INVISIBLE SERVICE TECHNICIANS, LLC

Invisible Service Technician Monitoring System

Installation Supplement for Refrigeration Systems Walk-in Coolers and Freezers.

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Product Description

The *Invisible Service Technician* is a device that combines real-time performance data from all the critical operations of HVAC and Refrigeration equipment and systems with ongoing instantaneous monitoring support from Invisible Service Technicians, LLC to the installing HVAC/R Contractor, owner or maintenance personnel.

The *Invisible Service Technician* works with new or existing, residential or light commercial HVAC systems and must be installed by a trained service technician.

About this Supplemental Guide

The *Invisible Service Technician* is *primarily* used for monitoring AC cooling and heat pump equipment and while these constitute the majority of our installations, the *Invisible Service Technician* is not constrained to these purposes.

The hardware will continuously track up to six (6) temperature inputs and eight (8) digital on/off inputs, providing an alarm where the reading deviates from the acceptable range. These inputs can be *any* six temperatures and eight digitals, provided the website configuration is updated to reflect the readings and correspond to the appropriate measurements taken by each sensor.

IST has provided this supplemental guide to indicate a preferred arrangement of temperatures and digital inputs in order to provide a more uniform installation practice and allow us to provide faster response to problems in alternative installations.

This Supplement is intended to be read in conjunction with the Installation Guide that was included with your *IST*.

IST provides Installation Supplements for the following applications and equipment

Installation Supplement No.	Refers
1001-S-R	Refrigeration Systems – Walk in Coolers and Freezers
1001-S-B	Boilers and Hydronic Heating Systems
1001-S-C	Chillers and Chilled Water Distribution Systems

Application Limitations

The digital one-wire temperature sensors used by the IST monitor are capable of measuring temperatures in the range of -65 to 250degF (-50 to 120degC).

There is no practical limitation for normal refrigeration systems that are used for the storage or freezing of food items. For special cryogenic applications where temperatures below the minimum range are possible, please contact IST regarding the availability of special low temperature sensors.

Before You Begin the Installation

Important Safety Information Warning:

1. Always follow safe work practices.
2. Please follow electrostatic discharge procedures. IST recommends the use of grounded wrist straps.
3. Thoroughly read all instructions before installation.
4. Verify that the customer's HVAC/R equipment will safely accept the installation of the *Invisible Service Technician*. For example, only a 24-volt power supply is acceptable.
5. You must be an experienced HVAC/R technician and be fully trained to install the IST monitoring system
6. Always turn off the power at the main power source by unscrewing the fuse or switching the circuit breaker to the off position before installation.
7. All wiring must conform to local and national building and electrical codes and ordinances.
8. Do not short (jumper) across terminals on the gas valve or at the system control to test installation.

Failure to comply with these requirements may result in injury to the installer or damage to the *Invisible Service Technician*, its accessories, and/or the customer's HVAC/R equipment.

NOTE: The selection and setting of parameters must be performed under correct operating conditions. Therefore, refrigerant pressure must be properly set within equipment recommendations, temperature rise and drop must be within factory recommendations, the filter must be perfectly clean, all coils must be clean, etc. Failure to follow these instructions could lead to further complications.

NOTE: Each time the monitor goes into alarm mode, a manual reset is required by pushing button located on the device. There is a hole in the case that is 1/8" in diameter that allows the technician to use a paper clip, small screwdriver or toothpick to reset the device without removing the casing. Press and hold the button until the red LED flashes twice.

The date and time is documented at the *IST* Data Center for both the time the alarm condition occurred, and the time it was manually reset

Checklist for Phone Connection

Before Installation, Be Sure To Check the Following.

Before installing at a business, be sure to get their approval to disrupt telephone and possibly internet connections during installation. Some businesses transmit critical information at scheduled times each day.

Does the Homeowner Or Business Have?

1. **A land telephone line? NOTE:** Some homeowners have begun to use cell phones for all their telecommunications. If the homeowner does not have an active telephone line, we cannot connect the *IST* monitor to the *IST* Data Center.
2. **DSL (high speed internet access over their telephone line)?** If so, before you begin, they should access the internet to ensure that it is working properly. After installation, test again to ensure that the installation did not negatively affect their connection.
3. **A Security system?** If so, before you begin, they should test the system to ensure that it is functioning properly. After installation, test again to ensure that the installation did not negatively affect the security system. The *Invisible Service Technician* can usually be connected to the same line as the Alarm.
4. **A multiple-line telephone system in the house? If so, is it a digital or analog system?** If so, and the homeowner cannot tell you if it is analog or digital, the best practice is to tie the *Invisible Service Technician* telephone line in at the network interface device (NID) or demark.

The Network Interface Device (NID) is a phone company installed device that connects your inside wiring to the telephone network. It is a gray box outside your house, probably mounted near the electrical meter. It contains a modular plug that allows you to disconnect all inside wiring and connect a working phone to test whether the local exchange network is working. The NID has two "sides" - one for the phone company and one for you, "the customer access" side. You should not attempt to enter the phone company side of the NID.

If the homeowner has a multiple line analog system, ask them if they have a line preference for connecting the *Invisible Service Technician*.

Finally, determine the location of the NID or demark. The NID is generally located next to the electrical box, but may be located in the garage or on the outside of the building. If it is located on the outside of the building, you may need to drill a hole through the foundation or wall to run the wire. If so, you will need to caulk the hole with water-proof caulk after installation.

Invisible Service Technician: Monitor and Sensors for Refrigeration Applications

Table 1: Invisible Service Technician Parts List

Part	Quantity	Part Number	Figure
Invisible Service Technician Monitoring Module – Microprocessor board with plastic casing.	1	1001-1	
Evaporator Air Temperature Sensor with 10' leads RED and white.	1	1003-1	
Liquid Line Temperature Sensor with 10' leads BROWN and white.	1	1004-1	
Suction Line Temperature Sensor with 10' leads YELLOW and white.	1	1005-1	
Ambient (OAT) Temperature Sensor with 10' leads ORANGE and white.	1	1010-1	
Space (Box) Temperature Sensor with 10' leads BLUE and white	1	1002-1OH	
Condenser Fan Motor Sensor with 10' leads GREY and White	1	1006-1	

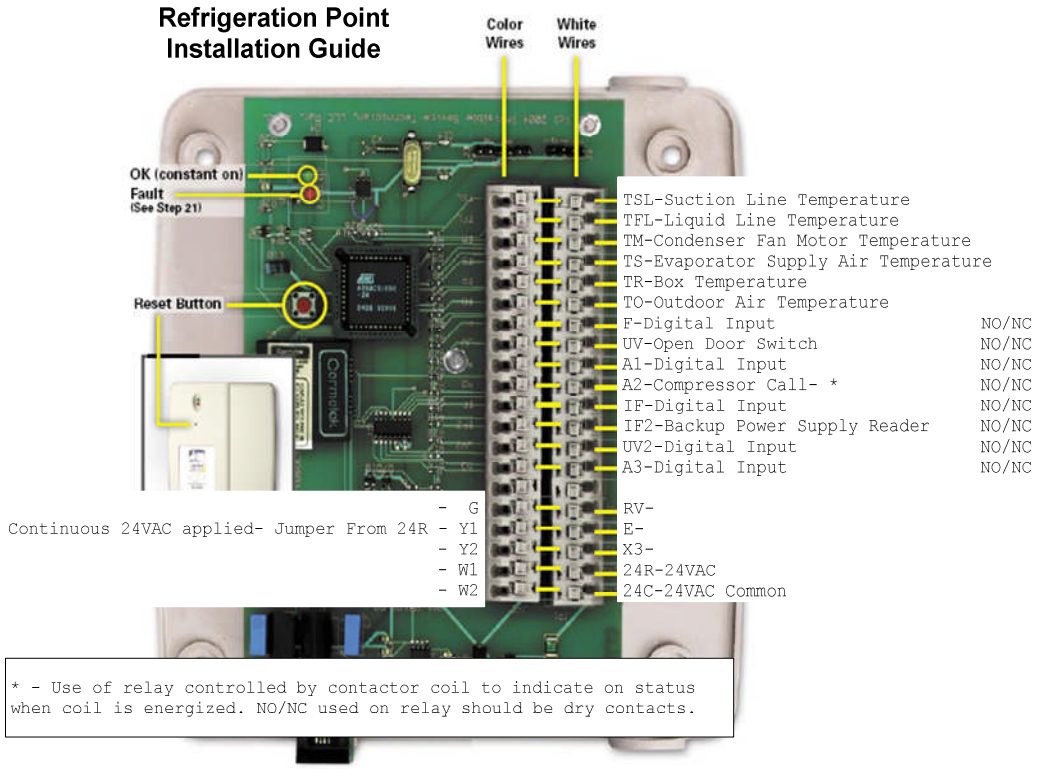
Part	Quantity	Part Number	Figure
Current Sensing Switch	1	1020-1	
Magnetic Door Switch	1	1019-1	
(Optional) Control Board Reader Sensor with 10' leads BLACK and white	1	1011-1	
(Optional) Defrost Cycle Monitoring Package	1	1107-R	
Ferrite Core	1	1105-1	
Phone Line: 10' single pair cable with male jacks at both ends.	1	1012-1	-
Sheet Metal Screws. #8 ½" Slotted Hex. #4 1 ¼" Pan Zinc.	12 2	1073-1 1074-1	-
Customer Log Sheet, Service Agreement, Contact Information & Warranty (1 each).	1 each	DN1009 DN1008 DN1011 DN1010	-
3M-UR Phone Connectors.	4	1066-1	
⚠	**NOTE:** IST Temperature Sensors are Digital sensors which transmit the temperature as data that can be recognized by a microprocessor. These probes cannot be substituted with analog temperature probes; thermocouples, thermistors or resistance type - RTD's, nor can they be interpreted with conventional meters and instruments		
⚠	**NOTE:** Equipment required for Defrost Cycle Monitoring will vary depending upon type of refrigeration equipment being monitored.		

Tools Required

The following list of additional supplies will be required when installing a monitor:

- AC Voltmeter or multimeter
- ¾" Sheet metal drill bit, or multi-step uni-bit with suitable pilot drill
- ¼" & 5/16" nut driver
- Multicore thermostat wire (18-2 minimum)
- Spool of twisted pair wire (18 gauge minimum)
- Electrical tape
- Strippers / cutters
- Wire ties and adhesive-backed wire ties
- Hacksaw
- Wire nuts
- Armacell pipe insulation
- For long wire runs (>30') use CAT 5 for temperature sensors
- 3M-UR connectors
- Spool of 2-wire solid core telephone wire
- Telephone wiring blocks with or without an RJ-11 jack (standard 42 A wire block recommended)
- 2-in-1 telephone line splitter and POT splitters
- 1/16"-3/32" flat-head screwdriver

Figure 1 - Connection Diagram for Refrigeration Installations



Installing the *Invisible Service Technician*

Step 1 - Determine the Operating Parameters

Before beginning installation, operate the refrigeration unit making adjustments as needed to reach the ranges required by the equipment manufacturer. Ensure the unit is correctly charged with refrigerant. Take notes to use for the monitor settings. To find the manufacturer's recommended performance parameters, check the inside of the front panel or in the refrigeration equipment owner's manual.

Note: The selection and setting of parameters must be performed under correct operating conditions. Therefore refrigerant pressures, superheat & subcool temperatures etc., must be properly set within equipment recommendations. Failure to commission or carry out an initial maintenance on the equipment may result in real malfunctions being present after the installation, persistent IST alarms and could lead to further complications with the operation of the unit.

Step 2 - Complete the Installation Log Sheet

Complete the Customer Log Sheet information regarding proper settings for this unit.

Document Number: IST009. A copy of the Log Sheet can be found at www.istmonitor.com

Step 3 - Disconnect Power Supply to Equipment

DISCONNECT POWER SUPPLY TO EQUIPMENT

ENSURE THAT THE MOUNTING SCREWS WILL NOT CONTACT ANY ELECTRICAL WIRING OR MECHANICAL PARTS OF THE EQUIPMENT.

Step 4 - Mount the *Invisible Service Technician*

Select a mounting location for the monitor so that the factory-supplied 10' leads on the sensors will easily and neatly reach the monitor (with the exception of any outdoor sensors being installed).

Remove the screws from the monitor cover and gently remove the cover. Set aside in a safe location until it is time to reinstall.

Mount the *Invisible Service Technician* in the chosen location by inserting the mounting screws through the marked locations on the unit. Take care to ensure the mounting screws will not contact any electrical wiring or mechanical parts of the equipment.

Step 5 - Install the Refrigerated Space Temperature Sensor

Mount the Refrigerated Space Temperature Sensor with blue and white leadwires using the self-tapping screws included.

Drill a small hole and mount the sensor directly to the inside surface of the wall, projecting the probe inwards and passing the lead wires through the wall. Ensure that the probe will not cause a nuisance to movement of people and materials.

In all cases, ensure that the sensor is positioned so that it cannot be mechanically or otherwise damaged.

Route the leadwires back to the *Invisible Service Technician* monitor board in a way that they will not be susceptible to damage.

Note: All temperature sensors must be connected to the monitor using the supplied wires or similar extension twisted pair wires. Do not attempt to extend the wires using untwisted thermostat wire or multi-strand core wire.

Note: Signal polarity must be maintained if wire is extended. Where color code is not maintained, label wires to avoid crossing inputs.

Step 6 – Install Liquid Line Temperature Sensor

This sensor is to be mounted between the condenser and the expansion device, and near a service valve on the outdoor unit or the adjacent refrigeration plant as applicable.

Cut or peel back the insulation to expose a section of the Liquid line, the smaller diameter copper tube between the condenser and the expansion device. Clean an area with contact cleaner before applying the sensor.

Mount the sensor by peeling off the tape protector and applying the sensor directly to the copper tubing and securing with the foil tape. Make sure the sensor is in contact with the copper. Cable tie the sensor to the copper tube on each side. After securing the sensor, cover with closed cell foam insulation.

Route the leadwires back to the *Invisible Service Technician* monitor board in a way that they will not be susceptible to damage.

Step 7- Install Suction Line Temperature Sensor

This sensor is to be mounted on the refrigerant line before the compressor, and near a service valve on the outdoor unit or the adjacent refrigeration plant as applicable.

Cut or peel back the insulation to expose a section of the Suction Line, the larger diameter copper tube entering the compressor. Clean an area with contact cleaner before applying the sensor.

Mount the sensor by peeling off the tape protector and applying the sensor directly to the copper tubing and securing with the tape. Make sure the sensor is in contact with the copper. Cable tie the sensor to the copper tube on each side. After securing the sensor, cover with closed cell foam insulation.

Step 8- Install Fan Motor Temperature Sensor

If the evaporator coil has a forced draft or induced draft fan, the fan motor temperature sensor can be used to determine if the casing temperature exceeds normal limits. If there is no fan or access is limited, this sensor can alternatively be used to measure the condenser motor casing temperature.

The sensor adheres directly to the outside of the fan motor casing. Mount the sensor by peeling off the tape protector and applying the sensor to the fan motor case and securing with insulating tape.

Step 9- Install Ambient Air Temperature Sensor

This sensor is for measuring Ambient Air temperature only.

Mount the Outdoor Ambient Temperature Sensor on the outdoor unit, or external wall of the structure where it will read indicative of the outdoor temperature. Mount the sensor in a location protected from heat created by the compressor and other equipment that may cause false temperature readings.

Mount the sensor out of direct sunlight; may affect temperature measurement.

Route the leadwires back to the *Invisible Service Technician* monitor board in a way that they will not be susceptible to damage.

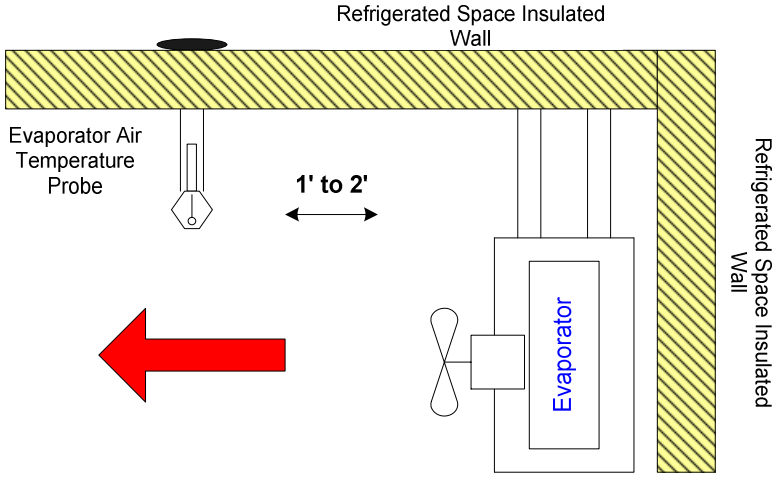
Temperature sensors must be connected to the monitor using twisted pair wires.

Step 10- Install Evaporator Air Temperature Sensor

The evaporator air temperature sensor measures the temperature of the air discharged from the evaporator fan/coil unit with in the cooler/freezer box.

Preferably mount the sensor on the ceiling of the box 1ft to 2ft away from the face of the

fan, so that the sensor is in the flow path of the discharge air. Do not mount closer than 1 foot or on the fan guard as this may accumulate ice during use, and be damaged during service. Consider service access to the evaporator when selecting final location. Screw the sensor casing directly onto the cooler panel with the self-tapping screws provided.

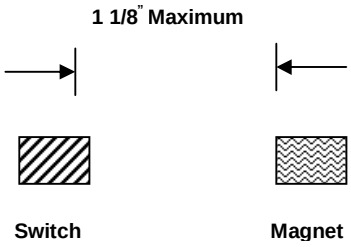


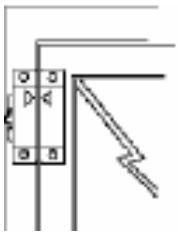
Step 11- Install Magnetic Door Switch

Note: Wide gap: 1⅛" maximum: Locate switch and magnet level and no more than1⅛" apart when the door is closed. NC= Door Closed

The switch may be mounted on the top or to the side of the door, so that as the door is closed the switch magnets meet face-on, or slide together from the side. Mount the switch on the opening side of the door, or as far from the hinge side as possible. The wired half is connected back to the monitor and should be mounted on the fixed door frame. The magnet half is mounted on the movable door so that the two halves of the switch meet within 1 1/8" when fully closed. Mount with included screws, loosely at first then set the gap to ensure that the switch contact opens immediately when the door is unlatched. Refer also switch manufacturers instructions to provide maximum sensitivity. Secure with included screws.

Route the leadwires back to the *Invisible Service Technician* monitor board in a way that they will not be susceptible to damage.

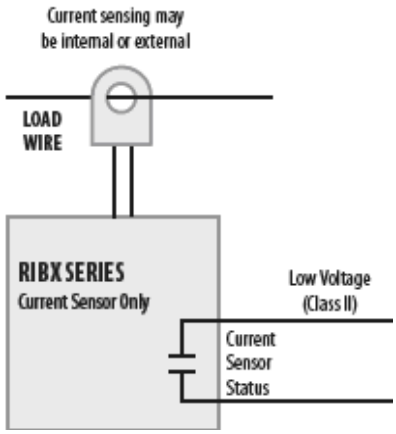




Step 12 – Install Current Sensing Switch

The current sensing switch clamps over a single conductor and requires no electrical connection to the refrigeration unit. Connect to the IST with standard extension wire at terminal A2. Ensure that the switch is clamped over only a single conductor and that this is the main conductor feeding the electrical component. If incorrectly installed, the device will sum the total current of multiple conductors, and null opposite current flows for two core conduits

Note: Refer to current sensing switch manufacturers instructions for more detail and circuit diagrams.



Step 13- Install the Control Board Reader *(Optional)*

The Control board sensor is used where the control system for the refrigeration has on-board error detection. On-board error diagnostics often provide the serviceperson with information relating to problems in the control board itself, or usually of terminal faults in the operation of the unit.

This sensor reads the control board indicating LED to determine if the LED is off, on or flashing. The IST monitor will report an on or flashing condition.

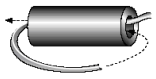
GENTLY slide the slotted Control Board Reader Sensor over LED bulb on indoor unit board. Some units use two LED's to indicate trouble codes. A second terminal is available for such units. Refer the Accessories List.

The Control Board Reader Sensor should be wrapped with black or dark colored electrical tape to reduce the affects of ambient light.

Step 14- Install the Ultraviolet Light Sensor *(Optional)*

Drill a ¾" hole in the duct or casing in the direct path of the light from the ultraviolet light and insert the Ultraviolet Light Sensor with the purple sheath. Be sure the sensor is in the direct path of the light. Mount with screws.

Step 15 - Connect Sensor Leads to the Invisible Service Technician



Note: Wind the wire supplying the 24 volt power to the monitor around the ferrite core at least two times prior to connecting to terminal.

Connect all wires to the terminals as shown in this Refrigeration specific connection diagram appended at the end this document. Leave empty any terminals that are not required.

Do not leave live wires unattached or you may risk shorting and causing damage to the equipment and/or monitor

Note: All temperature sensors must be connected to the monitor using the supplied wires or similar extension twisted pair wires. Do not attempt to extend the wires using untwisted thermostat wire or multi-strand core wire.
Note: Signal polarity must be maintained if wire is extended. Where color code is not maintained, label wires to avoid crossing inputs.

Before leaving the customer's location, be sure to check that:

- All phone lines are operational.
- The internet connection (if any) is operational.
- The security system (if any) is operational. Call the Alarm monitoring company to test the connection if necessary.

Once installation is complete, the work area is clear of debris, and all covers have been

replaced, restore the power to the Refrigeration Unit.

Depress the reset button as indicated below. This will cause the unit to call back to the server and update. Then call IST on 1-(866)-763-5500 to ensure that the monitor is installed and functioning properly.

Step 16 - Activate Unit

When you return to the office, connect to the website and enter www.istmonitor.com into your internet browser to access the IST website. Log in to the Data Center using your unique username and password. If this is your first activation, call IST at (866)-763-5500 to procure your username and password.

Then click the link to "Monitor Activation Instructions" at the top of the page and follow the on-line instructions.

Alternatively, you may fax the completed refrigeration specific Log Sheet IST to at 1-(513)-248-2470 to activate the monitor.

Please note that the monitor will not transmit data or alerts until this step has been completed.

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