



9. Possible sources of errors and remedies

Switching distance:

The maximum switching distance between the metal object and the coil depends on:

- the position of the sensitivity potentiometer,
- the size, shape and material of the object,
- the orientation of the object relative to the coil.

In difficult cases, only a test at the plant with the desired object can clarify whether it is detected under all possible conditions. It is important to note that in operation the object does not necessarily lie on the bottom of the belt (minimum distance), but in the worst case on the top of the material to be transported.

Environmental metal:

The amplifier masks surrounding metal so that the sensitivity remains unchanged. If, however, the amount of metal exceeds a certain threshold, the sensitivity may be reduced and functional disturbances up to the complete failure of the system can occur. Too much moving or vibrating metal in the environment can cause false alarms. As a remedy, the amount of metal in the vicinity of the coil should be reduced as much as possible. Non-reducible metal should be fixed without vibrations.

Rollers:

Moving rollers can cause false alarms. Remedy: Mount the rollers further away from the coil. It may help to insulate the rollers.

Mounting of the coil:

If the connection of the coil to the mounting frame is not tight enough, movements or vibrations can occur which lead to false alarms. Remedy: Carefully fix the coil.

Metal components in the conveyor belt:

Clamps or other metal parts at a sufficient size in the conveyor belt can trigger a metal detection. Remedy: Replacement by non-metallic parts or reduction of sensitivity.

Insufficient coil width:

If the coil is too small compared to the width of the conveyor belt, then the sensitivity may have to be set too high in order to be able to detect metal parts on the boundary of the belt. Remedy: Use a wider coil or combine several coils.

Electrical disturbances:

If the cables of the metal detection system are installed in the vicinity of cables for high currents (electric motors, valves, etc.) this can cause disturbances. Remedy: Increase the distance between these cables (both supply lines and coil lines). We recommend the use of an overvoltage protection NTG 251 / NTG 255 / DTG 24 to prevent disturbances caused by the power supply.

Metal Detector System 3000

Technical Manual MDV-MDS





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Revision: 15 March 2017



8. Accessories (optional)

Type	ID-No.	
KS031-DS05	P81051	5 m Extension cable with plug-and-socket connector
KS031-DS10	P81052	10 m Extension cable with plug-and-socket connector
KS031-DSXX	S.....	Special length up to 50 m with plug connectors

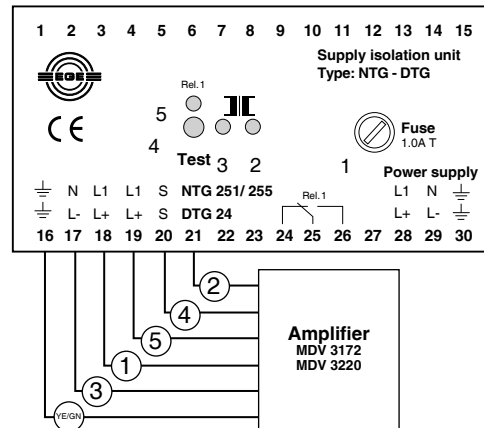
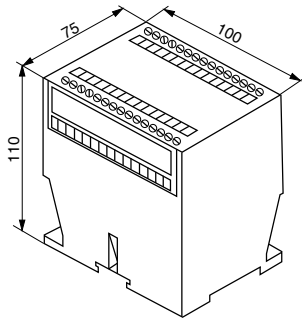
XX: Special length up to 50 m with plug connectors.

The KS031-DS double-end cable connects in particular the detector coil with an extension cable (watertight) that has on its opposite end a plug for connecting to the MDV or MU amplifiers.

The KS031-DS special connection cable is specially designed for use with the Series 3000 of metal detectors. Due to its solid construction and resistant polyurethane sheath, it will not generate any disturbances that could initiate an error signal in the amplifier.



7.5 Supply isolation unit NTG 251 / NTG 255 / DTG 24



- 1 Fuse 1A / slow, primary circuit
- 2 LED green, Supply voltage indication
- 3 LED green, Secondary voltage indication
- 4 Test-button simulates output
- 5 LED yellow, Relay activated

Technical Data	NTG 251	NTG 255	DTG 24
Input voltage	230 V AC $\pm 15\%$ 50 - 60 Hz	115 V AC $\pm 15\%$ 50 - 60 Hz	19 - 30 V DC
Output voltage	230 V AC $\pm 15\%$	110 V AC $\pm 15\%$	24 V DC $\pm 2\%$
Interfering impulse max.	1500 V / 2 s	1500 V / 2 s	55 V / 2 s
Power consumption max.	8 V A	8 V A	6 V A
Output	4 A, 250 V AC 1	4 A, 250 V AC 1	4 A, 250 V AC 1
Fuse	1.0 A slow	1.0 A slow	1.0 A slow
Ambient temperature	-25 °C....+60 °C	-25 °C....+60 °C	-25 °C....+60 °C
Protection (EN 60529)	IP 20	IP 20	IP 20
Weight	0.7 kg	0.7 kg	0.2 kg

Type	ID-No.	Supply
NTG 251	P81030	230 V AC
NTG 255	P81032	115 V AC
DTG 24	P81053	24 V DC



1. General Notes

This manual refers to following model of the Metal Detector System 3000:

Amplifier MDV and detector coil type MDS

Optional: Supply isolation unit type NTG 251 / NTG 255 / DTG 24, Extensions cable type KS031-DS

The metal detector System 3000 is designed to detect medium size and larger pieces of metal and to protect jaw crushers, stone mills, and to monitor conveyor belts. The metal detector is insensitive to small parts as nails, nuts etc. It will respond only to larger pieces of metal like teeth from excavator buckets, tools, or metal panelling which could destroy plants when being processed. If the detection of smaller parts is necessary, the amplifier type MU 3300 is recommended. This manual contains instructions how the metal detector should be installed. In order to have the unit work properly it is important to notice how it is to be handled and how it is operating inside the plant.

The amplifier MDV will operate a relay (relay contact closed) when metal is detected, but no further analysis functions are included. The number of control units is reduced to a minimum in order to make the unit resistant in extreme environmental conditions as moisture, dust, changing temperatures and vibrations.

Note

If problems occur which cannot be solved with help of this manual, please contact your distributor or our technical support in Germany:

EGE-Elektronik Spezial-Sensoren GmbH
D-24214 Gettorf, Ravensberg 34,
Telefon +49 (0) 4346 / 41580, Fax +49 (0) 4346 / 5658, info@ege-elektronik.com

2. Installation

The metal detection system consists of one or more detector coils at the conveyor belt and one separate amplifier device. When mounting more than one detector coil, the conditions and minimum distances specified below must be observed.

2.1 Amplifier MDV

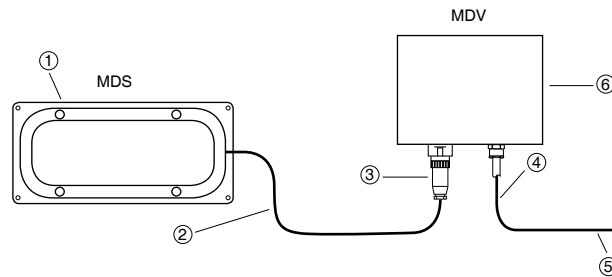
The amplifier MDV can be mounted near to the detector coil or with a distance up to 50 m.

2.1.1 Installation of MDV with up to 3 m to the coil

The amplifier MDV ... can be installed close to the detector coil and can be connected directly with the cable (length 3 m) of the coil via a plug connection. The MDV 3172 amplifier has a fixed power supply cable of 2 m length (Fig. 1). The MDV 3220 amplifier has a clamp connection for the power supply for cables of any length.

Figure 1

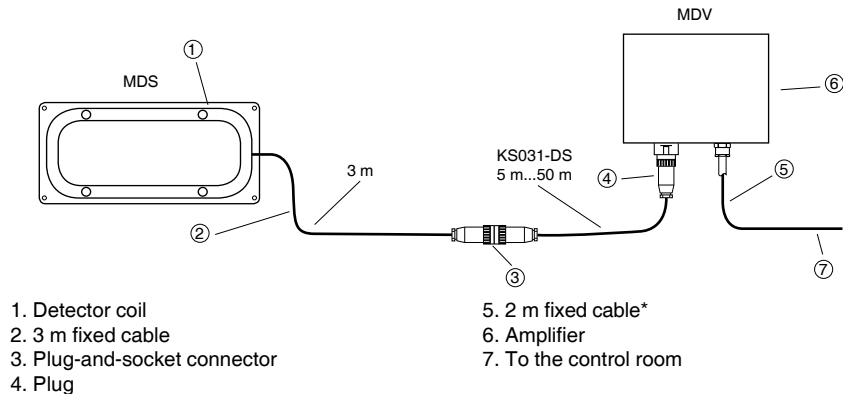
1. Detector coil
 2. 3 m fixed cable
 3. Connection plug
 4. 2 m supply cable*
 5. To the control room
 6. Amplifier
- *only MDV 3172



2.1.2 Installation of MDV with distance more than 3 m to the coil

By using the extension cable KS031-DS it is possible to install the amplifier in larger distances than 3 m from the detector coil (Fig. 2). The extension cable has a connector on both sides of the cable. An extension up to 50 m is admissible (see accessories, page 23). In many cases the ready-made cables KS031-DS with lengths of 5 m or 10 m are sufficient (Fig. 2).

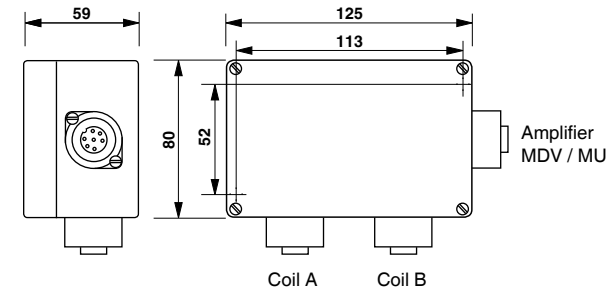
Figure 2



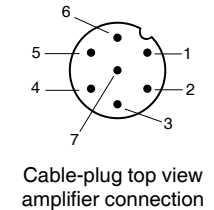
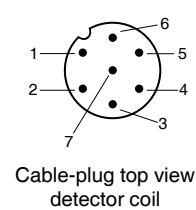
1. Detector coil
 2. 3 m fixed cable
 3. Plug-and-socket connector
 4. Plug
 5. 2 m fixed cable*
 6. Amplifier
 7. To the control room
- *only MDV 3172

7.4 Connection box MA 125

Ambient temperature -25 °C...+70 °C
 Protection EN 60529 IP 67
 Housing material Aluminium, lacquered
 Connection C16 plug-connection
 Mounting size 52 x 113 mm
 Weight 0.9 kg



- 1: (1)
- 2: (2)
- 3: (3)
- 4: - -
- 5: - -
- 6: shield / PE
- 7: - -

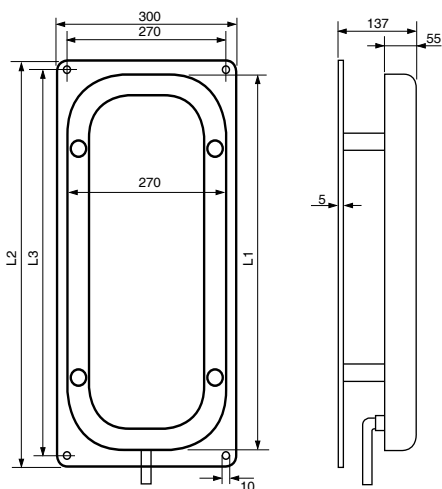


Type	ID-No.	Design
MA125	P81058	Connection box



7.3 Detector coil MDS

Ambient temperature	-25 °C...+70 °C
Protection (EN 60529)	IP 67
Housing material	Aluminium, PVC, GFK
Connection:	3 m shielded PUR-cable 4x0.75 mm ²
Weight (650)	10 kg
Weight (950)	12 kg



Detector coil	ID-No.	L1	L2	L3	Type
MDS 3065-SA	P81054	650	700	670	A
MDS 3065-SB	P81055	650	700	670	B
MDS 3095-SA	P81056	950	1000	970	A
MDS 3095-SB	P81057	950	1000	970	B

Note

When using a single detector coil connected to a single amplifier use type A.

When using two detector coils one coil must be type A and the other type B.

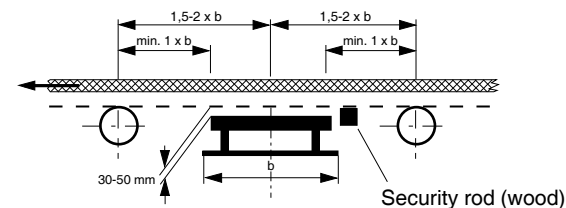
Coils MDS 3065-S (P81007) and MDS 3095-S (P81009) are replaced by MDS 3065-SA (P81054) or MDS 3095-SA (P81056) respectively. The technical and mechanical specifications are unchanged.



2.2 Detector coil MDS: Mounting underneath the conveyor belt

The detector coil is preferably mounted between two rollers underneath the conveyor belt. This is reducing the risk of mechanical damage of the coil. The distance between the rollers and the coil must be at least as long as the width of the coil. In order to reach the maximal sensitivity, a metal free zone with a diameter of 1.5 - 2 times the coil's width should be chosen around the center of the coil (Fig. 3). This mounting is the most common used method and should be preferred to other installations.

Figure 3



Note

In order to reduce the risk that a hanging or swinging belt is hitting the detector coil, the installation of a wooden security rod is recommended which will absorb the hits (Fig. 3). If metallic parts or transport rollers are placed near the detector coil faults may occur. In this case please contact our service department.

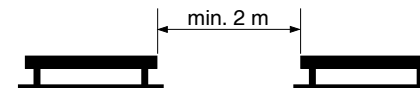
2.3 Detector coil MDS: Mounting distance

When the detector coil is mounted, it must be made sure that the iron construction around does not vibrate or is not too close to the detector coil. In such cases the sensitivity has to be reduced. This means that the detection range is reduced and only larger metal pieces can be detected.

The detector coil is mounted with distance pieces on an aluminium plate, which shields electromagnetic interferences from beneath and ensures a robust installation of the coil. The metal plate has double sided 10 mm holes. At places with strong electromagnetic interference, it is recommended to shield the sides of the metal detector with aluminum plates.

If two detector coils are to be operated with their own amplifier MDV (and not in combination as described in 2.4.1), the lateral distance between the coils must be at least 2 m (Fig. 4). Otherwise, mutual interference will occur.

Figure 4





Warning

The coil's fixed cable may only be installed together with signal lines. High voltage lines must have a distance of more than 30...50 cm.

2.4 Selection of the detector coil

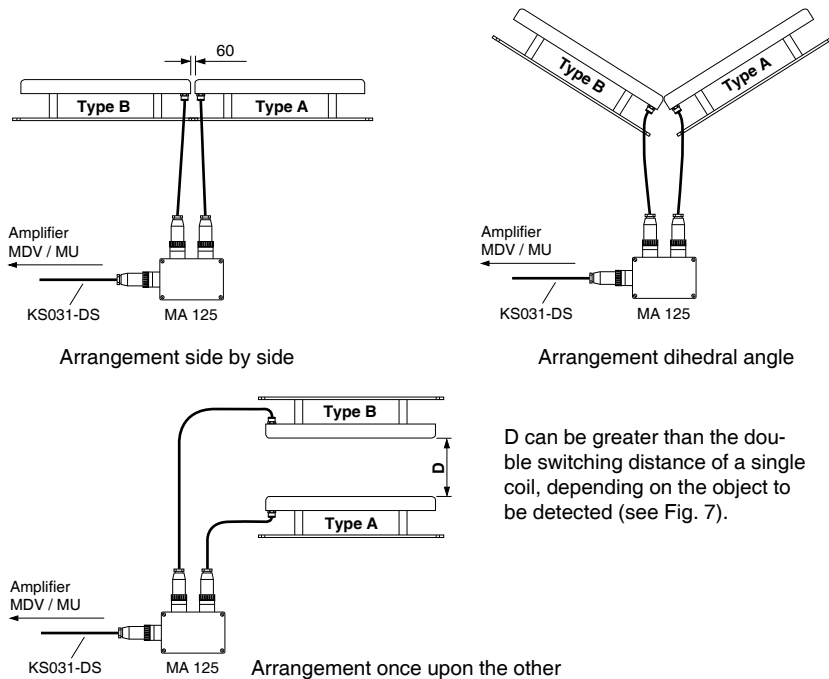
The detector coil with a width of 650 mm is recommended for conveyor belts with width up to 675 mm.

Conveyor belts with widths of up to 1000 mm are monitored with coils which have a width of 950 mm.

2.4.1 Combination of two detector coils

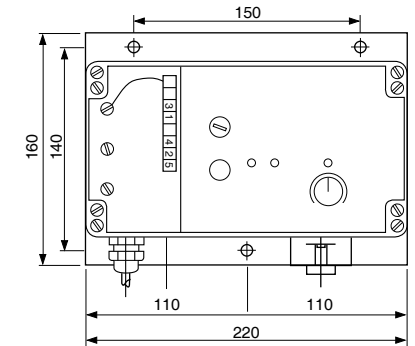
By using connection box MA 125 two detector coils can operate together with one amplifier MDV. Figure 5 shows the possible combinations.

Figur 5



7.2 Amplifier MDV 3220

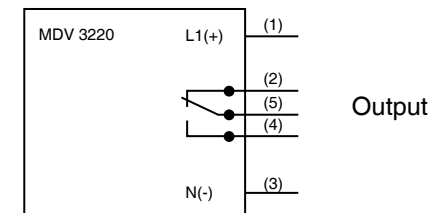
Ambient temperature -25...+70 °C
 Protection (EN 60529) IP 67
 Housing material Aluminium
 Connection Screw terminals



Nominal-Data (25 °C)	AC	DC
Supply voltage	230 V AC	24 V DC
Tolerance	±10%	±10%
Current consumption max.	20 mA	100 mA
Output	Relay-change over max. 2 A	
Switching voltage max.	250 V AC / 220 V DC	
Switching current max.	1 A AC / 2 A DC	
Switching power max.	125 VA / 60 W	
Weight	2.15 Kg	

		3	1	4	2	5
⊕	⊕	N	L1	[Relay symbol]		
230 V AC				Detection		

		3	1	4	2	5
⊕	⊕	-	+	[Relay symbol]		
24 V DC				Detection		



Note

The amplifier MDV 3220 has a change over function. During metal detection, the relay is activated and contact 4-5 is closed (2-5 is open).

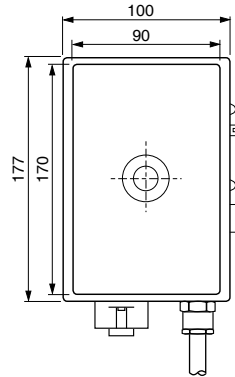
Type	ID-No.	Design
MDV 3220 WR2	P81060	Amplifier 230 V AC
MDV 3220 GR	P81061	Amplifier 24 V DC



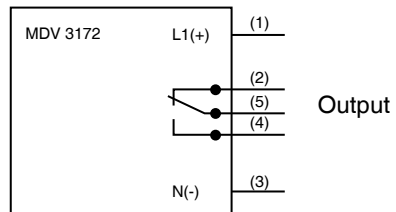
7. Technical Data

7.1. Amplifier MDV 3172

Ambient temperature	-25 °C...+70 °C
Protection (EN 60529)	IP 67
Housing material	PBT
Connection	PUR/PVC 0,5 mm ²
Length x Width x Depth	177x100x55 mm



Nominal-Data (25 °C)	AC	DC
Supply voltage	115 alt. 230 V AC	24 V DC
Tolerance	±10%	±10%
Current consumption max.	20 mA	100 mA
Output	Relay-change over max. 2 A	
Switching voltage max.	250 V AC / 220 V DC	
Switching current max.	1 A AC / 2 A DC	
Switching power max.	125 VA / 60 W	
Weight	1.85 Kg	



Note

The amplifier MDV 3172 has a change over function. During metal detection, the relay is activated and contact 4-5 is closed (2-5 is open).

Type	ID-No.	Design
MDV 3172 WR1	P81017	Amplifier 115 V AC
MDV 3172 WR2	P81010	Amplifier 230 V DC
MDV 3172 GR	P81011	Amplifier 24 V DC



When combining two detector coils to one amplifier: different detector coils (Type A and Type B) must be used.

Warning

The detector coil must not be mounted hanging from chains or by instable means. It must be mounted in a fixed position free of vibration.

Note

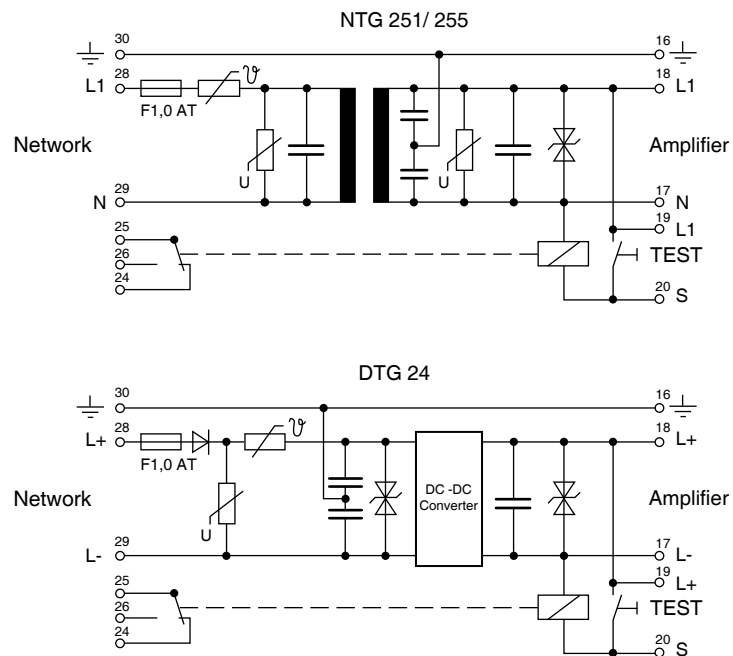
The mounting above the conveyor belt is not often used and is recommended only for special cases, where other mounting options are not available.

Precautions have to be taken that stacked material on the conveyor belt will not bump against the detectors coil resulting in damages.

2.5 Overvoltage protection - supply isolation unit NTG 251 / NTG 255/ DTG 24

The supply isolation unit NTG 251/ NTG 255/ DTG 24 is connected between the amplifier MDV and the power supply, especially when overvoltage is to be expected. The supply isolation unit also has a built in EMC filter and dampens interfering impulse coming from the network. It must be observed that the load of the output relay does not exceed 4 A 250 V AC (Fig. 6). The NTG / DTG... limits the voltage and current amplitudes for the amplifier MDV, so that its fuse cannot be overloaded.

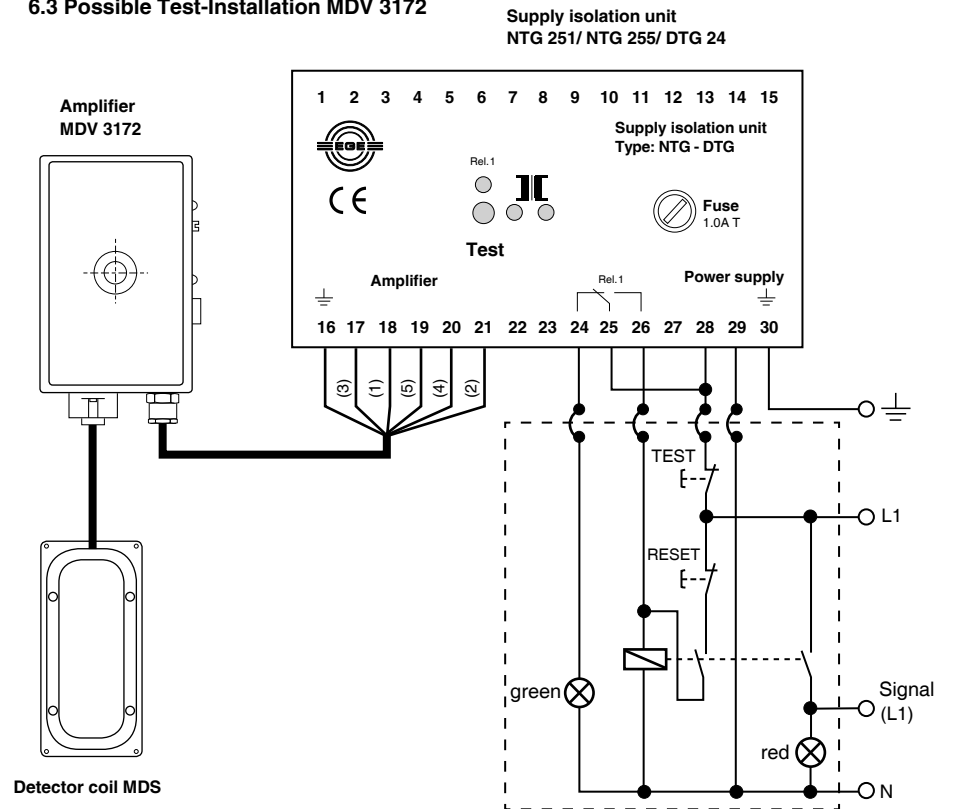
Figure 6



Note

In applications where increased AC-power line interference is to be expected, the MDV-fuse might blow. Then the MDV will not be able to operate its output-relay. Because of this behaviour, the usage of the overvoltage protection NTG 251/ NTG 255/ DTG 24 is recommended.

6.3 Possible Test-Installation MDV 3172



A simple test-installation with hold-function is shown here. This installation usually is done when installing the metal-detector. It is not part of delivery.

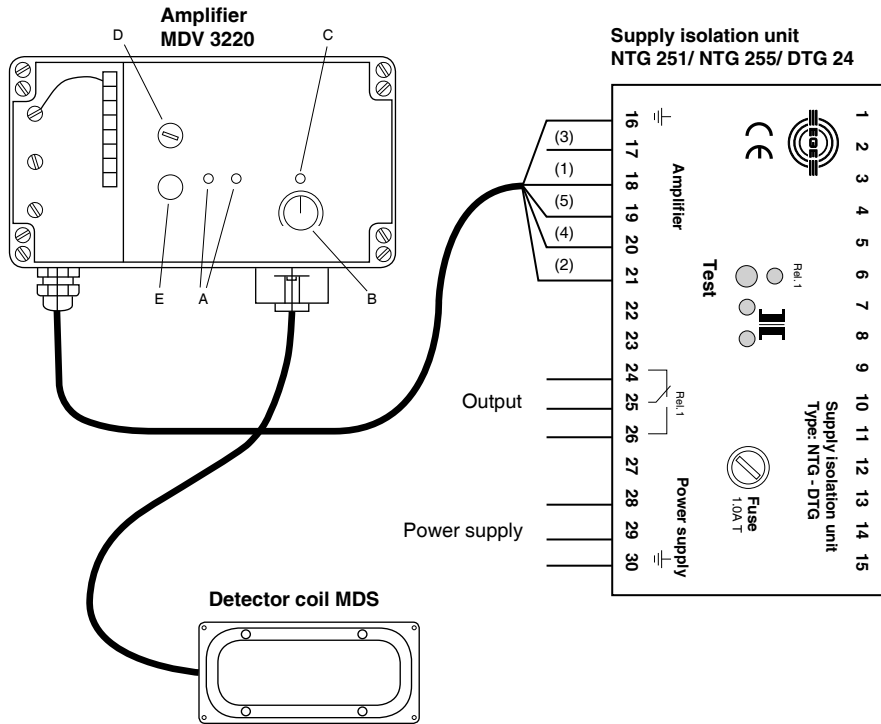
When metal is detected, a self-test at startup was successful, or a manual test is performed, the red lamp is lit and the output "Signal" is connected to L1 permanently. This activation holds on until the "RESET" button is pushed.

The manual test is performed by pushing the test-button for more than 2 seconds. The test is successful when the red lamp lights up after approx. 2 seconds after releasing the button.

When there is no activation of the red lamp after startup or after performing the manual test, the MDV or the NTG / DTG is defective and should be serviced.

The green lamp lights up when no metal is presently detected and no self-test is performed.

6.2 Amplifier MDV 3220



- A** Green LED is lit when the power supply is connected
- B** Sensitivity potentiometer
- C** Yellow LED for metal detection
- D** Fuse 1 A, slow
- E** Test-button

Note

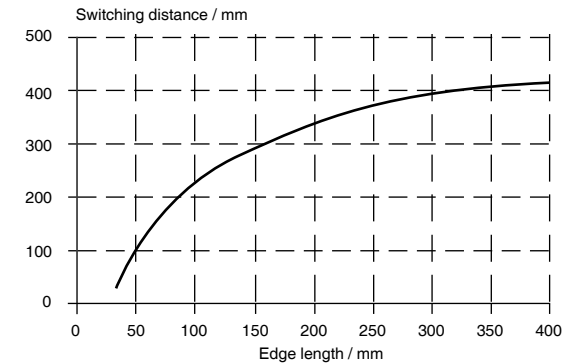
After switching on the power supply, the switching output of the MDV 3220 is activated for 15 seconds (contacts 5 and 4 connected). It is possible to test the complete function of the MDV 3220 with coil connected by pushing the test-button E. The yellow Led must light up, and the output is set to "metal detected".

The Test-button at the NTG / DTG only tests the function of the relay inside the NTG / DTG.

3. Function

The metal detector transforms the electromagnetic influences on the detector coil into a electrical impulse. The detector coil acts as oscillator and creates an electromagnetic alternating field. As soon as metal parts pass by this electromagnetic field the amplitude of the oscillator is affected. The sensitivity of the oscillator is adjusted by means of a potentiometer. The level of sensitivity, that can be set, is dependant of various factors: the environment of the coil as vicinity of metal construction parts, its electromagnetical properties and the conveyor belt speed (Fig. 7).

Figure 7
Sensitivity plot of MDV



The sensitivity plot shows the distance, where an object with a given edge length can be detected. This plot is based on a measurement with the detector coil MDS 3065 and the amplifier MDV in a metal free environment. For edges shorter than 50 mm a steel cube was used. For larger objects, a 2 mm thick steel plate (ST 37) was used. During the measurement the objects passed above the detection coil's center with a speed of 0,5 m/sec.

Metals differ in electromagnetic properties, leading to different sensing ranges. For example, aluminium has a smaller detection range than a part of iron (ST 37) of the same dimensions. The factor by which the sensitivity is reduced compared to iron is given in table 1 (correction factors) for different metals.



Correction factors

The correction factors are depending on the part's size and form.

Table 1

	Cube 50x50x50 mm	Plate 120x120 mm
Steel ST 37	1	1
Stainless steel	0.5	1
ZN	0.5	0.9
AL	0.4	0.85
CU	0.45	0.85
Brass	0.6	0.9

Example:

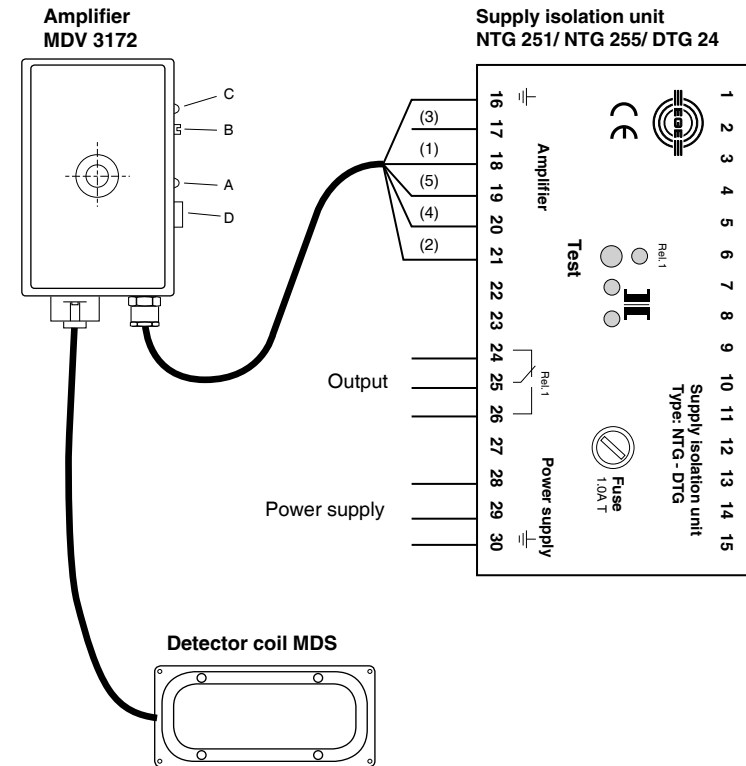
Assuming that a steel cube (50x50x50 mm, ST 37) can be detected in distance up to 130 mm.

Under the same conditions, an aluminium cube will only be detected in a distance of 52 mm (130 x 0,4 = 52 mm).



6. Installations-Hints

6.1 Amplifier MDV 3172



- A** Green LED is lit when the power supply is connected
- B** Sensitivity potentiometer (with protection screw)
- C** Yellow LED for metal detection
- D** Fuse 1 A, slow

Note

After switching on the power supply, the switching output of the MDV 3172 is activated for 3 - 10 seconds (contacts 5 and 4 connected). This test impulse can be used together with an additional evaluation electronic for a functional test of the metal detector (see 4: Adjusting).

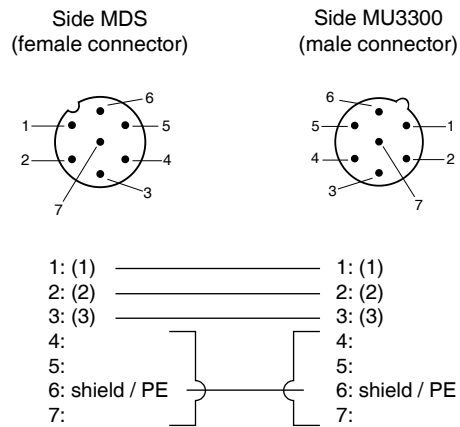
The Test-button at the NTG / DTG only tests the relay inside the NTG / DTG.



2. With a resistance measurement you can check the extension cable that connects the amplifier (MDV) to the detector coil (MDS).

The resistance must be 0...0.5 Ohm between all plotted connections, and between all others infinite resistance (Fig. 10).

Figure 10



4. Adjustment

4.1 Checking the amplifiers MDV

After mounting the metal detector and establishing an electrical connections to the power supply and the detector coil, the detector must be adjusted:

1. It must be ensured that the green LED (MDV 3172) or the two green LEDs (MDV 3220) light up (Fig. 8, Pos. A).

2. After the supply voltage has been applied, the amplifier MDV 3172 needs 3-10 s to perform a self-test (15 s for MDV 3220). It checks whether there are any disturbances in the system.

During this control process, the output relay goes several times (MDV 3172) or permanent (MDV 3220) to "Metal Detected" to check its own output signal. If a self-sustaining relay or contactor is connected to the output, this must be reset in order to permit a correct function.

4.2 Adjusting the sensitivity of the MDV 3172

The sensitivity is adjusted by means of a potentiometer. The potentiometer is protected by a plastic screw, which must be removed in order to operate it (Fig. 8, Pos. B). Once the correct sensitivity has been set, the plastic screw is screwed in again.

The potentiometer of the MDV 3172 has no mechanical stop. The electrical end position is reached after approx. 23 turns. Further turning in the same direction will not change the sensitivity.

The default sensitivity is set by turning the potentiometer 23 turns clockwise followed by 12 turns counter-clockwise.

With this setting, a medium sensitivity is achieved. Turning the potentiometer clockwise increases sensitivity, turning it counter-clockwise decreases sensitivity.

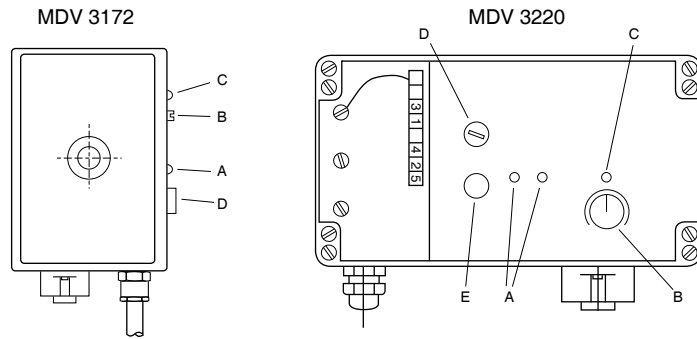
4.3 Adjusting the sensitivity of the MDV 3220

The potentiometer of the MDV 3220 has a scale from 1-10. The standard setting is 5. The highest sensitivity is 10.

Note

If the yellow LED for "metal detected" is blinking (Fig. 8, Pos. C) with a period of approx. 10 - 30 seconds during running of the conveyor belt, than the sensitivity is set too high, the detector coil is not connected properly, or the predamping is too high.

Figure 8



- A** Green LED lights up when the power supply is connected.
- B** Sensitivity potentiometer
- C** Yellow LED for metal detection
- D** Fuse 1 A, slow
- E** Test-button

5. Troubleshooting

5.1 Checking the amplifier

1. Check if the green LED for power supply is lit up.
2. Check if the fuse is installed and functional (Fig. 8, Pos. D).
3. Check power supply: Are there voltage dropouts >0.5 seconds ?
4. **MDV 3220:** Press the test-button: The yellow LED must light up and the output is set to "metal detected".

Note

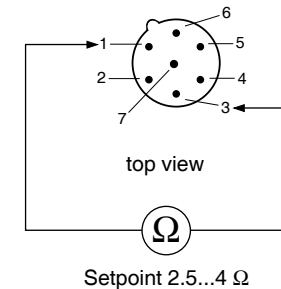
1. Pushing the Test button simulates a metal detection and the yellow LED is lit immediately. The coil has to be connected to the metal detector for this test.
2. If the yellow LED is not lit immediately after pushing the Test button, the system is faulty.
3. If the yellow LED is flashing periodically (period length: 20...60 sec.) at sensitivity set to 5...10 without the Test button being pushed, the connecting cable between amplifier MDV and the detector coil might be cut off.

5.2 Faults without using of an extension cable

1. Check if the amplifier is connected to proper supply voltage.
2. Remove coil plug from the amplifier and measure the coil-cable resistance with an ohm meter between pin 1 and pin 3. The normal resistance must be between 2.5 to 4 Ohm (Fig. 9).

Figure 9

- 1: (1)
- 2: (2)
- 3: (3)
- 4: - -
- 5: - -
- 6: shield / PE
- 7: - -



5.3 Faults with using of an extension cable

1. Remove coil plug and measure net resistance (detector coil + cable) according to point 5.2.

Note

To assemble your own extension cable, it is important to connect pin 4 and pin 7 internally inside the connector housing at the end, that is connected to the amplifier MDV. The connection is important for the correct function to the shielding system between detector coil and amplifier.