

## 11 CSR 50-2.401 General Specifications

### (1) Background Information.

(A) The Missouri Analyzer System (MAS) has been designed around a personal computer system to provide the capability to make modifications which are needed after the analyzers are put into use. There are a number of additional features that could be developed in the future to improve repair procedures providing substantial benefits to the program. Initially, the additional software capability will be used to improve the correlation of the emissions test procedure with the federal certification test procedure by reducing the number of pattern failures. The MAS will be capable of performing uniform and consistent tests for Missouri's annual motor vehicle safety and emissions inspection program.

#### (B) Features of the MAS will include:

1. Vehicular emission measurements of hydrocarbon (HC), carbon monoxide (CO) and carbon dioxide (CO<sub>2</sub>). (Oxygen (O<sub>2</sub>) shall be offered as an option);
2. Engine RPM measurements;
3. Exhaust dilution determinations;
4. A bar code scanner for more convenient and accurate data entry; and
5. A dedicated printer for vehicle inspection reports or other general purpose printouts other than state inspections; a dedicated printer to fill in all state certificates; data recording on standard 1.44 Mb 3.5" floppy disks and; a hard disk with a minimum of forty megabytes (40Mb); information display to the MAS operator; bidirectional communications via dial-up telephone line and modem; and fully menu driven, interactive, simple microprocessor controlled operation.

(C) The MAS shall be designed and constructed to provide reliable and accurate service in the automotive repair and service center environment. The manufacture of a MAS shall make every effort to maximize man/machine interface simplicity.

1. The MAS analyzer shall utilize the programming language of "C" unless otherwise approved in writing by the state.
2. The software used in the analyzer shall consist of a process control system as well as data look up files. Security

shall be provided that will prevent any unauthorized modifications of the software.

3. Where the word analyzer is used in the specifications, it refers in most cases to the analyzer system, which includes all of the components which make up a certified MAS.

4. The state reserves the right, at any time, to acquire analyzers currently in-use at licensed stations for the purpose of evaluating compliance with the certification specifications. When an analyzer is pulled from the field, manufactures shall supply the station from which it was removed with a loaner in working condition. Manufactures shall pay for all necessary shipping and transfer costs for the loaner and the analyzer selected for random testing.

5. The hard disk shall be partitioned so that at least thirty megabytes (30 Mb) are allocated for all of the required programs, all of the vehicle test and calibration records, and the disk operating system. All of the proprietary programming developed to meet the requirements of the specifications shall be contained in the remaining storage consisting of at least ten megabytes (10 Mb). The state will consider allowing the manufactures to use additional mass storage in the thirty megabyte (30 Mb) section for optional software applications if the programs stored there will benefit the motor vehicle inspection program.

(2) List of Abbreviations.

AI	Air injection
AC	Alternating current
ASCII	American Standard Code for Information Interchange
BIOS	Basic input output system
CAT	Catalytic converter
CE	Conversion equipment
cm	Centimeters
CO	Carbon monoxide
CO2	Carbon dioxide
CM	Convertible MAS
CRT	Cathode ray tube
Cyl	Cylinder
DC	Direct current
DIS	Direct ignition system
DNR	Missouri Department of Natural Resources
E	Either
ECSI	Emission control systems inspection

ECS	Emission control system
EPA	Environmental Protection Agency
ESC	Emission standards category
ETL	Environmental testing laboratory
F	Fahrenheit
F	Fail
Fed	Federal
FS	Full scale
GVW	Gross vehicle weight
GVWR	Gross vehicle weight rating
HC	Hydrocarbon
Hp	Horsepower
I/M	Inspection/maintenance
IMCS	Inspection/maintenance control system
ITM	Idle test MAS
K	Emission reduction factor
L	Left
LET	Low emission tune-up
LIC	License
MVI	Motor vehicle inspection
N	None
NAI	No air injection
NBS	National Bureau of Standards
O <sub>2</sub>	Oxygen
OBD	On-board diagnostics
OEM	Original equipment manufacturer
P	Pass
PEF	Propane equivalency factor
PCV	Positive crankcase ventilation
PPM	Parts per million
PRE	Previous
QA	Quality assurance
R	Right
ROM	Read only memory
RPM	Revolution per minute
SAE	Society of Automotive Engineers
SHP	State Highway Patrol
SPEC	Specially constructed vehicle
SS	Special standards
T	Tampering found
U	Unknown
UL	Underwriters' Laboratory
uP	Microprocessor/microcomputer
VDC	Volts direct current
VEC	Vehicle emission control label
VIC	Vehicle inspection certificate
VIN	Vehicle identification number

VIR            Vehicle inspection report # Number

(3) High Throughput Testing Capability. The emission analyzer shall be designed so that it is capable of testing at least ten (10) vehicles per hour without experiencing excessive hangup or other deleterious effects. A study shall be submitted to the state indicating the maximum number of tests per hour that were achieved using the analyzer submitted for certification. A brief description of the study methodology used by the manufacturer to make the throughput determination shall be included in the study. This evaluation shall not include the time required to enter vehicle identification data or to conduct the underhood inspection.

(4) Manufacturer's Assurance. The manufacturer shall certify to the state that the exhaust emission analyzer meets or exceeds the performance specifications of this document.

(5) Applicable Codes. The manufacturer shall certify that MAS submitted for certification complies with all applicable Missouri and federal administrative, safety, ergonomic, licensing and certification requirements. The state is not aware of any governmental or regulatory agency which will accept ignorance of the law as an excuse for noncompliance. The state feels that if manufacturers are going to market a product, it is their responsibility to determine if their product meets applicable laws and regulations. Outside of Underwriters' Laboratories (UL) or Environmental Testing Laboratory (ETL) approval, the state is not aware of additional requirements that the analyzers might be subject to in the station environment. However, the state cannot be held responsible, nor will the stations be held responsible, to pay for analyzer modifications required by regulations which the manufacturer was not cognizant of when the equipment was built. Therefore, at a minimum, it is recommended that in addition to UL and ETL, manufacturers contact the Federal Communications Commission (FCC) regarding radio frequency interference and the Occupational Health and Safety Administration (OSHA) regarding the storage and use of analyzers and calibration gases in the garage environment.

(6) Tamper Resistance.

(A) Controlled access design shall be the responsibility of the manufacturer and is subject to approval by the state. Analyzer operators shall be prohibited, to the state's satisfaction, from creating or changing any inspection or test results, state programs or state data files contained in the MAS.

Manufacturers shall utilize special BIOS partitions or equivalent (approved by the state), as well as other appropriate software and hardware provisions deemed necessary by the state to protect the files and programs. File and program protection may consist of mechanical systems in combination with electronic/software systems. The protection features shall prevent access to the secured floppy disk drive and portions of the hard disk containing I/M programs and inspection and test data. The control-break key (or its functional equivalent) giving access to the DOS shall not be activated except through the use of a special password and a blind entry on the QA/State menu. The password shall be chosen by the state at the time of certification testing. Access to the DOS shall not be available to the manufacturer's service technicians.

(B) In addition, the emission analyzer and the sampling system shall be made tamper-resistant to the state's satisfaction. At a minimum, the manufacturer shall develop tamper-resistant features to prevent unauthorized access through the cabinet. Microswitches, keyed locks and software algorithms requiring the use of a password which would be changed on a quarterly basis beginning January 1 by the manufacturer would all be acceptable provided the physical or logical design effectively prevents unauthorized access. For example, a mercury switch would not be effective if the analyzer can be tipped over to one side to trigger the switch. A keyed lock would not be effective if it is placed in a position that allows the analyzer cabinet to be flexed slightly to bypass the lock.

(C) Manufacturers may offer analyzers with additional floppy disk drives that can run optional software application programs. However the optional floppy disk drives shall be secured behind a locked compartment door (or its functional equivalent approved by the state) which uses the same key as the lock on the door securing the VIC. In addition, both of these doors shall have a microswitch (or state-approved equivalent) which prevents the printing of certificates whenever either door is open.

(D) If tampering occurs, a software lockout algorithm shall be activated which aborts any existing inspection sequence and prevents further state inspection until lockout is cleared by an SHP representative or other representatives with specific written authorization from the state. Software obtained independently by the inspector mechanic shall not be bootable from the optional floppy disk.

(E) The lockout system shall be designed so that it can be activated by an SHP representative from the MVI State Audit Menu. Only SHP representatives, or other representatives with specific written authorization from the state, may remove lockouts put in place from the MVI State Audit Menu. Manufacturers shall develop a system by which their service technicians shall be prevented, by some method approved by the state, from clearing SHP installed lockouts.

(F) It is the intention of the state to allow the MAS to be used with the systems being developed by the SAE committee attempting to develop standardized specifications for a general vehicle diagnostics link. The tamper-resistance features shall be designed so that these and other available software programs, especially those which deal with repair and diagnostics of vehicles, can be added at a later date.

(G) Optional software packages supplied by the manufacturer shall not interfere with the normal operation of the state inspection and testing software, shall not comprise the tamper-resistance of the analyzer (such as give the inspector mechanic access to the DOS) and be approved by the state prior to performing official state inspections.

(7) Microcomputer Compatibility

(A) A standard microcomputer must be included in the MAS analyzer and is to be used to control all MAS functions. The computer shall be a state certified and approved unit, including all features defined in Appendix A at the end of 11 CSR 50-2.407. Each vendor is to develop DOS executable programs for each major state required function. These programs shall-

1. Control each of the MAS functions and timing;
2. Examine and obtain values from all of the MAS sensors;
3. Read and write MAS information to diskette in standard DOS 1.44 Mb 3.5" format;
4. Prepare/format new floppy disks;
5. Archive floppy disk information between floppy disk and hard disk as indicated in section (8);
6. Copy the MAS identification information from the hard disk onto each new floppy disk;

7. Auto answer authorized modem telephone calls, receive and forward files on demand, permit external state access to the DOS; and

8. Read bar code labels from VIN labels, certificates, ECS guides and vehicles, and approved state representative identification cards.

(B) The state reserves the right to add additional programs and functional performance requirements, up to the technical limits of the hardware, to improve the safety and emission inspection program.

(8) File Backup.

(A) Directory and File Structure.

1. The hard disk shall have directories with the following names in the root of the C:/ directory: DOS, MASDATA, COMM and MAILIN. The manufacturer may name directories for use of the MAS software but must provide the previously mentioned directories for state use. The computer path must include the ROOT(C:/), the MAS software directory, DOS and COMM.

2. The C:/ MASDATA directory shall contain the following files: "MAS.DAT", "MAS.HST", "CAL.DAT", "AUDIT.DAT" and "LOCKOUT."

3. At the conclusion of each test or gas calibration, the test or calibration record (including aborted tests) shall be placed in the appropriate file indicated as follows:

A. MAS.DAT: This file will contain test records, from the start of any test, which have not been collected by the state. A mirror copy of this file, having the same name will be stored on the root directory of the "A:" floppy disk. Both files will be updated at the same time by the test software. The software must also test for the existence of the file before writing to the file.

B. MAS.HST: This file will contain archived test records that have been collected by the state. This file will have the "MAS.DAT" file appended each time "MAS.DAT" is collected by modem or a state representative. When a state representative selects "INSTALL NEW DATA DISK" from the MVI State Audit Menu, a message shall be displayed instructing the state representative to wait while the file is appended.

C. A "Bookmark" record shall be placed at the top of each "MAS.DAT" file before it is appended to the archive file. This record shall be of the same length as the test records. If any provision is made by manufacturer for reading the archive file, this record must be identified and ignored.

D. Bookmark record fields.

1. BOOK string identifier	4
2. Station No.	7
3. MAS No.	4
4. BLANK	16
5. Time-24 hour (HHMM)	4
6. Date-(MMDDYY)	6
7. Undefined	858
Total	900

E. CAL.DAT: This file shall contain gas calibration records. A mirror copy of this file, having the same name will be stored on the root directory for the "A:" floppy disk. Both files will be updated at the same time by the test software. The software must also test for the existence of the file before writing to the file.

F. AUDIT.DAT: This file shall contain records of the performance audits, all practical/demo test, and all additions, changes and deletions to the inspector mechanic file. This file shall reside in the C:/ MASDATA directory, and will be collected by the state on a regular basis. The file shall be initialized after each data collection. A mirror copy of this file, having the same name, will be stored on the root directory of the "A:" floppy disk. Both files will be updated at the same time by the test software. The software must also test for the existence of the file before writing to it.

G. LOCKOUT: This file shall contain the lockout data (Y or N) and must be read each time the MAS software is loaded.

H. The following information shall be retained as a valid vehicle test record on the hard disk and floppy disk, in file MAS.DAT, if the reset switch is activated or the analyzer is switched off after an inspection has been initiated and the vehicle identification number has been entered:

- (I) Record number (field 1);
- (II) Station number (field 2);
- (III) MAS number (field 3);

- (IV) Inspector mechanic number (field 8, 9, 10, 11, 16 or 17);
- (V) Date of inspection (field 12, 13, 14, 15, 18 or 19);
- (VI) Inspection start time (field 20, 21, 324, 325, 326, 327, 328, 329, 330, 331, 332 or 333); and
- (VII) VIN number (field 23).

I. As soon as the vehicle identification number is entered, the information in subparagraph (8)(A)3.6. shall be recorded on the test record before the test will be allowed to proceed.

The test record shall be complete in length. Pad blank fields with spaces.

J. The C:/ COMM directory shall contain the communications software and the file PASSWORD.DAT. Contained in PASSWORD.DAT will be a twelve to eighteen (12-18) month password list (twelve to eighteen (12-18) records). The password will be a nine (9) character string and will be used for one (1) calendar month. Password files will be provided by the state upon analyzer certification and for annual software updates.

K. PASSWORD.DAT record fields:

<u>Field</u>	<u>Description</u>	<u>Length</u>
1.	Month identifier	2
2.	Year identifier	2
3.	Password string	9

L. The C:/ MAILIN directory will contain the DNRMAIL.TXT file when downloaded by the state for display on the MAS screen. The MAS software must look for this file on startup to display, if found.

(B) Duplication of Files on the State "A:" Drive.

1. In order to limit MAS downtime after serious hard disk malfunctions which may require a new or reformatted hard disk, the manufacturer shall store duplicate files on the state "A:" floppy disk drive. The files to be duplicated are the Licensed Inspector Mechanic Name/License Number/Access Code file, Station Number, MAS Number and the CONTROL.DAT Files. Each time the files are modified, the changes must be written to both sets of the file. The mechanic backup file name to be used is MECHBACK.

2. If the file cannot be found on the hard disk, the MAS can restore the file from the floppy disk. this will mean less downtime for the station in restoring access codes and station information.

3. The MAS must write these files to the floppy after a disk change is made by a state representative.

(9) Required Printers.

(A) Printing Requirements. The MAS unit is to use two (2) printers.

1. The first printer is an impact printer to print vehicle inspection reports and general purpose (nonstate) documents. Continuous eight and a half by eleven inches (8 1/2" x 11" finished) fan-fold, pin fed paper is to be used.

2. A second, separate impact printer shall be dedicated to the task of filling in designated information on the certificates. Continuous, fan-fold, preprinted state certificates will be used. The certificate will consist of two (2) copies that will be torn away from a perforation on the bottom of the form. The finished size of the existing certificates are eight and a half by eleven inches (8 1/2" x 11") (not counting the additional width required for the pin-feed mechanism and printer margins). The top copy of the certificate may be printed on up to twenty-four (24)-pound paper, and carbonless copies on up to fifteen (15)-pound paper. The printer shall print information on the certificate using IBM-8 characters (ASCII), ten (10) characters per inch and eighty (80) characters per line. This is intended to ensure uniformity between manufacturers for style, size and number of characters per inch.

## (B) Security.

1. The inspection certificate printer and the certificate storage area shall be located in a secured area. Access to the area securing the printer and certificates shall be available only to the inspector mechanic at the station or SHP representative. The certificate storage area shall have a redundant security system utilizing both a hardware lock and a software lock which meet state approval. The secured area containing certificates and the inspection certificate printer shall be designed so that the same key can be used to open any access doors which secure the optional floppy disk drives. If any of these doors are opened, a microswitch (or equivalent) shall be used which prevents the printing of certificates of inspection.

2. The purpose of the hardware lock is to allow the station to physically secure certificates against theft when the analyzer is not being used for state inspections. The physical security shall prevent access to certificates which protrude outside of the printer and cabinet that could be pulled out by unauthorized personnel. The lock should be easily interchangeable to allow the vendor to change locks or combinations in the event security is breached or when personnel changes occur.

3. The purpose of the software lock is to restrict access to loading and aligning certificates prior to printing, clearing paper misfeed or jam problems, etc. and to provide a record of the personnel performing those functions. After an inspector mechanic has entered his/her access code to initiate a state inspection and after the criteria for issuing a certificate has been met, the inspector mechanic shall be allowed to check the certificate for alignment and make adjustments as necessary without entering additional access codes or aborting the inspection.

4. If tampering occurs, a software lockout algorithm shall be activated which aborts any existing test sequence and prevents further inspections and testing until the lockout is cleared by an SHP representative or other representatives with specific written authorization from the state.

(C) Storage.

1. The secured space designed to store unused certificates shall measure nine and a half inches deep eleven inches wide (9 1/2" x 11") and at least five inches (5") tall. The inspector mechanic will sign the certificate and a copy will be provided to the customer and a copy inserted in to the analyzer. The used certificate drop box shall be of the approximate size of the certificate and shall be designed to keep the certificates in sequential order. The certificate drop box need not be a secured area, but shall prevent certificates from being spilled out when access is gained.

2. The area containing the certificates shall be located so that proper tension is maintained on the certificates as they are fed up through the printer.

3. There shall be unlimited access to the test report printer so that paper can be easily replaced, printer jams can be cleared and ribbons can be replaced. Only SHP representatives, manufacturer representatives, authorized repair personnel and authorized station personnel shall be allowed access to the inspection certificate printer (see Appendix A at the end of 11 CSR 50-2.407 for more printer information).

(10) Vehicle Repair and Diagnostics Application.

(A) The analyzer's primary purpose will be to run the state inspection and test and record inspection/test data in a manner specified in this rule. The state's intent is to allow diagnostic and repair information in the software.

(B) Manufacturers may offer a diagnostics and repair software application program as an option to the analyzer purchaser. Methods for diagnosing or repairing components or systems will be allowed provided that they in no way shall interfere with any of the state inspections or contradict the low emissions tune-up procedure.

(C) Manufacturers that already offer optional emissions diagnostic and repair applications may submit those for state review. At a minimum, the guidance presented in the manufacturer's application must be easily accessed and be focused and organized on the basis of emissions failures.

(D) As an option, the analyzer manufacturer may establish a mechanism to obtain access to off-site repair information systems requested by the purchaser using the telephone modem (operating as a "dumb" ASCII or VT100 terminal) contained in the MAS so long as it does not interfere with the state inspection system.

(11) Capability to Access OBD Fault Codes.

(A) Manufacturers may offer the ability to access the on-board diagnostics (OBD) system on vehicles failing the state inspection. Although the MAS will not be required to have provisions for accessing vehicle OBD systems when the program starts, the provisions may be offered by the manufacturer as an option. The analyzer may be equipped with the necessary ancillary devices and associated software when the analyzer is submitted for certification.

(B) Analyzer manufacturers may develop provisions for reading fault codes contained in vehicle on-board computer systems using the SAE Standardized Link when those specifications become available if the state feels, after consultation with the manufacturers, that this feature can be added to the MAS. If the capability to access OBD fault codes using the SAE Link is added, it will function in much the same manner as the existing OBD check except that it will be automated and will only be usable on 1994 and later model year vehicles. The MAS would prompt the inspector mechanic to access the vehicle's OBD port, decode the fault codes and display results on the screen, print a short description of the codes on the VIR and record the fault codes on the test record. An analyzer submitted for MAS certification must include information on the ability to later upgrade the system to include OBD and SAE Link diagnostics.

(12) Master Reference Table.

(A) A Master Reference Table may be provided in the future. The state will transmit this information to the analyzer manufacturers as soon as a decision has been made to proceed with the Master Reference Table.

(B) Up to five megabytes (5 Mb) total information shall be provided to accommodate the reference table.

(13) Annual Software Modifications.

(A) Equipment manufacturers shall provide a maximum of three (3) state-approved software updates during the two (2) calendar years beginning at the implementation date of the Missouri enhanced I/M program at no additional cost to the purchaser. The software version shall be indicated on the analyzer status screen, on each vehicle test record and the inspection certificate. The version number shall consist of a four (4) digit alphanumeric code to be made up of the last two (2) digits of the year followed by a two (2) digit version number. The version of software used in running every vehicle test shall be indicated on the test record. The analyzer manufacturers shall notify the state in writing that they wish to make a software update and provide an implementation schedule, submit an affidavit signed by the chief executive officer or company president stating that the software update complies with state specifications, obtain written state approval prior to use of the software update in official state inspections, and install the correct software version number so that it is recorded to the test record and printed on each VIC.

(B) All state-required software updates done by the manufacturers shall cause the software version number to change as indicated on the Analyzer Status Screen (see 11 CSR 50-2.403). In addition, the updated software version number shall be recorded on the test record and inspection certificate as soon as it is installed. There will be a separate field on the test record indicating the software version currently in use and another field used to indicate the version number that the software will be updated to when the clock activates it. The state will then be able to search the records prior to the update activation date to determine how many analyzers have been updated by looking at the update field. The update field in the test record shall go blank when the update is activated.

(C) The state does not anticipate that extensive modifications to the software will be required. Rather, the state anticipates that only minor modifications or additions will be needed. Areas in the software where changes or additions might be required include: preconditioning procedures and emission test sequences, various look-up tables, diagnostic and repair procedures, data communication procedures, criteria affecting emission standards selection or referral of failing vehicles to referee stations, vehicle exemptions, capability to read on-board diagnostics fault codes and vehicle pass/fail criteria. Other areas not specifically mentioned may also be

affected at some point, but the state does not expect to make changes in all these areas at once.

(D) Additional software updates required between the annual updates shall be prepared by analyzer manufacturer on 3.5" PC/MS-DOS standard 1.44 Mb diskettes, designed to be installed by the SHP representatives or other authorized representatives. The analyzer shall also be designed to allow updates to be installed via the modem, at the state's option. If the software update is accomplished by modem, the analyzer shall identify itself by brand name and model number, when the system is accessed by the state.

(E) Manufacturers shall include the cost of software updates in the original purchase price of the analyzer.

(14) Bar Code Readers.

(A) Noncontact bar code scanners and all necessary interface software and hardware designed to read labels meeting SAE specifications J1877 and J1892 will be required on all analyzers. The information scanned shall be stored on the test record and will be used to identify the VIN.

(B) When the enhanced I/M program is implemented, analyzers delivered to stations are required to be equipped with an RS232 connector (which meets noise hardened electrical standards preventing electromagnetic interference from vehicle ignition systems) and the software needed to use the bar coded information in the test procedure. The state will allow submission of an alternative connector to the RS232 for consideration but reserves the right to make the final determination in each case. Analyzers submitted for certification shall be equipped at that time with fully functional noncontact scanners capable of reading bar coded labels meeting SAE J1877 and J1892 (see 11 CSR 50-2.407 (Appendix B)).

(C) In addition to collecting the VIN, scanners may also be required to enter certificate numbers and emission application information from a state-approved abbreviated lookup manual. Another function may include reading inspector mechanic and state inspector ID badges. The state inspector ID badges will be provided by the state and will be written in three (3) of nine (9) bar code format and otherwise consistent with applicable SAE specifications.

(D) The state recommends that the manufacturers contact the

vehicle manufacturers to inquire about obtaining bar coded labels for testing purposes. The state will allow vendors to submit contact readers for consideration.

(15) Training. The analyzer shall contain a training feature that will allow an inspector mechanic or student to complete the inspection procedure without generating an official inspection record or certificate. Vehicle inspection reports shall indicate to the satisfaction of the state that they are for training only and cannot be used for certification. The word VOID shall be printed in large letters on the face of the certificate. In addition the certificate number and sticker number fields of the certificate shall be printed with the word VOID. The training feature will be used by the state representatives for evaluating inspector mechanic performance, by the manufacturers for training purchasers of analyzers or by analyzer owners to train new employees. The training application shall not require the use of an inspector mechanic's access code or allow access to secured areas of hardware or software. The display shall show a message throughout the inspection that this is a training exercise and not a test for certification.

(16) State Representative Access to Test/Calibration Records.

(A) The software shall be designed to include provisions for retrieving and copying the test record file or designated portions of it for QA and enforcement purposes using floppy disk access. As indicated previously, the bar code reader shall be able to scan authorized bar code identifications cards. Once these cards are utilized by the state, the software shall be designed to prevent access by individuals without proper bar code identification.

(B) There shall be a menu item on the MVI State Audit Menu that allows a record search to be performed. The search shall locate, display and printout test and calibration records based on VIN, date/time, vehicle owner's name or certificate number information entered by an SHP representative. Once a test record is located, the QA/state representative shall be allowed to review the previous test records as well as those which follow the target record.

(17) Clock/Calendar.

(A) The MAS unit shall have real a time clock/calendar which shall make available the current date and time. Both time and date shall be in standard IBM PC format and used to set the computer's date and time on power-up.

(B) Analyzers shall store the date and time on the test record. For the display, the date may be indicated numerically by month, day and year (separated with a slash between each), or with the month spelled out and the day and year separated by commas. The time shall be on a twenty-four (24)-hour clock.

(C) The date/time, along with the time the inspection or test started and when it ended, is to be included on the test record. The start time is when the inspector mechanic's access code is entered and the end time is when the MAS data is written to the test file.

(D) If the clock/calendar fails or becomes unstable (as referenced to the initial time set at power-up), the MAS unit shall be locked out from state testing and a message shall be displayed indicating that service is required.

(E) Resetting of the clock shall require controlled access available only to the state representatives and the manufacturer's service technician. The access mechanism or procedures shall be approved by the state.

(F) The analyzer clock/calendar shall be equipped with a battery backup feature and a battery with a five (5) year expected life.

(G) The clock/calendar shall be used to allow the station to use the MAS software at times specified by the state. All software updates shall be activated by clock/calendar when directed by the state.

(18) Lockout Notification. The analyzer shall alert the operator of any lockout situation by prominently displaying a message on the CRT.

(19) Manual Testing Mode.

(A) The MAS shall be capable of being switched to an operations mode that will allow the MAS to be used as an ordinary garage emission analyzer for general automotive repair work and

diagnostics.

(B) If, during an inspection, the MAS is switched over to the diagnostic mode, the command shall be ignored.

(20) Software Loading. The inspector mechanic shall not have to load the microcomputer's operating or applications software to operate the MAS. On each POWER ON of the MAS, the MAS shall automatically do all microcomputer component self diagnostics, memory checking and loading of all necessary operating software without intervention by the inspector mechanic. Upon satisfactory computer component check-out, the applications software is to present a menu of available MAS operations. All offered features are to be menu-driven. For each feature, a context sensitive, on-line help facility is to be provided which can be accessed preferably with a single key stroke. If the MAS does not have a satisfactory computer component check-out, the applications software is to lockout the unit.

(21) Documentation.

(A) The MAS software shall be fully documented. One (1) copy of the documentation listed as follows shall be submitted to the state unless otherwise requested by the state. Manufacturers shall agree, in writing (signed by the chief executive officer (CEO) of the company), to submit copies of the program listings to the state upon request, within a timeframe satisfactory to the state, or whenever a decision is made by the manufacturer to voluntarily suspend or terminate production of the MAS. The state does not expect to ever have a need to review the program listings and, therefore, will not require that they be included with the application for certification. However, the state reserves the right to require that copies be provided, if the need does arise. Software documentation shall include at least the following:

1. Complete program listings, including the source code as well as the object code as well as the object code, in both machine readable and paper form, shall be provided upon request. They are not required to be submitted with the application for certification;

2. Functional specifications;

3. Functional flowcharts of the manufacturer's software;

4. Sample inputs and outputs from all processes;

5. Detailed interface information on the optical bench including the identification of protocol and output specifications; and

6. All DOS file layouts with file names, file types, file security, field names, field types, field sizes and field editing criteria.

(B) Documentation provided by the vendor to meet this requirement will be treated as proprietary information by the state, provided that material is clearly marked as confidential. Gross marking of all material as confidential is not acceptable; only that material which is proprietary should be marked.

(C) These requirements are imposed to permit the state to both operate and check out the MAS units. Doing so requires full file descriptions and either the detailed code or a full set of MS-DOS routines with all necessary protocol to perform the MAS functions.

(D) The purpose of the requirement for detailed code is to provide the state with a mechanism to assure continued performance of inspection stations in the event that a major supplier should fail. The state is not interested in any disclosure of proprietary information, nor in the detailed operations of vendor code. However, it is essential that all of the necessary working code, schematics, drawings and so forth be available in case of demise.

(22) Availability of Circuitry. All integrated circuits used in the MAS shall be types and brands that are presently in common usage. Custom ROM programs developed by the manufacturer for building the analyzer are allowed.

(23) State Access. The SHP representatives must have access to update certain portions of the analyzer software. The software shall be designed to include an MVI State Audit Menu as indicated in 11 CSR 50-2.403. Access to the MVI State Audit Menu will require entry of an access code that will be entered by a state representative when the initial station inspection is accomplished. The analyzer's testing functions shall not operate until the MVI State Audit Menu access code is entered. Information contained in the files associated with the State

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Representative Menu shall be hidden in software to the state's satisfaction. The access code shall consist of thirteen (13) alphanumeric characters.

(24) Data and File Transfer.

(A) Modes.

1. All calibration, vehicle test records and other MAS files shall be capable of being transferred from the MAS in three (3) ways-

A. By use of the 3.5" PC/MS-DOS standard 1.44 Mb floppy disk on which data is stored;

(B) By means of a standard IBM PC fully compatible RS232 serial port with the baud rate selectable for at least twelve hundred (1200), twenty-four hundred (2400) or ninety-six hundred (9600); and

(C) Via an internal (that is, located inside the cabinet) modem and connection to a telephone line. This modem (see 11 CSR 50-2.407 (Appendix A) for baud rate and other specifications is to be attached to a telephone line installed in the facility. It is to be activated in a receive mode during hours specified by the state. Upon contact, the MAS is to verify authorization for access via password and then respond to various commands as defined in the Modem Protocol for access via password and then respond to various commands as defined in the Modem Protocol Document, available on a need-to-know basis from the state.

(B) Modem.

1. A telephone line, separated from the power cord, shall be provided for the modem. The telephone line shall be enclosed in a protective cable meeting state and UL approval. Alternative methods to protect the telephone line may be submitted to the state for approval.

2. The telephone line shall be plugged in at the times specified by the state. If a dial tone is not found, or if inspection data is not transferred to the state at the specified time, an appropriate message shall be displayed the next time the power to the analyzer is turned on.

A. If the last data transfer occurred twenty-seven (27) or more days ago, a message shall be displayed the next time the power is turned on, as follows: "Please be sure the telephone cord is connected when the power is turned-off tonight. The analyzer will soon be called by the state for data transmittal."

3. If the power necessary to activate the modem cannot be supplied in another manner, the analyzer shall have a main power switch located on the back panel with a power-off/ standby mode switch on the front panel. The operator shall be instructed in the Owner's Manual to leave the main power switch on and the telephone line plugged when the state accesses the data each month. Exceptions to this may be made when the analyzer needs to be relocated or damage to the telephone line will result. The power-off/standby mode shall provide the power necessary for the telephone modem to remain in a standby condition.

4. During warmup, the analyzer shall display messages from the state, sent via the telephone. The display format shall include a header indicating that a message from the state is being displayed. The file name where the message will be held will be called DNRMAIL.TXT. If more than one (1) page is to be displayed, the inspector mechanic shall be instructed to strike any key to continue. When the entire message has been displayed, a menu shall be displayed as follows. Press one (1) of the following numbers:

1. Print a copy of the state message
2. Read the message again
3. EXIT

5. When the inspector mechanic selects EXIT, the message shall be erased.

6. If the inspector mechanic selects #1, the message shall be printed out, the screen cleared and the Main Menu displayed. If the inspector mechanic selects #2, the message shall be displayed and the menu displayed again. If the inspector mechanic selects #3, the analyzer shall display the Main Menu.

(C) Diskettes. Diskettes must be removable and show full compatibility with existent state microcomputers. Both a 3.5" floppy disk drive and the port must be secured logically and physically to permit only duly authorized state and manufacturer access. Vendor methodology to restrict access shall be approved by the state.

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(D) File Compression.

1. The state will provide to the manufacturers a utility to compress the data prior to data transmission. The data shall be compressed each time the MAS is put into communication mode (see Appendix A following 11 CSR 50-2.407).

2. The compression utility will be provided at no charge for distribution within the emission inspection area.

(25) Test Record Storage Capacity.

(A) The MAS floppy disk drive shall have the capability to store at least one thousand (1000) current test records not counting those on backup. Storage shall be maintained with power off.

(B) The analyzer shall display a prominent warning message to the operator when the floppy disk storage space is running low. The display shall indicate the number of remaining records available when space for fifty (50) or fewer inspections are left.

(26) On-line Pollution Control Equipment Manual.

(A) The analyzer shall be designed to provide future access to an on-line pollution control equipment manual. The manual shall be accessible from outside the state inspection sequences by manufacturer developed software. However, access to the manual from outside the inspection sequences must not allow an operator to enter the state inspection sequences.

(B) The on-line pollution control equipment manual shall prompt the inspector mechanic for the vehicle information necessary to identify which pollution control equipment should be installed on a particular vehicle (that is, PCV, evaporative control, air pump).

(27) State Certification.

(A) Pursuant to other requirements within 11 CSR 50-2.401. no licensed station may perform official inspections after implementation of the enhanced I/M program on October 1, 1990 without an analyzer system model which has been certified as a MAS. In order to be certified as a MAS, a sample of a candidate model must be submitted to the state for review and approval, under procedures designed by the state. Upon approval, the state

will document model certification for the responsible manufacturer and will add the model to its list of approved MAS units. In addition, the state will periodically distribute this list to licensed inspection stations. However, the state retains the authority to decertify a model at any time if production models used by licensed stations are found to be inconsistent with this specification.

(B) Manufacturers may submit for certification models which vary from these specifications. However, in order for a model to be certified, software functions must be consistent with the analyzer algorithm and the manufacturer must demonstrate to the satisfaction of the state that-

1. The performance of the model is equivalent or superior to a model which meets these specifications fully; and

2. There will be no extra cost or inconvenience to the state if the model is certified (see Appendix A following 11 CSR 50-2.407).

(28) Telephone Requirements.

(A) Each safety and emission inspection station shall be equipped with private telephone service utilizing an RJ11 jack connector, or state-approved functional equivalent, to which the emission analyzer shall be connected at time specified by the state.

(B) The Missouri State Highway Patrol shall be notified immediately when phone numbers are changed or service is interrupted.

(C) The telephone service shall be maintained in good working order.

