



GAI-TRONICS® CORPORATION
A HUBBELL COMPANY

Installation of 700 Series 24 V DC Page/Party® Systems

Confidentiality Notice

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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 paging 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 Publication 42004-135, Speaker Installation, or consult with a GAI-Tronics sales representative for additional system planning information.

Power Source Considerations



WARNING

NEVER connect 24 V dc Page/Party® equipment to a supply voltage in excess of 28.8 V dc or equipment damage may result.

The GAI-Tronics 24 V dc Page/Party® system equipment is designed to operate from a 24 V dc rechargeable battery. A battery charger may be connected to the battery to maintain the charge.



CAUTION

Under no condition should this equipment be operated from a battery charger without the batteries connected. Most chargers have an unloaded output of 35 to 45 volts, which can damage equipment designed for nominal 24 volts.

Ground the negative side of the battery system at only one point to ensure hum and noise-free operation. In planning a GAI-Tronics Page/Party® system using 24 V dc stations, careful consideration must be given to power cable losses. In order to use the same cable as used in 120 V ac systems, the installer is restricted to cable length and the number of units connected in parallel for dc power on one cable.

All units are wired in parallel. Good planning will minimize the cable required for each installation. GAI-Tronics can supply multi-conductor cable designed especially for this application. Additionally, for ease of installation GAI-Tronics cable is color-coded to match the termination points in our enclosures. The number, size and color-coding of conductors are listed in the accompanying system connection diagrams.

When installing an add-on station, consult the 24 V dc system layout diagrams at the end of this manual. These figures, when used in conjunction with the station installation information and cable layout guide, should provide all the information necessary to install additional Page/Party® stations.

In 24-volt systems, plan on several branch lines from the dc source with no more than six stations per branch. One branch could span up to 4,000 feet for a single station. The Maximum Cable Distance Table lists the limits. Where two or more stations are listed, the assumption is that they are evenly spaced along the cable.

Each amplifier contains two fuses on the PCBA in the 24 V dc input to protect and isolate the handset and speaker amplifier circuitry in the event of a failure. Power line wiring to each amplifier or group of amplifiers should have a fuse or circuit-breaker to protect against wiring failures.

If cable with No. 14 AWG power line conductors is used, a 15-amp fuse or circuit breaker should be installed for each branch line at the point it connects to the battery. Fuse or circuit breaker rating is determined by the size cable used in the branch. Consult the National Electrical Code (NFPA70) or Canadian Standards Association (CSA 22.1) for the maximum allowable capacity of the wire used.

Maximum Cable Distance in Feet*

Number of Units	14 AWG Total/Between	12 AWG Total/Between	10 AWG Total/Between	8 AWG Total/Between
1	4,000/4,000	6,400/6,400	10,000/10,000	16,000/16,000
2	2,800/1,400	4,480/2,240	7,000/3,500	11,200/5,600
3	2,000/660	3,200/1,060	5,000/1,667	8,000/2,667
6	1,200/200	1,920/320	3,000/500	4,800/800
9	800/90	1,280/142	2,000/222	3,200/356

*Based on the following assumptions:

- GAI-Tronics-supplied cable is used.
- Speech signals (Speech signals do not have the energy content of a continuous tone, and therefore do not require as much average current.) **NOTE:** With continuous tone signals, each station is driven to 12 watts and the distances stated should be reduced by half, or ideally one fourth, to minimize signal distortion.
- Wire resistance (ohms) is the nominal value for the applicable AWG at 1,000 feet of bare copper, stranded wire @ 20° C (68° F). Wire resistance values used are as follows:
14 AWG = ~2.525 ohms; 12 AWG = ~1.588 ohms; 10 AWG = ~0.999 ohm; 8 AWG = ~0.628 ohm
- DC V at cable run’s feed point = ~26.6 V dc
- DC V at the last unit in cable run = 21 V dc minimum
- Unit current draw (I) is the same regardless of the unit’s placement along the cable run for ease of calculation. (~1.1 amperes when unit is producing a 12-watt sine wave output.)

For conditions other than above, the following formula may be helpful in calculating the approximate maximum distance for a single station.

For continuous tone applications with minimum distortion:

$$\frac{V_{\text{FEEDPOINT}} - V_{\text{MINIMUM}}}{(2 \times \text{AWG WIRE RESISTANCE PER FOOT @} \sim 20^{\circ}\text{C}) \times \text{UNIT I [IN AMPS @12W OUT]}} = \text{APPROXIMATE MAXIMUM DISTANCE IN FEET}$$

For speech operation only, multiply the above result by a factor of 2 to a maximum factor of 4.

Example: What is the approximate maximum distance for a single dc station if the voltage feed is 27.5 V dc and a 14 AWG wire is used @ 20° C?

Info:

- 14 AWG @ 20° C = ~0.002525 ohms per foot
- Vfeedpoint = 27.5 V dc

Solution:

$$\begin{aligned} & (27.5 \text{ V} - 21 \text{ V}) / ((2 \times 0.002525 \text{ ohm per foot}) \times 1.1 \text{ amp}) \\ & = 6.5 / 0.005555 \\ & = 1170 \text{ feet (for continuous tone signal) or up to } \sim 4680 \text{ feet } (\times 4) \text{ for speech signals} \end{aligned}$$

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 is being 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. *Fiber Optic Cables*—Use audio cables with fiber optic cables in cable trays as an alternative to shielded cables. Fiber optic cables are immune to SCR-generated electrical noise.
4. *Isolation*—In 24 V dc systems, the battery/battery charger usually provides isolation from the SCR noise on the ac power system. Cable separation and shielding as mentioned above still apply.

NOTE: Avoid battery chargers that use 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 plug-in amplifiers at the factory, allowing the amplifiers to remain protected while the enclosures are installed and wired, which is 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 varies 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 1-1/4 conduit. Plates for single 1/2 inch or 1-1/2 inch, or dual 1-1/4 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.



CAUTION

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.

System	Enclosure	Amplifier	Subset
Single Party Line	702, 732, 733	701	None
Single Party Line	7245	723	711, 716, 726
Multiple Party Line	703, 7325, 7335	701	None
Multiple Party Line	7245	723	7115, 7165, 7265

NOTE: The above stock numbers are simplified. Most stock numbers include a single digit letter or three-digit suffix (i.e. 702A, 711-101).

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

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 Step 6. The following is the preferred method for mounting the line balance assembly is as follows:

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 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 cables discussed in this publication are listed in the following table. Size and installation of conduit and cable must meet the requirements of applicable electrical codes.

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.

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

Where GAI-Tronics cable is installed, each conductor should be lugged and attached to the terminal—either in accordance with the color code shown on the applicable accompanying diagram, or in accordance with special drawings provided for this purpose.

Exception: Some cables have an orange “spare” conductor. Unless otherwise instructed, this should be insulated 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.

Muting Defeat Instructions

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. Please see the chart on page 5 for series numbers covered by this bulletin.

Step 6 — Checkout and Adjustment

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

1. Apply dc 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 only occurs 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. 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.
3. 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 GAI-Tronics 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 amplifier has three additional internal controls: receiver volume control, transmission volume control, and receiver sidetone control. All controls are accessible using a screwdriver through the holes in the chassis. A fourth hole allows similar access from the rear of the paging speaker volume control. 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 speaking, 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 the two conductors are twisted pairs and there is 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 the ground location. By going from one junction point to another and disconnecting the affected circuit, the ground can be located. 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 are 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, a 33-ohm, 1/2-watt resistor should be connected across L1 and L2 of the Page/Party® line circuits. These resistors must be removed 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. Voices 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 affects gain and increases the level of sidetone. Please refer to specific instructions in Step 6 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. To locate the short circuit, it is necessary to proceed in the same way as locating a ground - checking junction points with an ohmmeter.

Cross Talk

Cross talk, or inter-channel 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.

Audio Voltage

In a system that is operating properly, audio voltage read across any of the page or party circuits (L1 or L2) will be 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.

Static Charges

In many normal installations, induced 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 occur only if one side of the page or party circuit becomes grounded.

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 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 NRTL-approved for use in USA and 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 the codes 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 MI cable is used.

Safe Power Connection/Disconnection

To satisfy Division 2 requirements, the equipment will not create arcs or sparks in 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.



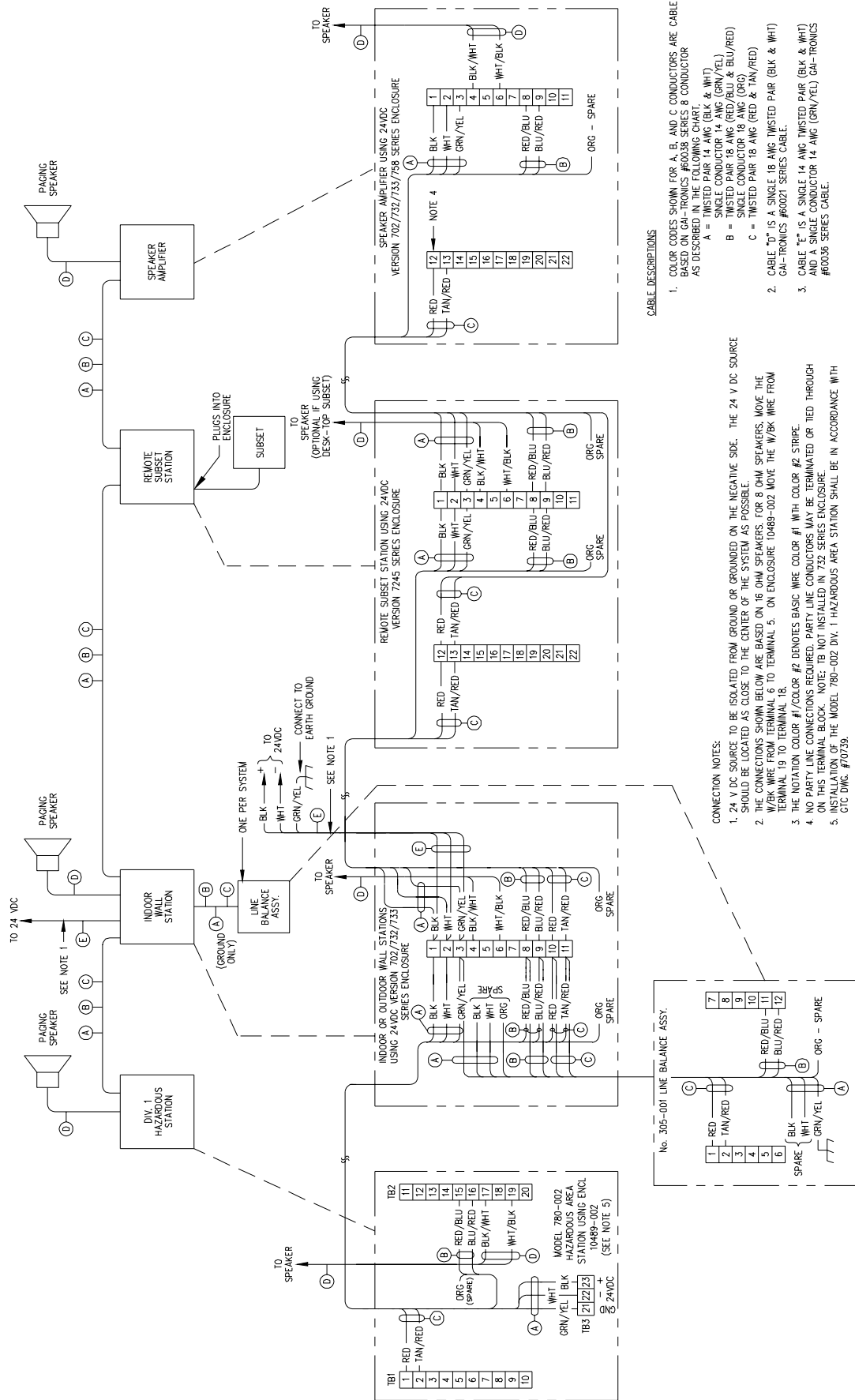
To guarantee safety, do not insert or remove equipment from live enclosures, unless the area is known to be non-hazardous at the time.

A better arrangement uses a separate power disconnect, performed safely in either of two ways:

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

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

TYPICAL SINGLE-PARTY SYSTEM CONNECTION DIAGRAM



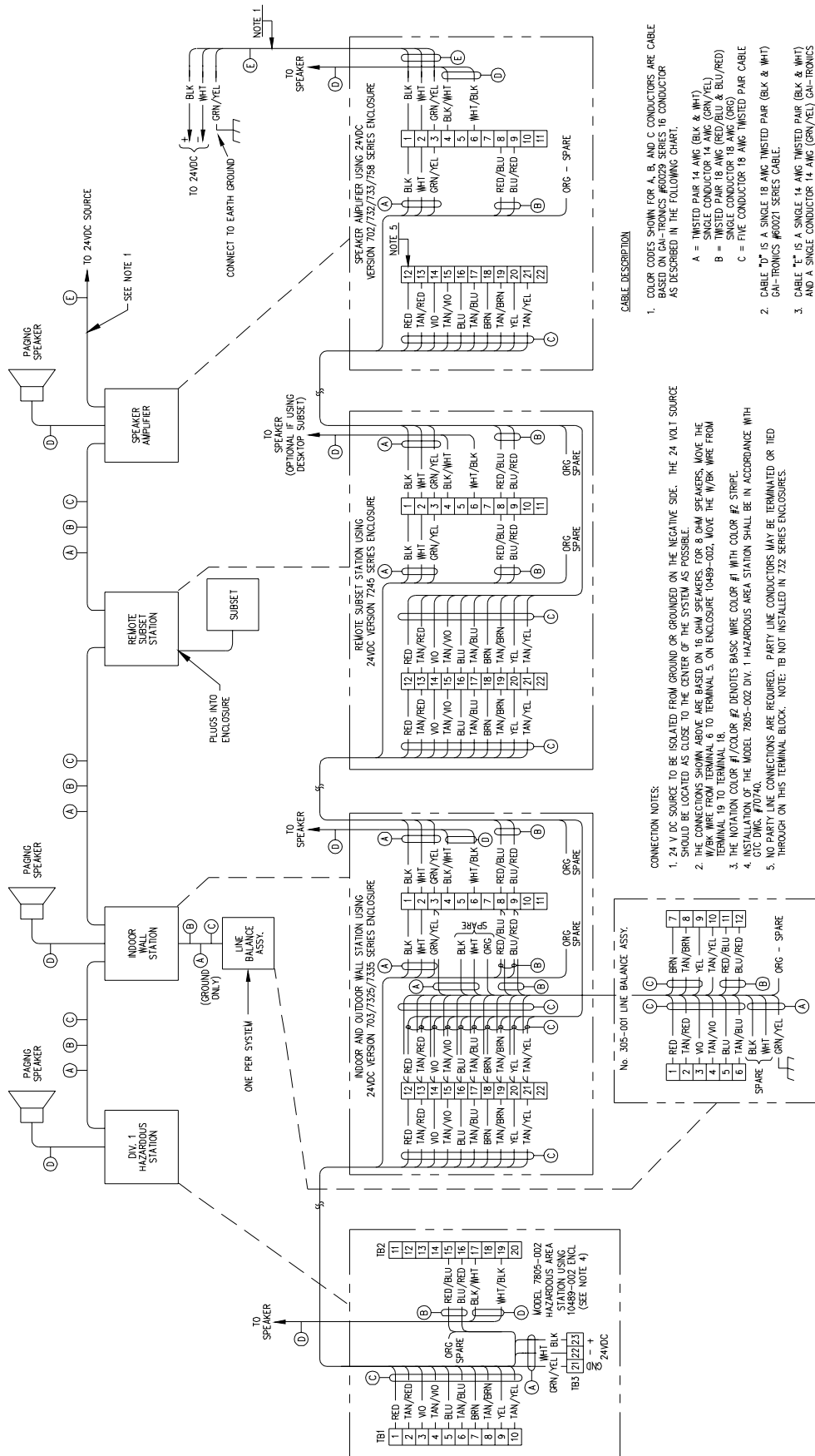
CABLE DESCRIPTIONS

- COLOR CODES SHOWN FOR A, B, AND C CONDUCTORS ARE CABLE BASED ON GAI-TRONICS #0038 SERIES 8 CONDUCTOR AS DESCRIBED IN THE FOLLOWING CHART (BLK & WHT)
 - A = SINGLE CONDUCTOR 14 AWG (GRN/YEL)
 - B = TWISTED PAIR 18 AWG (RED/BLU & BLU/RED)
 - C = TWISTED PAIR 18 AWG (RED & TAN/RED)
- CABLE "D" IS A SINGLE 18 AWG TWISTED PAIR (BLK & WHT) GAI-TRONICS #0021 SERIES CABLE.
- CABLE "E" IS A SINGLE 14 AWG TWISTED PAIR (BLK & WHT) AND A SINGLE CONDUCTOR 14 AWG (GRN/YEL) GAI-TRONICS #0038 SERIES CABLE.

CONNECTION NOTES:

- 24 V DC SOURCE TO BE ISOLATED FROM GROUND OR GROUNDED ON THE NEGATIVE SIDE. THE 24 V DC SOURCE SHOULD BE LOCATED AS CLOSE TO THE CENTER OF THE SYSTEM AS POSSIBLE.
- THE CONNECTIONS SHOWN BELOW ARE BASED ON 16 GND SPEAKERS. FOR 8 GND SPEAKERS, MOVE THE TERMINAL TO TERMINAL 18.
- THE NOTATION COLOR #/COLOR #2 DENOTES BASIC WIRE COLOR #1 WITH COLOR #2 STRIPE.
- NO PART LINE CONNECTIONS REQUIRED. PART LINE CONDUCTORS MAY BE TERMINATED OR TIED THROUGH THE SPEAKER TERMINAL BLOCK. NOTE: TB NOT INSTALLED IN 52 SERIES ENCLOSURE.
- INSTALLATION OF THE MODEL 780-002 DIV. 1 HAZARDOUS AREA STATION SHALL BE IN ACCORDANCE WITH GTC DWG. #70738.

TYPICAL MULTI-PARTY SYSTEM CONNECTION DIAGRAM



- CABLE DESCRIPTION**
- COLOR CODES SHOWN FOR A, B, AND C CONDUCTORS ARE CABLE BASED ON GAI-TRONICS #6029 SERIES 16 CONDUCTOR AS DESCRIBED IN THE FOLLOWING CHART.
 - A = TWISTED PAIR 14 AWG (BLK & WHT)
 - SINGLE CONDUCTOR 14 AWG (GRN/YEL)
 - TWISTED PAIR 18 AWG (RED/BLU & BLU/RED)
 - SINGLE CONDUCTOR 18 AWG (ORG)
 - C = FIVE CONDUCTOR 18 AWG TWISTED PAIR CABLE
 - CABLE "D" IS A SINGLE 18 AWG TWISTED PAIR (BLK & WHT) GAI-TRONICS #6021 SERIES CABLE.
 - CABLE "E" IS A SINGLE 14 AWG TWISTED PAIR (BLK & WHT) AND A SINGLE CONDUCTOR 14 AWG (GRN/YEL) GAI-TRONICS #60036 SERIES CABLE.

- CONNECTION NOTES:**
- 24 V DC SOURCE TO BE ISOLATED FROM GROUND OR GROUNDED ON THE NEGATIVE SIDE. THE 24 VOLT SOURCE SHOULD BE LOCATED AS CLOSE TO THE CENTER OF THE SYSTEM AS POSSIBLE.
 - IF THE SPEAKERS ARE TO BE USED ON REMOTE SPEAKERS, MOVE THE W/BK WIRE FROM TERMINAL 19 TO TERMINAL 18.
 - THE NOTATION COLOR #1/COLOR #2 DENOTES BASIC WIRE COLOR #1 WITH COLOR #2 STRIPE.
 - INSTALLATION OF THE MODEL 7805-002 DIV. 1 HAZARDOUS AREA STATION SHALL BE IN ACCORDANCE WITH CTC DING #70740.
 - NO PARTY LINE CONNECTIONS ARE REQUIRED. PARTY LINE CONDUCTORS MAY BE TERMINATED OR TIED THROUGH ON THIS TERMINAL BLOCK. NOTE: TB NOT INSTALLED IN 732 SERIES ENCLOSURES.

Warranty

Equipment. GAI-Tronics warrants for a period of one (1) year from the date of shipment, that any GAI-Tronics equipment supplied hereunder shall be free of defects in material and workmanship, shall comply with the then-current product specifications and product literature, and if applicable, shall be fit for the purpose specified in the agreed-upon quotation or proposal document. If (a) Seller's goods prove to be defective in workmanship and/or material under normal and proper usage, or unfit for the purpose specified and agreed upon, and (b) Buyer's claim is made within the warranty period set forth above, Buyer may return such goods to GAI-Tronics' nearest depot repair facility, freight prepaid, at which time they will be repaired or replaced, at Seller's option, without charge to Buyer. Repair or replacement shall be Buyer's sole and exclusive remedy. The warranty period on any repaired or replacement equipment shall be the greater of the ninety (90) day repair warranty or one (1) year from the date the original equipment was shipped. In no event shall GAI-Tronics warranty obligations with respect to equipment exceed 100% of the total cost of the equipment supplied hereunder. Buyer may also be entitled to the manufacturer's warranty on any third-party goods supplied by GAI-Tronics hereunder. The applicability of any such third-party warranty will be determined by GAI-Tronics.

Services. Any services GAI-Tronics provides hereunder, whether directly or through subcontractors, shall be performed in accordance with the standard of care with which such services are normally provided in the industry. If the services fail to meet the applicable industry standard, GAI-Tronics will re-perform such services at no cost to buyer to correct said deficiency to Company's satisfaction provided any and all issues are identified prior to the demobilization of the Contractor's personnel from the work site. Re-performance of services shall be Buyer's sole and exclusive remedy, and in no event shall GAI-Tronics warranty obligations with respect to services exceed 100% of the total cost of the services provided hereunder.

Warranty Periods. Every claim by Buyer alleging a defect in the goods and/or services provided hereunder shall be deemed waived unless such claim is made in writing within the applicable warranty periods as set forth above. Provided, however, that if the defect complained of is latent and not discoverable within the above warranty periods, every claim arising on account of such latent defect shall be deemed waived unless it is made in writing within a reasonable time after such latent defect is or should have been discovered by Buyer.

Limitations / Exclusions. The warranties herein shall not apply to, and GAI-Tronics shall not be responsible for, any damage to the goods or failure of the services supplied hereunder, to the extent caused by Buyer's neglect, failure to follow operational and maintenance procedures provided with the equipment, or the use of technicians not specifically authorized by GAI-Tronics to maintain or service the equipment. **THE WARRANTIES AND REMEDIES CONTAINED HEREIN ARE IN LIEU OF AND EXCLUDE ALL OTHER WARRANTIES AND REMEDIES, WHETHER EXPRESS OR IMPLIED BY OPERATION OF LAW OR OTHERWISE, INCLUDING ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

Return Policy

If the equipment requires service, contact your Regional Service Center for a return authorization number (RA#). Equipment should be shipped prepaid to GAI-Tronics with a return authorization number and a purchase order number. If the equipment is under warranty, repairs or a replacement will be made in accordance with the warranty policy set forth above. Please include a written explanation of all defects to assist our technicians in their troubleshooting efforts.

Call 800-492-1212 (inside the USA) or 610-777-1374 (outside the USA) for help identifying the Regional Service Center closest to you.