



Case Study  
December 2016  
Food Warehouse  
Walk-in Freezer  
Grässlin by Intermatic ICUBE™ Adaptive Defrost Module

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## The ICUBE™ Adaptive Defrost Module improves commercial refrigeration equipment efficiency, reduces energy consumption and saves money.

### Introduction

Business owners and utility companies alike have become increasingly interested in emerging technologies that can reduce refrigeration energy consumption and enhance control performance. Commercial refrigeration equipment accounts for a large portion of total energy consumption in food service businesses. Since perishable products must be kept cold constantly, commercial refrigeration equipment generally operates 24/7. According to the U.S. Department of Energy, a large commercial refrigerator can consume up to 17,000 kilowatt-hours of power per year, while a large commercial freezer can use up to 38,000 kilowatt-hours of power per year.

Unnecessary defrost cycles in walk-in coolers and freezers impact utility bills and impose undue strain on refrigeration components. Grässlin by Intermatic's ICUBE™ Adaptive Defrost Module continuously monitors the conditions of the evaporator coil so it only defrosts when necessary. This technology can reduce defrost cycles up to 40% or more per day.



### Situation Analysis

The Care and Share Food Bank, in Colorado Springs, CO, is a major non-profit food bank. In 2015, they distributed over 21,000,000 pounds of food to 31 Southern Colorado counties. The Food Bank utilizes five walk-in freezers at its 9,000 sq. ft. cold storage facility. Operators at Care and Share are always seeking new ways to minimize operating costs so they can focus on their core mission: supplying Coloradoans who are at risk of hunger with enough healthy and nutritious food to thrive.



operating conditions (e.g., measurements that represent coil frost load) rather than initiating defrost strictly based on compressor run time or clock time.

### Test Equipment and System Description

The objective of this study is to examine the energy usage and performance of an ICUBE™ Adaptive Defrost Module integrated into a Grässlin DTAV40 Defrost Timer and retrofitted onto a walk-in freezer originally equipped with a standard electromechanical defrost timer. Bill Brown, owner of Cooling Cubed, LLC, performed the installation and testing of the ICUBE™ Module. The test refrigeration unit is a low temperature system with a large, 21 HP compressor and a 21,400 watt electric defrost heating element.

### Intermatic Solution

Grässlin by Intermatic developed an energy management device, the ICUBE™ Adaptive Defrost Module, that integrates into a Grässlin DTAV40 Defrost Timer. The ICUBE™ Module adds energy saving characteristics commonly referred to by the DOE (Department of Energy) and commercial refrigeration system manufacturers as Adaptive Defrost. Adaptive Defrost means a defrost control system that reduces defrost frequency by initiating defrosts or adjusting the number of defrosts per day in response to

Energy usage at this facility was tracked both before and after the ICUBE™ retrofit installation using a Grässlin UWZ Series Hour Meter wired into the electric defrost heating circuit. The actual kWh value was then calculated using an Environmental Protection Agency (EPA) logic-based energy savings calculator (results portrayed below). Refrigeration temperatures and relative humidity levels were recorded using a Temperature/Humidity Data Logger. The test time spanned for one month in an effort to normalize varying operating conditions of the test freezer and monitor usage patterns at the facility.



ICUBE™ Energy Savings CALCULATOR	
Use this Energy Savings Calculator to easily estimate potential for saving money when you install an energy-efficient Grässlin by Intermatic control solution.	
Current Cost Watts	Cost Savings with ICUBE™ Watts
75500	75500
Average Time in Defrost Per Day (hrs)	Average Time in Defrost Per Day (hrs) 40% Savings with ICUBE™
3.14	2.14
Number of Days Used	Number of Days Used
365	365
Cost per KWH (\$)	Cost per KWH (\$)
.10	.10
Total KiloWatt Hours	Total KiloWatt Hours
86,531	58,973
Total Cost	Total Cost
\$8,653.05	\$5,897.30
Total Cost Savings with ICUBE™ <b>\$2,755.75</b>	
CALCULATE	CLEAR

ICUBE™ Energy Savings CALCULATOR	
Use this Energy Savings Calculator to easily estimate potential for saving money when you install an energy-efficient Grässlin by Intermatic control solution.	
Current Cost Watts	Cost Savings with ICUBE™ Watts
21400	21400
Average Time in Defrost Per Day (hrs)	Average Time in Defrost Per Day (hrs) 40% Savings with ICUBE™
3.14	2.14
Number of Days Used	Number of Days Used
365	365
Cost per KWH (\$)	Cost per KWH (\$)
.10	.10
Total KiloWatt Hours	Total KiloWatt Hours
24,527	16,716
Total Cost	Total Cost
\$2,452.65	\$1,671.55
Total Cost Savings with ICUBE™ <b>\$781.10</b>	
CALCULATE	CLEAR

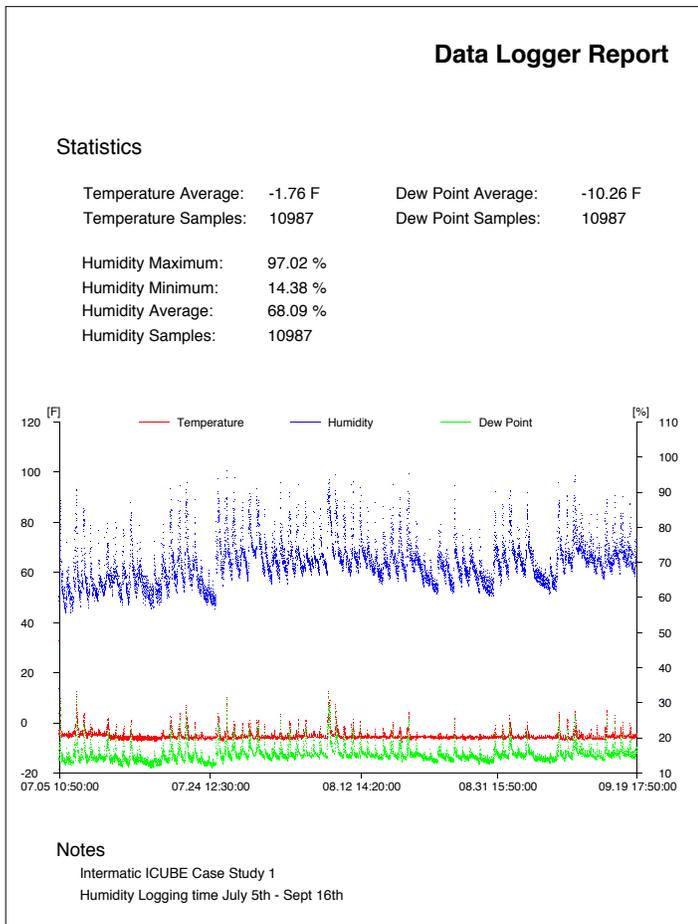
### Test Results

Application of the ICUBE™ Adaptive Defrost module resulted in fewer defrost cycles and appreciable reduction in energy use. The defrost frequency decreased from 3.14 hours per day using the base DTAV40 Time-initiated Temperature, Pressure or Time-terminated Defrost Timer to 2.14 hours per day using the DTAV40 with the ICUBE™ Adaptive Defrost Module representing a 32% reduction. The energy use would decrease from 67.19 kWh/d to 45.79 kWh/d representing a 21.4 kWh/d reduction and (31.8%) totaling 7811 kWh annually. The estimated annual savings associated to this one system equal \$781.10.

Based on the associated results, the overall energy savings for all five systems at the storage facility would be estimated as follows:

- Overall storage facility defrost wattage rating = 75,500 watts.
- A decrease in overall energy use from 237.07 kWh/d to 161.56 kWh/d, representing a 75.51 kWh/d reduction and (31.8%) totaling 27,558 kWh annually.
- An estimated annual savings of \$2,755.75 for the overall facility (five refrigeration systems).

Since Grässlin Defrost Timers can be installed on a wide range of refrigeration systems, the results of this case study could be representative of those expected in similar installations. However, the absolute and relative energy reduction will vary based on the system size, type, location, and regional circumstances (e.g., relative humidity conditions). Furthermore, the overall condition and usage level of a particular refrigeration system will affect the amount of energy savings the ICUBE™ Adaptive Defrost Module can provide.



Case Study #1 Results			
Timer only 8/19/16 thru 9/2/16	Timer with ICUBE™ 9/2/16 thru 9/16/16	Savings Realized	Savings Realized
2 week defrost time (Actual)			
44 hrs	30 hrs	14 hrs	32%
Defrost times scheduled (per timer)			
3.5 hrs per day = 49 wk	5 hrs per day = 70 wk	—	—
Electric Defrost Wattage (21,400 Watts) One 21 HP refrigeration system			
7811 Annual kWh reduction			
Commercial U.S. Energy Information Administration. Avg. regional price for electricity 10.26 cents (Colorado)			
32% Reduction in defrosting per day. Annual savings = \$796.72			
Average RH Levels = 68.09%			

## Conclusion

Long periods of door openings and improperly managed defrost cycles caused ice build-up and forced refrigeration equipment to work harder at the Care and Share Food Bank. The ICUBE™ Modules were installed to ensure defrost cycles are based on evaporator coil conditions and better manage the number of defrost cycles needed per day.

“Since the ICUBE™ Module will only defrost when it needs to, or skip a defrost because one isn’t needed, we can now schedule more defrost events per day without stressing the system,” stated Bill Brown, owner of Cooling Cubed, LLC.

The ICUBE™ Adaptive Defrost Module installed easily into a Grässlin DTAV40 timer – without any need to change system

wiring. Its versatility can add benefits to facilities of varying square footages, by either reducing the number of defrosts, or scheduling defrosts during later times, when kW prices are lower and at times more optimum to facility operations.

For every dollar the Care and Share Food Bank receives, \$0.95 is spent on food and food programs. One donated dollar provides an average of 8 meals. Simple retrofits can make a meaningful impact on the facility’s operating and utility costs. Integrating the ICUBE™ Module into just one system is estimated to provide an annual savings of \$2,755.75. This provides the Food Bank with savings that can be reinvested into their main mission: stomping out hunger in Southern Colorado.

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