Protocol Decoding

22 February 2008

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1 Introduction

There are many "strangnesses" in various companies' CCTV protocols. In this note I will try to list some of the ones that I have encountered and I will also provide a check list of things that should be considered when examining different camera protocols. As I get time, I'll do a write up on some of the details of each of the protocols that I have worked with. Until then this will have to serve as an introduction, i.e. a "short list", into some of the problems that have to be over come.

2 Available Documentation

The first thing to check on is "Is there any available documentation?". In this quest be very inclusive as what is ment by documentation. I.e. when starting anything is useful. After something is known about the competitor's system, then narrow your search/interest to getting information about:

1. Their Matrix(s).

2. Their Camera(s).

3. Their Keyboard(s).

4. Other ways to control a Camera. I.e. PCs.

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[1]$Header: d:/TXBs/Keepers/RCS/LookFor.tex,v 1.5 2008-02-21 11:42:25-08 Hamilton Exp Hamilton $

2.1   Evaluating Documentation

When starting to determine a competitor's CCTV control protocol, get and read everything that pertains to the protocol which controls cameras. In addition, get every thing avaliable about the competitor's equipment. This will help generate a framework where the protocol data will be "living". Evaluate each item as follows:

1. Is it written in English? If not we can get it translated if it "looks good". Much may be learned from reading tables and random numeric strings. (Just what do you suppose "19200" refers to? Etc.) Many times the commands, and other information, will be in a table and this way an idea of the number of commands may be estimated as well as the approximate format of the commands.

2. Is it written in good English? If so, it probably was produced professionally. Sometimes this is good, sometimes not. The problem here is, if it is a professionally written and produced document, then it was probably carefully editied to make sure that not everything needed to actually work correctly with their dome is there. Also if it is professionally written, then there is probably a long lead time in what it says *vs.* what has happened since then. I.e. many professionally written documents are out of date when they finally make it through the final internal review cycle.

   However if it is non-professional, then it has a chance of being up to date, but now things that are important may be left out "because every one knows that", and sometimes the author was highly focused on one small area of the protocol. Also some non-professionals have a strange command of the English language.

3. Can we get a "legal" copy? Pelco does not "steal" proprietary data from competitors. However if the information is available on the manfacture's web site and we download it, then that is not stealing it. FAXed copies of old documents are suspicions.

4. Can we get a "legal" copy in electronic format. Often it is very convinent to be able to make high quality copies of documents. Each copy of an electronic version has about the same quality level as did the original. Working with the only copy of an old heavily marked up copy of a protocol is not much fun. (But sometimes it is has to be done!)

5. Is the electronic format something that we can read? Many older documents were prepared in formats that are difficult to read today. PDF format is the most convinent format that is currently available.

6. Does the document indicate anything about timing? Some systems require that commands be resent quite often, Burle requires 50 ms or less between commands. This type of information may be difficult to acertain if one is not looking for it.

7. How thick is the document? Thicker documents tend to have more information inside them. However some still have nothing useful in them.

8. When reading the document, does it make any sense?

2.2   Comments about currently available documentation

Pelco has been making translators for several competitor's CCTV systems for several years. Only one of the systems had resonably good protocol documentation. The others had problems that ranged from errors to omissions. These problems made useing the documentatin of only marginal help.

AD/Sensormatic This company has at least three different protocols that are used to control their domes. The only document available describes parts of their RS-422 protocol and totally skipps over the two other protocols.

Burle This is one of the best protocol documents that I have seen. It does not describe Manchester Code, however when decoding commands encoded in Manchester Code, it has proved to be "error free" and very useful.

Hernis Nothing is available. This company has the least information that I have ever seen available to examine.

Kalatel Little protocol information is available. In some documents there is a hint of some commands. Evaluation is proceeding with this documentation. There is a resonable amount of documentation about the domes, etc., that is avaiable.

Pansonic There are two, probably applicable, documents available from Panasonic that relate to their domes. On examining a "breakout" dump of communications between a keyboard and dome, there are indications that there are many omissions in the documents. The documents are available in electronic format and by examineing them carefully I have found many inconsistancies and some errors.

Pelco Pelco has many different protocols. There are two documents for D Protocol.

The internal D Protocol document is resonably up to date and has a small number of errors. The external version is resonably up to date and has many intentional omissions.

The older P Protocol document, leaves much out. The newer one, at 500+ pages in length, includes more, but still has missed much of importance.

Tigris Unknown. The translator seems to work well.

Vicon There are several protocol documents available. I didn't do the TXB-V translator and have not evaluated the documents.

Videor Technical There has not yet been a request to do a translator for this protocol. However we have a source listing of a translator for it that was written by the Roads and Traffic Authority (RTA) in Australia. The legality of using the RTA source code, even though it was given to us by those working for RTA, is unknown. I assume that, non-classified, government documents of anything are always legal to use. Australian rules may be different. (Their football rules sure are different!)

3 Physical Characteristics

1. What is the physical transmission media?

    1.1 Wire? If so what type?

        1.1.1. _____Coax, if so what impedance?

            1.1.1.1. _____50 Ω

            1.1.1.2. _____75 Ω: Panasonic's Gateway Protocol, Pelco's Coaxitron Protocol

            1.1.1.3. _____93 Ω

            1.1.1.4. _____Other Ω _____

        1.1.2. _____Coax, if so one or two way?

            1.1.2.1. _____One Way: Pelco's Coaxitron Protocol

            1.1.2.2. _____Two Way: Panasonic's Gateway Protocol

        1.1.3. _____Coax, if so does the protocol coexist with VSync?

            1.1.3.1. _____Yes, if so is it compatible with Pelco's version? Pelco's Coaxitron Protocol does.

      1.1.3.2. _____No

    1.1.4. _____Twisted pair (2 wire circuit), if so what impedance?

      1.1.4.1. _____120 Ω: AD/Sensormatic's Manchester Code, Burle's Manchester Code

      1.1.4.2. _____600 Ω

      1.1.4.3. _____Other Ω _____

      1.1.4.4. _____Unknown Ω: All RS-422 Protocols

    1.1.5. _____Twisted twin pair (4 wire circuit), if so what impedance?

      1.1.5.1. _____120 Ω

      1.1.5.2. _____600 Ω

      1.1.5.3. _____Other Ω _____

      1.1.5.4. _____Unknown Ω: All RS-422 Protocols

    1.1.6. _____Ethernet, if so what type/speed?

      1.1.6.1. _____Thick

      1.1.6.2. _____Thin

      1.1.6.3. _____Twisted

      1.1.6.4. _____10 MBps

      1.1.6.5. _____10/100 MBps

      1.1.6.6. _____100 MBps

      1.1.6.7. _____Other _____

      1.1.6.8. _____Unknown

  1.2 _____Information transfer method, one or more types involved?

    1.2.1. _____RS-232

    1.2.2. _____RS-422: AD/Sensormatic's RS-422 Protocol, Pelco's D and P Protocols, Vicon's RS-422 Protocol

    1.2.3. _____RS-485: Panasonic's RS-485 Protocol

    1.2.4. _____Manchester Code: AD/Sensormatic's Manchester Code, Burle's Manchester Code

    1.2.5. _____Other _____

    1.2.6. _____Unknown

  1.3 _____Fiber

  1.4 _____RF

  1.5 _____IR

  1.6 _____Other _____

4   Logical Characteristics

1. What is the logical communications method?

  1.1 _____One or two way communications?

    1.1.1. _____One: Burle's Manchester Code, AD/Sensormatic's Manchester Code, Pelco's Coaxitron Protocol

    1.1.2. _____Two: Sensormatic's RS-422 protocol with an AD-2083-2 installed, Sensormatic's RS-422 on a VM-1 system

1.1.3. _____Either: Sensormatic's RS-422 protocol on an VM-96 system, Pelco's D or P Protocol

1.2 Known protocol?

  1.2.1. Yes, which _____

  1.2.2. No

1.3 Data communications rate

  1.3.1. 1200 baud

  1.3.2. 2400 baud: Pelco's D and P Protocols

  1.3.3. 4800 baud: Pelco's D and P Protocols, AD/Sensormatic's RS-422 Protocol

  1.3.4. 9600 baud: Pelco's D and P Protocols

  1.3.5. 19200 baud: Panasonic's RS-485 Protocol

  1.3.6. 31.25 KHz: AD/Sensormatic's Manchester Code, Burle's Manchester Code

  1.3.7. 125 KHz: AD's Data Line Protocol

  1.3.8. 230 KHz: Sensormatic's SensorNet Protocol

  1.3.9. Other _____

  1.3.10. Unknown

  1.3.11. Variable: Pelco's, Download Protocol

  1.3.12. Asymmetric

1.4 Message size

  1.4.1. Short, 3 bytes or less: AD/Sensormatic's RS-422 Protocol

  1.4.2. Medium, $4 \rightarrow 8$ bytes: Pelco's D and P Protocols, Panasonic's RS-485 Protocol

  1.4.3. Long, over 8 bytes in length: AD/Sensormatic's RS-422 Protocol

  1.4.4. Varies: AD/Sensormatic's RS-422 Protocol

  1.4.5. Other _____

  1.4.6. Unknown

1.5 Do messages get acknowledgments?

  1.5.1. Yes: Pelco's D and P Protocols, AD/Sensormatic's RS-422 Protocol, Panasonic's Gateway Protocol(?), Panasonic's RS-485 Protocol

  1.5.2. No: AD/Sensormatic's Manchester Code, Burle's Manchester Code, Pelco's Coaxitron Protocol

  1.5.3. Sometimes

1.6 If messages get acknowledgments, are they needed?

  1.6.1. Yes: AD/Sensormatic's RS-422 Protocol

  1.6.2. No: Pelco's D and P Protocols

  1.6.3. Sometimes

  1.6.4. Unknown

1.7 Are messages retransmitted?

  1.7.1. No

  1.7.2. Yes

    1.7.2.1. Only if no acknowledgment is received.

    1.7.2.2. Only if a negative acknowledgment is received.

    1.7.2.3. Only on a timeout of about _____

    1.7.2.4. Sometimes

    1.7.2.5. Always

    1.7.2.6. Always depending on the exact command.

    1.7.2.7. How long in between retransmissions _____

    1.7.2.8. What is the maximum number of retransmissions _____?

5   Mount Characteristics

1. Direct control? I.e. like a PT-xxx with an LRD, ERD or IRD.

    1.1 Yes: Pelco's PT-xxx series

    1.2 No: Pelco's Intercept, Spectra and Esprit series

2. Protocol control? I.e. Integrated receiver driver, like an Esprit/Spectra

    2.1 Yes: Pelco's Intercept, Spectra and Esprit series

    2.2 No, requires an external Receiver/Driver. Pelco's PT-xxx series

3. 360° or better in pan? If better how many? _____

    3.1 No: Older Pelco PT-xxx units

    3.2 Yes, slip rings?

        3.2.1. Yes: Pelco's Intercept, Spectra and Esprit series
        3.2.2. No

4. 90° or better in tilt? If better how many? _____

    4.1 No

    4.2 Yes, slip rings?

        4.2.1. Yes: Pelco's Intercept, Spectra and Esprit series, $\text{Spectra} = +2 \rightarrow -92^o$, $\text{Esprit} = 36 \rightarrow -87^o$.
        4.2.2. No

5. Variable Pan speed? If so how many? _____

    5.1 No

    5.2 Yes: Pelco's Intercept, Spectra and Esprit series. All three series has a potential of 64 speeds. Actual number varies by software revision.

        5.2.1. Unknown
        5.2.2. What are the Pan speeds(s)?
            5.2.2.1. _____ $^o/\text{sec}$
            5.2.2.2. _____ $^o/\text{sec}$
            5.2.2.3. _____ $^o/\text{sec}$
            5.2.2.4. _____ $^o/\text{sec}$
            5.2.2.5. _____ $^o/\text{sec}$
            5.2.2.6. _____ $^o/\text{sec}$
            5.2.2.7. _____ $^o/\text{sec}$

5.2.2.8. _____ ^{o}/sec

5.2.2.9. More?

6. Variable Tilt speed? If so how many? _____

    6.1 No

    6.2 Yes: Pelco's Intercept, Spectra and Esprit series. All three series has a potential of 64 speeds. Actual number varies by software revision. Tilt speeds are about 1/2 of pan speeds.

      6.2.1. Unknown

      6.2.2. What are the Tilt speeds(s)?

        6.2.2.1. _____ ^{o}/sec

        6.2.2.2. _____ ^{o}/sec

        6.2.2.3. _____ ^{o}/sec

        6.2.2.4. _____ ^{o}/sec

        6.2.2.5. _____ ^{o}/sec

        6.2.2.6. _____ ^{o}/sec

        6.2.2.7. _____ ^{o}/sec

        6.2.2.8. _____ ^{o}/sec

        6.2.2.9. More?

7. Pan hard stops?

    7.1 Yes: Pelco's PT-xxx series

    7.2 No: Pelco's Intercept, Spectra and Esprit series

8. Pan soft stops?

    8.1 Yes: Pelco's Intercept, Spectra and Esprit series

    8.2 No

9. Tilt hard stops?

    9.1 Yes: Pelco's PT-xxx series, Pelco's Intercept, Spectra and Esprit series

    9.2 No

10. Tilt soft stops?

    10.1 Yes: Pelco's Intercept, Spectra and Esprit series

    10.2 No

6 Protocol characteristics

This is a list of various commands that have been found in various manufactures protocol documents. Here the actual wording of the different manufacture's is used. Thus the same concept may appear in several different locations. Many times what one company calls something a different company will give a totally different name to.

How many different commands are there? _____

6.1   Commands to consider

1. Special command characteristics:

   1.1 _____The Auxiliary On and Off commands are sometimes issued repetitively to control level adjustment type functions. For those functions that use repetitive issuance of the command, the repetition rate is 20 Hz. Burle

   1.2 _____This opcode causes the specified function to be activated for at least 50 ms, so the command must be issued at a frequency of not less than 20 Hz for smooth operation. Burle

2. Asynchronous communications from the dome

   2.1 _____Boundary Confusion: AD/Sensormatic

   2.2 _____Boundary Crossing: AD/Sensormatic

   2.3 _____Dome Alarm: AD/Sensormatic

   2.4 _____Dome Powered Up: AD/Sensormatic

   2.5 _____Pattern Done: AD/Sensormatic

3. Response communications from the dome

   3.1 _____Acknowledge: AD/Sensormatic, Pelco D and P Protocols

   3.2 _____Dump Dome Memory: AD/Sensormatic

   3.3 _____Mark Boundary: AD/Sensormatic

   3.4 _____Negative Acknowledge: AD/Sensormatic, Pelco P Protocol

   3.5 _____Query Device Type Response: Pelco D Protocol

   3.6 _____Query Diagnostic Info Response: Pelco D Protocol

   3.7 _____Query Magnification Response: Pelco D Protocol

   3.8 _____Query Pan Response: Pelco D Protocol

   3.9 _____Query Tilt Response: Pelco D Protocol

   3.10 _____Query Zoom Response: Pelco D Protocol

   3.11 _____Request Alarm Status: AD/Sensormatic

   3.12 _____Request Dome Position: AD/Sensormatic, Pelco D Protocol

   3.13 _____Request Dome Type: AD/Sensormatic

   3.14 _____Request Software Version: AD/Sensormatic

   3.15 _____Terminate Pattern: AD/Sensormatic

4. Special command sequences, requiring that multiple keys be pressed simultaneously.

   4.1 _____Clear Pattern and Reset to Default Pattern: AD/Sensormatic

   4.2 _____Decrease V-Phase Delay: AD/Sensormatic

   4.3 _____Define Patterns: AD/Sensormatic

   4.4 _____Flip: AD/Sensormatic

   4.5 _____Get into menu mode: AD/Sensormatic

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