


Master Purchase Order

DO NOT INVOICE TO THIS ADDRESS		 DENVER <small>THE MILE HIGH CITY</small>	Supplier Contract No. SC-00003027	
City & County of Denver			Date: 06/01/18	Revision No.
Purchasing Division			Payment Terms: Net 30	Ordinance (if applicable):
201 West Colfax Avenue, Dept. 304			Freight Terms: DESTINATION	
Denver, CO 80202			Ship Via: Best Way	
United States			Buyer: Ruth Bruski	
Phone: 720-913-8100 Fax: 720-913-8101			Phone: 720-913-8153	

PS Vendor ID: DENVR0000002299 Phone: 303-772-2787

Email: dtenkely@trafsig.com

Traffic Signal Controls, Inc.
 255 Weaver Park Road, Ste 100
 Longmont, CO 80504
 Attn: David Tenkely
 dtenkely@trafsig.com

Ship To: Denver Public Works Transportation and Mobility
 5440 Roslyn Street
 Building E
 Denver, CO 80216
 And other locations as required

Colorado Secretary of State ID: 19871640311
 U.S. Federal SAM Registry Verification Date: 06/01/2018

Bill To: Denver Public Works Transportation and Mobility
 5440 Roslyn Street
 Building 5
 Denver, CO 80216
 Or as specified by Agency

1. Goods/Services:

Traffic Signal Controls, Inc. a Colorado Corporation ("Vendor") shall provide the goods, and any services related thereto, identified and described on attached Exhibit A, to the City and County of Denver, a Colorado municipal corporation (the "City"), all in accordance with the terms and conditions of this Master Purchase Order.

2. Ordering:

The City shall purchase one or more of the goods/services by issuing a written purchase order(s) or similar appropriate written document ("Order"), each of which will be deemed incorporated into this Agreement for purposes of such Order only.

3. Pricing:

The pricing/rates for the goods/services is contained on Exhibit A and shall be held firm for the term of this Master Purchase Order.

4. Term and Renewal:

The effective period of the annual contract or agreement resulting from this proposal shall be from date of City signatures to and including June 10, 2020. It is also a specific provision of this Master Purchase Order that the City and the vendor may mutually agree to renew and continue this Purchase Order for additional periods of one year at the same prices, terms and conditions. However, no more than three (3) yearly extensions shall be made to the original Master Purchase Order.

5. Non-Exclusive:

This Master Purchase Order is non-exclusive. City does not guarantee any minimum purchase other than as provided herein.

6. Inspection and Acceptance:

City may inspect all goods/services prior to acceptance. Payment does not constitute acceptance. Vendor shall bear the cost of any inspection/testing that reveal goods/services that are defective or do not meet specifications. City's failure to accept or reject goods/services shall not relieve Vendor from its responsibility for such goods/services that are defective or do not meet specifications nor impose liability on City for such goods/services. If any part of the goods/services are not acceptable to City, City may, in addition to any other rights it may have at law or in equity: (1) make a warranty claim; (2) repair and/or replace the goods or substitute other services at Vendor's expense; or (3) reject and return the goods at Vendor's cost and/or reject the services at Vendor's expense for full credit. Any rejected goods/services are not to be replaced without written authorization from City, and any such replacement shall be on the same terms and conditions contained in this Master Purchase Order. Vendor shall perform all services in accordance with the standard of care exercised by highly competent vendors who perform like or similar services.

7. Shipping, Taxes and Other Credits and Charges:

All pricing is F.O.B. destination unless otherwise specified. Shipments must be marked with Vendor's name, the Master Purchase Order number, and contain a delivery or packing slip. Vendor shall not impose any charges for boxing, crating, parcel post, insurance, handling, freight, express or other similar charges or fees. Vendor shall notify City in writing of any price decreases immediately, and City shall receive the benefit thereof on all unshipped items. Vendor shall comply with any additional delivery terms specified herein. Vendor shall be responsible for the cleanup and reporting of any contamination (environmental or otherwise) or spillage resulting from the delivery and/or unloading of goods within twenty-four (24) hours of the contamination or spillage or sooner if required by law. Vendor shall procure all permits and licenses; pay all charges, taxes and fees; and give all

notices necessary and incidental to the fulfillment of this Master Purchase Order and all cost thereof have been included in the prices contained herein. City shall not be liable for the payment of taxes, late charges or penalties of any nature, except as required by D.R.M.C. § 20-107, et seq. The price of all goods/services shall reflect all applicable tax exemptions. City's Federal Registration No. is 84-6000580 and its State Registration No. is 98-02890. Vendor shall pay all sales and use taxes levied by City on any tangible personal property built into the goods/services. Vendor shall obtain a Certificate of Exemption from the State of Colorado Department of Revenue prior to the purchase of any materials to be built into the goods/services and provide a copy of the Certificate to City prior to final payment.

8. Risk of Loss:

Vendor shall bear the risk of loss, injury or destruction of goods prior to delivery to City. Loss, injury or destruction shall not release Vendor from any obligation hereunder.

9. Invoice:

Each invoice shall include: (i) the Purchase Order number; (ii) individual itemization of the goods/services; (iii) per unit price, extended and totaled; (iv) quantity ordered, back ordered and shipped; (v) an invoice number and date; (vi) ordering department's name and "ship to" address; and (vii) agreed upon payment terms set forth herein.

10. Payment:

Payment shall be subject to City's Prompt Payment Ordinance D.R.M.C. § 20-107, et seq. after City accepts the goods/services. Any other provision of this Agreement notwithstanding, in no event shall the City be liable for aggregate payments under this Master Purchase Order in excess of two million dollars (\$2,000,000.00). The Vendor acknowledges that any goods/services provided beyond those specifically described in Exhibit A are performed at Contractor's risk and without authorization from the City. City's payment obligations hereunder, whether direct or contingent, shall extend only to funds appropriated by the Denver City Council for the purpose of this Master Purchase Order, encumbered by the City after receipt of Vendor's invoice and paid into the Treasury of City. Vendor acknowledges that: (i) City does not by this Master Purchase Order, irrevocably pledge present cash reserves for payments in future fiscal years; and (ii) this Master Purchase Order is not intended to create a multiple-fiscal year direct or indirect debt or financial obligation of City. City may setoff against any payments due to Vendor any claims and/or credits it may have against Vendor under this Master Purchase Order.

11. Amendments/Changes:

Only the Executive Director of General Services or his/her delegate is authorized to change or amend this Master Purchase Order by a formal written change order. Any change or amendment that would cause the aggregate payable under this Master Purchase Order to exceed the amount appropriated and encumbered for this Master Purchase Order is expressly prohibited and of no effect. Vendor shall verify that the amount appropriated and encumbered is sufficient to cover any increase in cost due to changes or amendments. Goods/services provided without such verification are provided at Vendor's risk. The Vendor has no authority to bind City on any contractual matters.

12. Warranty:

Vendor warrants and locals to City that all goods furnished under this Purchase Order are free from defects in workmanship and materials, are merchantable, and fit for the purposes for which they are to be used and that any professional services associated with the goods, or stand alone professional services under \$10,000, shall be performed in a workmanlike and professional manner with the degree of skill and judgment normally exercised by recognized professionals performing services of the same or substantially similar nature. For any goods or services which are, or become defective within twelve (12) months (unless otherwise specified) after date of receipt by City, Vendor shall at no expense to City, at City's election and to City's satisfaction, either remedy any and all defects or replace the defective goods within seven (7) days of receipt of the defective goods or accept the defective goods for full credit and payment of any return shipping charges. Vendor shall be fully responsible for any and all warranty work, regardless of third party warranty coverage. Vendor shall furnish additional or replacement parts at the same prices, conditions and specifications delineated herein.

13. Indemnification/Limitation of Liability:

Vendor shall indemnify and hold harmless City (including but not limited to its employees, elected and appointed officials, agents and representatives) against any and all losses (including without limitation, loss of use and costs of cover), liability, damage, claims, demands, actions and/or proceedings and all costs and expenses connected therewith (including without limitation attorneys' fees) that arise out of or relate to any claim of infringement of patent, trademark, copyright, trade secret or other intellectual property right related to this Master Purchase Order or that are caused by or the result of any act or omission of Vendor, its agents, suppliers, employees, or representatives. Vendor's obligation shall not apply to any liability or damages which result solely from the negligence of City. City shall not be liable for any consequential, incidental, indirect, special, reliance, or punitive damages or for any lost profits or revenues, regardless of the legal theory under which such liability is asserted. In no event shall City's aggregate liability exceed the agreed upon cost for those goods/services that have been accepted by City under this Master Purchase Order. Notwithstanding anything contained in this Master Purchase Order to the contrary, City in no way limits or waives the rights, immunities and protections provided by C.R.S. § 24-10-101, et seq.

14. Termination:

City may terminate this Master Purchase Order, in whole or in part, at any time and for any reason immediately upon written notice to Vendor. In the event of such a termination, City's sole liability shall be limited to payment of the amount due for the

goods/services accepted by City. Vendor acknowledges the risks inherent in this termination for convenience and expressly accepts them. Termination by City shall not constitute a waiver of any claims City may have against Vendor.

15. Interference:

Vendor shall notify the Director of Purchasing immediately of any condition that may interfere with the performance of Vendor's obligations under this Master Purchase Order and confirm such notification in writing within twenty-four (24) hours. City's failure to respond to any such notice shall in no way act as a waiver of any rights or remedies City may possess.

16. Venue, Choice of Law and Disputes:

Venue for all legal actions shall lie in the District Court in and for City and County of Denver, State of Colorado, and shall be governed by the laws of the State of Colorado as well as the Charter and Revised Municipal Code, rules, regulations, Executive Orders, and fiscal rules of City. All disputes shall be resolved by administrative hearing, pursuant to the procedure established by D.R.M.C. § 56-106. Director of Purchasing shall render the final determination.

17. Assignment/No Third Party Beneficiary:

Vendor shall not assign or subcontract any of its rights or obligations under this Master Purchase Order without the written consent of City. In the event City permits an assignment or subcontract, Vendor shall continue to be liable under this Master Purchase Order and any permitted assignee or subcontractor shall be bound by the terms and conditions contained herein. This Master Purchase Order is intended solely for the benefit of City and Vendor with no third party beneficiaries

18. Notice:

Notices shall be made by Vendor to the Director of Purchasing and by City to Vendor at the addresses provided herein, in writing sent registered, return receipt requested.

19. Compliance With Laws:

Vendor shall observe and comply with all federal, state, county, city and other laws, codes, ordinances, rules, regulations and executive orders related to its performance under this Master Purchase Order. City may immediately terminate this Master Purchase Order, in whole or in part, if Vendor or an employee is convicted, plead nolo contendere, or admits culpability to a criminal offense of bribery, kickbacks, collusive bidding, bid-rigging, antitrust, fraud, undue influence, theft, racketeering, extortion or any offense of a similar nature.

20. Insurance:

Vendor shall secure, before delivery of any goods/services, the following insurance covering all operations, goods and services provided to City. Vendor shall keep the required insurance coverage in force at all times during the term of the Master Purchase Order, or any extension thereof, during any warranty period, and for three (3) years after termination of this Master Purchase Order. The required insurance shall be underwritten by an insurer licensed to do business in Colorado and rated by A.M. Best Company as "A-"VIII or better. Each policy shall contain a valid provision or endorsement requiring notification to the City in the event any of the required policies be canceled or non-renewed before the expiration date thereof. Such written notice shall be sent to the parties identified in the Notices section of this Agreement. Such notice shall reference the City contract number listed on the signature page of this Agreement. Said notice shall be sent thirty (30) days prior to such cancellation or non-renewal unless due to non-payment of premiums for which notice shall be sent ten (10) days prior. If such written notice is unavailable from the insurer, contractor shall provide written notice of cancellation, non-renewal and any reduction in coverage to the parties identified in the Notices section by certified mail, return receipt requested within three (3) business days of such notice by its insurer(s) and referencing the City's contract number. If any policy is in excess of a deductible or self-insured retention, City must be notified by Vendor. Vendor shall be responsible for the payment of any deductible or self-insured retention. The insurance coverages specified in this Master Purchase Order are the minimum requirements, and these requirements do not lessen or limit the liability of Vendor. Risk Management reserves the right to require additional policies and/or limits based on agreement scope of work. Vendor shall provide a copy of this Master Purchase Order to its insurance agent or broker. Vendor may not commence services or work relating to the Master Purchase Order prior to placement of coverage. Contractor certifies that the attached certificate of insurance attached to the Master Purchase Order documents, preferably an ACORD certificate, complies with all insurance requirements of this Master Purchase Order. The City's acceptance of a certificate of insurance or other proof of insurance that does not comply with all insurance requirements set forth in this Master Purchase Order shall not act as a waiver of Vendor's breach of this Master Purchase Order or any of the City's rights or remedies under this Agreement. The City's Risk Management Office may require additional proof of insurance, including but not limited to policies and endorsements. Vendor's insurer shall name as Additional Insured to its Commercial General Liability and Business Auto Liability policies the City and County of Denver, its elected and appointed officials, employees and volunteers. Vendor's insurer shall waive subrogation rights against the City. All sub-contractors and sub-consultants (including independent contractors, suppliers or other entities providing goods/services required by this Master Purchase Order) shall be subject to all of the requirements herein and shall procure and maintain the same coverages required of Vendor. Vendor shall include all such entities as insureds under its policies or shall ensure that they all maintain the required coverages. Vendor shall provide proof of insurance for all such entities upon request by City. For Worker's Compensation Insurance, Vendor shall maintain the coverage as required by statute for each work location and shall maintain Employer's Liability insurance with limits of \$100,000 for each bodily injury occurrence claim, \$100,000 for each bodily injury caused by disease claim, and \$500,000 aggregate for all bodily injuries caused by disease claims. Vendor expressly represents to City, as a material representation upon which City is relying, that none of the Vendor's officers or employees who may be eligible under any statute or law to reject Workers' Compensation Insurance shall effect such rejection during any part of

the term of this Master Purchase Order, and that any such rejections previously effected, have been revoked. Vendor shall maintain Commercial General Liability coverage with limits of \$1,000,000 for each occurrence, \$1,000,000 for each personal and advertising injury claim, \$2,000,000 products and completed operations aggregate, and \$2,000,000 policy aggregate. Vendor shall maintain Business Auto Liability coverage with limits of \$1,000,000 combined single limit applicable to all owned, hired and non-hired vehicles used in performing services under this Master Purchase Order. For Commercial General Liability coverage, the policy must provide the following: (i) That this Master Purchase Order is an Insured Contract under the policy; (ii) Defense costs in excess of policy limits; (iii) A severability of interests, separation of insureds or cross liability provision; and (iv) A provision that coverage is non-contributory with other coverage or self-insurance provided by City. For claims-made coverage, the retroactive date must be on or before the first date when any goods or services were provided to City. Vendor must advise the City in the event any general aggregate or other aggregate limits are reduced below the required per occurrence limits. At their own expense, and where such general aggregate or other aggregate limits have been reduced below the required per occurrence limit, the Contractor will procure such per occurrence limits and furnish a new certificate of insurance showing such coverage is in force.

21. **Severability:**
If any provision of this Master Purchase Order, except for the provisions requiring appropriation and encumbering of funds and limiting the total amount payable by City, is held to be invalid, illegal or unenforceable by a court of competent jurisdiction, the validity of the remaining portions or provisions shall not be affected if the intent of City and Vendor can be fulfilled.
22. **Survival:**
All terms and conditions of this Master Purchase Order which by their nature must survive termination/expiration shall so survive. Without limiting the foregoing, Vendor's insurance, warranty and indemnity obligations shall survive for the relevant warranty or statutes of limitation period plus the time necessary to fully resolve any claims, matters or actions begun within that period. Bonds shall survive as long as any warranty period.
23. **No Construction Against Drafting Party:**
No provision of this Master Purchase Order shall be construed against the drafter.
24. **Status of Vendor/Ownership of Work Product:**
Vendor is an independent contractor retained on a contractual basis to perform services for a limited period of time as described in Section 9.1.1E(x) of the Charter of City. Vendor and its employees are not employees or officers of City under Chapter 18 of the D.R.M.C. for any purpose whatsoever. All goods, deliverables, hardware, software, plans, drawings, reports, submittals and all other documents or things furnished to City by Vendor shall become and are the property of City, without restriction.
25. **Records and Audits:**
Vendor shall maintain for three (3) years after final payment hereunder, all pertinent books, documents, papers and records of Vendor involving transactions related to this Master Purchase Order, and City shall have the right to inspect and copy the same.
26. **Remedies/Waiver:**
No remedy specified herein shall limit any other rights and remedies of City at law or in equity. No waiver of any breach shall be construed as a waiver of any other breach.
27. **No Discrimination in Employment:**
Vendor shall not refuse to hire, discharge, promote or demote, or to discriminate in matters of compensation against any person otherwise qualified, solely because of race, color, religion, national origin, gender, age, military status, sexual orientation, marital status, or physical or mental disability; and Vendor shall insert the foregoing provision in any subcontracts hereunder.
28. **Use, Possession or Sale of Alcohol or Drugs:**
Vendor shall cooperate and comply with the provisions of Executive Order 94. Violation may result in City terminating this Master Purchase Order or barring Vendor from City facilities or from participating in City operations.
29. **Conflict of Interest:**
No employee of City shall have any personal or beneficial interest in the goods/services described in this Master Purchase Order; and Vendor shall not hire or contract for services any employee or officer of City which would be in violation of City's Code of Ethics, D.R.M.C. §2-51, et seq. or the Charter §§ 1.2.8, 1.2.9, and 1.2.12.
30. **Advertising and Public Disclosure:**
The Vendor shall not include any reference to the Master Purchase Order or to services performed or goods purchased pursuant to the Master Purchase Order in any of the Vendor's advertising or public relations materials without first obtaining the written approval of the Director of Purchasing.
31. **No Employment of Illegal Aliens to Perform Work Under The Agreement:**
 - a. This Agreement is subject to Division 5 of Article IV of Chapter 20 of the Denver Revised Municipal Code, and any amendments (the "Certification Ordinance").
 - b. The Contractor certifies that:
 - (1) At the time of its execution of this Agreement, it does not knowingly employ or contract with an illegal alien who will perform work under this Agreement.
 - (2) It will participate in the E-Verify Program, as defined in § 8-17.5-101(3.7), C.R.S., to confirm the employment eligibility of all employees who are newly hired for employment to perform work under this Agreement.

- c. The Contractor also agrees and represents that:
- (1) It shall not knowingly employ or contract with an illegal alien to perform work under the Agreement.
 - (2) It shall not enter into a contract with a subconsultant or subcontractor that fails to certify to the Contractor that it shall not knowingly employ or contract with an illegal alien to perform work under the Agreement.
 - (3) It has confirmed the employment eligibility of all employees who are newly hired for employment to perform work under this Agreement, through participation in the E-Verify Program.
 - (4) It is prohibited from using the E-Verify Program procedures to undertake pre-employment screening of job applicants while performing its obligations under the Agreement, and that otherwise requires the Contractor to comply with any and all federal requirements related to use of the E-Verify Program including, by way of example, all program requirements related to employee notification and preservation of employee rights.
 - (5) If it obtains actual knowledge that a subconsultant or subcontractor performing work under the Agreement knowingly employs or contracts with an illegal alien, it will notify such subconsultant or subcontractor and the City within three (3) days. The Contractor will also then terminate such subconsultant or subcontractor if within three (3) days after such notice the subconsultant or subcontractor does not stop employing or contracting with the illegal alien, unless during such three-day period the subconsultant or subcontractor provides information to establish that the subconsultant or subcontractor has not knowingly employed or contracted with an illegal alien.
 - (6) It will comply with any reasonable request made in the course of an investigation by the Colorado Department of Labor and Employment under authority of § 8-17.5-102(5), C.R.S., or the City Auditor, under authority of D.R.M.C. 20-90.3.

d. The Contractor is liable for any violations as provided in the Certification Ordinance. If Contractor violates any provision of this section or the Certification Ordinance, the City may terminate this Agreement for a breach of the Agreement. If the Agreement is so terminated, the Contractor shall be liable for actual and consequential damages to the City. Any such termination of a contract due to a violation of this section or the Certification Ordinance may also, at the discretion of the City, constitute grounds for disqualifying Contractor from submitting bids or proposals for future contracts with the City.

32. Cooperative Purchasing:

The City and County of Denver encourages and participates in cooperative purchasing endeavors undertaken by or on behalf of other governmental jurisdictions, pursuant to Denver Revised Municipal Code Sec. 20-64.5. To the extent other governmental jurisdictions are legally able to participate in cooperative purchasing endeavors, the City and County of Denver supports such cooperative activities. Further, it is a specific requirement of this proposal or Request for Proposal that pricing offered herein to the City and County of Denver may be offered by the vendor to any other governmental jurisdiction purchasing the same products.

The vendor(s) must deal directly with any governmental agency concerning the placement of purchase orders, freight charges for destinations outside of the Denver Metro area, contractual disputes, invoicing, and payment. The City and County of Denver shall not be liable for any costs, damages incurred by any other entity.

33. Emergency Purchases:

The City and County of Denver reserves the right to purchase from other sources those items which are required on an emergency basis and cannot be supplied immediately from stock by the vendor.

34. Pallet Charge:

All pallets supplied shall be non-returnable, no deposit.

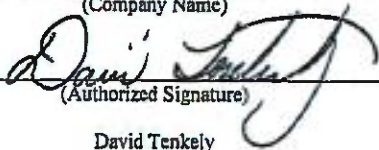
35. Federal Provisions:


Where the source of the funds, directly or indirectly for this Purchase Order is the Federal Government, the Vendor agrees to the applicable provisions set out below. The Vendor shall be responsible for determining which terms are applicable to its products and/or services.

EQUAL EMPLOYMENT OPPORTUNITY COMPLIANCE Contractor agrees to comply with Executive Order 11246 of September 24, 1965, entitled "Equal Employment Opportunity," as amended by Executive Order 11375 of October 13, 1967, and as supplemented in Department of Labor regulations (41 CFR Part 60). **DAVIS-BACON ACT COMPLIANCE** Contractor agrees to comply with the Davis-Bacon Act (40 U.S.C. 3148 to 3148) as supplemented by Department of Labor regulations (29 CFR part 5). **ANTI-KICKBACK ACT COMPLIANCE** Contractor agrees to comply with the Copeland "Anti-Kickback" Act (18 U.S.C. 874) as supplemented in Department of Labor regulations (29 CFR Part 3). **CONTRACT WORK HOURS AND SAFETY STANDARDS** Contractor agrees to comply with Sections 102 and 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 327-333), as supplemented by Department of Labor regulations (29 CFR part 5) **RIGHTS TO INVENTIONS MADE UNDER A CONTRACT OR AGREEMENT** Contractor agrees to comply with 37 CFR part 401, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any implementing regulations issued by the awarding agency. **CLEAN AIR AND WATER REQUIREMENTS** Contractor agrees to comply with all applicable standards, orders, or requirements issued under the Clean Air

Act (42 U.S.C. 7401 et. seq.), and the Clean Water Act (33 U.S.C. 1251 et. seq.). Contractor agrees to report each violation of these requirements to the City and understands and agrees that the City will, in turn, report each violation as required to the appropriate EPA regional office. **ENERGY CONSERVATION REQUIREMENTS** The Contractor agrees to comply with mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act. (42 U.S.C. 6201) **NO SUSPENSION OR DEBARMENT** Contractor certifies that neither it nor its Principals or any of its subcontractors is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this Agreement by any Federal department or agency. **BYRD ANTI-LOBBYING**. If the Maximum Contract Amount exceeds \$100,000, the Contractor must complete and submit to the City a required certification form provided by the City certifying that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress in connection with obtaining any Federal contract grant of any other award covered by 31 U.S.C. 1352. Contractor must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award.

This Master Purchase Order is acknowledged and agreed to by:

Vendor Name: Traffic Signal Controls, Inc.
(Company Name)
By: 
(Authorized Signature)
Print Name: David Tenkely
Title: Estimator
Date: 6/1/2018

City & County of Denver, Purchasing Division
By: 
Print Name: Ruth Bruski
Title: Senior Buyer
Date: 6/4/18

Supervisor Initial: _____

EXHIBIT "A"

Vendor: Traffic Signal Controls, Inc.
Title: Traffic Signal Controller Cabinets
Solicitation No.: 10906

It is recommended that you use your Supplier Contract Number SC-00003027, in all future correspondence and/or other communications.

Description of the goods, and services related thereto, being purchased and pricing:

A.1 F.O.B. POINT:

All prices quoted must be quoted at a firm price F.O.B. Denver, Colorado, delivered to Public Works Traffic Division and other locations as needed by using agency.

A.2 DELIVERY CONSIDERATIONS:

When a date is set for the delivery of merchandise or the performance of work, said merchandise must be delivered or work performed in accordance with the specifications or description herein contained on or before said date, or the order to the delinquent party may be cancelled and awarded to the next lowest vendor. In such case, the City and County will have the right to buy such articles at market prices for immediate delivery, and an excess in cost of same over price named hereon is to be paid by the vendor under this contract, or deducted from any money due or hereafter coming to him.

A.3 WARRANTY GUARANTEE:

Vendor shall be fully responsible for any and all warranty work, regardless of whether or not manufacturers of equipment, and/or its component parts, provide the actual warranty coverage. In addition, vendor shall have or establish a single, local source that will accomplish or coordinate any necessary warranty work. Vendor shall respond to requests for warranty assistance within twenty-four (24) hours.

A.4 VENDOR PERFORMANCE MANAGEMENT:

Awarded vendors are required to furnish a performance report to the buyer on an annual basis, no later than the anniversary date of the applicable Master Purchase Order or City Contract, providing at a minimum the following information:

FOR GOODS

- Total dollar value of purchases per City Agency
- Total number of transactions per City Agency
- Percentage of items shipped from local stock
- Percentage of items backordered
- Average delivery time for stock material
- Average delivery time for backorders

A.5 PRODUCT SPECIFICATIONS**PUBLIC WORKS, TRAFFIC ENGINEERING SERVICES TRAFFIC SIGNAL CONTROLLER CABINET SPECIFICATION(S).**

Traffic signal cabinets are to comply with NEMA (National Electrical Manufacturers Association) TS2 specifications and shall be compatible with NTCIP based distributed traffic signal systems. Unless otherwise noted in the bid document, all components, connections, and cables shall be supplied with the cabinet.

1. Cabinets

- 1.1 General – Traffic signal controller cabinets are to conform to the requirements for NEMA 3R rating, NEMA TS2-2003 v2.06 Section 7, and this specification. The manufacturer must be ISO 9001-2008 Registered and have been certified in the IPC “Class II” Electronics standards and training for all manufacturing staff to ensure manufacturing quality, documentation, and proper going/continuing employee training for manufacturing processes by IPC Certified Trainers. The cabinet and controller supplied under this specification must be by the same manufacturer to ensure matched component system testing. Where differences occur, this specification shall govern. Unless noted otherwise, size 6 cabinets shall be furnished.

Materials – Cabinets are to be fabricated from sheet aluminum alloy, 0.125 inch thick, meeting the requirements of ASTM 5052-H32.

- 1.2 Dimensions – Size “6S” cabinets shall be 66 inches high, 27 inches deep and 44 inches wide. Unless noted otherwise, cabinets shall be size 6S.
- 1.3 Construction – The cabinet top is to be constructed with a two-inch slope from front to back. All enclosures must be constructed, approved and marked in accordance with the requirements for Type 1 Industrial Control Panel Enclosures contained in UL 508A, the Standard for Industrial Control Panels. Enclosure must meet NEMA 3R rating requirements and be marked with UL approval sticker.
- 1.4 Doors – Cabinet main doors to be full width, hinged on the right side when facing the cabinet. The main door opening to be a minimum of 90% of the width and 80% of the height of the front surface of the cabinet. A stiffener plate, at least 15 inches long, 6 inches high and one-half inch deep, is to be welded across the inside of the main door. (The bottom of the door opening shall be at least 3 inches above the bottom of the cabinet.)
- 1.5 The main door hinge shall be continuous and bolted to the cabinet door using 1/4-20 stainless steel carriage bolts and ny-lock nuts. The hinge is to be attached so that no bolts or rivets are exposed. The hinges shall have a 0.120 inch diameter stainless steel hinge pin, capped top and bottom to render it tamper proof. The main door shall include a door restraint capable of holding the door open at approximately 90, 120, and 150 degrees under windy conditions. The door restraint shall be attached to the main door and pivot to placement holes in the bottom flange of the door opening.
- 1.5.1 A three-point draw-roller type door latch is to be provided with push rods of at least 0.25 inch by 0.75 inch steel. Rollers to be a minimum of 0.875 inches in diameter, be made of nylon, and have a 0.150 inch steel center. The handle on the main door is to be stainless steel with a three-quarter inch diameter shank. The handle shall rotate clockwise to open. The handle is to include a hasp for attachment of a padlock. The main door shall be equipped with a Corbin lock, No. 1548-1, or equivalent, and shall be provided with two keys. The lock shall be positioned so that the key shall not interfere with operation of the handle. The key shall turn counter-clockwise to unlock the door. The hinged police door compartment is to be provided with a Corbin lock, No. R357SGS, provided with one key, and the opening for the key shall have a cover that will swing out of the way for opening but shall fall back into place when key is removed, the purpose of the cover is to prevent bees, spiders, etc from entering the police compartment.

- 1.5.2 The main door and the police door are to close against weatherproof and dustproof closed-cell neoprene gasket seals. The gasket material for doors is to be a minimum of 0.250 inches thick. The main door gasket is to be a minimum of 1.00 inch wide; the police door gasket is to be a minimum of 0.50 inch wide. Both gaskets are to be permanently bonded to the cabinet.
- 1.6 Shelves – Unless noted otherwise, cabinets to be provided with two “C” channels mounted vertically on the interior of the back and both side walls. All channel nuts used in the cabinet shall be the spring-loaded type. Mounting channels are to extend at least 3 inches from bottom to at least 3 inches from the cabinet top.
 - 1.6.1 Cabinets are to be provided with three adjustable shelves, fabricated of 5052-H32 aluminum with “C” channels mounted on the bottom of the shelf for stiffening and attaching equipment.
 - 1.6.2 Shelves are to be at least 16 inches deep and extend the full width of the cabinet.
 - 1.6.3 The bottom shelf shall be mounted so that the back panel of the cabinet can tip forward to allow access to the back of it without striking the bottom shelf or the roll out drawer. This shelf shall be designated as the battery shelf and have a non-skid battery pad mounted to the top side for stability of the batteries. The detector racks shall be attached to the top shelf to the left side allowing enough room for the second detector rack to be mounted to the right, of the first detector rack. The middle shelf shall be mounted above the battery shelf allowing enough room for ventilation of the detector rack and equipment. The top shelf shall be mounted such that there is adequate space between the top of the middle shelf for installing additional equipment on the left side wall. (BIU Adders). Cabling for the controller and monitor shall be routed to the middle shelf. The power supply cabling will be routed to the top shelf.
- 1.7 Finish & Surface Preparation – Cabinets shall be provided with a natural aluminum finish meeting Federal Specification QQA-250/18. All surfaces are to be free from weld flash. Welds shall be smooth, neatly formed, and free from cracks, blow holes, and other irregularities. Any sharp edges or burrs shall be ground smooth. Care shall be taken during handling to prevent scratches or dents. Interior of cabinet is to be finished with a white powder coat.
- 1.8 Mounting – Cabinets are to be provided with internal mounting flanges for mounting on a base. All walls of the cabinet shall be folded under the cabinet at the base and each flange created shall be equal to or greater than 4”.
- 1.9 Ventilation – The lower portion of the main cabinet door is to be louvered for ventilation intake. The air inlet shall be large enough to accommodate the air flow of the rated fans. Louvers must meet the NEMA rod entry test for 3R ventilated enclosures. A heavy duty, non-corrosive, vermin and insect proof, air filter is to be mounted on the inside of the main door. The air filter must be held firmly in place by a fixed bottom bracket and a spring loaded top bracket that allow easy removal for cleaning. The top of the cabinet is to include an exhaust air plenum with a vent screen having perforations no greater than 0.125 inches in diameter. A removable fan plate is to be mounted in the top of the cabinet.
- 1.10 Equipment Outlet – Two 8 Position outlet strips are to be mounted vertically on the left and right rear rail between the 2nd and 3rd shelves. All of the outlets must be positioned to allow connection of power transformers without obstructing other outlets on the strip. The outlet strip should be wired after the 15amp breaker and may contain its own surge protection or be wired after the EDCO surge arrester but it must have surge protection. If it contains its own surge protection it shall be equal to or greater than the protection provided by the EDCO model SHA 1210. The outlet strip may be alternatively mounted to the back wall of the cabinet above the upper shelf.

- 1.11 Pull Out Drawer - A pull-out, hinged-top drawer, having sliding tracks, with lockout and quick-disconnect feature, such as a Vent-Rak Retractable Writing Shelf, #D-4090-13 or equivalent – is to be installed under the lower shelf. It shall be possible to lift this hinged platform in order to gain access to the interior of the drawer. Minimum interior dimensions of the drawer shall be 1 inch high, 11 inches deep and 24 inches wide. Drawer shall be mounted in the center of the lower shelf.
- 1.12 Din Rail - Two lengths of Din Rail are to be mounted to the left side of the cabinet with spring loaded channel nuts for the purpose of mounting additional equipment such as small power supplies, Ethernet switches, Radios etc. The Din Rails shall be mounted as far to the rear as possible Rail should be at least 12" in length.

2. **Terminals and Facilities**

- 2.1 General – Cabinets are to be assembled and wired to accommodate the following:

Main panel with 16 load switches, 8 flash transfer relays, 1 flasher, and 2 bus interface units.

- Power distribution panel on lower right side panel
- 2 Detector rack for 32 channels of detection, 8 channels of preemption, and 2 bus interface units mounted on the top left side of the top shelf.
- Power supply for bus interface units mounted on the top right side of the upper shelf
- One TS2 Type 2 ATC controller and Type 16 Smart malfunction management unit on middle shelf
- Police switch compartment on inside of main door
- Detector I/O panel mounted on the left side
- 2 ventilation fans mounted in the cabinet top with an adjustable thermostat.
- LED lighting mounted around the inside of the Front door of the cabinet and below the roll out tray in such a manner as to provide illumination of the entire interior of the cabinet.
- Loading capacitor/resistor circuit
- Equipment outlet strip

- 2.2 Main Panel – The main panel is to be constructed from 5052-H32 brushed aluminum of 0.090 inches minimum thickness and formed so as to minimize any flexing when plug-in components are installed.

Main panels are to be hinged at the bottom to allow easy access to all wiring on the rear of the panel. The panel is to be designed so it can easily be moved from vertical to a minimum of 60 degrees from vertical. The bottom of the panel is to be five to eight inches above the base of the cabinet. The exact distance will depend on the spacing of other cabinet components.

The main panel is to be fully wired in the following configuration:

Sixteen load switch sockets, 8 flash transfer relay sockets, one flasher socket, two main panel BIU rack slots, Two detector racks each with one BIU, and one Type-16 smart MMU.

Load switches - Load switch 9, 10, 11, & 12 yellow outputs shall be loaded with 2.2 microfarad 400VDC (275VAC) Metalized Polypropylene capacitors with a 100k 2 watt resistor in parallel. The capacitor/resistor circuit is to be mounted on a separate panel mounted to the side or back of the cabinet

and wired to the load switches, 12 additional capacitor/resistor circuits shall be provided on this panel to allow loading of additional outputs as needed for left turn phases etc.

All load switch and flash transfer relay sockets shall be labeled on the front and rear of the main panel to match drawing designations.

All load switches are to be supported by a bracket extending at least half the length of the load switch.

Rack style mounting is to be provided to accommodate the required BIUs per the configuration listed. A dual-row, 64-pin female DIN 41612 Type B connector shall be provided for each BIU rack position. Card guides are to be provided for both edges of the BIU. Terminal and facilities BIU mounting is to be an integral part of the main panel. Detector rack BIU mounting is to be an integral part of the detector rack.

All BIU rack connectors are to have prewired address pins corresponding to the requirements of the TS2 specification. The address pins shall control the BIU mode of operation. BIUs shall be capable of being interchanged with no additional programming.

Main panels should have all field wires contained on one rows of horizontally mounted terminal blocks with a neutral buss bar mounted below the field wiring terminal blocks in such a manner as to not interfere with connections of the field wires to the terminal blocks but close enough to allow for convenient and neat connection of the neutral wires for each output. This buss bar shall extend the full length of the field wiring terminal blocks.

All field output circuits are to be terminated on an unfused screw type (#10 screw) terminal block with a minimum rating of 10 amps.

All field input/output (I/O) terminals shall be accomplished at the field terminals with the use of a screwdriver only. It shall also be possible to program which flasher circuit the phase shall be programmed to. It shall not be necessary to debus field terminal blocks for flash programming.

The main panel is to contain 1 labeled flasher socket capable of operating 25-amp, 2-pole, NEMA solid-state flashers. The flasher is to be supported by a bracket that extends at least half its length.

One RC network is to be wired in parallel with each group of three flash-transfer relays and any other relay coils.

All logic-level, NEMA-controller and Malfunction Management Unit input and output terminations on the main panel shall be permanently labeled. Cabinet prints are to identify the function of each terminal position.

At a minimum, 8 20-position terminal blocks are to be provided at the top of the main panel to provide access to all the BIU/controller unit's programmable and non programmable I/O. Terminal blocks for DC signal interfacing shall have a number 6-32 x 7/32 inch screw as a minimum. All sixteen green/yellow/red load switch inputs, all vehicle detector channel outputs and inputs one through 32, and pedestrian detector inputs one through eight shall be terminated on the terminals and facilities panel. They shall be easily accessible.

The main panel is to incorporate a relay to remove +24 VDC from the common side of the load switches when the intersection is placed into flash. The relay is to have a momentary push-button to apply power to the load switch inputs for ease of troubleshooting.

- 2.3 Wiring and Cables – All main panel wiring shall be the size indicated below and is to be color-coded. As a minimum, colors shall be used to distinguish between different equipment. The following color code is proved as an example:

Green/Walk load switch output	Brown wire (14 gauge)
Yellow load switch output	Yellow wire (14 gauge)
Red/Don't Walk load switch output	Red wire (14 gauge)
MM (other than AC power)	Violet wire (22 gauge)
AC Line (power panel to main panel)	Black wire (8 gauge)
AC Line (main panel)	Black wire (10 gauge)
AC Neutral (power panel to main panel)	White wire (8 gauge)
AC Neutral (main panel)	White wire (10 gauge)
Earth ground (power panel)	Green wire (8 gauge)
Logic ground	Gray wire (22 gauge)
Flash programming	Orange wire to flasher terminal, black wire to red or yellow field terminal (14 gauge)

All wiring 14 AWG and smaller, shall conform to MIL-W-16878/1, type B/N, 600V, 19-strand tinned copper. The wire is to have a minimum of 0.010 inches thick PVC insulation with clear nylon jacket and rated to 105 degrees Celsius. All 12 AWG and larger wire is to have UL listed THHN/THWN 90 degrees Celsius, 600 V, 0.020 inches thick PVC insulation and clear nylon jacketed.

A TS2 controller power harnesses and connector shall be provided.

All cabinet configurations shall be provided with enough RS-485 Port 1 communication cables to allow full capabilities of that cabinet. Two additional RS-485 port cable, capable of reaching any RS 485 device, shall be supplied for testing. Each communication cable connector shall have 15-pin metal shell D subminiature type connector on both ends. The cable is to be shielded cable suitable for RS-485 communications. The additional port cable connector is to be coupled to prevent dirt or moisture contamination. The RS-485 port cables shall be as small as possible and remain flexible throughout the NEMA temperature range of operation. The cabinet shall be supplied with one 7 position SDLC Hub assembly and if needed also a 4 position SDLC Hub assembly for maximum connections of the equipment via the SDLC bus. SDLC cables shall be routed to the areas that will house the equipment to be bussed and be labeled as to the connection of the cable.

All main panels are to be prewired for a Type-16 Malfunction Management Unit.

Standard soldering and termination practices shall be followed. Wires soldered to .025 inch square posts are to be wrapped 270 degrees around the post. It is recommended that printed circuit boards or connectors be used with .025 inch squared posts. Great care shall be taken to prevent cold solder joints, solder bridges or shorts. Soldering shall be of the highest quality obtainable.

All wire (size 16 AWG or smaller) at solder joints shall be hooked or looped around the eyelet or terminal block post prior to soldering to ensure circuit integrity. Lap joint soldering is not acceptable.

All wiring is to be neat in appearance. All cabinet wiring shall be continuous from its point of origin to its termination point. Butt type connections/splices are not acceptable.

All connecting cables and wire runs shall be secured by mechanical clamps. Stick-on type clamps are not acceptable.

All wiring which passes through any metal panel shall be protected from abrasion by lining the hole with a grommet or similar material.

The grounding system in the cabinet is to be divided into three separate circuits (AC Neutral, Earth Ground, and Logic Ground). These ground circuits are to be connected together at a single point, using removable jumpers, as outlined in the NEMA TS2 Standard. There shall be no jumper installed between the neutral bus and ground bus on the main power panel.

All pedestrian push-button inputs from the field to the controller shall be opto-isolated through the BIU and operate at 12 VAC.

- 2.4 Power Panel – The power panel shall consist of a separate, wholly enclosed module, securely fastened to the right side wall of the cabinet. The power panel shall be wired to provide the necessary power to the cabinet, controller, Malfunction Management Unit, cabinet power supply and auxiliary equipment. It shall be manufactured from 0.090-inch, 5052-H32 aluminum with a removable plastic front cover. The panel shall be of such design so as to allow a technician to access the main and auxiliary breakers without removing the front cover.

The power panel shall house the following components:

- a. A 5-amp equipment breaker which also functions as an on/off switch. This breaker shall supply power to the controller, MMU, cabinet power supply and auxiliary panels. The equipment breaker shall be wired after the main breaker, transient protection and filtering.
- b. A 30 amp main breaker, which shuts off all power to the equipment breaker and all signal lights.
- c. A 15-amp auxiliary breaker. This breaker shall supply power to the fan, light and GFI outlet and shall be wired directly to the incoming power.
- d. All breakers shall be thermal magnetic type, UL listed for HACR service, with a minimum of 10,000 amp interrupting capacity.
- e. An EDCO model SHA 1210 or exact approved equivalent surge arrestor.
- f. A 50 amp, 125 VAC radio interference line filter.
- g. A normally-open, 60-amp, non-mercury contactor Struthers-Dunn model 418AXXL-120VAC or equivalent.
- h. A 10-position neutral bus bar capable of connecting three #12 wires per position. There shall be at least 7 positions, with no wires connected, available for field connections.
- i. A 7-position ground bus bar capable of connecting three #12 wires per position.
- j. A NEMA type 5-15GFI convenience outlet.

- k. A four-position power connector wired such that incoming power from the utility can be routed to a UPS unit and then back to the main power input circuitry for the cabinet.

- 2.5 Auxiliary Cabinet Equipment – The cabinet is to be provided with 2 thermostatically controlled (adjustable between 80-150 degrees Fahrenheit) ventilation fans in the top of the cabinet plenum. The fans are to be ball bearing type fans and shall be capable of drawing a minimum of 100 cubic feet of air per minute each

An 8 Position outlet strip is to be mounted to the left and right rear wall of the cabinet between shelf 2 and 3 shelf. All of the outlets must be positioned to allow connection of power transformers without obstructing other outlets on the strip. The outlet strip should be wired after the 15amp breaker and may contain it's own surge protection or be wired after the EDCO surge arrestor but it must have surge protection. If it contains it's own surge protection it shall be equal to or greater than the protection provided by the EDCO model SHA 1210. The outlet strip may be alternatively mounted to the back wall of the cabinet above the upper shelf.

Two sets of complete and accurate non-fading cabinet drawings are to be supplied with each cabinet.

All equipment supplied with the cabinet shall include one set of operating and service manuals per unit up to a maximum of ten sets per order.

- 2.6 Vehicle Detection Rack – 2 vehicle detector amplifier rack is to be provided in each cabinet. Detector racks are to support 32 channels of loop detection, four 2-channel preemption devices and one BIU and mounted on the top right side of the lower shelf.

The Pre-emption channels in the detector rack are to be cross wired in such a manner as to allow use of two 2-channel devices or one 4-channel device without any additional wiring or jumper cards.

Each cabinet is to contain detector interface panels for the purpose of connecting field loops and vehicle detector amplifiers. One 32-position interface panel shall be provided. The interface panel is to be secured to a mounting plate and attached to the left sidewall of the cabinet, no less than 12 inches above the bottom of the cabinet.

Interface panels shall allow for the connection of 32 independent field loops. A ground bus terminal shall be provided between each loop pair terminal to provide a termination for the loop lead-in cable ground wire.

Interface panels are to provide a 10-position terminal block to terminate the field wires for up to two 2-channel preemption devices.

Lightning protection devices are to be provided (EDCO SRA-16C, or EDCO SRA-6, or EDCO LCA-6 EDCO SRA 6LCA, or equivalent lightning protection device).

A cable consisting of 20 - 22 AWG twisted pair wires are to be provided to enable connection to and from the panel to a detector rack. All termination points shall be identified by a unique number and labeled on the panel.

Each detector rack is to accommodate rack mountable preemption devices such as Opticom™.

2.7 Cabinet Test Switches and Police Panel – The police door switch panel is to contain the following:

- a. SIGNALS ON/OFF SWITCH. In the OFF position, power shall be removed from signal heads in the intersection. The controller shall continue to operate. When in the OFF position, the MMU shall not conflict or require reset.
- b. AUTO/FLASH SWITCH. In the flash position, power shall not be removed from the controller and stop time is not to be applied. When the switch is returned to the Auto position the controller is to restart.
- c. AUTO/MANUAL SWITCH. Cabinet wiring is to include an AUTO/MANUAL switch and a terminal strip with a momentary push-button and 24" coiled hard cord, which is extendable to 12 feet. Terminal strip is to be accessible only from the inside of the cabinet.
- d. MANUAL PUSH BUTTON SWITCH. An additional manual advance momentary push button switch mounted on and accessible through the police panel door is to operate with the Auto/Manual switch.
- e. A MANUAL OPERATION interlock switch is to be mounted in the police panel in such a manner as to return the controller to AUTO operation in the case that the AUTO/MANUAL switch is left in the Manual position and the police panel door is closed.
- f. A door open/closed switch, connected to the BIU on Alarm 1, is to be provided. All toggle type switches are to be rated 5 amps. Single-(all the time) or double-pole switches may be provided, as required.

Any exposed terminals or switch solder points are to be covered with insulating material in such a manner as to prevent accidental contact with live circuits by maintenance personnel, this may be shrink tubing.

All switch functions must be permanently and clearly labeled.

All wire routed to the police door-in-door switch panel is to be adequately protected against damage from repetitive opening and closing of the main door.

All test switch panel wiring is to be connected to the main panel via a 15-pin AMP type connector.

2.8 BIU Adder assemblies – The following BIU adder assemblies shall be installed on the left inside wall of the cabinet:

- a. BIU ADDER #3: BIU adder #3 shall be mounted to a panel card cage that is jumper addressed per Table 5-4 of the TS2-2003 standards publication. Each BIU # 3 adder position shall be interfaced to a terminal block position located on the BIU adder panel and labeled as to the BIU #3 signal assignments called out in Table 5-7 of the TS2-2003 standard.
- b. BIU ADDER #4: BIU adder #4 shall be mounted to a panel card cage that is jumper addressed per Table 5-4 of the NEMA TS2-2003 standards publication. Each BIU # 4 adder position shall be interfaced to a terminal block position located on the BIU adder panel and labeled as to the BIU #4 signal assignments called out in Table 5-8 of the TS2-2003 standard.

3.0 **Auxiliary Devices**

- 3.1 Load Switches – Load switches are to be solid state and shall conform to the requirements of Section 6.2 of the NEMA TS2 Standard.

Signal load switches are to have a minimum rating of 20 amperes at 120 VAC for an incandescent lamp load. They shall be capable of handling a one cycle surge of 250 amperes at 125 degrees centigrade.

The front of the load switch is to be provided with three LED indicators to show the input signal from the controller to the load switch.

Load switches are to be dedicated per phase. The use of load switches for other partial phases is not acceptable.

The full complement of load switches to be supplied with each cabinet to allow for maximum phase utilization for which the cabinet is designed.

- 3.2 Flashers – The flashers are to be solid state and shall conform to the requirements of section 6.3 of the NEMA TS2 Standard.

Flashing of field circuits for the purpose of intersection flash is to be accomplished by a separate flasher.

The flasher is to be rated at 25 amperes, double pole with a nominal flash rate of 60 FPM.

- 3.3 Flash Transfer Relays – All flash transfer relays are to meet the requirements of Section 6.4 of the NEMA TS2 Standard.

The coil of the flash transfer relay must be de-energized for flash operation. Contacts is to be rated at 30 amps resistive.

The full complement of relays are to be supplied with each cabinet to allow for maximum phase utilization for which the cabinet is designed.

Flash Transfer Relays are to be a Struthers Dunn 21XBXP-120VAC or an approved equal.

- 3.4 Cabinet Power Supply – The cabinet power supply is to meet the requirements of Section 5.3.5 of the NEMA TS2 Standard. The power supply is to be a stand alone type. The power supply is to be mounted on top of the upper shelf at the left end.

The cabinet power supply is to provide LED indicators for the line frequency, 12 VDC, 12 VAC, and 24 VDC outputs.

The cabinet power supply is to provide (on the front panel) jack plugs for access to the +24 VDC for test purposes.

- 3.5 24V Load Switch Control Relay – The relay used to control the 24VDC to the load switcher is to have a push button, which allows it to be mechanically energized.

4.0 **Testing and Warranty**

- 4.1 Testing – Each controller and cabinet assembly is to be tested as a complete entity under signal load for a minimum of 48 hours.

Each assembly is to be delivered with a signed document detailing the cabinet final tests performed.

The cabinet is to be assembled and tested by the controller manufacturer or authorized local distributor to ensure proper component integration and operation.

- 4.2 Warranty – The controller and Malfunction Management Unit is to be warranted by the manufacturer against mechanical and electrical defects for a period of 5 years. The manufacturer's warranty is to be supplied in writing with each cabinet and controller. Second party extended warranties are not acceptable.

The cabinet assembly and all other components are to be warranted for a period of one year.

Any defects are to be corrected by the manufacturer or supplier at no cost to the owner.

A.6 ALTERNATIVE CABINET STYLE

The City and County of Denver may also consider a cabinet that meets the ITS cabinet standard v 01.02.17b with the following additions. Equal status shall be determined solely by the City.

1. Must support load current monitoring
2. High Voltage components (over 50V) must not be exposed per the NEC
3. Must support flashing of the intersection while replacing output assembly
4. Must support both 120VAC and 48VDC power architecture (ready to support easy transition to low voltage operation.)
5. Must support both AC and DC powered LED indications
6. Must support high density components (ie load switch packs that operate more than one output)
7. Preference given to a hermetically sealed (airtight) flash transfer relay
8. Preference given to a flash transfer relay that reports both open and close status.

PRICING

Item No.	Description	Unit Price Delivered
1A	<p>Base Price of NEMA Size 5 MSX Cabinet (60" High, 18" Deep, 30" Wide) per specification.</p> <p>Mfg. Offered: <u>McCain, Inc.</u> Model #: <u>NEMA Size 5</u></p> <p>EXCLUDING any and all of the following options: OPTICOM Detector Cards TS2 Type 2 Controller Twelve (12) Load Switches Six (6) Flash Transfer Relays Four (4) Loop Detectors One (1) Type 16 Malfunction Management Unit One (1) Flasher Three (3) BIU</p> <p>Indicate the percentage amount of recycled Aluminum content in this line item. 0 % recycled (AL content) Attach and reference support documentation for recycled content:</p> <p>Base Price of NEMA Size 6 "P" Cabinet (66" High, 24" Deep, 44" Wide) per specification.</p>	\$5,903.00
1B	<p>Mfg. Offered: <u>McCain, Inc.</u> Model #: <u>NEMA Size 6 "P"</u></p> <p>EXCLUDING any and all of the following options: OPTICOM Detector Cards TS2 Type 2 Controller Twelve (12) Load Switches Six (6) Flash Transfer Relays Four (4) Loop Detectors One (1) Type 16 Malfunction Management Unit One (1) Flasher Three (3) BIU</p> <p>Indicate the percentage amount of recycled Aluminum content in this line item. 0 % recycled (AL) content Attach and reference support documentation for recycled content:</p>	\$6,397.85

Item No.	Description	Unit Price Delivered
1C	<p>Base Price of NEMA Size 5 MSX Cabinet (60" High, 18" Deep, 30" Wide) per specification, with provisions for 16 Load Switches</p> <p>Mfg. Offered: <u>McCain, Inc.</u> Model #: <u>NEMA Size 5</u></p> <p>EXCLUDING any and all of the following options: OPTICOM Detector Cards TS2 Type 2 Controller Twelve (16) Load Switches Six (8) Flash Transfer Relays Four (4) Loop Detectors One (1) Type 16 Malfunction Management Unit One (1) Flasher Three (3) BIU</p> <p>Indicate the percentage amount of recycled Aluminum content in this line item. 0 % recycled (AL) content Attach and reference support documentation for recycled content:</p> <p>Adder PER INDIVIDUAL LOAD SWITCH to NEMA TS2 specification, Rated 20 Amp, 120 VAC for an incandescent lamp load.</p> <p>Mfg. Offered: <u>PDC</u> Model #: <u>SSS-86-I0</u></p>	\$ <u>6,021.51</u>
2A	<p>Adder PER INDIVIDUAL FLASH TRANSFER RELAY to specification.</p> <p>Mfg. Offered: <u>PDC</u> Model #: <u>SSS-86-I0</u></p>	\$ <u>18.34</u>
2B	<p>Adder PER INDIVIDUAL FLASH TRANSFER RELAY to specification.</p> <p>Mfg. Offered: <u>Struthers-Dunn</u> Model #: <u>430 FTR</u></p>	\$ <u>19.45</u>
2C	<p>Adder PER INDIVIDUAL LOOP DETECTOR CARD</p> <p>Mfg. Offered: <u>EDI</u> Model #: <u>LMD622</u></p>	\$ <u>75.55</u>

Item No.	Description	Unit Price Delivered
2D	Adder PER Type 16 Channel Malfunction Management Unit per NEMA TS2 Specification Mfg. Offered: ED I Model #: M MU 2 _ 1 6 L E i p	\$876.65
2E	Adder Per NEMA TS2 Flasher, Rated 25 Amp, Double Pole, with a nominal flash rate of 60 FPM Mfg. Offered: PD C Model #: S S F - 8 7	\$27.78
2F	Adder Per BIU per NEMA TS2 specifications Mfg. Offered: E DI Model #: B IU - 7 0 0	\$193.48
3A	ALL POWER PANELS MUST INCLUDE AN EDCO #SHA-1210 (OR APPROVED EQUAL) SURGE PROTECTOR Mfg. Offered: H e s c o r l s Model #: H E 3 0 0 - 1 5 COMPLETE TECHNICAL INFORMATION MUST BE INCLUDED WITH YOUR BID ON ANY SURGE ALL POWER PANELS MUST INCLUDE A STRUTHERS-DUNN MODEL #418AXXL-120VAC (OR APPROVED EQUAL) NORMALLY OPEN 60-AMP MERCURY RELAY	\$39.95
3B	Mfg. Offered: S t r u t h e r s - D u n n Model # 4 1 8 A X X L - 1 2 0 V A C COMPLETE TECHNICAL INFORMATION MUST BE INCLUDED WITH YOUR BID ON ANY DELAYS	\$34.89
GUARANTEED DELIVERY IN 90-120 CALENDAR DAYS AFTER RECEIPT OF ORDER FROM AGENCY.		Attach and Reference Warranty Information: <u>See Attached</u>