AI588T Intelligent Shooting System - User Manual

This manual covers all the functions of the application: page tracking operations, target locking and switching, shooting modes, preset positions, track vehicle linkage, PTZ-free mode, keyboard control, all parameters of the settings page, language switching, etc.

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1. System Overview

This application is an AI-based automatic tracking and shooting system for PTZ/track vehicles.

The core workflow is:

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Camera image → AI human/face detection → Target locking → PID pan-tilt control → PTZ camera automatic tracking
                                    ↓
          Track vehicle linkage (coarse compensation + height adjustment)
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Summary of Main Abilities:

Ability	Explanation
Human body detection	The model automatically selects the targets with higher scores.
PTZ automatic tracking	PID control + Kalman filtering + display box smoothing, target stable and centered
Multi-objective Management	Multi-frame confirmation, anti-dazzling gate control, loss reselection
Raise your hand to switch.	In the picture, the second person simply needs to raise their left hand to make the gimbal switch to lock onto the target.
Shooting mode	Close-up / Multiple People / Panorama. Three modes. One-click to call the corresponding preset position.
Pre-set bit recall	The target will automatically return to the preset position and wait after being lost for a long time.
Track vehicle linkage	Progressive axis (front-back) + Lateral axis (up-down) coarse compensation coordinated tracking
Face orientation control	Arc-shaped track scene: The vehicle moves to the direction where the locked target face is directly facing.
No PTZ mode	Do not control the gimbal, only use the track vehicle to follow the figure in the picture
Keystroke transmission	Hardware VISCA keyboard commands directly convert to PTZ serial port, including tracking switch shortcut commands
Bilingual (Chinese and English)	The settings page supports a one-click switch between Chinese and English.

2. Hardware and environmental requirements

Project	Requirements
Camera (source of image)	Local cameras accessible by the host: Rear / Front / USB external camera
PTZ Camera	Support VISCA (default) via RS-485/USB serial ports connection
Serial port	Built-in serial port (such as /dev/ttyS6) or USB-to-serial converter; requires corresponding read and write permissions
Track vehicle (optional)	Track vehicle with serial port command control for traveling axis / lifting axis
PTZ Keyboard (optional)	Hardware VISCA control panel connected via serial port

The initial startup requires granting camera permissions (for personnel detection); when using the USB serial port, USB permissions may also be required.

3. Get started quickly

Standard usage procedure:

1. **Connecting hardware: Connect the RS-485/USB serial port of the PTZ camera to the host and turn on the camera power.**
2. **Enter the settings page: Long press the "KIND" button in the center of the tracking page.**
3. **Configuration Protocol: Select "VISCA" (or the actual protocol) in the "PTZ Control Protocol" section, and enter the camera ID (VISCA 1 to 7).**
4. **Select Serial Port: In the "Serial Port Settings", select the baud rate (default 115200), data bits/stop bits/parity bits, and confirm the PTZ serial port device.**
5. **Save settings: Click on "Save Settings" at the bottom of the page.。**
6. **Start tracking: Return to the tracking page, click the KIND button (if not connected, it will automatically connect the serial port first before starting the tracking).**
7. A person appears in the picture → After about 0.5 seconds of confirmation, a red box is locked → The pan-tilt automatically follows the person.
8. **Stop tracking: Click the KIND button again (the button text will revert to KIND indicating that tracking has been stopped).**

4. Tracking page interface and operations

The tracking page is a full-screen camera preview, and by default, it displays 6 semi-transparent floating buttons：

Button	Short press function	Long press function
KIND（Top left corner, blue）	Start / Stop automatic tracking. In tracking mode, it turns green and displays "TRACK"	**Enter the settings page (the only entry point)**
B	Switch to close-up mode (activate the close-up preset position)	—
C	Switch to Multiplayer Mode (Activate the Multiplayer preset)	—
L	Set the position of the character image to the left by three quarters (horizontal offset -33%)	—
C	Set the position of the character image to centered (horizontal offset 0%).	—
R	Set the position of the character image to the right by three quarters (horizontal offset +33%)	—

- The currently active position button / mode button is highlighted in green, and unselected ones are displayed in blue.
- The adjustment of the position button is saved and takes effect immediately. It is also linked with the slider "Horizontal Position Offset" on the settings page.。

4.1 Keyboard shortcut keys (when using an external physical keyboard)

Press the button	Function
Enter	Start / Stop Tracking
↑	Switch to close-up mode
↓	Switch to multiplayer mode
←	Horizontal offset -10% (range ±50%)
→	Horizontal offset +10% (range ±50%)

5. Target detection and locking rules

5.1 The overlay layer shows the image.

- **Red frame (thick line): The currently locked tracking target. The confidence percentage is displayed above the frame.。**
- **Green box (thin line): Other individuals detected in the image but not yet locked.**
- The red frame has undergone adaptive smoothing processing, so slight jittering will not cause the frame to jump; when switching targets, the red frame jumps directly without trailing.

5.2 Lock confirmation (to prevent accidental triggering)

- After enabling tracking, the camera will not immediately activate the pan-tilt unit. It requires continuous detection of "quality qualified and position stable" targets for 3 frames (approximately 0.5 seconds) before it can lock onto the target, to prevent false positives in empty scenes (such as curtains, equipment, etc. being mistaken for people).
- Quality threshold: Comprehensive score ≥ 2.0 and confidence level ≥ 0.6; The face recognition target is the strongest real person signal, which can be quickly and directly locked onto.
- Abnormal frames such as those that are too close to the edge or too wide will be filtered out. However, the locked targets will enjoy the relaxed treatment within the tolerance period (to prevent being mistakenly discarded when they are too close to the edge upon turning).

5.3 Target loss and re-selection

Stage	Behavior
Short loss (< 15 frames, approximately within 2.5 seconds)	Continue tracking according to Kalman's prediction, and the gimbal does not stop.
More than 45 frames did not match	Judgment failed. Re-select the target (take the defensive interception door control, see 5.4)
丢失超过设定超时（默认 3 秒）	Lost after exceeding the set timeout (default 3 seconds)
After the preset position is recalled	Wait for approximately 75 frames before re-capturing. Pause the loss accumulation. Wait until the gimbal is in place and the target stabilizes again.

5.4 Anti-camera interception gate control (tracking without being snatched away by others)

The only normal way to switch targets during the tracking process is by having "the second person raise their left hand". When the target is lost and needs to be reselected,:

- In the picture, someone is raising their left hand (indicating a strong signal) → Lock onto the person who is raising their hand;
- There is only one high-quality figure in the picture → There is no ambiguity, regarded as the original target returning and locked.
- **Multiple people but no one raising hands → Reject locking on any target. Switch to preset position for recall and wait for someone to raise their hand.。**

6. Raise your hand to switch the target.

Key points for the movement: Raise your left hand above your head (the position of your wrist should be about 12% above your nose and above your height), and hold this position for approximately 0.5 seconds.

Rule details:

Project	Parameters
Recognize gestures	Only recognize the left hand raised (ML Kit Pose posture detection)
Confirm the frame rate	Three consecutive frames (approximately 0.5 seconds)
Quality threshold	Those who raise their hands must have their faces verified or a combined score of ≥ 3.0
Self-exclusion	Currently, raising your hand to target the current person does not trigger the switch.
Switching off the cooling system	After the switch is successful, it will not trigger again within approximately 15 seconds to prevent repeated jumping.
No PTZ mode	Also effective (after the switch, the track vehicle follows the new target)

Typical scenario: Lecturer A is being tracked. Lecturer B raises their hand → The camera/track vehicle switches to B; After B finishes speaking, A raises their hand → Switch back to A.

7. Shooting mode

Mode	Entrance	Behavior
Close-up	"Big" button / ↑ key / Settings page	Activate the preset position for the close-up mode (default is position 1)
A large number of people	"Small" button / ↓ key / Settings page	Activate the multiplayer preset position (default is position 2)
Panorama	Settings page	Activate the panoramic mode preset (default number 3) and extend the focal length to the wide-angle position (only once)

8. Pre-set position system

8.1 Lost recall preset position

- **Enable switch: Default on。**
- **Pre-set position number: 1 to 10 (default 1)**
- **Timeout for loss: 3 to 30 seconds (default 3 seconds) - If no person is detected within this time, the system will automatically recall.**
- **Empty scene protection: Empty scenes that have never successfully targeted real people will not trigger recall accidentally.。**
- **Stop tracking: If the function is enabled and not in PTZ mode, after stopping the tracking, the lost preset position will be automatically recalled and the device will return to the "waiting position".**
- The recall action will be accompanied by a re-capture grace period (approximately 75 frames), and the pan-tilt will not misjudge as lost before it reaches its position.。

8.2 Send custom instructions during recall

Used for 联动 ing third-party devices (such as lights, switches, track vehicle positioning, etc：

1. Turn on the "Send Custom Instructions During Recall" switch；
2. Enter the HEX instruction code. Support formats such as FF0100080032F8 or A5 0B 02 with spaces.；

3. Select serial port for transmission: "Current PTZ serial port" or specify another serial port device;

4. Each time the preset bit recall is executed, an instruction is automatically sent to this serial port.。

8.3 Mode preset position

Close-up / Multiple People / Panorama The three modes are each bound to a preset position (1-10, default 1/2/3). After selecting the mode on the settings page, adjust using the "Mode Preset Position" slider; switching modes will invoke.

8.4 Manual save / Call

Long press the L key to open the manual panel → Slide the slider to select the number (1 to 10) → "Save preset position" will save the current camera position as this number; "Call preset position" will immediately return to this position。

> Before saving the custom layout, it is recommended to first center it and adjust the appropriate offset to get the layout right, and then save the preset position.

9. Track vehicle linkage

After enabling "Track Vehicle Linkage" (which is enabled by default), the system simultaneously drives the track vehicle during tracking, forming a two-level coordination with the PTZ.:

9.1 Traveling axis (forward and backward movement, based on the absolute Pan angle of the PTZ)

- Parameters:
  - **Pan dead zone: When the camera angle is within the dead zone, the military vehicle remains stationary.**;
  - **Starting threshold: Vehicles exceeding this threshold will start moving. The greater the deviation, the higher the speed, until reaching the maximum speed.**;
  - **Maximum traveling speed: 1 - 15 (Fast Speed)**;
  - Each vehicle has a minimum number of running frames for a single start-up to prevent frequent starting and stopping.

9.2 Lifting axis (moving up and down, based on the height of the picture)

• Parameters: Tilt saturation angle, trigger frame count (anti-oscillation), maximum lift speed, target distance from the top。

9.3 VISCA Position Query

• Default enabled; Query the absolute Pan/Tilt angle of the camera at the set interval (1 to 10 frames). This is the basis for the precise linkage of the track vehicle.。

• **The maximum angle of Pan/Tilt is used to convert the query original value into an angle (calibrated according to the camera model, default 170° / 90°)。**

• The camera firmware must support the position query command; otherwise, it will automatically downgrade in an emergency.。

9.4 Face orientation control (arc-shaped track)

After activation, the track vehicle changes to "move along the direction of the face" (applicable to scenarios where the podium is an arc-shaped track):

• The vehicle slowly moves to the front of the locked target face; the PTZ is frozen in the horizontal direction, only retaining vertical tracking;

• Based on the ML Kit face yaw angle (yaw), smoothed by EMA to resist single-frame noise;

• If the yaw angle is less than the dead zone of 12°, it remains stationary; if it is greater than the medium-speed threshold of 30°, it uses medium speed, and in between, it uses low speed;

• When there is no face information of the target (backing up/obstructed), it automatically returns to the regular 9.1 driving mode.

10. No PTZ mode

After enabling the "No PTZ Mode", the system will not send any commands to the pan-tilt-zoom unit at all. It will solely rely on the tracking of the track vehicle screen (suitable for scenarios where the camera is fixed on the track vehicle):

Parameters	Scope	Default
No PTZ movement dead zone		12
No PTZ speed limit upper bound		20

No PTZ medium-speed limit		35
Low gear speed	1~15	5
Medium gear speed	1~15	10
High gear speed	1~15	15

- **The vehicle starts only when the center of the figure is outside the dead zone. The greater the deviation, the higher the gear; Direction: The person is on the right side of the screen → The vehicle is chasing to the right.**
- **The detection, locking, hand-raising switching, and preset timeout logic still operate as usual (for "target search"), but no PTZ instructions are sent.**
- **When stopping the tracking, the track vehicle is also forced to stop.**

11. PTZ Keyboard Control

Support the connection of the hardware VISCA control panel (keyboard) to this system via the serial port, enabling transparent control.:

1. Enable "PTZ Keyboard Control" on the setup page (default is off);

2. Select "Keyboard Serial Port" (board-mounted serial port, such as ttyS6);

3. Set the keyboard baud rate (default is 9600, commonly 9600/38400);

4. After saving, the keyboard commands will be directly forwarded without delay to the PTZ main serial port.

> Note: When the software tracking is in progress, all other keyboard commands will be automatically ignored to prevent manual and automatic commands from interfering with each other.

12. Detailed Explanation of Settings Page Parameters

Entry method: Long press the "KIND" button on the tracking page. After modification, click "Save Settings" at the bottom to take effect.

12.1 PTZ Control Protocol

Parameters	Options / Range	Default	Explanation
Language	中文 / English	Chinese	See Section 13
PTZ Protocol	VISCA	VISCA	See Section 13
Connection method	Serial port (RS-485/USB) / Network (IP)	Serial port	The current version is based on the serial port.
Camera ID	1~7（VISCA）；1~255（Pelco）	1	VISCA Address

12.2 PTZ control parameters (PID)

Parameters	Scope	Default	Adjustment suggestions
Automatic tracking speed	0.1x~2.0x	1.0x	Overall speed ratio
Manual speed control	1~63	30	Manual panel / Keyboard direction key speed
Level P	0~2.00	0.50	Too small leads to poor tracking and sluggish response, while too large causes instability.
Level I	0~1.00	0	Generally maintained at 0
Level D	0~1.00	0.20	Reduce overshoot, and overly amplify detection noise
Vertical P	0~2.00	0.50	Reduce overshoot, and overly amplify detection noise
Vertical I	0~1.00	0	Reduce overshoot, and overly amplify detection noise
Vertical D	0~1.00	0.18	Reduce overshoot, and overly amplify detection noise

12.3 Character scene position (composition offset)

Parameters	Scope	Default	Explanation
Quick preset	Center / Left / Right	—	One-click setting of commonly used compositions
Horizontal position	-50%~+50%	0%	The figure is positioned to the right (the camera rotates to the left), and the negative value is to the left.
Vertical position	-50%~+50%	0%	The positive values are at the lower part (the camera is tilted upwards), while the negative values are at the upper part.

The tracking page L/M/R buttons allow for quick adjustment of the horizontal position by -33% / 0% / +33%.

12.4 Shooting mode

Parameters	Scope	Default
Mode selection	Close-up / Multiple People / Panorama	Close-up
Mode preset position	1 to 10 (each mode is independent)	Close-up 1 / Multiple People 2 / Panorama 3

12.5 Lost target call preset bit

Parameters	Scope	Default
Enable preset recall	Open / Close	Open
Pre-set position number	1~10	1
Timeout of loss	3~30 s	3 s

12.6 Track vehicle linkage settings

Parameters	Scope	Default	Explanation
Enable the linkage of track vehicles	Open / Close	Open	Main switch
No PTZ mode	Open / Close	Close	See Section 10
No PTZ dead zone / Low speed limit / Medium speed limit	%	12 / 20 / 35	No PTZ mode adjustment
Without PTZ, low speed / medium speed / high speed gears	1~15	5 / 10 / 15	No PTZ mode speed
Reverse the traveling axis	Open / Close	Close	Turn the camera upside down and then turn it on.
Face orientation control	Open / Close	Close	
Enable the traveling axis	Open / Close	Open	Single-axis switch
The dead zone of the Pan movement	0~40°	15°	The vehicle does not move within the dead zone of the camera angle.
Starting threshold for movement	0~40°	10°	Beyond a certain point, it starts to move, but the larger it gets, the slower it becomes.
Maximum traveling speed	1~15	15	—
Enable the elevating shaft	Open / Close	Open	Single-axis switch
Up and Down Tilt Saturation	0~40°	20°	The gimbal pitch and roll approach this angle → The vehicle ascends and descends
Lift-up trigger frame count	1~41	6	Action is performed only after N consecutive frames meet the conditions, to prevent oscillation.
Maximum lifting and lowering speed	1~15	14	—

Target altitude distance	0~40%	10	The composition reference for the up-down positioning

12.7 VISCA Location query

Parameters	Scope	Default
Enable location query	Open / Close	Open
Query interval	1~10 Frame	3 Frame
Pan Maximum angle	Calibrated according to the model	170°
Tilt Maximum angle	Calibrated according to the model	90°

12.8 PTZ Keyboard control

Parameters	Scope	Default
Enable keyboard control	Open / Close	Close
Keyboard serial port	List of onboard serial ports	—
Keyboard baud rate	Commonly used: 9600 / 3840	9600

13. Language Switching

- **The "Language" switch bar at the top of the settings page: Switch between Chinese and English with a single click.**
- **After the switch, all labels, slider readings, and dialog box translations on the settings page will be updated instantly and will be persisted (remained after restarting the App).**
- **The serial port device name ("Onboard Serial ttyS6", etc.) will be displayed as "Onboard Serial ttyS6" depending on the language.**
- **The current translation scope is the settings page; status prompts on the tracking page and other parts are still in Chinese.**

14. Save with Default Value Mechanism

The three buttons at the bottom of the settings page:

Button	Function
Save settings	Write all parameters of the current page into the effective configuration.
Save as default value	Save the current settings as the "User Defaults" template
Restore to default settings	Restore to "default user settings" (if no settings have been saved, restore to the factory-hardcoded default settings)

Suggestion: After setting a set of satisfactory parameters on-site, click "Save as Default Values" once. Then, you can restore the settings by simply clicking the button at any time.

15. Typical usage scenario

Scene A: Automatic tracking of solo speaker

1. Long press KIND → Confirm Protocol/Serial Port/ID → Save;

2. Click KIND to start tracking;

3. Where the speaker goes, the camera follows; in close-up mode, the camera automatically zooms in to maintain 50% screen coverage.

Scene B: Hand-raising switching between two lecturers

1. Normal tracking of Lecturer A;

2. Lecturer B raises their left hand for about 0.5 seconds → The camera switches to B;

3. If Lecturer B raises their hand again within 15 seconds, the switching will not repeat; when Lecturer A raises their hand, it will switch back to A.

Scene C: Arc-shaped track + Face orientation

1. On the settings page, enable "Face Orientation Driver";

2. When the teacher is writing with their back to the board, the track vehicle automatically moves to the direction they are facing, and the PTZ is only responsible for pitch;

3. When the teacher turns back to the front, the vehicle stops and remains at the current position.

Scene D: Rail-mounted camera (without PTZ)

1. Enable "No PTZ Mode";

2. Adjust the three-speed and threshold according to the speed of the track vehicle;

3. Throughout the tracking process, only the track vehicle moves, and the figure in the picture automatically remains in the center area.

16. Frequently Asked Questions (FAQ)

Q1: No response after clicking KIND / The pan-tilt does not move?

• Confirm that the correct PTZ serial port has been selected on the setup page and "Save Settings" has been done; KIND will automatically connect. Connection failure (displaying "Error") is mostly due to incorrect serial port selection, incompatible baud rate, or lack of permissions.

• Confirm that there is a clear standing person in the picture and the confidence level is sufficient (the green box appears indicating normal detection).

Q2: Shaking during PTZ tracking / Left-right swaying?

• Increase the "dead zone range" (currently set to 5% by default);

• Reduce the horizontal/vertical P value, or appropriately increase the D value;

• For RK3588 devices, confirm the use of the NPU detection engine.

Q3: The lens is stolen by the person behind during tracking?

• This is normal and will not occur (anti-theft lens gate control). The key to avoiding accidental lens theft: Switch the target by raising your left hand, which is the only recognized signal for changing targets by the system.

Q4: The lens rotates randomly after the target is briefly obscured?

• The system will track based on the prediction within 45 frames; if the timeout is exceeded, the re-selection gate will be activated, and in multi-person scenarios, it will reject random locking and recall the preset position to wait. This is a normal behavior. You can increase the "loss timeout" to reduce frequent recalls.

Q5: Raised hand but no switch?

• It must be the left hand, and the wrist should be higher than about 12% of the height above the nose;

• It is invalid during the 15-second cooling period after switching;

• The person raising their hand must be clearly detected (face confirmation or quality meeting standards), and if too far or too dark, it will be rejected.

Q6: The PTZ returns to the original position after stopping tracking?

• This is the "lost recall to preset position" behavior, returning to the waiting position. There is no need to please turn off this switch.

Q7: The track vehicle does not move?

• Check the "Enable the linkage of track vehicles" and the individual switches for movement/height adjustment;

• VISCA position query requires the camera to support it; if not supported, the Pan angle judgment will deteriorate;

• Check if the installation compensation/reverse settings match the actual installation.

Q8: The settings do not take effect after being changed?

• You must click "Save Settings"; preset positions, serial ports, etc. will take effect upon saving, while PID types will be sent in real time.