AOYUE® Int732

Game Console Reworking System

INSTRUCTION MANUAL

Thank you for purchasing Aoyue Int732 Game Console Reworking System.
It is important to read the manual before using the equipment.
Please keep manual in accessible place for future reference.

This manual is designed to familiarize the technician with the proper operation and maintenance of the equipment. The "Care and Safety Precautions" section explains the hazards of using any type of soldering or reworking device. Please read carefully and observe the guidelines in order to maximize usage and minimize the risk of injury or accidents .

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CE ESD SAFE

BASIC TROUBLESHOOTING GUIDE

PROBLEM 1: THE UNIT HAS NO POWER

1. Check if the unit is switched ON.
2. Check the fuse. Replace with the same type if fuse is blown.
3. Check the power cord and ensure there are no disconnections.
4. Verify that the unit is properly connected to the power source.

PROBLEM 2: PANEL DISPLAYS "- - - -" MESSAGES

DESCRIPTION: Display show **"- - - -"**

- - - - A — Temperature probe A not detected

- - - - b — Temperature probe b not detected

- - - - C — Temperature probe C not detected

- - - - F — Solder Iron not attached.

SOLUTION: Turn off power and back on. Check the connection of externals sensors, Top heater tool and solder iron, connect plugs properly into its receptacle. Check if the temperature probe tip is still intact.

PROBLEM 3: DISPLAY AND OTHER DEVICE OPERATION ISSUES

SOLUTION: Turn off power and back on.

OTHER PROBLEMS NOT MENTIONED:

Contact the vendor.

Please write down your serial number, batch number and system codes on the space provided.

These information are need for product support and services.

Batch number:_____

Serial number:_____

System Code:_____

Batch number—green sticker located underneath the system.
Serial number—white sticker located underneath the system.
System Code— white sticker with signed number combination.

PROBE CALIBRATION PROCEDURES

9. The calibration numbers can be adjusted by pressing the increase and decrease buttons. To reach negative calibration numbers press the increase button until the displayed value shows a negative number. To save the calibration numbers repeatedly press the selection button until you loop back to probe A calibration adjustment screen **"Set Top 045A"**.
10. Repeat procedures 3, 4, and 5 to check if further calibration is needed. Calibration is not needed if the actual displayed temperature and the measured temperature of the type k thermocouple temperature meter is within ±2 degrees of each other.

Note: Default factory calibration is based on our calibrated type K thermocouple temperature sensor meters, Standard Type K thermocouple temperature sensor meters available in the market may have accuracy ratings ranging from ±0.25% to ±1% of the reading.

Additional Calibration Examples:

- Probe "A" needs to be recalibrated *lower* by 10 degrees. i.e. Probe "A" 260 vs. 250*

Example: if the calibration number of Probe A is already **"Set Top 001A"** we *subtract* 10 from the old number +01 [+01-10=-9]. So we input "**Set Top –09A"** as the new calibration number for probe "A". To input negative numbers press the increase button until the displayed value shows a negative number

- Probe "b" needs to be recalibrated *higher* by 10 degrees. i.e. Probe "b" 250 vs 260*

Example: if the calibration number of Probe "b" is already **"Set bot –50b"** we *add* 10 to the old number –50 [–50+10=-40]. So we input "**Set bot –40b"** as the new calibration number for probe "b".

- Probe "C" needs to be recalibrated *higher* by 10 degrees. i.e. Probe "b" 240 vs 250*

Example: if the calibration number of Probe "C" is already **"Set bot –01C"** we *add* 10 from the number –01 [-01+10=+9]. So we input "**Set bot 009C"** as the new calibration number for probe "C".

*type k thermocouple temperature meter reading.

Warning!

Do not access the system calibration types 3,5,6,7,8,9. Do not alter or enter these modes as it can clear primary level factory calibration of your system.

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CARE and SAFETY PRECAUTIONS

CAUTION: Improper usage can cause injury and physical damage. For your own safety, please observe the following precautions.

- Temperature may reach as high as 500°C when turned ON.
  - Do not touch the heating element inside the pre-heater.
  - Do not expose skin to infra-red light for long periods.
  - Prolonged exposure may damage the skin tissue.
- Handle with care
  - Never drop or sharply jolt the unit.
  - Contains delicate parts such as IR tubes that may break if the unit is dropped
  - Do not spill any liquid to the system.
- Do not tamper the electrical control unit or any wiring inside the device.
- Disconnect plug from main power source if the device will not be used for a long period.
  - Turn off power during breaks, if possible.
- Allow ample time for the equipment to cool down before commencing maintenance.
- Use only genuine replacement parts. Turn-off power and let the unit cool down before replacing any component.

PROBE CALIBRATION PROCEDURES

5. With the adjustment value assessed we enter calibration system by turning off the system and back on. While the system is in type selection screen simultaneously press and hold the increase and decrease button *(**#3 & #4** form the control panel guide)* until **"SLCt typE 4"** is displayed. Press the selection button *(**#2** form the control panel guide)* to enter calibration mode.
6. The display would show **"Set Top ###A"** indicating we are now in calibration mode. The ### indicates a calibration number saved in the CPU memory. The calibration number can be positive or negative depending on factory calibration. The default numbers are 001. Pressing the selection button allows us to cycle thru the calibration numbers of probes "A", "b", and "C". These numbers have suffixes that corresponds to their probe. Therefore if the display is **"Set Top 045A"** we are adjusting the calibration of probe "A", **"Set bot 040b"** means we are adjusting the calibration for probe "b" and **"Set bot –40C"** is for calibration of probe "C".
7. Based on our previous assessment in procedures 3,4 and 5.

- Probe "A" needs to be recalibrated *lower* by 5 degrees.

Example: if the calibration number of Probe A is already **"Set Top 045A"** we *subtract* 5 from the old number +45 [+45-5=+40]. So we input "**Set Top 040A"** as the new calibration number for probe "A".

- Probe "b" needs to be recalibrated *higher* by 5 degrees.

Example: if the calibration number of Probe "b" is already **"Set bot 040b"** we *add* 5 to the old number +40 [+40+5=+45]. So we input "**Set bot 045b"** as the new calibration number for probe "b".

- Probe "C" needs to be recalibrated *lower* by 10 degrees.

Example: if the calibration number of Probe "C" is already **"Set bot -40C"** we *subtract* 10 from the number -40 [-40-10=-50]. So we input "**Set bot –50C"** as the new calibration number for probe "C".

PROBE CALIBRATION PROCEDURES

The system is equipped with a digital calibration system to allow us to calibrate the external probes with a Type K thermocouple temperature meter .

IMPORTANT: Probes must be calibrated one at a time. The tip of Probe "A" should not come in contact with the tip of Probe "b" or probe "C".

1. Place the sensor tip of probe "A" and the reference Type K thermocouple temperature meter as close together as possible. It is best that the tips be firmly taped together for accurate calibration.
2. Enter Type 0 mode and set top heater temperature to 250C. Place the tips underneath the top heater. Wait for the actual temperature display of probe "A" to reach 250C. (Any value between 230 to 250 is acceptable).
3. Compare the actual probe "A" value displayed on the 732 system with the Type K thermocouple temperature meter. For example: the 732 displays probe "A" as 250C while the Type K thermocouple temperature meter is showing 245C. This means that we need to decrease the calibration value of probe "A" by 5 degrees.
5. Again tape together the sensor tips of probe "B" and the sensor tip of the type K thermocouple temperature meter. Place them underneath the Top heater and check the difference between the actual temperature display of probe "b" and the value registered in the Type K thermocouple temperature meter. When the temperature reaches 250C. For example: the 732 displays probe "b" as 245C while the Type K thermocouple temperature meter is showing 250C. This means that we need to increase the calibration value of probe "b" by 5 degrees.
6. Finally tape together the sensor tips of probe "C" and the sensor tip of the type K thermocouple temperature meter. Place them underneath the Top heater and check the difference between the actual temperature display of probe "C" and the value registered in the Type K thermocouple temperature meter. When the temperature reaches 250C. For example: the 732 displays probe "C" as 260C while the Type K thermocouple temperature meter is showing 250C. This means that we need to decrease the calibration value of probe "b" by 10 degrees.

PRODUCT DESCRIPTION

The Aoyue Int732 Game Console Repairing System is a reworking equipment that combines infrared and hot air heating technology, to provide top and bottom heating to the target components. It is equipped with a versatile board holder, Lead free compatible solder Iron, and software profile control of heating in one sophisticated package. It is designed for reworking double-sided, diverse technology printed circuit boards which utilizes traditional or lead free solder.

The system is equipped with High powered IR-heating elements combined with multiple types of operating mode to fit various task. Finally, the unique, innovative design with digital control panel offers precision, safety, and ease of use to meet all reworking requirements.

FUNCTIONS and FEATURES

- Complete Game Console Repairing System.-Combines large area bottom-heater, high powered top-heater and lead free compatible solder iron.
- Three different types of operation to suite different needs:
  Type 0 – For re-balling or pre-baking the board. Uses internal sensors.
  Type 1 – Allows manual control of the rework process. Uses external sensors.
  Type 2 – Automated reflowing process utilizing the user configurable profile.
- Closed Loop Temperature Control with Three External Sensors
  — Sensors attached to the board allows precise temperature control at board level minimizing damage to board due to inaccurate temperature settings or overheating. Two sensors are used as temperature control and monitoring, while an extra sensor is added to allow additional monitoring of other temperature sensitive areas of the PCB.
- Enhanced Top and bottom heater
  310 x 310 mm effective bottom heating area. 1500 watts of pre-heating power minimizes board warping.
  60 x 60 mm effective top heating area. 500 watts maximum heating power with various nozzles to fit different BGA sizes.
- Multi-Point Board Holder
  — Innovative board holder: Nine securing screws with four side grips to provide a secure fit for various board sizes and shapes. Effectively minimizes BGA balls shorting together due to board warping.

FUNCTIONS and FEATURES

- Multi-Axis Armature

  — Top heater's support allows 3 degrees of freedom: Rotation of the Top heater, Swiveling of the armature, and sliding adjustments. This new design expands the effective working coverage of the unit, allowing us to access even those ICs at the edge or corner of the PCBs.

- Digital System Control and Safety

  — CPU controlled system with easy to use digital controls and display. Uses advanced digital controls and signal processing for maximum performance, and accuracy. Built-in overheat protection and temperature limiting. The system automatically limits the rise in temperature to industry standard 3 degrees per second. This will minimize damage to sensitive components and ensure proper reflow.

- Profile mode with auto adjustment

  — Eight programmable 9 segment reworking profile. Set and store the desired duration and temperature to ensure high success rate for repetitive reworks. Equipped with auto profile adjustment, system auto edits your profile to ensure profile meets industry standard limits.

- Two types of Automation Mode

  — 4 profiles are allotted for the temperature hold method, in which the temperature and the hold duration are the basis for profile generation. And another 4 profiles are allotted for the time ramp mode in which the profile generation is based on the time allotted to reach desired temperature.

- The Integrated Solder Iron has excellent thermal recovery specifically designed for the lead free soldering process. It has a wide range of tips sizes and styles designed to fit different requirements. Select tunnel type when cleaning BGAs, use the blade type for drag soldering, conical types for normal thru-hole soldering and many more different tip size and styles.

- Wide Compatibility

  — The entire system is compatible with Lead free solder, is RoHS, CE and ESD Safe compliant.

OPERATING PROCEDURES

Airflow Control:

The airflow control knob is located at the back of the system. *(**#17** from the control panel guide)* .

- The airflow control knob can be adjusted to accommodate different IC sizes and reworking jobs. Adjust airflow to appropriate level to obtain best reworking results.

- It is not recommended to use the system at very low airflow levels as the system is developed to give best results at higher airflow levels.

Notes:

- ***There is a built in protection feature to automatically limit the temperature slope to no more than 3 degrees per second. Therefore the maximum set temperature will be based on your set time.***

- ***During automated reflow the down button maybe pressed to see the target temperature during each segment. The target temperature has a suffix "c".***

OPERATING PROCEDURES

9. To start automation repeatedly press the selection button until the display shows the word **"Run Prof 0"** (the bottom display number should correspond to the selected profile) then press the increase button. A 3 second countdown will commence before automated reworking starts.
10. To see the running time, or current segment the system is processing or the temperature of the temperature probes. repeatedly press the selection button to switch between different views. Follow the suffix guide to determine displayed temperature.
4. After the process is finish the display will show **"End",** the middle and bottom display would show the temperature of the probes. Press the increase button to save the profile and exit to profile adjustment mode.
5. To exit before the process is finished press the increase button while the profile is running. The system would exit and return to profile adjustment mode.

Sample Profile 4:

SEG1	SEG2	SEG3	SEG4	SEG5	SEG6	SEG4	SEG5	SEG6
090t	60t	150t	050t	060t	60t	050t	060t	60t
100C	150C	210C	190C	210C	230C	190C	210C	230C

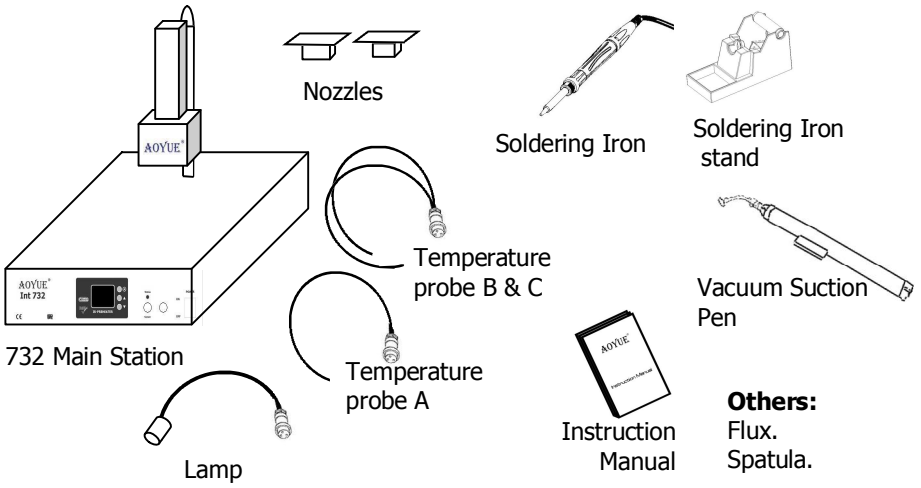
Segment one is set to 90 seconds to reach 100C. Which means after 50seconds at the end of segment one the temperature should reach 100C. Then Segment two is set to 60 seconds to reach 150C, which means by the end of 60 seconds (total running time after segment two is already 90+60=150 seconds) the set temperature should reach 150C, so on and so forth.

To check the slope from segment Three :

- 210C - 150C =60C ;Time to reach 210C is set to 150seconds.
- Therefore the slope is 60/110= 0.54 degrees per second increase.

Note: a negative number would denote a declining slope.

PACKAGE INCLUSION

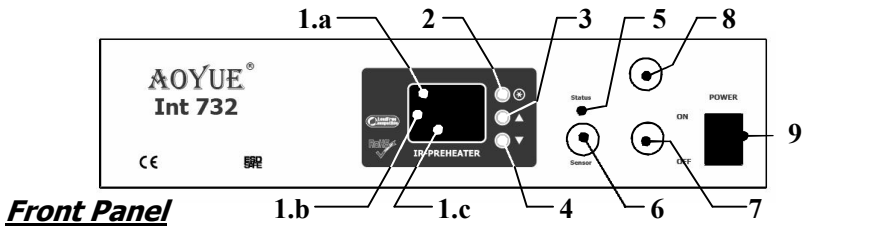


SPECIFICATIONS*

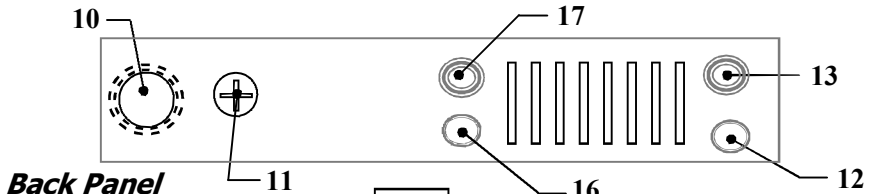
Power Input:	Available in 110V 21Amps / 220V 11 Amps (Max)
Dimensions:	**Main Unit:** 520(l) x 370(w) x 410(h) mm **Board Holder:**450(l) x 280(w) x 134(h) mm
Power Consumption:	**Total :** 2100 Watts Maximum **Top Heater:** 500 Watts **Bottom Heater:** 1500 Watts **Solder Iron:** 75 Watts
Temperature Range:	50°C - 280°C (^maximum)
Weight:	Approx. 11.6 Kg
Heating Element:	**Top Heater:** Forced Convection Quartz Infrared **Bottom Heater:** Quartz Infrared **Solder Iron:** Ceramic heater
Pre-Heating Area:	**Top Heater:** 60 x 60 mm **Bottom Heater:** 310 x 310 mm

^Depends on type of operation
*Specifications subject to change without prior notice
*** Expansion for future versions, may not be available for current releases.

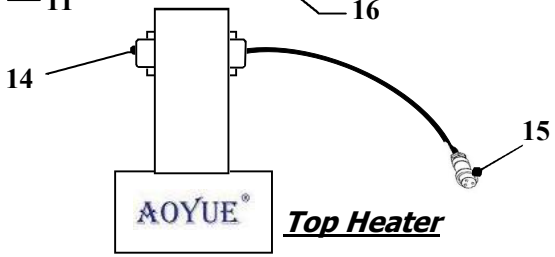
CONTROL PANEL GUIDE



Front Panel



Back Panel



Top Heater

LEGEND:

1 — Digital Display
- 1.a Top Display
- 1.b Middle Display
- 1.c Bottom Display

2 — Selection Button
3 — Increase Button/ Enter Button
4 — Decrease Button
5 — Status LED
6 — Probe B & C Connector
7 — Solder Iron Connector
8 — Lamp Attachment
9 — Main Power Switch
10 — Power Cord
11 — Fuse Holder
12 — Top Heater Power Cord
13 — Top Heater Sensor Connector
14 — Top Heater Power Connector
15 — Top Heater Sensor Cord
16 — Probe A Connector
17 — Airflow control

Suffix guide:

A - Actual Temperature of Sensor "A" / Set Temperature of Top Heater.

b - Actual Temperature of Sensor "b" / Set Temperature of Bottom Heater.

c - Actual Temperature of Sensor "c".

d - Actual Temperature of Top Heater Internal Sensor.

E - Actual Temperature of Bottom heater Internal Sensor.

F - Set/Actual Temperature of Solder Iron.

OPERATING PROCEDURES

Profile 4 to 7: Time ramp profiling system.

1. To adjust the time and temperature profile of each segment press the selection button twice. The top display will show which segment "**SEG1**" we are currently adjusting. The middle display will show whether we are adjusting the **"dur"** (duration/Time) or **"tEMP"** (temperature). The bottom display shows the value we are currently adjusting. Its suffix **"t**" signifies we are adjusting the time or temperature for a suffix "**C**".

4. Press the increase or decrease button to adjust the desired duration and temperature. The set temperature is adjustable from 50 to 250 C and duration 5 to 200 seconds

5. After the duration or temperature is set press the selection button to move to the next segment. There are nine segments available each with its own duration and temperature settings. The duration settings signifies the time it will take to reach our set temperature level. For example: if set duration is 50t and temperature is set at 100C. Then assuming the board temperature is 50C when the automated rework is initialized the system would gradually increase board temperature by 1 Degree per second such that after 50 seconds the board temperature would reach 100C.

6. Upon reaching segment 3, we must remember that the set temperature at this segment will be the temperature for the bottom heater for the remainder of the segments. It is ideal that we set segment 4 time to 60 and temperature to the same level as it is in segment 3 to allow both top and bottom temperature to reach equilibrium temperature before increasing the top heater temperature further. Then continue setting up the variables for each of the nine segments.

7. To save the newly developed profile repeatedly press the selection button until the display shows **"Save Prof 0"** (the bottom display number should correspond to the selected profile). Press the up button to save the settings and jump to profile selection screen.

8. To switch between using the external sensor or internal sensor as reference for the system repeatedly press the selection button until the display shows **"SLCt ref 0"** , the bottom display would show either **"0"** signifying the external sensors are used by the system or **"1"** signifying the internal sensor are used. Note: when the internal sensors are used as the reference, the set temperature is adjustable to 550 degrees.

4. Upon reaching segment 3, we must remember that the set temperature at this segment will be the temperature for the bottom heater for the remainder of the segments.
5. Continue setting up the variables for each of the nine segments. To save the newly developed profile repeatedly press the selection button until the display shows **"Save Prof 0"** (the bottom display number should correspond to the selected profile). Press the up button to save the settings and jump to profile selection screen.
6. To switch between using the external sensor or internal sensor as reference for the system repeatedly press the selection button until the display shows **"SLCt ref 0"** , the bottom display would show either **"0"** signifying the external sensors are used by the system or **"1"** signifying the internal sensor are used. Note: when the internal sensors are used as the reference, the set temperature is adjustable to 550 degrees.
7. To start automation repeatedly press the selection button until the display shows the word **"Run Prof 0"** (the bottom display number should correspond to the selected profile) then press the increase button. A 3 second countdown will commence before automated reworking starts.
8. To see the running time, current segment the system is processing, the hold duration or the temperature of the temperature probes. repeatedly press the selection button to switch between different views. Follow the suffix guide to determine displayed temperature.
9. After the process is finish the display will show **"End",** the middle and bottom display would show the temperature of the probes. Press the increase button or decrease button to return to profile adjustment mode.
10. To exit before the process is finished press the increase button while the profile is running. The system would exit and return to profile adjustment mode.

A. INITIAL PROCEDURES

1. Make sure all switches are deactivated.
2. Attach temperature probes b and c to the three pin socket *(**#6** on control panel guide)* . Attach temperature probe A to probe A Connector*(**#16** on control panel guide)*
3. Attach the Top Heater power cord (***#12*** *on control panel guide)* to the Top heater power connector *(**#14** on control panel guide)* .
4. Attach the Top heater sensor cord *(**#15** form the control panel guide)* to the base connector*(**#13** from the control panel guide)* .
5. Attach the device to the main power source. It is recommended to use NEMA plugs and receptacles with ratings compliant to the machine specifications *(see page 7)* .
6. Adjust airflow control knob *(**#17** from the control panel guide)* to the middle position.
7. To turn the unit ON. Toggle the main power switch to ON position *(**#9** on control panel guide)* .

B. OPERATION TYPE(MODE) SELECTION

1. Follow initial procedures, *"**A. INITIAL PROCEDURES**"*.
2. The display would show "**TYPE 0**", which means Type 0 operation will be used. To select between types 0 to 2. Press the increase or decrease buttons *(**#3** & **#4** of control panel guide)* .
3. To confirm selection and enter into operation mode using the selected operation type. Press the selection button *(**#2** of control panel guide)* .

C. SOLDER IRON UNDER OPERATION TYPE 0 and 1

1. To set the desired solder iron temperature press the selection button repeatedly until the top display shows "**SEt**" and the middle display shows "**iron**" . The bottom display would show the current set temperature of the solder iron followed by a suffix "**F**".

2. Press the increase or decrease button to adjust the set temperature level. The set temperature is adjustable from 200 to 480C.
3. For the solder iron actual temperature display. Follow **TYPE "0" OPERATION** number 5 *(see page 10)* .
4. To temporarily turn off the solder iron. Simultaneously press both the "Increase" and "decrease" button *(**#3** & **#4** from the control panel display see page 8)*. The bottom display will show "OFF" indicating the solder iron is now turned off.

D. TYPE "0" OPERATION

This type of operation utilizes the internal temperature sensors to control the heat. Using this type frees up the three extra external temperature probes for monitoring. Attach the three extra temperature probes to areas of interest such as the bottom of the board and/or near the component to we worked on.

1. To set the desired top heater temperature press the selection button repeatedly until the top display shows "**TOP**" and the middle display shows "**SEt**" . The bottom display would show the current set temperature of the top heater followed by a suffix "**A**".
2. Press the increase or decrease button to adjust the top heater set temperature level. The set temperature is adjustable from 50 to 550 C in this type of operation. To temporarily turn off the top heater. Simultaneously press both the "Increase" and "decrease" button *(**#3** & **#4** from the control panel display see page 8)*. The bottom display will show "OFF" indicating the top heater is now turned off. ***Note: In order to reach the maximum temperature it is recommended that a nozzle is attached.***
3. To set the desired bottom heater temperature press the selection button repeatedly until the top display shows "**bOt**" and the middle display shows "**SEt**" . The bottom display would show the current set temperature of the bottom heater followed by a suffix "**b**".

Note: During segments 1-3 the top heater heats up to 75% of the set temperature at these segments. This is to allow a faster ramp up in preparation for reflow for segments 4-6.

1. To enter type "**2**" operation. Select 2 at the initial screen then press the select button. The display would change to "**Slct Prof 0**". This signifies we are now in the type "**2**" mode.
2. We can then select which profile we would like to use by pressing the increase or decrease button. The number shown at the bottom display will change corresponding to your selection. There are eight stored and selectable profile.

Profile 0 to 3: Temperature hold profiling system.

1. To adjust the ramp, duration and temperature profile of each segment press the selection button until the top display shows "**SEG1**", This signifies we are currently adjusting segment 1 of the profile. The middle display will show whether we are adjusting the **"rate"** (ramp rate) **"dur"** (duration/Time) or **"tEMP"** (temperature). The bottom display shows the value we are currently adjusting. Its suffix **"r"** signifies we are adjusting the ramp rate, **"t**" signifies we are adjusting the time and "**C**" for temperature . Pressing the selection button will allow as to switch between rate, duration and temperature adjustment modes.
2. Press the increase or decrease button to adjust the desired rate, duration or temperature. The set ramp rate is adjustable from 50 to 150 degrees per minute. The set temperature is adjustable from 50 to 250 C and duration 5 to 200 seconds.
3. After the rate duration or temperature is set press the selection button to move to the next segment. There are nine segments available each with its own rate, duration and temperature settings. The duration settings signifies number of seconds the system should hold the set temperature level. The rate settings signifies the ramp rate limit for that particular segment. For example: if set rate is 100, duration is 50t and temperature is set at 100C. The system would increase the temperature to 100C at a ramp rate of 100 degrees per minute. Then when it reaches 100C the system would try to maintain the temperature of 100 for 50 seconds.

The desired temperature— is the target temperature at which the system must stabilize its heaters for the remainder of the hold duration.

The Time Ramp profiling system:

This system requires the input of two variables, the duration and desired temperature, This two variables would allow the system to automatically compute the ramp rate.

The duration— this the allotted time in seconds to reach the set temperature of each segment.

The desired temperature—- is the target temperature to be reached at the end of the duration.

For both types of profiling system there is an option to use the internal sensor or external sensor as reference.

When using the external sensor reference option, the Results of Probe "A" directly controls the Top heater while Probe "b" controls the bottom heater.

When using the internal sensor reference option, the internal top heater sensor "d" regulates the Top heater while the internal bottom heater sensor "E" regulates the bottom heater.

The default sensor reference for all profiles is set to the external sensors.

In both profiling system the first three segments utilizes the bottom heater to preheat the board up to 75% of the required reflow temperature. The bottom heater would regulate the board at the temperature set at segment 3 for the remainder of the segments. Segments 4 to 9 then utilizes the top heater to provide the final 25% of the heat to reach reflow.

OPERATING PROCEDURES

4. Press the increase or decrease button to adjust the bottom heater set temperature level. The set temperature is adjustable from 50 to 280 C in this type of operation. To temporarily turn off the bottom heater simultaneously press both the "Increase" and "decrease" button *(**#3** & **#4** from the control panel display see page 8)*. The bottom display will show "OFF" indicating the bottom heater is now turned off.
5. To view the actual internal temperature read by the Top heater and the bottom heater's internal temperature probe, repeatedly press the selection button until the top display shows the actual value of the top heater internal temperature followed by a suffix "**d**". The number displayed in the middle row followed by a suffix **"E"** is for the bottom heater actual internal temperature**.** The bottom display shows the actual temperature of the soldering iron , it is followed by a suffix "**F**".
6. To view the actual temperature read by the three external temperature sensor, repeatedly press the selection button until the top display shows the top heater external temperature prob's actual temperature followed by a suffix **"A"**. The middle display will show external temperature probe b's actual measured temperature followed by a suffix **"b".** And the bottom display would show the actual measured temperature of the external temperature **probe C**. It is followed by a suffix **"C".**

Note: External temperature probes are labeled. Top heater external probe is labeled A, while the other two is labeled b and C. The displayed actual temperature reading's suffix corresponds to the labels.

E. TYPE "1" OPERATION

Before proceeding with this type of operation, attach the top external temperature **probe A** to one corner of the BGA or IC to be reworked. Then attaché the external temperature **probe b** to the underside of the PCB to be worked on, preferably not near the are of the BGA or IC to be reworked on but not directly underneath the BGA or IC.. The external temperature **probe C** can be placed near any area of interest.

This type of operation utilizes the external temperature **probe A** to regulate the top heater, while the external temperature **probe b** regulates the heat of the bottom heater. Using this type of operation allows us to closely control the temperature at board level. While freeing up external temperature **probe C** for additional monitoring.

1. To set the desired top heater temperature press the selection button repeatedly until the top display shows "**TOP**" and the middle display shows "**SEt**" . The bottom display would show the current set temperature of the top heater followed by a suffix "**A**".
2. Press the increase or decrease button to adjust the top heater set temperature level. The set temperature is adjustable from 50 to 280 C in this type of operation. To temporarily turn off the top heater simultaneously press both the "Increase" and "decrease" button *(**#3** & **#4** from the control panel display see page 8)*. The bottom display will show "OFF" indicating the top heater is now turned off.
3. To set the desired bottom heater temperature press the selection button repeatedly until the top display shows "**bOt**" and the middle display shows "**SEt**" . The bottom display would show the current set temperature of the bottom heater followed by a suffix "**b**".
4. Press the increase or decrease button to adjust the bottom heater set temperature level. The set temperature is adjustable from 50 to 280 C in this type of operation. To temporarily turn off the bottom heater simultaneously press both the "Increase" and "decrease" button *(**#3** & **#4** from the control panel display see page 8)*. The bottom display will show "OFF" indicating the bottom heater is now turned off.
5. For this type ***(type 1)*** of operation we must closely monitor the actual temperature of the Top heater external temperature **probe A** and the external temperature **probe b.** As this two probes manage the heat of both the top and bottom heater.

6. To view the actual temperature read by the three external temperature sensor, repeatedly press the selection button until the top display shows the top heater external temperature probe's (**probe A**) actual temperature followed by a suffix **"A"**. The middle display will show external temperature **probe b**'s actual measured temperature followed by a suffix **"b".** And the bottom display would show the actual measured temperature of the external temperature **probe C**. It is followed by a suffix **"c".**

Note: Under type "1" mode of operation it is not necessary to monitor the internal temperature sensor's read out. *i.e. internal temperature readouts with suffix "d" and "E" .*

External temperature probes are labeled. Top heater external probe is labeled A, while the other two is labeled b and C. The displayed actual temperature reading's suffix corresponds to the labels.

F. TYPE "2" OPERATION

There are two different profiling system and sensor controls.

The temperature hold profiling system, is allotted to profile slots 0, 1, 2 and 3. While the time ramp profiling system is allotted to profile slots 4, 5, 6, and 7.

The temperature hold profiling system:

This system allows three variables to be controlled in each segment. The ramp rate, the hold duration and the desired temperature.

The ramp rate— is the limit in degrees per minute for the increase of temperature.

The default value for this settings is 100r which means the limit is 100 degrees per minute. (An industry standard recommendation is never to exceed 180 degrees per minute)

The Hold duration— is the duration in seconds in which the system must regulate the heaters at a particular set temperature.

A Quick Guide on using the AOYUE INT 732 for reworking.

1. Background on profiles used in reflow soldering.

Reflow soldering is a type of manufacturing method wherein components to be soldered to an assembly board are applied solder paste on their contacts. After which heat is applied to the PCBA to allow the solder paste to activate its flux and then form a solid electrical bond between the component and the board.

Most reflow soldering method utilizes reflow ovens to archive consistent results. These reflow ovens use different technologies to apply heat to the target board, some use convection heating, IR heating, conduction plates or a combination of various heating technology. Different oven types and heating technology produces different heating results therefore developing a heating profile is essential for optimum repeatability for a particular PCB assembly.

What is a heating profile? A heating profile or more commonly known as a reflow profile is a set of procedures and parameters entered into a machine to produce consistent results for every reflow. It should be noted that every profile is unique; a component manufacturer may release a recommended profile / temperature reflowing limits for a particular component. These data are to be used as a starting point for industry professionals to establish a working profile for the particular reflowing equipment they utilize. Other data such as component density, board thickness/layers, component packaging, solder paste/flux type, reflow oven type / heating technology, thermodynamic effects and other details are all considered when creating a working profile.

Multiple rounds of reflows using dummy components and profile adjustments are needed before a basic profile is obtained. Further tests using actual PCBAs and re-adjustments are then required to perfect the profile. The profile obtained after these multiple trials would then be the best profile for these particular types of boards using this particular reflowing machine. It is often misunderstood that after determining the best profile, that same profile would work for all type of boards and is applicable in all other reflowing machine in the market. That is not true as the same profile will not produce the same consistent results if used in other reflowing machines or PCBAs. Consistency would not be achieved as other reflow ovens may use a different heating or loading technology, PCBAs even if the same thickness of boards are used but the components are realigned would result in a different thermal mass, resulting to a totally incompatible profile. Therefore to achieve consistency it is important that a unique profile must be made for each machine/ type of board to be reflowed.

2. Aoyue INT 732 technology.

The system used in determining the best profile for reflow oven soldering can also be used in determining the profile for an advanced spot reflowing machine such as the Aoyue INT 732. Like reflow oven profiling we must first learn and understand the type of equipment we are going to use, its heating type, features and capabilities are important in setting up a working profile.

The Bottom Heater:

The system uses quartz infrared tubes for the bottom heater, these types of heaters produces medium wave infrared energy to heat up the target board. Unlike convection or conduction plate heaters; IR heaters work well even in vacuum, as the IR waves does not need physical contact with the target device for the IR wave to be absorbed by the board.

Using IR heating technology for the bottom heater has its advantages over conduction or convection heating when used in a spot reflowing machine. Conduction systems are difficult to control and with the increasing complexities of boards, conduction systems are now difficult to implement especially for multi layer diverse technology boards. Convection systems are bulky and inappropriate for spot reworking systems as the entire PCBA would need to be in an enclosed or semi enclosed system for precise temperature control. IR heaters are easy to implement, can accommodate current diverse technology boards, requires only minimal space and allows easy access to target components.

As with reflow oven systems, the board type, component densities and solder type are important in determining the time and temperature requirements for a successful reflow in spot reworking equipments. The board type and component densities will determine how long the board should be heated to reach thermal equilibrium. This initial heating is often called pre-heating the board and is composed of a ramp and a soak stage. The objective of the ramp stage is to gradually increase the temperature of the board minimizing thermal shock to the components or board warping which may occur during the later stages of the reflow. The soak stage will enable the entire board to reach thermal equilibrium. Allowing the board to reach thermal equilibrium before the targeted reflow of a component will maximize the heat transfer from the top heater to the solder and enable a more even heating effect on the target device due to less temperature variance around the immediate area of the target component.

The Top Heater:

The purpose of the top heater is to force a targeted component's solder to reach liquidus status in order to form an electrically stable bond between the component and the board when the solder cools and solidifies.

The Aoyue Int 732 top heater uses a square type forced convection Quartz heater. Its unique design incorporates IR penetrating energy and hot air convection to provide a more even and effective reflow. This design uses the hot air to envelope the BGA and its immediate surrounding in a hot air bath to mimic the environment inside a reflow oven. Then the IR energy penetrates the device and is absorbed by the target device to allow the solder to reach liquidus state.

The distance between the edges of the top heater nozzle to the target device is of importance. As it determines how much hot air and IR energy is transferred to the target device. The top heater level varies depending on the type of solder and SMD packaging (Some packaging absorb IR better while some don't, some BGA packages are designed to have heat dissipating packaging causing different core/ solder ball temperature when reflowed using purely convection conduction system). Therefore for each type of board, packaging and solder to reflow we must determine the optimum level so that the Hot air and IR energy can properly engulf and penetrate the target component. Determining the optimum level can be done as we attempt to make a working profile that best suit our target system.

This will be discussed in section three of this document “Profile creation using the Aoyue INT 732”.

The Software controls:

As with most industrial reflow ovens in the market, the Aoyue INT 732 allows precise control of the temperature slope by entering the required time and target temperature when using the automated reflowing mode. However unlike reflow ovens where-in the entire board is subjected to the same amount of heat for solder joints to form. A spot reworking machine like the INT 732 targets only a particular component.

The INT 732 spot reflowing system uses the 75-25 rule in its automated reflowing mode. This means that 75% of the required heat to reach reflow is produced by the bottom heater, while the top heater adds the additional 25% to the target device for reflow to occur. There are six stages available for customization, the first three stages is allotted for the pre-heating portion and the last three stages can be configured for reflow activation, time above liquidus state and/ or cool down mode.

During the first three stages of the profile, the bottom heater (probe B) will follow the rising slope rate as set in each stage, after which it will maintain the final set temperature of stage three throughout the remainder of the profile. Also during the initial three stages, the top heater (probe A) will also pre-heat the target component but only until ¾ of the instantaneous target bottom temperature of these stages. The pre-heating of the target component by the top heater during the initial stages of the profile is done to closely maintain a convection reflow oven environment throughout the entire reflowing stages.

After the end of stage three, the top heater (probe A) will then follow precisely the slope rate set in stages 4 to 6.

See example:

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Time	60	70	80	150	80	20
Temperature	120	150	180	182	230	232
Bottom Heater(Probe B) target actual temperature at end of stage	120	150	180	180	180	180
Top Heater(Probe A) target actual temperature at end of stage	90 (75% of 120)	112.5 (75% of 150)	135 (75% of 180)	182	230	232

3. Profile creation using the Aoyue INT 732.

In the PCBA repair industry it is common to handle boards of unknown history and reflowing specifications. Using a spot reflow machine for targeted rework on a specific component in the PCBA allows easy isolation/repair of questionable components or solder joints. There are cases wherein multiple identical boards with similar problem components are encountered. Creation of a reworking profile to handle these types of boards would allow fast, easy and reliable rework.

For a system to produce successful and repeatable rework of identical PCBAs, consistency in procedures and a finely tuned profile is required. Now with a basic idea on

industrial reflow soldering procedures and good understanding of our reworking equipment we can now develop a basic profile for a particular PCBA.

Initial Setup:

Place PCBA into a secure holder. Using the INT 732 system's multi-point board holder, the PCBA can be securely fastened to prevent board warping. Additional holding screws and side grips may be added to the holder for a more secure lock. Place the secured board on top of the INT 732 pre-heating area. The distance between the secured board and the pre-heater should be noted and marked. Place an appropriate sized nozzle on the top heater to fit the target component. Center the top heater onto the target component. Reflective tape can be applied to temperature sensitive devices adjacent to the target component.

Probe Placement:

Probe "b" controls the bottom heater during automated reflow mode (Type 2). Place probe "b" under the secured board, its position should not be in the immediate area where the target component to be reworked is positioned. Placement of probe "b" should be consistent, each time a similar board is reworked the same position should be used. The density and layering of the PCBA will affect its thermal absorption, positioning the Probe "b" under a larger copper plane or underneath a highly dense area of the board will have a different result compared to placing the probe underneath a less dense area or smaller copper planes.

Probe "A" controls the top heater during automated reflow mode (Type 2). Probe "A" is to be placed very near the target component to be reflowed. It is important that the placement and pressure of the probe tip be consistent. Slight movements of the Top heater may affect the position and pressure the tip exerts on the board.

Initial Board Temperature:

Initial board temperature differs depending on room temperature it is important to start reflows with consistent initial board temperature. To allow consistency always heat up the board to a definite temperature before starting an automated reflow profile. This can be done by using type "1" mode. Turn off the top heater by simultaneously pressing both the up and down button while in the Top heater set temperature page. Press select to move to bottom heater set temperature page. Set bottom heater to 100. Then wait for the board to stabilize at 100 before proceeding with the automated reflow.

Ramp Up Stage:

The initial target temperature for the ramp up is 75% of the solder melting temperature. We are now increasing the temperature of the board such that it reaches this level. If the solder melting point is 230 degrees then the initial target temperature at the end of the ramp up stage is around 170 to 180 degrees. Remember that our initial board temperature is already 100, therefore we must now increase that temperature to 180.

Now continuing from the last procedure (probe "b" bottom of the board, probe "A" near the target component on top of the board), we are using type 1 mode with the top heater off and the bottom heater set temperature to 100, increase the bottom set temperature to 180. Record the time it takes for probe "b" to reach 180. This will now be the duration for our pre-heat stage which is stage 1-3 of the profile.

Example:
Time it took for probe "b" to reach 180: 210 seconds

Set temperature of probe “b”: 180

We can spread the time and temperature from stage 1 thru 3 as such…

Profile 0:

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Time	60	70	80	-	-	-
Temperature	120	150	180	-	-	-

So based on this working profile we allowed the board to gradually heat up to our pre-heat temperature of 180.

Soak Stage:

Upon the end of the ramp up stage we would need to let the top and bottom of the board reach thermal equilibrium. With the top heater centered on the target component, and edge of nozzle to board distance of 10 to 15 mm (as a starting height). Place probe “A” to measure an area at the edge of the target device. Then turn on the top heater by pressing the select button until the top heater set temperature page is displayed then simultaneously press both the up and down button to turn on the top heater. Set the top heater to our pre-heat temperature in this example it is at 180 plus 2 degrees. Record the time it would take for probe “A” to reach the pre-heat temperature. Add a few seconds to that recorded time to allow the temperature to stabilize. This will now be our soak duration.

Example:
Time it took for probe “A” to reach 182: 150 seconds (add 10 seconds stabilization time)
Set temperature of probe “A”: 182
Set temperature of probe “B”: 180

Profile 0:

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Time	60	70	80	160	-	-
Temperature	120	150	180	182	-	-

Reflow Stage and TAL Stage:

Next we need to know the time it will take for the solder to reach reflow status and the temperature probe “A” reading at that instance. Continuing from where we are from the previous procedure (soak stage) the top and bottom of the board are now at thermal equilibrium with a temperature of roughly 180 to 185 degrees. We now slowly increase the set temperature of the top heater a few degrees per second until the solder reaches liquidus state. For BGA components the BGA can be lightly nudged to see if the solder balls have reached liquidus state. Record the time and temperature reading of Probe “A” . This will now be our set time and temperature for stage 5. The last stage can be set as the hold duration or

Time above liquidus duration, in which the temperature of the solder at liquidus state is maintained for several seconds to allow better solder joints.

For example:
Time it takes for the solder to reach liquidus state: 85
Temperature reading of Probe A at liquidus state: 230

TAL duration: 30 seconds
Profile 0:

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Time	60	70	80	160	85	30
Temperature	120	150	180	182	230	232

Profile Adjustments:

We now have a basic profile to start our automated reflow; additional adjustment will be needed for this profile to archive consistent results.

With the same board setup and probe placement as the one we used to determine the basic profile, we can now start the automated profile runs. First pre-heat the board to 100 degrees. This can be done by using type 1 mode and setting the bottom temperature to 100 degrees. Let board stabilize at this temperature. Turn off unit then enter type 2 mode (automated reflow mode). Select profile 0 and enter the basic profile into the system.

IMPORTANT: Always scroll thru the stages by pressing the select button for the system to load the stages into the working memory; selecting the profile alone at the profile selection page will not load the desired profile settings into the working memory.

Proceed to the "run profile" page and press the up button to initiate automated reflow. While the profile is running keep an eye on the instantaneous target temperature, this temperature is the ideal temperature the system should reach based on the profile entered. The instantaneous target temperature can be viewed by pressing the down button. The lower display will change to a number with a suffix "c" to indicate this is the instantaneous target temperature. The actual temperature reading probe "A" and "b" can be filled into the table below for better profile analysis.

Sample result 1:

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Set Time	60	70	80	160	85	30
Set Temperature	**120**	**150**	**180**	**182**	**230**	**232**
Total elapsed time	1:00	2:10	3:30	6:10	7:35	8:05
Probe "b" Temperature	**115**	**140**	**175**	180	182	178
Probe "A" Temperature	90	110	140	**184**	**225**	**227**

Analyzing sample result 1:

We see that during stage 1 the actual probe "b" reading at time 1:00 is within 8 degrees of the required temperature so further adjustments is not necessary. During the end of stage 2 at 2:10 elapsed time the probe reading of probe "b" is only 140 which is 10 degrees less that the target temperature of 150 we can adjust the duration of stage 2 longer to allow the temperature to reach the desired target. We now lengthen the set time of stage 2 to 75. During stage 3 we see that probe "b" is within 8 degrees of our target temperature so no further adjustment is necessary. At stages 4 to 6 probe "b" is able to maintain our target temperature of 180 (pre-heat temperature) therefore no further changes are necessary.

Probe "A" readings during stages 1 to 3 are not critical. We can concentrate on stages 4 to 6. We can see that at the end of stage 4 (elapsed time of 6:10) the actual probe "A" reading is 184 which is within a few degrees of our target so no further adjustments are necessary at stage 4. However at stage 5 we see that the actual probe reading at elapsed time 7:35 fell 5 degrees short of our target temperature of 230. We need to adjust the duration of stage 5 longer to allow the target temperature to be reached. So from 85 seconds at stage 5 we adjust it to 90 seconds. The hold duration and temperature at stage 6 can be maintained. Stage 6 time is adjusted only to allow longer hold duration, while the set temperature of stage 6 is normally 2 degrees higher than the set temperature of stage 5.

Sample result 2:

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Set Time	60	**75**	85	160	**90**	30
Set Temperature	**120**	**150**	**180**	**182**	**230**	**232**
Total elapsed time	1:00	2:10	3:30	6:10	7:35	8:05
Probe "b" Temperature	**116**	**147**	**173**	180	181	180
Probe "a" Temperature	92	118	145	**184**	**228**	**230**

Analyzing sample result 2:

We rerun the profile after the time adjustments to obtain a second result. Analyzing sample result 2 we see that probe "b" is able to reach our desired target at the end of each stage. At stage 1 to 3 probe "b" or the bottom of the board was able to reach within eight degrees of our target temperature. This is already an acceptable result thus further adjustments is not needed. We also see that at stages 4 to 6 probe "b" was maintained at our target pre-heat temperature of 180 (which is the set temperature at stage 3). Now looking at probe a, it has now able to meet out target temperature at stage 5. Therefore further adjustments are not necessary.

Sample General Reworking Profile with initial starting board temperature of 100 degrees:

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Time	60	70	80	150	80	30
Temperature	120	150	180	182	230	232