DNI NEVADA

Operating Manual

DS 6100

Patient Simulator

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Revision History		
Revision	Description	Date
D	Manual Update	1/98
E	Converted to Word 97	6/99
F	Text Correction	4/01

Copyright

Unpacking and Inspection

Follow standard receiving practices upon receipt of the instrument. Check the shipping carton for damage. If damage is found, stop unpacking the instrument. Notify the carrier and ask for an agent to be present while the instrument is unpacked. There are no special unpacking instructions, but be careful not to damage the instrument when unpacking it. Inspect the instrument for physical damage such as bent or broken parts, dents, or scratches.

Claims

Our routine method of shipment is via common carrier, FOB origin. Upon delivery, if physical damage is found, retain all packing materials in their original condition and contact the carrier immediately to file a claim.

If the instrument is delivered in good physical condition but does not operate within specifications, or if there are any other problems not caused by shipping damage, please contact DNI Nevada or your local sales representative.

Standard Terms and Conditions

Refunds & Credits

Please note that only serialized products (products labeled with a distinct serial number) and accessories are eligible for partial refund and/or credit. Nonserialized parts and accessory items (cables, carrying cases, auxiliary modules, etc.) are not eligible for return or refund. In order to receive a partial refund/credit of a product purchase price on a serialized product, the product must not have been damaged by the customer or by the common carrier chosen by the customer to return the goods, and the product must be returned complete (meaning all manuals, cables, accessories, etc.) within 90 days of original purchase and in "as new" and resellable condition. The *Return Procedure* must be followed to assure prompt refund/credit.

Restocking Charges

Only products returned within 90 days from the date of original purchase are eligible for refund/credit. Products returned within 30 days of original purchase are subject to a minimum restocking fee of 15%. Products returned in excess of 30 days after purchase, but prior to 90 days, are subject to a minimum restocking fee of 20%. Additional charges for damage and/or missing parts and accessories will be applied to all returns. Products not returned within 90 days of purchase, or products which are not in "as new" and resellable condition, are not eligible for credit return and will be returned to the customer.

Return Procedure

Every product returned for refund/credit must be accompanied by a Return Material Authorization (RMA) number, to be obtained from our Order Processing Department. All items being returned must be sent freight prepaid to our factory location.

Certification

This instrument was thoroughly tested and inspected and found to meet DNI Nevada's manufacturing specifications when it was shipped from the factory. Calibration measurements are traceable to the National Institute of Standards and Technology (NIST). Devices for which there are no NIST calibration standards are measured against in-house performance standards using accepted test procedures.

Warranty

Warranty and Product Support

This instrument is warranted by DNI Nevada against defects in materials and workmanship for one full year from the date of original purchase. During the warranty period, we will repair or, at our option, replace at no charge a product that proves to be defective, provided you return the product, shipping prepaid, to DNI Nevada, Inc. This warranty does not apply if the product has been damaged by accident or misuse or as the result of service or modification by other than DNI Nevada. IN NO EVENT SHALL DNI NEVADA BE LIABLE FOR CONSEQUENTIAL DAMAGES.

Only serialized products and their accessory items (those items bearing a distinct serial number tag) are covered under this one–year warranty. PHYSICAL DAMAGE CAUSED BY MISUSE OR PHYSICAL ABUSE IS NOT COVERED UNDER THE WARRANTY. Items such as cables and nonserialized modules are not covered under this warranty.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state, province to province, or country to country. This warranty is limited to repairing the instrument to DNI Nevada's specifications.

When you return an instrument to DNI Nevada, Inc., for service, repair, or calibration, we recommend using United Parcel Service, Federal Express, or Air Parcel Post. We also recommend that you insure your shipment for its actual replacement cost. DNI Nevada will not be responsible for lost shipments or instruments that are received in damaged condition due to improper packaging or handling. All warranty claim shipments must be made on a freight prepaid basis. Also, in order to expedite your claim, please include a properly completed copy of the Service Return Form. Recalibration of instruments, which have a recommended semiannual calibration frequency, is not covered under the warranty.

Use the original carton and packaging material for shipment. If they are not available, we recommend the following guide for repackaging:

- Use a double–walled carton of sufficient strength for the weight being shipped.
- Use heavy paper or cardboard to protect all instrument surfaces. Use nonabrasive material around all projecting parts.
- Use at least four inches of tightly packed, industrial–approved shock–absorbent material around the instrument.

Warranty Disclaimer

Should you elect to have your instrument serviced and/or calibrated by someone other than DNI Nevada, please be advised that the original warranty covering your product becomes void when the tamper-resistant Quality Seal is removed or broken without proper factory authorization. We strongly recommend, therefore, that you send your instrument to DNI Nevada for factory service and calibration, especially during the original warranty period.

In all cases, breaking the tamper-resistant Quality Seal should be avoided at all cost, as this seal is the key to your original instrument warranty. In the event that the seal must be broken to gain internal access to the instrument (e.g., in the case of a customer-installed firmware upgrade), you must first contact DNI Nevada's technical support department at 775-883-3400. You will be required to provide us with the serial number for your instrument as well as a valid reason for breaking the Quality Seal. You should break this seal only after you have received factory authorization. Do not break the Quality Seal before you have contacted us! Following these steps will help ensure that you will retain the original warranty on your instrument without interruption.

WARNING

Unauthorized user modifications or application beyond the published specifications may result in electrical shock hazards or improper operation. DNI Nevada will not be responsible for any injuries sustained due to unauthorized equipment modifications.

INDEX

ILLUSTRATIONS

Chapter 1

General Information

In this chapter you will learn how to use this manual, where to get help, and about the ***DS 6100*** *features and specifications.*

INTRODUCTION

DS 6100

The DS 6100 is a battery-operated, six-channel patient simulator and defib trainer that simultaneously simulates ECG/arrhythmia, respiration, as well as arterial, pulmonary arterial, and right atrial pressures. Standard waveforms and sequences, selected via keypad, are stored in microcomputer memory within the simulator. In the standard defib training mode you can interface the DS 6100 with Arrhythmia Anne and Chris Clean manikins. Among the many optional personality modules available, you'll find functions for special purpose ECG, Cardiac Output Dilution Curves, Capnography, and IABP.

SAFETY

Levels of signals available via the output connectors and th
Personality Module connector do not exceed 12 volts, and
such, do not constitute a potential danger to the operator.
However, if calibration or other service of the DS 6100 is
required, we recommend that only qualified service person
be permitted to remove the front panel of the simulator.

FRONT PANEL

The following front panel controls allow you to operate the DS 6100. (*See Figure 2 for locations*).

❶ **POWER INDICATOR**: Illuminates when power is ON.

❷ **ON/OFF SWITCH**: Switches power on and off. Battery operated unit is rechargeable with the supplied charger.

❸ **ECG SNAP CONNECTORS**: Outputs low level 12 lead ECG. Attach your standard patient ECG cable lead wires to these snap connectors to display the simulated ECG waveforms on your monitor screen.

I = +.25 mv (+/- 5%)	V1 = .40
II = +1.0	V2 = .90
III = +.75	V3 = +.60
AVR = .60	V4 = + 1.0
AVL = - .25	V5 = + 1.5
AVF = + .90	V6 = + 1.0

Figure 1: 12 Lead ECG Amplitude

NOTE:

To minimize 60-cycle artifact, it is important that a reference electrode connection is used. For example, most 5 lead ECG diagnostic recorders require that a simulator's REF signal is connected to the RL input of the patient cable. The DS 6100 can also output the ECG in a modified chest lead configuration (MCL2) used for bedside monitoring. Simply attach the LL (+) red, RA(-) white, and LA (ref) patient cable snaps to the patient simulator. Refer to the operator's manual of your ECG monitor for hook-up instructions.

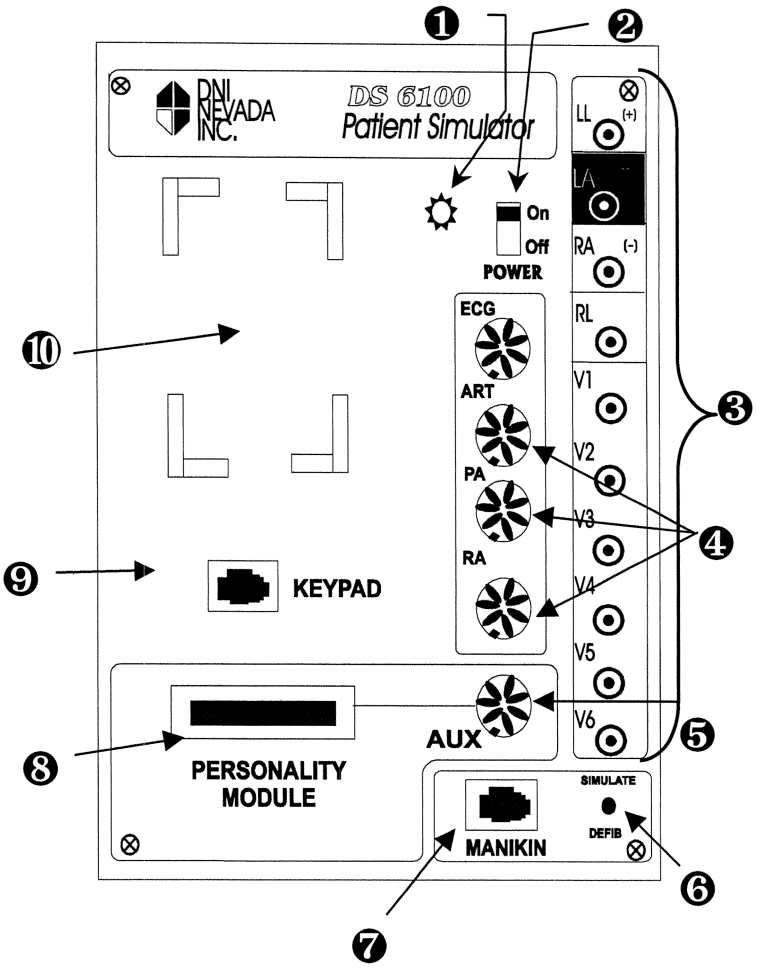

Figure 2: Front Control Panel

FRONT PANEL (CONTINUED)

❹ **PRESSURE OUTPUT CONNECTORS**: Output for arterial, PA, and RA pressures. Simulates the electrical output of the BP transducer that would be used with the patient monitor. The DS 6100 generates signals that are compatible with either 5 or 40-microvolt transducers.

❺ **AUX INPUT/OUTPUT CONNECTOR**: Cable interconnects for optional waveform such as capnography and IABP.

❻ **MANUAL DEFIB SWITCH:** Manually simulates defibrillation

❼ **DEFIB CONNECTOR:** Input for Arrhythmia Anne or Chris Clean manikins equipped with defibrillation option.

❽ **PERSONALLY MODULE CONNECTOR**: Input for optional modules. Used to add numerous functions and waveforms to the standard set.

❾ **KEYPAD CONNECTOR**: Input for hand-help keypad

❿ **KEYPAD REST**: Storage area for the keypad.

BACK BATTERY CHARGER INPUT CONNECTOR: (*Located on inner well*) Jack used to recharge battery. Unit can be operated while recharging.

KEYPAD

Using the Pendant Keypad

Direct functions

Select the rhythm desired by pressing one of the 15 Direct Function keys. The following pages list all of the functions and code numbers available in the standard simulator unit.

***Example**; to initiate a bradycardiac rhythm, press and release the key labeled BRAD. The simulator automatically determined the proper time in the cardiac cycle to begin a new rhythm.*

Special Functions

To initiate a Special Functions rhythm, press and release the red SPEC FUNC key followed by the appropriate two-digit code, found in the menu on either side of the keypad. The simulator displays the * to echo the Special Function key selection. You must enter a two digit function code whenever the * prompt is displayed.

***Example;** To select a bigeminy rhythm press the red SPEC FUNC key followed by code 27. You are free to select any function in any order, and in doing so, simulate virtually any patient condition sequence. Some of the Special Functions are actually programmed sequences of rhythms or events.*

A single PAC or PVC can be inserted into any rhythm by pressing the PAC, PVC1 or PVC2 key. When any of these keys are pressed, the respective PAC or PVC will be inserted into the next cardiac cycle. Only one PAC, PVC1 or PVC2 can be inserted at any one time. The 8-character LCD display echoes key entries by displaying the abbreviated function name.

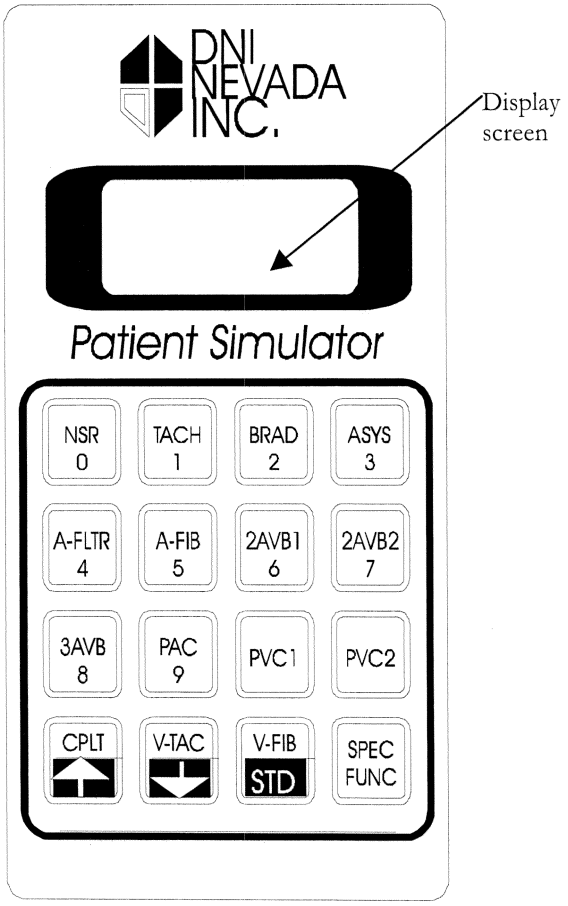

Figure 3: Pendant Keypad

KEYPAD CONTROLS

CODE	FUNCTIONS	DESCRIPTION
00	NORMAL SINUS	Provides a convenient way to return to normal sinus rhythm at a rate of 70 BPM.
01	SINUS TACHYCARDIA	Rapid regular rhythm with normal P wave and heart rate of 140 BPM.
02	SINUS BRADYCARDIA	Slow regular rhythm with normal P wave and heart rate of 35 BPM
03	ASYSTOLE	No beats but very small irregular signal remains
04	ATRIAL FLUTTER	Regular ventricular rhythm; atrial flutter with 4:1 conduction.
05	ATRIAL FIBRILLATION	Rapid irregular atrial signal with no real P waves. Irregular ventricular rate.
06	2ND DEGREE AV BLOCK I	Wenckebach. Irregular rhythm with normal P waves. PR interval lengthens progressively until a dropped beat occurs and cycle repeats.
07	2ND DEGREE AV BLOCK II	Slow regular rhythm with normal P wave. PR interval in conduced beats is normal; 3:1 block.
08	3rd DEGREE AV BLOCK	Slow regular ventricular rhythm; regular atrial rhythm. Independent atrial and ventricular rhythms.
09	PAC INSERT	Premature atrial contraction. A single PAC is inserted into the current rhythm when button is pushed.
10	PVC1 INSERT	Premature ventricular contraction. A Single PVC1 is inserted into the current rhythm when button is pushed.
11	PVC2 INSERT	Premature ventricular contraction; A single PVC2 is inserted into the current rhythm when button is pushed.
12	COUPLET	Irregular rhythms with frequent couplets and 1 pair ventricular beats. PVC's are premature; compensatory pause follows couplet.
13	VENTRICULAR TACHYCARDIA	Irregular, rapid rhythm with irregular, successive PVC's. No P waves.
14	VENTRICULAR FIBILLATION	Irregular, rapid, chaotic waveforms with no QRS

ATRIAL		
15	ATRIAL TACHCARDIA	Rapid, regular rhythm with biphasic P
16	ATRIAL TACHYCARDIA/ABERRANCY	Rapid, regular rhythms with biphasic P wave and notched wide QRS.
17	FREQUENT PACs	Irregular rhythm with frequent premature PACs and a biphasic P wave
18	PEDIATRIC TACHYCARDIA	Rapid regular rhythm with tall R wave and narrow QRS

BLOCKS		
19	1st DEGREE AV BLOCK	Normal beats except with long PR interval of .25 sec.
20	BUNDLE BRANCH BLOCK	Wide QRS complexes. Regular rhythm with a PR interval of .16 sec.

JUNCTIONAL		
22	ACCELERATED JUNCTIONAL	Regular rhythm with inverted P wave and short PR interval.
23	JUNCTIONAL	Slow regular rhythm with inverted P wave and short PR interval.
24	FREQUENT PJCs	Irregular rhythm with frequent, premature PJCs followed by a pause. Inverted P wave and short PR interval.

VENTRICULAR		
26	IDIOVENTRICULAR	Slow reg. rhythm, no P waves, wide QRS.
27	BIGEMINY	Irregular rhythm alternates between PVC and normal beat.
28	UNIFOCAL PVC's	Frequent, premature unifocal PVC's followed by pause. PVC has wide QRS.
29	MULTIFOCAL PVC's	Regular rhythms with frequent PVC's that alternate between type 1 and type 2. Pause follows PVC's
30	TRIPLET	Frequent runs of 3 consecutive PVC's

PACEMAKER		
31	VENTRICULAR	Pacer artifact precedes QRS. Regular rhythm, no P waves, wide QRS
32	ATRIAL	Normal rhythm, pacer artifact precedes P wave.
33	AV SEQUENTIAL	Prolonged PR interval. Pacemaker artifact precedes P and QRS waves. Wide QRS.
34	SENSE & CAPTURE FAIL	Frequent loss of capture, low amplitude escape beat, sensing failure of escape beat.
35	FAILURE TO CAPTURE	No capture. Pacer artifact amplitude is 8mV with 1 msec duration.

MISC ECG		
38	CARDIAC FAILURE	Intermittent PVC's and couplet followed by ventricular tachycardia, followed by ventricular fibrillation, followed by asystole.
39	ST ELEVATION	Regular rhythm with ST Elevation at 2 mm 80 msec after J point
40	ST DEPRESSION	Regular rhythm with ST Depression at 3 mm 80 msec after J point
41	AGONAL	No P waves; wide complexes with periods of asystole
42	VENTRICULAR ASYSTOLE	No QRS, regular atrial rhythm
43	CONVERSION	Vfib with CPR followed by Vfib without CPR for 2 seconds prior to defib. Defib artifact, Brady rhythm with CPR, Brady rhythm without CPR, followed by NSR

ECG ARTIFACT		
46	DEFIBRILLATION	Positive and negative baseline saturation. Artifact is automatically followed by pre-selected rhythm. (see #59 below)
47	60 CYCLE ARIFACT	Artifact amplitudes 0.1, 0.4, and 0.7 mV p-p. Use INC and DEC keys, or eliminate with STD key.
48	ECG/RESP ARTIFACT	Artifact amplitudes 0.4, 0.6 and 1.0 mV peak to peak. Use INC, DEC keys. STD will eliminate.
49	MUSCLE ARTIFACT	Artifact amplitudes 0.4, 0.6 and 1.0 mV peak to peak. Use INC & DEC keys. STD will eliminate
50	CPR	CPR artifact a 70/min

ADJUST		
53	ECG RATE ADJUST	Increases or decreases rate in 10% increments. STD returns to standard rate
54	SIZE ADJUST	Increases and decreases ECG, BP and respiration waveforms, or returns them to standard size. Use after selecting desired channel.
55	AUTO TREND	Automatically varies NSR heart and respiration rates, and blood pressures. Vtach episode 4 every 1 hour; trend repeats every 2 hours

DEFIB CONVERSATION		
59	RHYTHM SELECT	Permits selection of post defibs rhythm, which is then automatically inserted after defib artifact.
60	DEFIB DISABLE	Disables auto defib sequence

RESPIRATION		
71	APNEA	Thoracic impedance is simulated via ECG output snaps.
72	RESP AT 10 BPM	
73	RESP AT 20 BPM	
74	RESP AT 40 BPM	
75	RESP AT 80 BPM	
76	CVA COINCIDENCE	ECG and respiration are synchronized and timed appropriately for cardiovascular artifact. Impedance drops immediately after each R wave.
77	PEDIATRIC APNEA/BRADY	Intermittent apnea periods. Heart rate drops from 140 BPM to 70 BPM each apnea period.

CALIBRATION		
78	HEART RATE CALIBRATION	Calibrated heart rates from 30 to 300 BPM.
81	LINEARITY/SPEED	2.5 Hz triangular ECG waveform.
82	ECG SIZE CALIBRATION	Cal pulse amplitudes from .25 mV to 2.5 mV.
83	ARRHYTHMIA SEQUENCE	Automatic sequence of arrhythmias over 3 minute period of time. NSR, Dropped Beat, AV Pace, V Pace, Atrial Tach, Couplet, RBBB, Triplet, Bigeminy (3 Foci), Vtach.
84	RESPIRATION SIZE CAL	Respiratory depth ranging from 0.25 to 2.5 ohm; calibrated for RA-LA lead.

BLOOD PRESSURE		
62	ZERO PRESSURE	Zeros all three-pressure channels as well as auxiliary CO2 channel.
63	PATENT LINE	Outputs a 50 mmHg flush waveform on PA channel. PA waveform follows flush. Trailing edge of flush and PA pressure waveforms demonstrate ideal frequency characteristics of pressure line.
64	RESONANT LINE	Outputs a 50 mmHg flush waveform on PA channel. PA waveform follows flush. Trailing edge of flush and PA pressure waveforms demonstrate resonant frequency characteristics of pressure line.
65	DAMPED LINE	Outputs a 50 mmHg flush waveform on PA channel. PA waveform follows flush. Trailing edge of flush and PA pressure waveforms demonstrate damped frequency characteristics of pressure line.
66	CATHETER WHIP	Pressure artifact caused by motion of catheter. On PA channel
67	PRES/RESP ARTIFACT	Varies level of respiration artifact on pressures.

PROCEDURES		
68	IABP	Arterial pressure with cardiac assists pressure pulse, 2:1 augmentation. Simulation only; not interactive with the IABP. Output on arterial channel.
69	PA WEDGE	Outputs a PAW waveform
70	SWAN-GANZ INSERTION	Output on PA channel, Right atrium to right ventricle; right ventricle to pulmonary artery; pulmonary artery to wedged pulmonary artery; wedged pulmonary artery to pulmonary artery.

MODIFIER/CAL MODE

The bottom row of the keypad has three dual function keys. CPTL/up arrow, VTACH/down arrow, and VFIB/STD. These keys can be used in conjunction with the SPEC FUNC keys listed in Figure 4 to increase, decrease, or reset the standard value for parameters such as rate, waveform amplitude, or artifact level. When selected, these functions will display one of the following prompts: INC, DEC, or STD. See following pages for operating instructions.

INC 

Increases parameter value. Momentarily displays "at max " when maximum value is reached.

DEC 

Decreases parameter value. Momentarily displays "at min" when minimum value is reached.

STD Resets parameter value. All of the remaining keys exit the Modifier/Cal function, retain parameter level, and simulate rhythm selected (i.e. NSR, Bradycardia, etc)

53	Rate Adjust
54	Size
78	Heart Rate Cal 70 BPM
82	ECG Size Cal
84	Resp Size Cal
47	60 Cycle Artifact
48	ECG/Resp Artifact
49	ECG/Muscle Artifact

Figure 4: Special Functions used in the Modifier/Cal Mode

SIZE ADJUSTMENTS; SPEC FUNC 54

The size adjust function, SPEC FUNC 54, allows you to adjust the waveform size up or down from the STD level. Figure 5 lists waveform amplitudes for each channel. To adjust the size of a waveform channel.

❑ **STEP 1** **Select SPEC FUNC 54 (SIZE)**

❑ **STEP 2** **DS 6100 Enter desired channel number, 1-6.**

Channel	Parameters
1	ECG
2	ART
3	PA
4	RA
5	AUX
6	RESP

❑ **STEP 3** **Press INC to increase DEC to decrease STD to reset to standard level. The size adjust function is intended for in service and demonstration applications when size adjustments may be helpful in demonstrating a clinical situation i.e. Increasing the PA Wedge pressure to simulate LV heart failure.**

NOTE:

Pressure and R wave values are defined for normal sinus beats only. To obtain non-varying pressure valves, select SPEC FUNC 67 and decrease minimum level: For calibration of performance check applications, use SPEC FUNC 78 (Heart Rate Cal), SPEC FUNC 81 (Linearity/Speed), SPEC FUNC 82 (ECG Size Cal), and SPEC FUNC 84 (Resp Size Cal).

DS 6100 SIZE ADJUST LEVEL – SPEC FUNC 54

CH/PARAMETER	-3	-2	-1	STD	+1	+2	+3	+4
1) ECG R WAVE AMPLITUDE (mV)	.25	.50	.75	1mv	1.25	1.50	1.75	2.0
2) ART SYS/DIAS MEAN (mmHg)	116/62 80	123/66 85	130/70 90	137/73 95	143/76 100	150/80 105	157/84 110	164/88 115
3) PA SYS/DIAS MEAN (mmHg)	14/6 8	21/9 13	27/12 17	33/15 22	41/19 27	48/22 32	55/25 37	61/28 42
4) RA MEAN (mmHg)	2	4	6	8	10	12	14	16
5) AUX (CO, CO2)	NOT ADJUSTABLE							
6) RESP (RA – LA) (ohms)	.25	.50	.75	1.0	1.25	1.50	1.75	2.0

Figure 5- Size Adjust Special Function

CALIBRATION FUNCTION LEVELS;

SPEC FUNC 78, 82, & 84

Special function keys 78, 82, and 84 allow you to adjust calibration levels for heart rate, linearity/speed, ECG size, and respiration size as follows:

ADJUSTMENT LEVELS		
-4 -3 -2 -1	*STD*	*+1 +2 +3 +4 +5 +6 +7 +8 +9 +10 +11 +12*
SPEC FUNC 78: HR CAL 30 40 50 60	70	80 90 100 121 142 163 183 203 227 250 268 300
SPEC FUNC 82: ECG/SIZE/CAL .25 .50 .75	1	1.25 1.5 1.75 2.0 2.5 mV
SPEC FUNC 84: RESP SIZE CAL .25 .50 .75	1	1.25 1.5 1.75 2.0 2.5 Ohm

Figure 6- Calibration Functions

HEART RATE ADJUSTMENT: SPEC FUNC 53

The Rate Adjust function, SPEC FUNC 53, offers you the option of adjusting rates up or down in 10% increments. *Figure 7* lists the heart rates, which can be obtained for the various rhythms. On Power-up, each rhythm has the standard heart rate (STD) listed below. For performance check applications, the Heart Rate Calibration, SPEC FUNC 78 (ECG RATE), provides calibrated heart rates from 30 to 300 BPM, See Fig. 6.

RHYTHM	-40%	-30%	-20%	-10%	STD	+10%	+20%	+30%
Bradycardia	21	24	28	31	35	38	42	45
Ventricular	21	24	28	31	35	38	42	45
Junctional	24	28	32	36	40	44	48	52
Normal Sinus	42	49	56	63	70	77	84	91
Sinus Tach	84	98	112	126	140	154	168	182
Artial Tach	90	105	120	135	150	165	180	195
Artial Fib	60	70	80	90	100	110	120	130

Figure 7:Heart Rates Obtained via Rate Adjust Spec Func 53

ARTIFACT SIMULATION: SPEC FUNC 47, 48 & 49

Various types of artifact can be superimposed on the ECG. The type and level of artifact is selected via the Special Function keys 47, 48 and 49. To enable artifact, select the desired function, increase or decrease the level of artifact via the INC, DEC keys. The STD key returns the simulator to the standard level of artifact.

FUNC	TYPE	STD	+1	+2	+3
47	ECG 60 Hz	0	.1	.4	.7 mV
48	ECG RESP	0	.4	.6	1.0 mV
49	ECG MUSCLE	0	.4	.6	1.0 mV

Figure 8- Artifact Modifier

RESPIRATION

The DS 6100 provides a varying thoracic impedance signal via all 10 ECG electrode output snaps. Several respiration rates from apnea to 80 BPM can be selected. Once a respiration rate has been selected, the respiration rate remains fixed during subsequent rhythm selections or until a new respiration rate is selected.

The amplitude of the thoracic impedance signal (R) can be varied using Size Adjust, SPEC FUNC 54 and selecting Channel #6. Use the INC, DEC, and STD keys to vary the impedance amplitude. Respiration amplitudes will differ depending upon the lead that is monitored. Figures 5 & 6 list amplitudes for the RA-LA lead.

NOTE:

For calibration applications, use the Respiration Size Cal Function, SPEC FUNC 84 (Figure 6). This function displays impedance amplitudes.

Pressure waveforms are modulated by the respiration waveforms to simulate respiration artifact. The respiration artifact level can be varied using Pressure/Respiration Artifact, SPEC FUNC 67.

Cardiovascular artifact or ECG/respiration coincidence can be simulated by selecting the CVA Coincidence, SPEC FUNC 76 The impedance signal is synchronized with the ECG. Impedance decreases after each R wave, simulating a decrease in impedance due to an increase in pulmonary blood volume during systole.

DEFIBRILLATION TRAINING

In the Defib Training Mode, you can interface the DS 6100 with the Laerdal Arrhythmia Anne and the Armstrong Chris Clean manikins for realistic defibrillation and ECG paddle monitoring training. Follow the guidelines provided by your training manikin for proper cable connection.

❑ **STEP 1** **Connect the torso skin cable into the Defib Training Connector. Turn the DS 6100 on.**

❑ **STEP 2** **Select life threatening arrhythmia, i.e. VFIB**

❑ **STEP 3** **To enable the automatic defib conversion feature and select the post defib rhythm:**

a) Press and release the red Special Function key

b) Enter code number 59 to initiate the defib Rhythm Select function.

c) Select the desired post-defib rhythm by pressing a direct function key, or by pressing the red Special Function key followed by the two-digit code number of the desired rhythm. If a post defib rhythm is not programmed, the defib artifact will be followed by asystole until another rhythm is manually selected.

❑ **STEP 4** **To initiate the defrillation sequence: d*efibs equipped with apex/sternum paddles* – Firmly place the paddles on the electrodes located on the manikin chest skin or torso cover. Charge the defib to 25 joules for Arrhythmia Anne or up to 400 joules for Chris Clean, and defibrillate.**

Defibs equipped with disposable electrodes – Plug in adapters and connect cables from defib to adapter snaps. Charge defib to desired energy level and discharge the defibrillator.

***CAUTION**; See the Arrhythmia Anne and Chris Clean instruction manuals for the proper procedures and use of the defibrillator on the manikin. Under no circumstances should a defibrillator be discharged directly into the DS 6100.*

After defibrillation of the manikin the DS 6100 will simulate defibrillation artifact followed by your pre-selected rhythm. The programmed post defibrillation rhythm can be changed at any time by repeating STEP 2.

❑ **STEP 5** **To repeat a sequence, select another life threatening rhythm and defibrillate. The defib conversion feature can be disabled at any time by selecting SPEC FUNC 60 (NO DEFIB).**

MANUALLY INITIATING DEFIB SEQUENCE

Use the defib switch on the DS 6100's front panel, or SPEC FUNC 46 (DEFIB). When the Defib Artifact Function is selected, defib artifact will be simulated. If a post defib rhythm has been programmed, the defib artifact will be automatically followed by the programmed rhythm.

BLOOD PRESSURE SIMULATION

If you want to check the calibration of your invasive pressure monitor, it is important to first zero each pressure channel of the monitor. Connect BP cables from the simulator to your monitor, then.

Zero monitor before turning the DS 6100 on. When you do turn the DS 6100 on, it will automatically output an NSR ECG waveform and the normal BP waveforms.

OR

Turn the DS 6100 on and select SPEC FUNC 62 (0 mmHg). Up to three pressures channels can be zeroed simultaneously via channel 2-4. Use the pressure monitor manufacturer's suggested procedure to obtain a 0mmHg pressure baseline of each pressure channel.

After successfully adjusting the monitors zero point, select SPEC FUNC 79 to check calibration of the pressure monitor. Then select the desired pressure waveform via special function or direct function keys to output dynamic BP waveforms on all three channels. Pressure cables (listed on page 28) are available to connect the DS 6100 to most pressure monitors.

NOTE:

Figure 5 defines systolic, diastolic, and mean values of the dynamic pressure waveforms for normal sinus beats.

If your monitor or recorder does not closely agree with these pressure values, any of the following may be true.

1. *The monitor or recorder is not calibrated or property zeroed.*
2. *The inter-connect cable is not supplying an excitation reference voltage required by DS 6100.*
3. *The inter-connect cable is wired to the wrong signal output pin.*
4. *Respiration artifact on the pressures modulates the pressure values in sync with the respiration cycle. This artifact significantly alters the systolic/diastolic values. To remove respiration artifact, select SPEC FUNC 67 (PRES RESP) and decrease to the minimum level.*

PERSONALITY MODULES (Optional Spec Function)

Optional Personality Modules can be plugged into the front panel connector to increase the number of special functions available. **It is necessary to turn the simulator power off before inserting or removing a Personality Module**. Each Module has a function menu listing the functions and code numbers within the Module's memory. These functions will be assigned code numbers between 89 and 99 Personality Modules currently available are listed below.

Personality Modules currently available.

MDE Ref #	DNI PART #	DESCRIPTION	
6085-03B	3010-0333	Spacelabs Alpha 9 or 14 and PC Series	
6085-04B	3010-0334	Spacelabs 500 and 600	
6085-05B	3010-0335	Mennen Horizon 2000	
6070-01B	9513-0139	Intra-Aortic Balloon Assist (manual IABP waveform selection)	Early Inflation Late Inflation Early Deflation Late Deflation Proper Timing

MDE Ref #	DNI PART #	DESCRIPTION	
6070-03B	9513-0140	Pediatric ECG	Sinus Arrhythmia Junctional Junctional Escape Wandering Pacer Hyperkalemia Enlarged Atrium CPR Artifact Sinus Tachycardia
6070-05B	9513-0141	Intra-Cranial Pressures (ICP)	Normal ICP Normal w/Resp Artifact Damped w/Resp Artifact Cough Artifact Hypercapnia B Wave & A Wave Jugular Comp
6070-06B	9513-0142	Advanced Pacer	Undersensing Oversensing Muscle Artifact Oversensing tall T Waves Fusion Pseudo Fusion Runaway Pacer PAC with DVI Pacer Retrograde VA Conduction
6070-07B	9513-0143	MCL1 Atrials	Normal Sinus Rhythm Bradycardia Sinus Arrest Atrial Tach Atrial Flutter Atrial Fib PAC PAT
6070-08B	9513-0144	MCL1 Blocks	Normal Sinus Rhythm 1st degree AV block 2nd degree AV block Type I 2nd degree AV block Type II 3rd degree AV block RBBB LBBB
6070-09B	9513-0145	MCL1 Ectopy/Aberrancy	Normal Sinus Rhythm Right PVC Left PVC Multifocal PVC's R on T Bigeminy Atrial Fib w/Aberrancy Cardiac Failure Sequence
6070-11B	9513-0146	Left Heart Pressures	Pressure Zero Normal AO, LV, LA AO to LV Insertion LV to AO Pullback AO, LV, and LA with PVC's
6070-12B	9513-0147	Valve Disease	Mitral Stenosis Mitral Regurgitation Aortic Stenosis Aortic Regurgitation LV/AO Pullback with AS LV/AO Pullback with AR

MDE Ref #	DNI PART #	DESCRIPTION	
6070-13B	9513-0148	12-Lead Set	includes three previous modules
6070-14B	9513-0149	12-Lead Normal ECG	
6070-15B	9513-0150	12-Lead Anterior Infarct	
6070-16B	9513-0151	12-Lead Inferior infarct	Leads I, II, III, AVR, AVL, AVF, V1
6070-17B	9513-0152	ST Segments	2.5mm Horizontal ST Depression 2.5mm Horizontal ST Elevation ST Downslope Depression ST Upslope Elevation ST Upslope Depression 45° ST Upslope Depression 30° ST Upslope Depression 20°
6070-10B	9513-0153	MCL1 Set (07, 08, 09)	Includes 6070-07, 6070-08 & 6070-09
6070-18B	9513-0155	Cardiac Output (CO)(Injectate Temp=0° C)	Injectate temp for use w/6070-23
6070-19B	9513-0156	Marquette CO Module	
6070-20B	9513-0157	Cardiac Output (Injectate Temp=25° C)	Injectate temp for use w/6070-22
6070-22B	9513-0159	Capnography (CO2) and Cardiac Output (Injectate Temp=25° C)	
6070-23B	9513-0160	Capnography (C02) and Cardiac Output (Injectate=0° C)	CO st 5L/4L/3L per minute Left to right shunt Prolonged Curve Interrupted Injectate Normal Respiration Embolism Cheyne Stokes Deep Sigh CO2 Zero
6070-24B	9513-0161	Defib Training Module	
6070-25B	9513-0162	Interactive IABP/Kontron (K2000 and KAAT)	(7, 10, K2000, KAAT)
6070-26B	9513-0163	Interactive IABP/Datascope	System 80
6070-29B	9513-0165	Interactive IABP/Datascope	System 90
6070-30B	9513-0166	Interactive IABP/Aries	Early Inflation Late Inflation Early Deflation Late Deflation Proper Timing
6070-37B	9513-0168	Normal/Disease Heart	

INTERACTIVE IABP PERSONALITY MODULES

The Interactive Intra-Aortic Balloon Pump personality modules are used with the DS 6100 simulator and Kontron, Datascope System 80, Datascope System 90, and Aries monitors. Invasive arterial BP and sync timing cables are included with each module.

To generate the special waveforms.

❑ **Step 1** **Determine the need for a balloon according to monitor used.**

Datascope 90*; it is essential that a balloon (or suitable replacement) be connected to the Balloon Output connector for proper operation of the Datascope 90 pump.*

Datascope 80*, Kontron Aries; It may be necessary to defeat the alarm by connecting a balloon or suitable replacement to the Balloon Output Connector.*

❑ **Step 2** **Connect Datascope/Kontron/Aries ECG cable to the DS 6100 ECG snap connectors.**

❑ **Step 3** **Insert the Interactive IABP module into the DS 6100's Personality Module connector. Turn the DS 6100 on.**

❑ **Step 4** **Connect the following cables to their respective monitors;**

Datascope 90*: connect cable #3010-0314 (GE 3100/Datascope 6F cable) from the Datascope Pressure Transducer input connector to the DS 6100's ART connector.*

Datascope 80*: cable #3010-0314 (GE 3100/Datascope 6F cable) from the Datascope ART PRES input connector to the DS 6100's ART connector.*

Kontron *7, 10, 2000, KAAT: cable #3010-0354 (Kontron High Level cable) from the KONTRON AUX input connector to the DS 6100's ART connector (Kontron 2000 ART input)*

Aries: *cable #3010-0315 (4100-9 Space Labs 6M cable) from the ARIES ART PRES input connector to the DS 6100's ART connector.*

❑ Step 5 Remember to zero the arterial pressure channel on the pump. To simulate atmospheric pressure, selec SPEC FUNC 62 (OmmHg). Use the module's suggested procedure to obtain a OmmHg pressure reading. When zeroed, select any cardiac rhythm to bring the arterial waveform on the screen.

❑ Step 6 Connect the following IABP cable assemblies to the DS 6100's AUX connector;

Datascope 90: *#3010-0352 from the DATA COM output connector*

Datascope 80: *#3010-0351 from the System INTERFACE output connector*

Kontron: *#3010-0353 from the ASSIST INTERVAL output connector*

Aries: *#3010-0353 from the ASSIST INTERVAL output connector.*

❑ Step 7 Turn the balloon pump on and follow normal procedures for initializing the pump. Select a 2 to 1 assist ratio.

❑ Step 8 The DS 6100 will respond to the balloon pump's inflation/deflation signal with the appropriate augmented arterial pressure waveform. Change ECG rhythms using the DS 6100's keypad.

CARDIAC OUTPUT PERSONALITY MODULES

The DS 6100 can be used with either of two Cardiac Output Personality Modules. Degrees C injectate temperature (model 6070-18) and 25 Degrees C injectate temperature (model 6070-20) both simulate the Edwards style blood temperature catheter in generating several dilution curves.

The dilution curve at 0 degrees C injectate temperature assumes the following conditions;

10cc Injectate volume
Edwards 93-131-7F Catheter
Injectate Bath Probe, 90.22 k ohms (compatible with Switchcraft connector SL-40-47F)
Computation Coefficient .542. *

The dilution curve at 25 degrees C injectate temperature assumes the following conditions:

10cc Injectate volume
Edwards 93-131-7F Catheter
Injectate Bath Probe 62.34 k ohms (compatible with Switchcraft connector SL-40-47F)
Computation Coefficient .595*.

** The use of other computation LM10 coefficients could result in CO values other than specified.*

Follow these steps when using the CO module;

- ❑ **Step 1** **Insert the Cardiac Output Module into the DS 6100's Personality Module connector. Turn on the DS 6100.**

- ❑ **Step 2** **Connect the CO computer's BT (blood temperature) cable to the CO Module's 3-pin connector. (The BT cable in the clinical setting is attached to the thermistor on the Swan-Ganz catheter.)**

- ❑ **Step 3** **Connect the CO computer's injectate temperature cable to the black injectate temperature box which simulates 0 or 25 degrees C temperature. ***

- ❑ **Step 4** **Set up CO computer per the manufacturer's instructions. When ready to inject select SPEC FUNC and number for CO curve desired (Curves listed on module)**

** The internal resistor value is selected to meet the input requirements of the American Edwards or SpaceLabs bath probe injectate temperature. We suggest using the actual bath probe and bath to meet the input requirements for other desired cardiac output computer systems or modules. Some patient monitoring systems will default to an iced injectate (0° C) if no bath probe is attached to the system.*

CAPNOGRAPHY PERSONALITY MODULE

The DS 6100's Capnography Personality Module is available in combination with Cardiac Output Models 6070-22 and 6070-23. The capnography function simulates the graphic portrayal of the varying CO2 levels during the respiratory cycle. Capnography simulation is possible only with selected patient monitors. Compatible monitors (see list below) require the following interconnect cables.

MONITOR	CO2 Cable to Order
Spacelabs Alpha 9, 14,PC	#6085-03, P/N 3010-0333
Spacelabs 500, 600	#6085-04, P/N 3010-0334
Mennen	#6085-05, P/N 3010-0335

Note:

The Capnorgraphy option is not compatible with other manufacturers' CO2 monitors because they lack analog CO2 input.

- ❑ Step 1 — **Insert the CO/CO2 personality module into the DS 6100 personality module connector. Turn the DS 6100 on.**
- ❑ Step 2 — **Connect the CO2 cable from CO2 monitor Auxiliary Imput to the DS 6100 AUX channel**
- ❑ Step 3 — **Remember to calibrate the CO2 line. Select SPEC FUNC 99 (OmmHg). Use the CO2 monitor manufacturer's suggested procedure for calibration.**
- ❑ Step 4 — **Select SPEC FUNC 95 through 98 to obtain the specific capnography waveform desired.**

BLOOD PRESSURE CABLES

To ensure proper operation, be sure the interface cables you are using between simulator pressure outputs and your equipment include the proper connectors and wiring. If you wish to assemble cables. Please refer to the list below. Figure 9 through 13 on the following page show the proper wiring for cables connecting channels 2-4 to most pressure monitors. For assistance in wiring pressure cables, please contact DNI.

NOTE;

A special interface cable is not necessary for either ECG of respiration since the simulator's ECG snap outputs are directly compatible with most standard patient cable lead wires.

MODEL	ITEM	MODEL	ITEM
4100-01	Unterminated	4100-14	Abbott (7m)
4100-02	HP 5uV (5F)	4100-15	Gould/Care (5M)
4100-03	HP 40uV (5F)	4100-18	Litton (4M)
4100-04	HP 5uV (12M)	4100-19	Siemens (10M)
4100-05	HP 40uV (12M)	4100-20	Kontron/Rouche (6M)
4100-06	Spacelabs (5M) (700, Alpha 9, 14)	4100-23	Marquette (8M)
4100-08	GE 3100/Datascope (6F)	4100-24	Burdick DataSim
4100-09	Spacelabs (400,500,600,PC)	4100-25	Nihon/Kohden (5M)
	Physiocontrol (6M	4100-37	Honeywell/Meddars (9M)
	MDE Escort (6M)	4100-40	Fukuda Denshi (8M)
	Mennen (6M)	4100-42	Siemens Mingo 7 (15M)
	IVY (6M)		
4100-11	EforM/Honeywell (6F)	4100-50	Armstrong High Level Output
4100-12	BD/Datamedix/Ohio (9M)	4100-60	Marquette Eagle Series
		4100-61	Fukuda Denshi (12M)

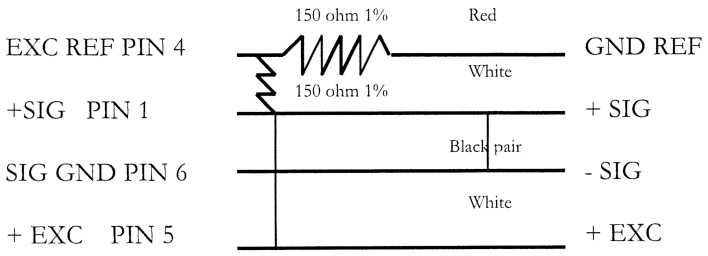

Figure 9: Pressure cable wiring for monitor with 5uV/VmmHg sensitivity

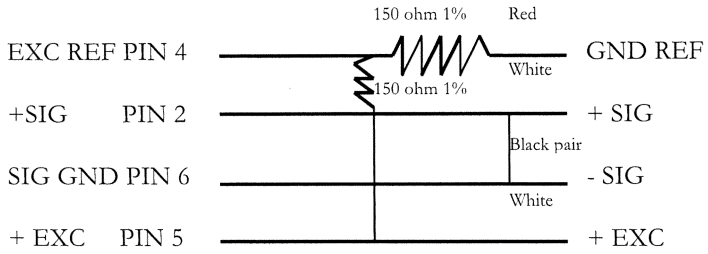

Figure 10: Pressure cable wiring for monitor with 40uV/VmmHg sensitivity

NOTE:

To minimize noise, the +/- SIG wires should be a twisted pair, as should the +/- EXC wires

CONNECTOR INTERFACE PIN DEFINITIONS

PIN # *	Function
1	N/C
2	N/C
3	HIGH LEVEL OUT
4	+ 9 V
5	DEFIB IN
6	GND
7	PACER FLAG (5V, 10 msec)

Figure 11: ECG Connectors

PIN # *	Function
1	+Signal Out (5uV/VmmHg)
2	+ Signal Out (40uV/VmmHg)
3	+ High Level Out
4	EXC REF
5	+ Excitation in
6	- Signal
7	+ 7.15 V.REF

Figure 12: Pressure Connectors

** Cable connectors #2710-0278 or Switchcraft #15 GM/7M*

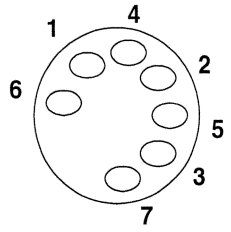

Figure 13: Connector Pin Assignments

CHARGING THE BATTERY

The rechargeable battery used by the DS 6100 is a 1.9 AH sealed lead acid battery, which powers the unit for up to 20 hours. The integrated charger requires up to 10 hours charging the battery if its charge is significantly depleted. A Low Bat message is displayed when the battery needs to be recharged.

To charge the battery, plug the DS 6100's battery charger into the unit and an AC line power source.

CAUTION the battery should never be discharged completely. Repeated complete discharging can result in damage to the battery. To avoid this situation:

** Recharge the battery every 6 months if the unit has not been used.*

** Immediately begin charging when the battery level is LOW. A fully charged battery will retain at least 95% of its charge for 7 days with the unit turned OFF. The maximum charge time to reach 95% battery capacity is approximately 10 hours.*

REPLACING THE BATTERY

Only qualified service personnel should be permitted to replace the battery. When replacing the battery follows these instructions

1. Turn power off and disconnect unit from AC line power
2. Remove the 6 front panel screws
3. Remove the front panel assembly exposing the battery
4. Detach the battery wires and remove the battery bracket
5. Replace with 1.9 AH 12 Volt sealed lead acid battery, part#1001-4004 or equivalent.