Catalog Supplement

G&W Electric Co.

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G&W Vacuum Interrupter (VI) Controls

G&W's Vacuum Interrupter switchgear used for systems requiring overcurrent protection offers many advantages over fused switchgear. Compare these features:

Features

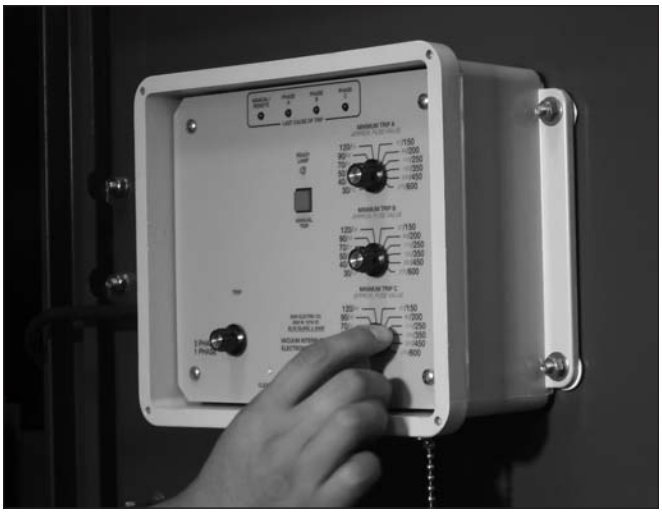
- Three phase protection with single phase or three phase trip option
- Resettable operation
- Load and fault interruption
- Field adjustment or upgrade without downtime
- Remote control and monitoring capability
- Ground fault (phase imbalance) protection
- Self-powered, requiring no batteries or external power
- Field selectable Time Current Curves (TCCs)
- 30 built-in curves emulate many relay and fuse curves aiding in coordination
- Last Cause of Trip Indication
- Option to provide external power which allows for SCADA Trip commands or to view the Last Cause of Trip information
- Option to communicate with the control (read or set settings) using RS485 (Modbus)

These popular features are possible because of an exclusive electronic control which:

- Senses and measures the current through the vacuum interrupter
- Checks the control settings
- Determines the time to trip (follows TCC protection curves)
- And sends a signal to the vacuum interrupter to trip open in as little as 8 milliseconds.

Operation

Incoming load on fault current to the electronics is sensed by current transformers mounted internally around each bushing of the switch. The CTs also provide power to the control thus eliminating the need for an external power supply. Approximately 6-10 Amps per phase of load current is required for self powering. If that is not present, the control is in sleep mode. It will power-up and trip once that load is present (either normal load or during a fault). There will be an approximate 1/2 cycle delay for power-up in this case.

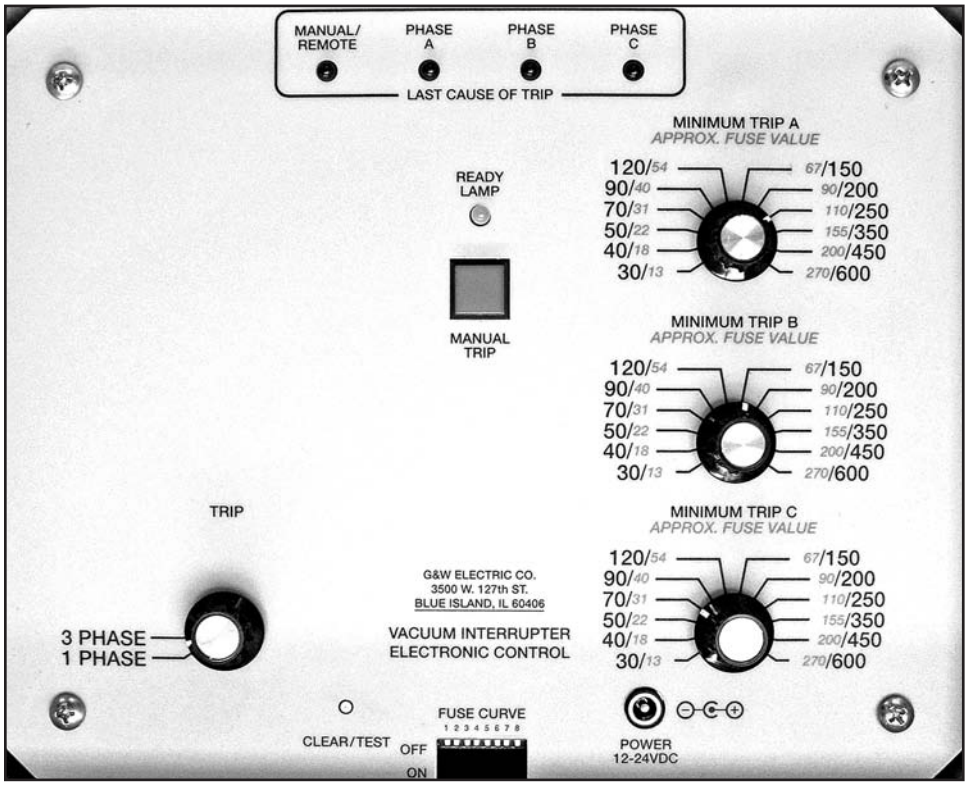


Controls are housed within NEMA 4X enclosures for pad-mount applications. Other styles are available.

In addition, a "READY" light is provided which flashes when the control is powered up when sufficient load current on the sensing CTs is present, or the control is provided with external power.

The incoming load or fault current is converted to a digital signal. The control constantly compares the measured current to the TCC programmed into the memory. Based on the programmed settings, the control determines when to trip open the vacuum interrupter to interrupt the fault. All front panel trip settings are in Minimum Trip Amperes. An approximate conversion of minimum trip to approximate fuse equivalent is provided. The VI Control can be tested in the field using primary or secondary current injection.

Controls are housed within NEMA 6P enclosures for submersible vault applications. Other styles are available.



Type 1 Control
See page 4 for Typical Specifications

Type 1 Control -
Single Phase and Three Phase

The Type 1 operates three, single phase vacuum interrupting mechanisms. The Type 1 can be field set for either single phase or three phase trip mode. It is used on switches with either single phase reset or three phase reset. When in the three phase mode, all three phases trip if the selected trip level of any individual phase is reached. Trip level selections can be made under load or no-load conditions with current ranges in 12 selectable levels. Two ranges of minimum trip settings are available, 15 to 300 amps and 30 to 600 amps. Each unit is preprogrammed with multiple TCCs. The curve selection can be set or changed at any time.

An 8 pole dip switch allows the user to choose the TCC that best matches their individual coordination requirements. A label, located on the inside of the lid, provides a key for the dip switch settings. The control can be factory preset to meet the user's requirements. As protection or coordination requirements change, settings can easily be changed in the field. Depressing the manual trip button when the control is powered up electronically trips all three phases of the vacuum interrupter. Each control also includes "Last Cause of Trip" LEDs. These LEDs indicate which phase experienced an overcurrent condition, or that the control was given an external or manual trip command.

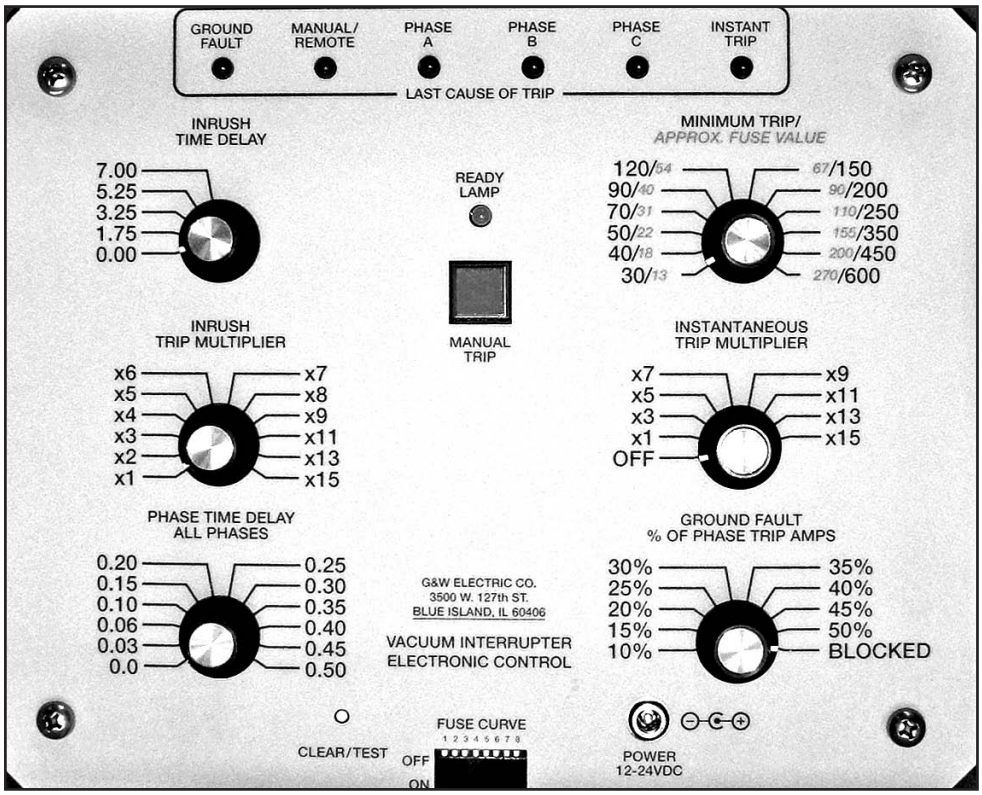
Type 2 Control - Three Phase Only

The Type 2 operates similar to the Type 1 with the following exceptions:

Since the control is three phase only, one minimum trip level for all three phases is set via a single selector knob. The control has a built-in, adjustable phase time delay. The control also provides a ground fault (phase imbalance) feature with adjustable trip and time delay settings as well as instantaneous trip and inrush restraint features.

Phase Time Delay: For applications requiring coordination with other protection devices, the Type 2 provides field selectable phase time delay capability. The phase time delay selector switch provides a phase delay range from 0 to 0.50 seconds before the programmed TCC delay time is initiated. This permits the user to select which protective device will trip the circuit first. The phase time delay allows sectionalizing schemes to be implemented while maintaining full line capacity throughout the circuit.

Ground Fault (Phase Imbalance): The ground fault or phase imbalance feature continuously checks for phase imbalance or unequal currents in each of the three phases. Protection from this condition is a common requirement for large three phase motors or other sensitive loads. The ground fault trip current can be adjusted in the field by the user and is represented on



Type 2 Control
See page 4 for Typical Specifications

the control panel as a percent (%) of the user programmed phase overcurrent minimum trip level.

A time delay minimizes nuisance tripping caused by temporary phase imbalances. The Minimum Trip selector sets the desired trip level in amperes depending upon the desired protection scheme. The ground trip feature protects against high impedance faults and loss of phase.

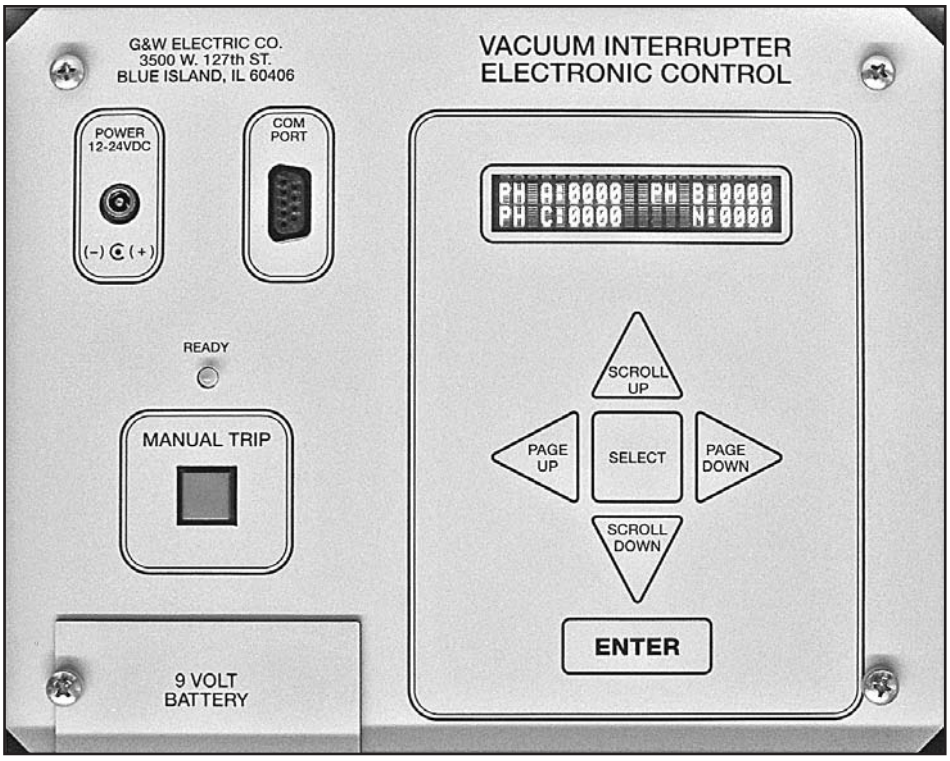
As an example, when emulating a conventional "E" speed protection, you would set the "Trip Amperes" selector to 90 for which the minimum trip current is 90 amps. If the Ground Trip Current is set at 30%, then the control will initiate timing (based upon the selected TCC) to trip all three phases if the total phase imbalance is greater than 30% of minimum trip level or 27 amps. The control measures phase imbalance by calculating the vector sum of all three phase currents. If a time delay is also selected, the vector sum would have to exceed 27 amps for the length of time specified by the TCC and the time delay. The ground trip feature will also interrupt power if one or two of the source phases should become de-energized.

Instantaneous Trip: The instantaneous trip multiplier aids in customizing the protection capabilities of the Type 2 control. The rotary switch has nine positions. The first position, OFF, disables this feature. The other positions (x1, x3, x5, x7, x9, x11, x13, and x15) affect how the Type 2 calculates delay times for over-current conditions. When any phase exceeds the current value defined by the minimum trip setting times the instantaneous trip multiplier, the Type 2 will initiate a trip command to all three phases within half a cycle, 8.3 msec at 60 Hz (10 msec at 50 Hz).

Inrush Restraint: The inrush restraint function is helpful in preventing nuisance trips due to cold load pick-up. The inrush restraint function is active when the Type 2 is initially powered up and will reactivate if the average three phase primary current drops below 7.5 Amps (15-300 Amp controls) or 15 Amps (30-600 Amp controls). The inrush restraint function consists of two selectable parameters, the Inrush Trip Multiplier (x1, x2, x3, x4, x5, x6, x7, x8, x9, x11, x13, and x15) and the Inrush Time Delay (0.00, 1.75, 3.25, 5.25, and 7.00 seconds).

The inrush trip multiplier increases the minimum trip value for the selected inrush time delay duration. For Example: If the minimum trip setting is 25 Amps, the inrush trip multiplier is x3, and there is a 5.25 second inrush time delay, the Type 2 will not trip due to any currents up to 75 Amps (25 x 3) for 5.25 seconds after the Type 2 is initially powered up by the load current.

Each control also includes "Last Cause of Trip" LEDs. These LEDs indicate what caused the control to issue a trip command - an over current condition, Ground Fault, Instantaneous, or an external or manual trip command.



Type 3 Control
See below for Typical Specifications

Type 3 Control -
Vacuum Flourescent Display

In addition to the overcurrent protection options of the Type 2, the Type 3 has the ability to trip either three single phase mechanisms (similar to the Type 1) or a single three phase mechanism (like the Type 2). Specific features include:

- Vacuum fluorescent display powered by the internal current transformers. A nine volt lithium battery provides backup power for the display when the control is not powered up.
- Keypad operation to set user defined parameters and retrieve status of current values per phase.
- Readout of real-time load current values.
- Ability to program the control using the front panel RS 232 serial communication interface via a personal computer.

Specifications for Type 1, 2 and 3

Power Requirements: Powered by measured current from the current transformers when current is more than 6 Amps per phase (for 500:1 CTs) or 10 Amps per phase (for 1000:1 CTs)

External Power Requirements: 12-24 VDC through the External Power Input or through the Auxiliary Power Jack

Minimum Trip Setting Option (500:1 CT):
FE = Fuse Equivalent

15 A (7 A FE)	75 A (33 A FE)
20 A (9 A FE)	100 A (43 A FE)
25 A (11 A FE)	125 A (55 A FE)
35 A (15 A FE)	175 A (80 A FE)
45 A (20 A FE)	225 A (100 A FE)
60 A (26 A FE)	300 A(132 A FE)

Minimum Trip Setting Options (1000:1 CT):
FE = Fuse Equivalent

30 A (13 A FE)	150 A (67 A FE)
40 A (18 A FE)	200 A (90 A FE)
50 A (22 A FE)	250 A (110 A FE)
70 A (31 A FE)	350 A (155 A FE)
90 A (40 A FE)	450 A (200 A FE)
120 A (54 A FE)	600 A (270 A FE)

Communications: RS485 using Modbus Protocol (Option)

Enclosure: NEMA 4X (IP56) Fiberglass Enclosure (Standard for padmount applications)
NEMA 6P (IP67) Fiberglass Enclosure (Standard for vault applications, option for padmount applications)

Frequency: 60 Hz (Standard) 50 Hz (Optional)

Environment: Operating Temperature -40ºC to +65ºC

Storage Temperature: -50ºC to +85ºC

Humidity: 10% to 95%

Type Tests: Electrostatic Discharge test: IEC 60255-22-2 Level 4 contact discharge

Radiated Electromagnetic Field Disturbance test: IEC 60255-22-3 Level 3

Radiated Electromagnetic Interference: IEEE C37.90.2-199510V/m 35V/m

Surge Withstand: ANSI/IEEE C37.60

Vibration: IEC 60255-21-1 First Edition - 1988 (EN 60255-21-1 First Edition - 1995) Electrical relays, Part 21: Vibration, shock, bump, and seismic tests on measuring relays and protection equipment; Section One - Vibration tests (sinusoidal); Severity: Class 1 Endurance; Class 2 Response.

IEC 60255-21-2 First Edition - 1988 (EN 60255-21-2 First Edition - 1995) Electrical relays, Part 21: Vibration, shock, bump, and seismic tests on measuring relays and protection equipment; Section Two - Shock and Bump tests. Severity Level: Class 1 Shock withstand, Bump; Class 2 Shock Response