Chapter 1

INTRODUCTION

1.0 How to Use This Manual

The Pinion Stat*Analyst is the finest analytical ESD instrument available. The application versatility of this piece of equipment is limited only by the user's imagination. To this extent, the user will find it most valuable to become familiar with the extremely wide range of utility which the Stat*Analyst provides.

We have structured this manual in a fashion which permits even the uninitiated ESD equipment user to begin using the Stat*Analyst immediately. However, we highly recommend that the user examine the instrument's depth of capability by browsing thru all of its functions. You will find that such browsing is simple and easy because of consistent menu formats and operating terminology.

In addition to outlining step-by-step procedures, it is the aim of this manual to provide technically specific detail in order to promote a more complete understanding of the actual analytical processes.

1.1 The Stat*Analyst Provides Answers to Your Tough ESD Questions

This section reviews some of the aspects of an ESD control program that can be monitored by the Stat*Analyst. As a preface, the following typical questions of interest to management and production staff at manufacturing facilities can be answered by the measurements obtained with the Stat*Analyst.

*What is the average voltage on the personnel in the plant?

*What is the probability of assembly personnel having more that 150 volts, or 300 volts, or 800 volts, or 2000 volts, etc?

*Are the voltages on the personnel typically the same day after day?

*Do conductive floors really reduce the voltages on people?

*Should the plant purchase conductive flooring or use conductive floor coatings instead?

*How do various ankle straps and conductive shoes perform? Should the plant purchase them?

*Are the static preventive materials (antistatic bags, foam packing material, work mats, etc.) used in the plant effective at reducing charge build up.?

*What are the voltages on sensitive devices such as integrated circuits (ICs), when they are removed from their shipping containers? Are the containers really antistatic? What is the probability of a voltage sensitive device in a container having greater than 2,000 volts on it (or 1,000 volts, etc.)?

*What phase in a particular manufacturing process is causing significant ESD damage to ESD sensitive components?

*How can management by convinced that there are ESD related problems in the plant? How can data be acquired that would be meaningful to them?

*Does air ionization play a major role in the total ESD protection program?

*Which air ionizer or ionization system is best for the task at hand?

*How well does a given ionizer hold its balance specifications over time?

*How often should an ionizer be cleaned & calibrated to maintain output?

*What is the AC and RMS voltage performance of a given ionizer?

*How can ESD clothing and furniture be evaluated for economic impact?

All the above questions can be answered easily and conveniently using the Stat*Analyst in one or both of its two main operating modes: Charged Object Analysis (COA) Mode and Charge Plate Monitor (CPM) Mode. Some typical applications are discussed below.

1.2 Charged Object Analysis (COA) Operation Mode

The Stat*Analyst is a versatile charge and voltage measuring instrument designed to measure the effectiveness of many aspects of an ESD control program. It is designed to measure and statistically interpret charge, capacitance and voltage. Statistical ESD data reduction to a clear concise graphical format is a key feature that separates the Stat*Analyst from other instruments currently on the market.

The Stat*Analyst may be used to measure voltage or charge on integrated circuits, PC boards, static preventive materials, and people and then statistically interpret the data. Rather than just reporting charge or voltage measurements as single entities, the Stat*Analyst contains a microprocessor-based system for data storage (up to 650 separate entries are possible for one evaluation). This is important because ESD evaluation measurements are inherently statistical in nature. As an example, when monitoring voltages on personnel it is not uncommon to obtain a reading of 10 volts on a person during one reading, and 5,000 volts during a reading made on the same person a few seconds later; the difference attributed to a quick movement made by the person under test. It becomes evident that many measurements should be made in order to provide a sufficient data base to apply mathematical averaging and standard deviation calculations. This provides the necessary base for probability calculations; yielding a repeatable result that is a more accurate indication of the voltage levels that are typical of the personnel or objects undergoing test. The Stat*Analyst provides these mathematical statistics instantaneously, allowing the operator to efficiently and quickly acquire meaningful data.

By evaluating charge and voltage as statistical quantities, the information obtained from the Stat*Analyst enables the user to make sensible decisions based on experimental data concerning the magnitude of ESD problems in the actual working environment. This capability is essential in order to effectively evaluate, improve, and monitor any ESD control program.

The Charged Object Analyzer (COA) operating mode incorporates two different input sensors: the PVT-100SA Personnel Voltage Tester and the FC-100/200SA Faraday Cup. In either case the Stat*Analyst functions as a powerful statistical computer to help you determine where the most damaging ESD conditions exist and which ESD solutions provide the most effective and economic answers for your specific needs.

1.21 Personnel Voltage Measurement

The PVT-100SA Personnel Voltage Tester is the Stat*Analyst input sensor used to measure the voltage on people. The PVT-100SA has a range of -10,000 volts to +10,000 volts. A READY indicator (green LED) is provided to show when the unit is ready to measure and process a new piece of data.

Personnel Voltage Test Configuration

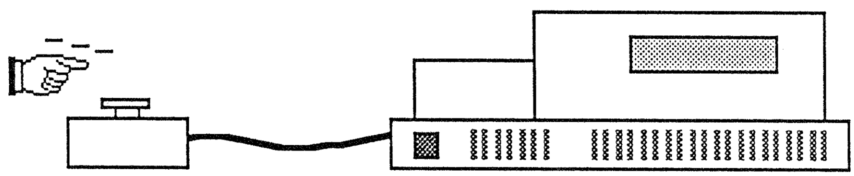
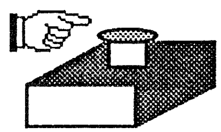


Figure 1: Personnel Voltage Test Set-Up

The Stat*Analyst personnel voltage test (as illustrated in figures 1 & 2) is a cost effective method for evaluating a company's ESD program by determining the probability of individuals having ESD potentials of critical magnitudes. By placing the PVT Sensor in the work environment where workers can touch the sensor frequently during the day, the subsequent data base collected can be summarized quickly with the push of a few buttons on the Stat*Analyst. The compiled information available is as follows:

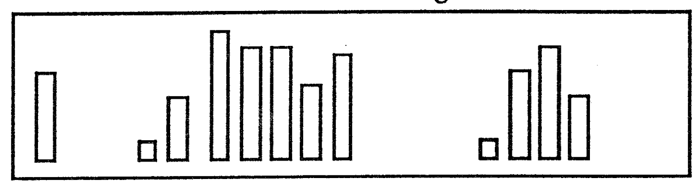
1. The number of readings taken.
2. The average voltage on personnel.
3. The standard deviation of the data taken.
4. The probability of personnel having an ESD critical voltage.

EVALUATING ESD PROTECTION STATISTICALLY BY MEASURING VOLTAGE ON PERSONNEL



Use the Stat*Analyst
PVT-100SA
Personnel Voltage Tester
to directly measure
voltage on workers.

HISTOGRAM: Voltage Menu



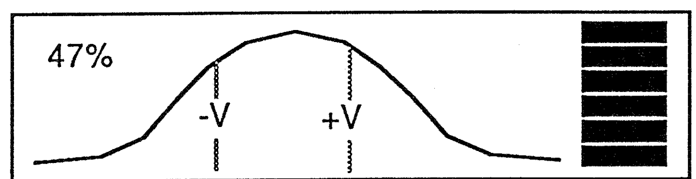
Also TEST and EVALUATE:

- Wrist Straps
- Heel Straps
- Conductive Floors
- Clothing & Furniture

... to name a FEW items.

All under ACTUAL work conditions.

PROBABILITY (Voltage Menu)
of an ESD CRITICAL EVENT



Set ESD Critical Voltage (V)

Figure 2:

Chapter 8

Stat*Analyst General Specifications

8.0 Software

Current Software is version 1.0, dated 4/5/91. Upgrades will be made available as refinements and new features are developed - consult Pinion Customer Service for updates and details. The entire software package is contained on 4 PROMs located in the base of the main Stat*Analyst Control Unit.

8.1 Hardware

8.11 Main Control Unit

Microprocessor: 4 MHz NSC800 8 Bit CPU

Memory: 88K PROM (program software)
8K battery backed RAM (data storage)
8K battery backed RAM Extension (data storage)

Printer Interface: CENTRONICS® Parallel

Remote Interface: RS-232C Serial

Main Battery: 12Volt, 3Amp Hour Sealed Lead Acid Battery

Battery Charger: 700 ma (max)

Battery Life: ~ 4 hours

Control Unit Physical:

Width:	18.8 in.
Height:	5.5 in.
Depth:	10.0 in.
Weight:	16.5 lbs

100 Volt Reference Output: 100VDC ± 2% (current limited with 1 megohm series resistance)

Environment:

Operating Temperature:	0 - 40 degrees Celsius
Humidity:	up to 85% RH (non-condensing)

Power: 110/220 volts (field selectable), 50/60 Hz

8.12 Charge Plate Monitor: CPSA

Sensor Unit Physical:

Width:	6.1 in	Sensor Plate Isolation:	> 10^{14} Ω
Height:	4.0 in	Sensor Plate:	6" x 6" Aluminum
Depth:	5.8 in	Sensor Capacitance:	20 pf ± 10%
Weight:	4 lbs		

Sensor Type: Electrostatic Fieldmeter, Vibrating Reed Type

Sensor Gain Accuracy:
1% at DC
3% to 20 Hz (Typ.)
10% to 60 Hz (Typ)

Sensor Settling Time: < 35 msec (to Spec)

Sensor High Voltage Source: –5000 to +5000 calibrated volts (current limited with 100 megohm series resistance)

Float Test Selectable Ranges:

Time Ranges: 0.125, 0.500, 1, 2, 5, 10, 20, 50, 100, 200 seconds
Voltage Ranges: ± 10 to ± 100 volts in 10 volt steps
± 100 to ± 5000 volts in 100 volt steps

Decay Test Selectable Ranges:

Time Ranges: 1, 2, 5, 10, 20, 50, 100, 200, 500, 1000, 5000, 10000 sec.
Initial Voltage: 100 to 5000 volts (+ or –) in 100 volt steps
1/e x Initial Voltage
1 to 99% x Initial Voltage in 1% steps
0 to 90 volts (+ or –) in 10 volt steps
100 to 4900 volts (+ or –) in 100 volt steps

8.13 Personnel Voltage Tester: PVT-100SA

Sensor Unit Physical:

Height	3"
Width	4.25"
Depth	4.25"
Weight	1 lbs.

Voltage:

Displayed Value	Displayed Accuracy
0.00 - 1000 volts	± 1% + 1 volt
1000 - 3000 volts	± 5% + 5 volts
3000 - 6000 volts	± 10% + 10 volts
6000 - 10,000 volts	± 15% + 10 volts

8.14 Faraday Cups: FC-100SA and FC-200SA

Sensor Unit Physical:	FC-100SA	FC-200SA
Height	5.5"	12.5"
Outside Diam.	4"	10"
Cup Inside Diam.	2.5"	8.75"
Cup Depth	2.5"	7"
Weight	2 lbs.	5 lbs.

Sensor Droop: 0.1 nc / minute (maximum); 0.052% / minute

Sensor Drift: .0002 nc / second (maximum)

Charge:	Displayed Value	Displayed Accuracy
	0.000 - 1.999 nc	0.6% + 0.002 nc
	2.00 - 19.99 nc	0.5% + 0.01 nc
	20.0 - 199.9 nc	0.5% + 0.1 nc

Capacitance:	Displayed Value	Displayed Accuracy
	0.00 - 19.99 pF	2.6% + 0.02 pF
	20.0 - 199.9 pF	2.5% + 0.1 pF
	200. - 1999 pF	2.5% + 1.0 pF

Temperature Coefficient: 0.04% / °C; +15 to +35°C

8.2 Port Specifications

8.21 Analog Output Port: Scale Factors

Cable Connector Required: male; BNC type

The Stat*Analyst Analog Output Signal is buffered raw sensor output. Buffer drive capability is 5 ma maximum load current. Nominal voltage swing is ± 10 volts. Signal is continuously available regardless of control unit sampling activity.

Zero reference is not absolute - the Stat*Analyst Control Unit performs the auto-zero function. On critical reference measurements a zero input reading should be taken to establish the corresponding analog signal reference point.

Scale factors for each analog function are as follows:

Charge Plate Monitor: multiply signal by 573.4 to get volts

Personnel Voltage: multiply signal by 1000 to get volts

Faraday Cup: multiply signal by 20 to get nanocoulombs

8.22 Connector Pin-out for RS-232 Port

Cable Connector Required: 25 pin male; D-Sub type

The Stat*Analyst transmits serial data on pin 3 and receives data on pin 2.

PIN	SIGNAL	PIN	SIGNAL
1	GND	14	NC
2	RxD	15	NC
3	TxD	16	NC
4	CTS	17	NC
5	RTS	18	NC
6	DTR	19	NC
7	GND	20	DSR
8	DCD	21	NC
9	NC	22	NC
10	NC	23	NC
11	NC	24	NC
12	NC	25	NC
13	NC		

8.23 Connector Pin-out for Centronics Printer Port

Cable Connector Required: 36 pin male; standard printer type

PIN	SIGNAL	PIN	SIGNAL
1	STROBE /	2	GND
3	DATA0	4	GND
5	DATA1	6	GND
7	DATA2	8	GND
9	DATA3	10	GND
11	DATA4	12	GND
13	DATA5	14	GND
15	DATA6	16	GND
17	DATA7	18	GND
19	NC	20	GND
21	BUSY	22	GND
23	NC	24	GND
25	NC	26	NC
27	NC	28	NC
29	NC	30	GND
31	GND	32	TYPE
33	GND	34	NC