JAMES MADISON UNIVERSITY

COMMONWEALTH OF VIRGINIA
STANDARD CONTRACT

Contract No. **UCPJMU5507**

This contract entered into this 1st day of March 2019, by Q-Free TCS, Inc., hereinafter called the "Contractor" and Commonwealth of Virginia, James Madison University called the "Purchasing Agency".

WITNESSETH that the Contractor and the Purchasing Agency, in consideration of the mutual covenants, promises and agreements herein contained, agree as follows:

SCOPE OF CONTRACT: The Contractor shall provide the services to the Purchasing Agency as set forth in the Contract Documents.

PERIOD OF PERFORMANCE: From May 8, 2019 through May 7, 2020 with four (4) one-year renewal options.

The contract documents shall consist of:

(1) This signed form;

(2) The following portions of the Request for Proposal MPM-1034 dated 10/7/2018
   (a) The Statement of Needs,
   (b) The General Terms and Conditions,
   (c) The Special Terms and Conditions together with any negotiated modifications of those Special Conditions;
   (d) Addendum #1
   (e) Addendum #2

(3) The Contractor's Proposal dated January 15, 2019 and the following negotiated modification to the Proposal, all of which documents are incorporated herein.
   (a) Negotiations Summary, dated February 23, 2019.

IN WITNESS WHEREOF, the parties have caused this Contract to be duly executed intending to be bound thereby.

CONTRACTOR:	PURCHASING AGENCY:
By: [signature] (Signature)	By: Michael Morrison (Signature)
Dave Radford (Printed Name)	Michael Morrison (Printed Name)
Title: Executive Vice President	Title: Buyer Senior

Rev 10/14/09

RFP# MPM-1034 VEHICLE COUNT SYSTEMS

2/23/2019

The Primary Point of Contact for this Contract is:

Dave Radford
Vice President & Managing Director
978-443-2527 ext. 36
dave.radford@q-free.com

- Q-Free shall take full responsibility for their subcontractors used to complete any work, post-installation support, and any other requirements for that project.
- Q-Free acknowledges that this contract shall be governed by the terms and conditions set forth in the RFP and that no additional terms and conditions shall apply.

PRICING SCHEDULE: All Zones

See Attached Rate Sheet for products to be offered to the University.

Other Fees	
Charge Card Processing Fees:	0 %
No travel-related costs or travel time shall be charged.	

F. System Hardware Breakdown

The proposal is the recommended system design based on a typical garage as currently installed at the James Madison University:

F.1 Vehicle Count System Equipment

ADA SINGLE SPACE SENSOR SYSTEM:

QTY	PART#	DESCRIPTION	UNIT COST
1	**HC TUS-100**	**ADA Single Space Sensors:** • Smart design located at the end of each ADA parking space for higher visibility; • Measuring vehicle occupancy through ultrasonic distance measurement; • Occupancy status indicating LEDs: o ADA spaces units with blue status for available ADA space and red status for occupied space provided. • RS-485 multi-drop communications to area controller; and • Max. mounting height 3 m.	**$65.00**

1	**SS-CP**	**Communication Enclosures:**
		
		All components for local network wireless clusters connected to communication points (CP):
		• Single space communication point enclosure provided including:
		  o Single space zone controllers:
		• Configured to manage inputs from all facility single space sensors;
		• Monitors single space sensors, maximum 96 single space sensors per area controller (3 bus lines);
		• Bus line maximum cable length 100 meters;
		• Total quantity depending on floor plan layouts;
		• Offline operation if communication to server fails;
		• Wireless communication chip & antenna;
		  o Peripheral equipment (i.e. power supplies, etc.).
		• Equipment pre-configured in 18” x 16” x 8” NEMA 4 PVC indoor enclosure.
			$1,435.00

ULTRASONIC DIRECTIONAL SENSORS FOR LEVEL/ZONE COUNTING:

<table>
<tr><th>QTY</th><th>PART#</th><th>DESCRIPTION</th><th>UNIT COST</th></tr>
<tr><td>1</td><td>USDS</td><td>Ultrasonic Directional Sensors:
• Three (3) unit cluster configuration at wide garage/level entrances/exits and single unit standard configuration at standard width garage/level entrances/exits provided;
• Built in central processing unit to control sensor logic;
• Built in self-test diagnostics;
• Maximum mounting height 8 ft;
• Directional counting of vehicles;
• Maximum effective speed 12 mph;
• 24 VDC low voltage;
• Output: plus-minus pulses and/or serial interface via RS-485;
• Max. 24’/Delineation required for optimal cluster counting accuracy;
• Max. 12’/Delineation required for optimal standard counting accuracy;
• Dimensions: 74” L x 2.75” H x 2.5” W; and
• Weight: 15.5 lbs.
NOTE:
• Patent pending;
• Proximity of vehicles under sensor can skew accuracy;
• Spacing of sensors depends on garage floor layout and is customized per installation; and
• Q-Free is not responsible for accurate system counts if proper lane delineation, if required, is not implemented, and maintained by others.</td><td>$885.00</td></tr>
<tr><td>1</td><td>USDS-CP</td><td>Communication Point Enclosures:
All components for local network wireless clusters connected to USDS communication points (CP).
• Ultrasonic directional sensor communication point enclosures provided including:
  o Wireless communication equipment (i.e. modems, power supplies, etc.);
  o Power supplies for USDS and/or signs; and
  o Peripherals, etc.
• Equipment pre-configured in 14” x 12” x 6” NEMA 4 PVC indoor enclosures.</td><td>$874.00</td></tr>
</table>

ADDITIONAL COMMUNICATION EQUIPMENT:

QTY	PART#	DESCRIPTION	UNIT COST
1	**RP**	**Repeater Communication Point Enclosure:** All components for local network wireless clusters connected to repeater communication points (RP) to ensure proper wireless communication. • Repeater point enclosure provided including: o Wireless communication equipment (i.e. modems, power supplies, etc.) • Equipment pre-configured in 14" x 12" x 6" NEMA 4 PVC indoor enclosures	**$795.00**

1	**GW**	**Gateway Enclosure:**
		All components for local network wireless clusters connected to wireless gateway (GW).
		  o Wireless gateway enclosure provided including:
		    ▪ Wireless communication equipment (i.e. gateways, power supplies, etc.).
		  o Equipment pre-configured in 14" x 12" x 6" NEMA 4 PVC indoor enclosure
		
		NOTE: Wireless gateway (GW) must be physically connected to the existing customer network or directly to the PGS server.
			$1,242.00

PERIPHERAL EQUIPMENT:

QTY	PART#	DESCRIPTION	UNIT COST
1	**DP**	**Directional Delineation Posts:** • Lane delineation equipment used to ensure proper vehicle counts; • Used to properly channel traffic under count sensor; • 36" standard post; • Includes two (2) reflector stripes; • Adhesive pads provided; • Installation by others; • Max. 24'/Delineation required for optimal cluster counting accuracy; and • Max. 12'/Delineation required for optimal standard counting accuracy. *NOTE:* • *Final quantity of required units is subject to site evaluation due to traffic flow concerns* • *Q-Free does not accept any responsibility for replacement of delineators if damaged or destroyed due to traffic flow. The delineators are placed to ensure proper system performance and are not designed to sustain extensive abuse due to traffic flow or abuse.*	**$49.00**

GARAGE ENTRY SIGN:

QTY	PART#	DESCRIPTION	UNIT COST

1	L4MP/VMS	**Garage Entry Sign (Sample Sign Design):**
		
		Sample Sign Design
		• 4-Level garage entry sign indicating space availability for each garage level at garage entrance/s;
		• VMS display for custom messages;
		• Approximate dimensions: 9’6” H x 48" W x 6" D;
		• Single sided sign; and
		• Total of (4) space availability displays per sign cabinet:
		  o 4-Digit double stroke seven segment display;
		  o 7.5” LED Character height;
		  o Number of spaces and OPEN in green; and
		  o FULL in 6” single stroke red LEDs.
		• Total of (1) variable message display per sign:
		  o Ability to display 2 lines of 4.4” text with up to 12 characters per line;
		  o Amber color LEDs.
		• White reflective vinyl lettering;
		• 120 VAC;
		• Will match existing single corporate color if required.
		• Includes transport and installation on footers provided by others
		
		NOTE:
			$28,707.00

QTY	PART#	DESCRIPTION	UNIT COST
		• Sign price only for quoted sign dimensions, design and mounting. Changes to sign design, dimensions, mounting etc. will require a new quote. • Footers by others	
1	PM	**Double Post Mount**	**Incl.**
1	XBEE-SIGN	**Wireless Communication Equipment for Sign Location:** • Includes 120 VAC wireless modem, antenna, peripherals, etc. for sign location	**$712.00**

QTY	PART#	DESCRIPTION	UNIT COST
1	ITS-420	**ParQSense Smart Sensors:** • Dual detection smart in-ground sensors o Radar and magnetic field detection • Accuracy at 99%+ • Robust sensor for every environment • Quick installation of 4 min per sensor estimated depending on site conditions • Super long range proprietary RF communication to centralized communication gateways • Dimensions: 4 1/3" diameter; and • Weight: 1 lbs.	**$134.00**
1	MP55	**Component Epoxy for Sensor Installation**	**$47.00**
1	ITS-950	**ParQSense Base Station** • ParQSense Base Station/s for ParQSense Smart Sensors ▪ Proprietary RF network for sensor communication • Base stations centrally installed may service more than (1) lot based on location	**$1,725.00**
1	ITS-950/CP	**Communication Enclosure for ParQSense Base Station** • Includes cellular modem & peripherals for cellular communication to central software system	**$1,575.00**

<table>
<tr><th>QTY</th><th>PART#</th><th>DESCRIPTION</th><th>UNIT COST</th></tr>
<tr><td>1</td><td>LOOP-CP/2</td><td>Communication Point Enclosures:
All components for local network wireless clusters connected to area controller/loop detector communication points:
• Loop counting communication enclosure provided including:
o Area controller:
▪ Configured to manage inputs from all loop counting locations;
▪ Manages all dynamic signage; and
▪ Power supply.
o (2) Anti-tailgating loop detectors including calibration loop & harness per enclosure;
o External antenna & cable; and
o Wireless communication equipment (i.e. modems, power supplies, etc.).
• Equipment pre-configured in 20” x 20” x12” NEMA 4X grey fiberglass enclosure.</td><td>$5,095.00</td></tr>
<tr><td>1</td><td>LOOP-CP/1</td><td>Communication Point Enclosures:
All components for local network wireless clusters connected to area controller/loop detector communication points:
• Loop counting communication enclosure provided including:
o Area controller:
▪ Configured to manage inputs from all loop counting locations;
▪ Manages all dynamic signage; and
▪ Power supply.
o Anti-tailgating loop detector including calibration loop & harness per enclosure;
o External antenna & cable; and
o Wireless communication equipment (i.e. modems, power supplies, etc.).
• Equipment pre-configured in 20” x 20” x12” NEMA 4X grey fiberglass enclosure.</td><td>$3,860.00</td></tr>
<tr><td>1</td><td>SC</td><td>Pre-Formed Loops:
• Pre-formed in-ground loops provided.</td><td>$106.00</td></tr>
<tr><td>1</td><td>BL-D</td><td>Loop Sealant:
• Includes tubes of loop sealant for in-ground saw-cut loops.</td><td>$25.00</td></tr>
</table>

SOFTWARE LICENSE PER ADDITIONAL LOT FOR EXISTING PGS SERVER:

QTY	PART#	DESCRIPTION	TOTAL COST
1	SL	**Software License:** • Software license to integrate the new PGS equipment into existing PGS server. • Per new garage/surface lot *Note: Customer is responsible for network connection between garages.*	**$2,880.00**

SYSTEM DESIGN, REMOTE PROJECT MANAGEMENT & SYSTEM COMMISSIONING

QTY	PART#	DESCRIPTION	HOURLY RATE
1	DES	**System Design:** • Standard in-house system design; and • Includes documentation, drawings, and all related design work.	$140.00
1	PM	**Remote Project Management:** • Perform all off-site coordination and remote project management to supply the PGS system.	$150.00
1	SC	**System Commissioning & Training:** • Provide on-site technician for final commissioning support; • Perform all testing for PGS system; • Labor related expenses for up to (3) contiguous days during the system commissioning phase of the project included; and • Provide on-site user training on the PGS System as part of the on-site system commissioning efforts, including: o System overview; o Hardware training; o System troubleshooting; and o General system maintenance & repair. *Note:* • Travel related expenses not included and will be billed in accordance with the Commonwealth of Virginia's per diem allowance for lodging, meals, and incidental expenses at the time of travel • All additional services and supporting expenses will be billed per standard rates if delays are caused by customer or a third party.	$140.00
1	FR	**Standard Freight & Handling**	N/A

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1	PM	**Remote Project Management:** • Perform all off-site coordination and remote project management to supply the PGS system.	**$150.00**

1	SC	**System Commissioning & Training:** • Provide on-site technician for final commissioning support; • Perform all testing for PGS system; • Labor related expenses for up to (3) contiguous days during the system commissioning phase of the project included; and • Provide on-site user training on the PGS System as part of the on-site system commissioning efforts, including: o System overview; o Hardware training; o System troubleshooting; and o General system maintenance & repair. *Note:* • Travel related expenses not included and will be billed in accordance with the Commonwealth of Virginia's per diem allowance for lodging, meals, and incidental expenses at the time of travel • All additional services and supporting expenses will be billed per standard rates if delays are caused by customer or a third party.	**$140.00**
1	FR	**Standard Freight & Handling**	**N/A**

F.2 Exclusions:

DESCRIPTION
Exclusions: **The following is excluded in this proposal:** • Required digging, trenching, coring, etc. other than for in-ground loops or in-ground sensors; • Any type of penetrating survey/initiatives to any structure required to install PGS equipment, signage, conduit, etc. • A/P connection/s to customer network; • Wireless interference; • Bonds, insurance, permits, engineering drawings, certifications, foundation design, foundation, delineation, etc.; • Traffic control; and • Lost revenue. *NOTE: All additional services and supporting expenses will be billed per standard rates if delays are caused by customer or a third party.*

Q-FREE PRESENTS

RFP RESPONSE TO RFP# MPM-1034 VEHICLE COUNT SYSTEM

JAMES MADISON UNIVERSITY

Q-Free TCS, Inc.
55 Union Avenue
Sudbury, MA 01776
P. 978-443-2527
F. 978-579-9545
www.q-free.com

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REQUEST FOR PROPOSAL

RFP# MPM-1034

Issue Date: **10/7/2018**

Title: **Vehicle Count Systems**

Issuing Agency: **Commonwealth of Virginia**
James Madison University
Procurement Services MSC 5720
752 Ott Street, Wine Price Building
First Floor, Suite 1023
Harrisonburg, VA 22807

Period of Contract: From Date of Award Through One Year (Renewable)

Sealed Proposals Will Be Received Until <u>2:00 PM on January 8, 2019</u> for Furnishing The Services Described Herein.

MANDATORY PRE-PROPOSAL: No Pre-Proposal meeting is scheduled/required for this RFP.

SEALED PROPOSALS MAY BE MAILED, EXPRESS MAILED, OR HAND DELIVERED DIRECTLY TO THE ISSUING AGENCY SHOWN ABOVE.

All Inquiries For Information And Clarification Should Be Directed To: Michael Morrison, Buyer Senior, Procurement Services, morrismp@jmu.edu; 540-568-6181; (Fax) 540-568-7935 not later than five business days before the proposal closing date.

NOTE: THE SIGNED PROPOSAL AND ALL ATTACHMENTS SHALL BE RETURNED.
In compliance with this Request for Proposal and to all the conditions imposed herein, the undersigned offers and agrees to furnish the goods/services in accordance with the attached signed proposal or as mutually agreed upon by subsequent negotiation.

Name and Address of Firm:

Q-Free TCS, Inc.

55 Union Avenue

Sudbury, MA 01776

By: ____________________
(Signature in Ink)

Name: Dave Radford
(Please Print)

Date: January 15, 2019

Title: Managing Director & Vice President

Web Address: www.q-free.com/solution/parking/

Phone: 978-443-2527 x36

Email: dave.radford@q-free.com

Fax #: 978-579-9545

ACKNOWLEDGE RECEIPT OF ADDENDUM: #1 DR #2 DR #3_____ #4_____ #5_____ (please initial)

SMALL, WOMAN OR MINORITY OWNED BUSINESS:

☐ YES; ☒ NO; *<u>IF YES</u>* ⇒ ⇒ ☐ SMALL; ☐ WOMAN; ☐ MINORITY ***<u>IF MINORITY</u>***: ☐ AA; ☐ HA; ☐ AsA; ☐ NW; ☐ Micro

Note: This public body does not discriminate against faith-based organizations in accordance with the *Code of Virginia*, § 2.2-4343.1 or against an offeror because of race, religion, color, sex, national origin, age, disability, or any other basis prohibited by state law relating to discrimination in employment.

Rev. 12/9/15 *(Previous Rev 8/18/15)* LMF

B. Introduction Letter

Commonwealth of Virginia
James Madison University
Procurement Services MSC 5720
752 Ott Street, Wine Price Building
First Floor, Suite 1023
Harrisonburg, VA 22807

January 16, 2019

Dear Michael Morrison;

I would like to take this time to thank you for giving Q-Free the opportunity to propose on the request for provision and installation of a complete vehicle counting system for the James Madison University.

Q-Free has assembled a project team ideally qualified to take on projects such as the one for the James Madison University. Our team has worked together on over 350 other projects including the vehicle counting projects currently installed at JMU, and we feel confident we can serve you well with our Vehicle Count System implementation.

Q-Free has grown into an organization with over 100 combined years in intellectual property and Parking industry experience. It is this industry experience throughout North America, which has allowed us to maintain a dominant position within the intelligent transportation and parking industry. Q-Free ASA is publicly traded on the Oslo Stock Exchange and operates from 22 worldwide offices with over 420 employees.

We have focused exclusively on the Vehicle Counting System market sector as it pertains to parking and real time parking space notification. This has allowed us to design products that are ideally suited for this market sector, with leading edge developments that enable us to offer very advanced, high level technical solutions to our ever-demanding clients. We are experts in designing and implementing multi-facility projects all tied together at a central location.

Our various patent pending system designs have allowed us to successfully install the widest range of systems in this market segment. With over 350 systems installed globally, we feel this success speaks for itself. The overall flexibility of our wireless communications and interface modules (web/mobile apps) give us the ability to inform the driver through multiple media channels.

Included in our submittal is a list of global installations as well as detailed technical information on our systems. We have done a detailed technical analysis of the system requirements and are confident that we meet and exceed the specifications in many areas.

I look forward to possibly working with you on this project and am available to answer any questions you may have.

Sincerely,

Dave Radford
Managing Director/Vice President
Q-Free TCS Inc.

C. Why Choose Q-Free?

Q-Free is leading the way with innovative solutions to any parking guidance challenge. Over the last ten years, we have designed and implemented a variety of leading edge solutions to the intelligent parking guidance market. Our project team located locally in Sudbury, MA is highly qualified to take on projects such as the one for the James Madison University. We have worked together on over 350+ other projects, including the vehicle count systems currently installed at James Madison University, and most of our team members have been designing, implementing, and managing projects for over 10 years. In addition, we take enormous pride in the fact that we own the IP to all our products, and that all our counting products are North American made. We feel confident we can serve the University well with our Vehicle Count System implementation, as we possess unmatched experience customizing and implementing PGS solutions boasting the largest customer base in North America. We have a total of over 350+ PGS systems installed worldwide in various industries such as hospitals, convention centers, large employers, shopping centers, casinos, etc.:

Picture 1 Sample Client Logos

C.1 Q-Free Information

C.1.1 Company Overview

Company Name: Q-Free TCS, Inc.
Year Founded: 1999
Parent Company: Q Free ASA
Year Founded: 1984
State of Incorporation: Trondheim Norway
Corporate HQ: Oslo Norway
Center of Componence for Parking: Sudbury, MA (20 miles west of Boston)

C.1.2 Company History

Q-Free was founded in 1984 and is headquartered in Trondheim, Norway. The annual turnover is over to $120M. The company is publicly listed on the Oslo Stock Exchange under the ticker QFR. With local offices in more than 20 countries around the world, Q-Free has global reach and local presence. Approximately 420 people representing over 30 nationalities are employed by the company. The map below shows Q-Free's current presence.

Picture 2 Q-Free Worldwide

2010 saw Q-Free move into the US market for tolling applications using video tolling or what we know today as LPR (license plate recognition). Q-Free quickly evolved into a true ITS Company through acquisitions of many market leaders including TCS International of Sudbury MA, a leader in Parking Guidance technology and IP. Acquired 100% in 2012, TCS International, now operating as Q-Free Boston is a world provider in Parking solutions.

C.2 Org Chart and Project Roles

ORG CHART

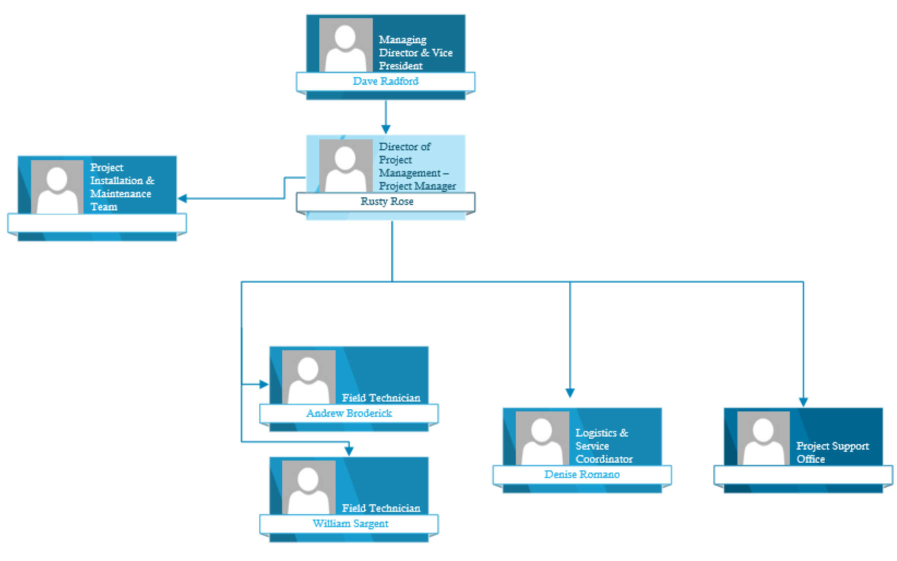


Figure 1 Proposed Organizational Chart

PROJECT ROLES

<u>Dave Radford – Managing Director & Vice President</u>

Will serve as the point of contact before the notice to proceed. Dave has been in the Parking Industry for over 17 years, focusing exclusively on the PGS market segment the last 10 years. Dave's experience in the PGS market has been the driving force to continued innovation at Q-Free and proves to be an unmatched asset to constant improvement.

Dave has been involved in the design, customization, and implementation of over 250 installations at Q-Free. He has been instrumental in the implementation of city wide solutions, multi-garage solutions and large scale projects, such as Nike Headquarters, City of Ottawa, and Disney World. This extensive market knowledge has resulted in extremely high customer satisfaction and loyalty, especially when opportunities for expansion at current properties arise, as well as when new innovations become available.

Dave is running the Business Unit Parking in Q-Free and is responsible for product roadmap, future development, sales strategy for all parking related product lines in Q-Free.

<u>Rusty Rose – Director of Project Management (Project Manager)</u>

Will serve as the point of contact after contract award. He has been with Q-Free for 12 years, and during that time has managed most of the Q-Free PGS projects ranging in value from $50K up to $2M. Rusty's extensive experience in PGS project management allows him to smoothly implement solutions and improve customer satisfaction.

Recently completed/ongoing PGS projects include:

- Single space system for over 2,500 parking spaces for a Reedy Creek Disney Parking Garage in Orlando, FL
- Montgomery County, MD battery operated/wireless single space system for four garages with over 3,000 sensors
- City of Edina, MN project managed a PGS system for four garages with roadway signs
- Nike Headquarters OR, project managed single space monitoring installations for 5 employee garages with over 4,500 single space sensors
- James Madison University, VA project managed level counting installations for 5 campus garages including current system upgrade project

William Sargent – Senior Field Technician

Is one of the field technicians assigned to perform any on-site related work for this project. He has been with Q-Free TCS for over 9 years and has been involved in the component assembly and system commissioning process of Q-Free TCS PGS systems during this time. His experience and in depth knowledge of each component of the system provides him with a unique ability to foresee potential long term complications and prevent them during the final stages of the installation.

Recently completed/ongoing projects include:

- International Monetary Fund Garages DC, level counting for 2 parking garages for employee and visitor parking
- Wounded Warrior Parking Garage DC, level counting for hospital garage
- Castle Towers Shopping Center Sydney Australia, single space system with over 5,000 single space sensors in 5 parking garages

Andrew Broderick – Field Technician

Is one of the field technicians assigned to perform any on-site related work for this project. He has been with Q-Free TCS for 3 years and has been involved in the system design and system commissioning process of Q-Free TCS PGS systems during this time..

Recently completed/ongoing projects include:

- Florida Hospital, 2,500 space single space system for 2 parking garages
- Hollywood Casino Jamul, CA single space system with LPR integration (Project management and system design and integration)

C.3 Resumes

K E Y   P E R S O N N E L



Rusty Rose, Director of Project Management

Project Experience

Nike Headquarters Garages
Beaverton, OR

Florida Hospital
Orlando, FL

Sherway Gardens
Toronto, Canada

Bayshore Mall
Eureka, ON

Disney Garages
Orlando, FL

James Madison University
Harrisonburg, VA

Dana Farber Cancer Center
Boston, MA

Education

Northern Essex CC - Haverhill, MA 1983
Associate Degree Criminal Justice

Southern Maine Vocational Tech – Portland, ME 1987
Associate Degree Applied Marine Science

Years of Experience:

Rusty has been a part of Q-Free TCS since 2006. Since then he has been the project manager for most Q-Free TCS PGS projects.

Project Responsibilities:

- Main point of contact for projects
- Implements the design of PGS system
- Prepares documentations for submittals, scope, and close out documentation.
- Provides project timelines to meet desired turn over schedule for client
- Arranges on-site project team members for installation, commissioning, and training.
- Produce and provide project closeout documentation

KEY PERSONNEL

Andrew Broderick, PGS Technician

Project Experience

Hollywood Casino - 2016

Jamul, CA

Northeastern University - 2016

Boston, MA

Florida Hospital - 2018

Orlando, FL

Roosevelt Field Mall - 2015

Garden City, NY

Nike Headquarters Garages - 2016

Washington Country, Oregon

King of Prussia Mall - 2016

King of Prussia, PA

One Loudoun Garage - 2016

Ashburn, VA

Education

University of Massachusetts, Lowell

2011-2015

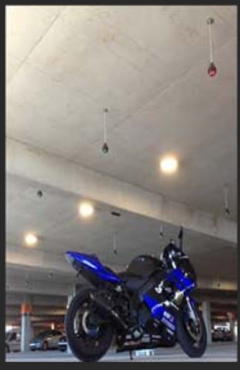
Bachelor of Science in Mechanical

Years of Experience:

Andrew has been a part of Q-Free since November 2015.

Project Responsibilities:

- Performs on-site service of the Parking Guidance System
- Designs the PGS layouts, and constructs the equipment for the PGS system
- Remotely provides service to new and existing systems
- Creates intallation documentation for onsite implementation
- Creates device manuals and diagrams
- Tests new equipment to enhance the PGS option
- Works on commissions for new PGS
- Attend meetings with Owners, Contractors, PM, and EC to maintain project schedule and progress



Q FREE

K E Y   P E R S O N N E L

Bill Sargent, PGS Technician

Project Experience

Disney Parking Garages

Orlando, FL

National Geospatial Agency

Springfield, VA

Calgary Parking Authority

Alberta, Canada

The Cosmopolitan Resort Casino

Las Vegas, NV

University of California Davis Medical Center

Davis, CA

Virginia Tech Campus

Blacksburg, VA

Castle Towers Shopping Mall

Sydney, Australia

Education

ITT Technical Institute, Framingham MA

1998-2000

Associate of Science Electrical Engineering

Experience:

Q-Free TCS	Sudbury, MA.
2008 - Present	Field Technician
Scheidt & Bachmann	Burlington MA.
2005 - 2008	Field Technician

Project Responsibilities:

- Manufacturing and quality control of all aspects of the Parking Guidance Systems
- Design and configure mesh networks
- Work directly with customers and onsite contractors to complete commissioning of projects
- Provide hardware and software training for the PGS systems
- Provide onsite and remote technical support

D. Executive Summary

D.1 Situation Analysis:

James Madison University (JMU) is a comprehensive public institution in Harrisonburg, Virginia with an enrollment of nearly 22,000 students and over 3,000 faculty and staff. There are over 600 individual departments on campus that support seven academic divisions. The University offers over 120 majors, minors, and concentrations.

Currently, JMU Parking Services operates 6 parking decks and approximately 80 surface lots for faculty, staff, and student permit parking.

D.2 Client Goals:

- Provide an accurate space occupancy and guidance system
- Convey occupancy information ahead of time, in real time and through site-wide signage and mobile applications to enhance customer satisfaction and loyalty
- Monitor parking operations and occupancy %'s and reduce the time having students/faculty/visitors cruising and searching for available space. This is accomplished by providing dynamic signs throughout the facility alerting patrons to space availability.
- Provide a sense of a safer parking environment
- Provide a solution that can grow and expand with the asset itself through key features such as user information screens, reservation ability, nested areas for special user groups, etc.

D.3 Overview:

The James Madison University will enjoy distinct benefits such as:

- A reduction of time driving around looking for a parking space adds up to significant reductions in carbon emissions and a dramatic improvement in the visitor experience.
- Optimize available inventory as users are not faced with situations where they can't find available space.
- Users can find available parking is as much as 40% less time
- The ability to show space availability in real time on smart phone applications and web sites enhances the garage visibility and creates a "user friendly" experience.
- With "parking" being the first and last experience of the visit to the University, ease of use is just as important and any other amenity offered.

E. Experience and Qualifications

E.1 Project Experience

1. BAYSHORE SHOPPING CENTRE – OTTAWA, CANADA

Bayshore Shopping Centre is one of Ottawa's largest shopping malls, containing over 190 retailers. It boasts more than 4,000 parking spaces, most of which reside in two multi-level parking structures. In 2015, Q-Free was contracted to install a Parking Guidance System (PGS) inside the main parking garage as part of a $200 million redevelopment and expansion project. The PGS consists of Ultrasonic Directional Sensors (USDS) counting vehicles entry/exits into each of the 5 levels. These counts are then sent to LED displays installed throughout the structure that efficiently guide traffic to available spaces. In 2016, Q-Free was contracted again to provide a PGS for the property's second 5 level parking structure.

<u>Specifics for this project include:</u>

- USDS tracking the throughput of 10,000+ vehicles daily
- Wireless system communication
- Large LED gantry sign overhanging a double lane entrance
- Master and Level signs display parking availability at key decision points
- Virtual PGS server maintained by property management which eliminates the need for a physical server on-site

Picture 3 Site Pictures Bayshore Shopping Centre

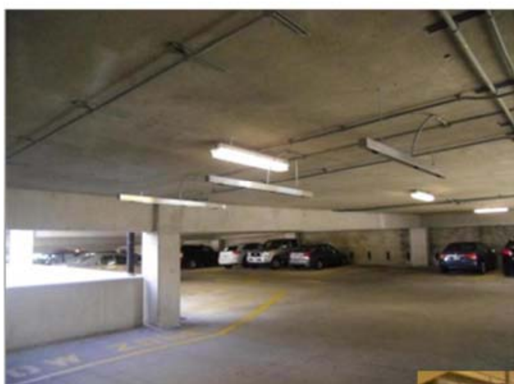
2. BOSTON CHILDREN'S HOSPITAL PARKING GARAGE – BOSTON, MA

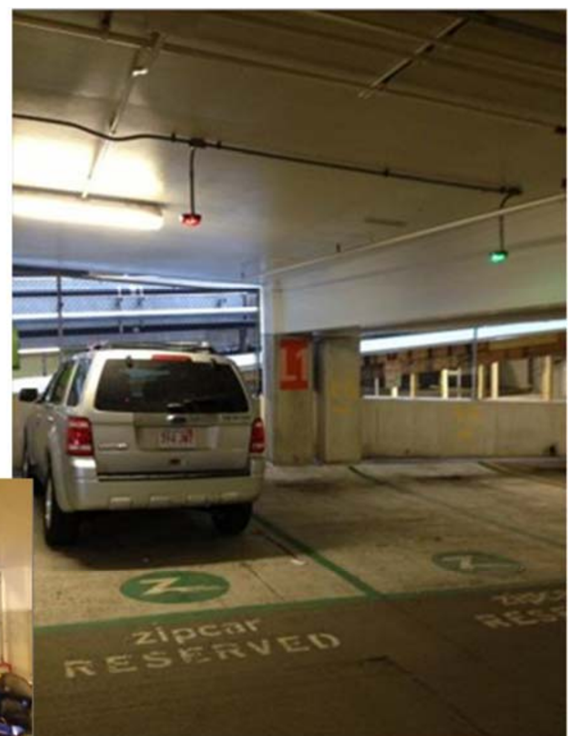
Boston Children's Hospital, the #1 ranked Children's hospital in the county, looked to Q-Free to provide them with a parking guidance system for one of their highly frequented garages. We were approached in 2012 install a level counting parking guidance system for the 9-level parking garage. In 2013, Q-Free was approached again to expand the system to include single space monitoring for the basement level of the garage.

Specifics for this project include:

- 2 Phase installation with phase I completed in 2012 and phase II completed in 2013
- Mix of level counting & single space monitoring
- 1 Custom parking guidance signs
- Custom designed variable message roadway signs
- Wireless system communication
- 20 Ultrasonic directional sensors for level counts
- Over 40 loops and 5 area controllers for surface counting
- Over 25 single space sensors for single space monitoring for general, ZIP CAR, and handicapped spaces on the basement level
- Central server networked over the customer network
- Design and implementation by Q-Free

Picture 4 Site Pictures Children's Hospital





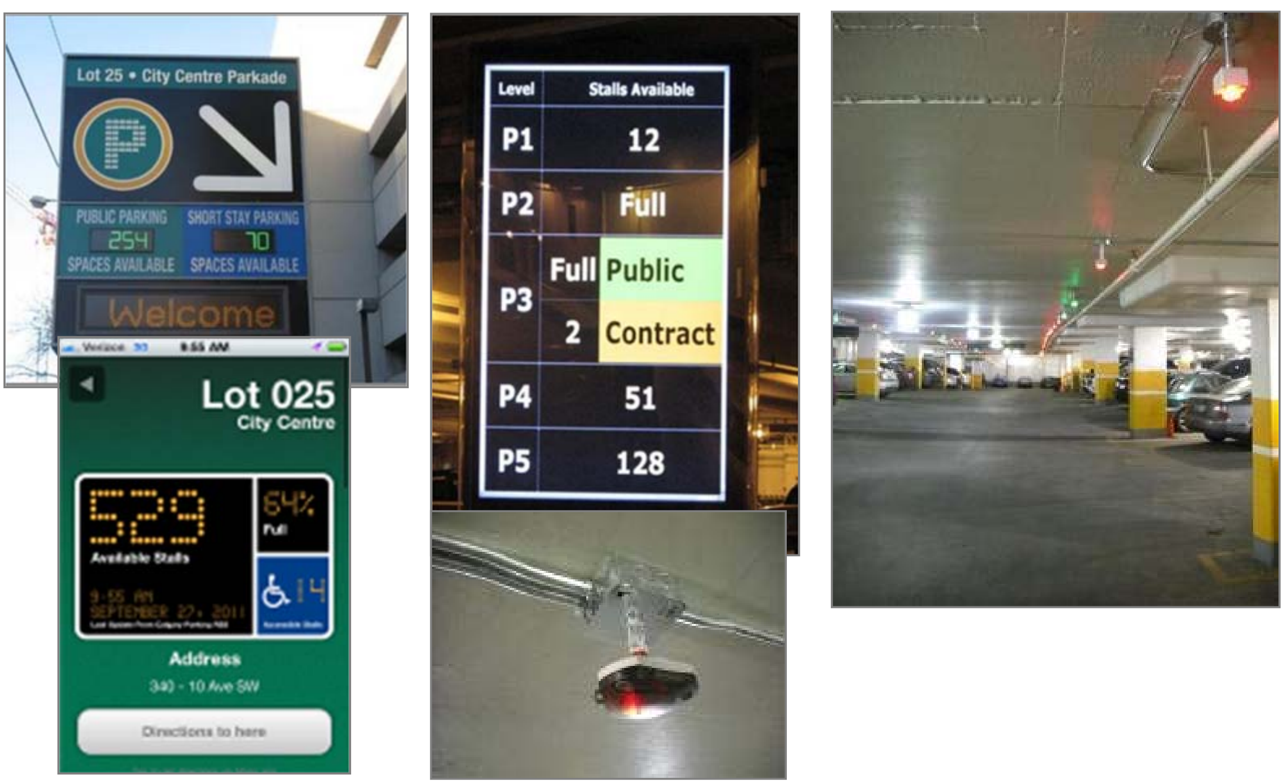
3. CALGARY PARKING AUTHORITY – CITY WIDE PARKING GARAGES, AB

This city-wide parking guidance system was installed based on wireless system communications. Phase I included a mixture of level counting (for hourly users) and single space monitoring (monthly or contract users). Phase II saw the migration to single space monitoring for all 7 City parking garages and was completed in 2011. This city-wide PGS system manages approximately 5,500 parking spaces. The first parking garage (Lot 60 garage) in Phase I was awarded & installed in the 3rd/4th quarter of 2010, with the installation of Phase II for the last garage (Lot 28) completed in the 3rd quarter of 2011. A 3-year warranty on the complete system was provided.

Specifics for this project include:

- Over 4,000 single space sensors in 7 city garages
- Loop counting for 1 surface lot
- 13 dynamic roadway signs with variable message displays
- 7 City garages/lots networked together
- Over 75 wireless control panels and count points
- Integration of Plasma TVs used as space availability signage
- Client/Server central system with web/mobile app interface
- Design, implementation, and installation by Q-Free TCS
- Two phase approach completed in 3rd quarter of 2011

Picture 5 Site Pictures Calgary Parking Authority



4. CITY OF OTTAWA – OTTAWA, CANADA

In 2013, the City of Ottawa contracted Q-Free to install customized Parking Guidance Systems (PGS) for two of their busiest downtown parking garages. Q-Free provided a mix of single-space monitoring and level-counting PGS equipment which included custom-designed dynamic and static message signs. In 2015 Q-Free was contracted again and asked to provide a single space guidance system to the newly renovated Glebe Garage, which is in one of Ottawa's most eclectic shopping districts. 2017, saw the inclusion of a PGS system for the prestigious City Hall Garage, with the installation for a 5th garage at Gloucester Street finished in 2018.

<u>Specifics for this project include:</u>

- Over 4,000 spaces monitored
- Wireless Mesh network
- Custom designed dynamic and static signage
- Mix of ultrasonic and single-space sensors
- Master and level signs displaying parking availability throughout the garage
- Real-time parking information through Visual Control Center
- Central PGS server for all garages

Picture 6 Site Pictures City of Ottawa

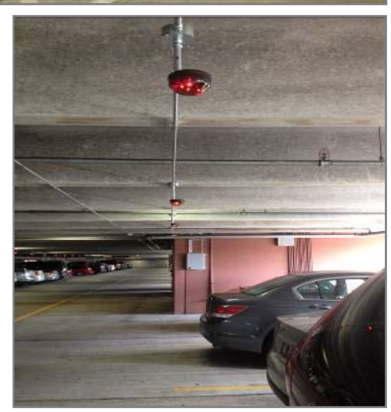
5. FLORIDA HOSPITAL - ORLANDO, FL

Q-Free TCS was contacted in 2013 to provide a custom designed single space monitoring system for the Florida Hospital parking garages. This two-phase approach project involved the provision of over 2,500 single space sensors, custom design wayfinding and VMS signs for two hospital parking garages. Phase I was completed in the fall of 2014, with the expansion for Phase II (another parking garage with an additional 1,600 single space sensors) completed in 2016. Since then, Q-Free has provided counting systems for two additional garages.

Specifics for this project include:

- Over 4,100+ single space sensors in three parking garages
- Level/facility count for two additional garages
- Wireless system communication
- Custom designed wayfinding and VMS signage
- Client/Server central system
- Design and implementation by Q-Free TCS
- Two phase approach to be completed spring of 2016

Picture 7 Site Pictures Florida Hospital



5. GO TRANSIT METROLINX GTA, ON

GO Transit Metrolinx first approached Q-Free to provide a combination of Single Space Monitoring and Level Counting for the newly erected 5 level parking structure in Oakville, ON. This 1,600-space facility was equipped with a Q-Free designed PGS system in the fall of 2012. In 2013 GO Metrolinx added PGS Systems for the Ajax, Aurora, Erindale and Clarkson GO station garages resulting in Q-Free TCS monitoring over 20,000 parking spaces. Q-Free TCS was contracted to provide PGS systems for the Hamilton, Burlington, and Bloomington GO sites in 2016, and again in 2018 to provide systems for the GO Cooksville station.

Specifics for these projects include:

- Over 10,000 TUS 100 single space sensors offering regular 3-color status lights as well as Handicap or accessible space monitoring.
- Over 100 USDS directional sensors for level count monitoring both in single and cluster design as required
- Dynamic LED signs in both English and FRENCH displays. Master Panel, Roadway and Level count signs
- User friendliness and high levels of accuracy has given Q-Free a total of 9 GO transit garage systems

Picture 8 Site Pictures Go Transit Station Garages

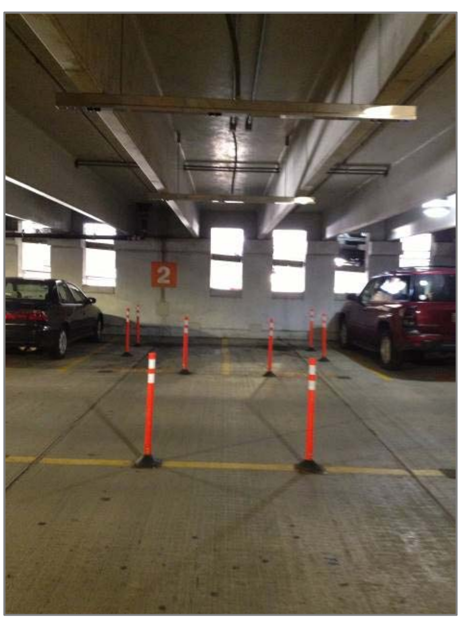
6. JAMES MADISON UNIVERSITY – HARRISONBURG, VA

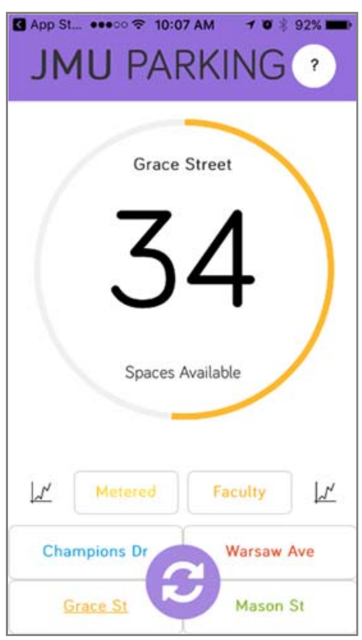
2007, Q-Free TCS was first approached to provide a Parking Guidance System for one of the mixed-use campus garages. The first installation included a level count system for designated parking groups as well as custom designed wayfinding signs, making parking easier for faculty, staff, and visitors. Since then. Q-Free TCS has provided PGS systems for (4) additional garages, in a multi-phase approach. Our open API tool also enabled the launch of a student created mobile app, which connects students, faculty & visitors on-the-go to parking availability information.

Specifics for this project include:

- Customized PGS systems for (5) mixed use campus garages
- Ultrasonic directional sensors strategically placed at entry/exit and the internal ramp system for level counting. Ultra-sonic single space sensors suspended at the entry to each ADA space addition to track separate from the general inventory.
- Q Free directional sensors capture vehicles entering and exiting a zone or level using A-B logic and adjust the counts in Real Time pushing this data to the intelligent signs at Garage and Campus level.
- Wireless system communication
- Custom designed way finding & space availability signage branding JMU requirements. The LED and VMS displays are proprietary to Q Free software requirements for communication.
- Central "scalable" server networked over the customer network allowing for unlimited additional Parking facilities, zones, or areas.
- Design and implementation by Q-Free TCS working with a customer appointed Electrical Contractor
- Web interface: https://www.jmu.edu/parking/faculty-staff/space-counts.shtml pushes the counts to a smart phone application showing Parking availability. This App was a product of JMU
- Parking App on the Apple and Google Platform: JMU Parking App
- 2019 saw the award of the CONVOCATION HALL Garage due to be completed in Q3 2019

Picture 9 Site Pictures James Madison University





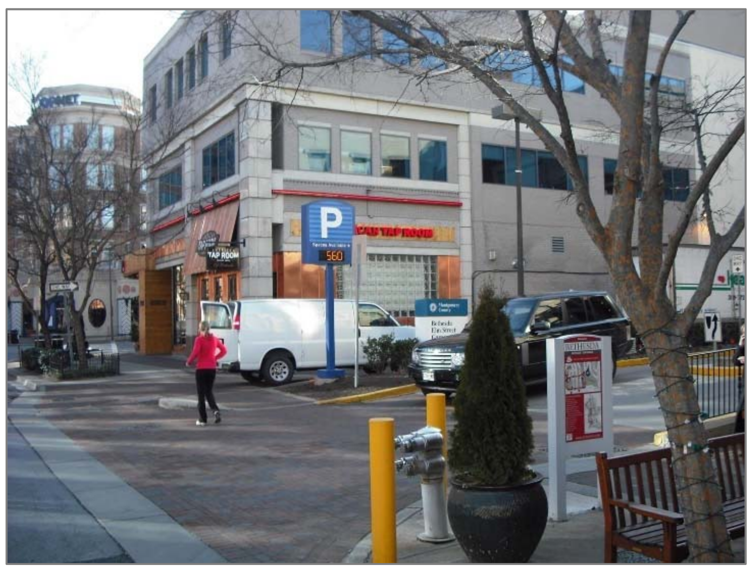
7. MONTGOMERY COUNTY, MD

In 2009, Q-Free TCS was first approached to install a battery powered single space monitoring system in one of the busy downtown garages. Since then we have installed systems in three additional downtown garages. Also provided were custom designed way-finding signs strategically placed at decision making points. Montgomery County uses the space availability information provided by the software API, and exports it to a municipality run website. We currently have an open non-committal agreement with Montgomery County for the provision of indoor parking guidance equipment for any additional downtown garages as it is required.

Specifics for this project include:

- Customized PGS system for (4) highly frequented parking garages
- Over 3,000 battery operated single space sensors
- Wireless system communication
- Custom designed way finding & space availability signage
- Central server networked over the customer network
- API to customer managed website https://www2.montgomerycountymd.gov/gisparking/parkingpublicmap.htm
- Design and implementation by Q-Free working with a customer appointed Electrical Contractor

Picture 10 Site Pictures Montgomery County



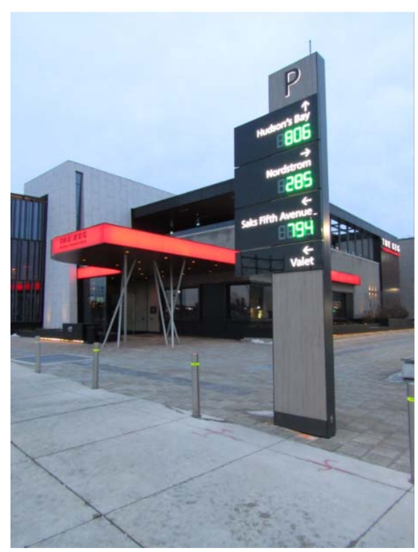
8. SHERWAY GARDENS – TORONTO, CANADA

Sherway Gardens is a large shopping mall located in the greater Toronto area (GTA). The garage has recently under gone renovations, constructing three new parking decks containing a total of 2700 parking spaces. In 2015, Q-Free was contracted to install a Parking Guidance System (PGS) inside the properties North, East, and South parking decks. The PGS is comprised of Single Spaces Sensors (SSS) detecting individual space occupancy for every covered parking space. Ultrasonic Directional Sensors (USDS) located on ramps detect vehicle entries and exits for the uncovered roof levels. LED Displays installed at garage entry points and ramps display individual floor availability. Large LED Master signs are also located along a ring road that spans the entire perimeter of the property. The LED Master signs help to direct traffic to the parkades with the most available spaces.

<u>Specifics for this project include:</u>

- A mixture of SSS and USDS monitoring availability of covered and uncovered parking spaces
- Large LED Master Signs located across the property directing traffic between parkades
- Centralized PGS server located on the property which provides real time parking counts and customizable reports

Picture 11 Site Pictures Sherway Gardens



9. SHOPS AT DON MILLS – TORONTO, CANADA

Shops at Don Mills is an outdoor shopping complex in the Greater Toronto area (GTA). In 2016, Q-Free was contracted to install a Parking Guidance System (PGS) inside the properties multi-level parking structure. The PGS consists of ultrasonic directional sensors (USDS) mounted from the ceiling at all garage entry/exit and level transition points. The USDS monitor traffic entering and exiting each floor. The data recorded is viewable in real-time by property staff using Q-Free's visual control center software. The customers 3rd party LED signs were integrated into the Q-Free PGS system. These LED signs, located at decision points along the properties roadways, direct traffic to the garage. Once at the garage, visitors are greeted by displays showing each floors parking space availability.

<u>Specifics for this project include:</u>

- USDS monitoring the space availability of each level
- Integration with 3rd party LED displays in custom designed wayfinding signs around the campus
- Centralized PGS server located on the property which provides real time parking counts and customizable reports

Picture 12 Site Pictures Shops at Don Mills


10. SQUARE ONE SHOPPING CENTRE – MISSISSAUGA, CANADA

The Square One Shopping Centre is the largest shopping center in Ontario and listed as one of Canada's top 10 malls. In 2013 Q-Free was contracted to provide a Parking Guidance System (PGS) at Square One to help direct traffic and reduce congestion. Ultrasonic Directional Sensors (USDS) were utilized to provide level counting systems for the properties 3 garages, and induction loops were used to monitor their 5 surface lots. The counts provided by the parking equipment relay to various roadway LED signs located around the property. In 2016 Q-Free was contracted to expand the system into 2 newly constructed garages and 3 surface lots. The expansion also ushered in the integration of an online interactive parking map using Q-Free's API Tool. The parking map provides real time parking updates that patrons can check before arriving.

<u>Specifics for this project include:</u>

- A combination of USDS and induction loops monitor covered and uncovered parking areas
- Wireless system communication
- Large LED roadway signs directing traffic to parking areas with the most available parking spaces
- Q-Free API Tool pushing parking data to the properties web based interactive marking map

Picture 13 Site Pictures Square One Shopping Centre

F. Project Compliance Matrix

Requirement	Q-Free Answer
A. Contractor shall perform work between 7:30 AM – 4:00 PM, Monday through Friday.	Q-Free is compliant with this requirement.
B. Vehicle counting technology that can be installed in parking garages or surface lots that detects vehicles upon entry and exit to facilities or zones within facilities in order to provide accurate counts of available spaces within each facility or zone. 1. This technology needs to be capable of being relocated to alternate locations within facilities in order to adjust to future changes in parking allocations. 2. Inductive loops are not desirable as they require cutting into precast concrete thus compromising the structural integrity of parking garages.	The proposed ultrasonic directional sensors and ceiling mounted and suspended over drive lanes (entry and exit) and can be placed on the internal ramp system. We use the "proprietary" cluster design of 2 or 3 USDS sensors to cover a wide span found in a bi-directional ramp of up to 24 ft. in width without the use of further delineation. 1. Mounted via thread rod makes the adjustment or movement to a different are very easy. 2. Q Free agrees with this statement and the mounting of the USDS sensors overhead avoids expensive X-ray to avoid rebar, post tension cabling and compromise of the membrane
C. Technology that is capable of monitoring the occupancy of individual parking spaces within facilities and incorporating that information into the overall occupancy of those facilities. This technology or technologies should be capable of counting individual spaces within both parking garages and surface lots.	Q Free systems are scalable and if additional areas both indoor and outdoor are required, the additional counting equipment can be configured in the software as additional zones, levels, spaces, etc.
D. Electronic signage that is capable of displaying current occupancy within facilities in real-time in order to guide drivers to facilities with open parking spaces. This signage should also include the capability to scroll messaging as needed in order communicate pertinent information to drivers.	The Q-Free proposed signage includes VMS (variable message system) panel that can be used to display pre-determined messages set in the software schedule. These messages can be based on occupancy levels or status of garage Example: Garage A is FULL please go to Garage B

<table>
<tr><th>Requirement</th><th>Q-Free Answer</th></tr>
<tr><td>E. Provide the complete specifications of all new equipment and operational components for a turn-key installation.</td><td>Q Free has included user manuals and data sheets for all included components within this submission. Please refer to Appendix A for additional information.</td></tr>
<tr><td>F. The various technologies employed need to communicate seamlessly in order to provide real-time information about facility occupancy to drivers. Where possible, communication between components should be achieved wirelessly in order to reduce the cost of installation and increase flexibility with regards to placement. A mesh network is preferred.</td><td>Q Free systems come with a DIGI Mesh network designed proven at JMU with previous installations and hundreds of other installations in North America and across the globe. Q Free devices work through the mesh network back to the gateway/s connected to the client network.</td></tr>
<tr><td>G. A software application that communicates with the various pieces of technology located across the campus, provides information in real-time about parking availability and includes the status of each piece of equipment included in the system.
The software should include a customizable graphical user interface that provides a visual representation of the signage and equipment across the campus as well as the current status of the pieces of equipment in specific facilities.
Users must have the capability to correct counts of open spaces remotely via the graphical user interface.
The software should include reporting capabilities that allow users to view, generate and store occupancy reports.
The software should have the capability to send alerts via email. The GUI needs to support sending and creating custom messages for variable message signs.
Describe licensing. If licensing of the software is based on number of users or screens, etc. describe the models used to obtain numbers both for current and future usage.</td><td>Q Free provides a customized “dashboard” in the VCC (Visual Control Center) showing all pertinent information.
The customizable graphic user interface provides a visual representation of all equipment in the system as well as occupancy in % and numbers, health status of the devices (alarmed and message sent to first line maintenance if desired).
Counts of open spaces can manually be adjusted in the Q-Free VCC software.
The VCC tool bar will take the customer to all required statistical reports, actions such as changing occupancy parameters, sign messages etc.
The Q-Free VCC software can send email alerts based on predefined business rules. Custom messages for the variable message signs can easily be created.
JMU already owns the Q-Free PGS central server. Any additional new garages/lots will only require a one-</td></tr>
</table>

Requirement	Q-Free Answer
	time license fee to set them up in the system. There are no ongoing licensing fees in the Q-Free software system.
H. An open web API module that allows the occupancy information generated by the system to be shared with websites and mobile applications in order to port real-time parking availability information to the department's website and an anticipated future mobile application for Android and iOS smart phones.	Q Free includes an OPEN API with our solution. This allows the counts to be pushed to a smart phone, web site to third party is the selected file type and frequency desired. This already existing open API was used by the student created JMU Parking Finder App using the Q-Free available space count information for the Champions Drive, Warsaw Ave, Grace Street, and Mason Street Decks.
I. All system hardware and software needs to be able to be maintained by department personnel and vendor tech support needs to be available via remote access.	Q Free provides remote support whenever needed via remote access. Comprehensive training and first line system maintenance is provided during the training and commissioning phase prior to turn over to owner.
J. Consistency and stability of the hardware and software – as well as rapid correction of system failures – are critical to JMU. 1. Describe the maintenance philosophy including frequency of updates as well as the approach to obtaining and completing updates. 2. Describe your ability to respond to emergency situations to include average response time, costs associated with responding to emergency situations (to include weekend, nights, and holidays). Include method of communication for emergency situations. 3. Describe capabilities for remote support and describe what access to accounts and systems is required. Describe the locations from which this activity would take place. 4. Describe any maintenance options/tiers and whether they vary in cost by time of day, response time, etc.	The Q-Free system is extremely stable and requires minimal maintenance customer interference. The first PGS system by Q-Free has been installed 12 years ago with minimal service required. Over the years Q-Free has installed systems in 4 additional garages including replacement of the originally installed system. The number of equipment replacements and service calls has been minimal. The Q-Free system has not had a critical system failure for the last 12 years. 1. Q Free strongly recommends the client enter a maintenance agreement at time of purchase to be performed 2 times per year to assure the longevity of the system. 2. Our local service partner will address any on-site repair work. This partner is well trained in the Q-Free products and can address any issues that require on-site personnel.

Requirement	Q-Free Answer
	• Standard hourly rates are: Mo-Fr 8 am to 4 pm: $160/hr. (1/2 hr min required & travel) • System has never critically failed so we have never had to provide after or weekend hour labor to address issues • Service must be directly scheduled with Q-Free at the provide service coordinator phone number 3. Remote support is provided by Q-Free engineers at the Q-Free Parking headquarters in Sudbury, MA. Remote access to the central PGS server is required, and already existing. 4. Q Free strongly recommends the client enter a maintenance agreement at time of purchase to be performed 2 times per year to assure the longevity of the system. Pricing to be discusses based on requirement.
K. All costs shall be exclusive of travel. Exception may be granted by JMU on a case-by-case basis. In the event an exception is made, contractors billing for travel-related expenses must be billed in accordance with the Commonwealth of Virginia's per diem allowance for lodging, meals, and incidental expenses at the time of travel.	Travel related costs are not included in our pricing submission. Travel related expenses will be billed in accordance with the Commonwealth of Virginia's per diem allowance for lodging, meals, and incidental expenses at the time of travel.
L. All services provided under this contract shall be by trained repair technicians and all work shall be performed in a workmanlike manner in accordance with the manufacturer's recommended equipment maintenance procedures. Submit all qualifications and certifications associated with the different systems.	Q-Free complies with this requirement.

G. Project Approach

G.1 Q-Free PGS Solution

The Q-Free solution is tried and tested, and combines well-known components with latest technology. This gives customers confidence that they are purchasing a trusted system that is high-performing and future-proof.

The system is developed and refined from our proven design philosophy based on four main value propositions; *accuracy*, *reliability*, *flexibility,* and *low maintenance*. The general aspect of the Q-Free design philosophy value propositions can be summarized as follows:

Accuracy – the system shall be correct and consistent, and provide fair treatment of all liable users.

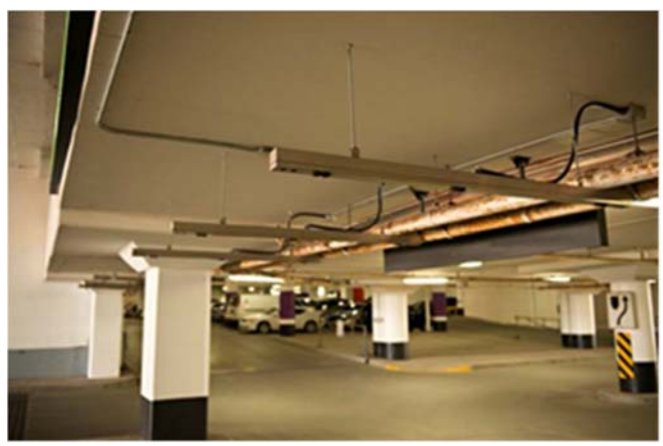
Reliability – the system shall be dependable for parking system operators as well as users under all varying applicable operating conditions.

Flexibility – the system shall be designed for the present and prepared for the future, with scalability and sustainability over the full life cycle in mind.

Low maintenance – the system shall use high quality components and simple mechanisms that allow for high automation rates with minimal manual intervention and a predictable maintenance schedule.

These value propositions ensure that the system maximizes the overall value for the PGS system owner through best performance and lowest possible costs.

G.1 Level Count Sensing Technology



In a Q-Free Level Counting installation, vehicle entry/exit at garage/level transition area entry/exits are monitored by overhead mounted Ultrasonic Directional Sensors (USDS). These sensors are suspended from ceilings at the counting points with threaded rod. Using A-B logic the ultrasonic beams are configured to identify the profile of a vehicle only and track the direction of travel (in-bound or out-bound). This calibration allows the system to not be “tricked” by pedestrians, carts, debris bicycles etc. The intelligence of the system allows for the tracking of wrong way traffic, meaning a vehicle entering an exit would be a “wrong way” count and automatically corrected in the software. Mounting these sensors to the ceiling gives Q-Free the advantage over competitive solutions which require saw-cutting loops into the parking deck thus requiring x-raying etc. These sensors can also easily be moved should traffic pattern change. This also provides an advantage over in-ground loops which must be re-cut and x-rayed again.

In the design provided, “cluster” design USDS configurations are proposed. This patented design is used in extra wide (20’+) lanes on entries/bi-directional ramps. A series of 3-USDS sensors are placed across the span to cover all possible transactions. See data sheet in the submission for various scenarios. Utilizing the Q-Free "cluster" design eliminates the need for lane delineation on the ramps and the additional use of flexible posts, bollards, etc.

Each group of USDS sensors are BUS cabled to a communication enclosure (CP) on the nearby walk or pillar where they receive power and communication. Low voltage 24V power supplies drive the sensors and we have a wireless modem for communication to the server gateway on site. All cabling within the system is low voltage and a 3-pair 18 AWG. Only the CPs and gateways require 120 VAC.

Our industry leading wireless design is KEY, as it eliminates the need for expensive cable and conduit running from each device to a server. This design has been deployed in some of the most highly sensitive government sites, as well as shopping centers, employee facilities, etc. around the world. Our wireless mesh networks guarantee a system uptime of 99.99% as each communication point is a receiver and transmitter at the same time. Each transaction is recorded in Real Time. To enhance the system design, user friendly intelligent signs are placed at key decision points.

G.2 Single Space Monitoring Technology for ADA/Specialized Spaces

For ADA/Specialized spaces at the James Madison University garage vehicle counting installations, Q-Free has provided single space sensors which are mounted at the end of each parking stall utilizing a raceway of uni-strut or EMT conduit carrying the required low voltage 2 pair 18AWG cable (power and communication). Our end of space installation provides higher visibility for drivers driving down a drive aisle. Our sensor detects vehicle presence by ultrasonic distance measurements. Ultrasonic distance measurement is highly accurate at nearly 100%, not triggered or false read by dust, nor dependent on parking orientation of the car (i.e. License Plate detection requires a license plate to be pointing out of the parking stall).

When a vehicle enters the parking space the sensor LEDs switch to red, and the change in occupancy is transmitted to a zone controller. Our sensors provide GREEN, RED, AMBER and BLUE LED status indication, as well as flashing capability. Typically, GREEN indication is used for general spaces, BLUE indication is used for ADA spaces, and AMBER indication is used for preferred and/or VIP spaces. In our experience too many colors lead to confusion of drivers that must remember color coding and associated space type. Our system design allows for individual space occupancy indication, i.e. every space has a LED indicator light versus some of our competitors having an indicator light for multiple spaces in the middle of the drive aisle. In our experience the "multi-space light middle of drive aisle" approach produces confusion as to the purpose of these lights along with the possibility of multiple cars driving down the same aisle with only a single space available.

If preferred, the RED status can also be turned off when a vehicle enters the space, as some customers prefer only availability indication. This was the request for a recently completed large project for a Disney World garage in FL.

The individual sensors are cabled together in a bus configuration with a maximum of 32 sensors making up a bus run. Each bus run meets at a NEMA rated enclosure that contains power supplies and the Q-Free zone controller. 2-Pair of 18 AWG low voltage cabling to the zone controller in the single space communication enclosures is required. These communication enclosures communicate wirelessly and need 120 VAC.

G.3 Surface Lot Counting

G.3.1 ParQSense Smart Outdoor Sensors

The ParQSense Smart Sensor is the latest development in on/off-street parking monitoring from Q-Free. Typical applications are on/off-street monitoring for public, private lots/spaces, Smart City Initiatives, etc.

The Q-Free ParQSense Outdoor Sensor is a battery-operated parking space sensor designed to be installed into the ground in the middle of each outdoor parking spot, and emits radar and magnetic pulses monitoring the designated parking space. Combining multiple sensing technologies ensures maximum detection accuracy. The installation process is easy and expected to take about 4 minutes for each sensor.

The ParQSense Outdoor Sensor sets a new standard for lifetime of outdoor sensors. A highly optimized ParQSense Outdoor Sensor architecture with a near-zero idle power consumption and the latest available battery technology, enables a record achieving of 10+ years lifetime.

The ParQSense Smart Sensors are connected to a **ParQSense Base Station** which functions as the centralized communication gateway for the ParQSense Outdoor Sensors. It is powered via PoE (Power over Ethernet) or solar power and is one of the most advanced ISM wireless gateways on the market.

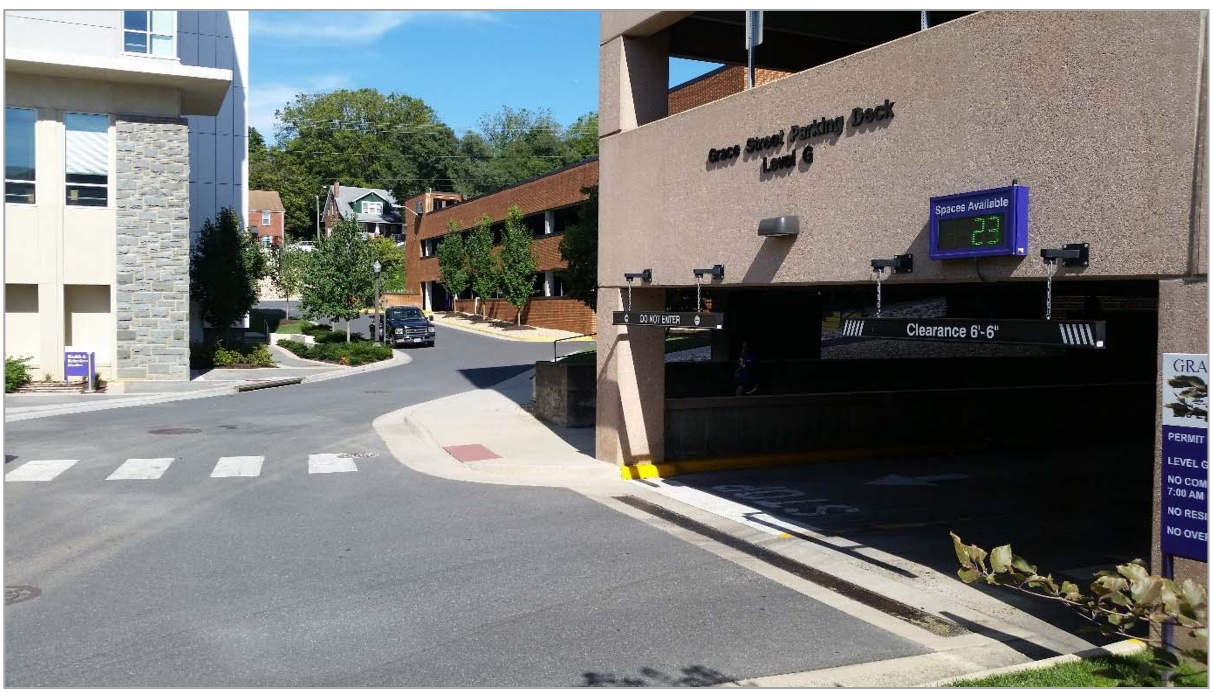
G.3.2 Inductive Loops

The inductive in-ground loops are used for counting entire surface lots. Loops are located at entry/exit points to the respective surface lot. The loops are installed by either creating a saw-cut channel, or are embedded into concrete or asphalt during the pour schedule. The loops cables are connected to a Loop Detector which is what can detect direction as well as tailgating patterns. The loop detector is connected to a PGS area controller collecting all the car count information. Should the area controller lose connection to the server, the loops will still operate if the communication enclosure is powered on. The detector/area controller has an internal memory so it will keep track of the vehicles that pass over the loops. Then once connection is restored it will update the software accordingly.

G.4 Space Availability Signs

ENTRY SIGNS

In previous projects, Q-Free has provided various sign designs for the existing Vehicle Count systems at the James Madison University.



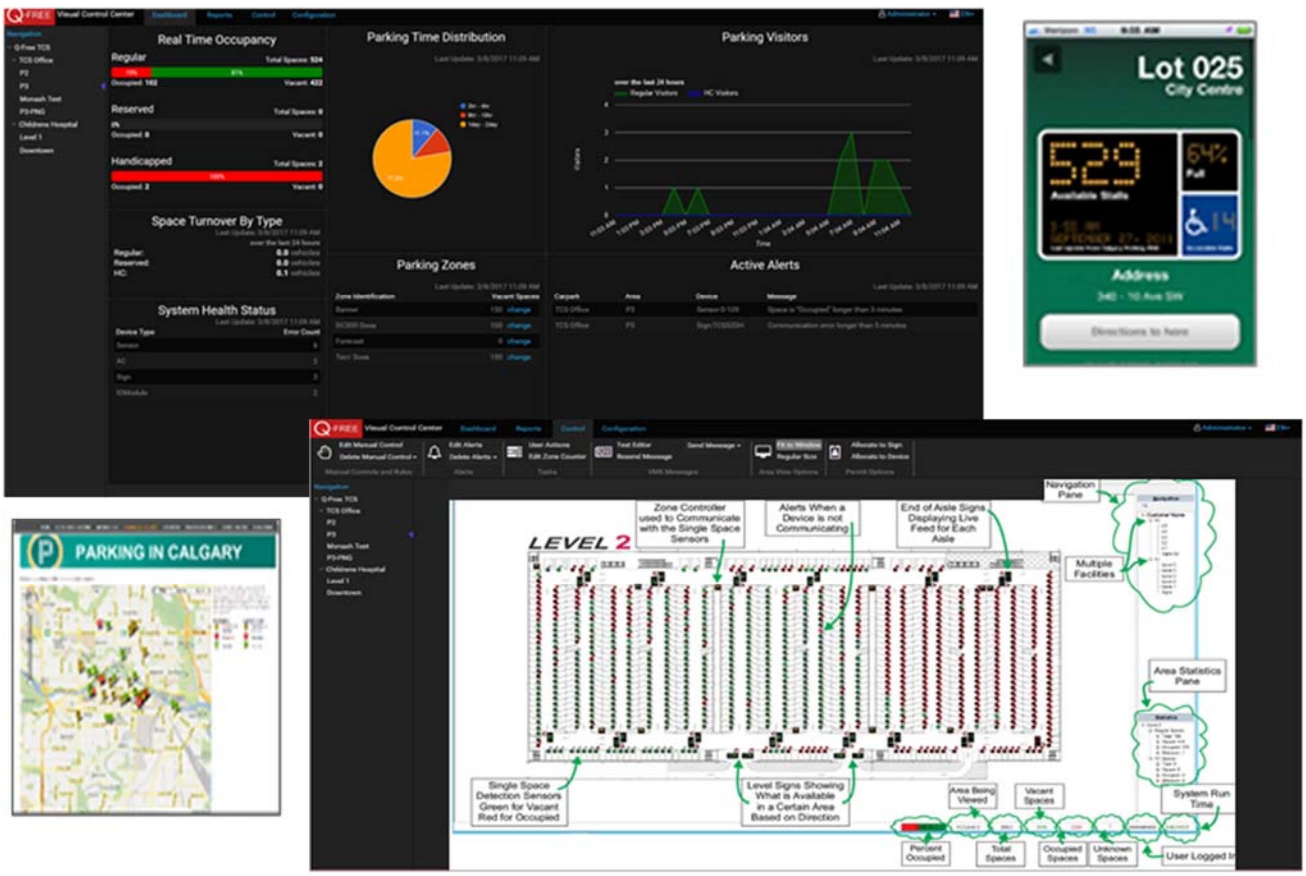
Any new signs will be cohesive with the existing sign design and may include:

- Standard displays with double stroke 7.5” LED character height that can display 4-digits, OPEN and CLSd in green LEDs and FULL in single stroke red 6” LEDs, as previously provided in existing signs

- Variable message display/s with the ability to display 2 lines of 4.4” text with up to 12 characters per line in amber color LEDs

G.5 Central PGS Software

Any additional garage/surface lot can easily be integrated into the existing PGS software. The existing software solution is client based web-enabled allowing for multi-user access and dashboard controls through a web-portal. Our PGS software has a customer friendly, windows based, easily maneuverable GUI interface, providing overall status information as well as the ability to generate statistics, and run reports. The dashboard overview provides easy access to the most important system data.



There are no 3rd party software packages in our proposal. All software is owned by Q-Free. Our system has an open API interface to 3rd party applications such as websites, apps, etc. Future expansion to other garages, facilities, roadway sign etc. is readily available.

Our software offers an unlimited expansion, so additional garages, surface lots, campuses, etc. can easily integrated.

G.6 Sample Overview Schematic

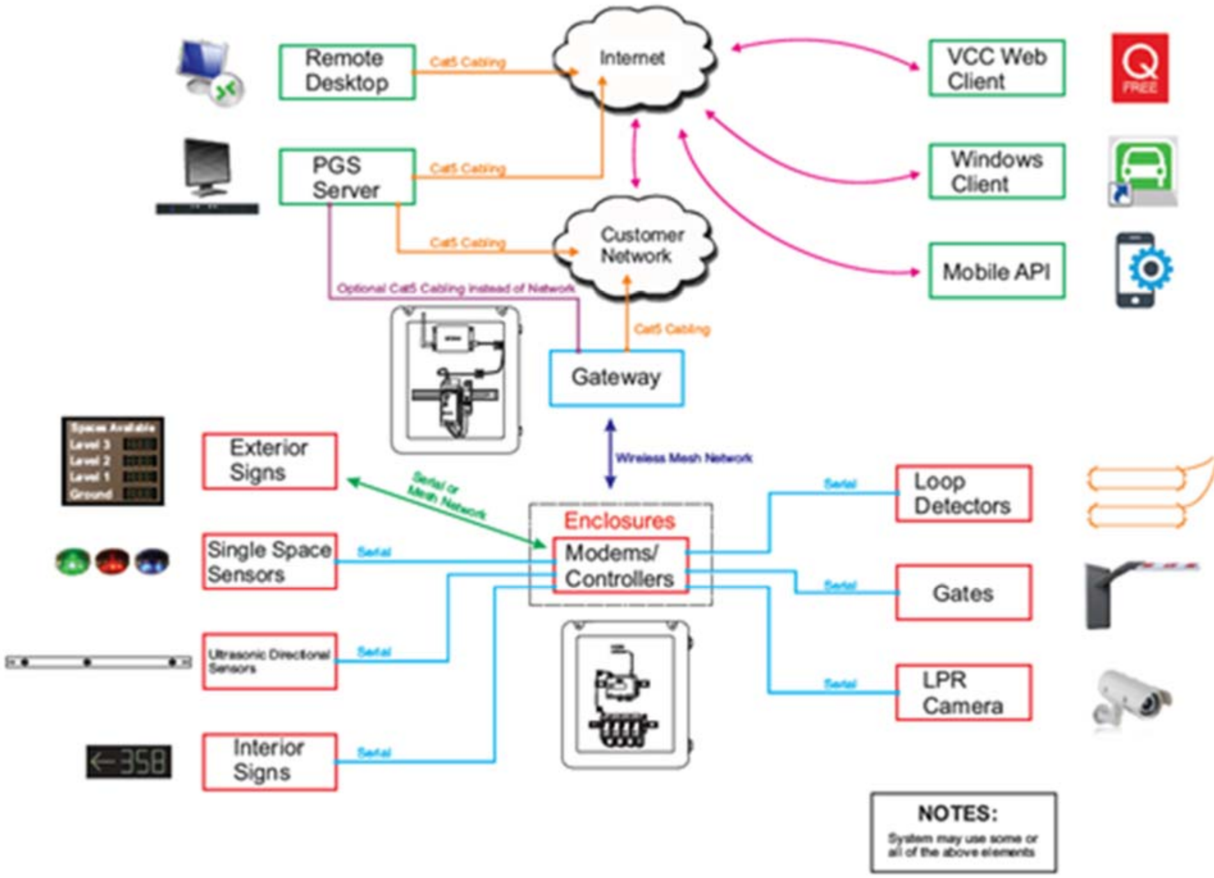


Figure 2 Sample Wireless Overview Schematic

G.7 Project Approach

Providing services in our competence, we feel we are a highly skilled group with experience in over 350 completed projects globally.

For the James Madison project, our project approach is as follows:

- The following tasks will be completed during the kick-off meeting/final site meeting:
  - Finalize any open questions or issues not already addressed;
  - Finalization of system design for the parking structure to ensure customer expectations and requirements are met;
  - Investigate current power locations to ensure required enclosures are in optimum locations to be less obtrusive and efficient;
  - Wireless propagation study may be done to ensure signal strength meets and exceeds requirements providing client with a reliable communication system; and
  - Using experience make suggested quantity and location suggestions for intelligent signage. Creating the optimum WAY FINDING and information platform for users.

- In our long experience with PGS systems, sign design confirmation and assembly usually determine the critical path;
- We will submit detailed project submittals within given timelines;
- The owner is required to sign off on the submittals;
- Once approved, all counting equipment will be assembled in its entirety, from our stock inventory at our headquarters in Sudbury, MA;
- The provision of the space availability signage cabinets is contracted to our approved sign cabinet manufacturer using Q-Free manufactured LED displays;
- Assembly of the counting components can be accomplished within 4 weeks after submittal sign off;
- The entry and interior signs can be ready for shipment 8-10 weeks after submittal sign off;
- The installation of the conduit, cabling and PGS equipment will be performed by a Q-Free appointed Electrical contractor, with Q-Free's remote support;
- Once the installation is completed, Q-Free will commission the site and train owner personnel on the equipment; and
- Any post installation related issues and warranty support will be addressed by Q-Free directly.

G.8 Installation Testing

- **Single Space Sensors (TUS-100):** Q-Free will test the start-up and connectivity of each sensor and confirm that each sensor is counting correctly and has a strong connection to the communication point.
- **Ultrasonic Directional Sensors (USDS):** Q-Free will test the start-up and connectivity of each USDS and confirm that each sensor is counting correctly and has a strong connection to the communication point.
- **Signs:** Q-Free will test the start-up and connectivity of the signs to the communication point as well as test the LEDs brightness on all signs.
- **Communication Equipment:** Q-Free will test the connectivity throughout the facility to make sure data is successfully being transmitted to and from the Parking Guidance Server. This includes the control and status updates on the Visual Control Center Software.

G.9 Project Timeline

MILESTONE PROJECT TASKS

- Notice to proceed
- Projects Submittals within 2 weeks after NTP
- Customer to sign off on project submittals within 1 week after receipt
- Delivery of counting equipment: 5 weeks after receipt of signed submittals
- Delivery of custom signage: 8-10 weeks after receipt of signed submittals
- Completion of electrical Installation of conduit & cabling: 7 weeks after receipt of signed submittals
- Completion Installation of counting hardware: 2 weeks after delivery on site
- Completion of Installation custom signage: 1 week after delivery on site

- System commissioning: immediately following completion of installation of counting equipment & signage for a duration of 3-5 days on site
- Customer training: 1-2 days during system commissioning
- System handover: 13-16 weeks after submittal sign off

G.10 Post Installation Customer Service

Support provided out of the Sudbury office consists of addressing hardware and software related issues. For software-related support Q-Free TCS staff will monitor and troubleshoot the system remotely. Our software team can remotely deploy software upgrades, reset sensors, and install patches to resolve the issue. If hardware support is required, Q-Free TCS will use trained local personnel to address any hardware issues during the duration of the contract.

G.11 Training Schedule

Q-Free TCS will provide the following training:

SOFTWARE/OPERATIONAL TRAINING (4 HOURS)

The software/operational training will consist of two (2) hour classes. To ensure effectiveness of the courses the trainer will include participants in each session. This can include asking questions and conducting a review of material at the end of each training session by asking questions for the participants of the subject matter. The class will include the following:

1. General Operation Training (2 hours – 1 session)

This class will include general use of the system software. Included topics for this training will be:

- Look & feel to the software
- General program navigation
- Secure logging in and out of system
- “User” level program functions
- Exporting data
- General troubleshooting
- General system manipulation
- & others

Session Materials: System software manual, notebook and writing utensils. Projector with software will be loaded as a training aid for participants to follow along with each function performed. All materials will be provided by Q-Free TCS.

2. Advanced Operation Training (2 hours – 1 session)

This class will be for the more advanced user, such as system administrators and more technical oriented users. The class will cover topics discussed in the General Operations Training in more detail as well as discuss more advanced functions. The topics discussed in this session will include:

- System manipulation
- Advanced system programming
- Working with the system

- Advanced data functions
- Outside system access
- Other advanced functionality within the system
- Software updates

Session Materials: System software manual, notebook and writing utensils. Projector with software will be loaded as a training aid for participants to follow along with each function performed. All materials will be provided by Q-Free TCS.

HARDWARE / MAINTENANCE TRAINING (4 HOURS)

The hardware/maintenance training will be composed of two (2) hour classes. To ensure effectiveness of the courses the trainer will include participants in each session. This can include asking questions and conducting a review of material at the end of each training session by asking questions for the participants of the subject matter. The class will be composed of the following:

1. General SYSTEM Functional Training (2 hours – 1 session)

This class will include general functionality of the system. This class will be for everyone so that they can better understand how the system works and how it is best used. This class will cover the following topics:

- General system functionality
- How a system works
- What a system is used for
- System benefits
- General hardware overview
- What each piece of a system is called and its function

Session Materials: General hardware training manual provided to all participants. A system overview will also be provided so the participant can better understand the layout of the system. All materials will be provided by Q-Free TCS.

2. Hardware Training (2 hours – 1 session)

The purpose of this course will be to train on the use of the hardware within the system. The topics included will be:

- Sensor hardware
- Controller hardware
- All other hardware

Session Materials: General hardware training manual provided to all participants. In addition to the general hardware training manual will be datasheets and training books for each piece of hardware. This will allow for better understanding of each system component. All materials will be provided by Q-Free TCS.

If additional training beyond the suggested training schedules is required, it will be provided remotely at no charge by Q-Free TCS.

H. System Hardware Breakdown

The proposal is the recommended system design based on a typical garage as currently installed at the James Madison University:

H.1 Vehicle Count System for a Typical Garage

ADA SINGLE SPACE SENSOR SYSTEM:

QTY	PART#	DESCRIPTION	UNIT COST	TOTAL COST
33	**HC TUS-100**	**ADA Single Space Sensors:** • Smart design located at the end of each ADA parking space for higher visibility; • Measuring vehicle occupancy through ultrasonic distance measurement; • Occupancy status indicating LEDs: o ADA spaces units with blue status for available ADA space and red status for occupied space provided (includes 1 spare unit/s). • RS-485 multi-drop communications to area controller; and • Max. mounting height 3 m.	**$65.00**	**$2,145.00**

3	**SS-CP**	**Communication Enclosures:**
		All components for local network wireless clusters connected to communication points (CP):
		• Single space communication point enclosure provided including:
		  o Single space zone controllers:
		• Configured to manage inputs from all facility single space sensors;
		• Monitors single space sensors, maximum 96 single space sensors per area controller (3 bus lines);
		• Bus line maximum cable length 100 meters;
		• Total quantity depending on floor plan layouts;
		• Offline operation if communication to server fails;
		• Wireless communication chip & antenna;
		  o Peripheral equipment (i.e. power supplies, etc.).
		• Equipment pre-configured in 18” x 16” x 8” NEMA 4 PVC indoor enclosure.
			$1,435.00	**$4,305.00**

ULTRASONIC DIRECTIONAL SENSORS FOR LEVEL/ZONE COUNTING:

QTY	PART#	DESCRIPTION	UNIT COST	TOTAL COST
24	**USDS**	**Ultrasonic Directional Sensors:** • Three (3) unit cluster configuration at wide garage/level entrances/exits and single unit standard configuration at standard width garage/level entrances/exits provided; • Built in central processing unit to control sensor logic; • Built in self-test diagnostics; • Maximum mounting height 8 ft; • Directional counting of vehicles; • Maximum effective speed 12 mph; • 24 VDC low voltage; • Output: plus-minus pulses and/or serial interface via RS-485; • Max. 24'/Delineation required for optimal cluster counting accuracy; • Max. 12'/Delineation required for optimal standard counting accuracy; • Dimensions: 74" L x 2.75" H x 2.5" W; and • Weight: 15.5 lbs. *NOTE:* • *Patent pending;* • *Proximity of vehicles under sensor can skew accuracy;* • *Spacing of sensors depends on garage floor layout and is customized per installation; and* • *Q-Free is not responsible for accurate system counts if proper lane delineation, if required, is not implemented, and maintained by others.*	**$885.00**	**$21,240.00**

6	**USDS-CP**	**Communication Point Enclosures:**
		All components for local network wireless clusters connected to USDS communication points (CP).
		• Ultrasonic directional sensor communication point enclosures provided including:
		  o Wireless communication equipment (i.e. modems, power supplies, etc.);
		  o Power supplies for USDS and/or signs; and
		  o Peripherals, etc.
		• Equipment pre-configured in 14" x 12" x 6" NEMA 4 PVC indoor enclosures.
			$874.00	**$5,244.00**

ADDITIONAL COMMUNICATION EQUIPMENT:

QTY	PART#	DESCRIPTION	UNIT COST	TOTAL COST
1	**RP**	**Repeater Communication Point Enclosure:** All components for local network wireless clusters connected to repeater communication points (RP) to ensure proper wireless communication. • Repeater point enclosure provided including: o Wireless communication equipment (i.e. modems, power supplies, etc.) • Equipment pre-configured in 14" x 12" x 6" NEMA 4 PVC indoor enclosures	**$795.00**	**$795.00**

1	**GW**	**Gateway Enclosure:**
		All components for local network wireless clusters connected to wireless gateway (GW).
		  o Wireless gateway enclosure provided including:
		    ▪ Wireless communication equipment (i.e. gateways, power supplies, etc.).
		  o Equipment pre-configured in 14" x 12" x 6" NEMA 4 PVC indoor enclosure
		
		NOTE: Wireless gateway (GW) must be physically connected to the existing customer network or directly to the PGS server.
			$1,242.00	**$1,242.00**

PERIPHERAL EQUIPMENT:

QTY	PART#	DESCRIPTION	UNIT COST	TOTAL COST
100	**DP**	**Directional Delineation Posts:** • Lane delineation equipment used to ensure proper vehicle counts; • Used to properly channel traffic under count sensor; • 36” standard post; • Includes two (2) reflector stripes; • Adhesive pads provided; • Installation by others; • Max. 24’/Delineation required for optimal cluster counting accuracy; and • Max. 12’/Delineation required for optimal standard counting accuracy. *NOTE:* • *Final quantity of required units is subject to site evaluation due to traffic flow concerns* • *Q-Free does not accept any responsibility for replacement of delineators if damaged or destroyed due to traffic flow. The delineators are placed to ensure proper system performance and are not designed to sustain extensive abuse due to traffic flow or abuse.*	**$49.00**	**$4,900.00**

GARAGE ENTRY SIGN:

<table>
<tr><th>QTY</th><th>PART#</th><th>DESCRIPTION</th><th>UNIT COST</th><th>TOTAL COST</th></tr>
<tr><td>2</td><td>L4MP/VMS</td><td>

Garage Entry Sign (Sample Sign Design):

Sample Sign Design

4-Level garage entry sign indicating space availability for each garage level at garage entrance/s;
VMS display for custom messages;
Approximate dimensions: 9’6” H x 48" W x 6" D;
Single sided sign; and
Total of (4) space availability displays per sign cabinet:

4-Digit double stroke seven segment display;
7.5” LED Character height;
Number of spaces and OPEN in green; and
FULL in 6” single stroke red LEDs.

Total of (1) variable message display per sign:

Ability to display 2 lines of 4.4” text with up to 12 characters per line;
Amber color LEDs.

White reflective vinyl lettering;
120 VAC;
Will match existing single corporate color if required.
Includes transport and installation on footers provided by others

NOTE:

</td><td>$28,707.00</td><td>$57,414.00</td></tr>
</table>

QTY	PART#	DESCRIPTION	UNIT COST	TOTAL COST
		• Sign price only for quoted sign dimensions, design and mounting. Changes to sign design, dimensions, mounting etc. will require a new quote. • Footers by others		
2	**PM**	**Double Post Mount**	**Incl.**	**Incl.**
2	**XBEE-SIGN**	**Wireless Communication Equipment for Sign Location:** • Includes 120 VAC wireless modem, antenna, peripherals, etc. for sign location	**$712.00**	**$1,424.00**

SOFTWARE LICENSE PER ADDITIONAL GARAGE FOR EXISTING PGS SERVER:

QTY	PART#	DESCRIPTION	TOTAL COST
1	**SL**	**Software License:** • Software license to integrate the new PGS equipment into existing PGS server. • Per new garage/surface lot *Note: Customer is responsible for network connection between garages.*	**$2,880.00**

INSTALLATION:

QTY	PART#	DESCRIPTION	TOTAL COST
1	IN	**Installation:** Inclusions: • Installation of CP enclosures; • Provision of 120 VAC power and conduit per local code to each CP enclosure; • Installation of all single space sensors to the ceiling; • Provision and installation of conduit with 4 conductor 18 AWG from CP to the first sensor on the bus line; • Provision and installation of conduit with 4 conductor 18 AWG between each sensor on the bus line; • Installation of directional sensors to ceiling with threaded rod and anchors Provision and installation of conduit with 6 conductor of 18 AWG from CP to the first directional sensor of each bus line; • Provision and installation of conduit with 6 conductor of 18 AWG between each directional sensor on the bus line; • Provision and installation of 120 VAC to entry sign locations; • Installation of AP gateway enclosure; • Provision and installation of 120 VAC power for gateway AP enclosure; Assumptions: • Install price is for work performed during standard hours; • Large sections of the garage can be blocked off during install; and • Work to be completed on a consecutive work day schedule (Mon.-Fri.). Work to be done on a day to day, week to week schedule. • Access to clean power within 50' of CP/gateway enclosures • Customer provided network connection at gateway location	**$91,429.00**

SYSTEM DESIGN, REMOTE PROJECT MANAGEMENT & SYSTEM COMMISSIONING

QTY	PART#	DESCRIPTION	HOURLY COST	TOTAL COST
22	DES	**System Design:** • Standard in-house system design; and • Includes documentation, drawings, and all related design work.	**$140.00**	**$3,080.00**
30	PM	**Remote Project Management:** • Perform all off-site coordination and remote project management to supply the PGS system.	**$150.00**	**$4,500.00**

32	SC	**System Commissioning & Training:** • Provide on-site technician for final commissioning support; • Perform all testing for PGS system; • Labor related expenses for up to (4) contiguous days during the system commissioning phase of the project included; and • Provide on-site user training on the PGS System as part of the on-site system commissioning efforts, including: o System overview; o Hardware training; o System troubleshooting; and o General system maintenance & repair. *Note:* • Travel related expenses not included and will be billed in accordance with the Commonwealth of Virginia's per diem allowance for lodging, meals, and incidental expenses at the time of travel • All additional services and supporting expenses will be billed per standard rates if delays are caused by customer or a third party.	**$140.00**	**$4,480.00**
1	**FR**	**Standard Freight & Handling**	**N/A**	**$6,672.00**

H.2 System Set-Up for Typical Lot Counting with ParQSense Sensors:

QTY	PART#	DESCRIPTION	UNIT COST	TOTAL COST
40	ITS-420	**ParQSense Smart Sensors:** • Dual detection smart in-ground sensors o Radar and magnetic field detection • Accuracy at 99%+ • Robust sensor for every environment • Quick installation of 4 min per sensor estimated depending on site conditions • Super long range proprietary RF communication to centralized communication gateways • Dimensions: 4 1/3" diameter; and • Weight: 1 lbs.	$134.00	$5,360.00
40	MP55	**Component Epoxy for Sensor Installation**	$47.00	$1,880.00
1	ITS-950	**ParQSense Base Station** • ParQSense Base Station/s for ParQSense Smart Sensors ▪ Proprietary RF network for sensor communication • Base stations centrally installed may service more than (1) lot based on location	$1,725.00	$1,725.00
1	ITS-950/CP	**Communication Enclosure for ParQSense Base Station** • Includes cellular modem & peripherals for cellular communication to central software system	$1,575.00	$1,575.00

SOFTWARE LICENSE PER ADDITIONAL LOT FOR EXISTING PGS SERVER:

QTY	PART#	DESCRIPTION	TOTAL COST
1	SL	**Software License:** • Software license to integrate the new PGS equipment into existing PGS server. • Per new garage/surface lot *Note: Customer is responsible for network connection between garages.*	$2,880.00

INSTALLATION:

QTY	PART#	DESCRIPTION	TOTAL COST
1	IN	**Installation:** Inclusions: • Installation and sealing of ParQSense Sensors; • Installation of ParQSense Base Station/Base Station Enclosure • Provision of 120 VAC power to ParQSense Base Station/Base Station Enclosure; Assumptions: • Install price is for work performed during standard hours; • Work to be completed on a consecutive work day schedule (Mon.-Fri.). Work to be done on a day to day, week to week schedule. • Access to clean power within 50' of CP enclosures	**$10,286.00**

SYSTEM DESIGN, REMOTE PROJECT MANAGEMENT & SYSTEM COMMISSIONING

QTY	PART#	DESCRIPTION	HOURLY RATE	TOTAL COST
16	DES	**System Design:** • Standard in-house system design; and • Includes documentation, drawings, and all related design work.	**$140.00**	**$2,240.00**
12	PM	**Remote Project Management:** • Perform all off-site coordination and remote project management to supply the PGS system.	**$150.00**	**$1,800.00**

24	**SC**	**System Commissioning & Training:** • Provide on-site technician for final commissioning support; • Perform all testing for PGS system; • Labor related expenses for up to (3) contiguous days during the system commissioning phase of the project included; and • Provide on-site user training on the PGS System as part of the on-site system commissioning efforts, including: o System overview; o Hardware training; o System troubleshooting; and o General system maintenance & repair. *Note:* • Travel related expenses not included and will be billed in accordance with the Commonwealth of Virginia's per diem allowance for lodging, meals, and incidental expenses at the time of travel • All additional services and supporting expenses will be billed per standard rates if delays are caused by customer or a third party.	**$140.00**	**$3,360.00**
1	**FR**	**Standard Freight & Handling**	**N/A**	**$1,101.00**

H.3 System Set-Up for Typical Lot Counting with In-Ground Loops

Option with (1) Combined Entry/Exit Location

QTY	PART#	DESCRIPTION	UNIT COST	TOTAL COST
1	LOOP-CP/2	**Communication Point Enclosures:** All components for local network wireless clusters connected to area controller/loop detector communication points: • Loop counting communication enclosure provided including: o Area controller: ▪ Configured to manage inputs from all loop counting locations; ▪ Manages all dynamic signage; and ▪ Power supply. o (2) Anti-tailgating loop detectors including calibration loop & harness per enclosure; o External antenna & cable; and o Wireless communication equipment (i.e. modems, power supplies, etc.). • Equipment pre-configured in 20” x 20” x12” NEMA 4X grey fiberglass enclosure.	$5,095.00	$5,095.00
1	GW	**Gateway Enclosure:** All components for local network wireless clusters connected to wireless gateway (GW). o Wireless gateway enclosure provided including: ▪ Wireless communication equipment (i.e. gateways, power supplies, etc.). o Equipment pre-configured in 14” x 12” x 6” NEMA 4 PVC indoor enclosure *NOTE: Wireless gateway (GW) must be physically connected to the existing customer network or directly to the PGS server.*	$1,242.00	$1,242.00
4	SC	**Pre-Formed Loops:** • Pre-formed in-ground loops provided.	$106.00	$424.00
20	BL-D	**Loop Sealant:** • Includes tubes of loop sealant for in-ground saw-cut loops.	$25.00	$500.00

SOFTWARE LICENSE PER ADDITIONAL LOT FOR EXISTING PGS SERVER:

QTY	PART#	DESCRIPTION	TOTAL COST
1	SL	**Software License:** • Software license to integrate the new PGS equipment into existing PGS server. • Per new garage/surface lot *Note: Customer is responsible for network connection between garages.*	**$2,880.00**

INSTALLATION:

QTY	PART#	DESCRIPTION	TOTAL COST
1	IN	**Installation:** Inclusions: • Installation of CP enclosures; • Provision of 120 VAC power and conduit per local code to each CP enclosure; • Saw-Cutting and sealing of in-ground loops • Provision of pathway and run loop leads from each loop to CP enclosure. • Termination of loop leads inside CP enclosures. • Provision and installation of 120 VAC power for gateway AP enclosure; Assumptions: • Install price is for work performed during standard hours; • Work to be completed on a consecutive work day schedule (Mon.-Fri.). Work to be done on a day to day, week to week schedule. • Access to clean power within 50' of CP enclosures/gateway • Customer provided network connection at gateway location	**$8,000.00**

SYSTEM DESIGN, REMOTE PROJECT MANAGEMENT & SYSTEM COMMISSIONING

QTY	PART#	DESCRIPTION	HOURLY RATE	TOTAL COST
16	DES	**System Design:** • Standard in-house system design; and • Includes documentation, drawings, and all related design work.	**$140.00**	**$2,240.00**
12	PM	**Remote Project Management:** • Perform all off-site coordination and remote project management to supply the PGS system.	**$150.00**	**$1,800.00**

16	SC	**System Commissioning & Training:** • Provide on-site technician for final commissioning support; • Perform all testing for PGS system; • Labor related expenses for up to (3) contiguous days during the system commissioning phase of the project included; and • Provide on-site user training on the PGS System as part of the on-site system commissioning efforts, including: o System overview; o Hardware training; o System troubleshooting; and o General system maintenance & repair. *Note:* • Travel related expenses not included and will be billed in accordance with the Commonwealth of Virginia's per diem allowance for lodging, meals, and incidental expenses at the time of travel • All additional services and supporting expenses will be billed per standard rates if delays are caused by customer or a third party.	**$140.00**	**$2,240.00**
1	FR	**Standard Freight & Handling**	**N/A**	**$1,011.00**

Option with (1) Separate Entry/Exit Location

QTY	PART#	DESCRIPTION	UNIT COST	TOTAL COST

2	**LOOP-CP/1**	**Communication Point Enclosures:**
		All components for local network wireless clusters connected to area controller/loop detector communication points:
		• Loop counting communication enclosure provided including:
		  o Area controller:
		    ▪ Configured to manage inputs from all loop counting locations;
		    ▪ Manages all dynamic signage; and
		    ▪ Power supply.
		  o Anti-tailgating loop detector including calibration loop & harness per enclosure;
		  o External antenna & cable; and
		  o Wireless communication equipment (i.e. modems, power supplies, etc.).
		• Equipment pre-configured in 20” x 20” x12” NEMA 4X grey fiberglass enclosure.
			$3,860.00	**$7,720.00**

1	**GW**	**Gateway Enclosure:**
		All components for local network wireless clusters connected to wireless gateway (GW).
		  o Wireless gateway enclosure provided including:
		    ▪ Wireless communication equipment (i.e. gateways, power supplies, etc.).
		  o Equipment pre-configured in 14” x 12” x 6” NEMA 4 PVC indoor enclosure
		
		NOTE: Wireless gateway (GW) must be physically connected to the existing customer network or directly to the PGS server.
			$1,242.00	**$1,242.00**

4	**SC**	**Pre-Formed Loops:** • Pre-formed in-ground loops provided.	**$106.00**	**$424.00**
20	**BL-D**	**Loop Sealant:** • Includes tubes of loop sealant for in-ground saw-cut loops.	**$25.00**	**$500.00**

SOFTWARE LICENSE PER ADDITIONAL LOT FOR EXISTING PGS SERVER:

QTY	PART#	DESCRIPTION	TOTAL COST

1	SL	**Software License:** • Software license to integrate the new PGS equipment into existing PGS server. • Per new garage/surface lot *Note: Customer is responsible for network connection between garages.*	**$2,880.00**

INSTALLATION:

QTY	PART#	DESCRIPTION	TOTAL COST
1	IN	**Installation:** Inclusions: • Installation of CP enclosures; • Provision of 120 VAC power and conduit per local code to each CP enclosure; • Saw-Cutting and sealing of in-ground loops • Provision of pathway and run loop leads from each loop to CP enclosure. • Termination of loop leads inside CP enclosures. • Provision and installation of 120 VAC power for gateway AP enclosure; Exclusions: • Painting & patching and asbestos or lead work; • Forced overtime work due to others; • Any allowances, GC work, demolition work, clean up & rubbish removal; • Required digging, trenching; concrete, asphalt, and protective bollards other than for in-ground loops; • Bonds, insurance, permits, engineering drawings, certifications, foundation design, inspection fees, etc.; • Lost revenue and traffic control. Assumptions: • Install price is for work performed during standard hours; • Work to be completed on a consecutive work day schedule (Mon.-Fri.). Work to be done on a day to day, week to week schedule. • Access to clean power within 50' of CP enclosures/gateway • Customer provided network connection at gateway location	**$13,715.00**

SYSTEM DESIGN, REMOTE PROJECT MANAGEMENT & SYSTEM COMMISSIONING

QTY	PART#	DESCRIPTION	HOURLY RATE	TOTAL COST

16	**DES**	**System Design:** • Standard in-house system design; and • Includes documentation, drawings, and all related design work.	**$140.00**	**$2,240.00**
12	**PM**	**Remote Project Management:** • Perform all off-site coordination and remote project management to supply the PGS system.	**$150.00**	**$1,800.00**
16	**SC**	**System Commissioning & Training:** • Provide on-site technician for final commissioning support; • Perform all testing for PGS system; • Labor related expenses for up to (3) contiguous days during the system commissioning phase of the project included; and • Provide on-site user training on the PGS System as part of the on-site system commissioning efforts, including: o System overview; o Hardware training; o System troubleshooting; and o General system maintenance & repair. *Note:* • Travel related expenses not included and will be billed in accordance with the Commonwealth of Virginia's per diem allowance for lodging, meals, and incidental expenses at the time of travel • All additional services and supporting expenses will be billed per standard rates if delays are caused by customer or a third party.	**$140.00**	**$2,240.00**
1	**FR**	**Standard Freight & Handling**	**N/A**	**$1,288.00**

H.4 Exclusions:

DESCRIPTION
Exclusions: **The following is excluded in this proposal:** • Required digging, trenching, coring, etc. other than for in-ground loops or in-ground sensors; • Any type of penetrating survey/initiatives to any structure required to install PGS equipment, signage, conduit, etc. • A/P connection/s to customer network; • Wireless interference; • Bonds, insurance, permits, engineering drawings, certifications, foundation design, foundation, delineation, etc.; • Traffic control; and • Lost revenue. *NOTE: All additional services and supporting expenses will be billed per standard rates if delays are caused by customer or a third party.*

H.5 Terms

DESCRIPTION
Terms: • Progress payment based on customer approved schedule. • This quote is valid for 180 days. • All prices in US Dollars. • All orders are binding upon proposal signing and/or PO reception at 100% proposal total. • Order will be confirmed within one week after receipt of signed proposal and deposit. Please allow 8-10 weeks for delivery from submittal approvals. • Purchaser is responsible for system maintenance upon project completion. *DISCLAIMER:* • *In the event of any discrepancy in pricing in this proposal, unit prices shall govern over total prices.* • *This document and information is property of Q-Free and is not intended for the use of any but the Business Entity to whom this proposal is addressed.* • *Warranty is void if watertight connectors are not utilized on all PGS equipment.* • *Q-Free is not liable for physical or monetary damages associated with onsite services, as well as installation or post installation of purchased equipment and/or system.* • *This proposal does NOT include a calculation of Sales, User, State, or Provincial Taxes. These taxes are the sole responsibility of the customer.*

All work is guaranteed to be as specified, and will be completed in a professional manner per standard practices. Any alteration or deviation from above specifications involving extra costs will be executed only upon written orders, and will become an extra charge over and above the estimate. All agreements contingent upon strikes, accidents or delays are beyond our control. Owner to carry fire, tornado, and other necessary insurance. Worker's Compensation insurance fully covers our workers.	**Acceptance of Proposal** – The above prices, specifications and conditions are satisfactory and are hereby accepted. You are authorized to do work as specified. Date of Acceptance: ____________________ Authorized Signature____________________ Name:____________________ PO #: ____________________

H.6 Warranty

Description

Limited Warranty:

- Q-Free ("Q-FREE") warrants to its direct customer ("Customer") that each Q-FREE product purchased by Customer (each, a "Product") will conform in all material respects to Q-FREE published specifications for such Product for a period of one (1) year from the date of Customer's completion of system commissioning or 14 months from date of Q-Free shipment, whichever incurs the earliest.
- Q-FREE provides warranty services during its normal business hours, and requires LogMeIn access for troubleshooting. If LogMeIn access is not provided, Q-FREE will charge for all phone & site services per Q-FREE' standard rates. Normal business hours are Monday through Friday, 8:00 am to 5:00 pm EST, excluding all US holidays. After hours phone support is available for an additional fee.
- Dell international warranty applies to all dell equipment for international sales where applicable.
- Q-FREE' sole obligation under the foregoing warranty shall be to repair or replace, at its option, any Product that fails to comply with the foregoing warranty and is returned to Q-FREE within the warranty period. Customer shall bear all shipping expenses to and from Q-FREE' facility. Labor expenses for diagnostics and/or repairs by Q-FREE will be billed at standard rates.
- This warranty extends only to the Customer, and does not cover Product components that are by nature expendable (i.e. batteries, lamps/bulbs, delineators, etc.) or any on-site labor or material costs associated with removal or replacement of Products or components thereof, nor supporting costs associated and scheduling of police, flagmen, permits, etc.
- In the event Customer purchases from or through Q-FREE materials, equipment or software manufactured by a party other than Q-FREE ("Third Party Products"), this warranty shall not apply to such Third Party Products and in lieu thereof Q-FREE shall use reasonable efforts to pass through to Customer any manufacturer's warranty regarding the Third Party Products.
- This warranty shall not apply if the Customer uses a Product in conjunction with any feature or device not approved in advance and in writing by Q-FREE.
- This warranty shall not apply if watertight connections for conduit, conduit fittings, and connectors are not utilized to protect electronic components.
- This warranty does not cover acts of God (i.e. lightning, earthquakes, flooding, etc.), vandalism, or unintended use or conditions of these products.
- This warranty does not cover any damage caused by the failure to provide a continuously suitable environment including, but not limited to: (i) neglect or misuse, (ii) a failure or sudden surge of electrical power, (iii) direct or indirect water exposure, (iv) improper air conditioning or humidity control, or (v) any other cause other than ordinary use.
- The foregoing warranty is in lieu of all other warranties, express or implied, including without limitation the implied warranties of merchantability, non-infringement, or fitness for a particular purpose, all of which are hereby disclaimed by Q-FREE. The United Nations Convention on Contracts for the International Sale of Goods shall not apply. Q-FREE does not warrant that the operation of any software will be uninterrupted or error free.
- Q-Free does not take any liability for (i) incorrect registration/detection or lack of such; (ii) under-/overcharging users for parking, or (ii) otherwise incorrect enforcement carried out based on output from the Product.
- In no event shall Q-FREE be liable for any loss of profits, loss of income, loss of revenue, or any indirect, special, punitive, or consequential damages arising out of this warranty or otherwise related to any Product
- The liability of Q-FREE for loss or damage arising out of or related to any Product, whether in contract, tort or under any other legal theory, shall in no event exceed 50% of the price paid by the Customer for the Product.

H.7 Customer Agreement Terms and Conditions

<u>Agreement Governs:</u> These terms and conditions (the "Agreement") govern your purchase of the parking guidance equipment including (without limitation) the hardware, software, and any documentation, data, and multimedia content (collectively, the "Equipment") sold to you by Q-Free ("Q-FREE"). This Agreement supersedes all terms and conditions provided by you in any document, including purchase orders accepted by Q-FREE. All other terms and conditions are invalid regardless of when delivered.

<u>Software:</u> With respect to the software that is part of the Equipment, you acknowledge and agree that (a) this Agreement permits you, the original user, to use the software solely in the device or computer it is embedded/installed in by Q-FREE (b) you may not transfer the software to another device, computer or storage media (c) you may not disassemble, reverse engineer, copy, sublicense, or distribute the software except as allowed in this agreement, (d) you may transfer the software to another person only if you deliver the device or computer it is embedded/installed in along with any documentation to that person without retaining any copies and that person complies with the terms of this agreement, (e) Q-FREE retains ownership of the software, and (f) the software contains confidential, propriety information that is a valuable trade secret of Q-FREE and is protected by copyright laws and you will keep such information strictly confidential.

<u>Limited Warranty:</u> The limited warranty applicable to the Equipment is set forth in Q-FREE' standard warranty terms, which accompany this Agreement and are incorporated by reference herein. All other warranties, express or implied, are hereby refused, including without limitation the implied warranties of merchantability, non-infringement, or fitness for a particular purpose.

<u>Governing Law:</u> This Agreement shall be constructed in accordance with the laws of Massachusetts, United States of America without regard to its choice of law provisions. The United Nations Convention on Contracts for the International Sale of Goods shall not apply. Any dispute arising out of or related to this Agreement shall be brought in a court of appropriate subject matter authority located in the Commonwealth of Massachusetts, and you hereby consent to the exclusive authority of such courts.

<u>Limitation of Remedies and Liability:</u> YOUR SOLE AND EXCLUSIVE REMEDIES FOR DEFECTIVE EQUIPMENT SHALL BE AS SET FORTH IN Q-FREE'S STANDARD WARRANTY TERMS REFERENCED ABOVE. IN NO EVENT SHALL Q-FREE BE LIABLE FOR THE COST OF PROCUREMENT OF SUBSTITUTE GOODS, LOSS OF PROFITS, OR FOR ANY OTHER SPECIAL, PUNITIVE, CONSEQUENTIAL, OR INCIDENTIAL DAMAGES, HOWEVER CAUSED, EVEN IF Q-FREE HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, WHETHER SUCH CLAIMS ARE BASED ON CONTRACT, TORT, PRODUCT LIABILITY, OR OTHER THEORIES OF LIABILITY. Q-FREE'S LIABILITY UNDER THIS AGREEMENT FOR LOSS OR DAMAGE SHALL IN NO EVENT EXCEED 50 % THE PRICE PAID FOR THE DEFECTIVE OR OTHERWISE NONCONFORMING EQUIPMENT GIVING RISE TO ANY CLAIM. EXCEPT AS OTHERWISE SET FORTH IN THIS AGREEMENT, Q-FREE MAKES NO REPRESENTATION OR WARRANTIES, EXPRESS OR IMPLIED, CONCERNING THE SERVICES, EQUIPMENT, MATERIALS OR PERFORMANCE.

<u>Assignment:</u> This Agreement shall not be assigned by either party without the written consent of the other party, which shall not be unreasonably withheld or delayed. Notwithstanding the above, Q-FREE may assign this Agreement, without consent, in whole or in part, to (a) any affiliate or subsidiary or (b) a third party in the event of merger, recapitalization, conversion, consolidation, other business combination or sale of all or substantially all the assets of Q-FREE to such third party.

<u>Vendor Product Procurement:</u> Q-FREE will at times change vendors and/or will be unable to procure originally quoted Equipment. In this event, Q-FREE reserves the right without bearing any cost, penalty, or legal exposure of any kind to alter customer approved purchased product and/or components at its own discretion to include but not limited to product availability, and technology changes or enhancements.

<u>Miscellaneous:</u> Any modification or waiver of this Agreement must be in writing and signed by the party against whom enforcement is sought. This Agreement represents the entire and final agreement between you and Q-FREE regarding its subject matter. In the event any suit or action is brought to enforce or interpret any of the terms of this Agreement, the prevailing party shall be entitled to recover from the other party all reasonable attorney fees incurred at trial, on appeal, and on any petition for review, together with such other expenses, costs, and disbursement as may be allowed by law. <u>Please Note:</u>

- *If proper delineation as proposed is not accepted by the customer at system counting points and overall traffic flow concerns, Q-FREE will not be held responsible for overall system counting accuracy. Counting Throughput Accuracy Averages are approximately 95% for USDS counting & loop counting, and 99% for single space monitoring. General count maintenance required with all PGS systems.*
- *Sign Prices quoted only for proposed sign design. Any requested changes in sign design will result in sign price to be re-quoted.*
- *All customer logos, brands, trademark names or other trademark symbols can be utilized free of any charge or expense in Q-FREE marketing and/or sales efforts.*
- *Count performance is subject to proper floor condition (i.e. flat/smooth surface).*
- *Structural circumstances might require the use of parking spaces for delineation purposes to ensure proper vehicle counts.*
- *Q-FREE reserves the right without bearing any cost, penalty, or legal exposure of any kind to alter customer approved purchased product and/or components at its own discretion to include but not limited to product availability, and technology changes or enhancements.*
- *Q-Free does not accept any responsibility for replacement of delineators if damaged or destroyed due to traffic flow. The delineators are placed to ensure proper system performance and are not designed to sustain extensive abuse due to traffic flow or abuse.*

I. Exhibit E – Supplemental Documents

I.1 Datasheets

I.2 Case Studies

I.3 Sample EC Scope

I.4 Sample Layout Drawings

I.5 Equipment Manuals

PARKING

Real-time parking information to allow drivers and operators obtain parking availability efficiently.

Q FREE

LEADING THE WAY

PARKING GUIDANCE SYSTEMS

Up to a third of all traffic in urban areas is generated by vehicles looking for somewhere to park. The need to address parking related congestion and pollution has given rise to more sophisticated indoor Parking Guidance Systems (PGS). These systems provide accurate real-time information on the location and availability of parking and can have a very positive effect on congestion, pollution and overall quality of life.

The Parking Guidance Solution, a product of the worldwide development and deployment of ITS in cities, reduces parking space search times by providing information on where space is available. Combining traffic monitoring, communication, processing and information dissemination technologies to give drivers dynamic, real-time information about parking availability within controlled areas, the PGS uses a combination of sensors in and around car parking facilities and information provision systems such as on-street and in-facility displays, the internet and smart device applications.

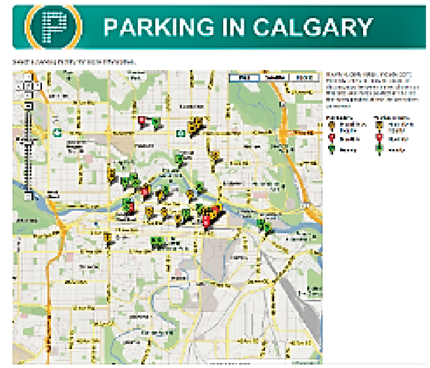
BENEFITS

A Parking Guidance System optimizes the available parking inventory utilizing all available parking spaces where typically a substantial amount of inventory would go unused due to the inability to be located. Applicable revenues are therefore maximized. Statistical data is tracked and logged, to be used to estimate future trends and provide the best possible parking experience for drivers. Reducing the time spent looking for parking improves the driver experience and ensures that visitors keep coming back. Less time spent looking for parking also provides a significant reduction in emissions, air and noise pollution. A Parking Guidance System is the easiest way for an operator to create a driver friendly experience, increase revenues, and reduce the carbon footprint.

Q-FREE'S TECHNOLOGY

Overhead mounted ultrasonic sensors track vehicles entering or exiting a garage/level or individual parking space. Space availability information is displayed on strategically placed wayfinding signs or other media such as websites or mobile applications, guiding drivers to the nearest available parking space.

The Q-Free wireless system design eliminates the need for expensive cable and conduit running from each device to the central server as typical in other Parking Guidance installations. The wireless mesh network is custom designed for each installation for optimal signal strength penetration guaranteeing a system uptime of 99.99% as each communication point is a receiver and transmitter at the same time. Hardwired applications are also available if required.



Q-Free Parking Guidance systems are flexible to fit any customer requirement. Different technologies and 3rd party products can all be integrated and mixed to provide one of the most flexible Parking Guidance Solutions in the market.

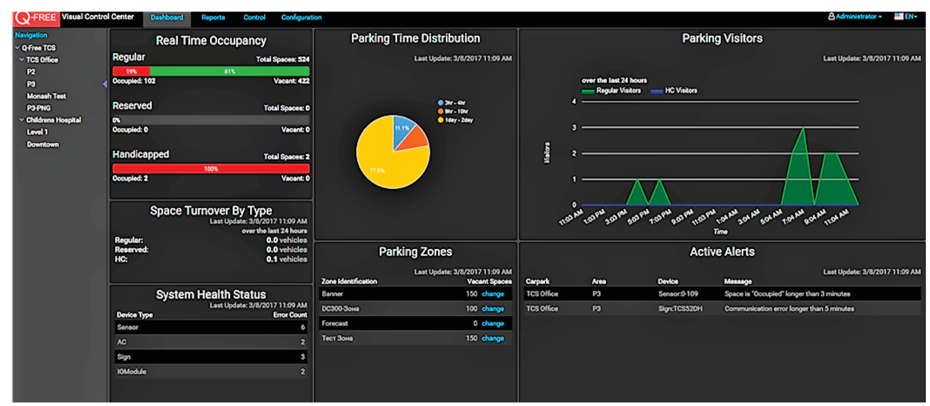
Q-Free Visual Control Center Software

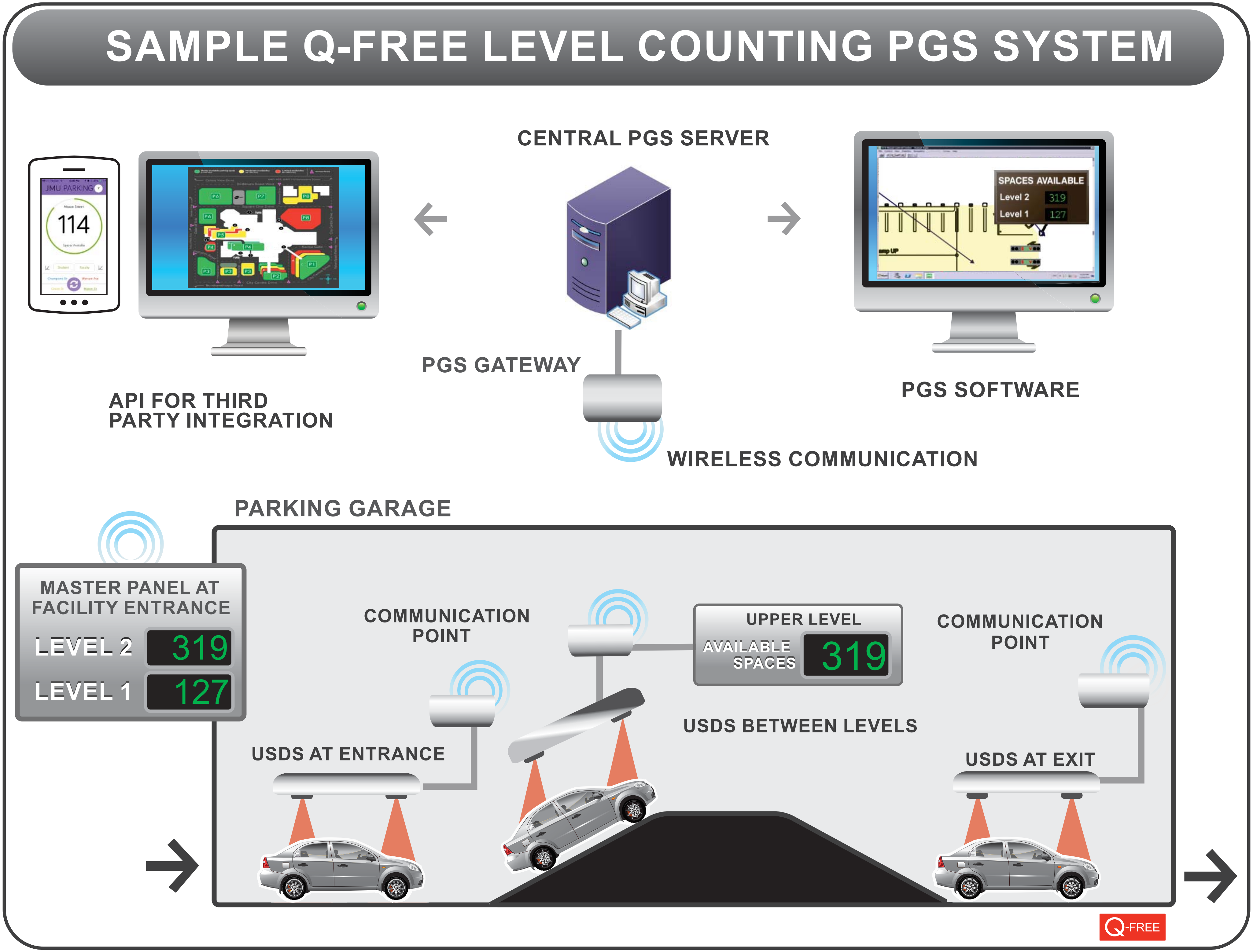
The best sensor technology is nothing without a robust and innovative software engine where the highly accurate sensor data is analyzed, processed and stored. The Q-Free Visual Control Center (VCC) is a client-based PGS software solution, which allows for multi-user access and dashboard controls through a web-portal. Our VCC software has a customer friendly, windows based, easily maneuverable GUI interface, providing overall status information as well as the ability to generate statistics, and run reports. The dashboard overview provides easy access to the most important system data. The Q-Free VCC does not contain any 3rd party software packages; all software is owned and maintained by Q-Free. The open API interface to 3rd party applications provides additional system flexibility.

Parking Guidance Solutions by Q-Free

Over the last 10 years, Q-Free has created one of the most flexible, industry leading Parking guidance solutions on the market.

Engineered and developed exclusively by Q-Free, Q-Free PGS solutions are installed in over 350 locations worldwide. The advantages in wireless system design, sensing accuracy and overall system flexibility, establishes Q-Free as one of the most experienced providers in Parking Guidance market. Q-Free's Parking Guidance Solutions are another great example of how Q-Free is Changing the Movements of Life.




SAMPLE Q-FREE LEVEL COUNTING PGS SYSTEM
CENTRAL PGS SERVER
JMU PARKING
114
API FOR THIRD PARTY INTEGRATION
PGS GATEWAY
SPACES AVAILABLE
Level 2 319
Level 1 127
PGS SOFTWARE
WIRELESS COMMUNICATION
PARKING GARAGE
MASTER PANEL AT FACILITY ENTRANCE
LEVEL 2 319
LEVEL 1 127
COMMUNICATION POINT
UPPER LEVEL
AVAILABLE SPACES 319
COMMUNICATION POINT
USDS BETWEEN LEVELS
USDS AT ENTRANCE
USDS AT EXIT
Q-FREE

TUS-100 SINGLE SPACE SENSOR

- End-of-space solution for higher visibility
- Reduction in installation/cabling cost and time due to integration of external lamp and sensor
- High visibility with LEDs on all sides

Available

Occupied

ADA/Handicap

OVERVIEW

TUS-100 Single Space Sensors are installed on the ceiling at the end of each parking space end in installations where single-space monitoring is required. Internal LEDs show green when the space is available, and red then the space is occupied. Other color options are available to indicate, for example, handicapped and other reserved spaces.

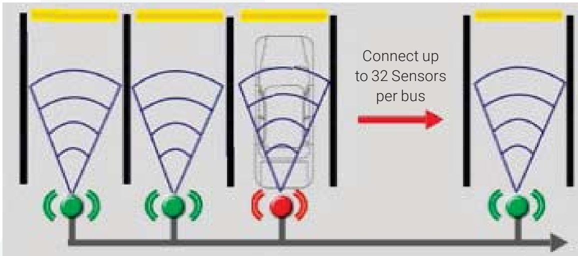
FUNCTION

The sensor detects occupancy status through ultrasonic distance measurement. Calibration takes place while parking spaces are empty. When a vehicle occupies a parking space, the sensor detects a change in measurement and reports the space as occupied. The integrated LED changes from green (unoccupied) to red (occupied).

A maximum of 32 sensors can be connected to the same data line. The zone controller employs a three bus system allowing up to 96 Single Space Sensors to be connected to a single controller.

OPERATIONAL DATA

- Detection of vehicles
- Flexible installation options
- Low maintenance



Sensor installed at end of parking space.

CONNECTION

18 AWG 4-conductor shielded wire

TECHNICAL DATA

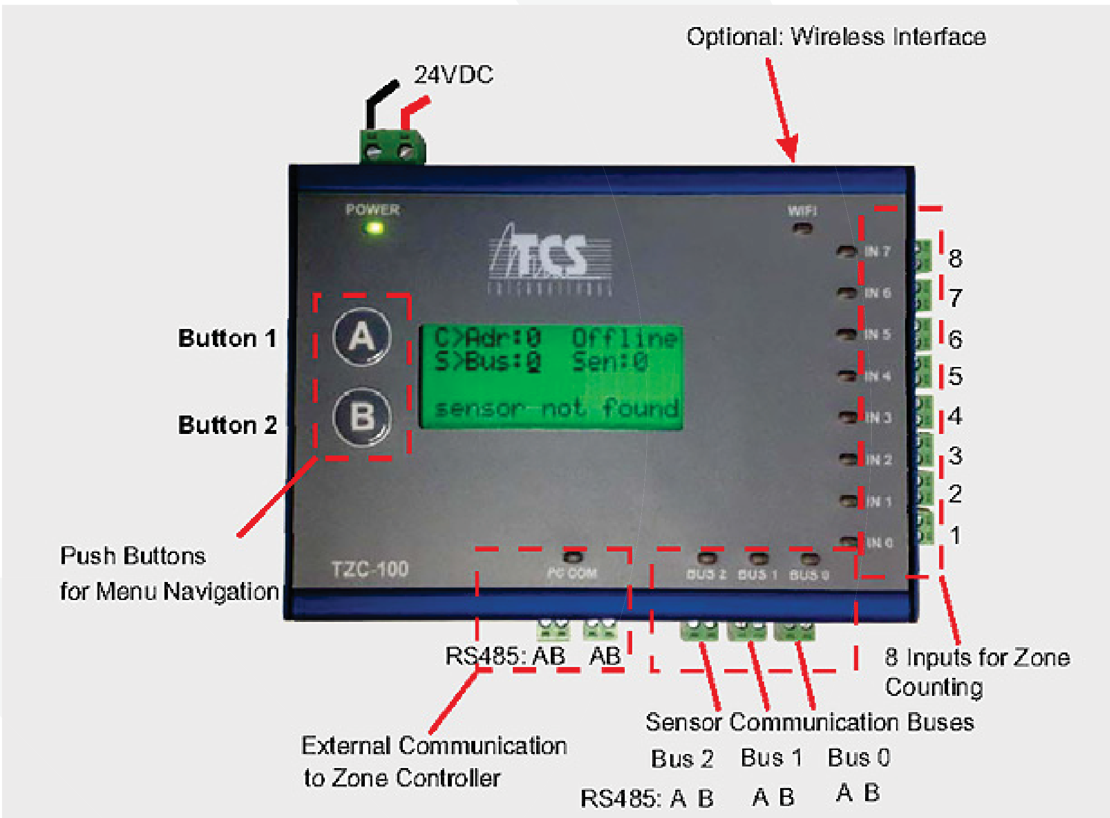
Type: Ultrasonic distance measurement
Voltage: Low, 24V DC
Data transfer: RS-485

VS.25.03.16

LEADING THE WAY

TZC-100 ZONE CONTROLLER

- Universal controller serving multiple counting technologies
- Used for single space monitoring, loop counting and sign communication
- User friendly menu keys to scroll through various configuration tasks
- Optional integrated wireless communication chip



OVERVIEW

In a single space parking guidance system all single space sensors are connected to and managed by the zone controller. Q-Free's Single Space Zone Controller TZC-100 uses a three bus system allowing it to provide power to and exchange data with up to 96 single space sensors (32 single space sensors per bus interface). Large installations employ multiple zone controllers which link to a server.

The zone controller operates as a data concentrator transmitting the information to the PC, from the PC to the indicator lights in the sensors, as well as to other external devices like dynamic parking guidance signs. The controller also provides counter information based on count pulses generated by digital inputs.

LEADING THE WAY

INSTALLATION

The zone controller is installed within close distance to the controlled zones. The controller is mounted in a CP (communication point) enclosure, mounted on a nearby wall. 100-240VAC is plumbed into the enclosure, powering a DC power supply which provides power to the controller. Each of the three busses on the controller will require their own individual power supply to provide power to each component connected.

HIGHLIGHTS

- Up to 8 count logic scenarios based on 8 digital inputs
- 2 Buttons/display panel for configuration
- Single space monitoring:
  - Control over 96 sensors through 3 RS485 bus lines
  - Sensor status indication: free, occupied, error
  - Many operating modes: automatic, static green, static red, static optional color, green/red alternating, red flashing, lights off while still monitoring space

TECHNICAL DATA

POWER CONSUMPTION

24 VDC/75m

DATA TRANSFER TO SIGNS/SERVER/OR 3RD PARTY DEVICE

RS-485

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LEADING THE WAY

PRODUCT SHEET

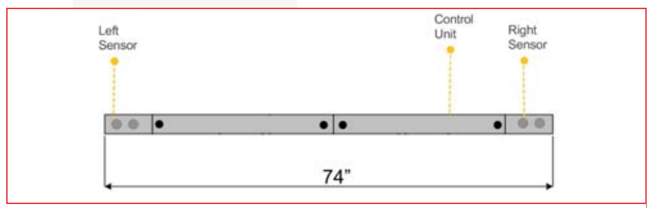
USDS ULTRASONIC DIRECTIONAL SENSOR

- Single unit standard or three-unit cluster design
- Overhead mounting with no need for saw-cutting ground work
- High-accuracy detection, even of wrong-direction events

OVERVIEW

The Ultrasonic Directional Sensor is designed to replace inductive loops and provide accurate vehicle counts. USDS sensors are extremely reliable and play an important part in any facility or level-counting parking guidance solution. These ceiling-mounted sensors eliminate the need for saw-cutting groundwork.

Installation is easy, and relocation is possible should traffic patterns change. The three-unit cluster technology reduces the need for delineation to separate entrance and exit lane counts.



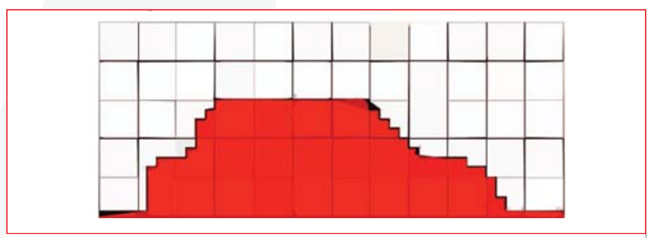
Sensor Dimensions

HIGHLIGHTS

- Single unit standard configuration at standard width garage/level entrances/exits (total lane detection of up to 12 feet)
- Three-unit cluster configuration at wide-width garage/level entrances/exits (total lane detection of up to 24 feet)
- One built-in central processing unit to control sensor logic
- Standalone operation with memory back-up offline
- Bi-directional counting of vehicles
- Up to 30km/h (19mph) effective counting speed
- Output: Dry contact and/or serial interface via RS-485
- Power supply voltage: 12–24V DC

FUNCTION

Two groups of ultrasonic sensors on a single USDS sensor continually measure the distance to ground. A passing vehicle produces a typical height profile (see illustration). A vehicle is differentiated from other objects by correlating information using a pattern-recognition process.



Sensor Directional Analysis

TECHNICAL DATA

Type: Ultrasonic distance measurement

Voltage: Low, 24V DC

Data transfer: RS-485 or Plus-Minus relay

Temperature: -4°F to +158°F (-20°C to +70°C)

OPERATIONAL DATA

- Detection of vehicles
- Flexible installation options
- Low maintenance

CONNECTION

18 AWG 4 conductor shielded wire

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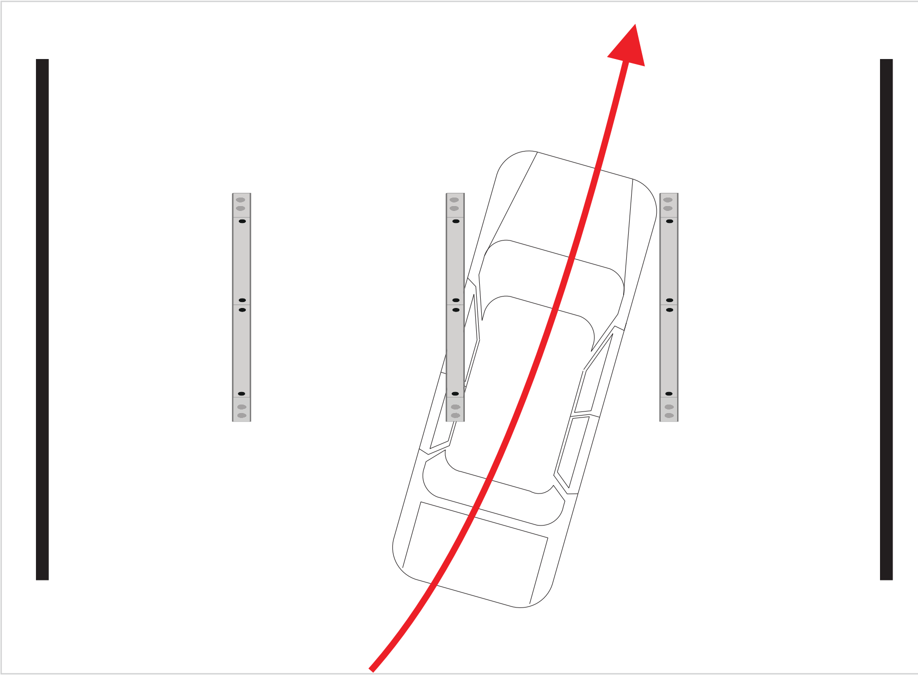
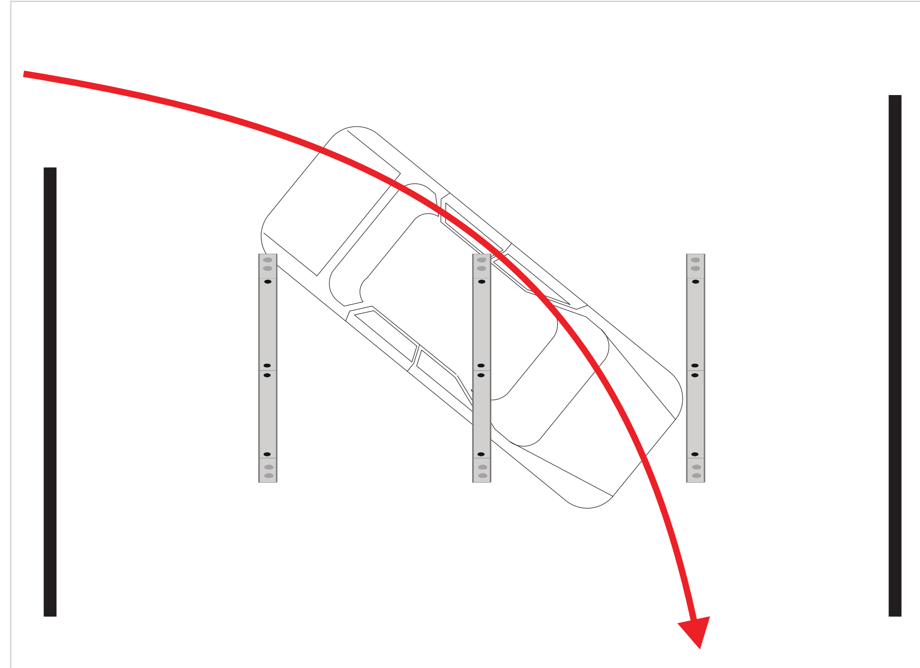
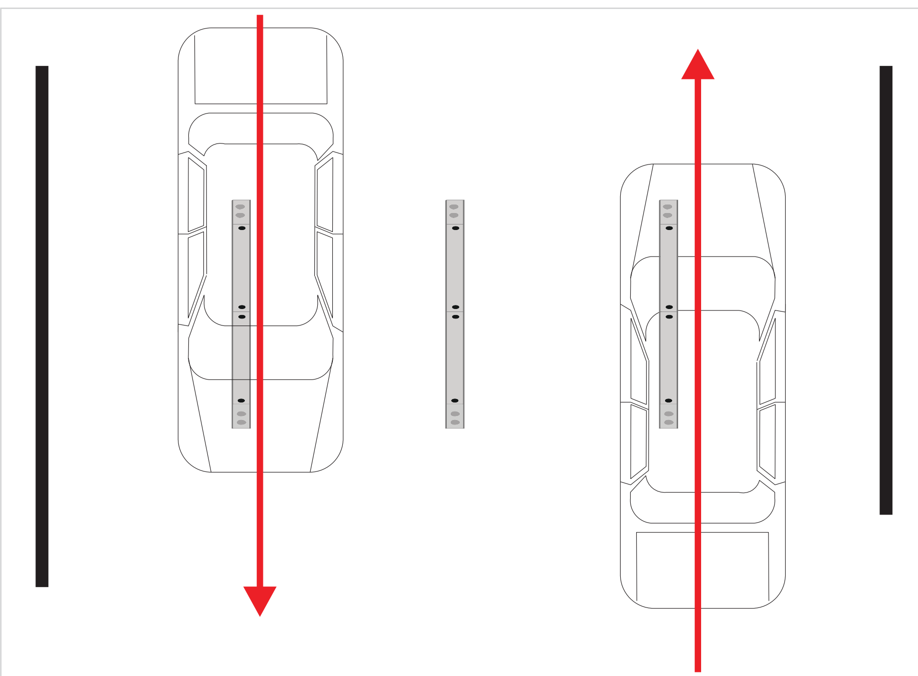
LEADING THE WAY



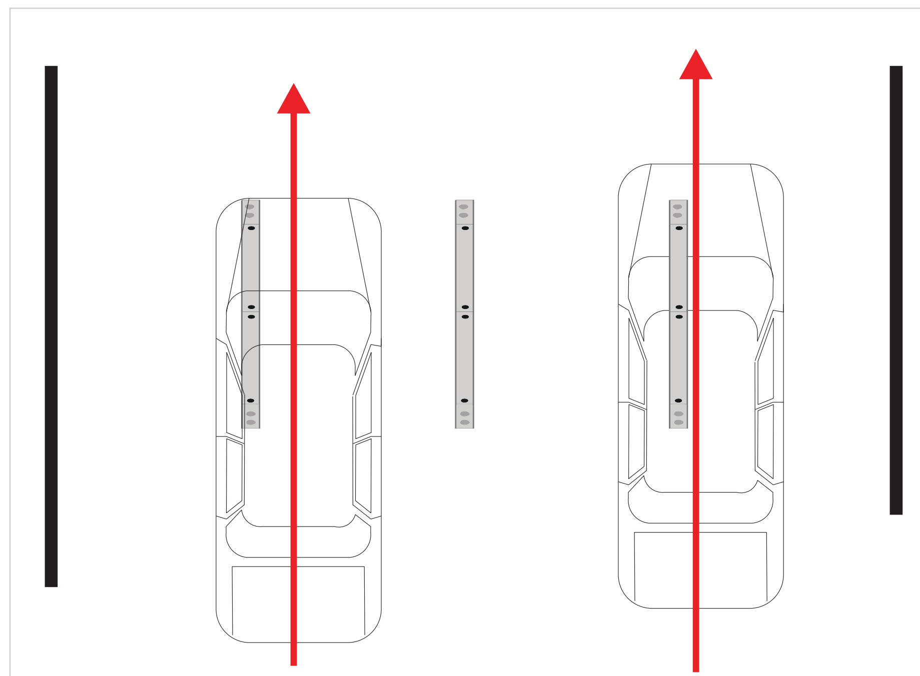
Diagonally across 2 USDS



Diagonally across 3 USDS



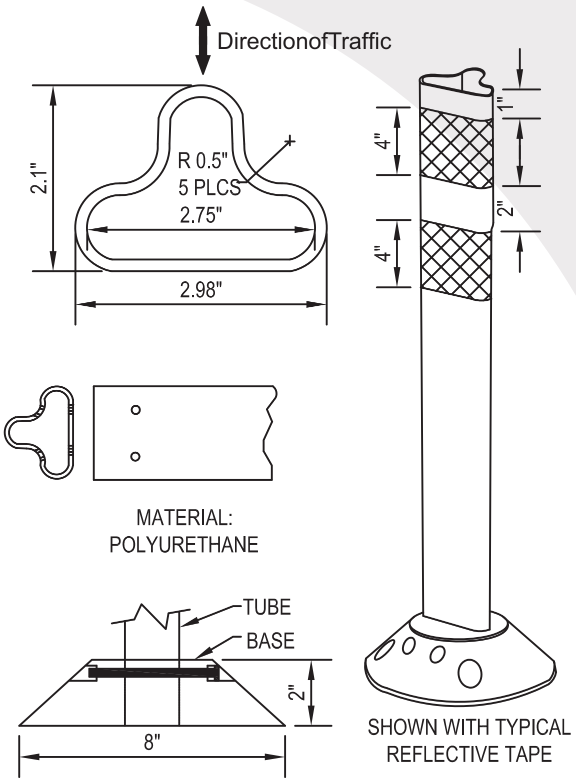
2 Vehicles traveling in opposite directions



2 Vehicles traveling in the same direction

PRODUCT

DP-300-UR DELINEATION POST



SHOWN WITH TYPICAL
REFLECTIVE TAPE

DP-300-UR INFORMATION

- Post HeightAvailability
  Standard: 36”
  Optional: 18”, 24”, 28”, or 42”
- Post ColorAvailability
  Standard: yellow
  Optional: white or orange
- Reflective Sheeting ColorAvailability
  Standard: yellow
  Optional: white or blue
- Superior resistance to tearing and puncturing
- Designed for daily traffic abuse

OVERVIEW

The Q-Free TCS Delineation Post (DP-300-UR) comes standard with a butyl pad for adherence to the ground. Delineation posts create a “counting point” for accurate system counts by controlling the traffic speed and proper lane travel throughout the parking facility. The delineation posts are composed of flexible polyurethane plastic which quickly restores back to an upright position after being struck. The polymer maintains its flexibility to -50° F (-45° C) as well as its toughness to fuels, oils, and grease.

Example of Lane Delineation

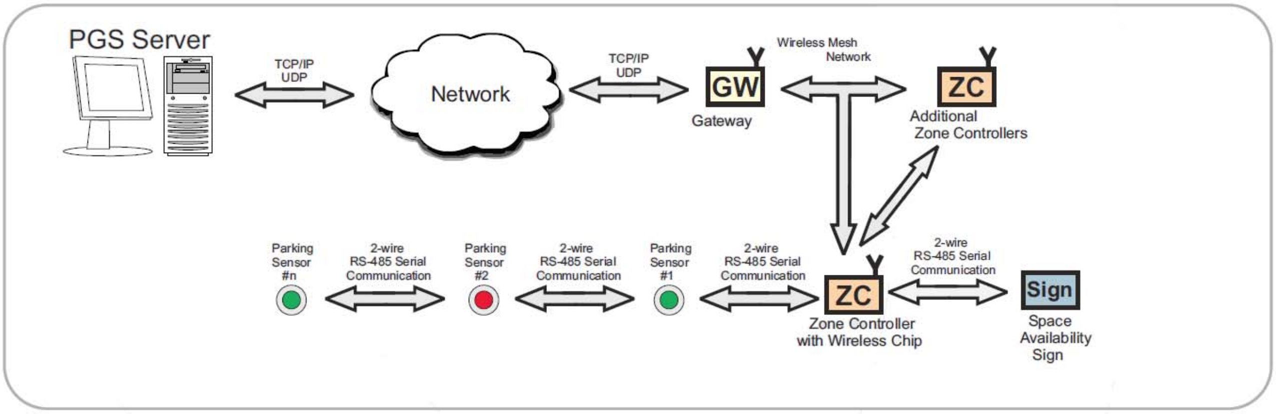
USA 55 Union Ave. | Sudbury, MA 01776 | T +1 978 443 2527 | F +1 978 579 9545
Canada 70 Six Point Rd. Etobicoke, ON M8Z2X2 | T +1 416 259 4862 | F +1 416 252-0285
www.q-free.com | www.tcsintl.com | @QFreeASA
For more information contact sales.usa@q-free.com

Q FREE
TCS

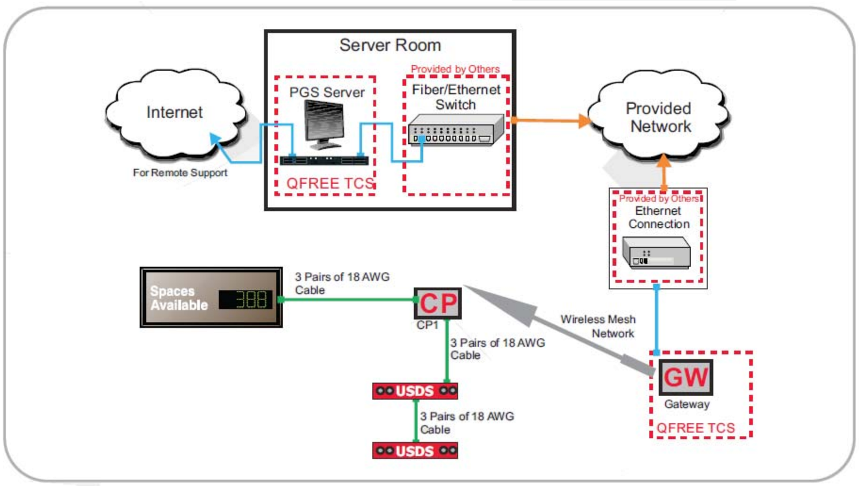
VS.09.07.15

WIRELESS SYSTEM COMMUNICATION

- Based on wireless Mesh technology
- Multiple gateway connection options
- Reduction in cabling and installation costs



Flow diagram of wireless communication single-space sensor system



Flow diagram of wireless communication level/facility counting system

OVERVIEW

The Q-Free wireless communication solution takes advantage of wireless Mesh technology, allowing at-the-edge devices such as sensors and signs to communicate through multiple wireless pathways. It reduces the cost of cabling and installation associated with a traditional hard-wired Parking Guidance System (PGS). Each device or group of devices is wired locally to a modem. This modem wirelessly transfers the device information to the PGS gateway. The gateway is connected through a network to the PGS server where the Q-Free Visual Control Center software manages the whole system and provides a graphical user interface.

HIGHLIGHTS

- Reduction in cabling and installation costs
- Self-healing network
- 100% network uptime
- Deployed in all of Q-Free's PGS installations
- First PGS provider in the world specializing entirely in wireless system communication

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www.q-free.com

For more information contact marketing@q-free.com

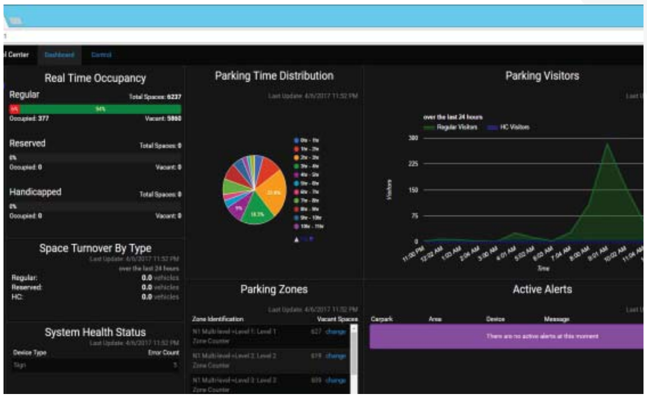
LEADING THE WAY

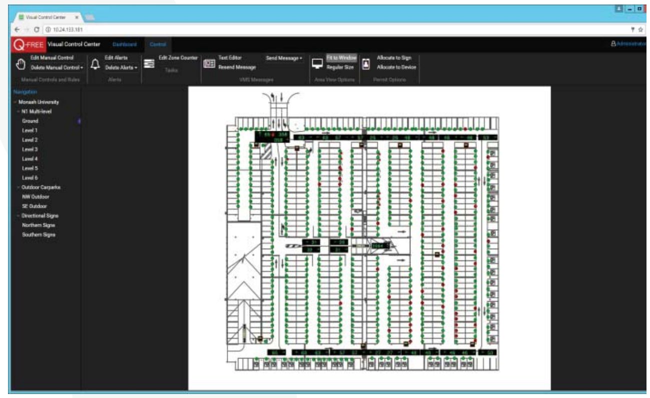
PRODUCT SHEET

VISUAL CONTROL CENTER PGS SOFTWARE

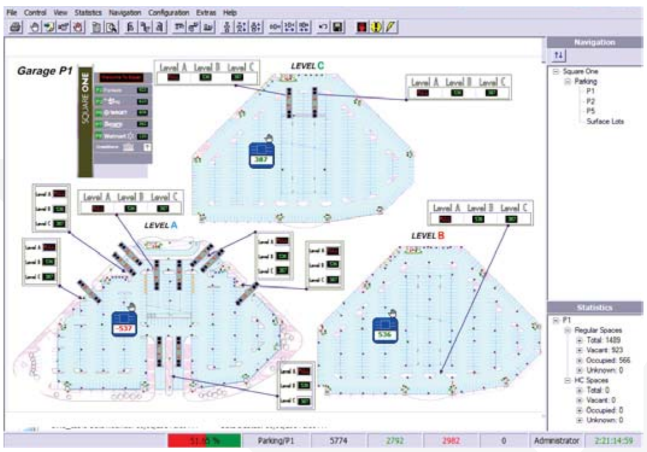
- Proprietary software with in-house development
- Unique optional multi-user platform

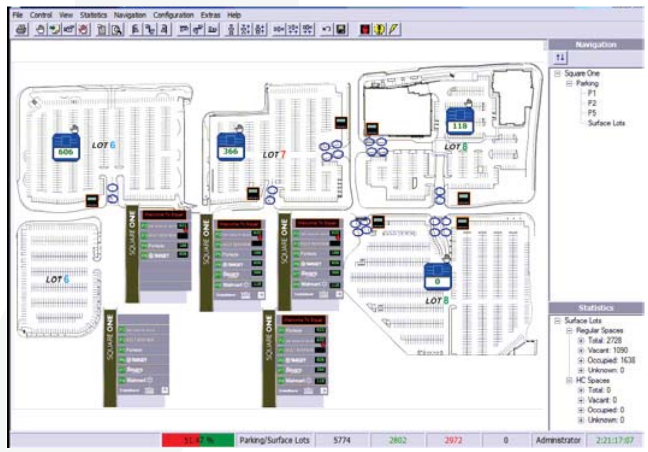
WEB BROWSER ACCESS





CLIENT SOFTWARE ACCESS





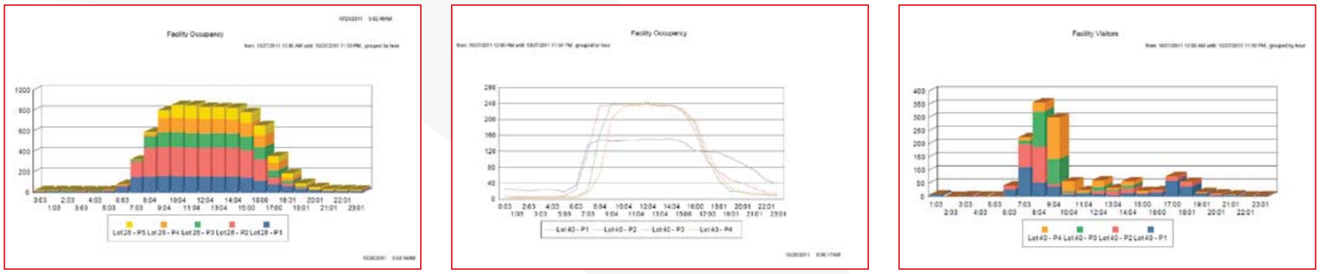
OVERVIEW

The Visual Control Center is the graphical user interface and communication service for Q-Free's parking guidance systems. It communicates to all installed devices and displays real-time parking availability, counting device statuses, and sign information. This software enables users to view and export numerical and graphical parking information statistics, providing important occupancy information.

FEATURES

A customized graphical user interface displaying all device statuses and real-time parking availability information. The application can be accessed through the client software on the parking guidance server, or through a web browser. Supported web browsers are Firefox and Google Chrome.

LEADING THE WAY



Example of reports available using the Visual Control Center PGS Software

HIGHLIGHTS

- Real-time parking availability
- Easy-to-use graphical user interface
- Device status updates
- Parking information statistics
- Customized on-screen parking guidance layout based on individual facility
- Compatible with all Q-Free parking guidance products
- API tool for exporting parking availability to customer website and/or mobile app
- Optional multi-user platform allowing multiple user access

TYPICAL APPLICATIONS

- Single-space monitoring
- Level counting
- Facility counting
- Surface lot space availability
- Way-finding

STATISTICS AND REPORTS

The Visual Control Center software provides access to a variety of important occupancy status reports:

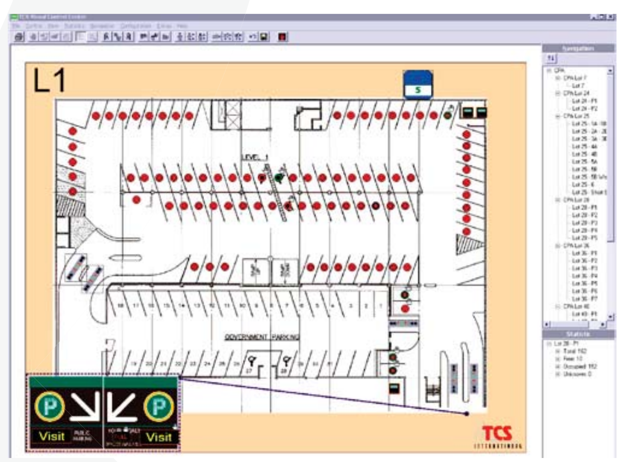
- Facility occupancy
- Zone or level occupancy
- Facility visitor tracking
- Parking time control
- Parking duration

Parking availability statistics provide vital occupancy information and can assist with staffing or marketing plans.

GRAPHICAL USER INTERFACE

The Visual Control Center software is used with all of our parking guidance products:

- Ultrasonic single space sensors
- Ultrasonic directional sensors
- Surface parking space sensors
- In-ground loop technology
- Space availability signs
- Variable message displays
- Wireless Mesh technology



Example of the Visual Control Center graphical user interface displaying a parking level with ultrasonic single-space monitoring technology. The user is able to view real-time parking availability and occupancy on a per-stall basis, as well as parking availability signs.

VS.12.03.18

Q FREE

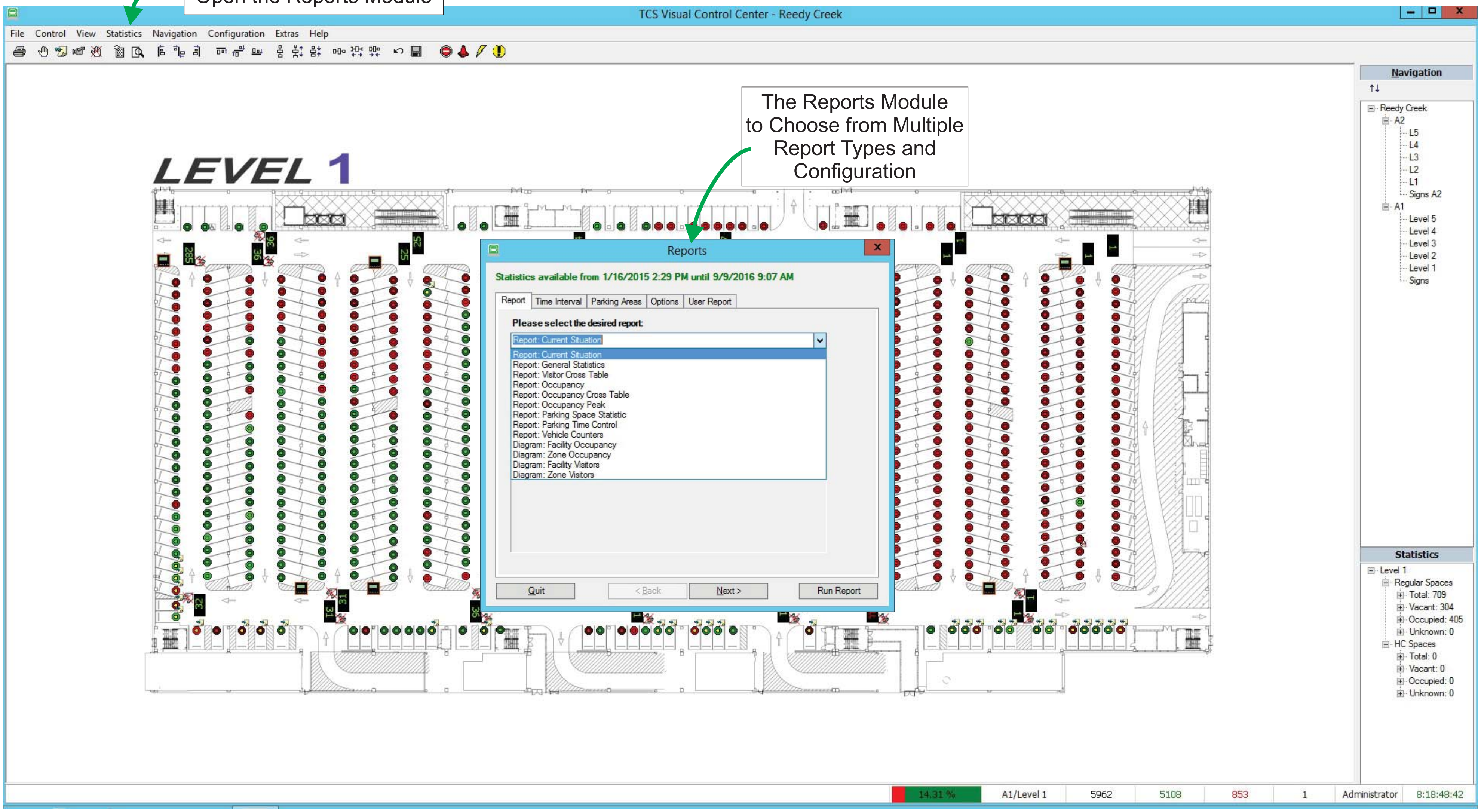
LEADING THE WAY

Example Visual Control Center GUI

Q-Free TCS
55 Union Avenue
Sudbury, MA 01776
Phone (978) 443-2527
Fax (978) 579-9545
www.q-free.com
www.tcsintl.com

Use the Statistics Menu to Open the Reports Module

The Reports Module to Choose from Multiple Report Types and Configuration



Example Visual Control Center GUI

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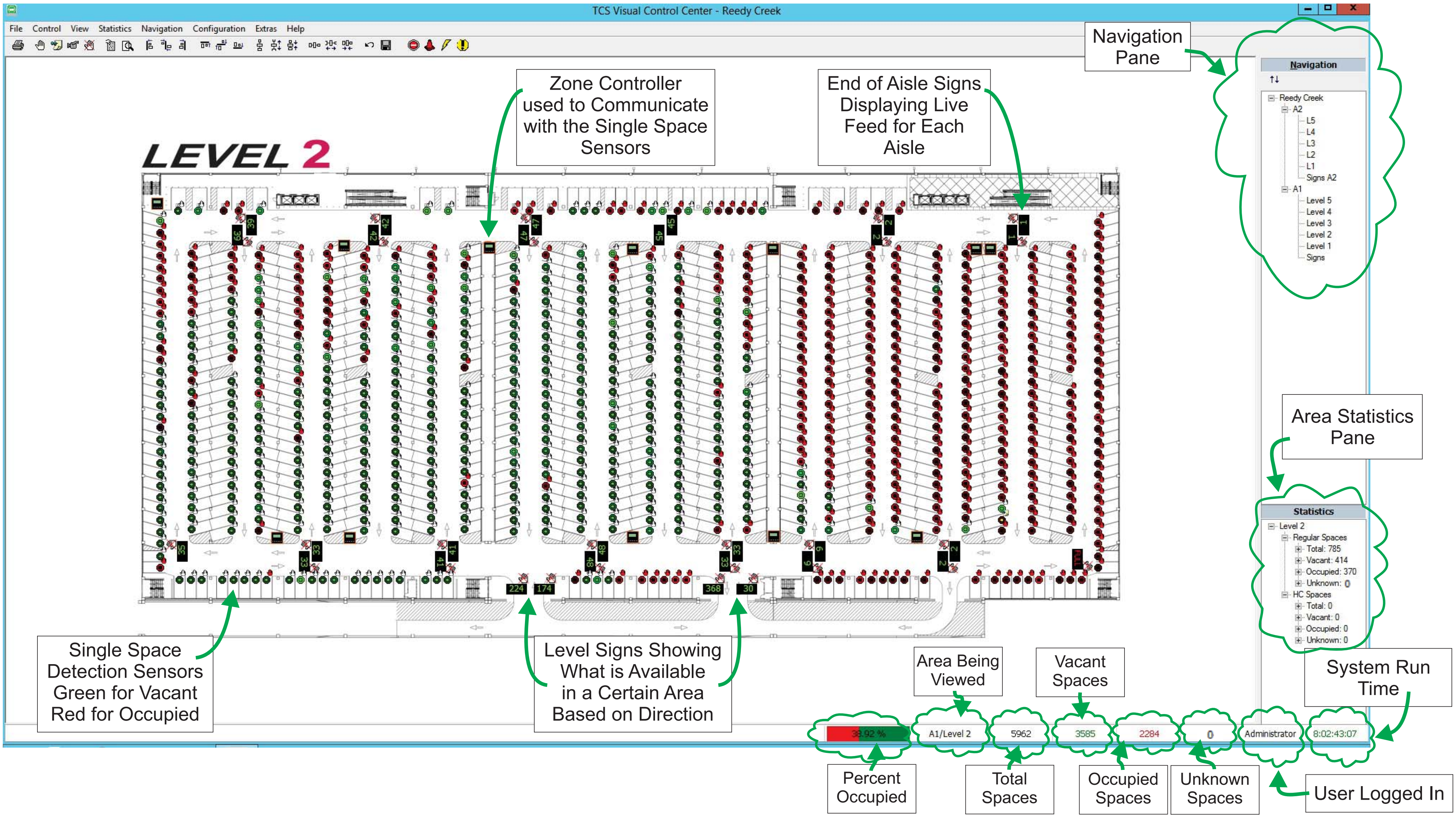
Phone (978) 443-2527
Fax (978) 579-9545
www.q-free.com
www.tcsintl.com



Example Visual Control Center GUI

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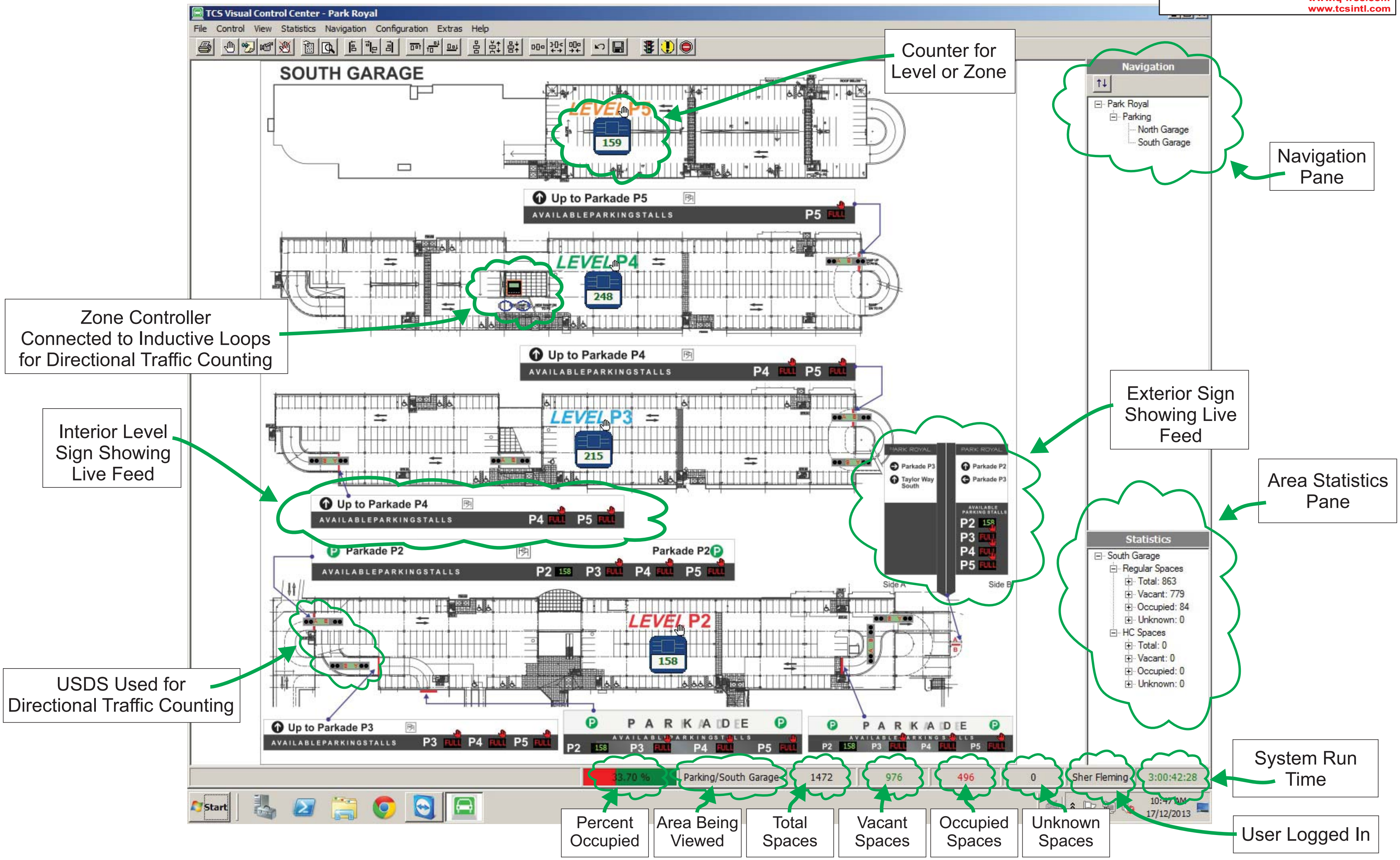
Fax (978) 579-9545
www.q-free.com
www.tcsintl.com



Example Visual Control Center GUI

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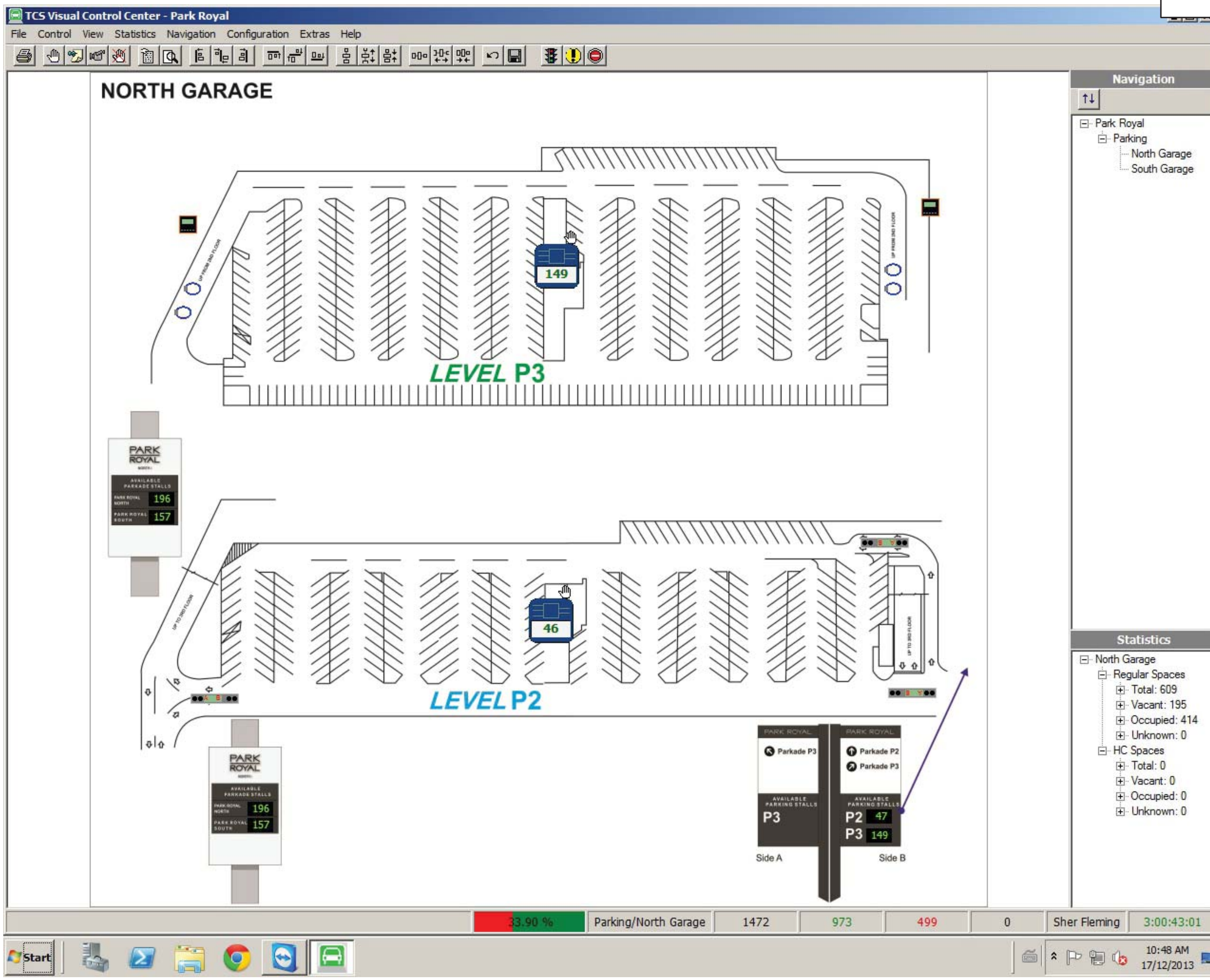
www.tcsintl.com



Example Visual Control Center GUI

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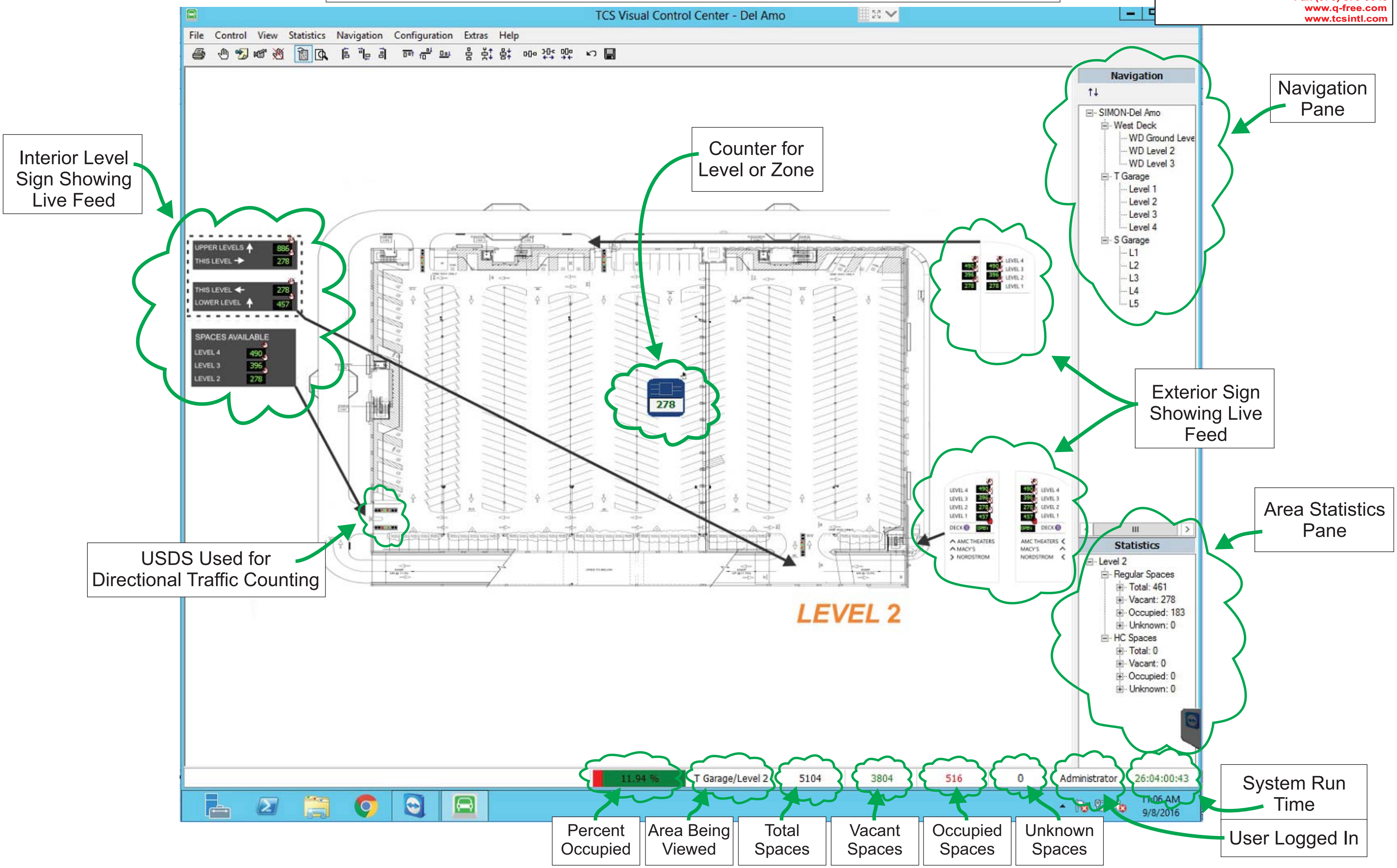

Example Visual Control Center GUI

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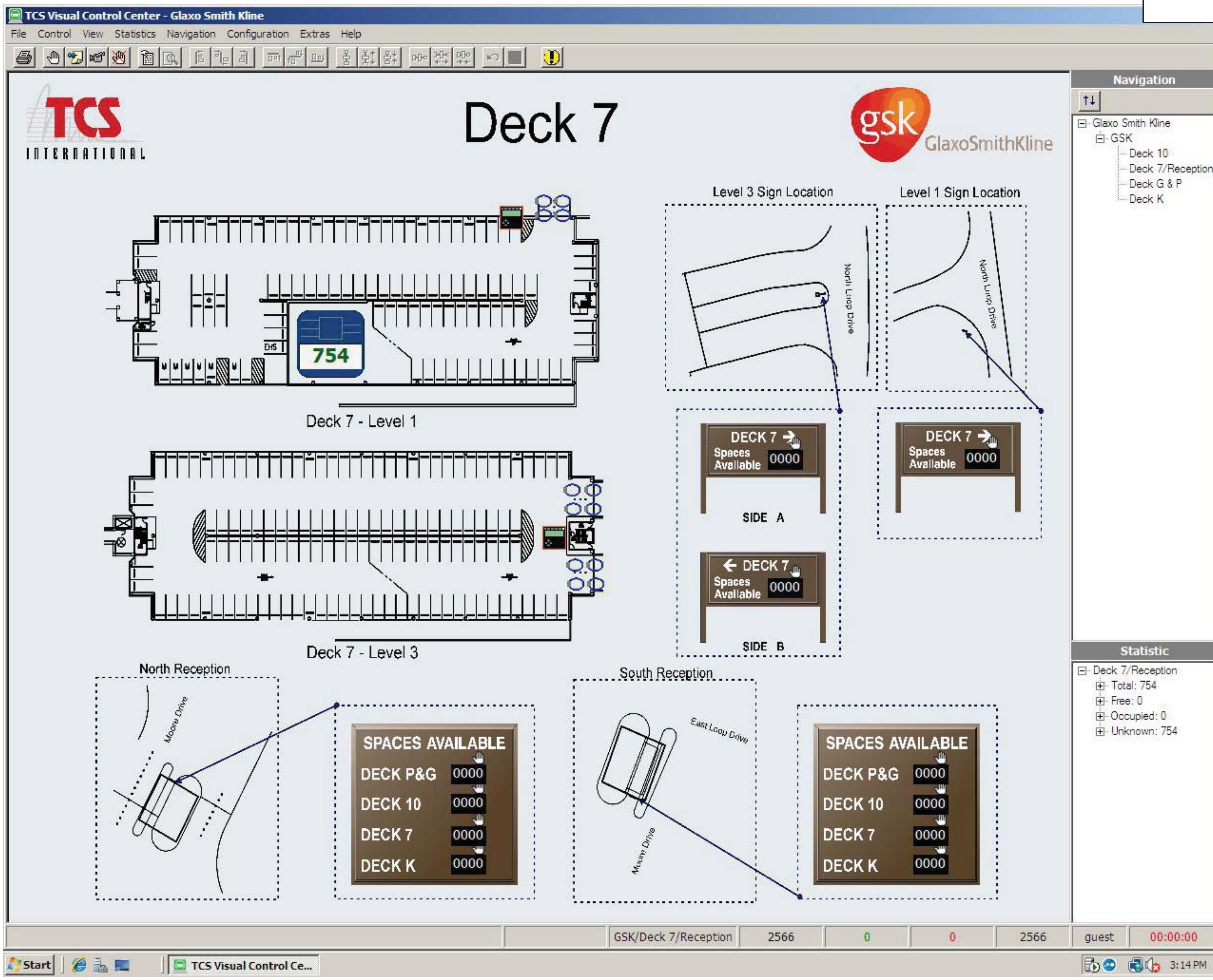

Example Visual Control Center GUI

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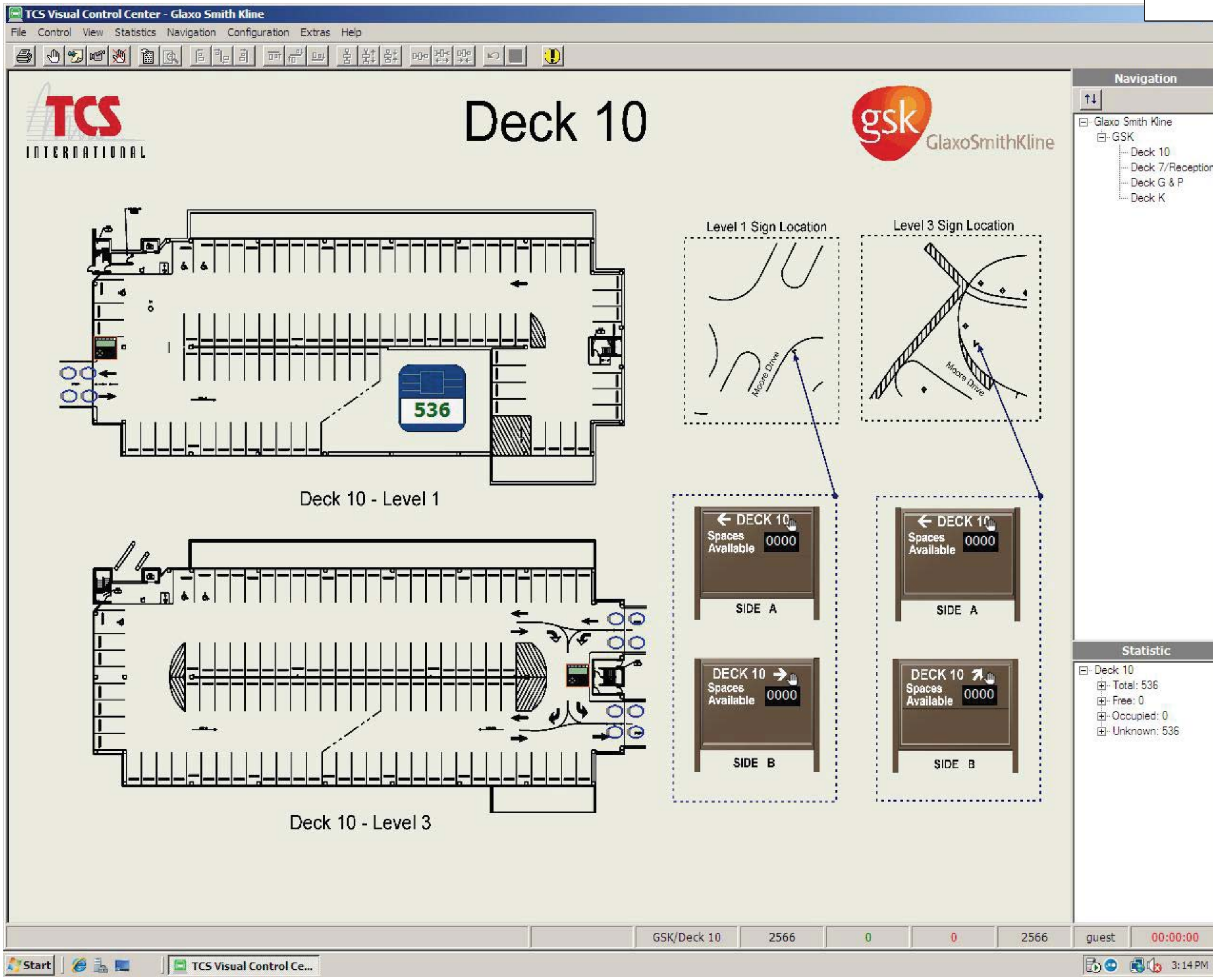

Example Visual Control Center GUI

Q-FREE TCS
Q-Free TCS
55 Union Avenue
Sudbury, MA 01776
Phone (978) 443-2527
Fax (978) 579-9545
www.q-free.com
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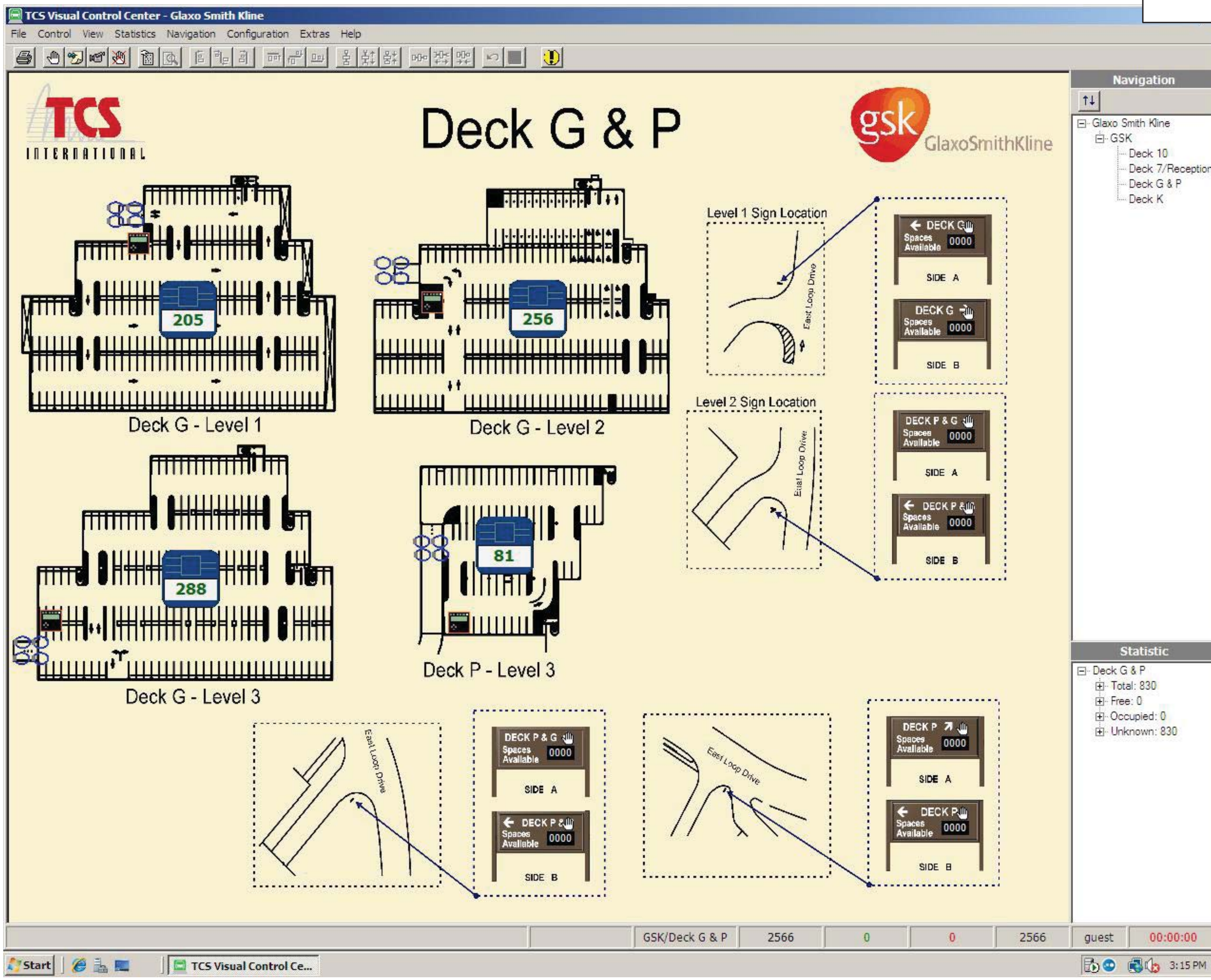

Example Visual Control Center GUI

Q-Free TCS
55 Union Avenue
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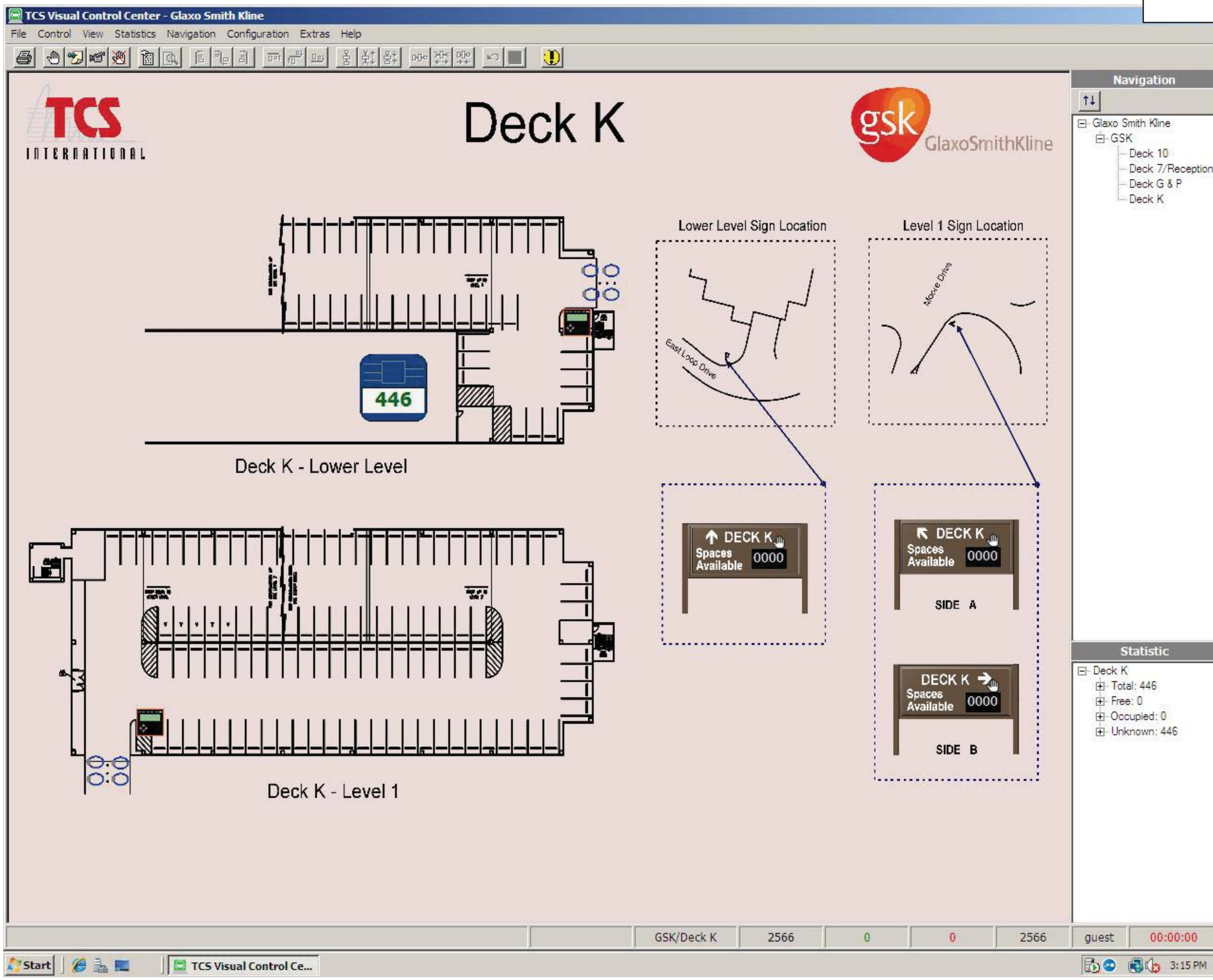

Example Visual Control Center GUI

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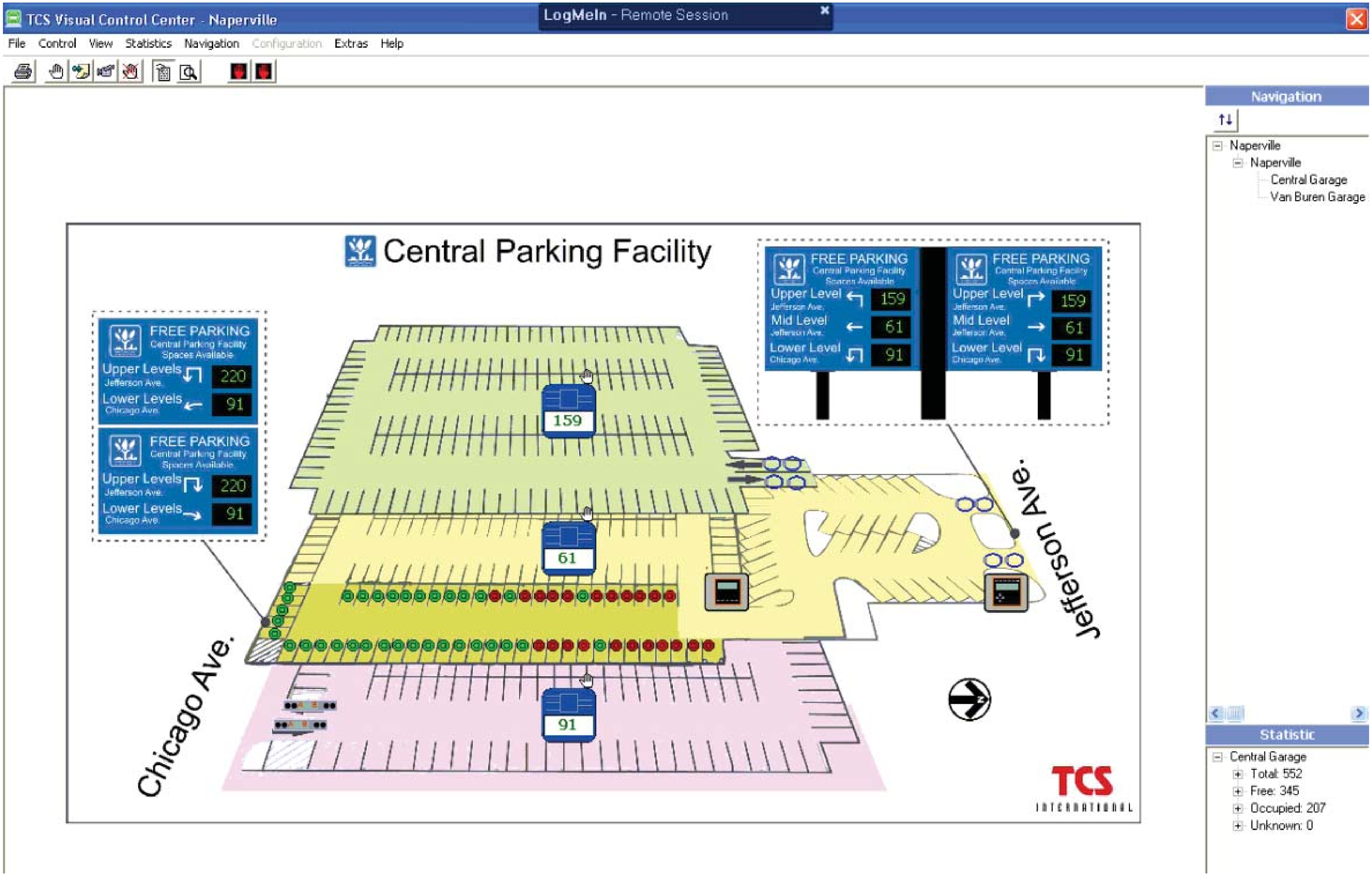


STANDARD SOFTWARE REPORTS

THE FOLLOWING STANDARD SOFTWARE REPORTS ARE AVAILABLE:

1. Report about the current occupancy situation, ordered by car park and area. Optionally: a detailed occupancy data about parking spaces and zones could be included

.2.Report about the occupancy situation in the past, specified by time interval or at a time point, ordered by car park and area.

3. Report about the occupancy situation in the past, shown as a cross table. The data are grouped by specified time intervals and by parking area. The content of rows and columns is customizable.

4. Report about visitor situation in the past, shown as a cross table. The data are grouped by specified time intervals and by parking area. The content of rows and columns is customizable.

5. Report provides different statistics about parking behavior in the past broken down in parking areas. Such as min/max occupancy, average occupancy time, etc.

6. Report about individual spaces they occupancy time exceeded a specified time interval. This report considers results about spaces with single space monitoring only.

7. Report provides visitor counters of individual sensors and/or zones in selected time interval, ordered by parking area and by time intervals.

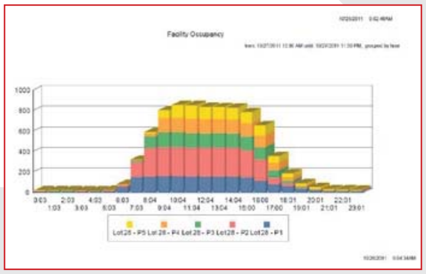
8. Report about with peak occupancy in selected time interval, ordered by parking area.

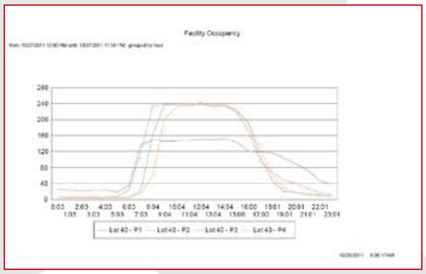
9. Graphical diagram about occupancy situation in specified time interval, grouped by car parks or parking areas.

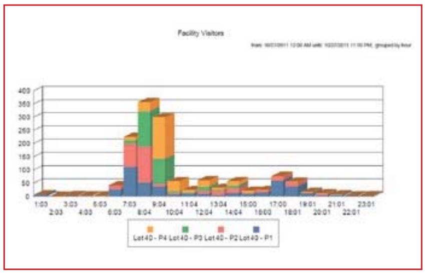
10. Graphical diagram about visitor situation in selected time interval, grouped by car parks or parking areas.

Custom reports are available upon request.

SAMPLE OVERVIEW







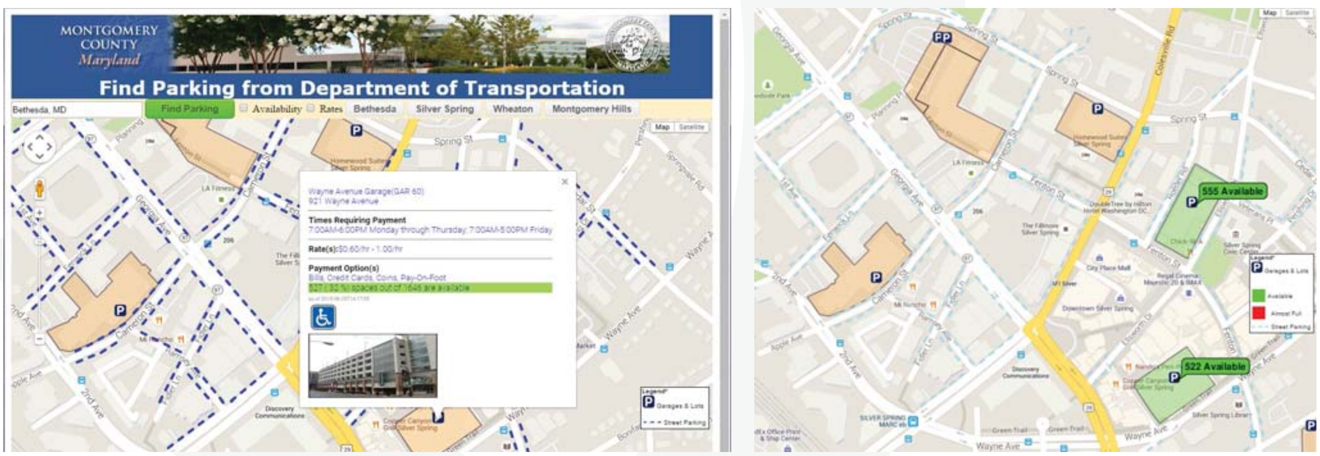
Example of reports available using the Visual Control Center PGS Software

LEADING THE WAY

PRODUCT SHEET

WEB INTERFACE MODULE/API TOOL

Naperville parking web interface



Montgomery County, MD parking web interface

OVERVIEW

The Q-Free Web Interface Module/API tool is an optional add-on to the PGS Visual Control Center software. It exports captured parking information to feed into third-party websites or mobile applications. These applications provide stress-free parking for customers by allowing them to save time and plan parking in advance.

- Provides detail of total parking spaces in selected parking facilities
- Provides space availability by type (reserved, handicapped, etc.)
- Multiple file formats available
- Tool for export of statistical/count data to third-party systems

Real-time parking information is exported from the Visual Control Center software via the web interface/API tool to a customer's existing website. Examples shown are:

- http://www.naperville.il.us/downtownparking.aspx
- http://www.calgaryparking.com/parkadeRssFeed/availability/lot/060/feed.rss
- http://www2.montgomerycountymd.gov/gisparking/parkingpublicmap.html

VS.25.03.16

FREE

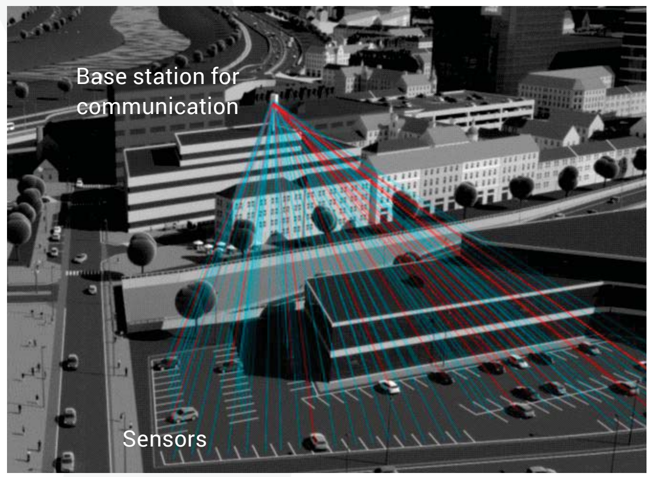
LEADING THE WAY

PRODUCT SHEET

ParQSense Outdoor Sensor

- Dual detection technology for increased accuracy
- Battery operated wireless sensor
- Rugged design and easy installation
- Long-life sensor with up to 10-year lifetime
- ParQSense Base Station configuration

PARQ SENSE



OVERVIEW

The ParQSense Outdoor Sensor is one of the most advanced outdoor sensors on the market. Industry single sensing technology sensors provide inaccurate parking data in certain conditions, as interference may negatively affect sensing accuracy. Utilizing dual detection technology (highly sensitive radar and magnetic field technology), the ParQSense Outdoor Sensor provides superior detection accuracy resulting in highly accurate data output.

With its compact form factor, the ParQSense Outdoor sensor is designed to require minimal in-ground installation efforts. New low-power technology ensures low current draw, enabling a device life-span of up to 10 years.

The ParQSense Outdoor Sensor signifies the latest development in the Q-Free ITS portfolio bringing proven sensing and guidance technology to the on/off-street market. Typical applications include surface lot/on/off-street and truck parking, as well as Smart City initiatives.

The ParQSense Outdoor Sensor is installed in-ground, flush to the surface using a fast curing sealant. In this version, up to 10,000 sensors can communicate wirelessly to a single ParQSense Base Station. The cloud based Q-Free HUB is the central software engine for ParQSense monitoring projects. Access to the Q-Free HUB can be achieved through ParQ, a web-based user portal, or through the ParQSense API.

Q FREE

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FEATURES

The ParQSense Outdoor sensor is installed in the middle of parking spaces for outdoor applications such as parking lots, on/off-street/ truck parking, Smart City initiatives, etc.

ParQSense Outdoor Sensors require connection to ParQSense Base Stations for communication. The number of sensors per base station is not limited by volume as in traditional systems, but is determined by the topological conditions of the project location.

FUNCTION

The ParQSense Sensors detect occupancy status through radar and magnetometer sensing technology. The status is wirelessly transmitted to ParQSense Base Stations, which communicate to the Q-Free HUB software engine.

Occupancy status can be transmitted to strategically placed way-finding signs, mobile/web applications, etc., guiding drivers quickly and efficiently to available parking. Valuable statistics can be obtained from the Q-Free HUB software engine enabling parking managers/ operators to make the smartest and most informed parking decisions.

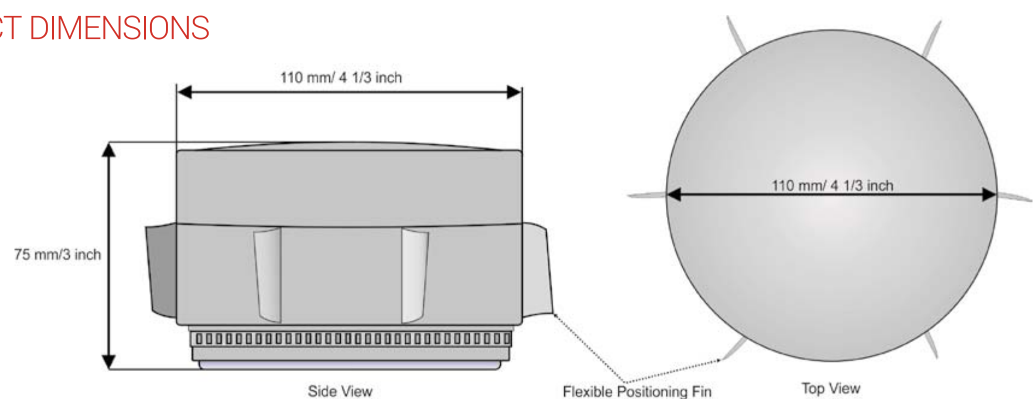
TECHNICAL SPECIFICATIONS

Product code:	ITS-420
Operating frequency:	868 MHz EUR, 915-921MHz US
Detection :	Magnetometer and Radar
Sensing Technology:	Temperature sensor
Mounting :	Buried in the ground, flush with the surface
Snow plow resistant :	Yes
Load resistance :	Heavy traffic
Mounting dimensions :	Ø 110 mm / 4.33in
Weight :	550 g / 1 lbs
Protection :	IP67, completely sealed

Color :	Grey
Storage/Operating temp :	- 40 to +85° C / -40 to +185° F
Detection height :	0 to 90 cm / 0 to 35.5in
Communication range :	dense urban radius - 250m / 820 ft (line of sight) rural area radius - 2000m / 2100 yd. (line of sight)
Power supply :	Built-in lithium battery
Expected lifetime :	Up to 10 years*
Installation time :	estimated at 4 min/sensor*

*depending on site conditions

PRODUCT DIMENSIONS



VS 11.07.18

FREE

LEADING THE WAY

www.q-free.com

For more information contact marketing@q-free.com

Specifications are subject to change without prior notice.

PRODUCT SHEET

ParQSense Base Station

- Connecting up to 10,000 ITS ParQSense Standard Outdoor Sensors
- Central communication gateway
- Rugged design and easy installation
- Low voltage device

PARQ SENSE

OVERVIEW

The ParQSense Base Station is developed for outdoor sensor communication connecting up to 10,000 ParQSense Standard Outdoor Sensors to the Q-Free HUB, the central ParQSense software engine .

This universal controller functions as a transmitter, receiver and/or repeater. The number of connected sensors does not depend volume as typical in industry standard applications, but is determined by the topological conditional of a project location.

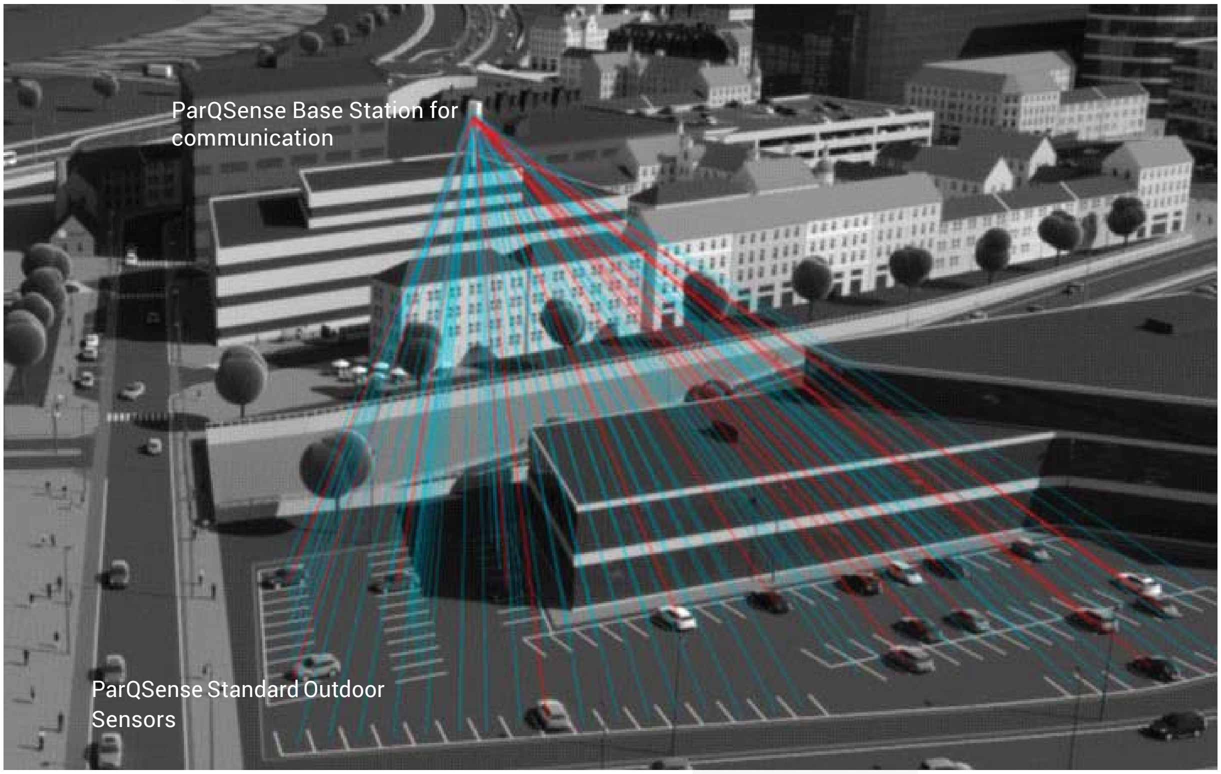
With its compact form factor, the ParQSense Base Station is designed to require minimal installation efforts. Power requirements are low-voltage with communication through various possible communication methods such as GSM/3G, Ethernet, RS-485, etc. depending on availability.

The ParQSense Base Station signifies the latest development in the Q-Free ITS portfolio bringing proven sensing and guidance technology to the off-street market. Typical applications include on/off-street/surface lot/truck parking, as well as Smart City initiatives in conjunction with the ParQSense Standard Outdoor Sensors.

The ParQSense Base Station can be installed on street lighting poles, building roof-tops/sides etc. Up to 10,000 sensors can communicate wirelessly to a single ParQSense Base Station. The cloud based Q-Free HUB is the central software engine for ParQSense monitoring projects. Access to the Q-Free HUB can be achieved through ParQ, a web-based user portal, or through the ParQSense API.

Q FREE

LEADING THE WAY



TECHNICAL SPECIFICATIONS

Product code:	ITS-950
Operating frequency:	868MHz EUR, 915-921MHz US
Max. Sensor :	10,000 ITS-420 ParQSense Outdoor Sensors*
Mounting :	Wall or pole mounted
Interface :	Ethernet, GSM-3G/UMTS, RS-485
Dimensions :	300mm x 350mm x 75mm / 12in x 14in x 3in
Weight :	2.5 kg / 5.5 lbs
Protection :	IP65
Color :	Grey (RAL 7035)
Operating temp :	- 40 to +55° C / -40 to +135° F
Storage temperature :	- 40 to +85° C / -40 to +185 F
Communication range :	dense urban radius - 250m / 820 ft (line of sight) rural area radius - 2000m / 2100 yd. (line of sight)
Power supply :	POE, 12-24VDC (solar power option)

*depending on topography

www.q-free.com

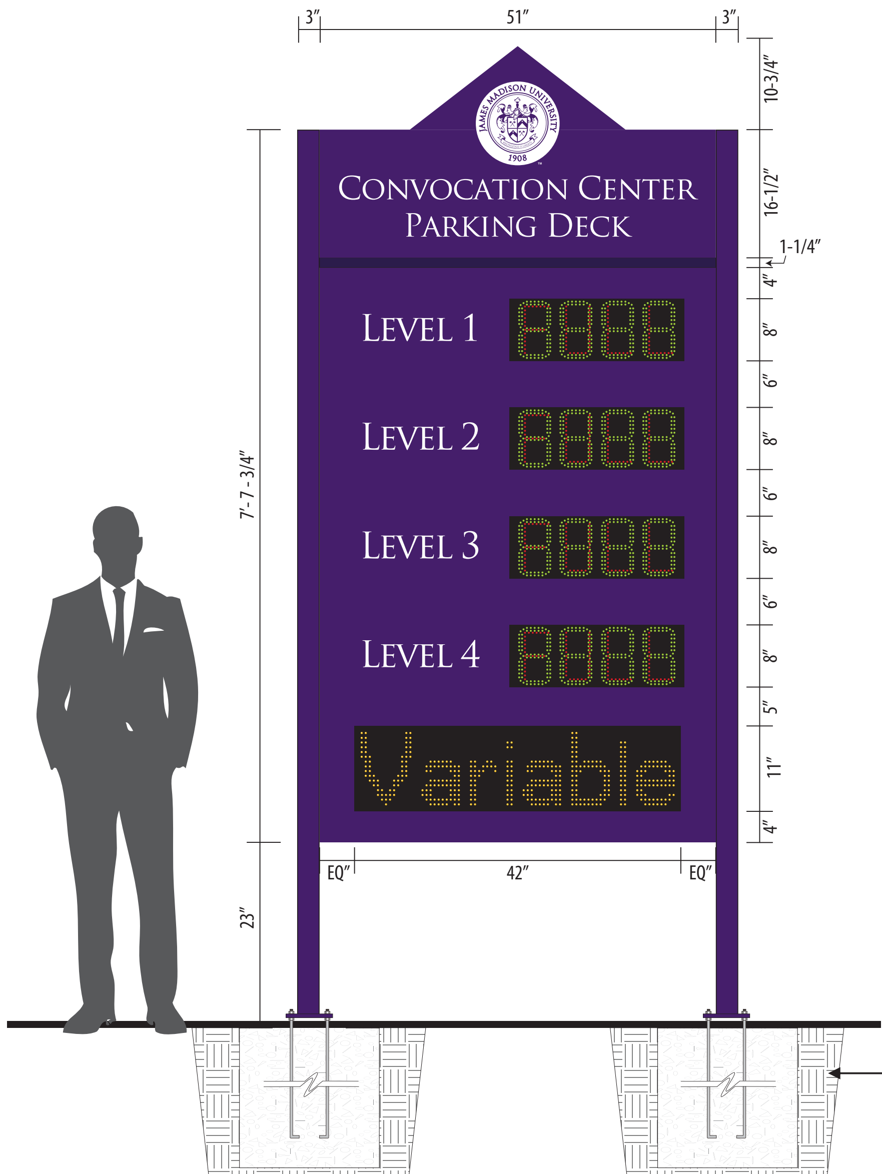
For more information contact marketing@q-free.com

Specifications are subject to change without prior notice.

VS110718

LEADING THE WAY

SINGLE - FACED SIGN QTY: 3



FRONT ELEVATION TYP. SINGLE - FACED SIGN QTY: 3
Scale: 3/4"=1'- 0"

SINGLE FACED SIGNAGE

UPPER CABINET STATIONARY:
ALUMINUM EXTRUDED RETAINER & FRAME w/
ALUMINUM FACES
FINISH COLOR TO MATCH PANTONE No. 2685C
w/ PURPLE & WHITE DIGITALLY PRINTED JMU SEAL
& WHITE REFLECTIVE VINYL LETTERING

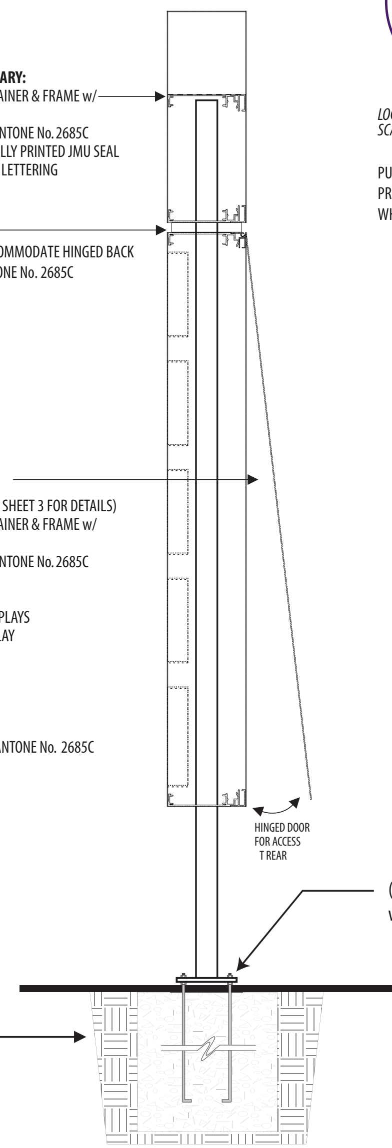
1-1/4"H. REVEAL-
HEIGHT INCREASED TO ACCOMMODATE HINGED BACK
FINISH COLOR TO BE PANTONE No. 2685C

LOWER CABINET:
w/ HINGED BACK (REFER TO SHEET 3 FOR DETAILS)
ALUMINUM EXTRUDED RETAINER & FRAME w/
ALUMINUM FACES
FINISH COLOR TO MATCH PANTONE No. 2685C

4 TRAFFIC CONTROLLER DISPLAYS
1 VARIABLE MESSAGE DISPLAY

POSTS & FOOTINGS:
FINISH COLOR TO MATCH PANTONE No. 2685C

18"x 18"x 45" DEEP FOOTERS
- BY OTHERS

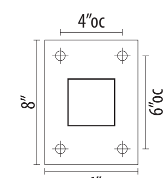


(2) 6"x 8"x 1/2" BASE PLATES
w/ 5/8" HOLE FOR 1/2" J-BOLTS

END VIEW
Scale: 3/4"=1'- 0"

LOGO DETAIL
SCALE: 1-1/2"=1'-0"

PURPLE & WHITE DIGITALLY
PRINTED JMU SEAL ON
WHITE REFLECTIVE VINYL



BASE PLATE DETAIL
Scale: 1-1/2" = 1'- 0"

Drawing No: 12195 **Sheet** 1 of 4 **Date:** 01-11-19
Revised: 12-21-18, 01-11-19 **Scale:** Noted
Drawn By: Sean Clyde

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Sudbury, MA 01776
978-443-2527
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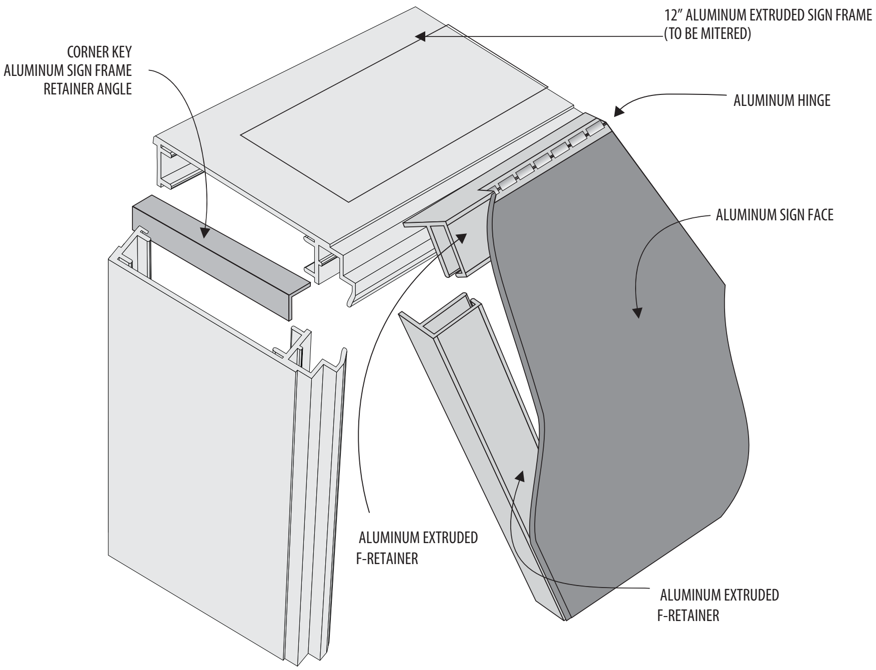
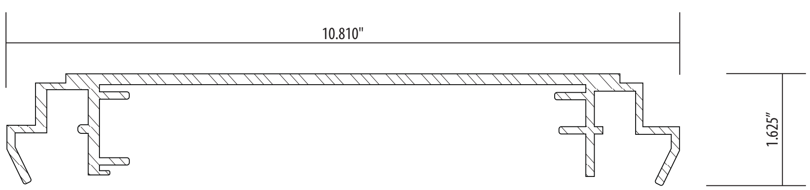
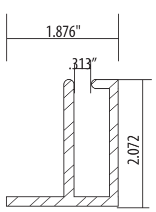




12" SIGN FRAME WITHOUT RETAINER
24-63-280
ACCEPTS 1/8" ANGLE AS CORNER KEY **RETAINER: 24-63-236**



F-RETAINER
24-63-250

Drawing No: 12195 **Sheet** 2 **of** 4 **Date:** 01-11-19
Revised: 12-21-18, 01-11-19 **Scale:** Noted
Drawn By: Sean Clyde

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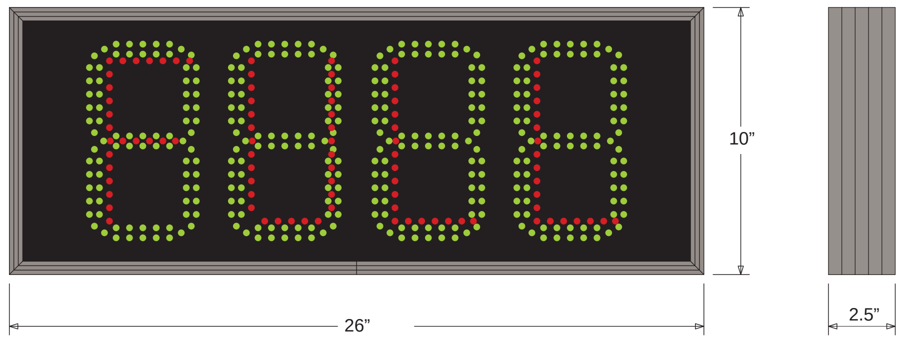
Product View

NOTE: Sign image may not exactly represent the finished product. For illustration purposes only.



Direct-View LED Traffic Controller
SA1026GR-F286

PRODUCT NUMBER
24285

CABINET DIMENSIONS
10” H x 26” W x 2.5” D

ILLUMINATION SOURCE
Super bright, wide viewing angle LEDs
Available in green, red, blue, amber, and white LEDs
Messages "blankout" when turned off, eliminating confusion
Long life, solid state lighting

ELECTRICAL
Integrated solid state power supply
Standard Voltage: 120 VAC, Optional Voltages: 9-36 V, 240 VAC, 277 VAC
Maximum amps per lighted message (at 120 V) shown in the table below
UL/CUL approved for wet locations

CONSTRUCTION
Faces: Single Faced Sign
Extrusion (TCL): Slim line continuous, corrosion resistant, aluminum housing 5.5” deep
Face Material: Impact Resistant, Smoke tinted Polycarbonate

FINISH
Standard Cabinet Color: Duranodic Bronze
Custom colors available upon request

MESSAGE	COLOR	HEIGHT	AMPS
Seven Segment Display	Green Wide Angle Oval	7.5”	0.24
FULL	Red Wide Angle Oval	6.0”	0.04

Seven Segment Display Functions

FULL

Q-Free TCS 55 Union Avenue, Sudbury, MA 01776 USA P. +1 978 443 2527

www.q-free.com www.tcsintl.com Twitter@QFreeASA

REV 0 | 072114 | RV

Drawing No: 12195 Sheet 3 of 4 Date: 01-11-19
Revised: 12-21-18, 01-11-19 Scale: Noted
Drawn By: Sean Clyde

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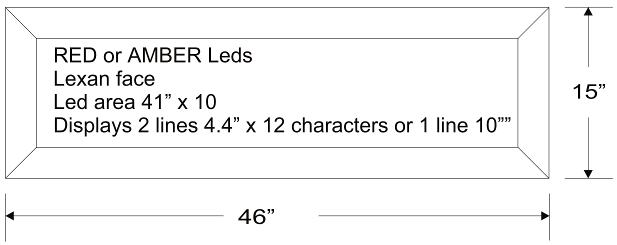
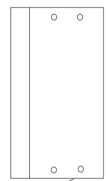
MODEL MXSR16-64/16

FRONT

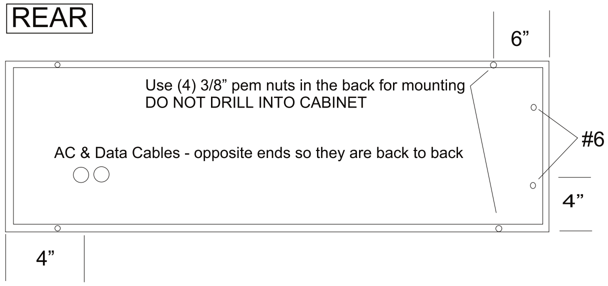


SIDE



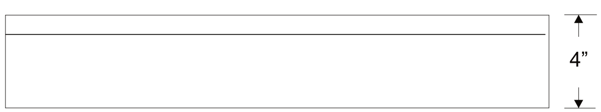
4X#8 SCREW

REAR

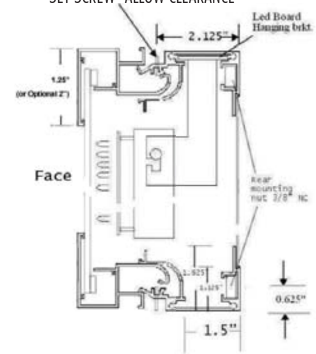


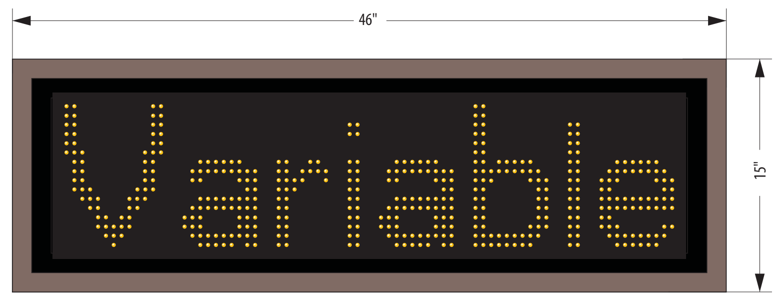
#6 SCREWS

TOP



4” FRAME - PROFILE DRAWING
FRONT SERVICEABLE CABINET
SIZE WHEN CLOSED-4-.25
SET SCREW -ALLOW CLEARANCE

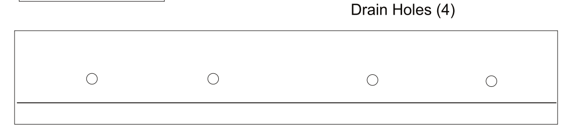




VMS DIRECT -VIEW LED DISPLAY
4.25”D

BOTTOM

Drain Holes (4)



Note:
Keep set screws in bottom accessible for opening faces for service
Power: 120V 1.3 amps per face
Weight: 24 lbs per face

Q-Free TCS 55 Union Avenue, Sudbury, MA 01776 USA P. +1 978 443 2527

www.q-free.com www.tcsintl.com Twitter@QFreeASA

Drawing No: 12195 Sheet 4 of 4 Date: 01-11-19
Revised: 12-21-18, 01-11-19 Scale: Noted
Drawn By: Sean Clyde

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Q-FREE TCS
55 Union Avenue
Sudbury, MA 01776
978-443-2527
www.tcsintl.com

Q-Free PGS Reference List September 2018

Parking HQ Boston: 55 Union Avenue - Sudbury, MA 01776 - P. (978) 443-2527 F. (978) 579-9545
Toronto: 70 Six Point Road - Etobicoke, ON M8Z 2X2 - P. (416) 259-4862 F. (416) 252-0285
Email: sales.usa@q-free.com
Web: https://www.q-free.com/solution/parking-guidance-systems/

Oct-18

	Project Name	Industry Type	City	State	Country	Parking Guidance System Type
1	7 Parcs	Mixed Use Installation	Arpajon		France	Single Space Counting PGS System
2	Afia Mall	Shopping Center Installation	Moscow		Russia	Single Space Counting PGS System
3	Agora at Walnut Creek Garage	Mixed Use Installation	Walnut Creek	CA	USA	Facility Counting PGS System
4	Agrobank Hadera Garage	Mixed Use Installation	Hadera		Israel	Single Space Counting PGS System
5	Agropur	Large Employer Installation	Saint-Hubert	QC	Canada	Level Counting PGS System
6	Air Rights Garage	Privately Owned Garages Installation	New Haven	CT	USA	Level Counting PGS System
7	Al Kout Mall Garage	Shopping Center Installation	Fahaheel		Kuwait	Single Space Counting PGS System
8	Alberta Boot Store Garage	Mixed Use Installation	Calgary	AB	Canada	Facility Counting PGS System
9	Alhamara Towers	Shopping Center Installation	Safat		Kuwait	Single Space Counting PGS System
10	Amazon Tilbury Distibution Centre Garage	Large Employer Installation	Tilbury		UK	Level Counting PGS System
11	American River College	College/University Installation	Sacramento	CA	USA	Level Counting PGS System
12	Andrews Air Force Base Medical Center	Hospital Installation	Joint Base Andrews	MD	USA	Single Space Counting PGS System
13	Annapolis Town Center	Mixed Use Installation	Annapolis	MD	USA	Level Counting PGS System
14	APCOA Kista Car Parks	Mixed Use Installation			Sweden	Single Space Counting PGS System
15	Arènes	Mixed Use Installation	Nimes		France	Single Space Counting PGS System
16	Ashburn Station	Transit Installation	Ashburn	VA	USA	Single Space Counting PGS System
17	Assembly Row	Shopping Center Installation	Boston	MA	USA	Single Space Counting PGS System
18	Assuta Village Garage	Mixed Use Installation	Tel Aviv		Israel	Single Space Counting PGS System
19	Austin Hospital Martin Street Garage	Hospital Installation	Melbourne	VIC	Australia	Single Space Counting PGS System
20	Azrieli Beer Sheva Garage	Shopping Center Installation	Beer Sheva		Israel	Single Space Counting PGS System
21	Azrieli Holon Business Centre	Business Center Installation	Tel Aviv		Israel	Single Space Counting PGS System
22	Azrieli Kirat Ata Garage	Shopping Center Installation	Kiryat Ata		Israel	Single Space Counting PGS System
23	Azrieli Mall Garage	Shopping Center Installation	Modiin		Israel	Single Space Counting PGS System
24	Azrieli Sarona Garage	Mixed Use Installation	Tel Aviv		Israel	Single Space Counting PGS System
25	Baltard	Mixed Use Installation	Nogent sur Marnes		France	Single Space Counting PGS System
26	Banco De Guayaquil	Privately Owned Garages Installation	Tel Aviv		Ecuador	Single Space Counting PGS System
27	Bay Area Transit Garage	Transit Installation	San Fransisco	CA	USA	Facility Counting PGS System
28	Bayshore Mall	Shopping Center Installation	Ottawa	ON	Canada	Level Counting PGS System
29	Bazalel Market Garage	Mixed Use Installation	Tel Aviv		Israel	Single Space Counting PGS System
30	Beer Sheva Mall	Shopping Center Installation	Beer Shava		Israel	Single Space Counting PGS System
31	Belcier	Mixed Use Installation	Bordeaux		France	Single Space Counting PGS System
32	Bellecour	Mixed Use Installation	Lyon		France	Single Space Counting PGS System
33	Bellevue	Mixed Use Installation	Biarritz		France	Single Space Counting PGS System
34	Ben Gurion Airport Garage	Airport Installation	Tel Aviv		Israel	Single Space Counting PGS System
35	Big Danilof Mall	Shopping Center Installation	Tel Aviv		Israel	Single Space Counting PGS System
36	Big Fashion Mall	Shopping Center Installation	Belgrade		Serbia	Single Space Counting PGS System
37	Big Tveria Mall	Shopping Center Installation	Tiberais		Israel	Single Space Counting PGS System
38	Blackwater Hospital Garge	Hospital Installation	Blackwater		Australia	Single Space Counting PGS System
39	Blue Ridge Community College	College/Univeristy Installation	Weyers Cave	VA	USA	Facility Counting PGS System
40	Broadway Shopping Centre	Shopping Center Installation	Broadway		Australia	Single Space Counting PGS System
41	Bucharest Shopping Center	Shopping Center Installation	Bucharest		Romania	Single Space Counting PGS System
42	Burgeau Trailhead Parking Lot	National Park Installation	Banff	AB	Canada	Lot Counting PGS System
43	Burlington International Airport	Airport Installation	Burlington	VT	USA	Level Counting PGS System
44	Cal State Chico	College/University Installation	Chico	CA	USA	Facility Counting PGS System
45	Calgary Board of Education	City/Municipality Installation	Calgary	AB	Canada	Facility Counting PGS System
46	Calgary Parking Authority Arts Commons Parkade (Lot 24)	City/Municipality Installation	Calgary	AB	Canada	Single Space Counting PGS System
47	Calgary Parking Authority Centennial Parkade (Lot 54)	City/Municipality Installation	Calgary	AB	Canada	Single Space Counting PGS System
48	Calgary Parking Authority City Centre Parkade (Lot 25)	City/Municipality Installation	Calgary	AB	Canada	Single Space Counting PGS System
49	Calgary Parking Authority City Hall Parkade (Lot 36)	City/Municipality Installation	Calgary	AB	Canada	Single Space Counting PGS System
50	Calgary Parking Authority James Short Parkade (Lot 40)	City/Municipality Installation	Calgary	AB	Canada	Single Space Counting PGS System
51	Calgary Parking Authority Lido Garage	City/Municipality Installation	Calgary	AB	Canada	Single Space Counting PGS System
52	Calgary Parking Authority Lot 7	City/Municipality Installation	Calgary	AB	Canada	Facility Counting PGS System
53	Calgary Parking Authority McDougall Parkade (Lot 28)	City/Municipality Installation	Calgary	AB	Canada	Single Space Counting PGS System
54	Calgary Parking Authority Telus Convention Centre (Lot 60)	City/Municipality Installation	Calgary	AB	Canada	Single Space Counting PGS System
55	Canadian Hospital University Montreal	Hospital Installation	Montreal	QC	Canada	Single Space Counting PGS System
56	Canberra Hospital Garage	Hospital Installation	Canberr		Australia	Single Space Counting PGS System
57	Capital One Employee Garage	Large Employer Installation	McLean	VA	USA	Level Counting PGS System
58	Carnot, Reine Garone, Gare	Mixed Use Installation	Agen		France	Single Space Counting PGS System
59	Cascade Ponds DUA Parking Lot	National Park Installation	Banff	AB	Canada	Lot Counting PGS System
60	Casino Biarritz	Casino Installation	Biarritz		France	Single Space Counting PGS System
61	Castle Towers Shopping Centre	Shopping Center Installation	Castle Hill		Australia	Single Space Counting PGS System
62	Casuarina Square Shopping Centre	Shopping Center Installation	Casuarina		Australia	Single Space Counting PGS System
63	Cave & Basin NHS Parking Lot	National Park Installation	Banff	AB	Canada	Lot Counting PGS System
64	CDG Interventions	Mixed Use Installation	Roissy		France	Single Space Counting PGS System
65	Central Park Hayarkon Garage	Shopping Center Installation	Tel Aviv		Israel	Single Space Counting PGS System
66	Central Street Garage	City/Municipality Installation	Naperville	IL	USA	Single Space Counting PGS System
67	Centre	Mixed Use Installation	Nogent sur Marnes		France	Single Space Counting PGS System
68	Centre de Congrès	Mixed Use Installation	Massy		France	Single Space Counting PGS System
69	Centre Ville	Mixed Use Installation	Antony		France	Single Space Counting PGS System
70	Chantier	Mixed Use Installation	Versailles		France	Single Space Counting PGS System
71	Charlotte Area Transit System	Transit Installation	Charlotte	NC	USA	Way Finding PGS System
72	Children's Hospital Boston	Hospital Installation	Boston	MA	USA	Single Space Counting PGS System
73	Cinemall	Shopping Center Installation	Haifa		Israel	Single Space Counting PGS System
74	City Center DC	Mixed Use Installation	Washington	DC	USA	Single Space Counting PGS System

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	Project Name	Industry Type	City	State	Country	Parking Guidance System Type
75	City Court Garage	Mixed Use Installation	Tel Aviv		Israel	Single Space Counting PGS System
76	City Hall Garage	City/Municipality Installation	Ottawa	ON	Canada	Single Space Counting PGS System
77	City of Austin City Hall Garage	City/Municipality Installation	Austin	TX	USA	Way Finding PGS System
78	City of Austin Library Garage	City/Municipality Installation	Austin	TX	USA	Way Finding PGS System
79	City of Austin Seaholm Garage	City/Municipality Installation	Austin	TX	USA	Way Finding PGS System
80	City of Baldwin Park Garage	City/Municipality Installation	Baldwin Park	CA	USA	Level Counting PGS System
81	City of Burbank City Garage #1	City/Municipality Installation	Burbank	CA	USA	Facility Counting PGS System
82	City of Burbank City Garage #2	City/Municipality Installation	Burbank	CA	USA	Facility Counting PGS System
83	City of Burbank City Garage #3	City/Municipality Installation	Burbank	CA	USA	Facility Counting PGS System
84	City of Burbank City Garage #4	City/Municipality Installation	Burbank	CA	USA	Facility Counting PGS System
85	City of Burlington Lot 3	City/Municipality Installation	Burlington	ON	Canada	Lot Counting PGS System
86	City of Burlington Lot 8	City/Municipality Installation	Burlington	ON	Canada	Lot Counting PGS System
87	City of Burlington Waterfront Park	City/Municipality Installation	Burlington	ON	Canada	Lot Counting PGS System
88	City of Edina Parking Lots	City/Municipality Installation	Edina	MN	USA	Way Finding PGS System
89	City of Hollywood Garfield Garage	City/Municipality Installation	Hollywood	FL	USA	Level Counting PGS System
90	City of Naperville Central Parking Garage	City/Municipality Installation	Naperville	IL	USA	Single Space Counting PGS System
91	City of Naperville Van Buren Garage	City/Municipality Installation	Naperville	IL	USA	Level Counting PGS System
92	City of Ottawa Byward Market Garage	City/Municipality Installation	Ottawa	ON	Canada	Level Counting PGS System
93	City of Ottawa City Hall	City/Municipality Installation	Ottawa	ON	Canada	Single Space Counting PGS System
94	City of Ottawa Dalhousie Garage	City/Municipality Installation	Ottawa	ON	Canada	Single Space Counting PGS System
95	City of Ottawa Glebe Garage	City/Municipality Installation	Ottawa	ON	Canada	Single Space Counting PGS System
96	City of Ottawa Gloucester Street Garage	City/Municipality Installation	Ottawa	ON	Canada	Single Space Counting PGS System
97	City of San Jose	City/Municipality Installation	San Jose	CA	USA	Way Finding PGS System
98	City of San Jose Market Street	City/Municipality Installation	San Jose	CA	USA	Level Counting PGS System
99	City of Stamford	City/Municipality Installation	Stamford	CT	USA	Level Counting PGS System
100	Clal Garage	Mixed Use Installation	Jerusalem		Israel	Single Space Counting PGS System
101	Clémeneau	Mixed Use Installation	Biarritz		France	Level Counting PGS System
102	Cloisters Square Garage	Mixed Use Installation	Perth	WA	Australia	Single Space Counting PGS System
103	Club Regent Casino	Casino Installation	Winnipeg	MB	Canada	Level Counting PGS System
104	Cosmopolitan Hotel & Casino	Casino Installation	Las Vegas	NV	USA	Single Space Counting PGS System
105	Cosumnes River College	College/University Installation	Sacramento	CA	USA	Level Counting PGS System
106	Cours Seguin	Mixed Use Installation	Boulogne		France	Single Space Counting PGS System
107	Crown Casino	Casino Installation	Southbank VIC		Australia	Level Counting PGS System
108	Dallas/Fort Worth International Airport	Airport Installation	Dallas	TX	USA	Level Counting PGS System
109	Dana Farber Cancer Institute	Hospital Installation	Boston	MA	USA	Single Space Counting PGS System
110	Daniel Frish Street Garage	Mixed Use Installation	Tel Aviv		Israel	Single Space Counting PGS System
111	Décathlon	Mixed Use Installation	Treillieres		France	Single Space Counting PGS System
112	Del Amo Fashion Center Garages	Shopping Center Installation	Torrance	CA	USA	Level Counting PGS System
113	Dolmen Garage	Mixed Use Installation	Qala		Malta	Single Space Counting PGS System
114	Dominion Workplace Garage	Large Employer Installation	Richmond	VA	USA	Single Space Counting PGS System
115	Don Mills Shopping Centre	Shopping Center Installation	Toronto	ON	Canada	Level Counting PGS System
116	Edmonton International Airport	Airport Installation	Edmonton	AB	Canada	Level Counting PGS System
117	Eduard VII	Mixed Use Installation	Paris		France	Single Space Counting PGS System
118	Edwards Life Sciences Employee Garage	Large Employer Installation	Irvine	CA	USA	Level Counting PGS System
119	El Camino Hospital	Hospital Installation	Mountain View	CA	USA	Level Counting PGS System
120	Estancia Mall	Shopping Center Installation	Pasig		Philippines	Single Space Counting PGS System
121	Fidelity Bank	Privately Owned Garages Installation	West Palm Beach	FL	USA	Single Space Counting PGS System
122	Five Oaks Garage	Mixed Use Installation	Houston	TX	USA	Level Counting PGS System
123	Flamingo Casino	Casino Installation	Las Vegas	NV	USA	Facility Counting PGS System
124	Florida Hospital Alden Street Garage	Hospital Installation	Orlando	FL	USA	Single Space Counting PGS System
125	Florida Hospital Ginsburg Garage	Hospital Installation	Orlando	FL	USA	Single Space Counting PGS System
126	Florida Hospital King Street Garage	Hospital Installation	Orlando	FL	USA	Single Space Counting PGS System
127	Florida Hospital McRae Street Garage	Hospital Installation	Orlando	FL	USA	Single Space Counting PGS System
128	Florida Hospital North King Street Garage	Hospital Installation	Orlando	FL	USA	Facility Counting PGS System
129	Foch	Mixed Use Installation	Surenes		France	Single Space Counting PGS System
130	Fontaine du Roy	Mixed Use Installation	Ville d'Avrey		France	Single Space Counting PGS System
131	Fort Lauderdable International Airport	Airport Installation	Fort Launderdale	FL	USA	Level Counting PGS System
132	Fort Meade Phase Garage	Government Installation	Meade	MD	USA	Facility Counting PGS System
133	Foxwoods Casino Rainmaker Garage	Casino Installation	Mashantucket	CT	USA	Level Counting PGS System
134	Freedom Plaza Garage	Mixed Use Installation	Washington DC		USA	Single Space Counting PGS System
135	Frémincout	Mixed Use Installation	Paris		France	Single Space Counting PGS System
136	Gambetta Casino Clémencau	Casino Installation	Hyeres		France	Single Space Counting PGS System
137	Gare de l'Est	Transportation Installation	Paris		France	Single Space Counting PGS System
138	Gare Nord	Transportation Installation	Nantes		France	Single Space Counting PGS System
139	Gare Sud	Transportation Installation	Nantes		France	Single Space Counting PGS System
140	Genentec	Large Employer Installation	San Fransisco	CA	USA	Level Counting PGS System
141	Genentec Garages	Large Employer Installation	San Fransisco	CA	USA	Facility Counting PGS System
142	Gilead Sciences PG309 Garage	Large Employer Installation	Seattle	WA	USA	Level Counting PGS System
143	Gilead Sciences PS355 Garage	Large Employer Installation	Seattle	WA	USA	Level Counting PGS System
144	Glaxo Smith Kline	Large Employer Installation	Durham	NC	USA	Facility Counting PGS System
145	Glaxo Smith Kline	Large Employer Installation	Philadelphia	PA	USA	Facility Counting PGS System
146	Glencoe Club	Privately Owned Garages Installation	Calgary	AB	Canada	Level Counting PGS System
147	GO Transit Ajax Station	Transit Installation	Ajax	ON	Canada	Single Space Counting PGS System
148	GO Transit Aurora Station	Transit Installation	Aurora	ON	Canada	Single Space Counting PGS System

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	Project Name	Industry Type	City	State	Country	Parking Guidance System Type
149	GO Transit Bloomington Station	Transit Installation	Bloomington	ON	Canada	Single Space Counting PGS System
150	GO Transit Bramalea Station	Transit Installation	Bloomington	ON	Canada	Single Space Counting PGS System
151	GO Transit Burlington Station	Transit Installation	Burlington	ON	Canada	Single Space Counting PGS System
152	GO Transit Clarkson Station	Transit Installation	Clarkson	ON	Canada	Single Space Counting PGS System
153	GO Transit Cooksville Station	Transit Installation	Cooksville	ON	Canada	Single Space Counting PGS System
154	GO Transit Erindale Station	Transit Installation	Erindale	ON	Canada	Single Space Counting PGS System
155	GO Transit Hamilton Station	Transit Installation	Hamilton	ON	Canada	Single Space Counting PGS System
156	GO Transit Oakville Station	Transit Installation	Oakville	ON	Canada	Single Space Counting PGS System
157	Go Transit Whitby Station	Transit Installation	Whitby	ON	Canada	Single Space Counting PGS System
158	Government Agency	Large Employer Installation		VA	USA	Level Counting PGS System
159	Government Installation #1	Government Installation	Bethesda	MD	USA	Single Space Counting PGS System
160	Government Installation #2	Government Installation	Bethesda	MD	USA	Level Counting PGS System
161	Government Installation #3	Government Installation	Riverside Park	MD	USA	Level Counting PGS System
162	Gramercy Woods Garge	Mixed Use Installation	Jacksonville	FL	USA	Level Counting PGS System
163	Grand Mall Haifa	Shopping Center Installation	Haifa		Israel	Single Space Counting PGS System
164	Grand Ohio Garage	Privately Owned Garages Installation	Chicago	IL	USA	Level Counting PGS System
165	Griffith University	College/University Installation	Nathan		Austalia	Facility Counting PGS System
166	Hartford Convention Center Garage	Convention/Entertainment Center Installation	Hartford	CT	USA	Level Counting PGS System
167	Hotel de Ville & Mowat & Pompidou	Mixed Use Installation	Vincennes		France	Single Space Counting PGS System
168	Hotel Ukraine Garage	Hotel Installation	Kiev		Ukraine	Single Space Counting PGS System
169	Howard Community College	College/University Installation	Columbia	MD	USA	Facility Counting PGS System
170	Ilot-Fontenay	Mixed Use Installation	Vincennes		France	Single Space Counting PGS System
171	Inbalim Garage	Mixed Use Installation	Jerusalem		Israel	Single Space Counting PGS System
172	Intel Garage	Large Employer Installation	Haifa		Israel	Single Space Counting PGS System
173	International Monetary Fund	Large Employer Installation	Washington	DC	USA	Level Counting PGS System
174	Jakarta Kuningan City Garage	Shopping Center Installation	Jakarata		Indonesia	Single Space Counting PGS System
175	James Madison University Champions Deck	College/Univeristy Installation	Harrisonburg	VA	USA	Level Counting PGS System
176	James Madison University Grace Street Garage	College/Univeristy Installation	Harrisonburg	VA	USA	Level Counting PGS System
177	James Madison University Main Street Garage	College/University Installation	Harrisonburg	VA	USA	Level Counting PGS System
178	James Madison University Mason Street Garage	College/University Installation	Harrisonburg	VA	USA	Level Counting PGS System
179	Jamul Casino Garage	Casino Installation	Jamul	CA	USA	Single Space Counting PGS System
180	Jean-Jaures & Gare	Mixed Use Installation	Toulouse		France	Single Space Counting PGS System
181	Jerusalem Haoma Garage	Mixed Use Installation	Jerusalem		Israel	Single Space Counting PGS System
182	Johnston Canyon Parking Lot	National Park Installation	Banff	AB	Canada	Lot Counting PGS System
183	Jvalley Garage	Large Employer Installation	Amman		Jordan	Single Space Counting PGS System
184	Kaiser Permanente Vallejo	Hospital Installation	Vallejo	CA	USA	Level Counting PGS System
185	Kaiser Permanente Woodland Hills	Hospital Installation	Woodland Hills	CA	USA	Level Counting PGS System
186	King of Prussia Mall	Shopping Center Installation	King of Prussia	PA	USA	Level Counting PGS System
187	La Guardia Airport	Airport Installation	New York	NY	USA	Facility Counting PGS System
188	La Madeline Garage	Mixed Use Installation	Paris		France	Single Space Counting PGS System
189	Lake Louise Parking Lots	National Park Installation	Banff	AB	Canada	Lot Counting PGS System
190	Landmark Tower	Mixed Use Installation	Abu Dhabi		UAE	Single Space Counting PGS System
191	Legacy Place Shopping Center	Shopping Center Installation	Dedham	MA	USA	Level Counting PGS System
192	Lev Hadera Mall Garage	Shopping Center Installation	Hadera		Israel	Single Space Counting PGS System
193	Libbie Mill Garage	Mixed Use Installation	Richmond	VA	USA	Level Counting PGS System
194	Liberation	Mixed Use Installation	Saint-Cloud		France	Single Space Counting PGS System
195	Lido Garage	Mixed Use Installation	Calgary	AB	Canada	Level Counting PGS System
196	Liquor Control Board Ontario Store #452 Garage	Mixed Use Installation	Toronto	ON	Canada	Level Counting PGS System
197	Los Angeles Trade Technical College	College/University Installation	Los Angeles	CA	USA	Level Counting PGS System
198	Los Rios Community College District	College/University Installation	Sacramento	CA	USA	Level Counting PGS System
199	Loudon Gateway Station	Transit Installation	Dulles	VA	USA	Single Space Counting PGS System
200	Madrid	Mixed Use Installation	Neulilly		France	Single Space Counting PGS System
201	Main Street Cupertino Garage	Large Employer Installation	Cupertino	CA	USA	Single Space Counting PGS System
202	Maison Carrée	Mixed Use Installation	Nimes		France	Single Space Counting PGS System
203	Maison de la Radio	Mixed Use Installation	Paris		France	Single Space Counting PGS System
204	Malha Jerusalem Garage	Shopping Center Installation	Jerusalem		Israel	Single Space Counting PGS System
205	Manulife Building	Privately Owned Garages Installation	Toronto	ON	Canada	Level Counting PGS System
206	Marché	Mixed Use Installation	Boulonge		France	Single Space Counting PGS System
207	Marengo	Mixed Use Installation	Toulouse		France	Single Space Counting PGS System
208	Marigny	Mixed Use Installation	Vincennes		France	Single Space Counting PGS System
209	Market Street Garage	City/Municipality Installation	San Jose	CA	USA	Level Counting PGS System
210	Market Street Place	Mixed Use Installation	San Fransisco	CA	USA	Facility Counting PGS System
211	Maryland Live! Casino At Arundel Mills	Casino Installation	Hannover	MD	USA	Level Counting PGS System
212	Maryland Procument Office	Government Installation	Maryland	MD	USA	Lot Counting PGS System
213	McPhillips Station Casino	Casino Installation	Winnipeg	MB	Canada	Level Counting PGS System
214	Melisron Group Garage	Mixed Use Installation	Moscow		Russia	Single Space Counting PGS System
215	Melisron Group HQ	Large Employer Installation	Tel Aviv		Israel	Single Space Counting PGS System
216	METRA Rail	Transit Installation	Chicago	IL	USA	Way Finding PGS System
217	MGM Grand at Foxwoods Casino	Casino Installation	Mashantucket	CT	USA	Level Counting PGS System
218	MGM Springfield	Casino Installation	Springfield	MA	USA	Level Counting PGS System
219	Microsoft Building 99	Large Employer Installation	Redmond	WA	USA	Level Counting PGS System
220	Milenum Tower Garage	Mixed Use Installation	Tel Aviv		Israel	Single Space Counting PGS System
221	Ministry of Defense Garage	Government Installation	Tel Aviv		Israel	Single Space Counting PGS System
222	Minnewanka RV Parking Lot	National Park Installation	Banff	AB	Canada	Lot Counting PGS System

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	Project Name	Industry Type	City	State	Country	Parking Guidance System Type
223	Monash University	College/Univeristy Installation	Melbourne		Australia	Single Space Counting PGS System
224	Montgomerty County Garage 57	City/Municipality Installation	Montgomery	MD	USA	Facility Counting PGS System
225	Montgomery County Lot 31	City/Municipality Installation	Montgomery	MD	USA	Single Space Counting PGS System
226	Montgomery County Lot 60	City/Municipality Installation	Montgomery	MD	USA	Single Space Counting PGS System
227	Montgomery County Lot 61	City/Municipality Installation	Montgomery	MD	USA	Single Space Counting PGS System
228	Montgomery Rockville College	College/Univeristy Installation	Rockville	MD	USA	Level Counting PGS System
229	Montholon	Mixed Use Installation	Paris		France	Single Space Counting PGS System
230	Morraine Lake Parking Lot	National Park Installation	Banff	AB	Canada	Lot Counting PGS System
231	Mosaic Shopping Center	Shopping Center Installation	Fairfax	VA	USA	Level Counting PGS System
232	Muir Woods National Park	National Park Installation	Mill Valley		USA	Lot Counting PGS System
233	National Oceanic and Atmospheric Association	Large Employer Installation	Washington	DC	USA	Level Counting PGS System
234	Naval Medical Center Transient Wounded Warrior Lodge	Hospital Installation	Bethesda	MD	USA	Single Space Counting PGS System
235	New Haven Parking Authority	City/Municipality Installation	New Haven	CT	USA	Level Counting PGS System
236	Nike Headquarters C Garage	Large Employer Installation	Beaverton	OR	USA	Single Space Counting PGS System
237	Nike Headquaters Fitness Garage	Large Employer Installation	Beaverton	OR	USA	Single Space Counting PGS System
238	Nike Headquaters Innovation Garage	Large Employer Installation	Beaverton	OR	USA	Single Space Counting PGS System
239	Nike Headquaters Murray Garage	Large Employer Installation	Beaverton	OR	USA	Single Space Counting PGS System
240	Northeastern Unversity	College/University Installation	Boston	MA	USA	Facility Counting PGS System
241	Novetel Garage	Mixed Use Installation	Calgary	AB	Canada	Single Space Counting PGS System
242	O&O Srl Garage	Mixed Use Installation	Correggio		Italy	Single Space Counting PGS System
243	One Loudoun Garage	Mixed Use Installation	Ashburn	VA	USA	Single Space Counting PGS System
244	Orange Grove Parking Structure	City/Municipality Installation	Burbank	CA	USA	Way Finding PGS System
245	Orient Garage	Mixed Use Installation	Jerusalem		Israel	Single Space Counting PGS System
246	Oshira Kfar-Saba	Shopping Center Installation	Kfar Saba		Israel	Single Space Counting PGS System
247	P5	Mixed Use Installation	Orly		France	Single Space Counting PGS System
248	Pacific Fair Shopping Centre	Shopping Center Installation	Broadbeach	QLD	Australia	Single Space Counting PGS System
249	Palazzo Casino	Casino Installation	Las Vegas	NV	USA	Level Counting PGS System
250	Palm Ave Garage	City/Municipality Installation	Sarasota	FL	USA	Level Counting PGS System
251	Parc de la Gare et Porte de Paris	Mixed Use Installation	Melun		France	Single Space Counting PGS System
252	Park Royal Shopping Centre	Shopping Center Installation	Vancouver	BC	Canada	Level Counting PGS System
253	ParkLake Shopping Center	Shopping Center Installation	Bucharest		Romania	Single Space Counting PGS System
254	PenFed Credit Union Garage	Large Employer Installation	Alexandria	VA	USA	Level Counting PGS System
255	Penn Square Mall	Shopping Center Installation	Oklahoma City	OK	USA	Level Counting PGS System
256	Pentagon Center Shopping Mall Garages	Shopping Center Installation	Arlington	VA	USA	Level Counting PGS System
257	Petach Tigva Mall	Shopping Center Installation	Jerusalem		Israel	Single Space Counting PGS System
258	Place Viau Shopping Centre	Shopping Center Installation	Montreal	QC	Canada	Level Counting PGS System
259	Place Ville Marie Shopping Mall Garage	Shopping Center Installation	Montreal	QC	Canada	Level Counting PGS System
260	Portland Community Colllege	College/University Installation	Portland	OR	USA	Facility Counting PGS System
261	Prado	Mixed Use Installation	Marseille		France	Single Space Counting PGS System
262	Prudential Center Garage	Mixed Use Installation	Boston	MA	USA	Level Counting PGS System
263	Psagot Garage	Mixed Use Installation	Tel Aviv		Israel	Single Space Counting PGS System
264	Radisson Royal Hotel	Hotel Installation	Moscow		Russia	Single Space Counting PGS System
265	Ramat Aviv Mall	Shopping Center Installation	Tel Aviv		Israel	Single Space Counting PGS System
266	Rehovot Mall	Shopping Center Installation	Rehovot		Israel	Single Space Counting PGS System
267	Renanim Mall	Shopping Center Installation	Ra'anana		Israel	Single Space Counting PGS System
268	Rennes Montparnasse	Mixed Use Installation	Paris		France	Single Space Counting PGS System
269	Revel Casino	Casino Installation	Atlantic City	NJ	USA	Level Counting PGS System
270	Rivers Casino	Casino Installation	Des Plaines	IL	USA	Single Space Counting PGS System
271	Riverwalk Parkade	City/Municipality Installation	Calgary	AB	Canada	Single Space Counting PGS System
272	Rockwell Power Plant Mall	Shopping Center Installation	Makati		Philippines	Single Space Counting PGS System
273	Rogovin Hertzelia Garage	Mixed Use Installation	Herzilya Piuah		Israel	Single Space Counting PGS System
274	Roosevelt Field Mall	Shopping Center Installation	Garden City	NY	USA	Level Counting PGS System
275	Rowan University	College/Universtiy Installation	Glassboro	NJ	USA	Single Space Counting PGS System
276	Royal Beach Garage	Hotel Installation	Eilat		Israel	Single Space Counting PGS System
277	Royal Childrens Hospital	Hospital Installation	Parkville	VIC	Australia	Single Space Counting PGS System
278	Royal Radisson Hotel Garage	Hotel Installation	Moscow		Russia	Single Space Counting PGS System
279	SA Government Building	Government Installation	Abu Dhabi		UAE	Single Space Counting PGS System
280	SACS Garage #1	Mixed Use Installation	Borgo Valsugana		Italy	Single Space Counting PGS System
281	SACS Garage #2	Mixed Use Installation	Borgo Valsugana		Italy	Single Space Counting PGS System
282	Safeway Gargage	Shopping Center Installation	Oakland	CA	USA	Facility Counting PGS System
283	San Antonio Military Medical Center	Hospital Installation	San Antonio	TX	USA	Level Counting PGS System
284	Santa Clara Alviso	College/University Installation	Santa Clara	CA	USA	Facility Counting PGS System
285	Santa Monica Beaches Garage	Transit Installation	Santa Monica	CA	USA	Way Finding PGS System
286	Santa Monica College	College/University Installation	Santa Monica	CA	USA	Facility Counting PGS System
287	Sarona Mall	Shopping Center Installation	Tel Aviv-Yafo		Israel	Single Space Counting PGS System
288	Scotia Square	Shopping Center Installation	Halifax	NS	Halifax, NS	Level Counting PGS System
289	SeaMall	Shopping Center Installation	Ashdod		Israel	Single Space Counting PGS System
290	Seaport Transportation Center Garge	Mixed Use Installation	Boston	MA	USA	Level Counting PGS System
291	Sensor Dynamics Garage	Large Employer Installation	Mitcham		Australia	Single Space Counting PGS System
292	Seven Star Mall	Shopping Center Installation	Herzilya		Israel	Single Space Counting PGS System
293	Sheik Abdulla Al Salem Cultural Center Museum Project	Museum/Cultural Center Installation	Kuwait City		Kuwait	Single Space Counting PGS System
294	Sheik Abdulla Al Salem Cultural Center Theater Project	Museum/Cultural Center Installation	Kuwait City		Kuwait	Single Space Counting PGS System
295	Sherway Gardens Shopping Centre Garages	Shopping Center Installation	Etobicoke	ON	Canada	Single Space Counting PGS System
296	Sherway Gardens Shopping Centre North Garage	Shopping Center Installation	Etobicoke	ON	Canada	Single Space Counting PGS System

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Toronto: 70 Six Point Road - Etobicoke, ON M8Z 2X2 - P. (416) 259-4862 F. (416) 252-0285
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Web: https://www.q-free.com/solution/parking-guidance-systems/

Oct-18

	Project Name	Industry Type	City	State	Country	Parking Guidance System Type
297	Sherway Gardens Shopping Centre South Garage	Shopping Center Installation	Etobicoke	ON	Canada	Single Space Counting PGS System
298	Shops at Clearfork Garage E1	Shopping Center Installation	Fort Worth	TX	USA	Level Counting PGS System
299	Shops at Clearfork Garage H1	Shopping Center Installation	Fort Worth	TX	USA	Level Counting PGS System
300	Shviro Kfar Saba	Shopping Center Installation			Israel	Single Space Counting PGS System
301	Silver Sun Gallery	Shopping Center Installation	Santo Domingo	DR	USA	Single Space Counting PGS System
302	Silverton Casino	Casino Installation	Las Vegas	NV	USA	Level Counting PGS System
303	Sorenson Parkade	Mixed Use Installation	Red Deer	AB	Canada	Facility Counting PGS System
304	Sound Transit	Transit Installation	Seattle	WA	USA	Facility Counting PGS System
305	Square One Shopping Centre	Shopping Center Installation	Mississauga	ON	Canada	Level Counting PGS System
306	Stanford University Redwood City	College/Univeristy Installation	Stanford	CA	USA	Single Space Counting PGS System
307	State Street Garage	City/Municipality Installation	Sarasota	FL	USA	Level Counting PGS System
308	Sulphur Mountain Parking Lot	National Park Installation	Banff	AB	Canada	Lot Counting PGS System
309	Sunnyvale Town Ceneter	Shopping Center Installation	Sunnyvale	CA	USA	Level Counting PGS System
310	Sydney Airport Drop-off Garage	Airport Installation	Sydney		Australia	Level Counting PGS System
311	Temecula Shopping Center	Shopping Center Installation	Termecula	CA	USA	Level Counting PGS System
312	The Triangle	Shopping Center Installation	Costa Mesa	CA	USA	Level Counting PGS System
313	Toronto Outlets Halton Hills	Shopping Center Installation	Toronto	ON	Canada	Lot Counting PGS System
314	Town of Banf Bear Street Garage	City/Municipality Installation	Banff	AB	Canada	Facility Counting PGS System
315	Town of Banf Bear Street Garage	City/Municipality Installation	Alexandria	VA	USA	Level Counting PGS System
316	Town of Banff Beaver Street Garage	City/Municipality Installation	Alexandria	VA	USA	Level Counting PGS System
317	Town of Banff Beaver Street Lot	City/Municipality Installation	Banff	AB	Canada	Facility Counting PGS System
318	Town of Banff P1 Surface Parking	City/Municipality Installation	Banff	AB	Canada	Lot Counting PGS System
319	Train Towers Mall	Shopping Center Installation	Tel Aviv		Israel	Single Space Counting PGS System
320	Transit Wounded Warrior	Hospital Installation	Bethesda	MD	USA	Single Space Counting PGS System
321	TUFTS Medical Center	Large Employer Installation	Watertown	MA	USA	Level Counting PGS System
322	Twist	Mixed Use Installation	Paris		France	Single Space Counting PGS System
323	University Kansas Medical Center Garge	Hospital Installation	Kansas City		KS	Level Counting PGS System
324	University of California Davis Medical Center Garage	College/University Installation	Davis	CA	USA	Single Space Counting PGS System
325	University of Chicago	College/University Installation	Chicago	IL	USA	Level Counting PGS System
326	University of Kansas Medical Center	College/University Installation	Kansas City	KS	USA	Level Counting PGS System
327	University of Louisville	College/University Installation	Louisville	KY	USA	Level Counting PGS System
328	VA Hospital DC	Hospital Installation	Washington	DC	USA	Level Counting PGS System
329	VA Hospital Orlando	Hospital Installation	Orlando	FL	USA	Level Counting PGS System
330	VA Hospital Palo Alto	Hospital Installation	Livermore	CA	USA	Level Counting PGS System
331	VA Hospital Portland	Hospital Installation	Portland	OR	USA	Level Counting PGS System
332	VA Hospital San Juan	Hospital Installation	San Juan		Puerto Rico	Level Counting PGS System
333	VA Palo Alto Garage	Hospital Installation	Palo Alto	CA	USA	Facility Counting PGS System
334	Valley View Casino	Casino Installation	San Diego	CA	USA	Level Counting PGS System
335	VDOT Front Royal I-66 Lot	Truck Parking Installation	Front Royal	VA	USA	Lot Counting PGS System
336	Vendôme	Mixed Use Installation	Paris		France	Single Space Counting PGS System
337	Viasat Bressi Ranch Garages	Large Employer Installation	Carlsbad	CA	USA	Level Counting PGS System
338	Victor Hugo	Mixed Use Installation	Toulouse		France	Single Space Counting PGS System
339	Victoria Comprehensive Cancer Centre	Hospital Installation	Melbourne		Australia	Single Space Counting PGS System
340	Virginia Tech University	College/University Installation	Blacksburg	VA	USA	Level Counting PGS System
341	VTA Bart Berryessa Garage	Transit Installation	San Jose	CA	USA	Level Counting PGS System
342	VTA Bart Milpitas Garage	Transit Installation	Milpitas	CA	USA	Level Counting PGS System
343	VTA Bart Surface Lots	Transit Installation	San Fransisco	CA	USA	Lot Counting PGS System
344	Water Street Hotel Garage	Hotel Installation	Naperville	IL	USA	Single Space Counting PGS System
345	West Light Rail Transit Station	Transit Installation	Calgary	AB	USA	Level Counting PGS System
346	Whyte Museum Garage	City/Municipality Installation	Banff	AB	Canada	Level Counting PGS System
347	Workday Garages	Large Employer Installation	Plesanton	CA	USA	Level Counting PGS System
348	Wynn Casino	Casino Installation	Las Vegas	NV	USA	Level Counting PGS System
349	Wynn Encore Casino	Casino Installation	Las Vegas	NV	USA	Level Counting PGS System
350	York Adams Transportation Authority	City/Municipality Installation	Gettysburg	PA	USA	Way Finding PGS System
351	Zamarot Gargae	Mixed Use Installation	Zamarot		Israel	Single Space Counting PGS System

REFERENCE

AMAZON DISTRIBUTION CENTRE – UNITED KINGDOM

The Amazon Distribution Centre at Tilbury, east of London, is one of the largest Amazon distribution centres in Europe. Its parking facility consists of 1,800 parking spaces on three levels that operate on three shifts, 24/7, for Amazon Associates.

On behalf of Amazon, Q-Free was approached by McLaren Construction Ltd to provide a Parking Guidance System (PGS) to guide Amazon Associates to available parking for their shift, enabling precise start and end times while maintaining free vehicle movement within the car park.

To maximize efficiency, Q-Free installed ceiling mounted Ultrasonic Directional sensors (USDS) detecting vehicle entry/exit at garage and level entry/exits. On the open air third level, inducitve loops were used.

Guidance information is displayed on Q-Free's Variable Message Signs, reflecting facility, zones and level counting. The accurate vehicle counting on entry, exit and levels is also used for internal and external reporting.

INSTALLATION HIGHLIGHTS

- Ceiling-mounted Ultrasonic Directional Sensors (USDS) and in-ground induction loops providing guidance and counting.
- Guidance information displayed on Q-Free's two external totems and four single VMS's and a further two VMS's inside the car park.
- All installations carried out and commissioned by Q-Free's in-house team.
- The Q-Free wireless communication solution takes advantage of wireless mesh technology, allowing the sensors, loops and information signs to communicate through multiple pathways. This reduces the cost of cabling and installation associated with a traditional hard-wired PGS.
- Q-Free's flexible and interchangeable PGS solution can be re-programmed to accommodate traditional space availability on each level or zone at any stage, if required.

VS.1.04.18

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LEADING THE WAY

BAYSHORE SHOPPING CENTRE -OTTAWA CANADA

Level signs displaying available parking of upcoming floors

USDS counting level entry/exits

Bayshore Shopping Centre is one of Ottawa's largest shopping malls, containing over 190 retailers. It boasts more than 4,000 parking spaces, most of which reside in two multi-level parking structures. In 2015, Q-Free was contracted to install a Parking Guidance System (PGS) inside the main parking garage as part of a $200 million redevelopment and expansion project.

The PGS consists of Ultrasonic Directional Sensors (USDS) counting vehicle entry/exits into each of the five levels. These counts are then sent to LED displays installed throughout the structure that efficiently guide traffic to available parking spaces.

In 2016, Q-Free was contracted again to provide a PGS for the property's second parking structure. This additional system has USDS and LED displays throughout the five levels. Data from both systems is fed back to a virtual server which can be monitored in real-time by property management and allows the creation of customizable reports.

INSTALLATION HIGHLIGHTS

- USDS tracking the throughput of 10,000+ vehicles daily
- Large LED gantry sign overhanging a double lane entrance
- Master and level signs display parking availability at key decision points
- Virtual PGS server maintained by property management which eliminates the need for a physical server on-site

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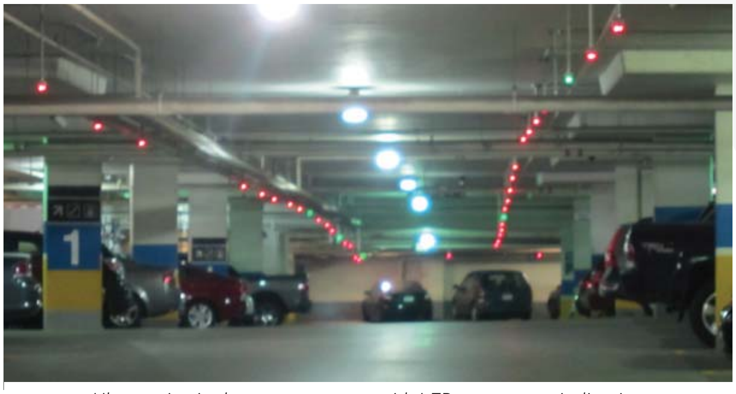
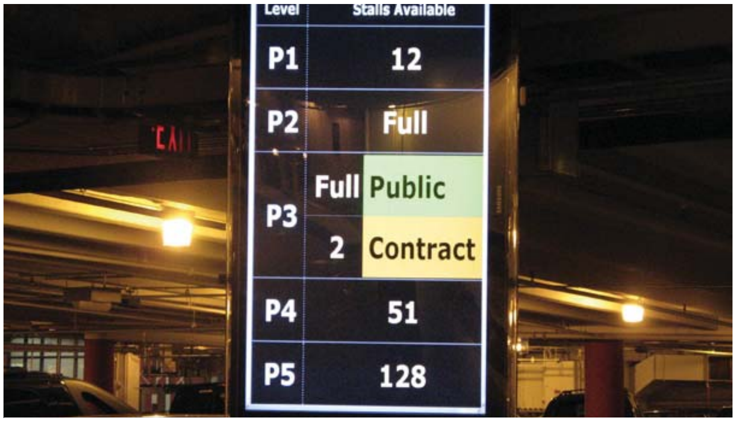
LEADING THE WAY

REFERENCE

CALGARY PARKING AUTHORITY — CANADA



Ultrasonic single-space sensors with LED occupancy indication



Interface to customized LCD information screens

Parking space availability signs at each facility

The Calgary Parking Authority (CPA) is responsible for all parking policies, and manages the public parking facilities for the City of Calgary.

The CPA required a city wide parking guidance solution to make parking easier and more efficient, while also monitoring and managing the quantity of monthly and daily parkers.

Q-Free provided a customized Parking Guidance System (PGS) utilizing ultrasonic directional sensors to monitor vehicle traffic at the entrance and exits of each facility as well as the parking levels within.

To monitor each individual parking space, ultrasonic single-space sensors were used. Roadway signs, indicating space availability with the ability to show customizable variable messages, were installed at facility entrances.

The Q-Free Visual Control Center software package is used to manage the system, providing a user interface and statistical information as well as interfaces to customized LCD information screens throughout the system.

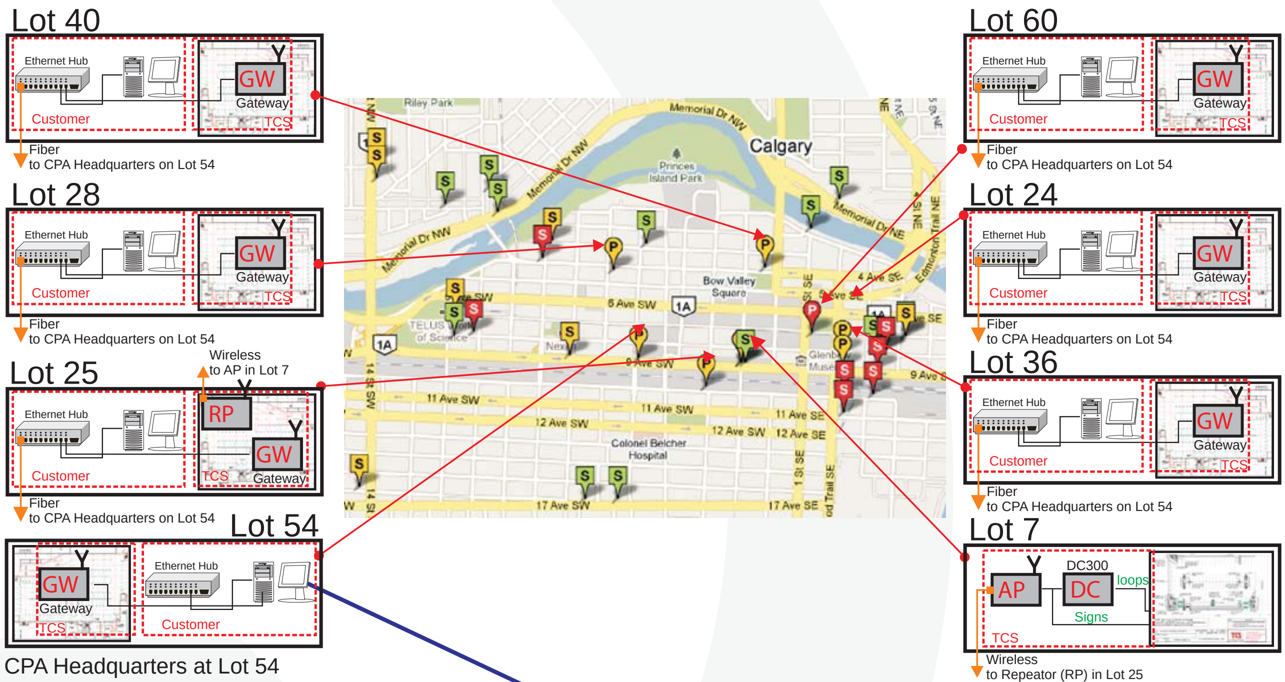
INSTALLATION HIGHLIGHTS

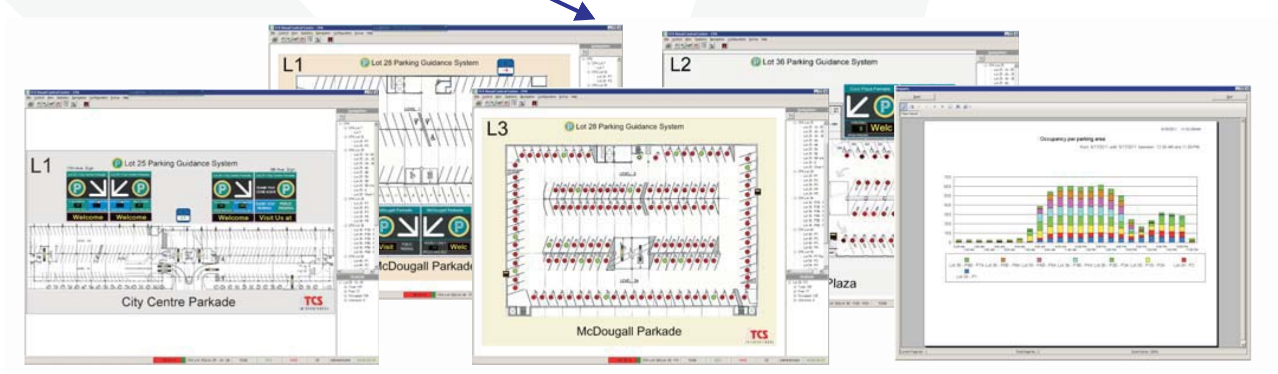
- Eight facilities and over 5,000 parking spaces monitored
- Ultrasonic directional sensors provide accurate counts
- Single-space sensors used to monitor the monthly and daily parkers
- LED occupancy indication on single-space sensors
- Wireless Mesh network uses less cable than traditional PGS
- Server with communication through city's existing network

LEADING THE WAY

The PGS for the CPA takes advantage of Q-Free's wireless Mesh technology, eliminating the need for communication wiring throughout the garage. This reduces cost and improves performance by removing a single point of failure as in typical wired systems. A server with parking guidance software is located at CPA headquarters and communicates to all facilities through the city's existing network.

The software provides a graphical user interface displaying real-time parking availability, counting device status, and sign information. The software allows a user to view, analyze and export parking information statistics in numerical and graphical forms.





Visual Control Center features graphical user interface, real-time parking availability, and statistics

VS.06.09.16

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LEADING THE WAY

CITY OF OTTAWA GARAGE — OTTAWA, CANADA

As the capital of Canada, Ottawa's population of over 952,000 creates a high volume of downtown traffic. In 2013, to reduce congestion and enhance the ease of finding parking, the City of Ottawa contacted Q-Free to install customized Parking Guidance Systems (PGS) for two of their busiest downtown parking garages. Q-Free provided a mix of single-space monitoring and level-counting PGS equipment which included custom-designed dynamic and static message signs.

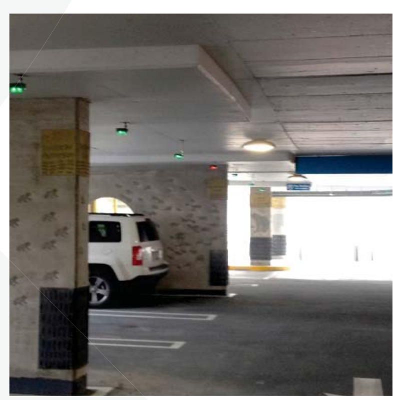
In 2015, Q-Free was contracted again and asked to provide a single-space guidance system to the newly renovated Glebe Garage, which is located in one of Ottawa's most eclectic shopping districts. The addition of two more garages is planned for 2016.

The PGS server located at City Hall provides central monitoring for all three parking garages including customizable reports. The PGS's API tool enables occupancy data to be exported to the city's third-party mobile application.

INSTALLATION HIGHLIGHTS

- Over 1,000 parking spaces monitored
- Wireless Mesh network
- Mix of ultrasonic and single-space sensors
- Master and level signs displaying parking availability throughout garage
- Real-time parking information through Visual Control Center

Space availability signage guiding drivers to spaces



Single-space sensors

VS.0609.16

Q FREE

LEADING THE WAY

REFERENCE

COSMOPOLITAN — LAS VEGAS, USA

Located on the Las Vegas Strip, The Cosmopolitan of Las Vegas offers hotel accommodation, residential living, meeting facilities, restaurants, retail space, spas and a casino in a multi-tower design. This luxury destination required a Parking Guidance System (PGS) that would allow customers to quickly and easily locate available parking spaces so that they could start enjoying all that the resort has to offer.

Q-Free deployed a system which uses ultrasonic single-space sensors above every parking space in the facility. These sensors each have an external occupancy status light indicating whether parking spaces are available or occupied. The sensors communicate locally to a zone controller which then communicates on an encrypted wireless Mesh network back to a central server.

The server provides a user interface and allows viewing of real-time parking availability as well as parking statistics. Parking availability is displayed throughout the facility on electronic master signs, level signs and aisle signs.

INSTALLATION HIGHLIGHTS:

- Over 2,500 parking spaces monitored
- Ultrasonic single-space sensors provide 100 percent accurate counts
- Wireless Mesh network
- Master signs, level signs and aisle signs display parking availability throughout the garage
- Real-time parking information through Q-Free's Visual Control Center software
- Valuable parking occupancy statistics

Parking aisle

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Specifications are subject to change without prior notice.

LEADING THE WAY

REFERENCE

CROWN CASINO COMPLEX — SOUTHBANK, AUSTRALIA

The Crown Casino complex is the largest casino complex in the Southern Hemisphere and one of the largest in the world. Q-Free was selected as the preferred Parking Guidance System (PGS) vendor for this project due to the challenging layout of the car park, which includes two-way traffic ramps with multiple entry/exit locations.

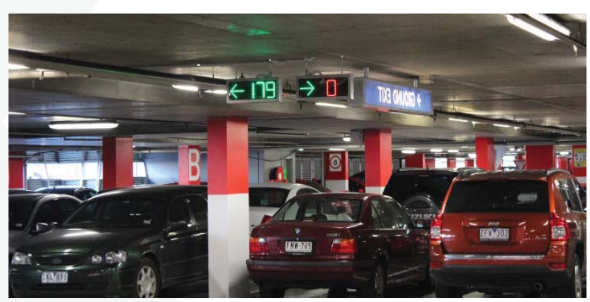
The custom-designed PGS system includes Ultrasonic Directional Sensors (USDS) used in a level/zone-counting application in conjunction with directional signage and a centralized management system. Clusters of two or three USDS sensors are placed across the width of each lane depending on lane layout. Wireless system communication reduces the need for additional cabling, thus reducing installation costs.

Custom-designed space availability signage guides drivers to available spaces on each level/zone of the garage. The Q-Free Visual Control Center software package is the backbone of the system. It provides an easy user interface and statistic information.

INSTALLATION HIGHLIGHTS

- Monitors over 2,000 spaces
- Ultrasonic directional sensors
- Provides level/zone counts
- Space availability signage guides drivers to available parking spaces
- Central PGS server at parking office provides easy

Signage guiding drivers to available spaces on eache level of garage



Custom designed space availability signage

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LEADING THE WAY

REFERENCE

DEL AMO FASHION CENTER MALL — CALIFORNIA, USA

Located in the South Bay area of Los Angeles County, the Del Amo Fashion Center has more than 200 stores and restaurants, making it one of the largest shopping centers in the United States.

Q-Free was asked to deliver a customized Parking Guidance System (PGS) for three parking garages utlizing ultrasonic technology that provides level by level parking information to guide drivers quickly and efficiently to available spaces.

Q-Free provided a multi-facility level-counting PGS with ultrasonic directional sensors, custom-designed space availability signage, wireless communication and a central PGS server which connects the three on-site parking garages.

INSTALLATION HIGHLIGHTS

- Over 3,000 parking spaces monitored in multiple garages
- Wireless Mesh technology
- Ultrasonic directional sensors
- Space availability signs display parking availability throughout the facility
- Real-time parking information provided by Q-Free's Visual Control Center software
- Valuable parking occupancy statistics

Ultrasonic directional sensors

Space availability signage guides drivers to available spaces

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FREE

LEADING THE WAY

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REFERENCE

FLORIDA HOSPITAL – FLORIDA, USA

Master panel sign at garage entrance

End-of-space single-space sensors

Florida Hospital is a highly sought group of hospitals in the Orlando, Tampa, and Daytona Beach, FL providing the latest providing the latest treatments and technology.

Q-Free has provided a Parking Guidance System for four of the garages at Florida Hospital. They comprise of ultrasonic directional sensors (USDS) to monitor vehicle traffic at the entrance and exits of each facility, as well as the parking levels within.

To monitor each individual parking space, ultrasonic single-space sensors were used. Roadway signs, indicating space availability with the ability to show customizable variable messages, were installed at facility entrances.

The Q-Free Visual Control Center software package is used to manage the system, providing a user interface and statistical information as well as interfaces to customized LCD information screens throughout the system.

INSTALLATION HIGHLIGHTS

- Single-space monitoring and level counting PGS for four parking garages
- Over 3,000 three-color end-of-space single-space sensors
- Over 70 ultrasonic directional sensors
- Central PGS server
- Space availability signage guides drivers to avaiable parking
- Wireless Mesh Network
- Roadway signs displaying facility space available

VS.29.03.17

LEADING THE WAY

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REFERENCE

GO TRANSIT METROLINX — GREATER TORONTO AREA, ONTARIO

Bilingual interior space availability and directional signage

Master panel sign at garage entrance

End-of-space single-space sensors

GO Transit Metrolinx first approached Q-Free to provide a combination of single-space monitoring and level counting for a newly erected five-level parking structure in Oakville, Ontario in 2012. This 1,600 parking space facility was equipped with a Parking Guidance System (PGS) designed by Q-Free. In 2013, Metrolinx added Q-Free systems to the Ajax, Aurora, Erindale and Clarkson GO station garages to monitor over 2,000 parking spaces.

Q-Free provided customized single-space monitoring and level-counting PGSs for each garage. Entrance and level signs guide drivers and display space availabilities. Q-Free's Visual Control Center software package is used to manage the system, providing an easy user interface and statistic information.

INSTALLATION HIGHLIGHTS

- Single-space monitoring/level-counting PGS for five transit parking garages
- Over 2,000 three-color end-of-space single-space sensors
- Over 100 ultrasonic directional sensors
- Bilingual (English and French) space availability signage and dynamic LED displays
- Individual PGS servers at each garage location

The Q-Free PGS software on each server provides a graphical user interface displaying real-time parking availability, counting device status and sign information. The software allows the user to view, analyze and export statistical information in numerical and graphical form.

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LEADING THE WAY

REFERENCE

HOLLYWOOD CASINO JAMUL -SAN DIEGO, USA

Interior level signs

Exterior garage signs

Intercom

Camera

Hollywood Casino Jamul - San Diego, CA, opened its doors to the public in October 2016. The casino includes a three-story gaming and entertainment facility of approximately 200,000 square feet, featuring over 1,700 slot machines, 40 live table games, multiple restaurants, bars and lounges and an enclosed below grade parking structure with approximately 1,800 spaces.

Q-Free has provided a complete parking system which includes single space sensors above every parking space, license plate recognition, and gated entry/exits with intercoms. It allows customers to quickly and easily locate available parking spaces so they can enjoy all the amenities the casino has to offer.

License plate recognition is used at VIP and employee restricted area entries to vend the entry gates. Key fobs provide valet entry/exit.

INSTALLATION HIGHLIGHTS

- Single-space monitoring PGS for all eight levels
- Approx.1,800 three-color end-of-space single-space sensors
- License plate recognition providing restricted area entry
- Intercom to security office to open gates
- Custom designed space availability signage
- Interface with 3rd party gantry signage provider

The Q-Free PGS software on each server provides a graphical user interface displaying real-time parking availability, counting device status and sign information. The software allows the user to view, analyze and export statistical information in numerical and graphical form.

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LEADING THE WAY

REFERENCE

JAMES MADISON UNIVERSITY CAMPUS — VIRGINIA, USA

James Madison University (JMU) is a public co-educational research establishment located in Harrisonburg, Virginia. With over 148 major buildings, it is home to over 20,000 students. Guiding drivers quickly and efficiently to available parking was one of the University's major concerns.

In 2007, to accomdate students, faculty and the large amounts of traffic due to the University sporting events, Q-Free was first contracted to provide a Parking Guidance System (PGS) for one of the garages on campus utilizing ultrasonic directional sensors, and custom designed space availability signage with wireless communication .

Since then, the company has installed PGS systems in two additional campus garages. All systems are connected to a central PGS server located in the parking management office. An additional garage expansion will be completed in 2016.

INSTALLATION HIGHLIGHTS

- Over 2,000 parking spaces monitored in three campus garages
- Wireless Mesh network
- Ultrasonic directional sensors
- Master and level signs display parking availability throughout garages
- Real-time parking information through Visual Control Center software
- Valuable parking occupancy statistics

VS.06.09.16

LEADING THE WAY

REFERENCE

KING OF PRUSSIA MALL – PENNSYLVANIA, USA

King of Prussia is a Simon Mall located in King of Prussia, PA. It has a diverse mix of over 400 stores and a collection of luxury retailers unsurpassed in the region. It has a delectable selection of international dining options at three unique food courts and is one of the most iconic malls in the nation.

Q-Free has provided a Parking Guidance System for the Orange garage at King of Prussia . They comprise of ultrasonic directional sensors to monitor vehicle traffic at the entrance and exits of the garage as well as the parking levels within.

To inform visitors of parking availability Q-Free LED displays are used in the PGS system. LED signs located at decision points along the properties roadways direct traffic to the garage. Once at the garage, visitors are greeted by displays showing each floors availability.

The Q-Free Visual Control Center software package is used to manage the system, providing a user interface and statistical information as well as interfaces to customized LCD information screens throughout the system.

INSTALLATION HIGHLIGHTS

- USDS monitoring the space availability of each level.
- Centralized PGS server located on the property which provides real time parking counts and customizable reports.
- Central PGS server
- Space availability signage guides drivers to available parking spaces
- Wireless Mesh Network

Master panel sign at garage entrance

Master panel signs near vallet entrance

VS.9.04.18

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Specifications are subject to change without prior notice.

Q FREE

LEADING THE WAY

REFERENCE

MONTGOMERY COUNTY GARAGE — MARYLAND, USA

Ultrasonic directional sensors

Space availability signage guiding drivers to available spaces

The city of Montgomery looked to address downtown traffic congestion issues by building three new parking garages. In 2014, Q-Free was invited to install a customized Parking Guidance System (PGS) in one of the garages. By the end of the same year, it had installed a PGS in all three.

Q-Free provided battery-operated, wireless, single-space sensors and custom-designed garage and way-finding signs. A central PGS server covers all three garages.

INSTALLATION HIGHLIGHTS

- Over 3,000 parking spaces monitored
- Wireless Mesh technology for all three garages
- Ultrasonic directional sensors
- Master and level signs display parking availability throughout the garages
- Real-time parking information through Visual Control Center software
- Valuable parking occupancy statistics

VS.06.09.16

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LEADING THE WAY

REFERENCE

CF SHERWAY GARDENS — TORONTO, CANADA

CF Sherway Gardens is a large shopping mall located in the Greater Toronto Area (GTA). It's home to over 190 top retailers accessible to patrons in a clean and modern atmosphere. The mall has recently under gone renovations, constructing three new parking decks containing a total of 2700 parking spaces.

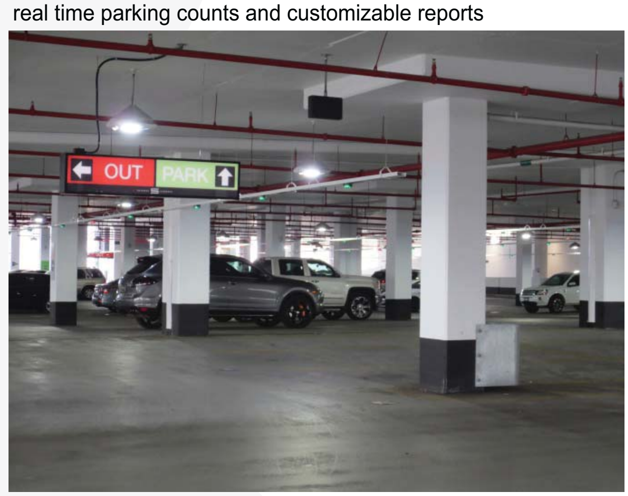
In 2015 Q-Free was contracted to install a Parking Guidance System (PGS) inside the properties North, East, and South parking decks. The PGS is comprised of Single Space Sensors (SSS) detecting individual space occupancy for every covered parking space. Ultrasonic Directional Sensors (USDS) located on ramps detect vehicle entries and exits for the uncovered roof levels.

Master Sign Display Available Parking for Each Parkade

LED displays installed at garage entry points and ramps display individual floor availability. Large LED Master Signs are also located along a ring road that spans the entire perimeter of the property. These LED Master Signs help direct traffic to the parkades with the highest amount of available spaces.

INSTALLATION HIGHLIGHTS

- A mixture of SSS and USDS monitoring the availability of covered and uncovered parking spaces
- Large LED Master Signs located across the property directing traffic between parkades
- Centralized PGS server located on the property which provides real time parking counts and customizable reports



Single Space Sensors Detecting Space Availability

VS.0609.16

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Specifications are subject to change without prior notice.

LEADING THE WAY

REFERENCE

SHOPS AT CLEARFORK – TEXAS, USA

Master panel signs near entrance/exit

Ramp counting point

The Shops at Clearfork is a Simon Mall located in Fort Worth, TX. It is an open-air shopping, dining, entertainment, living and office destination in the heart of Fort Worth. The Shops at Clearfork feature upscale and mainstream retail stores and restaurants, several of which are exclusive to Fort Worth.

For two of the garages, Q-Free has provided a Parking Guidance System comprised of ultrasonic directional sensors to monitor vehicle traffic at the entrance and exits, as well as the parking levels within.

To inform visitors of parking availability, Q-Free LED displays are used in the PGS system. LED signs, located at decision points along the property's roadways, direct traffic to the garage. Once at the garage, visitors are greeted by displays showing each floor's availability.

The Q-Free Visual Control Center software package is used to manage the system, providing an user interface and statistical information as well as interfaces to customized LED information screens throughout the system.

INSTALLATION HIGHLIGHTS

- USDS monitoring the space availability of each level.
- Centralized PGS server located on the property which provides real time parking counts and customizable reports.
- Central PGS server
- Space availability signage guides drivers to available parking spaces
- Wireless Mesh Network

VS.9.04.18

Q FREE

LEADING THE WAY

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CF SHOPS AT DON MILLS – TORONTO, CANADA

CF Shops at Don Mills is an outdoor shopping complex in the Greater Toronto Area (GTA) that offers designer shops centered around a scenic town square. With its unique layout and attention to quality, CF Shops at Don Mills has become a popular destination for visitors and locals alike.

In 2016, Q-Free was contracted to install a Parking Guidance System (PGS) inside the property's multi-level parking structure. The PGS consists of ultrasonic directional sensors (USDS) mounted from the ceiling at all garage entry/exits and level transition points. The USDS monitor traffic entering and exiting each floor. The data recorded is viewable in real-time by property staff using Q-Free's Visual Control Center Software.

To inform visitors of parking availability, Q-Free integrated the customer's third party LED displays into the PGS system. LED signs located at decision points along the properties roadways direct traffic to the garage. Once at the garage, visitors are greeted by displays showing each floor's availability.

INSTALLATION HIGHLIGHTS

- USDS monitoring the space availability of each level.
- Third party LED displays integrated into the system for wayfinding.
- Centralized PGS server located on the property which provides real time parking counts and customizable reports.

VS.08.03.18

LEADING THE WAY

SQUARE ONE SHOPPING CENTRE – MISSISSAUGA, CANADA

Photo credit: TripAdvisor

Located within the Greater Toronto Area, Square One Shopping Centre is a premier fashion and lifestyle destination. The largest shopping centre in Ontario and listed as one of Canada's top 10 malls, Square One offers over 320 shops and services.

In 2013, Q-Free was contracted to provide a Parking Guidance System (PGS) at Square One to help direct traffic and reduce congestion. Ultrasonic Directional Sensors (USDS) were utilized to provide level counting systems for the properties three garages, and induction loops were used to monitor their five surface lots. The counts provided by the parking equipment relay to various roadway LED signs located around the property.

In 2016, Q-free was contracted to expand the system into two newly constructed garages, and three surface lots. The expansion also ushered in the integration of an online interactive parking map using Q-Free's API tool. The parking map provides real time parking updates that patrons can check before arriving.

INSTALLATION HIGHLIGHTS

- A combination of USDS and induction loops monitor covered and uncovered parking areas.
- Large LED roadway signs directing traffic to parking areas with the most available parking spaces.
- Q-Free API tool pushing parking date to the properties web based interactive parking map.

VS.08.03.18

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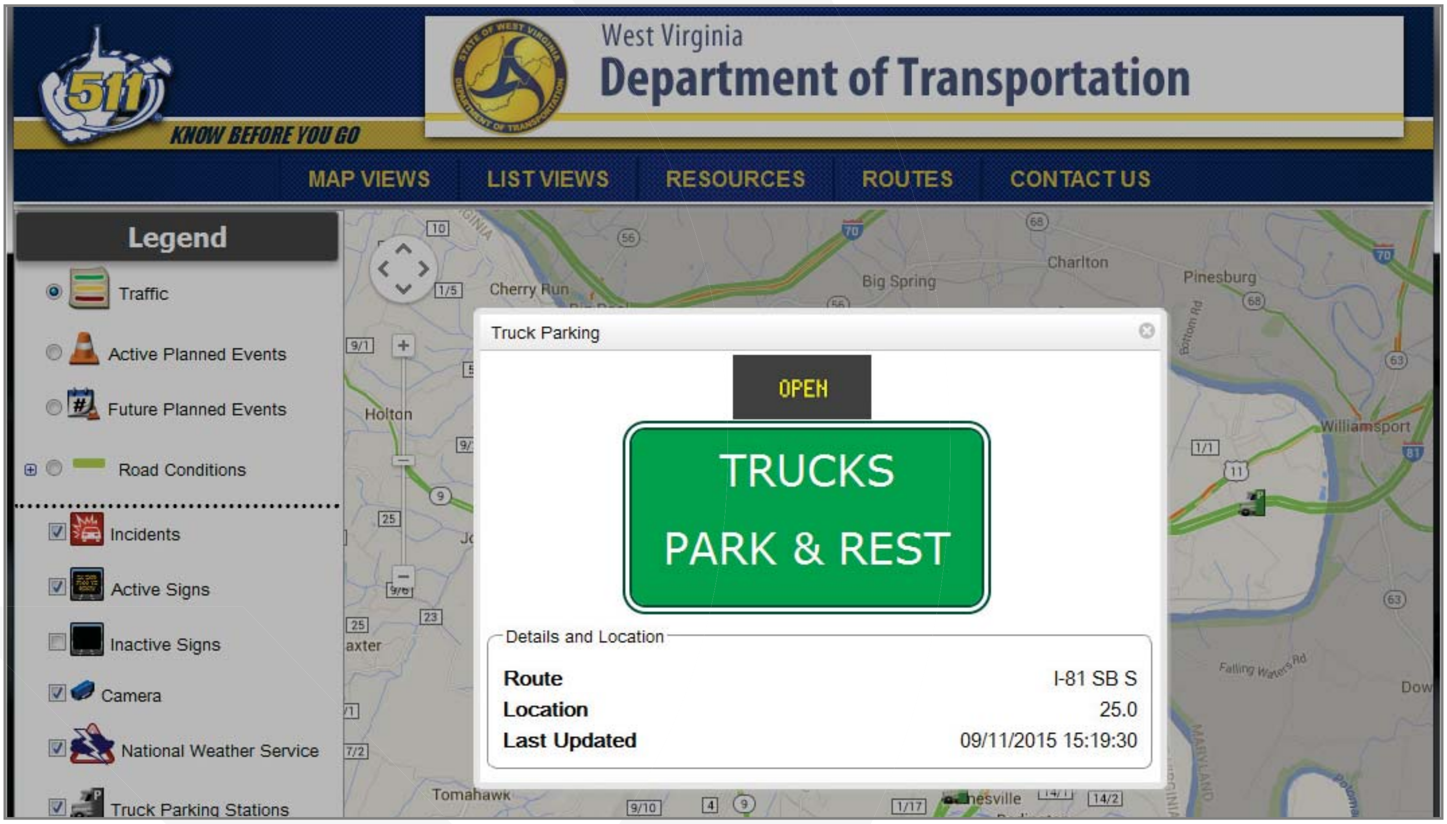
FREE

LEADING THE WAY

WEST VIRGINIA DEPARTMENT OF HIGHWAYS TRUCK PARKING – USA



The West Virginia Department of Highways needed a Truck Parking Guidance System (PGS) that uses the latest technology to detect, monitor and alert truckers to available parking in the most efficient way possible. The system required:

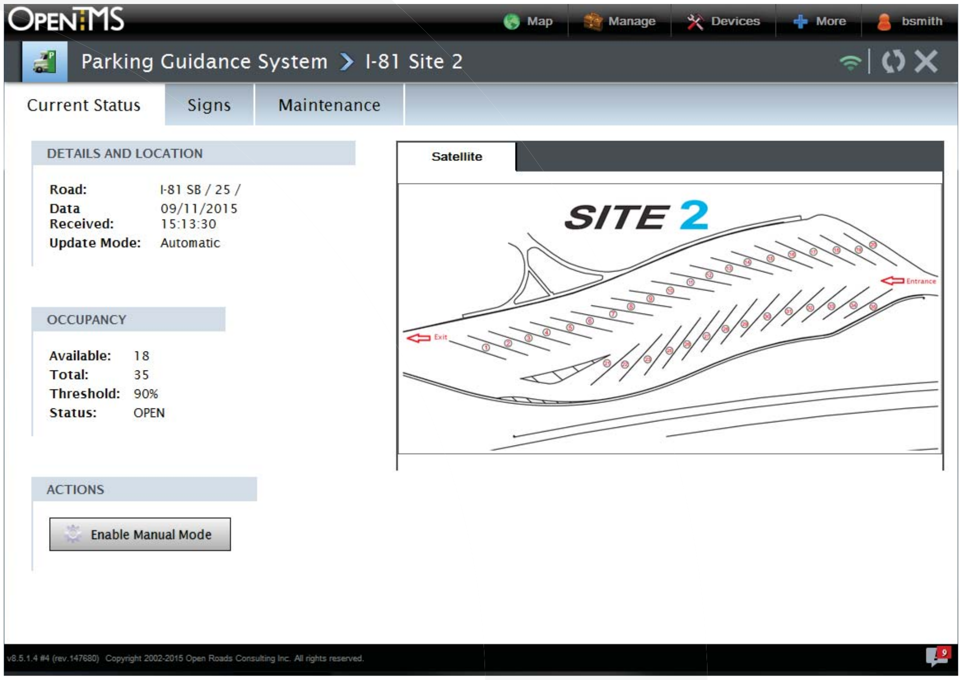
- Integration with the current ATMS platform
- Real-time field data for alerting and management purposes
- Graphical User Interface displaying overall system operation, device status and important statistical information
- Wireless communication between detection units
- Highway alerting signage
- Secure communication back with ATMS platform

The Q-Free Truck Parking Guidance System, which integrates OpenTMS with the Q-Free parking technology, incorporates several novel features. The PGS module provides the ability to monitor and report the availability of parking from parking areas that are instrumented with vehicle counting devices. Parking availability data is disseminated to third party public notification systems, such as the 511 Travelers Information System, alerting drivers of the state of the parking area. West Virginia is one of the first jurisdictions in the US to use such a solution.

Most parking management solutions for rest areas merely count the numbers of vehicles passing in and out and offer no real management of the rest area facility beyond that. The Q-Free solution adds another level of sophistication. In-ground sensors monitor the length of stay within each parking space and transmit data back to the traffic management center (TMC), where operators can actively assess and manage the parking capacity as well as truck operations.

Q FREE

LEADING THE WAY



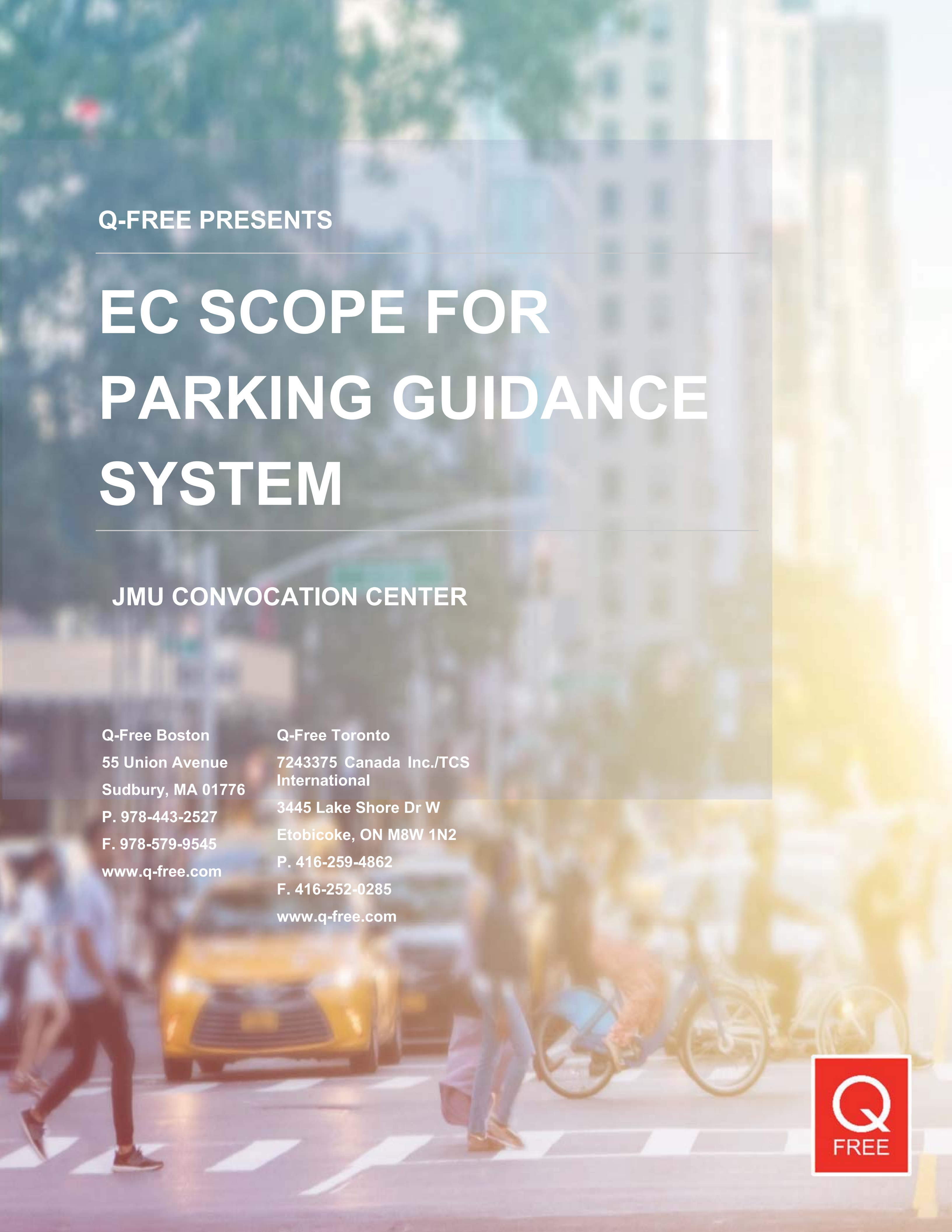
For example, a threshold can be configured in OpenTMS to generate alerts if a truck has been parked for an extended period of time. A freight hauler might be attempting to use a rest area as a storage location or the driver could be having a health issue.

"With our system, we can alert the appropriate authorities and provide the exact location of the vehicle so it can then be checked," Rick Beckwith, Q-Free Project Manager, states.

Beckwith continues "A valuable function of the West Virginia Truck Parking System is that we can provide detailed information to remote truck operators by sharing data processed by OpenTMS with the state's 511 application. A truck driver can find out whether a rest area is closed, full, or open prior to arrival and can make a better-informed decision on where to park while still some distance away. Rest area statuses are also displayed on LED signage near the rest areas themselves."

VS.06.09.16

LEADING THE WAY



Q-FREE PRESENTS

EC SCOPE FOR PARKING GUIDANCE SYSTEM

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Table of Contents

1.0 Overview of Level Counting System

Q-Free has proposed a parking guidance and management system for the JMU Convocation Center parking structure. This system is comprised of Ultrasonic Directional Sensors (USDS) counting vehicle entry/exit at garage and level entry/exits as well as individual space sensors for the ADA stalls. There will be electronic signs throughout the facility displaying the number of available parking spaces.

Directional sensors will be installed mounted to the ceiling for all garage and level entry/exit locations. The first directional sensor on the communication and 24 VDC power bus will be connected to a CP (communication/repeater point) mounted in an enclosure installed on the wall or column as per provided documentation. The CP enclosures require 100-240 VAC. The sensors will be connected to each other with 24 VDC power and communication in a daisy chained fashion. The cabling required is 3 pairs of 18 AWG.

The single space sensors will be installed from the ceiling above the parking spaces on all covered levels. The first single space sensor on the communication and 24 VDC power bus will be connected to a CP (communication point) mounted in an enclosure installed on the wall or column as per provided documentation. The CP enclosures require 100-240 VAC. The single space sensors will be connected to each other with 24 VDC power and communication in a daisy chained fashion. The cabling required is 2 pairs of 18 AWG.

There are multiple LED board Entry Signs that display level space availability which will be installed at the entrances to the facility. The signs require 100-240 VAC and will communicate wirelessly.

The CP enclosures and the Entry Signs will communicate wirelessly to the gateway enclosure. The gateways' cabling (Cat5 or better) will need to be connected to the network as shown in the drawings and documentation. There will be a Central PGS Server installed and connected to the customer's Ethernet network through a network interface card.

ALL BONDS AND PERMITS WILL BE THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR.

2.0 Equipment provided by Q-Free

- Entry Signs, Qty of 2
- Ultrasonic Directional Sensors, Qty of 24
- Delineation Posts, Qty of 100
- Single Space Sensors, Qty of 32
- Communication Point (CP), Qty of 9
- Communication Point Repeater (CP), Qty of 1
- Gateway, Qty of 1

3.0 Scope of Work

3.1 General

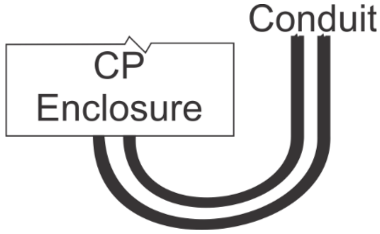
- Provide and install all electrical equipment.
- Comply with manufacturer's written instructions.
- Provide and install all cable and conduit as required. If conduit larger than ½" (13mm) is used, EC will be required to provide reducer at each equipment location to allow for ½" (13mm) connection.
- Do not install damaged components.
- Provide protective covering for sensors if sensors have the potential to be exposed to dust or debris (from construction or other means).
- When using spare parts for replacement, the replaced parts should be labeled appropriately and shipped back to Q-Free in like new condition.
- Single Space Sensors should be installed at a uniform height when possible so when viewed down an aisle the sensors and LEDs of the sensors are aesthetically pleasing.
- ***Install watertight connections for conduit, conduit fittings, and connectors at all connection points to protect electronic components from direct or indirect water exposure.***
- ***Provide and utilize expanding watertight foam application for single space sensor, sensor junction box, sensor connectors, and CP enclosure. Brand/Type: CRC 14077 for U.S.***
- Do not use cable lubricant as it could come in contact with electronic components. If lubricant is required action should be taken so that electronics are not exposed to lubricant.
- Do not use splices between Q-Free devices for communication or low voltage power cabling.
- **Always** use unique color wire inside multi-conductor cable for communication and low-voltage power.

Figure 1: 2 Pair 18AWG for Single Space Sensors and Signs.

Figure 2: 3 Pair 18AWG for USDS.

- Provide conduit for all exposed-to-view wiring and exposed-to-view cabling to meet local code requirements.
- Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and impediments to movement of joints

- ***CP enclosures require conduit entrance pathway through bottom of enclosure to prevent water infiltration and build up inside enclosure.***



- Install/terminate all equipment to specification as depicted in Q-Free drawings and documentation.
- Work within client schedule and in tandem with other site contractors.
- Provide/obtain all bonds and permits.
- Provide certified/appropriate licensed engineering stamped sign and layout drawings as required by client.
- Attend site/construction meetings as required.
- One-year warranty required for installation, wiring, conduit, or water exposure, etc.
- Purchased spare parts and/or parts shipped for installation: Each product in its original entirety, regardless of type is required to be returned in the new condition it was received for RMA &/or credit. Any product not returned properly will be invoiced based on Q-Free rates, and is not disputable.

3.2 Detail

1. Install CP (9) enclosures and (1) Repeater enclosures. Electronic components will come mounted and preconfigured in enclosures. All CP enclosures will communicate wirelessly to a gateway. CP enclosures should be installed on walls or columns at approximately 6-8 feet (1.8-2.4m) high. CP enclosures should not be mounted to the ceiling.
2. Provide and install a fused disconnect switch at each CP enclosure.
3. Provide 100-240 VAC power and conduit per local code to each fused disconnect switch.
4. Provide 100-240 VAC power and conduit per local code from the fused disconnect switch to the bottom of the CP Enclosure.
5. Provide and utilize expanding foam product for water infiltration protection. Brand/Type: CRC 14077 for U.S.
6. Provide and utilize foam application for conduit entering CP enclosure. The approximate quantity of application foam cans for all CP Enclosures required is (2).
7. Single Space System Installation Options:
   a. <u>Conduit Installation Option (where applicable)</u>:
      i. Install single space sensors (32) to the ceiling for covered parking spaces at a minimum distance of 7.2 feet (2.2m) and maximum distance of 9 feet (2.7m) from the floor. Provide and install conduit pendant from the junction box in the ceiling to each sensor. Pendant is required to drop sensor to optimal height and provide pathway for cabling. Water tight ½” (13mm) conduit connector is required between sensor and conduit pendant. Water tight connectors are required for all conduit connections and junction points. Sensors in the same aisle should be installed at a uniform height if possible. Sensors should be installed in a way that they do not move once mounted. Do not use swivel conduit connectors or any mounting method that would allow the sensor to move, affecting measurement and calibration. Sensors need to remain in a stationary position for proper detection and calibration.
      ii. Provide and utilize foam application in conduit pendant that attaches to each sensor. The expanding foam will create a watertight seal from water infiltrating the sensor through the conduit.
      iii. Provide and utilize foam application in conduit pendant junction box above sensor.
      iv. The approximate quantity of application foam cans for all single space sensor and sensor junction box required is (2).

v. Provide and install conduit with 4 conductor 18 AWG from CP to the conduit/junction box above the first sensor location of each bus line, leaving enough cable to properly cut and terminate wiring in sensor housing. DO NOT use any splices on the cabling between each single space sensor. Always use unique color wire inside multi-conductor cable for communication and low-voltage power.
   Provide and install 4 conductor 18 AWG between each sensor location on the bus line in the conduit system, leaving enough cable to properly cut and terminate wiring in sensor housing. DO NOT use any splices on the cabling between each single space sensor. Always use unique color wire inside multi-conductor cable for communication and low-voltage power.
vi. Pull cable down through conduit into each sensor.
vii. Terminate cabling inside single space sensor. DO NOT connect 24VDC power to communication terminals on sensors. Doing so may result in failed electronic components.
viii. Set address for each sensor using manual provided. Document addressing scheme and provide to Q-Free for use when configuring system.
ix. Ensure every sensor is communicating with zone controller using manual provided.
x. Calibrate and test operation of each sensor using manual provided. To calibrate sensors successfully parking spaces, need to be unoccupied during time of calibration.

b. <u>Uni-Strut/Rail System Installation Option</u> (where applicable):

i. Provide and install uni-strut/rail system for mounting single space sensors at a minimum distance of 7.2 feet (2.2m) and maximum distance of 9 feet (2.7m) from the floor. Uni-strut/rail system should be installed in such a way to provide optimal operating height for sensors. Uni-strut/rail system should be installed at a uniform height throughout each aisle. Uni-strut/rail system should have a top installed that will provide a water tight protection for sensors. Sensors should be installed in a way that they do not move once mounted. Do not use swivel conduit connectors or any mounting method that would allow the sensor to move, affecting measurement and calibration. Sensors must remain in a stationary position for proper detection and calibration. Provide stabilization for Uni-strut/rail system if system is capable of swaying.
ii. Install single space sensors (32) for the covered parking spaces to the provided uni-strut/rail system.
iii. Ensure water cannot enter unistrut/rail system.
iv. Provide and install water tight nipple and locknuts onto the uni-strut/rail system and to each sensor.
v. Provide and utilize foam application inside unistrut/rail connector that attaches to each sensor. The expanding foam will create a watertight seal from water infiltrating the sensor through the unistrut/rail connector.
vi. The approximate quantity of application foam cans for all single space sensor and sensor junction box required is (2).
vii. Sensors in the same aisle should be installed at a uniform height if possible.
viii. Provide and install conduit with 4 conductor 18 AWG from CP to the uni-strut/rail system above the first sensor location of each bus line, leaving enough cable to properly cut and terminate wiring in sensor housing. DO NOT use any splices on the cabling between each single space sensor. Always use unique color wire inside multi-conductor cable for communication and low-voltage power.
   Provide and install 4 conductor 18 AWG between each sensor location on the bus line in the uni-strut/rail system, leaving enough cable to properly cut and terminate wiring in sensor housing. DO NOT use any splices on the cabling between each single space sensor. Always use unique color wire inside multi-conductor cable for communication and low-voltage power.
ix. Pull cable down through nipple from uni-strut/rail system above sensor into each sensor.

x. Terminate cabling inside single space sensor. DO NOT connect 24VDC power to communication terminals on sensors. Doing so may result in failed electronic components.
xi. Set address for each sensor using manual provided. Document addressing scheme and provide to Q-Free for use when configuring system.
xii. Ensure every sensor is communicating with zone controller using manual provided.
xiii. Calibrate and test operation of each sensor using manual provided. To calibrate sensors successfully parking spaces need to be unoccupied during time of calibration.

8. Install all directional sensors (24) to the ceiling with threaded rod and anchors at a height of 7.5 feet (2.3m), if this isn't possible then contact Q-Free for possible solutions. Documenting orientation of all USDS.
9. Provide and install conduit with 6 conductor 18 AWG between each directional sensor on the bus line and to the CP. DO NOT use any splices on the cabling between USDS and CP and in between each USDS. Always use unique color wire inside multi-conductor cable for communication and low-voltage power.

   Terminate cabling inside directional sensor. DO NOT connect 24VDC power to communication terminals on USDS. Doing so <u>**will**</u> result in failed electronic components.

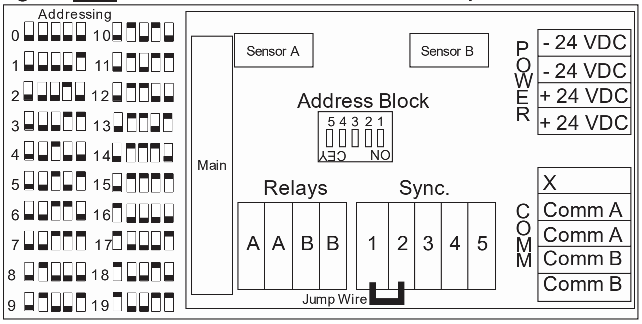


Figure 3: USDS Wire Termination Board

10. Assign an address to each directional sensor per documentation provided by Q-Free.
11. Calibrate and test operation of each USDS.
12. Install delineation posts as needed.
13. Install Entry Signs (2) including any foundation work.
14. Provide 100-240 VAC power and conduit per local code to Entry Signs as shown in the drawing.
15. Terminate cabling for Q-Free LED boards in Entry Signs.
16. Assign an address to Q-Free LED boards in Entry Signs.
17. Install Gateway enclosure (1) with connection to network. This enclosure should be installed in the garage and not in an office or closet.
18. Provide and install 100-240 VAC power for Gateway.
19. Provide and install pathway and cabling (Cat5 or better) from Gateway to customer's provided network.

3.3 Additional Requirements

- All work to be performed during normal hours unless otherwise specified by customer
- Work to be completed on a consecutive work day schedule (Mon.-Fri.). Work to be done on a day to day, week to week schedule
- Participate in on-site project management meetings if/as required
- Coordinate installation with site-owner
- Traffic control if required by owner
- Assist Q-Free in testing operation of system
- Assist Q-Free with start-up and commissioning of system
- **A remote connection to the server is required a minimum of 2 weeks prior to arriving on site for commissioning.**

4.0 Electrical Contractor Acceptance

Acceptance of EC Scope – All work is guaranteed to be as specified, and will be completed in a professional manner per standard practices. The above scope is hereby accepted. Date of Acceptance:______________________	Signature______________________ Name______________________ Companry______________________

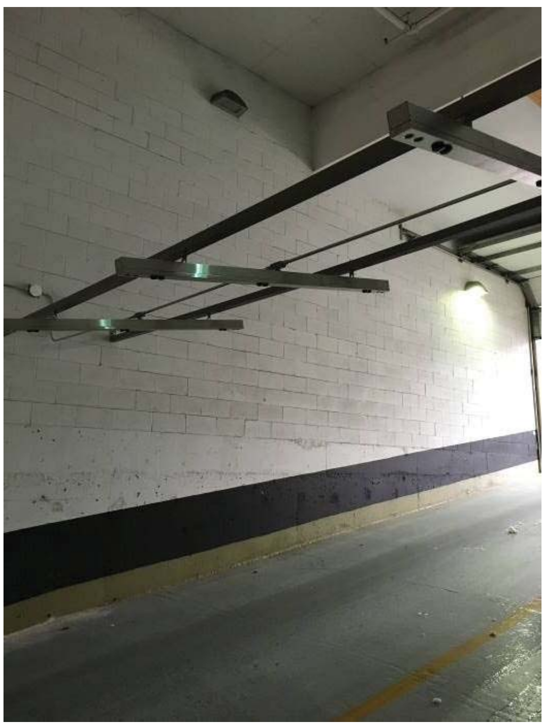
5.0 Electrical Contractor Compliancy

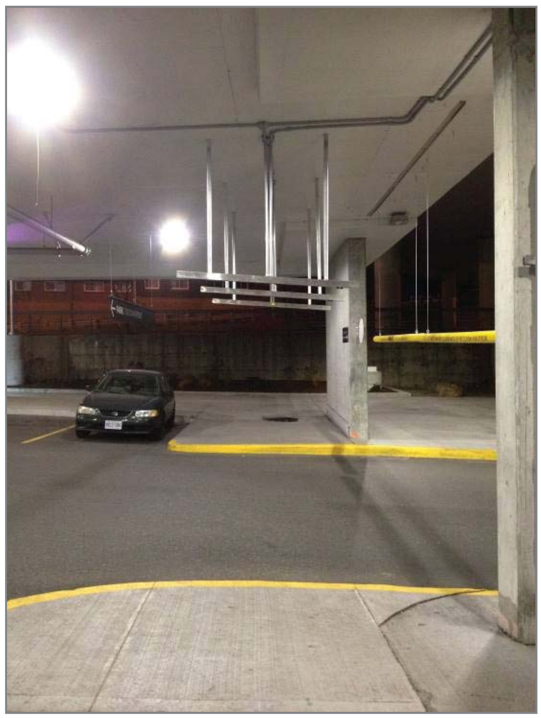
The following to be returned to Q-Free upon completion of the equipment installation instating the compliancy of installation with the previously stated instructions.

Guideline	Compliant	Non-Compliant	Notes
Installation of Watertight Connectors			
Installation of Foam in conduit entrances to CPs and sensors			
No Splicing in the communication and power cables			
Uniquely colored wire for communication and power			
All devices addressed			
Sensors calibrated			
Sensors installed within height requirements			
CP enclosures not mounted on or near ceiling			
Gateway enclosure mounted inside garage and not in closet or office			
CP and Gateway enclosures have conduit entering only from bottom of enclosure			

6.0 Appendix

Sample USDS Sensor Installation Pictures:





Sample Single Space Installation Pictures (Conduit Installation):

Sample Single Space Installation (Uni-Strut/Rail Installation):

Sample Entry Sign Installation Pictures:

Sample CP Enclosure Installation Pictures:

CONDUIT SHOULD BE INSTALLED THROUGH BOTTOM OF ENCLOSURE AS SHOWN ABOVE.

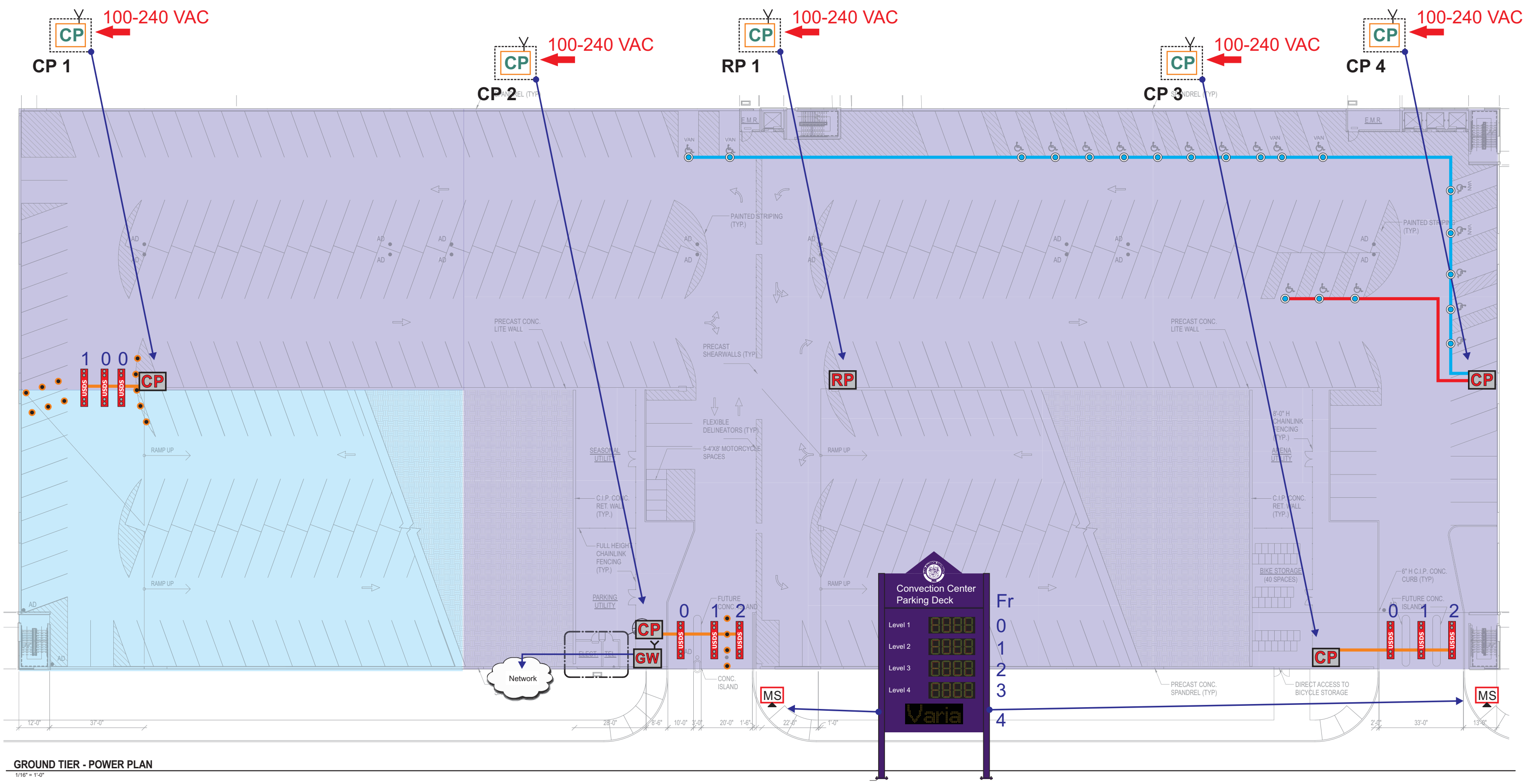
PGS -Details

- Delineator
- ADA Single Space Sensor
- USDS Ultrasonic Directional Sensor
- RP Repeater point
  - RP Enclosures Require 100-240 VAC Power
- CP Communication point
  - CP Enclosures Require 100-240 VAC Power
- GW Gateway for wireless communication
  - GW Enclosures Require 100-240 VAC Power
- MS Master Sign
  - MS Require 100-240 VAC Power
- Blue #'s: Addressing Scheme

PGS - Wiring Details

Orange Line	(Comm. Bus/24VDC) - 3 pairs of 18 AWG
Blue Line	(Comm. Bus/24VDC) - 2 pairs of 18 AWG
Red Line	(Comm. Bus/24VDC) - 2 pairs of 18 AWG

Zones
Level 1 Purple
Level 2 Blue
Level 3 Yellow
Level 4 Green



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Q-FREE

Convocation Center
Level 1

Submittal No.	
Submittal Date	
Drawing No.	E101P
Rev	- REV 3.1
Engineer	-
Draftsman	- TY/AB
Date	- 01/14/2018
Checked	-
Approved	-

☐ PGS Design Approved by Customer

Customer Signature

PGS -Details

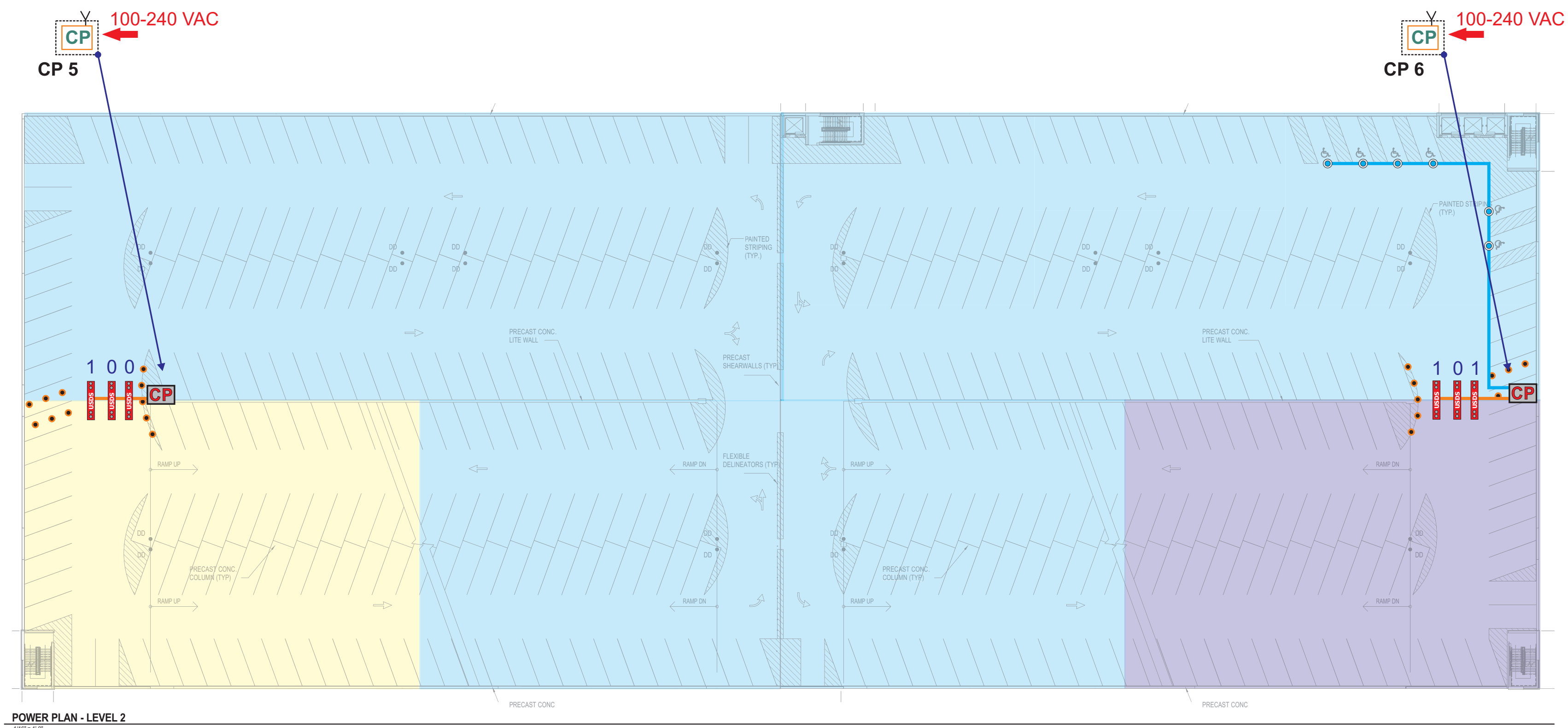
- Delineator
- ADA Single Space Sensor
- Ultrasonic Directional Sensor
- RP Repeater point
  - RP Enclosures Require 100-240 VAC Power
- CP Communication point
  - CP Enclosures Require 100-240 VAC Power
- GW Gateway for wireless communication
  - GW Enclosures Require 100-240 VAC Power
- MS Master Sign
  - MS Require 100-240 VAC Power

Blue #'s: Addressing Scheme

PGS - Wiring Details

Orange Line	(Comm. Bus/24VDC) - 3 pairs of 18 AWG
Blue Line	(Comm. Bus/24VDC) - 2 pairs of 18 AWG
Red Line	(Comm. Bus/24VDC) - 2 pairs of 18 AWG

Zones
Level 1 Purple
Level 2 Blue
Level 3 Yellow
Level 4 Green



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Convocation Center
Level 2

Submittal No.	
Submittal Date	
Drawing No.	E 102P
Rev	- REV 3.1
Engineer	-
Draftsman	- TY/AB
Date	- 01/14/2018
Checked	-
Approved	-

☐ PGS Design Approved by Customer

Customer Signature

PGS -Details

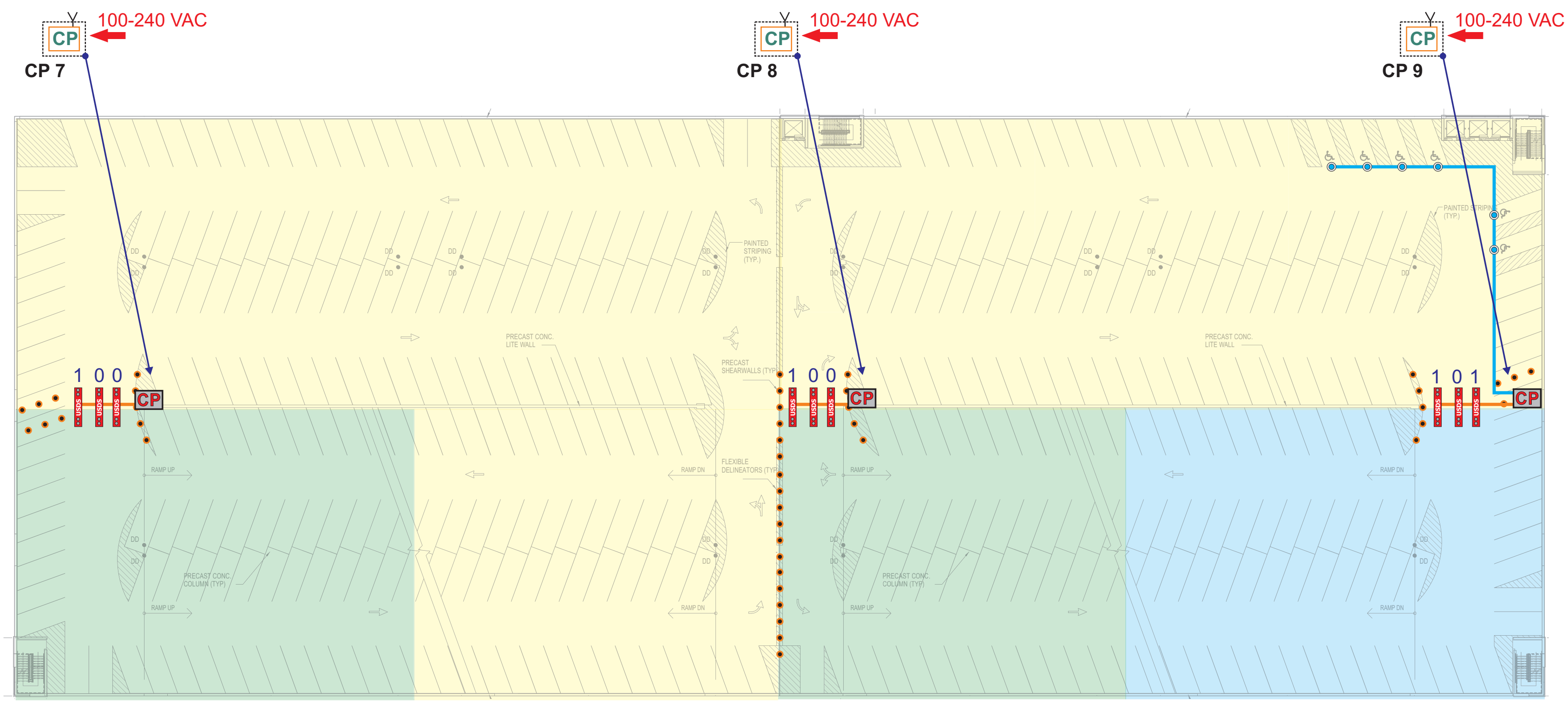
- Delineator
- ADA Single Space Sensor
- Ultrasonic Directional Sensor
- Repeater point
  RP Enclosures Require 100-240 VAC Power
- Communication point
  CP Enclosures Require 100-240 VAC Power
- Gateway for wireless communication
  GW Enclosures Require 100-240 VAC Power
- Master Sign
  MS Require 100-240 VAC Power

Blue #'s: Addressing Scheme

PGS - Wiring Details

Orange Line	(Comm. Bus/24VDC) - 3 pairs of 18 AWG
Blue Line	(Comm. Bus/24VDC) - 2 pairs of 18 AWG
Red Line	(Comm. Bus/24VDC) - 2 pairs of 18 AWG

Zones
Level 1 Purple
Level 2 Blue
Level 3 Yellow
Level 4 Green



POWER PLAN - LEVEL 3

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Convocation Center
Level 3

Submittal No.	
Submittal Date	
Drawing No.	E103P
Rev	- REV 3.1
Engineer	-
Draftsman	- TY/AB
Date	- 01/14/2018
Checked	-
Approved	-

☐ PGS Design Approved by Customer

Customer Signature

PGS -Details

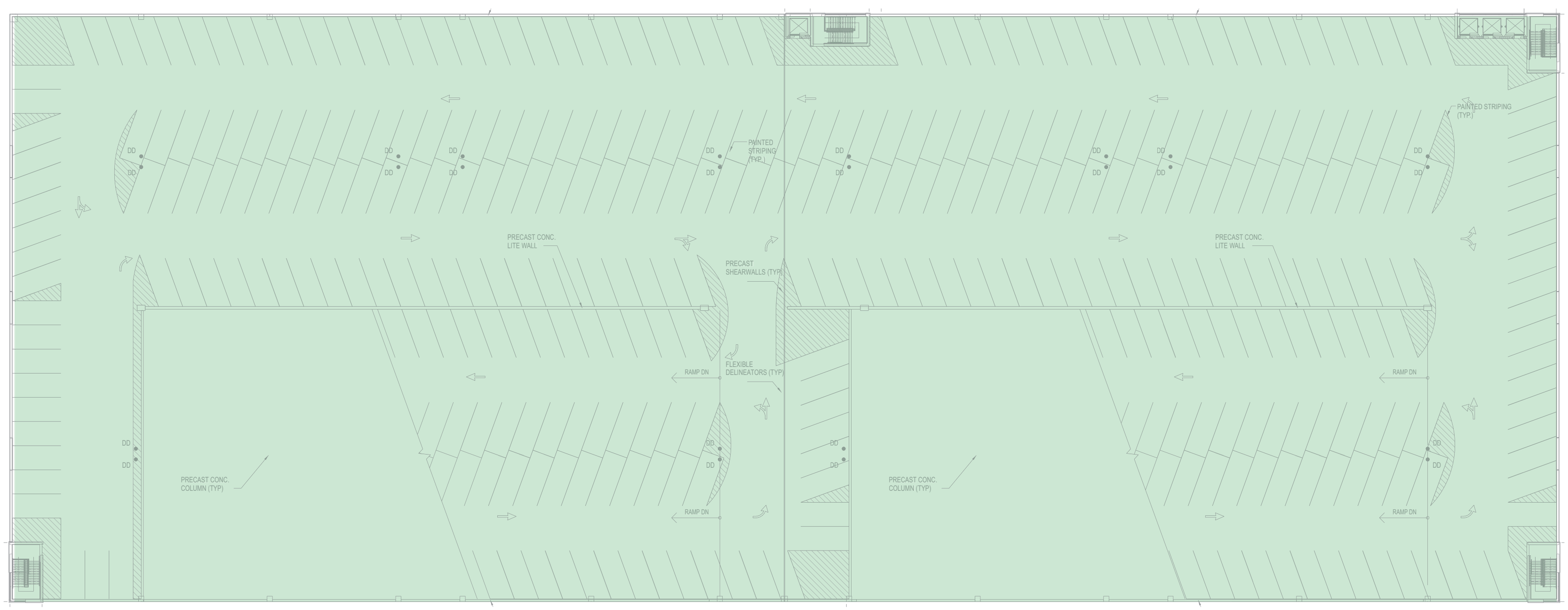
- Delineator
- ADA Single Space Sensor
- USDS Ultrasonic Directional Sensor
- RP Repeater point
  RP Enclosures Require 100-240 VAC Power
- CP Communication point
  CP Enclosures Require 100-240 VAC Power
- GW Gateway for wireless communication
  GW Enclosures Require 100-240 VAC Power
- MS Master Sign
  MS Require 100-240 VAC Power

Blue #'s: Addressing Scheme

PGS - Wiring Details

Orange Line	(Comm. Bus/24VDC) - 3 pairs of 18 AWG
Blue Line	(Comm. Bus/24VDC) - 2 pairs of 18 AWG
Red Line	(Comm. Bus/24VDC) - 2 pairs of 18 AWG

Zones
Level 1 Purple
Level 2 Blue
Level 3 Yellow
Level 4 Green



POWER PLAN - LEVEL 4(ROOF)
1/16" = 1'-0"

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Convocation Center
Level 4

Drawing No.	E104P
Submittal No.	
Submittal Date	
Rev	- REV 3.1
Engineer	-
Draftsman	- TY/AB
Date	- 01/14/2018
Checked	-
Approved	-

☐ PGS Design Approved by Customer

Customer Signature

Q-Free
USDS Technical Instructions
Version 8
USDS Ver. 3.54

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Table of Contents

Directional sensor USDS: Technical Instructions
Firmware Version 3.54 and above

1. General Information

The Ultrasonic Directional Sensors are designed to detect vehicle direction and provide accurate vehicle counts. These ceiling mounted sensors eliminate the need for saw-cutting groundwork in typical inductive loop vehicle detection systems. Installation is easy and relocation is possible should traffic patterns change. They are powered using 24VDC external power supply. The communication to external computer is achieved using RS-485 communication. **Failure to wire these properly will cause failures of the electronic components used to make up the USDS.**

Accuracy of a system with USDS counting points is based on a number of factors including number of counting points for each zone, position of USDS, and most importantly the throughput of vehicle traffic. Other factors may influence the detection accuracy such as tailgating vehicles, vehicles bypassing the counting point, and atypical vehicles (golf carts, floor cleaners, motorcycles, etc.).

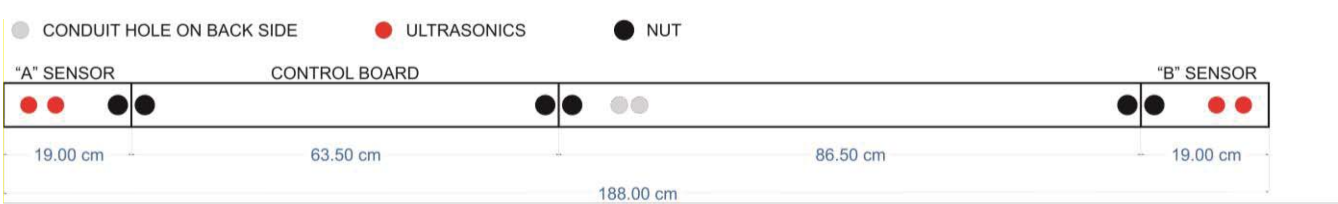
If proper delineation as proposed is not accepted by the customer at system counting points and overall traffic flow concerns, Q-Free will not be held responsible for overall system counting accuracy. General count maintenance is required with all PGS systems.

Environmental:

- Environmental Rating; NEMA 2 (Installed in enclosed parking garages on the ceiling ~3 meters high).
- Operating Temperature -4°F to +158°F

The USDS are made up of the following parts:

- Sensor A
- Control Module
- Electrical Supply Module
- Sensor B
- Stainless Steel Chassis



The "A" Sensor is referred to as the A Side of the USDS. Same as for the B Side.

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The riveted cover contains the control module and connection module. The steel chassis is connected together with thumbscrews and can be easily removed. The control module cover also has holes along the sides.

The thumbscrews can be used with these holes so that the control module can be mounted at 90º or 180º degrees for easier viewing of the screen and adjustment of menus.

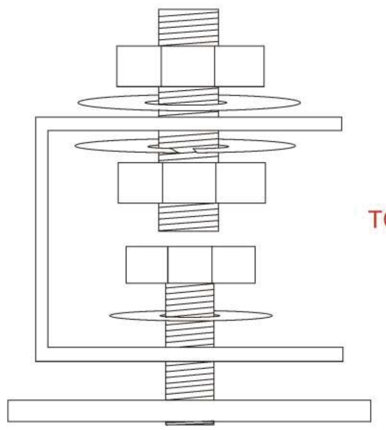
Use Thumbscrew to hold control module

2. The Control Module

The most important connections and operating components are found on the control module.

- **1** – Serial Connection RS 485.
- **2** – Connection to other USDS for Synchronizing or Cluster Configuration
- **3** – Relay A., Relay B
- **4** – Electrical Supply (24V DC).
- **5** – Connection for Sensor A
- **6** – DIP-Switch.
- **7** – Connection for Sensor B
- **8** – Menu operating key. From top to bottom: "OK", "+", "-", "Stop".

3. Bracket Assembly



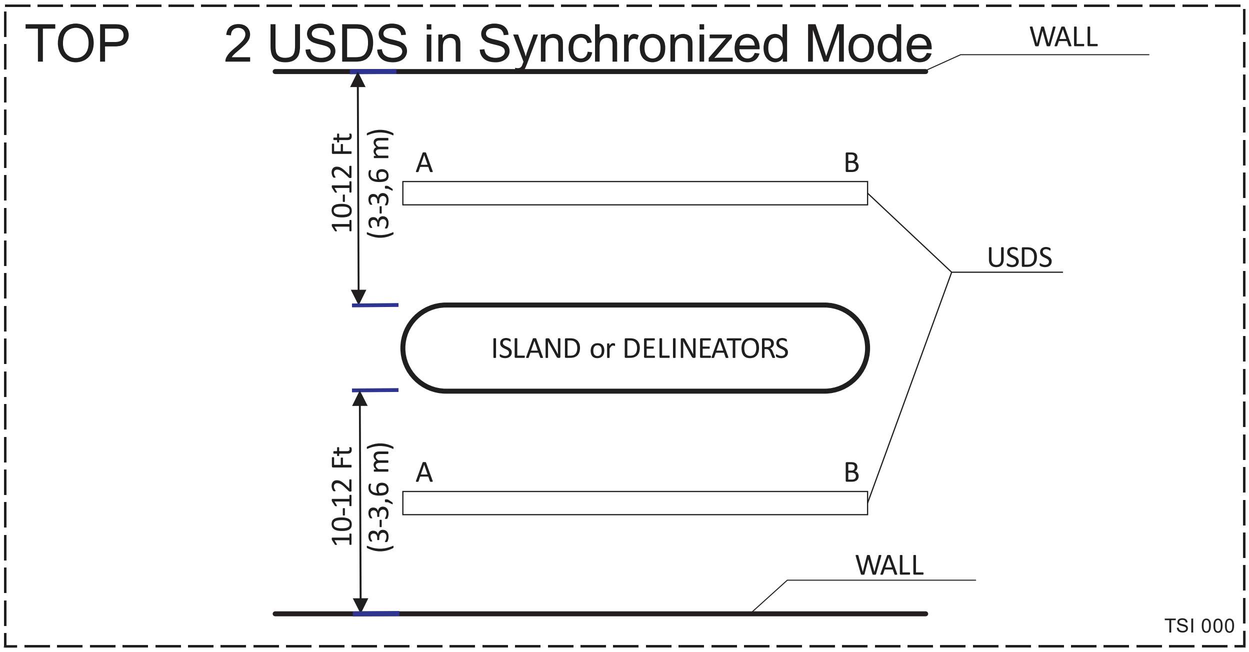
Bracket Assembly

NOT using the Q-Free bracket kit will void USDS warranty. 5/16" Threaded Rod recommended.

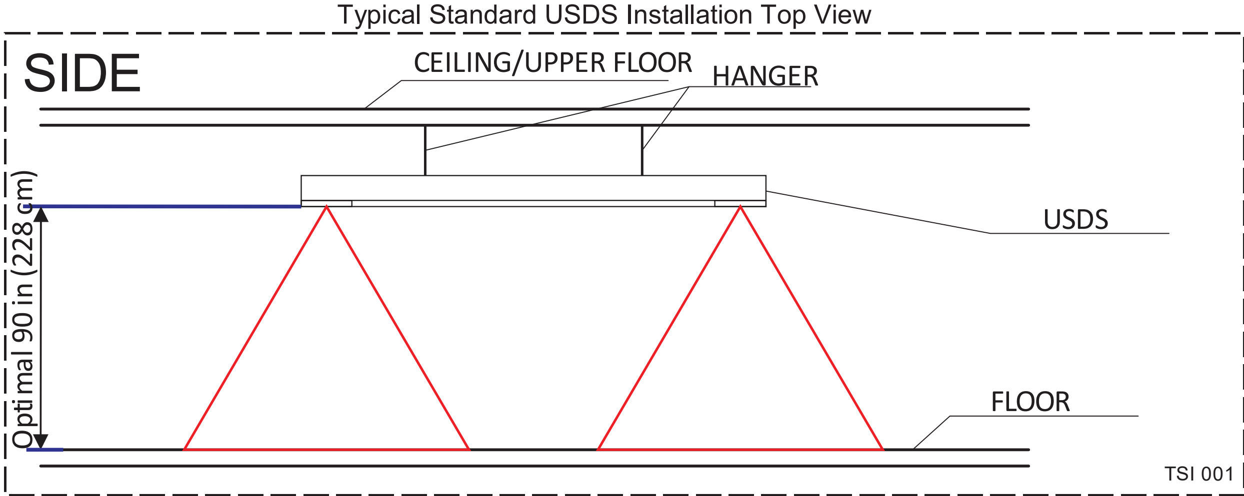
4. Standard Installation

- The USDS should be installed in the middle of the lane (unless otherwise directed) in which the vehicles are to be counted. The lane width requirements are 10ft to 12ft depending on USDS mounting height. See diagram.
- If the lane is larger than 12ft then delineation is required to reduce the width of the lane.
- If there are parking spaces on each side of the USDS they need to be blocked otherwise the counting accuracy will be skewed.
- The USDS should be positioned parallel with the direction of traffic.
- The lane under the USDS must be straight.
- **The optimal mounting height of the sensor is 7.5ft (2.3m) from the ground.** A variation of this height can be determined based on the construction and environment of the counting point.
- The distance between the floor and the device has to remain the same for the whole length of the USDS. If the lane is on a slope, then the USDS needs to be aligned parallel to the lane's surface.
- No objects should be placed between USDS and floor (e.g. lamps).
- USDS must be a minimum of 20" (50cm) away from lamps, especially florescent lamps or other electrical equipment. (EMV)

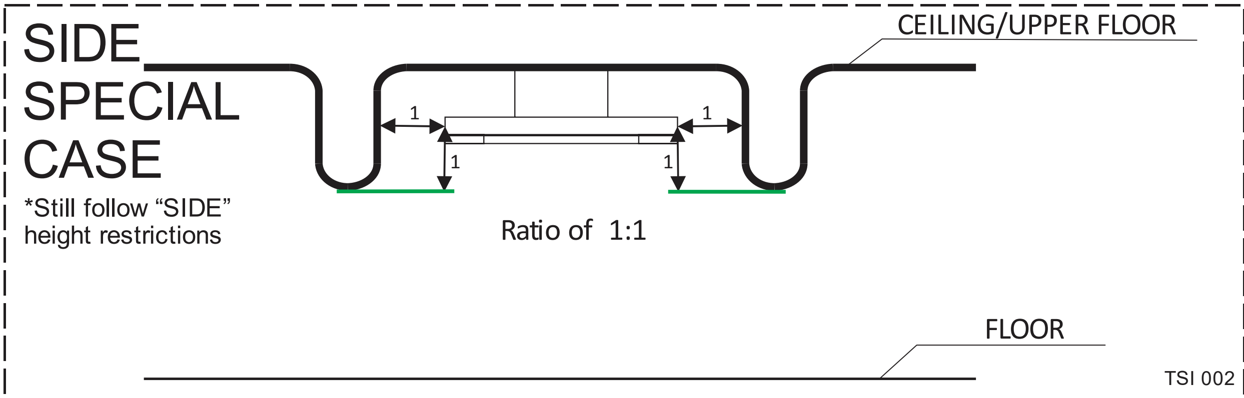
- For USDS that are configured in a standard installation, **not** synchronized or in cluster, the distance between each device shall be no less than the distance between the device and the floor.
- For a special case in which the ceiling has some sort of “ribbed” design follow the special case diagram TSI 002.
    - The distance from the protrusion to the USDS in both the vertical and horizontal coordinates must remain at a ratio of 1:1.



Typical Standard USDS Installation Top View



Typical Standard USDS Installation Side View



Typical Standard USDS Installation Side View Special Case

5. Cluster Configuration Installation

USDS can be used in a cluster configuration to cover approximately a 24ft lane with 3 USDS, or approximately 18ft lane with 2 USDS. Site conditions may affect maximum coverage area.

- For 2 USDS cluster, if the lane is larger than 18ft then delineation is required to reduce the width of the lane, or a different configuration may be appropriate.
- For 3 USDS cluster, if the lane is larger than 24ft then delineation is required to reduce the width of the lane.
- The USDS should be installed approximately 70" apart from each other. See diagram TSI 003 or TSI 004. Site specific conditions and lane widths will affect the 70" distance between USDS. Contact Q-Free for recommended mounting positions for each site.
- If there are parking spaces on each side of the USDS they need to be blocked otherwise the counting accuracy will be skewed.
- The USDS should be positioned parallel with the direction of traffic.
- The lane under the USDS must be straight.
- **The optimal mounting height of the sensor is approximately 7.5ft (2.3m) from the ground.** See diagram TSI 001. A variation of this height can be determined based on the construction and environment of the counting point.
- The distance between the floor and the device has to remain the same for the whole length of the USDS. If the lane is on a slope the USDS needs to be aligned parallel to the lane's surface.
- No objects should be placed between USDS and floor (e.g. lamps).
- USDS must be a minimum of 20" (50cm) away from lamps, especially florescent lamps or other electrical equipment. (EMV)

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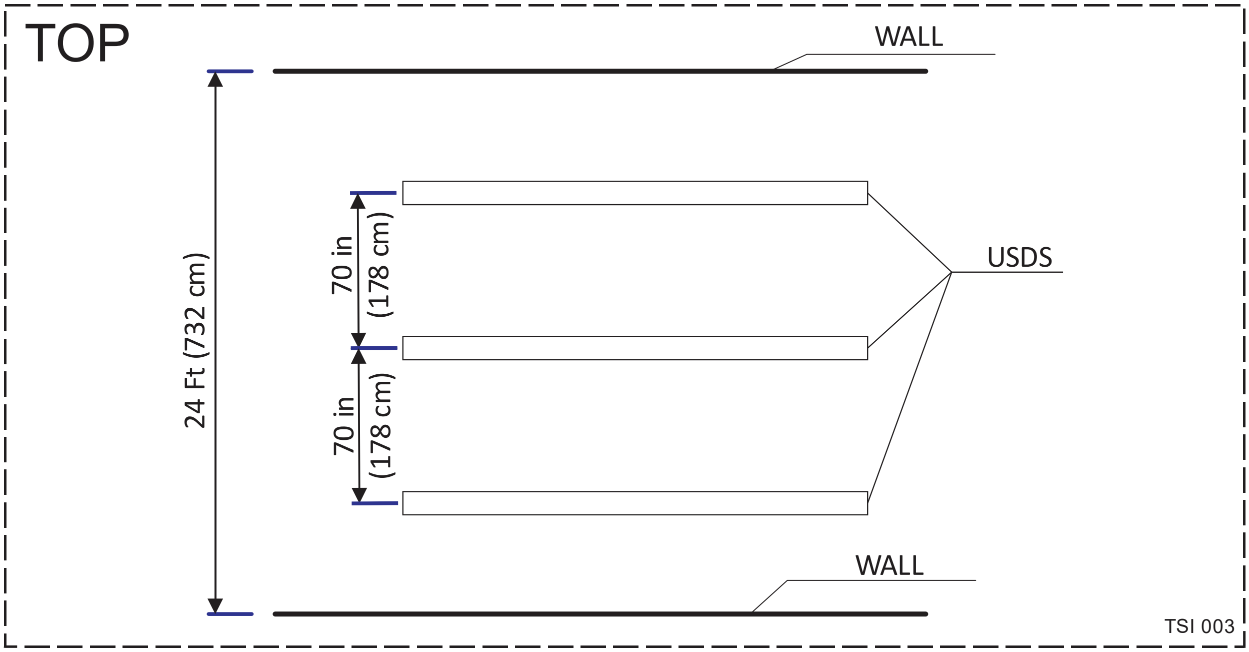
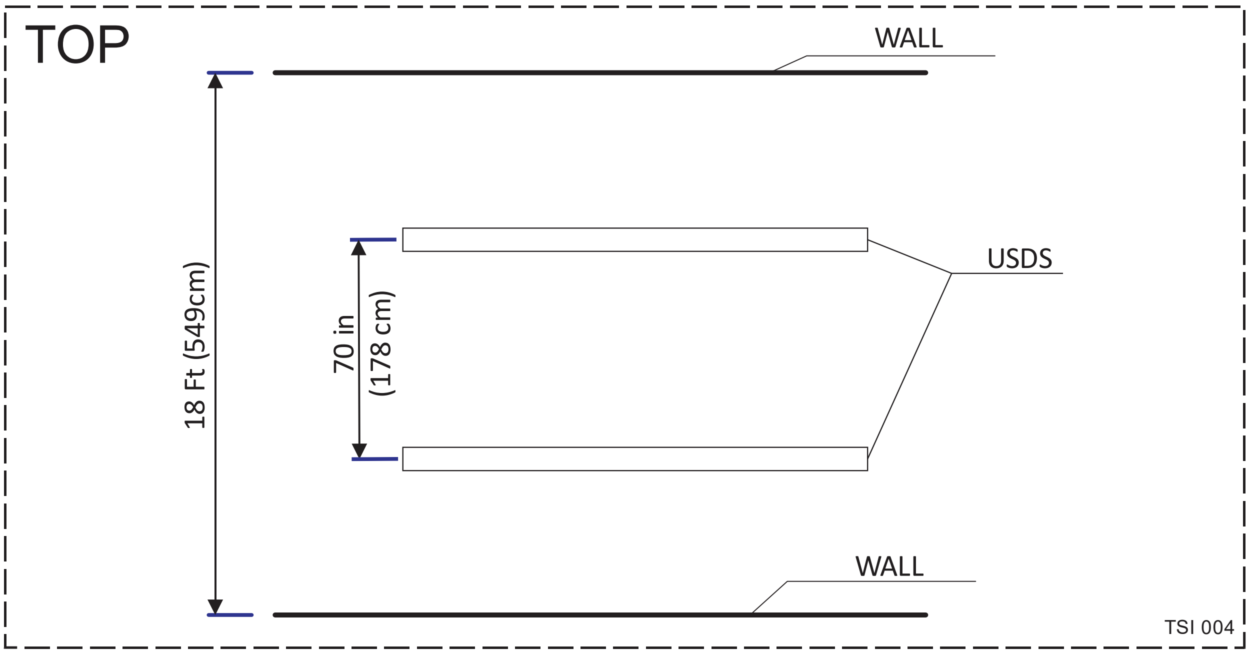


Typical 3 USDS in Cluster Configuration



Typical 2 USDS in Cluster Configuration

Ultrasonic Directional Sensor Mounting Instructions

Required Materials:
- Ultrasonic Directional Sensor
- (2) Mounting bracket kits
- (2) Threaded rods
- Concrete anchors

Installation Steps:
- Ground surface must be clear of objects and debris.
- Check ceiling for space to mount sensor.
- Mark location on ceiling where anchors will be drilled.
- Measure distance for threaded rod from concrete anchor location to desired sensor height.
- Align sensor parallel to the ground.
- Drill holes for concrete anchors.
- Insert concrete anchors.
- Cut threaded rod to size.
- Install threaded rod.
- Attach threaded rod to sensor brackets.
- Adjust sensor height with bracket to ensure sensor is parallel to ground.

6. Connections

Connection Requirements:
- Power: Pair of 18 AWG wiring for connection of 24VDC from external source. Typically from a Q-Free CP Enclosure.
- If applicable: Pair of 18 AWG wiring for connection of RS-485 communication. Typically from a Q-Free CP Enclosure.
- If applicable: Pair of 18 AWG wiring for connection of synchronization cabling between neighboring USDS.
- If applicable: 2 Pairs of 18 AWG wiring for connection of dry contacts.
- If connecting USDS in Cluster Configuration: 2 Pairs of 18 AWG wiring.
- If connecting USDS are in Cluster or Synchronized Configuration: Install a jumper connected onto JP1 on the control board near the screen. This is only needed on the Master USDS. See picture below.

Install the Jumper on
Master USDS if using
Cluster or Syncronzing
Neighboring USDS

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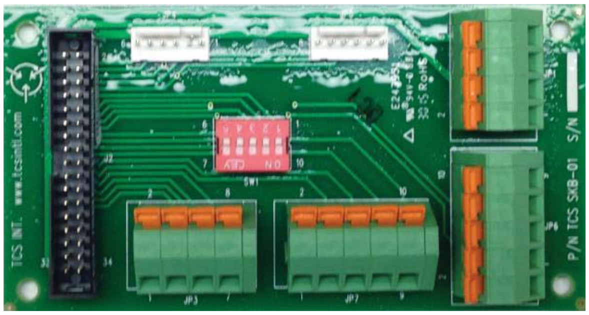
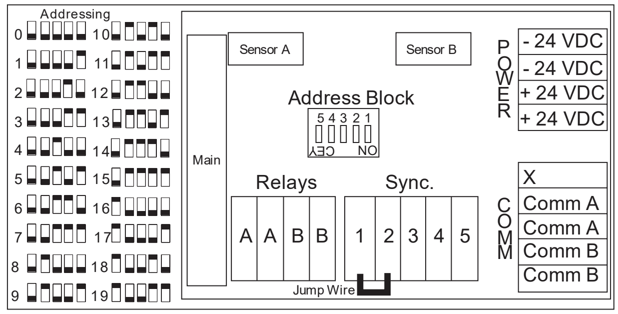
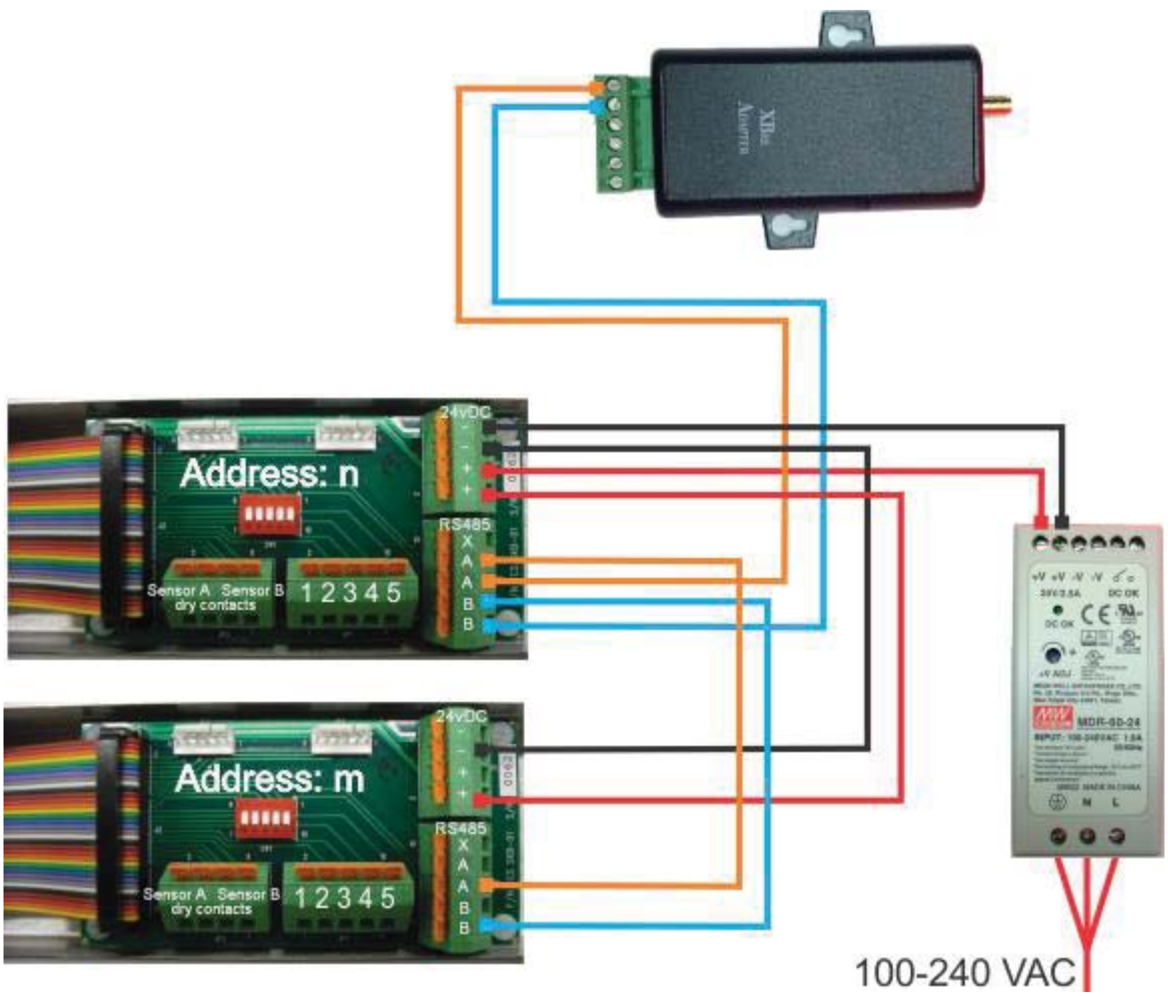
There is a sticker located next to the interface board on the USDS that shows what each terminal is used for. The sticker also shows a few of the addressing settings with what number it corresponds to.





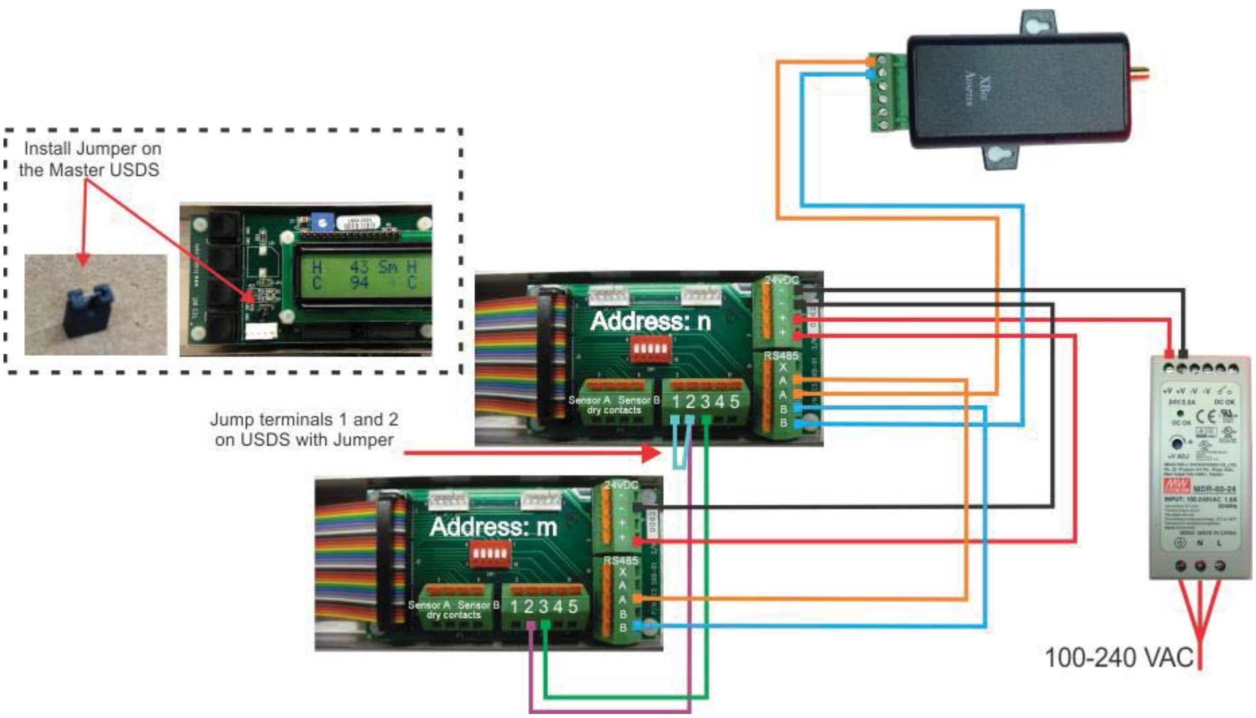
6.1 Standard USDS Wiring Diagram

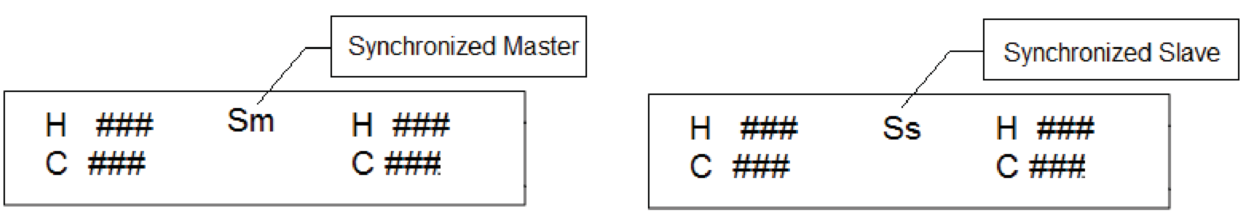


Each USDS connected on the same communication line requires a unique address. See USDS Addressing for more information. Use this wiring diagram for USDS that are not neighboring or near each other such that their ultrasonic could interfere with each other. Failure to wire properly will cause failures to the USDS components.

6.2 Standard USDS with Synchronization Wiring Diagram

Each USDS connected on the same communication line requires a unique address. See USDS Addressing for more information. Use this wiring diagram for USDS that are close to each other in neighboring lanes. For example: An exit lane next to an entrance lane. **Sensors must be set to "Single" mode under Function in the USDS menu. See menu Config for clarification.** Failure to wire properly will cause failures to the USDS components.





Example of Synchronized Control Board Screens

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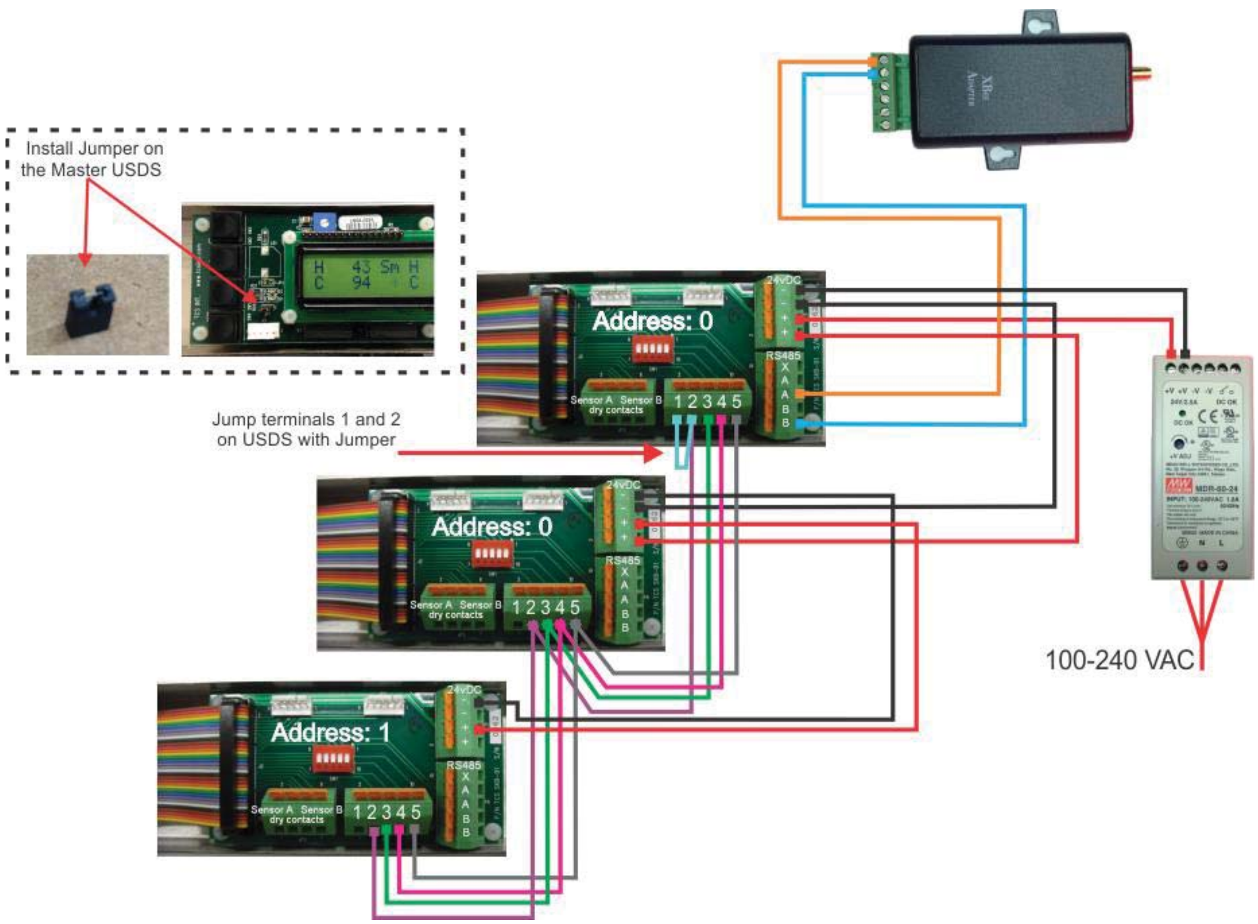
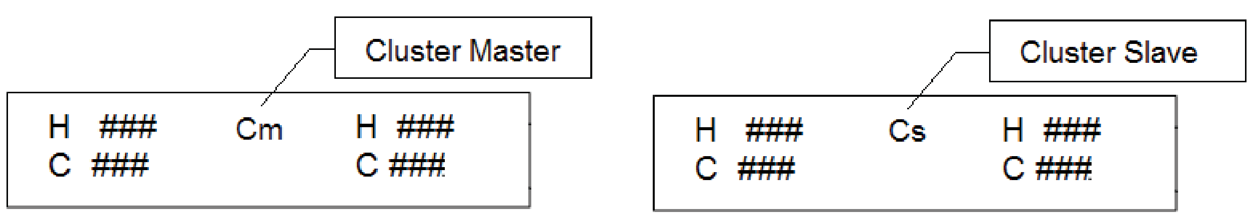
6.3 Standard Cluster USDS Wiring Diagram

Each Master USDS connected on the same communication line requires a unique address and jumper (see below). The middle USDS should be set to address 0. The third USDS should be set to address 1. See USDS Addressing for more information. **For Cluster configuration all USDS must be set to "Cluster" mode under Function in the USDS menu. See menu Config for clarification.** Failure to wire properly will cause failures to the USDS components.





Example of Cluster Control Board Screens

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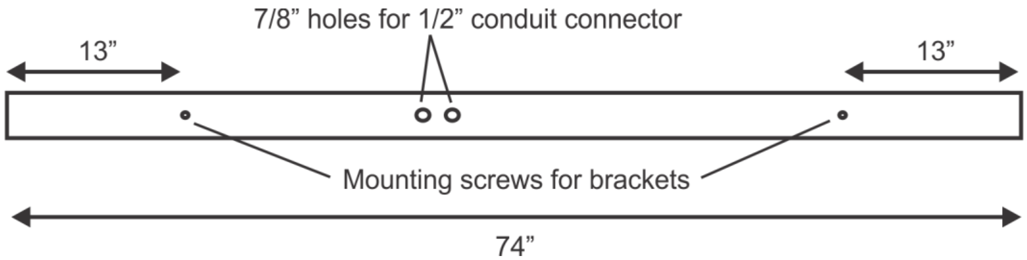
7. Assembly

The diagram below shows all relevant openings used for assembling the USDS.



7.1 Mechanics

The stainless steel chassis must be either fixed to or hung from the ceiling. The electrical cables are to be pulled through the conduit hole openings. If only one conduit hole is required the other hole should be covered with the conduit hole cover. The two thumbscrews should be used with the holes on the side of the control module to secure the module at 90º or 180º degrees for display reading.

7.2 Start-up

- Adjust DIP switch address for serial communication. See USDS addressing at end of document.
- Turn on AC power to the power supply.
- The USDS calibrate automatically when powered on. Please confirm that there are no objects (e.g. ladders, boxes, people etc.) under the device or it cannot calibrate.
- If calibration is successful the distance from the ultrasonic sensors to the floor for each sensor appears on the display.
- The heights should match closely with one another is the USDS is installed parallel to the ground.
- Completely close the casing after calibration and the heights are monitored.
- The device is now ready to operate. Read chapter “Troubleshooting” if the calibration is unsuccessful.

7.3 Direction recognition

The directional counting does not require any special installation or supplementary devices.

- Take note of the orientation of the sensor when it is installed (i.e. which sensor faces which direction). The closest one to the control unit is **Sensor A.**

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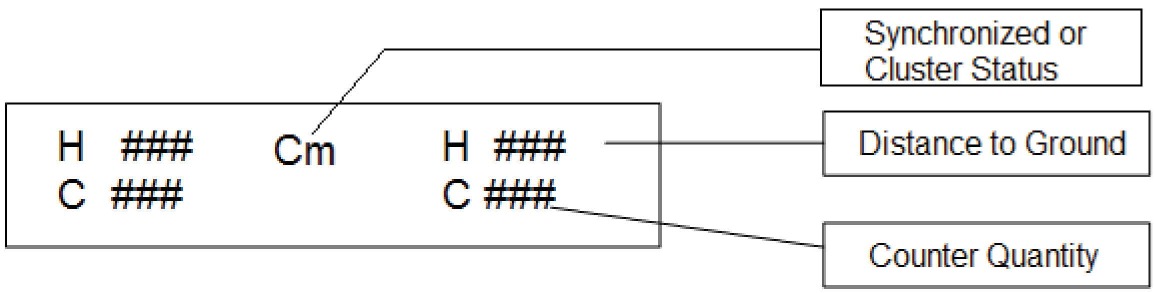
8. Main display

The main menu is always displayed during normal operation after calibration unless another menu point is activated. The display offers basic information about the actual operating status. The display top line consists of the distance to ground of each sensor A & B on the top line. The bottom line shows counters for the direction from A to B on the left and from B to A on the right.

If the USDS are configured in Synchronized or Cluster mode there will be letters indicating the status in the middle of the screen.

- Cm: for Cluster (m)aster USDS
- Cs: for Cluster (s)lave USDS
- Sm: for Synchronized (m)aster USDS
- Ss: for Synchronized (s)lave USDS



9. Menu system

The menu system is operated using 4 keys, and are situated in a row from top to bottom next to the display panel.

Description of the key's functions:

"**OK**" Affirmation of choice, access to menu system
"**+**" Menu navigation, value choice
"**-**" Menu navigation, value choice
"**Stop**" Abort action, jump to higher level in menu

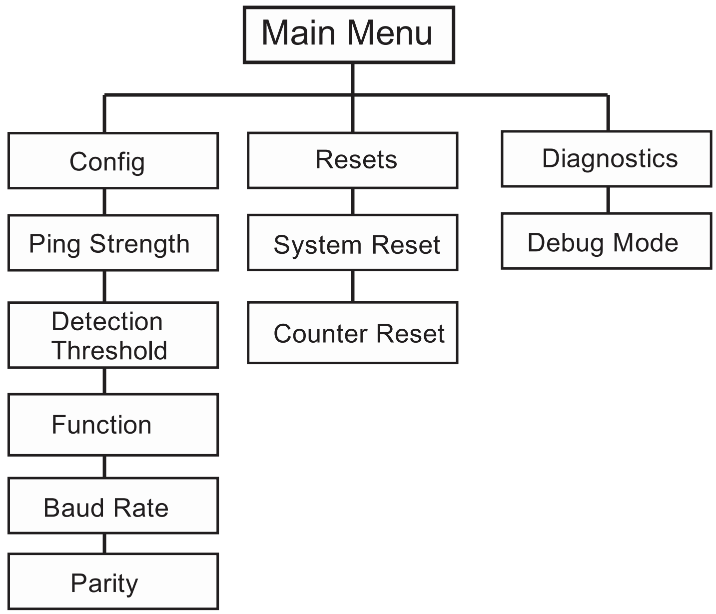
The menu system is accessed by pressing the **OK** key when the main display is shown.

The keys "**+**" and "**−**" navigate between different menus.

The setting's new value must be confirmed by pressing "**OK**". The display changes back to a menu in a higher level. If one stays in a menu for longer than 30 seconds without pressing a key the menu will automatically go back to the main screen.

10. Menu overview

The menu system is made up of main and sub menus. The sub menus can contain additional sub menus. Once having reached the intended menu the title will be shown in the top row and the potential values at the bottom.



11. Menu: Config

11.1 Ping Strength

This setting should only be changed if the ceiling is very high (>96”) or if the floor is in bad shape (e.g. absorbing substance such as gravel).

11.2 Detection Threshold

This setting can be adjusted if the sensor’s measured heights are fluctuating, but the ground is flat and there are no objects underneath the sensors.

11.3 Function

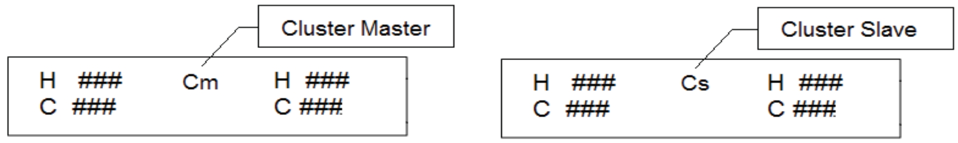
This setting is used when USDS are in Cluster or Synchronized configuration.

A. Cluster

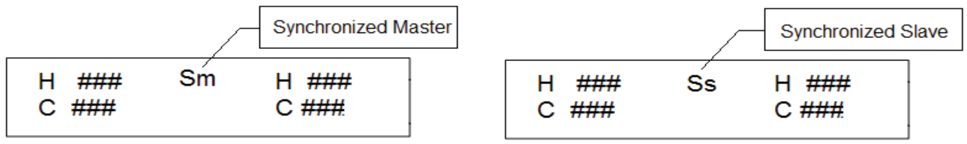
This is the default mode when USDS are wired in Cluster configuration and the hardware jumper is installed. It is activated by the jumper and wiring as shown in the Standard Cluster Wiring Diagram.

B. Single

The USDS should be changed to this mode if synchronization is required.



Example of Cluster Control Board Screens



Example of Synchronized Control Board Screens

11.4 Baud Rate

This setting is how fast the device communicates per second. The default setting of 1200 is not be changed unless noted otherwise.

11.5 Parity

The default setting of “even” is not be changed unless noted otherwise by Q-Free representative.

Menu: Resets

11.6 System Reset

This menu can restart the device. This is an alternative to the power switch. All of the settings (e.g. counter’s values) are saved. The safety question has to be answered with "yes" before starting operation. After restarting, a measuring procedure starts prior to operation.

11.7 Counter Reset

This menu can reset the internal counters to 0. All other settings are preserved.

12. Menu: Diagnostics

This menu is only for a certified technician familiar with the USDS:

- **Debug Mode**

13. Troubleshooting

Usually the device starts to measure as soon as it is turned on. This is part of the automatic process. The following display is shown during this process:

USDS Version #	**5**
CA#	**CB#**

The number after the text "USDS version" shows the software version number. This number in the upper right shows the calibration countdown from 5 to 1. The Bottom left shows the A to B counter. The bottom right shows the B to A counter. The device shows the measured ceiling height after the process is completed, and then automatically switches to the main display (see "Main Display" at the beginning of this document).

If the calibration is unsuccessful, the reason could be one of the following:

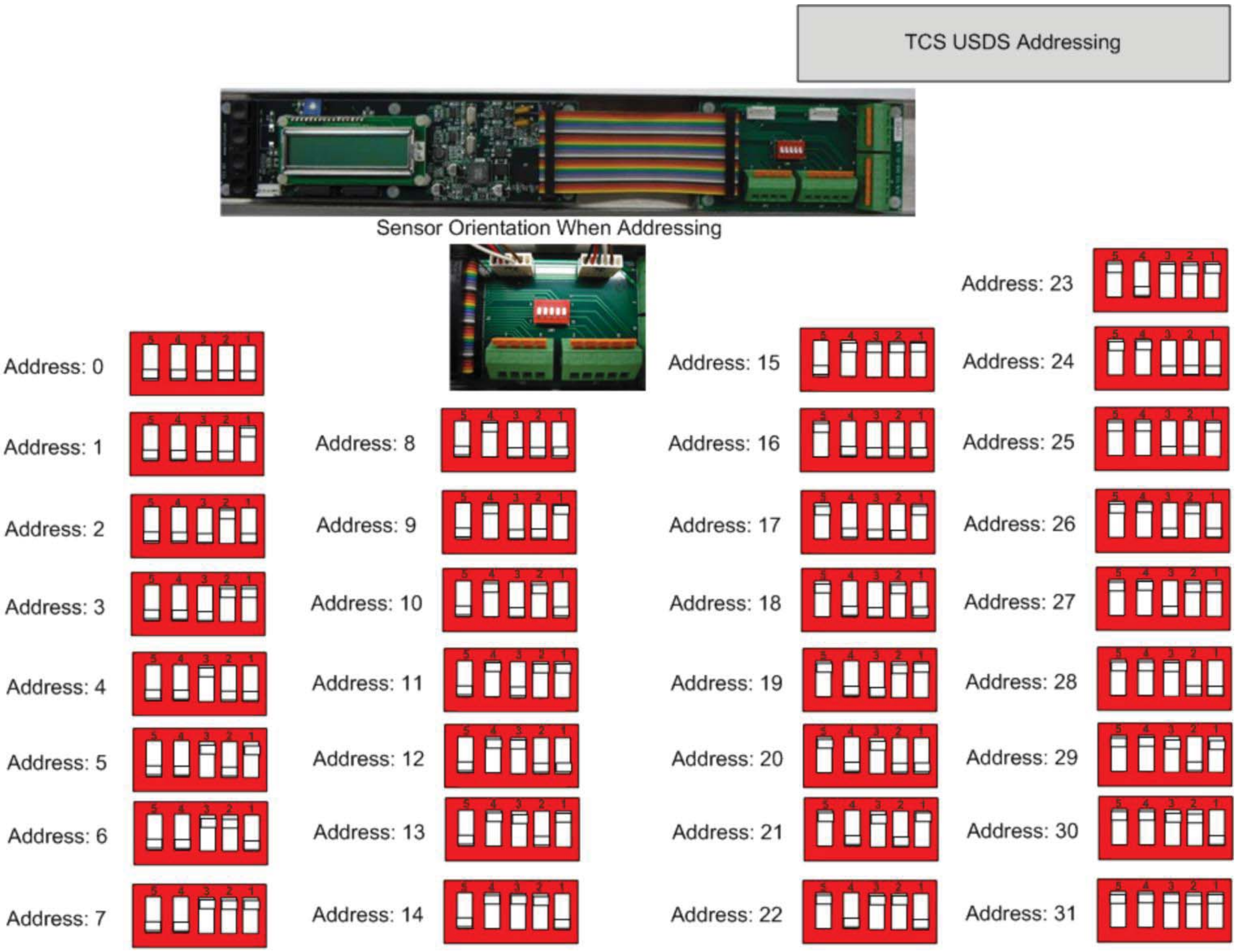
- Movement under the device (e.g. people)
- Objects under the device (e.g. empty boxes, etc.)
- The sensor is in an unfavorable position (e.g. not parallel to the lane's surface, too close to the walls, too close to other devices causing interference).
- Sensor cable is loose or is not plugged in. Check cable and connector connections.

The exact cause will be displayed:

- Ceiling too high.
- Ceiling too low.
- Sensor is not parallel.
- Sensor A or B no communication error

14. Assigning an address to USDS

Each USDS on the same communication cabling requires a unique address between 0 and 31. This address is set by changing the DIP switches. Below is a guide for each address between 0 and 31. Ensure that DIP switches are oriented as shown below for proper addressing. USDS will show its address as Sensor ID on startup.



Q-Free
Single Space Sensor & Zone Controller
Installation Manual
Version 2.9

Zone Controller: TZC-100
Single Space Sensor: TUS-100

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Table of Contents

1. SENSORS

1.1 Function

Single Space Sensors utilize ultrasonic to detect a vehicle's presence within an individual parking space. Typically, they are suspended from the ceiling at either the end or the center of the space. Once a sensor has been tuned to the space it continually measures the distance to the ground detecting parked vehicles by the resulting change in measurement. These sensors have LEDs that act as visual indicators for would-be parkers; green indicates unoccupied, red indicates occupied, and a 3rd LED color, amber, can be used for indicating other scenarios. Occupancy data is consistently sent to a zone controller which relays the information to the parking guidance server.

1.2 Assembly

Each sensor consists of their device components enclosed in a two-piece housing, the two halves of the housing lock in place when slid together. Near the conduit entrance of the housing there are terminal blocks for the termination of communication and power.

1.3 Mechanical and Electrical Specifications

- Dimensions: ø 4.9 x 2.3 in (ø125 x 58 mm)
- Operating temperature: -40 to 158 °F (-40 to 70 °C)
- Power: 24VDC
- Power consumption: maximum 35 mA per Sensor
- LED Brightness:
  - Green: 8700 mcd
  - Red: 4180 mcd
  - Amber: 4180 mcd
- Communication interface: serial RS485

Recommended Cable Type:

4 wire cable with a diameter of 18 AWG (2 for RS485 & 2 for 24VDC). The metric equivalent would be a diameter of 1.02mm and cross sectional area of 0.823mm^2.

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1.4 Sensor Information

1.4.1 Base Dimensions Diagram

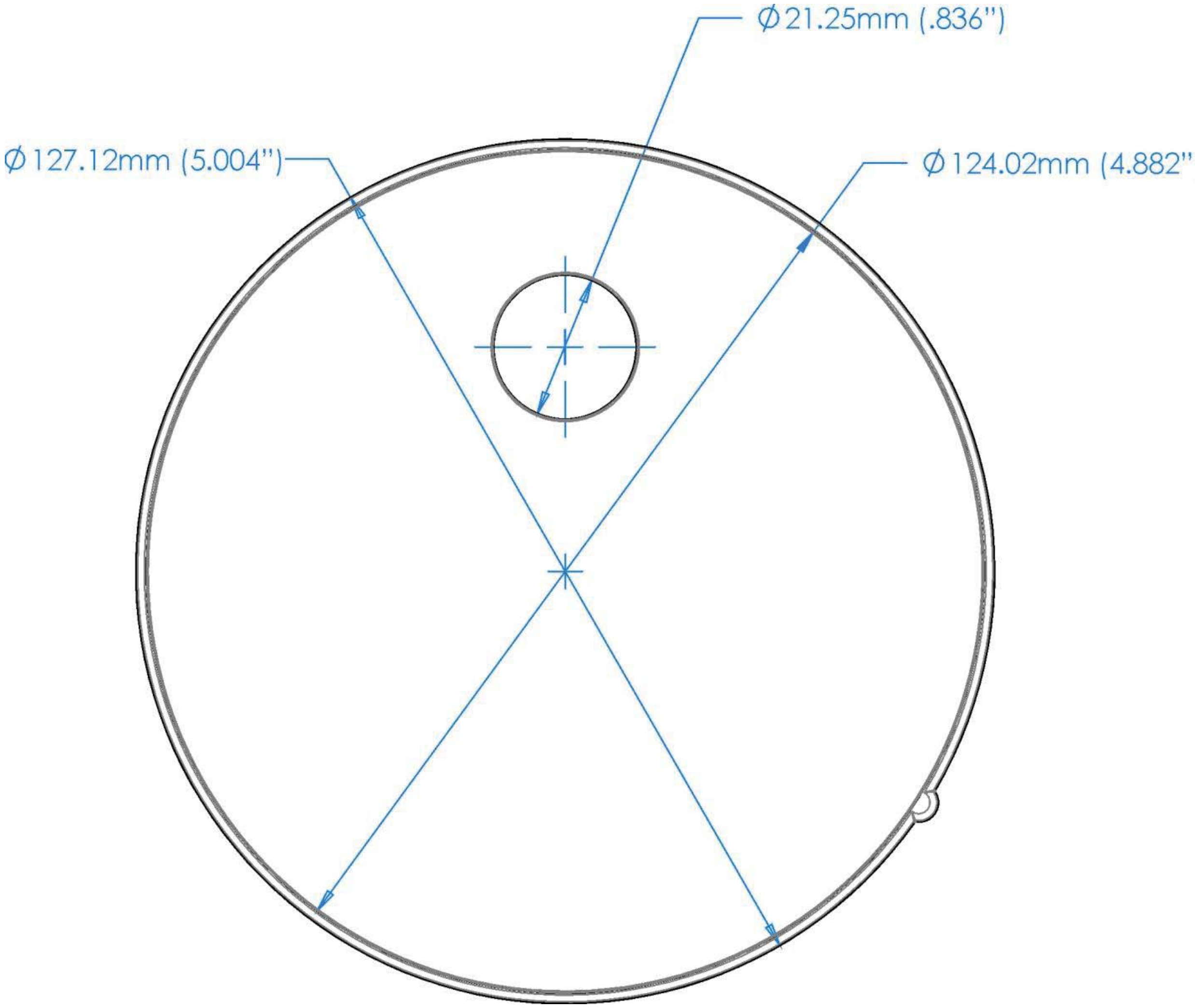

Figure 1: Sensor Base Dimension

1.4.2 Opening the Sensor

The two-piece plastic sensor housing is held together by an internal locking mechanism. To open it, follow this procedure:

1) Remove the ∅5mm plastic plug on the side of the housing to access the locking mechanism (IMPORTANT: save for reinsertion once wiring is complete to prevent moisture penetration).

Figure 2: TUS-100 Plastic Clip

2) Insert a small screwdriver at the same angle as the arrow shown in Figure 2, applying gentle pressure to the locking clip inside of the housing.

Figure 3: Opening TUS-100

3) While applying pressure to the locking clip turn the screw driver to the left which will release the two halves.

Figure 4: Opening TUS-100

1.5 Sensor Mounting Instructions

1.5.1 Mounting Placement for End of Space Sensors

It is important to mount the sensor in the **middle of the width** of the parking space. You must pay attention to parallel alignment for sensors along the same row. The sensor's ultrasonic radiating properties also need to be considered in order to determine the right mounting position free of obstructions.

The sensor mounting height must be in the range of **6.5 to 9.8 Ft (2 to 3 m).**

The sensor must be mounted directly at the end of the parking space. If necessary, you can vary the distance from end of the parking stall with regard to the detection area shown in Figure 4. The maximum variance is 11.5 in (30cm) in either direction. Note this will affect the detection area of the sensor.

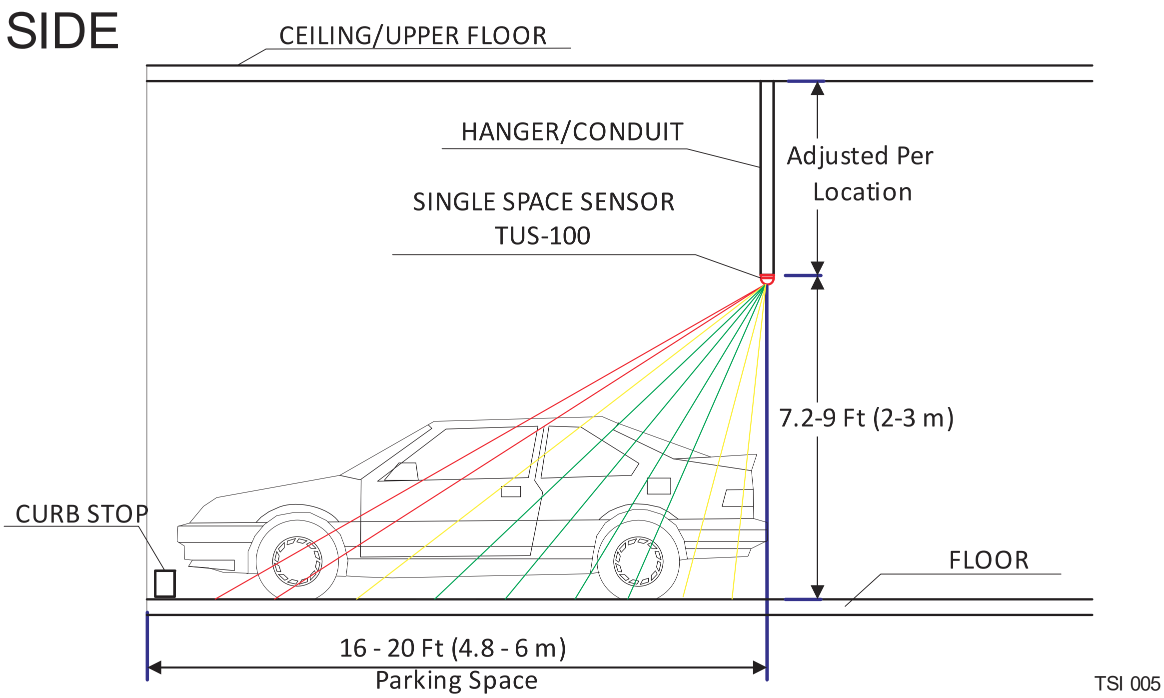

Figure 5: TUS-100 Single Space Sensor Side View

You get a safe detection when a vehicle covers at least a third of the good detection area (green). Therefore, small objects like shopping carts, motorcycles or people will likely not be detected. In weak detection area (yellow and red), the object must be much bigger to be detected.

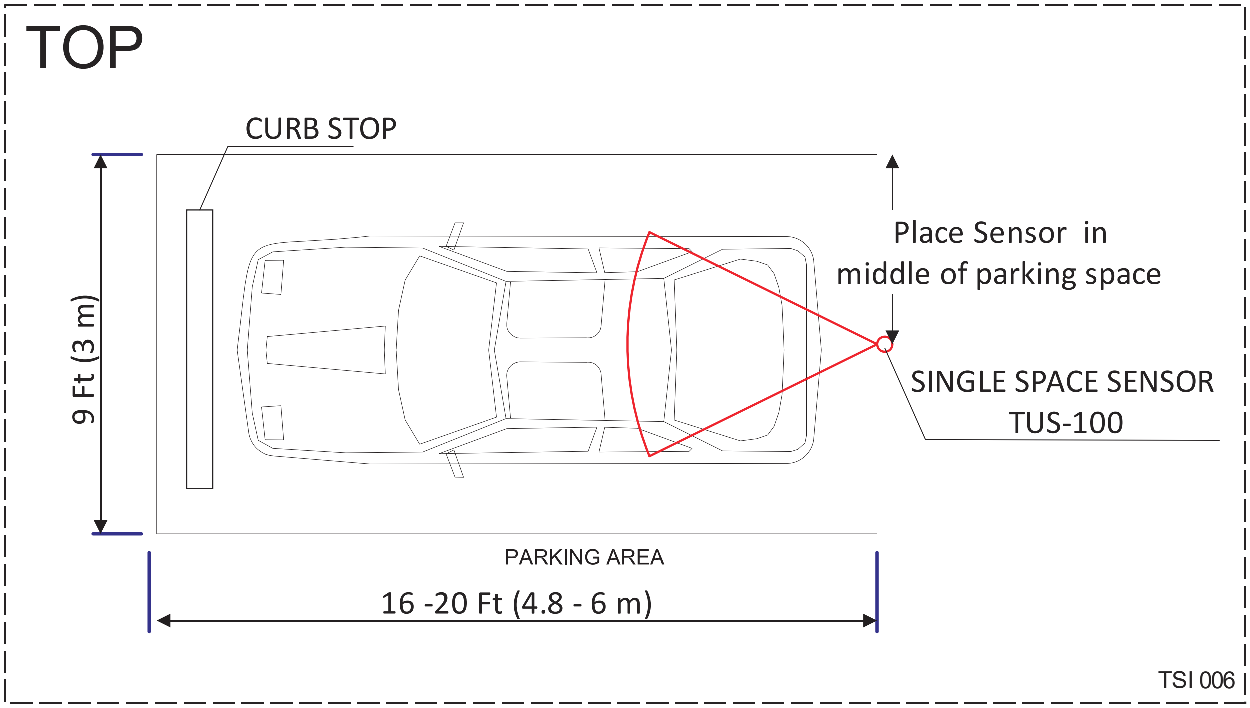

Figure 6: TUS-100 Single Space Sensor Top View

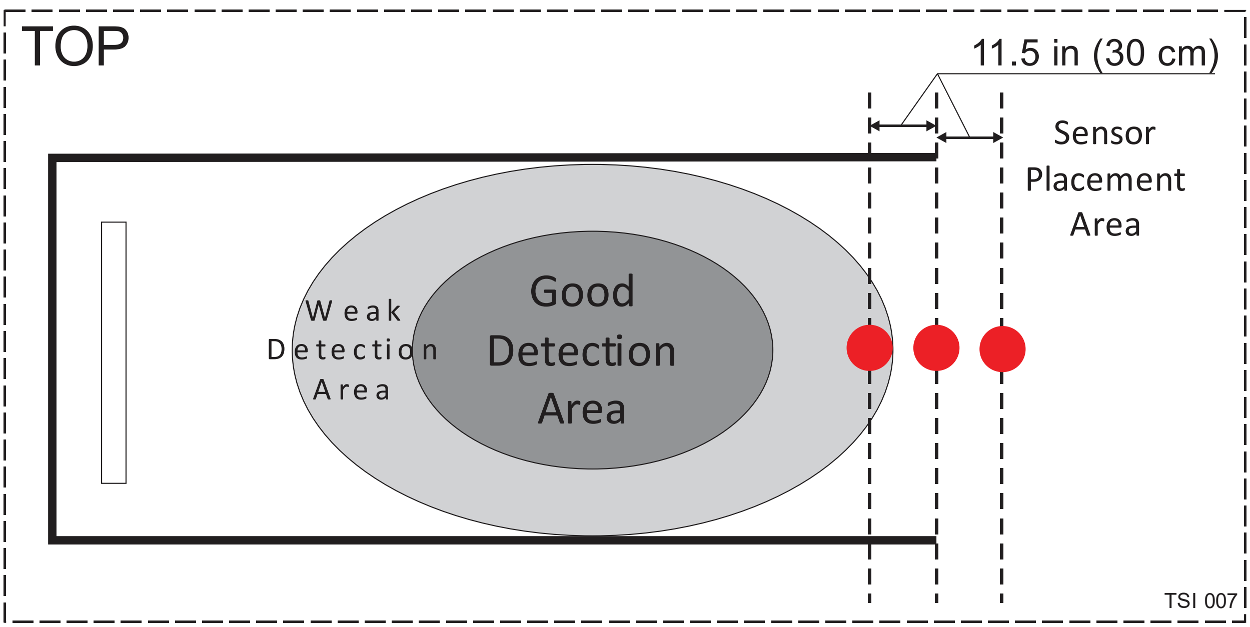

Figure 7: TUS-100 Mounting Variance/Detection Area

A vehicle parked in the parking space will be detected if the rear of auto is not further than 5.2 feet to 6.9 feet (1.6 m to 2.1 m) away from the sensor.

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Sensor Height	Safe Detection Distance
7.5 Ft (2,3 m)	5.2 Ft (1,6 m)
8.2 Ft (2,5 m)	5.9 Ft (1,8)
8.9 Ft (2,7 m)	6.6 Ft (2,0 m)
9.8 Ft (3,0 m)	6.9 Ft (2,1 m)

Figure 8: Safe detection area based on sensor height

If there is an obstruction (concrete beam, pipes, etc.) near the end of the parking space, the sensor must be installed at a safe distance from the obstruction so the vertical and horizontal coordinates are at a ratio of 1:2.

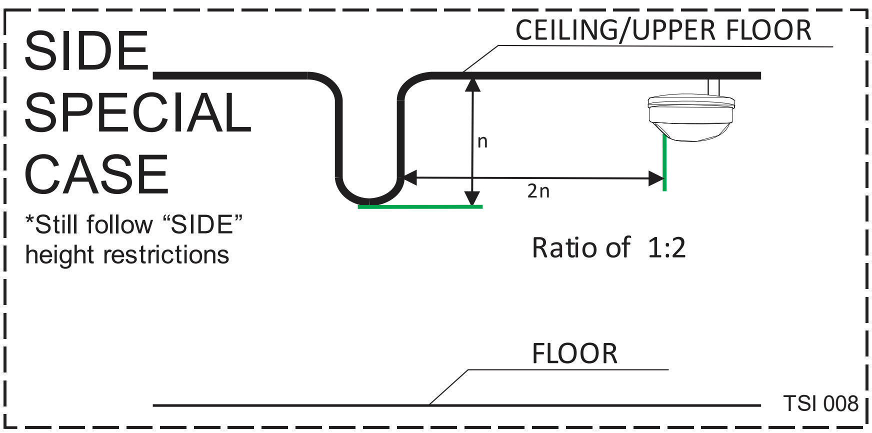

Figure 9: Special case for Sensor mounting

1.5.2 Mounting Direction

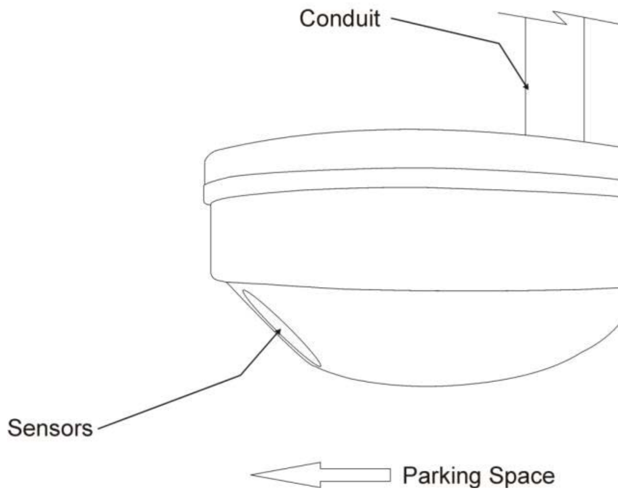

Figure 10: TUS-100 mounting direction

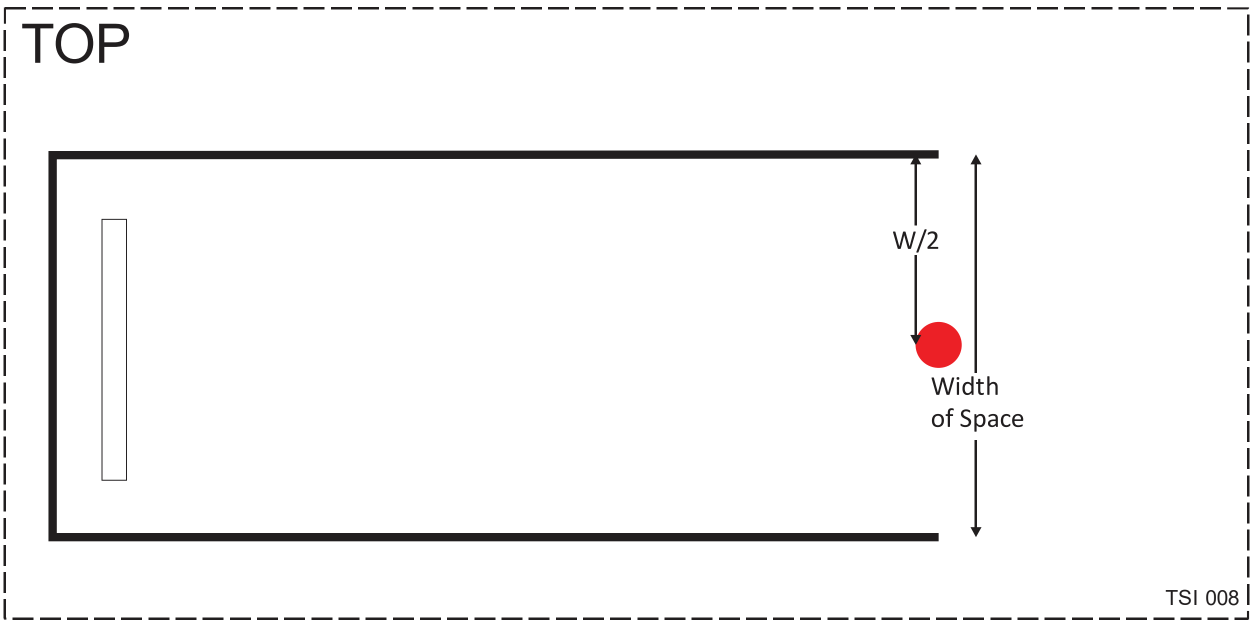

Figure 11: TUS-100 Mounting

1.5.3 Mounting Methods

1.5.3.1 Conduit Mounting

The TUS-100 is designed to mount to a piece of conduit fixed with either a **½" watertight EMT** (Similar or comparable to RACO © Watertight) connector as shown below or provide and utilize expanding watertight foam application for single space sensor. Brand/Type: CRC 14077 for U.S. and CRC 74077 for Canada. All connectors used must be watertight and not allow any infiltration of water.

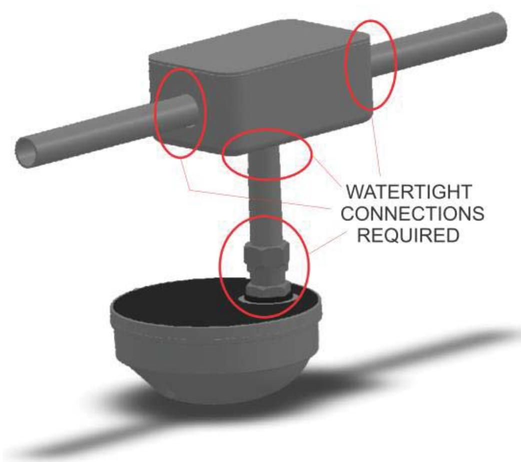

Figure 12: Mounting Selection

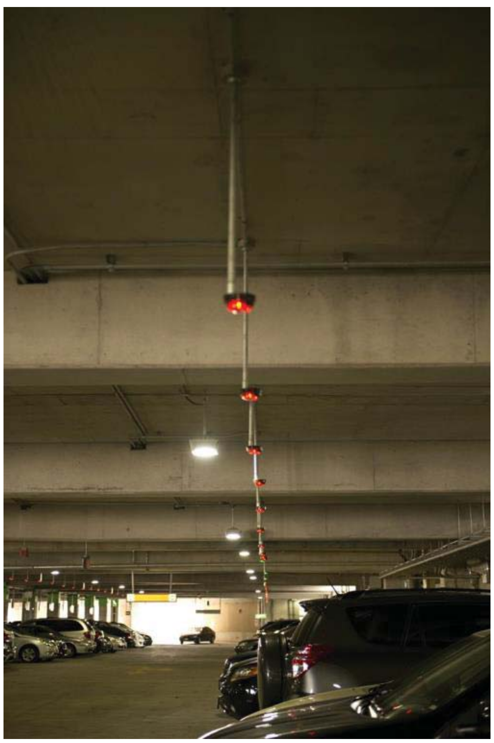

Figure 13: Conduit mounting

1.5.3.2 Uni-Strut/Rail Mounting for End of Space Sensors

The TUS-100 is also designed for being mounted onto a rail system. The rail system must be installed in such a way that it provides optimal operating and uniform height for sensors. Also, the rail system must have either a top installed that will provide a water tight protection for the sensors or use an expanding watertight foam application for single space sensor. A ½" cable gland is required if using the rubber connector. This is to create a water tight for the rail system and sensors. An example of a rail system installation is shown below. Be sure that the watertight rubber seals are located so there is one on the inside of the sensor and one on the outside. The wire can be no more than ¼" in diameter to fit through the cable gland. If using the foam application, use brand/type CRC 14077 for U.S. and CRC 74077 for Canada.


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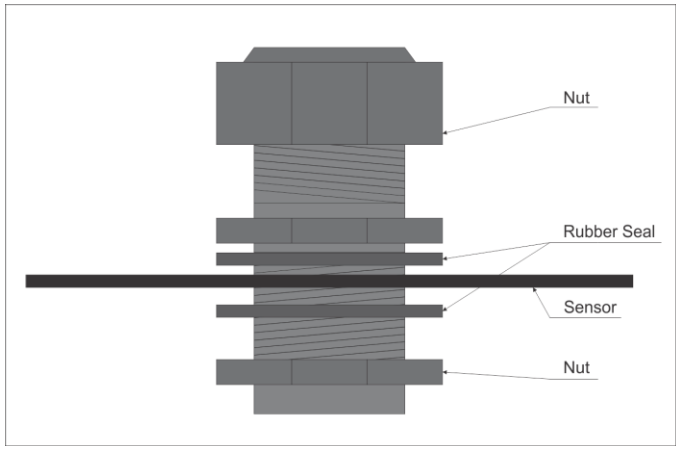

Figure 14: Uni-Strut/Rail mounting coupling installation

Using two pair 18 AWG cable, run the cable from the rail tray into the sensor. Terminate the wires as per the wiring diagram on page 14. Then with a new length of two pair 18 AWG cable, run the cable from inside the senor back into the rail tray down to the next sensor and repeat this in a daisy chain fashion. Secure the cable gland so the sensor is mounted tightly to the rail, and so that the nut creates a water tight seal around the cables.

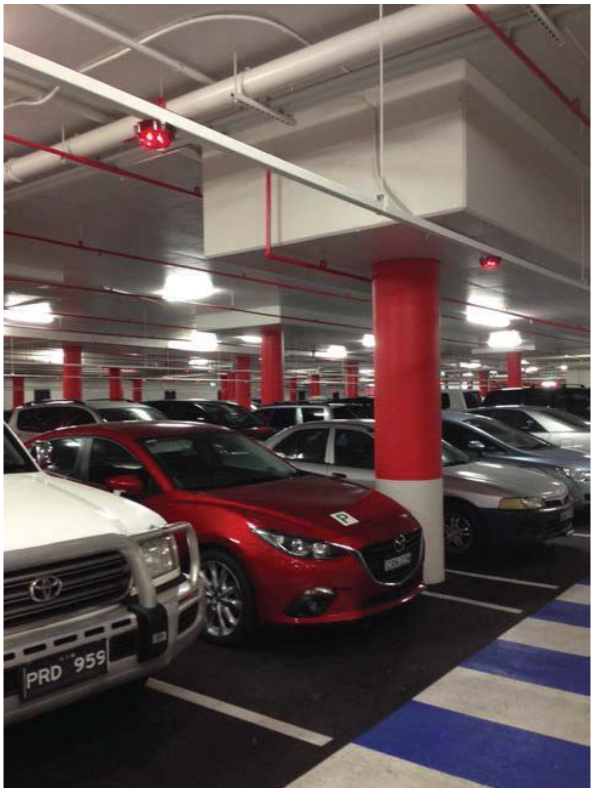

Figure 15: TUS-100 Uni-Strut/Rail mounting

Figure 16: TUS-100 Uni-Strut/Rail mounting

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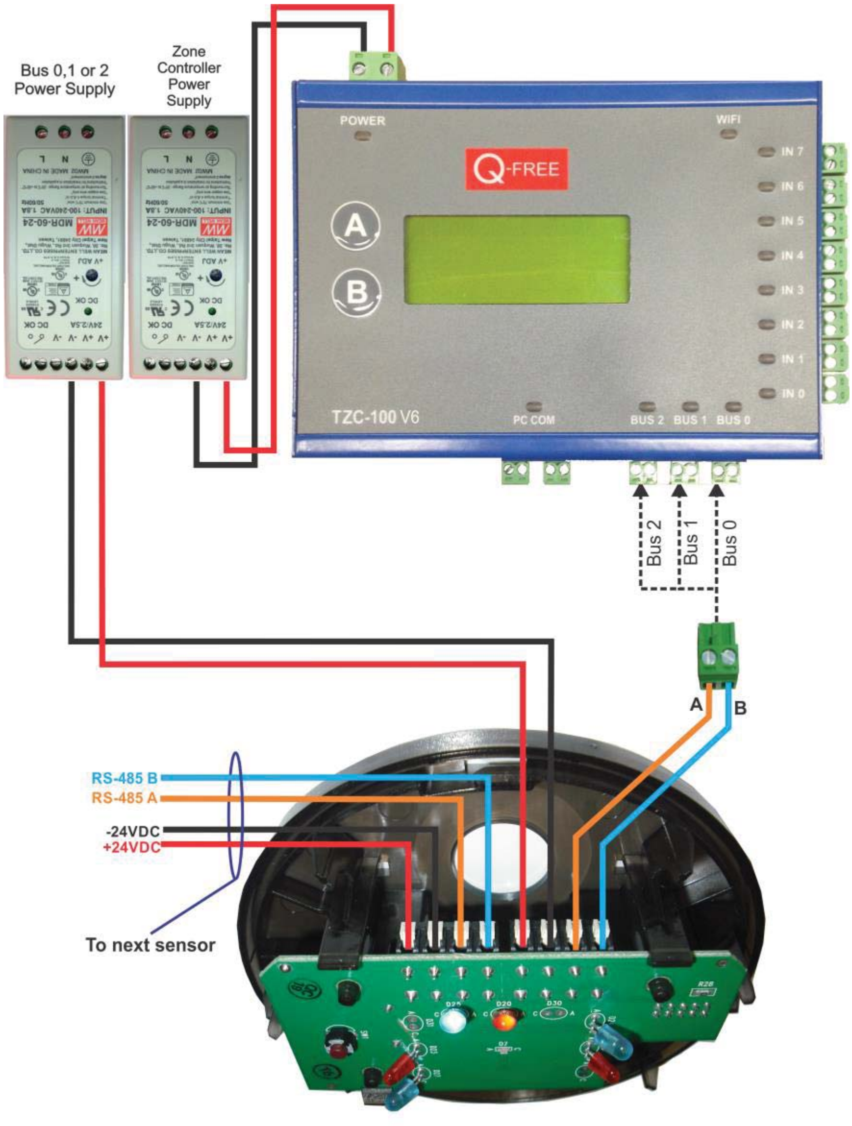
1.6 Cable Connection

A 4 wire cable with 18 AWG multi-colored conductors is required for establishing power and communication to the first sensor on a bus. The same cabling must be used for daisy chaining the rest of the sensors on that bus.

1.7 Wiring Terminations

Follow the diagram below for correct wiring:



WARNING: CHECK POLARITY OF 24VDC TO SENSOR BEFORE TURNING ON POWER.
REVERSE POLARITY COULD RESULT IN DAMAGED SENSOR(S).

Figure 17: Wiring Terminations

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1.8 Sensor Addressing

Each sensor on a bus must have a unique address between 0 and 31 in order for the zone controller to properly communicate with each sensor. This address is set using a push button on the sensor shown below in Figure 18 by the red arrow. The address for each sensor is required to correspond with the layout drawings for the specific project.

Figure 18: Inside a TUS-100

Start programming mode

Press and hold the button until all LEDs light then release the button (You're now in programming mode).

Programming address

When entering the programming-mode, the address starts at 0. Every **short push** on the button counts up the **address by 5**. Every push is acknowledged by a short blink of the **green LEDs**.

After that, **press and hold** the button again until all of the LEDs light up, once they light up release the button.

Now, every **short push** on the button counts up the **address by 1**. Every push is acknowledged by a short blink of the **red LED**.

To complete programming, **press and hold** the button again until all LEDs light up shortly.

Display current address

In normal operation mode, you can display the address by a short push on the button (after programming is completed the entered address is shown automatically). A **green blink is counted as 5** and a **red blink is counted as 1**.

Example:

The sensor blinks **3x green** and **2x red**

5+5+5+1+1 = 17

After displaying current address, all LEDs light up shortly and the sensor returns to normal operation mode.

When there is no input in programming mode for more than 10 seconds or if you entered an invalid address, the sensor returns to normal operation mode and shows this by repeated blinking of all LEDs. In this case, the entered address will not be saved on the sensor. The previous address will be used.

2. ZONE CONTROLLER

2.1 Function

The zone controller is the center of the system in single space sensor parking guidance installations. The zone controller is equipped with:

- 3 serial ports of type RS485 for communication with Single Space Sensor
- 2 serial ports of type RS485 for communication with PC
- 8 digital inputs for connecting of relays
- Modem module for wireless communication with PC (optional)

The zone controller allows connecting and controlling of up to 96 Single Space Sensors (up to 32 sensors per bus). The zone controller configuration is stored in none-volatile memory and protected against power outages.

2.2 Assembly

The zone controller is located in an enclosure which is mounted to the wall within proximity to the controlled zones' sensors as shown in the project drawings. There are 2 menu keys on the left side of the display on the circuit board for navigating the menus within the zone controller. The sensor bus interface connectors provide the communication from the zone controller to each of the three sensor buses. The 24VDC power supplies generate the supply voltage for each sensor bus.

2.3 Enclosure

The zone controller enclosure is delivered with the following devices:

1) Zone Controller for the operation of up to 96 sensors (up to 32 sensors on each bus)
2) Power supply for the zone controller
3) 3 Power supplies for the sensor buses
4) A modem for wireless communication to a central server (optional)
5) A power supply for sign bus (optional)

2.4 Serial Number

Each zone controller comes with a unique serial number. This number can be found inside the zone controller on the board. It is located on the left side of the board.

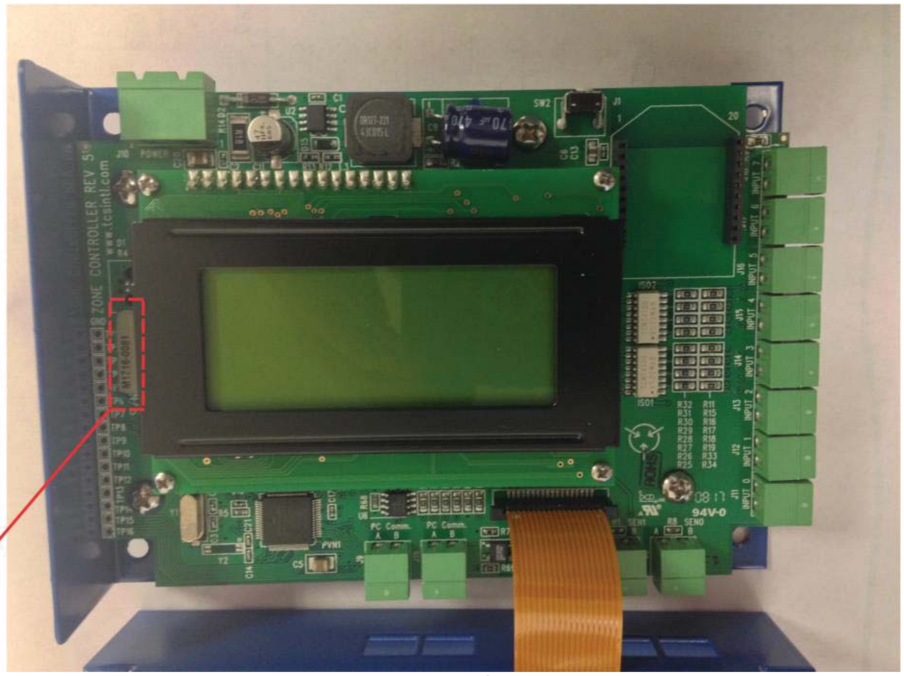

Figure 19: Zone Controller Board

2.5 Installation

The installation should be in close proximity to the three connected bus systems and according to design drawing. This way the voltage drop on the supply line is minimized. The maximum length of sensor bus must not exceed 100 meters.

2.6 Connection

The 24VDC power supply powering the zone controller requires 100-240VAC. The conduits containing incoming power, as well as the bus cabling for the sensor and signs must enter through the bottom of the enclosure. The wiring must be terminated on the sensors and signs prior to turning on power in the enclosure to prevent electronic failure from exposed copper. *Refer to the specific project's sign manual for instructions on sign connections and requirements*.

2.6.1 Bus Connections

Each bus can hold up to 32 sensors addresses, totaling 96 sensors per zone controller. Each bus can also carry more than one set of wires to split a bus run in multiple directions as long as it doesn't exceed 32 sensors.

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2.7 Zone Controller Operating

2.7.1 Zone Controller Component Descriptions

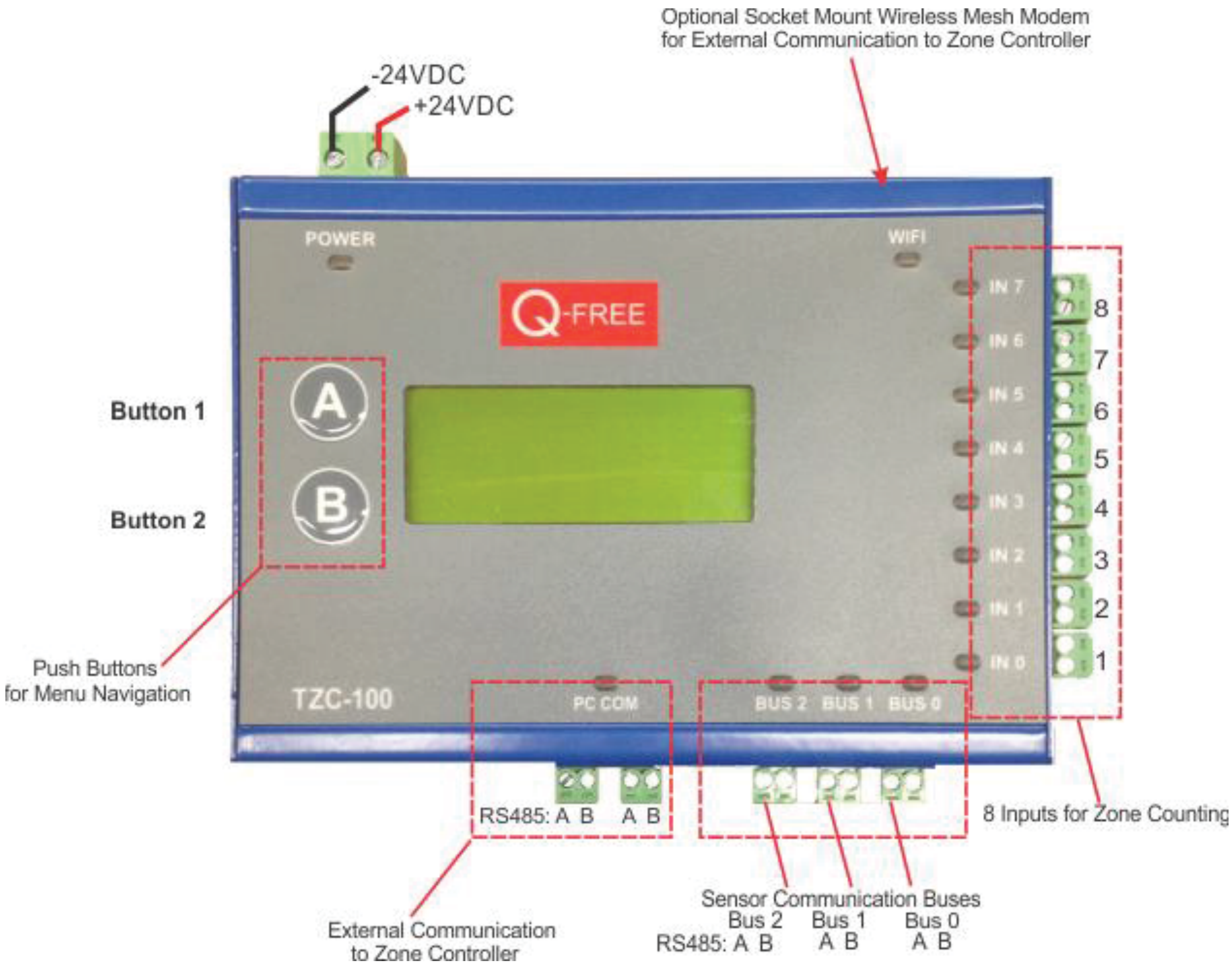

Figure 20: Zone Controller component description

2.7.2 Zone Controller Buttons

The Zone Controller is operated by Main Screens and Interactive Menus. For navigation in the main screens and interactive menu there are two push buttons on the left of the screen.

Button A:

1. Push and hold:
    a. Main Screen: Exit from changing mode (flashing cursor) without saving last changes
    b. Interactive Menu: Move up one level a time without saving last changes
2. Single Click:
    a. Main Screen: Move cursor across all items from right to left
    b. Interactive Menu: Move cursor across all items from right to left

Button B:

1. Push and hold:
    a. Main Screen: Save and exit from changing mode (flashing cursor)
    b. Interactive Menu: Move down one level at a time or save selected value if in changing mode
2. Single Click:
    a. Main Screen: Move cursor across all items from right to left
    b. Interactive Menu: Move cursor across all items from right to left once menu is activated

Pushing Button A and Button B together:

Switches between Main Screens and Interactive Menu

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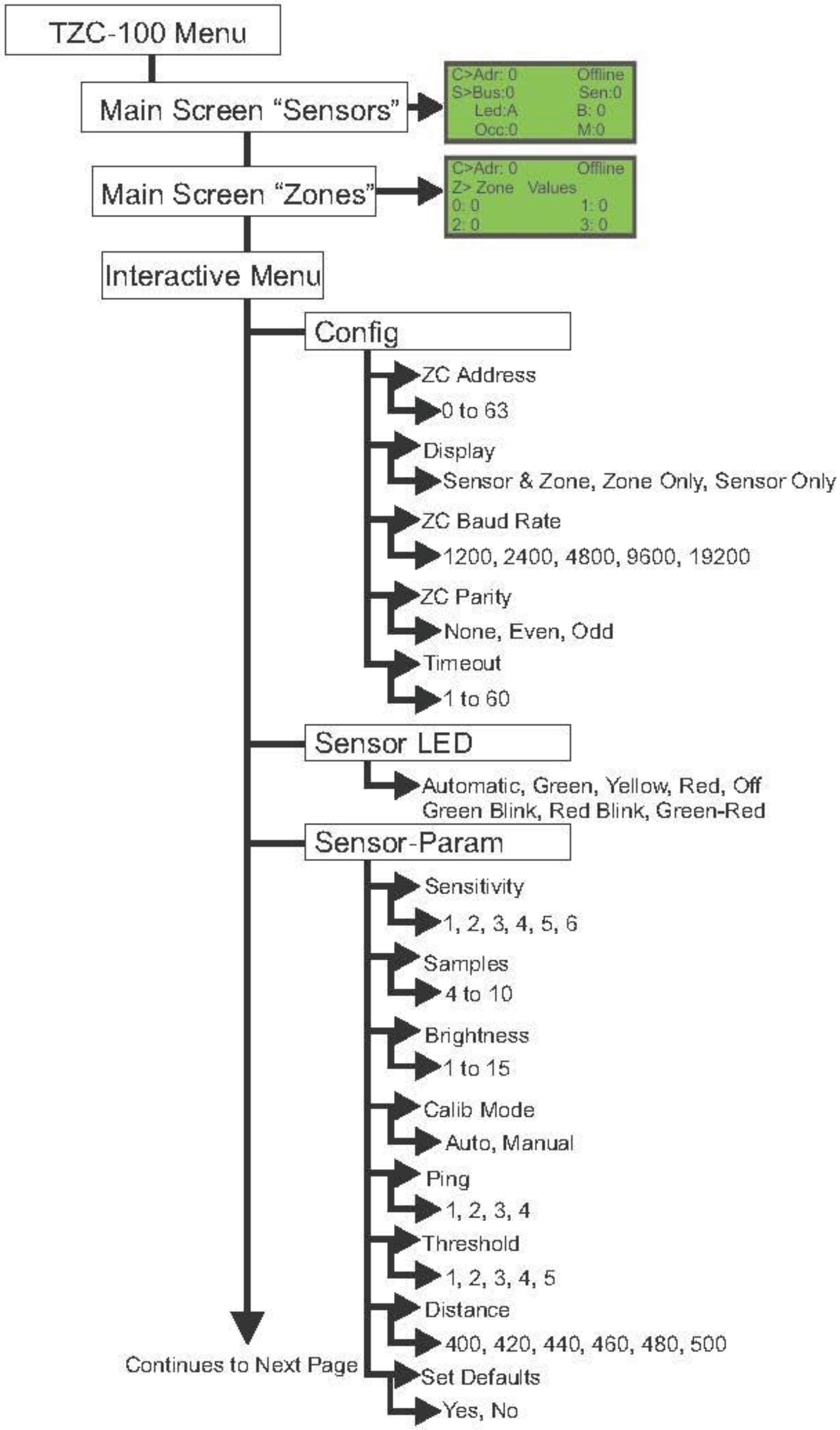
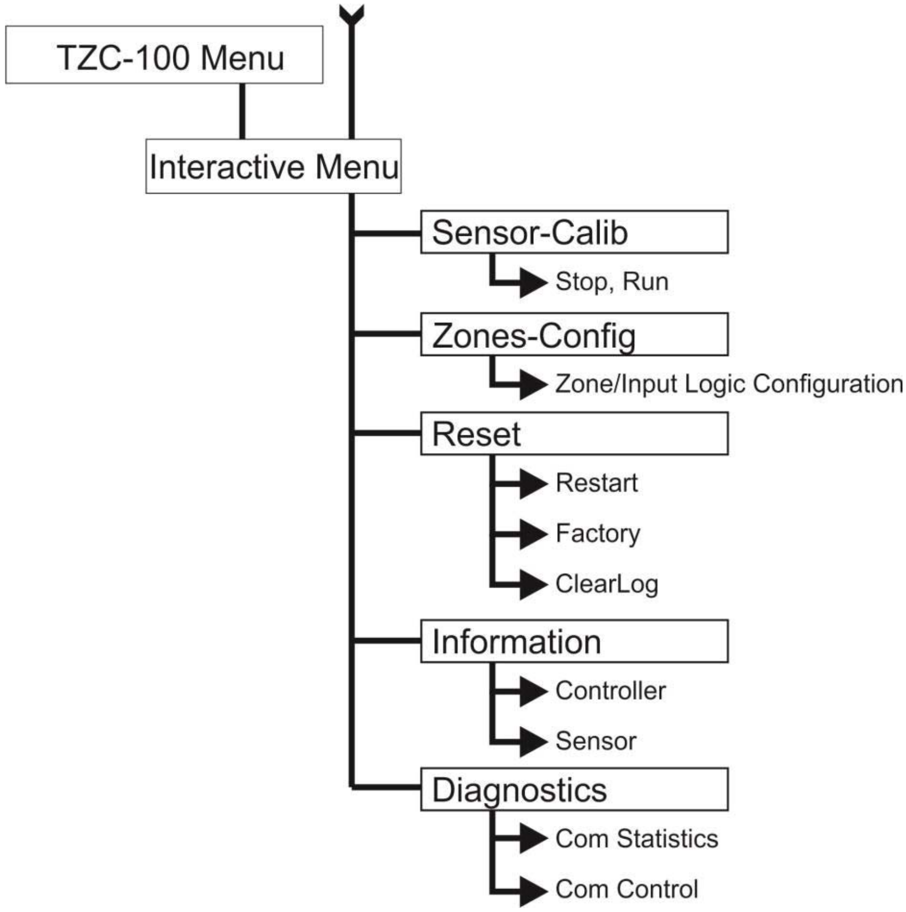
2.8 Menu Tree




TZC-100 Menu
Interactive Menu
Sensor-Calib
Stop, Run
Zones-Config
Zone/Input Logic Configuration
Reset
Restart
Factory
ClearLog
Information
Controller
Sensor
Diagnostics
Com Statistics
Com Control

2.9 Menu Descriptions

The Zone Controller is operated through a display and two pushbuttons on the left side of the display. All commands necessary for operation are integrated into a user-friendly menu. After powering on the zone controller the screen will display and start on the “Main Screen for Sensors” as shown below.

2.9.1 Main Screen Sensors

Figure 21: Main screen sensors

- First Row displays zone controller’s current address and communication status to PC.
- Second Row displays the currently viewed sensor’s bus and address.
- Third Row displays the currently selected sensor(s)’s LED status and Baseline value.
- Fourth Row displays the currently selected sensor(s)’s occupancy status and real time measurement value.

The two push buttons are used on this screen to select Bus 0, 1, 2 and select individual sensors on one of the three buses. Use push button A or B to move the underline cursor to Bus or Sen. Once Bus or Sen has an underline cursor, long press Button B. Bus or Sen will now flash. You can use Button A or B to change the selected Bus or Sensor up or down sequentially. Once the correct one is flashing, long press Button B again. The information will update for that selected sensor.

To move to the next screen (Main Screen Zones) push Button A and B at the same time.

2.9.2 Main Screen Zones

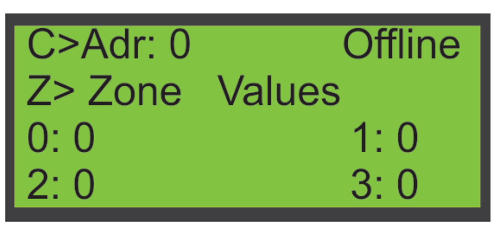


Figure 22: Main screen zones

- First Row displays zone controller’s current address and its online/offline state.
- Second, Third, and Fourth Rows displays the zone values.

Zone Counting is configured in the Visual Control Center software and not covered in this manual.

To move to the next screen (Interactive Menus,) push Button A and B at the same time.

2.9.3 Interactive Menu

Once in the Interactive Menu, press button B to advance through to each item: Config, Sensor-LED, Sensor-Param, Sensor-Calib, Zones, Radio, Reset, and Information. Once the desired menu item is selected, long press Button B to enter into the sub-menu for that item. *Use the Push Button descriptions on Page 18 to navigate the menus and sub-menus.*

2.9.3.1 Menu: Config

__ZC Address__

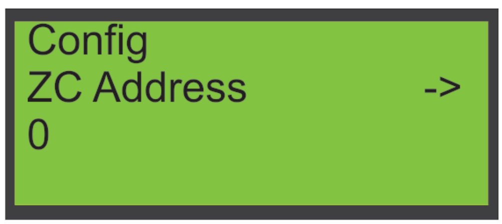


Figure 23: Config-ZC Address menu

In this sub-menu the zone controller's address can be changed. Default is 0. Zone controller addresses should not be changed unless specified by Q-Free. Adjusting the address can result in communication loss.

For example, to change the address from 0 to 1:

- From Main Screen Sensors press both buttons twice to access the Interactive Menu.
- From the Interactive Menu press Button B until "Config" is displayed.
- Long press Button B until ZC Address is also displayed.
- Short press so that underline cursor is moved to the "0".
- Long press Button B so that "0" is flashing.
- Short press Button A or B to increment the address up and down.
- Once desired address is reached long press Button B to save address.
- To go back to the top of the Interactive Menu long press Button A.

Display

Figure 24: Config-Display Menu

In this sub-menu you have the ability to choose which Main Screens will be displayed. The options are Sensors and Zone, Sensors only, and Zone only.

ZC Baud Rate

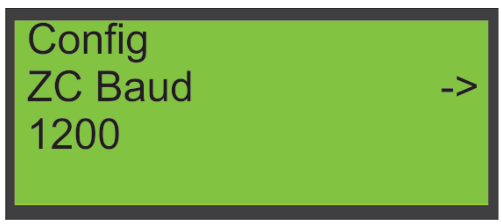


Figure 25: Config-ZC Baud Rate menu

In this sub-menu the zone controller's external communication baud rate can be changed. Default is 1200. Zone controller Baud rates should not be changed unless specified by Q-Free. Adjusting the baud rate can result in communication loss.

ZC Parity

Figure 26: Config-ZC Parity menu

In this sub-menu the parity of the zone controller's external serial communication can be changed. Default is Even. Zone controller Parity should not be changed unless specified by Q-Free. Adjusting the Parity can result in communication loss.

<u>Config: Timeout</u>

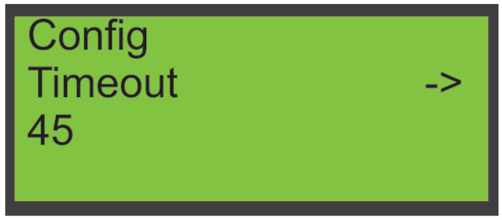


Figure 27: Config-Timeout menu

In this sub-menu the communication timeout of the zone controller's external serial communication can be changed. Default is 1.

2.9.3.2 Menu: Sensor-LED

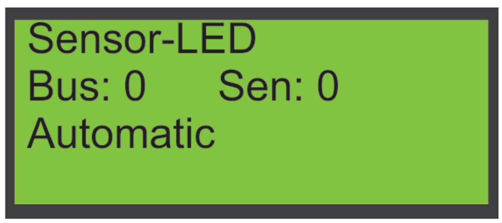


Figure 28: Sensor LED menu

In this menu individual sensors or groups of sensor's LED colors can be changed. Default is Automatic. Other options shown in Menu Tree on page 19.

2.9.3.3 Menu: Sensor-Param

<u>Sensor-Param: Sensitivity</u>

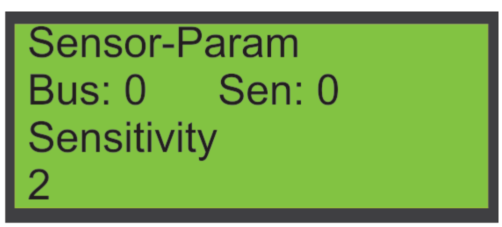


Figure 29: Sensor-Param-Sensitivity menu

In this sub-menu individual sensors or groups of sensor's sensitivity levels can be adjusted. Default is 3. If a vehicle from a neighboring parking is being detected by a sensor that has an empty parking space, lower the sensitivity. If smaller vehicles are not being detected in an occupied parking space, raise sensitivity. Sensitivity settings should not be changed unless specified by Q-Free. Adjusting the sensitivity can result in decreased accuracy.

Sensor-Param: Samples

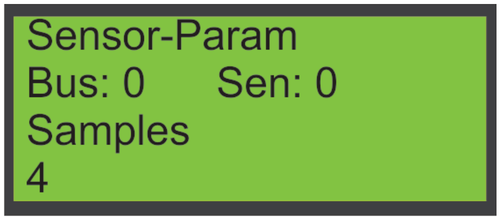


Figure 30: Sensor-Param-Samles menu

This sub-menu is for technician use only and should not be used for setting up the system.

Sensor-Param: Brightness

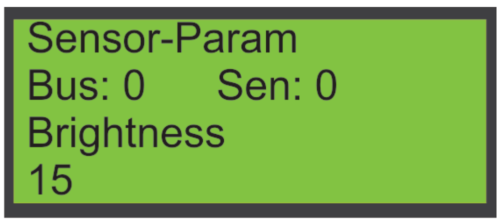


Figure 31: Sensor-Param-Brightness menu

In this sub-menu individual sensors or groups of sensor's LED brightness levels can be adjusted. Default is 15 for brightest.

Sensor-Param: Calib Mode

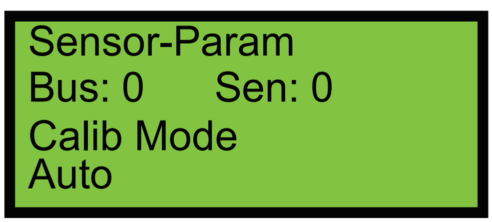


Figure 32: Sensor-Param-Calibration Mode menu

In this sub-menu individual or groups of sensors can be set to automatic or manual for calibration settings. The default setting is automatic and it is recommended to keep it automatic so that the sensor calibrates itself based on its installation.

Sensor-Param: Ping

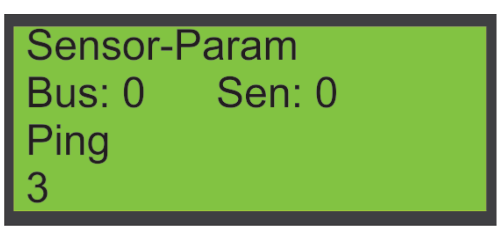


Figure 33; Sensor-Param-Ping menu

This sub-menu is for technician use only and should not be used for setting up the system.

Sensor-Param: Threshold

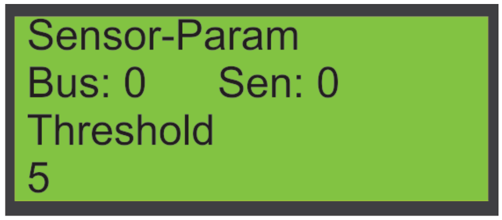


Figure 34: Sensor-Param-Threshold menu

This sub-menu is for technician use only and should not be used for setting up the system.

Sensor-Param: Distance

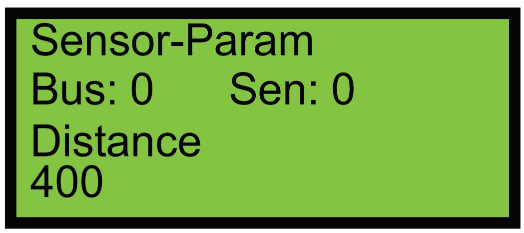


Figure 35: Sensor Param-Distance menu

In this sub-menu the distance that the sensor can read can be adjusted. It is recommended to leave it at its default setting. This setting can be adjusted for imperfect installation parameters of a sensor.

Sensor-Param: Set Defaults

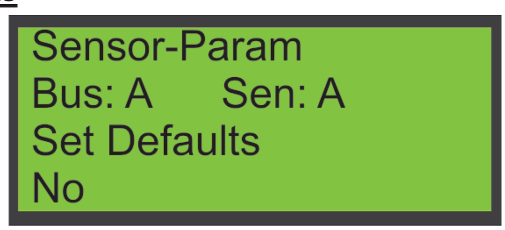


Figure 36: Sensor-Param-Set Defaults menu

This sub-menu allows resetting all parameters for individual sensors or groups of sensors to default values.

2.9.3.4 Menu: Sensor-Calib

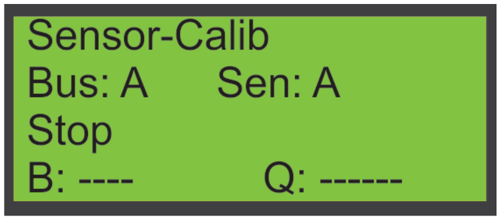


Figure 37: Sensor-Calibration menu

In this menu individual sensors or groups of sensors can be calibrated. **Once power is applied to zone controllers and sensors, all sensors must be calibrated for the system to be functional.** In order to calibrate sensors correctly, the parking spaces for the selected sensors must be unoccupied. (See “Sensor Calibration” section for further detail and instructions)

2.9.3.5 Menu: Zones-Config

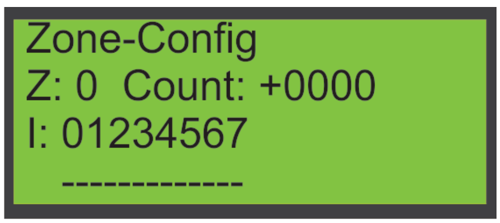


Figure 38: Zones-Config menu

This sub-menu is for technician use only and should not be used for setting up the system.

2.9.3.6 Menu: Reset

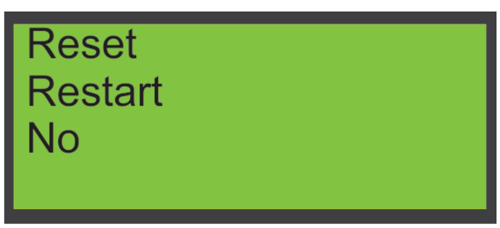


Figure 39: Sensor Reset menu

This menu is used for resetting the zone controller to factory settings and clearing the log file.

2.9.3.7 Menu: Information

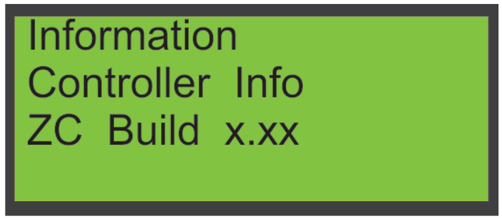


Figure 40: Information menu

This menu is used to display information about the controller, the sensors and the wireless interface.

2.9.3.8 Menu: Diagnostics

Figure 41: Diagnostics Menu Error Rate

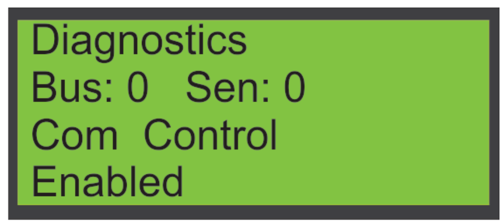


Figure 42: Diagnostics menu Control

This menu is used to display information about the status of the sensors and their current condition. Error rate has the potential to display the percentage of sensors on the bus that are not wired or functioning correctly. A fully functional bus will display an error rate of 0%.

3. SENSOR CALIBRATION

See page 15 for Steps to Configure Sensor Operation prior to calibrating.

A Single Space Sensor must be calibrated one time in following cases:

1) New sensor from production
2) Used sensor after mounting location was changed

In order to calibrate sensors correctly, the corresponding parking spaces must be unoccupied.

3.1 Calibration Process

Go to Menu "Sensor-Calib" in the Interactive Menu to access the calibration process.

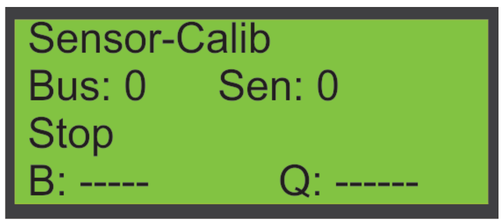


Figure 43: Sensor Calibration menu

"B:" is the baseline value of the calibration (measurement). Until the sensor(s) is calibrated you will see no value as depicted above. "Q:" is the quality of the calibration and is represented on a scale of 1 through 16. A quality of 16 will be better than 1 in this sense and will be dependent on the type and quality of the surface the sensor is calibrating itself to (i.e. concrete, paint, etc).

If the message "sensor not found" is displayed on the screen as shown below, then that particular sensor(s) are not communicating with the zone controller. Check the wiring and/or address of these sensors.

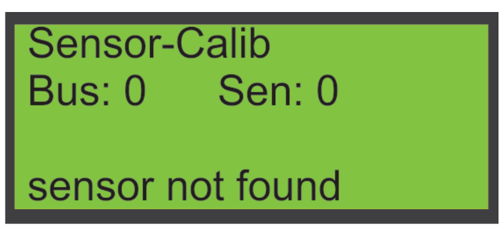


Figure 44: Sensor Calibration menu

- Use pushbutton A or B to move the underline cursor to Bus or Sensor.
- Once Bus or Sensor has the underline cursor; long press Button B. Bus or Sensor will now flash.
- You can use Button A or B to change the selected Bus or Sensor up or down sequentially. You can select "A" for ALL buses or ALL sensors to calibrate so that each sensor does not need to be calibrated separately.

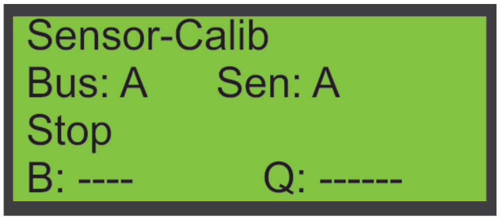


Figure 45: Sensor Calibration menu select All

- Once the correct one is flashing, long press Button B again.
- Then, short press Button B to move the underline cursor to “Stop.” Long press Button B so that “Stop” is flashing. Press Button A to change “Stop” to “Run”, then long press Button B to start calibration process.

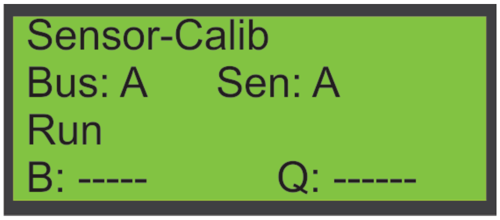


Figure 46: Sensor Calibration menu select All Running

The calibration process will go through all of the sensors that were selected.

During the process you can see on the screen which sensor is currently being calibrated. While that particular sensor is being calibrated, its LEDs will blink red and then turn solid green if the process was successful or solid red if unsuccessful.

Once the calibration process is over, all sensors that were calibrated should display green LEDs for their unoccupied parking spaces.

Note: If there are any sensors that display red LEDs with an unoccupied space check parking space for obstructions and recalibrate those particular sensors.

After all sensors are calibrated correctly use the menu “Sensor-Calib” to check the **“Q”** value (calibration quality) of each sensor.

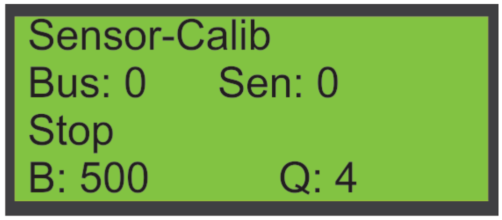


Figure 47: Sensor Calibration menu sensor information

The Q value should be between 1 (lower quality) to 16 (very good). A Q value of 0 means that the sensor’ calibration failed. If a sensor has a Q value of 0 or 1, try re-calibrating the sensor. If a sensor still has a Q value of 0 after re-calibration, it may be a defective sensor.

3.2 Sensor/Zone Controller Initialization Process

The following is the steps required when installing a zone controller enclosure and single space sensor system.

1. Mount Zone Controller enclosure in an easily accessible location in proximity to each sensor bus. Install enclosure 6' to 8' high. Do not install enclosures close to or on ceiling as it could affect wireless performance and technician access.
2. Install sensors for each bus at recommended height.
3. Bring cable and terminate each sensor according to documentation.
4. Terminate cabling in zone controller enclosure according to documentation.
5. Power on enclosure.
    a. If the power is terminated correctly, then all sensors on the bus should light up and flash green and red
    b. If a sensor or multiple sensors fail to light up, the power wiring may be incorrectly terminated. Refer to the wiring termination diagram for proper wiring instructions
6. Set address of each sensor with pushbutton on each sensor.
7. Use the buttons on the Zone Controller to navigate through the menus to check communication and operation.
    a. Go to Main Screen “Sensors” on the zone controller
    b. From here you can choose the bus and sensor(s) to verify communication
    c. You should have a B and M value for each sensor on the bus according to the project drawing
    d. If the sensor is not communicating the zone controller will display “Sensor not found” for that particular sensor
    e. If sensor is not found, check wiring and addressing
        i. Check Sensor Communication Error Rate
            1. Go to “Diagnostics” in the interactive menu
            2. From here you can choose the bus and sensor to verify communication error rate
            3. Additionally, “A” can be selected under “Bus:” and “Sen:” to verify error rate to all sensors connected to the zone controller
        ii. Send Default Values to Sensors
            1. Go to “Sensor-Param” in the interactive menu
            2. Here you want to set “Bus:” and “Sen:” to “A,” in order to send the default values to all sensors on the buses that are connected to the zone controller
            3. Next, under “Sensor-Param,” navigate to “Set Defaults”
            4. Then, change “No” to “Yes” to send these values to the sensors
8. Calibrate sensors using menus in zone controller.
    a. Ensure all parking spaces to be calibrated are free from any vehicles or other objects
    b. Go to “Sensor-Calib” in the interactive menu
    c. Here you want to set “Bus:” and “Sen:” to “A,” in order to calibrate all sensors on the buses that are connected to the zone controller
    d. Then, change “Stop” to “Run” in order to initiate the calibration process
    e. The screen should then display the percentage of calibration completion
    f. While calibrating, sensors will flash red and green.

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4. TROUBLESHOOTING

Problem	Possibility	Solution
Zone Controller will not power up	No power to Zone Controller	Check incoming AC power. Should measure 100-240VAC depending on local code.
		Check output from Zone Controller's power supply. Should measure 24VDC.
		Check cabling and termination for power, AC and DC.
One or more sensors will not light up after power up	No power to sensor or sensor's LED Mode is set to OFF	Check wiring from Zone Controller and to the sensor. Refer to wiring diagram for proper wiring.
		Check power supply for that sensor. Should measure 24VDC.
		If power and wiring are correct (small LED in the middle of board is flashing), swap sensor. Make sure you match the address of the sensor you are replacing.
		Check the set LED Mode of that sensor in Zone Controller.
After powering up system and using the menus shown on pages 21 to 28 to check sensor communication and operation you find one or more sensors not communicating	No power to sensors	Follow above steps to find problem.
	Wiring is not terminated correctly at Zone Controller or sensor/sensors	Check wiring from Zone Controller and to the sensor. Refer to wiring diagram for proper wiring.
	Sensor address is incorrectly assigned	Check drawing for proper addressing scheme, and refer to address setting instructions.
		Check sensor address by short pressing the address button on sensor and refer to address setting instructions.
Sensor is still light "Green" while a car is parked underneath	Sensor installed too high	Increase "Sensitivity"
Sensor displays "Red" when space is vacant	Sensor installed too low	Decrease "Sensitivity"

5. FAQ

What is wrong when a sensor is in a vacant parking space, and is always red and the Q value is 0 or 1?

This means, that the sensor is connected but is not calibrated or incorrectly calibrated. Go to "Sensors Calibration" and re-calibrate the sensor.

What is wrong when a sensor in a vacant parking space is always red and the Q value is between 2 and 16?

This means, that the sensor is connected and calibrated correctly but possibly detecting a vehicle from a neighboring parking space. Go to menu "Sensors-Param: Sensitivity" and try lowering the sensitivity for that sensor.

What does it mean if a sensor in an occupied parking space is always green?

Wait for the parking space to get free, and then re-calibrate the sensor. If the Q-Value is 0, check that no active ultrasonic transmitter (e.g. USDS or sensors that are connected to another Zone Controller) are near this sensor. If the Q-Value remains 0, the sensor may be damaged.

If sensor is correctly calibrated and this still occurs, try increasing the sensitivity of this sensor. This is done in the menu: "Sensors-Param: Sensitivity".

What do you do when a sensor has a problem calibrating?

First check if the sensor is communicating. On the "Main Screen Sensors" use the push buttons to select the particular sensor(s). If these particular sensors display "sensor not found" then the sensor is not communicating with the zone controller. Check address and wiring of sensor(s).

If the sensor is communicating, wait until the parking space is vacant, and then re-calibrate the sensor. Check for any obstructions or nearby vehicles that could disrupt the calibration process. If the sensor still does not calibrate, replace the sensor and try again.

Q-Free
Visual Control Center User Guide
For Parking Guidance Systems
Version 6.3

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Description

Parking guidance systems can be categorized by what they're monitoring; single space, level, facility, and surface lot monitoring systems are all examples. There are multiple devices used for these different types of systems. The zone controllers (TZC-100) and the single space sensors (TUS-100) are components that comprise a single space monitoring system. Ultrasonic directional sensors (USDS) are devices used to detect vehicle movements in level and facility monitoring systems. In-ground induction loops are used to monitor surface lots and other areas open to the sky where USDS cannot be mounted.

The devices that make up the parking guidance system communicate to the parking guidance server which acts as a mediator. It communicates to all the devices on the system without requiring human intervention. The server controls the parking guidance system, produces statistics, visualizes operations, and communicates with external systems.

The Visual Control Center user interface can be accessed through a client software, or a web browser.

The Visual Control Center Client is software that operates on Microsoft Windows ©, and is typically installed on the parking guidance server and/or client workstations. This software graphically relays parking availability data on a computer and allows users to configure and manage their parking guidance system. All configuration data, parking data and statistics are stored in a SQL database. This improves data protection and guarantees data availability even after a system breakdown.

The Visual Control Center may also be accessed through a web browser. Supported browsers: Firefox, Chrome, Edge, Internet Explorer 10 and above. This software graphically relays parking availability data on a computer and allows users to manage their parking guidance system.

Client User Interface

Starting Visual Control Center

To start the Visual Control Center software, double click on the Visual Control Center Client icon located on the parking guidance servers desktop.

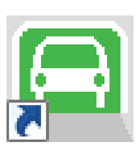

Figure 1: VCC Desktop Icon

A log in window will now open. This window allows the user to enter their username and password. The username and password should be set up by the Administrator during the commissioning process.

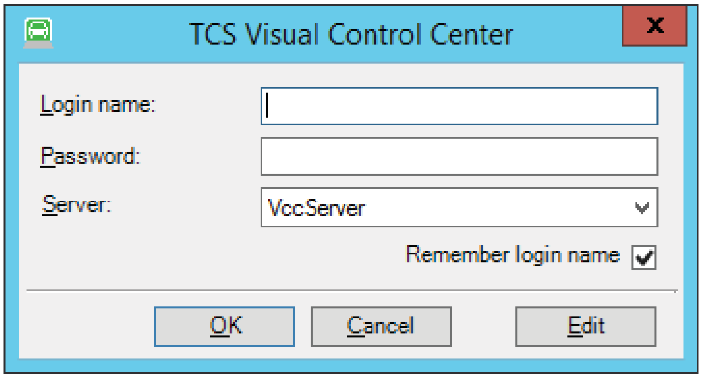

Figure 2: VCC Log In window

Once the user has successfully logged into the Visual Control Center, the applications main page will open. Navigating the main page allows users to manage and maintain counting zones, view statistics, and see real time vacancy of the monitored parking areas. **There's a background service running on the server that is controlling the parking guidance system; this means the Visual Control Center Client can be open or closed without disrupting the parking guidance system.**

Main Window

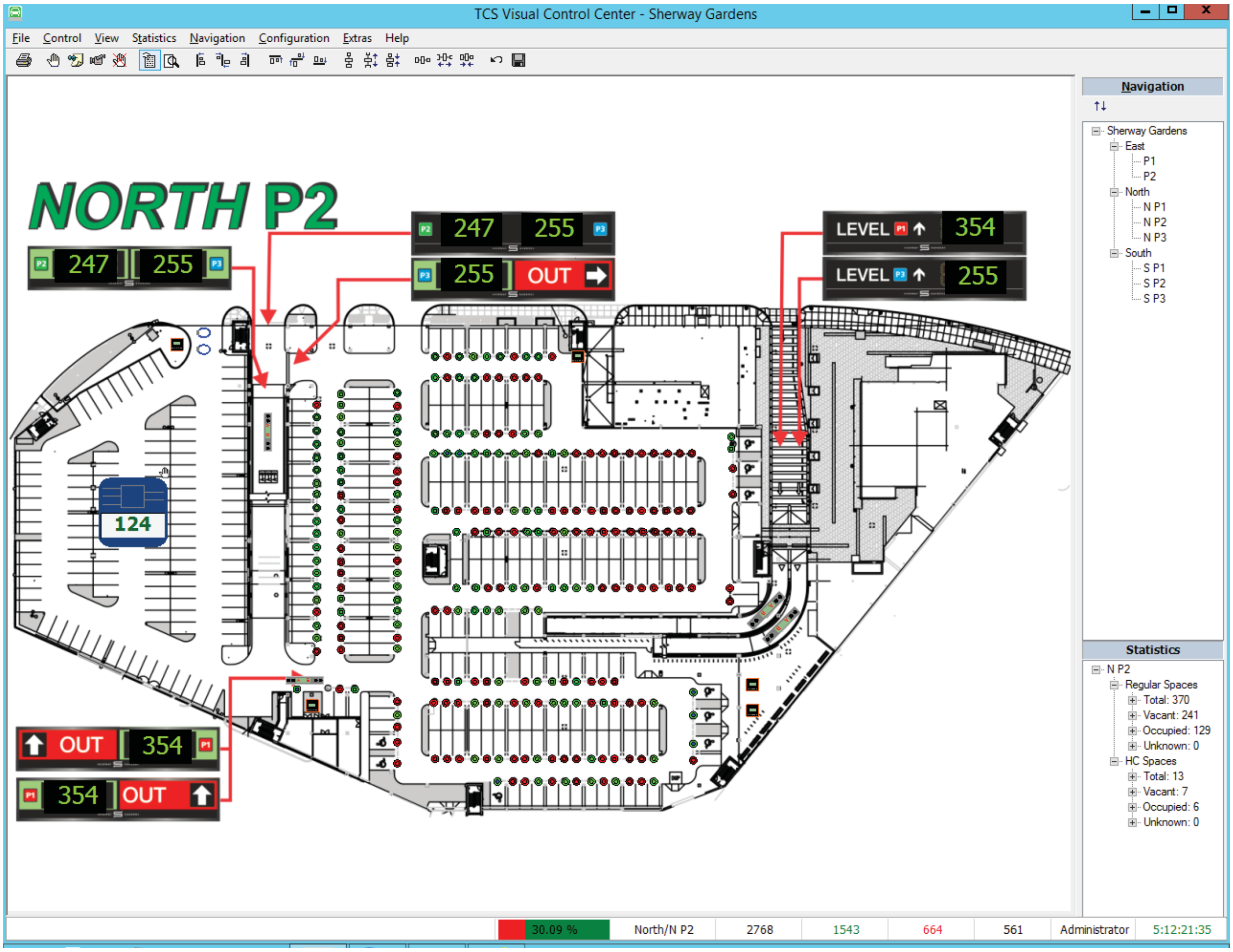

Figure 3: Example of the VCC main window displaying an area

The main window displays an area of the car park being monitored by the parking guidance system. A car park can consist of one or several parking areas. A car park area consists of a background picture and the parking guidance system's configured components. The allocation of areas can be determined by the car park's architecture. It can also be adapted to other technical circumstances. Swapping between areas within the car park is possible at any time using the navigation menu, keyboard or the navigation taskbar on the right hand side of the main window.

Components of the Main Window

Window Title

The name of the software and the car parks name.

Status Bar

The status bar is on the bottom of the main window, and provides a quick snapshot of the parking availability for the entire facility.

Figure 4: Example of the status bar

Field 1: Actual occupancy of the entire car park is shown in a percentage with a red/green indicator for quick viewing.

Field 2: The current car park and level or zone being viewed.

Field 3: The total capacity of parking spaces for the entire car park.

Field 4: The total number of available parking spaces for the entire car park.

Field 5: The total number of occupied parking spaces for the entire car park.

Field 6: The total number of single space sensors not communicating.

Field 7: The current user logged into the system.

Field 8: The current work time the communication control has been running.

Navigation

The area toolbar on the right hand side of the main window is used for quickly changing areas. Double click an area to view it in the main window. You can disable this toolbar by hovering over the View sub-menu in the top right corner and clicking on Area Toolbar. You can also navigate different areas of the garage by using the navigation tab in the top right corner.

Statistics

The statistic toolbar on the right hand side of the main window displays the parking data for the area currently being viewed. The statistic toolbar shows the total capacity for the area, total number of available parking spaces, total number of occupied parking spaces, and the number of unknown or failed single space sensors. It also displays this information for handicap parking spaces if applicable. To view the statistics of another area without changing the area being viewed in the main window, single click an area in the area toolbar, located just above the statistics toolbar, as opposed to double clicking.

Main Menu/Toolbar

The main menu is under the window title allowing access to the programs Functions. The menu functions can be chosen using the mouse or by using the *Hotkeys*. A *Hotkey* is an underlined letter in the instruction text. The menu functions can be called up in the form of a *Context menu*. To start the *Context menu,* use the left mouse click.
The main menu is partitioned into various submenus. Every submenu is a logical summary of the Visual Control Center's functions. Some menu orders/commands are deactivated (shown in grey). This also occurs if the user is not authorized to use the corresponding menu. Even if an option is not shown as gray, the authorization is always determined and a log-in dialog window for the necessary security is automatically shown.

The main menu contains the following sub-menus:

File

Print – Access to the Visual Control Center report system.
Quit – Stop all activities and quit the client.

Control

This sub-menu contains all the commands in which the parking guidance system is controlled. Many of the commands in this window will only be accessible when a specific device(s) is selected. The commands in this sub-menu can also be found when right-clicking a device. This is **only** to be used by the Manager or the Administrator.

Manual Control and Rules – Starts a dialog for the manual control of single space sensors, signs, and zones. Further information can be found in the section *manual control* in this manual.

Reserve Parking Spaces – Starts a dialog for reserving parking spaces. See section on Parking Space Reservations.

Delete ALL Manual Controls – All manual controls and reservations which have been configured in the various areas will be irreversibly deleted.

Delete Manual Control of Selection – Only the manual controls and reservations of the chosen devices will be irreversibly deleted.

User Actions – Creates hot buttons for manual control of devices which will appear in the toolbar. Example: All signs will turn off.

Alerts – Allows the user to set an alert notification on a device.

Delete ALL Alerts – All alerts which have been configured in the various areas will be irreversibly deleted.

Delete Alerts of Selection – Only the alerts of the chosen device will be irreversibly deleted.

Zone Counter – Allows one to set the counter for free parking spaces in the zone. A zone can be created when a group of parking spaces are not controlled by single space sensors. See section on setting and maintaining zone counters.

VMS – Variable Message Sign. This command is available if the use of VMS is active at the car park. It allows the user to access the display of the sign either changing the text or simply refreshing the image.

Device Actions – Used to make changes to the parameters of certain devices. Only accessible by Administrator account.
Communication Test – dialog for testing of communication with selected devices. This is available only for the Administrator.

Important! Visual Control Center will display a warning dialog before deleting. It will only be

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deleted if confirmed with "OK".

View

The commands in this sub-menu change the current display in the main window. All users (i.e. guest user, operator and administrator) can use these commands.

Overview – Reduces the size of the viewable area to fit within the available window. This command can be made using the shortcut key F2 on the keyboard.

Grid – Switches on a raster display and is only usable during the configuration phase. The shortcut key for this command is F3.

Objectname – Displays the name of each device under it. The shortcut key for this command is F4.

Area Toolbar – Blends the area bar on the right hand side of the main window in and out. This enables one to change quickly between different car park areas.

Go To – This is only activated when *Overview* is on in the main window. The command shows any component of the parking guidance system in the un-zoomed normal display with the use of the mouse. **Notice**: Use the context menu for this command.

Refresh – Manually updates the display of the main window. This is normally not necessary, because the window updates at regular, pre-programmed intervals. F5 is the shortcut key.

Statistics

This sub-menu summarizes all available statistics in the Visual Control Center. Further information can be found in the section *Statistics*.

Navigation

This sub-menu allows the user to jump to different areas of the facility, and will vary depending on the size and number of counting zones.

Configuration

This sub-menu contains various commands which are used for setting up or changing areas of the car park, and are therefore reserved for the administrator only. Some of the commands are available in the symbol bar as well. This sub-menu is deactivated during control operations.

Extras

Server Logs – Displays the system logs of the parking guidance system.

Change Password – Allows the user to change their password.

Users – This is only accessible for the Manager and Administrator, and allows them to create/set-up/manage other user accounts.
Rights – This is only accessible for the Manager and Administrator. This command shows the rights allotted to an “operator” or “user.” They rights may be altered if desired. These rights are also shown under the Description referred to earlier in the text.

Options – Access to the program options, and is only accessible to the Manager and Administrator.

Help

Info – This gives access to Version, License and Copyright information.

Symbols of The Parking Guidance System

The following symbols make up the parking guidance system. Each device will display a small window if the mouse is hovered over it similar to the one in Figure 5. These windows display a small amount of information regarding the device. Such as its name, others devices it may be in correspondence with, its communication address, a status of the device, and a duration of last known status or transaction.

Single Space Sensor (TUS-100)**:** The color of the sensor is in relation to the current occupancy state of the parking space. Green means the space is unoccupied, red means occupied, amber (option) means reserved. The following is the sensor symbol present in the software and its meaning.

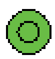
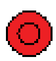
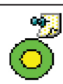
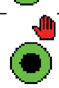
Image In Software	Status	Explanation
	Unnocupied Parking Space	Parking space is unoccupied, LED lights are green
	Occupied Parking Space	Parking space is occupied, LED lights are red
	Manually Reserved Parking Space	Parking space is unoccupied, LED lights are red
	Manually Turned Off External Light	Parking space is unoccupied, LED lights are turned off

Figure 5: Sensor images

The colors brightness reflects the amount of time the sensor has been in that state for. The darker the color the longer it has been in that state.

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Vacant	Occupied	Duration
		0 - 15 min
		15 - 30 min
		30 - 60 min
		Up to 2 Hours
		Up to 3 Hours
		Up to 4 Hours
		Up to 8 Hours
		Up to 24 Hours
		Longer than 1 day

Figure 6: Sensor color states

The length of time is shown in the pop-up area when hovering over a sensor.

Sensor: 1-28
Area Controller: B3CP8
Bus: 1, Address: 28
LED: automatic
Status: occupied
Duration: 0 Days, 2 Hours, 48 Minutes

Figure 7: Example of a pop-up window when the cursor is above a sensor

Zone Controller (TZC-100)  : The zone controller communicates to single space sensors in a particular area.

Ultrasonic Directional Sensor 

: The USDS are overhead sensors which detect vehicle entrances and exits for zone, level, or facility counting. These sensors are capable of directional logic as a vehicle passes underneath.

Zone Controller (TZC-100) : The TZC-100 is also used as a data collector that connects to loop detectors, and stores as well as processes the quantity of vehicle detections.

Vehicle Detection Loop : This is an in-ground induction wire loop, and when connected to a loop detector is used to detect vehicles. When combined with directional logic loop detectors and installed in sequence the loops can detect direction of vehicles.

Magnetic Sensor Gateway : This is used as a data controller that wirelessly communicates with in ground wireless magnetic sensors.

In ground magnetic sensors  **:** Are in ground vehicle detection sensors that are battery powered and communicate wirelessly.

Aisle Sign 

: An aisle sign displays the number of available spaces for a particular aisle or zone. In the garage these signs can have an LED arrow pointing in the direction of the available spaces.

Level or Master Sign 

: This display is shown in level and in master signs. This display will show the available spaces for multiple or individual levels, and is dependent on the static lettering around the LED sign for clarification on where these available spaces are located.

Zone Counter 

: The zone counter displays the available spaces for a particular zone. The logic is configured using one type or a combination of the sensors described above.

Setting and Maintaining Zone Counters

When a parking guidance system uses directional sensors (USDS) or loops to monitor the vehicles for counting zones, the zone counter needs to be adjusted or maintained on a regular basis to ensure an accurate display of available spaces on the signs.

To update the available spaces for a zone counter, follow the steps below (Note that the process is expedited and more accurate if two people participate):

1. Walk or drive to the particular zone and count the number of available parking spaces or occupied spaces. When the zone is more occupied, the number of available spaces should be counted. When the zone is less occupied the number of occupied spaces should be counted.
2. Call or relay the available or occupied spaces to someone who has instant access to the software.

The person at the computer should then double click on the zone counter for the zone that was counted, or right click on zone counter and choose Zone Counter.

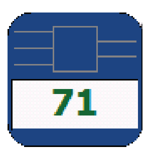

Figure 8: Zone Manager

3. A window will open allowing the user to enter in the Vacant or Occupied spaces. Make sure to select “Vacant Spaces” or “Occupied Spaces” correctly.

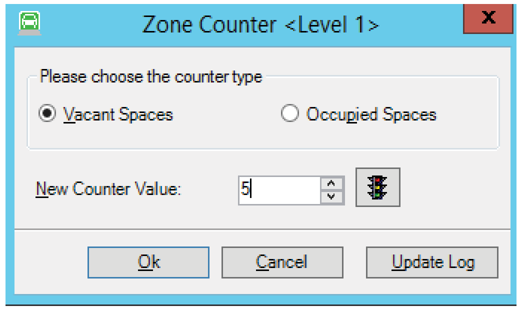

Figure 9: Zone counter used to maintain counts

4. After entering in the correct number, click “Ok”. The zone is now updated with the most recent count. Note: If you just need to reset a zone back to its default max. or min. values, you can click on the traffic light icon next to the counter value box. This will set the space value to its maximum value when “Vacant Spaces” is checked and will be set to “0” free when “Occupied spaces” is checked.
5. Each zone for the system should be updated and set in this way. The frequency in which the zones should be updated depends on the number of counting points for each zone, and the number of vehicles that travel through the zone.
6. The zone counters can also be automatically updated with a manual control. This is recommended in situations where the garage or lot completely empties out at night or another point during the day. Read about setting up manual controls on **Pages 13-17.**

Parking Space Reservations

It is possible to reserve a parking space in the Visual Control Center when using single space monitoring sensors. This form of control is only possible when using single space sensors. The sensors standard state is *automatic,* but the Reserve Parking Spaces command makes it possible to define when a specific space is shown as occupied or reserved (amber).

Under the Extras tab, select Options and the Options Window will appear. Then select the Control tab. The sensors have multiple modes to choose from changing how the sensor appears while unoccupied.

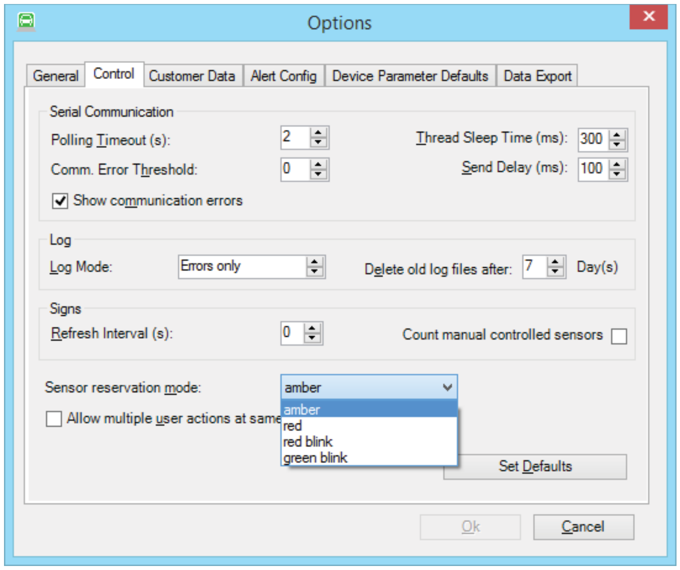

Figure 10: Sensor reservation window and sensor options

Reserving Parking Spaces

To reserve one or more parking spaces use the mouse to select the particular sensor(s). The chosen sensor is displayed in a red frame. To create the reservation open the Reservation of parking spaces window. On the Main Menu/Toolbar select: *Control - Reserve parking spaces.* A second and easier method to opening this window is to right click the chosen sensor symbol and then *Reserve parking spaces.* Here the user can add a reservation instantly or time scheduled. **Important**: Only Operators or Managers are able to configure parking space reservations.

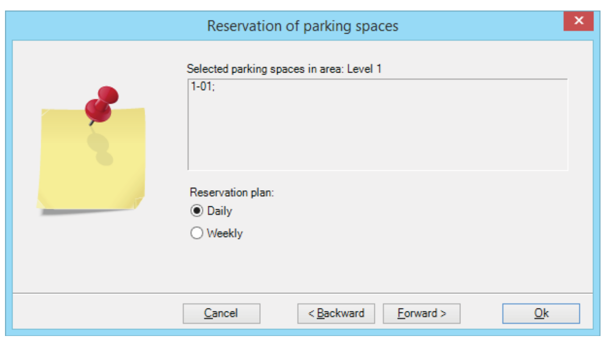

Figure 11: Reservation of parking spaces window

There are two ways to set a reservation, either Daily or Weekly.

- **Daily:** The sensor is set to *occupied* at a particular time every day. The state of *automatic* is switched on after the programmed time interval has run out. It is also possible to set the date on which the reservation shall start.

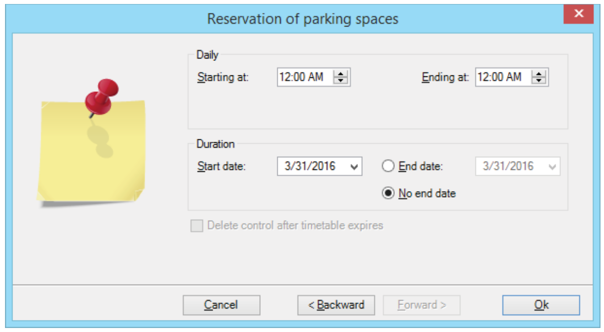

Figure 12: Daily reservation of a parking space

- **Weekly:** Like *Daily,* except the user is able to choose which day of the week.

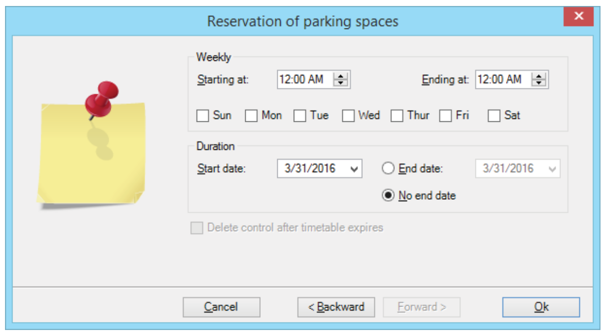

Figure 13: Weekly reservation of a parking space

The reservation is set on the sensor until the reservation is cancelled. There are two ways of canceling or deleting the reservation.

1. Use the menu: Control - Delete Manual Controls of Selection
2. Use the context menu when selecting the sensor then select Delete Manual Controls of Selection

Caution! If selecting Delete ALL Manual Controls then all manually programmed controls, in all car park areas, will be irreversibly deleted!!!
Notice: Like all delete functions in the Visual Control Center, one receives a warning beforehand.

Grouping Sensors

In the event that two or more sensors are being used to detect/show occupancy of a single parking space, the sensors can be grouped together to work as a group. There are two types of grouping that can be activated on the sensors involved. The first is a Space Lamp Control Group and also a Space Occupancy Control Group.

Space Lamp Control Group

In the space lamp control group, the sensors involved will include a manager and a member(s). This type of grouping sets up the involved sensors to work as individuals and together. This is an “And” sensor configuration, meaning that sensor 1 and sensor 2 must be occupied to change

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the status of the manager. The manager sensor is the “lamp” indicating that all sensors in the group have been occupied. So, for the manager to change its LED status to red, any grouped members as well as the manager must be occupied. The members will change their LED status to red upon being occupied.

Space Occupancy Control Group

In the space occupancy control group, the sensors involved will include a manager and a member(s). This type of grouping sets up the involved sensors to work together. This is an “And/Or” sensor configuration, meaning that sensor 1 and/or sensor 2 must be occupied to change the status of the manager. The member(s) of the group automatically turns off its LEDs during this grouping, therefore only the manager uses its LEDs.

Grouping Setup

To set up a group select the sensors desired by either holding Ctrl and selecting each one or clicking and dragging over the sensors. Once all the sensors are selected right click on the one to be the manager.

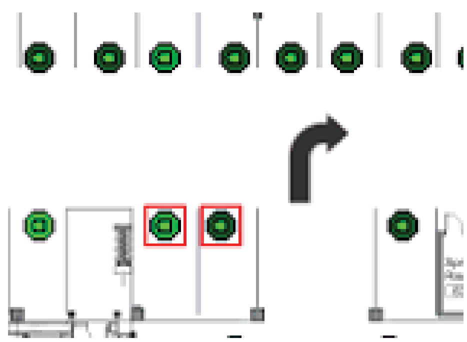

Figure 14: Select the desired sensors for the group.

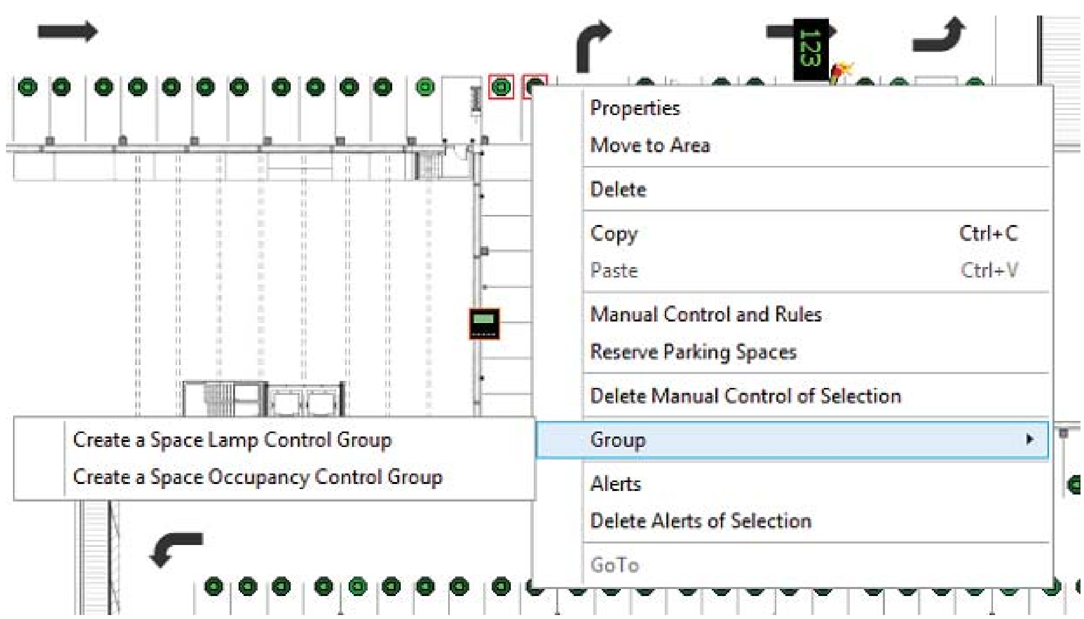

Figure 15: Right clicking the intended manager sensor and select Group.

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Select the Group option then select which grouping style to set up. This will set up automatically which grouping was selected. The two sensors will now be connected by a solid line meaning they are grouped together. Depending on the grouping type it will appear slightly different.

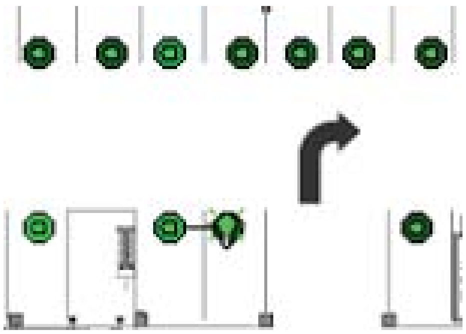
Figure 16: Space Lamp Control Grouping.

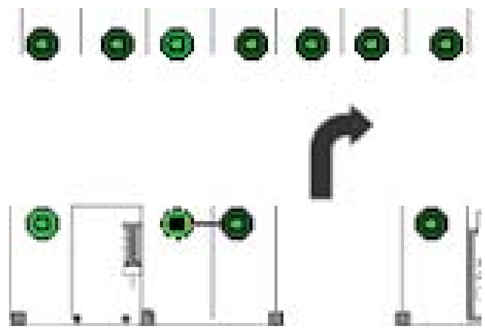
Figure 17: Space Occupancy Control Grouping.

The lamp control shows the manager with a lamp on the sensor. The lamp indicated the status of the LED in the manager. It will only turn red if all sensors in the group are occupied. The occupancy control shows the member with a black center circle indicating the LED is off.

To remove or edit the group control right click on the manager sensors and select Properties.

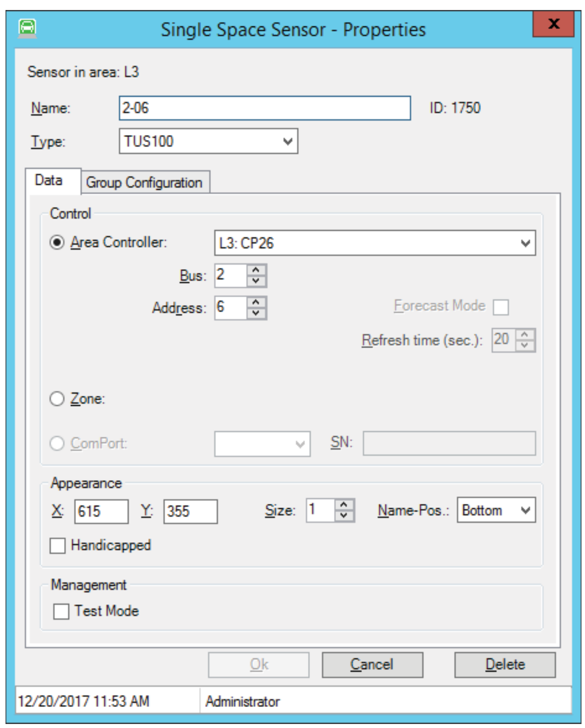

Figure 18:Sensor Properties window.

Select the Group configuration tab. Here you can select None to remove the control, or by selecting other spaces in the Available Sensors and dragging them to the Allocated Sensors edit the existing control. Also, the type of group control can be changed, then select the members of the group. (You will need to know the exact name of the sensors added to correctly add new members)

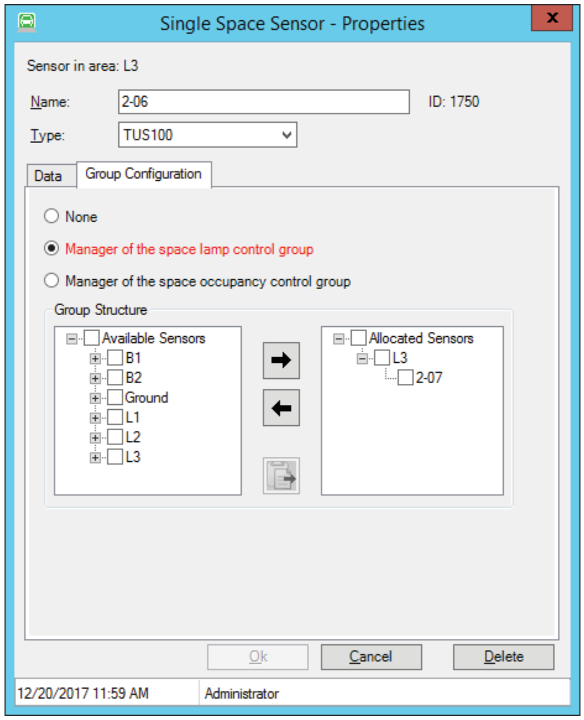

Figure 19: Sensor Properties Group Configuration window.

Manual Controls

The adjustments which have been described in the previous and following sections create a change in the automatic control of the Visual Control Center parking guidance system. It is also possible to control other components in the Visual Control Center (i.e. signs).

To access the manual controls for a device, first select the device by clicking on it with the mouse. Now to open the Manual Controls window either select Control in the Main Menu/Toolbar or right click the device and select Manual Control and Rules. You can also left click hold and drag a box around similar devices such as signs on a master panel to control them all at once. For selecting multiple devices on various parts of the GUI hold the control key down and left click the devices you would like to manually control.

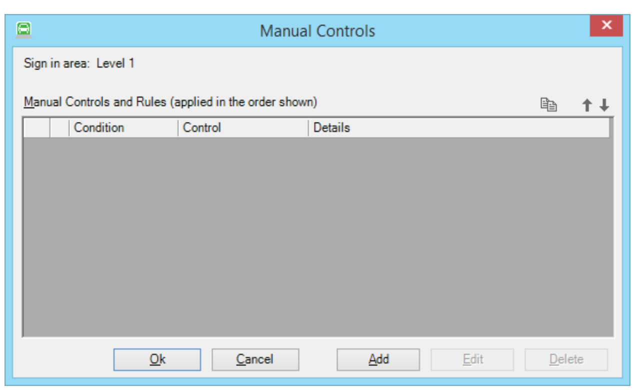

Figure 20: Manual Controls window

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The device chosen will be specified in the top left corner of the window. As seen here the example is of a sign. In here the user will have the ability to create new controls/rules or manage previously set ones. Controls/rules created will remain in the log unless otherwise deleted.

Adding a New Manual Control

To create a control click Add to open the Edit Manual Control window. From here the user will have the option to set the condition and control.

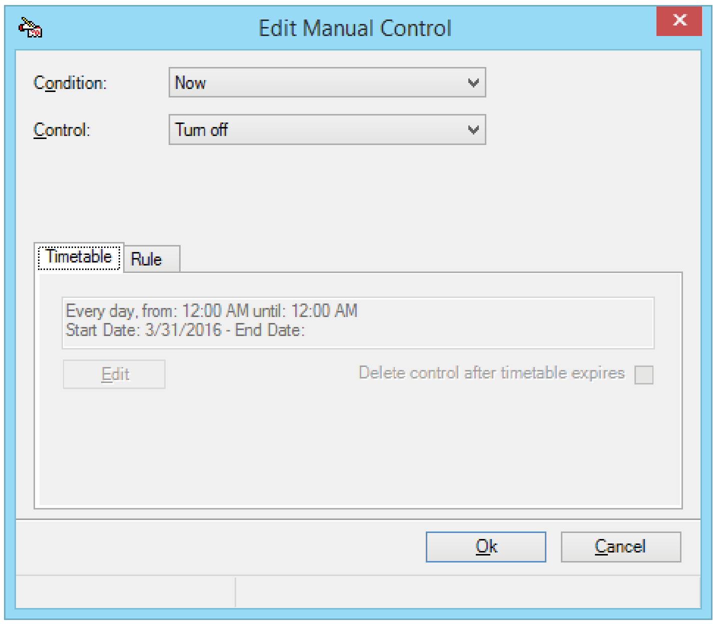

Figure 21: Edit Manual Controls window

Starting with the Condition, select which option fits the situation.

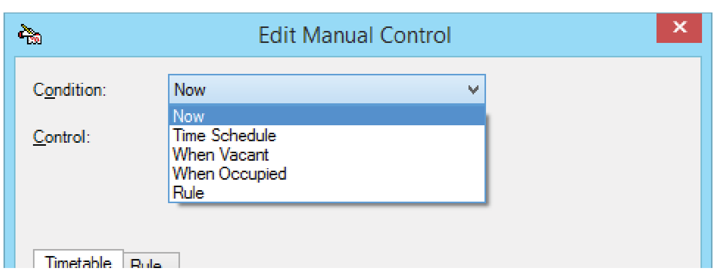

Figure 22: Condition options

- **Now:** Sends this manual control immediately to the sign.
- **Time schedule:** Allows the user to create a schedule for when this manual control will occur.
- **When vacant:** Sends the manual control selected when all the parking space counting zones allocated to the sign are available.

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- **When occupied:** Sends the manual control selected when all the parking space counting zones allocated to the sign are occupied.
- **Rule:** Allow the user to create a rule for when this manual control will occur.

After choosing when the manual control will occur select the control type of the manual control under the Control drop down menu.

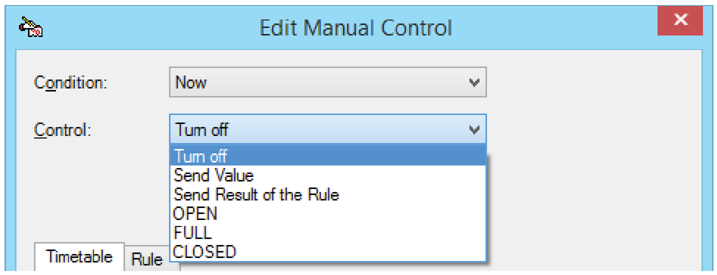

Figure 23: Control options

- **Turn off:** This option will turn the sign off. The sign will be blank and display no messages.
- **Send Value:** This option will allow the user to send a number value to the sign.
- **Send Result of the Rule:** Allows a created rule to be sent to the sign.
- **OPEN:** Tells the sign to display the message Open.
- **FULL:** Tells the sign to display the message Full.
- **CLOSED:** Tells the sign to display the message Closed by scrolling it across the display.

Time Schedule

If Time schedule was selected for when the manual control should occur, the user can now access the Timetable tab. To set the times and date select Edit.

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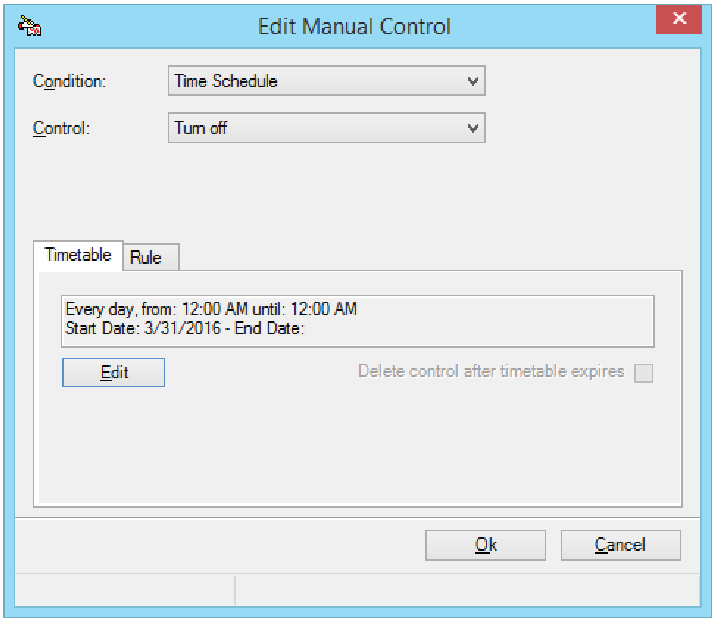

Figure 24: Edit Manual Control when choosing Time Schedule

After clicking Edit the Time Table Configuration window will appear. Here the user can create the schedule for when this manual control will occur. By choosing Daily as shown below, the manual control will occur every day between the hours that are selected.

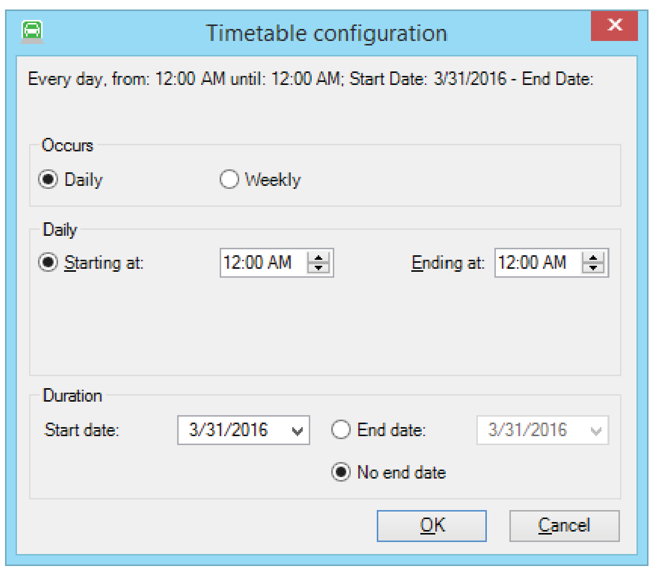

Figure 25: Daily timetable

By choosing Weekly as shown below, the user can select the days of the week and time for when the manual control will occur.

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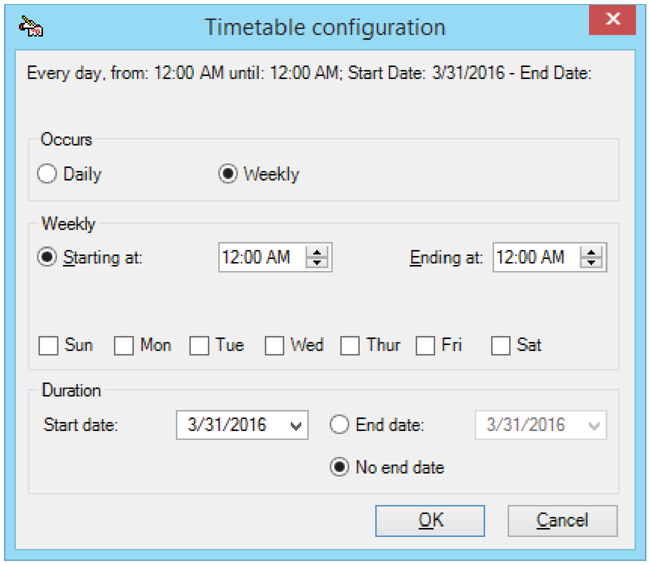

Figure 26: Weekly timetable

A message can be displayed multiple times at different times in the day by adding separate manual controls for the same message with different time frames under the weekly setting.

Rule

If Rule was selected for when the manual control should occur, the user can now access the Rule tab. To configure the rule, select New Rule. This will fill in the table with options to create the rule. There are different rules depending on the device selected. Each rule has parameters to be filled in depending on the desire.

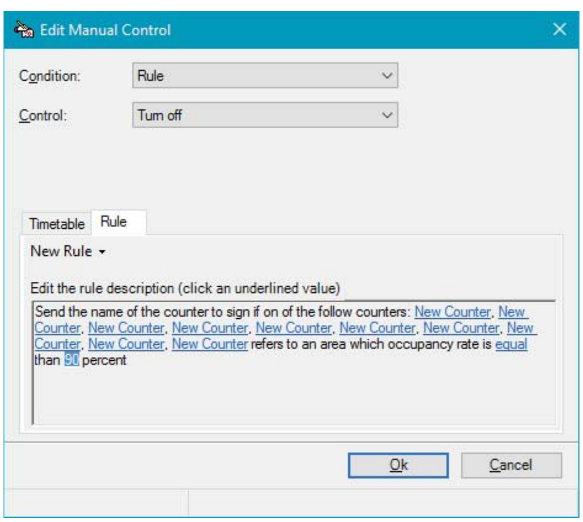

Figure 27: Adding a New Rule on a TMS54-DF

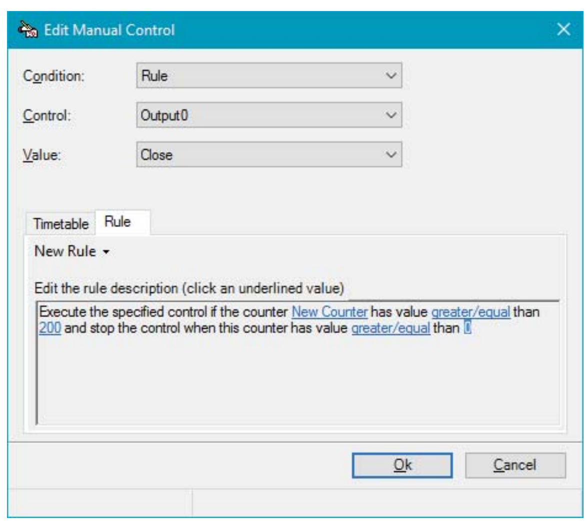

Figure 28: Adding a Rule on an I/O module and NuMedia VMS

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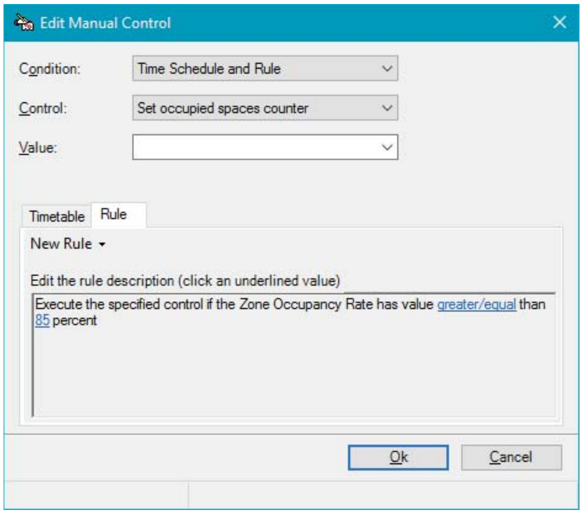

Figure 29: Adding a Rule on a Zone

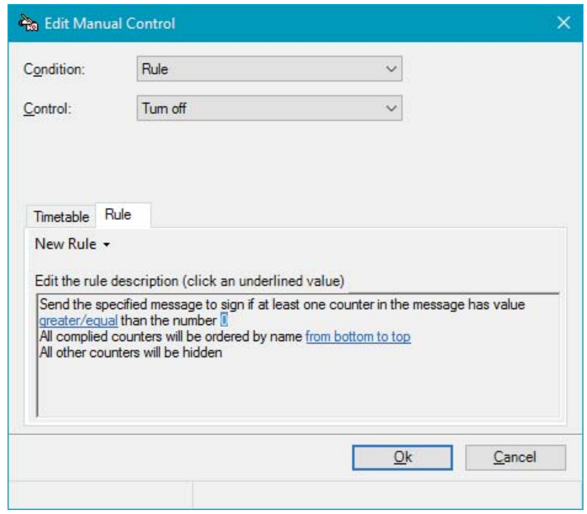

Figure 30: Adding a Rule on a NuMedia VMS (1)

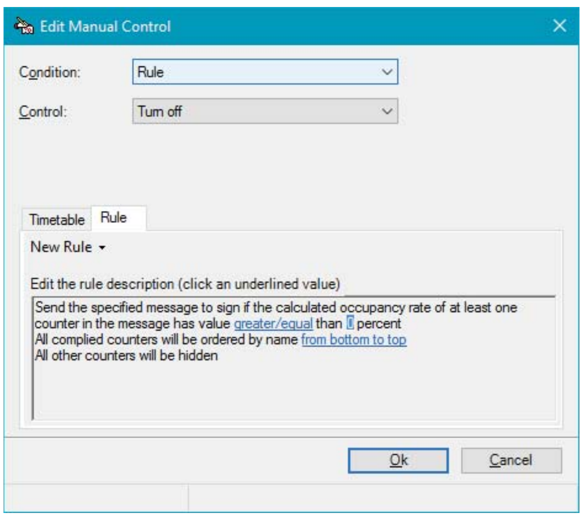

Figure 31: Adding a Rule on a NuMedia VMS (2)

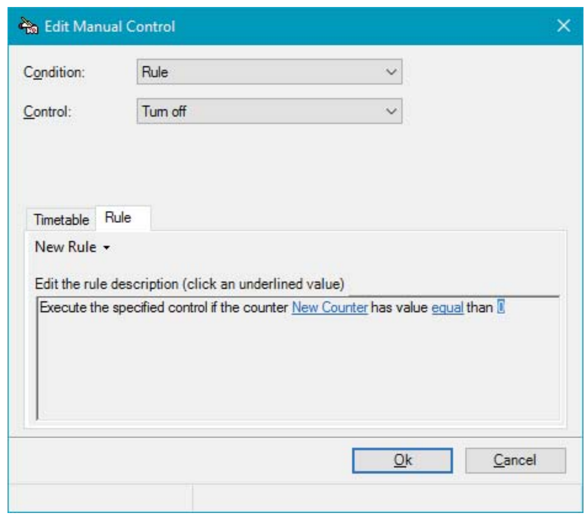

Figure 32: Adding a Rule on a NuMedia VMS (3)

Counter

One parameter is to set up a New Counter. Click on New Counter to edit the counter.

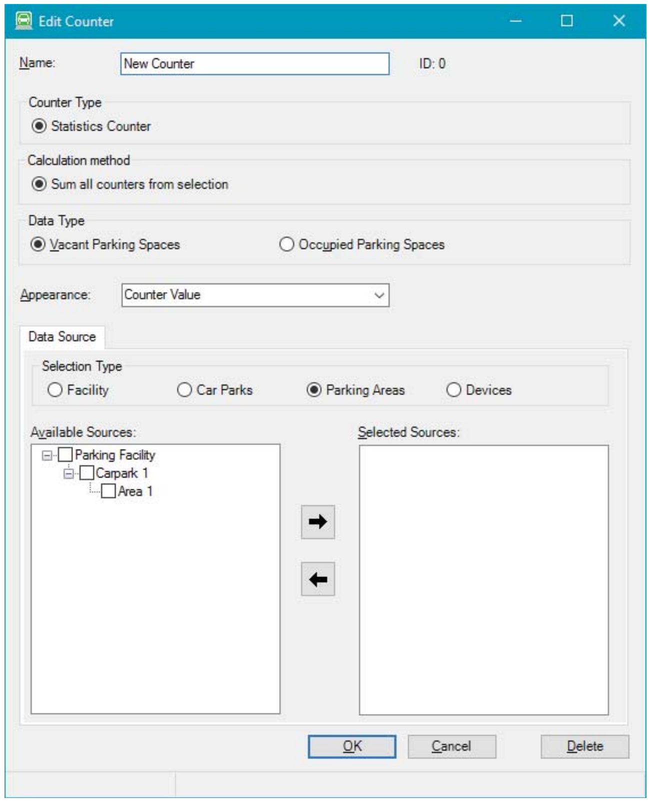

Figure 33: Edit the counter

Adding a Counter will determine a numerical value of vacant or occupied spaces. The Statistics Counter allows either a Facility, Car Park, Parking Area, or Device(s) to be displayed. Once selected the Edit Counter window will open.

When creating a Statistics Counter the Calculation method is the amount of devices being counted. The Data Type is whether or not the sign displays vacant or occupied parking spaces. The Appearance is exactly how it will display. Under the Data Source tab the Selection Type can be chosen for what exactly is being counted. Then select the box of what is to be counted then click the arrow to bring it to the Selected Sources area. Click Ok and the Counter has been created.

Range
Another parameter is to set if it occurs after greater than, greater/equal, equal, less/equal, or less than.

Order
For the NuMedia VMS, there is a parameter to order from bottom to top, top to bottom, or as it is.

Value
Lastly, there is parameter to either set a numerical value or a percentage value.

User Actions

Similar to the manual control. A fast and easy step to apply a manual control to many or all of the same device is with the User Action. To set up a User Action select the Control tab and click User Actions. The User action edit window will open. Click Add Action to begin configuring a control.

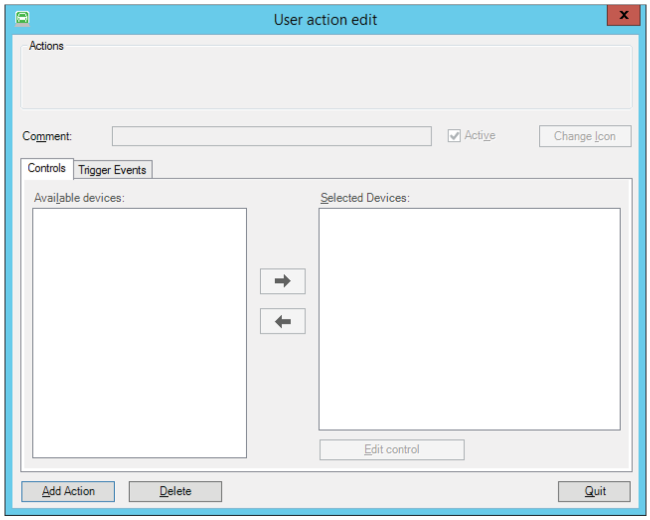

Figure 34: User action edit window

Begin by naming the control. Then begin to select which devices to control. The devices must be of the same type. Once the selected devices have been chosen, click Edit Control. Then select the control and click Ok. In the top left of the User action edit window shows the Icon related to this action. The Icon can be changed.

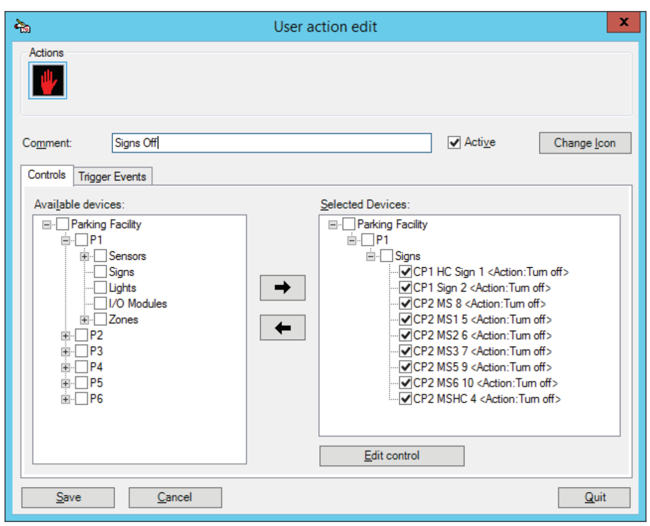

Figure 35: User action configuration

Once done click Save to add it to the User action edit window. Quit out of this window and to activate/deactivate the control click the Icon that has now been added to the menu at the top of the page.

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Alerts

The Alerts setting allows the user to be notified if a device or multiple devices are not communicating and when communication was re-established. The communication alert is set up for a certain time threshold. The alert can then be sent to the computer screen, or an email.

To get the alert sent to an email, the address will have to be configured. To set this up click on the Extras tab. Then select the Alert Config tab. Check off the Alert via Email enable box to start configuration.

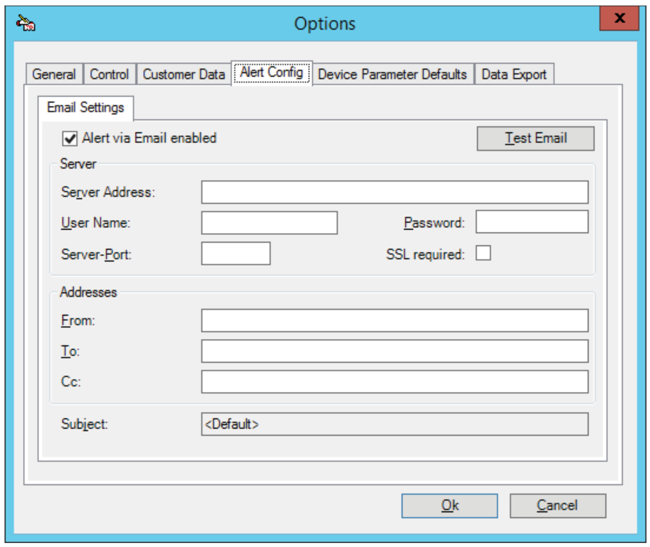

Figure 36: The Email Configuration Settings

You will need to know your email server for the Server settings. This information will depend on your email, for example for outlook office 365 it is outlook.office365.com. If you are not sure your IT department should be able to assist with this information. The username and Password are needed to send the emails. This would be of the email being used to send the message.

Then set the From addess that the software will appear as. Add the email address to be sent to and one additional address to be CC'd. You can also set up the Subject of the email or leave it as the default.

After the email server has been configured the alerts can be set up. To start select the device or devices the alert is to be set for. Note: if multiple selected the devices must be the same to create an alert. Once selected, click the Control tab and select Alerts. (not all user groups may have this ability) The Alerts window will open.

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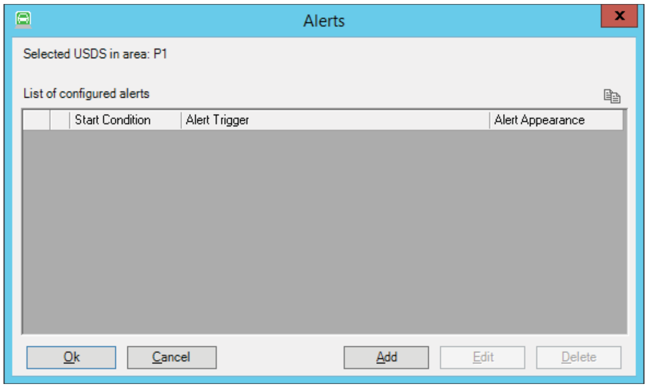

Figure 37: The Alerts window

Click Add to start the set up. First select the Start Condition. Selecting Now will have the alert start immediately and run until told to stop. A Time Schedule can be set up to have it only monitored during certain selected times. Then the event that triggers the alert can be set. If selecting Communication error longer than … then the time threshold will have to be set. The message that is sent can be adjusted or left at the default. Last set where the alert should be sent.

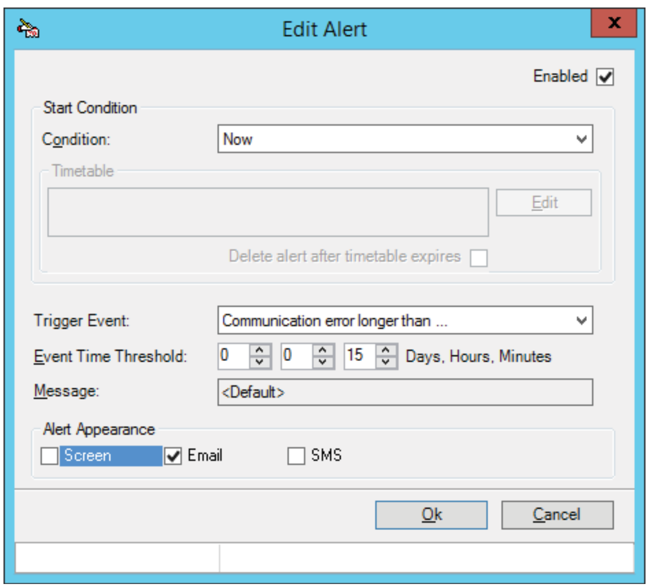

Figure 38: Device Alert set up window

Then click Ok and the Alert will be added to the Alerts window. If the box it checked off the alert will be active.

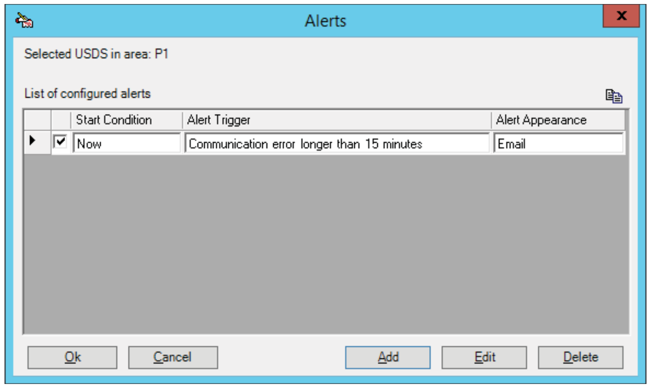

Figure 39: Alerts window after an alert has been configured.

Calibrating Sensors

In the event a single space sensor needs to be calibrated or re-calibrated during operation, an administrator or manager user can command the sensor(s) to do so from the software. It may be easier to calibrate a sensor or group of sensors using the software instead of the zone controller located in the garage.

To calibrate a sensor(s), the user must have administrator or manager user rights. The parking space must also be completely vacant of a vehicle or any other objects. This is important because the sensor calibrates to an empty space, therefore when a vehicle enters the space it recognizes the change of status.

First select the sensor or sensors to be calibrated.

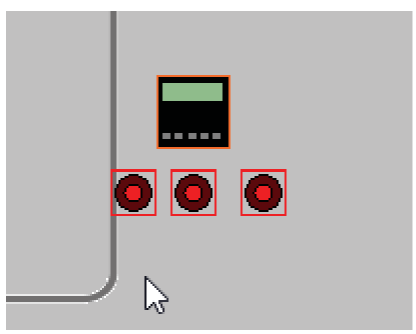

Figure 40: Select specified sensors for calibration.

Right click one of the selected sensors and select Calibrate Sensor from the drop down menu.

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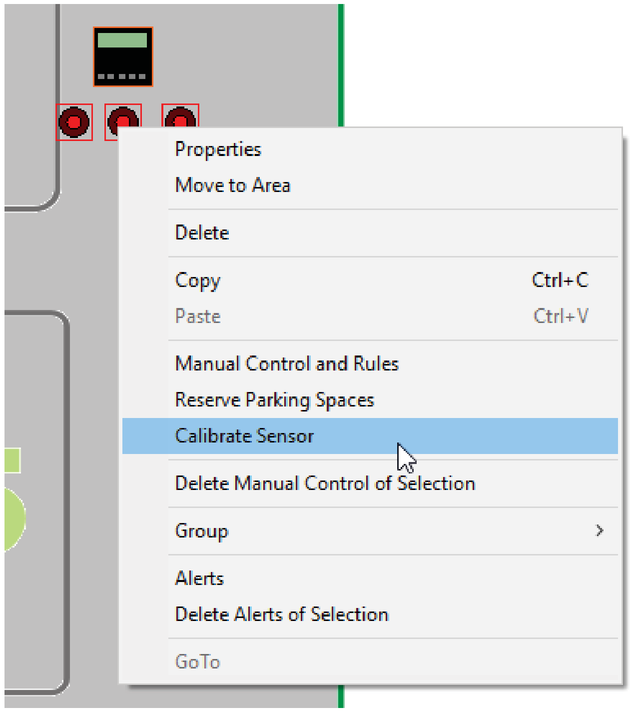

Figure 41: Select Calibrate Sensor.

The software will warn you to make sure the space(s) is vacant. By selecting Yes, you are agreeing this is true so the calibration will be accurate. If these terms are true, then select Yes.

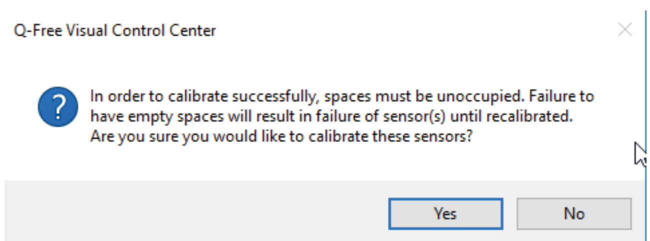

Figure 42: Selecting Yes says the parking stall(s) is vacant.

The icon in the software will now cycle between white and grey as the sensor(s) is calibrating. In the garage, the sensor will blink between red and green until complete.

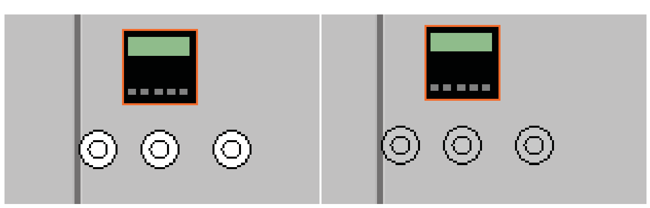

Figure 43: The sensor(s) cycles between white and grey.

To check the percentage of completion of the sensor calibration, hover the cursor of the sensors icon to view details.

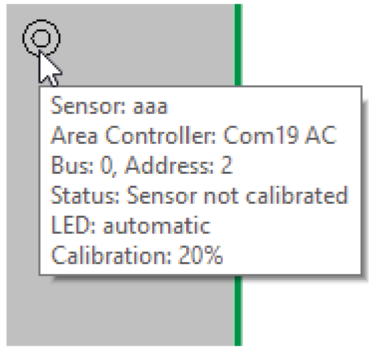

Figure 44: View the percentage of completion by hovering the mouse over the icon.

Once the sensor(s) have completed calibration the icon will return to green saying it is vacant.

Variable Message Signs

A variable message sign is an electronic sign that can display varying messages of text and numbers controlled through a computer and graphical user interface. The sign can be used to display information to customers such as special events, parking rates, or parking availability. Text can be sent immediately to the sign or timed using the time scheduler.

Important! The options available may differ depending on the sign manufacturer.

Figure 45: Variable Message Sign Icon in Visual Control Center

VMS Text Editor

The VMS Text Editor allows the user to create a library of messages as well as send the messages to the sign.

To create and/or edit text messages on a VMS, select the VMS icon to change then go to Control in the Main Menu/Toolbar and select VMS then VMS Text Editor, or simply right click on the VMS icon and select the same.

The VMS Text Editor window will open for this particular sign. You will now have the option to create new text, edit existing text, and send text to the sign.

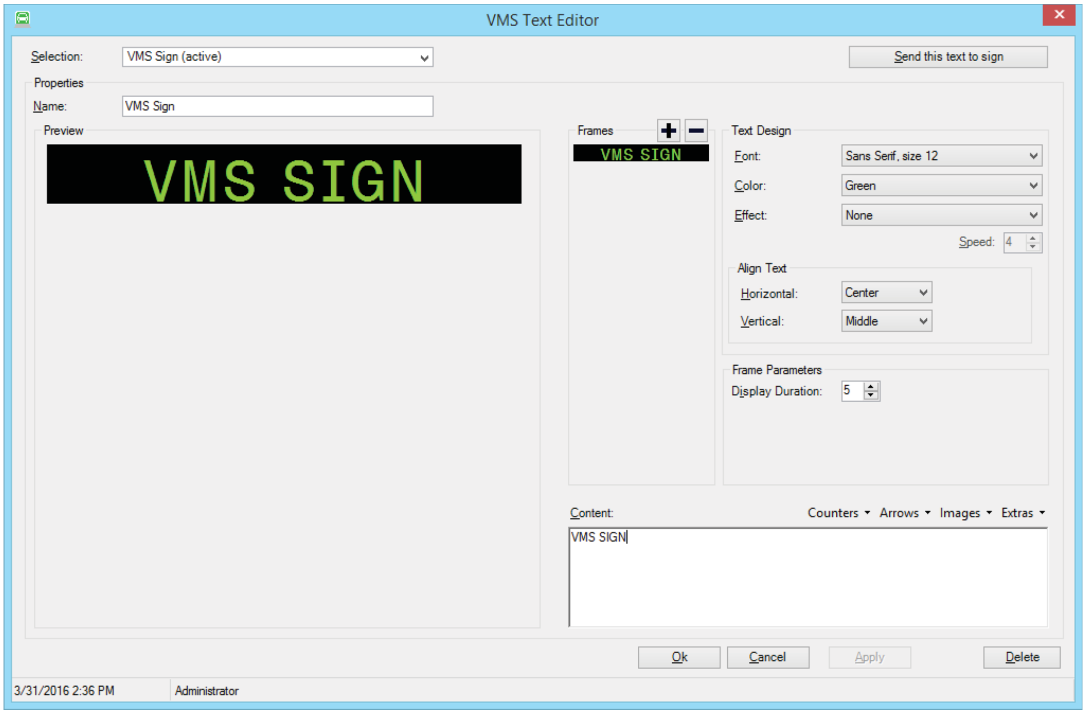

Figure 46: VMS Text Editor window

VMS Text Editor Window Overview

- **Selection:** This drop down menu lets the user choose an existing Text for editing or <New Text> for creating a new message.
- **Name:** This field allows the user to edit an existing text's title or name the newly created text.
- **Preview:** Shows a preview of what the sign will display. This will not give the user a sample of the effect chosen, and may not necessarily reflect what the sign will actually display.
- **Frames:** This section will allow the user to create multiple frames for the text to switch through to create longer messages. It will also display each frame in its sequential order.
- **Font:** This field allows the user to change the font type and size based on the capabilities of the current sign.
- **Color:** This field allows the user to change the color of the text in the message. This is only allowed when the sign is capable of displaying different colors.
- **Effect:** This field allows the user to change the effect of the message when it is displayed on the sign. The effects will be limited to the type and size of the selected sign.
- **Align text:** The two drop down menus allows the user to choose how the text will be oriented horizontally and vertically when displayed on the sign.
- **Frame Parameters:** This allows the user to set the Display Duration when using multiple Frames. This may vary depending on the signs capabilities.

- **Content:** This area is where the user can input the text to be displayed. See Section on Content below.
    - o Counters, Arrows, Images, and Extras may be added to the Content depending on the signs capabilities.
- **Ok:** Saves the changes made to the edited, existing, or new messages created, and will close the VMS Text Editor.
- **Cancel:** Voids any changes made.
- **Apply**: Saves the changes made to the edited existing or new messages created.
- **Delete:** Deletes the selected message in the Selection drop down menu.
- **Send this text to Sign:** Sends the currently selected message to the sign which will be displayed immediately.

Content

The Content field is for actually writing the text that is to be seen on the sign. For basic messages just enter the text desired the click Apply and Send this text to sign. The image of the device on the backdrop will reflect the Preview. Using the four drop down menus; Counters, Arrows, Images, and Extras, the sign can show more in detail messages. To add one or more of these contents click the drop down button and select an option.

Counter

Adding a Counter will show a numerical value of vacant or occupied spaces. There are two choices of Counters, a Statistics Counter or Sign Counter. The Statistics Counter allows either a Facility, Car Park, Parking Area, or Device(s) to be displayed. A Sign Counter will show the vacant or occupied parking spaces. Once selected the Edit Counter window will open.

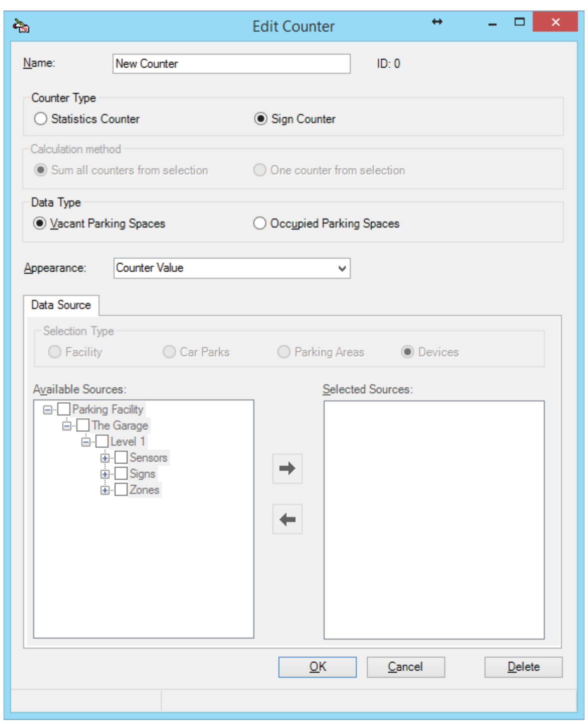

Figure 47: VMS Edit Counter window for Sign Counter

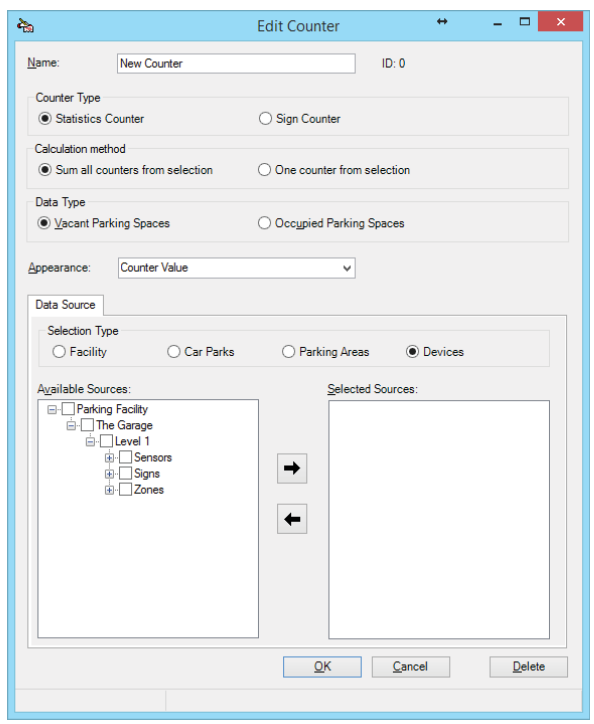

Figure 48: VMS Edit Counter window for Statistics Counter

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The same window opens for either option chosen. The type of counter can be selected under Counter Type. The Name of the counter is can be changed to reflect what is being counted.

When creating a Statistics Counter the Calculation method is the amount of devices being counted. The Data Type is whether or not the sign displays vacant or occupied parking spaces. The Appearance is exactly how it will display. Under the Data Source tab the Selection Type can be chosen for what exactly is being counted. Then select the box of what is to be counted then click the arrow to bring it to the Selected Sources area. Click Ok and the Counter has been created. A Sign Counter is created the same way but selecting only the options available.

Arrows
When adding Arrows to the content simply select the arrow to open the VMS-AddIns window. Here the arrow can be selected or changed, a color applied, and an option to put an X over the arrow on the display.

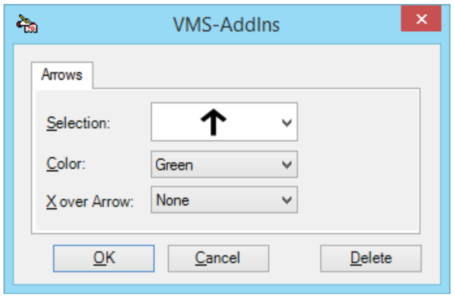

Figure 49: VMS-AddIns window for adding an Arrow

Image
When adding an Image to the content simply select the image to open the VMS-AddIns window. Here the image can be selected or changed to be shown on the display.

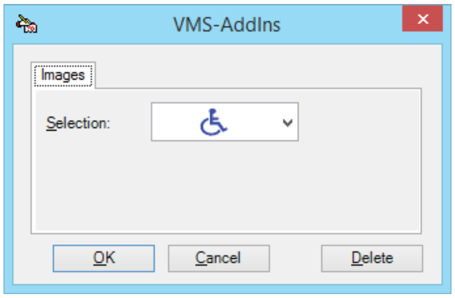

Figure 50: VMS-AddIns window for adding an Image

Extras
The Extras option allows the user to manipulate different characters or words in the message to have different fonts, colors, or alignment compared to what the VMS Text Editor shows selected.

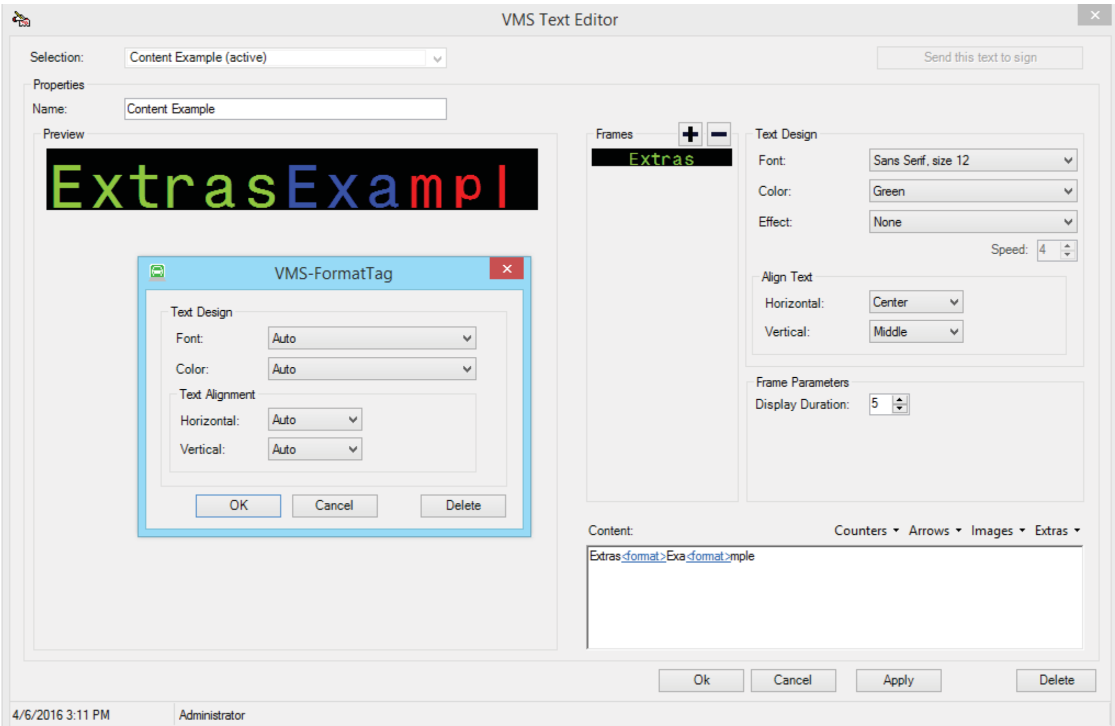

Figure 51: VMS-FormatTag window and example of Extras configuration

When adding any of these options, text can still be added along with them to create a detailed message.

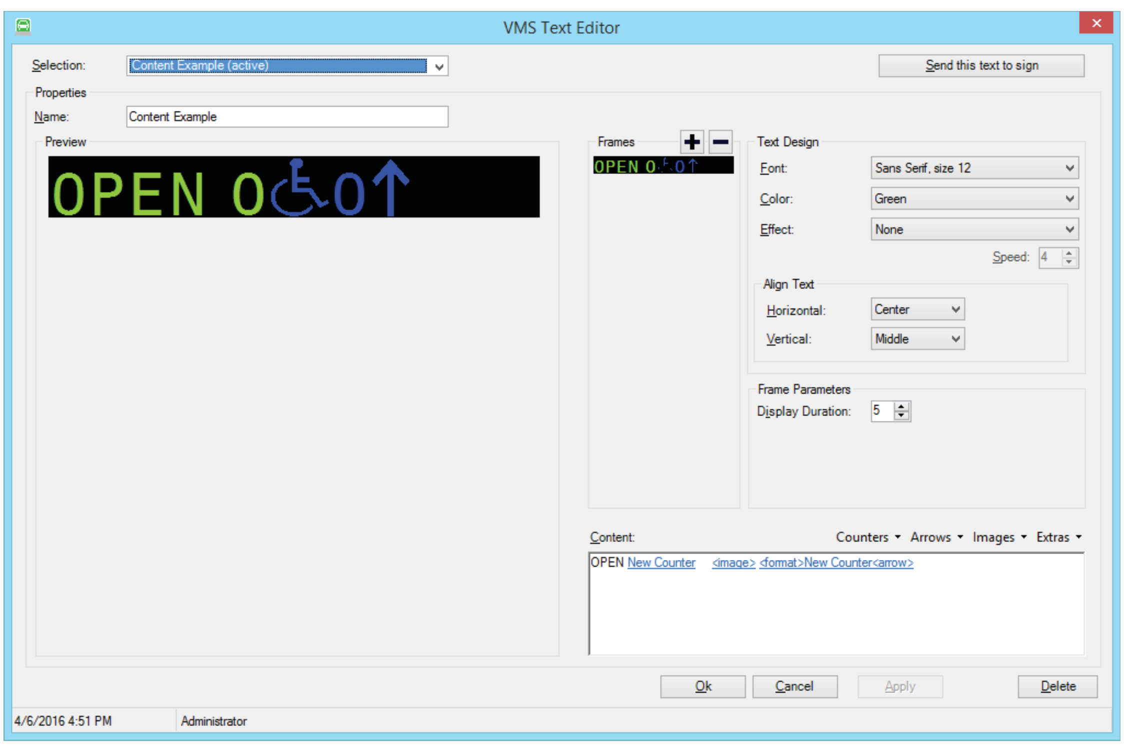

Figure 52: Example of mixed text and content options to display an informative message

Figure 53: Example of the device as shown in VCC

VMS Manual Control

Manual control allows the user to set up a time schedule for messages to be displayed on the sign. These controls are similar to the regular sign manual controls.

To access the Manual Control and Rules for a VMS, select the VMS icon to control then go to Control in the Main Menu/Toolbar and select Manual Controls and Rules, or simply right click on the VMS icon and select the same. The manual control window will now open for this sign. From here the user will have the option to create a schedule for the messages to be displayed on the sign as well as instantly turn the sign off.

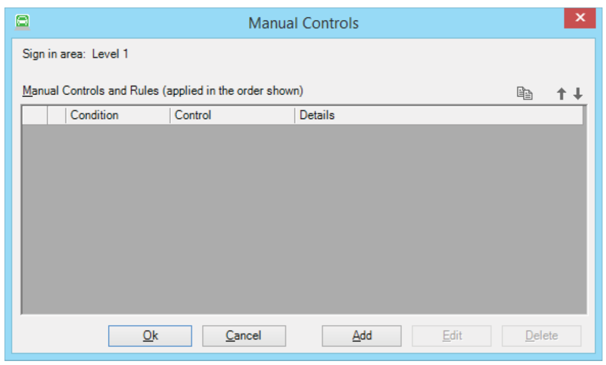

Figure 54: Manual Controls window for VMS

To add a manual control it is the same as in the Adding a new Manual Control. Refer to Adding a new Manual Control above. The only difference for a VMS is under the Control drop down there is only two selections, Turn off and Send Message.

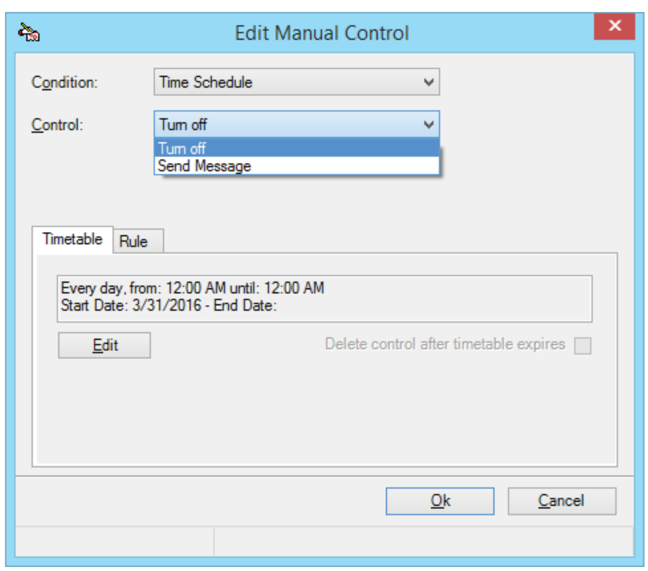

Figure 55: Edit Manual Control window for a VMS

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When Send Message is selected a Value option shows up. Here a previously created Text can be selected.

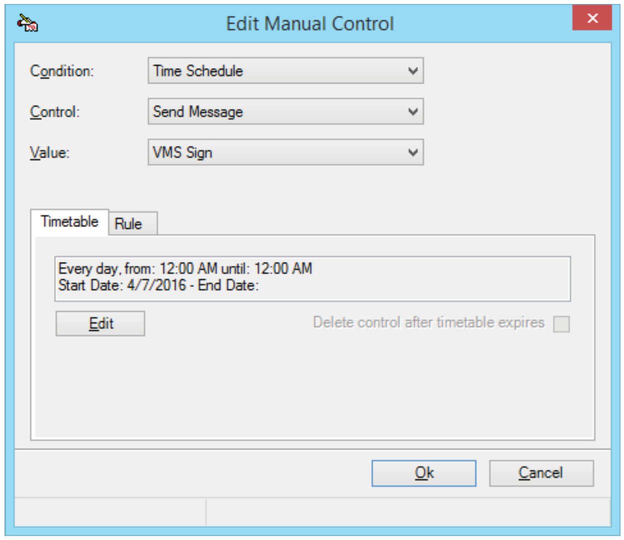

Figure 56: Edit Manual Control for a VMS when sending a message

Creating and Editing Users

There are four different user levels: **Administrator, Manage**r, **Operator**, and **User**. Each group is a different level of user rights. Starting from the Administrator having all rights to the User who has very minimal. It is possible to alter the rights for the Operator and User groups, but this will change for any account created in that group.

Description	Administrator	Manager	Operator	User
Configuration Create/Modify	✓			
Configuration Delete	✓			
Device Control Properties Modify	✓	✓	✓	
Manual Controls Create/Modify	✓	✓	✓	
Manual Controls Delete	✓	✓	✓	
Options "General" Modify	✓	✓	✓	✓
Options "Customer Data" Modify	✓			
Options "Control" Modify	✓			
Options "Folder" Modify	✓			
Options "Default Settings" Modify	✓			
Zone Counter Modify	✓	✓	✓	
User Actions Create/Modify	✓	✓	✓	
User Actions Delete	✓	✓		
User Actions Start/Stop	✓	✓	✓	
Alerts Create/Modify	✓	✓	✓	
Alerts Delete	✓	✓		

Password Change	✓	✓	✓	✓
VMS Message Create/Modify	✓	✓	✓	
VMS Message Delete	✓	✓		
Server Log Show	✓	✓		
Server Service Start/Stop	✓			
Reports Start	✓	✓	✓	✓
Communication Plan Show	✓			
Parking Area Configuration Show	✓			

Only Administrators and Managers have the ability to create and edit users. To do this go to the Extras tab at the top of the main window and select users.

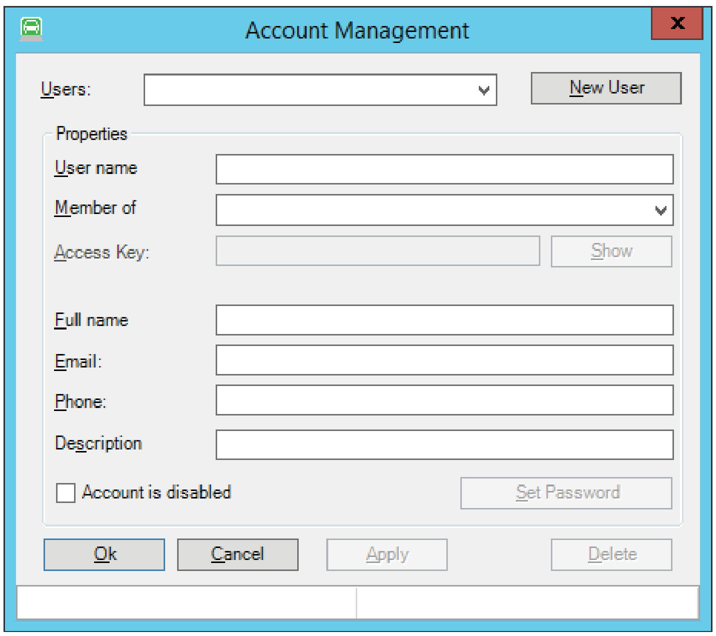

Figure 57: User account creator and editor.

Click new user and fillout all of the details, being sure to select the applicable level of access for the user under the “Member of “ tab. The Username can customized per user. After the fields have been filled in a password can be set if desired.Once finished, select “Apply”.

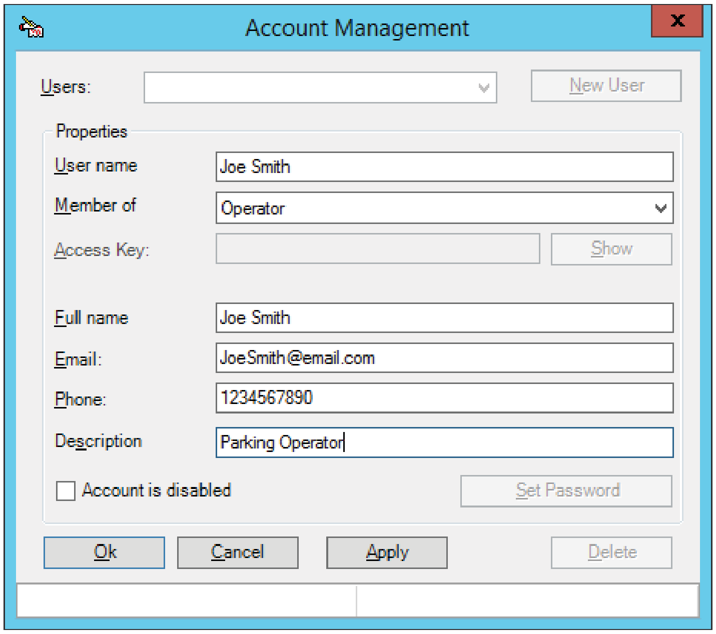

Figure 58: Creating a new software user.

When the user has been created close the software then reopen using the new users username and password. If there is no passord just leave that field blank when logging in. To change the user password, select the “Extras” tab and “Change Password”. Enter the new paswword and confirm it then click Ok. Now when logging in the user will need to use their password.

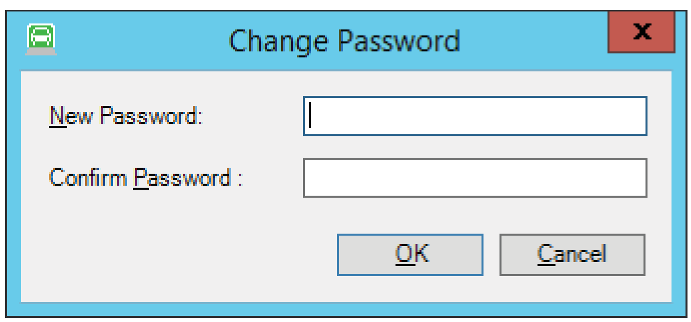

Figure 59: Setting or changing the account password.

Statistics

Visual Control Center offers various ways of analyzing parking availability information. There are two sections of Statistics which can be found in the Main Menu/Toolbar. The Reports provide all numerical information while Diagrams provide graphical representation.

Description of each Report

Current Situation – Displays the parking facility’s current parking availability information in a list format.

General Statistics – The following statistical values are processed per area.

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- Number of parking spaces.
- Minimum number of spaces occupied.
- Maximum number of spaces occupied.
- The longest parking period: The longest time a vehicle has parked. (Single space only)
- The shortest parking period: The shortest time a vehicle has parked. (Single space only)
- All values are shown at the bottom as a total.

Visitors Cross Table – Displays the number of visitors for a chosen zone during a specified time period.

Occupancy – Displays the occupancy per hour for a zone during a specified time period.

Occupancy Cross Table – Displays the occupancy for a zone during a specified time period in a horizontal table form.

Occupancy Peak – Displays peak occupancy times in selected time interval, ordered by parking area.

Parking Space Statistic – Displays the number of visitors and occupancy time of individual spaces in selected time interval. The data are grouped by parking areas, space name and time interval. (*For single space monitoring only!)

Parking time control – Displays all parking spaces which have been occupied for more than the preset duration of time chosen by the user.

Vehicle Counters – Displays the number of vehicles recorded by individual sensors during a specified time period.

Description of each Diagram

Facility Occupancy – This diagram shows the occupancy of the parking facility as a whole in a lineal form without depicting the separate areas.

Zone Occupancy – This diagram shows the occupancy of each counting zone if the facility is using vehicle sensing technology rather than single space sensors. There will be no data found if the facility is only using single space sensors.

Facility Visitors – This diagram shows the number of visitors for the parking facility as a whole without depicting the separate areas.

Zone Visitors – This diagram shows the number of visitors for each counting zone if the facility is using vehicle sensing technology other than single space sensors

How to Generate a Statistic

To access the Statistics generator, open the Manual Controls window by selecting Statistics in the Main Menu/Toolbar. Then select which form or statistic to be generated, a Report or Diagram. Both selections have the same setup process other than the Diagram setup allows either a Bar or Line chart to be selected. Once the selected form is chosen the Reports window will appear.

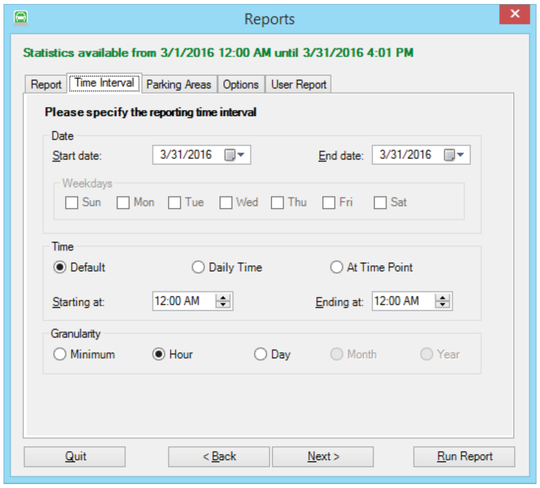

Figure 60: Reports window for a Report

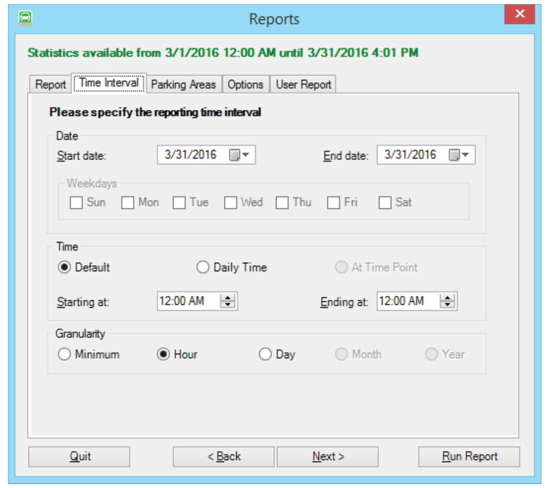

Figure 61: Reports window for a Diagram

As seen they have the same steps for configuring the report.
Steps for configuring the report:

1. Start by selecting the date(s) that the information is desired from.
    a. If only certain days of the week are needed then that can be selected as well after the dates have been chosen.
2. Then select the time that the information is desired from.
    a. If only for a specific time the At Time Point can be selected making only the start time to be changed.
3. Next select the Granularity at which the time intervals that the information is wanted to be seen at.
4. Then click Next.
5. Now select the Parking Areas or Car Parks that are being reviewed.
    a. This can be done by Facility or by area.
    b. Click the box next to the desired location(s) then click the arrow to transfer it to the Selected Areas window.

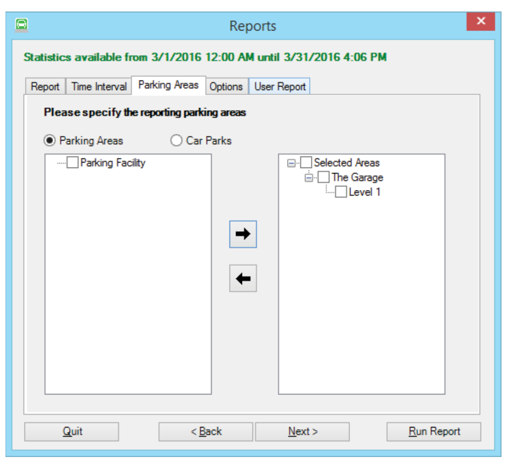

Figure 62: Moving desired location(s) to the Selected Areas window

6. The Report is now ready to be run which will generate the Report, but some specific reports i.e. Occupancy will have an Options Tab with alternate options available or

Counters Tab i.e. Parking Space Statistic where a chosen sensor is specified.

   a. For the Diagrams configuration the Option Tab will be a necessary tab to select either Bar or Line chart.

The Options Tab is not necessarily necessary to run a report. It contains more options to change the report from the default settings. The Counters Tab is necessary to run the report that calls for that information. This tab is what defines which counting device is being analyzed for that report. The Options Tab is used in three different ways in the Reports configuration.

One is for selecting whether or not both the data about the sensors and zones is displayed. By default it is just the zones.
This Options Tab is seen in the following Reports:

- Current Situation
- Occupancy

The Second way is for selecting two different options for viewing the data. By transforming the table by switching which data is in the Rows and Columns.
This Options Tab is seen in the following Reports:

- Visitor Cross Table
- Occupancy Cross Table

The third way is in the Diagram configuration, and this tab allows the user to select either to see the data in a bar or line chart. By default the Diagram Type is a bar chart.

The Counters Tab is for selecting the device(s) that is to be analyzed. Simply select the device(s) to be analyzed after going through the steps previously mentioned then click Run Report to view.
The Counters Tab is seen in the following Reports:

- Parking Space Statistics
- Vehicle Counters

Once the configuration has been completed and the report has been run, a new window will open displaying the report. This page can now be either just viewed by the user or, it can be printed or saved as a PDF or various other file extensions.

Web Browser User Interface

Starting Visual Control Center

To start the Visual Control Center software, open the web browser. Then type the Server's IP Address into the web address bar. This will open the Login page.

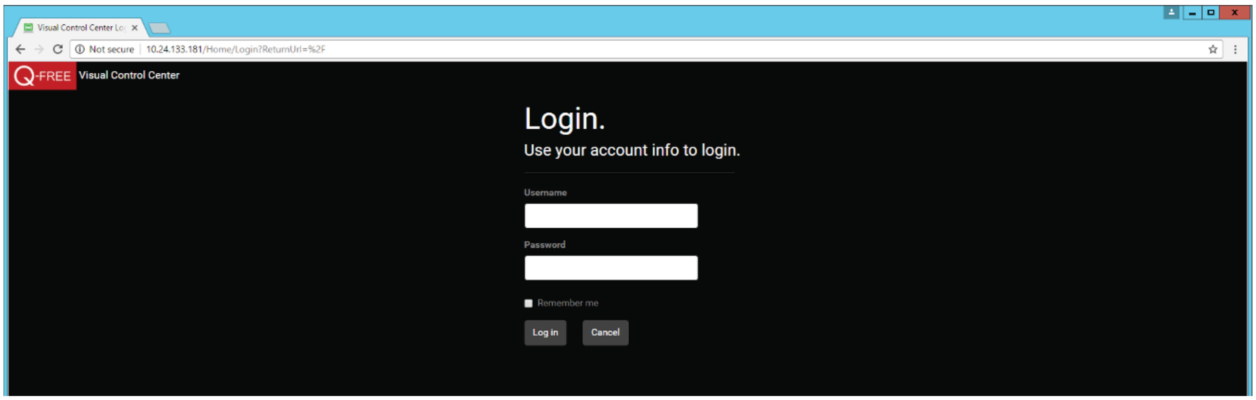

Figure 63: VCC web access login page.

This window allows the user to enter their username and password. The username and password should be set up by the Administrator during the commissioning process.

Once the user has successfully logged into the Visual Control Center, the applications main page will open. Navigating the main page allows users to manage and maintain counting zones, view statistics, and see real time vacancy of the monitored parking areas. **There's a background service running on the server that is controlling the parking guidance system; this means the Visual Control Center Client and web browser can be open or closed without disrupting the parking guidance system.**

Main Window

Dashboard

The main window displays a dashboard of the parking guidance system. It provides real-time statistics about the system. The statistics can be generalized by area by selecting different areas in the Navigation column.

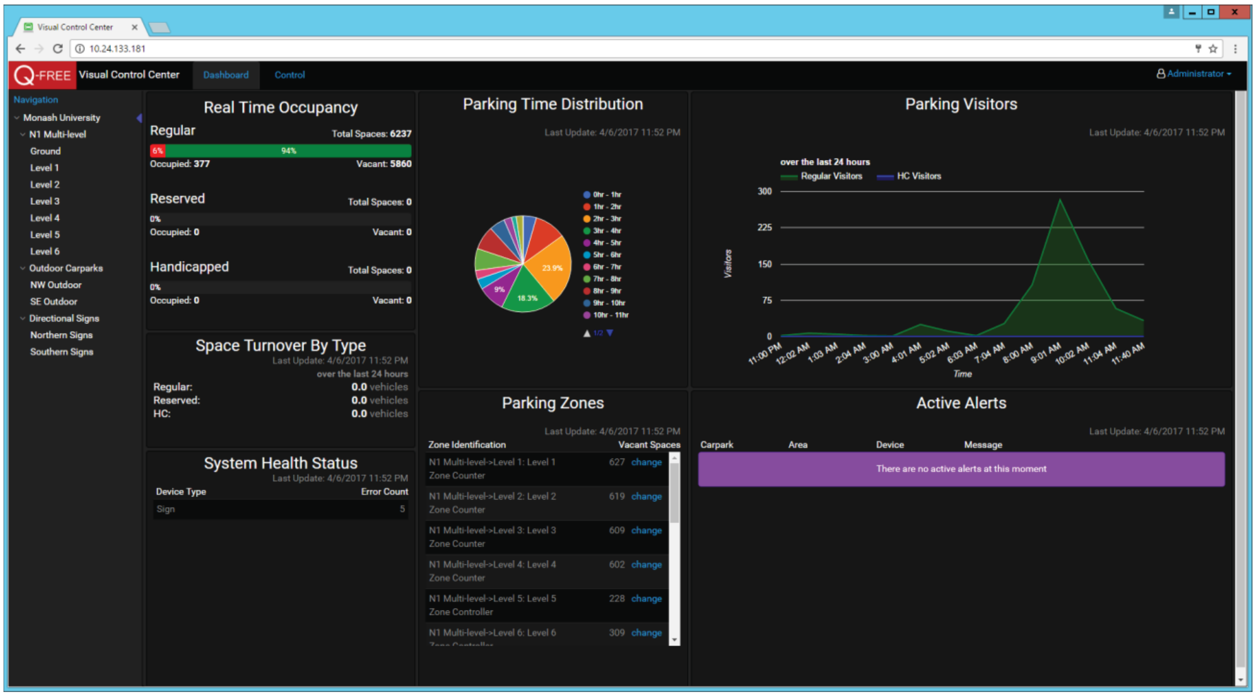

Figure 64: Example of the VCC main window after login.

Control

The visual representation of the system is shown in the Control tab. A car park can consist of one or several parking areas. A car park area consists of a background picture and the parking guidance system's configured components. The allocation of areas can be determined by the car park's architecture. It can also be adapted to other technical circumstances. Swapping between areas within the car park is possible at any time using the Navigation taskbar on the left-hand side of the main window.

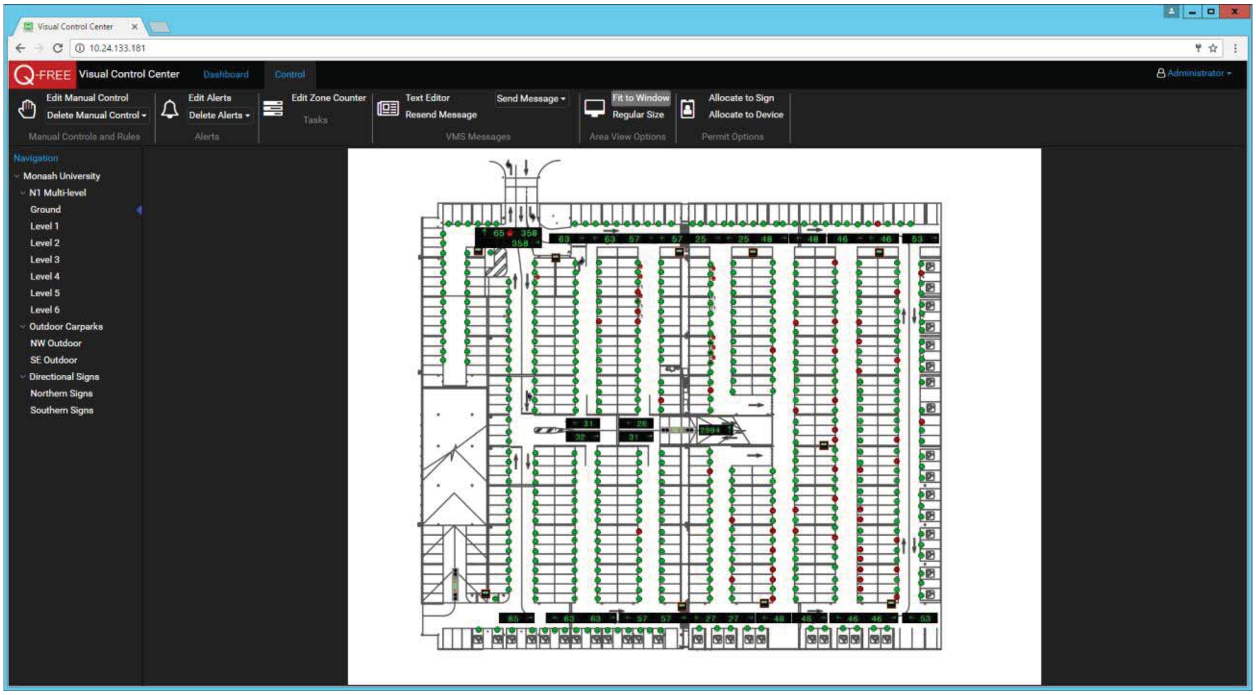

Figure 65: The Control tab main window.

Dashboard

The Visual Control Center offers various ways of analyzing parking availability information. The Dashboard offers a quick overview of data that can be broken down by system, facility, and level. To navigate through these options just click the group to be viewed in the Navigation pane on the left-hand side.

Data

Real Time Occupancy

On the upper left column, the real-time occupancy is shown. This is shown in three classes of parking space; regular, reserved, and handicapped. This gives a total number of spaces for the selected group and then breaks that down into occupied and vacant.

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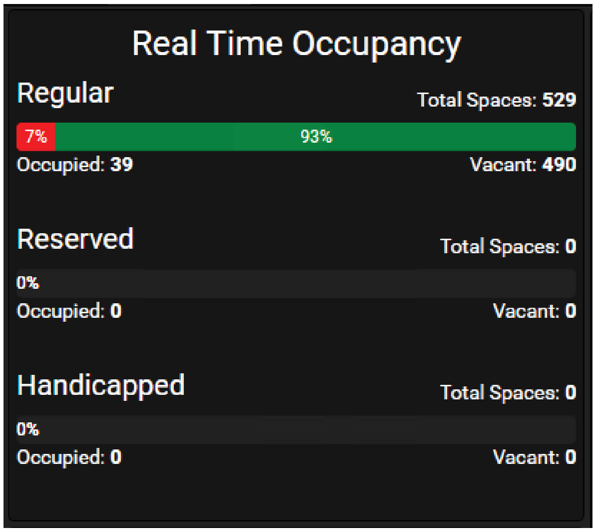

Figure 66: The real-time occupancy data.

Space Turnover by Type

The space turnover is shown in the middle left column and shows an average of how many vehicles have entered and vacated a parking space in the past 24 hours.

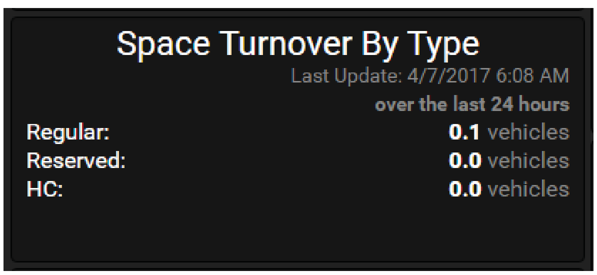

Figure 67: the space turnover by type data.

System Health Status

The system health status is located on the lower left column. This shows if any devices are not communicating. It will provide the information of what device type and how many devices.

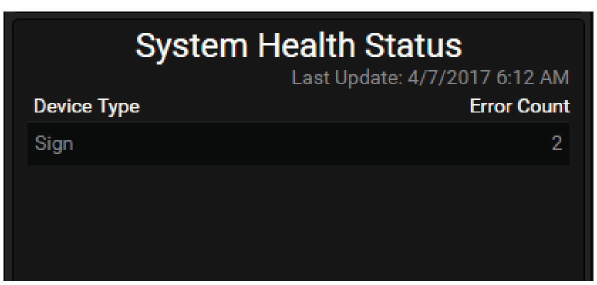

Figure 68: The system health status data.

Parking Time Distribution

The parking time distribution is in the upper middle column. This information is only available for single space systems. It shows the percentage of vehicles that have stayed for a certain duration range.

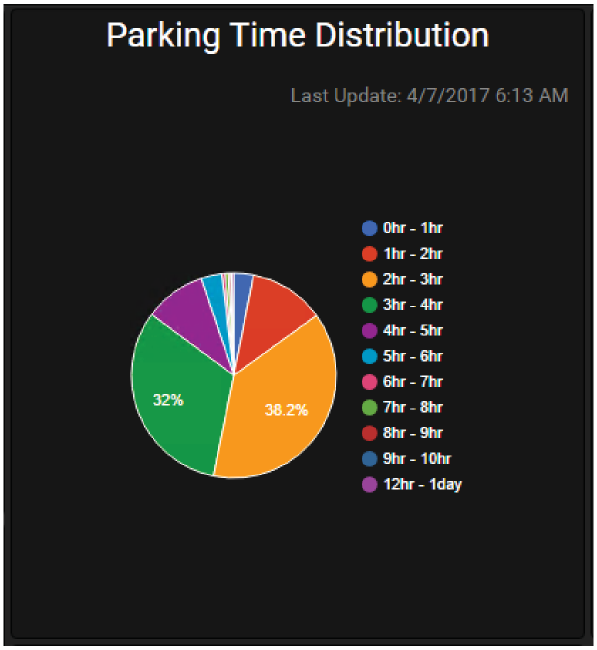

Figure 69: The parking time distribution data.

Parking Zones

The parking zones is in the lower middle column. This is only available for zone counters created in the software. This displays the name of the zone and the number of vacant parking spaces in it.

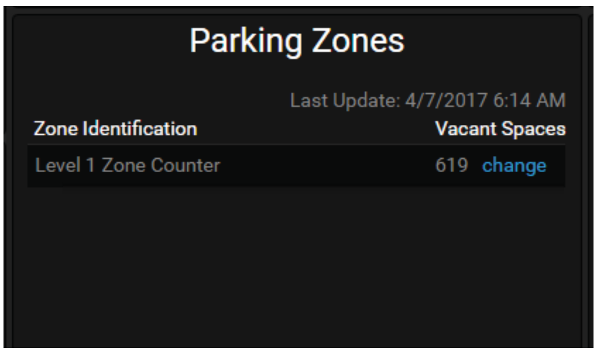

Figure 70: The parking zones data.

Parking Visitors

The parking visitors is in the upper right column. This information is only available for single space systems. This is a graph of the number of visitors over time displaying when peak hours are.

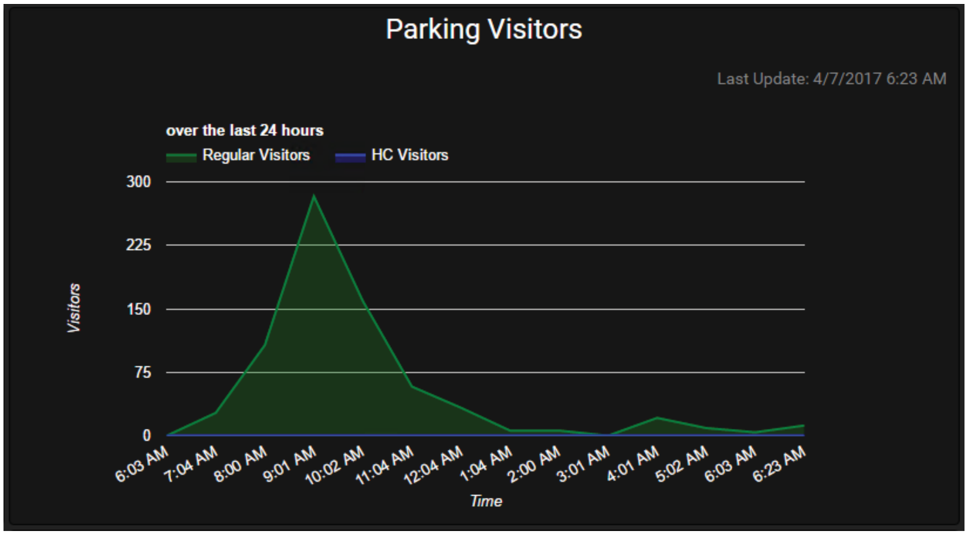

Figure 71: The parking visitor's data.

Active Alerts

The active alerts are in the lower right column. The active alerts will display any alerts that have been triggered. It displays which carpark, area, device, and message the alert was generated from.

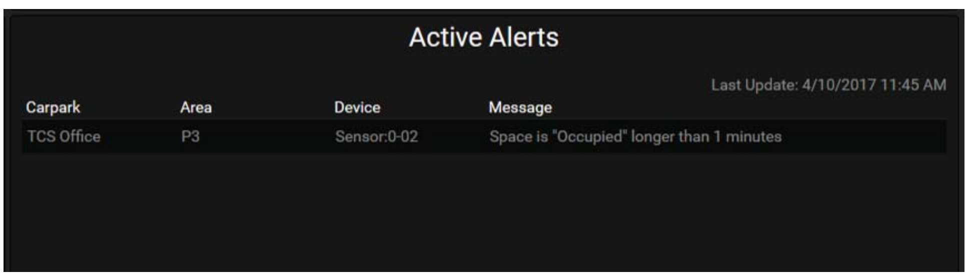

Figure 72: The active alerts data.

Control Tab

Components of the Control Tab

Window Title

The window title is Q-FREE Visual Control Center. Next to this is also the Dashboard and Control tabs to navigate between the two windows.

Navigation

The area toolbar on the left-hand side of the main window is used for quickly changing areas. Click an area to view it in the main window.

Toolbar

The main menu is under the window title allowing access to the programs Functions. These functions are for configuring different settings for the system.

The main menu contains the following sub-menus:

Manual Control and Rules

This tool allows the user to create manual controls and rules on devices to change their state from the default settings.

Alerts

This tool allows the user to create an alert on devices

Tasks

This tool is for editing the counts on a zone counter.

VMS Messages

This tool allows the user to create and send messages to a VMS sign.

Area View Options

This tool allows the user to adjust the zoom of the screen from Fit to Window and Regular Size.

Permit Options

This tool allows the user to allocate devices to a permit as well as allocate devices and/or permits to a sign.

Setting and Maintaining Zone Counters

When a parking guidance system uses directional sensors (USDS) or loops to monitor the vehicles for counting zones, the zone counter needs to be adjusted or maintained on a regular basis to ensure an accurate display of available spaces on the signs.

To update the available spaces for a zone counter, follow the steps below (Note that the process is expedited and more accurate if two people participate):

7. Walk or drive to the zone and count the number of available parking spaces or occupied spaces. When the zone is more occupied, the number of available spaces should be counted. When the zone is less occupied the number of occupied spaces should be counted.
8. Call or relay the available or occupied spaces to someone who has instant access to the software.
9. The person at the computer should then click on the zone counter for the zone that was counted, and choose Edit Zone Counter in the Tasks.

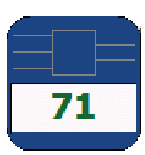

Figure 73: Zone Manager

10. A window will open allowing the user to enter in the Vacant or Occupied spaces. Make

sure to select “Vacant Spaces” or “Occupied Spaces” correctly.

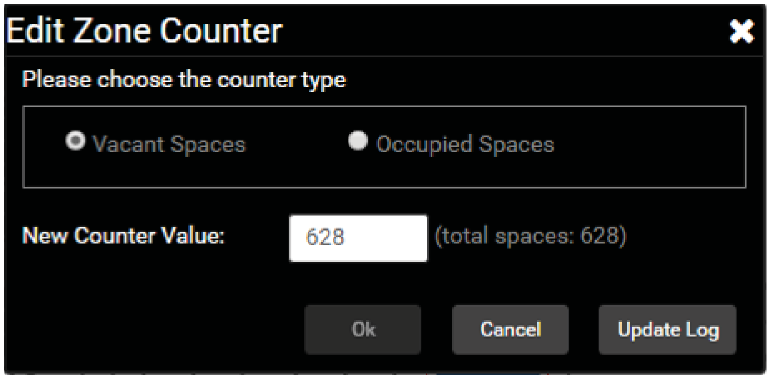

Figure 74: Zone counter used to maintain counts

11. After entering in the correct number, click “Ok”. The zone is now updated with the most recent count.
12. Each zone for the system should be updated and set in this way. The frequency in which the zones should be updated depends on the number of counting points for each zone, and the number of vehicles that travel through the zone.
13. The zone counters can also be automatically updated with a manual control. This is recommended in situations where the garage or lot completely empties out at night or another point during the day. Read about setting up manual controls on **Pages 13-17.**

Note: Zone Counter updates can be performed from the Dashboard screen. Clicking the “Change” link next to the Zone will open the same “Edit Zone Counter” screen as shown in Figure 74.

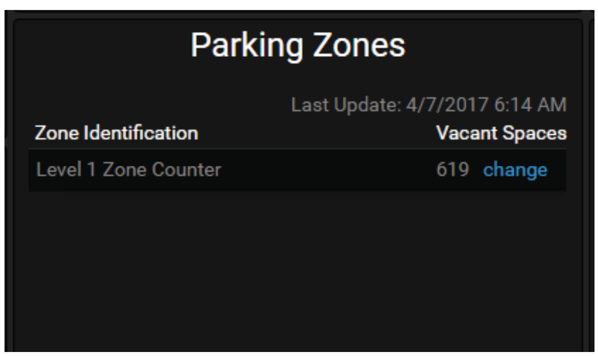

Figure 75: Dashboard link to Edit Zone Counter

Parking Space Reservations

It is possible to reserve a parking space in the Visual Control Center when using single space monitoring sensors. This form of control is only possible when using single space sensors. The sensors standard state is *automatic*, but the Reserve Parking Spaces control makes it possible to define when a specific space is shown as occupied or reserved.
Note: the LED status color can be changed in the client software. Amber is the default for reservation

Reserving Parking Spaces

To reserve one or more parking spaces, use the mouse to select the sensor(s). The chosen sensor is displayed in a red frame.

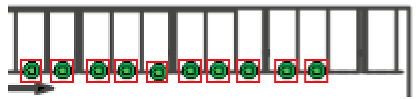

Figure 76: The selected sensors to set up a reservation.

Then click Edit Manual Control in the Manual Controls and Rules. **Important**: Only Operators or Managers can configure parking space reservations.

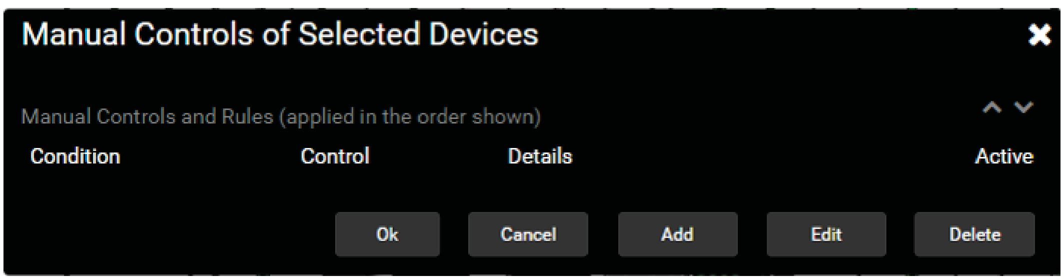

Figure 77: Reservation of parking spaces window

This window will show the list of controls set up. To add a control click Add. The Edit Manual Control window will open where the parameters can be set up.

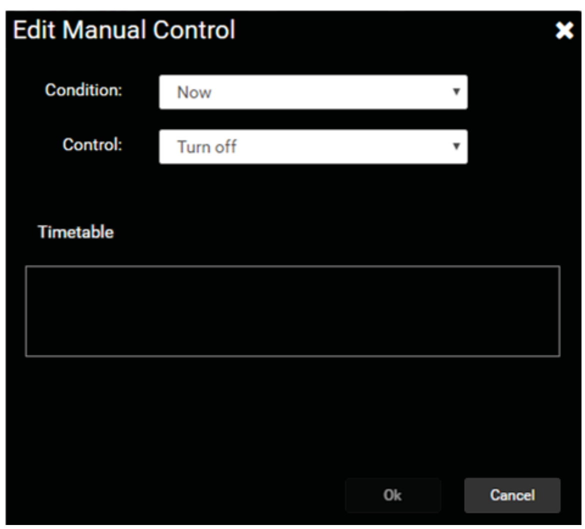

Figure 78: The Edit Manual Control window

The control can be set to define when the reservation is active by changing the Condition. For a reservation, the condition can be set as now so the control starts immediately or can be set on a time schedule. If selecting time schedule the parameters will need to be set for when the control is active.

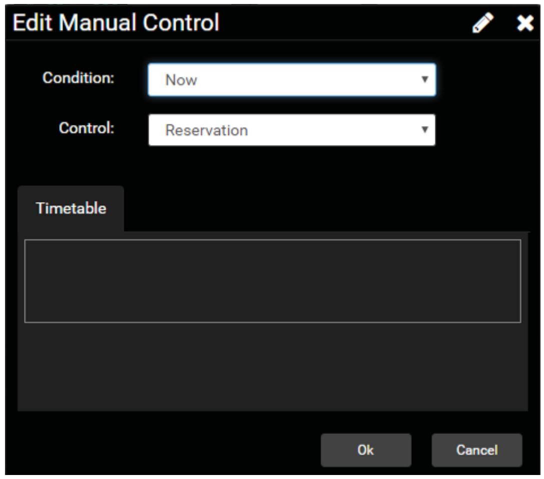

Figure 79: Parking Reservation set up.

Once finished with the setup click Ok and it will be added to the manual control list. To make the control active check the box under Active and click Ok.

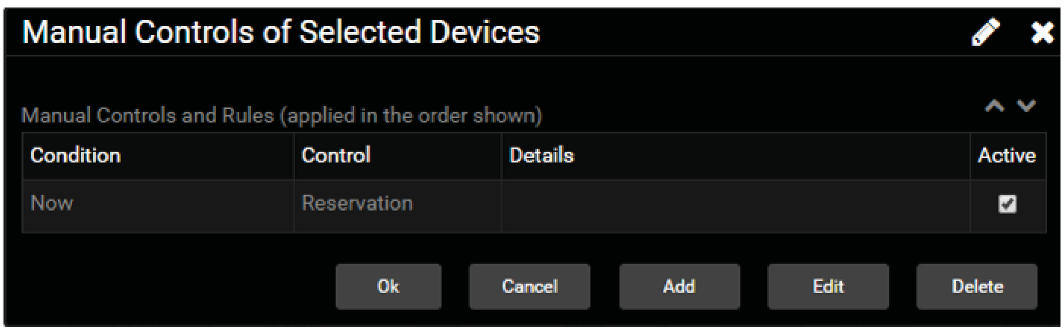

Figure 80: Reservation of parking spaces window.

The reservation is set on the sensor until the reservation is cancelled. There are two ways of canceling or deleting the reservation. One is to uncheck the box under Active and the other is to delete the control. To delete the control this can be done by selecting the control in the list and clicking Delete, or by selecting the devices and select Delete Manual Control in the Manual Controls and Rules.

Caution! If selecting Delete ALL Manual Controls then all manually programmed controls, in all car park areas, will be irreversibly deleted!!!
Notice: Like all delete functions in the Visual Control Center, one receives a warning beforehand.

Manual Controls

The adjustments which have been described in the previous and following sections create a change in the automatic control of the Visual Control Center parking guidance system. It is also possible to control other components in the Visual Control Center (i.e. signs and zones).

To access the manual controls for a device, first select the device by clicking on it with the mouse. You can also left click hold and drag a box around similar devices such as signs on a

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master panel to control them all at once. For selecting multiple devices on various parts of the GUI hold the control key down and left click the devices you would like to manually control. Then click the Edit Manual Control in Manual Controls and Rules.

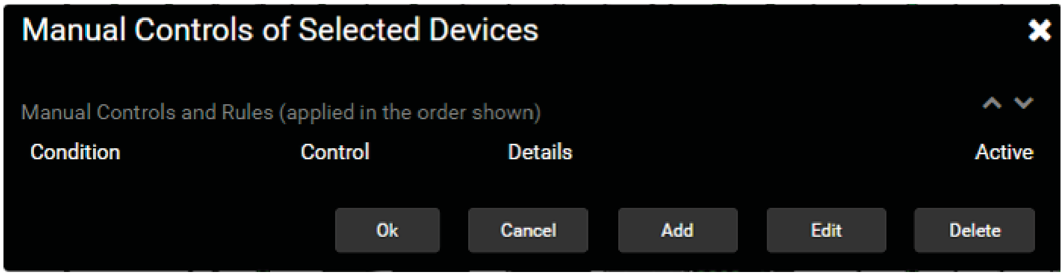

Figure 81: The Manual Controls window list.

This example is of a sign. In this window the user can create new controls/rules or manage previously set ones. Controls/rules created will remain in the log unless otherwise deleted.

Adding a New Manual Control

To create a control click Add to open the Edit Manual Control window. From here the user will have the option to set the condition and control.

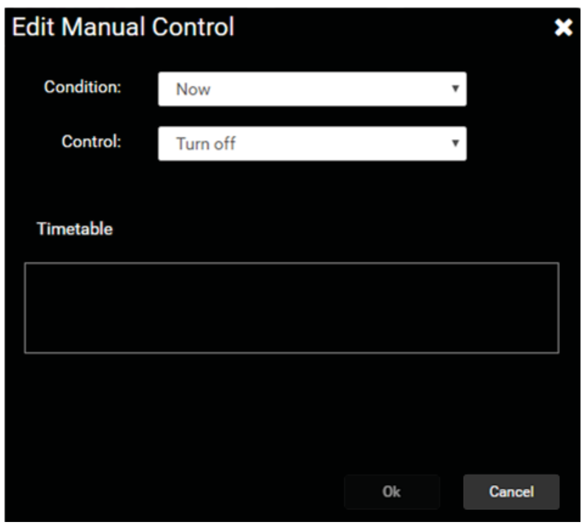

Figure 82: The Edit Manual Controls window.

Starting with the Condition, select which option fits the situation.

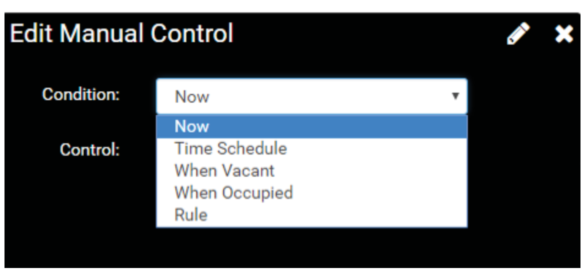

Figure 83: Condition options

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- **Now:** Sends this manual control immediately to the sign.
- **Time schedule:** Allows the user to create a schedule for when this manual control will occur.
- **When vacant:** Sends the manual control selected when all the parking space counting zones allocated to the sign are available.
- **When occupied:** Sends the manual control selected when all the parking space counting zones allocated to the sign are occupied.
- **Rule:** Allow the user to create a rule for when this manual control will occur.

After choosing when the manual control will occur select the control type of the manual control under the Control drop down menu.

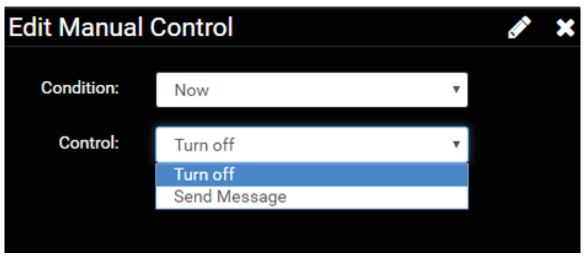

Figure 84: The Control options for a sign.

- **Turn off:** This option will turn the sign off. The sign will be blank and display no messages.
- **Send Message:** This option will allow the user to send a message that has been created in the VMS Text Editor.

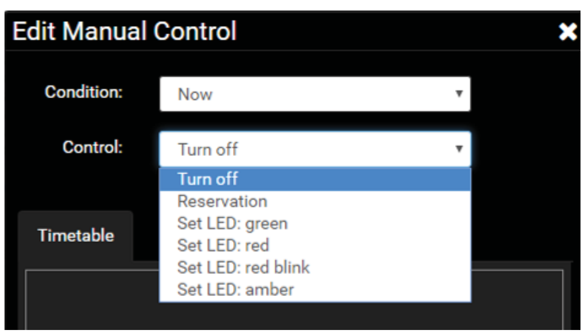

Figure 85: The Controls options for a single space sensor.

- **Turn off:** This option will turn the sign off. The sign will be blank and display no messages.
- **Reservation:** This option allows for a reservation to be set on the selected sensor(s).
- **Set LED: green:** This changes the LED to green regardless if the space is vacant or occupied.
- **Set LED: red:** This changes the LED to red regardless if the space is vacant or

occupied.

- **Set LED: red blink:** This changes the LED to blink red regardless if the space is vacant or occupied.
- **Set LED: amber:** This changes the LED to amber regardless if the space is vacant or occupied.

On a zone counter a value is also needed depending on the control.

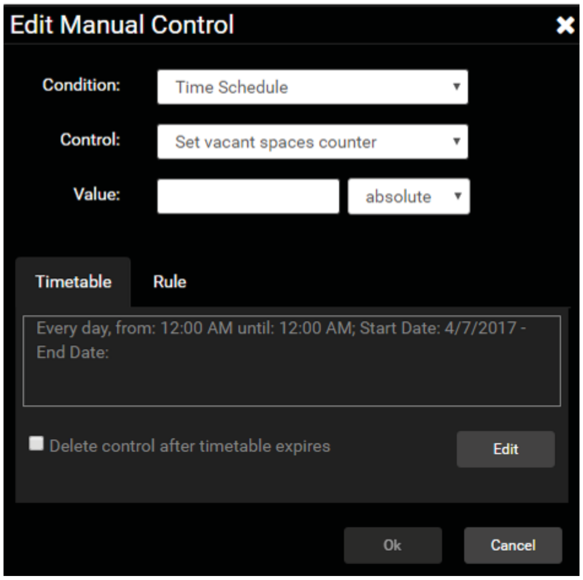

Figure 86: The manual control for a zone counter.

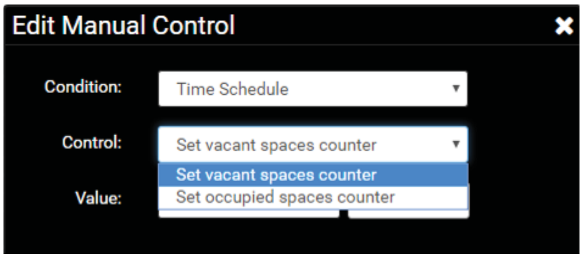

Figure 87: The Controls options for a zone counter.

If Time schedule was selected for when the manual control should occur, the user can now access the Timetable tab. To set the times and date select Edit.

55 Union Avenue
Sudbury, MA 01776
P. 978-443-2527
F. 978-579-9545
www.q-free.com

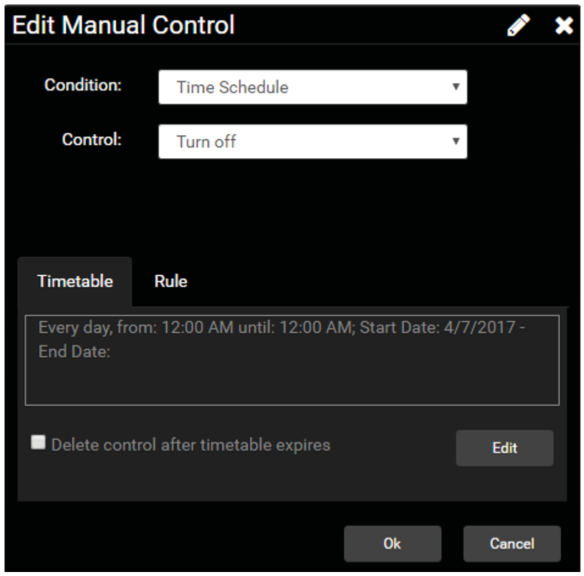

Figure 88: Edit Manual Control when choosing Time Schedule.

After clicking Edit the Time Table Configuration window will appear. Here the user can create the schedule for when this manual control will occur. By choosing Daily as shown below, the manual control will occur every day between the hours that are selected.

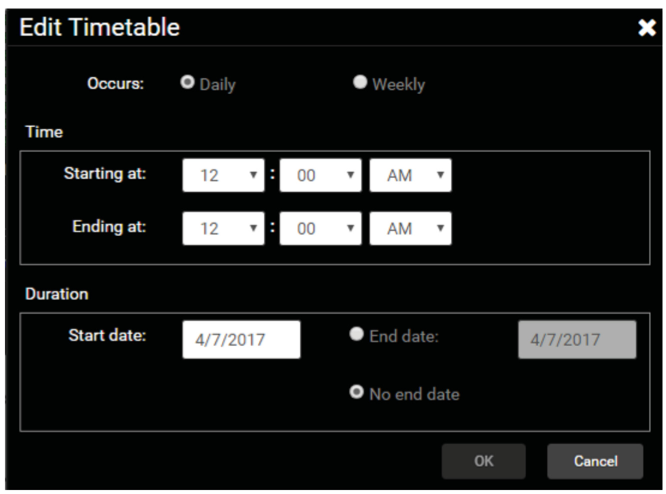

Figure 89: Daily timetable

By choosing Weekly as shown below, the user can select the days of the week and time for when the manual control will occur.

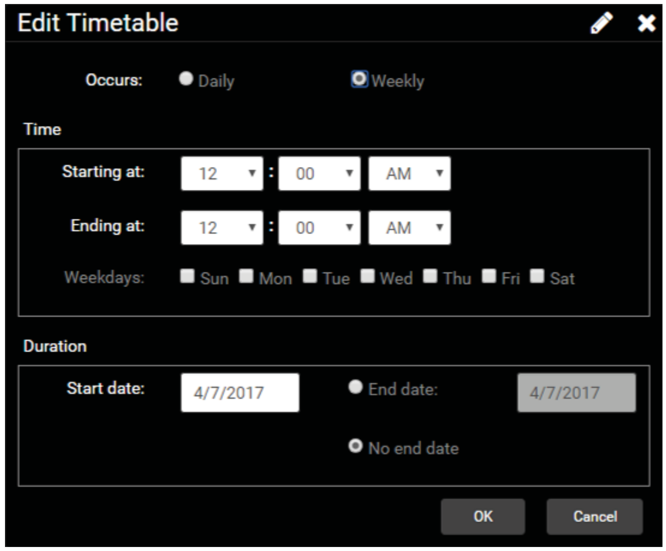

Figure 90: Weekly timetable

A message can be displayed multiple times at different times in the day by adding separate manual controls for the same message with different time frames under the weekly setting.

Alerts

The Alerts setting allows the user to be notified if a device or multiple devices are not communicating and when communication was re-established. The communication alert is set up for a certain time threshold. An alert can also be set up on a single space sensor for different status alerts. The alert can then be sent to the computer screen, an email, or an SMS.

To get the alert sent to an email or SMS, the address must be configured. This is done in the client software.

To start select the device or devices the alert is to be set for. Note: if multiple selected the devices must be the same to create an alert. Once selected, click the Control tab and select Alerts. (not all user groups may have this ability) The Alerts window will open.

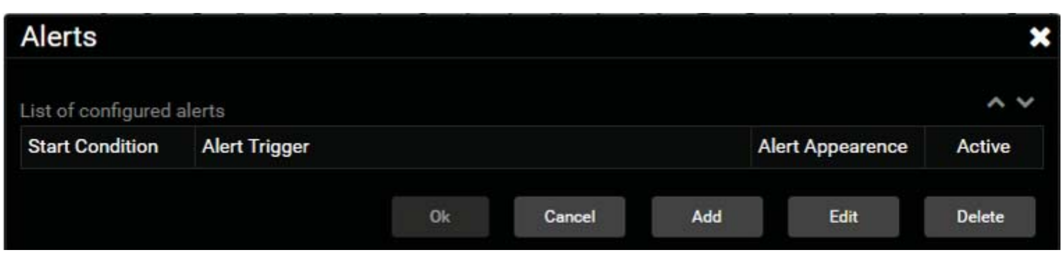

Figure 91: The Alerts window.

Click Add to start the set up. First select the Start Condition. Selecting Now will have the alert start immediately and run until told to stop. A Time Schedule can be set up to have it only monitored during certain selected times. Then the event that triggers the alert can be set. If selecting Communication error longer than … then the time threshold must be set. The message that is sent can be adjusted or left at the default. Last set the alert appearance.

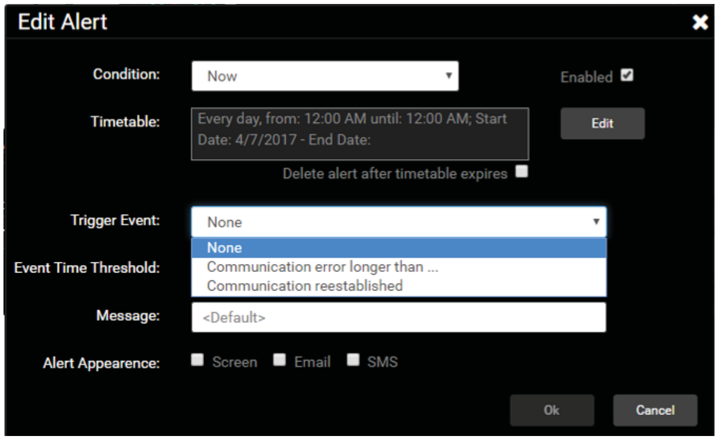

Figure 92: The device Alert set up window.

Then click Ok and the Alert will be added to the Alerts window. If the box it checked off the alert will be active.

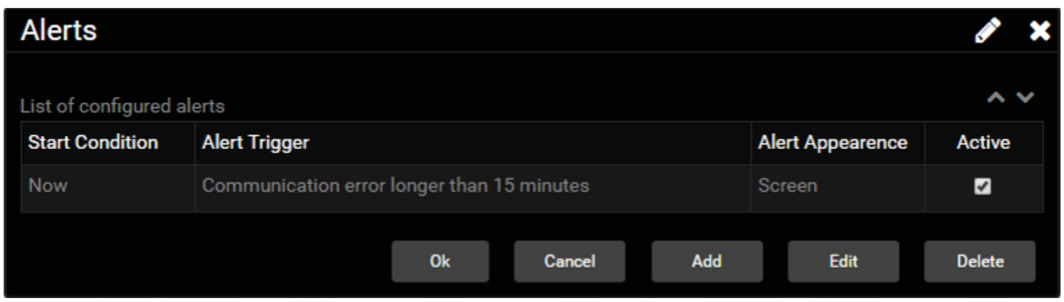

Figure 93: Alerts window after an alert has been configured.

For single space sensors, alerts can be set dependent on the status of the occupation.

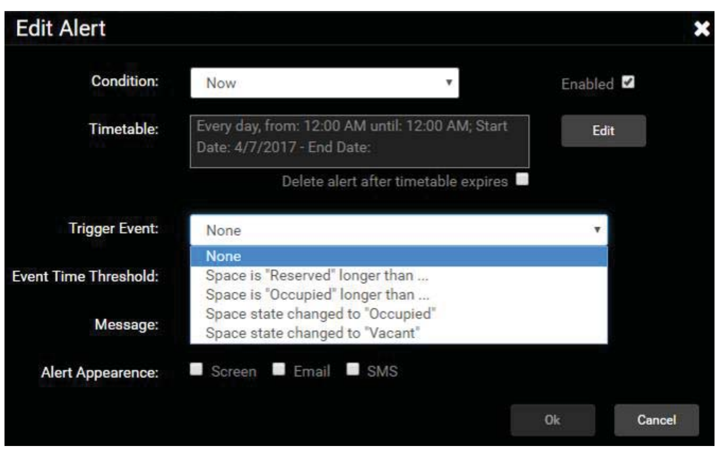

Figure 94: The device Alert set up window for single space sensors.

Variable Message Signs

A variable message sign is an electronic sign that can display varying messages of text and numbers controlled through a computer and graphical user interface. The sign can be used to display information to customers such as special events, parking rates, or parking availability.

Text can be sent immediately to the sign or timed using the time scheduler.

Important! The options available may differ depending on the sign manufacturer.

Figure 95: Variable Message Sign Icon in Visual Control Center

VMS Text Editor

The VMS Text Editor allows the user to create a library of messages as well as send the messages to the sign.

To create and/or edit text messages on a VMS, select the VMS sign to change then click Text Editor in VMS Messages.

The VMS Text Editor window will open for this sign. You will now have the option to create new text, edit existing text, and send text to the sign.

Figure 96: The VMS Text Editor window.

VMS Text Editor Window Overview

- **Selection:** This drop-down menu lets the user choose an existing Text for editing or <New Text> for creating a new message.
- **Name:** This field allows the user to edit an existing text's title or name the newly created text.
- **Preview:** Shows a preview of what the sign will display. This will not give the user a sample of the effect chosen, and may not necessarily reflect what the sign will actually display.
- **Frames:** This section will allow the user to create multiple frames for the text to switch

through to create longer messages. It will also display each frame in its sequential order.

- **Font:** This field allows the user to change the font type and size based on the capabilities of the current sign.
- **Color:** This field allows the user to change the color of the text in the message. This is only allowed when the sign is capable of displaying different colors.
- **Effect:** This field allows the user to change the effect of the message when it is displayed on the sign. The effects will be limited to the type and size of the selected sign.
- **Align text:** The two drop down menus allows the user to choose how the text will be oriented horizontally and vertically when displayed on the sign.
- **Frame Parameters:** This allows the user to set the Display Duration when using multiple Frames. This may vary depending on the signs capabilities.
- **Content:** This area is where the user can input the text to be displayed. See Section on Content below.
  - Counters, Arrows, Images, and Extras may be added to the Content depending on the signs capabilities.
- **Ok:** Saves the changes made to the edited, existing, or new messages created, and will close the VMS Text Editor.
- **Cancel:** Voids any changes made.
- **Apply**: Saves the changes made to the edited existing or new messages created.
- **Delete:** Deletes the selected message in the Selection drop down menu.
- **Send this text to Sign:** Sends the currently selected message to the sign which will be displayed immediately.

Content

The Content field is for writing the text that is to be seen on the sign. For basic messages just enter the text desired the click Apply and Send this text to sign. The image of the device on the backdrop will reflect the Preview. Using the four drop down menus; Counters, Arrows, Images, and Extras, the sign can show more detailed messages. To add one or more of these contents, click the drop-down button and select an option.

Adding a Counter will show a numerical value of vacant or occupied spaces. There are two choices of Counters, a Statistics Counter or Sign Counter. The Statistics Counter allows either a Facility, Car Park, Parking Area, or Device(s) to be displayed. A Sign Counter will show the vacant or occupied parking spaces. Once selected the Edit Counter window will open.

Figure 97: The VMS Edit Counter window for counter.

The same window opens for either option chosen. The type of counter can be selected under Counter Type. The Name of the counter can be changed to reflect what is being counted.

When creating a Statistics Counter the Calculation method is the amount of devices being counted. The Data Type is whether the sign displays vacant or occupied parking spaces. The Appearance is exactly how it will display. Under the Data Source tab the Selection Type can be chosen for what exactly is being counted. Then select the box of what is to be counted then click the arrow to bring it to the Selected Sources area. Click Ok and the Counter has been created. A Sign Counter is created the same way but selecting only the options available.

When adding Arrows to the content simply select the arrow to open the VMS-AddIns window. Here the arrow can be selected or changed, a color applied, and an option to put an X over the arrow on the display.

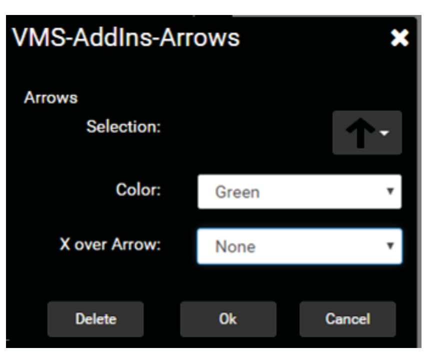

Figure 98: VMS-AddIns window for adding an Arrow.

When adding an Image to the content simply select the image to open the VMS-AddIns window. Here the image can be selected or changed to be shown on the display.

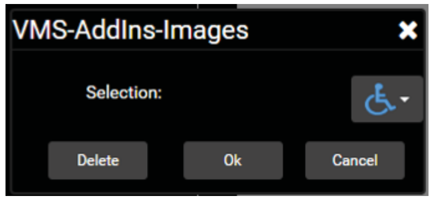

Figure 99: VMS-AddIns window for adding an Image

The Extras option allows the user to manipulate different characters or words in the message to have different fonts, colors, or alignment compared to what the VMS Text Editor shows selected.

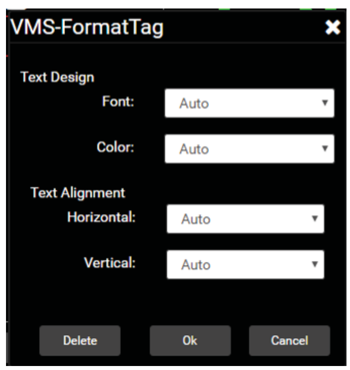

Figure 100: The VMS format tag window.

Figure 101: VMS-FormatTag window and example of Extras configuration

When adding any of these options, text can still be added along with them to create a detailed message.

Figure 102: Example of mixed text and content options to display an informative message

Figure 103: Example of mixed content VMS as shown in VCC

Permit Options

The permit options allow the user to allocate sensors and zones to a specific permit that can be changed at any time. Then the permits can be allocated to a sign. The sign can also have zones and/or sensors allocated to it.

Allocate to Sign

To add a permit to a sign, first select the sign or signs to be set. Then click Allocate to Sign in Permit Options. This will open the Permit Sign Properties window.

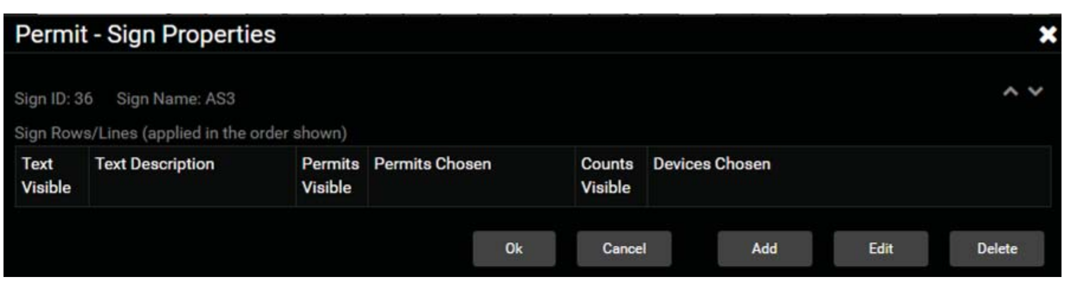

Figure 104: The sign properties window.

Click Add to choose the devices to allocate to the sign. A text description can be added that either describes the selection or this can be displayed on the sign by checking the box Text Visible. Here the zones and devices can be selected to show on the sign. Also, any permits can be selected to show those designated zones and devices.

There is the option to Count all chosen devices or Only count devices with chosen permits. This option allows the user to have a predefined set of devices allocated to a sign but then also a set of permits. If the Count all chosen devices is selected it will show the count of all selected devices. If the Only count devices with chosen permits is selected, then the selected permits will over rule the selected devices and only the permits counts will be shown.

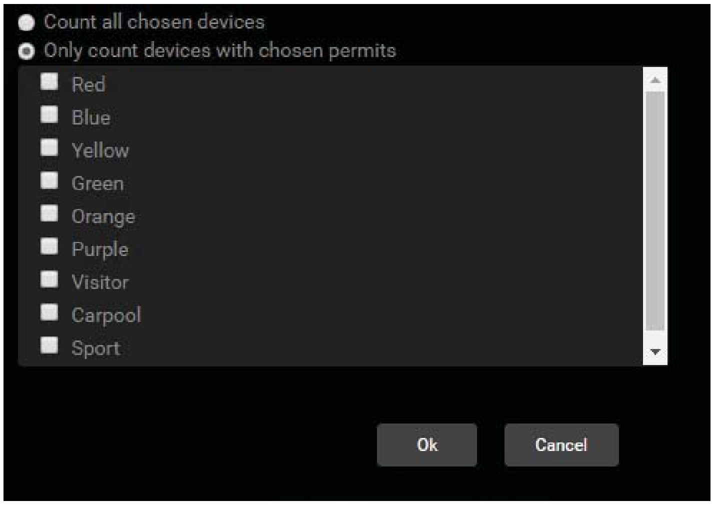

Figure 105: The list of permit to be added.

The three check boxes at the top; *Text Visible*, *Permits Visible*, and *Counts Visible* will display this information on the sign if checked off. If the *Text Visible* is checked the Text Description will display on the sign; If *Permits Visible* is checked the permit titles will display on the sign; If *Counts Visible* is checked the count will display on the sign.

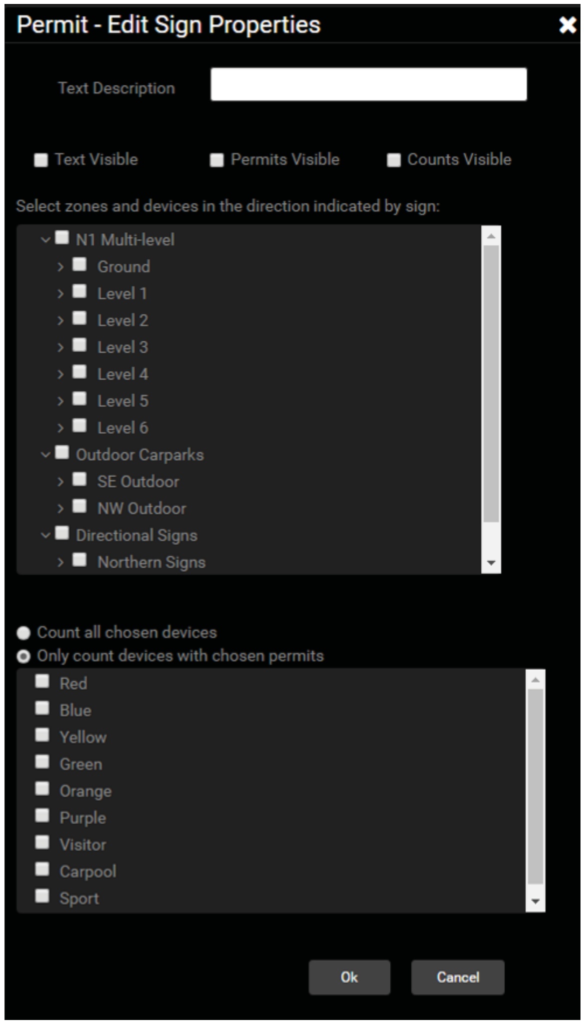

Figure 106: The Edit Sign Properties window.

Below is an example of a setup and what it will display.

55 Union Avenue
Sudbury, MA 01776
P. 978-443-2527
F. 978-579-9545
www.q-free.com

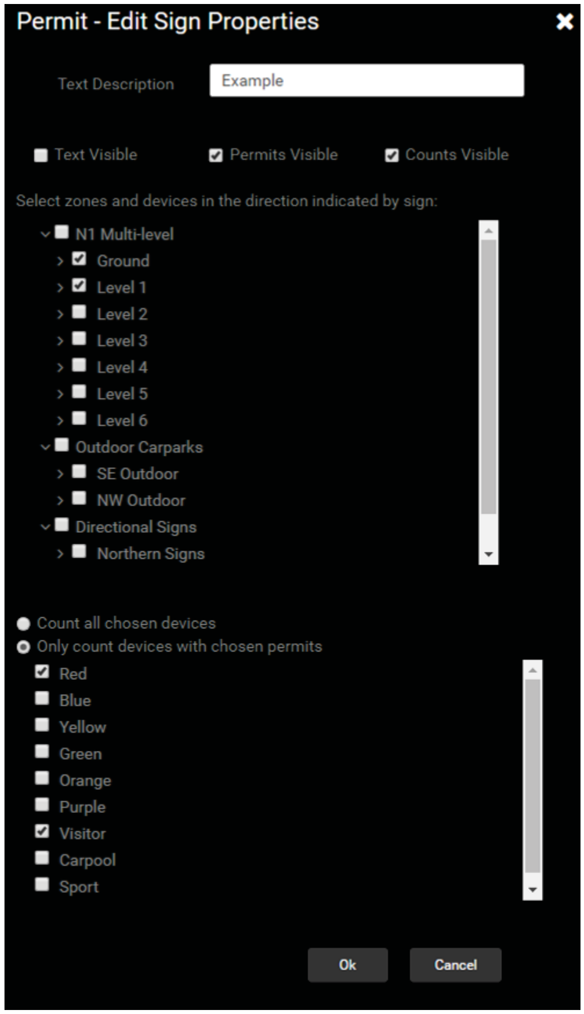

Figure 107: Example of a sign setup.

These properties selected will display the permits selected and the vacancy counts of those permits. Although Ground and Level 1 have been selected, because Only count devices with chosen permits is selected the count displayed will be of the Red and Visitor permits.

Then Click Ok to save the settings, and this will now show in the sign properties window. Select this setup and click Ok to send these properties to the sign.

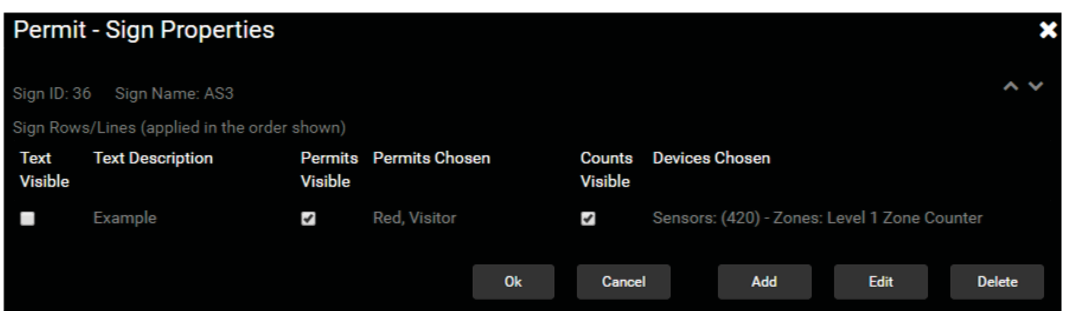

Figure 108: The sign properties list of configurations.

55 Union Avenue
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P. 978-443-2527
F. 978-579-9545
www.q-free.com

Allocate to Device

To add a permit to a device, first select the device or devices to be set. Then click Allocate to Device in Permit Options. This will open the Edit Device Allocation window.

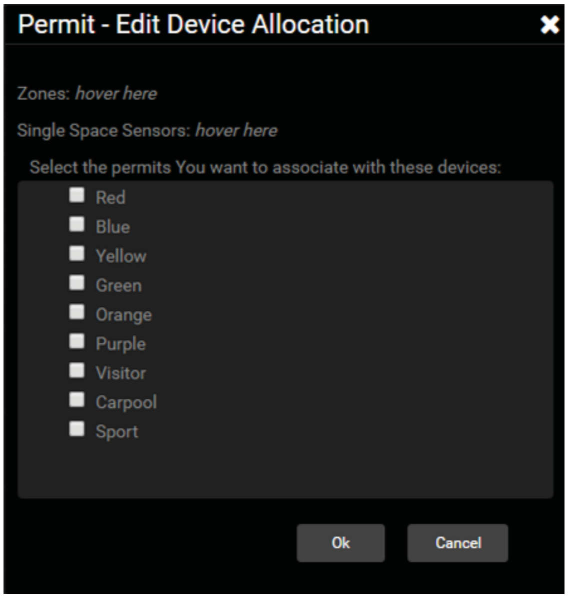

Figure 109: The device permit allocation setup.

Here the desired permit or permits can be selected for the device(s). Once the permits are selected click Ok. To remove all permits from the device(s) just leave all selections unchecked and click Ok.

ParQSense Smart Sensor
Product Specifications

Document number:	2018-820-005-ITS420				
Filename:	ParQSense Smart Sensor Product Specifications				
Revision number:	1.0	2.0	3.0	4.0	5.0
Creation/revision date:	Feb, 01 2018	Apr, 18 2018	May 9, 2018	June 5, 2018	Sep 19, 2018
Written/revised by:	RV	RV	RV	RV	RV
Checked by:	JS, JP, BB				
Approved date:					
Approved by:					

Revision history

Rev1. Initial release version

Rev2. Revised

Rev3. Revised with FCC statements

Rev4. Revised with FCC testing comments

Rev5. Revised with new nomenclature

Table of Contents

1 SCOPE

The scope of this document is to give a comprehensive description of the ParQSense Smart Sensor, as the newest development in on/off-street parking monitoring from Q-Free ASA.

Figure 1. Sensor Components

This document is intended for existing and new partners, customers, authorities, operators and others who wish to obtain a deeper understanding of the design and functionality of the ParQSense Smart Sensor without the need to study technical hardware and software specifications which requires engineering expertise.

Anyone who wishes to consider deploying the ParQSense Smart Sensor in an outdoor parking monitoring system will find this document useful when comparing features, to understand functionality and how to deploy the ParQSense Smart Sensors into an existing environment or as part of a new project.

1.1 ParQSense Smart Sensor Features

The ParQSense Smart Sensor is the latest development in on/off-street parking monitoring from Q-Free. Harnessing more than thirty years of experience in ultra-low power technology, makes this development unique in the market. Combining multiple sensing technologies ensures maximum detection accuracy. Typical applications are on/off-street monitoring for public, private lots/spaces, Smart City Initiatives, etc.

Lifetime options

The ParQSense Smart Sensor sets a new standard for lifetime of outdoor sensors. A highly optimized ParQSense Smart Sensor architecture with a near-zero idle power consumption and the latest available battery technology, enables a record achieving of 10+ years lifetime.

Next level communication method

The Q-Free ParQSense Smart Sensor is the most advanced outdoor sensors of its kind. Our experience in ultra-low power technology enables extended lifetime and high reliability.

No compromise on performance

The Q-Free ParQSense Smart Sensor utilizes ultralow power microprocessor technology enabling close to zero power consumption in its Sleep Mode. However, there is no compromise on performance when the Q-Free ParQSense Smart Sensor is in the Active Mode.

Design and installation

The Q-Free ParQSense Smart Sensor is designed to be installed into the ground in the middle of an outdoor parking spot, and emits radar and magnetic pulses at certain intervals monitoring the designated parking space. The installation process is easy and expected to take about 4 minutes for each sensor.

2 CONTEXT

2.1 Structure of documentation

This document describes the properties and usage of the Q-Free ParQSense Smart Sensor. Customer and market specific information are found in separate documents.

2.2 References

Ref:	Norm:	Title:
[1]	CEI IEC 60721-3-4	Classification of environmental conditions
[2]	ETSI EN 300 019	Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-4: Classification of environmental conditions; Stationary use at non-weather protected locations
[3]	Directive 2014/53/EU	Radio Equipment Directive (RED)
[4]	ETSI EN 301 489-3	Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 246 GHz
[5]	ETSI EN 300-440	Short Range Devices (SRD); Radio equipment to be used in the 1 GHz to 40 GHz frequency range; Harmonized Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU
[6]	ETSI EN 300-220	Short Range Devices (SRD) operating in the frequency range 25 MHz to 1 000 MHz; Part 2: Harmonized Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU for nonspecific radio equipment
[7]	ETSI EN 300-328	Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonized Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU
[8]	FCC CFR 47 15.247	§ 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz
[9]	Q-Free	2017-635-xxxxx ITS420 Marking & Packaging specification
[10]	ISO 9001	ISO 9001:2008 Quality management systems - Requirements

2.3 Definitions and abbreviations

Term	Definition
4G	Fourth generation of mobile telecommunications technology
5G	Fifth generation of mobile telecommunications technology
NB IoT	Narrow Band Internet of Things
ITS-420	Standard Outdoor Sensor
ITS-421	NB IoT Outdoor Sensor
ITS-950	Base Station for Standard Outdoor Sensor Communication
OPGS	Outdoor Parking Guidance System
PGS	Parking Guidance System
BS	Base Station
API	Application Programming Interface
SU	Sensor Units
UI	User Interface

2.4 Table of figures

2.5 Table of pictures

3 PROPERTIES

3.1 Architecture

The Q-Free ParQSense Smart Sensor consists of an encapsulation made of TPU (thermoplastic polyurethane) and polypropylene plastics, containing a circuit board with electronic components and a primary lithium battery designed around the outdoor sensor.

The electronics consists of:

- Microwave antennas
- 868/915 MHZ ISM transceiver
- Ultralow power radar sensor
- Magnetometer technology
- BLE transceiver (optional)

The Q-Free ParQSense Smart Sensor is an ultra-low power outdoor sensor using radar and magnetometer monitoring technology.

The sensing equipment, contains new innovative hardware designs and software algorithms enabling extremely low power consumption, long life time.

The system architecture consists of:

1. Parking lots which system wise are organized as **sites**.
2. A large population of battery powered very low duty cycle **sensor units** (SU) distributed on the sites
3. The SU communicate with a ParQSense Base Station (BS). The number of base stations required per site depends on topography. Sites can have more than 1 BS.
4. A central system capable of doing
   a. Logical operations on the sensor data
   b. Communication with the sites
   c. Monitoring the site functionality
   d. Administrating the sites
   e. Providing data access for customer fronted applications

Sensor-to-base station communication within the system is based on a packet-radio solution based on an IEEE 802.15.4g compliant chip set. The radio system is designed to be compliant with FCC regulations for the license-free ISM band at 902-928MHz in the US and 863-868MHZ or 915-921MHz in Europe. It utilizes a frequency-hopping scheme, where each sensor node can transmit at one randomly selected channel out of 50 available channels. (FCC requirements dictate a minimum of 50 channels available for hopping). 14 channels are reserved for communication between field repeaters and field controller. These channels utilize a lower output power level, thereby adhering to a different set of FCC regulations. The ParQSense Base Station will continuously scan all 64 channels for incoming messages.

The base station communicates with the Q-Free ParQSense software system using Ethernet or a radio link over a public service telecom network. Q-Free ParQSense software system is a cloud based application providing options for UI based presentation of data as well as API based access to data from the sensors. The system is entirely scalable and can range from a few sensors to deployment with thousands of sensors.

All data from the sensors are aggregated in a central Q-Free ParQ software system. The Q-Free ParQ backend software system is designed to be flexible, and is able to handle a multitude of small individual customers, or one single large parking operator. Processed data may also be provided to 3rd party entities.

For all customers, such as parking administrators, operators, etc. parking space user data will be provided over a customer data interface via API or the hosted Q-Free ParQSense software system. A customer application may include any use of the data aggregated in the database such as utilization over time of a parking area, present number of free parking spaces, user guidance etc.

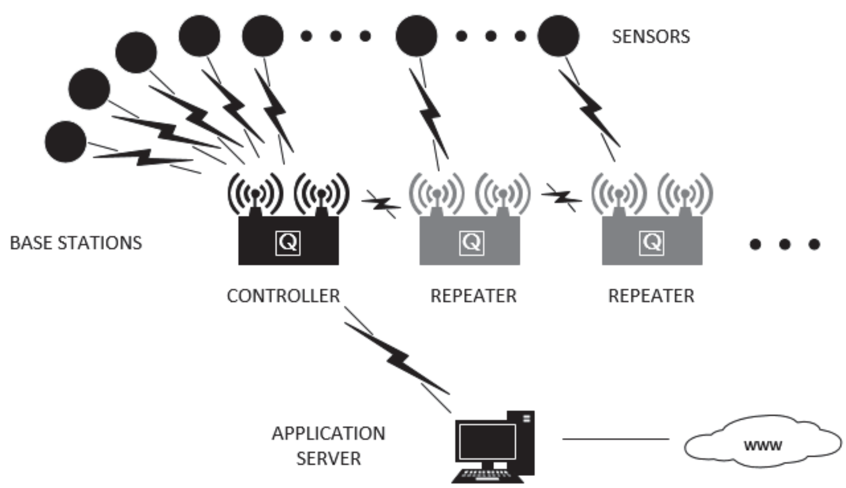

Figure 2. Communication & system overview

3.2 Mechanical specifications

The maximum physical dimensions of the Q-Free ParQSense Smart Sensors are:

- Ø 110 mm/ 4 1/3 inches
- Height: 75 mm/3 inches
- Weight: 550 g/ 1 lbs.

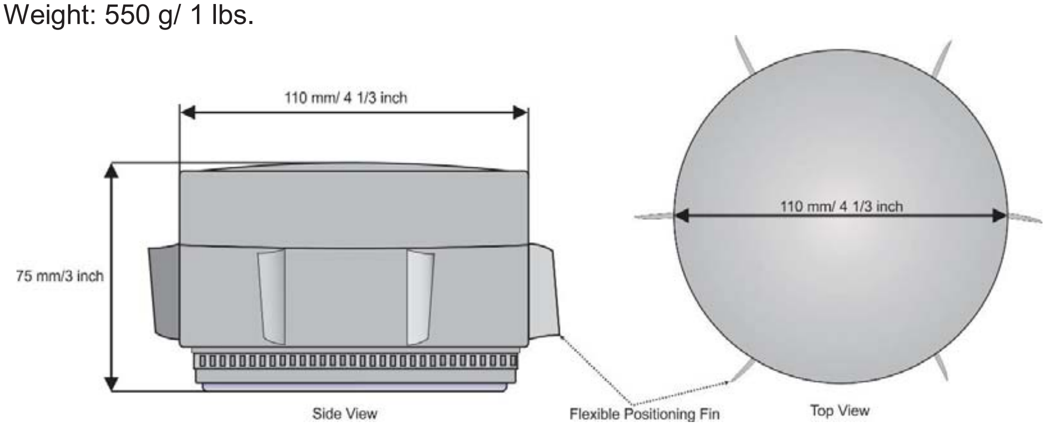

Figure 3 Sensor Dimensions

The color of the ParQSense Smart Sensor is grey. This is equal to RAL 7036 Platinum grey.

3.3 Electrical specifications

Parameter:	Specification:
Power supply	2 x Lithium Manganese Dioxide A size -cell battery, 10+ year lifetime
Electromagnetic emission	30 – 1000 MHz ref EN 301489-1, -3
Electromagnetic immunity	80 – 2000 MHz, 3V/m Ref EN 301489-1, -3
Electrostatic discharge (ESD)	Air discharge ± 8KV Contact discharge ± 4KV Ref EN 301489-1, -3

3.4 Environmental specifications

The Q-Free ParQSense Smart Sensor conforms to IEC 60721-3-4 Class 4K2/4Z5/4Z7/4B1/4C2(4C3)/4S2/4M5. This corresponds to Class 4.1 (Non-weather protected locations) as defined in ETSI EN 300 019 [2}.

Parameter:	Specification:
Operating temperature:	-40°C to +85°C / -40°F to +185°F
Storage temperature:	-40°C to +85°C / -40°F to +185°F
IP class:	IP 67

3.5 Operating modes

The Q-Free ParQSense Smart Sensor contains detection mechanisms for when the sensor is turned over activating the Active Mode. The two available operating modes (Transportation/Sleep Mode and Active Mode) are further explained in this chapter.

3.5.1 Transportation/Sleep Mode

The Q-Free ParQSense Smart Sensor is put in Transportation Mode in the last stage of manufacturing. This is a low power consumption mode in which the Q-Free ParQSense Smart Sensor turns off all radio interfaces and will not communicate. Transportation Mode is implemented to reduce the power consumption of the sensor, prevent unwanted radar and radiocommunication, and enable more efficient packaging, storage and shipping of the sensor. Transportation/Sleep Mode is activated by turning the sensor upside down.

The Q-Free ParQSense Smart Sensor is activated manually during installation by turning the sensor over.

Picture 1. Sensor in Transportation/Sleep Mode

3.5.2 Active Mode

Once the Q-Free ParQSense Smart Sensor is activated by turning it over during installation, the device starts a 4-minute (default) calibration period. Within this time the installer should have installed the sensor and cleared the parking spot. After this period, has elapsed, the sensor is fully active and starts emitting radar and magnetic pulses for occupancy detection as well as attempting to connect to the closest ParQSense Base Station.

This calibration procedure can also be initiated through the Q-Free ParQ software at any given time.

Picture 2. Sensor in Active Mode

3.6 Marking

3.6.1 Mandatory marking

The Q-Free ParQSense Smart Sensor is marked with the CE mark, the wastebasket, the C-Tick mark, FCC ID, and Q-Free brand mark.

3.6.2 Marking

The Q-Free ParQSense Smart Sensor housing will be marked with a label on the bottom side of sensor. The information printed on this label will contain the production specific information. An example of this information is, but may not be limited to:

- Q-Free Part number
- Serial number
- Revision
- A 2-D Barcode including the information above.

4 INTERFACES

4.1 Proprietary ISM radio interface

Interface	ISM radio sensor to ParQSense Base Station
Type	Proprietary ISM radio 868/915 MHz, packed binary data
User	ParQSense Smart Sensor and Base Station
Data	• Status information • Configuration • Monitoring • Firmware update

5 THEORY OF OPERATION

The ParQSense Smart Sensor relies on two object detection principles:

5.1 Primary radar sensor

The primary sensor in the sensor is a highly sophisticated extremely low power microwave radar.

This is developed taking advantage of technology made available from Q-Free's patented and well proven solutions used in semi passive 5,8 GHz CEN-DSRC tolling tags for more than 25 years.

It continuously monitors the reflection coefficients and absolute distance up to 1m/3.28 feet away and does not rely on ferrous materials in the parked vehicle. Even exotic vehicles made of aluminum or carbon fiber will easily be detected. Nearby objects outside the detection zone do not disturb its measurements.

This sensor typically has a **very high** detection rate, 99%+ for vehicles.

5.2 Secondary magnetic sensor

The secondary sensor is a 3-axis magneto resistive sensor which measures changes in the earth magnetic field due to ferrous objects in its proximity. Although a passive magnetic sensor normally performs well in this application, it is plagued with the fact that it is a passive sensor and only measures a relative value to a zero-point calibration which normally is done at the time of installation.

The ParQSense Smart Sensor introduces a concept where the magnetic sensor is continuously calibrated based on radar measurements. This will remove biases introduced by long term magnetic field changes on the parking spot caused by other objects or temperature variations.

This calibration concept makes the magnetic sensor a highly reliable source of data.

In the system, the normal task for the magnetic sensor is to provide parking data if the primary radar sensor is giving unreliable or inconclusive data. This will typically only happen if a relatively thick layer of water (>10 mm/0.4 inch) is covering the parking spot.

5.3 Detection setup

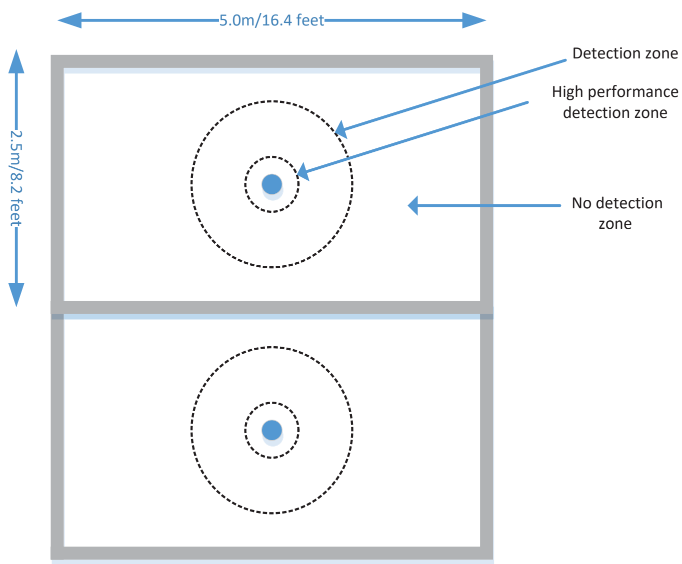

Figure 4 Detection area

By default, the sensor is set up to work in a standard parking space with the size of 2.5x5.0 meters/8.2x16.4 feet. The sensor is working on 2 performance zones:

- A parked object within the sensor's 0.5m/20-inch-high performance detection zone diameter will be detected with highest accuracy (>99 %)
- A parked object within the sensor's 1,0m/40-inch detection zone diameter will normally be detected but with lower accuracy (<99%)
- Objects parked outside these zones will not be detected

It is possible to extend the size of the detection zone if the parking spot is of different size by adjusting the sensitivity of the detectors. This can be accomplished in the Q-Free ParQSense software system.

5.4 Generic configurations

Parameter	Range	Default
Stable time from first sensor trigger before generating parking event	1-30 seconds	5 seconds
Periodic alive message	1-1440 minutes	30 minutes
Trigger threshold magnetic [advanced setting]	1-3	2
Trigger threshold radar [advanced setting]	1-3	2
Maximum detection distance radar [advanced setting]	0,5-2 m 1.64 feet – 6.56 feet	1 m 3.28 feet

- Magnetometer and radar threshold settings are defined as values:
  - 1- High sensitivity
  - 2- Medium sensitivity[default]
  - 3- Low sensitivity

Default configurations can be adjusted in the Q-Free ParQSense software.

6 PARQSENSE SMART SENSOR SPECIFICATIONS

6.1 Generic specifications

Parameter	Value
Detection principle	Active radar, passive magnetic sensor
Detection distance vertical	1,0m/3.28 feet [Typical], 2.0m/6.56 feet[Max]
Detection lobe diameter horizontal	0,5m/1.64 feet [Type] 1,0m/3.28 feet [Max]
Response time for generating parking event	Typical 5s (Configurable)
Operating frequency ISM radio	902-928MHz for FCC 863-870 MHz for EU/ETSI 915-928 MHz for Australia
Weather protection	IP67
Working temperature	-40/+85° C / -40/+185°F
Environmental specification	ETSI EN 300 019 Class 4.1 - Non-weather protected locations
Color	Gray, RAL 7036
Regulatory compliance Europe	Radio Equipment Directive - 2014/53/EU using: • ETSI EN 301 489-3 • ETSI EN 300-440 • ETSI EN 300-220 • ETSI EN 300-328 Waste Electrical and Electronic Equipment Directive – 2012/19/EU REACH – Regulation (EC) No 1907/2006 ROHS Directive - 2011/65/EU
Regulatory compliance USA / Canada	FCC 15.249 Industry Canada (ICED) Cellular: GCF, FCC
Regulatory compliance Australia	C-TICK

6.2 Physical (RF) layer specifications UHF communication interface

Parameter	Value
Operating frequency	902-927MHz for FCC, 863-870 MHz for EU/ETSI, 915-921 MHz for Australia
Modulation type	2-GFSK
Spectrum access	RTDMA-FHSS. 50 channels, 50 KHz spacing
Bitrate	2,4 Kbit/s
Rx sensitivity	-117 dBm, PER <1%
Maximum Tx Power	+13 dBm E.I.R.P
Adjacent channel blocking	50 dB at 25 KHz away from channel center frequency
Minimum out of band blocking	110 dB at 5 MHz from band edge
Antenna radiation pattern	Omni directional
Antenna polarization	Linear, Vertical

6.3 Physical (RF) layer specifications BLE communication interface (optional)

Parameter	Value
Operating frequency	2,4-2,48 GHz
Modulation type	2-GFSK
Bitrate	1 Mbit/s
Rx sensitivity	-93 dBm @ BER< 0,1%
Maximum Tx Power	+4 dBm E.I.R.P
Antenna radiation pattern	Omni directional
Antenna polarization	Linear, horizontal

6.4 Physical (RF) layer specifications Microwave transceiver

Parameter	Value
Operating frequency	5,8 GHz
Modulation type	BPSK
Spectrum access	DSSS, 10 MChips/s
Bitrate	Dynamic 0-1 Mbit/s
Rx sensitivity	-120dBm @ minimum baud rate
Maximum Tx Power	-50 dBm E.I.R.P / 1 MHz
Antenna radiation pattern	Omni directional
Antenna polarization	Linear, horizontal

6.5 Security

Communication is secured by the AES-128 EAX scheme. This enables both authentication of devices and encryption of the payload data. This ensures the integrity of the system and its parking data which is of paramount importance when utilizing the open 868/915 MHz ISM bands.

6.6 Security keys

The security keys are set in the sensors during manufacturing and distributed using highly secure KDSC's (key distribution centers) equal to the system used in manufacturing of Q-Free's road tolling devices.

There's distributed one set of 128 bit AES keys for each sensor.

6.7 Temperature sensor

The Q-Free ParQSense Smart Sensor contains a mechanism for measuring the surrounding temperature. This allows for the Q-Free ParQSense Smart Sensor to send out low temperature warnings through the Q-Free ParQSense software. The Temperature Measurement Module reports the surrounding temperature condition in regular uplink status frame.

7 FCC DECLARATIONS

7.1 Modification Statement (§15.21)

Changes or modifications to the equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

7.2 Compliance Statement (§15.19)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

7.3 RF exposure statement, for outdoor Mobile device (§2.1091)

To comply with FCC/IC RF exposure limits for general population / uncontrolled exposure, the antenna(s) used for this transmitter must be installed on outdoor permanent structures to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

7.4 FCC Testing Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

8 ISED DECLARATIONS

8.1 Interference Statement (RSS-GEN, Section 8.4)

This Device complies with Industry Canada License-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage ; (2) l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

9 BATTERY LIFETIME AND CONTROL

9.1 Battery Life Time

The battery lifetime is dependent on the use of the Q-Free ParQSense Smart Sensor and its surrounding temperature profile. As it is the case with all batteries, they will discharge slowly over time due to internal leakage, and this discharge current is dependent on the temperature of the battery. The temperature profile used for the discharge calculations is from an average European climate.

In order to save current consumption,

- The Q-Free ParQSense Smart Sensor is implemented with a sleep-function which reduces the current consumption when the sensor is in Transportation Mode. Transportation/Sleep Mode is achieved by turning the sensor upside down.
- The ParQSense Smart Sensor will automatically change status to Active Mode once it is manually turned over during the installation process.

After manufacturing, the Q-Free ParQSense Smart Sensor is put into a deep Sleep/Transportation Mode (see 3.5) and will not respond until it is activated. The Q-Free ParQSense Smart Sensor will be activated during the installation process.

Battery life for the ParQSense Smart Sensor is dependent on number of parking events per day. Please refer to the figure below for average estimates.

With an average number of 30 parking events per day, the battery lifetime can be estimated to be over 10+ years.

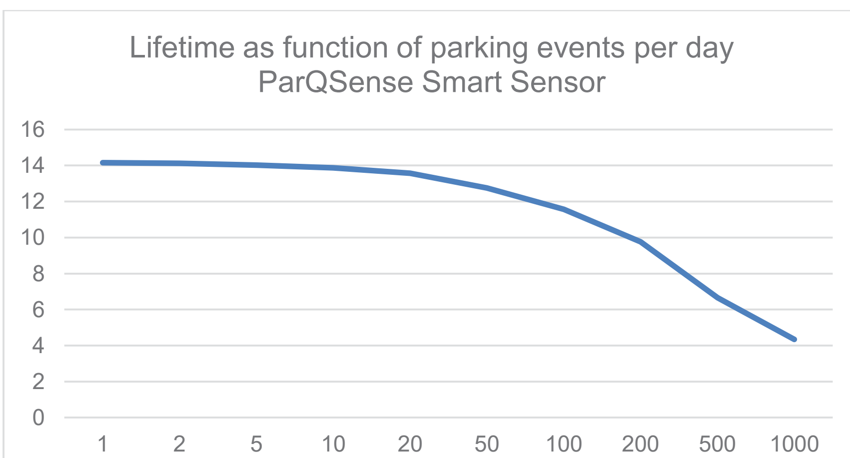

Figure 5: Sensor lifetime as function of parking event per day

9.2 Low battery voltage detection

The Q-Free ParQSense Smart Sensor contains a mechanism for measuring and determining when the battery is close to the end of its operational life. This will allow for the Q-Free ParQSense Smart Sensor to be replaced before the battery fails. The Battery Measurement Module reports the battery condition in regular uplink status frame.

10 PRODUCTION AND DELIVERY

10.1 Default delivery method

The Q-Free ParQSense Smart Sensor is manufactured according to the ISO 9001:2008 standards [10], stacked into trays, then into boxes, and finally onto pallets.

By default, the ParQSense Smart Sensor is delivered in Transportation Mode set as described in section 3.5.1.

Each ParQSense Smart Sensor has a unique ID printed on the sides as described in section 3.6.

10.2 Marking of delivery

Each 10-item box is marked with a label containing a unique box number and a corresponding barcode. The label will be applied on top of the 10-item box cover.

Each 100-item box is marked with a label containing a unique box number and a corresponding barcode. Three copies of the box label will be applied, one on front side, one on left side and one copy on right side of the box.

Each pallet is marked with a label containing a unique pallet number and a corresponding barcode. The pallet label will contain the box number of all 100-item boxes on the pallet. The pallet label will be attached onto all four sides of a completed pallet.

For each 100-item box an electronic file is generated containing the identification of all Q-Free ParQSense Smart Sensors in this box. These files will by default be delivered by electronic mail to a predefined address for each delivery.

11 WASTE MANAGEMENT & DISPOSAL

Q-Free and its selected manufacturing partners are certified according to ISO-9001 for quality management of processes for development and manufacturing. Q-Free and its selected manufacturing partners are also certified according to ISO-14001 for environmental management of development and manufacturing processes. This effectively means that throughout the whole value chain Q-Free and its manufacturing partners have established processes for ensuring product quality and sound environmental management minimizing the impact on the environment.

11.1 RoHs compliance

The Q-Free ParQSense Smart Sensors and its manufacturing process is compliant according to the EU ROHS directive (2011/65/EU) also called the RoHs2 directive. The directive is aimed at restriction of the use of certain hazardous substances in electrical and electronic equipment. All components, both electronic and mechanical in the Q-Free ParQSense Smart Sensor as well as all manufacturing processes are compliant to the strict limits set out in the RoHs directive. When the product is disposed of according to the waste management guidelines set out in the next sub chapter the product will have no or negligible impact on the environment

11.2 Waste management

The prime principle for Q-Free is waste prevention. Several measures have been taken in order to prevent waste and also to reduce the amount of material that goes into waste. As an example, the Q-Free ParQSense Smart Sensor transportation mode described in chapter 3.5 reduces battery consumption thus reducing the impact on the environment.

11.2.1 Waste management definitions

Waste management	Means the collection, transport, recovery and disposal of waste
EEE	electrical and electronic equipment' means equipment which is dependent on electric currents or electromagnetic fields in order to work properly
WEEE	Means EEE intended for waste and further waste management
Collection	Means the gathering of waste, including the preliminary sorting and preliminary storage of waste for the purposes of transport to a waste treatment facility
Separate collection	Means the collection where a waste stream is kept separately by type and nature so as to facilitate a specific treatment
Re-use	Means any operation by which products or components that are not waste are used again for the same purpose for which they were conceived
Treatment	Means recovery or disposal operations, including preparation prior to recovery or disposal
Recovery	Means any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfill a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy.
Preparing for re-use	Means checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing

Recycling	Means any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations
Disposal	Means any operation which is not recovery even where the operation has as a secondary consequence the reclamation of substances or energy.
Waste hierarchy	The following waste management hierarchy is the recommended order of priority in the prevention of waste (a) prevention; (b) re-use; (c) preparing for re-use; (d) recycling; (e) other recovery, e.g. energy recovery; (f) disposal.

11.2.2 Items applicable for waste management

All items applicable for waste management in relation with delivery of the Q-Free ParQSense Smart Sensors are listed below

Item	Description	Waste management
Pallet	Euro pallet made of wood for carrying 100-item boxes	1. Re-use 2. Recycling
Pallet plastic foil	Plastic foil wrapped around 100 item boxes on pallet to secure cargo on pallet	1. Re-use 2. Recycling
100-item box with ParQSense Smart Sensors	Box made of card-board holding 10 pieces of 10-item box	1. Re-use 2. Recycling
10-item box with ParQSense Smart Sensors	Plastic box made of APET clear plastic film 0,5mm	1. Re-use 2. Recycling
ParQSense Smart Sensors encapsulation	Bracket, top and bottom part encapsulation made of TPU and PP plastics	1. Treatment: disassemble 2. Collect for 3. Recycling
ParQSense Smart Sensor Battery	Lithium LiMnO2 A-Cell battery	1. Treatment: disassemble from 2. Collect for 3. Recycling/Disposal according to national or regional regulations
ParQSense Smart Sensor PCBA	Assembled Printed Circuit Board (PCBA) containing electronic components	1. Collect for 2. Recycling/Disposal according to national or regional regulations

12 FAQ

- Q: What happens if the sensor is covered by paper box?

  A: Detection should still function due to dual detection technology set-up; the magnetometer in the sensor should detect the car.

- Q: What happens with the sensor when used in road side parking and normal traffic tends to drive close by the parking spaces when not occupied, would this drain the battery?

  A: The radar has very high resolution and is only looking within the parking space itself and will not trigger on passing cars.

- Q: How will the sensors be installed in hilly environments?

  A: They should be installed parallel to the car for optimum detection same as for standard installations.

JAMES MADISON UNIVERSITY.

December 18, 2018

ADDENDUM NO.: ONE (1)
TO ALL OFFERORS:

REFERENCE: Request for Proposal No: **RFP# MPM-1034**
Dated: **December 7, 2018**
RFP Closing On: **January 8, 2019 at 2:00 p.m. *(Eastern)***

Please note the clarifications and/or changes made on this proposal program:

1. Does the parking technology vendor need to provide technology for all 80 lots and 6 garages?
   a. The University is currently more interested in providing occupancy information for existing and future parking decks with the potential to expand to include surface lots at a later date.
2. If yes, are you able to provide offerors with a list of the lots and garages?
   a. The JMU campus currently includes the following 5 garages that employ vehicle count systems.
      i. Champions Drive Parking Deck – 492 spaces (453 commuter – 13 faculty/staff – 12 service vehicle – 8 ADA – 6 parking customers)
      ii. Chesapeake Avenue Parking Deck – 650 spaces (637 commuter – 13 ADA)
      iii. Grace Street Parking Deck – 477 spaces (402 commuter – 63 faculty/staff – 12 ADA)
      iv. Mason Street Parking Deck – 1015 spaces (602 faculty/staff – 172 hotel guest – 119 hotel valet – 99 metered – 23 ADA)
      v. Warsaw Avenue Parking Deck – 782 spaces (542 commuter – 223 faculty/staff – 17 ADA)
      vi. A 6th parking deck that will include vehicle count system equipment is currently under construction and will provide approximately 1500 spaces for faculty/staff, commuters and guests.
3. How many spaces are in the parking lots and how many are in the garages?
   a. Our parking decks include a total of approximately 3,600 parking spaces with our surface lots providing approximately 8,500 additional parking spaces for a total of just over 12,000 parking spaces campus wide.
4. Is the vendor responsible for delivering a full turn-key solution?
   a. Any viable solution should include on-site installation, training and technical support with the university's initial responsibility being limited to operating and maintaining the software and hardware once it's up and running.
5. Please elaborate on the seamless communication between two potential parking systems.
   a. The university has vehicle count system equipment in five existing parking decks that provides real-time occupancy information that is communicated to constituents via the Parking Services website and on electronic signage strategically located near facilities and on nearby streets. As indicated in the RFP, any vehicle count system that is introduced will need to be capable of sharing occupancy information via electronic signage, porting information to the Parking Services website and sharing information with a future smart phone app. In order for the university to continue to provide occupancy information for existing and future facilities, both the current

solution and future solution will need to provide count data that can be combined to provide real-time occupancy information for constituents.

6. Is there currently Wi-Fi available in the parking lots/garages requiring single space detection?
    a. While Wi-Fi is routinely available throughout the campus, no Wi-Fi access points are currently available in the university's parking decks. Some decks may have access to Wi-Fi due to proximity to campus buildings but they do not have their own Wi-Fi service. Single space counting is currently accomplished by hardwiring individual sensors to a modem that then communicates wireless with a gateway that is directly connected to the university's network.
7. Please list the number of entry and exit lanes, reversible lanes, etc.
    a. Warsaw Deck: 1 entry lane on ground at the north entrance
    1 exit lane on ground at the north entrance
    1 entry lane on ground at the south entrance
    1 exit lane on ground at the south entrance
    2 entry lanes on the second level
    2 exit lanes on the second level

    b. Grace Deck: 1 entry lane at the ground floor entrance
    1 exit lane at the ground floor entrance
    1 entry lane at the second floor entrance
    1 exit lane at the second floor entrance

    c. Mason Deck: 1 entry lane on the ground floor on MLK Jr. Way
    1 exit lane on the ground floor on MLK Jr. Way
    1 exit lane on the ground floor on Mason Street
    1 entry lane on the second floor on Mason Street
    1 exit lane on the second floor on Mason Street
    1 entry lane on the third level
    1 exit lane on the third level

    d. Champions Deck: 1 entry lane at the ground floor entrance
    1 exit lane at the ground floor entrance

    e. Chesapeake Deck: 1 entry lane at the ground floor entrance
    1 exit lane at the ground floor entrance
    1 entry lane on level 3 at the gate location
    1 exit lane on level 3 at the gate location
    1 entry lane on level 4 at the gate location
    1 exit lane on level 4 at the gate location
    1 entry lane on level 5 at the gate location
    1 exit lane on level 5 at the gate location

    f. Note: all entry and exit points will need to be bidirectional as vehicular traffic cannot be consistently relied upon to utilize the proper lane

8. Will electrical and network be provided to each location?

JAMES MADISON UNIVERSITY.

   a. The current vehicle count system relies upon wireless communication back to a gateway in the telecom room located in each garage and low voltage (24v) power for sensors. There is electrical conduit in place at each of the entry/exit locations mentioned above but wire may have to be pulled because, in many instances, the installation relied upon 6 conductor cable to provide a pathway for both data and low voltage power.

9. How many signs at each location?
   a. The number of signs per location varies between 1 and 3 with a total of 17 campus-wide at this time.

10. Do you want simply an overall count of each garage or lot or do you want level by level counts or space by space counts?
    a. Most of our garages are split between multiple use groups so we want to provide counts of spaces for each group that utilizes a portion of each garage. That can include commuters, faculty/staff, hotel guests, valet parking, metered parking, etc.

Signify receipt of this addendum by initialing *"Addendum # **1**"* on the signature page of your proposal.

Sincerely,

Michael Morrison

Michael Morrison
Buyer Senior
Phone: (540-568-6181)

JAMES MADISON UNIVERSITY

December 26, 2018

ADDENDUM NO.: TWO (2)
TO ALL OFFERORS:

REFERENCE:	Request for Proposal No:	**RFP# MPM-1034**
	Dated:	**December 7, 2018**
	RFP Closing On:	**January 16, 2019 at 2:00 p.m. *(Eastern)***

Please note the clarifications and/or changes made on this proposal program:

1. Please note the following change to the RFP Closing Date.
   a. Proposals are due no later than 2:00 PM on **Wednesday January 16, 2019**.
2. Please note the following clarification.
   a. The University has received numerous questions asking for specific technical data and drawings, specifications, etc. for this RFP. Please read the Statement of Needs carefully and provide the requested information. This RFP is not for a specific project but seeks proposals describing the Offeror's proposed vehicle count system, related costs, and the ability of that count system to share information.
3. Regarding the Zone Map.
   a. James Madison University intends this contract to be cooperative, such that other agencies may be able to utilize this contract. The zone map is included to show the different VASCUPP regions (https://vascupp.org/) with cooperating institutions. JMU is part of region two. Any pricing differences which might apply to your proposals for other regions can be enumerated using the various zones for guidance. If location is not a specific factor, then pricing shall be established as being the same as offered to JMU in the Offeror's proposal.

Signify receipt of this addendum by initialing *"Addendum # **2**"* on the signature page of your proposal.

Sincerely,

Michael Morrison

Michael Morrison
Buyer Senior
Phone: (540-568-6181)

JAMES MADISON UNIVERSITY

Request for Proposal

RFP# MPM-1034

VEHICLE COUNT SYSTEMS

December 7, 2018

VIRGINIA ASSOCIATION OF STATE COLLEGE & UNIVERSITY PURCHASING PROFESSIONALS

VASCUPP

REQUEST FOR PROPOSAL

RFP# MPM-1034

Issue Date: **10/7/2018**

Title: **Vehicle Count Systems**

Issuing Agency: **Commonwealth of Virginia**
James Madison University
Procurement Services MSC 5720
752 Ott Street, Wine Price Building
First Floor, Suite 1023
Harrisonburg, VA 22807

Period of Contract: From Date of Award Through One Year (Renewable)

Sealed Proposals Will Be Received Until 2:00 PM on January 8, 2019 for Furnishing The Services Described Herein.

MANDATORY PRE-PROPOSAL: No Pre-Proposal meeting is scheduled/required for this RFP.

SEALED PROPOSALS MAY BE MAILED, EXPRESS MAILED, OR HAND DELIVERED DIRECTLY TO THE ISSUING AGENCY SHOWN ABOVE.

All Inquiries For Information And Clarification Should Be Directed To: Michael Morrison, Buyer Senior, Procurement Services, morrismp@jmu.edu; 540-568-6181; (Fax) 540-568-7935 not later than five business days before the proposal closing date.

NOTE: THE SIGNED PROPOSAL AND ALL ATTACHMENTS SHALL BE RETURNED.
In compliance with this Request for Proposal and to all the conditions imposed herein, the undersigned offers and agrees to furnish the goods/services in accordance with the attached signed proposal or as mutually agreed upon by subsequent negotiation.

Name and Address of Firm:

____

____

____

By: ______________________________
(Signature in Ink)

Name: ______________________________
(Please Print)

Date: ______________________ Title: ______________________

Web Address: ______________________ Phone: ______________________

Email: ______________________ Fax #: ______________________

ACKNOWLEDGE RECEIPT OF ADDENDUM: #1_____ #2_____ #3_____ #4_____ #5_____ (please initial)

SMALL, WOMAN OR MINORITY OWNED BUSINESS:
☐ YES; ☐ NO; *IF YES* ⇒ ⇒ ☐ SMALL; ☐ WOMAN; ☐ MINORITY ***IF MINORITY***: ☐ AA; ☐ HA; ☐ AsA; ☐ NW; ☐ Micro

Note: This public body does not discriminate against faith-based organizations in accordance with the *Code of Virginia*, § 2.2-4343.1 or against an offeror because of race, religion, color, sex, national origin, age, disability, or any other basis prohibited by state law relating to discrimination in employment.

Rev. 12/9/15 *(Previous Rev 8/18/15)* LMF

REQUEST FOR PROPOSAL

RFP# MPM-1034

TABLE OF CONTENTS

I. PURPOSE

The purpose of this Request for Proposal (RFP) is to solicit sealed proposals from qualified sources to enter into a contract to provide vehicle count systems for James Madison University (JMU), an agency of the Commonwealth of Virginia. Initial contract shall be for one (1) year with an option to renew for four (4) additional one-year periods.

II. BACKGROUND

James Madison University (JMU) is a comprehensive public institution in Harrisonburg, Virginia with an enrollment of nearly 22,000 students and over 3,000 faculty and staff. There are over 600 individual departments on campus that support seven academic divisions. The University offers over 120 majors, minors, and concentrations. Further information about the University may be found at the following website: http://www.jmu.edu.

Currently, JMU Parking Services operates 6 parking decks and approximately 80 surface lots for faculty, staff, and student permit parking.

III. SMALL, WOMAN-OWNED AND MINORITY PARTICIPATION

It is the policy of the Commonwealth of Virginia to contribute to the establishment, preservation, and strengthening of small businesses and businesses owned by women and minorities, and to encourage their participation in State procurement activities. The Commonwealth encourages contractors to provide for the participation of small businesses and businesses owned by women and minorities through partnerships, joint ventures, subcontracts, and other contractual opportunities. Attachment B contains information on reporting spend data with subcontractors.

IV. STATEMENT OF NEEDS

Contractor shall describe their ability to provide the following to the University. JMU reserves the right to change, add, or delete services; in the best interest of the University.

A. Contractor shall perform work between 7:30 AM – 4:00 PM, Monday through Friday.

B. Vehicle counting technology that can be installed in parking garages or surface lots that detects vehicles upon entry and exit to facilities or zones within facilities in order to provide accurate counts of available spaces within each facility or zone.

   1. This technology needs to be capable of being relocated to alternate locations within facilities in order to adjust to future changes in parking allocations.
   2. Inductive loops are not desirable as they require cutting into precast concrete thus compromising the structural integrity of parking garages.

C. Technology that is capable of monitoring the occupancy of individual parking spaces within facilities and incorporating that information into the overall occupancy of those facilities. This technology or technologies should be capable of counting individual spaces within both parking garages and surface lots.

D. Electronic signage that is capable of displaying current occupancy within facilities in real-time in order to guide drivers to facilities with open parking spaces. This signage should also include the capability to scroll messaging as needed in order communicate pertinent information to drivers.

E. Provide the complete specifications of all new equipment and operational components for a turn-key installation.

F. The various technologies employed need to communicate seamlessly in order to provide real-time information about facility occupancy to drivers. Where possible, communication between components should be achieved wirelessly in order to reduce the cost of installation and increase flexibility with regards to placement. A mesh network is preferred.

G. A software application that communicates with the various pieces of technology located across the campus, provides information in real-time about parking availability and includes the status of each piece of equipment included in the system.

1. The software should include a customizable graphical user interface that provides a visual representation of the signage and equipment across the campus as well as the current status of the pieces of equipment in specific facilities.
2. Users must have the capability to correct counts of open spaces remotely via the graphical user interface.
3. The software should include reporting capabilities that allow users to view, generate and store occupancy reports.
4. The software should have the capability to send alerts via email. The GUI needs to support sending and creating custom messages for variable message signs.
5. Describe licensing. If licensing of the software is based on number of users or screens, etc. describe the models used to obtain numbers both for current and future usage.

H. An open web API module that allows the occupancy information generated by the system to be shared with websites and mobile applications in order to port real-time parking availability information to the department's website and an anticipated future mobile application for Android and iOS smart phones.

I. All system hardware and software needs to be able to be maintained by department personnel and vendor tech support needs to be available via remote access.

J. Consistency and stability of the hardware and software – as well as rapid correction of system failures – are critical to JMU.

1. Describe the maintenance philosophy including frequency of updates as well as the approach to obtaining and completing updates.
2. Describe your ability to respond to emergency situations to include average response time, costs associated with responding to emergency situations (to include weekend, nights, and holidays). Include method of communication for emergency situations.
3. Describe capabilities for remote support and describe what access to accounts and systems is required. Describe the locations from which this activity would take place.
4. Describe any maintenance options/tiers and whether they vary in cost by time of day, response time, etc.

K. All costs shall be exclusive of travel. Exception may be granted by JMU on a case-by-case basis. In the event an exception is made, contractors billing for travel-related expenses must be billed in accordance with the Commonwealth of Virginia's per diem allowance for lodging, meals, and incidental expenses at the time of travel which can be referenced at http://www.jmu.edu/finprocedures/4000/4215mie.shtml.

L. All services provided under this contract shall be by trained repair technicians and all work shall be performed in a workmanlike manner in accordance with the manufacturer's recommended equipment maintenance procedures. Submit all qualifications and certifications associated with the different systems.

V. PROPOSAL PREPARATION AND SUBMISSION

A. GENERAL INSTRUCTIONS

To ensure timely and adequate consideration of your proposal, offerors are to limit all contact, whether verbal or written, pertaining to this RFP to the James Madison University Procurement Office for the duration of this Proposal process. Failure to do so may jeopardize further consideration of Offeror's proposal.

1. RFP Response: In order to be considered for selection, the **Offeror shall submit a complete response to this RFP**; and shall submit to the issuing Purchasing Agency:

   a. **One (1) original** and **one (1) copy** of the entire proposal, INCLUDING ALL ATTACHMENTS. Any proprietary information should be clearly marked in accordance with 3.f. below.

   b. **One (1) electronic copy in WORD format or searchable PDF** (*CD or flash drive*) of the entire proposal, INCLUDING ALL ATTACHMENTS. Any proprietary information should be clearly marked in accordance with 3.f. below.

   c. Should the proposal contain **proprietary information**, provide **one (1) redacted hard copy** of the proposal and all attachments with **proprietary portions removed or blacked out**. This copy should be clearly marked "*Redacted Copy*" on the front cover. The classification of an entire proposal document, line item prices, and/or total proposal prices as proprietary or trade secrets is not acceptable. JMU shall not be responsible for the Contractor's failure to exclude proprietary information form this redacted copy.

   No other distribution of the proposal shall be made by the Offeror.

2. The version of the solicitation issued by JMU Procurement Services, as amended by an addenda, is the mandatory controlling version of the document. Any modification of, or additions to, the solicitation by the Offeror shall not modify the official version of the solicitation issued by JMU Procurement services unless accepted in writing by the University. Such modifications or additions to the solicitation by the Offeror may be cause for rejection of the proposal; however, JMU reserves the right to decide, on a case-by-case basis in its sole discretion, whether to reject such a proposal. If the modification or additions are not identified until after the award of the contract, the controlling version of the solicitation document shall still be the official state form issued by Procurement Services.

3. Proposal Preparation

a. Proposals shall be signed by an authorized representative of the Offeror. All information requested should be submitted. Failure to submit all information requested may result in the purchasing agency requiring prompt submissions of missing information and/or giving a lowered evaluation of the proposal. Proposals which are substantially incomplete or lack key information may be rejected by the purchasing agency. Mandatory requirements are those required by law or regulation or are such that they cannot be waived and are not subject to negotiation.

b. Proposals shall be prepared simply and economically, providing a straightforward, concise description of capabilities to satisfy the requirements of the RFP. Emphasis should be placed on completeness and clarity of content.

c. Proposals should be organized in the order in which the requirements are presented in the RFP. All pages of the proposal should be numbered. Each paragraph in the proposal should reference the paragraph number of the corresponding section of the RFP. It is also helpful to cite the paragraph number, sub letter, and repeat the text of the requirement as it appears in the RFP. If a response covers more than one page, the paragraph number and sub letter should be repeated at the top of the next page. The proposal should contain a table of contents which cross references the RFP requirements. Information which the offeror desires to present that does not fall within any of the requirements of the RFP should be inserted at the appropriate place or be attached at the end of the proposal and designated as additional material. Proposals that are not organized in this manner risk elimination from consideration if the evaluators are unable to find where the RFP requirements are specifically addressed.

d. As used in this RFP, the terms “must”, “shall”, “should” and “may” identify the criticality of requirements. “Must” and “shall” identify requirements whose absence will have a major negative impact on the suitability of the proposed solution. Items labeled as “should” or “may” are highly desirable, although their absence will not have a large impact and would be useful, but are not necessary. Depending on the overall response to the RFP, some individual “must” and “shall” items may not be fully satisfied, but it is the intent to satisfy most, if not all, “must” and “shall” requirements. The inability of an offeror to satisfy a “must” or “shall” requirement does not automatically remove that offeror from consideration; however, it may seriously affect the overall rating of the offeror’s proposal.

e. Each copy of the proposal should be bound or contained in a single volume where practical. All documentation submitted with the proposal should be contained in that single volume.

f. Ownership of all data, materials and documentation originated and prepared for the State pursuant to the RFP shall belong exclusively to the State and be subject to public inspection in accordance with the Virginia Freedom of Information Act. Trade secrets or proprietary information submitted by the offeror shall not be subject to public disclosure under the Virginia Freedom of Information Act; however, the offeror must invoke the protection of Section 2.2-4342F of the Code of Virginia, in writing, either before or at the time the data is submitted. The written notice must specifically identify the data or materials to be protected and state the reasons why protection is necessary. The proprietary or trade secret materials submitted must be identified by some distinct method such as highlighting or underlining and must indicate only the specific words, figures, or paragraphs that constitute trade secret or proprietary information. The classification of an entire proposal document, line item prices and/or total proposal prices as proprietary or trade secrets is not acceptable and will result in rejection and return of the proposal.

4. Oral Presentation: Offerors who submit a proposal in response to this RFP may be required to give an oral presentation of their proposal to James Madison University. This provides an opportunity for the Offeror to clarify or elaborate on the proposal. This is a fact-finding and explanation session only and does not include negotiation. James Madison University will schedule the time and location of these presentations. Oral presentations are an option of the University and may or may not be conducted. Therefore, proposals should be complete.

B. SPECIFIC PROPOSAL INSTRUCTIONS

Proposals should be as thorough and detailed as possible so that James Madison University may properly evaluate your capabilities to provide the required services. Offerors are required to submit the following items as a complete proposal:

1. Return RFP cover sheet and all addenda acknowledgements, if any, signed and filled out as required.

2. Plan and methodology for providing the goods/services as described in Section IV. Statement of Needs of this Request for Proposal.

3. A written narrative statement to include, but not be limited to, the expertise, qualifications, and experience of the firm and resumes of specific personnel to be assigned to perform the work.

4. Offeror Data Sheet, included as *Attachment A* to this RFP.

5. Small Business Subcontracting Plan, included as *Attachment B* to this RFP. Offeror shall provide a Small Business Subcontracting plan which summarizes the planned utilization of Department of Small Business and Supplier Diversity (SBSD)-certified small businesses which include businesses owned by women and minorities, when they have received Department of Small Business and Supplier Diversity (SBSD) small business certification, under the contract to be awarded as a result of this solicitation. This is a requirement for all prime contracts in excess of $100,000 unless no subcontracting opportunities exist.

6. Identify the amount of sales your company had during the last twelve months with each VASCUPP Member Institution. A list of VASCUPP Members can be found at: www.VASCUPP.org.

7. Proposed Cost. See Section X. Pricing Schedule of this Request for Proposal.

VI. EVALUATION AND AWARD CRITERIA

A. EVALUATION CRITERIA

Proposals shall be evaluated by James Madison University using the following criteria:

		Points
1.	Quality of products/services offered and suitability for intended purposes	25
2.	Qualifications and experience of Offeror in providing the goods/services	20
3.	Specific plans or methodology to be used to perform the services	25
4.	Participation of Small, Women-Owned, & Minority (SWaM) Businesses	10
5.	Cost	20
		100

B. **AWARD**: Selection shall be made of two or more offerors deemed to be fully qualified and best suited among those submitting proposals on the basis of the evaluation factors included in the Request for Proposals, including price, if so stated in the Request for Proposals. Negotiations shall be conducted with the offerors so selected. Price shall be considered, but need not be the sole determining factor. After negotiations have been conducted with each offeror so selected, the agency shall select the offeror which, in its opinion, has made the best proposal, and shall award the contract to that offeror. The Commonwealth may cancel this Request for Proposals or reject proposals at any time prior to an award, and is not required to furnish a statement of the reasons why a particular proposal was not deemed to be the most advantageous. Should the Commonwealth determine in writing and in its sole discretion that only one offeror is fully qualified, or that one offeror is clearly more highly qualified than the others under consideration, a contract may be negotiated and awarded to that offeror. The award document will be a contract incorporating by reference all the requirements, terms and conditions of the solicitation and the contractor's proposal as negotiated.

VII. GENERAL TERMS AND CONDITIONS

A. PURCHASING MANUAL: This solicitation is subject to the provisions of the Commonwealth of Virginia's Purchasing Manual for Institutions of Higher Education and Their Vendors and any revisions thereto, which are hereby incorporated into this contract in their entirety. A copy of the manual is available for review at the purchasing office. In addition, the manual may be accessed electronically at http://www.jmu.edu/procurement or a copy can be obtained by calling Procurement Services at (540) 568-3145.

B. APPLICABLE LAWS AND COURTS: This solicitation and any resulting contract shall be governed in all respects by the laws of the Commonwealth of Virginia and any litigation with respect thereto shall be brought in the courts of the Commonwealth. The Contractor shall comply with applicable federal, state and local laws and regulations.

C. ANTI-DISCRIMINATION: By submitting their proposals, offerors certify to the Commonwealth that they will conform to the provisions of the Federal Civil Rights Act of

1964, as amended, as well as the Virginia Fair Employment Contracting Act of 1975, as amended, where applicable, the Virginians With Disabilities Act, the Americans With Disabilities Act and §10 of the Rules Governing Procurement, Chapter 2, Exhibit J, Attachment 1 (available for review at http://www.jmu.edu/procurement). If the award is made to a faith-based organization, the organization shall not discriminate against any recipient of goods, services, or disbursements made pursuant to the contract on the basis of the recipient's religion, religious belief, refusal to participate in a religious practice, or on the basis of race, age, color, gender or national origin and shall be subject to the same rules as other organizations that contract with public bodies to account for the use of the funds provided; however, if the faith-based organization segregates public funds into separate accounts, only the accounts and programs funded with public funds shall be subject to audit by the public body. *(§6 of the Rules Governing Procurement*).

In every contract over $10,000 the provisions in 1. and 2. below apply:

1. During the performance of this contract, the contractor agrees as follows:

    a. The contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, age, disability, or any other basis prohibited by state law relating to discrimination in employment, except where there is a bona fide occupational qualification reasonably necessary to the normal operation of the contractor. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.

    b. The contractor, in all solicitations or advertisements for employees placed by or on behalf of the contractor, will state that such contractor is an equal opportunity employer.

    c. Notices, advertisements, and solicitations placed in accordance with federal law, rule, or regulation shall be deemed sufficient for the purpose of meeting these requirements.

2. The contractor will include the provisions of 1. Above in every subcontract or purchase order over $10,000, so that the provisions will be binding upon each subcontractor or vendor.

D. <u>ETHICS IN PUBLIC CONTRACTING</u>: By submitting their proposals, offerors certify that their proposals are made without collusion or fraud and that they have not offered or received any kickbacks or inducements from any other offeror, supplier, manufacturer or subcontractor in connection with their proposal, and that they have not conferred on any public employee having official responsibility for this procurement transaction any payment, loan, subscription, advance, deposit of money, services or anything of more than nominal value, present or promised, unless consideration of substantially equal or greater value was exchanged.

E. <u>IMMIGRATION REFORM AND CONTROL ACT OF 1986</u>: By entering into a written contract with the Commonwealth of Virginia, the Contractor certifies that the Contractor does not, and shall not during the performance of the contract for goods and services in the Commonwealth, knowingly employ an unauthorized alien as defined in the federal Immigration Reform and Control Act of 1986.

F. DEBARMENT STATUS: By submitting their proposals, offerors certify that they are not currently debarred by the Commonwealth of Virginia from submitting proposals on contracts for the type of goods and/or services covered by this solicitation, nor are they an agent of any person or entity that is currently so debarred.

G. ANTITRUST: By entering into a contract, the contractor conveys, sells, assigns, and transfers to the Commonwealth of Virginia all rights, title and interest in and to all causes of action it may now have or hereafter acquire under the antitrust laws of the United States and the Commonwealth of Virginia, relating to the particular goods or services purchased or acquired by the Commonwealth of Virginia under said contract.

H. MANDATORY USE OF STATE FORM AND TERMS AND CONDITIONS RFPs: Failure to submit a proposal on the official state form provided for that purpose may be a cause for rejection of the proposal. Modification of or additions to the General Terms and Conditions of the solicitation may be cause for rejection of the proposal; however, the Commonwealth reserves the right to decide, on a case by case basis, in its sole discretion, whether to reject such a proposal.

I. CLARIFICATION OF TERMS: If any prospective offeror has questions about the specifications or other solicitation documents, the prospective offeror should contact the buyer whose name appears on the face of the solicitation no later than five working days before the due date. Any revisions to the solicitation will be made only by addendum issued by the buyer.

J. PAYMENT:

1. To Prime Contractor:

   a. Invoices for items ordered, delivered and accepted shall be submitted by the contractor directly to the payment address shown on the purchase order/contract. All invoices shall show the state contract number and/or purchase order number; social security number (for individual contractors) or the federal employer identification number (for proprietorships, partnerships, and corporations).

   b. Any payment terms requiring payment in less than 30 days will be regarded as requiring payment 30 days after invoice or delivery, whichever occurs last. This shall not affect offers of discounts for payment in less than 30 days, however.

   c. All goods or services provided under this contract or purchase order, that are to be paid for with public funds, shall be billed by the contractor at the contract price, regardless of which public agency is being billed.

   d. The following shall be deemed to be the date of payment: the date of postmark in all cases where payment is made by mail, or the date of offset when offset proceedings have been instituted as authorized under the Virginia Debt Collection Act.

   e. Unreasonable Charges. Under certain emergency procurements and for most time and material purchases, final job costs cannot be accurately determined at the time orders are placed. In such cases, contractors should be put on notice that final payment in full is contingent on a determination of reasonableness with respect to all invoiced charges. Charges which appear to be unreasonable will be researched and challenged, and that portion of the invoice held in abeyance until a settlement can be reached. Upon determining that invoiced charges are not reasonable, the Commonwealth shall promptly notify the contractor, in writing, as to those charges which it considers unreasonable and the basis for the determination. A contractor may not institute legal action unless a settlement cannot be reached within thirty (30) days of notification. The provisions of this section do not relieve an agency of its prompt payment obligations with respect to those charges which are not in dispute (*Rules Governing Procurement, Chapter 2, Exhibit J, Attachment 1 § 53; available for review at http://www.jmu.edu/procurement*).

2. To Subcontractors:

   a. A contractor awarded a contract under this solicitation is hereby obligated:

      (1) To pay the subcontractor(s) within seven (7) days of the contractor's receipt of payment from the Commonwealth for the proportionate share of the payment received for work performed by the subcontractor(s) under the contract; or

      (2) To notify the agency and the subcontractors, in writing, of the contractor's intention to withhold payment and the reason.

   b. The contractor is obligated to pay the subcontractor(s) interest at the rate of one percent per month (unless otherwise provided under the terms of the contract) on all amounts owed by the contractor that remain unpaid seven (7) days following receipt of payment from the Commonwealth, except for amounts withheld as stated in (2) above. The date of mailing of any payment by U. S. Mail is deemed to be payment to the addressee. These provisions apply to each sub-tier contractor performing under the primary contract. A contractor's obligation to pay an interest charge to a subcontractor may not be construed to be an obligation of the Commonwealth.

   c. Each prime contractor who wins an award in which provision of a SWAM procurement plan is a payment, evidence and certification of compliance (subject only to insubstantial shortfalls and to shortfalls arising from subcontractor default) with the SWAM procurement plan. Final payment under the contract in question may be withheld until such certification is delivered and, if necessary, confirmed by the agency or institution, or other appropriate penalties may be assessed in lieu of withholding such payment.

   d. The Commonwealth of Virginia encourages contractors and subcontractors to accept electronic and credit card payments.

K. <u>PRECENDENCE OF TERMS</u>: Paragraphs A through J of these General Terms and Conditions and the Commonwealth of Virginia Purchasing Manual for Institutions of Higher Education and their Vendors, shall apply in all instances. In the event there is a conflict between any of the other General Terms and Conditions and any Special Terms and Conditions in this solicitation, the Special Terms and Conditions shall apply.

L. <u>QUALIFICATIONS OF OFFERORS</u>: The Commonwealth may make such reasonable investigations as deemed proper and necessary to determine the ability of the offeror to perform the services/furnish the goods and the offeror shall furnish to the Commonwealth all such information and data for this purpose as may be requested. The Commonwealth reserves the right to inspect offeror's physical facilities prior to award to satisfy questions regarding the offeror's capabilities. The Commonwealth further reserves the right to reject any proposal if the evidence submitted by, or investigations of, such offeror fails to satisfy the Commonwealth that such offeror is properly qualified to carry out the obligations of the contract and to provide the services and/or furnish the goods contemplated therein.

M. TESTING AND INSPECTION: The Commonwealth reserves the right to conduct any test/inspection it may deem advisable to assure goods and services conform to the specifications.

N. ASSIGNMENT OF CONTRACT: A contract shall not be assignable by the contractor in whole or in part without the written consent of the Commonwealth.

O. CHANGES TO THE CONTRACT: Changes can be made to the contract in any of the following ways:

1. The parties may agree in writing to modify the scope of the contract. An increase or decrease in the price of the contract resulting from such modification shall be agreed to by the parties as a part of their written agreement to modify the scope of the contract.

2. The Purchasing Agency may order changes within the general scope of the contract at any time by written notice to the contractor. Changes within the scope of the contract include, but are not limited to, things such as services to be performed, the method of packing or shipment, and the place of delivery or installation. The contractor shall comply with the notice upon receipt. The contractor shall be compensated for any additional costs incurred as the result of such order and shall give the Purchasing Agency a credit for any savings. Said compensation shall be determined by one of the following methods:

   a. By mutual agreement between the parties in writing; or

   b. By agreeing upon a unit price or using a unit price set forth in the contract, if the work to be done can be expressed in units, and the contractor accounts for the number of units of work performed, subject to the Purchasing Agency's right to audit the contractor's records and/or to determine the correct number of units independently; or

   c. By ordering the contractor to proceed with the work and keep a record of all costs incurred and savings realized. A markup for overhead and profit may be allowed if provided by the contract. The same markup shall be used for determining a decrease in price as the result of savings realized. The contractor shall present the Purchasing Agency with all vouchers and records of expenses incurred and savings realized. The Purchasing Agency shall have the right to audit the records of the contractor as it deems necessary to determine costs or savings. Any claim for an adjustment in price under this provision must be asserted by written notice to the Purchasing Agency within thirty (30) days from the date of receipt of the written order from the Purchasing Agency. If the parties fail to agree on an amount of adjustment, the question of an increase or decrease in the contract price or time for performance shall be resolved in accordance with the procedures for resolving disputes provided by the Disputes Clause of this contract or, if there is none, in accordance with the disputes provisions of the Commonwealth of Virginia Purchasing Manual for Institutions of Higher Education and their Vendors. Neither the existence of a claim nor a dispute resolution process, litigation or any other provision of this contract shall excuse the contractor from promptly complying with the changes ordered by the Purchasing Agency or with the performance of the contract generally.

P. DEFAULT: In case of failure to deliver goods or services in accordance with the contract terms and conditions, the Commonwealth, after due oral or written notice, may procure them from other sources and hold the contractor responsible for any resulting additional purchase and administrative costs. This remedy shall be in addition to any other remedies which the Commonwealth may have.

Q. INSURANCE: By signing and submitting a proposal under this solicitation, the offeror certifies that if awarded the contract, it will have the following insurance coverage at the time the contract is awarded. For construction contracts, if any subcontractors are involved, the subcontractor will have workers' compensation insurance in accordance with§ 25 of the Rules Governing Procurement – Chapter 2, Exhibit J, Attachment 1, and 65.2-800 et. Seq. of the Code of Virginia (available for review at http://www.jmu.edu/procurement) The offeror further certifies that the contractor and any subcontractors will maintain these insurance coverage during the entire term of the contract and that all insurance coverage will be provided by insurance companies authorized to sell insurance in Virginia by the Virginia State Corporation Commission.

MINIMUM INSURANCE COVERAGES AND LIMITS REQUIRED FOR MOST CONTRACTS:

1. Workers' Compensation: Statutory requirements and benefits. Coverage is compulsory for employers of three or more employees, to include the employer. Contractors who fail to notify the Commonwealth of increases in the number of employees that change their workers' compensation requirement under the Code of Virginia during the course of the contract shall be in noncompliance with the contract.

2. Employer's Liability: $100,000

3. Commercial General Liability: $1,000,000 per occurrence and $2,000,000 in the aggregate. Commercial General Liability is to include bodily injury and property damage, personal injury and advertising injury, products and completed operations coverage. The Commonwealth of Virginia must be named as an additional insured and so endorsed on the policy.

4. Automobile Liability: $1,000,000 combined single limit.

R. ANNOUNCEMENT OF AWARD: Upon the award or the announcement of the decision to award a contract over $50,000, as a result of this solicitation, the purchasing agency will publicly post such notice on the DGS/DPS eVA web site (www.eva.virginia.gov) for a minimum of 10 days.

S. DRUG-FREE WORKPLACE: During the performance of this contract, the contractor agrees to (i) provide a drug-free workplace for the contractor's employees; (ii) post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana is prohibited in the contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition; (iii) state in all solicitations or advertisements for employees placed by or on behalf of the contractor that the contractor maintains a drug-free workplace; and (iv) include the provisions of the foregoing clauses in every subcontract or purchase order of over $10,000, so that the provisions will be binding upon each subcontractor or vendor.

For the purposes of this section, "drug-free workplace" means a site for the performance of work done in connection with a specific contract awarded to a contractor, the employees of whom are prohibited from engaging in the unlawful manufacture, sale, distribution, dispensation, possession or use of any controlled substance or marijuana during the performance of the contract.

T. NONDISCRIMINATION OF CONTRACTORS: An offeror, or contractor shall not be discriminated against in the solicitation or award of this contract because of race, religion, color, sex, national origin, age, disability, faith-based organizational status, any other basis prohibited by state law relating to discrimination in employment or because the offeror employs ex-offenders unless the state agency, department or institution has made a written determination that employing ex-offenders on the specific contract is not in its best interest. If the award of this contract is made to a faith-based organization and an individual, who applies for or receives goods, services, or disbursements provided pursuant to this contract objects to the religious character of the faith-based organization from which the individual receives or would receive the goods, services, or disbursements, the public body shall offer the individual, within a reasonable period of time after the date of his objection, access to equivalent goods, services, or disbursements from an alternative provider.

U. eVA BUSINESS TO GOVERNMENT VENDOR REGISTRATION, CONTRACTS, AND ORDERS: The eVA Internet electronic procurement solution, website portal www.eVA.virginia.gov, streamlines and automates government purchasing activities in the Commonwealth. The eVA portal is the gateway for vendors to conduct business with state agencies and public bodies. All vendors desiring to provide goods and/or services to the Commonwealth shall participate in the eVA Internet eprocurement solution by completing the free eVA Vendor Registration. All offerors must register in eVA and pay the Vendor Transaction Fees specified below; failure to register will result in the proposal being rejected. Vendor transaction fees are determined by the date the original purchase order is issued and the current fees are as follows:

Vendor transaction fees are determined by the date the original purchase order is issued and the current fees are as follows:

1. For orders issued July 1, 2014 and after, the Vendor Transaction Fee is:

    a. Department of Small Business and Supplier Diversity (SBSD) certified Small Businesses: 1% capped at $500 per order.

    b. Businesses that are not Department of Small Business and Supplier Diversity (SBSD) certified Small Businesses: 1% capped at $1,500 per order.

2. For orders issued prior to July 1, 2014 the vendor transaction fees can be found at www.eVA.virginia.gov.

3. The specified vendor transaction fee will be invoiced by the Commonwealth of Virginia Department of General Services approximately 60 days after the corresponding purchase order is issued and payable 30 days after the invoice date. Any adjustments (increases/decreases) will be handled through purchase order changes.

V. AVAILABILITY OF FUNDS: It is understood and agreed between the parties herein that the Commonwealth of Virginia shall be bound hereunder only to the extent of the funds available or which may hereafter become available for the purpose of this agreement.

W. PRICING CURRENCY: Unless stated otherwise in the solicitation, offerors shall state offered prices in U.S. dollars.

X. E-VERIFY REQUIREMENT OF ANY CONTRACTOR: Any employer with more than an average of 50 employees for the previous 12 months entering into a contract in excess of $50,000 with James Madison University to perform work or provide services pursuant to such contract shall register and participate in the E-Verify program to verify information and work authorization of its newly hired employees performing work pursuant to any awarded contract.

VIII. SPECIAL TERMS AND CONDITIONS

A. AUDIT: The Contractor hereby agrees to retain all books, records, systems, and other documents relative to this contract for five (5) years after final payment, or until audited by the Commonwealth of Virginia, whichever is sooner. The Commonwealth of Virginia, its authorized agents, and/or State auditors shall have full access to and the right to examine any of said materials during said period.

B. CANCELLATION OF CONTRACT: James Madison University reserves the right to cancel and terminate any resulting contract, in part or in whole, without penalty, upon 60 days written notice to the contractor. In the event the initial contract period is for more than 12 months, the resulting contract may be terminated by either party, without penalty, after the initial 12 months of the contract period upon 60 days written notice to the other party. Any contract cancellation notice shall not relieve the contractor of the obligation to deliver and/or perform on all outstanding orders issued prior to the effective date of cancellation.

C. IDENTIFICATION OF PROPOSAL ENVELOPE: The signed proposal should be returned in a separate envelope or package, sealed and identified as follows:

From: ____

Name of Offeror   Due Date   Time

____

Street or Box No.   RFP #

____

City, State, Zip Code   RFP Title

Name of Purchasing Officer: ____

The envelope should be addressed as directed on the title page of the solicitation.

The Offeror takes the risk that if the envelope is not marked as described above, it may be inadvertently opened and the information compromised, which may cause the proposal to be disqualified. Proposals may be hand-delivered to the designated location in the office issuing the solicitation. No other correspondence or other proposals should be placed in the envelope.

D. LATE PROPOSALS: To be considered for selection, proposals must be received by the issuing office by the designated date and hour. The official time used in the receipt of proposals is that time on the automatic time stamp machine in the issuing office. Proposals received in the issuing office after the date and hour designated are automatically non responsive and will not be considered. The University is not responsible for delays in the delivery of mail by the U.S. Postal Service, private couriers, or the intra university mail system. It is the sole responsibility of the Offeror to ensure that its proposal reaches the issuing office by the designated date and hour.

E. UNDERSTANDING OF REQUIREMENTS: It is the responsibility of each offeror to inquire about and clarify any requirements of this solicitation that is not understood. The University will not be bound by oral explanations as to the meaning of specifications or language contained in this solicitation. Therefore, all inquiries deemed to be substantive in nature must be in writing and submitted to the responsible buyer in the Procurement Services Office. Offerors must ensure that written inquiries reach the buyer at least five (5) days prior to the time set for receipt of offerors proposals. A copy of all queries and the respective response will be provided in the form of an addendum to all offerors who have indicated an interest in responding to this solicitation. Your signature on your Offer certifies that you fully understand all facets of this solicitation. These questions may be sent by Fax to 540/ 568-7936 or 540/568-7935.

F. RENEWAL OF CONTRACT: This contract may be renewed by the Commonwealth for a period of four (4) successive one year periods under the terms and conditions of the original contract except as stated in 1. and 2. below. Price increases may be negotiated only at the time of renewal. Written notice of the Commonwealth's intention to renew shall be given approximately 90 days prior to the expiration date of each contract period.

1. If the Commonwealth elects to exercise the option to renew the contract for an additional one-year period, the contract price(s) for the additional one year shall not exceed the contract price(s) of the original contract increased/decreased by no more than the percentage increase/decrease of the other services category of the CPI-W section of the Consumer Price Index of the United States Bureau of Labor Statistics for the latest twelve months for which statistics are available.

2. If during any subsequent renewal periods, the Commonwealth elects to exercise the option to renew the contract, the contract price(s) for the subsequent renewal period shall not exceed the contract price(s) of the previous renewal period increased/decreased by more than the percentage increase/decrease of the other services category of the CPI-W section of the Consumer Price Index of the United States Bureau of Labor Statistics for the latest twelve months for which statistics are available.

G. SUBMISSION OF INVOICES: All invoices shall be submitted within sixty days of contract term expiration for the initial contract period as well as for each subsequent contract renewal period. Any invoices submitted after the sixty day period will not be processed for payment.

H. OPERATING VEHICLES ON JAMES MADISON UNIVERSITY CAMPUS: Operating vehicles on sidewalks, plazas, and areas heavily used by pedestrians is prohibited. In the unlikely event a driver should find it necessary to drive on James Madison University sidewalks, plazas, and areas heavily used by pedestrians, the driver must yield to pedestrians. For a complete list of parking regulations, please go to www.jmu.edu/parking; or to acquire a service representative parking permit, contact Parking Services at 540.568.3300. The safety of our students, faculty and staff is of paramount importance to us. Accordingly, violators may be charged.

I. COOPERATIVE PURCHASING / USE OF AGREEMENT BY THIRD PARTIES: It is the intent of this solicitation and resulting contract(s) to allow for cooperative procurement. Accordingly, any public body, (to include government/state agencies, political subdivisions, etc.), cooperative purchasing organizations, public or private health or educational institutions or any University related foundation and affiliated corporations may access any resulting contract if authorized by the Contractor.

Participation in this cooperative procurement is strictly voluntary. If authorized by the Contractor(s), the resultant contract(s) will be extended to the entities indicated above to purchase goods and services in accordance with contract terms. As a separate contractual relationship, the participating entity will place its own orders directly with the Contractor(s) and shall fully and independently administer its use of the contract(s) to include contractual disputes, invoicing and payments without direct administration from the University. No modification of this contract or execution of a separate agreement is required to participate; however, the participating entity and the Contractor may modify the terms and conditions of this contract to accommodate specific governing laws, regulations, policies, and business goals required by the participating entity. Any such modification will apply solely between the participating entity and the Contractor.

The Contractor will notify the University in writing of any such entities accessing this contract. The Contractor will provide semi-annual usage reports for all entities accessing the contract. The University shall not be held liable for any costs or damages incurred by any other participating entity as a result of any authorization by the Contractor to extend the contract. It is understood and agreed that the University is not responsible for the acts or omissions of any entity and will not be considered in default of the contract no matter the circumstances.

Use of this contract(s) does not preclude any participating entity from using other contracts or competitive processes as needed.

J. SMALL BUSINESS SUBCONTRACTING AND EVIDENCE OF COMPLIANCE:

1. It is the goal of the Commonwealth that 42% of its purchases are made from small businesses. This includes discretionary spending in prime contracts and subcontracts. All potential offerors are required to submit a Small Business Subcontracting Plan. Unless the offeror is registered as a Department of Small Business and Supplier Diversity (SBSD)-certified small business and where it is practicable for any portion of the awarded contract to be subcontracted to other suppliers, the contractor is encouraged to offer such subcontracting opportunities to SBSD-certified small businesses. This shall not exclude SBSD-certified women-owned and minority-owned businesses when they have received SBSD small business certification. No offeror or subcontractor shall be considered a Small Business, a Women-Owned Business or a Minority-Owned Business unless certified as such by the Department of Small Business and Supplier Diversity (SBSD) by the due date for receipt of proposals. If small business subcontractors are used, the prime contractor agrees to report the use of small business subcontractors by providing the purchasing office at a minimum the following information: name of small business with the SBSD certification number or FEIN, phone number, total dollar amount subcontracted, category type (small, women-owned, or minority-owned), and type of product/service provided. **This information shall be submitted to: JMU Office of Procurement Services, Attn: SWAM Subcontracting Compliance, MSC 5720, Harrisonburg, VA 22807.**

2. Each prime contractor who wins an award in which provision of a small business subcontracting plan is a condition of the award, shall deliver to the contracting agency or institution with every request for payment, evidence of compliance (subject only to insubstantial shortfalls and to shortfalls arising from subcontractor default) with the small business subcontracting plan. **This information shall be submitted to: JMU Office of Procurement Services, SWAM Subcontracting Compliance, MSC 5720, Harrisonburg, VA 22807**. When such business has been subcontracted to these firms and upon completion of the contract, the contractor agrees to furnish the purchasing office at a minimum the following information: name of firm with the Department of Small Business and Supplier Diversity (SBSD) certification number or FEIN number, phone number, total

dollar amount subcontracted, category type (small, women-owned, or minority-owned), and type of product or service provided. Payment(s) may be withheld until compliance with the plan is received and confirmed by the agency or institution. The agency or institution reserves the right to pursue other appropriate remedies to include, but not be limited to, termination for default.

3. Each prime contractor who wins an award valued over $200,000 shall deliver to the contracting agency or institution with every request for payment, information on use of subcontractors that are not Department of Small Business and Supplier Diversity (SBSD)-certified small businesses. When such business has been subcontracted to these firms and upon completion of the contract, the contractor agrees to furnish the purchasing office at a minimum the following information: name of firm, phone number, FEIN number, total dollar amount subcontracted, and type of product or service provided. **This information shall be submitted to: JMU Office of Procurement Services, Attn: SWAM Subcontracting Compliance, MSC 5720, Harrisonburg, VA 22807**.

K. AUTHORIZATION TO CONDUCT BUSINESS IN THE COMMONWEALTH: A contractor organized as a stock or nonstock corporation, limited liability company, business trust, or limited partnership or registered as a registered limited liability partnership shall be authorized to transact business in the Commonwealth as a domestic or foreign business entity if so required by Title 13.1 or Title 50 of the Code of Virginia or as otherwise required by law. Any business entity described above that enters into a contract with a public body shall not allow its existence to lapse or its certificate of authority or registration to transact business in the Commonwealth, if so required under Title 13.1 or Title 50, to be revoked or cancelled at any time during the term of the contract. A public body may void any contract with a business entity if the business entity fails to remain in compliance with the provisions of this section.

L. PUBLIC POSTING OF COOPERATIVE CONTRACTS: James Madison University maintains a web-based contracts database with a public gateway access. Any resulting cooperative contract/s to this solicitation will be posted to the publicly accessible website. Contents identified as proprietary information will not be made public.

M. CRIMINAL BACKGROUND CHECKS OF PERSONNEL ASSIGNED BY CONTRACTOR TO PERFORM WORK ON JMU PROPERTY: The Contractor shall obtain criminal background checks on all of their contracted employees who will be assigned to perform services on James Madison University property. The results of the background checks will be directed solely to the Contractor. The Contractor bears responsibility for confirming to the University contract administrator that the background checks have been completed prior to work being performed by their employees or subcontractors. The Contractor shall only assign to work on the University campus those individuals whom it deems qualified and permissible based on the results of completed background checks. Notwithstanding any other provision herein, and to ensure the safety of students, faculty, staff and facilities, James Madison University reserves the right to approve or disapprove any contract employee that will work on JMU property. Disapproval by the University will solely apply to JMU property and should have no bearing on the Contractor's employment of an individual outside of James Madison University.

N. INDEMNIFICATION: Contractor agrees to indemnify, defend and hold harmless the Commonwealth of Virginia, its officers, agents, and employees from any claims, damages and actions of any kind or nature, whether at law or in equity, arising from or caused by the use of any materials, goods, or equipment of any kind or nature furnished by the contractor/any services of any kind or nature furnished by the contractor, provided that such liability is not attributable to the sole negligence of the using agency or to failure of the using agency to use the materials, goods, or equipment in the manner already and permanently described by the contractor on the materials, goods or equipment delivered.

O. ADVERTISING: In the event a contract is awarded for supplies, equipment, or services resulting from this proposal, no indication of such sales or services to James Madison University will be used in product literature or advertising without the express written consent of the University. The contractor shall not state in any of its advertising or product literature that James Madison University has purchased or uses any of its products or services, and the contractor shall not include James Madison University in any client list in advertising and promotional materials without the express written consent of the University.

P. ELECTRICAL EQUIPMENT STANDARDS: All equipment/material shall conform to the latest issue of all applicable standards as established by National Electrical Manufacturer's Association (NEMA), American National Standards Institute (ANSI), and Occupational Safety & Health Administration (OSHA). All equipment and material, for which there are OSHA standards, shall bear an appropriate label of approval for use intended from a Nationally Recognized Testing Laboratory (NRTL).

Q. REPAIR PARTS: In the event that the performance of maintenance services under the contract results in a need to replace defective parts, such items may only be replaced by new parts. In no instance shall the contractor be permitted to replace defective items with refurbished, remanufactured, or surplus items without prior written authorization of the University.

R. SERVICES WARRANTY: Contractor warrants that all services shall be provided for in accordance with manufacturer’s service manuals and as specified in this solicitation. Contractor shall act as the sole point of contact for all units repaired under this agreement.

S. WARRANTY (COMMERCIAL): The contractor agrees that the goods and services furnished under any award resulting from this solicitation shall be covered by the most favorable commercial warranties that the contractor gives any customer for such goods and services and that the rights and remedies provided therein are in addition to and do not limit those available to the University by any other clause of this solicitation. A copy of this warranty should be provided. Nationwide factory recall or product update repairs or replacement shall be the responsibility of the contractor. In such cases, factory recall and modification work shall be handled in the same manner as warranty work.

T. PROTECTION OF PERSONS AND PROPERTY: The contractor expressly undertakes both directly and through its subcontractor(s) to take every precaution at all times for the protection of persons and property that may come on the building site or be affected by contractor’s operation in connection with the work.

The Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work. The provisions of all rules and regulations governing safety as adopted by the Safety Codes Commission of the Commonwealth of Virginia, issued by the Department of Labor and Industry under Title 40.1 of the Code of Virginia shall apply to all work under this contract.

U. PRIME CONTRACTOR RESPONSIBLITIES: The contractor shall be responsible for completely supervising and directing the work under this contract and all subcontractors that they may utilize, using their best skill and attention. Subcontractors who perform work under this contract shall be responsible to the prime contractor. The contractor agrees that they are as fully responsible for the acts and omissions of their subcontractors and of persons employed by them as they are for the acts and omissions of their own employees.

V. SUBCONTRACTS: No portion of the work shall be subcontracted without prior written consent of the purchasing agency. In the event contractor desires to subcontract some part of the work specified herein, the contractor shall furnish the purchasing agency the names, qualifications, and experience of their proposed subcontractors. The contractor shall, however, remain fully liable and responsible for the work to be done by its subcontractor(s) and shall assure compliance with all requirements of the contract.

W. CONTINUITY OF SERVICES: The contractor recognizes that the services under this contract are vital to the University and must be continued without interruption and that, upon contract expiration, a successor, either the Agency or another contractor, may continue them. The Contractor agrees:

1. To exercise its best efforts and cooperation to effect an orderly and efficient transition to a successor;
2. To make all agency-owned facilities, equipment, and data available to any successor at an appropriate time prior to the expiration of the contract to facilitate transition to the successor; and
3. That the agency contractor officer shall have final authority to resolve disputes related to the transition of the contract from the Contractor to its successor.

The Contractor shall, upon written notice form the Contract Officer, furnish phase-in/phase-out services for up to ninety (90) days after this contract expires and shall negotiate in good faith a plan with the successor to execute the phase-in/phase-out services. The plan shall be subject to the agency's approval.

The Contractor shall be reimbursed for all reasonable, pre-approved phase-in/phase-out costs (i.e., costs incurred within the agreed period after contract expiration that result from phase-in/phase-out operations) and a fee (profit) not to exceed a pro rata portion of the fee (profit) under this contract. All phase-in/phase-out work fees must be approved by the agency in writing prior to commencement of said work.

X. ADDITIONAL GOODS AND SERVICES: The University may acquire other goods or services that the supplier provides than those specifically solicited. The University reserves the right, subject to mutual agreement, for the Contractor to provide additional goods and/or services under the same pricing, terms, and conditions and to make modifications or enhancements to the existing goods and services. Such additional goods and services may include other products, components, accessories, subsystems, or related services that are newly introduced during the term of this Agreement. Such additional goods and services will be provided to the University at favored nations pricing, terms, and conditions.

Y. LATEST SOFTWARE VERSION**:** Any software product(s) provided under the contract shall be the latest version available to the general public as of the due date of this solicitation.

Z. NEW EQUIPMENT**:** Any equipment furnished under the contract shall be new, unused equipment.

AA. OPERATIONAL COMPONENTS**:** Stated equipment prices shall include all cables, connectors, interfaces, documentation for all components, and any other items necessary for full systems operation at the user site. This does not include consumable supplies such as paper, tapes, disks, etc., unless such supplies are expressly identified in the pricing schedule.

BB. MAINTENANCE MANUALS: The contractor shall provide with each piece of equipment an operations and maintenance manual with wiring diagrams, parts list, and a copy of all warranties.

CC. PRODUCT SUBSTITUTION**:** During the term of any contract resulting from this solicitation, the vendor is not authorized to substitute any item for that product and/or software identified in the solicitation without the prior written consent of the contracting officer whose name appears on the front of this solicitation, or their designee.

DD. QUALIFIED REPAIR PERSONNEL**:** All warranty or maintenance services to be performed on the items specified in this solicitation as well as any associated hardware or software are to be performed by qualified technicians properly authorized by the manufacturer to perform such services. The Commonwealth reserves the right to require proof of certification prior to award and at any time during the term of the contract.

EE. REPAIR PARTS**:** In the event that the performance of maintenance services under the contract results in a need to replace defective parts, such items may only be replaced by new parts. In no instance shall the contractor be permitted to replace defective items with refurbished, remanufactured, or surplus items without prior written authorization of the Commonwealth.

FF. RENEWAL OF MAINTENANCE**:** Maintenance of the hardware or software specified in the resultant contract may be renewed by the mutual written agreement of both parties for an additional one-year periods, under the terms and conditions of the original contract except as noted herein. Price changes may be negotiated at time of renewal; however, in no case shall the maintenance costs for a succeeding one-year period exceed the prior year's contract price(s), increased or decreased by more than the percentage increase or decrease in the services category of the CPI-W section of the US Bureau of Labor Statistics Consumer Price Index, for the latest twelve months for which statistics are available.

GG. SOFTWARE UPGRADES**:** The Commonwealth shall be entitled to any and all upgraded versions of the software covered in the contract that becomes available from the contractor. The maximum charge for upgrade shall not exceed the total difference between the cost of the Commonwealth's current version and the price the contractor sells or licenses

HH. SOURCE CODE**:** In the event the contractor ceases to maintain experienced staff and the resources needed to provide required software maintenance, the Commonwealth shall be entitled to have, use, and duplicate for its own use, a copy of the source code and associated documentation for the software products covered by the contract. Until such time as a complete copy of such material is provided, the Commonwealth shall have exclusive right to possess all physical embodiments of such contractor owned materials. The rights of the Commonwealth in this respect shall survive for a period of twenty years after the expiration or termination of the contract. All lease and royalty fees necessary to support this right are included in the initial license fee as contained in the pricing schedule.

II. TERM OF SOFTWARE LICENSE: Unless otherwise stated in the solicitation, the software license(s) identified in the pricing schedule shall be purchased on a perpetual basis and shall continue in perpetuity. However the Commonwealth reserves the right to terminate the license at any time, although the mere expiration or termination of this contract shall not be construed as an intent to terminate the license. All acquired license(s) shall be for use at any computing facilities, on any equipment, by any number of users, and for any purposes for which it is procured. The Commonwealth further reserves the right to transfer all rights under the license to another state agency to which some or all of its functions are transferred.

JJ. TITLE TO SOFTWARE: By submitting a bid or proposal, the bidder or offeror represents and warrants that it is the sole owner of the software or, if not the owner, that it has received all legally required authorizations from the owner to license the software, has the full power to grant the rights required by this solicitation, and that neither the software nor its use in accordance with the contract will violate or infringe upon any patent, copyright, trade secret, or any other property rights of another person or organization.

KK. WARRANTY AGAINST SHUTDOWN DEVICES: The contractor warrants that the equipment and software provided under the contract shall not contain any lock, counter, CPU reference, virus, worm, or other device capable of halting operations or erasing or altering data or programs. Contractor further warrants that neither it, nor its agents, employees, or subcontractors shall insert any shutdown device following delivery of the equipment and software.

LL. NONVISUAL ACCESS TO TECHNOLOGY: All information technology which, pursuant to this Agreement, is purchased or upgraded by or for the use of any State agency or institution or political subdivision of the Commonwealth (the "Technology") shall comply with the following nonvisual access standards from the date of purchase or upgrade until the expiration of this Agreement:

1. effective, interactive control and use of the Technology shall be readily achievable by nonvisual means;
2. the Technology equipped for nonvisual access shall be compatible with information technology used by other individuals with whom any blind or visually impaired user of the Technology interacts;
3. nonvisual access technology shall be integrated into any networks used to share communications among employees, program participants or the public; and
4. the technology for nonvisual access shall have the capability of providing equivalent access by nonvisual means to telecommunications or other interconnected network services used by persons who are not blind or visually impaired.

Compliance with the foregoing nonvisual access standards shall not be required if the head of the using agency, institution or political subdivision determines that (i) the Technology is not available with nonvisual access because the essential elements of the Technology are visual and (ii) nonvisual equivalence is not available.

Installation of hardware, software or peripheral devices used for nonvisual access is not required when the Technology is being used exclusively by individuals who are not blind or visually impaired, but applications programs and underlying operating systems (including the format of the data) used for the manipulation and presentation of information shall permit the installation and effective use of nonvisual access software and peripheral devices.

If requested, the Contractor must provide a detailed explanation of how compliance with the foregoing nonvisual access standards is achieved and a validation of concept demonstration.

The requirements of this Paragraph shall be construed to achieve full compliance with the Information Technology Access Act, 2.2-3500 through 2.2-3504 of the *Code of Virginia*.

All information technology which, pursuant to this Agreement, is purchased or upgraded by or for the use of any Commonwealth agency or institution or political subdivision of the Commonwealth (the "Technology") shall comply with Section 508 of the Rehabilitation Act (29 U.S.C. 794d), as amended. If requested, the Contractor must provide a detailed explanation of how compliance with Section 508 of the Rehabilitation Act is achieved and a validation of concept demonstration. (http://www.section508.gov/). The requirements of this Paragraph along with the Non-Visual Access to Technology Clause shall be construed to achieve full compliance with.

IX. METHOD OF PAYMENT

The contractor will be paid on the basis of invoices submitted in accordance with the solicitation and any negotiations. James Madison University recognizes the importance of expediting the payment process for our vendors and suppliers. We are asking our vendors and suppliers to enroll in the Wells Fargo Bank single use Commercial Card Number process or electronic deposit (ACH) to your bank account so that future payments are made electronically. Contractors signed up for the Wells Fargo Bank single use Commercial Card Number process will receive the benefit of being paid in Net 15 days. Additional information is available online at:
http://www.jmu.edu/financeoffice/accounting-operations-disbursements/cash-investments/vendor-payment-methods.shtml

X. PRICING SCHEDULE

The offeror shall provide pricing for all products and services included in proposal indicating one-time and on-going costs. The resulting contract will be cooperative and pricing shall be inclusive for the attached Zone Map, of which JMU falls within Zone 2.

The offeror shall provide incentives and/or increased discounts that would be offered if multiple VASCUPP institutions utilize the contract for goods and offered services. A list of VASCUPP member schools can be found at www.vascupp.org.

Specify any associated charge card processing fees, if applicable, to be billed to the University.

Add additional rows/pages as needed to list all rates for labor and services as well as goods and equipment offered.

	PRICING SCHEDULE BY ZONE								
	Zone 1	*Zone 2*	*Zone 3*	*Zone 4*	*Zone 5*	*Zone 6*	*Zone 7*	*Zone 8*	*Zone 9*
Regular Time Labor Rates (7:30 a.m. to 4:00 p.m. Monday – Friday)* ***Service Rates***									
"Position" Labor Rate $/hour									
"Position" Labor Rate $/hour									
Overtime/Emergency Labor Rates (Outside of Regular Time working hours)* ***Service Rates***									
"Position" Labor Rate $/hour									
"Position" Labor Rate $/hour									

	PRICING SCHEDULE BY ZONE								
	Zone 1	*Zone 2*	*Zone 3*	*Zone 4*	*Zone 5*	*Zone 6*	*Zone 7*	*Zone 8*	*Zone 9*
Products and Equipment (List by Manufacturer and Discount rate offered)									
Item (or) Manufacturer	% Off List-Price Discount Offered by Zone								

Other Fees

XI. ATTACHMENTS

Attachment A: Offeror Data Sheet

Attachment B: Small, Women, and Minority-owned Business (SWaM) Utilization Plan

Attachment C: Standard Contract Sample

Attachment D: Zone Map

ATTACHMENT A

OFFEROR DATA SHEET

TO BE COMPLETED BY OFFEROR

1. QUALIFICATIONS OF OFFEROR: Offerors must have the capability and capacity in all respects to fully satisfy the contractual requirements.

2. YEARS IN BUSINESS: Indicate the length of time you have been in business providing these types of goods and services.

   Years_______ Months_________

3. REFERENCES: Indicate below a listing of at least five (5) organizations, either commercial or governmental/educational, that your agency is servicing. Include the name and address of the person the purchasing agency has your permission to contact.

CLIENT	LENGTH OF SERVICE	ADDRESS	CONTACT PERSON/PHONE #

4. List full names and addresses of Offeror and any branch offices which may be responsible for administering the contract.

   ____

   ____

   ____

   ____

3. RELATIONSHIP WITH THE COMMONWEALTH OF VIRGINIA: Is any member of the firm an employee of the Commonwealth of Virginia who has a personal interest in this contract pursuant to the CODE OF VIRGINIA, SECTION 2.2-3100 – 3131?
   [ ] YES [ ] NO
   IF YES, EXPLAIN:____

   ____

   ____

   ____

ATTACHMENT B

Small, Women and Minority-owned Businesses (SWaM) Utilization Plan

Offeror Name: ___________________________________ Preparer Name: ___________________

Date: ________

Is your firm a **Small Business Enterprise** certified by the Department of Small Business and Supplier Diversity (SBSD)? Yes_____ No_____

If yes, certification number: ____________ Certification date:______________

Is your firm a **Woman-owned Business Enterprise** certified by the Department of Small Business and Supplier Diversity (SBSD)? Yes_____ No_____

If yes, certification number: ____________ Certification date:______________

Is your firm a **Minority-Owned Business Enterprise** certified by the Department of Small Business and Supplier Diversity (SBSD)? Yes____ No_____

If yes, certification number: ____________ Certification date:______________

Is your firm a **Micro Business** certified by the Department of Small Business and Supplier Diversity (SBSD)? Yes_____ No_____

If yes, certification number: ____________ Certification date: ______________

Instructions: *Populate the table below to show your firm's plans for utilization of small, women-owned and minority-owned business enterprises in the performance of the contract. Describe plans to utilize SWAMs businesses as part of joint ventures, partnerships, subcontractors, suppliers, etc.*

Small Business: "Small business " means a business, independently owned or operated by one or more persons who are citizens of the United States or non-citizens who are in full compliance with United States immigration law, which, together with affiliates, has 250 or fewer employees, or average annual gross receipts of $10 million or less averaged over the previous three years.

Woman-Owned Business Enterprise: A business concern which is at least 51 percent owned by one or more women who are U.S. citizens or legal resident aliens, or in the case of a corporation, partnership or limited liability company or other entity, at least 51 percent of the equity ownership interest in which is owned by one or more women, and whose management and daily business operations are controlled by one or more of such individuals. **For purposes of the SWAM Program, all certified women-owned businesses are also a small business enterprise.**

Minority-Owned Business Enterprise: A business concern which is at least 51 percent owned by one or more minorities or in the case of a corporation, partnership or limited liability company or other entity, at least 51 percent of the equity ownership interest in which is owned by one or more minorities and whose management and daily business operations are controlled by one or more of such individuals. **For purposes of the SWAM Program, all certified minority-owned businesses are also a small business enterprise.**

Micro Business is a certified Small Business under the SWaM Program and has no more than twenty-five (25) employees **AND** no more than $3 million in average annual revenue over the three-year period prior to their certification.

All small, women, and minority owned businesses must be certified by the Commonwealth of Virginia Department of Small Business and Supplier Diversity (SBSD) to be counted in the SWAM program. Certification applications are available through SBSD at 800-223-0671 in Virginia, 804-786-6585 outside Virginia, or online at http://www.sbsd.virginia.gov/ (Customer Service).

RETURN OF THIS PAGE IS REQUIRED

ATTACHMENT B (CNT'D)
Small, Women and Minority-owned Businesses (SWaM) Utilization Plan

Procurement Name and Number: ______________________________________ Date Form Completed:_______________

Listing of Sub-Contractors, to include, Small, Woman Owned and Minority Owned Businesses
for this Proposal and Subsequent Contract

Offeror / Proposer:

______________________	______________________	______________________
Firm	Address	Contact Person/No.

Sub-Contractor's Name and Address	Contact Person & Phone Number	SBSD Certification Number	Services or Materials Provided	Total Subcontractor Contract Amount (to include change orders)	Total Dollars Paid Subcontractor to date (to be submitted with request for payment from JMU)

(Form shall be submitted with proposal and if awarded, again with submission of each request for payment)

RETURN OF THIS PAGE IS REQUIRED

ATTACHMENT C

COMMONWEALTH OF VIRGINIA
STANDARD CONTRACT

Contract No.__________

This contract entered into this__________day of_______________20____,by ______________________ hereinafter called the "Contractor" and Commonwealth of Virginia, James Madison University called the "Purchasing Agency".

WITNESSETH that the Contractor and the Purchasing Agency, in consideration of the mutual covenants, promises and agreements herein contained, agree as follows:

SCOPE OF CONTRACT: The Contractor shall provide the services to the Purchasing Agency as set forth in the Contract Documents.

PERIOD OF PERFORMANCE: From__________________ through__________________

The contract documents shall consist of:

(1) This signed form;

(2) The following portions of the Request for Proposals dated ____________________:
   (a) The Statement of Needs,
   (b) The General Terms and Conditions,
   (c) The Special Terms and Conditions together with any negotiated modifications of those Special Conditions;
   (d) List each addendum that may be issued

(3) The Contractor's Proposal dated ____________________and the following negotiated modification to the Proposal, all of which documents are incorporated herein.
   (a) Negotiations summary dated ____________.

IN WITNESS WHEREOF, the parties have caused this Contract to be duly executed intending to be bound thereby.

CONTRACTOR:	PURCHASING AGENCY:
By:____ (Signature)	By:___________________________________ (Signature)
____ (Printed Name)	____________________________________ (Printed Name)
Title:__________________________________	Title:___________________________________

ATTACHMENT D

Zone Map

Virginia Association of State College & University Purchasing Professionals (VASCUPP)

List of member institutions by zones

Zone 1 **George Mason University (Fairfax)**	**Zone 2** **James Madison University (Harrisonburg)**	**Zone 3** **University of Virginia (Charlottesville)**
Zone 4 **University of Mary Washington (Fredericksburg)**	**Zone 5** **College of William and Mary (Williamsburg)** **Old Dominion University (Norfolk)**	**Zone 6** **Virginia Commonwealth University (Richmond)**
Zone 7 **Longwood University (Farmville)**	**Zone 8** **Virginia Military Institute (Lexington)** **Virginia Tech (Blacksburg)** **Radford University (Radford)**	**Zone 9** **University of Virginia - Wise (Wise)**