

201-848-6800

MAINTENANCE MANUAL

~~800-638-8656~~
800-234-1147

IMI INFANT CARE CENTER MODEL 4000 SERIES

4004

Specifications are subject to change without notice.

Becton Dickinson Medical Systems
Route One, Sharon, MA 02067
~~Telephone (617) 228-0000~~

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SECTION I

WARNINGS AND SAFETY INFORMATION

Read this manual before servicing this equipment. Keep this manual for future reference and new employees. The operating instructions for this instrument are contained in Operating Manual OM-18, IMI Infant Care Center, Model 4000 Series.

When used in a flammable anesthetizing location, all electrical elements in this unit except the temperature probe must be five feet or more above the floor in accordance with the National Electrical Code, 1975, paragraph 517-60.

For your protection against shock hazards, connect this equipment only to an approved power source such as a 3-wire grounded receptacle. Where a 2-wire receptacle is encountered, it must be replaced by a qualified electrician with a properly grounded 3-wire receptacle in accordance with the National Electrical Code. Do not, under any circumstances, remove the grounding prong from the power plug. Do not use extension cords.

Should the power cord or plug become cracked, frayed, broken or otherwise damaged, it should be replaced immediately by a serviceman. Unplug the power cord before cleaning or servicing. The operator should not perform any servicing except as specifically stated in the operating manual.

Do not remove any caution labels from this equipment or the associated work area.

The use of any electrical instrument requires adequate training of personnel. Hospital administrative personnel are responsible for making certain that all operators of the instrument(s) described in this manual receive adequate training beforehand and that B-D ELECTRODYNE training courses for operators be scheduled with your authorized distributor of IMI products on a regular basis. It is especially important that instruction be given for use of the IMI-4000 Infant Care Center as described in the operating manual.

Troubleshooting and repair of the IMI-4000 Infant Care Center should be performed by trained and authorized personnel only. If a hospital desires to use its own maintenance personnel to supplement the B-D ELECTRODYNE authorized service that is available, a hospital official can contact B-D ELECTRODYNE, Sharon, Massachusetts for training information (Tel: (617) 828-9080).

WARNING

Do not, under any circumstances, perform any testing or maintenance on medical instruments, cables, or electrodes while they are connected to a patient.

SECTION II
DESCRIPTION

2.1 INTRODUCTION

The Infant Care Center consists of relatively few basic subassemblies. Its components are shown in figure 1.

- Hood Assembly
- Controller and Bracket Assembly
- Pole
- Carriage Assembly
- Base Assembly (Part of Carriage Assembly)

Hood Assembly

The Hood Assembly consists of a radiant heat panel with a protective cover. A power cord for supplying a-c power to the heating element is at one end of the hood near the mounting hole which fits over the pole. The only electrical elements in the Hood Assembly are a heating element and a thermostat for overheating protection.

Controller and Bracket Assembly

Two Controller options are available depending on the requirements of the pediatric facility.

- (1) Proportional Controller, Model 4004 (figure 2)
- (2) Manual Controller, Model 4002 (figure 3)

A Model number of an Infant Care Center is modified by a letter to designate the Controller that is included, as follows:

An Infant Care Center with a Model 4004 Proportional Controller is a Model 4000P.

An Infant Care Center with a Model 4002 Manual Controller is a Model 4000M.

A list of the assemblies, subassemblies, and components in the Infant Care Center is given in Table 1.

TABLE 1. INFANT CARE CENTER ASSEMBLIES 4000 SERIES

NAME	PART NO.	DESCRIPTION
Base Assembly	0590555615	Completely assembled base which supports carriage assembly.
Base Assembly	0220006102	Base support for Free Standing Radiant Warmer.
Wall Mounting Bracket Assembly.	0590926239	Wall mounting bracket for Radiant Warmer.
Pole with Indexing Block	0210196001	Used to mount the Controller and Radiant Warmer. The indexing block is used to set the position of the procedure table.

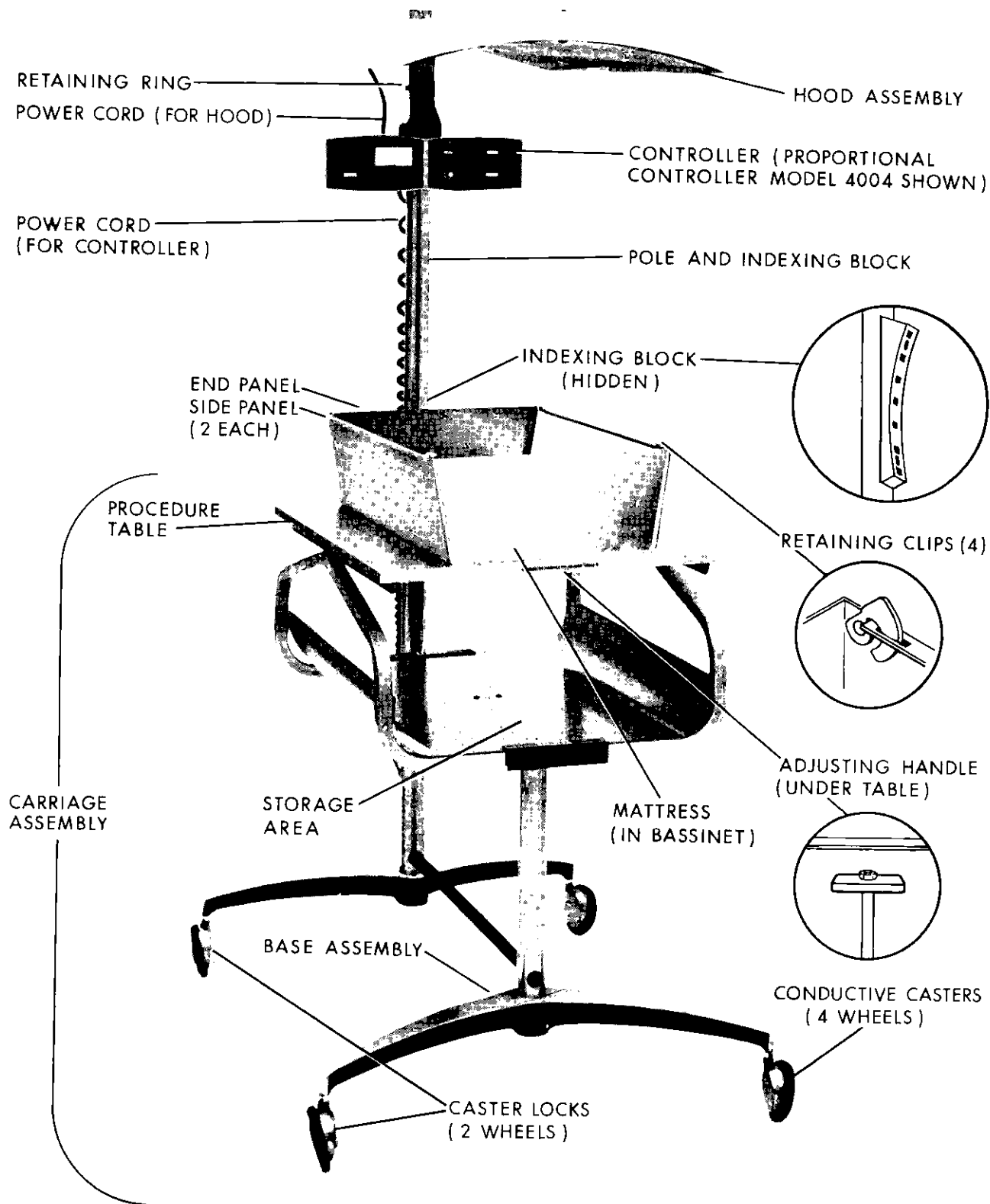


Figure 1. Infant Care Center

TABLE 1. INFANT CARE CENTER ASSEMBLIES 4000 SERIES (Cont)

NAME	PART NO.	DESCRIPTION
Mattress	1040475001	Bassinet mattress.
Radiant Warmer	2620018401 Model 4003	Curved canopy which emits 10-micron infrared heat energy.
Controller (2 Models available):		This unit controls the heat output of the radiant warmer.
Proportional Controller	2520018501 Model No. 4004	Temperature automatically regulated by the patient's demand or manually controlled. The patient's temperature can be monitored at all times.
Manual Controller	2520018301 Model No. 4002	Manual control for temperature selection.
Retaining Ring	0210185901	Stainless steel ring used to support the Controller assembly on the pole. This ring is also used to control the rotation of the radiant warmer.

Proportional Controller, Model 4004

The Proportional Controller, Model 4004 (figure 2) is an electronic control circuit that automatically maintains a preselected temperature by regulating heater output in response to patient's temperature. A skin or rectal probe is used in conjunction with a PROBE switch set in the SKIN or RECTAL position to sense a patient's temperature and provide continuous monitoring. A digital switch on the Proportional Controller is used for preselecting the desired skin or rectal temperature while the actual patient temperature is displayed on a panel meter. Front panel displays also indicate a-c power ON and heater POWER LEVEL and indicate when the AUDIBLE ALARM is enabled. The audible and visible alarms indicate temperatures over 38.3°C and under 34.0°C. The Proportional Controller also has a capability for MANUAL control of patient temperature whenever it is needed.

Manual Controller, Model 4002

The Manual Controller (figure 3) is used to control the temperature of the radiant heater, but does not sense the patient's temperature. Temperature adjustment is made manually by a control on the front panel.

Pole

The pole is a stainless steel tube, two inches (5.1 cm) in diameter and 48-3/8 inches (122.9 cm) long. The pole is the only structural member between the Bassinet Assembly and the Hood and Controller Assembly. It supports the Hood, Controller, and Examination Lamp and allows them to be rotated to any desired position.

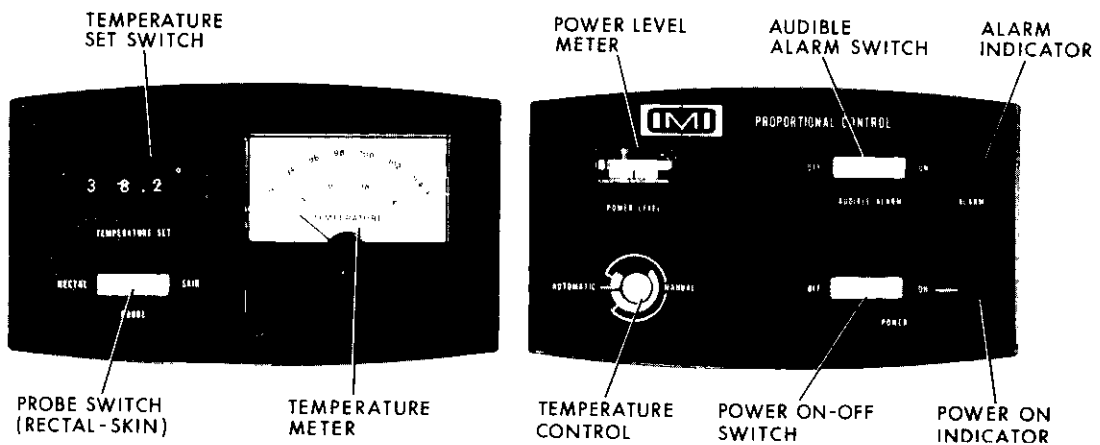


Figure 2. Proportional Controller, Model 4004

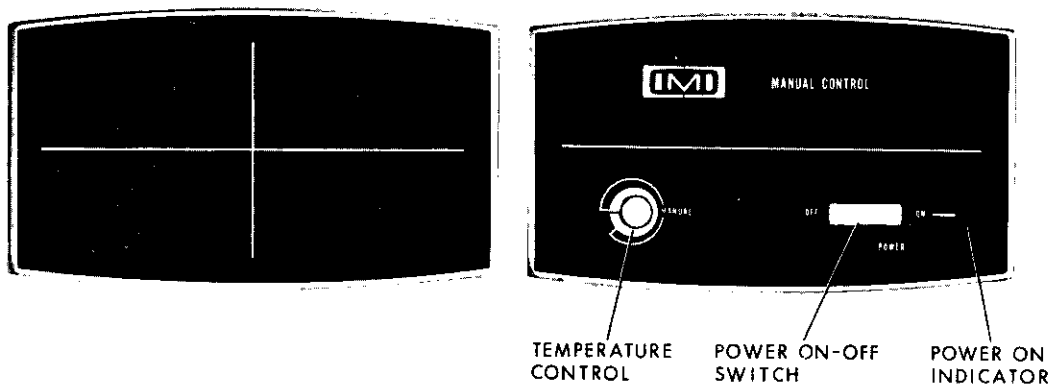


Figure 3. Manual Controller, Model 4002

Carriage Assembly

The Carriage Subassembly consists of a carriage base on locking, conductive casters and a support frame mounted on two carriage support poles. The top of the Carriage Assembly is the "procedure table" and is supported on a tubular frame so that it can tilt both ways for adjusting positions. The frame also encloses a storage bin which is underneath the procedure table and accessible for convenient storage of materials. The procedure table has slots for the panel hinges. When the panels are assembled to the procedure table they form a bassinets which has a conductive mattress for the patient.

Operation of the Infant Care Center consists of adjusting the mechanical parts of the unit for patient access, position, examination or procedures, and operation of the electrical controls on the Controller.

The whole unit may be moved within an eight or ten foot (244 cm to 305 cm) radius of its power source without unplugging by unlocking the conductive casters, and pushing gently.

Bassinets positions may be adjusted by squeezing the position handle and tilting the procedure table to any of the seven positions on the indexing block.

WARNING

Users of the Infant Care Center should make certain that the patient is protected while the table is being adjusted; and that they do not place their hands between the tubular frame and the procedure table while making adjustments. Always lock the side panels.

The bassinet side and end panels may be unlocked and lowered to permit greater access to the patient for medical procedures.

The Hood and Controller Assembly can be rotated around the pole to permit use of other equipment such as x-ray apparatus, or at the physician's discretion. To rotate the Hood and Controller Assembly, hold the spring-loaded plunger out and rotate the Hood to the position desired, then release the plunger.

All of the electrical controls and indicators are on the front panel of the Controller. The two Controller models available have different front panels and controls. The controls and indicators are described in Section 2.4.

WARNING

All surfaces of the Infant Care Center that are within five feet (152 cm) of the floor are conductive and have low resistance to the power cord grounding wire. This surface conductivity includes the bassinet mattress. This conductive state meets the antistatic requirements of NFPA Standard #56A (Inhalation Anesthetics). An infant is grounded at all times while in the bassinet or attached to a skin temperature probe. It is essential that any auxiliary apparatus attached to an infant be suitable for connection to a grounded patient.

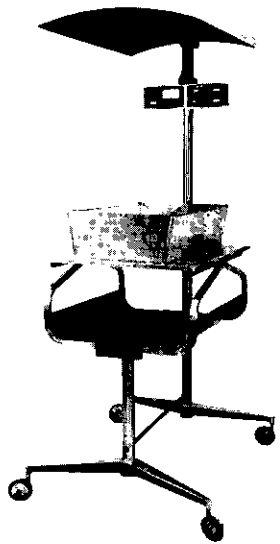
2.2 MODELS AND VARIATIONS OF THE INFANT CARE CENTER

The Infant Care Center is supplied in three major configurations (see figure 4).

- (1) Infant Care Center with Bassinet for infant care.
- (2) Free Standing Radiant Warmer for use over an infant crib, adult bed, or procedure table.
- (3) Wall-mounted radiant warmer.

Model Numbers

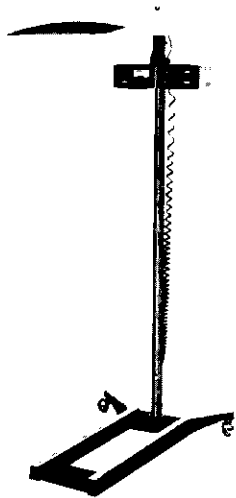
- 4000P – Infant Care Center with Proportional Controller
- 4001P – Free Standing Radiant Warmer with Proportional Controller
- 4009P – Wall Mounted Radiant Warmer with Proportional Controller



**MODEL 4000P Infant Care Center
with Proportional Controller**

**MODEL 4000M Infant Care Center
with Manual Controller**

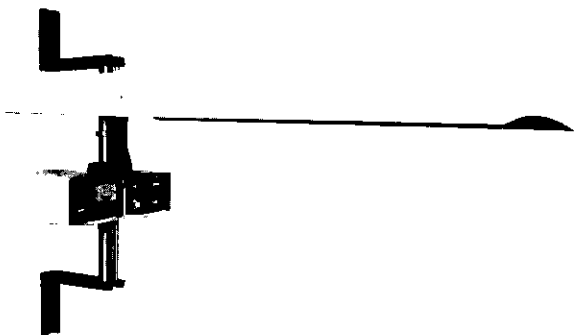
**Hood Model No. 4003
Proportional Controller Model No. 4004
Manual Controller Model No. 4002**



**MODEL 4001P Free Standing Radiant Warmer
with Proportional Controller**

**MODEL 4001M Free Standing Radiant Warmer
with Manual Controller**

**Hood Model No. 4003
Proportional Controller Model No. 4004
Manual Controller Model No. 4002**



**MODEL 4009P Wall Mounted Radiant Warmer
with Proportional Controller**

**MODEL 4009M Wall Mounted Radiant Warmer
with Manual Controller**

**Hood Model No. 4003
Proportional Controller Model No. 4004
Manual Controller Model No. 4002**

Figure 4. Infant Care Center Models and Variations

- 4000M – Infant Care Center with Manual Controller
- 4001M – Free Standing Radiant Warmer with Manual Controller
- 4009M – Wall Mounted Radiant Warmer with Manual Controller

NOTE

All models are available for 120V 50/60 Hz and 240V 50/60 Hz operation.

2.3 THE RADIANT WARMING PRINCIPLE

A heating unit embedded in a silicone rubber pad in the Hood Assembly warms the patient with invisible 10-micron wavelength energy. A curved “canopy” with approximately six square feet (.56 sq. m) of radiant surface directs the heat over and around the entire patient area. The heat penetrates the skin to provide subsurface as well as surface warmth. The long wavelength infrared radiant warmer heats uniformly and penetrates in depth so that with this heating principle hot-spots cannot occur. This principle is illustrated in figure 5.

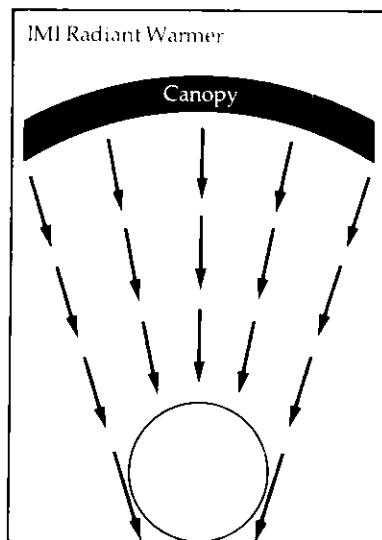


Figure 5. Radiant Warming Principle

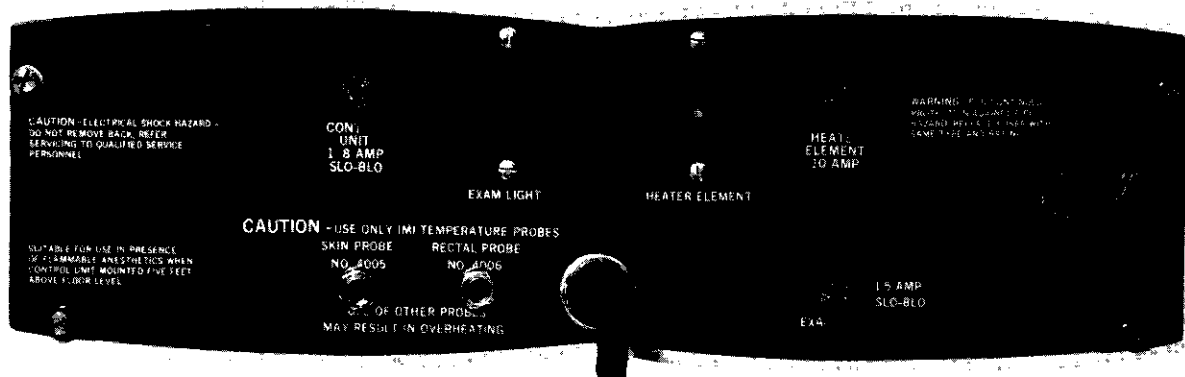
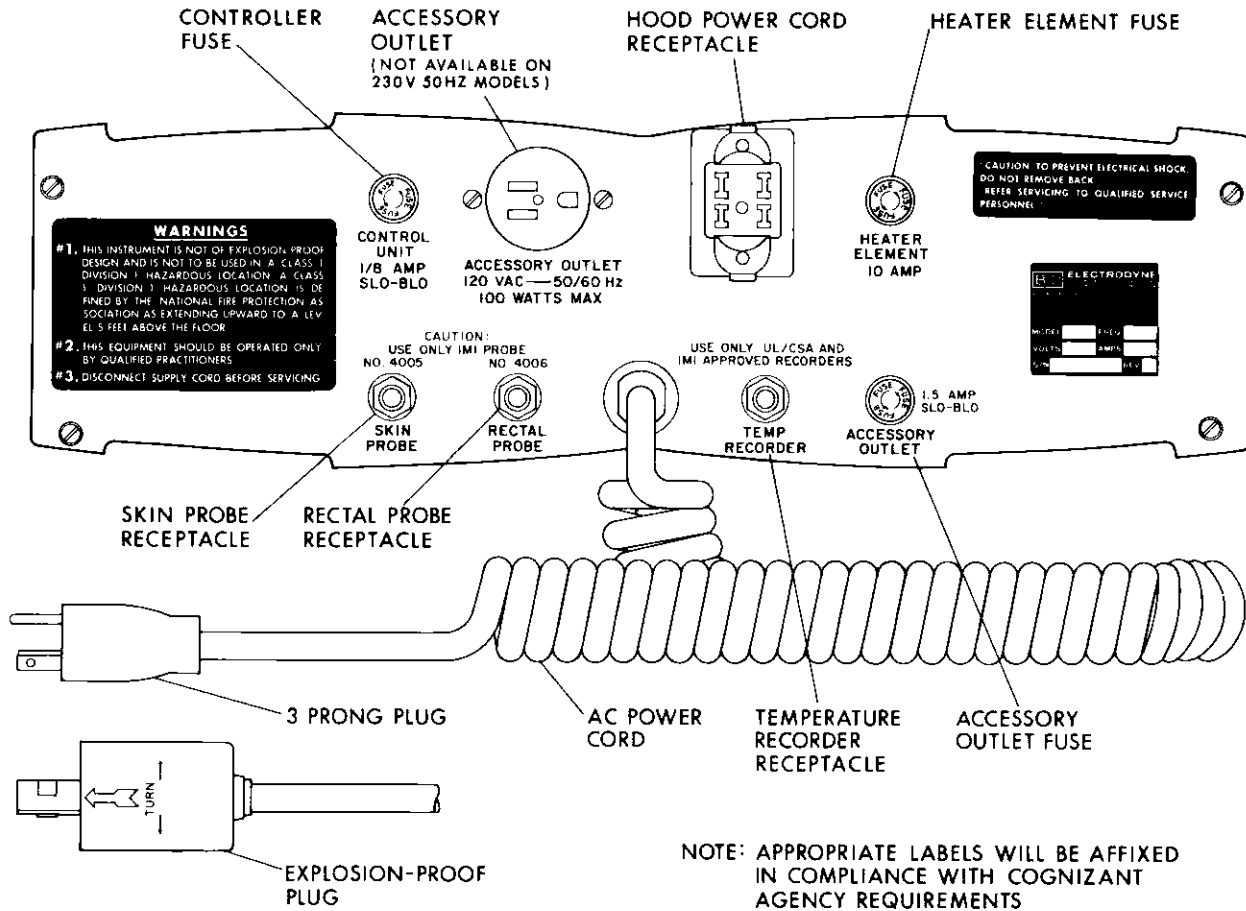
When the Infant Care Center is equipped with a Proportional Controller, automatic temperature controls adjust the heat output to meet the patient’s needs as sensed by the rectal or skin thermistors.

The desired patient temperature is dialed on the digital TEMPERATURE SET switch (see Section 2.4) and the Hood Assembly produces just enough energy to maintain the selected temperature. As the patient approaches the set temperature, the controller slowly lowers the energy output. If the patient’s temperature drops below the setting, the controller immediately responds to maintain the selected temperature within $\pm 0.1^{\circ}\text{C}$ under normal operating conditions.

If Manual Controllers are used, the energy output must be adjusted manually as the patient's temperature needs are determined.

2.4 CONTROLS AND INDICATORS

The front panel controls and indicators are shown in figures 2 and 3. The rear panel components are shown in figure 6.



**UL LISTED MEDICAL EQUIPMENT
FOR USE IN HAZARDOUS LOCATIONS**

Figure 6. Rear Panel Connectors and Fuses

TEMPERATURE SET Switch (Proportional Controller Only)

This device is a digital switch that is used to select the desired patient temperature when the Proportional Controller is operated in the AUTOMATIC mode. This switch is used to regulate the patient's temperature to within $\pm 0.1^{\circ}\text{C}$ of the preselected value.

POWER LEVEL Meter (Proportional Controller Only)

This meter displays the percentage of full power output of the heating element.

TEMPERATURE Meter (Proportional Controller Only)

The meter indicates patient temperature on a dual scale which correlates the temperature in degrees Centigrade and degrees Fahrenheit.

PROBE Switch (RECTAL-SKIN) (Proportional Controller)

This is a rocker switch used to switch from the skin probe or rectal probe input connectors depending on which Thermistor Assembly is used. Positions are SKIN and RECTAL.

Temperature Control

On the Proportional Controller, the Temperature Control allows the selection of AUTOMATIC or MANUAL modes of operation. In the AUTOMATIC mode it automatically responds to the patient's temperature and controls the patient's temperature by a proportional change in the power output level. In the MANUAL mode the control can be manually adjusted to increase or decrease the power output level at the discretion of the attending physician or nurse.

On the Manual Controller, the Temperature Control does not have an automatic position and can be used only as a manual control.

AUDIBLE ALARM Switch (Proportional Controller)

This switch is a rocker type with ON and OFF positions. In the ON position, this switch activates the AUDIBLE ALARM so that it will sound during alarm conditions. In the OFF position, the AUDIBLE ALARM will not sound.

ALARM Indicator Light (Proportional Controller)

This lamp is red and glows whenever an ALARM condition exists; i.e., when the temperature measured by the skin or rectal probe exceeds the low temperature limit of 34.0°C (93.2°F) and the high temperature limit of 38.3°C (100.9°F).

POWER Switch

This switch is a rocker type with ON and OFF positions used to turn the power to the Controller ON and OFF.

Pilot Light

This lamp is a red indicator light located to the right of the POWER switch that glows when the POWER switch is ON.

The following items are located on the rear panel of the Controller (see figure 6).

Controller Fuse

This fuse is a one-eighth ampere, 120V, (1/16 ampere, 240V) slo-blo type which protects the electronic circuits of the Controller. The fuse is in a twist-open fuse holder.

EXAMINATION LAMP OUTPUT

This outlet is a special receptacle for connection of an examination lamp. It is limited to 100 watts of power. The exam lamp fuse is 1.5A for 120V and 240V.

Hood Power Cord Receptacle

Receptacle for Hood power cord.

Heater Element Fuse

Protects the heating element and thermostat in the Hood Assembly. This fuse is rated at 10 amperes 120V (5 amperes for 240V) and is located in a twist-open fuse holder.

Skin Probe Receptacle

This connector is for the skin probe. It should be used only for Model IMI-4005 Thermistor Assembly (Skin Probe).

Rectal Probe Receptacle

This connector is for the rectal probe. It should be used only for Model IMI-4006 Thermistor Assembly (Rectal Probe).

A-C Power Cord

The a-c power cord is a retractile coil cord with three AWG No. 16 stranded conductors, UL Type SO rates for 10 amperes. The cord is two feet long when retracted, but will extend to 12 feet.

2.5 ACCESSORIES

Thermistor Assemblies

The thermistor assemblies are used as temperature sensors in the Proportional Controller. A skin probe is supplied with the Controller in an Infant Care Center (figure 7). A rectal probe (figure 8) is available as an optional extra.

A list of optional assemblies and equipment that can be supplied with the Infant Care Center appears in Table 2.

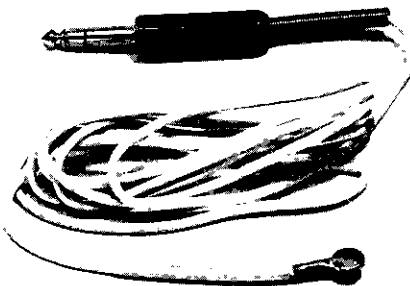


Figure 7. Thermistor Assembly,
Skin Probe Model 4005

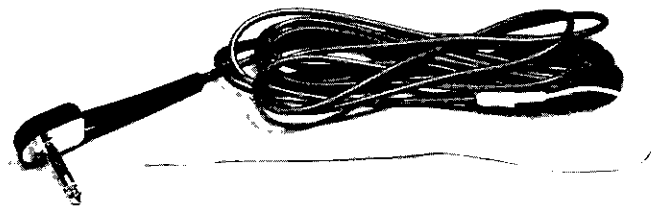


Figure 8. Thermistor Assembly,
Rectal Probe Model 4006

WARNING

Model 4005 skin probe and Model 4006 rectal probe are the only probes that are to be used with the IMI Infant Care Center. DO NOT USE ANY OTHER PROBES.

TABLE 2. OPTIONAL ACCESSORIES FOR USE WITH THE INFANT CARE CENTER

NAME	PART NO.	DESCRIPTION
Thermistor Assembly (2 models available):		Used as temperature sensors. These probes are used with the 4004 Controller.
Thermistor Assembly, Skin Probe	4005	Skin probe to monitor patient's surface temperature.
Thermistor Assembly, Rectal Probe	4006	Rectal probe to monitor patient's core temperature.
Complete Resuscitation Pkg.	2600	Included in this package are items 2601, 2602, 2604, 2605, 2606, and 2607.
Low Pressure Manifold Assembly	2601	Outlets for flowmeter and humidifier, resuscitator, aspirator and quick connect to oxygen source.
Horizontal High Pressure Oxygen System	2602	Mounting for two "D" or "E" oxygen cylinders, pressure regulator and gauge and oxygen line.
Vertical High Pressure Oxygen System	2603	Same as above.
Handy OB Resuscitator	2604	Positive/Negative resuscitator, resuscitator control, infant face mask, and balloon assembly.
Pressure Power Aspirator	2605	Vacuum control valve, venturi, muffler aspirator bottle, fifteen-inch 10F catheters, 30-inch catheter tubing, vacuum connection line.
Humidifier Assembly	2606	Humidifier bottle and lead.
Flow Meter	2607	Monitors Oxygen flow.
Aspirator Bottle	01-6100	Used with Resuscitator Package.
Aspirator Bottle Cap	01-6608	Used with Resuscitator Package.
Infant Mask	01-5998	Used with Resuscitator Package.
Infant Mask Cushion	01-5123	Used with Resuscitator Package.

TABLE 2. OPTIONAL ACCESSORIES FOR USE WITH THE INFANT CARE CENTER (Cont)

NAME	PART NO.	DESCRIPTION
Examination Lamp	4008	An aid in allowing visual access to the patient.
Replacement Bulb	01-6791	Replacement bulb for the 4008 Examination Light.
Foam Pads	120	Miniature foam pads. USE: Covers and holds
Foam Pads	220	Large foam pads. thermistor on skin.
Wall Mount for the Hood and Controller Assembly	231B	Bracket used to mount the Infant Care Center to wall.
Allen Wrench	01-5445	3-32" Allen Wrench (Hexagonal key wrench).

SECTION III PRINCIPLES OF OPERATION

3.1 GENERAL

All of the electronic circuitry in an Infant Care Center is contained in the Controller. The function of the Controller is the control of the heating element in the hood which radiates the heat to the infant patient. Control can be automatic in response to temperature variations in the patient as sensed by a skin probe or rectal probe, or can be manual. For automatic control, a Model 4004 Proportional Controller is used. For manual control a Model 4002 Manual Controller is used. This section describes the functional operation of each model Controller.

Proportional Controller, Model 4004 (Dwg. D04300412 and D04300413)

A block diagram of the Proportional Controller is shown in figure 9. The diagram shown is for a 120-volt circuit. A proportional controller for 240 volt use differs from the diagram shown only in the power transformer and it has a step-down transformer for the examination light outlet. A simplified block diagram of the 240-volt circuit is shown in figure 10.

Power is supplied to the heating element through power outlet J9. The level of the heat-controlling power is varied in response to sensor variations by the heater element power control circuit A3.

The patient probe circuit, which senses the infant's temperature is energized by a current source consisting of transistor Q1, CR1, and CR2. This circuit limits the maximum current flow in the patient probe circuit to 25 microamperes. The patient probe circuit is a resistive bridge network with a thermistor (patient probe) used as one of its sides. Changes in temperature at the probe cause it to change resistance, unbalancing the bridge circuit. The output of the probe (rectal or skin) appears as a differential d-c voltage at the inputs to the sensor amplifier Z1. When the sensed temperature of the patient rises, the resistance of the patient probe (thermistor) decreases, causing an imbalance of the temperature bridge. At this time the -input of the IC amplifier, type LM308 is driven more positive, causing the output of the amplifier to rise in voltage. This produces a change in the reading of the temperature meter M2 that is directly related to the sensed temperature change of the patient. The output of Z1, the high input impedance high gain sensor amplifier, provides a varying d-c voltage that is proportional to changes in temperature as sensed by the patient probe being used.

The High and Low Alarm Sense circuits sense the high-low temperature limits of the patient. Transistor Q4, the low alarm circuit is forward biased at a point lower than the low limit back bias applied to it by the output of amplifier Z1. Q4 is held in the off condition until the voltage at the output of Z1 drops below the forward bias voltage at the emitter of Q4. When the Z1 output voltage (back bias) falls below the forward bias of low alarm transistor Q4, the transistor Q4 turns on, disabling the flasher gate transistor Q9, indicating the presence of an abnormally low temperature.

The high alarm circuit Q5 is normally reverse biased by the high alarm adjust pot R17. Q5 is held in the off condition until the Z1 output voltage drops below the bias voltage present at the Q5 emitter. This turns high alarm limit transistor Q5 on, disabling flasher gate transistor Q9 and indicating the presence of an abnormally high temperature.

The alarm gate circuit consists of a 3.3 Hz free-running multivibrator (Q7 and Q8) and a gating transistor Q9. The gating transistor, in an on condition throughout the normal temperature range, holds the

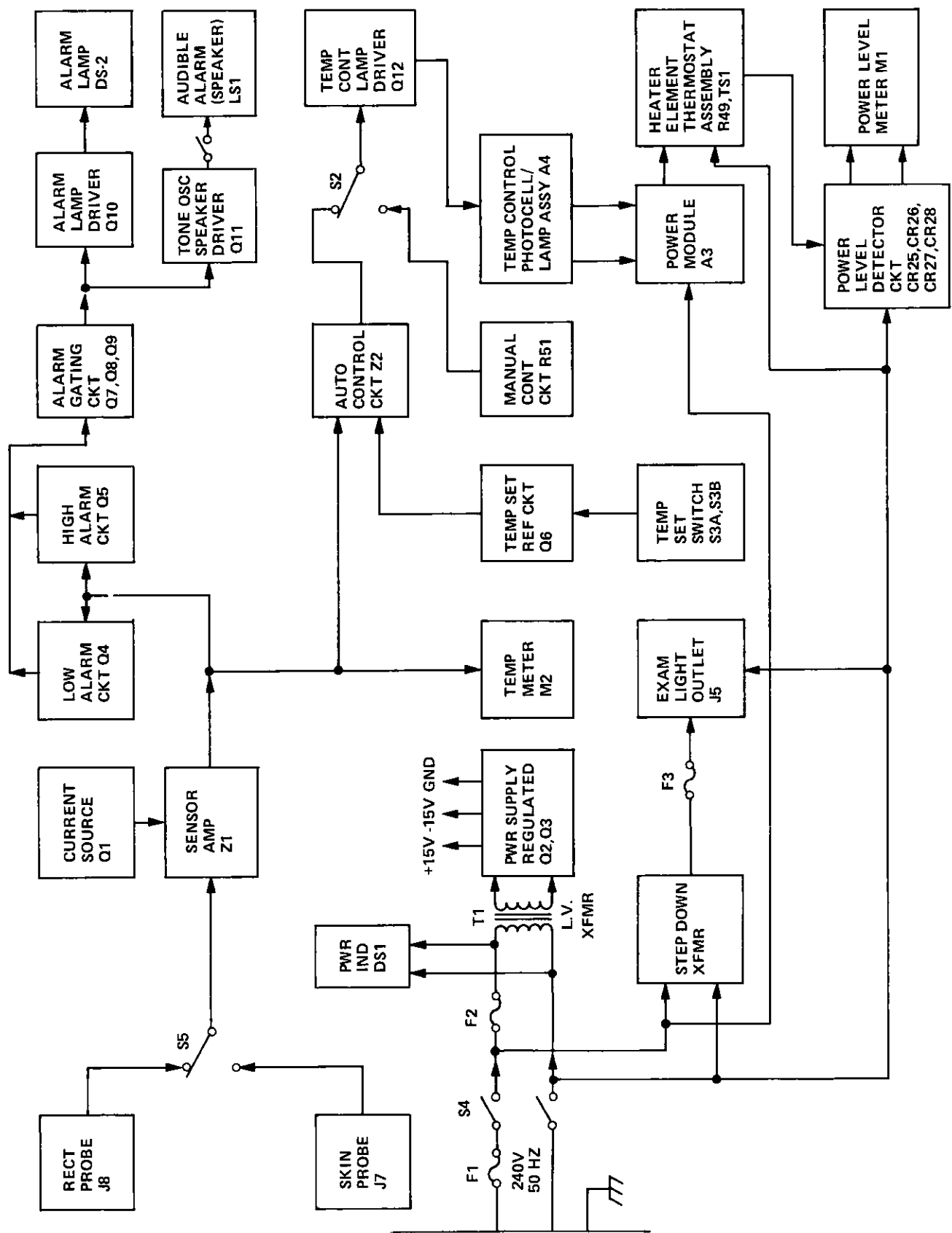


Figure 10. 240V Proportional Controller, Model 4004

multivibrator off, inhibiting its activity until the low alarm Q4 or the high alarm Q5 become active. The multivibrator, when free running, also acts as a gate activating the alarm lamp driver and tone oscillator speaker driver circuits at a 3.3 Hz pulsating rate, giving audible and visible indications that an abnormal temperature is being sensed by the patient probe. The alarm lamp driver circuit is transistor Q10 and the visible alarm is DS-2. The tone oscillator and speaker driver is Q11 and the audible alarm is the speaker, LS1. The audible alarm gives a 100 Hz tone at a 3.3 Hz rate when an alarm condition is present.

The output of Z1 is clamped by zener diode CR11 so that it will not rise above the zener reference voltage of 6.8 Vdc.

The automatic control circuit Z2 operates on fixed voltages from the collector of the temperature set reference transistor Q6. The fixed voltages are reference voltages provided at the Z2 input when input resistances are selected by the TEMPERATURE set switch. The automatic control circuit Z2 provides a controlling output voltage that is a function of the comparison of the reference voltage at its +input (positive) and the temperature sense voltage at its -input (negative).

The Manual control circuit is a potentiometer R51 that provides a manual control of the temperature setting of the heater element. The MAN/AUTO select switch (part of the MANUAL control potentiometer) provides selection of either manual or automatic control of the heater element.

The temperature control lamp driver Q12, controlled by either the manual or automatic control circuits, is an emitter follower that supplies the control voltage to the lamp in the photocell/lamp assembly.

The temperature control assembly is an optical isolator consisting of a lamp and a photocell. The lamp intensity determines the resistance of the photocell which, in turn, determines the amount of control voltage set on the power module.

Heater element power control circuit A3 provides controllable power to the heater element.

The Power level detector is a diode bridge rectifier circuit that displays on meter M1 (POWER LEVEL) the percent of power supplied to the heater element.

The heater element/thermostat assembly is an 800 watt maximum heater with a thermostat set at 300 degrees Fahrenheit.

The power supply Q2 and Q3 provides regulated +12 and -12 volts and an unregulated +20 volt outputs for the logic circuits.

Manual Controller, Model 4002 (Dwg. C04300424)

Simplified block diagrams of the 120 and 240 volt manual controllers are shown in figures 11 and 12. As in the proportional controller, the only differences are in the power transformer and the addition of a step-down transformer in the 240 volt model.

In the manual controller there are no sensing and alarm circuits and the heat control is simplified in that it is directly controlled by the MANUAL control potentiometer R51 and power module A3. The heating element and thermostat in the hood are the same as with the proportional controller. Adjustment of the temperature is made by a nurse who must constantly check the patient's temperature with a thermometer and increase or decrease the hood temperature as she deems necessary.

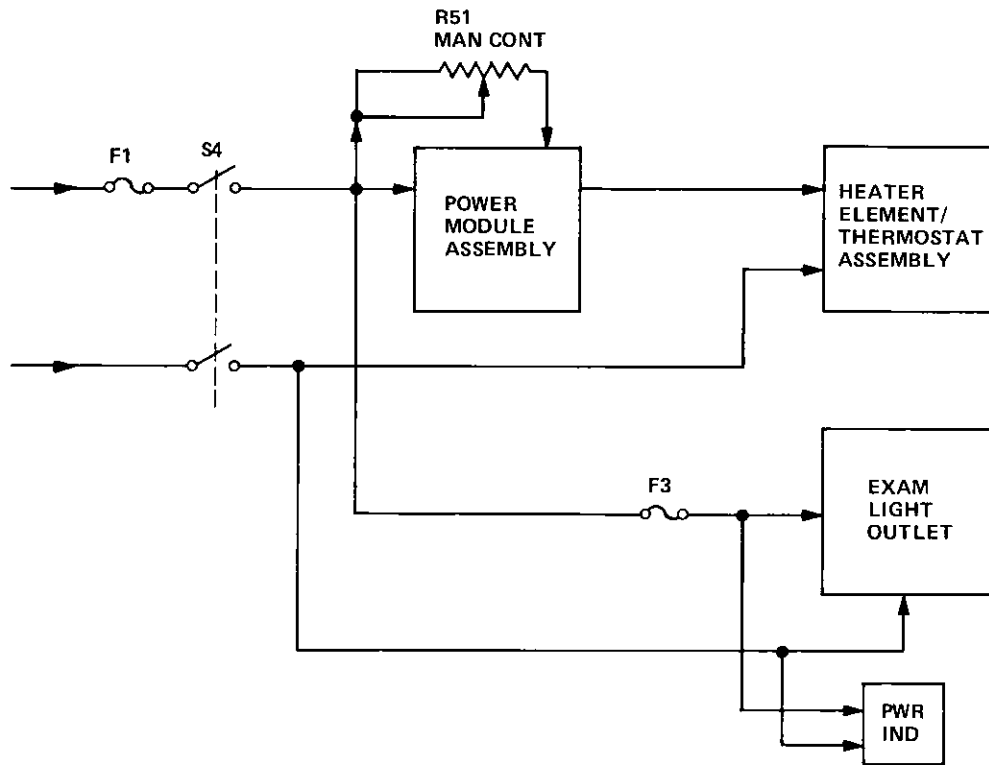


Figure 11. 120V Manual Controller, Model 4002, Simplified Block Diagram

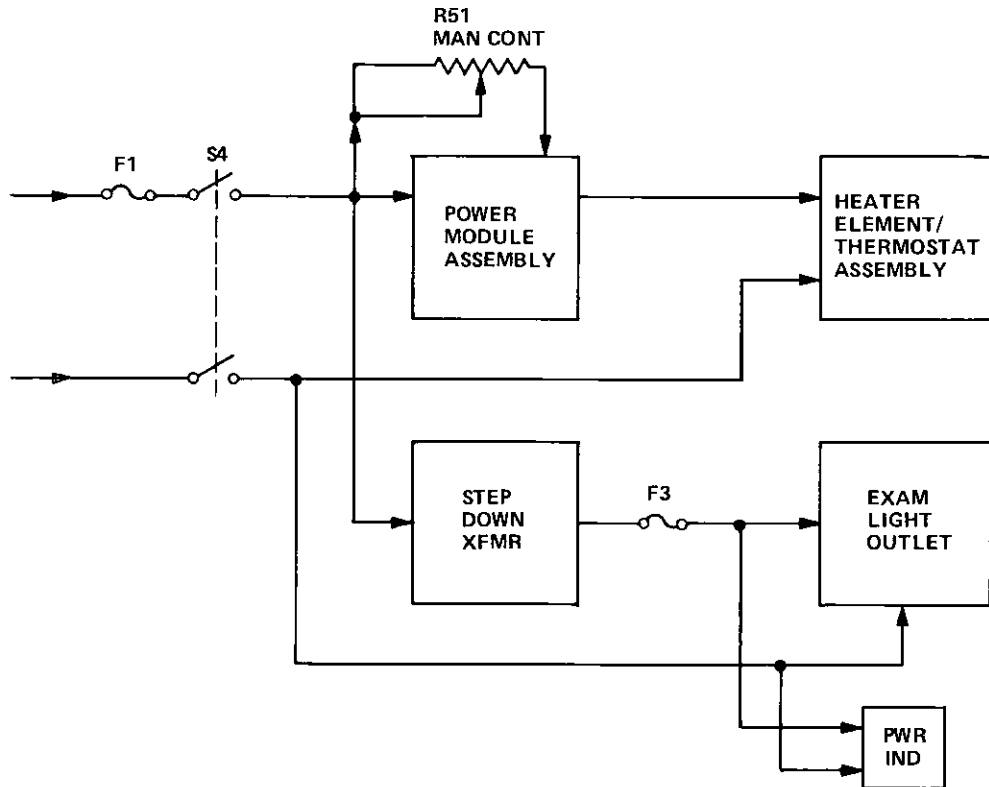


Figure 12. 240V Manual Controller, Model 4002, Simplified Block Diagram

SECTION IV SPECIFICATIONS

4.1 QUALITY STANDARDS COMPLIANCE

The IMI-4000 Series Infant Care Centers meet the high quality standards of B-D ELECTRODYNE and comply with existing and proposed agency standards for electromedical equipment. The standards consulted in the design of these instruments are those of the National Fire Protection Association (NFPA), the Underwriters' Laboratories (UL), the Canadian Standards Association (CSA), the International Electrotechnical Commission (IEC), and the Association for the Advancement of Medical Instrument (AAMI). This instrument will provide safe and efficient service when the instructions for its use are carefully followed.

The specific criteria applicable to these instruments are classified into categories of their electrical characteristics, performance characteristics, safety characteristics, environmental characteristics, and physical characteristics. The detailed specifications to meet the required characteristics are set forth in this section as the B-D ELECTRODYNE standard. These standards shall be maintained whenever service and maintenance functions are performed, for the useful life of these instruments.

The Calibration and Repair sections of this manual contain information for maintaining these instruments to the standards set forth, and these procedures shall be followed by B-D ELECTRODYNE personnel. B-D ELECTRODYNE assumes no responsibility for deterioration of performance below these standards when service is performed by unauthorized or unqualified personnel not properly trained in the maintenance of these instruments.

4.2 ELECTRICAL CHARACTERISTICS

Controller Ranges:

Temperature Set: 35.0°C to 38.9°C in 0.1° increments. Accuracy 0.1°C.

Temperature Meter: 33.3°C to 40.6°C. Accuracy 2%.

Alarm Limits: 34.0°C and 38.3°C. Accuracy 1/2°C.

Power Level: 0 to 100% equivalent to temperatures of ambient to 270°F (average value over surface of pad).

Power Requirements: 105-135 Vac, 50/60 Hz, 210-270 Vac, 50/60 Hz.

Power Dissipation: 800 watts, maximum.

4.3 SAFETY CHARACTERISTICS

Temperature Probe: All exterior conductive surfaces grounded. Electrical circuits isolated from ground to withstand 500 volts. (Power line tested to withstand 1500 volts.)

Power Cord Grounding Wire Leakage Current: 50 microamperes, maximum.

Overheating Protection: Safety thermostat which turns off power when heating element temperature reaches 300°F ± 7°F.

Mechanical Stability: Anti-tip construction meets requirements of NFPA Standard #56A (Inhalation Anesthetics).

Use in Hazardous Location: All electronics except temperature probes, above five-foot level. Complies with NFPA Standard #56A (Inhalation Anesthetics).

4.4 ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: 0 to 50°C (32°F to 122°F).

Storage Temperature: -25°C to 85°C (-13°F to 185°F).

Relative Humidity: 0 to 95%.

4.5 PHYSICAL CHARACTERISTICS

Controller Dimensions: 40.28 cm x 12.07 cm x 16.24 cm (16-1/4" x 4-3/4" x 6").

Hood Assembly Dimensions: 92.08 cm x 56.69 cm x 10.48 cm (36-1/4" x 23-1/2" x 4-1/8").

Carriage Assembly (with pole): 100.97 cm x 78.74 cm x 192.72 cm (39-3/4" x 31" x 75-7/8").

Shipping Weight:

Proportional Controller: 8.60 kg (18.0 lbs).

Manual Controller: 5.90 kg (13.0 lbs).

Hood Assembly: 9.07 kg (20.0 lbs).

Carriage Assembly: 54.43 kg (120.0 lbs).

6-Ft. Pole: 4.54 kg (10.0 lbs).

SECTION V CALIBRATION

5.1 CALIBRATION CHECKS AND MEASUREMENTS

This section contains procedures for calibrating the IMI-4000 Series Infant Care Centers whenever faulty operation is suspected or service and repair has been performed. The procedures can also be used to verify the initial factory calibration of the instrument whenever it is deemed advisable while performing regular maintenance or servicing. Performance of these procedures and any repair service as a result of the calibration checks will insure that the modules meet the specifications as stated in Section IV.

WARNING

Do not, under any circumstances, perform any testing or maintenance on medical instruments, cables, or electrodes while they are connected to a patient.

5.2 TEST EQUIPMENT REQUIRED

Table 3 is a list of test equipment required for making calibration checks and measurements and for verifying that the instruments meet the specified standards.

TABLE 3. TEST EQUIPMENT

ITEM	MODEL NO.	DESCRIPTION
Multimeter	268	Simpson Volt Ohmmeter (or equivalent).
Oscilloscope	503	Tektronix dc to 450 Hz differential input. Sensitivity 1 mV/cm - 20V/cm. Sweep 1 μ s/cm - 5 s/cm.
Volt Ohmmeter	601	Triplett FET V-O-M with low power ohms.
Temperature Calibration Box	IMI 4030 See figure 13	Resistance decade box that simulates temperatures by electrical equivalence.

5.3 OPERATIONAL CHECK

Before using the Infant Care Center, make the following operational checks to make certain that it is in good operating condition.

- (1) Check the caster locks to make certain that each caster can be locked and unlocked.
- (2) Make certain that the procedure table can be adjusted to any of the seven available positions.
- (3) Make certain that the panel catches are secure, the tab hinges are properly engaged, and that the panels can be lowered or raised as desired.

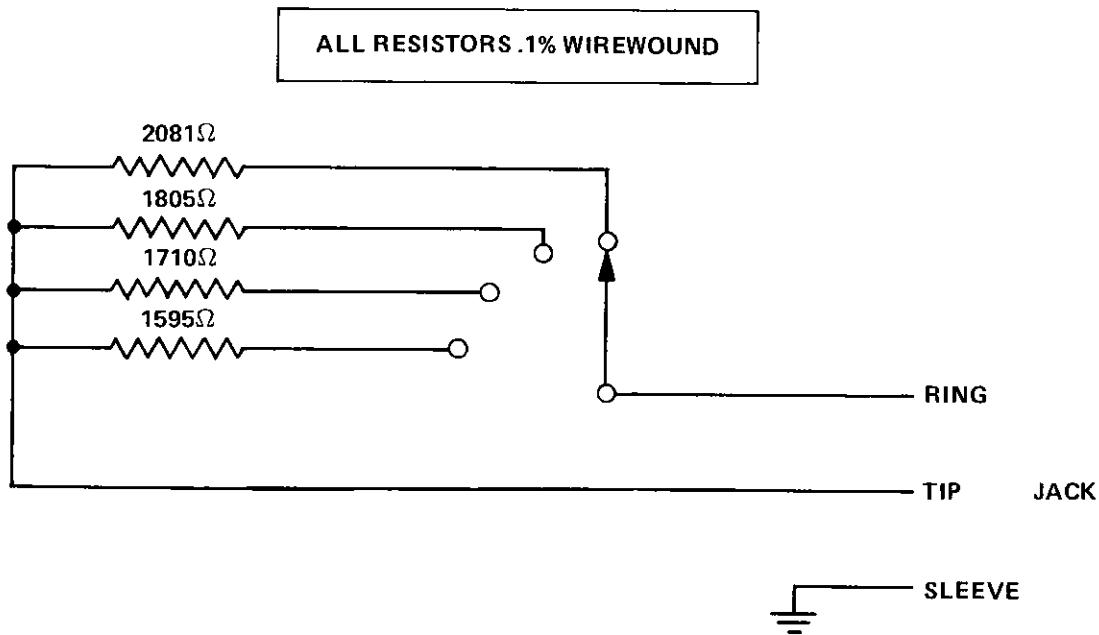


Figure 13. IMI 4030

- (4) Pull the hood position plunger and make certain that the Hood and Controller Assembly can be rotated to any desired position and locked in place.
- (5) Make sure that the a-c power cord is plugged in to an approved 3-wire grounded receptacle.
- (6) Check to make sure that the Hood Assembly cable is plugged into the square receptacle on the rear panel of the Controller.
- (7) Turn the **POWER** switch to **ON**. The red pilot light should glow and the **ALARM** indicator should glow.
- (8) Set the **AUDIBLE ALARM** switch to **ON**. The alarm should sound.

NOTE

The **AUDIBLE ALARM** will sound and the **ALARM** indicator will glow because there is no thermistor connected. When a thermistor is in the circuit, the alarm should not sound and the **ALARM** indicator should not glow unless the temperature limits are exceeded.

The following step applies to the Manual Controller:

- (9) Turn the **MANUAL** Temperature Control knob clockwise at least a half turn so that heat can be felt radiating from the Hood Assembly heating element.

- (10) Plug a skin or rectal probe into the appropriate connector on the rear panel and set the PROBE switch to the SKIN or RECTAL position, whichever is appropriate. Briefly hold the sensor end of the thermistor against the heating element and observe the temperature meter. The meter pointer should rise as the heat increases indicating that the meter and thermistor are operational.

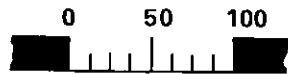
Step 11 applies to the Proportional Controller only.

- (11) Set the digital TEMPERATURE SET dial to a typical temperature setting, for example 37.0°C. Set the Temperature Control to AUTOMATIC. Briefly hold the sensor end of the thermistor against the heating element and observe the TEMPERATURE METER. The pointer should rise. At the same time observe the POWER LEVEL meter. The POWER LEVEL meter should indicate a high reading until the temperature rises to the preset level of 37.0°C. When the TEMPERATURE meter indicates 37.0°C the POWER LEVEL meter should change to a lower reading and move toward zero as the temperature of 37.0°C is exceeded.

5.4 ELECTRICAL CHECKS (See Electrical Characteristics in Section IV.)

Power Meter Calibration

- (1) Adjust the temperature meter mechanical zero to 92°F ±.1°F (33.3°C ±.55°C).
- (2) Adjust power level meter mechanical zero as shown. Looking straight at the power level meter, the needle rests just so that the edge of the black area can be seen. Refer to the right side for 100% setting.



Temperature Calibration

(Circuits Where Z1 is an LM3124H I.C.) (Schematic Dwg. No. 04300114 & 04300115)

- (1) Place cliplead across R2 (2K temperature null pot). Insert the IMI 4030 Temperature Calibration Box plug into the skin probe receptacle, making sure that the front panel Probe Switch (S5 left front panel) is in the skin probe position and that the Alarm Set/Cal switch of the IMI 4030 is in the Cal (out) position.
- (2) Set the IMI 4030 Calibrate switch to the 33.5 position. Coarse adjust R74 for 33.5°C on the front panel temperature meter.
- (3) Remove the cliplead that is across R2. Fine adjust R2 for a reading of 33.5°C on the front panel temperature meter. Further adjustments of the low setting (33.5°C) are to be made with R2 only, R74 should not be readjusted after the initial coarse setting.
- (4) Set the IMI 4030 Calibrate switch to the 40.0 position. Adjust R13 for a reading of 40.0°C on the front panel Temperature Meter.
- (5) Set the IMI 4030 Calibrate switch to the 37.0 position. The front panel Temperature Meter should read 37.0°C. If the reading is lower than 37.0°C readjust R2 for 37.0°C. If the reading is higher than 37.0°C readjust R13 for 37.0°C.

(Circuits Where Z1 is an LM308H or LM741C I.C.) (Schematic Dwg. No. 04300413, 04300412, 04200119, 2300-200-00)

- (1) Insert the IMI 4030 Temperature Calibration Box plug into the Skin Probe receptacle, making sure that the front panel Probe switch (S5 left front panel) is in the skin probe position, and that the Alarm Set/Cal switch of the IMI 4030 is in the Cal (out) position.
- (2) Turn the calibrate switch on the IMI 4030 to the 33.5 position. Adjust R2 (10K Temperature Null Pot.) for a reading of 33.5°C on the front panel Temperature Meter.
- (3) Set the IMI 4030 calibrate switch to the 40.0 position adjust R13 for a reading of 40.0°C on the front panel Temperature Meter.
- (4) Set the IMI 4030 Calibrate Switch to the 37.0 position, the front panel temperature meter should read 37.0°C. If the reading is less than 37.0°C readjust R2 for 37.0°C. If the reading is greater than 37.0°C readjust R13 for 37.0°C.

High Alarm Calibration

- (1) Insert the IMI 4030 Temperature Calibration Box plug into the Rectal receptacle, making sure that the front panel Probe switch (S5 left front panel) is in the Rectal position. Put the IMI 4030 Alarm Set/Cal switch into the Alarm Set (in) position and adjust the Alarm Set/Cal Pot for a reading of 38.2°C on the front panel Temperature Meter.
- (2) Set the Auto/Man switch to Auto (fully CCW to detent position. Check front panel Power Level Meter for minimum power output (less than 10%).
- (3) Adjust R17 so the alarms (Audio & Visual) just come on.
- (4) Adjust the IMI 4030 Alarm Set/Cal potentiometer to a reading of 38.1°C on the front panel Temperature Meter (the alarms should be off).
- (5) Set the IMI 4030 Alarm Set/Cal switch to the Cal (IN) position. Turn the Calibrate switch to the 38.3 position. (Alarms should be on.)
- (6) Set the Alarm Set/Cal switch to the Alarm Set (IN) position. Adjust the Alarm Set Pot for a reading of approximately 37.0°C. Slowly turn the potentiometer upscale. The Alarms should come on at 38.2°C ± .1°C and remain on as upscale reading is increased.

Low Alarm Check

- (1) Insert the IMI 4030 Temperature Calibration Box plug into the Rectal receptacle, making sure that the front panel Probe switch (S5 left front panel) is in the Rectal position.
- (2) Set the IMI 4030 Alarm Set/Cal switch to the Alarm Set (IN) position. Adjust the Alarm Set/Cal potentiometer for a reading of approximately 37.0°C. Slowly turn the Alarm Set potentiometer downscale, at 34.0°C ± .1°C the Low Alarms should come on and remain on for readings below 34.0°C. There is no adjustment for the low Alarm setting.

Manual Power Calibration

- (1) Rotate the Auto/Man potentiometer fully clockwise (maximum power out of hood).
- (2) Adjust R38 (small PC board on chassis) for a 100% reading on front panel power meter.

Automatic Power Calibration

- (1) Insert the IMI 4030 Temperature Calibration Box plug in either the Rectal or Skin Probe receptacle making sure that the front panel probe switch (S5) is in the
- (2) Set the IMI 4030 Alarm Set/Cal switch to the Cal (OUT) position. Set the IMI 4030 Calibrate switch to the 37.0 position to obtain a 37.0°C reading on the front panel Temperature Meter.
- (3) Set the front panel Temperature Set switch to 37.1°C.
- (4) Set the Auto/Man Switch to Auto (fully CCW into detent) and adjust R19 for a reading of 90% on the front panel Power Level Meter.
- (5) Set the front panel Temperature Set switch to 37.0°C. The front panel Power Level Meter should now read about 10%.
- (6) Set the IMI 4030 Alarm Set/Cal switch to the Alarm Set (IN) position and adjust the Alarm Set/Cal potentiometer for a front panel Temperature Meter reading of 34.0°C. Set the front panel Temperature Set switch to 35.0°C the front panel Power Level Meter should now read 90%. Turn the Alarm Set/Cal potentiometer towards 35°C. The front panel power meter should start decreasing at 34.9°C ±.1°C and at 35.0°C ±.1°C the front panel power meter should read about 10%.
- (7) Set the front panel Temperature Set switch to 36.0°C. Adjust the IMI 4030 Alarm Set/Cal potentiometer towards 36.0°C. The front panel power level meter should again go from 90% to about 10%.
- (8) Repeat Step (7) for 37.0°C, 37.1°C, 37.2°C, 37.3°C, 37.4°C, 37.5°C, 37.6°C, 37.7°C, 37.8°C, 37.9°C, and 38.0°C. Observe as the temperature meter approaches the temperature set reading the front panel Power Level Meter starts dropping. This determines the linearity of the circuit and that the wiring of D161 Switch (Temperature Set Control) is correct. The end points are not specified except when temperature set = 37°C and the temperature meter = 37°C, the minimum power level reading is about 10%. The reading at 35.0°C and 38.0°C should be ±.2°C.

SECTION VI INSTALLATION

6.1 GENERAL REQUIREMENTS

Installation of an Infant Care Center is a process of removing the assemblies and parts from the shipping cartons and assembling them together. Assembly instructions are shipped with each Infant Care Center. The Infant Care Center can be assembled in one area and then moved to the nursery or other place of use. All electronics in the Infant Care Center are above the five-foot level except the sensor probe and meet the requirements of NFPA Standard 56A (Inhalation Anesthetics). It can be used in an anesthetizing location.

See Assembly Instructions, Infant Care Center, 4000 Series for assembly of the Infant Care Center and Examination Lamp.

SECTION VII

REPAIR AND REPLACEMENT OF PARTS

7.1 DISASSEMBLY FOR REPAIR

The Infant Care Center can be disassembled by referring to the Assembly Instructions and reversing the procedures.

To disassemble the Controller, remove it from the Infant Care Center and, with the power cord disconnected, remove the rear panel by taking out the four screws; then remove the knobs and front panel components and slide the chassis out of the case.

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8.5 2300 TO 4000 SERIES HOOD

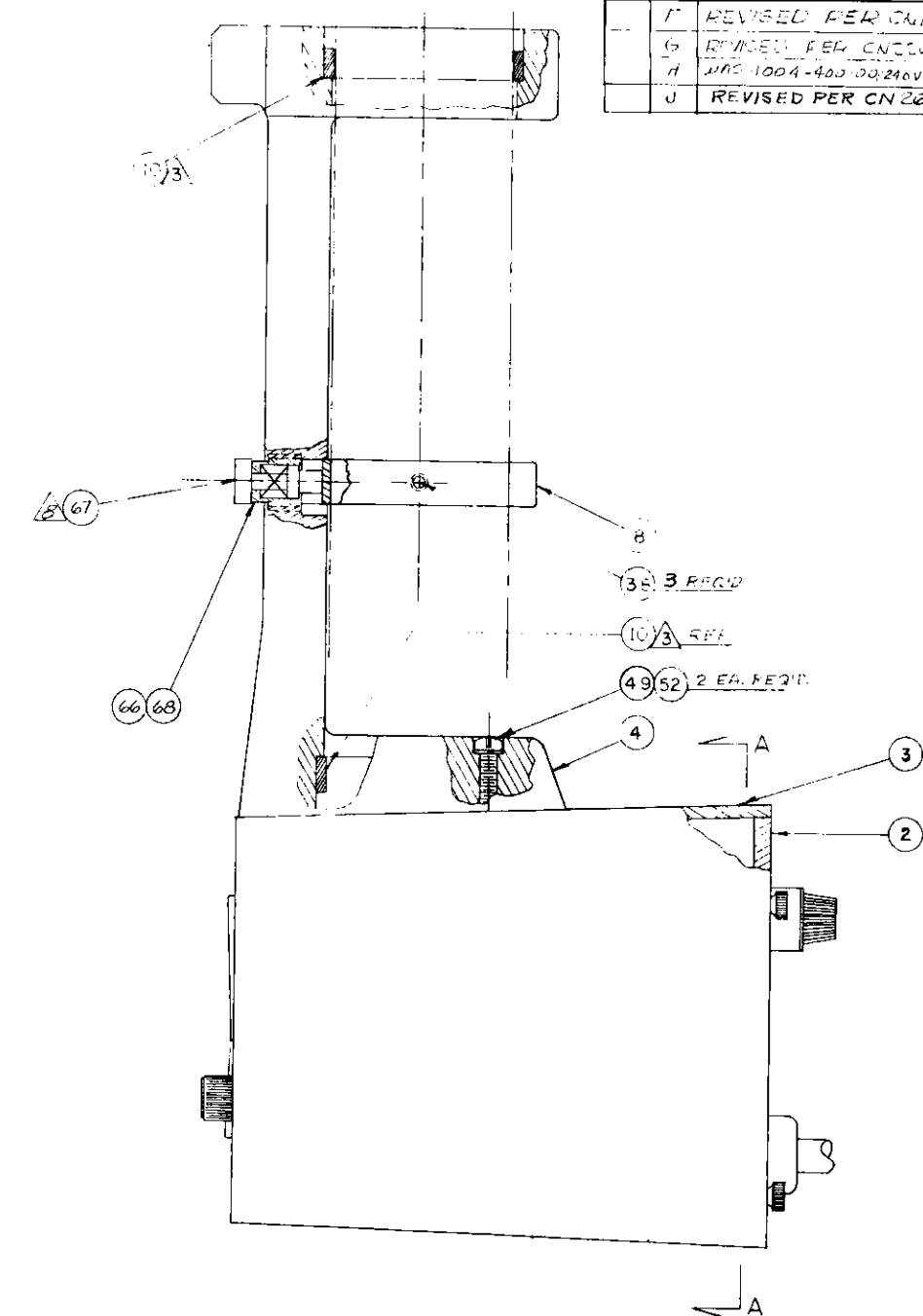
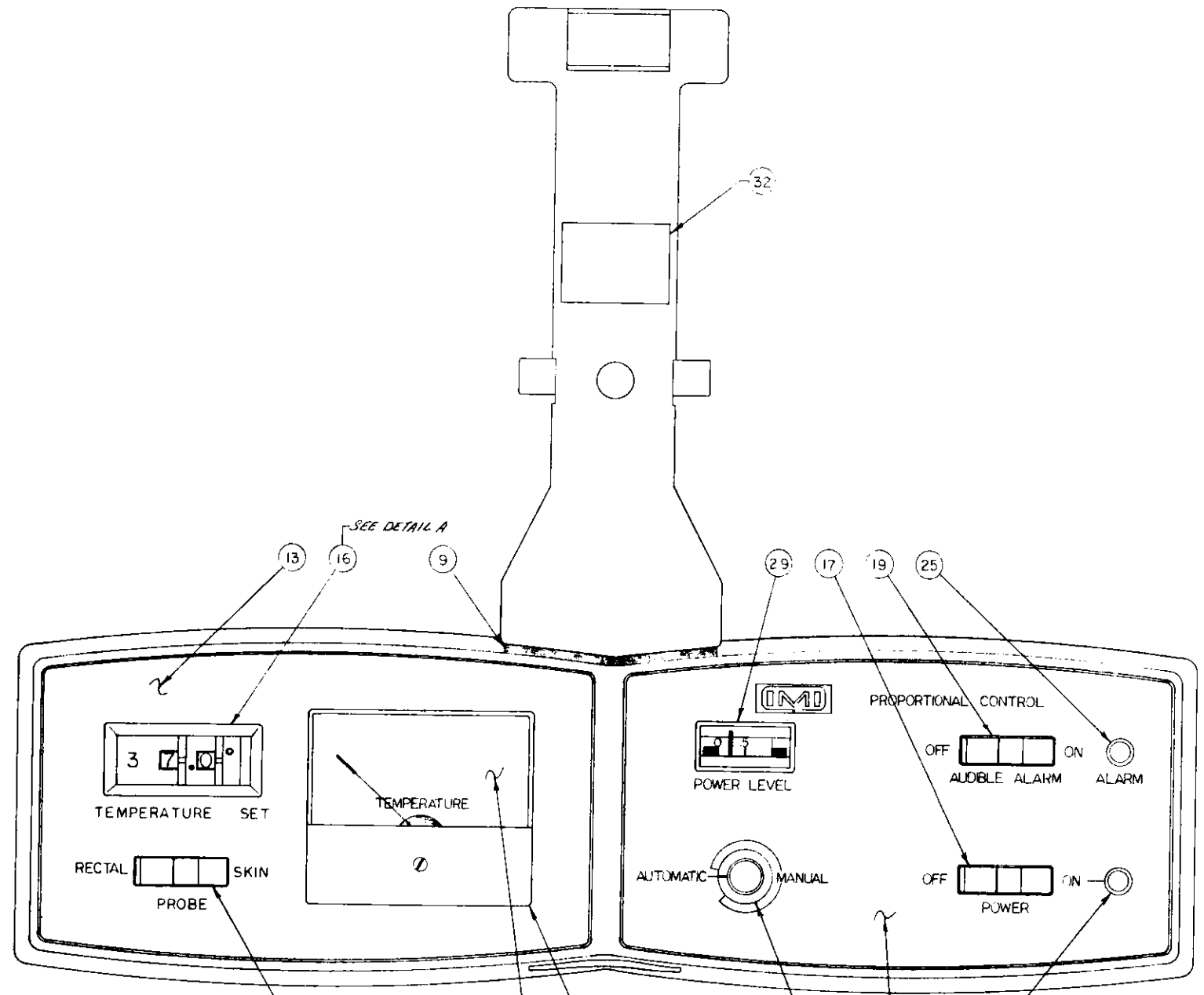
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REVISIONS				
ZONE	SYM	DESCRIPTION	DATE	APPROVAL
		SEE E.O. 414	1-15-70	ST
	B	SEE E.O. 577	12-1-70	ST
	C	SEE E.O. 577	2-1-71	ST
	D	SEE E.O. 577	2-1-71	ST
	E	RELEASED TO PRODUCTION	1/24/71	GS
	F	REVISED PER CN 2643	10/20/72	GS
	G	REVISED PER CN 2643	11/01/73	GS
	H	WAS 1004-400-00-240V UN2384	7/29/73	ed
	J	REVISED PER CN 2643	11/14/74	GS



- 9. WORKMANSHIP TO BE IN ACCORDANCE WITH A100649
- 8. DISCARD STAND-OFF PORTION OF PLUNGER ASSY & ASSEMBLE REMAINING PARTS TO ITEM 66.
- 7. TEST / CALIBRATE PER IMI SPEC 600VSI
- 6. ITEM 54 SHALL READ: MODEL NO. 4004, THE S/N, 240 VAC, 50/60 HZ, 100 WATTS.
- 5. PRESS ON RESPECTIVE SPRING CLIPS ITEMS, 24, 25, & 29.
- 4. INSTALL ITEMS 36 & 37 BY INSERTING BOLT & NUT INTO INSERT & TIGHTENING NUT AGAINST INSERT, THEN BEING CAREFUL OF ALIGNMENT, THE INSERT IS DRIVEN FLUSH. THE NUT IS THEN LOOSENED & THE BOLT & NUT IS THEN REMOVED.
- 3. 2, BEARINGS... ITEM 10. TO BE PRESS FITTED INTO CASTING BRACKET, ITEM 4.
- 2. FOR CABLE HARNESS SEE D04200183
- 1. FOR SCHEMATIC SEE D04200187 & D04300114

MODEL	DASH NO.	VARIATIONS
4004	-1	HOSPITAL DUTY PLUG
	-2	HOSPITAL DUTY PLUG, PRINTED CIRCUIT BD. W/LOW LEAKAGE

D00200194 APPROVALS
 DR. LETINCHE DATE 7-15-71
 CHK. E. S. L. DATE 12/1/71
 APP. J. J. H. DATE 16 July 71
 APP. DATE

QTY	ITEM NO.	IMI NO.	DESCRIPTION	PART NO.	REMARKS	REF. DRWG.

BY	DATE	CHK	DATE	APPD	DATE	APPD	DATE
DR. D.T. SHEPHERD	10-27-70						
ENGR. M	2-9-71						
APPD. J. J. H.	2-4-71						
APPD. M	2-9-71						

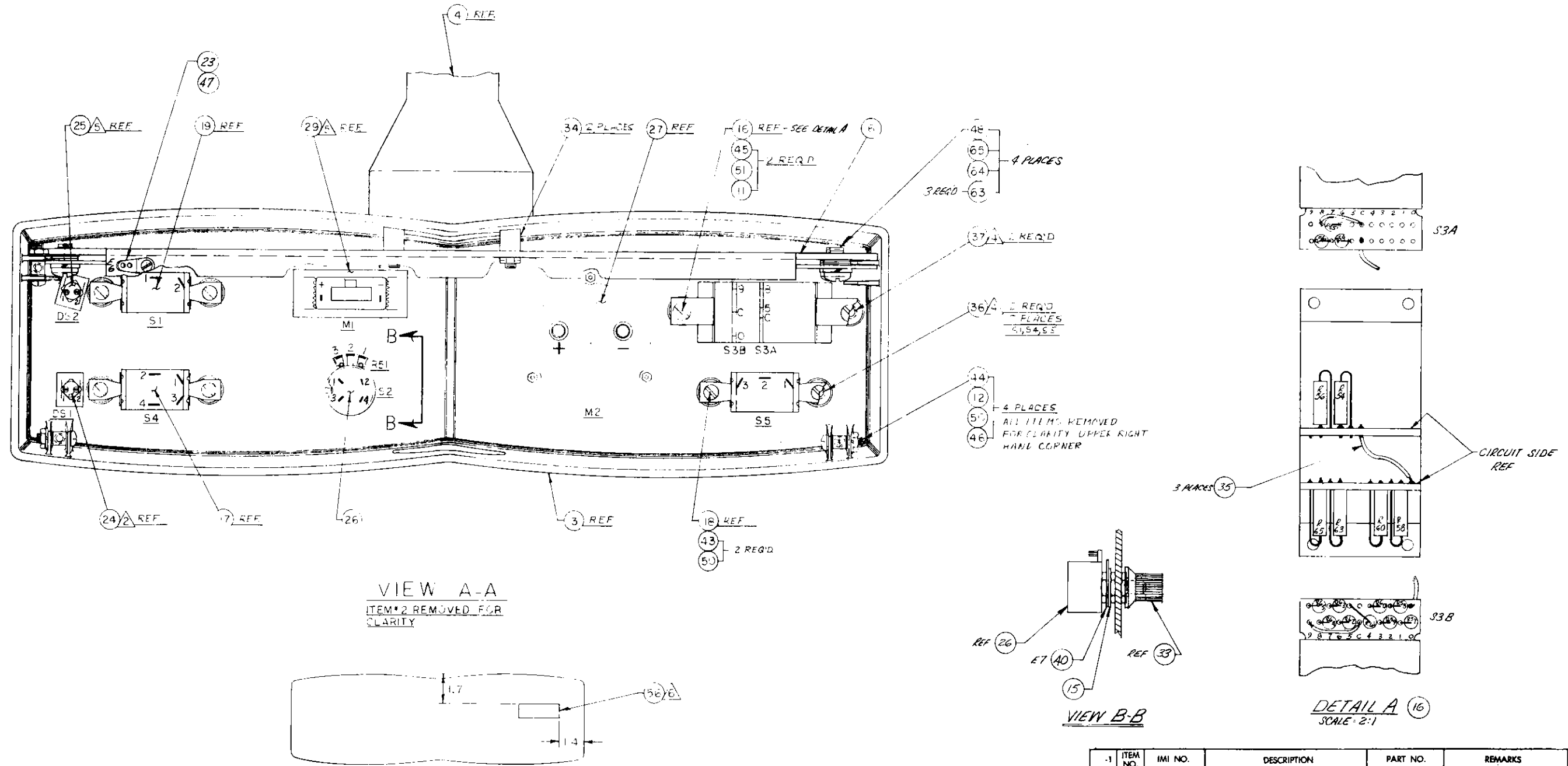
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SIZE	D	25200194	
SCALE	FULL	SHEET 1 OF 2	

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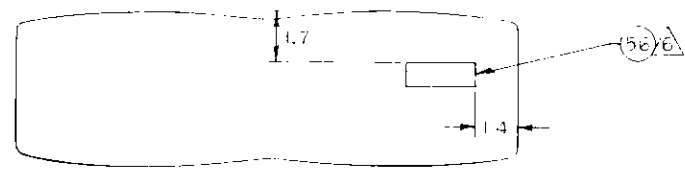
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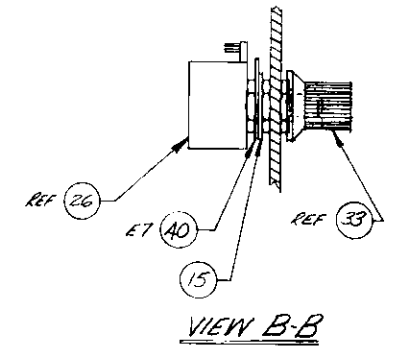
REVISIONS				
ZONE	SYM	DESCRIPTION	DATE	APPROVAL
SEE SHEET 1 FOR REVISIONS				



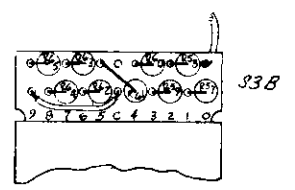
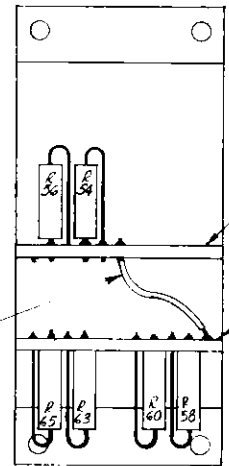
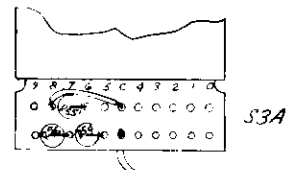
VIEW A-A
ITEM 2 REMOVED FOR CLARITY



REAR PANEL VIEW
1/3 SCALE ITEM 56 LOCATION



VIEW B-B



DETAIL A (16)
SCALE = 2:1

QTY	ITEM NO.	IMI NO.	DESCRIPTION	PART NO.	REMARKS	REF. DESIG.
MATERIAL LIST						

FINAL	ACG	UNLESS OTHERWISE SPECIFIED	BY	DATE	IMD	
FINAL	ACG	DIMENSIONS ARE IN INCHES TOLERANCES .X ± .050 ANGULAR ± 0°30' .XX ± .020 ALL RADII MAX. .XXX ± .010 MACH. SURF. ✓ THREADS: CLASS 2A OR 2B REMOVE BURRS AND SHARP EDGES .020 MAX. MACH. SURF. FLAT WITHIN .001 IN/IN OTHER SURF. FLAT WITHIN .005 IN/IN DO NOT SCALE DRAWING	DR D.T. Shear's	11-19-70	Division of Becton, Dickinson and Company 4321 Birch Street, Newport Beach, California 92660	
APPLICATION			CHK		TITLE PROPORTIONAL CONTROL ASSY. 240V	
MATERIAL			ENGR		SIZE D	
FINISH			APPD		25200197	
			APPD		SCALE FULL	
					SHEET 2 OF 2	

NOTES: UNLESS OTHERWISE SPECIFIED.

WAS 4004-400-00240Y V.3 SEE ASSY



TITLE
PROPORTIONAL CONTROL ASSEMBLY

BY *J. P. [Signature]* DATE 16 70
 DR *J. P. [Signature]* NEXT ASSY **FINAL** USED ON **4004**
 CHK ENGR APD *P.E. [Signature]* 9-2-70 5-24-70
 LTR EO A 414 B 57 C 57 D 57 F 1857 G 2362 H 2384 J 2642
 REV

LM2520 74
 SHEET 1 of 4

ITEM NO.	QTY. -1	QTY. -2	QTY. -3	QTY. -4	IMI NO.	DESCRIPTION	PART NO.	REMARKS	REF. DESIG.
1	1	1			D00200189-01	CABLE HARNESS ASSY, FRONT PANEL			
2	1	-			D20200190-01	REAR PANEL ASSY			
3	1	1			D00200143-01	HOUSING, CONTROLLER			
4	1	1			D00200144-01	CASTING, BRACKET			
5	-	1			D20200190-02	REAR PANEL ASSY			
6	1	1			C00200159-01	SUPPORT, HOUSING			
7	-	REF			D04300114	SCHEMATIC, INFANT WARMER			
8	1	1			B101859	RING, RETAINING			
9	1	1			B00200164-01	GASKET			
10	2	2			B00200165-01	BEARING - CASTING			
11	2	2			B00200167-01	BRACKET, SWITCH			
12	4	4			B00200168-01	SPACER, MODIFIED			
13	1	1			D00200169-03	PLATE, INST, LEFT SIDE			
14	1	1			D00200169-05	PLATE, INST, RIGHT SIDE			
15	1	1			930017	WASHER, LOCK, INT. TOOTH 3/8 ID			
16	1	1			100013	SWITCH, TRUMB (TEMP. SET)	B-1-19	DIGITRAN	S3A#8
17	1	1			100030-1	SWITCH, DPST (PWR. ON-OFF)	TIGK50-SC-WH-G	CARLING	S4
18	1	1			100030-2	SWITCH, SPDT ON-ON (RECTAL SENS/PROBE)	TIL860-SC-WH-G	CARLING	S5
19	1	1			100030-3	SWITCH, SPST ON-OFF (CALM. ON-OFF)	TIL860-SC-WH-G	CARLING	S1
20	REF	-			D04200187-01	SCHEMATIC, INFANT WARMER			

TITLE
PROPORTIONAL CONTROL ASSEMBLY

ITEM NO.	QTY.	REF.	QTY.	QTY.	QTY.	IMI NO.	DESCRIPTION	DATE		APPLICATION		REMARKS	REF. DESIG.
								BY	DATE	NEXT ASSY	USED ON		
21	3		3			283010	RESISTOR, 301Ω, 1%, 1/8 W	DR	9/16/80	FINAL	4004		LM25200194
22	9		9			283001	RESISTOR, 301Ω, 1%, 1/8 W	CHK					
23	1		1			140017	TERMINAL LUG, #6	ENGR	9-21-70				
24	1		1			110019	LIGHT INDICATOR (POWER)	APPD					
25	1		1			110020	LIGHT INDICATOR (ALARM)						
26	1		1				SWITCH/PNT. (AUTO MANUAL) 5V±20% SLEW						
27	1		1			121006-A	METER (TEMPERATURE)						
28	REF		REF			121012	METER SCALE (TEMP)						
29	1		1			121017	METER, 0-200 (POWER LEVEL)						
30	1		1			900257	SHIPPING CONTAINER INSERT						
31													
32	1		1			900252	LABEL, HOT ELEMENT						
33	1		1			950258	KNOB, SKIRTED						
34	2		2			950223	SPACER, 3/8 DIA, 10 X 3/4 LG.						
35	1/2		AIR			1905129	WIRE, VINYL, 22 GA. 750 WHIT						
36	6		6			950199	INSERT, #6-32						
37	2		2			950200	INSERT, #8-32						
38	3		3			950204	SCREW, SET, HALF DKG. 10-24 X .25						
39													
40	1		1			140051	TERMINAL 1116, 3/4 12						

REV. J
LM25200194
SHEET 2 of 4

REV	EO	A	B	C	D	F	G	H
	500	517	571	1857	2262	2384	2642	
LTR								

PART NO.	REMARKS	REF. DESIG.
1416-G	H. A SMITH	E6
858-R-AIC-68K	SLOAN	DS1
858-R-1762	SLOAN	DS2
CRT. TYPE TO SPEC. 45 V. TUBE VOLT. SWITCH OR 1100 SW. 11-10017		DS1/32
	HONEYWELL	M2
122D20	EMICO	M1
88-62-0-3K-7M	ROGAN	
9325-B174	HP470M	
N1332-12	TAP-LOK	
N16432-12	TAP-LOK	
CAD WHITE NYLON	DUCOMAN	
140051	L. A SMITH	E7