

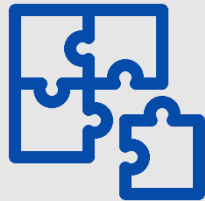
DATA I/O | INDUSTRY LEADING

FLASH MEMORY PROGRAMMING VS DUPLICATORS

01 EXECUTIVE SUMMARY



SECURITY



EXTENSIBILITY



PROGRAMMING



PERFORMANCE

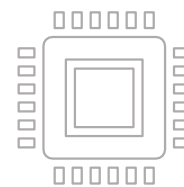


SERIALIZATION



Flash memory duplicators grew out of the media duplication business. Beginning with disk duplication, the media duplication industry expanded to DVDs, flash cards, USB, and compact flash as media technology evolved. Today's flash memory duplicators are similar in design and available in manual desktop and automated handling equipment. Duplicators copy data from a master device to blank devices placed into target sockets. Duplicators job changeovers are prone to human error and intellectual property (IP) theft.

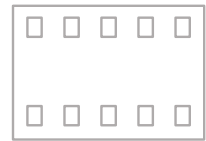
Desktop programmers entered the market in the late 1970's offering universal device support for memories, microcontroller and logic devices. In the 1990's the need of high-volume production pioneered the development of offline automated preprogramming solutions. Unlike duplicators, well designed programmers are extensible in their ability to support next generation programmable technologies. Programmers support secure network downloads, serialization, front end job management and back end traceability features required for the 21st century smart factory.



FEATURES/ BENEFITS	ADVANTAGE PROGRAMMERS	PROGRAMMERS	ADVANTAGE DUPLICATORS	DUPLICATORS
SUPPORTS ALL UNIVERSAL FLASH STORAGE (UFS) DEVICES	√	PROGRAMMERS CAN ADJUST CRITICAL TIMING FEATURES OF UNIQUE UFS DEVICES		GENERIC UFS INTERFACE NOT SUITABLE FOR ALL UFS DEVICES
UFS DEVICE TESTING	√	ALL UFS DEVICES ARE INDIVIDUALLY TESTED		GENERIC UFS INTERFACE UNIQUE UFS ARE NOT INDIVIDUALLY TESTED
DEVICE SUPPORT	√	SUPPORTS MEMORY AND MICROCONTROLLERS		NO MICROCONTROLLER SUPPORT SUPPORT SIGNIFICANT REDESIGN IS REQUIRED
UFS 3.0 STANDARD	√	HARDWARE SUPPORTS DIFFERENT VOLTAGE LEVELS REQUIRED FOR UFS 3.0		HARDWARE REDESIGN IS REQUIRED
SERIALIZATION (DYNAMIC DATA INJECTION)	√	SUPPORTED		NOT SUPPORTED
BARE NAND SUPPORT (NAND WITHOUT AN EMBEDDED CONTROLLER)	√	SUPPORTED WITH A LIBRARY OF BAD BLOCK MANAGEMENT SCHEMES		NOT SUPPORTED
REPLAY PROTECTED MEMORY BLOCK (RPM) SUPPORT	√	SUPPORTED		NOT SUPPORTED
COPY FROM MASTER DEVICE	√	NOT SUPPORTED		SUPPORTED
NETWORKED/ SECURE DATA FILE STORAGE	√	NETWORK FILE DOWNLOAD		NOT SUPPORTED
DESIGNED FOR AUTOMATION	√	YES, NO MASTER DEVICE MANAGEMENT REQUIRED FILES ARE DOWNLOADED VIA SECURE NETWORK	√	YES, HOWEVER JOB CHANGES REQUIRE MANUAL EXCHANGE OF MASTER DEVICES
INTELLECTUAL PROPERTY (IP) PROTECTION	√	LOW RISK		HIGH RISK
PERFORMANCE		HIGH-SPEEDS WRITE/READ		HIGH-SPEED DUPLICATION

FEATURES/ BENEFITS	ADVANTAGE PROGRAMMERS	PROGRAMMERS	ADVANTAGE DUPLICATORS	DUPLICATORS
PRODUCTION STATE AWARENESS	√	SUPPORTED		NOT SUPPORTED
MAX PRE-LOAD LIMIT WARRENTY	√	MESSAGE WHEN FILE EXCEEDS THE DEVICE SPECIFIC MAXIMUM PRE- LOAD LIMITS		NOT SUPPORTED
HIGH-SPEED FILE DOWNLOADS		50 MB/SEC.	√	ZERO DOWNLOAD TIME
GEOGRAPHICAL JOB MANAGEMENT (MANY S/W VARIENTS)		SUPPORTED, DATA I/O JOB COMPOSER		NOT SUPPORTED
TRACEABILITY AND MES INTEGRATION	√	DATA I/O PROGRAMMERS PROVIDE COMPLETE JOB STATISTIC VIA CONNEX SOFTWARE		NO FEEDBACK FROM DUPLICATORS FOR COPY JOB STATISTIC
EXTENSIBLE DESIGN-ADD TO INTERFACES (UFS, PCIe, NVMe)	√	SUPPORTED		NOT SUPPORTED
OPTIMIZED ALGORITHMS	√	SUPPORTED		NOT SUPPORTED
EXTENSIBLE DESIGN	√	SUPPORTED		NOT SUPPORTED
RECOMMENDED FOR MISSION CRITICAL APPLICATIONS	√	YES, VALIDATED AND PROVEN		NO
RISK OF HUMAN ERRORS	√	LOW RISK		SUPER HIGH RISK-MASTER DEVICE MANAGEMENT
PRICE	√	QUALITY, PERFORMANCE LONG-TERM INVESTMENT		LOW PRICE ENTRY

03 DUPLICATORS



Duplicator Advantages

Flash memory duplicators fit a niche market where code changes are infrequent and intellectual property (IP) protection is of little or no concern. For large files, zero download time is an attractive duplicator benefit in high-mix production environments with frequent job changeovers. Marketed as a low-cost alternative to device programmers, duplicator vendors target non-mission critical applications where cost is the driving factor for adoption.

Duplicators are High Risk

Perhaps the most important feature of the smart factory, its connected nature, is also one of its most crucial sources of value. An optimized smart factory allows operations to be executed with minimal manual intervention and high reliability. Unfortunately, duplicator job changeovers require machine operators to exchange master devices. Insert the wrong master device and you risk producing tens of thousands of output devices the wrong data. Worst case, these devices are assembled into final product and shipped to customers around the world. The end result is the high cost of managing a product recall and a tarnished reputation. Manual intervention and the high cost of human error is the reason you're not likely to find duplicators on the smart factory floor.

Duplicator Hardware Has Limited Scalability

Duplicator hardware designs are most often targeted for a specific memory technology. Semi-vendors are very selective in choosing trusted business partners. As a result access to semi-vendor roadmaps are rare. Once a new flash memory technology device is announced, development for the next duplicator hardware design begins. The types of dedicated memory duplicators include Disc, SD/Micro SD, UFS, SATA HDD/SDD, eMMC, UFS and others. Within each duplicator segment you might find derivate products or subsets for each. For example, a duplicator vendor might offer three eMMC duplicator models, one each for eMMC 4.5, eMMC 5.0 and eMMC 5.1 version of managed NAND. Like any test product, you get what you pay for. Low cost memory duplicators often advertise high performance yet deliver poor performance and yields. Service support may be limited to whatever you can find on the vendor website.

04 PROGRAMMING



Example Question from Duplicator Troubleshoot Guide:

“After copy, some sockets show red lights and copy fail?” Answer #1: If you find that the fail rate is high, please select “Working Mode” to slowdown the speed of data transmission. It can help you to increase the quality of the copy task. Answer #2: If you find your Flash media frequently needs more than one round of copy, that might be because the quality of your Flash is not stable. In this example, to produce higher yields the duplicator vendor suggests the user slow down the duplicator speed and reduce output. If that doesn’t work, blame the memory vendor and find another source.

LumenX Programmer

Key Benefits

- eMMC TurboBoost speeds up to 160MB/sec.
- UFS TurboBoost speeds up to 160MB/sec.
- File Download speeds up to 50MB/sec.
- 128GB cache memory, upgradeable to 512GB
- 8 Socket parallel programming
- Highest quality programming algorithms
- Secure provisioning for microcontrollers & SE
- Tool less changeover
- Status LED indicators (Pass, Fail, Processing)
- Single socket adapters
- Microcontroller support

Data I/O

A Trusted Supplier

- Data I/O is trusted by 8 of the top 9 automotive electronics manufacturers worldwide to meet their most demanding quality requirements.
- Data I/O develops the highest quality programming algorithms in strict accordance to semi-vendor specifications.
- Data I/O partners with Nordson DAGE, the world’s leading X-ray equipment supplier to study the impact of dose radiation on preprogrammed managed NAND.
- Data I/O studies the impact of oven reflow on data retention for automotive grade 3D UFS.

For questions please contact Data I/O at: www.dataio.com/contactus

05 ABOUT DATA I/O



Industry Leadership

For over 45 years Data I/O has served the global electronics manufacturing industry with industry leading, data programming and security provisioning solutions. Our customers in the automotive, industrial / Internet-of-Things, consumer electronics markets and their programming center and contract manufacturing partners manufacture hundreds of millions of products each year using Data I/O programming solutions to reliably, securely, and cost-effectively deliver their intellectual property into programmable devices. With over 200 PSV systems sold to over 70 customers worldwide in just the last 4 years, Data I/O has extended our lead as the largest global equipment supplier in the industry.

Innovating for the Future

While other companies are reducing investment or backing away from the market, Data I/O is investing heavily in new technologies and capabilities to support our customers' new products. Our investments include Universal Flash Storage (UFS) programming, small parts programming, Manufacturing Execution System (MES) Integration and Secure Provisioning. Automotive Flash memory demands show no signs of slowing, with UFS providing the next wave of performance and density. Automotive electronics programmable content is projected to grow from 32GB to over 1TB by 2025, driven primarily by infotainment systems, connectivity and autonomous driving. Data I/O has met this demand with the industry leading performance of the LumenX® programming system. The high precision of our handlers supports the industry move to smaller parts. Data I/O's ConneX® traceability and reporting software allow manufacturing companies to integrate pre-programming process into their MES systems. The SentiX® Secure Provisioning Platform helps OEMs of any size and volume provision secret credentials into their devices in a secure and cost-effective manner.

A Commitment to Quality

Data I/O is committed to deliver quality and drive continuous improvement in all manufacturing locations. Our Quality Management Systems (QMS) in our manufacturing locations in Shanghai, China and Redmond, WA USA are certified to the International Organization for Standardization (ISO) 9001:2015 standard. In addition, our customers' investments in programming solutions are backed by a global team of service engineers and device support engineers with system and software expertise in the Americas, Asia and Europe.

A Safe Investment

An investment in Data I/O is a safe investment that will deliver value now and far into the future. In a competitive business environment where long standing suppliers are exiting the industry it is comforting to know that customers can rely on Data I/O. Our financial stability and transparency, continued R&D investment year over year, global service, engineering and support mean that Data I/O will be there to support you when and where you need us; both today and in the future.