APPLICATION NOTE

AN_0026

SensorNet, RS-422, and Manchester Protocols

Application Note

This document explains the use of SensorNet, RS-422, and Manchester proprietary protocols. It also illustrates how domes are connected to matrixes / controllers MP48PLUS, MPCPU, MPLT, ADACSNET, and ADTT16E Touch Tracker®.

Contents

I. SensorNet Protocol .................................................. 2
   SensorNet Protocol Key Points ............................... 2
   Advantages of SensorNet Protocol ..................... 3
II. RS-422 Protocol................................................. 4
   RS-422 Protocol Key Points ................................ 4
   RS-422 Protocol Specifications ....................... 5
III. Manchester Protocol ........................................... 6
   Manchester Protocol Key Points ....................... 6
   Manchester Protocol Specifications ............... 6
Appendix A: Typical SensorNet Connections .... 7
Appendix B: Typical RS-422 Connections .......... 26
Appendix C: Typical Manchester Connections ... 33
I. SensorNet Protocol

SensorNet is a two-wire serial data protocol that provides half-duplex, multi-drop, differential communications.

**Cable segment**: Includes all of the electrically connected wire between all of the multi-drop devices of a communications topology. It does not include the wire beyond the repeater devices.

**Communication Source**: The device that is managing the communications or polling other devices, also referred to as host or primary. On a cable segment that does not have a direct communications source it is the repeater that is repeating the data from the host or primary.

**Repeater**: Any device that will amplify the signal.

**Device**: Any unit that is attached to a network.

**SensorNet Protocol Key Points**

1. Only terminate a communications source or network device if it is at the end of a cable or "end-of-line." Each SensorNet device has a termination switch or jumper. Terminating the devices at the ends of the cable prevent the signals from reflecting back along a cable. Proper termination makes communications more reliable. J-Box and distribution panel outputs renew or amplify the signals, so they are considered communications sources. In daisy chain and backbone networks, they are considered end-of-line and should be terminated. In star networks, they are not considered end-of-line and should not be terminated. J-Box and distribution panel inputs are considered network devices. Terminate them only if they are end-of-line.

2. No more than four repeaters are allowed between any two devices connected with cable segments through repeaters. Devices include SensorNet Domes, Touch Trackers, ADMPCPU, SensorNet I/O units, SensorNet to RS-422 converters, SensorNet Distribution Panels, SensorNet links for American Dynamics MFLT / MP48 / VM96 / AD168 switches, SensorNet J-Boxes, and fiber optic transceivers that contain repeaters between their separate output ports.

   This 4-repeater restriction includes devices that are not on the same cable segment or leg of the network. Data packet collisions resulting in loss of data may occur between out-bound (from the communications source) and in-bound (to the communications source) communications.

3. Signal repeaters (J-Boxes, Distribution Panels) should only be used when cable distances exceed the maximum allowed or when noise is an issue. SensorNet devices can operate at signal levels from 0.3V to 5V, but 1V to 5V is recommended.

4. If shielded cable is used, signals may rapidly decline as more devices are connected or as the cable length increases. As a result, the maximum length is less for shielded cable, and signal integrity is reduced; therefore they are not recommended, and should only be used for short distances when unavoidable. Problems have been experienced. The shield should be connected at the communications source end only.

5. Attach network devices in stages. Check that their response is correct so you can correct the problem before continuing with the installation. Use ping tests to measure failure rate or operate the dome to verify proper operation.

6. No more than 32 devices per cable segment. With a daisy chain or backbone network, a cable segment starts at the first network device on the cable and ends at the last network device on the cable. The network device at the start or end of the cable may be a communications source. A star network supports up to four branches. All four branches are considered one cable segment for determining the cable length. However, the network device at the end of each of the four branches should be terminated to ensure reliable communication.
7. If a repeater must be used, place the repeater at the 66% distance point along the cable (measured from the source). This will ensure that there is a reliable signal at the input to the repeater.

8. SensorNet can be used with Star, Daisy Chain, or Backbone networks.


**Advantages of SensorNet Protocol**

1. The connections are not polarized and the two wires can be connected in any order.

2. Firmware can be uploaded to domes using a PC with a USB-to-SensorNet module (ADACSNET), an MP48 Plus system, or an ADTT16E controller.

3. A ping test can be used to determine the reliability of the network.

4. Remote manual dome reset command from console.

5. SensorNet outputs are transformer coupled to provide 2000V galvanic isolation, to prevent ground loops, and to prevent conducted discharge currents from flowing through the system.


7. SensorNet outputs are protected with PTC (Positive Temperature Coefficient) self-resetting fuses to guard against inadvertent wiring connection to up to 30Vac, class 2, LPS power.

**Defining Devices vs. Repeaters**

<table>
<thead>
<tr>
<th>Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>SpeedDome</td>
</tr>
<tr>
<td>SpeedDome Ultra</td>
</tr>
<tr>
<td>SpeedDome Optima</td>
</tr>
<tr>
<td>ADMPCPU</td>
</tr>
<tr>
<td>Touch Trackers (VM16, ADTT16E, &amp; VM32)</td>
</tr>
<tr>
<td>SensorNet to RS-422 code converter (RCSN422)</td>
</tr>
<tr>
<td>USB SensorNet module (ADACSNET)</td>
</tr>
<tr>
<td>MPLT matrix</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Repeaters</th>
</tr>
</thead>
<tbody>
<tr>
<td>SensorNet J-Boxes</td>
</tr>
<tr>
<td>Matrixes such as MP48PLUS, &amp; VM96</td>
</tr>
<tr>
<td>SensorNet Fiber Module</td>
</tr>
<tr>
<td>SensorNet / Manchester Distribution Panel (ADACSNETD)</td>
</tr>
</tbody>
</table>
## SensorNet Protocol Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address Range</td>
<td>1 to 254</td>
</tr>
<tr>
<td>Bit Rate</td>
<td>230.4 kbps</td>
</tr>
<tr>
<td>Network Distance</td>
<td>1 km per node</td>
</tr>
<tr>
<td>Maximum Loads</td>
<td>32 per node</td>
</tr>
<tr>
<td>Node Repeaters</td>
<td>SensorNet J-boxes, distribution panels</td>
</tr>
<tr>
<td>Topologies</td>
<td>Daisy chain, backbone, or star</td>
</tr>
<tr>
<td>Transmission Medium</td>
<td>Single Non-polarized unshielded twisted pair UTP 0.326mm² (22AWG)</td>
</tr>
<tr>
<td>Terminating Resistor</td>
<td>120Ω, switch selectable</td>
</tr>
<tr>
<td>Physical Layer</td>
<td>RS-485, transformer-isolated, 2-wire</td>
</tr>
<tr>
<td>Data Encoding</td>
<td>FM-0</td>
</tr>
<tr>
<td>Link Layer Framing</td>
<td>SDLC/HDLC</td>
</tr>
<tr>
<td>Link Layer Channel</td>
<td>Bi-directional, half duplex</td>
</tr>
<tr>
<td>Collision Avoidance</td>
<td>Polling by primary Touch Tracker ®</td>
</tr>
<tr>
<td>Application Protocol</td>
<td>Proprietary</td>
</tr>
<tr>
<td>Network Nodes</td>
<td>Domes, Junction Boxes, Secondary Touch Tracker, and SensorNet I/O Unit</td>
</tr>
</tbody>
</table>

## II. RS-422 Protocol

**Duplex RS-422** uses four wires to provide duplex, multi-drop, differential communications.

**Advantages:** No termination required, allows more repeaters per line.

**Disadvantages:** Slower speed, 4-wire polarized, less noise immunity.

**Simplex RS-422** uses two wires to provide simplex, multi-drop, differential communications.

**Advantages:** Two wires, no termination required, allows more repeaters per line.

**Disadvantages:** Slow speed, one-way communications, polarized wiring, less noise immunity.

**Network Topologies:** Daisy Chain, Backbone.

## RS-422 Protocol Key Points

1. RS-422 does not require terminations.
2. If a repeater must be used, place the repeater mid-way along the cable. This will ensure that there is a reliable signal at the input to the repeater.
3. More than four repeaters are allowed between any two devices on the network. Devices include Domes, RS-422 converters (RCSN422), RS-422 Distribution Panels, RS-422 links for American Dynamics MPCPU / MP48 / VM96 / AD168 switches, and RS-422 J-Boxes.
4. Signal repeaters (J-Boxes, Distribution Panels) should only be cascaded when cable distances exceed the maximum allowed or when noise is an issue.
5. Ground the shield wire at the source device only. This will prevent ground loops.
6. Attach network devices in stages. Check that their response is correct so you can correct the problem before continuing with the installation.

7. No more than 10 devices per cable segment. With a daisy chain or backbone network, a cable segment starts at the first network device on the cable and ends at the last network device on the cable. The network device at the start or end of the cable may be a communications source.

8. RS-422 can be used with Daisy Chain or Backbone networks only.

9. RS-422 connections are polarized. Care must be taken to connect the correct wires to the appropriate device terminals.

RS-422 Protocol Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Duplex RS-422</th>
<th>Simplex RS-422</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable Type</td>
<td>2 Twisted-Pair Shielded Belden 8102 / 88102 (0.205mm² (24AWG) PVC / FEP 2 pair) or equivalent</td>
<td>1 Twisted-Pair Shielded Belden 8102 / 88102 (0.205mm² (24AWG) PVC / FEP 2 pair), Belden 8760 / 88760 (0.823mm² (18AWG) PVC/FEP 1 pair) or equivalent</td>
</tr>
<tr>
<td>Wire Gauge</td>
<td>0.326 mm² (22AWG)</td>
<td>0.326 mm² (22AWG)</td>
</tr>
<tr>
<td>Max. Length</td>
<td>1000m (3300ft)</td>
<td>1000m (3300ft)</td>
</tr>
<tr>
<td>Connection</td>
<td>Polarized</td>
<td>Polarized</td>
</tr>
<tr>
<td>Termination</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Data Rate</td>
<td>4.8 kbits/second</td>
<td>4.8 kbits/second</td>
</tr>
<tr>
<td>Max. Devices</td>
<td>10 per line</td>
<td>10 per line</td>
</tr>
<tr>
<td>Max. Address</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>Network Topologies</td>
<td>Daisy Chain, Backbone</td>
<td>Daisy Chain, Backbone</td>
</tr>
</tbody>
</table>
III. Manchester Protocol

Manchester uses two wires to provide simplex, multi-drop, differential communications.

Advantages: Moderate speed, high noise/surge/static immunity.

Disadvantages: Polarized wiring, not high speed, drives three devices. Proper termination required for reliable communications.

Network Topologies: Daisy Chain, Backbone.

Manchester Protocol Key Points

1. Only terminate a communications source or network device if it is at the end of a cable or “end-of-line”. Each device has a termination switch or jumper. Terminating the devices at the ends of the cable prevent the signals from reflecting back along a cable. Proper termination makes communications more reliable. Distribution panel outputs renew or amplify the signals, so they are considered communications sources. In daisy chain and backbone networks, they are considered end-of-line and should be terminated. Distribution panel inputs are considered to be network devices. Terminate them only if they are the end-of-line.

2. If a repeater must be used, place the repeater mid-way along the cable. This will ensure that there is a reliable signal at the input to the repeater.

3. No more than three repeaters are allowed between any two devices on the network. Devices include Domes, code converters, Manchester Distribution Panels, and Manchester links for American Dynamics MPCPU / MP48 / AD168 / AD2150 switches.

4. Signal repeaters (Distribution Panels) should only be cascaded when cable distances exceed the maximum allowed or when noise is an issue.

5. Ground the shield wire at the source device only. This will prevent ground loops.

6. Attach network devices in stages. Check that their response is correct so you can correct the problem before continuing with the installation.

7. No more than 3 devices per cable segment. In a daisy chain or backbone network, a cable segment starts at the first network device on the cable and ends at the last network device on the cable. The network device at the start or end of the cable may be a communications source.

8. Manchester can be used with Daisy Chain or Backbone networks only.

9. Manchester connections are polarized. Care must be taken to connect the correct wires to the appropriate device terminals.

Manchester Protocol Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable Type</td>
<td>1 Twisted Pair Shielded (Belden 8760 / 88760 or equivalent)</td>
</tr>
<tr>
<td>Wire Gauge</td>
<td>0.823 mm² (18AWG)</td>
</tr>
<tr>
<td>Max. Length</td>
<td>1500m (5000ft)</td>
</tr>
<tr>
<td>Connection</td>
<td>Polarized</td>
</tr>
<tr>
<td>Termination</td>
<td>Yes</td>
</tr>
<tr>
<td>Data Rate</td>
<td>31 kbits/second</td>
</tr>
<tr>
<td>Max. Devices</td>
<td>3 per line</td>
</tr>
<tr>
<td>Max. Address</td>
<td>64</td>
</tr>
<tr>
<td>Network Topologies</td>
<td>Daisy Chain, Backbone</td>
</tr>
</tbody>
</table>
Appendix A: Typical SensorNet Connections

Figure 1. ADTT16E Star (Diagram 01) ................................................................. 8
Figure 2. ADTT16E Backbone / Daisy Chain (Diagram 02) ................................. 9
Figure 3. ADTT16E to RJ6SN to Domes (Diagram 03) ...................................... 10
Figure 4. ADTT16E to ADACSNETD to Domes (Diagram 04) ....................... 11
Figure 5. ADMP48PLUS to Domes (Diagram 05) ................................................ 12
Figure 6. ADMP48PLUS to RJ6SN to Domes (Diagram 06) .......................... 13
Figure 7. ADMP48PLUS to ADACSNETD to Domes (Diagram 07) ............... 14
Figure 8. ADMPLT to Domes (Diagram 08) .......................................................... 15
Figure 9. ADMPLT to RJ6SN to Domes (Diagram 09) ....................................... 16
Figure 10. ADMPLT to ADACSNETD to Domes (Diagram 10) .................... 17
Figure 11. Intellex to ADACSNET to Domes (Diagram 11) ............................. 18
Figure 12. Intellex to ADACSNET to RJ6SN to Domes (Diagram 12) .......... 19
Figure 13. Intellex to ADACSNET to ADACSNETD to Domes (Diagram 13) 20
Figure 14. ADMPCPU to Domes (Diagram 14) .................................................... 21
Figure 15. ADMPCPU to RJ6SN to Domes (Diagram 15) ................................... 22
Figure 16. ADMPCPU to ADACSNETD to Domes (Diagram 16) .................. 23
Figure 17. Redundant ADMPCPUs to RJ6SN to Domes (Diagram 17) ......... 24
Figure 18. Redundant ADMPCPUs to ADACSNETD to Domes (Diagram 18) ... 25
ADTT16E Using a Star Topology

NOTE: The External Interface Module (EIM) is a passive circuit board required for interface to and considered part of the Touch Tracker.

• This is a star topology with 5 devices (key point #8).
• It has 4 branches with less than 32 devices total (key point #6).
• Devices #1, #2, #3, and #4 are terminated because they are at the end of the line (key point #1).
• No Sensornet repeater is used (key point #2).
• Total Sensornet cable distance is 345 meters (~1150 feet) (key point #6).

LEGEND

T Terminated
U Unterminated
Figure 2. ADTT16E Backbone / Daisy Chain (Diagram 02)

ADTT16E Using Backbone / Daisy Chain Topology

SENSORNET PROTOCOL KEY POINTS
- This is a backbone / daisy chain topology with 6 devices on one cable segment (key point #8).
- The cable segment starts with device #1, ends with device #6, and has less than 32 devices (key point #6).
- Devices #1 and the External Interface Module (EIM) are terminated (key point #1).
- No Sensornet repeater is used (key point #2).
- The Sensornet network cable length is 360 meters (~1200 feet).

NOTE: The External Interface Module (EIM) is a passive circuit board required for interface to and considered part of the Touch Tracker.

LEGEND
- Terminated
- Unterminated

T U

Backbone (Uncut)

Cable segment

Sensornet cable

150 meters (~500 feet)

Daisy Chain (Cut)

75 meters (~250 feet)
60 meters (~200 feet)
45 meters (~150 feet)
30 meters (~100 feet)

#1 #2 #3 #4 #5 #6

ADTT16E Touch Tracker

EIM
**SENSORET PROTOCOL KEY POINTS**

- Dome #1-2 and #3-5 cable segments are using the daisy-chain topology (key point #8).
- Domes #1-7 are properly terminated (key point #1).
- Dome #1-2, #3-5, #6, and #7 cable segments have less than 32 devices each (key point #6).
- There are 2 repeaters maximum in the path between any two devices. From device #6 to #7, the signal passes through only 1 repeater. From device #1 to #6, the signal passes through 2 repeaters (key point #2).
- Repeaters (RJ6SN) are used in this Sensornet configuration and each cable segment is less than 1km (~3300 feet).

**NOTE:** The External Interface Module (EIM) is a passive circuit board required for interface to and considered part of the Touch Tracker.

**LEGEND**

- **T** Terminated
- **U** Unterminated

---

**Figure 3. ADTT16E to RJ6SN to Domes (Diagram 03)**

ADTT16E to RJ6SN to Domes

Cable segments

- 60 meters (~200 feet)
- 80 meters (~300 feet)
- 90 meters (~300 feet)
- 120 meters (~400 feet)
- 150 meters (~500 feet)
- 150 meters (~500 feet)

**REPEATER**

- P4, P1, P5, P6, P3

**J-BOX**

- P4, P5, P6, P3

**HOST**

- JW3

**AUX**

- JW4

**DIAGRAM #3**

**NOTE:** The External Interface Module (EIM) is a passive circuit board required for interface to and considered part of the Touch Tracker.
Figure 4. ADTT16E to ADACSNETD to Domes (Diagram 04)

ADTT16E to ADACSNETD to Domes

NOTE: The External Interface Module (EIM) is a passive circuit board required for interface to and considered part of the Touch Tracker.

REPEATER

SENSORNET PROTOCOL
KEY POINTS

- Domes #1 and #2 are properly terminated (key point #1).
- Domes #1 and #2 are on separate cable segments with less than 32 devices each (key point #6).
- Between any two devices, such as device #1 and #4 or #1 and #2, the signal passes through only 1 repeater ADACSNETD (key point #2).
- A repeater is used in this Sensornet configuration and each cable segment is less than 1km (~3300 feet).

LEGEND

T Terminated
U Unterminated

Cable segments

75 meters (~250 feet)
90 meters (~300 feet)

#1
#2

#3

HOST A

ADTT16E

Touch Tracker

EIM

ADACSNETD

#4
Figure 5. ADMP48PLUS to Domes (Diagram 05)

AD MegaPower 48 PLUS to Domes

75 meters (~250 feet)  60 meters (~200 feet)  45 meters (~150 feet)  30 meters (~100 feet)

T #1
U #2
U #3
U #4
U #5

Sensornet cable
150 meters (~500 feet)

Daisy Chain (Cut)
Backbone (Uncut)

SENsOrNET PROTOCOL
KEY POINTS

• This is a backbone / daisy chain topology with 6 devices on one cable segment (key point #8).
• The cable segment starts with device #1, ends with device #6, and has less than 32 devices (key point #6).
• Devices #1 and #6 are terminated (key point #1).
• The Sensornet network cable length is 360 meter (~1200 feet).

NOTE: Although the MP48 PLUS has a REPEATER capability, this configuration does not utilize it.

LEGEND

T Terminated
U Unterminated
Figure 6. ADMP48PLUS to RJ6SN to Domes (Diagram 06)

**SENSORNET PROTOCOL KEY POINTS**

- Dome #1 and #3-5 cable segments are using the daisy-chain topology (key point #8). Dome #6, #7, and #8 cable segments have less than 32 devices each (key point #6).
- There are 3 repeaters (key points #2, #6, and #9) in each cable segment. Only 1 repeater is used in the path between any two devices (key point #10). Repeaters are used in this Sensornet configuration and each cable segment is less than 1 km (~3300 feet).
- Repeaters are used in this Sensornet configuration and each cable segment is less than 1 km (~3300 feet).

**LEGEND**

- **T**: Terminated
- **U**: Unterminated

**REPEATER**

- 60 meters (~200 feet)
- 90 meters (~300 feet)
- 75 meters (~250 feet)
- 60 meters (~200 feet)
- Balance connection ports with domes (don't limit loading to one side)
- Terminate the dome or host when it is NOT at the end of the line P4-P6, P1-P3, or P8
- Unterminate the dome or host when it is at the end of the line P4-P6, P1-P3, or P8

**DIAGRAM #6**

- **AD MegaPower 48 PLUS to RJ6SN to Domes**
- **RJ6SN J-BOX**
- **HOST AUX**
- **P2**
- **P1**
- **P3**
- **P4**
- **P5**
- **P6**
- **DOME 456**
- **DOME 123**
- **DOME 567**
- **DOME 123**
- **DOME 456**
- **HOST AUX**
- **P8**
- **AD MegaPower 48 PLUS**
- **REPEATER**
- **LEGEND**
- **#8**
- **#9**
- **#10**
Figure 7. ADMP48PLUS to ADACSNETD to Domes (Diagram 07)

AD MegaPower 48 PLUS to ADACSNETD to Domes

Cable segments

75 meters (~250 feet)

90 meters (~300 feet)

AD Megapower 48 PLUS

Domes #1 and #2 are properly terminated (key point #1). Domes #1 and #2 are on separate cable segments with less than 32 devices each (key point #6). Between any two devices, such as device #1 and #4 or #1 and #2, the signal passes thru only one repeater ADACSNETD (key point #2). Repeaters are used in this Sensornet configuration and each cable segment is less than 1 km (~3300 feet).

NOTE: Although the MP48 PLUS has a REPEATER capability, this configuration does not utilize it.

HOST A

REPEATER

NOTE: Although the MP48 PLUS has a REPEATER capability, this configuration does not utilize it.

DIAGRAM #7

SENSEORNET PROTOCOL KEY POINTS

Domes #1 and #2 are properly terminated (key point #1).

Domes #1 and #2 are on separate cable segments with less than 32 devices each (key point #6).

Between any two devices, such as device #1 and #4 or #1 and #2, the signal passes thru only one repeater ADACSNETD (key point #2).

Repeaters are used in this Sensornet configuration and each cable segment is less than 1 km (~3300 feet).

NOTE: Although the MP48 PLUS has a REPEATER capability, this configuration does not utilize it.

HOST A

REPEATER

NOTE: Although the MP48 PLUS has a REPEATER capability, this configuration does not utilize it.

LEGEND

T Terminated

U Unterminated
Figure 8. ADMPLT to Domes (Diagram 08)

**Legend**

- **T**: Terminated
- **U**: Unterminated

**Sensornet Protocol Key Points**

- Dome #1-2 and #17-21 cable segments are using the daisy-chain topology (key point #8).
- Domes #1, #2, and #17-21 are properly terminated (key point #1).
- Domes #1, #2, and #17-21 cable segments have less than 32 devices each (key point #6).
- No repeaters are used in this Sensornet configuration and each cable segment is less than 1 km (~3300 feet).

**NOTE:** Each Sensornet port on the MPLT has its own driver which means port A does not talk to port B or vice versa.
Figure 9. ADMPLT to RJ6SN to Domes (Diagram 09)
Figure 10. ADMPLT to ADACSNETD to Domes (Diagram 10)

**SENSeNET PROTOCOL KEY POINTS**

- Domes #17, #18, and #19 are properly terminated (key point #1).
- Between any two devices, such as device #1 and #2 or #1 or #17 and #19, the signal passes through only 1 repeater (key point #2).
- All Sensornet configuration and each cable segment is less than 1km (~3300 feet).

**LEGEND**

- T: Terminated
- U: Unterminated

**Note:** Each Sensornet port on the MPLT has its own driver which means port A does not talk to port B or vice versa.
Figure 11. Intellex to ADACSNET to Domes (Diagram 11)

**Intellex to ADACSNET to Domes**

- **75 meters (~250 ft.)**
- **60 meters (~200 ft.)**
- **45 meters (~150 ft.)**
- **30 meters (~100 ft.)**

---

**INTELLEX REAR VIEW**

- **USB PORT**
- **LEGEND**
  - **T**: Terminated
  - **U**: Unterminated

---

**DIAGRAM #11**

**SENSORNET PROTOCOL KEY POINTS**

- This is a backbone / daisy chain topology with 6 devices on one cable segment (key point #8).
- The cable segment starts with device #1 and ends with #6 and has less than 32 devices on it (key point #6).
- Devices #1 and ADACSNET are terminated (key point #1).
- No Sensornet repeater is used (key point #2).
- The Sensornet network cable length is 360 meters (~1200 feet).
The repeater function is not used when the cable distance from the ADACSNET to the last J-BOX is less than 1 kilometer (~3300 feet).

- Dome #1-2 and #3-5 cable segments are using the daisy-chain topology (key point #8).
- Domes #1-7 are properly terminated (key point #1).
- Dome #1-2, #3-5, #6, and #7 cable segments have less than 32 devices each (key point #6).
- There are 2 repeaters maximum in the path between any two devices. From device #10 to #1, the signal passes through only 1 repeater. From device #1 to #6, the signal passes through 2 repeaters (key point #2).
- Repeaters are used in this Sensornet configuration and each cable segment is less than 1km (~3300 feet).

**SENSORNET PROTOCOL KEY POINTS**

**INTELLEX REAR VIEW**

**DIAGRAM #12**

**REPEATER**

**ADACSNET**

**LEGEND**

- **T** Terminated
- **U** Unterminated

**Legend Diagram**

- **T** Terminated
- **U** Unterminated

**Balance connection ports with domes (don’t limit loading to one side).**
Figure 13. Intellex to ADACSNET to ADACSNETD to Domes (Diagram 13)

**Diagram #13**

**Intellex to ADACSNET to ADACSNETD to Domes**

- **Domes #1 and #2 are properly terminated (key point #1).**
- **Domes #1 and #2 are on separate cable segments with less than 32 devices each (key point #6).**
- **Between any two devices, such as device #1 and #4 or #1 and #2, the signal passes through only 1 repeater ADACSNETD (key point #2).**
- **A repeater is used in this Sensornet configuration and each cable segment is less than 1km (~3300 feet).**

**SENSORNET PROTOCOL KEY POINTS**

**Diagram #13**

**Legend**

- **T** Terminated
- **U** Unterminated
Figure 14. ADMPCPU to Domes (Diagram 14)

**ADMPower CPU to Domes**

- 75 meters (~250 feet)
- 60 meters (~200 feet)
- 45 meters (~150 feet)
- 30 meters (~100 feet)

**SENSORNET PROTOCOL KEY POINTS**

- This is a backbone / daisy chain topology with 6 devices on one cable segment (key point #8).
- The cable segment starts with device #1, ends with the ADMPCPU, and has less than 32 devices (key point #6).
- Device #1 and the ADMPCPU are terminated (key point #1).
- No Sensornet repeater is used (key point #2).
- The Sensornet network cable length is 360 meters (~1200 feet).

**Default Configuration:**
- Sensornet port 2 (dome addresses 255-508)
- Sensornet port 1 (dome addresses 001-254)

**LEGEND**
- T Terminated
- U Unterminated

**DIAGRAM #14**
- Daisy Chain (Cut)
- Backbone (Uncut)
- Cable segment

**Sensornet port**
- Port 2: Dome addresses 255-508
- Port 1: Dome addresses 001-254

**AD MegaPower CPU**

150 meters (~500 feet)

- Sensornet cable

- Terminated
- Unterminated
Figure 15. ADMPCPU to RJ6SN to Domes (Diagram 15)

ADMPCPU to RJ6SN to Domes

Default Configuration:
Sensornet port 2
(dome addresses 255-508)
Sensornet port 1
(dome addresses 001-254)

LEGEND
T Terminated
U Unterminated

AD MegaPower CPU
Figure 16. ADMPCPU to ADACSNETD to Domes (Diagram 16)

ADMPCPU to ADACSNETD to Domes

Default Configuration:
Sensornet port 2 (dome addresses 255-508)
Sensornet port 1 (dome addresses 001-254)

LEGEND

T Terminated
U Unterminated

DIAGRAM #16
Figure 17. Redundant ADMPCPUs to RJ6SN to Domes (Diagram 17)
Figure 18. Redundant ADMPCPs to ADACSNETD to Domes (Diagram 18)

Redundant ADMPCPs to ADACSNETD to Domes

DIAGRAM #18

Sensornet port 1 (dome addresses 001-254)

Sensornet port 2 (dome addresses 255-508)

Default Configuration:

- Sensornet port 1 (dome addresses 001-254)
- Sensornet port 2 (dome addresses 255-508)

50 meters (~160 feet)

50 meters (~160 feet)

200 meters (~650 feet)

75 meters (~250 feet)

60 meters (~200 feet)

200 meters (~650 feet)

TERMINATED

UNTERTMINATED

REPEATER

HOST A

HOST B

LEGEND

Terminated

Unterminated

Default Configuration:

- Sensornet port 1 (dome addresses 001-254)
- Sensornet port 2 (dome addresses 255-508)

50 meters (~160 feet)

50 meters (~160 feet)

200 meters (~650 feet)

75 meters (~250 feet)

60 meters (~200 feet)
Appendix B: Typical RS-422 Connections

Figure 19. Intellex to ADAC485CV232 (Diagram 22) .................................27
Figure 20. ADMPLT to RCSN422 to Domes (Diagram 23) ........................28
Figure 21. ADMPLT to RCSN422 to RJ860 to Domes (Diagram 24) ..........29
Figure 22. ADMP48PLUS RS-422 to Domes (Diagram 25) ......................30
Figure 23. ADMP48PLUS RS-422 to RJ-860 to Domes (Diagram 26) .......31
Figure 24. ADMPCPU to AD2083-02C RS-422 to Domes (Diagram 27) ....32
INTELLEX Dome Control Via RS-232 to RS-422 Converter (ADAC485CV232)

Figure 19. Intellux to ADAC485CV232 (Diagram 22)
Figure 20. ADMPLT to RCSN422 to Domes (Diagram 23)

ADMLT to RCSN422 Via RS-422 to Domes

NOTES(1):
- There are 2 separate Sensornet ports on the ADMPLT -- Port A & Port B.
- The matrix embedded configuration menu determines which camera address is routed to which Sensornet port.
- By default, ALL of the cameras are set to AD Up-the-Cable (UTC) protocol and must be reconfigured for Sensornet Port A or Port B routing.
- If conversion of both ports to RS-422 is necessary, a second RCSN422 module is required.

NOTE(2): If there are MINIDOMEs on the RS-422 network, set the device address to 16. For SPEEDDOME or later models, set the device address to 32.

Legend:
- T: Terminated
- U: Unterminated
Figure 21. ADMPLT to RCSN422 to RJ860 to Domes (Diagram 24)

The matrix embedded configuration menu determines which camera address is routed to which SensorNet port.

By default, ALL of the cameras are set to AD Up-the-Cable (UTC) protocol and must be reconfigured for SensorNet Port A or Port B routing.

If conversion of both ports to RS-422 is necessary, a second RCSN422 module is required.

LEGEND

T Terminated

U Unterminated

NOTE(2): If there are MINIDOMEs on the RS-422 network, set the device address to 16. For SPEEDDOMe or later models, set the device address to 32.

NOTE(1):

- There are 2 separate SensorNet ports on the ADMPLT – Port A & Port B.
- The matrix embedded configuration menu determines which camera address is routed to which SensorNet port.
- By default, all of the cameras are set to AD Up-the-Cable (UTC) protocol and must be reconfigured for SensorNet Port A or Port B routing.
- If conversion of both ports to RS-422 is necessary, a second RCSN422 module is required.
Figure 22. ADMP48PLUS RS-422 to Domes (Diagram 25)

ADMP48PLUS RS-422 to Domes

Ultra I/O Board

AD MegaPower 48 PLUS

RS-422
Figure 23. ADMP48PLUS RS-422 to RJ-860 to Domes (Diagram 26)

ADMP48PLUS RS-422 to RJ-860 to Domes

DIAGRAM #26

Ultra I/O Board
P1

Dome P1 RJ-860 Cinch Jones
Pin 1 Rx+ Pin 1 Tx+
Pin 2 Rx- Pin 2 Tx-
Pin 3 Tx+ Pin 8 Rx+
Pin 4 Tx- Pin 7 Rx-

Cinch Jones

10 Pos. J-Box
(RJ 860 AP)

MP48PLUS RJ-860 Host
Rx+ Pin 6 Tx+
Rx- Pin 5 Tx-
Tx+ Pin 12 Rx+
Tx- Pin 11 Rx-

AD MegaPower 48 PLUS

RJ-860 Cinch Jones

Rx+

RJ-860 Host

Rx-

Tx+

Rx-
Figure 24. ADMPCPU to AD2083-02C RS-422 to Domes (Diagram 27)

ADMPCPU to AD2083-02C RS-422 to Domes

Daisy Chain (Cut)  
Backbone (Uncut)

300 meters (~1000 feet)

Ultra I/O Board P1

Ultra I/O Board P1

Ultra I/O Board P1

AD2083-02C

Control Ops

Terminated with 75 ohms

AD MegaPower CPU

Terminated with 75 ohms

RS-422

RS-422
Appendix C: Typical Manchester Connections

Figure 25. ADMP48PLUS Manchester to Domes (Diagram 19)............................. 34
Figure 26. ADMP48PLUS Manchester to ADACSNETD to Domes (Diagram 20) .... 35
Figure 27. ADMPCPU to AD0291 Manchester to Domes (Diagram 21) ................. 36
Figure 25. ADMP48PLUS Manchester to Domes (Diagram 19)

ADMP48PLUS Manchester to Domes

MANCHESTER PROTOCOL
KEY POINTS

- This is a backbone / daisy chain topology with 3 devices on one cable segment (key points #7 and #8).
- Device #1 is terminated because it is at the end of the line (key point #1).
- Devices #1, #2, #3, and #4 are connected maintaining proper signal polarity (key point #9).
- No Manchester repeater is used (key point #4).
- Total Manchester cable distance is 170 meters (~600 feet).

Note: When using the Manchester protocol, the maximum number of domes that may be daisy chained is 3. If more than 3 domes are required, the ADACSNETD (Manchester distribution panel) is needed.

LEGEND

T Terminated
U Unterminated
Figure 26. ADMP48PLUS Manchester to ADACSNETD to Domes (Diagram 20)

AD MegaPower 48 PLUS Manchester to ADACSNET to Domes

DIAGRAM #20

REPEATER

AD MegaPower 48 PLUS

LEGEND

T Terminated

U Unterminated

Ultra I/O Board

P1

90 meters (~300 feet)

75 meters (~250 feet)

ADACSNETD

90 meters (~300 feet)
Figure 27. ADMPCPU to AD0291 Manchester to Domes (Diagram 21)

ADMP CPU to AD2091 Manchester to Domes

Terminated with 75 ohms