

# Installation, Operation and Maintenance Instructions



## **METALARM™ SERIES 3500 QM2 METAL DETECTOR**

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*WORLD AUTHORITY IN ADVANCED TECHNOLOGY FOR MAGNETIC, VIBRATORY and INSPECTION APPLICATIONS*

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# Introduction

Careful attention to the following requirements will assure the most efficient and dependable performance of this equipment.

If there are any questions or comments about the manual, please call Eriez at 814/835-6000 for metal detection assistance.



## **CAUTION**

**Metal Detectors emit electromagnetic fields. Contact the American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio, U.S.A. ([www.acgih.org](http://www.acgih.org)) for additional information.**



## **CAUTION**

**If you use a medical implant or similar device, you must never approach the equipment because your device may malfunction in the electromagnetic field, with consequences up to and including death.**

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# Important Information From Eriez

This information is provided to assemblers and electricians due to the importance of proper methods for wiring of controls. These methods are revised and updated from time to time as Eriez perceives necessary. This information covers distances from various categories of cables and Eriez Metal Detector wiring standards. The cable categories are:

1. AC Power cables
2. DC Distribution (thermocouple, power supplies)
3. Signal and Logic
  - 3a. Analog (low level)
  - 3b. Digital logic

Category 1 cables are to be routed along frame members and panels. Avoid open space hanging.

Category 2 cables are routed as 1 but separate from 1.

Category 3 cables are routed separately from 1 and 2.

Category 3b are to be spaced 2.5 cm (1") from Category 1 for each meter of run.

Category 3a cables are to be spaced 25 cm (10") from category 1 for each meter of run.

Use separate machine entry holes for categories 1, 2 and 3 cables.

When Eriez Metal Detectors are being installed in plants using VFC drives, the following precautions are recommended:

1. Route VFC wiring and Eriez Metal Detector wiring into separate metallic conduits.
2. Separate power sources should be used for VFC drives and Eriez Metal Detectors.
3. The use of a Harmonic Neutralized Constant Voltage Transformer for the Eriez Metal Detector power is recommended. Use separate conduits for in and out wiring.
4. Twist AC common circuit run wires together to minimize electromagnetic field interference.
5. Follow cable category separations as detailed above.

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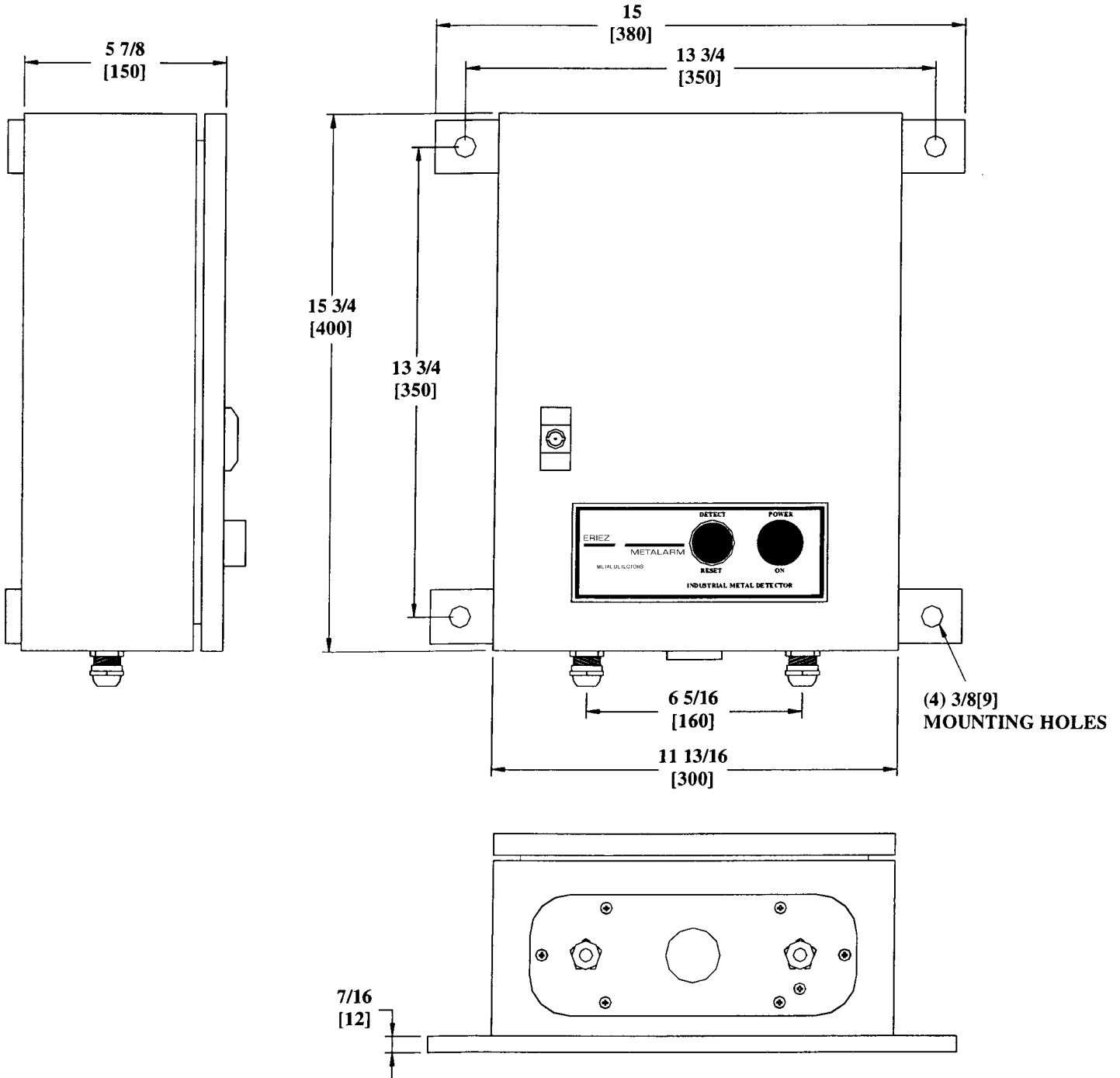


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# Description

The Metalarm 3500QM2 Metal Detector consists of a control unit, one or more sensor coils dependent upon the application, sensor coil for clip detection (belt splice detection), and optional accessories such as the sack dropper.



**FIGURE 1**  
Control unit dimensions

# Installation

## CONTROL UNIT MOUNTING

The Metalarm 3500 control unit is supplied with four mounting brackets for wall mounting. The dimensions are shown in Figure 1. The control unit must be mounted in a location with low amounts of vibration, if the area exhibits a high level of vibration, independent mounting of the control enclosure must be implemented. Shock mounts for the control enclosure may be another consideration, based on the severity of the installation.

Ideally the control unit should be mounted within 10-15' (3-5 meters) of the sensor coil unit and no more than 100' (30 meters). The expected sensitivities may be affected with the longer cable lengths.

The Metalarm 3500 control unit will normally be mounted by means of four 5/16" or M8 bolts utilizing the four mounting holes.

Adequate clearance must be allowed below the control unit enclosure to allow for cable entry and exit.

**NOTE:** Do not replace the HDPE mounting bars, as these are provided to electrically isolate the control unit from the metal conveyor framework. Similarly no metal work should be in contact with the metal control unit case after mounting on the conveyor.

Failure to comply with the above mounting procedures will invalidate the 'CE' certificate covering the EMC regulations.

## SEARCH COIL MOUNTING

The following instructions give details of how to install the various types of standard search coils supplied as part of the Metalarm Metal Detector. The search coil should be assembled using the instructions supplied with the search coil.

## IMPORTANT! UNDERBELT COIL (MODEL TR) - IDLER CONVEYORS

Locate a suitable position in the conveyor mid way between two idlers where:

- There will not be a return idler or cross piece beneath the search coil.
- There is not a joint in the conveyor frame.
- Metal, when detected, can easily be removed from the conveyor belt.
- There is no moving metal in the vicinity.
- Any metal base plate present can be removed or replaced by non-metallic material.
- Any metal covers over the belt can be removed or replaced by non-metallic material.

Place the search coil on the conveyor frame at the chosen position. There should be at least a 1" (25mm) gap between the underside of the conveyor belt and the top of the search coil. If not cut out notches in the bottom of the search coil at all four corners so as to lower the search coil within the conveyor frame.

User supplied stainless steel "L" brackets are suggested for securing the search coil assembly to the conveyor. Brackets should be fitted to the coil, in the area marked for such purposes, as shown on the coil assembly drawing. (See Figure 2).

The search coil should then be bolted to the conveyor frame with the coil electrical connection on the opposite side of the conveyor frame to any heavy-duty cables or wiring.

A recommended idler spacing of 48"-60" (122-152cm) should apply to the infeed and outfeed idlers adjacent to the search coil. An idler isolation kit is recommended and may be purchased from the factory. The idler isolation kit provides suitable materials to electrically insulate the idlers from the conveyor frame. Insulating the idlers directly adjacent to each side of the search coil will help to alleviate any possible false tripping. Electrical loops can be created from the metal detectors field in relation to the surrounding metal. The idlers on each side of the search coil should be checked to see that all nuts and bolts have been securely tightened.

## Installation (cont.)

The cable connecting the search coil to the control unit should then be attached to the connector on the underside of the search coil and to the control unit. The cable should be secured and protected from damage.

The search coil coax cable must not cross directly under the search coil, as this may cause false tripping to occur. The cable should be replaced should any nicks in its outer cover occur.

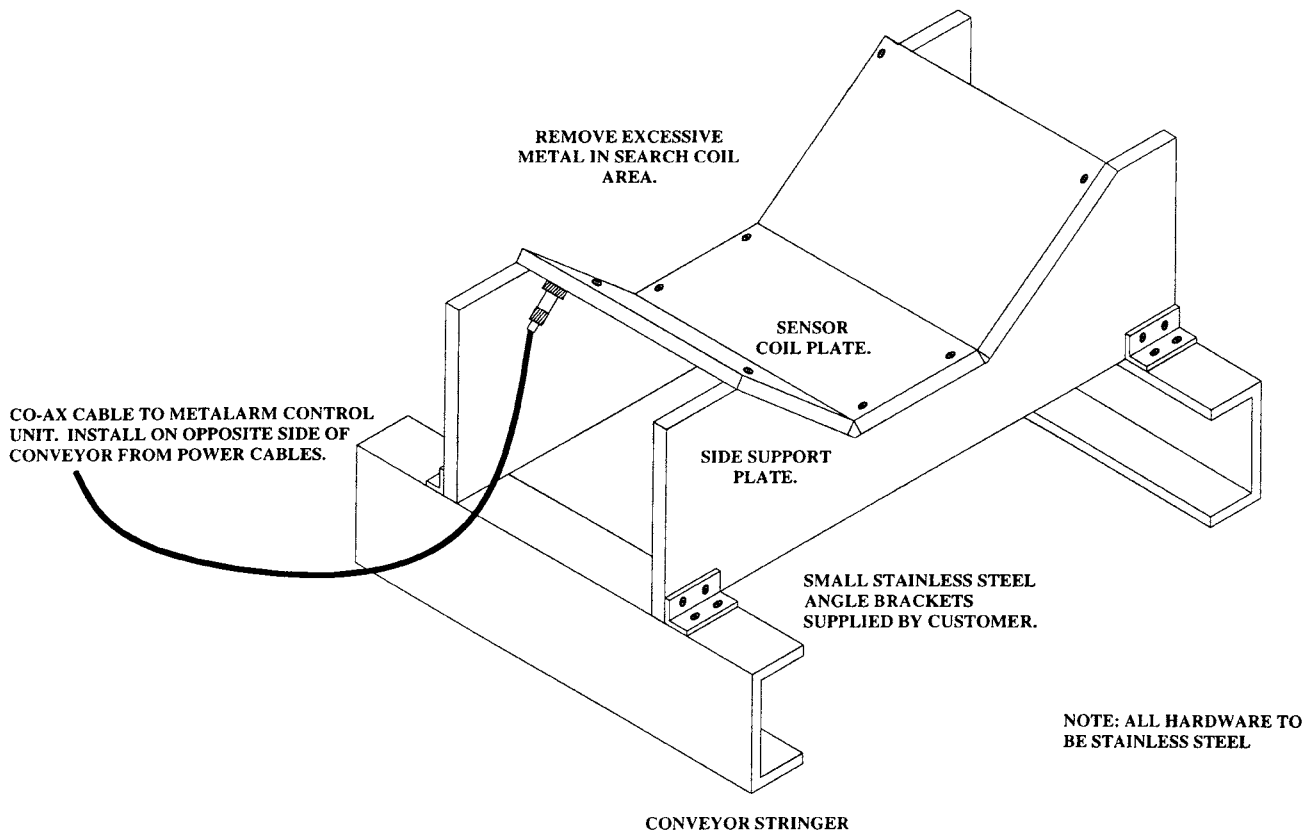
If standard metal conduit must be used to protect the search cables, separate conduits must be used for each cable; receiver and transmitter. If a clip detector is required, the cable may be run in the same conduit as the receiver or transmitter coil.

## IMPORTANT! BRIDGE TYPE (MODEL BR) SEARCH COIL - IDLER CONVEYORS

Locate a suitable position in the conveyor mid way between two idler sets where:

- There will not be a return idler or cross piece beneath the search coil.
- There is not a joint in the conveyor frame.
- Metal, when detected, can easily be removed from the conveyor belt.
- There is no moving metal in the vicinity.
- Any metal base plate present can be removed or replaced by non-metallic material.
- Any metal overbelt covers can be removed or replaced by non metallic material.

Place the search coil on the conveyor frame at the chosen position. There should be at least a 1" (25mm) gap between the underside of the conveyor belt and the top of the search coil. If not cut out notches in the bottom of the search coil at all four corners so as to lower the search coil within the conveyor frame.



**FIGURE 2**  
Coil assembly



User supplied stainless steel “L” brackets are suggested for securing the search coil assembly to the conveyor. Brackets should be fitted to the coil. The area for this purpose is shown on the coil assembly drawing. (See Figure 3).

The search coil should then be bolted to the conveyor frame so that the coil socket is on the opposite side of the conveyor frame from any heavy-duty cables or wiring. Fit the top search coil section and bolt it in place.

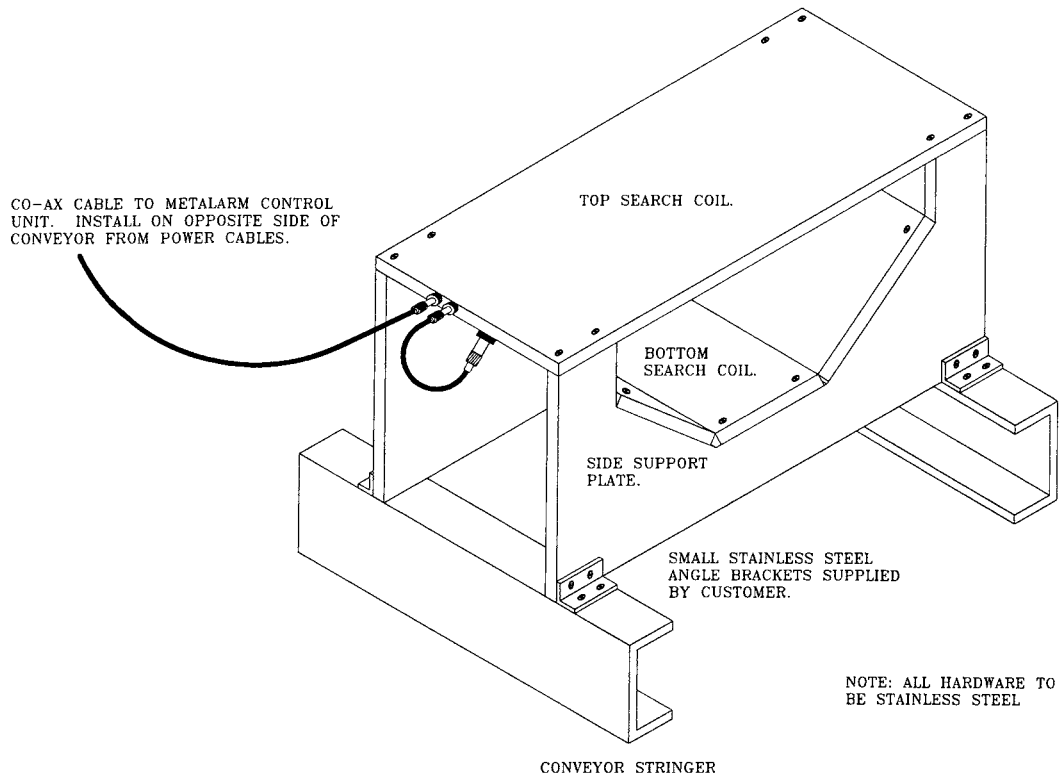
A recommended idler spacing of 48" - 60" (122-152cm) should apply to the infeed and outfeed idlers adjacent to the search coil. An idler isolation kit is recommended and may be purchased from the factory. The idler isolation kit provides suitable materials to electrically insulate the idlers from the conveyor frame. Insulating the idlers directly adjacent to each side of the search coil will help to alleviate any possible false tripping. Electrical loops can be created from the metal detectors field in relation to the surrounding metal. The idlers either side of the search coil should be checked to see that all nuts and bolts are tight.

In the case of series connection, connect the lower coil using the short length of cable provided to the unmarked socket on the top coil. The cable to connect the search coil to the control unit should be connected to the socket marked ‘CU’ on the top search coil. In the case of transmit/receive mode operation, both coils are connected directly to the control unit.

In both cases make sure the cables are secured to the conveyor frame and protected to prevent them being damaged.

The search coil coax cable must not cross directly under the search coil, as this may cause false tripping to occur. The cable should be replaced should any nicks in its outer cover occur.

If standard metal conduit must be used to protect the search cables, separate conduits must be used for each cable; receiver and transmitter. If a clip detector is required, the cable may be run in the same conduit as the receiver or transmitter coil.



**FIGURE 3**

## Installation (cont.)

### MODEL VC “U” SECTION BELT CONVEYORS OR VIBRATOR CONVEYORS - SEARCH COILS

Locate a suitable position in the conveyor where there is going to be no metal within approximately 20 inches (500mm) of the underside of the search coil when it is mounted onto the conveyor. There should be no moving metal in close proximity to the search coil. Cross braces under the search coil should be cut and moved. To install a trough coil, it is necessary to cut out a length of the base and part of the side walls of the conveyor. (See Figure 4).

The exact dimensions of the required cut out will be shown on the search coil assembly drawings supplied with the search coil.

Draw a line 1 inch (25mm) from the edge of the cut out. Along this line drill 5/16 dia (M8) holes at 4 inches (100mm) spacing or longer depending upon the weight and width of the search coil. Countersink the holes from the inside of the conveyor.

Locate the search coil into the cut out and clamp it in position. Using the holes in the conveyor as a guide, drill through side and base of the search coil.

Bolt the search coil into position using countersunk 5/16 (M8) bolts x 1-1/2 (40mm) long and lock washers.

The cable from the search coil to the control unit should be connected into the underside of the search coil. The cable should be secured and protected from damage.

The search coil coax cable must not cross directly under the search coil, as this may cause false tripping to occur. The cable should be replaced should any nicks in its outer cover occur.

If standard metal conduit must be used to protect the search cables, separate conduits must be used for each cable.

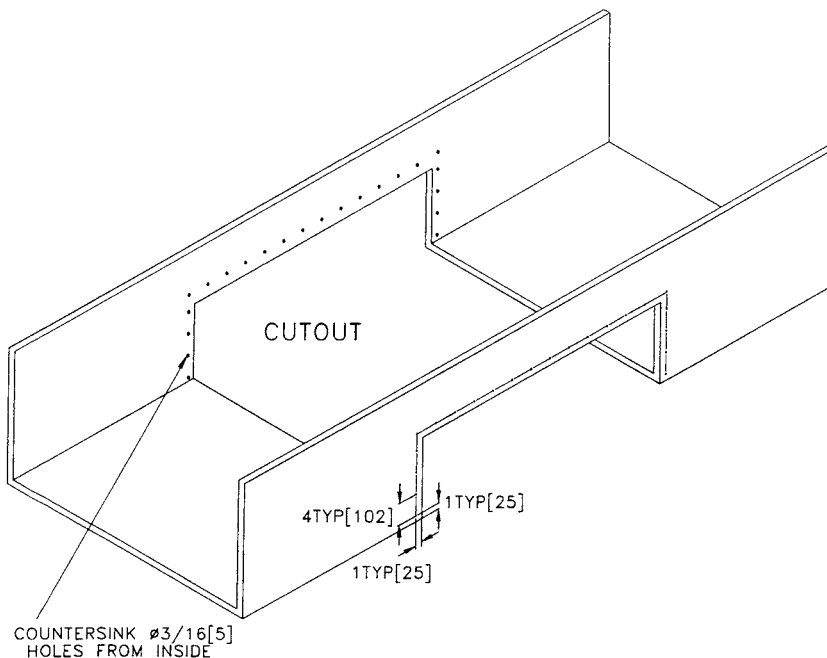


FIGURE 4

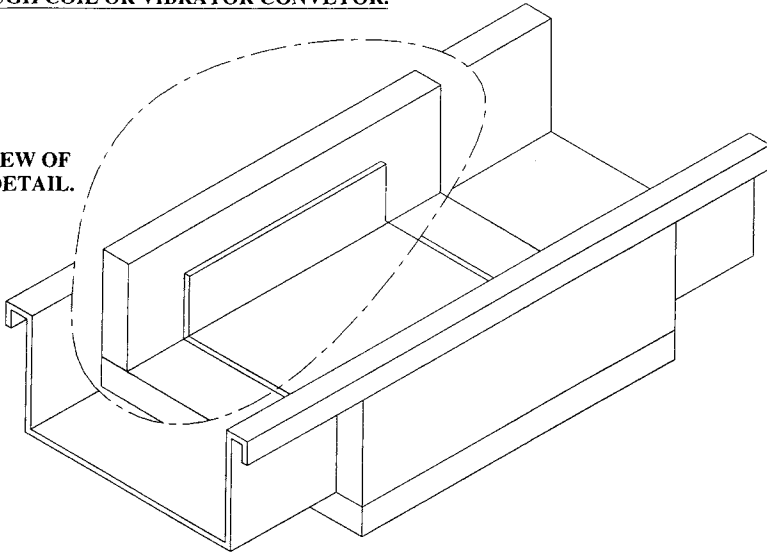
**MODEL PL PLATE COIL**

Plate coils can either be mounted under a previously prepared metal free section such as wood or fiberglass or if the plate coil is a SF or SFC type item directly mounted onto the base of a metal-sided conveyor.

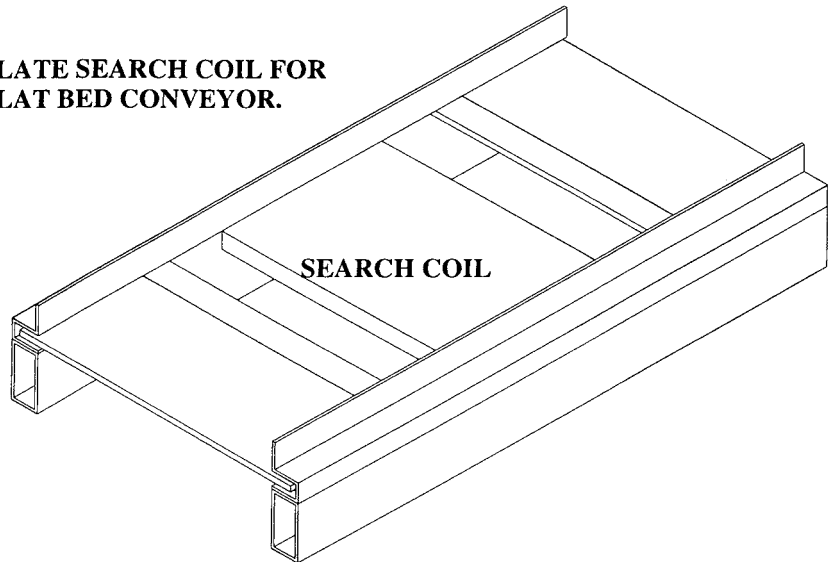
In the latter case if the base of the conveyor is metal, a section of it must be removed for the length of the coil plus .118 inch (3mm). The search coil can be drilled into or through in any of the crossed areas shown on the drawing supplied with the search coil.

**TROUGH COIL OR VIBRATOR CONVEYOR.**

**CLEAR VIEW OF HIDDEN DETAIL.**



**PLATE SEARCH COIL FOR FLAT BED CONVEYOR.**



**FIGURE 5**

## Installation (cont.)

### BELT CLIP - SENSOR

The sensor is mounted midway between the two sets of idlers ahead of the Metalarm sensor as shown in (Figure 6), typically 6' - 8' (1.8-2.4 meters) is recommended. As standard, the mounting bracket for the belt clip detector coil is not supplied, however, it is available as an option. Alternatively the bracket can be made from any suitable material such as aluminum, plastic or wood, such that the sensing area of the sensor is no more than 4 inches (10cm) from the nearest clip at the edge of the belt as shown in (Figure 7).

The cable is connected between the sensor and the control unit making sure that it is adequately protected from moving conveyor parts. It is connected to the green terminal block on the right hand side of the electronic module, the center conductor to the terminal marked 'C' and shield of the cable to the other terminal (1 and 2 of TB4).

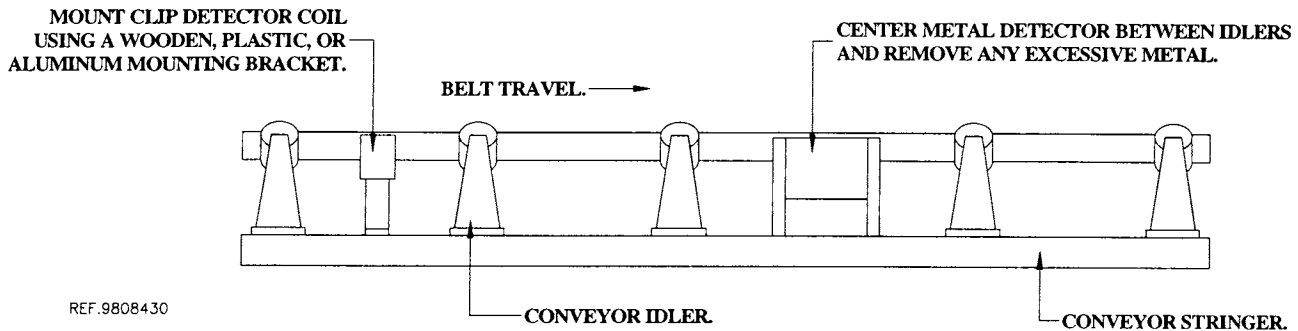


FIGURE 6

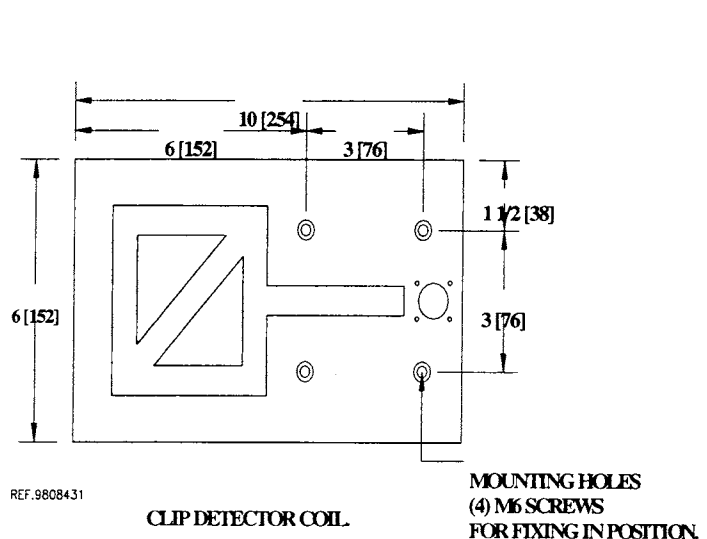
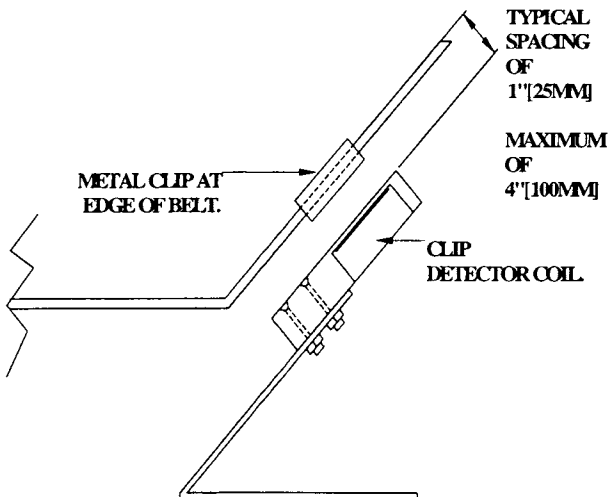


FIGURE 7

## INSTALLATION RECOMMENDATIONS FOR CONNECTING RFI FILTERS TO HIGH FREQUENCY INVERTER DRIVES

Because of the complex circuit design used in these filters an Ground Leakage Current of 8 to 80MA may be observed. It is possible that nuisance tripping of extremely sensitive type of ground fault circuit breaker may occur so this figure should be considered when choosing such a device. It is important to provide well-defined paths for the high frequency currents involved. The best results are achieved when both filter and inverter are mounted securely on the same conducting, grounded backplate and not on rails etc.

### SUPPLY CABLE

The supply cable should be a stranded conductor and not a solid conductor type to achieve proper connection inside the terminal block. Cable lengths inside the wiring cabinet should be kept to a minimum i.e. cable entry to filter and filter to inverter. This will reduce the effect of radiated emissions back into the input cables. (See Figure 8).

### MOTOR CABLE

Since the cable between the inverter and motor is a major source of radiated and conducted interference, it should be a shielded type and as short as possible with the shield and safety ground wire connected directly to the bonded ground post at one end and to the motor ground at the other. Never connect only one end of the shield to ground, as this can be detrimental. (Pig tail effect). It is strongly recommended that the conducting cores (not the ground or shield) are threaded through, or, if possible, wound around an output cable filter choke as shown. (See Figure 9).

If shielded cable is not available, SO cable can be run through a dedicated steel conduit.

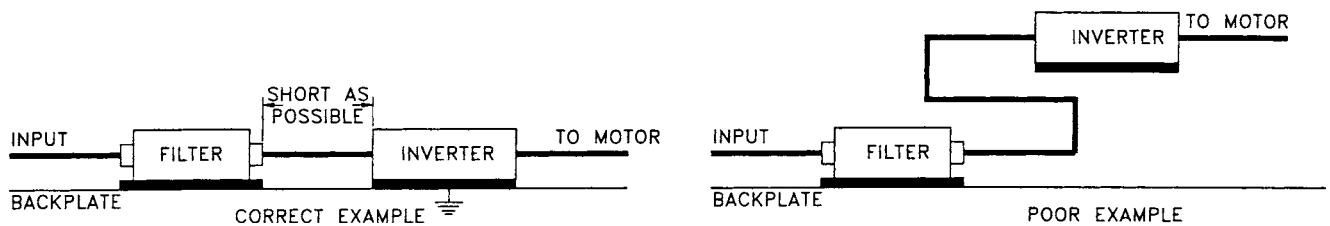


FIGURE 8

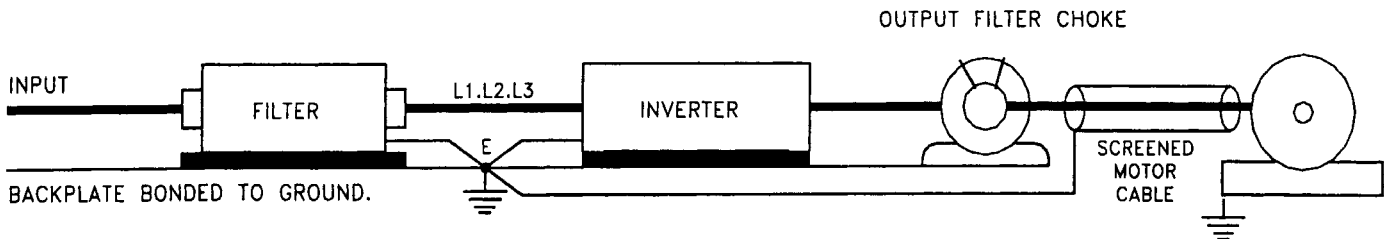


FIGURE 9

# Installation (cont.)

## GROUNDING

The point here is to clearly define the paths through which high frequency earth currents flow, and thereby minimize their harmful effect on other nearby, sensitive devices. All grounding leads, including the filter ground, inverter ground and shielded cable grounds, should be as short as possible and securely fastened to the bonded backboard ground post. Poor connections and loops of cable will act as aerials and pick up stray radiated emissions.

## SEPARATION

Keep the separation of the input and output cables as great as possible to prevent feedback. Input and motor output cables should never be run together in the same trunk or conduit. (See Figure 10).

## CONTROL CABLES

The control cables to the inverter or any other equipment in the vicinity are obviously highly susceptible to radiated emissions in the same way and should never be run with the motor output cables.

## MULTIPLE INVERTERS

Where more than one inverter is used, for effective suppression, it is preferable that a separate filter should be used for each inverter. (See Figure 11).

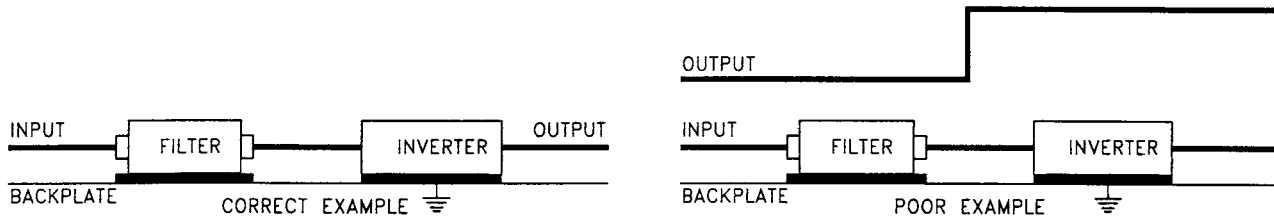


FIGURE 10

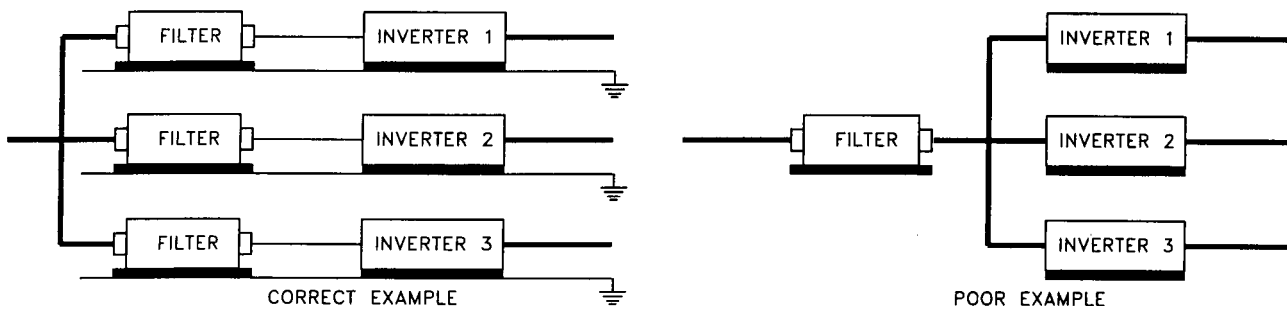


FIGURE 11

## BAG DROPPER INTRODUCTION

The bag dropper is used to indicate the location of tramp metal on the conveyor after the belt has stopped. The bag dropper consists of a bag dropper control unit and a bag.

## INSTALLATION

A frame should be constructed over the top of the conveyor to mount the bag dropper control unit. If the frame is constructed of metal, it must not be in the search field of the sensor coil, so a distance of at least 4 feet (1.5 meters) down line from the sensor is recommended.

Remove the bag dropper control unit by removing the 4 screws located in each of the four corners of the top cover. Mount the control unit to the frame over the conveyor by bolting through the existing holes. The fixing centers are marked on the back. Make sure the entry release hole and cable outlets are directed downwards.

## CONNECTION

The 3-wire power supply cable can be connected to the Metalarm power supply at terminal block TB1 on the Metalarm circuit board.

The blue wire of the 2-wire cable is used to trigger the bag dropper and it is connected through the Metalarm relay contacts. The red wire is used to disable the Metalarm and connects to terminal 3 on TB3.

Wire	Dropper	QM2
Red	O/P	TB3-3
Blue	I/P	TB2-11
Screen	OV	TB3-1

Also a jumper on the QM2 is required from TB2-12 to TB3-1. Refer also to the drawing on the following page.

## ADJUSTMENT

Switch the power on to both the bag dropper and the Metal Detector. It should not be possible to start the conveyor. If the conveyor can start refer to section entitled IMPORTANT NOTE below.

Push the bag stem all the way into the aperture on the underside of the control unit and press reset on the Metalarm. The conveyor should now be able to run.

In the bag dropper, check that the green LED (D1) is on and that the amber LED (D3) and the red LED (D2) light up when metal is detected.

D3 (amber) shows the delay from detection to the drop. This must be set up so that an object detected at the search coil will be under the 'bag dropper' when the bag drops (indicated by the red LED D2). Adjustment is made by rotating RV2 (coarse) and RV1 (fine).

RV3 is for the adjustment of the solenoid 'on time' and should not need any adjustment.

When satisfied that the operation of the bag dropper is correct the lid of the control unit needs to be replaced and tightly sealed against moisture.

## IMPORTANT NOTE

The bag dropper is set to run in Fail-Safe Mode and therefore will prevent the operation of the Metalarm when the bag is not present. This is indicated by the "Detect" light being illuminated.

It is vital that the conveyor is wired to stop when metal is detected, otherwise the bag stem may enter the equipment being protected. Although aluminum alloy has been used in its construction, it would still mean replacement of a relatively expensive part.

For any further information, please do not hesitate to contact ERIEZ customer service.

# Electrical Connections

The standard electrical connections are for power supply connections and for sensor coil connections. Other cables may be added as necessary for control and monitoring functions.

Please note where armoured cables are being used, the armour must be cut back at the gland plate of the control unit so that it does not touch the Metal Detector Control Unit. The control unit must be electrically isolated.

## POWER SUPPLY

The mains connection is made via the green terminal block (TB1) using 'E' Terminal 1 for earth/ground connection and Terminal 3 'L' terminals for live 1/positive connection and Terminal 2 'N' terminals for live 2/negative connection. The spare "L", "N", and "E" terminals can be used for driving external controls or the bag dropper accessory.

The Voltage Selector Switch should be set to 230V ac or 115V ac as required. This is located just above the green terminal block (TB1).

## CONTROL RELAY CONTACTS

Connections to the output contacts of the control relay are made to terminal block (TB2) as indicated in (Figure 13). Four sets of SPDT relay contacts are provided.

The contacts are rated for 5 amps resistive, for either low voltage DC application or for a maximum of 250V-ac application.

## FUSES

Please note there is one fuse FS1 for the Control Unit located on the front panel and rated at 0.5A A/S. There is also a fuse FS2 for the external supply via terminals 4, 5 and 6 and rated at 1A A/S.

## SENSOR COIL CONNECTIONS

The sensor coil connections are made to the right hand 6 position terminal block (TB4). The inner conductor is connected to terminals 2, 4, and 6. The outer shielding (ground) is connected to terminals 1, 3, and 5 for all coils respectively.

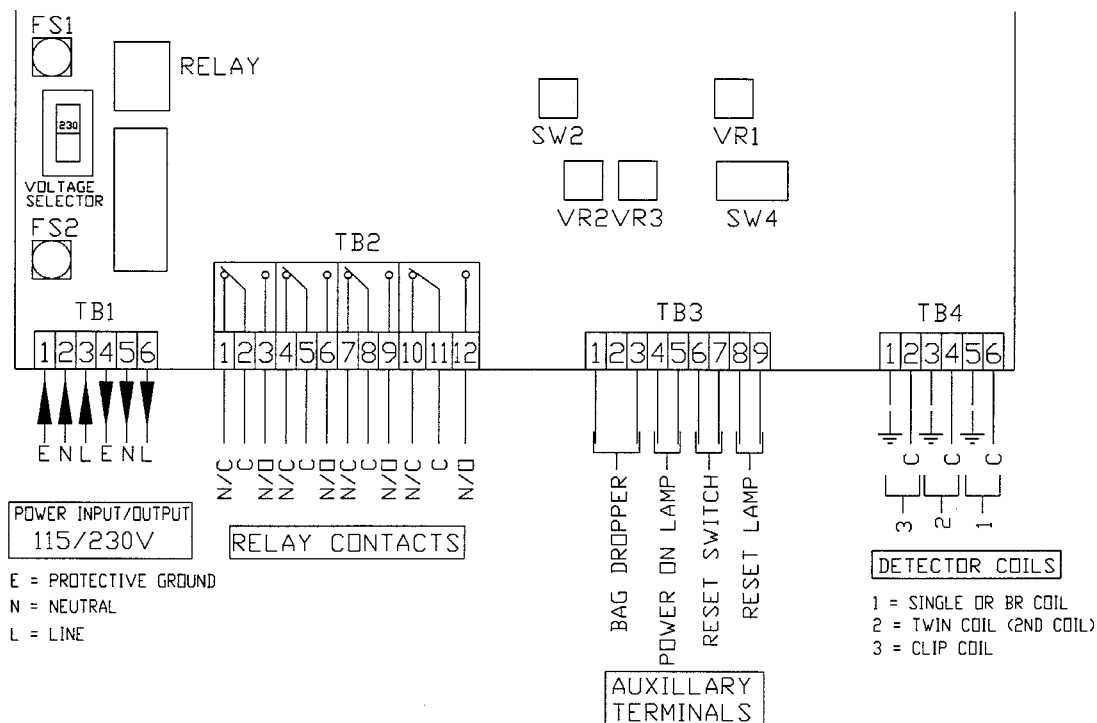


FIGURE 13



## BELT CLIP OPERATION

The belt clip detector coil is always connected to TB4, terminal 1 (for the ground/shield) and terminal 2 (for the center conductor).

**NOTE: Belt Clip detection not required.** If for any reason belt clip detection is not required, you must not leave the belt clip coil connections disconnected or the detector will go into fault mode and disable metal detection. If clip detection is not required, follow the procedure below:

Disconnect the control unit power source and any power signals being switched by the relays. Remove the belt clip search coil connections from TB4 terminals 1 & 2 and solder an insulated jumper wire between points TP3 & TP14 on the circuit board below the front panel.

## SINGLE SEARCH COIL & BELT CLIP COIL OPERATION

See Figure 14. Connect the detector search coil to TB4 terminals 5 (shield) & 6 and connect the belt clip detector coil to TB4 terminals 1 (shield) & 2. (NOTE: Switch SW4 on the metal detector control should be in Position 1).

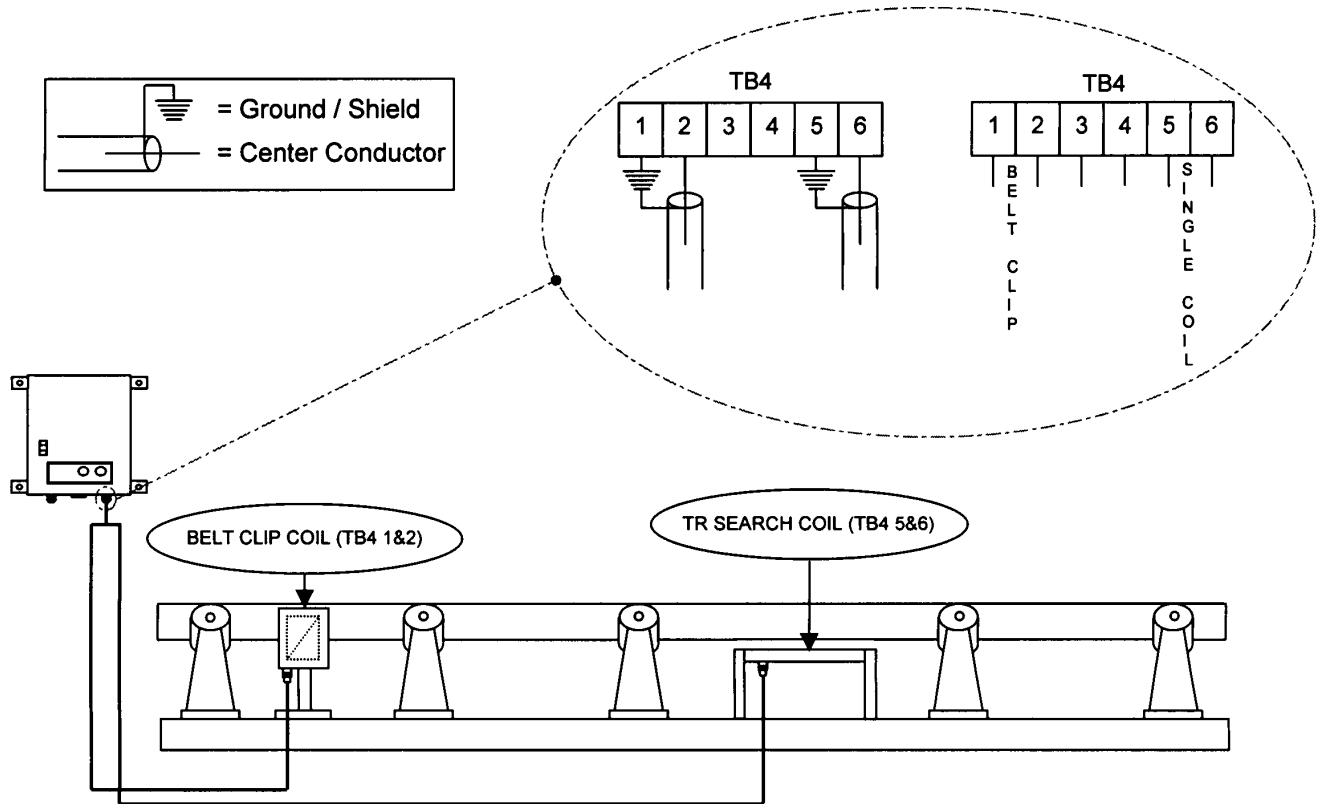


FIGURE 14

# Electrical Connections (cont.)

## BRIDGE (APERTURE) TYPE SEARCH COIL IN SERIES CONFIGURATION

See Figure 15. A Bridge type search coil will be supplied in a series configuration for optimum sensitivity. The top and bottom search coils will be connected together by means of a 20 inch (1/2 meter) or 3-foot (1 meter) interconnecting cable. (NOTE: Switch SW4 on the metal detector control should be in Position 1).

There will then be one main cable, which connects the search coil to the control unit. The cable is connected to TB4 terminal 5 (for the ground/shield) and terminal 6 (for the center conductor).

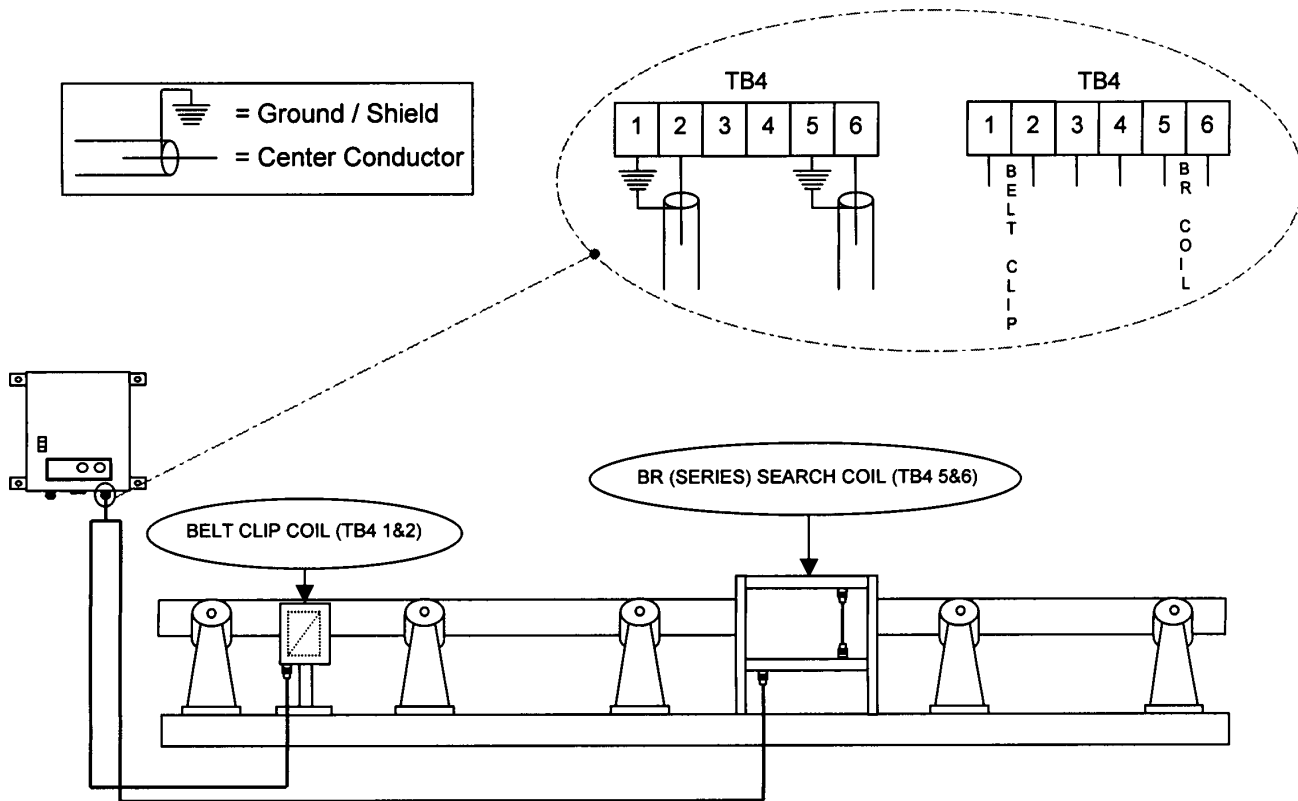


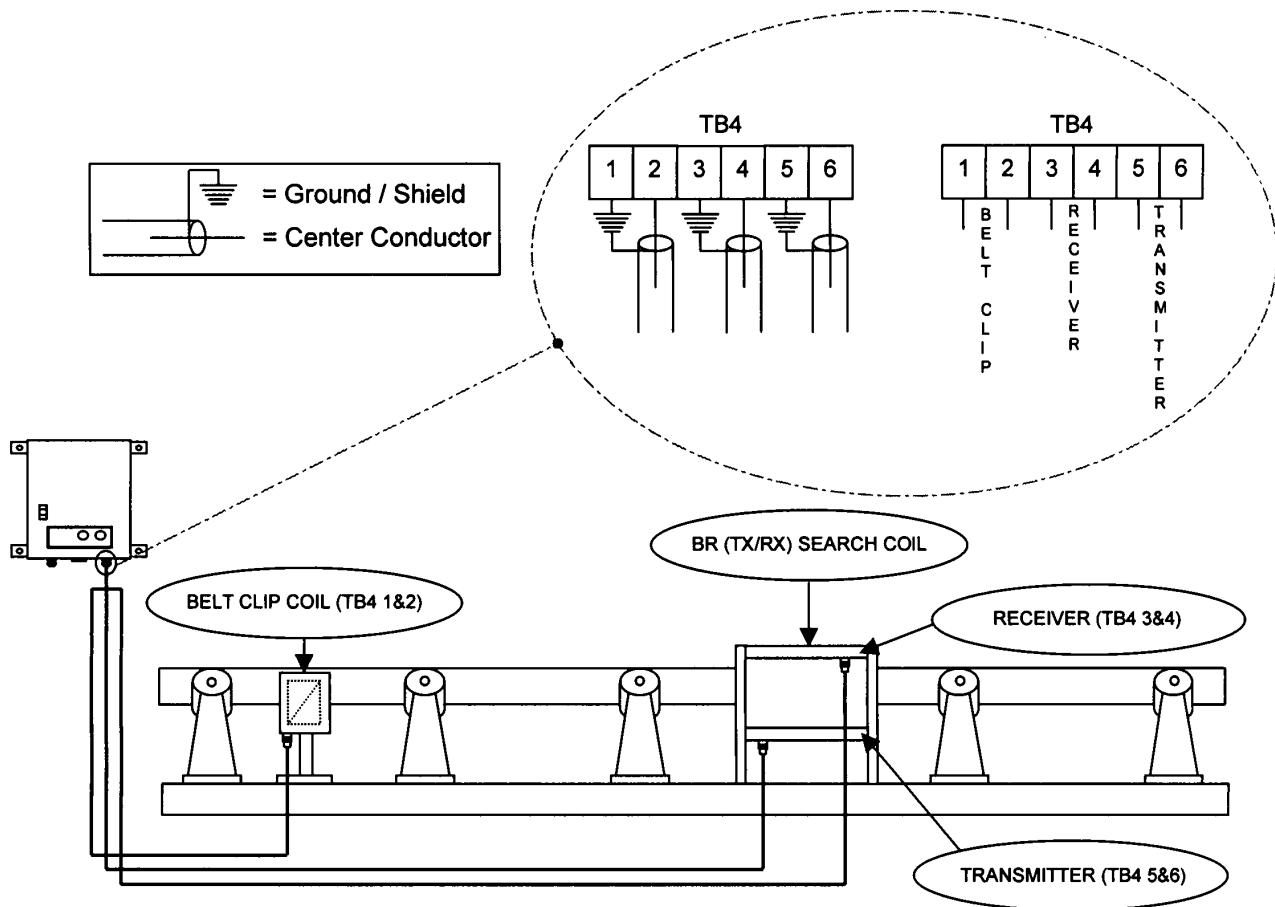
FIGURE 15

**BRIDGE (APERTURE) TYPE SEARCH COIL IN TX/RX CONFIGURATION**

See Figure 16. NOTE: When operating in a transmit/receive configuration, Switch 4 should be moved to position 2.

A Bridge type search coil will be supplied in a transmit/receive (TX/RX) configuration when either a conductive material is being conveyed or when a certain size piece of metal is to be detected and all smaller pieces being ignored

When in the TX/RX configuration both the top and bottom search coils are independently connected to the control unit. The lower coil, which is the transmitter, will be connected to TB4 terminal 5 (for the ground/shield) and terminal 6 (for the center conductor). The top coil, which is the receiver, will be connected to TB4 terminal 3 (for the ground/shield) and terminal 4 (for the center conductor).



**FIGURE 16**

# Operating Instructions

Switch on the line power and the 'ON' lamp on the case door illuminates. (See Figure 1) The red 'FAULT' light will be on if the sensor and the clip sensor coil are not connected. When the sensors are properly connected the light will extinguish.

**NOTE:** The illuminated fault light will also cause the 'Detect' lamp to be on.

Rotate the three SET ZERO controls fully clockwise and set the Channel select switch to Chan 1. If the right hand light illuminates, rotate the Chan 1. Set Zero control counter-clockwise until this light extinguishes and the green light illuminates. This adjustment compensates or zeros out any nearby metal in the sensor coil detect area. If this light cannot be illuminated there may be too much metal near the sensor coil. This can be confirmed by positioning the sensor coil away from all surrounding metal and repeating the test.

When the green light is on turn the Channel select switch to Chan 2. As this channel is also connected to the main sensor, the amount of surrounding metal will determine whether the green light is still illuminated. If it is not, turn the Chan 2. Set Zero control counter-clockwise until it is illuminated.

Now turn the Channel select switch to 'Clip' and rotate the Clip Set Zero as required to illuminate the green light. If it cannot be zeroed there may be too much surrounding metal, but this time near the clip sensor. This can be checked by repositioning the sensor and repeating the adjustment.

After these adjustments, the detector may have operated illuminating the 'Detect' light and the 'Reset' lamp on the detector door. Pressing the 'Reset' lamp button will extinguish both lights.

The relay function is controlled by the 'Relay' switch. In the OFF position only the 'Detect' light and door 'Reset' lamp operate when metal is present in the sensing area.

3500 QM2 QUARRYMASTER  
(FRONT PANEL)

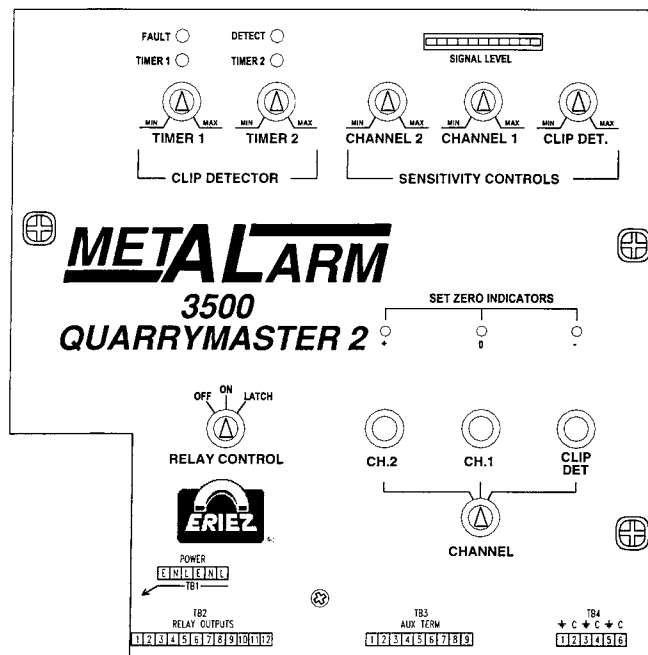


FIGURE 17



In the ON position, the 4 SPDT relay, the 'Detect' light and the door 'Reset' lamp operate when metal is present in the sensing area.

In the LATCH position, the relay and above indicators operate but after the metal is removed, the relay and the indicators remain on until either the door 'Reset' button is pressed or the 'Relay switch is turned to the ON or OFF position.

The Channel 1 'Gain' control is a sensitivity adjustment control to adjust for the detection of the desired size of material or to allow for smaller pieces of material to be ignored.

The Channel 2 'Gain' control is also a sensitivity control that is first turned counter-clockwise from maximum (if necessary) until the metal detector is ignoring the belt clips.

Normally the control would be left here to give maximum detection sensitivity to any material covering the clips but if required, it can be turned further to allow the size of this material to be increased and still avoid detection. This first requires the Belt Clip detection section of the detector to have been set correctly - see later.

The 'Clip' gain control is again a sensitivity control and is used when setting the clip detection section to ensure reliable detection of the belt clips - see later.

## INDICATOR LIGHTS

### SET ZERO

When the Metalarm is operating and correctly set, the green light of these three lights is the one illuminated.

If a piece of metal passing across the Sense coil is large enough it will cause the green light to go out and the right hand red light to come on while the metal is within the detect range of the Sense coil provided the Channel Select switch is set to Chan 1.

### DETECT

This red light illuminates whenever metal is within the detect range of the Metalarm.

## COIL FAULT

This red light illuminates if the main sensor or the clip Sensor is either open circuit, not connected or short circuit. This light also causes the 'Detect' light to illuminate to prevent operation of the Metalarm until the coil fault is rectified.

### TIMER 1

This yellow light illuminates to indicate belt clips have passed the clip sensor and are approaching the main Sensor coil.

### TIMER 2

When this red light illuminates the belt clips are now within the detect range of the main Sensor and the Metalarm is operating through Channel 2.

Normally, the Metalarm control unit should not require any major re-adjustments after performing the adjustments during installation. After switching the control unit on, the green 'Set Zero' light should illuminate immediately without the need to turn the 'Set Zero' control.

Proper operation may be verified by depressing the 'Test' button (SW5) (see Figure 18), which is mounted on the electronic circuit board beneath the front panel.

Certain extremely large objects may produce an overload signal causing the unit to indicate continuously even after the object has passed clear of the sensor coil. Depress the 'Reset' button to cancel the indication.

**NOTE:** Although the control unit will adequately zero out stationary masses of background metal, it will respond to moving metal near the sensor coil. When mounting the sensor coil, consideration should not be limited to only large objects such as fork lift trucks, but should be extended to smaller objects such as maintenance workers carrying metal tools and equipment in the vicinity.

Although the metal detector system is suppressed against both airborne and power supply interference, some false alarms may nevertheless occur occasionally. Such triggering is usually due to transient effects, which are both infrequent and unpredictable.

## Operating Instructions (cont.)

Metallic framework encircling the search coil can act as a “shorted turn”. It may be necessary to insert insulating sections to prevent comparatively small masses of metal generating inordinately large background signals.

### SENSITIVITY ADJUSTMENT

The ‘Gain’ control permits sensitivity adjustments for detecting or rejecting the desired size of objects. Rotate the ‘Gain’ control clockwise to increase the Metalarm sensitivity or counter-clockwise to decrease the sensitivity.

A coarse sensitivity adjustment (VR2) may be performed by means of the sensitivity adjustment control on the control unit printed circuit board. (See Figure 9) Extreme care must be used in performing the coarse sensitivity adjustment. Consult the factory prior to making any coarse sensitivity adjustments.

---

### CAUTION

**Take particular care with the mains supply connected, parts of the printed circuit board will be carrying high voltages. Therefore DO NOT touch anything other than the coarse sensitivity control.**

---

Examine the top face of VR2 and note that it is marked into 10 divisions with the center of the control pointing to a division. Rotate this control one division at a time, checking each time to determine whether the gain has been reduced sufficiently.

**VR2 Coarse gain control.** Clockwise REDUCES the overall gain of Channel 1; Normal channel. This control turns 270 -degrees.

After each coarse sensitivity adjustment, it may be necessary to re-zero the internal lights using the ‘Set Zero’ control and depress the reset button on the enclosure door.

### SIGNAL LEVEL INDICATOR

This consists of a row of ten lamps, which light in sequence from left to right, as the detected signal level increases when metal approaches the sensor.

The Metalarm will produce an alarm when the signal level reaches the right hand lamp that is permanently illuminated. Normally none or perhaps the first 1 or 2 lamps may be flickering ON and OFF.

However, if the Metalarm is suffering from ‘false alarms’ which are of a fairly regular nature, then this indicator should be examined, since it may show more than the first one or two indicators flickering On and OFF indicating the presence of some interference which is either mains or air-borne.

The effects of this may be reduced by rotating VR12 clockwise. The signal level should now move to the left until only 1 or 2 indicators are on. Care should be taken to not rotate this control further than necessary, since it does reduce the sensitivity of the unit.

**VR12 Trip level threshold.** This multi-turn trimmer should be used after reducing the overall gain via VR2 and VR3. Turning VR12 clockwise will provide further reduction in the units overall sensitivity. Since there is no indexing of this control, care must be practiced to record how many turns have been completed. It is suggested to perform adjustment of this control using a half turn per each sensitivity test, until the desired level is achieved.

The DC voltage threshold level can be measured at TP22 and is normally set to 200mV

# Repairs and Adjustments

## ELECTRONIC BOARD - MOUNTED SWITCHES

For the position of the switches, which control additional optional features, refer to Figure 18.

**SW1** - Selection of voltage - 115V or 230V 50Hz or 60Hz

**SW2 Brown** - Fail Safe Operation - With the switch down the 'Detect' relay is immediately energized when power is connected to the control unit rather than when metal is detected. When metal is detected or if the power to the unit fails the 'Detect' relay drops out, creating a fail safe mode.

**SW2 Red** - Used in setting up the belt clip timers. Up is the normal position. Down disables the detect circuit in timer 2 mode.

**SW4** - This separates the TX and RX coil connections when switched to Position 2 and is used when separate search coils are used for transmitting and receiving, such as to create an even search field or where magnetic ore is being processed.

**SW5** - Test button.

**SW6** - When switched 'ON', this switch reduces the integrator speed. This facility is used where belt speeds are slow, such as in the Wood Industry and/or where noise levels are high.

**VR1** - This control adjusts the frequency of the Metalarm and is pre-set by the factory. Where there is electrical interference slight adjustment of this control can reduce it.

**VR2** - Coarse gain control. Clockwise REDUCES the overall gain of Channel 1; Normal channel. This control turns 270 degrees.

**VR3** - Coarse gain control. Clockwise REDUCES the overall gain of Channel 2; Clip circuit channel. This control turns 270 degrees.

**VR12** - Trip level threshold. This multi-turn trimmer should be used after reducing the overall gain via VR2 and VR3. Turning VR12 clockwise will provide further reduction in the units overall sensitivity. Since there is no indexing of this control, care must be practiced to record how many turns have been completed. It is suggested to perform adjustment of this control using a half turn per each sensitivity test, until the desired level is achieved.

The DC voltage threshold level can be measured at TP22.

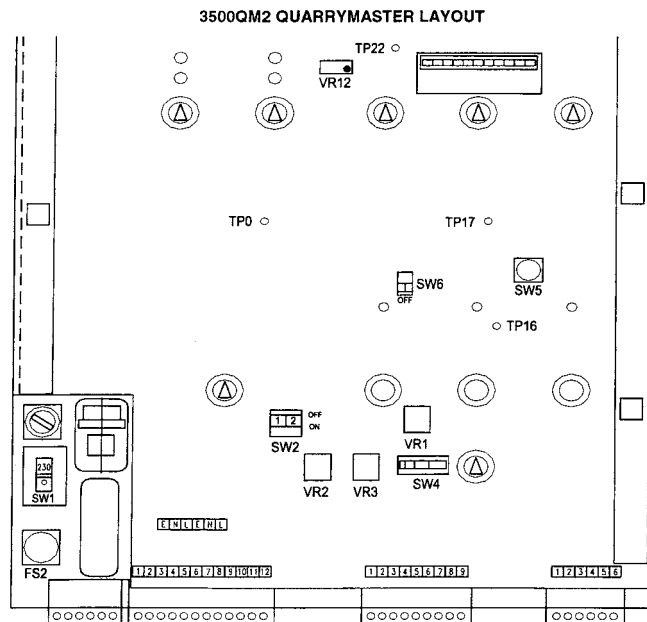


FIGURE 18

# Repairs and Adjustments *(cont.)*

## CLIP DETECTOR

### INTRODUCTION

The clip detector section of the metal detector is used in installations where a break in the belt has been mended with metal clips and these clips are now tripping the main detector every time they pass over the sense coil.

The clip detector has a separate sensor coil that is positioned on the side of the conveyor and in front of the main sense coil, so that it detects any belt clips (but not any metal on the conveyor), before the clips reach the main coil.

When any clips are detected the main detector is switched to a lower sensitivity. Preventing detection of the clips by the main sense coils. When properly adjusted the detector will still respond to any metal positioned directly over the clips.

To minimize the time the main detector is at the lower sensitivity, there are two timers in the clip detector unit.

**Timer 1** is adjusted for the time it takes for the clips to travel from the clip sensor to just before the detect area of the main coil. The time period is indicated by the yellow light being illuminated.

When the light goes out the main detector is switched to the lower sensitivity and **Timer 2** is started indicated by the red light. When the clips have passed across the main sensor and are outside its detect range, the red light of **Timer 2** goes out and the main detector is switched back to high sensitivity.

## ADJUSTMENT

It is necessary for the main detector and clip detector Sense coils to have been installed and the main detector to have been adjusted and working correctly before the following procedure can be carried out.

1. Turn Relay control knob to OFF.
  2. Set the Channel Select knob to CLIP and turn the Clip Zero knob fully clockwise.
  3. Slowly adjust the knob counter-clockwise until the green Zero light illuminates. When this light is on, reset the detector by briefly pressing the Reset button on the detector door. It is important that whenever this control has been adjusted the Reset button is operated.
  4. Turn the timer knobs Timer 1 and Timer 2 fully counter-clockwise.
  5. Turn the Clip Sensitivity knob fully counter-clockwise.
  6. When the belt is running, note whether the yellow and red Timer lights flash in sequence every time the belt splice passes the clip sensor. If these lights are not illuminating, slowly adjust the Clip Sensitivity knob clockwise until they do. If these lights still do not illuminate when the knob is fully clockwise, then the clip sensor needs to be repositioned closer to the belt clips.
- NOTE:** When the Timer lights are operating the green Zero light may go out and then come on again. This is perfectly normal.
7. Note that as the belt clips pass by the clip sensor the Timer lights flash and then a little later the red Detect light illuminates for a short time as the belt clips travel across the main detector sensor.
  8. Turn the Chan 2 Sensitivity knob fully clockwise.





9. Slowly turn the Timer 1 knob clockwise and the yellow Timer 1 light will stay on longer and longer before going out as the clips pass by the clip sensor. Keep turning until the yellow light goes out just before the Detect light illuminates.
10. This is the correct position for the Timer 1 control and it should now be noted that when the yellow light goes out, the red Timer 2 light will flash just before the red Detect light comes on.
11. If it is found that the Detect light is not coming on then remove the front panel and switch to the 'ON' (down) position (the red (2) section of Switch 2). Turn the Timer 1 fully counter-clockwise again and repeat Step (9) above.
12. Slowly turn Timer 2 knob clockwise and note that the Timer 2 light will stay on longer and longer before going out and the 'Detect' light will be on for a shorter and shorter time.
13. Keep turning this knob until the 'Detect' light no longer illuminates as the belt clips travel across the main sensor.
14. If the red section of switch SW2 has been operated to the 'ON' position (down), turn this section off by moving SW2 upward.
15. Observe the operation of the system. The belt clips should travel across both sensor coils, and the clip Timers operate. The 'Detect' light should remain off as the clips pass over the main sensor; no further adjustment is necessary since the operation is now correct.
16. If the 'Detect' light comes on as the clips travel across the main sensor, then slowly turn the Channel 2 sensitivity knob counter-clockwise until the light no longer illuminates. Do not turn the knob too far since the sensitivity to any metal resting on the clips will be reduced.
17. If the 'Detect' light still comes on when the sensitivity knob is fully counter-clockwise, remove the front panel and examine VR3. Note the top face is marked into 10 divisions with the center of the control pointing to a division. Rotate this control clockwise one division.
18. Replace the front panel, turn the sensitivity knob fully clockwise and repeat step (16) above.
19. After these adjustments if VR3 is fully clockwise and the detector is still being tripped, then an alternative sensor arrangement may be necessary, such as Transmit/Receive. Consult the factory for advice.
20. The belt clip section of the detector is now correctly set and the Relay knob can be set to the required position.

### **ELECTRONIC CIRCUIT BOARD REPLACEMENT**

Normally, access to the electronics is not required but if the circuit board requires replacement, the following procedures must be used.

Turn off the main supply to the control unit and disconnect all terminal blocks connected to the circuit board, by pulling downwards.

Undo the three panel fixing clips by turning a 1/4 turn counter-clockwise. Remove the five counter sunk screws holding the panel support brackets and remove the brackets.

Undo the five standoffs and three mounting screws. Remove the circuit board and inspect the enclosure. Remove any foreign material such as loose pieces of metal filings or wire cutting etc.

Install the new circuit board in the reverse procedure of above. Repeat the set-up procedure

# Repairs and Adjustments (cont.)

## WIRING TO THE CONVEYOR MOTOR STARTER

To stop the conveyor drive motor when metal is detected, connect a Metalarm normally closed relay contact terminals C and N/C on (TB2)) in series with the conveyor motor starter as in **Figure 19**.

When the Metalarm is wired as shown in **Figure 19**, the conveyor will not restart until after the metal is cleared, the Metalarm control unit is reset and the conveyor motor start switch is depressed.

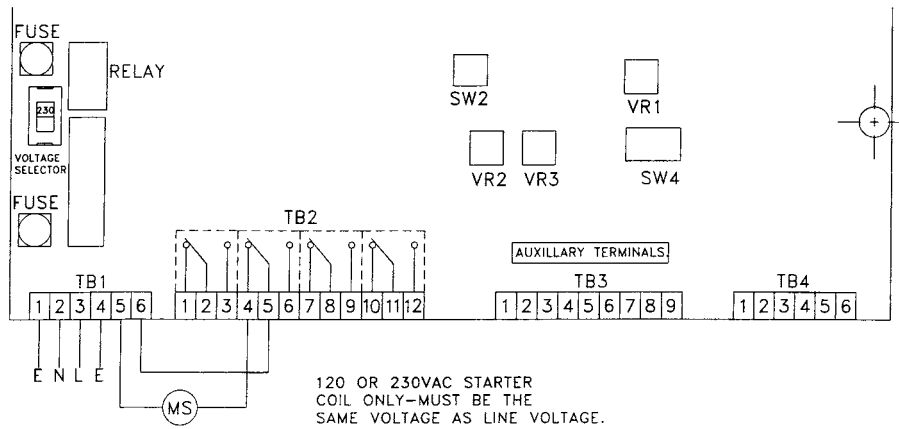
If the conveyor is required to restart automatically when the metal is cleared and the Metalarm is reset, it will be necessary to 'replace the motor start/stop circuit with the normally closed relay contacts.

**CAUTION**  
The motor will start when power is applied to the metal detector circuit.

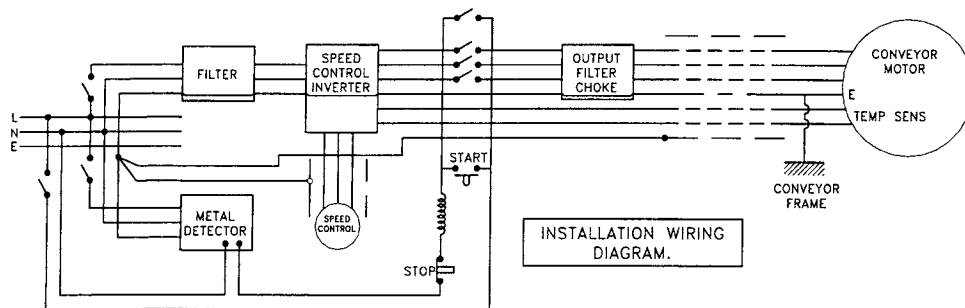
## GROUNDING OF ASSOCIATED PLANT WHEN FREQUENCY INVERTER SPEED CONTROLS ARE BEING USED.

Please note that when frequency inverter speed controls are being used in the vicinity of the metal detector all earth connections must be run independently back to a single star point as shown in Figure 20.

In addition, if filters are being used they should be mounted and connected as shown.



**FIGURE 19**



**FIGURE 20**

## AUXILIARY RELAY

An auxiliary relay is necessary between the Metalarm Control Unit and a motor starter or contactor when the motor wiring system uses a device with a coil voltage other than 115 or 230 volts or a current rating greater than 5A. An auxiliary relay may be necessary when the plant switch gear is generating electrical interference or brushes are arcing, or when other electrical noise is being created.

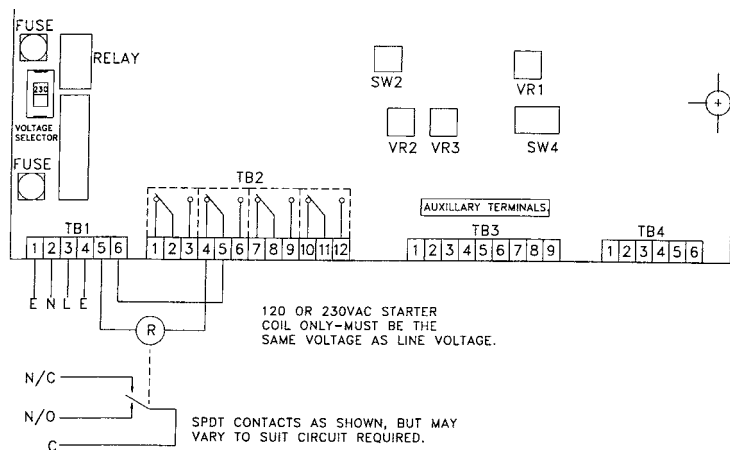
This interference will propagate through the air and may also travel along the conductors in close proximity to the noise sources. When this occurs, interference will be fed into the Metalarm Control Unit along the interconnecting wires, and will cause false triggering.

An auxiliary relay in a separate enclosure, external to the Metalarm and separate from the main switch gear cabinet, will normally isolate the offending interference.

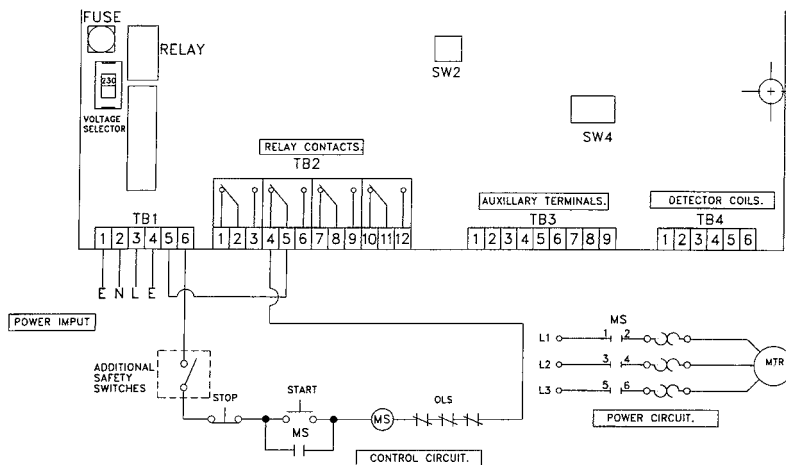
## AUXILIARY RELAY WIRING

Figure 21 shows an auxiliary 230V AC relay connected to C of (TB1) and drawing its power from the same power supply as the Metalarm's power supply.

Figure 22 is variation of Figure 21 wired so that the conveyor cannot operate when the power supply to the Metalarm is interrupted.



**FIGURE 21**  
Auxiliary relay wiring diagram



**FIGURE 22**  
Conveyor motor starter wiring variation

# Troubleshooting

## SUGGESTIONS FOR TROUBLE SHOOTING ENVIRONMENTAL INTERFERENCE

The Metalarm Control Unit generates a high frequency alternating field within and near the sensor coil. While the field is strongest on the sensor coil face or in the throat of the sensor coil, it is inherent in the sensor coil design that a certain amount of the field exists outside of the sensor coil. Certain environmental conditions may sometimes effect this alternating field causing false and erratic signals.

If after installation the unit does not work properly, check for compliance with the following hook-up and installation details before proceeding to the specific causes of interference.

All cable connections should be tight on the terminal blocks in the control unit.

The power source cables should be isolated from varying inductive loads and should be run in a separate conduit.

The control unit should have a good electrical ground connection.

In certain locations more than one problem may exist and the problems may be interrelated.

Observing the installation site and the operation of the metal detector for repeating symptoms is very helpful in isolating the causes of the problems.

Correlating malfunctioning occurrences is invaluable for environmental interference trouble shooting. Observe whether interference occurs at certain specific times and in conjunction with a specific activity.

Observe whether interference occurs when operated by certain personnel or only after physical change of the environment.

Use the following to help diagnose problems and problem sources and to implement corrective measures.

## BASICALLY ENVIRONMENTAL INTERFERENCE MAY BE OF FOUR TYPES:

### Movement of Metal

Metal objects moving into or out of the electromagnetic field of the sensor coil.

### Intermittent Loops of Metal Surrounding the Sensor Coil

Built in structural metal loops that reflect the electromagnetic field of the sensor coil may be present in the search area.

### Excessive Line Voltage Fluctuations

### Proximity to Severe RF Radiation Sources

Detailed specific discussions of each of the above interference sources follows:

### Movement of Metal

Large masses of metal such as shaker screens, metal deflection plates, vehicles etc. may affect metal detector operation even when at a considerable distance from the sensor coil. Other smaller masses of moving metal when sufficiently close to the search unit may also cause false trips. Interference may exist outside of the room or building and be hidden from operators' view, such as vehicular traffic in an alley next to the building wall or a chain conveyor below or above the floor, or moving metal objects in an adjacent room.

### Corrective Measures

- Secure moving metal objects or remove them altogether if possible, or replace with a non-metallic material. Re-route vehicular traffic.
- Place a metal shield securely fastened and stationary between the sensor and the source of interference. Place a shield as close to moving object as possible. The size of the shield will depend on the size of the moving object.
- Install the metal detector in another location free from interference sources.



## **INTERMITTENT LOOPS OF METAL SURROUNDING THE SENSOR (SHORTED TURNS)**

A source of interference, which is difficult to recognize is that of the shorted turn. A shorted turn is formed by metal pieces forming a complete path in some plane around or near the sensor.

If this is intermittent, as in the case of two pieces of conduit occasionally touching together, the detector will trip each time the conduits make or break connections. The intermittence may be caused by physical deflection or vibration of equipment, and by expansion or contraction of metal due to temperature changes.

The affect of the 'shorted turn' is that of a secondary 'coil' or 'turn' coupled to the metal detector sensor coil. The varying load of this secondary 'coil' when it makes or breaks is reflected to the sensor coil tripping the control unit.

The following metal objects may be part of or form a 'shorted turn' by themselves: metal framework, pipes, conduit, flexible conduit, guard railing, metal catwalks, conveyor rolls, etc.

To determine the existence of a 'shorted turn': switch the metal detector off and disconnect the sensor lead at the terminal block. This will disconnect the sensor from the control instrument and there will be no metal detection.

Now, turn the control instrument on again and set gain control to maximum. Run operation under normal conditions and observe the signal level indicator. If the indicator is stable at this time, it is most likely that a 'shorted turn' is being picked up by the sensor. However, the problem may also be a break on the sensor cable.

Check for breaks at this time and replace the cable if necessary.

If the cable is in good condition search for a 'shorted turn' as described in the following paragraph. If the level indicator is not stable at this time, the problem is likely to be due to excessive line voltage fluctuation.

To isolate and correct the 'shorted turn' problem, reconnect the sensor coil and turn off all surrounding equipment in order to eliminate any vibration.

The level indicator should settle down at this time or at least reduce the number of false trips.

Proceed by tapping on all metal objects, starting near the sensor coil and working out from there, in order to find where the break point is located. It is suggested that one person watch the level indicator on the control unit in order to observe any movement while another person is tapping on metal objects around and near the sensor coil.

In some cases, this may be several feet from the sensor coil. Sudden level indication movement when a metal object is tapped will indicated the intermittent connection. It may be possible to fix the problem by insulating or permanently securing this metal to metal connection. For example, in the case of broken weld, re-weld or in the case of a loose pipe or conduit, re-secure the holders.

## **EXCESSIVE LINE VOLTAGE FLUCTUATIONS**

Electrical interference may be in the form of line voltage 'spikes' caused on-off varying inductive loads of electrical equipment on the same power line as the metal detector, or other power lines in close proximity to the supply line for the metal detector.

### **Corrective Measures**

- Use another power line, (without the varying inductive loads) for the metal detector.
- Disconnect electrical equipment causing the large inductive loads.
- Connect interfering electrical equipment to another power source.
- Re-route the power line to the metal detector.
- Install a constant voltage transformer (120 VA minimum) between metal detector and power source.

## **PROXIMITY OF SEVERE RF RADIATION SOURCES**

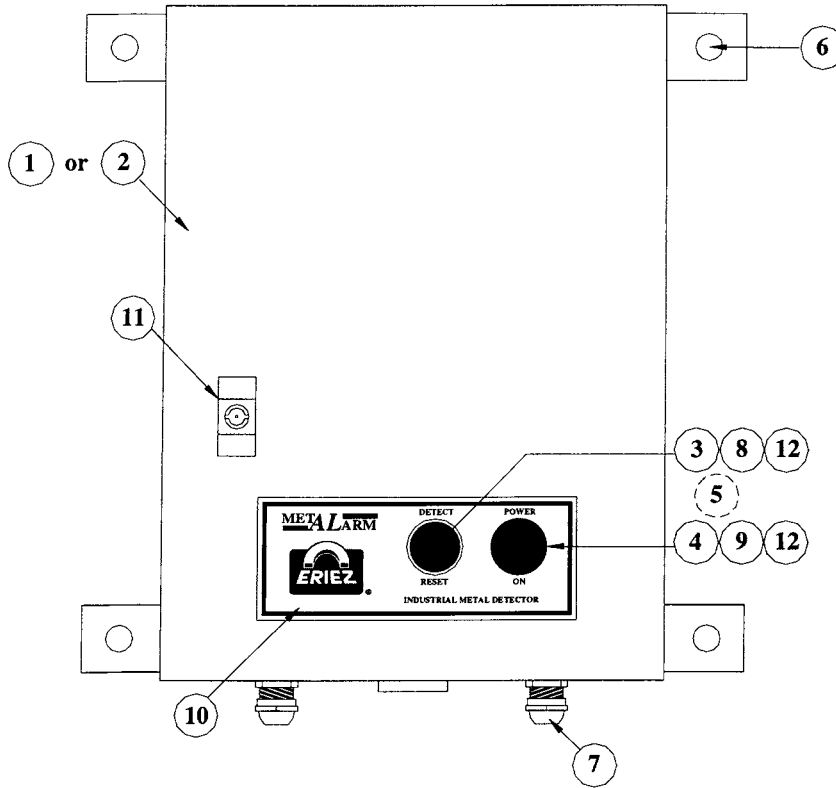
Electrical or electronic interference can be radiated into the sensor coil or introduced into the metal detector from other energy emitting devices such as arcing motors, arc welders, and arcing relay points.

### **Corrective Measures**

- Remove or replace equipment causing the interference.
- Operate welding equipment only at times when metal detector is not required to operate.

Call the factory service department if unable to arrive at a satisfactory solution.

# Parts List



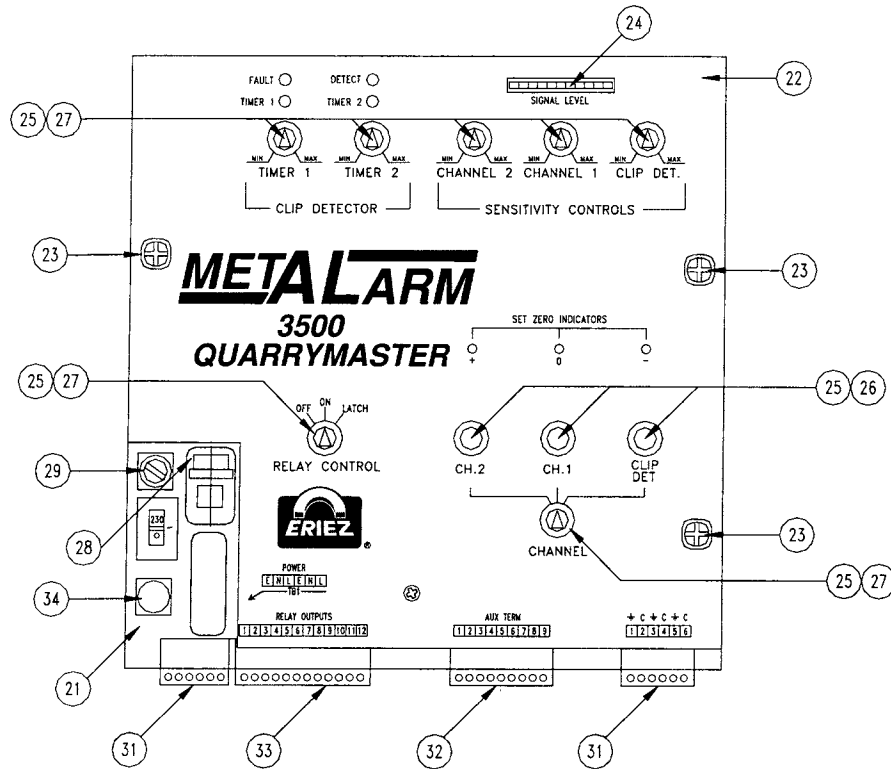
ITEM NUMBER	DESCRIPTION	PART NUMBER	QUANTITY
1	Case fully fitted	816557	1
2	Stainless steel case CRS43/150	816558	1
3	Momentary Illuminated Switch Assembly	816512	1
4	Indicator Assembly	816513	1
5	Front Door Wiring Loom	816514	1
6	Insulated Mounting Kit	816515	1
7	Cable Gland PG 11 Brass	816516	As Req'd
8*	LED's MBC Red	816517	1
9*	LED's MBC Yellow	816518	1
10	Front Label 3500QM2	816519	1
11	Door Key	816520	1
12*	Lamp 12V MBC	818594	2

\*NOTE: Certain controls use Items 8 and 9, while other controls use Item 12.

## SEARCH COIL CABLES

DESCRIPTION	ITEM NUMBER	QUANTITY
Cable Search Coil - 3m	816210	1
Cable Search Coil - 5m	816211	1
Cable Search Coil - 10m	816212	1
Metalarm Male Cable Connector	818213	1-2





ITEM NUMBER	DESCRIPTION	PART NUMBER	QUANTITY
*	Electronic Unit Complete	816531	1
21	PTL 154 Printed Circuit Board	816556	1
22	Front Panel 3500QM2		1
23	Push Latch Arrow 2001	816522	3
24	Bargraph Module with Plug	816523	1
25	Control Knob	816524	10
26	Plain Cap for Control Knob	816525	3
27	Pointer Cap for Control Knob	816526	7
28	Relay 4p C/O	816200	1
29	Fuse T500mA 20mm	816201	1
31	Combicon Plug 6 Way	816528	2
32	Combicon Plug 9 way	816529	1
33	Combicon Plug 12 Way	816530	1
34	Fuse T1A 20mm		1

\*Electronic unit comprises - printed circuit board, bargraph module, front panel etc. all mounted on back plate.

*Note: Some safety warning labels or guarding may have been removed before photographing this equipment.*

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