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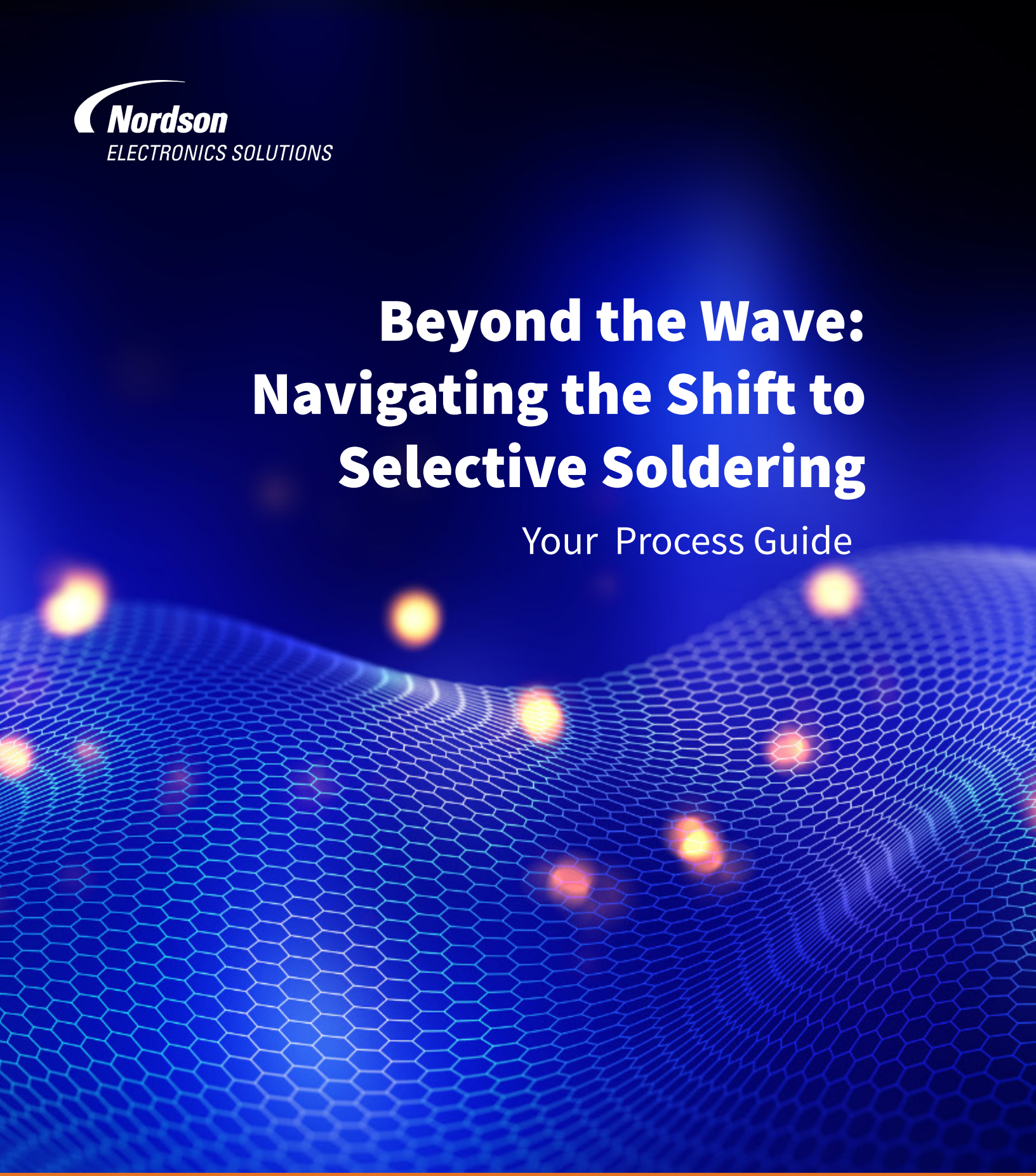
ELECTRONICS SOLUTIONS

Beyond the Wave: Navigating the Shift to Selective Soldering

Your Process Guide



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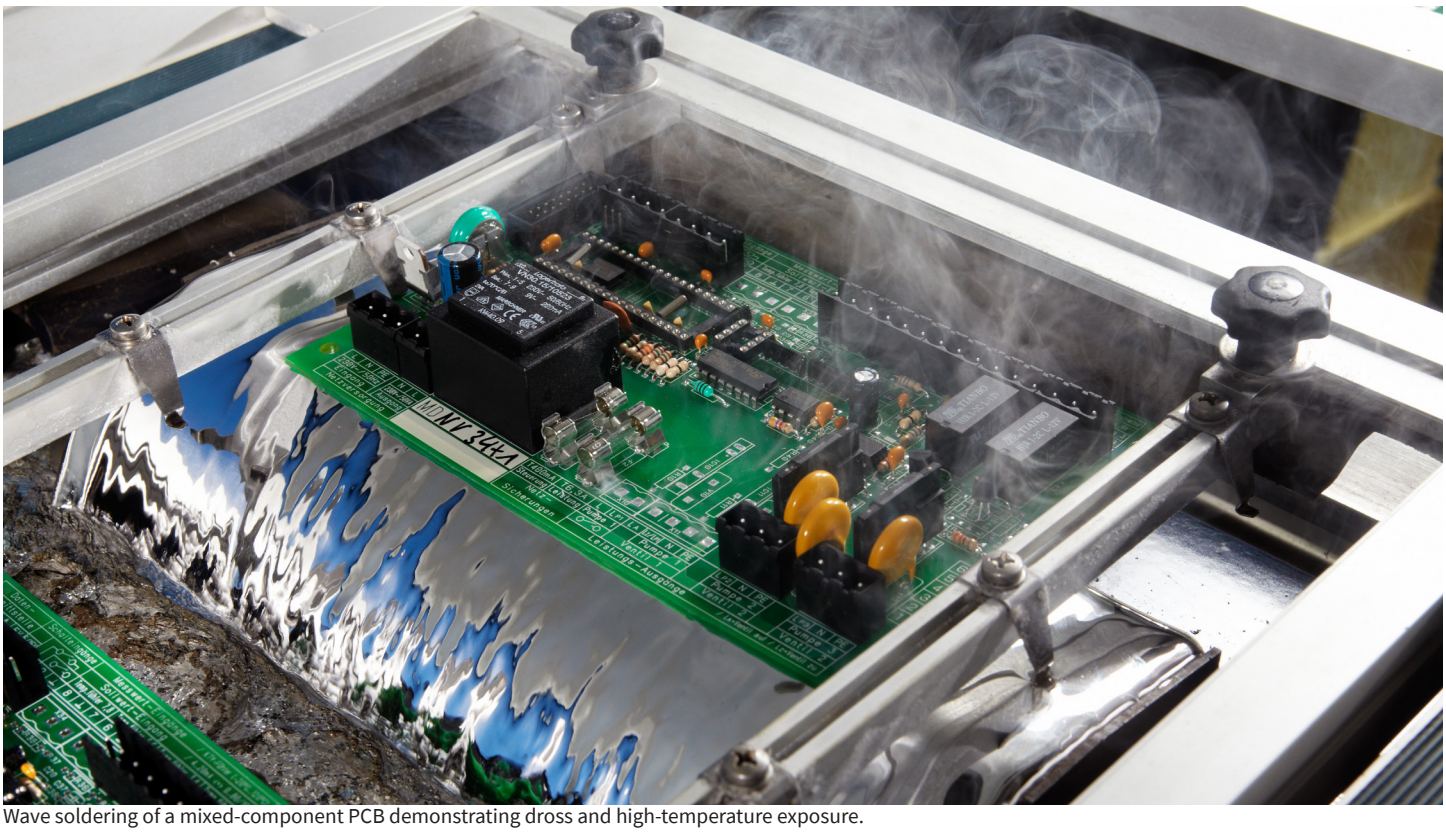
This ebook examines soldering techniques and discusses how shifting from wave soldering to selective soldering reduces cost and increases process flexibility for consistent, high-quality soldering results.

Soldering Progression



Wave soldering of a mixed-component PCB demonstrating dross and high-temperature exposure.

Wave soldering and manual hand soldering techniques are common. However, the increased need to solder printed circuit boards (PCBs) with mixed components, including through-hole (THT) and surface mount technologies (SMT), is driving the need for a more flexible soldering alternative. The answer? Selective soldering.

If you manage a mixed-component PCB soldering process, and your aging equipment or PCB designs are pushing the limits of your wave soldering process, consider selective soldering.

Manual and Wave Soldering

Established Processes with Room for Improvement

PCBs with a mix of THT and SMT require a flexible and consistent soldering technique that supports the precise application of solder only where it's needed. Manual hand soldering and wave soldering are limited in their consistency and flexibility. For these reasons, the industry is seeing a trend toward selective soldering.

Manual Hand Soldering Process

Once a helpful technology, manual soldering has, for the most part, been replaced by wave and selective soldering in mass production environments.

Manual soldering techniques are still feasible for simple one-off solutions or repairing individual solder joints. And while practical for small-volume production, the high-volume process and quality demands of automotive manufacturing, the automotive supply sector, and other high-reliability applications are unattainable with manual soldering.

Disadvantages of manual soldering in mass production include:

- Inconsistent quality from operator to operator
- Unpredictable reproducibility and throughput
- Extreme flux residue
- Higher localized thermal load due to smaller soldering tips and limited contact areas

Wave Soldering Technology

Wave soldering is a bulk process where printed circuit boards are passed over a wave of molten solder to attach THT, SMT, and mixed assemblies to PCBs.

The major downside of wave soldering is the limited ability to define process parameters, which leads to poor solder joint quality and diminished product reliability. This limitation forces a one-size-fits-all approach to application and makes selectivity impossible. Solder washes over the board, applied universally, even where it is not required.

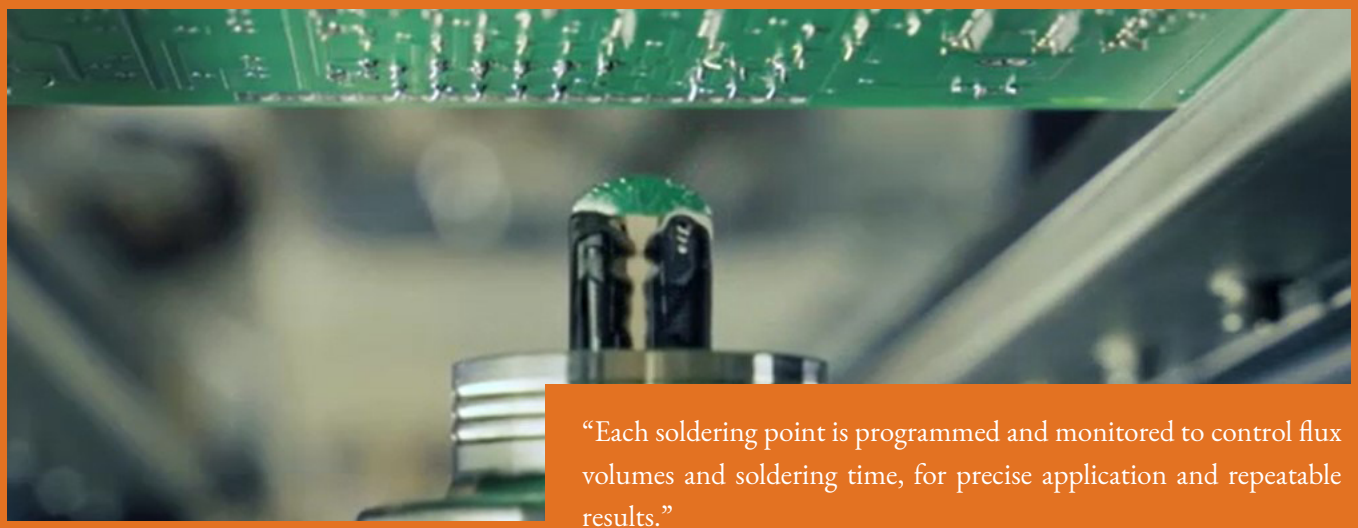
Additional, wave soldering disadvantages include:

- High solder consumption
- High flux consumption
- High power consumption
- High nitrogen consumption
- An increase in post-wave solder rework
- Masking of sensitive areas on PCB assemblies
- Cleaning of wave solder aperture pallets or masks
- Cleaning of soldered assemblies

With these significant disadvantages, wave soldering operating costs can be significantly higher when compared to selective soldering.

Selective Soldering

Your Flexible Alternative to Wave Soldering



"Each soldering point is programmed and monitored to control flux volumes and soldering time, for precise application and repeatable results."

Selective soldering, also known as mini-wave soldering, offers cost-effective, repeatable results for THT and mixed technology soldering applications. And it is the only reproducible method for soldering THT components on a two-sided PCB assembly.

With selective soldering, specific soldering points are individually programmed and monitored to control flux volumes and soldering time. Among the many advantages of selective soldering, excellent process repeatability and consistent results stand supreme.

The selective soldering process typically consists of three stages:

1. Fluxing or the application of liquid flux.
2. Preheating of the PCB assembly.
3. Soldering with a site-specific solder nozzle.

Selective soldering allows you to accelerate manufacturing throughput and achieve higher quality outcomes at a significantly lower cost when compared to other methods. It can also provide a convenient solution to several common challenges, including soldering:

- Two-sided PCB assemblies
- THT components with high mechanical loads, such as connectors or switches
- THT mounted power electronics that aid heat dissipation
- PCB assemblies with both temperature-sensitive and high thermal mass components
- High-reliability applications where wave or manual soldering temperatures could be too low or too high, resulting in quality issues

Build Flexibility Into Your Process

Selective soldering makes it possible to solder a wide range of printed circuit board assemblies with advantages, including:

- ✓ Secure and fast process optimization
- ✓ Reliable solder joint creation without overheating components
- ✓ Guaranteed process repeatability
- ✓ The elimination of expensive solder pallets and masks
- ✓ The ability to solder around tall parts with tight spacing
- ✓ The ability to solder dense concentrations of through-hole pins

SELECT Soldering Solutions

If you're managing a wave soldering process, consider switching to selective soldering to handle more advanced PCB designs and accommodate future technological advancements.

The SELECT MicroDrop drop-jet flux dispenser, combined with optional flux jet monitoring, automatic wave height monitoring, and closed-loop process control, equips SELECT soldering solutions with unparalleled process capability.

The SELECT MicroDrop drop-jet flux dispenser provides complete control of adjustable droplet size and the consumption of liquid flux. Every droplet contains a precise flux volume to meet the exact requirements for each soldering point.

Drop-jet fluxing:

- Eliminates entrapped flux residues
- Facilitates accurate no-clean processing
- Minimizes or eliminates post-soldering rework and repair

During the selective soldering process, no-clean flux is fully consumed. Giving the MicroDrop dispenser a distinct advantage over wave soldering, where large amounts of overspray lead to the entrapment of flux residue.

Liquid flux is placed selectively at individual points and along connectors in a single pass, drastically reducing flux consumption and minimizing contamination. Track the flux jetting process with optional flux jet monitoring, and capture data in an onboard recorder for traceability.

All SELECT solutions come standard with nitrogen inerting, a titanium solder pot to resist the corrosive effects of aggressive lead-free solder alloys, and intuitive system software you can set up in minutes without prior experience.

Understanding the Costs

Selective soldering can often achieve identical cycle time compared to wave soldering, is repeatable, and offers greater process flexibility, especially for mixed-technology PCB assemblies.

Several factors contribute to cost reduction, including:

- Reduced solder consumption due to less dross
- Elimination of solder pallet and mask cleaning
- Reduced energy cost
- Reduced flux consumption with selective MicroDrop drop-jet fluxing
- Elimination of taping and masking to protect critical areas
- Reduced rework
- Elimination of soldered PCB cleaning

SELECT soldering technologies conserve valuable resources, reduce operating costs, and ensure repeatability and reproducibility. Simple cost analysis reveals a clear opportunity to reduce operating costs.

Cost Analysis

Reduce Operating Costs

Category	Notes	Wave Soldering	Selective Soldering	Annual Savings	Comments
Solder cost	Solder alloy make-up cost due to dross	$29,828	$852	$28,976	Wave = 31.8 kg/month; Selective = 1.0 kg/month
Solder pallets	Pallet maintenance	$1,623	$0	$1,623	Estimated, actual costs vary
Floor space	Approx. $101/ sq. meter	$1,217	$162	$1,055	Estimated, actual costs vary
Power	Approx. $0.091/ kWh	$6,331	$2,110	$4,220	Estimated, actual costs vary
Flux usage	Approx. $12.18/ liter	$4,383	$547	$3,835	Estimated, actual costs vary
Nitrogen	Approx. $6.44/ cubic meter	$18,993	$1,466	$17,526	Wave = 14.5 cu. m3/hour; Selective = 1.1 m3/hour
	Annual operating costs without nitrogen on wave =	$52,007	$5,291	$46,716	Wave solder usage without nitrogen
	Annual operating costs with nitrogen on wave =	$71,000	$5,291	$65,709	Wave solder usage with nitrogen
Total Annual Savings				$169,660	

Your Nordson Electronics Solutions sales representative can provide you with your application's total cost of ownership calculation.

Notes:
1. Operating costs are based on SAC305 alloy and 460 mm wide PCB capability.
2. The cost of consumables, including solder, flux, electricity, and nitrogen, will vary by region.
3. Based on a 40-hour work week, operating costs multiply accordingly for 2 or 3 shifts.

Based on numerous case histories, selective soldering has proven to be a cost-effective alternative to wave soldering providing increased flexibility, faster time to market, and increased ability to meet challenging high-volume manufacturing demands.

Contact us today.

Simplify your process, save money, and ensure product reliability by switching to a SELECT product solution. You can be confident when choosing Nordson Electronics Solutions as your selective soldering partner. Our commitment to innovation, investment in R&D, and applications engineering excellence allow us to deliver consistent performance and reliability for your process.

Click to Explore Solutions

SELECT Synchro Product Line
SELECT Cerno 508.1
SELECT Integra 508.3
SELECT Integra 508.4

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