DSP2
Metal Detector
Conveyor, Gravity, Pipeline Applications

REC 4283 Rev B Part Number 96230

Revision History

Revision Number	Date Released	ECO Number	Release Specifics
Revision A			Original Release of the documents, see specific documents for details
Revision B	May 2007	1441	Updated to Thermo Fisher Scientific and combined conveyor, pipeline and gravity machines into one document.

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Preface Section

Thermo Fisher Scientific no longer manufactures the *DSP2* metal detector. This manual is designed for support of the machinery.

As part of this document you will find:

- DSP2 Conveyor Installation and Operation
- DSP2 Gravity Installation and Operation
- DSP2 Pipeline Installation and Operation
- Service Repair and Replacement Parts

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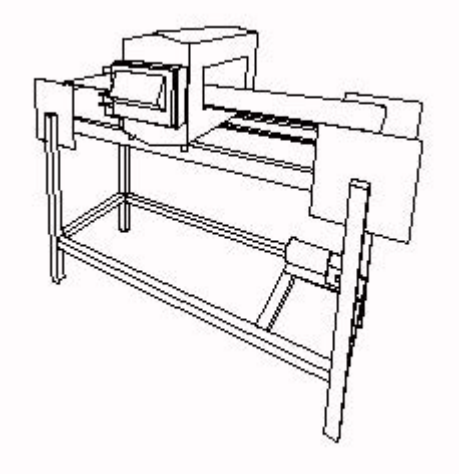
Model DSP2

Installation and Operation

Conveyor Applications



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Preliminary Inspection

Equipment

Model DSP 2 metal detector consists of four (4) major components:

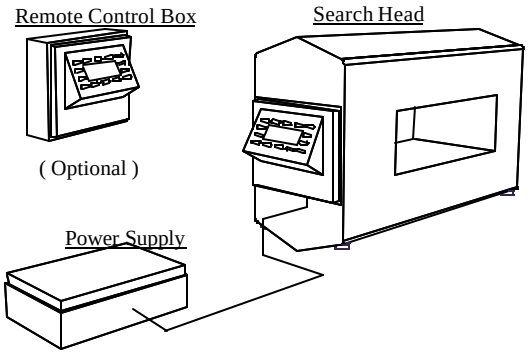


Figure 1

1) *Search Head*
The Search Head, which contains the inspection coils , through which the product to be monitored is passed.

2) *Control Unit*
The Control Unit, which contains the user interface controls, and main board electronics.
The Control Unit may be ordered directly mounted to the Search Head or remotely mounted. In the latter case, the correct length of cable is supplied with the Search Head.

3) *Power Supply*
The Power Supply Unit, which houses the power supplies, input/output devices and connection terminal strip.

4) *Photo Eye*
The Photo Eye. When inspecting discrete products a photo eye is needed to indicate the location of each package.

Preliminary Inspection

Check the contents of crate or crates against the order and/or packing slip. Look specifically for any reject device which might have been ordered with the equipment. Some reject devices (e.g.: an air-jet solenoid) are quite small and may get discarded with the packing. Check the equipment for any signs of damage in shipment.

Included with each metal detector are the following;

- Installation and Operation Manual
- Nylon Foot Mount and Nylon Bushings (4 of each)
- Metal Test Samples

NOTE:

If there are any signs of external damage to the crate, notify the transport company and do not discard the crate, it may have to be inspected by an insurance inspector.

A = Aperture Width
B = Aperture Height
C = Through Dimension
X = Aperture Border

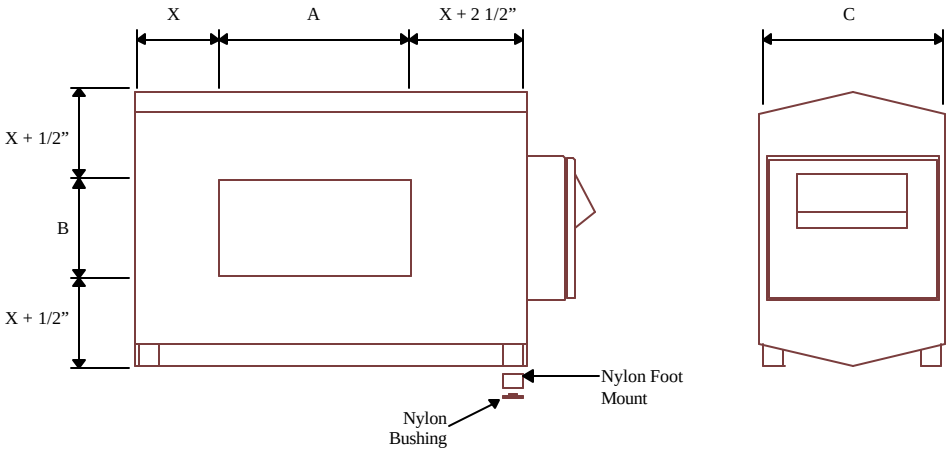


Figure 2

Systems

Goring Kerr manufactures various types of metal detectors and metal detector systems . This manual illustrates the installation requirements of the most common configuration, the belt conveyor system. However, the methods shown within this manual apply to all of the systems Goring Kerr manufactures. This manual is also available in a Windows Help format. Contact Goring Kerr on how to receive a your copy.

Model 402 Gravity Feed System

The model 402 system is supplied completely assembled and tested from the factory. The system you have may vary from that shown here. Four mounting holes are located at the top of the frame to support this system. The typical mounting method is to suspend the system with threaded rod. The threaded rod should support the complete load of the system. When securing the threaded rod to the 402 frame isolation bushings should be used on all four mounting holes. This will electrically isolate the frame from any support structure. The 402 system is not designed to support piping from any of the ports. Piping connected to any of the ports should be independently supported. Hanging piping from the reject value may distort the valve body and cause unreliable rejection.

(See manual NA-DSP2/GRAV)

Model 402

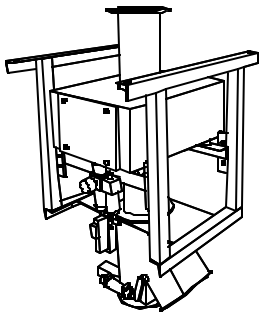


Figure 3

Model 426 Pipeline System

The model 426 pipeline system is supplied completely assembled and tested from the factory. Four mounting holes are located in the corners of the support frame. The typical mounting method is to suspend the system with threaded rod. The threaded rod should support the complete load of the system. When securing the threaded rod to the 426 frame isolation bushings should be used on all four mounting holes. This will electrically isolate the frame from any support structure. Any pipes connected to the system should be independently supported and not supported by the metal detector system.

(See manual NA-DSP2/PIPE)

Model 426

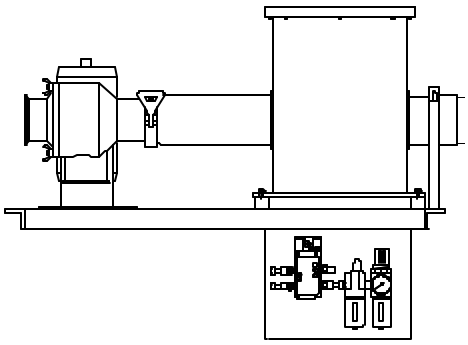


Figure 4

Model T7 Pharmaceutical System

The model T7 pharmaceutical system is supplied completely assembled and tested from the factory. The system is ready to use right from the crate. The reject device, control unit and search head are pre-wired. The mains supply power cord is also pre-wired.

(See manual NA-DSP2/PHARM)

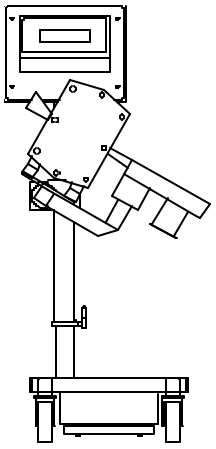


Figure 5

Metal Detector Principle Of Operation

The DSP 2 model metal detector operates on the balance coil full loop detection system.

Three equally spaced coils surround the aperture or opening through which the product to be inspected passes. The center coil is connected to an oscillator circuit to produce an electromagnetic field. This signal is received by two coils one on either side of the oscillator coil. These are the receiving or input coils. (See Figure 6)

Since the receiving coils are equally spaced from the oscillator, they receive equal amounts of signal. The coils are wound in such a way that their signals oppose each other; therefore, the net signal across the coil is zero.

When a piece of metal enters within the electromagnetic field, it alters the field strength around it. As this metal passes through the aperture, it changes the balance of the receiving coils so that the net signal is no longer zero.

This error signal is amplified, demodulated and converted to a digital signal to be processed by the Digital Signal Processor or DSP. The DSP performs all the product compensation, phasing, residual compensation filtering, and produces a reject signal.

A metal detector is a high performance measuring instrument. The quality of the installation will have a direct effect upon performance and reliability. Please read the installation instructions completely prior to installing the unit and contact Goring Kerr if you have any questions.

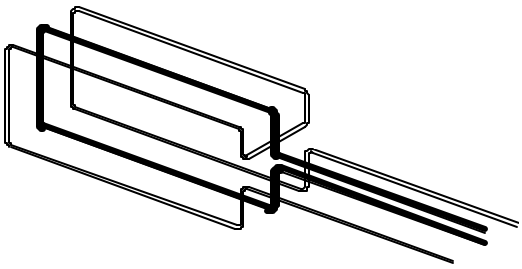


Figure 6

Mechanical Installation

The power supply unit and control unit (if remote) may be mounted as any other electrical control would be, wherever convenient. However, the search head must be installed as per the following instructions if correct performance is to be expected. Please contact Goring Kerr if you have any questions regarding installation requirements and restrictions.

Warning

To insure optimum performance the following considerations should be taken:

- Avoid contaminating the belt with metal fragments, weld splatters, etc. during installation.
- Use belting material designed for metal detectors. Antistatic or colored plastic chain belting may contain pigments that could affect the performance of the metal detector.
- Variable speed drives, walkie talkies or RF transmitters may affect the performance of the metal detector.

Contact Goring Kerr for assistance.

Safety

To insure personal safety care must be taken when working on or around the metal detector conveyor. As with all such devices the main supplies (electrical and air) to the conveyor must be locked off when performing repair or maintenance work. After disconnecting the supplies to the conveyor cycle the metal detector reject device to evacuate any air left in the system. Then switch off and lock the electrical supply to the metal detector.

Search Head Mounting And Isolation

The detector is supplied with four nylon isolation mounts and four nylon washers which should be used to attach the search head to the conveyor. These mounts ensure a rigid, electrically isolated mounting. Be sure to drill the frame hole large enough for the shoulder of the isolation bushing. This will isolate the bolt shaft from the frame. Care must be taken to ensure electrical isolation of the mounting bolt and support frame. (see Figure 7)

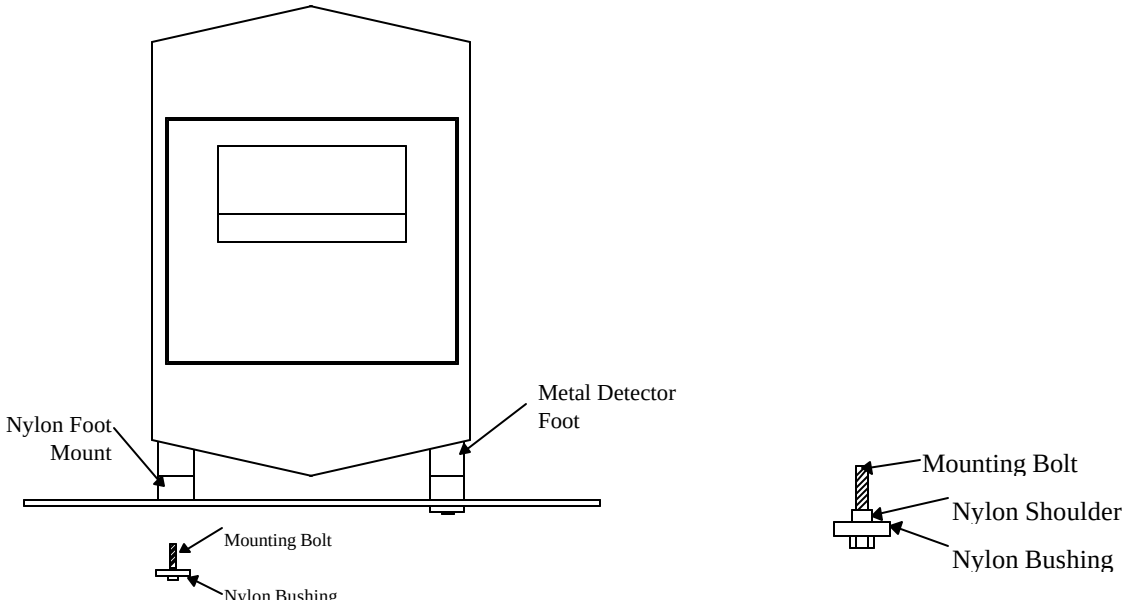


Figure 7

Metal Free Area

While the detector is shielded above, below and on the sides, metal objects have to be kept from the entrance and exit of the detector opening as shown below. No metal can be located in this area. Large moving metal should be kept fifty (50) percent further away or at least two (2) times the smaller aperture dimension. (see Figure 8). There are special models available for operation in areas which require smaller metal free areas. Contact Goring Kerr for more details.

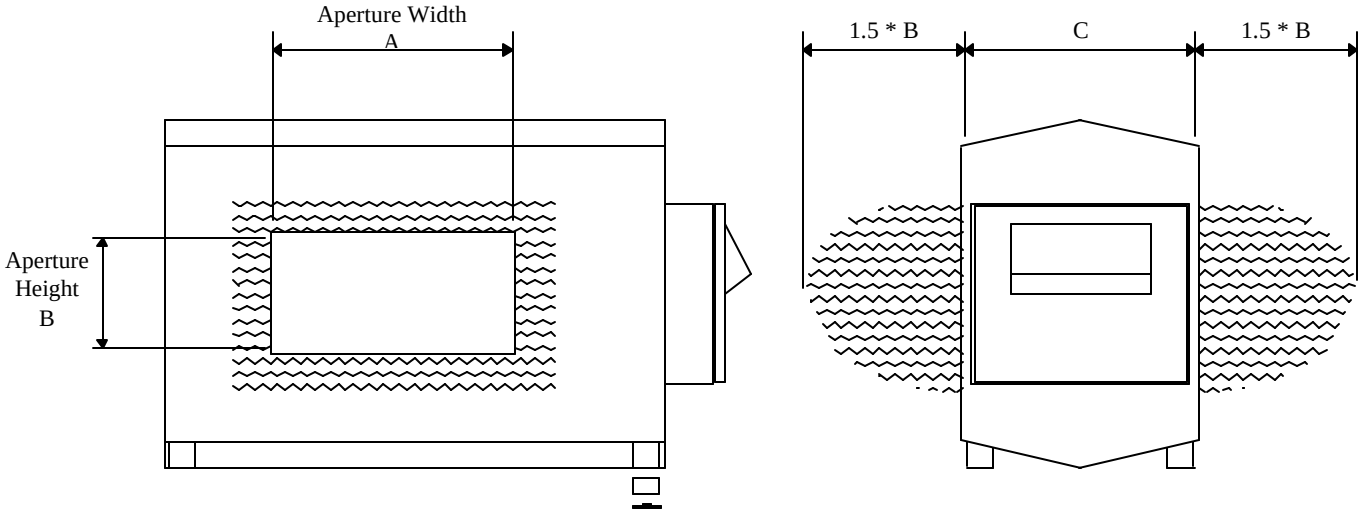


Figure 8

Aperture Clearance

It is important that nothing is allowed to touch any part of the detector's aperture. A slider bed or board is required to support the load of the product on the belt. This can be any non-metallic material; phenolic is recommended as it is easy to machine, does not generate static and has good wearing properties. The slider board must be supported outside the search head and should not rest on any part of the detector. One suggested way of installation is illustrated below. (see Figure 9)

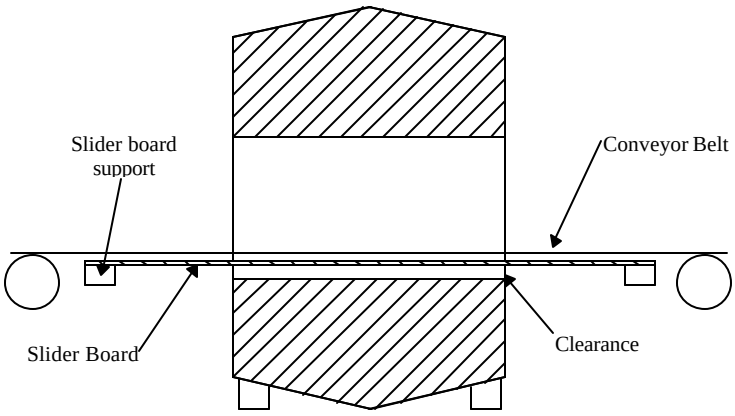


Figure 9

Loop Effect

Besides observing rules for metal-free areas, precautions should be taken to prevent the occurrence of loop effect. Loop effect is caused by an electrical loop in the conveyor, which is allowed to make intermittent contact (see Figure 10). This loop, when closed, can produce a large electromagnetic field. When the loop opens, the field collapses very rapidly, causing the detector's field to be disturbed. This results in false detections. Loops can be caused by rollers whose bearings make intermittent connection, or any metal which crosses the conveyor frame that is not securely fastened (e.g.: transfer plate, loose cross member, electrical conduit, retracting reject or flap gate reject).

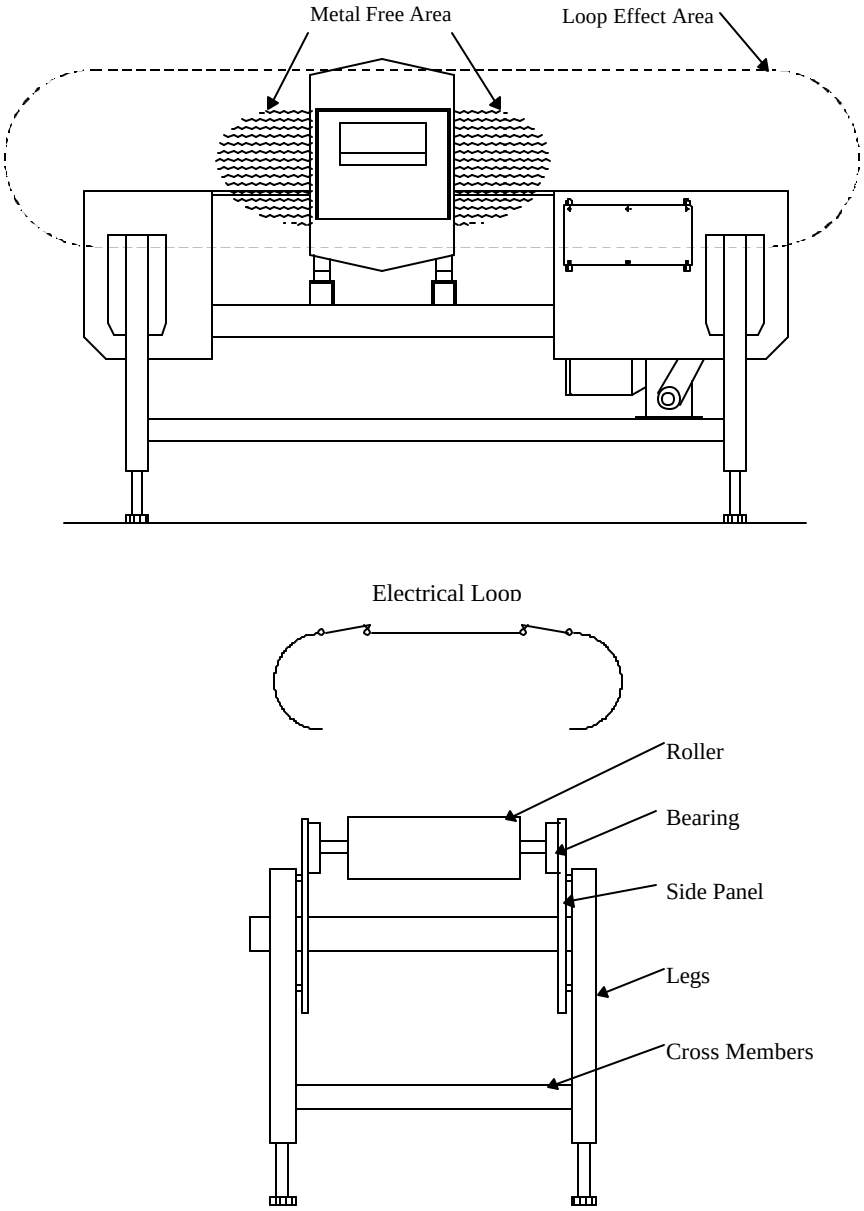


Figure 10

Roller Isolation

Loop effect is most prominent with detectors having an aperture height (smaller dimension 'B') greater than five inches and a width (or 'A' dimension) greater than twelve inches. Loops as far as three feet away may affect the operation of the metal detector. This depends on roller, bearing and frame materials and on the quality of contact.

It is recommended that all cross members and transfer plates, etc., be welded or securely fastened. Rollers, of course, cannot be secured and, therefore, should be isolated from making electrical contact. Only one side of each roller assembly needs to be isolated. ***DO NOT*** isolate both ends. The materials generally used are plastic and phenolic.

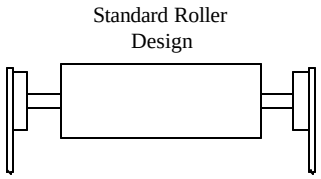
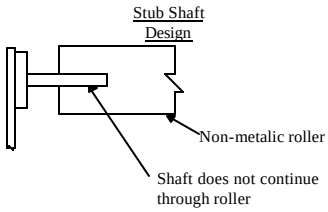


Figure 11

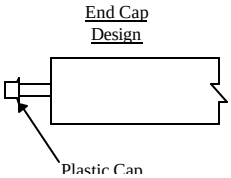
Option 1) Stub Shaft

With this design the roller shaft does not continue through the roller. This separation removes the electrical loop within the roller.
Note: The roller must be non-metallic



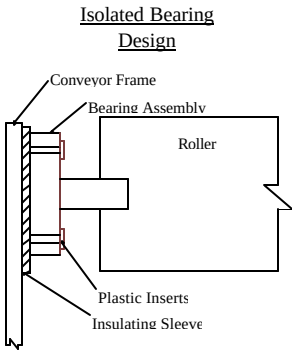
Option 2) End Cap

Placing a closed ended plastic cap on one end of the roller shaft will break the electrical connection between the shaft and bearing assembly.



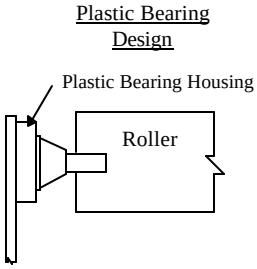
Option 3) Bearing Isolation

Isolating the bearing assembly requires both isolation of the housing, and the mounting bolts. An insulating sleeve is used to electrically isolate the bearing housing from the conveyor frame. Plastic inserts are used to isolate the mounting bolts from the bearing assembly.



Option 4) Plastic Bearing

The plastic bearing assembly is one of the easiest designs to implement. Most plastic bearings are available in standard mount designs. However, some plastic bearings contain a metal sleeve in the mounting holes which is internally connected to the bearing raceway. With this bearing plastic inserts would have to be used to create the electrical isolation.



Vibration

Efforts should be made to reduce excessive vibration, especially if a conductive (wet) product is to be inspected.

Conveyor Separation

If you have a separate conveyor for the metal detector system (which is preferred), you must make certain that this conveyor does not make intermittent contact with the infeed and discharge conveyors. Fastening them with a non-metallic material is the recommended method as shown below. (see Figure 12)

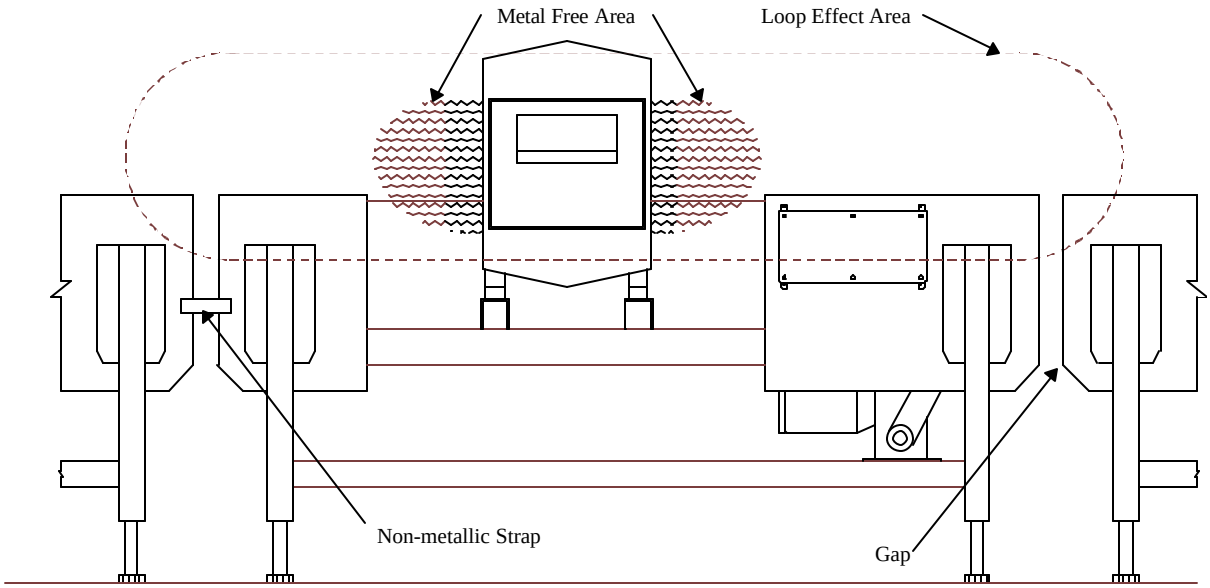


Figure 12

Electrical Installation

When choosing the power supply line for the metal detector, it should be remembered that starting of heavy electrical machinery creates very considerable (though momentary) voltage drops in the line. Such "spikes" can cause the metal detector to trigger. Since the power consumption of the detector is very low (approximately twenty-five watts), it is recommended that a lighting circuit be used for its supply rather than a machinery power circuit. Where this is not possible, and line noise does trigger the detector, contact Goring Kerr for recommendation of a suitable isolation transformer or power line filter.

a) The metal detector connections are shown in the Power Supply Connections section. If the control unit is mounted on the search head, the connections from the search head to the control unit are already made.

b) The cable between the power supply unit and control unit is of a specific type. Do not substitute or splice on extra cable. Likewise, the cable between the control unit and search head (when remote) is of a specific type. Do not substitute or splice on extra cable. Either cable <u>can</u> be cut to length and they are not sensitive to movement. Contact Goring Kerr for extra cable or cable information if required.

c) Use waterproof cable glands at all cable entries.

<u>Power Supply Layout</u>

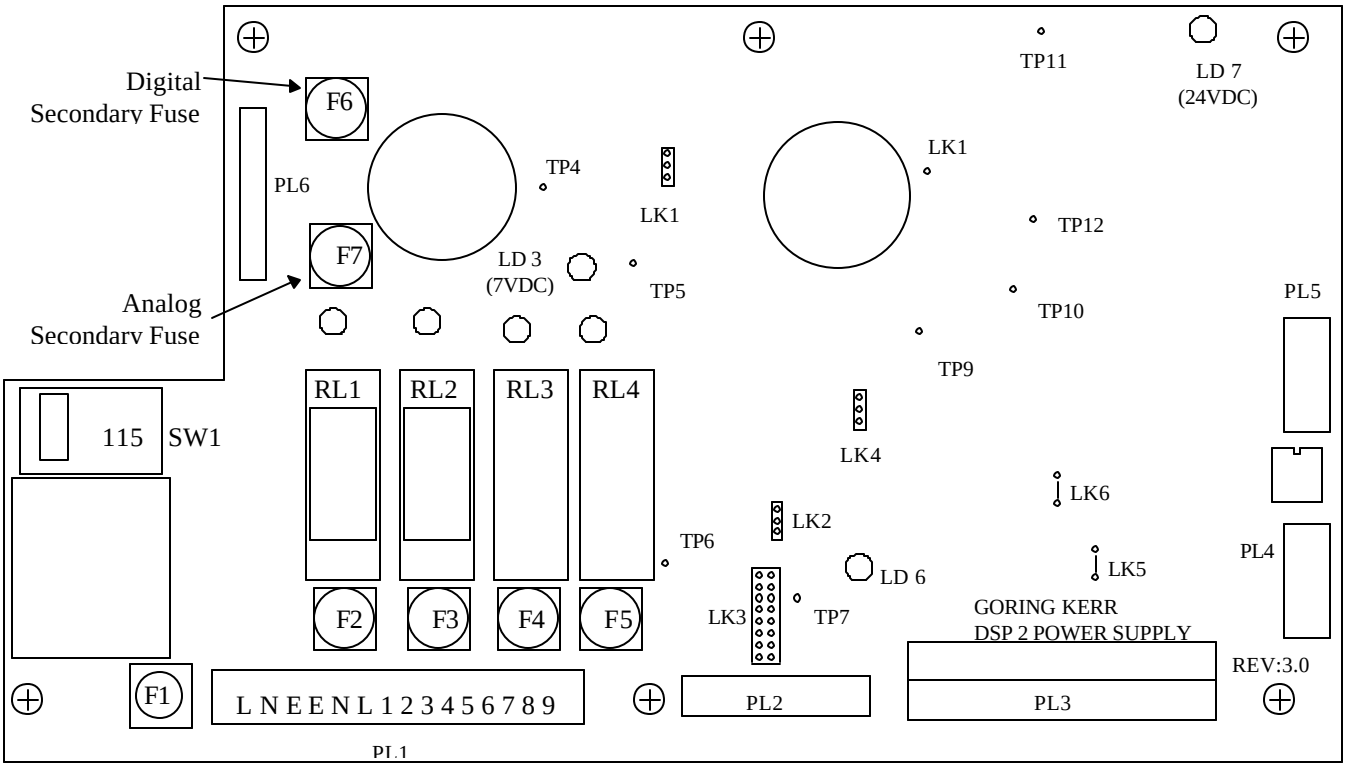


Figure 13

Power Supply Connections

Main connector PL1

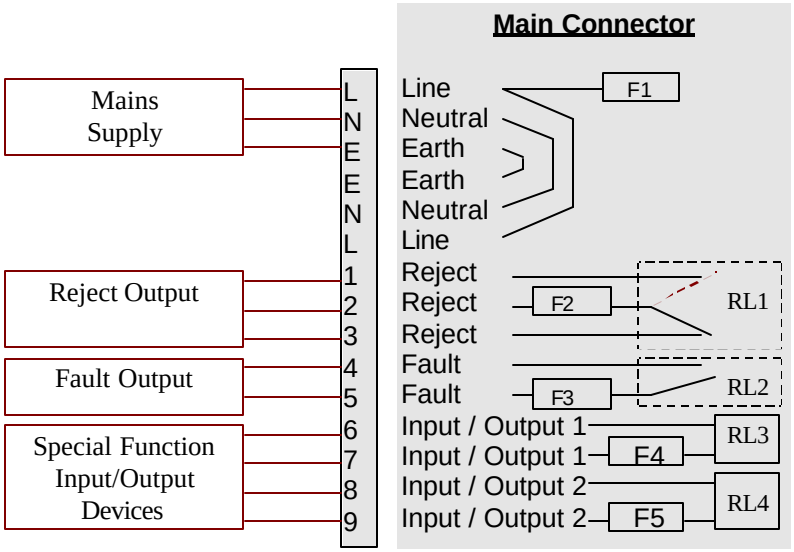


Figure 14

Mains Supply

Connect the supply line to, L-Live, N-Neutral, E-Ground (Earth).
Either 110 or 220 volts single phase can be used to power the metal detector. A selection switch (SW1)on the power supply board will switch between voltages. The metal detector can operate on either 50 or 60 Hertz, 55 va.

Fuses

Fuses F1 to F4 are 1 Amp 250 volt fast acting fuses, only use fuses with the same rating for replacements. Secondary fuses F6 and F7 are 2 Amp 250 volt slow blow, use only same rating for replacement.

Reject Output

When metal is detected or detector power is turned off dry contacts 1 and 2 close, 2 and 3 open. Terminal 2 is fused 1 Amp 250 volt fast acting fuses. To supply typical reject device (e.g.: solenoid), connect jumper from L to 2, connect solenoid to 1, N and E, or 3, N, E, depending on action required.

NOTE: ***DAMAGE*** may occur if wrong voltage is applied to relays !
Solid state relays are available. Check power unit lid for description of relay type. Mechanical relays are AC or DC - only terminals 2 and 3 are used for reject.

Fault Output

During a fault condition or when power is turned off terminals 4 and 5 will close. These connections can be connected to an external alarm to indicate a fault condition. Terminal 5 is fused at 1 Amp 250 volt fast acting fuses.

Note: It is advised that the fault output be connected to either a fault alarm e.g. horn, or to the reject device.

Special Function Input / Output Devices

Terminals 6, 7, 8, 9 are for use with special options. Terminals 7 and 9 are fused at 1 Amp 250 volt fast acting fuses.
Note: I/O devices are not normally fitted. ***DO NOT*** connect to these terminals if it is unclear of the type or voltage rating of devices fitted. Permanent damage may occur if incorrect voltage is applied.

Typical Reject Device Connections

110 Volt AC Reject Solenoid (Mechanical Control Relay)

When metal is detected terminals 1 and 2 will close and energize the reject solenoid.

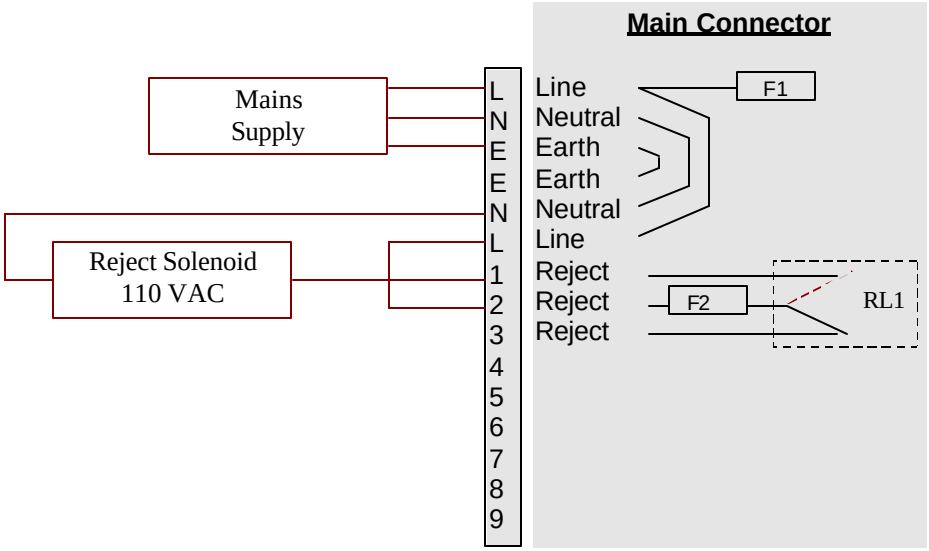


Figure 15

110 Volt AC Reject Solenoid (Solid State Control Relay)

When metal is detected terminals 2 and 3 will close and energize the reject solenoid.

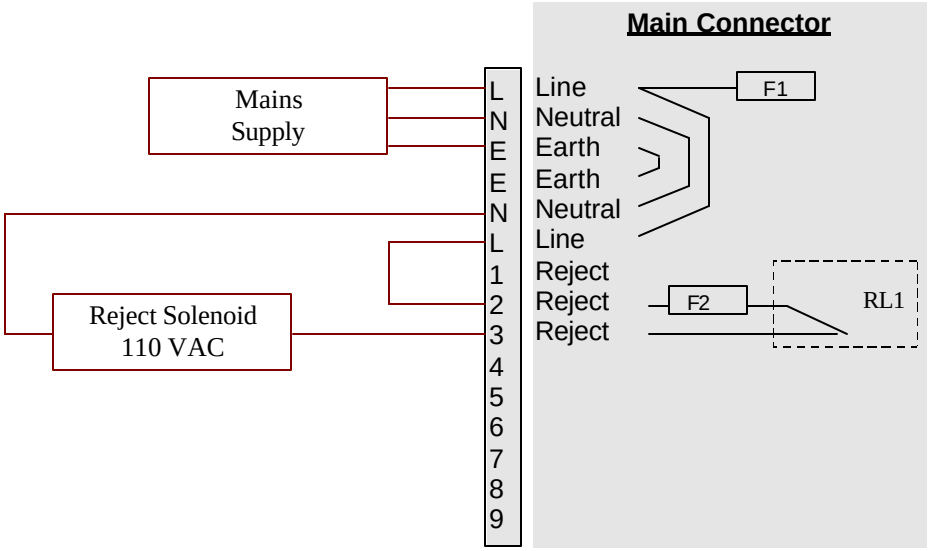


Figure 16

Photo Eye , EMU and Reject Confirm Connections Plug PL2

Photo Eye

The photo eye is mounted on the infeed side of the metal detector just above the belt. The photo eye mounting distance should be approximately equal to the smaller aperture dimension. The photo eye is used when inspecting discrete products.

Important: Insure link 2 in the power supply is in the photo eye position see Links on the following page.

EMU Sensing Head (Shaft Encoder)

When using a variable speed belt conveyor it is necessary to use a EMU sensing head, or shaft encoder. The EMU Sensing Head will generate an output pulse equal to the speed of the belt. This pulse is then used internally for configuring the reject timing. Contact Goring Kerr if you require more information.

Reject Confirm

To insure contaminated product is rejected correctly a feedback signal from the reject device can be used. A microswitch or photo eye connected to the reject device can be wired to terminals 6 and 4 on connector PL2. Contact Goring Kerr if you require more information.

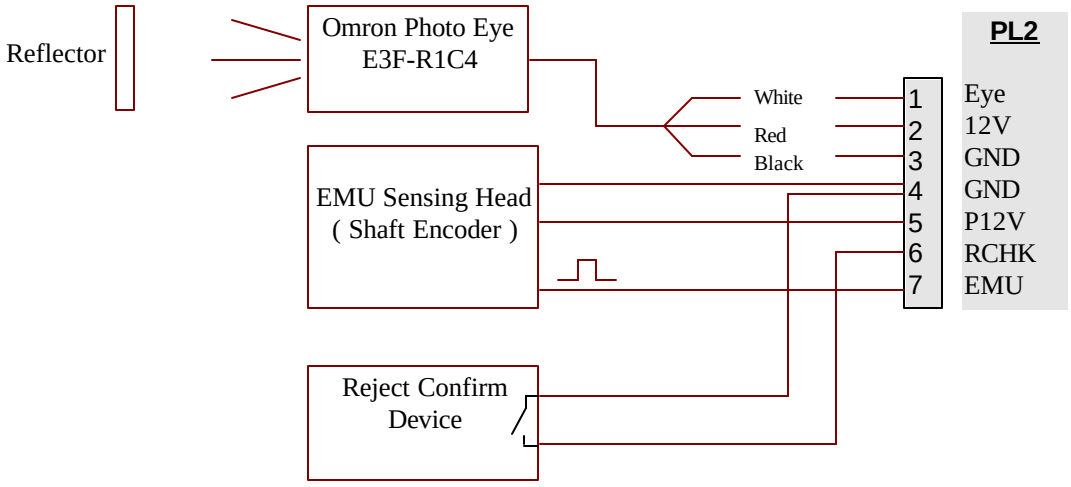


Figure 17

Power Supply Cable

Power to control unit Plug PL3

This connector is a plug-in terminal strip. It may be easier to unplug it while making terminal connections.

WARNING

This cable is for connection between control panel and power supply only. Do not connect any external devices or supplies to PL3.

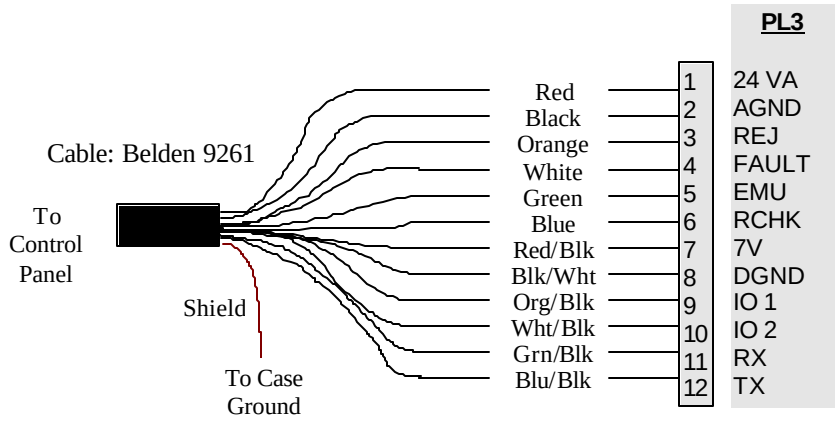


Figure 18

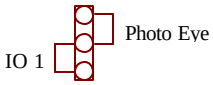
Fuses

F1	Main supply fuse 1 Amp 250 volt fast acting fuses
F2	Reject Output relay output fuse 1 Amp 250 volt fast acting fuses
F3	Fault relay output fuse 1 Amp 250 volt fast acting fuses
F4	IO 1 relay output fuse 1 Amp 250 volt fast acting fuses
F5	IO 2 relay output fuse 1 Amp 250 volt fast acting fuses
F6	Digital secondary fuse 2 Amp / 250 VAC Slow Blow
F7	Analog secondary fuse 2 Amp / 250 VAC Slow Blow

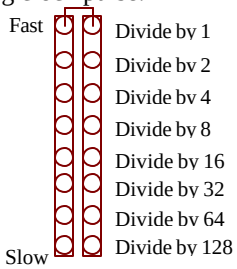
Links

LK1 DSP 1, DSP 2 selector.

LK2 Photo Eye / IO 1 selector.



LK3 EMU clock divider. Divides the incoming clock pulse.



LK4 485 Communications selector.

LK5 Ground ‘A’ Link.

LK6 5 VDC ‘A’ Link.

Plugs

PL1	Main connector
PL2	Photo eye and EMU sensing head connector
PL3	Interconnecting cable to control unit
PL4	DSP 1 communication connector
PL5	485 communication connector
PL6	Transformer connection

Control Panel Connections

Removing The Control Panel

Before removing the control panel insure that the *MAINS SUPPLY* is switched *OFF*. Either remove fuse F1 from the power supply or shut down power source to the metal detector.

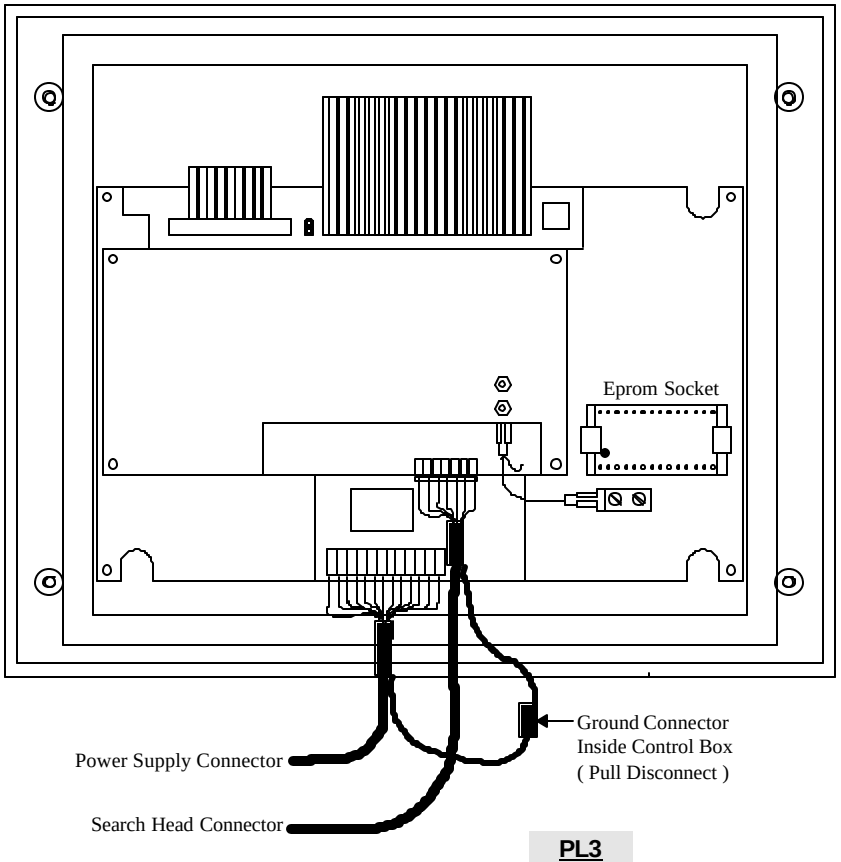
The control panel is mounted on the search head (or remote box) with four mounting bolts. Remove these bolts to gain access to internal connectors.

The power supply and search head cables are wired into *'quick disconnect'* connectors. It is not necessary to remove the wires from these connectors.

When removing the connectors be careful not to pull on the wires, pinch the connector and pull.

Figure 19

DSP 2 Control Panel
(Back View)



Installing The Control Panel

When installing the control panel repeat the above instructions in reverse order.

Note:

Care must be taken to insure that the search head connector is fitted correctly.

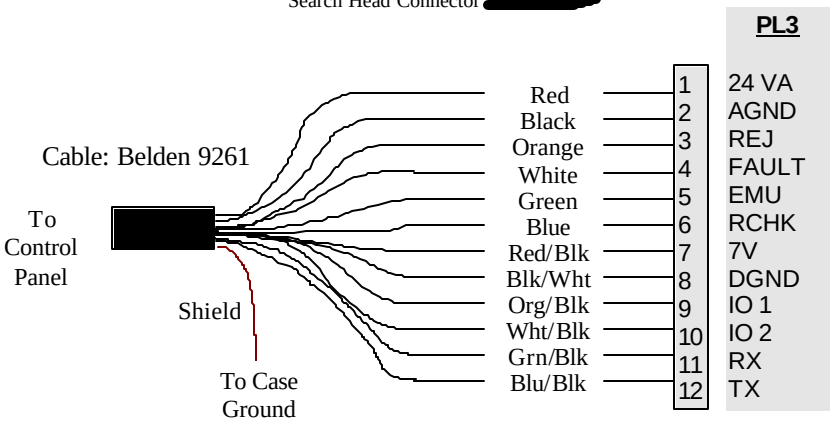


Figure 20

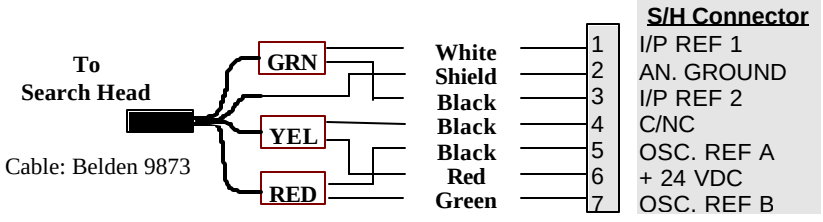


Figure 21

Search Head Connections

Standard Search Head Electronics

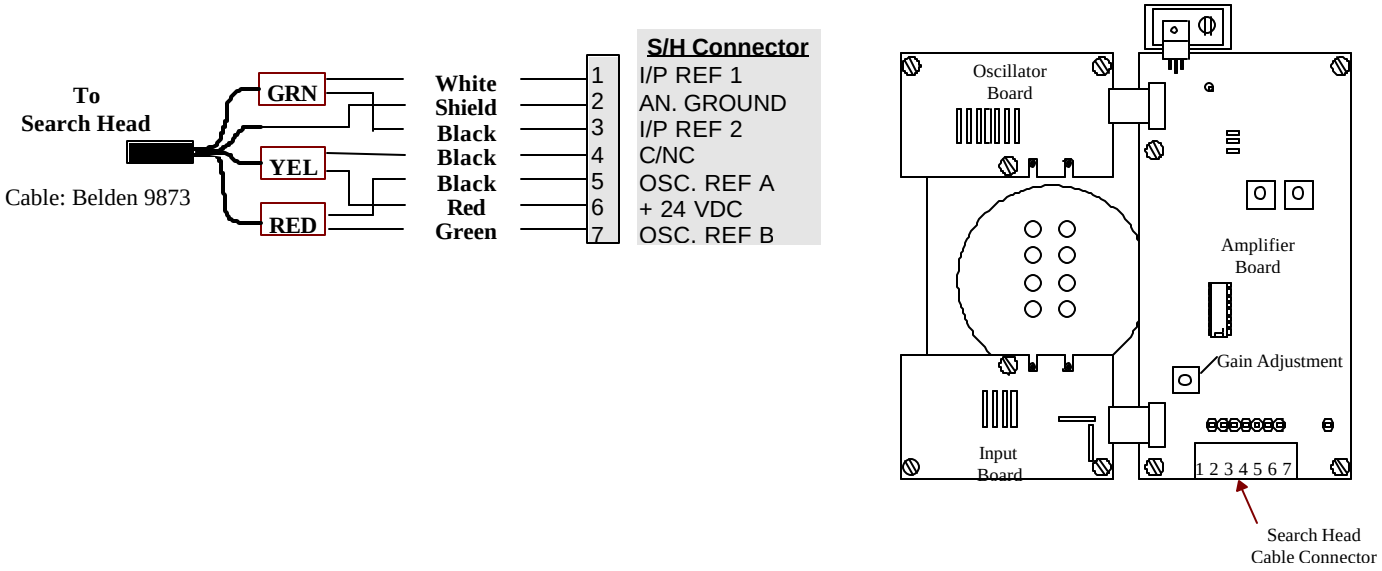


Figure 22

Mini Search Head Electronics

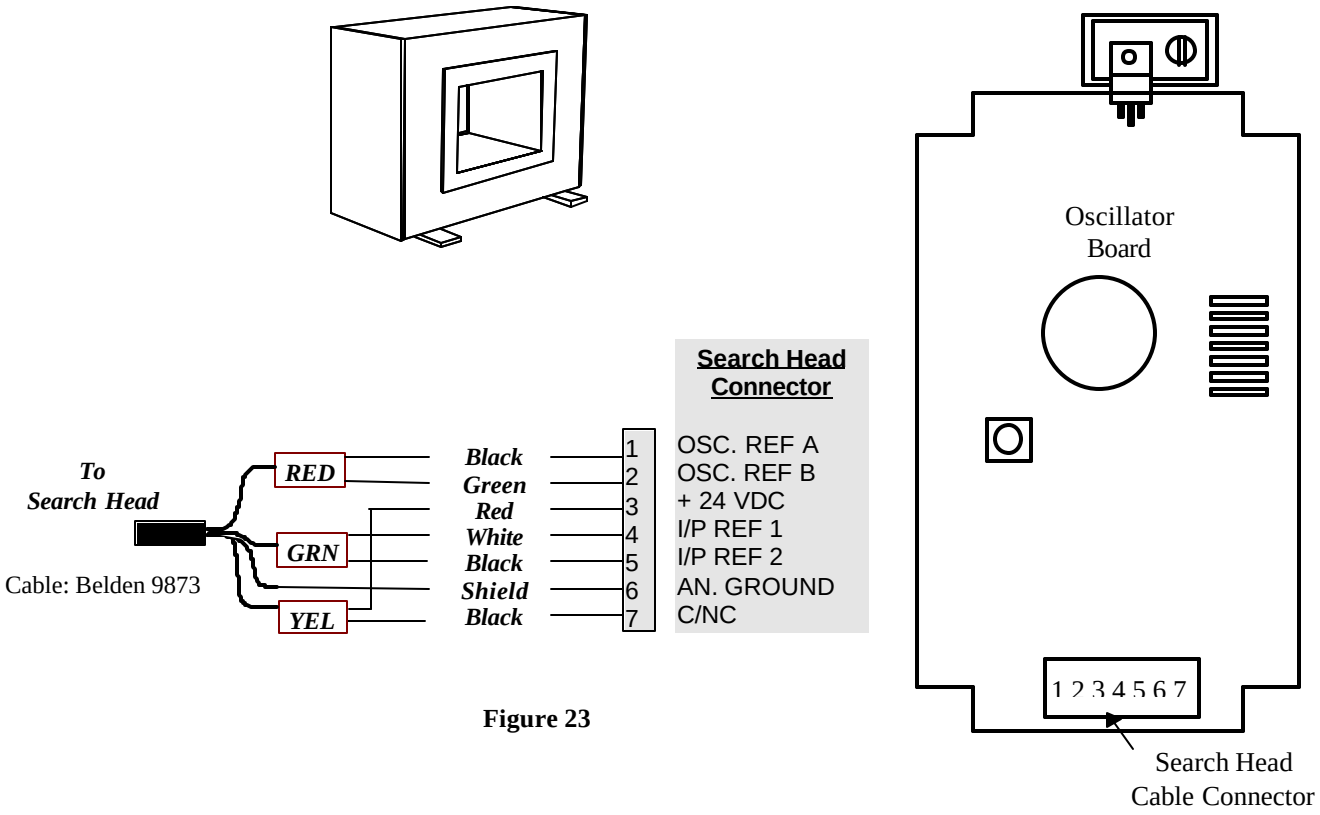


Figure 23

DSP 2 Menu Structure

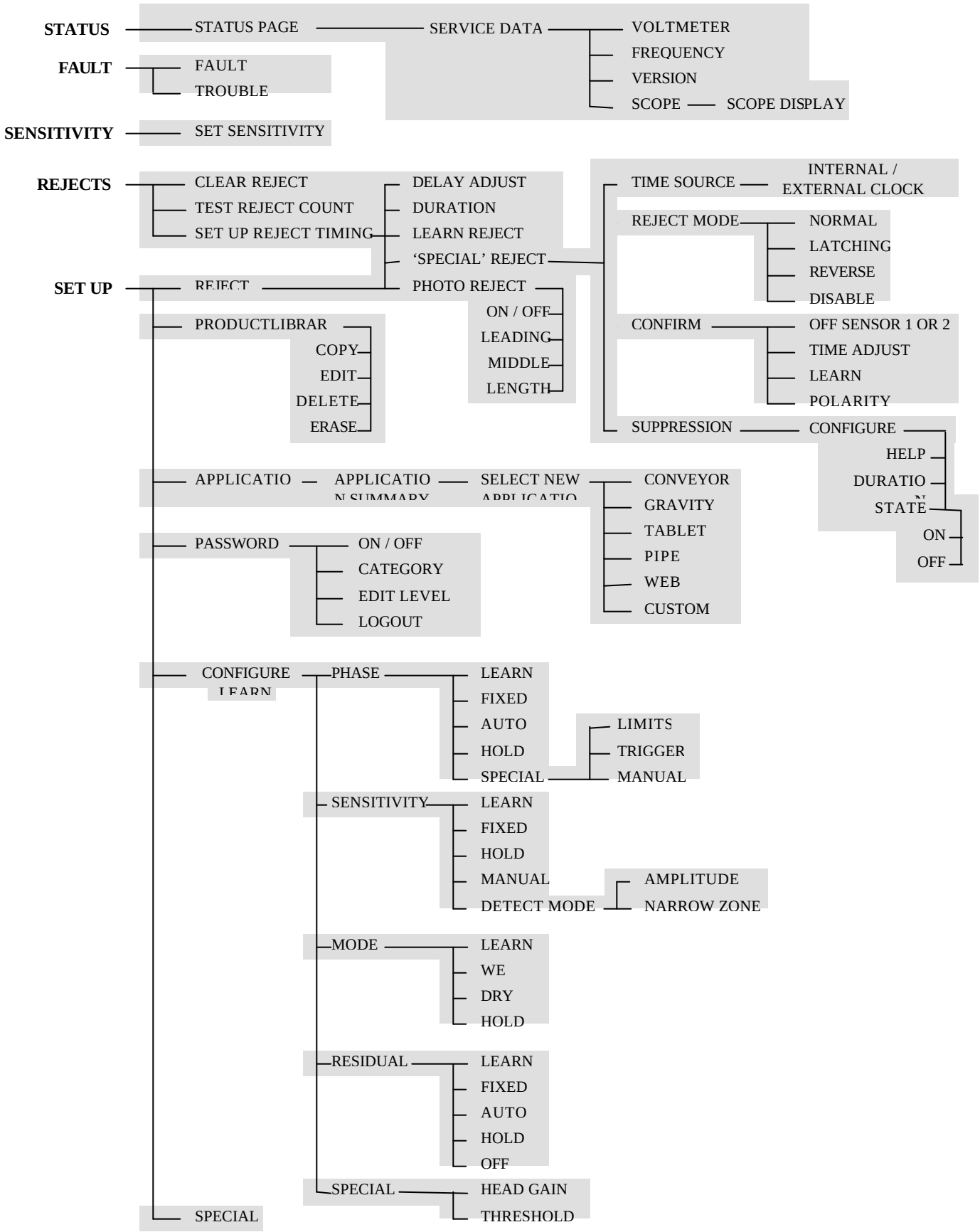


Figure 24

User Interface (Keypad)

Top Menu

Throughout this manual you will be asked to start from the Top Menu when selecting options etc.. To find the top menu press the '*Exit*' key until you see this screen.

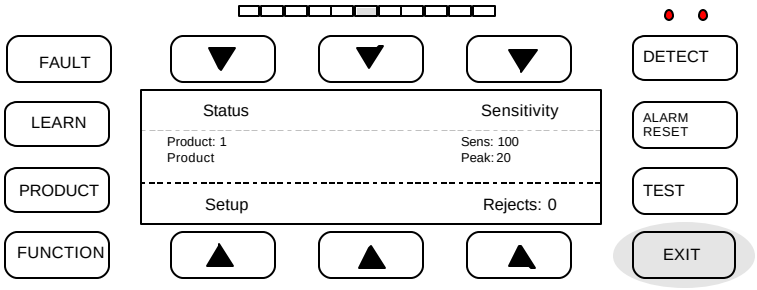


Figure 25

Path

Major functions described in the following pages will have a path specified. This path refers to key presses required to reach that menu from the 'Top Menu'

Soft Keys

The keypad has six soft keys which are labeled with an arrow. The function of these keys change depending on the menu you are currently in. Some menus will have need for only a few keys and others will use all of them. The remainder of the keys are dedicated to specific tasks and are called hard keys. The function of the hard keys is as follows:

Hard Keys

Learn The learn key when pressed jumps to the product learn menu.
Product This key toggles stored product settings. Each press of the key scrolls to the next stored product.
Function This is a user defined key and its function can be selected from a list of options.
Test Initiates the QA test routine menu.
Alarm Reset Can be configured to reset a reject alarm when using the latch reject output option.
Exit Use this key when you wish to leave a menu, and return to the "top" menu.

How To Edit Options

When editing an option that requires changing a number use the soft keys above the arrows to move the cursor to the digit you which to edit. Then use the soft keys below the plus / minus keys to change the value of the number. Once you have set the correct value press the arrow under ' ***Accept*** ' . This will change the value to the new number. Then press the ' ***Exit*** ' key to leave that menu.

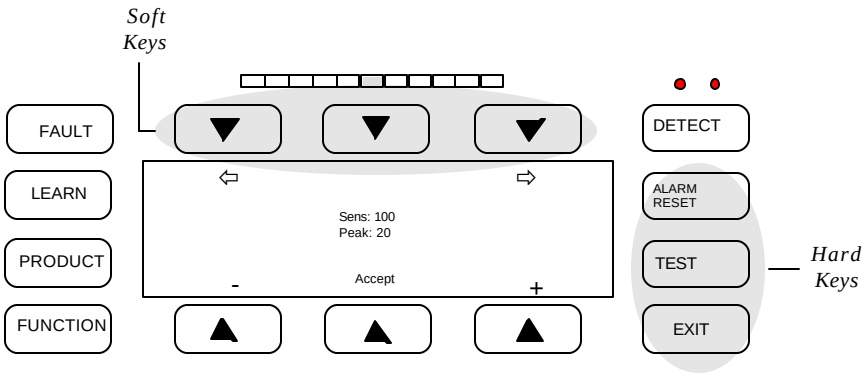


Figure 26

Item	Function
+	Increases number, or letter
-	Decreases number, or letter
⇦	Moves cursor to left
⇨	Moves cursor to right

Initial Setup

This manual describes only the features which can be used in Conveyor Applications. The following ***must be set*** in order for the detector to function properly (in order):

- The application type (conveyor)
- The application parameters (belt speed, aperture size, photo eye distance)
- Reject timing
- Product compensation
- Sensitivity

All other settings are optional and will vary depending on the requirements of the user.

Important

In most applications, the metal detector parameters will already be set prior to shipment. If supplied as a system the reject timing will also be set to the correct values. After installation and power up check the operation of the metal detector and any reject system and adjust as required.

Most 'dry' product applications (see Product Compensation pg. 29) will not require a product compensation adjustment. For most 'wet' product applications custom product compensation will be required. Always check and record factory settings before making changes. If changes are required use the copy product function to create a new product and perform custom settings under this record. This way the metal detector can be returned to factory settings under product 1.

Password

The metal detector is supplied with password protection turned 'off'. However, password protection should be enabled and custom passwords established to prevent unauthorized changes to the metal detector settings (see Password pg. 34).

Application

Path: Setup/Application

There are six application types available:

➔ **Conveyor**
Gravity
Tablet
Pipe
Web
Custom

This manual refers only to **Conveyor** type applications.

Conveyor applications require three numbers which the detector will use to optimize it's operation:

- Aperture size
- Belt speed
- Photo eye distance

NOTE: The factory settings may be set to your application. Check to make sure these are set properly; if not they should be edited.

Edit Application

Units

This menu toggles between metric and imperial (U.S.) units of measurement. Select the desired units.

Aperture Size

Aperture size is the smaller of the two dimensions of the search head aperture. If your search head opening measures 14" by 5", then your aperture size is 5". If you have a round aperture, then the aperture size is the diameter (a 9" diameter means that you enter aperture size as 9"). Use the *Plus* and *Minus* keys to change the value; press *Accept* to accept this value or *Exit* to restore the old value.

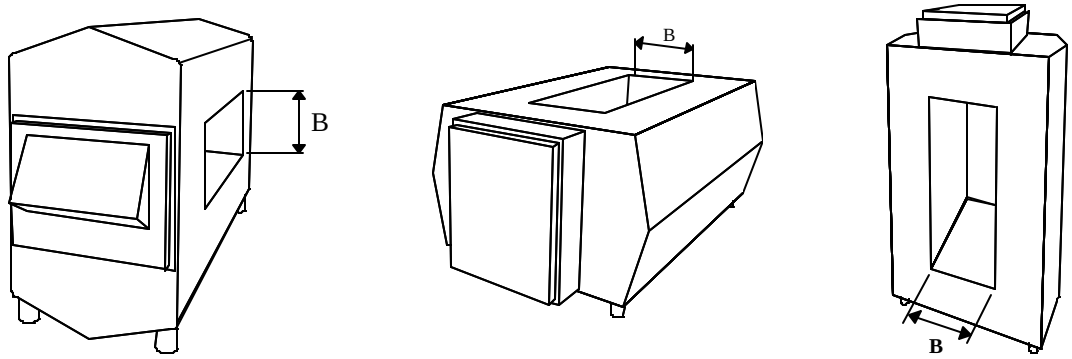


Figure 27

Belt Speed

This needs to be an approximate value only. There are two ways to enter the belt speed - manual and automatic learn. The automatic learn requires a photo eye to be present.

Manual:

Measure or calculate the belt speed and enter this value. Hint: Measure the distance an object travels during 6 seconds. Multiply this by 10 to give you the speed in distance per minute.

Example: 10 feet in 6 seconds

10 x 10 = 100 feet/min.

Automatic Belt Speed Learn:

This uses the photo eye to measure the block time produced by a known length package.

Select belt speed/learn and place an object on the belt so that it will break the photo eye beam. Then enter the package length in inches or millimeters.

The system will calculate the belt speed.

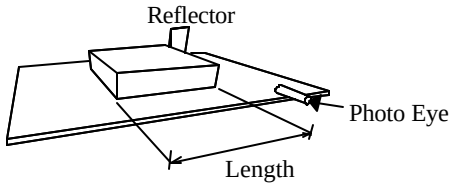


Figure 28

Photo Eye Distance

Photo eye distance is the distance between the side of the detector and the edge of the photo eye (see diagram below). Usually, photo eye distance is the same as the aperture size setting. Use the *Plus* and *Minus* keys to change the value.

NOTE: If no photo eye is used, enter '0' for this value.

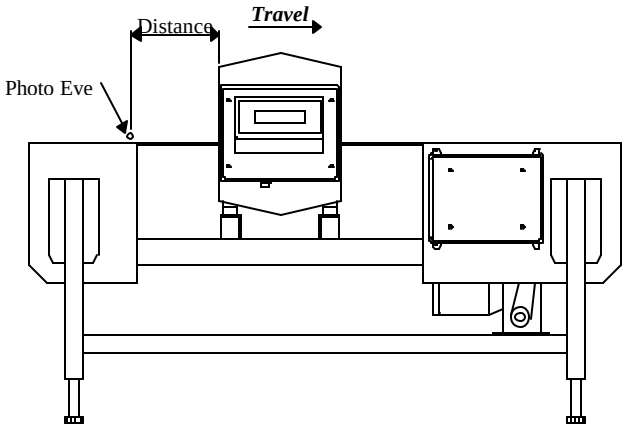


Figure 29

Rejects

Path: Rejects

Clear Reject Counter

This button clears the reject counter displayed on the top menu. Press to reset to '0'.

Test Reject

This button when pressed will activate the reject output. This is used to test the action of the reject device. This will not inhibit normal occurring rejects and the test function will return to normal when leaving this menu (*Exit*).

Setup Timing/Basic Setup

Delay

The reject delay time is the time delay between a detection and the activation of the reject device. This menu is used to change that time delay. Use the *Plus* and *Minus* keys to change the value; test the change, then press *Accept* to accept this value or *Exit* to restore the old value.

Duration

The reject duration is the length of time for which the reject device is activated after a detection has occurred. Use the *Plus* and *Minus* keys to change the value; test the change then press *Accept* to accept this value or *Exit* to restore old value.

Learn

This menu is used to do a one-step reject timing calibration which is the easiest way to set the reject parameters.

Learn Procedure

1. Place a detectable metal sample in the center of the product. Pass the product through the detector. (do not use large metal such as coins, etc.)

2. Press the Reject key when you wish to activate the reject device and hold the key down for the desired duration.

3. The delay, duration and reject confirm (if used) time will all be calculated. Use individual menus to make any small adjustments required to assure clean, complete rejection of a contaminated product.

Photo-Registration

If the system is equipped with a photo eye it can be used to increase the accuracy of the reject device. This is recommended where discrete packages are inspected. Especially those exceeding 6" in the direction of travel. Photo registered timing can allow the reject device to accurately reject the product regardless of where the contaminant metal is located within the product.

Options:

Off	Photo-registered reject timing is off.
Leading	Photo reject timing will register from the leading edge of the product. Recommended for drop-nose or retracting belt style reject systems.
Length	This option of photo reject will register on the leading edge of the product and will automatically extend the reject duration to compensate for the length of the package. Recommended when gaps between products cannot be maintained.

Photo Eye Queue Size

The number of products between the photo eye and the reject device at any given time is displayed in this menu and serves as a check that the photo eye is working properly. As a product passes the photo eye, the queue size increases. When the product passes the reject device, queue size decreases.

Reject-Special

The following functions are not normally required but are available for special applications:

Time Source

Selects internal clock or external clock source. External clock would be used for variable speed belt applications and requires an external pulse generator. Contact Goring Kerr for more information

Reject Mode

Normal

Normal is for normal reject applications.

Latching

This can be used to latch the reject relay output, for example with a reject alarm system. The reset will be done by the alarm reset hard key.

Reverse

This feature is used for applications where it is required to reject products which do not contain metal. A photo eye is required for this option.

Disable

This inhibits the reject output. ***WARNING***: This will render the detector inoperable.

Reject Confirm

Reject confirm will require external hardware which may not be installed on your system. Contact Goring Kerr for assistance.

This option permits the reject device response to be automatically monitored by the detector. Select from the following options:

No reject confirm
One sensor
Two sensor (this option monitors both strokes of the reject device)
Polarity (inverts the polarity of the incoming signal)
Confirm time (adjust the reject confirm signal window)
Learn (this allows the detector to automatically learn the reject response time)

Reject Confirm Setup

One Sensor

The reject confirm system continuously monitors the signal reflected back from the reject device generated by a reject confirm switch. The time delay between the initiation of a rejection signal and the returned confirmation signal is monitored to confirm that the reject device operated within a prescribed time period. Once the wiring of the switch has been completed, from reject confirm menu (Path: Rejects/Setup Timing/Special/Reject Confirm) press the Test button to enter the switch test menu. Press Test Reject and make sure the sensor state changes in conjunction with the reject activation. If this is true, the signal is reaching the DSP control. Press *Exit* to get back to the reject confirm window; press the Learn soft key and follow the on-screen instructions. This process will train the system so that the normal response time for the reject confirm signal is established. This can be manually adjusted if necessary using the Confirm Time soft key and the Reject Confirm menu.

Two Sensors

The system can be configured to monitor not only the reject response time, but also the time taken to return to normal position. This option will require that two sensors be used in such a way that both strokes of the reject can be monitored. Contact Goring Kerr for assistance in using this feature.

Suppression

This feature is designed to reduce false triggering caused by the action of the reject device.

Product Compensation

Metal detectors are capable of detecting metal by measuring two characteristics:

Conductivity: (Wet)

Any conductive material will generate a specific error signal. However, many food products by nature are electrically conductive themselves. Salt and moisture content combine to produce conductive product effect which must be overcome in order to detect small metal contaminants.

Magnetic: Permeability: (Dry)

Any material passing through the detector which has magnetic qualities will generate a signal which must be overcome in order to detect small contaminants. Products which contain iron fortification can produce magnetic error signal.

The DSP metal detector overcomes these product effects by automatically adjusting itself to compensate for the specific 'phase' of the error signals.

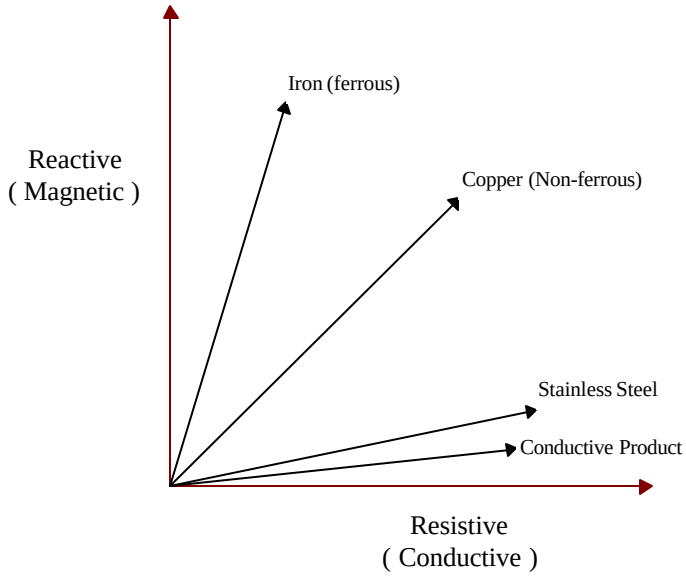


Figure 30

Typical 'Wet' products:

- Bread, buns, cakes
- Meat, poultry (fresh)
- Dairy products
- Fresh produce

Typical 'Dry' products:

- Cookies, candy, chocolate
- Dry powders
- Oil based products (peanut butter)
- Cereals

Definition of Terms

Phase	Refers to the phase vector of the product signal.
Mode	Groups the phase vectors into wet (near 0°) and dry (near 90°)
Residual	Product effect that cannot be eliminated with phase compensation. This feature requires the installation of a photo eye and can only be used with discrete products. This feature is not used in gravity applications.
Fixed	Any feature which is fixed will not be automatically updated.
Auto	Any feature in auto will be automatically updated. This feature requires the installation of a photo eye and can only be used with discrete products. This feature is not used in gravity applications.
Hold	This will maintain the entered parameter and will not be included during a 'product learn'. For example, if sensitivity is on -hold the sensitivity setting will not be included during a 'product learn'.
Head Gain	Selects a high or low gain setting.
Thresholds	The system maintains two independent thresholds: the conductive threshold and the magnetic threshold. These thresholds depend on external factors such as the installation environment and the type of product being inspected. This menu is used to set these thresholds. The standard threshold values are 100 for both. This should be fine for most installations.
Sensitivity	This adjusts or sets the sensitivity of the detector. A higher sensitivity number means the detector will detect a smaller piece of metal.
Learn Path	The learn path is displayed when the learn hard key is pressed. The features which will be included in the learn path will be marked with a box beside them. Any feature that is 'off' or 'on hold' will not be included in the learn process.

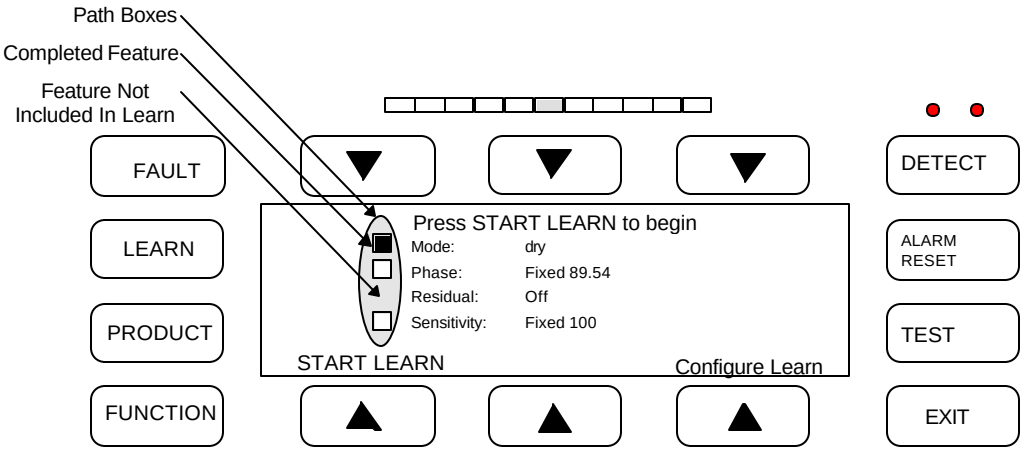


Figure 31

Learning the Product

Press the Learn hard key, then press the Start Learn button and run the product through the detector. Note: the product must turn on the green Product Light in order for the Phase Point to be learned. A red Product Light indicates excessive product signal and the gain should be reduced. If the product does not turn on the green Product Light you must set the thresholds. Path: Configure/Learn/Special/Thresholds.

The mode and phase will be learned in one or two passes of the product. Residual, if enabled, will take a single pass of product. Sensitivity takes four product passes.

Dry Products

Dry products will typically phase near 90°. Some dry products may not produce enough product effect for the system to learn. In these cases, after initiating the Start Learn, press on the top of the search head until the Product Light turns green. This should produce a standard dry Phase Point near 90°.

Wet Products

Wet products will typically phase near 0° but can vary by ±20°. It is advisable to use automatic phase when inspecting discrete wet products. In doing this, the detector will automatically track product phase changes caused by temperature or ingredient mix changes. To select auto phase press Configure Learn, then Phase, then Auto. When using auto phase it is advisable to limit the phase range. This can be done under Special in the Phase menu.

Special

Head Gain

Head gain selects high or low gain setting. High gain should be used in all applications unless the product effect is too high and turns on the red (high) Product Light. If this is the case low gain should be selected. Whenever the head gain is changed it will affect the overall sensitivity of the detector and therefore the sensitivity should be tested and recalibrated if necessary.

Thresholds

The system maintains two independent thresholds: the conductive threshold and the magnetic threshold. These thresholds depend on external factors such as the installation environment and the type of product being inspected. This menu is used to set these thresholds. The standard threshold values are 100 for both. This should be fine for most installations.

NOTE: With NO product running (and the conveyor running, if present) the Product Light should be off and the LED Meter should be green. In applications where the Product Light is On when no product is present, the thresholds should be learned or manually adjusted so that the product light only comes on when product is passing through the search head. The threshold should also be learned or adjusted in cases where the product is failing to turn on the Product Light. The detector uses the Product Light and therefore, these threshold settings to determine when to learn or update its Phase Point.

Phase Special

Phase Limits

Phase limits are used to limit the range of the Phase Point in automatic or learn phase operations. To set the limits use the Spread Limits option. This adds ±1° every time the button is pressed. For a wet product in Auto Phase it is recommended to have phase limits set at ±10-15° from the Phase Point.

Trigger

Trigger indicates a level at which the detector will initiate a Fast Phase when the unit is running in Auto Phase.

Phase Angle

This allows for manual adjustment of the Phase Point.

Sensitivity

Path: Sensitivity

This menu sets the sensitivity number which the detector is using. Increasing the number results in higher sensitivity detecting smaller particles of metal. Manually adjust the sensitivity using the + and - keys, then press *Accept* to enter the new value. Range: 0-1000.

Note: Coarse adjustment can be achieved by moving the cursor to the desired digit and adjusting that digit.

WARNING: Any adjustment made to the sensitivity setting should be followed by a thorough test of the detector's operation using the required test samples.

Peak Signal

The peak signal is always displayed with the sensitivity number and it shows the relative value of any signal which the detector receives. When the peak signal exceeds 100, the detection threshold is tripped and will result in a reject signal.
(if the detection mode is narrow zone, a higher peak - 120-140 - may be required before a rejection will occur - see - detect mode below).

The peak number should be used as a guide to assist in determining the sensitivity setting. Assuming any product effect has been compensated, the peak number will display the current background signal. This should be kept below 50-60 for reliable operation. Adjusting the sensitivity will scale the peak number also.

Example: If peak = 100
Sensitivity = 200 Changing sensitivity to '100' will scale the peak to '50'

Ideally the sensitivity should be set so that the background signal peak is 50 or below and the signal from the test sample(s) is 150 or greater.

Sensitivity - Special

Detect Mode

Narrow Zone

Under this mode, a detection will occur only if the signal from the entrance coil and exit coil (positive & negative) both exceed the threshold set by the sensitivity number.

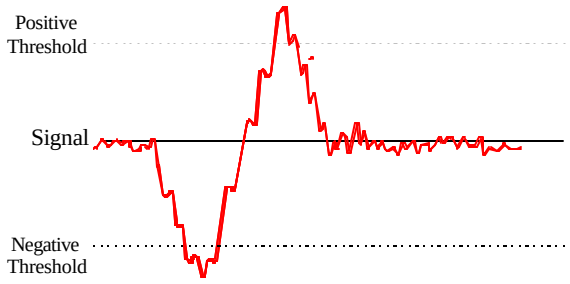


Figure 32

Amplitude

Under Amplitude, if either polarity (positive or negative) cross a threshold a detection will occur. Amplitude is usually more sensitive than narrow zone and should be used if in doubt. Narrow zone can improve immunity to external interference in some circumstances.

Fixed

Selecting fixed will include sensitivity and the Product Learn path.

Hold

Hold will remove sensitivity from the Product Learn path. Hold is the default setting for gravity applications.

Learn

Learn initiates an Automatic Sensitivity Learn. If the system has a photo eye the learn will take four product passes to be complete. If there is no photo eye, a learn will take approximately 15 to 20 seconds. During this period the detector will calculate an optimum safe sensitivity. This can then be manually adjusted if required.

Product Library

Path: Product (Hard Key)/Product Library

Individual product records which can store information such as sensitivity settings, reject parameters, etc. can be created. Since most parameters will be shared by all the products it is preferable to set one product record completely including all the reject parameters and then copy this product to a new product number. Then any individual parameter can be adjusted for this specific record.

Copy

This menu allows you to copy from the currently running product to a new product number. Press the Plus or Minus keys to select the new product number, then press copy. The menu will then change to Edit Product Name, press the Plus and Minus keys to select the first character in the desired name (range A-Z and 0-9). Use the cursor left or right keys to move to the desired character slot and repeat process until the desired name is complete. Press *Accept* when name is complete. You have now copied all the parameters from the running product to the new product memory position. If you wish to run the new product, press and release the Product hard key until the desired product name and number appears then press the Run It option. Now you can edit or modify the desired parameters such as sensitivity etc. for that specific product record. It is always advisable to make a backup copy even if only one product record is required.

Delete

This allows individual product records to be deleted. Press Plus and/or Minus to select the desired record to be erased and then press Delete.

NOTE:

- The Prime Product 1 cannot be deleted.
- The running product cannot be deleted.

Edit Name

This menu allows you to edit the name of the current running product.

Erase All Products

This menu allows you to erase the detector's entire memory.

WARNING: All learned and programmed parameters will be erased.

Product Selection

Selection of a new product from the already stored product records is achieved by pressing the Product hard key. Press and release until the desired product appears, then select Run It. That product record will now be loaded and will become the running product.

Password

Path: Setup/Password

The system has three levels of user passwords. Level 3 is the highest access level.

Most common functions can be assigned a specific password level. This allows the user to design their own password structure. Typically, low level functions such as Select Product, etc. would be assigned a level 0 (no protection) or level 1 password protection. More critical functions such as sensitivity should be protected at a higher level.

NOTE: By default, password protection is Off which would mean no menus are protected. It is recommended that custom passwords be established.

Default Passwords

Default passwords are as follows: ***Level 1*** - AAAA ***Level 2*** - BAAA ***Level 3*** - CAAA

On

This option turns on the Password Protection and will require a level 3 access.

Off

This disables Password Protection and will require level 3 access.

Category

This lists the functions which can be assigned a password level by the user. Use the cursor arrows to select the feature you wish to edit, press Plus or Minus to change the level (range 0-3) and press *Accept* to complete the edit.

The following features can be assigned passwords:

Select product	Learn All	QA test	Special menus
Set Sensitivity	Set application	Reject setup	Function Key
Clear rejects	Alarm key	Configure learn	Erase Products

Edit Passwords

This allows the user to define custom passwords for each level and requires level 3 access. Select the level to be edited, press the Plus and Minus keys and cursor arrows to define your new password. Only alphabetical characters can be chosen.

Log Out

Log Out tells the detector that you are leaving and therefore reinitiates Password Protection.

Using Passwords

When password protection is enabled any function which is protected will be visible to any user but cannot be edited unless the password to the correct level is entered. The unit will request the password at the initiation of an edit attempt. Once you have entered the password you may continue with the edit function. When you have completed the changes required, if you wish to reinitiate password protection you must log out. This can be done from the top display, select Log Out.

Forgot Your Password?

If the incorrect password is entered when requested, by pressing Forgot the Password, seed numbers will be displayed for the three password levels. By contacting Goring Kerr with these seed numbers, we can decipher your password. Be prepared to produce evidence of your authority.

Special Functions

Path: Setup/Special

The menus under special should only be set and adjusted after reading the pertinent section of this manual.

Language

Select from English, French and Spanish. When French or Spanish is selected, only commonly used menus will be displayed in that language, all others will remain in English.

Input/Outputs

This menu sets and checks the condition of various inputs and outputs of the detector.

Inputs

This allows you to view the state of the following inputs:

Photo eye (infeed P.E.)
Reject confirm 1
Reject confirm 2
Shaft encoder

Infeed Photo eye polarity can be changed in this menu. Reject confirm and shaft encoder are not changeable.

Output

The state of the reject and fault outputs can be monitored. The polarity of the reject output can be inverted from this menu. The fault output cannot be inverted due to its fail-safe nature.

Function Key

From this menu, the user can select which function will occur when the Function hard key is pressed.

I/O 2

From this menu, the function of I/O 2 in the power supply/terminal box can be chosen. Select from:

Reject sensor 2 (reject confirm 2)
Auxiliary reject (second reject output)
External suppression
Password key lock (extemal key switch password access)
Unused

Note: The correct device type must be installed for any of the above functions to work. Contact Goring Kerr for assistance.

Fault Configure

From this menu the following functions can be accessed:

Reboot (will reset the processor)
Frequency (displays the frequency of the control panel)
Configure fault
Fault

Configure Fault/Excess Reject

Configure fault is used to set the parameters for the fault source called excess reject. Excess reject monitors the number of rejections occurring within a window. The window is either a timed function or when the unit has a photo eye, a function of the number of products. For example, if excess reject is set to 10 rejects within 5 minutes and that number of rejects occurs within the specified period, a fault will occur. Be sure to check under fault to see that excess reject is listed as "OK".

Faults

This menu displays a list of fault sources and their current state. The fault sources are as follows:

Search head	Photo reject
R.F. Board	EMU reject
Reject confirm	QA test response
Battery low	QA test result
Product memory	Excess reject
Photo eye	Phase limits

Only those listed in the right hand side column can be edited to "ignore" the fault source. When listed as "ignore" this fault source will not be monitored by the unit. If you wish to change the state of these fault sources use the select key to move the cursor to the fault source and then the Ignore/Monitor key to change the monitoring state.

Refer to the Fault Finding section of this manual for help in troubleshooting fault conditions.

DSP Net

This menu is used to set communication identification and protocol for use with a Goring Kerr DSP Net communication system. Each detector connected to a communications network must have an individual ID number. Press DSP ID to edit the detectors identification number.

Communication protocol for DSP Net should be set to RS485. This can be changed to RS232 for local communication. Contact Goring Kerr for assistance.

Clear Peak Control

This menu selects the source that will clear the peak signal indicated in the sensitivity menu. Photo eye should be used whenever a photo eye is present with the system. This means that each time the photo eye is blocked, the peak signal number will be cleared and refreshed. On systems that do not have a photo eye, Threshold Trip will be used. In this condition, the peak signal will only be reset whenever a detection occurs.

Filter/Sample Rate

Under this menu the filter size and the sample rate can be monitored. Neither of these functions should be changed under normal conditions. The sample rate is a number which represents the rate at which the DSP is sampling the incoming analog signal. The detector selects this sample rate automatically when you program the application speed and aperture size. Also when the application is programmed, the detector determines the optimum filter it should use for the speed which you have programmed. It will select from a list of four defined filters, DNR1 through DNR4.

Status

Path: Status

This menu displays a summary of the important parameters which have been set.

SYSTEM

This shows the type of applications (gravity, etc.), the filter type, the current sample rate (SR), and if a photo eye is present.

PHASE

This displays the current phase point, the phase state (auto, fixed), the mode, and the state of residual compensation.

GAIN

This shows the state of the gain, the R and X thresholds, and the current sensitivity.

REJECT

This displays the current delay/duration of the reject system.

PASSWORD

This displays the current state and level of password protection and the QA Test state.

Service Data

This menu displays service and troubleshooting information.

FREQUENCY

This displays the frequency of the control panel. Example: 300Khz.

LEVELS

This represents a volt meter display of the search head signals. Three signals can be monitored here: the balance, the oscillator reference signal A and oscillator reference signal B. Refer to the Fault Finding section of this manual.

VERSION

This displays the version of software this panel is using. The version number should match the version number on the front of this manual.

SCOPE

The scope display can be used to show various wave forms. Refer to the Fault Finding section in this manual.

QA TEST

The Test hard key can be used to access a QA test menu. This can be configured to record QA test occurrences separately from normal rejects, etc. The system can also be configured to request that the unit be tested. In this mode an interval is set, for example 4 hours. When the interval has expired the test key light will turn on and the unit will expect to be tested. An operator would then press the test key entering the test mode and perform a prescribed test routine. For example: this may require 10 detections of a certain peak signal to be considered a valid test. Once the test is complete and passed, the test interval will be reset. At the end of the next interval the test key light will turn on requesting another test routine.

While in QA Test all rejects will be recorded separately for use with DSP Net files. Also, while in QA Test, the detector will still function and reject contaminant metal.

Normal mode

This button returns the unit to its normal inspection mode.

Test Mode

This initiates a test mode.

Clear Peak

This key resets the peak signal indication.

Setup

Setup provides access to configure a QA test routine.

Peak Limit

This number represents the maximum peak signal considered valid during a QA test. This is so that an invalid test sample, a coin for example, cannot be used during a test. If the peak signal is exceeded the unit will not accept it as a valid sample. The peak limit should be set above the peak signal generated by the specified test samples. For example: if the test sample you are required to detect generates a typical peak signal of 200-250, the peak signal limit should be set at 300-350.

Interval

This is the number of hours required between test requests. For example, if set to four hours the unit will request a test after every four hour period.

Required Detections

This is the number of valid detections which must occur during a QA test to reach a successful completion of the test.

Fault Finding

If the detector senses a system fault the fault LED will turn on, the fault relay will change state and a fault message will be displayed at the top menu. Press the fault button display to access a description of the fault. If there is more than one fault, press next fault to view the next fault description. The following is a description of the type and source of faults which can occur:

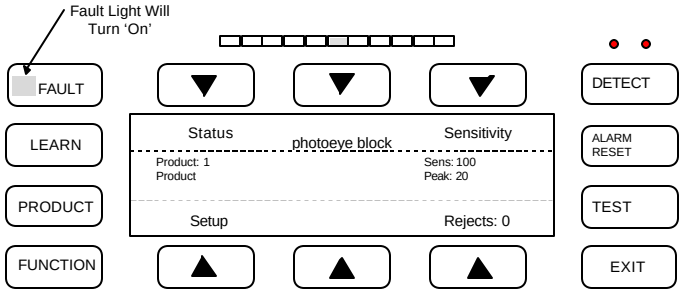


Figure 33

Search head Fault

Search head fault can occur for the following common reasons:

Search head cable connection has been broken.

Examine the cable connections at both ends to make sure that all wires are connected correctly. Refer to the Installation Section for assistance.

The oscillator reference levels may be out of range.

The oscillator references can be measured by the detector under status/service data. Reference A and reference B should both be within the following range: 100 +/- 20.

Search head balance may be out of range.

Again, this may be monitored using the volt meter feature under service data. The balance number displayed should be below 200.

Contact Goring Kerr for further assistance in troubleshooting.

RF Board Fault

This fault is a result of the RF board not responding to DSP requests. Common causes: 24 volt supply has failed. Check the 24 volt fuse in the power supply (F7); or control panel failure. Cycling power may clear fault.

Reject Confirm Fault

This fault results when reject confirm has been enabled and the confirmation signal has failed to return within the prescribed time period. This could be a result of reject device failure, a slow reject action, or reject confirm device (switch, etc.) failure. Check the reject device action, make sure the reject confirm switch is operating properly. It may be necessary to adjust the reject confirm time window -Path: Rejects/Setup/Special/Reject Confirm/Confirm Time.

Battery Low Fault

This indicates that the battery which is powering the memory when power is off is excessively low. Battery voltage could be checked in the control panel and the battery and/or control panel could be replaced. This does not affect the unit operation as long as power is maintained. (Battery voltage > 3.0 volts)

Product Memory Fault

This indicates that the product memory has been lost or damaged. Low battery condition could cause the memory to be lost when the unit is not powered. In applications where the detector has been subjected to high static discharges or lightning, the memory may have been corrupted. It will be necessary to erase memo ry (Path: Setup/Product Library/Erase All Products). Prior to erasing memory it may still be possible to record critical settings such as the application parameters, sensitivity, reject settings, etc.

Photo Reject Fault

This fault will occur if photo reject has been enabled and a detection has taken place when the photo eye was not blocked in the right sequence. Check the photo eye alignment, make sure the product is breaking the beam, and check for reasons for false triggering such as metal in the belt. Perform a complete test of the detector including the reject device.

Shaft Encoder Fault (EMU Fault)

This fault refers to applications using variable speed timing and an external clock source. If a detection occurs, but the external clock pulse is missing, the detector will assume an EMU fault has occurred. Check the external clock source (shaft encoder), check LED LD 6 (in the power supply). Retest detector with a test sample and the belt running, this may clear the fault.

QA Test Response Fault

This fault will occur if the QA test request light has been ignored and the interval timer has expired. Performing a QA test will clear the fault.

QA Test Result Fault

This fault will occur if during a QA test the required number of detections of the specific peak size did not occur. Enter QA test mode and repeat the test to achieve the required number of detections.

Excess Reject Fault

This fault will occur only if the excess reject fault has been turned on and the excess reject parameters programmed. The fault indicates that an excessive amount of rejects have occurred within the specified time window. To clear the fault, press the Clear Fault soft key. Please note that the fault may have been caused by excessive contamination in the product. The rejected product should be examined to confirm this and appropriate action should be taken.

Phase Limit Fault

This fault will occur if a phase limit has been reached during a learn phase or automatic phase period. This may be caused by contaminated product, metal in the belt, etc. If necessary, check and adjust the phase limits.

Photo Eye Block Fault

This fault indicates an excessive block time for the photo eye which is probably due to photo eye misalignment. Check the photo eye for proper operation.

24 Volt Fault

This fault indicates that the 24 volt supply has failed and therefore the unit is inoperable. Check power supply fuse F7 and LED LD7.

Recommended Testing Procedures

A complete and thorough test of the metal detector system must be done upon initial installation and whenever a major component of the system has been changed or altered (i.e. reject device repair, etc.). A complete check of the metal detector must include the reject device. Any test procedure designed for your application should take into account the following:

1. The metal detector's least sensitive point in the aperture is along the center line of the opening. Any testing should be done so that the test sample passes approximately through the center line of the opening. If the test sample is run at the side of the aperture, this will produce a larger signal than through the center line. The test procedure should take this into account for consistent results.

2. Sensitivity capabilities of different detectors used in different applications will vary. A smaller aperture is capable of detecting smaller pieces of metal. Product effect may also interfere with the detection capability. It is dangerous to rely on a corporate standard to determine and test the detector's operation. Ideally, each detector should have it's own standards of operation and a corporate outline should be used only as a maximum allowable guide. Sample sizes should be selected so that they are clearly detectable (peak signal size of 150 - 250) when compared to the signal produced by the product or other interfering signals. If samples are established which are very close to the product signal, frustration on the part of operators can lead to a lack of confidence in the detector's operation.

3. The detector should be tested at its normal operating speed. Test samples should be placed on the belt so that they will pass through the detector at normal speed.

4. The detector is not equally sensitive to all types of metal. Depending on the type of product and application there can be three typical metal groups which will produce three different levels of detection:

Ferrous - any magnetic metal and is typically the easiest metal to detect

Non Ferrous - any good electrical conducting metals such as aluminum, copper, brass, etc.

Stainless Steel - the 300 series stainless steels which are non-magnetic, these tend to be the most difficult metals to detect

If a single test sample is to be used for regular testing, it should be a stainless steel sample. This will ensure that other metal types will be detected to this same level or better (smaller).

5. Test samples used should contain spherical metal contaminants. Any other shape will produce a different size signal depending on it's orientation as it passes through the detector. This can lead to inconsistent results.

6. Any test procedure established must allow for the test product to be completely rejected by the reject device. The reject device will tend to be the most likely point of failure in any detector system.

7. Care must be taken so that if the detector or reject device fail to operate correctly the test sample can be recovered safely.

Testing Schedule

How often the detector should be tested must be decided by the user. If the test procedure can be designed to be simple it will help ensure that the test will performed more frequently. As a guide it must be decided how much product would have to be put on hold for re-inspection if a detector fails the test. Typically the minimum frequency is once per shift while other applications require hourly tests be performed.

Record Keeping

All detector tests should be documented. If faced with a consumer complaint or litigation a complete record of test results and procedures will be very useful. The following chart can be used as a base for a manual recording system. Automatic records can be produced by using Goring Kerr's DSPNet communication software program.

METAL DETECTOR TEST SHEET

	SHIFT 1			SHIFT 2			SHIFT 3		
LINE : 15	PERIOD 1	PERIOD 2	PERIOD 3	PERIOD 1	PERIOD 2	PERIOD 3	PERIOD 1	PERIOD 2	PERIOD 3
DATE : 96/08/08	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
NOTES /ACTION									

Figure 34

Rejected Product Examination

If possible, product which has been rejected by the detector during production should be examined to establish the source and type of contamination. This may lead to an improvement in the process equipment upstream from the detector. It is also useful to display these contaminants so that all employees can see the benefit of the metal detector.

Automatic Record Keeping

To simplify test record keeping, the use of a computer communications system called DSP Net is recommended. This system will automatically record all events occurring at the detector including when the test was performed, and its success or failure. This record is kept for each individual detector connected to the network and can be viewed, stored or printed at the host computer. Contact Goring Kerr for information about this product.

QA Test Request

This detector can be configured to request a test procedure be performed at given intervals. Refer to the section in this manual called QA Test on page 39.

Assistance

If you require any further assistance in establishing the test procedure, test samples, or test recording, please contact Goring Kerr.

DSP 2 Calibration Record

Company :_____ Date :_____

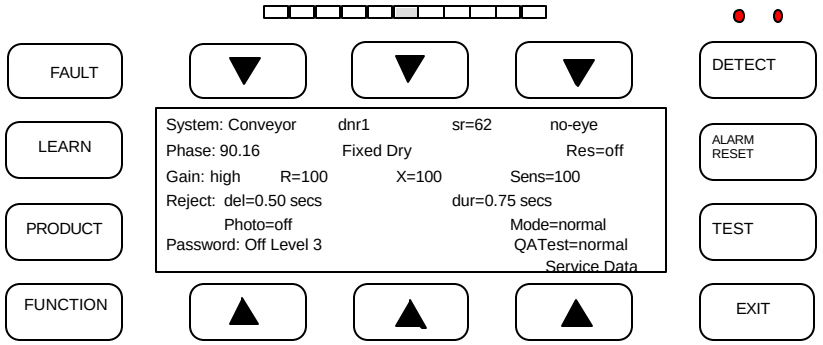
Location :_____ Serial Number :_____

Aperture Size :____Wide by ____High

Line :_____

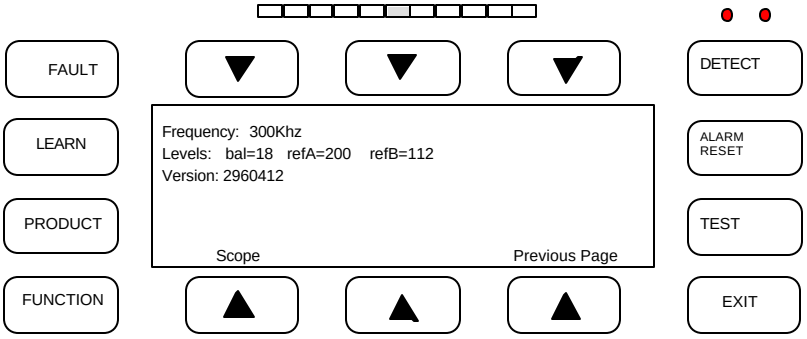
Product name:_____ Number :_____

Status Screen



System:_____ dnr:_____ sr:_____ eye:_____
Phase:_____ Fixed / Auto / Hold Mode: Wet / Dry / Hold Res: Off / Auto / Fixed / Hold
Gain: _____ R=_____ X=_____ Sens=_____
Reject: del= _____ dur=_____
Photo= _____ Mode=_____
Password:_____ QaTest=_____

Service Data Screen



Frequency :_____
Levels : bal=____ refA=_____ refB=_____
Version :_____

Misc. Data

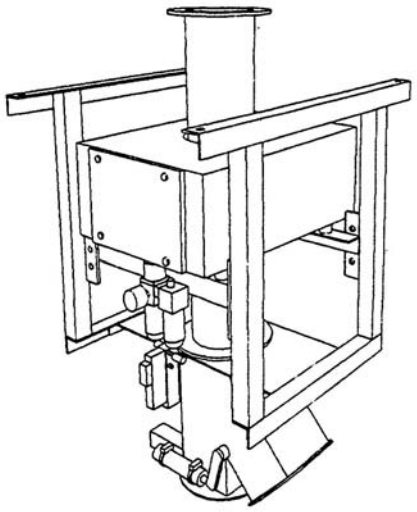
Phase Mode :_____ (Path: Setup/Configure Learn/Mode)
Reject Check :_____ (Path: Setup/Reject/Special/Rej Confirm Sensors)
Eye Distance :_____ (Path: Setup/Application)
Belt Speed :_____ (Path: Setup/Application)
Detect Mode :_____ (Path: Setup/Configure Learn/Sensitivity)

Sensitivity :_____ (Path: Setup/Configure Learn/Sensitivity)

Model DSP2

Installation and Operation

Model 402 Gravity Applications



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Preliminary Inspection

Equipment

The Model 402 system consists of four (4) major components:

1) *Search Head*
The Search Head contains the inspection coils through which the product to be monitored is passed.

2) *Control Unit*
The Control Unit contains the user interface controls and main board electronics.
The Control Unit is generally mounted remote. It is supplied with the correct length of cable and wired into the search head.

3) *Power Supply*
The Power Supply Unit houses the power supplies, input/output devices and connection terminal strip.

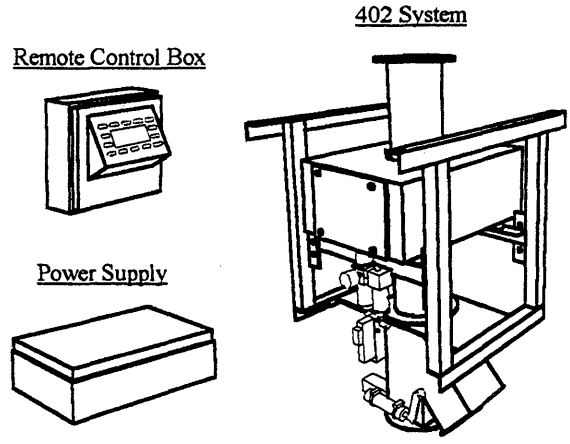


Figure 1

4) *Reject Assembly and Support Structure*
The support structure is mounted to the reject assembly. This structure supports the metal detector and product inspection tube.

Note:
The control and power supply units may be mounted directly to the 402 support structure.

Preliminary Inspection

Check the contents of crate or crates against the order and/or packing slip. Look specifically for any additional reject device which might have been ordered with the equipment. Some reject devices (e.g.: horn, beacon) are quite small and may get discarded with the packing. Check the equipment for any signs of damage in shipment.

Note:

If there are any signs of external damage to the crate, notify the transport company and do not discard the crate, it may have to be inspected by an insurance inspector.

Included with each metal detector are the following;

- Installation and Operation Manual
- Nylon Foot Mount and Nylon Bushings (4 of each)
- Metal Test Samples

Assembly

The model 402 system is supplied completely assembled and tested from the factory. The system you have may vary from that shown within this manual. Four mounting holes are located at the top of the frame to support this system. The typical mounting method is to suspend the system with threaded rod. The threaded rod should support the complete load of the system. When securing the threaded rod to the 402 frame isolation bushings should be used on all four mounting holes. This will electrically isolate the frame from any support structure. The 402 system is not designed to support piping from any of the ports. Piping connected to any of the ports should be independently supported. Hanging piping from the reject value may distort the valve body and cause unreliable rejection.

Systems

Goring Kerr manufactures various types of metal detectors and metal detector systems. This manual illustrates the installation requirements of the Model 402 system.

Conveyor Systems

Goring Kerr metal detectors are also used on a wide variety of conveyor systems. These systems vary from basic inline conveyors to special incline designs. A typical system would include an automatic reject mechanism to remove the contaminated product from the conveyor.

(See manual NA-DSP2/CONV)

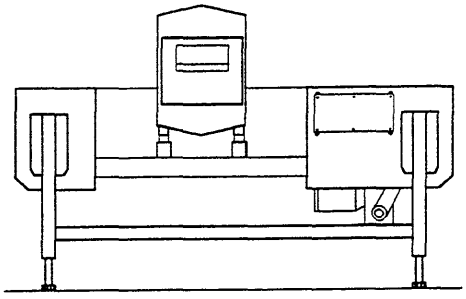


Figure 2

Model 426 Pipeline System

The model 426 pipeline system is supplied completely assembled and tested from the factory. Four mounting holes are located in the corners of the support frame. The typical mounting method is to suspend the system with threaded rod. The threaded rod should support the complete load of the system. When securing the threaded rod to the 426 frame isolation bushings should be used on all four mounting holes. This will electrically isolate the frame from any support structure. Any pipes connected to the system should be independently supported and not supported by the metal detector system.

(See manual NA-DSP2/PIPE)

Model 426

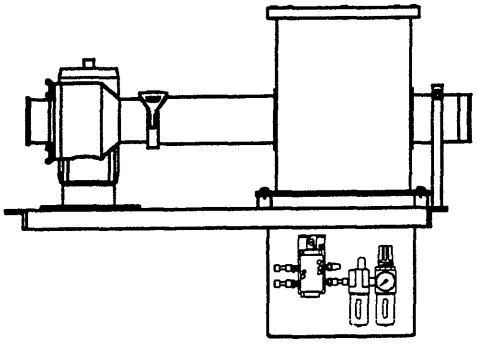


Figure 3

Model T7 Pharmaceutical System

The model T7 pharmaceutical system is supplied completely assembled and tested from the factory. The system is ready to use right from the crate. The reject device, control unit and search head are pre-wired. The mains supply power cord is also pre-wired.

(See manual NA-DSP2/PHARM)

Model T7

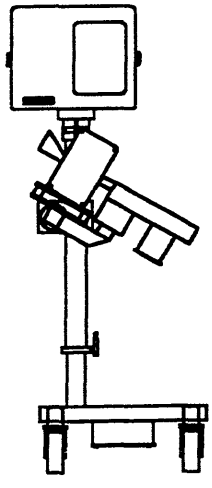


Figure 4

Metal Detector Principle Of Operation

The DSP 2 model metal detector operates on the balance coil full loop detection system.

Three equally spaced coils surround the aperture or opening through which the product to be inspected passes. The center coil is connected to an oscillator circuit to produce an electromagnetic field. This signal is received by two coils one on either side of the oscillator coil. These are the receiving or input coils. (See Figure 5)

Since the receiving coils are equally spaced from the oscillator, they receive equal amounts of signal. The coils are wound in such a way that their signals oppose each other; therefore, the net signal across the coil is zero.

When a piece of metal enters within the electromagnetic field, it alters the field strength around it. As this metal passes through the aperture, it changes the balance of the receiving coils so that the net signal is no longer zero.

This error signal is amplified, demodulated and converted to a digital signal to be processed by the Digital Signal Processor or DSP. The DSP performs all the product compensation, phasing, residual compensation filtering, and produces a reject signal.

A metal detector is a high performance measuring instrument. The quality of the installation will have a direct effect upon performance and reliability. Please read the installation instructions completely prior to installing the unit and contact Goring Kerr if you have any questions.

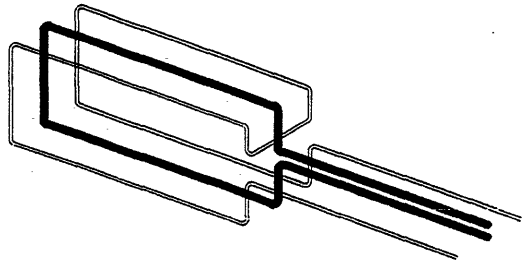


Figure 5

Mechanical Installation

The power supply unit and control unit may be mounted as any other electrical control would be, wherever convenient. However, the support frame must be installed as per the following instructions if correct performance is to be expected. Please contact Goring Kerr if you have any questions regarding installation requirements and restrictions.

System Mounting And Isolation

The 402 system is designed to support the metal detector, reject assembly and associated parts. Discharge and reject piping should have their own support structures. Hanging piping from these ports may distort the reject body and render the reject inoperable. It is equally important that input piping should be independently supported and not supported by the metal detector product tube.

When mounting the 402 system it is necessary to electrically isolate the support frame from the hanging rods. This can be accomplished with the use of nylon bushings. Two bushings are needed on each mounting hole to isolate both the upper and lower mounting nuts. (See Figure 6)

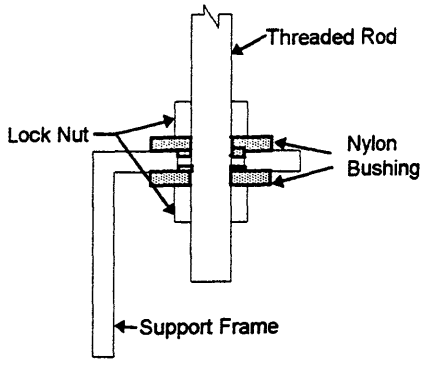


Figure 6

System Grounding

It is important to ground the metal detector search head, control box, power supply and 402 frame with a single point grounding wire. (See Figure 7)

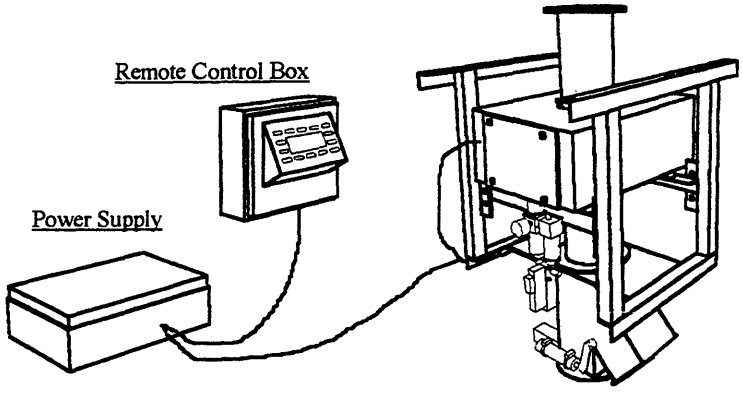


Figure 7

Warning

When servicing or inspecting the reject valve extreme care must be taken to prevent any injury.

The following steps will help insure personal safety when accessing the reject valve:

- Disconnect the main air supply from the reject F.R.L.
- Turn the mains power supply to the metal detector 'off'

To insure optimum performance the following considerations should be taken:

- Avoid excessive vibration.
- Avoid high static environments.
- Variable speed drives, walkie talkies or RF transmitters may affect the performance of the metal detector.

Contact Goring Kerr for assistance in resolving installation concerns.

Product Free fall

The 402 system has been designed to minimize space requirements while at the same time ensuring accurate response times. Your system has been designed to function correctly within the specifications stated when ordered. However if the distance from the top of the product tube to the *'zero velocity'* point is increased the metal detector may need to be moved accordingly. Contact Goring Kerr for assistance in determining the correct location of the search head. (See Figure 8)

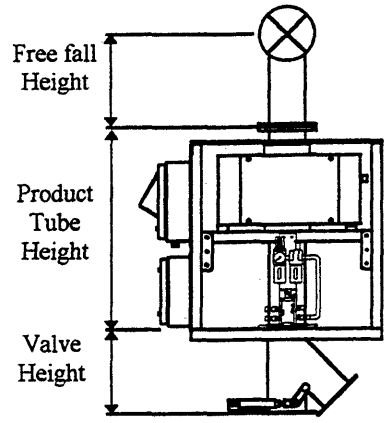


Figure 8

Flow Rate

There must be a free flow of product through the 402 system. Any product build up through the reject valve or product tube will obstruct the operation of the system.

Product Tube Clearance

The 402 system is supplied with a product tube support which locates the product tube in the center of the metal detector. To insure maximum performance the product tube should be held securely so as not to contact the inside of the metal detector.

System Testing

When testing the 402 system it is important to test both the sensitivity of the metal detector and the response of the reject valve. To accomplish this the metal test sample must be inserted at or near the zero velocity point of the product. Also, a means for retrieving the test sample after the 402 system should be incorporated in case the reject device fails to operate. Following these procedures will insure the correct detection and rejection of metal contaminants. (See Figure 9)

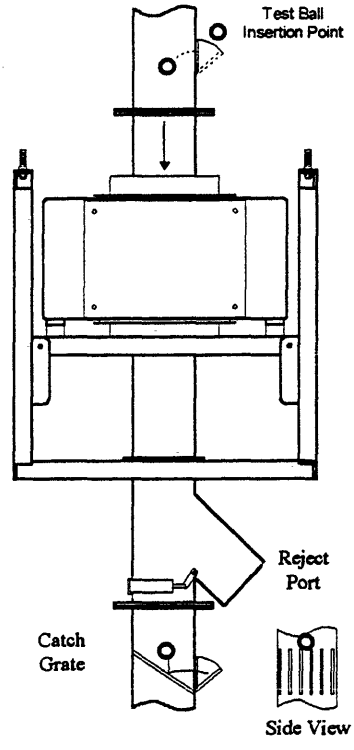


Figure 9

Electrical Installation

When choosing the power supply line for the metal detector, it should be remembered that the starting of heavy electrical machinery creates considerable (though momentary) voltage drops in the line. Such "spikes" can cause the metal detector to trigger. Since the power consumption of the detector is very low (approximately twenty-five watts), it is recommended that a lighting circuit be used for its supply rather than a machinery power circuit. Where this is not possible, and line noise does trigger the detector, contact Goring Kerr for recommendation of a suitable isolation transformer or power line filter.

a) The metal detector connections are shown in the Power Supply Connections section. If the control unit is mounted on the search head, the connections from the search head to the control unit are already made.

b) The cable between the power supply unit and control unit is of a specific type. Do not substitute or splice on extra cable. Likewise, the cable between the control unit and search head (when remote) is of a specific type. Do not substitute or splice on extra cable. Either cable <u>can</u> be cut to length and they are not sensitive to movement. Contact Goring Kerr for extra cable or cable information if required.

c) Use waterproof cable glands at all cable entries.

<u>Power Supply Layout</u>

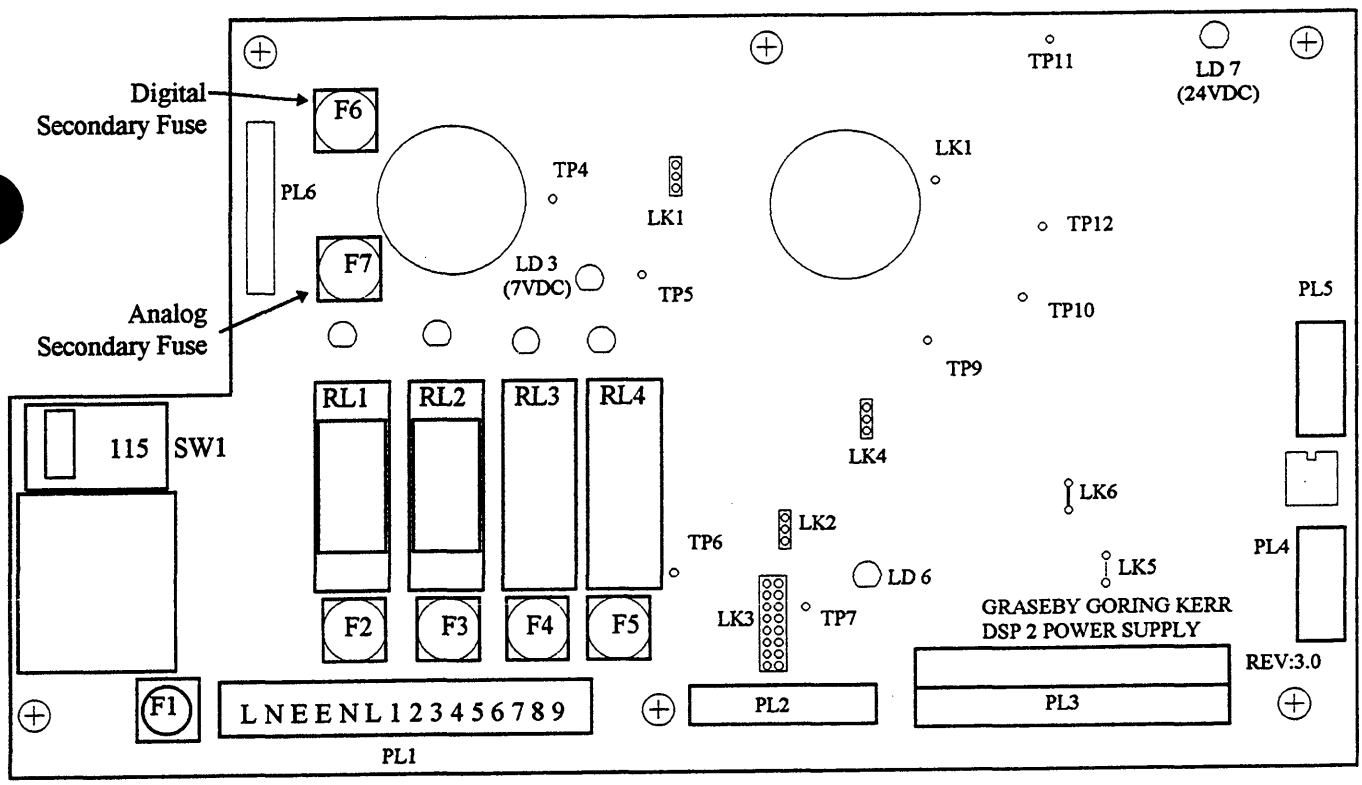


Figure 10

Power Supply Connections

Main connector PL1

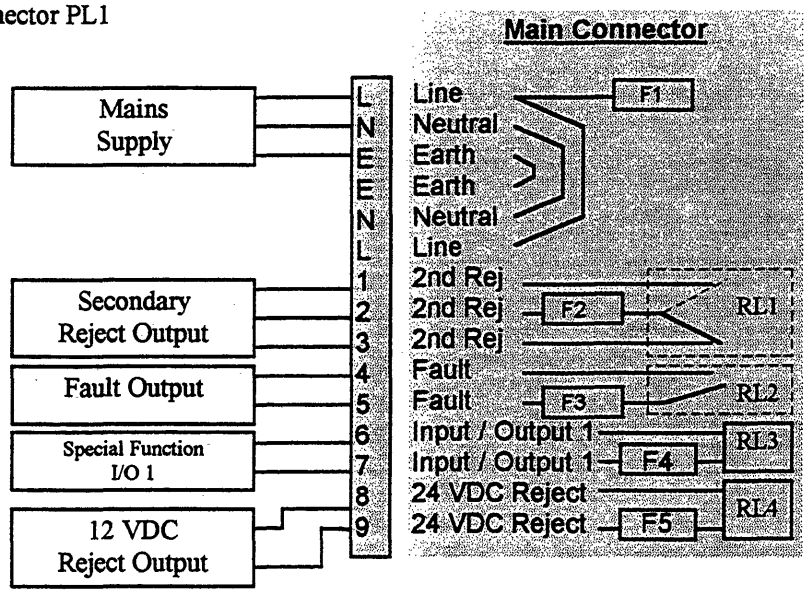


Figure 11

Mains Supply
Connect the supply line to, L-Live, N-Neutral, E-Ground (Earth).
Either 110 or 220 volts single phase can be used to power the metal detector. A selection switch (SW1)on the power supply board will switch between voltages. The metal detector can operate on either 50 or 60 Hertz, 55 va.

Fuses
Fuses F1 to F5 are 1 Amp 250 VAC fast acting. Only use fuses with the same rating for replacements. Secondary fuses F6 and F7 are 2 Amp 250 volt slow blow, use only same rating for replacement.

Secondary Reject Output
Note: The standard reject solenoid is 12 VDC and is connected to terminals 8 and 9.

When metal is detected or detector power is turned off dry contacts 1 and 2 close, 2 and 3 open. Terminal 2 is fused at 1 Amp fast acting. To supply typical reject device (e.g.: solenoid), connect jumper from L to 2, connect solenoid to 1, N and E, or 3, N, E, depending on action required.

Note: ***DAMAGE*** may occur if wrong voltage is applied to relays and solenoids!
Solid state relays are available. Check power unit lid for description of relay type. Mechanical relays are AC or DC - only terminals 2 and 3 are used for reject.

Fault Output
During a fault condition or when power is turned off terminals 4 and 5 will close. These connections can be connected to an external alarm to indicate a fault condition. Terminal 5 is fused at 1 Amp 250 VAC fast acting.

Note: It is advised that the fault output either should be connected to either a fault alarm e.g. horn, or to the reject device.

Special Function Input / Output Devices
Terminals 6, 7, are for use with special options. Terminals 7 is fused at 1 Amp 250 VAC fast acting.
Note: I/O devices are not normally fitted. ***DO NOT*** connect to these terminals if it is unclear of the type or voltage rating of devices fitted. Permanent damage may occur if incorrect voltage is applied.

Typical Reject Device Connections

12 VDC Solid State Reject Relay

When metal is detected terminals 8 and 9 will close and energize the reject solenoid.

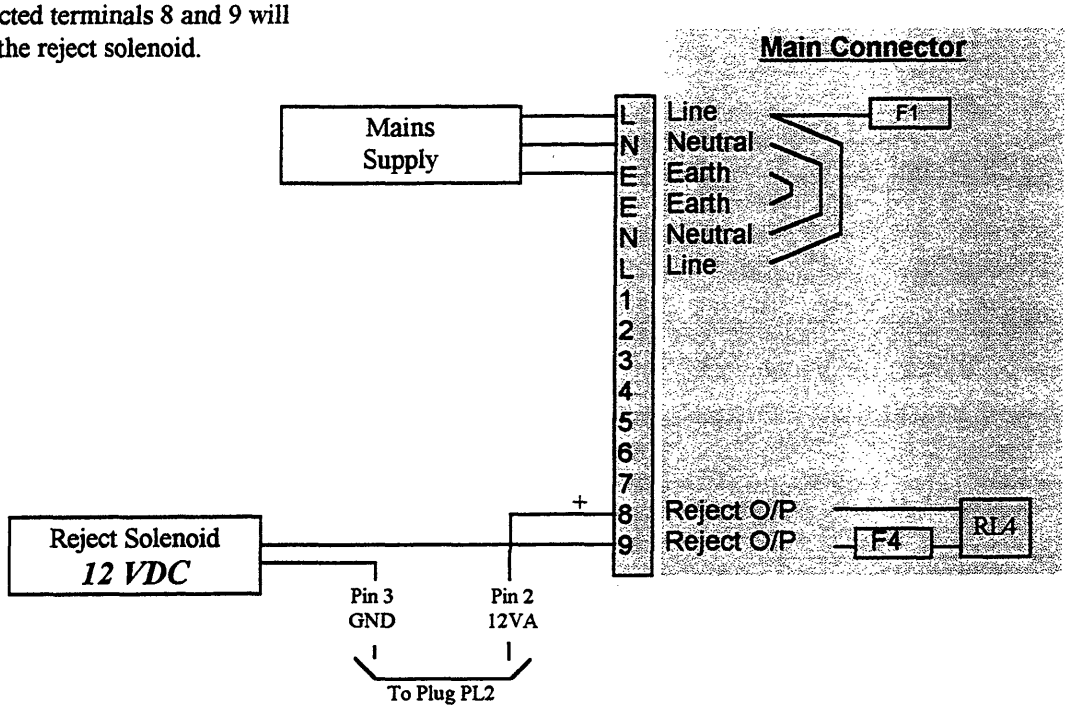


Figure 12

Secondary Reject Output

When metal is detected terminals 1 and 2 will close. This relay has dry contacts and can be used for secondary reject outputs. Max. rating 110vac 1 Amp.

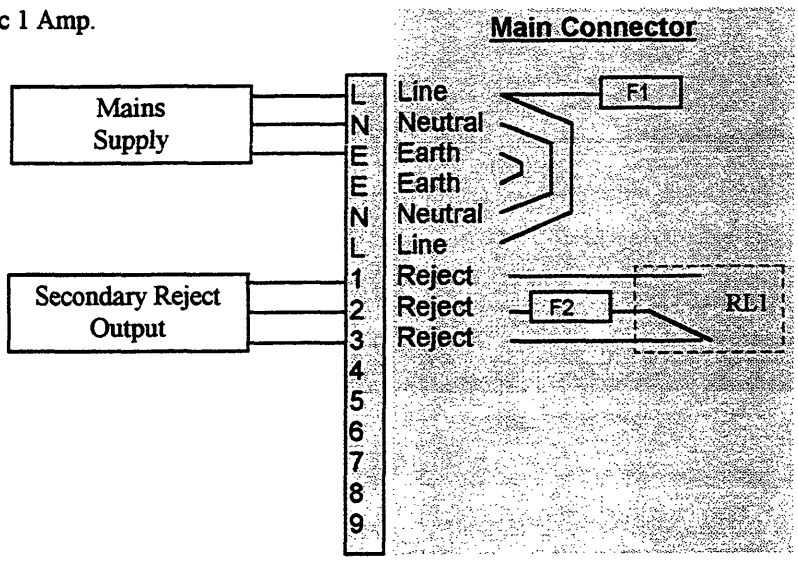


Figure 13

Filter Regulator Lubricator (F.R.L.)

The 402 system standard F.R.L. requires an air supply of 80 p.s.i.
The standard solenoid supplied is 12 VDC. Care should be taken when wiring the solenoid as some applications require different supply voltages. Check the inside cover of the power supply for details of the type and requirements of the solenoid supplied.

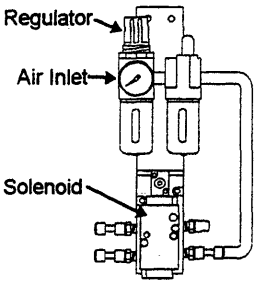


Figure 14

Reject Confirm

To insure contaminated product is rejected correctly a feedback signal from the reject device can be used. A microswitch or photo eye connected to the reject device can be wired to terminals 6 and 4 on connector PL2. Contact Goring Kerr if you require more information.

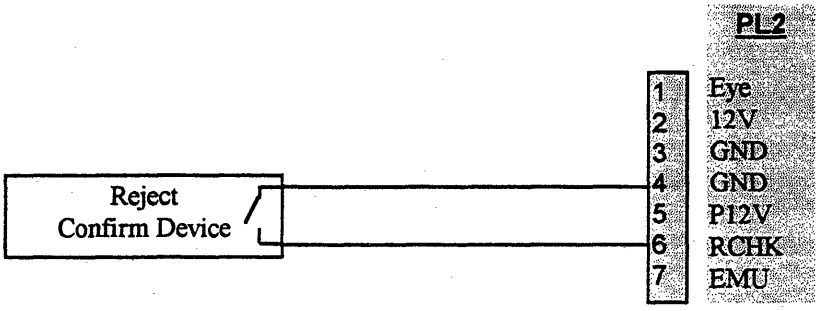


Figure 15

Power to control unit Plug PL3

This connector is a plug-in terminal strip. It may be easier to unplug it while making terminal connections.
WARNING this cable is for connection between control panel and power supply only. Do not connect any external devices or supplies to PL3.

Power Supply Cable

Use Belden 9261

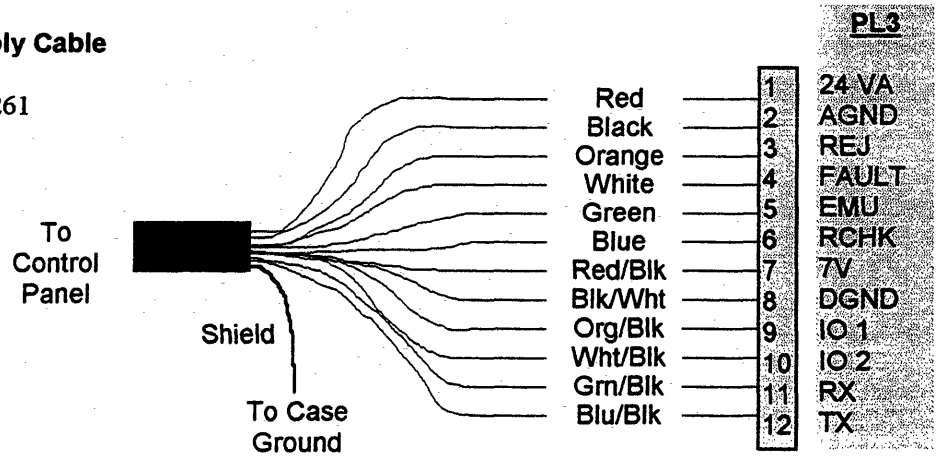


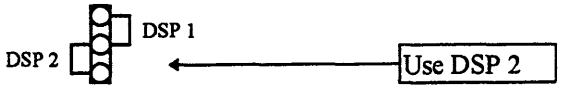
Figure 16

Fuses

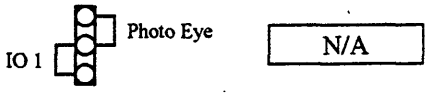
F1	Main supply fuse 1 Amp fast acting
F2	Reject Output relay output fuse 1 Amp 250 VAC fast acting
F3	Fault relay output fuse 1 Amp 250 VAC fast acting
F4	IO 1 relay output fuse 1 Amp 250 VAC fast acting
F5	IO 2 relay output fuse 1 Amp 250 VAC fast acting
F6	Digital secondary fuse 2 Amp / 250 VAC Slow Blow
F7	Analog secondary fuse 2 Amp / 250 VAC Slow Blow

Links

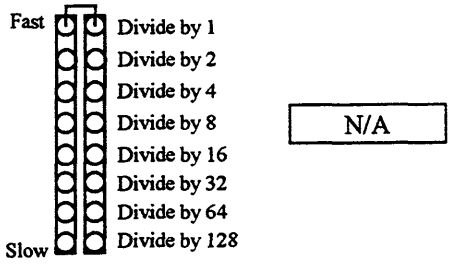
LK1 DSP 1, DSP 2 selector.



LK2 Photo Eye / IO 1 selector

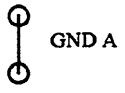


LK3 EMU clock divider. Divides the incoming clock pulse

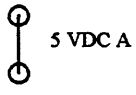


LK4 485 Communications selector

LK5 Ground 'A' Link



LK6 5 VDC 'A' Link



Plugs

PL1	Main connector
PL2	Photo eye and EMU sensing head connector
PL3	Interconnecting cable to control unit
PL4	DSP 1 communication connector
PL5	485 communication connector
PL6	Transformer connection

Control Panel Connections

Removing The Control Panel

Before removing the control panel insure that the *MAINS SUPPLY* is switched *OFF*. Either remove fuse F1 from the power supply or shut down power source to the metal detector.

The control panel is mounted on the search head (or remote box) with four mounting bolts. Remove these bolts to gain access to internal connectors.

The power supply and search head cables are wired into *'quick disconnect'* connectors. It is not necessary to remove the wires from these connectors.

When removing the connectors be careful not to pull on the wires, instead pinch the connector and pull.

DSP 2 Control Panel
(Back View)

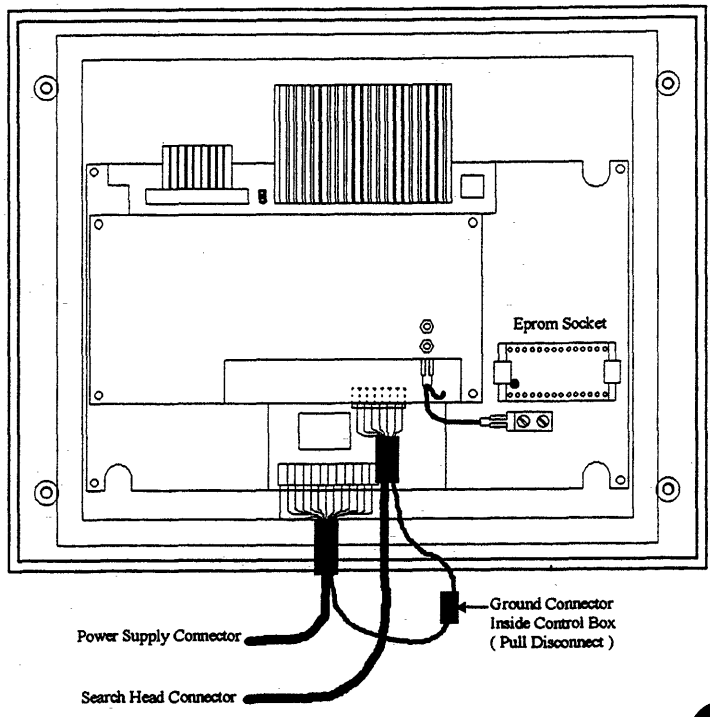


Figure 17

Installing The Control Panel

When installing the control panel repeat the above instructions in reverse order.

Note:

Care must be taken to insure that the search head connector is fitted correctly.

Use Belden 9261

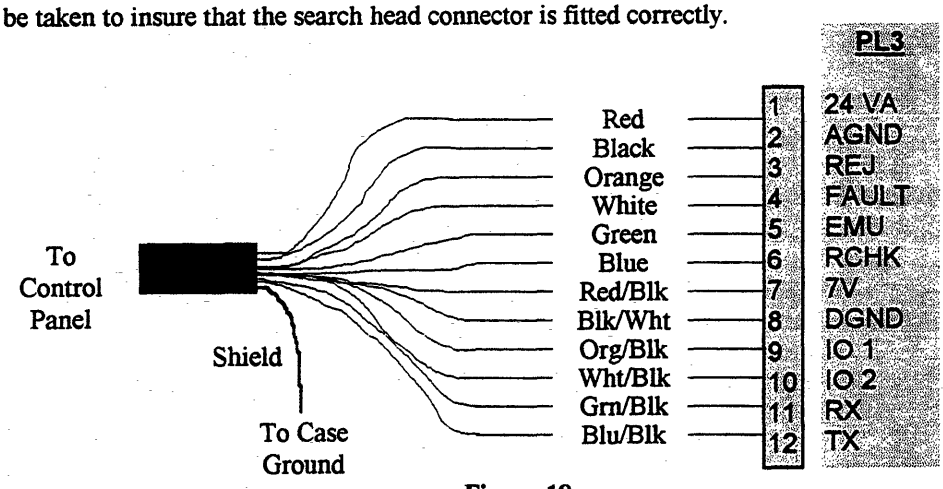


Figure 18

Use Belden 9873

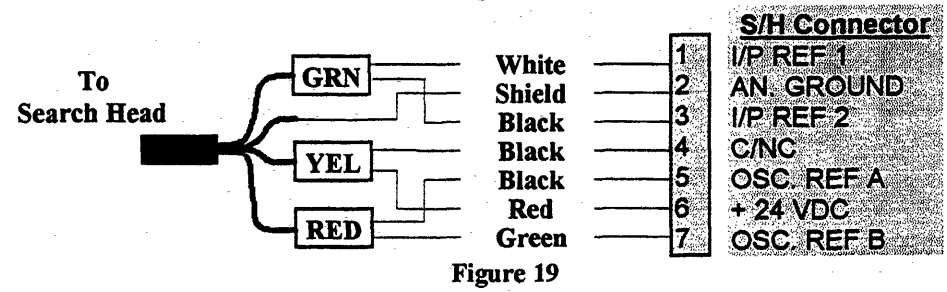


Figure 19

Search Head Connections

Standard Search Head Electronics

Use Belden 9873

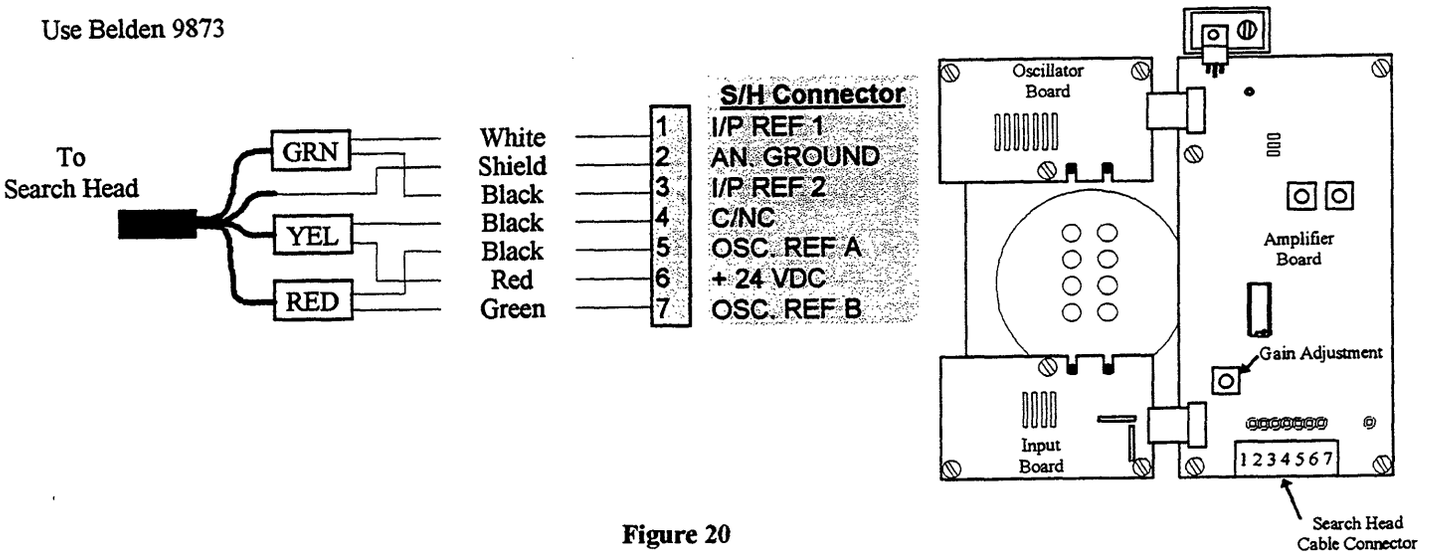


Figure 20

Mini Search Head Electronics

se Belden 9873

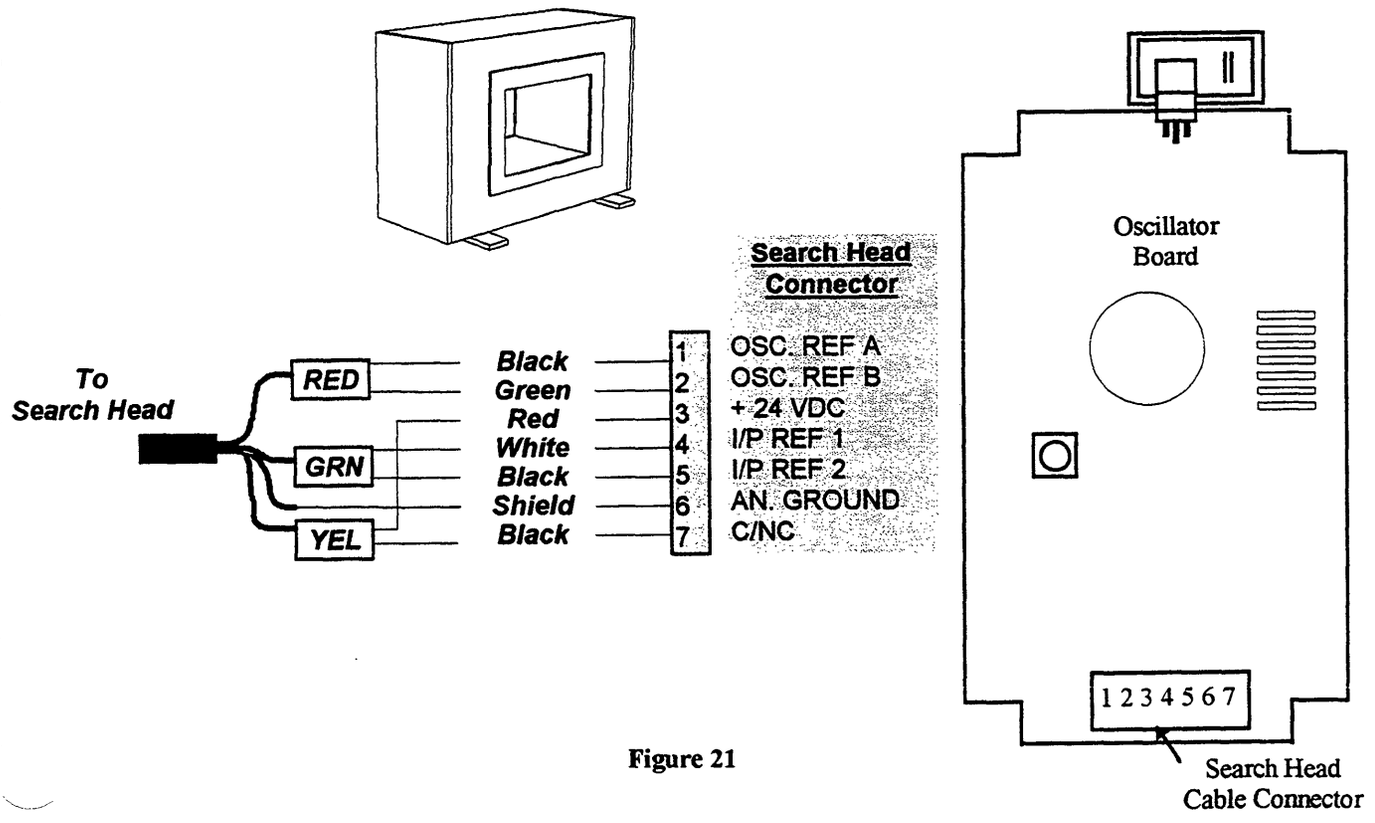


Figure 21

DSP 2 Menu Structure

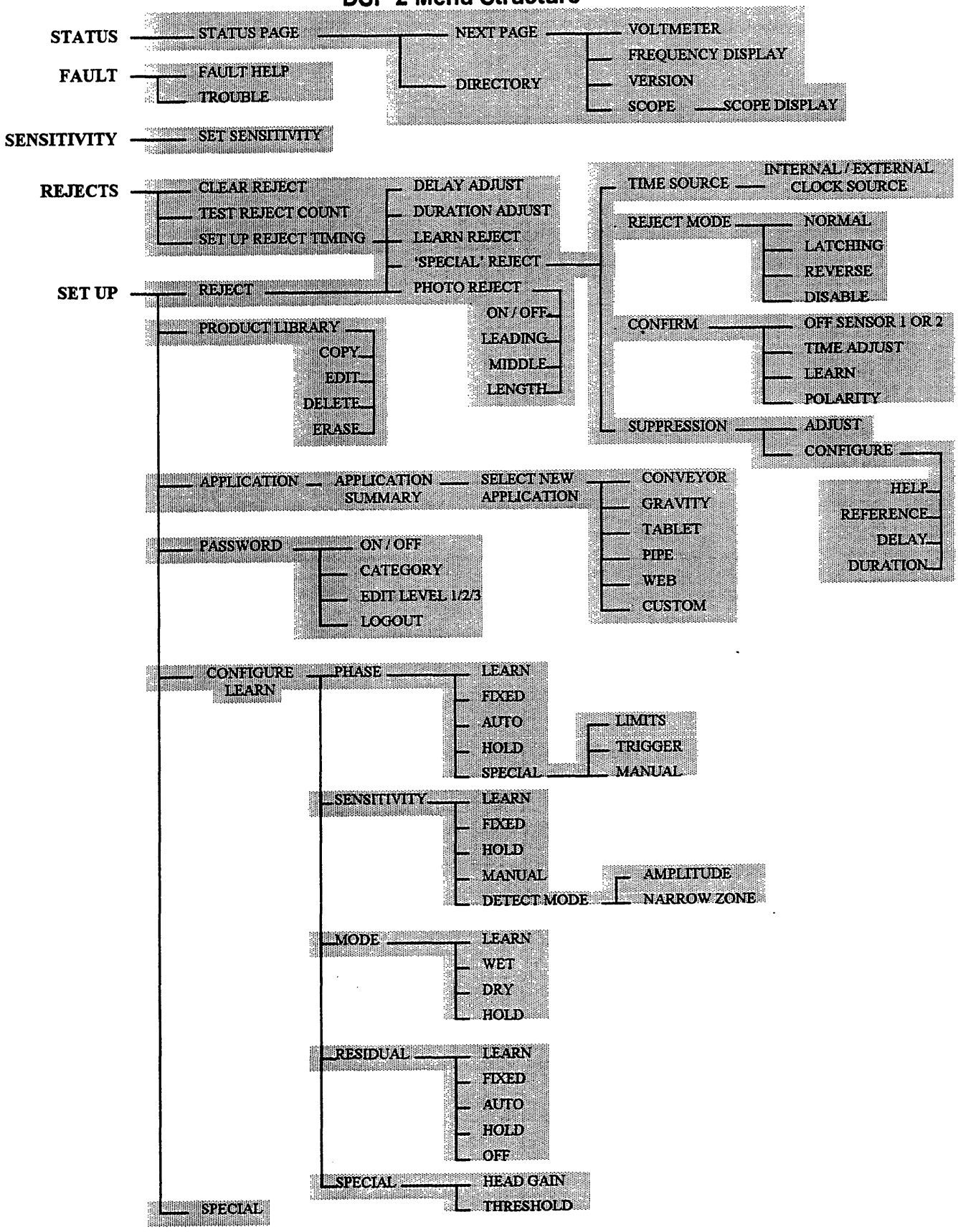


Figure 22

User Interface (Keypad)

Top Menu

Throughout this manual you will be asked to start from the Top Menu when selecting options etc.. To find the top menu press the '*Exit*' key until you see this screen.

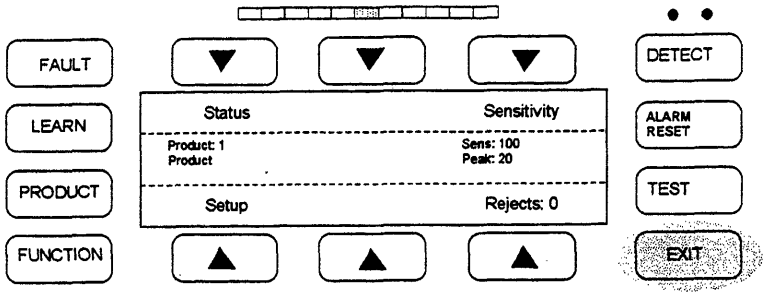


Figure 23

Path

Major functions described in the following pages will have a path specified. This path refers to key presses required to reach that menu from the 'Top Menu'

Soft Keys

The keypad has six soft keys which are labeled with an arrow. The function of these keys change depending on the menu you are currently in. Some menus will have need for only a few keys and others will use all of them. The remainder of the keys are dedicated to specific tasks and are called hard keys. The function of the hard keys is as follows:

Hard Keys

Learn	The learn key when pressed jumps to the product learn menu.
Product	This key toggles stored product settings. Each press of the key scrolls to the next stored product.
Function	This is a user defined key and its function can be selected from a list of options.
Test	Initiates the QA test routine menu.
Alarm Reset	Can be configured to reset a reject alarm when using the latch reject output option.
Exit	Use this key when you wish to leave a menu, and return to the "top" menu.

How To Edit Options

When editing an option that requires changing a number use the soft keys above the arrows to move the cursor to the digit you which to edit. Then use the soft keys below the plus / minus keys to change the value of the number. Once you have set the correct value press the arrow under ' *Accept* ' . This will change the value to the new number. Then press the ' ***Exit*** ' key to leave that menu.

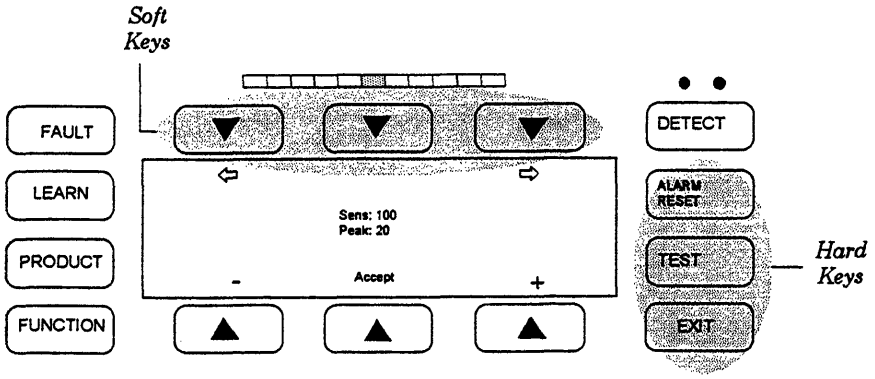


Figure 24

Item	Function
+	Increases number, or letter
-	Decreases number, or letter
⇦	Moves cursor to left
⇨	Moves cursor to right
Accept	Enters or accepts the new value

Initial Setup

This manual describes only the features which can be used in Gravity Applications. The following *must be set* for the detector to function properly (in order):

- The application type (gravity)
- Reject timing
- Product compensation
- Sensitivity

All other settings are optional and will vary depending on the requirements of the user.

Important

In most applications, the metal detector parameters will already be set prior to shipment. If supplied as a system the reject timing will also be set to the correct values. After installation and power up check the operation of the metal detector and any reject system and adjust as required.

Most 'dry' product applications (see Product Compensation pg. 29) will not require a product compensation adjustment. For most 'wet' product applications custom product compensation will be required. Always check and record factory settings before making changes. If changes are required use the copy product function to create a new product and perform custom settings under this record. This way the metal detector can be returned to factory settings under product 1.

Password

The metal detector is supplied with password protection turned 'off'. However, password protection should be enabled and custom passwords established to prevent unauthorized changes to the metal detector settings (see Password pg. 34).

Application

Path: Setup/Application

There are six application types available:

Conveyor
→ **Gravity**
Tablet
Pipe
Web
Custom

This manual refers only to **gravity** type applications.

Gravity applications assumes that the product is free-falling through the detector at high speed. The detector optimizes a number of parameters based on the knowledge that the application is for high speed inspection of falling product.

NOTE: Check to make sure that application type set is gravity and edit if necessary.

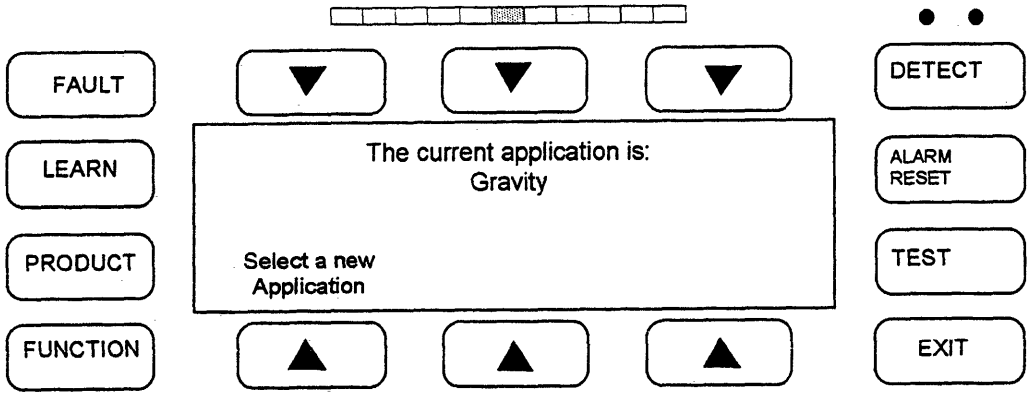


Figure 25

Reject

Path: Rejects

For gravity applications many of the reject options available are not used (photo reject, etc.). This manual will describe only those features which apply to the gravity applications.

Clear Reject Counter

This button clears the reject counter displayed on the top menu. Press to reset to '0'.

Test Reject

This button when pressed will activate the reject output. This is used to test the action of the reject device. This will not inhibit normal occurring rejects and the test function will return to normal when leaving this menu (Exit).

Setup Timing/Basic Setup

Gravity application will set default Delay and Duration parameters (Delay = 0, Duration = .21 seconds). These are typically acceptable for gravity applications. The reject timing should be tested and established upon initial installation and these parameters can be adjusted if necessary.

Delay

The reject delay time is the time delay between a detection and the activation of the reject device. This menu is used to change that time delay. Use the *Plus* and *Minus* keys to change the value; test the change, then press *Accept* to accept this value or *Exit* to restore the old value.

Duration

The reject duration is the length of time for which the reject device is activated after a detection has occurred. Use the *Plus* and *Minus* keys to change the value; test the change then press *Accept* to accept this value or *Exit* to restore old value.

Learn (Reject)

This menu can be used to do a one-step reject timing calibration. This may not always be practical for gravity applications due to the speed of the falling test sample.

Learn Procedure

1. Place a detectable metal sample in the product flow at the point at which the product begins its initial fall.
2. Press the Reject key when you wish to activate the reject device and hold the key down for the desired duration.
3. The delay, duration and reject confirm (if used) time will all be calculated. Use individual menus to make any small adjustments required to assure clean, complete rejection of a contaminated product.

Reject-Special

The following functions are not normally required but are available for special applications:

Reject Mode

Normal

Normal is for normal reject applications.

Latch

This can be used to latch the reject relay output, for example with a reject alarm system. The reset will be done by the alarm reset hard key.

Disable

This inhibits the reject output. WARNING: This will render the detector inoperable.

Reject Confirm

Reject confirm will require external hardware which may not be installed on your system. Contact Goring Kerr for assistance.

This option permits the reject device response to be automatically monitored by the detector. Select from the following options:

- No reject confirm
- One sensor
- Two sensor (this option monitors both strokes of the reject device)
- Polarity (inverts the polarity of the incoming signal)
- Confirm time (adjust the reject confirm signal window)
- Learn (this allows the detector to automatically learn the reject response time)

Reject-Special

The following functions are not normally required but are available for special applications:

Reject Mode

Normal

Normal is for normal reject applications.

Latch

This can be used to latch the reject relay output, for example with a reject alarm system. The reset will be done by the alarm reset hard key.

Disable

This inhibits the reject output. WARNING: This will render the detector inoperable.

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This option permits the reject device response to be automatically monitored by the detector. Select from the following options:

- No reject confirm
- One sensor
- Two sensor (this option monitors both strokes of the reject device)
- Polarity (inverts the polarity of the incoming signal)
- Confirm time (adjust the reject confirm signal window)
- Learn (this allows the detector to automatically learn the reject response time)

Reject Confirm Setup

One Sensor

The reject confirm system continuously monitors the signal reflected back from the reject device generated by a reject confirm switch. The time delay between the initiation of a rejection signal and the returned confirmation signal is monitored to confirm that the reject device operated within a prescribed time period. Once the wiring of the switch has been completed, from reject confirm menu (Path: Rejects/Setup Timing/Special/Reject Confirm) press the Test button to enter the switch test menu. Then press Test Reject and make sure the sensor state changes. If this is true, the signal is reaching the DSP control. Press *Exit* to get back to the reject confirm window; press the Learn soft key and follow the on-screen instructions. This process will train the system so that the normal response time for the reject confirm signal is established. This can be manually adjusted if necessary using the Confirm Time soft key and the Reject Confirm menu.

Two Sensors

The system can be configured to monitor not only the reject response time, but also the time taken to return to normal position. This option will require that two sensors be used in such a way that both strokes of the reject can be monitored. Contact Goring Kerr for assistance in using this feature.

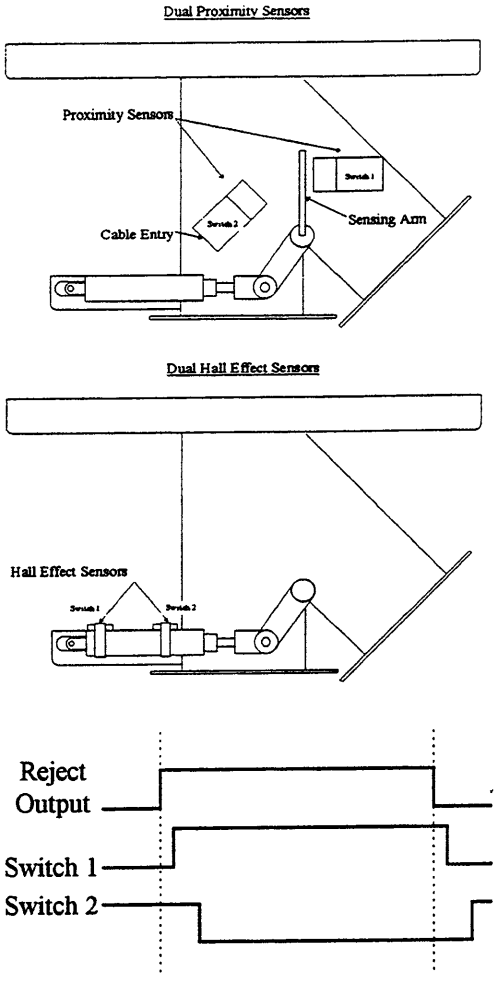


Figure 26

Suppression

This feature is designed to reduce false triggering caused by the action of the reject device.

Product Compensation

Metal detectors are capable of detecting metal by measuring two characteristics:

Conductivity: (Wet)

Any conductive material will generate a specific error signal. However, many food products by nature are electrically conductive themselves. Salt and moisture content combine to produce conductive product effect which must be overcome in order to detect small metal contaminants.

Magnetic: Permeability: (Dry)

Any material passing through the detector which has magnetic qualities will generate a signal which must be overcome in order to detect small contaminants. Products which contain iron fortification can produce magnetic error signal. For gravity applications most products are considered 'Dry'.

The DSP metal detector overcomes these product effects by automatically adjusting itself to compensate for the specific 'phase' of the error signal.

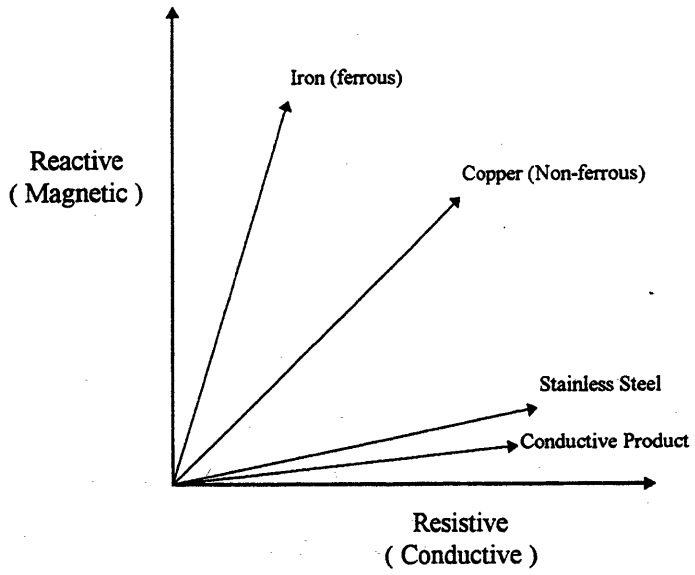


Figure 27

Typical 'Wet' products:

- Bread, buns, cakes
- Meat, poultry (fresh)
- Dairy products
- Fresh produce

Typical 'Dry' products:

- Cookies, candy, chocolate
- Dry powders
- Oil based products (peanut butter)
- Cereals

Definition of Terms

Phase	Refers to the phase vector of the product signal.
Mode	Groups the phase vectors into wet (near 0°) and dry (near 90°)
Residual	Product effect that cannot be eliminated with phase compensation. This feature requires the installation of a photo eye and can only be used with discrete products. This feature is not used in gravity applications.
Fixed	Any feature which is fixed will not be automatically updated.
Auto	Any feature in auto will be automatically updated. This feature requires the installation of a photo eye and can only be used with discrete products. This feature is not used in gravity applications.
Hold	This will maintain the entered parameter and will not be included during a 'product learn'. For example, if sensitivity is on -hold the sensitivity setting will not be included during a 'product learn'.
Head Gain	Selects a high or low gain setting.
Thresholds	The system maintains two independent thresholds: the conductive threshold and the magnetic threshold. These thresholds depend on external factors such as the installation environment and the type of product being inspected. This menu is used to set these thresholds. The standard threshold values are 100 for both. This should be fine for most installations.
Sensitivity	This adjusts or sets the sensitivity of the detector. A higher sensitivity number means the detector will detect a smaller piece of metal.
Learn Path	The learn path is displayed when the learn hard key is pressed. The features which will be included in the learn path will be marked with a box beside them. Any feature that is 'off' or 'on hold' will not be included in the learn process.

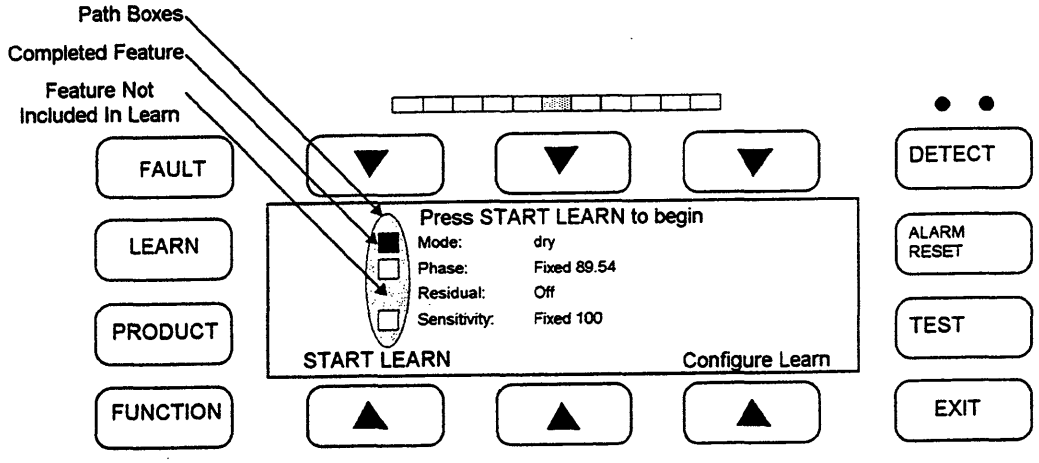


Figure 28

Learning the Product

In most gravity applications, the product is considered dry and will produce little or no product effect. In these cases, product compensation is not required, however, a phase point should be learned to reduce the effects of vibration.

Press the Learn hard key, press the Start Learn button and introduce vibration by shaking the system or by pressing directly onto the search head itself. The green product light should come on during this vibration. Continue until the cursor next to phase becomes a solid block and a fixed phase point appears; this should be at or near 90°. Test this phase point by again introducing vibration and making sure that the detector is stable and does not false trigger under normal vibration conditions. If in doubt, press Start Learn to repeat the procedure.

Special

Head Gain

Head gain selects high or low gain setting. High gain should be used in all applications unless the product effect is too high an turns on the red (high) Product Light. In gravity applications, it is normally not necessary to use the low gain setting. Whenever the head gain is changed it will affect the overall sensitivity of the detector and therefore the sensitivity should be tested and recalibrated if necessary.

Thresholds

The system maintains two independent thresholds: the conductive threshold and the magnetic threshold. These thresholds depend on external factors such as the installation environment and the type of product being inspected. This menu is used to set these thresholds. The standard threshold values are 100 for both conductive and magnetic (R, X) and these values should be used in all gravity applications.

Phase Special

Phase Limits

Phase limits are not used in gravity applications.

Trigger

Trigger is not used in gravity applications.

Phase Angle

This allows for manual adjustment of the Phase Point.

Sensitivity

Path: Sensitivity

This menu sets the sensitivity number which the detector is using. Increasing the number results in higher sensitivity detecting smaller particles of metal. Manually adjust the sensitivity using the + and - keys. Press *Accept* to enter the new value. Range 0-1000.

Note: Coarse adjustment can be achieved by moving the cursor to the desired digit and adjusting that digit.

WARNING: Any adjustment made to the sensitivity setting should be followed by a thorough test of the detector's operation using the required test samples.

Peak Signal

The peak signal is always displayed with the sensitivity number and it shows the relative value of any signal which the detector receives. When the peak signal exceeds 100, the detection threshold is tripped and will result in a reject signal. (if the detection mode is narrow zone, a higher peak - 120-140 - may be required before a rejection will occur - see - detect mode below).

The peak number should be used as a guide to assist in determining the sensitivity setting. Assuming any product effect has been compensated, the peak number will display the current background signal. This should be kept below 50-60 for reliable operation. Adjusting the sensitivity will scale the peak number also.

Example: If peak = 100
Sensitivity = 200 Changing sensitivity to '100' will scale the peak to '50'

Ideally the sensitivity should be set so that the background signal peak is 50 or below and the signal from the test sample(s) is 150 or greater.

Sensitivity - Special

Detect Mode

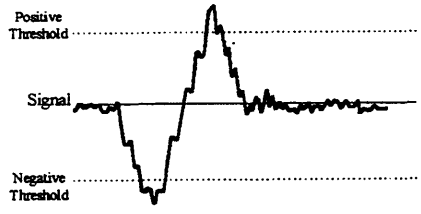


Figure 29

Narrow Zone

Under this mode, a detection will occur only if the signal from the entrance coil and exit coil (positive & negative) exceed the threshold set by the sensitivity number.

Amplitude

Under Amplitude, if either polarity (positive or negative) cross a threshold a detection will occur.
Amplitude is usually more sensitive than narrow zone and should be used if in doubt. Narrow zone can improve immunity to external interference in some circumstances.

Fixed

Selecting fixed will include sensitivity and the Product Learn path.

Hold

Hold will remove sensitivity from the Product Learn path. Hold is the default setting for gravity applications.

Learn

Learn initiates an Automatic Sensitivity Learn. This learn will take approximately 15 - 20 seconds. During this period the detector will calculate an optimum safe sensitivity. This can then be manually adjusted if required.

Product Library

Path: Product (Hard Key)/Product Library

Individual product records which can store information such as sensitivity settings, reject parameters, etc. can be created. Since most parameters will be shared by all the products it is preferable to set one product record completely including all the reject parameters and then copy this product to a new product number. Then any individual parameter can be adjusted for this specific record.

Copy

This menu allows you to copy from the currently running product to a new product number. Press the Plus or Minus keys to select the new product number, then press copy. The menu will then change to Edit Product Name, press the Plus and Minus keys to select the first character in the desired name (range A-Z and 0-9). Use the cursor left or right to move to the desired character slot and repeat process until the desired name is complete. Press *Accept* when name is complete. You have now copied all the parameters from the running product to the new product memory position. If you wish to run the new product, press and release the Product hard key until the desired product name and number appears then press the Run It option. Now you can edit or modify the desired parameters such as sensitivity etc. for that specific product record. It is always advisable to make a backup copy even if only one product record is required.

Delete

This allows individual product records to be deleted. Press Plus and/or Minus to select the desired record to be erased and then press Delete.

NOTE:

- The Prime Product 1 cannot be deleted.
- The running product cannot be deleted.

Edit Name

This menu allows you to edit the name of the current running product.

Erase All Products

This menu allows you to erase the detector's entire memory.

WARNING: All learned and programmed parameters will be erased.

Product Selection

Selection of a new product from the already stored product records is achieved by pressing the Product hard key. Press and release until the desired product appears then select Run It. that product record will now be loaded and will become the running product.

Password

Path: Setup/Password

The system has three levels of user passwords. Level 3 is the highest access level.

Most common functions can be assigned a specific password level. This allows the user to design their own password structure. Typically, low level functions such as Select Product, etc. would be assigned a level 0 (no protection) or level 1 password protection. More critical functions such as sensitivity should be protected at a higher level.

NOTE: By default, password protection is Off which would mean no menus are protected. It is recommended that custom passwords be established and password protection turned on.

Default Passwords

Default passwords are as follows: *Level 1* - AAAA *Level 2* - BAAA *Level 3* - CAAA

On

This option turns on the Password Protection and will require a level 3 access.

Off

This disables Password Protection and will require level 3 access.

Category

This lists the functions which can be assigned a password level by the user. Use the cursor arrows to select the feature you wish to edit, press Plus or Minus to change the level (range 0-3) and press *Accept* to complete the edit.

The following features can be assigned passwords:

Select product	Learn All	QA test	Special menus
Set Sensitivity	Set application	Reject setup	Function Key
Clear rejects	Alarm key	Configure learn	Erase Products

Edit Passwords

This allows the user to define custom passwords for each level and requires level 3 access. Select the level to be edited, press the Plus and Minus keys and cursor arrows to define your new password. Only alphabetical characters can be chosen.

Log Out

Log Out tells the detector that you are leaving and therefore reinitiates Password Protection.

Using Passwords

When password protection is enabled any function which is protected will be visible to any user but cannot be edited unless the password to the correct level is entered. The unit will request the password at the initiation of an edit attempt. Once you have entered the password you may continue with the edit function. When you have completed the changes required, if you wish to reinitiate password protection you must log out. This can be done from the top display, select Log Out.

Forgot Your Password?

If the incorrect password is entered when requested, by pressing Forgot the Password, seed numbers will be displayed for the three password levels. By contacting Goring Kerr with these seed numbers, we can decipher your password. Be prepared to produce evidence of your authority.

Special Functions

Path: Setup/Special

The menus under special should only be set and adjusted after reading the pertinent section of this manual.

Language

Select from English, French and Spanish. When French or Spanish is selected, only commonly used menus will be displayed in that language, all others will remain in English.

Input/Outputs

This menu sets and checks the condition of various inputs and outputs of the detector.

Inputs

This allows you to view the state of the following inputs:

Photo eye (infeed P.E.)
Reject confirm 1
Reject confirm 2
Shaft encoder

Infeed Photo eye polarity can be changed in this menu. Reject confirm and shaft encoder are not changeable.

Output

The state of the reject and fault outputs can be monitored. The polarity of the reject output can be inverted from this menu. The fault output cannot be inverted due to its fail-safe nature.

Function Key

From this menu, the user can select which function will occur when the Function hard key is pressed.

I/O 2

From this menu, the function of I/O 2 in the power supply/terminal box can be chosen. Gravity systems normally use I/O2 as the reject output. **Note**: The reject solenoid on the standard system is 12 VDC. Select from:

Reject sensor 2 (reject confirm 2)
Auxiliary reject (second reject output)
External suppression
Password key lock (external key switch password access)
Unused

Note: The correct device type must be installed for any of the above functions to work. Contact Goring Kerr for assistance.

Fault Configure

From this menu the following functions can be accessed:

Reboot (will reset the processor)
Frequency (displays the frequency of the control panel)
Configure fault
Fault

Configure Fault/Excess Reject

Configure fault is used to set the parameters for the fault source called excess reject. Excess reject monitors the number of rejections occurring within a window. The window is either a timed function or when the unit has a photo eye, a function of the number of products. For example, if excess reject is set to 10 rejects within 5 minutes, then if that number of reject ever occurs within the specified period, a fault will occur. Be sure to check under fault to see that excess reject is listed as "OK".

Faults

This menu displays a list of fault sources and their current state. The fault sources are as follows:

Search head	Photo reject
R.F. Board	EMU reject
Reject confirm	QA test response
Battery low	QA test result
Product memory	Excess reject
Photo eye	Phase limits

Only those listed in the right hand side column can be edited to "ignore" the fault source. When listed as "ignore" this fault source will not be monitored by the unit. If you wish to change the state of these fault sources use the select key to move the cursor to the fault source and then the Ignore/Monitor key to change the monitoring state.

Refer to the Fault Finding section of this manual for help in troubleshooting fault conditions, and descriptions of the above fault sources.

DSP Net

This menu is used to set communication identification and protocol for use with a Goring Kerr DSP Net communication system. Each detector connected to a communications network must have an individual ID number. Press DSP ID to edit the detectors identification number.

Communication protocol for DSP Net should be set to RS485. This can be changed to RS232 for local communication. Contact Goring Kerr for assistance.

Clear Peak Control

This menu selects the source that will clear the peak signal indicated in the sensitivity menu. For gravity applications only Threshold Trip should be selected.

Filter/Sample Rate

Under this menu the filter size and the sample rate can be monitored. Neither of these functions should be changed under normal conditions.

The sample rate is a number which represents the rate at which the DSP is sampling the incoming analog signal. The detector selects this sample rate automatically when you program the application. For gravity application this number must be 62.

Also when the application is programmed, the detector determines the optimum filter it should use for the speed which you have programmed. It will select from a list of four defined filters, DNR1 through DNR4. For gravity applications, the correct filter is DNR4; for some gravity applications where the speed of the reject device is critical the filter may be turned off. This will improve the reject response time by approximately 40 milliseconds.
However, the unit may prove to be more susceptible to interference signals.

Status

Path: Status

This menu displays a summary of the important parameters which have been set.

SYSTEM

This shows the type of applications (gravity, etc.), the filter type, the current sample rate (SR), and if a photo eye is present.

PHASE

This displays the current phase point, the phase state (auto, fixed), the mode, and the state of residual compensation.

GAIN

This shows the state of the gain, the R and X thresholds and the current sensitivity.

REJECT

This displays the current delay/duration of the reject system.

PASSWORD

This displays the current state and level of password protection and the QA Test state.

Service Data

This menu displays service and troubleshooting information.

FREQUENCY

This displays the frequency of the control panel. Example: 300Khz.

LEVELS

This represents a volt meter display of the search head signals. Three signals can be monitored here, the balance, the oscillator reference signal A and oscillator reference signal B. Refer to the Fault Finding section of this manual.

VERSION

This displays the version of software this panel is using. The version number should match the version number on the front of this manual.

SCOPE

The scope display can be used to show various wave forms. Refer to the Fault Finding section in this manual.

QA TEST

The Test hard key can be used to access a QA test menu. This can be configured to record QA test occurrences separately form normal rejects, etc. The system can also be configured to request that the unit be tested. In this mode an interval is set, for example 4 hours. When the interval has expired the test key light will turn on and the unit will expect to be tested. An operator would then press the test key entering the test mode and perform a prescribed test routine. For example: this may require 10 detections of a certain peak signal to be considered a valid test. Once the test is complete and passed, the test interval will be reset. At the end of the next interval the test key light will turn on requesting another test routine.

While in QA Test all rejects will be recorded separately for use with DSP Net files. Also, the detector will still function and reject contaminant metal.

Normal mode

This button returns the unit to its normal inspection mode.

Test Mode

This initiates a test mode.

Clear Peak

This key resets the peak signal indication.

Setup

Setup provides access to configure a QA test routine.

Peak Limit

This number represents the maximum peak signal considered valid during a QA test. This is so that an invalid test sample, a coin for example, cannot be used during a test. If the peak signal is exceeded the unit will not accept it as a valid sample. The peak limit should be set above the peak signal generated by the specified test samples. For example: if the test sample you are required to detect generates a typical peak signal of 200-250, the peak signal limit should be set at 300-350.

Interval

This is the number of hours required between test requests. For example, if set to four hours the unit will request a test after every four hour period.

Required Detections

This is the number of valid detections which must occur during a QA test to reach a successful completion of the test.

Fault Finding

If the detector senses a system fault the fault LED will turn on, the fault relay will change state and a fault message will be displayed at the top menu. Press the fault button display to access a description of the fault. If there is more than one fault, press next fault to view the next fault description. The following is a description of the type and source of faults which can occur:

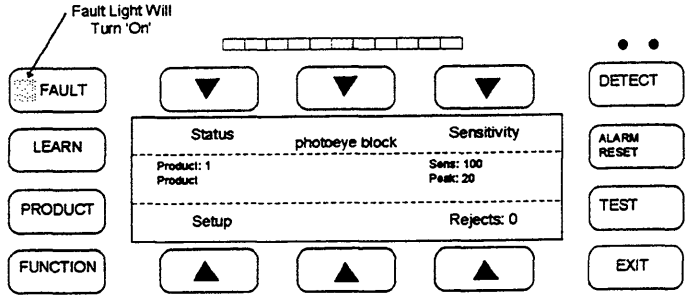


Figure 30

Search head Fault

Search head fault can occur for the following common reasons:

Search head cable connection has been broken.

Examine the cable connections at both ends to make sure that all wires are connected correctly. Refer to the Installation Section for assistance.

The oscillator reference levels may be out of range.

The oscillator references can be measured by the detector under status/service data. Reference A and reference B should both be within the following range: 100 +/- 20.

Search head balance may be out of range.

Again, this may be monitored using the volt meter feature under service data. The balance number displayed should be below 200.

Contact Goring Kerr for further assistance in troubleshooting.

RF Board Fault

This fault is a result of the RF board not responding to DSP requests. Common causes: 24 volt supply has failed-check the 24 volt fuse in the power supply (F7); or control panel failure. Cycling power may clear fault.

Reject Confirm Fault

This fault results when reject confirm has been enabled and the confirmation signal has failed to return within the prescribed time period. This could be a result of reject device failure, a slow reject action, or reject confirm device (switch, etc.) failure. Check the reject device action, make sure the reject confirm switch is operating properly. It may be necessary to adjust the reject confirm time window -Path: Rejects/Setup/Special/Reject Confirm/Confirm Time.

Battery Low Fault

This indicates that the battery which is powering the memory when power is off is excessively low. Battery voltage could be checked in the control panel and the battery and/or control panel could be replaced. This does not affect the unit operation as long as power is maintained. (Battery voltage > 3.0 volts)

Product Memory Fault

This indicates that the product memory has been lost or damaged. Low battery condition could cause the memory to be lost when the unit is not powered. In applications where the detector has been subjected to high static discharges or lightning, the memory may have been corrupted. It will be necessary to erase memory (Path: Setup/Product Library/Erase All Products). Prior to erasing memory it may still be possible to record critical settings such as the application parameters, sensitivity, reject settings, etc.

Photo Reject Fault

Note: This option is not used with Gravity systems.

Shaft Encoder Fault (EMU Fault)

Note: This option is not used with Gravity systems.

QA Test Response Fault

This fault will occur if the QA test request light has been ignored and the interval timer has expired. Performing a QA test will clear the fault.

QA Test Result Fault

This fault will occur if during a QA test the required number of detections of the specific peak size did not occur. Enter QA test mode and repeat the test to achieve the required number of detections.

Excess Reject Fault

This fault will occur only if the excess reject fault has been turned on and the excess reject parameters programmed. The fault indicates that an excessive amount of rejects have occurred within the specified time window. To clear the fault, press the Clear Fault soft key. Please note that the fault may have been caused by excessive contamination in the product. The rejected product should be examined to confirm this and appropriate action should be taken.

Phase Limit Fault

This fault will occur if a phase limit has been reached during a learn phase or automatic phase period. This may be caused by contaminated product, metal in the belt, etc. If necessary, check and adjust the phase limits.

Photo Eye Block Fault

Note: This option is not used with Gravity systems.

24 Volt Fault

This fault indicates that the 24 volt supply has failed and therefore the unit is inoperable. Check power supply fuse F7 and LED LD7.

Recommended Testing Procedures

A complete and thorough test of the metal detector system must be done upon initial installation and whenever a major component of the system has been changed or altered (i.e. reject device repair, etc.). A complete check of the metal detector must include the reject device. Any test procedure designed for your application should take into account the following:

1. The metal detector's least sensitive point in the aperture is along the center line of the opening. Any testing should be done so that the test sample passes through the center line of the opening approximately. If the test sample is run at the side of the product tube or between the product tube and the detector, this will produce a larger signal than through the center line.

2. Sensitivity capabilities of different detectors used in different applications will vary. A smaller aperture is capable of detecting smaller pieces of metal. Product effect may also interfere with the detection capability. It is dangerous to rely on a corporate standard to determine and test the detector's operation. Ideally, each detector should have it's own standards of operation and a corporate outline should be used only as a maximum allowable guide. Sample sizes should be selected so that they are clearly detectable (peak signal size of 150 - 250) when compared to the signal produced by the product or other interfering signals. If samples are established which are very close to the product signal, frustration on the part of operators can lead to a lack of confidence in the detector's operation.

3. The detector should be tested at its normal operating speed. Test rods should be placed so that they begin their fall from the same place that the product would normally begin its fall. This ensures that the detector and reject device responses are accurately tested.

4. The detector is not equally sensitive to all types of metal. Depending on the type of product and application there can be three typical metal groups which will produce three different levels of detection:

Ferrous	-	any magnetic metal and is typically the easiest metal to detect
Non Ferrous	-	any good electrical conducting metals such as aluminum, copper, brass, etc.
Stainless Steel	-	the 300 series stainless steels which are non-magnetic, these tend to be the most difficult metals to detect

If a single test sample is to be used for regular testing, it should be a stainless steel sample. This will ensure that other metal types will be detected to this same level or better (smaller).

5. Test samples used should contain spherical metal contaminants. Any other shape will produce a different size signal depending on it's orientation as it passes through the detector. This can lead to inconsistent results.

6. Any test procedure established must allow for the test product to be completely rejected by the reject device. The reject device will tend to be the most likely point of failure in any detector system.

7. For gravity applications care must be taken so that if the detector or reject device fail to operate correctly, the test sample can still be recovered. This can be achieved by the use of a second valve or a removable catch grid which can operate as a fail-safe device, catching the test sample and allowing product to flow through. Contact Goring Kerr for assistance.

Note:

If insertion testing is difficult to achieve, ' Side of the pipe' method may be used for frequent sensitivity testing. Adjustment to the test sample size should be made to compensate for the increase in sensitivity of the metal detector as you near the side of the aperture. Under most circumstances the metal detector will be approx. 0.5 to 1.0 mm more sensitive as you reach the edge of the aperture. If this method is used it is highly recommended that you use reject confirmation to ensure the correct performance of the system.

The insertion method must be performed upon initial installation and when any changes have been made to the system or process.

Testing Schedule

How often the detector should be tested must be decided by the user. If the test procedure can be designed to be simple it will help ensure that the test will performed more frequently. As a guide it must be decided how much product would have to be put on hold for re-inspection if a detector fails the test. Typically the minimum frequency is once per shift while other applications require hourly tests be performed.

Record Keeping

All detector tests should be documented. If faced with a consumer complaint or litigation a complete record of test results and procedures will be very useful. The following chart can be used as a base for a manual recording system. Automatic records can be produced by using Goring Kerr's DSPNet communication software program.

METAL DETECTOR TEST SHEET

	SHIFT 1			SHIFT 2			SHIFT 3		
LINE : 15	PERIOD 1	PERIOD 2	PERIOD 3	PERIOD 1	PERIOD 2	PERIOD 3	PERIOD 1	PERIOD 2	PERIOD 3
DATE : 96/08/08	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
NOTES /ACTION									

Figure 31

Rejected Product Examination

If possible, product which has been rejected by the detector during production should be examined to establish the source and type of contamination. This may lead to an improvement in the process equipment upstream from the detector. It is also useful to display these contaminants so that all employees can see the benefit of the metal detector.

Automatic Record Keeping

To simplify test record keeping, the use of a computer communications system called DSP Net is recommended. This system will automatically record all events occurring at the detector including when the test was performed, and its success or failure. This record is kept for each individual detector connected to the network and can be viewed, stored or printed at the host computer. Contact Goring Kerr for information about this product.

QA Test Request

This detector can be configured to request a test procedure be performed at given intervals. Refer to the section in this manual called QA Test Request on Page 35.

Assistance

If you require any further assistance in establishing the test procedure, test samples, or test recording, please contact Goring Kerr.

Static

In all gravity applications there is a concern with static electricity. All non-conductive falling powders or granules will generate static charges as they fall. The resultant charge on the product tube and/or frame of the detector system can exceed 70Kv and can represent a safety concern to the operator.

Care should be taken to ground the detector according to the instructions provided in this manual. If high static charges can be felt on the product tube itself it may be necessary to use an anti-static product tube material. Please contact Goring Kerr for assistance.

DSP 2 Calibration Record

Company :_____ Date :_____

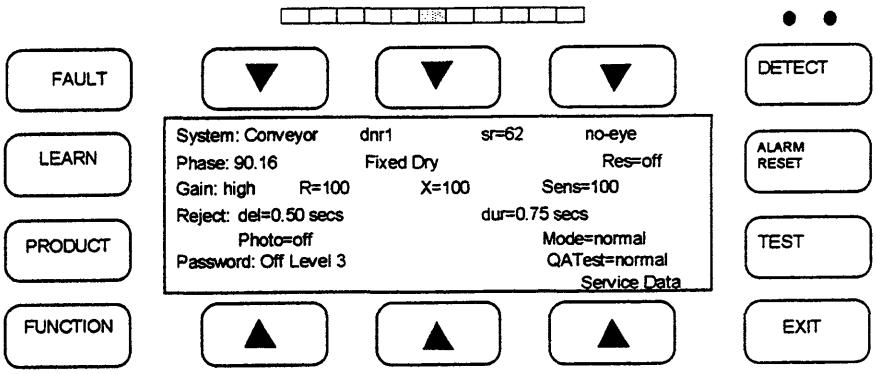
Location :_____ Serial Number :_____

Aperture Size :____Wide by ____High

Line :_____

Product name:_____ Number :_____

Status Screen



System:_____ dnr:_____ sr:_____ eye:_____

Phase:_____ Fixed / Auto / Hold Mode: Wet / Dry / Hold Res: Off / Auto / Fixed / Hold

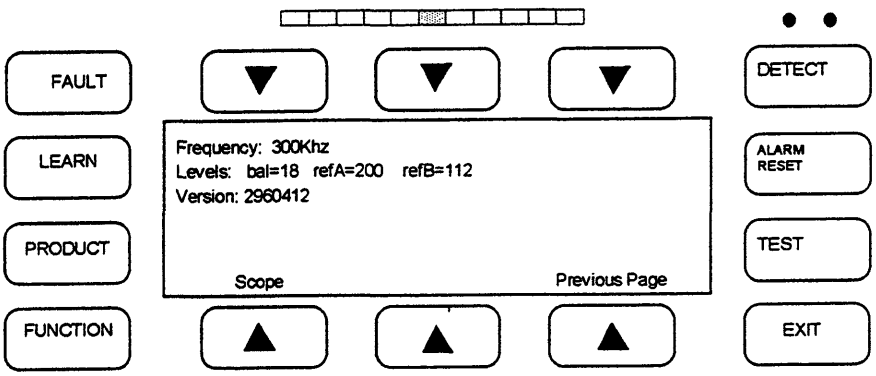
Gain: _____ R=_____ X=_____ Sens= _____

Reject: del= _____ dur=_____

Photo= _____ Mode=_____

Password:_____ QaTest=_____

Service Data Screen



Frequency :_____

Levels: bal=_____ refA=_____ refB=_____

Version :_____

Misc. Data

Phase Mode :_____ (Path: Setup/Configure Learn/Mode)

Reject Check :_____ (Path: Setup/Reject/Special/Rej Confirm Senors)

Eye Distance :_____ (Path: Setup/Application)

Belt Speed :_____ (Path: Setup/Application)

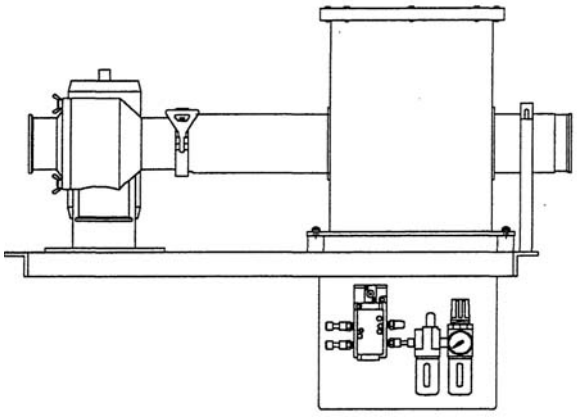
Detect Mode :_____ (Path: Setup/Configure Learn/Sensitivity)

Sensitivity :_____ (Path: Setup/Configure Learn/Sensitivity)

Model DSP2

Installation and Operation

Model 426 Pipeline Applications



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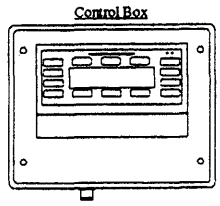
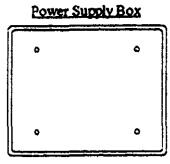
Preliminary Inspection

Equipment

The Model 426 system consists of four (4) major components:





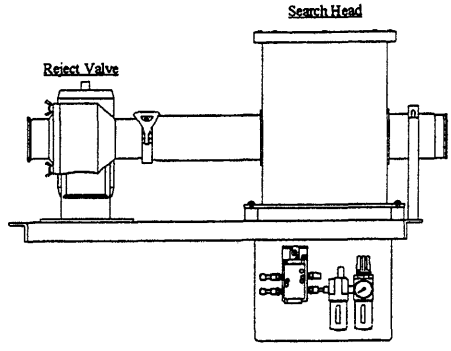


Figure 1

1) *Search Head*
The Search Head contains the inspection coils, through which the product to be monitored is passed.

2) *Control Unit*
The Control Unit contains the user interface controls, and main board electronics.
The Control Unit is generally mounted remote. It is supplied with the correct length of cable and wired into the search head.

3) *Power Supply*
The Power Supply Unit houses the power supplies, input/output devices and connection terminal strip.

4) *Reject Valve and Support Structure*
This structure supports the metal detector, reject valve and product inspection tube.

Note:
The control and power supply units may be mounted directly to the 426 support structure.

Preliminary Inspection

Check the contents of crate or crates against the order and/or packing slip. Look specifically for any additional reject device which might have been ordered with the equipment. Some reject devices (e.g.: horn, beacon) are quite small and may get discarded with the packaging. Check the equipment for any signs of damage in shipment.

Note:

If there are any signs of external damage to the crate, notify the transport company and do not discard the crate, it may have to be inspected by an insurance inspector.

Included with each metal detector are the following;

- Installation and Operation Manual
- Nylon Foot Mount and Nylon Bushings (4 of each)
- Metal Test Samples

Assembly

The model 426 system is supplied completely assembled and tested from the factory. The system you have may vary from that shown within this manual. Four mounting holes are located on the frame to support this system. The typical mounting method is to suspend the system with threaded rod. The threaded rod should support the complete load of the system. When securing the threaded rod to the 426 frame isolation bushings should be used on all four mounting holes. This will electrically isolate the frame from any support structure. The 426 system is not designed to support piping from any of the ports. Piping connected to any of the ports should be independently supported.

Systems

Goring Kerr manufactures various types of metal detectors and metal detector systems. This manual illustrates the installation requirements of the Model 426 system.

Conveyor Systems

Goring Kerr metal detectors are also used on a wide variety of conveyor systems. These systems vary from basic inline conveyors to special incline designs. A typical system would include an automatic reject mechanism to remove the contaminated product from the conveyor.

(See manual NA-DSP2/CONV)

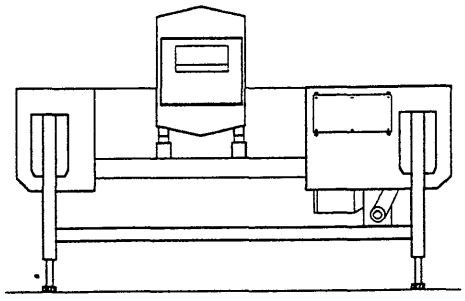


Figure 2

Model 402 Gravity Feed System

The model 402 system is supplied completely assembled and tested from the factory. The system you have may vary from that shown here. Four mounting holes are located at the top of the frame to support this system. The typical mounting method is to suspend the system with threaded rod. The threaded rod should support the complete load of the system. When securing the threaded rod to the 402 frame isolation bushings should be used on all four mounting holes. This will electrically isolate the frame from any support structure. The 402 system is not designed to support piping from any of the ports. Piping connected to any of the ports should be independently supported. Hanging piping from the reject value may distort the valve body and cause unreliable rejection.

(See manual NA-DSP2/GRAV)

Model 402

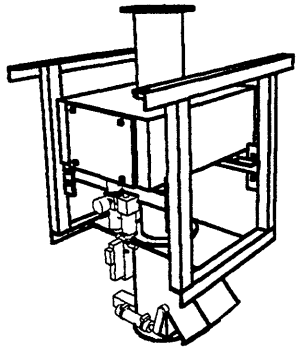


Figure 3

Model T7 Pharmaceutical System

The model T7 pharmaceutical system is supplied completely assembled and tested from the factory. The system is ready to use right from the crate. The reject device, control unit and search head are pre-wired. The mains supply power cord is also pre-wired.

(See manual NA-DSP2/PHARM)

Model T7

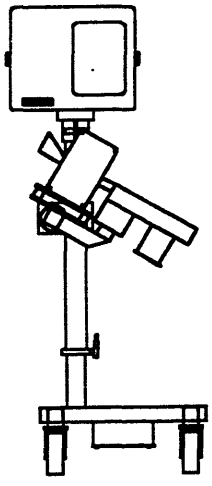


Figure 4

Metal Detector Principle Of Operation

The DSP 2 model metal detector operates on the balance coil full loop detection system.

Three equally spaced coils surround the aperture or opening through which the product to be inspected passes. The center coil is connected to an oscillator circuit to produce an electromagnetic field. This signal is received by two coils one on either side of the oscillator coil. These are the receiving or input coils. (See Figure 5)

Since the receiving coils are equally spaced from the oscillator, they receive equal amounts of signal. The coils are wound in such a way that their signals oppose each other; therefore, the net signal across the coil is zero.

When a piece of metal enters the electromagnetic field, it alters the field strength around it. As this metal passes through the aperture, it changes the balance of the receiving coils so that the net signal is no longer zero.

This error signal is amplified, demodulated and converted to a digital signal to be processed by the Digital Signal Processor or DSP. The DSP performs all the product compensation, phasing, residual compensation filtering, and produces a reject signal.

A metal detector is a high performance measuring instrument. The quality of the installation will have a direct effect upon performance and reliability. Please read the installation instructions completely prior to installing the unit and contact Goring Kerr if you have any questions.

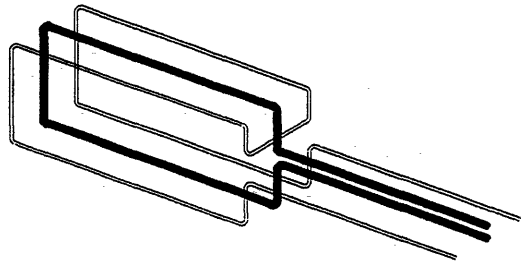


Figure 5

Mechanical Installation

The power supply unit and control unit may be mounted as any other electrical control would be, wherever convenient. However, the support frame must be installed as per the following instructions if correct performance is to be expected. Please contact Goring Kerr if you have any questions regarding installation requirements and restrictions.

System Mounting And Isolation

The 426 system is designed to support the metal detector, reject valve and associated parts. Infeed, discharge and reject piping should have their own support structures. Hanging piping from these ports may break the product tube or distort the reject body and render the reject inoperable.

When mounting the 426 system it is necessary to electrically isolate the support frame from the hanging rods. This can be accomplished with the use of nylon bushings. Two bushings are needed on each mounting hole to isolate both the upper and lower mounting nuts. (See Figure 6)

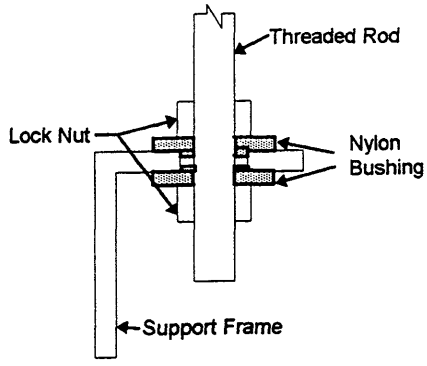


Figure 6

Warning

When servicing or inspecting the reject valve or product tube extreme care must be taken to prevent any injury.

The following steps will help insure personal safety when accessing the reject valve:

- Disconnect the main air supply from the reject F.R.L.
- Turn the mains power supply to the metal detector 'off'

To insure optimum performance the following considerations should be taken:

- Avoid excessive vibration.
- Avoid high static environments.
- Variable speed drives, walkie talkies or RF transmitters may affect the performance of the metal detector.

Contact Goring Kerr for assistance in resolving installation concerns.

Maintenance

Regular cleaning procedures must be implemented if reliable, trouble free operation is to be expected. Both the product tube and reject valve should be cleaned on a regular basis. Some products may build up on the inner wall of the product tube. If this occurs metal particles may be trapped in this build up, resulting in unreliable rejection of contaminant. Equally important is the cleanliness of the reject valve. If product buildup occurs within the valve, valve reaction will be sluggish and unreliable. A supplementary document specific to your valve is attached to this document. If you have any questions on the cleaning procedure please call Goring Kerr for further assistance.

Product Flow Rate

The 426 system has been designed to minimize space requirements while at the same time ensuring accurate response times. Your system has been designed to function correctly within the specifications stated when ordered. However, if the flow rate increases beyond the original specification the reject valve may fail to operate in time. It would then be necessary to increase the distance between the search head and the reject valve. Contact Goring Kerr for assistance in determining the correct location of the search head.
(See Figure 8)

When inspecting for metal there must be a constant flow of product through the system. If the product flow stops when metal is detected the contaminate will not be rejected correctly.

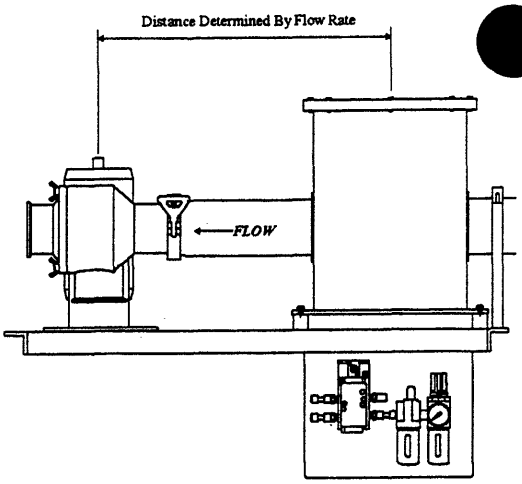


Figure 8

Product Tube Clearance

The 426 system is supplied with a product tube support which locates the product tube in the center of the metal detector. To insure maximum performance the product tube should be held securely so as not to contact the inside of the metal detector.

System Testing

When testing the 426 system it is important to test both the sensitivity of the metal detector and the response of the reject valve. To accomplish this a metal test sample must be inserted into the product flow. Also, a means for retrieving the test sample after the 426 system should be incorporated in case the reject device fails to operate. Following these procedures will insure the correct detection and rejection of metal contaminants. (See Figure 9)

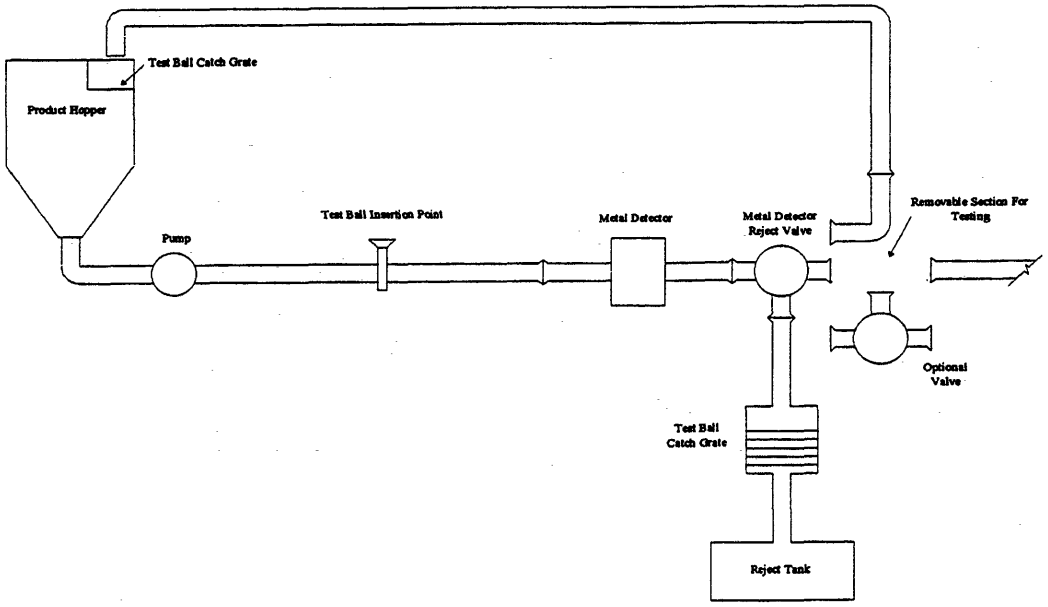


Figure 9

Electrical Installation

When choosing the power supply line for the metal detector, it should be remembered that the starting of heavy electrical machinery creates considerable (though momentary) voltage drops in the line. Such "spikes" can cause the metal detector to trigger. Since the power consumption of the detector is very low (approximately twenty-five watts), it is recommended that a lighting circuit be used for its supply rather than a machinery power circuit. Where this is not possible, and line noise does trigger the detector, contact Goring Kerr for recommendation of a suitable isolation transformer or power line filter.

a) The metal detector connections are shown in the Power Supply Connections section. If the control unit is mounted on the search head, the connections from the search head to the control unit are already made.

b) The cable between the power supply unit and control unit is of a specific type. Do not substitute or splice on extra cable. Likewise, the cable between the control unit and search head (when remote) is of a specific type. Do not substitute or splice on extra cable. Either cable can be cut to length and they are not sensitive to movement. Contact Goring Kerr for extra cable or cable information if required.

c) Use waterproof cable glands at all cable entries.

Power Supply Layout

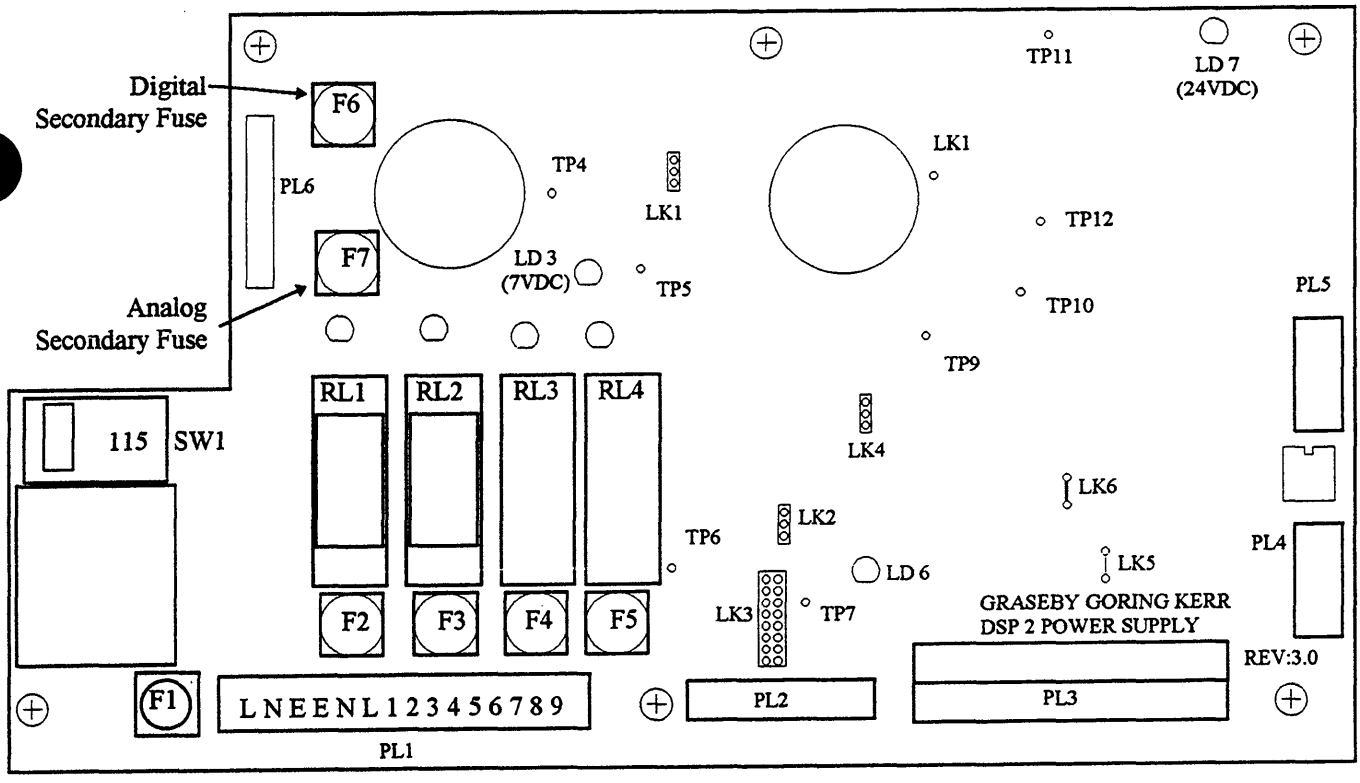


Figure 10

Power Supply Connections

Main connector PL1

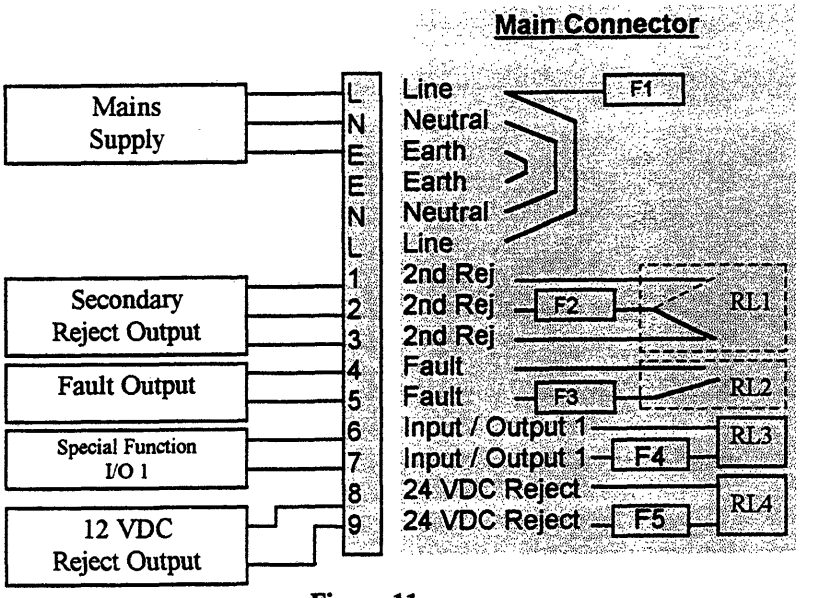


Figure 11

Mains Supply
Connect the supply line to, L-Live, N-Neutral, E-Ground (Earth).
Either 110 or 220 volts single phase can be used to power the metal detector. A selection switch (SW1)on the power supply board will switch between voltages. The metal detector can operate on either 50 or 60 Hertz, 55 va.

Fuses
Only use replacement fuses with the same ratings as original fuses. Fuses F1 to F4 are 1 Amp 250 volt fast acting fuses. Secondary fuses F6 and F7 are 2 Amp 250 volt slow blow.

Secondary Reject Output
Note: The standard reject solenoid is 12 VDC and is connected to terminals 8 and 9.

When metal is detected or power to the detector is turned off dry contacts 1 and 2 close, 2 and 3 open. Terminal 2 is fused at 1 Amp 250 volt fast acting. To supply a typical reject device (e.g.: solenoid), connect a jumper from L to 2, connect solenoid to 1, N and E, or 3, N, E, depending on action required.

Note: ***DAMAGE*** may occur if wrong voltage is applied to relays and solenoids!
Solid state relays are available. Check power unit lid for description of relay type. Mechanical relays are AC or DC - only terminals 2 and 3 are used for reject.

Fault Output
During a fault condition or when power is turned off terminals 4 and 5 will close. These connections can be connected to an external alarm to indicate a fault condition. Terminal 5 is fused at 1 Amp 250 volt fast acting.

Special Function Input / Output Devices
Terminals 6, 7, are for use with special options. Terminals 7 is fused at 1 Amp 250 volt fast acting.
Note: I/O devices are not normally fitted. ***DO NOT*** connect to these terminals if it is unclear of the type or voltage rating of devices fitted. Permanent damage may occur if incorrect voltage is applied.

Typical Reject Device Connections

12 VDC Solid State Reject Relay

When metal is detected terminals 8 and 9 will close and energize the reject solenoid.

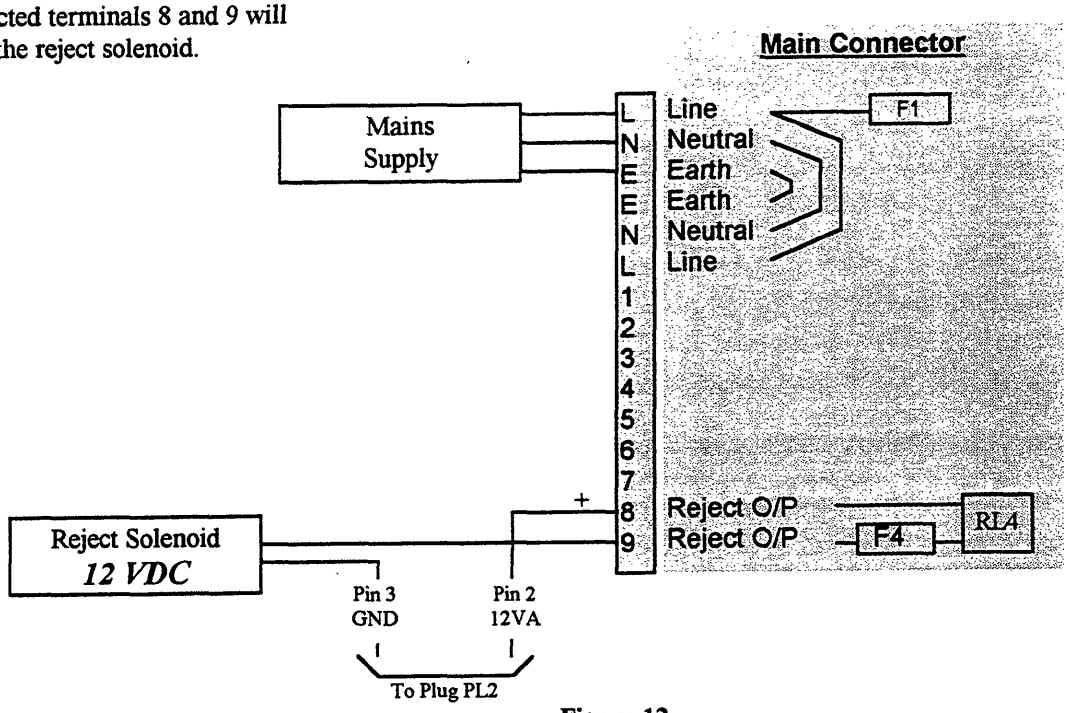


Figure 12

Secondary Reject Output

When metal is detected terminals 1 and 2 will close. This relay has dry contacts and can be used for secondary reject outputs. Maximum rating 110vac 1 Amp.

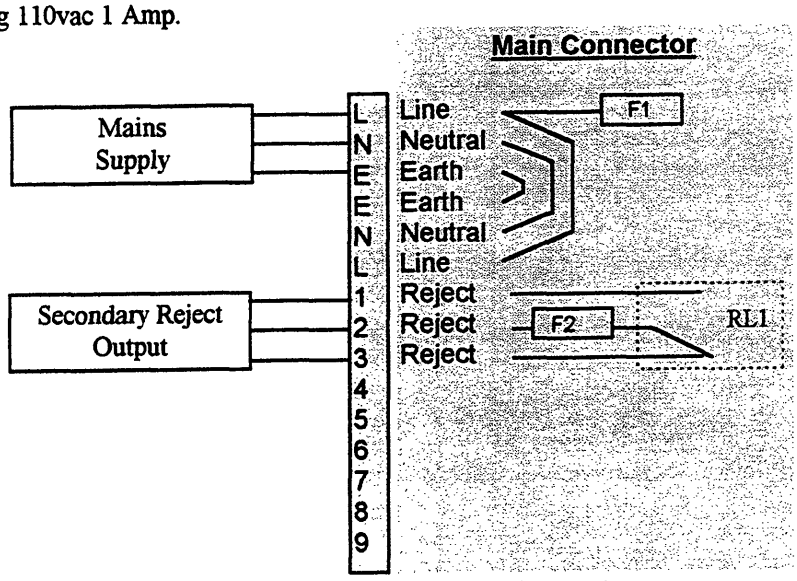


Figure 13

Filter Regulator Lubricator (F.R.L.)

The 426 system standard F.R.L. requires an air supply of 80 p.s.i.
The standard solenoid supplied is 12 VDC. Care should be taken when wiring the solenoid as some applications require different supply voltages. Check the inside cover on the power supply for details of the type and requirements of the solenoid supplied.

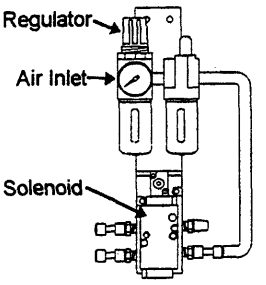


Figure 14

Reject Confirm

To insure contaminated product is rejected correctly a feedback signal from the reject device can be used. A microswitch or photo eye connected to the reject device can be wired to terminals 6 and 4 on connector PL2. Contact Goring Kerr if you require more information.

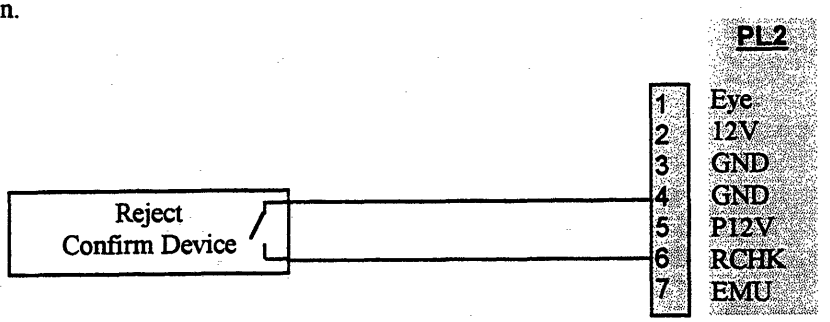


Figure 15

Power to control unit Plug PL3

This connector is a plug-in terminal strip. It may be easier to unplug it while making terminal connections.
WARNING: This cable is for connection between control panel and power supply only. Do not connect any external devices or supplies to PL3.

Power Supply Cable

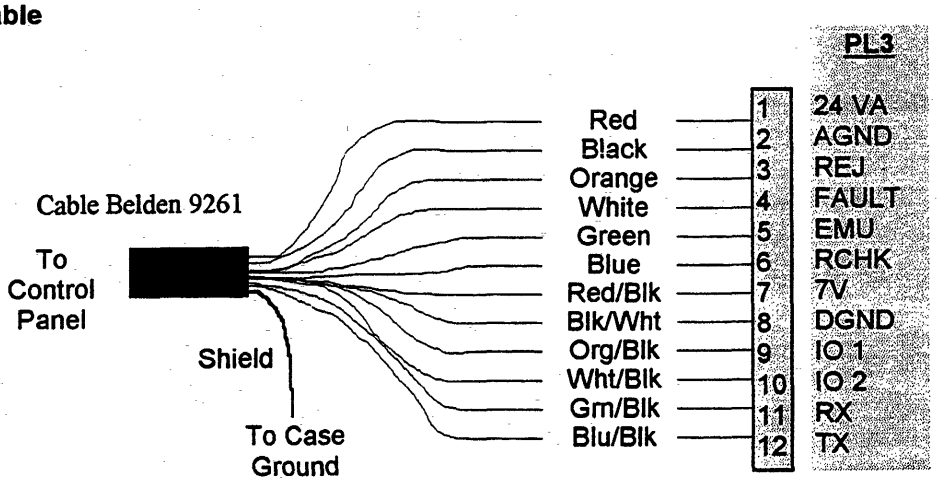


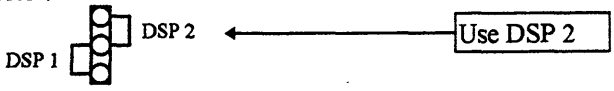
Figure 16

Fuses

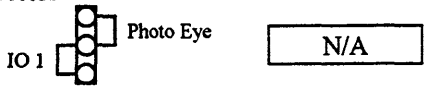
F1	Main supply fuse 1 Amp 250 volt fast acting
F2	Reject Output relay output fuse 1 Amp 250 volt fast acting
F3	Fault relay output fuse 1 Amp 250 volt fast acting
F4	IO 1 relay output fuse 1 Amp 250 volt fast acting
F5	IO 2 relay output fuse 1 Amp 250 volt fast acting
F6	Digital secondary fuse 2 Amp / 250 VAC Slow Blow
F7	Analog secondary fuse 2 Amp / 250 VAC Slow Blow

Links

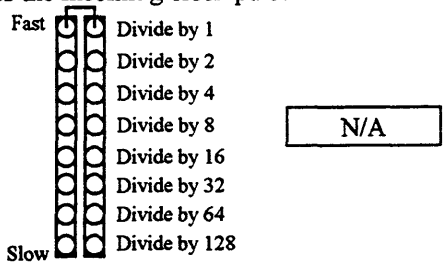
LK1 DSP 1, DSP 2 selector.



LK2 Photo Eye / IO 1 selector



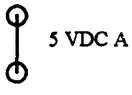
LK3 EMU clock divider. Divides the incoming clock pulse



LK4 485 Communications selector

LK5 Ground 'A' Link

LK6 5 VDC 'A' Link



Plugs

PL1	Main connector
PL2	Photo eye and EMU sensing head connector
PL3	Interconnecting cable to control unit
PL4	DSP 1 communication connector
PL5	485 communication connector
PL6	Transformer connection

Control Panel Connections

Removing The Control Panel

Before removing the control panel insure that the *MAINS SUPPLY* is switched *OFF*. Either remove fuse F1 from the power supply or shut down power source to the metal detector.

The control panel is mounted on the search head (or remote box) with four mounting bolts. Remove these bolts to gain access to internal connectors.

The power supply and search head cables are wired into *'quick disconnect'* connectors. It is not necessary to remove the wires from these connectors.

When removing the connectors be careful not to pull on the wires, instead pinch the connector and pull.

DSP 2 Control Panel
(Back View)

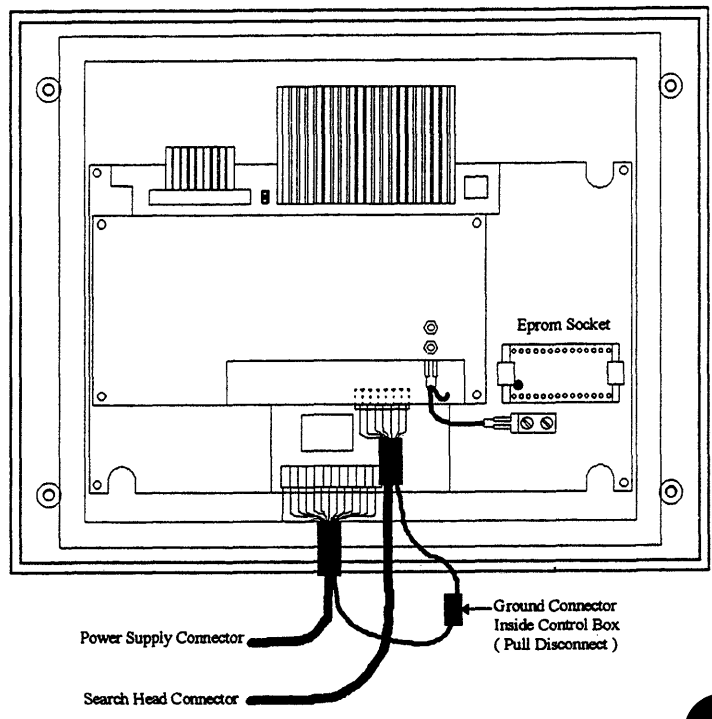


Figure 17

Installing The Control Panel

When installing the control panel repeat the above instructions in reverse order.

Note:
Care must be taken to insure that the search head connector is fitted correctly.

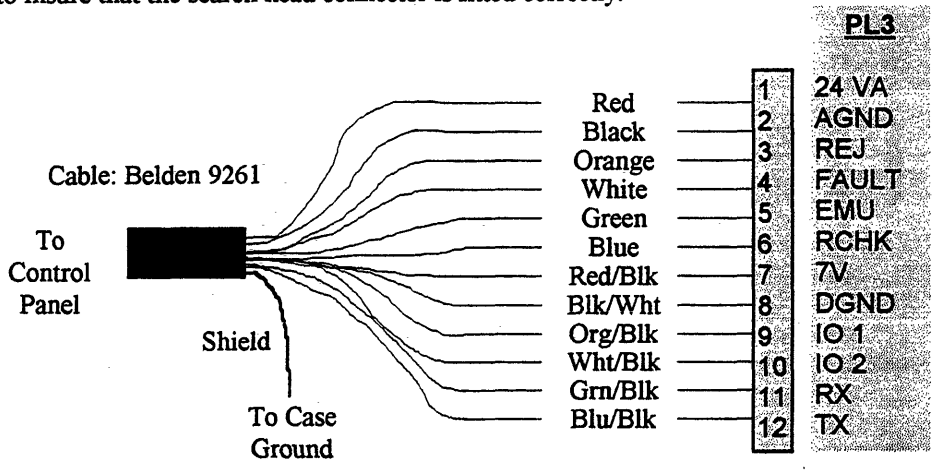


Figure 18

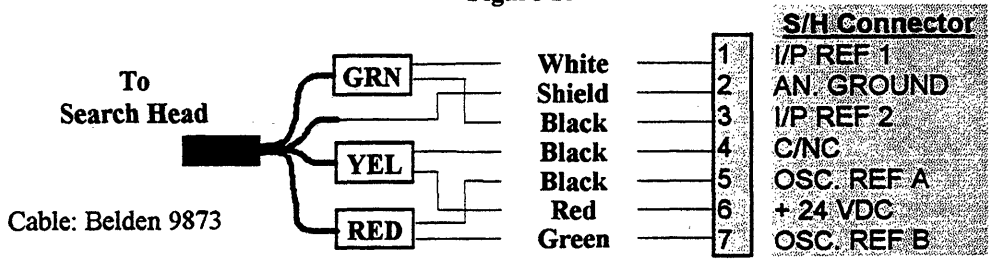
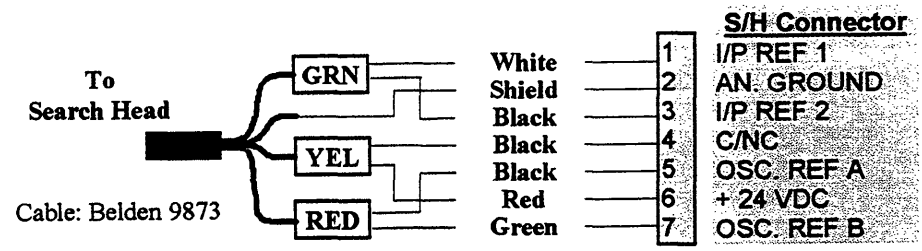


Figure 19

Search Head Connections

Standard Search Head Electronics



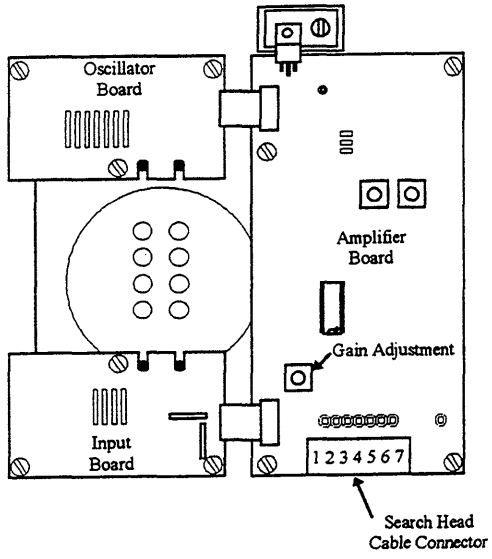
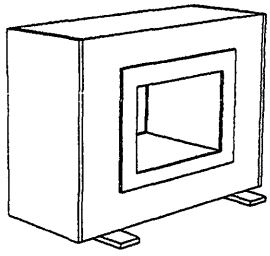
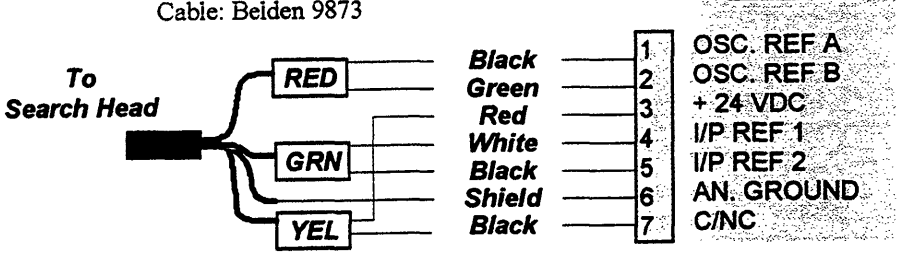


Figure 20

Mini Search Head Electronics





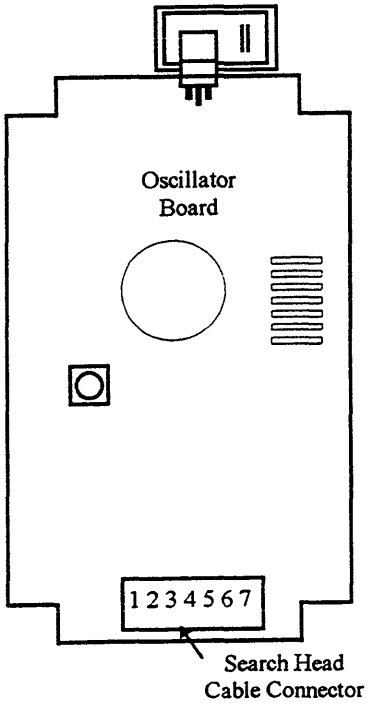


Figure 21

DSP 2 Menu Structure

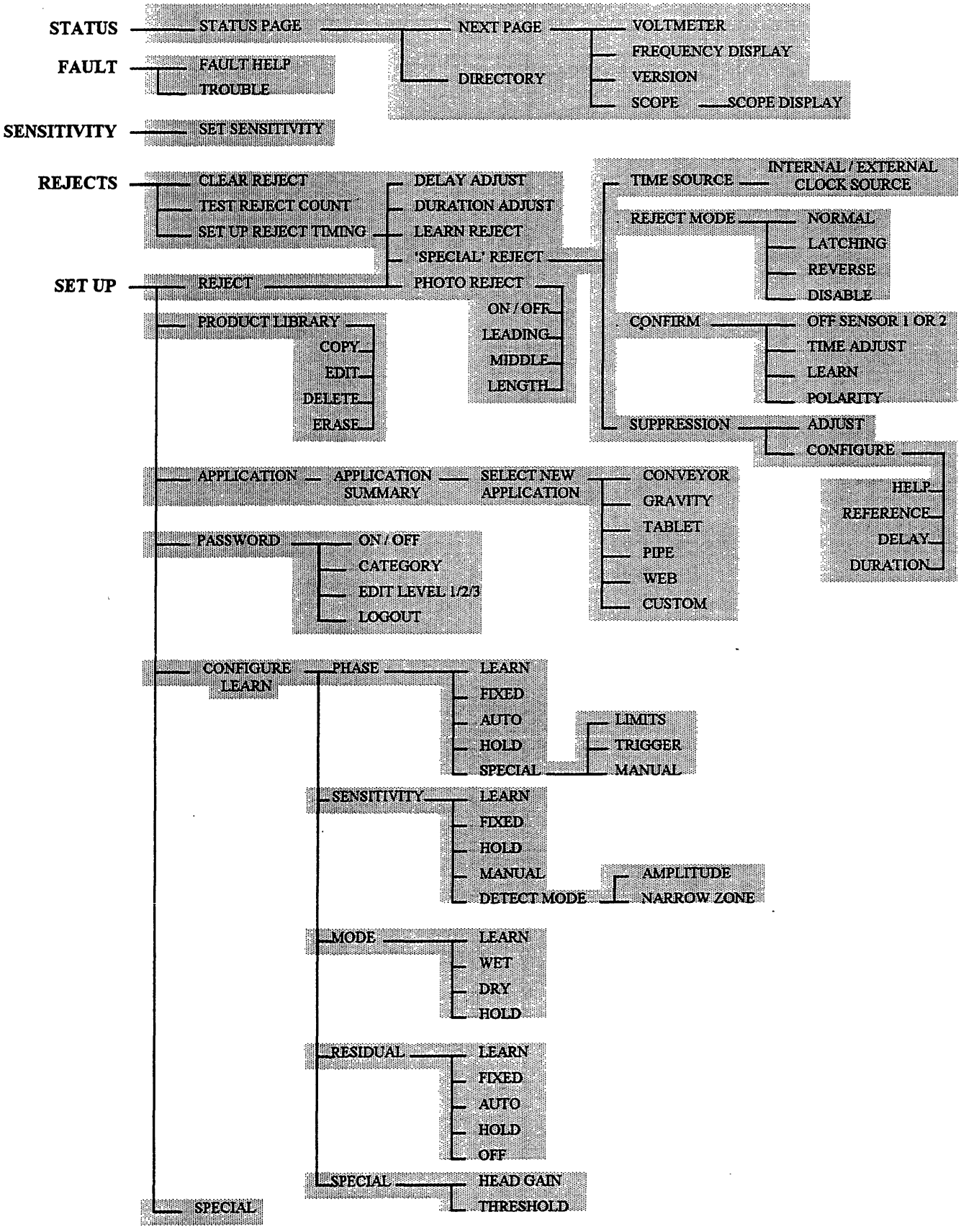


Figure 22

User Interface (Keypad)

Top Menu

Throughout this manual you will be asked to start from the Top Menu when selecting options etc.. To find the top menu press the 'Exit' key until you see this screen.

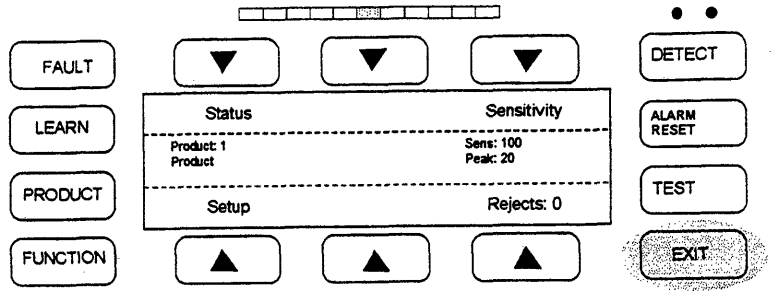


Figure 23

Path

Major functions described in the following pages will have a path specified. This path refers to key presses required to reach that menu from the 'Top Menu'

Soft Keys

The keypad has six soft keys which are labeled with an arrow. The function of these keys change depending on the menu you are currently in. Some menus will have need for only a few keys and others will use all of them. The remainder of the keys are dedicated to specific tasks and are called hard keys. The function of the hard keys is as follows:

Hard Keys

Learn	The learn key when pressed jumps to the product learn menu.
Product	This key toggles stored product settings. Each press of the key scrolls to the next stored product.
Function	This is a user defined key and its function can be selected from a list of options.
Test	Initiates the QA test routine menu.
Alarm Reset	Can be configured to reset a reject alarm when using the latch reject output option.
Exit	Use this key when you wish to leave a menu, and return to the "top" menu.

How To Edit Options

When editing an option that requires changing a number use the soft keys above the arrows to move the cursor to the digit you which to edit. Then use the soft keys below the plus / minus keys to change the value of the number. Once you have set the correct value press the arrow under ' ***Accept*** ' . This will change the value to the new number. Then press the ' ***Exit*** ' key to leave that menu.

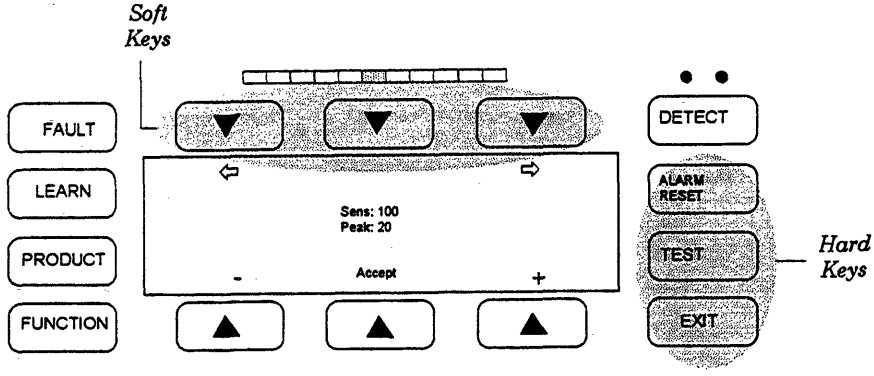


Figure 24

Item	Function
+	Increases number, or letter
-	Decreases number, or letter
⇦	Moves cursor to left
⇨	Moves cursor to right
Accept	Enters or accepts the new value

Initial Setup

This manual describes only the features which can be used in Pipeline Applications. The following *must be set* in order for the detector to function properly:

- The application type (pipeline)
- Reject timing
- Product compensation
- Sensitivity

All other settings are optional and will vary depending on the requirements of the user.

Important

In most applications, the metal detector parameters will already be set prior to shipment. If supplied as a system the reject timing will also be set to the correct values. After installation and power up check the operation of the metal detector and any reject system and adjust as required.

Most 'dry' product applications (see Product Compensation pg. 29) will not require a product compensation adjustment. For most 'wet' product applications custom product compensation will be required. Always check and record factory settings before making changes. If changes are required use the copy product function to create a new product and perform custom settings under this record. This way the metal detector can be returned to factory settings under product 1.

Password

The metal detector is supplied with password protection turned 'off'. However, password protection should be enabled and custom passwords established to prevent unauthorized changes to the metal detector settings (see Password pg. 34).

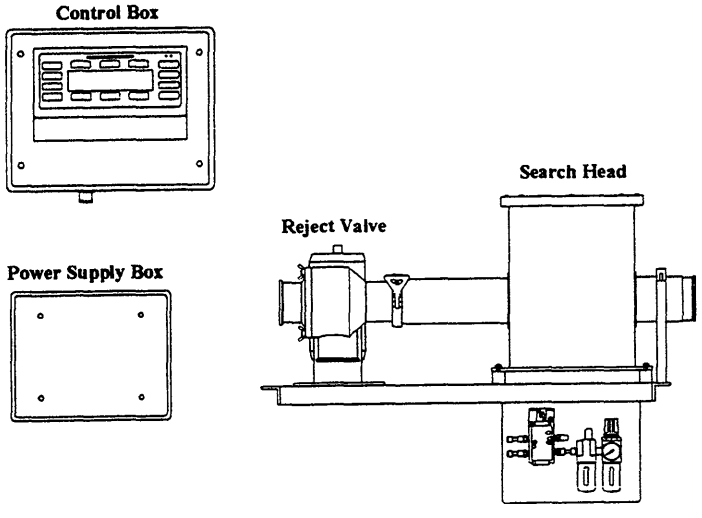


Figure 25

Application

Path: Setup/Application

There are six application types available:

Conveyor
Gravity
Tablet
➔ **Pipe**
Web
Custom

This manual refers only to **pipeline** type applications.

Pipeline applications assumes that the product is a slurry or liquid being pumped through the detector. The detector optimizes a number of parameters based on this knowledge.

NOTE: Check to make sure that application type is set to pipeline and edit if necessary.

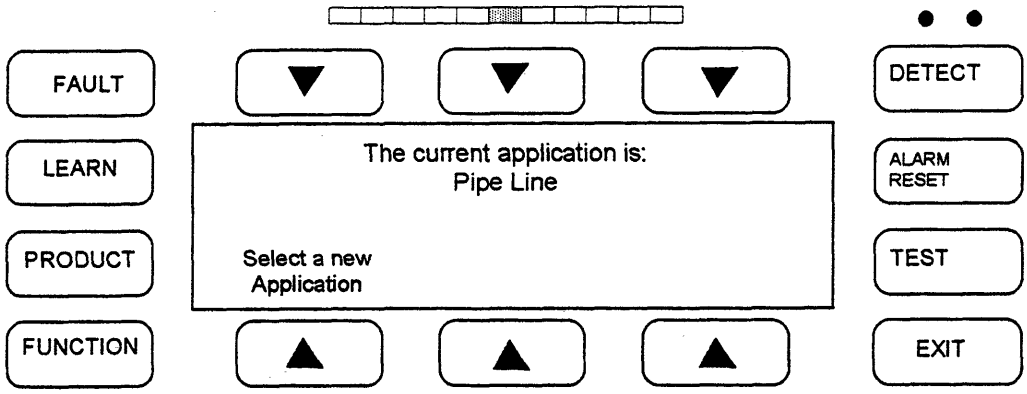


Figure 26

Reject

Path: Rejects

For pipeline applications many of the reject options available are not used (photo reject, etc.). This manual will describe only those features which apply to pipeline applications.

Clear Reject Counter

This button clears the reject counter displayed on the top menu. Press to reset to '0'.

Test Reject

This button when pressed will activate the reject output. This is used to test the action of the reject device. This will not inhibit normal occurring rejects and the test function will return to normal when leaving this menu (Exit).

Setup Timing/Basic Setup

Pipeline application will set default Delay and Duration parameters (Delay = 0, Duration = 3.00 seconds). These are typically acceptable for pipeline applications. The reject timing should be tested and established upon initial installation and parameters adjusted if necessary.

Delay

The reject delay time is the time delay between a detection and the activation of the reject device. This menu is used to change that time delay. Use the *Plus* and *Minus* keys to change the value. Test the change, then press *Accept* to accept this value or Exit to restore the old value.

Duration

The reject duration is the length of time for which the reject device is activated after a detection has occurred. Use the *Plus* and *Minus* keys to change the value. Test the change then press *Accept* to accept this value or Exit to restore old value. For pipeline applications the duration must be set excessively high. This is due to the fact that the product flow speed cannot be accurately measured and will vary continuously. Therefore, long duration times should be used as a safety measure.

Learn (Reject)

This menu can be used to do a one-step reject timing calibration. This is not practical for pipeline applications because the test sample cannot be seen or viewed within the pipe.

Reject-Special

The following functions are not normally required but are available for special applications:

Reject Mode

Normal

Normal is for normal reject applications.

Latch

This can be used to latch the reject relay output, for example with a reject alarm system. The reset will be done by the alarm reset hard key.

Disable

This inhibits the reject output. WARNING: This will render the detection system inoperable.

Reject Confirm

Reject confirm will require external hardware which may not be installed on your system. Contact Goring Kerr for assistance.

This option permits the reject device response to be automatically monitored by the detector. Select from the following options:

- No reject confirm
- One sensor
- Two sensors (this option monitors both strokes of the reject device)
- Polarity (inverts the polarity of the incoming signal)
- Confirm time (adjusts the reject confirm signal window)
- Learn (this allows the detector to automatically learn the reject response time)

Reject Confirm Setup

One Sensor

The reject confirm system continuously monitors the signal reflected back from the reject device generated by a reject confirm switch. The time delay between the initiation of a rejection signal and the returned confirmation signal is monitored to confirm that the reject device operated within a prescribed time period. Once the wiring of the switch has been completed, from reject confirm menu (Path: Rejects/Setup Timing/Special/Reject Confirm) press the Test button to enter the switch test menu. Press Test Reject and make sure the sensor state changes when the reject device is activated. It may be necessary to hold the test button down for 1 to 2 seconds to actually see the state change. If this is true, the signal is reaching the DSP control. Press Exit to get back to the reject confirm window; press the Learn soft key and follow the on-screen instructions. This process will train the system so that the normal response time for the reject confirm signal is established. This can be manually adjusted if necessary using the Confirm Time soft key and the Reject Confirm menu.

Two Sensors

The system can be configured to monitor not only the reject response time, but also the time taken to return to normal position. This option will require that two sensors be used in such a way that both strokes of the reject can be monitored. Contact Goring Kerr for assistance in using this feature.

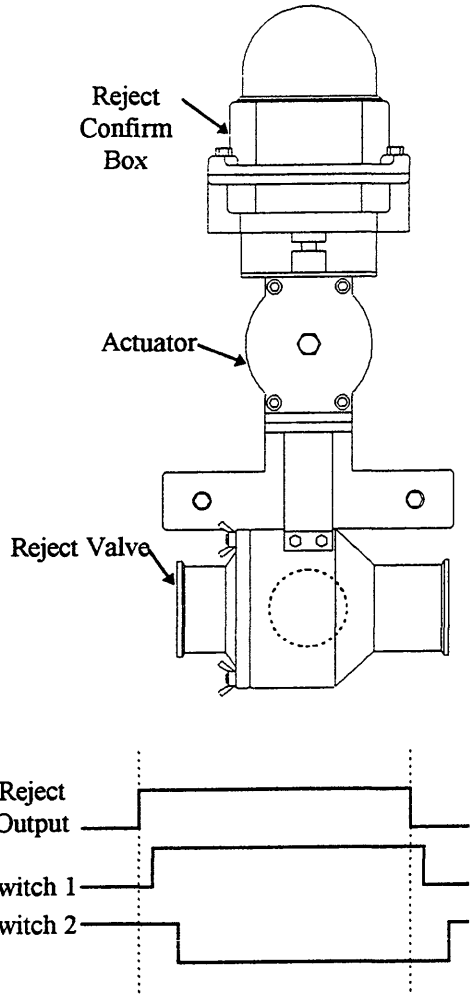


Figure 26

Suppression

This feature is designed to reduce false triggering caused by the action of the reject device.

Product Compensation

Metal detectors are capable of detecting metal by measuring two characteristics:

Conductivity: (Wet)

Any conductive material will generate a specific error signal. However, many food products by nature are electrically conductive themselves. Salt and moisture content combine to produce conductive product effect which must be overcome in order to detect small metal contaminants.

Magnetic: Permeability: (Dry)

Any material passing through the detector which has magnetic qualities will generate a signal which must be overcome in order to detect small contaminants. Products which contain iron fortification can produce magnetic error signal. For gravity applications most products are considered 'Dry'.

The DSP metal detector overcomes these product effects by automatically adjusting itself to compensate for the specific 'phase' of the error signal.

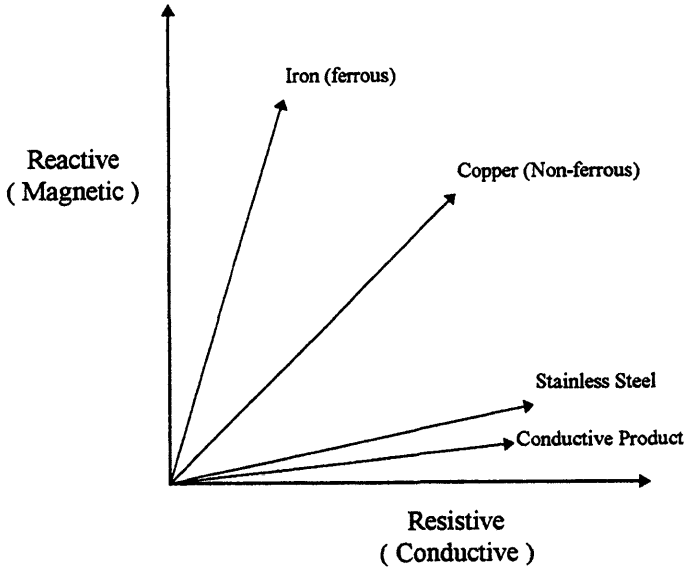


Figure 27

Typical 'Wet' products:

- Bread, buns, cakes
- Meat, poultry (fresh)
- Dairy products
- Fresh produce
- Most pumped slurries or liquids

Typical 'Dry' products:

- Cookies, candy, chocolate
- Dry powders
- Oil based products (peanut butter)
- Cereals

Definition of Terms

hase	Refers to the phase vector of the product signal.
Mode	Groups the phase vectors into wet (near 0°) and dry (near 90°)
Residual	Product effect that cannot be eliminated with phase compensation. This feature requires the installation of a photo eye and can only be used with discrete products. This feature is not used in pipeline applications.
Fixed	Any feature which is fixed will not be automatically updated.
Auto	Any feature in auto will be automatically updated. This feature requires the installation of a photo eye and can only be used with discrete products. This feature is not used in pipeline applications.
Hold	This will maintain the entered parameter and will not be included during a 'product learn'. For example, if sensitivity is on -hold the sensitivity setting will not be included during a 'product learn'.
Head Gain	Selects a high or low gain setting.
Thresholds	The system maintains two independent thresholds: the conductive threshold and the magnetic threshold. These thresholds depend on external factors such as the installation environment and the type of product being inspected. This menu is used to set these thresholds. The standard threshold values are 100 for both. This should be fine for most installations.
Sensitivity	This adjusts or sets the sensitivity of the detector. A higher sensitivity number means the detector will detect a smaller piece of metal.
Learn Path	The learn path is displayed when the learn hard key is pressed. The features which will be included in the learn path will be marked with a box beside them. Any feature that is 'off' or 'on hold' will not be included in the learn process.

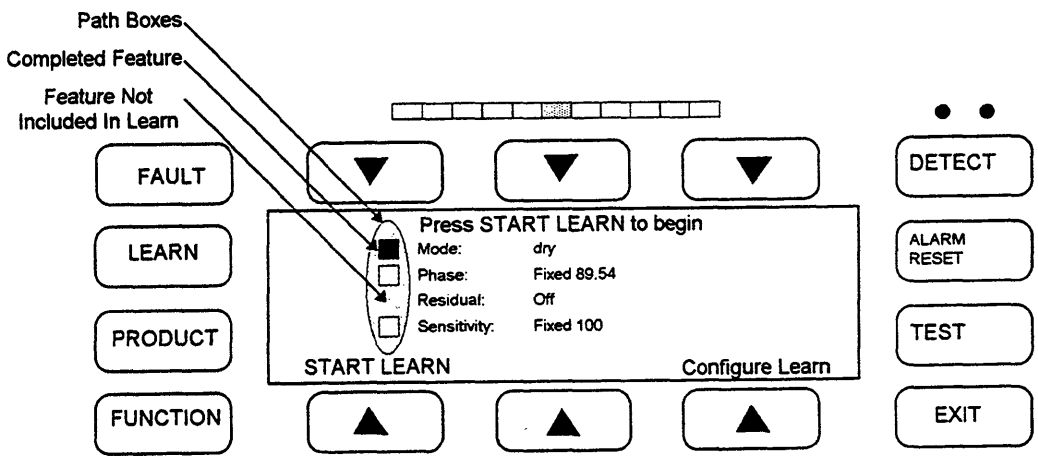


Figure 28

Learning the Product

In most pipeline applications, the product is considered wet and will produce a conductive product effect. In these cases, product compensation is required and the phase point will be at or near 0°. To determine whether the product effect can be learned automatically, check the state of the green product light (the left LED above the detect light). With product running, the product light should be turning green occasionally. If this is true the product effect can be learned. If the product light does not come on while running product through the pipe, the detector will be unable to assign a phase point. In this case, a standard phase point of 0° is recommended. Please note that the detector, when supplied as part of a pipeline system, will already be calibrated for a typical wet product.

If the product is turning on the product light, and then the Learn hard key, press the Start Learn button. When the detector has gathered enough product information the cursor next to Phase will become a solid block and a fixed phase point appears; this should be at or near 0°. By default the detector will also learn sensitivity which can be used based on the signals present during the learn process. After the learn is complete, the detector sensitivity must be tested to ensure that test samples are detectable.

Special

Head Gain

Head gain selects high or low gain setting. High gain should be used in all applications unless the product effect is too high an turns on the red (high) Product Light. In pipeline applications, it is normally not necessary to use the low gain setting. Whenever the head gain is changed it will affect the overall sensitivity of the detector and therefore the sensitivity should be tested and recalibrated if necessary.

Thresholds

The system maintains two independent thresholds: the conductive threshold and the magnetic threshold. The correct value of these thresholds depends on external factors such as the installation environment and the type of product being inspected. This menu is used to set these thresholds. The standard threshold values are 100 for both conductive and magnetic (R, X) and these values are usually acceptable for pipeline applications.

Phase Special

Phase Limits

Phase limits are not used in pipeline applications.

Trigger

Trigger is not used in pipeline applications.

Phase Angle

This allows for manual adjustment of the Phase Point.

Sensitivity

Path: Sensitivity

This menu sets the sensitivity number that the detector will use. Increasing the number results in higher sensitivity, therefore detecting smaller particles of metal. Manually adjust the sensitivity using the + and - keys. Press *Accept* to enter the new value. Range 0-1000.

Note: Coarse adjustment can be achieved by moving the cursor to the desired digit and adjusting that digit.

WARNING: Any adjustment made to the sensitivity setting should be followed by a thorough test of the detector's operation using the required test samples.

Peak Signal

The peak signal is always displayed with the sensitivity number and it shows the relative value of any signal which the detector receives. When the peak signal exceeds 100, the detection threshold is tripped and will result in a reject signal. (if the detection mode is narrow zone, a higher peak - 120-140 - may be required before a rejection will occur - see - detect mode below).

The peak number should be used as a guide to assist in determining the sensitivity setting. Assuming any product effect has been compensated, the peak number will display the current background signal. This should be kept below 50-60 for reliable operation. Adjusting the sensitivity will scale the peak number also.

Example: If peak = 100
Sensitivity = 200 Changing sensitivity to '100' will scale the peak to '50'

Ideally the sensitivity should be set so that the background signal peak is 50 or below and the signal from the test sample(s) is 150 or greater.

Sensitivity - Special

Detect Mode

Narrow Zone

Under this mode, a detection will occur only if the signal from the entrance coil and exit coil (positive & negative) both exceed the threshold set by the sensitivity number.

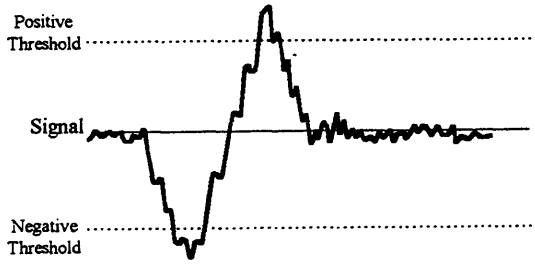


Figure 29

Amplitude

Under Amplitude, if either polarity (positive or negative) cross a threshold the detection will occur.
Amplitude is usually more sensitive than narrow zone and should be used if in doubt. Narrow zone can improve immunity to external interference in some circumstances.

Fixed

Selecting fixed will include sensitivity and the Product Learn path.

Hold

Hold will remove sensitivity from the Product Learn path.

Learn

Learn initiates an Automatic Sensitivity Learn. This learn will take approximately 15 - 20 seconds. During this period the detector will calculate an optimum safe sensitivity. This can then be manually adjusted if required.

Product Library

Path: Product (Hard Key)/Product Library

Individual product records which can store information such as sensitivity settings, reject parameters, etc. can be created. Since most parameters will be shared by all the products it is preferable to set one product record completely including all the reject parameters and then copy this product to a new product number. Then any individual parameter can be adjusted for this specific record.

Copy

This menu allows you to copy from the currently running product to a new product number. Press the Plus or Minus keys to select the new product number, then press copy. The menu will change to Edit Product Name. Press the Plus and Minus keys to select the first character in the desired name (range A-Z and 0-9). Use the cursor left or right keys to move to the desired character slot and repeat this process until the desired name is complete. Press *Accept* when name is complete. You have now copied all the parameters from the running product to the new product memory position. If you wish to run the new product, press and release the Product hard key until the desired product name and number appears. Then press the Run It option. Now you can edit or modify the desired parameters such as sensitivity etc. for that specific product record. It is always advisable to make a backup copy even if only one product record is required.

Delete

This allows individual product records to be deleted. Press Plus and/or Minus to select the desired record to be erased and then press Delete.

NOTE:

- The Prime Product 1 cannot be deleted.
- The running product cannot be deleted.

Edit Name

This menu allows you to edit the name of the current running product.

Erase All Products

This menu allows you to erase the detector's entire memory.

WARNING: All learned and programmed parameters will be erased.

Product Selection

Selection of a new product from the already stored product records is achieved by pressing the Product hard key. Press and release until the desired product appears then select Run It. That product record will now be loaded and will become the running product.

Password

Path: Setup/Password

The system has three levels of user passwords. Level 3 is the highest access level.

Most common functions can be assigned a specific password level. This allows the user to design their own password structure. Typically, low level functions such as Select Product, etc. would be assigned a level 0 (no protection) or level 1 password protection. More critical functions such as sensitivity should be protected at a higher level.

NOTE: By default, password protection is Off, which would mean no menus are protected. It is recommended that custom passwords be established, and password protection be turned on.

Default Passwords

Default passwords are as follows: *Level 1* - AAAA *Level 2* - BAAA *Level 3* - CAAA

On

This option turns on the Password Protection and will require level 3 access.

Off

This disables Password Protection and will require level 3 access.

Category

This lists the functions which can be assigned a password level by the user. Use the cursor arrows to select the feature you wish to edit, press Plus or Minus to change the level (range 0-3) and press *Accept* to complete the edit.

The following features can be assigned passwords:

Select product	Learn All	QA test	Special menus
Set Sensitivity	Set application	Reject setup	Function Key
Clear rejects	Alarm key	Configure learn	Erase Products

Edit Passwords

This allows the user to define custom passwords for each level and requires level 3 access. Select the level to be edited, press the Plus and Minus keys and cursor arrows to define your new password. Only alphabetical characters can be chosen.

Log Out

Log Out tells the detector that you are leaving and therefore reinitiates Password Protection.

Using Passwords

When password protection is enabled any function which is protected will be visible to any user but cannot be edited unless the password to the correct level is entered. The unit will request the password at the initiation of an edit attempt. Once you have entered the password you may continue with the edit function. When you have completed the changes required, if you wish to reinitiate password protection you must log out. This can be done from the top display, select Log Out.

Forgot Your Password?

If the incorrect password is entered when requested, by pressing Forgot the Password, seed numbers will be displayed for the three password levels. By contacting Goring Kerr with these seed numbers, we can decipher your password. Be prepared to produce evidence of your authority.

Special Functions

Path: Setup/Special

The menus under special should only be set and adjusted after reading the pertinent section of this manual.

Language

Select from English, French and Spanish. When French or Spanish is selected, only commonly used menus will be displayed in that language, all others will remain in English.

Input/Outputs

This menu sets and checks the condition of various inputs and outputs of the detector.

Inputs

This allows you to view the state of the following inputs:

Photo eye (infeed P.E.) - not applicable to pipeline applications.
Reject confirm 1
Reject confirm 2
Shaft encoder - not applicable to pipeline applications.

Infeed Photo eye polarity can be changed in this menu. Reject confirm and shaft encoder are not changeable.

Output

The state of the reject and fault outputs can be monitored. The polarity of the reject output can be inverted from this menu. The fault output cannot be inverted due to its fail-safe nature.

Function Key

From this menu, the user can select which function will occur when the Function hard key is pressed. Select either Scope or Reject Test. This will assign the selected option to the function key.

I/O 2

From this menu, the function of I/O 2 in the power supply/terminal box can be chosen. Pipeline systems normally use I/O2 as the reject output. **Note**: The reject solenoid on the standard system is 12 VDC. Select from:

Reject sensor 2 (reject confirm 2)
Auxiliary reject (second reject output)
External suppression
Password key lock (external key switch password access)
Unused

Note: The correct device type must be installed for any of the above functions to work. Contact Goring Kerr for assistance.

Fault Configure

From this menu the following functions can be accessed:

Reboot (will reset the processor)
Frequency (displays the frequency of the control panel)
Configure fault
Fault

Configure Fault/Excess Reject

Configure fault is used to set the parameters for the fault source called excess reject. Excess reject monitors the number of rejections occurring within a window. The window is either a timed function or when the unit has a photo eye, a function of the number of products. For example, if excess reject is set to 10 rejects within 5 minutes, and if that number of reject ever occurs within the specified period, a fault will occur. Be sure to check under fault to see that excess reject is listed as "OK".

Faults

This menu displays a list of fault sources and their current state. The fault sources are as follows:

Search head	Photo reject
R.F. Board	EMU reject
Reject confirm	QA test response
Battery low	QA test result
Product memory	Excess reject
Photo eye	Phase limits

Only those listed in the right hand side column can be edited to "ignore" the fault source. When listed as "ignore" this fault source will not be monitored by the unit. If you wish to change the state of these fault sources use the select key to move the cursor to the fault source and then the Ignore/Monitor key to change the monitoring state.

Refer to the Fault Finding section of this manual for help in troubleshooting fault conditions, and descriptions of the above fault sources.

DSP Net

This menu is used to set communication identification and protocol for use with a Goring Kerr DSP Net communication system. Each detector connected to a communications network must have an individual ID number. Press DSP ID to edit the detectors identification number.

Communication protocol for DSP Net should be set to RS485. This can be changed to RS232 for local communication. Contact Goring Kerr for assistance.

Clear Peak Control

This menu selects the source that will clear the peak signal indicated in the sensitivity menu. For pipeline applications only Threshold Trip should be selected.

Filter/Sample Rate

Under this menu the filter size and the sample rate can be monitored. Neither of these functions should be changed under normal conditions. For pipeline applications the filter state should be Off due to the unpredictable product speed.

The sample rate is a number which represents the rate at which the DSP is sampling the incoming analog signal. The detector selects this sample rate automatically when you program the application. For pipeline applications this number must be 62.

Also when the application is programmed, the detector determines the optimum filter it should use for the speed which you have programmed. It will select from a list of four defined filters, DNR1 through DNR4. For pipeline applications, the correct filter state is Off.

Status

Path: Status

This menu displays a summary of the important parameters which have been set.

SYSTEM

This shows the type of applications (pipeline, etc.), the filter type, the current sample rate (SR), and if a photo eye is present.

PHASE

This displays the current phase point, the phase state (auto, fixed), the mode and the state of residual compensation.

GAIN

This shows the state of the gain, the R and X thresholds and the current sensitivity.

REJECT

This displays the current delay/duration of the reject system.

PASSWORD

This displays the current state and level of password protection and the QA Test state.

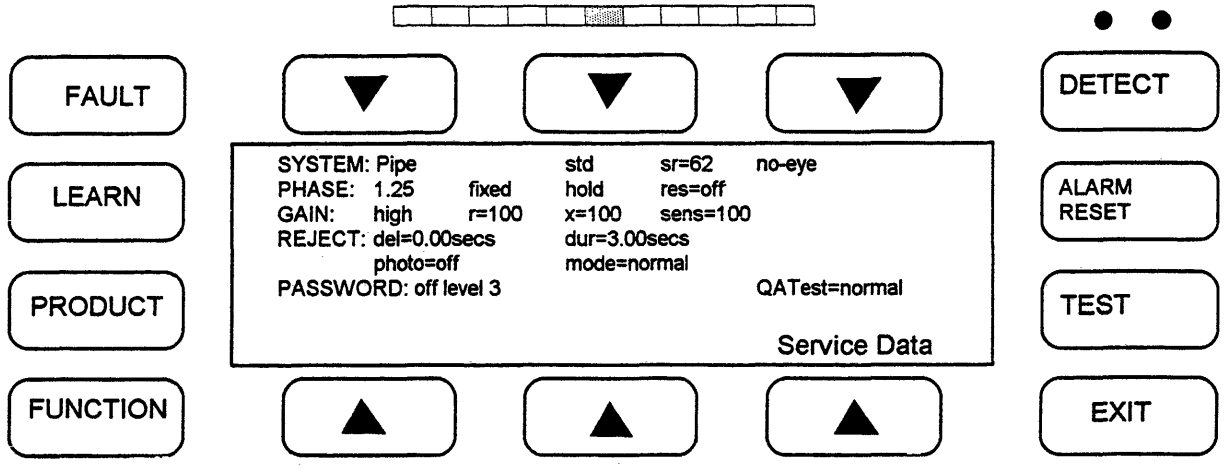


Figure 29

Service Data

This menu displays service and troubleshooting information.

FREQUENCY

This displays the frequency of the control panel. Example: 300Khz.

LEVELS

This represents a volt meter display of the search head signals. Three signals can be monitored here, the balance, the oscillator reference signal A, and oscillator reference signal B. Refer to the Fault Finding section of this manual.

VERSION

This displays the version of software this panel is using. The version number should match the version number on the front of this manual.

SCOPE

The scope display can be used to show various wave forms. Refer to the Fault Finding section in this manual.

QA TEST

The Test hard key can be used to access a QA test menu. This can be configured to record QA test occurrences separately from normal rejects, etc. The system can also be configured to request that the unit be tested. In this mode an interval is set, for example 4 hours. When the interval has expired the test key light will turn on and the unit will expect to be tested. An operator would then press the test key entering the test mode and perform a prescribed test routine. For example: this may require 10 detections of a certain peak signal to be considered a valid test. Once the test is complete and passed, the test interval will be reset. At the end of the next interval the test key light will turn on requesting another test routine.

While in QA Test all rejects will be recorded separately for use with DSP Net files. Also, the detector will still function and reject contaminant metal.

Normal mode

This button returns the unit to its normal inspection mode.

Test Mode

This initiates a test mode.

Clear Peak

This key resets the peak signal indication.

Setup

Setup provides access to configure a QA test routine.

Peak Limit

This number represents the maximum peak signal considered valid during a QA test. This is so that an invalid test sample, a coin for example, cannot be used during a test. If the peak signal is exceeded the unit will not accept it as a valid sample. The peak limit should be set above the peak signal generated by the specified test samples. For example: if the test sample you are required to detect generates a typical peak signal of 200-250, the peak signal limit should be set at 300-350.

Interval

This is the number of hours required between test requests. For example, if set to four hours, the unit will request a test after every four hour period.

Required Detections

This is the number of valid detections which must occur during a QA test to reach a successful completion of the test.

Fault Finding

If the detector senses a system fault the fault LED will turn on, the fault relay will change state and a fault message will be displayed at the top menu. Press the fault button display to access a description of the fault. If there is more than one fault, press next fault to view the next fault description. The following is a description of the type and source of faults which can occur:

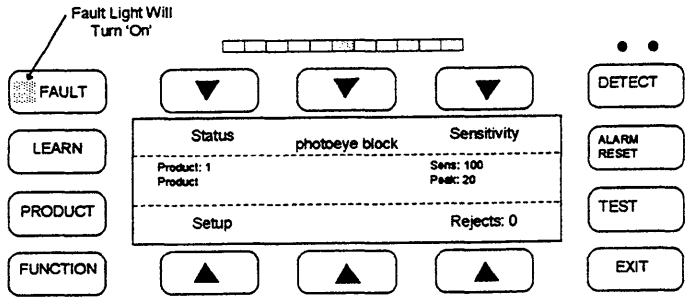


Figure 30

Search head Fault

Search head fault can occur for the following common reasons:

Search head cable connection has been broken.

Examine the cable connections at both ends to make sure that all wires are connected correctly. Refer to the Installation Section for assistance.

The oscillator reference levels may be out of range.

The oscillator references can be measured by the detector under status/service data. Reference A and reference B should both be within the following range: 100 +/- 20.

Search head balance may be out of range.

Again, this may be monitored using the volt meter feature under service data. The balance number displayed should be below 200.

Contact Goring Kerr for further assistance in troubleshooting.

RF Board Fault

This fault is a result of the RF board not responding to DSP requests. Common causes: 24 volt supply has failed-check the 24 volt fuse in the power supply (F7); or control panel failure. Cycling power may clear the fault.

Reject Confirm Fault

This fault results when reject confirm has been enabled and the confirmation signal has failed to return within the prescribed time period. This could be a result of reject device failure, a slow reject action, or reject confirm device (switch, etc.) failure. Check the reject device action, make sure the reject confirm switch is operating properly. It may be necessary to adjust the reject confirm time window -Path: Rejects/Setup/Special/Reject Confirm/Confirm Time.

Battery Low Fault

This indicates that the battery which is powering the memory when power is off is excessively low. Battery voltage can be checked in the control panel and the battery and/or control panel maybe be replaced. This does not affect the unit operation as long as power is maintained. (Battery voltage > 3.0 volts)

Product Memory Fault

This indicates that the product memory has been lost or damaged. Low battery condition could cause the memory to be lost when the unit is not powered. In applications where the detector has been subjected to high static discharges or lightning, the memory may have been corrupted. It will be necessary to erase memory (Path: Setup/Product Library/Erase All Products). Prior to erasing memory it may still be possible to record critical settings such as the application parameters, sensitivity, reject settings, etc.

Photo Reject Fault

Note: This option is not used with Pipeline systems.

Shaft Encoder Fault (EMU Fault)

Note: This option is not used with Pipeline systems.

QA Test Response Fault

This fault will occur if the QA test request light has been ignored and the interval timer has expired. Performing a QA test will clear the fault.

QA Test Result Fault

This fault will occur if during a QA test the required number of detections of the specific peak size did not occur. Enter QA test mode and repeat the test to achieve the required number of detections.

Excess Reject Fault

This fault will occur only if the excess reject fault has been turned on and the excess reject parameters programmed. The fault indicates that an excessive amount of rejects have occurred within the specified time window. To clear the fault, press the Clear Fault soft key. Please note that the fault may have been caused by excessive contamination in the product. The rejected product should be examined to confirm this and appropriate action should be taken.

Phase Limit Fault

This fault will occur if a phase limit has been reached during a learn phase or automatic phase period. This may be caused by contaminated product, metal in the belt, etc. If necessary, check and adjust the phase limits.

Photo Eye Block Fault

Note: This option is not used with Pipeline systems.

24 Volt Fault

This fault indicates that the 24 volt supply has failed and therefore the unit is inoperable. Check power supply fuse F7 and LED LD7.

Recommended Testing Procedures

A complete and thorough test of the metal detector system must be done upon initial installation and whenever a major component of the system has been changed or altered (i.e. reject device repair, etc.). A complete check of the metal detector must include the reject device. Any test procedure designed for your application should take into account the following:

1. The metal detector's least sensitive point in the aperture is along the center line of the opening. Any testing should be done so that the test sample passes approximately through the center line of the opening. If the test sample is run at the side of the product tube or between the product tube and the detector, this will produce a larger signal than through the center line.

2. Sensitivity capabilities of different detectors used in different applications will vary. A smaller aperture is capable of detecting smaller pieces of metal. Product effect may also interfere with the detection capability. It is dangerous to rely on a corporate standard to determine and test the detector's operation. Ideally, each detector should have it's own standards of operation and a corporate outline should be used only as a maximum allowable guide. Sample sizes should be selected so that they are clearly detectable (peak signal size of 150 - 250) when compared to the signal produced by the product or other interfering signals. If samples are established which are very close to the product signal, frustration on the part of operators can lead to a lack of confidence in the detector's operation.

3. The detector should be tested at its normal operating speed. Test pieces should be inserted so that they travel through the detectors at the product's normal rate of flow. This ensures that the detector and reject device responses are accurately tested.

4. The detector is not equally sensitive to all types of metal. Depending on the type of product and application, there can be three typical metal groups which will produce three different levels of detection:

Ferrous	-	any magnetic metal and is typically the easiest metal to detect
Non Ferrous	-	any good electrical conducting metal such as aluminum, copper, brass, etc.
Stainless Steel	-	the 300 series stainless steels which are non-magnetic, these tend to be the most difficult metals to detect

If a single test sample is to be used for regular testing, it should be a stainless steel sample. This will ensure that other metal types will be detected to this same level or better (smaller).

5. Test samples used should contain spherical metal contaminants. Any other shape will produce a different size signal depending on it's orientation as it passes through the detector. This can lead to inconsistent results.

6. Any test procedure established must allow for the test product to be completely rejected by the reject device. The reject device will tend to be the most likely point of failure in any detector system.

7. For pipeline applications, care must be taken so that if the detector or reject device fail to operate correctly, the test sample can still be recovered. This can be achieved by the use of a second valve or a removable catch grid which can operate as a fail-safe device, catching the test sample and allowing product to flow through. Contact Goring Kerr for assistance.

Testing Schedule

How often the detector should be tested must be decided by the user. If the test procedure can be designed to be simple it will help ensure that the test will be performed more frequently. As a guide it must be decided how much product would have to be put on hold for re-inspection if a detector fails the test. Typically the minimum frequency is once per shift while other applications require hourly tests be performed.

Record Keeping

All detector tests should be documented. If faced with a consumer complaint or litigation a complete record of test results and procedures will be very useful.

METAL DETECTOR TEST SHEET

	SHIFT 1			SHIFT 2			SHIFT 3		
LINE : 15	PERIOD 1	PERIOD 2	PERIOD 3	PERIOD 1	PERIOD 2	PERIOD 3	PERIOD 1	PERIOD 2	PERIOD 3
DATE : 96/08/08	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
NOTES /ACTION									

Figure 31

Rejected Product Examination

If possible, product which has been rejected by the detector during production should be examined to establish the source and type of contamination. This may lead to an improvement in the process equipment upstream from the detector. It is also useful to display these contaminants so that all employees can see the benefit of the metal detector.

Automatic Record Keeping

To simplify test record keeping, the use of a computer communications system called DSP Net is recommended. This system will automatically record all events occurring at the detector including when the test was performed, and its success or failure. This record is kept for each individual detector connected to the network and can be viewed, stored or printed at the host computer. Contact Goring Kerr for information about this product.

QA Test Request

This detector can be configured to request a test procedure be performed at given intervals. Refer to the section in this manual called QA Test Request on Page 35.

Assistance

If you require any further assistance in establishing the test procedure, test samples, or test recording, please contact Goring Kerr.

DSP 2 Calibration Record

Company :_____ Date :_____

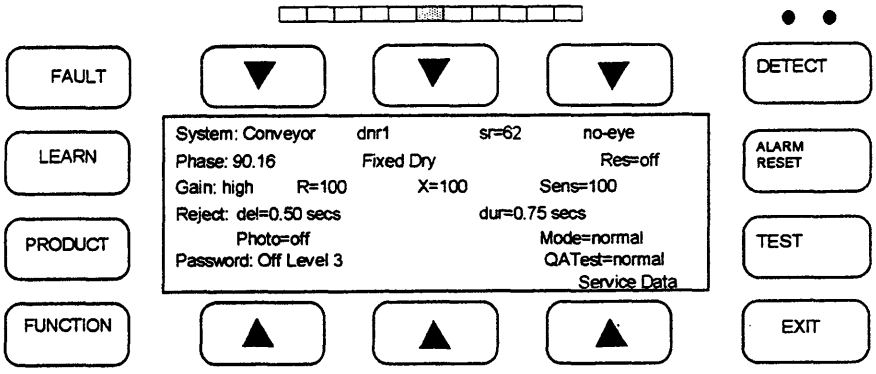
Location :_____ Serial Number :_____

Aperture Size :____Wide by ____High

Line :_____

Product name:_____ Number :_____

Status Screen



System:_____ dnr:_____ sr:_____ eye:_____

Phase:_____ Fixed / Auto / Hold Mode: Wet / Dry / Hold Res: Off / Auto / Fixed / Hold

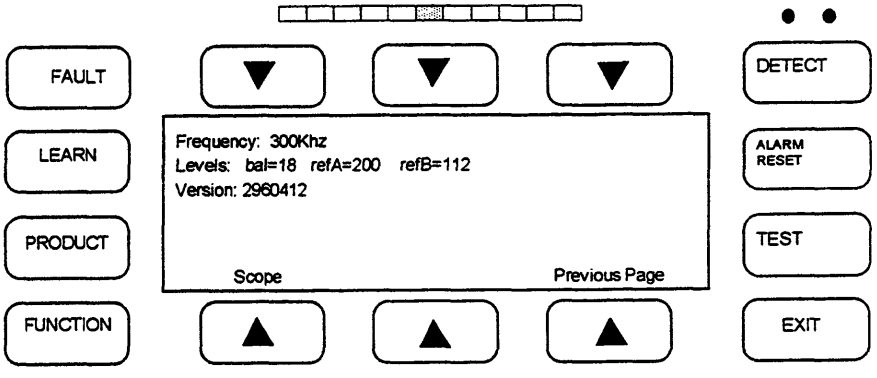
Gain: _____ R=_____ X=_____ Sens= _____

Reject: del= _____ dur=_____

Photo= _____ Mode=_____

Password:_____ QaTest=_____

Service Data Screen



Frequency :_____

Levels: bal=____ refA=_____ refB=_____

Version :_____

Misc. Data

Phase Mode :_____ (Path: Setup/Configure Learn/Mode)

Reject Check :_____ (Path: Setup/Reject/Special/Rej Confirm Senors)

Eye Distance :_____ (Path: Setup/Application)

Belt Speed :_____ (Path: Setup/Application)

Detect Mode :_____ (Path: Setup/Configure Learn/Sensitivity)

Sensitivity : (Path: Setup/Configure Learn/Sensitivity)

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Service Repair and Replacement Parts

This chapter provides information about service, repair, and replacement parts for your *Thermo Scientific* product. It includes the telephone numbers for various departments at *Thermo Scientific*, the procedure for ordering replacement parts, a Return Material Authorization Form, and the parts list for the product are also included in this chapter.

The maintenance information in this manual is designed to meet your service needs. If you should encounter a problem that requires technical assistance, you may call *Thermo Product Service* at (800) 227-8891.

Thermo Scientific also provides on-site service technicians to assist customers with installation, setup, initial calibration, customer training, maintenance, and repair. Contact the *Thermo Scientific Field Service* department at the number given below for current rates and scheduling.

Thermo Scientific has repair centers located at the plant in Minneapolis, Minnesota. Products that need system checkout or repair can be returned to the plant with the Return Material Authorization (RMA) Form or the Foreign Customer Repair Authorization form. Contact our Repair and Return department (800) 227-8891 to get an RMA number to use on the form.

Note: Have your machine model number and serial number available when you call.

Main Switchboard	(800) 227-8891
FAX	(763) 783-2525
Service	(800) 227-8891
Return Material Authorization & Repair	(800) 227-8891

24 x 7 phone support

Or any local *Thermo Scientific* office.

ThermoFisher SCIENTIFIC

501 90th Avenue N.W.
Minneapolis MN 800-227-8891

Return Material Authorization
RMA -

(This RMA Number Must Be Marked On All Paperwork And On Outside Of Package)

Req'd. By: _____

Date: _____

Customer Contact: _____

Phone: ( ) _____
Area Code

Return, Freight Prepaid To:
Thermo Fisher Scientific
501 90th Avenue N.W.
Minneapolis, MN 55433

Bill To Customer #: _____ Ship To _____

Returned From: Return To:

_____ _____

_____ _____

_____

Description Of Material Being Returned:

_____

_____

Describe Equipment Malfunction Or Defect, If Any; Symptoms:

_____

_____

Minimum Charge

☐ Informed Customer of ☐ Inspection Charge Per Item

Service Requested:

☐ Repair & Return

☐ Return for Credit

☐ Estimate Required P.O. No.: _____

☐ Original P.O. or *Thermo Scientific Scientific* Order No.: _____

☐ Warranty Repair or Replacement Serial No: _____

☐ Return Warranty/Exchange Unit Shipped on *Thermo Scientific* Order No.: _____

☐ Other: _____

Disposition/Comments: (*Thermo Scientific* Internal Use Only)

_____

_____

ThermoFisher SCIENTIFIC

501 90th Avenue NW Minneapolis, MN 55433
(763) 783-2500 Fax (763) 780-1537

Foreign Customer Repair Authorization

Please complete the following regarding equipment that will be returned for repair

Contact Name: Telephone 011-
(country code) (telephone number)

Company Name: _____

Fax011- _____ - _____ E-mail _____
(country code) (fax number)

Billing Address: _____

_____

Purchase Order No.(**required):** _____

Equipment Type: _____ Serial No. _____

Description of problem: _____

Shipping Method (Please check one option):

☐ *Thermo Scientific* sends good direct to customer. *Thermo Scientific* determines shipping method and carrier. Charges will be prepaid by *Thermo Scientific* and customer will be invoiced for charges. Truck and/or air freight will always be utilized unless customer arranges shipment

☐ *Thermo Scientific* sends goods to customer's designated freight forwarder. Charges for inland freight to U.S. port will be prepaid by *Thermo Scientific* and customer will be invoiced for charges.

Shipping Address: _____ Freight forwarder? ☐ Yes ☐ No

_____

_____

_____

Atn: _____ Telephone _____

Copies of shipping documents should be sent to the following individual via e-mail or fax. Originals will be sent to the billing address above via regular mail

Contact Name: _____

Fax 011- _____ - _____ E-mail: _____
(country code) (telephone number)

Important Notice:

Shipment requests will be processed according to this document, which must be fully completed prior to issuance of a Return Material Authorization (RMA) number. Shipping documents will be sent as requested to the individual above upon shipment of goods from *Thermo Scientific*'s plant in Minneapolis, MN. Thereafter, *Thermo Scientific* bears no responsibility for charges associated with customs clearance or warehouse charges due to customer failure to liberate goods from customs.

This completed form should be faxed to: Attn: Customer Service fax (763) 780-1537

Parts Ordering Information

For the fastest service when ordering parts, telephone or FAX the *Thermo Scientific Parts Department* at the numbers given below. Your regional field service representative can also assist you with parts orders.

The recommended procedure for ordering parts is:

Determine the broken or faulty part.

1. Locate the part in the Parts List.
2. Find the part number(s) for the item(s) you need.
3. Before you contact *Thermo Scientific* for your parts, make sure you have the following information:
   - Machine model and serial number
   - Purchase Order number
   - Date Required
   - Preferred shipping method
   - Part number(s), description, and quantity needed.
   - Telephone or FAX:

Thermo Fisher Scientific
Customer Service Department
501 90th Ave. NW
Minneapolis, MN 55433
FAX: (763) 783-2525
Phone: (800) 227-8891
Return Material Authorization and Repair: (800) 227-8891

WARNING. Modifications and repairs should only be performed under supervision of a *Thermo Scientific* Service Engineer and with written consent from *Thermo Scientific*. ▲

Phone/Fax Contacts for *Thermo Scientific* Offices

Argentina
+54 (0) 11 4 334 3827
+54 (0) 11 4 334 9159 fax

Australia
+61 (0) 8 8150-5300
+61 (0) 8 8234-5882 fax

Canada
+1 (905) 888-8808
+1 (905) 888-8828 fax

Chile
+56 (0) 2-335-3388
+56 (0) 2-335-1590 fax

China
+86 (0) 21 5465 7588
+86 (0) 21 6445 7830 fax

France
+33 (0) 1 60 92 48 00
+33 (0) 1 60 92 49 00 fax

Germany
+49 (0) 208-824930
+49 (0) 208-852310 fax

India
+91 (0) 20-4011245
+91 (0) 20-26125739 fax

Italy
+39 02-959514-1
+39 02-953200-15 fax

Malaysia
+60 (0) 3 2300 1626
+60 (0) 3 2300 1636 fax

Mexico
+52 (01) 55 5638 0237
+52 (01) 55 5639 2227 fax

Netherlands
+31 (0) 33-454-9000
+31 (0) 33-454-9009 fax

Poland
+48 (0) 22848 3708 phone and fax

South Africa
+27 (0) 11-609-3101
+27 (0) 11-609-3110 fax

Spain
+34 91-484-5949
+34 91-661-5572 fax

United Kingdom
+44 (0) 1788-820300
+44 (0) 1788-820301 fax

United States
+1 (877) 290-7422
+1 (763) 783-2525 fax

Disposal of Hazardous Waste

Disposal of lithium batteries and soldered printed circuit boards must be in accordance with your local Hazardous Waste Policy.

As an alternative product supplied by *Thermo Scientific* may be returned freight pre-paid, for disposal. Contact the Repair Department for a Return Material Authorization Number before shipping any product for disposal.