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CANADIAN POLICE RESEARCH CENTRE



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CENTRE CANADIEN DE RECHERCHES POLICIÈRES

TR-03-94
Mobile Computer Workstation
Minimum Standard for Police

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Markham, Ontario

TECHNICAL REPORT

January, 1994

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SUMMARY

The company of Fraser, Popovski & Associates Inc. was contracted to develop a common set of requirements for public safety agencies, in combination with a thorough industry review of current and emerging technologies. In order to accomplish this task, a survey of a large segment of the police and security community was conducted. The ensuing Standard(TR-03-94) is intended to define the elements and performance of the equipment in order to facilitate compatibility and standardization without limiting the design approach of individual suppliers.

This Standard defines the requirements for a mobile workstation from a hardware perspective. The requirements for application software, wireless communication and connectivity through radio systems are considered to a limited extend.

This Standard defines a mobile workstation device as an MS-DOS compatible computer, for installation in a vehicle, with a primary function of being a mobile data communications device. Even though the main function of the workstation is to serve as an integral part of the vehicle's radio communications system, it must be removable as well as capable for use as a personal computer.

In addition to this Technical Report are three others resulting from the contract work:

- . Common Requirements for a Police Specific Enhanced Mobile Workstation(TR-04-94)
- . Technology Developments and Industry Product Reviews for a Police Specific Enhanced Mobile Workstation(TR-05-94)
- . Future Trends and Technology Developments for Police Mobile Workstations(TR-06-94)

The Canadian Police Research Centre would like to thank Mr. Robert Fraser, Mr. George Popovski, and Mr. David Burns of Fraser, Popovski & Associates Inc., the Committee members, Ms. Francine Boucher of the Royal Canadian Mounted Police, Mr. Peter Ungar of Peel Regional Police, and Constable Graydon Patterson of Ottawa Police, and finally, all those police and security agencies that participated in this very worthwhile project.

SOMMAIRE

Une entente a été conclue avec la compagnie Fraser, Popovski & Associates Inc. en vue de l'élaboration d'une série commune d'exigences pour les organismes de sécurité publique, en plus d'un examen approfondi des technologies actuelles et naissantes offertes par l'industrie. Afin de réaliser ce projet, on a fait un sondage auprès d'une grande partie de la communauté policière et des organismes charges de la sécurité. La norme qui suit (TR-03-94) vise à définir les éléments et les caractéristiques du matériel afin de faciliter la compabilité et la normalisation sans imposer de limites aux conceptions des fournisseurs individuels.

La présente norme définit les exigences d'un poste de travail mobile du point de vue du matériel. On y traite dans une certaine mesure des exigences reliées aux logiciels d'application, à la communication sans fil et à la connectivité par des liaisons radioélectriques.

La norme définit un poste de travail mobile comme étant un ordinateur compatible avec le MS-DOS pouvant être installé dans un véhicule et servant avant tout de dispositif mobile pour la transmission des données. Même si la première fonction du poste de travail est de servir de partie intégrante du système de radiocommunications du véhicule, il doit être amovible et utilisable comme ordinateur personnel.

A cause des travaux de ce contrat trois autres rapports en résulte en plus du Rapport technique:

- . Exigences communes reliées à un poste de travail mobile amélioré destine à la police (TR-04-94)
- . Mises au point et examens des produits de l'industrie pour un poste de travail amélioré destine à la police (TR-05-94)
- Tendances futures et développements technologiques pour des postes de travail mobile destines à la police (TR-06-94)

Le Centre canadien de recherches policières aimerait remercier MM. Robert Fraser, George Popovski et David Burns de la compagnie Fraser, Popovski & Associates Inc., les membres du comité, Mme Francine Boucher de la GRC, M. Peter Ungar du Service de police régional de Peel et l'agent Graydon Patterson de la Police d'Ottawa et, finalement, tous les services de police et de sécurité publique qui ont participé à ce projet intéressant

**Minimum Standard
for a Police
Mobile Computer Workstation**

Version 1.1

January, 1994

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Preface

The following Standard for a Police Specific Enhanced Mobile Workstation (MWS) has been prepared for the Canadian Police Research Centre for publication to both industry and police agencies.

Previous to the formation of this document, a survey of Canadian Police Agencies was conducted in order to derive a common set of MWS requirements. In addition, current industry offerings and near-future technologies were reviewed.

As a result, the composition of this document is based upon a balance of feasible needs in combination with realistic technical developments, given an overall objective to:

- i) provide individual police agencies a foundation and guide for developing procurement specifications
- ii) provide industry a comprehensive overview and standard for common requirements

and finally;

- iii) facilitate the communication of police requirements to industry and inform agencies of current developments

FP&A

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1. INTRODUCTION

1.1. Objective

This Standard, for a Police specific Mobile Workstation computing device, has been developed from research which has defined a common set of requirements for public safety agencies, in combination with a thorough industry review of current and emerging technologies. The Standard is intended to define the elements and performance of equipment in order to facilitate compatibility and standardization without limiting the design approach of individual suppliers.

Publication of this Standard does not commit any agency to purchase any equipment described herein, require any agency to use this Standard for procurement, nor constitutes endorsement of any product designed and build according to this Standard.

1.2. Scope

This Standard defines the requirements for a Mobile Workstation from a hardware perspective. The requirements for application software, wireless communication and connectivity through radio systems are considered to a limited extent and do not constitute the major focus of this document.

1.3. Applicable Documents

EIA Standard RS 232. Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange.

EIA Standard RS-204. Minimum Standards for Land Mobile Communications FM or PM Receivers.

CSA Standard C108.8-M1983 (R1989) Electromagnetic Emission from Data Processing Equipment and Electronic Office Machines.

Communications Canada ICES-003 Interference -Causing Equipment standard, Digital Apparatus, Issue 1, June 199 1.

1.4. Mobile Data Workstation Definition

This standard defines a mobile workstation device as an MS-DOS compatible computer, for installation in a vehicle, with a primary function of being a mobile data communications device. Even though the main function of the workstation is to serve as an integral part of the vehicle's radio communications system, it must be removable as well as capable for use as a personal computer.

2. CHARACTERISTICS

The performance characteristics and elements of the mobile workstation specified in this Standard are recommended minimum requirements needed to assure the suitability of the device for the majority of the intended applications. In order to accommodate the wide variety of potential needs, the implementation of the Standard is left to the discretion of the individual agency, who may modify parameter requirements in order to accommodate specific applications.

2.1. Mobile Workstation Elements

2.1.1. Microprocessor

Central Processing Unit (CPU) of the workstation shall be an **Intel 80386/80486**, or compatible, type microprocessor operating with a minimum 20 MHz clock.

2.1.2. Random Access Memory (RAM)

2.1.2.1. Installed RAM

The minimum data storage capacity of the installed Random Access Memory (RAM) shall be 1 Mega (1x10⁶) bytes.

2.1.2.2. RAM Expansion Capability

The workstation RAM shall be expandable to 4 Mega (4x10⁶) bytes minimum.

2.1.3. Non-volatile Data Storage Devices

2.1.3.1. Memory containing the operating system

The MS-DOS™ or compatible operating system shall be resident in Flash ROM, battery backed SRAM (Static RAM) or a similar non-volatile memory sub-system.

2.1.3.2. Primary Non-volatile Data Storage

The workstation shall be equipped with a minimum of one non-volatile, all solid-state memory sub-system, such as a RAM card read/write device, solid-state virtual hard drive, Flash ROM or battery backed Static Random Access

Memory (SRAM), which shall be configured as the primary mass storage for programs and data.

2.1.3.3. Secondary Non-volatile Data Storage

Temperature compensated, ruggedized mechanical hard drives are acceptable as optional auxiliary secondary mass data storage devices. The temperature compensation shall be accomplished by thermostatically controlled circuit inhibiting the drive operation below certain temperature or by use of thermostatically controlled heaters for extension of the safe temperature range of operation.

2.1.4. Expansion (PCMCIA) Slots

The workstation shall be equipped with minimum of two (2) PCMCIA Type II or Type III standard expansion slots. Any combination of Type II and Type III slots is acceptable.

2.1.5. Display

- a) The workstation shall be equipped with colour or monochromatic display, VGA or SVGA compatible, with resolution of 640x480 pixels in graphics mode and 80 columns by 25 lines in text mode. **A colour SVGA is the preferred display configuration.**
- b) The display screen shall offer convenient viewing under both bright daylight and complete darkness.
- c) The size of the display shall have a minimum diagonal dimension of 180 mm (7").
- d) The horizontal viewing angle shall be 30" minimum.
- e) Manual or automatic controls for contrast, brightness and back lighting (if applicable) shall be provided.
- f) The display shall be provided with suitable plastic or tempered glass screen for protection of mechanical damage.

2.1.6. Keyboard(s)

- a) The workstation shall be equipped with a keyboard fully protected from dust and accidental liquid spills.

- b) The keyboard shall be IBM AT™ or Extended PC Laptop compatible with QWERTY layout and embedded cursor control keys.
- c) A minimum of 12 DOS compatible function keys shall be provided, either on the main keyboard or as an auxiliary keypad.
- d) The individual keys shall have minimum of 3 mm travel and a positive tactile response.
- e) The keyboard shall be illuminated for convenient viewing in low ambient light conditions.

2.1.7. Pointing Devices

A suitable pointing device such as a touch screen, build-in mouse, trackball or pen shall be provided. **Touch screen is the preferred option.**

2.1.8. Interface Ports (I/O)

The workstation shall be equipped with the following I/O (Input/Output) ports:

- a) Minimum of 1 parallel port (IBM PC™ compatible DB-25 connector)
- b) Minimum of 2 serial RS-232 ports (standard DB-25 or DB-9 sub-set connector). If the workstation is equipped with a companion vehicular docking unit containing additional serial ports, a minimum of one serial port on the workstation is acceptable.

2.1.9. Built-in Battery

- a) Workstations intended for operation outside of a vehicular installation, as a self contained portable device, shall be equipped with a rechargeable, **user removable**, internal battery, capable of providing minimum of 3 **hours** of continuous operation on a single charge.
- b) An automotive battery charger shall be provided, either built in the workstation or as a part of the vehicular installation facility.
- c) External AC powered charger capable of recharging the battery in **1.5 hours** or less (while the workstation is turned off) shall be available.

2.1.10. Quick Connect/Disconnect and Docking Devices

Workstations intended for frequent removal from the vehicular installation shall be provided with a companion vehicular docking station or equipped with a docking connector allowing single action quick connect/disconnect operation. The docking connector shall contain all I/O ports as well as the power supply terminals.

2.2. **Security**

The workstation shall be protected from unauthorized operation by a software password or a mechanical security key.

2.3. **Power Requirements**

- a) The primary power for the mobile workstation shall be obtained from an automotive power supply via the mobile installation.
- b) Workstations intended for use outside of the vehicle shall be equipped with internal rechargeable batteries.

2.4. **Physical Characteristics**

2.4.1. General

The work station may be packaged in the style of a traditional mobile data terminal for permanent installation in a vehicle or as a portable laptop/notebook computer removable from the mobile installation for stand alone use.

2.4.2. Size and Weight

The maximum acceptable dimensions and weight of the workstation are highly application dependent and are not specified in this standard.

2.4.3. Mounting Facilities

- a) The workstation shall be equipped with a mobile mount or automobile docking station compatible with the requirement for clearance for full deployment of dual airbags. The primary consideration shall be given to installation in General Motors Chevrolet Caprice Classic and Lumina and Ford Motors Co. Crown Victoria Taurus, Police version (two front bucket seats) full and mid size passenger automobiles.

- b) The mount shall swivel to allow for convenient operation.
- c) An optional mechanical key operated security lock, to prevent unauthorized removal of the workstation shall be available

2.5. Environmental Characteristics

2.5.1. Standard Test Conditions

2.5. I. 1. Standard Primary Input DC Voltage

The standard primary input voltage shall be the **13.8** Volts EIA standard automotive voltage for equipment with current consumption less than 10A. This voltage shall not deviate by more than +/- 2% during measurement performed under standard environmental conditions.

2.5.1.2. Standard AC Voltage and Frequency

The standard AC voltage for workstations equipped with facilities to operate on external AC power is 120 V, 60 Hz. This voltage shall not deviate by more than +/- 2% during measurement performed under standard environmental conditions.

2.5. I. 3. Standard Atmospheric Conditions

The following conditions shall be considered standard for mechanical and performance testing:

- a) Ambient temperature of +15° to +35°C
- b) Relative Humidity of 45% to 75%
- c) Air Pressure of 0.86x10⁵ Pa to 1.06x10⁵ Pa

2.5.1.4. Deviation from standard environmental test conditions

The temperature and relative humidity shall not vary more than indicated in Table 1 during a series of tests required for one particular performance characteristic of the given equipment.

Table 1

Temperature °C	Relative Humidity %	Air Pressure Pa
----------------	---------------------	-----------------

+20°C +/- 1%	63 to 67	0.86x10 ⁵ to 1.06x10 ⁵
+23°C +/- 1%	48 to 52	0.86x10 ⁵ to 1.06x10 ⁵
+25°C +/- 1%	48 to 52	0.86x10 ⁵ to 1.06x10 ⁵
+27°C +/- 1%	63 to 67	0.86x10 ⁵ to 1.06x10 ⁵

2.5.1.5. Test program

The test program shall consist of software subroutines for testing the performance of the various elements of the workstation including: the CPU, RAM and ROM storage, disk drives, display, keyboard and I/O devices. The program shall allow execution of any individual subroutine or a complete test in a continuous, sequential mode (looped test). The test program shall be provided by the manufacturer of the workstation.

2.5.2. Power Supply Voltage Range

2.5.2.1. Definition

The power supply voltage range is the range of power supply voltage over which the workstation will operate with a specified performance.

2.5.2.2. Method of Measurement

2.5.2.2.1. DC power source

- a) The unit shall be connected to a power supply and the voltage adjusted to 11 Volts (20% lower than the standard operating voltage). The workstation shall be turned on, the test program executed and the performance of the unit observed, after which the power shall be switched off.
- b) The power supply voltage shall be adjusted to 16.6V (20% higher than the standard operating voltage of 13.8 Volts). The workstation shall be turned on, the test program executed and the performance of the unit observed, after which the power shall be switched off.

2.5.2.2.2. AC power source

- a) The unit shall be connected to a power supply and the voltage adjusted to 108 Volts (10% lower than the standard operating voltage of 120 Volts). The workstation shall be turned on, the test program executed and the performance of the unit observed, after which the power shall be switched off.

- b) The power supply voltage shall be adjusted to 132 V (10% higher than the standard operating voltage of 120 Volts). The workstation shall be turned on, the test program executed and the performance of the unit observed, after which the power shall be switched off.

2.5.2.3. Minimum Performance Requirements

The workstation shall operate without degradation of performance over the range of the specified voltage deviation in 2.5.2.2.1 and 2.5.2.2.2.

2.5.3. Temperature Range

2.5.3.1. Operating Temperature Range

2.5.3.1.1. Definition

The operating temperature range is the range of ambient temperature over which the workstation will be functional with no more than a specified degradation of overall performance

2.5.3.1.2. Low temperature

2.5.3.1.2.1. Method of measurement

- a) The workstation shall be placed into a suitable temperature chamber at standard environmental conditions, with power switched on and test program running in looped execution mode.
- b) With the workstation switched off, the temperature shall be adjusted to -30 C° and sufficient time allowed for the chamber to reach thermal equilibrium.
- c) The workstation shall be turned on and allowed 15 minutes to stabilize.
- d) The test program shall be executed and the performance of the unit observed.
- e) If the workstation configuration includes temperature compensated mechanical hard disk drive(s), the chamber shall be adjusted to a temperature, 1°C higher than the manufacturer specified operating low temperature limit of the hard drive and allowed sufficient time to reach thermal equilibrium after which the drive test program shall be executed.

2.5.3.1.2.2. Minimum Performance Requirements

The workstation shall be fully operational. The display shall be normal without black-out or white-out areas and with sufficient contrast, brightness and resolution to allow for convenient viewing of the displayed material.

If the unit is equipped with mechanical hard disk drive(s), the average drive access time shall not be degraded by more than 50% than the manufacturers specified for standard environmental conditions.

2.5.3.1.3. High temperature

2.5.3.1.3.1. Method of measurement

- a) The workstation shall be placed in to a suitable temperature chamber at standard environmental conditions, with power switched on and the test program running.
- b) With the workstation switched off, the temperature shall be adjusted to +60 °C and sufficient time allowed for the chamber to reach thermal equilibrium.
- c) The workstation shall be turned on and allowed 15 minutes to stabilize.
- d) The test program shall be executed and the performance of the unit observed.

2.5.3.1.3.2. Minimum Performance Requirements

The workstation shall be fully operational. The display shall be normal without “black-out” or “white-out” areas and with sufficient contrast, brightness and resolution to allow for convenient viewing of the displayed material.

2.5.3.2. *Storage Temperature Range*

2.5.3.2.1. Definition

The storage temperature range is the range of ambient temperature, to which the workstation can be exposed, without damage or degradation of overall performance when operating at standard environmental conditions.

2.5.3.2.2. Low temperature

2.5.3.2.2.1. Method of measurement

- a) The workstation shall be placed in a suitable temperature chamber, switched off and with the external power source disconnected. The temperature shall be adjusted for -40°C and maintained for minimum of 12 hours, after which increased to $+25^{\circ}\text{C}$.
- b) After allowing sufficient time the unit to stabilize thermally, the power shall be switched on, and the test program executed at standard operating environmental conditions.

2.5.3.2.2.2. Minimum Performance Requirements

The workstation shall operate normally without performance degradation.

2.5.3.2.3. High Temperature

2.5.3.2.3.1. Method of measurement

- a) The workstation shall be placed in a suitable temperature chamber, switched off and with external power source disconnected. The temperature shall be adjusted for $+70^{\circ}\text{C}$ and maintained for minimum of 12 hours, after which decreased to $+25^{\circ}\text{C}$.
- b) After allowing sufficient time the unit to stabilize thermally, the power shall be switched on, and the test program shall be executed at standard operating environmental conditions.

2.5.3.2.3.2. Minimum Performance Requirements

The workstation shall operate normally without performance degradation.

2.5.4. Vibration Stability

2.5.4. I. *Definition*

Vibration stability is the ability of the workstation to maintain specified mechanical and electrical performance during and after being subjected to vibration.

2.5.4.2. *Method of measurement*

- a) The workstation shall be installed in the standard mobile mounting facility or mobile docking station and the mount attached to a suitable vibration test

table and connected to a DC power source with standard operating voltage and the test program running.

- b) The unit shall complete three 5 minute cycles of simple harmonic (sinusoidal) motion having an amplitude of 0.4 mm (total excursion of 0.8 mm), applied initially at a frequency of 10 Hz and increased at an uniform rate to 30 Hz in 2.5 minutes, then decreased to 10 Hz in 2.5 minutes.
- c) The unit shall next complete three 5 minute cycles of simple harmonic (sinusoidal) motion having an amplitude of 0.2 mm (total excursion of 0.4 mm) applied initially at a frequency of 30 Hz and increased at an uniform rate to 60 Hz in 2.5 minutes, then decreased to 30 Hz in 2.5 minutes.
- d) The above two part test shall be applied for a total of 30 minutes in the directions parallel to both axes of the base and the direction perpendicular to the plane of the base.

2.5.4.3. *Minimum Performance Requirements*

No fixed parts shall become loose or movable parts shifted in position or adjustment under either of the two conditions of vibration. While being subjected to the vibration the workstation shall meet all specified performance requirements.

2.5.5. Shock stability

2.5.5. I. *Operating Shock Stability*

2.5.5.1.1. Definition

Operating shock stability is the ability of the mobile workstation to maintain specified mechanical integrity and operational performance while being subjected to mechanical shock.

2.5.5.1.2. Method of measurement

- a) The workstation shall be installed in the standard mobile mounting facilities or a mobile docking station and connected to a DC power source with standard operating voltage.
- b) Acceleration shall be applied to the mounting facilities and may be measured by means of a suitable accelerometer. The unit shall be subjected to ten impacts in each of the three planes (total of thirty impacts). Each impact shall consist of a half sine wave acceleration of 20G peak amplitude

and duration of 11 milliseconds, During five of the ten impacts the workstation shall be turned on with the test program running.

2.5.5.1.3. Minimum Performance Requirements

The unit shall suffer no mechanical damage and shall meet all performance requirements while being subjected to the impacts.

2.5.5.2. *Storage Shock Stability*

2.5.5.2.1. Definition

Storage shock stability is the ability of the mobile workstation to maintain specified mechanical integrity and operational performance after being subjected to mechanical shock.

2.5.5.2.2. Method of measurement

- a) The workstation shall be installed in the standard mobile mounting facilities or mobile docking station.
- b) Acceleration shall be applied to the mounting facilities and may be measured by means of a suitable accelerometer. The unit shall be subjected to ten impacts in each of the three planes (total of thirty impacts). Each impact shall consist of a half sine wave acceleration of 40G peak amplitude and duration of 11 milliseconds.

2.5.5.2.3. Minimum Performance Requirements

The unit shall suffer no mechanical damage and shall meet all performance requirements after being subjected to the impacts.

2.5.6. High Humidity (Non-Condensing)

2.5.6.1. *Definition*

High humidity represents the maximum level of relative humidity at which the mobile workstation will operate without overall degradation of performance.

2.5.6.2. *Method of measurement*

- a) Place the workstation in a humidity chamber, apply standard supply voltage, with the workstation turned off, adjust the chamber for 90 to 95% relative humidity at 50°C.

- b) After 8 hours in the chamber with the high humidity and temperature maintained, turn the workstation on and execute the test program.

2.5.6.3. *Minimum Performance Requirements*

All sub-systems of the workstation, including the keyboard and the display shall function normally.

2.5.7. Electromagnetic Interference

The workstation shall meet the limits for radiated and conducted radio noise presented in the standards of **Communications Canada ICES-003 , Issue 1** and **CSA Standard C108.8M1983**

2.6. **Reliability**

Individual police agencies shall establish the reliability requirements. 10,000 operating hours is a recommended specification parameter for reliability.

2.7. **Mean Time To Repair**

Mean time to repair (MTTR) is the amount of time needed by a trained service technician to remove the workstation from the installation (if needed), analyze, repair, re-install, and test the unit. Travel time for field repairs is not included in the MTTR. The recommended MTTR is 1.4 hours or less.

2.8. **Availability**

The availability is defined as the percent of time that the workstation is available for service, and is calculated as the MTBF divided by the sum of MTTR and MTBF (Availability = { MTBF/(MTTR+MTBF) } x 100 [%]). Assuming MTBF of 10000 hours and MTTR of 1.4 hours, the workstation shall provide 99.98% functional availability

3. **DOCUMENTATION**

The following (minimum) documentation shall be provided:

- a) Operating Instructions. Operating instructions on a computer diskette or a VHS video tape are preferred.

- b) **Installation** Guide
- c) Basic Troubleshooting Guide
- d) Preventive Maintenance Guide
- e) Warranty Information

4. TABLE 2 MINIMUM REQUIREMENTS QUICK REFERENCE

Reference	Description	Minimum Requirement
2.1.1.	CPU	80386 / 80486, 20 MHz
2.1.2.1.	Installed RAM	1 Mega byte minimum
2.1.2.2.	RAM Expansion	4 Mega bytes minimum
2.1.3.1.	Operating System Residence	FLASHROM / SRAM
2.1.3.2.	Primary Non-volatile Storage	RAM Card / SRAM / FLASH ROM
2.1.3.3.	Secondary Non-volatile Storage	Rugged, Temp. Compensated Hard Drive
2.1.4	Expansion (PCMCIA) slots	Two (2) Type II or Type III PCMCIA Slots
2.1.5.	Display	Monochrome or colour, VGA or SVGA, 640x480 pixels, 180 mm diagonal min. A colour SVGA display is the preferred option.
2.1.6.	Keyboard	Extended PC Laptop, Illuminated, QWERTY, 12 Function Keys, min. 3 mm Key Travel.
2.1.7.	Pointing Device	Touch Screen preferred, Trackball or Pen.
2.1.8.	I/O Ports	One (1) Parallel, Two (2) RS-232 Serial Ports
2.1.9.	Built-in Battery	Rechargeable, removable, 3 Hours of Operation, 1.5 Hour Recharge Time
2.1.10	Docking Devices	Quick Connect/Disconnect, Includes I/O Ports and Power
2.2.	Security	Software Password or Key Lock
2.3.	Power Requirements	Primary Power - 12 V Automotive, Secondary - AC Power, 120 V
2.4.2.	Size and Weight	Not Specified
2.4.3.	Mounting Facilities	Mobile Mount or Docking Station, Swivel, Compatible with Dual Air Bags. Optional Key Lock
2.5.1.1.	Standard Primary Input Voltage	13.8 V +/- 2 % DC, 120 V +/- 2 % AC
2.5.1.3.	Standard Atmospheric Conditions	Temperature +15 °C - +35 °C, Relative Humidity 45 -75 %, Air Pressure 0.86x10 ⁵ Pa
2.5.2.3.	Power Supply Voltage Range	+/- 20 % DC, +/- 10 % AC
2.5.3.1.	Operating Temperature Range	- 30 °C to + 60 °C
2.5.3.2.	Storage Temperature Range	- 40 °C to + 70 °C
2.5.4.	Vibration Stability	EIA RS 204
2.5.5.1..	Shock Stability, Operating	20 G, EIA RS-204 Method
2.5.5.2..	Shock Stability, Storage	40 G, EIA RS-204 Method
2.5.6.	High Humidity	90 % Relative Humidity, 8 Hours @ 50 °C
2.5.7.	Electromagnetic Interference	CSA C108.8 M1983 (R1989), ICES-003, Issue 1
2.6.	MTBF	10,000 Hours
2.7.	MTTR	1.4 Hours
2.8.	Availability	99.98 %
3.0	Documentation	Operating Instructions, Installation Guide, Basic Troubleshooting Guide, Preventive Maintenance Guide, Warranty Information