

FREEZER FLOOR HEAT MONITOR AND CONTROL

MODEL #FFCH-XXXXXX-JX

The model FFCH is designed specifically to monitor and control self-regulating heat cable to maintain freezer floor temperature at ultimate design conditions.

Basic freezer floor designs up to 15,000 square feet use self-regulating heat cable to prevent “frost heave” — the process where moisture in the ground below the freezer freezes and expands, causing the floor and/or the entire building foundation to rise. Floors, depending on the amount of moisture present, can rise as much as several feet, causing structural damage to the building. The cost of replacing the floor is extremely expensive: the floor must be removed and all of the frozen ground below replaced or thawed.



FFCH control & monitoring panel

In the past, self-regulating cable was monitored using techniques specifically designed to control the older technology of constant-wattage heat cable by monitoring current. But with the advent of self-regulating cable as the main heating source for freezer floors, current changes with the temperature of the cable and can no longer provide a true indication of cable operation.

Our FFCH system monitors end-of-run relays to ensure cable is always on and functioning. We also monitor other relevant failure indicators and annunciate a 98 dB alarm when and if a failure occurs. This alarm will re-sound every 7 days until the problem has been solved and the system is back in working condition.

The FFCH system is designed to monitor and control up to 5 circuits and up to 15 separate runs of cable as a standard configuration — larger installations are available, with completed projects scaling up to 36 circuits and 72 runs of cable. Each fault is data-logged to help with troubleshooting — not only are faults shown, but the time the floor has been in default is recorded. Full troubleshooting guides are easily accessible at the touch screen interface and provide detailed instructions for checking components.

THIS SYSTEM MONITORS:

- Temperature of the ground below the freezer
- Ground fault circuit breaker for short circuit conditions
- Far-end voltage confirmation on each circuit (SSR)
- End-of-run relay to monitor cable operation

THIS SYSTEM INDICATES:

- Ground temperature
- Heater output
- SSR circuit status
- GFI circuit breaker fault
- End-of-run relays
- Number of faults, each condition
- Fault time

We provide our systems with detailed conduit layout details, wiring details, amperage and power requirements, control panel wiring drawings, and back-up technical support with phone-guided troubleshooting assistance.

FREEZER FLOOR FREEZE PROTECTION DESIGN

Heat Cable Design

APPLICATION

Freezers and other refrigerated storage areas are maintained at temperatures below freezing. Therefore, moisture in the soil under the floor can also freeze. Expansion of the soil caused by freezing temperatures can result in damage to the surface above. Some floors, depending on size and temperature of the freezer, have been observed to raise 12", 24", or more. In many cases this causes the floor to crack, costing thousands of dollars in removal and replacement. Heat cable installed under the floor and in the substrate will prevent the soil from freezing.

STANDARDS & CODE CONSIDERATIONS

- **IEEE Std. 515.1** — Recommended Practice for the Testing, Design, Installation, and Maintenance of Electrical Resistance Heat Tracing for Commercial Applications
- National Electric Code (NEC) Article 426
- National Electric Code (NEC) Article 427
- National Fire Protection Association (NFPA)
- Applicable local codes

DESIGN CONSIDERATIONS

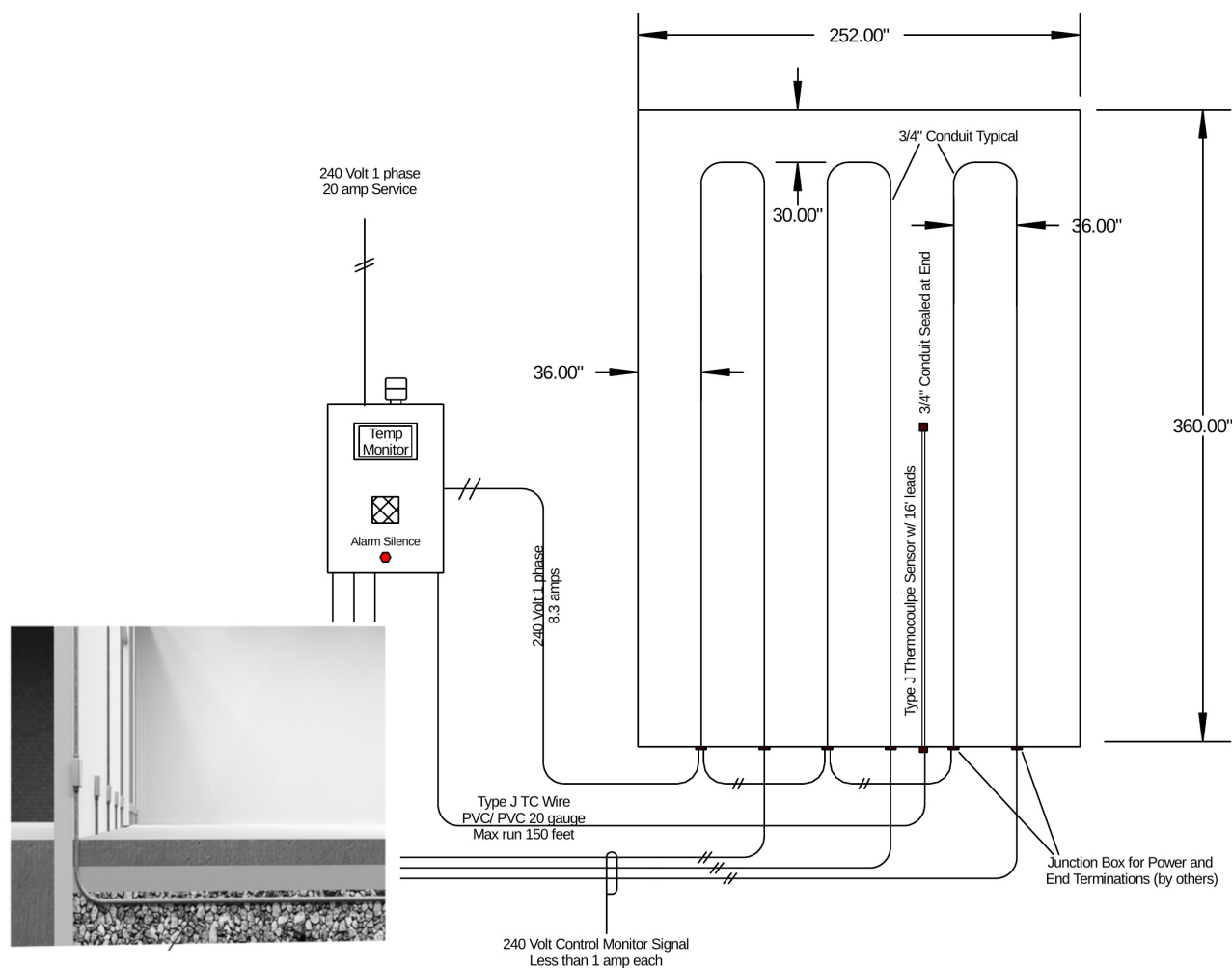
- A typical substrate design includes the concrete slab, a layer of rigid foam insulation, and a heater cable embedded in sand or concrete. The heater cable is generally installed on 2 to 4 foot (0.6 to 1.2 meter) centers.
- The heat load requirement is calculated based on the amount of insulation between the concrete floor and the heated substrate, and the refrigerated area temperature. For elevated applications, insulation around the perimeter should be considered.
- Heater load requirements are based on insulation thickness, cable spacing, and freezer temperature — using low-temperature self-regulating cable with a copper braid and outer jacket.
- Although not required, it is recommended that polymer-based heaters be installed in conduit for ease of access and/or replacement. If non-metallic conduit is used, care should be taken that the cable sheath temperature does not damage the pipe — this can occur with high-temperature self-regulating cable or constant-wattage/zone heaters. Self-regulating cable also requires de-rating when installed in conduit (de-rate low-temperature self-regulating products by 40% when installed in metallic conduit).
- Power connection kits and end seals should be mounted in an accessible junction box. Branch breakers feeding the cables shall be 30mA GFEPD.
- Thermostatic control is recommended for this application. The sensor should be located in conduit halfway between two runs of heater cable, toward the center of the heated area.

FREEZER FLOOR FREEZE PROTECTION

Layout

Heater cable conduit shall be mounted in the sand or concrete base and run no closer to the outside wall than 1'6". Each conduit shall be located at "A" centers and be a minimum of 1/2", 3/4" where allowed. A weatherproof junction box shall be mounted at each end of the heater cable conduit, located for easy access to both the power termination end and end-run connection. The junction box will include a molded silicone end seal and power termination kit with silicone adhesive.

Temperature sensor mounted in a separate conduit, centered between two heater cable conduit runs. Sensor shall be Type J with weatherproof 30' leads. Sensor wire to the control cabinet shall be made with Type J PVC-insulated thermocouple wire, with connections made using minimum 90% silver solder. Wire nuts are not permissible.



Typical Layout — reference dimensions shown; actual layout engineered per project

SAMPLE SPECIFICATION

DESCRIPTION

Self-Regulating Heat Trace Cable

- Semi-conductive polymer core heating matrix
- Continuous maintenance temperature: 150°F (66°C)
- Intermittent exposure temperature: 185°F (85°C)
- Supply voltages: 110–120VAC or 208–277VAC
- Moisture, chemical, and flame resistant
- 16 AWG bus wires
- Tinned copper over-braid with thermoplastic elastomer overjacket

Sensor

Type J thermocouple, lead lengths equal to ½ floor width, designed for direct submersion with stainless steel overbraid and Teflon overjacket for moisture and corrosion resistance.

FREEZER FLOOR TEMPERATURE CONTROL SYSTEM

Model FFCH-XXXXX-ALRET

Monitor and control system shall be designed to monitor and control self-regulating heat cable using a 3.5" touchscreen. System shall monitor and indicate alarms for:

- Continuity on each run of cable
- GFI fault
- Low temperature
- Floor temperature
- Circuit (SSR) operation
- History of alarm operations and time spent in temperature alarm conditions

Panel includes:

- Schneider Electric PLC with 3.5" color touchscreen (HMI)
- Main disconnect, lockable for lockout/tagout (LOTO)
- Dedicated circuit breaker, per circuit
- ABB GFI circuit breakers with aux contact, per circuit
- Solid-state relays (SSR) switching each heat cable circuit
- Far-end voltage sensing, per circuit — confirms actual cable energization at the far end of the run
- End-of-run relays (1 each, per run of cable)
- Main lugs only
- Combination red alarm beacon and 98 dB horn, with reset push button
- Dry output contacts for remote alarm monitoring and building management system (BMS) interlock
- Remote input for peak-demand setback operation
- Sensor fault alarm, plus fault logging with precise location and a troubleshooting guide built into the fault history
- Low-temperature event timer/history

All control and power equipment shall be mounted and pre-wired in a NEMA-rated enclosure — 12, 3R, 4, or 4X as required by the installation, with NEMA 4X fiberglass offered where practical.

Moisture-resistant power connection kits / end termination kits shall be provided for each termination point.

Equipment shall be provided from one source with application experience in both monitoring and controlling sub-freezing floor applications, as manufactured by Thermal Equipment Sales, Inc. **Contact: Richard Jordan — (901) 452-4516**