WORKSHOP EQUIPMENT MANUAL

Chladni Rig

Wiring, setup, operating instructions, protection limits, and a repeatable classroom procedure for making standing-wave patterns visible.

CORRECT THREE-PART SIGNAL CHAIN

FY6900-60M
signal generator

→

Nobsound
TPA3116D2 power amp

→

Dayton TT25-8
8-ohm shaker

Signal → power → motion

Read before switching on

The TT25-8 is rated **15 W RMS / 30 W maximum**. The Nobsound amplifier can exceed that. Start with its volume fully down, use a sine wave at **0.5 Vpp**, and raise power only until particles begin to move. Stop immediately for heat, odor, scraping, or violent grain ejection.

Key limitation: Dayton publishes a **20-80 Hz usable response** for the TT25-8. This makes the present kit good for low-frequency proof-of-motion, but it may not reach many modes of a thin ukulele plate. Failure above 80 Hz is not automatically a wiring fault.

Contents

What each part does

SOURCE

FeelTech / FeelElec FY6900-60M

Creates the test tone. Use CH1, sine wave, zero DC offset. Its output is a *signal*, not speaker power.

Output	BNC, 50 Ω nominal
Low-frequency amplitude range	Up to 24 Vpp in the published specification; this rig uses much less.
Sweep	CH1; linear or logarithmic; 0.01-999.99 s

POWER

Nobsound mono 100 W TPA3116D2 amplifier

Supplies current to the shaker. Use a **full-frequency** mode or board; a subwoofer low-pass mode blocks higher frequencies.

Load	The 8 Ω TT25-8 is compatible with the TPA3116D2 family.
Power input	8-25 V DC. Match the connector and polarity marked on the unit.
Important	“100 W” is not a safe setting for this shaker.

MOTION

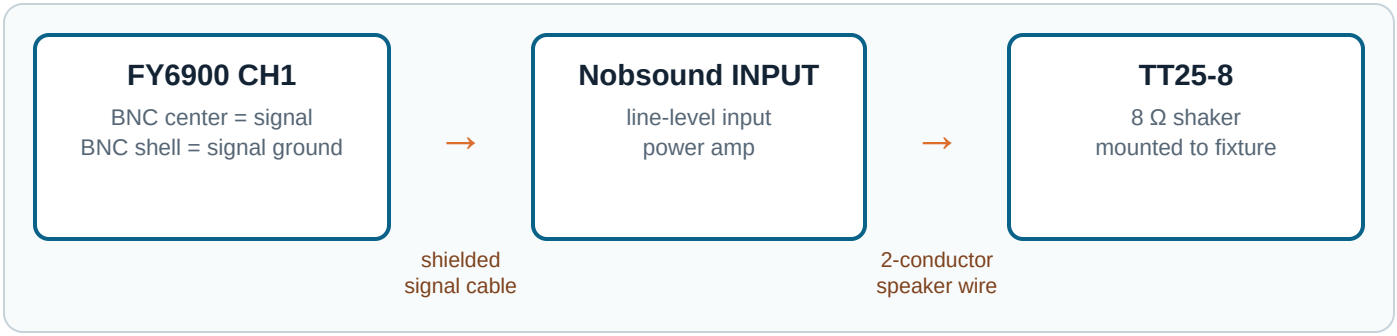
Dayton Audio TT25-8 PUCK

Converts amplified current into mechanical vibration. It must be rigidly mounted; it is not a free-air speaker.

Impedance	8 Ω
Power	15 W RMS / 30 W max
Published response	20-80 Hz; resonance 40 Hz
Size	3.5 in diameter × 1 in high

Confirmed amplifier details: this Nobsound unit is **mono** and accepts **8-25 V DC**. Use its single `OUT+ / OUT-` pair. Before powering it, verify the input connector and DC polarity on the unit, and note whether it has a `FULL / SUB` switch.

Three components, two cable types



Buy or gather these cables

CONNECTION	USE THIS	HOW TO CHOOSE
FY6900 → amplifier	**One shielded cable, BNC male at the generator end.**	If the amp has RCA input: BNC-male-to-RCA-male. If it has 3.5 mm AUX: BNC-male-to-3.5-mm cable, or BNC-to-RCA plus an RCA-to-3.5-mm adapter. If it has IN/GND terminals: BNC-to-test-lead cable, center to IN and shell to GND.
Amplifier → TT25-8	**16-18 AWG stranded, two-conductor speaker wire.**	Bare ends work with screw terminals. Add banana plugs only if the amp has binding posts. Use insulated crimp/spade connectors only if they match the puck leads or mounting ring.
Amplifier power	**Regulated 8-25 V DC supply.**	Use a plug size and polarity that match the amplifier marking. A lower voltage within the supported range reduces available output but does not replace careful gain control.

Connect this way

- Amplifier **OUT+** to puck positive.
- Amplifier **OUT-** to puck negative.
- Keep the signal cable separate from speaker wire where practical.
- Power off while changing any wire.

Never do this

- Do not connect the puck to FY6900 directly.
- Do not tie amplifier OUT- to chassis, BNC shell, or signal ground.
- Do not short the speaker outputs together.

The amplifier is mono: use its single `OUT+ / OUT-` speaker-output pair. Do not tie either output terminal to chassis, BNC shell, or signal ground.

Cable search terms: “BNC male to RCA male coax cable,” “BNC male to 3.5 mm mono audio cable,” and “18 AWG two-conductor stranded speaker wire.” The first cable depends on the input jack actually fitted to the Nobsound unit.

Coupling matters as much as electronics

The shaker must transfer vertical motion into the test plate without the rest of the bench absorbing it. Loose contact produces buzzing; heavy or soft contact damps the mode.

Preferred classroom demonstration

Use a sacrificial metal or plywood Chladni plate with a deliberate center attachment or purpose-built coupling fixture. Mount the TT25-8 to a rigid carrier using its surface ring or the manufacturer's six-screw pattern, then couple the carrier to the plate.

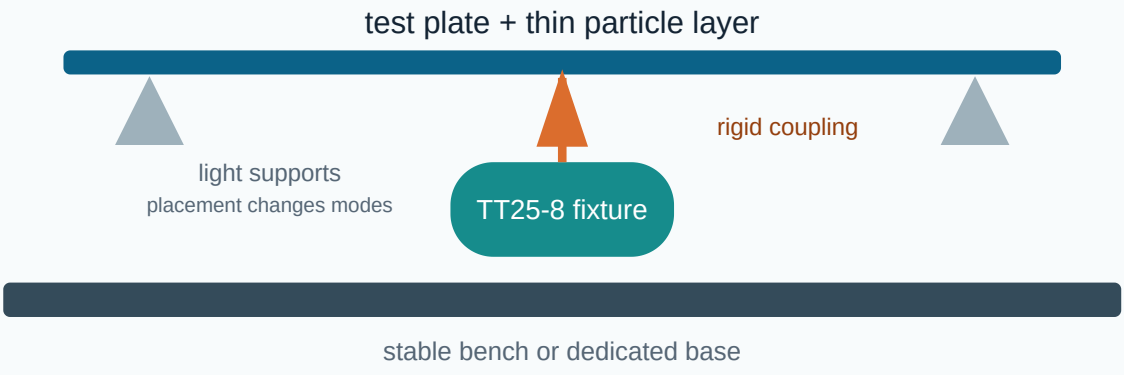
- Support the plate so its edges can move freely.
- Keep the fixture stable and restrained.
- Use a thin, even dusting of fine, dry particles.
- Keep faces and electronics out of the ejection path.

Thin ukulele top or back plate

Do not drive six mounting screws through tonewood. The 3.5 in puck and its fixture add substantial mass and damping, shifting the resonances being observed.

- Use a reversible, low-mass coupler designed for the plate.
- Keep particles out of pores, joints, and future glue surfaces.
- Record the fixture and support points with every frequency.
- Treat the result as qualitative visualization, not a target specification.

Bench arrangement



Conceptual arrangement only: the exact coupler depends on the plate and the puck's mounting ring.

Particle and hearing safety

Wear eye protection, keep the layer sparse, and stop if grains launch off the plate. Avoid inhaling fine dust. Resonant fixtures can become unexpectedly loud; use hearing protection when needed. Keep students' fingers off the moving plate and coupler while energized.

Start with a clean, small signal

Waveform **SINE**	Frequency **40 Hz**	Amplitude **0.5 Vpp**
DC offset **0.000 V**	Phase **0°**	CH2 **OFF**

Startup trap: the FY6900 manual says CH1 and CH2 may default to ON at power-up. Put the amplifier volume at zero before powering the generator, then deliberately confirm the CH1 status indicator.

Fixed-frequency setup

1. **Select CH1.** Press CH1 until its parameters are selected; if output is already on, turn it off while configuring.
2. **Select SINE.** Press WAVE until the sine waveform is shown.
3. **Set 40 Hz.** Press FREQ, position the cursor with the arrow keys, and turn ADJ.
4. **Set 0.500 Vpp.** Press AMPL and adjust. This is a conservative line-level starting point, not a hard maximum.
5. **Set offset to 0.000 V.** Press OFFS and adjust. DC offset provides no useful vibration and reduces clean headroom.
6. **Enable CH1 only after the amplifier is at zero.** The CH1 key toggles the selected channel's output.

Slow sweep for the present TT25-8

Object	Frequency
Start / end	25 Hz → 80 Hz
Type	Linear
Time	60 s for a first pass; slower if patterns need time to settle
Direction	Up; stop near visible movement and tune manually

Press **SWEEP**; choose frequency with **OBJE**; set **STAR** and **END**; set **SOUR** to TIME; choose linear with **MODE**; then press the **ADJ** knob to start or stop. Sweep output is from CH1.

Better than endless auto-sweep: use the broad sweep only to find activity. Stop, return to fixed-frequency mode, then approach the resonance in 1 Hz steps and finally 0.1 Hz steps. A pattern needs dwell time to sharpen.

Run the rig in a controlled sequence

Preflight - power off

- ☐ Puck rigidly mounted to fixture
- ☐ Signal cable in CH1, not counter input
- ☐ Amplifier mode is full-frequency
- ☐ FY6900 planned at sine / 40 Hz / 0.5 Vpp / 0 V offset
- ☐ Plate and supports stable
- ☐ Speaker wire secure; no loose strands
- ☐ Amplifier volume fully counterclockwise
- ☐ Only a light particle layer on plate

1. **Power the FY6900.** Confirm CH2 is off. Configure CH1 with output off if possible.
2. **Power the amplifier.** Keep its volume at zero. If the board has a FULL/SUB switch, select FULL.
3. **Enable CH1.** At 40 Hz, slowly raise amplifier volume until the mounted puck can be felt and the particles just begin to move.
4. **Search 25-80 Hz.** Sweep slowly, or step manually. Pause whenever particle motion increases. Do not compensate for a nonresponsive frequency by suddenly adding power.
5. **Resolve a mode.** Move in 1 Hz steps, then 0.1 Hz steps. Adjust volume only enough to produce a stable pattern.
6. **Document it.** Record frequency, generator amplitude, amplifier knob position or measured output, plate, support points, coupler, and a photo.
7. **Move to the next mode.** Reduce volume before a large frequency change; resonance can increase motion abruptly.
8. **Shut down.** Volume to zero → CH1 output off → amplifier off → generator off. Let the puck cool before handling.

Protect the shaker with voltage, not the “100 W” label

For an 8 Ω load, power is approximately $P = V^2/R$. The TT25-8’s 15 W RMS rating corresponds to about **11 Vrms across OUT+ and OUT-**. Start much lower: 5 Vrms is about 3 W; 8 Vrms is about 8 W. Do not exceed about 11 Vrms continuously.

Measure only across the two speaker terminals with a meter rated for the frequency. Do not clip a grounded oscilloscope lead to either Class-D speaker terminal. Many meters are inaccurate on Class-D output; if uncertain, rely on conservative volume, short runs, and temperature checks.

Duty cycle: irrelevant for a sine wave. **Modulation/burst:** off. **Generator amplitude:** leave at 0.5 Vpp initially; increase toward 1.0 Vpp only if the amplifier cannot reach useful motion without clipping or noise.

Find the failed stage

SYMPTOM	LIKELY CAUSE	ACTION
No motion or sound	CH1 off; wrong jack; amplifier off/muted; wrong input mode; open cable.	Return volume to zero. Verify CH1 output indicator, cable path, amplifier supply and input selection. Test at 40 Hz.
Puck moves, plate does not	Loose or compliant mechanical coupling.	Power off; tighten the fixture. Remove soft foam or tape from the force path. Do not add power to cure a loose joint.
Plate moves, no pattern	Too much particle material; poor supports; frequency between modes; mode outside 20-80 Hz.	Use a lighter layer; adjust support points; step slowly. Recognize the TT25-8 range limit.
Pattern flashes but will not settle	Sweep is too fast or amplitude too high.	Stop sweep, hold the frequency, tune in 0.1 Hz steps, and lower volume.
Only low modes appear	Expected TT25-8 behavior; possible subwoofer low-pass filtering.	Confirm FULL mode. For higher modes, use a lightweight full-range exciter with a suitable rated range rather than forcing this puck.
Buzzing or rattling	Loose screw, wire, plate support, or shaker mount; amplifier clipping.	Volume to zero, power off, and tighten hardware. Resume at lower level.
Puck or amp becomes hot	Too much continuous power or a fault.	Stop immediately and disconnect power. Allow cooling; inspect wiring before retrying.
Strong 60 Hz hum	Grounding problem or unshielded signal path.	Use a short shielded signal cable, keep it away from power wiring, and verify that signal ground is connected only through the amplifier input.

Electrical isolation test

1. Remove particles and test plate.
2. Keep the puck mounted to a scrap block or its fixture.
3. Set 40 Hz, 0.5 Vpp, zero offset.
4. Raise amplifier volume gently.

If it vibrates, the generator, amplifier, cable, and shaker chain is working; troubleshoot coupling and supports next.

What this rig can and cannot prove

A stable pattern shows a driven standing-wave mode under the current support and loading conditions.

It does **not** establish an ideal ukulele top frequency, and the heavy puck/fixture changes the system. Use the demonstration to teach nodes and antinodes; keep build decisions grounded in the class's broader deflection, tap, and construction process.

Upgrade trigger: if the electrical chain works at 40 Hz but the plate's useful patterns occur above 80 Hz, stop increasing power. The right fix is a lighter, full-range exciter and compatible fixture, not more wattage into the TT25-8.

One-page operator card

Wiring

```
FY6900 CH1 → Nobsound INPUT
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Nobsound OUT+ / OUT- → TT25-8
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Amplifier: mono; 8-25 V DC input. Use the single OUT+ / OUT- pair.

Starting settings

Wave	Sine
Frequency	40 Hz
Amplitude	0.5 Vpp
Offset	0.000 V
CH2	Off

Run

1. Amp volume zero.
2. Configure generator.
3. Power amp; select FULL mode.
4. Enable CH1.
5. Raise volume gently.
6. Search 25-80 Hz slowly.
7. Hold a mode; tune 1 Hz, then 0.1 Hz.
8. Record frequency and fixture.

Stop for

- Heat or odor
- Scraping or harsh rattling
- Violent particle ejection
- Loose fixture
- More than about 11 Vrms continuous across the puck

Shutdown: volume zero → CH1 off → amp off → generator off.

> **Expected ceiling:** the TT25-8 is specified for 20-80 Hz. No higher-frequency pattern may be available with this driver even when everything is wired correctly.

Verified references

FeelElec, FY6900 Series User's Manual, Rev. 1.0 (May 2019). Waveform setup, output enable behavior, CH1 sweep operation, 50 Ω nominal output, sweep range and timing.
https://www.tonyplaza.nl/download/YT010/FY6900UM.pdf

Dayton Audio, TT25-8 PUCK product specifications. 8 Ω impedance, 15 W RMS / 30 W maximum, 20-80 Hz usable response, 40 Hz resonance, dimensions and six-screw mounting note.
https://www.daytonaudio.com/product/1668/tt25-8-puck-tactile-transducer-mini-bass-shaker-8-ohm-4-pack

Texas Instruments, TPA3116D2 data sheet. Class-D topology, supported load configurations, voltage range and protection features at the chip level. The assembled Nobsound board may impose narrower limits.
https://www.ti.com/lit/ds/symlink/tpa3116d2.pdf

Harvard Natural Sciences Lecture Demonstrations, "Chladni Plates." Sand gathers at nodal lines on a resonating plate.
https://sciencedemonstrations.fas.harvard.edu/presentations/chladni-plates

Assumptions and limits. The Nobsound amplifier is mono and marked for an 8-25 V DC input. Its connector layout, DC polarity, and presence of a FULL/SUB switch have not been documented here; match the labels on the physical amplifier. The 0.5 Vpp generator setting and 25-80 Hz search are conservative operating recommendations derived from the verified component ratings, not manufacturer presets.