Sentrol, Inc

DV1200 Series, Advisor X
Structural Vibration Detection System

Installation Instructions

Models DV1201, DV1221

1.0 INTRODUCTION

The Advisor X Structural Vibration Detection System is a seismic detection system designed to detect attempts to break into vaults, safes, night deposit safes, automatic cash dispenser units and other reinforced physical areas such as data storage and filing cabinets.

To achieve this high level of accuracy, the system analyzes three major parameters-signal strength, signal frequencies, and signal duration-before triggering an alarm. These parameters differentiate real break-in attempts from nuisance signals. In general, the signal characteristics of a true break-in attempt include:

• **Explosives:** generate a signal with a very high amplitude and a short duration.

• **Mechanical Destruction (hammer and chisel):** generates signals with a rather high amplitude and a short intermittent signal duration.

• **Rotating Devices:** generate signals with a moderate to high amplitude and a long signal duration.

• **Thermal Devices:** generate signals with low amplitude and a long signal duration.

2.0 PLANNING INSTALLATION

2.1 What to Avoid

Although the Advisor X System is designed to provide a high level of immunity against nuisance alarms, some precautions should be considered when planning an installation. Do not install detectors close to electric motors, transformers, fans, air conditioners or other electrical devices that create mechanical vibrations in the protected structure. Avoid mechanical contact between electrical devices and the surface of the protected structure, or dampen the vibrations by using rubber-like insulating materials.

Water Piping

The flow of water through piping in mechanical contact with the protected structure emits a strong signal in the structure itself and may cause nuisance alarms.

Ultrasonic Detectors

Ultrasonic detectors may emit a signal that is within the frequency range of the Advisor X detectors. Avoid placing ultrasonic detectors closer than six feet to the protected surface.

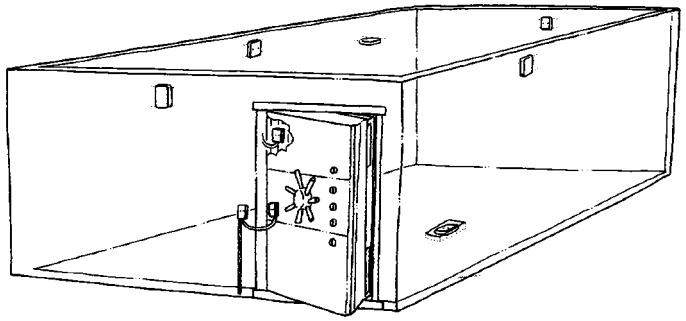
Bells

Bells may generate overtones in the frequency range of the Advisor X detectors. Place a piece of tape on the bell to suppress the overtones, drill a hole in the gong, or relocate the bell to remove the hazard.

2.2 Planning Vault Protection

Generally, it is advisable to place one detector on each wall, floor, and ceiling inside the vault and one detector on or inside the vault door. See the following section on detection range and sensitivity test. The detectors can be mounted with the Mounting Plate (supplied), the DV1212 Steel Surface Mounting Plate recess mounted with the DV1203 Recessed Mounting Plate. Mount the detectors at a height of at least six feet (1.8m) to avoid interference from document cabinets and deposit boxes.

FIGURE 1 - DETECTOR PLACEMENT



Special consideration must be given to installations in which a UL certificate (UL 681) is to be awarded. This includes, but is not limited to, power supply requirements, system test needs, and protection of interconnection cable.

Since the vault door is isolated from the walls by its hinges, have one detector inside the vault door. Newer vault doors normally have cable channels inside the hinges to provide easy connection of the sensor.

An optional means of protecting the vault doorway is to mount a detector on the outside of the door. This provides protection against torch-cutting and thermic bar attack at an early stage, since the vault door acts as a membrane and detects the signal even before the surface attack has started. The detector can be mounted directly on the surface or with a DV1202 or DV1203 mounting plate. See mounting instructions, Section 3.0.

The DV1219 Armed Cable Kit and the DV1228 Metal Junction Box allows cabling from the door to the door frame on the hinge side with armored cable. Be careful when drilling into the vault door. Sometimes there is a printed circuit board drill protection behind the outer steel plate. **(Consult the vault door manufacturer for details.)**

2.3 The Vault Sensitivity Test for Irregularities

If the surface of the vault or safe shows cracks, gaps or has other irregularities, perform a test to determine if the protection range of each sensor is affected. Additional sensors may be required for optimal coverage. This test is not necessary when sensors are mounted on a steel surface. For concrete, block and brick construction, perform the following test, using an electric drill and a 1/4" (6mm) carbide-tipped bit.

1. Locate any irregularity in the construction. The mortar between bricks and blocks should be considered as irregularities.
2. Install the sensor at one side of the suspected irregularity. See mounting instructions.
3. Wire the sensor to power and to the alarm circuit.
4. Set the sensor sensitivity to MAX.
5. Drill into the wall at a point equal to the protection radius (R) depending on the construct type as described in the table below. Check for an alarm.
6. If an alarm does not occur, assume that the irregularity inhibits the protection range of the detector. Redrill closer to the sensor until an alarm occurs and identify the proper protection radius for that particular site.
7. Take all irregularities into account when spacing sensors. Additional sensors may be required. **Note: The separation between the vault door and the frame will require an additional detector on the door to counter a possible weakness at this point.**

TABLE 1 - ESTIMATING DETECTOR RANGE ON A VAULT

		Protective Radius		
		Methods of Attack		
Material	**Sensitivity Setting**	**Thermic Lance**	**Diamond Disk**	**Drilling**
Concrete K-350	1	13ft.,2in. (4m)	45ft.,11in. (14m)	45ft.,11in. (14m)
Steel		26ft.,3in. (8m)	45ft.,11in. (14m)	45ft.,11in. (14m)
Brick	G Max	9ft.,10in. (3m)	26ft.,3in. (8m)	26ft.,3in. (8m)
Concrete K-350	2	9ft.,10in. (3m)	29ft.,7in. (9m)	29ft.,7in. (9m)
Steel		13ft.,2in. (4m)	29ft.,7in. (9m)	29ft.,7in. (9m)
Brick	G Ref	3ft.,4in. (1m)	19ft.,8in. (6m)	19ft.,8in. (6m)
Concrete K-350	3	6ft.,7in. (2m)	19ft.,8in. (6m)	19ft.,8in. (6m)
Steel		6ft.,7in. (2m)	19ft.,8in. (6m)	19ft.,8in. (6m)
Brick	G Min	-	13ft.,2in. (4m)	13ft.,2in. (4m)
Concrete K-350	4	3ft.,4in. (1m)	16ft.,5in. (5m)	16ft.,5in. (5m)
Steel		3ft.,4in. (1m)	16ft.,5in. (5m)	16ft.,5in. (5m)
Brick		-	9ft.,10in. (3m)	9ft.,10in. (3m)
Concrete K-350	5	-	13ft.,2in. (4m)	13ft.,2in. (4m)
Steel		-	13ft.,2in. (4m)	13ft.,2in. (4m)
Brick		-	6ft.,7in. (2m)	6ft.,7in. (2m)

2.4 Planning Guidelines

Dos

- Do prepare a vault layout plan showing vault dimensions and locations of all equipment to be installed.
- Do check that vault is constructed of monolithic concrete or concrete with steel liner; if constructed of concrete block or brick, masonry must be bonded with Portland cement.
- Do check that sensors are mounted directly to masonry or steel surface and that approved mounting hardware is used.
- Do install at least one sensor on each wall, as well as on the floor and ceiling.
- Do protect vault door with sensor mounted as close as possible to side of door, embedding it in door frame.
- Do perform drill tests, whenever possible, on the outside of the vault.
- Do apply silicone sealant around all openings of sensor cover, screw heads, and cable port) after surface-mounting sensor on floor.

Don'ts

- Don't assume that covered concrete walls are free of cracks, loose mortar or other irregularities.
- Don't install sensors permanently before determining sensitivity settings and ambient noise levels.
- Don't install sensors on cinder block or other unapproved masonry surface.
- Don't install ultrasonic sensors inside the vault.

- Don't install sensors close to bells, buzzers, or telephones unless gong(s) or hammer(s) can be taped to deaden sounds.
- Don't mount sensors on rough surfaces. Smooth all surfaces.
- Don't allow test signal transmitter to make contact with mounting plate or sensor on masonry installation.
- Don't use rigid conduit inside vault except where specified, e.g. run wiring to door contacts and heat detectors in conduit.
- Don't install sensors behind safe deposit boxes unless sensors are made accessible for service.

2.5 Requirements When Using One Sensor (DV1201 or DV1221)

All-steel safes with 1/4" walls*

Safes must be a minimum of 1/4" steel on the body and 1/2" on the door. For this type of safe construction, the overall size of the safe must not be larger than 12 cubic feet or have:

- The height plus the width not greater than 55 inches, nor
- The height plus the depth not greater than 55 inches, nor
- The width plus the depth not greater than 55 inches.

The sensor can be mounted in or on the safe in close proximity to the door hinges or on the door itself. The sensitivity settings (Refer to Tables 2 and 3) must be adjusted so that adequate detection with the lowest setting is obtained. Use of the Mounting Plate is optional. (Refer to Section 3.0 for additional information).

All-steel safes with 1" walls*

Safes must have a minimum of 1" of steel on the body and the door. The overall size must not exceed 52 cubic feet or

- The height plus the width not greater than 90 inches, nor
- The height plus the depth not greater than 90 inches, nor
- The width plus the depth not greater than 90 inches.

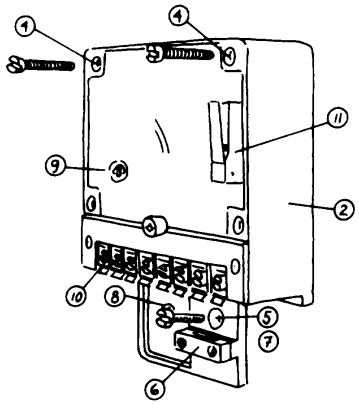
The DV1201 and DV1221 sensors can be mounted on the safe door or on the body in close proximity to the hinges or inside the safe. The sensitivity settings must be adjusted to obtain adequate detection with the lowest possible setting. Use of the Mounting Plate is optional.

* Control panel must be within visual or audible range for testing.

A concrete-clad safe

The same dimensional rule of thumb applies as for an all-steel safe with 1" walls. However, if the previous check of safe construction revealed cracks, seams, or other irregularities in the concrete shell, always assume that two sensors are required for the safe housing regardless of its size.

FIGURE 2 - STRUCTURAL VIBRATION DETECTOR



Removing the cover screws and cover from the base plate (2) provides access to the connection terminals (10) and the sensitivity adjustment control (9).

Inside the unit are located:
- main mounting holes (4) (5)
- test transmitter areas (8) (7)
- strain relief (6)
- tamper switch (11)

3.0 INSTALLATION INSTRUCTIONS

3.1 General Instructions for DV1201/DV1221 Structural Vibration Detector

The DV1201/DV1221 Structural Vibration Detectors consist of cast aluminum housings, with dimensions of 3.1in. x 3.9in. x 1.2in. (8 x 10 x 3cm), and weigh 9 ounces (250gr) each.

To mount the DV1201 and DV1221 on any surface, the following tools are recommended:

- Mounting plate (also used as drilling template) supplied with each DV1201/DV1221.
- Power drill with hammer facility.
- Felt pen.
- #36 high speed steel drill, diam. (for 6-32 tap).
- #29 high speed steel drill, diam. (for 8-32 tap).
- High speed steel drill, diam. 7/16".
- Concrete drill, diam. 1/2" (for expansion plug).
- Tap for 6-32 screw.
- Tap for 8-32 screw.
- Cutting oil to cool drill bit and tap when steel mounting is required.

FIGURE 3 - MOUNTING PLATE

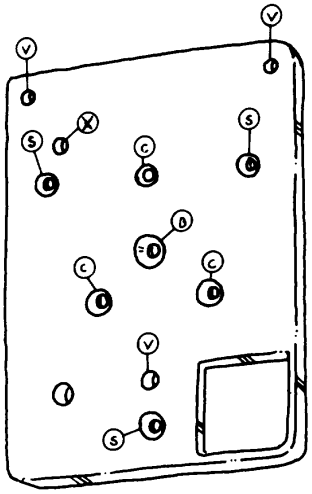
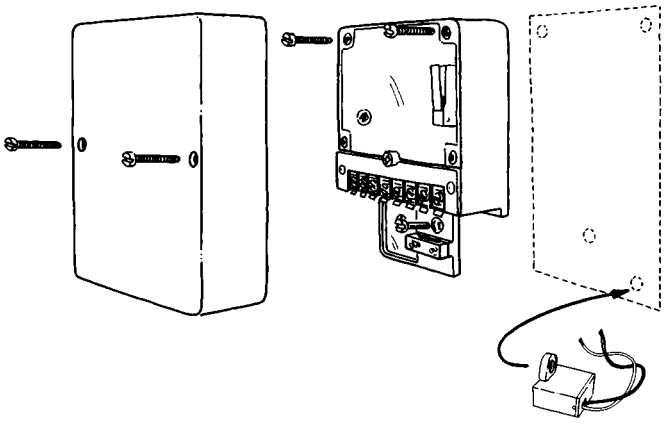


FIGURE 4 - MOUNTING DETECTOR ON A STEEL SURFACE



3.2 Instructions for Mounting Plate

The mounting plate can be used for mounting the DV1201 and DV1221 onto specific surfaces such as steel and concrete (see Sections 3.4 and 3.5). The mounting plate also provides an adaptation hole layout for use in replacing the Securitas SSD70 and the Cerberus GM31,35 GM550 or Arrowhead 3810 detectors (see figure 3).

V = mounting holes for DV1201/DV1221 (threaded holes)

S = mounting holes for DV1201/DV1221 (when replacing Securitas SSD70)

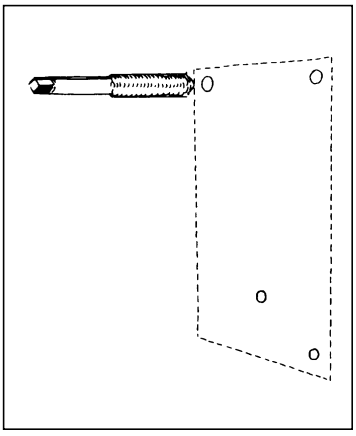
C = mounting hole for DV1201/DV1221 (when replacing Cerberus GM31,35 GM550 or Arrowhead 3810)

X = DV1215 drilling pattern on concrete

B = mounting hole for expansion plug

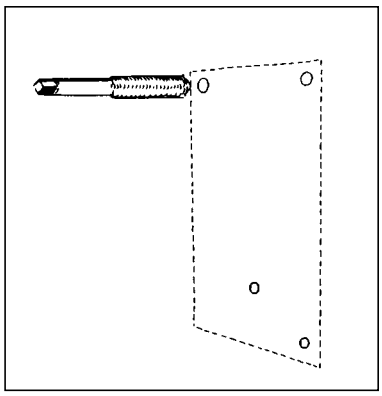
3.3 Direct Mounting the DV1201/DV1221 on a Steel Surface

In certain cases, it is advisable to mount the detector directly onto a steel surface using the bolts provided and threaded holes (made by the installer).



Mounting instructions for direct mounting on steel.

1. Define the exact location of the DV1201/DV1221 when mounted. Hold the mounting plate in position on the steel surface.
2. Using the felt pen and the mounting plate as a template, mark the location of the three threaded holes (see holes marked “V” in figure 9).



3. Drill three holes, using a #29 drill, at least 7/16” deep (see drawing) in the three positions marked.
4. After drilling the holes, tap them with a 8-32 tap, using a little cutting oil to lubricate the tap. After tapping the holes, use a 7/16” diam. drill to smooth the surface around the hole and to remove burrs.
5. Mount the detector to the steel surface using the three 8-32 screws provided (see figure 10).
6. If a DV1215 Test Transmitter is used, it can be mounted in the lower right corner of the detector.

3.4 Indirect Mounting of DV1201/DV1221 on a Steel Surface

In some cases, indirect mounting of the DV1201/DV1221 detectors may be advisable:

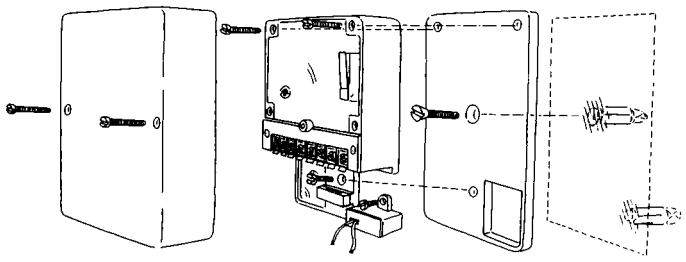
- Use the mounting plate when replacing Securitas SSD70, Cerberus GM31,35 GM550 or Arrowhead 3810.
- Use the DV1212 Welded Mounting Plate if drilling on the protected surface is impractical or impossible.

3.5 Mounting the DV1201/DV1221 on Concrete

Surface mounting with the mounting plate.

In order to mount the DV1201/DV1221 on concrete, a mounting plate is always required. Follow the instructions below.

FIGURE 5 - MOUNTING THE DETECTOR ON CONCRETE



1. Define the exact location of the DV1201/DV1221 and hold the mounting plate to the wall.
2. Using the felt pen, mark the location of the hole for the expansion plug on the wall (see drawing).
3. Drill a hole using a 1/2” diam. drill on the spot marked. Be sure the expansion plug is set flush with or below the surface of the wall.

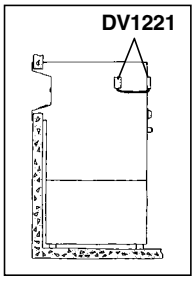
4. Insert the expansion plug into the hole just drilled and make sure that the top end of the plug does not protrude from the wall. Align the mounting plate over the hole and use a bolt to secure the mounting plate to the wall. If no test transmitter is used, go to step #10.
5. Before tightening the bolt, twist the mounting plate to position the DV1215 drill pattern hole (see drawing in Section 3.2) where the cable is to be routed (in most cases, at the bottom). Check for proper horizontal/ vertical alignment of the DV1201/DV1221.
6. Mark the DV1215 mounting hole using the felt pen. Position the mounting plate so that the marked spot is over the DV1215 mounting hole (see drawing in Section 3.2).
7. Drill a hole using a 1/2" diam. drill on the spot marked. Be sure the expansion plug is flush with or below the surface of the wall.
8. Insert the DV1215 expansion plug into the hole you have just drilled, ensuring that the top end of the plug does not protrude from the wall. Place the DV1215 test transmitter over the hole and secure using the bolt provided with the expansion plug.
9. Ensuring that the DV1215 does not touch the mounting plate, tighten the bolt. To provide proper seating of the plug, hit the bolt's head (carefully avoiding the DV1215) a few times with a hammer and tighten the bolt once more. NOTE: At the first service visit after the installation, tighten all bolts once more to compensate for inevitable material expansion in both wall and plug.
10. After completion of the mounting of the mounting plate on concrete, install the DV1201/DV1221 detector according to the description in 3.3.

TABLE 2 - RECOMMENDED SENSITIVITY SETTINGS FOR A SAFE WITH ONE DV1201 OR DV1221 DETECTOR

Thickness of Steel	Maximum Cubic Ft.	Method of Attack		
		Torch	Drilling	Mechanical
Over 1/4" but under 1"	12 Cu ft:			
	DV1201	3	3	3
	DV1221	2	2	2
Over 1"	52 Cu ft:			
	DV1201	3	3	3
	DV1221	1	1	1

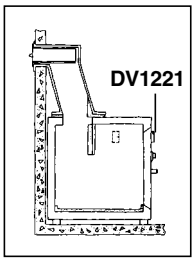
Note: These settings are only guidelines. All final settings are to be made following the steps in Section 5.0.

Planning the Protection of an Automatic Cash Dispensing Unit (ATM) and a Night Depository Box



For both units, use the DV1221 to filter out noise generated by normal operation of the units. The DV1221 can be mounted directly on the surface of the structure.

- Automatic Cash Dispensing Unit - Protection is planned exactly as for a safe. Note: The DV1221 is not designed for use on concrete. If the ATM has a concrete body, a DV1201 can be mounted on the outside surface or a DV1221 can be mounted on the inside metal surface.



- Night Safe Deposit Box - Protection is planned exactly as for a safe. Insulate the chute and the landing place with rubber insulating material to muffle the noise created by the cash boxes as they are deposited.

TABLE 3 - RECOMMENDED SENSITIVITY SETTINGS ON A CASH DISPENSING UNIT (ATM) AND NIGHT DEPOSITORY WITH ONE DV1221 DETECTOR

Thickness of Steel	Maximum Cubic Ft.	Method of Attack		
		Torch	Drilling	Mechanical
Over 1/4" but under 1"	12 Cu ft:			
	DV1221	2	2	2
Over 1"	52 Cu ft:			
	DV1221	1	1	1

Note: These settings are only guidelines. All final settings are to be made following the steps in Section 5.0.

4.0 CABLE REQUIREMENTS

TABLE 4 - ADVISOR X SYSTEM CABLE REQUIREMENTS

		Number of Conductors
Feature	Stand-alone	Multi Sensor System with Individ. Indication DV1208
Power	2	2
Alarm form C	2-4	2-4
Tamper	2	2
Test in	1	1
Test out (LED)	-	1 separate home run

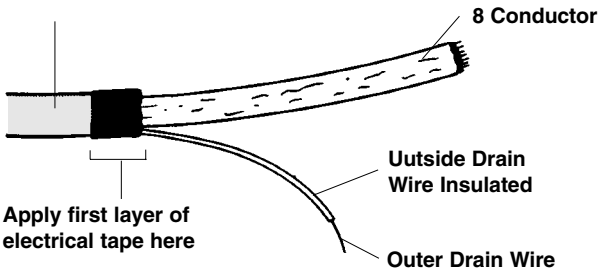
4.1 WS300 Cable Preparation Instructions

The Aritech WS300 High Security Cable is specially designed to provide electrically protected cabling in a UL Complete Mercantile Safe System. The cable consists of double circuit shields that enclose all conductors. When wired per the Wiring Diagrams in Sections 4.0 and 7.0, the WS300 Cable complies with the description of electrically protected cable in UL 681.

The two aluminum shields that wrap the eight-conductor cable are isolated from each other. Each shield is electrically conductive to a drain wire (stranded cable, no insulation). In the preparation of the cable for connection to the DV1201/DV1221 detector and at the control panel, the shields and corresponding drain wires must be kept isolated. A special cable preparation procedure is described below.

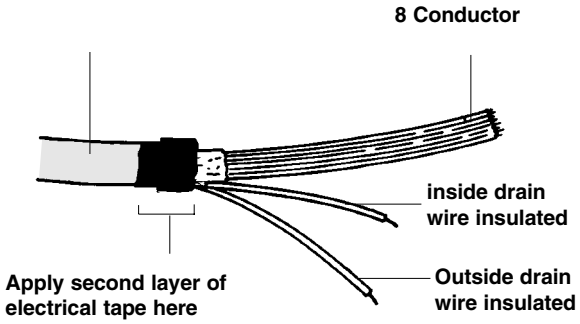
1. Carefully remove approximately six inches of the PVC jacket. The outside protective shield detaches with the PVC jacket, leaving the drain wire loose.
2. To isolate this drain wire from the inside protective shield, slide a five-inch piece of wire insulator over the exposed drain wire. Then wrap a layer of electrical tape around the now-insulated drain wire and the remaining wires at the point where the PVC jacket is cut. See drawing below.

FIGURE 6 - INITIAL CABLE PREPARATION



3. Remove the mylar wrap isolating the shields and the second (inside) shield. Cut off both shields at the edge of the electrical tape.
4. Isolate this drain wire with wire insulator and wrap with a second layer of electrical tape.
5. Make connection to the DV1201/DV1221 sensor as indicated in the Wiring Diagram in Sections 7.0.

FIGURE 7 - FINAL CABLE PREPARATION



5.0 TESTING

1. Prior to applying power, recheck all connections and be sure all mounting screws are tight.
2. Apply power. Connect an ohmmeter to Terminals 5 and 6 of the DV1201 or DV1221. Check for a closed alarm loop.
3. Connect a DC volt-meter (internal resistance 20 KΩ or more) to Terminal 2 (negative) and the test point TP (positive). Place the volt-meter in the range around 3V. Put the sensitivity selector in the maximum sensitivity position (1). Make sure that all possible causes for vibrations in the protected area are present and operating. Check the output voltage and take measures accordingly. Reduce the detector's sensitivity until the voltage reading is acceptable or remove the source of ambient noise.

FIGURE 8 - TESTING THE DETECTORS

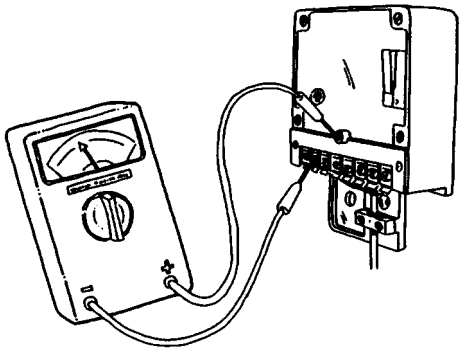


TABLE 5 - DETECTOR OUTPUT VOLTAGE LEVELS

For DV1201	For DV1221	
0.7V	0V	OK
1.4V	2V	reduce range/remove source
2.5V	3.7V	alarm

4. The voltage levels should meet the "OK" ranges stated above. If the levels are not "OK," then locate and remove the source(s) of ambient noise. Only reduce the sensitivity settings below the recommended levels shown in Tables 1 and 3 after taking all possible steps to eliminate the sources of noise. If the settings are reduced, ensure, through testing of all surfaces, that proper detection is maintained.
5. Perform the following tests:

- Scratch the surface around the detector with a screwdriver. Depending on the strength of the signal you generate, the detector triggers an alarm within approximately 30 seconds for the DV1201 and 45 seconds for the DV1221 (the circuit opens between Terminals 5 and 6). This test simulates an attack with a drill, diamond disk or a thermal attack.
- Knock firmly with a hammer on the protected surface around the detector with two-second intervals between blows. After five blows, the DV1201 alarms. To protect the surface from damage, place a small aluminum plate between hammer and surface. This test simulates the attack of a hammer and chisel and is only valid for the DV1201.
- Give one powerful blow near the detector with a hammer. Both the DV1201 and the DV1221 alarm immediately. This test simulates an attack with explosives.

6. Close the cover of the detector(s) and check for a closed-loop condition of the tamper loop.
7. Connect the alarm and tamper loop to the alarm panel and perform a functional test of both alarm and tamper signals according to panel specifications.
8. Confirm proper activation at the system control to insure proper loop wiring.

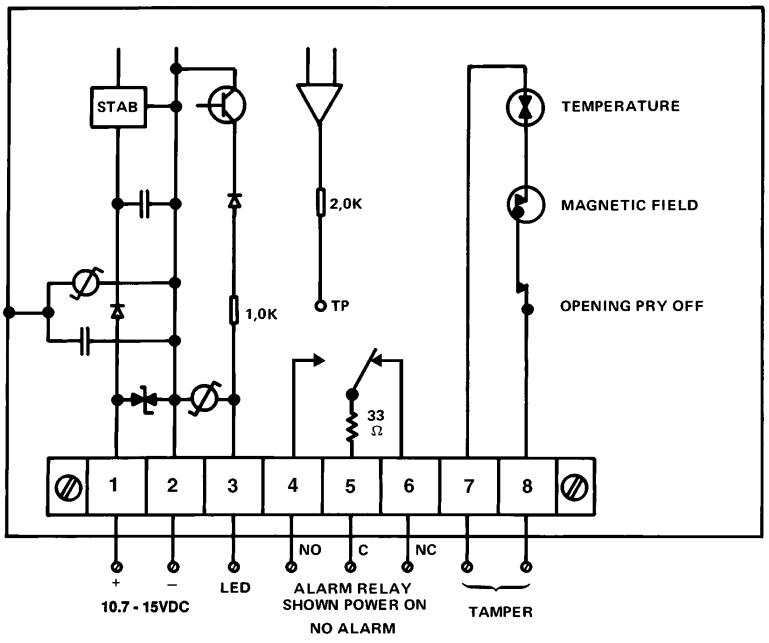
6.0 THE ADVISOR X TEST SYSTEM

6.1 General Description

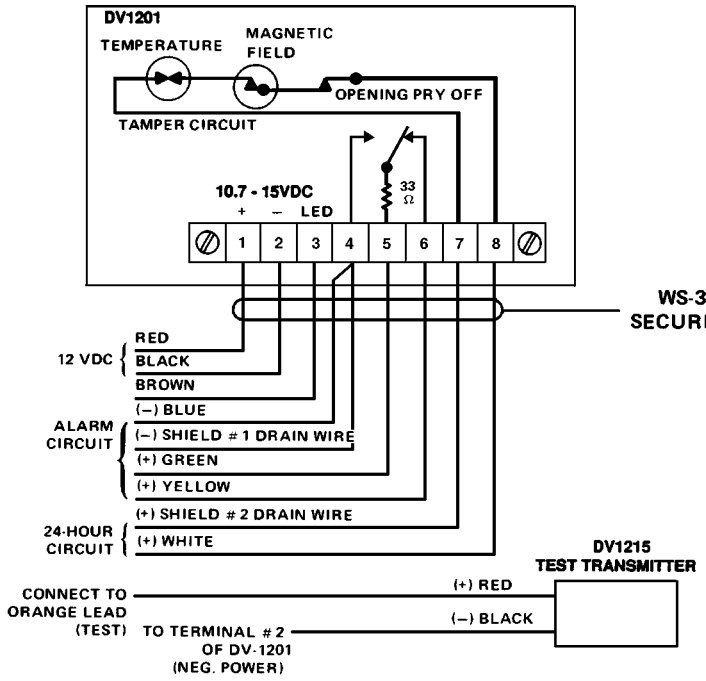
The structural vibration detectors in the Advisor X System can be checked with the Remote Test System. A DV1215 Test Transmitter is mounted inside the detector on the supervised surface. Upon application of 12VDC power, the transmitter's transducer converts the supplied oscillations into signals which are transmitted into the protected surface and picked up by the detector. The detector goes into alarm and its LED output (Terminal 3) goes out of conductive mode. In the indicator unit, a corresponding LED is activated. The LED remains on as long as the sensor is in alarm.

7.0 WIRING DIAGRAMS

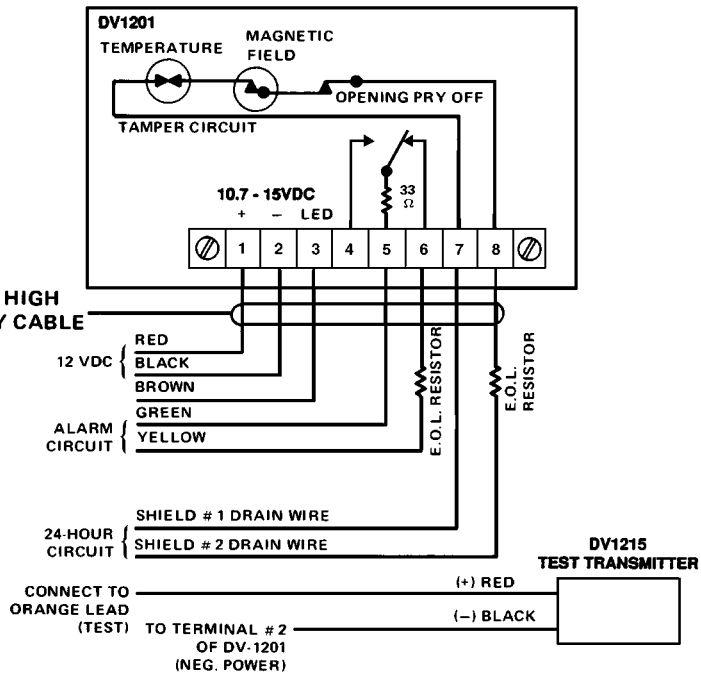
7.1 Wiring the DV1201/DV1221 into Most Security Systems



7.2 Connecting the DV1201 to a Four-wire Circuit Type Control in a UL Complete Mercantile Safe System



7.3 Connecting the DV1201 to a Two-wire Balanced Loop Type Control in a UL Complete Mercantile Safe System



8.0 TECHNICAL DATA

8.1 Technical Data for the DV1201/DV1221

Operating data:

Input power:
external DC power source 10.7-15VDC,
2V maximum ripple peak-to-peak @ $12V_{PS}$

Current consumption:
14 mA maximum.

Alarm output:
SPDT relay contact rating 100 mA, 15V, 3W.

Tamper connection:
normally closed tamper switch rated at 100 mA @ 30V.

Alarm indication:
remote LED output for use with DV1208.

stand-by = negative
alarm = open connection

Adjustment:
sensitivity adjustment in 5 steps of approximately 6 dB.

Test output level:
TP1 for measuring the ambient noise.
See wiring and testing.

Range:
See planning instructions.

Tamper heat attack:
Protection from temperature 93 degrees C of drilling protective plate, magnetic field contact, opening contact, pry-off contact, low voltage alarm if voltage below 7V.

Operating life:
MTBF 240,000 hours.

Environmental data:

Temperature limits:
operational -4°F to 131°F (-20° to +55° C);
storage -58°F to 158°F (-50°C to +70°C).

Relative humidity:
operational 90% at 86°F (30°C).

Electric field:
max. 5×10^4 gauss.

Static discharge:
max. 20kV.

Electric discharge:
max.1.5kV at 0.4m joule; max. 300V at 0.5 joule.

Physical Data:

Dimensions:
3.9in. x 3in. x 1.2in. (10 x 8 x 3cm).

Color:
beige.

Weight:
8.8oz.(250grs.)

8.2 Technical Data for DV1215

Input power:
external DC power source 10.7-15V .2V,
maximum ripple peak-to-peak.

Current consumption:
typical 5 mA.

Sweeping frequency:
6-20 kHz.

Size:
.8in. x .8in. x .4in. (2 x 2 x 1cm).

ORDERING INFORMATION

Model Number	Description
DV1201	Structural Vibration Detector for Vaults and Safes
DV1221	Structural Vibrator Detector for ATM and Night Deposit Safe
DV1160	Test Transmitter/Generator
DV1208	Eight-Point Remote Annunciator
DV1209	Summed Remote Annunciator
DV1215	Self-Contained Test Transmitter
DV1218	Plastic Insert for Armored Cable
DV1219	Armored Cable Kit (6')
DV1220	Recessed Floor Mounting Box
DV1228	Tampered Junction Box
WS300	High Security Cable

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