WiDAQ™ Technical Installation Manual

Products designed and manufactured in the USA
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WiDAQ™ Technical Installation Manual

1 OVERVIEW

The WiDAQ™ wireless mesh network data acquisition system is designed to provide the Industry's first reliable wireless data network. The WiDAQ™ system enables reliable temperature monitoring with no wires from equipment to the controller or other monitoring system. The WiDAQ Wireless Data Acquisition system is capable of providing data from multiple types of sensors enabling the monitoring of Temperature, Pressure, Humidity, Electrical Current, Switch and Relay states and can remotely turn devices on and off.

The universal interface allows quick and easy installation regardless of the monitoring equipment. The WiDAQ™ system is an intelligent data collection and distribution system utilizing ZigBee wireless technology and an advanced digital communication system with large system scalability. Refrigeration Innovation's WiDAQ™ (Wireless Data Acquisition) system does not rely on batteries and eliminates the need for line of sight node placement.

If line power is not available or practical, ultra low power sensors are capable of operating for many years on batteries before battery replacement is necessary.

With the UPS battery option the full system can continue operation for up to 12 hours during power outages.

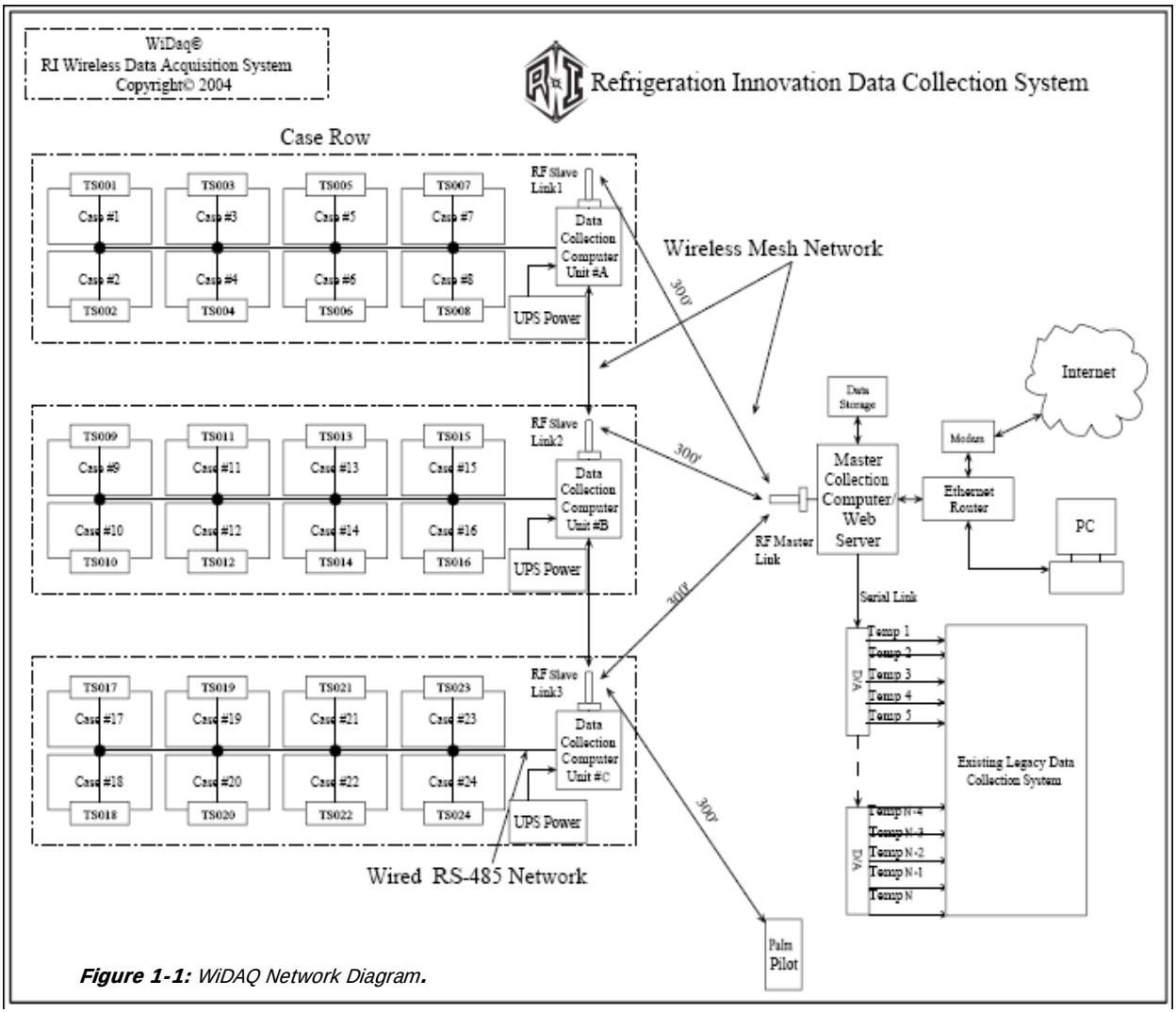

Figure 1-1: *WiDAQ Network Diagram.*

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Hardware components

1.1.1 THERMO-SIMPLE THERMOMETERS

Figure 1-2: *Thermo-Simple 2 thermometer.*

1.1.1.1 Thermo-Simple 2

The Thermo-Simple 2, (TS-2), is an advanced communicating digital thermometer/alarm with preprogrammed settings for many low, medium and hot temperature applications. Alert functionality can be as simple as "no light, no problem" to full color effects for conditions such as defrost, normal operation, fresh or frozen and freeze warning.

1.1.1.1.1 Thermo-Simple 2 models

Devices shipped previous to September 2007 were all Dual Temp models only in which the settings are either +5.0°F or +40.0°F based upon the orange and white orange wires being either open or closed (closed for low and open for medium). If a device does not allow you to make set point changes it is likely an older device.

Devices shipped after Sept. 2007 are all standard devices unless purchased with custom programming. The standard program has a built in 60 minute time delay for alarm and -2 degree Fahrenheit hysteresis for alarm reset. Built-in set points are:

- dt => Dual Temperature, 5°F (low, dual temp relay closed) and 40°F (medium, dual temp relay open).
- 0.0°F => Defrost is enabled, 60 minute delay before Alarm above 0°F.
- 5.0°F => Defrost is enabled, 60 minute delay before Alarm above 5°F.
- 36.0°F => Defrost is enabled, 60 minute delay before Alarm above 36°F.
- 40.0°F => Defrost is enabled, 60 minute delay before Alarm above 40°F.
- 41.0°F => Defrost is enabled, 60 minute delay before Alarm above 41°F, Flashing Blue Freeze Alarm immediately below 33.5°F (produce).
- 52.0°F => Defrost is disabled, 70 minute delay before Alarm above 52°F (meat preparation room)
- 57.0°F => Defrost is disabled, 70 minute delay before Alarm above 57°F, Flashing Blue Freeze Alarm immediately below 43.0°F (dairy application)
- 142.0°F => Hot Food Alarm. When Dual Temp switch is open, unit is off and displays temperature but no color. When Dual Temp switch is first turned on a one hour time delay is started before any display of color to allow case to heat up. After one hour, display Green above 142°F or Flashing Amber Alarm if case is below 140°F. If case has been above 142°F, a one hour Alarm timer will start when the case falls below 140°F and will flash an Amber Alarm after one hour. If the case remains below 140°F for four more hours the Alarm changes to a flashing Red Alarm, (Discard food).

Refer to the **Thermo-Simple 2 Installation Manual** for more information.

Figure 1-3: *Thermo-Simple 1 thermometer.*

1.1.1.2 Thermo-Simple 1

The Thermo-Simple 1, (TS-1), is an advanced digital thermometer alarm with adjustable set points and Single-Color alarm functionality to provide a flashing alert for out of temperature conditions.

The TS-1 has four easily selected alarm set-points for standard refrigeration cases or walk-ins. A version is available that is capable of automatically switching between low and medium temperature set points for use in dual temperature cases. The TS-1 features the unique "alert indicator LED". This is a multidimensional light that enables identification from impressive distances and viewing angles. An audio alarm option is also available for conditions where a visual alarm is not desirable.

The TS-1 can be configured with a unique color for alarms if red is not desired. When a case is in an alarm condition or there is a failed or shorted sensor, the TS-1 can flash a red or amber color to notify employees and technicians of the need for service.

The temperature sensor can be mounted remotely up to 100 feet away from the display and has an accuracy of ±0.5°C, (±0.9°F). The display is a large Liquid Crystal Display that displays temperature in either Fahrenheit or Centigrade with a range of -55°C to +92.8°C, (-67°F to +199°F). If a sensor is open, shorted or has failed, Thermo-Simple devices will display dashed lines and flash the Alarm LED.

Thermo-Simple units are capable of providing remote temperature data using a several methods. Thermo-Simple 2 devices can be ordered with an analog output for replacement of existing sensors. With the Wireless Data Acquisition option, WiDAQ™, the Thermo-Simple utilizes mesh network technology to deliver temperatures wirelessly to a standard controller in the mechanical room. The WiDAQ™ system is the most robust and reliable wireless system in the refrigeration industry.

The Thermo-Simple communication system is the only system that provides 100% digital temperature readings, which eliminate typical analog sensor errors. The Thermo-Simple units communicate on a two-wire network for each refrigeration case line-up and with the WiDAQ™ system can communicate wirelessly with any standard EMS controller.

OEM availability – The Thermo-Simple is a standard option with most refrigerated case manufacturers. Inquire with your preferred case manufacturer for availability. If your refrigerated case manufacturer does not carry our products our US factory is able to supply all your needs. If your location is on the west coast RI can perform installation services.

1.1.1.3 Temperature Sensors

Temperature sensors used with the Thermo-Simple device line and other products in the WiDAQ™ product line are unique in the industry. These sensors provide a digital representation of temperature with error correction codes directly out of the sensor. There are no analog signals on the wires and therefore the sensor wires do not pick up electrical noise to skew the signal. RI digital Temperature Sensors require no analog calibration by the user and will never go out of calibration. RI digital temperature sensors are laser calibrated at the factory and are guaranteed to be within ±0.5°C accuracy within the specified temperature range of -55°C to +92.8°C.

1.1.1.4 Wiring Harness

Thermo-Simple devices come standard from the factory with short 8 inch sensor and communications/power cables out of the device. The RI sensor has a 2-pin Molex Micro-Fit® connector that mates with the harness from the device and is a standard 6 feet in length. The communications/power harness has an 8-pin Molex Micro-Fit® connector that mates with the harness from the unit and is a standard 20 feet in length. The other end of the communication harness has a standard RJ-45 modular connector that mates with the ST.2 Spinal-Tap adapter which is standard with all units. The ST.2 Spinal-Tap adapter provides the correct connection with the WiDAQ™ Spinal Network.

1.1.2 SPINAL NETWORKS

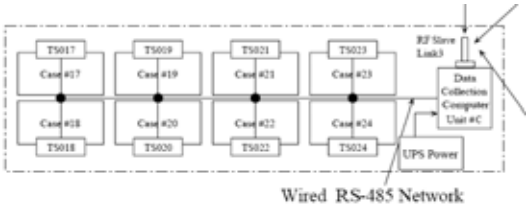


Figure 1-4: *Spinal Network Diagram.*

The Spinal Network is the wired RS-485 network as shown in ***Figure 1-4***. A Spine-Network enables communication between multiple Thermo-Simples to the Row Control Computer, (RCC).

A Spine-Network consists of one or more sensor devices such as the Thermo-Simple 2, (TS-2), or Quad Sensor Tap, (QST), the Spinal-Tap 2, (ST.2), standard RJ45 Communication Cable, network cable terminator and a Row Control Computer, (RCC).

Figure 1-5: *Spinal-Tap 2 (ST2).*

1.1.2.1 Spinal Tap 2

Spinal-Tap 2 (ST2) is an individual junction tap in the Spinal Network between the Spine Cable and each Thermo-Simple, (TS1 or TS2).

Each device requires an ST.2 to connect to the Spinal Network. The ST.2 comes standard with each Thermo-Simple device. The last Thermo-Simple in any line-up must use an ST.2 that is marked as a Terminator.

1.1.2.2 Spine to Spine Communication Cables (RJ45 CAT5 Ethernet Cable)

Spine cable follows the TIA/EIA 568 B standard. An ST.2 to ST.2 Spine communication cable contains 4 pair UTP stranded wire, (8 wires). Both ends of the Spine cable are wired identically. On both ends of the Spine cable are standard RJ45 modular plugs as shown in ***Figure 1-6***.

(Note: The **RCC to Spine** communication cable is not wired identically on both ends. One end of this cable is colored black to differentiate it from regular spine cable).

Figure 1-6: *Spine to Spine communication cable.*

1.1.2.3 RCC to Spine Communication Cable

Figure 1-7: *RCC to Spine Communication Cable.*

RCC, (***R****ow* ***C****ontrol* ***C****omputer*), to Spine communication cable is needed for all RCCs with serial number less than **1000**. New RCCs with serial number **1000** or greater use the regular Spine to Spine Communication Cable, (CAT 5e LAN Patch Cable).

RCC to Spine Communication Cable follows a custom in-house wiring scheme. An RCC to Spine communication cable contains 8 wires, (4 twisted pairs), of 26 AWG stranded copper wire. The Spine end conforms to the TIA/EIA 568 B wiring standard, while the RCC end follows a custom in-house wiring scheme. On both ends, RCC to Spine communication connectors are regular RJ45 connectors. To distinguish the RCC end from the Spine end, the RCC end has a black RJ45 connector. This black connector is shown in ***Figure 1-7***.

1.1.2.4 Row Controller Computer (RCC)

***Figure 1-8:** Row Control Computer (RCC).*

The Row Control Computer (RCC) is an accumulator and gateway to the WiDAQ network. The RCC temporarily stores all temperature readings and the status of all Thermo-Simple and other WiDAQ devices connected to the Spinal Network. When the data is requested from other devices in the WiDAQ network the RCC delivers all stored data in one or more secure packets to the requesting device. In addition, the RCC unit also manages Wireless Network resources for its wireless node and any child devices that may be attached to it. Refer to section **1.1.3.2**, RCC Wireless Module, for more information.

1.1.3 WIRELESS NETWORK

Inside every RCC, there is an RCC wireless module. An RCC wireless module maintains network structure for any child devices connected to it, and with other RCCs in the vicinity, and/or the **M**aster **C**ollection **C**omputer (MCC) wireless node contained in the **R**emote **Z**ig**B**ee module, (RZB). This particular wireless network is called the MESH network.

The MCC's RZB module and all RCCs are each considered a wireless node. Each wireless node dynamically calculates the shortest path and least number of hops for a data packet to reach its destination, (i.e. temperature data packet from a line-up of Thermo-Simples in that RCC's Spinal Network). This allows data to flow through the network even if the reporting node is too far away to directly transfer data to the requesting node. The dynamic nature of the network also provides for network path reconfiguration if a node in the pathway drops offline or is removed and allows the network to self-heal.

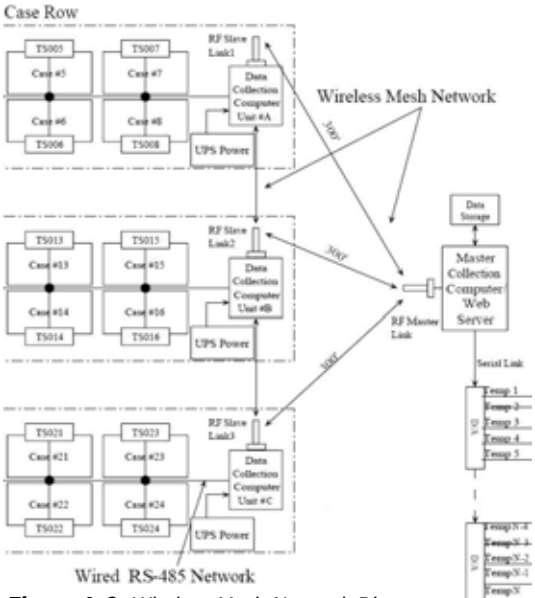


***Figure 1-9:** Wireless Mesh Network Diagram.*

1.1.3.1 Master Collection Computer Wireless Remote ZigBee Module (RZB module)

The MCC wireless module (RZB module) is the wireless Mesh network coordinator. All data packets from devices such as Thermo-Simple units attached to RCCs in the system are delivered to the MCC via the RZB coordinator module. The RZB is connected to the MCC through CAT3 cable with RJ11 modular connectors at both ends and can be located up to 2000 feet from the MCC. It is recommended that the RZB module be installed above false ceiling tiles approximately in the center of the groupings of RCC nodes for best performance. A small hole can be drilled in the tile in order to allow the short antenna to protrude downward towards the floor. If this location is not possible or unfeasible then location up high on a wall where the antenna is visible or in proximity to a large percentage of the RCC nodes will provide good performance.

Effort should be made to orient all antennas in the network to point up and/or down for best performance, (both up and down are OK in the same system). If that orientation cannot be made for a particular node in the system it should still work but performance may be degraded slightly. Locations of nodes in the system should be made based upon received signal strength and data path performance testing before permanently locating the node. If location of the RCC in an optimal wireless location is not practical or feasible then an RCC designed to use the RZB remote module is recommended. This allows location of the small antenna in an inconspicuous location or under a plastic cover.

Note1: Do not install the RZB module or any RCC node behind metal walls, posts or inside metal cases as metal objects will interfere and block the radio signals leading to poor or non-performance of the system.

Note2: Do not install the RZB module near other sources of radio signals such as Wi-Fi, wireless Ethernet nodes, wireless telephone systems or microwave ovens.

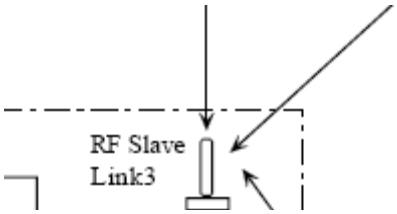


Figure 1-11: *Row Controller Computer (RCC) Wireless Module Diagram.*

1.1.3.2 Row Controller Computer Wireless Module (RCC Wireless Module)

The RCC wireless modules are transceiver (router) nodes in the Mesh wireless system. Data packets containing temperature data from its own Spinal Network and neighboring RCC nodes pass through on their way to the RZB coordinator, (MCC wireless module).
RCC nodes that are associated directly to the MCC RZB module are called the **Tier 1 Wireless Layer**. Up to 10 RCC nodes can be directly associated to the MCC RZB coordinator module.

1.1.3.3 Tier 1 Wireless Layer

The **Tier 1** Wireless Layer refers to the RCC nodes that are associated directly to the MCC RZB module. This association is a Parent-Child association that allows the Parent node to allocate network addresses to the Child nodes directly associated to it. The Coordinator node, (MCC RZB), can have up to 10 Children directly associated to it. Each RCC node is a Router node in the Mesh Network. A Router is both a Parent to other Routers and End Devices attached to it and it is a Child to either another Router or the Coordinator. Each Router can have up to 12 other Routers or 8 End Devices (Children) associated to it and is responsible for allocating network addresses to its Children. The network can form with a maximum of 5 layers deep of descendants from the Coordinator. The Parent-Child relationship does not determine how data moves through the network. A data packet can hop from any node to any other node to reach its destination and will take the shortest route. **Tier 1** nodes should be a group of from 4 to 10 RCC devices that are within the closest radius from the MCC RZB. These **Tier 1** nodes should be the first group of RCCs commissioned to the network to allow association to the Coordinator RZB. Good **Tier 1** setup leads to reliable network performance, while bad **Tier 1** setup may result in poor network performance and slow data packet delivery.

It is recommended that effort be made to choose or arrange the **Tier 1** Wireless Layer in a rough arc of the closest RCC nodes to the Master's RZB module. If at all possible, locate the MCC RZB on the ceiling roughly above the center of all the RCC nodes. **Tier 1** association is performed by having only the MCC RZB node powered on and commissioning each RCC node one at a time with all other RCC nodes powered down. Once the **Tier 1** layer of nodes is commissioned then all other RCC nodes can be powered up and commissioning of the remaining nodes can take place by commissioning nodes in radial patterns with expanding radii from **Tier 1**.

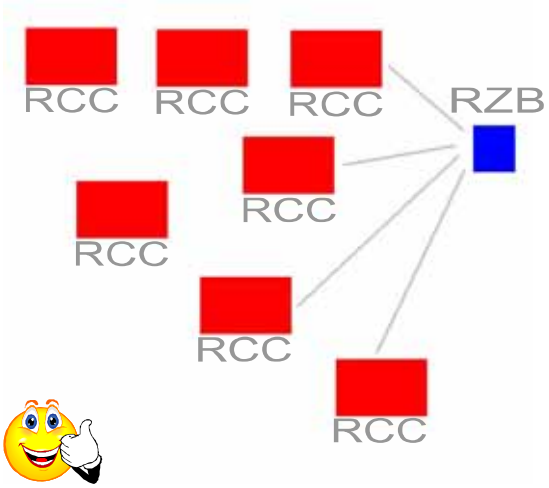


Figure 1-12: *example of good Tier 1 Wireless Layer layout.*

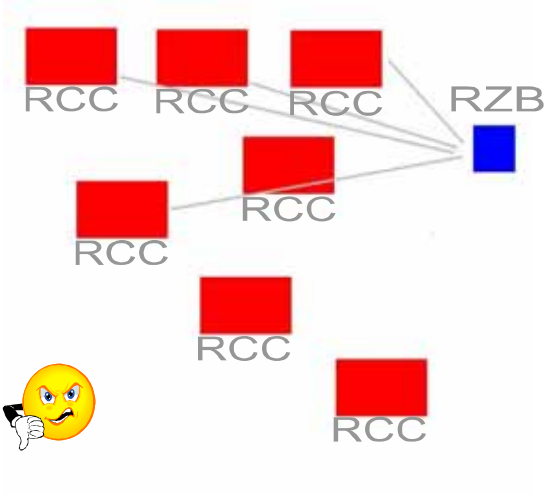


Figure 1-13: *example of bad Tier 1 Wireless Layer layout.*

1.1.4 iDAC Panel & Master Collection Controller Assembly

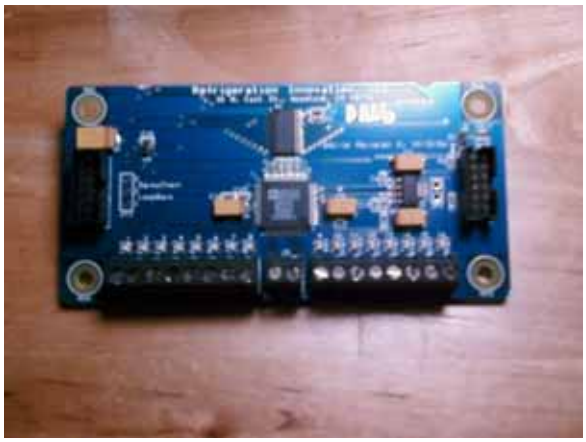
The iDAC panel and MCC assembly is the interface between Refrigeration Innovation's WiDAQ system and an existing Legacy EMS Controller.

Figure 1-14: *Installed iDAC panel and MCC assembly*

1.1.4.1 Master Collection Computer (MCC)

The iDAC panel and Master Collection Computer are where all the digital sensor data, (temperature, pressure, voltage, current, humidity), readings from the entire WiDAQ system are gathered and converted to analog voltages. The MCC passes this data to the Energy and Refrigeration Management System, (EMS). Sensor points can be assigned directly to input points on the EMS AI board. Any EMS system capable of accepting a 0-5 Vdc linear signal can be interfaced to. Interface to popular controls from Danfoss, Com-Trol, CPC and Micro-Thermo have been achieved successfully with simple sensor input configuration changes. Contact Refrigeration Innovation technical support for configuration parameters for these controllers.

RI's iDAC panel can be provided from the factory with the EMS Analog Input boards installed and pre-wired with all points needed for a system. Multiple racks with multiple EMS controllers are possible and easily configured with the iDAC panel pre-assembled from the factory. AI points can be randomly assigned to any available point at commissioning time with the push of a button.



Digital to Analog Converter (DAC)

The Digital to Analog Converter, (DAC) board converts the digital data from the network to linear analog signals that range from 0 volts to 5 volts dc, representing the original sensor on the network. Offset and Gain settings in the Legacy EMS system determine the range of values that the sensor represents and allow Refrigeration Innovation's WiDAQ system to communicate sensor data to the existing Legacy Data Collection System.

There are 16 analog output points from each DAC board and the WiDAQ system is capable of delivering up to 512 sensor points.

Figure 1-15: Digital to Analog Converter-DAC

2 INSTALLATIONS

2.1 INSTALLING IDAC PANEL & MCC ASSEMBLY

2.1.1 INSTALL/MOUNT THE MASTER/MCC IDAC PANEL IN THE MECHANICAL ROOM CLOSE TO THE EMS SYSTEM(S)

2.1.2 CONNECT IDAC PANEL AND MCC ASSSEMBLY TO A DEDICATED POWER SOURCE.

Locate a suitable place in the electrical distribution room or mechanical room on a wall with a dedicated circuit rated at 15 amps for the iDAC panel. The iDAC panel must be hard wired using EMT conduit to provide for proper grounding of the system. Do not mount the panel directly on vibrating machinery as this can cause malfunction of the system over time. Do not mount the iDAC panel directly in sunlight or in extremely hot or humid locations, the panel is designed for indoor use only and is not intended for wash-down environments. It is highly recommended that a battery backup system, (Uninterruptible Power Supply), is used as a power source for the iDAC panel to provide continuous reliable operation during power outages, voltage spikes and voltage sags. Refrigeration Innovation can provide a UPS power supply with the pre-configured iDAC panels assembled at the factory.

We recommend the APC Back-UPS ES 325 VA UPS (BE325-LAM) UPS System. This can be purchased at most computer stores or online from www.APC.com or www.Amazon.com for under $50.

2.1.3 DO NOT POWER UP IDAC PANEL AND MCC ASSEMBLY

The iDAC panel gets powered up during system test-out and node commissioning.

2.1.4 LOCATE RZB IN THE MIDDLE OF THE SALES FLOOR CEILING.

It is recommended that the RZB Coordinator module be located in a central location preferably on the ceiling overlooking the entire sales floor of the store. This provides for optimal network functionality. In some cases ceiling placement may not be accessible or practical and in this case the RZB can be placed on a wall closest to the sales floor and the Tier 1 RCC nodes. There should be no metal objects blocking or near the RZB antenna. The RZB module should not be placed near any Wi-Fi, wireless Ethernet, wireless telephone system or microwave ovens. The WiDAQ system can peacefully co-exist with other wireless systems and the network can be configured for minimal interference with other wireless networks. Contact Refrigeration Innovation technical support for more information if this is a concern with your IT personnel.

The RZB can be placed up to 3000 feet from the iDAC Panel and MCC assembly. A 100 foot RZB cable is shipped as a standard option with the WiDAQ™ system. Custom RZB cable lengths can be ordered from Refrigeration Innovation at 530.666.3020 if needed.

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2.2 INSTALLING THE ROW CONTROL COMPUTER (RCC)

2.2.1 INSTALL EACH RCC IN AN APPROPRIATE LOCATION AT THE LINEUP TO BEGIN THE THERMO-SIMPLE NETWORK INSTALLATION.

It is recommended that each RCC be powered temporarily with a battery powered UPS to allow for testing of the signal strength and data path integrity before permanently locating the RCC node.

2.2.2 CONNECT THE RCC POWER CABLE TO A DEDICATED CIRCUIT IF AVAILABLE OR THE UNINTERRUPTED CASE FAN CIRCUIT.

If ultra reliable data delivery is desired a UPS should be used for power protection on each lineup as with the iDAC panel. The RCC has a universal power supply and can operate from 90 to 240 Volts AC, 50-60 Hz.

Once the electrical circuit to use is provided and energized, power up the RCC and verify that the green "Power On" LED is lit.

2.2.3 CHECK THE RCC INITIALIZATION TEST.

All LED indicators should briefly turn on one by one from LED "#1" to "Service" LED when the RCC is first powered up. This step ensures that all the LED indicators work and that the RCC can provide an accurate status of the network and line-up.

2.2.4 THE GREEN "TS-NET" LED SHOULD ALWAYS BE BLINKING.

If the Green TS-Net LED is not blinking then there may be a problem with the RCC and another RCC should be substituted in its place.

2.2.5 THE GREEN "WAN ASSOCIATION" (WIDE AREA NETWORK – WIRELESS NETWORK) LED SHOULD BE OFF.

Unless the RCC has been commissioned previously, the green "WAN Association" LED should be off.

Once an RCC has been commissioned, it will always attempt to connect to the WiDAQ wireless network when power is applied.

2.3 INSTALLING SPINAL NETWORK

2.3.1 PLUG THE BLACK END OF THE RCC TO SPINE COMMUNICATION CABLE INTO THE MODULAR JACK ON THE SIDE OF THE RCC.

2.3.2 ROUTE THE RCC TO SPINE COMMUNICATION CABLE TO THE LOCATION FOR THE FIRST THERMO-SIMPLE UNIT.

Plug the Black colored modular connector of the ***RCC to Spine*** cable into the jack located next to the antenna on the RCC and route the cable to the first Spinal Tap (ST.2) of the first Thermo-Simple device in the line-up.

2.3.3 Plug the clear end of the RCC to Spine Communication cable into the modular jack on EITHER SIDE of the ST.2 labeled "SPINE".

Note: The clear modular plug of the Spine cable must be plugged either one of the two modular jacks on the ST.2 labeled "SPINE", do not plug the Spine cable into the jack labeled ***Thermo Simple***.

2.3.4 Verify that the ST2 green power LED is lit. This verifies that the installation is correct.

2.3.5 Install each Thermo-Simple unit or sensor in an appropriate location on/in the case for good visibility.

Do not mount the Thermo-Simple unit inside freezer cases where it is exposed to extremely low or high temperatures, wash-down or high humidity conditions. It is recommended that the temperature sensor be attached to the honeycomb in the discharge air duct of the refrigeration case. Refer to the Installation Manual for each device being installed and attached to the Spinal Network for specific instructions regarding installation. Other types of sensors may require special installation instructions depending upon the type and location of the sensor(s).

2.3.6 Locate the sensor in the case supply air duct.

2.3.7 Route the Thermo-Simple cable through the case

The Thermo-Simple power/communications cable should not be routed across sharp edges of cut or drilled metal in the case. Where this is the case, install grommets or other wire protection to prevent wire cuts or shorts. Always leave 6" or more slack in the cable at both ends to allow for removal of the device from its can for servicing and to prevent accidental disengagement of connectors.

2.3.8 Plug Thermo-Simple RJ45 connector into the modular jack labeled "Thermo-Simple" on the Spinal-Tap (ST2).

If the wiring is correct the Thermo-Simple or sensor should power up and start reading temperatures. If there is a short in the power wires of the cable to the Thermo-Simple unit the Spinal Tap power LED will turn off and the ST.2 will protect the rest of the line-up from failure.

Note: If this installation is part of a communicating WiDAQ network then installation of a cable terminator at the end of the spine opposite the RCC is recommended for reliable data transmission. One ST.2 with built-in termination is standard with each RCC and should be installed for the tap of the last device in the RCC line-up. Additional ST.2s can be obtained with a termination resistor installed for the end of the spine through Refrigeration Innovation, LLC. at 530-666-3020.

2.3.9 VERIFY THAT THERMO-SIMPLE UNITS IN THE LINE-UP HAVE BEEN CORRECTLY INSTALLED AND ARE FULLY OPERATIONAL.

Each Thermo-Simple unit must be reading temperatures and displaying correct colors.

If the TS device is displaying dashed lines and flashing the alarm LED there is a problem with the sensor. Check the sensor wire for a short, cut wire or loose connector in the cable or circuit board. If no fault can be found in the sensor wires try plugging in a spare sensor or another sensor from an adjacent unit to verify unit functionality.

Note: Do not cut the sensor wires or reverse them as this will cause sensor failure. These sensors are digital devices and require no calibration. Other types of sensors will not work with Thermo-Simple units. RI sensors are guaranteed to be accurate from the factory to within ±0.5°C. This can be verified by using a bath of 50% ice with 50% water and immersing the sensor in the bath for a few minutes. The reading on the Thermo-Simple should be within half a degree of 0°C, (32°F).

If the Thermo-Simple unit is in alarm, check the set-point and change if necessary. The Thermo-Simple unit will start in Alarm until the case has reached a temperature 2° below the set-point.

Refer to individual Thermo-Simple or Sensor Tap installation manuals for detailed instructions on making set-point changes.

2.3.10 FOR THE NEXT DEVICE, PLUG THE SPINE TO SPINE CABLE INTO EITHER MODULAR JACK OF THE ST.2 LABELED "SPINE" AND CONTINUE IN A DAISY-CHAIN MANNER.

Repeat steps **2.3.3** through **2.3.9** for each new device in the line-up. A maximum of 24 Thermo-Simple 2 devices can be installed on one RCC line-up. The last device installed on the line-up should use an ST.2 Terminator to terminate the end of the wired network.

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2.4 COMMISIONING THERMO-SIMPLES/DEVICES TO THE RCC

2.4.1 FOR TS-2 UNITS, USE AN RI-MAGIK WAND TO DOUBLE-TAP "THERMO-SIMPLE 2".

Tap the hyphen in the text '*Thermo-Simple 2*' above the display twice in short succession using the magnet end of the RI screwdriver. The first tap will light the Green LED and the second tap will light the Blue LED. After two seconds the Blue LED will flash rapidly, the Thermo-Simple 2 will be assigned the next available address from the RCC and this address will be shown in the display. Make a note of this address in the point map documentation of the commissioned sensor points for later use. A system point map is shipped with complete WiDAQ™ systems for convenient documentation of the sensor points.

2.4.2 MAKE SURE THAT THERE ARE 2 ARROWS ON THE TOP AND BOTTOM OF THE PLUS SIGN ON THE LEFT SIDE OF THE TS2 DISPLAY

Once a Thermo-Simple unit has been correctly assigned an address by the RCC, the communications 'In', (->), and 'Out', (<-) arrows should flash every few seconds indicating correct communication with the RCC. An In (->) arrow is a command received from the RCC and an Out (<-) arrow is a response from the Thermo-Simple device.

On the RCC, the "TS-Net" LED should blink Green and Red indicating Transmit and Receive respectively from each unit on the line-up. This can sometimes show as Amber which is a combination of Green, (Transmit), and Red, (Receive).

Note: After the double tap of "Thermo-Simple 2" and address have been assigned, ***do not*** tap the "M/L" while the Blue LED is flashing – This will erase TS2 address from the device but the RCC will still attempt communication with the device. This will cause the RCC to send the temperature of the device to 80°F after 10 minutes, indicating a failure of the device. This is not important if the sensor point has not been commissioned to an iDAC panel AI point yet. If a unit needs to be replaced for any reason it should be replaced with a device having the same unit address to permit continued proper delivery of temperatures for that point. A replacement unit with the same address can be ordered from RI if necessary. Alternatively an RCC that is not part of the network can be used to address a replacement device and the recorded address(es) can be cleared from the spare RCC when done. If a spare RCC is not available then it may be necessary to clear all the device addresses of the units on the line-up, clear the unit addresses on the RCC for that line-up and then re-assign device addresses. Use the point map documentation filled out in ***2.4.1*** to assign the same unit address for each point that was previously assigned. This is necessary only if points have already been commissioned to corresponding points in the EMS system.

2.4.3 TAP THE F/C TEXT USING THE RI-MAGIK-WAND TO RETURN TO NORMAL TEMPERATURE DISPLAY

After receiving an address from the RCC, the ***F/C*** button text can be tapped once to stop the Blue LED from flashing and return the unit back to temperature display.

2.4.4 AVOID USING ADDRESS #1 FOR THE FIRST TS-2 IN THE LINE UP

By default the first commissioned TS-2 unit will receive an address #1. There have been problems with this address and it is not recommended to be used at this time. Simply erase the

address by double-tapping the "Thermo-Simple 2" text followed by tapping the "M/L" text and then repeat steps **2.4.1** to **2.4.3** to acquire the next address, (i.e. #2 or #3 and so on..). This is only necessary for address #1 and will be corrected with the next software revision.

Note: After assigning a new address to any device on a line-up there is a 2-1/2 minute delay before any points from that line-up can be commissioned to the iDAC panel AI points.

2.5 Power Up iDAC Panel & MCC Assembly

2.5.1 MCC DAC boards will initialize immediately after the iDAC Panel has been turned on

Follow the MCC initialization process to make sure that all LEDs are in working condition. During initialization all MCC LEDs will turn on sequentially from number "1" to "Service" LEDs.

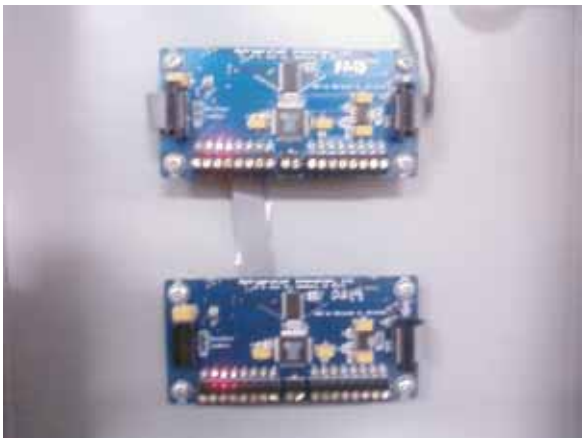
Note1: The "TS-Net" and "WAN" LEDs have dual colors; Green for Transmit and Red for Receive. The Green "Power On" LED is always on as long as there is power.

Note2: Once the MCC is initialized the "TS-Net" LED should blink continuously indicating the MCC is operational.

2.5.2 The initialization step is completed after all the "signal strength" LEDs from "1"to "32" light up and then turn off.

After all the LEDs have gone through the testing cycle the "TS-Net" Green LED should always blink rapidly. The DAC board LEDs from 16 through 1 will start a regular scan cycle also, updating the DAC points approximately every 2 seconds. If the MCC RZB module and cable have been installed correctly then the MCC will successfully initialize the RZB Coordinator module. This is indicated by the signal strength row of LEDs on the right of the MCC rapidly turning on in succession from 1 to 32. If the RZB module is accessible you will observe a Green LED on the module blinking once per second indicating that the Coordinator has started the network. After the RZB has initialized the iDAC panel will search the network for any RCC units that have already been commissioned. If any nodes are active in the network their address will be lit on the signal strength LED during discovery. When the node discovery cycle has been completed, (approximately 10-30 seconds), the Blue LED to the top right of the signal strength LEDs should turn on indicating the normal data acquisition scan mode. If any RCC nodes have been commissioned to the WiDAQ network an LED combination of the RCC address will blink for a short period on the signal strength LEDs. The address of the RCC can be determined by adding up the numbers next to the LEDs that are on.

Note: If no RCCs have been commissioned to the network yet, (normal in a new installation), then no nodes will be found during the discovery cycle. As RCC nodes are commissioned to the network the MCC will automatically record the new node and start scanning it for data.



2.5.3 Make sure that the DAC16 board(s) is(are) scanning continuously.

The LEDs numbered from #1 through #16 will light up at low brightness in succession from #1 to #16 continuously. This is the normal sensor output update cycle.

3 COMMISSIONING

3.1 SELECTING THE TIER 1 WIRELESS LAYER

3.1.1 SELECT UP TO 10 RCCS TO BECOME MEMBERS OF THE TIER 1 WIRELESS LAYER

Select from 4 to 10 RCCs that are in closest proximity to the RZB module antenna. Ideally these RCCs should form a radial pattern around the RZB module close to the center. Please review section **1.1.3.3** for more information.

These RCCs will become the members of the **Tier 1** Wireless Layer and the Children of the RZB Coordinator.

3.2 COMMISSIONING THE TIER 1 RCCS

LEGEND:
A Dashed Circle signifies a Blinking LED.

A Solid circle signifies Solid LED

The color of the circle is the color of corresponding LED

3.2.1 TURN ON ONLY ONE RCC IN THE TIER 1 WIRELESS LAYER.

During this step never power more than one **Tier 1** RCC at a time**.** All other RCC nodes should be powered off during this phase. *Always power down a newly commissioned **Tier 1** RCC before moving on to the next RCC in **Tier 1**.*

3.2.2 VERIFY THE RCC INITIALIZATION LED TEST.

The RCC initialization step is identical to the MCC initialization process. Verify the initialization step to make sure that all the LEDs are working when an RCC is powered up. Also verify that each device in the line-up is properly displaying the communications arrows as shown in ***2.4.2***.

3.2.3 TAP THE SERVICE REQUEST TEXT USING THE MAGNET END OF AN RI-MAGIK WAND.

Each tap of the Service Request will cause the LED to advance to the next LED in the Signal Strength row of LEDs. Each numbered LED from #1 through #32 represent a special function of the RCC or MCC respectively. Tap the Service Request until the Green Function #4 LED is lit. If you accidently pass the #4 LED you can keep tapping until the LED comes back around.

3.2.4 WAIT SIX SECONDS OR UNTIL THE RED "SERVICE' LED STARTS BLINKING.

A blinking Red Service light signifies that the RCC is waiting for your confirmation of the function you have selected.

3.2.5 TAP THE SERVICE REQUEST TEXT AGAIN TO CONFIRM YOUR FUNCTION SELECTION.

A blinking "Function #1" LED means that you have confirmed your function selection. Wait for six seconds or until the "Function #1" LED stops blinking for the Function to go into effect.

3.2.6 Wait until the green "WAN Association" LED turns on solid, and then begins blinking

Note: Prior to the WAN Association LED blinking, all signal strength LEDs will light up signifying a correct initialization of the radio module.

3.2.7 If RCC commissioning to the WiDAQ™ network is successful then the MCC will assign an address to the RCC.

If this step is successful then the MCC will provide a unique network address to the RCC. The commissioning of a new RCC node can take up to 1 minute before an address is assigned to the RCC. This new address will be displayed on the signal strength LEDs and is determined by adding up the numbers next to each LED that is turned on. When the new address is received the Service LED will also start blinking. For example if LED #1 and LED #4 are on then the assigned address is 1 + 4 = 5. Make sure you look directly perpendicular to the face of the RCC to read the LED numbers correctly. The newly assigned network address will remain displayed on the signal strength LEDs and the Service LED will blink for 10 minutes or until the Service Request switch is triggered one more time. Document the newly assigned address of the RCC in the System Point Map. An RCC's address can always be read later by using a function #1 to read the address back. Refer to the **MCC/RCC Switch Function** document in the appendix for all the functions and their descriptions.

Unplug/Turn off this RCC, you have successfully commissioned a **Tier 1** RCC to the WiDAQ™ Network.

3.2.8 Continue commissioning the rest of the Tier 1 RCCs by repeating steps 3.2.1 through 3.2.7

3.3 Commission the rest of the RCCs in the WiDAQ™ network.

3.3.1 Turn on all Tier 1 RCC nodes.

3.3.2 Commission one RCC at a time. Follow steps 3.2.2 through 3.2.7 and repeat these steps until you have commissioned all the remaining RCCs in a <u>radial pattern</u> around the Tier 1 RCCs.

3.4 Associate Thermo-Simple sensors with iDAC EMS AI points.

This procedure is best accomplished with 2 people equipped with 2-way radios. One person will move around the sales floor double-tapping the Thermo-Simple sensor devices in the same manner as the address assignment procedure was performed. Sensors will be assigned to iDAC points in ascending order of the order in which they are commissioned by the person on the sales floor. The person on the floor will double-tap a device and the person at the iDAC panel will signify when the point has been commissioned to an AI point. This is indicated by a bright flashing LED on the DAC point that has been assigned. Document this point in the System Point Map as a DAC board and point number next to the RCC and Thermo-Simple device addresses in the Map.

Note: A 2-1/2 minute delay timer will run whenever a device has been assigned a new address on an RCC line-up. This delay will prevent commissioning of sensor points to the iDAC panel AI points until the RCC delay time-out is over. For this reason, all Thermo-Simple devices should already have been assigned addresses as shown in section **2.4** as this will allow enough time for the 2-1/2 minute timer to expire.

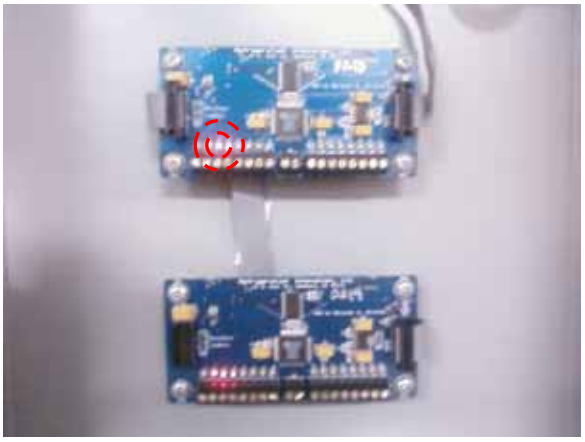
3.4.1 Use an RI-Magik Wand to double-tap the text "Thermo-Simple 2".

The person on the sales floor should signal the person at the iDAC panel that they have triggered commissioning of the desired point and that the blue LED is flashing rapidly on the Thermo-Simple device.

The person at the iDAC panel should confirm a successful point assignment on an iDAC panel DAC board.

Note: Do not double tap "Thermo-Simple 2" followed by tapping "M/L" – This action sequence will erase the Thermo-Simple 2 device address and cause you much heartburn.

At the iDAC panel this is what you should see:



3.4.2 Tap the F/C text using the RI-Magik-Wand, to complete the commissioning process

Tapping the '***F/C***' text will clear the flashing Blue LED and return the device to normal operation. This is recommended to prevent confusion at the iDAC panel. As long as the Blue LED is flashing, the corresponding point at the iDAC panel will continue flashing.

3.4.3 Repeat steps 3.4.1 through 3.4.2 until all Thermo-Simple devices in the network have been commissioned.

Commission all remaining points in the network that are desired to be assigned to EMS AI points. Make sure to record and document all point assignments in the System Point Map. It is recommended that a copy of the point map be left in the plastic sleeve inside the iDAC panel for any field service personnel use during service calls.

3.4.4 Complete programming of the EMS controller with newly assigned points.

The WiDAQ network should now be delivering all commissioned device data to the EMS AI board points and this data should be available for use by the EMS controller.

4 TROUBLESHOOTING

WiDAQ system users and installers should not handle any electronic circuit boards in the field. If circuit boards are directly handled without prior authorized procedures from the factory warranties could be voided. Do not open any RCC enclosures or directly handle circuit boards in the field.

Generally, there are 3 windows to check the status of WiDAQ Network.

RCC is the window to see the status of the Thermo-Simple Thermometer devices in the Spinal Network. The RCC also shows the status of the Wireless Network for that particular RCC only (i.e. whether it is associated to the Wireless Network).

The MCC is the window to confirm the status of the entire group of RCCs in the Wireless Network.

The DAC board is the window to confirm the function of the entire WiDAQ Network.

4.1 RCC

4.1.1 RETURN AN RCC TO REFRIGERATION INNOVATION, LLC. IF ANY OF THESE PROBLEMS OCCUR:

4.1.1.1 RCC will not light the power LED after providing power to the unit.

4.1.1.2 RCC does not initialize and sequentially scan through the LEDs.

4.1.1.3 If one or more LEDs on the RCC do not light up.

The most important LEDs are the "TS-Net" and "WAN" LEDs. These LEDs are the only way to check the status of the Spinal Network line-up and the Wireless Network at the RCC level.

Another important light is the "WAN Association" LED. This LED gives the status of the wireless commissioning process and indicates a successful commissioning of an RCC to the Wireless Network.

If any of these LEDs are not working it becomes very difficult to check the status of the system. Contact Refrigeration Innovation If more advanced networking tools are desired. If you will be commissioning many WiDAQ systems then there are tools available that will map the nodes in the network, check the performance of the network and assist with node placement. Tools that will soon become available allow importing of fixture plans into a personal computer and mapping of point temperatures to fixtures on a floor plan for wireless live case operational status displays.

4.1.1.4 Service Request switch does not function.

This means that there is a bad connection or the magnetic switch has failed.

4.1.1.5 After commissioning an RCC, (function #4), the array of "Signal Strength" LEDs do not shoot up from "#1" to "#32" and the WAN Association LED does not blink.

This indicates that there is a problem with the wireless module inside the RCC. This RCC will not be able to commission to the WiDAQ™ network and will not communicate with the MCC.

4.1.1.6 "WAN Association" LED won't blink after the array of "Signal Strength" LEDs have indicated initialization.

If the wireless module in the RCC successfully initializes with the row of Signal Strength LEDs but the "WAN Association" LED does not blink then the RCC node has failed to find a Coordinator for the WiDAQ™ network. Check to make sure the iDAC panel is powered up and that the RZB module has a blinking Green LED status light. If the RZB does not have a blinking Green LED or no Green LED at all there may be a problem with the RZB communications cable. Check for proper connector engagement and that there are no cuts in the cable.

4.1.1.7 If the RCC "Power On" LED is flashing there is an electrical short in the system.

This means there is an electrical short in the Spinal Network. Check the spine cables for damage. A problem in the spine can be diagnosed by disconnecting every Spinal Tap, (ST.2), from the spine cable. Start by only connecting the first Thermo-Simple device to the RCC and checking the ST.2 LED and the RCC "Power On" LED. Repeat this procedure by connecting each successive TS unit one at a time to the Spine. When the power LED fails then the problem is in the cabling of the last unit attached.

4.2 MCC (PART OF IDAC PANEL & MCC ASSEMBLY)

4.2.1 MCC WON'T TURN ON AFTER APPLYING POWER TO THE IDAC PANEL.

If the MCC "Power On" LED is not lit, verify that the circuit breaker to the panel is on. If the iDAC panel has a UPS battery backup device, make sure the UPS is turned on. The APC UPS has a clear round plastic button in the middle of the UPS which is the On/Off switch. Press and hold the button down for 2 seconds to turn the UPS on. When the UPS is on the clear button should be lit Green.

4.2.1.1 MCC "Power On" LED is not lit.

If the "Power On" LED is not lit, check the iDAC system fuses. Turn off the circuit breaker for the panel and pull the black fuse holder out of each power screw terminal block to check for a blown fuse. If a fuse is blown try to identify if there is an electrical short in any of the internal wiring of the iDAC panel. If no visible faults are found, replace the fuse with a spare of the same rating. Each iDAC panel comes shipped from the factory with spare fuses inside the panel for replacements. If a spare fuse is used, it is recommended that the spare be replaced as soon as possible to ensure a spare is immediately available for service.

4.2.1.2 MCC LEDs won't initialize or sequentially scan through every LED.

If the MCC "Power On" LED is lit but none of the LEDs will initialize and the "TS-Net" LED is not flashing there could be a problem with the MCC. If this is the case a replacement MCC can be ordered from Refrigeration Innovation and can be delivered overnight.

4.2.1.3 MCC RZB module Signal Strength LEDs do not shoot up from #1 to #32 during initialization.

If the Signal Strength LEDs do not indicate RZB initialization during power up there is most likely a problem with the RZB cable or module. Check the module to verify that the Green LED is on and flashing once per second. If the module LED is flashing then check the RZB cable for cuts or bad connector pins. If no visible problems with the cable are found, try swapping the cable with another Cat3 RZB cable. If this fails then replace the RZB with a new module.

4.2.1.4 Service Request switch does not function.

This means that there is a bad connection or the magnetic switch has failed.

4.2.1.5 If the MCC "Power On" LED is flashing there is an electrical short in the system.

This means there is an electrical short somewhere in the DAC boards or cables. There could also be an electrical short in the RZB cable. Check the DAC and RZB cables for damage. A problem in the DAC cables can be diagnosed by disconnecting all DAC boards from the MCC and then connecting the DAC boards in sequence starting with DAC board #1. Each DAC board should start scanning its point LEDs when powered up. When the MCC power LED starts flashing, then the problem is in the cabling or the board of the last DAC attached.

4.3 DAC BOARDS (PART OF IDAC PANEL & MCC ASSEMBLY)

4.3.1 DURING COMMISSIONING THE DAC BOARD DOES NOT REGISTER A BRIGHT BLINKING LED.

Occasionally during point commissioning, it can take 2-3 minutes before a point will get registered with the iDAC panel. If the flashing Blue LED on the Thermo-Simple times out after 2-1/2 minutes, verify that the Thermo-Simple has the flashing "In"(->) and "Out"(<-) arrows. If the arrows are not flashing then there may be a problem with the device or cabling. If the device was not addressed in section **2.4** then this commissioning process actually caused the Thermo-Simple to acquire an address from the RCC and a 2-1/2 minute delay is still running. Wait 2-1/2 minutes before attempting to commission the point to the iDAC panel.

If there is a problem with the RCC on the Thermo-Simple line-up communicating with the wireless network check for WiDAQ™ communication. Verify that the RCC shows signal strength and that the WAN Transmit/Receive LEDs are flashing occasionally with transmitted packets. If the RCC appears that it is not communicating with the network try re-commissioning the RCC to the WiDAQ™ network. If successful the RCC should display its address and the Service LED should blink. If this fails then an RCC Swap function must be performed with a replacement RCC. Refer to the MCC/RCC Service Request Switch Function instructions in the appendix.

If all DAC boards show functional scanning LEDs verify that all LED points are lighting up. If not all LEDs are lighting up with the DAC board LED scan change the DAC board with a replacement and try the commissioning again.