GAI-TRONICS®
A HUBBELL COMPANY

Model 12599-102 & 12599-104
Rack Mount Hot Standby Amplifier Module

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General Information

The Hot Standby Amplifier Module (HSM) is designed for use in system cabinets equipped with central power amplifiers requiring hot (automatic) switching to a standby (backup) amplifier when any one of the primary power amplifiers fail.

The HSM is available in two versions; Model 12599-102 for switching a two-channel amplifier, and Model 12599-104 for switching a four- channel amplifier. Both versions can switch up to 700 watts of output power per channel. Multiple modules can be cascaded using an "In/Out" board control feature.
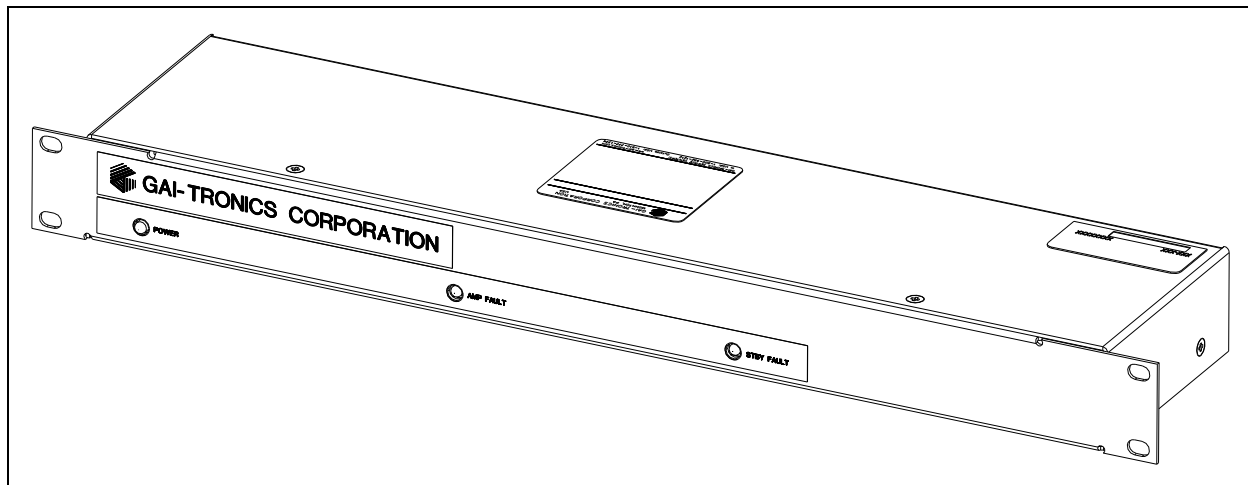

Figure 1. Models 12599−102 and 12599−104 Hot Standby Amplifier Modules

Hardware Configuration

The Hot Standby Amplifier Module consists of the Hot Standby Amplifier in a 1U (1.75 inch) high, standard 19-inch, EIA rack mount chassis. The chassis is equipped with plug-in type terminal blocks and RJ45 connectors. All connectors are located on the rear of the chassis. The front of the unit has three LEDs for Power, Amplifier Fault, and Standby Amplifier Fault indications.

Inside the chassis is the HSM Printed Circuit Board Assembly (PCBA) that features high-current relays for switching the amplifier outputs and low-power relays for switching the amplifier inputs and providing dry contact status outputs. The PCBA is also equipped with audio transformers to provide audio input gain and coupling of the input audio signals. Jumper clips are provided to select the various modes of operation.

Front Panel Indicators

The 12599-102 and -104 Hot Standby Modules are equipped with three LED indicators on the front panel to indicate if power is applied to the unit, or if a fault condition exists for the main or standby amplifiers.
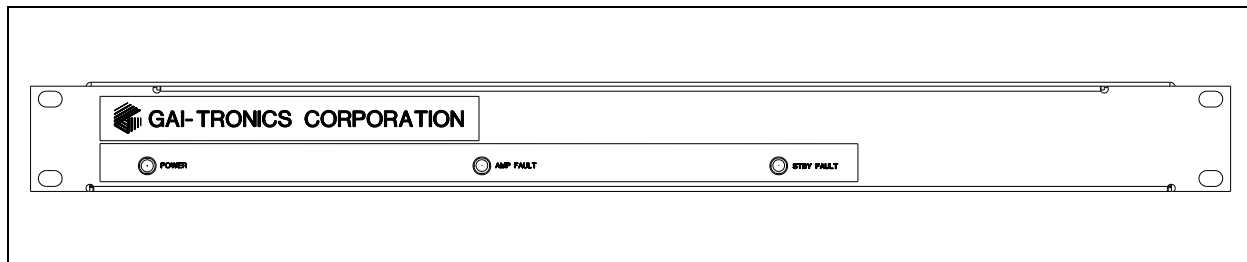

Figure 2. Models 12599-102 and 12599-104 Hot Standby Amplifier Modules – Front View

Rear Panel Connections

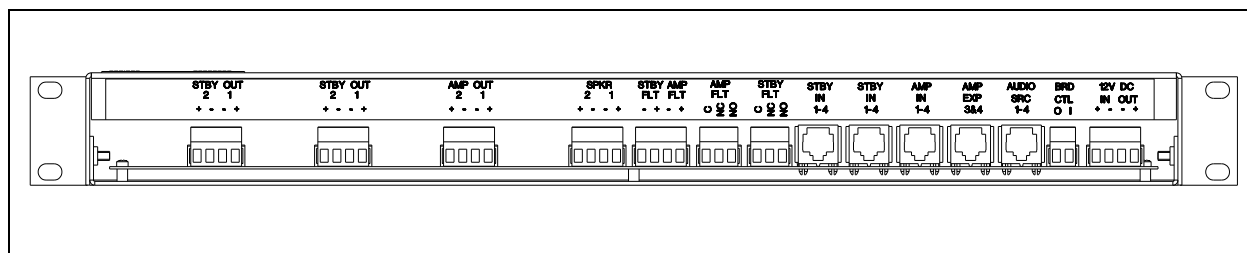Refer to Figure 3 for the 12599-102 and Figure 4 for the 12599-104 rear panel connections.

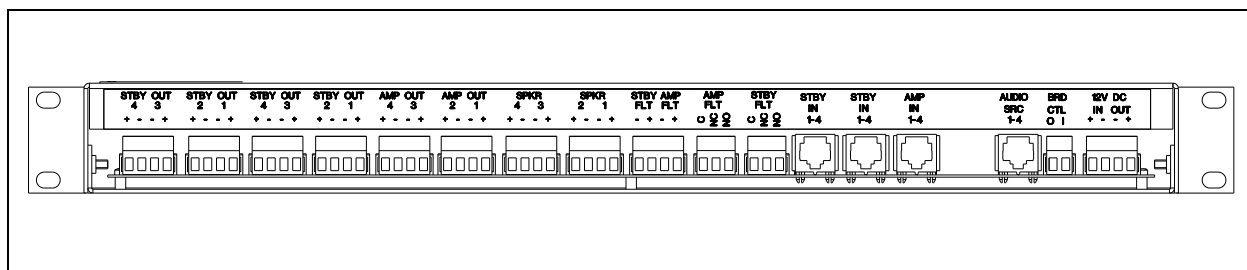Figure 3. Model 12599-102 Two-Channel Hot Standby Amplifier Module – Rear View

Figure 4. Model 12599-104 Four-Channel Hot Standby Amplifier Module – Rear View

Installation

⚠**WARNING** ⚠

1. For safety; disconnect the power prior to installing, servicing, or replacing the module.

2. Do not service or replace the module during electrical storms.

3. Do not touch un-insulated wires.

4. Notify plant personnel prior to servicing or replacing the unit.

5. External power supply, if used, shall be certified LPS Power Supply with adequate electrical ratings.

6. Class 2 circuit wiring must be performed in accordance with NEC 725.55.

Mounting

The HSM is designed for mounting in a standard 1U, 19-inch, EIA rack. Insertion depth of the chassis is approximately 4.31 inches. Installation above the amplifiers (in the rack area) may be preferable to facilitate access to the terminals and connectors.

Wiring

The Hot Standby Amplifier Module is equipped with modular (plug-in type) terminal blocks and RJ45 connectors. These terminal blocks and connectors simplify external wiring during installation, and provide quick disconnect if service or replacement is ever required. The following is a breakdown of each terminal block and connector with their function(s). The terminals and connectors are listed in the order of placement from <u>Right to Left</u> when viewed from the rear of the unit.

TB1 – is the **"12 V dc Power"** connection. The IN terminals are the input from the dc power source. The OUT terminals are provided to connect another module or device requiring 12 V dc power. Be sure to observe polarity when making these connections. The TB1 pin-out is shown in Table 1 below.

Table 1. 12 V dc Connections at TB1

TB1 - 12V DC POWER			
OUT		IN	
+	–	–	+

TB3 – is the **"Board Control In/Out"** connection that is used when cascading multiple modules. In a cascade arrangement, no connection is made at the "I" (In) terminal of the first module. At the second module, connect the "O" (Out) terminal of the first module to the "I" (In) terminal of the second module, and continue this wiring scheme across subsequent modules. The TB3 pin-out is shown in Table 2, and the wiring scheme across multiple modules is shown in Figure 5 below. Also see the P6 jumper setting in Table 13 located on Page 8.

Table 2. Board Control Connections at TB3

TB3 - BOARD CONTROL	
O	I
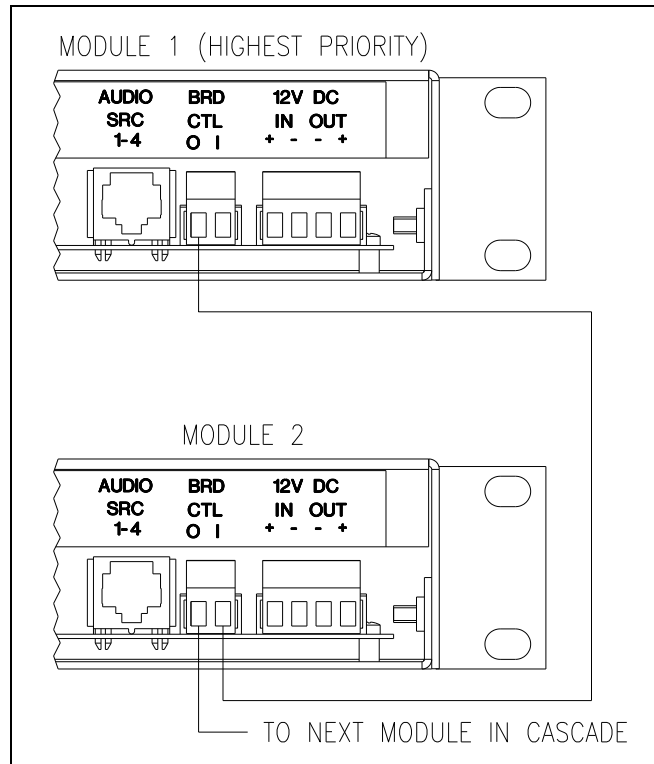
Figure 5. Board Control In/Out Wiring

J1 – is the **"Audio Source Input"** connection for Channels one through four. The J1 connector pin-out is shown in Table 3 below:

Table 3. Pin-out at J1

PIN NO.	FUNCTION	PIN NO.	FUNCTION
1	AUDIO CHANNEL 1+	5	AUDIO CHANNEL 3+
2	AUDIO CHANNEL 1-	6	AUDIO CHANNEL 2-
3	AUDIO CHANNEL 2+	7	AUDIO CHANNEL 4+
4	AUDIO CHANNEL 3-	8	AUDIO CHANNEL 4-

J3 – is the **"2-Channel Audio Expansion"** connector. This connector is only installed on Model 12599-102 (2-channel) Hot Standby Amplifier Module for the purpose of adding another amplifier if expanded speaker coverage is needed or if access to audio channels three or four is needed.

If adding another amplifier to expand speaker coverage, another HSM is required for the added amplifier. To get audio channels three and four to the input of the added amplifier, connect J3 of this module to J1 of the added HSM. The J3 connector pin-out is shown in Table 4 below.

Table 4. Pin-out at J3

PIN NO.	FUNCTION	PIN NO.	FUNCTION
1	AUDIO CHANNEL 3+	5	NONE
2	AUDIO CHANNEL 3-	6	AUDIO CHANNEL 4-
3	AUDIO CHANNEL 4+	7	NONE
4	NONE	8	NONE

J2 – is the **"Primary Amplifier Input"** connector for providing audio signals to the primary amplifier inputs (*see notes*). The J2 connector pin-out is shown in Table 5 below.

Table 5. Pin-out at J2

PIN NO.	FUNCTION	PIN NO.	FUNCTION
1	AUDIO CHANNEL 1+	5	AUDIO CHANNEL 3+
2	AUDIO CHANNEL 1-	6	AUDIO CHANNEL 2-
3	AUDIO CHANNEL 2+	7	AUDIO CHANNEL 4+
4	AUDIO CHANNEL 3-	8	AUDIO CHANNEL 4-

NOTES:

1. For installations with a 4-channel amplifier, all four channels are utilized.

2. For installations with a 2-channel amplifier, only channels one and two are utilized. If an additional (future) amplifier is needed for expanded coverage, follow the J3 connection instructions.

J4 and J5 – are the **"Standby Amplifier Input"** connectors for providing audio signals to the standby amplifier inputs. These two connectors are wired in parallel to allow interconnection of the standby amplifier inputs across multiple (cascaded) modules. See Table 6 for the J4 and J5 pin-outs below.

Table 6. Pin-outs at J4 and J5

PIN NO.	FUNCTION	PIN NO.	FUNCTION
1	AUDIO CHANNEL 1+	5	AUDIO CHANNEL 3+
2	AUDIO CHANNEL 1-	6	AUDIO CHANNEL 2-
3	AUDIO CHANNEL 2+	7	AUDIO CHANNEL 4+
4	AUDIO CHANNEL 3-	8	AUDIO CHANNEL 4-

TB4 and TB14 – are the **"Standby Amplifier Fault"** and **"Primary Amplifier Fault"** output contacts. Both outputs can be set to provide a 20-kilohm inline resistance for supervision, or as a dry form "C" contact with a maximum rating of 2 A @ 30 V dc. Connect these fault outputs to other system devices to monitor the status of the primary and standby amplifiers. See Table 7 below for the TB4 and TB14 pin-outs, along with the P7 and P9 jumper settings in Table 13 on Page 8.

Table 7. Primary and Standby Amp Fault Outputs at TB4 and TB14

TB4 - AMP FAULT			TB14 - STANDBY FAULT		
C	NC	NO	C	NC	NO

TB2 – is the **"Primary Amplifier Fault"** and **"Standby Amplifier Fault"** control inputs. Each input is designed to accept either an active fault signal of 5 V dc @ 0.9 mA, or a dry contact from the respective amplifier. See Table 8 and Figure 6 below for the TB2 pin-out and wiring, along with the P1 and P8 jumper settings in Table 13 on Page 8.

Table 8. Primary and Standby Amp Fault Input Connections at TB2

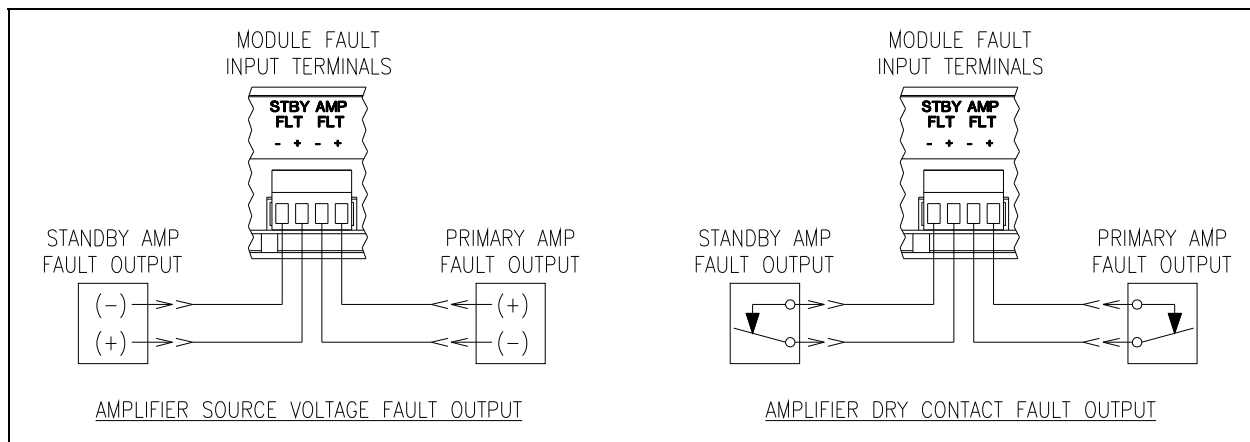| TB2 - FAULT INPUTS			
STBY FLT		AMP FLT	
–	+	–	+

Figure 6. Fault Input Wiring

TB7 and TB8 – are the **"Speaker Line"** connections to the module. TB7 is for connection of speaker lines one and two (channels one and two respectively). TB8 is installed <u>only</u> on the four-channel module for connection of speaker lines three and four (channels three and four respectively). See Table 9 below for the TB7 and TB8 pin-outs.

Table 9. Speaker Connections at TB7 and TB8

TB8 - SPEAKER LINES				TB7 - SPEAKER LINES			
CHN 4		CHN 3		CHN 2		CHN 1	
+	–	–	+	+	–	–	+

NOTE: TB8 is installed only on Model 12599-104 (four-channel) Hot Standby Amplifier module.

TB5 and TB6 – are the **"Primary Amplifier Outputs"** connection to the module. TB5 is for connection of amplifier output channels one and two. TB6 is installed <u>only</u> on the four-channel module for connection of amplifier output channels three and four. See Table 10 below for the TB5 and TB6 pin-outs.

Table 10. Amplifier Output Connections at TB5 and TB6

TB6 - AMP OUTPUTS				TB5 - AMP OUTPUTS			
CHN 4		CHN 3		CHN 2		CHN 1	
+	–	–	+	+	–	–	+

NOTE: TB6 is installed only on the Model 12599-104 (four-channel) Hot Standby Amplifier Module.

TB9 – TB12 – are the **"Standby Amplifier Output"** connections to the module. TB9 and TB11 are installed <u>only</u> on the two-channel modules, whereas TB9 through TB12 are installed on the four-channel modules. See Table 11 and Table 12 for the TB9 – TB12 pin-outs and the guidelines below for utilizing these output connections.

2-Channel Modules – connect the standby amplifier outputs to TB9. If any amplifiers and hot standby modules are added in the future for expanded speaker coverage, connect TB11 at this module to TB11 of the added module(s). This wiring arrangement creates a bus for the standby amplifier outputs across the modules.

4-Channel Modules – connect the standby amplifier outputs to TB9 and TB10. If any amplifiers and hot standby modules are added in the future for expanded speaker coverage, connect TB11 and TB12 at this module to TB11 and TB12 of the added module(s). This wiring arrangement creates a bus for the standby amplifier outputs across the modules.

Table 11. Standby Amplifier Output Connections at TB9 and TB10

TB10 - STBY OUTPUTS				TB9 - STBY OUTPUTS			
CHN 4		CHN 3		CHN 2		CHN 1	
+	–	–	+	+	–	–	+

Table 12. Standby Amplifier Output Connections at TB11 and TB12

TB12 - STBY OUTPUTS					TB11- STBY OUTPUTS			
CHN 4		CHN 3			CHN 2		CHN 1	
+	–	–	+		+	–	–	+

NOTE: TB10 and TB12 are installed only on the Model 12599-104 (four-channel) Hot Standby Amplifier Module.

Jumper Settings

The Hot Standby Amp Module contains several jumper clips on the internal circuit board that are used to set how the module will function. To access the jumper clips, remove the six cover screws; two are located on the top and two are located on each side.

Table 13. Jumper Settings

Jumper	Function	Position	Description
P1	Amp Fault Type	WET	Wet activation (default)
		DRY	Dry activation
P2	Amp Ch. 1 Input Gain Select	2X	2X (2.6 dB) Gain (default)
		1X	1X (Unity) Gain
P3	Amp Ch. 2 Input Gain Select	2X	2X (2.6 dB) Gain (default)
		1X	1X (Unity) Gain
P4*	Amp Ch. 3 Input Gain Select	2X	2X (2.6 dB) Gain (default)
		1X	1X (Unity) Gain
P5*	Amp Ch. 4 Input Gain Select	2X	2X (2.6 dB) Gain (default)
		1X	1X (Unity) Gain
P6	Board Sequence	1ST	1st Module in a Sequence (default)
		2ND	2nd Module in a Sequence
P7	Amp Fault Supervision	IN	20K Resistor is "in" the circuit (default)
		OUT	20K Resistor is "out" of the circuit
P8	Standby Amp Fault Type	WET	Wet activation (default)
		DRY	Dry activation
P9	Standby Amp Fault Supervision	IN	20K Resistor is "in" the circuit (default)
		OUT	20K Resistor is "out" of the circuit

NOTES:

1. Jumper clips with an asterisk * are installed only on the 4-channel module.

2. When finished setting the jumper clips, be sure to reattach the cover.

The following sections describe the functions of the jumper clip settings on the board.

Fault Type Jumpers (P1 and P8)

WET – This setting is used if the amplifier provides an active source voltage of 5 V dc @ 0.9 mA when healthy and 0 V dc when faulted.

DRY – This setting requires a normally closed (N.C.), dry contact from the amplifier when healthy and removal of the contact when the amplifier is faulted. This setting is also used when the amplifier has an open collector fault output, which is actively low (sinking to dc common) when healthy, and floating high when the amplifier is faulted.

Gain Select Jumpers (P2, P3, P4, and P5)

2X – This setting is selected if the source audio signal level is not sufficient to achieve full amplifier output since some newer amplifier's now require a 1.4 V $_{(RMS)}$ input level versus a 0.775 V $_{(RMS)}$ (0 dBm) level in older amplifiers. When selected, the signal gain is increased by 2.6 dB to the amplifier input.

1X – This setting is selected if the source audio is adequate to achieve full amplifier output. This position can also be used to couple a single-ended audio source to a balanced input or provide dc isolation between the source and amplifier input.

NOTE: Jumper clips P4 and P5 are installed only on the 4-channel module.

Board Sequence Jumper (P6)

1ST – This position is selected if the module is standalone, or is the first in a series of cascaded modules with the connected amplifier having highest priority if a fault occurs.

2ND – This position is selected if another module has already been set to 1ST in a series of cascaded modules.

Fault Supervision Jumpers (P7 and P9)

IN – This setting is selected if the fault output contact connects to a supervised input, such as a Monitored Input Module (MIM) or a Monitored Relay Module (MRM) in a GAI-Tronics ADVANCE cabinet.

OUT – This setting is selected if the fault output contact is used to simply key another device and supervision is not required.

Operation

The Hot Standby Amplifier Module operates from a 12 V dc power source. With all wiring properly connected, all jumper clips properly set, and power applied; no circuits should be active until an amplifier fault occurs. The block diagram below depicts typical circuit functionality.
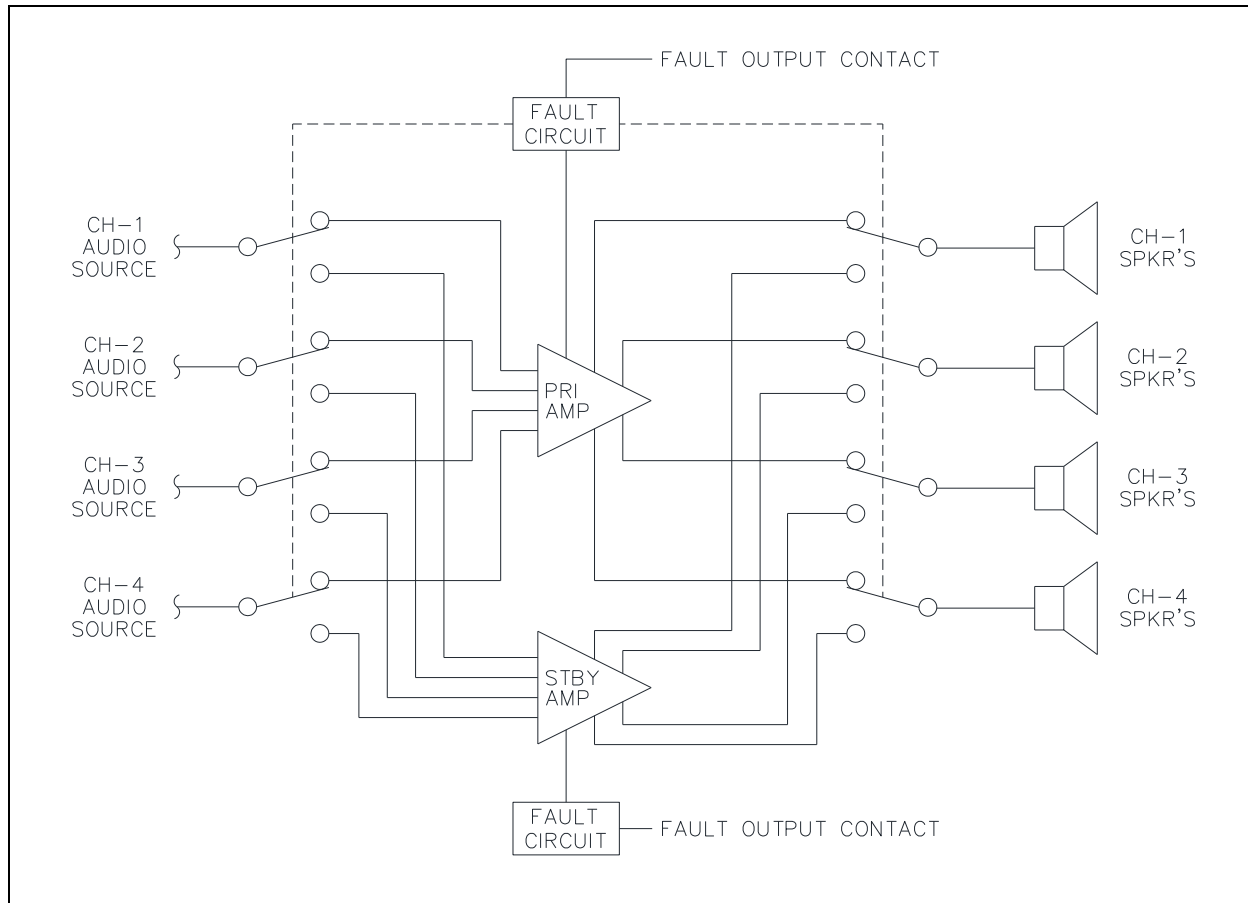

Figure 7. Block Diagram (4−channel version shown)

The amp fault input at TB2 provides a connection point for an amplifier fault output. The module's fault input can be configured to accept wet or dry amplifier fault output types.

If the amplifier's internal fault circuits detect a problem (e.g., a shorted or overloaded output, excessive temperature, etc.), or ac power is removed from the amplifier, the amplifier's fault output is no longer producing an active output voltage. The input circuit detects this change, and activates internal relays to switch over to the standby amplifier in place of the faulty amplifier. The circuit will remain active until the amplifier fault condition is remedied.

Dry Contact Outputs

The Hot Standby Amplifier Module provides two, form "C" dry contact outputs; one for the main (primary) amplifier, and one for the standby amplifier. Each output can be used for triggering either a remote status indicator, or an input at a supervised system device for visual text display. Each output contact operates in conjunction with its respective fault detection circuit so that the status of the connected amplifiers can be monitored at all times.

Cascading Modules

The Hot Standby Amplifier Module can be operated with a series of other modules in a cascade. This feature is useful in cabinet/system applications when a higher ratio of active (primary) amplifiers to standby amplifier is needed.

When using the cascade feature, the IN/OUT control at TB3 must be used between modules. For the cascade to function properly, connect the OUT terminal of the first module to the IN terminal at the second module. Do **not** make any connections to the IN terminal at the first module. For subsequent modules in the cascade, this in/out wiring arrangement is continued across all modules in the cascade.

In addition to in/out control across modules, the board sequence jumper P6 must also be set to the proper operating position. See the board sequence jumper P6 in Table 13 on Page 8 for additional information.

Priority Switching

The Hot Standby Amplifier Module prioritizes the switching of the standby amplifier if connected across multiple modules for two reasons, which are:

1. To avoid excessive loading of the standby amplifier in the event of multiple amplifier failures, and

2. To ensure that critical facility areas receive alarm and voice audio broadcasts during emergencies.

The order of priority switching is from the first to the last in a cascade. Thus, module one has highest priority, and the last module has lowest priority. While it is difficult to determine which area of a facility is the most critical (as in item 2 above), an example would be an offshore oil platform system with multiple amplifiers. In this case, the living quarters (LQ) are usually considered a high priority area. In this type of system/cabinet design, the LQ amplifier should be connected to module one to ensure that personnel (sleeping in the LQ) will be alerted during emergencies.

Maintenance

The Hot Standby Amplifier Module does not contain any user serviceable parts. Do **not** attempt to make any repairs to the module.

If the module requires service, contact your Regional Service Center for a return authorization number (RA#). The module should be shipped prepaid to GAI-Tronics with a return authorization number and a purchase order number. If the module is under warranty, repairs or a replacement will be made in accordance with GAI-Tronics' warranty policy. 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.

Troubleshooting

Problem	Solution
Module is damaged.	Do not attempt to repair the module. Contact GAI-Tronics service for repair or replacement of the module in accordance with the information provided on page 11.
Module does not switch to backup amplifier when the primary amplifier fails or is powered-down.	Check polarity of wiring between fault input at the module, and the fault output at the amplifier. Also, ensure the P1 jumper clip is set to the correct position for either wet or dry mode, based on the fault output type produced by the amplifier.
Some relay switching activity can be heard on the module and output contacts are functioning. But the associated LED does not illuminate and the primary amplifier is not switching to the standby (backup) amplifier.	If the module is used standalone or is the first in a cascade, ensure the BRD SEQ jumper clip (P6) is installed in the 1st position, as described in the "Jumper Settings" section in Table 13 on Page 8.
Amplifiers on the second (cascaded) module operate independently.	In a cascade arrangement, jumper P6 must be set to the 1st position at the first module, and the 2nd position at the second module, and all subsequent modules, as described in the jumper settings section in Table 13 on Page 8. Also, ensure wiring at the BRD CNTL terminals (TB3) are properly wired across all modules.
After performing all wiring checks, trouble-shooting, etc. as described in this section, the module still does not function properly.	Contact GAI-Tronics service for repair or replacement of the module in accordance with the information provided on Page 11.

Specifications

Electrical

Power requirements ....9.5 V dc to 14 V dc (12 V dc nominal)

Current draw ....322 mA maximum @ 12 V dc

Number of amplifier connections .... 2 (one primary, one standby)

Fault input voltage (Wet mode) .... 5 V dc @ 0.9 mA (healthy); 0 V dc (faulted)

Fault input current (Dry mode) ....3.9 mA (closed/healthy); 0 mA (open/faulted)

Number of fault outputs ....2 (one primary, one standby)

Fault output type ....20 kΩ inline resistor or Form "C" (jumper selectable)

Fault output contact rating ....2 A maximum @ 30 V dc

Amplifier Audio Switching

Amplifier type...2-channel (Model 12599-102) or 4-channel (Model 12599-104)

Audio input levels (jumper selectable) .... 600 Ω @ 0.775 V $_{RMS}$ (0 dBm) or 1.5 V $_{RMS}$

Amplifier output power (maximum per circuit).. 700 W (100% duty cycle)

Speaker load switching ....4 Ω, 8 Ω, 16 Ω, or 25 V, 70 V, 100 V constant voltage lines

Wired Terminals

Type ....Plug-in terminal blocks (TB1–TB12)

Minimum conductor size ....No. 28 AWG (0.5 mm^2)

Maximum conductor size...No. 12 AWG (3.0 mm^2)

Modular Connectors

Type .... RJ45 Modular (J1–J4)

Required Cabling ....CAT5e Straight Patch Cable (per T568B)

Mechanical

Module dimensions... 1.72 H × 19.00 W × 4.21 D in (43.7 × 1482.6 × 09.9 mm)

Module weight .... 3.25 lb (1.47 kg)

Environmental

Temperature range (operating/storage).. 32 °F to 140 °F (0 °C to 60 °C)

Humidity .... 85% relative non-condensing humidity

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.