Section D
Model 10XHD-Series
Hole Detection Sensor
Operator’s Manual
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D.1  Introduction

The Hole Detection Sensor – 10XHD-Series is a non-contact, electro-optical sensor designed specifically for the detection of weld holes in strip materials, though it is capable of many various hole detection applications. The 10XHD-Series sensor operates with a Hole Detection Processing Computer – Model HDPC (Section S). Because of its versatility and reliability, the 10XHD-Series sensor is one of the most reliable and cost effective hole detection sensor systems on the market today.

D.1.a  Sensor Overview

The 10XHD-Series sensor consists of an emitter with 20 foot [6.1m] emitter-to-processor cable and a receiver with 15 foot [4.6m] emitter-to-receiver cable for hole detection applications (Figure D.1-1). Longer cables are available upon request (XCB Option). Each emitter contains scanned high-intensity infrared (IR) light emitting diodes (LED’s) grouped into 10-1 inch [25mm] arrays per 10 inch [254mm] section. The 10 diode groups pulse consecutively to permit 500 microsecond hole detection’s anywhere along the length of the group. Additional groups may be connected to the first (up to four groups) and operate consecutively with the first group. The visible light filtered receiver with its IR filtered photocell detects holes in strips moving at typical production line speeds.

D.1.b  Functional Description

The 10XHD-Series emitter module contains a scanned array of 100 infrared LEDs that light sequentially with a scan rate of 0.5ms per ten inches [254mm]. The receiver light detector is a silicon photocell. All of the light focused by the receiver lens onto the photocell generates an electrical current. The light coming from the emitter is visible-light filtered and pulses at 20kHz, so the current generated in the receiver also pulses at 20kHz. This assists in preventing ambient light from interfering with the 10XHD-Series sensor.

When the 10XHD-Series receiver (Model 10XRHD) is positioned to “see” all of the diodes in the emitter, the absence of light at the instant in time when a diode is being lit indicates that an object is blocking the light path at that diode. When light is detected, the photocell produces an electrical current proportional to the infrared energy falling on its surface. The resulting current is delivered to the input of a balanced low noise pre-amplifier that is tuned to pass only the 20kHz signals generated by the emitter infrared LED array(s).

D.2  Operational Considerations

The 10XHD-Series sensor is highly resistant to most of the industrial environments that can cause problems with many hole detection systems.

Because the 10XHD-Series sensor is producing and looking for light modulated at approximately 20kHz, it is unlikely that typical low level ambient light sources will be a problem. It is best to avoid placing a direct high-intensity light or reflected, modulated light source in the receiver view path. A bright light source can overload the receiver photocell and prevent it from detecting the emitter light.

Even though the 10XHD-Series sensor is tolerant of most ambient light situations, high-intensity strobe lights can cause receiver cell overload, producing false detection’s. Because of the high frequency pulsing of strobe lights, the receiver can interpret the strobe pulses as an extra edge or trigger a fault detection. Care should be taken when installing a 10XHD-Series sensor to locate the sensor as far as possible from any strobe light(s). If operational constraints require that the SCAN-A-LINE™ sensor be mounted in close proximity to a strobe light, horn blinders (HBLD Option – Section HH) are available for 10XHD-Series receivers that may assist in preventing any strobe light interference.

A reasonably uniform buildup of dust, dirt or oil will not affect the operation or accuracy of a SCAN-A-LINE™ sensor. Dust, dirt and oil build-up can attenuate the sensor signal by over 90% before any loss of accuracy occurs. Large pieces of material or opaque coatings of paint or heavy grease can completely block the beam or attenuate it below tolerable limits. To avoid erratic readings or maintenance difficulty, care should be taken to install the emitter and receiver where the danger of such contamination is minimized. A simple air wipe installed over the emitter viewing window can be helpful where contamination cannot be avoided. In applications where the sensor may be vulnerable to strip collisions, the ULTRA-TOUGH™ (UT Option) is available. ULTRA-TOUGH™ enclosures are designed to withstand most industrial conditions, including high moisture and corrosive environment conditions.
D.2.a Temperature Range

The operating temperature for the 10XHD-Series sensor is 32°F to 122°F [0°C to 50°C]. Operations outside this range are possible with special provisions made to protect the equipment, such as heat shields and water jackets.

D.2.b Vibration Considerations

Vibration is of little or no consequence to the detection of holes with the SCAN-A-LINE™ sensor. In very high vibration applications, simple vibration dampening will solve most vibration problems encountered.

D.3 Specifications for 10XHD-Series

Power for the 10XHD-Series sensor must be supplied by a SCAN-A-LINE™ Hole Detection Processing Computer (Model HDPC – Section S), with one up to three sensor(s) per processing unit. A good system earth ground can be helpful in reducing the possibility of interference from other electrical equipment. Care should be taken to insure that the SCAN-A-LINE™ earth ground is separate from the grounds used by high current or high noise systems (such as motor controllers and welding equipment). This is most important when high current (i.e., welding equipment) and high voltage is involved.

D.3.a Power Requirements

Power Supply (rated at 50 ºC):
+12VDC ±0.25VDC @ 250mA
-12VDC ±0.25VDC @ 50mA

D.3.b Signal Output

The output signal from the 10XHD-Series sensor is a 12VDC CMOS signal that goes to the logic zero state any time the emitter light is detected by the receiver. The position of holes and number of edges encountered by the sensor during a scan can be determined by observing the output signal from the emitter. This signal MUST be processed by a Model HDPC Hole Detection Processing Computer.

D.3.c Physical Dimensions

Drawings showing the dimensions of the 10XHD-Series sensors are located in Section D.7 of this manual. The following list shows the dimensional drawings for these sensors:

1295004 Rev. B           Model 10X Emitter Dimensions
1295007 Rev. A           Model 10X ULTRA-TOUGH™ Emitter Dimensions
1295011 Rev. B           Model 10XR ULTRA-TOUGH™ Receiver Dimensions
1295015 Rev. C           Model 10XR Receiver Dimensions

The 10XHD-Series emitter measures 3 inches [76.2mm] tall by 2.8 inches [71.4mm] wide in lengths from 14.06 inches [357mm] (Model 10XHD-10) to 44.06 inches [1119mm] (Model 10XHD-40) and integrates a mounting plate, with four 5/16 inch [7.9mm] mounting holes, into the base of the emitter. The emitter is constructed of an extruded aluminum enclosure with 2 (two) extruded aluminum end caps. The extruded aluminum enclosure incorporates the Lexan window. The enclosure includes 2 (two) MS-Style circular connectors for emitter - to - receiver and emitter - to - processing unit cable connections.

The receiver measures 6.6 inches [168mm] long by 3 inches [76mm] wide by 3.6 inches [91mm] tall. It is constructed of a cast aluminum housing with extruded aluminum mounting plate and bezel containing the borosilicate glass viewing window. A MS-style circular connector is for the emitter - to - receiver cable connection.

The 10XHD-Series emitter and receiver are also available in the ULTRA-TOUGH™ enclosure (Model 10XHD-UT) for extreme operating conditions (such as high collision and/or fluid intensive environments). The ULTRA-TOUGH™ emitter measures 4.5 inches [114mm] tall by 4 inches [102mm] wide in lengths from 16 inches [406mm] (Model 10XHD-10-UT) up to 46 inches [1168mm] (Model 10XHD-40-UT). The emitter is constructed of cast aluminum housings over 0.625 inches [16mm] thick with an extruded aluminum bezel 0.75 inches [19mm] thick with a borosilicate glass emitter window approximately 0.375 inches [9.5mm] thick.

The ULTRA-TOUGH™ receiver measures 8 inches [203mm] long by 4 inches [102mm] wide by 4.6 inches [117mm] tall. They are also constructed of cast aluminum housings with extruded aluminum bezels and borosilicate glass viewing windows similar to the ULTRA-TOUGH™ emitters. All cable connections for the ULTRA-TOUGH™ are identical to the standard 10XHD-Series sensor cable connections.
D.3.d Minimum Hole Size

The minimum hole size(s) that the 10XH-Series sensor can detect are 0.2" [5.08mm] plus the product thickness. Hole size(s) of
0.5" [12.7mm] to 1" [25.4mm] are recommended. For sizes other than specified, contact Harris Instrument Corporation for more
information.

D.3.e Operational Configurations

The 10XH-Series sensor is available in several optional configurations to meet a variety of application requirements. The various
configurations may be specified as follows:

<table>
<thead>
<tr>
<th>Model Number &amp; Suffix</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10XHD</td>
<td>Designates the standard sensor, the emitter and receiver connected by electrical cable. The emitter and receiver are housed in the standard aluminum enclosures with a Lexan® bezel viewing window.</td>
</tr>
<tr>
<td>10XHD-UT</td>
<td>Indicates the emitter and receiver are housed in the ULTRA-TOUGH™ enclosures instead of the standard housings.</td>
</tr>
<tr>
<td>10XRHD</td>
<td>Indicates that the unit is a receiver for the 10XH-Series emitter.</td>
</tr>
<tr>
<td>CR</td>
<td>Indicates that the emitter and receiver are protected for corrosive environments. All seals are Teflon® Joint Sealant, all connectors are sealed, all screws are stainless steel and are sealed with the Teflon® Joint Sealant Compound on the threads as needed. The borosilicate viewing window in the receiver is sealed with epoxy resin, as well as the emitter borosilicate lens in the ULTRA-TOUGH™ configuration. All external surfaces are painted with corrosion-resistant polane paint.</td>
</tr>
<tr>
<td>E</td>
<td>Indicates that the unit is a 10XH-Series emitter.</td>
</tr>
<tr>
<td>HBLD</td>
<td>Indicates that the receiver is configured with a horn blinder. This blinder is typically used with system that will be installed on lines that may have interference from strobe or other pulsing light sources.</td>
</tr>
<tr>
<td>POL</td>
<td>Indicates the sensor is protected with polane painted surfaces and stainless steel screws to resist corrosion (included with the CR and UT Options).</td>
</tr>
<tr>
<td>XCB</td>
<td>Indicates that the cables supplied with the system are longer than the standard cables (15 feet [4.6m] to 20 feet [6.1m] up to 50 feet [15.2m]).</td>
</tr>
</tbody>
</table>

Table D.3-1: Optional Configurations for 10XH-Series Sensors

D.4 Installation

The 10XH-Series sensor is designed for operation with a Hole Detection Processing Computer – Model HDPC for hole detection applications. The Model HDPC uses 1 (one) up to 3 (three) sensors of the same type and size.

When installing the 10XH-Series sensor, some commonsense procedures to protect the sensor from any line collision should be taken. Damage to sensors from line collisions is the primary cause of SCAN-A-LINE™ sensor failures. Install the sensor in a position on the line where it is protected as much as possible from strip collisions. Many times, a simple deflection bar mounted above the sensor components will prevent such collisions. Once properly installed (refer to your system configuration drawing provided with your new system purchase) and protected, the 10XH-Series sensor will provide a lifetime of reliable operation.

NOTE:

If any welding is to be performed near a 10XH-Series sensor, COVER THE LEXAN® BEZEL with a protective material (i.e., metal plate, wood sheet, etc.) to prevent the welding flash from coming in contact with the bezel. Such welding flash is hot enough to melt the Lexan®, causing pitting of the bezel that shows up as incorrect readings.

D.4.a Hole Detection Installation

The 10XH-Series emitter and receiver are mounted parallel with the receiver typically positioned directly above the center of the emitter. The centerline of the emitter and receiver should be perpendicular to the strip, with a maximum tip of ±5°. The wedge of light is approximately 30° wide. The receiver lens system has a more narrow angle (10°) and may require mounting adjustment. A greater emitter-to-receiver separation creates greater requirement for proper aim adjustment [Figure D.4-1 on pg 7]. (Refer to your system configuration drawing that was provided with your new system purchase.)
Emitter-to-Receiver Separation

Emitter-to-receiver separation for a 10XHD-Series sensor is generally 1.5 to 2 times the emitter length (Figure D.4-2 and Table D.4-1) and offer well-balanced receiver viewing sensitivity. The optimum emitter-to-receiver distance depends upon the length of the emitter and several other factors. Close emitter-to-receiver separation will limit the width inspection range of the sensor and may cause a loss of sensitivity at the outside edges when long emitters are used.

Emitter-to-receiver separations greater than these nominal separations should be avoided for several reasons. Although low level ambient light sources are largely rejected by the 20kHz tuning of the video signal processing circuits and the IR filtering in the silicon cells, some interference may be experienced. Strobe lights or any pulsed IR light source can pose special problems for the 10XHD-Series sensor. Keeping the field of view of the sensor as small as possible with close emitter-to-receiver separation will reduce the possibility of false hole detection’s while also improving smaller hole sensitivity. Shielding the receiver from interfering light sources to reduce such light interference will improve performance.

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Scan Time</th>
<th>Nominal Emitter-to-Receiver Separation</th>
</tr>
</thead>
<tbody>
<tr>
<td>10XHD-10</td>
<td>0.5ms</td>
<td>15 Inches [381mm] to 20 Inches [508mm]</td>
</tr>
<tr>
<td>10XHD-20</td>
<td>1.0ms</td>
<td>30 Inches [762mm] to 40 Inches [1016mm]</td>
</tr>
<tr>
<td>10XHD-30</td>
<td>1.5ms</td>
<td>45 Inches [1143mm] to 60 Inches [1524mm]</td>
</tr>
<tr>
<td>10XHD-40</td>
<td>2.0ms</td>
<td>60 Inches [1524mm] to 80 Inches [2032mm]</td>
</tr>
</tbody>
</table>

Table D.4-1: Hole Detection Sensor Scan Times and Emitter-to-Receiver Separation

Emitter-to-receiver separations greater than these nominal separations should be avoided for several reasons. Although low level ambient light sources are largely rejected by the 20kHz tuning of the video signal processing circuits and the IR filtering in the silicon cells, some interference may be experienced. Strobe lights or any pulsed IR light source can pose special problems for the 10XHD-Series sensor. Keeping the field of view of the sensor as small as possible with close emitter-to-receiver separation will reduce the possibility of false hole detection’s while also improving smaller hole sensitivity. Shielding the receiver from interfering light sources to reduce such light interference will improve performance.

The maximum detection width range for the 10XHD-Series sensor varies depending upon the length of the emitter. However, operational considerations, such as lateral strip deviation (Figure D.4-3) and product passline (Figure D.4-4) (distance from the emitter face to the strip) can lessen the width range. The 10XHD-Series sensor should be placed on the line where the strip lateral position is relatively stable to prevent loss of range from lateral deviation. Typically, the detection width range is approximately two (2) inches [50.8mm] less than the length designation of the sensor (i.e. a Model 10XHD-10 sensor will have an effective detection width range of eight (8) inches [203.2mm]).

Product Passline

The recommended product passline spacing for the 10XHD-Series sensor is one (1) inch [25mm] minimum up to six (6) inches [152mm] maximum, with optimal spacing of two (2) inches [51mm] to four (4) inches [102mm] (Figure D.4-4). As the product passline increases the active inspection range of the sensor decreases, so any passline spacing higher than four (4) inches [102mm] may seriously degrade the detection abilities of the system.
D.4.b Sensor Connections

When connecting a 10XHD-Series sensor to the processing unit, the type of processing unit dictates the way in which the sensor(s) are connected.

Emitter-to-Receiver Connection

Connect the receiver to the emitter via the 6-pin MS-style circular connectors receiver cable and tighten securely. The Model 10XRHD receiver has a 6-pin male MS-style circular connector. This cable attaches to the emitter-to-receiver cable (female 6-pin MS-style inline circular connector) (Figure D.4-7). Be sure to tighten all connectors securely.

Emitter-to-Processing Unit Connection

The emitter-to-processing unit cable attaches to the emitter at the 7-pin male MS-style circular connector. This cable is terminated with a 7-pin male circular connector for attachment to the processing unit.

Model HDPC

The Model HDPC Processing Computer has three sensor connectors located on the bottom panel of the unit. The sensor connectors are labeled Sensor A, Sensor B, and Sensor C. Each sensor(s) used in your system is connected to the Model HDPC by a 7-pin emitter-to-processor cable. One 7-pin emitter-to-processor cable is required for each 10XHD-Series sensor(s) used in your system configuration.

Before connecting the emitter cable(s) to the processing computer, verify that the connectors are free of foreign materials and check the number of pins on each connector.

Single Sensor Connection: Requires one emitter-to-processing cable

Connect one emitter cable to the Sensor A 7-pin circular MS-style connector located on the bottom panel of the unit. (Figure S.4-2).

Dual Sensor Connection: Requires two emitter-to-processing cables

Connect one emitter cable to the Sensor A 7-pin circular MS-style connector and the second emitter cable to the Sensor B 7-pin circular MS-style connector located on the bottom panel of the unit. (Figure S.4-2).

Triple Sensor Connections: Requires three emitter-to-processing cables

Connect one emitter cable to the Sensor A 7-pin circular MS-style connector the second emitter cable to the Sensor B 7-pin circular MS-style connector and the third emitter cable to the Sensor C 7-pin circular MS-style connector located on the bottom panel of the unit. (Figure D.4-8)
D.5 Receiver Horn Blinder Option

The Horn Blinder Option – HBLD Option is designed for SCAN-A-LINE™ 10X-Series Receivers {Figure D.5-1} and 10X-Series ULTRA-TOUGH™ Receivers {Figure D.5-2} in applications where ambient light may cause improper edge detection’s. In conditions where high intensity lamps, strobe lights, or other bright light conditions may hamper the sensor edge, hole detection or measurement, the HBLD Option will assist in restricting the receivers field of view. This means that ambient light will have a smaller chance to interfere with the proper operation of the sensor.

HBLD Option Overview

The HBLD Option is built of aluminum and is mounted directly to the bezel on the Model 10XRHD receiver for 10XHD-Series - sensor(s) and all sensors with the ULTRA-TOUGH™ option. Each receiver in a system will be supplied with a blinder when the HBLD Option is ordered (one per receiver).

Functional Description

The standard 10XRHD receiver for 10XHD-Series - sensor(s) have an approximate 30° field of view of the emitter {Figure D.5-3}. The horn blinder restricts that field of view, permitting the receiver to view only the emitter LED light. This will assist in eliminating any intense ambient or strobe light interference.

D.5.a Horn Blinder Specifications

The HBLD Option is typically supplied pre-installed on the Model 10XRHD or 10XRHD-UT receivers from the factory. The HBLD Option is 12.25 inches [311mm] wide by 9 inches [229mm] tall by 1.325 inches [34mm] thick. It is attached to the standard receiver with the bezel face plate mounting screws and to the bezel on ULTRA-TOUGH™ receivers. Units already in the field can be upgraded to use Horn Blinders, though it may require new mounting holes on the bezels of ULTRA-TOUGH™ receivers (see Section D.5.b).

Separation Settings

The SCAN-A-LINE™ emitter and receiver can typically be mounted with a separation anywhere from one times the emitter length up to 72 inches [1829mm] (extended separations are available under an Engineering Variance Order only). Depending upon the emitter-to-receiver separation, the HBLD Option has mounting holes for the blinder end bars to restrict the field of view. The settings {Figure D.5-4} on the blinder are:

A) One times emitter length emitter-to-receiver separation {minimum separation} (i.e. Model 10X-10 with emitter-to-receiver separation of 15 inches [381mm]);

B) Two times emitter length emitter-to-receiver separation {suggested separation}(i.e. 10X-10 with emitter-to-receiver separation of 20 inches [508mm]);

C) Over two times emitter length emitter-to-receiver separation up to 72 inches [1829mm] {maximum separation} (i.e. 10X-10 with emitter-to-receiver separation of 70 inches [1778mm] {optional separation}).

Finishes

The HBLD Option is typically supplied with all surfaces black anodized and the interior of the blinder painted in flat black (to reduce reflected glare). When supplied with an ULTRA-TOUGH™ sensor (UT Option), the horn blinder may be painted with nitro blue polane paint at the customers request.

Figure D.5-1: HBLD Option Installed on Model 10XRHD-Series Standard Duty Receiver

Figure D.5-2: HBLD Option Installed on Model 10XRHD-Series ULTRA-TOUGH Receiver

Figure D.5-3: Field of View with Model 10XHD-20E-B Standard Duty Sensor with Horn Blinder

Figure D.5-4: Separation Settings for HBLD Option
D.5.b Installation

Usually, the HBLD Option is supplied with the sensor when it is ordered. Sometimes though the HBLD Option must be ordered after the sensor has been installed. The following sections detail the installation of the HBLD Option on both the standard Model 10XR-Series receiver and the Model 10XR-UT-Series ULTRA-TOUGH™ receiver.

10XR-Series Receiver
The installation of 10XR-Series receivers can be performed with the receiver on-line. If your company policies allow and/or if the receiver is easily accessible. If either of these cases exist, remove the receiver from the line BEFORE performing the following procedure. Kit should contain the assembled horn blinder and four screws, flat washers and lock washers.

1. Remove any existing blinder from the receiver, if applicable.
2. Determine the separation of the emitter-to-receiver and set the end bars for that separation (Section D.5.a & Figure D.5-5) by loosening the ‘A’ screws and removing the ‘B’ screws. Rotate the end bars until ‘B’ holes line up and insert the ‘A’ screws. Tighten all screws securely.

3. Remove the four bezel retaining screws (Figure D.5-6). Be sure to hold the bezel in place when the screws are removed.
4. Exchange the four bezel retaining screws with the new screws, lockwashers and flat washers supplied with the horn blinder.
5. Align the Horn Blinder with the outer holes over the bezel retaining holes (Figure D.5-7).

6. Assembly the screws with lock washer first and the flat washer second (Figure D.5-8).
7. Insert the four mounting screws into the bezel and finger tighten (Figure D.5-8).
8. Visually inspect that the horn blinder is aligned properly (Figure D.5-9) and tighten the mounting screws securely (be careful not to over-tighten the screws, as they are stainless steel screws threading into cast aluminum).
If necessary, use the Model AA10X Alignment Adapter (Section AA) and an oscilloscope to check the view of the emitter and the receiver output. Review the sensor manual section to verify proper operation of the sensor with the horn blinder attached.

### 10XR-Series ULTRA-TOUGH™ Receiver

The installation for 10XR-Series ULTRA-TOUGH™ receivers can be performed with the receiver on-line if your company policies allow and/or if the receiver is easily accessible. If either of these cases exist, remove the receiver from the line BEFORE performing the following procedure. Kit should contain the assembled horn blinder and four screws, flat washers and lock washers.

1. Remove any existing blinder from the receiver, if applicable.
2. Determine the separation of the emitter-to-receiver and set the end bars for that separation (Section D.5.a & Figure D.5-5) by loosening the ‘A’ screws and removing the ‘B’ screws. Rotate the end bars until ‘B’ holes line up and insert the ‘A’ screws. Tighten all screws securely.
3. Align the Horn Blinder with the inner holes over the bezel retaining holes (Figure D.5-10).
4. Assemble the screws with a lock washer first and the flat washer second (Figure D.5-11 next page).
5. Insert the four mounting screws into the bezel and finger tighten (Figure D.5-11).
6. Visually inspect that the horn blinder is aligned properly (Figure D.5-12) and tighten the mounting screws securely (be careful not to over-tighten the screws, as they are stainless steel screws threading into aluminum).

If necessary, use the Model AA10X Alignment Adapter (Section AA) and an oscilloscope to check the view of the emitter and the receiver output. Review the sensor manual section to verify proper operation of the sensor with the horn blinder attached.

**NOTE:**

Older Model 10XR-UT receiver bezels may not have the mounting holes drilled and tapped on the bezel for the Horn Blinder mounting screws. These bezels must be machined to accept the Horn Blinder.
D.5.c Trouble Shooting

Trouble shooting the HBLD Option is relatively simple. First, verify that all screws of the unit are secure. The alignment of the receiver to the emitter is fairly critical because of the restricted field-of-view. Review the sensor section of this manual and the system configuration drawing that was provided with your system for information on the alignment of the receiver and the emitter.

![Figure D.5-12: Horn Blinder Properly Aligned on Model 10XRHD-UT (ULTRA-TOUGH™) Receiver](image)

D.6 General Maintenance

All SCAN-A-LINE™ sensors are highly reliable and tolerant to most industrial environments. Maintenance of the 10XHD-Series sensor after installation is extremely limited. Since there are no moving parts in the 10XHD-Series, there is nothing to lubricate. If any form of maintenance is performed on the line near the 10XHD-Series sensor, be sure to cover the sensors view windows to protect the glass from hot or falling objects.

NOTE:

If welding is to be performed anywhere on the process line where the 10XHD-Series sensor is installed, disconnect ALL cables from the 10XHD-Series sensor. This prevents a system overload from the current generated by the welding.

The only typical maintenance for the 10XHD-Series sensor is:

1. Check all cable connections. All connections should be snug.
2. Clean the viewing window. Even though the 10XHD-Series sensor can operate with an almost 90% attenuation of the light source, cleaning the window will insure constant and reliable detection’s.
3. Check all mounting fixtures. Tighten if necessary. In high vibration environments, mounting plates can vibrate loose, which may change the emitter-to-receiver alignment. If vibration is still causing problems, simple vibration dampening can solve most cases of vibration interference.

D.6.a Cable Building & Repair

In many applications, the cables that are supplied with SCAN-A-LINE™ sensor systems need to be modified for installation; or repaired because of incidental damage. Harris Instrument Corporation can supply custom cables for special situations and we suggest that you order the cables directly from Harris Instrument Corporation. Installation of customer-built cables that are improperly wired is one of the major causes of malfunction of SCAN-A-LINE™ systems (next to strip collisions). Improperly built cables can CAUSE SERIOUS DAMAGE to the SCAN-A-LINE™ system and the installation of customer-supplied cables MAY VOID THE WARRANTY of the SCAN-A-LINE™ equipment. For further information on customer-supplied and/or built cables, please contact Harris Instrument Corporation Sales or Service.

In many cases, the customers electrical maintenance personnel will be modifying the cables for routing through conduit or direct wiring of power. Please review the processing unit Section (Section S - HDPC) for more information on direct wiring of system power. The current section describes the proper procedures for building and/or repairing cables. Be aware that this section only covers the standard cables supplied with all SCAN-A-LINE™ sensors and processors. It does not necessarily pertain to cables supplied with Engineering Variance Orders (EVO’s). Contact Harris Instrument Corporation Engineering for further information on cabling instructions for EVO installations.
General Cable-Building Procedures

Please review this section BEFORE attempting to build a custom cable. These specifications, if followed fully and correctly, will help ensure that the cable is built to operate properly with 10XHD-Series sensors.

1. Remove two inches of outer insulation. Be careful not to cut inner insulation.

2. Pull outer insulation back about four inches.

3. Remove exposed foil shields. Twist together bare shield wires. Cut off shield wires at one inch length.

4. Add one four inch grey insulated wire to the twisted bare wires. Western Union splice and solder together.

5. Cover soldered, spliced wires with heat shrink insulation and use hot gun to shrink the insulation.

6. Tuck insulated wire bundle under outer insulation and pull outer insulation back over the exposed inner wires.

*Figure D.6-1: General Cable-Building Instructions*
Belden 8777 or equivalent cable is used for the receiver pigtail (section one) cable, the receiver extension (section two) cable and for the emitter-to-processing unit cable. Figure D.6-1 shows the proper procedure to prepare the Belden 8777 or equivalent cable for attachment to the circular connectors. Figure D.6-2 shows an exploded view of a 7-pin cable and it’s components.

**NOTE:**

ULTRA-TOUGH™ enclosures utilize watertight versions of the 6- and 7-pin cables listed below. Contact Harris Instrument Corporation for information on building watertight cables if necessary.
Receiver Cable

The MS-style circular connectors on the standard receiver cable are of two different types. On the end that attaches to the receiver, the shell is a 97-3101A-14S inline connector with 97-3057-6 strain relief, 97-79-513-6 rubber boot and a 97-14S-6S female insert. The standard connector that attaches to the 6-pin bulkhead on the emitter is a 97-3106A-14S shell, 97-3057-6 strain relief, 97-79-513-6 rubber boot and a 97-14S-06P male plug insert. Drawing number 3495104 Rev A shows the pinouts of the circular inline connectors for both ends of the receiver cable. The ULTRA-TOUGH™ (UT Option) option require a sealed circular connector MS3106E14S-6P on the end of the cable that attaches to the emitter 6-pin circular bulkhead. Drawing number 3495109 Rev A shows the pinouts of the sealed receiver cable.

Emitter-to-Processing Unit Cable

The standard enclosure emitter-to-processing unit cable also has two circular connectors. On the end that attaches to the emitter is a 97-3106A-16S shell, 97-3057-8 strain relief, 97-79-513-8 rubber boot and a 97-16S-1S female insert. The end that attaches to the processing unit is a 97-3106A-16S shell, 97-3057-8 strain relief, 97-79-513-8 rubber boot and a 97-16S-1P male plug insert. Drawing number 3486060 Rev A shows the pinouts of the circular connectors for both ends of the emitter-to-processing unit cable. The ULTRA-TOUGH™ (UT Option) option requires a sealed circular connector MS3106E16S-1S on the end of the cable that attaches to the emitter 7-pin circular bulkhead. The inline connector is the same as the standard enclosure emitter-to-processor cable. Drawing number 3495109 Rev A shows the pinouts of the sealed emitter-to-processing unit cable.

Typical Cable Building Tutorial

Review Figure D.6-1 and D.6-2 for information on building a typical SCAN-A-LINE™ cable. The following tutorial will assist, in association with these pictures, in assuring that the cable is properly built.

1. Determine the length of the cable to be cut. Use only Belden 8777 cable or equivalent. Cut the cable to the proper length.
2. Starting on one end, cut the outer (gray) insulation, being sure not to cut the internal wire insulation, approximately two inches from the end of the cable. Remove the cut insulation. Pull back the gray outer insulation approximately four inches [102mm].
3. Peel back the foil on the internal wire pairs and remove the foil down to the insulation cut point.
4. Separate the shields. Separate out the three pairs of wires (green & black, white & black, red & black) and twist each pair together (twist the green & black together, etc.).
5. Cut a four inch [102mm] 24-gauge wire in gray. Cut shields to approximately one inch [25mm] in length. Strip the ends of the four inch [102mm] gray wire approximately one inch [25mm]. Connect shields and the gray wire with a Western Union splice, solder and shrink wrap.
6. Tuck shrink wrapped shields back into cable bundle and push gray outer insulation back up to cover the shields.
7. Strip and tin all wire ends approximately one-half inch [13mm].
8. Check the wiring diagram for the cable being built (i.e., if receiver extension cable, check drawing #3495104 Rev A) for the wire connections, connector pinouts, circular shell type and circular connector insert type. Run the cable through the appropriate rubber boot, strain relief, and circular connector plug shell.
9. Verify the pinout locations on the back of the circular connector insert with the proper drawing. Run the wires through a small piece of heat shrink tubing (approximately 0.375 inch [9.5mm]) and solder the correct wires to their corresponding connector pinouts. Heat the heat shrink tubing.

Attach the circular insert to the plug shell with the split retaining ring. Assemble the circular plug and tighten all connections securely.
D.7 Trouble Shooting

The following procedures are designed to isolate problems that may occur in systems that are installed and have been operating properly. For installation problems, see the installation portion of this manual, or contact your SCAN-A-LINE™ representative or Harris Instrument Corporation for more information.

1) Begin with a thorough visual inspection of the system under test. Before testing for circuit malfunctions, ensure the power switch on the processing unit is on and that power is supplied to the system processing unit.
2) Verify that the emitter and receiver lenses are unbroken, reasonably clean and free of foreign material. Cracked lenses, excessive dirt and foreign material on the lens can cause the system to perform incorrect detection's.
3) Examine all cables for cuts, nicks or crimps that could cause open or short circuits. Ensure that all connectors are secure and free of foreign material.

Further trouble shooting of the sensors is only possible with the sensor connected to the processing unit (Model HDPC). All diagnostics for the sensor relies upon the diagnostic circuitry in the processing unit. See the Model HDPC Operators Manual for more information.

S.7 Related Drawings

The following pages contain various drawings for the Model HDPC. For drawings of other configurations, please contact Harris Instrument Corporation.

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<tr>
<th>Drawing #</th>
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<td>1203004 Pg. 1</td>
<td>10X-Series B-Style Emitter Dimensions</td>
<td>AutoCAD LT Rel. 3</td>
</tr>
<tr>
<td>1295004 Rev. B P. 1</td>
<td>10X-Series Emitter Dimensions</td>
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<td>1295007 Rev. A Pg. 1</td>
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</tr>
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<td>1495176 Rev. D Pg. 1</td>
<td>Hole Detection System - Single Sensor</td>
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<td>3486060 Rev. A</td>
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Table S.7-1: Drawing Information