



Product Introduction Manual

IPH3501 1.7MHz Atomizer PCB 24V / 20W Ultrasonic Atomization Control Board

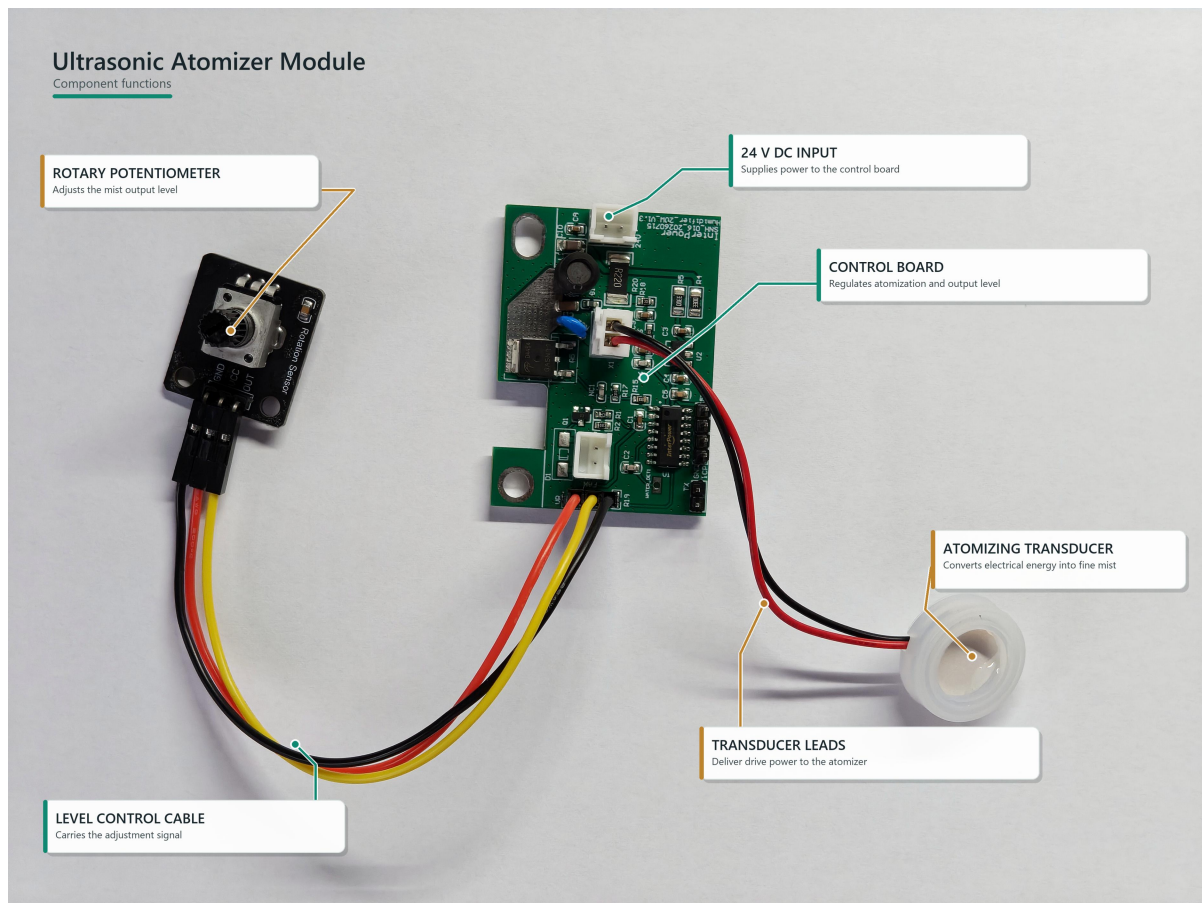


Figure 1 Module Connections and Key Components

Core Positioning

IPH3501 is designed for small atomization products such as home humidifiers, office humidifiers, and hotel aroma diffusers. It drives a 1.7MHz ultrasonic transducer from a 24V supply and integrates mist-level adjustment, frequency tracking, and water-shortage protection.

1. Product Overview

The IPH3501 atomizer PCB uses a dedicated ultrasonic atomization MCU to drive the atomizing transducer at high frequency through precision PWM control, breaking liquid water into a fine, natural mist. The module is designed for systems that require stable mist output, external rotary adjustment, and water-shortage protection.

1.1 Operation Instructions

Power-On Operating Logic

1. After 24V DC is applied, the control board initializes the MCU, I/O, PWM output, ADC sampling, water detection, and protection parameters.
2. The system first reads the water-shortage detection status. If no water is detected, atomization PWM remains off to prevent the transducer from dry firing.
3. When water is detected, the control board determines the target mist level from the current potentiometer position. If the potentiometer is at the minimum position, atomization remains off. If it is above the off position, frequency tracking and atomization drive start, and fan control enters operation according to the product configuration.
4. During operation, the system periodically rechecks water level and knob input. If water shortage is detected, atomization output is shut down first; operation resumes only after water level is restored and startup conditions are met again.

Potentiometer Operating Logic

5. The potentiometer connects to the mist-level adjustment input. Rotating it changes the analog voltage sampled by the control board.
6. The MCU periodically reads the potentiometer ADC value and maps it to a target mist-level setting or output ratio. When the potentiometer is turned to the minimum position, the control board treats it as the off position and stops atomization PWM output and transducer drive. The increase/decrease direction should follow the actual wiring and knob marking.
7. Mist output is controlled through fast periodic intermittent operation. After rotating up from the minimum off position, the low mist range uses a lower atomization on-ratio, while the high mist range uses a higher on-ratio, increasing mist output accordingly.
8. If water-shortage protection is triggered during operation, the potentiometer position will not force continued output. The system first shuts down PWM and transducer drive; protection has higher priority than the mist-level setting.

Note: After first installation, water-tank structure changes, or transducer replacement, perform no-water calibration in a dry state before filling and testing atomization, so water-shortage detection remains stable and reliable.

Item	Description
Solution Type	1.7MHz / 24V / 20W ultrasonic atomization PCB control solution
Control Core	Dedicated ultrasonic atomization MCU for atomization drive, frequency tracking, water-detection protection, and mist-level adjustment control.
Atomization Method	The MCU outputs high-precision PWM to directly drive a MOSFET and boost inductor, driving the transducer at high frequency.
Adjustment Method	External rotary potentiometer adjusts mist output; the control program adjusts the output rhythm according to the potentiometer ADC value.
Protection Function	Capacitive water detection / water-shortage detection; atomization output is shut down during water shortage to protect the transducer.
Application Scenarios	Home humidifiers, office humidifiers, hotel aroma diffusers, and small atomization devices.

2. Working Principle

The system consists of a 24V DC input, control board, atomization driver, and atomizing transducer. The MCU generates a PWM signal close to 1.7MHz, which drives the piezoelectric transducer through a MOSFET and boost inductor. Under the high-frequency electric field, the piezoelectric element vibrates and breaks liquid water into fine mist. The control system also includes frequency tracking, capacitive water detection, mist-level adjustment, and fan control.

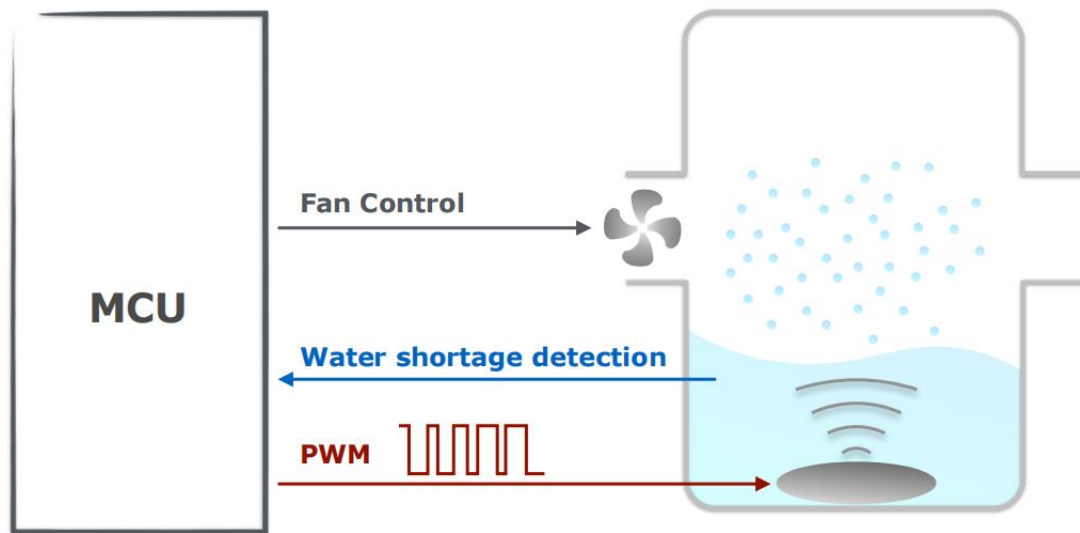


Figure 2 Basic Working Principle Diagram

Stage	Function	Design Focus
Input	24V DC supplies the control board and atomization driver.	Keep sufficient filtering and surge margin at the power input.

Stage	Function	Design Focus
Control	The MCU controls atomization output according to the potentiometer, water-detection status, and frequency-tracking result.	Atomization must be off when no water is present; knob changes should respond smoothly.
Drive	PWM directly drives the MOSFET and works with the boost inductor to drive the transducer.	High-current loops should be short, wide, and have a small enclosed area.
Actuation	The 1.7MHz transducer converts water into mist.	The transducer, sealing structure, and water level affect mist output.
Protection	Capacitive water detection identifies water-shortage status.	No-water calibration is required during first assembly to avoid misjudgment or dry firing.

- Frequency tracking gradually adjusts the drive frequency from high to low and uses current sampling to find a suitable operating point, improving atomization power and batch-to-batch consistency.
- Mist-level adjustment is implemented by reading the potentiometer ADC value. When the potentiometer is at the minimum position, atomization is off; above the off position, fast periodic intermittent control changes the actual atomization output.
- Capacitive water detection works with the software algorithm to detect water shortage. When no water is detected, atomization is turned off.

3. Solution Features

Feature	Description
High-Precision Frequency Adjustment	The control MCU includes one 9-bit adjustable PTMOSC oscillator. At 1.7MHz output, the average frequency trimming resolution is about 1.4kHz.
Capacitive Water-Detection Protection	With the InterPower water-detection library and mechanical no-water calibration, water shortage can be detected and atomization can be shut down automatically.
PTP Direct MOSFET Drive	The PTP pin includes built-in MOSFET drive capability with up to 150mA output current, reducing external driver components.
Higher Drive Efficiency	Direct PWM-to-MOSFET drive is more efficient than traditional self-oscillating solutions and helps reduce MOSFET heating.
Adjustable Mist Output	An external potentiometer allows users to adjust humidification output according to the application.
Product-Level Expansion	The control system includes a fan-control circuit; the actual product can be configured according to structure and airflow requirements.

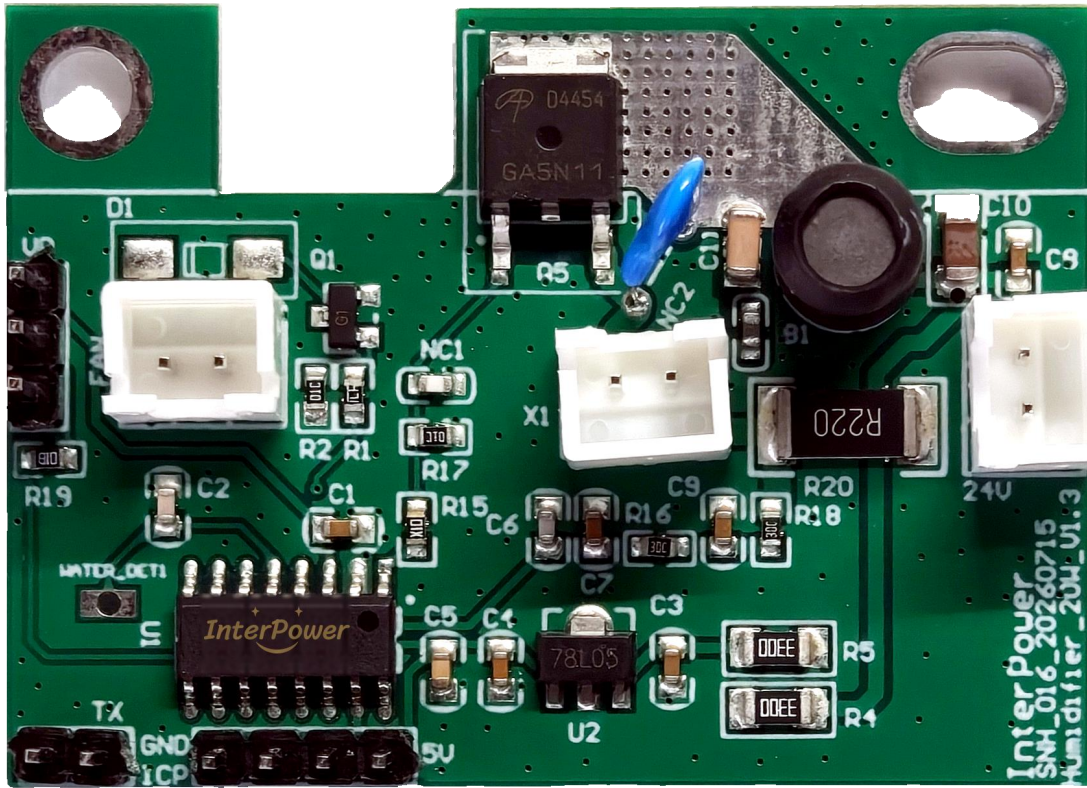


Figure 3 IPH3501 Atomizer PCB Front Side

4. Module Appearance and Connections

The front side of the module integrates the control MCU, MOSFET driver, boost inductor, power input connector, transducer connector, and adjustment/debug-related connection points. The back side uses copper areas and vias to strengthen high-current paths and heat dissipation. Actual wiring should follow the PCB silkscreen and the product harness definition.

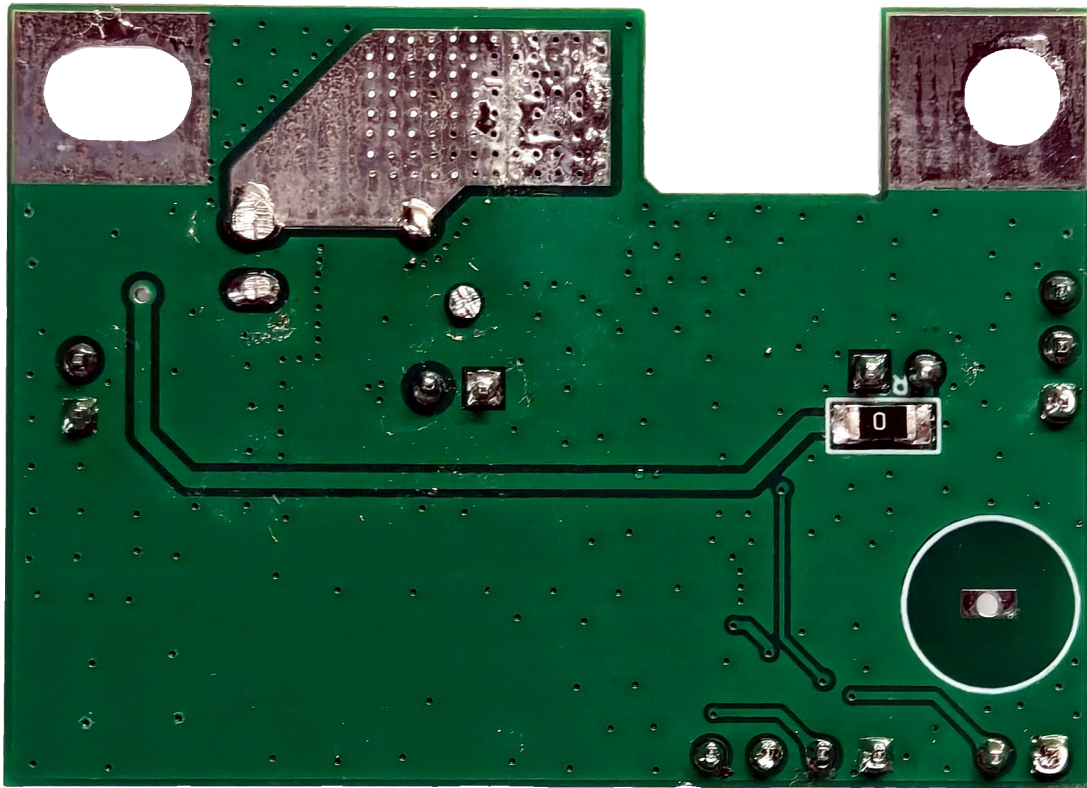


Figure 4 IPH3501 Atomizer PCB Back Side

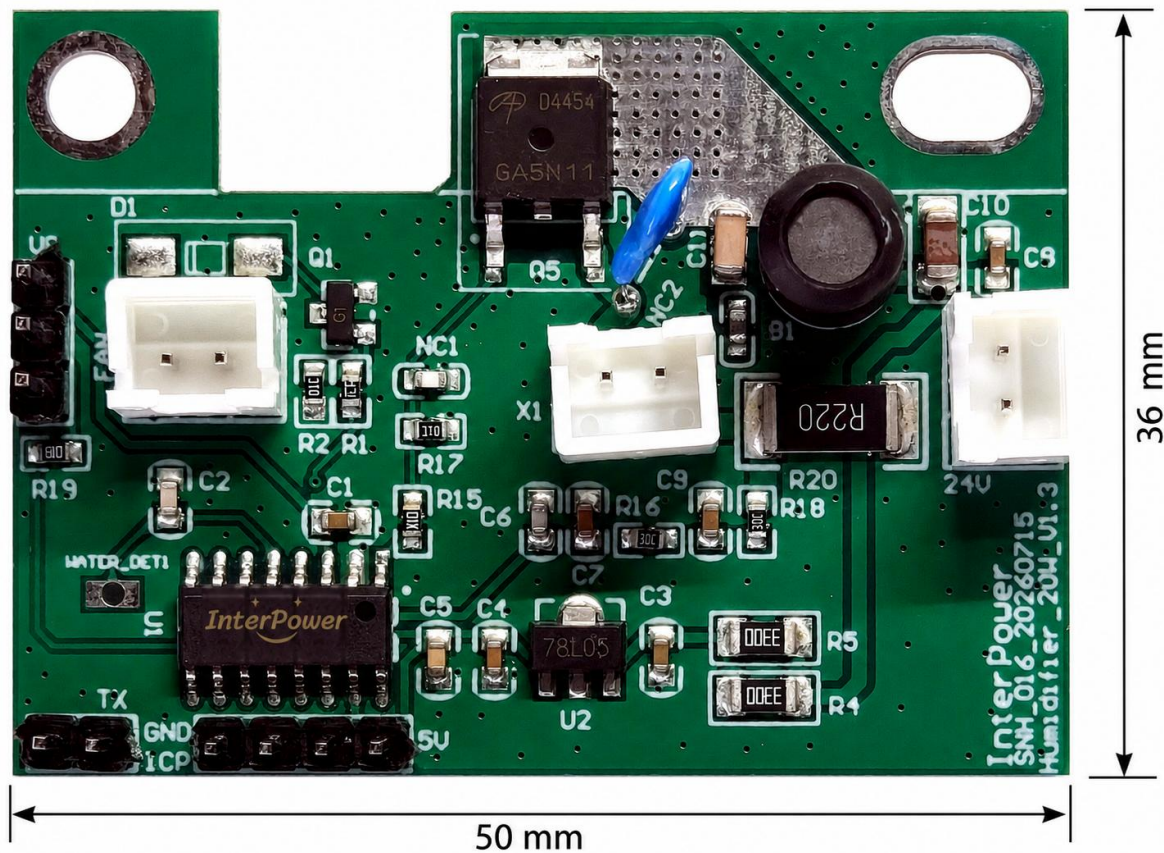


Figure 5 IPH3501 Atomizer PCB Dimension Drawing

Connection / Component	Purpose	Usage Note
24V DC INPUT	Supplies power to the control board and atomization driver.	Confirm polarity, wire gauge, and power-supply margin to avoid voltage drop under load.
ATOMIZING TRANSDUCER	Atomizing transducer / atomizing head.	Use a transducer matched to the 1.7MHz solution and avoid long dry operation without water.
TRANSDUCER LEADS	Transducer drive wires.	Keep the high-frequency, high-current path as short as possible and away from sensitive signal lines.
ROTARY POTENTIOMETER	Mist-level adjustment knob.	Used to change mist output. Pay attention to knob direction and end-stop feel during assembly.
LEVEL CONTROL CABLE	Adjustment signal harness.	Connects to the potentiometer or product control board; secure the harness before functional testing.
CONTROL BOARD	Atomization drive and control core.	Pay attention to heat dissipation and insulation clearance around the MOSFET, boost inductor, sampling, and water-detection areas.

5. Design and Integration Guidelines

5.1 PCB and Hardware Notes

- Use as much ground copper as possible, and keep one layer as a relatively complete ground plane for shielding to reduce interference from the high-frequency drive to control and water-detection signals.
- Keep the atomization drive loop area as small as possible and widen high-current traces. Pay special attention to temperature rise around the MOSFET, boost inductor, and transducer connector.
- Add sufficient filtering and energy storage at the power input. Harness voltage drop, connector contact resistance, and adapter transient capability all need to be verified.
- The water-detection structure must be verified together with the water tank, transducer mounting position, and plastic parts. No-water calibration is required after assembly.
- If the product includes a fan or other loads, separate the fan power/control loop from the high-frequency atomization loop with proper partitioning.

5.2 Operation and Calibration Procedure

9. Mount the transducer, sealing ring, water tank, and PCB according to the product structure, and confirm that the transducer and water-level area are assembled reliably.
10. Connect the 24V power supply, transducer leads, mist-level potentiometer, and product control wiring.
11. After first firmware programming or structural-part replacement, power on in a dry state to perform no-water calibration. Calibration details should follow the corresponding firmware/library instructions.
12. After adding water, start atomization and observe mist output, startup time, MOSFET temperature rise, and input power.
13. Rotate the potentiometer to verify the mist adjustment range. Then perform a water-shortage test to confirm that atomization output shuts down promptly when no water is present.

6. Reference Test Data

The following data can be used as reference for IPH3501 solution evaluation and product verification. Mass-production specifications should still be confirmed with the actual PCB, transducer, water-tank structure, power adapter, and test environment.

Test Item	Reference Value	Description
Total adapter input power	21W	Includes power supply, atomization, fan, and other loads.
Atomization power	17W	Prototype test value.
Power-supply power	3W	Prototype test value.

Test Item	Reference Value	Description
Fan power	1W	Prototype test value; whether enabled depends on the product configuration.
MOSFET temperature	63°C	Prototype test value; mass production should be retested with actual thermal design.
Average mist output	250mL/H	Depends on the transducer, water level, air path, and structure.
Conducted disturbance 150kHz-30MHz	PASS	Margin about 4.5dB?V.
Disturbance power 30MHz-300MHz	PASS	Margin about 7dBpW.
Radiated emission RE 30MHz-1GHz	PASS	Margin about 4dB?V/m.

7. Application Scenarios

- Home desktop humidifiers: suitable for consumer products that require fine mist, low-voltage DC power, and knob adjustment.
- Office/hotel humidification: can be matched to the product according to water-tank capacity, air path, and noise targets.
- Aroma diffusers: can be combined with an aroma water tank, mist outlet structure, and exterior parts to form a finished product solution.
- Small atomization prototypes: suitable for quickly verifying 1.7MHz transducers, structural water level, and control logic.

8. Contact Information

For samples, solution evaluation, or customization support, please contact us through the channels below.

WhatsApp: +86 138 2963 2935

WeChat: Scan the QR code below to add us on WeChat.



WeChat QR Code

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