



www.matrixcontrols.net

330 Elizabeth Ave. Somerset, N.J. 08873 U.S.A.
Tel: 732-469-5551 800-722-6839 Fax: 732-469-7299

Expanded Review

The discussion begins with the most important aspect of any quality and production management system; that being company savings and increased annual profits. In the case of Matrix's Knit Monitoring System (**MKMS**) its assets cover an impressive eight areas:

Seven Areas of Production Savings

- A.** Fabric Defect Detection Ensuring Reduced Waste.
- B.** Yarn Rate Monitoring Resulting in Savings Due to Correction of Previous Overfeeding of Machines
- C.** Increased Efficiency Through Downtime Reduction
- D.** Machine Speed Increases Allowing Additional Production
- E.** Increased Efficiency Due to Yarn Quality Improvement
- F.** Improvement in Quality of Fabric (not included in total calculations): ↑ Customer Satisfaction → ↑ Orders → ↑ Branding of Company's Reputation
- G.** Savings Due to Labor Reductions
- H.** Reductions in Personnel Turnover (From Testimonials- Perhaps the Most Significant)

The **Matrix Knit Management System (MKMS)** is made up of 2 primary components, the F-1000 Scanner/Monitor/Controller (F-1000) mounted on each of the knitting machines and the PC based MKMS Software. With the implementation of the Matrix Knit Management System, plants can typically achieve increases in productivity of 3 to 5%. In some cases we have seen greater than 10% improvements. Results, however, will differ for individual plants. Matrix IE Services provides support in determining productivity and savings opportunities and post implementation realization of those savings.



www.matrixcontrols.net

330 Elizabeth Ave. Somerset, N.J. 08873 U.S.A.
Tel: 732-469-5551 800-722-6839 Fax: 732-469-7299

The Matrix Knit Monitoring System (**MKMS**) will reduce labor-intensive processes, provide accurate data and reporting, increase production, reduce downtime, increase efficiency, greatly improve fabric quality and enhance customer satisfaction leading to potential increased orders and profits to follow. Each of the above eight categories translates into short and long term cost savings, improved on time delivery, improved efficiencies and reduced work-in-process, as follows:

Improved productivity and efficiency

Mills measure productivity in a number of ways, but in any mill the goal is to produce more first quality output at lower cost, with lower capital employed, faster and with more accuracy. Knitting productivity and efficiency are determined in four key ways. The MKMS impacts each of these areas to improve plant productivity. MKMS combined with our IE services can help mills in their TQM (Total Quality Management) and ESA (Error Sourcing Analysis) endeavors:

Reduced machine stops

Machine downtime is typically caused by fabric defects, yarn related stops, style changes/set-up times and preventive maintenance. The MKMS reduces the number of fabric defects and yarn related stops both directly and indirectly. By setting limits to the number of point defects and forcing the operator to take action, the total number of repeated point defects is reduced. Substandard yarn can be flagged within hours and corrective action taken. In addition, the MKMS provides a scheduled maintenance plan based on accurate counts of machine revolutions and knit element life to reduce the number of defects due to improperly timed preventive maintenance.



www.matrixcontrols.net

330 Elizabeth Ave. Somerset, N.J. 08873 U.S.A.
Tel: 732-469-5551 800-722-6839 Fax: 732-469-7299

Reduced machine downtime

The length of a stop is influenced by the type of stop and the operator's response. MKMS combined with the visual display of the F-1000 provides the operator as well as production management immediate knowledge of the stop reasons, thereby helping the operator to pinpoint the remedy to the particular stop. In addition, it gives the operator the ability to prioritize the remediation of the stop when multiple machines are simultaneously stopped. Lastly, MKMS stop-time reporting provides feedback to the operator both generally as well as compared to other plant benchmarks to reduce the length of each particular stop.

Increased machine speed

By monitoring machine production efficiency and quality, the F-1000 allows the machine speed to be increased. MKMS sets tolerances and can stop machines from the PC when out of tolerance conditions occur, while maintaining quality and efficiency. By increasing machine speed by just one rpm (very conservative) or five rpm (typical), customers have generated additional revenue in the thousands of dollars per machine per year.

Knitting more first quality fabric

Through faster, automated and accurate defect detection the F-1000 reduces the overall amount of off quality fabric produced. The productivity when calculated for first quality fabric production is increased. A one percent reduction in off quality fabric produced yields increases in mill productivity of one percent (conservative). Fabric Defects are totaled and compared to a variable limit. When this limit is reached the machine is stopped and a supervisor code is required for restarting a machine. The roll can then be sent to visual inspection.



www.matrixcontrols.net

330 Elizabeth Ave. Somerset, N.J. 08873 U.S.A.
Tel: 732-469-5551 800-722-6839 Fax: 732-469-7299

This guarantees visual inspection of all bad rolls giving 100% inspection of defective rolls.

Improved production process coordination

Through a reduction in off quality, and greater production accuracy, under-knits are minimized, reducing the amount of re-knits and re-finishing. Over-knits are minimized, reducing the amount of over-knit first quality fabric not saleable or otherwise having to be sold as second quality. Target-to-end dates are more accurate improving overall production scheduling, especially between knitting and dyeing, as well as in reduction of greige storage and Work in Process. It improves the ability of a mill to 'knit to order' versus simply 'knit to inventory.' Available resources for fabric inspection can be applied to those rolls that are known to contain defects.

With the additional features provided by the MKMS, operators, mechanics and management can maximize their performance to the benefit of the company. Use of downtime from the MKMS linked with the plant payroll and other internal systems accurately, quickly, fairly, with less manpower, improves payroll fairness and accuracy.

With the MKMS, more output for the same amount of capital employed can be achieved; fewer machines need to be purchased and labor reductions are automatic.

Improved Fabric Quality

Fabric quality is determined by the number of defects in the finished fabric and the yield in terms of yarn count/denier. Fabric quality produced at any mill comes in three levels: first quality, second quality and rags. The higher the ratio of first quality to seconds and rags, the lower the cost of raw materials



(yarn) and the higher the productivity of the mill. Fabric quality is influenced in four ways:

- **Reduced running defects** – Running defects are reduced in length to less than 12". The F-1000's ability to detect when the Scanner is not working prevents the machine from running without a working scanner. Improvements in scanning technology now allow the scanner to work on needle out ribs and yarn dyed fabrics.
- **Reduced point defects** – Many point defects are caused by inadequate machine housekeeping and/or incorrect set-up. With the F-1000 Scanner/Monitor/Controller, limits can be set to stop the machine after reaching a set number of repeated point defects. Automatic air and oil control through the F-1000 reduces some of the lint related defects. Through periodic stops for manual inspection, defects not detectable by the scanner are also reduced.
- **Yarn rate** - The F-1000's continuous yarn rate monitoring capability allows strict tolerances to be maintained. Time spent on periodic audits is eliminated. Overfeeding is known to cause a lighter fabric- more porous with loops and a wider fabric. This leads to more susceptibility to shrinkage and excess yarn usage, in addition to poor quality fabric and money wasted on unnecessary dyeing and finishing of defective product. Underfeeding is no bargain either, as yarn is wasted through the production of a heavier fabric, denser and narrower. More yarn usage per revolution leads to loops that are smaller and again poor fabric quality, and again unnecessary dyeing and finishing. The MKMS prevents this vicious circle. In addition poor quality yarn can be detected leading to requests from vendors for higher quality yarn.



www.matrixcontrols.net

330 Elizabeth Ave. Somerset, N.J. 08873 U.S.A.
Tel: 732-469-5551 800-722-6839 Fax: 732-469-7299

- **DOGs (Dirt, oil and grease)** – **DOGs** are typically caused by poor machine housekeeping. These defects are detected and recorded in the F-1000, and are used by production management to provide feedback to the operators to improve their housekeeping and processes.

Reductions in Personnel Turnover

Repeated customer testimonials have attested to reductions in personnel turnover, as the MKMS provides for smoother operation on the plant floor. Less chaos and a working environment leading to greater productivity will take the load off of human resources; a budgetary allocation that is always expensive.

New Customers and Increasing Orders

With improved fabric quality and deliveries on time your company can look forward to new customers and additional orders. We've stated that MKMS' ability to increase your knitting efficiencies across the board will allow fewer knitting machines to be active, but hold onto them. We'll put them back in use with your new increasing demands.

The Matrix Knit Management System Difference

In contrast to other defect detection and monitoring systems on the market today, the F-1000 combined with the Matrix Knit Monitoring Software provides a number of advantages.



www.matrixcontrols.net

330 Elizabeth Ave. Somerset, N.J. 08873 U.S.A.
Tel: 732-469-5551 800-722-6839 Fax: 732-469-7299

Scanning

As opposed to mechanical defect detectors, when the scanner stops working or is unplugged or is pulled away from the fabric, the machine is stopped. With the F-1000 defect scanner the operator is unable to disable the scanner without stopping the machine making certain that the efficiency gains and yarn savings are achieved. Newly designed scanning heads work on just about every fabric color and style.

The F-1000 provides highly accurate defect detection for point defects. In addition, the scanner allows the operator to enter the type of defect in order to improve overall results through a review of the error types.

Monitoring

The MKMS improves mill productivity through highly effective machine monitoring:

- The F-1000 provides continuous yarn rate monitoring for more accurate finished fabric specification conformance
- Machine stops can be coded by stop type for later evaluation
- Stop types are identified both automatically or manually thereby improving stop type accuracy for improved operator efficiency and reduced defects
- The F-1000 tracks the number of point defects in a roll to allow the operator to take earlier corrective measures



www.matrixcontrols.net

330 Elizabeth Ave. Somerset, N.J. 08873 U.S.A.
Tel: 732-469-5551 800-722-6839 Fax: 732-469-7299

- The MMKS Software allows the department management team to view overall downtime occurrences to minimize opportunity lost

Control

The MKMS provides high levels of control over the following:

- The F-1000 provides accurate control of the size of the roll through doff and pre-doff for improved production scheduling, coordination and accuracy
- The F-1000 provides greige roll inspection control when point defect limits have been exceeded
- Control of air and oil by the F-1000 maximizes cleanliness, minimizes air usage and guarantees machine lubrication for fewer and extended knit element life
- The MKMS software integrates downtime and revolution information for improved payroll calculations facilitating pay-for-performance
- The MKMS software provides Preventive Maintenance control based on-revolution count for reduced downtime, improved quality levels and enhanced production scheduling
- The MKMS Software color coding provides the department management team a real-time overview of production status with immediate drill down capability to an individual machine/style/operator



www.matrixcontrols.net

330 Elizabeth Ave. Somerset, N.J. 08873 U.S.A.
Tel: 732-469-5551 800-722-6839 Fax: 732-469-7299

- The MKMS Software allows flexibility for custom reporting for additional productivity enhancements

In addition, Matrix provides knitting department operations, manufacturing expertise through its staff of highly qualified Engineers. These Engineers have many years experience specifically in knitting, bringing broad industry experience to our customers' individual operations. This capability can easily augment your staff during implementation to make certain that productivity gains and cost savings can be realized and expectations can be surpassed.

Continue Next Page -->

To ***MKMS Management Software Screen Shot***



www.matrixcontrols.net

330 Elizabeth Ave. Somerset, N.J. 08873 U.S.A.
Tel: 732-469-5551 800-722-6839 Fax: 732-469-7299

MKMS Management Software Screen Shot

Matrix Knit Monitoring

- MKMS Management Software

Shift Efficiency and Stops Report
to 2/3/00 Shift: All

Mach #	Total	Eff	TotDwn	TotSigs	TS/1000	YmSigs	YS/1000	ScasSigs	SCS/1000	DfSigs	Df/1000
2100	107	0.00%	0	0	0.0	0	0.0	0	0.0	0	0.0
Shift 1											
1	0	0.00%	0	0	0.0	0	0.0	0	0.0	0	0.0
2	0	0.00%	0	0	0.0	0	0.0	0	0.0	0	0.0
3	0	0.00%	0	0	0.0	0	0.0	0	0.0	0	0.0
Shift Totals:	0	0.00%	0	0	0.0	0	0.0	0	0.0	0	0.0
2200	159	2.30%	0	0	0.0	0	0.0	0	0.0	0	0.0
Shift 1											
4	0	0.00%	0	0	0.0	0	0.0	0	0.0	0	0.0
5	0	0.00%	0	0	0.0	0	0.0	0	0.0	0	0.0
Shift Totals:	0	0.00%	0	0	0.0	0	0.0	0	0.0	0	0.0
2100	4008	0.33%	0	0	0.0	0	0.0	0	0.0	0	0.0
Shift 1											
6	0	0.00%	0	0	0.0	0	0.0	0	0.0	0	0.0
7	0	0.00%	0	0	0.0	0	0.0	0	0.0	0	0.0
Shift Totals:	0	0.00%	0	0	0.0	0	0.0	0	0.0	0	0.0
2100	3243	41.11%	0	0	0.0	0	0.0	0	0.0	0	0.0
Shift 1											
8	0	0.00%	0	0	0.0	0	0.0	0	0.0	0	0.0
9	0	0.00%	0	0	0.0	0	0.0	0	0.0	0	0.0
Shift Totals:	0	0.00%	0	0	0.0	0	0.0	0	0.0	0	0.0

Sample Reports

The screenshot displays the Matrix Knit Monitoring System interface. It includes several key components:

- Machine Information Panel:** Shows details for Machine No. 2, including Manufacturer (HUNZLBERG), Model # (J54), Machine Type (JERSEY), Machine S/N (12345), YPM Value (1000), F1000 Value (1000), RPM Tolerance (3), Cyls Size (12), # Of Feeders (1), Cut (0), Cyls S/R (12345), and Pay Factor (1).
- Efficiencies and Exceptions Panel:** Displays efficiency metrics for Current Shift 2:
 - Knitter Efficiency: 0%
 - Machine Efficiency: 0%
 - Style Efficiency: 0.59%
 - Production Efficiency: 0.12%
 - % Efficiency Key: 0-100 (Green), 50-100 (Yellow), 0-50 (Red)
- Efficiency Grid:** A large grid showing efficiency percentages for multiple machines (02-37) across different shifts. Values range from 0.00% to 90.01%.
- Knitter Declaration Indicator:** A small indicator for machine 09 showing a value of 7.46.



MATRIX CONTROLS



www.matrixcontrols.net

330 Elizabeth Ave. Somerset, N.J. 08873 U.S.A.
Tel: 732-469-5551 800-722-6839 Fax: 732-469-7299

MKMS-Details

Central System Overview **F-1000/Scanner Capabilities** **Other Features and Options**

OVERVIEW of CENTRAL SYSTEM

The Matrix Knit Monitoring System is a PC based, Windows platform, complete knitting machine monitoring system. The Matrix Knit Monitoring System (**MKMS**) consists of two sub-systems: **The Matrix Real-time Display System** (RTDISP) and **The Matrix Auto Data Acquisition System** (AUTODA). The software used is Visual Basic and Access.

The **RTDISP** system shows the current status of the knitting machines on the main screen. Using the computer's mouse, point and click menu, items provide a simple and friendly ability to:

- View plant, production, knitter, Machine Efficiencies and Exceptions
- Access utilities to configure the system
- Configure individual F1000s
- Retrieve data from individual F1000s
- Build knitter set assignments quickly
- Log knitters and mechanics ON and OFF of knitting machines
- Create a knitting machine information database
- Machine preventive maintenance scheduling
- Provide database backups
- Generate reports from the data gathered by the AUTODA program
- Report Scheduling
- Create Style Database and download styles to F1000s



330 Elizabeth Ave. Somerset, N.J. 08873 U.S.A.
Tel: 732-469-5551 800-722-6839 Fax: 732-469-7299

- Access comprehensive online help

The **AUTODA** program automatically retrieves data from the F1000s at user specified intervals. This system is 100% independent from any human tasks once the system is started. The data that is collected from the F1000s includes:

Shift Data (current and past shifts)

- Revolutions
- Efficiency
- Top, Bottom, Needle, and Auxiliary stops
- Missed Inspections
- User Stops

Piece Data

- Piece #
- Revolutions on the piece
- Defects and their locations
- Number of unknown defects
- Knitted date

Machine Status

- Machine Running
- Top Stop
- Bottom Stop
- Needle Stop
- Auxiliary Stop
- User Stop
- Host Stop
- Missed Inspection
- Pre Doff
- Doff
- Fabric Defects
- Scanner
- No Rev Pulse
- Calibration Error
- System Error
- Machine to Start

Style Data

- Style Number
- Revolutions
- Top, Bottom, Needle, and Auxiliary stops
- Number of unknown defects
- Number of known defects
- Number of each type of defect



www.matrixcontrols.net

330 Elizabeth Ave. Somerset, N.J. 08873 U.S.A.
Tel: 732-469-5551 800-722-6839 Fax: 732-469-7299

OVERVIEW F-1000

The hardware component of the system is the **Model F-1000 SCANNER MONITOR CONTROLLER.**

It is a sophisticated instrument that encompasses defect scanning, as just one of its many features.

The F1000 will improve fabric quality, increase mill efficiency and reduce operating costs.

Fabric Defect Scanner stops are automatically assigned a location by revolution count, in the roll and logged. The F-1000 has defect mapping capabilities and can stop production when a programmable number of defects are exceeded in a roll. Operators are prompted to visually inspect the fabric at programmable, periodic intervals to catch defects not detectable by Fabric Defect Scanners.

Automatic Oil and Air Control optimize machine cleanliness, while reducing oil and air usage. The result is less lint buildup, thereby decreasing defects. Doff control with Pre-Doff, produces a cleaner end of roll, leading to reduced wasted fabric.

Continuous Yarn Rate (ravel) measurement eliminates yield variations and the need for periodic audits.

Knitting Element Life is monitored on a revolution basis to assist in scheduling preventative maintenance. Mechanics are also assisted with Automatic Scanner Calibration, Automatic Yarn Rate Measurement and Speed Monitoring.



330 Elizabeth Ave. Somerset, N.J. 08873 U.S.A.
Tel: 732-469-5551 800-722-6839 Fax: 732-469-7299

Operator response to machine stops is increased with Visual Displays of stop reasons. The machines' efficiency is displayed and updated continuously for the current shift, while Oil Flush and Sinker Air Purge are sequenced automatically. Rotating Needle Blowers can be sequenced for maximum cleaning, reducing the time operators must spend blowing off knitting elements. Stop data is maintained to evaluate Efficiencies and Yarn Quality.

MACHINE MONITORING and CONTROL

- Revolution Counter
- Positive Feeder Stops: Top (Creel), Bottom (Carrier)
- Needle detector, gate or any other additional stop
- Operator Stop
- 1 Non-Dedicated Input - Gate, Oil Level, Air Pressure, etc.
- Yarn Rate Meter interface
- Machine stops at pre-set Pre-Doff and Doff revolutions
- Automatic Oil Flush, Air Purge, Rotating Needle Air at pre-set revolutions
- Fabric inspection alarm to increase product quality
- Reset and Start Delays
- Positive Feeder Override
- Defect Scanner Override

DATA PROCESSING

- Continuous display of rev-in-roll, machine RPM, and % efficiency
- Data stored by Piece or by Shift:

By Piece:

Date the piece was knitted	# revolutions knitted
Shift the piece was knitted	Type of defect(s) in the piece and location of effects



www.matrixcontrols.net

330 Elizabeth Ave. Somerset, N.J. 08873 U.S.A.
Tel: 732-469-5551 800-722-6839 Fax: 732-469-7299

By Shift:

Date of the Shift	# of Top Stops during the shift
# of revolutions in the shift	# of Bottom Stops during the shift
Efficiency of the shift	# of Needle Stops during the shift
# Missed inspections per shift	# user Stops during the shift
# Auxiliary Stops during the shift	

OTHER FEATURES:

- **Click and drag machine icons on real-time display**
- **Real-time display of yarn rate, RPMs and declaration status**
- **Masking of machines with declarations on real time display**
- **Ability to build trial sets for yarn, needle, and machine tracking**
- **Shift schedule for multi-week shift rotations**
- **Enhanced set building abilities**
- **Pay factoring for knitter pay**
- **Custom Downtime calculations to be used for knitter pay and incentives**

MKMS



www.matrixcontrols.net

330 Elizabeth Ave. Somerset, N.J. 08873 U.S.A.
Tel: 732-469-5551 800-722-6839 Fax: 732-469-7299

- **Software available in Spanish simply by selecting menu item**
- **Firmware to display data on F-1000 available in Spanish**

OPTIONS:

- **Payroll System interface**
- **Roll weight calculation**
- **Bar code ticket printing**
- **Greige Inspection/Mending Interface**
- **Error Sourcing Analysis**
- **Machine Scheduling**

