PHOTOELECTRIC DETECTOR
AX-250PLUS, AX-500PLUS
AX-350TF, AX-650TF

FEATURES
• Beam interruption time adjustment
• Anti-Frost Structure
• Alignment level monitor jack
• Form C relay
• Tamper
• Option
• UL Listed

AX-350TF, AX-650TF ONLY
• LED indicator for fine beam alignment level
• Selectable beam frequencies
• Re-Transmit Circuit
• D.Q.Circuit (Environmental Disqualification)
• Alarm Memory

For Safe Use of the Product
• Read this instruction manual carefully prior to installation.
• After reading, store this manual carefully in an easily accessible place for reference.
• This manual uses the following warning indications for correct use of the product and harm to you or other people and damage to your assets, which are described below. Be sure to understand the description before reading the rest of this manual.

WARNING
Failure to follow the instructions provided with this indication and improper handling may cause death or serious injury.

CAUTION
Failure to follow the instructions provided with this indication and improper handling may cause injury and / or property damage.

This symbol indicates prohibition. The specific prohibited action is provided in and/or around the figure.

This symbol requires an action or gives an instruction.

WARNING
Do not use the product for purposes other than the detection of moving objects such as people and vehicles. Do not use the product to activate a shutter, etc., which may cause an accident.

Do not touch the unit base or power terminals of the product with a wet hand (do not touch when the product is wet with rain, etc.). It may cause electric shock.

Never attempt to disassemble or repair the product. It may cause fire or damage to the devices.

Do not exceed the voltage or current rating specified for any of the terminals during installation, doing so may cause fire or damage to the devices.

CAUTION
Do not pour water over the product with a bucket, hose, etc. The water may enter, which may cause damage to the devices.

Clean and check the product periodically for safe use. If any problem is found, do not attempt to use the product as it is and have the product repaired by a professional engineer or electrician.

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1. PARTS IDENTIFICATION

2. PRECAUTIONS

1. Mount unit only on a solid surface.

2. Do not install the unit where objects moved by the wind such as plants and laundry, which may block the beam.

3. Prevent direct sunlight from entering into internal receiver.

4. A different type of beam should not reach the receiver.

5. Avoid aerial wiring.

6. Do not install the unit on unsteady surfaces.

7. Mount the units more than 1m away from the wall or fence.

STANDARD ACCESSORIES

- Screws (4×20 Self tapping) x 8
- Screws (M4×30) x 8
- U-Shaped brackets x 4
- Beam Blocking Tool x 2

3.3 ft. (1m)
3. INSTALLATION METHOD

a. General

1. Detection range and installation height.

\[
\text{Detection range} \\
27° - 40° \quad (0.7 \sim 1m)
\]

Maximum distances between Receiver and Transmitter are listed below.
AX-250PLUS = 250ft (75m) Max
AX-500PLUS = 500ft (150m) Max
AX-350TF = 350ft (100m) Max
AX-650TF = 650ft (200m) Max
and the installation height should be at 27"~40", (0.7~1m)

b. Installation Method

1. Lossen the cover lock screw and remove the front cover. And loosen the unit base mounting screw and remove mounting plate by sliding it down against the unit base.

2. Alignment angle

- Horizontally: 180° (±90°)
- Vertically: 20° (±10°)

2. Pole mounting

- Pole size should be as follows: 1 3/8"~1 7/8" O.D (Ф34~Ф48mm)
  (Standard U.S. 1 1/4" or 1 1/2" pipe.)
- The length of the wiring cable out of the pole should be within 20 inches (60cm).

3. Two unit installation (back to back)

- Place U-Shape brackets at the top of the pole. And pull out the wire through the wiring hole on the mounting plate and attach the plate to the well with the screw.

- Fix two U-shape brackets in layers on a pole, two units can be installed back to back on a pole at the same height.

* Connect wire to the terminals (See Sec. 4-1, 5-1 "Terminal").

* After checking optical alignment and operation check (See Sec. 4-3, 5-3 OPTICAL ALIGNMENT), replace the cover, and fasten the lock screw tightly.

NOTE

- Pole Mount Back Cover

- Electric Box Mounting

- Conduit Installation

Back cover : BC-1 (Optional)

Pole mounting:

Pitch 3.26” (83.5mm)

Knockout

For connections to single gang electric boxes, follow instructions for wall mounting.

Conduit can be installed directly into the bottom of the unit by removing the knockout on the bottom of the cover.
4. AX-250/500PLUS

4-1. TERMINAL

- **Receiver**
  - POWER INPUT 10.5~30VDC
  - ALARM OUTPUT Form C (28VDC 0.2A max.)
  - SPARE

- **Transmitter**
  - POWER INPUT 10.5~30VDC
  - SPARE

### Wiring Distance

○ When using two or more units on one wire, the maximum length is obtained by dividing the wire length listed below by the number of units used.

○ Power wires should not exceed the following length.

<table>
<thead>
<tr>
<th>MODEL</th>
<th>AX-250/500PLUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>WIRE SIZE</td>
<td>12V DC</td>
</tr>
<tr>
<td>AWG22 (0.33mm²)</td>
<td>1300' (400m)</td>
</tr>
<tr>
<td>AWG20 (0.52mm²)</td>
<td>2000' (600m)</td>
</tr>
<tr>
<td>AWG18 (0.83mm²)</td>
<td>3300' (1000m)</td>
</tr>
<tr>
<td>AWG16 (1.31mm²)</td>
<td>5000' (1500m)</td>
</tr>
</tbody>
</table>

**WARNING**

Do not exceed the voltage or current rating specified for any of the terminals during installation, doing so might cause fire or damage to the devices.

UL requires AX-250PLUS/500PLUS to be connected to a UL listed power supply capable of providing a nominal input of 12VDC, (10.5~30VDC) 50mA and battery standby time of 4 hours.

4-2. WIRING

#### 1 Set

- **CONTROL PANEL**
  - POWER
  - ALARM

#### 2 Set in the line

- **CONTROL PANEL**
  - POWER
  - ALARM
When using two or more units on wire, the maximum length is obtained by dividing the maximum wire length listed below of units used. Power wires should not exceed the following lengths.

### 4-3. OPTICAL ALIGNMENT

#### STEP1
**Rough alignment by view finder**

Looking through the view finder, locate the other detector in the center of the sights by adjusting vertically and horizontally.

#### STEP2
**Upper Mirror Fine Adjustment**

Adjust the optical alignment for Transmitter and Receiver one at a time.

- **Vertical Adjustment**
  - Connect the volt-meter to monitor jack input on Receiver's (+) and (-), then fine tune optical alignment.
  - Put the attached “Beam Blocking Tool” on the lower mirror of both the transmitter and the Receiver.
  - Adjust the vertical alignment screw to obtain the maximum voltage from the monitor jack.

- **Horizontal Adjustment**
  - Adjust the vertical alignment screw to obtain the maximum voltage from the monitor jack.

#### STEP3
**Lower Mirror Fine Adjustment**

Secondly, adjust the lower mirrors.

- After the final adjustment are made on the upper mirrors, carefully without moving mirror remove “Beam Blocking Tool” from the lower mirrors and place them on the upper mirrors of both the Transmitter and Receiver.
- **SENSITIVITY CHART**

<table>
<thead>
<tr>
<th>ALIGNMENT LEVEL</th>
<th>Realign</th>
<th>Fair</th>
<th>GOOD</th>
<th>EXCELLENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>MONITOR JACK OUTPUT</td>
<td>0V</td>
<td>2.0V</td>
<td>3.5V</td>
<td>5.0V</td>
</tr>
</tbody>
</table>

optical Alignment for Indoor Use

obtain maximum voltage from the monitor jack, at least more than 2.2V

#### STEP4
**Final checking after removing the “Beam Blocking Tool” from the mirror.**

Carefully remove the “Beam Blocking Tool” from the upper mirror of both Transmitter and Receiver also check the voltage from the monitor jack again. Then check again that the voltage from monitor jack is more than about 5.0V if not, adjust the optical alignment again.

#### Confirmation of Action

1. Check that the operation indicator (“ALARM CONDITION” LED) light is OFF.
2. If the indicator light is ON even though the beams are not blocked, re-adjust the optical alignment and check wiring. (See sec. 4-3)
3. After alignment is achieved and the units work properly, conduct a walk test at a minimum of three points.
   - In front of the Transmitter.
   - In front of the Receiver.
   - At the middle point between Transmitter and Receiver.
5. AX-350/650TF

5-1. TERMINAL

**Receiver**

- POWER INPUT 10.5～30VDC
- ALARM OUTPUT (Form C, 28VDC 0.2A max.)
- DQ (Environmental Disqualification, Form C, 28VDC 0.2A max.)
- ALARM MEMORY
- SPARE
- TAMPER (N.C.)

**Transmitter**

- POWER INPUT 10.5～30VDC
- ALARM INPUT (Re-Transmitting)
- SPARE
- TAMPER (N.C.)

---

**Wiring Distance**

- When using two or more units on one wire, the maximum length is obtained by dividing the wire length listed below by the number of units used.
- Power wires should not exceed the following length.

<table>
<thead>
<tr>
<th>MODEL</th>
<th>AX-350/650TF</th>
</tr>
</thead>
<tbody>
<tr>
<td>WIRE SIZE</td>
<td>12V DC</td>
</tr>
<tr>
<td>AWG22 (0.33mm²)</td>
<td>980' (300m)</td>
</tr>
<tr>
<td>AWG20 (0.52mm²)</td>
<td>1500' (470m)</td>
</tr>
<tr>
<td>AWG18 (0.83mm²)</td>
<td>2450' (750m)</td>
</tr>
<tr>
<td>AWG16 (1.31mm²)</td>
<td>3900' (1150m)</td>
</tr>
</tbody>
</table>

**WARNING**

- UL requires AX-350TF/AX-650TF to be connected to a UL listed power supply capable of providing a nominal input of 12VDC, (10.5～30VDC) 75mA and battery standby time of 4 hours.

**5-2. WIRING**

- **1 Set**
- **2 Sets Stacking**
- **2 Set in the line**
- **DQ and ALARM MEMORY**

---

Do not exceed the voltage or current rating specified for any of the terminals during installation, doing so might cause fire or damage to the devices.

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6
When using two or more units on wire, the maximum length is obtained by dividing the maximum wire length listed below of units used. Power wires should not exceed the following lengths.

**STEP 1**

**Beam Frequencies Selection**

Select the beam frequencies switch.

- Match the frequency settings. (See Sec. 7-1 SELECTABLE BEAM FREQUENCIES.)
- When stacking beams or installing more than one set in the same area.

**STEP 2**

**Horizontal & Vertical Adjustment**

- **HORIZONTAL ADJUSTMENT**
  - Looking into view finder of the Transmitter, adjust the lens horizontally and vertically, so that the Receiver can be seen in the center of the image.
  - Turn mirror base by hand to obtain the highest alignment level.
  - Make fine adjustment by turning "Fine Adjustment Screw".

- **VERTICAL ADJUSTMENT**
  - Turn vertical adjustment screw to get highest level.

**STEP 3**

**ADJUST THE UPPER MIRROR**

- Looking into view finder of Receiver and make fine adjustments horizontally and vertically.
- Attach the "Beam Blocking Tool" to the lower mirror on both the transmitter and receiver.
- "Excel" reading on the LED indicator is sufficient.

**ADJUST THE LOWER MIRROR**

- After the final adjustments are made on the upper mirrors, carefully (do not move mirror) remove the shield tools from the lower mirrors and place them on the upper mirrors of both the transmitter and receiver.
- Make the horizontal and vertical adjustments to the lower mirrors.
- "Excel" reading on the indicator is sufficient.

**STEP 4**

**Checking From The Monitor Jack**

- Confirm the beam alignment level by setting your volt-meter to the 5~10V DC range, cover either the upper or lower beam and compare the voltage reading with the following chart.
- Connect the volt-meter probes (+) to monitor jack (+), and volt-meter probes (-) to monitor jack (-).
- Set the volt-meter range to 5~10 VDC.

**Confirmation of Action**

1. Check that the operation indicator ("ALARM CONDITION" LED) light is OFF.
2. If the indicator light is ON even though the beams are not blocked re-adjust the optical alignment and check wiring. (See sec. 5-3)
3. After alignment is achieved and the units work properly, conduct a walk test at a minimum of three points.
   - In front of the Transmitter.
   - In front of the Receiver.
   - At the middle point between Transmitter and Receiver.
6. BEAM INTERRUPTION TIME ADJUSTMENT

The beam interruption time adjustment is on Receiver unit. This function allows you to match the units sensitivity to its surroundings. Slower steering reduce sensitivity.

CAUTION:
• Speeds shown above are the maximum detectable speeds for each setting. Faster speeds will not be detected. Where birds, newspapers or flying debris can occasionally interrupt the beam, adjust setting to a slower speed (longer interruption period.)
• Beam interruption times exceeding 70 msec do not comply with the requirements in UL639. Intrusion Detection Units.

7. AX-350/650TF

7-1. SELECTABLE BEAM FREQUENCIES

The selectable beam frequencies can be used to avoid unwanted crosstalk that can occur when using multiple photobeams for long distance or beam stacking applications.
• To select between 4 separate beam frequencies, use the switch provided.
• Make sure the receiver and transmitter that are facing each other are set to the same code.

IMPORTANT Always switch the frequencies TWO channels apart when stacking units on top of one another (See following example). The upper unit is set on channel 1 while the lower is on channel 3, channel 2 and 4 could have also been used.

1 beam stacking

2 beam long distance stacking

3 Long distance

4 Perimeter protection

7-2. ALARM MEMORY

1. Wiring
Connect control voltage signal terminal (System arming status voltage output terminal) of control panel to A.M. terminal.

2. Operation of Alarm Memory
If the units is triggered during an armed period, when the system is disarmed, its LED will remain lit to confirm that it reported the alarm.
• Alarm Memory will not latch while system is disarmed.
• LED operation and alarm output are not affected by alarm memory when system is armed.

3. Reset
Alarm memory resets automatically when system is re-armed.
• Optical, compatible control panel required.
D.Q. will send a trouble signal when the beam strength is below an acceptable level due to heavy fog, rain, snow or other changes in the installation site. The trouble signal output continues as long as the beam strength is below an acceptable level. It will reset when the environmental conditions clear.

(EXAMPLE)
A. Trouble Output + Alarm Output

B. Bypasses Alarm

C. Bypasses Alarm + Trouble Output

NOTE: If the control panel's input terminals have the same common, the alarm output, sleep and trouble output can be triggered simultaneously.

7-4. RE-TRANSMITTING CIRCUIT

• The advantage of this method is elimination of wiring from a detector or switch, back to the control panel.

• Remove the jumper (U shaped connector) from the transmitter’s alarm input terminals (3 & 4) and connect the N.C. output of the detector or switch.

****CAUTION****
• Make sure you connect the jumper (U shaped connector) when the retransmitting circuit is not in use.
• Output of the detector or switch must be N.C. (N.O. is not acceptable.)
## 8. SPECIFICATIONS

<table>
<thead>
<tr>
<th>MODEL</th>
<th>AX-250PLUS</th>
<th>AX-500PLUS</th>
<th>AX-350TF</th>
<th>AX-650TF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detection Method</td>
<td>Infrared Photoelectric</td>
<td>Pulsed Infrared</td>
<td>Pulsed Infrared</td>
<td>Pulsed Infrared</td>
</tr>
<tr>
<td>Range Outdoor</td>
<td>250ft(75m)</td>
<td>500ft(150m)</td>
<td>350ft(100m)</td>
<td>650ft(200m)</td>
</tr>
<tr>
<td>Range Indoor</td>
<td>500ft(150m)</td>
<td>1000ft(300m)</td>
<td>700ft(200m)</td>
<td>1300ft(400m)</td>
</tr>
<tr>
<td>Maximum Arrival Distance Outdoor</td>
<td>2500ft(750m)</td>
<td>5000ft(1500m)</td>
<td>3500ft(1000m)</td>
<td>6500ft(2000m)</td>
</tr>
<tr>
<td>Maximum Arrival Distance Indoor</td>
<td>500ft(150m)</td>
<td>1000ft(300m)</td>
<td>700ft(200m)</td>
<td>1300ft(400m)</td>
</tr>
<tr>
<td>Beam Characteristics</td>
<td>Pulsed Infrared</td>
<td>4 channel</td>
<td>4 channel</td>
<td>4 channel</td>
</tr>
<tr>
<td>Intermittent Period</td>
<td>50~500 msec (Selectable)</td>
<td>50, 100, 250, 500 msec (4steps)</td>
<td>50, 100, 250, 500 msec (4steps)</td>
<td>50, 100, 250, 500 msec (4steps)</td>
</tr>
<tr>
<td>Power Input</td>
<td>10.5~30VDC</td>
<td>10.5~30VDC</td>
<td>10.5~30VDC</td>
<td>10.5~30VDC</td>
</tr>
<tr>
<td>Current Draw (transmitter + receiver)</td>
<td>Normal operation 50 mA max</td>
<td>Normal operation 60 mA max</td>
<td>Normal operation 62 mA max</td>
<td>Normal operation 60 mA max</td>
</tr>
<tr>
<td></td>
<td>T:22mA+R:28mA</td>
<td>T:11mA+R:49mA</td>
<td>T:13mA+R:49mA</td>
<td>T:11mA+R:49mA</td>
</tr>
<tr>
<td>Alarm Period</td>
<td>2sec±1 nominal</td>
<td>2sec±1 nominal</td>
<td>2sec±1 nominal</td>
<td>2sec±1 nominal</td>
</tr>
<tr>
<td>Alarm Output</td>
<td>Form C Relay (28VDC 0.2A max)</td>
<td>Form C Relay (28VDC 0.2A max)</td>
<td>Form C Relay (28VDC 0.2A max)</td>
<td>Form C Relay (28VDC 0.2A max)</td>
</tr>
<tr>
<td>Tamper Switch</td>
<td>N.C. opens when cover is removed (RECEIVER only)</td>
<td>N.C. opens when cover is removed</td>
<td>N.C. opens when cover is removed</td>
<td>N.C. opens when cover is removed</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-13°F<del>131°F (-25°C</del>+55°C)</td>
<td>-30°F<del>140°F (-35°C</del>+60°C)</td>
<td>-30°F<del>140°F (-35°C</del>+60°C)</td>
<td>-30°F<del>140°F (-35°C</del>+60°C)</td>
</tr>
<tr>
<td>Environment Humidity</td>
<td>95% max</td>
<td>95% max</td>
<td>95% max</td>
<td>95% max</td>
</tr>
<tr>
<td>Alignment Angle</td>
<td>±10° Vertical, ±90° Horizontal</td>
<td>±10° Vertical, ±90° Horizontal</td>
<td>±10° Vertical, ±90° Horizontal</td>
<td>±10° Vertical, ±90° Horizontal</td>
</tr>
<tr>
<td>Environmental Disqualification Circuit</td>
<td>Form C relay operates when beam energy has been gradually reduced to abnormal level.</td>
<td>Form C relay operates when beam energy has been gradually reduced to abnormal level.</td>
<td>Form C relay operates when beam energy has been gradually reduced to abnormal level.</td>
<td>Form C relay operates when beam energy has been gradually reduced to abnormal level.</td>
</tr>
<tr>
<td>Mounting</td>
<td>Wall or Pole</td>
<td>Wall or Pole</td>
<td>Wall or Pole</td>
<td>Wall or Pole</td>
</tr>
<tr>
<td>Weatherproof</td>
<td>IP54</td>
<td>IP54</td>
<td>IP54</td>
<td>IP54</td>
</tr>
<tr>
<td>Weight</td>
<td>95.2 oz (2700g) Transmitter and Receiver</td>
<td>97.0 oz (2750g) Transmitter and Receiver</td>
<td>97.0 oz (2750g) Transmitter and Receiver</td>
<td>97.0 oz (2750g) Transmitter and Receiver</td>
</tr>
</tbody>
</table>

*Specifications and design are subject to change without prior notice.*

### 9. DIMENSIONS

![Dimensions Diagram](image)

Dimensions: inches (mm)
1. “No Action” on the TRANSMITTER or RECEIVER after power has been applied.

- NG: Does the power supply output more than 12VDC?
  - NG: Call Technical Support.
  - YES: OK

- NG: Correct terminal connection and/or polarity.
  - NG: Call Technical Support.
  - YES: OK

- NG: Check to see that input power is within the product’s requirements.
  - NG: Call Technical Support.
  - YES: OK

- NG: Check to see that power cables are properly connected and polarity is correct.
  - NG: Call Technical Support.
  - YES: OK

- NG: There is a possibility that the power line has been cut.
  - NG: Call Technical Support.
  - YES: OK

- NG: The power line is short circuited or grounded.
  - NG: Call Technical Support.
  - YES: OK

- NG: The power supply may be malfunctioning, repair is required, or call power supply manufacturer.
  - NG: Call Technical Support.
  - YES: OK

- NG: The unit may be affected by electrical noise. May need to use shielded wire and/or metallic conduit pipe. Call Technical Support if you are unsure of the proper shielding techniques.
  - NG: Call Technical Support.
  - YES: OK

2. “No Action” on alarm zone even though the beams are completely blocked.

- NG: Remove the alarm circuit wire from the RECEIVER, place your voltmeter on resistance and measure the alarm output relay. Does the relay open when power is removed?
  - NG: Call Technical Support.
  - YES: OK

- NG: The unit may be affected by electrical noise. May need to use shielded wire and/or metallic conduit pipe. Call Technical Support if you are unsure of the proper shielding techniques.
  - NG: Call Technical Support.
  - YES: OK

- NG: Adjust vertical and/or horizontal alignment in order to move the IR energy off the reflective surface. Monitor the beam strength (Monitor Jack) while adjusting beam to insure stable alignment.
  - NG: Call Technical Support.
  - YES: OK

- NG: Turn the interruption time adjustment dial counter-clockwise one graduation.
  - NG: Call Technical Support.
  - YES: OK

- NG: The intended target does not block both upper and lower beams completely.
  - NG: Call Technical Support.
  - YES: OK

- NG: The beam interruption time is set too long.
  - NG: Call Technical Support.
  - YES: OK

- NG: Remove the alarm circuit wire from the RECEIVER, place your voltmeter on resistance and measure the alarm output relay. Does the relay open when power is removed?
  - NG: Call Technical Support.
  - YES: OK

- NG: The beams are being reflected off of a shiny surface.
  - NG: Call Technical Support.
  - YES: OK

- NG: The RECEIVER may be affected by other beam TRANSMITTERS, or the beams are being reflected off of a shiny surface.
  - NG: Call Technical Support.
  - YES: OK

- NG: Are there any other outdoor beams near the installation site?
  - NG: Does the Photoelectric Beam work properly?
    - NG: Check other items.
    - YES: OK

- NG: Are there any other outdoor beams near the installation site?
  - NG: Does the Photoelectric Beam work properly?
    - NG: Check other items.
    - YES: OK

- NG: Does the Photoelectric Beam work properly?
  - NG: Check other items.
  - YES: OK

- NG: The control panel may be malfunctioning, call the control panel manufacturer.
  - NG: Call Technical Support.
  - YES: OK

- NG: “Change the lay-out of the beams or call Technical Support for further advice.”
  - NG: Call Technical Support.
  - YES: OK
3. Alarm signal is being generated though beams are not blocked

4. False activations

Important:
The majority of false activations can be attributed to poor beam alignment. When aligning outdoor beams accept no less than an "EXCEL" value for the most stable and trouble free system!! Refer to the installation manual for acceptable Monitor Jack Voltage Values.

NOTE
This unit is designed to detect an intruder and activate an alarm control panel. Being only a part of a complete system, we cannot accept responsibility for any damages or other consequences resulting from an intrusion. These units are designed to detect an intruder and activate an alarm control panel. Being only a part of a complete system, we cannot accept responsibility for any damages or other consequences resulting from an intrusion. These products conform to the EMC Directive 89/336 EEC.