



## Council Agenda Report

**From:** Matt Thompson, Wastewater Resources Manager

**Subject:** Wastewater Collections SCADA System Upgrade

**Date:** October 3, 2017

---

### Facts

1. The City owns and operates 14 sewage lift stations. These stations, located throughout town, use pumps to move sewage towards the Paso Robles Wastewater Treatment Plant (WWTP). Continuous operation of the lift stations is essential to prevent sewage spills, thus protecting public health and the environment, as well as to reduce liability exposure.
2. The lift stations are equipped with instruments, programmable controllers (small computers), and a radio network that communicates with the WWTP. This system, called the Wastewater Collections Supervisory Control and Data Acquisition (SCADA) System, enables City staff to remotely monitor and control all of the lift stations simultaneously from the WWTP.
3. The Wastewater Collections SCADA System is equipped with alarms that promptly alert City staff to any problems at the lift stations, such as power outages or pump failures. This enables staff to respond before a sewage spill occurs. This also enables staff to not work at night and on weekends (one standby operator monitors the system during those times), thus minimizing the number of staff needed to effectively operate the wastewater system and reducing overtime expenses.
4. The existing SCADA system is now 12 years old. Various electronic components have degraded due to the harsh operating environment (e.g., heat, corrosive air), which is now affecting the overall reliability of the SCADA system. Intermittent failures of the existing SCADA system have contributed to three sewage spills in the last two years. These incidents highlight the need for a complete upgrade of the Wastewater Collections SCADA System. It is important that the system be uniform, and not a conglomeration of various technologies and components.
5. In late 2016, the City requested qualifications from professional firms in California known to design and build SCADA systems for the water and wastewater industry. Eight firms submitted qualifications. The City formed a selection committee comprised of Public Works and Information Technology staff. The selection committee invited the four most qualified firms to submit full scope of work and fee proposals.
6. After reviewing the proposals, meeting the project team for the highest-ranked firm, checking their references, and touring some of their similar project sites, the selection committee unanimously recommends Cannon be retained to upgrade the Paso Robles Wastewater Collections SCADA System.
7. The project includes both design and installation of the SCADA system upgrade. Cannon's Scope of Work (attached) includes: design drawings; purchase of all hardware; fabrication, testing, and installation of new control panels; programming of control software; integration of hardware and software; factory testing; and training of City operations staff. Also, cooling systems will be installed on electrical enclosures at some of the lift stations. Cannon's fee for this scope of work is \$499,927.

**Options**

1. Take no action;
2. Authorize the City Manager to enter an agreement with Cannon for upgrade of the Paso Robles Wastewater Collections SCADA System, in the amount of \$499,927;
3. Amend or modify Option 2.

**Analysis and Conclusions**

Cannon – an engineering firm with offices in San Luis Obispo, Bakersfield, and Santa Monica - is well known in Paso Robles for its civil engineering work, but also has a good reputation for quality electrical engineering and automation work. Cannon has completed projects very similar to the Wastewater Collections SCADA System Upgrade for the cities of San Luis Obispo, Shafter, Delano, and McFarland, as well as California Men's Colony and Vandenberg Air Force Base. Cannon also does complex automation work for the oil and gas industry. It would be in the City's best interest to retain Cannon for upgrade of the Paso Robles Wastewater Collections SCADA system. Cannon's fee of \$499,927 is reasonable for this scope of work. Cannon's fee is less than all other firms that proposed to complete the project.

**Fiscal Impact**

This project will not adversely affect the Sewer Fund. The City has established an annual budget line item in the Sewer Fund for ongoing upgrades to sewage lift stations (6019101-C0018) that has been underspent in recent years and is adequate to pay for this project. The project will reduce liabilities associated with operation of the wastewater system.

**Recommendation**

Authorize the City Manager to enter an agreement with Cannon for upgrade of the Paso Robles Wastewater Collections SCADA System, in the amount of \$499,927.

**Attachment**

1. Cannon's Scope of Work for the Wastewater Collections SCADA System Upgrade



## **SCOPE OF WORK**

This scope of work was developed based on the previous RFQ, four site visits, and detailed discussions with the City.

### ***PROJECT UNDERSTANDING AND APPROACH***

Based on information gathered during our site visits and through follow-up discussions with City staff, we have adapted our previously submitted project approach to match our current understanding of the City's needs. We are providing the following value-added modifications to the original request, which are described below.

#### ***1. Telemetry System***

- a. After investigation and coordination with several telemetry vendors, we recommend that the City maintains its existing licensed 466MHz frequency and replace the existing serial radios with newer leading edge 466MHz Ethernet radios as shown in Appendix B. As a result, the existing radio antennas, radio paths and communication approach will be reused. No new solar repeater sites will be needed. The existing repeater at Golden Hills will be retained.
- b. We have identified GE MDS Orbit radios as an excellent replacement for your obsolete serial DataRadios.
  - i. The GE MDS Orbit radios will work on the same licensed 466MHz frequency, but will provide Ethernet communication over this licensed band.
  - ii. We believe this reduces the risk of telemetry failures, protects against other radio system conflicts (such as EMS system), and reduces the number and types of repeaters required for a functional system.
  - iii. We understand that two of the existing sites may have communication issues that may require troubleshooting and correction. Our team will include a radio path survey for up to two sites, as requested, to validate antenna heights and radio paths.
- c. Additionally, the GE MDS Orbit has the capability to have an on-board cellular modem back-up capability. Should communication fail or get interrupted on the primary 466MHz radio, the cellular modem could serve as a backup network for providing lift station data to the central SCADA system. This feature will be provided with each new radio, per City direction. Data plans and cellular network configuration will be provided by the City in the future. Additionally, our team will evaluate the cellular signal strength at each of the sites for Verizon and AT&T, unless otherwise specified.
- d. Furthermore, we have worked with the GE MDS distributor to secure trade-in credit for your existing DataRadios. We will provide 100% of the trade-in credit for the existing radios to the City. Based on the information provided, we estimate this is \$150 per radio and these radios will need to be shipped to GE.



2. *Environmental Conditions*

- a. Air conditioners/cooling units have been requested for sites where the lift station control panel is located outside. Additionally, Lift Station 2 has been identified as needing cooling, due to heat produced by the adjacent indoor generator. The intent of the added air conditioner units will reduce the internal temperature to maintain below the environmental/temperature specifications of the equipment. The cooling will be limited to the space specifically designated for the control components and not for cooling of motor starter components.
- b. The following Lift Stations have been identified to receive air conditioning units:
  - i. LS #2
  - ii. LS #3
  - iii. LS #4
  - iv. LS #6
  - v. LS #7
  - vi. LS #8
  - vii. LS #11
  - viii. LS #12
  - ix. LS #13
  - x. LS #15

3. *Instrumentation*

- a. Based on information identified during our site visits, we determined that the existing instrumentation and appurtenances in the wet wells do not require replacement. Additionally, no new intrinsically safe components or relays will be added. We will reuse the reactive air system from the existing control panel at each site, including the compressor and solenoid valve. However, as we discovered the pressure transducer was integrated into the older Tesco controller, a new pressure instrument will be required in each control panel.
- b. For motors that currently have motor seal and temperature monitoring capabilities, we will incorporate those signals into the new PLC. This monitoring will not be added to motors that do not currently have it. However, the PLC will have sufficient spare I/O, should motors be added in the future which possess these monitoring points.

4. *Power Monitoring and Backup*

- a. Based on information identified in the RFQ and site visits, we determined that the power monitoring at each of the remote sites is mainly to provide notification of power outages and general power condition. Cannon will provide a power monitoring solution that integrates seamlessly with the proposed Rockwell Automation PLCs. Rockwell Automation provides a PowerMonitor 500 (see appendix B) which mounts on the face of the control panel, providing an easy-to-read display of real-time power. The power data will be connected to the SCADA system for storage and trending of power status and demands at lift station sites. Where the Current Transformers (CTs) are in good condition, these will be reused and connected to the new power monitoring unit.



5. Spare Parts

- a. The RFQ identified specific spare parts with the assumption that those parts would be incorporated into the final design. Based on our hardware modifications noted above, we have modified the spares as follows:
  - i. 2 x PLC
  - ii. 2 x I/O modules, per type
  - iii. 1 x HMI (local touchpanel)
  - iv. 2 x Ethernet radios
  - v. 2 x Antenna lightning arrestor
  - vi. 2 x UPS batteries
  - vii. 4 x Relays
  - viii. 2 x Circuit Breakers

6. Intrusion Detection

- a. We noticed that the existing control panels do not have intrusion detection.
- b. We propose to install intrusion switches on all the remote sites panels. This will provide operators an indication when the SCADA system is accessed.
  - i. As the new telemetry system will be connected via Ethernet network, this will help protect the SCADA system from unwanted access or potential cyber-attacks originating from the remote sites.

**Design**

Cannon will develop a thorough design and implementation plan, which will be reviewed by the City prior to any fabrication or construction. The implementation plan will include a detailed approach for maintaining the existing City system and confirm that modifications and upgrades of the SCADA system will have minimal impact to operations.

The attention to operations impacts needs to start during the design and carry through the rest of the project. We will develop construction sequencing that facilitates minimal cut-over time from the existing system to the new SCADA system. All design efforts will involve the City team members, including design workshop(s) and milestone review meeting(s).

The detail of the design submittals will be sufficient to communicate the design intent and allow the City to make modifications appropriate to its needs. The design effort will occur over a short period so adequate time can be allocated to the field installation and commissioning. Where possible, we will leverage the existing infrastructure and avoid replacement of control panel enclosures, power supplies, and other components which are assessed to be healthy.

**Fabrication & Development**

As part of our approach to upgrading your wastewater collections SCADA system, we will implement reliable and standardized SCADA hardware. We will provide standardization of software so all the sites have common functionality and display. To that end, we



propose PLC/HMI standardization workshops that allow the City to provide input regarding the standardization, alarms, reports, and general look-and-feel of the final solution.

We feel this approach will give the City maximum input and ownership of the final SCADA system solution. Our team will come together for weekly reviews to confirm all hardware/software are on track for the Factory Acceptance Test (FAT), which is the culmination task for this step of the project. City staff will be invited to attend the FAT which will validate the hardware and software to the maximum extent possible in the factory. We will simulate all system loops and demonstrate that the SCADA hardware and software are ready to deploy to the field. Additionally, we will submit Panel QC/Fabrication checklists and loop checks to the City as documentation of the FAT.

**Installation & Implementation**

We will send our teams to site to install, implement, and commission the SCADA system as designed and fabricated. Our lead electrician will oversee field electrical installation, as required. We will conduct daily safety meetings for on-site personnel; we have a company safety plan that includes the use of Job Safety Analysis (JSA) before each new task. These daily tailgates may include all personnel on-site, including City staff or other City representatives. We will coordinate all on-site work with the City prior to commencement of work.

We will prepare a startup and commissioning plan that minimizes risks and interruptions and results in the successful integration of the lift stations. This plan will include field verification of field I/O wiring, loop function testing, network communication testing, and the transition from the existing RTU and OIT and other enclosure components to the new ones. This plan will define critical aspects of the Site Acceptance Test (SAT) which will be performed prior to commissioning of the site. We propose to start by integrating the least critical facility first and end with the most complex facility last to minimize the effects of unforeseen risks. This plan will also include a schedule to help keep the project on track and operations staff with a roadmap of upcoming disturbances.

Below is a summary of the selected SCADA components for our proposed solution:

<i>Category</i>	<i>Manufacturer</i>	<i>Model</i>
PLC	Rockwell Automation	CompactLogix
HMI	Wonderware	InTouch ME
Radio	GE MDS	Orbit
Power monitoring	Rockwell Automation	Power Monitor 500

In order to provide you with the maximum insight into our recommended solution, Appendix B contains cut sheets of this proposed equipment. Although our fee is based upon our preliminary design using these components, we can make modifications based on the City's input and direction.





**PROJECT TASKS**

**Phase 1. Design**

As discussed in our initial proposal, the design will be broken into two parts, each with a corresponding milestone:

- 50% Design
- Final Design

We will provide a review workshop for the 50% Design to receive input and modifications prior to commencement of the Final Design.

The following deliverables will be included with this phase:

- Network Architecture Diagram
  - o Telemetry schematic
  - o Ethernet network schematic
  - o Radio Path Survey – 2 sites
- Lift Station Site Design (only two typical designs - 2 & 3 pump configurations)
  - o Electrical/Controls Site Plan Schematic
  - o Control Panel Layout
  - o Control Panel Power Distribution
  - o Control Panel Loop Diagrams
- Repeater Site Design
  - o Control Panel Layout
  - o Control Panel Power Distribution
- WWTP Operations Building Design
  - o Control Panel Layout
  - o Control Panel Power Distribution

**Phase 2. Panel Fabrication and Software Development**

- Hardware Procurement
- PLC/HMI Standards Workshop
- Panel Fabrication
- PLC Programming
- HMI Programming
- Factory Acceptance Test (FAT)

The following deliverables will be included with this phase:

- PLC/HMI Standards Workshop Notes
- New PLC Applications
- New HMI Applications
- FAT + UL508A documentation



**Phase 3. Installation and Implementation**

- Installation of new panels
- Retrofit of existing panels
- Loop/Functional Testing
- Site Acceptance Testing (SAT) + Commissioning
- Operator Training
- Final Record Drawings + Documentation

The following deliverables will be included with this phase:

- New control panels
- New SCADA hardware components
- New PLC Applications
- New HMI Applications
- New SCADA Application
- SAT + Commissioning documentation
- Operator Training documents
- Final Record Drawings + supporting documentation





**FEES**

The project will be billed on a fixed-fee basis. Additional work not covered in the above scope of work will be billed as an addendum to this proposal as an Additional Services Agreement with prior written authorization from the City. Reimbursable expenses and materials are included in the fixed fee.

Following completion of the project, Cannon will provide the option to the City for follow-on support in the amount of eight hours per week for months 0-3, and eight hours per month for months 4-6, after completion of the project.

It is our understanding that this project qualifies for California Prevailing Wages.

<i>Labor **</i>	\$ 247,460
<i>Materials</i>	\$ 236,965
<i>Spare Parts</i>	\$ 15,502
<b>Total Fixed Fees:</b>	<b>\$ 499,927</b>

*\*\* Refer to Appendix A for Labor Fee Table, which provides the hourly rates and hourly breakdown, per staff member on the project. Per City direction, the Labor Fee includes an optional \$20,000 for follow-on support.*

**SCHEDULE**

The following schedule is based upon an aggressive timeline requested by the City and timely reviews by the City. We will negotiate the final schedule upon contract with the City. The projected start dates for each phase of work are included below, assuming the Notice to Proceed is received in November 2017.

Phase 1. Design .....	November 2017
Phase 2. Fabrication and Software Development .....	January 2018
Phase 3. Installation and Implementation .....	March 2018



### ASSUMPTIONS AND EXCLUSIONS

This proposal was based on the following assumptions related to the proposed project. Items not specifically identified in the scope of work sections of this proposal are to be excluded from this work effort and will be considered additional services. The assumptions and exclusions include the following:

1. Cannon will be given accurate electronic copies of the as-built drawings of the existing facility in AutoCAD 2010 format. If as-built drawings do not reflect the installed condition, this could increase the time to make modifications, should they be required.
2. Working time shall be eight hours, Monday-Friday. If deviations to this schedule are needed, additional labor may be required. We can shift the work as necessary with prior coordination.
3. The City will provide Cannon access and escort to sites for a period of time agreed upon in the contract schedule.
4. Cannon will not provide a vacuum truck for backup at the lift station sites. Should this be requested, additional fees will be required.
5. Controls design will provide schematics to reflect the design intent of SCADA upgrades, specifically with regard to site plans.
6. The existing radio antennas and antenna masts are functioning properly and are in good working order. The existing antennas and antenna masts will be reused at the sites.
7. The existing radio paths from the remote sites to Golden Hill repeater or to WWTP have good Line-of-Sight (LOS) and do not require new radio paths.
  - o Cannon will provide Radio Path Survey for up to two sites with recommendations.
  - o Cannon can provide Radio Path Survey for more than two sites for additional fees.
  - o Cannon may require additional fees to implement these recommendations.
8. The City will handle all updates to FCC applications and licensing updates for their existing license.
  - o Cannon is capable of providing this service for additional fees, if required.
9. Controls design will provide schematics to reflect the design intent of the wastewater collection upgrades.
10. Power to the existing sites is sufficient for the added loads that may be required based on the design requirements, including air conditioning/cooling loads.
11. Field instrumentation will be reused per the RFQ and City direction, with the exception of the pressure sensor provided in the control panel.
  - o No field conduit or wiring is required. Cannon will use existing field terminations as the boundary of our scope of work.
  - o New pressure sensors will be installed in the panel to replace the integrated and the reactive air system from each panel will be reused.
  - o No new intrinsically safe relays or barriers will be installed. All field wiring will terminate as existing.
12. To the maximum extent possible, Cannon will reuse the existing enclosures and replace the PLC, telemetry, networking, and HMI hardware components; all existing field terminal terminal blocks, power distribution, and miscellaneous devices will remain intact, if possible.
13. Modifications to the existing SCADA software may be required. It is assumed that all new modifications will be implemented using Wonderware System Platform templates/objects.
14. Cannon will not provide SCADA software development licenses with the provided SCADA applications.

**APPENDIX A**  
**LABOR FEE TABLE**

Appendix A - Labor Fee Table

Hourly Rate	City of Paso Robles - Upgrade of Wastewater Collections SCADA System																Totals		
	Automation Director		Project Manager		SCADA Electrician		SCADA Hardware Lead		SCADA Software Lead		Automation CAD Designer		Administrative Assistant		Reimbursable Expenses		Hrs	Cost	
	Hrs	Cost	Hrs	Cost	Hrs	Cost	Hrs	Cost	Hrs	Cost	Hrs	Cost	Hrs	Cost	Hrs	Cost			
<b>Task 1 - Design</b>																			
Project Management + Meetings	2	\$390	20	\$3,900		\$0	\$0	2	\$294		\$0	1	\$70				25	\$4,654	
Kickoff Meeting	4	\$780	4	\$780		\$0	\$0	6	\$882		\$0		\$0				14	\$2,442	
Radio Path Survey		\$0	2	\$390	12	\$1,956	12	\$1,440		\$0			\$0				26	\$3,786	
50% Design/Drawings	2	\$390	20	\$3,900		\$0	\$0	24	\$3,528	64	\$7,104		\$0				110	\$14,922	
50% Design Review Meeting	4	\$780	4	\$780		\$0	\$0	6	\$882		\$0		\$0				14	\$2,442	
Final Design/Drawings	2	\$390	20	\$3,900		\$0	\$0	24	\$3,528	48	\$5,328	1	\$70				95	\$13,216	
<b>Design Subtotals</b>	<b>14</b>	<b>\$2,730</b>	<b>70</b>	<b>\$13,650</b>	<b>12</b>	<b>\$1,956</b>	<b>12</b>	<b>\$1,440</b>	<b>62</b>	<b>\$9,114</b>	<b>112</b>	<b>\$12,432</b>	<b>2</b>	<b>\$140</b>		<b>\$0</b>	<b>284</b>	<b>\$41,462</b>	
<b>Task 2 - Fabrication + Programming</b>																			
Project Management + Meetings	2	\$390	20	\$3,900		\$0	\$0	8	\$1,176		\$0	1	\$70				31	\$5,536	
PLC/HMI standards workshop		\$0	8	\$1,560		\$0	\$0	8	\$1,176		\$0		\$0				16	\$2,736	
Procure hardware		\$0	2	\$390		\$0	\$480	4	\$480		\$0	2	\$140				8	\$1,010	
Panel fabrication		\$0	2	\$390	16	\$2,608	240	\$28,800		\$0			\$0				258	\$31,798	
PLC programming		\$0	8	\$1,560		\$0	\$0	160	\$23,520		\$0		\$0				168	\$25,080	
HMI programming		\$0	8	\$1,560		\$0	\$0	80	\$11,760		\$0		\$0				88	\$13,320	
Panel/SCADA FAT	2	\$390	8	\$1,560		\$0	\$960	8	\$1,176		\$0		\$0				26	\$4,086	
<b>Fabrication + Programming Subtotals</b>	<b>4</b>	<b>\$780</b>	<b>56</b>	<b>\$10,920</b>	<b>16</b>	<b>\$2,608</b>	<b>252</b>	<b>\$30,240</b>	<b>264</b>	<b>\$38,808</b>	<b>0</b>	<b>\$0</b>	<b>3</b>	<b>\$210</b>		<b>\$1,000</b>	<b>595</b>	<b>\$84,566</b>	
<b>Task 3 - Installation &amp; Implementation</b>																			
Project Management + Meetings	2	\$390	20	\$3,900		\$0	\$0	8	\$1,176		\$0	1	\$70				31	\$5,536	
Installation of new panels		\$0	8	\$1,560	64	\$10,432	96	\$11,520		\$0			\$0				168	\$23,512	
Retrofit of existing panels		\$0		\$0	64	\$10,432	96	\$11,520		\$0			\$0				160	\$21,952	
Loop/Functional Testing		\$0	8	\$1,560		\$0	\$7,680	64	\$7,680		\$0		\$0				136	\$18,648	
SAT + Commissioning		\$0	8	\$1,560		\$0	\$7,680	64	\$7,680		\$0		\$0				136	\$18,648	
Operator Training		\$0	8	\$1,560		\$0	\$0	8	\$1,176		\$0		\$0				16	\$2,736	
Record Drawings + Documentation		\$0	8	\$1,560		\$0	\$0	8	\$1,176	24	\$2,664		\$0				40	\$5,400	
<b>Installation &amp; Implementation Subtotals</b>	<b>2</b>	<b>\$390</b>	<b>60</b>	<b>\$11,700</b>	<b>128</b>	<b>\$20,864</b>	<b>320</b>	<b>\$38,400</b>	<b>152</b>	<b>\$22,344</b>	<b>24</b>	<b>\$2,664</b>	<b>1</b>	<b>\$70</b>		<b>\$5,000</b>	<b>687</b>	<b>\$101,432</b>	
<b>Subtotals</b>	<b>20</b>	<b>\$3,900</b>	<b>186</b>	<b>\$36,270</b>	<b>156</b>	<b>\$25,428</b>	<b>584</b>	<b>\$70,080</b>	<b>478</b>	<b>\$70,266</b>	<b>136</b>	<b>\$15,096</b>	<b>6</b>	<b>\$420</b>		<b>\$6,000</b>	<b>1566</b>	<b>\$227,460</b>	
<b>Task 4 - Follow-on Support</b>																			
Follow-on Support		\$0	32	\$6,240	32	\$5,216	32	\$3,840	32	\$4,704		\$0		\$0			128	\$20,000	
<b>Installation &amp; Implementation Subtotals</b>	<b>0</b>	<b>\$0</b>	<b>32</b>	<b>\$6,240</b>	<b>32</b>	<b>\$5,216</b>	<b>32</b>	<b>\$3,840</b>	<b>32</b>	<b>\$4,704</b>	<b>0</b>	<b>\$0</b>	<b>0</b>	<b>\$0</b>		<b>\$0</b>	<b>128</b>	<b>\$20,000</b>	
<b>Totals</b>	<b>20</b>	<b>\$3,900</b>	<b>218</b>	<b>\$42,510</b>	<b>188</b>	<b>\$30,644</b>	<b>616</b>	<b>\$73,920</b>	<b>510</b>	<b>\$74,970</b>	<b>136</b>	<b>\$15,096</b>	<b>6</b>	<b>\$420</b>		<b>\$6,000</b>	<b>1694</b>	<b>\$247,460</b>	

**APPENDIX B**  
SAMPLE COMPONENT CUTSHEETS

# CompactLogix™ 5370 L2 Programmable Automation Controllers



1769L24ER-QB1B, -L24ER-QBFC1B, -L27ERM-QBFC1B

## Features and Benefits

The CompactLogix 5370 L2 controllers deliver scalable, affordable control in a space-saving form factor. From small stand-alone equipment to higher performance applications, these controllers are ideal for assembly machines, hoisting systems, process skids, indexing tables, and packaging.

Machine builders and end users can take advantage of the cost-saving features of these controllers:

- Support for Integrated Motion on EtherNet/IP
- Support for Device Level Ring (DLR) network topologies
- Built-in energy storage eliminates the need for lithium batteries
- Support reuse of existing 1769 I/O
- Removable 1GB secure digital (SD) card improves data integrity
- Memory options up to 1MB
- Higher resolution analog capability supports thermocouple and RTD inputs
- Support for Kinematics eliminates the need for additional robot controllers and software
- Open socket capability allows support for Modbus TCP as well as devices such as printers, barcode readers and servers

*Build a better machine with CompactLogix 5370 L2 Programmable Automation Controllers.*



Expanding on the scalability of the Logix family of controllers, the CompactLogix 5370 L2 programmable automation controllers (PAC) are designed to meet the growing need for a higher performance controller in a compact and affordable package. Offering a 40% reduction in required panel space and the same capabilities as the CompactLogix 5370 L3, the L2 controllers truly enable you to build a high performance, more cost-effective machine.

As part of the Integrated Architecture system, the CompactLogix 5370 L2 controllers use the same programming software, network protocol, and information capabilities as all Logix controllers, providing a common development environment for all control disciplines.

## Integrated Motion on EtherNet/IP

The CompactLogix 5370 L2 controllers provides a strong motion solution for customers looking for performance and cost competitiveness.

- Supports up to 4 axes of integrated motion
- Together with the Kinetix 350, offers cost-effective, scalable motion solution

## Network Capabilities

With dual Ethernet ports and an integrated Ethernet switch, these controllers now support Device Level Ring (DLR) network topologies, simplifying integration of components in your control system and reducing system cost:

- Provides resiliency from loss of one network connection
- Allows replacement of devices one at a time without stopping production
- Reduces the number of Ethernet switches in the control system

LISTEN.  
THINK.  
SOLVE.

## CompactLogix 5370 L2 Controller Product Specifications

	1769-L24ER-QB1B	1769-L24ER-QBFC1B	1769-L27ERM-QBFC1B
User memory	750 KB	750 KB	1 MB
Controller tasks	32 tasks	32 tasks	32 tasks
Programs per task	100 tasks	100 tasks	100 tasks
Integrated Motion	--	--	4 axis CIP motion position loop axis
Package Size	115mm wide x 118mm high x 105mm deep	140mm wide x 118mm high x 105mm deep	
Certifications	cULH (Class I Division 2), KCC / UL (UL 508), ULH (Class I & II, Division 2 and Class III, Divisions 1 & 2) / ATEX, CE, C-Tick / Marine and GOST certifications in 2012		
Local Expansion Modules	4	4	4
Embedded I/O	16 digital inputs 16 digital outputs	16 digital inputs / 16 digital outputs, 4 universal analog input, 2 analog output, 4 channels HSC	
Local Expansion I/O Points	96	96	96
Communication Module Additions	DeviceNet with 1769-SDN or 3rd party		
Flash Memory Card	Industrially rated and certified Secure Digital (SD) memory card (1 and 2 GB options); all controllers shipped with 1 GB card		
Servo Drives (Position Loop CIP)	--	--	4
Ethernet I/O IP nodes	8	8	16
Virtual axes	100	100	100
Feedback only, torque, velocity, Vhz (max CIP motion drives)	--	--	16
Axes/ms	--	--	2
Kinematics support	--	--	yes
Software / Firmware	RSLogix 5000 V20 and RSLinx Classic V2.58 Firmware v20.1x or later		

CompactLogix, Integrated Architecture, Kinetix, RSLogix, Integrated Motion on EtherNet/IP are trademarks of Rockwell Automation, inc. Trademarks not belonging to Rockwell Automation are property of their respective companies.

[www.rockwellautomation.com](http://www.rockwellautomation.com)

### Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444

Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640

Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846





### Features and Benefits

- Cost-effective control and monitoring for simple HMI apps
- HMIs offer machine-oriented operation and monitoring
- Rugged, compact, fanless, and multiple interface options
- High performance processor, graphics, memory and power
- Intel® Celeron® N2930 CPU, DDR3L-1333 SDRAM up to 8 GB
- IP65 degree of protection, resistance against corrosion
- High availability communication and storage
- Highly reliable touchscreens and long lasting displays
- Comprehensive operating system, software, and services
- High temperature, vibration, shock, and EMC resistance
- UL listed, CB certified, RoHS, FCC and CE compliant

### Introduction

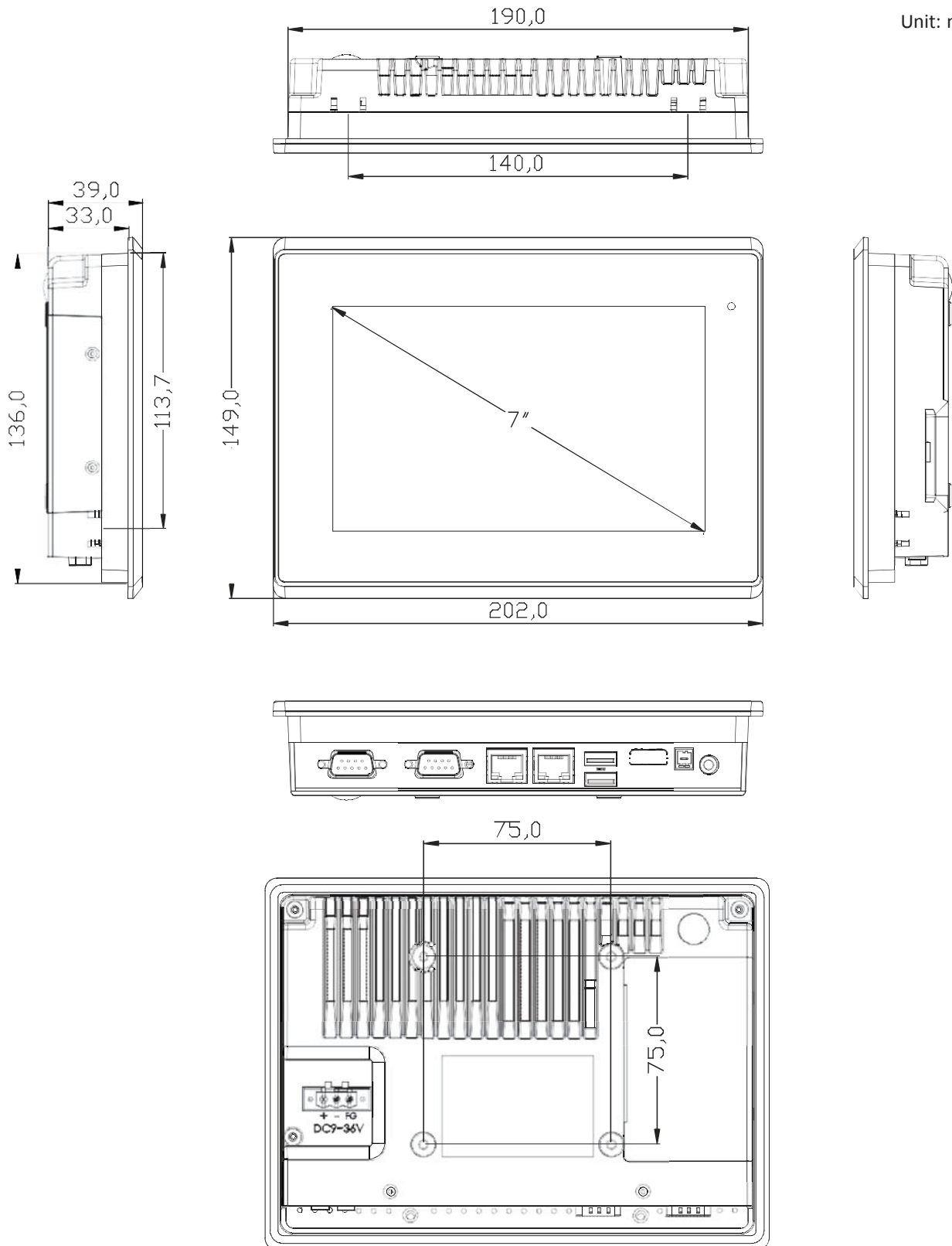
AIS 7" Compact HMI Multi-touch Panel PCs are equipped the cutting-edge processor, Intel® Celeron® N2930, energy-efficient PC with 32- or 64-bit operating systems, highly reliable touch screens, and long lasting industrial displays. These AIS systems feature compact and lightweight aluminum die-cast housing and are: easy to service, maintenance-free, space-saving, fan-less, able to withstand high electromagnetic environments, resistant to shock and vibration, and ideal for entry-level simple HMI applications. AIS 7" embedded Panel PCs are powered by: Quad-core Intel® Celeron® Processor N2930, 2M Cache up to 2.16 GHz, Intel HD Graphics supporting DirectX 11.1, OpenCL /GL, and 4K videos Quick Sync encoder, onboard non-volatile DDR3L-1333 memory, and 12-24 VDC (± 20% power tolerance) wide input-voltage range power supply.

### Specifications

Display	
Size in inches / resolution in pixels	7" / WVGA, 800 x 480
Brightness / luminance	350 nits / 350 cd/m <sup>2</sup>
MTBF of backlight	LED-backlight up to 100,000 hours in Eco mode
Touchscreen	Multi-touch (projected capacitive)
System hardware	
Processor	Intel® Celeron® N2930 Processor; 2M Cache up to 2.16 GHz, 7.5 W maximum TDP
Cores / speed	4 / 1.83 GHz
Memory	On board 4 GB DDR3
Graphics / video	Intel HD graphics; DirectX 11.1, OpenCL /GL, and 4K videos Quick Sync encoder
Drives	
Mass storage	1 x 1.8" half size SATA (default: 16 GB SSD)
Secondary storage	1 x SD slot
Optical drives	Connection via USB port

Interface ports	
Ethernet	2 x Ethernet LAN ports (Power over Ethernet - optional)
USB	1 x USB 2.0. 1 x USB 3.0
Serial	1 x RS232/422/485, 2 x RS232 (1 x RS232 w/ POE option)
Audio	1 x Line-out
General features	
Operating system	Windows Compact 7, Windows Embedded 7 32/64-bit ; Windows Embedded 8
Current supply	24 V DC; 9.6 to 28.8 V, isolated
Bezel / housing	Aluminum die-casting
Mounting options	Panel / wall mount
Packages / bundles	Packages with Wonderware InTouch, ready-to-use HMI software (optional)
Environment / ambient conditions	
Degree of protection / thermal	Front: IP65; Rear: IP20 / Fanless
Electromagnetic compatibility	CE, FCC A, EN 61000-6-2, EN 61000-6-3, CISPR22, RoHS
Vibration during operation	Tested according to DIN IEC 60068-2-6: 10-500 Hz: 1G / 3 axis
Shock during operation	Tested according to DIN IEC 60068-2-27: 15G for 11 ms
Ambient temperature	0...50°C (32...122°F)
Relative humidity	10 to 90% at 40°C (non-condensing)
Certifications / regulations	UL/cUL/IEC 61010-1, UL/cUL/IEC 62368-1, CB reports available for all models
Dimensions	
Operator panel / cut-out (W x H)	192 x 138 mm
Installation dimensions (W x H x D)	202 x 149 x 39 mm
Product weight (lb / kg)	2.6 / 1.2
Contractual warranty	
Period	12 months

Unit: mm



# Bulletin 1420 PowerMonitor 500



Achieve Greater Visibility and Control Over Your Energy Spend

The Allen-Bradley® PowerMonitor™ 500 features an on-device LCD display in a compact footprint giving you instant visibility into your energy use.

## Features

- Measure voltage, current, power, energy, demand and power factor
- Multiple communication types including Modbus RTU or EtherNet/IP™
- Two optional analog outputs for variable speed process control
- Two optional digital relay outputs
- Four configurable alarms notify you of specified conditions

## Benefits

- Display and data communications allow you to record data centrally and display it locally
- Fewer components to install and compact size can help save time and space
- LCD display can help you make at-process decisions using real-time data
- Instant and accurate energy information can help lower operating costs
- Easy-to-configure on-device display can help simplify installation
- Fully integrated with RSEnergyMetrix® software for a complete energy management solution



Allen-Bradley PowerMonitor 500

## Product Description

The Allen-Bradley® PowerMonitor™ 500 can give you greater insight into energy consumption across the plant floor and enterprise-wide. Featuring an at-process display, the PowerMonitor 500 allows you to view energy data directly at the monitoring site without the need for additional human-machine interface (HMI) components. The local display provides instant and accurate sub-metering data to help keep you well-informed of how much power you use, what your major loads are and when you use power the most.

The PowerMonitor 500 features a compact, space-saving design which mounts directly on the panel door. Installation is simplified with on-device configuration. Offering digital or analog outputs and Serial Modbus or EtherNet/IP™ communications, the PowerMonitor 500 can be easily integrated into your existing energy monitoring systems. RSEnergyMetrix® software can further enhance your view into your energy spend. As part of an integrated network, the PowerMonitor 500 can easily communicate with your existing Allen-Bradley PLCs (PLC-5®, SLC™, ControlLogix® Compact/Control family), allowing energy data to be used in control systems.

The PowerMonitor 500 is a cost-effective sub-metering option, providing critical data that can help you make at-process decisions, reduce energy usage and increase your company's profits.

LISTEN.  
THINK.  
SOLVE.™

## Product Specifications

Catalog Number	Description
1420-V1	PowerMonitor 500 Power Meter Indicator 240V AC V-LL 120V AC V-LN/208V AC V-LL
1420-V1P	PowerMonitor 500 Power Meter 240V AC V-LL 120V AC V-LN/208V AC V-LL Pulse (digital) Output
1420-V1A	PowerMonitor 500 Power Meter 240V AC V-LL 120V AC V-LN/208V AC V-LL Analog Output
1420-V1-ENT	PowerMonitor 500 EtherNet/IP Power Meter 240V AC V-LL 120V AC V-LN/208V AC V-LL
1420-V1P-485	PowerMonitor 500 Serial Power Meter 240V AC V-LL 120V AC V-LN/208V AC V-LL Pulse (digital) Output
1420-V1P-ENT	PowerMonitor 500 EtherNet/IP Power Meter 240V AC V-LL 120V AC V-LN/208V AC V-LL, Pulse (digital) Output
1420-V1P-485	PowerMonitor 500 Serial Power Meter 240V AC V-LL 120V AC V-LN/208V AC V-LL, Pulse (digital) Output
1420-V1A-ENT	PowerMonitor 500 EtherNet/IP Power Meter 240V AC V-LL 120V AC V-LN/208V AC V-LL Analog Output
1420-V1A-485	PowerMonitor 500 Serial Power Meter 240V AC V-LL 120V AC V-LN/208V AC V-LL Analog Output
1420-V2	PowerMonitor 500 Power Meter Indicator 400V AC V-LN and 690V AC V-LL
1420-V2P	PowerMonitor 500 Power Meter 400V AC V-LN and 690V AC V-LL, Pulse (digital) Output
1420-V2A	PowerMonitor 500 Power Meter 400V AC V-LN and 690V AC V-LL, Analog Output
<b>1420-V2-ENT</b>	<b>PowerMonitor 500 EtherNet/IP Power Meter 400V AC V-LN and 690V AC V-LL</b>
1420-V2-485	PowerMonitor 500 Serial Power Meter 400V AC V-LN and 690V AC V-LL
1420-V2P-ENT	PowerMonitor 500 EtherNet/IP Power Meter 400V AC V-LN and 690V AC V-LL, Pulse (digital) Output
1420-V2P-485	PowerMonitor 500 Serial Power Meter 400V AC V-LN and 690V AC V-LL, Pulse (digital) Output
1420-V2A-ENT	PowerMonitor 500 EtherNet/IP Power Meter 400V AC V-LN and 690V AC V-LL, Analog Output
1420-V2A-485	PowerMonitor 500 Serial Power Meter 400V AC V-LN and 690V AC V-LL, Analog Output

### Display, LEDs, and Commands

Display refresh time	≤ 100 ms
Display	4 lines, 4 -DGT, 1 lines, 10-DGT
Type	LCD, single color backlight
Instantaneous variables read-out	4-DGT
Energy variables read-out	Imported Total/Partial: 9+1DGT or 10DGT; Exported Total/Partial: 9+1DGT (with '-' sign).
Virtual alarms	4 red LED available in case of virtual alarm ( AL1-AL2-AL3-AL4)
Energy consumption	Red LED (only kWh)

General Specifications	
Temperature, operating	-25°C...55°C(-13...131°F)(R.H. from 0...90% noncondensing @ 40°C) according to EN62053-21, EN50470-1 and EN62053-23
Temperature, storage	-30°C...70°C(-22...158°F)(R.H. < from 90% noncondensing @ 40°C) according to EN62053-21, EN50470-1 and EN62053-23
Installation category	Cat.III (IEC60664, EN60664)
Dielectric strength	4 kV AC RMS for 1 minute
Noise rejection CMRR	100dB, 48...62 Hz
Standard compliance	
Safety	IEC60664, IEC61010-1 EN60664, EN61010-1 EN62052
Metrology	EN62053-21 EN62053-23, EN50470-3. MID 'annex MI-003'
Pulse output	DIN43864, IEC62053-31
Approvals	CE, cULus (E56639)
Dimensions (WxHxD)	Module holder: 96x96x50mm (4x4x2 inches) 'A' and 'B' type modules: 89.5x63x16mm (3.5x2.5x0.6 inches) 'C' type module: 89.5x 63x20mm (3.5x2.5x0.8 inches)
Material	ABS, self-extinguishing: UL 94 V-0
Mounting	Panel mounting
Front	IP65, NEMA 4X, NEMA 12
Screw Terminals	IP20
Weight Approx.	400 g (0.88 lb) (packing included)

### Input and Output Ratings

Parameter	Rating
Control Power	90...260V AC/DC (48...62 Hz)
Voltage Sense Inputs V1, V2, V3	V1:Un: 40-144V LN (70-250V LL); V2: Un: 160-480V LN (277-830V LL)
Current Sense Inputs: I1, I2, I3	Continuous Current: 5 A Max current (Imax): 6 A Accuracy: From 0.01...0.05 In: ±(1.0% of reading (RDG) + 2 digit (DGT)) From 0.05 In to Imax: ±(0.5% RDG +2 DGT)
Digital Output	Relay, SPDT type AC 1-5 A @ 250V AC; AC 15-1.5 A @ 250V AC DC 12-5A @ 24V DC; DC 13-1.5A @ 24V DC
Analog Output	0...20 mA

Allen-Bradley, ControlLogix, PLC-5, PowerMonitor, RSEnergyMetrix and SLC are trademarks of Rockwell Automation, Inc. Trademarks not belonging to Rockwell Automation are property of their respective companies.

[www.rockwellautomation.com](http://www.rockwellautomation.com)

### Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444

Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640

Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

# MDS Orbit Licensed Solutions



## High Speed, Long Range, Exceptional Performance for Licensed Wireless Networks

The constant evolution of industrial SCADA applications coupled with the ever increasing scale of asset deployment cause significant challenges on underlying licensed narrowband networks. Such networks need to offer an always-on connectivity to maximize application availability. They must provide a comprehensive framework of security in order to guard against the intensified waves of cyber attacks. Finally, the wireless networks must enable advanced performance in order to scale and support modern TCP/IP applications.

The GE MDS Orbit is an industrial-strength wireless router platform that helps overcome the challenges of deploying modern industrial automation applications. In addition to enabling high performance communication over the 900MHz, 700MHz, 400 MHz, 200MHz\* and 100 MHz\* licensed narrowband spectrum, the Orbit platform offers a diverse range of integrated secondary radio options including cellular, Unlicensed 900MHz ISM as well as Wi-Fi.

### Key Benefits

- Repurpose narrowband spectrum for more bandwidth-intensive IP applications using QAM modulation
- Provide backward compatibility with GE MDS SD Series or legacy GE MDS x710 radios to seamlessly expand or migrate networks
- Minimize network downtime with dual radio uplinks and other redundancy features
- Protect network and assets against intrusion with powerful cyber security capabilities
- Simplify operations, reduce learning curves and reduce cost by unifying the deployment of multiple wireless technologies on a single platform

### Applications



#### Oil & Gas

- Well Head and Production Pad Controllers & Metering Automation
- Remote Field Office Connectivity



#### Electric Utilities

- Field Area Network
- AMI Backhaul
- Workforce Mobility



#### Water & Wastewater

- Monitoring and Control
- Maintenance Workforce Mobility



#### Smart Cities & Municipalities

- Traffic Signals Control
- Video Security
- Weather Monitoring Stations



#### Emergency & Utility Vehicles

- Law enforcement connectivity
- Utility Workforce Mobility



#### Heavy Industrial

- Train Control and Machinery Monitoring
- Excavation Machine Control

## Exceptional Network Performance

- Up to 64QAM of modulation enables newer applications in narrowband networks
- Bi-directional per-packet, per-remote Adaptive Modulation maximizes network throughput in uplink and downlink directions
- IP Header and Payload compression improve efficiency by up to 30%

## Advanced Security and Networking

- Enterprise-class cyber security including VPNs, key rotation, firewalling and centralized authentication for advanced protection
- FIPS 140-2 (Level 2) certification\*
- Rich Quality of Service allows for various modes of traffic prioritization in addition to per-application bandwidth allocation

## Platform Flexibility

- Backward-compatibility with GE MDS SD Series and x710 networks for a seamless migration path
- Variety of form factors with single or dual radio configurations

## Industry Leading Reliability

- A patented Media Access Control guarantees message delivery and eliminates collision at the Access Point
- Various uplink redundancy options, including cellular backup to improve network availability
- 3rd party Certified for IEEE1613, IEC61850-3, ATEX and Class 1 Div 2 for deployment in harsh environments



## Exceptional Network Performance

Improved productivity, optimization, preventive maintenance, quality control, regulatory compliance, safety and security are just a few of the requirements that drive the need to for high performance networks to support multiple applications and deliver actionable data collected from remote, geographically dispersed assets.

The GE MDS Orbit Licensed radio solutions bring new levels of networking performance to users operating narrowband licensed networks in 6.26, 12.5, 25, and 50\* KHz channels.

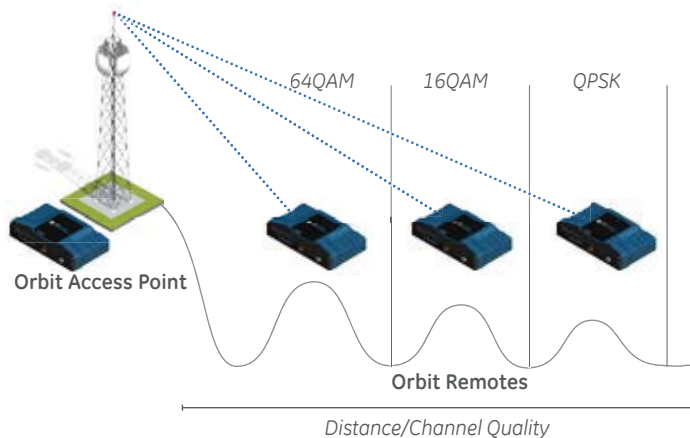
### Up to 64QAM of Modulation

The GE MDS Orbit platform implements QAM modulation to achieve raw data rates up to 6 times faster than traditional FSK modulation variants typically utilized in legacy narrowband networks. Through QAM modulation, speeds up to 120 kbps in a 25 KHz channel and 60 Kbps in 12.5 KHz are achieved.

CHANNEL SIZE	QPSK	16QAM	64QAM
6.25 KHz	9.6 kbps	19.2 kbps	28.8 kbps
12.5 KHz	20.0 kbps	40.0 kbps	60.0 kbp
25.0 KHz	40.0 kbps	80.0 kbps	120.0 kbps

### Bi-Directional Adaptive Modulation

Bi-Directional Adaptive modulation maximizes throughput in both upstream and downstream directions for each remote independently. It enables Access Points and Remotes to transmit data at the highest possible modulation in real time, on a per-packet basis. The outcome is a network that does not sacrifice its overall performance for the least common denominator link.



### IP Header and Payload Compression

Orbit's IP Header and Payload compression improves network throughput efficiency by up to 30%. It is especially beneficial when using TCP based applications that tend to have a lot of handshaking, thus overhead.

## Advanced Security & Networking

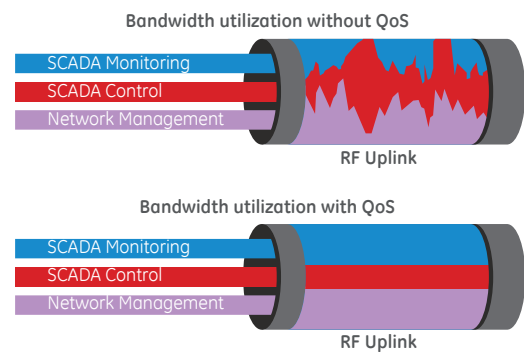
### Enterprise Class Security

The MDS Orbit platform is built on a comprehensive cyber security framework to enable the deployment of highly secure industrial applications. It offers standards-based IPSec VPN and DMVPN capabilities to ensure end-to-end IP encryption between remotes and headend regardless of the underlying backhaul. As an added layer of security, Orbit supports the encryption of licensed radio links at the RF layer with secure key rotation algorithms.

Centralized RADIUS authentication and 802.1x enable only authorized users and machines to access the network at the intended entry points and times. Orbit's stateful firewall and MAC-filtering block unwanted traffic from flowing through the network. Orbit also employs secure device practices such as Secure Firmware and Secure Boot to protects against the tampering with its hardware and software.

### Dynamic Routing and Quality of Service

Orbit's support for dynamic and static routing as well as managed switch capabilities facilitate the deployment in a multitude of network architectures. Orbit's advanced QoS functionality enable the transport of multiple application streams in the same network without compromising the performance of critical traffic. With fair and priority queuing, and traffic shaping, Orbit offers choices to engineer traffic priorities and carve dedicated bandwidth on a per-application basis in order to maximize application performance and adhere to Service Level Agreements (SLAs).



## Platform Flexibility

### Variety of Form Factors

To help extend communications to a variety of enclosure systems, Orbit is offered in compact (ECR) and standard (MCR) form factors. They can be factory-configured with different interface and radio combinations.

### Diverse Radio Technologies

In addition to being offered in licensed spectrum, the Orbit platform supports communication in unlicensed 900Mhz, cellular technology as well as WiFi. Orbit can be factory-configured with single or dual-radios. This allows customers to deploy various radio technologies on the same platform, firmware and user experience thus standardizing operations, reducing cost and learning curves.

### Backward Compatibility with MDS SD and x710

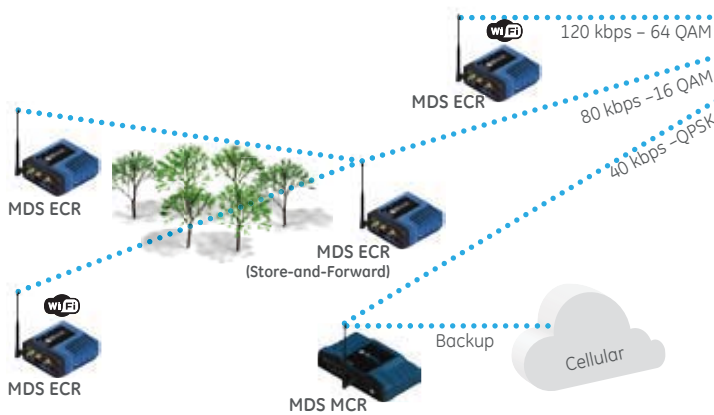
The MDS Orbit licensed narrowband radio can operate in a CPFSK Digital A backward compatible modulation to interface with existing MDS SD Series or x710 Access Points. Supporting Transparent (serial streaming) as well as Packet-with-Mac (IP) modes, this capability enables customers to seamlessly expand or migrate brownfield networks with minimum disruption.

### Integration with MDS Master Station

Orbit's Licensed Narrowband radio technology integrates seamlessly with the MDS Master Station. The Master Station is a fully redundant solution for licensed communications, offering dual power supplies, dual radios, an integrated duplexer and with no cooling fans or moving parts.

## Application Example

### Remotes



### Access Point

### Backhaul

### Headend

## Access Interfaces

- Connect multiple RTU and Controller types to a single remote radio
- Access interfaces include Ethernet, Serial, and an optional WiFi

## Performance

- Use QoS to prioritize critical SCADA over lower priority traffic
- Adaptive modulation automatically adjusts optimum speed in both directions
- A patented MAC enables network scalability with minimized impact on performance

## Security

- Firewalling and MAC filtering block unwanted traffic at the network perimeter
- RF and IPSec VPN encryptions provide options for end to end communication security
- 802.1x at remote locations allow network access to only authorized users and machines

## Industry Leading Reliability

### A Patented Media Access Control

Media Access Control (MAC) is a mechanism that orchestrates and manages how devices access a network to transmit data. Orbit's patented MAC maintains optimal throughput as more devices and applications are added to the network. It further guarantees the delivery of data packets to intended destinations and eliminates data collision at the Access Point.

### Network High Availability

To achieve maximum application uptime, Orbit supports a variety of High Availability mechanisms to enable multiple uplink paths. The Orbit platform supports dual radio configurations, such as Licensed Narrowband and Cellular, interface bonding, Spanning Tree, Layer 3 failover, VRRP as well as latency and packet-loss based failover. GRE tunneling coupled with IPSec VPNs and DMVPN further enable the establishment of secure Virtual Private Networks (VPN) across any wireless technology.

## Ease of Use and Management



### Intuitive User Interface

An easy-to-use Graphical User Interface (GUI) allows for the quick provisioning and maintenance from a web browser. Orbit supports HTTP, HTTPS, and SSH. Orbit's wizards speed up the configuration of complex network functionality by breaking down processes into simple, concise and automated steps.

### Network Management

The Orbit platform supports standards based management using SNMPv1/2c/3, MIN-II and Enterprise MIB. NETCONF is also supported. The GE MDS PulseNET NMS fully integrates with Orbit to offer advanced network as well as device management capabilities. PulseNet enables auto-provisioning to simplify network deployment and reduce operation expenses.

## Orbit ECR and MCR Licensed Spectrum Models Comparison

FORM FACTOR	PRIMARY LICENSED RADIO OPTIONS	SECONDARY RADIO OPTIONS	COMMUNICATION PORTS	MOUNTING
MCR 	150-174 MHz*, 216-235 MHz*, 330-406 MHz, 406-470 MHz, 450-520 MHz*, 757-758 & 787-788 MHz, 896-960 MHz	WiFi, 2G/3G/4G LTE 2G/3G GSM World Unlicensed 900 MHz (some combinations not supported)	Option A: 2 Ethernet, 1 Serial, 1 USB Option B: 1 Ethernet, 2 Serial, 1 USB Option C: 4 Ethernet, 2 Serial, 1 USB	Surface Mount DIN Mount Option
ECR 	150-174 MHz*, 216-235 MHz*, 330-406 MHz, 406-470 MHz, 450-520 MHz*, 757-758 & 787-788 MHz, 896-960 MHz	WiFi	1 Ethernet, 1 Serial, 1 USB	Surface Mount DIN Mount Option



# Specifications

ORBIT LICENSED NARROWBAND TECHNOLOGY	
Module	Single
Configuration	
Frequency	Configurable
Duplex Modes	Half duplex
Modulation	CPFSK, QPSK, 16QAM, 64QAM
Adaptive Modulation	Per-packet, per-remote, bi-directional
Dynamic FEC:	Convolutional, Reed Solomon
Compression	IP Header and Payload with up to 30% efficiency improvement
Media Access Control	High performance MAC

ORBIT LICENSED NARROWBAND FREQUENCY BANDS	
•	150-174 MHz*
•	216-235 MHz*
•	330 - 406 MHz
•	406.1 MHz - 470 MHz
•	450 MHz - 520 MHz*
•	757-758 and 787-788 MHz
•	896 - 960 MHz

RAW DATA RATES (ALL FREQUENCIES)			
Channel	QPSK	16QAM	64QAM
6.25 KHz	9.6 Kbps	19.2 Kbps	28.8 Kbps
12.5 KHz	20 Kbps	40 Kbps	60 Kbps
25 KHz	40 Kbps	80 Kbps	120 Kbps
50 KHz	TBA	TBA	TBA

TRANSMITTER CHARACTERISTICS	
Frequency Stability	+/- 0.5 ppm
Peak Carrier Power	+40 dBm 330-470 MHz +39.5 dBm 896-9160 MHz
Average Power (Programmable)	QPSK: +36 dBm 16QAM: +33 dBm 64QAM: +33 dBm
Power Range	+20dBm to +40dBm
Carrier Power Accuracy	(+/- 1.5 dB typical)
Adjacent Channel Power	< -60 dB
Output Impedance	50 Ohms

RECEIVER CHARACTERISTICS			
Type	Direct Conversion		
Adjacent Channel Rejection	60 dB nominal		
Sensitivity (Actual)	@ 1x10-6 BER, No FEC		
Channel	QPSK	16QAM	64QAM
12.5 KHz	-112 dBm	-102 dBm	-95 dBm
25 KHz	-109 dBm	-99 dBm	-92 dBm

Sensitivity (Actual)	@ 1x10-6 BER, No FEC		
Channel	QPSK	16QAM	64QAM
12.5 KHz	-115 dBm	-109 dBm	-102 dBm
25 KHz	-112 dBm	-106 dBm	-99 dBm

AGENCY APPROVALS / STANDARDS	
•	FCC Part 15 and IC
•	ETSI / CE
•	PTCRB, GCF
•	IEEE 1613**, IEC61850-3
•	CSA Class 1, Div. 2, UL 508, UL 1604
•	ATEX approval for EU on MCR
•	EN 60079-0:2012, EN60079-15:2010
•	Shock: MIL-STD-810F Method 516.5
•	Vibration: MIL-STD-810F Method 514.5
•	Shock and Vibration: EIA RS374A
•	Storage Temp: Mil-Std 810F Section 501.4 with 1 week soak test
•	IP 40/41 per IEC 60529 for Vertical Falling Water and Pollution 3 for Dust

\*Planned future release. Roadmap items subject to change.  
 \*\*Requires an external DC to DC converter having floating DC inputs (neither side grounded)

NETWORKING	
•	IPv4 Routing OSPF, EIGRP, RIPv2 with performance-based route failover
•	IPv6 Routing*
•	Full managed switch capability, IEEE 802.3, 802.1Q/VLANs, 64 VLANs, STP
•	Concurrent Bridging & Routing
•	GRE Tunneling with Layer 2 (Ethernet) and Layer 3 support
•	Route/path failover between any two wireless/Ethernet interfaces based on link loss, latency degradation or packet loss thresholds
•	Quality of Service 16 egress queues, Priority Queuing, Fair Queuing, Traffic Shaping, Classification based on DSCP, 802.1p and Layer 2-4 classifiers
•	IP Protocols TCP, UDP, ARP, DHCP, ICMP, NTP, FTP, SFTP, TFTP, DNS, configurable HTTP and HTTPS, SSH
•	Serial TCP server, Modbus/TCP, Modbus RTU, TCP client, UDP Unicast and Multicast, BSAP, and DNP3

SECURITY	
•	IPSec VPN Server (responder) and Client (initiator) with DMVPN
•	Authentication Public Key, EAPTLS, Pre-Shared, IKE 1-2
•	Encryption : 3DES, AES 128/192/256, CBC, CTR, CCM, GCM, SHA 256/384/512 HMAC
•	Firewalling: Stateful Layer 3-4 Firewall with MAC Filtering, NAT, Source NAT (Masquerading), Static NAT, Port Forwarding
•	Device Security : Secure Boot, Secure Firmware, Digitally Signed Hardware and Software, Magnetometer Tamper Detection
•	Certificate Management: X.509, SCEP, PEM, DER, RSA
•	User Authentication: Local RBAC, AAA/RADIUS, 802.1x
•	FIPS 140-2 (Level 2) certification in progress

MANAGEMENT	
•	GE MDS PulseNET NMS Support with device management and auto-provisioning
•	GUI configuration Wizards to simplify operation
•	Secure device management via an intuitive web-based GUI and/or CLI
•	Event logging, Syslog-over-TSL, SSH, Console
•	Iperf throughput diagnostic, NETCONF
•	SNMP v1/2c/3, MIB-II, Enterprise MIB

MECHANICAL	
Case	Rugged die-cast aluminum
Dimensions MCR	1.75 H x 8.0 W x 4.8 D in. 4.45 H x 20.32 W x 12.19 D cm
Weight MCR	2 lbs., .91 kg
Dimensions ECR	2.1 H x 4.3 W x 4.6 D in. 5.33 H x 10.92 W x 11.68 D cm
Weight ECR	1.45 lbs., .65 kg

ENVIRONMENTAL	
•	Operating Temp -40° to +70° C (-40° 158°F)
•	Storage Temp -40° to +85° C (-40° 185°F)
•	Humidity 95% at 60° C (140° F) non-condensing

WARRANTY	
•	5-year standard manufacturer warranty on all Orbit MCR/ECR models

GE  
 175 Science Parkway  
 Rochester, NY 14620  
 Tel: +1-585-242-9600

GEGridSolutions.com/Communications

IEEE is a registered trademark of the Institute of Electrical Electronics Engineers, Inc. IEC is a registered trademark of Commission Electrotechnique Internationale.

GE, the GE monogram, MDS and Orbit are trademarks of the General Electric Company.

GE reserves the right to make changes to specifications of products described at any time without notice and without obligation to notify any person of such changes.

Copyright 2016, General Electric Company.

## SECONDARY RADIO OPTIONS

Unlicensed 900Mhz ISM	
•	Frequency Bands: 902-928 MHz FHSS
•	Bandwidth 152 to 1320 kHz, up to 80 channels
•	Modulation: 2, 4-level GFSK, Adaptive
•	Raw Data Rates: 125Kbps, 250Kbps, 500 Kbps, 1000 Kbps, 1250 Kbps
•	Latency of < 5 msec
•	TX Power: 1 watt, configurable

Cellular	
•	2G/3G GSM World (AT&T, GSM, world coverage)
•	2G/3G/4G LTE North America with GPS: Verizon, AT&T, T-Mobile, Bell Canada, Rogers, Telus. Modem allows switching between carriers by upgrading to corresponding carrier profile firmware.
•	2G/3G/4G LTE EMEA & APAC with GPS
•	2G/3G/4G LTE Australia Telstra with GPS
•	LTE Private Band 26

Wi-Fi	
•	802.11 b/g/n operating at 2.4 GHz
•	Up to 52 Mbps of throughput
•	Operating Modes: AP, Client/Station

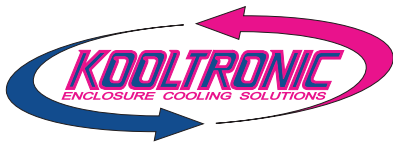
## ORBIT MODEL INTERFACES

<b>MCR Option A</b>	(2) 10/100 Ethernet, RJ45
	(1) RS232/485 Serial, RJ45
<b>MCR Option B</b>	(1) mini USB 2.0
	(1) 10/100 Ethernet, RJ45
<b>MCR Option C</b>	(2) RS232/485 Serial, RJ45
	(1) mini USB 2.0
<b>ECR</b>	(4) 10/100 Ethernet, RJ45
	(2) RS232/485 Serial, RJ45
<b>Antenna Connectors</b>	(1) mini USB 2.0
	Licensed NB:TNC
<b>900Mhz Unlic: TNC</b>	Wi-Fi: RP-SMA
	Cellular: SMA
	GPS: SMA female

## ELECTRICAL & POWER CONSUMPTION

•	Input Voltage 10 to 60 VDC	
•	Power Consumption Calculations with nominal 25C at 13.8V	
<b>With 3G GSM World</b>	<b>Power</b>	<b>13.8V</b>
Connected (Idle)	2.5W	182mA
Typical download	3.2W	235mA
<b>With 4G LTE</b>	<b>Power</b>	<b>13.8V</b>
Connected (Idle)	4.0W	292mA
Typical download	4.3W	310mA
<b>With 4G LTE + Wi-Fi</b>	<b>Power</b>	<b>13.8V</b>
Connected (Idle)	4.8W	350mA
Typical download	5.5W	400mA
<b>With 900Mhz ISM</b>	<b>Power</b>	<b>13.8V</b>
Typical	3.2 W	232mA
Maximum	5.3 W	385mA
<b>With Licensed NB</b>	<b>AP</b>	<b>Remote</b>
Idle	910 mA	350 mA
50% Duty Cycle	950 mA	780 mA

\* check with sales for availability



# GUARDIAN & GUARDIANX DP15 NEMA 4 or 4X AIR CONDITIONERS

Model	Normally In Stock	NEMA Rating	BTU/H Capacity	95/95 Rating BTU/H	Ambient Temp.			Volts	*	**	Running Amps	Weight lbs	kg
					°F		°C						
					Max.	Min.	Max.						
KNA4C1DP15L	Yes	4	1160	950	131	-20	55	-29	115/100	60/50	4.3/4.3	26	12
KNA4C1DP15LV	Yes	4X	1160	950	131	-20	55	-29	115/100	60/50	4.3/4.3	26	12

\* 115 60 Hz models perform at reduced capacity when operated at 100V 50 Hz.  
\*\* Rating shown for operation at maximum ambient temperature.

## STANDARD FEATURES

- Baked Powder Finish (NEMA 4 models)
- Built-in Condensate Evaporator
- CFC-Free Refrigerant
- Closed-Loop Cooling
- Compressor Short Cycle Protector
- Epoxy-Coated Condenser and Evaporator Coils
- Filter
- Heavy-duty Steel Shell (NEMA 4 models)
- Internal Corrosion Protection (NEMA 4X models)
- Programmable Temperature Alarm
- Programmable Thermostat
- NEMA 12, 3R and 4 Ratings Maintained (UL50)
- Six-Foot [1.8m] (minimum) 3-Wire Power Cord
- Stainless Steel Shell (NEMA 4X models)
- UL/CUL Listed

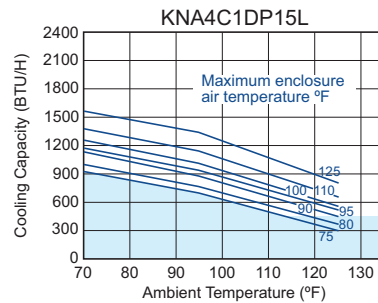
## ACCESSORIES AND OPTIONS

- Enclosure Heater
- Filter Recoating Adhesive
- Lead-Lag Controller
- Remote Monitoring
- Remote Thermostat Relay
- Replacement Filters
- Special materials or finishes
- Special motors, line cords or connectors



NEMA TYPE 4 OR 4X MAINTAINED

## PERFORMANCE



Operation within shaded area not recommended.

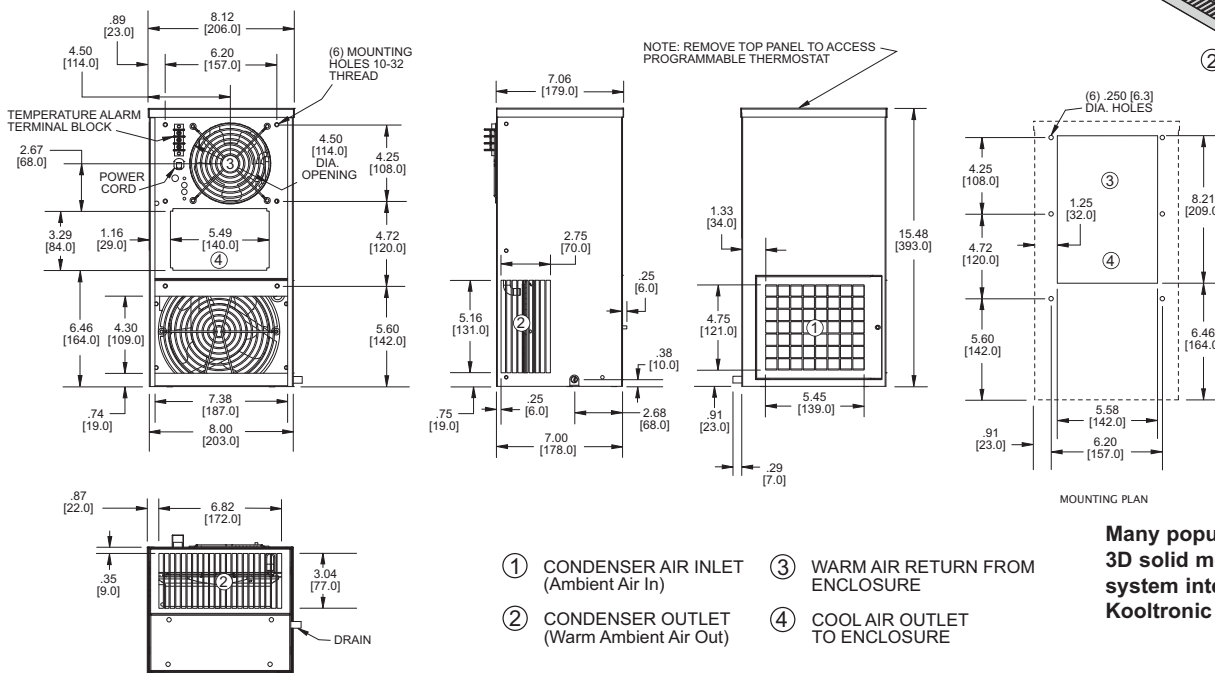


Find additional information on this model at [kooltronic.com](http://kooltronic.com), or use the Technical Documents QR code below.

Technical Documents

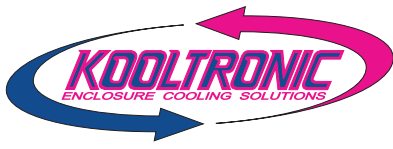


## DRAWINGS



Many popular units are available as 3D solid models for customer system integration. Please contact Kooltronic for details.

Dimensions, inches [mm], are for reference only and are subject to change. dp15.qxd 6/27/17



# GUARDIAN & GUARDIANX DP15 NEMA 4 or 4X AIR CONDITIONERS

## DESCRIPTION

---

The **Guardian/GuardianX** Indoor/Outdoor Air Conditioners are designed specifically for **NEMA 4** and **4X** enclosure applications that require washdown or are subject to outdoor storm conditions. All **Guardian** models have a **NEMA 4** Rating, offering protection against the hazards of unwanted environmental penetration. The **GuardianX**, with the **NEMA 4X** Rating, is offered with a Stainless Steel Shell and Internal Corrosion Protection.

With Epoxy-coated condenser coils and a closed-loop cooling system, the **Guardian Series** offers added security by providing an operating environment safe from harsh ambient conditions.

The features engineered into all of the **Guardian Series** models make them a tamper-resistant choice for external applications. Combined with a NEMA 4 Rating, with all models UL/CUL Listed, the **Guardian Series** is an excellent choice for telecommunications or other outdoor cabinet applications.

## FEATURES AND BENEFITS (STANDARD)

---

All models UL and cUL Listed, a standard of safety.

Built-in condensate evaporator eliminates the need for a drain (normal operation\*).

CFC-free refrigerant provides a zero ozone depletion potential.

Closed-loop cooling provides stable temperature control while excluding dust and humidity from the electrical enclosure.

Compressor short-cycling protection extends compressor life.

Condenser impeller cycling provides stable capacity and temperature control.

Condenser filtration to maintain peak thermal performance extends compressor life.

Internal corrosion protection to increase reliability in hostile environments.

Programmable thermostat capable of remote monitoring and control.

Programmable temperature alarm to alert if early action required.

NEMA 12, 3R & 4 ratings for compatibility with listed electrical enclosures.

Stainless steel shell for NEMA 4X corrosive environments (NEMA 4X models).

Both evaporator and condenser coils are epoxy coated, prolonging unit life.

\* May not be adequate in extremely high humidity with open or leaky enclosure. Overflow condensate drain fitting and hose are included.

## FEATURES AND BENEFITS (OPTIONAL)\*

---

Enclosure heater eliminates damaging condensation, increasing reliability of electrical enclosure components.

Lead-lag control for two air conditioners provides for capacity control, and alternates usage, increasing reliability.

Mounting adapter plates are offered to replace another manufacturer's unit.

Remote monitoring provides temperature data for warning of early action required.

Remote thermostat relay for control by a user-supplied control system.

Special paint finishes.

\*Contact KOOLTRONIC for more information.

## REPLACEMENT FILTERS

---

The DP15L-LV filter Part No. is 525F (5.25" x 6.44" x 0.09" [133.3mm x 112.8mm x 2.3mm]).