OFF PREMISES SWITCHING:ALTERNATIVES IN CATV CONTROL SYSTEMS

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ABSTRACT

At present, the delivery of pay television signals has primarily involved scrambling of protected signals. This method has several inherent problems, particularly in the area of program and equipment security.

The initial obvious solution was to employ off premises control systems. These system designs are primarily based on off premises converters, which have proven to be less than the ideal answer. It appears that either off premises addressable tap systems, or hybrid tap/scramble systems may prove more effective in this application. This paper examines the functional, application, and cost aspects of various system control technologies currently available.

FUNCTIONAL DEFINITION OF CONTROL SYSTEMS

The ongoing discussions on the relative merits of off premises control have suffered from a lack of functional definition. This lack of definition, and in particular, excursions into non-traditional areas of operation, has generally led to system over-complexity.

The functional requirement can be described as follows, under several categories:

CATV Control	:Program Access
	Normal Pay Control
	PPV Control
Secondary Service	:Interactive Services
	Telephony
	Text Services
Convenience Services	:Channel Selection

These functional requirements can differ in motivation, for example: channel selection is a requirement in British Systems where tuners are not incorporated in TV Receivers, while in North America, channel selection is a byproduct of the control technology employed.

Most attempts at systems to perform these functions are based on the obvious solution of remotely located converter, or converter-descramblers. While this method appears, at first, to perform the majority of desired functions, the operational reality is somewhat less than perfect. This system concept has, however, been attempted by various manufacturers in North America, and has also appeared in Germany as the NIXDORF/FUBA F.A.T.S. system as well as the various versions of British Telecom Switched Star Systems. (CABLETIME, DELTAKABEL ETC.)

As attempts to implement these systems progress, several major constraints become apparent. Of particular note are the following items:

1) The switched star, or off premises converter system,is extremely capital intensive.
2) The requirement for operator equipment in the customer home.
3) The inability to serve multiple receivers without duplicating the amount of dedicated hardware.
4) Incompatibility with cable ready TV's and VCR's.
5) Physical mass of the system.
6) Overall system electronic complexity.

The primary cause may be that the switched star or off premises converter does its job too well, and, in fact, undertakes functions which could be considered as beyond the domain of the CATV operator.

Perhaps we should disgress slightly and examine the proposed functional requirements in the context of a CATV operator.

Basic Service Control	:Primary system requirement
Pay Television Control	:Primary Revenue Generation
Pay Per View	:Primary Future Potential

These are the obvious primary requirements of an off premises system. Many systems also have designed-in capability for secondary services. The following are the most commonly discussed optional capabilities:

Interactive Functions: These are best defined as two way transactional services,such as tele banking, tele shopping, polling, etc. Up to now experiments with this type of service have been just that: experiments. We have seen that, to date, these concepts have been technology driven as opposed to market driven (i.e. how can we sell what we do? as opposed to "how can we do what they want to buy?"). This technologically driven approach to product has invariably led to failure, because it is impossible to sell a technological means to which there is no market driven end. CATV customers are NOT DEMANDING tele-banking, tele-shopping and similar services, nor could they be readily convinced of their need for such services.

Text Services: These services have had success in several very limited applications. In particular, hearing impaired captioning has proven viable, as has text delivery on a narrowcasting basis. Text service have been successful in remote areas, such as Western Australia, where it is normally the first print information to be delivered to the customers. The supply of text services as a revenue generating vehicle on a broadcast scale has yet to be proven viable.

Telephony: The delivery of telephone communcations via the CATV network has been considered primarily by European Government Telephone Agencies. If we observe the operation of a traditional North American telephone system, especially in light of de-regulation and diversification, we can observe one obvious effect : The local telephone network is not necessarily revenue self-sustaining. Traditionally, the telephone network has been self-subsidizing via long haul revenue generation. To isolate the local telephone net, especially in the context of a CATV system which is by nature a localized system, does not hold significant potential as a revenue generating vehicle. In fact, the application of a CATV system to telephony has a somewhat reversing technological effect, in that we must build a telephone network carrying TV as opposed to a TV network carrying telephone service.

Channel Selection: Most television receivers in Europe and the U.K. do not incorporate a multichannel tuner. All North American television receivers have at least a twelve channel tuner, and most medium and high priced receivers have full tuning capacity. The European telecoms, particularly British telecom, have taken the task of channel selection to be the responsibility of the CATV system as a marketing advantage position.

In North American Systems, the function of channel selection has been provided as a by-product of the technology of remote converters, along with the inherent weaknesses of having only one channel at a time enter the customer's home. The overriding question remains : is it the responsibility of the CATV operator to provide channel selection, or is the operator's primary responsibility limited to delivery of the signals?

In order to clarify this situation, the CATV operator must approach the problem from the viewpoint of "what must a CATV control system do?" as opposed to "what can be done with a CATV control system?". The critical requirements of a CATV control system are:

1. Secure access to basic and premium programming.
2. Reduce the cost of ongoing field service caused by basic connections, disconnects, pay churn, etc.
3. Provide a vehicle to support the sale of impulse programming, and demand services.
4. Allow full use of customer owned video and audio equipment at a reasonable capital cost!

The foregoing items require a careful analysis of the proposed control system, realizing that optimum design may result from a mix of technologies as opposed to a single all encompassing technique. It is much more critical that the system be upgradable than to try to allow for all possibilities at the outset.

AVAILABLE OPTIONS IN CATV CONTROL NETWORKS

When we approach the three primary functions of CATV Control, these being; Basic service access, Pay television security, and Potential Pay Per View, we have various technologies at our disposal.

It is primarily the"Pay Per View"requirement which complicates these options. When we were dealing with only Basic and Pay television, it was possible to employ totally static or passive methods; i.e. drop control and traps, or similar devices. Pay Per View, by virtue of timing requirements,requires active or dynamic control systems.

Thus, in today's system we have the following available options:

- addressable scrambling
- off premises converters
- addressable taps
- a combination of these technologies

We also have, with each method available, a potential for some or all of the following problems:

- high capital cost per sub
- customer access to secured programming
- operator owned equipment in home
- field installation
- VCR/cable ready interface

The following addressable tap technology options are currently available:

Basic service (all band) switch.
Basic service plus x pay tiers (eg; low, mid, high, super, hyper).
Basic plus tiers plus descrete channel control.

Hybrid systems(addressable tap plus addressable descrambler):

Addressable Basic plus encrypted pay/PPV.
Addressable Basic plus addressable pay plus encrypted PPV.

If we examine several of these options on a capital cost vs flexibility basis, we may see that the obvious solution is not necessarily the best solution.

Addressable scrambling. The most widely employed CATV control technology is the addressable scrambling system. FIG (1)

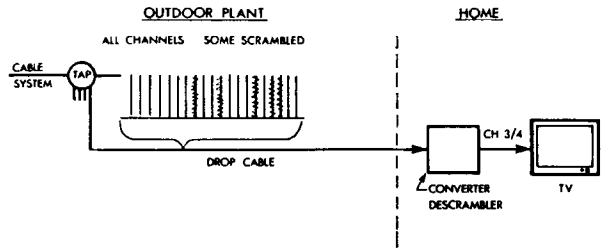


FIG.(1) ADDRESSABLE DESCRAMBLER TECHNOLOGY

These systems are quite similar in concept and end result, although the technologies involved vary widely between manufacturers. There are, however, several parameters which are relatively universal: These are:

- Scrambling usually requires little or no modification to existing plant.

- Scrambled services are brought into the customer's home along with basic cable service.

- Expensive operator owned equipment is installed inside the customer home.

- Descramblers are largely incompatible with customer equipment such as; cable ready TV's stereo television, and programmable VCR's.

Off premises converters. A natural development of the addressable scrambling approach was to move the operator owned converter out of the customer's home. FIG (2)

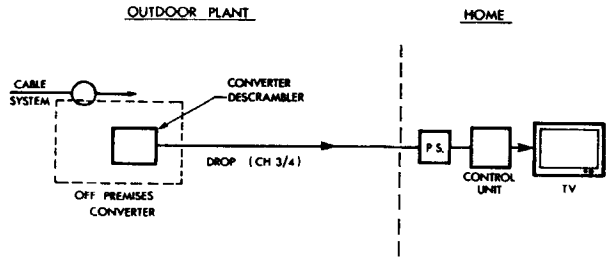


FIG.(2) OFF PREMISES CONVERTER

While at first glance, this may seem to be a solution to some of the problems posed by addressable scrambling, there are new limitations imposed by this technology. Among these are:

- A requirement to install at least the support structure (housings, power supplies, etc.)for all homes passed in the system.

- A requirement to separate the addressable descrambler/converter, so as to leave the channel selection circuit in the customer's home.

- A requirement to duplicate hardware in order to serve multiple televisions.

- System is still incompatible with most customer owned equipment.

Full function addressable tap. Many operators have found that addressable tap technology can solve many of the problems encountered with off premises converter system. FIG (3)

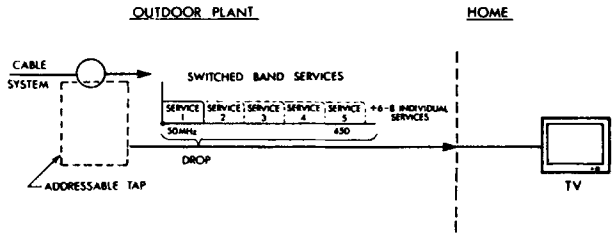


FIG.(3) FULL FUNCTION ADDRESSABLE TAP

The addressable tap is considerably less complex than the off premises converter with the following particular advantages:

- No operator owned equipment in the customer's home, except leased low cost converter if required.

- Full cable ready and VCR compatibility.

- No disconnect/reconnect or equipment recovery manpower costs for basic service cusomters.

- No customer access to either secured programming or converter control interfaces.

- Particularly adaptable to high churn and transient residential areas (apartment etc).

Hybrid system. The use of a combination of technologies can provide better security/flexibility/cost performance than single technologies in some cases. In particular, the combination of a limited function addressable tap with addressable descramblers for pay service can have advantages in both operating cost and security. In this system FIG (4), access to all programming is secured via addressable tap.

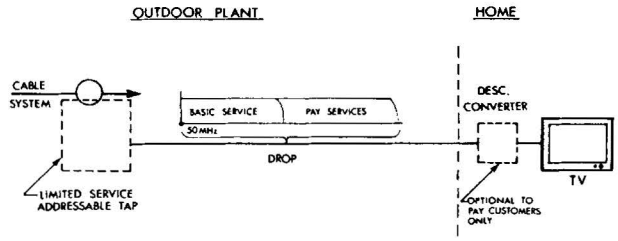


FIG.(4) HYBRID ADDRESSABLE / SCRAMBLE

Even basic service customers do not receive encrypted pay services. Pay reception requires both a descrambler from the operator, and the activation of the pay service tap. While this system retains some of the difficulties of normal addressable scrambling systems (i.e. operator equipment in the home) it does offer several distinct advantages. In particular:

- No service costs for basic reconnect/disconnect.

- No access to secured programming by non pay TV customers.

CAPITAL COST ANALYSIS OF VARIOUS CONTROL TECHNOLOGIES

In order to properly analyze the comparative costs of various control technologies, it is necessary to examine several different customer applications. The following comparison deals with four different technologies under eight basic applications:

- Off Premises converter

- Full Function addressable tap, including converter where required

- Basic function (Basic plus pay TV) tap, including descrambler were required

- Addressable descrambler

The following applications are analyzed.

1 BASIC	1 BASIC Cable Ready TV
2 BASIC	2 BASIC Cable Ready TV
1 PAY	1 PAY Cable Ready TV
2 PAY	2 PAY Cable Ready TV

The comparison assumes 50% penetration of basic, where the support structure (housings, power supplies etc) are installed for 100% homes passed, and amortized over the actual penetration.

The following representative prices were developed from market analysis, and were employed in the comparison.

- Off premises converter	$290-340 per drop.
- Full function addressable	$230
- Basic function tap	$ 60
- Addressable descrambler	$100
- Basic converter	$ 50
- Basic tap and hardware	$ 10

As can be seen by the comparison graphs FIG (5) & (6) the effect of various applications can show dramatic variation in capital cost depending on technology employed.

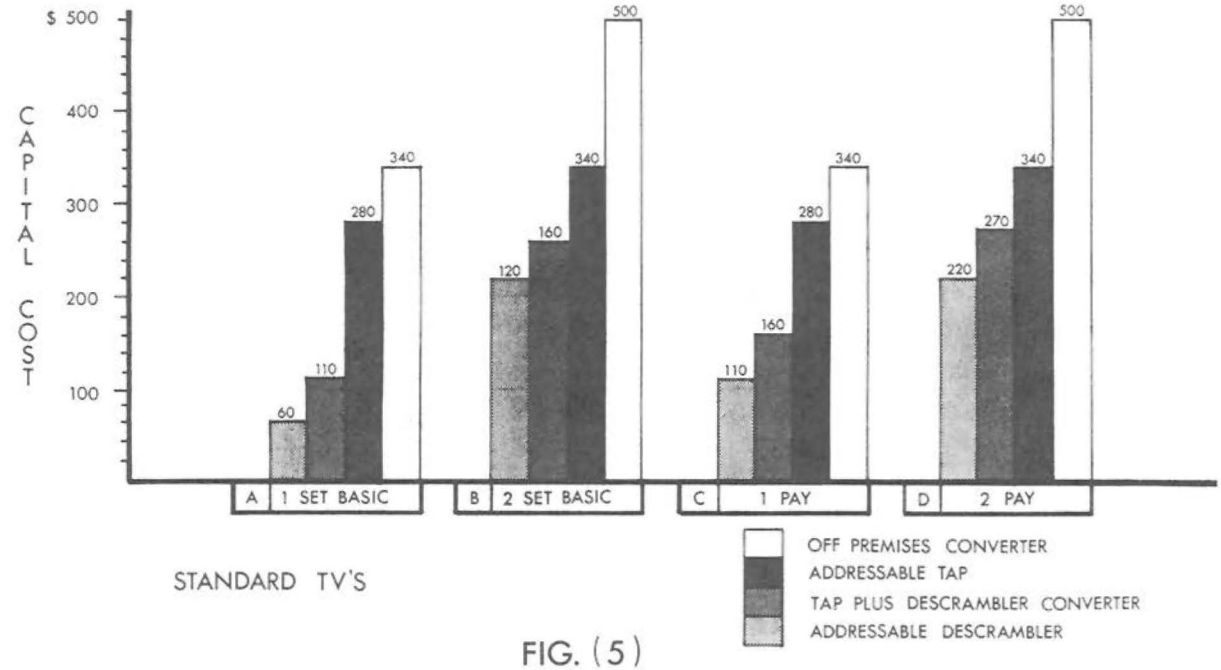
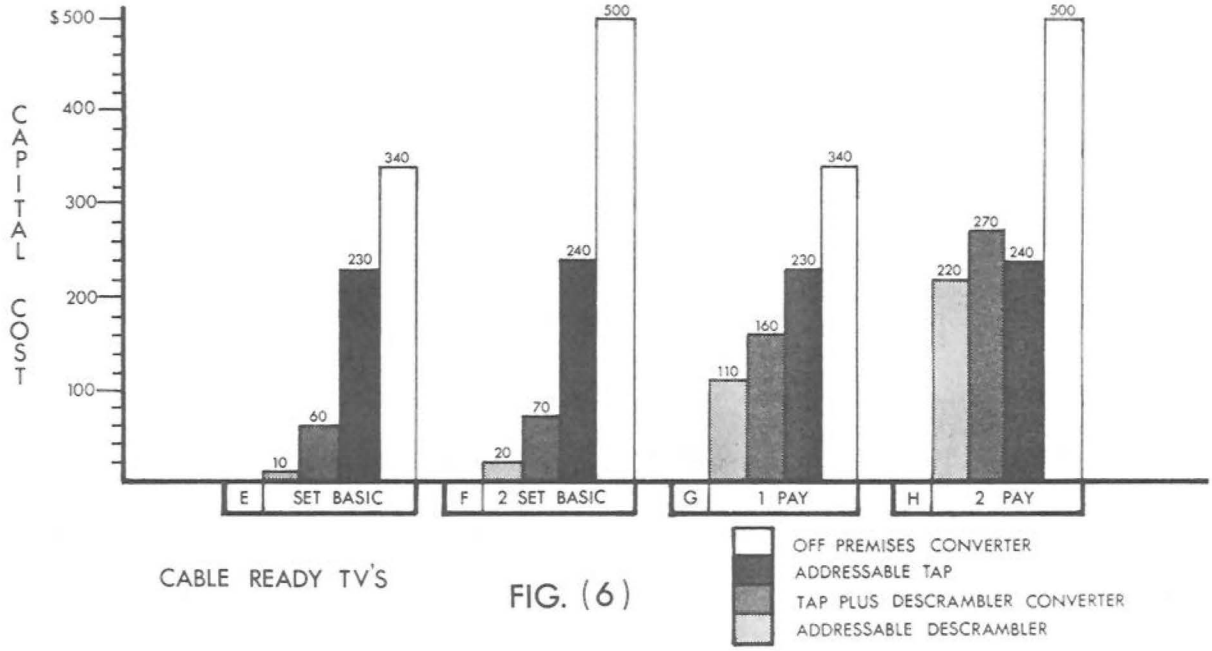


FIG. (5)



CABLE READY TV'S

FIG. (6)

Of particular note are the following;

In comparison of column (A) & (B):

1. The capital cost increase from single to dual outlet varies from $60.00 to $160.00, depending on the technology.

2. The actual capital cost for two basic sets varies from $120.00 to $500.00. In the basic service application, both the off premises converter and the addressable tap have much higher cost due to having the pay service capability built in. This can be seen in column (C) and (D) where no increase is shown for addition of pay services with these technologies.

A major difference in the cost effectiveness of technologies can be seen by comparison of FIG (5) & (6) where the effect of cable ready TV's is examined.

It can be seen that all technologies except off premises converters take some advantage from cable ready TV's in the Basic service application (column E,F).

In the pay service modes (column G,H) only the addressable tap system gains a cost advantage from cable ready sets.

OBSERVATIONS

The most significant observation from the analysis are:

- The combined addressable tap/descrambler systems compares favorably to the addressable descrambler system cost with the benefit of much higher security.
- As both penetration of pay service, and penetration of cable ready sets increase, the cost effectiveness of full function addressable tap systems increases.
- Off premises converter systems gain no advantage from cable ready TV's or multiple set connections.

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