analysis, he can receive the most sufficient information. If

in quiet environment, he will has the best capacity is carry out analysis. However, in environments with large noise and various interferences, a beginner may hardly master the skills. As such, he needs to switch to the “Band-pass” mode. The “All-pass/Band-pass” button is to switch between the two modes. In the so-called “Band-pass” mode, AJL-3000 provides 6 frequency bands and 3 bandwidths. The central frequencies of such 6 frequency bands are 100Hz, 200Hz, 400Hz, 800Hz, 1500Hz and 3000Hz, which fall into three bandwidths, namely the narrow band, middle band and broadband, in order to carry out more detailed frequency analysis.

There are two rows of symbols under the LCD display. The upper row indicates the central frequency of current band. When the detector is in “Band-pass” mode, then the corresponding frequency value flashes. If no central frequency value flashes, then it means that the detector is working in “All-pass” mode. The lower row indicates the bandwidth of current band.

Narrow band is indicated by three narrow bars|||. .

Middle band is indicated by five narrow bars||||.

Broad band is indicated by seven narrow bars|||||. .

3.5.2 Selection of central frequency: [only available in “Band-pass” mode]

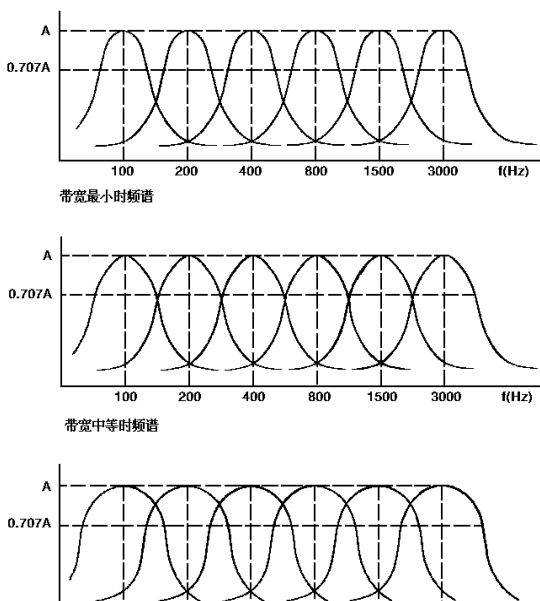
The operator may observe the flashing frequency values on the LCD. If a higher frequency is required, he can press the “▲” key to increase the frequency, or otherwise, if lower frequency is required, he can press the “▼” key to reduce the frequency. But it is noteworthy that if the central frequency is already 3000Hz, a press on the “▲” key will toggle to the lowest frequency (100Hz), and if the current central frequency is already “100Hz”, a press on the “▼” key will jump to the highest frequency (3000Hz).

3.5.3 Selection of bandwidth: [only available in “Band-pass” mode]

The operator may observe the bandwidth symbols on the LCD (the lowest row), if the detector works in narrow band mode “|||”, he can press the “Bandwidth” button to switch and the “|||” symbol begins to flash. Then he can press the “▲” key again to switch to the “||||”, and press the “▲” key again to switch to “|||||”. However the symbol is still flashing, then the operator needs to press the “Bandwidth” key and the identifier stops flashing. Then the whole process is completed. If the detector is working under broad band and needs to be switched to narrower bands, the operation is quite similar to the steps described above. The operator should press the “Bandwidth” key and the identifier begins to flash, then he can press the “▼” key and toggle the bandwidth symbol. To confirm the bandwidth, the operator may press the “Bandwidth” key again and the identifier stops flashing. Then the whole process is completed.

Bandwidth is a parameter in frequency band covering a certain frequency range. The diagram of three bandwidth provided by AJL-3000 is given as below, in which the frequency range covered by the intersection point of line 0.707 and the frequency band curve is the frequency band where it is in the center position.

Fig. 3.3



带宽最小时频谱	Frequency spectrum at minimum bandwidth
带宽中等时频谱	Frequency spectrum at medium bandwidth
带宽最大时频谱	Frequency spectrum at maximum bandwidth

Display mode II, the dynamic detection signal information of 6 central frequency is displayed on the LCD, which may be used as sufficient basis for the operator to understand the frequency characters of signals tested.

On basis of such frequency characters, the operator can understand the main frequency distribution of the current leakage signals, in order to precisely locate and confirm the leakage characters.

3.6 Storage of volume values, 6 storage channels

During the leakage detection process, the operator may need to compare the volume levels of different signals, and in order that the detection value will not be mistaken, AJL-3000 leakage detector allows storing the volume information of signals detected.

3.6.1 The instant rate on the LCD display

For instance: When the detector works in Band-pass mode and in a display mode of 6 vertical bars, the “100” under the light bar flashes, indicating that the detector is currently receiving vibration signals in the frequency band centered by 100Hz. When the light bar becomes stable, the current value should be taken as the leakage signal intensity. If the operator needs to record such value, he can

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press the “ ” key. Then the receiving frequency is automatically switched to “200hz”, and the character of “200” flashes while “100” stops and the value on the top is also fixed. When the operator records the detection value at “200Hz”, he can press the “ ” key again to continue with the “400Hz” band, so on and so forth.

For another instance, in “All-pass” mode, 6 light bars are displayed in Mode II, there are detection values on all the 6 frequency bands. If the operator needs to record such value, he can press the “All-pass/Band-pass” key, then values on 5 light bars will be fixed and only one light bar is in “Band-pass” detection mode.

3.6.2 Storage of volume value

In order to save the volume information in the detector for future reference and comparison, after the detection value is confirmed, the operator needs to press the “Save” key. Then the volume value on the LCD will not change by the detection signal but is fixed. Such fixed value is to be saved in the detector. After the operator releases the “Save” key, a message “Saved to Channel 1”. To confirm the channel, the operator needs to press the “Save” key again, then the volume information is saved to Channel “1”. If the channel “1” has been used previously, then when “Save to Channel 1” is prompted on the LCD, the operator can press ▲ ” or ▼ ” to change the channel to “2” or another channel. After the saving operation is confirmed by the operator, he may press the “Save” key again to complete the operation. The detector allows to store up to 6 values.

If after the “Save” key is pressed, the operator changes his mind, he can press the “Clear” key to exit.

3.7 View volume levels stored

3.7.1 The operator may press the “View” key to enter browsing state. At this time, the channel number on the upper right corner of LCD flashes, and the volume level of such channel is displayed on the LCD display. To view the volume levels stored in other channels, the operator may press “▲” or “▼”, then the channel number begins to flash and the volume level corresponding to such channel will be displayed on the LCD display. When the viewing operation is completed, the operator may press the “View” key again to exit to the detection state.

3.7.2 When the operator switches to “View” state in single bar display mode, only one light bar will be displayed on the LCD. To check if the volume value is a value at a specific frequency band or in the “All-pass” mode, there is a “◀” prompt to the right of the corresponding frequency (see the right side of 100Hz in Fig. 3.1). If there is a “◀” prompt to the right of all frequencies, it means that the current value is a volume value saved in the “All-pass” mode. At this time, the operator may press the “All-pass/Band-pass” key to toggle and check the volume values at various frequencies.

3.7.3 Attention: The channel number flashes on the upper right corner, indicating that the detector is currently in View mode. At this time, the volume of the headphone is cut off, which has nothing to do with the detection mode. In view state, only the “View”, “▲” and “▼” keys are operable, while in the single horizontal bar display mode, the “All-pass/Band-pass” key is also operable, with all other keys disabled.

3.8 Backlight control:

When backlight is off, the operator may press the “Backlight” key to

switch on the backlight. In order to save power energy, the backlight will be automatically shut off in 3 minutes after the last operation. If the “Backlight” key is pressed when the backlight is on, it will be shut off immediately.

3.9 Application of Clear key:

3.9.1 The Clear key is to clear the light bar and volume values on the LCD display, to continue with new detection.

3.9.2 If after the “Save” key is pressed, the operator changes his mind and device to abort, he can press this Clear key to exit.

3.10 View battery level and charging prompts:

There is battery level indication on the lower right corner of the LCD display. A higher bar indicates higher battery level, and if there is no bar indicated or the battery icon begins to flash, it means that the battery is exhausted.

3.11 Charging:

AJL-3000 provides a special charger and a charging port on the right side of the main unit. To charge the battery, please connect the charger to 220V power supply and then insert the output end to the charging port. Then the red light on the charger is on, indicating that the detector is currently in charging state. The indicator turns green after battery is full. In urgent cases, the operator may charge the battery for a short period, but should avoid over charging.

3.12 Backup battery and replacement:

To meet the urgent needs of users, the detector is also provided with a backup battery set. The operator may have the backup battery fully charged off the detector in accordance with related procedures. When in urgent needs, he

may replace the exhausted battery by the fully charged one, or in normal situations please keep the battery case closed and avoid frequent connection and disconnection of the battery plug.

Replace battery: The battery chamber cover is located on the bottom of the detector case. The operator may push aside the latch to open the battery chamber and replace the battery. Special care should be taken of the positioning slots and embossment on the battery plug and the socket. Reversed polarity is not allowed.

3.13 Packaging and precautions in use:

AJL-3000 leakage detector is a precise instrument. Although it is for use in field operation and special attentions have been paid to its durability, the operator should operate carefully, to avoid collision, water intrusion, scratches or violent pull of the wires. Special care should be taken to protect the vibration pick-up from falling from high places, to protect the detector from heavy load on the surface or damages to the LCD display and keys. The special package provides positioning cushion, and the device must be stored in the correct position in the package. Please keep the package in good order and from heavy load. Please store the device in clean areas free of corrosive matters or excess temperature or humidity.

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