



To detect foreign metal objects
in a variety of materials



Brief presentation - of Medetec Metal Detector



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

Medetec 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.



The operation and design of the detector

The search coil (or coils) 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.

Detector sensitivity

The sensitivity of the detector is defined as the diameter of the smallest detectable steel ball, Fig 1. The smallest detectable steel ball is about 1.5 % of the equivalent diameter (D_{eq}) of the search coil. The D_{eq} of the coil can easily 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 2 gives a simplified illustration of the way in which the sensitivity varies depending on the position of the object.

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.

Sensitivity and position alternatives

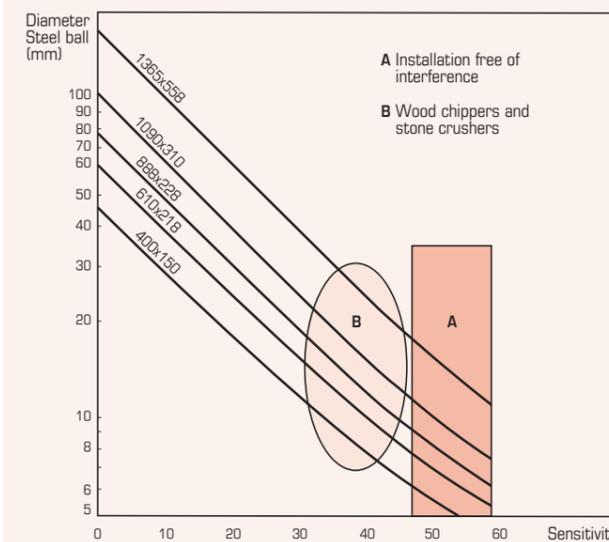


Fig 1. Sensitivity in the centre of the search coil relative to the setting of the sensitivity.

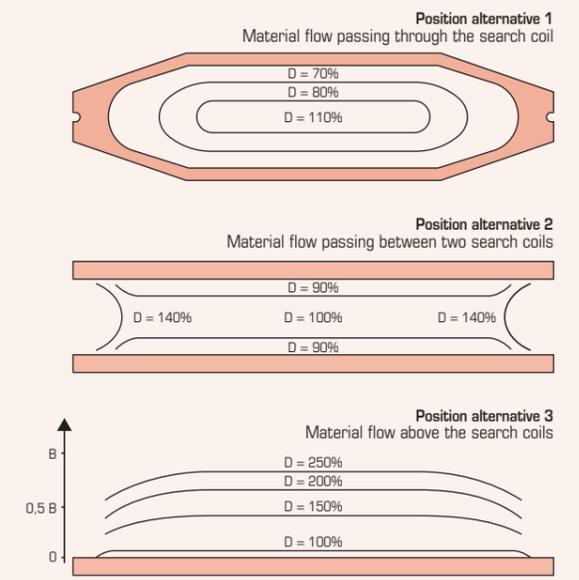
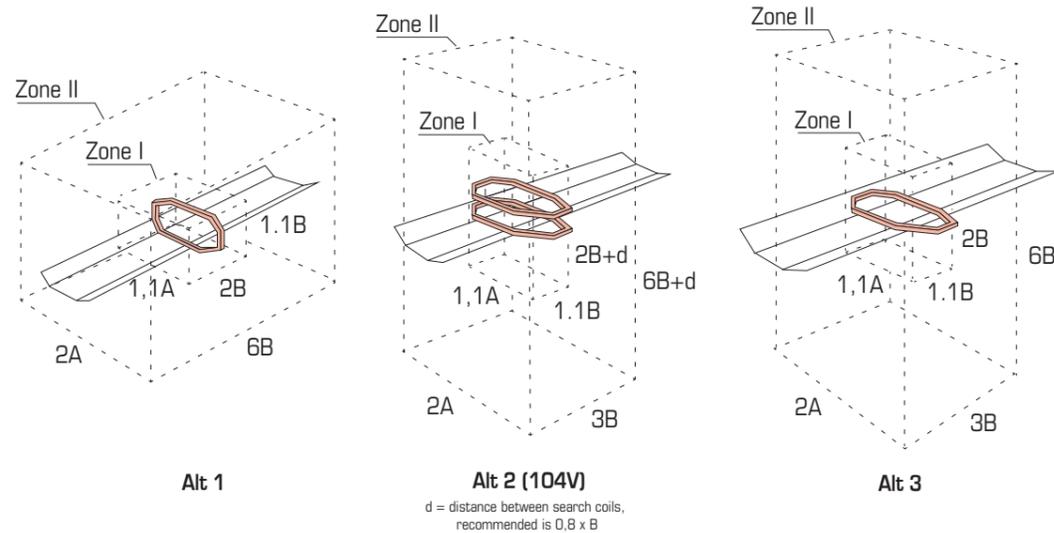


Fig 2. Alternative coil positions. D = smallest steel ball detected.



The metal-free zones of the detector



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.

Search coil positioning

The coil(s) can be mounted in three different ways relative to the conveyor belt:

- 1) Belt passing through one search coil
- 2) Belt passing between two search coils (only 104V)
- 3) Belt passing above (or below) one search coil

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

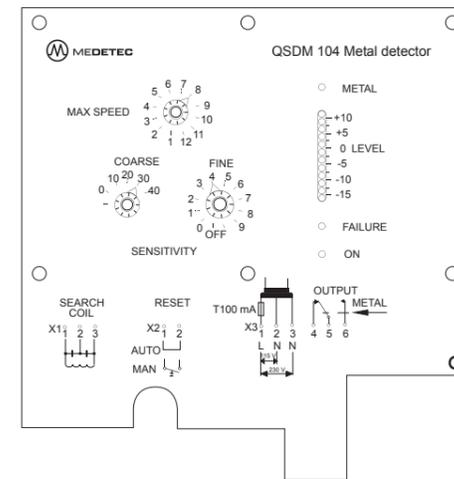
The sensitivity of the detector can be fully exploited if there are no moving metal objects within a sphere with the same centre as the search coil and a diameter four times the largest diameter (A) of the search coil. B is the inner width of the coil.

Alternative coil positions and their limitations

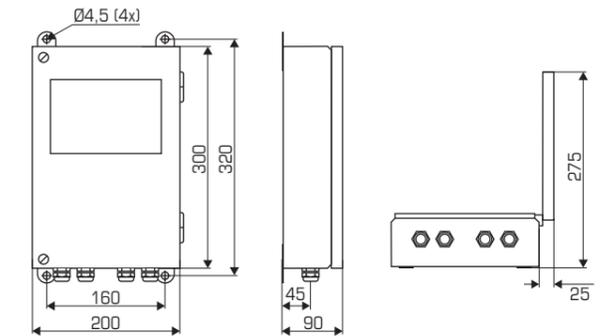
	Alt 1	Alt 2 (only 104V)	Alt 3
Sensitivity	Highest possible	Slightly lower than alt 1	Decreases with height above search coil
Metal-free zones	Small above and below belt	Small in lengthwise direction of belt	Small in lengthwise direction of belt
Installation	Belt must be cut	Belt not cut, easy to move	Belt not cut, easy to move
Load height	Limited by coil height	Limited by upper coil	Coil located under belt does not limit load height



Electronics unit



Front panel overview and dimension drawing



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

- 1) Convert changes in amplitude into suitable pulses
- 2) Eliminate interference and prevent spurious indications
- 3) Give an alarm or stop signal

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.

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	90-130 V/185-265 V
Power consumption	10 VA
Sensitivity	Maximum, approx 1,5 % 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	250 V AC/DC
Max current	30 A for 200 ms, 8 A continuous
Breaking capacity, AC	8 A at 250 V cos Φ > 0.4
Breaking capacity, DC	0.3 A at 127 V, 0.2 A at 240 V
Contact resistance	0.2 Ω at 0.1 A/24 V/50 Hz (see IEC 255-0-20)
Duration of alarm signal	> 0,15 s

Environmental data

Permitted ambient temp	-25 till +55°C
Degree of protection	IP65 to IEC 144



Search coils

Choice of coil

The choice of coil or coils depends on the required sensitivity, the size of the conveyor belt, the type of installation chosen and so on. The table below 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 that there are advantages in choosing a small coil as possible. This maximizes the sensitivity and minimizes the metal-free zones.

Environmental data	
Ambient temperature	-40 to +55°C
Degree of protection	IP65 to IEC 144

Dimension drawings

Dimension table showing sensitivity

Coil	AxB	C	C2	D	E	H	J	K	L	L2	M	R	T	D _{eq}	Smallest steel ball
A	400x150	500	-	10	-	200	1000	-	520	-	-	-	60	400	5
B	610x218	715	-	15	80	265	1000	45	740	280	-	40	65	500	6
B	888x228	1005	-	15	108	278	1000	60	1028	550	-	75	55	700	7
B	1090x310	1200	-	15	122	360	1000	60	1220	560	-	84	55	900	8
C	1365x558	1505	190	15	270	628	1000	-	1525	520	210	30	70	1250	10
C	1800x500	1875	200	15	300	580	1000	-	1900	1000	-	150	80	1500	12

Measurements in mm.

Rectangular shielded coil

For applications, for example, when logging for paper mills, where large metal objects are searched. In large material flows, tunnel detectors are preferred. These are available in standard sizes, but can also be customized.

Type	Inner dimension
M104R106	R106 1000x600
M104R10	R10 1000x800
M104R12	R12 1200x900
M104R14	R14 1400x1000
M104R16	R16 1600x1100
M104R16A	R16A 1650x1350
M104R18	R18 1850x1200

Coils for vibration trays

Coils designed to follow the tray movement. These coils have sensitivity directed upwards and are not affected by moving metal under the bottom of the tray. Standard sizes are produced.

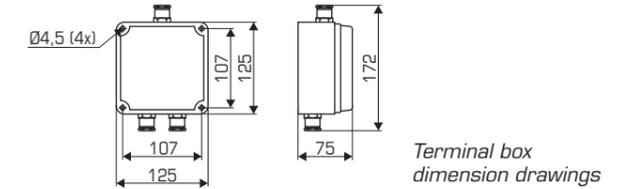
Type	Inner dimension
M104F045	F045 450
M104F060	F060 600
M104F065	F065 650
M104F080	F080 800
M104F100	F100 1000
M104F120	F120 1200
M104F140	F140 1400



Terminal box

Environmental data

Ambient temperature	-40 to +55°C
Degree of protection	IP65 to IEC 144



Ordering guide

Instructions

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

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

Description	Dimensions	Ordering No.	Weight, kg
Electronics unit QSDM 104E		M104E	4,5
Electronics unit QSDM 104		5699 675-AA	4,5
Signal cable 3 x 0,5 m ²		YL 331 001-A	
Terminal box QSDM 103 A		YL 331 006-A	0,6
Spare circuit board QSDM 104 Y		3BSE 009431-R1	0,7
Spare circuit board QSDM 104 X		YL 331 001-DL	0,7
Manual, swedish		5699 678-1	
Manual, english		5699 678-2	
Manual, german		5699 678-3	
Search coils (Length A x Height B)	400 x150 610 x218 888x228 1090x310 1365x558 1800x500	YL 331 016-A YL 331 011-A YL 331 012-A YL 331 013-A YL 331 015-A YL 331 018-A	4,8 6,0 6,3 8,5 15 28

Ordering example

The example to the right is of a metal detector with two coils for dual-coil mounting according to alt 2, page 4.

Description	Ordering No.
1 x Electronics Unit QSDM 104	5699 675-AA
1 x Terminal box	YL 331 006-A
2 x Search coils	YL 331 013-A
1 x Manual	5699 678-2



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