Ⓖ Zone Selective Interlock Module

For MicroVersaTrip® RMS-9 and Epic MicroVersaTrip™ Solid-State Programmers

Figure 1. Zone Selective Interlock (ZSI) module.

I. INTRODUCTION

A. What Is Zone Selective Interlocking?

Zone selective interlocking is an optional feature of Epic MicroVersaTrip™ and MicroVersaTrip® RMS-9 solid-state programmers, which provides added protection to the power system through an enhanced method of coordination. See Figure 1.

With zone selective interlocking, maximum system protection is provided because each circuit breaker responds to a Ground Fault or a Short Time fault in its immediate zone, quickly (minimum time delay), thereby subjecting the system to minimum stress. Simultaneously, the breaker(s) closest to the fault will transmit an interlock signal to upstream

breakers selectively shifting them to a longer time delay. This action prevents undesirable tripping of upstream breakers, yet permits them to serve as back-up protection to the faulted zone.

B. What Is a Zone Selective Interlock Module?

The zone selective interlock (ZSI) module is an intermediate control device used between upstream and downstream circuit breakers to communicate with the short time and ground fault zone selective interlock functions of the Micro-VersaTrip programmer.
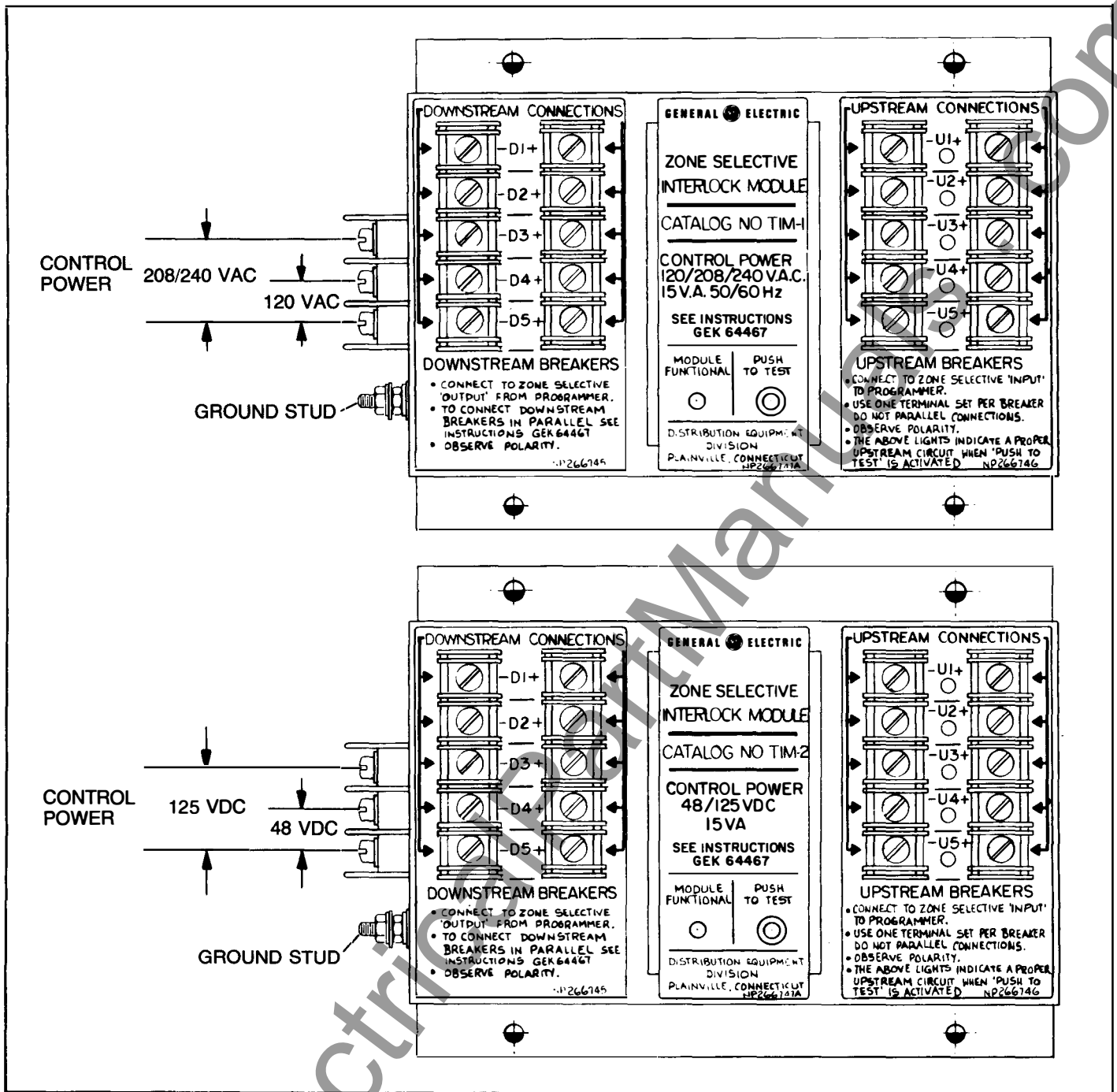
GENERAL Ⓖ ELECTRIC

Figure 2. Control power for module is applied from left side of enclosure.

II. DESCRIPTION

A. General

The zone selective interlock (ZSI) module receives a signal from a downstream MicroVersaTrip programmer (Logic O) which causes the module to transmit a low-level interlock signal to a MicroVersaTrip programmer upstream. The inter-lock signal activates the LED portion of an LED-transistor opto-isolator in the upstream programmer causing the fixed delay band to shift from "MIN" to the programmer delay band setting. Both the short time and ground fault functions (if present) will be interlocked.

II. DESCRIPTION (CONT'D)

B. Downstream (Load)/Upstream (Source) Connections

Terminals are provided for the acceptance of wiring from downstream and upstream breakers. Carefully note the polarity and instructions on the label of the zone selective interlock module. See also Section IV, *"Installing and Connecting the ZSI Module."*

C. Control Power

Control power for the module is applied via the terminals on the left side of the enclosure. See Figure 2.

D. Energy Storage Feature

In the event that a fault occurs, the possibility exists for the loss of control power. To ensure the integrity of the signal transmitted to upstream breakers and to ensure that coordination is not lost, the ZSI module has an energy storage feature that permits follow-through of the interlocking function in the event that control power is lost. (Refer to application notes for greater detail.)

E. Test Feature

The ZSI module is provided with an integral test means which will provide an indication of:

- Simple module functionality.
- Shorted or reverse polarity of the downstream wiring.
- A proper upstream circuit.

Use of the module test means is described in Paragraph III-F.

III. APPLICATION INFORMATION

A. Control Power Requirements

   1. Cat. No. TIM-1: 120/208/240 Vac—50/60 Hz—15 Vac max. Input voltage Tolerance +10% −15%.

   2. Cat. No. TIM-2: 48/125 Vdc—15 Va. max. Must be clean dc with a peak-to-peak ripple voltage of not more than 15% of rated voltage. Input Voltage Tolerance ± 20%. See Fig. 3 for use of the TIM-2 with 250-Vdc control power.

B. Max Ambient Temperature

The ambient temperature surrounding the module shall not exceed 85°C.

C. Wiring

The wiring for the equipment shall be as follows:

   1. Wiring from the breakers to the ZSI module shall be twisted pairs—non-shielded, AWG #18-12. A minimum twist configuration of one turn per inch is recommended.

   2. Maximum recommended line length (distance between a breaker and the ZSI module) is 1000 feet.

   3. Note that downstream/upstream connections and dc control power (if used) require proper observance of polarity. For downstream/upstream connections use RED for plus. WHITE for minus. For control power use BLACK for plus, WHITE for minus.

   4. The signals being conducted via the downstream/upstream wiring are low-level signals (dry circuits). It is important, therefore, to ensure that splices are soldered connections (or other approved connections for dry circuits); also, if connectors are used, they should be gold-plated terminations. Standard terminal boards used for intermediate connections do not require gold plating.
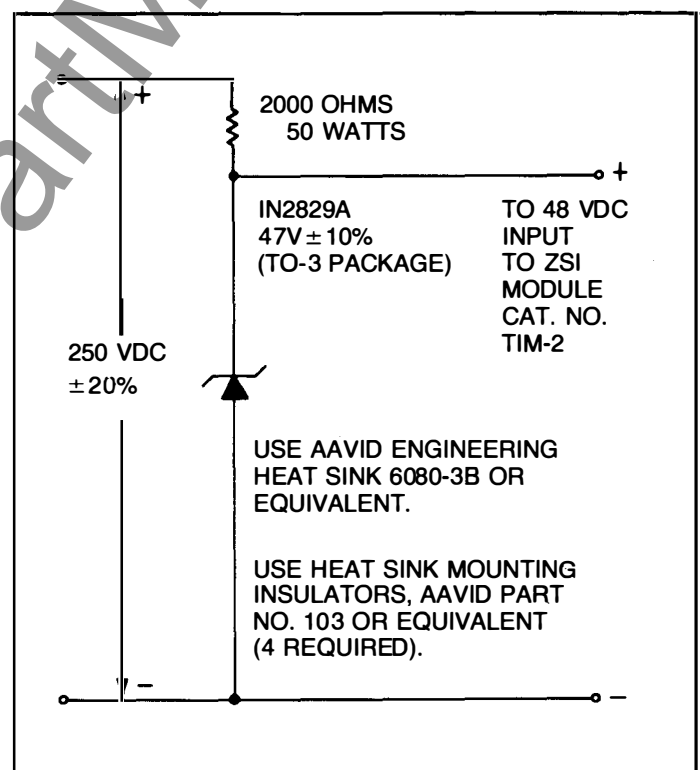

Figure 3. Using the ZSI module Cat. No. TIM-2 with 250-Vdc control power.

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III. APPLICATION INFORMATION (CONT'D)

D. Connections

Downstream Connections (Connections toward Load)

A maximum of thirty zone selective "OUTPUTS" from downstream breakers may be connected in parallel provided that:

- No more than six parallel "OUTPUTS" are used per downstream terminal set (e. g. D1; D2; D3, etc.). See Figure 4.

- Paralleling is done so that only one set of wires (one twisted pair) is connected to each downstream terminal set of the ZSI module.

- Wiring is per Section III-C and Figure 4.

See **"Downstream Connections"** portion of Paragraph III-F to use the integral test means of the ZSI module as an aid in checking downstream wiring.

Upstream Connections (Connections toward Power Source)

In some applications, it may be desirable to interlock an upstream breaker from more than one zone selective interlock module (e.g. it may be desirable to interlock a main breaker from several separate zones). To accommodate coordination schemes that require this, up to four modules may be connected in parallel to one circuit breaker zone selective "INPUT."

Two basic rules that apply to upstream connections are:

    1. The upstream connections of several zone selective interlock modules (up to four) may be connected in parallel provided they are terminated in the zone selective "INPUT" of only one breaker. See Figure 5.

    2. NEVER parallel the zone selective interlock "INPUT" connections of breakers. Upstream connections must ALWAYS be terminated in the Zone Selective Interlock "INPUT" of only one programmer. See Figure 6.

E. Energy Storage Feature

The zone selective interlock module has an energy storage feature which enables it to follow-through with full interlock power should control power to the module be lost simultaneously with the initiation of an interlock signal.

Although the module is capable of operating immediately upon application of control power, the energy storage feature cannot be realized unless the module has been energized for one minute prior to the loss of control power. This is applicable whenever control power is removed and then reapplied.

Therefore, if there is a possibility that control power could be lost during the closing of a circuit breaker and coordination of upstream breakers is important during that interval, the control power for the module should be either (1) derived from an independent source, or (2) derived from the line side of an upstream breaker, with the closing of the downstream breaker delayed by one minute.
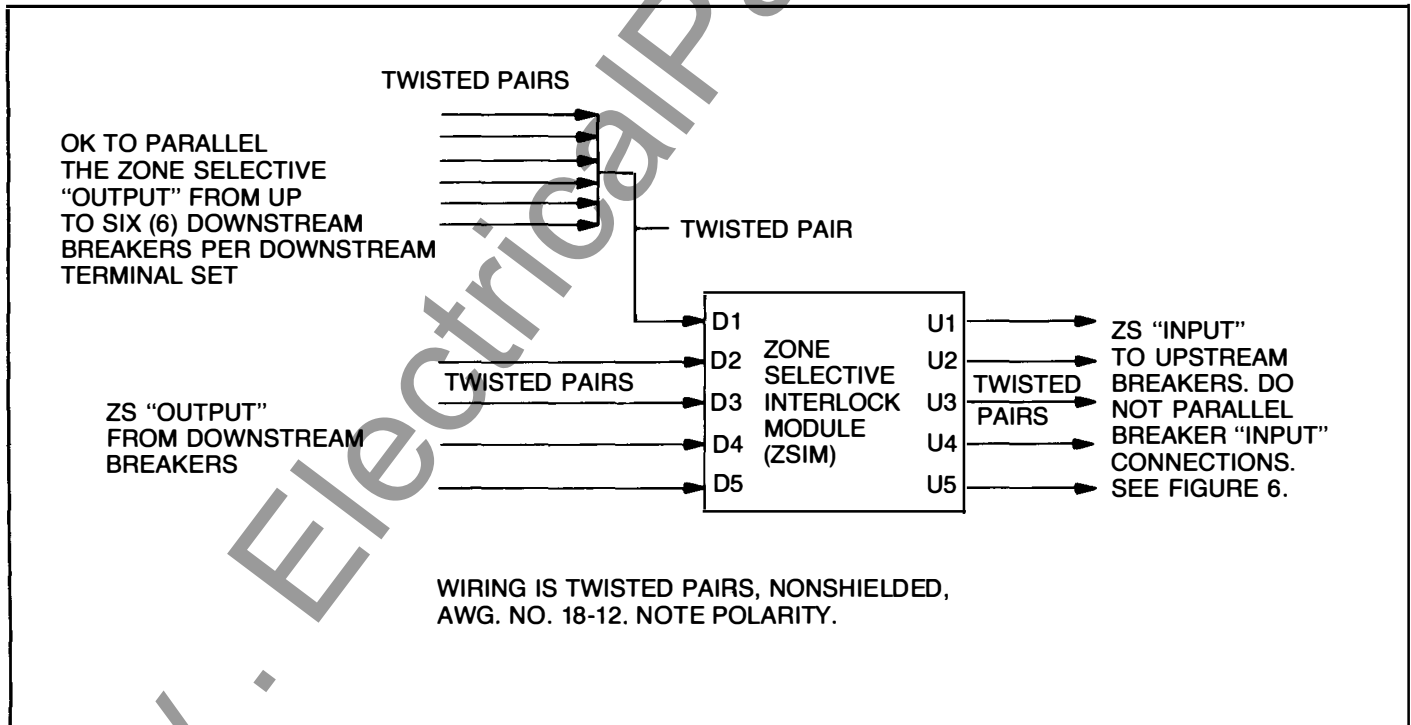

Figure 4. Wiring diagram showing "upstream" and "downstream" connections

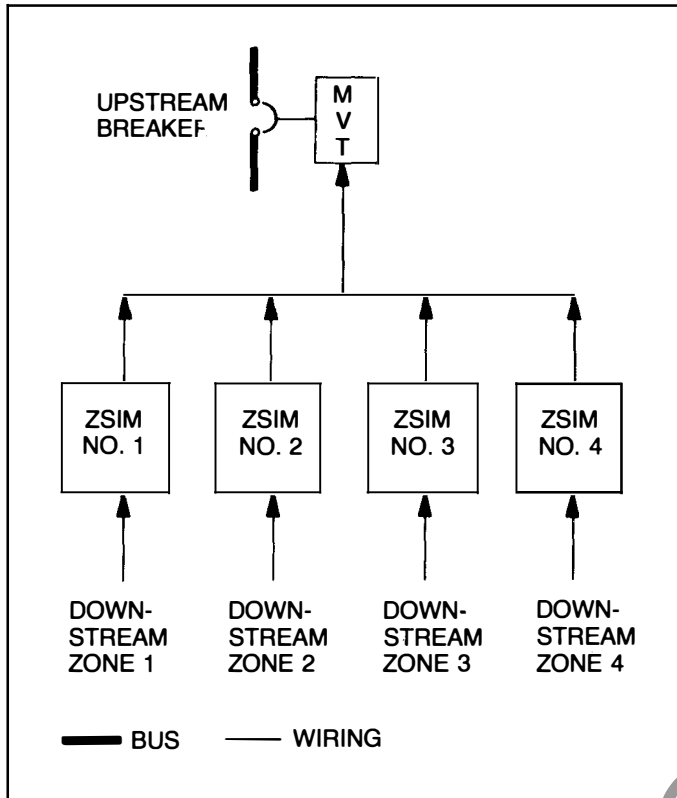# III. APPLICATION INFORMATION (CONT'D)

Figure 5. Interlocking one "upstream" breaker from several separate zones

F. Test Feature—How To Apply It

NOTE: To use the test feature, control power must be applied to the module.

Module Functionality

The "MODULE FUNCTIONAL" light will illuminate whenever there is an interlock signal at the "DOWNSTREAM CONNECTIONS" terminals. This can be simulated manually by pushing the "PUSH TO TEST" button in the center of the module, thereby proving simple module functionality.

Downstream Connections

If the "MODULE FUNCTIONAL" light is illuminated continuously (without pushing the "PUSH TO TEST" button), one or more of the following problems exist with the downstream circuits:

1. At least one set of wires connected to the "DOWNSTREAM CONNECTIONS" terminals, D1 through D5 are connected reverse polarity.

2. Downstream wiring is shorted.

3. A MicroVersaTrip programmer in a downstream breaker is defective.

To isolate the problem remove the wires from the "DOWNSTREAM CONNECTIONS" terminals one at a time, noting when the "MODULE FUNCTIONAL" light goes out. This will identify the problem circuit. The following checks may be useful in identifying the specific problem:
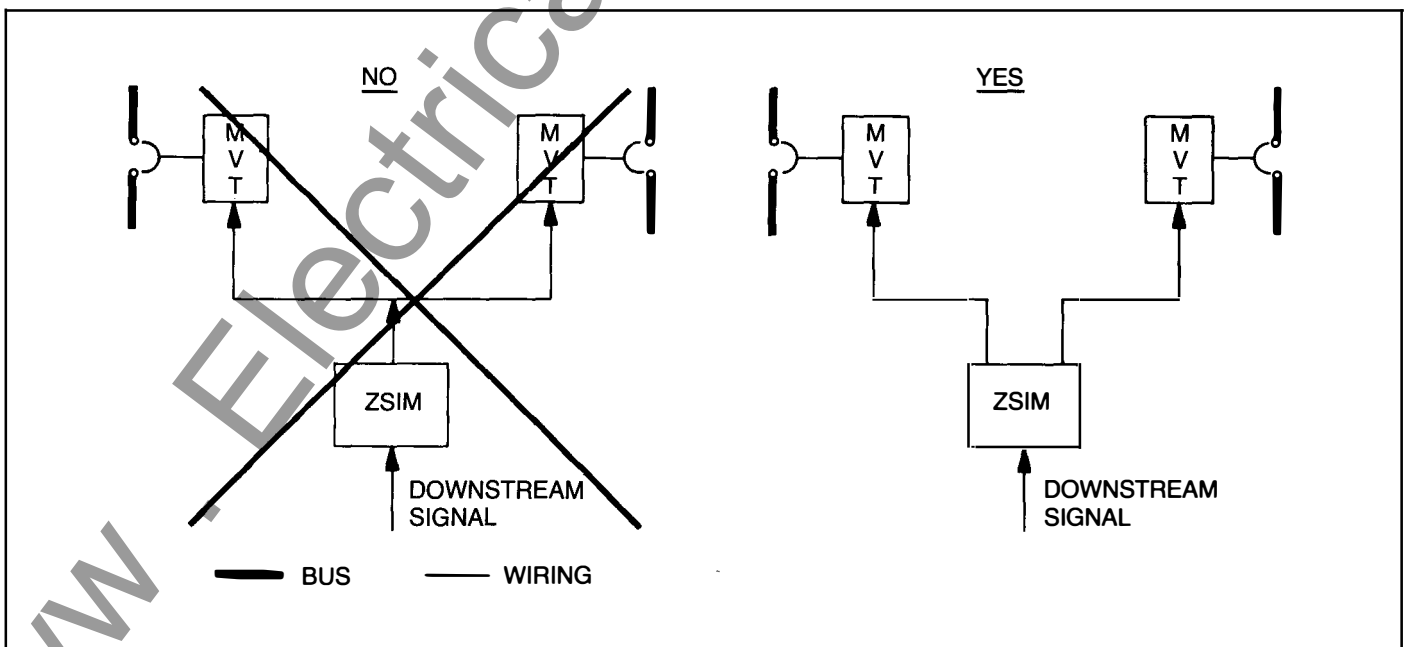

Figure 6. Do not parallel circuit breaker zone selective interlock "inputs."

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III. APPLICATION INFORMATION (CONT'D)

- Check for reversed polarity by simply reversing the lead connections from what they were originally and observing whether the "MODULE FUNCTIONAL" light goes out.

- Check for shorted downstream wiring by checking between the disconnected wires with an ohmmeter.

> **IMPORTANT:** The open circuit output voltage of the ohmmeter must be less than 15 Vdc if the down-stream MicroVersaTrip programmer is connected.

- The Zone Selective Interlock "OUTPUT" circuit from the MicroVersaTrip programmer is essentially an NPN transistor with a reverse diode connected from collector to emitter. To check this circuit for a shorted transistor, check for the forward/reverse characteristic of the diode with an ohmmeter.

> **IMPORTANT:** The open circuit output of the ohmmeter must be less than 15 Vdc.

Upstream Connections

You will note that for each set of upstream terminals (U1-U5), an LED is provided between them.

When the "PUSH TO TEST" button is pressed, these LEDS will light if the voltage developed across the upstream circuit is within an acceptable voltage window. Failure of a particular LED to light is an indication of one or more of the following upstream conditions:

1. Reverse polarity
2. Open circuit
3. Shorted upstream wiring
4. Improper resistivity of the upstream circuit

The following checks may be considered for isolating the problem area:

- Check for reversed polarity by simply reversing the lead connections from what they were originally and observing whether the appropriate upstream LED "lights" when the "PUSH TO TEST" button is pressed.

- To check for open, shorted, or high-resistance connections in the upstream wiring, disconnect the circuit in question from the ZSI module and check the wiring with an ohmmeter.

  Because the equivalent circuit of the zone selective interlock "INPUT" to the MicroVersaTrip programmer is essentially an LED with a reverse-connected shunt diode, it may be necessary to disconnect the wiring at the circuit breaker or to temporarily remove the programmer from the circuit breaker to make a good check of the wiring.

- The ZSI module test means may itself be tested by disconnecting the wires from the U1-U5 terminal set in question and connecting to it a 390-ohm ±20% resistor. The appropriate LED must light when the "PUSH TO TEST" button is pressed.

- NOTE: In the event that *all* connections to upstream terminals U1-U5 are open (or not connected) the five LED indicators may light *without pushing the "PUSH TO TEST" button*. This is not an abnormal condition. A valid test of the upstream circuits will always be obtained when the "PUSH TO TEST" button is activated.

Testing the Energy Storage Feature

As described in section III-E, the ZSI module has an energy storage feature that allows follow-through of the interlocking function in the event that a fault causes a simultaneous loss of control power to the module. Energy storage is via an electrolytic capacitor which will have a tendency to lose capacitance over an extended period of time. Thus, it is advisable to perform the following in-service check every 6–12 months and whenever additional upstream circuits are connected (added) to terminals U1-U5.

- Allow the module to be energized with rated control power for a minimum of one minute.

- Interrupt control power and immediately push the "PUSH TO TEST" button. The "MODULE FUNCTIONAL" light must come on for at least one-third of a second (a long blink). Allow at least one minute charge time before repeating the test.

- Failure to achieve the above noticeable time delay will require replacement of the energy storage capacitor.

G. Dielectric Testing

> **CAUTION:** IF IT IS NECESSARY TO PEFORM DIELECTRIC TESTING, THE FOLLOWING PROCEDURE MUST BE FOLLOWED, EXACTLY, OR DAMAGE TO THE ZSI MODULE WILL RESULT.

The ZSI module may be tested at 1500 Vac for one minute or 1650 Vac for one second, between all upstream, all downstream, all control power terminals shorted together (inclusively), and the ground stud. In other words, every terminal on the ZSI module (except the ground stud) shall be shorted together and the potential applied between that point and the ground stud. Under the above test conditions, the test current will not exceed 500 microamperes.

CAUTIONS

1. DO NOT TEST BETWEEN INDIVIDUAL TERMINALS AND GROUND.

2. DO NOT TEST BETWEEN DOWNSTREAM/UPSTREAM TERMINALS.

3. ALL TERMINALS MUST BE SHORTED TOGETHER!

H. Fusing

Recommended control power input fusing is 0.5 amperes, 250v (Little fuse 312.500 or equivalent).

IV. INSTALLING AND CONNECTING THE ZSI MODULE

To install and connect the ZSI module, proceed as follows:

- Read the application information (Section III).

- Wire the module in accordance with Section III-C and Figure 4.

- Torque terminals to 20 in-lbs.

- Connect control power. See label on the left side of the ZSI module. Refer also to Figure 2. For dc versions, note polarity. Note that filtered direct current must be used. Also, refer to Section III-A-2.

- Follow the instructions on the face of the ZSI module regarding connections. Pay particular attention to the polarity and nomenclature (i.e. downstream connections go to the "OUTPUT" of the MicroVersaTrip programmers; upstream connections go to the "INPUT" of the programmer).

- Use the integral test means of the ZSI module to check downstream and upstream connections. See Section III-F.

V. SYSTEM COORDINATION USING ZONE SELECTIVE INTERLOCKING

Zone selective interlocking can be a valuable tool in achieving efficient system protection and coordination. To apply it effectively requires a thorough understanding of what zone selective interlocking is and the application of that knowledge to form a strategic plan of system protection. As with any plan, the system is best protected when there is a thoughtful strategic plan which factors in significant variables and contingencies.

It is beyond the scope of these instructions to attempt a detailed discussion of coordination schemes. Figures 7 and 8 are shown only in the interest of illustrating examples of two basic applications of the ZSI module.

Figure 7 is a simple example of multiple zone interlocking. If a fault occurs, each breaker will interlock the breaker immediately upstream from it.

Figure 8 is an example of a double-ended substation with a tie breaker, feeding two banks of downstream feeder breakers. Note that ZSI module No. 1 interlocks both mains and the tie breaker for the occurrence of a fault on the load side of any of the feeder breakers (Zone 2).

ZSI module No. 2 is an option which provides coordination between the tie breaker and the main breakers (i.e. the TIE will trip first in the event of a bus fault in Zone 1. Without ZSI module No. 2, a bus fault in Zone 1 would probably cause tripping of both the tie breaker and the main(s).
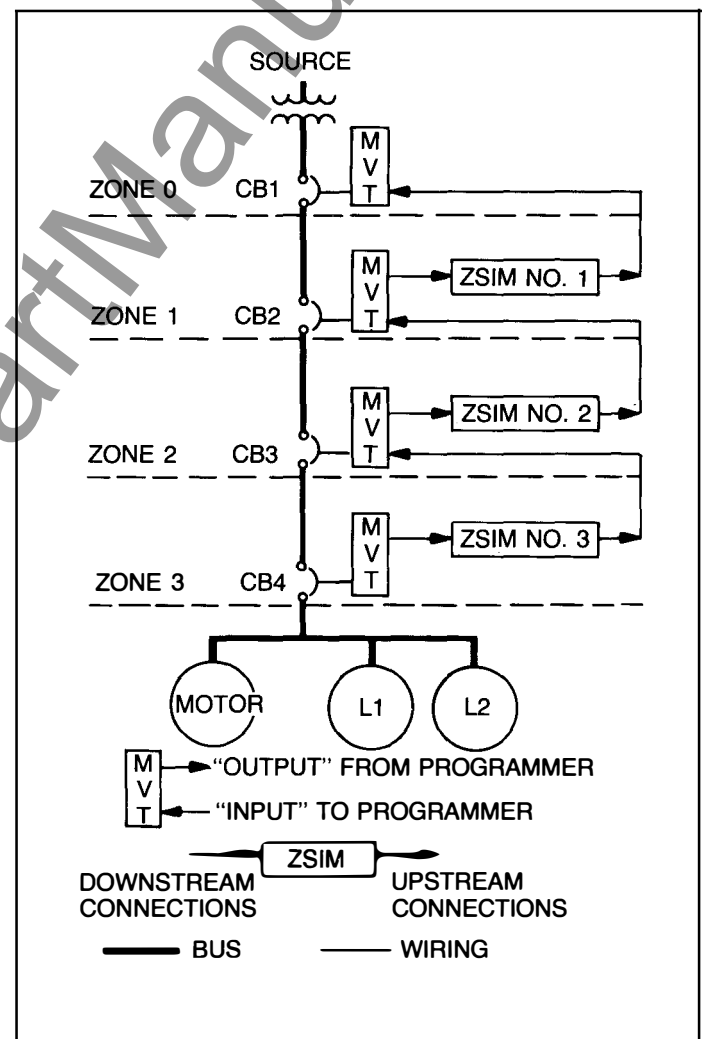

Figure 7. Diagram showing multi-zone interlocking

V. SYSTEM COORDINATION USING ZONE SELECTIVE INTERLOCKING (CONT'D)

SOURCE NO. 1

SOURCE NO. 2

MAIN NO. 1

MAIN NO. 2

ZSIM NO. 2

MVT

ZONE 1

TIE BREAKER

ZSIM NO. 1

ZONE 2

BUS   WIRING

MVT → "OUTPUT" FROM PROGRAMMER

MVT ← "INPUT" TO PROGRAMMER
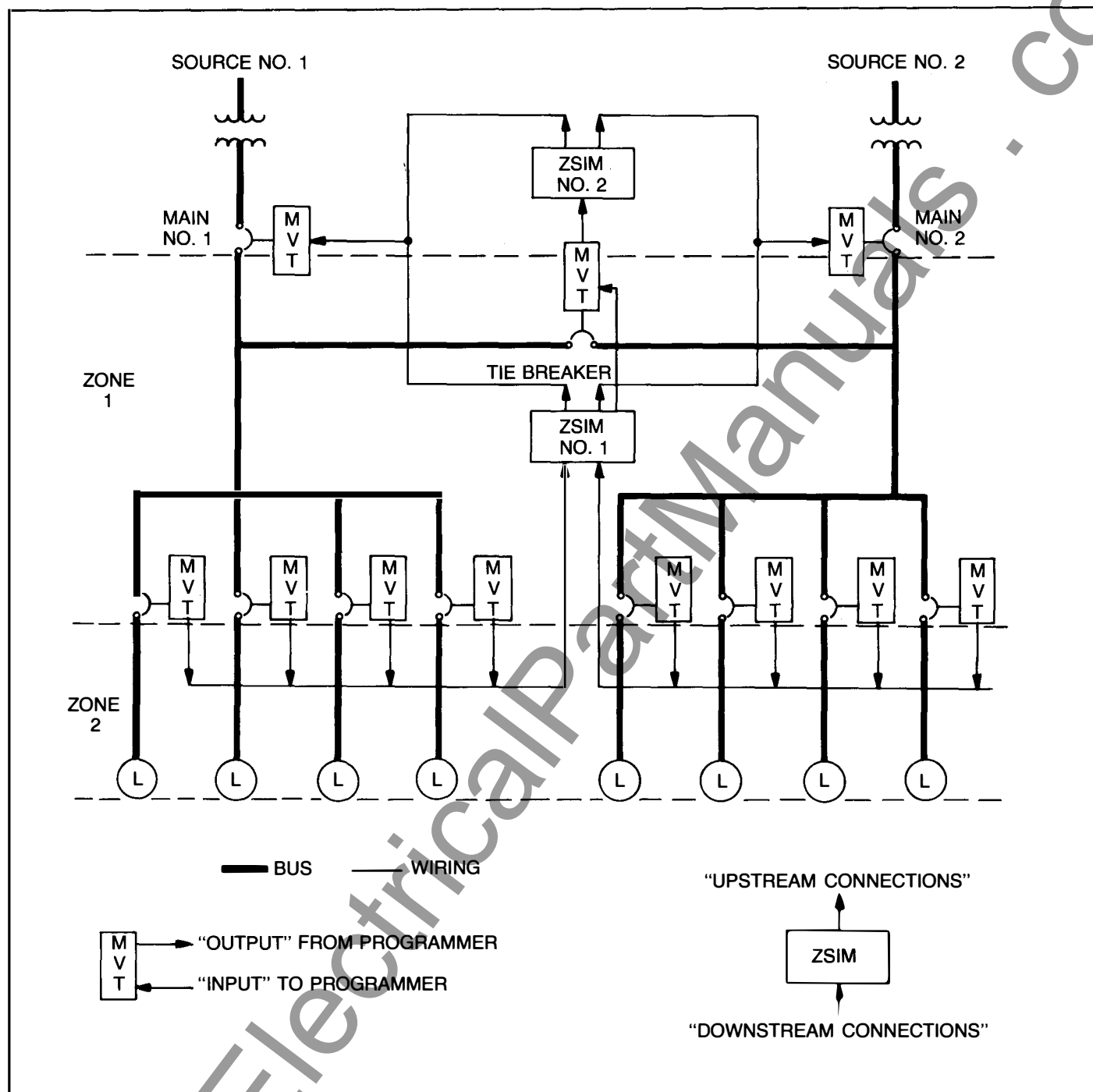
"UPSTREAM CONNECTIONS"

ZSIM

"DOWNSTREAM CONNECTIONS"

Figure 8. Diagram showing Zone Selective Interlocking a double-ended substation

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VI. BASIC COMMENTS ABOUT MICROVERSATRIP PROGRAMMERS EQUIPPED WITH THE ZONE SELECTIVE INTERLOCK OPTION

While a detailed discussion of the MicroVersaTrip programmer is beyond the scope of these instructions, a basic understanding of the programmer's response with regard to the initiation (transmission) and receiving of a zone selective interlock signal is important if the user is to effectively apply the ZSI module. It is recommended, therefore, that the user become thoroughly familiar with the following concepts before attempting the system design.

A. Time-current Curves

Study time-current curves GES-6228 (Figure 9) (for Ground Fault) and GES-6227 and GES-6235 (Figures 10 and 11) (for Short Time). It is important to understand these curves.

B. Zone Selective Interlocking

Zone Selective interlocking applies only to the fixed time delay bands of the Short Time and Ground Fault time delay functions. See Time-Current Curves GES-6228 (Figure 9), GES-6227 (Figure 10) and GES-6235 (Figure 11).

C. Initiating An Interlock Signal

The programmer will initiate (transmit) a signal from the programmer zone selective "OUTPUT" under the following conditions:

1. Short Time:

Whenever the fault current exceeds the ST pickup setting (all inclusive, whether I^2t is in or out, or whether the programmer is interlocked or not).

2. Ground Fault

A. "I^2t IN"

CASE 1. PROGRAMMER NOT INTERLOCKED: (i.e. no signal at zone selective "INPUT" to the programmer.)

When the multiple of GF pickup setting is equal to, or greater than the point of intersection of the I^2t (diagonal) curve and the "MIN" fixed (horizontal) time delay band of GES-6228, Figure 9.

CASE 2. PROGRAMMER IS INTERLOCKED: (i.e. a signal is being received at the zone selective "INPUT" to the programmer.)

When the multiple of GP pickup setting is equal to, or greater than, the point of intersection of the I^2T (diagonal) curve and the fixed (horizontal) time delay band SETTING ("MIN, "INT, "MAX") of curve GES-6228, Figure 9.

3. Ground Fault "I^2t OUT"

Whenever the GF current exceeds the "GROUND FAULT PICKUP" setting.

D. Programmer Time Delay

1. PROGRAMMER NOT INTERLOCKED: (no signal at zone selective "input" to programmer).

A. SHORT TIME (refer to GES-6227; GES-6235)

CASE 1. "I^2t IN"

The delay will be per the I^2t portion of the curve until the fault reaches a magnitude (about 10C) sufficient to place it in the fixed "MIN" delay band which will then dominate.

CASE 2: "I^2t OUT"

The "MIN" time delay band applies regardless of the programmer short time delay setting.

B. GROUND FAULT (refer to GES-6228)

CASE 1: "I^2t IN"

The delay will be per the I^2t portion of the curve until the fault reaches a magnitude (about four times the Ground Fault pickup setting) sufficient to place it in the fixed "MIN" delay band which will then dominate.

CASE 2. "I^2t OUT"

The "MIN" time delay band applies regardless of the programmer ground fault delay setting.

2. PROGRAMMER INTERLOCKED (i.e. a signal is being received at the zone selective "INPUT" to the programmer)

A. SHORT TIME (refer to GES-6227; GES-6235)

CASE 1. "I^2t IN"

The delay will be per the I^2t portion of the curve until the fault reaches a magnitude where the I^2t and the programmer "SHORT TIME DELAY" setting intersect, whereupon the "SHORT TIME DELAY" setting will dominate.

CASE 2. "I^2t OUT"

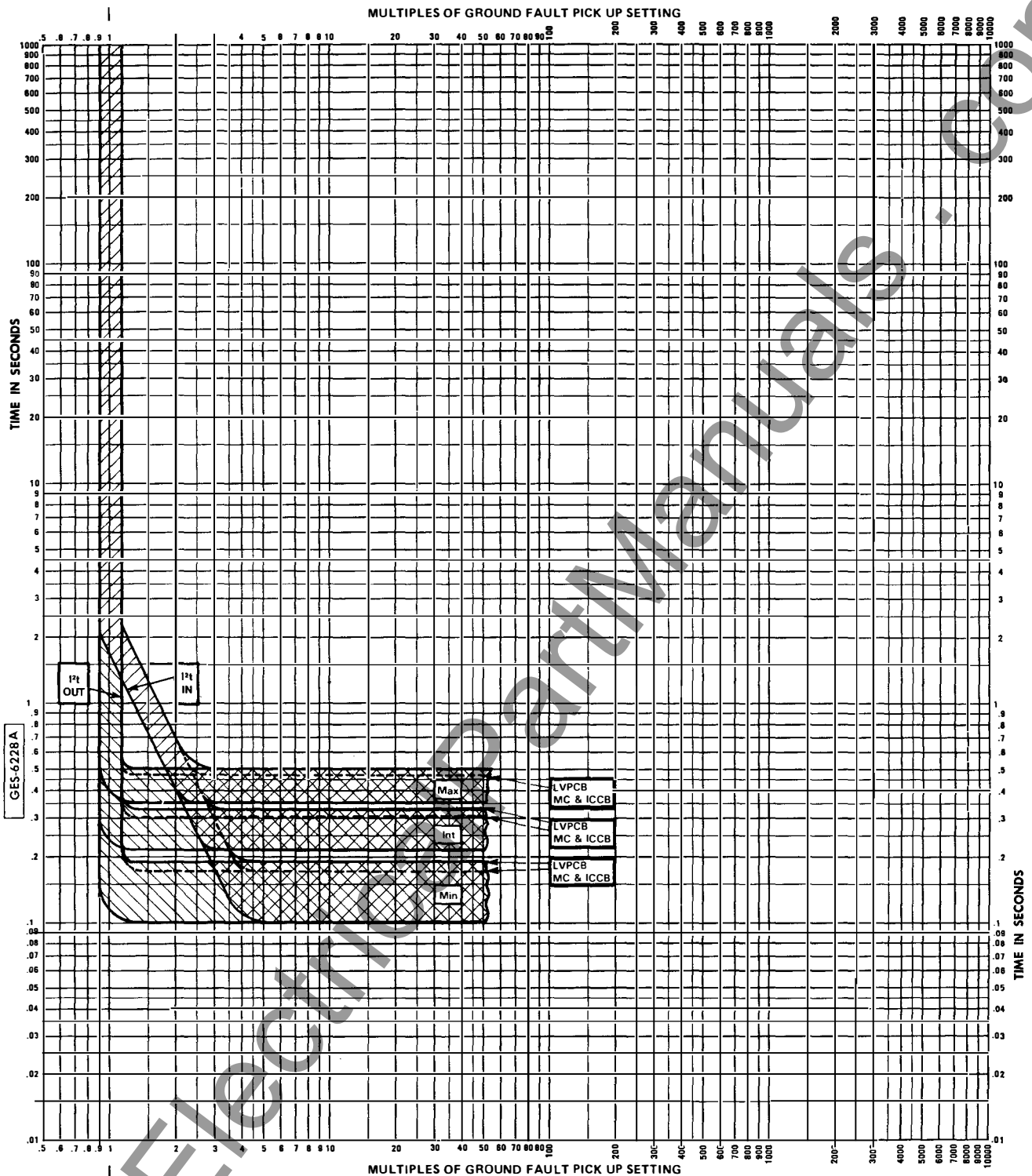The time delay will be the programmer "SHORT TIME DELAY" setting.

B. GROUND FAULT (refer to GES-6228)

CASE 1. "I^2t IN"

The delay will be per the I^2t portion of the curve until the fault reaches a magnitude where the I^2t curve and the programmer fixed "GROUND FAULT DELAY" setting intersect, whereupon the "GROUND FAULT DELAY" setting will dominate.

CASE 2. "I^2t OUT"

The time delay will be the programmer "GROUND FAULT DELAY" setting.

MULTIPLES OF GROUND FAULT PICK UP SETTING

TIME IN SECONDS

GES-6228A

I²t OUT   I²t IN

Max
Int
Min

LVPCB MC & ICCB
LVPCB MC & ICCB
LVPCB MC & ICCB

MULTIPLES OF GROUND FAULT PICK UP SETTING

TIME IN SECONDS

GENERAL ⊛ ELECTRIC

Available Ratings (Amperes)

Type	Breaker Model	Frame	Current Sensor (S)
MCCB	TJH/TJL	400	150, 300, 400,
		600	600
	TKH/TKL	800	800
		1200	1200
ICCB	TP/THP/TC/THC	800	200, 400, 800
		1600	1000, 1600
		2000	2000
		2500	1000, 2000, 2500
		3000	3000
		4000	4000
LVPCB	AKR-30S/30H	800	150, 400, 800
	AKR-50/50H	1600	800, 1600
	AKRT-50H	2000	2000
	AKR-75	3200	3200
	AKR-100	4000	4000

S = Current Sensor Amps

10/86 (3M)

**LOW-VOLTAGE POWER CIRCUIT BREAKERS
TYPE AKR
INSULATED-CASE CIRCUIT BREAKERS
TYPES TP, THP, TC, THC
MOLDED-CASE CIRCUIT BREAKERS
TYPES TJH, TJL, TKH, TKL
All with MicroVersaTrip® RMS-9
or
Epic MicroVersaTrip™
Ground Fault
Time-current Curves**
(Curves apply at 50/400 Hertz and from
−20C to +55C breaker ambient)

GES-6228A

Programmer Adjustments

Ground Fault Function:

Pickup settings in multiples of current sensor amps (S):
0.2, 0.25, 0.3, 0.35, 0.4, 0.45, 0.5 and 0.6 for 150 thru
2000 amps sensors (S)
0.2, 0.22, 0.24, 0.26, 0.28, 0.30, and 0.34 for 2500 thru
3200 amp sensors (S)
0.2, 0.22, 0.24, 0.26, 0.28 and 0.30 for 4000 amp sensors (S)
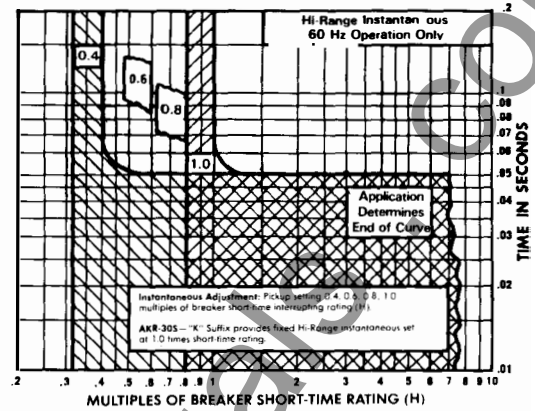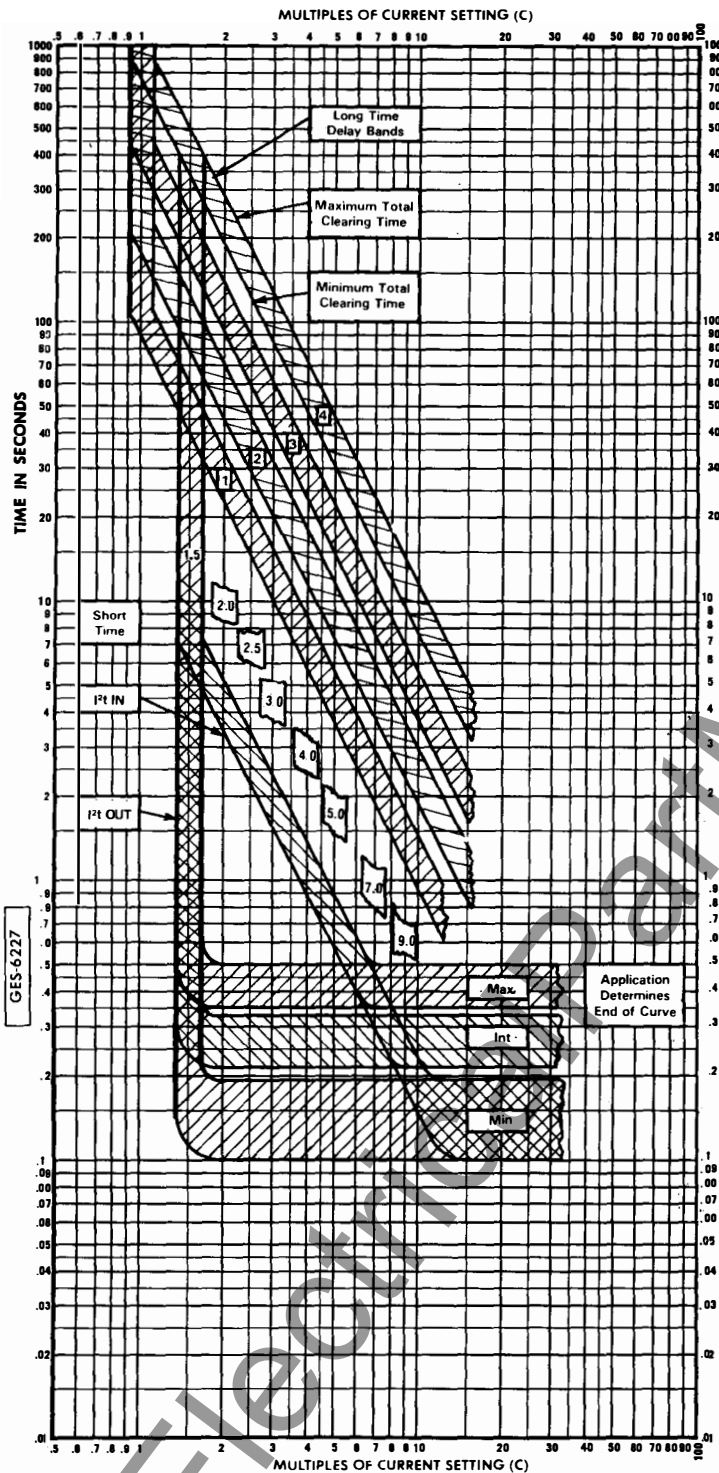
Delay bands:
Min, Int, Max; I²t IN/OUT

NOTE: Operation above 60 Hertz requires thermal and
interrupting derating of the circuit breaker.

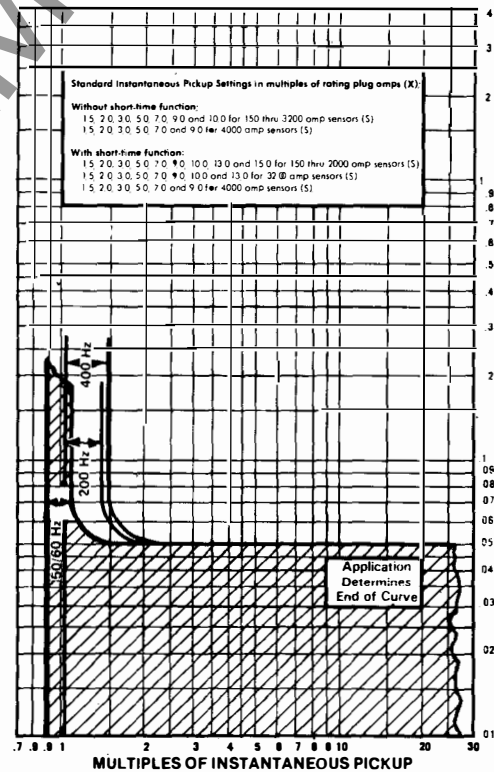**Voltage Rating:** 600 Volts, ac, 50 through 400 Hertz

GENERAL ELECTRIC CO, CONSTRUCTION EQUIPMENT BUSINESS OPERATIONS, PLAINVILLE, CONN. 06062

Figure 9. Curve GES-6228

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Figure 10. Curve GES-6227

11

MULTIPLES OF CURRENT SETTING (C)

Long Time Delay Bands

Maximum Total Clearing Time

Minimum Total Clearing Time

TIME IN SECONDS

Short Time

I²t IN

I²t OUT

GES-6235

Max

Int

Min

Application Determines End of Curve

MULTIPLES OF CURRENT SETTING (C)

Hi-Range Instantaneous 60 Hz Operation Only

Insulated Case Circuit Breaker Total Clearing Time

Application Determines End of Curve

TIME IN SECONDS

Instantaneous Adjustment: Pickup setting 0.4, 0.6, 0.8, 1.0 multiples of breaker short-time interrupting rating (H)

MULTIPLES OF BREAKER SHORT-TIME RATING (H)

	Breaker		Short-time Rating (H)
Type	Max. Frame Amps		(Amps, rms symmetrical)
ICCB	800		25,000
	1600, 2000		30,000
	2500, 3000, 4000		42,000

Standard Instantaneous Pickup Settings in multiples of rating plug amps (X):
Without short-time function:
1.5, 2.0, 3.0, 5.0, 7.0, 9.0 and 10.0 for 150 thru 3200 amp sensors (S).
1.5, 2.0, 3.0, 5.0, 7.0 and 9.0 for 4000 amp sensors (S).
With short-time function:
1.5, 2.0, 3.0, 5.0, 7.0, 9.0, 10.0, 13.0 and 15.0 for 150 thru 2000 amp sensors (S). Note: 10.0 max. for Type TJL with 600 amp sensors (S).
1.5, 2.0, 3.0, 5.0, 7.0, 9.0, 10.0 and 13.0 for 2500 thru 3200 amp sensors (S).
1.5, 2.0, 3.0, 5.0, 7.0 and 9.0 for 4000 amp sensors (S).

400 Hz
200 Hz
50/60 Hz

Molded Case and Insulated Case Circuit Breaker Total Clearing Time

Application Determines End of Curve

TIME IN SECONDS

MULTIPLES OF INSTANTANEOUS PICKUP

GENERAL ⊛ ELECTRIC

Available Ratings (Amperes)

Type	Model	Frame	Current Sensor (S)	Rating Plug (X)
MCCB	TJH/TJL	400	150	60, 80, 100, 125, 150
			300	150, 200, 225, 250, 300
			400	150, 200, 225, 250, 300, 400
	TKH/TKL	600	600	300, 400, 450, 500, 600
		800	800	300, 400, 500, 600, 700, 800
		1200	1200	600, 800, 1000, 1200
ICCB	TP/THP/TC/THC	800	200	100, 150, 200
			400	150, 200, 225, 250, 300, 400
			800	300, 400, 500, 600, 700, 800
		1600	1000	400, 600, 800, 1000
			1600	600, 800, 1000, 1200, 1600
		2000	2000	800, 1000, 1200, 1600, 2000
		2500	1000	400, 600, 800, 1000
			2500	1600, 2000, 2500
		3000	3000	2000, 2500, 3000
		4000	4000	1500, 2000, 2500, 3000, 4000

INSULATED CASE CIRCUIT BREAKERS TYPES TP, THP, TC, THC
MOLDED-CASE CIRCUIT BREAKERS TYPES TJH, TJL, THK, TKL
All with MicroVersaTrip® RMS-9

Long-time-delay, Short-time delay, and Instantaneous Time-current Curves

(Curves apply at 50–400 Hertz and from −20C to +55C breaker ambient)

GES-6235

Programmer Adjustments

Long-time function:
Current settings (C): 0.50, 0.60, 0.70, 0.80, 0.85, 0.90, 0.95 and 1.00 multiples of rating plug amps (X).
Delay Bands: 1, 2, 3 and 4.

Short-time function:
Pickup settings: 1.5, 2.0, 2.5, 3.0, 4.0, 5.0, 7.0 and 9.0 multiples of current setting (C).
Delay Bands: Min, Int, Max, I²t IN/OUT.

Instantaneous Adjustments: See Curves above.

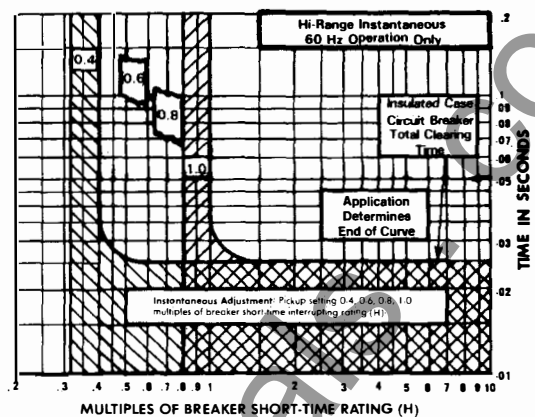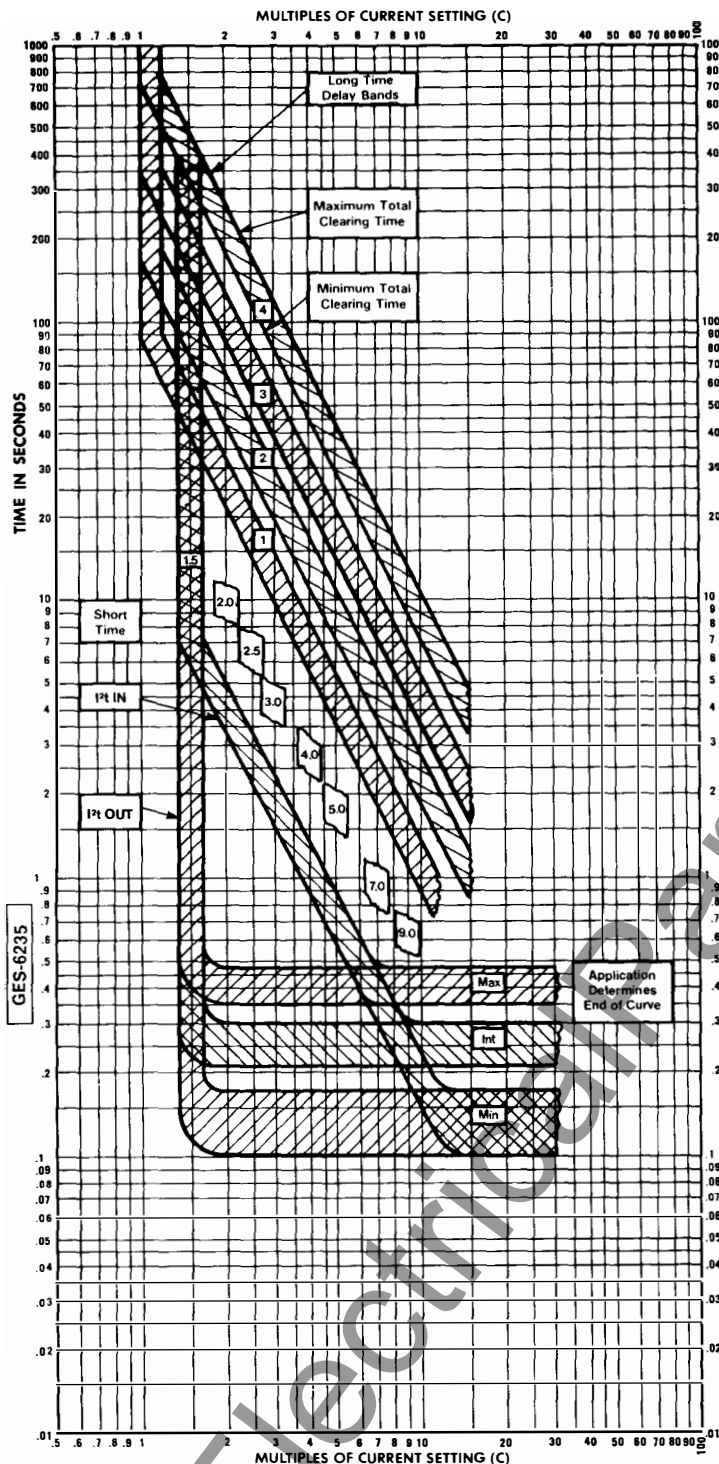NOTE: Operation above 60 Hertz requires thermal and interrupting derating of the circuit breaker.

Voltage Rating: 600 volts ac, 50-400 Hertz

S = Current Sensor Amps
X = Rating Plug Amps
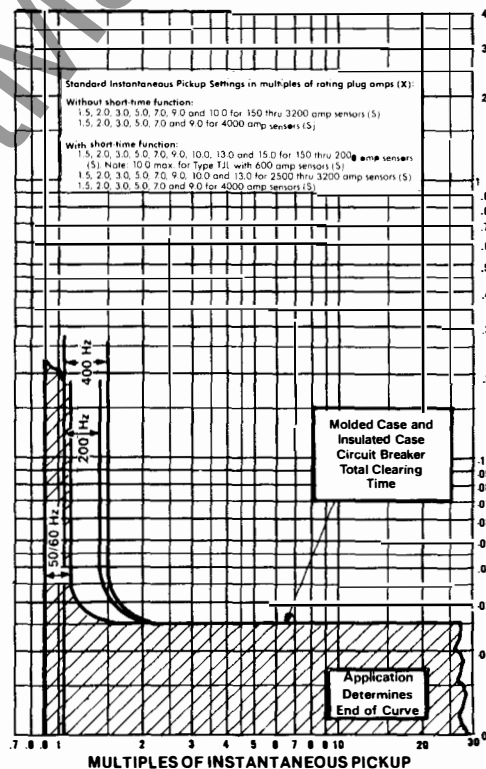C = Current Setting Amps
H = Breaker Short-time Rating Amps

11/86 (3M)

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Figure 11. Curve GES-6235

VII. RETROFIT

This section is provided to show typical examples of retrofitting, where older type MicroVersaTrip programmers are replaced by MicroVersaTrip® RMS-9 or Epic MicroVersaTrip™ programmers.
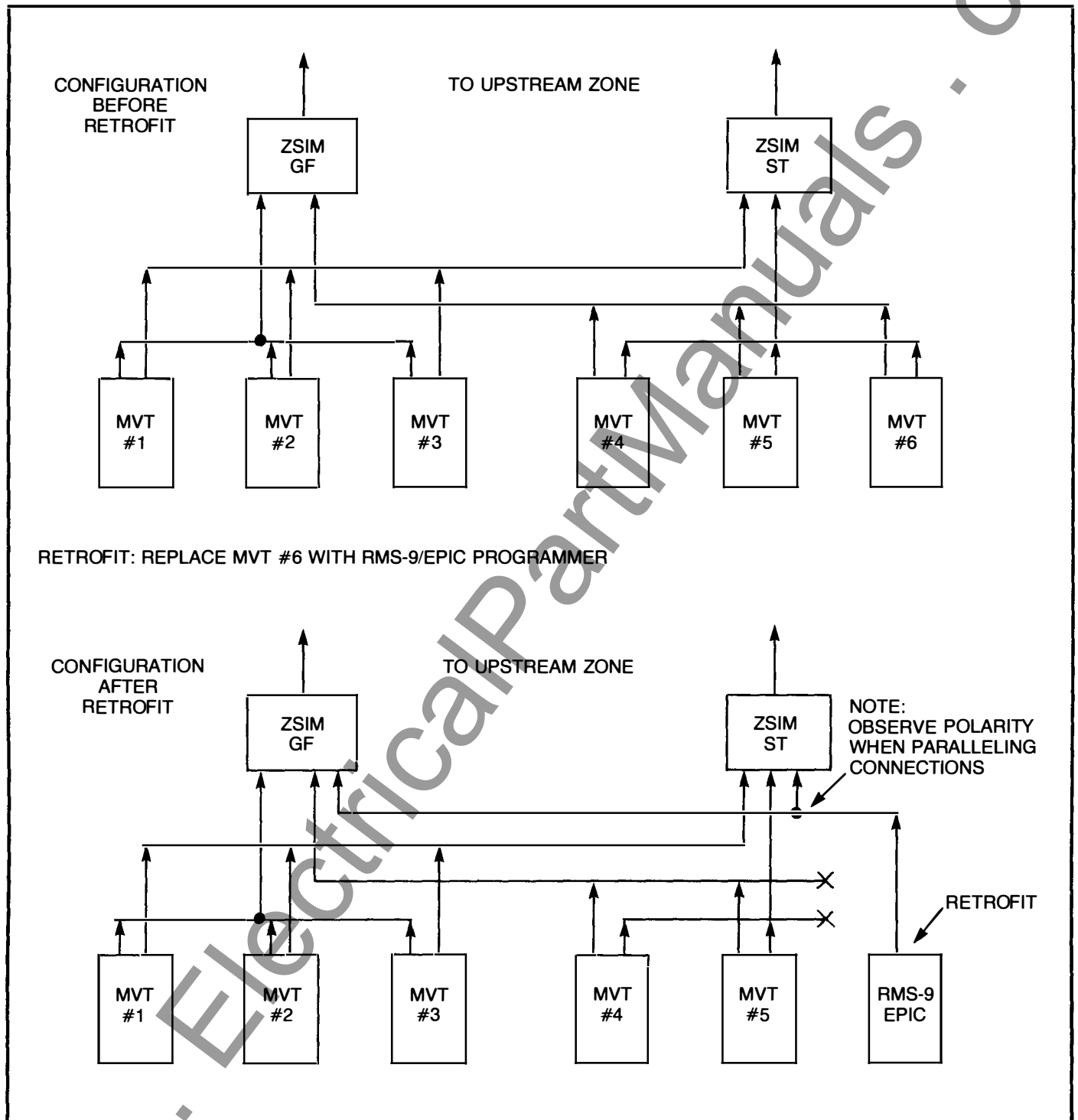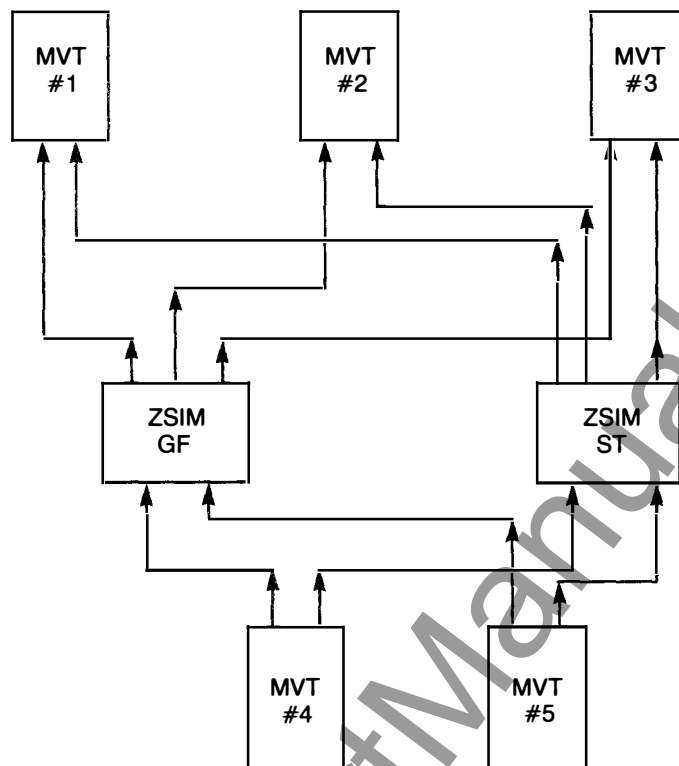
CONFIGURATION BEFORE RETROFIT

TO UPSTREAM ZONE

ZSIM GF

ZSIM ST

MVT #1

MVT #2

MVT #3

MVT #4

MVT #5

MVT #6

RETROFIT: REPLACE MVT #6 WITH RMS-9/EPIC PROGRAMMER

CONFIGURATION AFTER RETROFIT

TO UPSTREAM ZONE

ZSIM GF

ZSIM ST

NOTE: OBSERVE POLARITY WHEN PARALLELING CONNECTIONS

RETROFIT

MVT #1

MVT #2

MVT #3

MVT #4

MVT #5

RMS-9 EPIC

Figure 12. Retrofit Example #1

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CONFIGURATION
BEFORE
RETROFIT

MVT #1   MVT #2   MVT #3

ZSIM GF   ZSIM ST

MVT #4   MVT #5

RETROFIT: REPLACE MVT #4 WITH RMS-9/EPIC PROGRAMMER

CONFIGURATION
AFTER
RETROFIT

MVT #1   MVT #2   MVT #3

ZSIM GF   ZSIM ST

NOTE: OBSERVE
POLARITY WHEN
PARALLELING
CONNECTIONS

RETROFIT

RMS-9

EPIC

MVT #5
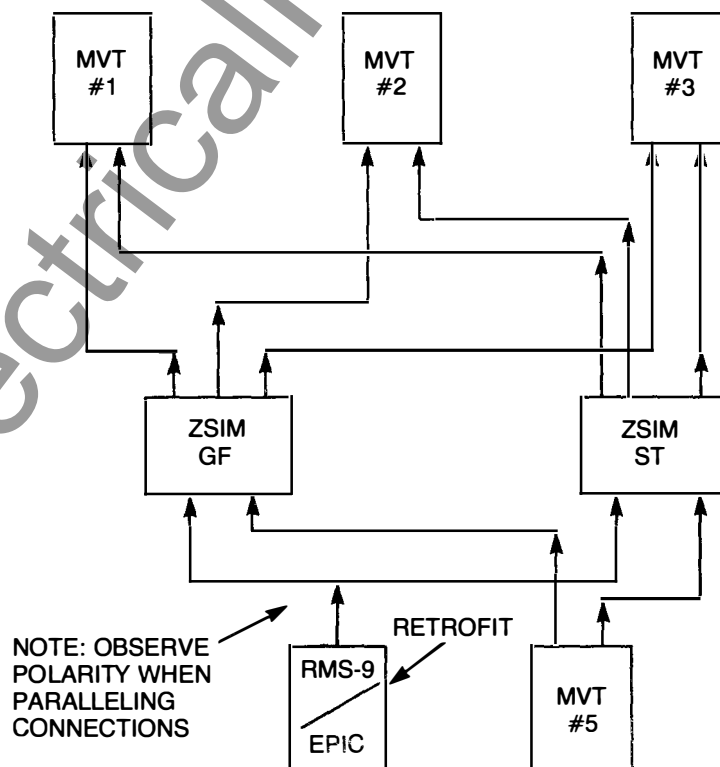
Figure 13. Retrofit Example #2

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CONFIGURATION BEFORE RETROFIT

MVT #1   MVT #2   MVT #3

ZSIM GF   ZSIM ST

MVT #4   MVT #5
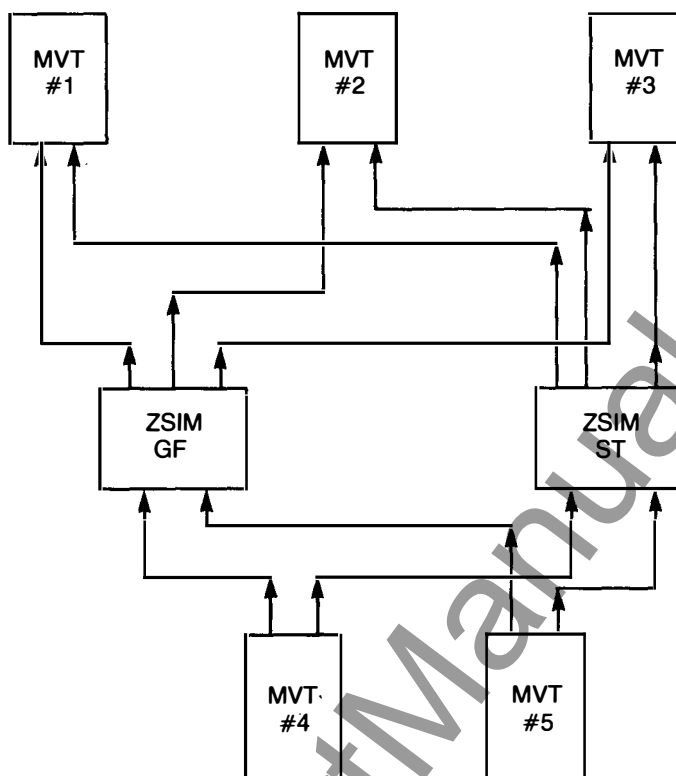
RETROFIT: REPLACE MVT #1 WITH RMS-9/EPIC PROGRAMMER

RMS-9 / EPIC   RETROFIT

NOTE: OBSERVE POLARITY WHEN PARALLELING CONNECTIONS

CONFIGURATION AFTER RETROFIT

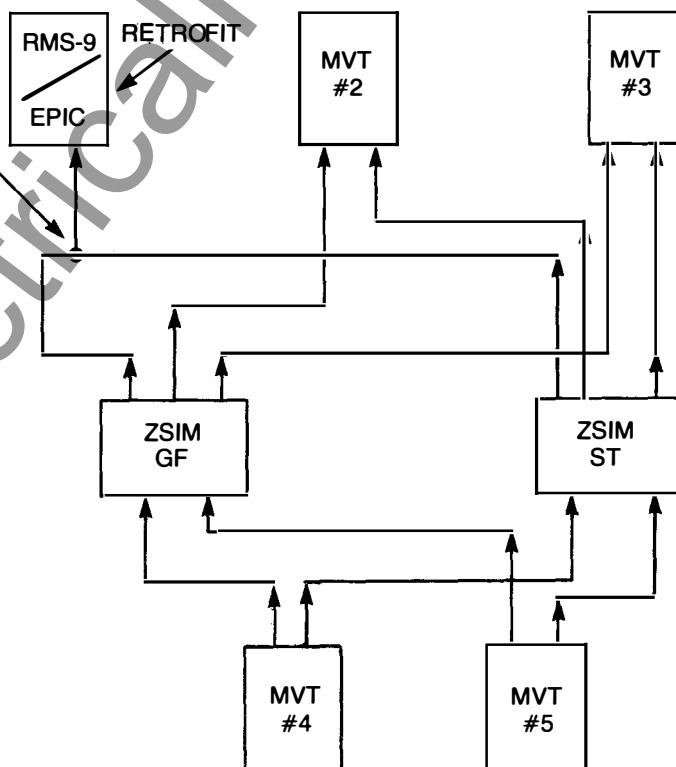MVT #2   MVT #3

ZSIM GF   ZSIM ST

MVT #4   MVT #5

Figure 14. Retrofit Example #3

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VIII. CIRCUIT DESCRIPTION

The following is a brief circuit description of the ZSI module. See Figure 15 for circuit diagram.

The "DOWNSTREAM CONNECTIONS" consist of five separate terminal sets, each set providing a voltage reference input via a resistor divider network to a voltage comparator. This voltage reference is compared to a second internal comparator reference. As long as the reference at the "DOWNSTREAM CONNECTIONS" is higher than the comparator reference there is no output at the "UPSTREAM CONNECTIONS" of the module.

When an interlock signal (Logic O) is received at any of the downstream terminals, the comparator will go "high." This actuates the electronic switch and provides an output volt-age at all "UPSTREAM CONNECTIONS;" the output from the electronic switch will also illuminate the "MODULE FUNCTIONAL" LED.

The window detectors sense the voltage across each of the five terminal sets for "UPSTREAM CONNECTIONS" and will illuminate an LED if the voltage across its particular terminal set is within an acceptable voltage window. Therefore, the window detectors, (with their associated LED) serve to indicate that a proper upstream circuit exists.

The "PUSH TO TEST" button is a means by which a downstream interlock signal can be simulated, thereby providing a test means for module functionally and proper upstream circuitry.
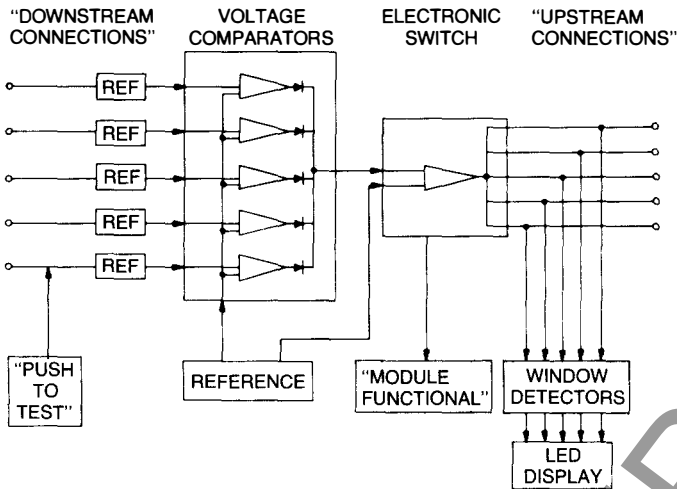

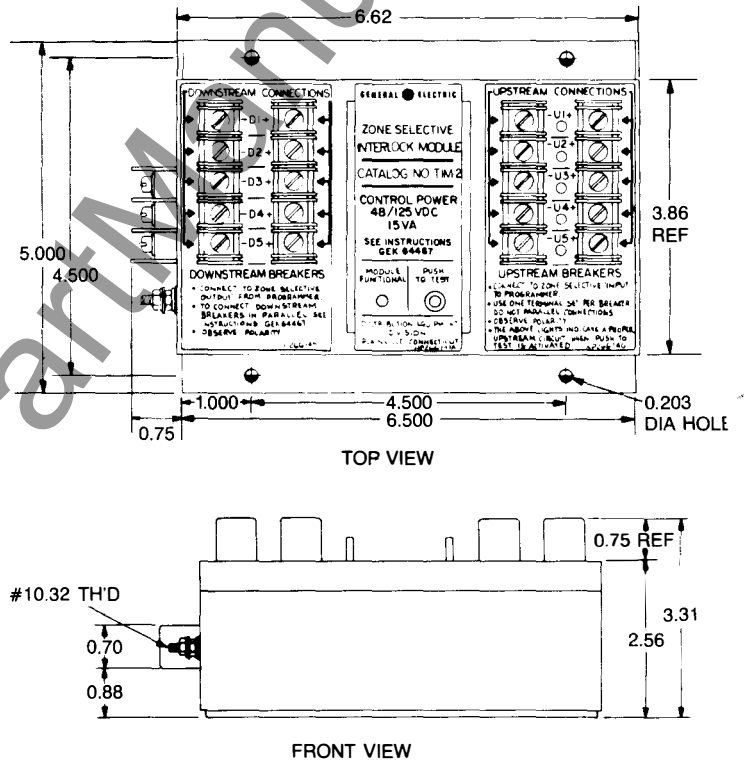**Figure 15. Zone Selective Interlock Module circuit diagram**

Figure 16. Outline Diagram

For further information call or write your local General Electric Sales Office or . . .

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