THE GATES SERIES

1, 2.5, 5KW SOLID STATE MW TRANSMITTERS

PRE-INSTALLATION MANUAL

HARRIS

INTRODUCTION

Harris Allied Broadcast Equipment hopes this GATES Series Pre-Installation Manual will be helpful as you prepare to install your new transmitter. While we've made every effort to address questions our customers most frequently ask, we encourage you to contact us if you need any other information.

We also have included information about Harris Allied's service, parts and training programs for your reference.

Thank you for choosing a new GATES Series Transmitter. We at Harris Allied will do our best to justify your confidence in this product and in our company.

GATES SPECIAL NOTE

While we've made every effort to address questions our customers most frequently ask, we encourage you to contact us if you need any other information.

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About the GATES Series

The GATES Series Transmitters are 100 percent solid state transmitters using Harris' patented four-phase Pulse Duration Modulation (PDM) and MOSFET power amplifiers. These high performance transmitters are designed for high reliability, ease of installation, and servicing.

Each transmitter is fully self-contained. There are no external power supplies or networks for you to install.

Depending on destination and mode of shipment, certain transmitter components may be removed and packed separately before shipment. These will be listed on a packing check list.

Physical Layout

GATES Series Transmitter Diagrams (Figures 1 through 5) show the physical dimensions of the transmitter, with placement of the output flange and other connections to be made. BTU and air flow information also is included.

Entrances for AC power, remote control, audio, and RF sampling are from the bottom sides of the cabinet through various two-inch diameter openings.

FIGURE 1: GATES TRANSMITTERS — TOP VIEW

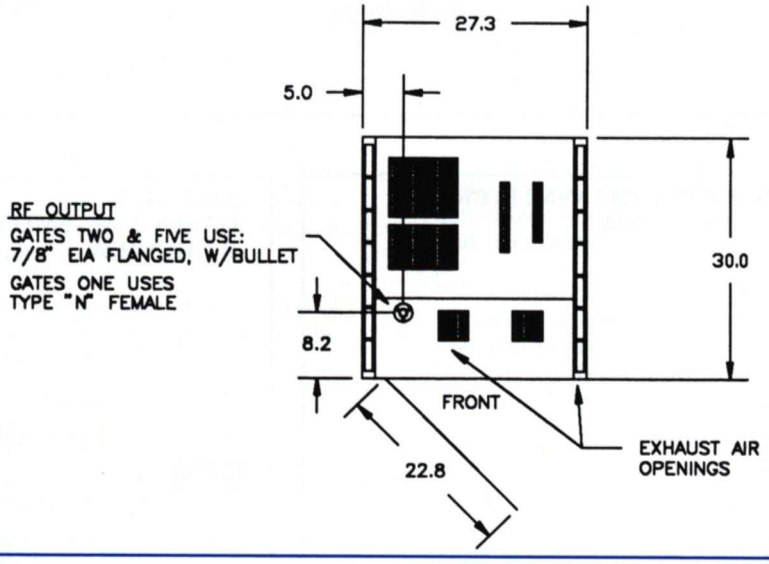


FIGURE 2: GATES TRANSMITTERS — BASE

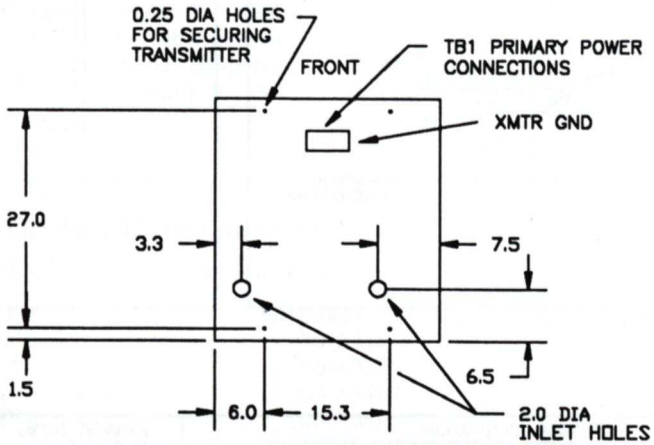


FIGURE 3: GATES TRANSMITTERS — FRONT VIEW AND SIDE VIEW

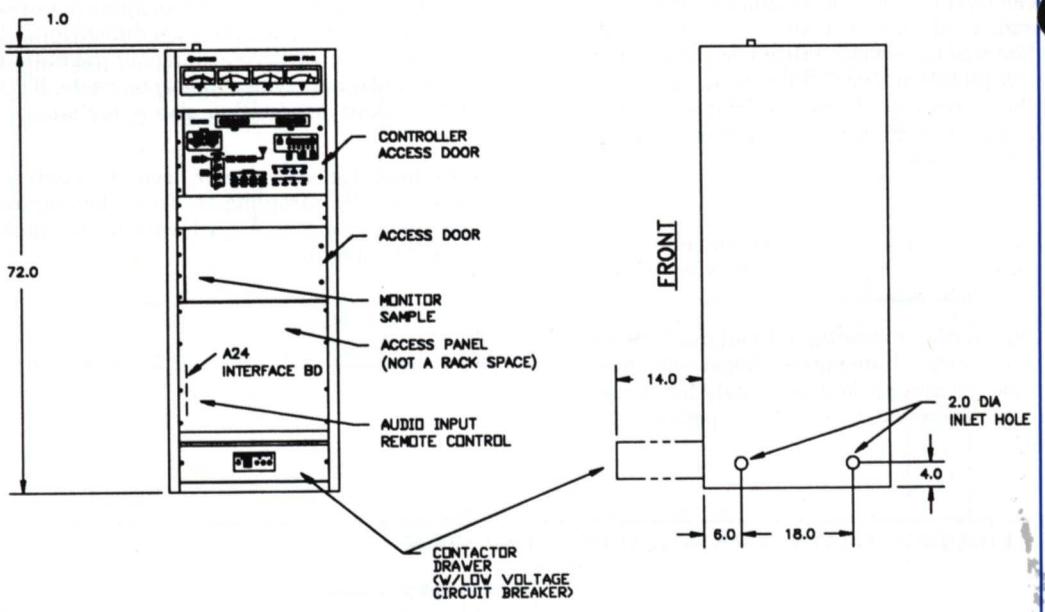


FIGURE 4: GATES TRANSMITTERS — SIDE VIEW

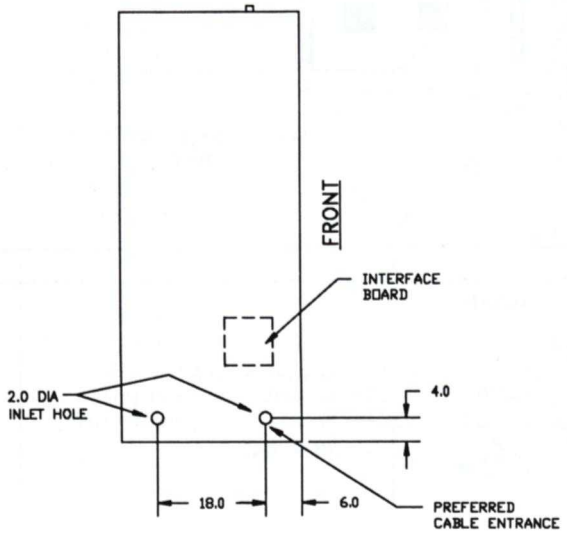
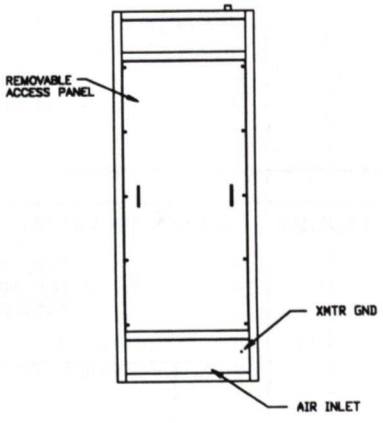


FIGURE 5: GATES TRANSMITTERS — REAR VIEW



	TOTAL DISSIPATION: BASED ON 65% OVERALL EFFICIENCY	EXHAUST (CFM) @ 60 HZ	WEIGHT #(Kgs)
GATES ONE	100% SINE WAVE MODULATION AT 1KW OUTPUT 807W OR 2,756 BTUH	CONVECTION	400(181)
GATES TWO	100% SINE WAVE MODULATION AT 2.5KW OUTPUT 2,019W OR 6,895 BTUH	250 CFM	450(204)
GATES FIVE	100% SINE WAVE MODULATION AT 5KW OUTPUT 4,038W OR 13,790 BTUH	500 CFM	500(227)

Equipment Grounding

Proper grounding of equipment is important in terms of personal safety, lightning protection, and noise performance. A lightning strike to your antenna may result in some of the lightning charge coming in on your coaxial cables. It is very important that you provide a good low impedance path to earth ground for lightning current.

Make provisions for connecting the transmitter to the station ground system with a minimum two-inch wide copper strap. Copper strap is recommended because of its low impedance characteristics, low profile, and the ease of soldering straps together to form a good electrical bond.

Use either of the two ground connections provided: One is at the bottom right rear of the transmitter, and the other is a stud adjacent to the primary power terminal block behind the contactor drawer.

Output Termination

The GATES ONE has a type "N" female output connector.

The GATES TWO and GATES FIVE have a 7/8 male EIA flange connector with a removable bullet.

For either of these type connectors, you will need an appropriate mating connector for the type of coax you will be using.

For safety reasons, there is no provision for an open end cable connection.

Load Impedance Considerations

GATES Series Transmitters are tunable to match to an output VSWR of up to 1.5:1. Therefore, your load impedance does not need to be exactly 50 ohms. However, it is best to have your antenna system and coax properly matched. A mismatched coax could, for example, decrease the bandwidth of the system and can cause higher-than-normal voltages and currents along the line.

When matched, the ability to switch back and forth between antenna and dummy load without any re-tuning can save time and facilitate transmitter maintenance.

Primary Power Usage

The GATES Series Transmitters operate with a nominal 50 or 60 Hz AC input, and are easily set-up for any primary voltage between 197 and 251 volts.

The GATES FIVE transmitter is available with either a three phase or single phase power supply. The three phase version can also be wired for an input voltage of 341 to 434 volts in a four wire WYE configuration for international installations.

The GATES ONE and TWO are powered from single phase sources.

There are no requirements for 120 volts in any case, however there are provisions for having separate AC inputs for low voltage and high voltage circuits. This allows you to separate the low voltage and high power circuits so that they operate from different circuit breakers. Although not a requirement, this set-up sometimes is advantageous for maintenance and troubleshooting.

When separate power sources are used (by removing jumper wires), the low voltage circuit should be protected by a 10 amp circuit breaker for 197 to 251 volts. For the high voltage circuits, use the breaker size specifically recommended for your transmitter model.

Note

Three phase delta power systems often have a center tap grounded on one of the power company transformers. This provides 120 volt service from two of the legs of a three phase system. This also creates a "high leg" relative to ground. It is not important to the GATES Series transmitters which AC input terminal this "high leg" connects.

CHART 1: GATES MODEL/BREAKER SIZE/WIRE GAUGE

For nominal 230 volt operation and wiring runs of 50 feet or less:

Transmitter	Breaker Size	Wire Gauge
GATES ONE	30 AMPS	8 gauge
GATES TWO	60 AMPS	6 gauge
GATES FIVE, 3 PH	60 AMPS	6 gauge
GATES FIVE, 1 PH	100 AMPS	4 gauge

GATES SPECIAL NOTE

If you have a three phase power source, it is important that the configuration not be an open delta type. This is a two transformer configuration which is prone to AC line imbalance and transient disturbances.

A closed delta or a WYE service are equally acceptable. If you wish to have more detailed information on this subject, you may obtain a Harris publication on the deficiencies of the open delta system by contacting the Radio Service department. Ask for the publication entitled "Power Distribution Recommendation."

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AC Input Protection

Although GATES Series Transmitters are designed with built-in MOV type surge protection, the best protection would include an external protection device at the AC mains entrance selected for your particular AC power system.

Destructive transients can occur as a result of lightning, and/or by load switching on the power line. There are protection devices available which, when properly installed, will nearly eliminate the threat of damage via the AC power source.

If you would like more information concerning AC power protection, you may obtain it by contacting the Radio Service department.

Ventilation Considerations

The most common mistake in a transmitter installation is improper ventilation. It simply is not something to be taken for granted, even when installing an efficient, low air volume transmitter such as the GATES Series.

The following discussion primarily references transmitters with more heat generation and higher volume air flow. However, these are factors to consider in most any installation where the transmitter is a significant element in heating the building or transmitter room.

The conventional methods of removing waste heat are:

1) An exchange of fresh outside air with heated air.
2) Dissipating the heat with air conditioning.
3) A combination of the above two approaches.

For an installation with an exchange of outside air, you will need to know how much air volume (in CFM) the transmitter moves.

For dissipating the heat, you will need to know the heat generation in BTU's per hour.

Examples:

Poor Air System: A typical problem installation of a transmitter with a forced air system has an exhaust duct firmly attached to the top of the transmitter, with unknown static pressure and no assist fan to overcome the duct losses. The duct may be undersized and have sharp turns. Moreover, while there are provisions for ducting air out of the building, often there are no provisions for bringing air into the building.

Such an installation has a transmitter and building which is unnecessarily hot and starved for air. The transmitter tries to overcome inefficiencies in the exhaust duct, causing some heated air to stagnate above the exhaust opening. Without provisions for bringing air into the building, bugs and dirt particles are drawn in through every crack and crevice of the building. Refer to the drawing for the Poor Air System Example.

Closed Air System: In a closed system, there is normally no venting to the outside, but rather the additional heat is removed by air conditioning. In terms of cleanliness, this is the ideal system since the amount of outside air entering the building should be insignificant.

The operating cost of a closed system will depend on the amount of heat generated by the equipment, as well as environmental factors.

The closed system may be your best choice if the outside air is salty, dirty, extremely hot, humid, or otherwise undesirable. However, if you choose to implement a closed system, you should include a backup ventilation system to protect your facility in the event of an air conditioning failure.

With a closed system, the amount of air conditioning needed will be at least equal to the equipment's heat over and above the amount of cooling needed without transmitter equip-

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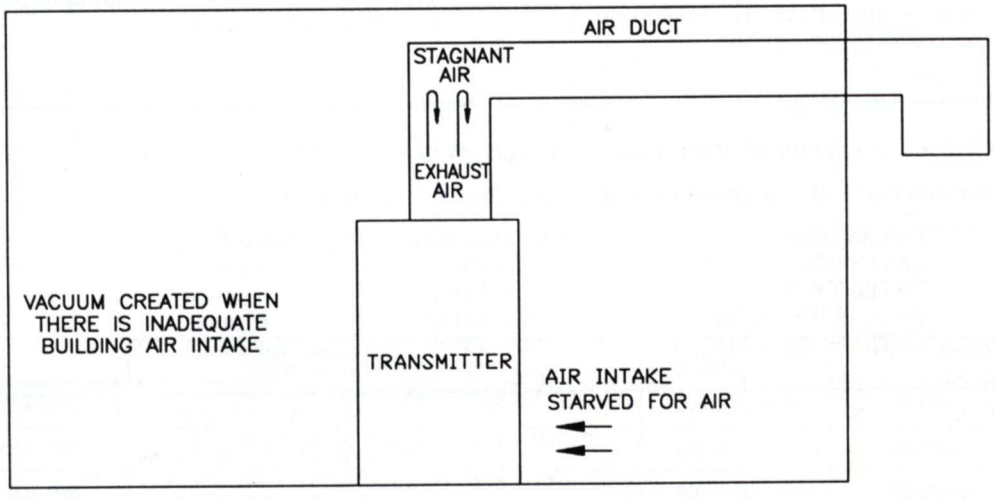
FIGURE 6: POOR AIR SYSTEM



GATES SPECIAL NOTE

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The most common mistake in a transmitter installation is improper ventilation.

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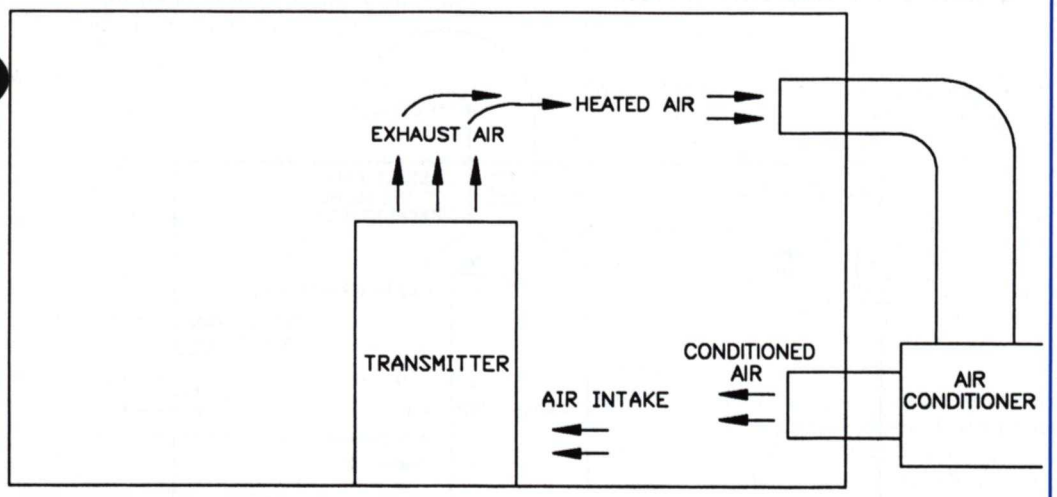
FIGURE 7: CLOSED AIR SYSTEM



ment. The amount of heat which the equipment generates depends on the amount of power dissipated in the transmitter room. Therefore, if you expect to be able to operate the transmitter into an air-cooled dummy load without raising the room temperature, the air conditioning will have to be large enough to handle the full wattage drawn by the transmitter. In other words, the A/C will have to be sized according to the overall power consumption, rather than the transmitter's normal waste heat.

The conversion from watts dissipated to BTU's is 3.415 BTU per watt. Operating into the antenna, worst case dissipation from the GATES Series transmitters, i.e. 100% tone modulation at full rated power, the BTU generation would be as follows:

GATES FIVE	13,790 BTU
GATES TWO	6,895 BTU
GATES ONE	2,756 BTU

At reduced power or modulation levels, any transmitter will generate less heat, but NOT proportionately less. For example, a transmitter operating at half of its rated power will produce MORE than half of its dissipation at full power. This is because some circuitry consumes the same amount of electricity regardless of power level and other circuits become less efficient at reduced power levels.

To determine details of a closed air system, consult a heating and cooling contractor in your area.

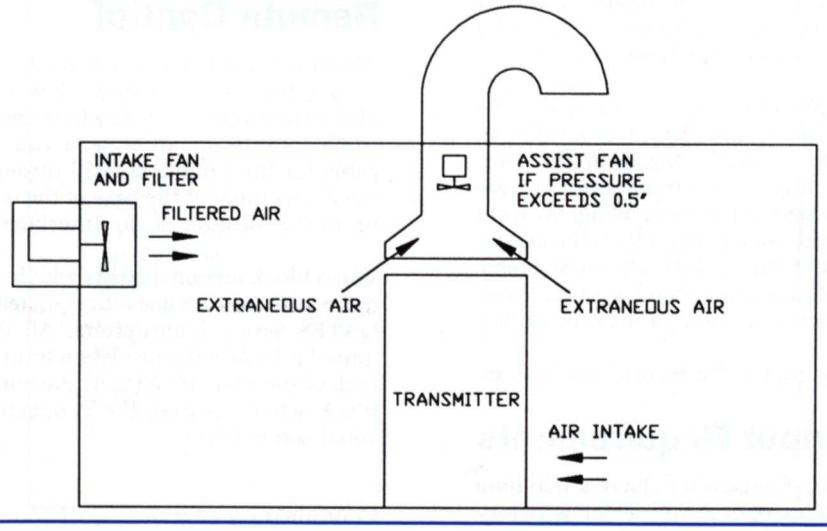
Positive Pressure Air System: The positive air pressure system keeps a transmitter relatively clean and well ventilated. In this system, outside air is brought into the building by an intake fan through an air filter.

The intake fan should be sized approximately 5 to 10 percent larger in CFM than the fans which are exhausting the air, so that the building will be under a slight positive pressure.

The GATES ONE does not have a fan, but is cooled strictly by convection. Therefore, it is

continued on page 6

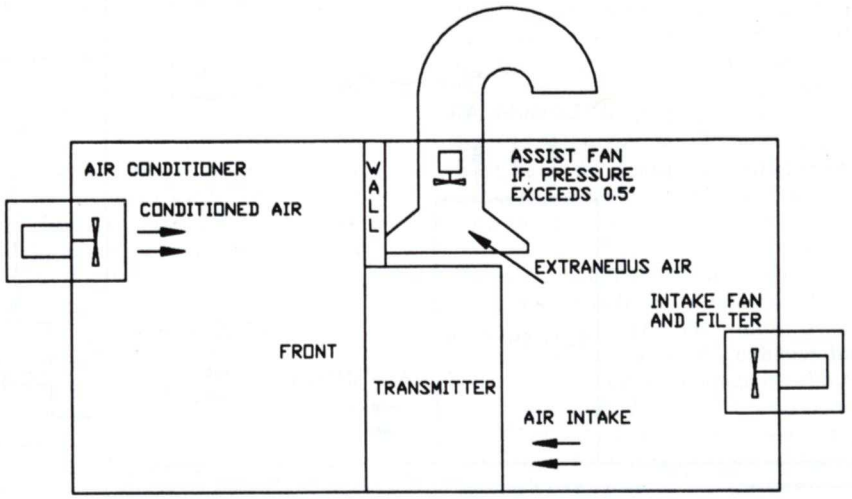
FIGURE 8: POSITIVE PRESSURE AIR SYSTEM



GATES SPECIAL NOTE

At reduced power or modulation levels, any transmitter will generate less heat but not proportionately less.

FIGURE 9: HYBRID AIR SYSTEM



GATES SPECIAL NOTE

For finalizing an air system to meet your requirements, consult a heating and cooling contractor in your area.

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not necessary to consider the transmitter CFM.

The fan in the GATES TWO moves 250 CFM of air.

The two fans in the GATES FIVE move 500 CFM of air.

The slight positive pressure not only will ensure the transmitter is supplied enough air, but it will force air out of any leaks in the building. This is advantageous because it prevents dust and bug infiltration.

The exhaust duct is best left detached from the transmitter cabinet, much like a range hood. This has the advantage of creating an escape path for extraneous heated air, and offers a pressure relief gap in the event of unexpected back pressure.

See the drawing for the Positive Pressure Air System.

For details on air flow requirements, refer to the Outline drawing. For finalizing an air system to meet your requirements, consult a heating and cooling contractor in your area.

Hybrid Air System: A hybrid air system includes both air conditioning and ventilation to the outside. Typically, the air intake (rear) and exhaust (top) of the transmitter are enclosed in one part of the room, while the front side is air conditioned. This offers the advantage of isolating the sound from cooling fans, while providing a comfortable area for viewing and servicing the front of the transmitter.

See the drawing for the Hybrid Air System.

Audio Input Requirements

GATES Series Transmitters have a 600 ohm solid state audio input circuit which is factory set for a nominal +10 dBm input level for 100 percent modulation. If you require more audio sensitivity, it is adjustable down to −10 dBm by a simple adjustment on the PDM Generator.

The audio input terminals are located on the Interface board. The audio connections are on a Wago block. The Wago block does not use terminal lugs. All that is required is to strip the wires back about 1/4 inch, and insert them into the block while holding the connector open with a small screwdriver.

Monitoring Provisions

An adjustable, 0 to 5 Volt RMS RF sample source is provided on the Output Monitor board. The Output Monitor board is located behind an access door on the front of the transmitter. If you will be using the monitor sample, you will route the cable for the modulation monitor from the base of the transmitter up to the location of the Output Monitor board.

Remote Control

All remote connections are made on the Interface board located in the lower left front of the transmitter. If you will be remote controlling the transmitter, you can route the cable for the remote control through one of the 2" openings at the base of the transmitter up to the location of the Interface board.

Wago block terminal strips which do not require wire lugs are used for remote control of GATES Series Transmitters. All that is required is to strip the insulation from about 1/4 inch of the wire, then insert the wire into the block while opening the connector with a small screwdriver.

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Control Inputs: Except for Failsafe, all control inputs can be activated by a momentary contact closure to ground, or an open collector output from the remote control system.

A typical setup would be to have one side of the remote control unit's relay contacts (common, for example) bussed together and connected to ground. The other side of the contacts would connect directly to the various control inputs on the transmitter's Interface board.
A remote control unit with open collector outputs would just simply connect directly with the transmitter's control inputs.

Failsafe: A Failsafe input is provided as a means of shutting the transmitter down if remote control is lost. It also may be used as an external interlock which will shut the transmitter high voltage off.

The Failsafe input needs to be a continuous closure, capable of handling 24 VAC at 1 amp. A connection is required at the Failsafe terminals even if the transmitter will be locally controlled. Switching the transmitter to Local control by means of the local/remote switch on the control board does *not* bypass the Failsafe interlock.

Status Lines: All status outputs are open collector outputs. These may be directly connected to many remote units, or may be used to energize a 12 volt relay or indicating device with 100 ma or less current draw.

Status outputs may be directly connected to remote control units which have a TTL-type input. This type of input requires an "active low" to show a change of status.

Metering: Remote sample voltages for Power Output, PA Voltage, and Supply Current are positive outputs of less than 5 volts, and are designed for driving a 10K ohm input impedance.

Cable Shield: The shield connection for the remote control cabling should be connected to a nearby ground stud or one of the Interface board mounting screws.

INTERFACE BOARD CONNECTIONS

CONTROL INPUTS	TERMINAL
Low	TB2-1
Two	TB2-2
Three	TB2-3
Four	TB2-4
Five	TB2-5
High	TB2-6
Off	TB2-7
Raise	TB2-8
Lower	TB2-9
Ext Kill (RF Mute)	TB2-10
FAILSAFE	TB1-15 and TB1-16
METERING OUTPUTS	TERMINAL
PA Voltage	TB2-11
PS Current	TB2-12
Power Output	TB2-13
STATUS	TERMINAL
Overload Ind Reset	TB2-14
Low	TB2-15
Two	TB2-16
Three	TB2-17
Four	TB2-18
Five	TB2-19
High	TB2-20
OVERLOAD STATUS	TERMINAL
Auto Cutback	TB2-21
Supply Voltage	TB2-22
Supply Current	TB2-23
Underdrive	TB2-24
VSWR	TB2-25
Audio (+)	TB2-26
Audio (−)	TB2-27
Ground	TB2-28

GATES KEY POINTS

- Provide proper size of AC service.
- Use good grounding techniques.
- Ensure the antenna system is properly tuned.
- Provide a proper connector for the coax and output termination.
- Remote control system has all desired control and monitoring capabilities desired.
- Make sure adequate ventilation is used.

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NOTE

Every Harris transmitter is supported by Harris Allied for as long as it is in use. For 24-hour emergency service or routine service, parts or training, please phone 217/222-8200.

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SERVICE

Every Harris transmitter is supported by Harris Allied's 24-hours-a-day, 365 days-a-year service department. For emergency service or routine service, please phone 217/222-8200.

During regular hours Monday through Friday from 8 a.m. to 5 p.m. CST, press "8" if you have touch-tone service as soon as the phone is answered. If you don't have touch-tone service, our operator will assist you as soon as the recorded message is completed. At other times, your call will automatically go to the Parts Department.

Emergency Service

Emergency service is *any* service that is required on an emergency basis. This includes any time when you are off the air; operating on a standby transmitter, or broadcasting at reduced power. *The most important thing you can do if you are calling for emergency service is to identify that this is an emergency call.* A service engineer is available 24-hours per day. The engineer will need to know what type of equipment you have; meter readings, and if you are off the air, on standby, or at reduced power.

We will do everything possible to get you back on the air at full power quickly without sending an engineer to your site. We also will try to identify parts you need then send them to you immediately.

If you would prefer an engineer visit your site, please let us know.

Routine Service

Routine service includes installation, check-outs, proof of performance and transmitter updates. To schedule a visit, phone the Service Department (217/222-8200, Ext. 3525) Monday through Friday from 8 a.m. to 5 p.m. CST. Please try to order field visits two weeks to one month in advance so we can ensure necessary test equipment and parts are available.

Installation: Service engineers are available to install your transmitter. When ordering an installation, we will need to know the age of your facility; whether you are replacing an old transmitter, and if you will be using remote control. Service will request an equipment list and a building layout that shows the location of each piece of equipment. You also will be asked for a projected completion date and availability of a staff engineer.

Check-outs: If you install the transmitter by yourself, you can still have a service engineer do a check-out. Two types of check-outs are available. We can check the entire system from the microphone through the output, or we can check only the equipment directly associated with the transmitter. The check-out can identify set-up problems that could cause more serious problems in the long run.

When you order a check-out, field service will ask whether your transmitter will be housed in an existing or a new building; whether you're replacing a transmitter; whether you will be using remote control, and whether you have a staff engineer to help with the check-out. You'll also be asked for an equipment list, meter readings and building plans for the site.

Transmitter Updates: If you want to overhaul your old transmitter for use as a standby or to sell, Harris Allied can provide this service. Generally, overhauls are beneficial for transmitters one or two generations old. During overhaul, a service engineer will correct problem areas and get your transmitter back to expected performance levels.

When you order an overhaul, field service will want to know everything you know about transmitter problem areas.

Proof-of-Performance: Harris Allied can provide an annual Proof-of-Performance. While these no longer are required by law, this annual check-out is a good way to identify any problems or deficiencies in your system.

PARTS

Harris Allied's Parts Department is staffed 24-hours per day, 365-days per year. To contact the department, phone 217/222-8200. If you have touch-tone service, press "7" as soon as the phone is answered Monday through Friday from 8 a.m. to 5 p.m. CST. If you don't have touch-tone phone service, our operator will personally help you as soon as the recorded message is completed. Between 5 p.m. and 8 a.m. weekdays and on weekends, your call will automatically go to the Service Parts Department.

Harris Allied maintains a service parts inventory worth more than $1 million at all times, and stocks items customers may need as long as the parts are manufactured.

How To Order Parts

If you know what parts you need, it is helpful to have the ten-digit part number available when you call to place your order. However, if you don't know the number, Harris Allied order editors have a computerized log of every part we offer.

If you aren't sure what part you need, our service engineers are available to help you. Talking with a service engineer is the best way to avoid having to return undesired parts later.

Warranties

Parts for your new GATES transmitter are backed by the original equipment warranty for one year from the date of shipment. All other Harris parts are backed by a 90-day warranty from date of shipment.

Parts Returns

To return a part, phone the Parts Department and request a Return Authorization Form. We will send you an Equipment Failure Report Form, a return authorization number and a label immediately. Complete the Equipment Failure Report Form and return it with your equipment, transportation and insurance prepaid, to: Harris Allied Broadcast Equipment, 3200 Wismann Lane, Building 1, North Dock, Quincy, Illinois U.S.A. 62301.

After Harris Allied receives and evaluates the part or equipment you are returning, we will credit your account.

Spare Parts Kits

Our engineers have developed the following spare parts kits for GATES Series Transmitters:

- **Semiconductor and Fuse Kit:** Transistors, diodes, thiristors, varactors, and at least five of each type of fuse used in the transmitter.
- **Parts Kit:** Discrete components and assemblies that are not frequency-determined, including such items as capacitors, inductors, resistors, meters and lamps.
- **Boards Kit:** Printed board assemblies.
- **Major Components Kit:** This kit of high-dollar components can be helpful when planning a depot site to serve multiple equipment systems.

Keeping recommended spare parts kits on hand is an excellent way to ensure you have the parts you need when you need them. For a complete listing of components in each GATES transmitter kit, please phone the Parts Department.

Module Exchange Programs

Harris Allied sponsors a module exchange for GATES Series Transmitters. You'll be able to replace a repairable module with a tested replacement module, then receive credit once you return your old module to us.

To participate, please phone the Parts Department and indicate you need to order a replacement module for your GATES Transmitter. We will send your replacement module as well as a Return Authorization and Equipment Failure Report Form. Complete the Equipment Failure Report Form and return it, along with your old module, transportation and insurance prepaid, to: Harris Allied Broadcast Equipment, Parts Department, 3200 Wismann Lane, Building 1, North Dock, Quincy, Illinois U.S.A. 62301.

After we receive and evaluate your returned module, your account will be credited. Your module will be refurbished and re-stocked in inventory.

Refurbished modules in stock are available at a lower price than new modules. Both the new and refurbished modules carry the same 90-day warranty from the date of shipment.

TRAINING

How your transmission equipment is operated and maintained is as important to its long-term reliability as how it was designed and manufactured. That's why Harris Allied sponsors the world's only Broadcast Technology Training Center. Each year the Training Center offers over 50 regularly scheduled programs for engineers with all levels of experience. Our goal is to give station engineers with around-the-clock responsibility the skills and knowledge needed to ensure long life and top performance of RF transmission equipment.

Types of Training

Harris Allied offers general RF training as well as courses on specific Harris product lines. Because classes combine theory with hands-on practice, class size is limited and enrollment is on a first-come, first-served basis. Regular classes are offered at our Quincy, Illinois Broadcast Technology Training Center.

General Training programs are designed for personnel who recently have been given responsibility for testing, maintaining and servicing transmission equipment. Each general training program normally is offered four times a year. They are: AM Transmitter Workshop; FM Transmitter Workshop; TV Transmitter Workshop; RF Circuits I; RF Circuits II, and Digital Control Logic.

Product Training focuses in detail on specific families of Harris transmitters and remote control products. The GATES Series course is offered twice a year.

For complete information and training schedules, phone 217/222-8200 from 8 a.m. to 5 p.m. CST Monday through Friday. If you have touch-tone service, press 3508 as soon as the phone is answered. If you don't have touch-tone phone service, our switchboard operator will personally help you as soon as the recorded message is completed.

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