



**CONSTRUCTION SPECIFICATION FOR
THE INSTALLATION OF TRAFFIC SIGNAL CONTROLLERS**

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APPENDICES **Not Used**

622.01 **SCOPE**

This specification covers the requirements for the installation of traffic signal controllers and associated components.

622.01.01 **Specification Significance and Use**

This specification is written as a provincial-oriented specification. Provincial-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of the Ontario Ministry of Transportation.

Use of this specification or any other specification shall be according to the Contract Documents.

622.01.02 Appendices Significance and Use

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.

Appendices are developed for the Owner's use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.

The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

622.02 REFERENCES

When the Contract Documents indicate that provincial-oriented specifications are to be used and there is a provincial-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.PROV, unless use of a municipal-oriented specification is specified in the Contract Documents. When there is not a corresponding provincial-oriented specification, the references below shall be considered to be to the OPSS listed, unless use of a municipal-oriented specification is specified in the Contract Documents.

This specification refers to the following standards, specifications or publications:

Ontario Provincial Standard Specifications, Construction

OPSS 501	Compacting
OPSS 603	Installation of Ducts
OPSS 609	Grounding
OPSS 610	Removal of Electrical Equipment
OPSS 623	Traffic Actuation Equipment

Ontario Provincial Standard Specifications, Material

OPSS 1350	Concrete - Materials and Production
OPSS 2475	Uninterruptible Power Supply Systems for LED Traffic Signals

Ontario Ministry of Transportation Publications:

Ontario Traffic Signal Control Equipment Specifications (OTSCES)

CSA Standards

C22.2 No. 65-13	Wire Connectors (Tri-national standard, with UL 486A-486B and NMX-J-543-ANCE)
C22.2 No. 75-14	Thermoplastic Insulated Wires and Cables (Tri-national standard, with UL 83 and NMX-J-010-ANCE-2010)
C22.2 No. 197-M1983 (R2013)	PVC Insulating Tape
C22.2 No. 211.2-06 (R2011)	Rigid PVC (Unplasticized) Conduit

International Municipal Signal Association (IMSA)

MTO 170/332 Training Manual

Others

Caltrans Transportation Electrical Equipment Specifications (TEES)

622.03 DEFINITIONS

For the purpose of this specification the following definitions apply:

AC+ means 120 V AC, 60 Hz power bus.

AC- means 120 V AC, 60 Hz neutral bus, grounded at power source.

Conflict Monitor means a device for detecting and interrupting conflicts in the traffic signal output circuits.

Controller means a complete traffic signal control equipment package including cabinet, controller unit and all associated power control, actuation or interconnection devices.

Controller Cabinet means an outdoor enclosure used for the housing of the controller unit and all associated power, control, activation or interconnection devices.

Controller Unit means that portion of the controller assembly devoted to the selection and timing of traffic movements.

Detection means the operation of a detector sensor unit in registering the presence or passage of a vehicle or pedestrian.

Hold means a command to the controller unit which causes it to retain the existing traffic signal phase.

Interconnection means the system of cables and devices which operate traffic signal controllers at consecutive intersections in a fixed or preprogrammed timing sequence.

Interval means the part or parts of the signal cycle during which signal indications do not change.

Interval Sequence means the order of appearance of signal indications during successive intervals.

Interval Sequence Chart means a chart designating the order in which the signal phases occur and the associated signal display for each interval.

Light Emitting Diode (LED) means as defined in OPSS 620.

Microprocessor means a small, self-contained limited capability computer with the central processing unit on a single chip.

Motherboard means a printed circuit connector interface board with no active or passive components.

Phase Skip means a controller function used to provide omission of a phase in the absence of actuations on that phase.

Pre-emption means the transfer of the normal control of signals to a special control mode which may be required by railroad trains at crossings, emergency vehicles, mass transit vehicles, or other special needs.

Vehicle Extension means the time in seconds added to the green interval to permit additional green time upon actuation by a vehicle approaching the intersection.

622.05 MATERIALS

622.05.01 Conduits and Fittings

Rigid PVC conduits and fittings shall be according to CSA C 22.2 No. 211.2.

622.05.02 Low Voltage Cables

Low voltage cables single conductor, shall be stranded copper type TWH according to CSA C 22.2 No. 75.

622.05.03 Wire Connectors

Wire connectors shall be of the fork tongue compression type for terminal connections of the insulated wing nut vibration proof spring type for wire to wire connections and shall be according to CSA C 22.2. No. 65.

622.05.04 Electrical Insulating Tape

Electrical insulating tape shall be rated for 600 V at -10°C to 90°C working temperature and conform to CSA C22.2 No. 197.

622.05.05 Grounding Materials

Ground wire and connectors shall be according to OPSS 609.

622.05.06 Traffic Signal Controllers

A used traffic signal controller may be used for a temporary installation provided that it is in good condition and it complies with the requirements of the contract.

622.05.07 Concrete

Concrete shall be 30 MPa class according to OPSS 1350.

622.05.08 Solder

Solder shall be 60% tin and 40% lead mix resin core type.

622.05.09 Uninterruptible Power Supply (UPS) System

The UPS system shall be according to the OPSS 2475.

Used UPS systems may be used for temporary installations provided that they are in good condition and meet the requirements of the Contract Documents.

The information contained in this specification covers the UPS system to be used with a Model 332 controller cabinet. If the Contractor uses a different type of traffic signal controller cabinet, such as a NEMA cabinet, then the Contractor shall make all necessary modifications to suit the type of cabinet used.

Uninterruptible power supply systems for LED traffic signals shall include an Arc Flash and Shock Hazard warning label according to Figure 1. The warning sign shall be prominently displayed on the outside of each exterior door. The Contractor shall enter the location information in Figure 1 as indicated by the local MTO electrical coordinator.

The DC arc flash analysis and results in Figure 1 are applicable only to ministry traffic signal UPS systems with the following characteristics:

- a) Application – DC system for back-up power for traffic signals
- b) Nominal DC system voltage of 60 VDC or less.
- c) DC system short circuit current of 5000 A or less.
- d) Condition of electrical plant shall be in good condition and well maintained.

622.05.10 Forced Flash Relay

The forced flash relay shall be 10 Amp, 60 Hz, Double Pole Double Throw (DP DT) relay.

622.05.11 Heater/Fan Breaker

The heater/fan breaker shall be 15 Amp breaker mounted on the service panel.

622.07 CONSTRUCTION

622.07.01 Controller Supplied by the Owner

When the controller is supplied by the Owner, the controller shall be picked up and transported from the location specified in the Contract Documents. The Contractor shall ensure that all components are safely connected, secured or packaged prior to transporting the controller.

The Owner guarantees to the Contractor that the controller and all associated equipment is free of any defects.

622.07.02 Controller Supplied by the Contractor

When the Contractor supplies the controller, the Contractor shall carry out all pre-shipping shop tests specified in the Pre-installation Testing and Inspection clause.

Acceptable storage and testing facilities with temperature and humidity regulated environment shall be provided.

Each traffic signal controller cabinet shall be a model 332 traffic signal controller cabinet capable of 2 to 8 phase operation. Each traffic signal controller cabinet shall be complete with mounting pedestal base, uninterruptible power supply (UPS), 170 type traffic signal controller, conflict monitor, and all other equipment required to perform its intended function, either in standalone operation or as part of the ministry's traffic signal control system, according to the timing sheets, PHM-125 drawing, and the Contract Documents. Without limiting the foregoing, each traffic signal controller cabinet shall include the components listed in Table 1.

All traffic signal control equipment shall be according to the Ontario Traffic Signal Control Equipment Specifications (OTSCES) or the Caltrans Transportation Electrical Equipment Specifications (TEES).

Each traffic signal controller cabinet shall be supplied fully assembled and tested. The testing shall be carried out according to the MTO Operation Guidelines and Procedures in the MTO 170/332 Training Manual. The MTO 170/332 Training Manual may be purchased from the Ontario Section of the International Municipal Signal Association.

All temporary traffic signal controllers shall be equipped with an UPS system.

622.07.03 Timing of Work

The controller shall be installed and the controller cabinet shall be energized within 48 hours of shipment from the place of storage.

622.07.04 Signal Controller Cabinet and UPS Cabinet

622.07.04.01 Pole Mounted Controller Cabinet

Cabinets shall be installed complete with all mounting brackets, hardware stainless steel strapping and pole mounted conduits and fittings.

Pole mounted controller cabinets shall be located such that:

- a) A person operating the controls will be facing the intersection.
- b) The edges of the cabinet do not protrude over a sidewalk or beyond the pole in the direction of the pavement.
- c) Pole handholes and pedestrian push-buttons remain unobstructed.

622.07.04.02 Pad Mounted Controller Cabinet

The cabinet shall be installed complete with all hardware and accessories in an orientation that allows a person operating the controls to face the intersection.

The neoprene gasket shall be attached squarely and symmetrically on the bottom channel of the cabinet prior to installation, with holes for mounting bolts drilled where necessary.

Anchor bolts shall be secured in place in the locations specified in the manufacturer's instructions or where bolt holes have been provided.

Clear silicone shall be used as a sealant between the top of an extension and the bottom of the controller cabinet.

622.07.04.03 Pedestal Mounted Controller Cabinet

Pedestals for controller cabinet mounting shall be installed in an orientation that allows a person operating the controls to face the intersection.

In earth, where the excavation extends beyond the neat limits, concrete may be placed to the undisturbed ground or the concrete encasement may be formed.

The excavation shall be backfilled with native material and compacted according to OPSS 501.

Where bedrock is encountered, rock excavation shall be done such that a minimum of 600 mm length of steel pedestal can be installed in sound rock. The bottom of the pedestal shall be cut off to obtain the proper controller mounting height above finished grade. Rock excavation shall be according to OPSS 603.

The cabinet shall be installed complete with all hardware and accessories.

622.07.04.04 Power Connection

Low voltage feeder cables shall be connected to the controller cabinet. The neutral shall be connected to the AC-terminal bus.

622.07.04.05 Equipment Ground

Stranded copper ground cable shall be installed between the controller cabinet ground bus and the service ground bus. Connections shall be according to OPSS 609 and the manufacturer's drawings or instructions.

For microprocessor type controllers, the AC-terminal bus shall not be grounded to the cabinet or connected to logic ground.

622.07.04.06 Pad Mounted UPS Cabinet

The pad mounted UPS cabinet shall be installed on a pedestal manufactured of the same material as the traffic signal controller cabinet and supplied with the same lock and key. The pedestal shall be anchored to the pad and secured in place at the location specified according to the Contract Documents.

The UPS control unit and the UPS automatic switch shall be installed in the traffic signal controller cabinet according to the Contract Documents. A forced flash relay shall be installed in the traffic signal controller cabinet to allow flash operation when initiated by the UPS control unit. All wiring shall be according to the Contract Documents.

622.07.04.07 Pole Mounted UPS Cabinet

The pole mounted UPS cabinet including batteries and heating pads shall be installed complete with all mounting brackets, hardware, stainless steel strapping and pole mounting conduits and fittings.

The edges of the cabinet shall not protrude over a sidewalk or roadway pavement. The cabinet shall not obstruct access to the pole handhole and pedestrian pushbuttons.

The UPS control unit and the UPS automatic switch shall be installed in the signal controller cabinet according to the Contract Documents. A forced flash relay shall be installed in the traffic signal controller cabinet to allow flash operation when initiated by the UPS control unit. All wiring shall be according to the Contract Documents.

622.07.04.08 UPS Automatic Switch, Forced Flash Relay and Heater/Fan breaker

The UPS automatic switch, forced flash relay, heater/fan breaker and terminal block shall be installed in the signal controller cabinet according to the Contract Documents.

622.07.05 Installation of Controller Equipment

622.07.05.01 Shelf-mounted Equipment

Shelf-mounted controller equipment shall be neatly and suitably arranged on the shelves such that all preformed wiring harnesses are of adequate length to allow connections and may be trained to out-of-the-way locations. Similar items of equipment shall be grouped together. All equipment shall be installed with the front facing outward such that the main operational controls and switches are readily accessible.

622.07.05.02 Rack-mounted and Jack-mounted Equipment

Controller equipment shall be installed only in the racks or jacks intended for use with the particular item of equipment. Equipment shall be installed within the guide provided and shall be set snug so as to lock into any motherboard, channel or connection specified.

622.07.05.03 Cabinet Wall-mounted Equipment

Equipment shall be installed level and clear of nearby components. The equipment shall be bolted in place with 5 mm diameter stainless steel machine bolts, nuts and lock washers.

622.07.05.04 Identification of Equipment

Equipment used for different traffic phases or operations shall be identified by traffic phase with labels of plastic embossed tape.

622.07.05.05 Wiring and Connections

All connections to terminal boards or screw type equipment terminals shall be made with insulated fork-tongue compression connectors only when using stranded cable. All wiring to bulkhead connectors on equipment housings shall be made with military specification (MS) bayonet type connectors according to the Contract Documents or in the manufacturer's drawings.

All connector joints for use with extra-low voltage systems shall be soldered, with the joint metals preheated to the flow temperature of the solder.

Traffic signal cables shall be connected to the terminal board address as assigned on the Contract Drawings. The controller output circuit assigned shall match the proper traffic signal cable circuit. The traffic signal cable neutral(s) shall be securely connected to the AC-bus in the cabinet.

Extra-low voltage cables and interconnection cables shall have the outer jacket removed to expose approximately 150 mm of the shielding and/or drain wire. The shielding or drain wire for all cables serving a similar function shall be twisted together and soldered with a green #10 AWG minimum insulated ground lead securely connected to the cabinet ground bus.

Upon completion of wiring and connections, all incoming cables shall be bundled and held in place with nylon cable ties.

Unused conductors shall be terminated with insulated wing nut vibration proof spring connectors, leaving sufficient cable to reach terminal boards. Incoming cables shall be identified as follows:

- a) Extra-low voltage cable shall be identified with PVC sleeve wire markers having the same number as the traffic phase served.

- b) Traffic signal cable shall be identified with PVC sleeve wire markers placed over the outer multi conductor cable, naming the corner of the intersection that the cable is routed towards such as "northeast", "south-west", etc.
- c) Interconnection cable shall be identified similar to traffic signal cable, naming the direction that the cable is routed towards such as "north", "south", etc.

622.07.05.06 Controller Security

The controller cabinet shall be kept locked during all non-working times. Upon completion of the work, the controller keys shall be given to the Contact Administrator.

622.07.06 Quality Control

622.07.06.01 Pre-installation Testing and Inspection

622.07.06.01.01 General

All tests shall be completed prior to transporting the controller to the Working Area.

Traffic signal controllers, UPS systems, and other components shall be inspected prior to installation to ensure that they are according to the Contract Documents.

622.07.06.01.02 Cabinet Assembly and Components

A visual check shall be made to ensure that all components necessary to the complete controller are present and that all pre-assembled equipment is securely mounted and connected.

622.07.06.01.03 Circuit Output

The output terminal board voltage shall be tested for 108 V minimum output from load switches and for proper terminal assignment according to the manufacturer's wiring diagram.

622.07.06.01.04 Interval Sequence

With the proper programming for the intersection in operation but with modified timing values suitable to test conditions, the controller unit shall be cycled through all phases for a minimum of six hours. Controller output shall be tested to ensure that the proper phases and phase intervals appear in the correct sequence by use of a 120 V test board with lamps or by use of a 24 V test board with LED or other appropriate indicators wired to the input side of the load switches. Test results shall be confirmed a minimum of six times.

622.07.06.01.05 Actuation

With an appropriate test board, the effect of detection devices and pedestrian push-buttons in entering a call to the controller unit shall be tested. All modes of detector sensor unit program and vehicle extension calls shall be tested. Tests shall confirm that all calls are registered, activated and are associated with the correct traffic phase.

622.07.06.01.06 Conflict Monitor

The conflict monitor shall be tested by removal of the monitor programming card or by methods recommended by the manufacturer. Diode breakouts in the monitor card shall be according to the signal operation required. All flash and reset functions shall be tested.

622.07.06.01.07 Flasher

The output of flasher units and flash transfer relays shall be tested for proper functioning over a two hour period.

622.07.06.01.08 Recall

Recall switch functions for each phase shall be tested to ensure that the controller recalls to the phase selected and remains on 'hold' in the absence of a call on an opposing phase.

622.07.06.01.09 Programming

With actual phase timing for the intersection operational, the controller programming or cam breakouts shall be tested to ensure that the intended operation is accomplished. This test shall include all possible combinations of actuation and recall settings together with any special features such as advance green, phase skip, pre-emption or co-ordination.

622.07.06.01.10 Manual Control

The manual over-ride controls shall be tested for proper operation under all possible switching combinations.

622.07.06.01.11 Environmental Protection

The heater element and circuitry shall be tested for continuity and proper resistance. The ventilation fan shall be checked for proper operation in conjunction with the thermostat control system. If the average temperature during the installation period is below 5°C and falling, the cover plate shall be installed over the louvres and the heater circuit shall be prepared for operation.

622.07.06.02 Proof of Performance Testing and Inspection

622.07.06.02.01 Controller

These tests shall be performed upon installation of the controller. The controller shall be allowed to operate functionally only after all testing has been completed and all components are operational.

The Contract Administrator and ministry electrical staff shall be notified of the time and location of all testing 3 Business Days prior to the start of each test.

The work shall be inspected and tested 3 Business Days prior to the actual switch on of the signals to ensure that it according to the requirements of the Contract Documents and without limiting the foregoing, the Contractor shall ensure the following:

- a) All components are installed, tested and proven as indicated in the Contract Documents.
- b) All systems are energized and in working order
- c) The signal timing is consistent and complete, without activating the traffic signals for public display.

The testing and inspection results shall be documented in a report and submitted to the Contract Administrator within 3 Days of completion of the testing and inspection.

622.07.06.02.02 Signal Cable

All traffic signal cable circuits shall be tested disconnected for continuity and the absence of short circuits as determined by an ohmmeter test.

622.07.06.02.03 120 V Test

The operation of all signal head lamps and the absence of short circuits shall be tested by progressively connecting each active signal cable conductor to the AC+ bus through a temporary 10A fuse bypassing the load switches.

622.07.06.02.04 Interval Sequence

With the proper programming and timing functions in operation, the controller shall be cycled through all phases for a minimum of 1 hour with all signal circuits connected but with signal heads covered.

622.07.06.02.05 Actuation

All calls shall be observed to be registered and activated. Actuation equipment shall be tested according to OPSS 623.

622.07.06.03 Testing of UPS System

The UPS system shall be activated according to the manufacturer's recommendations. The Contractor shall be responsible for all testing and documentation required to establish acceptance of the installation and operation of material supplied.

622.07.06.03.01 Pre-installation Testing and Inspection of UPS System

Prior to the installation of the UPS system, the UPS system shall be tested and inspected to verify that it performs according to the manufacturer's specifications and the Contract Documents. In particular, and without limiting the foregoing, the UPS system shall be operated and tested to verify the following:

- a) Transfer time in case of power failure is less than 60 milliseconds.
- b) Voltage regulation at 120 VAC is +/- 3 percent.
- c) Frequency regulation at 60 Hz is +/- 3 Hz.
- d) Thermostat controlled battery heating mats operate according to the manufacturer's specifications.
- e) When powered by the batteries alone, the UPS system provides full signal operation at full load for a minimum of 4 hours, and then switches over to flashing operation and provides flashing operation for a further 6 hours.

Prior to installation, certification from the manufacturer stating that the product is according to the Contract Documents shall be submitted to the Contract Administrator. This certification shall include an explicit certification that, when powered by the batteries alone, the UPS system provides full signal operation at full load for a minimum of 4 hours, and then switches over to flashing operation and provides flashing operation for a further 6 hours.

622.07.06.03.02 Proof of Performance Testing and Inspection

The UPS system and all components shall be tested and inspected to verify that it performs according to the manufacturer's specifications and the Contract Documents.

The proof of performance testing and inspection shall include all testing and inspection identified under the Pre-installation Testing and Inspection clause and the testing of grounding equipment according to OPSS 609.

In particular, and without limiting the foregoing, the Contractor shall ensure that all components are installed, tested and proven as specified in the Contract Documents. In addition, the Contractor shall perform visual inspection on the installed UPS system and perform all tests on grounding of equipment according to OPSS 609.

The testing and inspection results shall be documented in a report and submitted to the Contract Administrator within 3 Days of completion of the testing and inspection.

622.07.06.03.03 Testing for New UPS System "Switch On"

A new UPS system installed at a location not previously equipped with a UPS system or to replace an existing UPS system shall be initially switched on for operation according to the following requirements:

- a) The Contract Administrator shall be given a minimum of 3 Business Days notice of when the UPS system is to be installed or switched over and 24 hours notice prior to the start of the work.
- b) All repairs or replacement of defective components shall be completed prior to activation.
- c) Switch on for operation of UPS shall not be permitted on Fridays, Saturdays, Sundays, Mondays, and statutory holidays.
- d) Switch on for operation of UPS shall be under police supervision.

622.07.07 Traffic Signal Controller Modifications

Traffic signal controller modifications shall include the following:

- a) Relocation, rearrangement repair or replacement of traffic signal controller components.
- b) Modification to actuation equipment.
- c) Modification to interconnection equipment.
- d) Removal and salvage or disposal of components according to OPSS 610.

622.07.08 Traffic Signal Control Programming and Timing

Traffic signal interval timing as provided on the Generic Signal Timing Sheet specified in the Contract Documents shall be installed into the traffic signal controller only after verifying that it is complete and consistent and all controller and conflict monitor programming is installed and all timing controls, switches and programming controls are set.

The temporary traffic signals shall have full manual mode operation functionality to allow an operator to interrupt the other modes (e.g. fixed time or actuated) and return to the previous mode when finished.

When directed by the Contract Administrator, the traffic signal operation shall be manually overridden to operate in fixed/actuated or manual as required to reduce or eliminate queuing traffic. The date, start and end time of each manual override occurrence shall be recorded in a log book as specified elsewhere in the Contract Documents.

All routine and emergency maintenance work required for 24-hour operation of the temporary traffic signals shall be performed as specified in the Contract Documents.

622.08 QUALITY ASSURANCE

The testing of the traffic signal controller and UPS system performed by the Contractor shall be witnessed by the Contract Administrator and the Ministry electrical coordinator or inspector. The Contract Administrator shall also be in attendance during the "turn-on" of the traffic signal.

622.09 MEASUREMENT FOR PAYMENT

622.09.01 Actual Measurement

622.09.01.01 Traffic Signal Controllers

For measurement purposes, a count shall be made of the number of traffic signal controllers installed.

622.09.01.02 Traffic Signal Controllers Modifications

For measurement purposes, a count shall be made of the number of traffic signal controllers modified.

622.09.02 Plan Quantity Measurement

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clauses under Actual Measurement.

622.10 BASIS OF PAYMENT

622.10.01 Traffic Signal Controllers - Item

Payment at the Contract price for the above items shall be full compensation for all labour, Equipment, and Materials to do the work.

622.10.02 Traffic Signal Controller Modifications – Item

Payment at the Contract price for the above tender item shall be full compensation for all labour, Equipment, and Materials required to modify traffic signal controllers, and such work shall include the removal, salvage, installation, relocation, rearrangement, repair or replacement of components.


622.10.03 Rock Excavation

Payment for rock excavation shall be according to OPSS 603.

**Table 1
Traffic Controller Components**

Item Quantity	Description
1	170 type traffic signal controller
1	Conflict Monitor
1	412C Prom Module with McCain's MTO 233ON1.D local intersection control program
0	412C Prom Module with McCain's MTO 245FM02.09.16 field master control program local intersection control program
1	412C Prom Module with the latest MTO approved McCain PROM Chip
8	Loop Detector, Model 222
8	Load Switch, Model 200
8	DC Isolator, Model 242
1	AC Isolator, Model 252
1	Uninterruptible Power Supply (UPS) system
1	Bell Mobility Sierra GX400 Modem with I/O module Note: To be supplied by the Owner.
1	170 Communication board M33329 Rev B or later (Serial to Ethernet).
1	Cat 5E Ethernet Cable – 2 metres
1	BMAX 824/1850 Antenna
1	GPSPSM-MSMA/MSMA (stud mount) Antenna base.

Figure 1
Arc Flash and Shock Hazard Warning Label

	
<p>Arc Flash and Shock Hazard</p> <p>Location: _____</p>	
<p>Arc Flash</p>	<p>Shock</p>
<p>Working distance: 460 mm (19 in.)</p> <p>Incident energy: 4.4 cal/cm²</p> <p>Arc Flash Boundary: 870 mm (35 in.)</p>	<p>Nominal system voltage: 60 VDC</p> <p>Limited approach: 1000 mm (40 in.)</p> <p>Restricted approach: 300 mm (12 in.)</p>
<p>Minimum PPE Requirements: PPE according to CSA Z462 Arc Flash PPE Category 2 and all other PPE required for protection from battery hazards</p>	
<p>Analysis Date: October 2015</p>	

