


■ Precision Cooling for
Business-Critical Continuity

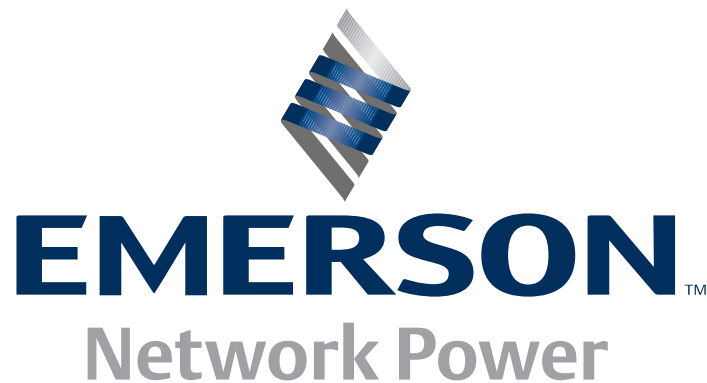
Liebert HPM
Reducing Operating Cost up to 75%



 **Liebert**®


EMERSON™
Network Power

Emerson Network Power, a Division of Emerson, is a global company matching technology and design to supply innovative solutions for its customers' benefit. Emerson Network Power is the leader in the “**Business-Critical Continuity™**” field thanks to its products and services.



Data Center / Wireline Network

Wireless Network / Small Computer Room

IT World, the most advanced market needs

The advanced and continuously evolving IT market, is one of the quickest high tech industries. Data center cooling needs the most sophisticated ambient control, able to keep very precise room conditions, limit the energy consumptions and enhance the performances of customers' electronic equipment.



Choose the top 4 Precision Cooling industry Technologies to Upgrade your Precision Cooling Units

■ iCOM Control The Heart of the system

- Developed by Emerson Network Power to suit customers' requirements at best
- Simple System Management team work
 - No additional cost for U2U through the Standard Infrastructure Network
 - Integrated Web communication
 - Embedded ethernet connection
 - On-line unit log
 - Preventative maintenance through advanced troubleshooting
 - 400 stored events/unit
 - Up to 16 stored temperature and humidity days

■ Ec Fan for Air flow modulation and energy saving

- Energy Saving up to 30%
- Easy Adaptation to the site needs
- Increased efficiency during the running stage due to the speed variation

■ Tight Control with electronic expansion valve

Optimized operation and efficiency even in extreme operating conditions: the precise and quick control of the refrigerant flow allows energy saving and keeping a stable operation even in extreme conditions

■ Precision Cooling and Performance with Copeland Digital Scroll

- Better room control
- Energy saving with partial load
- Fast adjustment to load changes
- Simple and reliable





Liebert HPM is using the top industry technologies to drive the unique precise room cooling unit in an highly changing IT environment.

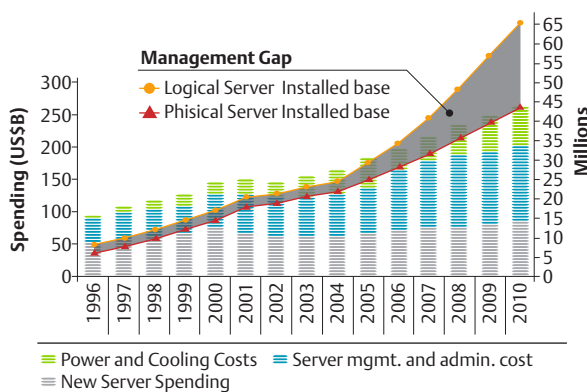


Half of Data Centers Will Run Out of Power by 2008

Gartner predicts that, by the end of 2008, 50 percent of the data centers in the world will not have enough power to meet the power and cooling requirements of the high-density computing gear.

According to **IDC**, investment in ICT world for power and cooling are forecasted to really increase in the next years. **ICT is becoming one of the highest energy consuming industries in the world, and energy efficiency is more and more critical.**

Graph of Investment in Data Centers



Source: IDC, May 2006 Power and cooling Investment are forecasted to highly increase in the next 5 years

Size your Cooling System at the Maximum Predicted Load, but Use Now only a limited required Cooling and Power.

Liebert HPM is a solution provided by Emerson Network Power which can give

- ability to run at partial load and therefore use limited electric power and which
- can be forced to work at maximum load once the server equipment and heat load increase



Performance and tight control.

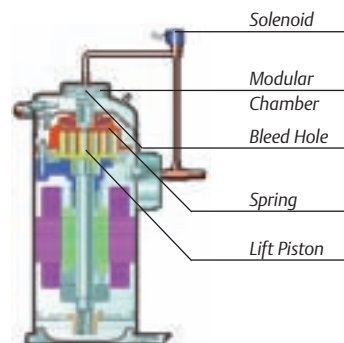
Liebert HPM Digital takes the proven Copeland Scroll™ design one step further

Thanks to Copeland Digital Scroll and Electronic Expansion Valve, Liebert HPM Units can achieve a continuous spectrum of capacity output, ensuring a very tight and precise Control of Temperature and Humidity. The Copeland Digital Scroll modulates a solenoid which loads and unloads the scroll members (orbiting scroll moves up). This design enables the Digital Scroll to manage capacity modulation from 10% to 100%, significantly lowering energy consumption.

Copeland Digital Scroll Technology

How it works

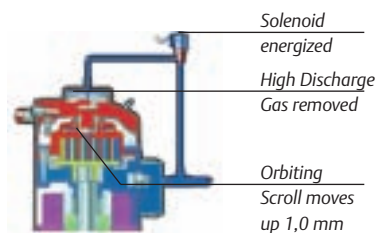
The Digital Scroll operates with two stages: the loaded state and the unloaded state. By electronically varying the unloaded and loaded state (energizing and de-energizing the solenoid), the capacity can modulate between 10% to 100%. (On Liebert HPM the minimum Capacity is set at 30% to keep the best Temperature/Humidity control).



Modulating Capacity Control from 2 to 60 kW

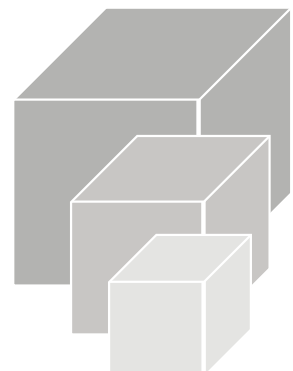
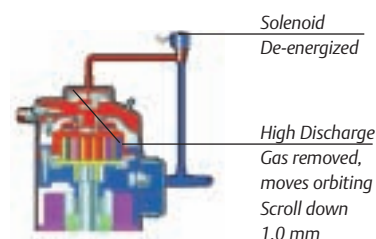
Unloaded state

Solenoid energized, allowing "lift piston" to move rotating scroll away from fixed scroll, which creates a no capacity and no mass flow condition.



Loaded state

Solenoid de-energized closed, allowing chamber pressure (high pressure gas) to increase pressure on lift piston, which moves rotating scroll closer to the fixed scroll, increasing capacity and mass flow.





*Precision Temperature and Humidity control, Lower Energy Consumption
Reduced compressor cycling*

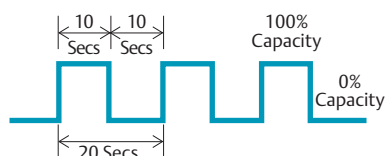


Electronic Expansion Valve Technology: how it works

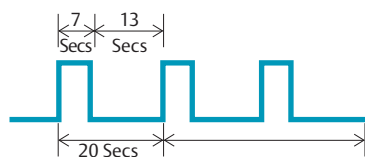
The electronic expansion valve is designed for modulating control of the refrigerant circuits with Copeland Digital Scroll compressor.

The electronic expansion valve controlled by a PID algorithm, optimizes the refrigerant flow in the evaporator and lowers the superheat compared to a mechanical thermostatic valve.

50% Load



35% Load



Digital Scroll Compressor Capacity is a time average of the loaded and unloaded state. For Example being the cycle time 20" if the scrolls are loaded for 10" and unloaded for other 10", the average modulated capacity is 50%



Longer lasting customer equipment

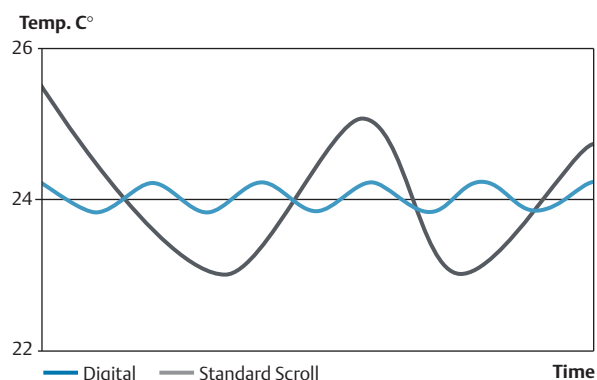
- The Digital Scroll can achieve a continuous spectrum of capacity output within a wide range, ensuring a very tight and precise control on room temperature.
- An inverter, for instance, can only achieve 40-100% capacity range in intermittent steps.
- Starting and stopping the compressor uses a lot of power and puts a great amount of stress on the components.
- With a broad capacity range offered by Copeland Digital Scroll, we have fewer compressor starts-stops and we hence increase the efficiency and life of the system.

High Unit Availability in all Conditions

- Unit is granted even with external temperature over the operative limits. iCom Software modulates the unit capacity and prevents the unit from shutting down due to high condensing pressure.

High SHR to maximize sensible cooling

Digital Scroll allows to have $SHR = 1$ even at load lower than 80%, thus allowing to maximize the cooling of customer's equipments.



Temperature variation of a system using a standard Scroll with On and Off Cycling and Digital Scroll with continuous Capacity Modulation Capabilities

Further savings with Electronic Expansion Valve

Thanks to its precise and quick regulation it brings a reduction in energy consumption. Additional Energy Saving can be achieved with Electronic Expansion Valve in combination with condensing pressure control. The unit will work with the lowest possible condensing temperature, reducing compressor power input and increasing cooling capacity.

Lower Energy Bills

Liebert HPM Digital has a high improving effect in term of Energy Savings, in fact sensible cooling capacity is not linear with capacity modulation and input power reduces with modulation.

For example at 80% Modulation Load, Sensible Cooling Capacity is 90% of the capacity we can have at full load, and Input Power varies almost linearly

- Traditional modulation technologies consume close to full-load energy (no matter what the required capacity is)
- Digital Scroll™ technology reduces power consumption linearly



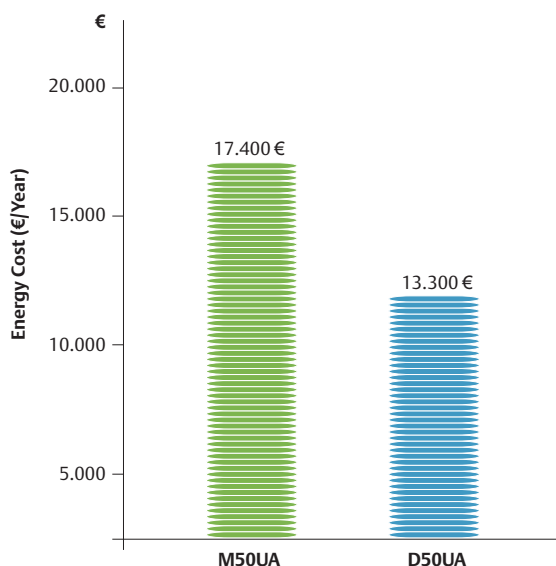
ROI, Return of investment, for HPM Digital, can be lower than 6 months



Heat Load in Data Centers is 70-80% of maximum design heat load on average.

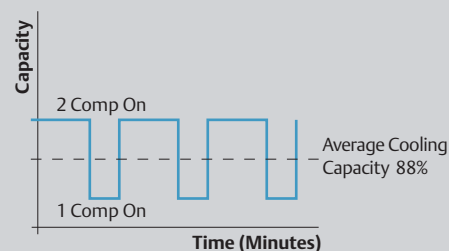
Precision Cooling Units are normally not running at full load. This is due to a number of reasons:

- Outdoor operating conditions vary continuously during the day and day by day all year long.
- Server heat output depends on its usage
- Room Cooling Units are normally selected at ambient air 24°C and relative Humidity 50%, despite the fact that such cooling units, if installed in a data center environment with racks in Cold and Hot aisle arrangement, can have return air temperature at much higher temperature. Therefore the selected cooling unit may be oversized versus the real room heat load.

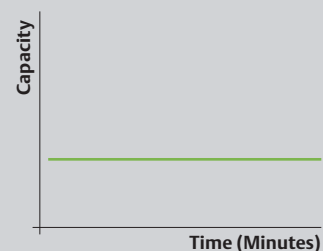


Data calculated for a double circuit unit with two standard scrolls (M50UA) versus a unit with one scroll and one digital compressor (D50UA)

- 42 kW net sensible heat load
- 24°C 50% R.H. ambient condition
- 35°C outdoor Temperature
- Condenser equipped with fan speed controls
- Energy Cost considered at 0,1 €/kWh



Liebert HPM M50 Equipped with Two Standard Scroll Compressors



Liebert HPM DIGITAL D50 Equipped with One Standard Scroll and One Digital Compressors

How is Energy Saving Achieved with HPM Digital?

- With a partial Heat load of 88%, with standard scrolls we would have a second compressor making **Start and Stop cycling**. HPM Digital units, would simply modulate to achieve the requested capacity, reducing input power.
- In addition the sensible heat load of the Digital Scroll at partial load is 1, thus achieving additional benefits.
- A unit with standard scroll, and a lower SHR, would have to run the humidifier to keep constant Humidity values, thus wasting additional Energy versus **HPM digital which does not require to run the Humidifier**.
- Thanks to the Electronic Expansion Valve (Standard on HPM units) the units can run at a lower condensing temperature thus achieving further Energy Saving.

Energy Savings and quick adaptation to site needs with EC Electronically Commutated Fans.

EC fans are plug-in, electronically commutated fans available across the Liebert HPM range. The use of electronically commutated fans allows to save energy, to reduce noise levels and adapt easily to air flow and external static pressure site needs.

Technology - How it works

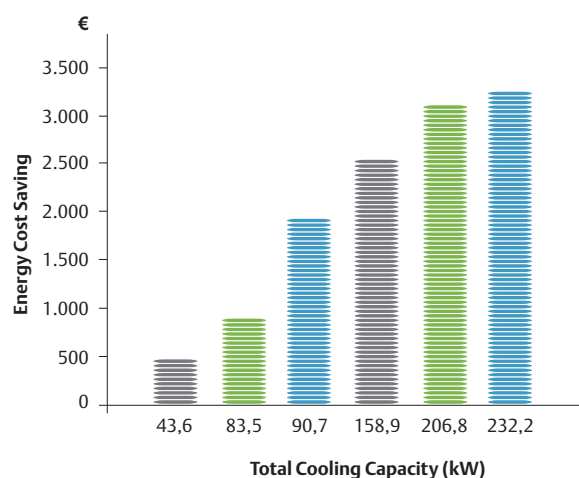
In EC motors the magnetic field is produced by permanent magnets in the rotor; the commutation is done electronically and therefore without wear.

This kind of innovative fan presents several technical and economical benefits:

- Large energy costs saving (efficiency of motor up to 90%)
- Less part numbers
- Optimized low noise fan design
- Variable speed control system via linear interface 0-10V DC, through iCOM control
- External static pressure up to 350 Pa
- No need of autotransformer to control the fan speed.
- Soft start
- Extremely quiet operation
- High MTBF (mean time between failures)



Energy Saving on Chilled water units with EC Fan



Lower Energy Bills - EC fans allow huge energy savings

The Graph shows the energy cost saving in one year of Liebert HPM chilled water units equipped with EC fans versus the same units having standard fans.

Calculations are done assuming an energy cost of 0,1 €/kWh and considering nominal air flow.

Energy Saving Function

Liebert HPM chilled water units are equipped with dedicated software which further enhances energy savings through an algorithm which optimizes the operation of chilled water valve and fan modulation.

In case of heat load increase, the priority is given to chilled water valve opening versus the EC fan modulation.

This special algorithm operation allows for even higher energy savings.

Best air distribution in Data Center Energy Saving maximized



Data Center Dimensioning with EC fans

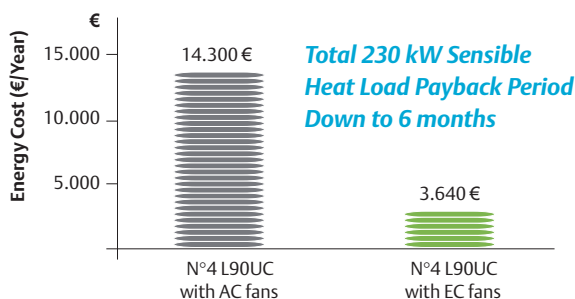
Energy savings can be further enhanced in case the room cooling units are dimensioned at a reduced fan speed.

You can see a typical data center example with two different units configurations both providing cooling up to 230 kW of Room Sensible Heat Load.



L90UC units are dimensioned at nominal air flow 3 units are running and one is in stand by mode To provide cooling N+1 redundancy.

L90UC units are dimensioned at reduced air flow all 4 units are running. In case of one unit fault, the remaining ones can run at higher fan speed to recover the room heat load. N+1 redundancy is still maintained.



On the graph Yearly Energy Costs are shown for the two configurations. Energy savings is up to 75% and a payback period of 6 months can be achieved

Easily Adaptation to the site needs

With EC fans it is possible to change the fan speed and air flow, through the iCom Control.

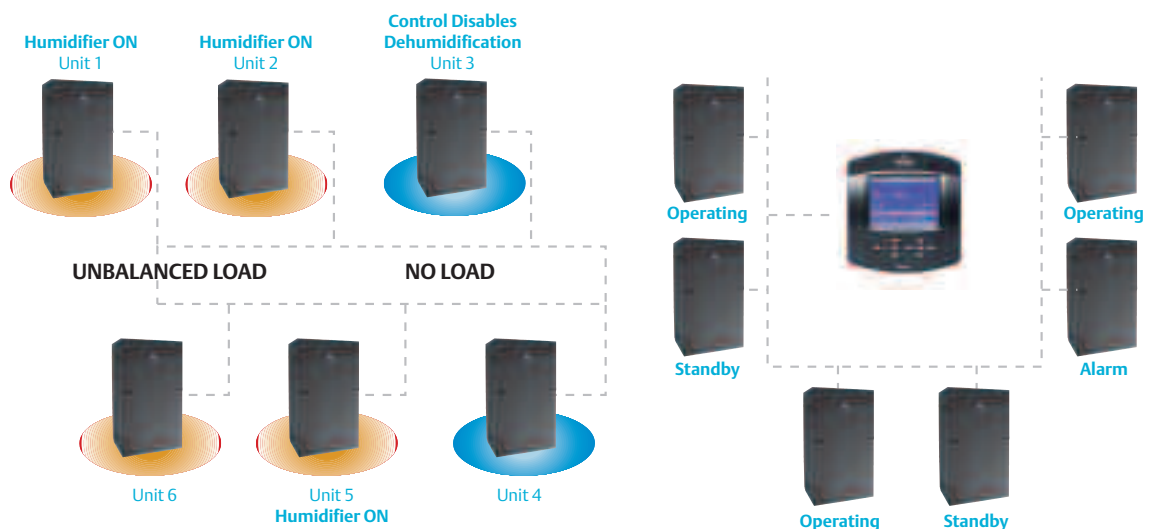
The EC fan can run, integrated in a range of velocities between 50 and 100% of the maximum velocity, thus air flow and ESP can be easily adjusted to raised floor pressure needs.



Controlling the Critical Environment

The iCOM control device handles the operation of the Liebert HPM units, using over twenty years of experience in the development of communication systems and controls. The iCOM control is featured with a special control algorithm, ensuring top reliability under every condition. It directly connects with the facility network (Ethernet) and enables the communication between multiple Liebert HPM units for synchronized operations, guaranteeing top reliability and precise room control.

Plug in Your Display in the Network



Teamwork: Mode 2

Units work together to provide precision cooling in rooms with unbalanced loads.

- **TeamWork:** between the Liebert HPM units within the same room is available thanks to the integrated Ethernet connection.

The self-control of redundant units alternates the standby positions and gives priority to possible hot spots.

The high-level supervision of multiple units allows them to work together as a single system to optimize room temperature and humidity performances, without the need of a master controller.

Your display wherever you need on the network

- **U2U Configuration 2:** Liebert HPM units with Graphic Display may be centrally monitored and controlled with the Optional Wall Mounted Display.



iCOM™ controller provide top reliability under every conditions



The Wall Mounted Large Graphic Display provides centralized monitoring and control of connected Liebert HPM units.

Intelligent Communications and Monitoring

- Saves Energy using Predictive Humidity Control
- Wellness Calculation alerts service personnel before problems occur
- Unit to Unit Communication allows Lead/Lag and optional teamwork settings for maximum flexibility of control
- Built-in Lead/Lag Functions for enhanced system reliability
- Temperature and humidity record for the last 16 days
- Working hours and other key parameters for a precise analysis of the unit

SPARE PART LIST page 81		UNIT 81	
DESCRIPTION	REV	PART #	
MOTOR 7.5HP COP PE (AUG 15-22)			
ON AUTOFEED SENSING	1	002-6190	
MOTOR 7.5HP 230V480V-48 PE	1	1822733P1	
BUSHING PULLEY 1/2-3/8"	1	1822733P4	
CONTRACTOR TPL 24000L 25-200HP	1	E-6140	
OVERLOAD RELAY 1/2 HP 120V 0-4	1	124547P1	
FUSEBLOCK 800V 1P600V 30A 3P	1	136811P1	
FUSE DUAL EDWIT 7" 600V 17.5A	2	126821P13	

Parts list available on control for easier maintenance.

Critical spare part numbers are saved in unit memory and may be displayed on the Large Graphic Display, speeding identification of parts.

SERVICE MENUS		UNIT 81	
STANDBY SETTINGS / LEAD-LAG			
SSM1 PMSMPS Unit Level 81	1	1	1
SSM2 Number of Standby Units	1	1	1
SSM3 Rotation Frequency	Monthly MED	1	1
SSM4 Rotate at (hour)	14	1	1
SSM5 Rotate at (minute)	00	1	1
SSM6 Rotate in	1	1	1
SSM7 Priority on Rotation	10	1	1

Monitors all key system functions and reports to alarm, if needed.

System View— Allows you to see the average operation of the “system” or all units that are working together in Unit to Unit (U2U) Communication mode for Teamwork or Lead/Lag from a centralized location.

UNIT DIARY page 81		UNIT 81	
DATE	NOTE		
2005-12-25	Unit checked all OK		Fred
2005-05-19	Set TSP as setpoint, convinced customer that 64F is far too low.		Jim
2005-07-09	Filters changed, were dirty		John
2005-05-31	Fanspeed changed to 100% on customer request		Jack

On-board Unit Diary provides a maintenance history to any authorized user.

Free field area within the unit memory where unit maintenance shares history with any authorized user or logged-in service contact, including record of what others have done.

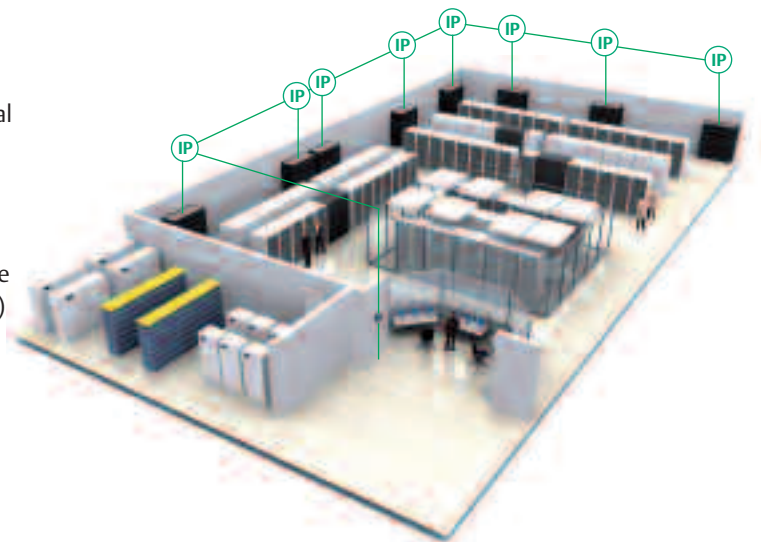
Integrate your Network Management Environment

Liebert HPM offers several Levels of Monitoring Capabilities. Whenever you are in the network you can plug iCOM user interface and browse the connected units thus enabling a first level of monitoring.

Easy Web Unit supervision

Browse from the web

- Embedded function with no need of additional hardware installation
- Each user has free access to the system
- Unit Status and list of the most important parameters (temperature/humidity) available
- Status report and graphical visualization of the data to keep a constant monitoring (Unit diary)
- Efficient service interface enable a fast diagnostics and interaction



OpenComms Web

Distributed Management with OpenComms Interface Cards (SNMP and HTTP)

The OpenComms Web card deliver SNMP and web-management communications capabilities.

- Monitoring and control through your existing Network with no additional software required.
- Each Liebert system equipped with an OpenComms Web card takes full advantage of your Ethernet network, allowing remote monitoring from your computer desktop, network operations center or wherever network access is permitted, without the need for front-end software.
- The OpenComms Web cards support 10 and 100 MBit Ethernet network transmission speed, which will be auto-detected upon connection to the network.
- These cards support in-the-field firmware updates, which increase the value of your investment.



Leading Precision Cooling Over IP



Hirovisor IP

An Easy, fast & efficient tool for supervision and Tele maintenance.

Hirovisor IP can integrate Liebert HPM units with Liebert HPC chiller units, and UPS.

Units can be monitored and parameters can be set at a distance, through the user interface when alarms and warnings are received, Hirovisor IP Forwards them to settable users via e-mail or text message.



Centralized Mangement with OpenComms Nform Software

As business grows your critical equipment infrastructure will expand, thus the need for the centralied management of this equipment will be the key to your business success. Connecting to equipment in the distributed critical space is only part of the monitoring challenge.

Liebert OpenComms Nform leverages the network connectivity capabilities of your Liebert equipment to provide a centralized monitoring view of your distributed equipment. Utilizing the SNMP and Web technologies built into each of the OpenComms communication cards, OpenComms Nform will centrally manage the alarm notifications to provide you with an easy interface to access critical status information.

OpenComms Nform puts critical system information at the fingertips of support personnel - wherever they are- increasing the responsiveness to alarm-event conditions, thus allowing IT organizations to maximize their system availability.



OpenComms Nform



Enterprise Management with SiteScan Web Software

For customers that require extensive management of critical system equipment that may span multiple locations in an ever moving global enterprise, SiteScan Web will centrally manage your critical equipment and give you the power to move beyond the event responsive service paradigm.

SiteScan Web does it all

- Real-Time Monitoring and Control
- Event Management and Reporting
- Data Analysis and Trending
- Building Management Integration



*Leading Precision Cooling
Over IP up to excellence*



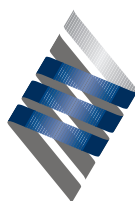
Liebert Site Scan

Liebert SiteScan®Web is a comprehensive critical systems management solution

Dedicated to ensuring reliability through graphics, event management and data extrapolation. The standard Web interface allows users to easily access from anywhere at anytime.

- Single and multi-site applications
- Event management and unit control
- Trend and historical data captures and reporting
- Full ASHRAE BACnet compatibility
- Windows platform compatible
- Java based





EMERSON™

Network Power

Business-Critical Continuity Expert™

Emerson Network Power Global Presence



Integrated Product Solutions Over 150 Countries Worldwide

Ensuring The High Availability Of Mission-Critical Data And Applications.

Emerson Network Power, a business of Emerson (NYSE:EMR), is the global leader in enabling Business-Critical Continuity™. The company is the trusted source for custom, adaptive and ultra-reliable solutions that enable and protect its customers' business-critical technology infrastructures. Backed by the largest global services organization in the industry, Emerson Network Power offers a full range of innovative power, precision cooling, connectivity and embedded products and services for computer, communications, healthcare and industrial systems. Key product brands within the Emerson Network Power family include Liebert, Knürr, ASCO, Astec, Lorain.

Locations

Emerson Network Power - Headquarters EMEA

Via Leonardo Da Vinci 16/18
Zona Industriale Tognana
35028 Piove di Sacco (PD) Italy
Tel: +39 049 9719 111
Fax: +39 049 5841 257

Emerson Network Power - Service EMEA

Via Leonardo Da Vinci 16/18
Zona Industriale Tognana
35028 Piove di Sacco (PD) Italy
Tel: +39 049 9719 111
Fax: +39 049 9719045

United States

1050 Dearborn Drive
P.O. Box 29186
Columbus, OH 43229
Tel: +1 614 8880246

Asia

7/F, Dah Sing Financial Centre
108 Gloucester Road, Wanchai
Hong Kong
Tel: +852 2572220
Fax: +852 28029250

While every precaution has been taken to ensure the accuracy and completeness of this literature, Liebert Corporation assumes no responsibility and disclaims all liability for damages resulting from use of this information or for any errors or omissions.
© 2008 Liebert Corporation
All rights reserved throughout the world. Specifications subject to change without notice.
® Liebert and the Liebert logo are registered trademarks of Liebert Corporation. All names referred to are trademarks or registered trademarks of their respective owners.

104124

Emerson Network Power.

The global leader in enabling Business-Critical Continuity™.

- | | | | |
|---------------------|------------------------------|------------------|------------------------------|
| ■ AC Power | ■ Connectivity | ■ DC Power | ■ Embedded Computing |
| ■ Embedded Power | ■ Monitoring | ■ Out Side Plant | ■ Power Switching & Controls |
| ■ Precision Cooling | ■ Rack & Integrated Cabinets | ■ Services | ■ Surge Protection |