WHITE PAPER

Environmental Technology, Inc.
GIT-3A and GIT-4 Automatic Gutter Ice Melting Controls

Sept. 27, 2001

We Manage Heat™

OVERVIEW

The GIT-3A (Order Number 19554) and GIT-4 (Order Number 19556) Automatic Gutter Ice Melting Controls provide energy-efficient automatic snow and ice melting heater operation based upon environmental conditions in gutters and down spouts. Ice melting heaters operate only while needed thus keeping energy consumption to a minimum without reducing ice melting capability. These products are UL Listed to Standard 873 for Temperature Indicating and Regulating Equipment and C-UL Listed for Canadian applications. The GIT-3A and GIT-4 differ only in features. The patented and patent pending GIT-4 offers the advantages of built-in GFEP (ground fault equipment protection) and unique remote control and monitor capability.

These products operate from jumper selected 120, 208/240 and 277 supply voltages. Their internal contactors control up to 26 amp single-phase ice melting heater loads throughout their supply voltage ranges. Since the GIT-4 has both GFEP and multi-voltage capability, safety dictates breaking both sides of the branch circuit. Otherwise, a interrupting power may not clear the ground fault current thus creating a safety problem.

Since these products operate from all common distribution voltages used for gutter and roof ice melting in North America, stocking is practical. This provides superior customer service during the busy winter months.

Two connected components comprise these products: a Sensor and a Control. The Sensor mounts in the gutter or down spout. It checks for icing conditions in its immediate area. Icing conditions are considered to exist while moisture is present at ambient temperatures below 38° F (3.33° C). Upon detecting these conditions, the Sensor signals the Control to operate the ice melting heaters. Operation continues until icing conditions are no longer present and for the hold-on time of one hour thereafter. Continuing ice melting heater operation for the hold-on time ensures melting of any residual snow and ice.

The Control enclosure, which mounts on any convenient vertical surface up to 12 feet (3.6 meters) from the Sensor, supplies low voltage for operating the Sensor. It also interfaces the Sensor's call for heat signal while providing the ice melting heater control contactor. The low voltage source meets the new NEC (National Electrical Code) requirement for wet locations.

The Control enclosure shelters all electrical connections while providing a safety barrier that prevents mixing low and line voltage wiring. Because the GIT-4 is more complex than the GIT-3A, it uses a larger enclosure.

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The GIT-4 provides integral GFEP capability. An RCU-2 Remote Control is included with the GIT-4 since the Control enclosure is not easily accessed once installed. The RCU-2 performs the following functions:

- Indicates system operation via **SUPPLY** and **HEATER** indicators
- Tests/resets the GFEP
- Selects 60 and 120 milliamperes GFEP trip currents in addition to the standard 30 milliampere value
- Can toggle the snow and ice melting heaters on and off

The low voltage NEC Class 2 RCU-2 can be located up to 150 feet (45 meters) from the GIT-4 Control. It employs customer-supplied 2-conductor #18 AWG (American Wire Gauge) unshielded jacketed extension cable. Installation is simplified since the electrical connections to the RCU-2 are non-polar.

The GIT-4 uses a microcontroller. This computational capability minimizes false GFEP trips through digital filtering. It also implements the complex interface required by the RCU-2 and the Sensor.

The GIT-3A and GIT-4 Sensors, although physically identical, they differ electronically. Thus, they are not interchangeable. Both the GIT-3A and GIT-4 are supplied with the Sensor wired to the Control.

The Sensor employs a brass tube housing. Epoxy potting ensures ruggedness and moisture protection. Additionally, the electronic components in the Controls of both the GIT-3A and GIT-4 are epoxy potted for environmental protection.

As it occurs in nature, ice is not frozen pure water. It contains entrapped air and other impurities. Under certain conditions, ice can melt and leave an air filled dome over a moisture detector. This could prevent melted water from reaching the heated moisture detector. If this occurs, the moisture detector would falsely indicate a dry condition.

The Sensor uses a microcontroller to execute the complex moisture detection algorithm required to prevent ice bridging. Tests have shown that the Sensor can be frozen in a block of ice and still perform properly. This important feature ensures effective deicing even if the ice melting system is not turned-on until after ice forms in the gutter and down spout.

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GIT-3 And GIT-3A Automatic Gutter Ice Melting Controls Compared

The GIT-3A is the successor to the GIT-3. With the exception of additional supply voltage flexibility, these product are functionally and mechanically identical. The GIT-3 operates from either 120 or 240 volts that is selected by an internal selector switch. The GIT-3A operates from 120, 208/240 or 277 volts that is selected by an internal jumper . Both products control single-phase heater loads of up to 26 amps throughout their operating voltage range.

GIT-4 Automatic Gutter Ice Melting Control Features

Important features differentiate the GIT-4 from the GIT-3A. The GIT-4 provides an integral programmable GFEP (ground fault equipment protection) along with standard remote control and monitoring capability through the RCU-2 Remote Control which is included.

The GIT-4 is located adjacent to the gutter and down spout containing the ice melting heater. Since this location is not conveniently accessible, the remote test and reset of the GFEP is an essential feature. Prudent operating practice requires verification of the GFEP function in anticipation of the winter season. This helps identify problems while good weather is still the rule rather than the exception.

RCU-2 Remote Control

The RCU-2 Remote Control provides an interface conveniently located within 150 feet (45 meters) from the GIT-4. It provides two switches and two indicators. The green ***SUPPLY*** indicator operates while the supply voltage is present at the GIT-4. The yellow ***HEATER*** indicator operates with the ice melting heaters. As described below, this indicator serves other purposes. The ***TEST/RESET*** switch controls GFEP operation while the ***HEATER CYCLE*** switch can operate the snow and ice melting heaters on command. The ***TEST/RESET*** switch is also used for setting the GFEP trip current value.

GFCI (Ground Fault Circuit Interrupter) Details

The TEST/RESET switch controls GFEP operation. The effect that this switch has depends upon both the current state and history of the ice melting system. Assume than a ground fault has occurred but has cleared because the gutter and down spout are now dry. The GIT-4 electronically stores this information, even if electrical power has been interrupted. While the GIT-4 is powered, the ***HEATER*** indicator blinks every 0.8 seconds indicating that a ground fault condition exists or that it has existed. Power to the ice melting heaters is interrupted independent of environmental conditions until the GFEP condition is reset.

Operating the ***TEST/RESET*** switch causes one of two actions depending upon the state of the GIT-4. First, if a ground fault has occurred, operating this switch clears the fault indication and performs a self-test. If the self-test fails or the ground faut condition continues and snow and ice melting heater operation remains inhibited.

GFCI (Ground Fault Circuit Interrupter) Details

If there is no ground fault, operating the ***TEST/RESET*** switch causes the GIT-4 to perform a self-test by generating a test current that simulates the ground fault condition. If the ground fault detection system operates correctly, the GIT-4 to resumes normal operation. During the self-test interval, both the ***SUPPLY*** and ***HEATER*** indicators rapidly flash alternately.

If the self-test fails, ice melting heater operation is inhibited and both the ***SUPPLY*** and ***HEATER*** indicators flash slowly and alternately at the same rate. In this case, it is likely that the GIT-4 ground fault detection system has failed. Since GIT-4 electronic components are potted in epoxy and cannot be repaired, the Control requires replacement.

If the ground fault persists after completion of the self-test, a new trip will occur. This sequence will reoccur whenever the ***TEST/RESET*** switch is operated.

ANY TIME THAT A GROUND FAULT CONDITION OCCURS, THE ICE MELTING HEATERS HAVE ALMOST CERTAINLY FAILED. EVEN IF OPERATING THE TEST/RESET SWITCH CLEARS THE GROUND FAULT INDICATION, DO NOT ATTEMPT TO OPERATE THE ICE MELTING SYSTEM. INTERRUPT ELECTRIC POWER TO THE ICE MELTING SYSTEM AT THE SERVICE BOX. TAG THE CIRCUIT BREAK "DO NOT OPERATE" AND CALL QUALIFIED SERVICE PERSONNEL TO CORRECT THE PROBLEM.

The ice melting system should be checked by operating the ***TEST/RESET*** switch in advance of the winter season. This identifies problems that might prevent the ice melting system from remaining functional throughout the winter months.

The ground fault current limit is set to 30 milliamperes at the factory. Should the need arise, this limit can be increased to 60 or 120 milliamperes. This feature accommodates the ground fault current resulting from stray snow and ice melting heater capacitance which is an operating parameter rather than a safety issue.

Changing The GFCI Trip Current Setting

The heating cable capacitance effects the ground fault current in two ways. First the capacitance, and thus the ground fault current, is proportional to cable length, all other factors being equal. Also, for a given capacitance, the ground fault leakage current is proportional to supply voltage. The worst case occurs with a long heating cable operating at the highest voltage. The most common problem is nuisance tripping of the GFEP. In this case, operating personnel eventually ignore the possibility of a heating cable failure.

For safety reasons, changing the ground fault current trip level is an involved procedure. This feature, when needed, is used during installation by qualified personnel. It is virtually impossible to change the trip level without specialized knowledge. The instruction manual does not provide this information. Rather, it advises contacting the factory for application assistance in the event of nuisance GFEP tripping.

The next few paragraphs describe the operation of this feature. The setting procedure is made difficult by design. It is enabled and set using the GFEP ***TEST/RESET*** switch with progress being monitored by observing the operation of the ***HEATER*** indicator. The action sequence shown below describes how to set the trip current level.

1. Press the GFEP ***TEST/RESET*** switch for 10 seconds. At the end of this time, both the ***SUPPLY*** and ***HEATER*** indicators will flash very rapidly.
2. Release the switch. The ***HEATER*** indicator will flash between one and three times, delay for and few moments, and the repeat this aequence to show the trip current setting.

- One flash = 30 milliamperes
- Two flashes = 60 milliamperes
- Three flashes = 120 milliamperes

3. Quickly press the GFEP ***TEST/RESET*** switch the number of times necessary to set the trip current to the desired level as is described below:

- Once = 30 milliamperes
- Twice = 60 milliamperes
- Thrice = 120 milliamperes

4. The ***HEATER*** indicator will blink as described above to show the new trip current choice.
5. To change the choice, repeat steps 2 and 3 above.
6. To make the choice permanent, press and hold the GFEP ***TEST/RESET*** switch for four seconds. After four seconds, both indicators stop blinking and operate continuously.
7. Not operating the GFEP ***TEST/RESET*** switch for 30 seconds aborts the current trip setting function. Both the ***SUPPLY*** and ***HEATER*** indicators will flash rapidly for two seconds. Thereafter, the new setting will be ignored and the original value restored. The GIT-4 then resumes normal operation.

Cycling the Ice Melting Heaters

The GIT-4 starts the ice melting heaters at temperatures below 38° F (3.33° C) when moisture is present in the Probe area. Heater operation continues until the Probe's moisture sensor is dry and for one hour thereafter or the temperature remains above 38° F (3.33° C). This additional interval is called the hold-on time. This ensures complete ice melting even though the sensor or ice melting heaters may not be ideally sited, drifting snow may be present, etc.

Under unusual conditions, additional snow and ice melting heater hold-on time, beyond that normally provided by the GIT-4, may be required. Blowing or drifting snow can be one of these conditions. Also, testing the ice melting heaters other than during the winter must be accommodated. Operating the ***HEATER CYCLE*** switch toggles the ice melting heaters on for one hour provided the ambient temperature in the Probe area is at or below 38° F (3.33° C). Operating the ***HEATER CYCLE*** switch a second time toggles the ice melting heaters off. At higher temperatures, operating the ***HEATER CYCLE*** causes the ice melting heaters to operate for 30 seconds. Thereafter, the ***HEATER CYCLE*** switch is ignored for two minutes to prevent thermal stress from occurring during the summer months. The GIT-4 ignores the ***HEATER CYCLE*** switch if ice melting heater are operating as the result of environmental conditions or during the normal hold-on time interval.

Self-Tests Performed Upon The Application of Power to the GIT-4

When power is first applied to the GIT-4, it checks its memory. If the test fails, ice melting heater operation is inhibited since the GIT-4 cannot remember whether or not a ground fault has occurred. In this case, both the ***SUPPLY*** and ***HEATER*** indicators flash slowly and alternately. This condition almost certainly indicates a GIT-4 Control failure requiring its replacement.

If there are certain Probe failures or the communications between the Probe and the Control fails, the ***HEATER*** and ***SUPPLY*** indicators flash unevenly. The ***HEATER*** indicator operates three times as long as the ***SUPPLY*** indicator. Snow and ice melting heater operation is inhibited. Normal operation resumes if the fault condition disappears.

Electrical Ratings

Supply voltage ratings:	120, 208/240 and 277 volts 60 Hz (jumper selectable)
Contactor ratings:	277 volts AC (maximum) 26 amps heater load (maximum)

GIT-4

Factory preset trips:	30 milliamperes
Field programmable trips:	30, 60 and 120 milliamperes (remotely set)

Applications

GIT-3A Automatic Gutter Ice Melting Control

The GIT-3A is intended for cost sensitive applications. These include most residential and small commercial installations requiring no-frills highly reliable energy management where features are less important than cost. Selectable 120, 208/240 or 277 volt operation is a definite advantage in these applications as is the availability of relatively low-cost GFEP distribution panel-mounted circuit breakers for 120 volt applications.

Another useful family of applications use the GIT-3A's contactor as a pilot duty relay for controlling external contactors in large commercial installations. Selectable operating voltage adds flexibility in these applications.

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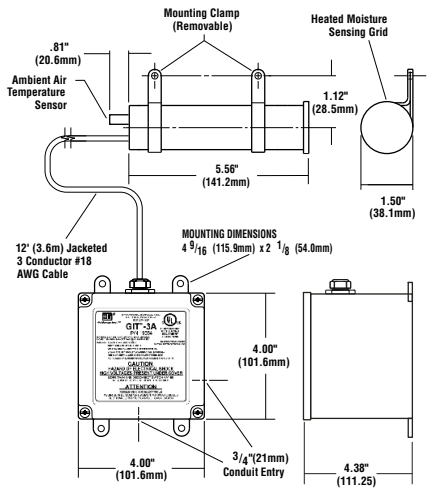
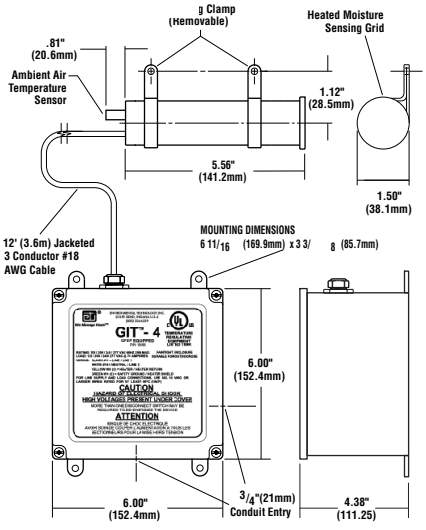
The GIT-4 performs the same functions as the GIT-3A while offering the important advantage of standard remote control and monitoring along with programmable GFEP capability. The ability to remotely control the GFEP function and to cycle the ice melting heaters for a fixed time interval adds to the reliability and usefulness of the gutter ice melting system. In commercial installations, the GIT-4 currently costs less than most 208 or 277 volt GFEP circuit breakers alone.

Dividing a snow and ice melting system into independently controlled zones improves efficiency when compared to using single-point control for the entire gutter ice melting system. The icing conditions present in each zone depend upon a variety of factors including the building orientation and construction. As a rule, some zones will be exposed to more severe icing conditions than others. Using singe-point control for an entire system, often operates all snow and ice melting heaters when only one is needed thus wasting wastes energy and increasing operating costs. The use of a GIT-4 for each zone is a cost effective way to eliminate this problem.

GIT-3A



GIT-4



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