


ELECTROLINE



ELECTROLINE EQUIPMENT INC.

Return Path Switching

- a white paper

Return Path Switching

Today's cable operators are facing pressure to "clean up" the 5-42 MHz return band to provision this spectrum for planned upstream services, such as High Speed Data (HSD) and IP Telephony. Once the nodes are conditioned and the green light is given for deployment of these services, the issue of maintaining network integrity becomes paramount. The onus falls on the engineering group to find quicker, less disruptive and more cost-effective tools to assist them in accomplishing this goal.

The problem is impairments, which can take several forms: Intermodulation such as CPD, Impulse Noise, HAM, CB, Customer Equipment, etc. Any one of these can interfere with, and result in, the loss of data traffic, which is essential to maintain these new services. If the source of the interference is extreme, it could spill into other nodes at the combining network, causing large areas of the network to fail.

Traditional Methods: Time and Personnel Intensive & Intrusive

The current method of identifying and locating ingress starts at the headend. The technician, through a regular maintenance routine, or a trouble ticket, checks each node looking for ingress. This involves connecting an analyzer to one test point at a time and translating the results. This process alone can take several hours, depending on the number of nodes and travel time.

Once ingress is identified and the need for repair is established, it is referred to field technicians for resolution. Typically, the procedure is to locate the source of the ingress by process of elimination. Starting at the node, return pads are removed from each feeder leg of the node until the ingress disappears. The ingress is then narrowed to a distribution area. Next, traveling downstream from the node, the technician proceeds to the next active device (line amplifier) and repeats the process. It may require visits to two or three "actives" before isolating the ingress to a single distribution segment.

As each distribution segment can have up to four "actives" and 30 or more passive devices (multitaps, couplers, splitters), this is the most time-consuming part of the process. At this level, it is usually a matter of removing components along the feeder (tap plates, coupler boards) while disrupting both power and RF downstream.

A number of problems can be identified with this scenario:

- **It is time-consuming.** Using this methodology, it takes at least two hours at the headend to confirm a problem exists and several hours or even days in the field isolating the ingress.
- **It is disruptive.** Existing CATV and HSD customers will be without their services while cable company technicians are locating ingress.
- **It is reactive.** The cable company is reacting to a situation that may already be causing problems to customers.
- **It is low-tech.** This technology does not respond well in meeting customer needs associated with return path applications, such as data transmission over cable.

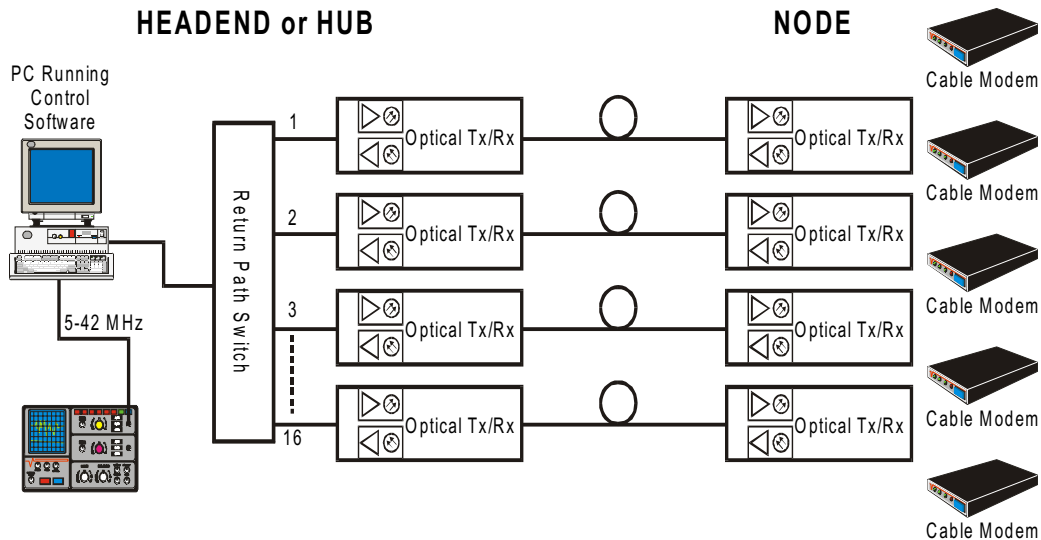
Return Path Switching

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Return path switching ("wink" switches) involves electronically segmenting the entire cable plant into small pockets, with the express purpose of quickly locating potentially destructive ingress and other impairments in the return band. This process can be remotely managed, and the results viewed from one, or possibly many locations. Return path switching gives the technical staff the ability to quickly interrogate any portion of the cable plant looking for ingress without being disruptive to existing upstream or downstream services.

Node Switching

The first phase involves the coupling of an "intelligent" switching device at the headend or hub site, with optical receiver test points. This gives the operator, from a central location, "on-demand visibility" into any node within the cable network. It also accommodates the sharing of one analyzer over multiple node locations, thereby eliminating the need for dedicated analyzers at each hub. Controlling the switches with an intuitive software program, the operator can conduct strategic searches of the system while viewing the results on a spectrum analyzer display built into the application. This can facilitate the automating of searches for suspect nodes and also provide 24/7 alarm conditions to alert "on call" technicians to potential problems.

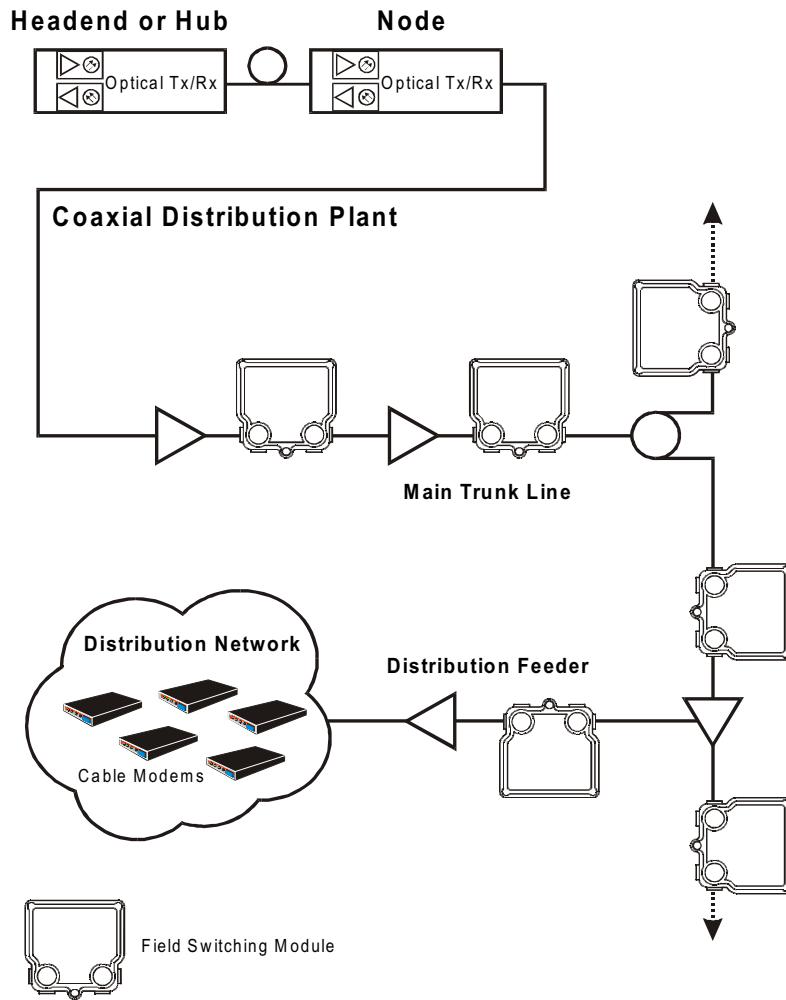


Typical cable network layout

Field Switching

To get visibility beyond the node requires the installation of field switching devices. The modules are in an environmental housing similar to a line coupler, and are installed at strategic locations within the node, starting at each coaxial output of the optical receiver, then at each distribution amplifier and main line splits. The deeper into the distribution network the modules are installed, the smaller the pocket to isolate ingress.

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Typical placement of field switching modules in a cable network

To locate the source of ingress using field modules, a 6 dB pad is selectively switched in. Engineering tests have proven that this switch is non-destructive and will not affect HSD services. In locations where ingress is severe or where services are not yet deployed, it is possible to momentarily shut down (terminate) the 5-42 MHz band. The results of the field switching are displayed on a spectrum analyzer for interpretation. When the ingress is reduced by 6 dB or disappears (depending on the option selected), it is then a matter of switching devices deeper into the plant in order to locate the point of origin of the ingress.

Once the ingress source is located within a certain distribution area, technicians are dispatched to the site. In all cases, this process of testing and locating is achieved from a single location, by one person.

Return Path Switching

Return Path Monitoring

Another application for field switching is as an automated monitoring system of the return path. This is a proactive approach to maintaining the integrity of the network. After setting up alarm parameters for each node, the Cable Ingress Management software will scan, at a predetermined rate, all the nodes in the cable plant. Once an alarm is triggered, it can set off escalation procedures based on the significance of the ingress. This alarm condition can range from a visual screen alarm to the paging of a technician.

If a technician is paged, he calls in to the control software via modem or LAN (TCP/IP) connection and interrogates the system for the cause of the alarm. Post-alarm traces can be retrieved to determine the actual type and severity of the ingress. Once in control of the system, field modules are switched to determine exactly where in the cable plant the ingress is originating.

At What Price?

The implementation of this type of system as described does involve costs, but the operational savings in reducing the fault locating time from hours to minutes without any disruption of paying services are considerable. Technicians can, from one location, perform extensive testing of the return path. The system is also scaleable: it can be added to as needed, driving the locating of ingress deeper into the distribution plant.

Of equal importance is the fact that existing paying customers are not adversely affected by the process. In the effort to clean up the return path, the tearing apart of equipment to search for ingress can be very disruptive to the "bread and butter" cable TV customer.

Traditional methods of locating the source of ingress do work, but they are very labor-intensive, technically frustrating and time-consuming. The capital required to install intelligent switching devices within the distribution network is quickly offset by the ability to be able to hastily interrogate the network and isolate return path problems before they affect customers.

A clean, reliable return plant is the cable company's key to gaining additional revenue streams from today's new applications.

The Solution: Remote Return Path Switching

With CLEARPath™, today's cable network managers now have access, at a reasonable cost, to a **scaleable** return path technology that monitors and rapidly detects ingress beyond the node.

By installing field-switching modules at strategic locations beyond the fiber node, in the distribution plant, the operator is ready to quickly locate the source of ingress between two modules. This results in a proactive approach to managing ingress.

Traditional vs Remote Switching Methods

	<i>Traditional Methods</i>	<i>Remote Switching Methods</i>
Capital Cost	Low capital cost	Initial capital cost
Operating Cost	High	Low
Problem Resolution	Slow and disruptive	Fast and non-intrusive

Return Path Switching

Issues of time, cost and flexibility are clearly paramount from the moment network managers begin to use their return path: there is now a clear and urgent need for the right technology to meet the exploding requirements generated by today's applications, especially data communications.

Fortunately, specialized equipment is now available to replace traditional methods of cable ingress troubleshooting, which addresses the growing requirements for maintaining a reliable cable network.

To find out more, you may contact:

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