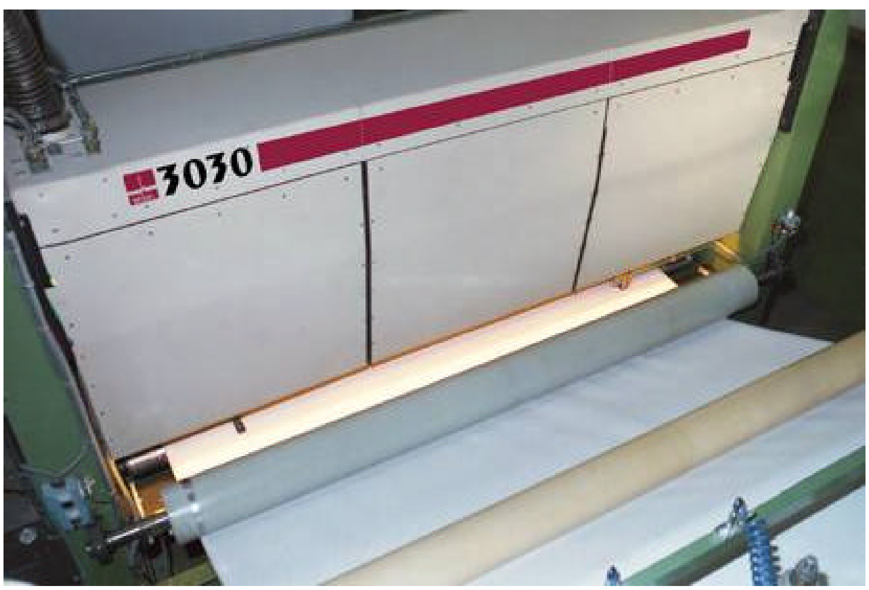
Model 3030® OPTOMIZER®

CCD Camera-based Video Web Inspection System

SYSTEM MANUAL



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RKB OPTOELECTRONICS

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FOREWORD

This system manual provides information to install, operate and/or program and troubleshoot the referenced product(s) manufactured by R.K.B. OPTO-ELECTRONICS, INC. The following pages contain information regarding the warranty and repair policies.

Technical Assistance is available from:

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1(800) 513-3945 in the US
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Managing Director

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An R.K.B. OPTO-ELECTRONICS, INC Affiliate
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Attn: Kyo Kook Lee
Managing Director Pulp & Paper Mill Equipment

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Andy Anderssen Pulp & Paper
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Fax: [27] (31) 838103
E-mail: andya@iafrica.com
Web Site: www.rkbopto.com
Attn: Andy Anderssen
Managing Director

Manual Errors and/or Omissions: A reply sheet is included as the last page of this manual. Please use the replay sheet if you experience any problems with the manual that require correction.

The information in this document is provided for *reference* only. R.K.B. OPTO-ELECTRONICS, INC. does not assume any liability arising from the application or use of the information or products described herein. This document may contain or reference information and products protected by copyrights and patents and does not convey any license under the patent rights of R.K.B. OPTO-ELECTRONICS, INC., nor rights of others.

Guarantee

The product(s) and/or services provided are custom manufactured and supplied in accordance with the project specifications as described by the client and agreed between the client and R.K.B. OPTO-ELECTRONICS, INC. RKB guarantees that the product(s) provided will be free from defects in material and workmanship for a period of forty-eight (48) months from the date of shipment. RKB will only be liable under this guarantee if the product(s) is used, adjusted, maintained and operated by competent personnel accordingly as specified in the instructions and system manuals. All products manufactured by RKB are covered by its Limited Warranty listed below.

Refunds/Credit

In order to receive a refund or credit on a product purchase price, the product must not have been damaged by the customer or by the common carrier chosen by the customer to return the goods, and the product must be returned complete (meaning all manuals, software, cables, etc.) within 30 days of receipt and in as-new and re-salable condition. The Return Procedure must be followed to assure a prompt refund.

Restocking Charges

Stock products ordered by the customer that are returned to R.K.B. OPTO-ELECTRONICS, INC., after 30 days, and before 90 days, of the purchase will be subject to a minimum restocking charge of 40% for manufactured goods and 30% for OEM goods. The customer will be subject to any fees and charges for damage or missing parts.

Products not returned within 90 days of purchase, or products that are not in as-new and re-salable condition, are not eligible for credit return and will be returned to the customer at customer expense.

Cancellation Fee

Any product that is manufactured for the customer and is not stock will be subject to a 40% cancellation charge within the first 30 days. After 30 days but prior to 90 days all costs associated with the manufacturing of the product will be applied and charged to the customer if greater than 40%. The customer is not eligible nor will R.K.B. OPTO-ELECTRONICS, INC., accept any cancellation of manufactured goods if the cancellation exceeds 90 days.

Warranty and Disclaimers

Disclaimer & Warranties: R.K.B. OPTO-ELECTRONICS, INC., of P.O. Box 157, 6677 Moore Rd., in the City of Syracuse, County of Onondaga, State of New York, and Country of the United States of America, the manufacturer of said proposed goods does hereby warrant to the Client of this equipment and/ or product(s) will be free from defects in material and workmanship for a period of forty-eight (48) months from the date of delivery. The manufacturer will only be liable under this warranty if the product is used, adjusted, maintained, and operated by competent personnel accordingly as specified in the enclosed instructions and system manuals.

The manufacturer, RKB, will be liable for the replacement of any manufactured part that fails through a defect in material or workmanship during the forty-eight (48) month period of the warranty at no charge to the Client, except as follows:

a). The routine replacement of lamps (IR, UV, White Light, etc.) Fuses, filters, Spray marker filters, Air filters or any other type of filter and other routine maintenance items pursuant to the owner's manual will be replaced at the Client's own cost and expense.

b). In the event that the repairs will involve travel and living expenses from the manufacturer's place of business in Syracuse, New York, to the Client's place of business, within said warranty period, then the Client will reimburse the manufacturer all such travel and living costs including, but not limited to, room, board, travel, food, and other necessary expenses.

c). RKB will cover and be liable for all parts that are not manufactured by RKB, but supplied by RKB (i.e., IC chips, glass covers, relays, etc.) for a period of twelve (12) months from date of delivery to mill site. After the twelve- (12) month period, Client will be responsible for replacing at his own cost and expense.

If the product will, within said forty-eight (48) month period, cease to operate as warranted, the Client will provide written notice of the nature of the defect to the manufacturer. The Client grants to the manufacturer the right to repair or replace any defective part and/or parts of the equipment. Furthermore, the Client grants to the manufacturer ample and reasonable time to repair or replace the defective part(s). Should work of the defective part(s) require on-site service, the Client grants to the manufacturer the required time to repair or replace the defective part, including a reasonable machine down time and delivery times for said part(s). The manufacturer may elect to either repair or replace the defective product if it is found that the defective condition is covered by this warranty. If the product will within forty-eight (48) months, cease to operate, the Client will mail the defective part directly to the manufacturer, where upon the manufacturer will correct said defective part within thirty (30) days of the receipt thereof, and will return said part by mail with the manufacturer paying the shipping charges on way and the Client paying shipping charges one way.

The warranties contained herein are the only warranties made by the manufacturer and no other warranties, expressed or implied, are given in this product.

The manufacturer will not be liable under this warranty if the Client fails to comply with the requirements of use of the product, maintenance of the product or notice of the defects contained in this warranty.

The Client will be solely responsible for determining adequacy of the product for any and all uses to which the Client will apply the product and the application of the product by the Client will not be subject to any implied warranty of fitness for that purpose.

Any warranty contained in this agreement will not apply to any product which will have repaired or altered outside the manufacturer's facilities or in any way so as in the manufacturer's judgement to affect its stability or reliability, or which has been subject to misuse, negligence, or accident.

The warranty will commence upon receipt of the equipment at the Clients place of business or 30 days from delivery, whichever is to occur first.

Warranties will not apply to any product made by the manufacturer which will not have been operated in accordance with manufacturers printed instructions or will have been operated beyond the rated capacity of the product or due to the Client's neglect. The manufacturer will not be liable for any consequential damages or incidental damages resulting from the use of the product. The Client undertakes and agrees to indemnify the manufacturer from any and all liability, loss, or damage the Client may suffer as a result of claims, demands, costs or judgements against it arising out of the use or misuse of said products whether the liability, loss, or damage is caused by or arising out of the negligence of the Client, or of its officers, agents, employees or otherwise.

The manufacturer is not liable for any product damage due to acts of god (i.e.; floods, lightning, earthquakes, etc.) or acts of civil unrest (i.e.: riots, strikes, etc.).

Limitation of Liability & Remedy: The limitations of liability and of remedies as set forth in the standard RKB warranty agreement, above referenced and acknowledged by the Client, will be in effect and RKB will not be liable for incidental or consequential damages and that the remedies set forth herein being exclusive.

Taxes: The Client will pay all taxes arising from this agreement including all state or provincial and local sales, use taxes and VAT's. Any and all personal property taxes assessable on the equipment will be borne by the Client. The Client will reimburse RKB for all amounts paid or payable by RKB in discharge of the foregoing taxes.

Patent Indemnity: RKB will indemnify the Client from direct loss, damage and liability which may be incurred on account of infringement of any US Patent relating to equipment provided hereunder by RKB will, at its own expense, defend all claims, suits and actions against the Client in which such infringement is alleged, provided, RKB is promptly notified in writing and has sole control of the defense and settlement of such claims, suits and actions, but RKB indemnity will not apply to any infringement arising solely from the use or sale of equipment in combination with any device or equipment not provided hereunder by RKB or to any infringement caused by modification of the equipment other than RKB.

Non-Assignability: This agreement is not assignable by Client without the written consent of R.K.B. OPTO-ELECTRONICS, INC.

Attorneys Fees/Costs: The Client will pay all costs and expenses relating to enforcement or preservation of RKB's rights under this agreement including reasonable attorneys fees.

Notices: Notices required pursuant to this agreement will be mailed to RKB at the office at the address identified on the Client's most recent invoice and the Client at the billing address. All notices made pursuant to this agreement will be effective upon the date of the postmark.

Extraordinary Relief: Except for the obligation of payment, neither RKB nor the Client will be liable for nonperformance caused by circumstances beyond its control, including but not limited to work stoppages, fire, civil disobedience, riots, rebellions, and acts of God.

Compliance with Statutes and Regulations: RKB represents that it complies with the requirements of Federal statutes and regulations.

Governing Law: This agreement will be governed by the Uniform Commercial Code as enacted in the State of New York, Country of United States of America.

Security Interest: RKB reserves and Client grants to RKB a purchase money security interest in the equipment and any and all replacements, substitutions, and repairs thereto, as well as any and all proceeds of the foregoing for the purpose of securing the balance due hereunder and all other promises and obligations of the Client to RKB arising under this agreement. The Client agrees to sign and execute at any time alone or with RKB any financing statements or other documents that RKB deems reasonably necessary to protect and continue RKB security interest under this agreement. RKB is also granted an irrevocable power of attorney to execute such financing statements or other documents on the Client's behalf. The Client will prevent and hold RKB harmless against the assertions of interest or claims by third parties. When all of the Client's promises and obligations have been fully paid and satisfied, RKB security interest will terminate.

Shipping, Handling and Insurance: All shipping, handling and insurance fees will be applied to all orders separately and billed accordingly. Overseas accounts may have miscellaneous bank service fees applied if they do not deal directly in US currency and require a bank to exchange currency formats for them.

Performance Clause: The client will have six months from the date of delivery or three months from the date of POWER ON, whichever first occurs, to evaluate the above system in a manner in which it was designed to perform. If at the end of the evaluation Client accepts the system based solely on its criteria, Client will then pay RKB the final payment of 10% as stated. Should RKB be required to bond for this project, then balance will be paid Net 30 days from date shipment to mill site. Should the system not perform accordingly to predetermined results, Client may, by written notice to RKB, terminate all further obligations it may have to make additional payments against the system. Furthermore, Client has the right to send equipment back, after exhausting all other options available to include system repair and replacement, provided adequate time is given to RKB to make all necessary repairs and/or replacements.

EQUIPMENT INSTALLATION AND ENVIRONMENT SPECIFICATIONS

Installation: The customer is responsible for and will provide and pay for all installation costs and related materials, labor costs, tools, equipment, water, airs, light, power, steam, fuel, transportation, and other facilities necessary for the execution and completion of the work. The customer is responsible for ensuring the installation is carried out and completed as described in the equipment manual. The customer is responsible for ensuring that any necessary catwalks or equipment access points are provided to ensure a proper and safe work environment for future maintenance requirements.

Errors: The customer is required to report promptly and in writing to RKB, its employees, and agents, any errors, inconsistencies or omissions in the drawings and specifications or any other document. The customer must review, within two weeks of receipt all approval drawings (i.e.; mechanical & electrical) layouts, hookups, and dimensions, and return them to RKB for certification. If approval drawings are not reviewed and returned to RKB for certification within the prescribed time period, the delivery of all goods as proposed may be delayed.

Material: The customer is to supply all footings and/or sole plates, hardware, tools, and other related materials to install and support lamp housing, sensing assemblies and control enclosures. If required, RKB will assist with mechanical design at a nominal sum upon two weeks written notice from the customer.

Primary Power: The customer is responsible for ensuring that all proper power requirements and power conditioners are provided for successful installation and effect equipment operation.

Checks: The customer is required to ensure that the installation area is free of excess water, vibration, dust and/or any other type of foreign material which may cause damage to the mechanical, electrical and computer components of the equipment during operation. Most dry-end paper machine environments are suitable, but should be verified safe.

Humidity: The customer is responsible for ensuring the operational atmosphere is within an ambient temperature range of 30 to 140 degrees Fahrenheit. Humidity range for equipment operation must be between 0 & 95%, non-condensing.

Web Flutter: The customer is required to ensure that the web area being monitored is free of excess web flutter. If material exceeds 1/4" (6.35mm), equipment may not operate effectively, therefore inhibiting the detection of full black spots on the web surface.

Repairs: The customer is to provide three weeks written notice prior to downtime for any and all services or equipment corrections in order to allow RKB the opportunity to correct all problems. Since equipment is custom manufactured and is to be installed in a different environment than that of the manufacturer's facility, the customer agrees and grants RKB the necessary modifications, changes and repairs in the field.

Performance Specifications: The specifications as outlined in the initial proposal and/or purchase order are applicable to the proposed Model 3020 system, and define RKB and customer requirements at the mill site.

TECHNICAL SERVICES

RKB will provide technical service for equipment installation supervision and commissioning as specified under bid specifications.

RKB will manage and direct technical services of goods supplied after equipment commissioning. RKB will provide direct service and support to Interlake Papers Inc.

INVOICES

All invoices pursuant to the purchase order and contract will be mailed to Interlake Papers Inc., unless otherwise instructed

NOTICES

All notices, demands or communications required or permitted will be given in writing either by mail, fax or E-mail. All communications, notices or demands are deemed given if provided within ten (10) business days after posting.

TESTING PROCEDURES

All defect size specifications are calculated by the sensor field of view versus machine production speed. All specifications and testing are carried out in accordance with TAPPI testing procedures, which is a recognized industry standard.

ADVISORIES

There may be advisories used throughout this manual to stress important points or warn of potential hazards to the user or the system. A warning sign notes them. The following is an example of this advisory:

Note: the note is used to present information that may provide special instructions or extra information that may help to simplify the use of the product(s)

CAUTIONS AND WARNINGS

A danger sign is used to alert you to a situation which if ignored may cause injury or damage equipment

Cautions are accented with triangular symbols. The danger symbol is used in all cautions to help alert you to the important instructions. Use caution when servicing any electrical component and handling power. We have tried to identify the areas that may pose a caution condition in this manual; however, RKB does not claim to have covered all situations that might require the use of a caution warning and common sense.

You must refer to the documentation for any component you install into the product; fix or replace to ensure proper precautions and procedures are followed.

A. **The equipment within the camera assembly, lamp housing, control cabinet, and junction boxes are fragile. Exercise proper care when handling and during installation. Lifting of these components should be done from strength areas. Follow all instructions carefully during installation to ensure safety.**

B. **Be mindful when handling the Lamp Housing Assembly and Lamp Source. The maximum running temperature of the high-pressure Sodium lamps is generally between 600 and 650 degrees Fahrenheit. Do not place any object on or near the Lamp Housing Assembly. When maintenance is needed, allow the lamps to cool before touching the Lamp Housing. Precautions should be made when handling or changing these lamps.**

INTRODUCTION TO THIS MANUAL

This manual describes the Series 3000™ OPTOMIZER® CCD Camera-based Video Web Inspection System and related products. The introduction, Section 1, provides the user with an overview of the product line, the scope of the product, detection methodology and benefits gained by the use of this system. Section 2 describes the sensing assembly, lamp assembly and controls. Section 3 describes the main system control console and electronics. Section 4 describes the printer function and controls (if applicable). Section 5 describes the multicolor spray marking system (if applicable). Section 6 describes the encoder unit. Section 7 describes the system software, Section 8 describes the installation procedures and Section 9 consists of the troubleshooting guide.

PRODUCT LINE

RKB provides high performance, reliable, and field proven equipment capable of detecting and analyzing many different types of defects commonly found in web based processes used for manufacturing papers, boards, films, foils, steel, aluminum, fabrics, and related allied products. Equipment offered by RKB include:

- Splice Detection
- Registration Control
- Reject Control
- Marking System
- Hole Detection
- Flaw Detection
- Machine Vision

Our equipment is compatible with a wide variety of web manufactured materials including:

- Cotton Fiber Bond
- Embossed, Text, and Specialty Papers
- De-inked Recycled Papers
- Films
- Gloss and Matt Coated Offset and Rotogravure
- Papers Lightweight Coated Groundwood Papers
- Magnetic Media
- Metals and Foils
- Nonwovens
- Plastics
- Rubber

R.K.B. OPTO-ELECTRONICS, INC. (RKB) COMPANY PROFILE

R.K.B. OPTO-ELECTRONICS, INC., (RKB as it is more widely known) was founded with a commitment to innovation in the creation of new approaches for on-line web inspection techniques that are successful, proven and reliable. Located in Syracuse, New York, RKB designs, manufactures and implements the most diverse and innovative online web inspection solutions for the detection of various defect faults commonly found in much web-based process manufacturing environments. RKB alone has installed more than 1300 web inspection solutions worldwide ranging from splice detection solutions to full sheet defect fault monitoring systems. RKB has more than fifty years experience specific to paper, paperboard and conversion web inspection applications. The cornerstone of our success is our technological expertise headed by the industries leading web inspection expert William Dobbie. Under the guidance of Mr. Dobbie, RKB developed and patented many of the common techniques in use today such as ultraviolet hole detection, infrared, photo transistor-based flaw detection and recently developed a revolutionary technique for the detection of very subtle coating streaks and scratches in all forms of coated material. This new patented coating streak detection system now makes possible the reliable detection of very small scratches (down to 5µm) at any known production speed. Certainly a phenomenon unattainable until now!

RKB is currently developing a new splice detection solution that will revolutionize the detection capability and eliminate all forms of interference such as web flutter that can cause false splice indications if not properly corrected. This new splice detection solution will eliminate the need for our customers to take extra precautions and extra expense when installing our leading edge, state of the art splice detection solutions. Many of the employees have been with RKB firm for more than 18 years with key personnel celebrating more than 20 years with RKB. RKB’s technological expertise coupled with it’s leading market position and support disciplines provide all customers with leading edge technology that is unequaled in our industry. We are committed to our industry and to the manufacturers of paper and paperboard who depend on us to ensure that quality is maintained at the highest possible level. We rely on openness and cooperation, enabling us to become an integral part and valuable link in the overall process of papermaking.

In 1992, RKB was awarded from the United States Patent and Trademark Office a patent for it’s innovative design making way for RKB to release its new coated web based material detection technology to the paper, paperboard, and allied trade industries. Since 1992, RKB has successfully implemented its new coating streak and scratch detection technology in both the United States and European Markets.

Today, RKB continues to develop new technology and has over 800 installations worldwide in over 46 countries.

HISTORY OF RKB

RKB was the first commercial on-line web inspection supplier in the world. With more than fifty years experience in web inspection techniques and solutions, RKB has significantly extended the benefits of automatic optical web inspection. Early RKB systems were based on patented ultraviolet, photomultiplier and infrared, phototransistor technology. Originally based in Canada, RKB developed and patented many of the void and defect fault technologies currently used by many well-known multinational companies. Many installations are still on-line performing with unprecedented reliability today! In 1960, Leigh Controls Ltd., a namesake, acquired RKB (known at that time as Nash and Harrison). Under the guidance of Leigh Management, RKB developed and patented the first camera-based system called the Vidicon 7000. The Vidicon 7000 was designed to detect defect faults in various microfilm processes.

In the late 1970's, RKB relocated to the United States to improve its logistics and purchasing power where it remains today. In 1980, the web inspection industries most experienced engineer purchased Leigh and changed the name to R.K.B. OPTO-ELECTRONICS, INC. As the leading industry expert in web inspection, William Dobbie, President and CEO improved existing technologies, introduced CCD line scanning technology and developed and patented the most innovative, state-of-the-art solution for the on-line detection of very subtle streaks and scratches. Using the most advanced digital technology available, RKB’s streak detection systems can monitor and detect streaks and scratches down to sizes that no other company can achieve no matter what process speed your manufacturing at. Called the OPTOMIZER®, it is the latest breakthrough in the art of defect fault detection. This advanced scanner truly represents a quantum leap forward in the technology!

INSPECTION METHODOLOGY RELATIVE TO UNDERSTANDING CAMERA RESOLUTION

To understand the methodology of high-speed, web inspection defect detection using CCD technology, you must first understand camera resolution and how that resolution is derived versus size of fault, machine speed and process manufacturing environment. Since the invention of the *Charged Coupled Device* (CCD*;* A semiconductor device that stores energy and transfers it sequentially to an amplifier and/or detector, ***Figure 1***) back in the 1960's by Bell Labs, CCD technology has become an industry-standard image sensor. In particular, CCD line scanning technology has become the most widely used imaging platform for non-contact, electro-optical measurement of various defect faults commonly found in many paper, paperboard and conversion operations.

Of the available CCD line scanning arrangements (i.e., 512, 1024, 2048 and 4096), most suppliers base their standard platform off of the 2048 pixel formats (RKB uses the 1024 platform). This device is a monolithic component generally containing a single row of 13µm (0.00051 inches) square light sensing elements (pixels or photosites)[1] (***Figure 2***). Light energy or the lack thereof received by the pixels generates electron charge packets proportional to the product of integration time and incident light intensity. The electron charged packets are then transferred in parallel to processing circuitry for delivery to signal amplifiers where they are converted into proportional voltage levels. Additionally, CCD's contain additional processing pixels (non-active sensing pixels) used internally by the sensor for other various functions. All CCD cameras operate with two differential clock signals, a data rate clock (fixed) with a preset frequency that determines the frequency which the video data is clocked out of the camera and a line rate clock (individually adjustable) which specifies the camera scan rate and integration period.

Figure 1 – 2048 Pixel Line Scan CCD Chip

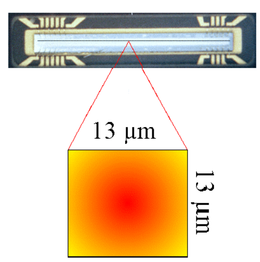

Figure 2 – Detailed view of the Pixel Dimensions

CCD camera based web inspection suppliers typically define system resolutions (or minimum defect size) as the field of view (FOV) per sensor in the cross machine direction divided by the number of pixels contained within that sensor. That means a 2048 pixel linear array camera viewing 20 inches (50.8 cm) of material in the cross machine direction should have a resolution of slightly less than 10 thousandths of one inch (0.254 mm) or the size of the pixel resolution in the cross machine direction (***Table 1***).

[1] Photosites or pixels are silicon based energy packets similar in function to phototransistors.

TABLE 1.

FOV	÷	P	=	SR
20	÷	2048	=	SR
		0.010 inches	=	SR
		0.254 mm	=	SR

System Resolution

It, therefore, is also true that a 1024 pixel camera with a 10-inch (25.4-cm) field of view cross machine direction would have approximately the same resolution. The subtle difference is that this resolution may only be true for non-moving or static material, thus it is most accurately called ***"Static Resolution" (Figure 3)***.

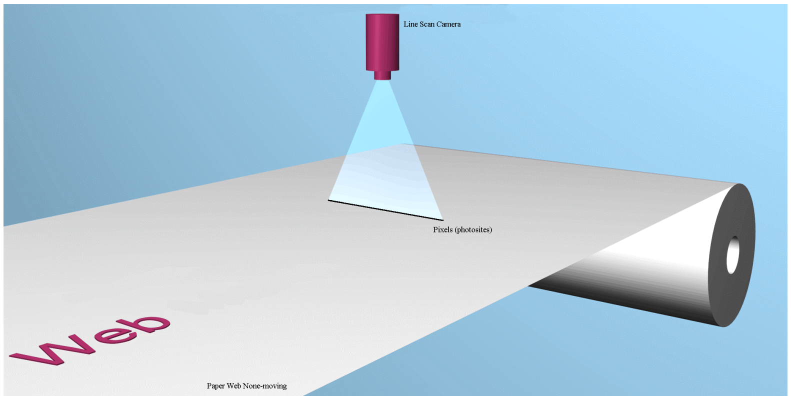

Figure 3 - Cross machine pixel resolution on a stationary web or *"Static Resolution"*

In reality, the actual resolution of any CCD camera based video imaging inspection solution is more difficult to calculate precisely, especially when applied to material that is manufactured at high rates of speed such as coated paper. Unfortunately, there are too many unknown factors that can affect the overall resolution of any given CCD camera based system to accurately pinpoint the systems finite resolution in any given application. Light intensity, machine speed variances, vibration, environmental conditions, applicable data and scan rates actually used in and/or by camera sensors, camera sensor placement from the focal point, to name a few can all adversely affect the expected output of any CCD camera based system, no matter who supplies the system.

Another factor, which has a direct affect on system resolution capability, is Nyquist Theorem. In 1928, Henry Nyquist determined that, when sampling at a given rate, the highest frequency that can appear in the sampled signal is half the sampling frequency. If the sampled signal contains frequencies higher than half the sampling frequency (higher than 4 kHz when sampling at 8 kHz as is the case for μ-law), these higher frequencies will appear folded down to below half the sampling frequency when the signal is reconstructed. This is the Aliasing problem. This problem, commonly referred to as Nyquist's Law of Unambiguous Detection Measurement, states that the "Defect or event being inspected must be 3 times the diameter of the actual pixel coverage size to guarantee that the defect fault or event covers at least one full pixel under any circumstance (***Figure 4***).

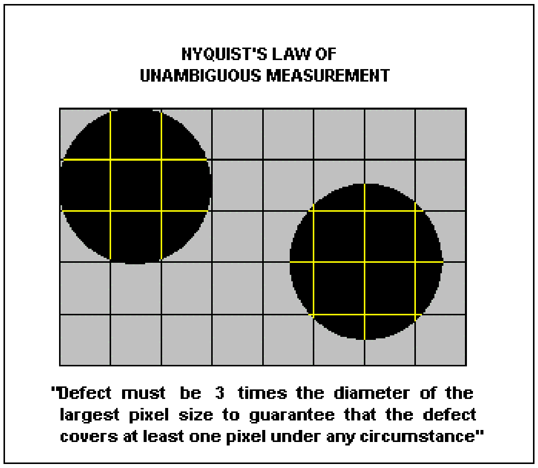

Figure 4 – Nyquist's Law of Unambiguous Measurement

Since *"Static Resolution"*, as described above, does not account for web movement during the time interval that the CCD array is collecting and reading off the energy, true pixel array resolution cannot be determined for any applicable application. Actual resolution or *"Dynamic Resolution"* of any CCD array must be calculated to include the web material process speed, which can have a dramatic affect on overall resolution capabilities of any CCD Array. To determine, within reason, the approximate true resolution of a CCD Array, we must know two things; the web material process speed and the actual scan rate used by the equipment supplier to drive the CCD Array. As we should all know by now, CCD arrays measure the amount of energy falling on them over some time interval. The length of the interval is a function of the number of pixels within the CCD array, and the clock rate used to drive the array. Pixel count and clock rate are normally provided by the inspection system supplier or listed on the system suppliers product literature[2].

It is fairly easy to estimate what true resolution can be expected for any CCD array as applied to any potential inspection application. Thus, a best-case and worst case resolution scenario can be determined. First of all, two pieces of data are required to effectively calculate the true resolution of any CCD camera based solution. You need to know the cross machine direction resolution (CDR – commonly referred to as static resolution; ***Figure 3***) and the machine direction resolution (MDR – commonly referred to as dynamic resolution; at speed; ***Figure 5***) per pixel. These two resolutions, when calculated together, determine the true operational pixel resolution for a particular application.

[2] Be wary of the clock rate figure provided as many suppliers will provide the maximum allowable rate, but not necessarily the rate that is actually used by them for inspection.

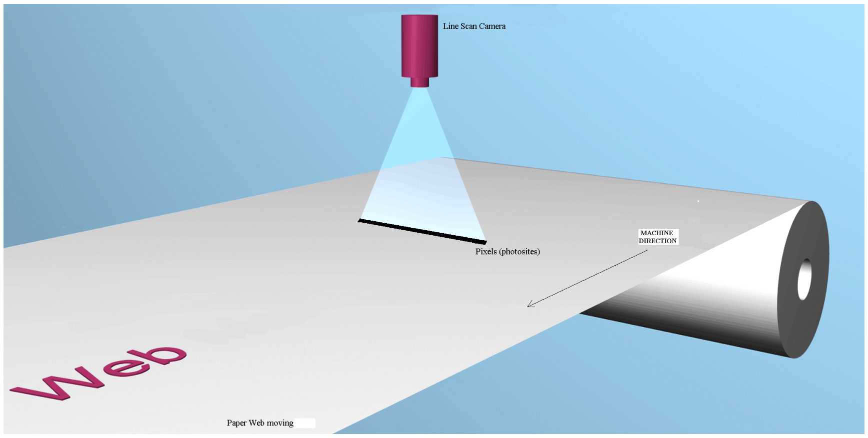

Figure 5 – Machine Direction pixel resolution on a moving web or *"Dynamic Resolution"*

An example is instructive:

Your application involves the inspection of a paper web 100 inches (2.54 meters) wide being processed at 1000 feet per minute (304 m/min). The CCD array you decided to use is based on 2048 linear pixels and you are going to place each sensor so that the field of view per sensor is 20 inches (50.8 cm). This array will operate or scan at 20MHz. What are the static and dynamic resolutions? To determine the static (CDR) resolution you take the field of view (FOV) of the sensor and divide it by the number of active pixels used by the CCD array (i.e., 20" FOV ÷ # of pixels (***Table 2***)).

TABLE 2.

FOV	÷	P	=	CDR
20	÷	2048	=	CDR
		0.010 inches	=	CDR
		0.254 mm	=	CDR

CDR – Cross Machine Direction Resolution per pixel

To determine the dynamic resolution (machine direction resolution; MDR) you must take the number of active pixels (P) plus the additional non-active pixels and divide by the data rate (DR) used. This will give you the actual scan rate. The scan rate, which is the time it takes to scan through all pixels, is then multiplied by the web speed (WS[3]) which will give you an initial pixel resolution (IPR) in the machine direction. That IPR is then added to the CDR[4] to give you the actual MDR of the above listed example (***Table 3***).

TABLE 3.

P + 38	X	WS	+	CDR	=	MDR
DR						
2048 + 38	X	WS	+	0.010	=	MDR
20 MHz						
2086	X	200	+	0.010	=	MDR
20,000,000						
104.3 µs	X	200	+	0.010	=	MDR
	IPR =	0.021	+	0.010	=	MDR
				0.031 inches	=	MDR
				0.784 mm	=	MDR

MDR – Machine Direction Resolution per pixel (at speed)

3 Remember to adjust the web speed from fpm (m/min) to inches per second (mm/sec).
4 Remember the pixels 13 µm square which means that the CDR static is = to the MDR static and must be added to the IPR for actual MDR resolution at speed.

The above calculations have now provided you with both the CDR (***Figure 3***) and MDR (***Figure 5***) resolution of the active pixels contained in the sensor you are using for the above example. Thus, for a paper web traveling at 1000 fpm (304 m/min) with a 2048 pixel camera applied at a FOV of 20 inches (50.8 cm), the pixel coverage area is 0.010 inches (0.254 mm) CD by 0.031 inches (0.784 mm) MD. From the above calculations, we can now calculate the true resolution of each pixel contained within the specified CCD array. By taking the CDR and multiplying it by the MDR, the overall area that each pixel covers for this specified example is 0.21 sq. mm (according to TAPPI Test Method T437; Dirt in paper and paperboard). Another fact born from the calculations above is how much the paper web will move during one full CCD array scan. We know that the scan rate is 104.3 µs, thus the paper web which is traveling at 1000 fpm (304 m/min) moved 0.020 inches (0.508 mm), twice the static resolution (***Figure 3***).

Every CCD camera-based solution, no matter what CCD pixel array you use, has a best case and worst-case resolution scenario. If a defect fault or event covers the full pixel, either in a static environment or dynamic environment, the voltage signal output is at its highest optimum level or full modulation (***best case***). However, in reality one has to deal with machine process speed, various energy levels, and web tension control fluctuations, web wander, shrinkage and other variables generally not present during inspection in a static environment. All these factors can seriously alter your best case resolution scenario. Another "real-world" issue that most suppliers neglect to consider is the relative timing between a defect fault or event during any one particular CCD pixel array scan. Unfortunately, reality being such as it is, many defect faults or events cover only a portion of the full pixel during any one scan and the resultant voltage signal output is reduced from its optimum level or modulation. It is quite feasible that a defect fault or event could fall on a quarter of the pixel coverage providing only a 25% optimum voltage level output or modulation (***worse case***). Refer to ***Figure 6*** for a depiction of the best case and worse case signal responses.

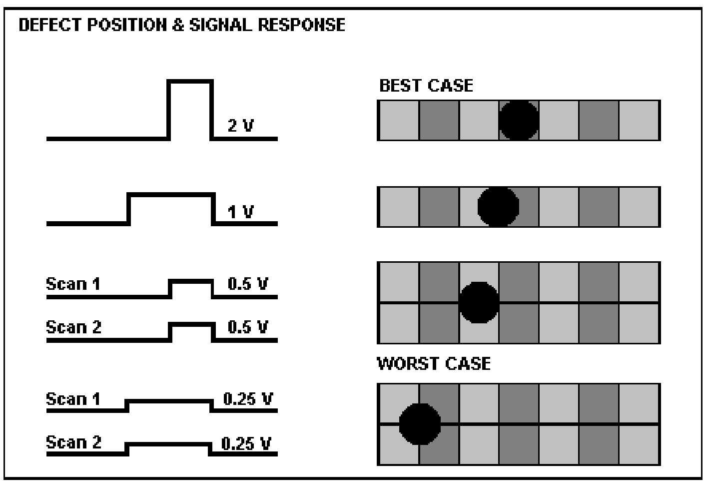

Figure 6 – Best Case/Worse Case Signal and Defect Resolution Response

As seen above in figure 6, when a defect fault during a CCD linear array scan lands completely within the pixel, the resultant voltage level output is at full modulation or 100%. However, when the defect fault lands on the crosshairs, so to speak, upon completion of one scan and initiation of another, approximately ¼ of the defect fault is detected resulting in ¼ modulation or 25%. This phenomenon, which can reduce the ability of the detection process, can be avoided if proper and direct care is taken prior to manufacturing a system to take the possibility of decrease modulation into account. Additionally, the reduction in defect modulation dramatically gets worse when machine process speeds are increased. Of course, lighting which is another factor, can play an important roll if you cannot generate enough energy to run the CCD array at optimum scan rates.

Although it is common knowledge that most, if not all, CCD linear array chip sets are rated to work at 20MHz data rate (pixel clock rate). In reality, it takes a very high-energy source to actually achieve this operational rate, if achievable at all. Some CCD chip set suppliers claim to have developed linear arrays, such as a 2048 pixel array, that can operate at 40MHz or higher. This is true and false. If the camera is broken into sections (i.e., dividing 2048 pixels by 4) and parallel processed, then the flow of information is increased from a standard 2048 at 20MHz. However, these types of sensors are very expensive and generally are prohibitive from being used in most applications when costs to implement defect detection are just not warranted. It is believed that all vendors of CCD camera-based video web inspection systems claim the highest possible data rates. RKB does the same thing and it is considered a very viable marketing tool. However, taking this hype out of the picture, reality sets in. In most on-line CCD camera based systems, the actual data rates being used by vendors such as HMX, ABB, Cognex, etc… is not the suggested data rate by CCD chip set manufacturers. In fact, in many cases, the current installed based on camera based systems are operating with scan rates within the 7 to 12 MHz range. RKB generally operates, depending on the application, between 15 and 18 MHz, which is more than sufficient for most inspection applications.

Point of fact! It has been disclosed to RKB by various users of current CCD camera systems and through head to head, on-line trials with two of the worlds biggest suppliers that their actual operational data rate (scan rate) used is much lower than the rated data rate of the CCD chip sets used and specified the Chip manufacturers. This is due to many factors including, but not limited to sensor placement (distance to web surface), utilization of wide angle lenses, use of extensive software oriented controls and algorithms for actual defect detection (not defect display), types of lighting techniques used and the use of improper CCD linear array chip sets or improper number of sensors. Finally, web speed plays an enormous roll as a detractor for reliable, consistent and accurate detection.

It is a known fact that light or energy reflected off paper has a much higher illuminant level then light transmitted through paper. Thus, any type of line scanning CCD chip set that uses transmitted energy only would be handicapped relative to optimum performance levels. It is also a known fact that, to date, only RKB has provided line-scanning solutions based on a 1024 linear array chip set. Other companies have claimed they can do it, but no one has ever done so. Every system that has been installed since 1989 starting with Combustion Engineering, ABB, ROIBOX, Measurex, Honeywell-Measurex, Cognex and others have all been based on the inherently slower 2048 CCD linear array chip set. Most likely due to its cheap costs and ability to make large profits. Although RKB also provides solutions based on the 2048 chip set, we have provided and have proven systems based on the 1024 chip set and other types of chip sets. It really depends on the application at hand, machine speed, and of course, the financial ability of the customer. Certainly, when possible, one would want to use a faster chip set like the 1024 linear array as the overall resolution and results are much improved over slower scanning systems. Lets look at the top three suppliers of CCD camera-based video web inspection systems. The following tables list operational parameters for RKB, ABB and Cognex (Formally Honeywell-Measurex; HMX). The tables below, numbered 4 and 5, will provide a rough comparison on system resolution and capability.

Table 4

STATIC RESOLTUION CAPABILITY			
Vendor Name	**Pixel Count**	**Field of View**	**Static Resolution/pixel**
RKB	1024	10 inches (25.4 cm)	0.010” (0.254mm)
ABB	2048	20 inches (50.8 cm)	0.010” (0.254mm)
Cognex (formally HMX)	2048	20 inches (50.8 cm)	0.010” (0.254mm)

Table 5

DYNAMIC RESOLUTION CAPABILITY				
Vendor Name	**Pixel Count**	**Data Rate**	**Scan rate**	**Dynamic Resolution/pixel**
RKB	1024	18 MHz	56.8 µs	0.028” (0.7mm)
ABB	2048	6 MHz	341 µs	0.171” (4.4mm)
Cognex (formally HMX	2048	10 MHz	205 µs	0.102” (2.6mm)

Most web-based material manufacturers can calculate static and dynamic resolutions themselves. RKB provides the necessary formulas in its methodology description of its solutions below. All one needs to actually know from a potential vendor is what will be the actual data rate they will use per their recommendations or proposed systems. Then the potential customer can decide if what is being offered will actually do the job or not and if they wish to invest. RKB strongly recommends that you investigate all suppliers no matter how many systems have been supplied to fully understand what it is your investing in.

As stated earlier in this report, paper machine processing speeds can greatly affect the overall results of CCD linear array resolutions thus affecting the detection capability, assurance and consistency. Through many years of development and supplying inspection solutions, RKB has found that one thing has never, and most likely will never change. The need for speed. As markets tighten up and become more competitive, paper manufacturers are required to produce more with less. To accomplish this task, machine-processing speeds are ever increasing with no signs of stabilizing. As a result, inspection solutions have to be modified to accommodate these ever increasing speeds. New systems must conform to inspect for defects at higher rates of speed. It is not enough that you could detect a 0.010” (0.254mm) defect at 1500-fpm (457 m/min), you now have to be able to detect that size of defect at 3000 fpm (914 m/min). An inherent problem with CCD solutions versus phototransistor systems, although both sensing solutions are made of similar material, is machine speed. In the older phototransistor type systems, you wanted faster line speeds which helped generate the defect signal pulse due to AC coupling. Since the CCD linear arrays do the scanning, machine speed has become the enemy of high speed, on-line machine vision inspection, so to speak.

As with all inspection solutions, the resultant output obtained from the electronic processing modules is an electronic signal. In this signal you have what we call noise (generated by the product itself). From that noise, you have discrete voltage spikes that may or may not be defect faults (***Figure 7***). This overall signal is referred to as the signal to noise ratio. In most cases, one would want a signal to noise ratio of 3:1 or better, with 3 representing the defect and 1 representing the noise. However, since reality shows that defects do not necessarily land and cover a full pixel in any given scan, as shown in Figure 6, the resultant voltage levels become lower and more difficult to discern. This phenomenon is especially true with subtle dirt and coating streaks/scratches. Under a static environment, all sensors should produce similar results with similar outputs. However, when machine speed is applied to the equation, the defect may not provide the optimum modulation during detection to provide a reliable output signal. This has been demonstrated in the paper industry time and time again. RKB Commonly hears from papermakers that the units they currently use are so sensitive and see everything that they have to reduce the detection threshold. This was a common statement made when Laser Systems had there hey day. What is actually occurring is that the defect electronic signal is not strong enough nor contains significant characteristic changes for the inspection system to pick out the defect from the random noise. As such, the inspection system is rendered for all intent and purpose, useless.

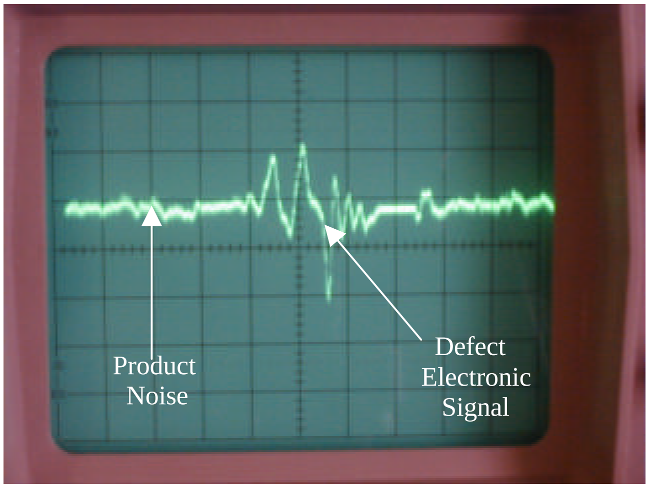

Figure 7 - Signal to Noise Level of Defect Vs Material

The fact is that over sensitive systems cannot discriminate between junk noise produced by the web material from an actual defect. Yes, it may be true the systems did detect the defect fault, but they detected a lot of other stuff (i.e., fibers, dust, etc.) that was not considered defective material. In most, if not all cases, the operational staff end up adjusting the unit to eliminate the false detection's and settle for what the unit can do which is a far cry from what they paid for the unit to do.

For example, lets take a 1/32" (0.8mm) black spot on a white paper. Apply machine speed to the paper web and increase said speed accordingly. As you can see in *Figure 8*, the detection capability of the CCD linear array chip set deteriorates due to the fact that the defect fault or event is no longer falling or covering one full pixel, but only part of a pixel during any given scan. Therefore, the modulation of the defect electronically starts to decrease until it become completely immersed within the noise level of the product material itself.

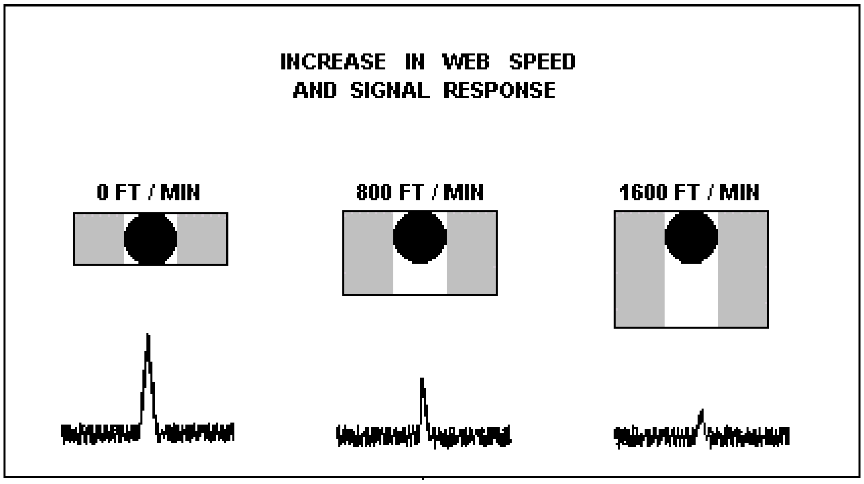

Figure 8 – Effects of web speed on the defect signal to noise ratio

An another phenomenon that hinders reliable detection with CCD's, unless taken into account, is pixel stretch. Again, as you can see in figure 8 above, as you increase the machine speed, the machine direction resolution per pixel also increases or stretches. This affect causes the total area covered by the pixel to increase. Therefore, if you are looking at a 1/32" (0.8mm) black spot that covers a full pixel in static mode (left view in ***Figure 8***), the same size spot will cover less of the pixel as machine speed increases until the modulation level of the voltage signal decreases to the point of non-detection (right side view in ***Figure 8***). Now, take a white colored streak on white-coated paper and apply the same principal. Not only does the contrast level significantly decrease, but streak detection no longer can be done using line scanning technology as there is no way of being able to bring the subtle defect out of the noise level if your pixel coverage is, lets say 2mm wide by 10 mm line and your fault is only 5% or 10% of that coverage.

Earlier we mentioned that wide angle lenses also affects reliable detection. The main reason why suppliers of inspection systems would use this type of lens is to facilitate the use of as few sensors as possible, keeping costs down while maintaining profit margin. Although some applications would require the use of wide-angle lenses, main stream paper inspection is not one of them. Utilizing wide-angle lenses creates Vignette (***Figure 9***). Vignette is defined as "an image that shades off gradually into the surrounding background."

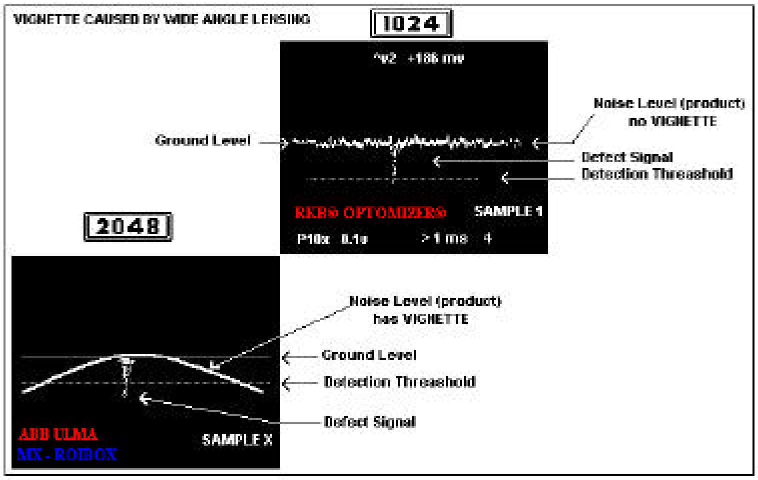

Figure 9 - Vignette Affect on Electronic Signal resulting from Wide Angle Lensing

Vignette applied to the electronic output signal of a paper defect fault or event, the defect eventually fades off into the noise level of the product material itself seriously degrading the detection systems capabilities for reliable, accurate and consistent detection. This becomes more apparent towards the outer fields of view of the sensors. It is RKB's opinion, although commonly used in our industry by others, that wide-angle lenses sacrifices the ability of the detection system to perform for the customer as intended. As seen in figure 9, the top oscilloscope representation shows the RKB CCD solution that is designed without the use of wide angle lenses, thus NO VIGNETTE phenomena affects detection reliability. The bottom picture shows what happens when wide-angle lenses are put in place to reduce the number of sensors required to do the job. The result, serious vignette problems exist.

What about coating streaks and scratches? It is true the above information mostly talks about CCD resolution as applied to autonomous defect detection and not streaks which are line type defects that generally run true to the machine direction. The reason is that the above information is relative to CCD line scanning solutions. It is RKB's position that line-scanning solutions do not work well when applied to streak type phenomena. Why, for many reasons, but the most apparent is that streaks are commonly very subtle in nature and do not have significant deviations from the material in which they occur in. Therefore, the signal to noise ratios generally obtained using line-scanning cameras is not defined well enough to generate a significant electronic defect signal from the electronic noise level of the material being inspected. As a result, the threshold detection settings would have to be set very low which can cause false signals to be generated.

Another reason RKB believes line-scanning techniques are not a valid approach for streak detection is due to the sensor make up themselves which are very similar to phototransistor type sensors. Every pixel, no matter what type of line scan chip set format is used, is made up of similar material (silicone) as a phototransistor. Since you are dealing with one TV line cross machine direction, the line scanning array becomes more or less like a point source sensor like phototransistors packed cross direction. The only difference is that under machine speed, the pixel of a line scan array will stretch and the phototransistor sensor will remain constant. What happens during streak detection is that the material with the defect will pass under the sensor (i.e., pixel or phototransistor) and without significant contrast, causing the sensor, in a way, to recalibrate itself to the new material in this case the defect. Thus, to the sensor, there is no defect, just new material. Yes, the sensor may pick up the change at the beginning of the streak and end, but will not signal during the length of the streak. As a result, many times, a line scan camera will misinterpret the defect as a spot and report as such completely missing the actual event. This has been proven time and time again since the introduction of camera systems that use only line scanning techniques.

Another fact to consider is that if all the so called "Brand Name" suppliers use the same sensor array (i.e., 2048 pixel chip set), then how could one system outperform the other if the main "BRAIN" of the unit is the same. The answer is that they cannot and this has been proven by many current installations worldwide, especially those at coated paper making facilities. In short, if the system you implement cannot see or discriminate the defect from the noise, it will never register or classify the defect. To the knowledge of RKB, all suppliers of camera inspection equipment base their systems around the 2048 pixel line scan chip set. As a result, none of these companies have been overly successful in coating streak detection. As a result, these systems become, in effect, useless tools that can only provide hole and gross spot detection. Specifications that most paper makers finally accept. But at what cost? We for one would not want to end up with a hole detector that we could have gotten at 1/10th the price. This is not just RKB opinion, but based on facts presented to us from users in the field and the physical makeup of the sensors themselves.

RKB will address its streak detection methodology, along with its line scanning methodology in the following section titled RKB methodology. We recommend that this section be read completely as it will provide very good insight into how camera technology works and ours in particular.

Scratch and streak detection applied with RKB's streak sensing technology

As stated above, RKB does not use line-scanning technology for coating scratch and streak detection for many of the reasons as stated above. Instead, RKB envisioned a radical approach that can guarantee reliable and consistent detection of very subtle scratches and streaks. So radical is this invention, the United States Patent Office awarded RKB patent protection under patent number 5,118,195 (***Figure 10***). The invention features a real time system for detecting scratches and streaks which occur substantially parallel to the direction of motion of a continuous or sheet feed web. An energy source such as an incandescent lamp impinges or transmits energy (light) which is then received by RKB's CCD based streak camera (what we call our Opto-Tek II™ **- *Figure 11***) technology.

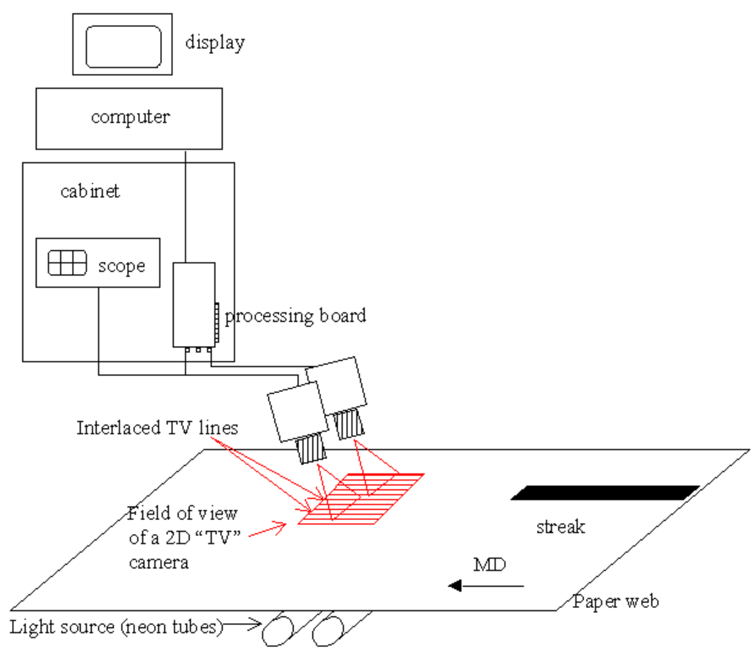

Figure 10 - Diagram of RKB Inspection Technology for subtle continuous defect detection

The sensors, standard two-dimensional CCD cameras are mounted relative to the web by conventional means well known in the art. The sensors contain an array of pixels horizontal by pixels vertical. It should be noted that cameras can be mounted collinear or staggered or arranged in any other suitable fashion as long as their cumulative fields of view cover the entire width of the web being monitored with each field of view overlapping its adjacent fields. The overall system design enables the use of a standard 2 inch (5.08 cm) field of view (FOV) per sensor in the transverse web motion (Cross Direction) by a 2.7 inch (6.858 cm) FOV per sensor in the web motion (Machine Direction). The sensors scan at a data rate of 1/60 of a second, producing a standard picture frame every 1/30 of a second. Horizontally, the sensors contain a number of photo-sites or pixels (relative to the chip set used) providing overall tens of thousands of pixels in total pixel coverage. Dividing the 2 inches (5.08-cm) FOV by the number of complete raster lines results in an effective resolution that can range from microns to millimeters per line. The resultant data received by the cameras is processed through proprietary and patented electronic circuitry.

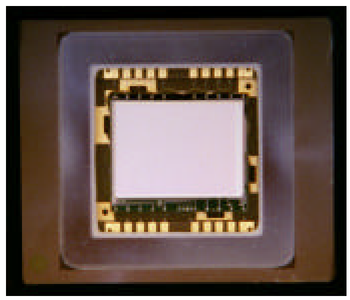

Figure 11 – OPTO-TEK II®

Since the sensors are standard types, a full frame takes only microseconds to read out. The outputs are processed along with undesirable control signals and are shuttled to our proprietary processing circuitry (PPC). The PPC processes each raster separately over its time constant, approximately 63.5µs. As a result of the longer exposure time, the final output reaches an energy level that represents the sum of the energy received by the individual pixels focused on the target web. By using PPC power and other proprietary circuitry, short term background noise (i.e., material noise), as well as very low frequency noise is eliminated, thereby enhancing the overall signal-to-noise (defect to material) ratio of the desired signal that is generated by scratches and streak defects. Since autonomous events (i.e., holes and dirt) or other high frequency background noise affects only a few pixels, normally less than 1% of a raster line and line type events (i.e., scratches and streaks) affects all (100%) of the pixels along a raster line, autonomous events and undesirable frequency noise are eliminated and have no affect on the signaling process of scratches and streaks.

Thus, the invention is not plagued with false signals and undesirable noise, which normally affect point source sensors such as line scanning technology. Therefore, false signals are not present and are not detected. The resultant signal is a very clean and discernible fault that is indisputably detected. Once identified, the data is transmitted to the Quality Assurance Management System (**QAMS™**).

To determine actual resolution of this innovative, state-of-the-art CCD camera scratch and streak detection process the following formulas are used. These implications are (***Table 9 and Table 10***): **-**

The cross direction resolution (effectively a static resolution) per raster line is determined by dividing the field of view (FOV) by the number of active pixel lines (APL) contained within that FOV. RKB minimum FOV per sensor in any given application is 2 inches (50.8 cm) cross direction. For this example; we will use a 4.2-inch (10.67-cm) field of view per sensor. The web width will be 200" (5.0 meters) wide @ 3500 fpm (1066 m/min). The minimum size scratch required to be detected will be 0.004" (0.1mm) wide. To determine minimum pixel resolution capability in the cross machine direction, the following formula is used: **-**

FOV[5] ÷ APL[6] = CDR[7]

[5] Where FOV represents 'Field of View' per sensor
[6] Where APL represents total number of 'TV Lines' (raster lines) in each sensor
[7] Where CDR represents cross direction resolution per TV (raster) line

TABEL 9

FOV	÷	APL	=	CDR	
4.2	÷	525.00	=	CDR	
		CDR	=	**0.008**	inches CD
				0.203	millimeters CD

Cross Direction Resolution Calculation (CDR)
FOV = Field of View per sensor (Any Streak Sensor can be used)
APL = Active Pixel Lines

The machine direction resolution (effectively a dynamic resolution) per raster line is somewhat more involved in determining. Since we are using two dimension camera sensors with an approximate ratio of 4:3, the static resolution in the machine direction can easily be obtained. Since we know our CD resolution per sensor is 4.2 inches (10.67 cm), the MD resolution per TV line is 5.6 inches (14.22 cm). However, the calculation of true dynamic resolution involves machine speed and the appropriate number of fields required to obtain a minimum of two fields of scratch and streak data. Again, since we know what type of sensor we are using (our patent allows us to use any two dimensional sensor), the picture field rate is pre defined at 1/60 of a second, producing a standard picture frame every 1/30 of a second or 0.033 seconds. Thus the formula to use to determine actual dynamic resolution is a follows: **-**

DR[8] x NF[9] x WS[10] x SMD[11] = MDR

Thus the actual dynamic resolution as calculated using the above formula indicates that the resolution achieved by the RKB system using its patented, state-of-the-art CCD area scanning technology provides a resolution capability of 1/60 x 3 x WS x SMD = MDR.

TABLE 10

DR	x	NF	X	WS	+	SMD	=	MDR
	0.0167	3	X	700	+	5.59	=	MDR
		0.05	x	700	+	5.59	=	MDR
			35.00	+	5.59	=	MDR	
			MDR	=	**40.58**	inches MD		
					1030	millimeters MD		

Machine Direction Resolution Calculation @ Speed (MDR)
DR = Actual Data Rate used by sensor (i.e., 20Mhz, 18Mhz etc)
NF = Required number of Fields for 100% coverage @ Speed
WS = Production Speed in feet per second
SMD = Static Machine Direction Resolution per Line

NOTE at 700 inches per second machine speed the web will travel 40.58” in 0.057 seconds

Thus for the example listed the overall resolution per pixel an equivalent resolution of 0.008 inches (0.203 mm) CD x 0.070 inches (1.79 mm) MD. What does this mean?

By utilizing a complete raster line containing numerous pixels per line, RKB’s Model 3020 CCD Camera-based Video Web Inspection System can process over a much longer integration time period. As a result, the integration process eliminates noise (***Figure 11***) and other variables that affect line scan type sensors using just one pixel. Additionally, by viewing a longer area of the web with hundreds of thousands of pixels, comparisons can be made quickly as to what is noise versus an actual defect fault and thus be processed accordingly.

[8] Where DR represents sensor data rate in seconds
[9] Where NF represents the required number of fields
[10] Where WS represents maximum web speed in inches/sec

[11] Where SMD represents the static machine direction resolution (no web movement)

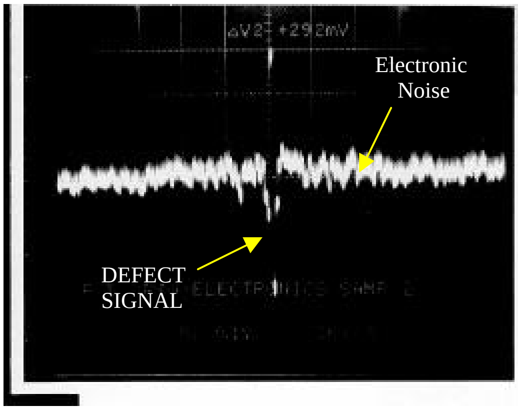

Figure 11 - Signal to Noise Ratio

This is the theory, but does it work? Yes. RKB's coating scratch and streak detection technology is fully field tested and mill proven with very successful installations. In fact, one of our references in Europe has stated "It is the best streak detection system he has ever seen or used." The end result is that RKB's Model 3020 can detect more reliably, consistently and accurately coating scratches and streaks in any coated web process. Additionally, the Model 3020 can successfully detect faults as small as 0.002" (0.05mm) wide at any speed. The only restriction faced by RKB's approach is the length required to fire a signal which lengthens as machine speed increases (i.e., @1000 fpm the length required is 15 inches; @2000 fpm the length required is 25"; @3000 fpm the length required is 35 inches; @4000 fpm the length required is 45 inches and @ 10000 fpm the length required is 105 inches).

Whilst it is by no means theoretically impossible for a line scanning system to detect these types of defects at lines speeds, RKB's approach is more in line with being able to achieve it more consistently. Furthermore, Manufacturers that have contacted RKB, who have purchased line scanning systems over the past months and years have all stated that what they are using does not work effectively, if at all. RKB's 3000 Series CCD Video Web Inspection Systems are intended for those who are serious about successful on-line detection of coating streaks and scratches. The 3000 Series will provide a superior level of coating scratch detection and spot type fault detection. For those not serious about successful detection and their investment, RKB recommends they discuss their applications with some other line scan camera supplier.

INTRODUCTION TO THE MODEL 3020®

The RKB Model 3020® OPTOMIZER® CCD Camera-based Video Web Inspection System uses Charge Coupled Device (CCD) cameras, power regulators, custom image processing hardware, and a CPU to assist paper manufacturers with their quality control goals. The system is composed of four major subsystems, as shown in ***Figure 12***.

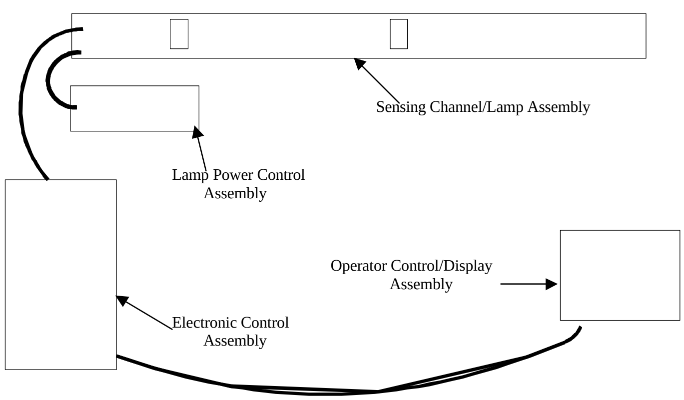

Figure 12 - Model 3020® OPTOMIZER® CCD Camera-based Video Web Inspection System Subsystems.

PHYSICAL CHARACTERISTICS OF DEFECTS

The size of a defect event that will exceed the threshold values described above varies with each system, but are typically in the 0.002" and larger (0.0508mm and larger) region. Detection requires not only sufficient size, but also significant contrast.

The defect must be significantly different than the surrounding product. For streaks and scratches on matte type material (basis weight of 80 lbs/3000 sq. ft and lower) this is achieved by placing a light source on the opposite side of the web from the camera sensors. When a streak or scratch passes between the sensor and lamp source, the camera 'sees' the light that is significantly brighter than the web itself. For streaks or scratches on gloss type material (basis weight above 80-lbs/3000 sq. ft.) a lamp is normally placed on the same side of the web as the camera sensors. As the light reflects off the web, an absence of light as compared to that reflected off the web is generated. The camera then sees this difference. Defects that do not provide a significant contrast with the surrounding web may be enhanced through various lighting and filtering techniques and are tested and approved by RKB prior to system manufacturing.

BENEFITS GAINED BY USING THE MODEL 3020®

One of the most pressing problems facing coated web material and converting manufacturers is the need to reliably, accurately and consistently identify various critical streak and scratch faults that cause damage to mechanical components (i.e., soft calendar rolls) and adversely effect overall quality and production in printing, embossing, coating, laminating and supercalendar processes. To help optimize the production of material and eliminate these critical defects, RKB incorporates its Model 3020® OPTOMIZER® CCD Camera-based Video Web Inspection System. By using the Model 3020 system, manufacturers in all coated web industries can benefit by literally saving hundreds of thousands of dollars, if not millions per annum in lost production, broke, unnecessary down time, re-manufacturing costs, customer claims, damaged soft rolls, damaged printing blankets, damaged embossers, coatings and laminators. Additionally, manufacturers will realize a higher quality product that has a higher value and increased market share. Overall, manufacturers will realize a significant increase in bottom line profits generated from products produced off of machines where inspection is applied.

THE MODEL 3020® CCD CAMERA-BASED VIDEO WEB INSPECTION SYSTEM

Sensing Channel

Fundamental parts of the Model 3020® OPTOMIZER® CCD Camera-based Video Web Inspection System, the sensing assembly houses the digital Opto-Tek II™ cameras and distribution control module. Relative to the web material production equipment, the Model 3020 system is generally located between the basis weight scanner and the take up reel. Since the sensing assembly is sealed and self contained, it is not recommended that it be opened except for purposes of supervised maintenance or repair. For additional information regarding the maintenance of the Model 3020 sensing assembly, consult the maintenance section of this manual. In connection with the sensing cameras, fifteen (15) coaxial cables run between the sensing assembly and the operational/electronic control assembly (***Figure 14***). Likewise, cables containing power and sensing signals for the cameras are connected on the side of the sensing assembly toward the drive side of the machine (***Figure 15***). The coaxial cable travels to BNC connector(s) on the operational/electronic control console from the BNC connector(s) on the sensing assembly. Also mounted within the sensing assembly is the control distribution-module that carries timing signals between the cameras and the control console hardware circuitry. Lighting for the cameras is also contained within the sensing channel. Power for the lights is provided by the lamp power enclosure. Video images from the cameras are sent to the system electronics cabinet, and power for the cameras comes from the system electronics cabinet.

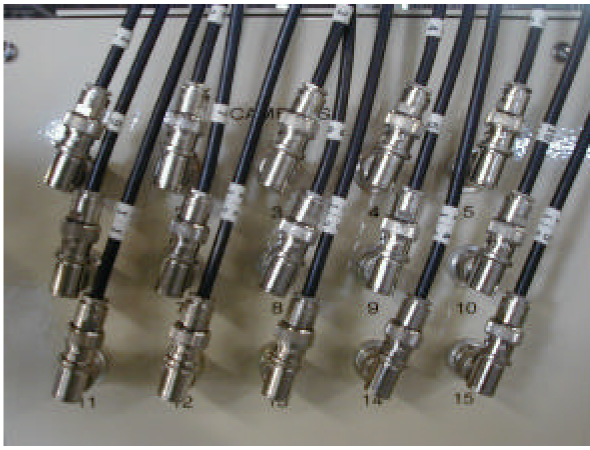

Figure 14 – BNC Connection Plate Assembly

Figure 15 – J-Plug; 7 Pin power & Sensing Connections

15 digital area type scan cameras are mounted three in row to a sensing plate mounting unit. Each plate is mounted side by side along the entire length of the housing that spans the entire web width below (*Figure 16*). Each camera is outfitted with a 25-mm lens and mounted directly over the moving web of material approximately 25.2 inches (64.0 cm) away (refer to approval drawing [*D113621_1.dwg*] in the appendix of this manual). Set up relative to the light sources, namely the R30 flood lamps, the cameras receive energy reflected off of the web material. Accordingly, the cameras are designed to monitor variable field of views as specified by the setup information that is manually entered and stored as product codes for future reference.

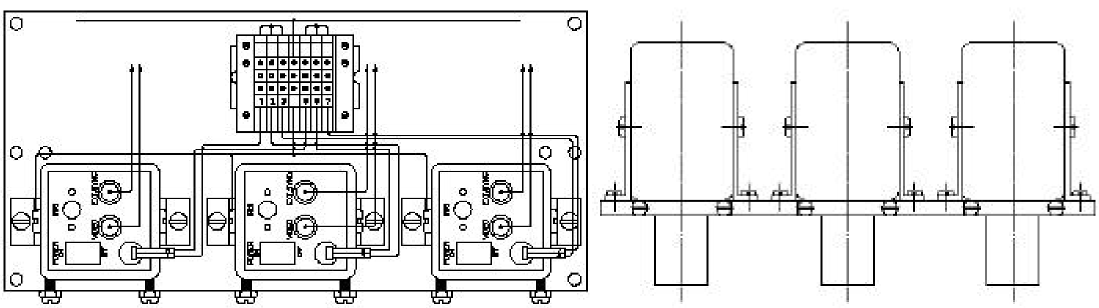

Figure 16 – Camera Mounting Plate Assembly 4 inch (10.16 centimeters) field of view system setup

The Model 3020 generally utilizes one lamp assembly in a reflective or transmissive mode of operation, depending on the overall basis weight of the material being monitored. In this case, a reflective lamp assembly containing 16 R30 flood lamps is utilized. This assembly is located in the same housing unit where the sensors are located (***Figure 17***). The lighting units are positioned directly next to one another at a predefined and proprietary angle to the material web being inspected (***Figure 18***). Additionally, the camera sync distribution board[12] (***Figure 19***) with two 7-pin connectors (J3 & J4) (***Figure 20***), several terminal blocks, and the sensing channel interconnection plate[13] (***Figure 21***) and contained within the sensing channel assembly.

[12] RKB Drawing Number D111056.
[13] RKB Drawing Number D111147.

Figure 17 - Lamp Assembly containing 16 R30 Flood Lamps

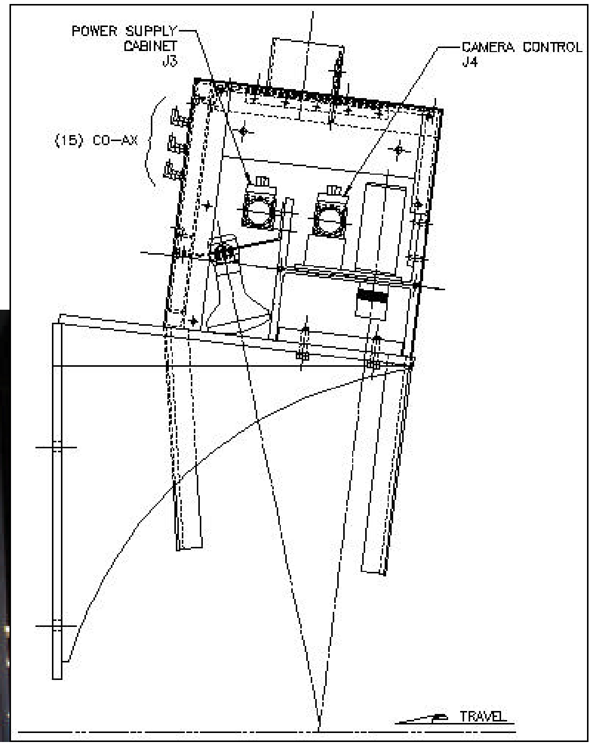

Figure 18 – Lamp Assembly proprietary angle setting

Figure 19 – Camera Sync Distribution Module

Figure 20 – J3 Plug

Figure 21 – J4 Plug

The lamp power enclosure provides power to the lamps that illuminate the material to be inspected. The lighting is required to be set at a proprietary angle down from parallel with the cameras[14]. Use of this angle produces a specular lighting that enhances defects within the material (***Figure 22***). The five (5) volt DC power supply (located in the electronic control assembly) provides power to the camera sync distribution board, which buffers the camera sync pulses generated in the system electronics cabinet, and feeds the buffered signal through the two 7 pin connectors, to the cameras. The cameras power, and power for the DC supply is brought to the sensing head from the system electronics cabinet.

The video image produced by the CCD cameras is carried via RG-188 miniature coax (***Figure 23***) through the sensing channel interconnection plate to the system electronics cabinet. All connections into and out of the sensing channel pass through the sensing channel interconnection plate.

Figure 23 – RG188 Miniature Coax

Lamp Power Assembly

The lamp power enclosure (***Figure 24***) provides regulation of AC power to produce appropriate lamp intensity.

[14] The lighting reference is taken as parallel with the camera body, and "down" has reference to the lens side of the camera body.

Figure 24 – Lamp Power Assembly

System Electronics Cabinet

The electronic control assembly (***Figure 25***) is generally located within 20 feet (6 meters) from the inspection assembly. However, it can be located or custom manufactured to be located anywhere within the facility provided it is approved prior to manufacturing. In this particular installation the electronic control assembly is located approximately 10 feet (3 meters) or so from and adjacent to the inspection assembly on the drive side of the production machine. The appropriate cable lengths of 20 feet (6 meters) per cable have been approved and should be already run prior to receiving the system. The enclosure contains the low voltage DC power supplies, module racks, electronic modules, engineering workstation, oscilloscope, and miscellaneous electronics and hookups needed to generate accurate defect ***information (Figure 26***). Central to the process of detection, the OECE process circuitry receives power via a power conditioner, 50/60Hz and transformers and sensory data from the sensing assembly. From the OECE the resulting defect signals are generated and sent to the Quality Assurance Management System, QAMS® that logs defect data for production and management use.

Figure 25 – Electronic Control Assembly

Figure 26 **-** low voltage DC power supplies, module racks, electronic modules, engineering workstation, oscilloscope, and miscellaneous electronics and hookups

On the engineering workstation located within the OECE are a number of switches to be noted (***Figure 27***):

1. The main system power switch (S1) is an on/off push button found at the bottom of the panel door
2. The main system spray marking on/off push button with associated Dwell and Spray timing potentiometer adjustments
3. Main spray system indicator light
4. DC power supply on/off toggle switch
5. Low voltage power supply indicator lights.

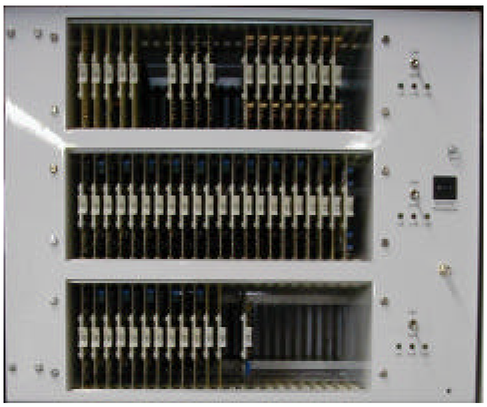

Figure 27 – OECE Control Panel

The oscilloscope trigger is located in the front of the console to the right of the electronic modules rack system. These switches (thumb wheel) are used for system calibration purposes only. Located via the left side of the OECE you will see the military connector plug J2 and associated coax cable connectors (***Figure 28***) for the cameras. These connectors are used to carry signals to and from the OECE to the sensing assembly. Various terminal strips, fuses, relays and BNC connectors are also located within the OECE. For further information regarding the internal composition of the OECE see drawing [D113618] for clarification.

Figure 28 – J2 Plug & RG188 BNC Coax Connectors

Voltage Requirements

+15 VDC power supply
- 15 VDC power supply
+ 5 VDC power supply

These power supplies are regulated and are required for powering the low voltage electronics. The +15VDC and **-**15VDC are required for the cameras and the sensor amplifiers within the analog part of the system. This includes the video, mixer, buffer and detection circuits and the **-**15VDC is required for the detector thresholding circuitry. These power supplies are located in the Lamp Power Enclosure (***Figure 29***)

The +5VDC is required for the digital logic of the integration circuits and cameras. These power supplies are available as standard commercial items. They are self-contained and rarely require adjustment. Of course, standard-troubleshooting procedures should be used if problems arise.

Video images provided by the CCD cameras are processed within the system electronics cabinet. When coating streaks are detected they are registered on the CPU system located in the operational control assembly or via a desktop version (approved prior to manufacturing).

The system electronic cabinet[15] houses all RKB custom video processing hardware, a data acquisition system[16] (DAS™), the engineering panel[17], TV video monitor[18], oscilloscope[19], and various necessary terminal blocks and connectors, including the system electronics cabinet connector plate[20].

[15] RKB System Electronics Cabinet Wiring Diagram - Drawing Number D111171.
[16] The D.A.S. provides a data communication path between RKB hardware, and the MetraByte MBIC-3 computer.
[17] The engineering panel is used in setup of the system, and for diagnostics should and future trouble occurs.
[18] for viewing any given cameras image.
[19] for setup, and diagnostic use.
[20] RKB Drawing Number D111158.

Card Rack Information

In the appendix of this manual you will note the system schematics and mechanical assembly drawings with printed circuit boards that include:

Module; Camera Sync Gen.	D111055		1A1
Module; Timing, Horizontal	D110606		1A2
Module; Timing, Vertical	D110672A		1A3
Module; System Timing Dist.	D111076		1A4 & 1A5
Module; Video Multiplexer	D111051		1A8 – 1A11
Module; Edge Detection			1A12
Module; Streak Finder	D110045A		1A14 – 1A21

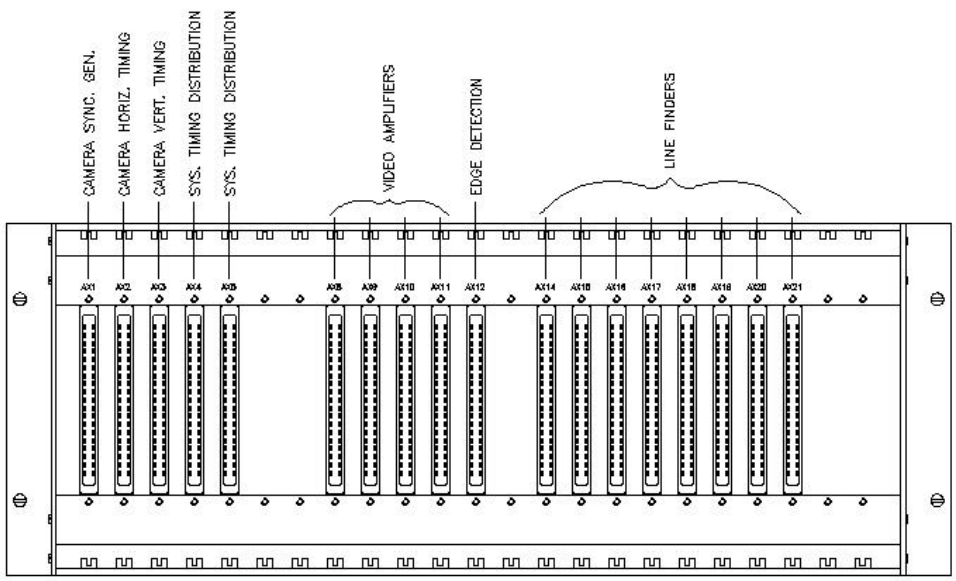

Figure 30 – Rack #1 (position on rack is referred to as XA1, XA2)

Module; Fir Filter #1	D110207		2A1, 2A3, 2A5,2A7, 2A9, 2A11, 2A13, 2A15, 2A17, 2A19
Module; Fir Filter #2	D110557		2A2, 2A4, 2A6, 2A8, 2A10, 2A12, 2A14, 2A16, 2A18, 2A20
Module; Field Odd/Even	D112855		2A21
Module; Comparator Reference Voltages	D111081A		2A22

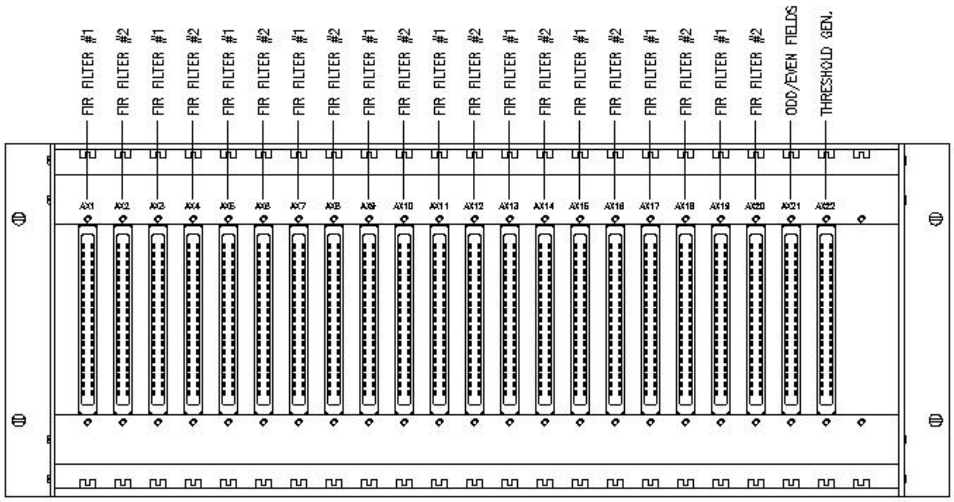

Figure 31 – Rack #2 (position on rack is referred to as XA1, XA2)

Module; Fir Filter #1	D110207		3A1, 3A3, 3A5, 3A7, 3A9
Module; Fir Filter #2	D110557		3A2, 3A4, 3A6, 3A8, 3A10
Module; Fields Odd/Even	D112855		3A11
Module; Diode Matrix	D110581		3A12
Module; Output	A113653		3A14

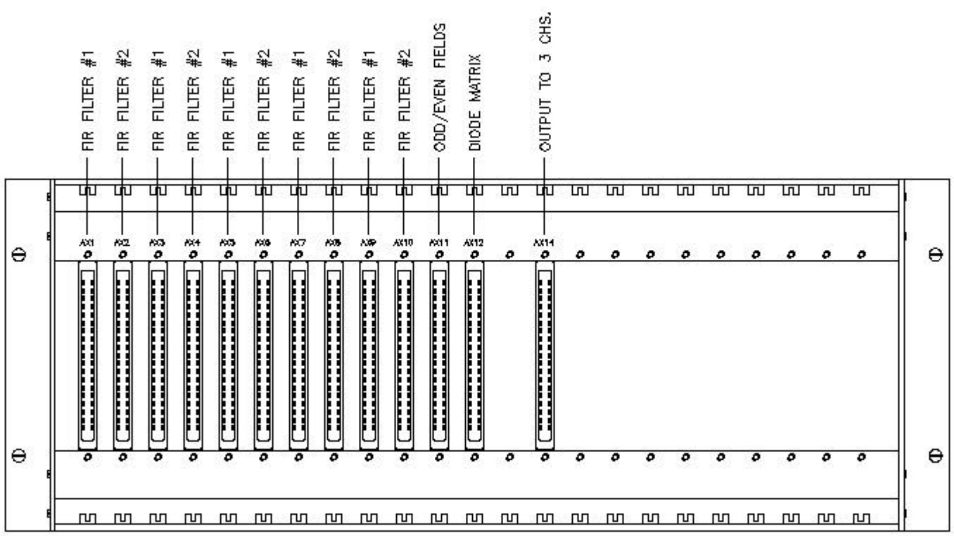

Figure 32 – Rack #3 (position on rack is referred to as XA1, XA2)

Signal Path -:

The video signals from the sensing channel are brought to the system electronics cabinet connector plate, and then to the system rack. Assuming all appropriate timing and power is present, the video signal is taken to the Video Multiplexer[21], and to the Video Selector[22]. (The video selector is not a part of the system rack, and is discussed later in this manual.)

The Video Multiplexer board combines two camera signals together to produce one video line, containing input from two video cameras. Video outputs from this board can no longer be viewed on a monitor, because the required monitor sync pulses have been removed from the composite video. The video information can however be seen on the oscilloscope. The video line is then taken to the Video Level Indicator[23] and the Line Finder Integrator[24].

The Video Level Indicator provides three outputs per video line in. The three outputs are lighting level indicators. Two appear on the engineering panel as LED's and are for use during setup and maintenance, they are labeled UPPER and LOWER. When both LED's are lit, the lighting level is appropriate. If either is off, the camera F-stop or the lamp intensity can be adjusted[25]. When both LED's are on, the third signal VIDEO OK is sent to the computer to indicate that the lighting is correct.

The Line Finder Integrator converts the video input to an analog voltage level on a per line basis, and provides a board attached LED to indicate maximum integration of the video signal, called MAX INT[26]. This LED is used in setup of the system to set appropriate video levels, and in diagnostic evaluation of system performance. From the output of the Line Finder Integrator, the voltage levels are passed to board 1 of the FIR Filter[27].

Board one of the FIR FILTER allows three comparisons to any given video line. The comparisons may range from 1 to 7 lines away from the given line, and are outputs called A, B, and C. These outputs become the inputs for board 2 of the FIR Filter[28], which converts the analog comparisons made on board 1 into digital representations of a streak. This digital output is then taken to the Defect Size Classification[29] board.

Defect size classification determines which of three categories a particular streak belongs to. The sizes are given the generic terms NARROW, MEDIUM, and WIDE, and are provided as outputs. These outputs are then presented to the Defect Storage Latches[30].

The defect storage latches save the streak information, and interrupt the computer alerting it to the flaw. The computer is then able to read the latches and can display which camera encountered what category of steak. A separate shaft encoder[31] supplies the input to the Footage Counter[32], which in turn provides the computer with a 20 bit binary count[33] of the length of web that has passed the sensing channel. The streak width and footage are displayed graphically on the computer monitor, and can be saved for up to two weeks on the computer hard disk.

[21] RKB Drawing Number D111051.
[22] RKB Drawing Number D111052. Although not a part of the system rack, this board is housed in the system electronics cabinet.
[23] RKB Drawing Number D110194A.
[24] RKB Drawing Number D110045A.
[25] Lamp intensity is not singularly adjustable, i.e. all lamp intensities change together.
[26] The MAX INT LED may occasionally flash, but should not be on steadily.

[27] RKB Drawing Number D110207.
[28] RKB Drawing Number D110557.
[29] RKB Drawing Number D111083.
[30] RKB Drawing Number D111059.
[31] The shaft encoder should provide one 5 Volt pulse every foot of web travel. In the event that this is not available, a rate multiplier is available to modify this requirement.
[32] RKB Drawing Number D111079.
[33] Maximum count of 1,048,575 feet.

Auxiliary Electronics -:

The system electronics cabinet contains eight additional boards not used to process the video signals directly. The boards are the: Area Camera Sync Generator[34], Camera Horizontal Timing[35], Camera Vertical Timing[36], System Timing Distribution[37], Marker Controller[38], Footage Counter[39], Alarm Circuits[40], and Diagnostics[41].

These boards are required for proper system operation and are explained later in this manual under the title board level functions.

Board Level Functions -:

NOTE: This section of the manual is provided as an aid to system debugging and troubleshooting. It is expected that the reader will have all appropriate drawings at their disposal when reviewing this section[42].

System Timing Requirements

a) Area Camera Sync Generator (*D111055*):

The camera sync generator uses a Savoy S1100 crystal oscillator to generate a 20.664 MHz clock. That clock is called the Data Rate Clock or DRC. The DRC is then reduced to 2.583 MHz that is used to drive the ZNA134 video timing chip. This chip then produces the required Horizontal and Vertical Sync pulses also call Horizontal and Vertical Drive, the Mixed or Composite Sync signal, and the Even Field sync pulses.

The data rate clock and the horizontal and vertical Sync pulses are used throughout the rack to provide correct timing information. The composite sync signal is sent to the sensing channel for distribution to each camera. Even field sync pulses are used in the rack to identify Frame starts. A frame is the combined video signal from two cameras, multiplexed onto one line. The even field sync is buffered through a 74LS244 for distribution, and renamed Frame Index or FI.

Timing information relevant to the signals discussed is included on the drawing and is available on Drawing Number D111196 as well.

b) Series 3000 Area Camera Horizontal Timing (*D110606*):

The area camera horizontal timing board produces additional timing signals as well as defining the pixel width of the video signal actually processed[43].

The horizontal and vertical sync pulses are passed through a series of one shot mono-stable multi-vibrators to produce three signals:

Video Timing Check - is used as a visual indicator of video signal presence.[44] Sample and Hold Control - a signal used to provide appropriate timing information for video processing.

[34] RKB Drawing Number D111055.
[35] RKB Drawing Number D110606.
[36] RKB Drawing Number D110672.
[37] RKB Drawing Number D111076.
[38] RKB Drawing Number D110563.
[39] RKB Drawing Number D111079.
[40] RKB Drawing Number D111095.
[41] RKB Drawing Number D111003.
[42] Enough space to view at least four "D" size drawings simultaneously is recommended.

[43] The pixel width of the video signal is set by the camera itself, and not all of the pixels are appropriate for video interpretation. Therefore a portion of the pixels at the beginning and end of each horizontal line are ignored.
[44] Video timing check is not used in the MEAD system.

Video Switch Gate - provides switch timing information to the video Multiplexer. The data rate clock (DRC) is counted using three 74LS192 chips, the outputs of which are compared to jumper set values using two sets of three 74LS85 chips. When the count reaches the values set by the jumpers[45], a pulse is sent to the 74279 SR flip flop, creating the integrator control signal output which is 7high when pixels contain valid video information, and low when they do not. The integrator control signal is combined with the vertical field of view (VFOV)[46], to create the field of view gate (FOVG).

The data rate clock is also reduced to provide a 1.202 MHz signal for the FIR filter boards. Timing information for these signals is included on the drawings, as well as drawing number D111196.

c) Series 3000 Area Camera Vertical Timing (*D110672A*):

The vertical timing counts the number of lines produced by the camera, and compares the count against jumper set ODD/EVEN FIELD START/END values[47]. When the count is equal a jumper value, the comparator pulses an SR flip flop, setting and resetting the vertical field of view for both odd and even fields. VFOV0 is high when valid video is present, and low when the video is invalid.

The line count is also compared to a switch setting to create an adjustable oscilloscope trigger. Changing the switch changes which lines can appear on the oscilloscope during testing.

Timing information for these signals is included on the drawings, as well as drawing number D111196.

d) System Timing Distribution (*D111076*):

The system timing distribution board is simply a multiple buffer board, capable of buffering five independent TTL signals. Although each buffer is labeled for a specific signal, it is not mandatory to use the buffers for those signals exclusively[48].

e) Video Multiplexer, Camera Selector (*D111051*):

The video multiplexer is the first board in the video processing sequence. The video signals are multiplexed through a DG181AP that is timed using a toggle configuration on a JK flip-flop. The multiplexed signal is buffered and available for display on the monitor[49] using the monitor select board described later. The pre-buffer multiplexed signal is also taken to a test-point to allow monitoring with an oscilloscope, and then is amplified using a variable gain non-inverting configuration op-amp with adjustable DC level setting[50].

The video signal is then split. One portion being sampled and the sync pulses removed using the sample and hold circuitry on drawing number D111051, and the other portion being passed directly to another DG181AP switch. The timing of the control signals to the switches causes the sampled line to be injected in to the interval previously occupied by the sync pulse, thus removing the sync pulses from the video signal, and replacing them with that particular lines sampled video level.

The final video signal is then buffered, passed to a test point, and available as output.

f) Edge Detection (*N/A*):

The description for Edge Detection will be amended to this manual shortly.

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[45] Initial factory settings are PEL START at 090, and PEL END at 530. Note that the most significant digits of both jumpers are the right-most values on the schematic.
[46] VFOV is explained under the heading Series 3000 Area Camera Vertical Timing.
[47] Initial factory values are set at: ODD FIELD START 050, ODD FIELD END 252, EVEN FIELD START 314, EVEN FIELD END 522.
[48] Only one of the three boards used in the MEAD system actually uses the signals as labeled.
[49] In the MEAD system, video images are sent directly to the monitor select board, bypassing the video multiplexer entirely.
[50] The average signal level at the op-amp output should be 20mV.

g) Video Level Indicator (*D110194A if applicable*):

The video level indicator buffers the incoming video signal before driving two comparator inputs. The remaining input terminals are adjustable DC levels, allowing the video threshold to be manually set. Proper level settings cause both upper and lower engineering panel LED's to light, and send a video ok signal to the computer. Failure to properly set these indicators is displayed on the computer, but does not inhibit system operation, unless of course the video signal is not sufficiently strong.

h) Line Finder Integrator (*D110045A*):

Video at the input of the line finder integrator is switched to a miller integrator using timing from the integrator control signal[51]. The integration of the signal is passed through another DG181AP switch until interrupted by an internally generated Sample CONTROL. The integrated signal passed by the switch is stored on a capacitor and buffered by a non-inverting op-amp[52]. After this sample and hold configuration, the signal is split, the first path is simply buffered and presented at the output.

The second path is the input for a comparator that allows the integrated signal level to be compared with a manually set negative five (-5) volt DC level. The miller integrator builds a negative voltage that is compared with the threshold voltage. A more negative voltage on the integrator[53], causes the MAX INT (maximum integration) LED to come on. Because any streak detected reduces the magnitude of the integration, occasional flashes on MAX INT can be ignored, however a steady illumination indicates too much gain in the system. Gain can be reduced using the input pot on the line finder integrator.

i) FIR Filter Board #1 (*D110207*):

The first board of the FIR FILTER stores eight (8) integrated line voltages using timing produced on board two. The timing signals labeled A,B,C, and D are explained with board two. At this point it is sufficient to know that the signals occur in alphabetical order[54]. The board presents the integrated lines at three sets of eight different jumper positions, utilizing two unused positions to keep the incoming lines in singular sequential order. Jumpers on the board allow comparisons between lines up to seven positions away[55]. A significant difference between two lines indicates the presence of a streak.

Three outputs measuring the difference in line integration levels between the three different jumper positions[56] are then available for board two.

j) FIR Filter Board #2 (*D110557*):

The second fir filter board, is an analog to digital converter for the outputs of board one, with timing generation for both boards one and two.

The differential outputs A and B of board one are switched onto board two, buffered, DC stripped, buffered again, and compared to two reference voltages[57]. The comparator outputs are recombined and available as board outputs A and B.

[51] Explained on Series 3000 Area Camera Horizontal Timing drawing number D110606.
[52] The capacitor and buffer combination is labeled Sample & Hold on D110045A.
[53] i.e. integrator voltage is less than -5 Volts DC.
[54] i.e. A then B then C then D then A then B then C ...
[55] The line at jumper 1 is compared to the line present at one other jumper position. Thus three comparisons can be made on the board.
[56] The three jumpers are originally set 1&2, 1&4, 1&8.
[57] Reference voltages are generated by the MBIC-3 computer.

Differential input C is also switched and buffered, but is not DC stripped. The input is split, and compared to two manually set[58] reference voltages using single supply op-amps, and recombined to produce a rectified output which is then compared to another manually set DC level[59]. The DC level is gated at the input of the comparator using VFOV0[60], integrated[61], DC stripped, and compared to another reference voltage[62]. The output of the comparator is then inverted, and available as output.

The timing generation on board two is complex, and page two of drawing number D110557 contains several timing diagrams to aid in comprehension of the circuitry. Essentially, the data rate clock DRC was divided by sixteen and became the digital filter control (DF Control). DF Control is divided by two, counted using a BCD counter (74LS192), and de-multiplexed using a 7442. Timing signals A through D are available as outputs for board one.

TECHNICAL NOTE: *At this point, the analog video signal has been converted to a digital streak indicator. When viewing FIR Filter output on an oscilloscope, a pulse will be present at the start of each horizontal camera trace. This occurs due to camera recharging during vertical retrace, and is not considered a streak. The signal itself is removed using the field of view (FOV) gate on the defect size classification board*[63].

k) Comparator Reference Voltages: (*D111081A*):

The comparator reference voltage board accepts as input four[64] analog inputs from the data acquisition system, which range from 0 to 10 volts dc. Each input is split and serves as input for two op-amps. One amplifier is in a non-inverting configuration, while the other is inverting. Both op-amps serve as buffers. The inverting configuration provides the negative polarity.

l) Defect Size Control: (*D111086 if applicable*):

The defect size control board serves as a buffer for the distinctions between narrow and medium, and medium and wide streaks. The actual distinctions are provided by the DAS[65]. The system horizontal sync (HD) is also buffered. An additional signal is generated using Frame Start and is called FIELD INDEXED. Setting jumper B1 to connect Z5 with Z4, passes a 33 ms pulse generated through the 10 us one shot driven by the frame start. The field index is used as a reset later in the system.

m) Defect Size Classification: (*D111083 if applicable*):

By using jumpers B1 through B9, the defect size classification board, allows masking of the inputs which are the digital streak detection outputs from the FIR Filter boards. All valid signals should be jumped to provide input[66]. The combined pulses of the input signals are counted using the 74LS193 and compared to the narrow-medium, and medium-wide values using 74LS85's. If the count exceeds the setup values, then the A>B output of the chip is asserted indicating that the streak width has passed from narrow to medium, or from medium to wide. A medium streak asserts both narrow and medium signals, and a wide streak asserts all three signals, but the number of signals passed to the output is reduced to only one of the three.[67] Finally, the camera multiplexing is removed using the odd/even signals and 74LS00 NAND gates. Use of the NAND gates also inverts the output in preparation for the next board.

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[58] Using potentiometer R7 and R13 mounted on the board.
[59] Potentiometer R19.
[60] Described previously.
[61] Integration is used to detect faint streaks.
[62] Reference voltage supplied by MBIC-3 computer.
[63] RKB Drawing Number D111083.
[64] In the Mead system only three of the four inputs are used.
[65] Data Acquisition System.
[66] Jumping to ground should only be done to eliminate floating inputs.
[67] Note that if wide and narrow are low when narrow is asserted, that narrow will be preset, but if medium is asserted before clk1 is pulsed, narrow will be cleared, and the narrow input will be disabled. Similarly, if wide is asserted before clk1, medium will be cleared and disabled, and narrow will continue to be disabled, thus allowing only one of the three signals to be clocked to the output.

n) Defect Storage Latches: (*D111059 if applicable*):

The defect storage latches serve to store the defect data until the computer can retrieve it.[68] Any streak signal from the defect size classification board generates an interrupt for the computer, and traps the signal in a SR flip-flop. The SR output is presented to a 74LS153 multiplexer as input. The computer responds to the interrupt by enabling the multiplexer output, and selecting (S0 & S1) which input is to pass to the output. By polling the output in this manner, the computer is able to discern which of the cameras are detecting streaks within the web.

o) Marker Controller: (*D110563 if applicable*):

The marker controller board receives the interrupts generated for the computer, and provided the marker is not currently spraying, triggers the dwell[69] one shot, which in turn triggers the spray one shot, which if the web is present, asserts the spray output for the period of the spray one shot.

p) Footage Counter: (*D111079 if applicable*):

A shaft encoder mounted on the paper machine provides one pulse per foot[70] which is counted using a series of 74LS193's, that provide a 20 bit binary footage count for the computer.

The reel turn-up signal is clocked through a D flip-flop, and alerts the computer when the end of the reel is reached. A reset from the computer is used to clear the flip-flop, after reel turn-up has been set.

q) Alarm Circuits: (*D111095 if applicable*):

The interrupts generated on the defect storage latches board, are inverted, nanded, and inverted again[71] to preset a D flip-flop. Jumper B1 passes a regular clock signal to the flip-flop, and as long as the web is present, the horn relay signal is active for the length of the streak.[72]

r) Diagnostics Circuits (*D111003 if applicable*):

The diagnostic circuits provide the computer with a signal that indicates whether or not all the power supplies are properly functioning. Each positive supply is voltage divided, and becomes input to an AND gate. If all the positive supplies are functioning correctly, the voltage division remains a valid high TTL signal, and the signal to the computer indicates properly functioning positive power supplies. If one or more positive supplies are too low, the voltage divider will cause a low TTL signal, and the signal will indicate a faulty supply.

The negative power supplies are handled in a similar manner but require the use of a voltage comparator to convert the negative voltages to valid TTL signal levels. Each supply is voltage divided with voltages stepping from -1 to -7 volts. The supply providing the -1 volt level also provides a -7 volt level so that no supply can fail without being identified. Each of these levels is compared to the next higher level. If all the power supplies operate correctly, all comparators will be driven high. If any power supply fails, the voltage dividers will no longer maintain their negative voltages, and at least one comparator will drive its output low, thus providing a signal that indicates that all the negative supplies function, or that at least one does not.

[68] Computer delay is extremely short by mechanical standards, and can be assumed to be zero for web travel calculations.
[69] Dwell is an adjustable delay before spraying starts, and is used to allow multiple spray marker mounting positions while still marking the beginning of a streak.
[70] One pulse per foot can be obtained using the rate multiplier provided in the system cabinet.
[71] A low asserted AND is equivalent to a high asserted NOR, which is inverted to produce an OR, to preset the D flip-flop.
[72] A horn delay requested by Mead is mounted within the system cabinet, and allows a variable delay between streak detection, and horn sound.

s) <u>DIGIO Controller I/O Module</u> (*D113494 if applicable*):

The CPU system is interfaced with a digital I/O unit manufactured by R.K.B. OPTO-ELECTRONICS, INC. By manufacturing our own I/O, RKB has been able to maintain tighter control over the use of its I/O that can be applied to any CPU system available on the market. This facilitates easy interfaces and operations from system to system. The I/O handles the defect signaling processes prior to displaying the information in software format for operational and management use.

t) <u>DIGIO Controller I/O Module</u> (*D113495 if applicable*):

The CPU system is interfaced with a digital I/O unit manufactured by R.K.B. OPTO-ELECTRONICS, INC. By manufacturing our own I/O, RKB has been able to maintain tighter control over the use of its I/O that can be applied to any CPU system available on the market. This facilitates easy interfaces and operations from system to system. The I/O handles the defect signaling processes prior to displaying the information in software format for operational and management use.

u) <u>Relay Module</u> (D108147):

The relay module is used to convert DC output of the CMOS circuitry to 110-Volt AC capable of driving a 2.5 amp, non-inductive loads.

INTRODUCTION TO THE MODEL 3010® and/or MODEL 3040®

The RKB Model 3010® and/or 3040® OPTOMIZER® CCD Camera-based Video Web Inspection System uses Charge Coupled Device (CCD) cameras, power regulators, custom image processing hardware, and a CPU to assist paper manufacturers with their quality control goals. The system is composed of four major subsystems, as shown in ***Figure 33***.

Figure 33

PHYSICAL CHARACTERISTICS OF DEFECTS

The size of a defect event that will exceed the threshold values described above vary with each system, but are typically between the 0.001" to 0.010" (0.0254mm to 0.254mm) region. Detection requires not only sufficient size, but also significant contrast.

The defect must be significantly different than the surrounding product. For holes this is achieved by placing a light on the opposite side of the web from the camera sensors (*Figure 34*). When a hole passes between the sensor and lamp source, the camera 'sees' the light, which is significantly brighter than the web itself. To detect dark spots, a lamp source is normally placed on the same side of the web as the camera sensors (*Figure 35*). As the light reflects off the web, a dark spot presents another sizeable difference between the normal web material and the spot. Surface defects, which do not present a significant contrast with the surrounding web may be enhanced through various lighting and filtering techniques.

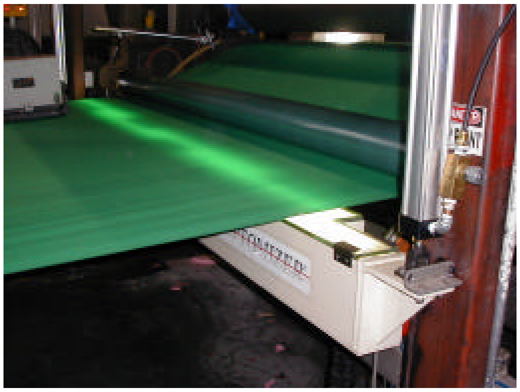


Figure 34

Figure 35

BENEFITS GAINED BY USING THE MODEL 3010/3040

One of the most pressing problems facing web material and converting manufacturers is the need to reliably, accurately and consistently identify various critical defect faults which can damage mechanical components and adversely effect overall quality and production in printing, embossing, coating, laminating and supercalender processes. To help optimize the production of material and eliminate these critical defects, RKB incorporates its Model 3010/3040 CCD camera-based video web inspection system, commonly called the OPTOMIZER. By using the OPTOMIZER system, manufacturers in all web industries can benefit by literally saving hundreds of thousands of dollars, if not millions per annum in lost production, broke, unnecessary down time, re manufacturing costs, customer claims, damaged soft rolls, damaged printing blankets, damaged embossers, coatings and laminators. Additionally, manufacturers will realize a higher quality product that has a higher value and increased market share. Overall, manufacturers will realize a significant increase in bottom line profits generated from products produced off of machines where inspection is applied.

THE MODEL 3010/3040® CCD CAMERA-BASED VIDEO WEB INSPECTION SYSTEM

Sensing Assembly, Lamp Assembly and controls

Fundamental parts of the Model 3010/3040 are as follows. The sensing assembly houses the digitally converted 1024 or 2048 pixel cameras and distribution control module (*Figure 36*). Relative to the web path, the system is generally located between the basis weight scanner and the take up reel (*Figure 37*). Since the sensing assembly is sealed and self contained, it is not recommended that it be opened except for purposes of supervised maintenance or repair. For additional information regarding the maintenance of the 3010/3040 sensing assembly, consult the maintenance section of this manual.

Figure 36

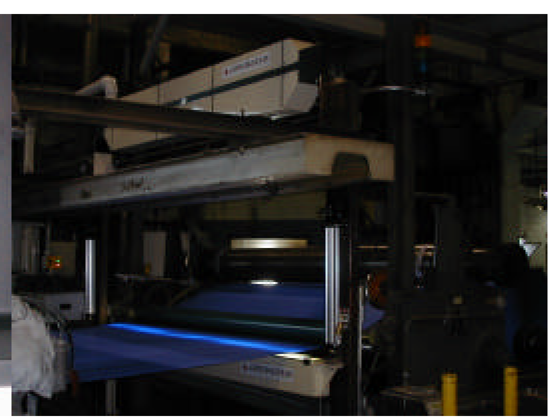


Figure 37

In connection with the sensing cameras, coaxial cables run between the sensing assembly and the operational/electronic control console. Depending on the number of sensors, you may have anywhere from 2 or more cable runs that are numbered according to the sensors with camera one specified at the tending side of the machine (*Figure 38*). Likewise, cables containing power and sensing signals for the cameras are located on the drive side of the machine and are connected on the top or side of the sensing assembly (*Figure 39*). The coaxial cable travels to BNC connector(s) on the electronic control enclosure (in cases of integrated floor units; the ops/elec control console) from the BNC connector(s) on the sensing assembly. These BNC connections are numbered and correlate to the sensor and its position with camera #1 located on the tending side (*Figure 40*). Also mounted within the sensing assembly are the controls distribution-module [D113514] which carries timing signals between the cameras and the control console hardware circuitry.

Figure 38

Figure 39

Figure 40

Digital CCD Cameras, containing either 1024 or 2048 line pixels, are mounted separately along the inside of the sensing assembly (*Figure 41*). Each camera is outfitted with a standard 25-mm lens for the 1024 pixel sensor and a 50-mm lens for the 2048 pixel sensor. These camera assemblies are then mounted directly over the moving web of material at a pre-designated distance away as approved prior to manufacturing (refer to approval drawing [D113625] in the appendix of this manual). Set up relative to the light sources, namely the VHO fluorescent bulbs, the cameras receive energy via the lamps (*Figure 42*). Accordingly, the cameras are designed to monitor variable field of views as specified by the setup information which is manually entered and stored as product codes for future reference (in some installations the fields of views are not variable or adjustable).

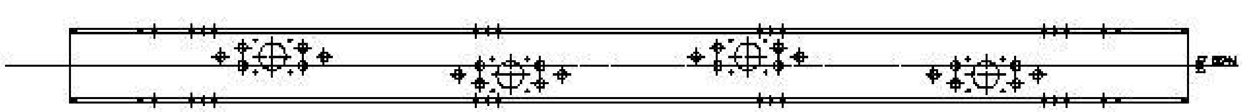


Figure 41

Figure 42

The Model 3010/3040 can contain two lamp assemblies, one providing reflective light, the other transmissive light. The reflective light sources are located on the same side as the sensing assembly (*Figure 43*) approximately one to two inches (2.54 to 5.08 cm) from the web material. The reflective lamp assembly consists of two triangular structures that span the entire web width. These structures are separated by approximately three inches (7.62 cm) allowing the cameras to focus the pixels onto the web material freely without any interference. Each assembly contains a varied number of 48" (121.9 cm), 64" (162.56cm), 72" (182.88cm) or 96" (243.84 cm) VHO fluorescent lamps which slightly overlap one another to provide an even and consistent lamp intensity across the entire web. These lamps are wired up and connected to individual high frequency power supplies located within the side frame structure which is completely housed from the environment in which it is installed in (refer to approval drawing [D113525] in the appendix).

Figure 43

The second lamp assembly that provides transmitted energy through the web for hole detection is located on the opposite side of the web from the sensing assembly *(Figure 44*). This assembly is located approximately one to two inches (2.54 to 5.08 cm) from the web and contains similar lamps as the reflected lamp assembly. Again, the lamps are slightly overlapped to provide an even, consistent intensity across the entire web.

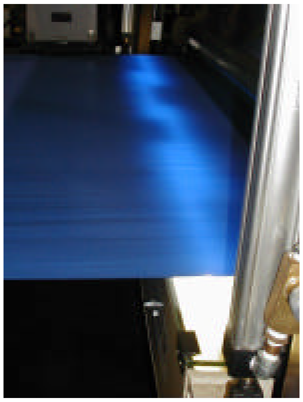


Figure 44-

These lamps are connected via a single bi-pin to a lamp socket at each end. The lamp sockets are spring loaded for easy access and removal (*Figure 45*). These lamp sockets are wired by way of an interior terminal trip to individual high frequency power supplies that are mounted within the lamp assembly on the bottom side. The emission of the lamp energy is controlled by way of a photodetector interfaced directly into the HF lamp power supply to facilitate a constant illuminant (*Figure 46*). The transmissive lamp assembly is completely sealed from the environment with a tempered glass cover approximately ¼" (6.35cm) to ¾" (19.05cm) thick to prevent any debris from damaging and obstructing the lamp sources themselves or their emission of energy (*Figure 47*).

Figure 45

Figure 46

Figure 47

The sensing assembly and lamp assemblies are configured such that the camera's field of view will always be perpendicular to the illuminated web. These fields of views are related to the channel or zone locations setup via the software prior to running a prescribed product mix. The number of channels generally can be changed to facilitate future slit lines for subsequent processing (some systems are provided with fixed channels). The number of channels can be configured per sensor or any part of anyone sensors. The fields of view setups allow for the desired trim on either side of the web material. Beginning with the first pixel location (of zone one), the zones or channels progress in a cross web direction from the tending side of the production machine to the drive side. Having the camera assembly and lamp assembly fixed in this position allows for a variation of the web width per future slit position while ensuring an accurate generation of channel locations. Under no circumstances should the aperture between the bottom lamp assembly and the sensing assembly be blocked. To ensure a valid defect signal for holes, it is necessary to keep the path clear between this aperture and the cameras. Equally important, a direct alignment between the sensing assembly and the bottom lamp assembly must be established upon installation (see installation procedure).

System Power Cabinet

The systems power cabinet provides primary power to the system and contains the low voltage power supplies, inspection system lamp source power on/off and related electronics (*Figure 48*). The five (5) volt DC power supply (located in the electronic control assembly) provides power to the various electronic signaling modules located in the system electronic cabinet, camera sync distribution board located in the camera housing, which buffers the camera sync pulses generated in the system electronics cabinet, and feeds the buffered signal through the two multi-pin connectors, to the cameras. The cameras power, and power for the DC supply is brought to the sensing head from the system electronics cabinet.

Figure 48

System Electronics Cabinet

The electronic control assembly (**Figure 49**) is generally located within 20 feet (6 meters) from the inspection assembly on the drive side of the production machine. However, it can be located or custom manufactured to be located anywhere within the facility to include integrating it within the operational control enclosure for stand alone units provided it is approved prior to manufacturing. The appropriate cable lengths have been approved and should be already run prior to receiving the system. The enclosure contains the module racks, electronic modules, engineering workstation, oscilloscope, and miscellaneous electronics and hookups needed to generate accurate defect ***information (Figure 50***). Central to the process of detection, the OECE process circuitry receives power via a power conditioner, 50/60Hz and transformers (*Figure 51*) and sensory data from the sensing assembly. From the OECE the resulting defect signals are generated and sent to the Quality Assurance Management System, QAMS® that logs defect data for production and management use. Integrated control enclosures contain low voltage power supplies, module racks, electronic modules, CPU system, Keyboard and mouse, oscilloscope, engineering workstation, CRT display and miscellaneous electronics.

Figure 49

Figure 50

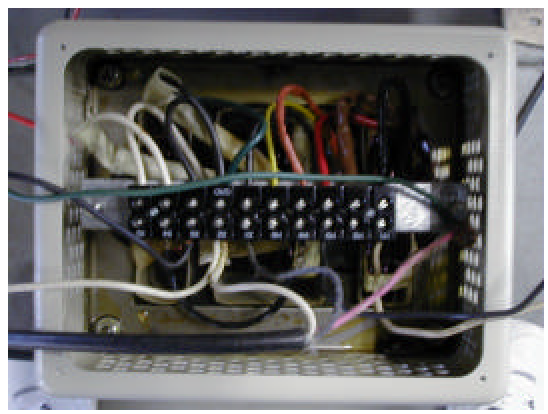


Figure 51

On the engineering workstation located within the OECE are a number of switches to be noted:

1. The main system power switch (S1) is an on/off push button found at the bottom of the panel door
2. The main system spray marking on/off push button with associated Dwell and Spray timing potentiometer adjustments
3. Main spray system indicator light
4. DC power supply on/off toggle switch
5. Low voltage power supply indicator lights.

The oscilloscope trigger is located in the front of the console to the right of the electronic modules rack system. These switches (thumb wheel) are used for system calibration purposes only. Located via the left side of the OECE you will see the military connector plug J1 and associated coax cable connectors for the cameras. These connectors are used to carry signals to and from the OECE to the sensing assembly. Various terminal strips, fuses, relays and BNC connectors are also located within the OECE. For further information regarding the internal composition of the OECE see drawing [D113709] for clarification.

Figure 52

Voltage Requirements

+15 VDC power supply
- 15 VDC power supply
+ 5 VDC power supply

These power supplies are regulated and are required for powering the low voltage electronics. The +15VDC and **-**15VDC are required for the cameras and the sensor amplifiers within the analog part of the system. This includes the video, mixer, buffer and detection circuits and the **-**15VDC is required for the detector thresholding circuitry. These power supplies are located in the Lamp Power Enclosure (***Figure 48***)

The +5VDC is required for the digital logic of the integration circuits and cameras. These power supplies are available as standard commercial items. They are self-contained and rarely require adjustment. Of course, standard-troubleshooting procedures should be used if problems arise.

Video images provided by the CCD cameras are processed within the system electronics cabinet. When coating streaks are detected they are registered on the CPU system located in the operational control assembly or via a desktop version (approved prior to manufacturing).

The system electronic cabinet[73] houses all RKB custom video processing hardware, a data acquisition system[74] (DAS™), the engineering panel[75], oscilloscope[76], and various necessary terminal blocks and connectors, including the system electronics cabinet connector plate[77].

[73] RKB System Electronics Cabinet Wiring Diagram - Drawing Number D111171.
[74] The D.A.S. provides a data communication path between RKB hardware, and the computer.
[75] The engineering panel is used in setup of the system, and for diagnostics should and future trouble occurs.
[76] for setup, and diagnostic use.
[77] RKB Drawing Number D111158.

Card Rack Information

In the appendix of this manual you will note the system schematics and mechanical assembly drawings with printed circuit boards that include:

Camera Timing Module	D110487A	RKB 402286	1A1
Buffer, Timing Distribution Module	D111076A	RKB 403340	1A2
Comparator Reference Voltage Module	D111081B	RKB 403343	1A3
Analog Signal Processing Module	D111947	RKB 403993	1A6 & 1A9
Edge Crack Detection Module	D113496	RKB 404756	1A10
Hole Fault Size Classification Module	D110753	RKB 403392	1A13 & 1A14
Spot Fault Size Classification Module	D110753	RKB 403392	1A15 & 1A16
Defect Size Latch Module	D113492	RKB 404757	1A17
Odd/Even Module	N/A	N/A	1A18
Signal Multiplexor Module	D112800	RKB 404755	1A21

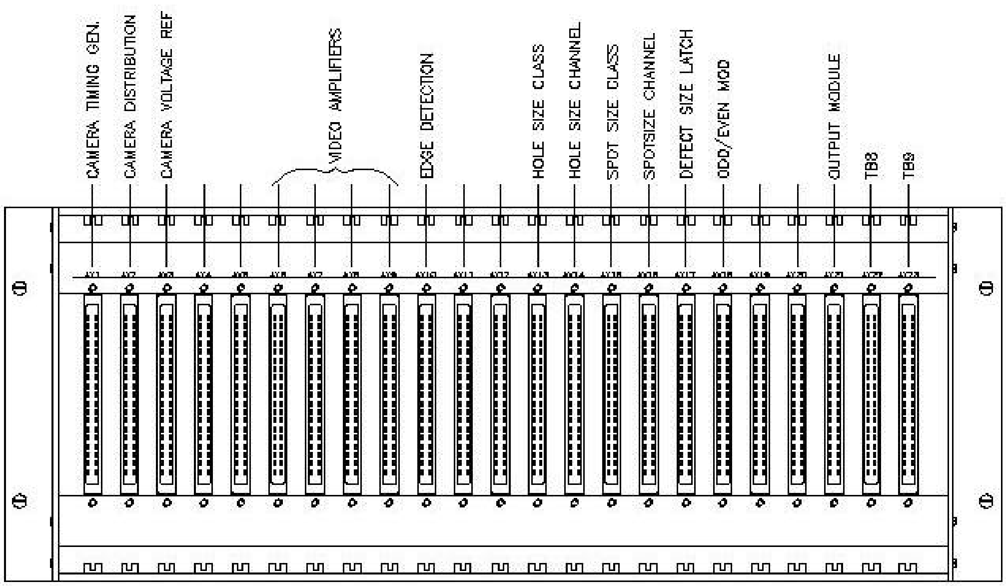


Figure 53 – Rack #1 (position on rack is referred to as XA1, XA2, etc)

Series 3000 CCD Camera Timing Module [D110487A]

The **MASTER TIMING** or series 3000 digital camera timing module [D110487A] generates all pulses and signals that make the camera work. A quartz crystal oscillator generates up to a *18-megahertz frequency*, and this frequency is the basic signal used to generate the data rate (+/- DRC), the exposure time of the camera sensors (+/- EXP), the video switch gate (VIDEO SWITCHES GATE) which allows for a completed signal with the S/H insert, and this sample and hold operation. For further information regarding these functions, please see schematic D110487A, two sheets.

PLEASE REMEMBER CARE MUST BE TAKEN WHEN TROUBLESHOOTING; ALL CIRCUITS ARE CMOS. FOLLOW PROPER POWER UP AND POWER DOWN SEQUENCES DURING TROUBLESHOOTING PROCEDURES.

Buffer, Timing Distribution Module [D111076A]

The VMBD module conditions the analog signal from the camera such that it can be used in the channelization modules. The analog signal processor module [D111947] conditions the incoming analog signal in preparation for further digitalization. The auxiliary field of view (FOV) gates [D110202A] are programmed to define each pixel start and stop location utilized in the subsequent channelization. As stated previously, each channel or zone is related to the predefined setup entered by operational staff. These locations are generated through counters that set the data parameters for the possible FOVs that are to be later channelized, stored and monitored.

Comparator Reference Voltage Module [D111081B]

This module is set by the software to render a variable DC voltage level. This level is called the detector threshold level and is fed to the Buffer, Timing Distribution Module. When any analog voltage exceeds the detector threshold voltage on the VMBD, a 5-volt pulse is generated for the duration that the analog voltage exceeds the detector thresholds in accordance with the positive operational amplifier input. Negative polarity and threshold parameters are processed through an inverting operational amplifier configuration in a similar fashion. In this way, the PCB generates the comparator levels for the detector circuitry that then follows.

Analog Signal Processing Module [D111947]

The analog signal-processing module conditions the incoming analog signal in preparation for further digitalization.

Edge Crack Detection Module [N/A]

The Edge Crack Detection Module or logic timing generates the timing to determine where the edge of the web is being inspected as it is located relative to the sensor video window. It also generates a pulse that appears at the output if a crack is detected. The pulses that are required from the master timing are the video switch gate, the +/- DRC and the +/- EXP. The +/- EXP is used to derive the proposed five-second time constant needed to determine the edge of the sheet position. The video switch gate is used to allow only valid video information that is produced during the 2000 pixel readout. The +/- DRC is needed in counter changes to count the number of pixels, beginning with the edge of the sheet where pixel one is located. The resulting output is a level shifter from 5 VDC to 15 VDC as the input to the VMBD Module.

Diagnostics Module [D111003C]

The diagnostic's module provides the CPU with a signal that indicates whether or not the power supplies are properly functioning. Each positive supply is voltage divided, and becomes input to an AND gate. If all the positive supplies are functioning correctly, the voltage division remains a valid high TTL signal, and the signal to the CPU indicates properly functioning positive power supplies. If one or more positive supplies are too low, the voltage divider will cause a low TTL signal, and the signal will indicate a faulty supply.

The negative power suppliers are handled in a similar fashion but require the use of a voltage comparator to convert the negative voltages to valid TTL signal levels. Each supply is voltage divided with voltages stepping from -1 to -7 volts. The supply providing the -1 volt level also provides a -7-volt level so that no supply can fail without being identified. Each of these levels is compared to the next higher level. If all the power supplies operate correctly, all comparator's will be driven high. If any power supply fails, the voltage dividers will no longer maintain their negative voltages, and at minimum, one comparator will drive its output low, thus providing a signal that indicates that all the negative supplies function, or that at least one does not.

Marker Control Module [D110563B] (IF APPLICABLE)

The MCM controls all functions of the Model 1280™ multicolor spray marking system. This module contains the logic to control the automatic web tracking, activate appropriate spray and color valves, control dwell and spray time and control all movement of the spray head assembly. This module is a 15-VDC CMOS digital circuit receiving input signals from the inspection and control device, sheet break indicator, edge sensors, test station and control station. Outputs all go to a solid state relay module.

The solid state relay module is used to convert the DC output of the CMOS circuitry to 110-Volt AC capable of driving a 2.5 amp, non-inductive loads. Power supplies provide regulated DC power for use on both the MCM and relay modules.

Auxiliary Field of View Gates Module[D110202A] (IF APPLICABLE)

The auxiliary fields of view gates are programmed to define each pixel start and stop location utilized in the subseq2uent channelization. As stated previously, each channel is related to the channelization setup, maximum 10 channels available. These locations are generated through counters that set the data parameters for the possible field of views used by the system and are later channelized, stored, and monitored.

Channelization Logic Module [D110997] (IF APPLICABLE)

The channelization logic modules determine the channel positions by converting the pixel counts generated in the AFV gates. By combining the channel position information set up by the FOV modules and defect status per channel generated by the DTCs, the channelization logic modules transfer this composite data to the defect storage latches.

While the distinguishing of small defects is completed by the defect fault size classifier circuitry, the small spot separator does the separating of large and small dirt (spot) defect. The defect fault size classifier [D110753] distinguishes large spots from small spots following channelization. While large spots are automatically reported to the QAMS™ system to be processed, small spots are redirected to the central processing unit. There they are counted and monitored. If the small hole count exceeds a preset level defined by operational staff, a defect signal is generated. In this way quality assurance is maintained without unnecessary losses.

Defect Fault Size Classification Module [D110753]

The defect fault size classifier utilizes data signals received from the defect size latch modules and converts it from serial to parallel output. This process of conversion and storage prepares the defect data for quick transport to the CPU system software program or QAMS. The DFSC decodes, analyzes and processes the defect data into various sizes (i.e., large, medium and small). While large defects are automatically reported to subsequent processes such as marking, medium and small defects are redirected to the systems central processing unit. There they are counted, stored and monitored. If the small defect count exceeds a present level defined prior by mill operations, a reject signal is generated and the roll is subsequently marked as with large defects. In this way quality assurance is maintained without unnecessary losses. Should an event be detected during this process an interrupt occurs, thus flagging the location of the defect and generating a defect signal. Located not within the racks, but within the sensing assembly, the Opto-Tek III timing distribution module]D110796] distributes power and signals to the cameras.

Defect Size Latch Module [D113492]

The DFL modules receive information from the CPU relative to setting up defect sizes. Once the desired defect sizes are set (i.e., large, medium and small) the DFL is ready to transport the data to the defect fault size classifier for further processing. Once there, the information is decoded, analyzed and processed.

Signal Multiplexor Module [D112800]

All defect signals including holes and spots pass through the signal Multiplexor [D112800] which are located in Rack one. From there the signals are redirected to the relay module which is mounted separately behind the oscilloscope within the OECE. Through the relay module the spray marking system and indicator lamps are served and maintained.

Items mounted within the electronics control console (not rack wired):

Relay Module [D108147]

The relay module is used to convert DC output of the CMOS circuitry to 110-Volt AC capable of driving a 2.5 amp, non-inductive loads.

DIGIO Controller I/O Module [N/A]

The CPU system is interfaced with a digital I/O unit manufactured by R.K.B. OPTO-ELECTRONICS, INC. By manufacturing our own I/O, RKB has been able to maintain tighter control over the use of its I/O that can be applied to any CPU system available on the market. This facilitates easy interfaces and operations from system to system. The I/O handles the defect signaling processes prior to displaying the information in software format for operational and management use.

DIGIO Controller I/O Module [N/A]

The CPU system is interfaced with a digital I/O unit manufactured by R.K.B. OPTO-ELECTRONICS, INC. By manufacturing our own I/O, RKB has been able to maintain tighter control over the use of its I/O that can be applied to any CPU system available on the market. This facilitates easy interfaces and operations from system to system. The I/O handles the defect signaling processes prior to displaying the information in software format for operational and management use.

Oscilloscope

RKB has chosen the Tektronix® digital real time oscilloscope for use in the Model 3040. The oscilloscope is used primarily for system setups and troubleshooting. It is also used when the calibration of the equipment is checked or adjusted. The oscilloscope features a 100-MHZ bandwidth with selectable 20 MHz bandwidth limits. Each channel has a 1 GS/s sample rate with a 2,500 point record length. The display is a high resolution, high contrast LCD with temperature compensation and backlight. It has a dual time base, video triggers and a RS-232, GPIB and Centronics communication port capability. A user interface is available in 10 user selectable languages.

Items mounted within the Camera Inspection Housing (not in the Electronic Control Console):

Camera Timing Dist. Module [D110723]

The sensor sync timing distribution module is found in the sensing assembly. Its sole function is to serve the distribution of power and signals from the electronic controls to the camera sensors.

Miscellaneous Items:

Air-conditioning Unit (IF APPLICABLE)

The air-conditioning unit selected by RKB is a KOOLTRONIC® self contained, closed loop system. The unit will provide up to 4,000 cooling BTU/H. The power requirements are provided by RKB and will run off of 115V, 50 Hz. The Design Pressure P.S.I.G. runs from 150 minimum to 350 maximum with a 20-Amp maximum fuse capability. The unit contains its own built in condensate evaporators.

Power Conditioner

RKB has selected a state-of-the-art power-conditioning unit supplied by SOLA®. The unit is a single phase, 220/240 VAC input, 50 Hz regulator that provides virtually instantaneous voltage regulation and isolation from both transverse and common mode noise for any type of load. It also suppresses transients, protects from overloads and serves as a portable dedicated line.

Encoder Unit (IF APPLICABLE)

The Model 3040 comes complete with a digital encoder unit used to calculate footage, whether in inches or millimeters. This footage is put through various algorithms to determine actual machine speed. Once the speed of the machine is determined, defect locations and correct spray time intervals can be setup and/or accomplished. If the encoder is not setup correctly, you may spray well after a defect has gone by or mis spray when not required.

Operator Console (IF APPLICABLE)

The NEMA rated operator console provides the man/machine interface for the RKB® Model 3010/3040® OPTOMIZER® CCD Camera-based Video Web Inspection System. Housed within the console, is a custom designed data acquisition system including the computer, monitor, multiple disk drives, and the keyboard. Textual and graphical representations of the streaks are available (where control rooms are available, RKB provides a desktop CPU Operational Unit).

INSTALLATION & HOOK UP

MODEL 3020

After physical installation of the Sensing Channel, System Electronic Cabinet, Operator Console, and the Lamp Power Supply, each unit must be wired to power, and to the other subsystems that comprise the Model 3020. Once all connections for the Model 3020 have been made, the system must be calibrated to insure proper performance. Physical adjustments to the cameras within the sensing channel should be performed first.[78]

NOTE: Each subsequent instruction assumes that all previous instructions have been completed.

System Installation and Hookup

Lighting techniques and camera angles are significant factors in the reliable detection of defect events, web breaks and edge cracks. Specific relationships between the physical components of each system are calculated at R.K.B. OPTO-ELECTRONICS, INC., prior to construction of any system itself. The installation of this equipment must be done in accordance with the certified approval drawings from which the system design is based from. The following instructions are to be used as an aid in the installation process only. Prior to installation, make certain that you have reviewed the Master Assembly drawing [D113621].

Mechanical Installation

When installing the camera assembly and lamp housing be especially careful not to drop or damage the equipment since the units are very fragile. Follow the installation drawings referenced in the following sections and be certain that final installation measurements are complied precisely. Alterations of the camera assembly or lamp housing measurements can greatly affect the accuracy and efficiency of the overall system performance.

Mounting the Sensing Beam

The sensing assembly or beam is to be mounted 8.82 inches (22.40 cm) over the center of the web relative to the bottom of the sensing beam covers (not from the cameras). The assembly is comprised of one piece with four access panels that are screwed down into the main channel framework on both sides. It is these panels, when removed, which will facilitate access to the cameras for adjustments or replacement. Make certain there is no other components or material blocking the capability of removing these panels. The sensing beam alignment is very vital to the overall success of detection and quality assurance monitoring. Its orientation relative to the material web must be maintained; likewise the distance between the sensing beam and bottom lamp-housing unit is specified in the mechanical drawings. The sensing beam comes with two steel structured angle mounts. The angle mounts are bolted onto both ends of the sensing beam The sensing beam is then hoisted to the installation area (ensuring that you keep your measurements as listed above) and is bolted to the frame work supplied by the customer (in the case of an O-Frame, RKB supplies frame work). Do not tighten the bolts completely until the lamp housing is installed as some slight adjustments must be made. The blower unit, which comes with the system to provide positive purging of the sensing assembly, must be secured to the floor to ensure stability. Likewise, all cables running to and from the sensing assembly should be run through shielded conduit to minimize interference or noise.

[78] Camera adjustments normally require the web to be absent.

Installation of the lamp housing (*If required*)

In most systems, two lamp housing are supplied, one providing reflective light the other transmissive light. The reflective lighting is generally provided in the same enclosure as the sensors and is setup prior to shipment. The bottom lamp housing if provided, is to be mounted in as specified by approval drawing [*not required for this application*]. The lamp housing should be bolted to the lamp housing support weldment, which in turn mount to steel structure framework or pneumatic cylinders for removal during web breaks. Make certain that the lamp housing is mounted directly under the top lamp-housing unit if applicable or the sensing beam. The unit should be mounted to ensure the distance from the paper is maintained across the entire length of the lamp assembly. At this time, a plump bob should be used to ensure the lamp assembly is directly centered and under the sensing beam. Once verified, the lamp assembly should be bolted down securely. At this time the sensing beam can be tightened down securely.

Be sure not to drop the lamp assembly during installation as the fluorescent lamps and power supplies are fragile and will break. It is imperative that alignment between the bottom lamp housing and sensing beam be maintained as well as the distance between them. Without proper alignment or accurate distance the detection of defect events will be compromised and faulty. Be sure to bolt the bottom lamp-housing framework or mounting plates directly to the floor and secure all cables running to it in shielded conduit.

Electrical Installation

Interconnections between the separate components of the Model 3020® OPTOMIZER® CCD Camera-based Video Web Inspection System and Mill power are required for proper operation. **In wiring, be careful never to exceed the suggested voltage values needed to drive the CMOS and TTL electronics; in other words, do not mistakenly wire 115-120 volts to the printed circuit boards as it will damage or destroy them altogether**. Specific details of all connections are given in the wiring instructions within this manual. Copies of those pages may be made for installation purposes, but they may not be used in any way detrimental to the interests of R.K.B. OPTO-ELECTRONICS, INC.

Wiring Instructions

Drawing [A113697], sheets 1 through 2, are enclosed as the needed wiring instructions for this project. Be certain to follow these drawings when making interconnections between the sensing beam (for both lamps and cameras), bottom lamp wiring, rack wiring, system power distribution, computer wiring and related PCB modules, system interconnection, i/o units and cabling. All the aforementioned drawings are contained in the appendix of this manual.

Power Up Sequence

Locate the main power switch on the front door of the electronic enclosure and turn it ON. Within the control enclosure locate the toggle switches for the VDC circuits. Power up each one individually by switching the toggle switches to ON. Locate the lamp power switches and turn them ON. The Model 3020 should now be operational. Should problems occur with any component of the system during power up, please refer to the troubleshooting section of this manual.

Power Down Sequence

Locate the lamp power switch and turn it OFF. Locate the toggle switches for the VDC circuits and turn them OFF. No locate the main power switch on the front door of the electronic enclosure and turn it OFF. The Model 3020 should now be shutdown.

System Set Up

Once all connections for the Model 3020 have been made, the system must be calibrated to insure proper performance. Physical adjustments to the cameras within the sensing channel should be performed first.[79]

[79] Camera adjustments normally require the web to be absent.

NOTE: Each subsequent instruction assumes that all previous instructions have been completed.

(a) **Camera Adjustments**

To achieve a four-inch field of view,[80] the camera lenses should be set to a focal length of two (2) feet, with an F-stop of 8. The cameras are position adjustable front to back, left to right, rotationally, and angularity.

To align and adjust the cameras a tape measure must be affixed across the machine, in the web location as a target for the cameras, and a monitor should be used to view the video image. Each camera should see the tape in roughly the same vertical position,[81] and should not overlap with, or leave a gap from the previous cameras position.[82] Counting the number of inches visible on the monitor should set the field of view.[83]

NOTE: Not all of the video signal used to detect streaks is visible on the monitor, as a result the field of view appears to be about 1/8 inch less than it actually is. In adjusting the camera positions, it is important to be certain that the non-visible portion of the video signal, is aligned uniformly. (i.e. when aligning the cameras leave the 1/8-inch at the top of the monitor, or the bottom, but DO NOT alternate.)

The final camera adjustment requires the use of an oscilloscope. In order to maximize signal strength, the cameras must be aligned so that any streak will occupy the same horizontal lines completely across the monitor.[84] First a simulated streak must be placed within the camera view. Great care must be taken to assure that the simulation is in the machine direction, failure to match machine direction will cause this adjustment to weaken streak signal strength.[85] After loosening the rotational adjustment screws, connect the oscilloscope to the video output of the camera. Then while watching the oscilloscope, rotate the camera and watch for the point of maximum signal strength. The signal should be vertical and sharp on the oscilloscope. Once the greatest signal strength has been achieved, tighten the adjustment screws, and recheck the video signal on the oscilloscope. If the signal has remained strong, continue to the next camera until finished, if the signal has deteriorated, readjust the same camera again.

NOTE: After all sensing channel adjustments are completed, adjustment to the System Electronics Cabinet requires coated product to be present, and 60 AC volts across the lamp power triacs. To achieve this level, attach a RMS voltmeter across TB1-1 and TB1-8, and adjust the silver potentiometer on the left lamp controller board to obtain 60 AC volts. Then attach the voltmeter across TB3-1 and TB3-8 and adjust the silver potentiometer on the right lamp controller board again to obtain 60 AC volts.

(b) **System Cabinet Adjustments**

Adjustments within the System Electronics Cabinet begin with the Video Multiplexor board (D111051). The first adjustment should be to RA1. With the oscilloscope viewing TP5, adjust the potentiometer to replace the sync pulses with DC levels equal to the video levels of the signal.[86] While still viewing TP5, adjust R38 to create a 250-mV offset for the entire video signal. Repeat the same adjustments for RA2 and R39 with TP6, RA3 and R40 with TP7, and RA4 and R41 with TP8. Refer to ***Figure 54***.

---

[80] Mead Coated Board field of view is four inches.
[81] This adjustment is two screws located beneath the camera body which allow the camera to vary the angle between the light source and the camera itself.
[82] Three allen screws located under the camera lens provide this adjustment, which allow left to right movement of the camera.
[83] This adjustment is made by loosening the four mounting bolts and moving the camera forward or backward as needed.
[84] Two screws mounted under the camera lens provide this adjustment.
[85] It is best to place thread parallel to a machine support, in the view of the camera. Remember to place stock behind the thread to achieve the simulated streak.
[86] Frequently, only one cameras sync pulse will conform to the proper level at a time, in this case, be sure the alternate cameras sync pulse is at a level greater than the video level.

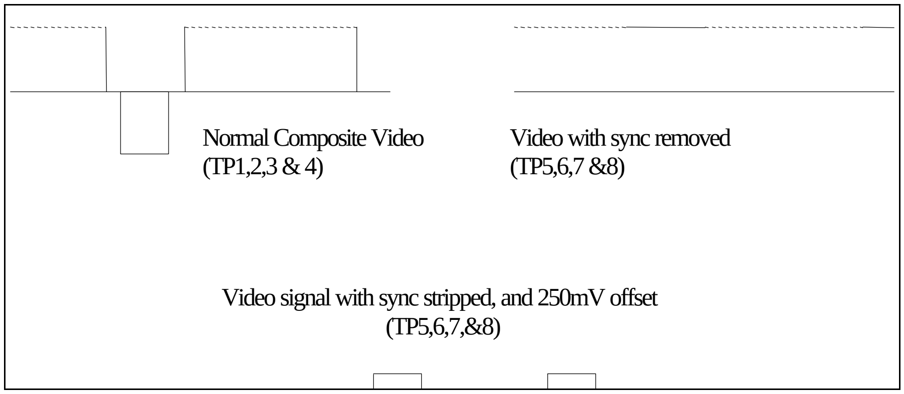


Figure 54 - Video Multiplexor Oscilloscope Images.

The adjustments to the video level indicator board (D110194B) do not require the use of the oscilloscope. While watching the appropriate UPPER LED, adjust R6,22,38,53 until the LED comes on.[87] To adjust the LOWER LED, turn the lamp intensity up to 100% (Voltage across triacs should be equal to zero volts), and adjust R12,28,44,60 such that the LOWER LED is off. Return the lighting to 50%, and verify that the LOWER LED is on.[88]

To adjust the Line Finder Integrator (D110045A), first adjust R12,29 to achieve a -5V DC level. Next turn R39,41 until the board mounted LED is on, then turn in the opposite direction until the LED is normally off.[89]

FIR Filter Board #1 (D110207) uses only jumper setting adjustments, which should be set from the factory. Any questions related to these settings can normally be answered by reviewing the schematic of the board, or calling RKB Opto-Electronics at (315) 455-6636.

To adjust FIR Filter Board #2, place the oscilloscope probe against Z12 pin 4 and adjust R13 until the scope shows a zero offset with very few raised levels, then move the probe to Z12 pin 5 and adjust R7 to accomplish the same zero offset with few raised levels. Move the probe to TP2 and adjust R19 to obtain a sharp spike at camera sync positions with little to no noise during valid video intervals. Verify FIR Filter output by probing TP6,7,4. Each test point should have pulses at sync positions.

To adjust the Comparator Reference Voltages Board (D11081A), set the computer defect threshold levels to 99. Then using the oscilloscope on TP1,2,3,4 set R2,29,56,83 to obtain a DC level of 2 Volts.

MODEL 3010/3040

Lighting techniques and camera angles are significant factors in the reliable detection of defect events, web breaks and edge cracks. Specific relationships between the physical components of each system are calculated at R.K.B. OPTO-ELECTRONICS, INC., prior to construction of any system itself. The installation of this equipment must be done in accordance with the certified approval drawings from which the system design is based from. The following instructions are to be used as an aid in the installation process only. Prior to installation, make certain that you have reviewed the Master Assembly drawing [D113625A].

[87] Assuming the LED is initially off, it should first flash, and then become steady during adjustment.
[88] It is suggested to adjust all UPPER settings first, and then increase lamp intensity and set all LOWER settings.
[89] Occasional flashing is acceptable.

Mechanical Installation

When installing the camera assembly and lamp housing be especially careful not to drop or damage the equipment since the units are very fragile. Follow the installation drawings referenced in the following sections and be certain that final installation measurements are complied precisely. Alterations of the camera assembly or lamp housing measurements can greatly affect the accuracy and efficiency of the overall system performance.

Mounting the Sensing Beam

The sensing assembly or beam is to be mounted 67.67 inches (171.96 cm) over the center of the web relative to the top of the camera lens position of the camera sensor. The assembly is comprised of one piece with three access panels that are screwed down into the main channel framework on both sides. It is these panels, when removed, which will facilitate access to the cameras for adjustments or replacement. Make certain that there are no other components or material blocking the capability of removing these panels. The sensing beam alignment is very vital to the overall success of detection and quality assurance monitoring. Its orientation relative to the paper web must be maintained; likewise the distance between the sensing beam and bottom lamp-housing unit is specified in the mechanical drawings. The sensing beam comes with two steel structured angle mounts welded onto each end. The sensing beam is then hoisted to the installation area (ensuring that you keep your measurements as listed above) and is bolted to the frame work supplied by the customer (in the case of an O-Frame, RKB supplies frame work). Do not tighten the bolts completely until the lamp housing is installed as some slight adjustments may have to be made. The blower unit, which comes with the system to provide positive purging of the sensing assembly, must be secured to the floor to ensure stability. Likewise, all cables running to and from the sensing assembly should be run through shielded conduit to minimize interference or noise.

Installation of the lamp housing

In most systems, two lamp housing are supplied, one providing reflective light the other transmissive light. The reflective lighting should be mounted according to the master installation drawing and positioned securely across the web to side frames if not already supplied by RKB. The lamp housing should be placed parallel to the sensing beam installed earlier. Once you have finalized initial alignment of the lamp housing to the sensing beam, tighten the beam to the side frames securely (make certain that the lamp housing is set at the appropriate distance from the paper all the way across and perpendicular prior to securing).

The bottom lamp housing is to be mounted in as specified by approval drawing [D113625A] provided earlier. The lamp housing should be bolted to the lamp housing support weldment which in turn mounts to steel structure frame work or pneumatic cylinders for removal during web breaks. Make certain that the lamp housing is mounted directly under the top lamp-housing unit if applicable and the sensing beam. The unit should be mounted to ensure the distance from the paper is maintained across the entire length of the lamp assembly. At this time, a plump bob should be used to ensure the lamp assembly is directly centered and under the sensing beam. Once verified, the lamp assembly should be bolted down securely. At this time the sensing beam can be tightened down securely. Be sure not to drop the lamp assembly during installation as the fluorescent lamps and power supplies are fragile and will break. It is imperative that alignment between the bottom lamp housing and sensing beam be maintained as well as the distance between them. Without proper alignment or accurate distance the detection of defect events will be compromised and faulty. Be sure to bolt the bottom lamp-housing framework or mounting plates directly to the floor and secure all cables running to it in shielded conduit.

Final adjustments relative to the sensing beam and bottom lamp housing are done by using the oscilloscope at TP1 of the analog signal-processing module. Adjusting the camera sensor position relative to the lamp then maximizes the signal. Focus and F stop of the camera is also finalized at this time (refer to calibration procedure located in the maintenance and troubleshooting section of this manual.

Electronic/Operational Control Enclosure

Remove any and all wheels from the operational and electronic control consoles and mount them onto a raised cement platform with mounting studs in the platform. In the case of operational equipment being supplied in a control room, find an adequate and suitable area that is easily accessed by operational staff and plug and play the CPU/Touch system. Cable entry to and from the console is normally through the floor. Drill holes in the mill floor prior to mounting the console, and either punch or drill holes in the console floor as required for conduit entry. This procedure may have been already provided by RKB if knowledge of mounting and preparatory work for mounting enclosures were already done prior to manufacturing of the system.

Electrical Installation

Interconnections between the separate components of the Model 3010/3040 OPTOMIZER and mill power are required for proper operation. In wiring, be careful not to exceed the suggested voltage values needed to drive the CMOS and TTL electronics, which are rated DC voltages. In other words, do not wire 115/220 volts to the printed circuit boards as they will be destroyed. Specific details of all connections are given in the wiring instructions within this manual [A113710].

Wiring Instructions

Drawing [A113710], sheets 1 through 4, are enclosed as the needed wiring instructions for this project. Be certain to follow these drawings when making interconnections between the sensing beam (for both lamps and cameras), bottom lamp wiring, rack wiring, system power distribution, computer wiring and related PCB modules, system interconnection, i/o units and cabling. All the aforementioned drawings are contained in the appendix of this manual.

Power Up Sequence

Locate the main power switch on the front door of the electronic enclosure and turn it ON. Within the control enclosure locate the toggle switches for the VDC circuits. Power up each one individually by switching the toggle switches to ON. Locate the lamp power switches and turn them ON. The 3010/3040 OPTOMIZER should now be operational. In some installations, RKB has installed a power up sequencer circuit so all you have to do is initiate the main power switch. Should problems occur with any component of the system during power up, please refer to the troubleshooting section of this manual.

Power Down Sequence

Locate the lamp power switch and turn it OFF. Locate the toggle switches for the VDC circuits and turn them OFF. No locate the main power switch on the front door of the electronic enclosure and turn it OFF. The Model 3010/3040 OPTOMIZER should now be shutdown. Again, if the equipment is installed with an auto sequencer circuit, then just turn off the main power switch.

Encoder Unit

The Model 3010/3040 usually comes complete with a digital encoder unit used to calculate footage, whether in inches or millimeters. This footage is put through various algorithms to determine actual machine speed. Once the speed of the machine is determined, defect locations and correct spray time intervals can be setup and/or accomplished. If the encoder is not setup correctly, you may spray well after a defect has gone by or mis-spray when not required. Additionally, you may have in-accurate footage readings. If current or pulses are provided via an outside source, make certain they are consistent and reliable. Any fluctuation will result in footage count irregularities. RKB cannot be responsible if the input is not consistent.

MODEL 1280

Model 1280 Multicolor Spray Marking System (*if provided*)

The Model 1280 multicolor spray marking system is intended to be employed in industrial web manufacturing processes for marking the edge of moving webs which are reeled up subsequent to the application of the mark. Spraying suitable marking fluids onto the sheet edge makes the marks such that when reeled up, the marks are visible as concentric, colored rings on the end of the reel.

The marking system may be employed with various types of automatic web inspection, splice detection or process control equipment to place marks at the sheet edge whenever a defect is identified in the web. Multicolor markers provide a red, green, blue, black or orange spray for different defect signals. This enables the colors to be used to indicate defect location in the cross machine direction or to be used to classify different types of defects.

The marks are applied by means of a fine spray nozzle that projects a controllable jet of fluid at the web. The spray system is operated under pneumatic pressure, with spray intensity adjustments available. The marking system is equipped with an electronic edge guiding system and, when operating in its automatic mode, will position the movable carriage assembly accurately over the edge of the web. A fine adjustment is provided to ensure that the spray is directed onto a narrow band at the web edge when the carriage is positioned.

RKB provides all ink and spare parts required for the proper operation and maintenance of the Model 1280. RKB requests that customers use RKB supplied ink as it is formulated exactly for use in our marking systems. If outside sources are used, RKB asks that a sample of the ink be provided to ensure correct acidity levels, etc. Note: Viscosity, acidity and other factors may affect operations.

Marker Controls

The Model 1280 Spray Marking Systems controls are located within the operational/electronic control console with access via the back door. All marker controls such as the low voltage power supplies, CMOS digital control modules, relay modules, sheet break relay and dwell and spray controls are contained within this enclosure which is NEMA rated.

Digital controls

The CMOS digital control modules control all functions of the marker's operation. These controls contain the logic to control the electronic edge guiding system, activate appropriate spray and color valves, control dwell and spray time and control all movement of the spray head assembly. These controls are run off of a +15 VDC circuit receiving input signals from the web inspection system or control device. Sheet breaks indicator, edge sensors, and test station and control station. Outputs all go to a solid state relay module.

Relay Module

The solid state relay module is used to convert the DC output of the CMOS controls to 110 VAC capable of driving a 2.5 amp non-inductive load.

Power Supply

The power supply provides regulated DC power for use on both the CMOS controls and the relay module.

Test Station

The test station, a separate NEMA rated enclosure, is a control station that is to be used to verify the application of ink. The test station has an activation button for each color and a web break bypass button for sheet break periods. The test station may also be used for manual activation of the spray marking system.

Spray Marking Assembly

This assembly contains all mechanisms required to mark the sheet and follow any web drift if required. The assembly consists of two major subassemblies. First, the sprays head assembly. The spray head of the marking system contains the ink applicator (spray nozzle) and the electronic edge guiding system. The mounting arrangement of the spray head will allow for a path that deviates +/- 30 degrees. The body of the marking system contains all color valves, regulators, fluid lines, ink well, ink bottles, flow caps, dust covers and lids to deliver the ink to the spray head assembly. The body of the marker also incorporates the mechanism to allow for movement to and from the sheet edge.

Over spray collection system

The over spray collection system mounts to the electronic edge guiding frames on the spray head assembly. The collection system is used to contain over spray form the ink applicator when activated. Because the marking ink is atomized when leaving the application nozzle, it is strongly recommended that the collection system remains attached and/or is installed on the unit. If physical restraints prevent installation of the over spray collection system, contact RKB so an appropriate collection system can be manufactured or modified.

PHYSICAL INSTALL of the MODEL 1280 (*if required*)

Model 1280 Multicolor Spray Marker Installation

When installing the spray head assembly, it is important to consider the following factors:

Location of the Inspection System

The location of the spray head assembly must be downstream from the inspection system to which it is interfaced with. This is done in order to permit accurate marking of the web. The marker must not be too far downstream from the inspection system or the spray will begin before the defect event arrives.

Roll Handling

The markings on the web should be visible to the rewinder operator. If the rolls are not turned around before being mounted on the rewinder, then marking should occur on the operator side of the web. If the reel is turned around before rewinding, then the marks should be made on the backside of the web, which when mounted on the re3winder would become the operator side. If physical constraints force marking the web on the side that will be opposite the rewinder operator, a mirror mounted at the rewinder can enable the operator to see the markings. Additionally, RKB can implement an automatic mark detection system which will interface into the rewinder controls to automatically bring the winder down in speed to a stop where the defect event is located for production splicing or patching.

Accessibility of the web

To properly install the spray head, a span of web < 4.25" (10.80 cm) wide, free of excessive edge flap, and with draw angle no more than 30/ from horizontal is required.

Spray Head Rotation

The spray head assembly must be mounted appropriately to allow proper flow of ink through the ink system. The acceptable range of mounting positions is shown on the dimensional drawing [D112389A] located in the appendix of this manual. Rotation of the spray head is done by loosening two bolts on the subassembly coupling and rotating the spray head until the paper guides are aligned with the web.

Mounting the Spray Head Assembly

The spray head assembly is rigidly secured to a support structure using mounting studs extending out of the bottom of the spray head chassis. Dimensional information regarding the mounting of the spray head assembly is given in the appendix of this manual and is referenced under drawing [D112389B]. An adjustable height stand allowing height adjustments from 1/2" (1.27 cm) to 7" (17.78 cm) is included, and mounts onto the spray head chassis

Edge Tracking

In order to automatically track the drift of the web, the marker must sense the location of the web edge. A pair of edge sensors is used to accomplish this function. The sensors are optoelectronic based. These sensors must be kept clean and free from dirt, oils, coatings, and other debris in order to function properly. The edge sensors must be mounted upstream from the spray nozzle since mounting them downstream would permit ink to cover the sensors and cause the marker to track incorrectly or not at all.

One of the spray markers web guides houses the mounting for the edge sensors. If the web guide with the sensors is forced to be downstream form the nozzle, remove both web guides and return them to R.K.B. OPTO-ELECTRONICS, INC. The guides are oriented left and right. We will replace your guides with a new set having the opposite orientation (if they are returned unused prior to the initial installation of the marker). This will enable the sensors to be upstream from the nozzle.

Edge Sensor Operation

Two infrared light sources are placed beneath the web with two infrared detectors placed above the web opposite the light sources. Counting the number of light sources detected monitors web position. No detection indicates that the marker must retract away from the web. A single light source detected indicates correct positioning, and two light sources detected prompts the marker to advance onto the web.

Mounting the Control Enclosure

The control electronics for the spray marker are located in the main systems electronic enclosure unit. If however, the spray marker is installed as an optional piece later on, the unit will come with a wall mounted electronic enclosure. This unit should be located in an area convenient to operators. The enclosure is rated NEMA 4X.

Power Requirements for the Model 1280

The power requirements for the spray-marking unit are 110/220V, 50/60 Hz, 10 Amps. The air utilized by the spray marker for operation should be set between 65 and 90 p.s.i., clean air. The marking unit will reliably work in temperatures of 30/ to 160/ F with a relative humidity from 0 to 95%, non-condensing.

QUALITY ASSURANCE & MANAGEMENT SYSTEM (QAMS®)

The Model 3010/3040/3020 & 3030® OPTOMIZER® CCD Camera-based Video Web Inspection System software program, referred hereafter as QAMS, is a custom written program developed entirely at R.K.B. OPTO-ELECTRONICS, INC. The software, which accompanies the following license ("QAMS"), is the property of R.K.B. OPTO-ELECTRONICS, INC. or its licensors and is protected by copyright law. While RKB continues to own the software, you will have certain rights to use the software after your acceptance of this license. Except as may be modified by a license addendum which accompanies this license, your rights and obligations with respect to the use of this software are as follows:

RKB LICENSE & WARRANTY

You may:

(i) use one copy of QAMS on a single computer;

(ii) make one copy of the QAMS for archival purposes, or copy QAMS onto the hard disk of your personal computer and retain the original for archival purposes;

(iii) use QAMS on a network, provided that you have a licensed copy of QAMS for each computer that can access the QAMS over that network;

(iv) after written notice to RKB, transfer QAMS on a permanent basis to another person or entity, provided that you retain no copies of QAMS and the transferee agrees to the terms of this agreement; and

(v) if a single person uses the computer on which QAMS is installed at least 80% of the time, then after returning the completed product registration card which accompanies the software, that person may also use the software on a single home computer.

You may not:

(i) copy the documentation that accompanies QAMS or this manual

(ii) sub license, rent or lease any portion of QAMS

(iii) reverse engineer, de-compile, disassembly, modify, translate, make any attempt to discover the source code of QAMS, or create derivative works from QAMS; or

(iv) use a previous version or copy of QAMS after you have received a disk replacement set or an upgraded version as a replacement of the prior version.

Limited Warranty:

R.K.B. OPTO-ELECTRONICS, INC. warrants that the media on which QAMS is distributed will be free from defects for a period of sixty (60) days from the date of delivery of QAMS to you. Your sole remedy in that event of a breach of this warranty will be that RKB will, at its option, replace any defective media returned to RKB within the warranty period. RKB does not warrant that QAMS will meet your requirements or that operation of QAMS will be uninterrupted or that QAMS will be error-free.

THE ABOVE WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NON INFRINGEMENT. THESE WARRANTIES GIVE YOU SPECIFIC LEGAL RIGHTS. YOU MAY HAVE OTHER RIGHTS, WHICH VARY FROM STATE TO STATE, COUNTRY TO COUNTRY.

Disclaimer of Damages:

Regardless of whether any remedy set forth herein fails of its essential purpose, in no event will RKB be liable to you for any special, consequential, indirect or similar damages, including any lost profit or lost data arising out of the use or inability to use QAMS even if RKB has been advised of the possibility of such damages.

Some States and/or Countries do not allow the limitation or exclusion of liability for incidental or consequential damages so the above limitation or exclusion may not apply to you.

In no case will RKB's liabilities exceed the purchase price for QAMS. The disclaimers and limitations set forth above will apply regardless of whether you accept QAMS.

U.S. Government Restricted Rights:

Restricted rights legend. Use, duplication, or disclosure by the Government is subject to restriction as set forth in the subparagraph (c) (1) (ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.227-7013 or subparagraphs (c) (1) and (2) of the Commercial Computer Software-Restricted Rights clauses at 48 CFR 52.227-19, as applicable, R.K.B. OPTO-ELECTRONICS, INC., 6677 Moore Road, Syracuse, New York, 13211, United States of America.

General:

The laws of the State of New York, country of the United States of America, will govern this agreement. This agreement may only be modified by a license addendum that accompanies this license or by a written document that has been signed by both you and RKB. Should you have any questions concerning this agreement, or if you desire to contact RKB for any reason, please write:

R.K.B. OPTO-ELECTRONICS, INC.
6677 Moore Road
Syracuse, NY 13211
United States of America

Addendum; License and Warranty

The QAMS program you are using has been configured to run on a network, and consequently RKB grants you the right to use the enclosed QAMS program on a computer network provided that for each and every concurrent user on the network, you have acquired and dedicated one licensed copy of the software. RKB grants you the right to have modifications made to QAMS by RKB for a period of 24 months from the date of delivery provided modifications are within reason. RKB has installed in the main computer a copy of Symantec® pcANYWHERE 32 (version 10.0) and Microsoft® Windows XP® Workstation for operations. pcANYWHERE 32 is installed and to be utilized for remote accessing via a network LAN or modem hookup for control and software modifications by RKB and the licensee. Windows XP is installed as the main operating system used by QAMS for process control and quality assurance reporting. All applicable copyright laws, warranties and licenses by Symantec and Microsoft apply and are not guaranteed or supported by RKB.

Getting Started

Welcome to QAMS® for Windows, the only software application you need to manage your RKB® Model 3020® OPTOMIZER® CCD Camera-based Video Web Inspection System for the detection of line type defect faults that occur during the process of web based material manufacturing. QAMS help you keep track of a virtually unlimited amount of information about various defect faults, their types, sizes, locations, probable causes, history, web breaks, reel turn ups and inspection and process machine diagnostics. You can track events with your mapping functions, review defect profiles, track defect fault history, set up defect fault parameters and process reels, shift and product reports. QAMS keeps detailed information and histories for each product code and rolls of material produced and perform many more effective operational and managerial tasks.

System Requirements

To use QAMS and its associated hardware you need the following hardware and software:

- A Web Inspection System
- PC with 300 megahertz or higher processor clock speed recommended; 233 MHz minimum required (single or dual processor system);* Intel Pentium/Celeron family, or AMD K6/Athlon/Duron family, or compatible processor recommended
- 128 megabytes (MB) of RAM or higher recommended (64 MB minimum supported; may limit performance and some features)
- 1.5 gigabytes (GB) of available hard disk space*
- Super VGA (800 × 600) or higher-resolution video adapter and monitor
- CD-ROM or DVD drive
- Keyboard and Microsoft Mouse or compatible pointing device
- RKB® QAMS®
- Microsoft® Windows XP® workstation
- Microsoft® Office XP® with Access, Excel and Word
- A modem supported by WindowsXP (56K or higher)
- A printer supported by WindowsXP
- Touchscreen Flat Panel SVGA monitor
- Ethernet capabilities with TCP/IP communication protocols

CPU system

The CPU system supplied with all OPTOMIZER® CCD Camera-based Video Web Inspection Systems is the latest technology in state-of-the-art processor design (*Figure 55*). It consists of a custom feature card set, a standard backplane, voltage regulator module (VRM) and the best processing unit available. The CPU chassis accepts several standard motherboards or passive backplanes. The mother board mounting accepts baby AT or ATX motherboards. The keyboard unit supplied is of wireless technology with a controller unit connected directly to the motherboard via a rear chassis connection. The passive backplane accepts plugs in CPU boards that install just like any other adapter card. Backplane components include sockets for adapter cards, LED circuitry, and ICS buss power check for each power supply. Backplanes are available in either ISA and/or PCI bus architectures.

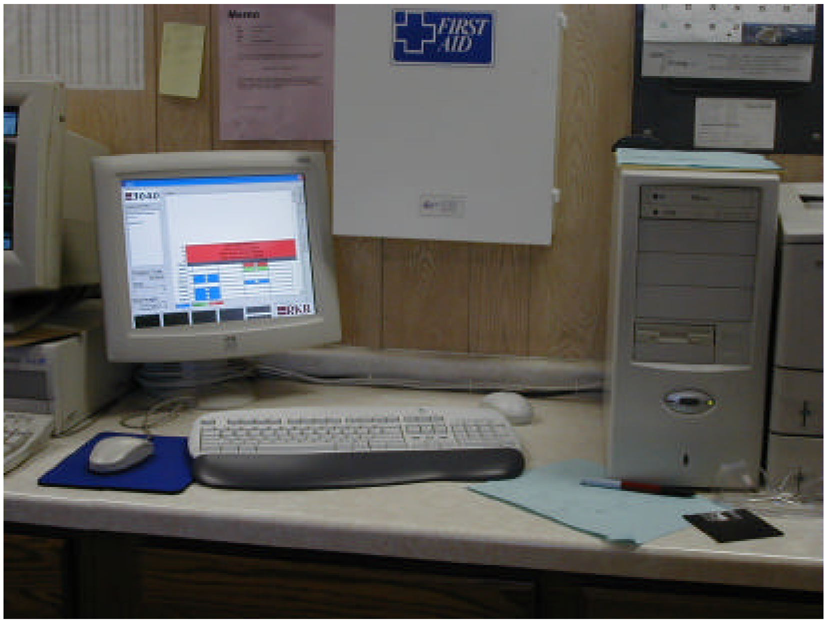


Figure 55

The CPU comes with an Athlon XP 1600 processor model (*Intel® Pentium IV optional*) rated at 1.4 GHz 266 FSB, Model810 LM Socket A PCC Chip Motherboard, 5 PCI slots, 4 USB ports, 3 IEEE 1394 ports, 3 serial, 2 parallel and one AGP slot. The CPU also contains a RJ-11 port, RJ-45 port and a 10/100 Ethernet LAN adapter. The memory we chose for this particular application is a 256 MB SDRAM, PC133 (*512 optional*). The hard drive consists of a 60 GB, 7200 RPM Ultra ATA with controller. The unit has a 52X CD ROM internal IDE drive and a 1.44-MB internal floppy drive. Additionally, we have installed a graphic memory of 64 MB SDRAM (*upgradable*), a 56K V.90 Data/Fax/Voice modem, wireless optical mouse and keyboard unit, 5 GB tape back up unit, printer buffer and a start-of-the-art Touch Flat Panel monitor system. The operating system used by the Model 3020 is based on the Microsoft® Windows XP®, professional version and is bundled with Office 2000 XP® pro+publisher, MS Word®, MS Access®, MS Excel®, AVG Antivirus and RKB® QAMS®. The power requirement chosen for this CPU setup is a 300 W, 48 VDC system with two positive purge cooling fans.

CRT monitor

The CRT display is an Active matrix TFT LCD Model 1525L and 1527L Touchmonitor from Elo. This model is simple, stable, and very durable for the widest range of touch-input applications. This particular model offers state-of-the-art AccuTouch five-wire resistive technology with a viewable 15.1" (38.4 cm) diagonal screen. Additional monitor specifications are as follows:

Figure 56

- Monitor dimensions Width 15.4" (39.1 cm)
- Height (including base) 15.4" (39.1 cm)
- Depth (including base) 11.0" (28.0 cm)
- Dimensional drawing number MS500104 (available at www.elotouch.com)
- Optimal (native) resolution 1024 x 768 at 60, 70, or 75 Hz
- Other supported resolutions 1024 x 768 at 60, 70, or 75 Hz; 800 x 600 at 56, 60, 72, or 75 Hz; 640 x 480 at 60, 72, or 75 Hz; 640 x 480 at 67 Hz (Mac); 640 x 480 at 60 Hz (PC 98)
- Colors 16 million with dithering (unlimited)
- Brightness LCD panel with Touchscreen AccuTouch: 170 cd/m²; IntelliTouch: 185 cd/m²
- Viewing angle (from center) Horizontal (left/right) ±60° or 120° total
- Vertical (up/down) ±60° or 120° total
- Contrast ratio 200:1, up to 16 shades of gray
- Input video format VGA/SVGA/XGA analog video
- Input video signal connector Mini D-Sub 15-Pin (female)
- Scanning frequency Horizontal 24–64 kHz; vertical 56–75 Hz
- Power supply Universal AC/DC power adapter; 12 VDC @ 3.75 amps
- Power dissipation 45 W max.
- Temperature Operating 0°C to 40°C; storage 0°C to 60°C
- Humidity Operating 80% noncondensing
- Weight (approx.) Actual 16.0 lb (7.3 kg); shipping 19.5 lb (8.9 kg)
- Warranty Monitor 3 years

- Touch technology 10 years IntelliTouch Touchscreen, 5 years AccuTouch Touchscreen
- Touch controller 5 years
- Backlight lamp life 40,000 hours
- Other features Digital on-screen display (OSD); two built-in 1 W speakers; removable base; sealing;
- VESA mounting

Air-conditioning Unit (IF APPLICABLE)

The air-conditioning unit selected by RKB is a self contained, closed loop system. The unit will provide up to 4,000 cooling BTU/H. The power requirements are provided by RKB and will run off of 115V, 50 Hz. The Design Pressure P.S.I.G. runs from 150 minimum to 350 maximum with a 20-Amp maximum fuse capability. The unit contains its own built in condensate evaporators.

Printer and related components. (IF APPLICABLE)

The system printer supplied with the Model 3020 Streak Detection System is HP LaserJet 4000/5000 N Series Printer. The printer is compatible with Windows 9x; Windows NT; Windows XP ; UNIX®; and Windows (3.x) operating systems. The printer is also compatible with Windows (95; NT; XP); NetWare; IBM OS/2 Warp; LAN manager; UNIX;® AppleTalk; LocalTalk via HP Jetdirect EIO print servers Network Operating Systems. Other printer specifications are as follows:

Figure 57

- Connectivity, Std IEEE 1284-compliant bi-directional parallel, RS-232C 9-pin serial, 1 open EIO slot, HP Jetdirect EIO internal print server for Fast Ethernet 10/100Base-TX in second EIO slot (*optional; HP Jetdirect 600n and 610n (EIO) internal print servers, external print servers, and Jetdirect Connectivity Card for serial, USB, and LocalTalk connectivity*)
- Duty Cycle 65,000
- Input Capacity, Std 850
- Input Capacity, Max 1,100
- Media Sizes
  - Custom, U.S 3 x 5 in to 12.3 x 18.5 in
  - Media Sizes, Standard, International A5; B5 (JIS); B4; A3; executive
- Media Sizes, Standard U.S
  - Letter
  - Legal
  - Tabloid
  - No. 10 envelopes
  - Monarch envelopes
- Media Types Paper (copier, bond, transparency, special application, recycled)
- Memory, Max 164 MB
- Memory, Std 12 MB

- Output Capacity, Max 250
- Output Capacity, Std 250
- Print Speed, Black 16 ppm.
- Print Speed Black, Normal Quality 16 ppm
- Print resolution, Black 1200 x 1200 dpi
- Print Cartridges 1 (black)
- Print Languages, Std HP PCL 5e, HP PCL 6, PostScript® Level 2 emulation
- Print Colors No
- Print technology Laser
- Warranty Features 1 year return to HP warranty

The printer should be placed on a study, level surface with plenty of space allowance around the printer. The environment should be well ventilated with no direct exposure to sunlight or chemicals. Relative humidity should be between 20% to 80% with a room temperature of 50/ to 91/ F (10/ to 32/ C).

Installing QAMS

When you install QAMS, you can specify the location in which you want to install the application and select which version to install based on your country location. If you have a previous version of QAMS installed on your computer, you should generally install the new version in its own folder. QAMS should already be installed and operational in the systems computer when your inspection system arrives. However, if you are installing this program in a different inspection system or on another computer you need to follow the steps listed below.

To install QAMS:

Log on as Administrator and insert the QAMS for Windows disk 1 into your floppy disk drive, or insert the QAMS for Windows CD into your CD-ROM drive.

Click the start button in the lower-left corner of your Windows screen. The Windows start menu appears.

From the Windows start menu, choose SETTINGS > CONTROL PANEL.

Double-click the Add/Remove Programs icon.
The Add/Remove Programs Properties dialog box appears.

Click the Install button in the Install/Uninstall tab page

Follow the on-screen installation instructions.

At the end of the installation procedure, you should register your software. You must e-mail RKB or send via post mail confirmation that you have initialized the QAMS program. Be sure to register your software to receive notification of the product updates and special offers. If at some point you need to remove QAMS from your computer, you can do so by using the Windows Add/Remove Programs Properties dialog box.

Start to Use QAMS

All events and information tagged or logged in by QAMS is stored in a database for operational/management usage and can be manipulated in many various ways. To start QAMS once it is loaded (systems come pre-loaded for easy startup) you perform the following steps.
To start using QAMS:

Start the QAMS application by doing the following:

- From the Windows start menu, choose PROGRAMS > QAMS.EXE.
- Double-click the QAMS icon which initializes the program

However, you may wish to setup your inspection systems parameters and/or product codes prior to initializing the QAMS.EXE.

DESCRIPTION OF QAMS

The RKB Distributed Control System (DSC) is also called QAMS® (Quality Assurance Management System). In this system, the QAMS receives the data information from hardware circuitry and processes the information into usable parameters that the operational and managerial staff can manipulate. This information can be the type of defect, size of defect, location of defect in both machine and cross machine direction, how many defects, defect sizes, footage counts, start and stop times of defects, etc. Other information such as paper machine diagnostics, i.e., repeating defects, intervals they occur at, where and probable cause (i.e., dryer, felt, wire, etc.), inspection machine diagnostics (i.e., power supplies, sensors, lamps, blowers, etc.), and a variety of other information can be received and processed by the QAMS. This information can be manipulated by the staff and can be transferred to other process stations or systems like Bailey, Honeywell, etc…. Via RS232, RS422 and Ethernet. Since the data is developed and stored in and based on Microsoft® Access® (*.mdb format), the data can be simply converted into other database formats to include by not limited to (*.xl, *.xls, *.xla, *.prn, *.txt, *.csv, *.dbf, *.xlm, *.xlc, *.xll, *.xlb, *.slk, *.dif, *.htlm). User data sources utilized but not limited to dBASE, EXCEL, FoxPro, VISUAL FoxPro, MQIS, SQL, and Text. RKB refers to its QAMS as its DCS as it is really a distributed control system for on-line quality assurance and control inspection.

QAMS FORMS

As stated above, QAMS is developed to work with MS Access as the main database protocol. There are four main forms designed to keep the overall system as simple, but useful as possible. These forms are indicated as “Tables”, “Queries”, “Form” and “Reports”. Refer to ***Figure 58,59,60 and 61*** for a more detailed look.

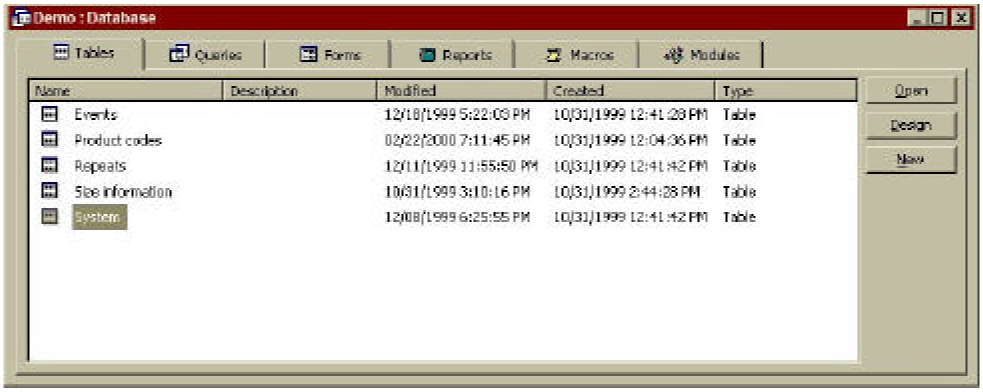


Figure 58 – Tables Form

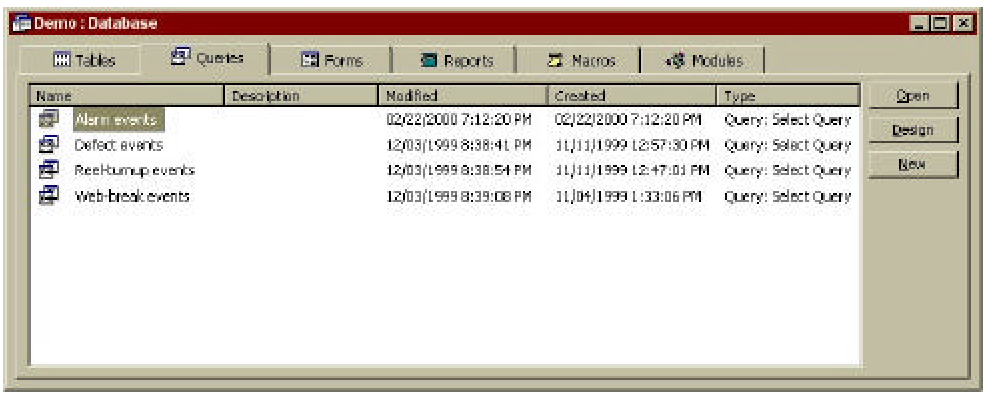


Figure 59 – Queries Form

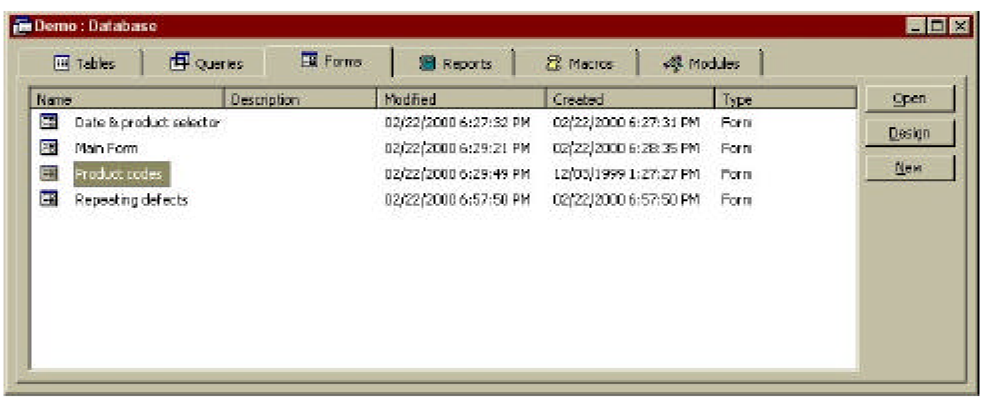


Figure 60 – Forms Form

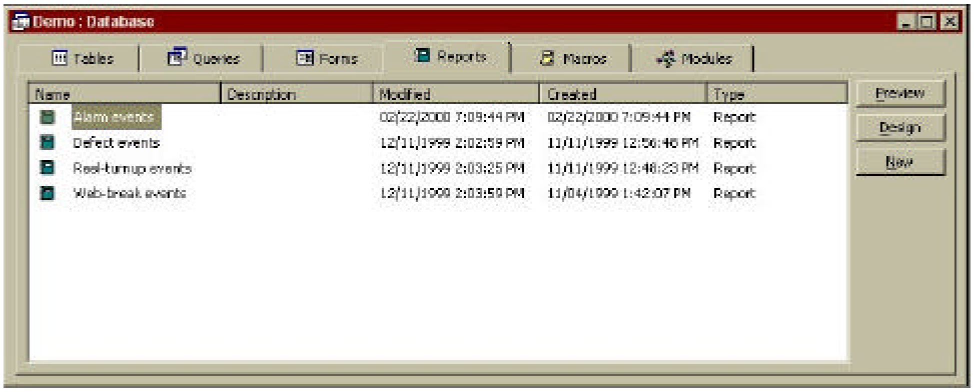


Figure 61 – Reports Form

Setting Your Inspection Parameters

After installing QAMS you will need to set up various parameters which will correlate to the product or products being manufactured to specified database protocols. Obviously if you are manufacturing various products, similar products to different clients, or various basis weights, you may want to setup product codes that will automate the inspection system database storage capability for present and future use. If you are running various deckle widths, you may want to setup product codes to correlate to the various deckles and/or channelization parameters required ensuring no false detection is logged.

Where to you start?

Before you can run your inspection system you must set up your operational and managerial specifications. The first set is to set up your various product codes that will be used by QAMS throughout the life of your system. These setup parameters appear in a separate dialog communication box outside of the QAMS.exe command. This dialog box called "Qams System Data Setup" (***Figure 64***) must be accessed through MS Access®. To gain access to this dialog box you move your cursor to the "Start" button (***Figure 62***) located on the bottom left hand side of your CRT monitor and click once. The start menu should appear. Move your cursor to the shortcut located in the top bar of the start menu called "Shortcut to QAMS.mdb" (***Figure 63***) and click once. This will bring up the main QAMS database with the main system setup dialog box.

Figure 62 – Windows Start Button

Figure 63 – Windows Start Menu

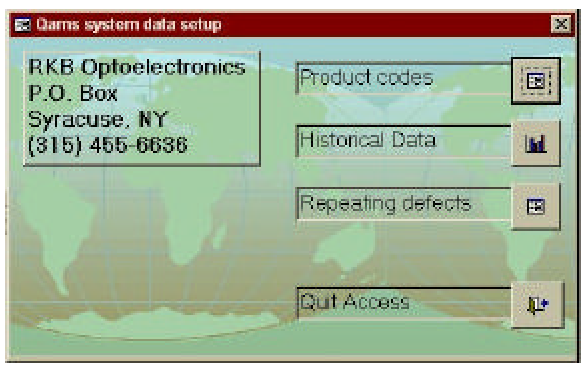


Figure 64 – System Data Setup Dialog Box

PRODUCT CODE SETUP

Move your cursor to the "Product codes" selection icon and click once. This will bring up the "Product codes" selection dialog box (***Figure 65***). Contained within this dialog box are three setup parameters called "Size Data" (***Figure 66***) and "Channel Data" (***Figure 67***) and "Other" (*Figure 68*). All dialog boxes including the main information must be filled out per product code prior to advancing to the next product code setup. In the case of a fixed channel system, you do not need to access or change any of the Channel Data.

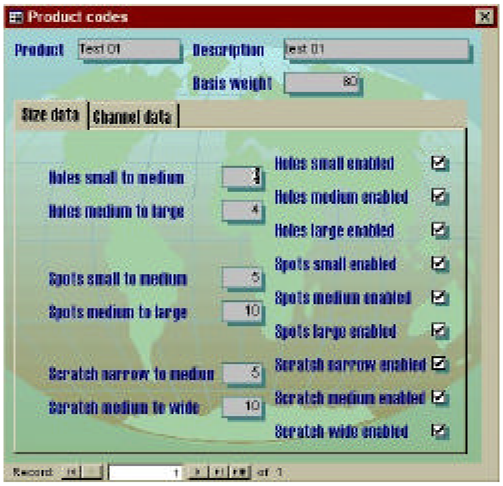


Figure 65 – Product Code Setup Parameter Box

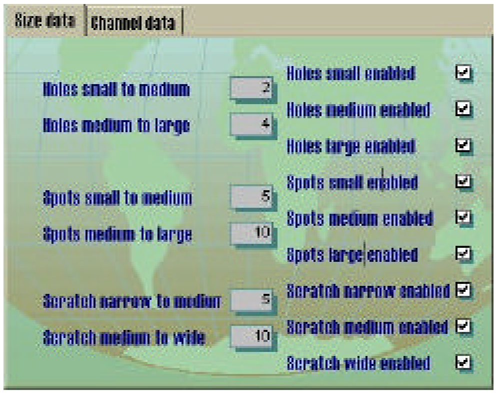


Figure 66 – Size Data Dialog Box

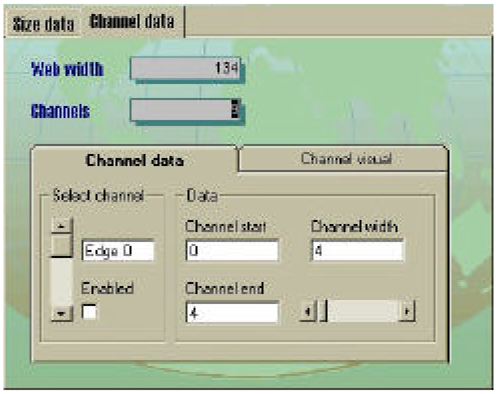


Figure 67 – Channel Data Dialog Box

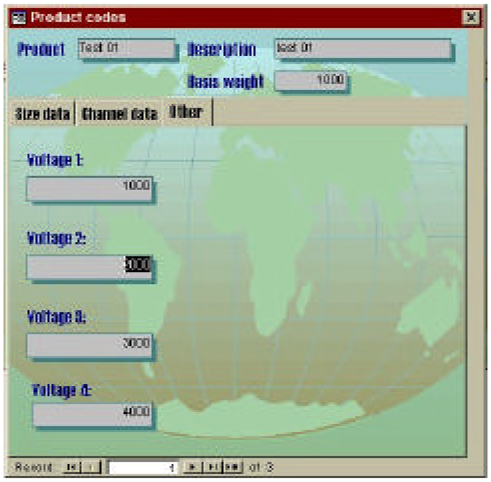


Figure 68 – Voltage Reference Dialog Box

To set up the product code you place your cursor in the "Product" text dialog box (***Figure 69***) and type in your product code identification (*i.e., Title, number, etc*). Then move your cursor over to the "Description" text dialog ***box (Figure 70***) and type in your product description. Upon completion of your description, move the cursor to the "Basis Weight" text dialog box and type in your products basis weight lbs/sq. ft (***Figure 71***). The first parameter you set up is the product code. Once you have typed in all the appropriate identification to be associated with the particular product material for this product code, you move your cursors to the "Size Data" dialog box (***Figure 65 above***). In this box you will enter the defect size threshold information that will define classification between defect sizes and type of defect. The numbers you enter beside each size category will correlate to the number of pixel coverage for line scan cameras or TV lines for streak cameras). Type in your threshold crossover settings for defect sizes and click the enable box to enable or disable the logging of data (***Figure 72***). A check mark means the data is enabled and will log into the database. You are now ready to move to the "Channel Data" dialog box (***Figure 66 above***).

Figure 69 – Prod Code Identification

Figure 70 – Prod Code Description

Figure 71 – Prod Code Basis Weight

Figure 72 – Threshold Setting and Enable Boxes

CHANNELIZATION SETUP (IF APPLICABLE)

Now that you have set up your defect size threshold data, code number, description and basis weight, you can now set up the channelization of this product code. Move your cursor to the "Channel Data" tab (***Figure 67 above***) and click once. You should now see two dialog boxes called "Web Widths" (***Figure 73***) and "Channels" (***Figure 74***). Move your cursor to the "Web Widths" Dialog box and type in the web width that will be appropriate for this product code. Once you have entered the web width, move your cursor to the "Channels" dialog box and type in the appropriate number of channels you wish to have for this product code. Within this main "Channel Data" dialog box you will see two more selection tabs that will direct you to another "Channel Data" dialog box and a "Channel Visual" dialog box (***Figure 75***). Again, making certain you are on the "Channel Data" tab, move your cursor to the "Select Channel" dialog box (***Figure 76***). This is where you can select your individual channels by clicking the up/down arrow. Select the channel you want to setup and move your cursor to the "Data" dialog box (***Figure 77***). Again, by controlling the up/down arrows, you can adjust this channel to whatever width in the cross machine direction is appropriate for your product code. The program will provide default if you do not wish to adjust any parameters within these settings.

Figure 73 – Web Width

Figure 74 - Channels

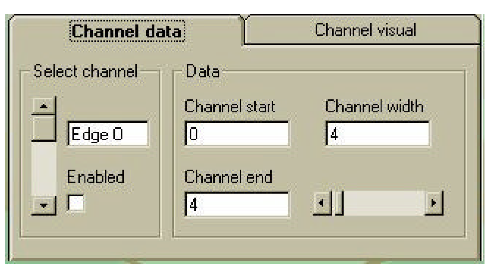


Figure 75 – Channel Data

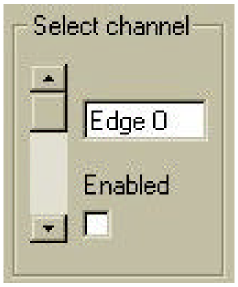


Figure 76 – Select Channel

Figure 77 – Data

If you choose to have varying channels, move your cursor to the “Channel Visual” dialog box (***Figure 78***) and view the graphical representation. This will give you an idea of what the channel break outs will be and approximately where in the CD they are located and how they correlate to the material web being inspected. Perform or repeat these functions for each product code setup you wish to enter. This information will be stored in the database and can be used at anytime by operational staff for future production runs.

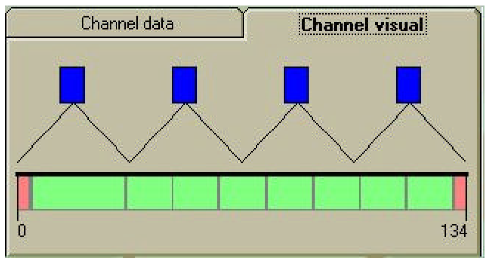


Figure 78 – Channel Visual Dialog Box

VOLTAGE REFERENCE SETUP

Once you have set up the defect sizing and channelization, you move your cursor to the “Other” dialog box. In this box you will see various voltage references. These values are defaulted between 1, 2, 3, 4, etc… You must change these voltage references to the appropriate value to ensure that false signals are not being generated due to over sensitivity. In most applications these settings should be set to 4000 in all entries. 4000 represents 4000 millivolts(4 Volts). Once you have completed this step, you can go to the next product code setup.

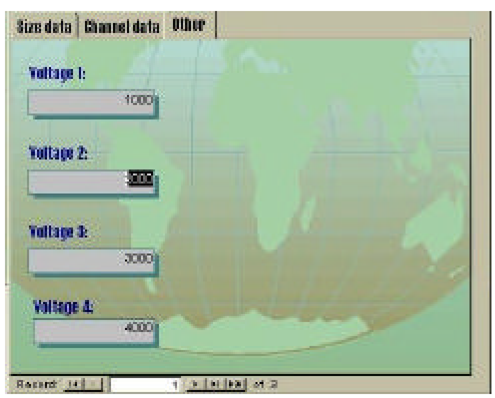


Figure 79 – Voltage Reference Dialog Box

****NOTE** REMEMBER TO SET THIS VALUE FOR EACH PRODUCT CODE OR THE SYSTEM WILL BECOME OVER SENSTIVE AND UNSTABLE RESULTING IN A SHUTDOWN OF COMMUNICATION BETWEEN THE I/O MODULE AND THE CPU. IF AN UNSTABLE ENVIRONMENT HAPPENS, YOU WILL NEED TO SHUT DOWN THE QAMS PROGRAM, ENTER THE *.MDB DATA BASE AND MANNUALLY DELETE THE PRODUCT CODE THAT IS NOT CORRECT AS RE-INITIATING THE QAMS PROGRAM WILL PREVENT ANY CHANGES AND THE UNIT WILL STILL BE UNSTABLE.**

REPEATING DEFECT ANALYSIS SETUP

The final setup parameter prior to initializing QAMS will be setting up the repeating defect analysis data. To do this you need to close the "Product codes" setup dialog box which will bring you back to the main "QAMS System Data Setup" dialog box (***Figure 37 above***). Move your cursor to the "Repeating defects" icon and click once (***Figure 80***). This will bring you into the setup dialog box for logging various potential areas of your machine that may cause repeating defects during production.

Figure 80 – RDI Access Button

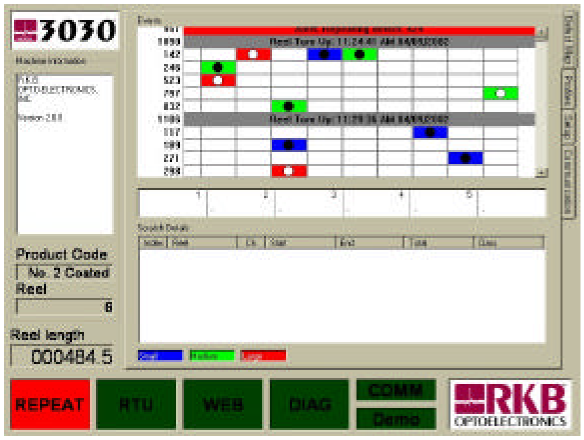
Once in the repeating defect setup parameter, you will be prompted to enter the potential "Repeating defect description" (i.e., wire, felt, calendar roll, etc.) and the item descriptions length (***Figure 81***). This information, based on specific processes in your production equipment will be monitored for repeatability. If an alarm indicates, the mapping function and database will store the information and the possible area of defect. Operational staff will then be alarmed as to the potential cause where corrective action can take place.

Figure 81 – Repeating Defect Parameter Setup

OPERATIONAL SETUP AND PERFORMANCE

Once the managerial staff and/or the system administrator have setup the inspection systems parameters, the unit will be ready for operational staff to utilize. There is a variety of displays and information for operational and service staff to view and use. To start using QAMS, you initialize the QAMS.exe as described earlier in the manual. After short systems warm up dialog (***Figure 82***), the unit will boot directly into the main operational display called our "Defect Map"(***Figure 83***). Looking at this main display you will notice one row of access tabs for various functions. This row located towards the right of the CRT monitor is for accessing operational display information, profiling, system setups and manual overrides, and system communications (***Figure 84***)

Figure 82 – System Bypass Timing Dialog



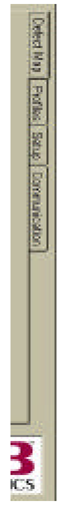


Figure 83 – Main System "Defect Map"

Figure 84 – Access Tabs

The following section described herein will go into detail regarding the operational displays in order of the access tabs shown on the main "Defect Map" display (top to bottom). The display you are currently in is the real time mapping function of QAMS. This display will update automatically and is event driven. This display will show you all current defect information and location as well as the past 50 to 100 events in real time.

Looking at the mapping display you will note that there are three levels to this display. The first level deals with the mapping of autonomous defects like holes, spots, dirt, etc (***Figure 85***). This level also logs all alarm and diagnostics information for both production equipment and inspection equipment. The second level deals with the real time mapping of coating streak and scratch defect information (***Figure 86***). The third and final level is a text dialog station that provides all the required information on coating streak and scratch detection (***Figure 87***).

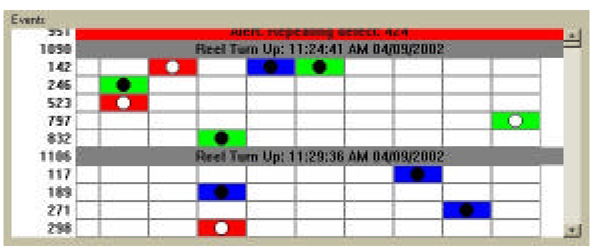


Figure 85 – Autonomous Defect Mapping

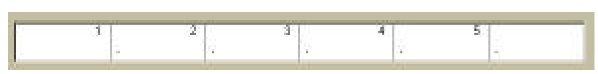


Figure 86 – Coating Streak Defect Mapping

Figure 87 – Text Dialog Coating Streak Info

Autonomous Defect Mapping

As viewed in ***Figure 85*** above the Autonomous Defect Mapping level logs and stores data relative to hole and spot type defect faults, there location in the cross machine direction and machine direction, size and type. This mapping level also logs and stores all related paper machine and inspection machine alarm functions such as web breaks, reel turn ups, repeating defects, classification changes, as well as any other action that is enabled in the QAMS program. Additionally, diagnostic alarms relative to power supplies, camera sensors, light level, etc. are logged and stored in this level. Hole defects are shown on the map as open (clear) circles with a color-coded (***Figure 88***) band indicating size (***Figure 89***). Spot defects are shown on the map as closed (black) circles with a color-coded band indicating size (***Figure 90***). Diagnostic alarms such as reel turn up, web breaks, repeating defects, power supply, camera sensors are indicated by a solid band that spans the entire map in the cross direction. Web breaks are color-coded yellow, reel turn-ups are color coded grey and repeating defects are color-coded red. All other alarm functions are color-coded red or yellow (***Figure 91***). Channelization is represented by the number of columns present with two small column located on each edge indicating material trim (***Figure 92***). Location of the defect in the cross machine direction depends on where the defect symbol falls and within what column. Footage location or defect location in the machine direction is represented by the footage count located to the left of the map. This number can be placed in measurements of feet or meters (***Figure 93***). The program can be scanned back in real time to view the last 50 to 100 defect events by placing the cursor on the up/down arrow located to the right of the map (***Figure 94***).

Figure 88 – Color Code Identification Table

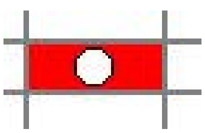


Figure 89 – Hole

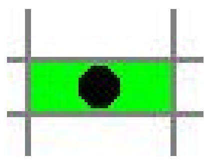


Figure 90 – Spot

Figure 91 – Diagnostic Alarm

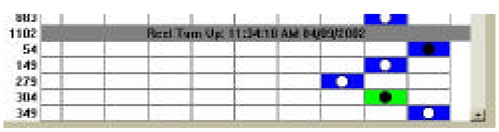


Figure 92 – CD Channelization/Location

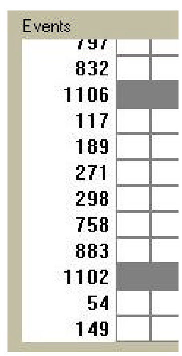


Figure 93 – MD Location

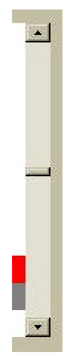


Figure 94 – Scrolling Cntl.

Defect Profiling Displays

The next operational button labeled "Profiles" (***Figure 95***) deals with the various defect types and profiles thereof. To access this display you click you mouse on this button once. It will then bring you into the main profile display that shows all defect types, the total count of defects per roll and total count per reel. The first row on this display deals with "Hole" type defects. These rows are broken into two columns indicating the total defect count per reel ***(Figure 96***) and total defect count per product (***Figure 97***). The counts are broken up into the default three-size category "small, medium and large". The second row shown deals with "Spot" type defects. This row as with holes, is broken up into two columns indicated the total number of defects per reel and per product. The last row deals with coating streaks and scratches and is broken up into two columns, again showing total defect count per reel and per product. Refer to ***Figure 98,99 and 100*** for closer depictions of these count sections.

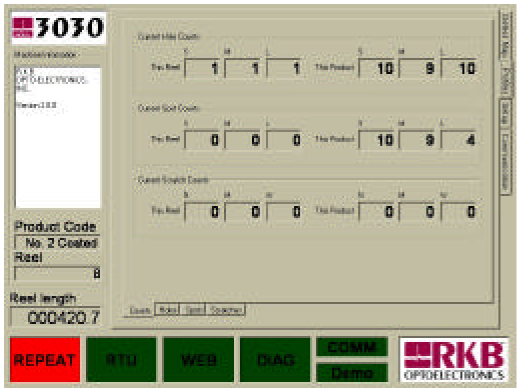


Figure 95 – Main Profile Display

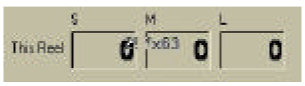


Figure 96 – Total Count per Reel

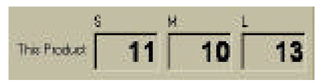


Figure 97 – Total Count per Product

Figure 98 – Total Hole Count per Reel/Product

Figure 99 – Total Spot Count per Reel/Product

Figure 100 – Total Streak/Scratch Count per Reel/Product

Located towards the bottom of the main profile defect count display are three access buttons labeled “Holes”, “Spots” and “Scratches” (***Figure 101***). These buttons lead to a more defined profile display of the defects per type and are accessed by clicking on the button you wish to view. Once inside these displays, you will note a graphical representation of the defect type by reel and by product. These displays are color-coded (***Figure 102***) using red, blue and green. These colors match the color coding of size as in the mapping display described above. Please refer to ***Figures 103,104,105,106,107, and 108.***

Figure 101 – Access Buttons

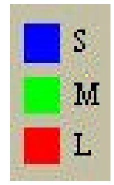


Figure 102 – Color Code Chart

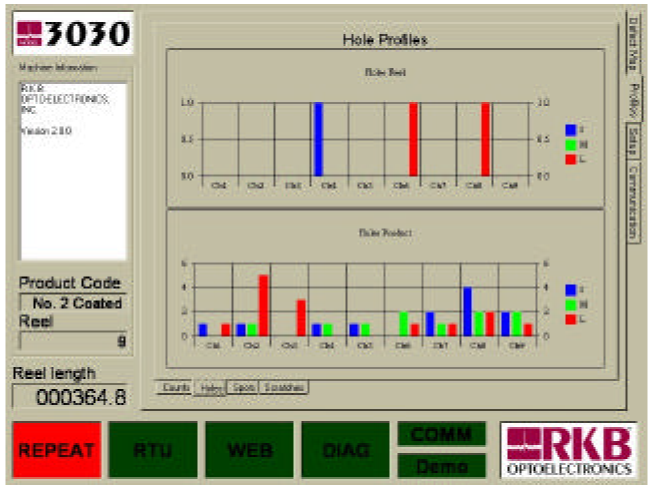


Figure 103 – Hole Defect Profile

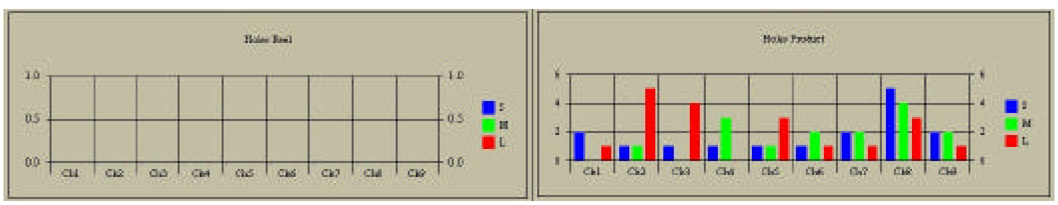


Figure 104 – Hole Defect Profile per “Reel” and “Product”

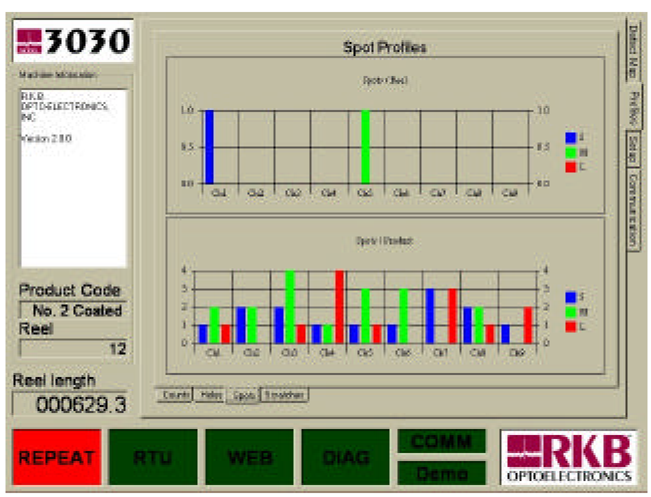


Figure 105 – Spot Defect Profile

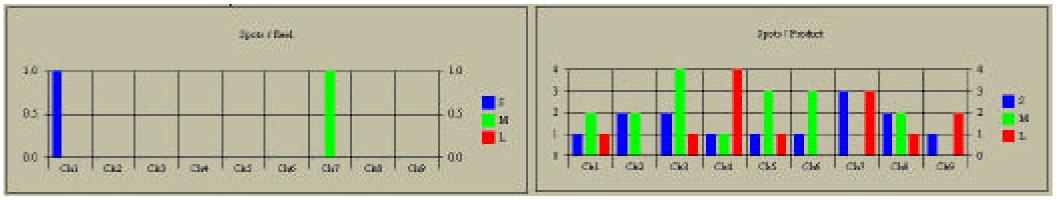


Figure 106 – Spot Defect Profile per "Reel" and "Product"

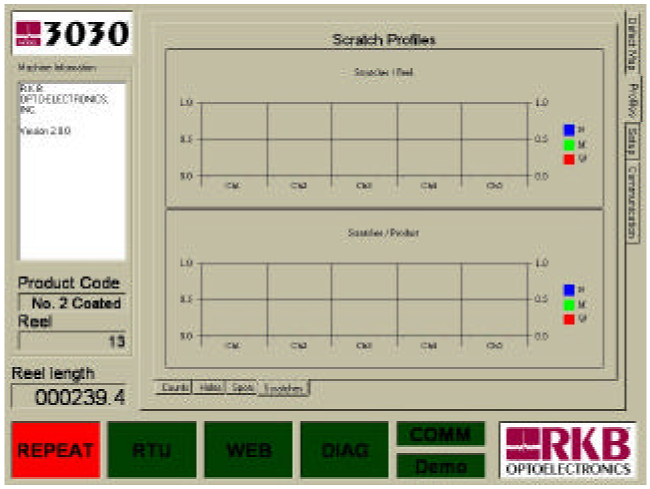


Figure 107 – Coating Scratch/Streak Defect Profile

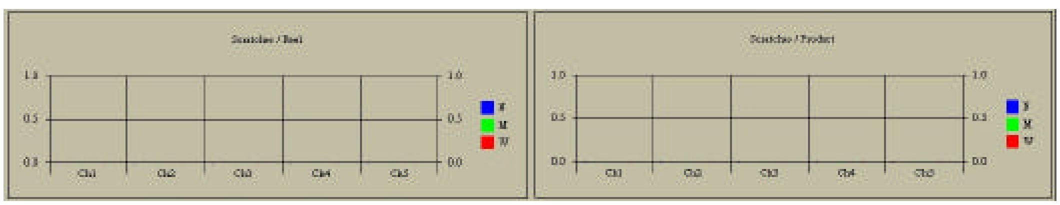


Figure 108 – Coating Scratch/Streak Defect Profile per "Reel" and "Product"

Setup Displays

The third access button located to the right of the CRT screen is labeled "Setup" and deals with the defect type, size setups (manual control), product code selection, repeating defect analysis information and the general system information. To access the setup, you move your cursor to the setup button and click once. This will bring you into the main setup display that shows the various defect types, sizes and their controls for manual adjustment (***Figure 109***). There are four main access buttons located to the top of this display. They are called "Defect Classes", "Product Codes", "Repeating Defects", and "System" (***Figure 110***).

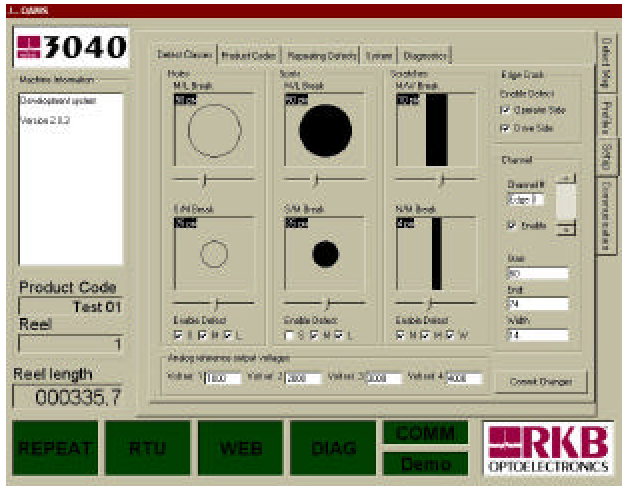


Figure 109 – Main Setup Display (default)

Figure 110 – Setup Access Buttons

The first access button called "Defect Classes" is an operational display indicated the types of defects enabled, their size classifications and database enable information. Generally these setups are initiated and stored when the product codes are setup and will display the default when a product code is selected. However, each category has a manual override that can be enabled on the run to adjust the type of defects logged, their sizes and channel locations. These changes once committed run until either a new product code is established or if you reboot the system. Each defect type has its own column showing the current size setting in pixels (moving the cursor over the graphical representation will provide size in inches or mm) and current break over thresholds between small, medium and large with large being the size that is flagged or marked automatically for grading or culling. By clicking and holding the left mouse button on the small arrow underneath each box, you can adjust the size of the defect break point. The size of the defect will be shown in the upper left-hand corner of the defect size box. Adjust the size according to the parameter you wish to set for the particular production run you are inspecting. Below these size adjustments are three enable select buttons indicated "S", "M", and "L" (***Figure 111***). These buttons enable the logging of data for that size. To disable logging of data for a particular size, you move your cursor to the access box and click once (you should not see a check mark). The box is now disabled and data will not log. The defect size setup columns are identical in operation for all three-defect categories (i.e., holes, spots and streaks). Refer to ***Figure 112,113, & 114*** for a clearer depiction of these columns.

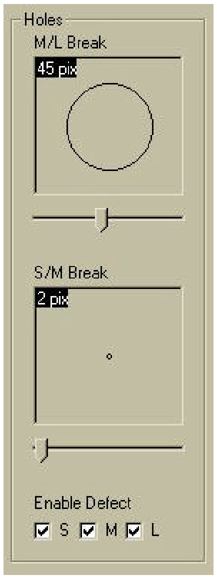


Figure 112 - Hole Size Threshold Setting

Figure 113 – Spot Size Threshold Setting

Figure 114 – Streak Size Threshold Setting

Figure 111 – Size Enable for database logging

Located to the right side of this display is the channel information dialog box (***Figure 115***). To verify the channel setup you move your cursor to the up/down dialog box. You will notice the channel number located to the left of this box. The channels start out with default D indicated “drive side edge”. This channel is for edge crack detection only and should only be enabled if edge cracks are warranted. Otherwise you should not enable this box. Again, like the defect type setups, you move your cursor to the enable box and click once to enable or disable the appropriate channel. Below the channel enable, you will notice a start and stop text box. This will inform the operational staff where in the cross machine direction the channel starts and stops. This will be provided for each and every channel.

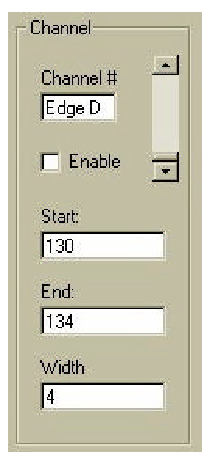


Figure 115 – Edge Crack Enable Box

Once you have made your selections you must commit the changes by moving your cursor to the “Commit Changes” dialog box (***Figure 116***) and click once. Once you commit changes you cannot automatically revert back to the default unless you reselect the product code or if you wrote down the prior settings before manually changing. This new setup will run until the parameters are changed again or if the system has a reboot.

Figure 116 – Commit Changes Dialog Box

Product Codes Selection Displays

Now that you have your defect classes verified, you need to select, if required, your product code for the type of product that will be manufactured during this run. To do this (being in mind that the product codes have all been predetermined), you move your cursor to the “Product Codes” access button and click once. A display will appear showing all product codes that have been pre-determined by management (***Figure 117***). To select the product code you move your cursor to the product identification and highlight it (***Figure 118***). Once that is done you move your cursor to the “USE” button (***Figure 119***) and the system will automatically setup for this code and no other adjustments will be required unless you manually wish to change something.

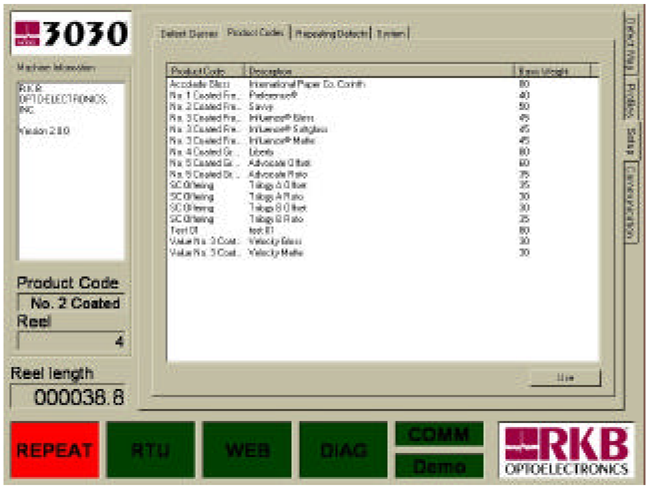


Figure 117 – Main Product Code Display

Product Code	Description	Basis Weight
Accolade Gloss	International Paper Co. Corinth	80
No. 1 Coated Freesheet	Preference®	40
No. 2 Coated Freesheet	Savvy	50
No. 3 Coated Freesheet	Influence® Gloss	45
No. 3 Coated Freesheet	Influence® Softgloss	45
No. 3 Coated Freesheet	Influence® Matte	45
No. 4 Coated Groundwood	Liberty	80
No. 5 Coated Groundwood	Advocate Offset	60
No. 5 Coated Groundwood	Advocate Roto	35
SC Offering	Trilogy A Offset	35

Figure 118 – Product Code Selection Box

Figure 119 – Use Button

Repeating Defects Displays

The last display in the setup parameters is the "Repeating Defects" display (***Figure 120***). This display will show operational and managerial staff the predefined parameter setup prior to running QAMS. This is an indication display should a repeating defect occur. If a repeating defect occurs an alarm will indicate to operational staff that a repeating defect is present. Then can then access this display and review which area of the production machine is most likely the cause of the repeating defect (***Figure 121***). Once the cause is determined, operational staff can either fix the problem themselves or call service to schedule corrective action to eliminate the defective area causing the repeating defect.

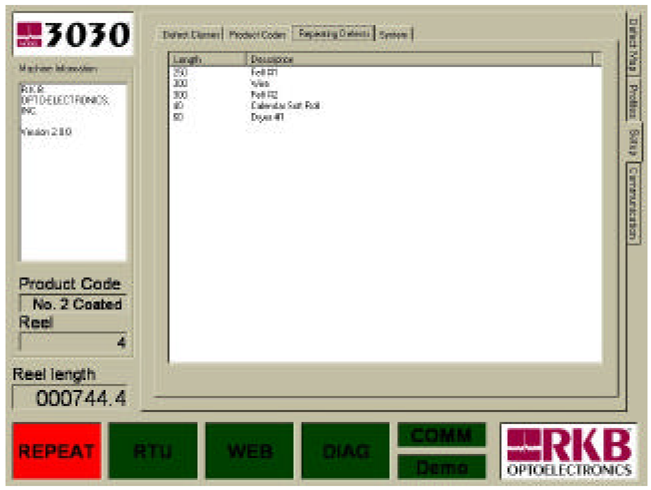


Figure 120 – Repeating Defect Display

Length	Description
250	Felt #1
300	Wire
300	Felt #2
40	Calendar Soft Roll
60	Dryer #1

Figure 121 – Problem Causing Area; Repeating Defect Display

System Display

System Diagnostic Display

This display is the inspection systems diagnostics. These values are defaulted and cannot be changed and are located in the program. The list of diagnostics includes lamp failure, power supply failure, etc. Refer to *Figure 122* below for a description of items contained within the program. If and when a problem related to these items occurs, the DIAG indicator light located on all screens will go red. To view what this alarm is, you click the mouse on this box and it will auto take you to the Diagnostic screen where text will show what the problem is and what needs to be corrected (*Figure 123*).

ID	diag type
1	Camera Power supply 1(+15v)- Low voltage
2	Camera Power supply 1(+15v)- High Voltage
3	Camera Power supply 1(-15v)- Low Voltage
4	Camera Power supply 1(-15v)- Low Voltage
5	Rack Power supply 1(+15v)- Low Voltage
6	Rack Power supply 1(+15v)- High Voltage
7	Rack Power supply 1(-15v)- Low Voltage
8	Rack Power supply 1(-15v)- High Voltage
9	Power supply 3(+5v)-Low voltage
10	Power supply 3(+5v)-High voltage
11	Encoder Input voltage Low
12	Encoder Input voltage High
13	No Fault
14	No Fault
15	No Fault
16	No Fault
17	Lamp 1 defect
18	Lamp 2 defect
19	No Fault
20	No Fault
21	No Fault
22	No Fault
23	Lost connection with IO module
24	Too many IO modules , no free addresses
(AutoNumber)	

Figure 122 – System Diagnostic List in Program

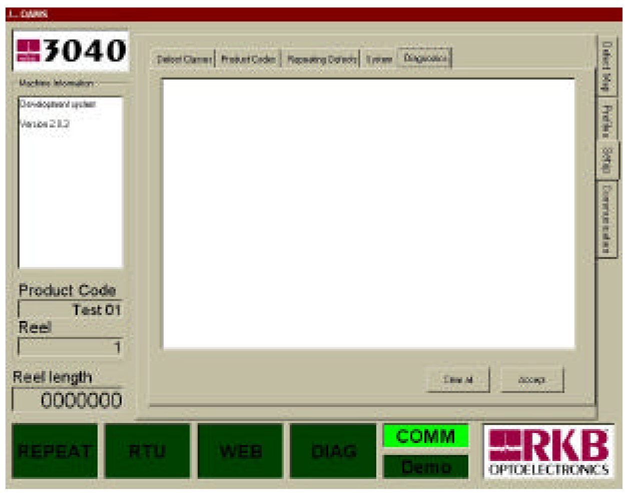


Figure 123 – System Diagnostic Display

Communication Display

The last parameter display is the system display (***Figure 124***). This display has two-access button that may be required by operational staff and that is the conversion button that changes the information into metric and the reporting function enable. Moving the cursor over the button and clicking once accesses the metric conversion button (***Figure 125***). All information will then be available in metric. The reporting function enable allows you to either have an end of reel report processed or not ***(Figure 126***). It also allows for a detailed report or a general report. The other two access buttons labeled "Exit" ***(Figure 127***) and "Meter" (***Figure 128***) is for service personnel or management. The exit button initiates the exit from QAMS and no data will be logged. The Meter button allows for verification of communication or footage reset. All other information on this display is for information purposes only should more than one unit be in operation at your facility and someone wishes to access through the Ethernet. If they view this display, they will know which machine they are looking at.

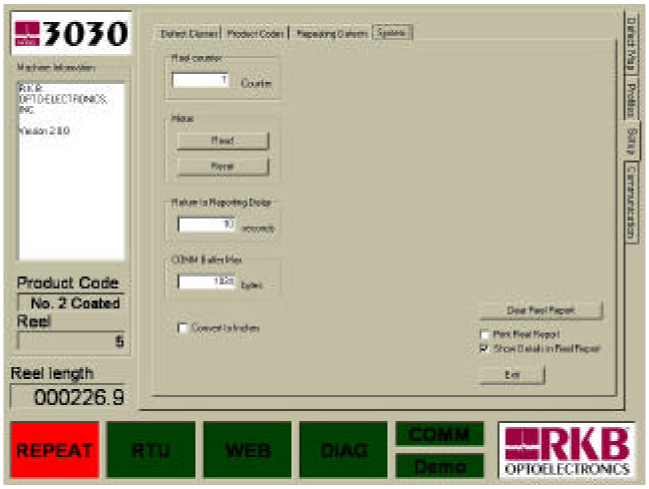


Figure 124 – System Information Display

Figure 125 – Conversion Button

Figure 126 – Reporting Button

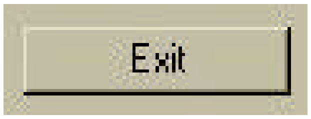


Figure 127 – Exit QAMS Button

Figure 128 – Meter Reset/Read Button

The last access tab located to the right of the main mapping display is the communication display (***Figure 129***). This if setup be default prior to running QAMS and can only be changed by management through the “ini” file. This display is for information only and allows service and managerial staff to verify that the CPU is communicating with the inspection systems hardware through its I/O.

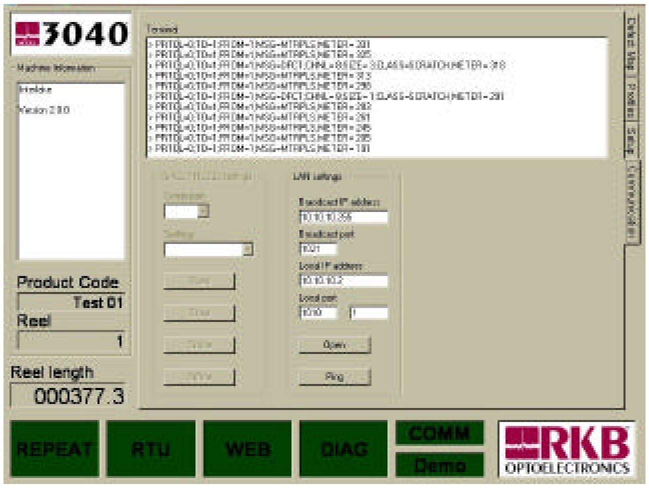


Figure 129 – Communication Display

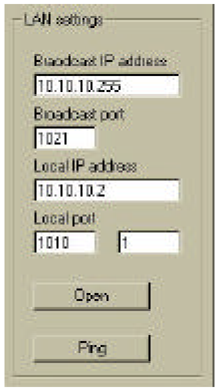


Figure 130 – LAN Communication Setting

Figure 131 – Serial Communication Setting

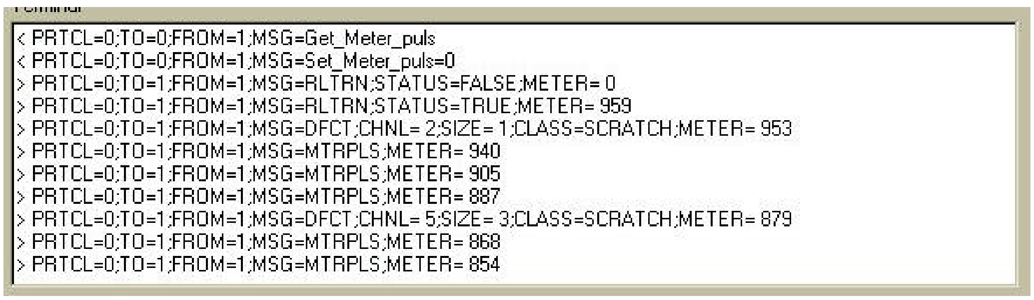


Figure 132 – Communication Code

System Diagnostic Alarms

Shown on all displays at the bottom of the CRT is an alarm bar that indicates various alarms (***Figure 133 and 134***). There are four boxes, one for reel turn up, one for repeating defect, one for web break and the other labeled diagnostics. If there is a problem with the equipment the diagnostic button will illuminate red. If there is a web break or real turn up, the associated buttons will illuminate red. If there is a repeating defect the button will illuminate red. Both the reel turn up and web break alarm will reset automatically and the data will be logged. The real turn up and diagnostic buttons will stay red and must be initiated by operational staff to change the color. This is so we know operational staffs have been alerted to the alarm problems. All data will be logged into the database.

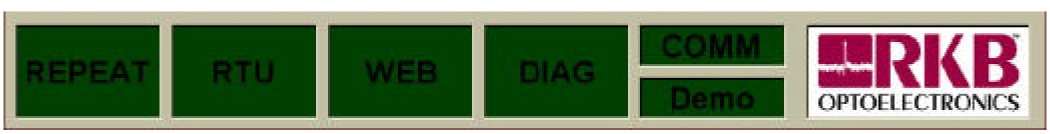


Figure 133 – Alarms all OK

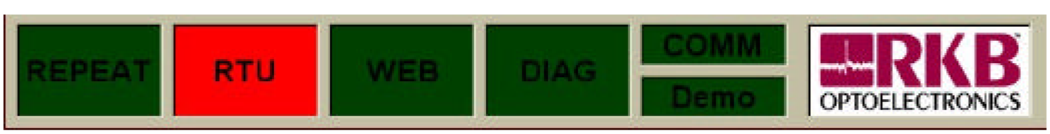


Figure 134 – System Alarm Indication; Reel Turn Up

Additional System Information

System Online/Offline. If the system offline tab button is selected in the “COMM” window, the CPU will be shut down from reporting defect events. If operations select this button, it will be logged on the map with time and footage in which it was activated. This will help deter operations from shutting down the unit during production runs that could lead to the misinformation on actual defect counts per roll. If the online button is selected, again the time and footage in which it is activated will be logged and reported on the map and stored in the database.

Historical: (***Figure 135***) To access historical information, you move your pointing device to the tab button “Historical” located through the main database setup QAMS.mdb and click once. A grey black screen will appear with a drop down window. You move your pointing device to the arrow and click once. A selection will appear for you to access. Move your pointing device to the selection and highlight it. Another drop down window will appear called “Defects/Product/Real.” In this drop down box you will note a “Date/Time” selection, “Product Code” selection and “Reel” selection. By entering the appropriate information you wish to look at, a graphical display will appear showing all of the defect events that have occurred over the selection period you have chosen. The defect faults are indicated by color and line type formats (i.e., solid blue line indicates small spots, solid red indicates large spots, broken blue line indicates small holes, etc). The bottom of the graph shows the reel numbers chosen for viewing. The numbers located on the left and right-hand side shown the defect counts. This information is stored in the database of the system and can be accessed any way you desire.

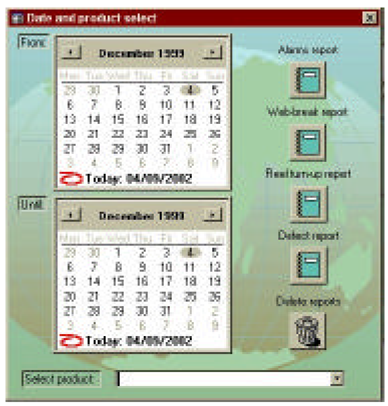


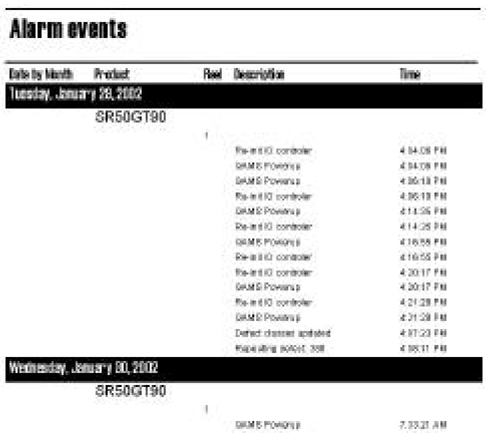
Figure 135 – Main Historical Selection Display

Figure 136 – Historical Display; Product Selection

Figure 137 – Historical Report Access Button/Icons

System Reports Historical

Besides having an end or reel report initialized, QAMS provides four other standard reports. The reports are labeled "Alarm Report", "Defect Report", "Reel Turn Up Report" and "Web Break Report". These reports are accessed through the historical information dialog box discussed above. Samples of these forms are provided herein and are referred by ***Figure 138,139,140 and 141.***



Alarm events

Date by Month	Product	Reel	Description	Time
Tuesday, January 28, 2002				
	SR50GT90			
		1		
			Re-init IO controller	4:04:08 PM
			QAMS Powerup	4:04:08 PM
			QAMS Powerup	4:06:18 PM
			Re-init IO controller	4:06:18 PM
			QAMS Powerup	4:14:26 PM
			Re-init IO controller	4:14:26 PM
			QAMS Powerup	4:16:55 PM
			Re-init IO controller	4:16:55 PM
			Re-init IO controller	4:20:17 PM
			QAMS Powerup	4:20:17 PM
			Re-init IO controller	4:21:28 PM
			QAMS Powerup	4:21:28 PM
			Defect classes updated	4:37:23 PM
			Repeating defect: 338	4:38:11 PM
Wednesday, January 30, 2002				
	SR50GT90			
		1		
			QAMS Powerup	7:33:21 AM
			[illegible]	[illegible]

Figure 138 – Alarm Report

Defect events

Date by Month	Product	Reel	Meter	Ch.	Type	Time
Tuesday, January 28, 2002						
	SR50GT90					
		1				
			84	1	Holes large	4:17:16 PM
			487	1	Holes medium	4:37:51 PM
			647	1	Spots small	4:39:06 PM
			776	1	Spots medium	4:39:11 PM
			832	1	Holes medium	4:39:26 PM
			962	1	Spots large	4:10:12 PM
			1379	1	Spots small	4:10:46 PM
Wednesday, January 30, 2002						
	SR50GT90					
		1				
			38	1	Holes medium	8:46:47 AM
			57	1	Holes small	8:46:53 AM
			74	1	Spots small	7:33:40 AM
			88	1	Spots medium	7:33:44 AM
			115	1	Holes small	7:33:51 AM
			341	1	Holes medium	8:46:09 AM

Figure 139 – Defect Report

Reel turn-up event

Date by Month	Product	Reel	Meter	Time
Tuesday, January 28, 2002				
	SR50GT90			
		1	1308	4:18:48 PM
Wednesday, January 30, 2002				
	SR50GT90			
		1	1305	7:38:05 AM
		2	1302	7:42:54 AM
		3	1302	7:47:42 AM
		4	1303	7:53:23 AM
		5	1304	7:58:52 AM
		6	1304	8:01:21 AM
		7	1308	8:08:08 AM
		8	1305	8:10:45 AM
		9	1303	8:15:25 AM
		10	1308	8:20:07 AM
		11	1303	8:24:48 AM
		12	1308	8:28:31 AM
		13	1305	8:34:03 AM
		14	1305	8:38:39 AM

Figure 140 – Reel Turn Up Report

Web-break event

Date by Month	Product	Reel	Meter	Time
Tuesday, January 28, 2002				
	SR50GT90			
		1		
			52	4:21:42 PM
			516	4:17:52 PM
Wednesday, January 30, 2002				
	SR50GT90			
		1		
			414	7:35:08 AM
			439	8:48:34 AM
			638	8:49:29 AM
			982	7:37:26 AM
			1826	7:36:33 AM
		2		
			629	7:40:54 AM
			1122	8:51:52 AM
		3		
			330	7:44:22 AM
			[illegible]	[illegible]

Figure 141 – Web Break Report

Displaced Symbols and Colors for Defect Fault Detection

RKB follows the guidelines set forth in the TAPPI test methods T437 (*refer to appendix C*) for determination of dirt in paper and paperboard. In this test method dirt sizes are given in mm² based on the formula for defining area of a circle (pir²). Therefore, in the RKB Model 3020 CCD Camera-based Video Web Inspection System, the symbol used for holes and spots are circles with spots having a dark circle and holes a white circle. The spot circle can be made of a black spot or grey spot, depending on the severity of the spot. The hole symbol is a white circle as the main difference among various holes is in size not appearance. Both holes and spots have a rectangular symbol that surrounds the circle symbol. This rectangular symbol is color-coded in three main colors that are red, blue and green. These colors represent the sizing threshold changes (i.e., blue represents small defects, green represents medium defects and red represents large defects). These sizes are operationally adjustable on the fly or can be preset via the product code setup parameter by managerial staff prior to production depending on what product or grade will be produced. In this evaluation, small holes were set at 0 to 4 mm, medium holes were set at 4.1 to 8 mm and large defects were set a 8.1 mm or larger. If additional size categories are required, they can be implemented with additional color schemes. Additional information provided is the location of the defect in the cross machine and machine direction, total defect count per reel and product run, profiles of holes and spots, historical information, and possible fault causing area in the material production equipment (i.e., felt, wire, dryer, etc…). Additional information can be applied and is generally formulated with each client on a user basis.

Symbols as well as text represent the coating streak defects. The streak defect symbols are lines that vary in width depending on the defect size. Wide lines represent true coating streaks and thin lines represent coating scratches. The lines are color-coded similar to the hole and spot defects for easy identification. Blue lines represent scratches, green lines represent scratch/streak and red lines represent streaks. Below these symbols is a text window that provides operational and managerial staff with precise defect location. Each line of text represents a streak or scratch and includes the channel the defect is located in, the start footage of the defect, end footage of the defect, total footage of the defect, location of the defect in the cross machine and machine direction, severity of the defect (i.e., scratch or streak), and possible fault causing location in the paper machine and/or coating machine (i.e., coater station, dryer section, etc.) Additional information can be implemented and it generally formulated with each client on a user basis prior to system implementation.

*****NOTE** THIS INFORMATION CAN ALSO BE TRANSPORTED TO MICROSOFT ACCESS® OR MICROSOFT EXCEL® PROGRAMS FROM A LAN HOOKUP OR BY DOWNLOADING THE DATA ONTO DISK. BY USING THE ABOVE PROGRAMS YOU OPEN YOURSELF UP TOO MANY MORE WAYS TO ANALYZE THE DEFECT INFORMATION AND HAVE ACCESS TO MANY FORMS OF GRAPHICAL REPRESENTATIONS OF THE INFORMATION WHICH MAY BETTER SUIT YOUR INDIVIDUAL REPORTING FUNCTIONS.***

*****NOTE** IF YOU WISH TO HAVE DIFFERENT SETTINGS FOR DEFECT CLASSES, CHANNELIZATION, ETC. . . . YOU MUST FIRST CHANGE THOSE SETTINGS PRIOR TO ADDING NEW PRODUCT CODES OR THE SETTING YOU COMMITTED TO FOR THE FIRST PRODUCT CODE WILL BE ENTERED. PRODUCT CODES CANNOT BE ALTERED, and OR DELETED, SO MAKE CERTAIN EVERYTHING IS CORRECT BEFORE ADDING YOUR PRODUCT CODE.***

TOUCHSCREEN OPERATORES JUST NEED TO TOUCH THE ACCESS BUTTONS ONCE TO HAVE ACCESS TO THE VARIOUS DISPLAYS. THE TOUCHSCREEN REPLACED MOUSE FUNCTIONS.

TROUBLESHOOTING & COMPUTER MAINTENANCE

Routine maintenance should be performed on a monthly basis.

With proper maintenance, the Series 3000™® OPTOMIZER® CCD Camera-based Video Web Inspection System will provide years of consistent and dependable service. The primary requirements for all equipment is to keep it CLEAN. The following outline should help in increasing the life of the equipment and maintaining performance.

MODEL 3020

Routine maintenance should be performed on a monthly basis.

With proper maintenance, the Model 3020® OPTOMIZER® CCD Camera-based Video Web Inspection System will provide years of consistent and dependable service. The primary requirements for all equipment is to keep it CLEAN. The following outline should help in increasing the life of the equipment and maintaining performance.

Sensing Beam

The sensing beam contains the CCD cameras and distribution module. Since the sensing beam is self-contained and requires little or no maintenance, under no circumstance should the sensing beam be opened without authorized supervision. The cameras are separated within the sensing beam and maintenance of them should be rare. Occasionally a camera may require cleaning of the lens. A dirty lens will frustrate all other efforts to enhance system performance. To clean the lens, remove the lower apertured cover and use a soft cotton cloth, or lens tissue to gently wipe the surface of the lens to remove dust and particles. If this fails, use lens cleaning solution (typically available at most photo stores) and moisten the cleaning cloth before trying again.

The camera lenses are structured to prevent changes in the f-spot and focus settings (and each of these settings are adjusted by movement of the lens barrel) if the cleaning is done gently, no refocusing or resetting of the camera is required. If however, the settings are changed, the system will require recalibration. Obviously, this should not inhibit cleaning of the lens. The retaining structure is sufficient to prevent most movement. Only carelessness or maliciousness will cause changes in the lens settings.

More often than not, lamp maintenance is all that will be needed.

NEVER ALLOW THE CAMERAS OR CABLES TO GET WET!

Bottom Lamp Assembly (*if provided*)

Dirt tends to trap heat within the lamp housing that may cause premature failure of a bulb. Be certain to clean the outside of the sensing beam and ensure nothing is blocking the view of the paper web. This task should be performed once each week (in real dirty environments once each day). This is important because debris between the sensing beam and the paper will impede light transmission and overall operation of inspection.

In addition, each shift should check the bottom lamp-housing unit to make certain that nothing is obstructing the apertures. Remove any debris that is blocking the lamp housing. This is imperative, as any obstruction will effect system performance.

Lamp Power Supplies

The lamp power supplies include small filters and air purge fans. These filters must be cleaned monthly. The fans provide airflow to reduce the temperature within each supply. Electronic failures increase dramatically in high temperature environments, and dirty filters reduce the airflow through the supplies. With less airflow the temperature within each supply rises and the likelihood of electronic failure increases.

Additionally, dirty filters pass the dirt into the supplies themselves and settles on the various electronic components. This results in the components being insulated causing them to operate at higher temperatures than required which may cause electronic failure.

To clean the filters once a month you need to remove them from each supply, and using compressed air, blow through the filters opposite the normal direction of airflow. Make certain that the air used does not contain water and oil. Also, open each supply unit and inspect for dust infiltration. If dust has penetrated the filter and is in the supply, use 20 p.s.i. gage air and blow the dust out[90].

Control Cabinet

The control cabinet is NEMA rated and should be kept closed at all times to keep dirt and dust out. The cabinet is positively purged with air to alleviate any heat build up. All exposed electronics may be cleaned with low-pressure (20-30 psi) compressed air. NOTE** IF COMPRESSED AIR IS USED, MAKE CERTAIN THAT ALL MOISTURE HAS BEEN FILTERED OUT OF THE AIR. IF THE AIR CONTAINS MOISTURE, DO NOT USE!!!!

Shaft Encoder (*if provided*)

The shaft encoder, if supplied with this equipment, should be inspected monthly and debris removed from around the shaft and off the case. Inspect and clean the gearing apparatus to insure long life.

Printer Enclosure (*if provided*)

The printer enclosure, if supplied, should be kept closed to protect the printer from dirt. The enclosure should be wiped clean at least once a week. Check the printer each day for paper and print quality. Be certain to obtain more paper before the printer is out. Use only HP or equivalent paper. Poor print quality may be the result of incorrect paper, low toner or malfunctioning components.

Troubleshooting

Most problems with the Model 3020 can be avoided entirely if the system is correctly calibrated and operated. RKB does not assume responsibility for maliciousness relative to operational access to the CPU, deleted files, changed passwords, etc. The system, which should have calibration checked quarterly, would be maintained as prescribed. There are a total of 51 printed circuit boards utilized within the system, but relatively few require adjustment. These boards as described in this manual are:

[90] If continuous dust build up is a problem, verify that the conduit passing wires into and out of each supply are sealed so that the cooling air must pass through the filters, not the conduit.

Module; Camera Sync Gen.	D111055		1A1
Module; Timing, Horizontal	D110606		1A2
Module; Timing, Vertical	D110672A		1A3
Module; System Timing Dist.	D111076		1A4 & 1A5
Module; Video Multiplexor	D111051		1A8 – 1A11
Module; Edge Detection			1A12
Module; Streak Finder	D110045A		1A14 – 1A21
Module; Fir Filter #1	D110207		2A1, 2A3, 2A5,2A7, 2A9, 2A11, 2A13, 2A15, 2A17, 2A19
Module; Fir Filter #2	D110557		2A2, 2A4, 2A6, 2A8, 2A10, 2A12, 2A14, 2A16, 2A18, 2A20
Module; Field Odd/Even	D112855		2A21
Module; Comparator Reference Voltages	D111081A		2A22
Module; Fir Filter #1	D110207		3A1, 3A3, 3A5, 3A7, 3A9
Module; Fir Filter #2	D110557		3A2, 3A4, 3A6, 3A8, 3A10
Module; Fields Odd/Even	D112855		3A11
Module; Diode Matrix	D110581		3A12
Module; Output	A113653		3A14

MODEL 3010/3040

With proper maintenance, the Model 3040 OPTOMIZER will provide years of consistent and dependable service. The primary requirements for all equipment is to keep it CLEAN. The following outline should help in increasing the life of the equipment and maintaining performance.

Sensing Beam

The sensing beam contains the CCD cameras and distribution module. Since the sensing beam is self-contained and requires little or no maintenance, under no circumstance should the sensing beam be opened without authorized supervision. The cameras are separated within the sensing beam and maintenance of them should be rare. Occasionally a camera may require cleaning of the lens. A dirty lens will frustrate all other efforts to enhance system performance. To clean the lens, remove the lower apertured cover and use a soft cotton cloth, or lens tissue to gently wipe the surface of the lens to remove dust and particles. If this fails, use lens cleaning solution (typically available at most photo stores) and moisten the cleaning cloth before trying again.

The camera lenses are structured to prevent changes in the f-spot and focus settings (and each of these settings are adjusted by movement of the lens barrel) if the cleaning is done gently, no refocusing or resetting of the camera is required. If however, the settings are changed, the system will require recalibration. Obviously, this should not inhibit cleaning of the lens. The retaining structure is sufficient to prevent most movement. Only carelessness or maliciousness will cause changes in the lens settings.

More often than not, lamp maintenance is all that will be needed.

NEVER ALLOW THE CAMERAS OR CABLES TO GET WET!

Bottom Lamp Assembly

Dirt tends to trap heat within the lamp housing that may cause premature failure of a bulb. Be certain to clean the outside of the sensing beam and ensure nothing is blocking the view of the paper web. This task should be performed once each week (in real dirty environments once each day). This is important because debris between the sensing beam and the paper will impede light transmission and overall operation of inspection.

In addition, each shift should check the bottom lamp-housing unit to make certain that nothing is obstructing the apertures. Remove any debris that is blocking the lamp housing. This is imperative, as any obstruction will effect system performance.

Top Lamp Assembly

The top lamp assembly if provided with this system is completely enclosed and housed from the mill environment. The lamp assembly is positively purged to prevent heat build up, which could adversely affect lamp life. To ensure that proper airflow is maintained, the filter unit on the blower should be checked monthly and cleaned or replaced accordingly.

Lamp Power Supplies

The lamp power supplies include small filters and air purge fans. These filters must be cleaned monthly. The fans provide airflow to reduce the temperature within each supply. Electronic failures increase dramatically in high temperature environments, and dirty filters reduce the airflow through the supplies. With less airflow the temperature within each supply rises and the likelihood of electronic failure increases.

Additionally, dirty filters pass the dirt into the supplies themselves and settles on the various electronic components. This results in the components being insulated causing them to operate at higher temperatures than required which may cause electronic failure.

To clean the filters once a month you need to remove them from each supply, and using compressed air, blow through the filters opposite the normal direction of airflow. Make certain that the air used does not contain water and oil. Also, open each supply unit and inspect for dust infiltration. If dust has penetrated the filter and is in the supply, use 20 p.s.i. gage air and blow the dust out[91].

Control Cabinet

The control cabinet is NEMA rated and should be kept closed at all times to keep dirt and dust out. The cabinet is positively purged with air to alleviate any heat build up. All exposed electronics may be cleaned with low-pressure (20-30 psi) compressed air. **NOTE** IF COMPRESSED AIR IS USED, MAKE CERTAIN THAT ALL MOISTURE HAS BEEN FILTERED OUT OF THE AIR. IF THE AIR CONTAINS MOISTURE, DO NOT USE!!!!**

Shaft Encoder

The shaft encoder, if supplied with this equipment, should be inspected monthly and debris removed from around the shaft and off the case. Inspect and clean the gearing apparatus to insure long life.

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[91] If continuous dust build up is a problem, verify that the conduit passing wires into and out of each supply are sealed so that the cooling air must pass through the filters, not the conduit.

Printer Enclosure

The printer enclosure, if supplied, should be kept closed to protect the printer from dirt. The enclosure should be wiped clean at least once a week. Check the printer each day for paper and print quality. Be certain to obtain more paper before the printer is out. Use only HP or equivalent paper. Poor print quality may be the result of incorrect paper, low toner or malfunctioning components.

Troubleshooting

Most problems with the 3010/3040 OPTOMIZER can be avoided entirely if the system is correctly calibrated and operated. RKB does not assume responsibility for maliciousness relative to operational access to the CPU, deleted files, changed passwords, etc. . . The system, which should have calibration checked quarterly, will be maintained as prescribed. There are a total of 24 printed circuit boards utilized within the system, but relatively few require adjustment. These boards as described in section 3.0 of this manual are:

Camera Timing Module	D110487A	RKB 402286	1A1
Buffer, Timing Distribution Module	D111076A	RKB 403340	1A2
Comparator Reference Voltage Module	D111081B	RKB 403343	1A3
Analog Signal Processing Module	D111947	RKB 403993	1A6 & 1A9
Edge Crack Detection Module	D113496	RKB 404756	1A10
Hole Fault Size Classification Module	D110753	RKB 403392	1A13 & 1A14
Spot Fault Size Classification Module	D110753	RKB 403392	1A15 & 1A16
Defect Size Latch Module	D113492	RKB 404757	1A17
Odd/Even Module	N/A	N/A	1A18
Signal Multiplexor Module	D112800	RKB 404755	1A21

Calibration Procedure

1) The Model 3010/3040 OPTOMIZER Timing Module [D110487A] has present jumpers that do not require any changes. The timing board is tested and calibrated by RKB technicians in-house and needs no further technical support.

2) Likewise, the Defect Size Classifier module [D110753] has only one preset jumper and requires no further calibration.

3) The Channelization modules [D110997] are similar and have preset jumpers and do not require changes.

4) The Analog Signal Processor module [D111947] requires recalibration annually and should be done by an authorized RKB field service engineer. This module has seven (7) adjustments which are simple to complete, but are critical for proper system performance. Prior to adjusting any setting, ensure the camera sensors are setup correctly and aligned. The potentiometers located on the modules should all be set as close to 0VDC as possible. In addition, the preset jumpers found on the board do not require changes. Refer to Appendix G for calibration procedure of this module.

Camera Adjustments

When looking at a particular camera make certain that the F-Stop is set to 2 (standard setting, however, RKB may set stops higher), then focus, then adjust to maximize the signal spikes utilized during the focusing procedure.[92] Verify that the video signal is maximally flat across the entire filed of view[93] without severe signal degradation. This step typically requires practice and experience. All the cameras should be set to the same F-Stop if possible.

To focus the cameras, place a camera target or alignment page from this manual in the view of the camera to be adjusted. Be certain that the page is in the plane of the web. Using the oscilloscope and a portable video amplifier[94], connect the camera output to the amplifier input, then connect the amplifier output to the oscilloscope. Turn on the amplifier and adjust the focus ring of the camera lens until the spikes in the video signal are maximized.

Aiming the camera sensor requires the camera to be oriented with the CCD array in the cross machine direction. To correctly orient the camera, first orient the camera target or alignment page so that the longest line is perpendicular to the machine direction (i.e., in the cross machine direction), and directly in the path between the camera and the transmitted and/or reflected light source. Correct target alignment is very important. Take the time now to do it right to prevent poor performance later. It may be easiest to draw a thread tight across the machine. Then use the thread to locate the target correctly. This method is rather simple and produces very good results especially when compared to sighting the target itself. Once the target is aligned the camera may be adjusted.

To formally make your adjustments, remove the top and bottom covers surrounding the cameras in the sensing beam. Gently loosen the camera mounting assembly[95] to allow the camera to move. Once loose, the camera should stay fixed in the mounting until it is manually positioned. Connect the camera to an oscilloscope in the same manner used to focus the camera. Adjust the scope to view one scan of the target or alignment page. The target has one-inch hash marks that should be seen as negative spikes on the oscilloscope. Adjust the camera position until the camera has a field of view as prescribed under the methodology section of this manual. Be certain that there are no gaps in the field of view between cameras, then adjust the camera position and rotation until the thick centerline on the target fills the field of view of the camera. Tighten the adjustment screws, and move to the next camera sensor.

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[92] Typically opening the lens further (f 1.4) will increase the signal

[93] This is normally accomplished by reducing the lens aperture (f 2.8 or above)

[94] This step is normally done by RKB personnel at the time of installation, using their portable amplifier. If this is to be done by mill personnel, two individuals will be required. One must adjust the camera focus, while the other views the oscilloscope in the operator conso9le. The oscilloscope should be probing TP2 of D111947.

[95] Use a 3/32" Allen wrench and a flat blade screw driver

When all cameras have been correctly aimed and focused, replace the camera target or alignment page with a sample of good product.[96] Using the oscilloscope probe TP2 and adjust R44 until the video signal is centered around ground. Then probe TP3, adjust R8 until the most positive portions of the video signal are clipped flat. Next probe TP4 and adjust R15 until the most negative portions of the signal are clipped flat. Move the probe to TP5 and adjust R31 to prevent the signal from saturating upon defect detection. Use TP6 and R36 for the same purpose. TP5 and TP6 are used to adjust the amplified gain for spot detection. Typically this gain will be higher than the gain for hole detection.

Adjust the hole detection gain by probing TP8 and adjusting R24 to prevent signal saturation. Probe TP9 and adjust R27 in the same manner. J1 should have the jumper placed nearest to Z22, J2 should have the jumper placed farthest from Z22.

5) The potentiometers found on the Threshold Voltage module are preset by RKB and do not require changes.

6) Auxiliary Field of View Gates Module D110202A, Buffer, Timing Distribution Module D111076A and OPTO-TEK III Camera Timing Dist. Module D110723 requires no calibration as all of the jumpers located on these modules are preset by RKB.

7) The Comparator Reference Voltage Module has three DC inversion adjustments. Utilizing the oscilloscope, probe TP1 and TP2. Adjust R1 until TP2 is the same magnitude but opposite polarity as TP1.[97] Move probes to TP3 & TP4 and adjust R4 until TP4 is opposite polarity, but same magnitude as TP3. Repeat the procedure for TP5 & TP6. One additional adjustment is available but is not utilized within the system. No adjustment is required for correct operation.

If adjustments of any settings are required, consult an RKB authorized service engineer. Although many adjustments are simple to complete, they are critical to the successful functioning of the system. Prior to making any adjustments electronically, make certain the camera sensors are correctly aimed, set and focused. If a camera position and setting is not known to be correct, they must be before the electronic adjustments can be made.

Occasionally difficulties will arise that require parts replacement within the system. A competent electronic technician should be able to utilize the system schematics to isolate any problems. Once a problem has been isolated to a particular board or component, it should be replaced with a spare. The dysfunctional board or component should then be sent back to RKB for repair. DO NOT THROW AWAY PCBs. If you are unsure the part can be replaced, call, fax or email RKB for advise.

Display Troubleshooting

QAMS is a fairly straight program. From time to time, RKB will be providing updates to this program to ensure the performance of the equipment is valid. If a problem with QAMS occurs, please consult RKB for advice.

WindowsNT7 problems are unusual, but do occur. Consult your owners' book provided with this manual for troubleshooting advice. RKB is also preparing a guide to problems with windows that will be added as an addendum at a later date when finalized.

[96] Calibrating to something else will not yield the correct results

[97] i.e., if TP1 is +5 volts, TP2 should be adjusted to -5 volts

1) Make sure that the communications cable on the back of the monitor is connected securely. If the screen remains blank the VGA board located within the PC may require repair or replacement. Return the PC computer to RKB for service.
2) You may have a system communication crash, especially if the product codes setups are not setup correctly. If this happens, you need to shut down QAMS and/or the CPU, re-cycle the main power on the Power Control Enclosure located on the drive side all to facilitate re-initialization of the I/O Module. Turn on the CPU and resume as usual.

Additional System Troubleshooting

If a problem is a sounding alarm, or an incorrectly functioning marker, open the operator console and turn off the offending item. The alarms and spray marker have switches to turn them off. The switches are located on the engineering workstation panel and are labeled. This should eliminate the immediate problem and permit the service technician to work on the cause of the difficulty without being under pressure to Afix it now.@ Remember to turn all switches back on when the trouble has been remedied, or the alarms will fail to operate then they should. Spray maker troubleshooting is continued further in this manual.

Locating the problem can be accomplished by verifying signal path continuity from beginning to end. To do this, start with the electronic controls located in the racks. Before removing or inserting any PCB (printed circuit board), turn the DC power switch off or you may weaken or cause electronic component failure. Turn the power back on after the PCB(s) have been inserted, and press the system initialization key on the CPU. This procedure must be done each time a PCB is removed or inserted.

Timing Module: Test the system timing module [Series 3000 CCD Camera Timing Module D110487A] by removing the existing board, inserting the extender card, and placing the timing module in the extender. The timing module connector pins are numbered top to bottom from 1 to 22 on the wire side and A through Z on the component side.[98] Probe edge pin 6. The trace should be a square wave. Pin 7 should also be a square wave, but inverted compared to pint 6. Pin 8 should have a positive pulse(s) and pin 9 should be the inverse of pin 8. Pin 14 should be a digital pulse that remains high.

Adjust the scope trigger thumb wheel and watch the oscilloscope trace. The trace should move with the thumb wheel changes. Pin 13 should pulse, pin 19 should have a pulse. If any of these pins are incorrect, replace the module with a spare and retest. If the signals still fail to match these instructions, contact RKB for service. If all of these pins are correct, reinsert the module and move the extender card to the next PCB [D110202A]. Do not throw away any PCBs as they can be repaired.

Field of View Gates Module: Test the system field of view gates [Auxiliary Field of View Gates Module D110202A] by probing pines 16, 17 and 18. At least one of these pins and possibly more should be pulsing. If there is no output, or one of the outputs is excessively noisy, replace the module with the spare and retest. Move the extender to the next FOV module and test in the same fashion. Remove the extender card, replace the module and move to the next PCB [D111081B].

[98] Note that there is no G,I,O or Q thus only 22 letters of the alphabet are used.

Comparator Reference Voltage Module: Test the system reference voltages [Comparator Reference Voltage Module D111081B] by probing TP1 and TP2. The voltages should be equal in magnitude, but opposite polarity (i.e., +5 and -5 volts). Repeat the test for TP3 and TP4, and TP5 and TP6. If the signals do not match this description, and cannot be adjusted using the calibration procedure given earlier in this manual, replace the module with a spare and calibrate the new module. Move onto the next PCB [D111947].

Analog Signal Processing Module: Test the systems signal processing [Analog Signal Processing Module D111947] by probing TP6 on the PCB. Defect signal amplitude should be large[99] but not saturated. Probe TP9, the signal period should match TP6. Again the defect signal amplitude should not saturate, but should be large.

If the signals are present, but defect signals are saturating, recalibrate the system as outlined in the appendix of this manual. If the signals are not present, replace the module with a spare and calibrate the new module. If the spare has made no change in the signal behavior or the signals simply are not there, replace the 4th PCB in the top rack and retest the board. If at this point, the video signals are still not there, the problem may be related to the OPTO-TEK III Camera Timing Dist. Module [D110723] located in the top of the sensing beam assembly.

Finally probe TP7 and TP10, both signals should be at zero volts unless a defect is present. It may be necessary to place an artificial defect in the view of the camera sensor to be certain that a signal is being generated when a defect is detected. If there signals are incorrect, replace the board with a spare, calibrate the spare, and retest TP7 and TP10. Move to the next PCB and test in the same fashion, until all the modules have been tested.

Camera Timing Dist. Module: To test the timing distribution [OPTO-TEK III Camera Timing Dist. Module D110723] probe E7 and E8, these lines should have small pulses. Probe E9 and E10, these lines should be square waves. Continue this procedure throughout the module. Each of these sets should behave in the same manner, if not the module needs repair. Contact RKB for specific instructions regarding repair.

Channelization Logic Module: To test the channelization logic [Channelization Logic Module D110997] probe edges U, V and W using the extender card. These signals should be zero volts[100] unless a defect is being detected. Any defect pulse should be +5 volts. If the signal is high, or exceeds 2 volt steadily, replace the module with a spare.

Defect Fault Size Classification Module: To test the defect sizing [Defect Fault Size Classification Module D110753] use the extender card and probe edges E, F, H, J, K, L, M, N and P. These lines should remain high[101] unless a defect is detected. If the lines remain low constantly, or a pulse is visible when no defect is present, replace the module with a pare and retest.

[99] Typically greater than 5 volts

[100] within 2 volt of ground

[101] Three to Five volts

DIGIO Controller I/O Modules: The remaining modules [DIGIO Controller I/O Module D113494 and DIGIO Controller I/O Module D113495] provide communication with the CPU. Their functions may be partially monitored from the data acquisition panel mounted in the computer itself. Access to the computer is through the front door, if housed in the control enclosure, or apparent as a self-standing unit. These units are preset by RKB and should never be adjusted without an RKB representative present.

Relay Module: The relay module [D108147] is used to change logic voltages to 110 volts A.C. Signals which are used to operate the spray marking unit and alarms. A faulty relay can interrupt signals and cause problems. To test a relay, first verify that the correct DC voltages are applied. Then remove the signal wire to the relay and replace the signal wire with ground. Probe the associated output with a voltmeter.[102] The output should be 110 VAC. If not, replace the relay (be certain that the alarms switch within the console is on).

Printer and related components.

The system printer supplied with the Model 3010/3040 OPTOMIZER is the HP LaserJet® printer. The printer comes with 8 MB RAM, an HP JetDirect print server card for network connections and a 500 sheet feed tray. The printer should be placed on a study, level surface with plenty of space allowance around the printer. The environment should be well ventilated with no direct exposure to sunlight or chemicals. Relative humidity should be between 20% to 80% with a room temperature of 50° to 91° F (10° to 32° C).

Edge Crack Detection Troubleshooting

Most problems with the edge crack detection system can be avoided entirely if the system is correctly calibrated each quarter and maintained as prescribed. There are a total of five circuit modules utilized within this system, but relatively few require adjustment.

Calibration Procedure

The edge crack detection system uses the Series 3000 CCD Camera Timing Module D110487A, Buffer, Timing Distribution Module D111076A and the Edge Crack Detection Module D113496.

D110487A: The only adjustments available on this module are jumpers which are preset at RKB prior to system implementation.

D111076A: Upon installation, RKB will adjust the following onboard potentiometers to the appropriate levels: Video Offset, Video Gain, Filter Offset, and Filter Gain. These are all noted on the enclosed schematic and no further adjustments need be done.

D113496: No adjustments available. Occasionally difficulties will arise that require part replacements within the system. A competent electronic technician should be able to utilize the system schematics to isolate any problems. Once a problem has been isolated to a particular module or component, it should be replaced with a spare.

[102] Positive lead to TB, negative lead to ground

MODEL 1280

Spray Marking Troubleshooting

If you feel that the spray marking system is not performing, run a test prior to making any electronic changes or modifications. After proper installation, the following procedure should be used to setup and operate the spray marker.

Marker operation and initial startup

place the Start/Stop selection switch located on the engineering workstation panel to the stop position.

press the power switch to the ON position

with no web present, place the Start/Stop selection switch to Start.

with no web present, press the test pushbutton located on the test station. The ink carriage spray head assembly will move forward. There will be a delay of 2-3 seconds before the marker moves forward.

place a piece of paper in the web guide so that both sensors are blocked or covered. The carriage should retract to the stop position. There will be a delay of 2-3 seconds before the marker moves.

slide the paperback so that only the sensor nearest the web is covered. Not that the carriage should not move.

remove the paper. The carriage should now move forward until it reaches the stop. There will be a delay of 2-3 seconds before the marker moves.

press the Stop button on the Start/Stop switch, the carriage should retract. There will be no delay, marker will move immediately.

Position the marker to allow enough space beyond the widest web width to allow complete retraction of the marker.

ensure that the marker is able to travel from its fully retracted position to the narrowest web width. The maximum travel is 12 inches (30.48 cm). If more travel than this is required, a manual adjustment must be provided to move the entire assembly for different grades or materials.

verify that the web guides are parallel to the web. If the guides are not parallel, loosen the two hex head bolts on the spray head coupling and rotate the spray head to the proper position.

Verify that the web guides are the proper height to engage the web with minimal contact. Adjust as required.

install the inks by removing the shipping caps and replacing them with the gravity flow caps provided with the marker. Install filters in the inkwells over opening. Place the bottles with gravity flow caps attached in the inkwells, squeeze the bottle to start the ink flow. The ink level in the ink well must be above the filter for proper function.

test the colors at the test station (provided there is more than one color) by pressing the appropriate switches. If the web is not present, test will have to be held to perform this step.

place the Start/Stop switch in the Start position. The spray head assembly should move out onto the web and stop with the web between the edge sensors. The marker is no in an operation position.

the marker is now functional except for occasional addition of ink. Maintenance is outlined further in this manual.

Changing the setting of the air regulator may vary the spray. The factory setting is 10 p.s.i.

Spray Marker Preventative Maintenance

The Model 1280 multicolor spray marking system should be connected to filtered mill air. Every six to twelve weeks, the airline filter should be changed to insure no excess build up of oil or dirt is present. The transparent ink well covers should be kept on at all times. The Model 1280 is an industrial piece of equipment and will operate with a minimum amount of maintenance and cleaning. However, it is always sound practice to clean mechanical equipment at regular intervals.

Cleaning the 1280

The edge sensors should be kept free of dirt and build up. Clean them by spraying air across their surfaces each shift. Heavy build up can be removed with a soft cotton cloth. Avoid the use of solvents and harsh chemicals.

The ink system will also require occasional flushing. To clean the ink system, first remove the ink bottles and wash all gravity flow caps. Obtain empty ink bottles and fill with water and place gravity flow caps on the bottles. Place the bottles of water into the inkwells. Using the test station, activate each color until all water has been sprayed out. Remove the empty water bottles and check condition of the ink well filter located on the bottom of the ink well. Wash if necessary. If dirt, debris or other matter exists in the ink well, remove as much as possible. ALWAYS REPLACE THE INK WELL DUST COVERS.

No Spray Cycle

Check the setting of the Dwell and Spray time controls. Using a multi meter, check the output voltage of the solid state relay associated with the spray solenoid (See relay module D108147). If you have 110 VAC for the interval of the desired spray, the trouble is in the spray marker assembly. Be certain that the input air is 65 to 90 p.s.i. Also check the electric solenoid and verify that it is functioning. Verify that the color valve is not plugged or defective.

If the 110 VAC is not exiting the relay, the relay may be at fault. Check the relay, only after verifying that the Start/Stop switch is set to Start. If neither of these solves the problem, test the Dwell and Spray one shots on the marker control module [D110563].

Single Color Malfunction

Check ink flow system. Gravity flow cap and ink well filter must not be clogged. Check the ink level in the ink well. Check the associated relay output voltage as described above. If the relays outputs 110VAC after triggering, and the ink passage is clear, verify the air-input pressure is 65 to 90 p.s.i. Check the color valve and the color solenoid. If the 110 is not present, test the marker control module and then the relay.

Marker does not retract on web break

Verify that the web break signal is getting to the marker control module and that 110 VAC is being sent to the marker assembly

Marker does not advance when web is present

Follow the same instructions as listed in 9.8.5.6 above

APPENDIX A

WIRING, DRAWING AND PARTS LIST INFORMATION

MODEL 3020

D113621	Approval Drawing	Sheets	2
PL113621	Parts List, Approval Drawing	Sheets	1
D113636	Cable Lengths	Sheets	1
A113697	Field Wiring	Sheets	2
D113701	Power Supply Wiring	Sheets	1
D113664	Control Cabinet Wiring	Sheets	1
D113618	Electronic Control Assembly	Sheets	1
PL113618	Parts List, Electronic Control Assembly	Sheets	1
D113702	Card Rack Assembly	Sheets	1
PL11302	Parts List, Card Rack Assembly	Sheets	1
D113698	Card Rack, Sub-Assembly	Sheets	1
PL113698	Parts List, Card Rack, Sub-Assembly	Sheets	1
A113668_1	Card Rack #1, Sub-Assembly	Sheets	1
PL113668_1	Parts List, Card Rack #1, Sub-Assembly	Sheets	1
D113665	Card Rack #1, Sub-Assembly, Interconnection	Sheets	3
N/A	PCB, Module, Camera Sync Generator	Sheets	1
D111055	Schematic, Module, Camera Sync Generator	Sheets	1
N/A	PCB, Module, Horizontal Timing	Sheets	1
D110606A	Schematic, Module, Camera Sync Generator	Sheets	1
N/A	PCB, Module, Vertical Timing	Sheets	1
D110672	Schematic, Module, Vertical Timing	Sheets	2
N/A	PCB, Module, Timing Distribution	Sheets	1
D111076A	Schematic, Module, Timing Distribution	Sheets	1
N/A	PCB, Module, Video Multiplexor	Sheets	1
D112794	Schematic, Module, Video Multiplexor	Sheets	2
N/A	PCB, Module, Streak Finder	Sheets	1
D110045A	Schematic, Module, Streak Finder	Sheets	1
A113668_2	Card Rack #2, Sub-Assembly	Sheets	1
PL113668-2	Parts List, Card Rack #2, Sub-Assembly	Sheets	1
D113666	Card Rack #2, Sub-Assembly, Interconnection	Sheets	3
N/A	PCB, Module, FIR Filter #1	Sheets	1
C110207	Schematic, Module, FIR Filter #1	Sheets	2
N/A	PCB, Module, FIR Filter #2	Sheets	1
D110557	Schematic, Module, FIR Filter #2	Sheets	2
N/A	PCB, Module, Aux. Field of View	Sheets	1
D112854	Schematic, Module, Aux. Field of View	Sheets	1
N/A	PCB, Module, Comparative Ref Voltage	Sheets	1
D111081A	Schematic, Module, Comparative Ref Voltage	Sheets	2
A113668_3	Card Rack #3, Sub-Assembly	Sheets	1
PL113668-3	Parts List, Card Rack #3, Sub-Assembly	Sheets	1
D113667	Card Rack #3, Sub-Assembly, Interconnection	Sheets	3
N/A	PCB, Module, Diode Matrix	Sheets	1
D110581A	Schematic, Module, Diode Matrix	Sheets	1
N/A	PCB, Edge Track	Sheets	1

A113653	Schematic, Edge Track (to be amended)	Sheets	1
D113619	Electronic Control, Inner Panel Assembly	Sheets	1
PL113619	Parts List, Electronic Control, Inner Panel Assembly	Sheets	1
D113700	Electronic Control, Inner Panel, Oscilloscope Assembly	Sheets	1
PL113700	Parts List, Electronic Control, Inner Panel, Oscilloscope Assembly	Sheets	1
D113662	Master Assembly, Camera Housing	Sheets	2
PL113662	Parts List, Master Assembly, Camera Housing	Sheets	2
C113614	Master Assembly, Camera Housing, Camera Sub-Assembly	Sheets	1
PL113614	Parts List, Master Assembly, Camera Housing, Camera Sub-Assembly	Sheets	1
D113704	Master Assembly, Camera Housing, Wiring	Sheets	1
N/A	PCB, Module, Sync Timing Distribution	Sheets	1
D112893	Schematic, Module, Sync Timing Distribution	Sheets	1
D113622	Camera Housing, Mounting Bracket	Sheets	1
PL113622	Parts List, Camera Housing, Mounting Bracket	Sheets	1
D113699	Power Supply Assembly	Sheets	1
PL113699	Parts List, Power Supply Assembly	Sheets	1

APPENDIX B

WIRING, DRAWING AND PARTS LIST INFORMATION

MODEL 3010/3040

APPENDIX C

Equipment Spare Parts Information
MODEL 3020 OPTOMIZER®

APPENDIX D

Equipment Spare Parts Information
MODEL 3010/3040 OPTOMIZER®

400262	Socket, Lamp	ALF272/51
499263	Socket, Lamp	ALF272/52
401923	Module, Relay	D108147
402286	Module, Timing	D110487A
402287	Module, FOV Gates	D110202A
402658	Lamp, VHO, 48"/PB/30	n/a
n/a	Lamp, VHO, 96"/PB/30	n/a
402923	Supply, Power, Mercron®	n/a
403286	Sensor,	1550NR01
403343	Module, Comparator Threshold Voltage	D111081B
403349	Module, System Diagnostics	D111003C
403392	Module, Defect Fault Size Classifier	D110753
403733	Module, Camera Timing Dist.	D110723
403992	Module, Channelization Logic	D110997A
403993	Module, Signal Processor	D111947
404380	Filter, Blower	N/A
404381	Supply, Power	F15-15-A+
404383	Supply, Power	HE5-18/OVP-A+
404392	Supply, Power, Mercron	FX0696-4
404659	Lens, Sensor,	NIKOR50/1/8
404755	Module, Signal Multiplexor	D112800
404756	Module, Edge Crack Detection	D113496
404757	Module, Defect Size Latch	D113492
404805	Module, I/O Controller	D113494
404806	Module, I/O Controller	D113495

MODEL 1280 MULTICOLOR SPRAY MARKING SYSTEM

400755	Ink, Blue	n/a
400756	Ink, Red	n/a
400757	Ink, Black	n/a
400758	Ink, Green	n/a
401027	Gauge	274Z 160 WS
401030	Solenoid Valve	MB-12-3CSC
401032	Nozzle, Spray, 1/4JAU	Set up #4
401225	Adapter, Bulkhead	207ACB2
401239	Regulator, Valve	MF1-12
401541	Cap, Gravity Control	n/a
402298	Module, Model 1280, Marker Control	D110563B
403844	Cylinder, Rodless	ORIGA
403868	Valve, Solenoid	n/a
404037	Regulator Assembly	n/a
404038	Solenoid Valve, Coil Assembly	n/a
404078	Valve, Solenoid	4040 78
404302	Ink, Orange	n/a

APPENDIX E

MCR Hardwired - Power Line Conditioning with Voltage Regulation

The MCR Hardwired Series provides excellent noise filtering and surge suppression to protect connected equipment from damage, degradation or miss-operation. Combined with the excellent voltage regulation inherent to Sola's patented ferroresonant design, the MCR can increase the actual Mean Time Before Failure (MTBF) of protected equipment. The MCR is a perfect choice where dirty power, caused by impulses, swell, sags, brownouts and waveform distortion can lead to costly downtime because of damaged equipment.

Features

- Noise attenuation.
  - 120 dB common mode
  - 60 dB transverse mode
- Surge suppression tested to ANSI/IEEE C63.41
  Class A & B Waveform: <10 V let through typical.
- Acts as a step-up or step-down transformer.
- Hardwired.
- Galvanic isolation.
- 25 year typical MTBF.
- No maintenance required.

Applications

- Industrial automation and control equipment (PLCs).
- Machine tools.
- Computer loads and electronic equipment.
- Robotics
- Semiconductor fabrication equipment.
- Micro-processor controlled equipment

Specifications

Parameter	Condition	Value
Input		
Voltage	Continuous at full load (lower input voltage possible at lighter load)	+20% to -35% of nominal
Current[1]	at Full Load & 80% of nominal input voltage	I_{in} @ (VA/.87) / (V_{in} * 80%)
Frequency	See the Operating Characteristics pdf for details.	50 or 60 Hz depending on model
Output		
Line Regulation	V_{in} >80% and <110% of nominal	±3%
Overload Protection	At Nominal Input Voltage	Current limited at 1.65 times rated current
Noise Attenuation	-Common Mode -Transverse Mode	120 dB 60 dB
Output Harmonic Distortion	3% total RMS content at full load.	
Let-Through	ANSI/IEEE C62.41 Class A & B Waveform	<10 V Typical
General		
Efficiency	at Full Load	92% Typical
Storage Temperature	Humidity <95% non-condensing	-20° to 85°C
Operating Temperature		-20° to 50°C
Audible Noise		35 dBA to 65 dBA
Approvals	60 Hz Models 50 Hz Models	UL1012[2]; CSA[2] CE (EMC & LVD)
Warranty		10 + 2 Years

Notes:
1 - Values are generalized for simplicity, consult user manual for fuse sizing.
2 - Depending on model, see Selection Tables to confirm agency approvals for specific model numbers.

Selection Tables

Group II - MCR Series, 60 Hz

VA	Catalog Number	Voltage Input	Voltage Output	Height (inch)	Width (inch)	Depth (inch)	Ship Weight (lbs)	Design Style	Elec Conn
120	63-23-112-4	120, 208, 240, 480	120	9	4	5	15	1	D
250	63-23-125-4	120, 208, 240, 480	120	10	5	8	27	1	D
500	63-23-150-8	120, 208, 240, 480	120, 208, 240	13	8	7	37	1	E
750	63-23-175-8	120, 208, 240, 480	120, 208, 240	14	8	7	52	1	E
1000*	63-23-210-8	120, 208, 240, 480	120, 208, 240	17	8	7	62	1	E
1500*	63-23-215-8	120, 208, 240, 480	120, 208, 240	16	11	9	95	1	E
2000*	63-23-220-8	120, 208, 240, 480	120, 208, 240	17	11	9	109	1	E
3000*	63-23-230-8	120, 208, 240, 480	120, 208, 240	19	11	9	142	1	E
5000*	63-23-250-8	120, 208, 240, 480	120, 208, 240	28	11	9	222	1	E
7500**	63-28-275-8	208, 240, 480	120, 208, 240	27	24	9	362	2	F
10000**	63-28-310-8	208, 240, 480	120, 208, 240	28	24	9	446	2	F
15000**	63-28-315-8	208, 240, 480	120, 208, 240	28	36	9	710	3	F

Notes:
*Canadian option: CSA certified units must be ordered by changing "-8" to "-C8".
**Not CSA certified. Use Group III.

Group III - MCR Series, 60 Hz (Canadian Version)

VA	Catalog Number	Voltage Input	Voltage Output	Height (inch)	Width (inch)	Depth (inch)	Ship Weight (lbs)	Design Style	Elec Conn
500	63-31-150-8	600	120, 208, 240	13	8	7	38	1	B
1000	63-32-210-8	600	120, 208, 240	17	8	7	62	1	B
2000	63-32-220-8	600	120, 208, 240	17	11	9	109	1	B
3000	63-32-230-8	600	120, 208, 240	19	11	9	142	1	B
5000	63-29-250-8	208, 240, 480, 600	120, 208, 240	28	11	9	221	1	A
7500	63-29-275-8	208, 240, 480, 600	120, 208, 240	27	24	9	360	2	A
10000	63-29-310-8	208, 240, 480, 600	120, 208, 240	28	24	9	441	2	A
15000	63-29-315-8	208, 240, 480, 600	120, 208, 240	28	36	10	706	3	A

Group IV - MCR Series, 50 Hz

VA	Catalog Number	Voltage Input	Voltage Output	Height (inch)	Width (inch)	Depth (inch)	Ship Weight (lbs)	Design Style	Elec Conn
120	63-23-612-8	110, 120, 220, 240, 380, 415	110, 120, 220, 240	9	4	8	24	1	C
250	63-23-625-8			10	4	8	27	1	C
500	63-23-650-8			13	8	7	40	1	C
1000	63-23-710-8			18	8	7	64	1	C
2000	63-23-720-8			17	11	9	113	1	C
3000	63-23-730-8			27	11	9	162	1	C
5000	63-23-750-8			30	11	9	266	1	C
7500	63-28-775-8	220, 240, 380, 415		28	24	9	393	2	C1
10000	63-28-810-8			30	24	9	490	2	C2
15000	63-28-815-8			30	36	10	776	3	C2

Design Styles

These styles are single phase only. Three phase models are not available.

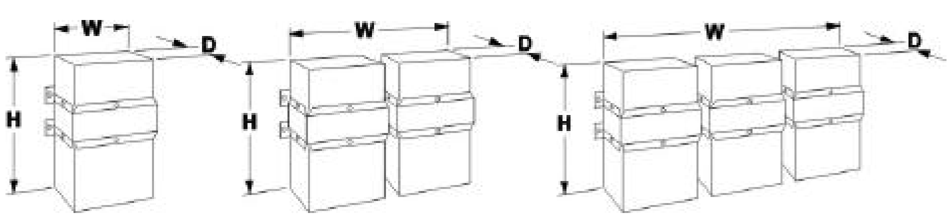
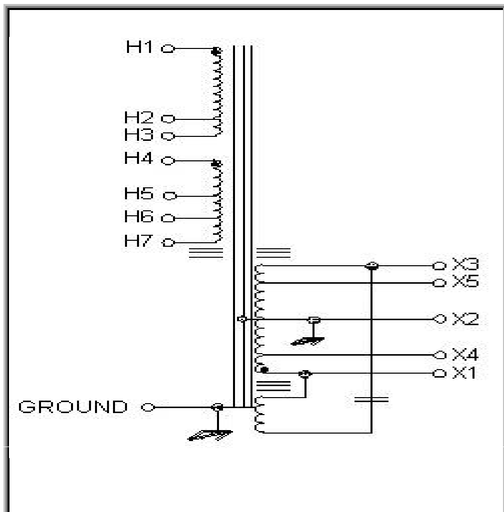


Figure 1 - From Left to Right – Style 1, Style 2 and Style 3

Electrical Connections

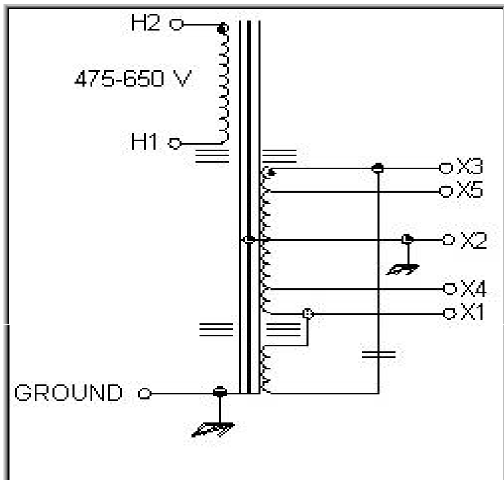
Connection A



Primary Voltage	Interconnect	Connect Lines To
208	H1 to H4 H2 to H5	H1 & H5
240	H1 to H4 H3 to H6	H1 & H6
480	H3 to H4	H1 & H6
600	H3 to H4	H1 & H7
Secondary Voltage	**Interconnect**	**Connect Lines To**
120		X1 & X2 or X3 & X2
208		X4 & X5
240		X1 & X3

60 Hz; 5000-15000 VA

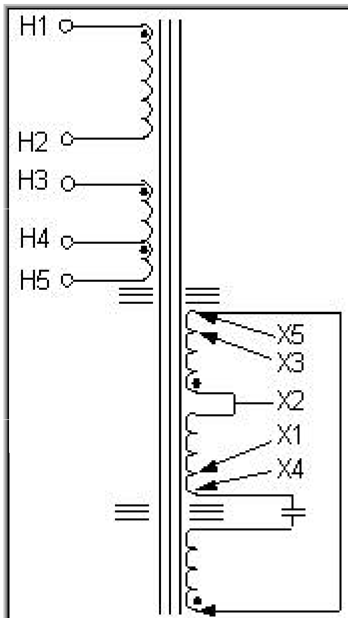
Connection B



Primary Voltage	Interconnect	Connect Lines To
600		H1 & H2
Secondary Voltage	**Interconnect**	**Connect Lines To**
120		X1 & X2 or X3 & X2
208		X4 & X5
240		X1 & X3

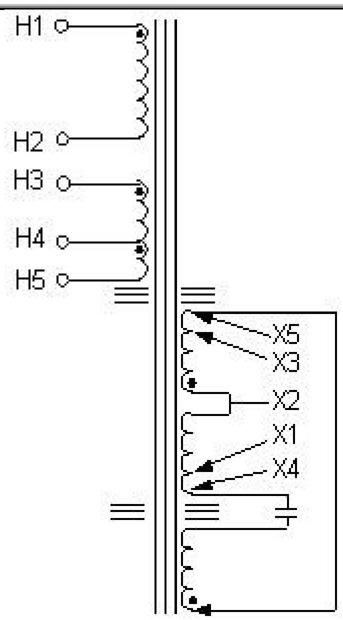
60 Hz; 500-3000 VA

Connection C



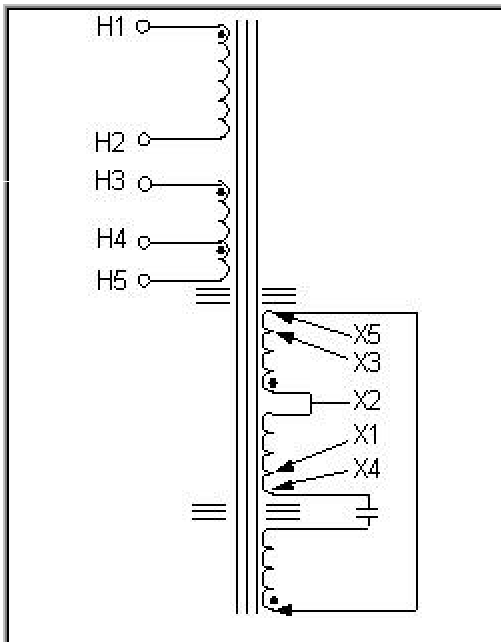
Primary Voltage	Interconnect	Connect Lines To
110-120	H1 to H3 H2 to H4	H1 & H4
220-240	H2 to H3	H1 & H4
380-415	H2 to H3	H1 & H5
Secondary Voltage	**Interconnect**	**Connect Lines To**
110		X1 & X2 or X3 & X2
120		X4 & X2 or X5 & X2
220		X1 & X3
240		X4 & X5
50 Hz; 120-5000 VA		

Connection C1



Primary Voltage	Interconnect	Connect Lines To
220-240	H1 to H3 H2 to H5	H1 & H5
380-415	H2 to H3	H1 & H4
Secondary Voltage	**Interconnect**	**Connect Lines To**
110		X1 & X2 or X2 & X3
120		X4 & X2 or X5 & X2
220		X1 & X3
240		X4 & X5
50 Hz; 7500 VA		

Connection C2

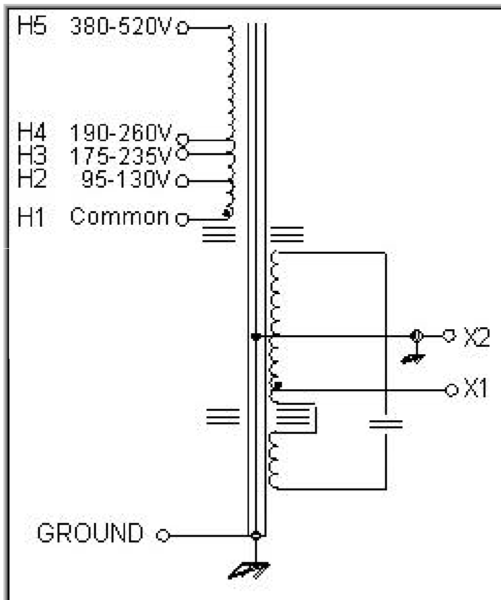


Primary Voltage	Interconnect	Connect Lines To
220-240	H2 to H3	H1 & H4
380-415	H2 to H3	H1 & H5

Secondary Voltage	Interconnect	Connect Lines To
110		X1 & X2 or X3 & X2
120		X4 & X2 or X5 & X2
220		X1 & X3
240		X4 & X5

50 Hz; 10000-15000 VA

Connection D

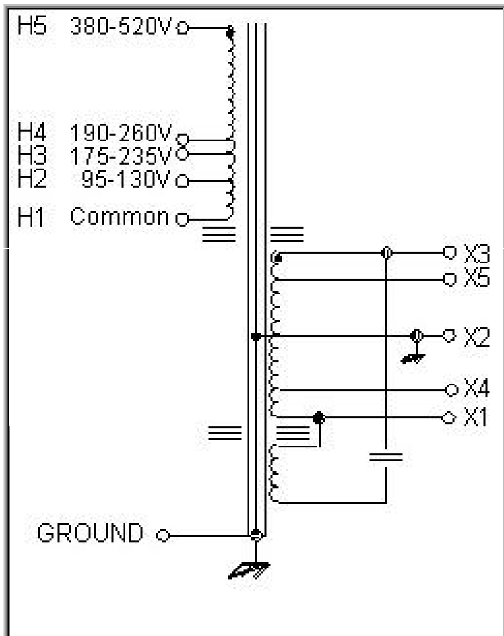


Primary Voltage	Interconnect	Connect Lines To
120		H1 & H2
208		H1 & H3
240		H1 & H4
480		H1 & H5

Secondary Voltage	Interconnect	Connect Lines To
120		X1 & X2

60 Hz; 120-250 VA

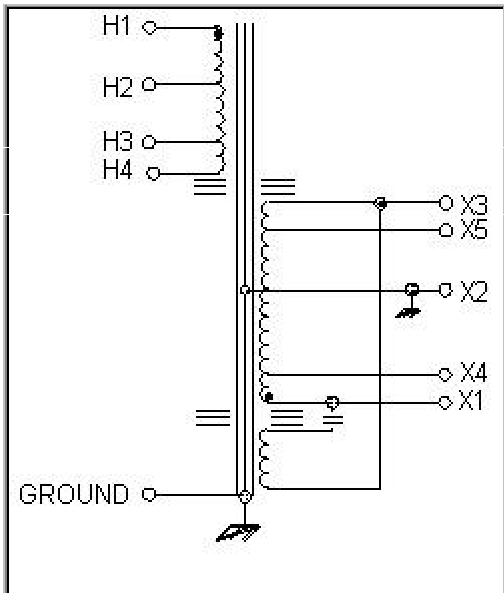
Connection E



Primary Voltage	Interconnect	Connect Lines To
120		H1 & H2
208		H1 & H3
240		H1 & H4
480		H1 & H5
Secondary Voltage	**Interconnect**	**Connect Lines To**
120		X1 & X2 or X3 & X2
208		X4 & X5
240		X1 & X3

60 Hz; 500-5000 VA

Connection F



Primary Voltage	Interconnect	Connect Lines To
208		H2 & H3
240		H2 & H4
480		H1 & H4
Secondary Voltage	**Interconnect**	**Connect Lines To**
120		X1 & X2 or X3 & X2
208		X4 & X5
240		X1 & X3

60 Hz; 7500, 10000 and 15000 VA

APPENDIX F

Type HP Pressure Blowers
from
The **N**ew **Y**ork **B**lower **C**ompany

New **Y**ork **B**lower Type HP Pressure Blowers are designed for high-pressure, industrial-process applications. All applications can be handled in either induced draft configurations or forced-draft. Numerous modifications and accessories make the Type HP Pressure Blower suitable for a wide range of systems. For lower pressures and volumes

DESIGN FEATURES

- CAPACITIES - to 10,000 CFM
- PRESSURES - to 85" WG
- TEMPERATURES - to 600°F
- WHEEL CHOICES
- ALUMINUM
- STEEL
- STAINLESS STEEL
- 13 SIZES - 14" through 26"

ACCESSORIES

Aluminum construction, cleanout door, drain, drives, heat-fan construction, inlet filter, motor, nominal-airtight construction, shaft seals, silencer, safety equipment, cladding (attenuation), spark-resistant construction, special coatings, stainless-steel construction unitary base, weather cover, low leakage construction.

CONSTRUCTION FEATURES

ALUMINUM WHEEL - blades are backwardly canted for highest efficiency . . .lowest noise.

STEEL WHEEL - all-welded construction for more rugged and higher temperature applications.

INLET CONNECTIONS - choice of venturi, plain-pipe, or flanged for maximum installation flexibility.

LIFTING EYES - located for balanced handling.

ALL-WELDED STEEL HOUSINGS - heavy-gauge housings are rigidly braced to prevent "flexing" at high pressures.

BEARINGS - utilize adapter-mount concentric locking collars for optimum shaft to bearing fit to ensure long bearing life and reduced vibration.

BALANCE - all wheels are precision balanced prior to assembly . . . fans with motors and drives mounted by nyb are final-balanced at the specified running speed.

SPECIFYING TYPE HP PRESSURE BLOWERS

GENERAL

The fans shall be size_______single-width single-inlet as designed and manufactured by The New York Blower Company. Fan wheels shall be high pressure radial designed for optimum efficiency and stability. Unless otherwise directed, fans shall be in compliance with the layout shown on the drawings.

PERFORMANCE

Fan ratings shall be based on tests made in accordance with AMCA Standard 210 in an AMCA Registered Laboratory. Fans shall have a smooth pressure characteristic extending throughout the operating range to assure quiet, stable operation from wide open to closed off. Fan brake horsepower shall be equal to or less than_______BHP at _______inches static pressure and _______CFM at _______density. SOUND Fan manufacturers shall provide sound power level ratings for fans tested and rated in accordance with AMCA Standards 300 and 301. Sound power ratings shall be in decibels (reference 10-12 watts) in eight octave bands. Sound power levels will be corrected for installation by the specifying engineer...dBA levels only are not acceptable.

CONSTRUCTION

Fan housings are to be heavy gauge, continuously welded on the outside of fan housing. Housings with lock seams or partially welded construction are not acceptable. Housings are to be reinforced with rigid bracing to increase structural integrity and prevent vibration. Housings shall feature aerodynamically designed outlet transitions providing a minimum separation of airflow. Wheels shall utilize taper lock hubs for easy wheel removal. Outlets are to be standard pipe sizes with flanges drilled to match ANSI Class 125/150 hole patterns.

BEARINGS

Bearings on Arrangement 1 and 8 are to be grease lubricated, precision anti-friction ball, self-aligning, pillow block design utilizing an adapter mount concentric locking collars for optimum shaft to bearing fit. Bearings shall be selected for a minimum L-10 life of 40,000 (200,000 L-50 life) at the fan's maximum cataloged operating speed.

SHAFT

Shafts are to be ASTM A-108 steel, grade 1040/1045, precision turned, ground and polished. Grade 1018 steel is not accept-able. The shaft's first critical speed shall be at least 125% of the fan's maximum operating speed. The drive end of the fan shaft shall be counter-sunk for tachometer readings.

PAINT

All fan surfaces are to be thoroughly prepared prior to painting. After cleaning, all surfaces are to be coated with industrial grade alkyd enamel. Surfaces of components not accessible after assembly shall be coated and allowed to dry prior to final assembly. Primer only will not be accepted.

BALANCE AND RUN TEST

All wheels are precision balanced prior to assembly. Fans with motors and drives mounted by nyb are final-balanced at the specified running speed.

ACCESSORIES

Accessories shall be provided as called for in the plans and specifications.

Required accessories include:

- Wheels - Aluminum - Steel - Alloy 2205
- Cleanout Door - Flush Bolted
- Spark-Resistant Construction - Airstream Type - Wheel

Type

- Drain
- Drain Plug
- Low Leakage Construction
- Flexible Connector - Complete with Companion Flange –Sleeve and Clamps only - Companion Flange only
- Shaft Seal (Arr. 1 or 8) -Buna-N -Viton

Teflon

Mechanical

- Silencer - Flanged - Venturi with Wire Guard - Plain Pipe -Support

Leg

- Inlet - Flanged - Plain Pipe - Venturi with Wire Guard
- Cladding (Attenuation)
- Stainless Steel Construction
- Heat-Fan Construction (600°F. maximum)
- Integral Outlet Damper
- Wafer-Type Outlet Damper - with Bolt Holes - without Bolt

Holes

- Belt Guard with Tachometer Opening and Plug
- Shaft and Bearing Guard with Extended Bearing Lubrication

Fittings

- Coupling Guard
- Flanged Inlet Guard
- Unitary Base
- Isolation Bases - Spring - Rubber-In-Shear
- Drive - Constant V-Belt
- Coupling
- Inlet Filter - Oil Wetted - Dry Type - with Hood - Support Leg

FINAL INSPECTION

All fans shall receive a final inspection by a qualified inspector prior to shipment. Inspection to include: fan description and accessories, balance, welding, dimensions, bearings, duct and base connection points, paint finish and overall workmanship.

APPENDIX G

ANALOG/DIGITAL SIGNAL PROCESSING MODULE

TROUBLESHOOTING AND SETUP VERIFICATION GUIDE

From time to time, the analog signal processing module (D111947; RKB #403993; POS 1A4-1A8) may need simple adjustment. In the most extreme case, this can be seen if your defect alarm indication lights and/or audio horn continually stays active. If you have continual defect indication, two issues need to be addressed. First is the camera sensor itself. To check this, unplug the BNC connected to the appropriate sensor (this correlates to the ASP Module position [i.e., ASP in position 1A4 = Camera 1, ASP in position 1A2 = Camera 2, etc.]) and verify alarm indication. If the defect alarm is still present, then the problem lies most likely lies within the ASP Module for that particular sensor.

To properly check the ASP Module, you should start out from Test Point 1 (TP1) and go through to Test Point 11 (TP11). Test Point 12 (TP12) is ground. All video signals should be verified and adjusted accordingly. If adjustment cannot be made satisfactorily, then the most likely problem lies with one of the Integrated Circuit (IC) chips. In this particular module, the most likely culprit is either the EL2041 (or EL2044) OP AMP or the EL2018 OP AMP. Each module has 11 EL2041 IC's and 6 EL2018 IC's. The EL 2018 IC's are located in a particular area of the module and sit in two rows of three. The top row identified as position Z19, Z20 and Z21 deal with amplification of the digital hole signal. The bottom row identified as position Z14, Z15 and Z16 deal with the amplification of the digital spot signal (***Figure 1***). If your system is not looking at spots, then you do not need to put attention to the bottom row as they should already be tuned out. Same is true if you are not looking for holes.

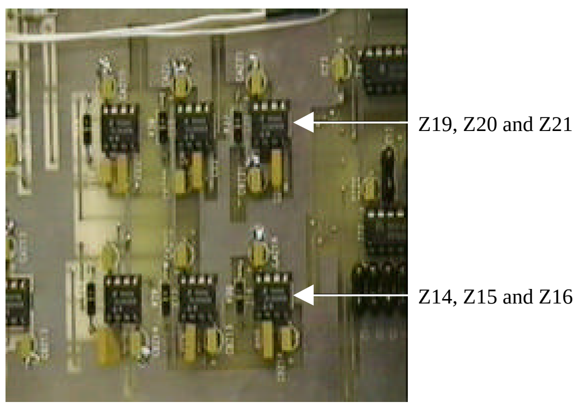


Figure 13 - EL2018 IC Positions on ASP Module

The EL2041 IC's deal with various analog signal amplification positions for both hole defects and spot defects. These positions are AC coupled which makes determining the potential IC problem easier. There are 6 analog amplification stations located throughout the ASP Module (TP3, TP4,TP5, TP6, TP8 and TP9) that deal directly with analog defect signal amplification. TP3, TP 5 (***Figure 2***) and TP6 (***Figure 3***) deal with the amplification of spot defect signals and TP4 (***Figure 2***), TP8 and TP 9 (***Figure 3***) deal with amplification of the hole defect signals. TP2 (***Figure 2***) deals with the amplification of the sample and hold signal. TP 7 (***Figure 4***) deals with the digital spot signal after amplification through the EL2018 IC's; position Z19, Z20 and Z21. TP 10 (***Figure 4***) deals with the digital hole signal after amplification through the EL2018 IC's; position Z14, Z15 and Z16. TP 11 (***Figure 4***) deals with the digital signal verification of both hole and spot defect signals and TP12 (***Figure 4***) is designated ground.

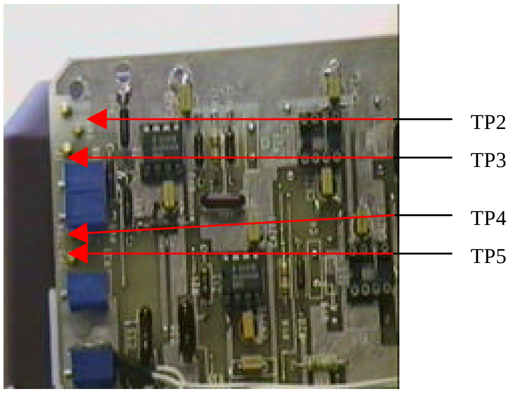


Figure 2 – TP Positions

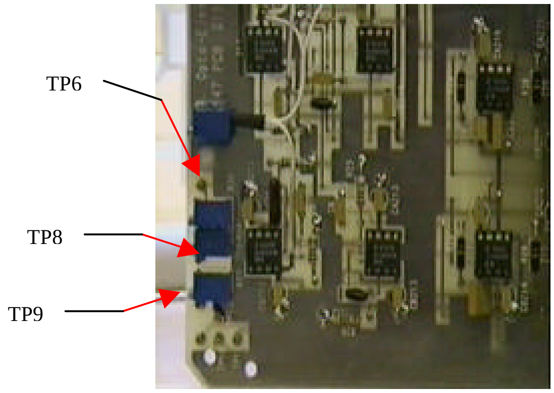


Figure 3 – TP Positions

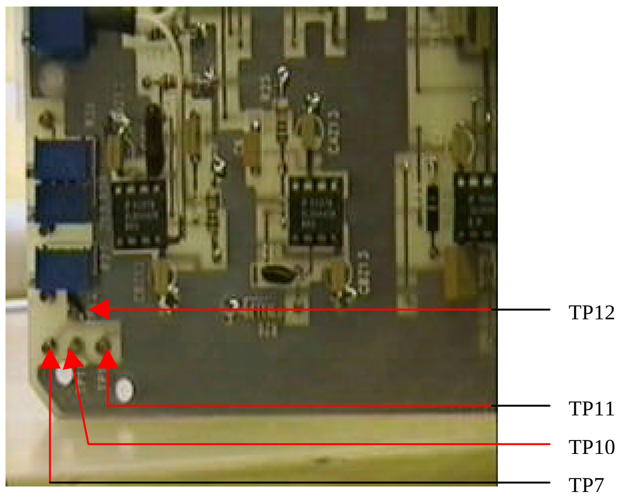


Figure 4 – TP Positions

Test Point 1 is designated for the raw video in. This is the electronic signal transferred directly from the sensor to the ASP Module. Depending on the type of product you are running, you may or may not see any significant signal here with units using only transmitted light. However, if you do have a signal it should look something like the signal shown in ***Figure 5*** with transmitted or reflective light and/or in ***Figure 6*** with no apparent light transmission through the product material.

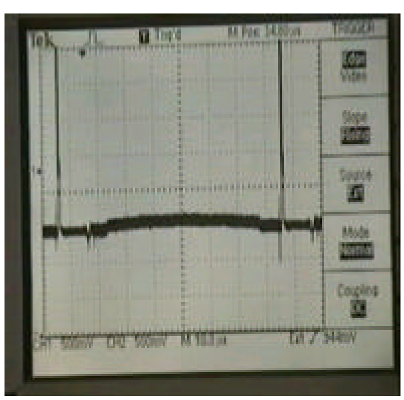


Figure 5 – Raw Video w/Light Transmission

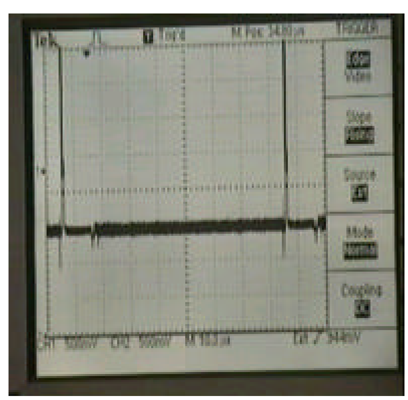


Figure 6 – Raw Video w/ No Light

To see the raw video signals, attach your oscilloscope probe to channel one on the dual channel oscilloscope and place the probe end on position TP1. Make certain your probe is set to 10X and the voltage switch is set to 500 mV (there abouts) and the timing switch is set to 10 to 20 µseconds (depending on what type of line scan camera is being used). The signal should be fairly flat if there is any light transmission unless it is a specially designed unit for other materials that are transparent. The two positive going pulses that you should see on both ends of the electronic signal are sync signals which are gated out and indicate the beginning of the valid video (***Figure 7***) and the end of the valid video (***Figure 8***) that will be the same in appearance. There are not adjustments required at this position as it is the raw video in. If you do not have video, then there is a problem with the associated camera sensor that correlates to the ASP Module you are looking at.

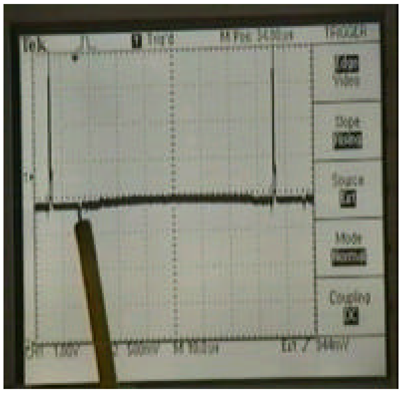


Figure 7 – Beginning of Valid Video

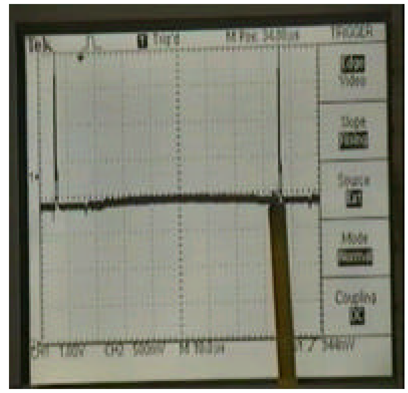


Figure 8 – End of Valid Video

Once you have checked the valid video in, take your oscilloscope probe and place it on TP2. TP2 is the raw video and sample and hold signals after initial amplification. Upon initial viewing, you may notice that the signal drops off the scope (high or low) relative to ground (***Figure 10***). Do not worry about this voltage difference relative to TP1 video (***Figure 9***). Reposition the trace using the horizontal selector until you see the base line of the signal. Once you have visual base line viewing you will now be able to adjust the signal if required.

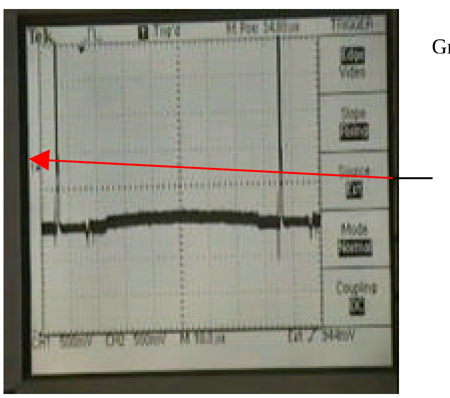


Figure 9 – Valid Video prior to amplification

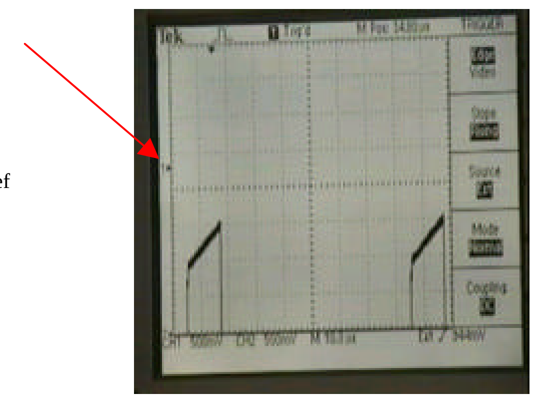


Figure 10 – Valid Video after initial amplification

The two signals that may be present while viewing TP2 are not the same as those indicated while viewing TP1. The step signals that may be present while monitoring TP2 are the "Sample/Hold" signals. These signals can be adjusted and should be adjusted back to 0 VDC or as close as possible. To do this, you need to take a very fine, non-metallic screwdriver. Place the screwdriver on the 10K adjustable potentiometer labeled R47 (***Figure 11***). While viewing the oscilloscope picture, turn the adjustable screw until the S/H steps are equal to or close to 0VDC (***Figure 12***).

10K Turn Potentiometer; #R47

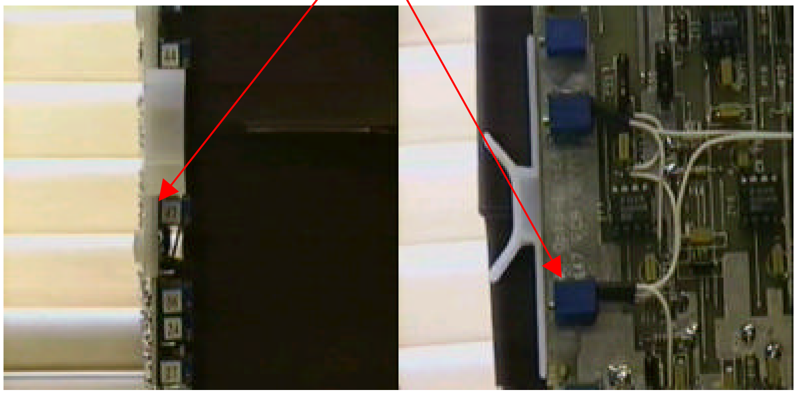


Figure 11 – R47 Adjustment Potentiometer

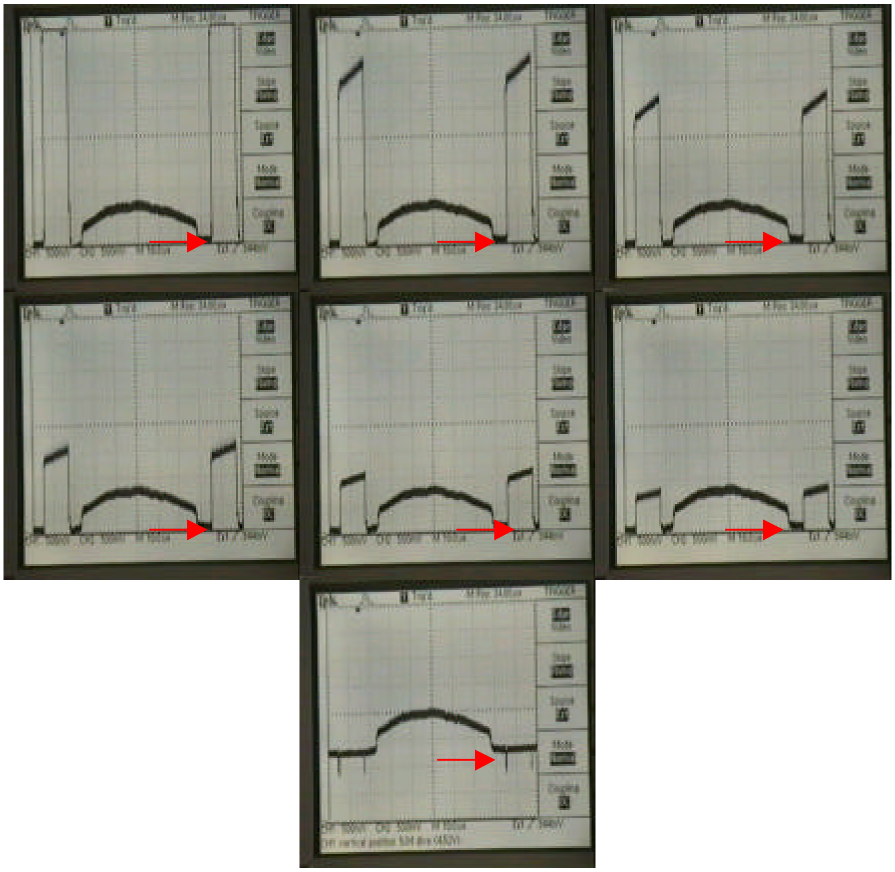


Figure 12 – Signal Adjustment of the S/H and Valid Video

***NOTE** Base line video reference in figure 12 is shown by the red arrow. Signal should be adjusted to that level or as close as possible*

Once you have adjusted for optimum level on TP2, move your oscilloscope probe to TP3. TP3 is the post amplification for the analog spot defect signal (*op amp EL2041;Z6 and EL2041;Z8*). Obviously, if you are not looking for spot defects, this section does not apply as the amplification should already be tuned out. You may notice the signal on the oscilloscope is sitting off from the ground reference point. This signal can be adjusted and should be. To adjust this signal correctly, place your screwdriver on the 10K adjustable potentiometer labeled R8 (***Figure 13***). Turn the adjustable screw until the signal is positioned as close to 0VDC relative to the ground reference line as possible (***Figure 14***). You may see that there is a slight alignment change in the S/H step when adjusting the valid video signal to the ground reference point (***Figure 15***). If the S/H miss-aligns slightly in the offset step (beginning of valid video and end of valid video) place your screw driver back onto the 10K adjustable potentiometer R47 and adjust accordingly until you achieve a flat line (0VDC).

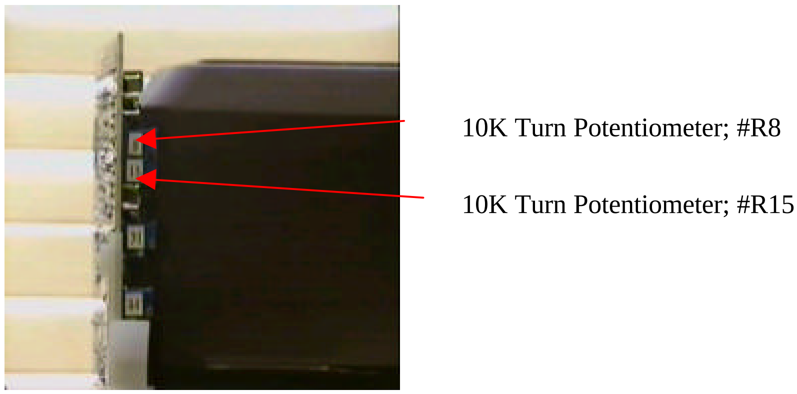


Figure 13 – R8 & R15 Adjustment Potentiometer

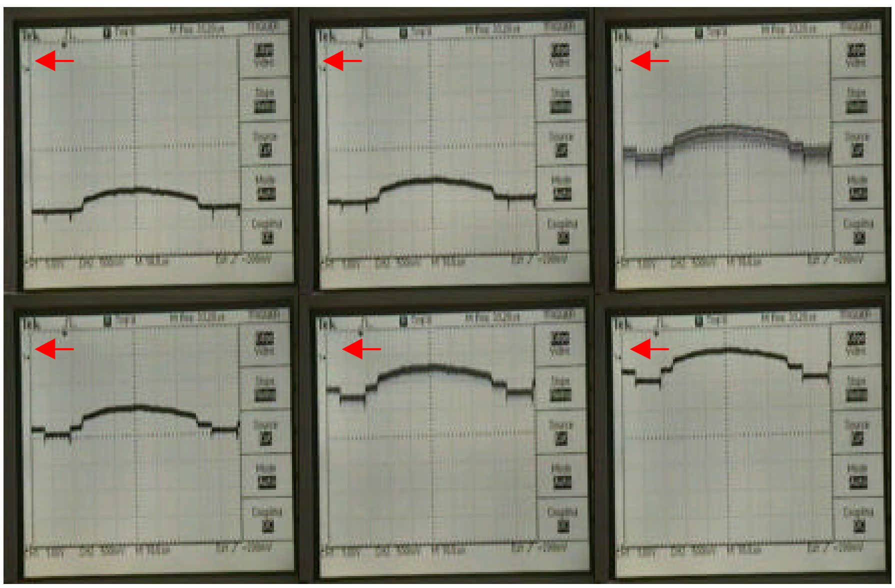


Figure 14 – Signal Adjustment of TP3 Valid Video

***NOTE** Ground reference in figure 14 is shown by the red arrow. Signal should be adjusted to that level or as close as possible.*

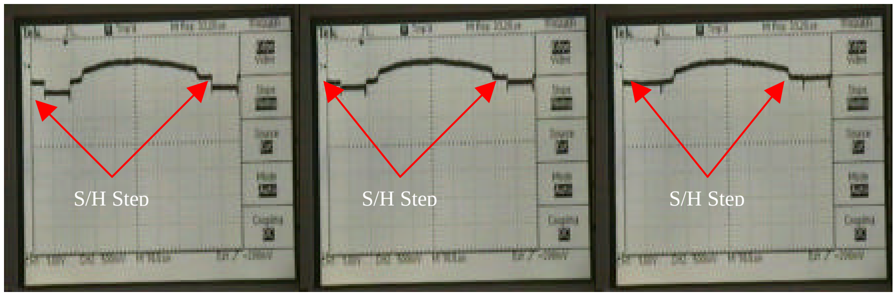


Figure 15 – S/H offset adjustment TP3 Valid Video

Once you have fine tuned the offset of the S/H and confirmed the valid video as shown on TP3 you can move to TP4. TP4 is a mirror image of TP3 and deals, as stated above, with the Analog Spot amplification. Place your oscilloscope probe on TP4. You should get similar signals as with TP3, just mirrored. TP4 is the post amplification for the analog hole defect signal (*op amp EL2041;Z9 and EL2041;Z10*). Obviously, if you are not looking for hole defects, this section does not apply as the amplification should already be tuned out. You may notice the signal on the oscilloscope is sitting off from the ground reference point. This signal can be adjusted and should be. To adjust this signal correctly, place your screwdriver on the 10K adjustable potentiometer labeled R15 (***Figure 13***). Turn the adjustable screw until the signal is positioned as close to 0VDC relative to the ground reference line as *possible (same procedure as TP3 adjustment*). You may see that there is a slight alignment change in the S/H step when adjusting the valid video signal to the ground reference point (***Figure 15***). If the S/H miss-aligns slightly in the offset step (beginning of valid video and end of valid video) place your screw driver back onto the 10K adjustable potentiometer R47 and adjust accordingly until you achieve a flat line (0VDC). When you are finished with all necessary adjustments, the final valid video should appear similar to that shown in ***Figure 16***.

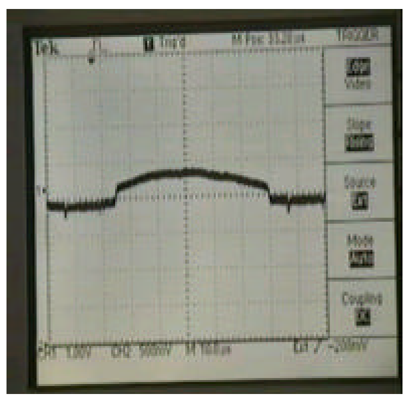


Figure 16 – TP4 Valid Video Signal

Place your oscilloscope probe on TP5. TP5 is the post amplification for the analog spot defect signal (*op amp EL2041;Z17*). The valid video signal should appear similar to that shown in ***Figure 17***. There really are no adjustments to make here. Although you can make adjustments, the adjustments are strictly gain related and should be done only by an authorized RKB Service Representative. Adjusting the 5K potentiometer labeled R31 (Figure 18) makes this adjustment. Miss-adjusting this will result in a very sensitive unit that may produce false defects. RKB requires its customers to just note down the signal and to verify. Checking this test point facilitates verification that op amp Z17 is functioning correctly. That is all it is intended for.

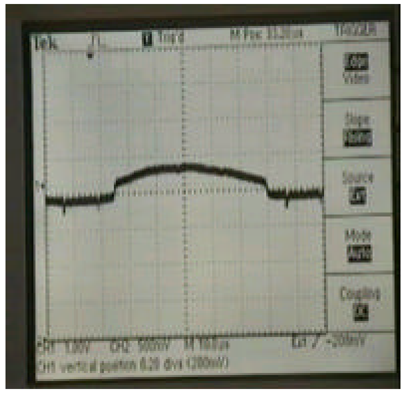


Figure 17 – TP5 Valid Video Signal

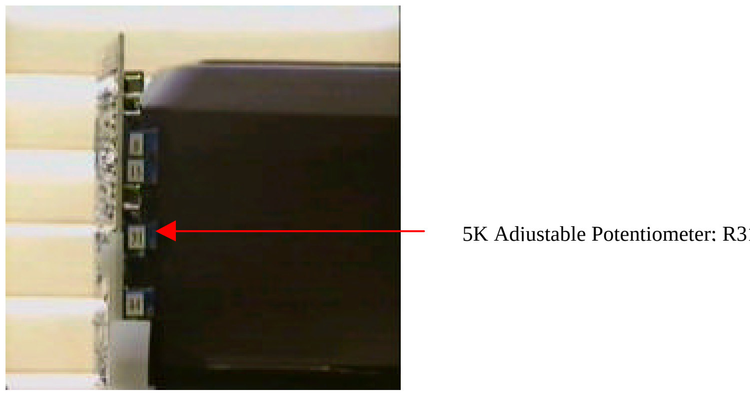


Figure 18 – R31 Adjustment Potentiometer

Place your oscilloscope probe on TP6. TP6 is the post amplification for the analog spot defect signal (*op amp EL2041;Z18*). The valid video signal should appear similar to that shown in ***Figure 19***. There really are no adjustments to make here. Although you can make adjustments, the adjustments are strictly gain related and should be done only by an authorized RKB Service Representative. Adjusting the 5K potentiometer labeled R36 (Figure 20) makes this adjustment. Miss-adjusting this will result in a very sensitive unit that may produce false defects. RKB requires its customers to just note down the signal and to verify. Checking this test point facilitates verification that op amp Z18 is functioning correctly. That is all it is intended for.

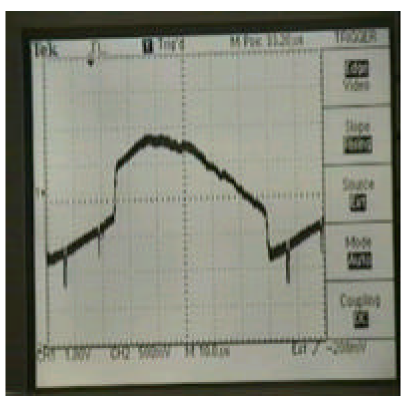
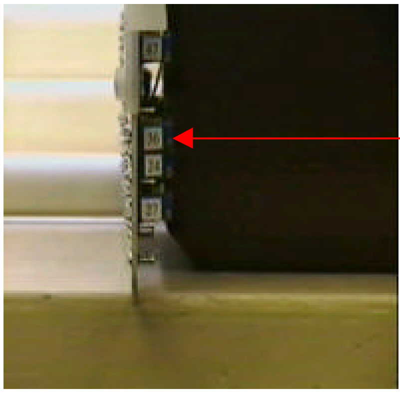


Figure 19 – TP6 Valid Video Signal



5K Adjustable Potentiometer: R36

Figure 20 – R36 Adjustment Potentiometer

Place your oscilloscope probe on TP7. TP7 is the post amplification and conversion of the digital spot defect signal (*op amp EL2018; Z19,Z20 and Z21*). Again, if you are not dealing with spot detection you will not get any signal here. The signal generated here is will consist of a minimum 5 VDC going in a negative path amplitude. This signal only appears when a defect is directly under the camera sensor. Under normal operational conditions, the valid video will appear as in ***Figure 21***.

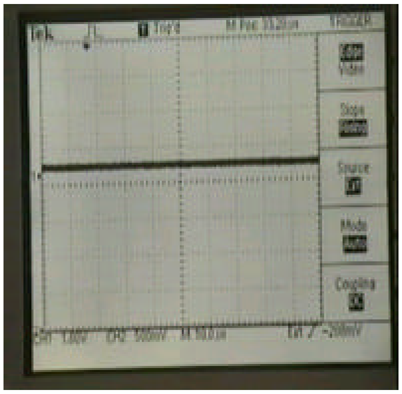


Figure 21 – TP7 Valid Video Signal

Place your oscilloscope probe on TP8. TP8 is the post amplification for the analog hole defect signal (*op amp EL2041;Z12*). The valid video signal should appear similar to that shown in ***Figure 22***. There really are no adjustments to make here. Although you can make adjustments, the adjustments are strictly gain related and should be done only by an authorized RKB Service Representative. Adjusting the 5K potentiometer labeled R24 (Figure 23) makes this adjustment. Miss-adjusting this will result in a very sensitive unit that may produce false defects. RKB requires its customers to just note down the signal and to verify. Checking this test point facilitates verification that op amp Z12 is functioning correctly. That is all it is intended for.

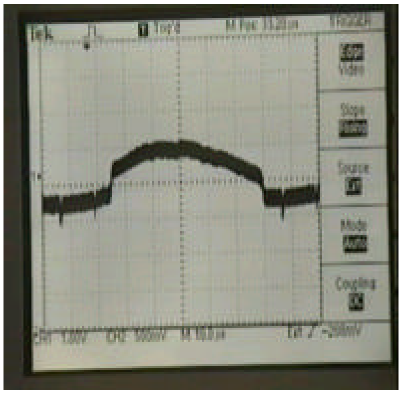


Figure 22 – TP8 Valid Video Signal

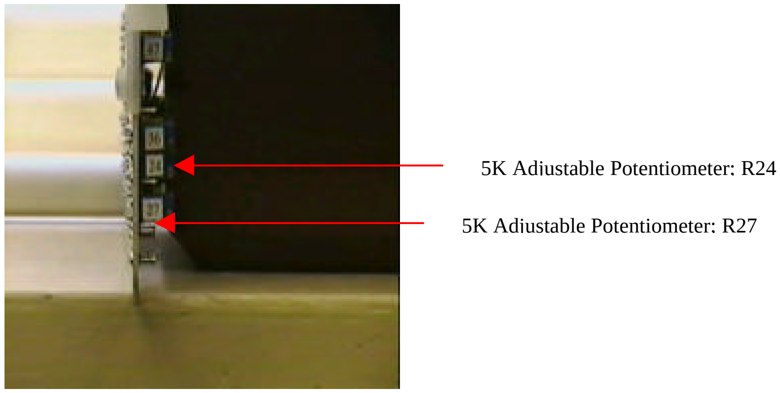


Figure 23 – R24 Adjustment Potentiometer

Place your oscilloscope probe on TP9. TP9 is the post amplification for the analog hole defect signal (*op amp EL2041;Z13*). The valid video signal should appear similar to that shown in ***Figure 24***. There really are no adjustments to make here. Although you can make adjustments, the adjustments are strictly gain related and should be done only by an authorized RKB Service Representative. Adjusting the 5K potentiometer labeled R27 (Figure 23) makes this adjustment. Miss-adjusting this will result in a very sensitive unit that may produce false defects (***Figure 25***). RKB requires its customers to just note down the signal and to verify. Checking this test point facilitates verification that op amp Z13 is functioning correctly. That is all it is intended for.

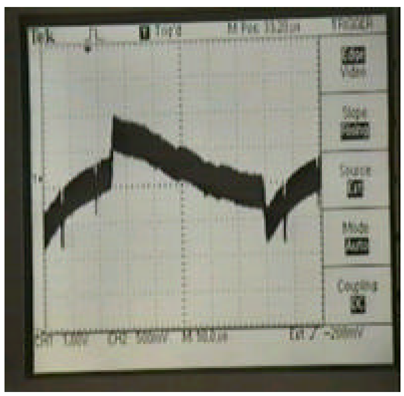


Figure 24 – TP9 Valid Video Signal

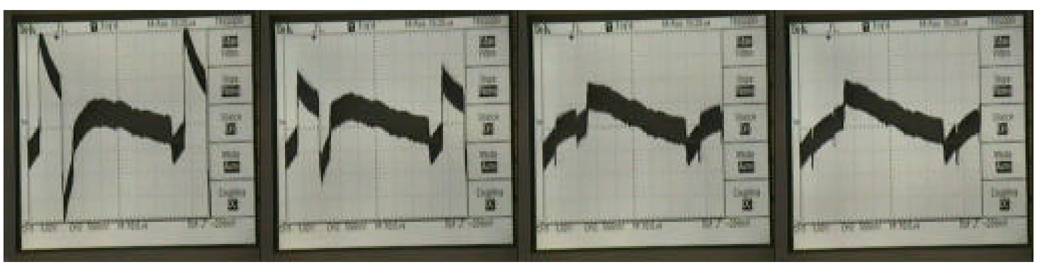


Figure 25 – TP9 over sensitive resulting in false signal

***NOTE** Adjustment for the offset as viewed in Figure 25 can be accomplished by adjusting R47 while viewing TP9. It is recommended to do the system check procedures correctly, but if you do not have time, you can look at the final analog output, herein for holes (TP9) just prior to digitization. Same is true for spots by looking at the final analog output for spots (TP6) just prior to digitization. This should only be done in cases where you are running product and need to adjust quickly. This is not the true setup function of this module.*

To verify hole detection is working, place the oscilloscope probe on TP9. Slide or make a hole in the product being monitored. You should get a signal that looks something like ***Figure 26***. If you do not get any signal, then either your lamps are not aligned correctly to the sensors or your cameras are not focused. This would be true for spot verification as well on TP6.

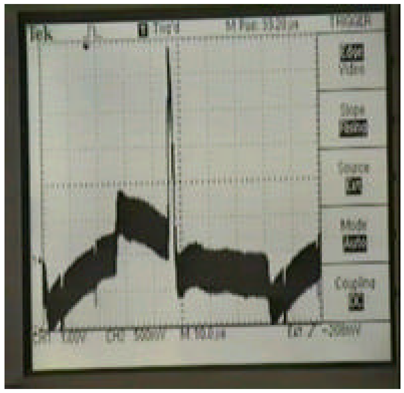


Figure 26 – TP9 Analog Signal of Hole Defect

Place your oscilloscope probe on TP10. TP10 is the post amplification and conversion of the digital hole defect signal (*op amp EL2018; Z14,Z15 and Z16*). Again, if you are not dealing with hole detection you will not get any signal here. The signal generated here is will consist of a minimum 5 VDC going in a positive path amplitude. This signal only appears when a defect is directly under the camera sensor ***Figure 27***. Under normal operational conditions, the valid video will appear as in ***Figure 28***.

Figure 27 – TP10 Valid Video Signal

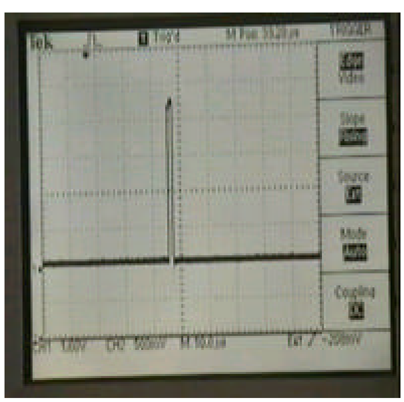


Figure 28 – TP10 Digital Signal of Hole Defect

Place your oscilloscope probe on TP11. TP11 is the post amplification and conversion of the digital hole and spot defect signal. Again, the defect is not present under the sensor while checking this signal you should see something like in ***Figure 29***. If a defect occurs you should see both positive and/or negative going 5 VDC signals.

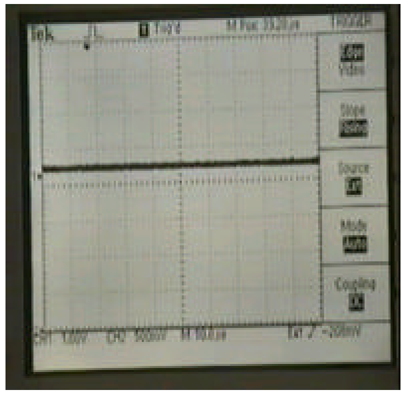


Figure 29 – TP11 Valid Video Signal

This concludes the ASP Module verification and setup. Turn off the low voltage power, re-insert the module into its position and go on to the next one until they are all done. Never take out or re-install the modules while power is on. This may cause problems with the modules. They are not hot swappable.

APPENDIX H

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