



GAI-TRONICS®
A HUBBELL COMPANY

Model 12579-003

Monitored Relay Module (MRM)

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How to Use the Assembly/Model

Application

The Model 12579-003 Monitored Relay Module (MRM) is a Snaptrack module designed for use in the SmartSeries systems. GAI-Tronics uses the MRM to provide a maximum of eight independently controlled relay-contact outputs. Each of the eight relay-contact outputs has an associated LED to indicate its current status. These relay-contact outputs are typically used to switch power to signaling devices, such as beacons, on command from the 69254 Series or 69440 Series Master Control Unit (MCU).

The MRM also provides the capability of supervising the cable runs to these signaling devices for such abnormal conditions as open-circuit conditions, ground faults, and wire-to-wire short circuit conditions. In addition, if fewer than eight relay-contact outputs are needed for a particular application, then the MRM may also be used to receive inputs from field devices. The MRM is comprised of three main components: the 69613-001 Central Processing Unit (CPU) printed circuit board assembly (PCBA), the 69252-001 Power Relay Module, and the 69251-201 Monitored-In-8 PCBA.

The MRM is designed to be mounted in a Snaptrack that is installed in an enclosure. Snaptrack is a grooved plastic channel designed to allow PCBAs to securely 'snap' into the groove. The Snaptrack provides flexible installation because the track may be installed inside an enclosure wherever it is convenient.

The MRM communicates with the MCU via the 69613-001 CPU PCBA over a FSK modem intended for use in GAI-Tronics SmartSeries systems. This FSK link (page line) is periodically monitored by the MCU for any interruptions in communication. The MCU uses this communication channel to control activation/de-activation of the MRM's relay-contact outputs. In turn, the MRM uses this communication channel to report to the MCU any cable run fault conditions that are detected. The MCU identifies a particular MRM on this FSK link by its module address. This module address is set by rotary hex switch S1 and S2 of the MRM (located on the CPU PCBA.) The range of valid settings is from 05 to FE (hex).

Interfaces

The Model 12579-003 MRM interfaces to a Page/Party[®] Interface (PPI) card in the ADVANCE control cabinet via the system page line (FSK link).

Installation Safety Guidelines

Please adhere to all warnings, safety, and operating instructions on the unit and in the installation manual.

 **WARNING** 

1. Disconnect power before servicing. Do not disconnect the equipment while circuit is energized.
2. Avoid servicing the unit during electrical storms.
3. Do not touch uninsulated wires.

Installation Guidelines



Warning: Observe precautions for handling electrostatic sensitive devices.

1. Notify plant personnel of a system shutdown prior to servicing the unit.
2. Disconnect power before installing or removing the MRM.

Mounting

To install the module into the Snaptrack, slide either the right or left edge of the module into the top groove on the track. On the opposite side, press firmly on the top and bottom corners of the module until they snap into the groove. Carefully press from each corner toward the center and simultaneously snap the edges firmly into place.

Power

After the MRM is installed onto the Snaptrack, 12 V dc power is brought in from the auxiliary power supply and terminated on TB9 (PWR IN). The positive leg is connected to TB9-1(+) and the return leg is landed on TB9-2(-). An earth ground is connected to TB9-3 (EGND). TB9 is paralleled with TB10. TB10 (PWR OUT) may be used to distribute power to additional Snaptrack modules.

NOTES:

- Although power may be daisy-chained between MRMs and other Snaptrack modules, the preferred method of delivering power to these modules is by providing a dedicated cable run between each module and the auxiliary power supply.
- The auxiliary power supply return leg must be connected to earth ground for proper operation. The physical connection should be made at the auxiliary power supply terminals.
- The ground reference for this assembly must be identical to that of the enclosure.
- The MRM does not contain any current-limiting for power. It is recommended that an external fuse be provided with the appropriate voltage and current ratings. The selected fuse should be of the slo-blo variety.

Data Communication Line

Terminal blocks TB11 and TB12 are for the page line connection (FSK data communication) from the PPI card to additional MIM and MRM modules.

FSK Signal Gain

The FSK Signal Gain, R8, adjusts the FSK transmit signal strength. It is set at the factory and should not be adjusted by the installer.

Relay - Contact Outputs

The MRM contains eight individually configurable relay-contact outputs, allowing it to control field devices such as beacons. Connections with these field devices are made at connectors TB1 through TB8 of the 69252-001 Power Relay Module.

Each connector corresponds to a single output (TB1 is used for output #1, TB2 is used for output #2, etc.). If fewer than eight supervised relay-contact outputs are required, the unused outputs may be used to receive inputs (dry contact closures or non-supervised 24 V dc wet contact closures) from field devices.

In this case, connections with these field devices are made at connectors TB1 through TB8 of the 69251-201 Monitored-In-8 PCBA. Each of these outputs may be configured to operate in one of six modes. Two of these six modes are used to control signaling devices, while the remaining four modes are used to receive inputs (contact closures) from field devices.



Each mode requires a unique connection scheme between the external field devices and the appropriate connector on the MRM. The connection scheme for each mode is described below. Since the connection scheme is independent of which output is used, only Output #1 will be discussed.

To ensure proper termination, ferrules must be crimped on the ends of all conductors that are terminated on the terminal blocks. The size of the ferrule is dependent upon the size of the conductor used and can be sourced from any supplier such as Phoenix, Altec or Weidmuller. The terminals accept a maximum conductor size of No. 12 AWG and a minimum conductor size of No. 28 AWG.

Mode 0: Deactivate Circuit

In Mode 0, outputs may be used to control several signaling devices by connecting/disconnecting power to these devices. In this mode, no supervision of the loop is supported. This mode supports both ac- and dc-powered signaling devices.

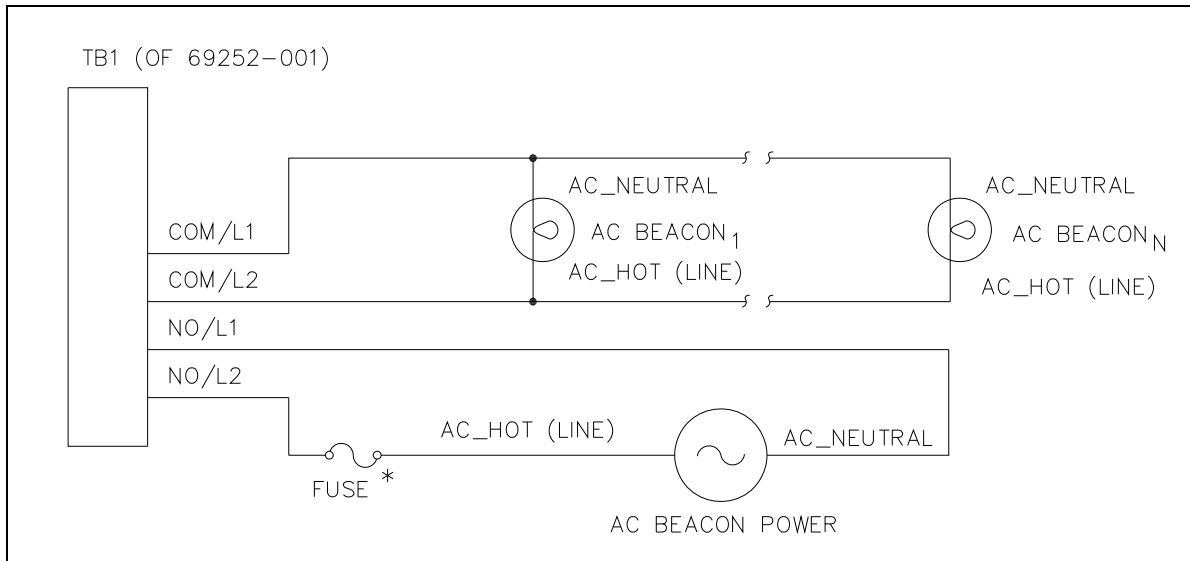


Figure 3. Deactivate Circuit - AC-Powered Beacons

Figure 3 shows the recommended wiring diagram for ac-powered signaling devices, while Figure 4 shows the recommended wiring diagram for dc-powered signaling devices (using Output #1 as an example.)

***NOTE:** The MRM does not contain any current-limiting for the signaling device power. It is recommended that an external fuse be provided for each output circuit with the appropriate voltage and current ratings. The selected fuse should be of the slo-blo variety.

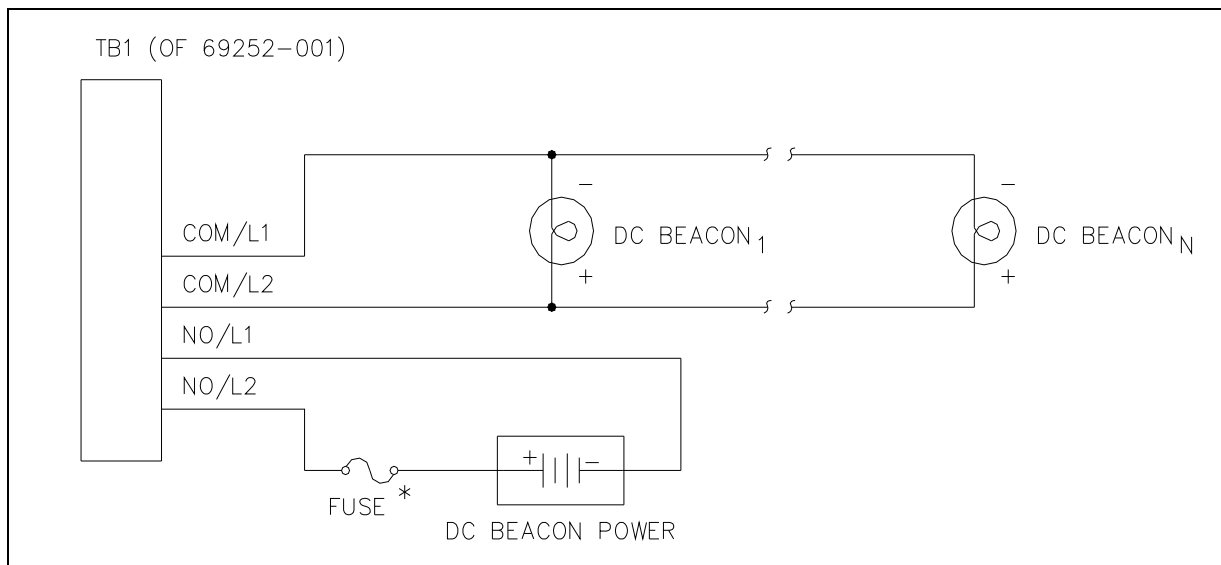


Figure 4. Deactivate Circuit - DC-Powered Beacons

Mode 1: IDC Line Supervision Multiple Switch

In this mode any number of normally-open dry contact closures may be installed on the line. The loop is monitored for ground faults and open circuits in Mode 1. The end-of-line device is a 20 kΩ, 5% tolerance resistor.

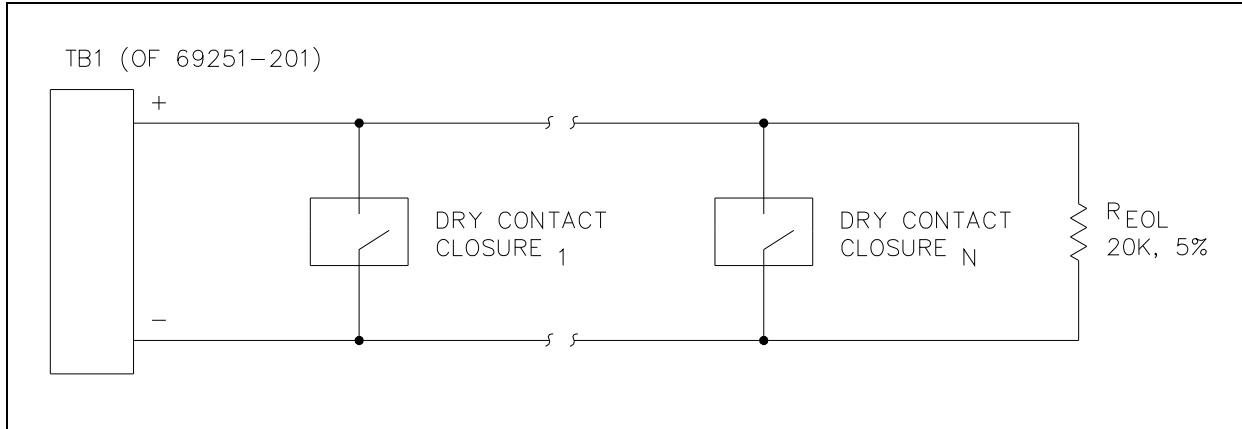


Figure 5. IDC Line Supervision Multiple Switch

NOTE: The 20 kΩ, 5% tolerance resistor is not included with the MRM. The resistor is included in a kit (12509-004), which must be ordered separately.

Mode 2: IDC Single Normally-Open (N.O.) Switch

In this configuration, only one normally-open dry contact closure may be installed per supervised line. In this mode, the loop is monitored for open circuits, wire-to-wire short circuits (across + and -), and ground faults. When the contact closure is not active (open), the loop appears as 20.1 k Ω load (15 k Ω in series with 5.1 k Ω). This appears on the input to the MIM and indicates a healthy loop. When the contact closure is active (closed), the 15 k Ω resistor is bypassed.

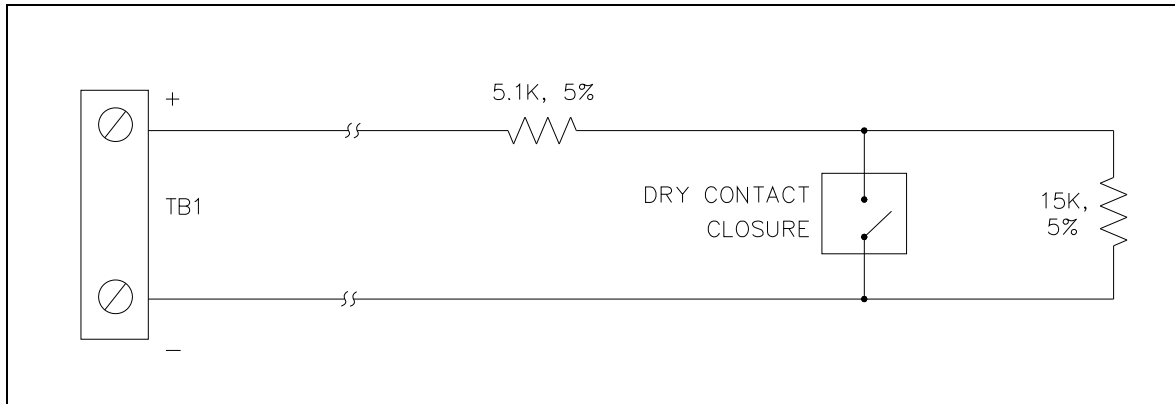


Figure 6. IDC Single Normally-Open Switch

When the contact closure is active (closed), the 15 k Ω resistor is bypassed. In this case, output #1 only sees a 5.1 k Ω load. When this occurs, it indicates to the MRM that the contact closure is active. If there is a short across L1 and L2, if either leg is grounded, or if a break occurs on either leg, the MRM indicates that a fault has occurred.

NOTE: The terminating resistors are not included with the MRM. These resistors are included in a kit (12509-004), which must be ordered separately.

Mode 3: IDC Single Normally-Closed (N.C.) Switch

In this configuration, only one normally-closed dry contact closure may be installed per supervised line. In this mode, the loop is monitored for open circuits, wire-to-wire short circuits (across + and -), and ground faults. When the contact closure is not active (closed), the 15 k Ω is bypassed and the circuit sees only the 5.1 k Ω load.

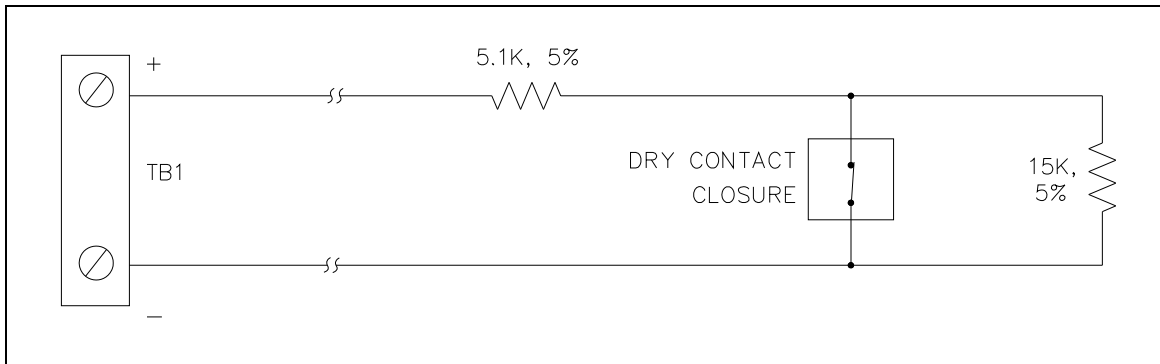


Figure 7. IDC Single Normally-Closed Switch

This change is sensed by the MRM and indicates to the MRM that the contact closure is active. If there is a short across L1 and L2, if either leg is grounded, or if a break occurs on either leg, the MRM indicates that a fault has occurred.

NOTE: The terminating resistors are not included with the MRM. These resistors are included in a kit (12509-004), which must be ordered separately.

Mode 4: IAC Line Supervision

In Mode 4, outputs can be used to control several dc-powered signaling devices by connecting/disconnecting power to these devices. In addition, this loop is monitored for open circuits, wire-to-wire short circuits (across + and -), and ground faults. If any of these three conditions are detected by the MRM, the MRM indicates that a fault has occurred. Please note that monitoring of the loop only occurs while the loop is **inactive** (signaling devices are off).

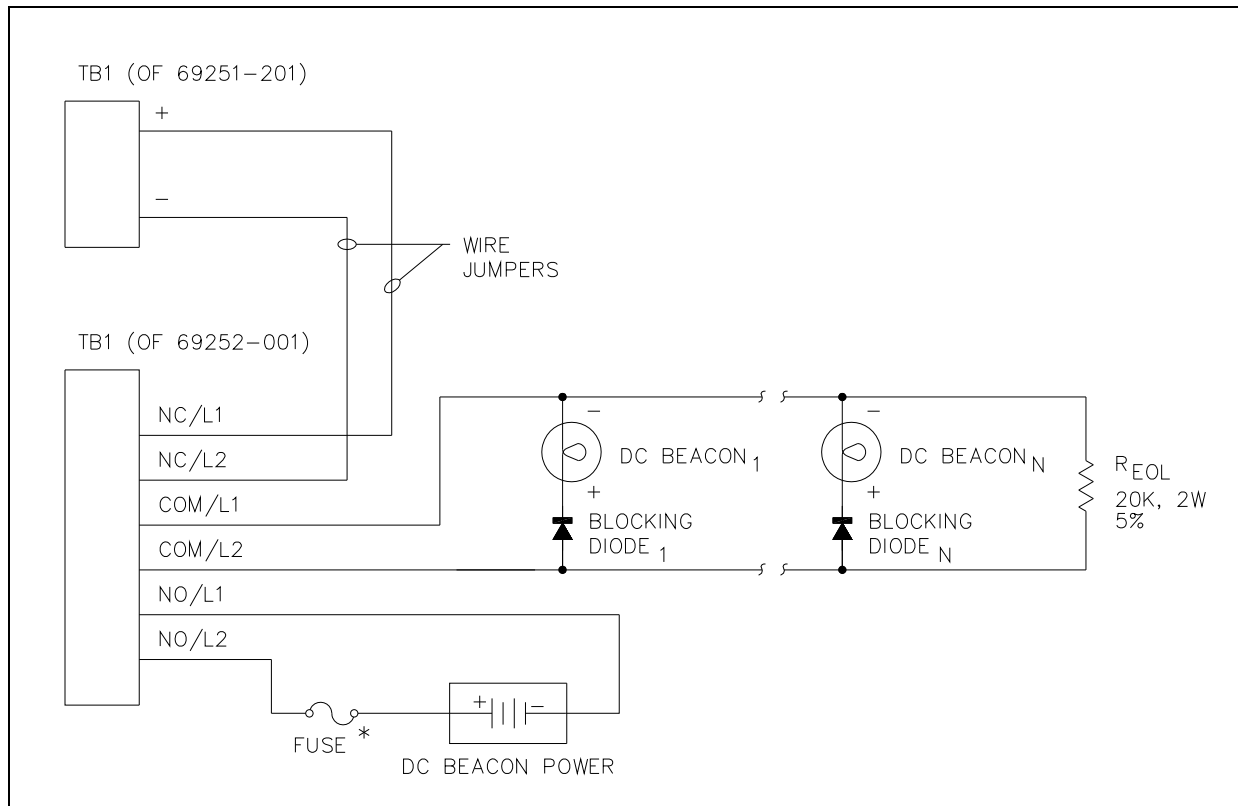


Figure 8. IAC Line Supervision – DC-Powered Beacons

It is recommended that Mode 4 only be used with dc-powered signaling devices. In Mode 4, one blocking diode must be provided for every signaling device connected to the loop. Note that some signaling devices already include a blocking diode in the unit - in this case, no additional blocking diode is required. The end-of-line device is a 20 k Ω , 2-watt, 5% tolerance resistor. Please observe all polarities as indicated in Figure 8 above.

NOTE: The blocking diodes, the wire jumpers, and the 20 k Ω , 2-watt, 5% tolerance resistor are not included with the MRM. These components are included in a kit (12509-004), which must be ordered separately.

***NOTE:** The MRM does not contain any current-limiting for the signaling device power. It is recommended that an external fuse be provided for each output circuit with the appropriate voltage and current ratings. The selected fuse should be of the slo-blo variety.

⚠ CAUTION ⚠

If ac-powered signaling devices are being used on an output loop configured for Mode 4 (Figure 9), observe the following limitations necessary for reliable operation for the loop monitoring feature:

- The dc-resistance measured across the loop (with both end-of-line device and the MRM removed from the loop) must be at least 100 kΩ
- Do NOT use blocking diodes in this loop.

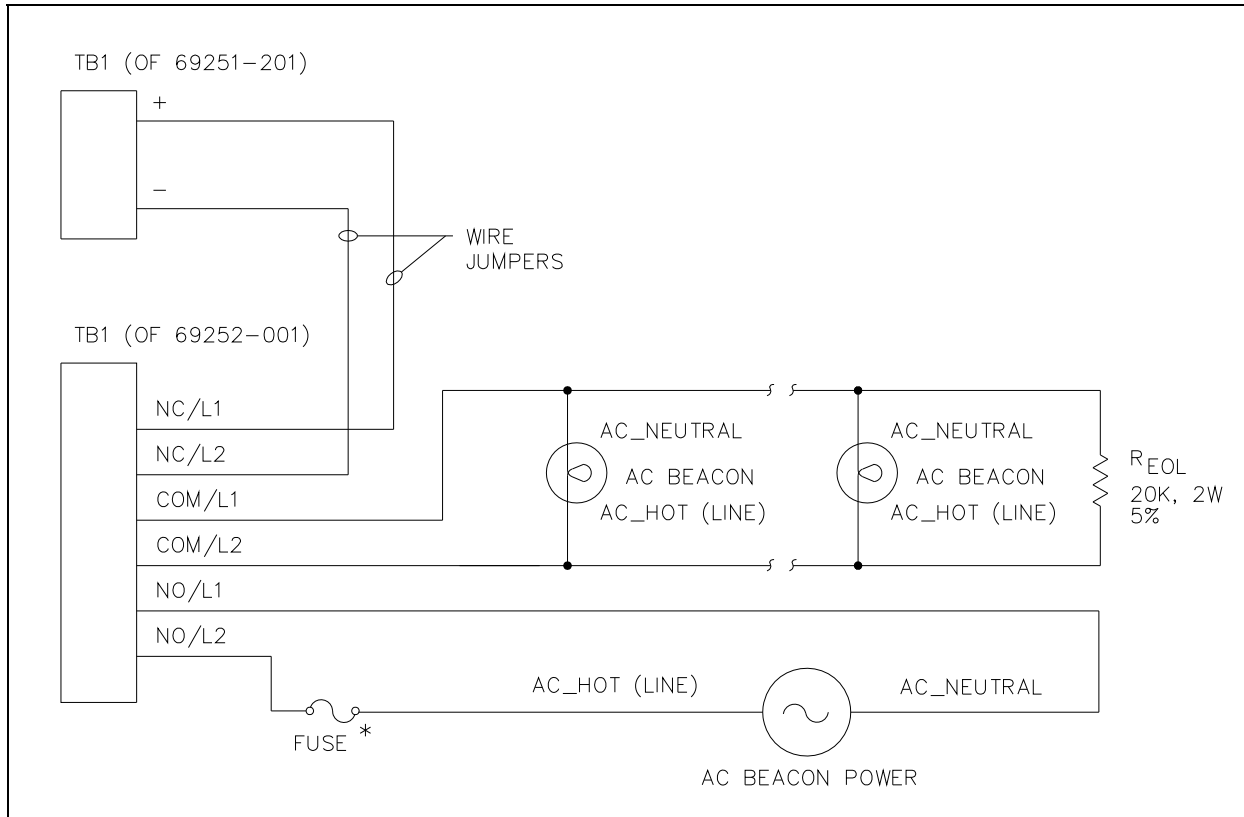


Figure 9. IAC Line Supervision – AC-Powered Beacons

Mode 5: IDC Non-supervision Multiple Switch (Dry Contact)

In this mode, any number of normally-open dry contact closures can be installed on the line. The loop will not be monitored for any faults in Mode 5.

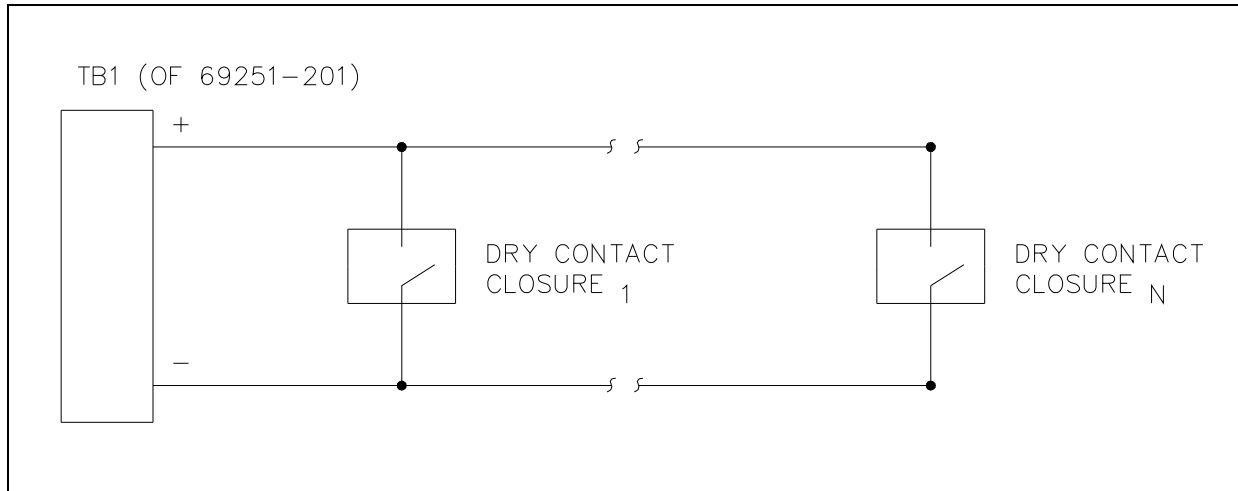


Figure 10. IDC Non-Supervision Multiple Switch (Dry Contact)

Mode 5: IDC Non-Supervision (Wet Contact)

In this wet contact mode, shorting jumpers for each input must be moved from the factory default of “dry” to “wet” contact mode. When in “wet” contact mode, the input can be activated during a 0 V condition or a 24 V condition. The factory default setting is “24 V dc input when active” (position 2-3).

If “0 V dc input when active” is desired, move jumper from position 2-3 to position 1-2. The loop will not be monitored for any faults in Mode 5. Ensure the polarity of input connection is correct as it is polarity sensitive.

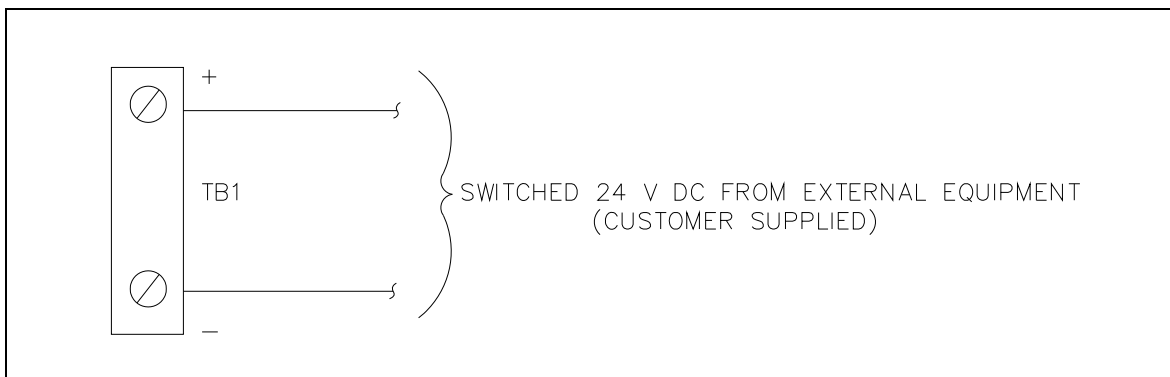


Figure 11. IDC Non-Supervision (Wet Contact)

Table 1. Jumper Settings for Mode 5 Input Operation

Input No.	Dry Contact Input Selection	24 V DC Wet Contact Input Selection	Factory Default Setting
1	P1 – Pins 2 & 3 P2 – Pins 2 & 3 P3 – Pins 2 & 3	P1 – Pins 1 & 2 P2 – Pins 1 & 2 0 V dc – Active: P3 – Pins 1 & 2 24 V dc – Active: P3 – Pins 2 & 3	P1 – Pins 2 & 3 P2 – Pins 2 & 3 P3 – Pins 2 & 3
2	P4 – Pins 2 & 3 P5 – Pins 2 & 3 P6 – Pins 2 & 3	P4 – Pins 1 & 2 P5 – Pins 1 & 2 0 V dc – Active: P6 – Pins 1 & 2 24 V dc – Active: P6 – Pins 2 & 3	P4 – Pins 2 & 3 P5 – Pins 2 & 3 P6 – Pins 2 & 3
3	P7 – Pins 2 & 3 P8 – Pins 2 & 3 P9 – Pins 2 & 3	P7 – Pins 1 & 2 P8 – Pins 1 & 2 0 V dc – Active: P9 – Pins 1 & 2 24 V dc – Active: P9 – Pins 2 & 3	P7 – Pins 2 & 3 P8 – Pins 2 & 3 P9 – Pins 2 & 3
4	P10 – Pins 2 & 3 P11 – Pins 2 & 3 P12 – Pins 2 & 3	P10 – Pins 1 & 2 P11 – Pins 1 & 2 0 V dc – Active: P12 – Pins 1 & 2 24 V dc – Active: P12 – Pins 2 & 3	P10 – Pins 2 & 3 P11 – Pins 2 & 3 P12 – Pins 2 & 3
5	P13 – Pins 2 & 3 P14 – Pins 2 & 3 P15 – Pins 2 & 3	P13 – Pins 1 & 2 P14 – Pins 1 & 2 0 V dc – Active: P15 – Pins 1 & 2 24 V dc – Active: P15 – Pins 2 & 3	P13 – Pins 2 & 3 P14 – Pins 2 & 3 P15 – Pins 2 & 3
6	P16 – Pins 2 & 3 P17 – Pins 2 & 3 P18 – Pins 2 & 3	P16 – Pins 1 & 2 P17 – Pins 1 & 2 0 V dc – Active: P18 – Pins 1 & 2 24 V dc – Active: P18 – Pins 2 & 3	P16 – Pins 2 & 3 P17 – Pins 2 & 3 P18 – Pins 2 & 3
7	P19 – Pins 2 & 3 P20 – Pins 2 & 3 P21 – Pins 2 & 3	P19 – Pins 1 & 2 P20 – Pins 1 & 2 0 V dc – Active: P21 – Pins 1 & 2 24 V dc – Active: P21 – Pins 2 & 3	P19 – Pins 2 & 3 P20 – Pins 2 & 3 P21 – Pins 2 & 3
8	P22 – Pins 2 & 3 P23 – Pins 2 & 3 P24 – Pins 2 & 3	P22 – Pins 1 & 2 P23 – Pins 1 & 2 0 V dc – Active: P22 – Pins 1 & 2 24 V dc – Active: P22 – Pins 2 & 3	P22 – Pins 2 & 3 P23 – Pins 2 & 3 P24 – Pins 2 & 3

Operation

All operation is controlled by the MCU and is set up in the configuration software. See the MCU Configuration details in the system manual for all operation information.

How to Diagnose Assembly Faults

Symptom	Action
MRM does not communicate with MCU.	<ul style="list-style-type: none"> • Verify power is applied to the MRM • Verify page line is connected to the MRM • Verify address of MRM agrees with the setup configuration • Ensure CPU PCBA is correctly connected via J1 • Call for service of the MRM
MRM does not recognize dry inputs.	<ul style="list-style-type: none"> • Verify power is applied to the MRM • Verify page line is connected to the MRM • Verify end-of-line resistor(s) properly installed on each input circuit • Verify total loop resistance is less than 100Ω • Call for service of the MRM
MRM does not activate an alarm with 24 V dc applied to input terminal. (Wet contact mode ONLY)	<ul style="list-style-type: none"> • Verify that the jumper that selects the proper “__ V dc when active” mode is in the correct position for the desired mode. Refer to Mode 5: IDC Non-Supervision (Wet Contact) on page 12. • Verify that the input jumpers have been repositioned for “wet” operation. • Verify that input is within the acceptable dc voltage range (20–30 V dc). • Verify that the proper voltage polarity has been observed for external connections to the input terminals. • Call for service of the MRM.

Specifications

Electrical

Power requirements	12 V dc \pm 10%
Current draw	1 amp maximum @ 12 V dc (does not include beacon power)
Number of output/input loops.....	8 loops
Maximum devices on output/input loop	Limited by maximum current draw (Mode 0) Unlimited (Mode 1) One (Mode 2) One (Mode 3) Limited by maximum current draw (Mode 4) Unlimited (Mode 5) (dry) One (Mode 5) (wet)
Input/output.....	Power in Power out Page line (FSK) in Page line (FSK) out Eight field outputs/inputs
Data communications.....	FSK
End-of -line device.....	20 k Ω (Mode 1) 5.1 k Ω in series with 15 k Ω across contact (Mode 2) 5.1 k Ω in series with 15 k Ω across contact (Mode 3) 20 k Ω , 2-watt resistor (Mode 4 - up to 132 V ac/V dc) None (Mode 5)

Field Outputs/Inputs

Mode 0

Maximum current draw (per output).....	5 amps @ 24 V dc or 240 V ac
Maximum dc switching voltage.....	150 V dc
Maximum ac switching voltage	240 V ac

Mode 1

Contact closure resistance (activated).....	1 k Ω maximum
Open fault detection.....	Minimum 65 k Ω
Ground fault detection	Less than 200 Ω to ground

Modes 2 and 3

Contact closure resistance (Mode 2: activated/ Mode 3: de-activated)	3 k Ω maximum
Open fault detection.....	Minimum 65 k Ω
Ground fault detection	Less than 200 Ω to ground
Wire-to-wire short fault detection.....	Less than 200 Ω

Mode 4

Maximum current draw (per output)..... 5 amps @ 24 V dc or 132 V ac
 Maximum dc switching voltage..... 150 V dc
 Maximum ac switching voltage 132 V ac
 Open fault detection..... Minimum 65 kΩ
 Ground fault detection Less than 200 Ω to ground
 Wire-to-wire short fault detection..... Less than 1 kΩ

Mode 5 (Dry)

Contact closure resistance..... 900 Ω maximum

Mode 5 (Wet)

DC input voltage range 20–30 V dc (24 V dc nominal)

Loop Supervision Limitations:

Cable limitations 100 Ω maximum loop resistance
 Resistance across loop (excluding end-of-line device)..... 100 kΩ minimum

Terminals:

Minimum conductor size No. 28 AWG (0.5 mm²)
 Maximum conductor size..... No. 12 AWG (3.0 mm²)

Mechanical

Unit dimensions 4.00 H × 10.5 W × 2.25 D inches (102 × 267 × 58 mm)
 Unit weight 1.75 lbs. maximum

Environmental

Temperature range (operating/storage)..... -30° C to 70° C (-22° F to 158° F)
 Humidity 95% non-condensing relative humidity

Replacement Parts

Part Number	Description
69613-001	CPU PCBA
69251-201	Monitored In 8 PCBA
69252-001	Power Relay Module

References

Published By	Title	GAI-Tronics Ref. No.
GAI-Tronics	Monitored Relay Module Assembly Drawing	73568

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.