

## PUBLIC-INTEREST FINDING FOR PROPRIETARY-MATERIAL USE

ROUTE: VARDES NO: VAR

PROJECT NO: VAR COUNTY: VAR

PROJECT DESCRIPTION: Programmatic approval.

FHWA OVERSIGHT:  YES  NO

PROPRIETARY MATERIAL:

Aries Field Processor (AFP)

AFPjrDC - AFPJRDC-16ATOM-1-GB-4GBSSD

AFPav - AFPAV-11ATOM-1-GB-4GBSSD

AFPproav - AFPPROAV-16ATOM-1-GB-4GBSSD

AFPfusion - AFPFUSION-16ATOM-1-GB-32GBSSD

Manufactured by Iron Mountain Systems, Inc.

### 1. Description of Need:

The ITS Technology Deployment Division of the Indiana Department of Transportation is seeking approval to create a recurring special provision and ultimately incorporate into the Standard Specifications equipment essential to the creation and maintenance of the INDOT ITS network.

AFP is a computer, designed for field conditions. It is using LINUX based operating system, developed and supported by IMS, Inc.

Required functionality includes:

- Support unique addressing in the network using Internet Protocol address.
- Provide interface between existing network (TMC) and vehicle detectors (Microloops or Microwave).
- Provide interface between existing network (TMC) and CCTV camera, including software based digital video coding/decoding and transfer video to TMC and PTZ control commands from TMC to camera.
- Provide interface between existing network (TMC) and Highway Advisory Radios, including storage of the .wav Play Files.
- Provide interface between existing ATIS network (TMC) and Dynamic Message Signs (overhead and portable).
- Provide interface between existing network (TMC) and Travel Time signs.
- Provide interface between existing network (TMC) and Weigh-in-Motion data collection stations.

### 2. Product History:

These devices have been chosen at the inception of the system approximately 15 years ago and since are the main part of each remote component. Over 500 of AFP are currently being used in Indiana. They demonstrate very high reliability (over 96% uptime) and maintainability. Desired product is currently listed on INDOT Approved Materials List for Traffic Signal and ITS Control Equipment under ITS AFP Controller. Testing was conducted according the ITM No. 949-10P

**3. Product Availability:** AFP, manufactured by Iron Mountain Systems, Inc., is only product on the market, meeting all requirements. Although there are computers on the market carrying LINUX based Operating System, capable of interfacing with some of the vehicle detection and video systems, there is none, which is rugged enough for field conditions and can interface all types of equipment and existing network. There were no attempts by the manufacturers to present their products to be tested to ITM No. 949-10P. Google search for Field Processor returns only devices, designed specifically for purpose and sold with the System (purpose) for which they are designed.

**4. Product Cost:** There is no equipment on the market, meeting the requirements, to make a cost comparison with. The next closest product is Dell Latitude E6420 suite ranging in price from \$1,374.00 to \$4,552.00. However, these products will not communicate with the existing field hardware.

**5. Project Compatibility:** AFP is the only computer on the market that is compatible with existing ITS hardware. Application matrix below describes which AFP model can be used to interface various (listed) technologies and TMC. The lowest cost AFP model is being selected for any particular project based on the technology needs.

Model \ Application	AFPjrDC	AFPav	AFPproav	AFPfusion
Vehicle detection < 4 interfaces	X	X	X	
Vehicle detection 20 interfaces			X	
Bluetooth Travel time	X	X	X	
Video Encoder (MPEG4)		X	X	
CCTV Control	X	X	X	
DMS Control (Overhead)	X	X	X	
DMS Control (Portable)	X			
HAR Function	X	X	X	
Vehicle operation				X
Cost	\$3,302.00	\$4,800.00	\$5,311.00	\$3,580.00

**6. Maintenance:** Desired equipment is designed such a way, that most of maintenance functions: monitoring up/down time, restoring functionality, updating/upgrading – can be done remotely, which drives down maintenance cost. Training is available on line in Wiki Notes, accessible for tech personnel from any location in Indiana. Low failure rate (less then 5% including “acts of God”) and short order turn around time results in the minimal storage requirement.

**7. Engineering Analysis:** This application is programmatic by nature and unique not to a specific ITS project, but to the ITS architecture that is already in place. AFP is essential component that allows communication between TMC and field hardware. The specifications are needed for synchronization with existing system and not unique to the specific project.

**8. Expanded Economic Analysis:** Due to the fact, that there is no equipment on the market to do comparison life cycle analysis, it may be stated that actual yearly maintenance cost is low. Iron Mountain Systems, Inc is providing 5 years warranty for AFP. The average life cycle of the AFP is evaluated as 6 to 10 years. There are units currently in service installed in 2007. Annual replacement rate, including damage done by lightning, is 25 units. With average cost of \$4,500.00, maintenance cost per unit does not exceed \$180.00. Replacement of AFP is predominantly driven by technology progress, rather than wear.

**9. Contractual or Performance Implications:** Use of desired items does not impose any restrictions on the use of other items on the contracts.

**10. Attach Supplemental Documentation:** Attached are:

- a) INDOT ITS Architecture;
- b) ITM # 949-10P Field Processor/Controller.

**11. Length of Time that Approval is Effective:** 10/2011 until 10/2014

Prepared By: Konstantin Veygman

Field Engineer

INDOT-ITS Technology Deployment Division

Date: 10/5/2011

APPROVED: David B. Hel Date: 6 Oct 2011  
INDOT Deputy Commissioner  
Engineering Services and Design Support

APPROVED: E. J. H. Hel Date: Oct. 17, 2011  
Federal Highway Administration

**INDIANA DEPARTMENT OF TRANSPORTATION  
OFFICE OF MATERIALS MANAGEMENT**

**PROCEDURE FOR BENCH TESTING, FIELD TESTING, AND APPROVAL LIST  
REQUIREMENTS FOR ITS FIELD PROCESSOR/CONTROLLER  
ITM No. 949-10P**

**1.0 SCOPE.**

- 1.1 This test procedure covers the methods that a Field Processor/Controller is evaluated in the field, and is placed, maintained, or removed from an approval list.
- 1.2 The values stated in either English or acceptable SI metric units are to be regarded separately as standard, as appropriate for a specification with which this ITM is used. Within the text, SI metric units are shown in parenthesis. The values stated in each system may not be exact equivalents; therefore each system shall be used independently of the other, without combining values in any way.
- 1.3 This ITM may involve hazardous materials, operations, and equipment and may not address all of the safety problems associated with the use of the test method. The user of the ITM is responsible for establishing the appropriate safety and health practices and for determining the applicability of regulatory limitations prior to use.

**2.0 REFERENCES.**

**2.1 Indiana Standards.**

806 Approval List Requirements

**2.2 NTCIP Standards.**

1103 NTCIP Transportation Management Protocol (TMP)  
9012 NTCIP Testing Guide for Users

**3.0 TERMINOLOGY.** Definitions for terms and abbreviations shall be in accordance with the Department's Standard Specifications, Section 101 and NEMA TS-2 Section 1.

**4.0 SIGNIFICANCE AND USE.** This ITM is used to evaluate, approve, maintain approval, and remove from the approval listing an Field Processor/Controller which is placed on the Department's List of Approved Traffic Signal and ITS Control Equipment. Each model of the Field Processor/Controller will be bench tested and field tested separately.

**5.0 APPARATUS.**

**5.1** Complete ITS fully functional system

**6.0 SAMPLING.** The manufacturer shall furnish, at no cost to the Department; one randomly selected production-run Field Processor/Controller of each model for bench testing and field testing.

**7.0 PROCEDURE.**

**7.1** The manufacturer of the material shall submit the Preliminary Product Material Evaluation Form (Appendix A) for each model type of Field Processor/Controller which the manufacturer is requesting to be added to the listing.

**7.2** The manufacturer of the material shall submit with the Evaluation Form the following:

**7.2.1** An invoice showing an initial zero dollar amount (\$0.00) for the use of the evaluation sample material during the evaluation. The invoice shall also list the deferred cost of the material that the Department would pay if the material is purchased instead of returned upon the successful completion of the evaluation.

**7.2.2** A certification of environmental testing shall be furnished with each major unit approval request indicating the unit has been tested and is in accordance with the environmental requirements from NTCIP. The certification shall specify the model and serial number of the Field Processor/Controller tested. A complete log of each test shall be provided to the Department and will be maintained by the Department. The log shall indicate which, if any, component failed during the test, when the component failed, and the steps taken to repair the Field Processor/Controller. The log shall include the date of testing, name and title of person conducting the tests, a record of conditions throughout the tests, and a temperature and humidity verses time chart. The maximum report interval of any chart shall be 24 h. The chart shall be from a recording machine used to monitor the status of the environmental chamber during testing.

**7.2.3** Operation and Maintenance Manual(s), including theory of operation, schematics and components parts listing

**7.2.4** One randomly selected production run Field Processor/Controller for bench testing and field testing

**7.2.5** List of required software and any additional items required to realize the full potential of the product

ITM 949-10P

7-9-10

- 8.0 SUBMITTAL REVIEW.** The documentation, including the environmental testing, will be reviewed for usability of the Field Processor/Controller with Department approved NTCIP based ITS system in Indiana. The manufacturer's recommended schedule and extent of maintenance will be reviewed for acceptability.
- 9.0 BENCH TESTING.** The Field Processor/Controller will be bench tested for compatibility with all ITS equipment assemblies used by the Department. The Field Processor/Controller will be verified for full NTCIP functionality and full manufacturer's claimed optional functionality.
- 10.0 FIELD TESTING.** The field testing of the Field Processor/Controller will consist of installing the Field Processor/Controller in an actual ITS cabinet for a period of up to 12 months to monitor the following:
- 10.1** A log of any failures for the Field Processor/Controller.
  - 10.2** The relative ease of use for the field personnel
  - 10.3** Overall build quality and expected lifecycle of the Field Processor/Controller. The build quality and expected lifecycle shall be comparable with existing Field Processor/Controller
- 11.0 REPORT.** A final report will include the notations and findings from the electronic bench test and field testing results and documentation.
- 12.0 APPROVAL LIST**
- 12.1 Approval of Field Processor/Controller.** The Field Processor/Controller model may be placed on the approval list when the following conditions are met:
    - 12.1.1** A potential net benefit to the Department is realized by inclusion of the item on the approved list.
    - 12.1.2** The unit passes the NTCIP environmental requirements .
    - 12.1.3** The required documentation is submitted.
    - 12.1.4** The bench and field testing are completed with satisfactory results.
    - 12.1.5** No excessive amount of routine or periodic maintenance is required.
    - 12.1.6** There are no failures with any of the different types of ITS assemblies or individual components used by the Department.
    - 12.1.7** All manuals, documents, and required software to realize the full potential of Field Processor/Controller are submitted.

12.1.8 Only minimal maintenance operations were necessary during the field testing.

**12.2 Maintaining Approval.**

12.2.1 The ITS Technology Deployment Division of TMBU shall be notified each time any update or revision is made, and an explanation of the benefits of the change shall be submitted. Operations Support Division will determine if and to what extent a revision is to be placed into field operation and may fully re-evaluate the Field Processor/Controller with the revision.

12.2.2 If the manufacturer makes any changes to an approved model to correct a non-NTCIP compliant or safety issue, the Department shall be notified immediately. The manufacturer shall correct all existing equipment purchased by the Department either directly, by contract, or through agreement prior to the change being incorporated at the manufacturer's production level.

12.2.3 A design change to an approved model shall require a submittal of documented changes. At the discretion of the Department, resubmission of the model for testing and evaluation may be required. Permanent addition or removals of component parts or wires, printed circuit board modifications, or revisions to memory or processor software, are examples of items that are considered to be design changes.

**12.3 Removal from Approval List.** Field Processor/Controller will be removed from an approval list for, but not limited to, the following reasons:

12.3.1 Changes in the Field Processor/Controller components or production process that fail testing and/or evaluation

12.3.2 If three consecutive years elapse without furnishing the Field Processor/Controller.

12.3.3 Performance of the Field Processor/Controller no longer meets the intended purpose

12.3.4 Recurring similar product failures indicate a manufacturer's defect

**INDIANA DEPARTMENT OF TRANSPORTATION  
DIVISION OF OPERATIONS SUPPORT  
PRELIMINARY INFORMATION FOR PRODUCT MATERIAL EVALUATION**

Trade Name \_\_\_\_\_ Date \_\_\_\_\_

Manufacturer \_\_\_\_\_ Patented? Yes \_\_\_\_\_ No \_\_\_\_\_ Applied for \_\_\_\_\_

Address \_\_\_\_\_  
Street No (P. O. Box) City State Zip Code

Representative \_\_\_\_\_ Phone No ( ) \_\_\_\_\_

Address \_\_\_\_\_  
Street No (P. O. Box) City State Zip Code

Product Information \_\_\_\_\_  
\_\_\_\_\_

Materials Composition \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\*\* Is this product considered HAZARDOUS MATERIAL when disposing of non-used or surplus materials? Yes \_\_\_\_\_ No \_\_\_\_\_

\*\* What is the shelf life of this material? Years \_\_\_\_\_ Months \_\_\_\_\_ N/A \_\_\_\_\_

Recommended Use-Primary \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Recommended Use-Alternate \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Advantages and/or Benefits \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\*\* Materials specifications by manufacturer, installation/operation manual, maintenance manual, literature, test results, guarantee, hazardous material data sheets, plan, picture or sketch must be submitted with this form. In the case of electronic devices the schematic diagram, parts list, and parts layout diagram must be submitted for each printed circuit board within the device.

Meets following specifications:

AASHTO \_\_\_\_\_

ASTM \_\_\_\_\_

OTHER \_\_\_\_\_

Use by highway authorities or similar agencies in other states.

Agency	Years Used	Remarks
_____	_____	_____
_____	_____	_____
_____	_____	_____

\*\* Has product ever been evaluated by and rejected for use by a governmental agency?

Yes \_\_\_\_\_ No \_\_\_\_\_ If yes, by what agency and for what reason?  
\_\_\_\_\_  
\_\_\_\_\_

Will demonstration be provided? Yes \_\_\_\_\_ No \_\_\_\_\_

Availability: Seasonal \_\_\_\_\_ Nonseasonal \_\_\_\_\_ Delivery at site \_\_\_\_\_

After receipt of order, are quantities limited? Yes \_\_\_\_\_ No \_\_\_\_\_

\*\* Will FREE SAMPLES be furnished? Yes \_\_\_\_\_ No \_\_\_\_\_  
If yes, Quantity Furnished \_\_\_\_\_

\*\* If the sample is salvageable, do you desire to have it returned Yes \_\_\_\_\_ No \_\_\_\_\_

(Desired return of salvageable samples will be at the supplier's expense.)  
(The manufacturer agrees upon the return of salvageable samples, such samples may be damaged or non-operable. Normal care will be taken that the samples, when returned, are in operable condition; INDOT, however, does not guarantee that the returned samples are operable.)

Will laboratory analysis be furnished? Yes \_\_\_\_\_ No \_\_\_\_\_

\*\* Approximate cost \_\_\_\_\_ Royalty Cost \_\_\_\_\_

When was the product introduced to the market? \_\_\_\_\_

This product is an alternate for what product? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

Will warranty be provided? Yes \_\_\_\_\_ No \_\_\_\_\_ If yes, for how long? \_\_\_\_\_

Background of company, including principal products \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

What offices of the Indiana Department of Transportation have been contacted?

\_\_\_\_\_

Additional Information \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(Attach additional sheets as necessary)

Person furnishing information \_\_\_\_\_

Name

Title

Address \_\_\_\_\_

Street No (P. O. Box)

City

State

Zip Code

Items marked \*\* MUST BE RESPONDED TO or further consideration may not be given for this product.

Please mail this form to:

Manager, Office of Traffic Engineering  
100 N. Senate Ave., Room N925  
Indianapolis, IN 46204-2249

If INDOT elects to evaluate your product/material - traffic signal equipment will be shipped to:

Electronic Technician I  
Indiana Department of Transportation  
7701 East Melton Road  
Gary, IN 46403

While all other materials to be evaluated will be shipped to:

ITS Field Engineer  
Indiana Department of Transportation  
8620 East 21<sup>st</sup> Street  
Indianapolis, IN 46219

INDOT has developed ITS infrastructure in urban areas statewide. It consists of vehicle detection, Closed Circuit TV cameras (CCTV), Highway Advisory Radio (HAR) sites, Dynamic (Variable) Message Signs (DMS), Travel Time Signs (TTS), and Virtual Weigh-in-motion (VWIM), Weigh-in-Motion (WIM), and Automatic Traffic Recorder (ATR) stations.

All data collected by the detectors and cameras is distributed to the Traffic Management Centers (TMCs). Information addressed to the driving public is sent from TMCs to the DMSs, HARs, and TTSs.

Communication to and from TMCs is provided via hybrid wireless/fiber optic means. The communication system is based on a "Back Bone", consisting of several nodes called Communication Data Processors (CDPs), connected with each other via redundant circuits (licensed wireless or fiber optic). The TMC is connected directly to the CDPs. Networking and communication equipment located at the TMC comprises the TMC Core Devices group. Field Core Devices installed at CDPs and major nodes include FCC Licensed and non-licensed wireless equipment, terminating and interfacing Fiber Optic equipment, and other networking equipment.

A typical INDOT ITS System consists of up to 3 distinguished groups of devices, described as follows.

1. Traffic Management Center (TMC) Core Devices. This group consists of major networking and communication equipment.
2. Field Core Devices. This group consists of FCC Licensed and non licensed wireless equipment, terminating and interfacing Fiber Optic equipment, and all networking equipment.
3. Field Devices. This group consists of:
  - a) Public information devices: DMS, TTS, HAR;
  - b) Detection devices: CCTV Cameras, non-invasive inductive detectors, microwave detectors;
  - c) Communication and networking devices: field processors, radios, fiber optic equipment, field switches.
  - d) Traffic Monitoring System devices: Virtual Weigh-in-motion (VWIM), Weigh-in-Motion (WIM), and Automatic Traffic Recorder (ATR): system controllers, roadway sensors, and communication and networking devices.

Existing ITS infrastructure is being expanded according with ITS Strategic Deployment Plan located at:

[http://trafficwise.org/stratplan/TrafficManagementStrategicPlan\\_v2-4.pdf](http://trafficwise.org/stratplan/TrafficManagementStrategicPlan_v2-4.pdf)

Each ITS project involving Federal Funds adheres to the National ITS Architecture and the Systems Engineering Process as defined in 23 CFR 940. A Systems Engineering form is being completed and submitted to the FHWA for review and approval on each federally funded ITS project.

located within the communications shed at the mm128 and is shown in Figure 4.6.

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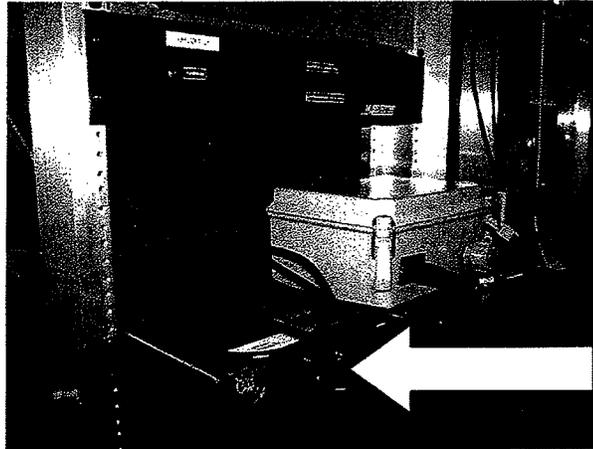


Figure 4.6 Aries Field Processor @ mm 128 ITS Site

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The AFP is a Linux based machine which collected and binned sensor data using an Iron Mountain Systems, Inc. program. Data recorded by the AFP consisted of summary files for each of the sensors, as well as unprocessed data from the 3M Canoga detector cards. The overall data collection architecture, including applicable Internet Protocol (IP) addresses is shown in Figure 4.7.

# AFFpro

Iron Mountain Systems Inc.  
Government Contracting



IN MIC OUT  
HAR

1540  
1541  
1542  
1543

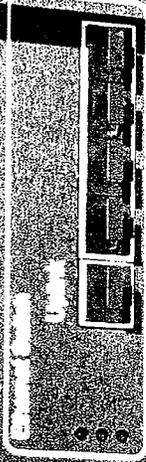
USB

VGA

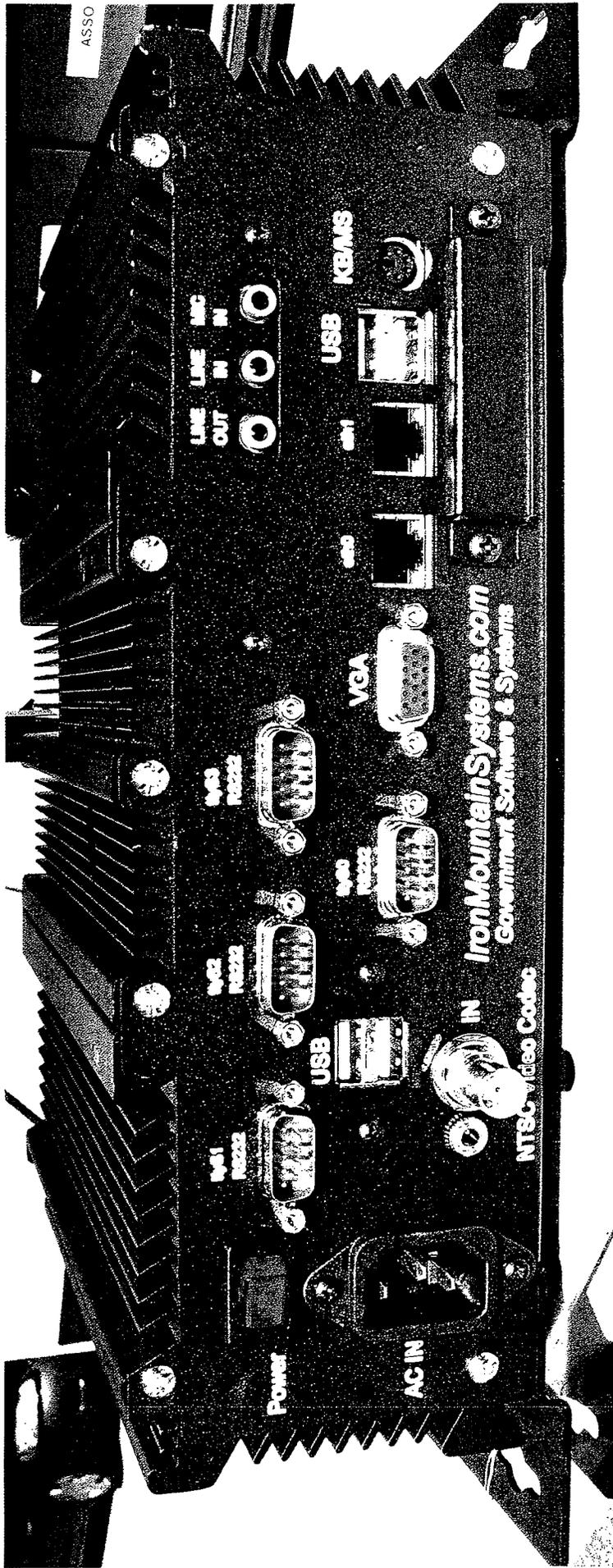
LAN

USB

1544



FireWire  
USB



ASSO

LINE OUT  
LINE IN

USB  
KBMS

eth0

eth1

VGA

VGA

VGA

VGA

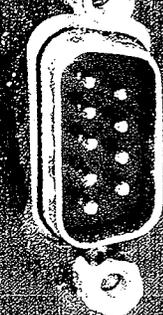
USB

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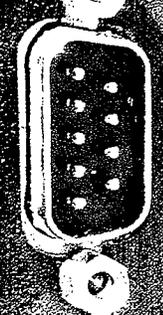
NTSC Video Codec

Power

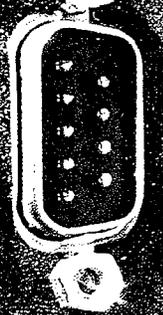
AC IN



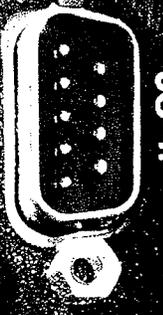
ttyS0



ttyS1



ttyS2

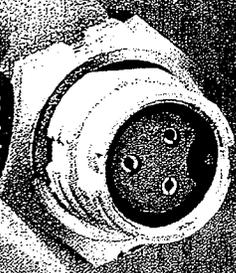


ttyS3

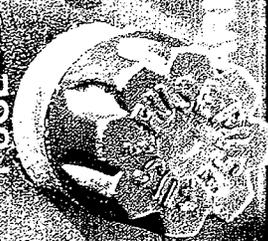
Power ON



12 VDC  
PWR IN



FUSE



eth0



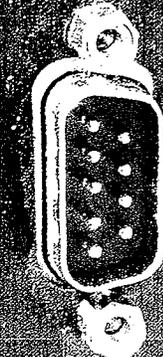
eth1



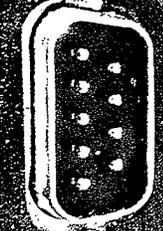
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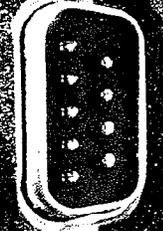
ARMIES Field Processor



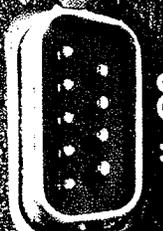
ttyS0



ttyS1



ttyS2

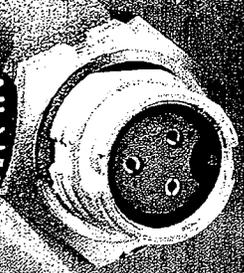


ttyS3

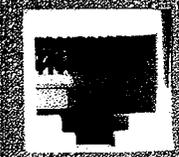
Power ON



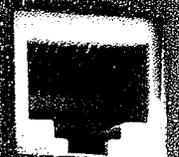
12 VDC  
PWR IN



FUSE



eth0



eth1

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ARMIES Field Processor