NASA-CR-193156

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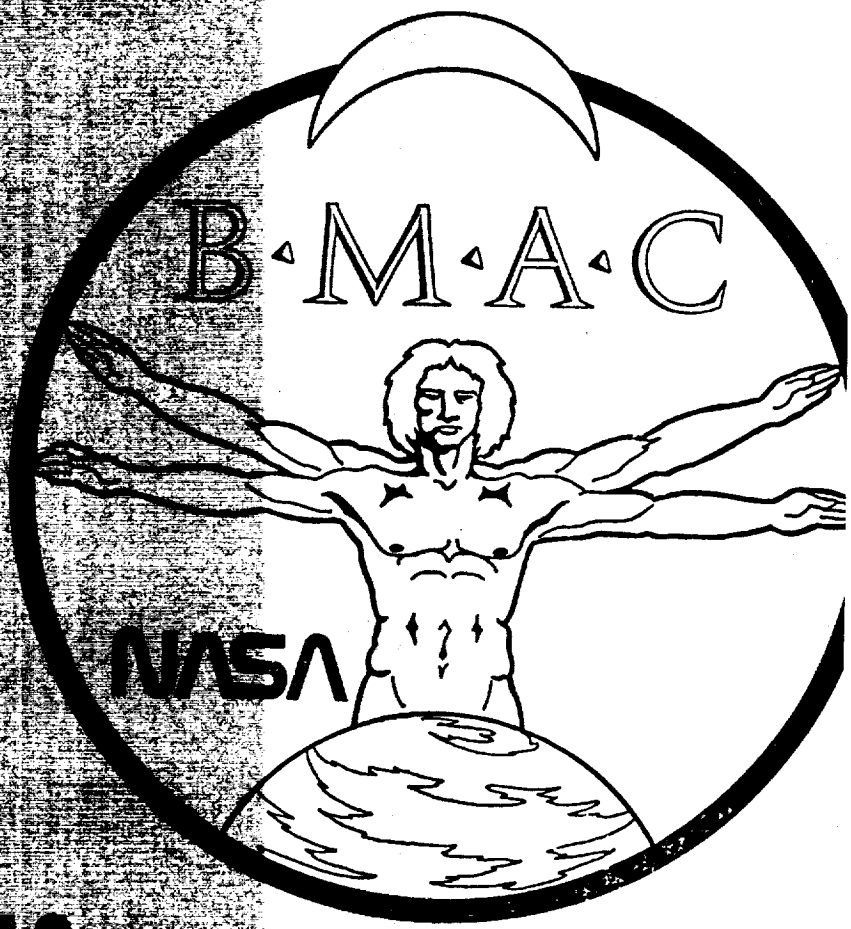
BIOMEDICAL MONITORING AND COUNTERMEASURES

Biomedical Facility Hardware Catalog



NASA
National Aeronautics and Space Administration

Lyndon B. Johnson Space Center
Houston, Texas 77058

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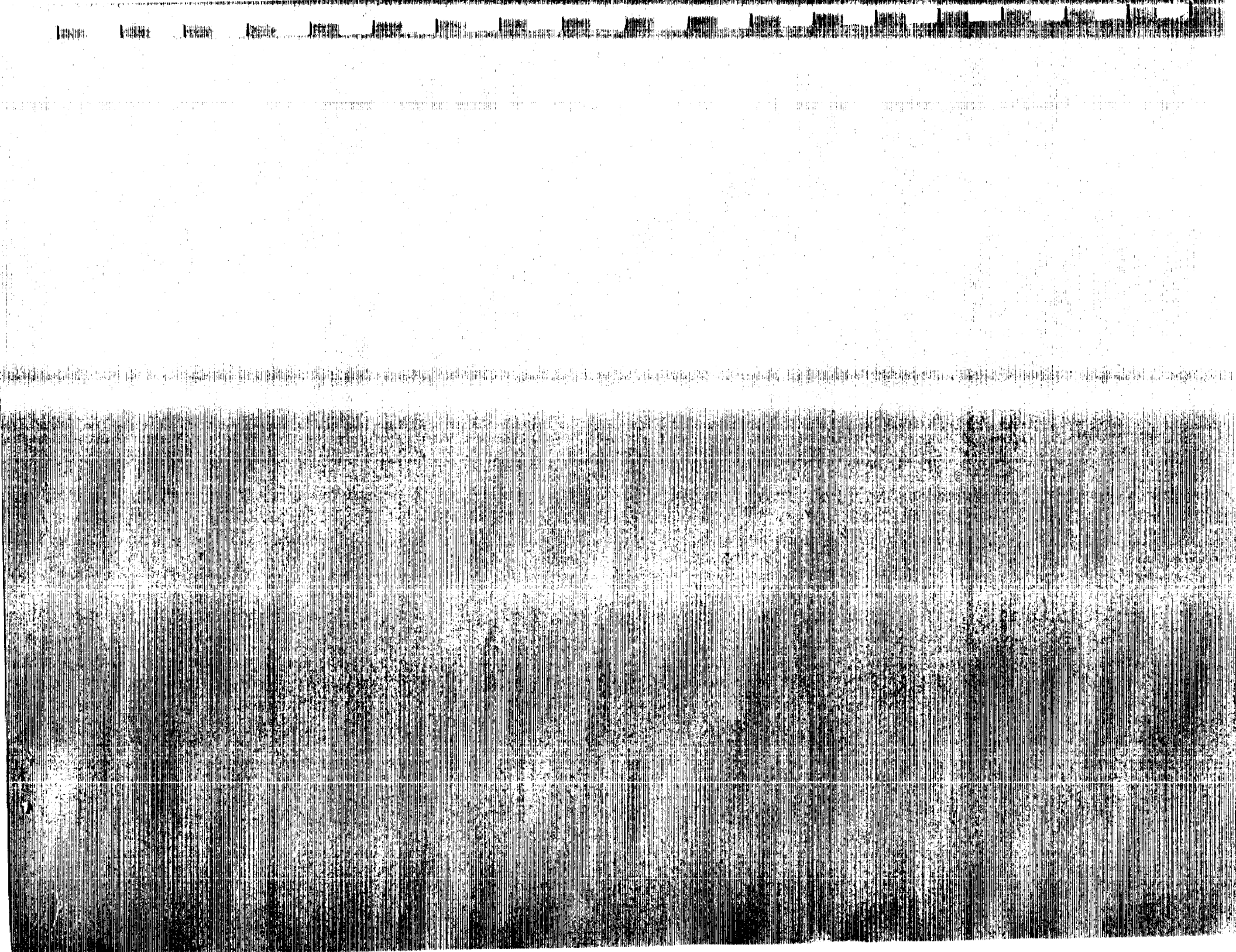
(NASA-CR-193156) SPACE STATION FREEDOM BIOMEDICAL MONITORING AND COUNTERMEASURES: BIOMEDICAL FACILITY HARDWARE CATALOG (GE) 183 p



SPACE STATION FREEDOM

BIOMEDICAL MONITORING AND COUNTERMEASURES

BIOMEDICAL FACILITY

HARDWARE CATALOG

DEVELOPED

BY

GENERAL ELECTRIC GOVERNMENT SERVICES

ADVANCED PROGRAM PLANNING OFFICE

HOUSTON, TEXAS

FOR

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

JOHNSON SPACE CENTER

HOUSTON, TEXAS

JUNE 15, 1990

TABLE OF CONTENTS

INTRODUCTION

THIS HARDWARE CATALOG COVERS THAT HARDWARE PROPOSED UNDER THE BIOMEDICAL MONITORING AND COUNTERMEASURES DEVELOPMENT PROGRAM SUPPORTED BY THE JOHNSON SPACE CENTER.

THE HARDWARE ITEMS ARE LISTED SEPARATELY BY ITEM, AND ARE IN ALPHABETICAL ORDER.

EACH HARDWARE ITEM SPECIFICATION CONSISTS OF FOUR PAGES.

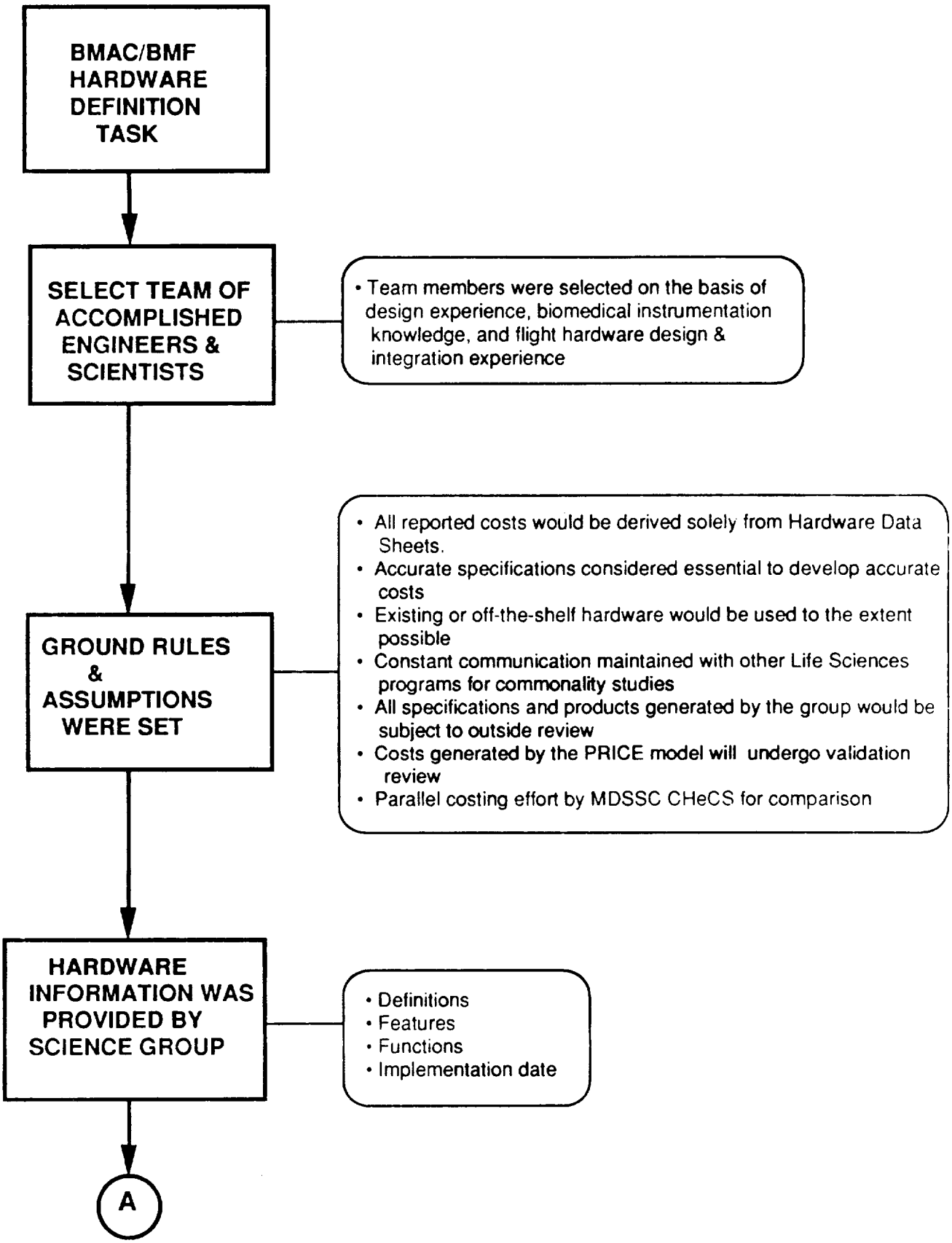
THE FIRST PAGE DESCRIBES BACKGROUND INFORMATION WITH AN ILLUSTRATION, DEFINITION AND A HISTORY/DESIGN STATUS.

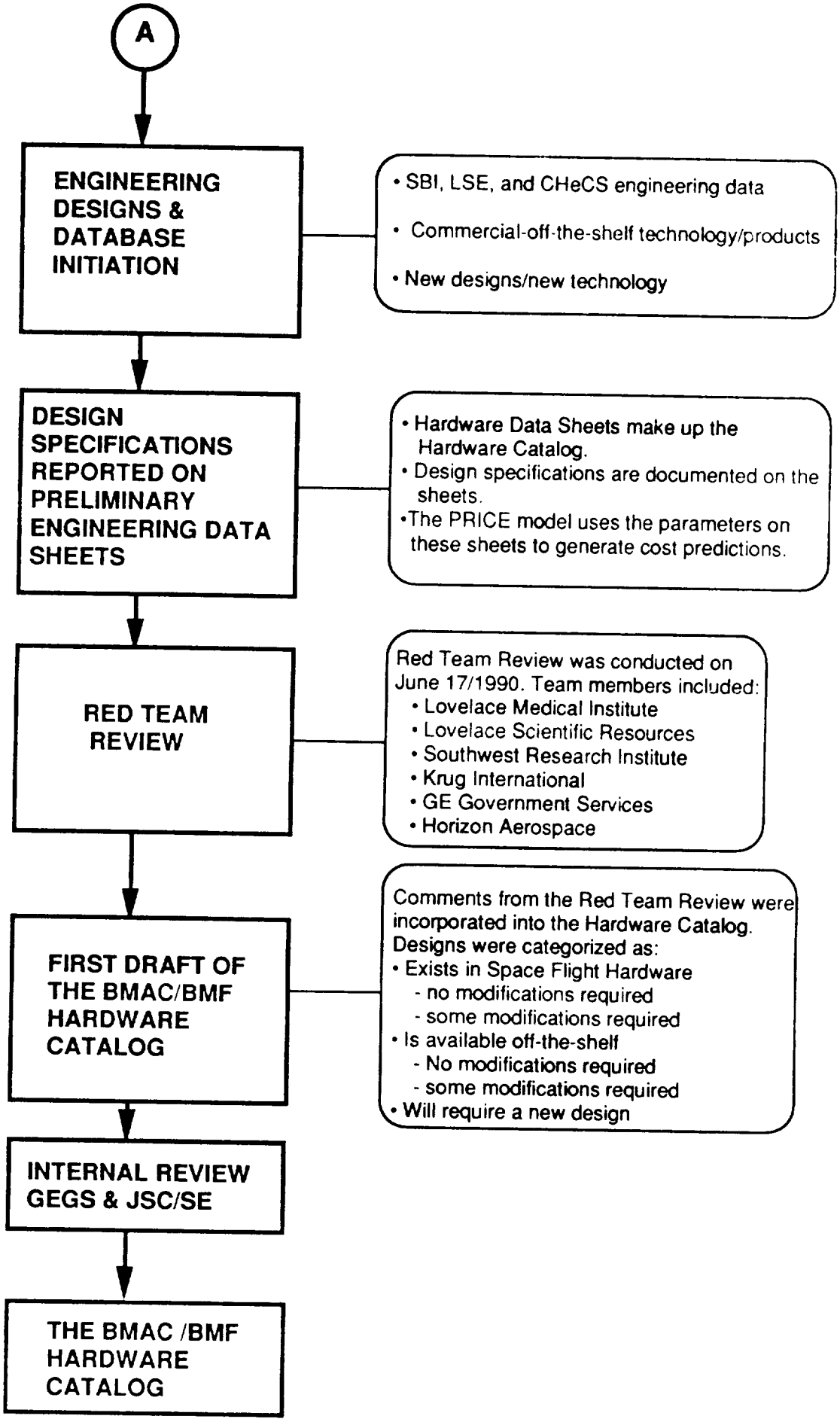
THE SECOND PAGE IDENTIFIES THE GENERAL SPECIFICATIONS, PERFORMANCE, RACK INTERFACE REQUIREMENTS, PROBLEMS, ISSUES, CONCERNS, PHYSICAL DESCRIPTION, AND FUNCTIONAL DESCRIPTION. THE LEVEL OF HARDWARE DESIGN RELIABILITY IS ALSO IDENTIFIED UNDER THE MAINTAINABILITY AND RELIABILITY CATEGORY (MARC I, II, III).

THE THIRD PAGE SPECIFIES THE MECHANICAL DESIGN GUIDELINES AND ASSUMPTIONS. DESCRIBED ARE THE MATERIAL TYPES AND WEIGHTS, MODULES, AND CONSTRUCTION METHODS. ALSO DESCRIBED IS AN ESTIMATION OF PERCENTAGE OF CONSTRUCTION WHICH UTILIZES A PARTICULAR METHOD, AND THE PERCENTAGE OF REQUIRED NEW MECHANICAL DESIGN IS DOCUMENTED.

THE FOURTH PAGE ANALYZES THE ELECTRONICS, THE SCOPE OF DESIGN EFFORT, AND THE SOFTWARE REQUIREMENTS. ELECTRONICS ARE DESCRIBED BY PERCENTAGES OF COMPONENT TYPES AND NEW DESIGN. THE DESIGN EFFORT, AS WELL AS, THE SOFTWARE REQUIREMENTS ARE IDENTIFIED AND CATEGORIZED.

BMAC HARDWARE DEFINITION ACTIVITY FLOW




A
ENGINEERING DESIGNS & DATABASE INITIATION
• SBI, LSE, and CHeCS engineering data
• Commercial-off-the-shelf technology/products
• New designs/new technology
DESIGN SPECIFICATIONS REPORTED ON PRELIMINARY ENGINEERING DATA SHEETS
• Hardware Data Sheets make up the Hardware Catalog.
• Design specifications are documented on the sheets.
•The PRICE model uses the parameters on these sheets to generate cost predictions.
RED TEAM REVIEW
Red Team Review was conducted on June 17/1990. Team members included:
• Lovelace Medical Institute
• Lovelace Scientific Resources
• Southwest Research Institute
• Krug International
• GE Government Services
• Horizon Aerospace
FIRST DRAFT OF THE BMAC/BMF HARDWARE CATALOG
Comments from the Red Team Review were incorporated into the Hardware Catalog. Designs were categorized as:
• Exists in Space Flight Hardware
- no modifications required
- some modifications required
• Is available off-the-shelf
- No modifications required
- some modifications required
• Will require a new design
INTERNAL REVIEW GEGS & JSC/SE
THE BMAC /BMF HARDWARE CATALOG

ACRONYMS LIST

CHeCS	Crew Health Care System
GEGS	General Electric Government Services
LSE	Laboratory Support Equipment
MARC	Maintainability and Reliability Category
MDSSC	McDonald Douglas Space Station Company
SBI	Space Biology Initiative

BIOMEDICAL MONITORING AND COUNTERMEASURES HARDWARE CATALOG

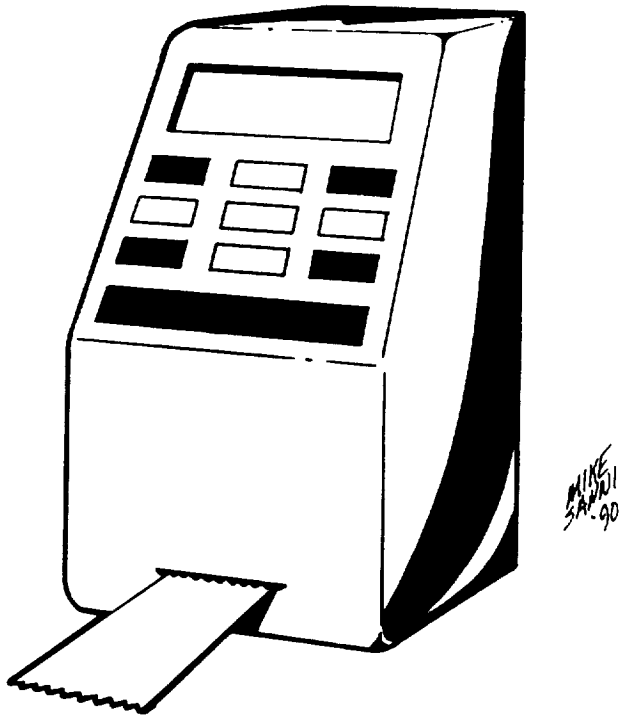
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME BIOWASTE TAG PRINTER

HARDWARE ID. NO.: 21 ORIGINATOR: H. Nguyen

VERSION : 1

ILLUSTRATION



DEFINITION

A device used to print self-adhesive labels for attachment to biowaste packages, laboratory specimens, and other related items.
Bar code system is utilized.

HISTORY/DESIGN STATUS:

Current commercial product design.
Modifications are needed.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: BIOWASTE TAG PRINTER ID# 21

VER : 1 **ORIGINATOR:** H. Nguyen

GENERAL SPECIFICATIONS

Mass (kg):	3.48
Height (m)	.08
Width (m)	.1
Depth (m)	.14
Volume (m3):	.001
Standby Power (W)	
Operational Power (W)	
Peak Power (W)	15
Power Source (VDC)	battery

PERFORMANCE SPECIFICATIONS:

Barcode Language: Code 3 of 9 (developed by the DOD)
Recognition of color and black& white barcodes.
Keyboard entry and terminal.
Information storage and processing.

RACK INTERFACE

Rack Mounted? ☐

	NONE	STANDARD	EXTRA
ELECTRICAL	☒	☐	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☒	☐	☐

PROBLEMS/ISSUES AND CONCERNS

ASSUMPTIONS/ JUSTIFICATIONS

Commercial product is available for customizing to space based purposes and needs.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

LCD display with calculator type keypad for data entry/date change. Printed label is dispensed via a gate on the front panel.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

To monitor and inventory biowaste products.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: BIOWASTE TAG PRINTER ID# 21

VER : 1 **ORIGINATOR:** H. Nguyen

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 3.5 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 35 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

motor
gear

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
20	70 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
30	30 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☒ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: BIOWASTE TAG PRINTER ID# 21

VER : 1 **ORIGINATOR:** H. Nguyen

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☐ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☒ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics -0.02

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	50	10	90	0	0	0
DIGITAL	30	25	75	0	0	0
DISP W/CRT	0	0	0	0	0	0
DISPLAY	20	45	55	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	0	0	0	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

30 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

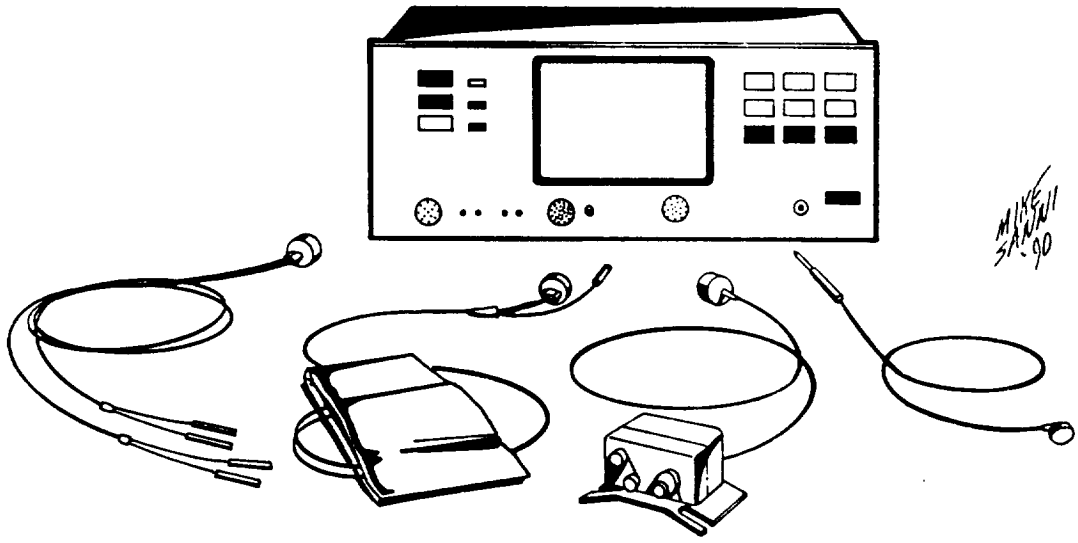
- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☒ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☒ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☒ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☐ MEDIUM ☐ HIGH

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME BLOOD FLOW AND PLETHYSMOGRAPH	Page 1 of 4
	HARDWARE ID. NO.: 45 ORIGINATOR: J. Stephenson	
	VERSION : 1	

ILLUSTRATION



DEFINITION

A system used to measure, record, and display changes in volume and blood flow of an organ or limb.

HISTORY/DESIGN STATUS:

Combination of a laser doppler, an impedance plethysmograph system and a venous occlusion plethysmograph system (SLS-1).
These items currently exist.
Some parts need modification for microgravity.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: BLOOD FLOW AND PLETHYSMOGRAPH ID# 45

VER : 1

ORIGINATOR: J. Stephenson

GENERAL SPECIFICATIONS

Mass (kg):	25
Height (m)	.22
Width (m)	.45
Depth (m)	.42
Volume (m3):	.041
Standby Power (W)	
Operational Power (W)	90
Peak Power (W)	
Power Source (VDC)	28

PERFORMANCE SPECIFICATIONS:

Flow measurement in superficial vessels as small as 8-10 microns in diameter.
Detection of circumference changes as small as .0199 mm.
Programmable pressure range of venous occlusion cuff from 1-300 mm Hg.
Impedance measurement:

Resistance: range 0-1000 Ohms, resolution 1 Ohm, accuracy +- 1%.

Reactance: range 0-500 Ohms, resolution 1 Ohm, accuracy +-1 %

Frequency range 20-100 KHz
Milliamps Max : 1 milliamp

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☐	☒	☐
THERMAL:	☐	☒	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☒	☐

PROBLEMS/ISSUES AND CONCERNS

Bioelectrical impedance is emperical and requires assumptions. Occlusive venous plethysmography is limited to 2 readings/minute, requires many cuff sizes and can be uncomfortable.
Doppler and impedance portions of the system may need to be detachable if the system is not close to exercise facility.

ASSUMPTIONS/ JUSTIFICATIONS

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

System features retractable laser doppler probe, CRT for doppler readout, LCD for impedance and venous occlusive plethysmography readout. Doppler and impedance portions of the system may need to be detachable because they are required during excercise studies.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

The system utilizes the laser doppler to measure capillary flow velocity, electrical impedance as an adjunct to laser doppler to quantify blood flow and occlusive venous plethysmography to detect volume in limbs of the body.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: BLOOD FLOW AND PLETHYSMOGRAPH ID# 45

VER : 1 **ORIGINATOR:** J. Stephenson

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:
aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 22 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 30 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

fan
CRT
air pump
laser optics
LCD's

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	**CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:**
12	65 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
23	35 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☐ PRECISION MACHINED PARTS, MANY MOVING PARTS ☒ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: BLOOD FLOW AND PLETHYSMOGRAPH ID# 45

VER : 1 **ORIGINATOR:** J. Stephenson

TYPE OF ELECTRONICS:

- [x] ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- [x] DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- [x] DISPLAY WITH CRT
- [ ] TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- [x] POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- [ ] DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 3.00

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	15	25	55	15	0	5
DIGITAL	60	35	35	15	5	10
DISP W/CRT	15	25	70	5	0	0
DISPLAY	5	0	0	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	5	50	50	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

25 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- [ ] SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- [x] MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- [ ] NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- [ ] NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- [ ] NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- [ ] DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- [x] COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- [x] ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE
  - [ ] LOW
  - [ ] MEDIUM
  - [ ] HIGH

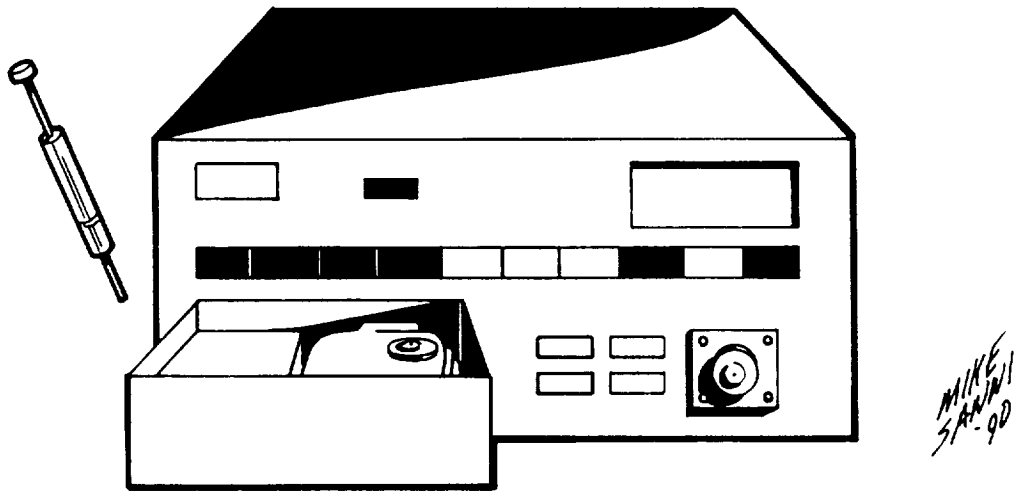
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME BREATH HYDROGEN ANALYZER

HARDWARE ID. NO.: 9 ORIGINATOR: G. McFadyen

VERSION : 1

ILLUSTRATION



DEFINITION

Breath hydrogen analyzer is an instrument used to measure gastrointestinal transit times.

HISTORY/DESIGN STATUS:

Commercial units exist.
Instrument must be modified for microgravity.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: BREATH HYDROGEN ANALYZER ID# 9

VER : 1 **ORIGINATOR:** G. McFadyen

GENERAL SPECIFICATIONS

Mass (kg):	7.3
Height (m)	.133
Width (m)	.483
Depth (m)	.851
Volume (m3):	.054
Standby Power (W)	12
Operational Power (W)	112
Peak Power (W)	
Power Source (VDC)	28

PERFORMANCE SPECIFICATIONS:

Power required 112W
Linear response range 2-150 ppm H2
Accuracy +/- 2ppm
Sensitivity 1ppm
Sample size 15 ml

RACK INTERFACE

Rack Mounted? ☒

	NONE:	STANDARD	EXTRA:
ELECTRICAL	☒	☐	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☒	☐	☐

PROBLEMS/ISSUES AND CONCERNS

Requires calibration and carrier gases
Uses Hydrogen
Unit must be on standby power at all times to prevent oxidation of sensor.

ASSUMPTIONS/ JUSTIFICATIONS

Specifications are for commercially available manual unit. Space unit can be designed to be automated.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☐ MARC II ☒ MARC III

PHYSICAL DESCRIPTION:

Unit contains breath sample bags, calibrated syringes, and analyzer unit.
Analyzer unit consists of sample ports, control valve, GC column, pump and calibration gas.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

Subject exhales into a collection bag. A sample is withdrawn from the bag by syringes and is injected into the sample part. The hydrogen concentration of the sample is determined by gas chromatography.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: BREATH HYDROGEN ANALYZER	ID# 9	PAGE 3 of 4
	VER : 1	ORIGINATOR: G. McFadyen	

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 7 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 50 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

pump sample part
GC column
control valve
gas cylinder
power supply

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
10	70 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
25	30 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☐ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: BREATH HYDROGEN ANALYZER	ID# 9	PAGE 4 of 4
	VER : 1	ORIGINATOR: G. McFadyen	

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☐ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☒ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☒ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 0.30

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	50	90	10	0	0	0
DIGITAL	0	0	0	0	0	0
DISP W/CRT	0	0	0	0	0	0
DISPLAY	10	100	0	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	40	100	0	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

35 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☒ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL.

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☒ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☒ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE — ☐ LOW ☒ MEDIUM ☐ HIGH

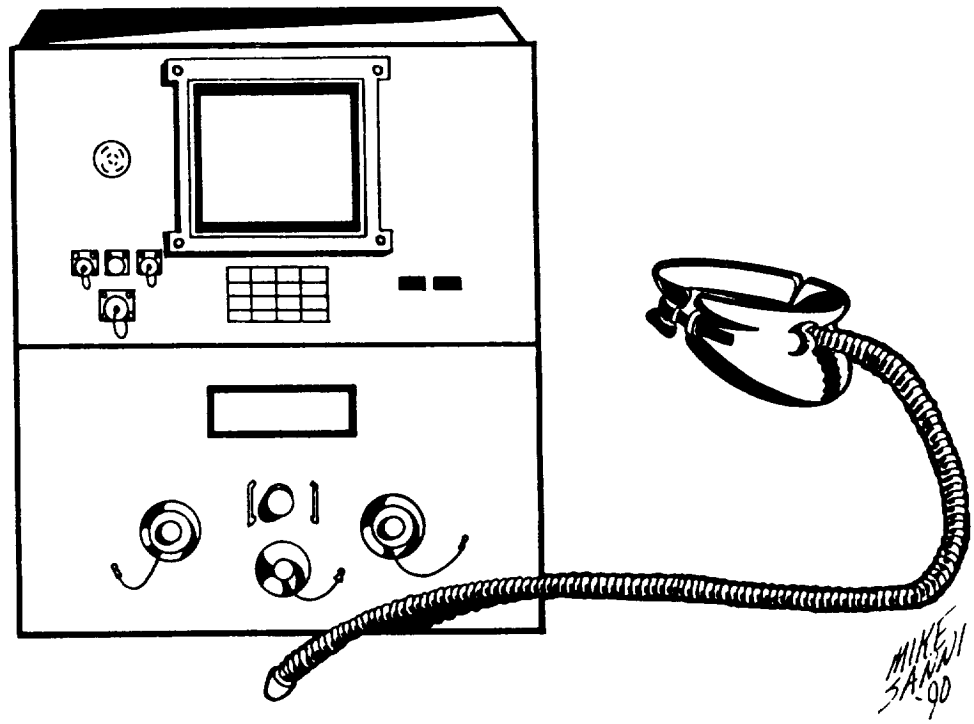
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME CAROTID SINUS BARORECEPTOR STIMULATOR

HARDWARE ID. NO.: 3 ORIGINATOR: H. Nguyen

VERSION : 1

ILLUSTRATION



DEFINITION

A system to stimulate the carotid sinus baroreceptors with positive and negative transmural pressure and from this records the resulting heart responses.

HISTORY/DESIGN STATUS:

The E-022 neck barocuff system is flight certified and is manifested on SLS-1, SLS-2, and S/L - D2.
Slight modifications are required to achieve upgraded performance specifications.
KSC presently working on new performance requirements.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: CAROTID SINUS BARORECEPTOR STIMULATOR ID# 3

VER : 1

ORIGINATOR: H. Nguyen

GENERAL SPECIFICATIONS

Mass (kg):	45.3
Height (m)	.54
Width (m)	.45
Depth (m)	.51
Volume (m3):	.123
Standby Power (W)	
Operational Power (W)	145
Peak Power (W)	225
Power Source (VDC)	28

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☐	☒	☐
THERMAL:	☐	☒	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☒	☐

PERFORMANCE SPECIFICATIONS:

Cuff pressure sensitivity to within +/- 1.0 mm Hg
Incremental pressure reproducibility to within +/- 5.0 mm Hg
Continuous ECG, respiration, and cuff pressure recording with analog display.
Digital display of R-R internals in milliseconds.
12 bit analog to digital conversion for data storage

PROBLEMS/ISSUES AND CONCERNS

Hose connections must be rigid enough to avoid accidental crimping.
Neck chambers must be custom fit due to inability of present system to provide reproducible pressure increments.
Moderate discomfort during cuff inflation.

ASSUMPTIONS/ JUSTIFICATIONS

General specifications listed are pertaining to those for the neck chamber pressure system and neck chamber electronics system of the EO22 system manifested on SLS-1.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

A neck cuff which is connected to a rack-mounted electronics and pressure system by an air hose. A CRT display, touch pad, air pump outlets, and ECG plugs are featured on the front panel of the rack-mounted system.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

As the pressure system inflates/deflates the neck cuff, ECG recordings of the resulting cardiac responses are made.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: CAROTID SINUS BARORECEPTOR STIMULATOR ID# 3	PAGE 3 of 4
	VER : 1 ORIGINATOR: H. Nguyen	

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 40 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 15 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

CRT
pumps (air)
fan

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
40	80 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
10	20 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☐ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: CAROTID SINUS BARORECEPTOR STIMULATOR ID# 3

VER : 1 **ORIGINATOR:** H. Nguyen

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☒ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☒ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☐ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 5.30

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	10	70	30	0	0	0
DIGITAL	70	30	60	10	0	0
DISP W/CRT	10	80	20	0	0	0
DISPLAY	0	0	0	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	10	70	30	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

20 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☒ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL.

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☒ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☒ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☐ MEDIUM ☐ HIGH

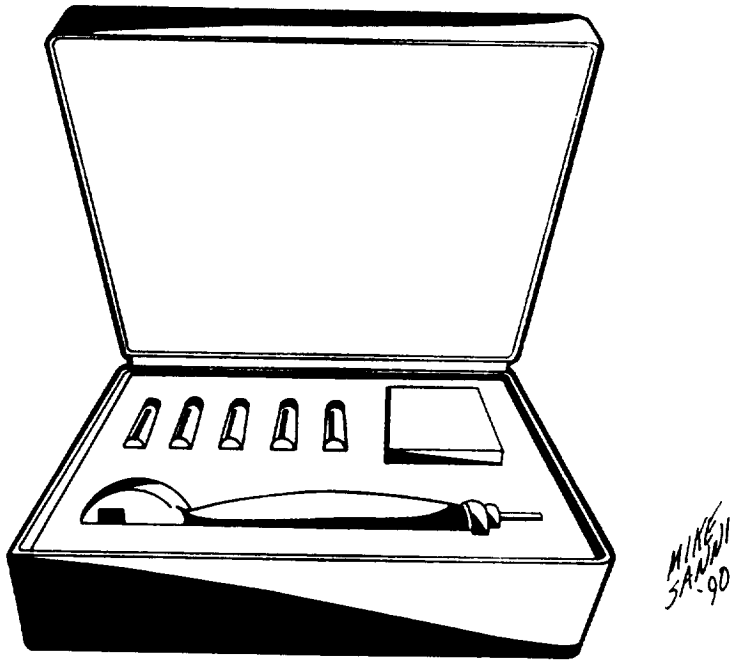
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME CELL HANDLING ACCESSORIES

HARDWARE ID. NO.: 22 ORIGINATOR: J. Stephenson

VERSION : 1

ILLUSTRATION



DEFINITION

Tools used to transfer cells from biological specimens onto microscope slides while in a microgravity environment.

HISTORY/DESIGN STATUS:

Laboratory cell handling is man intensive.
Moderate modifications are required

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: CELL HANDLING ACCESSORIES ID# 22

VER : 1 **ORIGINATOR:** J. Stephenson

GENERAL SPECIFICATIONS

Mass (kg): 4.76

Height (m) .044

Width (m) .482

Depth (m) .851

Volume (m3): .018

Standby Power (W)

Operational Power (W)

Peak Power (W)

Power Source (VDC) 0

RACK INTERFACE

Rack Mounted? ☐

	NONE	STANDARD	EXTRA
ELECTRICAL	☒	☐	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☒	☐	☐

PERFORMANCE SPECIFICATIONS:

Must be capable of transferring samples in volume from 1 drop to 1 ml.

The cell handling accessories must be easily cleaned for subsequent cell transfer without any contamination.

PROBLEMS/ISSUES AND CONCERNS

The problem of liquids in the microgravity environment.

ASSUMPTIONS/ JUSTIFICATIONS

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☐ MARC II ☒ MARC III

PHYSICAL DESCRIPTION:

Hand-held instruments made of aluminum or stainless steel which could be autoclaved and reused.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

Replaceable pipette or suction devices to prevent contamination.
Accurate mechanism for volume transfer.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: CELL HANDLING ACCESSORIES	ID# 2 2	PAGE 3 of 4
	VER : 1	ORIGINATOR: J. Stephenson	

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:
aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 1 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 20 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

none

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
13	20 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
43	80 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☐ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: CELL HANDLING ACCESSORIES ID# 22

VER : 1 **ORIGINATOR:** J. Stephenson

TYPE OF ELECTRONICS:

- ☐ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☐ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☐ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☐ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 3.76

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	0	0	0	0	0	0
DIGITAL	0	0	0	0	0	0
DISP W/CRT	0	0	0	0	0	0
DISPLAY	0	0	0	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	0	0	0	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

0 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☒ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☐ MEDIUM ☐ HIGH

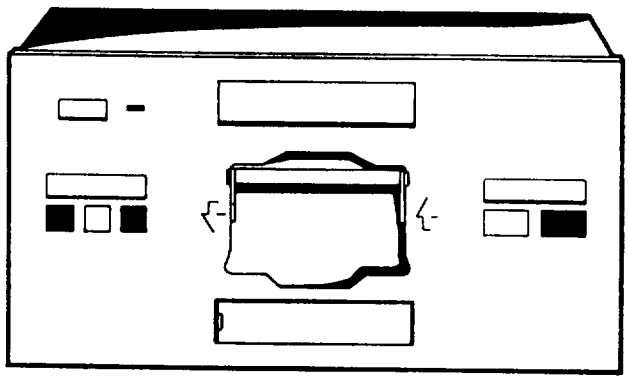
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME CELL HARVESTER

HARDWARE ID. NO.: 30 ORIGINATOR: J. Stephenson

VERSION : 1

ILLUSTRATION



DEFINITION

A device used to isolate biological cells from a large sample, and then deposit the required isolated cells into a chamber for further analysis.

HISTORY/DESIGN STATUS:

New design is required.
This will be a highly complex instrument.
Present systems are partially automated and use 'open' wells as the means of introducing samples into the system.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: CELL HARVESTER ID# 30

VER : 1

ORIGINATOR: J. Stephenson

GENERAL SPECIFICATIONS

Mass (kg):	29
Height (m)	.133
Width (m)	.482
Depth (m)	.851
Volume (m3):	.054
Standby Power (W)	
Operational Power (W)	50
Peak Power (W)	
Power Source (VDC)	28 VDC

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☐	☒	☐
THERMAL:	☐	☒	☐
WASTE:	☐	☐	☒
FLUID:	☐	☐	☒
DATA:	☐	☒	☐

PERFORMANCE SPECIFICATIONS:

Simultaneously harvests and deposits up to 96 samples into vials.

Fully automated, once microtiter plate is in place.

PROBLEMS/ISSUES AND CONCERNS

Automation of unit may not be feasible. Fully automated lab device which harvests just one well is much larger than a double rack width.
Current technology is gravity dependent.
Some experiments require radioactive tracers.
No ground based unit at present is fully automated.

ASSUMPTIONS/ JUSTIFICATIONS

Specifications are that of a partially automated unit packaged for rack mounting. A fully automated system will increase the volume and weight significantly. Placement of the harvestor head into the microtiter tray, loading of filter paper, punching of filter paper (containing cells) and capping and removal of vials is done manually on earth.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☒ MARC I ☐ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

System features port for introduction of microtiter plate, a collection head which punctures the microtiter wells as the microtiter plate is lowered on to it, a reversible vacuum, a puncture block (manually operated) which punches out cell containing filter paper, liquid reservoirs and a port for the removal of vials.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

Cells are vacuumed from microtiter wells and deposited onto the filter paper. The areas of filter paper containing the cells are punche out an dispensed into vials

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: CELL HARVESTER ID# 30

VER : 1

ORIGINATOR: J. Stephenson

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 28.8 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 50 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

reversible vacuum/pump
fan

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	**CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:**
30	20 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☐ SUPPORT STRUCTURE, NO MOVING PARTS ☒ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
200	80 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☐ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

Information pertains to a partially automated system.
Cell Harvester to be built into a slide mounted enclosure of standard rack size.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: CELL HARVESTER	ID# 30	PAGE 4 of 4
	VER : 1	ORIGINATOR: J. Stephenson	

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☒ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☒ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 0.20

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	25	50	50	0	0	0
DIGITAL	25	0	50	50	0	0
DISP W/CRT	0	0	0	0	0	0
DISPLAY	25	100	0	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	25	0	0	100	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

40 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☒ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL.

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☒ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☒ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☒ MEDIUM ☐ HIGH

BMAC HARDWARE DATA SHEET

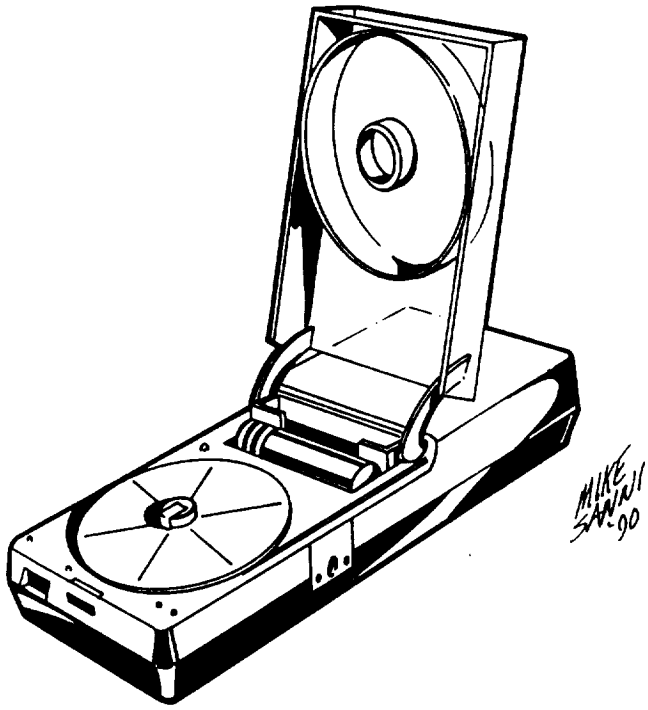
EQUIPMENT NAME CENTRIFUGE, HEMATOCRIT

Page 1 of 4

HARDWARE ID. NO.: 23 ORIGINATOR: J. Stephenson

VERSION : 1

ILLUSTRATION



DEFINITION

A lightweight, hand-held and battery operated centrifuge. 9 microliters of venous blood are collected in six capillary tubes for spinning. At the end of the spin the hematocrit is read directly from the graduation scale, which is located on the rotor.

HISTORY/DESIGN STATUS:

LSLE # JO16
Improvements will be necessary for Space Station such as more units or updated technology.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: CENTRIFUGE, HEMATOCRIT ID# 23

VER : 1 **ORIGINATOR:** J. Stephenson

GENERAL SPECIFICATIONS

Mass (kg): .83

Height (m) .06

Width (m) .08

Depth (m) .2

Volume (m3): .001

Standby Power (W)

Operational Power (W)

Peak Power (W)

Power Source (VDC) 1.5 BAT

PERFORMANCE SPECIFICATIONS:

Operating temperature:0-40 degrees centigrade
Stowage temperature:-20 - +55 degrees centigrade
Rotation speed: 11,500 rpm (5396g)
Duration: 3 min. 20sec.
Accuracy: +/- 1%
Range: 10-80%
Capacity: 6 capillary tubes
32 mm. in length and heparinized
Vol of capillary tube: 9 microliters.

RACK INTERFACE

Rack Mounted? ☐

	NONE	STANDARD	EXTRA
ELECTRICAL	☒	☐	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☒	☐	☐

PROBLEMS/ISSUES AND CONCERNS

ASSUMPTIONS/ JUSTIFICATIONS

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

A small hand-held battery operated device with a small rotor that will hold up to 6 capillary tubes of 9 microliters' volume each.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

Spin blood samples at 5000g's to separate plasma from the cellular components.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: CENTRIFUGE, HEMATOCRIT ID# 2 3

VER : 1

ORIGINATOR: J. Stephenson

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

Anodized aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): .8 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 15 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

6 manganese alkali 1.5.V batteries
small motor

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	**CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:**
7	40 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
15	60 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☐ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: CENTRIFUGE, HEMATOCRIT ID# 23

VER : 1 **ORIGINATOR:** J. Stephenson

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☐ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☐ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 0.03

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	30	50	50	0	0	0
DIGITAL	70	25	45	30	0	0
DISP W/CRT	0	0	0	0	0	0
DISPLAY	0	0	0	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	0	0	0	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

15 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☒ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☐ MEDIUM ☐ HIGH

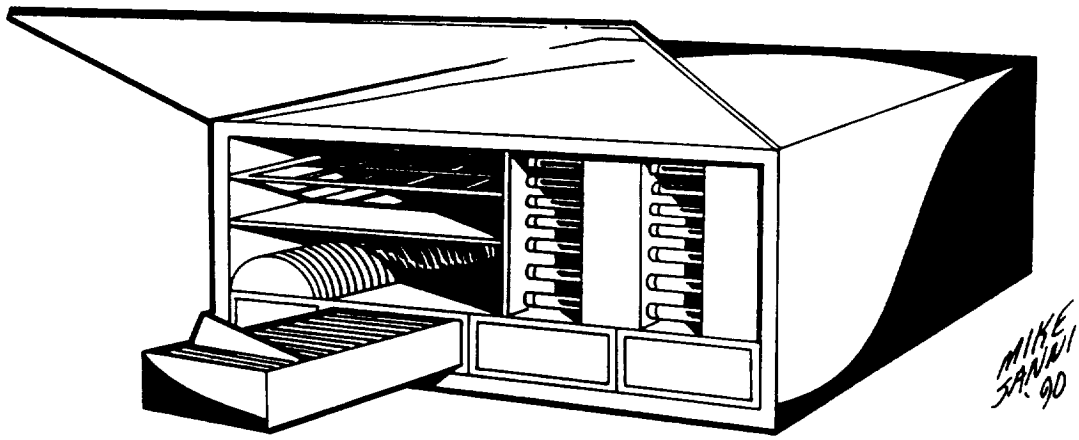
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME CONTROLLED TESTING UNITS

HARDWARE ID. NO.: 24 ORIGINATOR: H. Nguyen

VERSION : 01

ILLUSTRATION



DEFINITION

Auxiliary equipment necessary to calibrate, set-up and manipulate other host experimental equipment.

HISTORY/DESIGN STATUS:

Design is based on the requirement to store and inventory special equipment for the performance of the biomedical tests.
Modification is necessary.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: CONTROLLED TESTING UNITS ID# 24

VER : 01 **ORIGINATOR:** H. Nguyen

GENERAL SPECIFICATIONS

Mass (kg):	7.14
Height (m)	.352
Width (m)	.483
Depth (m)	.851
Volume (m3):	.144
Standby Power (W)	
Operational Power (W)	15
Peak Power (W)	
Power Source (VDC)	28VDC

PERFORMANCE SPECIFICATIONS:

0.14 m3 of containment volume.
Racks and equipment holders to secure equipment while in storage.

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☒	☐	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☒	☐	☐

PROBLEMS/ISSUES AND CONCERNS

ASSUMPTIONS/ JUSTIFICATIONS

BMAC electro-mechanical instruments require calibration and supplies
Disposables need inventory.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☐ MARC II ☒ MARC III

PHYSICAL DESCRIPTION:

Container consisting of a wire rack, box, three drawers and has a plexiglass front door used for quick visual reference.
Items to be placed in the Controlled Testing Unit includes vacutainer bottles, reagent storage, electrodes, gels, swabs, wires, electrical testing, and auxilary calibration accessories, and other readily available items.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

Calibration equipment rack. Container box for control reagents and assays.
Drawers to store liquid samples, experiment accessories, sample containers, skin test kits..etc..

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: CONTROLLED TESTING UNITS ID# 24

VER : 01 **ORIGINATOR:** H. Nguyen

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 7.1 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 20 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

housing
racks

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	**CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:**
17	100 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
	%	☐ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☐ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☐ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: CONTROLLED TESTING UNITS ID# 24

VER : 01 **ORIGINATOR:** H. Nguyen

TYPE OF ELECTRONICS:

- ☐ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☐ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV. LASER, ETC.
- ☐ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☐ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 0.04

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	0	0	0	0	0	0
DIGITAL	0	0	0	0	0	0
DISP W/CRT	0	0	0	0	0	0
DISPLAY	0	0	0	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	0	0	0	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

0 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☒ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
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- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☐ MEDIUM ☐ HIGH

BMAC HARDWARE DATA SHEET

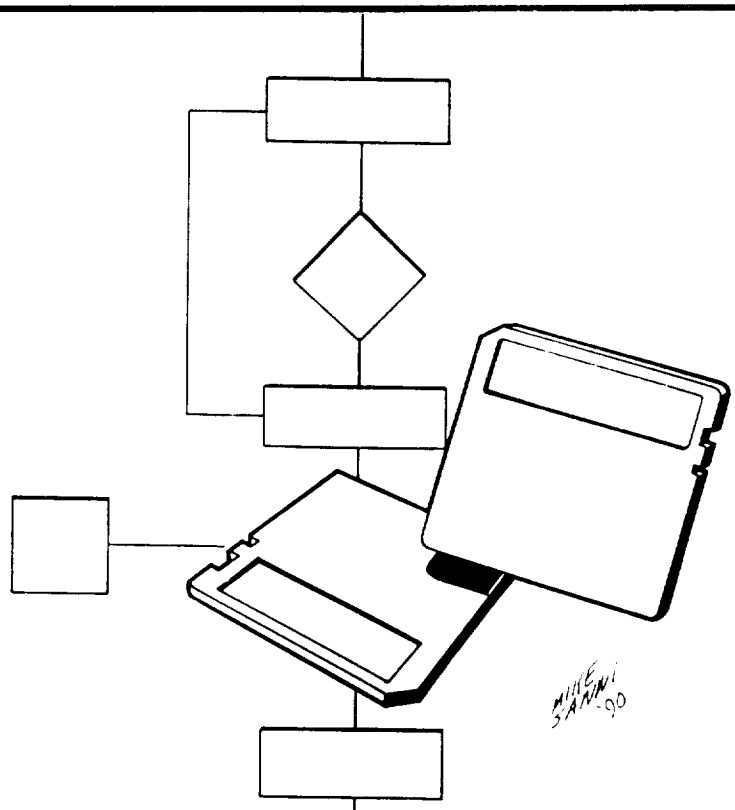
EQUIPMENT NAME CREW DEBRIEF/ANALYSIS SOFTWARE

Page 1 of 4

HARDWARE ID. NO.: 44 ORIGINATOR: M. Singletary

VERSION : 1

ILLUSTRATION



DEFINITION

The crew debrief software is designed to determine and analyze crew behavior in terms of changing mood/motivation patterns and interpersonal conflict.

HISTORY/DESIGN STATUS:

New design is required

TITLE: CREW DEBRIEF / ANALYSIS SOFTWARE

This software will provide for interactive graphic and alphanumeric displays to assist in the collection, interpretation and analysis of crew responses and debriefings on operational and functional procedures and investigations.

QUALITATIVE DESCRIPTORS

PROGRAM SPECIFICATION LEVEL	Military	MANAGEMENT COMPLEXITY	1.00
SYSTEM INTEGRATION	Yes	DESIGN REVIEWS	Yes
CODE WALK THRU	Yes	TOP DOWN APPROACH	Yes
STRUCTURE/MODULE TEST	Yes	REQUIREMENTS GROWTH	12%
PLATFORM	2.00	UTILIZATION FACTOR	0.50
INTERNAL INTEGRATION FACTOR	0.50	EXTERNAL INTEGRATION FACTOR	0.30

QUANTITATIVE DESCRIPTORS

OUTPUT PAGES	6.0	ALPHANUMERIC DISPLAYS	10.0
GRAPHIC DISPLAYS	5.0	INPUT STREAMS	4.0
OUTPUT STREAMS	4.0	CONTROL STATES	50.0
MESSAGE FIELDS	100.0	OPERATOR ACTIONS	10.0
INPUT ANALOGS	5.0	COMPUTED TABLES	10.0
FUNCTIONAL BULKINESS	1.2		

SIZING FACTORS

SIZE CALIBRATION	1.00
LANGUAGE	4th Generation
TARGET SIZE	NONE
ESTIMATED SOURCE INSTRUCTIONS	**4046**

LANGUAGE DESCRIPTORS

Language	4TH-GENERATION
Lines of Source Code	4046
Non-executable Fraction	0.10
Complexity 1	1.40
Complexity 2	1.00
Productivity Factor	4.00

CODE TYPING

Application Categories	% of Total Program	% New Design	% New Code
User Defined	0.00	0.00	0.00
Data Storage & Retrival	0.25	0.25	0.25
Online Communication	0.40	0.80	0.80
Realtime C&C	0.00	0.00	0.00
Interactive	0.10	1.00	1.00
Mathematical	0.20	1.00	1.00
String Manipulation	0.05	1.00	1.00
Operating Systems	0.00	0.00	0.00

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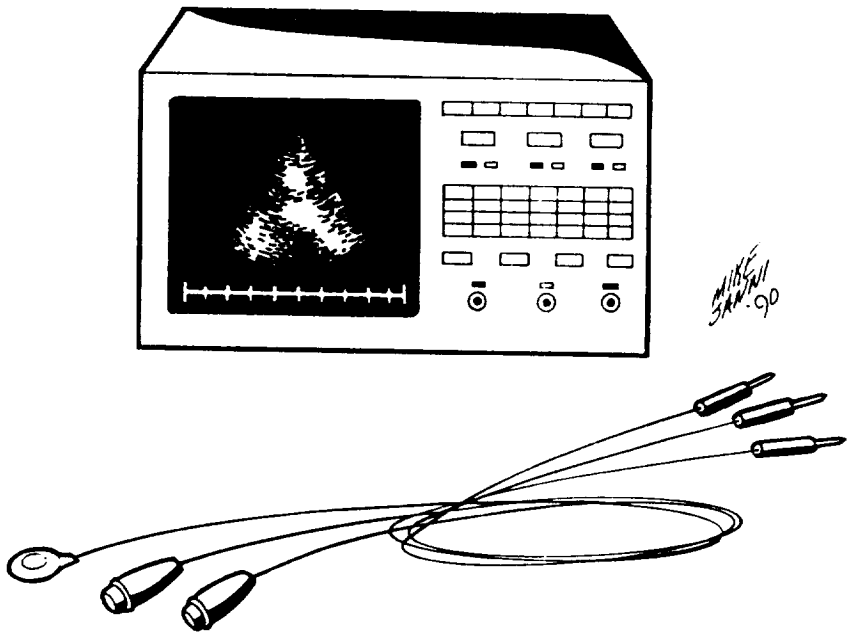
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME ECHOCARDIOGRAPH/DOPPLER VELOCIMETER

HARDWARE ID. NO.: 400 ORIGINATOR: J Stephenson

VERSION : 1

ILLUSTRATION



DEFINITION

Instrument to perform full peripheral vascular imaging. Color imaging capabilities delivers detailed images of vascular structures and complete blood flow information for the accurate diagnosis of vascular pathology.

HISTORY/DESIGN STATUS:

Current existing technology.
Further modification is required notably in the areas of size and weight of the instrument.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: ECHOCARDIOGRAPH/DOPPLER VELOCIMETER ID# 400

VER : 1

ORIGINATOR: J. Stephenson

GENERAL SPECIFICATIONS

Mass (kg):	70
Height (m)	.352
Width (m)	.483
Depth (m)	.851
Volume (m3):	.144
Standby Power (W)	60
Operational Power (W)	100
Peak Power (W)	
Power Source (VDC)	28VDC

PERFORMANCE SPECIFICATIONS:

Color monitor: High resolution
2-D imaging 4, 6, 8, 10, 12, 16, 20, and 24 cm depth.
7.5 MH2 wide - aperature linear array transducer.
Doppler: Digital FFT utilizing quadrature detection
Wall filter: 50 HZ to 1500 HZ - 8 setting
32 frame storage capability.

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☐	☒	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☐	☒

PROBLEMS/ISSUES AND CONCERNS

Highly operator-dependent for test accuracy.

ASSUMPTIONS/ JUSTIFICATIONS

Data is recorded on VHS tapes and downlinked to ground control center for further analysis.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

Instrument consisting of transducer and doppler, ground terminals connected to CRT screen.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

The function of ECG/Doppler is to perform blood flow passage through the heart valves and chambers in order to monitor physiological , structural changes in microgravity.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: ECHOCARDIOGRAPH/DOPPLER VELOCIMETER ID#400 VER : 1 ORIGINATOR: J. Stephenson	PAGE 3 of 4

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

aluminum, glass

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 65 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 30 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

fan
housing
sensor unit
data storage
cables

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	**CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:**
38	80 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
10	20 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☐ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: ECHOCARDIOGRAPH/DOPPLER VELOCIMETER ID# .00

VER : 1

ORIGINATOR: J. Stephenson

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☒ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM. NAV, LASER, ETC.
- ☒ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☐ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 5.00

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	10	50	40	10	0	0
DIGITAL	20	70	20	10	0	0
DISP W/CRT	60	80	20	0	0	0
DISPLAY	0	0	0	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	10	50	50	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

30 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☒ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
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- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE

☐ LOW ☒ MEDIUM ☐ HIGH

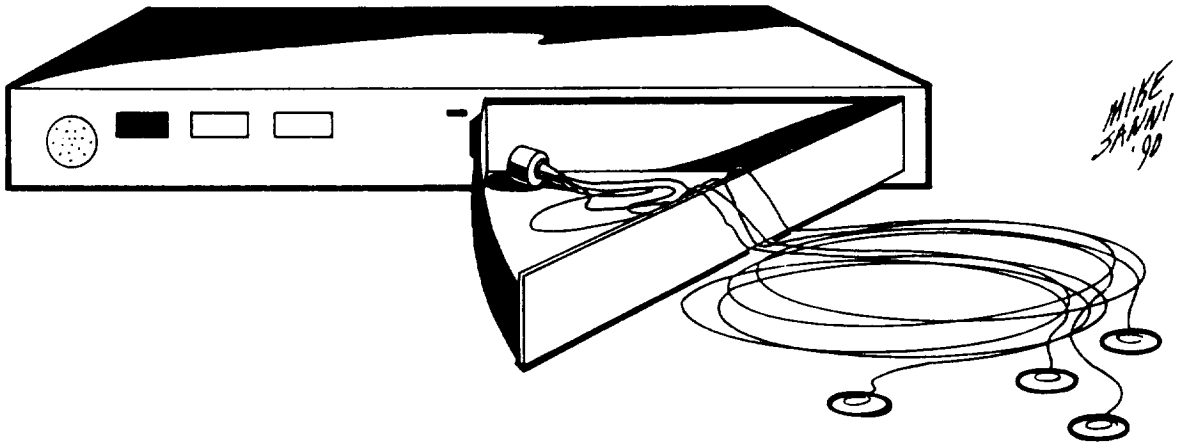
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME ELECTRO-OCULOGRAPH MODULE

HARDWARE ID. NO.: 5 ORIGINATOR: J. Stephenson

VERSION : 1

ILLUSTRATION



DEFINITION

The Electro-Oculograph monitors the electrical activity of the muscles controlling eye movement. The measurements correlate vestibular function with task performance.

HISTORY/DESIGN STATUS:

Modification of current technology.
New component design is required.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: ELECTRO-OCULOGRAPH MODULE ID# 5

VER : 1 **ORIGINATOR:** J. Stephenson

GENERAL SPECIFICATIONS

Mass (kg):	2
Height (m)	.044
Width (m)	.482
Depth (m)	.851
Volume (m3):	.018
Standby Power (W)	
Operational Power (W)	25
Peak Power (W)	
Power Source (VDC)	28

PERFORMANCE SPECIFICATIONS:

Response to 30 Hz
10 millivolts per peak
Amplitude Linearity 2% full scale
Amplitude Resolution 50:1
Hysteresis: LESS THAN 0.5 mm
Input Impedance: 10 MegaOhms differential,
5 MegaOhms common mode
Noise Level: 5 Micro volts
Zero suppression: +- 150 millivolts
Frequency response: DC to 1000 Hz
Bio-potential isolation provided

RACK INTERFACE

Rack Mounted? ☒

	NONE:	STANDARD	EXTRA:
ELECTRICAL	☐	☒	☐
THERMAL:	☐	☒	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☒	☐	☐

PROBLEMS/ISSUES AND CONCERNS

Operator dependent for accurate results.
Possible shock risk factor.

ASSUMPTIONS/ JUSTIFICATIONS

Recorder will be used in conjunction with the visual tracking system.
Module will be a part of the physiological bio-potential system, linked to the multichannel data recorder for processing.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

Rack mounted instrument with direct curvilinear control on front panel.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY. INCLUDE WHERE AND HOW USED)

Instrument to be used in conjunction with the Physiological Biopotential Recorder, which conditions, calibrates, processes, and stores the data for downlink to ground control center.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: ELECTRO-OCULOGRAPH MODULE ID# 5	PAGE 3 of 4
	VER : 1 ORIGINATOR: J. Stephenson	

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:
aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 1.5 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 30 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

switches
cable harness for electrodes

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
15	70 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
7	30 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☐ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: ELECTRO-OCULOGRAPH MODULE ID# 5

VER : 1 **ORIGINATOR:** J. Stephenson

TYPE OF ELECTRONICS:

- [x] ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- [x] DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- [ ] DISPLAY WITH CRT
- [ ] TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- [ ] POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- [x] DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 0.50

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	40	40	20	40	0	0
DIGITAL	40	40	40	10	0	10
DISP W/CRT	0	0	0	0	0	0
DISPLAY	20	25	25	30	0	20
XMTR	0	0	0	0	0	0
PWR SUP	0	0	0	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

20 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- [ ] SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- [x] MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- [ ] NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- [ ] NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- [ ] NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- [ ] DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- [ ] COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- [ ] ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE [ ] LOW [ ] MEDIUM [ ] HIGH

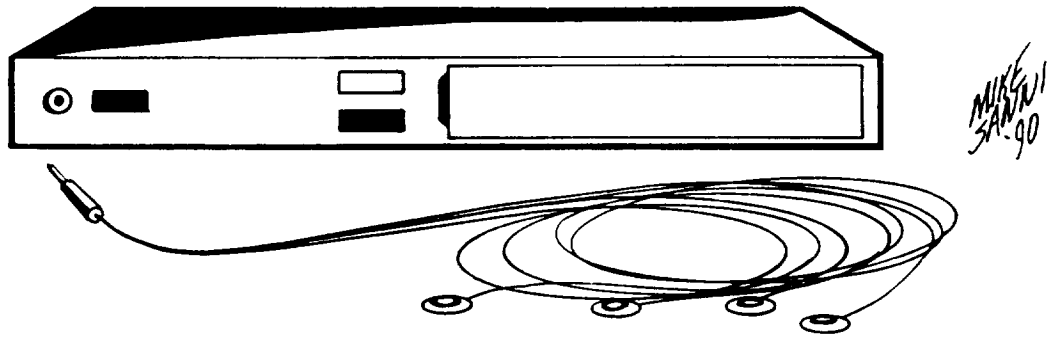
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME ELECTROCARDIOGRAPH MODULE

HARDWARE ID. NO.: 6 ORIGINATOR: J. Stephenson

VERSION : 1

ILLUSTRATION



DEFINITION

The Electrocardiograph module detects variation in body surface potential caused by depolarizations and repolarizations of the heart. This module is to be used in conjunction with the Physiological Bio-potential Recorder to record and playback the signal.

HISTORY/DESIGN STATUS:

ECG monitoring systems have been developed for extra vehicular activity suits and for Spacelab experiments.
New component design is required.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: ELECTROCARDIOGRAPH MODULE ID# 6

VER : 1 **ORIGINATOR:** J. Stephenson

GENERAL SPECIFICATIONS

Mass (kg):	4
Height (m)	.044
Width (m)	.482
Depth (m)	.851
Volume (m3):	.018
Standby Power (W)	
Operational Power (W)	25
Peak Power (W)	
Power Source (VDC)	28

PERFORMANCE SPECIFICATIONS:

Computation of heart rate based on R waves
Sampling rate>=250 samples/sec
Input Impedance: 10 Mega Ohms differentials
50 Mega Ohms common modes
for leads.
Noise level: Less than 5 microvolts peak to peak.
Time constant: Selectable 3.2 and .3 seconds.

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☐	☒	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☒	☐

PROBLEMS/ISSUES AND CONCERNS

Proper electrode placement is critical to assure continuous signal.
Electrode adhesive may cause skin irritation.

ASSUMPTIONS/ JUSTIFICATIONS

Data recorded by the ambulatory subsystem will be automatically transferred to the physiological bio-potential data recorder.
This item will be used in conjunction with the exercise facility.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

Rack mounted equipment with LED and a detachable ambulatory recorder/transmitter which can be worn by a crew member.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

The unit will be used to monitor and record depolarization and repolarization patterns of the heart during exercise and at rest via the attached body electrodes.
Data will be transferred to the physiological bio-potential recorder for translation and storage.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: ELECTROCARDIOGRAPH MODULE ID# 8	PAGE 3 of 4
	VER : 1 ORIGINATOR: J. Stephenson	

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 1.8 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 30 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

fan
optical storage unit
electrical cable harness for electrodes

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
15	70 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
7	30 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☐ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: ELECTROCARDIOGRAPH MODULE ID# 6

VER : 1 **ORIGINATOR:** J. Stephenson

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☐ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☒ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 2.20

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	40	40	20	40	0	0
DIGITAL	40	40	50	0	0	10
DISP W/CRT	0	0	0	0	0	0
DISPLAY	20	25	25	30	0	20
XMTR	0	0	0	0	0	0
PWR SUP	0	0	0	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

35 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☒ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☐ MEDIUM ☐ HIGH

BMAC HARDWARE DATA SHEET

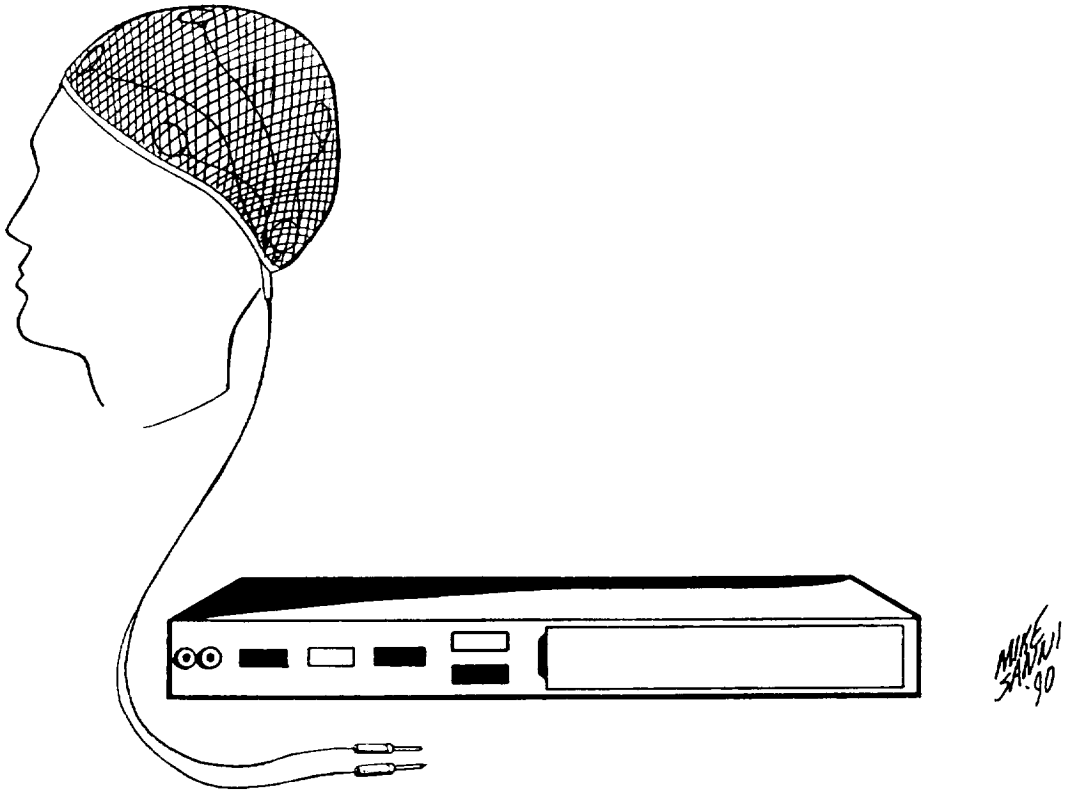
EQUIPMENT NAME ELECTROENCEPHALOGRAPH MODULE

Page 1 of 4

HARDWARE ID. NO.: 7 ORIGINATOR: H. Nguyen

VERSION : 01

ILLUSTRATION



DEFINITION

A device used to measure and record neural electrical activities via electrodes placed on subject's head.

HISTORY/DESIGN STATUS:

Current technology available.
New component design is required.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: ELECTROENCEPHALOGRAPH MODULE ID# 7

VER : 01 **ORIGINATOR:** H. Nguyen

GENERAL SPECIFICATIONS

Mass (kg):	7.5
Height (m)	.089
Width (m)	.483
Depth (m)	.851
Volume (m3):	.036
Standby Power (W)	
Operational Power (W)	25
Peak Power (W)	
Power Source (VDC)	28 VDC

PERFORMANCE SPECIFICATIONS:

Twenty four bio-electric signal channels input via differential amplifiers impedance 10 mOhm.

Skin voltage tolerance: 500 mV or greater.

Electrode selections are programmable up to 18 combinations.

Electrode to skin contact impedance checking is displayed on CRT or LED.
Range from 1 to 10 KOhm and 10 to 100 KOhm.

Remote control capability to enable one crew man operation

RACK INTERFACE

Rack Mounted? ☒

	NONE:	STANDARD	EXTRA:
ELECTRICAL	☐	☒	☐
THERMAL:	☐	☒	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☐	☒

PROBLEMS/ISSUES AND CONCERNS

Possible leakage of current to subject.

ASSUMPTIONS/ JUSTIFICATIONS

Operator must be properly trained.in this complex procedure.
Twenty-four channels are available.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

Digital readouts and controls are positioned horizontally with respect to rack which is mounted on a slide drawer to maximize its compact configuration. Twenty-four channels are available.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

The EEG module will be used to collect bio-electrical data to measure brain activity when required.
The EEG cap facilitates easy crew use.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: ELECTROENCEPHALOGRAPH MODULE ID# 7	PAGE 3 of 4
	VER : 01 ORIGINATOR: H. Nguyen	

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:
aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 2.5 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: ____ %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

electrical cable harness for electrodes
surface electrodes
gel

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
6	75 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE. NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
6	25 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☐ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
____	____ %	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: ELECTROENCEPHALOGRAPH MODULE ID# 7

VER : 01 **ORIGINATOR:** H. Nguyen

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☐ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☒ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 5.00

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	40	40	20	40	0	0
DIGITAL	40	40	50	0	0	10
DISP W/CRT	0	0	0	0	0	0
DISPLAY	20	25	25	30	0	20
XMTR	0	0	0	0	0	0
PWR SUP	0	0	0	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

20 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☒ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☐ MEDIUM ☐ HIGH

BMAC HARDWARE DATA SHEET

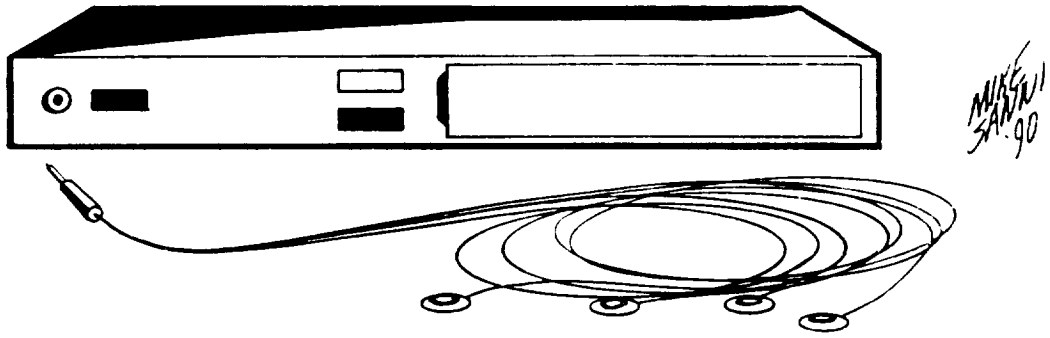
EQUIPMENT NAME ELECTROMYOGRAPH MODULE

Page 1 of 4

HARDWARE ID. NO.: 8 ORIGINATOR: J. Stephenson

VERSION : 01

ILLUSTRATION



DEFINITION

A diagnostic device used to monitor the bio-electric signals produced by muscles, to stimulate peripheral nerves, and to monitor and display the electrical activity produced by nerves.

HISTORY/DESIGN STATUS:

Current technology is applicable.
Modification is required for flight unit.
New component design is required.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: ELECTROMYOGRAPH MODULE ID# 8

VER : 01 **ORIGINATOR:** J. Stephenson

GENERAL SPECIFICATIONS

Mass (kg):	4
Height (m)	.044
Width (m)	.482
Depth (m)	.851
Volume (m3):	.018
Standby Power (W)	
Operational Power (W)	25
Peak Power (W)	
Power Source (VDC)	28

PERFORMANCE SPECIFICATIONS:

Solid state stimulator with low impedance of isolated, square wave voltage output.
Voltage, frequency, and duration are all independently adjustable.
Output wave form: 5 microseconds rise time
10 microseconds fall time
Output impedance: 500 ohms on all ranges.
Stimulus Frequency: single or continuous pulse from .2 to 250 pulses/second in 3 ranges.
Stimulus duration. 0.1 to 120ms in 3 ranges.

Frequency Response: .05 to 10kHz
Time Constant: 3.2, 0.3, 0.03 seconds.
Input Impedance: 10 megaohms differential,
50 megaohms common mode
Noise level: Less than 5 microvolts peak to peak.

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☐	☒	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☒	☐

PROBLEMS/ISSUES AND CONCERNS

FDA recommends the operation of this device to be restricted to physicians trained in diagnostic electro-myography.
Risks include:
1) Electrical shock.
2) Misdiagnosis due to inaccurate measurements.
3) Local burns and tissue damage.

ASSUMPTIONS/ JUSTIFICATIONS

Raw uncalibrated signal is recorded, modulated, processed and stored in the physiological bio-potential data recorder. The data will be recorded on VHS tape and down-linked to ground control center for analysis.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

A modular part of the bio-potential measuring device system
Controls are located on the front panel.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

The device will be used to test muscle degeneration weekly. Data will be down-linked to ground control station for further analysis.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: ELECTROMYOGRAPH MODULE	ID# 8	PAGE 3 of 4
	VER : 01	ORIGINATOR: J. Stephenson	

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:
aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 1.8 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 30 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

electrical cable harness for electrodes
surface electrodes
gel

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
26	100 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED
		☒ SUPPORT STRUCTURE, NO MOVING PARTS
		☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES
		☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
		☐ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC.
	%	☐ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT
		☐ PRECISION MACHINED PARTS, MANY MOVING PARTS
		☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
		☐ C. LAMINATED STRUCTURAL COMPOSITES
	%	☐ LAID UP FLAT SURFACE WITH STIFFENERS
		☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY
		☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET | EQUIPMENT NAME: ELECTROMYOGRAPH MODULE | ID# 8 | VER : 01 | ORIGINATOR: J. Stephenson | PAGE 4 of 4

TYPE OF ELECTRONICS:

- [X] ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF. SERVO DRIVE, ETC.
- [X] DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- [ ] DISPLAY WITH CRT
- [ ] TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- [ ] POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- [X] DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 2.20

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	40	40	20	40	0	0
DIGITAL	40	40	50	0	0	10
DISP W/CRT	0	0	0	0	0	0
DISPLAY	20	25	25	30	0	20
XMTR	0	0	0	0	0	0
PWR SUP	0	0	0	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

35 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

(●) Yes ( ) No

SCOPE OF DESIGN EFFORT:

- [ ] SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- [X] MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- [ ] NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- [ ] NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- [ ] NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- [ ] DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL.

IF HARDWARE NEEDS SOFTWARE TO RUN:

- [ ] COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- [ ] ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE [ ] LOW [ ] MEDIUM [ ] HIGH

BMAC HARDWARE DATA SHEET

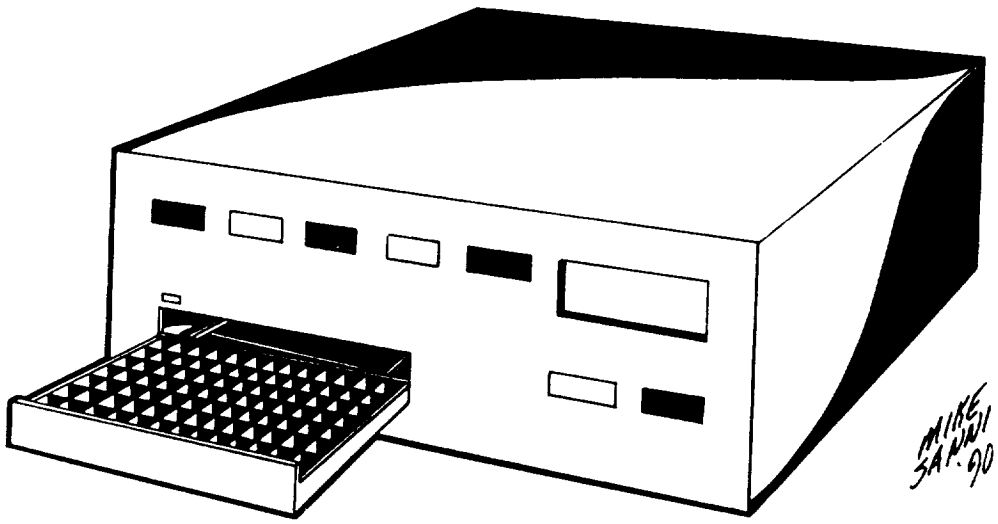
EQUIPMENT NAME ELISA READER

Page 1 of 4

HARDWARE ID. NO.: 31 ORIGINATOR: J. Stephenson

VERSION : 1

ILLUSTRATION



DEFINITION

The Elisa Reader quantitatively analyzes levels of erythropoietin by enzyme linked immunoassay. It also has the capability to perform other ELISA tests such as cell activity and immunoglobulin levels.

HISTORY/DESIGN STATUS:

Some current models available commercially.
Significant modification required for space.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: ELISA READER ID# 31

VER : 1 **ORIGINATOR:** J. Stephenson

GENERAL SPECIFICATIONS

Mass (kg):	18
Height (m)	.22
Width (m)	.482
Depth (m)	.851
Volume (m3):	.090
Standby Power (W)	
Operational Power (W)	150
Peak Power (W)	
Power Source (VDC)	28

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☐	☒	☐
THERMAL:	☐	☐	☒
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☒	☐

PERFORMANCE SPECIFICATIONS:

Capable of processing twenty samples sequentially per batch.
Manual and automatic modes

PROBLEMS/ISSUES AND CONCERNS

Modification is required for liquids used in this type of testing

ASSUMPTIONS/ JUSTIFICATIONS

Complicated item.
Must be highly automated to reduce crew requirements.
Calibration to be performed via commands from ground control center.
Enzymes need to be maintained at set temperature to prevent degradation.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

Rack mounted unit with:
1. Automated fluid dispenser to wash enzymes between stages of the chemical process.
2. Servo-motor driven sample movement assembly to manipulate samples between washes.
3. Light source for colorimetric measurement.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

Instrument required to perform erythropoietin and other specific antibody tests.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: ELISA READER	ID# 31	PAGE 3 of 4
	VER : 1	ORIGINATOR: J. Stephenson	

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:
aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 16 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 30 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

fan

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	**CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:**
6	85 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☐ SUPPORT STRUCTURE, NO MOVING PARTS ☒ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
20	15 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☐ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: ELISA READER ID# 31 PAGE 4 of 4

VER : 1 **ORIGINATOR:** J. Stephenson

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☒ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☒ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 2.00

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	25	20	80	0	0	0
DIGITAL	40	0	30	70	0	0
DISP W/CRT	0	0	0	0	0	0
DISPLAY	15	100	0	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	20	0	0	100	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

35 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☒ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☐ MEDIUM ☒ HIGH

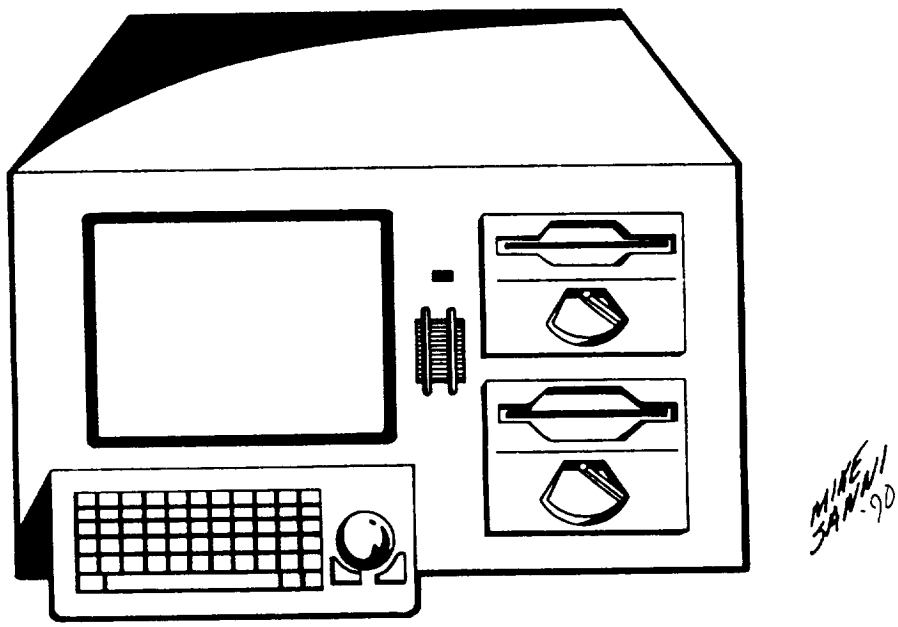
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME EXPERIMENT CONTROL COMPUTER SYSTEM

HARDWARE ID. NO.: 43 ORIGINATOR: H. Nguyen

VERSION : 1

ILLUSTRATION



DEFINITION

The Experiment Control Computer System provides acquisition, processing, storage and downloading of data generated by Life Sciences instrumentation and procedures. The system is used as a sequencer for experiment and inter-experiment control.

HISTORY/DESIGN STATUS:

Extensive modification to current computer technology

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: EXPERIMENT CONTROL COMPUTER SYSTEM ID# 43

VER : 1 **ORIGINATOR:** H. Nguyen

GENERAL SPECIFICATIONS

Mass (kg):	67
Height (m)	.178
Width (m)	.482
Depth (m)	.851
Volume (m3):	.073
Standby Power (W)	15
Operational Power (W)	250
Peak Power (W)	
Power Source (VDC)	28

PERFORMANCE SPECIFICATIONS:

Must be capable of handling data produced from all Life Sciences experiments while being conducted simultaneously.
Must have adequate storage available.
May have remote crew member interfaces (more than one monitor and keyboard)

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☐	☒	☐
THERMAL:	☐	☒	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☐	☒

PROBLEMS/ISSUES AND CONCERNS

ASSUMPTIONS/ JUSTIFICATIONS

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

A computer system with CRT, keyboard and disk drives.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

This is the control and command center for Life Sciences experiments. It drives the sequences of experiments, coordinating inter-experiment activities, processing and routing data to the appropriate destinations.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: EXPERIMENT CONTROL COMPUTER SYSTEM	ID# 43	PAGE 3 of 4
	VER : 1	ORIGINATOR: H. Nguyen	

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:
aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 59 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 25 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

optical disk drives
color monitor
fan
card cage
track ball
infrared receiver/transmitter

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
8	75 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
15	25 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: EXPERIMENT CONTROL COMPUTER SYSTEM ID# 43

VER : 1 **ORIGINATOR:** H. Nguyen

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☒ DISPLAY WITH CRT
- ☒ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☒ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☐ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 8.00

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	20	15	55	30	0	0
DIGITAL	40	10	35	55	0	0
DISP W/CRT	20	10	60	30	0	0
DISPLAY	0	0	0	0	0	0
XMTR	10	0	60	40	0	0
PWR SUP	10	20	80	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

30 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☒ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☒ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☒ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☐ MEDIUM ☒ HIGH

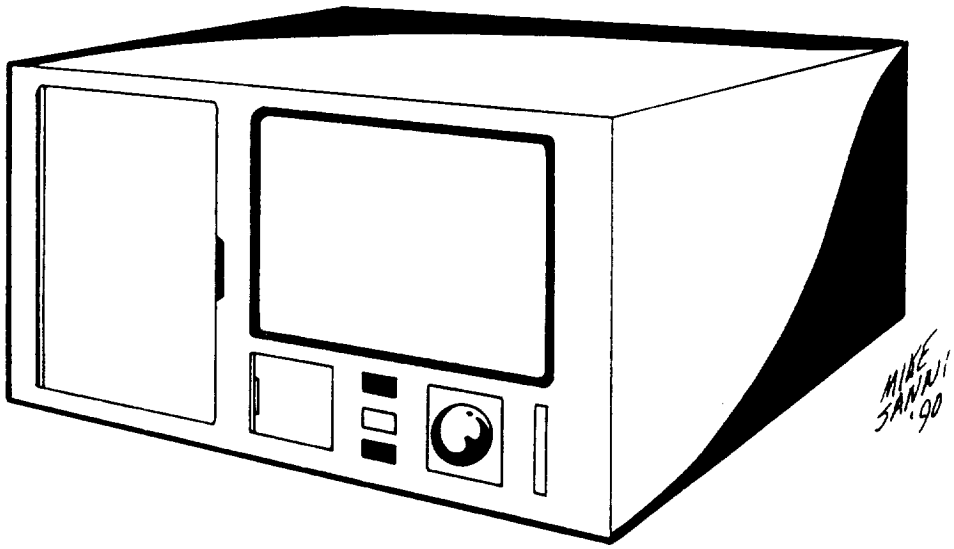
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME FLOW CYTOMETER

HARDWARE ID. NO.: 32 ORIGINATOR: H. Nguyen

VERSION : 1

ILLUSTRATION



DEFINITION

An instrument used to perform primarily DNA analysis.
The Flow Cytometer features a unique flow chamber with epi-illumination and photodiode/photomultiplier tubes.

HISTORY/DESIGN STATUS:

Current technology produces flow cytometer for use in clinical lab environment.
Extensive modification necessary to be operational in microgravity.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: FLOW CYTOMETER ID# 32 Page 2 of 4

VER : 1 **ORIGINATOR:** H. Nguyen

GENERAL SPECIFICATIONS

Mass (kg):	36
Height (m)	.74
Width (m)	.482
Depth (m)	.851
Volume (m3):	.303
Standby Power (W)	
Operational Power (W)	250
Peak Power (W)	
Power Source (VDC)	28

PERFORMANCE SPECIFICATIONS:

Mercury arc lamp (100 watt)
Flow chamber design produces stable flow.
Back wash system using air burst injection
Self aligning optic system with remote control capabilities.
Differential pressure head
Non achromatic condenser allows heat dissipation without heat filter, saving 20% of light intensity.
Solid state photodiode and photomultiplier tube are used interchangeably, depending on the required sensitivity.
All fluids, waste,and components are housed in one containment unit.

RACK INTERFACE

Rack Mounted? ☒

	NONE:	STANDARD	EXTRA:
ELECTRICAL	☐	☒	☐
THERMAL:	☐	☒	☐
WASTE:	☐	☒	☐
FLUID:	☒	☐	☐
DATA:	☐	☒	☐

PROBLEMS/ISSUES AND CONCERNS

Fluids waste diposal management
Mercuric arc lamp poses the hazard of contamination on-board .

ASSUMPTIONS/ JUSTIFICATIONS

Need for cytometer for cell analysis on Space Station.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

The self-contained unit will fit into a standard 19" rack on slides for access.
Unit will be powered by 28VDC at a maximum of 25 amps and the total power shall not not exceed 250 Watts.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

This instrument is used primarily for DNA analysis. The design requirements puts emphasis on automation and self-calibration capabilities to minimize crew time.
Manual adjustment is kept to a minimum. Optical components are controlled and adjusted by software to attain the smallest coefficient of variation of the signals.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: FLOW CYTOMETER ID# 32

VER : 1

ORIGINATOR: H. Nguyen

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

aluminum, glass

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 31 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 30 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

fluidics
cooling, thermal control, heat rejection
optics
servo Motors
fluid and pneumantic pressure systems
calibration control, stepper motors, micrometer positioning

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	**CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:**
25	65 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☒ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
70	35 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☒ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: FLOW CYTOMETER ID# 32 PAGE 4 of 4

VER : 1 **ORIGINATOR:** H. Nguyen

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☒ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☒ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☐ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 5.00

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	20	30	20	30	20	0
DIGITAL	30	20	20	50	0	10
DISP W/CRT	40	10	20	50	20	0
DISPLAY	0	0	0	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	10	40	40	0	20	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

30 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☒ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL.

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☒ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☒ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☐ MEDIUM ☒ HIGH

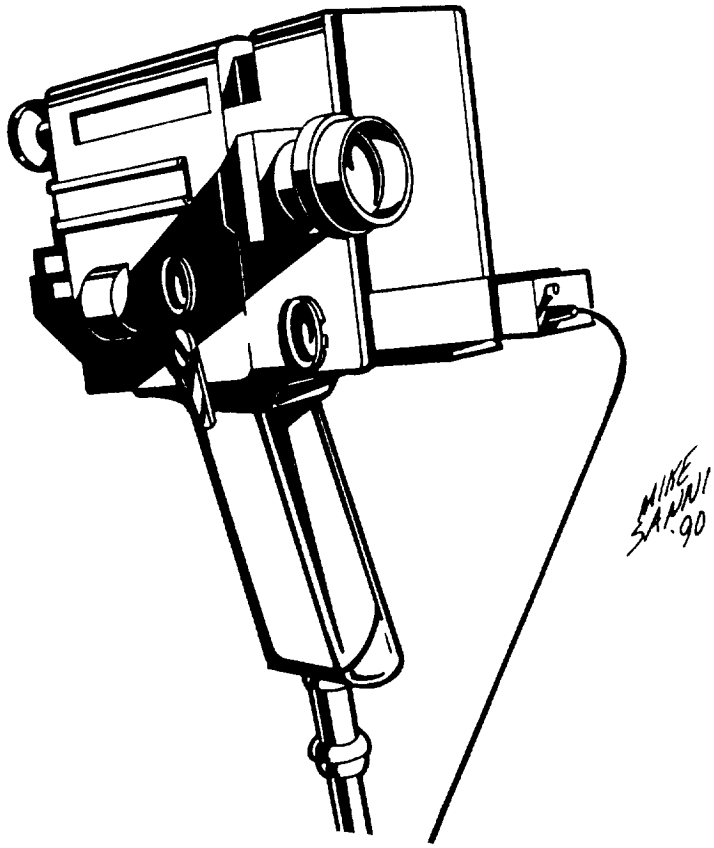
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME FUNDUS CAMERA

HARDWARE ID. NO.: 15 ORIGINATOR: H. Nguyen

VERSION : 1

ILLUSTRATION



DEFINITION

A hand-held instrument used in examining the fundus (the part of the eye opposite the pupil).
The Fundus Camera utilizes either a camera pack for still photographic recording, or a video interface for observing live retinal images.

HISTORY/DESIGN STATUS:

The fundus camera has flown on the KC-135 .
Modifications are required to supply photography for both still and video

The camera is currently equipped for still photography only.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: FUNDUS CAMERA ID# 15

VER : 1 **ORIGINATOR:** H. Nguyen

GENERAL SPECIFICATIONS

Mass (kg):	2
Height (m)	.23
Width (m)	.05
Depth (m)	.28
Volume (m3):	.003
Standby Power (W)	
Operational Power (W)	
Peak Power (W)	
Power Source (VDC)	battery

RACK INTERFACE

Rack Mounted? ☐

	NONE	STANDARD	EXTRA
ELECTRICAL	☒	☐	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☒	☐	☐

PERFORMANCE SPECIFICATIONS:

Must be capable of capturing high quality black & white and/or color images of the retinal area.
Must contain a continuous light source for video and digital imaging and a flash source for photography.
Must interface with video system and image digitizing system.

PROBLEMS/ISSUES AND CONCERNS

For best results, the subject's head should be restrained during the photographic sesssion.

ASSUMPTIONS/ JUSTIFICATIONS

The camera interfaces directly with the image digitizing system.
Due to the odd shape of the camera, volume is calculated based on the largest dimensions.
Dimensions are based on video configuration.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

The camera is a compact, light-weight, battery powered unit with trigger finger control. An adaptor plate on the back of the camera allows for still (35mm) or video (CCTV) interface. A miniature light source just below the lens provides retinal illumination.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

The camera is held close to the crew member's eye and photographs or sends video images of the retina to a video system and/or digitizing system.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: FUNDUS CAMERA ID# 15

VER : 1

ORIGINATOR: H. Nguyen

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

noryl, aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 1.7 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 15 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

batteries
lens, prism and mirror
miniature lamp
miniature strobe

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
5	65 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
30	35 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☐ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☒ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

Stabilization of camera and head restraint may be required for quality images.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: FUNDUS CAMERA ID# 15

VER : 1 **ORIGINATOR:** H. Nguyen

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☒ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☐ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☐ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 0.30

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	30	10	10	80	0	0
DIGITAL	50	10	75	5	5	5
DISP W/CRT	20	0	40	20	0	40
DISPLAY	0	0	0	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	0	0	0	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

10 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☒ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☒ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☒ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☐ MEDIUM ☐ HIGH

BMAC HARDWARE DATA SHEET

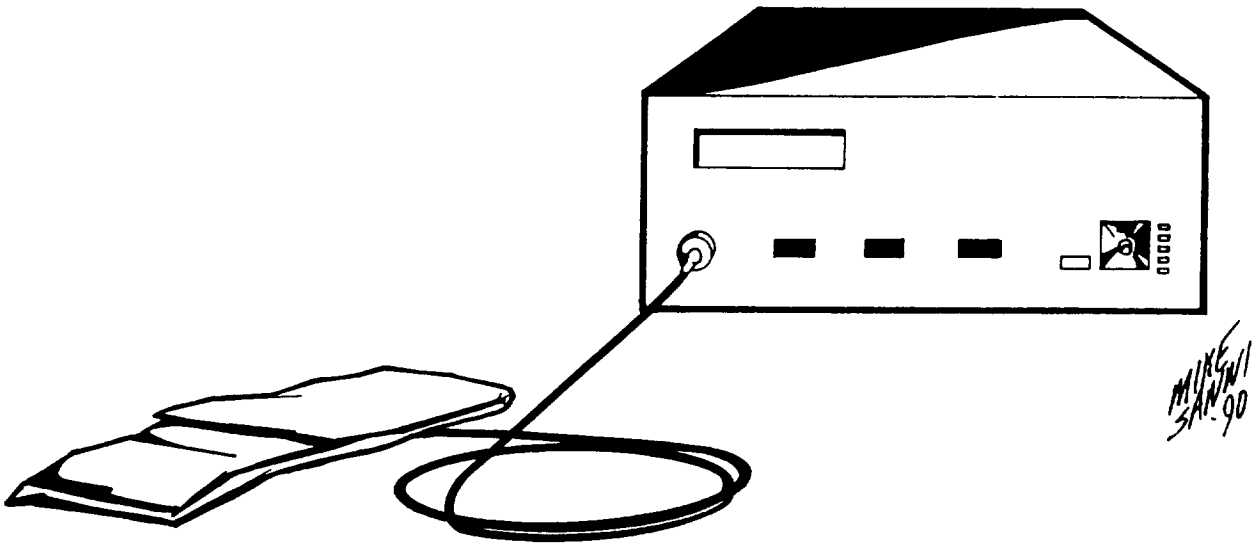
EQUIPMENT NAME GASTROINTESTINAL PH METER

Page 1 of 4

HARDWARE ID. NO.: 10 ORIGINATOR: G. McFadyen

VERSION : 1

ILLUSTRATION



DEFINITION

A frequency modulated, radio signal measuring receiver with meter and recorder used for monitoring gastro-intestinal physiology in terms of hydrogen ion concentration(pH).

HISTORY/DESIGN STATUS:

Commercial system developed at Heidelberg University in W.Germany over 20 years ago.
System has never been used in microgravity environment.
Modifications are needed.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: GASTROINTESTINAL PH METER ID# 10

VER : 1 **ORIGINATOR:** G. McFadyen

GENERAL SPECIFICATIONS

Mass (kg):	31.8
Height (m)	.2
Width (m)	.4
Depth (m)	.3
Volume (m3):	.024
Standby Power (W)	
Operational Power (W)	70
Peak Power (W)	
Power Source (VDC)	28

PERFORMANCE SPECIFICATIONS:

Frequency 1.9 - 2.0 Mega Herzt
Range 1.0 - 7.0 pH
Capsule battery life 20 hours
Sensitivity 10 KHz/pH
Accuracy +- 0.5 pH

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☐	☒	☐
THERMAL:	☐	☒	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☒	☐

PROBLEMS/ISSUES AND CONCERNS

Capsule is excreted in feces and may cause problem with waste management system.
Capsule needs to be calibrated in pH2 and pH7 solutions at 37 degrees Centigrade prior to use.
Current design requires subject to be connected to control unit via belt.
Possible RFI problems due to transmitter system requiring

ASSUMPTIONS/ JUSTIFICATIONS

This system provides in-vivo pH measurements in the gastrointestinal tract.
Capsule is not re-usable.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☐ MARC II ☒ MARC III

PHYSICAL DESCRIPTION:

Capsule is designed to be swallowed, containing Zinc/Silver Chloride battery and transistor.
Receiving belt antenna, 6" wide, worn around abdomen .
Control unit contains power supply, circuit board, printer, meter, and control knobs.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

Ingested capsule transmits signal to receiving belt antenna. Transmitted frequency is related to pH. Receiving belt antenna is connected to control unit, which calculates the pH and displays results on printer and meter. Capsule moves through digestive tract and is excreted in feces.
Data will be stored in the experimental control computer and transmitted to ground control center as needed.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: GASTROINTESTINAL PH METER	ID# 10	PAGE 3 of 4
	VER : 1	ORIGINATOR: G. McFadyen	

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

Sheet metal/aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 29.9 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 15 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

batteries
power supply
meter
capsule

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
20	84 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
7	16 %	☐ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☐ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☐ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

Commercial structure/mechanical can be redesigned to reduce weight and allow for rack mounting

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: GASTROINTESTINAL PH METER ID# 10

VER : 1 **ORIGINATOR:** G. McFadyen

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☐ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☒ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☒ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☒ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 1.90

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	30	40	60	0	0	0
DIGITAL	0	0	0	0	0	0
DISP W/CRT	25	20	40	40	0	0
DISPLAY	0	0	0	0	0	0
XMTR	30	10	55	25	0	10
PWR SUP	15	30	70	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

35 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☒ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL.

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☐ MEDIUM ☐ HIGH

BMAC HARDWARE DATA SHEET

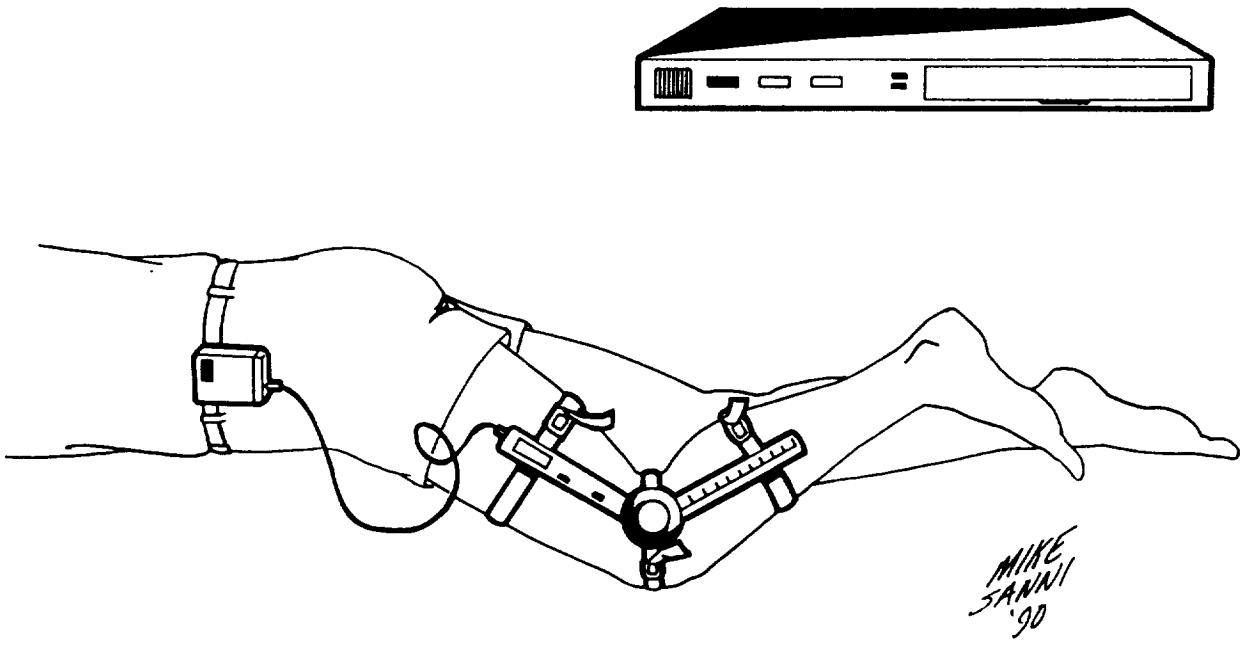
EQUIPMENT NAME GONIOMETER AND RECORDER

Page 1 of 4

HARDWARE ID. NO.: 19 ORIGINATOR: J. Stephenson

VERSION : 1

ILLUSTRATION



DEFINITION

An instrument used to detect variations in the range of motion of major joints. Uncalibrated signals will be recorded on a portable recorder and periodically transferred to the Physiological Bio-potential Recorder for signal conditioning, modulation, and storage. Data will be downlinked to ground control center for further analyses.

HISTORY/DESIGN STATUS:

Modification of current technology
New component design is required.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: GONIOMETER AND RECORDER ID# 19 Page 2 of 4

VER : 1 **ORIGINATOR:** J. Stephenson

GENERAL SPECIFICATIONS

Mass (kg):	5
Height (m)	.044
Width (m)	.482
Depth (m)	.851
Volume (m3):	.018
Standby Power (W)	
Operational Power (W)	10
Peak Power (W)	
Power Source (VDC)	28

PERFORMANCE SPECIFICATIONS:

Measurement of angle adjustments.
Accuracy: +- 3 degrees
Streamlined protractor strapped on subject's legs for minimal interference with daily activities.

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☒	☐	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☒	☐

PROBLEMS/ISSUES AND CONCERNS

ASSUMPTIONS/ JUSTIFICATIONS

Data is processed by the Physiological Bio-potential Recorder..
Battery will be used to record data and then transmitted to above recorder for translation.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☐ MARC II ☒ MARC III

PHYSICAL DESCRIPTION:

Flat adjustable instrument with photoelectric sensing device for measurement.
Adjustable straps for connection to limb.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

An instrument used to measure the range of motion of joints (angles) of crew members in microgravity. Recording is performed by a battery-powered portable recorder, attached to subject's belt. Raw data is loaded into the Bio-potential recorder for signal processing and routing.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: GONIOMETER AND RECORDER	ID# 19	PAGE 3 of 4
	VER : 1	ORIGINATOR: J. Stephenson	

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:
aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 1.1 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 25 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

battery

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
6	31 %	☐ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☐ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
32	69 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: GONIOMETER AND RECORDER	ID# 19	PAGE 4 of 4
	VER : 1	ORIGINATOR: J. Stephenson	

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☒ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☒ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 3.90

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	30	25	75	0	0	0
DIGITAL	35	75	25	0	0	0
DISP W/CRT	0	0	0	0	0	0
DISPLAY	20	90	10	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	15	75	25	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

40 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☒ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☐ MEDIUM ☐ HIGH

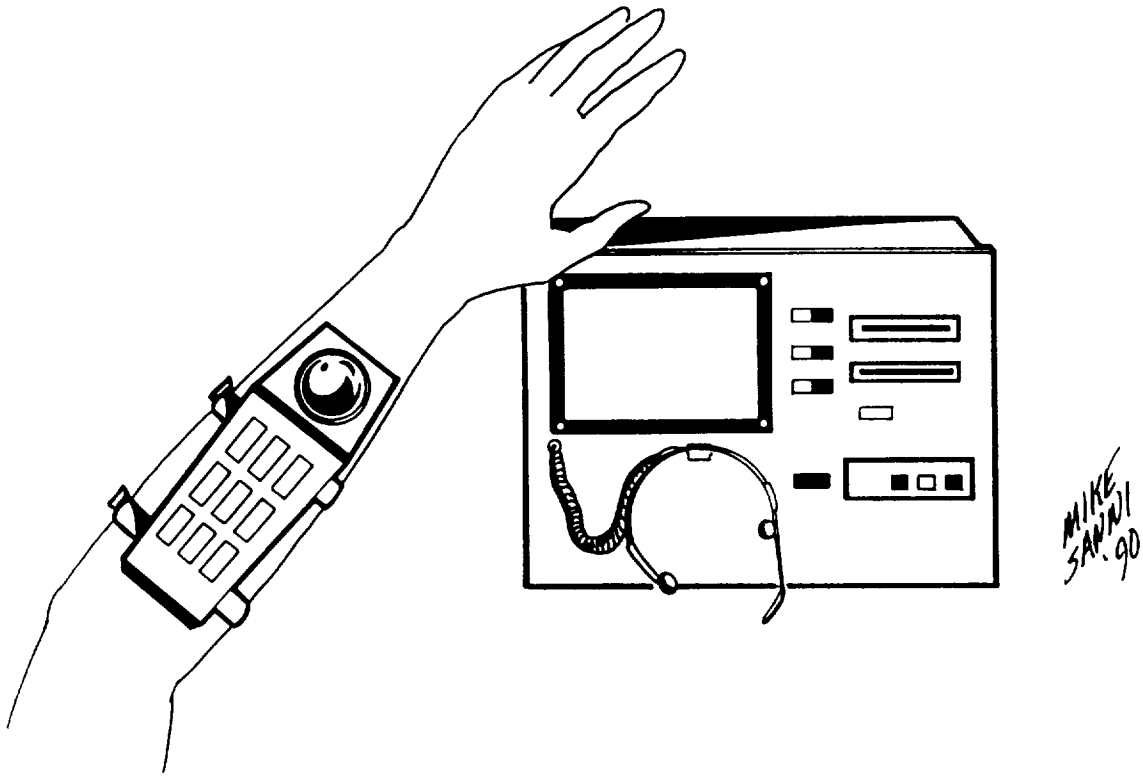
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: IMAGE DIGITIZING SYSTEM

HARDWARE ID. NO.: 14 ORIGINATOR: H. Nguyen

VERSION : 1

ILLUSTRATION



DEFINITION

A system which receives and digitizes color or monochrome images from any source. The system also performs limited pattern recognition, provides image processing analysis & display and sends images to the storage computer or downlink facility.

HISTORY/DESIGN STATUS:

New Design
The system will consist of a digitizing unit, two color monitors, a touchpad, and/or voice activated control device.

All required technology exists, but needs refining.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: IMAGE DIGITIZING SYSTEM ID# 14

VER : 1 **ORIGINATOR:** H. Nguyen

GENERAL SPECIFICATIONS

Mass (kg):	7.8
Height (m)	.22
Width (m)	.483
Depth (m)	.851
Volume (m3):	.090
Standby Power (W)	
Operational Power (W)	500
Peak Power (W)	
Power Source (VDC)	28

PERFORMANCE SPECIFICATIONS:

Must meet NTSC standards of 30 frames per second.
The option between black and white or color images must be available.
Voice recognition/activation required.
Section between 512x512 or 1024x1024 processing capability.

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☐	☒	☐
THERMAL:	☐	☒	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☐	☒

PROBLEMS/ISSUES AND CONCERNS

Storage space is a major concern for the expected large numbers of digital images to be produced.
Adequate downlink rates and times between the event and ground evaluation are also needed.
Training of voice recognition system needs simplification.
Compatible bus interface 1553

ASSUMPTIONS/ JUSTIFICATIONS

Video input into the system will occur through a direct interface port on the front of the panel of the system or through video ports in the back of the racks.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

The system is a compact processsing unit with two optical disk ports, two 9 in. diagonal color monitors, and with touch pad and /or voice activated control device.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

The unit receives images from any video source: performs limited pattern recognition; provides image processing analysis.
The Image Digitizing system then digitizes these images for storage or downlink.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: IMAGE DIGITIZING SYSTEM ID# 14

VER : 1 **ORIGINATOR:** H. Nguyen

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 4.8 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 40 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

color monitors two
optical storage units two
optical storage unit cartridge
fan
voice activation system
infrared touchpad

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
14	25 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
20	75 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☒ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

Color liquid crystal displays may be substituted for color CRTs when technology improves quality of LCD.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: IMAGE DIGITIZING SYSTEM ID# 14 PAGE 4 of 4

VER : 1 **ORIGINATOR:** H. Nguyen

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☒ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☒ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☐ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 3.00

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	15	25	75	0	0	0
DIGITAL	60	0	0	20	30	50
DISP W/CRT	10	0	0	100	0	0
DISPLAY	0	0	0	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	15	0	0	100	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

30 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

◉ Yes ○ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☒ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☒ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☒ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☒ MEDIUM ☐ HIGH

BMAC HARDWARE DATA SHEET

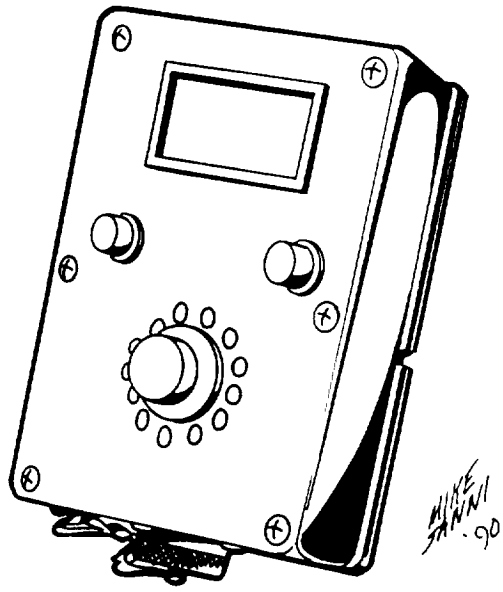
EQUIPMENT NAME IMPEDANCE METER

Page 1 of 4

HARDWARE ID. NO.: 500 ORIGINATOR: G. McFadyen

VERSION : 1

ILLUSTRATION



DEFINITION

A device used to ensure low impedance when measuring bio-electrical impulses.

HISTORY/DESIGN STATUS:

Developed for IML-1 Shuttle flight
Modification is required for use with all bio-potential recording devices i.e. EEG.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: IMPEDANCE METER ID# 500

VER : 1 **ORIGINATOR:** G. McFadyen

GENERAL SPECIFICATIONS

Mass (kg):	3.76
Height (m)	.044
Width (m)	.482
Depth (m)	.851
Volume (m3):	.018
Standby Power (W)	
Operational Power (W)	
Peak Power (W)	
Power Source (VDC)	Battery

PERFORMANCE SPECIFICATIONS:

Rapid assessments of applied electrodes through touch control electronics (36 seconds for 36 electrodes).

LED indicators of impedances above preset values (5,10,20, or 30 KOhm)

LCD displays of electrode impedances from 100-200,000 Ohms

Hand-held portable device.

RACK INTERFACE

Rack Mounted? ☐

	NONE	STANDARD	EXTRA
ELECTRICAL	☒	☐	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☒	☐	☐

PROBLEMS/ISSUES AND CONCERNS

Will batteries be disposable or rechargable?

ASSUMPTIONS/ JUSTIFICATIONS

Device will be used to check resistances on all biomedical surface electrodes.
Modification to existing flight unit.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

Box containing electronic meter (analog or LED) to display reading.,
Also consists of power switch, batteries, attachment leads and circuitry to produce current at proper frequency.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

The leads attach to electrodes mounted on the skin. When the switch is activated, microlevel current flows through the electrodes. The resulting voltage is measured to determine the impedance. Used for ECG, EMG, EEG, and EOG electrodes.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: IMPEDANCE METER ID#500

VER : 1 **ORIGINATOR:** G. McFadyen

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:
aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 2.7 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 15 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

batteries
meter
circuitboard
box

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	**CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:**
20	85 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
25	15 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☐ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: IMPEDANCE METER ID# 100 PAGE 4 of 4

VER : 1 **ORIGINATOR:** G. McFadyen

TYPE OF ELECTRONICS:

- ☐ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☐ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☒ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 1.06

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	0	0	0	0	0	0
DIGITAL	30	50	50	0	0	0
DISP W/CRT	0	0	0	0	0	0
DISPLAY	70	0	100	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	0	0	0	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

18 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☒ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☐ MEDIUM ☐ HIGH

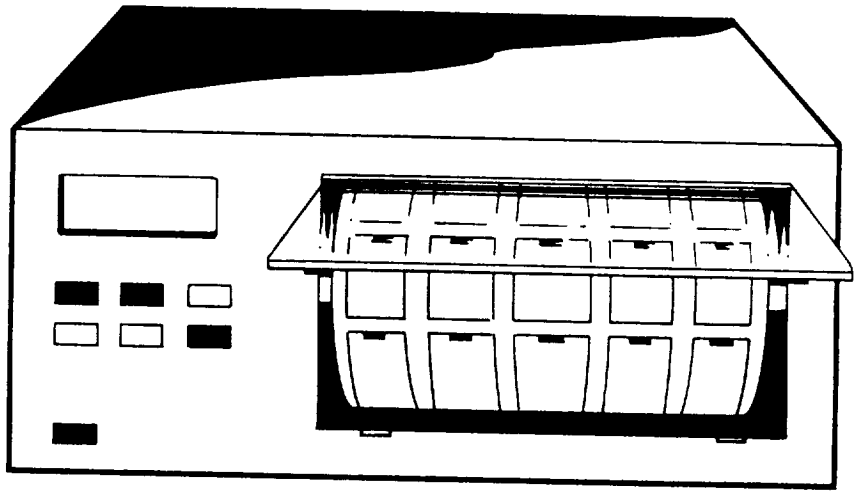
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: INCUBATOR-CENTRIFUGAL

HARDWARE ID. NO.: 25 ORIGINATOR: G. McFadyen

VERSION : 1

ILLUSTRATION



MIKE SANDI 3A-90

DEFINITION

Equipment for the mitogenic stimulation assay to simulate a 1g environment in space.

HISTORY/DESIGN STATUS:

Extensive modification of incubator cell attachment test (ICAT) apparatus to incorporate 1g centrifuge is required.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: INCUBATOR-CENTRIFUGAL ID# 25

VER : 1 **ORIGINATOR:** G. McFadyen

GENERAL SPECIFICATIONS

Mass (kg):	12
Height (m)	.308
Width (m)	.48
Depth (m)	.48
Volume (m3):	.070
Standby Power (W)	
Operational Power (W)	500
Peak Power (W)	
Power Source (VDC)	28

PERFORMANCE SPECIFICATIONS:

Temperature Control: 37 degrees C.
Chamber Rotates to Produce 1g.
Chamber is sealed during operation to contain carbon dioxide and/or mitogen.

RACK INTERFACE

Rack Mounted? ☒

	NONE:	STANDARD	EXTRA:
ELECTRICAL	☐	☒	☐
THERMAL:	☐	☐	☒
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☒	☐

PROBLEMS/ISSUES AND CONCERNS

Carbon dioxide must be supplied and disposed of.
Mitogen must be contained.

ASSUMPTIONS/ JUSTIFICATIONS

Although based on ICAT, requirements are sufficiently different to require new design.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

Unit contains holders for cell culture vessels, centrifuge arms and motor,heater, and mechanism for introducing CO2 during centrifugation.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

Produces 1g at 37 degrees with controlled environment to culture cells. Controlled environment includes CO2 and mitogen.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: INCUBATOR-CENTRIFUGAL	ID# 25	PAGE 3 of 4
	VER : 1	ORIGINATOR: G. McFadyen	

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 13 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 40 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

motor
centrifuge arm and sample holder
heater
power supply
environmental control unit
timer

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
20	60 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☐ SUPPORT STRUCTURE, NO MOVING PARTS ☒ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
30	40 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☐ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: INCUBATOR-CENTRIFUGAL ID# 25	PAGE 4 of 4
	VER : 1 ORIGINATOR: G. McFadyen	

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☒ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☒ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics -1.00

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	30	50	30	20	0	0
DIGITAL	30	0	50	50	0	0
DISP W/CRT	0	0	0	0	0	0
DISPLAY	30	70	30	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	10	50	50	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

30 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☒ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE

☒ LOW ☐ MEDIUM ☐ HIGH

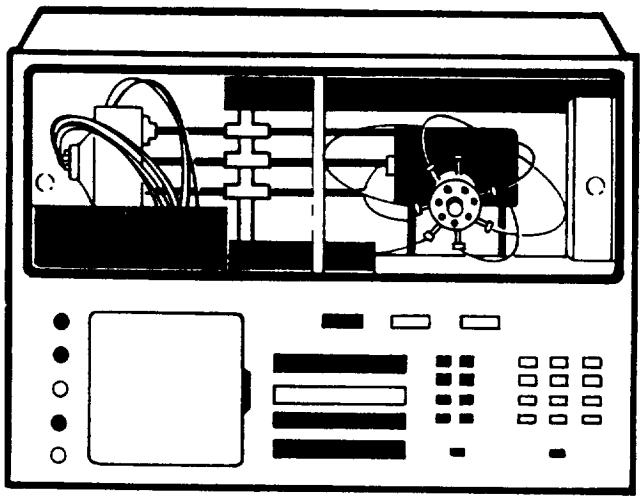
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME ION CHROMATOGRAPH

HARDWARE ID. NO.: 11 ORIGINATOR: J. Stephenson

VERSION : 1

ILLUSTRATION



DEFINITION

Instrument to measure both anion and cation contaminants in urine, as well as serum potassium levels.

HISTORY/DESIGN STATUS:

Current technology available.
Modification necessary for use in microgravity.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: ION CHROMATOGRAPH ID# 11 Page 2 of 4

VER : 1 **ORIGINATOR:** J. Stephenson

GENERAL SPECIFICATIONS

Mass (kg):	31
Height (m)	.352
Width (m)	.482
Depth (m)	.851
Volume (m3):	.145
Standby Power (W)	
Operational Power (W)	250
Peak Power (W)	
Power Source (VDC)	28

PERFORMANCE SPECIFICATIONS:

Halides, calcium, magnesium and potassium concentration quantitation.
Concentration limits: 1ppb to .01%
Detection wavelength: 190-700nm
Flow rate: 0.001 to 9.99 ml/minute
Adjustable in .01 ml increments

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☐	☒	☐
THERMAL:	☐	☐	☒
WASTE:	☐	☒	☐
FLUID:	☐	☐	☒
DATA:	☐	☒	☐

PROBLEMS/ISSUES AND CONCERNS

Waste management of solvent and diluent

Performance of ion exchange column in microgravity environment

ASSUMPTIONS/ JUSTIFICATIONS

An instrument capable of separating and identifying components of a solution (urine) by the virtue of their differences in polarities and magnitude of their ionic charges.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

Rack mounted instrument with fan, heat sources, and pumps

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

Perform weekly crewmembers' calcium concentration monitoring.
When need arises, serum potassium quantitative analyses.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: ION CHROMATOGRAPH ID# 11

VER : 1

ORIGINATOR: J. Stephenson

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:
aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 29 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 40 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

fan
heat source
pumps

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	**CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:**
12	20 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
35	80 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET | EQUIPMENT NAME: ION CHROMATOGRAPH | ID# 11 | PAGE 4 of 4

VER : 1 | ORIGINATOR: J. Stephenson

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☒ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☒ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 2.00

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	40	80	20	0	0	0
DIGITAL	35	70	30	0	0	0
DISP W/CRT	0	0	0	0	0	0
DISPLAY	20	70	20	10	0	0
XMTR	0	0	0	0	0	0
PWR SUP	5	100	0	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

35 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☒ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
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- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☒ LOW ☐ MEDIUM ☐ HIGH

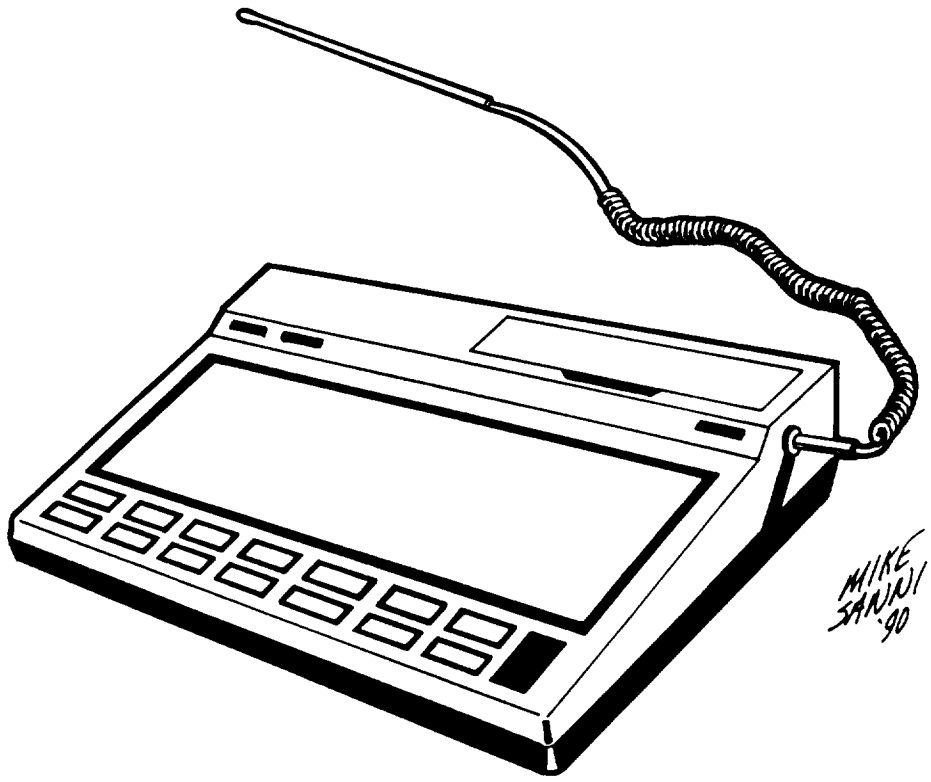
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME ION SPECIFIC/PH METER

HARDWARE ID. NO.: 12 ORIGINATOR: H. Nguyen

VERSION : 1

ILLUSTRATION



DEFINITION

A device used to measure the acid-base status of various types of samples. By attaching specific ion electrodes to the meter, concentration of particular ionic species in a solution can be determined.

HISTORY/DESIGN STATUS:

Commercially available.
Modification for use in space is necessary.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: ION SPECIFIC/PH METER ID# 12

VER : 1 **ORIGINATOR:** H. Nguyen

GENERAL SPECIFICATIONS

Mass (kg):	7
Height (m)	.089
Width (m)	.486
Depth (m)	.851
Volume (m3):	.036
Standby Power (W)	
Operational Power (W)	
Peak Power (W)	
Power Source (VDC)	batteries

PERFORMANCE SPECIFICATIONS:

Digital display of pH range of 0-14
Conduct 'self-test' in stand-by mode and report malfunctions.
Maximum drift:0.0001pH unit or .1mV over 25 hours.
Provide measurement repeatability to within +- .01 pH units.
Conduct 'self test' in stand-by mode to report any malfunction.

RACK INTERFACE

Rack Mounted? ☐

	NONE	STANDARD	EXTRA
ELECTRICAL	☒	☐	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☒	☐	☐

PROBLEMS/ISSUES AND CONCERNS

ASSUMPTIONS/ JUSTIFICATIONS

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

Battery powered, handheld stowable device
LED readout and touchpad controls. Electrodes are cable linked to the main unit and are interchangeable.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

Measure acid-base status and ionic concentrations of various samples.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: ION SPECIFIC/PH METER ID# 12

VER : 1 **ORIGINATOR:** H. Nguyen

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:
anodized aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 6 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 25 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

batteries

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	**CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:**
8	70 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
15	30 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☐ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: ION SPECIFIC/PH METER ID# 12

VER : 1 **ORIGINATOR:** H. Nguyen

TYPE OF ELECTRONICS:

- [X] ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- [X] DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- [ ] DISPLAY WITH CRT
- [ ] TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- [ ] POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- [X] DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 1.00

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	30	25	60	15	0	0
DIGITAL	50	30	50	20	0	0
DISP W/CRT	0	0	0	0	0	0
DISPLAY	20	10	90	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	0	0	0	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

35 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

( ) Yes (•) No

SCOPE OF DESIGN EFFORT:

- [ ] SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- [ ] MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- [ ] NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- [X] NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- [ ] NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- [ ] DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- [ ] COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- [ ] ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE

[X] LOW [ ] MEDIUM [ ] HIGH

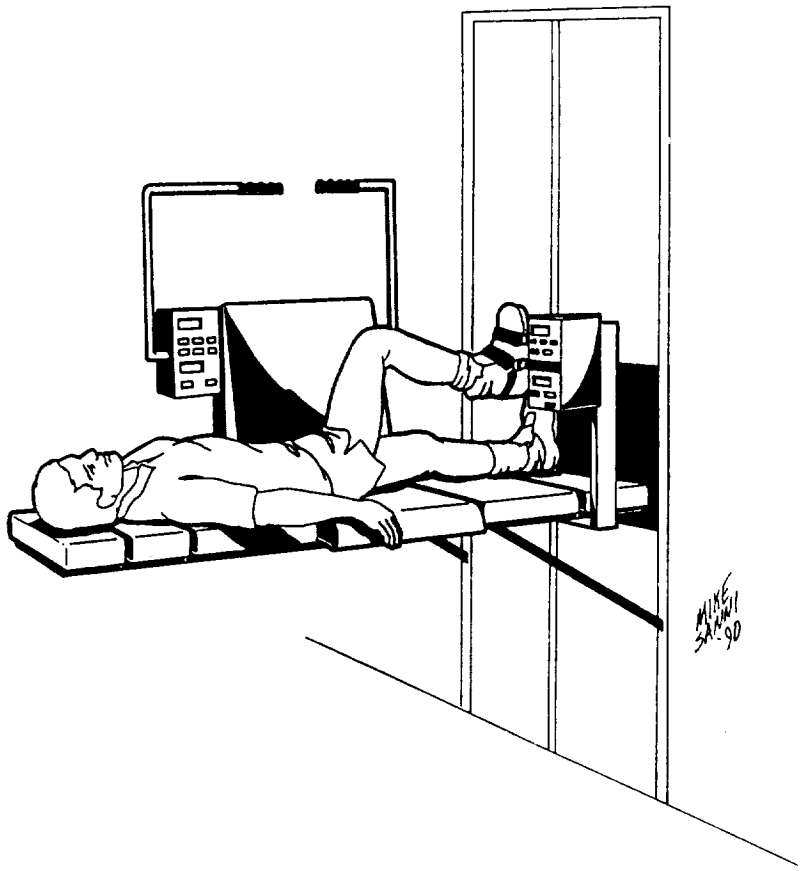
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME ISOKINETIC DYNAMOMETER

HARDWARE ID. NO.: 20 ORIGINATOR: H. Nguyen

VERSION : 1

ILLUSTRATION



DEFINITION

A device used for the measurement of muscle fatigue.
The speed and range of muscle movement are controlled by this device.

HISTORY/DESIGN STATUS:

Currently available on the commercial market.
Modifications to streamline and to reduce mass to meet flight constraints are required.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: ISOKINETIC DYNAMOMETER ID# 20

VER : 1 **ORIGINATOR:** H. Nguyen

GENERAL SPECIFICATIONS

Mass (kg):	32
Height (m)	.178
Width (m)	.482
Depth (m)	.851
Volume (m3):	.073
Standby Power (W)	
Operational Power (W)	50
Peak Power (W)	
Power Source (VDC)	28

PERFORMANCE SPECIFICATIONS:

Tension varies between 1 to 200 foot pounds
Self calibration capabilities

LCD read out of peak and average force in pounds.

Computer controlled speeds and ranges of motion.

RACK INTERFACE

Rack Mounted? ☒

ELECTRICAL	NONE:	STANDARD	EXTRA:
THERMAL:	☐	☒	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☒	☐

PROBLEMS/ISSUES AND CONCERNS

ASSUMPTIONS/ JUSTIFICATIONS

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

Digital read out on the front plate.
A handle to accommodate arms and wrists with a foot fitting for leg muscles quantification.
Strapdown board to immobilize subject's body.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

Used daily to measure fluctuation in muscle strength.
LCD readout gives the peak power measurement and the average over the entire period of activities.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: ISOKINETIC DYNAMOMETER ID# 20 PAGE 3 of 4

VER : 1 **ORIGINATOR:** H. Nguyen

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

aluminum,steel

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 11.7 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 25 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

digital read-out
foot fitting
hand bar
strapdown board

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
25	80 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☒ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
15	20 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☐ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: ISOKINETIC DYNAMOMETER ID# 20

VER : 1 **ORIGINATOR:** H. Nguyen

TYPE OF ELECTRONICS:

- [x] ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- [x] DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- [ ] DISPLAY WITH CRT
- [ ] TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- [x] POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- [x] DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 20.30

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	60	10	90	0	0	0
DIGITAL	10	0	68	32	0	0
DISP W/CRT	0	0	0	0	0	0
DISPLAY	20	64	24	12	0	0
XMTR	0	0	0	0	0	0
PWR SUP	10	50	50	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

15 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- [ ] SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- [ ] MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- [x] NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- [ ] NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- [ ] NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- [ ] DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- [ ] COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- [ ] ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE

[x] LOW [ ] MEDIUM [ ] HIGH

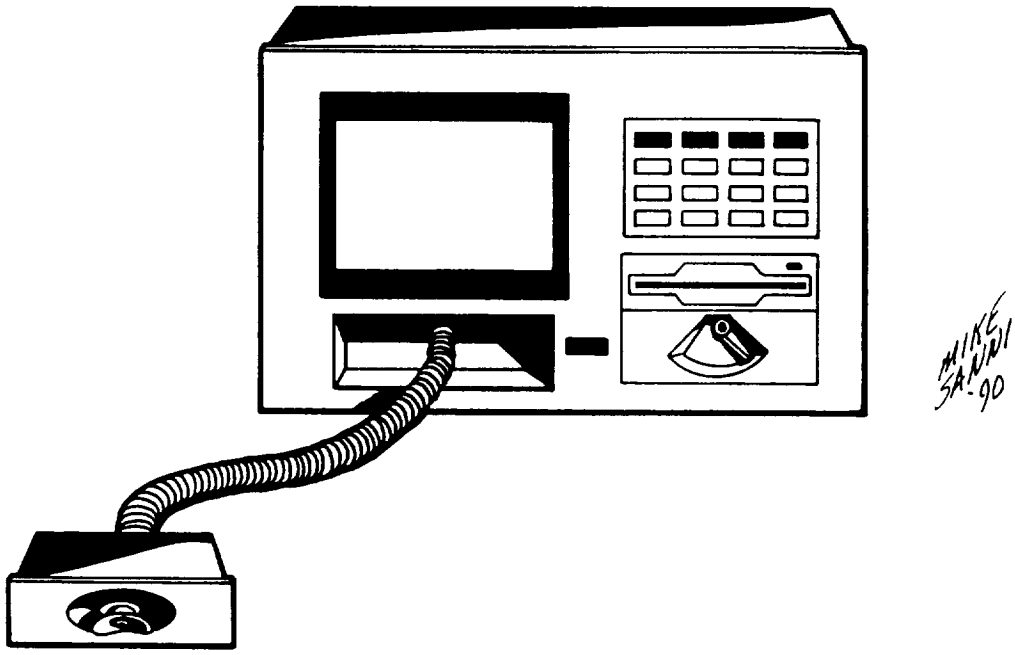
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME MASS SPECTROMETER

HARDWARE ID. NO.: 13 ORIGINATOR: J. Stephenson

VERSION : 1

ILLUSTRATION



DEFINITION

An instrument which analyzes subject's inspired and/or expired gases by ionization of the eluting compounds into molecular fragments. The molecular fragments are then analyzed according to their atomic mass.

HISTORY/DESIGN STATUS:

New design, current GAMS is not suitable.
Prototype unit is currently under development,however, a three component lab unit controlled by microcomputer exists.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: MASS SPECTROMETER ID# 13

VER : 1 **ORIGINATOR:** J. Stephenson

GENERAL SPECIFICATIONS

Mass (kg):	40.7
Height (m)	.66
Width (m)	.482
Depth (m)	.851
Volume (m3):	.271
Standby Power (W)	14
Operational Power (W)	150
Peak Power (W)	
Power Source (VDC)	28

PERFORMANCE SPECIFICATIONS:

Concentration range:
- O2, N2 0-100%
- CO2, Ar, N2O He, SF6 0-10%
- C18O, Acetylene 0-1%

Precision:
- O2, N2 0.1%
- CO2, Ar, N2O Fe, SF6 0.01%
- C18O, Acetylene 0.001%

Mass range: 1-200 AMU
Resolution: 1 AMU
Response time: Less than 100 milli seconds
Scan speed: 1-2 milliseconds
Scan period: 40 milliseconds

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☐	☒	☐
THERMAL:	☐	☒	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☒	☐

PROBLEMS/ISSUES AND CONCERNS

Technology used in the high performance respiration mass spectrometer lab prototypes is ten years old. and does not reflect current advances in power consumption and efficiency.
Some gases may not currently be included in the gas cylinder assembly,yet, these measurements can be possibly taken with different gases.

ASSUMPTIONS/ JUSTIFICATIONS

Dimensions are based on the present gas analyzer/mass spectrometer flight unit.
The remaining hardware and performance specifications are those anticipated for the new high performance respiration mass spectrometer.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

Rack mounted system consisting of a control console and an extendable/detachable breath through system. Console contains quadruple drive electronics, flow measuring electronics, ion pump, microprocessor. The breath -through system consists of mouthpiece with inlet valve, ion pump, mass spectrometer unit.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

Direct samples inspired and/o expired air from a respiratory valve are conducted into a high bombardment ionizer through a servo-controlled needle valve.
And from this analyzes the resulting molecular fragments according to atomic mass.
The device will be used in conjunction with pulmonary function equipment.

BMAC HARDWARE DATA SHEET | **EQUIPMENT NAME:** MASS SPECTROMETER ID# 13 | VER : 1 | **ORIGINATOR:** J. Stephenson | **PAGE** 3 of 4

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:
aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 37.1 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 30 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

cooling fan
ion pump
flow meter system
breathing inlet system
quadrupole analyzer
optical storage unit
optical storage unit recorder

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
20	80 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
65	20 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

Extendable/detachable connecting system will allow displacement of breath through system for exercise use.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: MASS SPECTROMETER ID# 13

VER : 1 **ORIGINATOR:** J. Stephenson

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☒ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☒ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 3.60

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	40	40	40	10	10	0
DIGITAL	30	10	55	20	0	15
DISP W/CRT	0	0	0	0	0	0
DISPLAY	20	30	50	20	0	0
XMTR	0	0	0	0	0	0
PWR SUP	10	32	40	28	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

35 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☒ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☒ MEDIUM ☐ HIGH

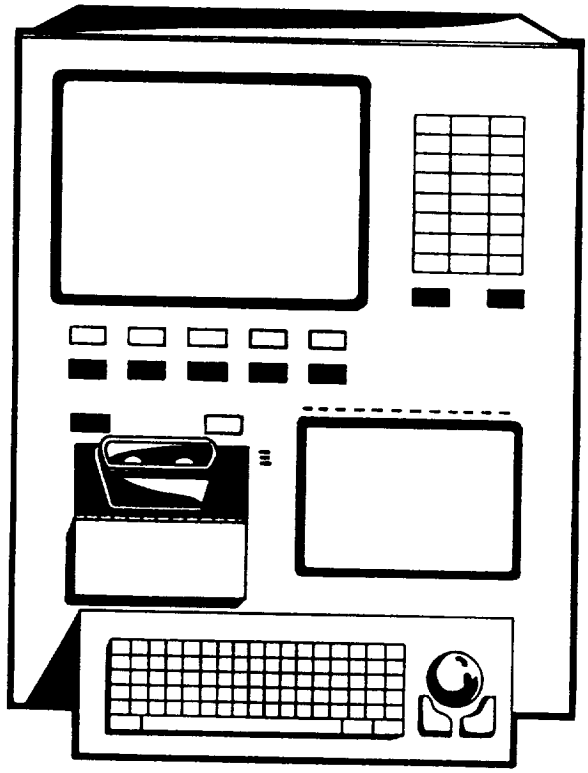
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME MICROSCOPE SYSTEM

HARDWARE ID. NO.: 703 ORIGINATOR: H. Nguyen

VERSION : 1

ILLUSTRATION



MIKE SANJI -90

DEFINITION

A system used in conjunction with an image digitizing system which enables examination of human cell morphology and subcellular components.
The microscope system has the capabilities to perform metallographic, optical, and stereo microscopy.

HISTORY/DESIGN STATUS:

New design and new technology is required.
Optical components are commercially available.
Interfaces between the digital imagiing system and optical unit need to be developed.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: MICROSCOPE SYSTEM ID# 703

VER : 1 **ORIGINATOR:** H. Nguyen

GENERAL SPECIFICATIONS

Mass (kg):	60
Height (m)	.352
Width (m)	.483
Depth (m)	.851
Volume (m3):	.144
Standby Power (W)	
Operational Power (W)	250
Peak Power (W)	
Power Source (VDC)	28

PERFORMANCE SPECIFICATIONS:

16-2000 power
Bright field illumination
Dark field illumination
Objective field from 15-.12 mm
Variable light sources: Halogen, mercury vapor, xenon phase contrasting
Camera/video attachment capabilities
Fluorescence
Eyepiece calibration to within +- 0.01 % of scale

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☐	☒	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☐	☒

PROBLEMS/ISSUES AND CONCERNS

ASSUMPTIONS/ JUSTIFICATIONS

Shared resource with other areas of Space Station.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

A central microscopic system with CRT displays and control panel. Several auxiliary optical components are connected to the central unit by wire.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

One central microscopic processing unit will support several image input stations. At each station there is an optical subsystem that is integrated with a digital image converter.
Converter transforms images into digital signals which are to be transmitted to the central microscope for examination and magnification.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: MICROSCOPE SYSTEM ID#703	PAGE 3 of 4
	VER : 1 ORIGINATOR: H. Nguyen	

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

glass, aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 49 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 38 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

lens
eyepieces
control Knobs
gear
motors
fans

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
17	42 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
39	58 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☐ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☒ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: MICROSCOPE SYSTEM ID# 03	PAGE 4 of 4
	VER : 1 ORIGINATOR: H. Nguyen	

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☒ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☒ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☐ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 11.00

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	20	75	25	0	0	0
DIGITAL	55	45	35	20	0	0
DISP W/CRT	15	40	60	0	0	0
DISPLAY	0	0	0	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	10	78	22	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

38 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☒ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☒ MEDIUM ☐ HIGH

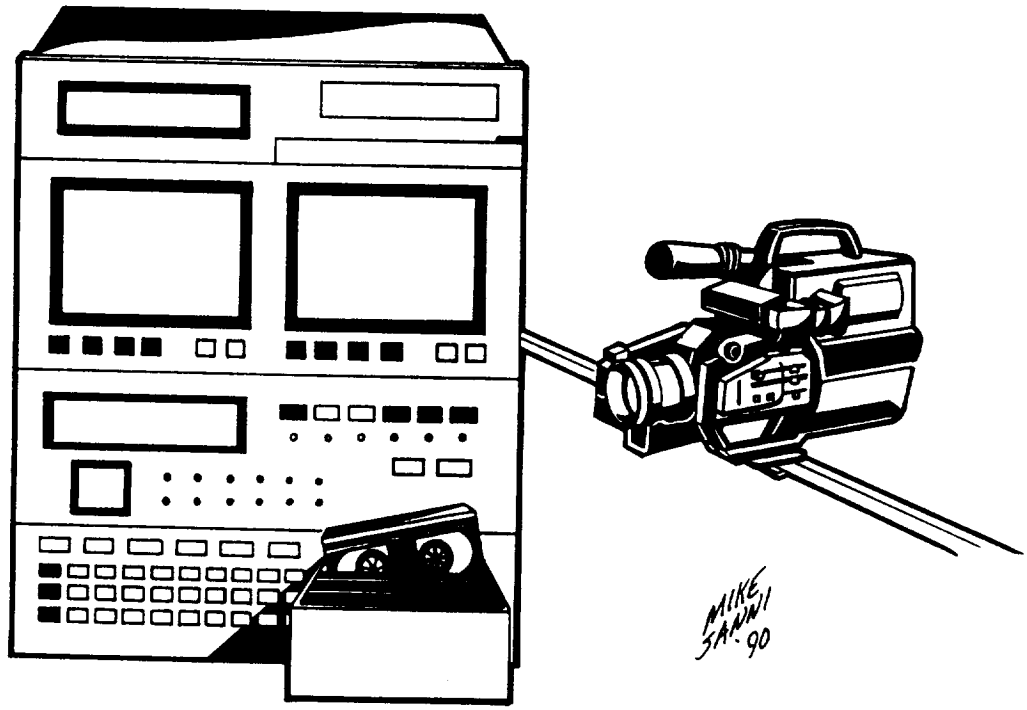
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME MOTION ANALYSIS SYSTEM

HARDWARE ID. NO.: 16 ORIGINATOR: J. Stephenson

VERSION : 1

ILLUSTRATION



DEFINITION

A video system used to monitor, record, and analyze the motion of the crew members during weightlessness.
Includes video cameras and background grid.

HISTORY/DESIGN STATUS:

Entire system is available commercially.
Currently, the system is designed to do analysis on the ground only.
Some work done on KC-135 flights.
Modification is required for microgravity.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: MOTION ANALYSIS SYSTEM ID# 16

VER : 1

ORIGINATOR: J. Stephenson

GENERAL SPECIFICATIONS

Mass (kg):	8.7
Height (m)	.044
Width (m)	.482
Depth (m)	.851
Volume (m3):	.018
Standby Power (W)	
Operational Power (W)	
Peak Power (W)	
Power Source (VDC)	Batteries

PERFORMANCE SPECIFICATIONS:

Captures data at frame rates up to 200 Hs for direct transfer o 2000 Hx for recording on standard 1/2 inch magnetic tape. Paths of 30 markers can be identified and tracked. Incorporate up to 16 analog channels, accelerometer, load cells, EMGs, forceplates, etc. and match them to the video. Includes 3 professional quality 30 frame quality 30 frame/second video cameras with digital timers, camera cases, two mobile video recording stations, dual camera cases, dual camera timing control center and cable for external control of camera timers.

RACK INTERFACE

Rack Mounted? ☐

	NONE	STANDARD	EXTRA
ELECTRICAL	☒	☐	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☒	☐	☐

PROBLEMS/ISSUES AND CONCERNS

Calibration fixture required for initiating each video sequence Ground based version-PVC pipe, Rectangualar frame.

ASSUMPTIONS/ JUSTIFICATIONS

System is set up in BLdg. 29 at JSC

Will use recording and preprocessing capabilitites of the image digitizing system.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

Video Camera

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

The system will be used in conjunction with wrist monitor to track crew members' body motions during microgravity.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: MOTION ANALYSIS SYSTEM	ID# 16	PAGE 3 of 4
	VER : 1	ORIGINATOR: J. Stephenson	

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:
aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 7.8 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 30 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

3 professional quality, 30 frame/sec video cameras with digital timers.

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
3	80 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
20	20 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: MOTION ANALYSIS SYSTEM ID# 16

VER : 1 **ORIGINATOR:** J. Stephenson

TYPE OF ELECTRONICS:

- [X] ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- [X] DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- [X] DISPLAY WITH CRT
- [ ] TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- [X] POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- [ ] DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 0.90

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	60	0	50	50	0	0
DIGITAL	20	0	50	0	50	0
DISP W/CRT	0	0	0	0	0	0
DISPLAY	10	0	0	100	0	0
XMTR	0	0	0	0	0	0
PWR SUP	10	0	100	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

15 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

( ) Yes (•) No

SCOPE OF DESIGN EFFORT:

- [ ] SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- [X] MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- [ ] NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- [ ] NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- [ ] NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- [ ] DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- [ ] COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- [ ] ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE [ ] LOW [ ] MEDIUM [ ] HIGH

BMAC HARDWARE DATA SHEET

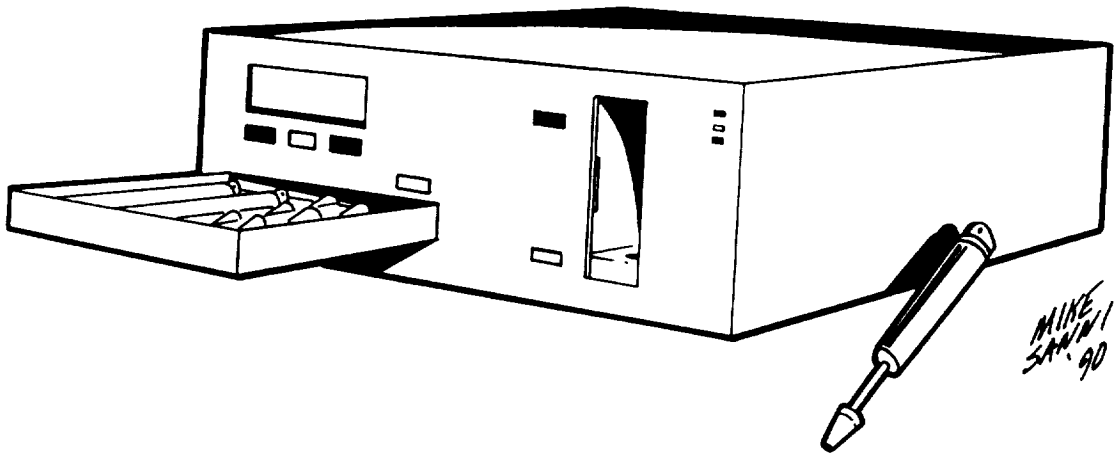
EQUIPMENT NAME: OSMOMETER

Page 1 of 4

HARDWARE ID. NO.: 33 ORIGINATOR: H. Nguyen

VERSION : 01

ILLUSTRATION



DEFINITION

An instrument used to measure the osmotic pressure of body fluids.
Osmotic pressure is a function of solution concentration and has direct relationship to the solution freezing point.

HISTORY/DESIGN STATUS:

Current technology available.
Extensive modification is required for microgravity use.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: OSMOMETER ID# 33

VER : 01 **ORIGINATOR:** H. Nguyen

GENERAL SPECIFICATIONS

Mass (kg):	13.7
Height (m)	.178
Width (m)	.482
Depth (m)	.851
Volume (m3):	.073
Standby Power (W)	
Operational Power (W)	150
Peak Power (W)	
Power Source (VDC)	28

PERFORMANCE SPECIFICATIONS:

Sample transfer is executed by collecting 20 micro-liter of sample, and then the entire pipettor with sample ,is placed in the osmometer.

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☐	☒	☐
THERMAL:	☐	☐	☒
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☒	☐

PROBLEMS/ISSUES AND CONCERNS

Disposable plastic tips used in pipettors may be an environmental concern.

ASSUMPTIONS/ JUSTIFICATIONS

To be used with minimal crew training and familiarizations.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

An electro-mechanical device which ismicro-processor controlled.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

Used to measure osmolality of fluids with freezing point between 0 and minus 4 degree centigrade.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: OSMOMETER	ID# 33	PAGE 3 of 4
	VER : 01	ORIGINATOR: H. Nguyen	

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:
aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 11 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 55 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

motor
freeze Chamber

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
25	60 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
25	40 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☐ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: OSMOMETER ID# 33 PAGE 4 of 4

VER : 01 **ORIGINATOR:** H. Nguyen

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☒ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☒ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 2.70

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	45	25	50	25	0	0
DIGITAL	15	20	20	0	35	25
DISP W/CRT	0	0	0	0	0	0
DISPLAY	25	40	50	10	0	0
XMTR	0	0	0	0	0	0
PWR SUP	15	90	10	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

45 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☒ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☒ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☒ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☒ MEDIUM ☐ HIGH

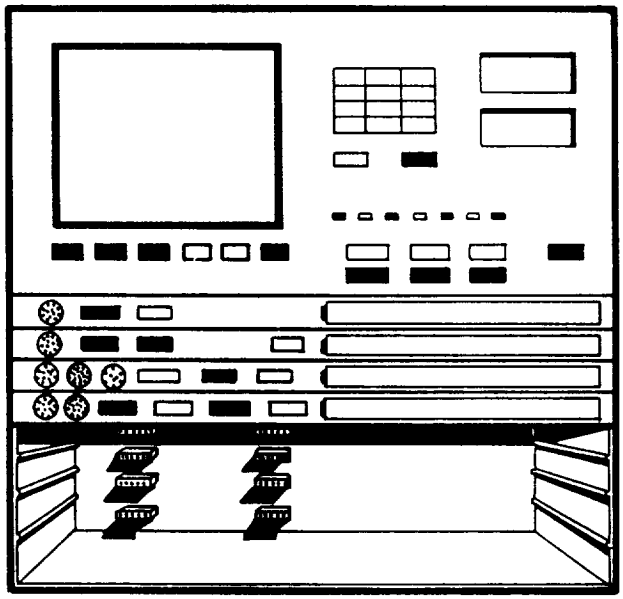
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME PHYSIOLOGICAL BIO-POTENTIAL RECORDER

HARDWARE ID. NO.: 4 ORIGINATOR: H. Nguyen

VERSION : 1

ILLUSTRATION



MIKE SAWAI 90

DEFINITION

An electrical signal measurement device which is capable of measuring and recording neural, cardiac, and muscular electrical activities.

HISTORY/DESIGN STATUS:

New design

In order to optimize hardware utilization and to save mass & volume on Space Station, commonalities between individual bio-potential measuring devices are integrated into a common recorder.

This is the "mother" board for the EEG,ECG,EOG,Goniometer, EMG and EMG Stimulator.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: PHYSIOLOGICAL BIO-POTENTIAL RECORDER ID# 4

VER : 1 **ORIGINATOR:** H. Nguyen

GENERAL SPECIFICATIONS

Mass (kg):	20
Height (m)	.22
Width (m)	.482
Depth (m)	.851
Volume (m3):	.09
Standby Power (W)	10
Operational Power (W)	200
Peak Power (W)	
Power Source (VDC)	28

PERFORMANCE SPECIFICATIONS:

Automatic calibration for each input channel.
High frequency amplifier.
Butterworth low pass filter to remove undesirable high frequency components in data-
i.e. 1,10,30,100Hz and 10Khz
Peripheral device interface
Noise level <5 microvolts peak to peak.
Must be capable of displaying signal channels during recording and playback.

RACK INTERFACE

Rack Mounted? ☒

	NONE:	STANDARD	EXTRA:
ELECTRICAL	☐	☐	☒
THERMAL:	☐	☒	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☒	☐

PROBLEMS/ISSUES AND CONCERNS

Need power source with low noise and surge protection.

ASSUMPTIONS/ JUSTIFICATIONS

All biopotential signals will be conditioned, measured, and recorded by the Physiological Bio-potential Recorder.
The data is recorded by use of VHS tape and then downlinked to ground control center.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

CRT display
Seven couplers on front panel for EEG, EOG, ECG, EMG, Goniometer applications.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

An instrument which measures biopotential activities for physiological studies, and is capable of recording a pre-determined amount of channels of analog input data ranging from DC to 100 KHz. When the individual modules,such as EMG,are inserted this instrument operates as the Main power source and recorder (mother-board).

Each type module has its own unique required electrodes for recording.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: PHYSIOLOGICAL BIO-POTENTIAL RECORDER ID# 4

VER : 1 **ORIGINATOR:** H. Nguyen

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

aluminum,glass

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 12 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 60 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

fan

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	**CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:**
10	60 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
10	40 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: PHYSIOLOGICAL BIO-POTENTIAL RECORDER ID# 4	PAGE 4 of 4
	VER : 1 ORIGINATOR: H. Nguyen	

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☒ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☒ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☐ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 8.00

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	10	30	20	50	0	0
DIGITAL	35	0	100	0	0	0
DISP W/CRT	40	0	100	0	0	0
DISPLAY	0	0	0	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	15	50	50	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

35 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☒ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE

☐ LOW ☒ MEDIUM ☐ HIGH

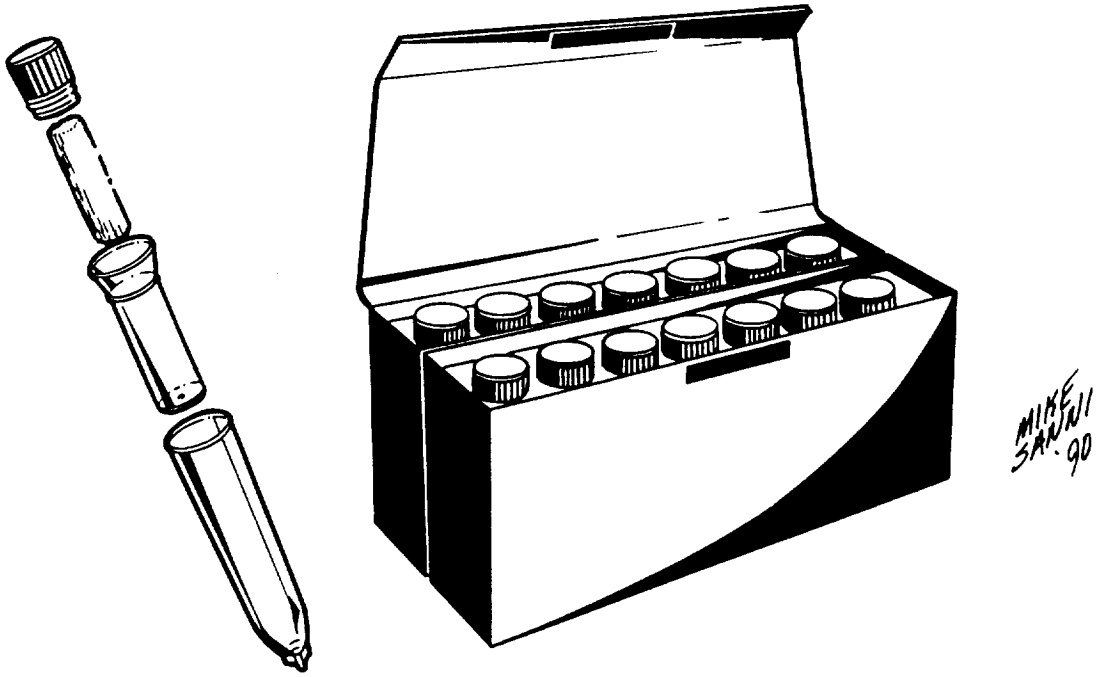
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME SALIVA COLLECTION UNIT

HARDWARE ID. NO.: 26 ORIGINATOR: J. Stephenson

VERSION : 1

ILLUSTRATION



DEFINITION

A kit used to temporarily collect and store saliva samples for later on-board or ground analyses in support of pharmokinetic and pharmacologic reference experiments.

HISTORY/DESIGN STATUS:

The current design is flight certified, and has been flown several times as a Detailed Supplementary Objective (DSO).
Modifications will be required for the future requirements.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: SALIVA COLLECTION UNIT ID# 26 Page 2 of 4

VER : 1 **ORIGINATOR:** J. Stephenson

GENERAL SPECIFICATIONS

Mass (kg):	.17
Height (m)	.04
Width (m)	.15
Depth (m)	.18
Volume (m3):	.001
Standby Power (W)	
Operational Power (W)	
Peak Power (W)	
Power Source (VDC)	none

PERFORMANCE SPECIFICATIONS:

Mass of kit w/o vial: .125 kg
Mass of vial: .004 kg

RACK INTERFACE

Rack Mounted? ☐

	NONE	STANDARD	EXTRA
ELECTRICAL	☒	☐	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☒	☐	☐

PROBLEMS/ISSUES AND CONCERNS

none

ASSUMPTIONS/ JUSTIFICATIONS

A saliva collection does currently exist but a more efficient model will be required.

QUANTITY REQUIRED: 40 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

Contains a cloth pouch with a foam insert that holds the sample vial, and ziplock bag with teflon squares.
The vials contain cotton dental rolls.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

Cotton rolls are placed in the subject's mouth along with the teflon squares to stimulate salivation.
The saliva secretion is absorbed by the cotton roll.
The saliva soaked cotton rolls are then returned to vials and frozen.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: SALIVA COLLECTION UNIT	ID# 26	PAGE 3 of 4
	VER : 1	ORIGINATOR: J. Stephenson	

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

teflon,cotton

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): .17 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 15 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

tube
plug
teflon gauze

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
2	100 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
	%	☐ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☐ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☐ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: SALIVA COLLECTION UNIT ID# 26

VER : 1 **ORIGINATOR:** J. Stephenson

TYPE OF ELECTRONICS:

- ☐ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☐ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☐ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☐ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 0.00

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	0	0	0	0	0	0
DIGITAL	0	0	0	0	0	0
DISP W/CRT	0	0	0	0	0	0
DISPLAY	0	0	0	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	0	0	0	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

0 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☒ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☐ MEDIUM ☐ HIGH

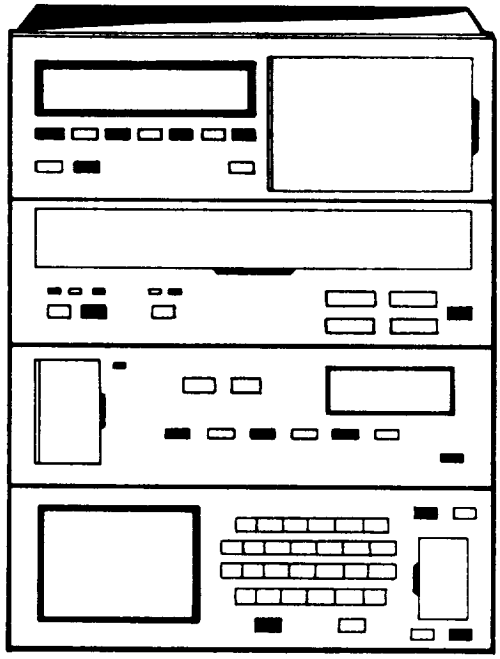
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME SAMPLE PREP DEVICE

HARDWARE ID. NO.: 300 ORIGINATOR: H. Nguyen

VERSION : 1

ILLUSTRATION



DEFINITION

A device which will prepare various biological samples for subsequent analyses. This task includes the proper addition of specific reagents and required storage methodology.

HISTORY/DESIGN STATUS:

Some models exists with a portion of the needed capabilities. Extensive modification is required for use in microgravity.

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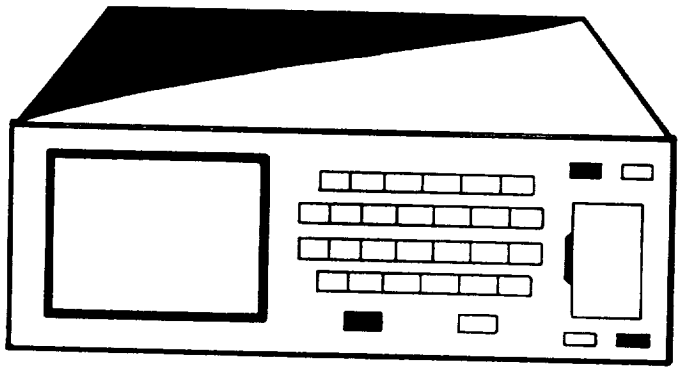
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME SAMPLE PREP MODULE 1: BLOOD

HARDWARE ID. NO.: 37 ORIGINATOR: H. Nguyen

VERSION : 1

ILLUSTRATION



DEFINITION

This a module of the sample preparation device for processing blood samples.

HISTORY/DESIGN STATUS:

New design required in co-ordination with the Sample Preparation Device.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: SAMPLE PREP MODULE 1: BLOOD ID# 37 VER : 1 **ORIGINATOR:** H. Nguyen

GENERAL SPECIFICATIONS

Mass (kg):	14.09
Height (m)	.133
Width (m)	.482
Depth (m)	.851
Volume (m3):	.054
Standby Power (W)	
Operational Power (W)	55
Peak Power (W)	
Power Source (VDC)	28

PERFORMANCE SPECIFICATIONS:

This part of the module separates blood components into solids and liquids for appropriate testing.
Adds preservative for other analysis.
Automatically dispenses appropriate volumes for specific tests ,such as, antibody titer and Coombs test.

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☐	☒	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☐	☒

PROBLEMS/ISSUES AND CONCERNS

ASSUMPTIONS/ JUSTIFICATIONS

This is a module used in conjunction with the central Sample Preparatioon Device.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

Unit is based on Coulter Blood Preparation System

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

Instrument samples blood from vaccutainer tubes as supplied by the inflight blood collection system.
The sample is diluted and subjected to various reagents for specific tests.
These tests include: flow cytometry, coagulation analysis, antigen-antibody reactions, agglutination assays, and enzyme or flourescence immunoassays.
Reagents are stored in replaceable containers.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: SAMPLE PREP MODULE 1: BLOOD ID# 37

VER : 1 **ORIGINATOR:** H. Nguyen

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

aluminum, plastics

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 13 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 40 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

peristaltic pumps
low pressure pumps
filtration

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
30	40 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
55	60 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☒ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

Mass does not include the masses of the liquid reagents.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: SAMPLE PREP MODULE 1: BLOOD ID# 37

VER : 1 **ORIGINATOR:** H. Nguyen

TYPE OF ELECTRONICS:

- [X] ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- [X] DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- [ ] DISPLAY WITH CRT
- [ ] TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- [X] POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- [X] DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 1.09

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	20	25	50	25	0	0
DIGITAL	60	10	40	40	0	10
DISP W/CRT	0	0	0	0	0	0
DISPLAY	10	40	40	20	0	0
XMTR	0	0	0	0	0	0
PWR SUP	10	75	25	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

30 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

(●) Yes ( ) No

SCOPE OF DESIGN EFFORT:

- [ ] SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- [ ] MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- [ ] NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- [ ] NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- [X] NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- [ ] DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL.

IF HARDWARE NEEDS SOFTWARE TO RUN:

- [ ] COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- [ ] ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE

[X] LOW [ ] MEDIUM [ ] HIGH

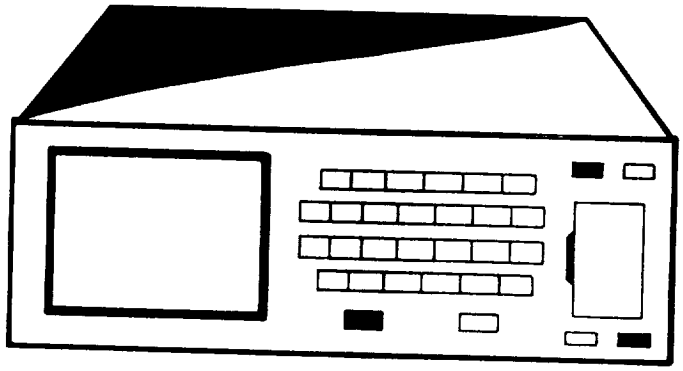
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: SAMPLE PREP MODULE 1: AUTOMATION UNIT

HARDWARE ID. NO.: 36 ORIGINATOR: H. Nguyen

VERSION : 1

ILLUSTRATION



DEFINITION

The Automation Unit processes, controls, and stores information from the other sample preparation modules.

HISTORY/DESIGN STATUS:

New design required in co-ordination with the Sample Preparation Device.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: SAMPLE PREP MODULE 1: AUTOMATION UNIT ID# 3 6

VER : 1

ORIGINATOR: H. Nguyen

GENERAL SPECIFICATIONS

Mass (kg):	7.5
Height (m)	.089
Width (m)	.483
Depth (m)	.851
Volume (m3):	.036
Standby Power (W)	15
Operational Power (W)	200
Peak Power (W)	
Power Source (VDC)	28

PERFORMANCE SPECIFICATIONS:

Self-diagnostic program capabilities maintain and control all functions of other sub-subsystems. 8086 microprocessor based.

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☐	☒	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☐	☒

PROBLEMS/ISSUES AND CONCERNS

Most critical component of the entire system. Redundancy should be considered.

ASSUMPTIONS/ JUSTIFICATIONS

This unit is the command and control center for the entire system.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

Unit processes, controls, and stores information from the other sample preparation modules.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

Performs automation and information processing for other units, especially in blood processing.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: SAMPLE PREP MODULE 1: AUTOMATION UNIT	ID# 3 6	PAGE 3 of 4
	VER : 1	ORIGINATOR: H. Nguyen	

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:
aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 2.5 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 50 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

optical drives
fans
motor

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
30	95 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
3	5 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☐ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: SAMPLE PREP MODULE 1: AUTOMATION UNIT ID# 36

VER : 1 **ORIGINATOR:** H. Nguyen

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☒ DISPLAY WITH CRT
- ☒ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☒ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☐ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 5.00

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	10	20	0	30	50	0
DIGITAL	40	0	0	0	25	75
DISP W/CRT	20	80	10	10	0	0
DISPLAY	0	0	0	0	0	0
XMTR	15	0	40	20	40	0
PWR SUP	15	50	50	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

40 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

◉ Yes ○ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☒ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☒ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☒ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☐ MEDIUM ☐ HIGH

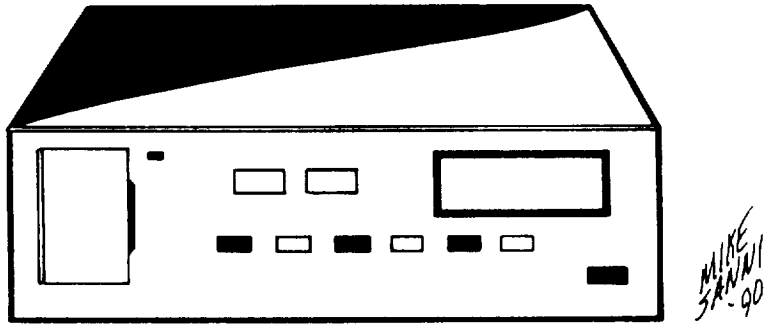
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME SAMPLE PREP MODULE 2: URINE, SALIVA

HARDWARE ID. NO.: 40 ORIGINATOR: H. Nguyen

VERSION :

ILLUSTRATION



DEFINITION

This device is a component module of the Sample Preparation Device. It processes urine, saliva, and emesis specimens for appropriate analyses.

HISTORY/DESIGN STATUS:

New design in co-ordination with the Sample Preparation Device.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: SAMPLE PREP MODULE 2: URINE, SALIVA ID# 40

VER : **ORIGINATOR:** H. Nguyen

GENERAL SPECIFICATIONS

Mass (kg):	7.63
Height (m)	.133
Width (m)	.482
Depth (m)	.851
Volume (m3):	.054
Standby Power (W)	
Operational Power (W)	65
Peak Power (W)	
Power Source (VDC)	28

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☐	☒	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☒	☐

PERFORMANCE SPECIFICATIONS:

PROBLEMS/ISSUES AND CONCERNS

ASSUMPTIONS/ JUSTIFICATIONS

Module will be used in-conjunction with the Sample Preparation Device

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

Unit consists of reagent dispenser and diluter.
Urine, saliva, and semi-solid wastes, such as emesis samples are placed in a vial and processed through a series of dilution and filtration techniques.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

This is a module of the Sample Preparation Device to process solids into homogeneous mixtures for laboratory processing.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: SAMPLE PREP MODULE 2: URINE, SALIVA	ID# 40	PAGE 3 of 4
	VER :	ORIGINATOR: H. Nguyen	

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

aluminum, plastics

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 5.2 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 50 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

peristalic pumps
low pressure pumps
filtration

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
50	72 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
5	28 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

Mass does not include the masses of the reagents.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: SAMPLE PREP MODULE 2: URINE, SALIVA ID# 40

VER : **ORIGINATOR:** H. Nguyen

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☒ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☒ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 2.43

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	40	65	35	0	0	0
DIGITAL	40	10	75	15	0	0
DISP W/CRT	0	0	0	0	0	0
DISPLAY	10	50	50	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	10	68	32	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

40 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☒ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE

☒ LOW ☐ MEDIUM ☐ HIGH

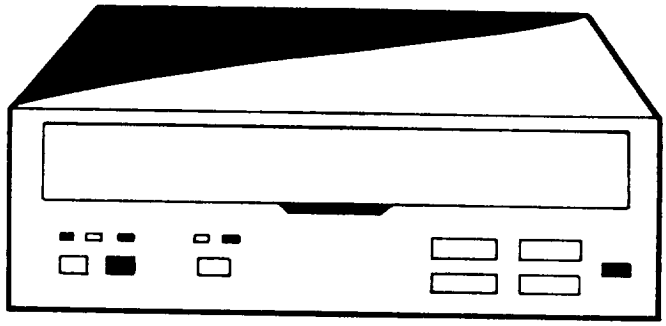
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: SAMPLE PREP MODULE 3: VORTEX

HARDWARE ID. NO.: 38 ORIGINATOR: H. Nguyen

VERSION : 1

ILLUSTRATION



DEFINITION

Module of the Sample Preparation Device used to mix specimens.

HISTORY/DESIGN STATUS:

New design in co-ordination with the Sample Preparation Device.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: SAMPLE PREP MODULE 3: VORTEX ID# 38 Page 2 of 4

VER : 1 **ORIGINATOR:** H. Nguyen

GENERAL SPECIFICATIONS

Mass (kg): 1.5

Height (m) .089

Width (m) .482

Depth (m) .851

Volume (m3): .036

Standby Power (W)

Operational Power (W)

Peak Power (W)

Power Source (VDC)

PERFORMANCE SPECIFICATIONS:

Mixes all biological specimens homogeneously for future analyses.

Automatic timer

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☐	☒	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☒	☐

PROBLEMS/ISSUES AND CONCERNS

ASSUMPTIONS/ JUSTIFICATIONS

This is a module used in-conjunction with the central Sample Preparation Unit.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

Rack mounted instrument with loading gate for sample insertion.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

Standard laboratory vortex mixer or a new model for use in microgravity.
The function is to mix solids and liquids.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: SAMPLE PREP MODULE 3: VORTEX ID# 38	PAGE 3 of 4
	VER : 1 ORIGINATOR: H. Nguyen	

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:
aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 1.4 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 30 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

motor

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
7	80 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
5	20 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: SAMPLE PREP MODULE 3: VORTEX ID# 38

VER : 1 **ORIGINATOR:** H. Nguyen

TYPE OF ELECTRONICS:

- [x] ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- [ ] DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- [ ] DISPLAY WITH CRT
- [ ] TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- [x] POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- [x] DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 0.10

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	45	90	10	0	0	0
DIGITAL	0	0	0	0	0	0
DISP W/CRT	0	0	0	0	0	0
DISPLAY	10	50	50	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	45	60	40	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

30 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- [ ] SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- [ ] MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- [ ] NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- [x] NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- [ ] NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- [ ] DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- [ ] COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- [ ] ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE [ ] LOW [ ] MEDIUM [ ] HIGH

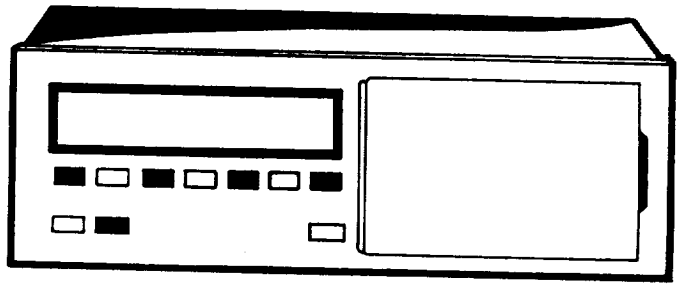
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME SAMPLE PREP MODULE 4: FILTRATION UNIT

HARDWARE ID. NO.: 39 ORIGINATOR: H. Nguyen

VERSION : 1

ILLUSTRATION



MIKE SAWNI 90

DEFINITION

Module of the Sample Preparation Device used to separate fluids from solids.

HISTORY/DESIGN STATUS:

New design is required in co-ordination with the Sample Preparation Device.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: SAMPLE PREP MODULE 4: FILTRATION UNIT ID# 39

VER : 1 **ORIGINATOR:** H. Nguyen

GENERAL SPECIFICATIONS

Mass (kg):	4.2
Height (m)	.089
Width (m)	.482
Depth (m)	.851
Volume (m3):	.036
Standby Power (W)	
Operational Power (W)	60
Peak Power (W)	
Power Source (VDC)	28

PERFORMANCE SPECIFICATIONS:

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☐	☒	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☒	☐

PROBLEMS/ISSUES AND CONCERNS

ASSUMPTIONS/ JUSTIFICATIONS

This unit is used in conjunction with the central Sample Preparation Device

QUANTITY REQUIRED:

SPECIFICATIONS ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

The device is a container with filters or strainers to accomplish the filtration process.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

Unit filters, sterilizes, deposits, or separates samples from other sample prep modules.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: SAMPLE PREP MODULE 4: FILTRATION UNIT ID# 39

VER : 1 **ORIGINATOR:** H. Nguyen

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

aluminum, plastics

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 3.9 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 50 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

filters
filter holder
peristaltic and air pumps

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
20	67 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
10	33 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: SAMPLE PREP MODULE 4: FILTRATION UNIT ID# 39

VER : 1 **ORIGINATOR:** H. Nguyen

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☒ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☒ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 0.30

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	25	70	30	0	0	0
DIGITAL	25	70	15	10	0	5
DISP W/CRT	0	0	0	0	0	0
DISPLAY	15	60	40	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	35	75	25	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

20 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☒ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☐ MEDIUM ☐ HIGH

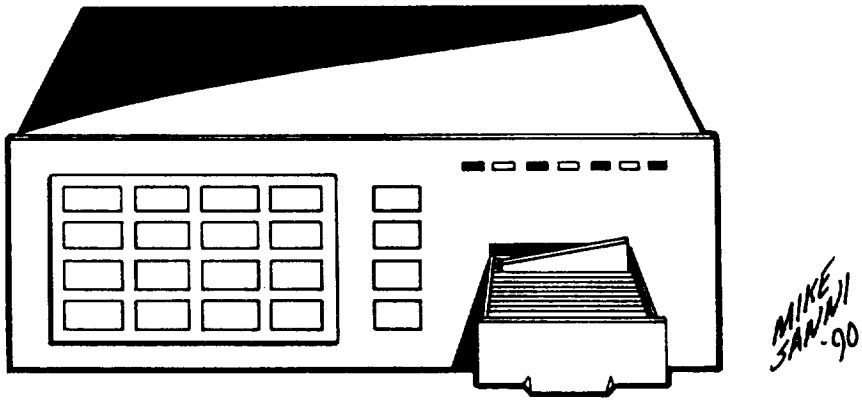
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME SLIDE PREPARATION DEVICE

HARDWARE ID. NO.: 41 ORIGINATOR: G. McFadyen

VERSION : 1

ILLUSTRATION



DEFINITION

The Slide Preparation Device automatically prepares blood samples on a slide for viewing by microscopy.

HISTORY/DESIGN STATUS:

Commercial units are not applicable to microgravity.
New conceptual design is required.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: SLIDE PREPARATION DEVICE ID# 41

VER : 1 **ORIGINATOR:** G. McFadyen

GENERAL SPECIFICATIONS

Mass (kg):	25
Height (m)	.308
Width (m)	.482
Depth (m)	.851
Volume (m3):	.126
Standby Power (W)	
Operational Power (W)	100
Peak Power (W)	
Power Source (VDC)	28

PERFORMANCE SPECIFICATIONS:

Simulate 1g for chromosomal slide preparation.
Dispense consistent quantity of sample, fixes, washes and stains slides as needed.
Must be capable of dispensing at least 4 stains.

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☐	☒	☐
THERMAL:	☐	☒	☐
WASTE:	☐	☒	☐
FLUID:	☐	☒	☐
DATA:	☐	☒	☐

PROBLEMS/ISSUES AND CONCERNS

Requires advances in state-of-the-art technology.
Must provide handling and containment of biological samples.
Will require long lead time for development and testing.

Complex, automated item.

ASSUMPTIONS/ JUSTIFICATIONS

Important item to reduce crew time requirements and to provide consistent sample preparation.
Commmercial procedure not adaptable to space use.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☒ MARC I ☐ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

Consists of blank slide carousel, transport mechanism, sample dispenser, stain dispenser and storage , water supply, warm air supply, and control assembly.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

Prepares microscope slides of blood samples for imaging analysis.
Slides for chromosomal analysis must allow sample to "drop" onto slide.
Samples must be evenly dispersed onto slide, then fixed and stained.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: SLIDE PREPARATION DEVICE ID# 41

VER : 1

ORIGINATOR: G. McFadyen

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

al, plexiglass, glas

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 23 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 50 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

Motor
Heater
Fan
Sample dispenser
Stain dispenser
Water dispenser
Transport mechanism

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	**CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:**
20	40 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☐ SUPPORT STRUCTURE, NO MOVING PARTS ☒ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
40	60 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☐ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☐ PRECISION MACHINED PARTS, MANY MOVING PARTS ☒ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

Device will handle contaminated samples. Structure must be sealed from environment or able to be cleaned.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: SLIDE PREPARATION DEVICE ID# 41 PAGE 4 of 4

VER : 1 **ORIGINATOR:** G. McFadyen

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☒ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☒ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 2.00

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	30	65	35	0	0	0
DIGITAL	40	0	0	50	25	25
DISP W/CRT	0	0	0	0	0	0
DISPLAY	15	70	30	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	15	70	30	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

50 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

◉ Yes ○ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☒ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☐ MEDIUM ☒ HIGH

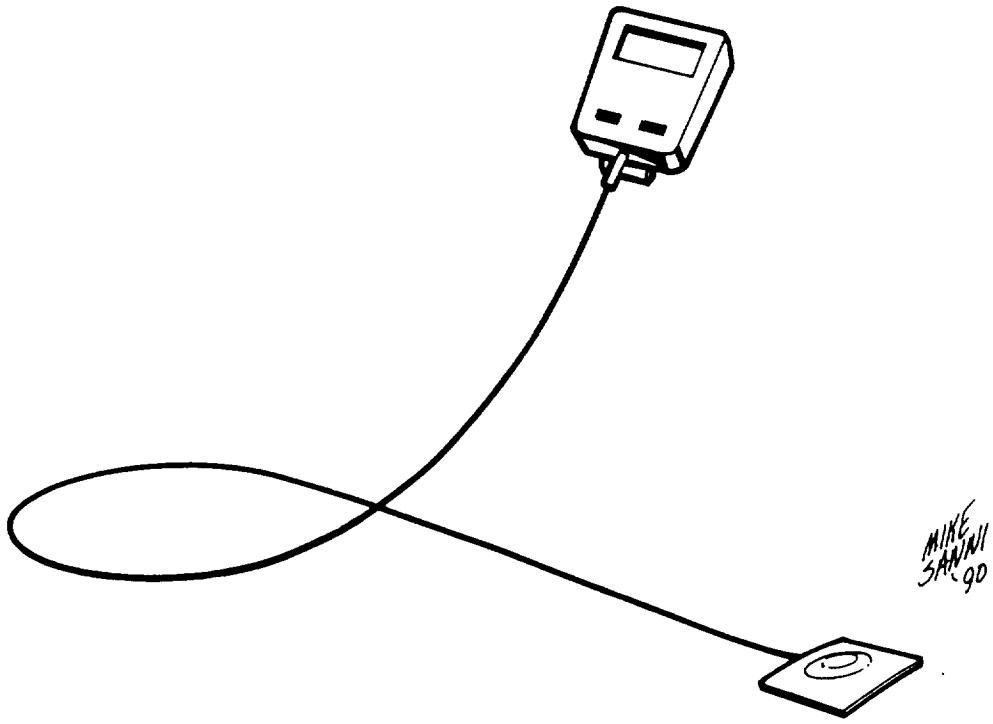
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: TELETHERMOMETER

HARDWARE ID. NO.: 27 ORIGINATOR: J. Stephenson

VERSION : 1

ILLUSTRATION



DEFINITION

Instrument to measure minute incremental changes in body core temperature.

HISTORY/DESIGN STATUS:

The currently available commercial off-the-shelf design needs modifications for recording and telemetry.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: TELETHERMOMETER ID# 27

VER : 1 **ORIGINATOR:** J. Stephenson

GENERAL SPECIFICATIONS

Mass (kg): 2.5
Height (m) .05
Width (m) .08
Depth (m) .15
Volume (m3): 00
Standby Power (W)
Operational Power (W)
Peak Power (W)
Power Source (VDC) Battery

PERFORMANCE SPECIFICATIONS:

High accuracy and sensitivity: 0.1 degrees C.
Repeatability is 0.01degrees C.
High stability: No calibration necessary.
Safety: Low voltage battery operation.
Long battery life: 1200 hours.
Calibration conforms to National Bureau of Standards.
Monograph: 125.

RACK INTERFACE

Rack Mounted? ☐

	NONE	STANDARD	EXTRA
ELECTRICAL	☒	☐	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☒	☐	☐

PROBLEMS/ISSUES AND CONCERNS

ASSUMPTIONS/ JUSTIFICATIONS

Instrument does not have recording capability at present.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

A flat soft sensor to be placed under the arm pit to record body core temperature.
Digital recording of temperature to be stored or processed for future reference.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

The sensor is placed in subject's arm-pit after exercise to record temperature.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: TELETHERMOMETER ID# 27

VER : 1 **ORIGINATOR:** J. Stephenson

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:
plastic, aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 2 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 15 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

battery

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	**CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:**
5	20 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
10	80 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☐ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: TELETHERMOMETER ID# 27

VER : 1 **ORIGINATOR:** J. Stephenson

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☐ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☒ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 0.50

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	20	0	0	100	0	0
DIGITAL	50	40	0	60	0	0
DISP W/CRT	0	0	0	0	0	0
DISPLAY	30	100	0	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	0	0	0	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

10 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☒ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☐ MEDIUM ☐ HIGH

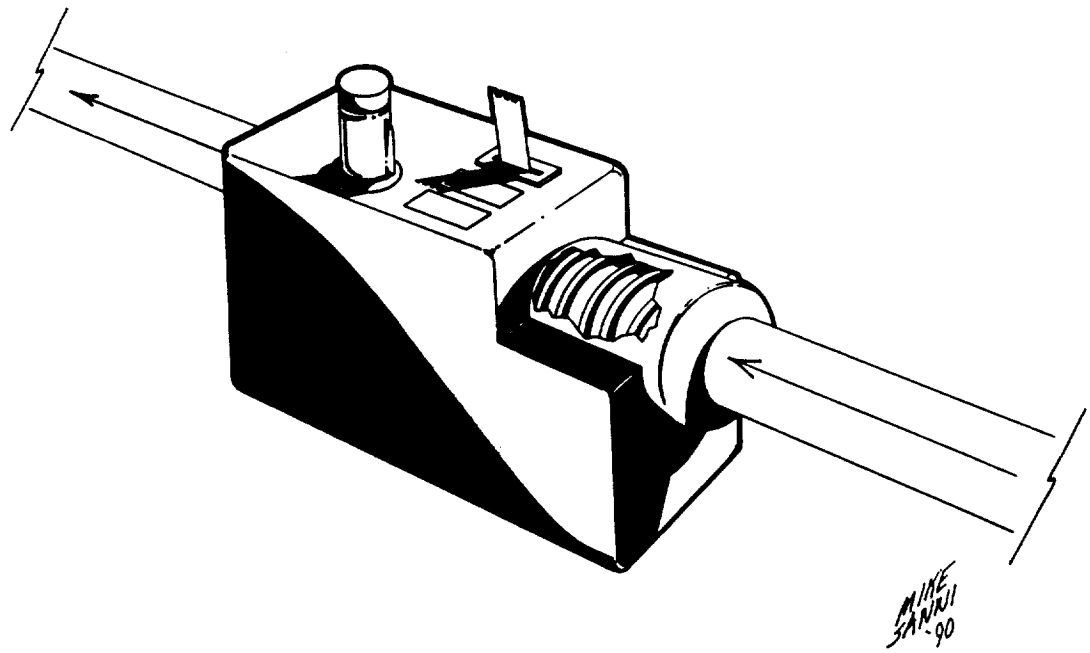
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME URINE SAMPLE DEVICE

HARDWARE ID. NO.: 42 ORIGINATOR: M. Singletary

VERSION : 1

ILLUSTRATION



DEFINITION

The Urine Sample Device is used for collecting a specific volume of urine for future analysis. The volumetric device will project an electromagnetic field across the flow tube. Upon the passage of the urine, the disturbance of the electromagnetic field will be measured and calibrated to quantitate the flow.

HISTORY/DESIGN STATUS:

New design is necessary

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: URINE SAMPLE DEVICE ID# 42

VER : 1 **ORIGINATOR:** M. Singletary

GENERAL SPECIFICATIONS

Mass (kg):	3
Height (m)	.044
Width (m)	.482
Depth (m)	.851
Volume (m3):	.018
Standby Power (W)	
Operational Power (W)	20
Peak Power (W)	
Power Source (VDC)	battery

PERFORMANCE SPECIFICATIONS:

Will automatically collect 15 ml of urine without hands on operation.

Volumetric accuracy or the measuring component is within +- 0.05 ml

RACK INTERFACE

Rack Mounted? ☐

	NONE	STANDARD	EXTRA
ELECTRICAL	☒	☐	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☒	☐	☐

PROBLEMS/ISSUES AND CONCERNS

ASSUMPTIONS/ JUSTIFICATIONS

The design is based on the assumption that the Urine Sample Device will be integrated into the Space Station Waste Collection System (WCS). The scope of this design, therefore, does not include the human-interface collection and the disposal of the urine. The collection and disposal functions are within the WCS.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☒ MARC I ☐ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

A flow tube with a volumetric measuring device wrapping around the circumference and followed by a chamber loaded with a disposable wick for fluid collection.
Automatic labeling provides date, time, crew-member identification and volume.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

Device will be used for all required urine samplings. The passage of urine through the flow tube will be quantitated. A sampling amount of urine will be trapped in the wick chamber, which will be extracted by centrifugation.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: URINE SAMPLE DEVICE ID# 42

VER : 1 **ORIGINATOR:** M. Singletary

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:
aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): .7 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 50 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

flow tube
batteries

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
5	85 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
3	15 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☐ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: URINE SAMPLE DEVICE ID# 42

VER : 1 **ORIGINATOR:** M. Singletary

TYPE OF ELECTRONICS:

- ☐ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☐ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☒ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 2.30

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	0	0	0	0	0	0
DIGITAL	80	40	40	15	0	5
DISP W/CRT	0	0	0	0	0	0
DISPLAY	20	25	60	15	0	0
XMTR	0	0	0	0	0	0
PWR SUP	0	0	0	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

60 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☒ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☐ MEDIUM ☐ HIGH

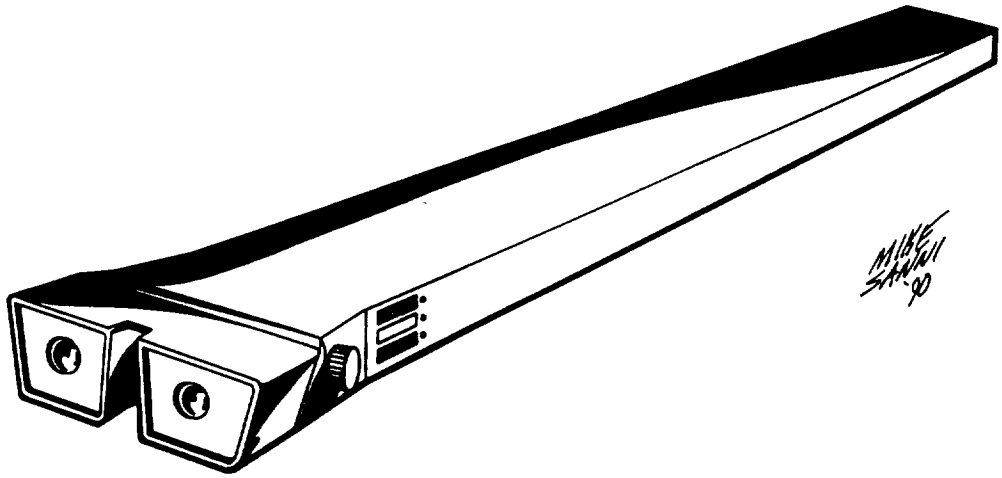
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME VISUAL FUNCTION TESTING KIT

HARDWARE ID. NO.: 17 ORIGINATOR: J. Stephenson

VERSION : 1

ILLUSTRATION



DEFINITION

The Visual Function Testing kit is a hand-held instrument, which is used to test several parameters of human vision. A portion of these tests include visual acuity, muscle balance, retinal, rivalry, contract threshold, and target accommodation.

HISTORY/DESIGN STATUS:

Currently used by the U.S. Air Force.
Some modification required for use in microgravity.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: VISUAL FUNCTION TESTING KIT ID# 17

VER : 1

ORIGINATOR: J. Stephenson

GENERAL SPECIFICATIONS

Mass (kg): 10.4

Height (m) .133

Width (m) .482

Depth (m) .851

Volume (m3): .054

Standby Power (W)

Operational Power (W) 115

Peak Power (W)

Power Source (VDC) 28

PERFORMANCE SPECIFICATIONS:

Accurate amplitude and latency measurement using cursors.
Displays eight wave forms simulataneously with up to eight cursors per waveform,
Automatic electrode impedance test
Automatic artifact rejection.
Transfer waveforms and data via modem
Performs Arden Ratio determination.

RACK INTERFACE

Rack Mounted? ☒

	NONE	STANDARD	EXTRA
ELECTRICAL	☐	☒	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☐	☒	☐

PROBLEMS/ISSUES AND CONCERNS

ASSUMPTIONS/ JUSTIFICATIONS

Modification to existing Air Force unit

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

A rack mounted instrument with an eye piece, controls and readouts for selection of optical images.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

Subject looks at the optical images through the eye piece.
Images are selected by subject to test for vision capabilities and health status.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: VISUAL FUNCTION TESTING KIT	ID# 17	PAGE 3 of 4
	VER : 1	ORIGINATOR: J. Stephenson	

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

aluminum,glass

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 6.6 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 35 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

light assembly
husing
mirrors/ Prisms
power supply

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
10	40 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☒ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
23	60 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☐ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☐ PRECISION MACHINED PARTS, MANY MOVING PARTS ☒ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: VISUAL FUNCTION TESTING KIT ID# 17

VER : 1 **ORIGINATOR:** J. Stephenson

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☒ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☒ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 3.80

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	30	85	15	0	0	0
DIGITAL	30	10	75	15	0	0
DISP W/CRT	0	0	0	0	0	0
DISPLAY	10	60	40	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	30	100	0	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

20 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☒ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE

☒ LOW ☐ MEDIUM ☐ HIGH

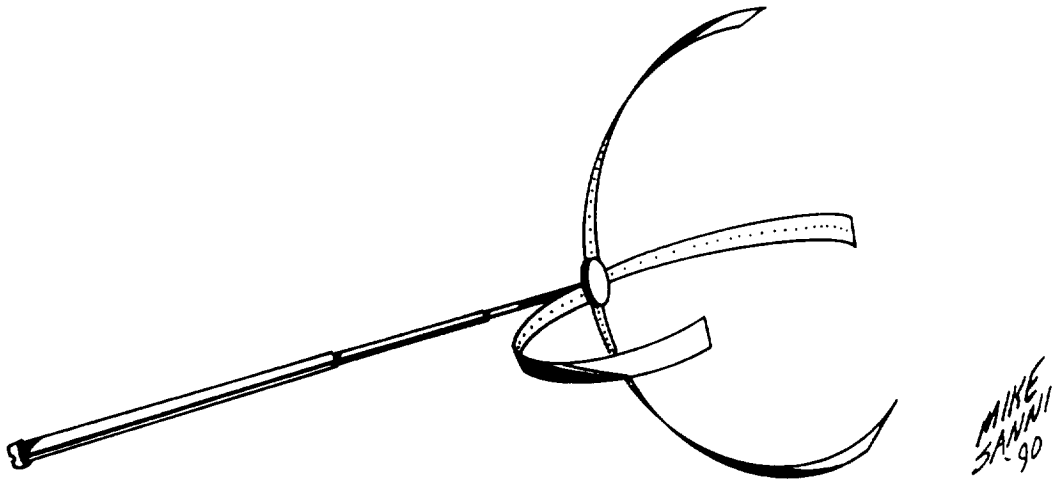
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME VISUAL TRACKING SYSTEM

HARDWARE ID. NO.: 18 **ORIGINATOR:** J. Stephenson

VERSION : 1

ILLUSTRATION



DEFINITION

A cross-shaped LED display serves as a focusing target for crew members during neurovestibular testing.

HISTORY/DESIGN STATUS:

System is suitable for use in a space environment.
Will be flight certified for IML-1 and IML-2 as part of the microgravity vestibular investigations.
Modification is required for Space Station use.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: VISUAL TRACKING SYSTEM ID# 18

VER : 1 **ORIGINATOR:** J. Stephenson

GENERAL SPECIFICATIONS

Mass (kg):	2
Height (m)	
Width (m)	.225
Depth (m)	.33
Volume (m3):	.007
Standby Power (W)	
Operational Power (W)	20
Peak Power (W)	
Power Source (VDC)	28

RACK INTERFACE

Rack Mounted? ☐

	NONE	STANDARD	EXTRA
ELECTRICAL	☒	☐	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☒	☐	☐

PERFORMANCE SPECIFICATIONS:

PROBLEMS/ISSUES AND CONCERNS

none

ASSUMPTIONS/ JUSTIFICATIONS

Neurovestibular is controlled by the Experiment Control Computer controls this item instead of ground

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

System consists of 4 curved fiberglass boards covered by fire resistant cotton cloth.
The PC boards are arranged in a cross pattern with LEDs placed at various angles from horizontal and vertical axes.
In its deployed position, it is connected to a handrail by a telescoping arm.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

The system will be used as a focusing target during neurovestibular testing. The Experiment Control Computer will control the LEDs lighting sequences and power supply to the system.

BMAC HARDWARE DATA SHEET	EQUIPMENT NAME: VISUAL TRACKING SYSTEM	ID# 18	PAGE 3 of 4
	VER : 1	ORIGINATOR: J. Stephenson	

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

phenoglass

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): 1.98 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 15 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

LEDs

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
8	35 %	☐ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☐ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
12	65 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☐ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: VISUAL TRACKING SYSTEM ID# 18

VER : 1 **ORIGINATOR:** J. Stephenson

TYPE OF ELECTRONICS:

- ☐ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☐ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☒ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 0.02

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	0	0	0	0	0	0
DIGITAL	39	55	35	10	0	0
DISP W/CRT	0	0	0	0	0	0
DISPLAY	61	57	24	19	0	0
XMTR	0	0	0	0	0	0
PWR SUP	0	0	0	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

15 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☒ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- ☐ NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- ☐ NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- ☐ DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☐ MEDIUM ☐ HIGH

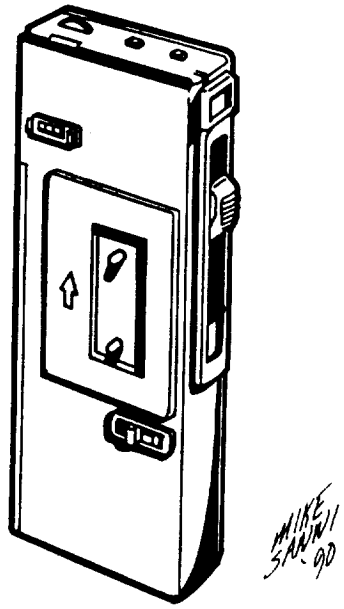
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME VOICE RECORDER

HARDWARE ID. NO.: 28 ORIGINATOR: J. Stephenson

VERSION : 1

ILLUSTRATION



DEFINITION

A hand-held audio device used to record crew voices during experiment procedures.

HISTORY/DESIGN STATUS:

LSLE #J013 is being replaced with this model in 1990.
Suitable off-the -shelf
Future new specifications will require improvements.

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EQUIPMENT NAME: VOICE RECORDER ID# 28

VER : 1 **ORIGINATOR:** J. Stephenson

GENERAL SPECIFICATIONS

Mass (kg):	.19
Height (m)	.133
Width (m)	.11
Depth (m)	.101
Volume (m3):	.001
Standby Power (W)	
Operational Power (W)	
Peak Power (W)	
Power Source (VDC)	Battery

PERFORMANCE SPECIFICATIONS:

2 speeds, 2.4 cm/sec and 1.2 cm/sec
Built in microphone
Minimum 2 hour recording per cassette
Speaker 2.8 cm diameter
Power output 250 mW@ 10% harmonic distortion.

RACK INTERFACE

Rack Mounted? ☐

	NONE:	STANDARD	EXTRA:
ELECTRICAL	☒	☐	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☒	☐	☐

PROBLEMS/ISSUES AND CONCERNS

Magnetic tape used could be damaged by external fields.

ASSUMPTIONS/ JUSTIFICATIONS

LSLE #JO13 is being replaced with this model in the near future.
Crew prefers it and it flies off-the-shelf per Angel Plaza SE3.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

Sony tape recorder

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

Voice recorder is stowed when not in use.
uses micro-cassettes to make audio recordings

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EQUIPMENT NAME: VOICE RECORDER ID# 28

VER : 1 **ORIGINATOR:** J. Stephenson

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:
aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): .15 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 15 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

batteries
motors

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:
20	25 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
80	75 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☒ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: VOICE RECORDER ID# 28

VER : 1 **ORIGINATOR:** J. Stephenson

TYPE OF ELECTRONICS:

- [x] ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- [x] DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- [ ] DISPLAY WITH CRT
- [ ] TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- [ ] POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- [ ] DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 0.04

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	70	30	70	0	0	0
DIGITAL	30	0	100	0	0	0
DISP W/CRT	0	0	0	0	0	0
DISPLAY	0	0	0	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	0	0	0	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

15 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- [x] SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- [ ] MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- [ ] NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. NO DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS COMMERCIALLY AVAILABLE
- [ ] NEW DESIGN FOR SPACE. USES EXISTING MATERIALS, PROCESSES, AND ELECTRONIC COMPONENTS. SIGNIFICANT DESIGN IMPACT DUE TO MICROGRAVITY ENVIRONMENT. GROUND BASED SYSTEMS DO NOT EXIST
- [ ] NEW DESIGN FOR SPACE. REQUIRES THE DEVELOPMENT OF NEW MATERIALS, PROCESSES AND/OR ELECTRONIC COMPONENTS. AT OR NEAR THE STATE OF THE ART.
- [ ] DEVELOPMENT OF NEW TECHNOLOGY WELL BEYOND EXISTING STATE OF THE ART AND/OR MULTIPLE DESIGN PATHS REQUIRED TO REACH THE GOAL

IF HARDWARE NEEDS SOFTWARE TO RUN:

- [ ] COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- [ ] ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE

[ ] LOW [ ] MEDIUM [ ] HIGH

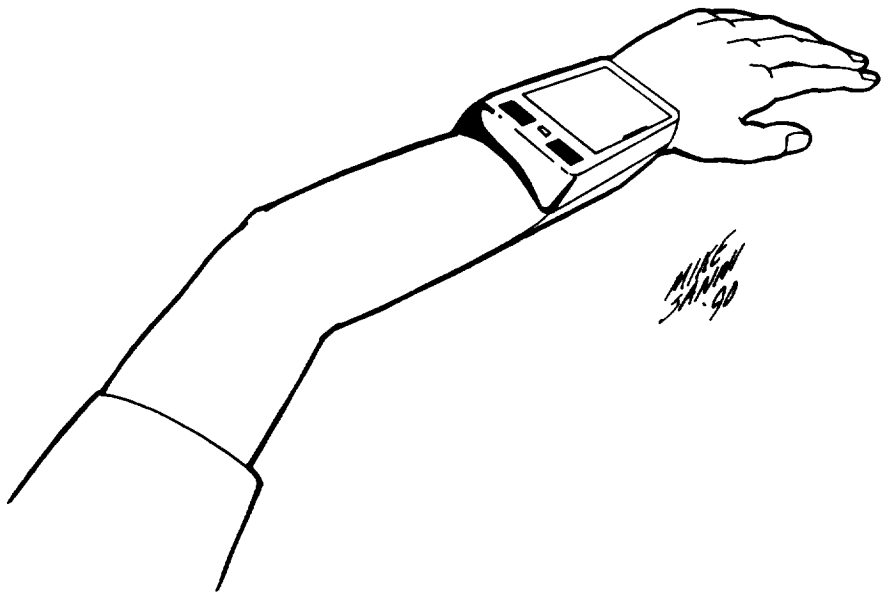
BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: WRIST ACTIVITY MONITOR

HARDWARE ID. NO.: 29 ORIGINATOR: G. McFadyen

VERSION : 1

ILLUSTRATION



DEFINITION

The device monitors patterns in limb motion during prolonged periods in microgravity.

HISTORY/DESIGN STATUS:

Developed for IML-2
New specifications require improvements for use on Space Lab.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: WRIST ACTIVITY MONITOR ID# 29 Page 2 of 4

VER : 1 **ORIGINATOR:** G. McFadyen

GENERAL SPECIFICATIONS

Mass (kg):	1.2
Height (m)	.05
Width (m)	.21
Depth (m)	.11
Volume (m3):	.001
Standby Power (W)	
Operational Power (W)	
Peak Power (W)	
Power Source (VDC)	battery

PERFORMANCE SPECIFICATIONS:

Advanced microprocessor technology
Detects, processes and accurately quantifies motor activity in all 3 directions over any period of time.

RACK INTERFACE

Rack Mounted? ☐

	NONE	STANDARD	EXTRA
ELECTRICAL	☒	☐	☐
THERMAL:	☒	☐	☐
WASTE:	☒	☐	☐
FLUID:	☒	☐	☐
DATA:	☒	☐	☐

PROBLEMS/ISSUES AND CONCERNS

ASSUMPTIONS/ JUSTIFICATIONS

Device will be attached to subject's wrist. Data will be recorded on magnetic tape by built in recorder.

QUANTITY REQUIRED: 2.5 **SPECIFICATIONS** ☐ MARC I ☒ MARC II ☐ MARC III

PHYSICAL DESCRIPTION:

A device with built-in recorder to be attached to subject's wrist.

FUNCTIONAL DESCRIPTION (DESCRIBE FULLY, INCLUDE WHERE AND HOW USED)

The wrist monitor is worn for prolonged periods (4 hours and during sleep).
Directional movements of the wrist will be recorded for future analysis.

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: WRIST ACTIVITY MONITOR ID# 29

VER : 1

ORIGINATOR: G. McFadyen

CONSTRUCTION OF STRUCTURE/MECHANICS

MATERIAL:

aluminum

TOTAL STRUCT/MECH WT. (EXCLUDING ACTIVE ELECTRONICS): .8 Kg

ESTIMATED TOTAL % NEW DESIGN OF ALL STRUCT/MECH COMPONENTS: 15 %

DISCRETE STUCTURAL/MECHANICAL MODULES (e.g. MOTORS, FANS, BATTERIES, ANTENNAS)

bracelet
LED's
battery

ESTIMATED # OF STRUCT PARTS (EXCLUDING NUTS, BOLTS, SCREWS, ETC.) OF EACH A/B/C	PCT. OF TOTAL STRUCT WEIGHT:	**CHECK THE APPROPRIATE MAJOR AND SUB CATEGORY FOR MECH CONFIGURATION:**
8	45 %	☒ A. SHEET METAL CONSTRUCTION, EXTRUDED SHAPES, RIVETED, WELDED ☒ SUPPORT STRUCTURE, NO MOVING PARTS ☐ CONTAINMENT STRUCTURE SUBJECT TO PRESSURE AND FORCES ☐ STRUCTURES UNDER SIGNIFICANT DYNAMIC FORCES
12	55 %	☒ B. MACHINED CONSTRUCTION FROM DRILLING, MILLING, GRINDING ETC. ☒ NORMAL MACHINED PARTS, FUNCTION IS SUPPORT AND CONTAINMENT ☐ PRECISION MACHINED PARTS, MANY MOVING PARTS ☐ OPTICAL COMPONENTS AND ASSY BUILT TO HIGHEST PRECISION
	%	☐ C. LAMINATED STRUCTURAL COMPOSITES ☐ LAID UP FLAT SURFACE WITH STIFFENERS ☐ STRUCTURAL FRAMES, SUPPORTS, BULKHEADS, BONDED ASSY ☐ CYLINDRICAL SHAPED, FILAMENT WOUND ASSEMBLIES

ADDITIONAL COMMENTS CONCERNING STRUCT/MECH COMPONENT:

BMAC HARDWARE DATA SHEET

EQUIPMENT NAME: WRIST ACTIVITY MONITOR ID# 29

VER : 1 **ORIGINATOR:** G. McFadyen

TYPE OF ELECTRONICS:

- ☒ ANALOG RECEIVERS, OP AMPS, AUDIO VIDEO, RF, SERVO DRIVE, ETC.
- ☒ DIGITAL GATES, REGISTERS, COMPUTERS, ETC.
- ☐ DISPLAY WITH CRT
- ☐ TRANSMITTER TV, RADAR, COMM, NAV, LASER, ETC.
- ☒ POWER SUPPLY CONVENTIONAL LINEAR RECTIFICATION, CHOPPER & AC-DC CONVERTERS
- ☒ DISPLAY - NO CRT LED's LIQUID CRYSTAL PRINTERS

ELECTRONIC DESCRIPTION BY PERCENTAGE OF ELECTRONICS WEIGHT

Kg. of Electronics 0.40

	% TOTAL	%DISC	%IC	%LSI	%HYB	%VLSI
ANALOG	0	0	0	0	0	0
DIGITAL	10	0	100	0	0	0
DISP W/CRT	0	0	0	0	0	0
DISPLAY	50	100	0	0	0	0
XMTR	0	0	0	0	0	0
PWR SUP	40	0	100	0	0	0

ESTIMATED TOTAL % NEW DESIGN OF ELECTRONICS:

40 %

WILL ELECTRONICS BE OF ABOVE AVERAGE DENSITY?

○ Yes ◉ No

SCOPE OF DESIGN EFFORT:

- ☐ SIMPLE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
- ☒ MODERATE TO EXTENSIVE MODIFICATION TO AN EXISTING SPACE-BASED DESIGN
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IF HARDWARE NEEDS SOFTWARE TO RUN:

- ☐ COTS HARDWARE AVAILABLE W/ THE REQUIRED SOFTWARE
- ☐ ADDITIONAL AUTOMATION REQUIREMENTS THAN CURRENTLY AVAILABLE ☐ LOW ☐ MEDIUM ☐ HIGH

☆ U.S. GOVERNMENT PRINTING OFFICE: 1990—761-014/20193