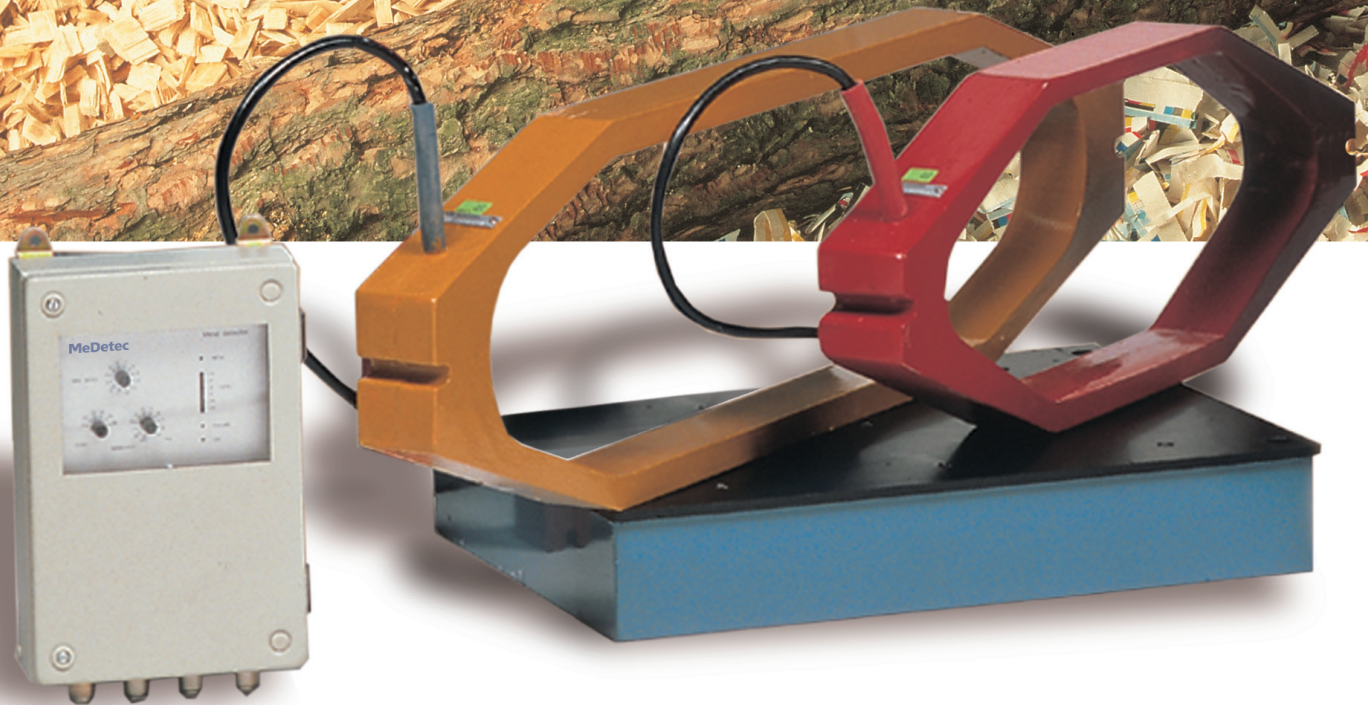


# Metal Detector QSDM 104V

## User's Guide

M104VMENG



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### Use of **DANGER**, **WARNING**, **CAUTION**, and **NOTE**

This publication includes, **DANGER**, **WARNING**, **CAUTION**, and **NOTE** information where appropriate to point out safety related or other important information.

<b>DANGER</b>	Hazards which could result in severe personal injury or death
<b>WARNING</b>	Hazards which could result in personal injury
<b>CAUTION</b>	Hazards which could result in equipment or property damage
<b>NOTE</b>	Alerts user to pertinent facts and conditions

Although **DANGER** and **WARNING** hazards are related to personal injury, and **CAUTION** hazards are associated with equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process performance leading to personal injury or death. Therefore, comply fully with all **DANGER**, **WARNING**, and **CAUTION** notices.

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## **Chapter 1 Presentation**

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### **1.1 General**

Metal detector QSDM 104 is used to detect undesirable metallic objects in flows of non-metallic, electrically non-conducting materials. The detector is sensitive to all metals.

The flow of material passes one or two search coils. The magnetic field of the coils is affected by the presence of metals.

If metal is detected, a relay falls in the electronics unit. The relay may be connected to activate an alarm, send a stop impulse to the conveyor belt, a signal to the scraping device, etc. As the relay is normally on, a fault signal is obtained in the event of loss of power or a cable failure. This increases the reliability of the equipment.

All metals are indicated. Certain hygroscopic (water-absorbing) materials that are not indicated in the dry state become electrically conducting in the moist state. They can then be indicated as if they were metallic objects. Such indications can normally be avoided by suitable adjustment of the sensitivity of the QSDM 104, but difficulties may be encountered whenever the moisture content of the material fluctuates widely.

## 1.2 Equipment

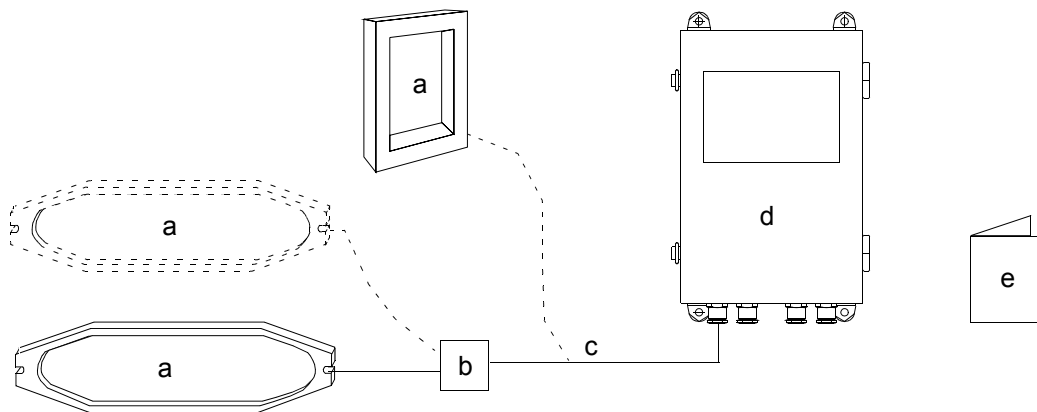


Figure 1-1. Metal detector equipment

A complete set of detector equipment consists of the following parts:

- a. A search coil or coil system, with two coils (data as per the order specification). The search coil has 1 m of signal cable for connection to the connection box. In certain cases, the connection box capacitors are in the coil. This applies to screened coils.
- b. Connection box QSDM 103A.
- c. Signal cable, 1-100 m, for connecting the electronics unit and the connection box. A cable with a length of 10 m is normally supplied.
- d. Electronics unit QSDM 104.
- e. This manual

### NOTE

In certain cases the search coil and connection box are integrally built.

## Chapter 2 Technical description

### 2.1 Function

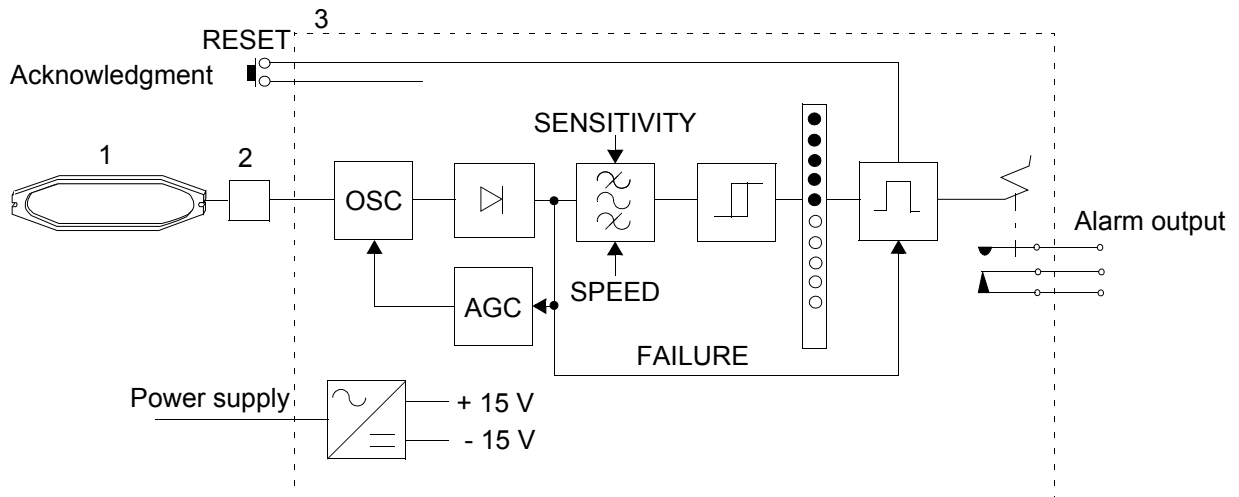


Figure 2-1. Block diagram

The search coil (1) and connection box (2) form an oscillating circuit for the oscillator located in the electronics unit (3). The oscillation of the oscillator generates an alternating magnetic field in and around the coil. A metallic object that is encountered by this magnetic field sends out, in turn, a magnetic field. This affects the oscillating amplitude of the oscillator and is detected.

The metal detector is fitted with automatic adjustment (AGC) of the correct working point. This ensures good performance under varying ambient conditions for a long period.

When the signal has passed a filter, which takes into account the sensitivity and speed settings, level detection takes place. This involves measuring the changes in the oscillating amplitude of the oscillator,

The green LEDs on the level indicator indicate that the signal does not activate an alarm, while the red one indicates a metal alarm (METAL). The relay drive circuit provides a break pulse that lasts at least 0.15 seconds if the acknowledgment input (RESET) is closed. Open acknowledgment input results at the output relay entering the alarm state until it is reset by closing the RESET briefly.

The function of the metal detector is monitored by a fault-indication system. In the event of a FAILURE, a continuous break that cannot be reset results at the output relay. Loss of measuring voltage to the metal detector also results in a break at the output relay. This is energized during normal operation without the metal alarm.

## 2.2 Settings

### MAX SPEED

MAX SPEED is used to set the maximum speed at which the metallic object being sought will travel. If the set speed is exceeded, the object passes without being detected.

The function of the MAX SPEED setting is to effectively remove interference of the vibration and pulse type. Settings may be altered in steps, 1 - 12. The relevance of a certain setting in terms of the speed in meters/second depends on the size of the search coil. 1 is the lowest speed and 12 the highest.

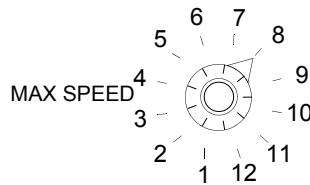


Figure 2-2. Setting of highest speed

### SENSITIVITY

The SENSITIVITY setting is divided into COARSE and FINE. FINE covers the range between the COARSE steps (For example, SENS 45 = COARSE 40 + FINE 5). An increase in the sensitivity setting results in a higher signal level on the LEVEL indicator. If the sensitivity setting is increased, smaller metallic objects can be detected. The OFF position on FINE disconnects the input signal and is for testing the electronics.

Short interference can occur in conjunction with changes in sensitivity.

The FINE SENSITIVITY switch has a twelfth, unmarked position between "9" and "OFF", which is connected to position 9.

SENSITIVITY COARSE has a first unmarked position before "0", which gives an extra reduction of the sensitivity (to -10).

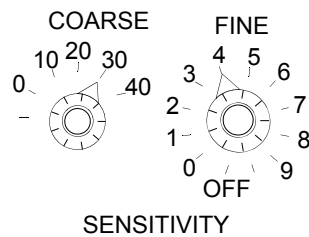


Figure 2-3. Setting of sensitivity

### RESET

If it is desirable to have a hold function after a METAL signal, an external, momentarily connected switch can be connected to X2:1-2 (See Section 2.4) to obtain a manual RESET function.

## 2.3 Indications

### METAL

The red METAL LED lights up whenever the metal detector indicates metal. Whenever the METAL is lit up, the output relay is unenergized.

If the MAN RESET function is used METAL lights up until RESET is closed briefly. With AUTORESET a short light pulse is received every time metal is detected.

### LEVEL

The LEVEL indicator shows the present signal and noise levels. Whenever the signal reaches up to any of the red LEDs the metal alarm is activated. The green LEDs indicates signal levels below the alarm limit. The level normally "fluctuates" up and down in the line of green LEDs in step with interference.

### FAILURE

The yellow FAILURE LED indicates that the oscillator is not oscillating. This may be due to a cable failure or damaged coil, for instance. Very large magnetic objects at the coil may also activate the FAILURE LED.

### ON

The green ON LED indicates that the metal detector is in operation. In the event of a power failure or fuse failure the ON LED goes out.

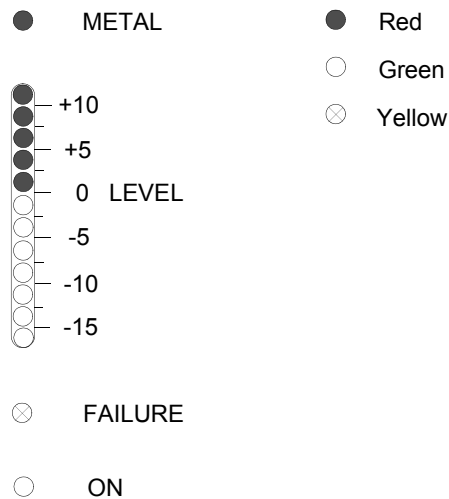


Figure 2-4. LED-indications

## 2.4 Connections

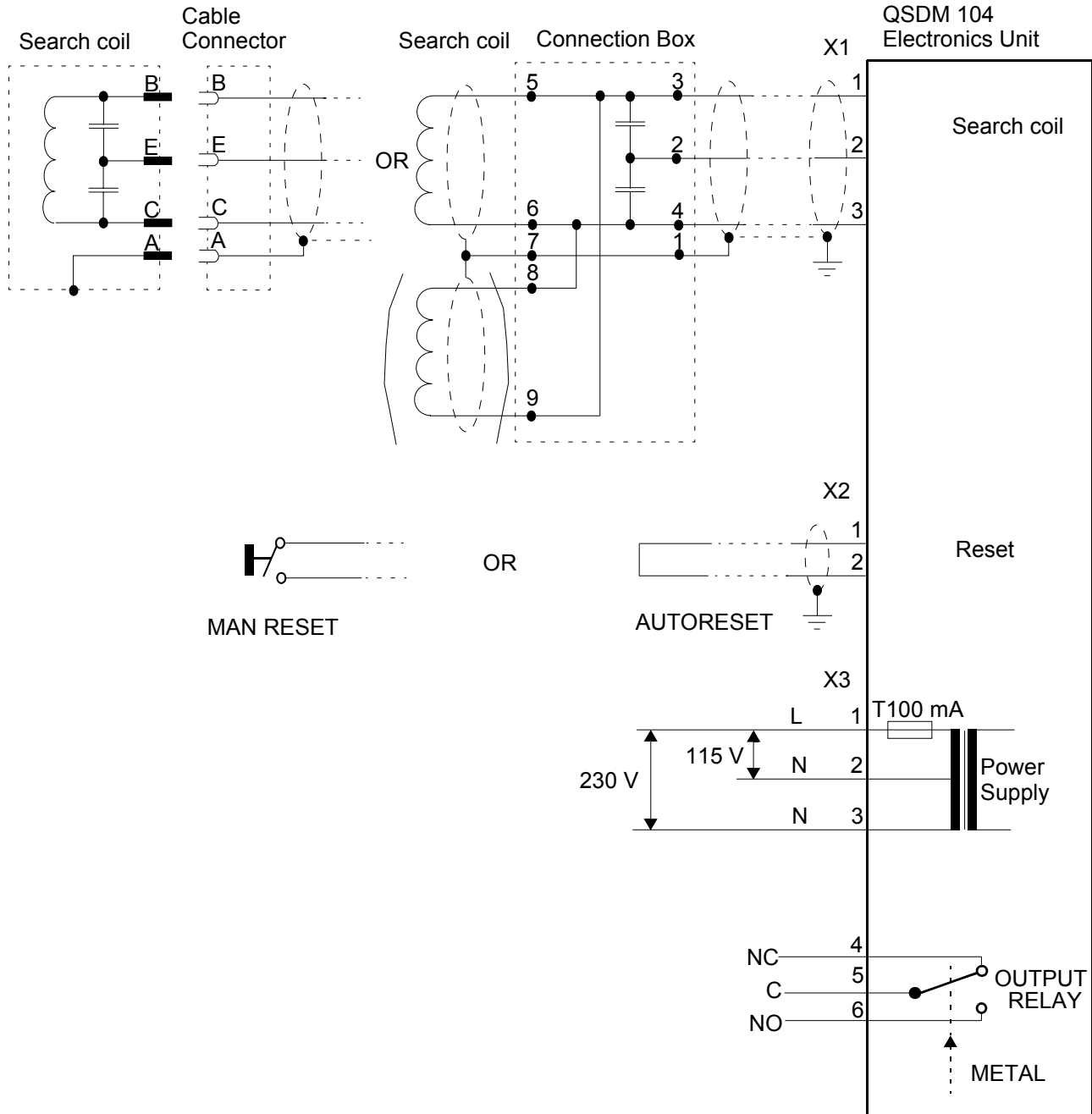


Figure 2-5. External connections

## 2.5 Sensitivity of the metal detector

### 2.5.1 General

The sensitivity of the detector, i.e. its ability to indicate metallic objects, is dependent on the position of the object, its size, speed and orientation relative to the coil. The sensitivity to different metals also varies slightly.

### 2.5.2 The smallest object that can be indicated

The smallest metallic object that can be indicated at maximum sensitivity is approx. 2 % of the equivalent diameter of the search coil. This means that the object must be at least 2 % of the diameter of the circle whose circumference corresponds to that of the coil.

The equivalent diameter is given approximately by the formula:

$$D_{eqv} \approx \frac{\text{Circumference}}{3} \approx \frac{2 \times (B + L)}{3}$$

where B and L are the inside dimensions of the search coil as per Figure 2-6.

Example: With B = 218 mm, and L = 610 mm,  $D_{eqv}$  is 550 mm and the diameter of the smallest object that can be indicated is approximately 11 mm.

Because of the oval shape of the search coil the distance between the metal object and the coil is short. In this case, the smallest steel ball that can be indicated is approximately 8 mm.

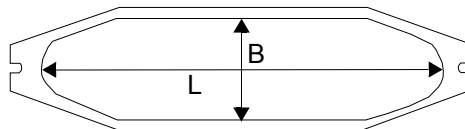


Figure 2-6. Unshielded search coil

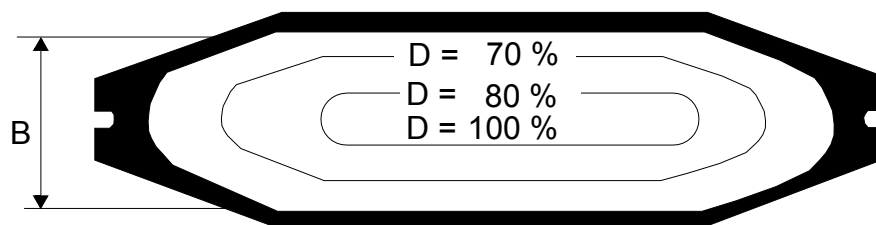


Figure 2-7. Flow of material through a search coil

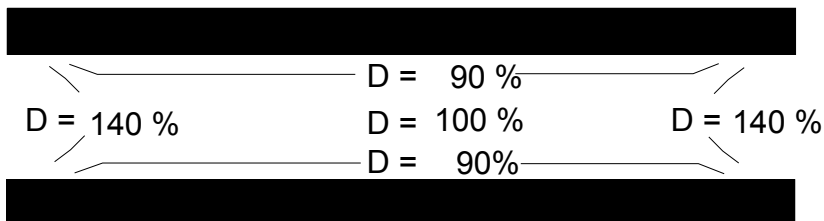


Figure 2-8. Flow of material between two search coils

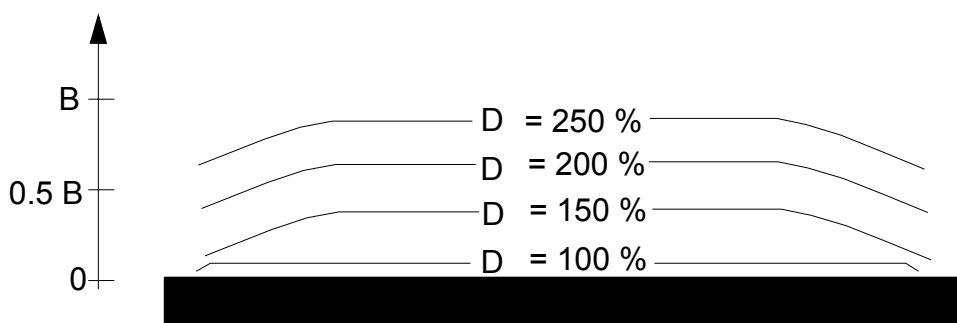


Figure 2-9. Flow of material above a search coil

Figures 2-7, 2-8 and 2-9 give an idea of how the sensitivity varies in a search coil system. The sensitivity is always greatest close to the surface of the coil. In the figures, D is the diameter of the smallest steel ball that can be detected at the sensitivity setting in use.

The search coils in the figure above are of the same size and shape. The dimension B is the internal width of the coil (Figures 2-7 and 2-9).

The real limits are naturally flexible. Those given in the figures provide a simplified picture of the reality.

## 2.6 Technical data

<b>Power supply:</b>	90 - 130 V AC (106 V -15 % to 118 V +10 %) 185 - 265 V AC (218 V -15 % to 240 V +10 %)
<b>Power frequency:</b>	47 - 65 Hz
<b>Power consumption:</b>	10 VA
<b>Sensitivity:</b>	Max. approximately 2 % of the equivalent diameter of the search coil.
<b>Travel speed of the object:</b>	Max. 4 times the "B" dimension per second Min. 1/4 of the "B" dimension per second
<b>Indicating relay switch data:</b>	Insulation working voltage = 250 V AC/DC  Max. current = 15 A for 200 ms, 4 A continuous Break capacity, AC: 8 A at 250 V $\cos \Phi > 0.4$ Break capacity, DC: 0.3 A at 127 V, 0.2 A at 240 V Switch resistance: 0.2 ohm at 0.1 A / 24 V 50 Hz (refer in other respects to IEC 255-7)
<b>Duration of alarm signal:</b>	Min. 0.15 s
<b>Ambient temperature:</b>	
Electronics unit:	-25 to + 55 °C
Connection box and search coil:	-40 to + 55 °C
<b>Form of protection:</b>	
Electronics unit, connection box and search coil:	IP 65 in accordance with IEC 144 and DIN 40 050
<b>Dimensions:</b>	
Electronics unit:	300 × 200 × 90 mm
Connection box:	125 × 125 × 76 mm
Search coil:	See separate dimension drawing
Signal cable:	1 - 100 m, screened, 3 × 0.5 mm <sup>2</sup> . A cable with a length of 10 m is normally supplied.
<b>Weights:</b>	
Electronics unit:	4.5 kg
Connection box:	0.6 kg
Search coil:	As per the catalogue

## 2.7 Dimension drawings

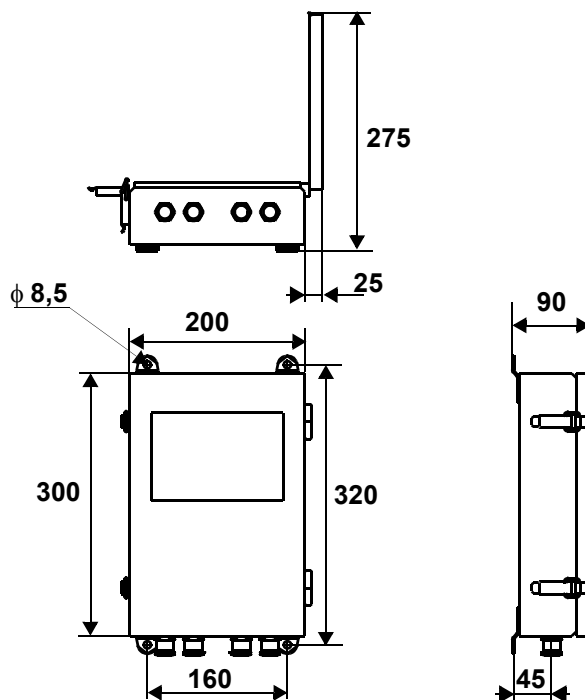


Figure 2-10. Electronics unit QSDM 104

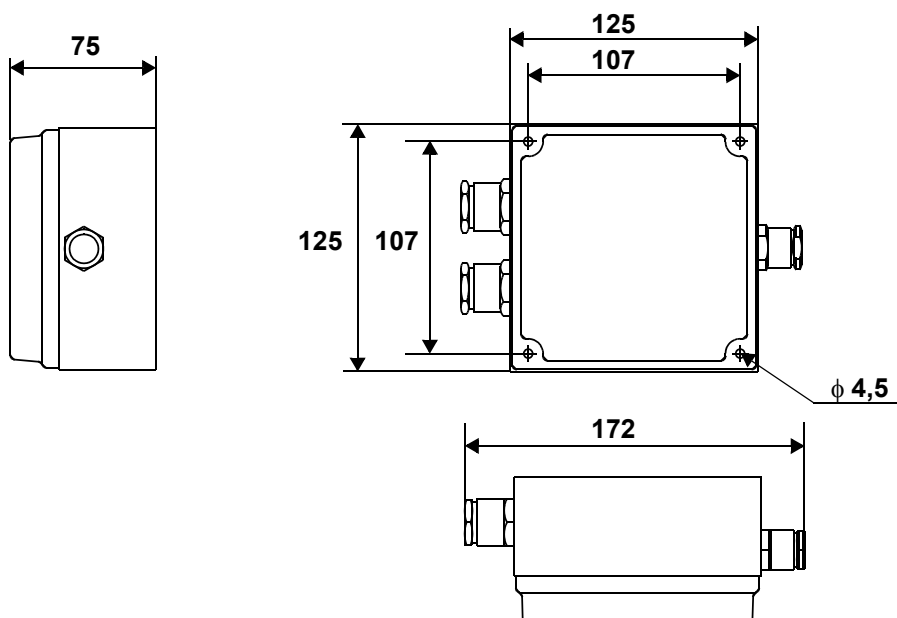


Figure 2-11. Connection box QSDM 103A

## **Chapter 3 Installation**

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### **3.1 General**

Careful selection of the location and careful installation of the search coil/coils and other parts are of decisive significance for the performance of the metal detector. Follow, therefore, the installation instructions carefully and take into account the metal-free zones.

The detector only indicates objects of metal or other electrically conducting material that move in relation to the search coil. Objects that do not move do not cause any indication. But a large, stationary metallic object close to the coil can affect the magnetic field, so as to reduce the sensitivity of the detector slightly.

**NOTE**

- A** To avoid disturbance and possible damage to the coil itself, the search coil should be protected from blows and vibration at all times.
  
- B** Movable metal parts in the vicinity of the coil may be a source of interference, especially if they are large or very close to the coil.
  
- C** Poorly fitting or loose electrical connection between metal parts in the vicinity of the coil may be a source of severe interference. Check for welding cracks, loose rivets or screws, rust and damaged painting.
  
- D** Electric cables are usually emitters of disturbance and where they run past the coil they must be housed in iron pipes or tubes. This is especially important if a thyristor control or frequency converter is connected to the cable from which the interference originates.
  
- E** The search coil winding is on the inside of the search coil and it should not be placed close to iron objects such as the supporting beams of the conveyor, since this will cause extra magnetic loss.
  
- F** Magnetic fields set up by electric motors may represent a powerful source of interference, especially if the motors are connected to thyristor equipment. Sparks in the motor brushes may be another source of disturbance.
  
- G** Unless provided with spark quenchers, contactors and contacts may also cause interference.
  
- H** Electric welding may occasionally be a source of interference even at some distance (>50 m), depending on how the cables run. Electric welding in the immediate vicinity of the search coil may cause permanent damage to the electronic apparatus. The coil's connections with the connection box will therefore have to be short-circuited, e.g. by winding a non-insulated copper wire round the soldering turrets. This will not be necessary on screened search coils (where the connection box is mounted directly on the search coil itself).

## 3.2 Installing the search coil

Depending on the use, the search coils may be located in three different positions in relation to the material being transported.

1. The material passes through one search coil.
2. The material passes between two search coils.
3. The material passes above one search coil.

There are also variants of these three location alternatives. The material may, for example, pass under one search coil.

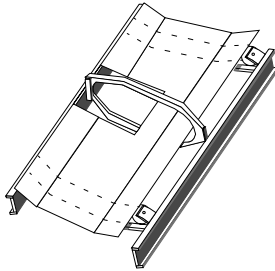
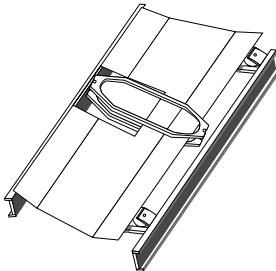
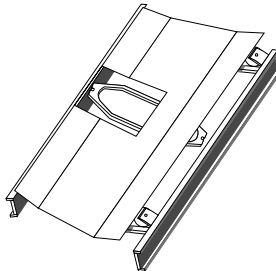
	<b>Location 1</b>	<b>Location 2</b>	<b>Location 3</b>
			
<b>Sensitivity</b>	Highest. possible	Somewhat lower than Location 1.	Diminishes with increasing distance above the search coil.
<b>Metal-free zones</b> (See also Section 3.3)	Small above and below the conveyor.	Short along the longitudinal axis of the conveyor.	Short along the longitudinal axis of the conveyor.
<b>Installation</b>	The conveyor belt must be cut to thread it through.	The conveyor belt need not be cut. Easy to move.	The conveyor belt need not be cut. Easy to move.
<b>Load height</b>	Limited by the height of the coil.	Limited by the upper coil but is adjustable within certain limits.	May vary without risk of causing damage.

Figure 3-1. Review of the location alternatives

### **Location 1**

Location 1 permits the highest sensitivity. But the conveyor belt must be cut for installation and then vulcanized together again. This may be unnecessarily difficult, particularly if it is then found to be necessary to move the search coil because of interference or alteration of the conveyor installation.

### **Location 2**

The sensitivity in location 2 is somewhat lower than that in Location 1, but it may be said to be equivalent to it, because it is seldom desirable to use the detector's maximum sensitivity in practical applications.

Mount the search coils with the arrows on the coil rating plates pointing in the same direction, both pointing upwards or both downwards. Attach the coils with great care, as false indications can occur if the magnetic coupling between the coils changes, i.e. the coils can move in relation to one another.

The distance between the search coils should be  $0.8 \times B$ , where B is the internal width of the coil (See Figure 2-6). The minimum permitted distance between the coils is  $0.7 \times B$ . If the best sensitivity is sought, the distance should not be greater than B, as the sensitivity in the zone between the coils diminishes with increasing distance between the coils.

### **Location 3**

Location 3 is intended for cases in which the load height can fluctuate widely and the metallic objects to be detected are on or close to the conveyor belt.

Example: Conveyor belts that carry items such as isolated large stones and possibly bucket teeth. In the transport of timber, where it is desirable to detect any tools or other metallic objects upstream of a chipper.

Install the search coil as close to the underside of the conveyor as possible, but the conveyor must not be able to touch the coil. If the sag of the conveyor belt varies widely, a sheet of wood can be installed between the coil and the conveyor belt. The conveyor belt can then slide on the sheet of wood whenever the sag is large.

### 3.3 Metal-free zones

The metal-free zones are not an absolute requirement, but recommendations to achieve interference-free performance without false alarms at maximum sensitivity.

The sketch below shows the magnitude of these zones for the different locations in accordance with Section 3.2, if the highest sensitivity is required.

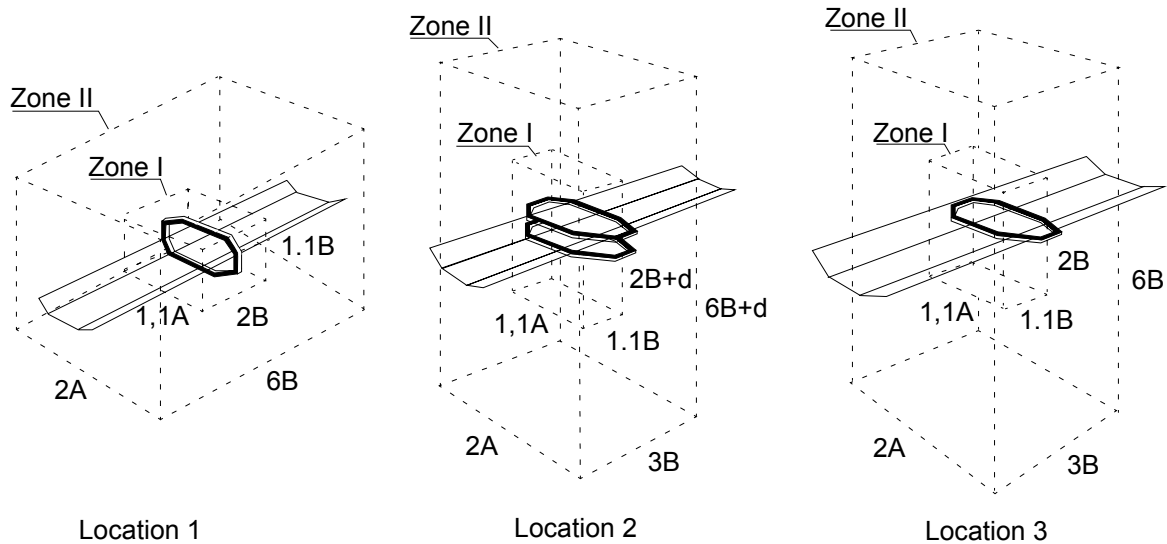


Figure 3-2. Recommended metal-free zones.

*d*: the distance between the search coils (optically 0.8B)

Zone I: No metallic objects, with the exception of the coil attachment bolts.

Zone II: Small metallic objects permitted, but no moving or vibrating ones.

If the investigated material is being transported by conveyor belt, the belt must not itself be made of metal or other conducting material. Nor may the conveyor be reinforced with wire ropes. The conveyor joints must be glued or made in some other way that employs non-conducting materials.

The width of the conveyor belt is limited in certain cases by edge-pieces that rest against the conveyor. These devices must not be made of metal when they are within the metal-free zone of the search coil.

### 3.4 Loose contact between metallic parts

This type of interference can be difficult to detect, as very small movements of material far from the search coil can generate large signals.

If the coil is installed between two support rollers, the support rollers and the conveyor's longitudinal beams form a short-circuited loop around the search coil that generates interference if the resistance in it varies or if it moves in relation to the coil

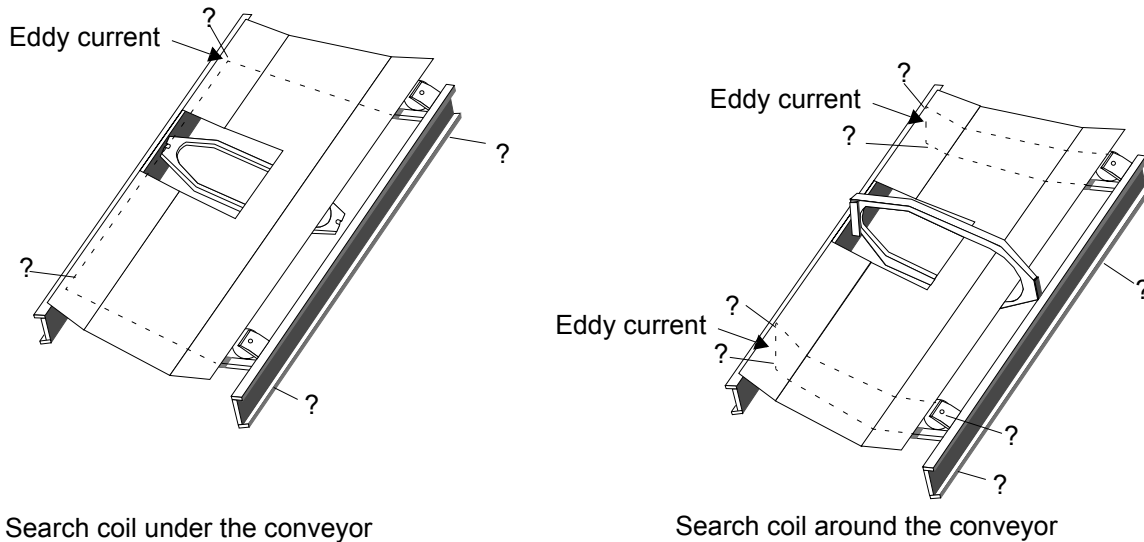


Figure 3-3. Eddy currents (? = poor contact)

Such a short-circuited loop can be broken, but the problem then moves, instead, to the next possible transverse connection between the longitudinal beams.

An effective and tested solution to the problem is usually to ensure, instead, that the resistance in the circuit formed does not fluctuate. This can be done by short-circuiting the magnetic flux of rollers and idlers. Weld iron plates between the beams as near to the conveyor idlers as possible on the sides of the idlers facing towards the search coil.

### 3.4.1 Screening plates

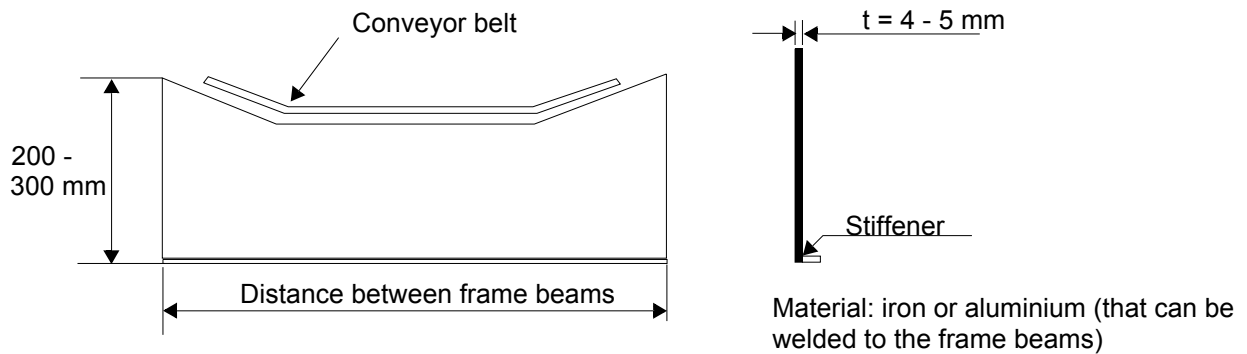


Figure 3-4. Screening plates (2 pieces)

- Cut one of the sides of the plates so that it matches the bulge of the conveyor.
- Reinforce the plate by bending the lower edge or welding on an angle iron.
- Fit the plates between the search coil and conveyor idler as far from the coil as possible, (See Figure 3-5). The plates must be mounted at right angles to the conveyor and must not be moved to a higher point, towards the conveyor belt, than permits the conveyor belt to move freely in all positions. The distance between the roller and the plate should be about 10 mm. **Weld the plates to the frame beams.** The plates and welds should naturally then be anti-corrosion treated.

The method of screening the search coil using screening plates is shown below. This often provides good results.

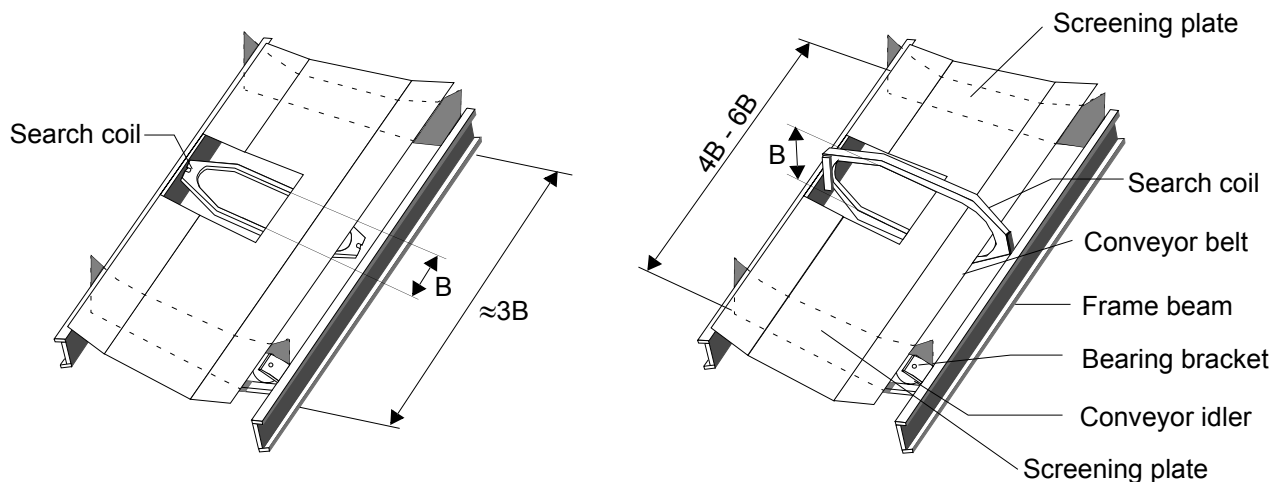
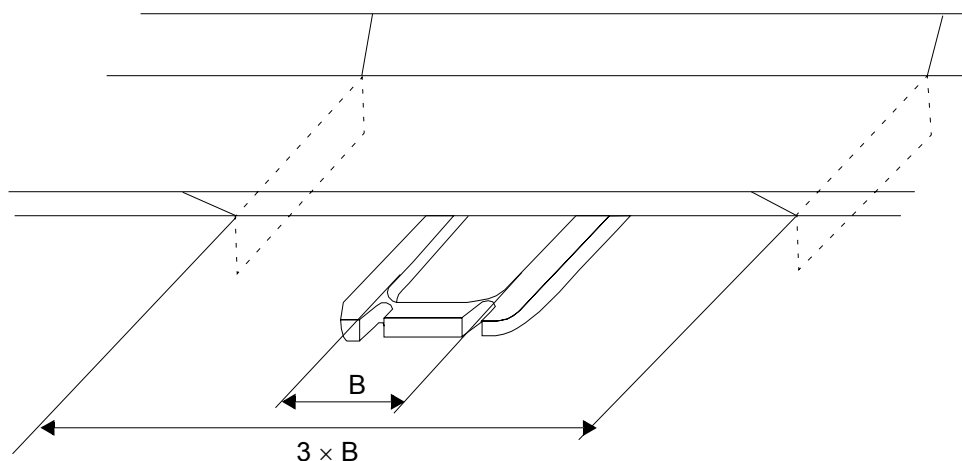


Figure 3-5. Location of screening plates

## 3.5 Installation examples

### 3.5.1 Chipper



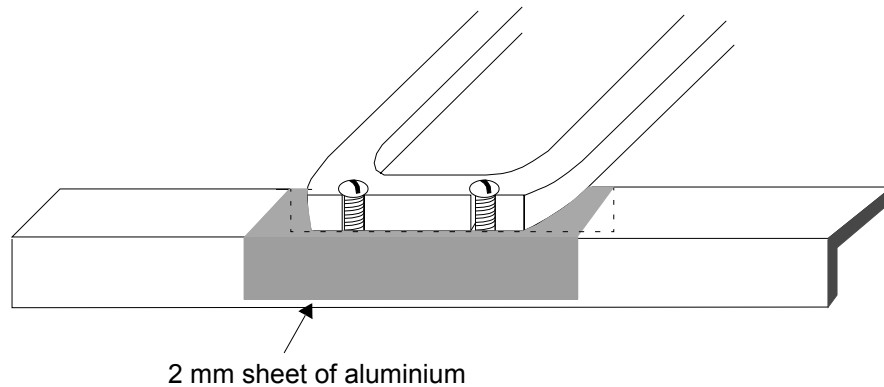
*Figure 3-6. Metal-free zone ( $3 \times B$ ) in vibrating conveyor*

Beware of heavy impacts that can result from rough loading onto the conveyor close to the search coil (within a few meters).

To avoid vibrations from a vibrating conveyor, mount the coil under the chute, so that the vibrating conveyor can never come in contact with the coil.

The section of the vibrating conveyor must be free from metal over a distance of about three coil widths.

If the conveyor belt consists of a strip in the bottom of a plate-metal chute, the chute should be replaced by a section free from metal that is about three coil widths long. If only the bottom under the strip is free from metal there is a great risk that even large metallic objects can remain undetected if they pass close to a side plate.

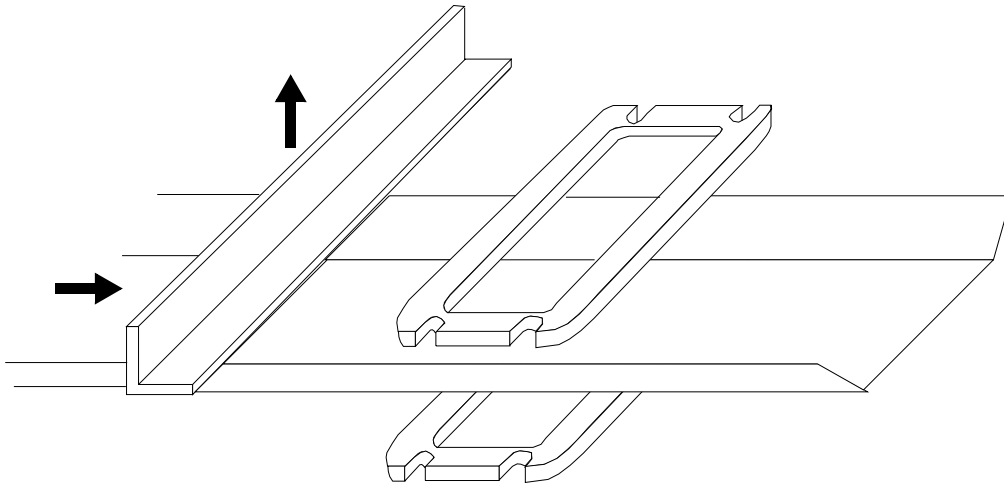


*Figure 3-7. Screen of aluminium decreases losses and increases sensitivity*

The search coil may be attached with metallic bolts. The inside, where the winding is, should not be located near parts made of iron.

If the search coil must be bolted onto wide iron beams, a 2 mm thick sheet of aluminium should be placed between the coil and the iron beam to screen the disturbing effect of the beam.

If a double-coil arrangement is used, the upper coil should be protected mechanically so that material on the conveyor cannot damage it. The device can be arranged so that it swings away and activates an emergency stop switch whenever the load is too high.



*Figure 3-8. Mechanical protection of upper search coil*

Any search coil under the conveyor should be at sufficient distance from the conveyor that there is no risk of it being touched by a fully loaded conveyor.

The conveyor belt must never contain metal strands or be joined using metal parts.

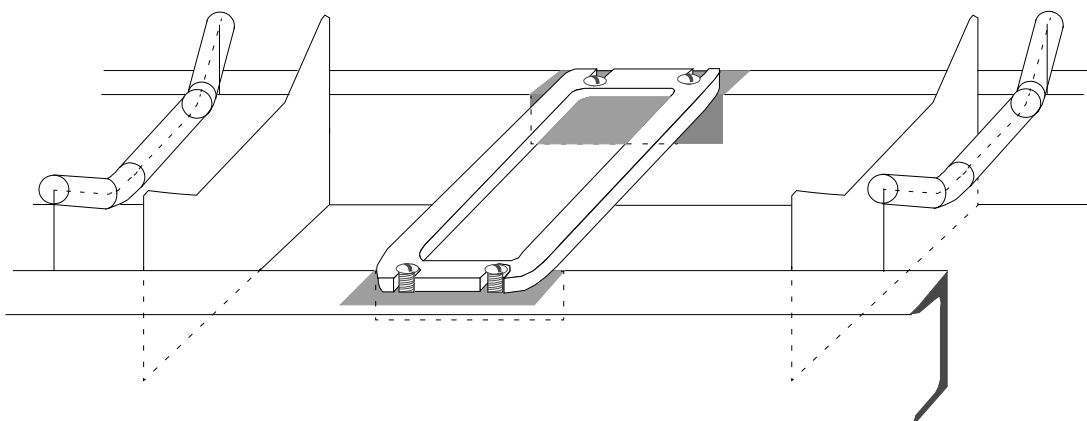
### 3.5.2 Stone crusher

The search coil should generally be mounted under the conveyor belt, so as to protect it from rock on the conveyor. If the coil is fitted above the conveyor belt, check that the distance between the coil and conveyor belt is sufficiently large for stones not to hit the coil.

Blows and impacts from loading the conveyor can cause interference. The amount of interference can be reduced to a minimum by separating the loading zone and crusher mechanically from the part in which the search coil is suspended.

Short-circuited loops of ignition cable in rock masses can produce metal signals and false alarms. The same thing applies to large, thin sheets of aluminium foil (such as from bars of chocolate).

Conveyor idlers are usually bolted securely onto the conveyor to facilitate service. This implies a built-in interference risk, due to the loose connections that can occur at the idler attachment points. The problem can usually be remedied by connecting idlers electrically, using a short-circuiting device that is welded on (see Section 3.4).



*Figure 3-9. Additional screening measures around the search coil*

This arrangement also reduces the sensitivity to electrical interference.

### 3.6 Fitting the connection box

Mount the connection box (b) on a support that is as vibration-free as possible. The maximum distance to the search coil is limited by the length of the coil signal cable (1 m), but efforts should be made to fit the connection box outside Zone II, as described in Section 3.3.

A drawing with dimensions is shown in Section 2.7.

### 3.7 Fitting the electronics unit and signal cable

Mount the electronics unit (d) vertically on a support that is as vibration-free as possible. The cable fittings should face down.

The maximum distance of the electronics unit from the connection box is determined by the length of the cable (c), 100 m maximum.

The electronics unit should be protected from direct sunlight. Otherwise the temperature in the box can become too high. A protective roof that prevents snow and rain from entering the box when it is open is recommended.

The signal cable (c) must not be run parallel to any power cable. This applies particularly to cables carrying strongly fluctuating current. Install the cable carefully, so that vibrations and suchlike do not cause false indications or failure of the cable. There is a risk of false indications if the outer sheath of the signal cable is damaged so that the screen makes loose contact with any metallic object.

The cable or cables that are connected to the connection box must be attached properly. There must be no loose loops that can sway or vibrate, as these can cause false indications.

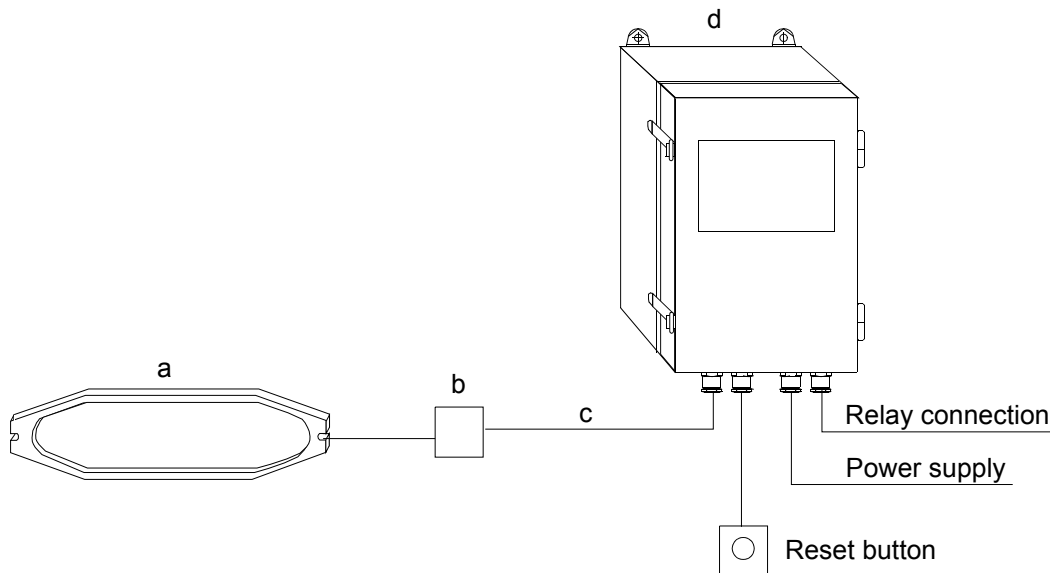


Figure 3-10. Installation and cabling of electronics unit

## 3.8 Connecting cables

### 3.8.1 Connecting the search coil to the connection box

Connect the cable from the search coil or coils to the connection box as shown in Figure 3-11.

The cable consists of an 8-conductor and screen, with the conductors, bundled four and four, and marked "+" and "-".

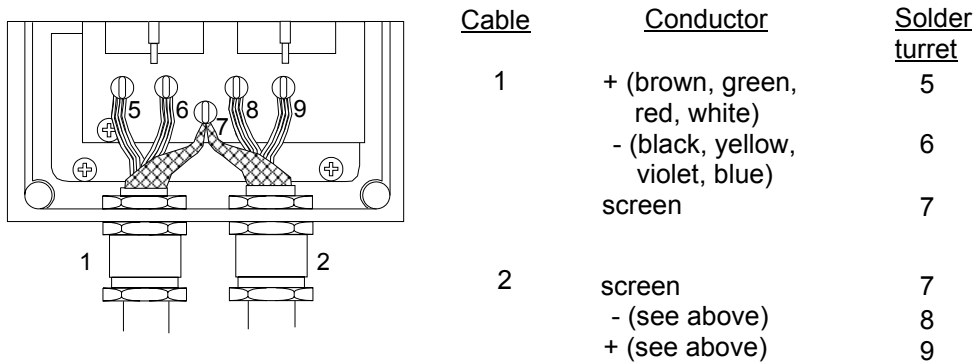


Figure 3-11. Connection of one or two search coils in the connection box

For soldering make the conductors as short as possible. After soldering, bundle them together with a strap or similar, so that the conductors will not be able to vibrate and cause false indications.

Use solder that has a flux core and is designed for soldering electronics. Do not use acid flux.  
**Seal any unused cable fittings.**

### 3.8.2 Connecting the signal cable to the connection box

Connect the signal cable from the electronics unit as shown in Figure 3-12.

For soldering make the conductors as short as possible.

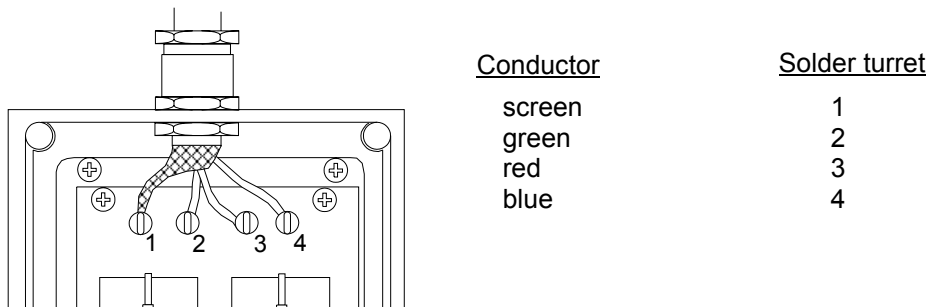


Figure 3-12. Connection of the signal cable in the connection box

### 3.8.3 Connecting the signal cable to the cable connector

Certain coils are fitted with built-in capacitors. Make the connection via a connector. No connection box is required in this case.

Cable connector with 10 m cable: 2639 0834-AA

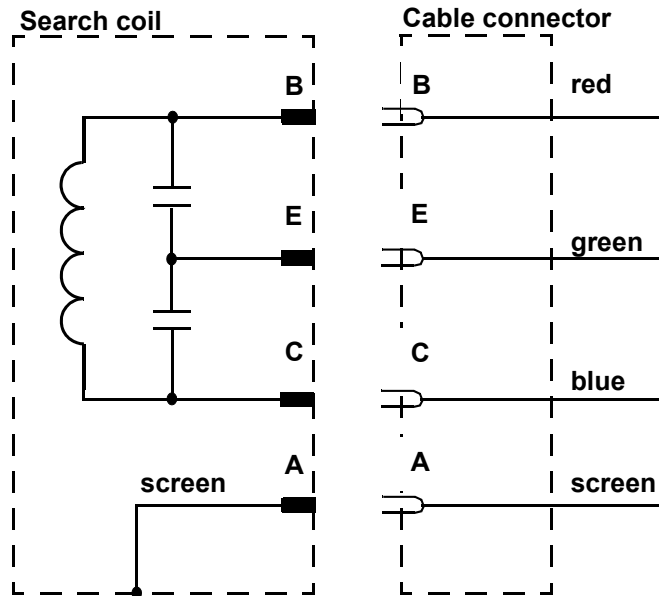


Figure 3-13. Connection of signal cable to cable connector (valid for screened search coils)

### 3.8.4 Connecting the signal cable into a connection box on the search coil

Certain coils are equipped with a built-in connection box. The circuit board in this has screw terminals for connecting the signal cable from the electronics unit.

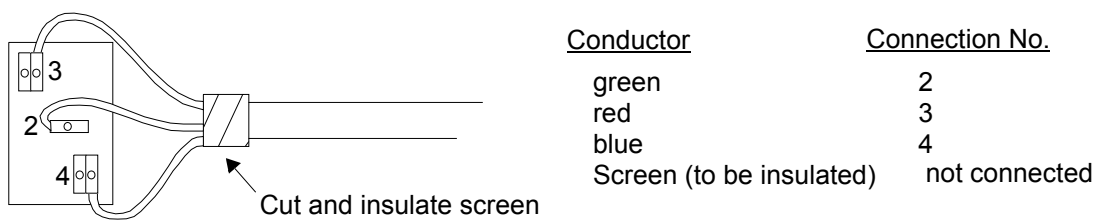


Figure 3-14. Connection of signal cable in the built-in connection box on the search coil (special design)

### 3.8.5 Connecting the signal cable into the electronics unit

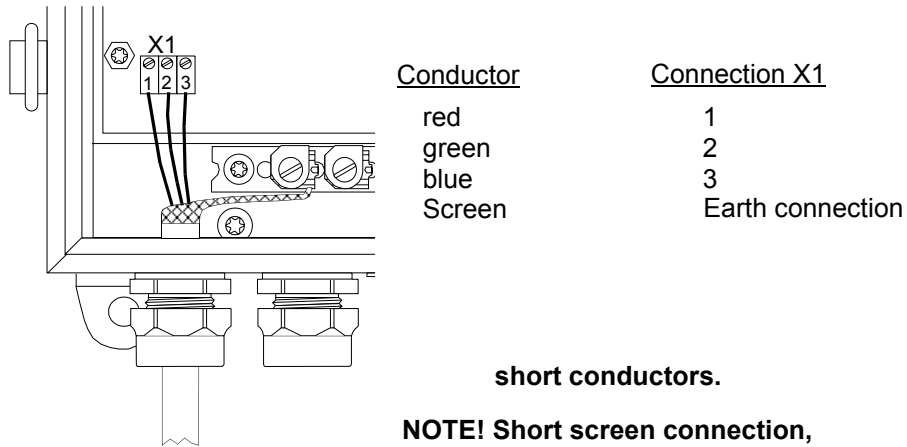


Figure 3-15. Connection of signal cable to electronics unit

### 3.8.6 Connecting the RESET-button into the electronics unit

The RESET button is a spring-loaded closing switch, connected between X2:1 and X2:2 (See also Section 2.4).

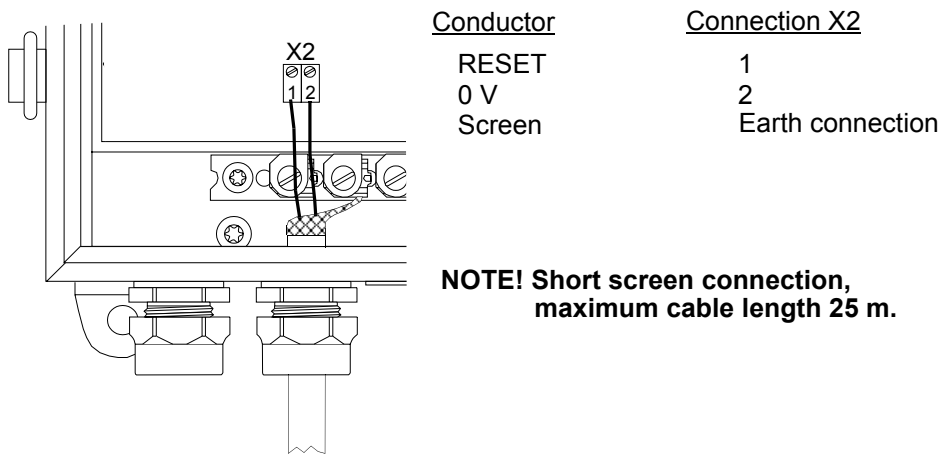


Figure 3-16. Connection of RESET button to electronics unit

If the function MAN RESET is not to be used, connect X2:1 and 2 permanently. This provides automatic RESET, which results in metal detection providing a short pulse on the relay output.  
**Seal any unused cable fittings.**

### 3.8.7 Connecting the indicating circuit

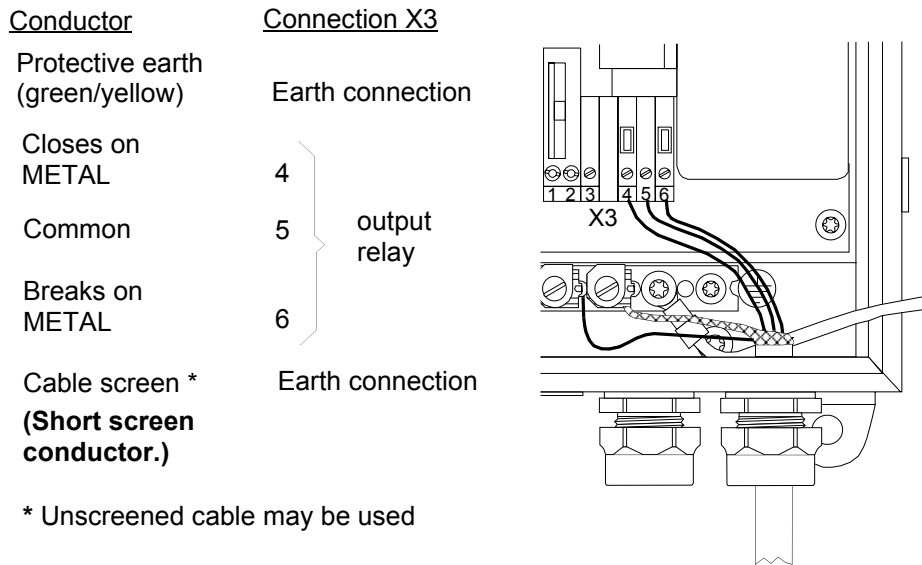


Figure 3-17. Connection of indication circuit

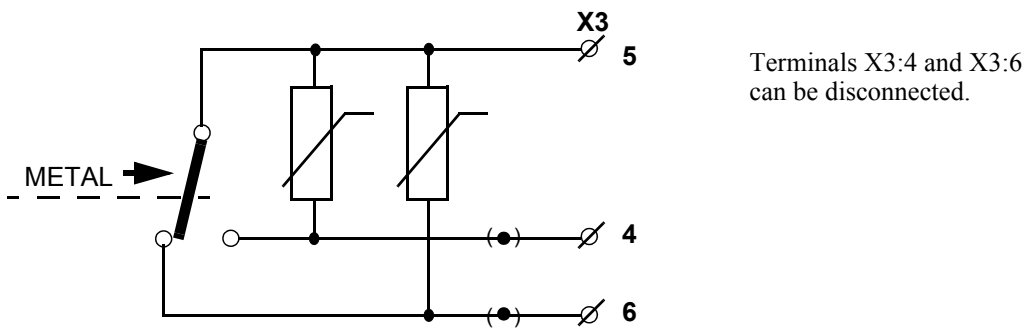


Figure 3-18. Output relay contacts equipped with protective components

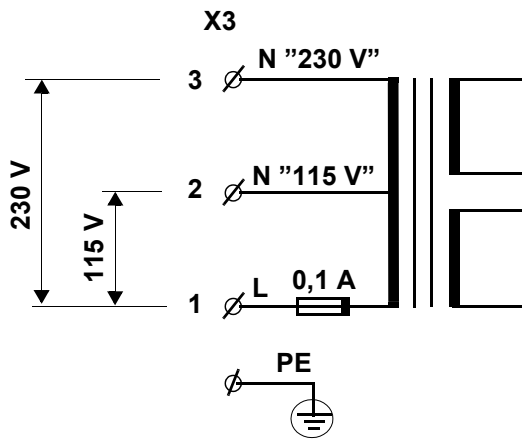
#### Contact protector

The make-and-break contact on the output relay is fitted with varistors, 70J (2 ms) 250 V, as a contact protector.

### 3.8.8 Connecting the power supply

Electronics works best with a continuous power supply. Avoid turning off the power supply to the metal detector. Connect the metal detector to a power supply network that is always energized.

If several networks are available, select the one with the smallest voltage fluctuations and the lowest interference level. This is generally a lighting network



Conductor	Connection X3
Protective earth (green/yellow)	Earth connection
L	1
N 90-130 V	2
N 185-265 V	3
Cable screen *	Earth connection

\* Unscreened cable may be used

Figure 3-19. Connection of power supply

Example:  
 Connection of a 220 V supply

Power consumption: Approx. 10 VA  
 Fuse (X3:1):  
 0.1 A, 250 V (5 × 20 mm), time fuse

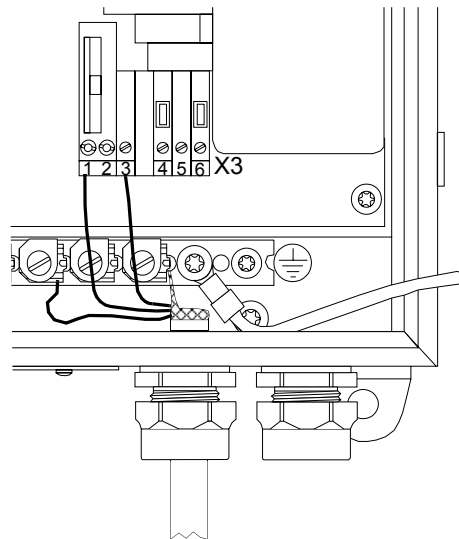


Figure 3-20. Connection of 230 V supply

## Chapter 4 Commissioning

### 4.1 Equipment

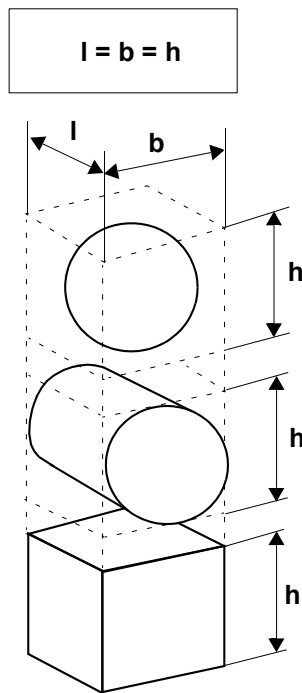


Figure 4-1. Recommended dimensions of test objects

Equipment:

1. Manual for the QSDM 104
2. Test object

The test object must be as small as the smallest object that must be detected. To permit simple adjustment, its width, height and length should be the same, i.e. it should be a cube, ball or short cylinder.

If it will be necessary to detect stainless steel, the test object must also be made of stainless steel, which generates smaller signals than other metals.

## 4.2 Preparations

- Check that the power supply is correctly connected.
- Check the signal cable connection in the connection box and electronics unit.
- Connect the power supply by inserting a fuse in the X3:1 terminal

## 4.3 Automatic adjustment of the working point

After the power has been switched on, it takes about 30 seconds before the metal detector has adjusted to the present operating situation. After that full sensitivity is achieved.

## 4.4 Sensitivity adjustment

The LEVEL indicator has the same graduations as the SENSITIVITY selector, so that the desired change in sensitivity can be read off the LEVEL indicator directly.

Example:

If the signal from the test object reaches up to the LEVEL 15, the SENSITIVITY should be increased by 15.

- Set the MAX. SPEED to the maximum position (12).
- Set the coarse and fine adjustments of the SENSITIVITY selector so that the lowermost red LED blinks whenever the test object passes the search coil. Brief interference may be experienced in conjunction with sensitivity selection. Wait 20 to 30 seconds after selecting the sensitivity so that it becomes stable.
- Reduce the MAX. SPEED setting until the signal from the test object (with maximum speed) does not cause the lowermost red LED to light up.
- Increase the MAX. SPEED setting by two steps.

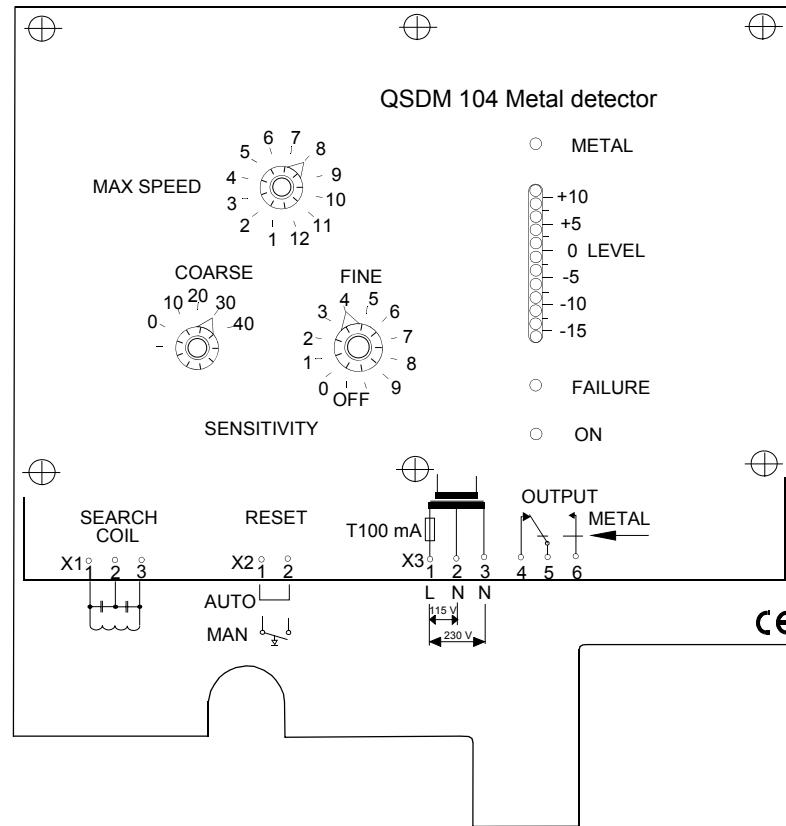


Figure 4-2. Metal detector panel

**REMARKS**

In installations in which the level of interference is high, it may be difficult to adjust the SENSITIVITY with the MAX. SPEED in position 12. In such a case it is worth trying to start with a MAX. SPEED setting lower than 12 whenever the sensitivity is being adjusted. Try, for example, using a MAX. SPEED setting of 8 -10.



## Chapter 5 Operation

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### 5.1 General

In detecting metal, either a break pulse is given or a continuous break is sent to the output relay.

When using a break pulse (X2:1-2 jumpered) the METAL alarm resets automatically after the metal has affected the metal detector.

Whenever the material being transported has stopped because of a METAL alarm, search the area in which the metal may be expected (found by practical tests).

If the MAN RESET input is used, reset the output relay by pressing the RESET button briefly.



## Chapter 6 Maintenance

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### 6.1 Search coil

Ensure that the search coil has been securely attached to its support surface.

Remove rubbish that is resting on or in the coil. Otherwise there is a risk that the rubbish will transmit vibrations mechanically to the coil from the material being transported.

Superficial mechanical damage to the search coil should be repaired as soon as possible using epoxy adhesive or similar, for example.

#### **WARNING**



If electric welding is to be carried out in the immediate vicinity of the search coil, the coil's connections with the connection box must be short-circuited, e.g. by winding a non-insulated copper wire round the soldering turrets. After welding, remove the wire.

### 6.2 Connection box and electronics unit

Wipe clean the boxes before opening them, so that rubbish and dirt will not get into them.

Clean the window with a soft cloth.

No special maintenance is normally required.



## Chapter 7 Fault tracing

### 7.1 The FAILURE LED is lit up

The FAILURE LED lights up whenever the oscillator is not oscillating. This also means that the METAL signal cannot be reset.

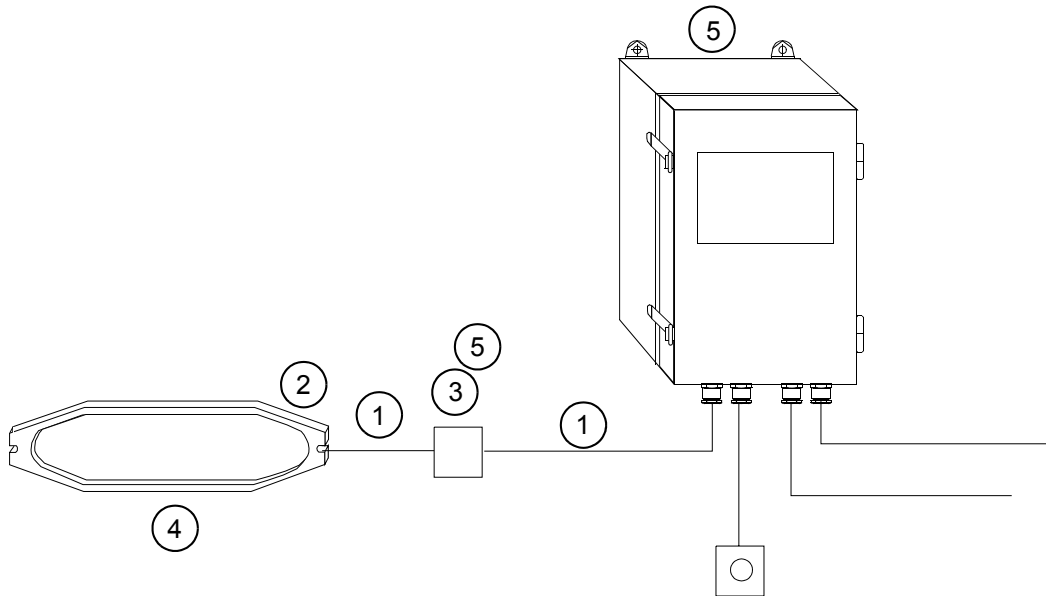


Figure 7-1. How to locate different types of faults

Conceivable causes:

1. Failure or short-circuiting in the signal cable.
2. Damaged search coil.
3. Failure or short-circuiting in the connection box.
4. A very large metallic object close to the search coil.
5. Fault on the circuit board.

### 7.2 The ON LED does not light up

Conceivable causes:

1. No power supply to X3.
2. Broken fuse (X3:1) 0.1 A, 250 V, time fuse.
3. Fault on the circuit board in the electronics unit.

### 7.3 False alarm

Spurious METAL signals are often caused by conditions in the immediate surroundings of the search coil. Electronics faults seldom occur.

The LEVEL indicator can be used to trace interference. For good performance, the interference should be sufficiently low to not affect the uppermost green LED.

Investigate whether the LEVEL signal coincides with mechanical stresses and movements close to the search coil.

The TEST outlet X4, between the X2 and X3 terminals on the circuit board, can be connected to a printer or oscilloscope. 0 V is connected to earth.

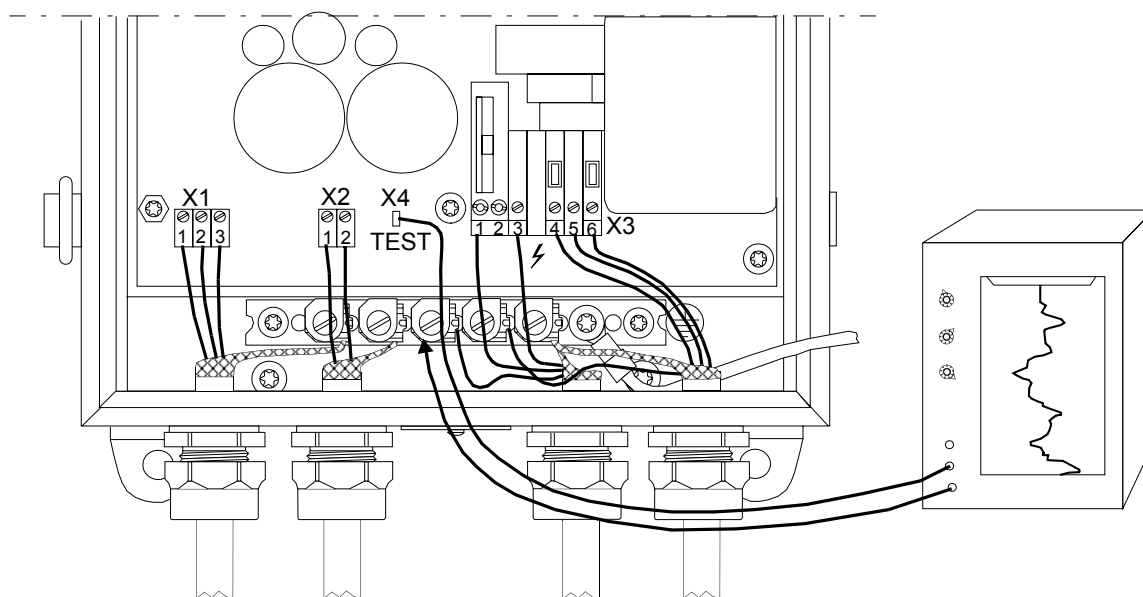


Figure 7-2. Connection of printer to TEST outlet

This TEST outlet shows the analogue measurement signal after filtering.

A METAL alarm is obtained for signals that exceed the level +0.5 V on the TEST outlet.

## 7.4 Fault tracing using the TEST outlet

If no measuring instrument is available, the metal detector's built-in LEVEL indicator may be used.

Allow the smallest metallic object that is to be detected to pass by or through the search coil at normal speed and at the least sensitive place, i.e. in the centre of the coil, exactly between the coils or at the greatest height above the coil (depending on the location used, see Section 3.2). The printer (and LEVEL, which is logarithmic) will then show the signal from the metallic test object used.

The signal from the test object must always be greater than any interference.

Allow the conveyor to:

1. Stand still
2. Run without load
3. Run with a normal load, and so on.

Start a successively larger part of the plant and note when the interference becomes greater than the signal from the test object. This is a relatively fast way of locating a source of interference.

**Eliminate any source of interference you find. Continue fault tracing in the same way until all sources of interference have been eliminated.**

If interference is encountered whenever the conveyor is standing still, the source is probably an external electromagnetic field, such as that from power supply cables.

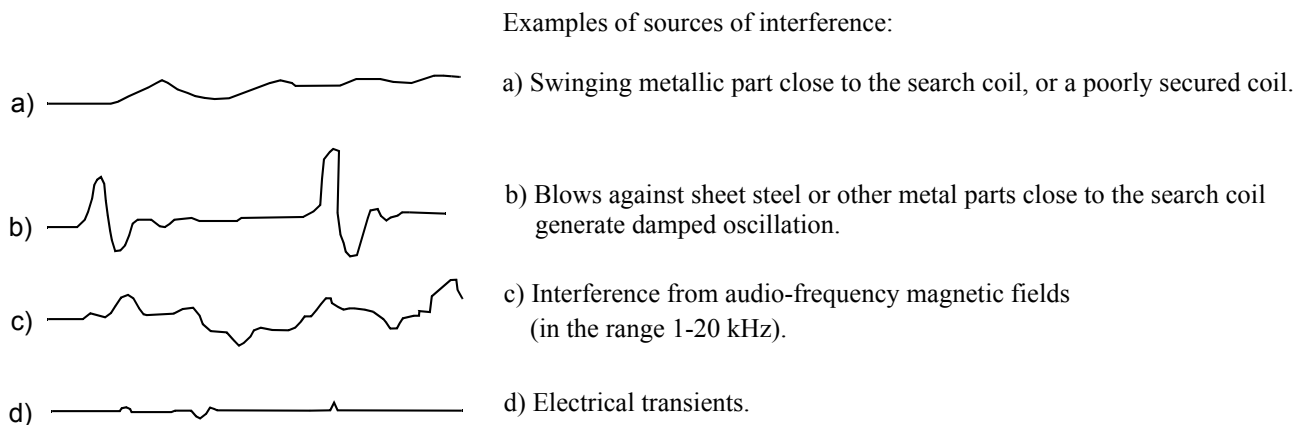


Figure 7-3. Examples of sources of interference

A common source of interference is loose contacts between parts made of metal close to the search coil. Loose contacts can be detected by pulling different metallic parts close to the coil and noting at the same time any events on the printout from the printer connected. Act according to Section 3.4.

## **7.5 Loss of METAL alarm**

The MAX. SPEED or SENSITIVITY settings are too low.

## Chapter 8 Spare parts

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### 8.1 List of spare parts

	<u>Order No.</u>	<u>Old order No.</u>
<b>Connection box QSDX 103 A</b>	M103A	(YL 331 006-A)
<b>Electronics unit QSDM 104V</b>	M104V	(5699 675-AA)
<b>Circuit board QSDM 104X</b>	M104V 12	(YL 331 001-DL)
Time fuse, 0.1 A, 250 V	3BSC770001R4	
Varistor, 70 J (2ms) 250 V	5248 122-339	
Transformer	4781 049-2	
<b>Enclosure</b>	M104 1	(5281 2060-1)
<b>Signal cable, screened</b>		
3 × 0.5 mm <sup>2</sup> (specify length)	M104 41	(1683 0013-3)





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