NASS EX 2005: Central Station Receivers & Communication Formats

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Central Station Receivers

There has been a big change in the technology used by central stations over the past few years. Central station receivers were relatively basic and received a handful of different formats that were usually related to the manufacturer of the receiver and the alarm panels that they made. So if a central station wanted to be capable of receiving alarms from many different manufactured panels then they would have to buy many different manufactured receivers. Over the years the manufactures have developed receivers that are referred to as "Multi-Format Receivers" which means that a central station now only needs one or two types of receivers to receive their alarms were in the past it required four of five different types. Another technology change in today's receivers is the move from analog to digital with the use of a DSP. The DSP allows for manufacturers to replace a great deal of circuitry with one chip that has software to perform the functions of many chips in the past. This allows the manufactures to make the receivers much smaller and more powerful. However this also means that the receivers are more accurate and not as tolerant of the communication format when noise, timing delays and frequency's are added due to unknown factors over the phone network. What this means is that in some cases panels that were able to communicate to an older receiver may have trouble communicating to a newer receiver.

Multi-Format Receivers

The following is a list of Multi-format receivers:

- **DSC/Sur-Gard → MLR-2000/ System III/ MLR2DG / MLR2E**
- **GE Interlogix → OH2000/ OH2000E**
- **Bosch Security → Radionics 6600**
- **ADEMCO → MX-8000**

What Kind of Formats Are There?

There are three methods of communication over a phone line that are commonly used by alarm panels and they are Pulse, DTMF and FSK. Within these three different types of communications methods there are many different types of formats. Below is a list of the most common formats:

- **Pulse (4/1, 3/1, 4/2, 3/1 with parity, 3/1 Extended, 4/1 Extended etc.)**
- **DTMF (Contact ID, Ademco Superfast, Ademco High Speed, FBI Superfast etc.)**
- **FSK (SIA, Modem II, IIIa2, ITI, BFSK, Westec etc.)**

Another type of communication that is becoming popular in the industry is IP. Many alarm panels can now be fitted with an internet communicator to send alarms to the central station using the Internet. There are two types of formats used for communicating over the Internet. They are UDP and TCP

How Do They Work?

Pulse Formats

- **Pulse formats answer to steady tone handshakes such as 1400 Hz , 2300 Hz and communicate at 10bps, 20bps & 40bps**

Example of 4/2 Double Round

Ring On Primary Line
sending: 1400Hz for 1000ms ← Handshake

2710B5
2710B5 ← Two matching rounds

(54-101001 **2710** B5)

(54-00-01-001-**2710**-B5-)
Panel Account Number

sending: 1400Hz for 1000ms
FORMAT IS:PULSE
Kissoff

Example of 3/1 Parity (Checksum)

Ring On Primary Line
sending: 2300Hz for 1200ms ← Handshake

654B4 ← Checksum byte

(4D-101001 **654** B)
(4D-00-01-001-**654**-B-)
Panel Account Number

sending: 2300Hz for 1200ms
FORMAT IS:PULSE
Kissoff

DTMF Formats

- **DTMF formats answer to steady tone handshakes and combination low high handshakes like 1400 Hz followed by 2300 Hz**

Example of Contact ID Signal

Ring On Primary Line
sending: 1400Hz for 100ms
sending: 2300Hz for 100ms — Handshake

65561834A2A1A15D — Checksum byte

(16-501001 186556R40201015)

(16-00-01-001-6556-R402-01 GROUP O/C 015) — Panel Account Number

sending: 1400Hz for 800ms
FORMAT IS:DTMF — Kissoff

Example of Ademco High Speed

Ring on Primary
sending: 1400Hz for 100ms
sending: 2300Hz for 100ms — Handshake

12341AAAAAAA7
12341AAAAAAA7 — Two matching rounds

(14-8010011234 1AAA AAAA 7)

(14-00-01-001-1234--1AAAAAAA7) — Panel Account Number

sending: 1400Hz for 800ms
FORMAT IS:DTMF — Kissoff

Calculating Checksums (Parity)

The following information was received from a panel sending a Contact ID signal:

65561834A2A1A15D — Checksum byte

Add up all of the numbers except for the checksum byte

6+5+5+6+1+8+3+4+10+2+10+1+10+1+5=77

Now subtract 15 from the number and keep subtracting 15 until you get a number that is less then 15.

77-15=62-15=47-15=32-15=17-15=2

Now take 15 and subtract the answer from up above (In this case 2) the answer will be your checksum.

15 – 2 = 13 → Converted 13 to Hex = D
D is your checksum byte

Hex Conversion

A = 10
B = 11
C = 12
D = 13
E = 14
F = 15

FSK Formats

- **FSK formats answer to steady tone handshakes or handshakes with a carrier tone. For example SIA answers to a steady tone handshake of 2225 Hz while Radionics Modem and ITI answer to a carrier tone handshake**

Ring on Primary
sending: 2300Hz for 1000ms
baud=300 — Handshake
->7}
[4]
[23]
[33]
[31]
[34]
[31]
[DF]
->6}
[3]
[4E]
[52]
[50]
[31]
[81]
(6B-S01001[#3141|NRP1])
(6B-00-01-001-3141-NRP1) — Panel Account Number
->3}
[40]
[30]
[8F] — Zone
Sending: ACK — Kissoff
FORMAT IS:SIA

RP is the SIA event code for "automatic test"

Is One Format Worse Than Another?

There are many technologies on the PSTN to enhance bandwidth and voice quality such as:

- **Echo chancellors**
- **Echo suppressers**
- **voice compression**

Any or all of these can affect the communication of alarms to the central station. One of the biggest problems seen when receiving an alarm signal is the signal to noise ratio. Signal to noise ratio is the difference in the amplitude between the noise on the line and the signal itself. Every time an analog to digital or digital to analog conversion takes place, noise is added to the line and the amplitude of the signal on the line is decreased. So the more conversions the closer the signal amplitude is to the amplitude of the noise. This causes problems when receiving FSK and DTMF type formats. Pulse is more robust and is easier to discriminate from the noise. However Pulse formats are much slower and send much less information then FSK and DTMF formats.

Possible Format Issues

In the following example the installer did not program an account number into the alarm panel. Many manufactures of Digital Dialers have a default account number programmed into the panel. One of the most common default accounts numbers is "FFFF". When a situation like this occurs the proper central station account will not receive the intended signal.

Account number in panel not programmed!
Ring On Primary Line
sending: 1400Hz for 100ms
sending: 2300Hz for 100ms

FFFF1834AAAAAA3B — Panel Account number
(16-501001 18FFFFR40000003)
(16-00-01-001-FFFF-R400-00 OPEN / CLOSE 003)
sending: 1400Hz for 800ms
FORMAT IS:DTMF

Possible Format Issues

Reporting zone not programmed into the alarm panel

Aug 12 2004-06:54:31-01/00-SG-02-037-6831-FF — Event & Zone

The above example is a installed system where the installer did not program the reporting zone when using the 4 X 2 format.

Account number not programmed into the alarm panel properly using a Hex 'A'

2004-07-17-09:37:56-01/00-SG-01-674-132-3 — Account number

The account number should have been '0132' but because the panel was programmed with a '0' instead of an 'A' the panel sent account 132 instead. Some panel manufactures require the installer to program an 'A' in the account code if they would like a '0' to be sent.

Possible Format Issues

Many formats conflict with each other and the receiver cannot tell the difference. In these cases the receiver will need to be programmed to tell how to decode the alarm. In the example below the alarm communicator sent in two rounds of five digit pulse and the receiver was programmed to decode any five digit pulse as 4/1 which means that the first four digits where used as the account number and the last digit was used as the zone in alarm. However the panel was actually sending the alarm using the 3/1 pulse with parity format so the receiver needs to be programmed to check the information that was sent to see if the last digit (in this case 9) equals to the parity (checksum) of "2685" and if so then it should decode the first three digits as the panel account code and the fourth digit as the zone that is in alarm.

Receiver programmed incorrectly. Format decoded as 4/1 instead of 3/1 w/parity

4/1 Pulse
Ring On Primary Line
sending: 2300Hz for 1000ms

26859 ← Matching rounds
26859

(4D-101001 2685 9)
(4D-00-01-001-2685-9-)
sending: 2300Hz for 1000ms
FORMAT IS:PULSE

3/1 with Parity
Ring On Primary Line
sending: 2300Hz for 1000ms

26859 ↘ Checksum byte

(4D-101001 268 5)
(4D-00-01-001-268-5-)
sending: 2300Hz for 1000ms
FORMAT IS:PULSE

Possible Account Issues

Account numbers such as 333, 444, 555 etc. can create false dispatches for your customers. This is a common problem in many Central Stations.

When monitoring 3 X 1 or 4 X 1 Extended Formats, the use of "like account numbers" can create false alarms. Even if you state that you do not monitor any extended formats, it is possible for a technician to program a panel and send these types of formats. To be safe it is common place in many Central Stations not to use like account numbers such as 111, 222, etc.

Using the Automation

- One way to help identify format issues due to mis-programming of a panel, is to use your alarm automation system.
- For instance the example of Default account numbers, as previously stated one of the most common default account numbers is "FFFF".
- You can create in your automation system a "in-house" account number of "FFFF". This can be done for each receiver line in the alarm automation software. This account will capture the signals and log all signals being transmitted with the FFFF account number to the history for research.
- For example: 16-FFFF, 241-FFFF, WG-FFFF etc..
- If your automation system supports receiving and logging Caller ID to the history of the accounts, then you have a valuable source of information to start research to be able to identify where this signal is actually coming from.
- If the alarm automation system does not support Caller ID, some central stations have the ability to track signal traffic to PBX call records that may have ANI, Caller ID, DNIS or DID information, which may also be helpful.

THANK YOU