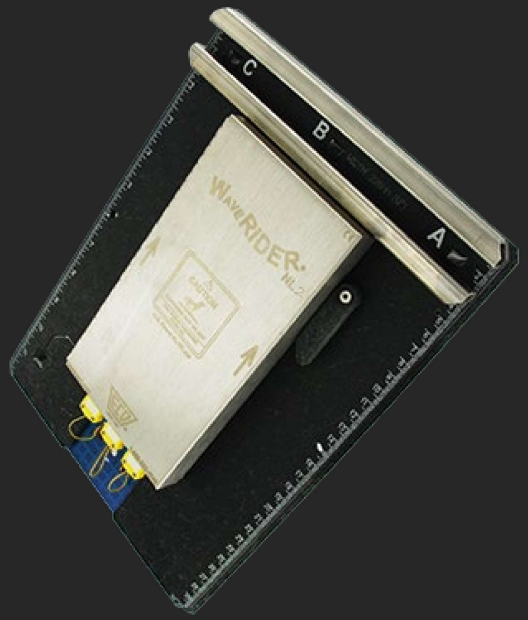
WaveRider® NL2

Home of THE M.O.L.E.® Thermal Profiler



Excellence in Measurement Solutions Worldwide

QUALITY SOLUTIONS ECD SINCE 1964

The WaveRIDER® NL 2 is a Lead-Free compatible self contained Quality Management Tool for maintaining Wave Solder Machine Repeatability. It is an 'electronic glass plate' that replaces your golden board to profile the machine.

Why do you need a device like the ECD WaveRIDER® NL 2 ?

Wave Soldering

- *Wave solder machines are mechanically complicated compared with reflow ovens – many things can go out of adjustment and make process control very difficult.*
- *Classic Profiling i.e. temperature measurement is not enough to capture and verify the recipe of a Wave soldering Process and machine condition.*
- *To verify Wave solder machine performance additional tools such as ECD Fluxometer and WaveRIDER® NL 2 are needed.*

Wave Soldering Complexity

• *FLUXER*	-	*Chemistry*
• *PREHEATING*	-	*Heat Transfer*
• *SOLDERING*	-	*Metallurgy*
		Hydraulics
		Fluid Dynamics
• *CONVEYOR*	-	*Machinery*
• *ENTIRE MACHINE*	-	*Maintenance &*
		Process Control

The 3 Major Wave Soldering Subsystems

- *FLUX Station*
  - *Removes light oxides*
  - *Prevents re-oxidation*
  - *Reduces Surface Tension*
  - *Promotes Capillary Action*
- *PREHEATING*
- *Activates the Flux & Evaporates the Carrier*
- *Conditions Assembly to Minimize Warpage*
- *Minimizes Heat Shunting from Solder Pot*
- *Prevents Cracking of Components due to sudden temperature changes*

- *SOLDERING*
  - *Creates solder joints*

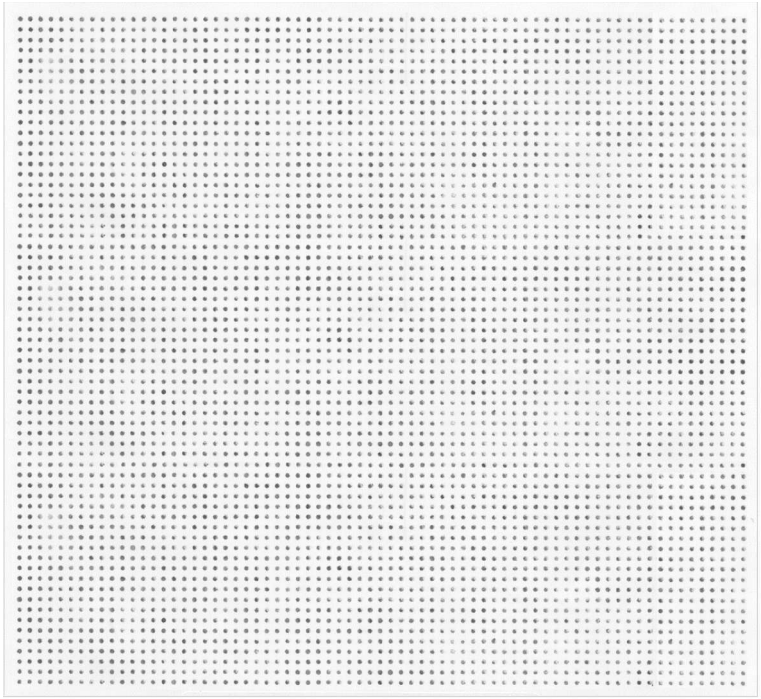
Flux is usually applied in form of Spray

- *Flux Penetration through PCB holes and Uniformity spray need to be quantified for adequate and consistent whetting.*
- *This is not easy task without proper tool, like ECD Fluxometer®*

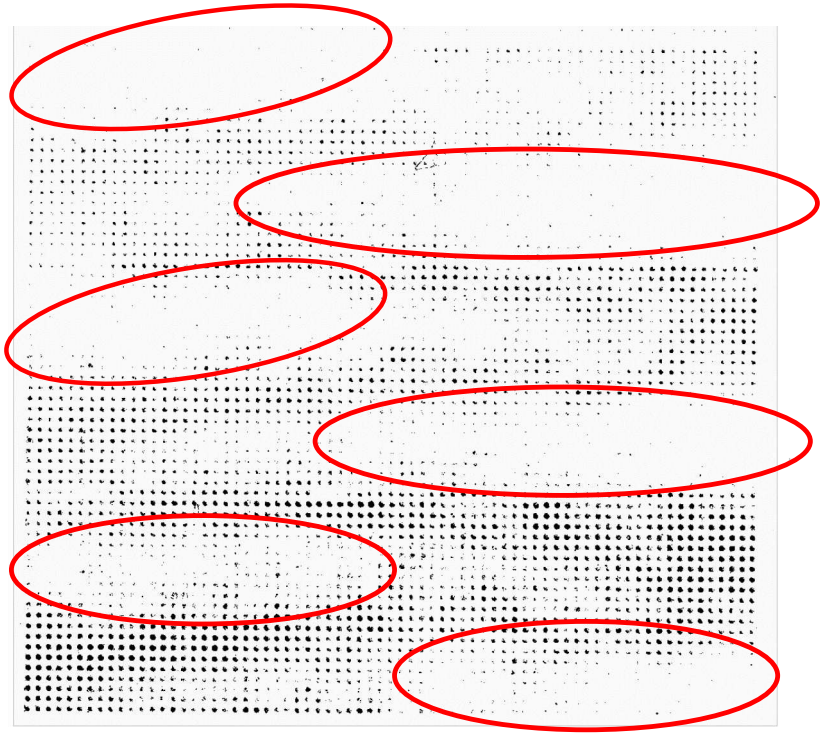
Fluxometer®

- *Eliminates Spray Fluxer Application Guesswork*
- *Easy and Rapid Quantification of Top Side Board*
  - *Penetration*
  - *Uniformity*
- *Fluxometer® and WaveRIDER® NL 2 – two integral tools for successful Wave Soldering Process*

Fluxometer®



Good Uniformity with Adequate Flux Penetration

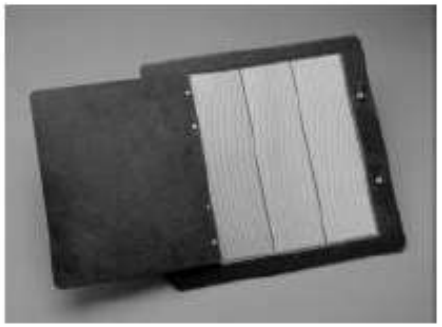


Voids & Skips indicate need for tuning the spray fluxer

Fluxometer®

Fluxometer™

Spray Flux Uniformity Measurement System



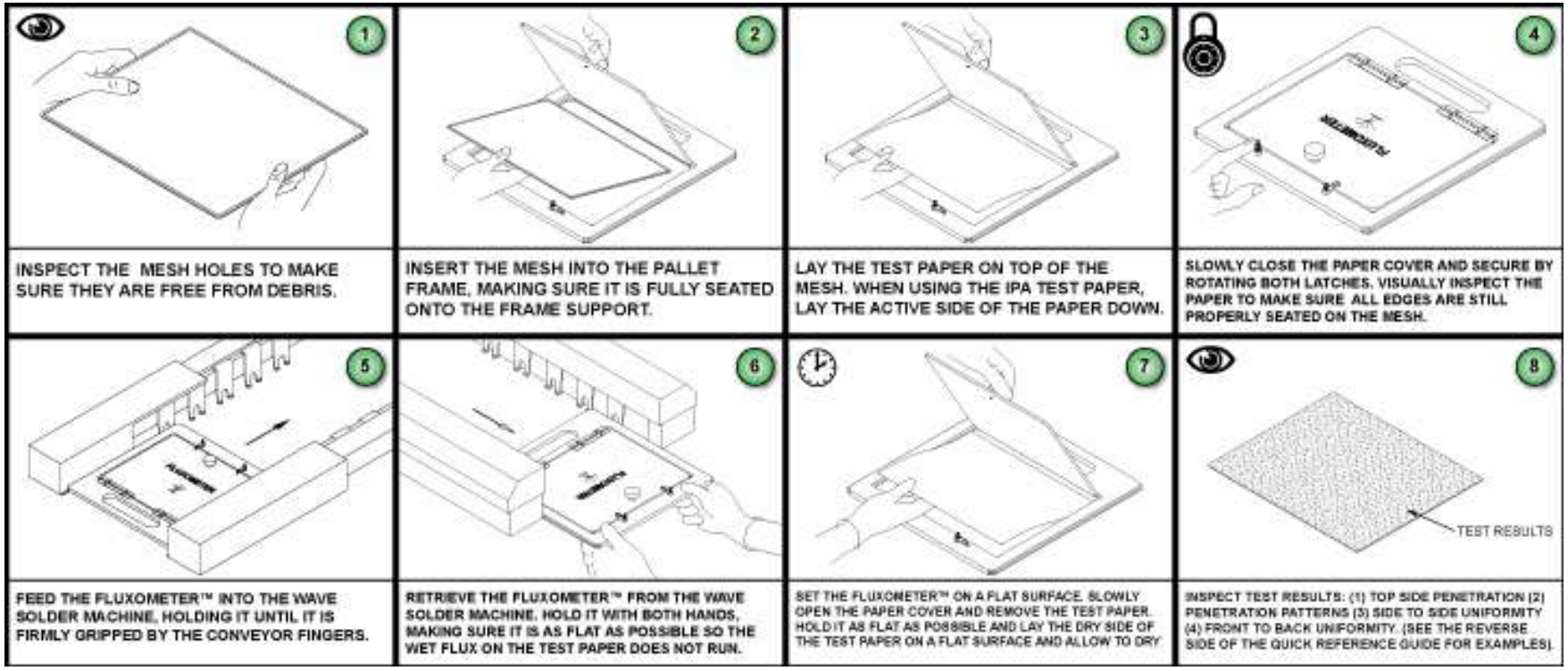
Pallet

Standard Widths:	9 in. (229 mm) 12 in. (305 mm) 15 in. (381 mm) 18 in. (458 mm)
Custom Widths:	Contact ECD
Height, overall:	1.08 in. (28 mm)
Thickness, Pallet:	0.315" (8mm)
Length:	12.32 in. (313 mm)
Pallet Material:	Electrostatic Dissipative Composite

Mesh

Material:	G10 Glass Epoxy
Length:	8.5 in. (216 mm)
Width:	Variable (based on Pallet Width) (Approx. 2 in. (51 mm) less than Pallet Width)
Thickness	0.062 in. (1.58 mm)
Pattern:	0.1 in. (2.54 mm) square grid pattern
Hole Diameter:	0.035 in. (0.889 mm) plated through

Fluxometer® Quick Reference Guide



Fluxometer® Test Paper Selection Chart

	----	Test Paper	----
Flux Type	IPA	pH Neutral	pH Low
No Clean	Y	Y	N
NC Voc Free	N	Y	Y
Water Soluble	N	Y	Y
Rosin - Mil	N	Y	N
Contrast	High	Medium	High
Paper Medium	Thermal	Litmus	Brompheonal
Use w/Flux pH	Alcohol	pH 7 or less	pH 4 or less
Start Color	White	Blue	Blue
Changes to	Black	Pink	Yellow

The WaveRIDER® NL 2 Kit

- *WaveRIDER® NL 2 Pallet*
- *Lead-Free Polyimide Test Coupon*
- *M.O.L.E.® MAP Software*
- *Quick Reference & Expert Guides*
- *Carrying Box*

What WaveRIDER® NL 2 offers?

Machine

Conveyor speed verification

Preheat Analyzes

Min/Max Temperatures

Preheat Slope Calculation

Chip and Secondary Wave Analyses

Contact/Solder temperatures

Delta T in a Wave

Dwell time across the wave

Contact length across the wave

Immersion Depth and parallelism

Machine Consistency and setup verification

All of above in easy to understand CPK analyses

WaveRIDER® NL 2

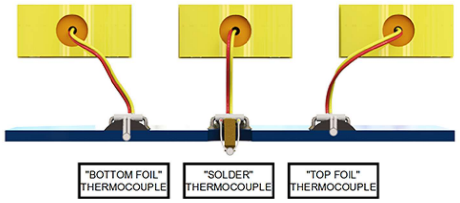
Dimensions:

- Standard Widths: 6.6” (167 mm), 12” (305 mm), 18” (458 mm)
- Custom Widths: >6.6“ (>167 mm)
- Height: 1 in.(25 mm)
- Length: 17.8 in.(452 mm)

Weight:

- 9”: 3.0 lbs (1352 grams)
- 12”: 3.8 lbs (1633 grams)
- 15”: 4.1 lbs (1787 grams)
- 18”: 5.5 lbs (2495 grams)

All Process Sensors are built right into the rugged pallet



External Features

1) Barrier box:
This is the thermal protective barrier for the M.O.L.E.®

2) Barrier Locking Latch:
This latch secures the top cover of the barrier to prevent it from opening.

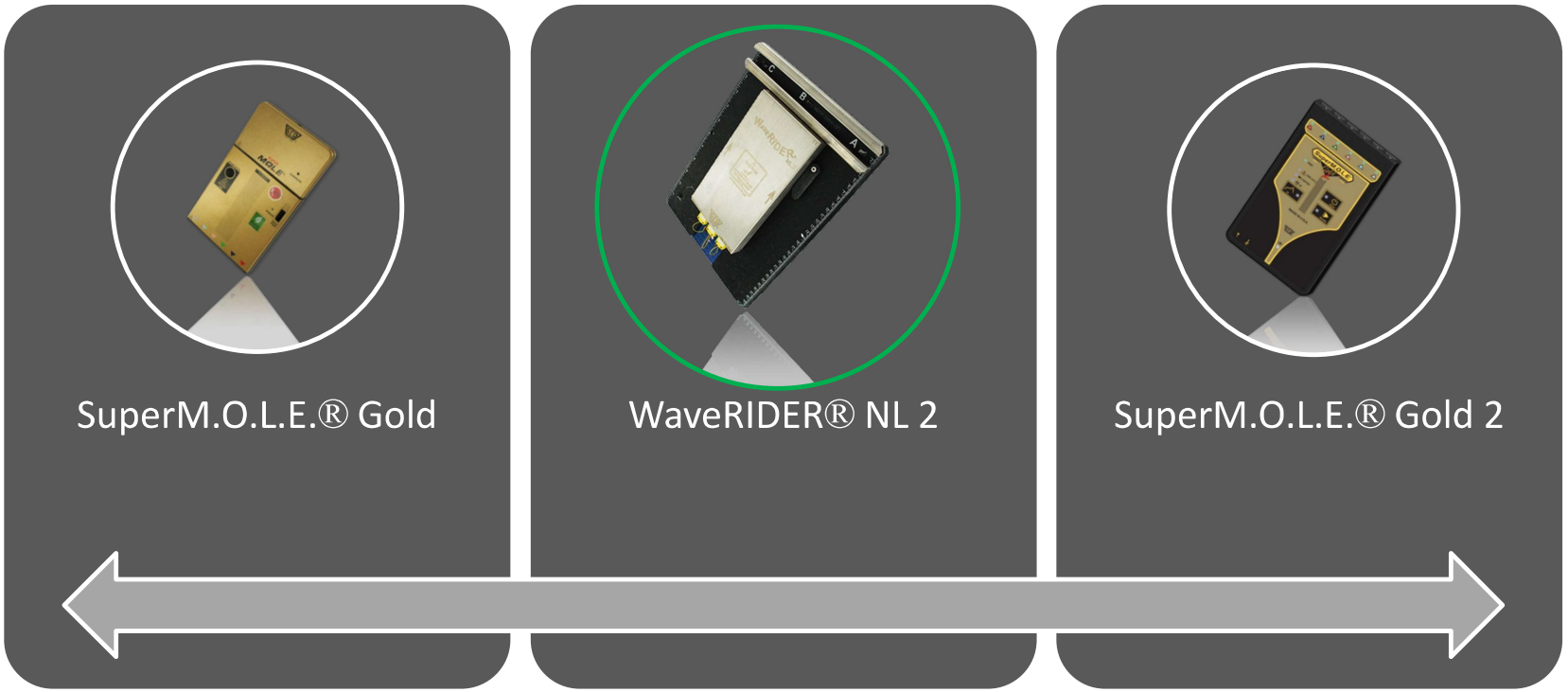
3) Coupon:
Sensors that record temperature data from the solder machine. Newly designed it now includes an anchor which fixes the “Solder” sensor at a 2mm [0.08”] depth. This provides optimum repeatability and a better representation of solder temperatures.

Internal Features

1) Connector Bridge:
This is where the M.O.L.E.® plugs into the WaveRIDER® NL 2 so it can collect data from the RIDER sensors.

2) Extractor Handle:
This handle assists in the removal of the M.O.L.E.®

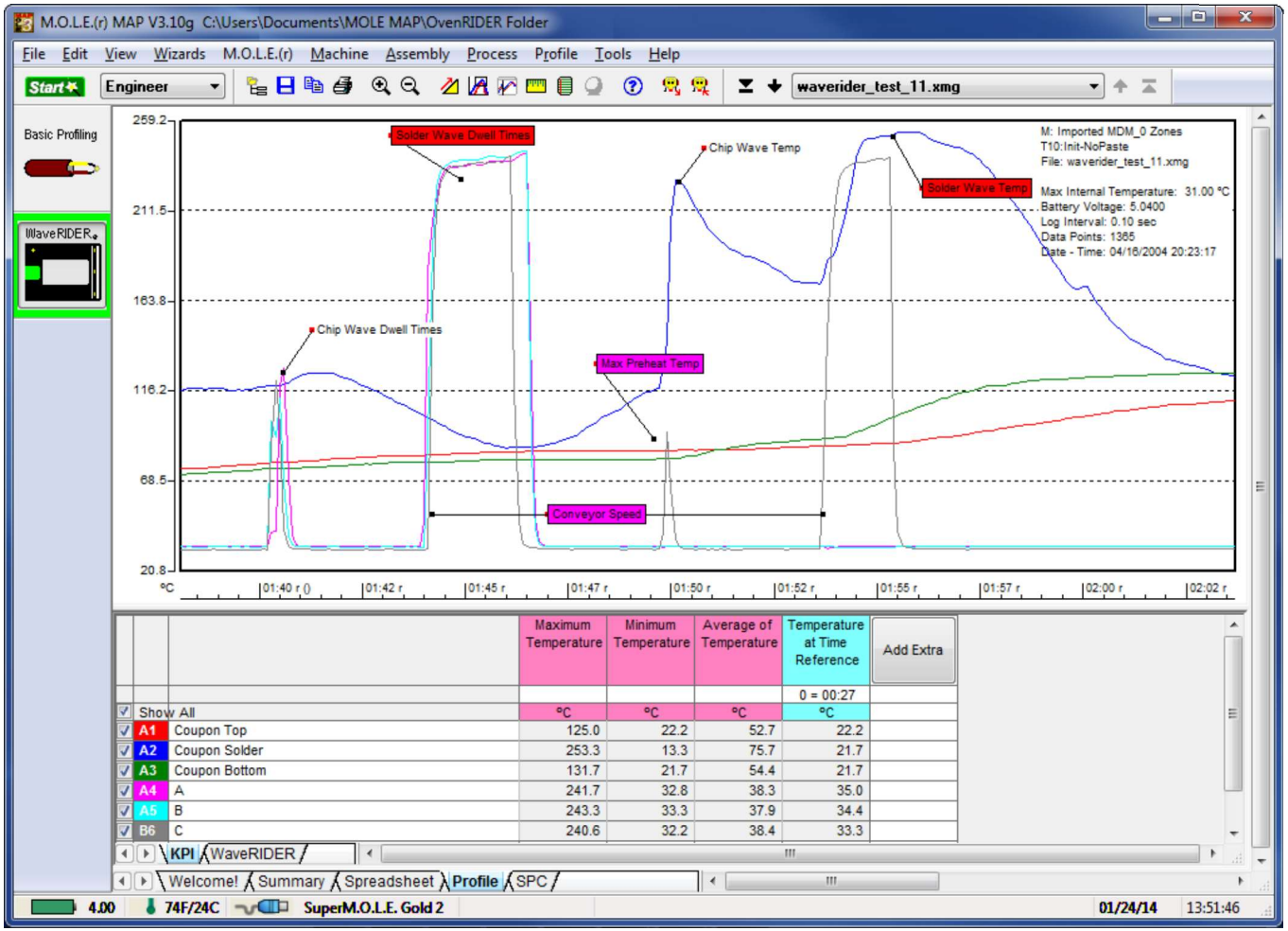
The WaveRIDER® NL 2 works with the SuperM.O.L.E.® Gold 2 and Xpert Ready models of SuperM.O.L.E.® Gold.



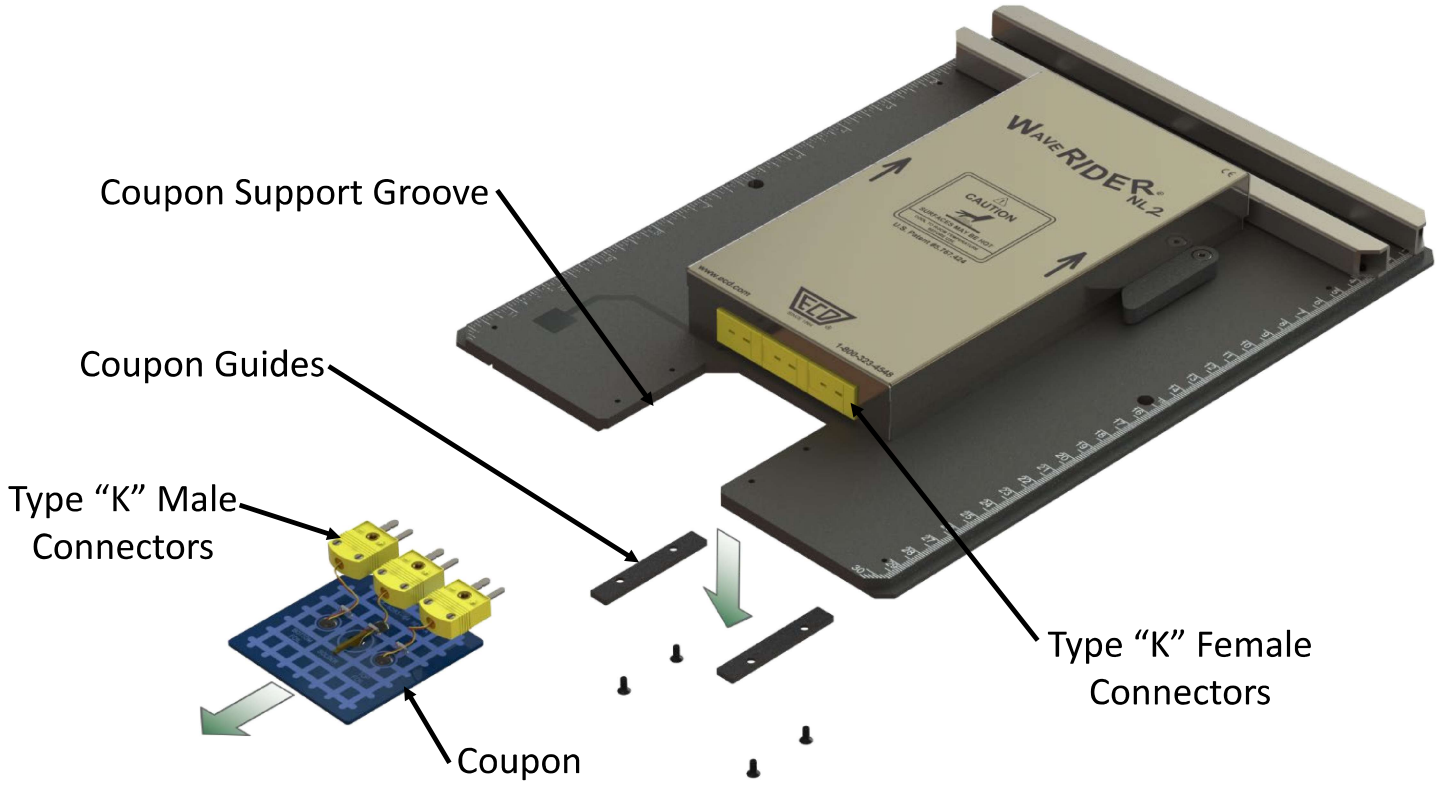
Operation (with SuperM.O.L.E. ® Gold 2):

1) Set the WaveRIDER® NL 2 on the conveyor, Press the ON Button then Record.
2) Confirm the SuperM.O.L.E. ® Gold 2 is properly docked indicated by the Channel and Rider Mode LED's.
3) Lock the barrier closed and let the conveyor pull it through for a 1st Article pass.

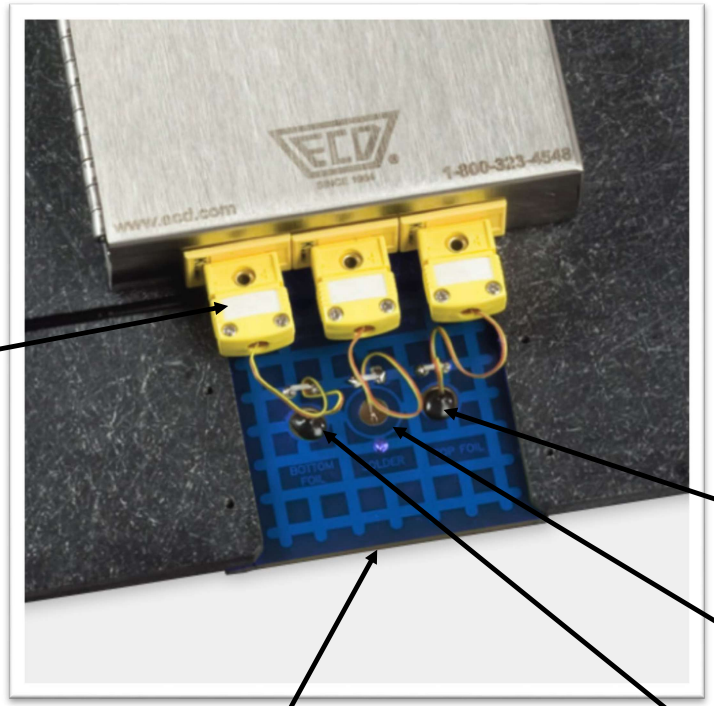
How does WaveRIDER® NL 2 Do All Measurements?


M.O.L.E.(r) MAP V3.10g C:\Users\Documents\MOLE MAP\OvenRIDER Folder
File Edit View Wizards M.O.L.E.(r) Machine Assembly Process Profile Tools Help
Start
Engineer
waverider_test_11.xmg
Basic Profiling
WaveRIDER
259.2
211.5
163.8
116.2
68.5
20.8
°C
Solder Wave Dwell Times
Chip Wave Temp
Solder Wave Temp
Chip Wave Dwell Times
Max Preheat Temp
Conveyor Speed
M: Imported MDM_0 Zones
T10:Init-NoPaste
File: waverider_test_11.xmg
Max Internal Temperature: 31.00 °C
Battery Voltage: 5.0400
Log Interval: 0.10 sec
Data Points: 1365
Date - Time: 04/16/2004 20:23:17
01:40 r ()
01:42 r
01:45 r
01:47 r
01:50 r
01:52 r
01:55 r
01:57 r
02:00 r
02:02 r
Maximum Temperature
Minimum Temperature
Average of Temperature
Temperature at Time Reference
Add Extra
0 = 00:27
Show All
°C
A1 Coupon Top 125.0 22.2 52.7 22.2
A2 Coupon Solder 253.3 13.3 75.7 21.7
A3 Coupon Bottom 131.7 21.7 54.4 21.7
A4 A 241.7 32.8 38.3 35.0
A5 B 243.3 33.3 37.9 34.4
B6 C 240.6 32.2 38.4 33.3
KPI WaveRIDER
Welcome! Summary Spreadsheet Profile SPC
4.00
74F/24C
SuperM.O.L.E. Gold 2
01/24/14
13:51:46

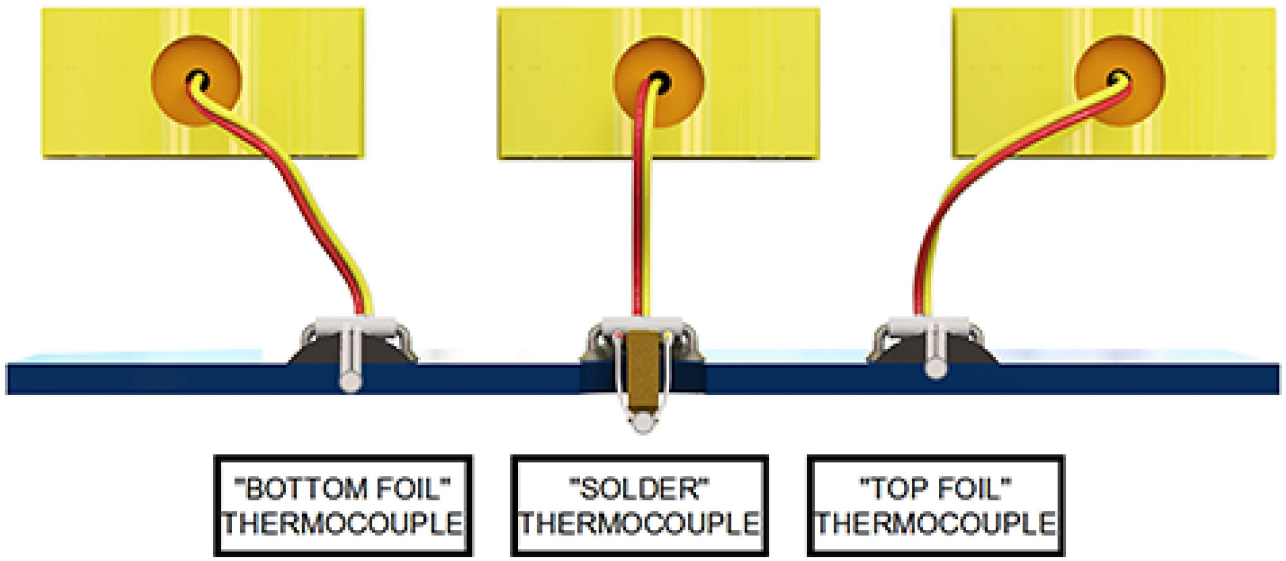
Periodic Test Coupon Replacement



How Does WaveRIDER® NL 2 Measure Temperatures?



Coupon Thermocouples



Best Top-Side Board Temperature

- *160-220F/70-105C Mil-Spec*
- *200-220F/95-105C SMD Mixed Tech*
- *230-240F/110-120C Current Trend*
- *Lead-Free*

WaveRIDER® NL 2 Measured Parameters

- *Wave Parallelism*
- *Contact Length*
- *Immersion Depth*
- *Conveyor Speed*
- *Preheat Slope*

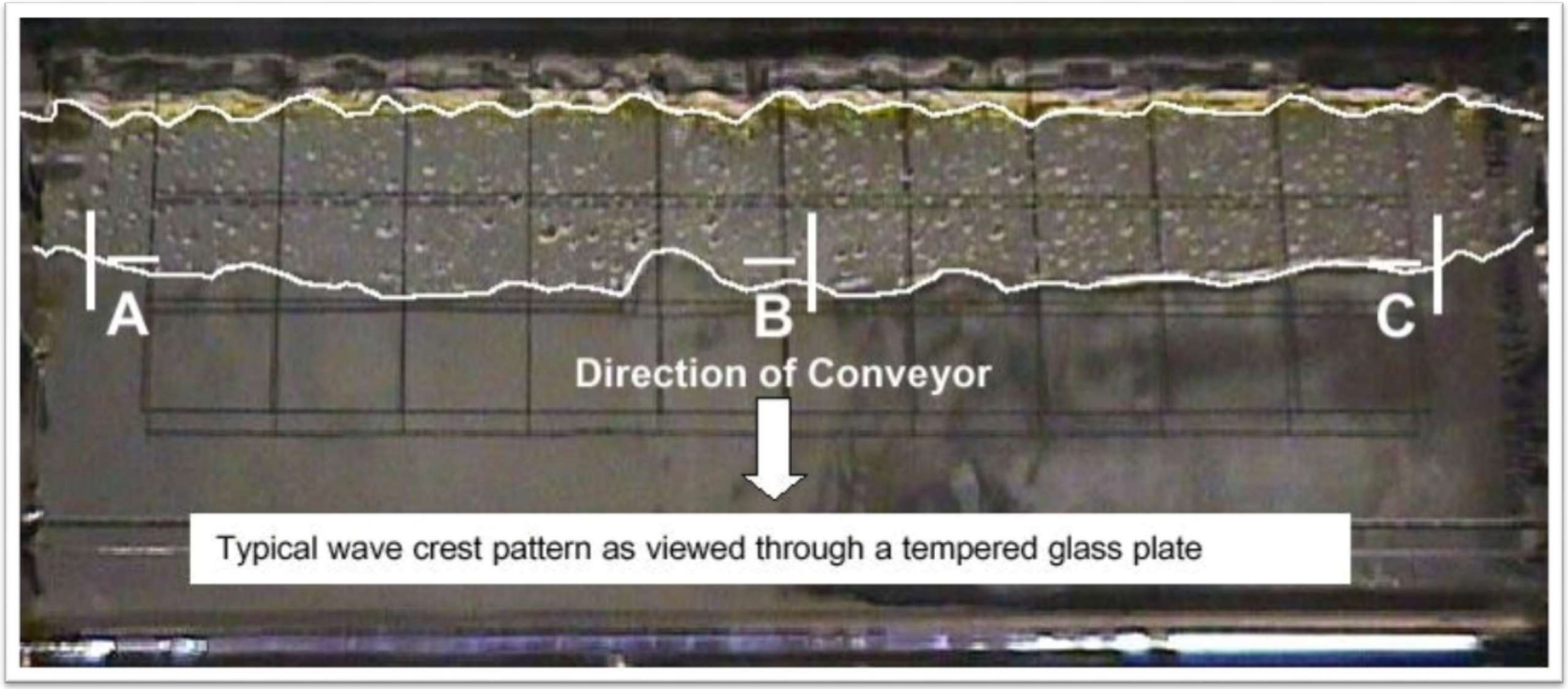
WaveRIDER® NL 2 Data

Chip Wave				Solder Wave			
Delta T at Wave:		2	F	Delta T at Wave:		63	F
Contact Temp:		482	F	Contact Temp:		491	F
Dwell Time:	(A)	0.3	Sec	Dwell Time:	(A)	2.4	Sec
	(B)	0.4	Sec		(B)	2.5	Sec
	(C)	0.3	Sec		(C)	2.1	Sec
Cont Length:	(A)	0.31	In	Cont Length:	(A)	2.46	In
	(B)	0.41	In		(B)	2.56	In
	(C)	0.31	In		(C)	2.15	In
				Immersion Depth:		0.10	In
Parallelism:		0.0	Sec	Parallelism:		-0.3	Sec

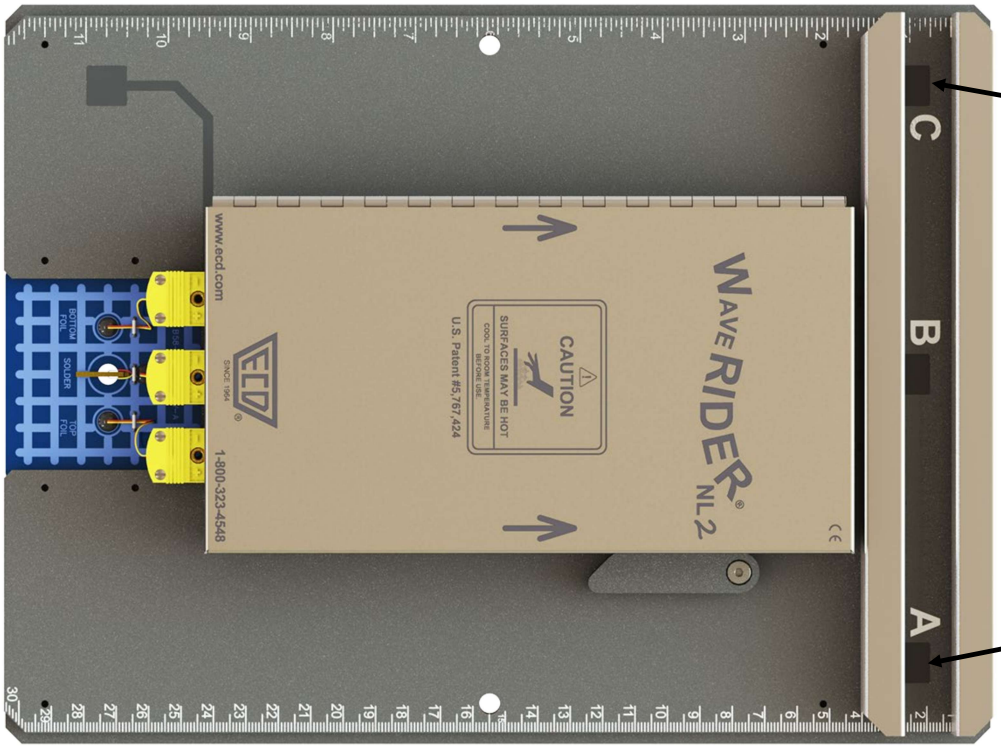
How Does WaveRIDER® NL 2 Measure Dwell Time?

Lag between solder spike at C and Speed Sensor and physical distance between them = Conveyor Speed .

Parallelism



Parallelism



Dwell Sensor (C)

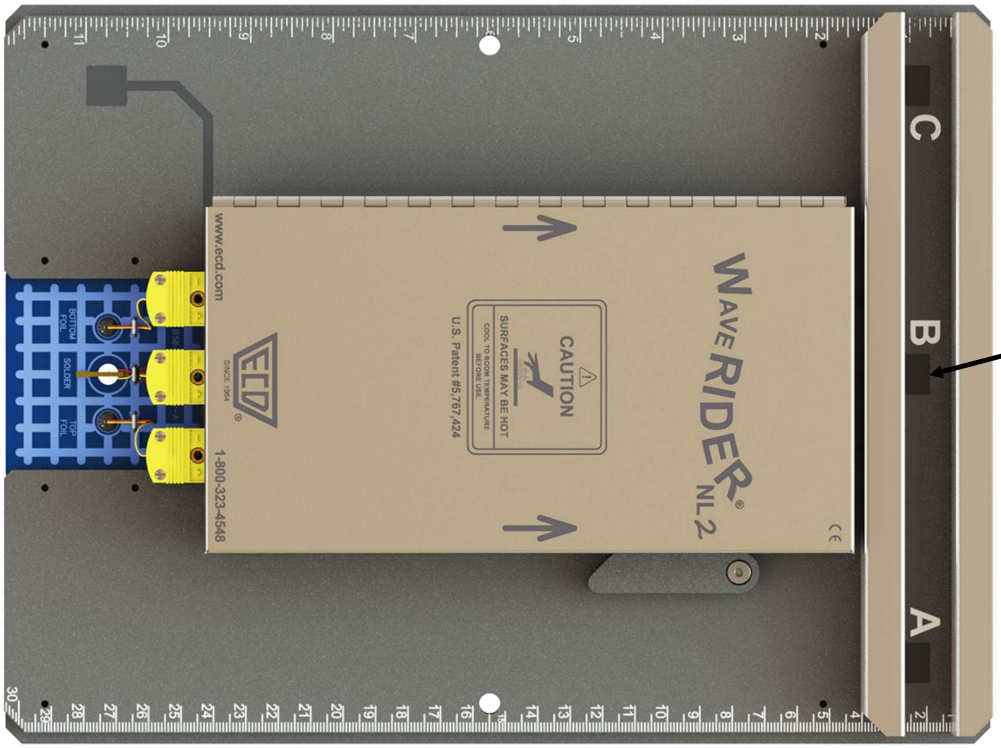
Dwell Sensor (A)

Dwell Time ‘C’ minus ‘A’ = Parallelism Value for SPC

Contact Length

- *Contact Length is duration of A,B, & C Dwell Sensors in solder immersion as a function of conveyor speed.*
- *Immersion Depth/Wave Height effects Contact Length*
  - *Solder quantity in pot [replenishment]*
  - *Pump RPM's [proper setpoint]*
  - *Nozzle Adjustments [experienced maintenance technician]*

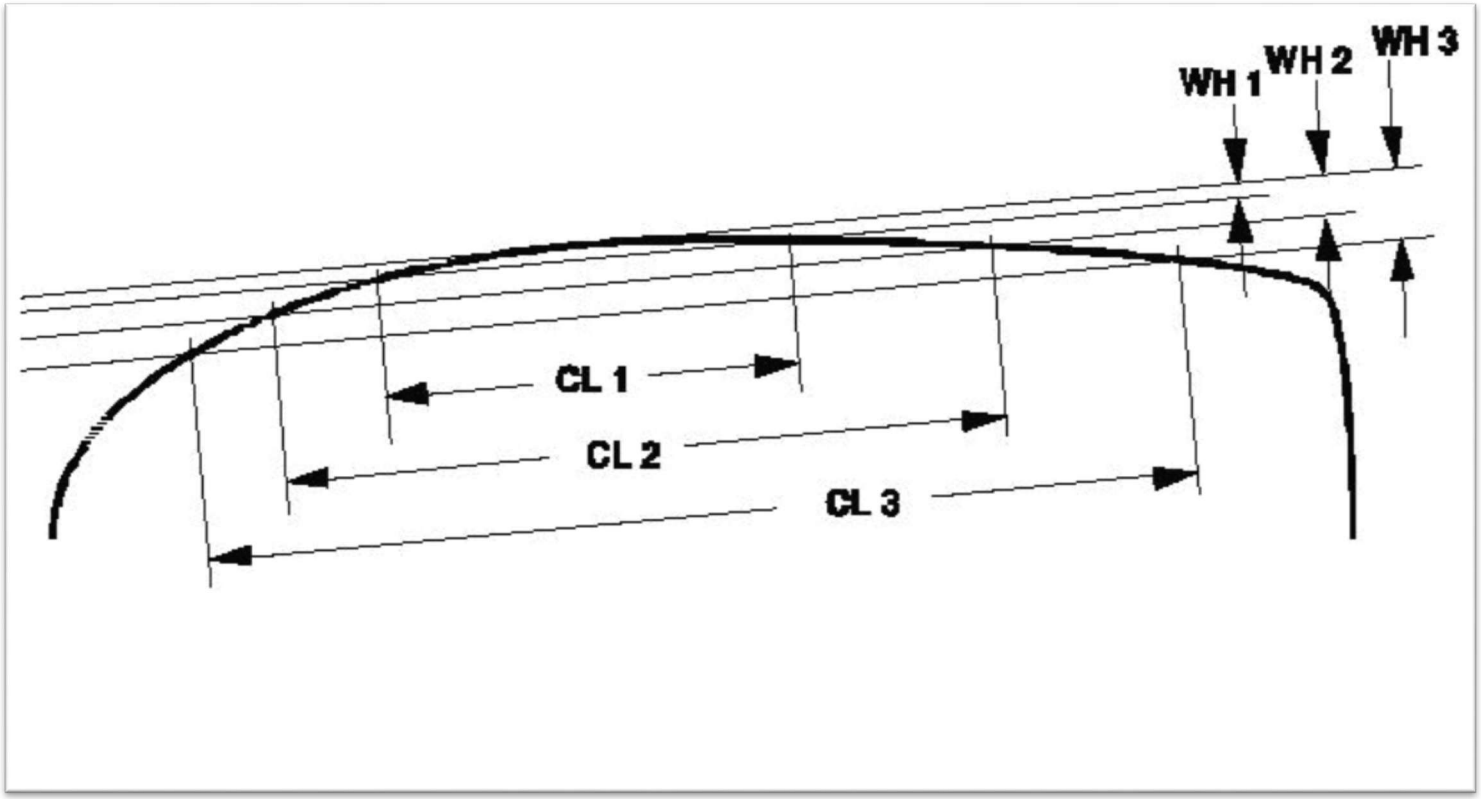
Immersion Depth



Dwell Sensor (B)

The Immersion Depth SPC Value is Calculated from the Contact Length of Sensor ‘B’

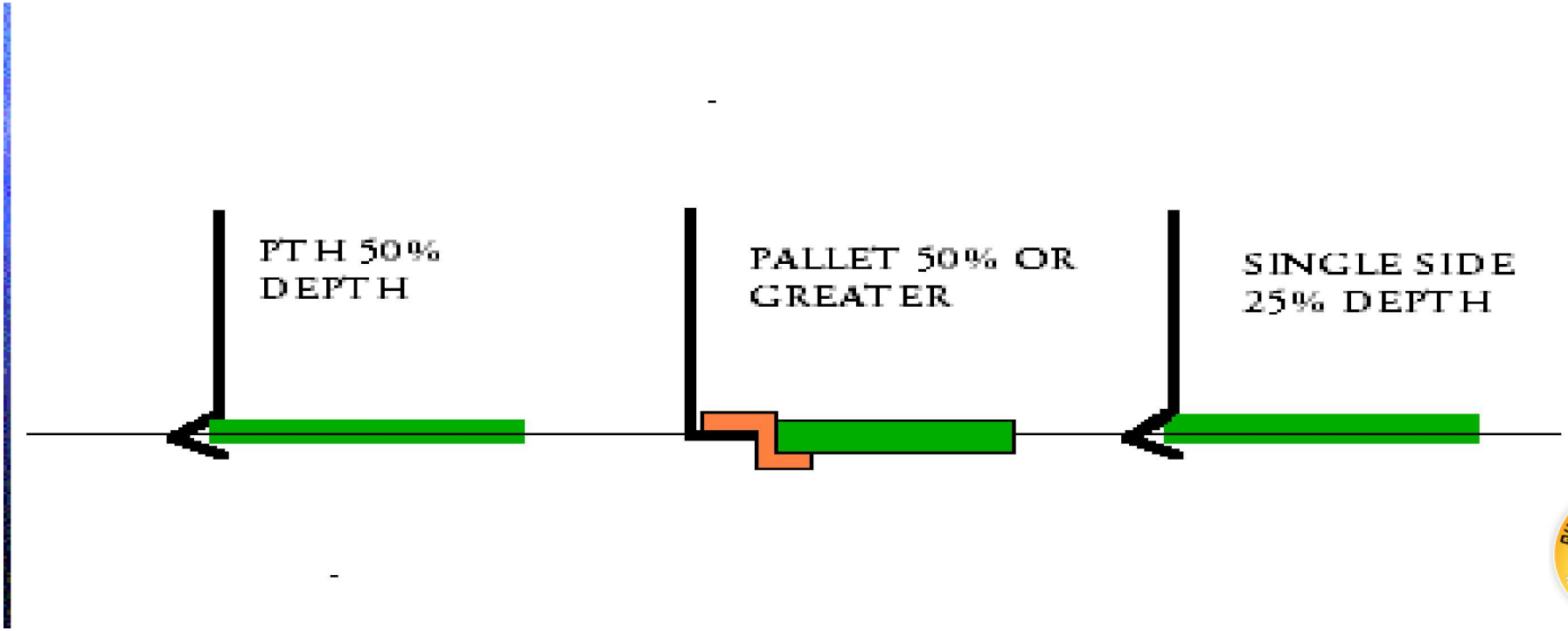
Immersion Depth as a Function of Contact Length



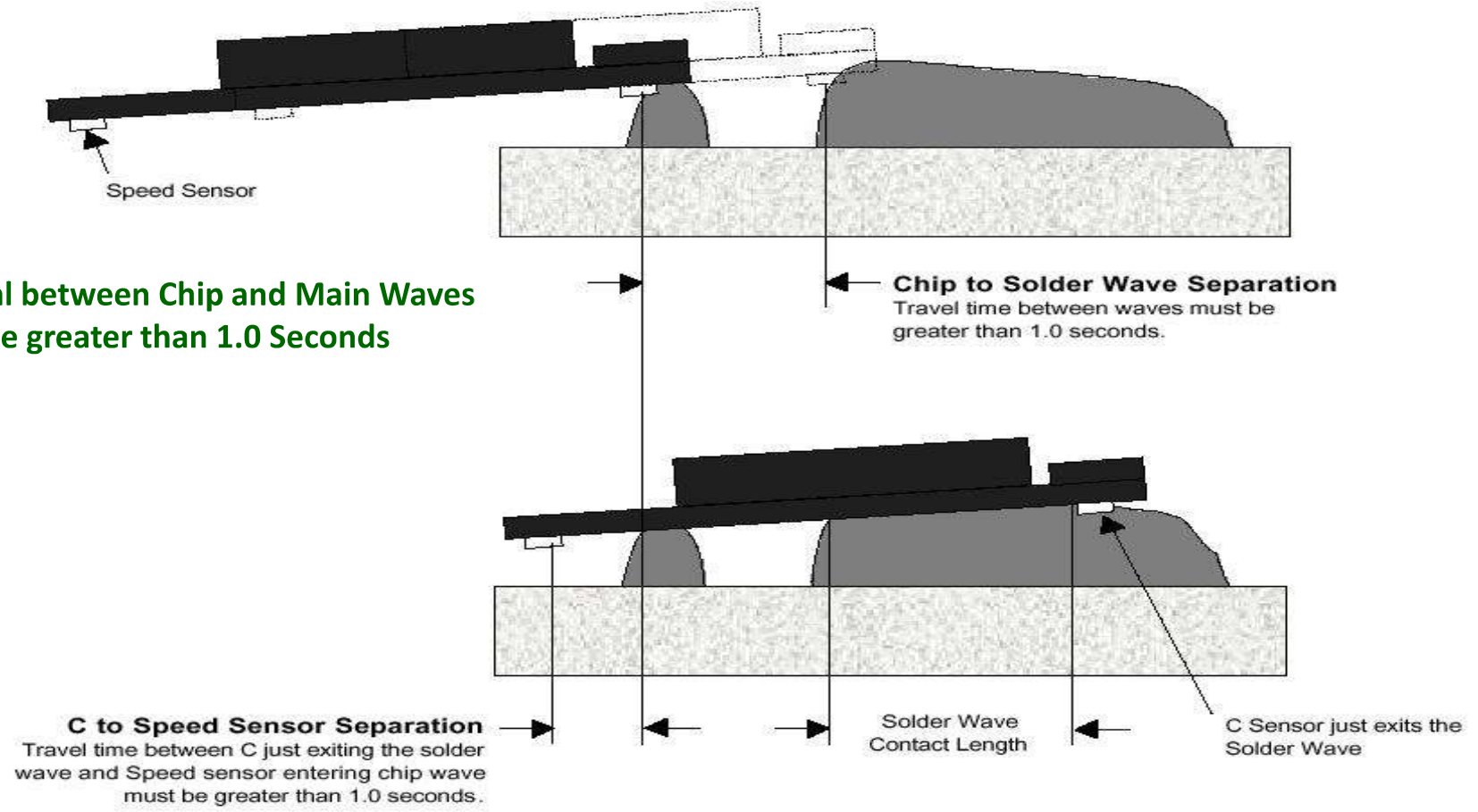
Immersion Depth

WAVE HEIGHT SETTING

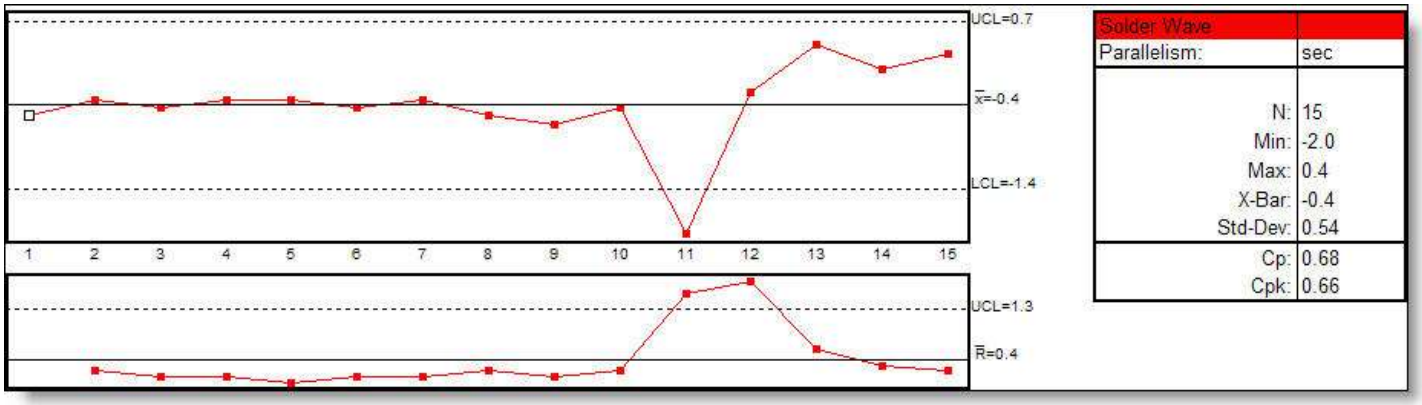
- *Typical for PTH = Half Board Thickness*
- *Setting for Single-Sided Boards is Less*
- *Pallets Requires a Special Setup*



Interval between Chip and Main Waves must be greater than 1.0 Seconds



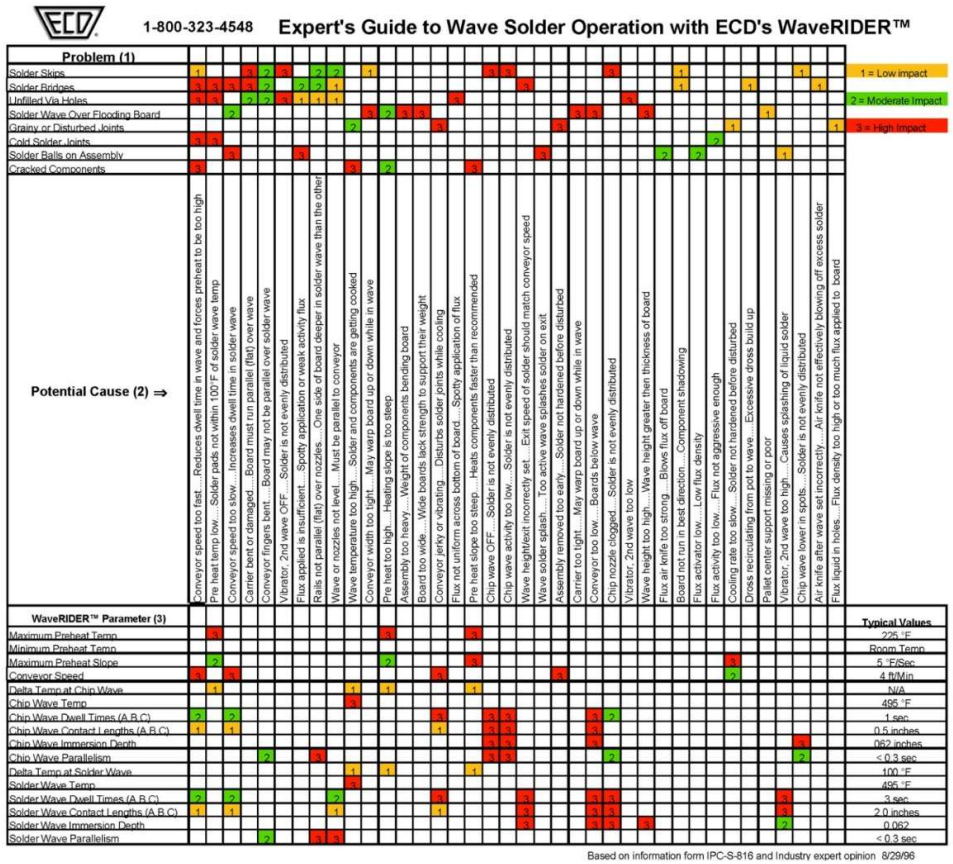
Each Data Run is automatically saved to the Spreadsheet and wave solder machine performance is compared by Parameter against Spec Limits built from a set of baseline standard runs.



Using WaveRIDER® NL 2 on a regular basis collects Machine process data.

- By a Consistent Method
  - Built-In Thermocouples
- With a Consistent Vehicle
  - Pallet is rated for lead-free processes
- That is compared statistically over time
  - Built-In Statistical Process Control Features
- To gauge process conditions remain in spec
  - SPC Control Charts & Cp, CpK Process Capability
- Such that product Quality is Managed proactively
  - Process variance trends are tracked to their assignable cause

Let WaveRIDER® NL 2 help you solve soldering problems and verify production readiness everyday



1-800-323-4548 **Expert's Guide to Wave Solder Operation with ECD's WaveRIDER™**

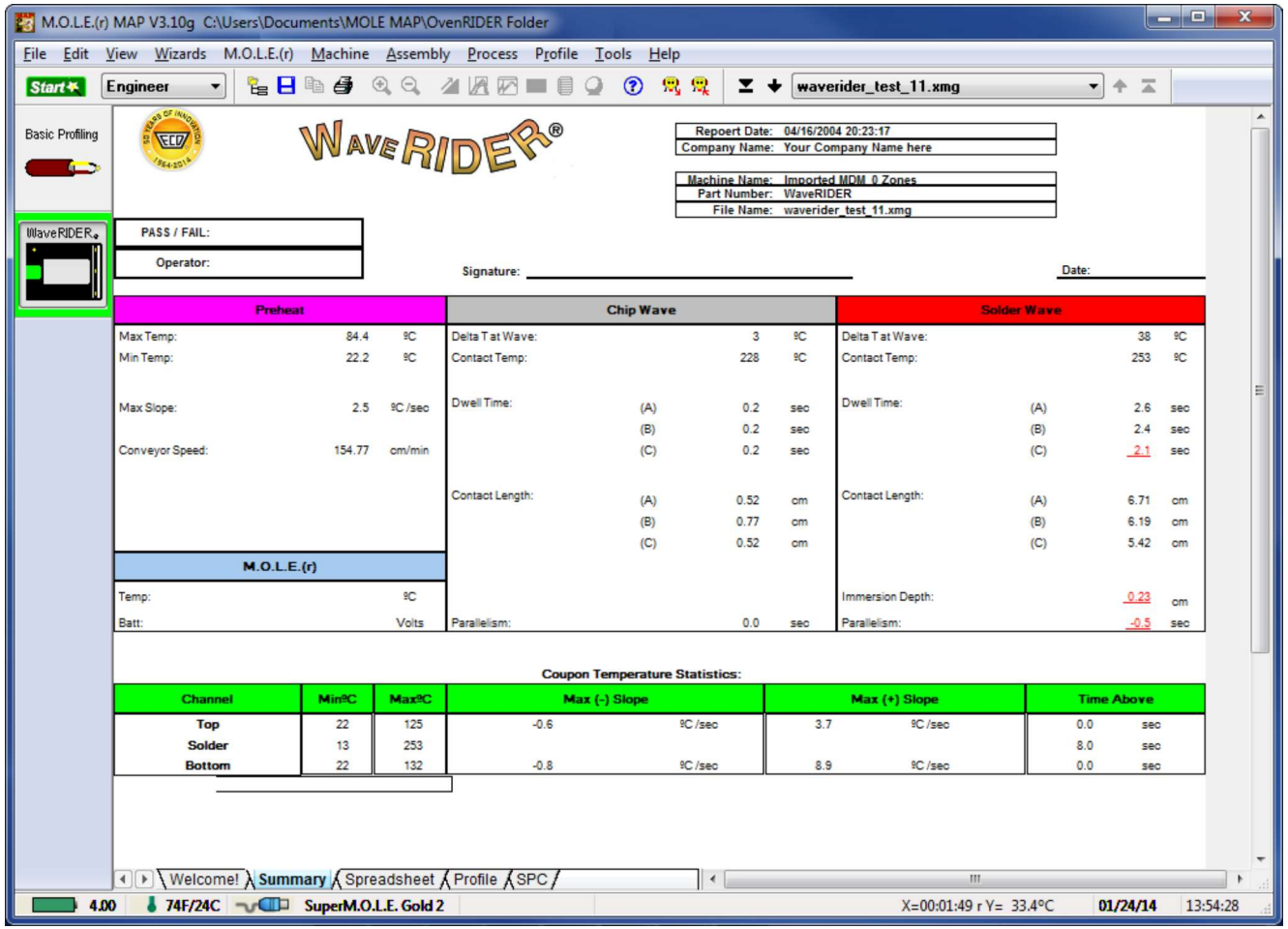
Problem (1)	Conveyor speed too fast... Reduces dwell time in wave and forces preheat to be too high	Pre heat temp low... Solder pads not within 100°F of solder wave temp	Conveyor speed too slow... Increases dwell time in solder wave	Carrier bent or damaged... Board must run parallel (flat) over wave	Conveyor fingers bent... Board may not be parallel over solder wave	Vibrator, 2nd wave OFF... Solder is not evenly distributed	Flux applied is insufficient... Spotty application or weak activity flux	Rails not parallel (flat) over nozzles... One side of board deeper in solder wave than the other	Wave or nozzles not level... Must be parallel to conveyor	Wave temperature too high... Solder and components are getting cooked	Conveyor width too tight... May warp board up or down while in wave	Pre heat too high... Heating slope is too steep	Assembly too heavy... Weight of components bending board	Board too wide... Wide boards lack strength to support their weight	Conveyor jerky or vibrating... Disturbs solder joints while cooling	Flux not uniform across bottom of board... Spotty application of flux	Pre heat slope too steep... Heats components faster than recommended	Chip wave OFF... Solder is not evenly distributed	Chip wave activity too low... Solder is not evenly distributed	Wave height/exit incorrectly set... Exit speed of solder should match conveyor speed	Wave solder splash... Too active wave splashes solder on exit	Assembly removed too early... Solder not hardened before disturbed	Carrier too tight... May warp board up or down while in wave	Conveyor too low... Boards below wave	Chip nozzle clogged... Solder is not evenly distributed	Vibrator, 2nd wave too low	Wave height too high... Wave height greater then thickness of board	Flux air knife too strong... Blows flux off board	Board not run in best direction... Component shadowing	Flux activator low... Low flux density	Flux activity too low... Flux not aggressive enough	Cooling rate too slow... Solder not hardened before disturbed	Dross recirculating from pot to wave... Excessive dross build up	Pallet center support missing or poor	Vibrator, 2nd wave too high... Causes splashing of liquid solder	Chip wave lower in spots... Solder is not evenly distributed	Air knife after wave set incorrectly... Air knife not effectively blowing off excess solder	Flux liquid in holes... Flux density too high or too much flux applied to board	Typical Values
Potential Cause (2) ⇒																																								
Solder Skips	1			3	2	3		2	2		1							3	3					3			1					1							1 = Low impact
Solder Bridges	1	1	1	1	2			2	2	1										3							1			1		1						
Unfilled Via Holes	3	3		2	2	3		1	1	1					3																							2 = Moderate Impact
Solder Wave Over Flooding Board			2									3	2	3	3									3	3			3					1						
Grainy or Disturbed Joints										2						3							3									1						1	3 = High Impact
Cold Solder Joints	3	3																																				
Solder Balls on Assembly			3					3															3				2		2					1				
Cracked Components	3									3		2						3																				
WaveRIDER™ Parameter (3)																																						
Maximum Preheat Temp		3										3						3																				225 °F
Minimum Preheat Temp																																						Room Temp
Maximum Preheat Slope		2										2						3																				5 °F/Sec
Conveyor Speed	3		3												3								3									3							4 ft/Min
Delta Temp at Chip Wave		1								1		1						1																				N/A
Chip Wave Temp										3																													495 °F
Chip Wave Dwell Times (A,B,C)	2		2												3			3	3					3	2														1 sec
Chip Wave Contact Lengths (A,B,C)	1		1												1			2	2					1	1														0.5 inches
Chip Wave Immersion Depth																		2	2					1														3	.062 inches
Chip Wave Parallelism					2			3										3	3								2										2		≤ 0.3 sec
Delta Temp at Solder Wave									1			1						1																					100 °F
Solder Wave Temp									3																														495 °F
Solder Wave Dwell Times (A,B,C)	2		2						2						3				3					3	3													3		3 sec
Solder Wave Contact Lengths (A,B,C)	1		1						1						1				3					3	3													3		2.0 inches
Solder Wave Immersion Depth																			3					3	3			3										2		0.062
Solder Wave Parallelism					2			3	3																														< 0.3 sec

Based on information form IPC-S-816 and Industry expert opinion 8/29/96

The WaveRIDER® NL 2 is Easy to Use

- *Utilizes any SuperM.O.L.E.® Gold/2*
- *No Programming Required*
- *Just DOCK,*
  - *Insert into the barrier bridge*
- *START*
  - *Turn the M.O.L.E. on and press the Start button & lock barrier closed*
- *and RUN*
  - *Place on conveyor to send WaveRIDER® NL 2 through*

Inspect WaveRIDER® NL 2 Data First



WaveRIDER® NL 2 Data Checks

- *Does Conveyor Speed Report?*
- *Have you got A,B & C Dwell Times?*
- *Was Chip Wave Detected?*
- *Are Parallelism and Immersion Depth Reporting?*
- *If so, then you've made a good run on a properly setup Wave Solder Machine*

WaveRIDER® NL 2

WaveRIDER® NL 2 ensures wave soldering repeatability, reduces rework and time, adding to your profitability. Isn't that what you want?

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2018/11