



GAI-TRONICS® CORPORATION
A HUBBELL COMPANY

700 Series Page/Party® Systems

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General Information

The GAI-Tronics Page/Party® System is a modular industrial communication system incorporating from two to possibly hundreds of stations. Available in several forms, each station includes a handset, two amplifiers (one for the handset and the other to drive one or more paging speakers), associated controls, and a paging speaker (usually mounted separately). All stations are wired in parallel and additional stations may be added at any time.

A GAI-Tronics Page/Party® System layout should be planned in advance of installation. Select handset station locations carefully, taking convenience, accessibility, and personal safety into account. The quantity and location of paging speakers must be carefully considered, particularly in areas of high ambient noise or reverberation. The speaker amplifier built into each station drives one horn-loaded page speaker. If additional paging speakers are needed, separate speaker amplifiers can be added to the system. In quiet areas, such as offices, several paging speakers can be connected to a single station. Please refer to Pub. 42004-135, Speaker Installation, or consult with a GAI-Tronics sales representative for additional system planning information.

All units are wired in parallel. Good planning will minimize the cable required for each installation. GAI-Tronics Corporation can supply multi-conductor cable designed especially for this application. The number, size and color-coding of conductors are listed in the accompanying system connection diagrams. Standard cable has 600-volt insulation and is UL-rated for power cable tray use. Additionally, for ease of installation GAI-Tronics' cable is color-coded to match the termination points in our enclosures. The maximum standard cable length is 5250 feet (1600m) from the Line Balance Assembly systems. For non-standard cable, please contact a GAI-Tronics representative.

The cable described above includes conductors to provide ac operating power to each station. All stations operate from a common source, enhancing reliability, particularly if no other ac load is placed on the circuit breaker or branch line feeding the system. This configuration also allows easy transfer to an emergency power source in the event of power failure. However, if preferred, each station may be individually powered from a nearby nominal 115 volt, 50 or 60 Hz single phase outlet.

Installation Procedure

Step 1 — Electrical Noise Considerations

When planning your system, consider the following suggestions to avoid electrical noise caused by slip rings and silicon control rectifier (SCR) power supplies.

Slip Rings - Use a radio frequency (RF) alternative and avoid using slip rings as audio conductors. Slip rings are a source of electrical noise and are not reliable.

SCR Power Supplies - If the Page/Party® system will be installed in areas where SCR power supplies are used to power motors or other heavy equipment, consider using one or all of the following four recommendations to reduce electrical noise.

1. *Separation*—Locate the Page/Party® system cables as far as possible from the SCR power supply input or output cables. Electrical coupling between cables is reduced by the square of the distance between the cables.
2. *Shielding*—Use shielded (armored) system cables if the cable must be run in the same bundle or cable tray with the SCR power supply cables. Shielded cables reduce capacitive coupling between SCR power supply cables and Page/Party® audio cables.
3. *Isolation*—Two methods of power source isolation can be used to avoid electrical noise:
 - A. Use a low capacitance (primary to secondary) isolation transformer between the Page/Party® system and the ac supply to the SCRs. This electrically isolates the Page/Party® system's ac power from the noise generated by the SCR on the ac power feed. Also use an isolation transformer to isolate the Page/Party® ac power from an ungrounded ac power source. Note: The neutral side of the transformer output must be grounded in all instances.

The size of the isolation transformer should be based on the number of amplifiers used in the system. If ten or less amplifiers are used in the system, a 500 VA transformer is sufficient. If 11 to 20 amplifiers are used in the system, select a 1000 VA transformer. For systems with more than 20 amplifiers, the transformer should be sized to accommodate a load of 50 VA per amplifier.

- B. A battery powered 24 V Page/Party® system can be used as an alternative to the standard 120 V ac system. In this instance, the battery/battery charger provides isolation from the SCR noise on ac power systems. Cable shielding and separation as mentioned above still apply.

NOTE: Avoid battery chargers that utilize SCRs in their design.

Step 2 — Mounting of Station and Speaker Amplifier Enclosure

Each Page/Party® system station includes a plug-in amplifier, that mates with a fabricated steel, cast aluminum, or molded reinforced non-metallic enclosure. Each enclosure provides a terminal strip for connecting inter-station cable. Enclosures are packed separately from the plug-in amplifiers at the factory, allowing the amplifiers to remain protected while the enclosures are installed and wired — particularly important during system installation in areas under construction.

The 16-gauge steel enclosures do not provide any openings for conduits or cables because the location of these will vary with each installation. Drill or punch the necessary openings before mounting the enclosure. Locate the openings either along the top or bottom of the enclosure and near the rear surface. Avoid the top center because of possible interference with the plug-in amplifier receptacle. A drill template is supplied with each enclosure.

Cast aluminum enclosures are drilled and tapped on the top and bottom for specially-designed hub plates. Unless special arrangements are made, the enclosures include plates for single 1¼-inch conduit. Plates for single ½-inch or 1½-inch, or dual inch are available. The molded enclosures are supplied without any conduit openings. Sealed threaded hubs, such as Myers “Scru-tite”, are recommended. A drill template is supplied with each enclosure.



Use caution when drilling holes to avoid damaging internal electrical components and wiring.

Suggested mounting height for all station enclosures is 54 inches (137 cm). Subsets used with remote subset amplifiers are supplied with 8-foot (244 cm) cables. Enclosures for remote subset amplifiers must be mounted within reach of the 8-foot cable. Desktop or desk-edge stations enclosures are often mounted in the knee-well of the desk.

Step 3 — Mounting of Line Balance Assembly

Each GAI-Tronics Page/Party® system requires one line balance assembly. Its function is to properly load the page and party line circuits. When using GAI-Tronics standard cable, select a location that is:

- near the electrical center of the system
- adjacent to an indoor station in a relatively quiet area
- no more than 5250 feet (1600m) from the most distant station

For larger systems or when using other types of cable, contact a GAI-Tronics representative for further information. The line balance assembly has one electrical adjustment that must be made while using a station (see below). The following is the preferred method for mounting the line balance assembly:

1. Suspend the assembly from the lower side of the indoor wall station using a 1-inch conduit nipple (not supplied).
2. Connect one twisted pair wire for the page circuit and another for each of the party lines between the terminal blocks of the line balance assembly and the associated indoor wall station.
3. Make the wiring connections between the 305 Series Line Balance Assembly and the Model 702 and 703 Indoor Wall Station enclosures in accordance with the wiring diagrams at the end of this publication.

Step 4 — Installation of Inter-station Conduit and Cable

Inter-station cables are generally installed in cable trays or conduit. To assist in determining the conduit sizes required, the outside diameters of the GAI-Tronics Corporation cables discussed in this publication are listed below. Size and installation of conduit and cable must meet the requirements of applicable electrical codes.

Cable	Conductors	O.D.
60038-101	8	0.60 in. (15.1mm)
60029-101	16	0.68 in. (17.2mm)

A ground conductor, with green/yellow insulation, should be included with cable in any area where no conduit or non-metallic conduit is used. Non-metallic enclosures used with metallic conduit and cable without a ground conductor require a bond between the conduit(s) and the ground terminal (point 3) within the enclosure.

When using GAI-Tronics cable, attach wire lugs to each conductor and connect to the terminal in accordance with either the color code shown on the applicable accompanying diagram or with special drawings provided for this purpose.

Exception: Some cables have an orange “spare” conductor. Unless otherwise instructed, this should be taped and not connected to the terminal strip(s) in the enclosures.

GAI-Tronics cable is considered to be a Class 1 cable (maximum voltage is less than 600 V). In a cable tray, Class 1 cable may only be grouped with other Class 1 cables. Long runs of GAI-Tronics cable in proximity to 600-volt cable may cause an undesirable amount of hum being induced onto the Page/Party® system’s signaling lines. To reduce undesired hum, it is recommended that runs of cable over ½ mile be separated from 600-volt cable by a minimum of 12 inches.

Step 5 — Installation of Amplifiers and Subsets

One of the many features of GAI-Tronics Page/Party® system equipment is automatic speaker muting. When the push-to-page switch is pressed at a particular station, the paging speaker connected to that station is silenced, preventing acoustic feedback to the handset microphone. However, while the handset is in use for the party line conversations, the paging speaker is still “live” to paging calls from other stations.

For cases where the muting feature is not necessary or may be a disadvantage, it can be defeated as outlined below:

1. Locate lugged violet wire attached to terminal point 7 (Mute) on the terminal block within the enclosure for station to be modified.
2. Transfer lugged violet wire to terminal point 8 (Page L1).

After making any necessary muting changes, unpack and install the amplifier for each station. Also, unpack remote subsets (for desktop, desk-edge or panel-mount stations) and plug each into the bottom sides of the amplifier enclosure.

Step 6 — Checkout and Adjustment

Test all field wiring connections (page line, party line(s), mute, ac power and speaker) between stations, and complete the line balance assembly installation before checkout begins. Ensure that all handsets are on-hook.

1. Apply ac power, and check the station next to the line balance assembly.
2. Press the “push-to-page” switch (in the handset handle on some stations) and speak directly into the microphone of the handset. The broadcast should be heard at all paging speakers in the system except those associated with the station under test. If working properly, very little or none of your own voice (sidetone) is heard from the handset earpiece. If the line balance assembly is not connected properly, there will be a high level of sidetone, perhaps enough to cause feedback. Adjust the line balance assembly to optimize sidetone rejection on the page line. If the system is complete when the first station is checked, adjust the line balance assembly as noted below. **Do not adjust station (amplifier) controls until the line balance assembly is adjusted.**
3. Release the push-to-page switch and check the party line(s) sidetone level by speaking into the microphone of the handset. If working properly, very little or none of your own voice is heard from the handset earpiece. This sidetone rejection will only occur if the line balance assembly is properly connected because it contains a fixed resistor load for each party line. In addition, no party line adjustments are provided. Check party line operation by conversing between two or more stations.

Adjustment of the Line Balance Assembly

To set the control for proper page circuit loading:

1. Remove the line balance assembly cover to expose the line balance control.
2. Lift the handset from the adjacent handset hook and press the push-to-page button.
3. From the normal speaking distance (approximately ½-inch), blow steadily into the handset microphone and adjust the control to minimize receiver sidetone. This adjustment needs to be made only at the initial installation of the system. However, if in the future more than 10 speaker amplifiers are added or deleted, repeat adjustment of page circuit loading.
4. After final adjustment, replace and secure the cover with the four mounting screws to discourage tampering by unauthorized personnel and prevent entry of contaminants.

Each amplifier has a paging speaker volume control. It is accessible from the front panel with a screwdriver, but is concealed behind the metal nameplate. To reach it, simply loosen (do not remove) the two nameplate screws and pivot the nameplate around the left screw. This control is adjusted at the factory so that a moderate page level produces 4 watts of output power.

Each handset/speaker station amplifier has two additional internal controls: receiver volume control and receiver sidetone control, both accessible using a screwdriver through the holes in the chassis. A third hole allows similar access from the rear of the paging speaker volume control. Both controls are factory-adjusted for optimum results in most industrial applications. Do not readjust these controls to solve system problems until other possible faults are checked, such as a missing, defective, or improperly connected line balance assembly. There is very little drop in receiver (handset earpiece) volume level due to system cable losses. Generally, the only reason to reset the receiver volume control is to compensate for extremely high ambient noise levels (up to 110 dB) or to meet particular personnel needs.

At stations with cable lengths of 3,000 feet (1 km) or more from the line balance assembly, receiver sidetone rejection is noticeably affected by cable impedance. Use the receiver sidetone control to compensate for this by rotating the control clockwise approximately 60 degrees for 3,000 feet (1 km) of cable length.

Step 7 — Troubleshooting the System

Hum or Buzz

Hum or buzz on the page circuit (or one or more party circuits) is usually due to either a short circuit of one of the two conductors for each circuit to ground or unbalanced leakage to ground. As long as both conductors are twisted pairs and there are no significant leakage paths or short circuits to ground, any included voltages are the same on both conductors and do not appear across the line.

To correct the problem, locate the source of the ground. Using an ohmmeter, check various junction points of the system wiring to determine in which direction the ground can be located. Locate the ground by going from one junction point to another and disconnecting the affected circuit. The fault could be within a plug-in amplifier. However, most ground circuits occur in improper terminations or are caused by small strands protruding from an improperly lugged wire.

Another source of grounds or near-grounded circuits is junction boxes filled or partially-filled with water. In many cases, there are deposits in the boxes, which, when combined with water, produce conductive or corrosive solutions. These deposits cause leakage between circuits and can corrode the wire and terminals.

Isolation of field wiring may be necessary for test purposes. If such isolation removes the line balance assembly from the operating portion of the system, connect a 33-ohm, 0.5-watt resistor across L1 and L2 of the Page/Party® line circuits. Remove these resistors after completion of the tests.

Feedback or Distortion on the System

Each page and party circuit must be loaded to the optimum 33 ohms using the line balance assembly. If the line balance is not connected, or is defective, the system will have excessive gain and will break into feedback quite easily. Speech will also be distorted, and there will be a high level of sidetone in the handset receiver.

Each party line is terminated with fixed 33-ohm resistor in the line balance assembly. However, an adjustable control is provided for the page line to compensate for the number of speaker amplifiers connected to the system. Improper adjustment will affect gain and increase the level of sidetone. Please refer to specific instructions above for adjusting the line balance assembly.

Very Low Audio Level on One or More Lines at all Stations

It is possible for the system, or part of the system, to function with a dead short across the page or party circuits. If this occurs, the level of the system will be very low, decreasing to minimum level in the vicinity of the short circuit. Locate the short circuit in the same manner as locating a ground, by checking junction points with an ohmmeter.

Cross Talk

Cross talk, or interference, is generally caused by accidental crossing of circuits in a junction box. To check for this condition, measure resistance between circuits of the interfering channels. The resistance should be infinite or a very high value. Leakage or shorts to ground in two or more circuits can result in cross talk on those circuits.

In a multi-party line system, it is possible to have a small amount of cross talk between channels if line balance resistors are opened or not connected. This condition can be detected by the presence of high sidetone in the handset.

Static Charges

In many normal installations, a static ac voltage may be read from the conductors of the page and party line circuits to ground. In many cases this voltage may be as high as 50 volts or more. This voltage is induced into the circuits by capacitance to the ac power circuit (generally carried in the same cable, and also from power cables paralleling communication cables). This voltage is inconsequential and can be ignored. Problems would only occur if one side of the page or party circuit becomes grounded.

Audio Voltage

In a properly operating system, audio voltage read across any of the page or party circuits (L1 or L2) is 0.5 to 0.75 volts ac on peaks when an audio signal is present: i.e., someone speaking into a handset. The voltage is proportional to the loudness of the person's voice using the handset.

One Inoperative Station in a Working System

Except for a wiring error, an inoperative station indicates a defect in the amplifier at the station. This is checked quickly by installing a spare amplifier or exchanging amplifiers with a properly operating station.

Special Note Regarding Installation

GAI-Tronics Corporation Page/Party® system equipment does **not**, in normal operation, produce arcs, sparks or heat that would ignite industrial gases or dusts. Many standard GAI-Tronics products are approved by Factory Mutual (USA) and certified by CSA (Canada) for intended use in specified Division 2 areas if properly installed and maintained.

Proper installation is defined as (1) mounting and wiring per factory directions without unauthorized modification and (2) following all requirements of the U.S. National Electric Code (NFPA - 70) or the Canadian Electric Code (CSA Standard C22.1). Installers must be familiar with these codes and consult them as required. The most applicable parts of the N.E.C. code are in articles 500-503. The most applicable parts of the Canadian code are in Section 18. Some, but not all, significant points are:

1. Conduits in a Class I, Division 2 area to or from a non-hazardous area or an adjacent Class I, Division 1 area must have approved seals in the boundary.
2. Conduits or raceways in a Class II, Division 2 or Class III area must have dust seals at entrances to dust-tight equipment and at boundaries to other areas unless such conduits or raceways are also dust-tight.
3. Explosion-proof (Division 1) equipment may be installed in a Division 2 area but must have the same conduit and cable seals as if installed in the corresponding Division 1 area.
4. Sealing of multi-conductor cables or conduits containing multi-conductor cables in Class I, Division 1 or 2 areas must be around each conductor of the cable - except where type MI cable is used.

Safe Power Connection/Disconnection

In order to satisfy Division 2 requirements, equipment must not create arcs or sparks during normal operation, when completely installed and powered. Installing or removing an amplifier or plugging in a live enclosure is not normal operation and can create arcs. To guarantee safety, adhere to the following cautionary note:



Do not insert or remove equipment from live enclosures, unless the area is known to be non-hazardous at the time.

A separate power disconnect is highly recommended. It can be installed and safely used in either of two ways:

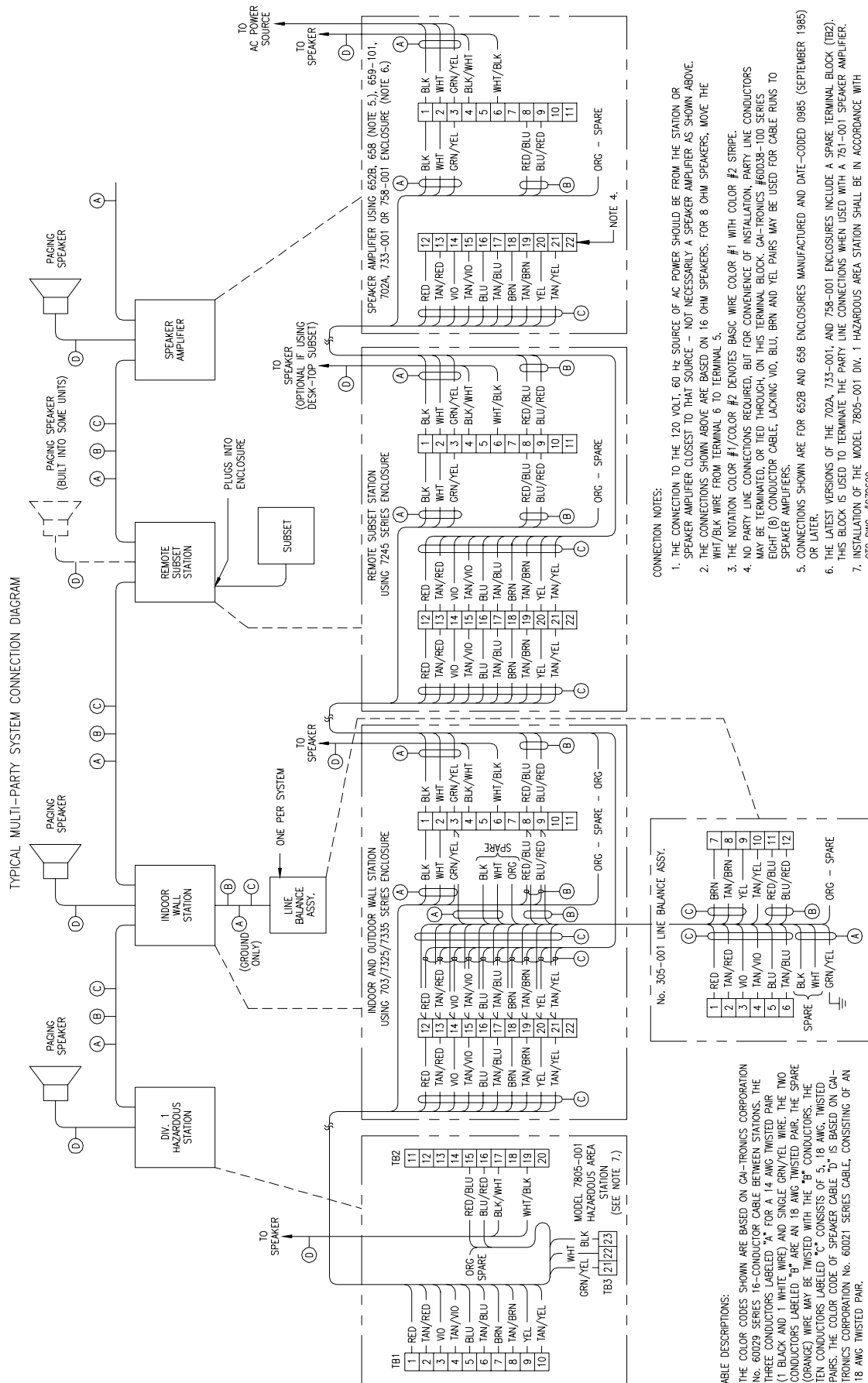
1. An explosion-proof disconnect switch can be located in the Division 2 area.
2. An ordinary disconnect switch can be located in a non-hazardous area (outside the Division 2 area).

Either method will allow the use of the switch at all times. Connect field wiring as detailed in instructions for the same equipment mounted in non-hazardous areas.

Power Distribution Recommendations

The ac input current for a 12-watt 700 Series Station (Handset/Speaker Amplifier or Speaker Amplifier) is 0.46 amperes RMS at full power output (50 VA/27 watts) with 120 V ac line voltage. The 14 AWG wire used for power distribution in standard GAI-Tronics cable is rated at 15 amperes. This limits the number of speaker amp stations per ac feed to 32 units or less. System larger than 32 stations will require breaking the ac power feed into different branches.

Voltage drop must also be taken into consideration for long cable runs. The minimum operating voltage for a GAI-Tronics station is 90V ac and the resistance of 14 AWG cable is 26.8 ohms per loop mile. Contact your nearest GAI-Tronics representative if you require assistance with system layout.



TYPICAL SINGLE-PARTY SYSTEM CONNECTION DIAGRAM

