

Articmaster™

Energy Efficiency Products

Cell Tower Case Study

Our Mission: to deploy the most effective energy efficiency technologies,
to improve quality of life.

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Articmaster Confidential Information



Articmaster™, Inc.

Energy Efficiency Products

Articmaster makes and sells products that save 20 to 35% of energy consumed by air conditioning and refrigeration



Articmaster
Condenser Controller



RMS-1
Evaporator Optimizer



Typical Data Center
Installation

Cell Phone Tower Application

- In April, 2009, Articmaster products demonstrated a 38% savings on HVAC units on a cell phone tower site in Southern California

- Product Solution Set:

1. The Articmaster
2. The RMS-1
3. The Smart Energy Controller



- Cell Phone Tower Equipment

- Two Marvair 5-Ton air conditioning units
- Articmaster's Distributor for this project is THR & Sons, and their Dealer & Installer is USIGT

The Articmaster™



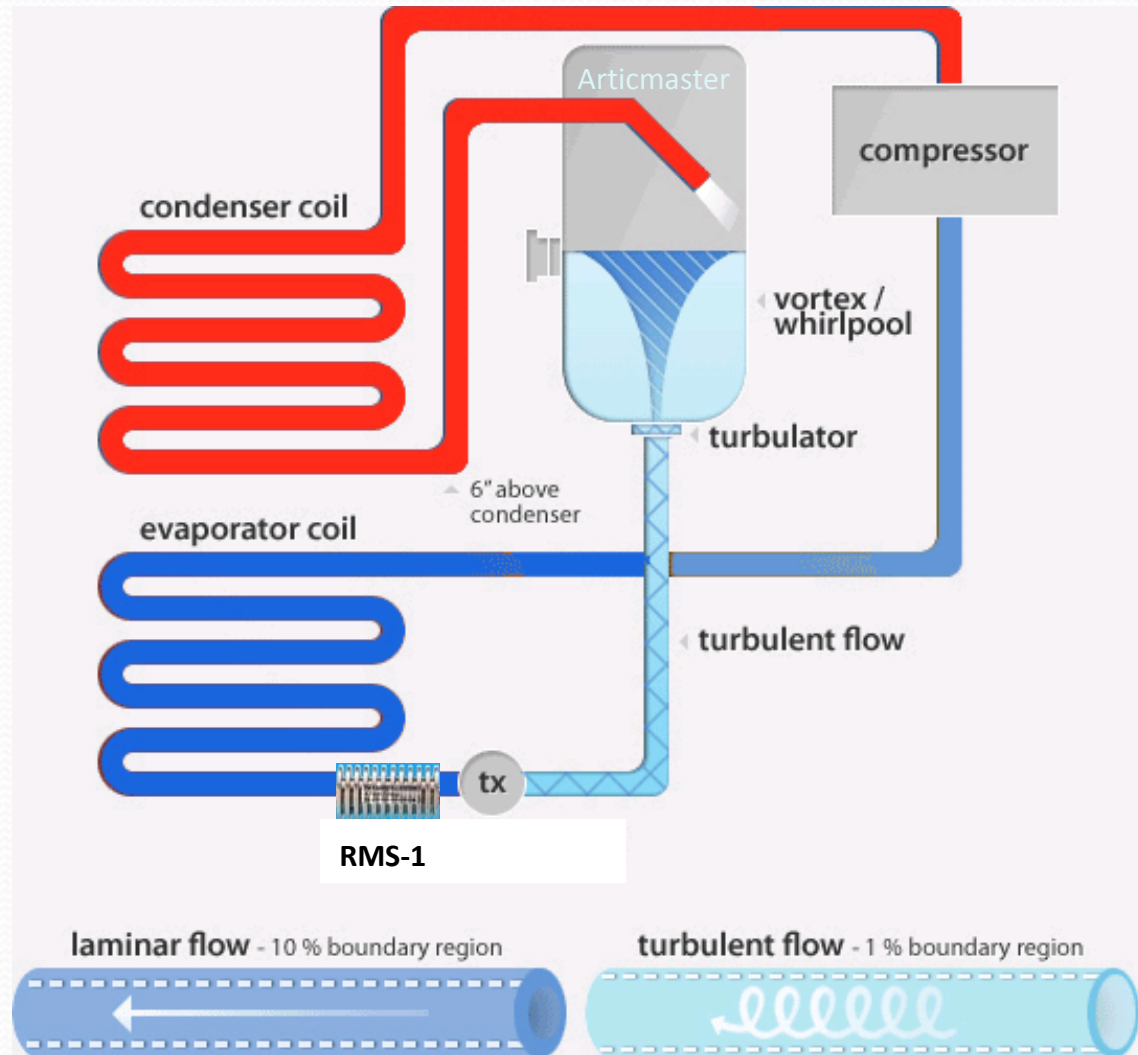
- The Articmaster is a dynamic condenser controller which reduces pressure and pressure fluctuations.
- The Articmaster vessel is installed in-line between the condenser and the evaporator above the level of the condenser.
- The lower system pressure means the compressor doesn't work so hard nor draw as many amperes.
- The Articmaster is extremely reliable and has no software, no electronics, no moving parts. It consumes no water or electricity.
- An extra benefit of the Articmaster is that it makes the compressors last longer due to lower pressure, lower refrigerant temperature, shorter duty cycle, and enhanced circulation of refrigerant oil back to the compressor. Compressor life is dramatically increased.
- The Articmaster improves efficiency by about 20%. It will save 20% of the electricity when the system has adequate capacity *or* it will add capacity if the system is already at maximum capacity.

Articmaster Products



The Articmaster

- A passive *condenser controller* that enables dynamic adjusting of refrigerant level
- Reduces head pressure
- Lower Amp Draw
- Delivers colder refrigerant. Compressor turns off sooner
- Saves ~ 20%
- Extreme Reliability
 - No moving parts
 - Prevents evaporator icing
 - Extends compressor life

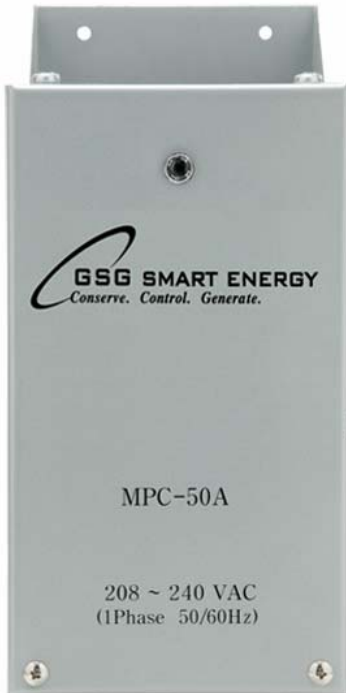


RMS-1™ Evaporator Optimizer



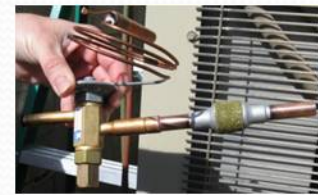
- The RMS-1 is installed on the low pressure side of the TX Valve. The RMS-1 provides:
 - Increased atomization of refrigerants.
 - A controlled vortex pattern to more uniformly disperse refrigerant to evaporator coils.
 - Added insurance against frost buildup.
 - No moving parts, Extreme reliability
 - Improvement of efficiency by 8 to 15%

The Smart Energy Controller



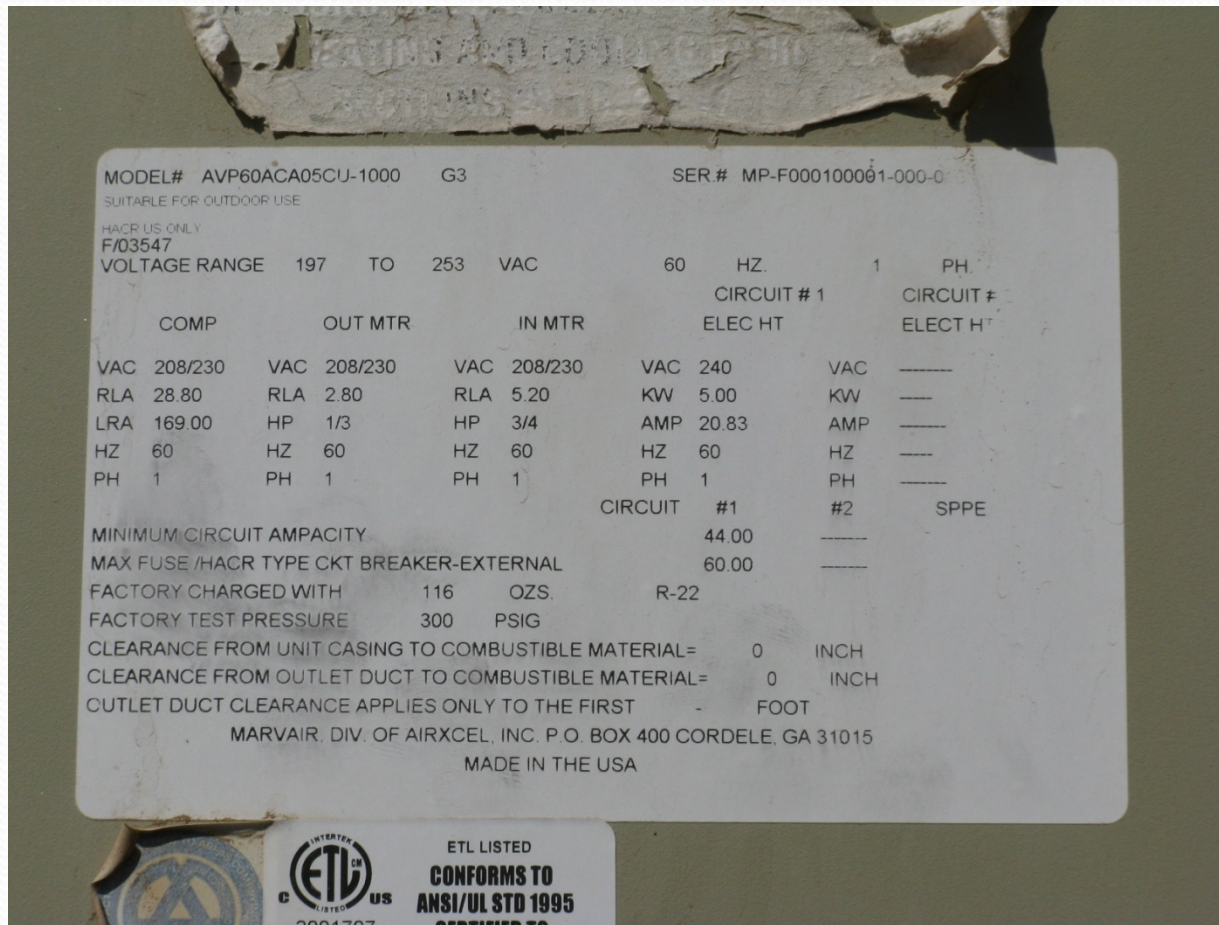
- The Smart Energy System is a high-speed, Nola-based, microprocessor-controlled inductive load management system providing:
 - Increased operating efficiency.
 - Motor soft start and over current protection.
 - Increased equipment life and reliability.
 - Low voltage protection to prevent short-cycling of compressors.
- Unlike other Nola based systems, the Smart Energy System “communicates” with inductive loads to provide the precise amount of power required to complete the work without risk of voltage dropping to dangerous levels.
- Any increase in load demand results in an instantaneous return to full power and a re-assessment of power requirements.
- The Smart Energy unit saves 10 to 15%

Cell Phone Tower Installation



The Artimaster, RMS-1, and Smart Energy Controller combined to slash 38% of HVAC electricity consumption!

MARVAIR Model AVP60ACA05CU-1000



Test Set-up

- Test equipment utilized for evaluation
 - Hobo U30 data-logger with the following sensor hook-ups:
 - (3) S-THB-M008 temperature sensors measuring
 - HVAC1 supply air
 - HVAC2 supply air
 - Outside ambient temp (on the north side of the shelter with no direct sunlight)
 - (2) T-VER-8051-300 kWh transducers measuring
 - Current draw of each HVAC unit at the breaker input.
 - Voltage measurements were taken with a Fluke Model 77 Multi-meter.
 - Current measurements were taken with a Cen-Tech Model P98675 clamp meter.
 - Pressure measurements were taken by the mechanical contractor (Vic's Air Conditioning).

Cell Tower Test Results

Detailed Results Based on Outside Ambient Temperature

Outside Ambient Temp F°	Avg kW Baseline	Avg kW with RMS	Avg kW RMS & Smart Energy	Percentage of Savings with RMS	Additional Savings Above RMS	Savings with RMS & Smart Energy	kWh Savings per 24hr Period	Carbon Emission Reductions CA (lbs)	Carbon Emission Reductions USA (lbs)
50-55 F°	2.37	2.17	2.05	8.44%	5.53%	13.50%	7.68	4.68	10.29
55-60 F°	3	2.3	2.18	23.33%	5.22%	27.33%	19.68	12.00	26.37
60-65 F°	4.51	2.84	2.7	37.03%	4.93%	40.13%	43.44	26.50	58.21
65-70 F°	4.61	3.23	2.88	29.93%	10.84%	37.53%	41.52	25.33	55.64
70-75 F°	5.4	3.27	3.08	39.44%	5.81%	42.96%	55.68	33.96	74.61
75-80 F°	5.46	4.27	3.54	21.79%	17.10%	35.16%	46.08	28.11	61.75
80-85 F°	6.44	4.44	4.02	31.06%	9.46%	37.58%	58.08	35.43	77.83
85-90 F°	7.53	5.6	4.6	25.63%	17.86%	38.91%	70.32	42.90	94.23
90-95 F°	9.22	5.56	4.8	39.70%	13.67%	47.94%	106.08	64.71	142.15

Cell Tower Test Results (cont)

System Power Usage (Watts)

	Pre-Install	Smart Energy	Savings
HVAC 1	7357	6387	13.2%
HVAC 2	7284	6299	13.5%

Supply Temperature Measurements

	Pre-Install	Articmaster & RMS-1 Only	Articmaster, RMS-1 & Smart Energy	Supply Temp Reduction
HVAC 1 Supply	62.5°	58.2°	*58.5°	4.3°
HVAC 2 Supply	56°	52.2°	51.2°	4.8°

* Limited Sample Period

Test Results Summary

- Overall energy savings on the HVAC systems at the site were 38% (we used 33% for ROI calculations to allow for variations between sites).
- The supply air was at least 4 degrees cooler. Analysis of the data shows that although the lowest readings only varied by 4 to 5 degrees, the average in cycle decrease was closer to 10. This is due to the modified systems quickly achieving a lower “set point” and remaining there throughout the cycle period.
- Lag unit runtime was dramatically reduced.
- Lower Wattage consumption by the compressors reduces the internal compressor temperature resulting in a decrease of heat induced into the refrigerant.

Installed Cost Breakdown

TYPICAL U.S. INSTALLATION (For Two 5-Ton A/C Units)

	Quantity	Unit Price	Totals
ArticMaster	2	\$ 1,200.00	\$ 2,400.00
MicroPlug Motor Controller	2	\$ 1,847.00	\$ 3,694.00
RMS-1 Evaporator Optimizer	2	\$ 590.00	\$ 1,180.00
TXV (Thermostatic Expansion Valve)	2	\$ 125.00	\$ 250.00
Subtotal			\$ 7,524.00
Install (assume ~40% of material cost in US, for commercial installation)			\$ 3,009.60
Total Installed Cost			\$ 10,533.60

Payback Calculation

PayBack Calculation for Articmaster installation on a typical cell phone site										
Prepared for Peter Barry	20-Jun-09									
	Today's Energy Usage (2009 Price)	Projected Energy Usage with Articmaster, RMS-1, & MicroPlug combined								
Articmaster projected Savings		33%								
Cost of Elec (\$/kWh)	\$0.120									
# kWh / year for A/C	100,242									
Cost per Year for HVAC Elec	\$12,029.04	\$8,059.46								
Savings per Year		\$3,969.58								
Year	1	2	3	4	5	6	7	8	9	10
Electric Rate (5% annual increases)	\$0.120	\$0.126	\$0.132	\$0.139	\$0.146	\$0.153	\$0.161	\$0.169	\$0.177	\$0.186
Elec Bills for Existing System	\$12,029.04	\$12,630.49	\$13,262.02	\$13,925.12	\$14,621.37	\$15,352.44	\$16,120.06	\$16,926.07	\$17,772.37	\$18,660.99
Payback Assuming No Rebate										
Articmaster Purchase	(\$10,533.60)									
Elec Bills with Articmaster	\$8,059.46	\$8,462.43	\$8,885.55	\$9,329.83	\$9,796.32	\$10,286.14	\$10,800.44	\$11,340.47	\$11,907.49	\$12,502.86
Energy Savings	\$3,969.58	\$4,168.06	\$4,376.47	\$4,595.29	\$4,825.05	\$5,066.31	\$5,319.62	\$5,585.60	\$5,864.88	\$6,158.13
Total Cash Flow	(\$6,564.02)	\$4,168.06	\$4,376.47	\$4,595.29	\$4,825.05	\$5,066.31	\$5,319.62	\$5,585.60	\$5,864.88	\$6,158.13
IRR	68.5%									
Payback Period (Years)	2.7									
NPV	\$47,241.91									

- 2.7 Year Payback without a rebate
- 68.5% IRR
- NPV of \$47,242, on an investment of \$10,534