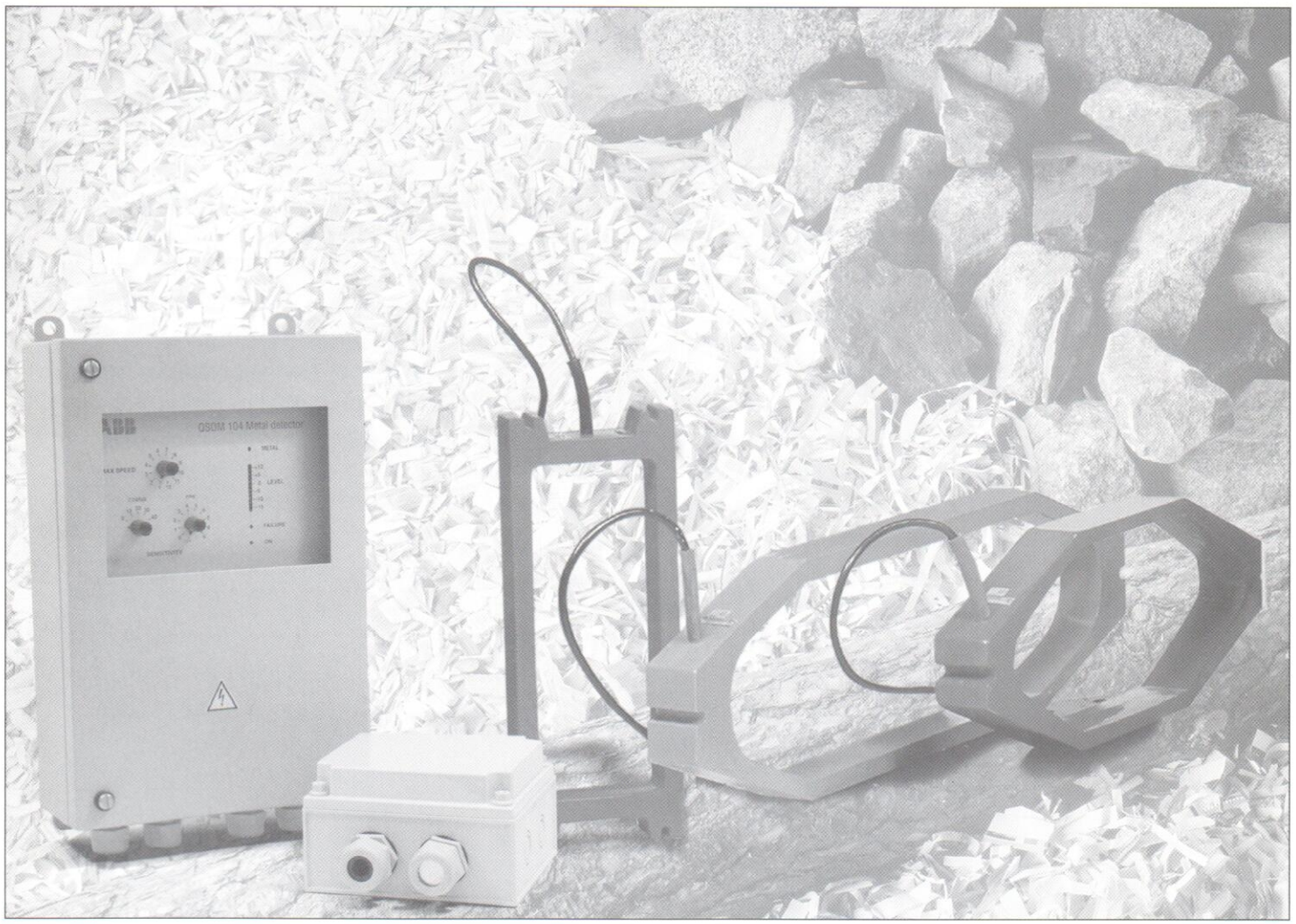
ABB Metal Detector




**QSDM 104**

ABB

# Brief Presentation
## – Metal Detector QSDM 104

*The metal detectors from ABB incorporates selective sensing, greatly improving their sensing performance and allowing them to be used for applications that previously had required considerably more expensive solutions.*

ABB Metal Detector QSDM 104 can detect tramp metal in various materials. It is a simple, reliable way of eliminating stoppages and reducing machine repair costs, for example by avoiding damage to sawblades or crushers. Metal Detector QSDM 104 meets the requirements for reliability and performance.

The metal detector consists of one or two search coils, an electronics unit and a terminal box.

The electronics unit contains the oscillator circuit, amplifier, discriminator and power supply circuits. The unit is housed in an enclosure of sheet steel with protective paint finish. The electronics are arranged on a single circuit board that is easy to replace.

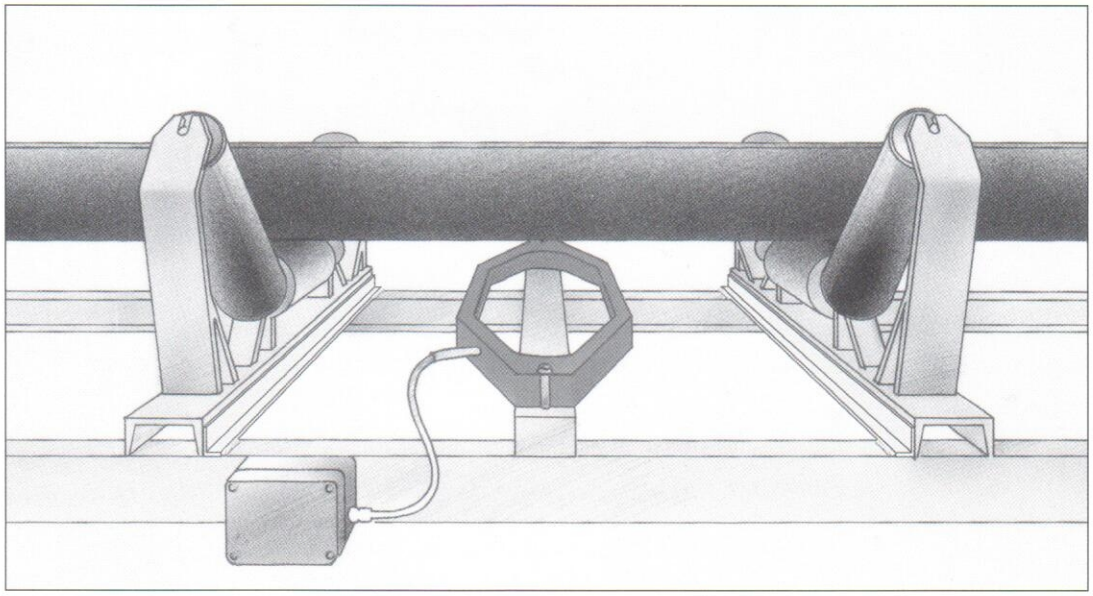
The winding and connections of the search coil are encapsulated in glassfibre-reinforced plastic. This makes the coil mechanically stable and immune to water and dirt.

The terminal box is in the form of an impact-resistant drip-proof plastic inclosure. The equipment is easy to install and operate.

The metal detector indicates all metals and certain other materials with high electrical conductivity. Objects of stainless steel and other conductive materials with a high electrical resistance are indicated slightly less well than objects of copper or iron, for example.

This catalogue provides important information about the detector and its characteristics. At the end of the catalogue there is an ordering guide.

*Glassfibre-reinforced plastic provides protection against impact, dust and moisture.*



# Operation of the detector

The search coil and the capacitors in the terminal box together form a tuned circuit oscillating at about 10 kHz. A metal object moving through the electromagnetic field of the coil has an immediate effect on the oscillator circuit, changing its Q (quality factor) and thus the amplitude of the oscillation. The electronics unit converts the change into a suitable pulse. Slow variations are eliminated by automatic amplitude control with delay. Only approved pulses are allowed to result in an alarm, a stop signal or a signal to scrape mechanisms or a marker. An alarm can also be given on power failure.

Security is further enhanced by an autotest function, which senses the amplitude of the oscillation. If the amplitude is too low, the output relay is deenergized and gives metal alarm until the fault has been put right. The fault situation is also indicated by a yellow LED.

The detector can be wired for automatic or manual reset. With manual reset, the alarm persists until the reset function is activated.

# Sensitivity of the detector

The sensitivity of the detector is defined as the diameter of the smallest detectable steel ball. The smallest detectable steel ball is about 2 % of the equivalent diameter ($D_{eq}$) of the search coil. The $D_{eq}$ of the coil can easy be calculated by dividing the circumference by 3. The shortest detectable nail length is about 9 times the diameter of the smallest detectable ball.

The sensitivity is always greatest closest to the surface of the coil. Fig. 3 gives a simplified illustration of the way in which the sensitivity varies depending on the position of the object.

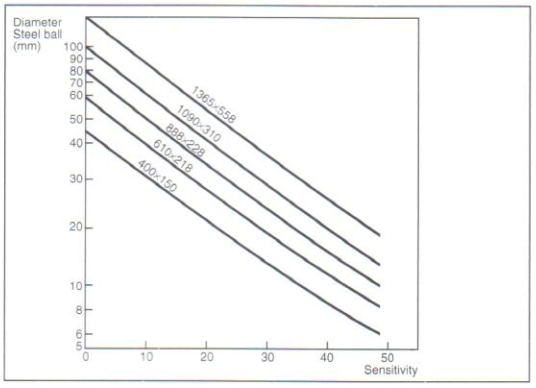



*Fig. 2*

The velocity, position and orientation of the object relative to the magnetic field of the coil affects the sensitivity of the detector, as do the electromagnetic properties of the object, the presence of large metal objects and electrical equipment such as contactors or power cables close to the coil.

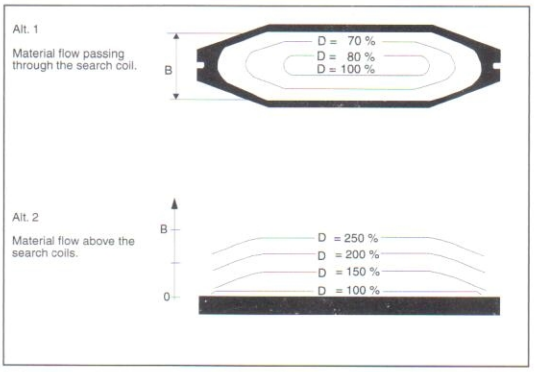
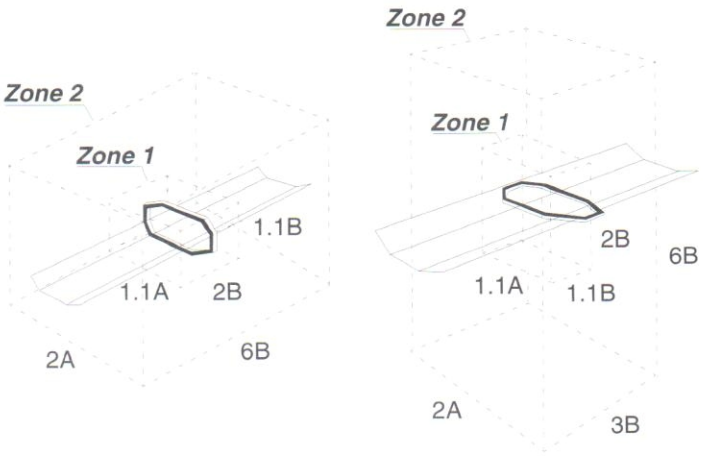



*Fig. 3*

*Fig. 2 Sensitivity in the centre of the search coil relative to the setting of the sensitivity.*

*Fig. 3 Alternative coil positions.*
*D is the diameter of the smallest steel ball that can be detected at the sensitivity setting in use.*
*B is the internal width of the coil.*
*100% is the sensitivity according to fig. 2.*

# The metal-free zones of the detector
## – when an unscreened search coil is used




**Through the coil** **Above the coil**

Metal objects in the immediate vicinity of the coil affect the sensitivity of the detector. There are therefore certain rules governing the size of these metal-free zones around the detector; see diagram. Zone 1 must be as free from metal as possible. In zone 2, small stationary metal objects are permissible.

The sensitivity of the detector can be fully exploited if there are no moving metal objects within a sphere with the same centre as the search coil and a diameter four times the largest diameter (A) of the search coil. B is the inner width of the coil.

### Search coil positioning

The coil can be mounted in two different ways relative to the conveyor belt:

1) Belt passing through the search coil.
2) Belt passing above (or below) the search coil.

As the table below shows, each of the arrangements has its advantages and disadvantages.

| Alternative coil positions and their limitations | | |
|---|---|---|
| | Through the coil | Above the coil |
| **Sensitivity** | Highest possible | Decreases with height above search coil |
| **Metal-free zones** | Small above and below belt | Small in lengthwise direction of belt |
| **Installation** | Belt must be cut | Belt not cut<br>Easy to move |
| **Load height** | Limited by coil height | Coil located under belt does not limit load height |

# Electronics Unit

Apart from energizing the search coil, the electronics unit has a number of other important functions:

- to convert changes in amplitude into suitable pulses
- to eliminate interference and prevent spurious indications
- to give an alarm or stop signal

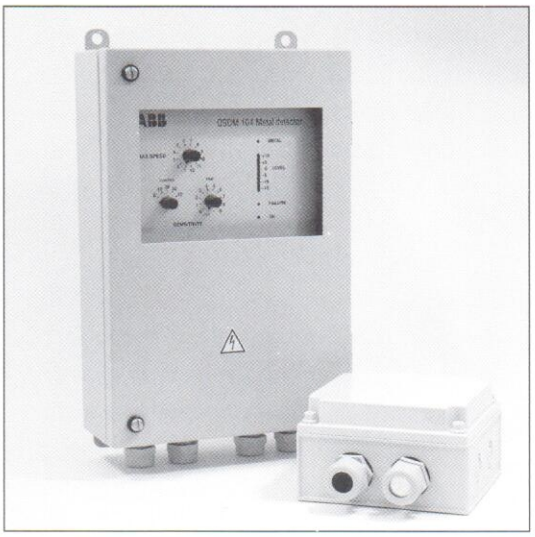
The electronics unit is described in the section on the operation of the detector. Here the functions that prevent spurious indications are described in detail.

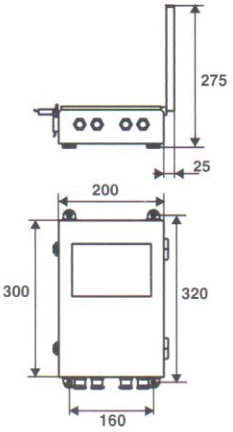
### *Setting the sensitivity*

The *sensitivity* function is of particular use in avoiding false indications resulting from the material on the conveyor having relatively high conductivity, or due to mechanical vibrations. The function allows the sensitivity to be adjusted to suit the particular installation.

### *Level indicator for easier adjustment*

A level indicator to make sensitivity adjustment easier is a very useful feature, not least where there are problems with interference. The indicator is in the form of a row of light emitting diodes.






### *Setting the maximum speed*

The *max speed* setting is used to damp rapid interference. The setting is adjusted for the highest conveyor speed that occurs, but must not be set so slow that the signal from metal objects on the conveyor belt is filtered out.

### *Filter for spurious indications*

Built-in filters prevent spurious indications due to interference from the mains.

| **Electronics Unit – general data** | |
|---|---|
| Balancing | Automatic |
| Operation monitoring | Automatic with fault alarm |
| Level indicator | LED indication with 12 steps |
| Hold function | Selectable reset: automatic/manual |
| Supply voltage | 90-130V/185-265V, 47-65Hz |
| Power consumption | 10VA |
| Sensitivity | Maximum, approx 2% of equivalent diameter of search coil |
| Transport velocity of objects | Max. 4 times coil inner width per sec. Min. 1/4 of coil inner width per sec. |

| **Contact data of indication relay** | |
|---|---|
| Max. voltage | 250V AC/DC |
| Max current | 15A for 200ms, 4A continuous |
| Breaking capacity, AC | 8A at 250V, cosφ>0.4 |
| Breaking capacity,DC | 0.3A at 127V, 0.2 A at 240V |
| Contact resistance | 0.2Ω at 0.1A/24V/50Hz (see IEC 255-7) |
| Duration of alarm signal | >0.15s |
| **Environmental data** | |
| Permitted ambient temp. | -25 to +55°C |
| Degree of protection | IP 65 to IEC 144 and DIN 40050 |
| Insulation | 2kV to IEC 439-1 |

# Search Coils

### Choice of coil

The choice of coil depends on the required sensitivity, the size of the conveyor belt, the type of installation chosen and so on. The diagram (see page 3, fig. 2) shows the sensitivity of a standard coil with the object (steel ball) passing through the coil. The sensitivity is defined as the smallest steel ball diameter that can be indicated. It is clear from Fig. 2 that there are advantages in choosing as small a coil as possible. This maximizes the sensitivity and minimizes the metal-free zones.

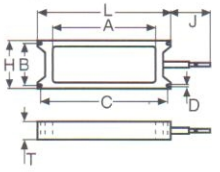
If the search coil is screened the metal free zone will be even smaller.

### Environmental data

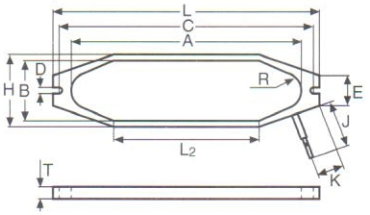
| | |
|---|---|
| Ambient temperature | -40 to +55°C |
| Degree of protection | IP 65 to IEC 144 and DIN 40050 |

### Dimension drawings

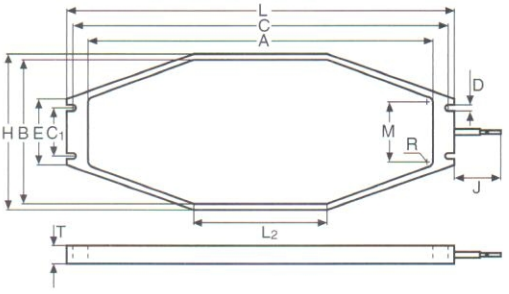
Coil a)




Coil b)



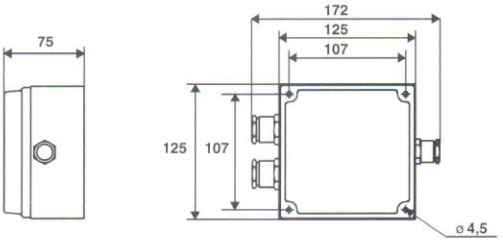

Coil c)




# Terminal Box

### Environmental data

| | |
|---|---|
| Ambient temperature | -40 to +55°C |
| Degree of protection | IP 65 to IEC 144 and DIN 40050 |



## Dimension table showing sensitivity

| Coil | AxB | C | $C_1$ | D | E | H | J | K | L | $L_2$ | M | R | T | $D_{eq}$ | Smallest detectable steel ball |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a) | 400×150 | 500 | – | 10 | – | 200 | 1000 | – | 520 | – | – | – | 60 | 400 | 7 |
| b) | 610×218 | 715 | – | 15 | 80 | 265 | 1000 | 45 | 740 | 280 | – | 40 | 65 | 500 | 8 |
| b) | 888×228 | 1005 | – | 15 | 108 | 278 | 1000 | 60 | 1028 | 550 | – | 75 | 55 | 700 | 10 |
| b) | 1090×310 | 1200 | – | 15 | 122 | 360 | 1000 | 60 | 1220 | 560 | – | 84 | 55 | 900 | 12 |
| c) | 1365×558 | 1505 | 190 | 15 | 270 | 628 | 1000 | – | 1525 | 520 | 210 | 30 | 70 | 1250 | 18 |

*Measurements in mm. ABB reserves the right to change dimensions without previous notice.*

## Ordering guide

The ordering instructions below should be followed for fast, reliable delivery. Check that the correct ordering number has been given. See ordering example below.

| Ordering numbers | | | |
|---|---|---|---|
| **Description** | **Dimensions (mm)** | **Ordering No.** | **Weight (kg)** |
| Electronics Unit QSDM 104 with 10 m signal cable | | 5699 675-AA | 4.5 |
| Terminal box QSDM 103A | | YL 331 006-A | 0.6 |
| Signal cable between QSDM 103A and electronics unit (order max 100 m) | | 3BSC950205R3 | 0.083/m |
| Spare circuit board QSDM 104Y | | 3BSE009431R1 | 0.7 |
| Manual, English | | 3BSE010056R0401 | |
| Search coils (length A × height B) | 400×150 | YL 331 016-A | 4.8 |
| | 610×218 | YL 331 011-A | 6.0 |
| | 888×228 | YL 331 012-A | 6.3 |
| | 1090×310 | YL 331 013-A | 8.5 |
| | 1365×558 | YL 331 015-A | 25.0 |

*All items listed in this ordering table are normally stocked. Search coils with other dimensions will be quoted for on request.*

## Ordering example

| Qty | | |
|---|---|---|
| 1 | Electronics Unit QSDM 104 | 5699 675-AA |
| 1 | Terminal box | YL 331 006-A |
| 1 | Search coil | YL 331 013-A |
| 1 | Manual | 3BSE010056R0401 |

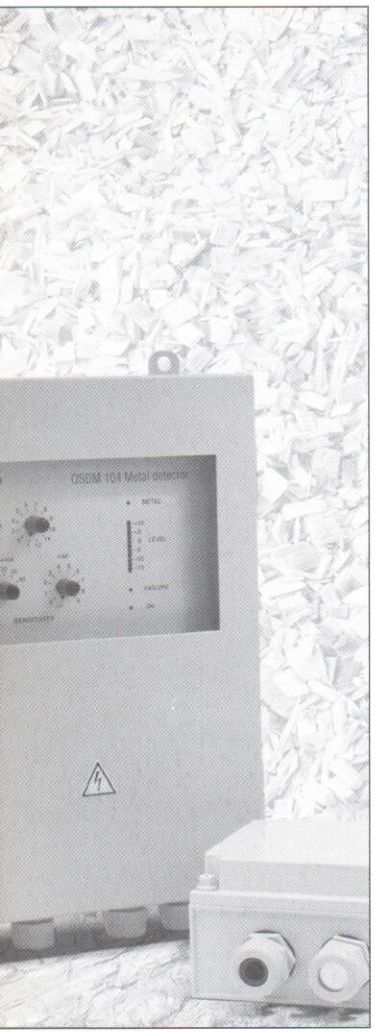



ABB is a global leader in power and automation technologies that enable utility and industry customers to improve performance while lowering environmental impact. ABB has some 155,000 employees in more than 100 countries.

ABB Automation Technology Products is the global market leader in automation technology. We provide products, software and services for the automation and optimization of discrete, process and batch manufacturing operations. Key technologies include measurement and control, instrumentation, process analysis, drives and motors, power electronics, robots and low-voltage products, all geared toward one common Industrial IT architecture for real-time automation and information solutions throughout a business.

ABB Force Measurement is a business unit within ABB Automation Technology Products. It provides equipment for accurate, reliable measurement and control in a broad range of applications from steelmaking to paper converting industries.

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**ABB Automation Technologies**
Force Measurement
S-721 59 Västerås, Sweden
Phone: +46 21 34 20 00
Fax: +46 21 34 00 05
Internet: www.abb.com/pressductor

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