JAMES MADISON UNIVERSITY.

COMMONWEALTH OF VIRGINIA
STANDARD CONTRACT

Contract No. UCPJMU6879

This contract entered into this 19th day of April 2024, by TCS International, 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, 2024 through May 7, 2025 with 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-1202 dated January 31, 2024:
- (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) VHEPC Agreement Publicly Accessible Contract (PAC)

(3) The Contractor's Proposal dated February 28, 2024 and the following negotiated modification to the Proposal, all of which documents are incorporated herein.
- (a) Negotiations Summary, dated April 19, 2023.

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

CONTRACTOR:	PURCHASING AGENCY:
By: _____ (Signature)	By: Michael Morrison (Signature)
Dave Radford (Printed Name)	Michael Morrison (Printed Name)
Title: President	Title: Buyer Senior

Rev. 5/12/21

NEGOTIATION SUMMARY **TCS INTERNATIONAL, INC.**

RFP# MPM-1202 VEHICLE COUNT SYSTEMS

4/19/2024

The Primary Point of Contact for this Contract is:

Dave Radford
1-978-443-2527 x36
dradford@tcsintl.com

GENERAL:

1. Any change in the scope described herein shall be mutually agreed upon by the Purchasing Agency and Contractor with all changes first being authorized through either a contract modification and/or a change order issued by the Purchasing Agency.

2. Parties agree that this Negotiation Summary modifies RFP# MPM-1202 and the Contractor's initial response to RFP# MPM-1202, and in the event of conflict this negotiation summary shall take precedence.

3. Contractor agrees that all exceptions taken within their initial response to RFP# MPM-1202 that are not specifically addressed within this negotiation summary are null and void.

4. Contractor agrees that the terms and conditions as stated in the RFP will govern and be abided by.

5. Contractor agrees that the VHEPC PAC Agreement shall be incorporated as a part of this contract.

PRICING SCHEDULE:

The following Labor, Other Fees, and Discounts sections represent the negotiated pricing for all represented items and should be reflected in all quotes and proposals for the University. No other fees or charges shall be acceptable.

1. TCS International, Inc. agrees that for remote support, there will be no minimum hours and the first hour shall be offered free of charge for James Madison University.

2. The following pages, taken from the RFP and edited where negotiated, represent the agreed-upon pricing for this contract.

Other Fees		
Charge Card Processing Fees:	0	**%**
Any extra travel will meet GSA standards.		

7.0 System Hardware Breakdown

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

7.1 Vehicle Count System Hardware:

7.1.1 Single Space Sensor System:

QTY	PART#	DESCRIPTION	UNIT COST
1	**TUS-300**	**RGB Single Space Sensor:** • Smart design located at the end of each covered parking space for higher visibility. • Measuring vehicle occupancy through ultrasonic distance measurement. • Occupancy status indicating LEDs: o RGB color standard space units with i.e., green status for available space, red status for occupied space, and amber status for reserved or EV space and blue status for handicapped space, etc. provided o Freely programmable RGB colors to fit customer requirements • IP 65 rating. • RS-485 multi-drop communications to area controller; and • Max. mounting height 3 m.	**$80.00**
1	**HHP**	**Handheld Programming Unit for Single Space Sensors**	**$61.00**
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.	**$1,380.00**

7.1.2 Ultrasonic Directional Sensors for Level/Zone Counting:

QTY	PART#	DESCRIPTION	UNIT COST
1	**USDS**	**Ultrasonic Directional Sensor:** • For use in a three (3) unit cluster configuration or single unit configuration to cover varying widths of garage/level entrances/exits. • 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* • *TCS is not responsible for accurate system counts if proper lane delineation, if required, is not implemented, and maintained by others.*	**$990.00**
1	**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.	**$975.00**
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.) o Equipment pre-configured in 14" x 12" x 6" NEMA 4 PVC indoor enclosures	**$888.00**

QTY	PART#	DESCRIPTION	UNIT COST
1	DP	**Directional Delineation Posts:** • Lane delineation equipment used to ensure proper vehicle counts. • Min. box of (25) units • 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.	**$61.00**
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.*	**$1,386.00**

7.1.3 Outdoor Lot Monitoring Equipment:

QTY	PART#	DESCRIPTION	UNIT COST
1	CAM VCC1	**Mistall Camera:** • Panoramic 180°5 MP PoE camera or equivalent • To be installed on existing/new poles *Note: The higher the mounting height the higher the counting accuracy*.	**$1,040.00**
1	MNT-CAM1	**Camera Mount Pole** • Camera mount bracket for mounting camera to existing pole	**$166.00**
1	MNT-CAM1	**AC Power Kit:** • Electrical junction box, transformer, pole mount, cabling, connectors, and accessories	**$395.00**
1	MNT-SP	**Solar Power Kit:** • Electrical junction box, battery, 50W solar panel, charge controller, pole mounts, cabling, connectors, and accessories	**$1,395.00**
1	COM-CELL	**High Speed Cellular Communication Kit**	**$520.00**

7.2 Space Availability Signage:

QTY	PART#	DESCRIPTION	UNIT COST
1	WFS/ 3x7.5	**Wayfinding Sign Type 1 (Sample Sign Design):** • New wayfinding sign indicating space availability for (2) parking garages per new Master Plan sign design • To be installed on existing foundation/s using existing J-bolts or new foundations by others • Total of (2) space availability displays per sign cabinet: o Number of spaces and OPEN in double stroke green LEDs with 7.5" LED character height; and o FULL in single stroke 6" LED character height. • White reflective vinyl lettering. • Includes single 8' clearance pole *NOTE:* • *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* 	**$31,801.00**
1	XBEE-SIGN	**Wireless Communication Equipment for Wayfinding Sign Type 1 Locations:** • Includes (1) 120 VAC wireless modem, antenna, peripherals, etc. for Type 1 Wayfinding Sign location/s	**$584.00**
1	WFS/ 3x7.5/INST	**Delivery & Installation of Wayfinding Sign Type 1** • Includes delivery and installation of Type 1 Wayfinding Sign on existing/provided footings by others	**$4,018.00**

QTY	PART#	DESCRIPTION	UNIT COST
1	**ES-1/ 3x7.5/ 16x64 VMS**	**Entry Sign Type 1 (Sample Sign Design):** • Entry Sign Type 1 indicating space availability for parking garage per new Master Plan sign design • To be installed on existing foundation/s using existing J-bolts • Total of (3) space availability displays per sign cabinet: o Number of spaces and OPEN in double stroke green LEDs with 7.5" LED character height; and o FULL in single stroke 6" LED character height. • Total of (1) 16x64 AMBER VMS display per sign cabinet • White reflective vinyl lettering. • Includes double posts *NOTE:* • *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* 	**$27,157.00**
1	**XBEE-SIGN/VMS**	**Wireless Communication Equipment for Entry Sign 1 Locations:** • Includes (2) 120 VAC wireless modems, antenna, peripherals, etc. for Entry Sign 1 location/s	**$984.00**
1	**ES-1/ INST**	**Delivery & Installation of Entry Sign Type 1** • Includes delivery and installation of Entry Sign Type 1 on existing/provided footings by others	**$2,961.00**

QTY	PART#	DESCRIPTION	UNIT COST
1	**ES-2/ 1x7.5/ 1x16x64 VMS**	**Entry Sign Type 2 (Sample Sign Design):**  • Entry Sign Type 2 indicating space availability for parking garage per new Master Plan sign design • To be installed on existing foundation/s using existing J-bolts • Total of (1) space availability display per sign cabinet: o Number of spaces and OPEN in double stroke green LEDs with 7.5" LED character height; and o FULL in single stroke 6" LED character height. • Total of (1) 16x64 AMBER VMS display per sign cabinet • White reflective vinyl lettering. • Includes double posts *NOTE:* • *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*	**$18,755.00**
1	**XBEE-SIGN/VMS**	**Wireless Communication Equipment for Entry Sign 2 Locations:** • Includes (2) 120 VAC wireless modems, antenna, peripherals, etc. for Entry Sign 2 location/s	**$984.00**
1	**ES-2/ INST**	**Delivery & Installation of Entry Sign Type 2** • Includes delivery and installation of ES-2 entry sign 2 on existing/provided footings by others	**$2,961.00**

7.3 Software

7.3.1 Software License per Additional Garage for Existing PGS Server:

QTY	PART#	DESCRIPTION	TOTAL COST
1	SL	**Indoor PGS 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.*	**$4,265.00**

7.3.2 Outdoor Lot Camera Monitoring Recurring Costs (Annually):

QTY	PART#	DESCRIPTION	ANNUAL COST
1	SIMUS	**SIM Card and Data Plan** • Cost per cellular kit per year • Includes project specific SIM card and data plan for cellular communication. *Note: Invoiced annually at the beginning of each year.*	**$528.00**
1	SWSTD	**Outdoor Camera Monitoring Software License** • Software license cost per camera per year • Includes software license for Mistall Insight monitoring dashboard • Hosted software solution for Mistall *Note: Invoiced annually at the beginning of each year.*	**$406.00**

7.4 Additional Provisions:

QTY	PART#	DESCRIPTION	UNIT COST
1	DES	**System Design:** • Hourly rate for standard in-house system design for new projects; and • Includes documentation, drawings, and all related design work.	**$198.00**
1	PM	**Remote Project Management:** • Hourly rate to perform all off-site coordination and remote project management to supply the new PGS system expansion/s.	**$208.00**
1	SOFT-D	**Software Development** • Hourly rate for software development support	**$228.00**
1	RIS	**Remote Support:** • Hourly rate to provide remote engineering support *NOTE:* • *All additional services and supporting expenses will be billed at standard rates if delays are caused by the customer or a third party.*	**$198.00**

QTY	PART#	DESCRIPTION	UNIT COST
		• *Remote installation support must be scheduled at least 1 week in advance.* • *Remote installation support to be provided during regular business hours Mo-Fri 8 am to 4 pm EST.*	
1	**SITE-SUR**	**Site Survey** • Site survey to review all existing sign locations to determine which cabinets/locations can be refaced and which locations require new sign cabinets as quoted included.	**$3,895.00**
1	**SH**	**Remote System Health Check:** • Inclusions: o Weekly remote system health check for 6-months for system expansions to ensure proper system functionality *Note: Remote system access required.*	**Incl.**
1	**2YW**	**2-Year Warranty**	**Incl.**

7.5 Exclusions:

DESCRIPTION
Exclusions: **The following is excluded in this proposal:** • Freight & handling • Travel related expenses • Related civil work, including but not limited to: o Electrical work includes conduit for communications & power, power wiring, and final electrical connections. o Required digging, trenching, coring, etc.; and o Concrete, asphalt, and protective bollards. • 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. • Installation of the PGS components other than for availability signs as selected. • 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.*

AGREEMENT
PUBLICLY ACCESSIBLE CONTRACT (PAC)

This Agreement, effective the 8th day of May, 2024 is by and between James Madison University (the "University"), on behalf of the Virginia Higher Education Procurement Consortium (the "Consortium") (collectively the "University"), and TCS International, Inc., ("Vendor").

TERM

The term of this Agreement shall begin May 8, 2024 to May 7, 2025 with (4) four one-year renewal options, and an expected final expiration date of May 7, 2029. This end date coincides with the Primary Agreement's (UCPJMU6879) end date.

WITNESS

WHEREAS, the University and Vendor have executed an agreement, UCPJMU6879, dated April 19, 2024 (the "Primary Agreement"), and included in the Primary Agreement is a third-party access / cooperative clause. Now therefore, the University and Vendor wish to express in this Agreement the specific terms that will allow third party access to the Primary Agreement.

Accordingly, and in consideration of the mutual premises and provisions hereof, the parties hereby agree as follows:

I. Vendor will:

A. Pay the University 1% of all sales to accessing entities outside of the Consortium membership associated with the Primary Agreement (as the "PAC Annual Fee"). The PAC Annual Fee will be paid in exchange for marketing services provided by the University and the Consortium described below in Section II.
B. Fully support this marketing relationship by promoting the availability of the Primary Agreement to non-Consortium entities;
C. Provide quarterly sales reports detailing the amount of sales to each non-Consortium accessing entity; and

II. The University/Consortium will:

A. Promote the Primary Agreement on its website and through other channels (e.g., conferences) to non-Consortium members
B. Maintain an approved version of Vendor's logo on the Consortium website

III. Payment

A. Payment of PAC Annual Fee will arrive at the University no later than August 31st of each year. The University and Consortium will share the payments equally and allocate payments to the appropriate accounts.

In the event of early termination of the Primary Agreement, this residual payment will arrive at the University no later than 45 calendar days from termination date of the Primary Agreement.

B. Payment of PAC Annual Fee will take the form of a check. Checks will be made payable to the University of Virginia and sent to:

Constance Alexander, Office Manager
Procurement and Supplier Diversity Services
University of Virginia, Carruthers Hall
PO Box 400202
1001 N. Emmet Street
Charlottesville, VA 22904

IV. Notices

Any notice required or permitted to be given under this Agreement will be in writing and will be deemed duly given: (1) if delivered personally, when received; (2) if sent by recognized overnight courier service, on the date of the receipt provided by such courier service; (3) if sent by registered mail, postage prepaid, return receipt requested, on the date shown on the signed receipt: or (4) if sent by electronic mail, when received (as verified by the email date and time) if delivered no later than 4:00 p.m. (receiver's time) on a business day or on the next business day if delivered (as verified by sender's machine) after 4:00 p.m. (receiver's time) on a business day or on a non-business day. All such notices will be addressed to a party at such party's address as shown below.

If to the University:

Michael Morrison, Buyer Senior
JMU Procurement Services
752 Ott Street, MSC5720
Harrisonburg, VA 22807

If to Vendor:

Dave Radford
TCS International, Inc.
55 Union Avenue
Sudbury, MA 01776
Email: dradford@tcsintl.com

ACCEPTANCE

For James Madison University

Michael Morrison

Michael Morrison
Procurement Buyer Senior

5/7/2024
Date

For TCS International, Inc.

Dave Radford
President

May 7, 2024
Date

Agreement #: UCPJMU6879-PAC

TCS INTERNATIONAL PRESENTS

James Madison University

RFP # MPM-1202

VEHICLE COUNT SYSTEMS
BID SUBMISSION

ORIGINAL

CONTACT

TCS International Inc.
55 Union Avenue – Sudbury, MA 01776
P. 978.443.2527

7243375 Canada Inc./ TCS International
3445 Lake Shore Dr W
Etobicoke, ON M8W 1N2
P. 416.259.4862
E. sales@tcsintl.com W. www.tcsintl.com

TCS International

Table of Contents

REQUEST FOR PROPOSAL
RFP# MPM-1202

Issue Date: **January 31, 2024**

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 February 29. 2024 for Furnishing The Services Described Herein.

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:

TCS International, Inc.

55 Union Avenue

Sudbury, MA 01776

By: _____
(Signature in Ink)

Name: Dave Radford
(Please Print)

Date: February 28, 2024

Title: President

Web Address: www.tcsintl.com

Phone: 978.443.2527

Email: dradford@tcsintl.com

Fax #: 978.579.9545

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.

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 24 Months 7

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 #
AdventHealth Orlando, FL	Since 2013	801 Benjamin Center Drive Suite 101, Tampa, FL 33634	Julie Alonso P. 407.303.2789 E. julie.alonso@abm.com
Charles Schwab	Since 2019	9800 Schwab Way, Lone Tree CO 80124	Anna Fischer P. 720.418.2750 E. anna.fisher1@schwab.com
City of Lawrenceville, GA	Since 2021	435 W Pike Street, Lawrenceville, GA 30046	Brian Osborne P. 770.963.2414 E. brian.osborne@lawrencevillega.org
James Madison University	Since 2007		William Yates P. 540.568.7206 E. yateswc@jmu.edu
Montgomery County	Since 2009	101 Monroe St, 10th Floor, Rockville, MD, 20850	Jeremy Souders P. 240.777.8706 E.jeremy.sounders@montgomerycountymd.gov

4. List full names and addresses of Offeror and any branch offices which may be responsible for administering the contract.

   Dave Radford - President

   55 Union Avenue

   Sudbury, MA 01776

   P. 978.443.2527 x36 E. dradford@tcsintl.com

5. 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 [X] NO
   IF YES, EXPLAIN:

ATTACHMENT B

Small, Women and Minority-owned Businesses (SWaM) Utilization Plan

Offeror Name: TCS International, Inc **Preparer Name:** Dave Radford

Date: 02/28/24

Is your firm a **Small Business Enterprise** certified by the Department of Small Business and Supplier Diversity (SBSD)? Yes_____ No__X__

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_X___

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__X__

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__X__

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

4.0 Cover 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 29, 2024

Dear Michael Morrison.

I would like to take this time to thank you for giving TCS the opportunity to propose on the RFP # MPM-1202 to provide Vehicle Count Systems/Parking Guidance Systems for James Madison University.

TCS has been the chosen contracted provider for customized vehicle count/parking guidance systems for the university since 2019, with sone of our PGS installations at JMU dating back to 2007. Since then, we've worked with the university to upgrade and expand our PGS offerings. Our project team is intrinsically familiar with the campus parking requirements and will continue to work with the university to provide cutting-edge PGS systems to reduce parking congestion and carbon emissions. Our project team has worked together on over 500 global projects, and we feel confident we can continue to serve the university well with our customized Parking Guidance implementation. We own the IP to all our products, and all are North American made eliminating lengthy lead times.

TCS has extensive experience in providing customized wayfinding and parking guidance systems for all market sectors including universities, municipalities, employers, shopping centers, etc. We boast high return customer value, due to our holistic approach to system implementation and focus on various technologies to provide the best and most cost-effective solution to each customer.

Our systems are expandable and have an open API which allows the owner to push accurate REAL TIME Parking Availability to their own or any known 3rd party parking app provider such as Passport, SpotHero, SpotAngels etc. This allows for arrival planning prior to entering the garage.

TCS International Inc. can and will continue to deliver the best possible solution for the university and looks forward to further dialogue with all as the process continues.

Sincerely,

Dave Radford
President
TCS International Inc.
P. 978-443-2527 x36
E. dradford@tcsintl.com

5.0 Project Understanding

5.1 TCS Overview

Founded in 1999, TCS International was first to market in North America with Single Space monitoring and Level Counting PGS solutions. Evolving from Distributor to Manufacturer in 2004, TCS International went to market with several cutting-edge designs. End of space single space ultrasonic sensors eliminating the need for a remote lamp, USDS directional sensors eliminating the need to saw cutting loops into the deck, wireless mesh networks reducing cable and civil work, cluster USDS design directional sensors eliminating the need of delineation posts are just a few of the reasons Q-Free acquired TCS in 2012. In 2021, TCS International was acquired by Managing Director Dave Radford.

Strong development and financial support have allowed TCS to expand and become one of the largest Parking Guidance providers in the world. With installations in 22 countries, our customer base exceeds 500 systems (300+ in the North American region).

Some of our key account installations are:

- Aksarben Village – Omaha, NE
- Charles Schwab Employee Campus Garages – Westlake, TX
- Charles Schwab Employee Campus Garage – Austin, TX
- Charles Schwab Employee Campus Garages – Denver, CO
- City of Austin, TX
- City of Calgary, AB Canada
- City of Ottawa, ON Canada
- City of Sarasota, FL
- Del Amo Fashion Center Garages – Torrance, CA
- AdventHealth - Orlando, FL
- GO Transit Metrolinx - Greater Toronto Area, ON Canada (12+ stations)
- Jamul Casino - Jamul, CA
- LinkedIn Employee Garage - Sunnyvale, CA
- Sherway Gardens – Toronto, ON Canada
- Stanford University Redwood City, CA

TCS International supplies a complete line of technologies depending on the application. Other Parking Guidance providers claim to “specialize” in one technology and try to fit it in all applications not always working and being the most budget friendly. This does a disservice and can in some applications do more damage by providing inaccurate counts.

TCS looks at the application and then applies the best solution based on 20+ years of experience and an installation base of over 500+ systems globally.

5.2 Why You Should Choose a TCS Parking System

- **Pioneer in the market:**
  - TCS International is a pioneer bringing Parking Guidance to the North American market in 1999. Our global Parking headquarters are located outside of Boston, MA with additional offices in Toronto, ON, and Dallas, TX.
- **Diverse Product Portfolio:**
  - We have the most diverse product portfolio in the market, not just focusing on a single detection type but offering a wide range of products to address any parking issue and budget.
- **Extensive Project Experience:**

  - Our engineers bring experience from 500+ GLOBAL projects to assure the right technology is used to provide the highest level of accuracy depending on parking area architecture, amount of throughput, and all unique characteristics of the project.
- **Scalability:**
  - Our "scalability" allows for a blend of technologies within the project to meet unique inventory requirements and use cases. We have an open API and can interface with any PARCS providers, App providers, Gate systems, Gate/frictionless solutions, etc.
- **North American Made:**
  - We own and write our IP. All counting equipment is manufactured in North America and is stocked in multiple strategic locations allowing for immediate delivery or replacement in the unlikely event that it is required.
- **Warranty & Support:**
  - We stand behind our products in offering a standard 2-year warranty. We also offer a free weekly system remote health check for the first 6 months after commissioning with all our systems to ensure maximum customer satisfaction.
- **Custom design:**
  - TCS will work with prospective clients to design and ensure the accuracy levels of the suggested system are provided and will NOT sell where objectives cannot be met. Our integrity is more important than the NEXT order.
- **References:**
  - There is no better reference than a repeat order. With over 500 systems and more than half a million spaces monitored globally, we also boast one of the highest levels of return customers purchasing multiple systems over the years.
- **Technology:**
  - TCS International uses ultrasonic detection technology providing the highest most reliable detection accuracy, with quick installation, minimal maintenance, and long-life expectancy.

5.3 Project Roles

Dave Radford – President

Will serve as the point of contact before the notice to proceed. Dave has been in the Parking Industry for over 20+ years, focusing exclusively on the PGS market segment for the last 15 years. Dave's experience in the PGS market has been the driving force for continued innovation at TCS and proves to be an unmatched asset to constant improvement.

Dave has been involved in the design, customization, and implementation of over 300+ installations. He has been instrumental in the implementation of City-wide solutions, multi-garage solutions and large-scale projects, such as Nike Headquarters, City of Calgary, and City of Ottawa.

Rusty Rose – Director of Project Management (Project Manager)

Will serve as the point of contact after the contract award. He has been with TCS for 15+ years, and during that time has managed most of the 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. He is available to start work on this project as soon as the contract/PO is received.

Recently completed/ongoing PGS projects include:

- Montgomery County, MD battery operated/wireless single space system for four garages with over 3,000 sensors

- Nike Headquarters OR, project managed single space monitoring installations for 5 employee garages with over 5,000 single space sensors
- James Madison University, VA project managed level counting installations for 5 campus 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 TCS for 7+ years and has been involved in the system design and system commissioning process of TCS PGS systems during this time. He is available to start work on this project as soon as the contract/PO is received.

Recently completed/ongoing projects include:

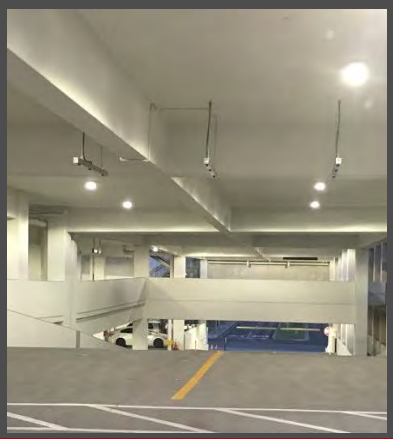
- AdventHealth - Orlando FL 7,500+ space single space system for 5 parking garages
- Jamul Casino, CA 2,000+ space single space system
- VA Lakeview Orlando, FL- 2,600+ space single space system for 2 parking garages

Denise Romano – Service & Logistics Coordinator

Denise is the Service & Logistics Coordinator assigned to coordinate all post-installation service and maintenance work for this project. She has been with TCS for 15+ years and has been taking good care of all TCS customers since then. He is available to start work on this project as soon as the contract/PO is received.

5.4 TCS 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
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

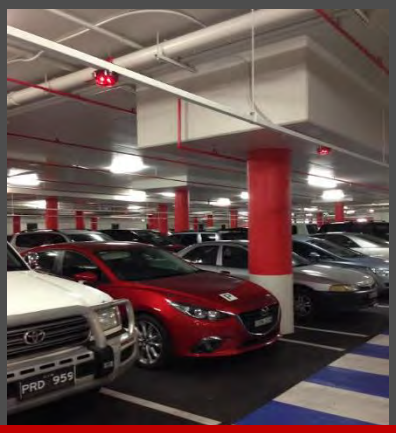
Years of Experience:

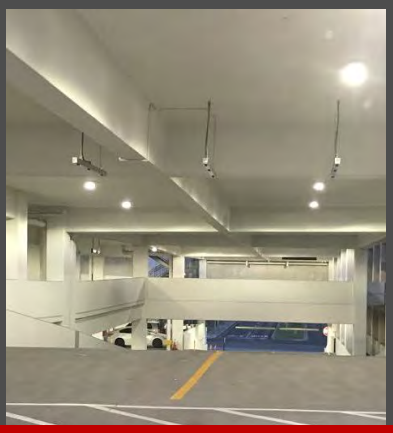
Rusty has been a part of TCS since 2006. Since then, he has been the lead project manager for most US TCS PGS projects.

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

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





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

Education

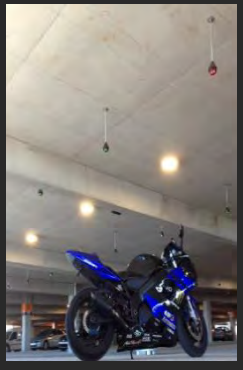
University of Massachusetts, Lowell
2011-2015
Bachelor of Science in Mechanical Engineering

Years of Experience:

Andrew has been a part of TCS since November 2015. Since then, he has been involved in the design, commissioning, and warranty/repair process for TCS PGS projects.

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



5.5 Situation Analysis:

James Madison University (JMU) is a comprehensive public institution in Harrisonburg, Virginia with an enrollment of nearly 22,000 students and over 4,000 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.

5.6 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 campus 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.

5.7 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 websites enhances 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.

5.8 Statement of Needs Compliancy Matrix

Requirement	TCS Answer
A. Contractor shall perform work between 7:30 AM – 4:00 PM, Monday through Friday.	TCS is compliant with this requirement.
B. James Madison University currently uses a mix of ultrasonic counters at entry and exit points and single space sensors in special-use spaces to factor them out of the general count.	TCS has provided ultrasonic directional sensors as well as ultrasonic single space sensors for multiple campus garages over the years.

Requirement	TCS Answer
C. 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.	Our proprietary ultrasonic directional sensors are ceiling mounted and suspended over drive lanes (entry and exit) and can be placed on the internal ramp system. We use our 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. TCS 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.	TCS 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. We currently use outdoor cameras for monitoring outdoor parking spaces.
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 TCS 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
E. Provide the complete specifications of all new equipment and operational components for a turn-key installation.	TCS has included user manuals and data sheets for all included components within this submission. Please refer to Appendix A for additional information.
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	TCS 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. TCS devices work through the mesh network back to the gateway/s connected to the client network.

Requirement	TCS Answer
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. 6. Describe licensing. If licensing of the software is based on number of users or screens etc. describe the models used to obtain numbers for both current and future usage	TCS provides a customized "dashboard" in the VCC (Visual Control Center) showing all pertinent information. 1. 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). 2. Counts of open spaces can manually be adjusted in the TCS VCC software. 3. The VCC tool bar will take the customer to all required statistical reports, actions such as changing occupancy parameters, sign messages etc. 4. The TCS VCC software can send email alerts based on predefined business rules. Custom messages for the variable message signs can easily be created. 5. JMU already owns the TCS PGS central server. Any additional new garages/lots will only require a one-time license fee to set them up in the system. There are no ongoing licensing fees in the indoor TCS software system. 6. There are on-going monitoring fees for any outdoor camera monitoring applications. These fees typically depend on the number of parking spaces monitored. Details can be found in the pricing section.
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	TCS 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

Requirement	TCS Answer
website and an anticipated future mobile application for Android and iOS smart phones.	using the TCS 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.	TCS 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 TCS system is extremely stable and requires minimal maintenance customer interference. The first PGS system by TCS was installed in 2007 with minimal service required. Over the years TCS has installed systems in multiple additional garages including replacement of the originally installed system. The number of equipment replacements and service calls has been minimal. The TCS system has not had a critical system failure for the last 16 years. 1. TCS 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 TCS products and can address any issues that require on-site personnel. • Standard hourly rates are: Mo-Fr 8 am to 4 pm: $195/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 TCS at the provide service coordinator phone number 3. Remote support is provided by TCS engineers at the TCS Parking headquarters in Sudbury, MA. Remote access to the central PGS

Requirement	TCS Answer
	server is required, and already existing. 4. TCS strongly recommends the client enter into a maintenance agreement at time of purchase to be performed 2 times per year to assure the longevity of the system. Pricing to be discussed 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.	TCS complies with this requirement.

6.0 Proposed Solution

The TCS solution is tried and tested and combines well-known components with the 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 TCS 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 parking system operator through best performance and lowest possible costs.

6.1 Overview of our TCS Parking Guidance System Technologies

6.1.1 Single Space Sensing Technology

In a TCS International Single Space installation every parking space is monitored by an overhead mounted single space sensor at the end of each parking stall utilizing a raceway of uni-strut or EMT conduit carrying the required low voltage cable. Our end of space installation provides higher visibility for drivers driving down a drive aisle. Combining sensor and indicator light into the same housing vs. sensor in parking space middle and indicator light at the end as some of our competitors, provides significant savings on installation.

Our sensor detects vehicle presence by ultrasonic distance measurements. Ultrasonic distance measurement is the most accurate method of detection at nearly 100% for cars/trucks/SUVs, 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).

Our sensors provide full RBG LED status indication, so any color can be assigned to a parker type. We also provide flashing capability as well as the ability to turn the sensor LEDs off when the space gets occupied. 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. When a vehicle enters the parking space the sensor LEDs switch to red, and the change in

occupancy is transmitted to a zone controller and from there to strategically placed wayfinding signage.

With IP 65 protection and easy installation, our sensors require little to no maintenance. Although the initial cost of installing an ultrasonic system is relatively high compared to a camera system, maintenance is low, and parts are easily replaced at a fraction of the cost compared to camera-based systems.

Our system design allows for individual space occupancy indication, i.e., every space has an 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.

All the covered parking spaces will be monitored by individual single space sensors. The uncovered roof spaces will be monitored by ultrasonic directional sensors installed at covered roof access points on each roof level entry. Our proposed “cluster” design USDS configuration is used in extra wide (20’+) lanes on entries/bi-directional ramps. A series of 3-USDS sensors is placed across the span to cover all possible transactions. See data sheet in the submission for various scenarios. Utilizing the TCS International “cluster” design eliminates the need for lane delineation on the ramps and the additional use of flexible posts, bollards, etc.

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 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.

6.1.2 Level/Facility Count Sensing Technology

TCS International’s level/facility count system is the most accurate and advanced system on the market. Vehicle entry/exit at garage/level transition area entry/exits are monitored by overhead mounted Ultrasonic Directional Sensors (USDS). These sensors measure vehicle entry exit and driving direction accurately providing reliable counting information to the server backend and to strategically placed wayfinding signage.

These Ultrasonic Directional 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 TCS International 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.

Within our system, we have the flexibility to provide single USDS for delineated entry/exit and/or ramp lanes as well as 3-unit "cluster" design configurations that can cover extra wide (20'+) lanes on entries/bi-directional ramps. Utilizing the TCS International "cluster" design eliminates the need for lane delineation on the ramps and the additional use of flexible posts, bollards, etc. while providing the highest accuracy total garage/floor counts.

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 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.

6.1.3 Outdoor Monitoring Solution

TCS has partnered with Mistall Insight Inc.to provide the latest camera-based inventory management technology for outdoor lot monitoring.

Mistall has developed a time-lapse cellular-enabled camera specifically for the parking industry. This off-grid camera uses artificial intelligence to count vehicles and measure dwell-time. The cameras are designed for surface-lot parking in outdoor locations and withstand adverse weather conditions typical of Virginia. Cameras can be mounted to existing lamp posts, buildings, or any location with a view of the parking spaces:

- The solar panel and accompanying battery provide power, so no electrician is required.
- The cellular modem communicates anywhere that 3G (or better) cellular coverage is available so there is no IT involvement required.
- The time-lapse nature of the imaging takes a photograph every 3-minutes for near real-time processing.
- Up to three cameras can connect to one mount (solar panel, battery, modem).

Implementation of cameras may look like this:

6.1.4 Space Availability Signs

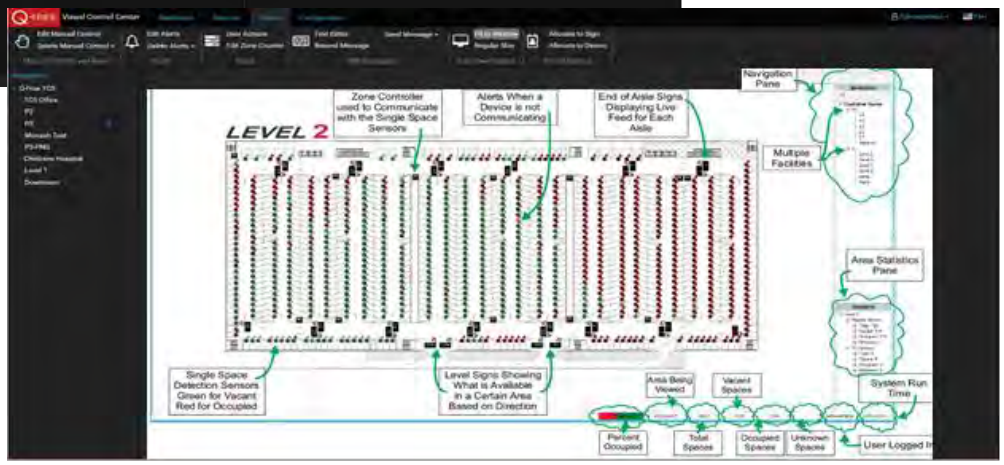
In previous projects, TCS has provided various sign designs for the existing Vehicle Count systems at James Madison University. We've also started upgrading existing sign designs to new school colors and design.

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

6.1.5 Central PGS Software

Any additional garage 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 TCS. Our system has an open API interface to 3rd party applications such as websites, apps, etc. Future expansion to other garages, facilities, roadway signs etc. is readily available.

Our software offers unlimited expansion, so additional garages, campuses, etc. can easily be integrated.

6.1.6 Open API

TCS International has an open API and can provide parking availability information to any known 3rd party parking app provider such as Passport, SpotHero, SpotAngels etc. Our open API also makes it easy to integrate parking availability information to your own website or app.

Examples of TCS International integrated parking information on customer websites/apps:

- https://www2.montgomerycountymd.gov/gisparking/parkingpublicmap.htm
- https://www.jmu.edu/parking/
- https://www.calgaryparking.com/findparking/lotlocations

6.2 Project Approach

Providing services in our competence, we feel we are a highly skilled group with experience in over 500 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 to make 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.
- 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 10-12 weeks after submittal sign off
- The installation of the conduit, cabling and PGS equipment will be performed by a TCS appointed Electrical contractor, with TCS remote support
- Once the installation is completed, TCS may remote or on-site commission the site and train owner personnel on the equipment.
- Any post installation related issues and warranty support will be addressed by TCS directly

6.3 Post Installation Customer Service

Support provided out of the Sudbury office consists of addressing hardware and software related issues. For software-related support 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, TCS will use trained local personnel to address any hardware issues during the duration of the contract.

7.0 System Hardware Breakdown

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

7.1 Vehicle Count System Hardware:

7.1.1 Single Space Sensor System:

QTY	PART#	DESCRIPTION	UNIT COST
1	**TUS-300**	**RGB Single Space Sensor:** • Smart design located at the end of each covered parking space for higher visibility. • Measuring vehicle occupancy through ultrasonic distance measurement. • Occupancy status indicating LEDs: o RGB color standard space units with i.e., green status for available space, red status for occupied space, and amber status for reserved or EV space and blue status for handicapped space, etc. provided o Freely programmable RGB colors to fit customer requirements • IP 65 rating. • RS-485 multi-drop communications to area controller; and • Max. mounting height 3 m.	**$80.00**
1	**HHP**	**Handheld Programming Unit for Single Space Sensors**	**$61.00**
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.	**$1,380.00**

7.1.2 Ultrasonic Directional Sensors for Level/Zone Counting:

QTY	PART#	DESCRIPTION	UNIT COST
1	**USDS**	**Ultrasonic Directional Sensor:** • For use in a three (3) unit cluster configuration or single unit configuration to cover varying widths of garage/level entrances/exits. • 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* • *TCS is not responsible for accurate system counts if proper lane delineation, if required, is not implemented, and maintained by others.*	**$990.00**
1	**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.	**$975.00**
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.) o Equipment pre-configured in 14" x 12" x 6" NEMA 4 PVC indoor enclosures	**$888.00**

QTY	PART#	DESCRIPTION	UNIT COST
1	DP	**Directional Delineation Posts:** • Lane delineation equipment used to ensure proper vehicle counts. • Min. box of (25) units • 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.	**$61.00**
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.*	**$1,386.00**

7.1.3 Outdoor Lot Monitoring Equipment:

QTY	PART#	DESCRIPTION	UNIT COST
1	CAM VCC1	**Mistall Camera:** • Panoramic 180°5 MP PoE camera or equivalent • To be installed on existing/new poles *Note: The higher the mounting height the higher the counting accuracy*.	**$1,040.00**
1	MNT-CAM1	**Camera Mount Pole** • Camera mount bracket for mounting camera to existing pole	**$166.00**
1	MNT-CAM1	**AC Power Kit:** • Electrical junction box, transformer, pole mount, cabling, connectors, and accessories	**$395.00**
1	MNT-SP	**Solar Power Kit:** • Electrical junction box, battery, 50W solar panel, charge controller, pole mounts, cabling, connectors, and accessories	**$1,395.00**
1	COM-CELL	**High Speed Cellular Communication Kit**	**$520.00**

7.2 Space Availability Signage:

QTY	PART#	DESCRIPTION	UNIT COST
1	WFS/ 3x7.5	**Wayfinding Sign Type 1 (Sample Sign Design):** • New wayfinding sign indicating space availability for (2) parking garages per new Master Plan sign design • To be installed on existing foundation/s using existing J-bolts or new foundations by others • Total of (2) space availability displays per sign cabinet: o Number of spaces and OPEN in double stroke green LEDs with 7.5" LED character height; and o FULL in single stroke 6" LED character height. • White reflective vinyl lettering. • Includes single 8' clearance pole *NOTE:* • *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* 	**$31,801.00**
1	XBEE-SIGN	**Wireless Communication Equipment for Wayfinding Sign Type 1 Locations:** • Includes (1) 120 VAC wireless modem, antenna, peripherals, etc. for Type 1 Wayfinding Sign location/s	**$584.00**
1	WFS/ 3x7.5/INST	**Delivery & Installation of Wayfinding Sign Type 1** • Includes delivery and installation of Type 1 Wayfinding Sign on existing/provided footings by others	**$4,018.00**

QTY	PART#	DESCRIPTION	UNIT COST
1	**ES-1/ 3x7.5/ 16x64 VMS**	**Entry Sign Type 1 (Sample Sign Design):** • Entry Sign Type 1 indicating space availability for parking garage per new Master Plan sign design • To be installed on existing foundation/s using existing J-bolts • Total of (3) space availability displays per sign cabinet: o Number of spaces and OPEN in double stroke green LEDs with 7.5" LED character height; and o FULL in single stroke 6" LED character height. • Total of (1) 16x64 AMBER VMS display per sign cabinet • White reflective vinyl lettering. • Includes double posts *NOTE:* • *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* 	**$27,157.00**
1	**XBEE-SIGN/VMS**	**Wireless Communication Equipment for Entry Sign 1 Locations:** • Includes (2) 120 VAC wireless modems, antenna, peripherals, etc. for Entry Sign 1 location/s	**$984.00**
1	**ES-1/ INST**	**Delivery & Installation of Entry Sign Type 1** • Includes delivery and installation of Entry Sign Type 1 on existing/provided footings by others	**$2,961.00**

QTY	PART#	DESCRIPTION	UNIT COST
1	**ES-2/ 1x7.5/ 1x16x64 VMS**	**Entry Sign Type 2 (Sample Sign Design):**  • Entry Sign Type 2 indicating space availability for parking garage per new Master Plan sign design • To be installed on existing foundation/s using existing J-bolts • Total of (1) space availability display per sign cabinet: o Number of spaces and OPEN in double stroke green LEDs with 7.5" LED character height; and o FULL in single stroke 6" LED character height. • Total of (1) 16x64 AMBER VMS display per sign cabinet • White reflective vinyl lettering. • Includes double posts *NOTE:* • *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*	**$18,755.00**
1	**XBEE-SIGN/VMS**	**Wireless Communication Equipment for Entry Sign 2 Locations:** • Includes (2) 120 VAC wireless modems, antenna, peripherals, etc. for Entry Sign 2 location/s	**$984.00**
1	**ES-2/ INST**	**Delivery & Installation of Entry Sign Type 2** • Includes delivery and installation of ES-2 entry sign 2 on existing/provided footings by others	**$2,961.00**

7.3 Software

7.3.1 Software License per Additional Garage for Existing PGS Server:

QTY	PART#	DESCRIPTION	TOTAL COST
1	SL	**Indoor PGS 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.*	**$4,265.00**

7.3.2 Outdoor Lot Camera Monitoring Recurring Costs (Annually):

QTY	PART#	DESCRIPTION	ANNUAL COST
1	SIMUS	**SIM Card and Data Plan** • Cost per cellular kit per year • Includes project specific SIM card and data plan for cellular communication. *Note: Invoiced annually at the beginning of each year.*	**$528.00**
1	SWSTD	**Outdoor Camera Monitoring Software License** • Software license cost per camera per year • Includes software license for Mistall Insight monitoring dashboard • Hosted software solution for Mistall *Note: Invoiced annually at the beginning of each year.*	**$406.00**

7.4 Additional Provisions:

QTY	PART#	DESCRIPTION	UNIT COST
1	DES	**System Design:** • Hourly rate for standard in-house system design for new projects; and • Includes documentation, drawings, and all related design work.	**$198.00**
1	PM	**Remote Project Management:** • Hourly rate to perform all off-site coordination and remote project management to supply the new PGS system expansion/s.	**$208.00**
1	SOFT-D	**Software Development** • Hourly rate for software development support	**$228.00**
1	RIS	**Remote Support:** • Hourly rate to provide remote engineering support *NOTE:* • *All additional services and supporting expenses will be billed at standard rates if delays are caused by the customer or a third party.*	**$198.00**

QTY	PART#	DESCRIPTION	UNIT COST
		• *Remote installation support must be scheduled at least 1 week in advance.* • *Remote installation support to be provided during regular business hours Mo-Fri 8 am to 4 pm EST.*	
1	**SITE-SUR**	**Site Survey** • Site survey to review all existing sign locations to determine which cabinets/locations can be refaced and which locations require new sign cabinets as quoted included.	**$3,895.00**
1	**SH**	**Remote System Health Check:** • Inclusions: o Weekly remote system health check for 6-months for system expansions to ensure proper system functionality *Note: Remote system access required.*	**Incl.**
1	**2YW**	**2-Year Warranty**	**Incl.**

7.5 Exclusions:

DESCRIPTION
Exclusions: **The following is excluded in this proposal:** • Freight & handling • Travel related expenses • Related civil work, including but not limited to: o Electrical work includes conduit for communications & power, power wiring, and final electrical connections. o Required digging, trenching, coring, etc.; and o Concrete, asphalt, and protective bollards. • 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. • Installation of the PGS components other than for availability signs as selected. • 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.*

7.6 Terms:

DESCRIPTION

Terms:

- Progress payments based on owner approved schedule.
- This quote is valid for 180days. Prices are subject to increase after the validity period.
- 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.
- The purchaser is responsible for system maintenance upon project completion.

DISCLAIMER:

- *All POs to be issued to TCS International TCS, Inc.*
- *In the event of any discrepancy in pricing in this proposal, unit prices shall govern over total prices.*
- *This document and information are property of TCS International and is not intended for the use of any but the Business Entity to whom this proposal is addressed.*
- *This proposal does NOT include a calculation of Sales, User, State, or Provincial Taxes. These taxes are the sole responsibility of the customer unless tax exempt certificate is provided*

7.7 Warranty

DESCRIPTION

Limited Warranty:

- TCS International ("TCS") warrants to its direct customer ("Customer") that each TCS product purchased by Customer (each, a "Product") will conform in all material respects to TCS published specifications for such Product for a period of two (2) years from the date of Customer's completion of system commissioning or 26 months from date of TCS International shipment, whichever incurs the earliest. Spare parts warranty is 90 days from equipment shipment.
- TCS provides warranty services during its normal business hours and requires TeamViewer access for troubleshooting. If TeamViewer access is not provided, TCS will charge for all phone & site services per TCS' 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.
- 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 TCS.
- This warranty shall not apply if watertight connections for conduit, conduit fittings, and connectors are not utilized to protect electronic components or if LED failure in 3rd party sign cabinets is due to cabinet integrity, moisture, condensation, or leakage determined at TCS' discretion.
- 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.
- TCS' 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 TCS within the warranty period. Customer shall bear shipping expenses to TCS' facility. TCS will bear shipping expenses back to the customer. Labor expenses for diagnostics and/or repairs by TCS for items not deemed under warranty 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 TCS materials, equipment or software manufactured by a party other than TCS ("Third Party Products"), this warranty shall not apply to such Third-Party Products and in lieu thereof TCS shall use reasonable efforts to pass through to Customer any manufacturer's warranty regarding the Third-Party Products.
- 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 TCS. The United Nations Convention on Contracts for the International Sale of Goods shall not apply. TCS does not warrant that the operation of any software will be uninterrupted or error free.
- TCS International 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 TCS 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 TCS 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.

7.8 Customer Agreement Terms and Conditions

Agreement Governs: 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 TCS International ("TCS"). This Agreement supersedes all terms and conditions provided by you in any document, including purchase orders accepted by TCS. All other terms and conditions are invalid regardless of when delivered.

Software: 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 TCS (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) TCS retains ownership of the software, and (f) the software contains confidential, propriety information that is a valuable trade secret of TCS and is protected by copyright laws and you will keep such information strictly confidential.

Limited Warranty: The limited warranty applicable to the Equipment is set forth in TCS' 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.

Governing Law: 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.

Limitation of Remedies and Liability: YOUR SOLE AND EXCLUSIVE REMEDIES FOR DEFECTIVE EQUIPMENT SHALL BE AS SET FORTH IN TCS' STANDARD WARRANTY TERMS REFERENCED ABOVE. IN NO EVENT SHALL TCS INTERNATIONAL 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 TCS INTERNATIONAL HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, WHETHER SUCH CLAIMS ARE BASED ON CONTRACT, TORT, PRODUCT LIABILITY, OR OTHER THEORIES OF LIABILITY. TCS' 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, TCS INTERNATIONAL MAKES NO REPRESENTATION OR WARRANTIES, EXPRESS OR IMPLIED, CONCERNING THE SERVICES, EQUIPMENT, MATERIALS OR PERFORMANCE.

Assignment: 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, TCS 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 TCS to such third party.

Vendor Product Procurement: TCS will at times change vendors and/or will be unable to procure originally quoted Equipment. In this event, TCS 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.

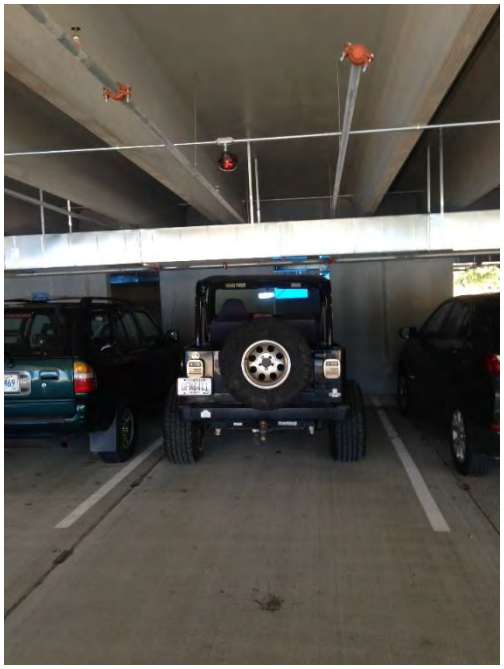
Miscellaneous: Any modification or waiver of this Agreement must be in writing and signed by the party against whom enforcement is sought. This Agreement represents the entire and final agreement between you and TCS regarding its subject matter. In the event any suit or action is brought to enforce or 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.

8.0 TCS References

TCS International. has been continuously operating since 1999. Some of our recently completed most prolific PGS installations are included below.

8.1 AdventHealth Orlando - Orlando, FL

TCS Inc. was contacted in 2013 to provide a custom designed single space monitoring system for the AdventHealth (formerly 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, TCS has provided counting systems for three additional garages including a large 2,600+ sensor installation for the newly constructed Dade Avenue garage.



Specifics for this project include:

- Over 8,000+ TUS-100 single space sensors in 4 parking garages
- Level/facility count for 2 additional garages with over 25+ USDS ultrasonic directional sensors
- Wireless system communication
- Custom designed wayfinding and Daktronics VMS signage
- Central client/server system for all garages at parking office location
- Design and implementation by TCS Inc. working with a customer appointed Electrical Contractor
- Multi-phase approach from 2013 to 2022
- We recently completed a large single space sensor installation for the newly constructed Dade Avenue garage in May 2022 that included 1,300+ RGB sensors and Variable Message displays

Contact Info:
Julie Alonso
Operations Manager Parking and Guest Services
ABM Healthcare
5801 Benjamin Center Drive Suite 101, Tampa, FL 33634
P. 407-303-2789 (Office)
E. julie.alonso@abm.com

8.2 Charles Schwab – Lone Tree Campus, CO

In 2019, TCS was selected during an RFP process to provide a custom designed single space parking guidance system for (3) Charles Schwab employee locations. Having recently moved their operations from CA to TX and CO respectively, Charles Schwab was looking to optimize parking for

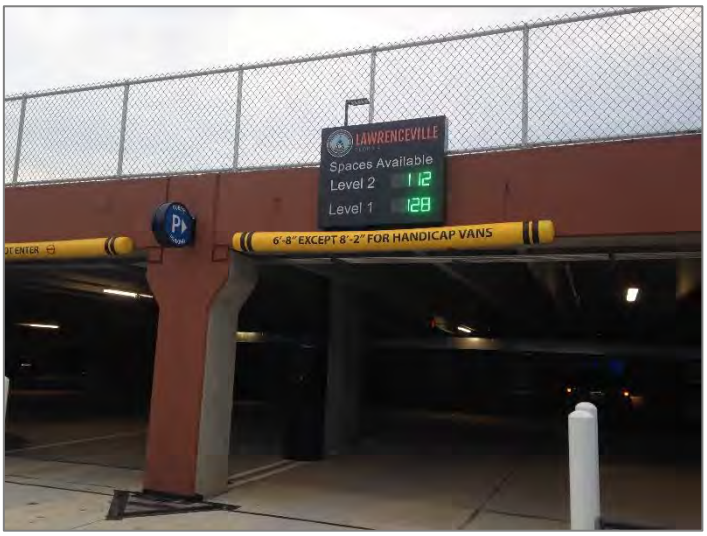
their employees in the (5) newly constructed employee parking garages on the (3) campuses. Each location had a different contact. For the two Lone Tree Campus Garages, TCS provided ultrasonic single space sensors along with space availability signage. All garages were completed and commissioned on time and on budget in 2021.

Specifics for this project include:

- Customized PGS system for (2) newly constructed employee garages
- Over 1,750+ single space sensors in two parking garages
- Wireless system communication
- Custom designed space availability signage
- Central server serving all garages networked over the customer network
- Design and implementation by TCS Inc. working with a TCS appointed Electrical Contractor
- Project PM: Rusty Rose
- Total of $850K in PGS installations

Contact Info:
Anna Fisher
Sr Specialist - Systems Engineering | Corporate Security
Charles Schwab Lone Tree Campus
9800 Schwab Way, Lone Tree CO 80124
P. (720) 418-2750
E. anna.fisher1@schwab.com

8.3 City of Lawrenceville, GA



TCS in an RFP process was selected to provide a custom designed single space monitoring system for (2) City of Lawrenceville Garages. To improve downtown parking congestion. Ultrasonic single space sensors were installed at all covered parking spaces of the garage to accurately track parking space availability. Custom designed interior and entry signs quickly and efficiently guide parkers to the first available parking space. The project was completed in two phases in August of 2021, on budget and on time.

Specifics for this project include:

- Custom designed single space monitoring system APGS system for 2 downtown garages
- 400+ Ultrasonic single space sensors
- Custom designed garage entry and interior wayfinding signs
- Wireless system communication
- Central server networked over the customer network
- Design and implementation by TCS
- System for 2nd garage commissioned in March 2022

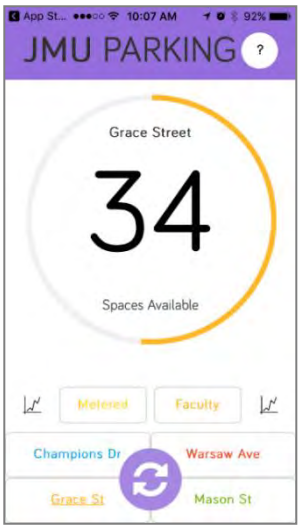
Contact Info:
Brian Osborne
Public Works - City of Lawrenceville, GA
435 W Pike Street,
Lawrenceville, GA 30046
P. 770-963-2414
E. Brian.Osborne@lawrencevillega.org

8.4 James Madison University – Harrisonburg, VA

In 2007, 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. TCS has provided Parking Guidance & Dynamic Wayfinding Signage 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 Parking Guidance & Dynamic Wayfinding Signage for (5) mixed use campus garages
- Over 30+ Ultrasonic directional sensors for level counting in addition to over 100+ TUS-100 ultrasonic single space monitoring for ADA/specialized spaces
- Wireless system communication
- Custom designed roadway signs with space availability and VMS displays
- Central server networked over the customer network
- Design and implementation by TCS working with a customer appointed Electrical Contractor
- Web interface: https://www.jmu.edu/parking/faculty-staff/space-counts.shtml
- Outdoor monitoring pilot installed in November 2021



Contact Info:
William C. Yates,
Director Parking Services
Division of Administration and Finance
James Madison University
P: 540.568.7206
E. yateswc@jmu.edu

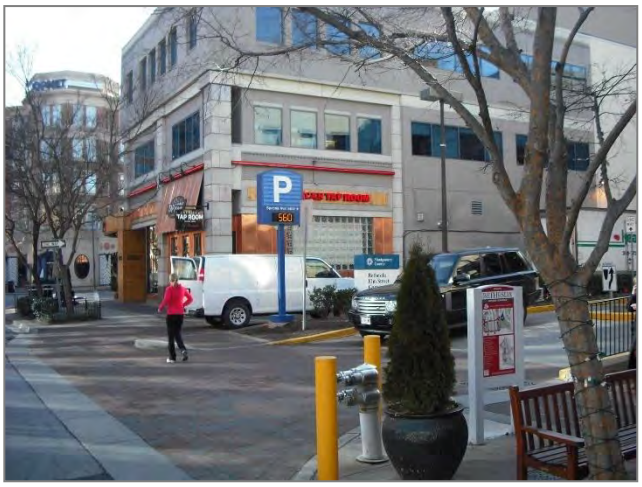
8.5 Montgomery County, MD

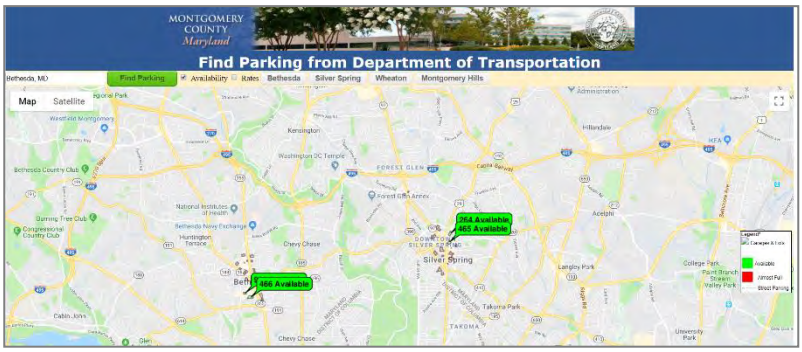
In 2009, TCS was first approached to install a battery powered single space monitoring system in one of the busy downtown garages. Since then, we have installed systems in three additional downtown garages. Also provided were custom designed way-finding signs strategically placed at decision making points. 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 APGS system for (4) highly frequented parking garages
- Over 3,000 battery operated ultrasonic single space sensors
- Wireless system communication
- Custom designed way finding & space availability signage
- Central server serving all garages networked over the customer network
- API to customer managed website https://www2.montgomerycountymd.gov/gisparking/parkingpublicmap.htm
- Design and implementation by TCS Inc. working with a customer appointed Electrical Contractor

Contact Info:
Jeremy Souders, Chief Management Services Section MCDOT
Division of Parking Management
P. 240-777-8706
E. Jeremy.Souders@montgomerycountymd.gov





9.0 Exhibit E – Supplemental Documents

- Datasheets
- Case Studies
- Sample Layout Drawings
- Equipment Manuals

TCS PGS

Parking Guidance System Overview

OVERVIEW

Globally proven for more than a decade, TCS Parking Guidance Systems help drivers locate more than 500,000 parking spaces each day. Accurate space availability is gathered by ultrasonic sensors – the most reliable technology on the market – and shared with drivers via wayfinding signs, websites, mobile apps, and more. Systems help drivers locate more than 500,000 parking spaces.

Drive down congestion, pollution, and stress related to the search for parking

Optimize operational costs, garage utilization, and boost revenues

Create a positive user experience

TCS Parking Guidance Systems are flexible to fit any customer requirement from large single space installations to small facility count projects. An open API interface allows the system to easily integrate with other technologies and third-party products, providing one of the most flexible solutions on the market.

APPLICATIONS

Parking Guidance Systems are gaining popularity across a wide variety of industries.

TCS solutions currently support:

- **Large Employers**
- **Universities**
- **Hospitals**
- **Casinos**
- **Airports**
- **Shopping Malls**
- **Mixed-Use Facilities**
- **etc.**

(978) 443.2527
www.tcsintl.com | sales@tcsintl.com

Unparalleled Technology

HOW IT WORKS

Overhead ultrasonic sensors track vehicles to accurately determine occupancy by facility, level, or individual space. Availability is shared on strategically placed wayfinding signs or other media, guiding drivers quickly to available parking.

VEHICLE SENSORS

TCS has two types of ultrasonic sensors that may be used alone or in conjunction with each other to meet any goal and budget.

Ultrasonic technology is the most accurate and reliable on the market, delivering better results than camera or loop-based systems.

- **Ultrasonic Single Space Sensors**
  Monitor individual space occupancy for the entire garage or for specific spaces like ADA/handicap or electric vehicle charging. Each sensor has RGB LEDs that illuminate to indicate status, e.g. open, occupied, reserved.
- **Ultrasonic Directional Sensors**
  Track vehicles in multiple directions as they enter, exit, or maneuver the parking garage to manage space availability by facility or level.
- **Third Party Sensors or Devices**

  We can interface with 3rd party providers

WIRELESS COMMUNICATION

TCS' unique wireless system design eliminates the need for expensive cable and conduit from each device to the central server – required in most parking guidance installations.

The wireless mesh network is custom designed for each installation for optimal signal strength guaranteeing system uptime of 99.99%.

Hardwired applications are also available.

VISUAL CONTROL CENTER

TCS' user-friendly Visual Control Center (VCC) is a robust solution to monitor, store, and analyze parking sensor data.

Based on their permissions, users can access the VCC:

- **Dashboard** — View real-time occupancy charts, turnover rates, and visitor trends at a glance.
- **Reports** — Create and schedule reports to identify usage trends, occupancy, and length of stay.
- **Control** — Set up, monitor, and control parking guidance devices including sensors and signs.
- **Configure** — Establish business rules, custom messaging, and more.

Visit our website www.tcsintl.com for more information.

Our Partners

Mistall

UbiPark

parksol
simple to install • effortless to park

TCS International

(978) 443.2527
www.tcsintl.com | sales@tcsintl.com

TCS MIXED COUNTING PGS SYSTEM OVERVIEW

CENTRAL PGS SERVER

API FOR THIRD PARTY INTEGRATION

PGS GATEWAY

PGS SOFTWARE

WIRELESS COMMUNICATION

PARKING GARAGE

MASTER PANEL AT FACILITY ENTRANCE

LEVEL 2	319
LEVEL 1 (♿)	4
LEVEL 1	127

UPPER LEVEL AVAILABLE SPACES 319

COMMUNICATION POINT

USDS AT ENTRANCE

Single Space Sensors at ♿ Spaces

COMMUNICATION POINT

USDS AT EXIT

USDS BETWEEN LEVELS

TCS International

RGB ULTRASONIC SINGLE SPACE SENSOR

INDIVIDUAL PARKING SPACE SENSORS FOR TCS PARKING GUIDANCE SYSTEMS

Sensors illuminated in RGB colors

OVERVIEW

Ultrasonic distance measurement provides the highest accuracy vehicle counts for individual parking spaces.

The TCS-300 ultrasonic single space sensors are mounted overhead at the end of a parking space, and use ultrasonic distance measurement to determine space occupancy and then illuminate in green/other RGB colors (unoccupied) or red (occupied) to visually denote the space status.

The LEDs provide clear indication of status for each individual parking space vs. multispace systems with a single indication light for multiple parking spaces.

> **Built to withstand, heat, humidity, and dust, the IP65 TUS-300 single space sensors, can be used in any environment; delivering greater accuracy and less maintenance than camera-based systems.**

TUS-300 single space sensors can be used to monitor occupancy for all covered individual spaces within a parking facility or in conjunction with TCS Ultrasonic Directional Sensors (USDS) to monitor ADA/handicap, electric vehicle charging locations, or other reserved spaces.

BENEFITS

- Monitor parking occupancy and availability by space
- Communicate space status with brightly-colored RGB LEDs
- Leverage the most reliable technology in parking space monitoring
- Save money on ongoing maintenance compared to camera-based systems
- Weather-proof with IP65 rating

ACCURATELY MONITOR INDIVIDUAL SPACE OCCUPANCY

SHARE AVAILABILITY VIA WEB & MOBILE APPS

OPTIMIZE GARAGE UTILIZATION

TCS International

(978) 443.2527
www.tcsintl.com | sales@tcsintl.com

HOW IT WORKS

Ultrasonic technology is the most reliable on the market for individual-space vehicle detection.

TCS sensors detect occupancy status through ultrasonic distance measurement. The automotive-grade ultrasonic technology calibrates the distance to the ground while a space is empty.

When a vehicle occupies a parking space, the sensor detects a change in measurement and reports the space as occupied; changing the color of the integrated LED from green or any other RGB color (unoccupied) to red (occupied).

Typically blue is used for ADA indication; amber is used for reserved or VIP indication.

The red LEDs in sensors in occupied spaces can also be turned off if required.

INSTALLATION

Sensors are connected to TCS Zone Controllers (see separate product sheet) via low-voltage power/communication cables. Zone Controllers connect wirelessly with each other and via a central access point back to the central PGS server, eliminating the need and cost associated with additional conduit and cabling running from each device to a central server, as typical in most parking guidance installations.

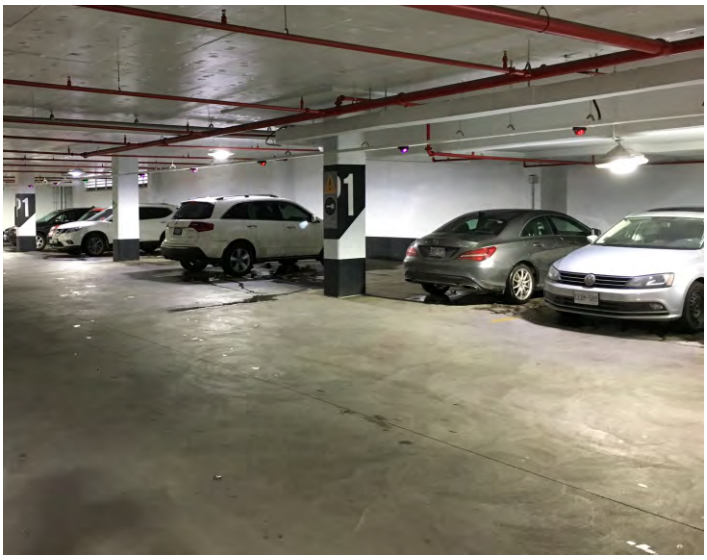
The wireless mesh network is custom designed for each installation for optimal signal strength guaranteeing system uptime of 99.99%.

TECHNICAL SPECIFICATIONS

Dimensions:	Diameter: 7” (177 mm)
	Height: 3.5” (89 mm)
	Width: 5.25” (133 mm)
Weight:	< 1 lbs (.45 kg)
Data transfer:	RS-485
Power:	48 VDC
Temperature:	-4°F to +158°F (-20°C to +70°C)
Connection:	18 AWG 4-conductor shielded wire
LED Colors:	Full RGB
Protection:	IP 65
Detection Height:	7’6” (228 cm) - 9’ (274 cm)

PART NUMBER

TUS-300 Single Space Sensor



(978) 443.2527
www.tcsintl.com | sales@tcsintl.com

USDS PARKING SENSOR

ULTRASONIC DIRECTIONAL SENSOR FOR TCS PARKING GUIDANCE SYSTEMS

△ *Three-unit cluster design*

OVERVIEW

The Ultrasonic Directional Sensor (USDS) is an overhead sensor that provides high-accuracy vehicle counts for parking garages looking to maximize occupancy or revenue.

As one of the detection options available for use with a TCS Parking Guidance System, the USDS is an effective alternative to individual space sensors that offers notable cost-savings. USDS are less intrusive than conventional in-ground loops with no compromise to membrane, rebar, or post-tension cabling.

Units can be deployed individually or as part of a three-unit cluster design to determine vehicle direction. The three-unit configuration covers up to 24 feet (7.3 meters), reducing the need for delineation to separate entrance and exit lane counts.

Sensor installation is easy and, best of all, the units can be relocated should traffic patterns change.

Sensors are connected to communication point enclosures via low-voltage power/communication cables. Enclosures house power supplies and wireless modem/s to connect wirelessly with each other and via a central access point back to the central PGS server, eliminating the need and cost associated with additional conduit and cabling running from each device.

HIGHLIGHTS

- Manage parking space availability by facility or level
- Cost efficient solution
- Track vehicles in multiple directions
- Monitor vehicles traveling up to 19 mph (30 km/h)
- Retrofit existing structures with ease and without the need for costly saw-cutting
- Control sensor logic with built-in central processing unit
- Save energy with 24 VDC low-voltage device

ACCURATELY TRACK VEHICLES

SHARE AVAILABILITY VIA WEB & MOBILE APPS

OPTIMIZE GARAGE UTILIZATION

TCS International

(978) 443.2527
www.tcsintl.com | sales@tcsintl.com

HOW IT WORKS

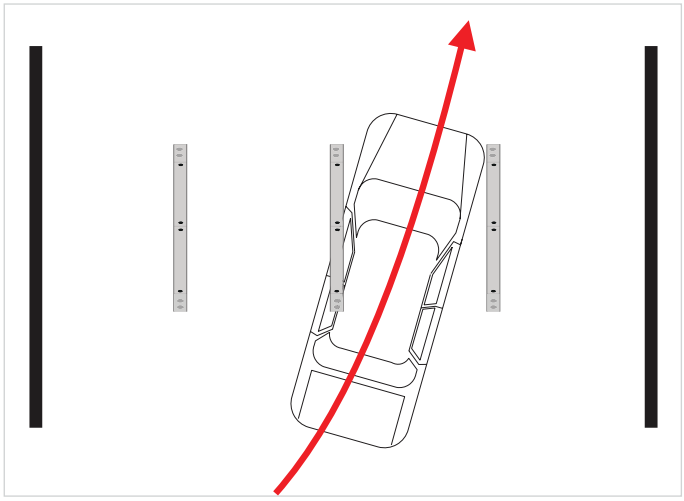
Ultrasonic distance measurement is the most reliable vehicle detection technolgy on the market.

All TCS sensors detect occupancy status through ultrasonic distance measurement. The automotive-grade ultrasonic technology calibrates the distance to the ground. When a vehicle passes under the ultrasonic directional sensor, changes in distrance measurement are recorded as well as vehicle direction and movement are detected.

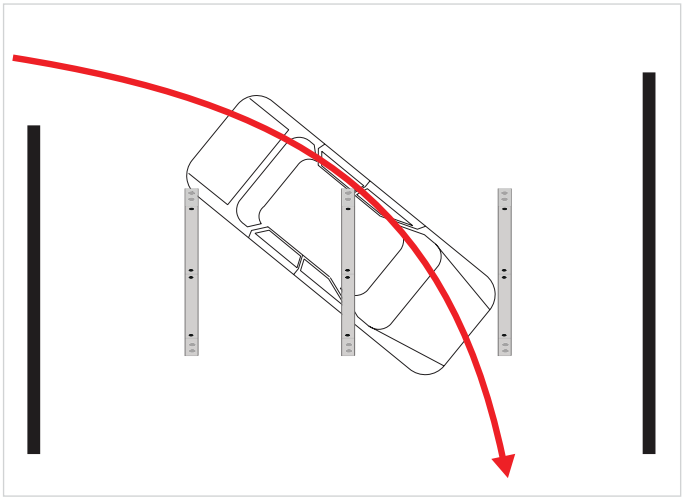
This information is then transmitted to the central PGS software reconciling it with the previously stored occupancy information.

TECHNICAL SPECIFICATIONS

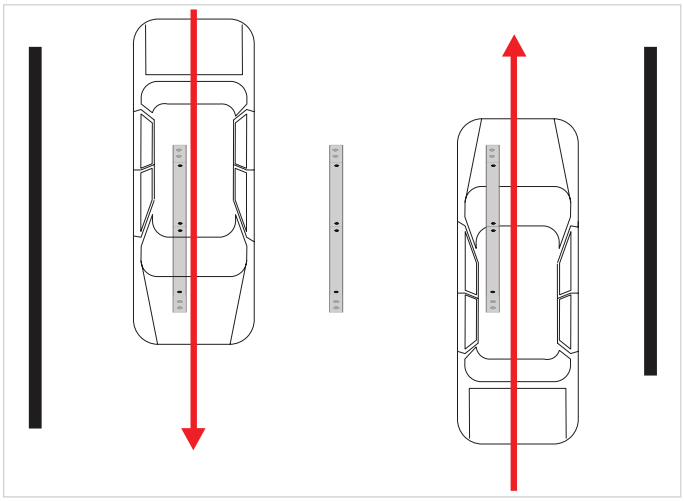
Dimensions:	74” W (1,879.6 mm)
Weight:	12.5 lbs (5.66 kg)
Data transfer:	Dry contact/serial interface via RS-485
Power:	12-24 VDC
Temperature:	-4°F to +158°F (-20°C to +70°C)
Connection:	18 AWG 4-conductor shielded wire
Detection Height:	6’8” (203 cm) - 9’ (274 cm)



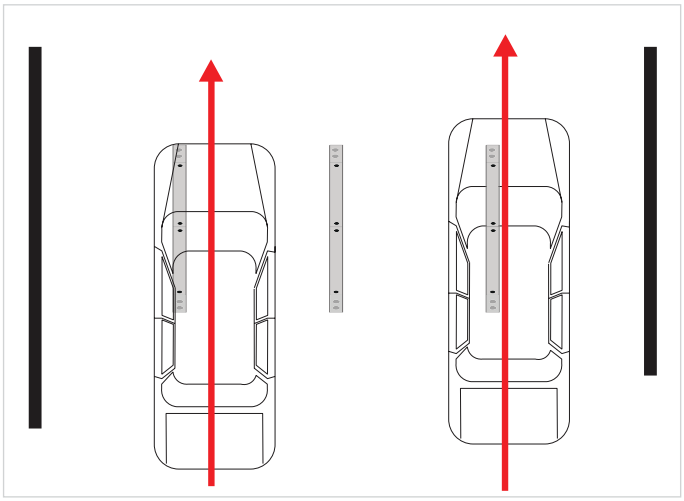
Vehicle traveling diagonally across two (2) USDS



Vehicle traveling diagonally across three (3) USDS



Two (2) vehicles traveling in opposite directions

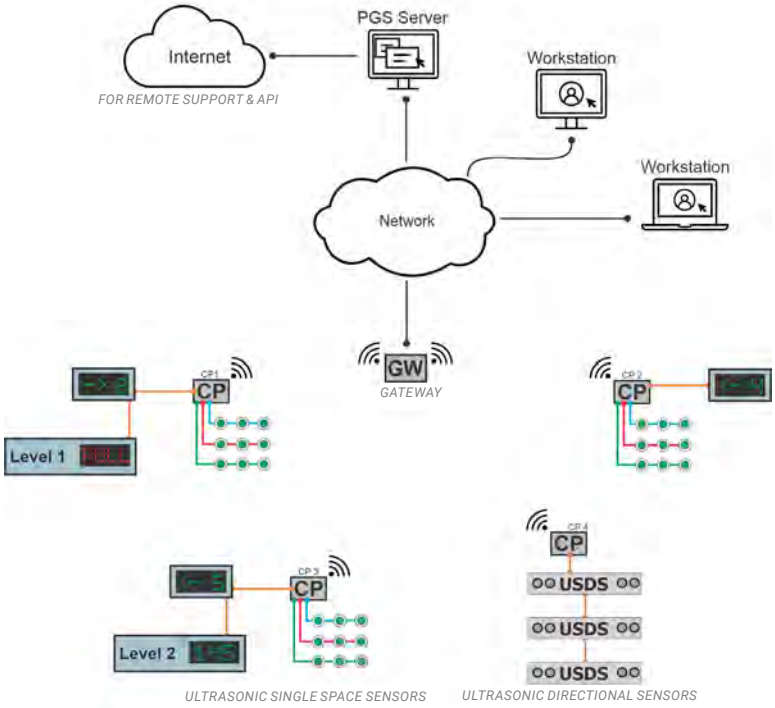


Two (2) vehicles traveling in the same direction

(978) 443.2527
www.tcsntl.com | sales@tcsintl.com

WIRELESS PGS NETWORK

COMMUNICATION SYSTEM FOR SINGLE AND MULTI-LEVEL TCS PGS SOLUTIONS



SAMPLE COMMUNICATION OVERVIEW

OVERVIEW

TCS' unique Wireless PGS Network eliminates the need for expensive cable and conduit from each device to the central server as required in most parking guidance installations. It is flexible in design and can be used in single and multi-level facilities, including underground facilities. The wireless mesh network is custom designed for each installation for optimal signal strength guaranteeing system uptime of 99.99%.

It significantly reduces the cost of cabling and installation associated with a traditional hardwired PGS.

Device information is transferred via a wireless mesh network to the central communication gateway. The gateway is connected directly or via the customer network to the central PGS server managing the parking system.

Real-time parking availability, device status, and extensive parking reports and statistics are made available through the Visual Control Center (see separate data sheet).

BENEFITS

- Reduce cabling and installation costs
- Install in single level, multi-level, or multiple facilities
- Maintain a seamless wireless connection in aboveground and underground facilities
- Adapt and expand when more or less coverage is needed
- Cover large and small facilities with high throughput and reliable wireless connectivity

COMPATIBLE PRODUCTS

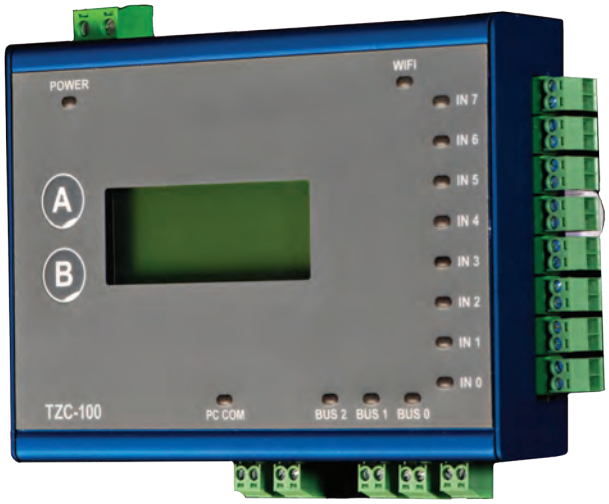
The Wireless PGS Network is used with all TCS PGS products and third-party components:

- TCS ultrasonic single space sensors (TUS-300)
- TCS ultrasonic directional sensors (USDS)
- In-ground loop technology
- Space availability signs
- Variable message displays

(978) 443.2527
www.tcsintl.com | sales@tcsintl.com

ZONE CONTROLLER

UNIVERSAL CONTROLLER FOR TCS PARKING GUIDANCE SYSTEMS



◁ *Shown without antenna*

OVERVIEW

The Zone Controller connects and manages components in a parking guidance system, including TCS single space parking sensors, third-party gates, loop counters, and signs.

The controller uses a three-bus system allowing it to exchange data with up to 96 single space sensors (32 sensors per bus interface). Installations with more than 96 sensors, utilize multiple zone controllers linked to a central server.

It is a central controller for TCS-300 single space sensors as well as for 3rd party digital inputs.

The Zone Controller acts 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 such as loop detectors, third-party gate inputs, and more.

BENEFITS

- Control up to 96 single space sensors per unit
- Link multiple units to a central server for large installations
- Configure various tasks with user-friendly menu keys
- Communicate with single space sensors, third-party gates, loop counters, and signs
- Save on installation costs with built-in wireless communication chip

(978) 443.2527
www.tcsintl.com | sales@tcsintl.com

MODES OF OPERATION

The Zone Controller has a variety of operating modes:

- Automatic
- Static green
- Static red
- Static optional color
- Green/red alternating
- Red flashing
- Lights off while still monitoring space

INSTALLATION

Each Zone Controller is installed within close distance to the connected sensors in a communication point (CP) enclosure.

It requires 100-240 VAC power into its DC power supply to power the controller. Each bus run requires its own low-voltage power supply.

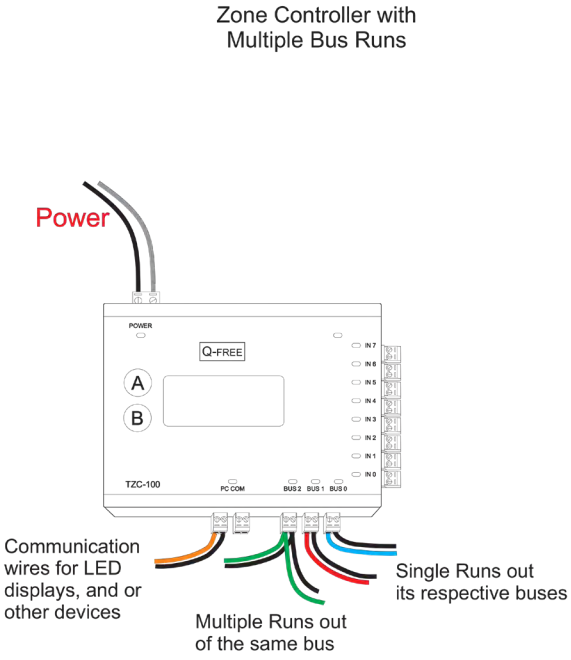
TECHNICAL SPECIFICATIONS

Dimensions:	4” x 5.5” x 1.25”
(H x W x D)	101.6 mm x 139.7 mm x 31.75 mm
Data transfer:	Dry contact and/or serial interface via RS-485
Mounting:	DIN rail mount
Power Consumption:	24 VDC / 75 mA

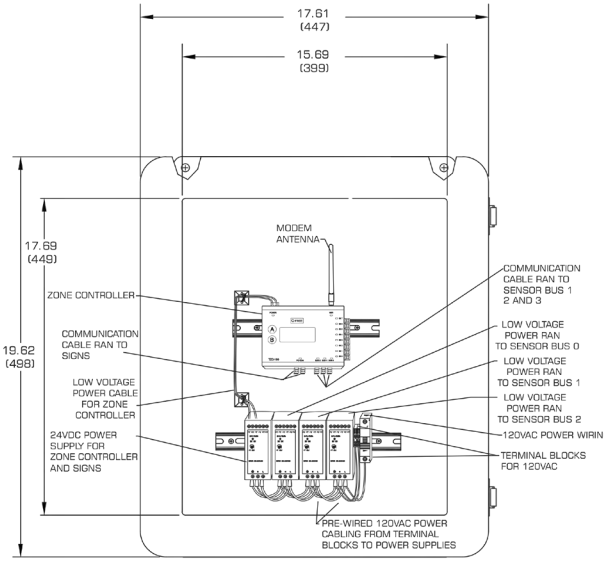
PART NUMBER

TZC-100 Zone Controller

Zone Controller
with Multiple Bus Runs



Typical Single Space
Sensor Enclosure



(978) 443.2527
www.tcsintl.com | sales@tcsintl.com

VISUAL CONTROL CENTER

CENTRAL SOFTWARE MANAGER FOR TCS PARKING GUIDANCE SYSTEMS

OVERVIEW

The Visual Control Center allows parking operators to easily visualize real-time parking availability, device status, and sign information for TCS Parking Guidance Systems (PGS).

> **Parking availability statistics provide vital occupancy information and can assist with staffing, optimization, and marketing plans.**

Monitor and manage parking facilities with a variety of occupancy status reports:

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

BENEFITS

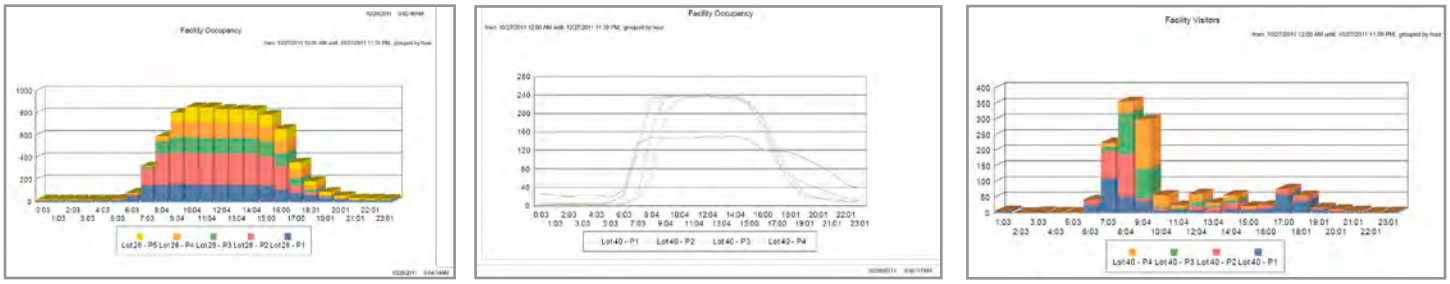
- View real-time parking availability and device status
- Understand how the parking facility fills up, peak times of the garage, what days are the busiest, and more
- Share parking availability with 3rd party applications such as websites and mobile apps
- Create user accounts with optional multi-user platform
- Integrate with all TCS PGS products and components
- Export and view data numerically or via easy-to-read graphics
- Access through client software or a web browser

SHARE AVAILABILITY VIA WEB & MOBILE APPS

IDENTIFY TRENDS TO MAXIMIZE USAGE

TCS International

(978) 443.2527
www.tcsintl.com | sales@tcsintl.com



Example of facility occupancy and visitor reports.

COMPATIBLE PRODUCTS

The Visual Control Center is used with all TCS PGS products and third-party components:

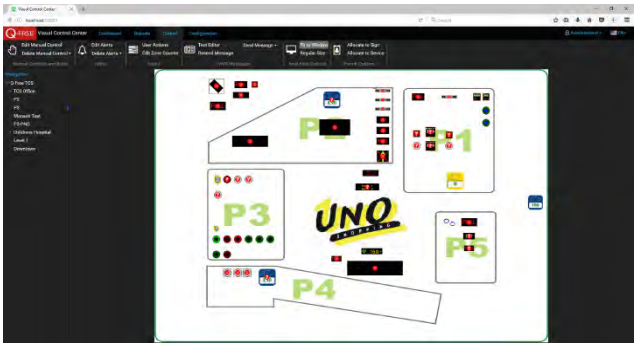
- TCS ultrasonic single-space sensors (TUS-300)
- TCS ultrasonic directional sensors (USDS)
- In-ground loop technology
- Space availability signs
- Variable message displays

APPLICATIONS

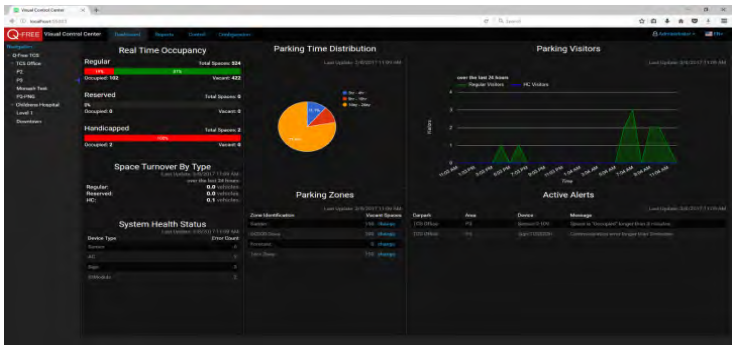
The Visual Control Center is typically used in the following applications:

- Single space monitoring
- Level counting
- Facility counting
- Surface lot space availability
- Wayfinding

CLIENT SOFTWARE ACCESS



Example of web contol.



Example of web dashboard.

(978) 443.2527
www.tcsintl.com | sales@tcsintl.com

CHILDREN'S HOSPITAL - BOSTON, MA

Custom entry sign and ultrasonic directional sensors at garage/level entry/exit.

Conduit mounted single space sensors for speciality spaces.

Boston Children's Hospital is ranked as one of the US' top pediatric facilities and sees over 1,500 patients per day. Due to the hospital's high-volume traffic flow, it was in desperate need of a Parking Guidance System (PGS) for one of its busiest garages.

In 2010, TCS was contracted to provide a customized level-counting PGS and in 2012 was again contracted to provide a single-space monitoring system for the basement level of the garage. In 2014, single-space monitoring was extended to the whole garage.

The PGS software provides a graphical user interface which displays real-time parking availability, counting device status and sign information. The software enables the user to view, analyze and export statistical information in numerical and graphical forms.

INSTALLATION HIGHLIGHTS

- Single-space monitoring/level-counting PGS
- Custom designed pace availability sign at garage entrance
- Single space sensors for speciality parking spaces
- Wireless system communication
- Central PGS provides easy user interface and statistical information

(978) 443.2527
www.q-free.com
For more information contact sales@tcsintl.com

TCS International

COSMOPOLITAN RESORT & CASINO - LAS VEGAS, NV

Ultrasonic single space sensors monitor every parking space.

Located on the Las Vegas Strip, The Cosmopolitan Resort & Casino 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.

TCS 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 entry signs, level signs and individual aisle signs.

INSTALLATION HIGHLIGHTS:

- Over 2,500 parking spaces monitored
- Ultrasonic single space sensors for highest monitoring accuracy
- Highly stable wireless mesh network with 99% uptime in this multi-level below ground garage
- Entry signs, level signs and aisle signs display parking availability throughout the garage
- Real-time parking information through TCS' Visual Control Center software
- Valuable parking occupancy statistics

(978) 443.2527
www.q-free.com
For more information contact sales@tcsintl.com

TCS International

DEL AMO FASHION CENTER MALL — TORRANCE, CA

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.

TCS 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.

TCS 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.

Ultrasonic directional sensors monitor vehicle entry exit at garage/level entry exit.

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 TCS' Visual Control Center software
- Valuable parking occupancy statistics

Wayfinding Signage guiding drivers quickly to available spaces.

(978) 443.2527
www.q-free.com
For more information contact sales@tcsintl.com

TCS International

ADVENT HOSPITAL — ORLANDO, FL

Garage entry signs.

Single space sensors monitoring space availability.

The Advent Hospytal group priovides hospital care in the Tampa, and Daytona Beach areas of Florida, deploying the latest treatments and technology.

TCS has provided a Parking Guidance System (PGS) for four of the garages at the Advent Hospital Orlando location. They are comprised 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 decision making points

The TCS Visual Control Center software package is used to manage the system, providing a user interface and statistical information for garage optimization..

INSTALLATION HIGHLIGHTS

- Single space monitoring and level counting PGS for four parking garages
- Over 5,000+ spaces monitored
- Over 70 ultrasonic directional sensors
- Central PGS server
- Space availability signage guides drivers to avaiable parking
- Wireless Mesh Network
- Roadway signs displaying facility space availability

(978) 443.2527
www.q-free.com
For more information contact sales@tcsintl.com

TCS International

REFERENCE

GO TRANSIT METROLINX - GREATER TORONTO AREA, ON

Metrolinx is an Ontario government agency that improves the coordination and integration of all modes of transportation in the Greater Toronto and Hamilton area. It operates GO Transit, a regional public transit system serving the Greater Golden Horseshoe region of Ontario, Canada and operates since 1967.

Increased commuter travel also increased the parking demand along the transit routes. the agency built multiple parking garages along the transit lines to combat increased parking numbers. Going one step further, the agency also wanted to focus on enabling the public transit customers to quickly and easily find available parking thus reducing parking congestion and stress for travellers.

GO Transit Metrolinx selected TCS to custom design a PGS system. The initial project was for a five-level parking garage with 1,600 parking spaces utilizing a custom combination of single space monitoring and level counting with bilingual (English and French) displays indicating space availability at the Oakville GO Station gargae. Since then, the agency has added 11 additional parking garages with further expansion planned for the following years.

INSTALLATION HIGHLIGHTS

- 12 Parking garages
- 22,000+ spaces monitored
- Ultrasonic single space sensors monitor all covered parking spaces
- Ultrasonic directional sensors monitor uncovered roof levels
- Bi-lingual space availability sigange
- Local PGS server due to customer requirements

(978) 443.2527
www.q-free.com
For more information contact sales@tcsintl.com

TCS International

THE JAMUL CASINO - JAMUL, CA

Interior level signs

Exterior garage signs

Intercom

Camera

The Jamul Casino, formerly 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.

TCS was selected to provide 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
- Over 1,500+ 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
- Central PGS server

The TCS 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.

(978) 443.2527
www.q-free.com
For more information contact sales@tcsintl.com

TCS International

REFERENCE

JAMES MADISON UNIVERSITY - HARRISONBURG, VA

James Madison University (JMU) is a top-ranked public university by *U.S. News & World Report* and *The Wall Street Journal* located in Virginia's Shenandoah Valley.

- 20,000+ students
- NCAA Division 1

The University has seven parking decks that serve a combination of faculty/staff, visitors, and sports fans.

Increased student numnbers left the university with the callange to reduce parking congestion for students and faculty navigating JMU's expansive campus of over 140 buildings.

James Madison University selected TCS' Parking Guidance System to reduce the time necessary to locate available parking. The initial project was for one campus garage utilizing ultrasonic directional sensors and custom-designed signs using wireless communication.

Because of the benefit of a PGS system, the University has expanded the TCS PGS system to four additional garages.

INSTALLATION HIGHLIGHTS

- 5 Parking garges
- 6,000+ spaces monitored
- Ultrasonic directional sensors monitor garage and level occupancy
- Ultrasonic single space sensors monitor ADA and specialty spaces
- Custom designed wayfinding signage
- Wireless system communication
- Centralized PGS server for all gargages
- Student developed availability app

(978) 443.2527
www.q-free.com
For more information contact sales@tcsintl.com

TCS International

REFERENCE

KING OF PRUSSIA MALL - KING OF PRUSSIA, PA

© David Whitcomb, CallisonRTKL Inc.

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.

TCS has provided a Parking Guidance System for the campus. They comprise of ultrasonic directional sensors to monitor vehicle entry/exit at garage and level entry/exit.

To inform visitors of parking availability LED displays are used. Signs located at decision points along the properties roadways direct traffic to the garage. Once at the garage, visitors are greeted by entry signs showing space availability for each floor.

The TCS Visual Control Center software package is used to manage the system, providing a user interface and statistical information to optimize garage utiization.

INSTALLATION HIGHLIGHTS

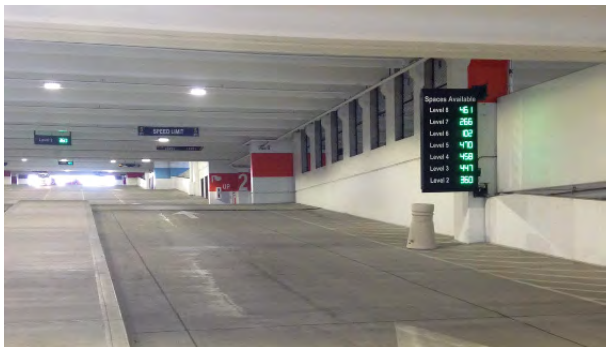
- Ultrasonic directional sensors monitoring vehicle entry/exit at each gargage/level entry/exit.
- Centralized PGS server located on the property which provides real time parking counts and customizable reports.
- Space availability signage guides drivers quickly to available parking spaces
- Wireless Mesh Network

Wayfinding signs guiding drivers quickly to available spaces.

(978) 443.2527
www.q-free.com
For more information contact sales@tcsintl.com

TCS International

MGM SPRINGFIELD — SPRINGFIELD, MA



Wayfinding signs guiding drivers quickly to available spaces.

As a revitalized Union Station and an $960 million world-class dining, retail and entertainment district on about 10 acres of land in Downtown Springfield, MGM Springfield Hotel and Casino is the first casino in the state of Massachusetts. The casino is expected to draw tens of thousands of visitors in addition to MGM's more than 3,000 employees.

With 3,400 parking spaces in a seven-level garage, MGM Springfield needed a parking guidance solution to track and guide their visitors and employees to available spots to reduce congestion and "cruising" caused by the search for an empty space. TCS was commissioned to install a custom designed Parking Guidance System, which included ultrasonic directional sensors, designed to replace inductive loops and provide accurate vehicle counts, along with intelligent signs placed throughout the garage to guide patrons to available parking spaces.

INSTALLATION HIGHLIGHTS

- Ultrasonic directional sensors monitoring vehicle entry/exit at each gargage/level entry/exit.
- Centralized PGS server located on the property which provides real time parking counts and customizable reports.
- Space availability signage guides drivers quickly to available parking spaces
- Wireless Mesh Network

(978) 443.2527
www.q-free.com
For more information contact sales@tcsintl.com

TCS International

REFERENCE

MONTGOMERY COUNTY GARAGES, MD

Montgomery County is the most populous county in the state of Maryland, which is located adjacent to Washington, DC. with 1,000,000+ residents as of 2018.

Over the years, increased visitors and downtown parking demand left the County with the callange to reduce parking congestion and improve driver satisfaction in the Bethesda and Silver Spring downtown areas.

Montgomery County selected TCS' Parking Guidance System (PGS) to alleviate downtown traffic congestion by reducing the time necessary to locate available parking in the county's four downtown parking garages. The garages contain more than 4,000 parking spaces in total and each feature roadway signage and single space sensors to guide drivers to available parking spaces.

This phased approach demonstrates the trust the County has in TCS and the benefits of a custom tailored PGS solution for municipalities.

INSTALLATION HIGHLIGHTS

- 4 Parking garages
- 4,000+ spaces monitored
- Ultrasonic single space sensors monitor all covered spaces Ultrasonic directional sensors monitor roof level occupancy
- Custom designed wayfinding signage
- Wireless system communication
- Centralized PGS server for all gargages
- API export of parking information to County website

(978) 443.2527
www.q-free.com
For more information contact sales@tcsintl.com

TCS International

PGS - Wiring Details

Purple Line (Comm. Bus) - 1 pair of 18 AWG
Orange Line (Comm./24VDC Bus) - 3 pair of 18 AWG
Yellow Line Existing Cable

PGS -Details

USDS Ultrasonic Directional Sensor

CP Communication point
CP Enclosures Require 100-240 VAC Power

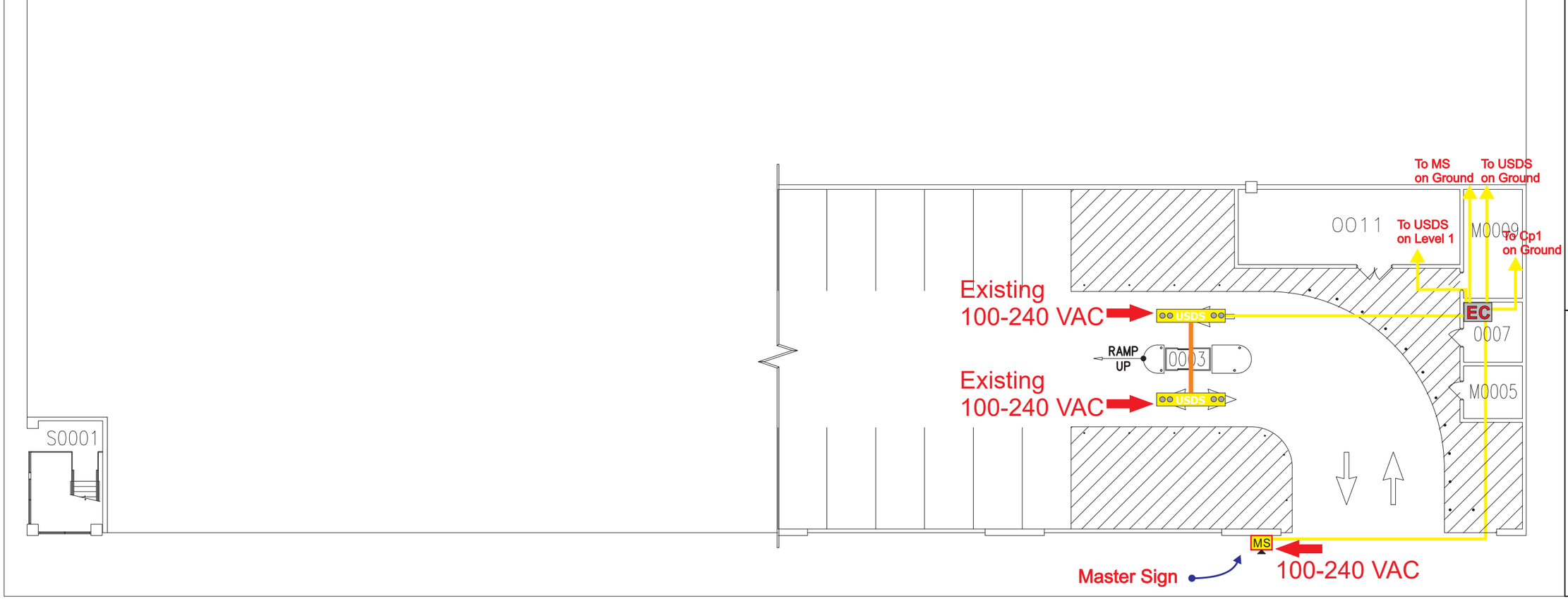
EC Existing Ethernet Controller
EC Enclosures has 100-240 VAC Power and Ethernet (Cat5e or Better)

Existing HC Single Space Sensor

USDS Existing Ultrasonic Directional Sensor

CP Existing Communication point

MS Existing Entry Sign



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

TCS International

Warsaw Deck - Single Space Upgrade
Lower Ground

Rev	- REV 2
Engineer	-
Draftsman	- AB
Date	- 12/15/2022
Checked	-
Approved	-

Drawing No.

Submittal No.

Submittal Date

☐ PGS Design Approved by Customer

Customer Signature

PGS - Wiring Details

Purple Line (Comm. Bus) - 1 pair of 18 AWG
Orange Line (Comm./24VDC Bus) - 3 pair of 18 AWG
Yellow Line Existing Cable

PGS -Details

- USDS Ultrasonic Directional Sensor
- CP Communication point
  CP Enclosures Require 100-240 VAC Power
- EC Existing Ethernet Controller
  EC Enclosures has 100-240 VAC Power and Ethernet (Cat5e or Better)
- Existing HC Single Space Sensor
- USDS Existing Ultrasonic Directional Sensor
- CP Existing Communication point
- MS Existing Entry Sign

Master Sign
SW
100-240 VAC

Existing CP 1
ZC
100-240 VAC

Existing
100-240 VAC

Existing
100-240 VAC

Existing
100-240 VAC

USDS
USDS
USDS

RAMP
UP

RAMP
DOWN

VAN
VAN
VAN

MG011
EG013
EG015
SG017

To Level 1
To Level 2
To Level 3
CP

GO04
GO02
SG001

STOP

To Ethernet Converter
on Lower Ground

RAMP
UP

RAMP
DOWN

RAMP
DOWN

RAMP
UP

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

TCS International

Warsaw Deck - Single Space Upgrade Ground

Rev	- REV 2
Engineer	-
Draftsman	- AB
Date	- 12/15/2022
Checked	-
Approved	-

Drawing No.

Submittal No.
Submittal Date

☐ PGS Design Approved by Customer

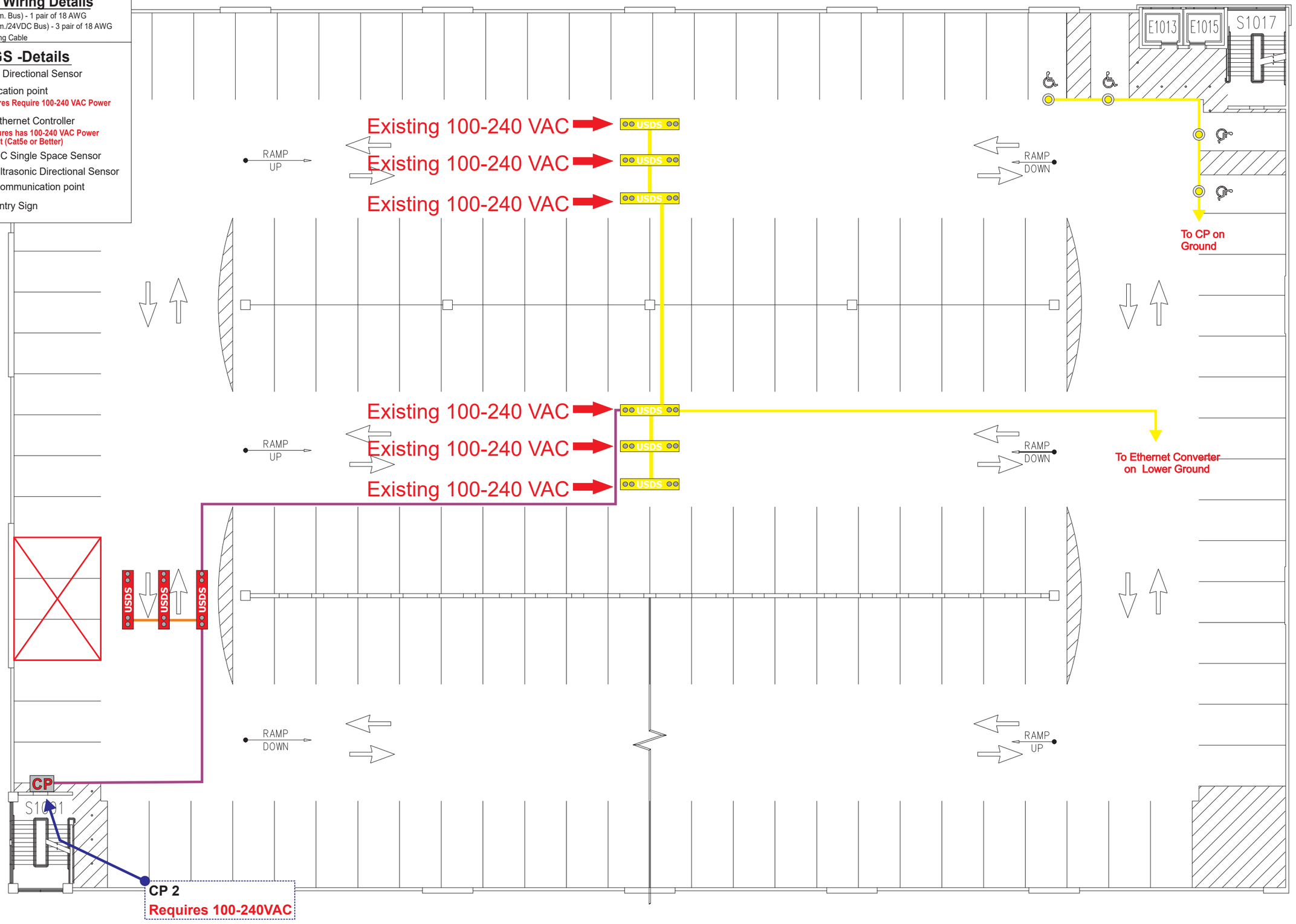
Customer Signature

PGS - Wiring Details

Purple Line (Comm. Bus) - 1 pair of 18 AWG
Orange Line (Comm./24VDC Bus) - 3 pair of 18 AWG
Yellow Line Existing Cable

PGS -Details

- USDS Ultrasonic Directional Sensor
- CP Communication point
  CP Enclosures Require 100-240 VAC Power
- EC Existing Ethernet Controller
  EC Enclosures has 100-240 VAC Power and Ethernet (Cat5e or Better)
- Existing HC Single Space Sensor
- USDS Existing Ultrasonic Directional Sensor
- CP Existing Communication point
- MS Existing Entry Sign



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

TCS International

Warsaw Deck - Single Space Upgrade Level 1

Rev	- REV 2
Engineer	-
Draftsman	- AB
Date	- 12/15/2022
Checked	-
Approved	-

Submittal No.
Submittal Date
Drawing No.

☐ PGS Design Approved by Customer

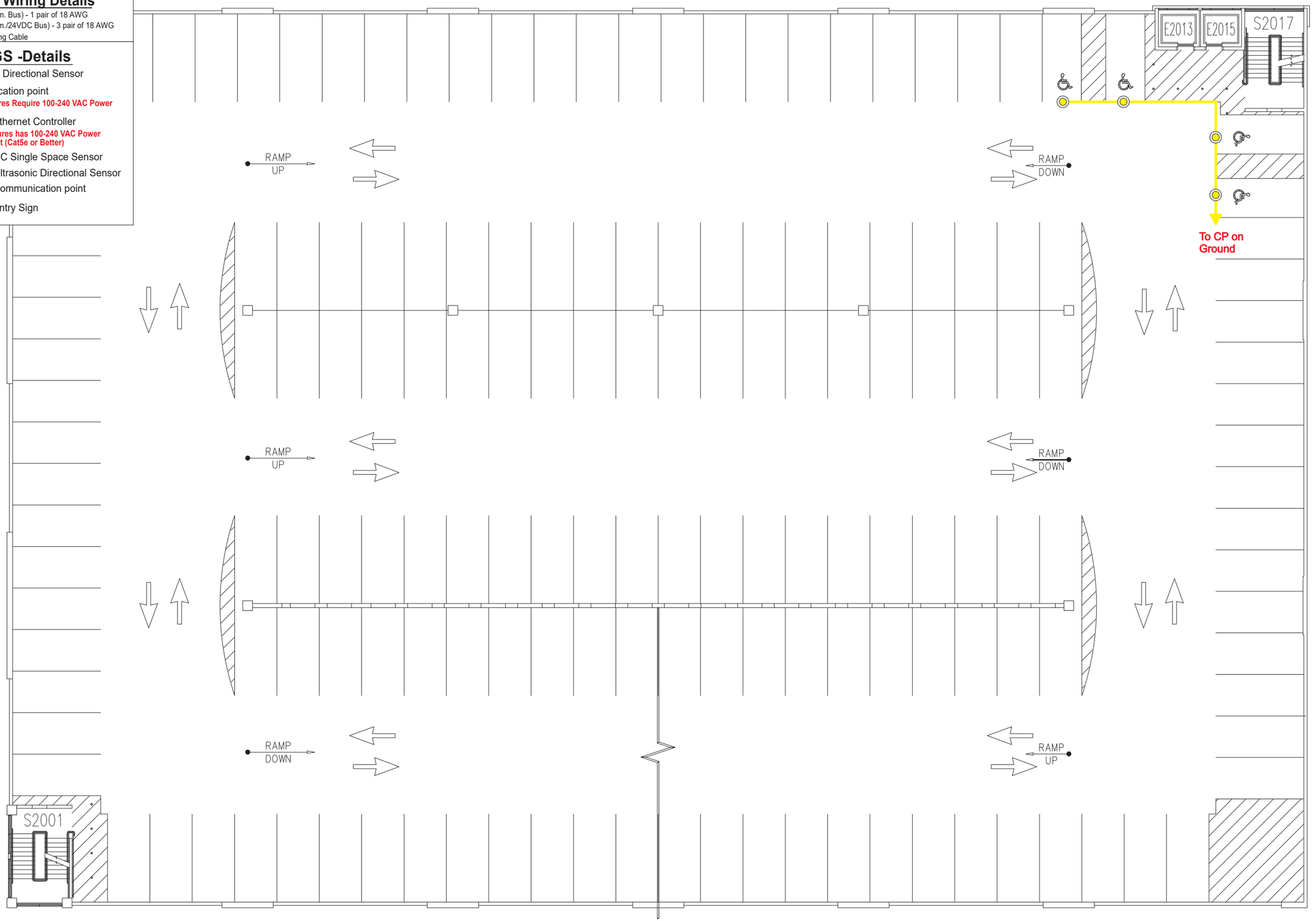
Customer Signature

PGS - Wiring Details

Purple Line (Comm. Bus) - 1 pair of 18 AWG
Orange Line (Comm./24VDC Bus) - 3 pair of 18 AWG
Yellow Line Existing Cable

PGS -Details

- Ultrasonic Directional Sensor
- CP — Communication point
  CP Enclosures Require 100-240 VAC Power
- EC — Existing Ethernet Controller
  EC Enclosures has 100-240 VAC Power and Ethernet (Cat5e or Better)
- Existing HC Single Space Sensor
- Existing Ultrasonic Directional Sensor
- CP — Existing Communication point
- MS — Existing Entry Sign



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

TCS International

Warsaw Deck - Single Space Upgrade Level 2

Submittal No.	
Submittal Date	

Rev	- REV 2
Engineer	-
Draftsman	- AB
Date	- 12/15/2022
Checked	-
Approved	-

Drawing No. -

☐ PGS Design Approved by Customer

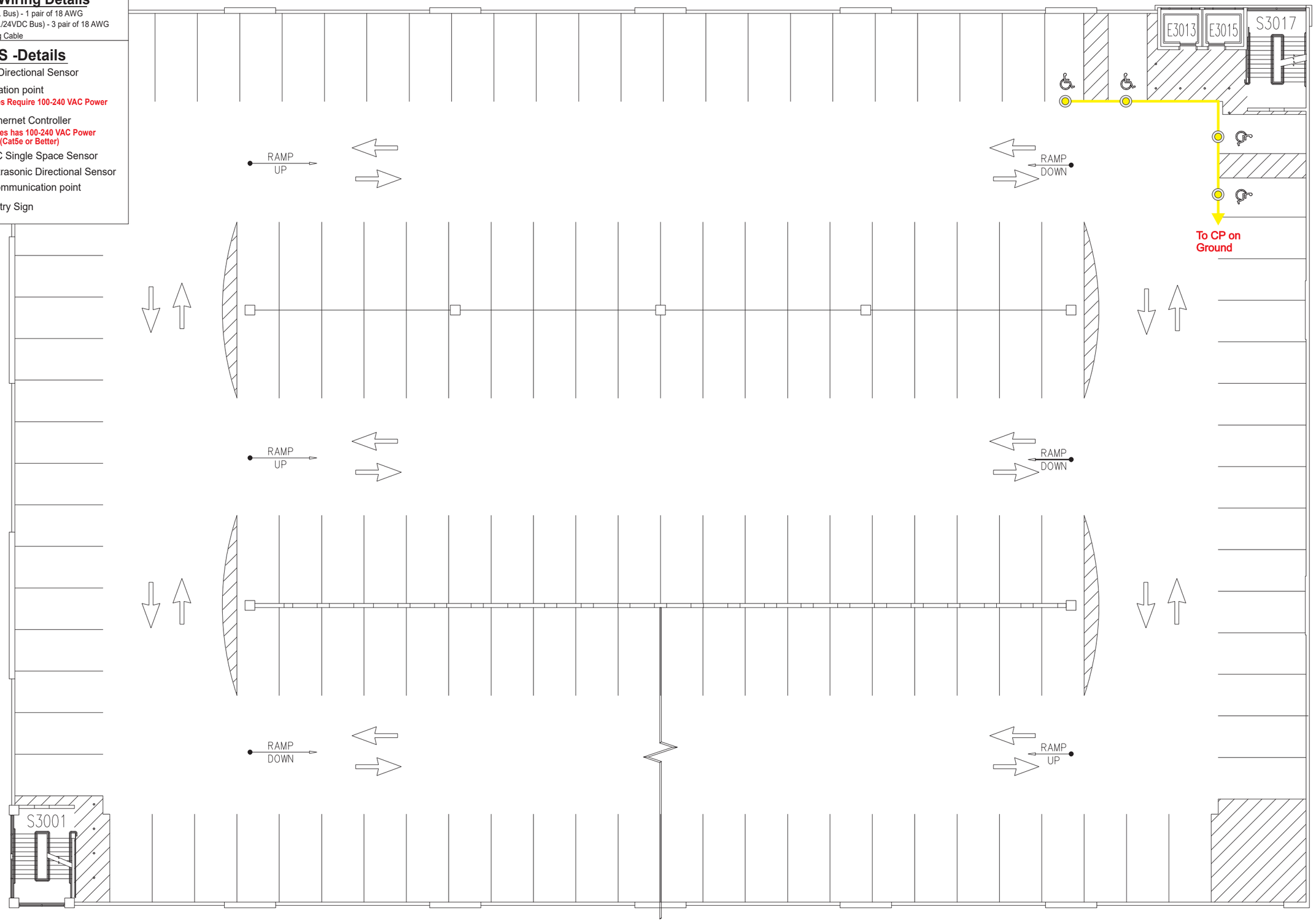
Customer Signature

PGS - Wiring Details

Purple Line (Comm. Bus) - 1 pair of 18 AWG
Orange Line (Comm./24VDC Bus) - 3 pair of 18 AWG
Yellow Line Existing Cable

PGS -Details

- Ultrasonic Directional Sensor
- CP — Communication point
  CP Enclosures Require 100-240 VAC Power
- EC — Existing Ethernet Controller
  EC Enclosures has 100-240 VAC Power and Ethernet (Cat5e or Better)
- Existing HC Single Space Sensor
- Existing Ultrasonic Directional Sensor
- CP — Existing Communication point
- MS — Existing Entry Sign



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

TCS International

Warsaw Deck - Single Space Upgrade Level 3

Submittal No.	
Submittal Date	

Rev	- REV 2
Engineer	-
Draftsman	- AB
Date	- 12/15/2022
Checked	-
Approved	-

Drawing No. -

☐ PGS Design Approved by Customer

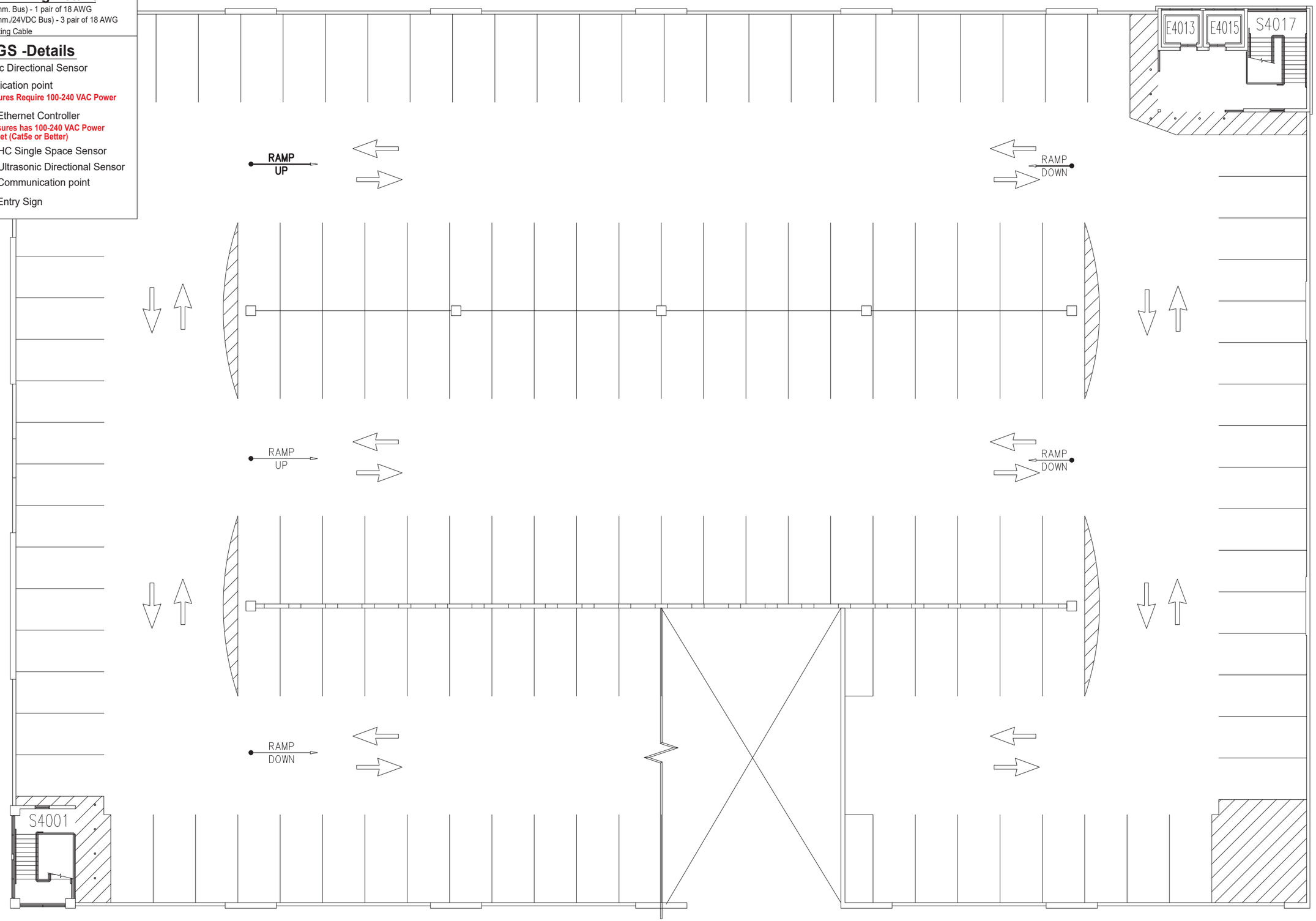
Customer Signature

PGS - Wiring Details

Purple Line (Comm. Bus) - 1 pair of 18 AWG
Orange Line (Comm./24VDC Bus) - 3 pair of 18 AWG
Yellow Line Existing Cable

PGS -Details

- Ultrasonic Directional Sensor
- CP — Communication point
  CP Enclosures Require 100-240 VAC Power
- EC — Existing Ethernet Controller
  EC Enclosures has 100-240 VAC Power and Ethernet (Cat5e or Better)
- Existing HC Single Space Sensor
- Existing Ultrasonic Directional Sensor
- CP — Existing Communication point
- MS — Existing Entry Sign



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

TCS International

Warsaw Deck - Single Space Upgrade Level 4

Rev	- REV 2
Engineer	-
Draftsman	- AB
Date	- 12/15/2022
Checked	-
Approved	-

Drawing No.

Submittal No.

Submittal Date

☐ PGS Design Approved by Customer

Customer Signature

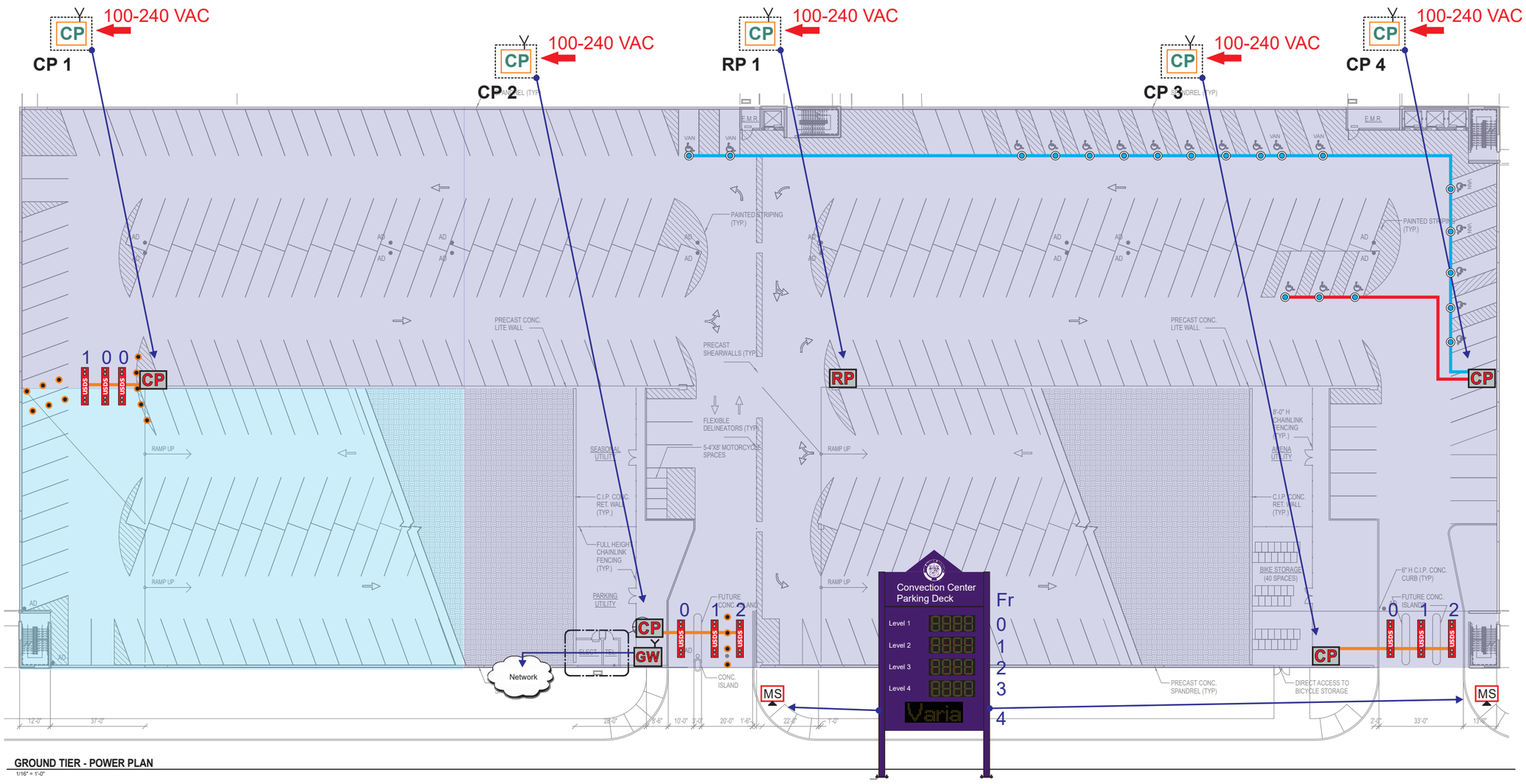
PGS -Details

- 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



GROUND TIER - POWER PLAN
1/16" = 1'-0"

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

Convocation Center
Level 1

Submittal No.	Submittal Date

Rev	- REV 3.1
Engineer	-
Draftsman	- TY/AB
Date	- 01/14/2018
Checked	-
Approved	-

Drawing No. E101P

☐ PGS Design Approved by Customer

Customer Signature

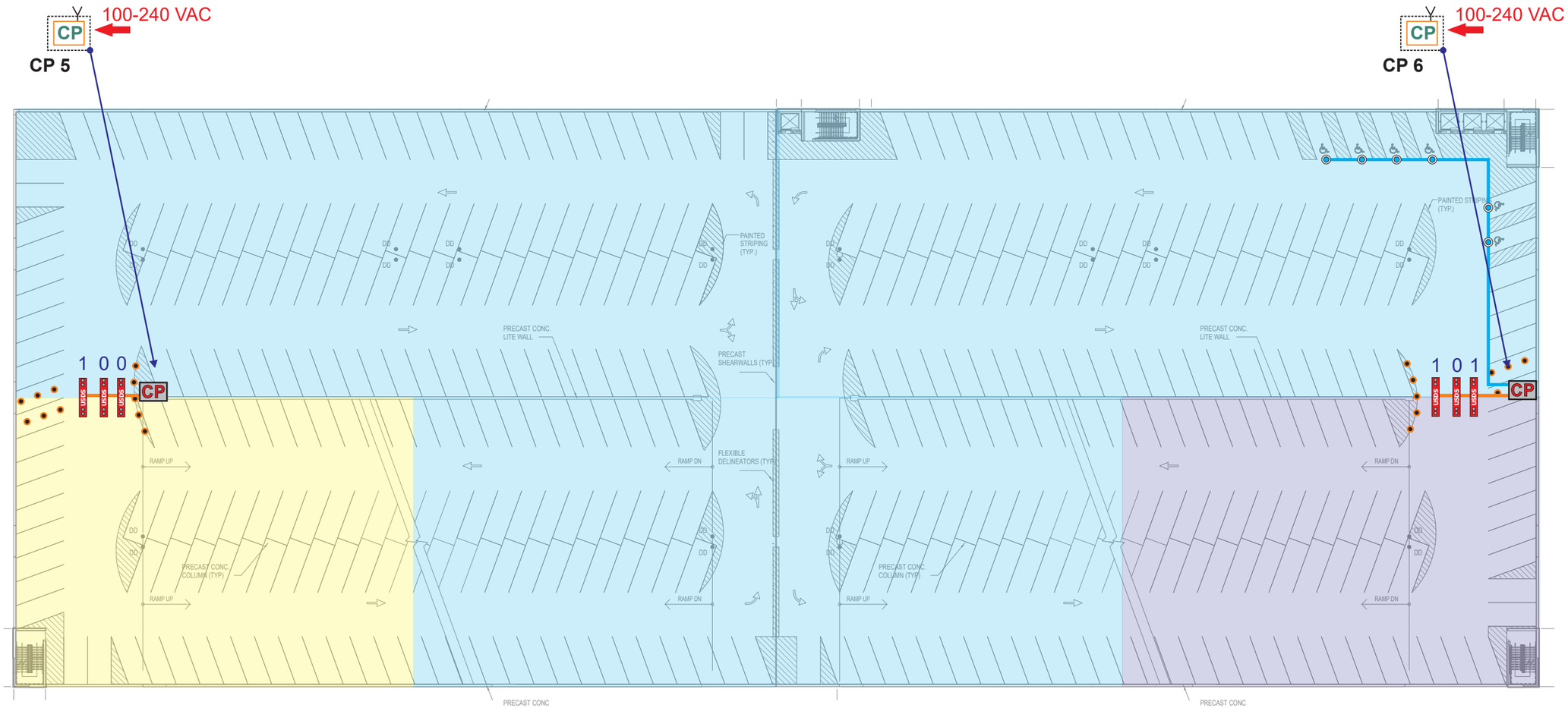
PGS -Details

- 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 2
1/16" = 1'-0"

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

Convocation Center
Level 2

Rev	- REV 3.1
Engineer	-
Draftsman	- TY/AB
Date	- 01/14/2018
Checked	-
Approved	-

Submittal No.
Submittal Date

Drawing No. E102P

☐ PGS Design Approved by Customer

Customer Signature

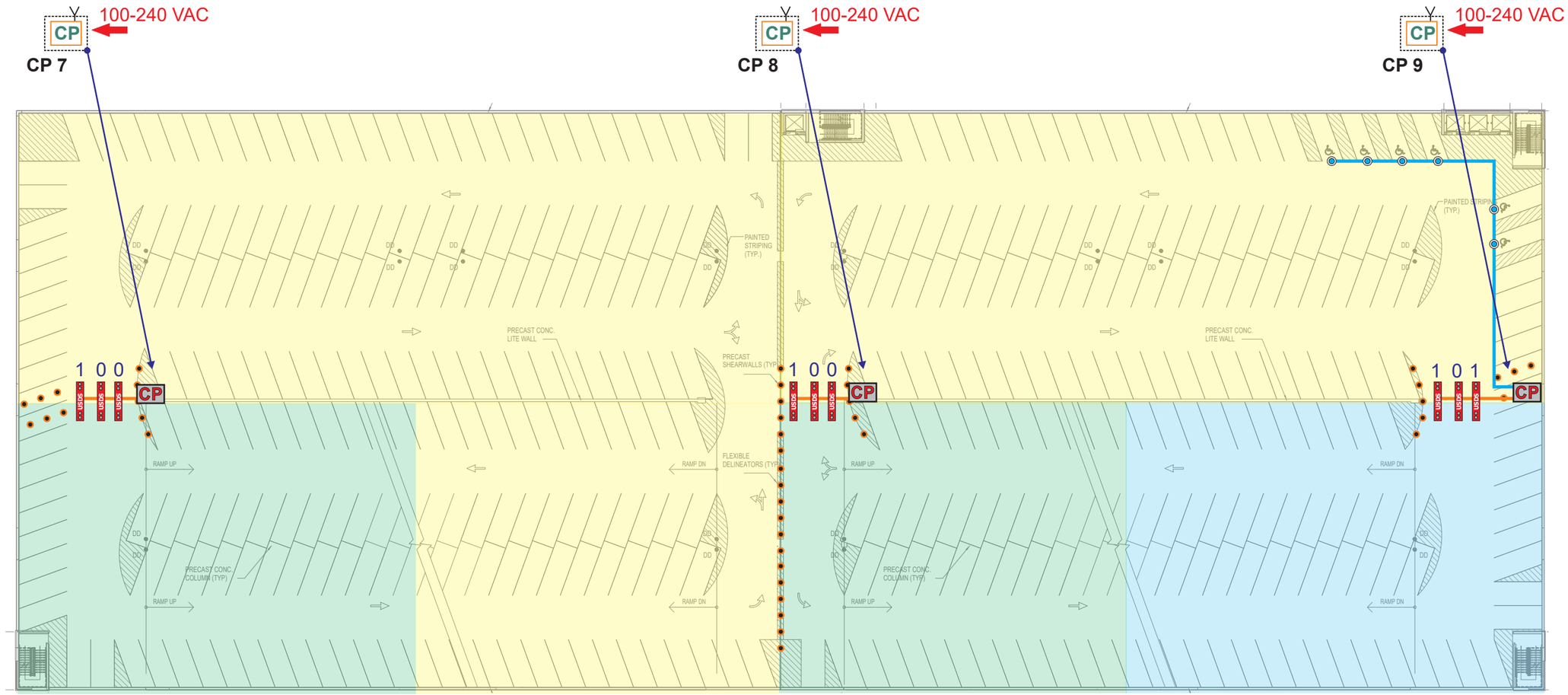
PGS -Details

- 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 3
1/16" = 1'-0"

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

Convocation Center
Level 3

Rev	- REV 3.1
Engineer	-
Draftsman	- TY/AB
Date	- 01/14/2018
Checked	-
Approved	-

Submittal No.
Submittal Date

Drawing No. E103P

☐ 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"

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

Convocation Center
Level 4

Submittal No.	Submittal Date

Rev	- REV 3.1
Engineer	-
Draftsman	- TY/AB
Date	- 01/14/2018
Checked	-
Approved	-

Drawing No. E104P

☐ PGS Design Approved by Customer

Customer Signature

VISUAL CONTROL CENTER

User Guide

TCS International Inc.
Boston
55 Union Avenue
Sudbury, MA 01776
P. 978-443-2527
F. 978-579-9545

TCS International Inc./
7243375 Canada Inc.
3445 Lake Shore Dr W
Etobicoke, ON M8W 1N2
P. 416-259-4862
F. 416-252-0285

W. www.tcsintl.com
E. Sales@tcsintl.com

Table of Contents

1. 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.

2. Client User Interface

2.1. 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 server's 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.

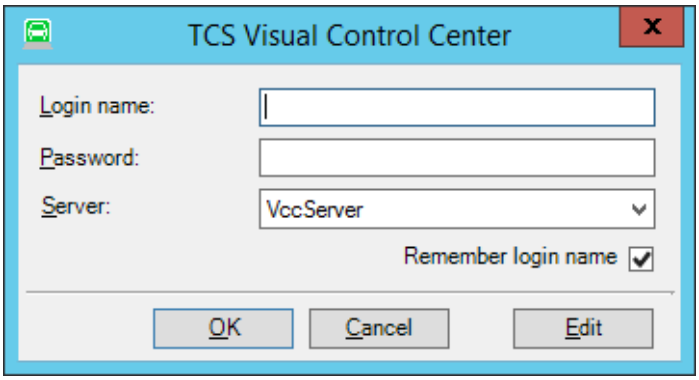


Figure 2: VCC Log In window

- 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.**

2.2. Main Window

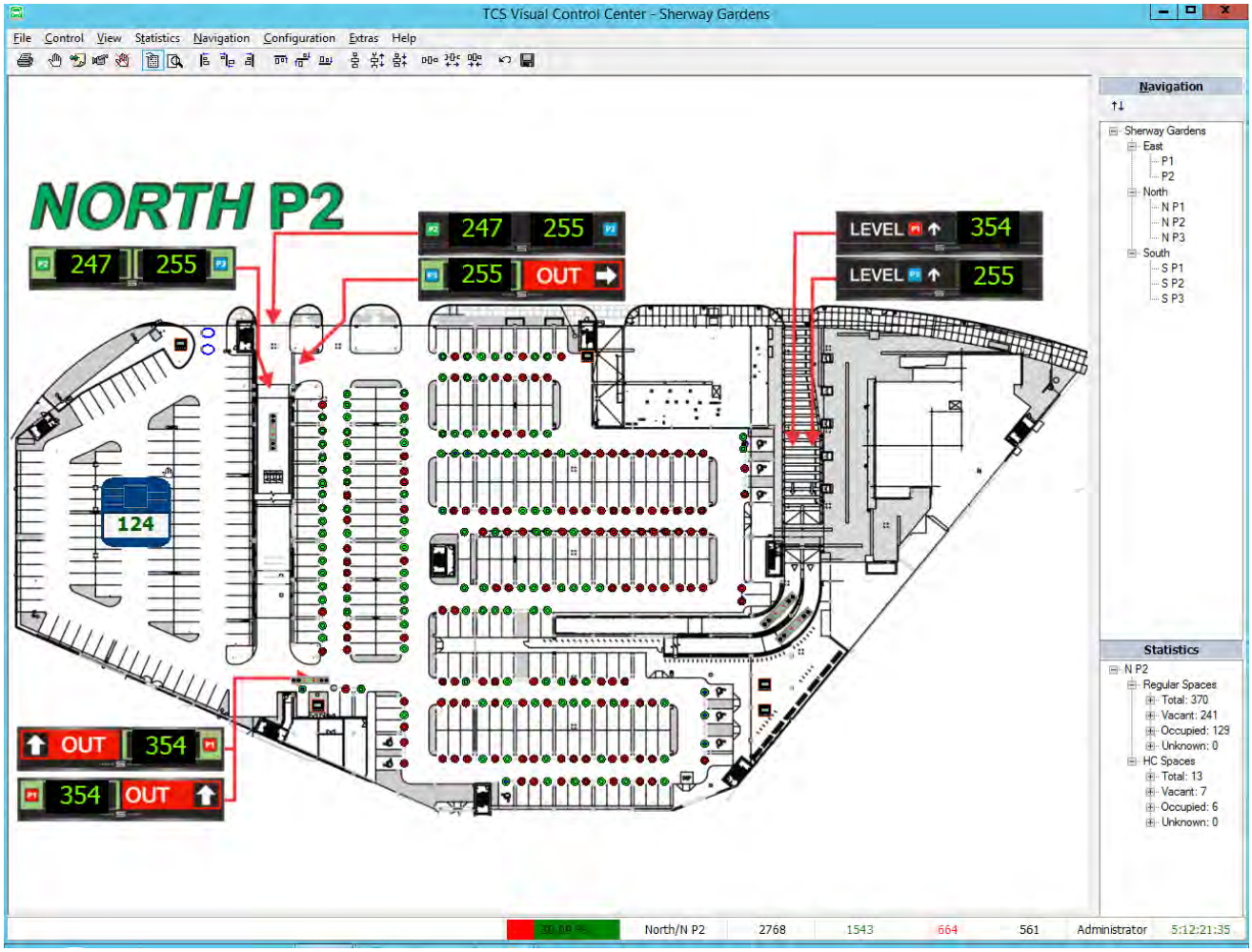


Figure 3: Example of the VCC main window displaying an area

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.

2.2.1. Components of the Main Window

2.2.1.1. Window Title

The name of the software and the car parks name.

2.2.1.2. 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.

2.2.1.3. 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.

2.2.1.4. 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.

2.2.2. 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:

2.2.2.1. File

Print – Access to the Visual Control Center report system.

Quit – Stop all activities and quit the client.

2.2.2.2. 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 deleted if confirmed with "OK".

2.2.2.3. 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.

2.2.2.4. Statistics

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

2.2.2.5. 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.

2.2.2.6. 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.

2.2.2.7. 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.

2.2.2.8. Help

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

2.3. 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.

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.

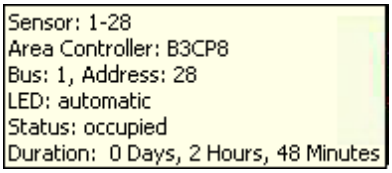


Figure 7: Example of a pop-up window when the cursor is above a sensor

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.

2.4. 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.

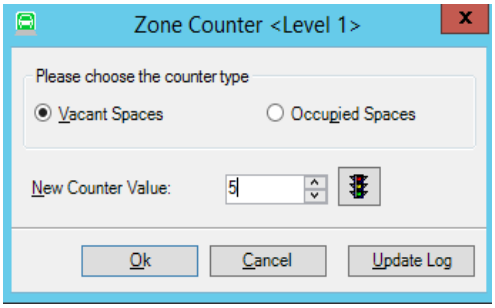


Figure 9: Zone counter used to maintain counts

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 18-24.**

2.5. 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.

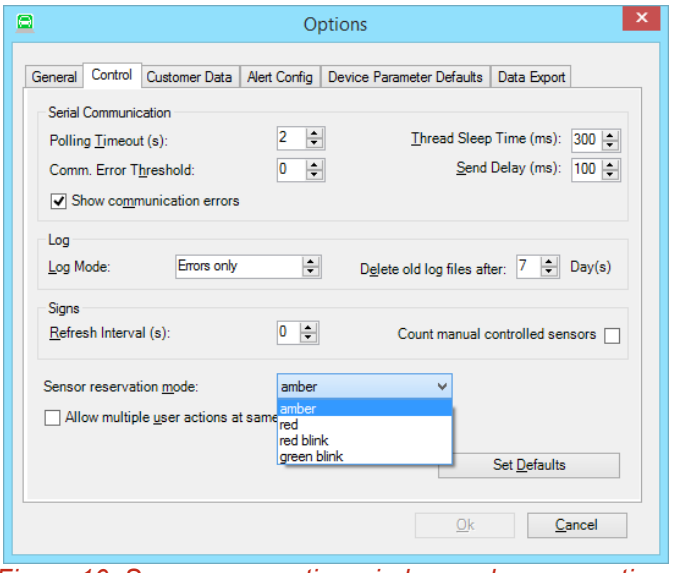


Figure 10: Sensor reservation window and sensor options

2.5.1. 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.

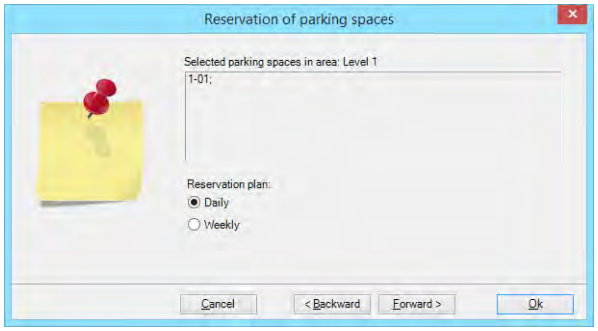


Figure 11: Reservation of parking spaces window

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.

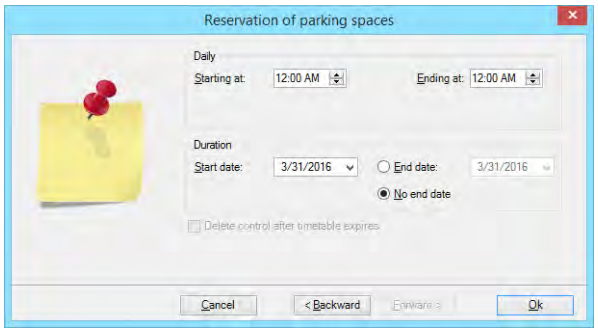


Figure 12: Daily reservation of a parking space

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

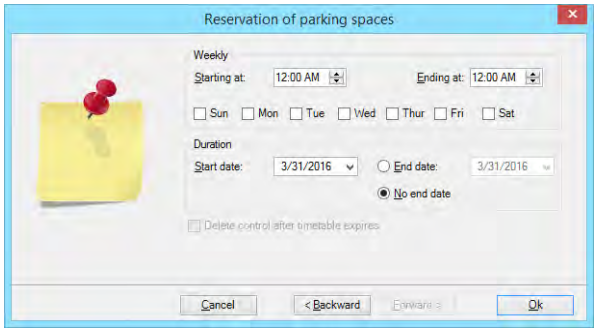


Figure 13: Weekly reservation of a parking space

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.

2.6. 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.

2.6.1. 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 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.

2.6.2. 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.

2.6.3. 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.

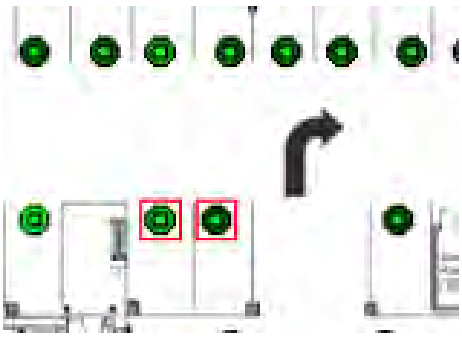


Figure 14: Select the desired sensors for the group.

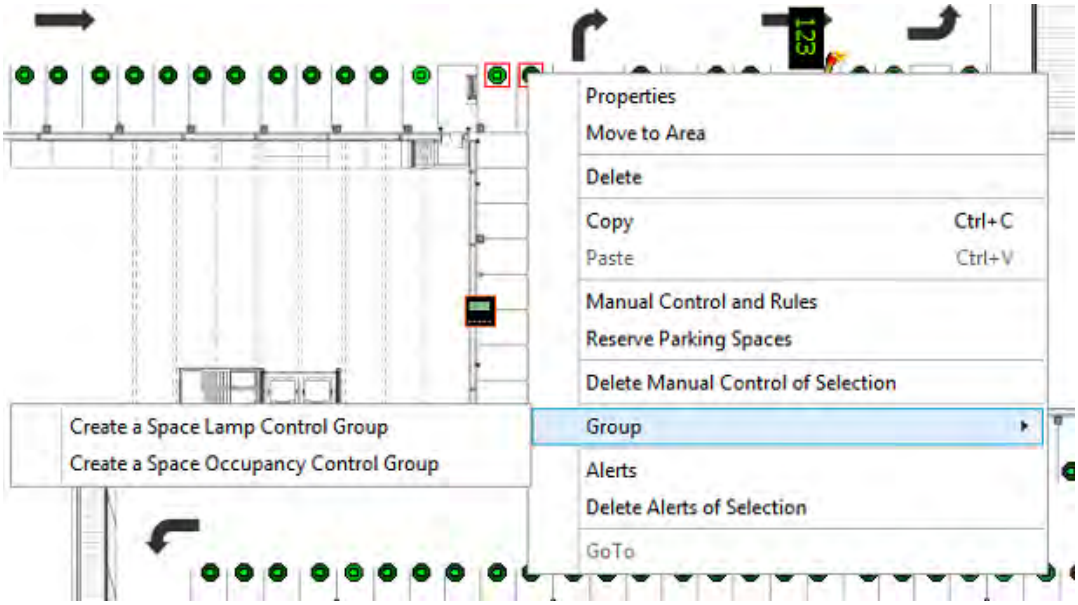


Figure 15: Right clicking the intended manager sensor and select Group.

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.

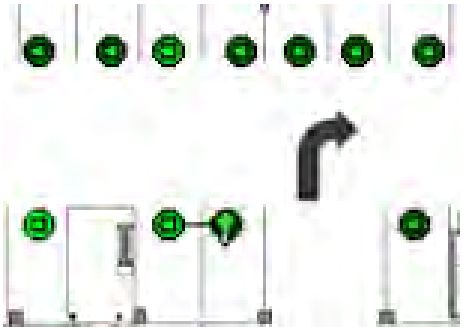


Figure 16: Space Lamp Control Grouping.

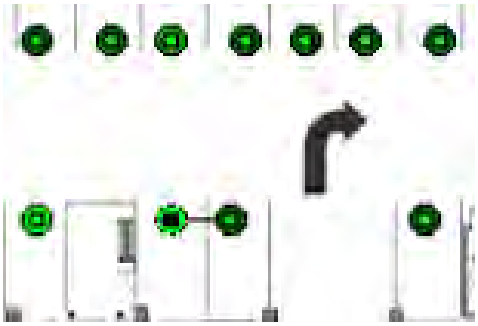


Figure 17: Space Occupancy Control Grouping.

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.

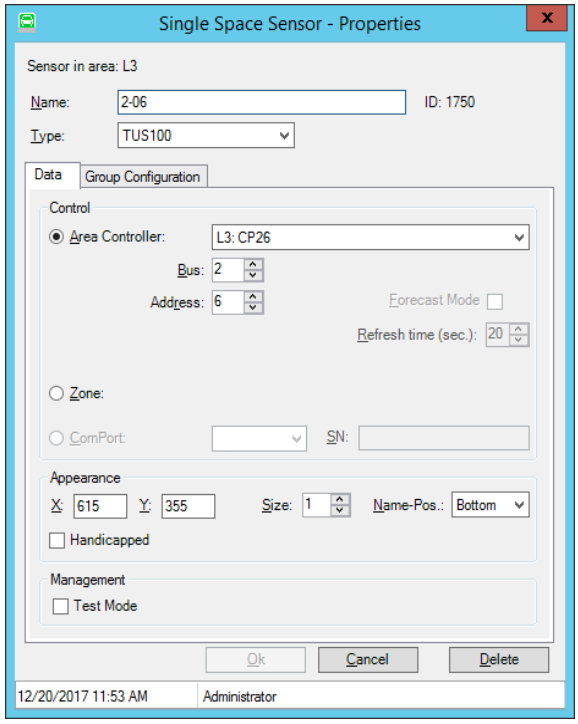


Figure 18:Sensor Properties window.

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)

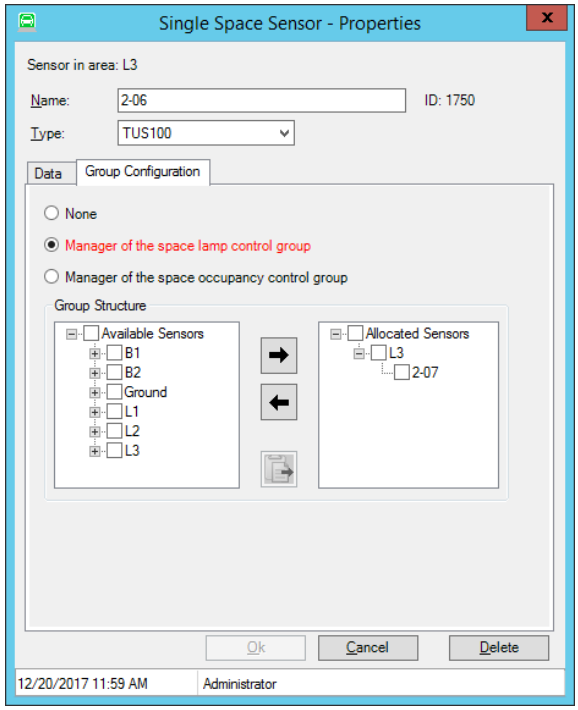


Figure 19: Sensor Properties Group Configuration window.

2.7. 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.

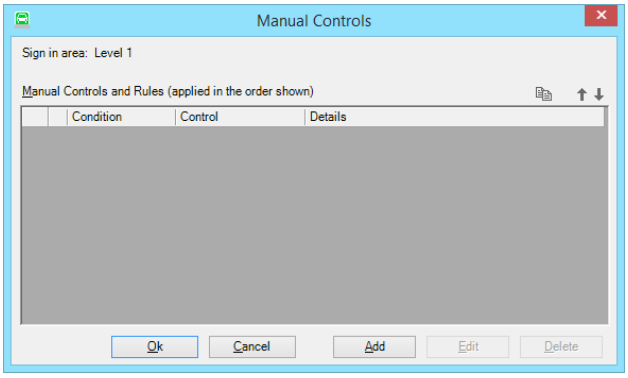


Figure 20: Manual Controls window

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.

2.7.1. 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.

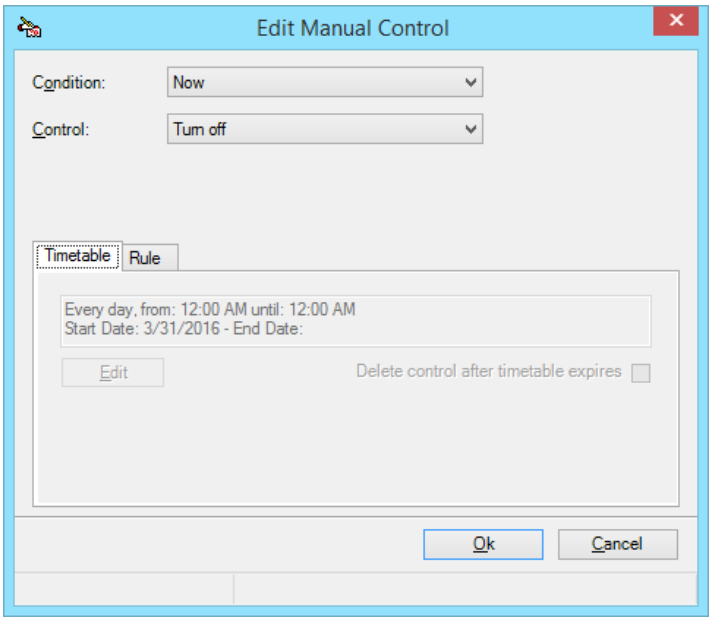


Figure 21: Edit Manual Controls window

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

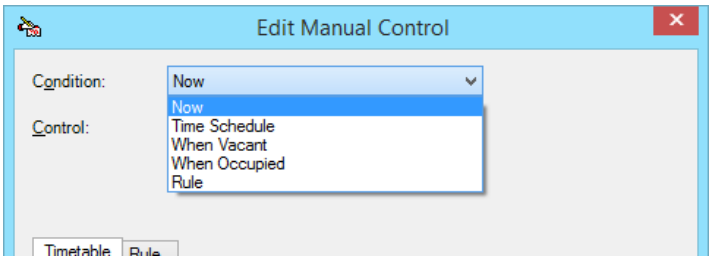


Figure 22: Condition options

- **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.
- **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.

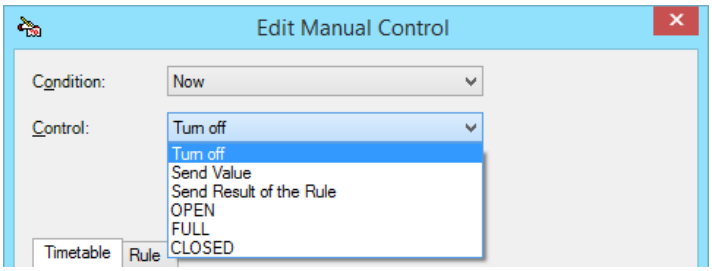


Figure 23: Control options

- **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.

2.7.1.1. 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.

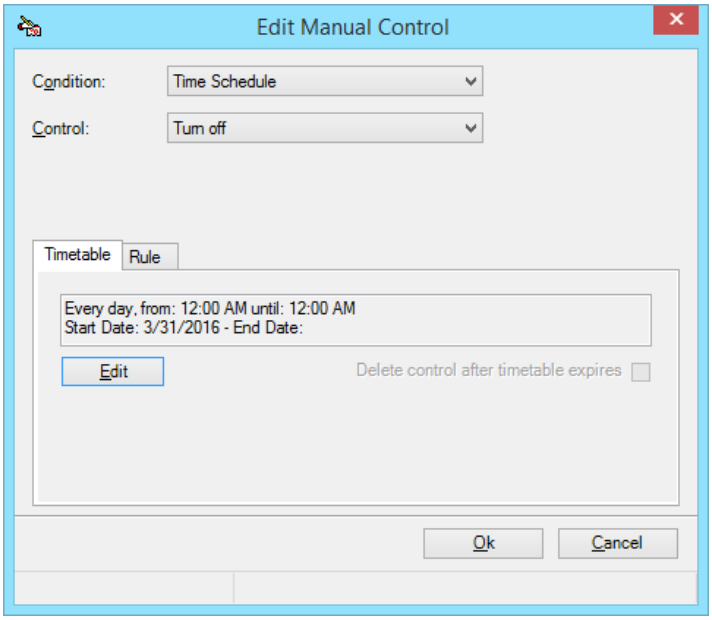


Figure 24: Edit Manual Control when choosing Time Schedule

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.

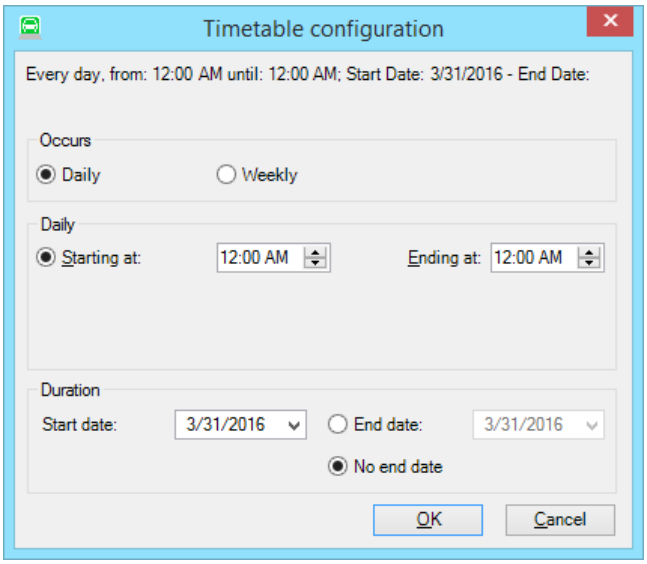


Figure 25: Daily timetable

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

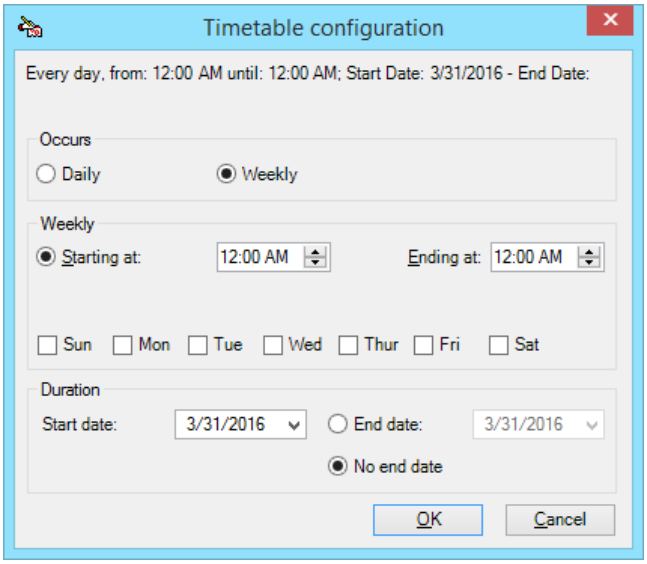


Figure 26: Weekly timetable

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.

2.7.1.2. 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.

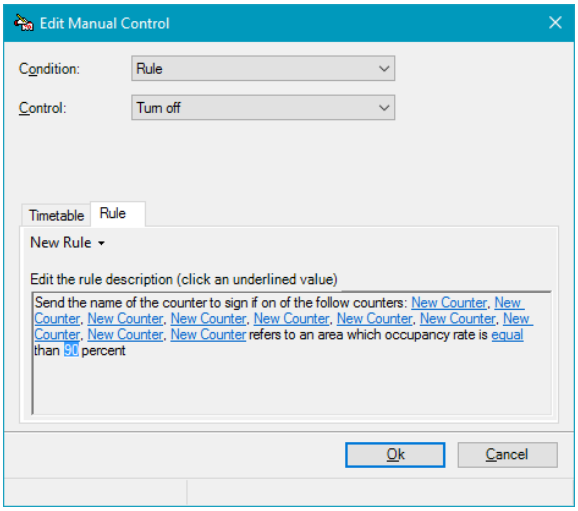


Figure 27: Adding a New Rule on a TMS54-DF

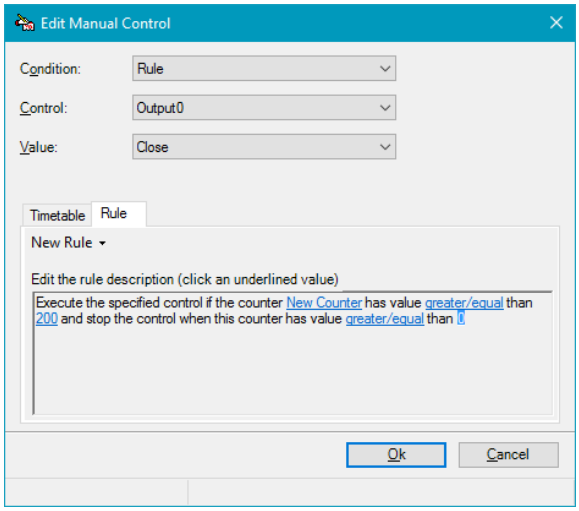


Figure 28: Adding a Rule on an I/O module and NuMedia VMS

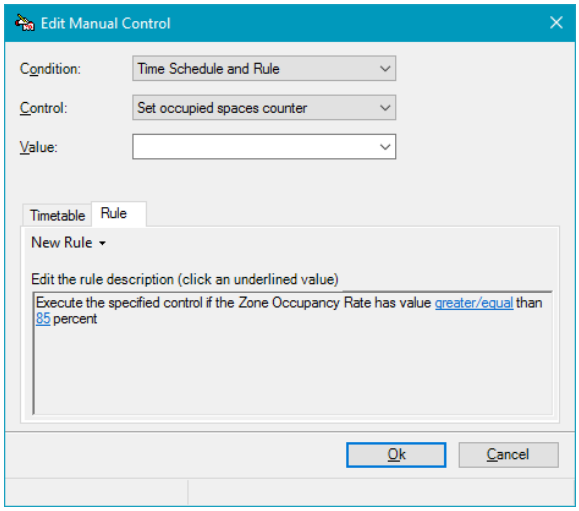


Figure 29: Adding a Rule on a Zone

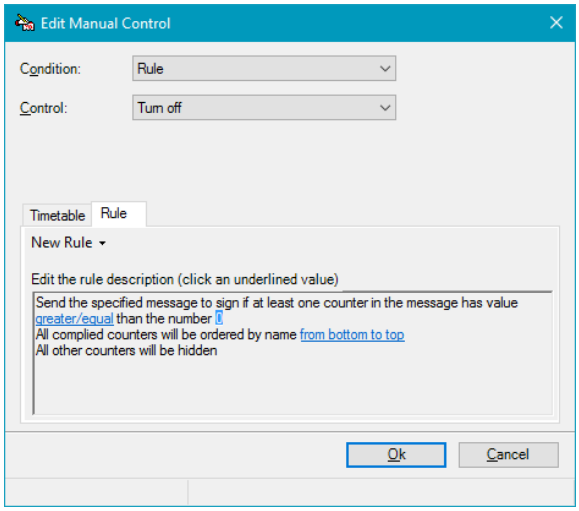


Figure 30: Adding a Rule on a NuMedia VMS (1)

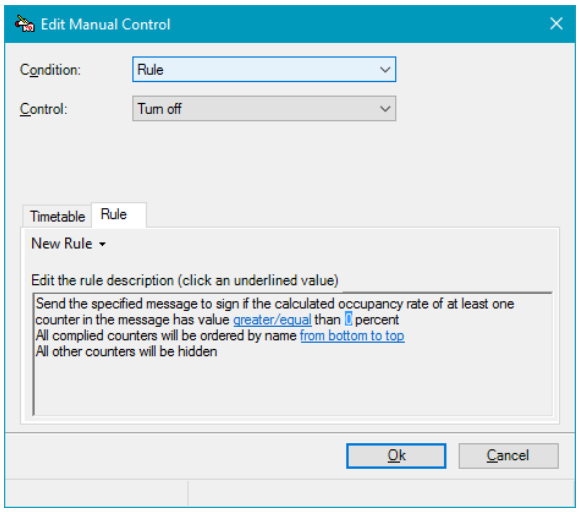


Figure 31: Adding a Rule on a NuMedia VMS (2)

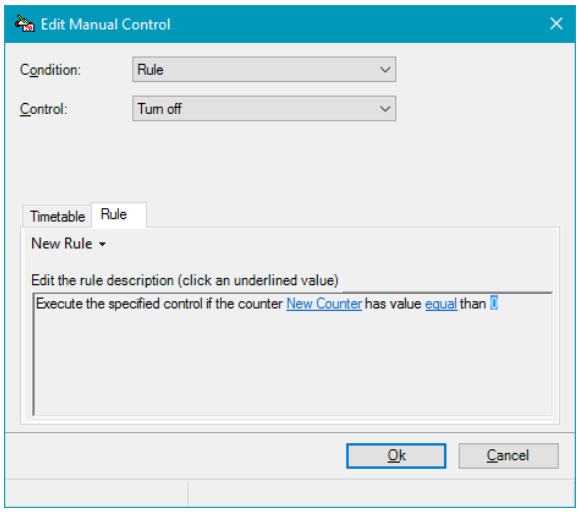


Figure 32: Adding a Rule on a NuMedia VMS (3)

2.7.1.2.1. Counter

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

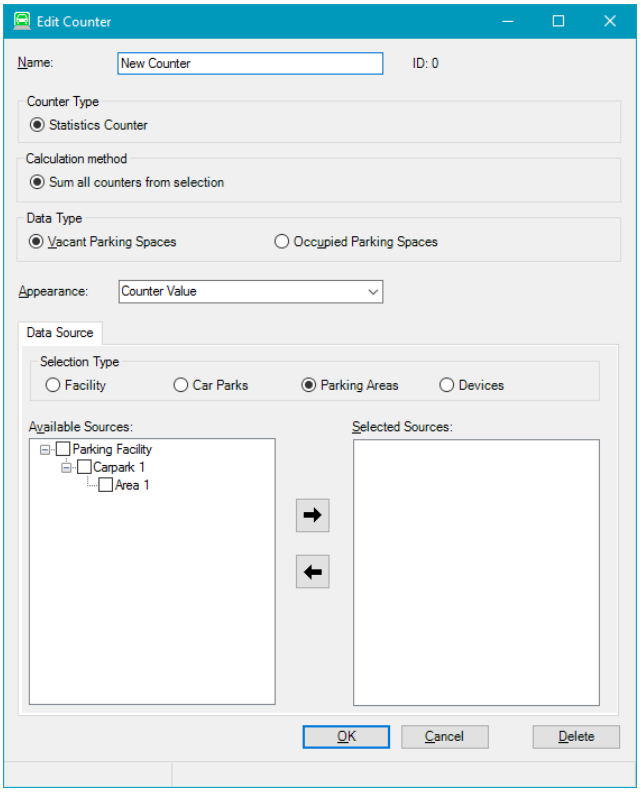


Figure 33: Edit the counter

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.

2.7.1.2.2. Range

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

2.7.1.2.3. Order

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

2.7.1.2.4. Value

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

2.8. 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.

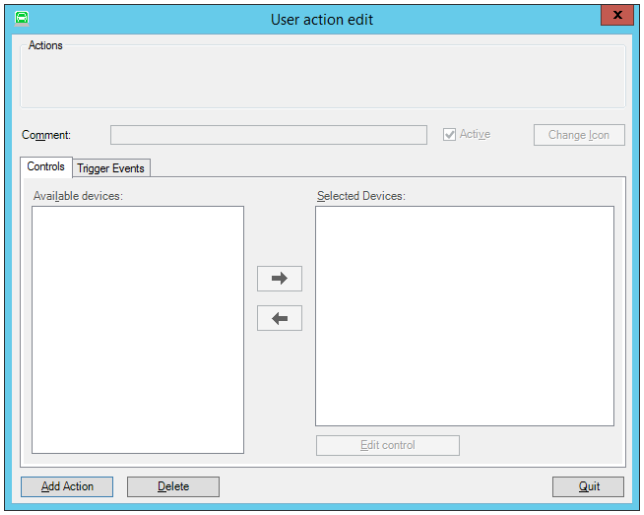


Figure 34: User action edit window

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.

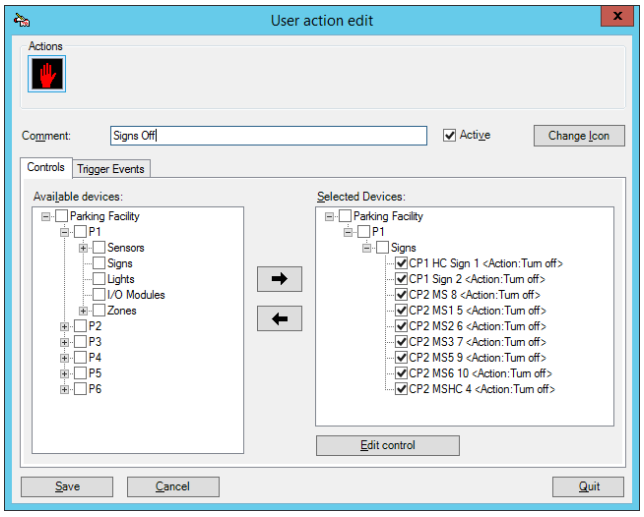


Figure 35: User action configuration

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.

2.9. 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.

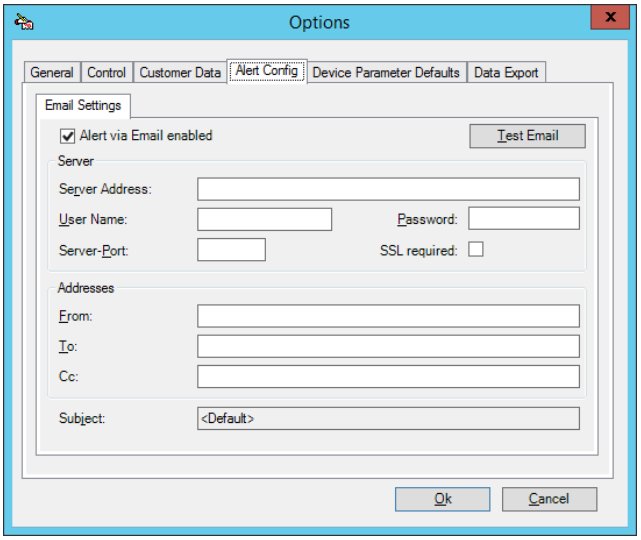


Figure 36: The Email Configuration Settings

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 address 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.

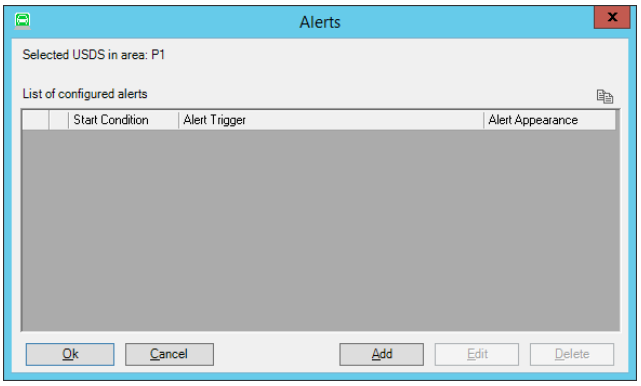


Figure 37: The Alerts window

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.

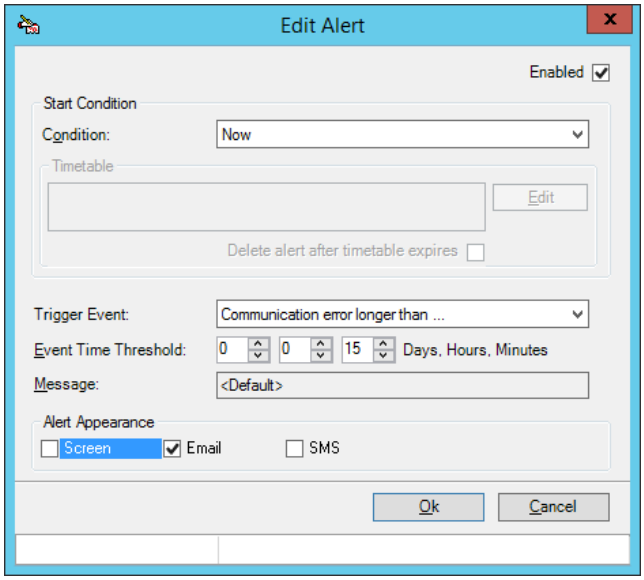


Figure 38: Device Alert set up window

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

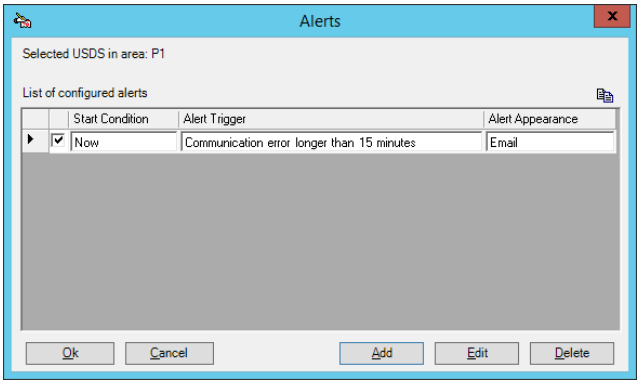


Figure 39: Alerts window after an alert has been configured.

2.10. 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.

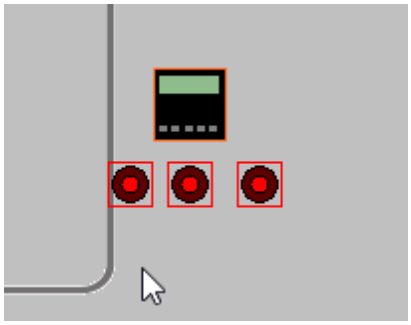


Figure 40: Select specified sensors for calibration.

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

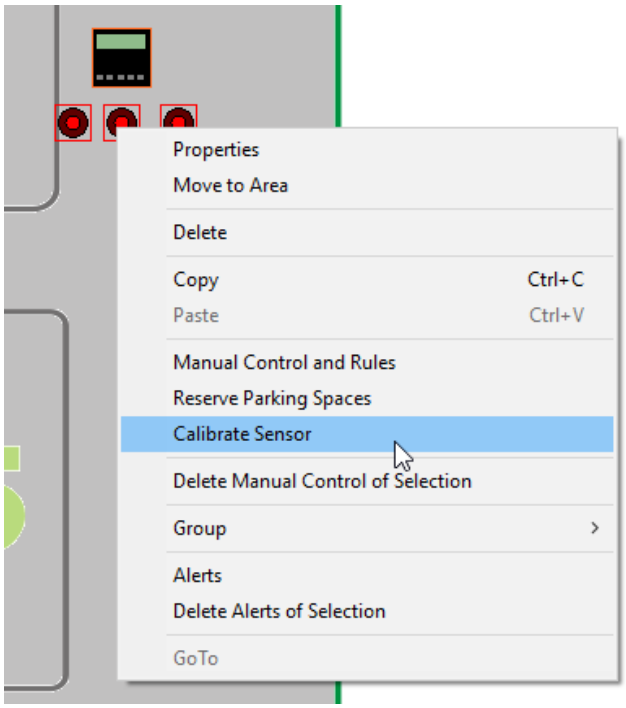


Figure 41: Select Calibrate Sensor.

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.

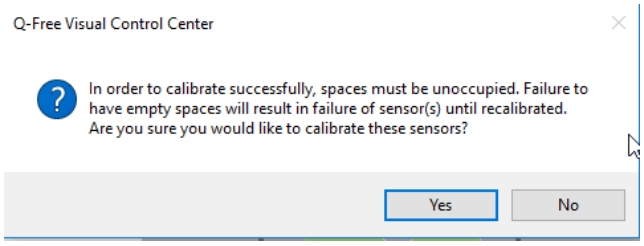


Figure 42: Selecting Yes says the parking stall(s) is vacant.

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.

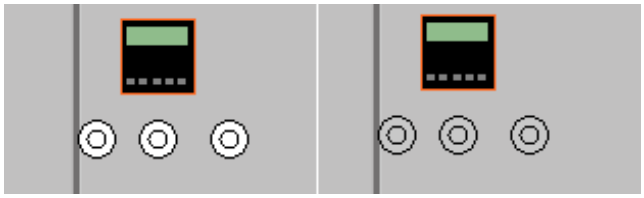


Figure 43: The sensor(s) cycles between white and grey.

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

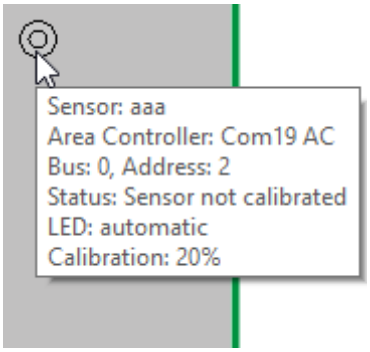


Figure 44: View the percentage of completion by hovering the mouse over the icon.

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

2.11. 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

2.11.1. 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.

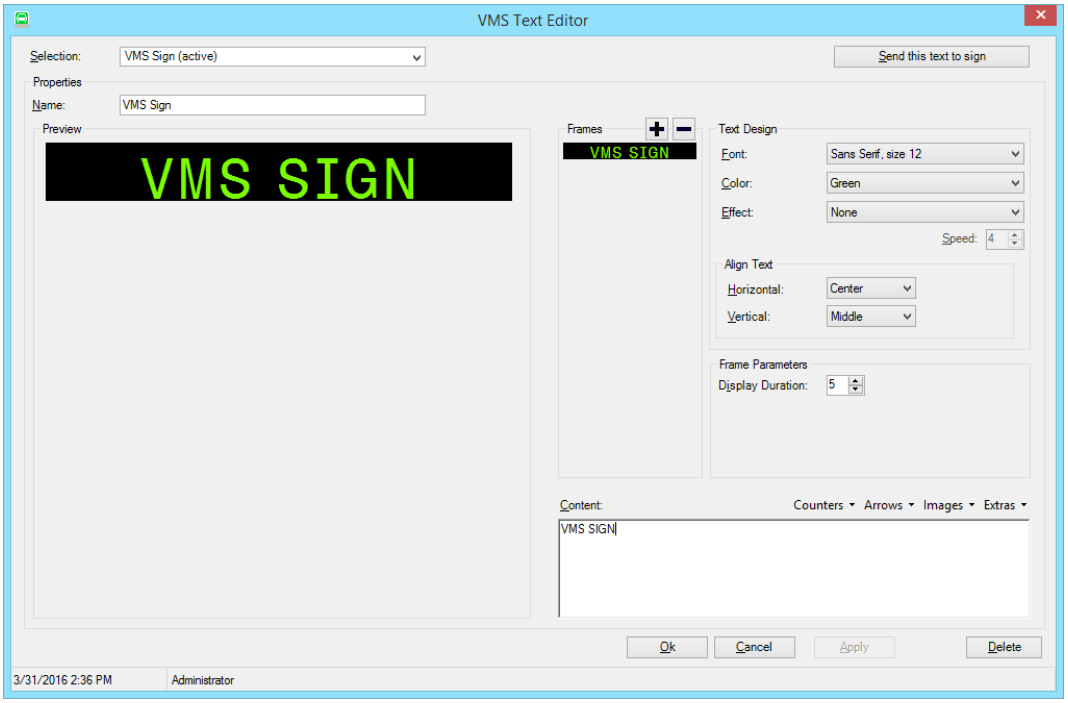


Figure 46: VMS Text Editor window

2.11.1.1. 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.

2.11.1.1.1. 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.

2.11.1.1.2. 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.

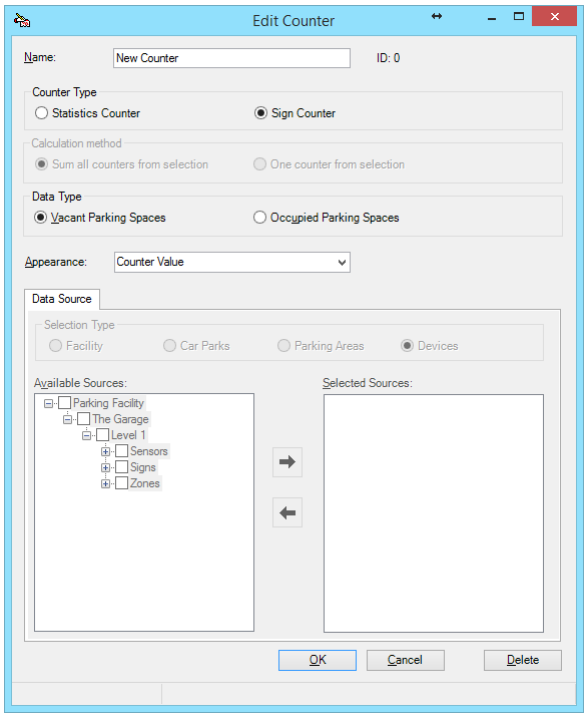


Figure 47: VMS Edit Counter window for Sign Counter

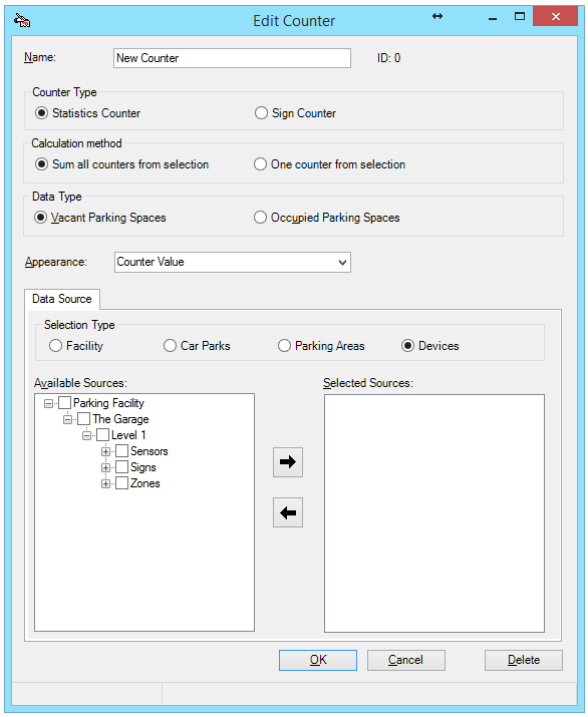


Figure 48: VMS Edit Counter window for Statistics Counter

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.

2.11.1.1.3. 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.

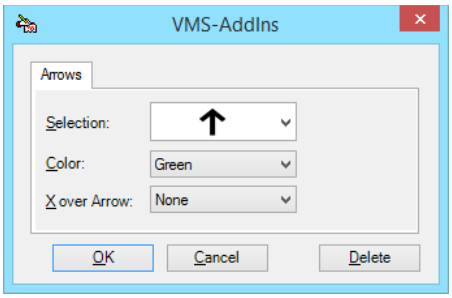


Figure 49: VMS-AddIns window for adding an Arrow

2.11.1.1.4. 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.

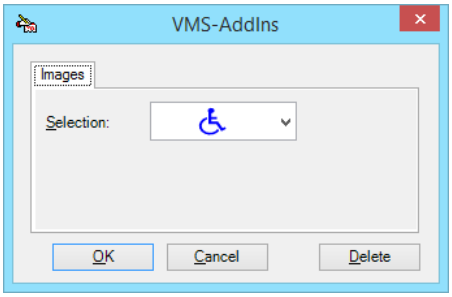


Figure 50: VMS-AddIns window for adding an Image

2.11.1.1.5. 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.

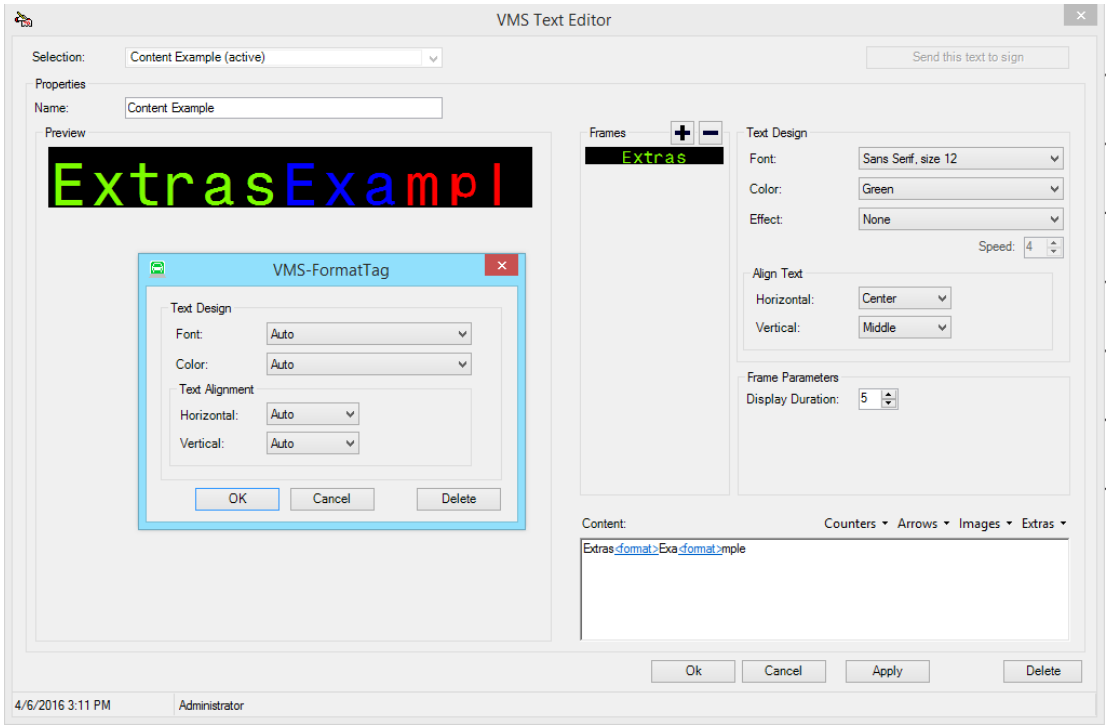


Figure 51: VMS-FormatTag window and example of Extras configuration

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

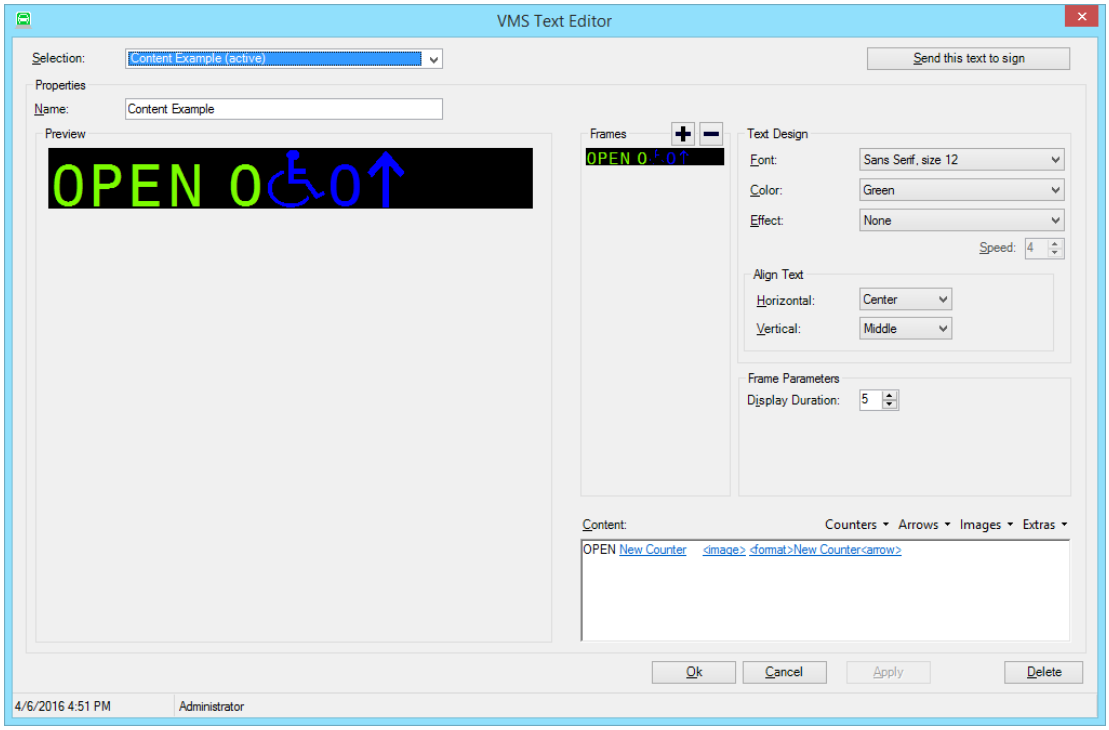


Figure 52: Example of mixed text and content options to display an informative message

Figure 53: Example of the device as shown in VCC

2.11.2. 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.

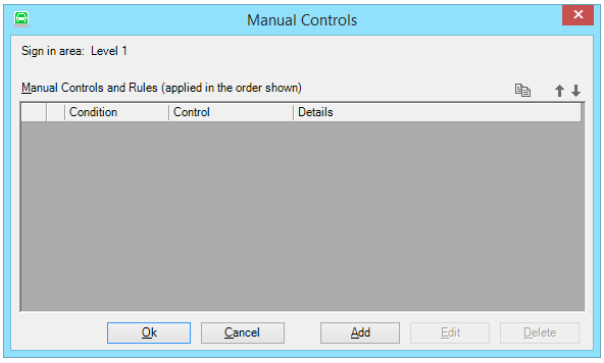


Figure 54: Manual Controls window for VMS

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.

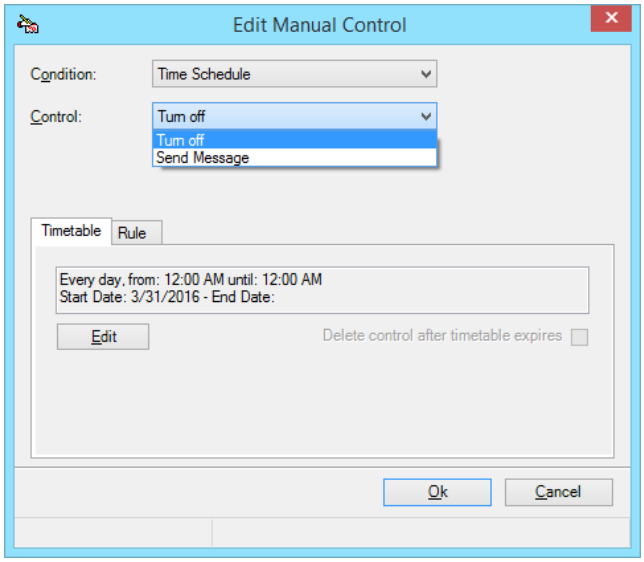


Figure 55: Edit Manual Control window for a VMS

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

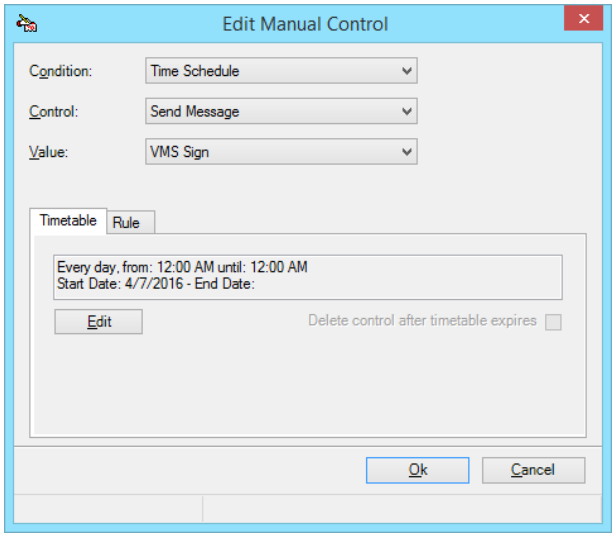


Figure 56: Edit Manual Control for a VMS when sending a message

2.12. 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.

User Rights:

Configuration Create/modify – Allows creation/editing of "Options" items. **Required to utilize all "Options" items.**
Configuration Delete – Allows deletion of "Options" items. **Required to utilize all "Options" items below:**

Options "General" Modify – Allows the user to access and modify the General settings under Extras>Options General.
Options "Customer Data" Modify – Allows the user to access and modify the customer data under Extras>Options Customer Data.
Options "Control" Modify – Allows the user to access and modify different control settings.
Options "Folder" Modify – Allows the user to send data export and configure ParQ settings.
Options "Default Settings" Modify – Allows the user to adjust default device parameters under Extras>Options Device Parameter Defaults.

Device Control Properties Modify – Allows the user to change device properties. **Required to utilize all "Device Properties" items below:**

Zone Counter Modify – Allows the user to adjust the vacant/occupied spaces of a Zone Counter.
User Actions Create/Modify – Allows the user to create and modify user actions.
User Actions Delete – Allows the user to delete user actions.
User Actions Start/Stop – Allows the user to activate/deactivate a user actions using the radio buttons on the Menu Bar.
Alerts Create/Modify – Allows the user to create and modify alerts of devices.
Alerts Delete – Allows the user to delete alerts.

The rights below are standalone and not dependent on the Configuration and Device Control Properties User Rights:

Manual Controls Create/Modify – Allows the user to create and modify manual controls of devices.

Manual Controls Delete – Allows the user to delete manual controls of devices.

Password Change – Allows the user to change their password.

VMS Message Create/Modify – Allows the user to create and modify VMS sign messages.

VMS Message Delete – Allows the user to delete VMS sign messages.

Server Log Show – Allows the user to view the Server Logs under Extras>Server Logs.

Reports Start – Allows the user to create and run reports under Statistics.

Report Counter Create/Modify – Allows the user to create a User Report in the Statistics options. This allows a user to create a report and save their settings.

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.

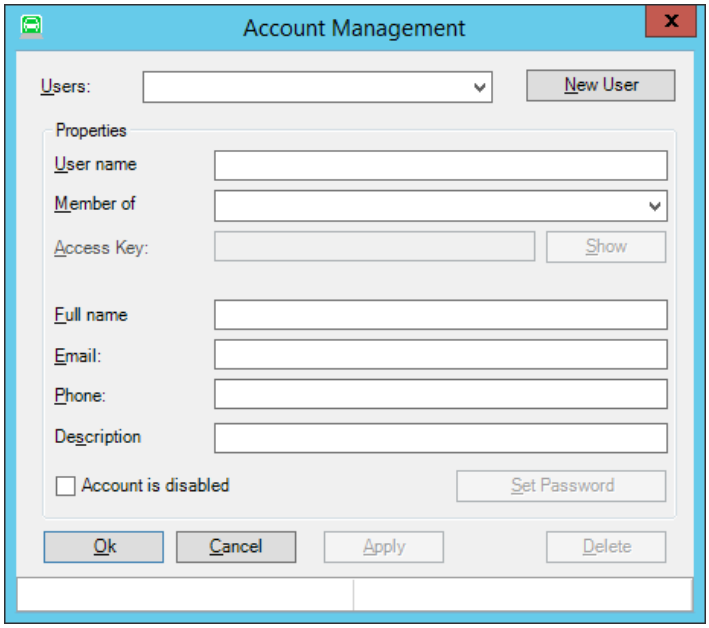


Figure 57: User account creator and editor.

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

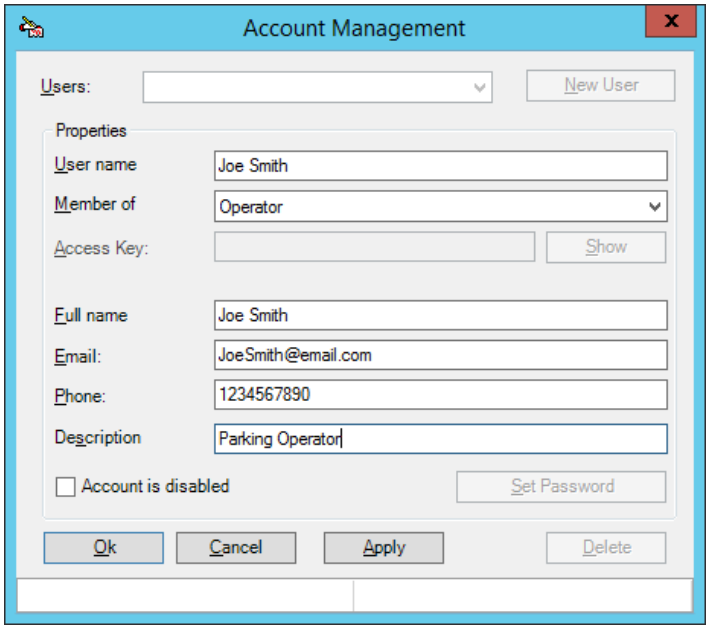


Figure 58: Creating a new software user.

When the user has been created close the software then re-open it using the new user's username and password. If there is no password, just leave that field blank when logging in. To change the user password, select the "Extras" tab and "Change Password". Enter the new password and confirm it then click Ok. Now when logging in the user will need to use their password.

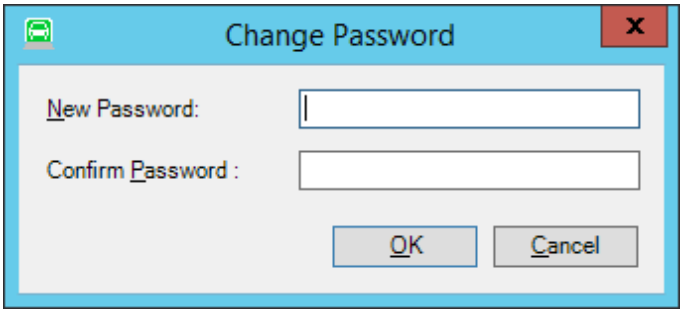


Figure 59: Setting or changing the account password.

2.13. 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.

2.13.1. 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.

- 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.

2.13.2. 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

2.13.3. How to Generate a Statistic

To access the Statistics generator, open the Reports 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.

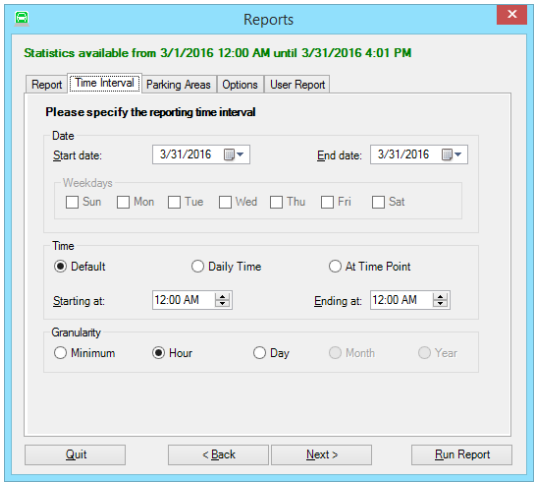


Figure 60: Reports window for a Report

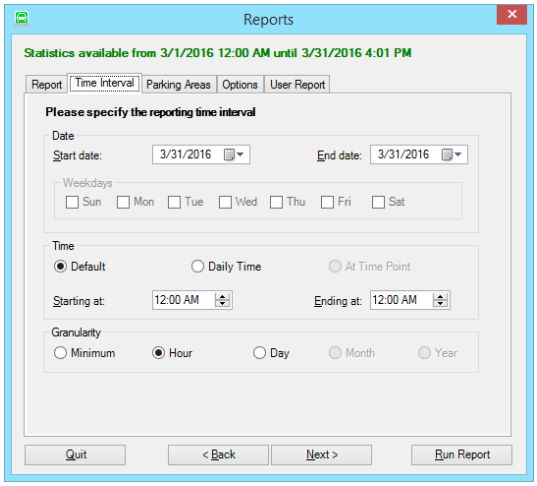


Figure 61: Reports window for a Diagram

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.

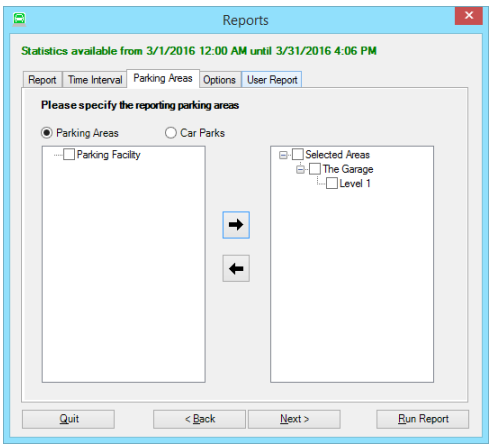


Figure 62: Moving desired location(s) to the Selected Areas window

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.

3. Web Browser User Interface

3.1. 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.

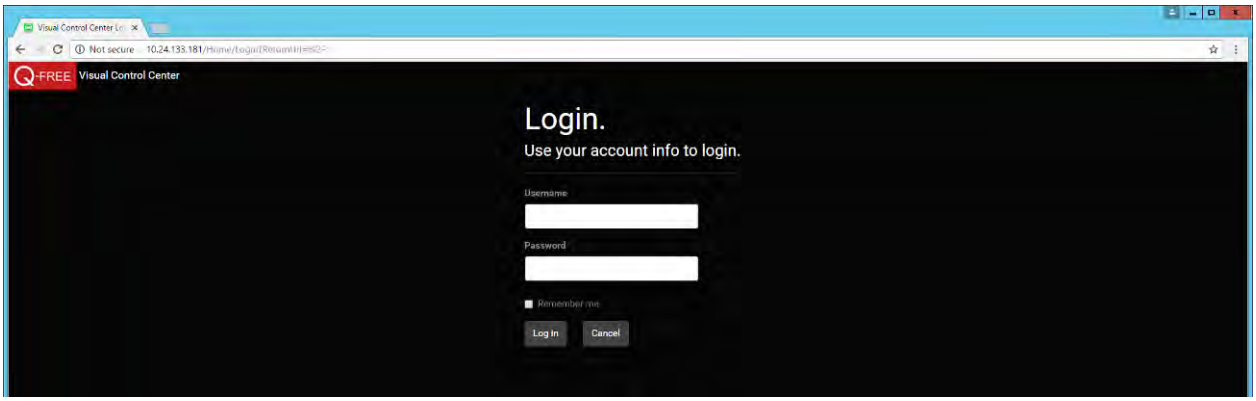


Figure 63: VCC web access login page.

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.**

3.1.1. Main Window

3.1.1.1. 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.

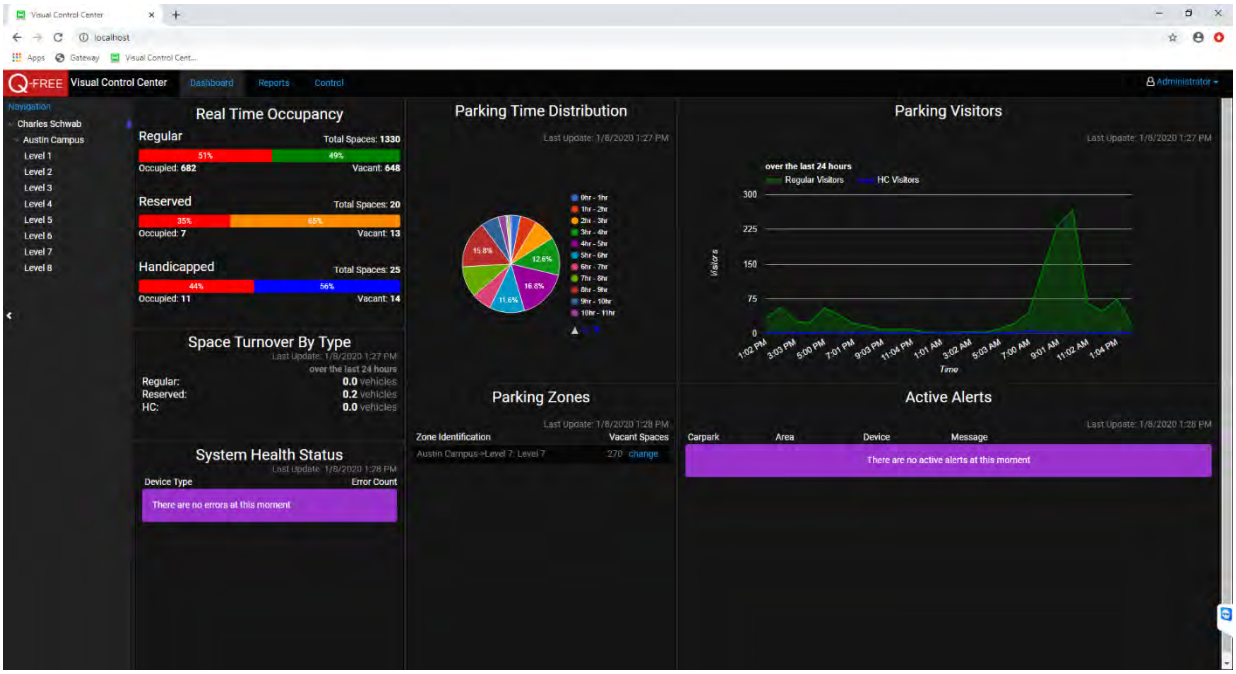


Figure 64: Example of the VCC main window after login.

3.1.1.1. 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.

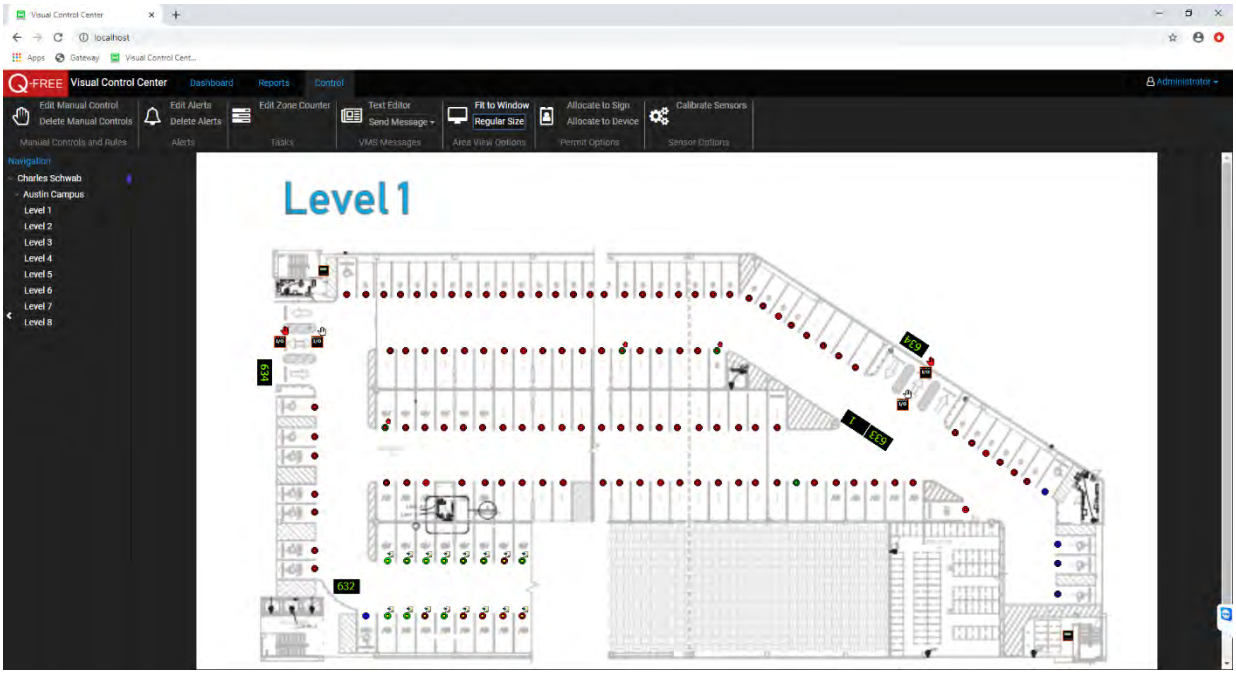


Figure 65: The Control tab main window.

3.1. 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.

3.1.1. Data

3.1.1.1. 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.

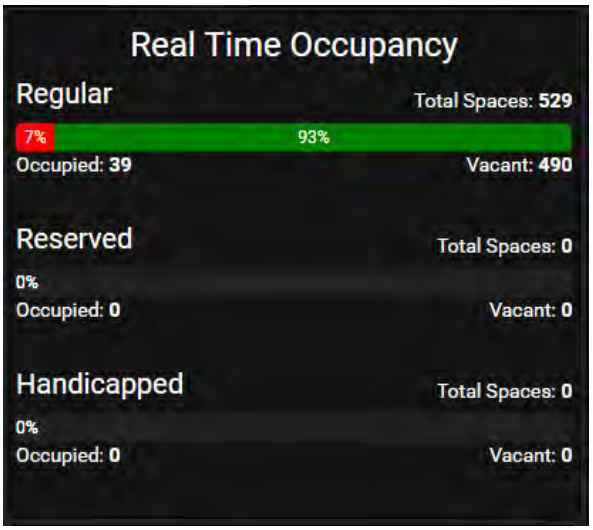


Figure 66: The real-time occupancy data.

3.1.1.1. 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.

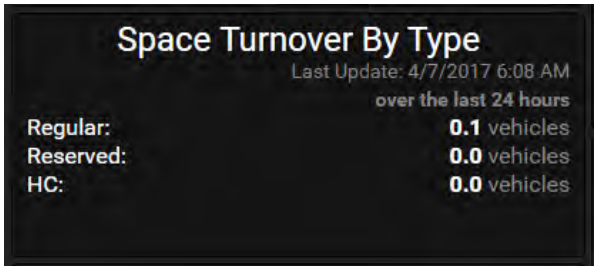


Figure 67: the space turnover by type data.

3.1.1.1. 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.

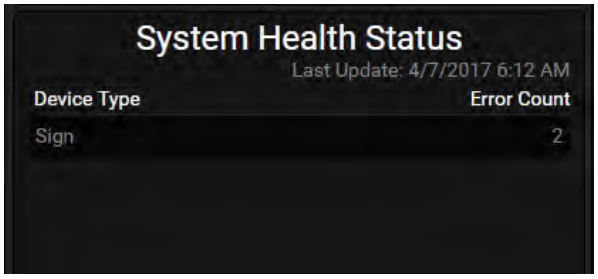


Figure 68: The system health status data.

3.1.1.1. 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.

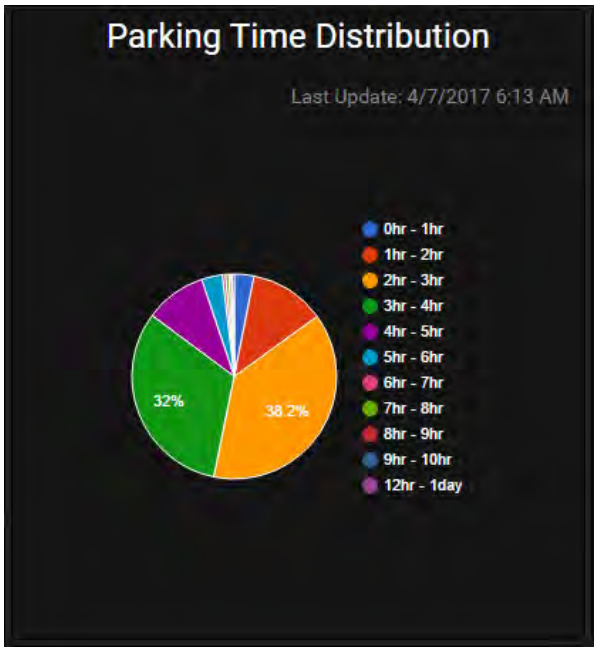


Figure 69: The parking time distribution data.

3.1.1.1. 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.

3.1.1.1. 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.

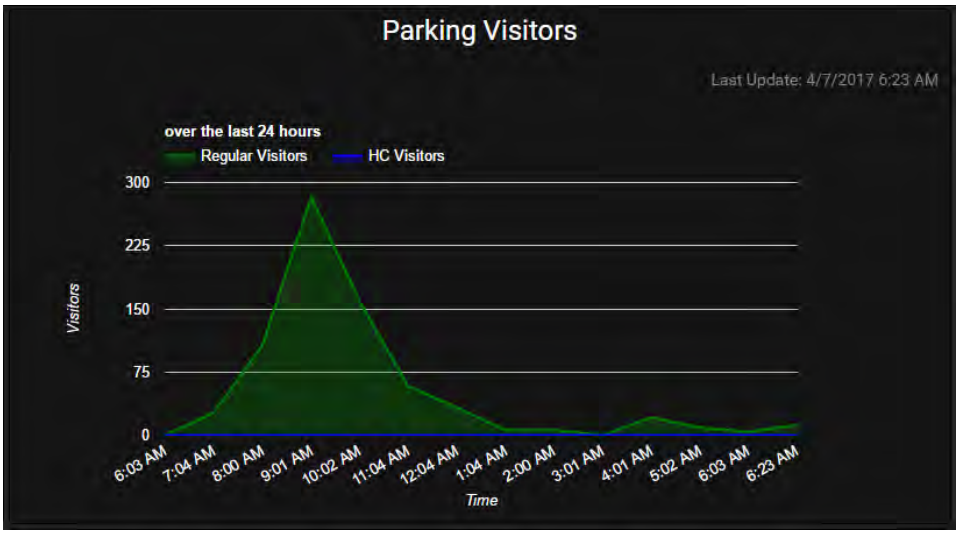


Figure 71: The parking visitor's data.

3.1.1.1. 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.

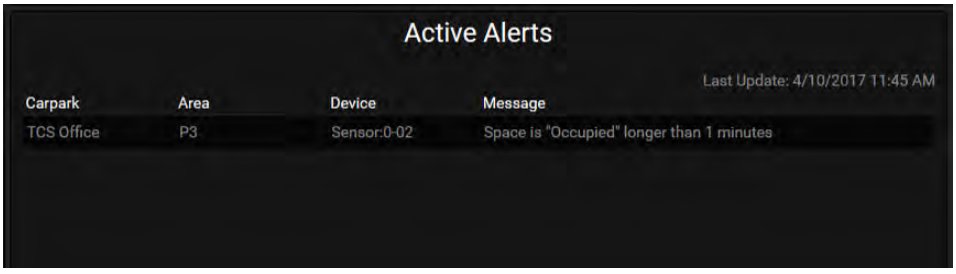


Figure 72: The active alerts data.

3.2. Reports Tab

The Reports Tab . . . .

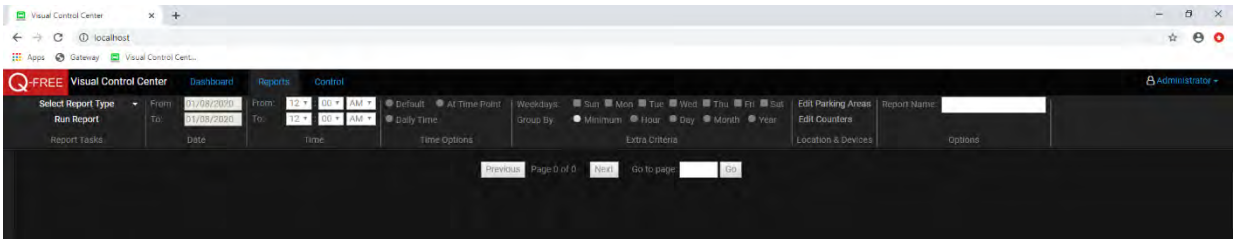


Figure 73: Reports Tab.

3.2.1. How to Generate a Report

To access the Reports generator, open the Reports tab. 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.

Steps for configuring the report:

1) Starting on the left side, select the report type.
2) Then select the dates that the information is desired from.
3) Then select the time that the information is desired from.
   a) A time option can be selected or leave at default.
4) The time at which the report is run can be further detailed by selecting only certain days of the week.
5) Next select the Granularity at which the time intervals that the information is wanted to be seen at.
6) Depending on the report being generated, the options for Parking Areas of Counters will be accessible. Select the areas or counters that the data is to be run for.
   a) Select the areas and click the arrows to either add to or remove from the Selected Sources column.

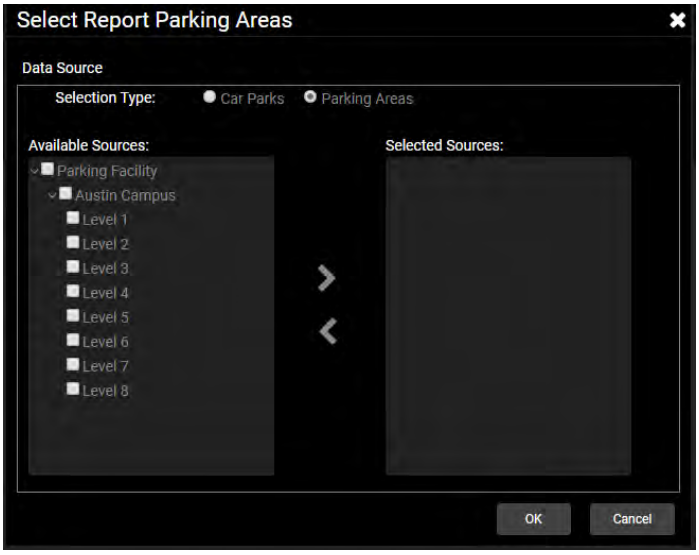
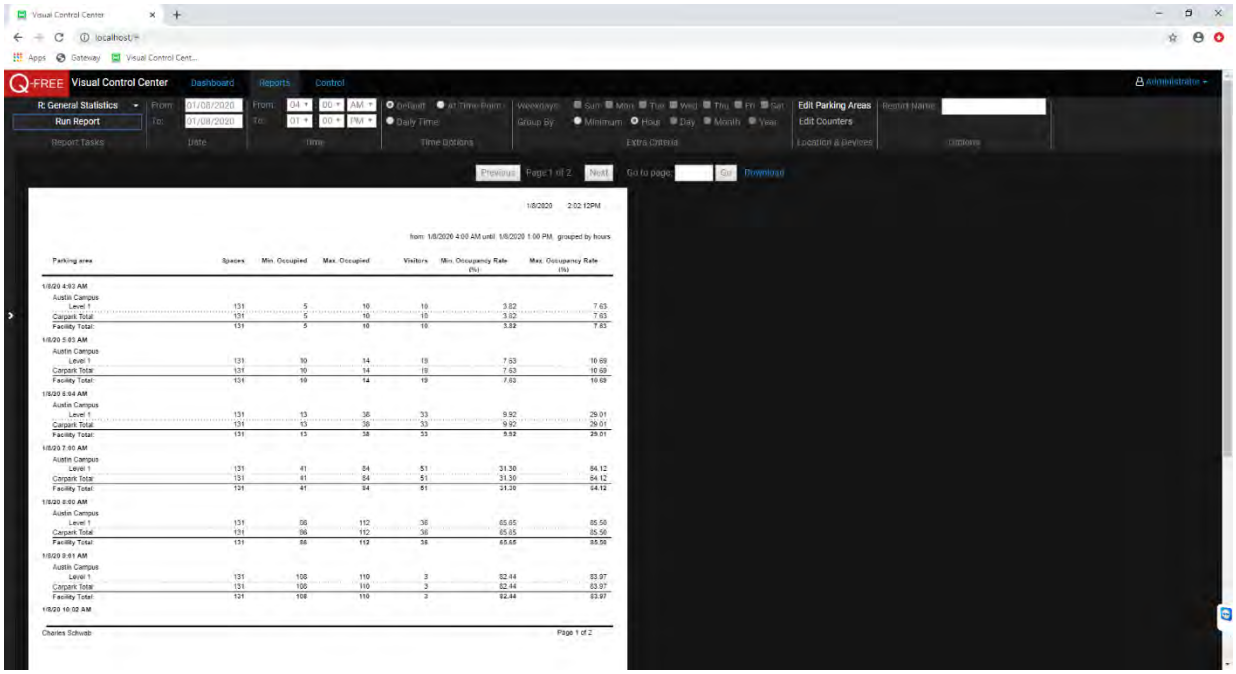


Figure 74: Select Report Parking Areas.

7) The report is ready and to run the report, click Run Report on the left side in Report Tasks.



3.3. Control Tab

3.3.1. Components of the Control Tab

3.3.1.1. Window Title

The window title is TCS Visual Control Center. Next to this is also the Dashboard and Control tabs to navigate between the two windows.

3.3.1.2. 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.

3.3.2. 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:

3.3.2.1. 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.

3.3.2.2. Alerts

This tool allows the user to create an alert on devices

3.3.2.3. Tasks

This tool is for editing the counts on a zone counter.

3.3.2.4. VMS Messages

This tool allows the user to create and send messages to a VMS sign.

3.3.2.5. Area View Options

This tool allows the user to adjust the zoom of the screen from Fit to Window and Regular Size.

3.3.2.6. Permit Options

This tool allows the user to allocate devices to a permit as well as allocate devices and/or permits to a sign.

3.3.3. 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 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.
3. 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 75: Zone Manager

4. 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.

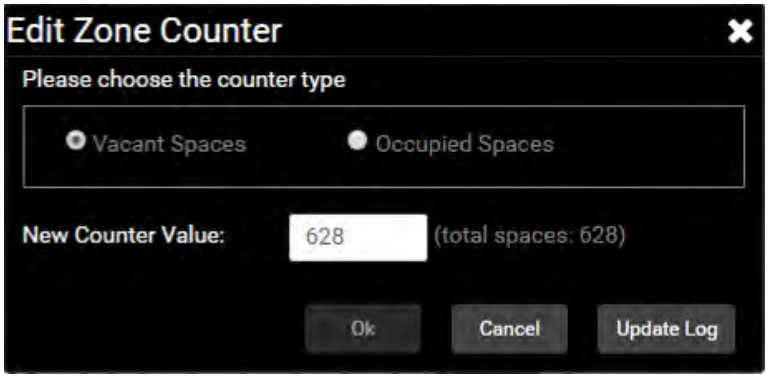


Figure 76: Zone counter used to maintain counts

5. After entering in the correct number, click “Ok”. The zone is now updated with the most recent count.
6. 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.
7. 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 52-56.**

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 76.

Figure 77: Dashboard link to Edit Zone Counter

3.3.1. 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

3.3.1.1. 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 78: 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.

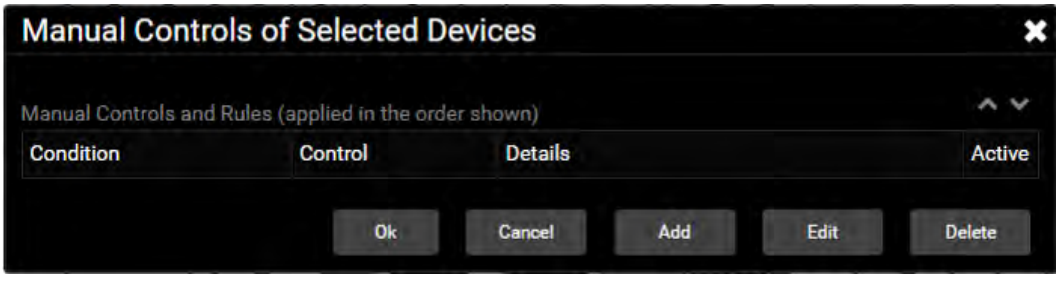


Figure 79: Reservation of parking spaces window

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.

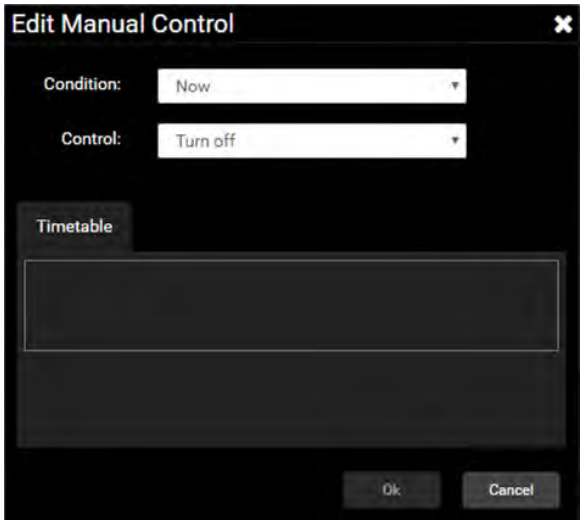


Figure 80: The Edit Manual Control window

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.

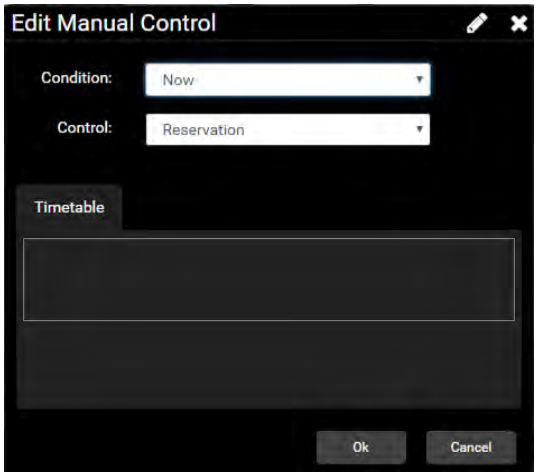


Figure 81: Parking Reservation set up.

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.

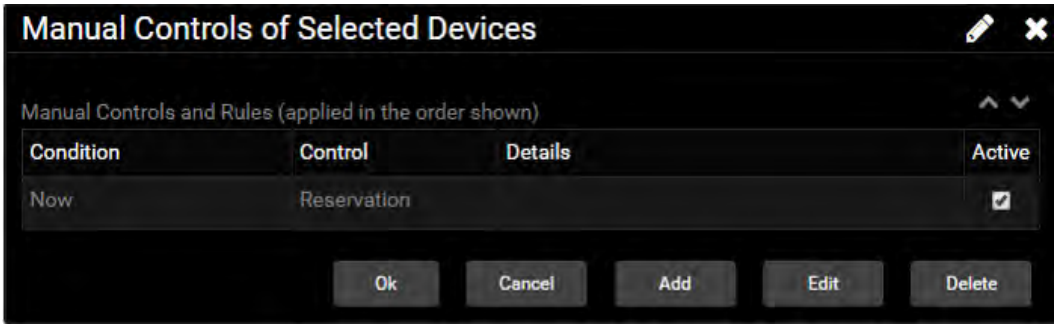


Figure 82: Reservation of parking spaces window.

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.

3.3.2. 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 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.

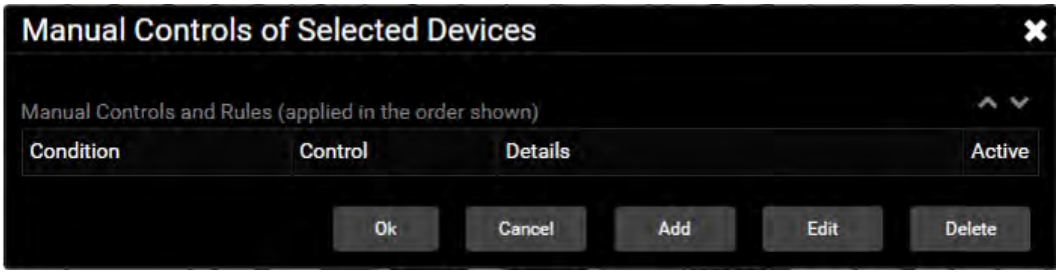


Figure 83: The Manual Controls window list.

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.

3.3.2.1. 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.

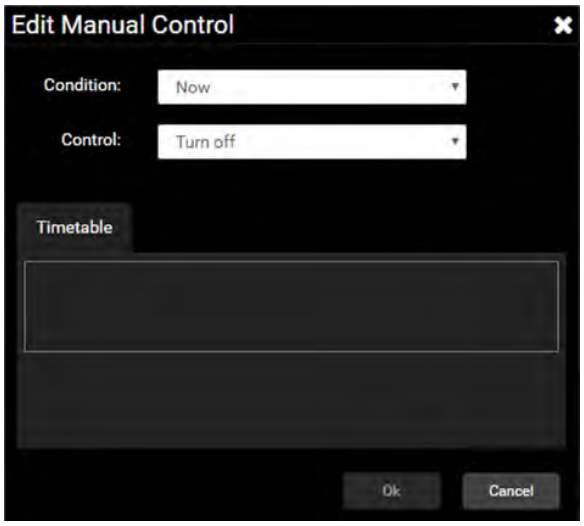


Figure 84: The Edit Manual Controls window.

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

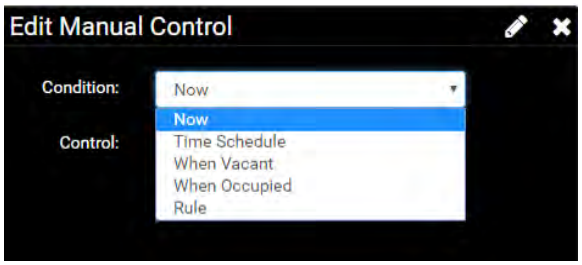


Figure 85: Condition options

- **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.
- **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.

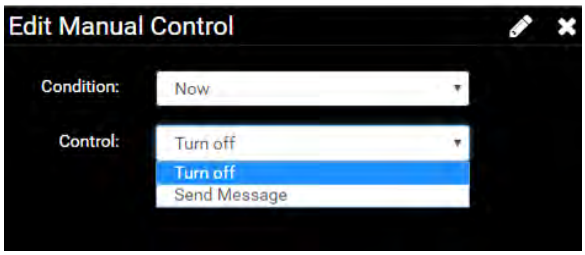


Figure 86: The Control options for a sign.

- **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.

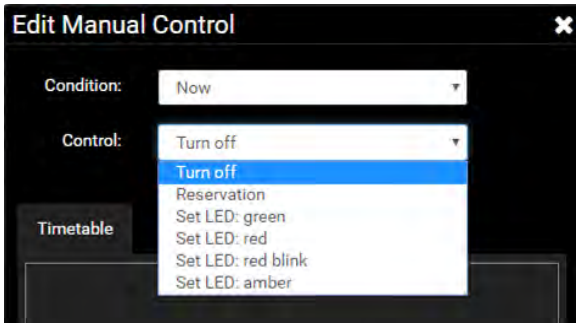


Figure 87: The Controls options for a single space sensor.

- **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.

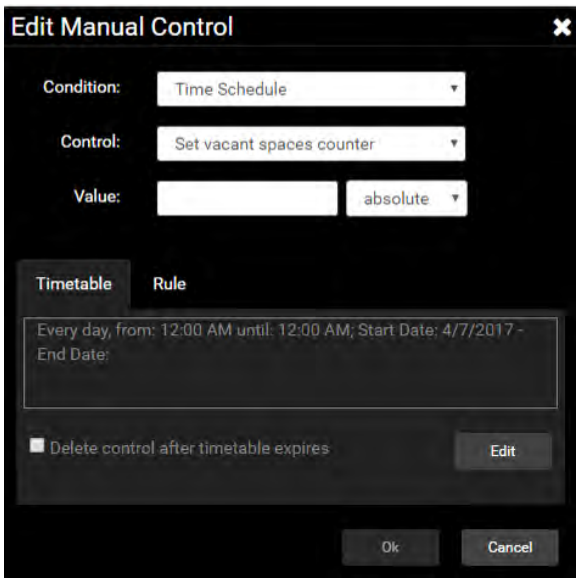


Figure 88: The manual control for a zone counter.

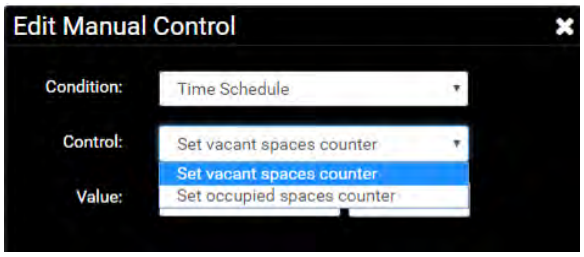


Figure 89: The Controls options for a zone counter.

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.

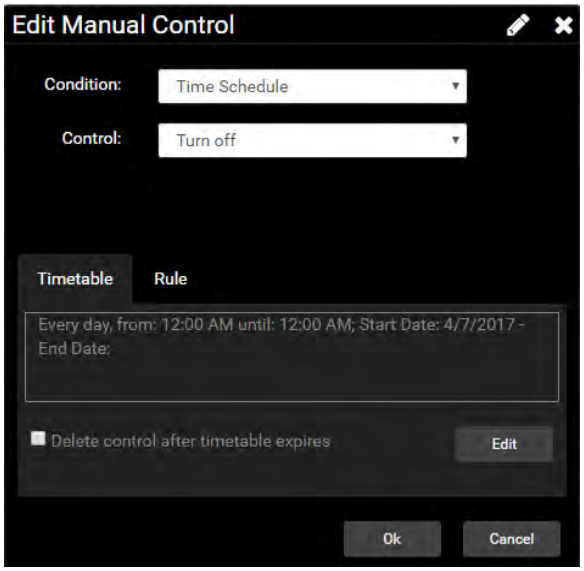


Figure 90: Edit Manual Control when choosing Time Schedule.

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.

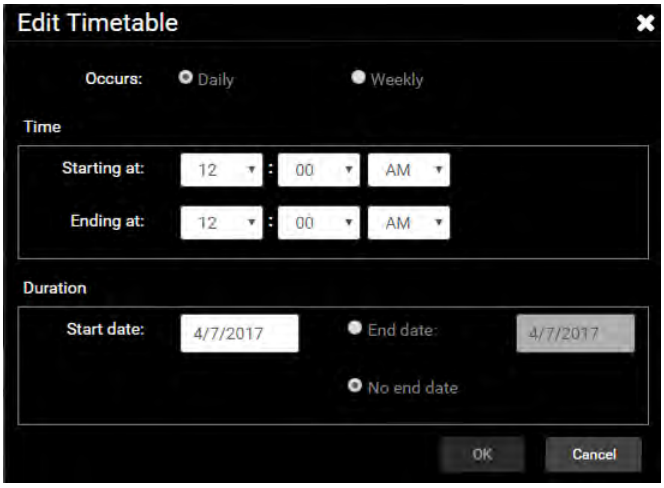


Figure 91: Daily timetable

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

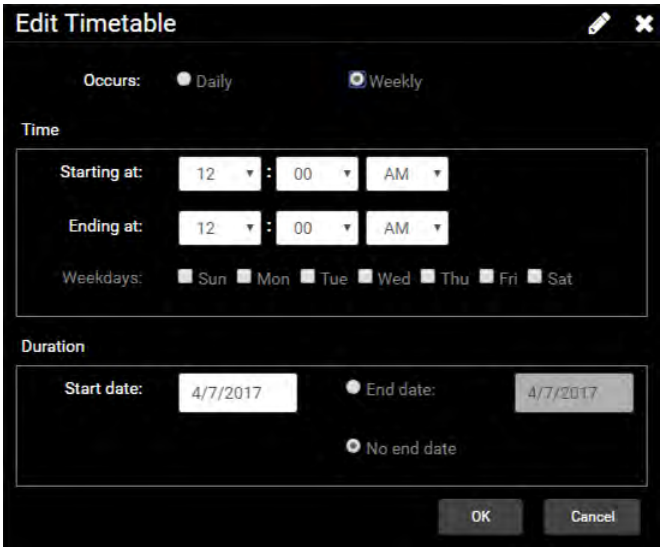


Figure 92: Weekly timetable

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.

3.3.3. 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.

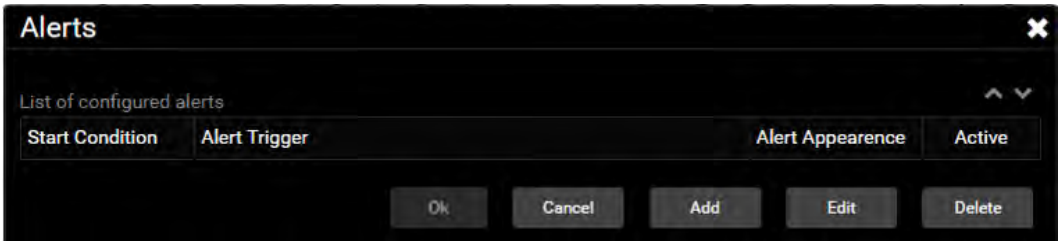


Figure 93: The Alerts window.

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.

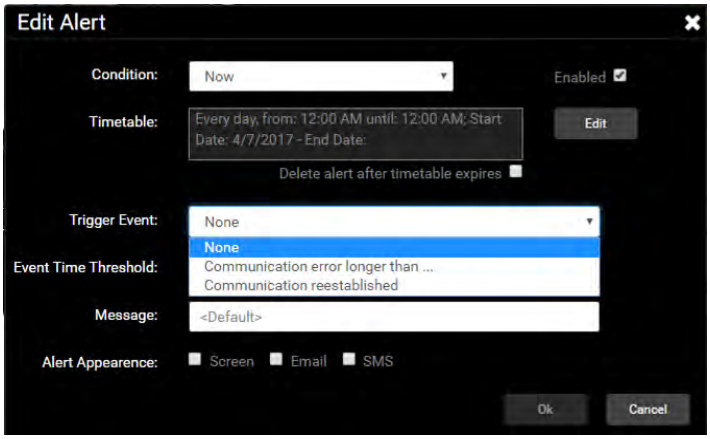


Figure 94: The device Alert set up window.

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

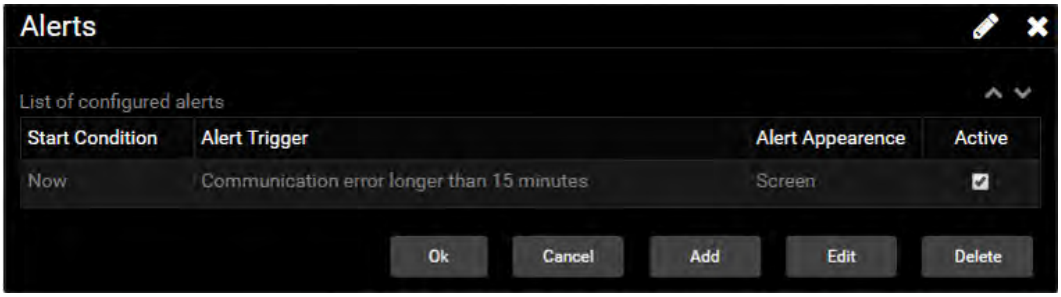


Figure 95: Alerts window after an alert has been configured.

For single space sensors, alerts can be set dependent on the status of the occupation.

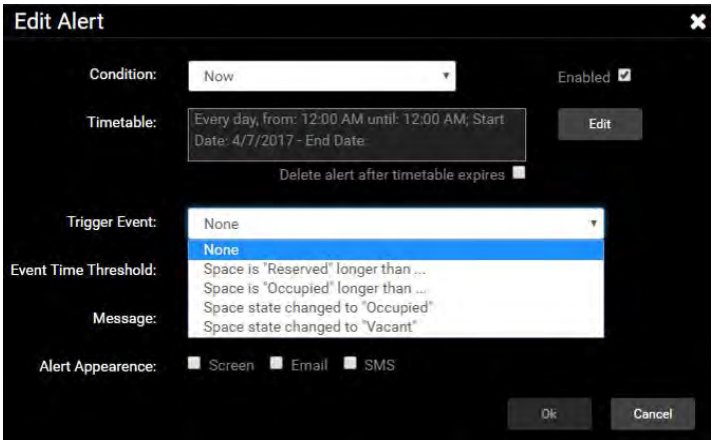


Figure 96: The device Alert set up window for single space sensors.

3.3.1. 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 97: Variable Message Sign Icon in Visual Control Center

3.3.1.1. 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 98: 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 99: 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.

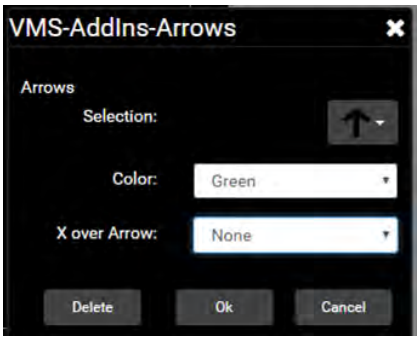


Figure 100: VMS-AddIns window for adding an Arrow.

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.

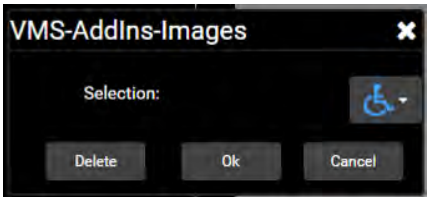


Figure 101: VMS-AddIns window for adding an Image

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.

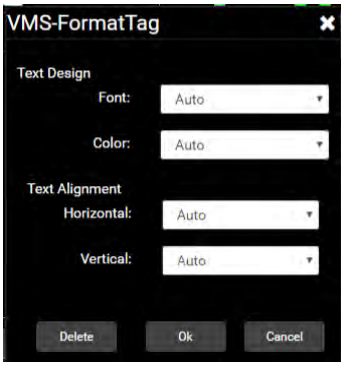


Figure 102: The VMS format tag window.

Figure 103: 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 104: Example of mixed text and content options to display an informative message

Figure 105: Example of mixed content VMS as shown in VCC

3.3.1. 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.

3.3.1.1. 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.

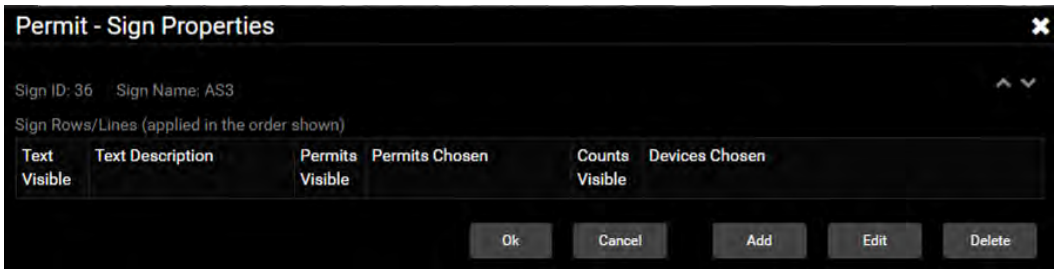


Figure 106: The sign properties window.

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.

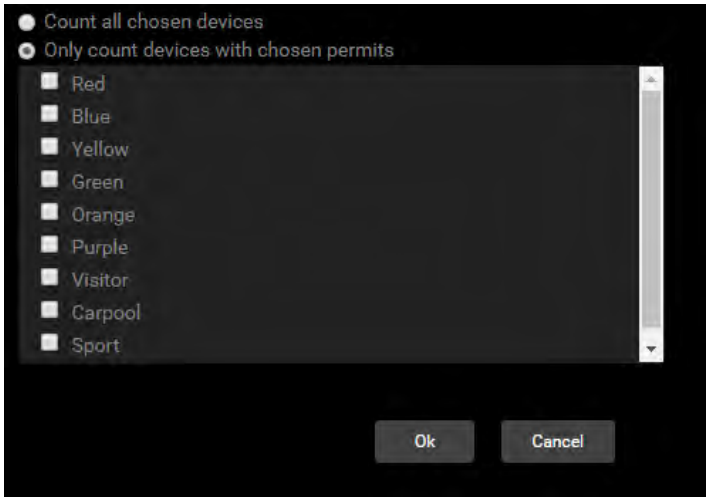


Figure 107: The list of permit to be added.

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.

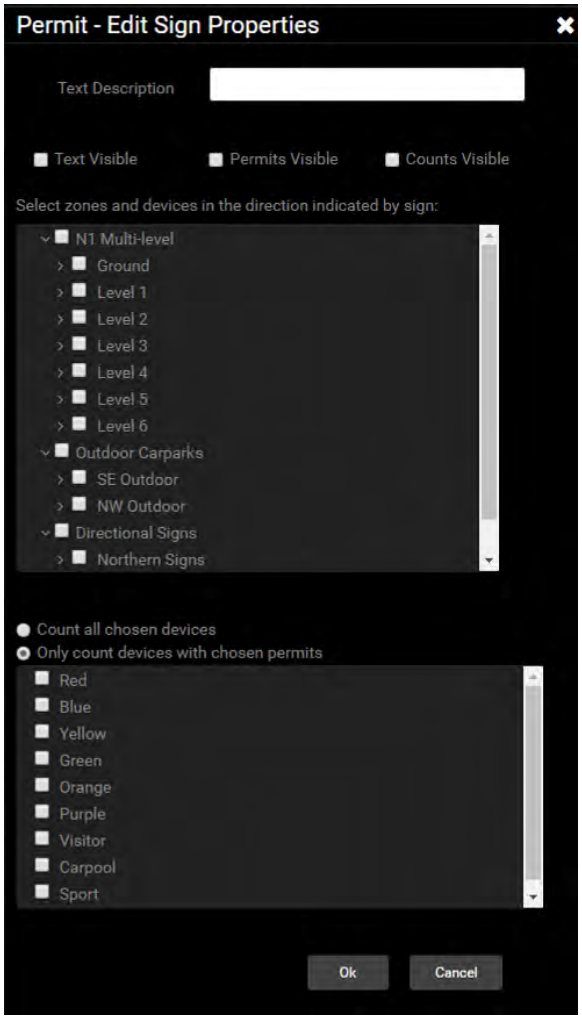


Figure 108: The Edit Sign Properties window.

Below is an example of a setup and what it will display.

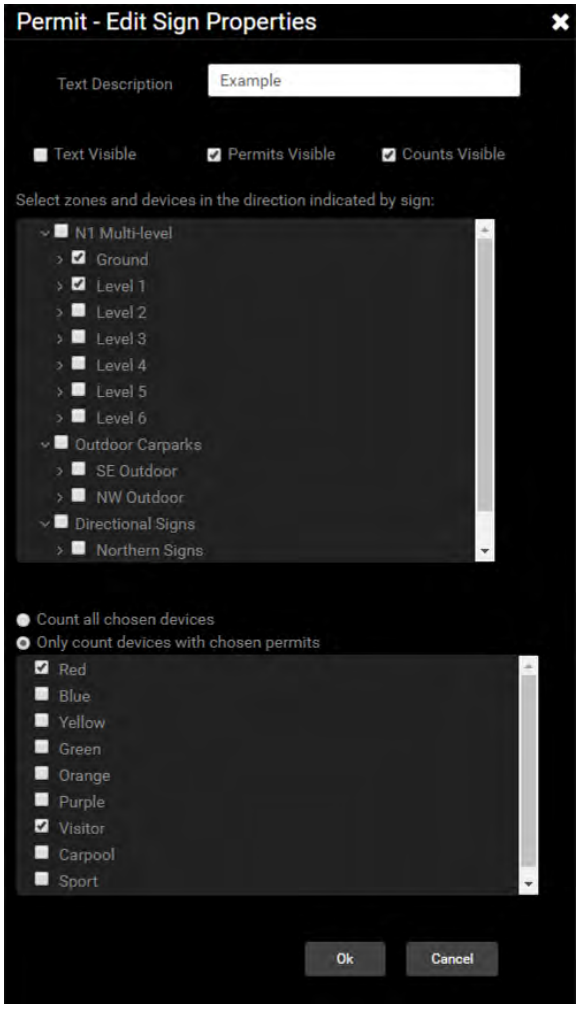


Figure 109: Example of a sign setup.

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.

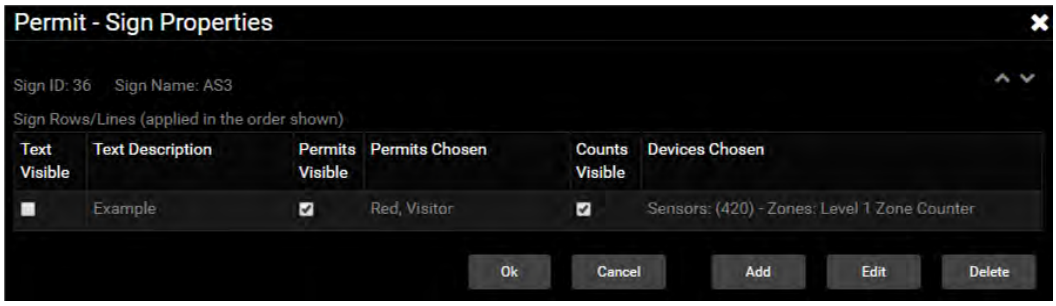


Figure 110: The sign properties list of configurations.

3.3.1.1. 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.

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.

ULTRASONIC DIRECTIONAL SENSOR (USDS)

Installation Manual

TCS International Inc.
Boston
55 Union Avenue
Sudbury, MA 01776
P. 978-443-2527
F. 978-579-9545

TCS International Inc./
7243375 Canada Inc.
3445 Lake Shore Dr W
Etobicoke, ON M8W 1N2
P. 416-259-4862
F. 416-252-0285

W. www.tcsintl.com
E. Sales@tcsintl.com

Table of Contents

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 several 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, TCS 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

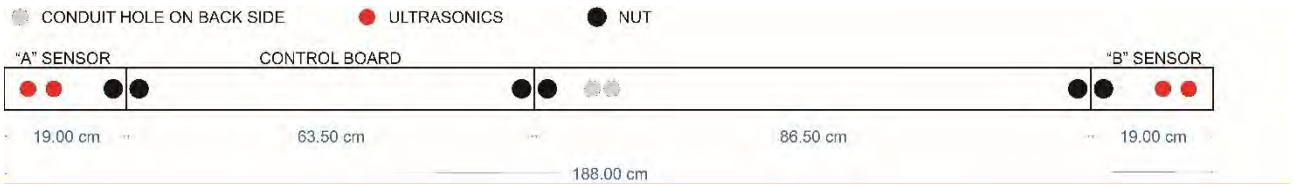


Figure 1: USDS Dimensions

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

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.

Figure 2: USDS tray mounting while working on device

2. The Control Module

Figure 3: USDS 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

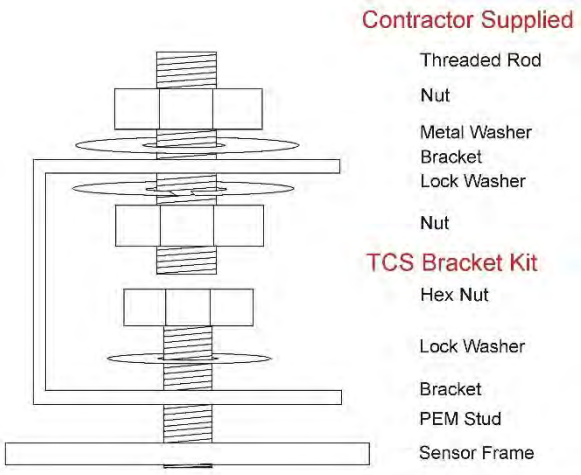


Figure 4: Mounting bracket assembly

NOT using the TCS 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 must 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.

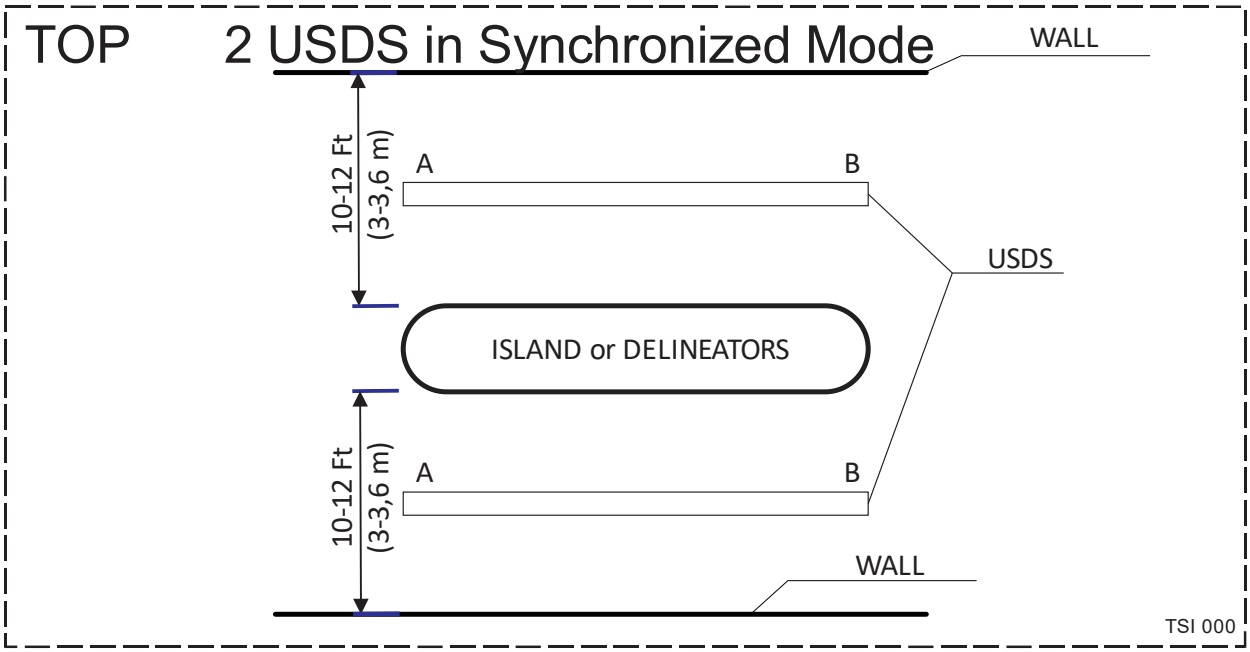


Figure 5: Typical standard USDS installation top view

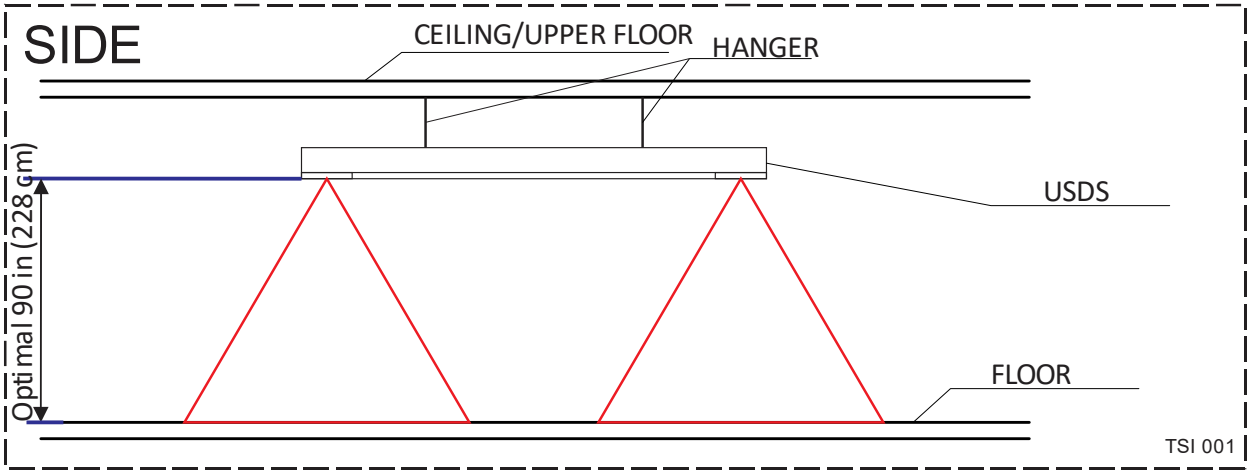


Figure 6: Typical standard USDS installation side view

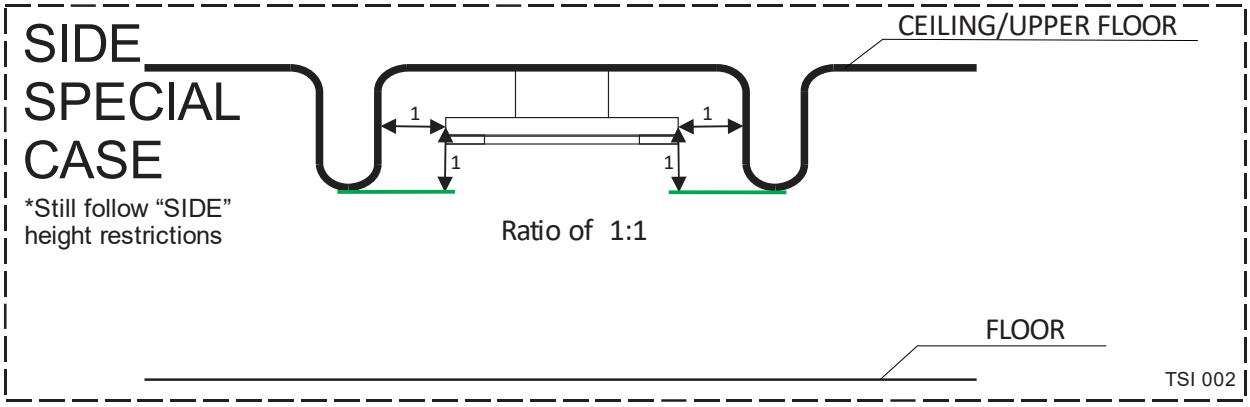


Figure 7: Typical standard USDS installation side view special case

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 TCS 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 must 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)

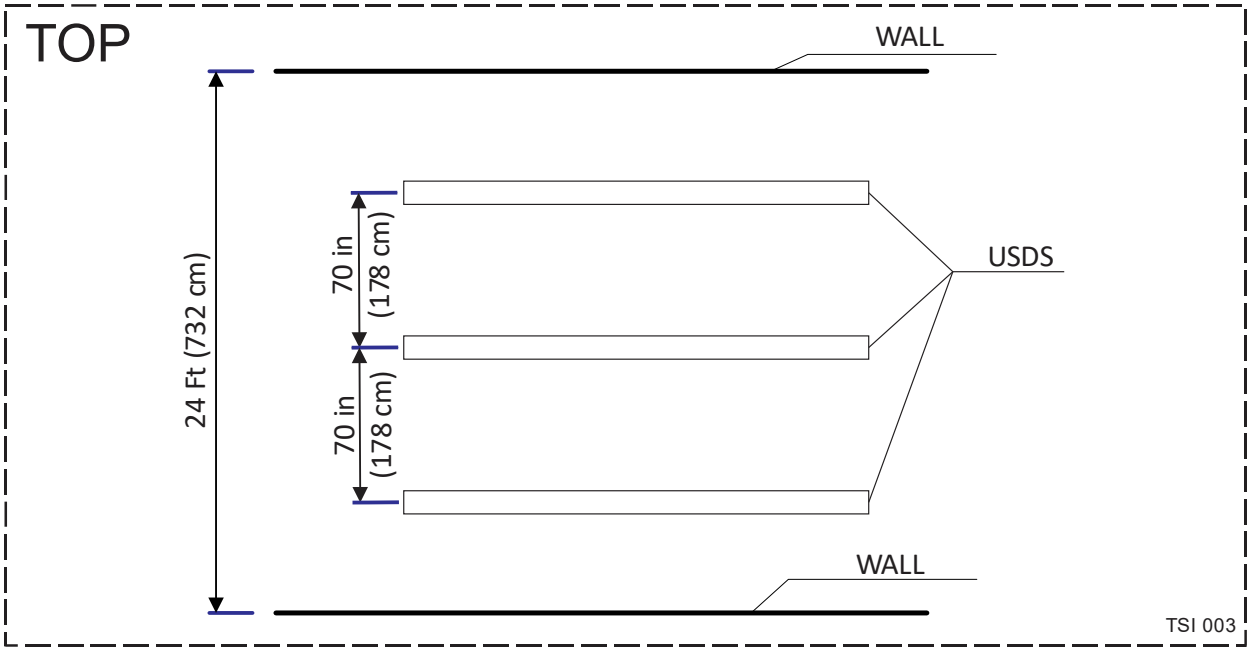


Figure 8: Three USDS in cluster configuration

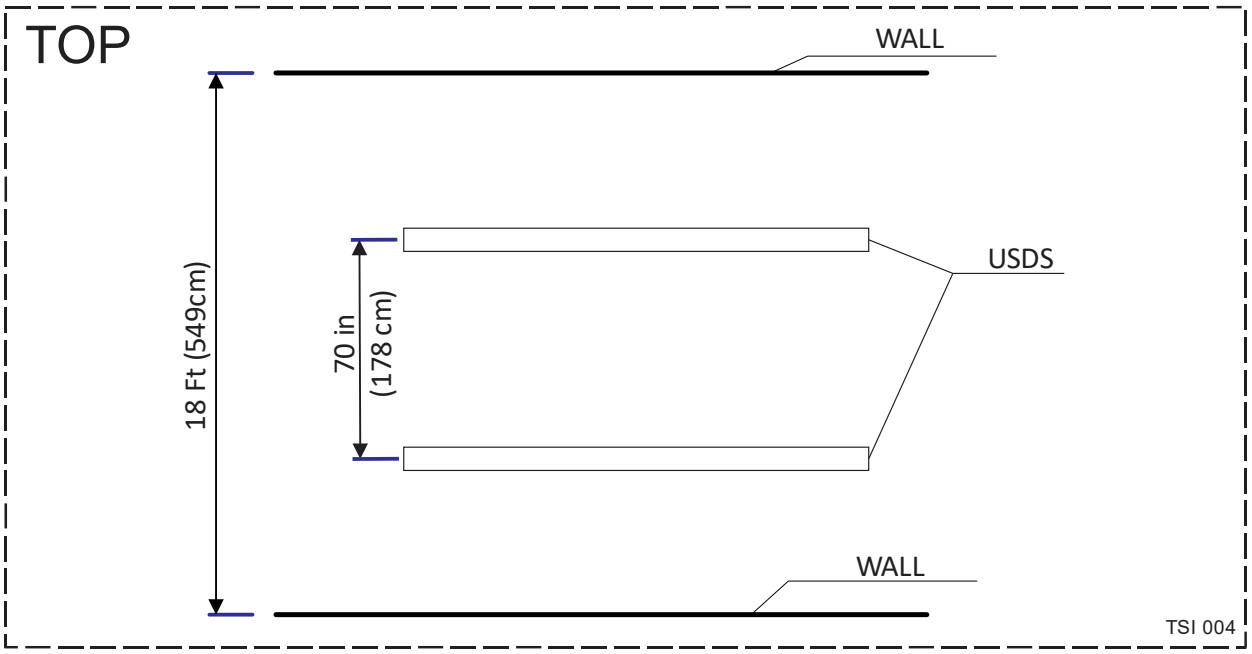


Figure 9: Two USDS in cluster configuration

6. Connections

Connection Requirements:

- Power: Pair of 18 AWG wiring for connection of 24VDC from external source. Typically, from a TCS CP Enclosure.
- If applicable: Pair of 18 AWG wiring for connection of RS-485 communication. Typically, from a TCS 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.

Figure 10: Jumper install location for cluster and synchronized configuration

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.

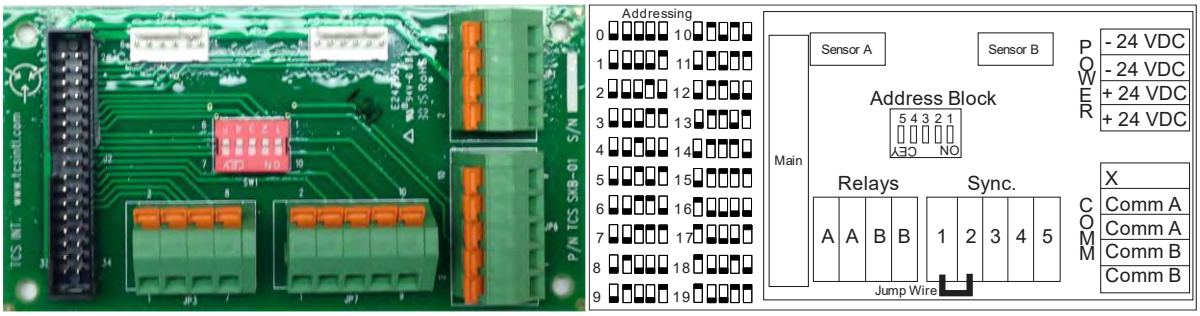


Figure 11: Interface board & sticker

6.1. Standard USDS Wiring Diagram

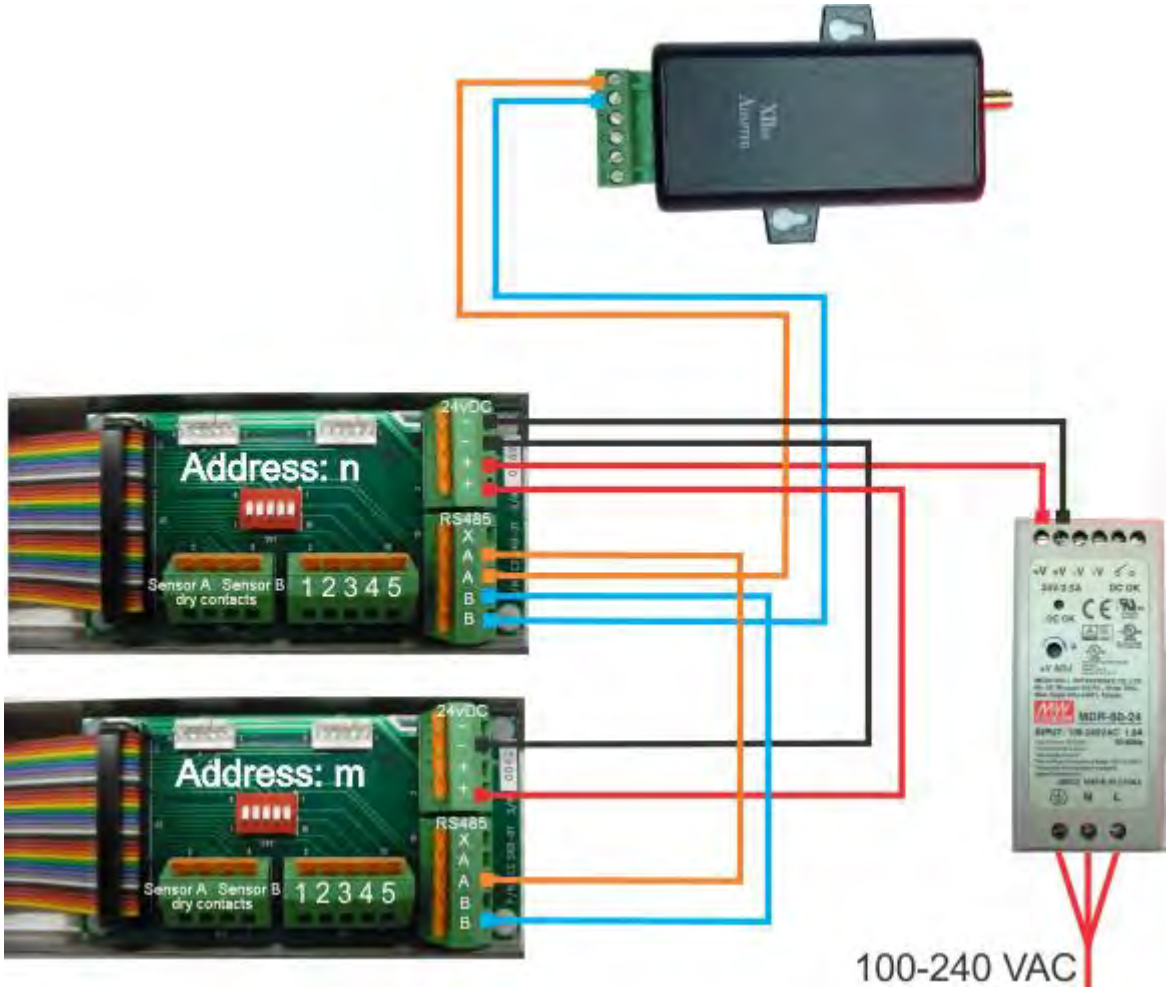


Figure 12: Standard configuration USDS wiring

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.

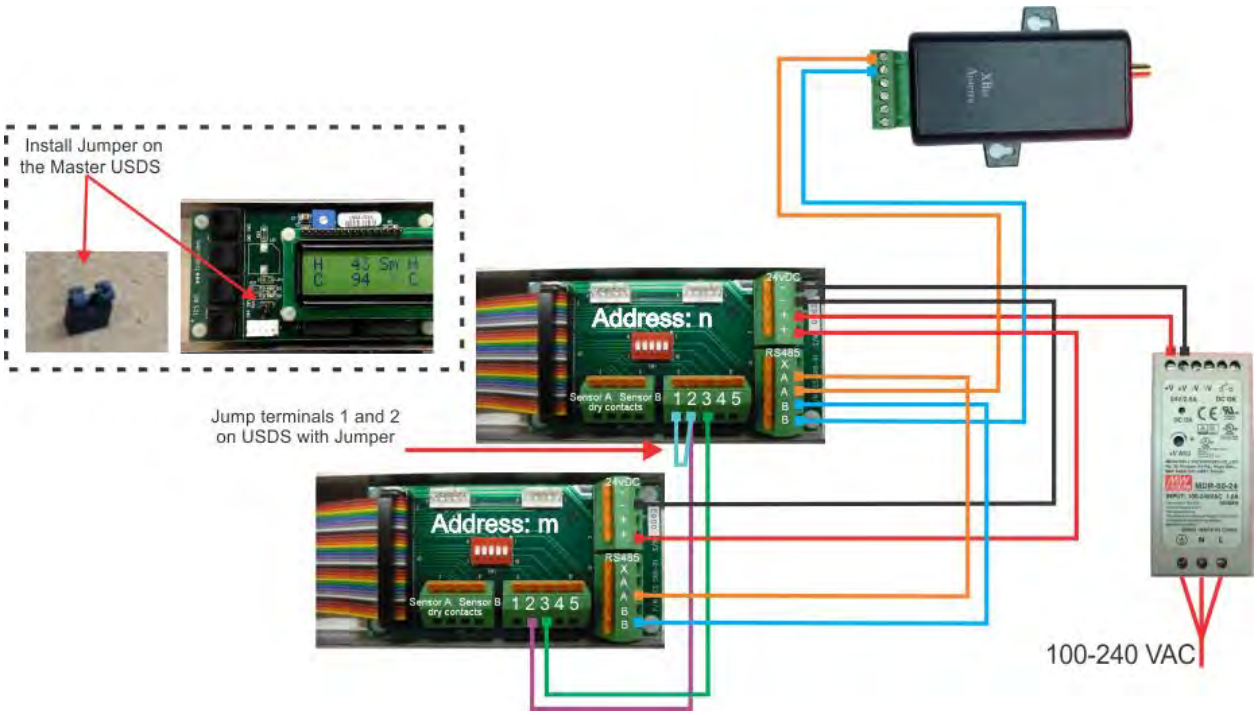


Figure 13: Standard Synchronization configuration USDS wiring

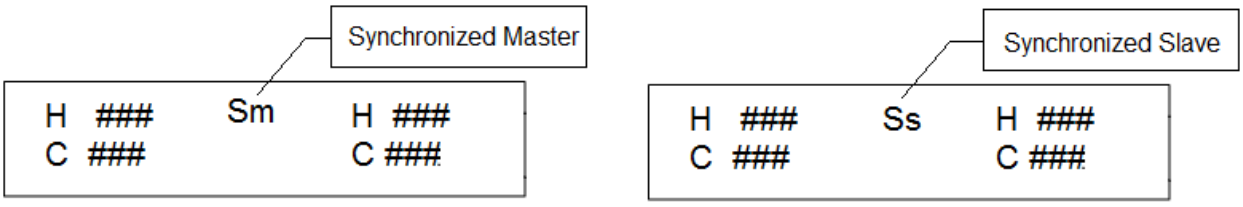


Figure 14: Screen readout when setup for synchronized configuration

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.

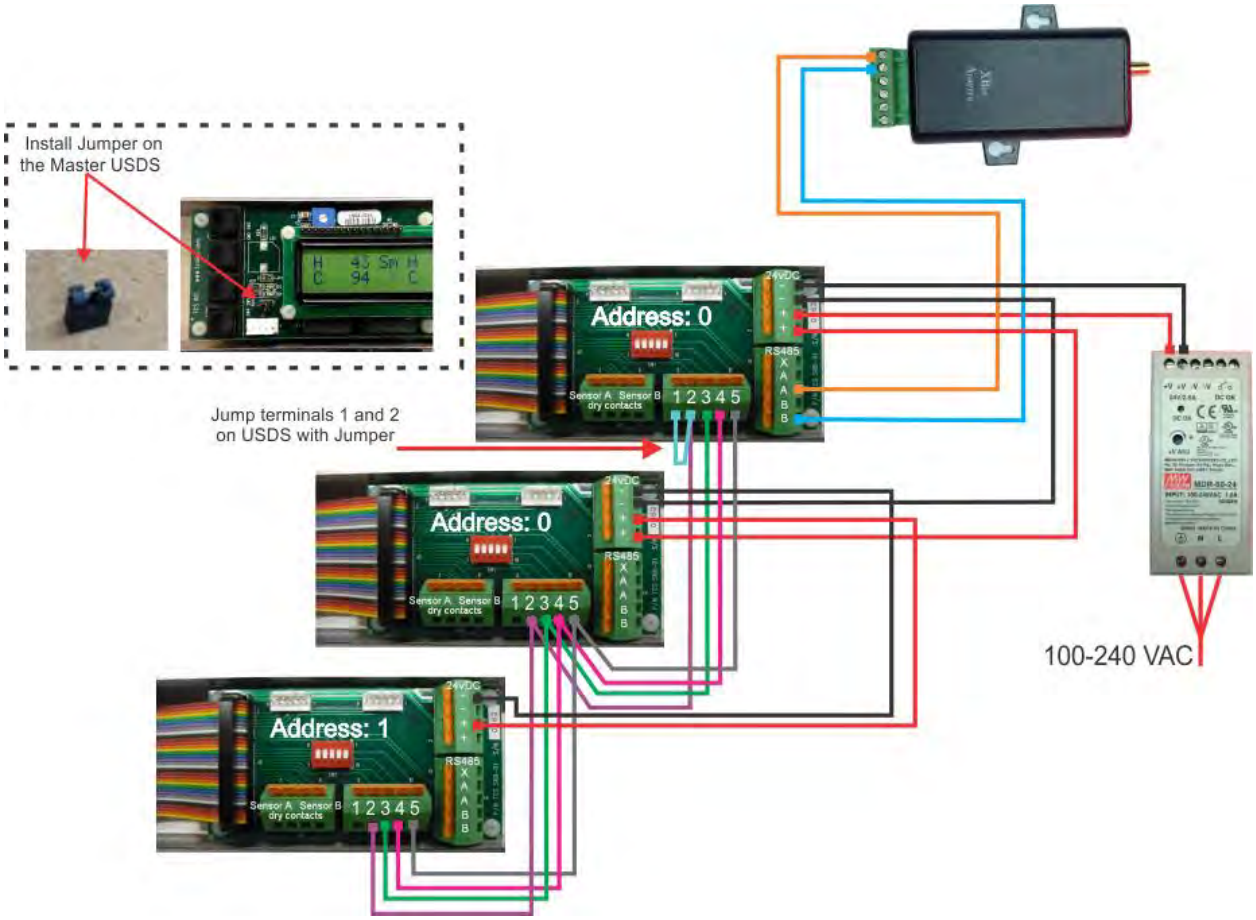


Figure 15: Three USDS cluster configuration USDS wiring

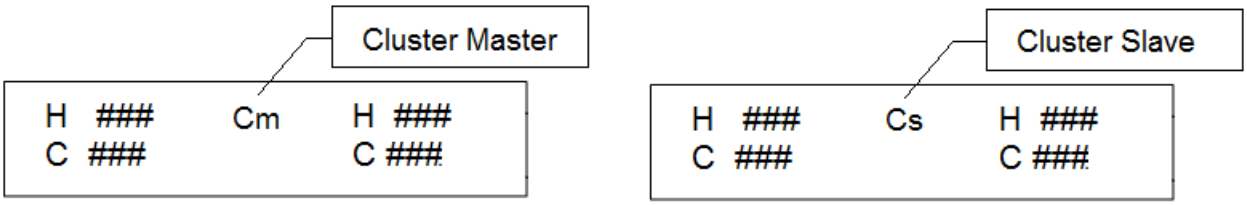


Figure 16: Screen readout when setup for cluster configuration

7. Assembly

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

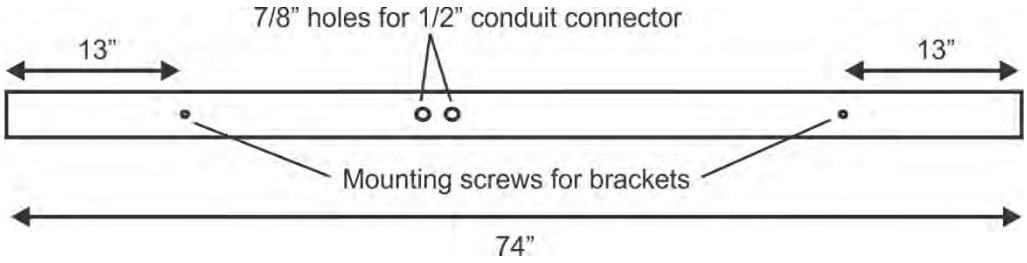


Figure 17: Mounting adaptations

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.**

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

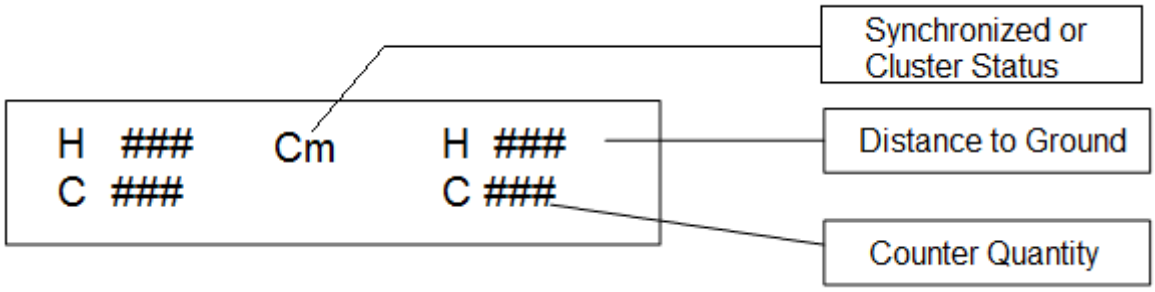


Figure 18: Screen reading definitions

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.

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.

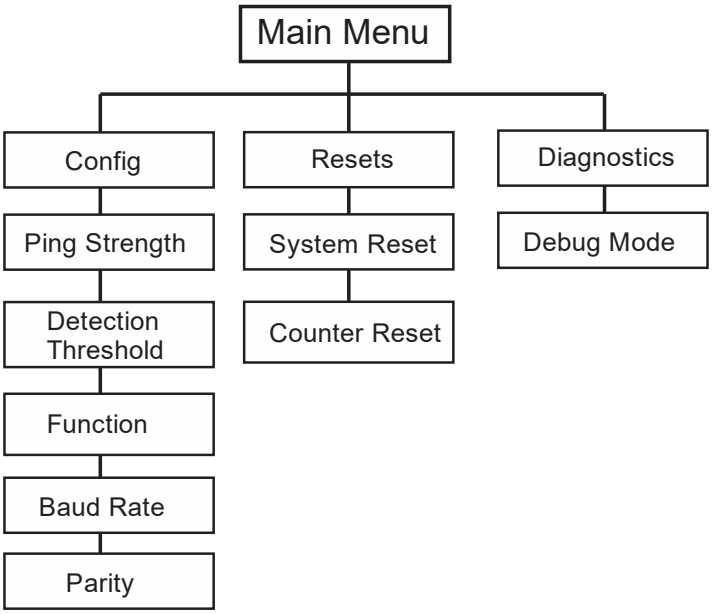


Figure 19: Menu tree

9.1. Menu: Config

9.1.1. 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).

9.1.2. 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.

9.1.3. Function

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

9.1.3.1. 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.

9.1.3.2. Single

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

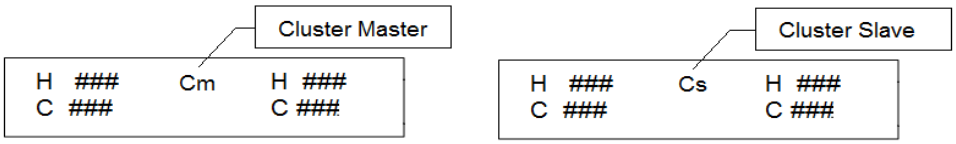


Figure 20: Example of cluster control board screens

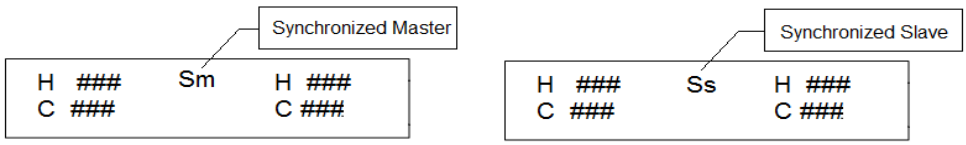


Figure 21: Example of synchronized control board screens

9.1.4. Baud Rate

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

9.1.5. Parity

The default setting of “even” is not to be changed unless noted otherwise by TCS representative.

9.2. Menu: Resets

9.2.1. System Reset

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

9.2.2. Counter Reset

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

9.3. Menu: Diagnostics

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

- Debug Mode

9.4. 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**

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.)

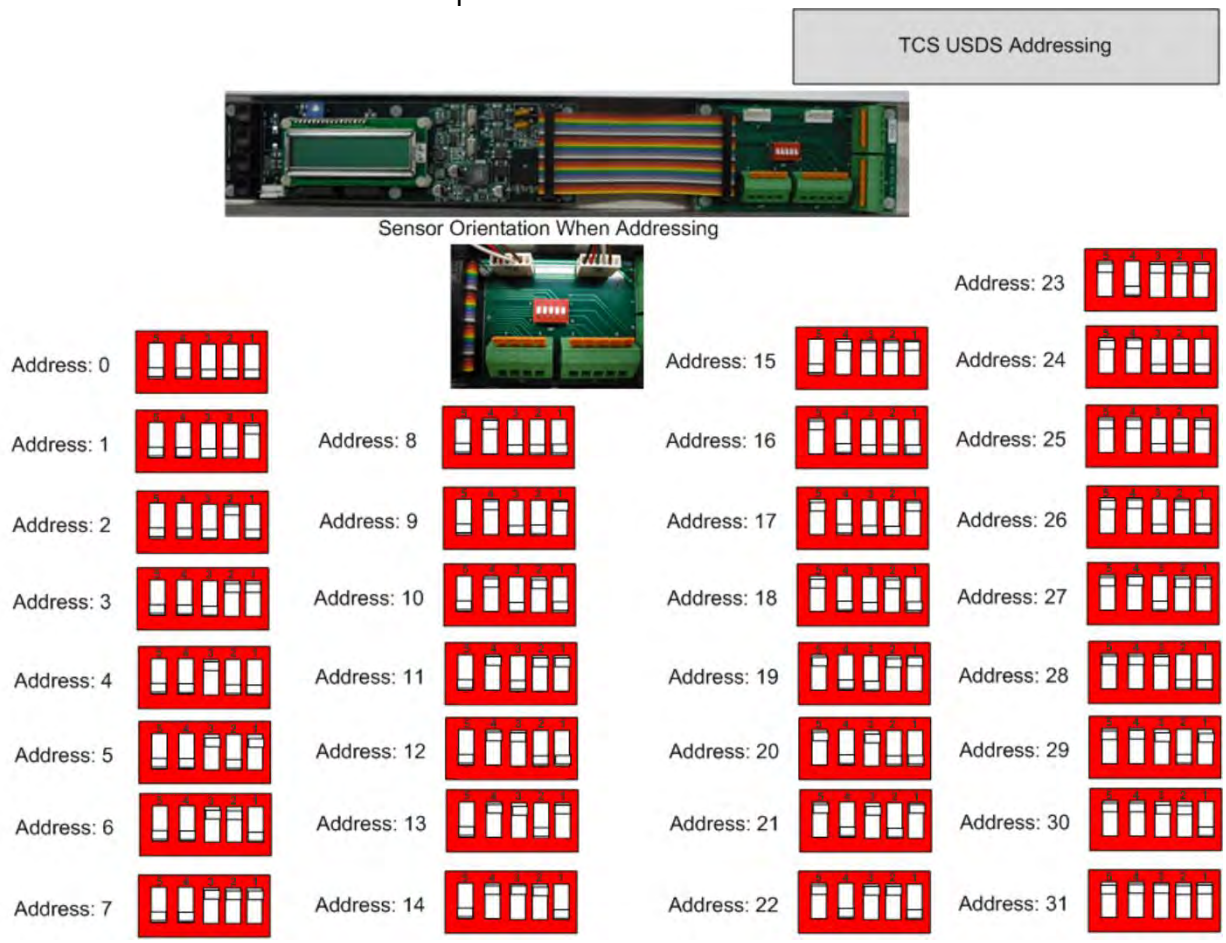
- The sensor is in an unfavorable position (e.g., not parallel to the lane's surface, too close to the walls, too close to other devices causing interference).
- Sensor cable is loose or is not plugged in. Check cable and connector connections.

The exact cause will be displayed:

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

10. 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.



ZONE CONTROLLER & SINGLE SPACE SENSOR

Installation Manual

Zone Controller: TZC-100
Single Space Sensor: TUS-300

TCS International Inc.
Boston
55 Union Avenue
Sudbury, MA 01776
P. 978-443-2527
F. 978-579-9545

TCS International Inc./
7243375 Canada Inc.
3445 Lake Shore Dr W
Etobicoke, ON M8W 1N2
P. 416-259-4862
F. 416-252-0285

W. www.tcsintl.com
E. Sales@tcsintl.com

TCS International

Table of Contents

SENSORS

1.1. Function

1. Single Space Sensors utilize ultrasonic to detect a vehicle's presence within an individual parking space. They are suspended from the ceiling at the end of the stall. 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 RGB LEDs that act as visual indicators for would-be parkers; typically, green indicates unoccupied, and red indicates occupied. Occupancy data is consistently sent to a zone controller which relays the information to the parking guidance software.

1.1 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.

1.2 Mechanical and Electrical Specifications

- Dimensions: 7” x 5.25” x 3.5” (177mm x 133mm x 89mm)
- Operating temperature: -4 to 158 °F (-20 to 70 °C)
- Power: 48VDC
- Power consumption: maximum 53 mA per Sensor
- LED Brightness:
    - Green: 11,800 mcd
    - Red: 5,508 mcd
    - Blue: 1,488 mcd
- Communication interface: serial RS485

Recommended Cable Type:

4 wire cable with a diameter of 18 AWG (2 wires for RS485 & 2 wires for 48VDC). The metric equivalent is a diameter of 1.02mm and cross sectional area of 0.823mm^2. The entire cable diameter should be with 0.197” to 0.276” (5.003mm to 7.010mm).

1.3 Sensor Information

1.3.1 Base Dimensions Diagram

Figure 1: Sensor Base Dimension

1.3.2 *Opening the Sensor*

The two-piece plastic sensor housing is held together by an internal locking mechanism. Don't apply pressure to the metal transducer on the front of the sensor as it may cause damage. To open it, follow this procedure:

1) Locate the locking tab just above the detection cone.

Figure 2: TUS-300 Locking Tab

2) Using a small flathead screwdriver or similar tool, press the locking tab inwards.

Figure 3: TUS-300 Locking Tab Movement

3) While applying pressure to the locking tab, twist both halves of the sensor housing in opposite directions to separate.

Figure 4: Opening TUS-300

1.4 Sensor Mounting Instructions

1.4.1 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 must be considered to determine the right mounting position free of obstructions.

The sensor mounting height must be in the range of **7.5 to 9 Ft (228cm to 274cm).**

The sensor should be mounted near the drive aisle between **18 feet (5.5m) to 21 feet (6.4m)** from the back of the parking stall.

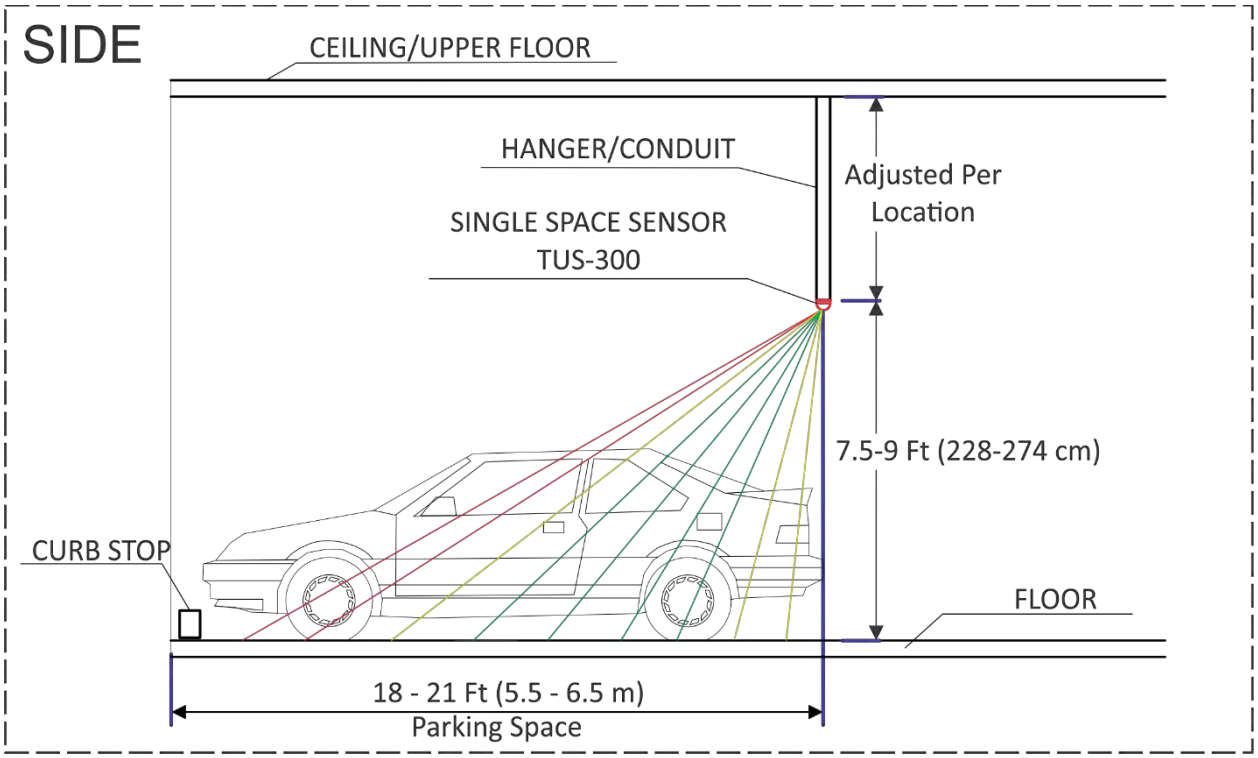


Figure 5: TUS-300 Single Space Sensor Side View

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.

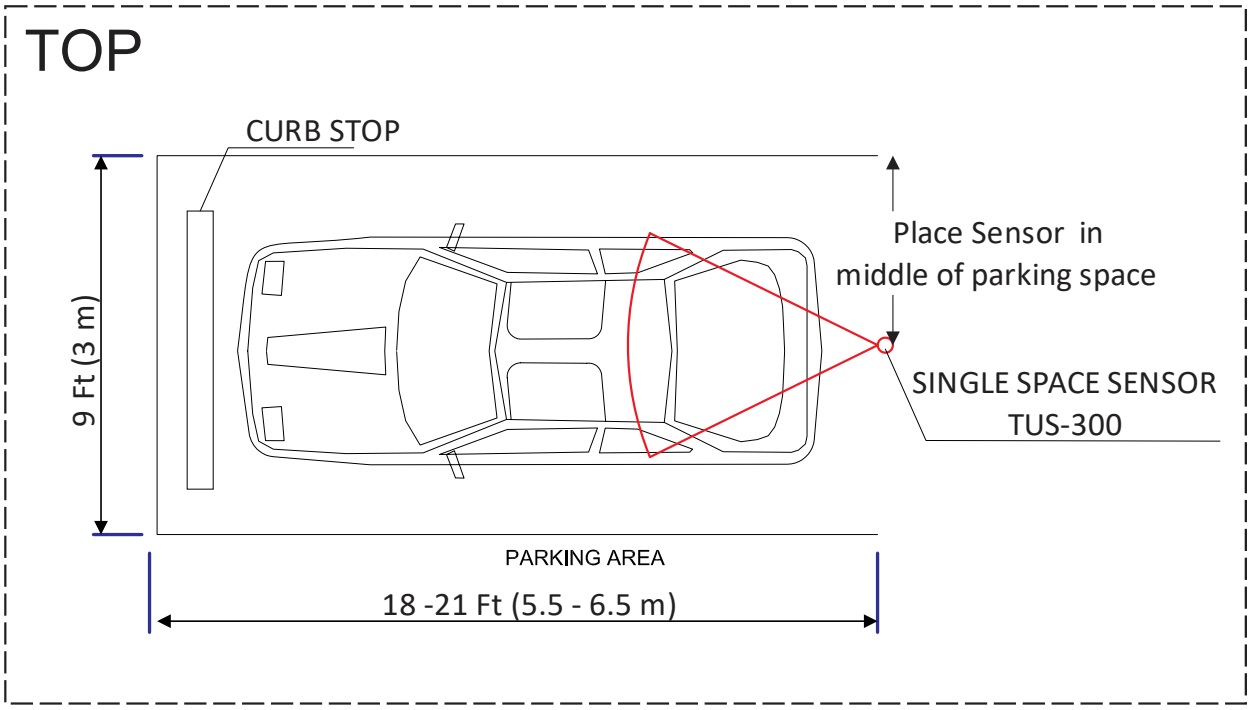


Figure 6: TUS-300 Single Space Sensor Top View

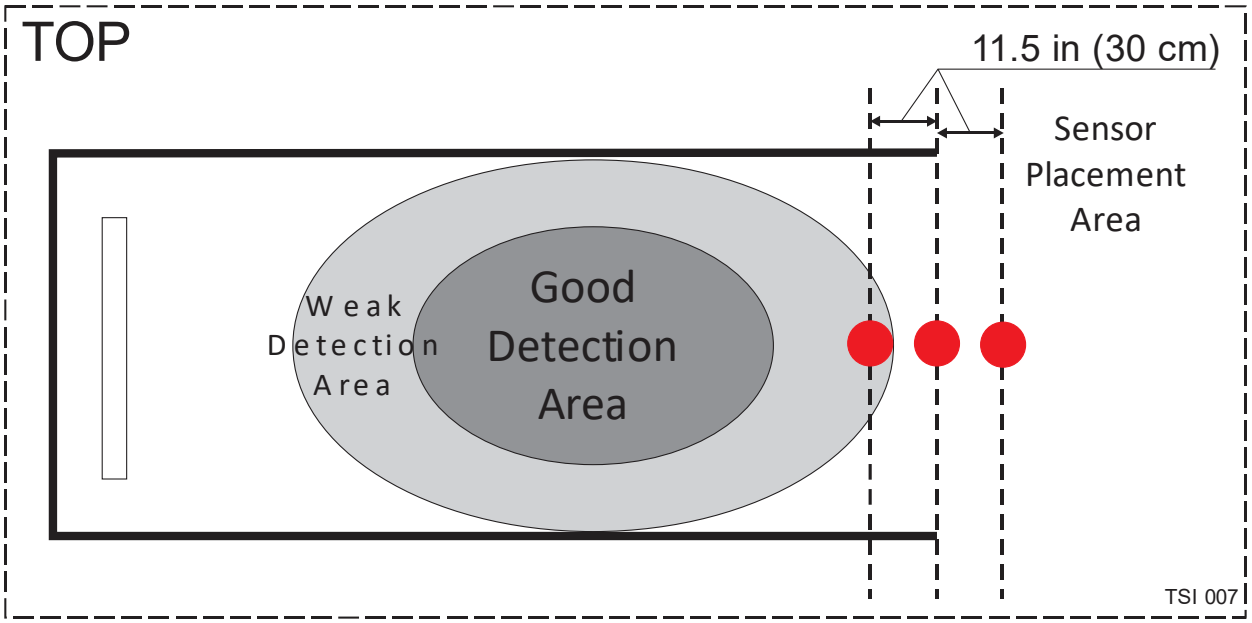


Figure 7: TUS-300 Mounting Variance/Detection Area

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.

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)

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 1:4.

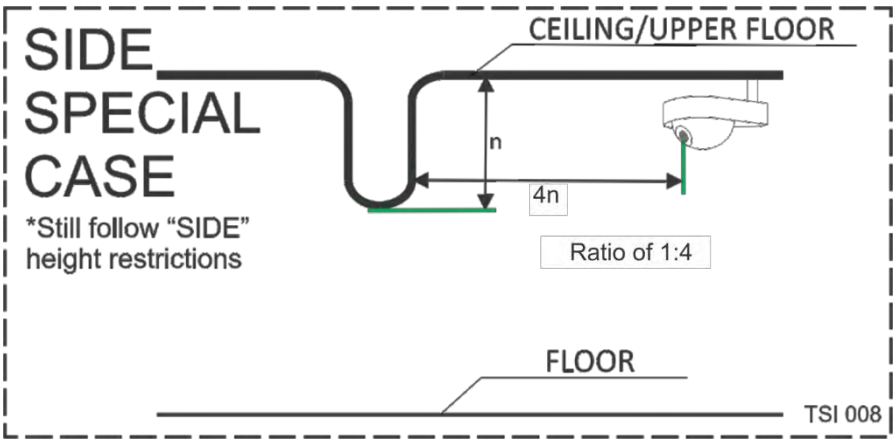


Figure 9: Special case for Sensor mounting

1.4.2 Mounting Direction

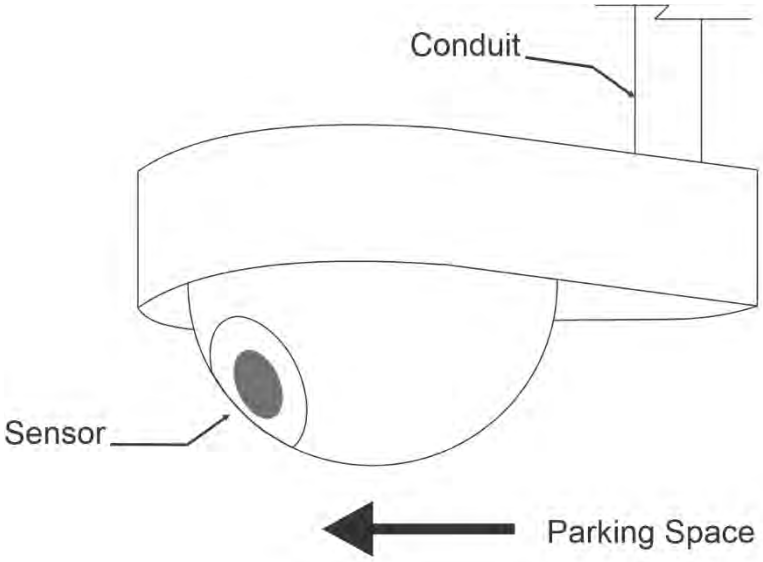


Figure 10: TUS-300 mounting direction

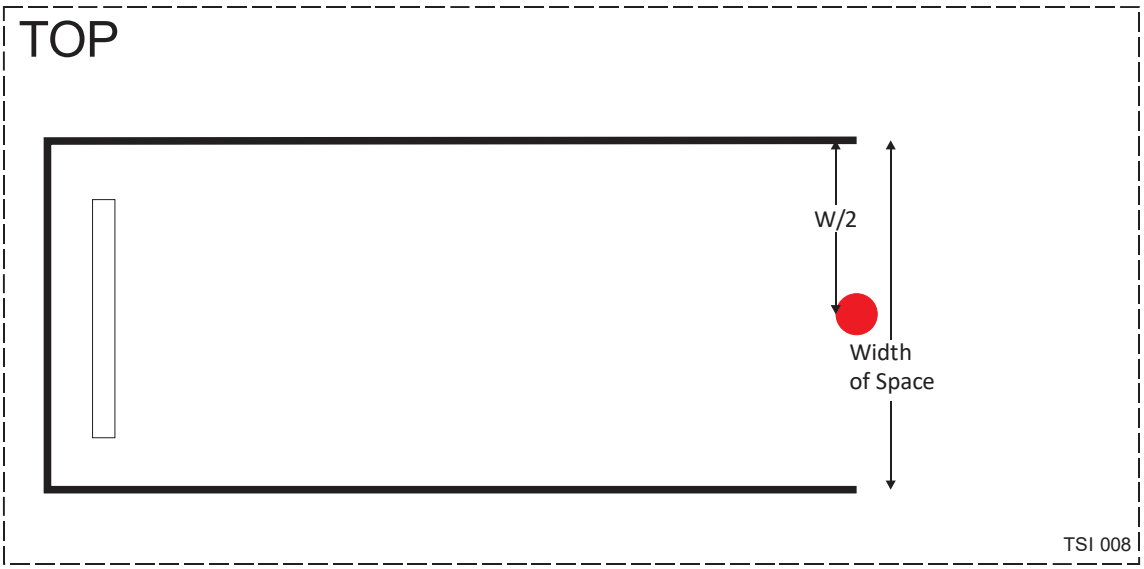


Figure 11: TUS-300 Mounting

1.4.3 Mounting Methods

1.4.3.1 Conduit Mounting

The TUS-300 is designed to mount to a piece of conduit, uni-strut, or customer tray fixed with a ½" **EMT** connector as shown below. Watertight connections are not required.

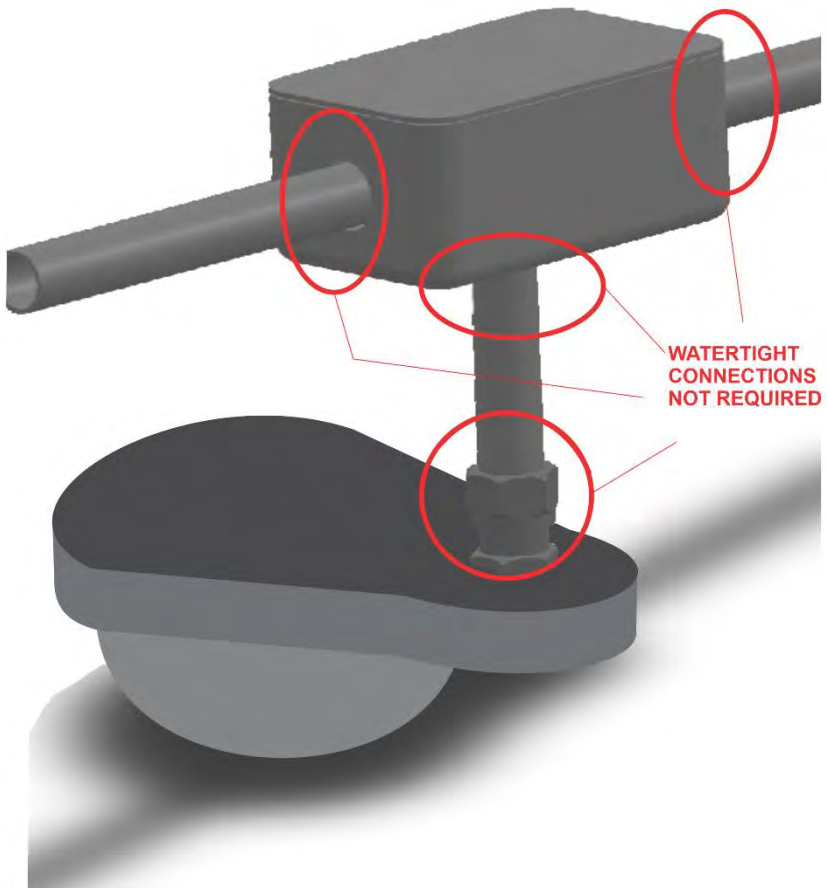


Figure 12: Mounting Selection

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

The TUS-300 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 should have a top installed that will hide all cabling. A ½" EMT connector is required to mount the sensor. The connection does not need to be watertight but should be secure.

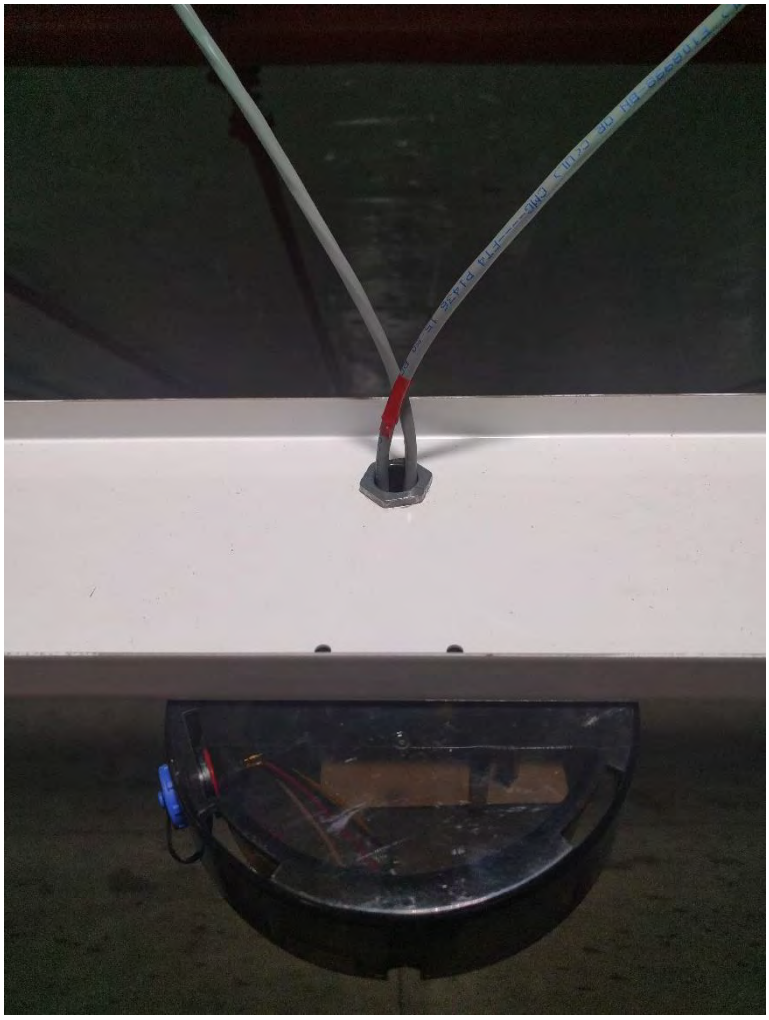


Figure 13: Uni-Strut/Rail mounting coupling installation

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 13. Then with a new length of two pair 18 AWG cable, run the cable from inside the sensor back into the rail tray down to the next sensor and repeat this in a daisy chain fashion.

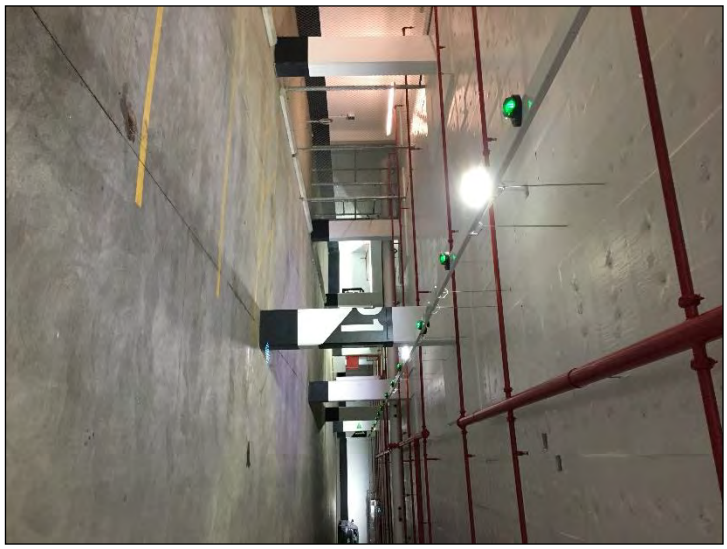


Figure 14: TUS-300 Uni-Strut/Rail mounting

Figure 15: TUS-300 Uni-Strut/Rail mounting

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.

1.5 IP65 Watertight Design

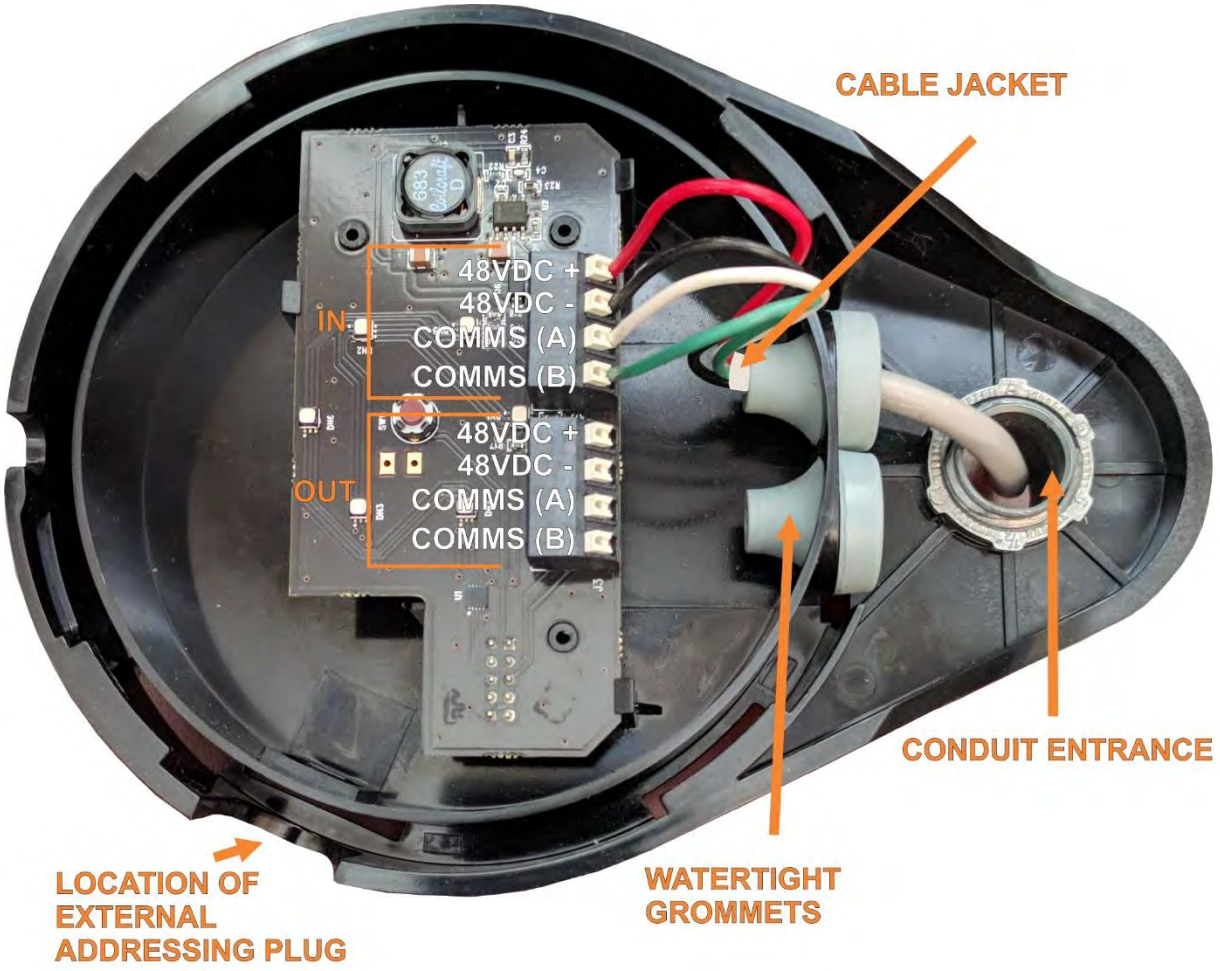


Figure 16: Inside a TUS-300

The TUS-300 design provides an IP65 protection rating for the electronics within. This is achieved by passing the cabling through watertight grommets before entering the main housing area. The cable jacket should be intact throughout the entirety of the watertight grommet to remain its IP65 rating. The cabling shouldn't be stripped until after it's passed through the grommets. Once the cabling is pulled through the watertight grommets the cable jacket can be cut back and individual wires stripped.

1.6 Wiring Terminations

Follow the diagram below for correct wiring:

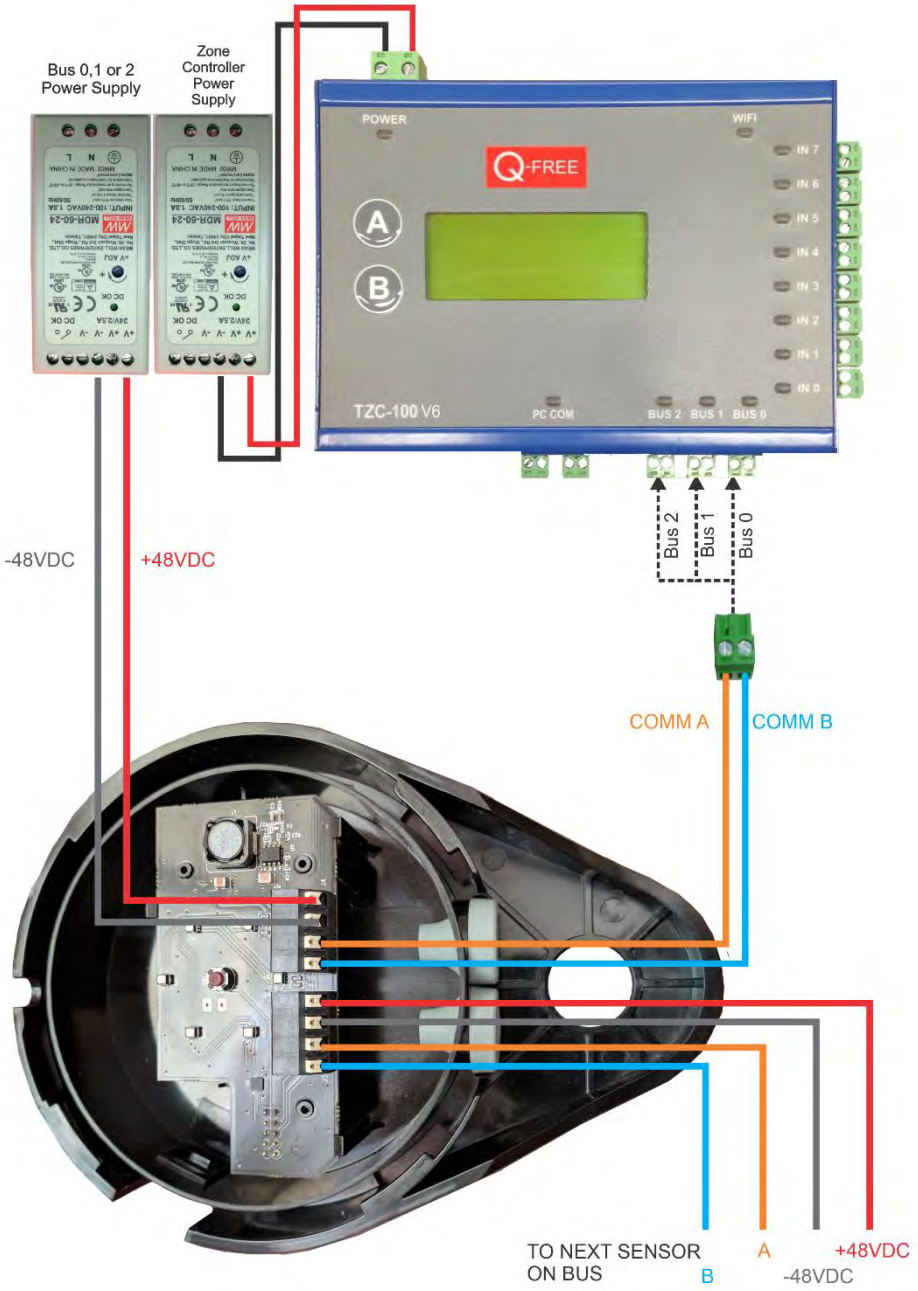


Figure 17: Wiring Terminations

1.7 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. The address is set using a Handheld Programming unit or the push button located inside the sensor. The address for each sensor is required to correspond with the layout drawings for the specific project.

Figure 18: Addressing Option 1

Figure 19: Addressing Option 2

1.7.1 Option 1: Handheld Programmer

Sensors do not require power for the Handheld Programmer to apply an address. This gives the installer flexibility as they can be addressed before, during, or post installation. Ensure the programmer has the 9V battery installed and the addressing cable is connected. See figure 20 below for the button functions:

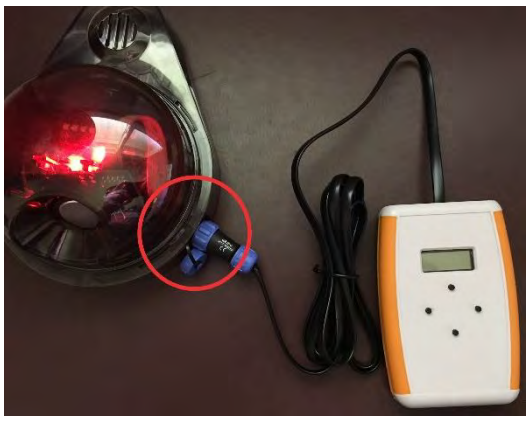


Figure 21: Addressing Plug

Figure 20: Addressing Option 2

Reading Address: Plug the Handheld Programmer into the address plug on the exterior of the sensor. Click the “Read Address” button on the left hand side of the programmer. The display with show “RDG” for a moment then the address will appear. Note, all sensors are default address 00 out of the box.

Writing Address: With the Programmer plugged into the sensor, cycle through the desired address using the “Increase Address” and Decrease Address” buttons. To apply the address, press the “Program Address” button on the right. The display will show “PRG” for a moment then display the programmed address. Note * Wait for programmer to display programmed address before unplugging from sensor or address will not hold.

Sleep Mode: The handheld programmer automatically enters sleep mode after 20 seconds of inactivity. To awake from sleep mode press the “Read Address” button on the left hand side.

1.7.2 Option 2: Addressing Button

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.

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:

2.

- 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.

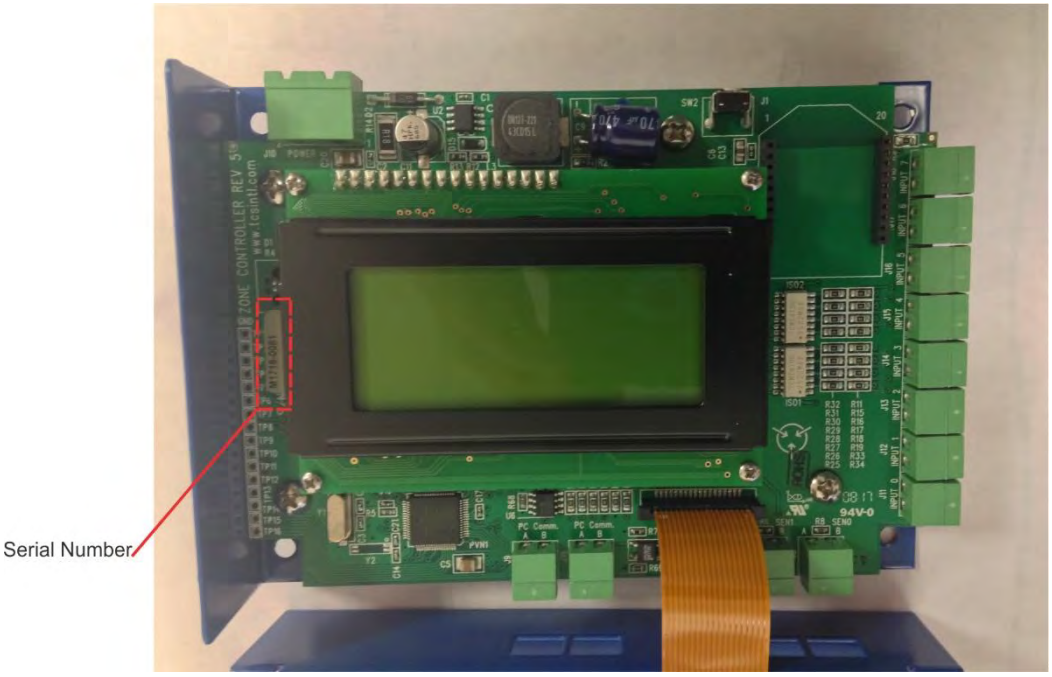


Figure 22: Zone Controller Board

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 650 feet or 200 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.

2.1. Zone Controller Operating

2.6.2 Zone Controller Component Descriptions

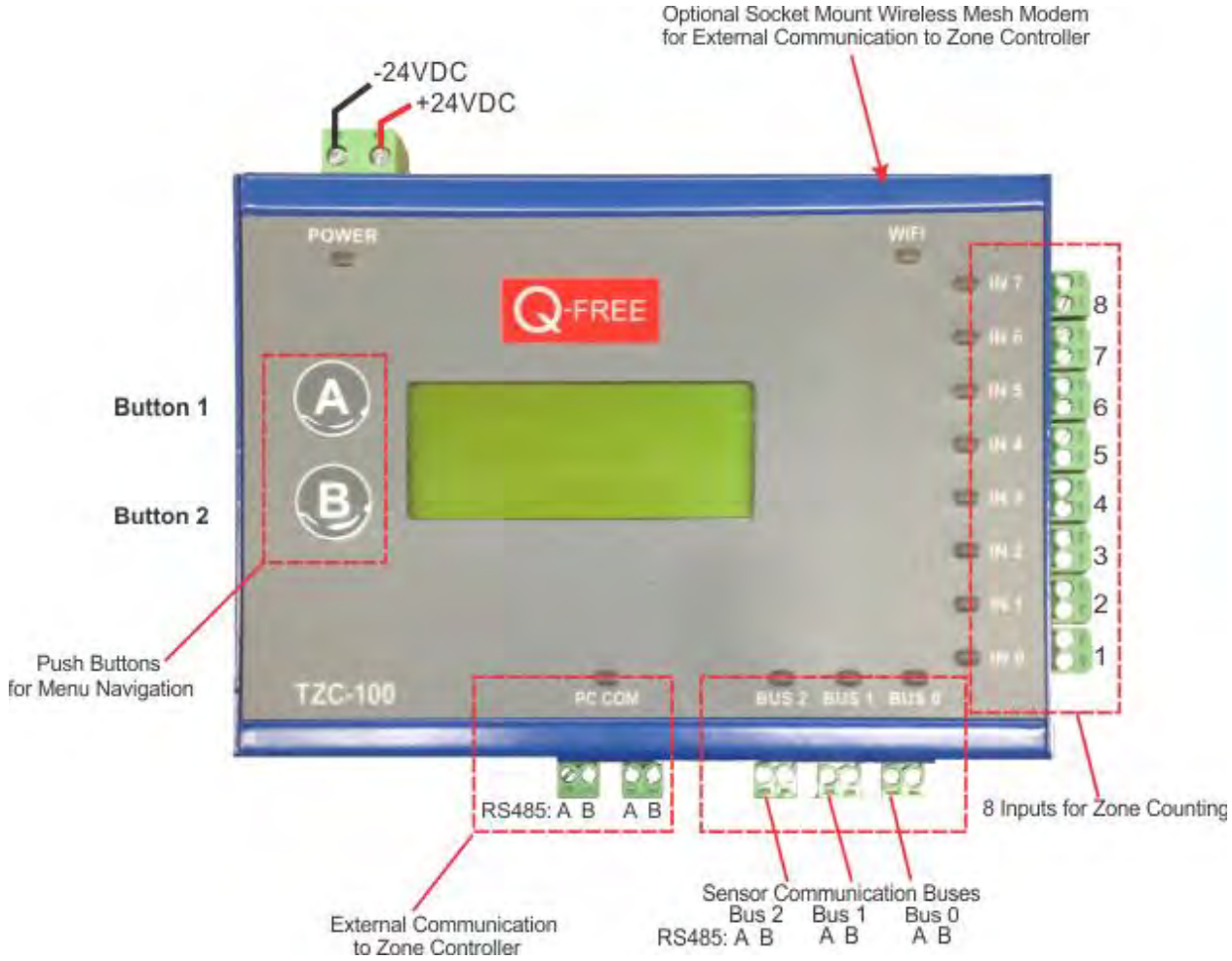


Figure 23: Zone Controller component description

2.6.3 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

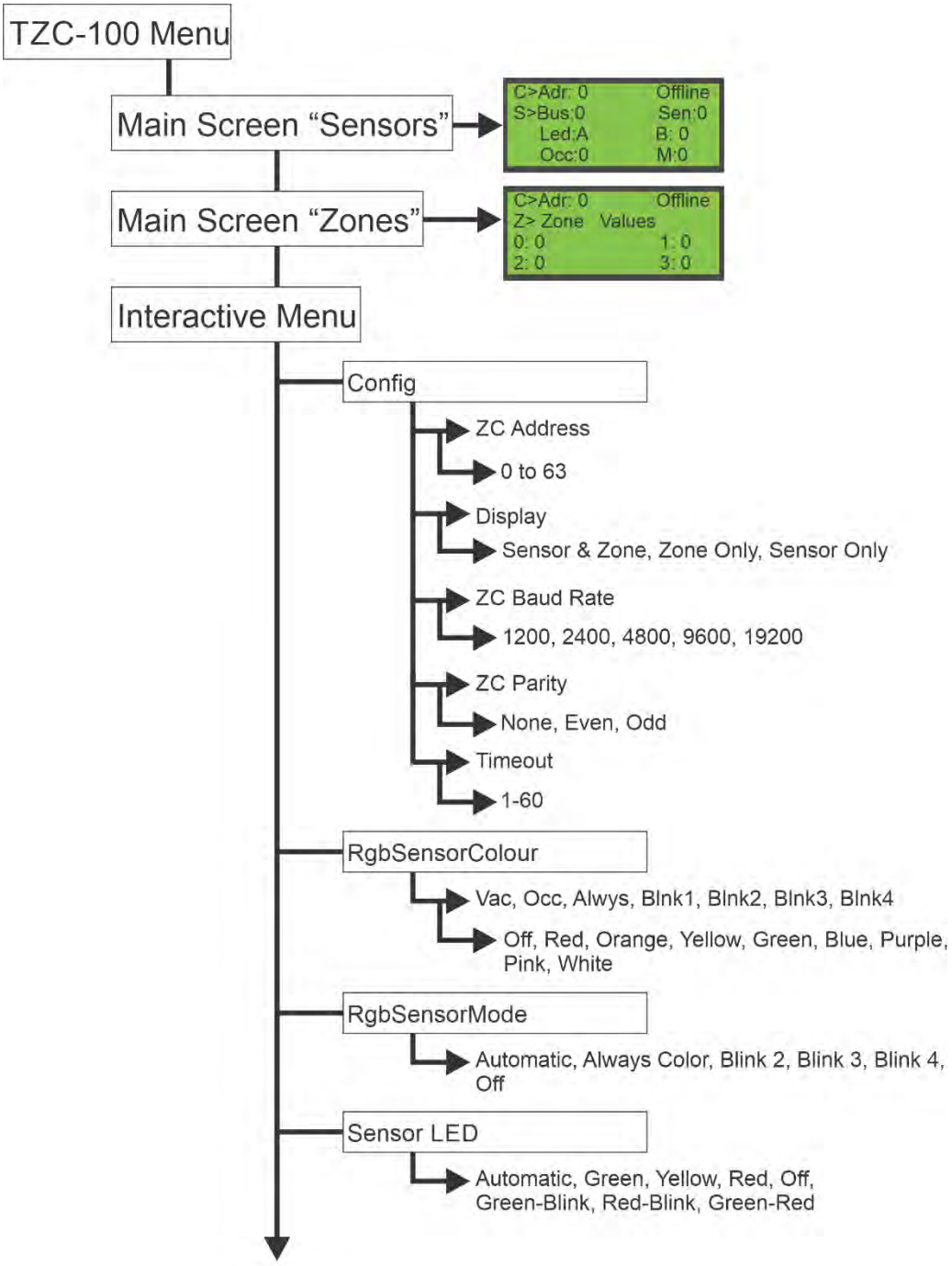
Button B:

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

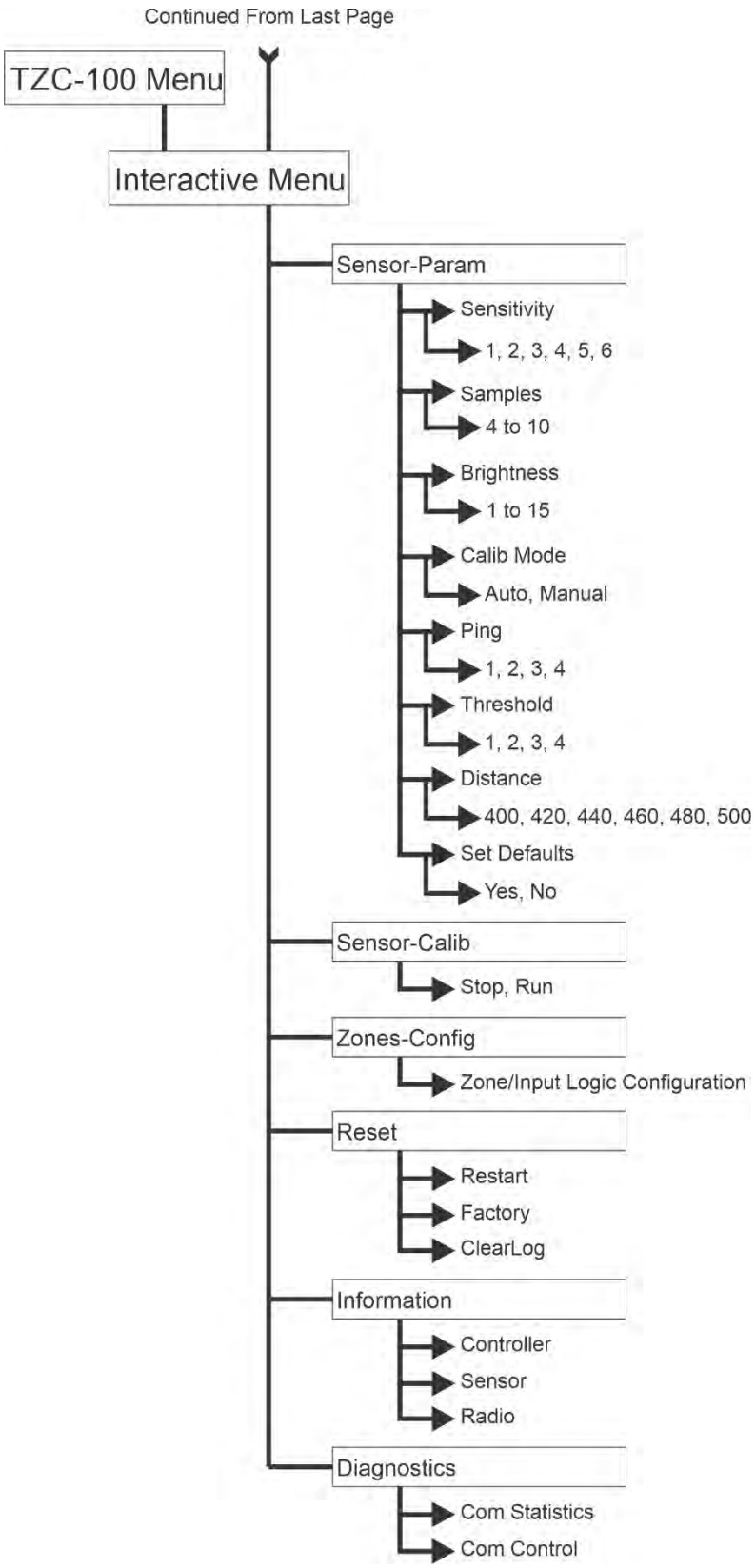
Pushing Button A and Button B together:

Switches between Main Screens and Interactive Menu

2.7 Menu Tree



Continues Next Page


Continued From Last Page
TZC-100 Menu
Interactive Menu
Sensor-Param
Sensitivity
1, 2, 3, 4, 5, 6
Samples
4 to 10
Brightness
1 to 15
Calib Mode
Auto, Manual
Ping
1, 2, 3, 4
Threshold
1, 2, 3, 4
Distance
400, 420, 440, 460, 480, 500
Set Defaults
Yes, No
Sensor-Calib
Stop, Run
Zones-Config
Zone/Input Logic Configuration
Reset
Restart
Factory
ClearLog
Information
Controller
Sensor
Radio
Diagnostics
Com Statistics
Com Control

2.8 *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.

2.8.1 Main Screen Sensors

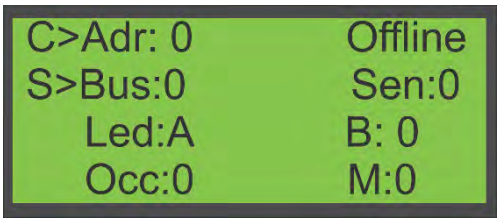


Figure 24: Main screen sensors

- 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.

2.8.2 Main Screen Zones

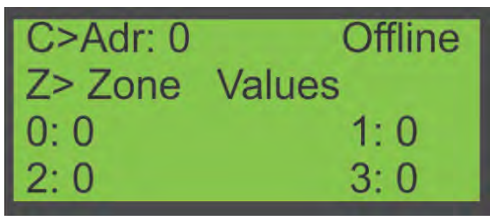


Figure 25: Main screen zones

- 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.

2.8.3 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.*

2.8.3.1 Menu: Config

ZC Address

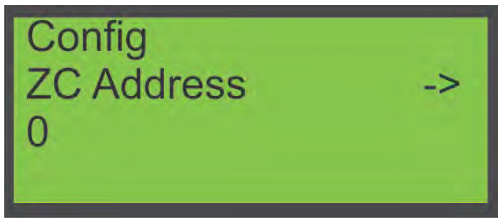


Figure 26: Config-ZC Address menu

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 TCS. 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 27: 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

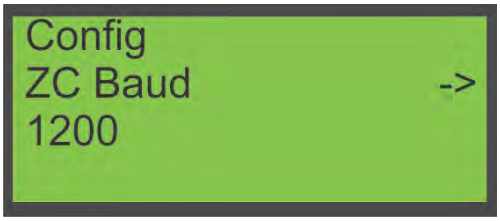


Figure 28: Config-ZC Baud Rate menu

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 TCS. Adjusting the baud rate can result in communication loss.

ZC Parity

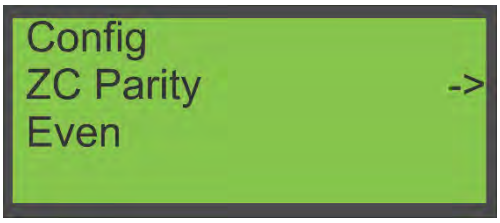


Figure 29: Config-ZC Parity menu

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 TCS. Adjusting the Parity can result in communication loss.

Config: Timeout

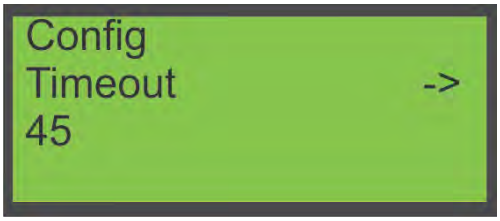


Figure 30: Config-Timeout menu

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

*2.8.3.2 Menu: RgbSensorColor (**TUS-300 ONLY**)*

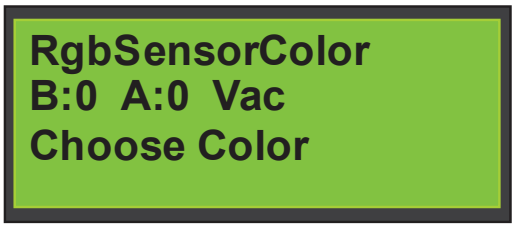


Figure 31: RgbSensorColor

This menu allows the allocation of colors for sensor RBG modes. Cycle through modes where "Vac" is shown above, once the desired mode is selected, pick the desired color where "Choose Color" is shown.

*2.8.3.3 Menu: RgbSensorMode (**TUS-300 ONLY**)*

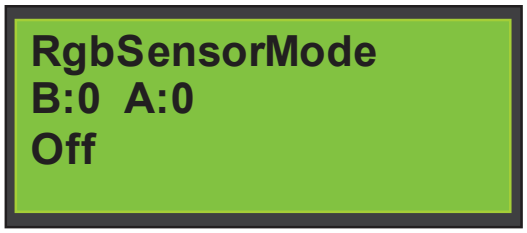


Figure 32: RgbSensorMode

In this menu sensors are forced to go to a desired mode. After selecting the bus and address, cycle through the menu where "Off" is shown above to force sensors into a mode.

*2.8.3.4 Menu: Sensor-LED (**TUS-100 ONLY**)*

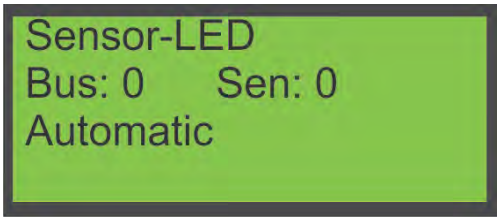


Figure 33: Sensor LED menu

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.

2.8.3.5 Menu: Sensor-Param

Sensor-Param: Sensitivity

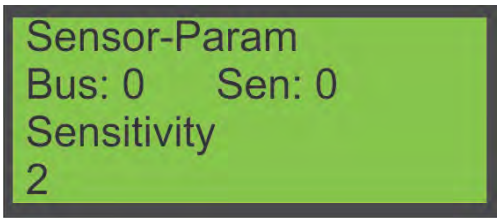


Figure 34: Sensor-Param-Sensitivity menu

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 TCS. Adjusting the sensitivity can result in decreased accuracy.

Sensor-Param: Samples

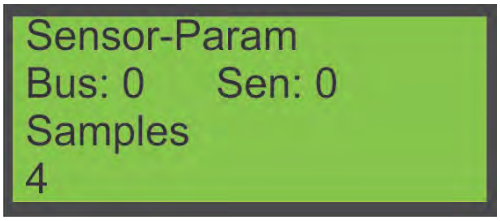


Figure 35: Sensor-Param-Samles menu

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

Sensor-Param: Brightness

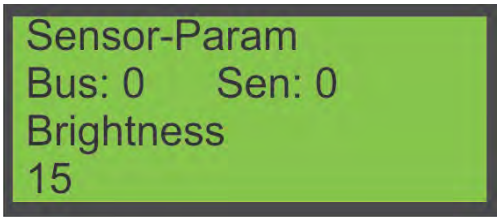


Figure 36: Sensor-Param-Brightness menu

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

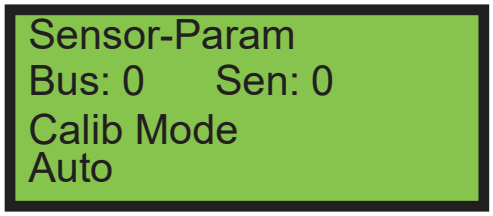


Figure 37: Sensor-Param-Calibration Mode menu

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

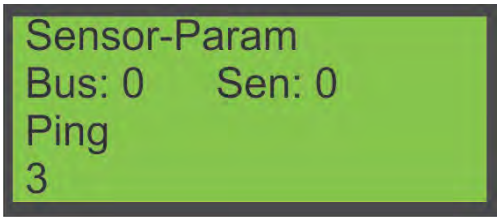


Figure 38; Sensor-Param-Ping menu

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

Sensor-Param: Threshold

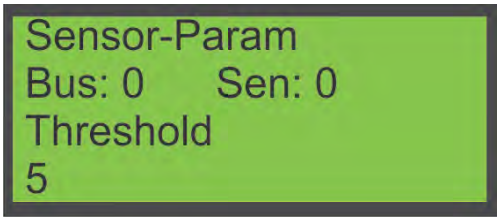


Figure 39: Sensor-Param-Threshold menu

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

Sensor-Param: Distance

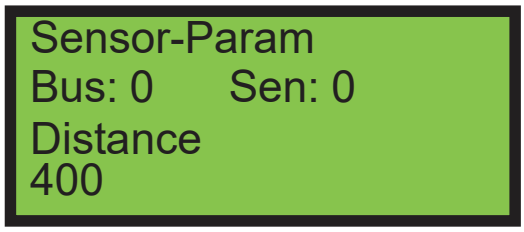


Figure 40: Sensor Param-Distance menu

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

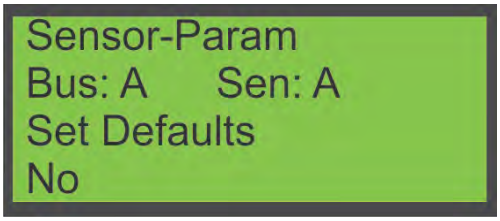


Figure 41: Sensor-Param-Set Defaults menu

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

2.8.3.6 Menu: Sensor-Calib

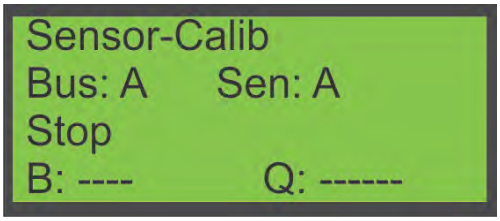


Figure 42: Sensor-Calibration menu

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)

2.8.3.7 Menu: Zones-Config

Figure 43: Zones-Config menu

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

2.8.3.8 Menu: Reset

Figure 44: Sensor Reset menu

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

2.1.1.1. Menu: Information

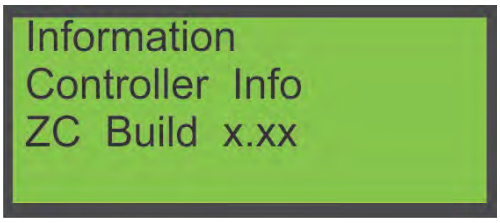


Figure 45: Information menu

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

2.8.3.9 Menu: Diagnostics

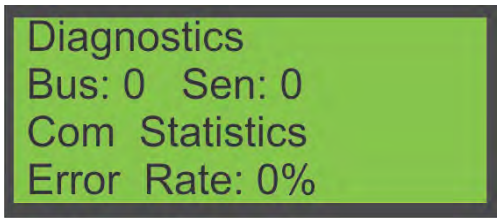


Figure 46: Diagnostics Menu Error Rate

Figure 47: 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%.

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
3. 2) Used sensor after mounting location was changed

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.

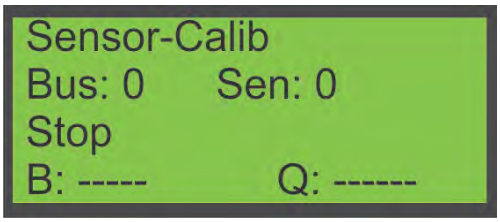


Figure 48: Sensor Calibration menu

“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.

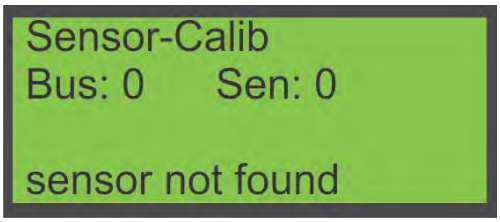


Figure 49: Sensor Calibration menu

- 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.

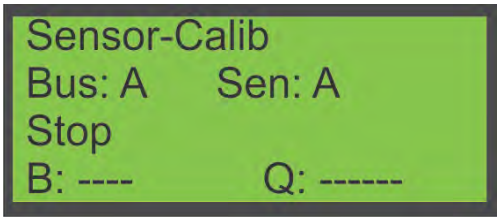


Figure 50: Sensor Calibration menu select All

- 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.

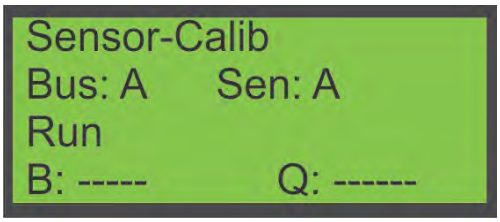


Figure 51: Sensor Calibration menu select All Running

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.

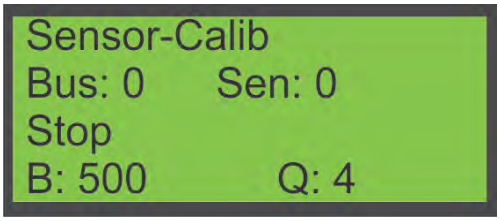


Figure 52: Sensor Calibration menu sensor information

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.

TROUBLESHOOTING

4.

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"

FAQ

5. **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.