Measurement System (system capability)

- Resistance measure: 0.1uohm to 100Mohm (Hioki 3545)
- Resolution: +0.01uohm@10mohm (Hioki 3545)
- Accuracy: ±0.060% rdg. ±0.001 % fs @10mΩ range (med)
- Multiplexer card: Solid State Relay (SSR) with 24 channels 4 wire (Kelvin) per card. Current: 2A max per Ch. Std: 2 Mux cards (48chs), Option: 3 Mux cards(72chs)
- Probe card Interface: industry std GT7 probe card interface
- Measurement Systems: Qtest PMU (trimming/measure) and Calibrator Meter (Hioki 3545)
- Qtest RTS measurement accuracy: within 99.9% of Hioki 3534 for range 2mohm to 100ohm.
- Accuracy traceability : Hioki ("Hioki" is a brand of Hioki E.E. Corporation, Japan).

Qtest RTS Measurement repeatability:

1. 1 to 10mR: ±2uohm on fixed load.
2. 1 to 10mR: ±10uohm using Probe card on average(probe contact R)

Trimming Specifications for Qtest Ultra Low/ High Laser trimmer

1. Trimming capability: Printed, FOS /Metal Strip.
2. Chip Resistor Size: from 01005
3. Trim Range: 1mΩ~100Ω; 1M to 50Mohm (check for specific trim conditions for required range)
4. Trim Precision for resistor 1mohm: std >±0.5% and higher.
5. CV for resistor >1mR to 10mR: avg <0.25%. (also depend on material, size of resistor, speed of trim, type of cut etc).
5. Trim Yield (IRV within limit): normally avg 98%.
6. Trim time: depend on trim method used, number of cut needed, thickness of material, laser power etc.
7. Resistive material thickness: from 1um to 100um
8. Laser: std IR air cool
9. Trim Algorithm: Proprietary Qtrim from Qtest Technologies.
10. Trim type: Single/Multiple/Serpentine/Plunge/Scan/custom
11. Qtest is able to develop new trim technique/method to handle new type of chip resistors.

Site Environment Requirement

1. Power Supply: Single phase 230V/16A.
2. Room Temperature: Air Conditioned at constant temperature.
3. Compressed Air Supply: min 5 PSI, free of dust, oil and water.
4. Require Air filter to capture trimmed particles and dust to prevent contamination of working environment. Qtest trimmer comes with air pump to exhaust these particles from trimming area.

Laser System

1. Printed resistors: 1064nm IR 7W; Air Cool.
2. Laser power meter to check for laser power consistency.
3. Beam Expander:2X to 10X option
4. Spot Size: adjustable from 20um to 45um

Mechanical Handler Specifications

1. Vacuum Work-Holder with theta rotation stage: 50x60mm, 60x70mm reversible.
2. Position repeatability: ±10um;
3. Position Accuracy: ±10um;
4. XY stage repeatability: ±10um;
5. Z-Stroke step size (with probe overdrive protection system): 0.01mm-10mm (programmable) .
6. XY stage : ball-screw with encoder.
7. Vacuum system : to suck up debris from trimming.

Camera/Optics

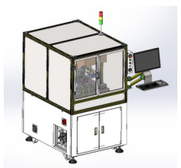
1. PR Camera for automatic panel positioning
2. User Aid camera for probe/resistor contact and "live trim viewing"
3. Zoom in and out capability on PR camera for trim position check

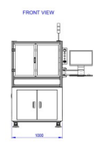
In loader/Out loader with elevator

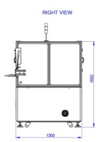
Removable for easy loading and unloading. Can be rotated 90° to handle 60X70mm or 70X60mm

Footprint: 1000 x 1300 x 1700 (mm)

Weight: < 1000kg.







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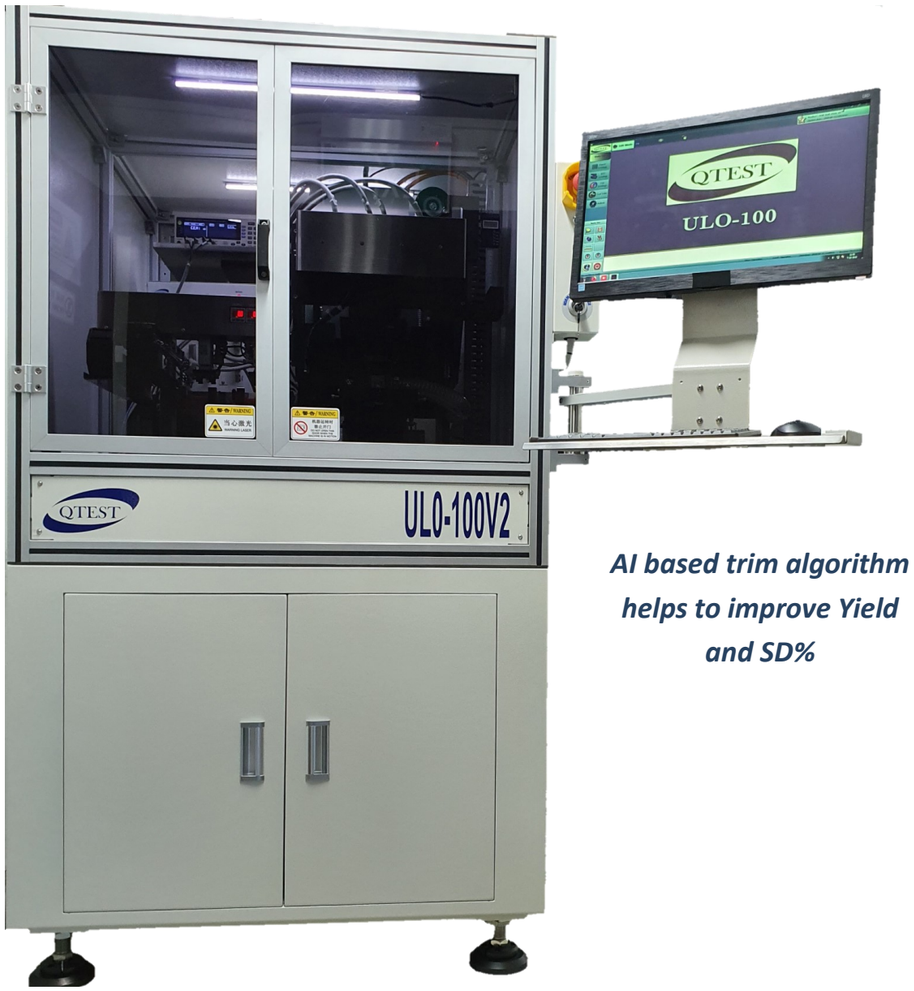
QTEST Ultra Low/High Ohm Laser Resistor Trimmer



AI based trim algorithm helps to improve Yield and SD%

Ultra Low Ohm Trim from: 1mohm to 100 Ohm

High Ohm trim: 1M to 50Mohm

Resistor Size: from 01005

FUTURE LASER TRIMMING TECHNOLOGY

Trimming Ultra Low/High Ohm resistors (Thick/Thin film, FOS/Metal strip)

Introduction: The present resistor trimming technologies that were developed some 30 years ago and have not really kept up with time.

The most commonly used thick film trimmers today are capable of trimming from 100mohm. The modern electric motors, batteries, solar panels need lower resistance to reduce heat. These thick film printed resistors range from 1mohm upwards. These mid range trimmers(0.1ohm to 100Kohm) are not capable of trimming these ultra low ohm resistors to the required SD and yield.

Qtest ULO-100V2 was designed and developed fully by Qtest's R&D team from ground up for the ultra-low ohm trimming industry. This includes fast accurate measurement systems, QTRIM AI based algorithm and laser control system to enable consistent low SD during trimming. Qtest trimmer comes with *2 difference measurement systems.* Qtest own RTS is used for fast accurate measurement and trimming. Hioki RM3545 is used as a reference to ensure that the trimmed values are accurate.

Accuracy and Repeatability

Accurate trimming and measurement are key to high yield and low CV(SD%). Qtest ULO100V2 has the following measurement repeatability:

1. **Measuring 1 mohm fixed load :±2uohm.**

Measurement correlation to Hioki 3545 meter from 2mohm: >99.9%

Qtest ULO100V2 Measurement System is calibrated with the Hioki 3545. The maximum error measuring fixed load between Qtest RTS and Hioki is <±0.1%.

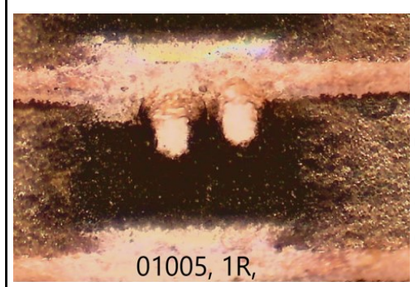
Importance of Measurement Accuracy and Repeatability

The trimmer measurement accuracy and repeatability must be consistent and calibrated to a Standard Calibrated meter. This will give confidence to the users during the trimming process.

Qtest own measurement system, RTS, has a maximum error of less than ±0.08% compared to the Hioki 3545 when measuring fixed load.

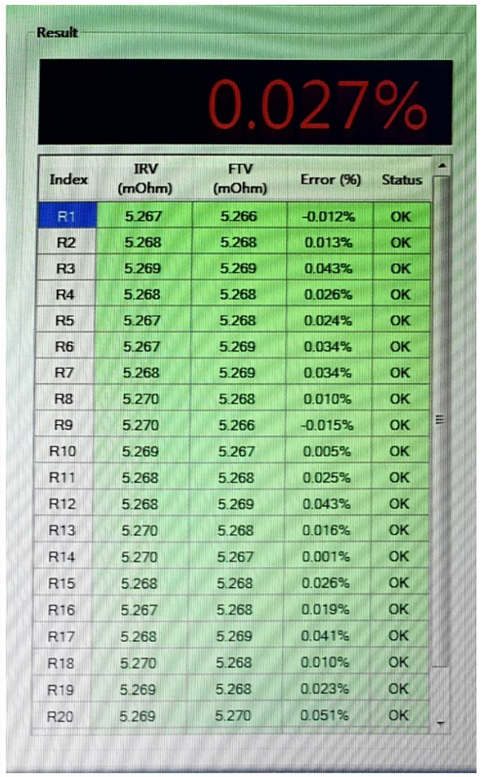
Trimming thick film printed resistors in Production

Qtest ULO trimmers are used in production to trim 2, 5, 10 and 20mohm printed resistors. Printed resistors are cheaper to manufacture compared to metal foil but are more difficult to trim get low SD. ULO100V2 special trim algorithm with its AI software is able to consistently trim to SD%<0.25 and Yield of over >95~98% % or more. *In fact, Qtest ULO trimmer is the only trimmer capable of trimming 2mohm in production with usable yield.*



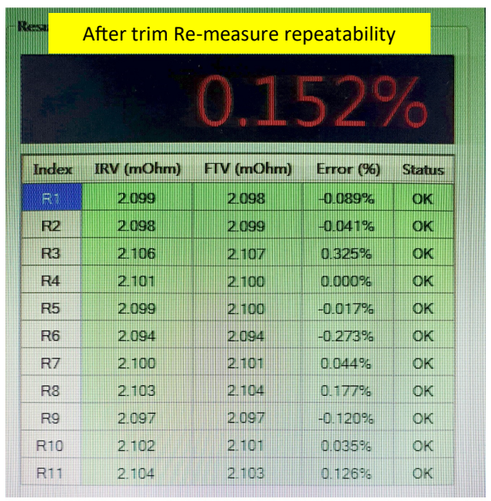
Trimming 01005, 1 ohm chip resistors

Qtest ULO is capable of trimming 01005, from 1R to 10R ohm. On average the SD<0.28% with yield>92%. Laser used is a IR air cool and camera change-kit to allow higher magnification.



Index	IRV (mOhm)	FTV (mOhm)	Error (%)	Status
R1	5.267	5.266	-0.012%	OK
R2	5.268	5.268	0.013%	OK
R3	5.269	5.269	0.043%	OK
R4	5.268	5.268	0.026%	OK
R5	5.267	5.268	0.024%	OK
R6	5.267	5.269	0.034%	OK
R7	5.268	5.269	0.034%	OK
R8	5.270	5.268	0.010%	OK
R9	5.270	5.266	-0.015%	OK
R10	5.269	5.267	0.005%	OK
R11	5.268	5.268	0.025%	OK
R12	5.268	5.269	0.043%	OK
R13	5.270	5.268	0.016%	OK
R14	5.270	5.267	0.001%	OK
R15	5.268	5.268	0.026%	OK
R16	5.267	5.268	0.019%	OK
R17	5.268	5.269	0.041%	OK
R18	5.270	5.268	0.010%	OK
R19	5.269	5.268	0.023%	OK
R20	5.269	5.270	0.051%	OK

Qtest ULO Trimmer
Measure Fixed load: 5.267mohm
Repeatability within:±2uohm
SD%<0.03%



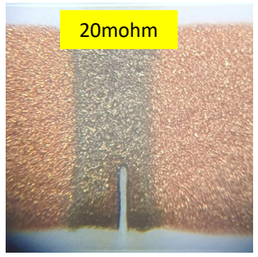
Index	IRV (mOhm)	FTV (mOhm)	Error (%)	Status
R1	2.099	2.098	-0.089%	OK
R2	2.098	2.099	-0.041%	OK
R3	2.106	2.107	0.325%	OK
R4	2.101	2.100	0.000%	OK
R5	2.099	2.100	-0.017%	OK
R6	2.094	2.094	-0.273%	OK
R7	2.100	2.101	0.044%	OK
R8	2.103	2.104	0.177%	OK
R9	2.097	2.097	-0.120%	OK
R10	2.102	2.101	0.035%	OK
R11	2.104	2.103	0.126%	OK

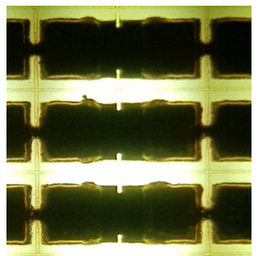
High Yield, Low CV, Repeatable and Consistent results!

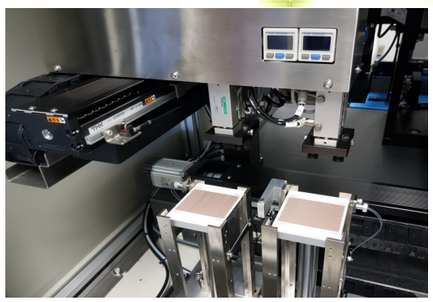
Qtest's ULO100V2 is totally developed by Qtest own R&D team. The important point is that Qtest is capable of resolving most trimming issues, improving the functions and performance of the trimmer. If the customer has a special trim requirement, Qtest will be able to help develop this function.

Qtest ULO100V2 can be interfaced to different types of laser to trim different types of material used in the resistors. The yield and low SD% are independent of the laser used. Normally IR laser is mostly used.

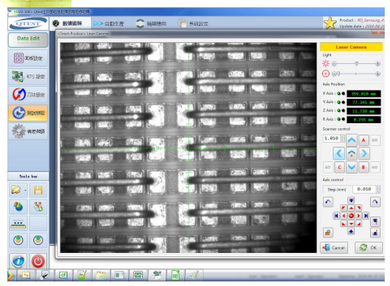
IR laser is cheaper and will therefore save cost for the company.



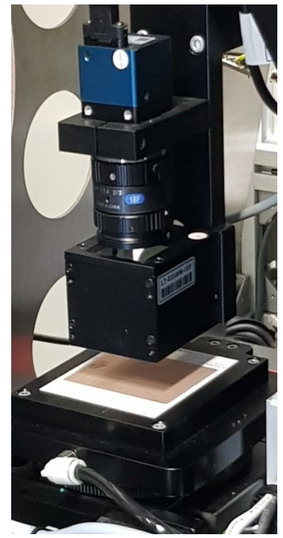




In Out loader. Easy change kit 50*60/60*70mm



Live view camera



PR camera for auto panel alignment

Advantage of Qtest Ultra Low/High Trimmer.

- ***Qtest ULO100V2 AI based Qtrim trimming algorithms is capable of handling heated related thermal-couple effect which is the main cause of low yield and high SD in laser trimming.***
- ***The Multiplexer card used for switching between resistors are capable of carrying max 2A per channel. The switching relays are so reliable that you almost never have to maintain or change these. This means less trimmer down time.***
- ***ULO100V2 uses 2 different measurement system. Qtest own very fast RTS is used for trimming measurement and the Hioki RM3545 used as final reference and as a calibrator. This will ensure all the trimmed resistors values are measurement accuracy.***
- ***ULO100V2 mechanical handling system is very robustly built. We have systems running in production for 5 years without ever breaking down. This is testimony to the capabilities of the built quality.***
- ***Qtest RTS's Precision Measurement Unit or PMU is calibrated to Hioki 3545 and is used for the fast trimming requirement. Using its 10mohm range, it has a measurement error of average ±2uohm error in continuous measurement using all the multiplexer channels measuring the same 2mohm calibration resistor. This accurate measurement will give user a very high level of confidence in Qtest Low Ohm Trimmer.***
- ***The ULO-100V2 is capable of trimming both thick film Ultra Low Ohm, High Ohm, Thick Film, Thin Film, FOS chip resistors. This offers the best value for money of any trimmer in the industry.***