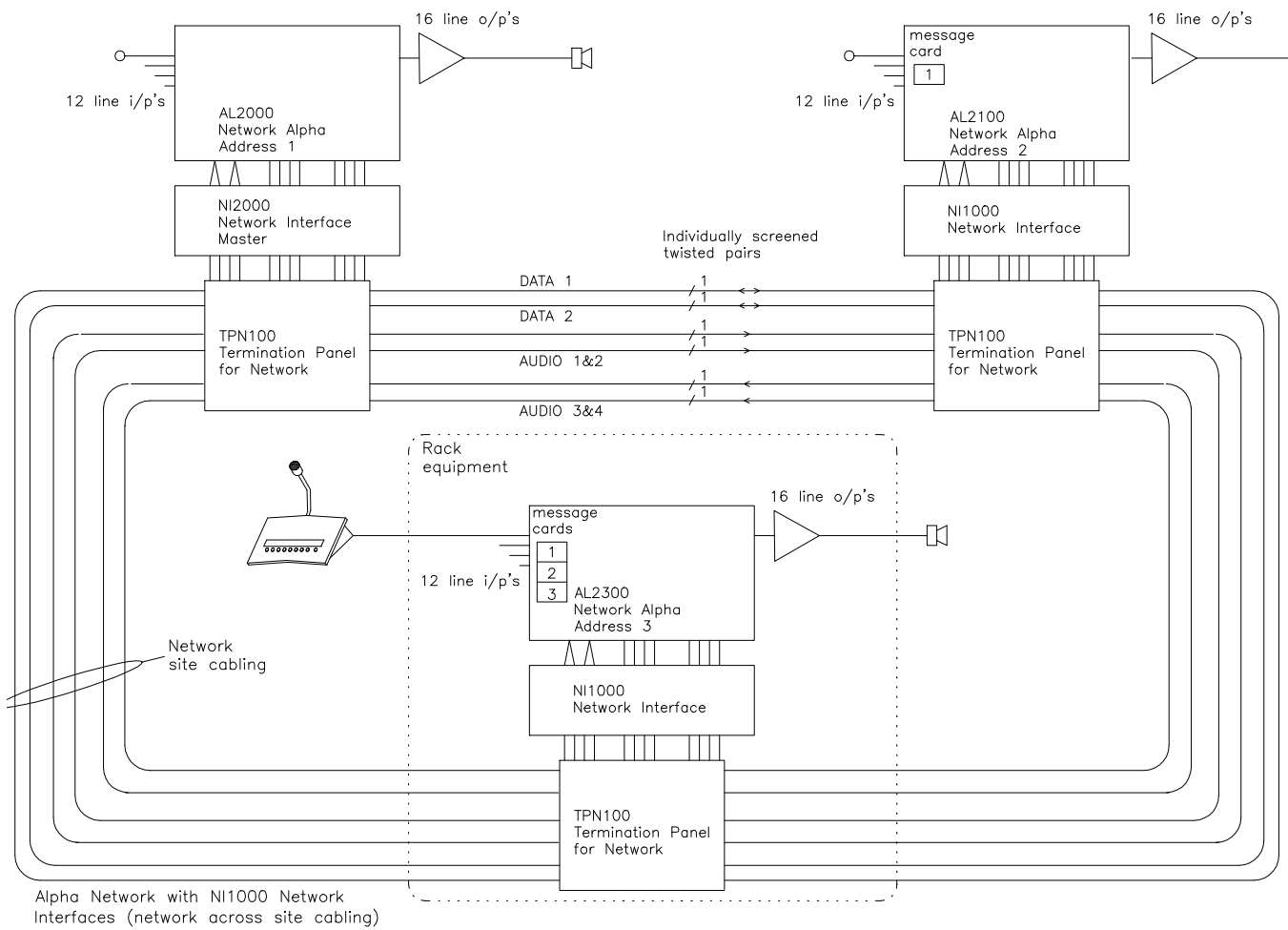


Alpha Network Fault Tolerance Overview



Create distributed fully monitored Voice Alarm systems using the Audix Alpha Network.

The *Alpha* Network has been designed to extend the number of input sources and output destinations that the matrix system can route and control. This allows the creation of large systems with up to 192 inputs plus 480 high quality digital messages and 256 zones.

Each *Alpha* matrix group or 'node' of a distributed *alpha* network system is connected to the network via a network interface unit.

The Audix Alpha network is a fault tolerant dual redundant ring;

- In the event of a break in the network, audio and data automatically switches over to a working line.

Full audio and data monitoring provide Voice Alarm fault status reporting in accordance with the requirements of BS5839 (when installed using fire rated cable ie FP200).

1 Introduction

An Alpha network comprises a number of matrices configured in a ring with 2 data cable and 4 audio tie lines forming concentric rings.

The provision of multiple data and audio rings enable the network to be extremely fault tolerant and allows a number of faults to occur without significant loss of network functionality.

Each Alpha rack acts as an independent system; the loss of an Alpha on a network does NOT affect the operation of any other aspect of the network.

The Alpha network configuration allows the alpha's to be connected together over long distances i.e. 1km (dependant on cable types used). Only one Ni1000 Network Interface is required to interface one equipment rack to the network cables.

The Ni1000 provides audio cable drivers, electrical protection and data repeaters. A built-in equaliser allows adjustment of the frequency response and gain to overcome losses in the site network cabling.

If an NI1000 network interface fails the network bypasses the failed node and continues to operate as before. The Alpha in the bypassed rack continues to operate as a standalone system

2 Alpha Network Fault indications

The Network faults that are detected and flagged on each Alpha are as follows:-

- 1) Alpha offline fault
- 2) Alpha missing fault
- 3) Audio line fault (flagged if there is a fault on any tie line)
- 4) Surveillance tone from source / matrix missing fault
- 5) Ident system not responding fault
- 6) Network card fault

3 Data Network

The Data network is controlled by the NI2000 / Data Link Monitor which tells the network Alphas which data lines they should be communicating on. The switch from one data line to another is carried out automatically and the Alpha is informed which data line is being used.

If one data network cable is cut, the system automatically and instantly switches over to the second cable. Any ongoing calls are unaffected and the network continues to operate.

If both network cables are cut the NI2000 detects this and joins the data lines together allowing them to maintain communications. This allows the data network to continue operating with a complete break in both data lines.

If more than one complete cable break occurs and an Alpha loses contact with the NI2000 network controller, that Alpha logs off the network but keeps monitoring the both data lines. When the fault is fixed the Alpha logs back on. All other Alphas which are in communication with the NI2000 act as a network.

4 Audio Network

4.1 Audio Tie Lines

Each Alpha in the loop is connected clockwise and anticlockwise with four audio “tie lines” which carry the audio signal around the network.

Three of the four lines are monitored. Surveillance of the audio network uses sub-audio (30 bits/second) data transmission over the audio tie lines.

The surveillance master Alpha 1 sends an S Ident message around the loop. If an Alpha cannot see an S Ident message, it reports a tie line error over the data network. The surveillance master then determines which tie lines can be used and flags a tie line fault.

This fault is reported to all the other Alphas on the network which instantly stop using that tie line. Any signal being carried by that tie line when it breaks is switched over to a good line without any break in transmission.

4.2 Tie Line Allocator

Any Alpha is capable of performing the tie line allocation function. The particular Alpha that carries out this task is defined as the Alpha with the lowest matrix address number that is online. If the Alpha that is designated as the allocator goes offline for whatever reason then the task of allocating the tie lines passes to the Alpha with next highest matrix address number.

4.3 Tie Line Fault(s)

If any Alpha on the network reports that there is a fault on a tie line then the tie line fault flag will be set and tie line allocator will stop allocating calls to that tie line. Consequently all of the other Alphas will stop using it. If all of the tie lines have a reported fault on them then the system goes into “limp mode”

4.4 Limp Mode

The tie lines form a loop that carries the audio around the network of Alphas. These tie lines are passed through repeater amplifiers at every Network Interface unit. Two of the tie lines are driven in a clockwise direction around the loop while the other two are driven in an anti-clockwise direction. Provided that a system has at least one monitored tie line in either direction, then the loop can be cut / disconnected at any point and the system can still carry on working as a single tie line system. This mode is called “limp mode”. In “limp mode” the calling Alpha drives its audio onto all enabled tie lines and the receiving Alphas take their audio from any tie line that has an the ident signal (and hence audio) on it. In this mode the one effective tie line has its calls allocated simply on a priority basis.

5 Fault tolerance overview

The fully monitored Alpha network can still function even when major faults have occurred. The following table is of typical faults and their impact on the network;

Fault Type	Effect
Network Alpha fail	Communications with the zones served by that Alpha is lost. No affect on the network.
NI1000 fail	Network communications lost with the Alpha served by the NI1000. Audio and data lines are bypassed. No affect on the network.
Single data line cable break	Network switches over to the working line. No affect on the network operation
Both data cable lines break	NI2000 switches to "Heal" mode. No affect on the network operation.
Both data cables broken in multiple places	All Alphas that can "see" the network controller (NI2000) continue to operate . Any Alphas that cannot see the controller switch to local mode and operate as standalone systems.
One monitored audio tie line breaks	All Alphas told not to use that tie line. Users still able to make calls over the network. Number of simultaneous calls on the network reduces from 3 to 2.
Two monitored audio tie line breaks	All Alphas told not to use the broken tie lines. Users still able to make calls over the network. Number of simultaneous calls on the network reduces from 3 to 1.
Three monitored audio tie line breaks	System switches to "limp mode". The calling Alpha drives its audio onto all monitored tie lines. Users still able to make calls over the network. Number of simultaneous calls on the network reduces from 3 to 1.