AUTOMATIC TRANSMITTER OPERATOR™

THE Widget Works INC
P.O. BOX 79
MEDINA, OHIO 44256

FEATURES

A complete Automatic Transmission System for the FM or nondirectional AM broadcaster.

Complex microprocessor algorithm precisely follows new FCC rules on maximum permitted modulation.

Modulation control located at transmitter for all stations except stereo FM's with composite STL.

Operates in either direct or indirect power-measuring mode, independently selectable for each transmitter.

Auxiliary transmitter capability optionally available. Will automatically transfer to auxiliary if main transmitter fails.

Subaudible return available...used only to inform studio unit of mode changes and alarms; typically on for less than one minute a day.

Monitor and alarm unit designed for easy operation by nontechnical personnel.

Routine calibrations performed by keying in corrected readings on calculator keyboard; the microprocessor does the calibrating.

Time clock for AM stations includes battery backup.

No need to adjust timeclock at end of each month; all times specified on license programmed in memory at time of manufacture.

Includes tower light provisions.

Available as a single system to handle AM-FM combinations.

Designed with Intel 8080-series microprocessors and LSI peripherals...the most widely accepted microprocessor components.

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INTRODUCTION

In the infancy of broadcasting, running a broadcast transmitter was a major undertaking. Engineers hustled about, busy making adjustments and repairs to keep the station running. On a regular basis, the Radio Inspector would appear with some magical devices to determine whether the engineers were succeeding in keeping the station operating within the legal limits. Nobody would even consider trying to run the station without a full staff of qualified engineers, on duty any time the station was on the air, and most of the time while it was off.

In perspective, in the early days of automobiles, nobody would think of venturing out on the highways without a complete toolbox, and few trips were completed without using most of the tools. Several spare tires were a necessity, along with a repair kit so that tires could be repaired as the trip slowly progressed.

In 1977, spare tires are needed so infrequently that the auto manufacturers are considering eliminating them. Broadcast transmitters of recent vintage run by remote control unattended for a week at a time all over the country. Until now, it has been necessary for a human operator to be present at the control point all of the time, keeping the transmitter log, and making periodic adjustments to keep the station operating within the legal limits. No longer does this job fall to a fully qualified engineer, but it is usually handled by an operator with a third-class license, usually the announcer, as an addition to his regular duties.

On December 21, 1976, the FCC approved the long-awaited automatic transmission system rules to bring the broadcast industry into step with modern advances in reliable technology. These rules allow the station's transmitting plant to be run by a qualified Automatic Transmitter Operator.

On March 25, 1977, the FCC authorized the nation's first ATS operation, at WDBN in Medina, Ohio, using the prototype of The Widget Works' Automatic Transmitter Operator. WDBN, long a technical pioneer in FM broadcasting, uses three parallel transmitters totalling 80-kw.

The Widget Works, Inc. now manufactures and sells a complete ATS system to suit any broadcast station's needs. This manual will examine the complex subject of ATS as it affects the broadcaster and will examine The Widget Works' ATS system, its various configurations, and its options which allow it to suit the transmitter control needs of any broadcast station for which ATS operation is now permitted.

Although the most obvious advantage of ATS operation to the Broadcaster is the relaxation in operator requirements, a careful analysis reveals many other advantages.

The Automatic Transmitter Operator monitors and adjusts, if necessary, the station's power every minute of the broadcast day. Most stations now schedule this adjustment only once every three hours. Use of ATS assures power within 1% of licensed value throughout the broadcast day.

Modulation is continuously controlled by the Automatic Transmitter Operator to be at the maximum legal level. Without ATS, most stations adjust modulation only at maintenance periods, and cannot take full advantage of the new rules provisions for maximum modulation. Maximum loudness, without distortion-causing overmodulation, is assured by use of the Automatic Transmitter Operator.

Many stations presently have the announcer operate the transmitter. Time spent by the announcer taking meter readings, writing logs, making necessary adjustments, etc., can distract him from his job as a performer. With ATS, the only time that the announcer needs to pay attention to the transmitting system is in the event of a failure, to call the maintenance engineer.

Often, the reverse of this problem exists...the announcer pays little or no attention to the transmitter, allowing the power to vary below what is desired for maximum coverage, or above the legal limit, leaving the station exposed to a possible violation. ATS also cures this problem, by maintaining power, modulation, and the proper mode of operation automatically, without attention from the operator.

Thus, ATS releives station management of worrying about several of the most common violations of FCC rules...overpower operation, overmodulation, missing, late, or incorrect transmitter log entries, and operation past licensed hours or with the wrong power.

The new Automatic Transmission System rules are not unattended station rules. The FCC still requires somebody to be present, and to sign an operating log. However, this person only needs to have a restricted permit; no third class license is required. The restricted permit is obtained by filling out a card and mailing it to the FCC. No test is required, and the permit is good for life.

This simplification of the operator rules allows some additional advantages for a station using ATS:

Currently, when hiring an announcer or operator, a station must not only be concerned with how well the person can do the job, but also with whether he or she holds the proper FCC license. The third-class endorsed license has proven quite difficult for some to obtain. ATS allows hiring on the basis of qualifications alone.

This could prove especially important for minority hiring. Since many minority applicants have not previously held a position in the broadcast industry, they do not have the third-class endorsed license. With an Automatic Transmitter Operator, this need not be a concern.

As ATS becomes the most popular way to operate a station, finding people with the third-class endorsed license will become more difficult, and a station without ATS will experience increasing difficulty in hiring.

Another advantage to some stations will be the ability to use personnel such as salesmen and management to operate the station during emergencies. Often, this is not possible at the present simply because these people do not hold the third-class endorsed license.

An Automatic Transmitter Operator will free personnel from a specified operating point. Currently, the operator must be stationed at the control point, in view of either the transmitter or the remote control equipment. With ATS, the operator may be anywhere in the station, as long as he or she can monitor the off-air signal and alarms, and respond to EBS alerts.

Stations with program automation may consider assigning nontechnical personnel, such as the receptionist, to monitor the station. Their only transmitter duties would be to sign the operating log, respond to EBS alerts, and, in case of an alarm from the Automatic Transmitter Operator, to notify the station's maintenance engineer.

The ATS rules require only monthly maintenance logs for stations operating with ATS. With this reduction, transmitter maintenance may be performed when needed, not merely because the FCC requires that a weekly log be taken.

All stations with an Automatic Transmitter Operator will thus be able to more efficiently schedule routine transmitter maintenance. For ATS stations with remote transmitters, that difficult trip to the transmitter in miserable weather just to get that maintenance log will be unnecessary.

Stations with contract engineers may find that a more

thorough inspection and maintenance routine monthly will be more beneficial than a cursory weekly inspection. With the Automatic Transmitter Operator watching the shop, if there is a real problem, the operator will be notified to call the engineer.

Any Automatic Transmission System (ATS) has the following basic functions:

1. Monitor and control power
2. Monitor and control modulation
3. Automatically change power levels or sign off the station at the appropriate times, if specified in the station's license.
4. Send certain required alarms to the control point.
5. Shut off the transmitter in case of certain specified failures of the transmitter or the ATS system.

ATS operation is currently permitted for all FM stations and for nondirectional AM stations. Directional AM stations and TV stations are not currently permitted to operate with ATS. Rules permitting ATS operation for directional AM's and TV's have been promised for December 1977.

The Widget Works' trademark for its ATS system is The Automatic Transmitter Operator, currently available to control FM stations and nondirectioal AM stations. For the technically minded, a thorough description of many of the major functions of The Automatic Transmitter Operator is included in this manual.

SUMMARY OF ATS RULES

In order to operate under the ATS rules, a station must have installed certain equipment to meet the rules. This equipment must:

1) Monitor and control power. If power falls below the legal minimum, an alarm must be sent to the ATS attendant. If power goes above the legal maximum, and the ATS equipment is unable to lower it to within legal limits in three minutes, the station must be turned off.

2) Monitor and control modulation. Specific rules are added defining maximum legal modulation. Existing rules concerning minimum legal modulation must continue to be met. If excessive overmodulation continues for three minutes, the station must be turned off.

3) Send aural, and, optionally, visual alarms to the monitor and alarm point. These alarms must include a low power alarm, an alarm to indicate failure of modulation or carrier, and, unless visual tower light observations are made daily, an alarm for tower light failure. If visual alarms are provided, the aural alarm may be turned off after it is noted. Other alarms may be provided if they can be distinguished from the required alarms.

4) Automatically change power levels or sign off the station, if required, at the times specified in the station's license.

5) Shut off the transmitter if:

power continues to exceed 105% of licensed value for three minutes.

excessive overmodulation continues for three minutes.

the mode switching clock, if required, fails for three minutes.

the transmitter cannot be turned off from the monitor and control point for three minutes.

the alarm functions fail for three minutes.

the required ATS samples fail for three minutes.

6) A limiter must be provided in the input to any FM SCA.

The Automatic Transmitter Operator meets each of these requirements, except for providing the FM SCA limiter. Since the requirements vary in detail from station to station, each will be described seperately in this manual.

POWER CONTROL

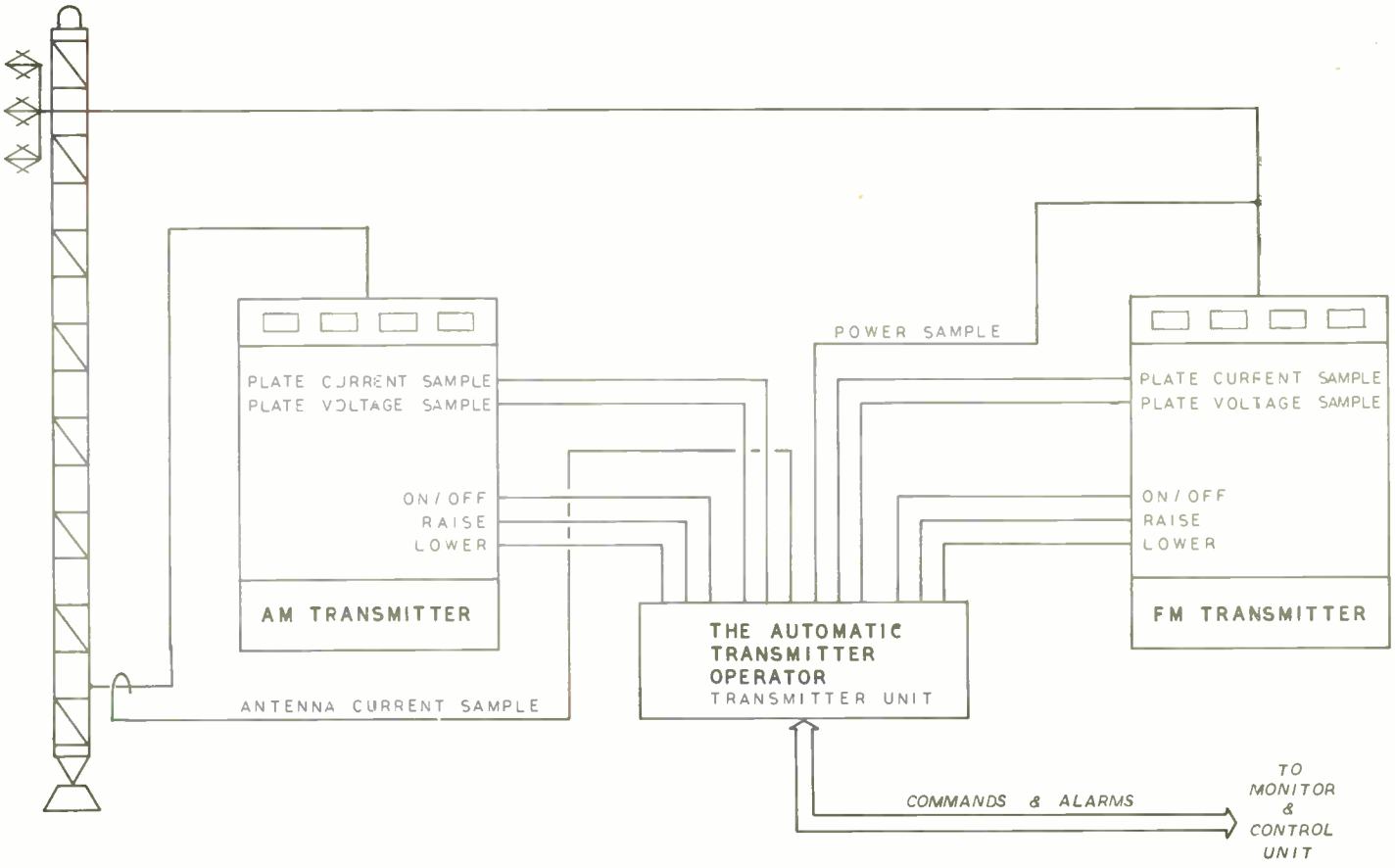
The ATS rules require that a station's power be monitored and controlled by the ATS equipment. The existing rules regarding power levels are retained, so power must be within the range of 90%-105% of licensed power at all times. If power goes above 105% of licensed power, and remains at that level for more than three minutes, or more than three samples of power, the station must be shut off. If power goes below 90% of licensed power, an alarm must be sent to the monitor and alarm point.

FM stations may use either the direct method or the indirect method to determine power. Most now use the indirect method, since it requires less equipment than the direct method. AM's now use the direct method, except during antenna repairs or construction, when they are required to use the indirect method. An editorial error in the ATS rules fails to allow AM ATS operation using the indirect method, but this will be changed to allow use of the indirect method in the same circumstances as it is now used for non-ATS operation.

The Widget Works' Automatic Transmitter Operator operates using either the direct method or the indirect method of determining power, selectable for each transmitter controlled by the system at the flip of a switch. This allows AM's to continue ATS operation even during periods of antenna construction when it is necessary to use the indirect method, and allows FM's to operate using either the indirect method, which does not require the purchase of expensive power-measuring equipment, or the more precise direct method.

Refer to Figure 1. Samples of the plate voltage and plate current from the transmitter are applied to the Automatic Transmitter Operator's inputs. Also, for FM's which use the direct method, a sample of the forward power in the transmission line, as measured by the power metering device supplied with the transmitter, is connected to the input of the ATS controller. For nondirectional AM's, a sample of antenna current from the antenna circuit, just ahead of the antenna ammeter, usually DC from the station's existing remote antenna ammeter, is connected to the controller.

Once a minute, the processor causes the appropriate samples to be connected to the analog to digital converter in the ATS unit. The result of this conversion is then calibrated, using the information stored during the calibration proceedure. This number is then converted into a number representing the output power of the station, using the appropriate formula for the type of station and mode of operation. This number is then compared to the station's licensed power for its current mode of



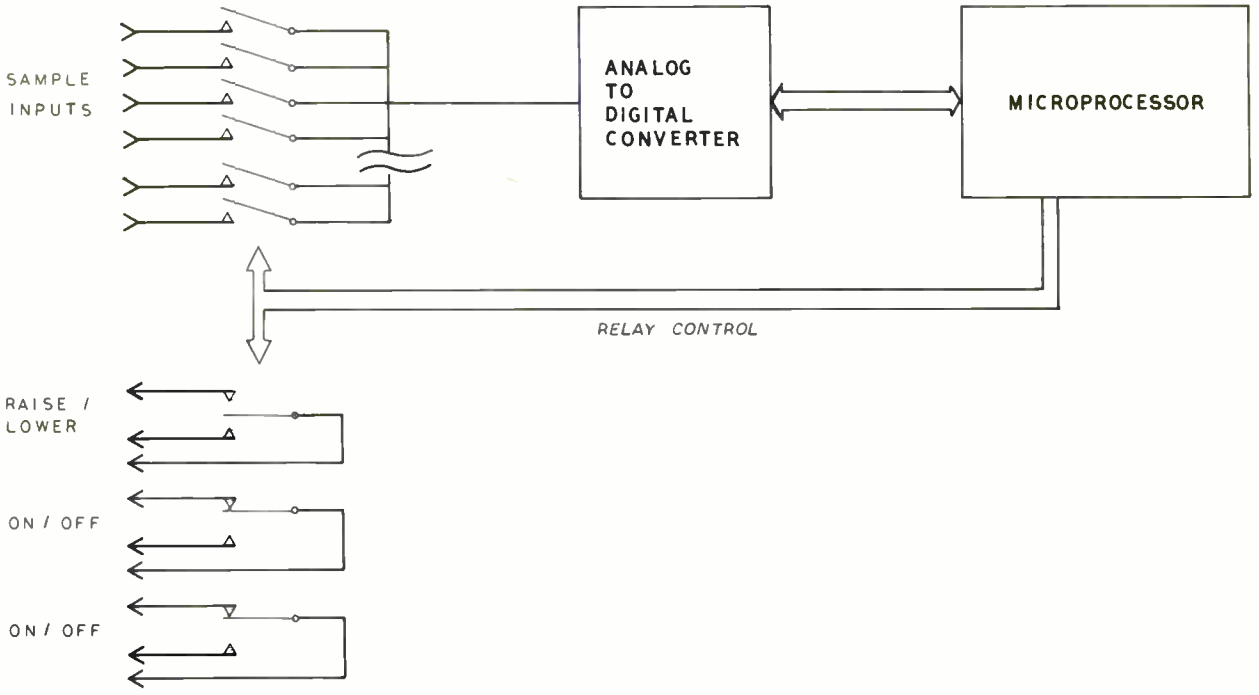


FIG 1

operation.

If the power is within the legal power limits, the timer indicating correct operation of the station is refreshed. If power is within 1% of licensed power, no other action is taken. Otherwise, the raise or lower contacts of the ATS controller are briefly closed, to bring the transmitter back to correct power. If an attempt to lower power is made, and the power does not drop, an alarm is sent to the monitor and alarm point to provide an advance warning of a possible shutdown condition.

The length of time that the contacts are closed is determined by a user-adjustable monostable. This is set so that the power will be raised or lowered by approximately 1% of licensed power each time that the computer determines that it is necessary to adjust power.

At each sample time, the internal timer representing operation within legal limits is checked. If power has been more than 105% of licensed power for three minutes, the station is shut down. If power has been below 90% of licensed power for three minutes, an alarm is sent to the monitor and alarm point.

MODULATION CONTROL

For the first time in the history of broadcast regulation, the new ATS rules provide a precise definition of how modulation control is to be accomplished, and of what constitutes overmodulation. These rules will apply to all stations, both ATS and non-ATS.

The rules specify two levels of action for ATS control of modulation, and strongly imply a third level of action, without specifying how it shall take place. The first level is the conditions which require the audio input to the transmitter to be reduced, reducing modulation. The second level specifys the conditions which constitute illegal overmodulation, and require the station to be shut off until remedial action is taken. The third, uspecified level, is that of restoring input levels which have previously been reduced, so that the station operates at a high level of modulation, and meets the FCC rules regarding minimum levels of modulation.

Except for the first level of action, that of reducing modulation, the rules are identical for AM and FM stations, so no reference to the class of station will be made, except where necessary in the description of level one.

For the purposes of clarity, let us define some terms. A "burst" of overmodulation will be the FCC-defined condition where high modulation is detected. This is not necessarily an illegal condition. A "mod reduce" is the FCC-defined requirement to reduce modulation because of an excessive number of "bursts".

Level one of the rules specifies the conditions requiring a reduction of modulation. The output of the transmitter is to be monitored to determine modulation, and each time that modulation exceeds 100% for an FM or 100% negative for an AM, an occurrence of overmodulation has happenned. Further over-modulation within the following 5 milliseconds may be ignored. Each of these occurrences is called a "burst" of overmodulation. If ten or less bursts occur within a one-minute period, no action need be taken. However, if more than ten bursts occur within a one-minute period, the audio input to the transmitter must be reduced. This action is called a "mod-reduce" by the Widget Works.

For AM stations only, the output of the transmitter must also be monitored for any occurrences of 125% positive modulation. Again, the 5-millisecond rule applies...after one 125% positive peak has been noted, any others within 5 milliseconds may be ignored. However, each 125% positive burst requires an immediate "mod reduce". There is no count of ten allowed for excessive positive AM modulation.

The rules require a shutdown of the station if excessive modulation levels continue uncorrected for a period exceeding three consecutive minutes. This is the second level of control. If an inspector monitoring the station finds excessive modulation continuing for more than three consecutive minutes, and the station remains on, a citation will be in order.

The third, implied level of control is that of bringing the level of modulation up if it is lower than required. The existing rules concerning minimum levels of modulation remain in force for ATS stations, but it is left up to the person designing the ATS equipment to determine the exact method for determining when to increase modulation.

The Widget Works implements modulation control as follows: The audio output of the station's modulation monitor is sampled to determine the instantaneous level of modulation. (This is the composite output in the case of FM stations, and the "test" or "proof" output in the case of AM's.) If modulation exceeding 100% (100% negative for AM's) is detected, this fact is noted by the computer of the Automatic Transmitter Operator, and stored in memory. If, at any time, more than ten bursts have been detected within the past minute, a "mod reduce" command is issued. Additional bursts within the same one-minute period cause additional mod-reduce commands to be issued. The method used to check the number of bursts is what we describe as a "floating window", a method which guarantees that any time that more than ten bursts have occurred within the past minute, a mod reduce command will be issued. Simpler systems with fixed windows may miss conditions which should cause a mod reduce on occasion.

Any occurrence of a 125% positive burst causes an immediate mod reduce command to be issued.

To implement the second level of the rules, the Automatic Transmitter Operator checks for the frequency of occurrence of the mod reduce commands. If these commands are generated more than once per minute, for more than three consecutive minutes, the system causes a failsafe shutdown.

To prevent these shutdowns from occurring except in the case of a major failure of the station's modulation control equipment, if the system determines that a condition requiring a failsafe shutdown is approaching, it goes into a "panic" mode, where modulation is reduced four times as rapidly as it would otherwise be, so that it becomes extremely improbable that normal variations in modulation control equipment will ever cause a transmitter shutdown.

To prevent interfering with the normal gain-control

action of the station's audio processing equipment, a completely seperate method is used to control modulation increases. The station specifies the desired time-constants at the time of ordering the Automatic Transmitter Operator. Let us assmue that these values are 95% modulation and 30 seconds. The system then checks for the absence of at least 95% modulation for a period of 30 seconds, and if this condition occurs, input level is increased by one step. This provides a condition where the ATS equipment will find a level which meets the rules, and maintain this level as long as the transmitter, limiting equipment, and program source do not change significantly. If a change occurs, the new attenuation is rapidly determined, and then maintained.

The actual control of modulation is done just prior to the input to the transmitter, or the stereo generator for FM stereo stations. A resistive attenuator, consisting of fixed resistors switched in and out of circuit by commands from the processor. Since there is no active circuitry added to the audio path, no significant noise, distortion, or frequency response errors occur in the circuit. By controlling the audio prior to the stereo generator, no undesirable effects on pilot level occur.

Since the Automatic Transmitter Operator has a computer both at the transmitter site and at the control point, there is no problem with FM stereo stations with composite STL's, and the stereo generator located at the studio. In this case, the audio is controlled at the studio, just before the stereo generator, under control of the studio computer.

The station's modulation monitor must be connected to the Automatic Transmitter Operator so that the system may know the current modulation level. The permitted location of the modulation monitor varies with the type of station. AM's should generally have the monitor located at the transmitter, since, as John Reiser of the FCC has said, "...atmospheric noise, and co-channel or adjacent channel interference will affect the accuracy of off-air AM modulation measurements." For stereo FM stations with composite STL's, the monitor must normally be located at the studio to provide modulation control at the studio. (There can be exceptions... contact the factory if you find this necessary.)

For all other FM's, the monitor can be located either at the transmitter or at the studio, as desired for operation of the station.

While The Automatic Transmitter Operator is not sold as a device to provide "super-modulation," experience has shown that in many cases, a net increase in modulation does occur with the use of ATS. The Widget Works feels certain that the use of The

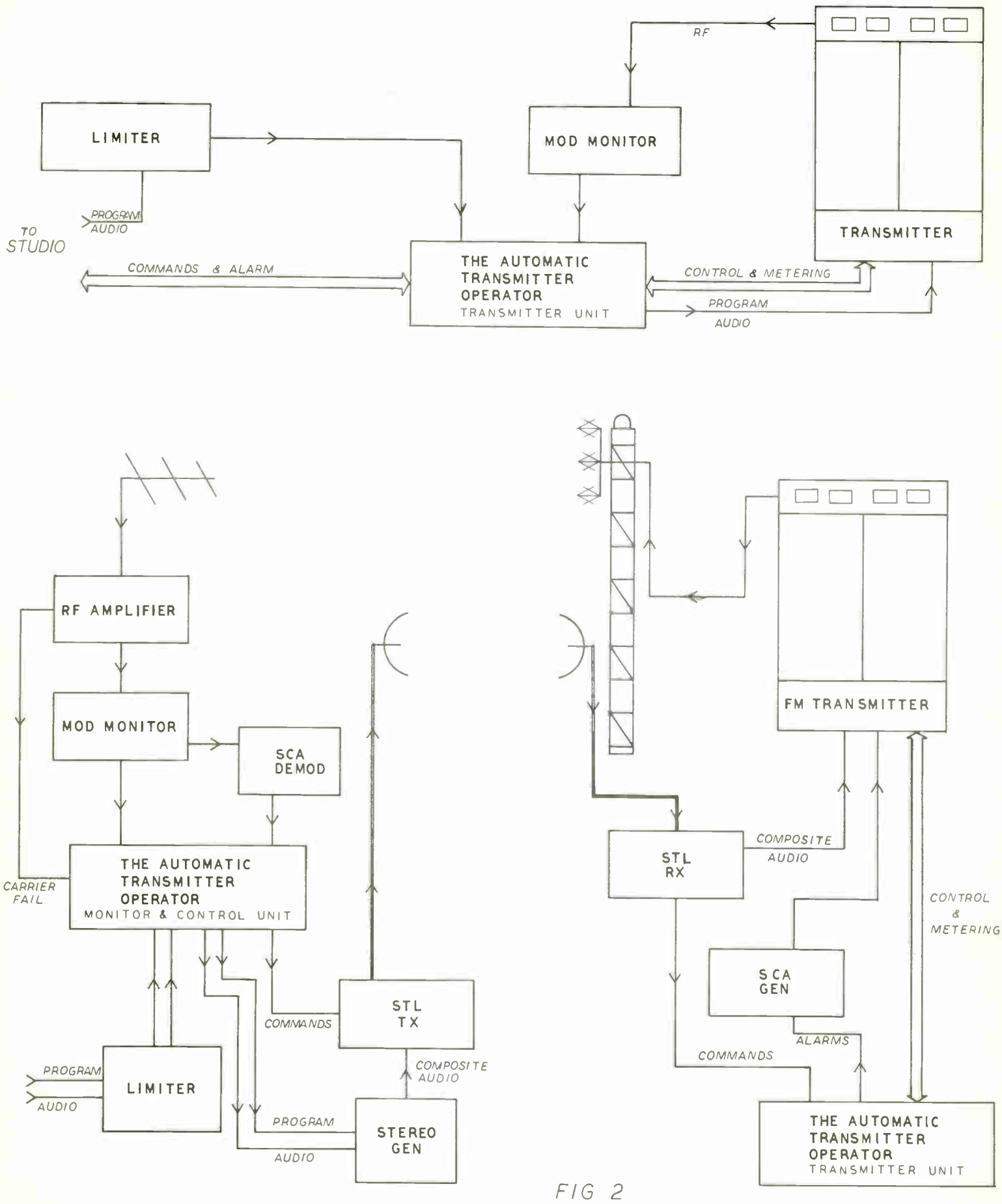


FIG 2

Automatic Transmitter Operator will not reduce your present, legal level of modulation.

Figures 2 and 3 show the various configurations for modulation control.

Note--For stations with Optimod, a Dolby port must be installed in the Optimod so that the ATS control can be provided at this point. The Dolby port is available as a simple field-installed option from the manufacturer of Optimod.

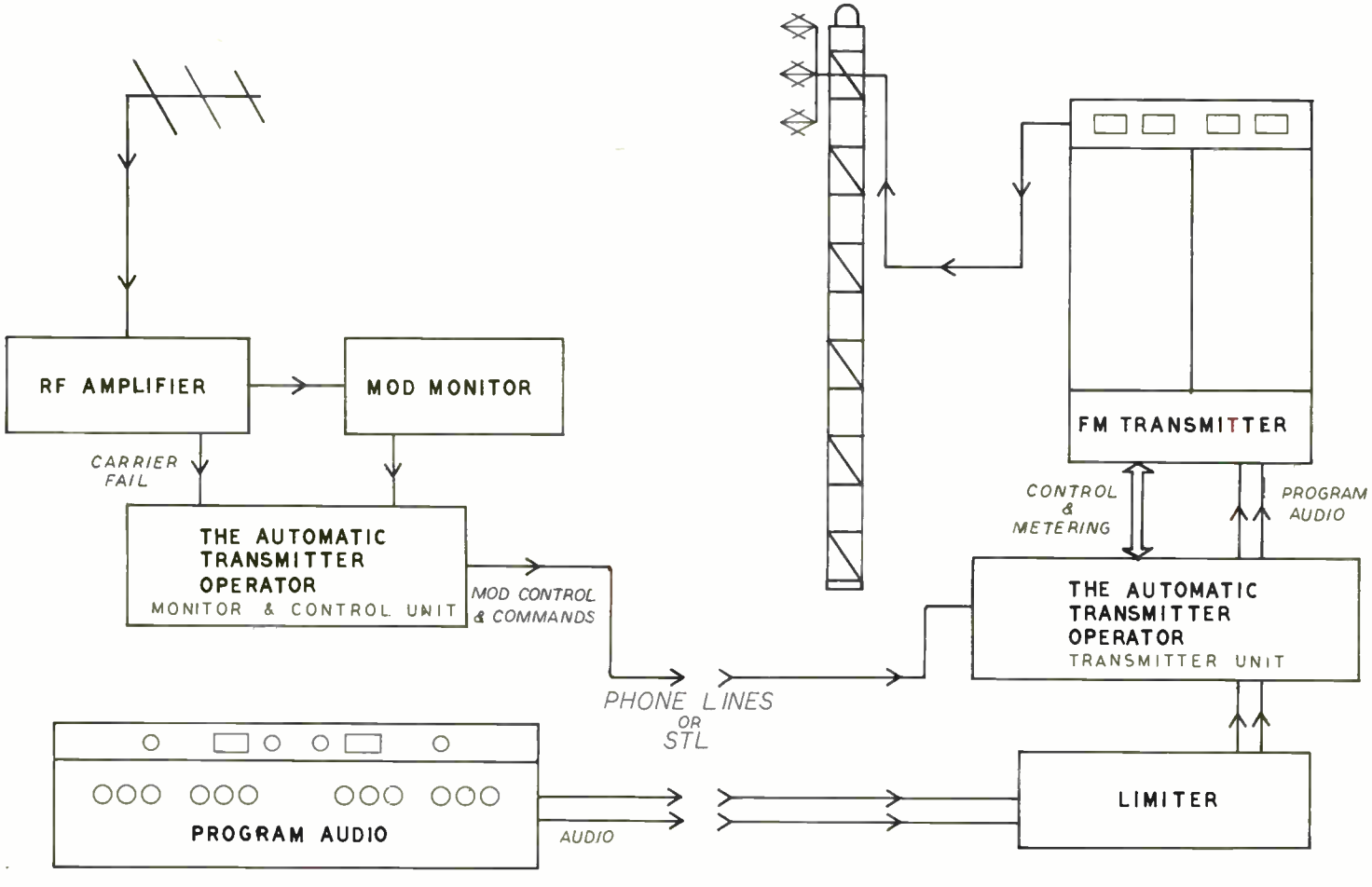


FIG 3

COMMUNICATION FOR REMOTE CONTROL AND SPLIT SITES

The concept of ATS suggests that there will be equipment to provide transmitter control, and equipment to provide the person responsible for the transmitter with a means of supervision and control of the system. These two functions are logically separate, and in the Widget Works' Automatic Transmitter Operater, they are physically separated. The Automatic Transmitter Operater consists of two pieces of equipment, a transmitter control unit, and a monitor and alarm unit. These two units may in some cases be located side by side, or they may be separated by a distance of a room or two, or they might be separated by many miles. In any case, there must be a path for two-way communication between the two units, so that the transmitter unit can be aware of the commands being issued by the attendant at the control point, and so that alarms can be provided to the attendant by the transmitter unit, to indicate faults in the transmitting system.

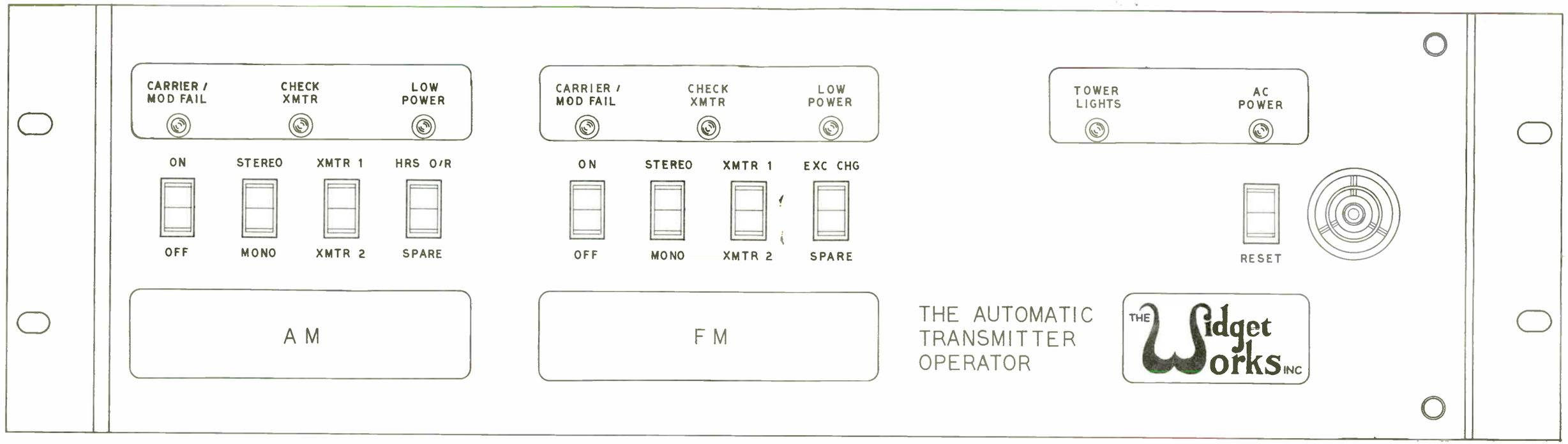
If the control point and the transmitter are located within 500' of each other, a simple hard-wire link between the two units will satisfy the communication requirement. If they are further apart, more complex communication paths must be used, at additional cost. This is the "remote control" charge on the price list.

Some stations have two different transmitter sites. ATS control for this type of station requires two seperate transmitter units. This is the "split site" charge on the price list.

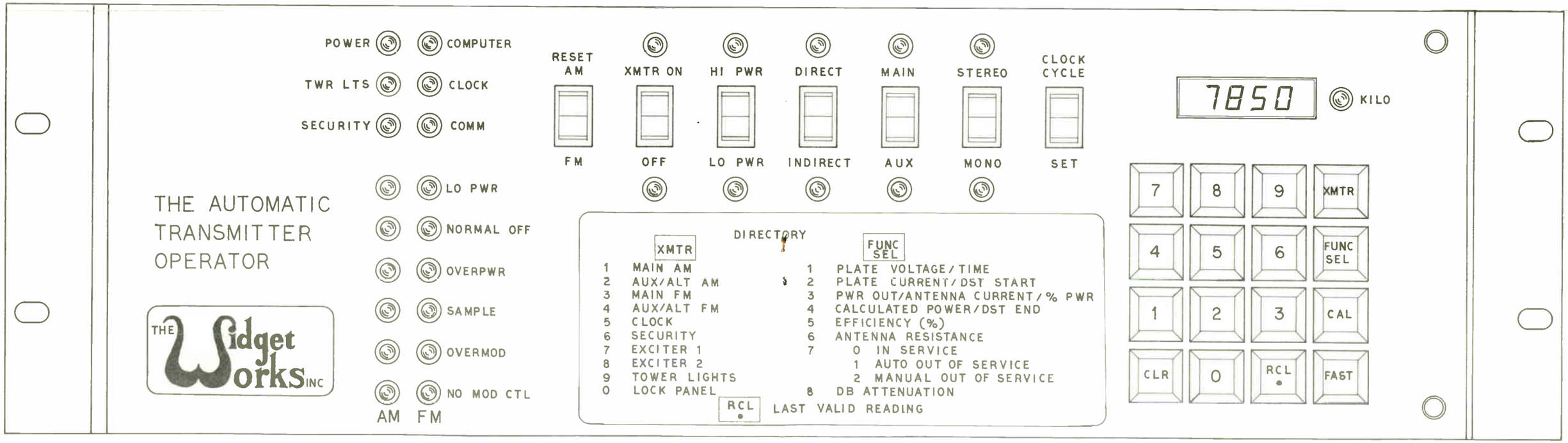
The ATS rules require, in essence, that each of the two communication paths, from the control point to the transmitter, and from the transmitter to the control point, be designed so that a failure in the path will shut down the station. Previous radio remote control rules have required a fail safe link only in the control-point-to-transmitter direction. The communications package included with the Automatic Transmitter Operator provides the communication in both directions, and also provides the fail safe control for the two links.

Over the years, with remote control of radio stations, many different methods of communication between studios and transmitters have developed. To provide compatibility with as many of these methods as possible, the Widget Works provides an option of four different communication modes from the control point to the transmitter, and three different modes from the transmitter to the control point.

The first method of communication, in each direction, is a short, local hard-wire link. In this method, data is transmitted in each direction over a separate pair, with TTL



MONITOR AND CONTROL UNIT



TRANSMITTER UNIT

TIMECLOCK

The ATS rules require that AM stations which are required by their license to sign off at sunset or to change power must have this action controlled by a timeclock. They continue to establish rules for the accuracy of this clock, when it must be set for the new month, and require a fail-safe shutdown of the station if the clock fails.

The Automatic Transmitter Operator provides this clock, when required, by using an integrated circuit originally designed for use in a digital calendar watch. This circuit provides not only the correct time of day, but also the date and month. A complete copy of the sunrise and sunset times specified in the license is included in the memory of the Automatic Transmitter Operator. Using this information, the unit is able to control the hours of operation and power, without any outside help required, except for the required monthly accuracy check, a yearly entry of the date that daylight savings time begins and ends (for stations with PSA's), and a correction once every four years for leap year.

The clock's power supply is backed up by a battery, so that if there is a power failure, the clock will remain on time. During normal operation, the processor checks the operation of the clock, using a seperate internal time base, to provide failsafing if the clock fails.

levels. Specifications limit the maximum distance with this method to 500'. This method is normally used only by non-remote stations.

The second method, in each direction, uses an audio (voice-grade) path between the two units. The standards used for this are those of the widely adopted Western Electric 103 Dataset. This protocol will operate on any standard voice-grade telephone pair. Only a single, bidirectional line is required.

This same method is used when the station provides a voice-grade path between the two sites over a radio link. It may be used in both directions, or may be combined with one of the other methods for unidirectional operation. For this type of operation, the send and receive terminals are brought out separately.

The third and fourth methods of control-point-to-transmitter communication both use a subcarrier on the station's STL. For the third method, this is a subcarrier centered at 24 khz, for use with a mono STL or dual-stereo STL's. For the fourth method, the subcarrier is centered at 94 khz, for use with composite STL's.

The third method of transmitter-to-control-point communication is a subaudible return, either on the main carrier for AM's, or on a subcarrier for FM's. Using this method, a low-level, low frequency tone is added to the audio already present, with the input level reduced so that no overmodulation occurs. This tone is present only when needed, such as when an alarm is actually being transmitted to the control point. When the path is no longer required, the tone is removed entirely, and program modulation is restored to full level.

Subaudible communication requires special methods to provide a fail safe path, so that a continuous subaudible tone is not required. The FCC has approved ATS installations using the Widget Works' equipment with subaudible return. Options such as a CRT readout at the control point are not available with subaudible return, as too much information must be passed along this limited communications path with these options.

All communication uses a modified asynchronous format, eight bits plus parity. All except TTL use frequency-shift keying, with the idle, or marking state the higher frequency.

FAIL SAFE CONTROL

While the concept of turning off a station's transmitter is abhorant to any devoted broadcaster, in the interests of protecting other stations from interference caused by a station with technical problems, several conditions are specified in the ATS rules which require a fail safe shutdown.

The basic design principle of the Automatic Transmitter Operator is to avoid in any legal way possible the conditions which would require a fail safe shutdown. For instance, the modulation control system includes a "panic" mode to rapidly reduce modulation if it appears likely that a fail safe shutdown may be required without this action. Additional warnings are provided in the power control system to alert the station to possible overpower conditions which the system cannot correct.

However, it is not in the interest of the station to completely avoid these shutdowns. A good transmitter engineer would manually turn off the transmitter in the event of most of these problems, with or without an ATS system. Therefore, the Automatic Transmitter Operator performs a thorough check on all of the required fail safe shutdown conditions, and several additional ones, to assure the licensee of the station that if the station is on the air, it is running legally and properly.

The required fail safe shutdowns all occur in the event of the FAILURE of certain portions of the equipment to work properly. Since it is not a very reliable concept to expect a piece of equipment which has failed to report on itself that it has failed, the system instead checks for proper operation of the individual portions of the system, and if it determines proper operation, timers are set allowing continued operation for a certain period of time. If these timers do not continue to get set, they time out, and cause the station to leave the air.

Most of these timers are actually portions of the program executed by the computer. Since the failure of the computer would invalidate the meaning of these timers, the computer is required to self-test itself ten times a second, and upon completion of a successful self-test, it sets a timer which is a physical device outside the computer. Should this timer time out, the station is also shut off.

One of the self-tests that the computer does is to actually test its ability to force the transmitter to turn off, by turning off the control relay momentarily. The output of the relay driver is then monitored to see whether it has actually turned off, and if it has, the relay is turned back on, and the test continues. Otherwise, a seperate circuit turns the

transmitter off when it times out. All of this happens so rapidly that the relay never has time to drop, so the transmitter never knows that the test is happening.

Since this entire sequence of self-tests occurs ten times a second, and since the calculated probability of a defective unit succesfully completing the self-test is less than one part in a million, no additional provisions are made for routine testing of an operating unit. Indicators are provided to show that the self-test is actually being executed.

The conditions which are specifically tested are:

1. Overpower
2. Overmodulation
3. Mode clock, if required
4. Communications from monitor and alarm point
5. Ability to communicate to monitor and alarm point and proper indication of all alarms
6. Required input samples, including modulation and carrier to modulation monitor, and off-air receiver if off-air communications are being used.
7. Computer in both units
8. Memory in both units
9. Fail-safe relay driver for each transmitter
10. Analog-to-digital converter

This thorough self-testing of the unit provides the licensee of a station using the Automatic Transmitter Operator with a high degree of assurrance that the station is always meeting the rules regarding transmitting system operation.

MONITOR AND CONTROL UNIT

The monitor and control unit of the Widget Works' Automatic Transmitter Operator is designed to provide a simple, easily understandable control panel for the ATS attendant. Since the transmitter may be operated with nontechnical personnel, using ATS, the operation of the panel has been designed to be intuitively obvious, and not to require a great deal of training.

Since the Automatic Transmitter Operator can independently control two stations (as an AM-FM combination), there are two groups of controls. For each station, there are four switches, controlling transmitter on-off, stereo-mono, transmitter select (for stations with alternate or auxiliary transmitters), and a spare position.

The on-off switches also provide filament control for each station's transmitter. For AM's, there is also a switch overriding the timeclock to allow emergency operation with daytime facilities outside normally licensed hours. This switch is protected against accidental operation. For FM stations, an exciter change switch is provided.

Three alarm indicators are provided for each station. Two of these, low power and carrier/mod fail, are required alarms. The third serves a combination of functions, and is intended to alert the station of a problem requiring transmitter maintenance in advance of the time where it threatens a shutdown. An external circuit at the transmitter, provided by the customer, will cause this third indicator to blink, to provide an indication of unauthorized entry, over-temperature at the transmitter site, etc.

In addition, each monitor and control unit has a common indicator for tower light failure, and an AC line indicator, which flashes if power to the monitor and control panel has been interrupted. There is an audible alarm which is sounded when any of the alarm lights come on. The audible alarm may be silenced by the ATS attendant once the alarm has been noted, but the visual indicator will stay on until the problem is corrected.

In addition to the communication and control circuitry, there may be circuitry for modulation control and detection, as required by the system layout. The monitor and control unit contains a full microprocessor and associated memory.

If the optional remote-premise control is ordered, circuitry is provided in the monitor and control unit at the studio to provide limited control of the station's automation

equipment from the remote site. This is provided largely for EBS conditions, or to allow "panic" switching in the event of a program automation failure.

If the CRT option is ordered, interface circuitry for the CRT display is contained in the monitor and control unit.

The house monitor option, if ordered, is also located in the monitor and control unit. In this case, the monitor and control unit is located at the studio of the station, and house monitor audio, at line level, is passed through the unit, which adds audio from the station's EBS receiver and the alarm tone from the ATS unit to the house monitor audio. This allows the ATS attendant to monitor the station using the station's existing house monitor facilities from anywhere in the station that they may reach.

TRANSMITTER UNIT

The transmitter unit of the Automatic Transmitter Operator includes the circuitry to control the station's transmitter and, normally, the modulation control circuitry. This unit is designed to interface to any broadcast transmitter which has motor-driven power controls and DC samples of plate current, plate voltage, and antenna current or output power available. Most modern transmitters include all of these samples, and either include, or have available, a power-control motor.

Modulation control is provided by a stepped resistive pad, directly controlled by the microprocessor, to eliminate any noise, distortion, or frequency response errors.

All transmitter controls are relay-driven, with 2-amp, 120-volt relays. The contacts are SPDT, and may be strapped to be either latching or momentary.

The microprocessor and associated memory, the analog to digital converter, and the time clock, if required, are also included in the transmitter unit. All memory is provided with battery backup, to retain memory in the event of a power failure. If the parameter logging option is ordered, circuitry for this is also included in the transmitter unit.

There are three groups of items on the front panel of the transmitter unit...status indicators, mode controls, and calibration controls and the readout. These give the maintenance engineer complete control over the operation of the ATS unit and the station, provide indications as to the current condition of the transmitting plant, and provide convenient means of calibrating the ATS unit to the transmitters and verifying calibration.

To prevent unauthorized personnel from altering any of the calibration controls on the ATS unit, all controls are "locked" by the microprocessor until an authorization code is entered on the keyboard.

The status indicators indicate any problem which has shut down the transmitting system. These include such indicators as overpower, overmodulation, communications failure, etc. Also provided are indicators for low power, AC power failure, and tower lights failure, to allow the maintenance engineer to know the status being displayed at the alarm and control point.

The mode controls select the mode of operation of the ATS unit for each transmitter being controlled. These include controls to turn the transmitter on and off, select high or low

power, select stereo or mono, and to select direct or indirect method of determining power. These controls all work separately on each transmitter, with the transmitter selected by the keyboard. Also included in this group are switches to reset the ATS unit, and clear any shutdown condtions, and to calibrate the timeclock.

The keyboard and digital readout provide means of calibrating the ATS unit to the transmitters being controlled, and also provide retained readings in case of a transmitter failure, and several miscellaneous functions. Using the keyboard, plate voltage, plate current, and power can be calibrated for each transmitter, as well as the setting of the tower lights sample and the user-defined input to the ATS unit.

The keyboard also enables the calibration of the clock, using a switch in the mode controls. Available for observation using the keyboard are the power calculated by the unit, and the attenuation of the modulation control section of the ATS. Efficiency and antenna resistance are set using the keyboard, as well as the start and end dates for Daylight Time each year.

Using the keyboard and display, it is also possible to observe the status of each piece of equipment controlled by the ATS unit in a multiple transmitter or multiple exciter installation. If the ATS unit detects a problem with a transmitter and switches to the other transmitter, it will lock out of service the defective piece of equipment, and indicate this problem with a light at the studio. The maintenance engineer may then check the status of each piece of equipment to determine which one was locked out. If the engineer takes a piece of equipment out of service, he may inform the ATS unit of this by using the keyboard, so that the ATS will not attempt to switch to a defective transmitter or exciter.

In the event of a transmitter failure, or a condition which causes the ATS unit to shut down the station, the last valid readings on each transmitter are retained in memory, and may be observed by the maintenance engineer to aid in diagnosing the problem.

Although initial rough calibration is done using a multi-turn trimmer, routine calibrations of the transmitter parameters are done by selecting the reading to be calibrated, and comparing the reading on the display of the ATS against the reading on the transmitter meter. If these two readings are not in agreement, calibration may be done by entering the observed transmitter reading on the keyboard, and pressing the "CAL" button. The processor then takes care of the mechanics of calibrating the unit to the transmitter.

For AM stations, the rules require that readings be taken "without the effects of modulation." Circuitry to accomplish this is built into the unit, but it may be disabled for quick calibration by pressing the "FAST" button.

Connections to the station's equipment are all brought out to the back panel of the unit. Most transmitter controls and samples are connected with a single ribbon cable for each transmitter. Since the relay contacts may be strapped into either momentary or latched configuration, and a full SPDT set is available for each relay, this provides a simple interface to the transmitter. Miscellaneous connections for the unit, such as tower lights, audio, etc., are connected to terminal strips on the back panel of the unit. Composite audio from the FM mod monitor, if used at the transmitter, and composite audio from the STL, if used, are connected to BNC's on the rear panel. AC power is brought in through a fused, voltage selecting connector, which also provides line filtering to the unit.

The input voltage samples to the ATS unit may be anywhere in the range of from 1 to 10 volts, positive or negative, no more than 100 volts from ground. These sample inputs are fully floating.

While no equipment can totally assure protection from damage from lightning strikes, careful design has largely reduced the probable damage from any lightning strike. Various forms of protection are used, ranging from varistor protection of the incoming AC line, to use of relays for input selection, rather than FET switches. Also, all components directly connected to incoming lines are designed to be easily replacable if damaged.

CRT OPTION

The CRT readout option provides data on current transmitter operating conditions at the monitor and alarm location. The exact format of the screen, the rate at which readings are sent to the CRT readout, and the data displayed are all subject to discussion at the time the order is placed.

The CRT normally used is a Lear-Siegler ADM-3A, with 24 lines of 80 characters per line available.

It is not possible to have the CRT option if subaudible return is used to bring readings from the transmitter to the studio.

The price given in the price list is for guidance only. Exact pricing will depend on the information required to be displayed.

PARAMETER LOGGING OPTION

The parameter log option provides a hard-copy record, at the transmitter site, of the past operating conditions of the transmitting plant. Periodically, at intervals selected by the customer at the time the ATS unit is ordered, all operating parameters are printed out, along with the time of day. The printer uses standard 8 1/2 inch paper, and room is left for the records to be cut into pages and filed, if desired. A heading is printed on each page.

All readings are printed in standard engineering units (volts, kv, db, amperes, etc.) for easy interpretation. The log identifies which transmitter is on the air in a multiple-transmitter installation. If desired, a record of ATS actions can also be printed (such as power adjustments, mode switching, transmitter switching, etc.)

An electronic/dot matrix printer is used for this option. This printer has no motor which idles when the printer is not being used, providing long operating life even in an unattended environment.

The timeclock option is required for parameter logging. This is used to provide the time and date for the log and to initiate printing of the log.

HOUSE MONITOR OPTION

FCC rules say "the station employee on duty at the ATS monitoring and alarm point is not restricted to a specific duty position provided that such person can monitor the off-air program signal and alarm signal at all times. If that person is the only person in attendance at the station, that person must also be able to observe and respond to an EBS alert as required by Subpart G of this part."

The Widget Works offers an option so that the ATS attendant can be anywhere in the station and still comply with this rule. The house monitor option adds the ATS alarm tone and EBS monitor audio to the station's existing house monitor system, so that a transmitter malfunction or EBS alert can be easily noted by a station anywhere in the station.

Four independent line-level circuits are provided, allowing AM, stereo FM, and an SCA to be distributed around the building. The appropriate off-air signal is connected to the inputs of the monitor and control unit. Speaker-level audio from the station's EBS monitor is connected to its input. The unit adds the EBS audio and the ATS alarm tone to each off-air input and provides a line-level output. This audio is then amplified and distributed by the station's existing house monitor facilities.

With this option, an employee such as the receptionist, at her desk in the lobby, can recieve EBS alerts and ATS alarms while monitoring the station's off-air signal, meeting the requirements of the FCC rules.

OFF PREMISE CONTROL

Much interest has been generated concerning operating a station with ATS from a monitor and control point remote from both the studio and the transmitter, at a point such as a taxi dispatch point, an answering service, a hotel desk, or even from the General Manager's house. The ATS rules allow this type of operation, with two special requirements:

1. It must be possible to monitor and respond to an EBS condition from the control point.

2. Specific FCC authority is required to establish this type of control point.

An optional off-premise control point is available for The Automatic Transmitter Operator, designed to make it easy to implement these requirements. This option provides a duplication of the normal studio controls at a third point, along with some limited switching and status indication between the studio and the off-premise control point.

The switching and status indications are intended to provide some control of the station's program automation from the off-premise point, allowing the person responsible for the transmitter to also excersize some degree of control over the programming of the station. The only interface provided by The Widget Works is 16 lines providing TTL levels indicating switch closures at the off-premise point, and 8 lines which light an indicator at the off-premise point in response to TTL levels applied to the lines.

The station's engineer must provide and install appropriate interfacing of these lines to the station's program equipment. Some typical uses will include using these controls to initiate the EBS alert tones, switch transmitted audio to repeat a state EBS network, cause the program automation to switch out of a defective source, etc. Again, the interfaces are the responsibility of the station...only TTL levels are provided by the ATS equipment.

Anyone considering this type of ATS operation should consult their communications attorney for advice on the legal requirements of off-premise ATS.

DIRECTIONAL ANTENNAS AND TELEVISION

The following information concerning directional antennas and television is for planning purposes only. As of the date this was written, the FCC rules permitting DA and TV operation have not been released, so this information is based on proposed rules only.

AM directional operation will require an interconnection between a type-accepted antenna monitor and the ATS unit, to allow the ATS unit to monitor antenna parameters. We anticipate that this interconnection will be available for any remotable antenna monitor.

Also required will be connections to allow the ATS unit to control and monitor the switching of the directional antenna, if there is more than one mode of operation. This means that the ATS unit will do the failsafing of the pattern change, and will also control transmitter interruption during pattern change.

The preliminary rules suggested that the antenna parameters would only need to be monitored once each ten or fifteen minutes. This should allow acceptable life for the switching elements currently used in antenna monitors.

Specifications on phase and ratio tolerance, and the actions to be taken in the event of out of tolerance readings, have not yet been determined. Whatever these specifications are, The Automatic Transmitter Operator will be properly programmed to carry out the required actions, and to take advantage of any rules which allow continued operation at reduced power in the event of a fault.

We expect TV ATS will require many of the same tests and adjustments as radio ATS, with some extra control of video parameters. The proposed rules suggested controlling video by a closed-loop correction using the VIR signal. If this is followed in the rules, the Automatic Transmitter Operator will interface to a Tektronix 1440 or a similar video corrector.

We anticipate using an interactive control, allowing the studio technical director to determine whether major control actions such as isolating a defective visual power amplifier are in fact timely, or wheter these actions should be delayed to allow a spot to be completed before the control action is performed.

The use of a microprocessor allows complex logical decisions to be done by the transmitter controller, so that the correct action can be taken in response to the difficult problems of visual transmitter control.

SPECIFICATIONS

COMMUNICATIONS MODES

Local
4-wire, TTL level, not to exceed 500 feet.

Phone Line
Bidirectional, in accord with 103-type modem specifications. (Ordinary voice-grade telephone line)

Audio STL
(Studio to transmitter) Operates in the 24-kHz region, as used by most remote control devices.

Composite STL
(FM Stereo studio to transmitter) Operates in the 94-kHz region, as used by remote control devices for this type of STL.

Subaudible Return
(AM transmitter to studio) In accord with FCC rules for remote control. The subaudible carrier is on only during the time that an alarm is actually being sent to the studio, and briefly at sign-on and just before sign-off or power changes. Program level is automatically reduced while the subaudible tone is on so that no overmodulation will occur, and restored to full levels on completion.

Subaudible SCA Return
(FM transmitter to studio) In accord with FCC rules, and in accord with the more stringent FCC rules for AM subaudible return. The subaudible carrier is on only during the time that an alarm is being sent to the studio, and briefly at sign-on, and just before sign-off. Subchannel input level is automatically reduced while the subaudible tone is on so that no overmodulation will occur, and restored to full level on completion. The SCA generator must be located at the transmitter site. Demodulated SCA audio must be available at the studio.

NOTE: For any remote communication mode other than phone lines, a carrier-fail voltage must be provided at the control point. This is normally available from the modulation monitor or its RF amplifier.

MODULATION CONTROL

Demodulated audio from the output of the transmitter must be supplied to the ATS controller, usually by the station's modulation monitor. For FM stations, this must be undeemphasized, composite audio.

This audio may be supplied to either the transmitter unit or the monitor and control unit, as specified at time of order. For AM remote stations, this audio should normally be supplied at the transmitter, to eliminate undesirable propogation effects on the signal.

The audio supplied must accurately represent modulation, regardless of the station's operating power level. This is especially critical for AM's. If your present modulation monitor cannot meet this specification, a new one should be purchased.

Modulation control is performed by balanced, ungrounded, isolated resistive audio pads, inserted in the program line immediately before the transmitter or stereo generator. Impedance is nominally 600 ohms, and minimum insertion loss is 5 dB.

FM stereo stations with a composite STL require modulation control at the studio. This will normally require that the demodulated audio from the station's modulation monitor be supplied at the studio.

TRANSMITTER CONTROL AND AUXILIARY SWITCHING

2-Amp, 120-Volt relays are provided for all transmitter controls. Either momentary or continuous operation may be specified for each function. A SPDT contact is provided for each function. A continuous, normally-closed contact must be used as a failsafe transmitter shutdown control.

The transmitter must be equipped with a motor-driven power control. If this is not currently in the transmitter, it should be available from the manufacturer.

SAMPLE VOLTAGES

Sample voltages must be provided for plate voltage, plate current, and output power or antenna current. These samples may be positive or negative, anywhere in the range from one to five volts DC, and not more than 100 volts from ground. Samples of AM antenna current derived from thermal ammeters are not acceptable.

DIMENSIONS

5¼ x 19 x 16¼ inches behind rack (13,3 x 48,3 x 41,3 cm)
Allow additional room for wiring.

ENVIRONMENT

0-40 degrees Centigrade
5-95% relative humidity, noncondensing.
8000 feet (2500 meters) AMSL, maximum altitude for full ratings.

POWER

100/120/200/240 volts AC, 50/60 Hz, less than 100 watts per unit.

LIMITED GUARANTEE

The Widget Works, Inc. guarantees the Automatic Transmitter Operator to be free from defects in workmanship and materials and, when properly installed, to meet FCC rules for Automatic Transmission System controllers for a period of one year from date of delivery, as follows:

Any Automatic Transmitter Operator which fails due to defects in workmanship or materials for one year from date of delivery will be repaired free if returned to The Widget Works, Inc., in Medina, Ohio.

Any Automatic Transmitter Operator which fails to meet current FCC rules for ATS control, when properly installed, on the station for which it was originally purchased, will be updated without cost for a period of one year from date of delivery. Updating will be done either by supplying new components (ROM's) to plug into sockets in the equipment, or, if necessary to meet the rules, the equipment will be modified at the factory. Transportation costs for this service must be paid by the user. A deposit will be required to assure return of ROM's if field updating is provided.

This guarantee does not cover damage due to improper AC supply voltages, lightning, electrical transients, fire, flood, sample voltages or control contact currents in excess of ratings, improper installation, obvious physical abuse, or shipping damage. This is the entire guarantee. Consequential costs, such as the value of lost air time, extra operator expenses, costs of installation and removal, or damage to external equipment are NOT covered.

The Automatic Transmitter Operator is commonly used with equipment containing lethal voltages. Automatic control actions may cause transmitters to be turned on at unpredictable times. Maintenance personnel MUST insure that transmitters are disconnected from The Automatic Transmitter Operator and that all interlocks are functional before entering transmitters for maintenance.

The Widget Works, Inc. supplies two warning labels for each transmitter to be controlled. Failure to affix these labels to the transmitters voids this entire warranty.

Provisions have been made to quickly disconnect each transmitter from The Automatic Transmitter Operator. Persons attempting to maintain transmitting equipment without first disconnecting it from the Automatic Transmitter Operator do so at their own risk.

For further information, pricing, or to place an order, contact:

The Widget Works, Inc.
P O Box 79
Medina, Ohio 44256

(216) 336-7500

THE AUTOMATIC TRANSMITTER OPERATOR

THE Widget Works INC

3RD CLASS MAIL

E H MUNN JR AND ASSOC, INC
E H MUNN JR, PRES
BOX 220
COLDWATER, MI 49036

A PRIMER ON AUTOMATIC TRANSMISSION SYSTEMS FOR THE GENERAL MANAGER

Why do I need an Automatic Transmitter System?

In the infancy of broadcasting, running a broadcast transmitter was a major undertaking. Engineers hustled around, busy making adjustments and repairs to keep the station running. On a regular basis, the radio inspector would appear with some magical device to determine whether the engineers were succeeding in keeping the station operating within the legal limits. Nobody would even consider trying to run the station without a full staff of qualified engineers, on duty any time the station was on, and most of the time while it was off.

In perspective, in the early days of automobiles, nobody would think of venturing out on the highways without a complete toolbox, and few trips were completed without using most of the tools. Several spare tires were a necessity, along with a repair kit so that tires could be repaired as the trip slowly progressed.

In 1977, spare tires are needed so infrequently that the auto manufacturers are considering eliminating them. While nobody would suggest eliminating broadcast engineers entirely, broadcast transmitters of recent vintage run unattended for a week at a time all over the country. Until now, it has been necessary for a human operator to be present all the time, keeping a transmitter log, and making periodic adjustments to keep the station operating within the legal limits. No longer does this job fall to a fully qualified engineer, but it is usually handled by an operator with a third-class license, usually the announcer, as an addition to his regular duties.

On December 21, 1976, the FCC approved the long-awaited automatic transmission system rules to bring the broadcast industry into step with the 70's. These rules allow the transmitter to be operated by a qualified Automatic Transmitter Operator.

There must be as many different ways of running a broadcast station as there are licensed broadcast stations, so the specific advantages of an Automatic Transmitter Operator cannot apply equally to all stations. Here are some of the more important advantages:

An Automatic Transmitter Operator continuously monitors and adjusts a station's transmitter for maximum permitted modulation and full power. Most stations now schedule these adjustments once every three hours. The extra edge can make a difference in today's competitive markets.

Excess power is often wasted during certain hours of the day due to line voltage variations. By assuring no overpower operation of the transmitter, an Automatic Transmitter Operator can make a surprising difference on the electric bill. Since part of the power bill is normally figured on peak demand, this constant regulation will save one station in excess of $700 per year!

Since the Automatic Transmitter Operator constantly monitors and adjusts power and modulation, a properly installed system will all but guarantee no FCC citations for overpower operation or overmodulation!

Another common FCC violation is operators being behind in meter readings. With an Automatic Transmitter Operator, no meter readings are required... eliminating another possible citation!

Yet another common citation, and probably the most common fine for an AM station with two or more different modes of operation, is being in the wrong mode at the wrong time. Since the Automatic Transmitter Operator is a real clock-watcher, this citation should also be a thing of the past!

Overmodulation not only earns your station an FCC citation, it also causes a distorted, muddy sound. Since the Automatic Transmitter Operator helps your limiting equipment control modulation by observing audio at the output of the transmitter, and using this to control the audio going to the transmitter, these problems are also eliminated!

The new Automatic Transmission System rules are not unattended station rules. The FCC still requires somebody to be present, and to sign an operating log. However, this person need only have a restricted permit; no third class license is required. The restricted permit is obtained by filling out a card and mailing it to the FCC. No test is required, and the permit is good for life.

THE Widget Works INC

THE AUTOMATIC TRANSMITTER OPERATOR

FEATURES

- A complete Automatic Transmission System for the broadcaster.
- Complex Microprocessor Algorithm precisely follows new FCC rules on maximum permitted modulation.
- Modulation Monitor remains at studio for house monitoring and setup use.
- Modulation Control located at transmitter for all stations except stereo FM's with composite STL's.
- Operates in either direct or indirect power-measuring modes. Mode is independently selectable for each transmitter.
- Auxiliary Transmitter capability optionally available. Will automatically transfer to auxiliary if Main Transmitter fails.
- Subaudible Return is used only to inform studio unit of mode changes and alarms, typically on for less than one minute per day.
- Studio Unit designed for easy operation by nontechnical personnel.
- Routine Calibrations performed by keying in corrected readings on Calculator Keyboard ...the Microprocessor does the calibrating.
- Time-clock for AM stations requiring one includes one-day battery backup.
- No need to adjust timeclock at the end of each month ...all times specified on license placed into nonvolitle memory at the factory.
- Includes tower light provisions.
- Available as a single system to handle AM-FM combinations.
- Designed with Intel 8080-Series Microprocessors and LSI Peripherals ...the most widely accepted Microcomputer components.

• General Description

The Widget Works' Automatic Transmitter Operator™ is a complete Microprocessor based Automatic Transmission System for the control of any FM or nondirectional AM transmitter. The system is housed in two attractive rack-mounting cabinets, one for the control of the transmitter, and the other to be located in the main control room to allow turning the transmitter on and off, and to provide alarms in the case of transmitter breakdowns.

The two units are designed so that the studio unit can be easily located at a remote studio, in accord with any of the common STL's or with phone lines connecting the two units.

Once installed, the Automatic Transmitter Operator takes over full control of the stations transmitters, and, if properly installed, assures that the station operates within the appropriate FCC rules concerning power and modulation levels, modes of operation, and failsafe control, at all times.

The Automatic Transmitter Operator will operate in either the direct mode of operation, as is normally required of AM's and is occasionally elected by FM's, or in the indirect mode of operation, as the great majority of FM's currently operate, and as AM's must operate during failure of certain metering components, and during antenna construction and modification.

For stations with Auxiliary or Alternate Main Transmitters or Exciters, or with Parallel Transmitters, the Automatic Transmitter Operator will, in the event of a failure of a transmitter, automatically select the working transmitter or exciter and bring it on the air. Transmitters may also be manually selected at the studio.

The Automatic Transmitter Operator will operate an AM-only station, an FM-only station, or an AM-FM combination. Although current rules do not permit AM-Directionals to be operated by ATS, if specified at time of ordering, an FM-only Automatic Transmitter Operator installed at an FM-AM Directional Station will be upgraded to full AM-FM operation when the Commission does approve AM Directional ATS, for only the difference in the list prices of the two units.

• Studio Unit

The studio unit of the Widget Works' Automatic Transmitter Operator is designed to provide for simple interaction with nontechnical personnel who may operate the transmitter. For each station, there are four switches, to control transmitter On-Off, Stereo-Mono, Transmitter or Exciter change (in the event that the station has a alternate Main or Auxiliary Transmitter or Exciter), and, in the case of AM stations with specified hours of operation, a switch to allow emergency operation outside the specified hours. One spare switch position is provided for miscellaneous control.

The studio unit also contains Alarm Indicators for Low Power and Transmission Fail for each station, and a Common Indicator for Tower Light Fail. In addition, there is an Audible Alarm provided to call attention to the Visual Alarms. The Audible Alarm may be silenced once the alarm has been noted.

The circuitry for Modulation Detection is normally located in the studio unit, since most stations will wish to keep their Modulation Monitor at the studio location.

• Transmitter Unit

The transmitter unit of the Widget Works Automatic Transmitter Operator contains the circuitry to control the station's transmitter and, normally, the circuitry to control modulation. This unit is designed to interface with any broadcast transmitter which has motor-driven power controls and DC samples of plate current, plate voltage, and antenna current or output power available, as do most recent broadcast transmitters.

Modulation control is provided by a variable resistive pad, directly controlled by the Microprocessor, to eliminate any noise, distortion, or frequency response errors.

All transmitter controls are relay-driven, with 2-amp, 120-volt relays, and may be specified to operate most current transmitters.

For AM stations with specified hours of operation, or two different modes of operation, the time-clock for these modes is also located in the transmitter unit. The processor is programmed with the hours of operation in each mode at the time of manufacture, so no monthly adjusting of times is required.

Stations whose hours of operation are affected by Daylight Savings Time must inform the Automatic Transmitter Operator of the date of beginning and ending of daylight time each year, since Congress has recently been changing this date frequently. This may be done at any time in the year.

After installation, routine calibrations are performed with the aid of a calculator keyboard and display on the panel. The correct value of the function being calibrated is read from the transmitter's meter, and is keyed into the calculator. The Automatic Transmitter Operator then does the calibration internally, with no adjustment of controls required.

PRELIMINARY SPECIFICATIONS

COMMUNICATIONS MODES

• Local
4-wire, TTL level, not to exceed 500 feet.

• Phone-Line
Bidirectional, in accord with 103-type Modem specifications. (Ordinary voice-grade telephone line).

• Audio STL
(Studio to transmitter) Operates in the 24-KHZ region, as used by most remote control devices.

• Composite STL
(FM Stereo studio to transmitter) Operates in the 105-KHZ region, as used by remote-control devices for this type of STL.

Note: If a 67-KHZ subcarrier is generated at the studio with this type of STL, subaudible return is not available.

• Subaudible Return
(AM transmitter to studio) In accord with FCC rules. The subaudible carrier is on only during the time that an alarm is actually being sent to the studio, and briefly at sign-on and just before sign-off or power changes. Modulation is automatically reduced during subaudible metering so that no over modulation will occur, and restored to full levels on completion of metering.

• Subaudible SCA Return
(FM transmitter to studio) In accord with FCC rules, and in accord with the more stringent FCC rules for AM subaudible return. The subaudible carrier is on only during the time that an alarm is actually being sent to the studio, and briefy at sign-on, and just before sign-off. Subchannel modulation is automatically reduced so that no over modulation of the subcarrier will occur, and restored to full levels on completion of metering. The SCA generator must be located at the transmitter site. Demodulated SCA audio must be available at the studio.

• Modulation Control
Modulation is normally detected by the studio unit so that the Modulation Monitor may be located at the studio. An accurate audio sample of modulation must be provided to the studio unit, normally from the "test" output of the Modulation Monitor. For FM stations, this must be undeemphasized, composite audio.

For stations other than FM stations with a composite STL, modulation control is actually performed by resistive pads at the transmitter. These resistive pads are balanced, ungrounded, and totally isolated. Impedance is nominally 600 Ohms, and minimum loss is 5 DB.

FM stations with a composite STL require that modulation control be performed at the studio. In this case, the resistive pads are located at the studio.

• Transmitter Control
2-Amp, 120-Volt relays are provided for all transmitter controls. Either momentary or continuous operation may be specified for each function. Either normally-open or normally-closed contact may be specified for each function. A continuous, normally-closed contact must be used as a fail-safe transmitter shutdown control.

The transmitter must be equipped with a motor-driven power control. If this is not currently in the transmitter, it is normally available from the manufacturer.

• Sample Voltages
Sample voltages must be provided for plate voltage, plate current, and output power or antenna current. These voltages may be positive or negative, anywhere in the range of from one to five volts DC, and not more than 100 volts from ground. Samples of AM antenna current derived from thermal ammeters are not acceptable.

• Environment
0-40 degrees centrigrade
5-95% R.H., noncondensing

• Power
120 Volts AC, less than 100 watts per unit.

Note: For any remote communication mode other than phone-line, a carrier-fail voltage must be provided at the studio. This is normally available from the Modulation Monitor or its RF Amplifier.

THE WIDGET WORKS, INC • P.O. BOX 79, MEDINA, OHIO 44256 • 216-336-7500

THE Widget Works INC
P.O. Box 79
Medina, Ohio 44256
216-336-7500

AUGUST 23, 1978

E HAROLD MUNN
P O BOX 220
COLDWATER, MI 49036

DEAR MR. MUNN

I SPOKE WITH BILL CLEMENTS AT WMIT IN BLACK MOUNTAIN, NC TODAY AND HE TOLD ME THAT HE HAD BEEN TALKING WITH YOU ABOUT ATS FOR THE STATION, AND THOUGHT THAT YOU MIGHT NOT HAVE OUR CURRENT LITERATURE, SO I AM SENDING YOU A COPY.

FROM TALKING WITH BILL, ATS SOUNDS LIKE A REAL NATURAL FOR WMIT...ESPECIALLY IN REDUCING MAINTENANCE LOG REQUIREMENTS TO MONTHLY DURING THE WINTERTIME. I TOLD HIM THAT WE WOULD HAVE NO PROBLEMS IN MODIFYING HIS UNIT TO AUUTOMATICALLY DROP TO LOWER POWER DURING ANTENNA ICING CONDITIONS (ON THE BASIS OF THE VSWR READING). ALSO, HE WANTED THE POWER LOWERED JUST BEFORE SIGN-OFF AND RAISED IMMEDIATELY AT SIGN-ON TO PROTECT THE FINALS...THIS IS AGAIN NO PROBLEM FOR THE UNIT.

WE ALSO HAVE THE ABILITY TO COMMUNICATE OVER HIS EXISTING FACILITIES...WE CAN SEND DATA FROM THE STUDIO TO THE TRANSMITTER USING A SUBCARRIER ON HIS STL'S, AND RETURN THE DATA TO THE STUDIO SUBAUDIBLY, ON HIS EXISTING SCA.

IF YOU HAVE ANY QUESTIONS CONCERNING THE CAPABILITIES OF THE AUTOMATIC TRANSMITTER OPERATOR FOR WMIT...OR FOR ANY OF YOU OTHER CLIENTS...FEEL FREE TO GIVE ME A CALL!

SINCERELY,

Jim Beebe

JAMES C BEEBE
PRESIDENT

THE Widget Works INC

PRICE LIST #3 AND ORDER FORM
EFFECTIVE 4/24/78

P.O. Box 79
Medina, Ohio 44256
216-336-7500

Gordon DuVall, V.P. Sales
6838 North Ottawa
Chicago, Illinois 60631
312-774-5115

BILL TO: _____

SHIP TO: _____

AUTOMATIC TRANSMITTER OPERATOR (SINGLE STATION) °NON-REMOTE OPERATION	__$ 4,950	_____
°AS ABOVE, FOR REMOTE OPERATION	__$ 6,100	_____
AUTOMATIC TRANSMITTER OPERATOR (AM-FM STATION) °FOR NON-REMOTE AM-FM STATIONS °OPERATES ONE TRANSMITTER PER STATION.	__$ 6,950	_____
°AS ABOVE, WITH COMMON REMOTE SITE	__$ 8,100	_____
AUTOMATIC TRANSMITTER OPERATOR (SPLIT SITE) °WITH TWO TRANSMITTER SITES CONTROLLED FROM THE SAME LOCATION °ONE SITE REMOTE FROM CONTROL POINT °ONE TRANSMITTER PER SITE	__$ 8,950	_____
°AS ABOVE, WITH BOTH TRANSMITTER SITES REMOTE	__$10,100	_____
TIME CLOCK °REQUIRED FOR AM STATIONS REQUIRED TO CHANGE POWER OR SIGN OFF	__$ 500	_____
EACH AUXILIARY OR PARALLEL TRANSMITTER	__$ 1,000	_____
EXTENSION CONTROL POINT °PROVIDES CONTROL OF SYSTEM FROM SITE REMOTE TO MAIN CONTROL POINT.	__$ 3,100	_____
PRINTED LOG (REQUIRES TIME CLOCK)	__$ 2,000	_____
CRT READOUT (PRICE APPROXIMATE...FOR GUIDANCE ONLY)	__$ 2,000	_____
HOUSE MONITOR	__$ 250	_____
	TOTAL	_____

FOB: MEDINA, OHIO
TERMS: 1/3 DEPOSIT WITH ORDER
1/3 DUE AT TIME OF SHIPMENT
1/3 ... 30 DAYS
5% DISCOUNT FOR CASH WITH ORDER

DEPOSIT WITH ORDER _____
DUE AT TIME OF SHIPMENT _____
BALANCE 30 DAYS _____

AUTHORIZED SIGNITURE _____ TITLE _____ DATE _____

THE Widget Works INC

P.O. Box 79
Medina, Ohio 44256
216-336-7500
Gordon DuVall, V.P. Sales
6838 North Ottawa
Chicago, Illinois 60631
312-774-5115

THE AUTOMATIC TRANSMITTER OPERATOR

Price List #2 and Order Form
July 1, 1977

QTY.			PRICE
	The Automatic Transmitter Operator (includes $1000 for perpetual software license)	$4500.00	
	Timeclock	$ 500.00	
	Remote control	$1000.00	
	Each auxiliary or parallel transmitter	$1000.00	
	AM/FM combination (includes second transmitter)	$1500.00	
	Split site operation	$2000.00	
	Extension control point	$1800.00	
	House monitor option	$ 200.00	
	Printed log (requires timeclock)	$1500.00	
	CRT readout	$1700.00	
	TOTAL		
	Deposit With Order		
	Due at time of shipment		
	Balance due 30 days after delivery		

Date Company By Title

TERMS: For qualified buyers,
1/3 with order
1/3 at time of shipment
1/3...30 days
A 5% discount will be allowed for 100% cash with order

THE Widget Works INC

P.O. Box 79
Medina, Ohio 44256
216-336-7500
Gordon DuVall, V.P. Sales
6838 North Ottawa
Chicago, Illinois 60631
312-774-5115

JULY, 1977

Hi Friend

Many thanks to all of you good Broadcasters who responded to advertising of our new Automatic Transmitter Operator!

Some of you have not received our new #2 price list and order form, so here it is for all - -

QUANTITY			TOTAL
_____	Automatic transmitter Operators (Includes $1,000.00 for perpetual software license --possible tax deduction)	$4,500.00	_____
_____	Timeclock	500.00	_____
_____	Remote control	1,000.00	_____
_____	Each auxiliary or parallel transmitter	1,000.00	_____
_____	AM/FM combination, includes 2nd transmitter	1,500.00	_____
_____	Split site operation (2 transmitter sites)	2,000.00	_____
_____	Extension of control point	1,800.00	_____
_____	House monitor option	200.00	_____
_____	Printed log (requires timeclock)	1,500.00	_____
_____	CRT readout	1,700.00	_____
		Total	_____

Terms for qualified buyers
1/3 with order, 1/3 time of shipment
balance 30 days *

Deposit with order _____

Due shipment time _____

Balance 30 days _____

_____
Company name

_____
Street

_____ _____ _____ _____ _____
City State zip date signature title

_____ _____
telephone individual to contact

* 5% discount for 100% cash with order!

This simplification of the operator rules allows some additional advantages for your station:

Currently, when hiring an announcer or operator, a station must not only be concerned with how well the person can do the job, but also with whether he or she holds the proper FCC license. The third-class endorsed license has proven quite difficult for some to obtain. ATS would allow hiring on the basis of qualifications alone.

This could prove especially important for minority hiring. Since many minority applicants have not previously held a position in the broadcast industry, they do not have the third-class endorsed license. With an Automatic Transmitter Operator, this need not be a concern.

As ATS becomes the most popular way to operate, finding people with the third-class endorsed license will become more difficult, and a station without ATS will experience increasing difficulty in hiring.

Another advantage to some stations will be the ability to use personnel such as salesmen and management to operate the station during emergency conditions. Often, this is not possible at the present simply because these people do not hold the third-class endorsed license.

An Automatic Transmitter Operator will free personnel from a specified operating point. Currently, the operator must be stationed at the control point, either in view of the transmitter or of the remote control equipment. With ATS, the operator may be anywhere in the station, as long as he can monitor the off-air signal and alarms, and respond to EBS alerts.

Stations with program automation may consider assigning nontechnical personnel, such as the receptionist, to monitor the station. Their only transmitter duties would be to sign the operating log and, in case of an alarm from the Automatic Transmitter Operator, to notify the station's engineer.

The new rules require only monthly maintenance logs for stations with Automatic Transmitter Operators. With this reduction, transmitter maintenance may be performed when needed, not merely because the FCC requires that a weekly log be taken.

All stations with an Automatic Transmitter Operator will thus be able to more efficiently schedule routine transmitter maintenance. For ATS stations with remote transmitters, that difficult trip to the transmitter in miserable weather just to get that maintenance log will be unnecessary.

Stations with contract engineers may find that a more thorough inspection and maintenance routine monthly will be more beneficial and less costly than a cursory weekly inspection. With the Automatic Transmitter Operator watching the shop, if there is a real problem, the operator will be notified to call the engineer.

We at the Widget Works feel that every station that can use ATS will find enough advantages in ATS operation to go ahead with the purchase. We also feel that the Automatic Transmitter Operator you buy should be from the Widget Works. ATS equipment is not type accepted. The responsibility for assuring compliance with FCC rules is upon the station licensee. Our technical brochure answers the following questions which your engineer should be sure to ask about any ATS you may consider.

1. Does the ATS precisely follow the new FCC rules on maximum permitted modulation, or will you be explaining to the inspector how the approximation is almost the same as the rules? Can your modulation monitor remain at the studio, or must you install new monitoring equipment? Does the ATS control modulation at the studio for FM stations with composite STL's, and at the transmitter for all other stations?

2. Does the ATS allow either direct or indirect modes of operation, or, for AM stations, will you keep a full staff of third-class operators so that when you must do antenna maintenance, repairs, or construction, you may operate in the indirect mode without ATS? For FM stations, will you be forced to purchase expensive power-measuring equipment so that you are able to operate in the direct mode?

3. Does the ATS have the capability to also run your present or future auxiliary transmitter, or do you plan to keep a full staff of third-class operators to run the auxiliary without ATS? Will the ATS automatically put the auxiliary on the air when needed without the help of technical personnel?

4. If you plan to use subaudible return, does the ATS treat the subaudible carrier as a resource to be used only briefly, and when absolutely necessary, or does it reduce your station's coverage by 6% for as much as half of your broadcast day? When it is not using the subaudible carrier, does the ATS automatically increase modulation to the maximum permitted?

5. Is that portion of the ATS which nontechnical personnel must occasionally use laid out to be simple and easily understood, or will it require elaborate instructions to understand? Will you miss reacting to an ATS alarm because of a complex control panel meant for engineers, not secretaries?

6. Is the ATS built using the latest reliable state-of-the-art technology? Freedom from citations can only be assured by the use of competently designed equipment which is working properly.

When you have made your decision, you may contact your Widget Works representative, or you may call or write:

THE Widget Works INC

P.O. BOX 564
ASHLAND, OHIO 44805
419 289-3122