SECTION 1: CHAPTER 2

SYSTEM INTRODUCTION

2.1 OVERVIEW

The Heatpulse® 8108 system is a single-wafer, cassette-to-cassette rapid thermal processor, capable of processing in inert or corrosive ambients. The system is built for the production environment. It is housed in a compact, through-the-wall frame (which can also be installed stand-alone, if desired). Front views of the 8108 Heatpulse system are shown as follows: Figure 1:2-1a shows the Monitor-Fab-Wall-Mount configuration; Figure 1:2-1b shows the Monitor-Side-Panel-Mount configuration.

8108 system components include:

- Heating chamber (also called the oven), containing two high-intensity tungsten halogen lamp arrays
- STD Bus for real-time operation
- Quartz isolation tube
- Robot and robot controller
- Gas control electronics
- ULPA filtration system
- Graphic User Interface (GUI) computer system

The 8108 contains a subsystem for each of the following:

- Electronics (including a dedicated microprocessor)
- Mass-flow-controlled gas handling
- Cooling
- ULPA filtration
- Mechanical assemblies

Software programs, called recipes, specify the details for each process. The system includes a 3-1/2-inch floppy disk drive for process recipe storage.

A three-axis industrial robot automates processing by transporting wafers into and out of the heating chamber. It uses closed-loop feedback for precise motion control and accurate positioning.

To provide cold-wall processing, water is circulated through the heating chamber walls. The quartz isolation tube is cooled with nitrogen or compressed air.

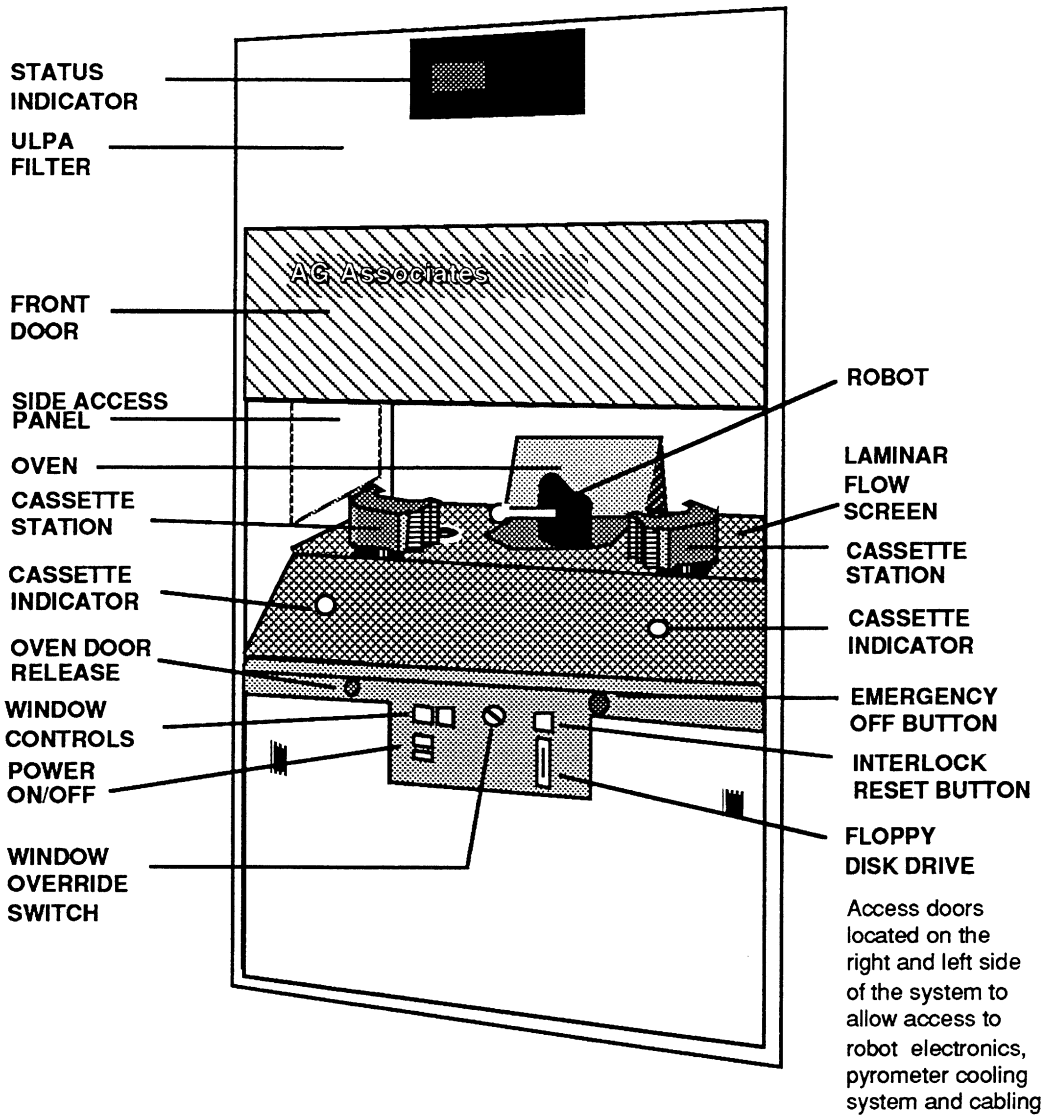

Figure 1:2-1a. *8108 Heatpulse System Features (Monitor-Fab-Wall Mount)*

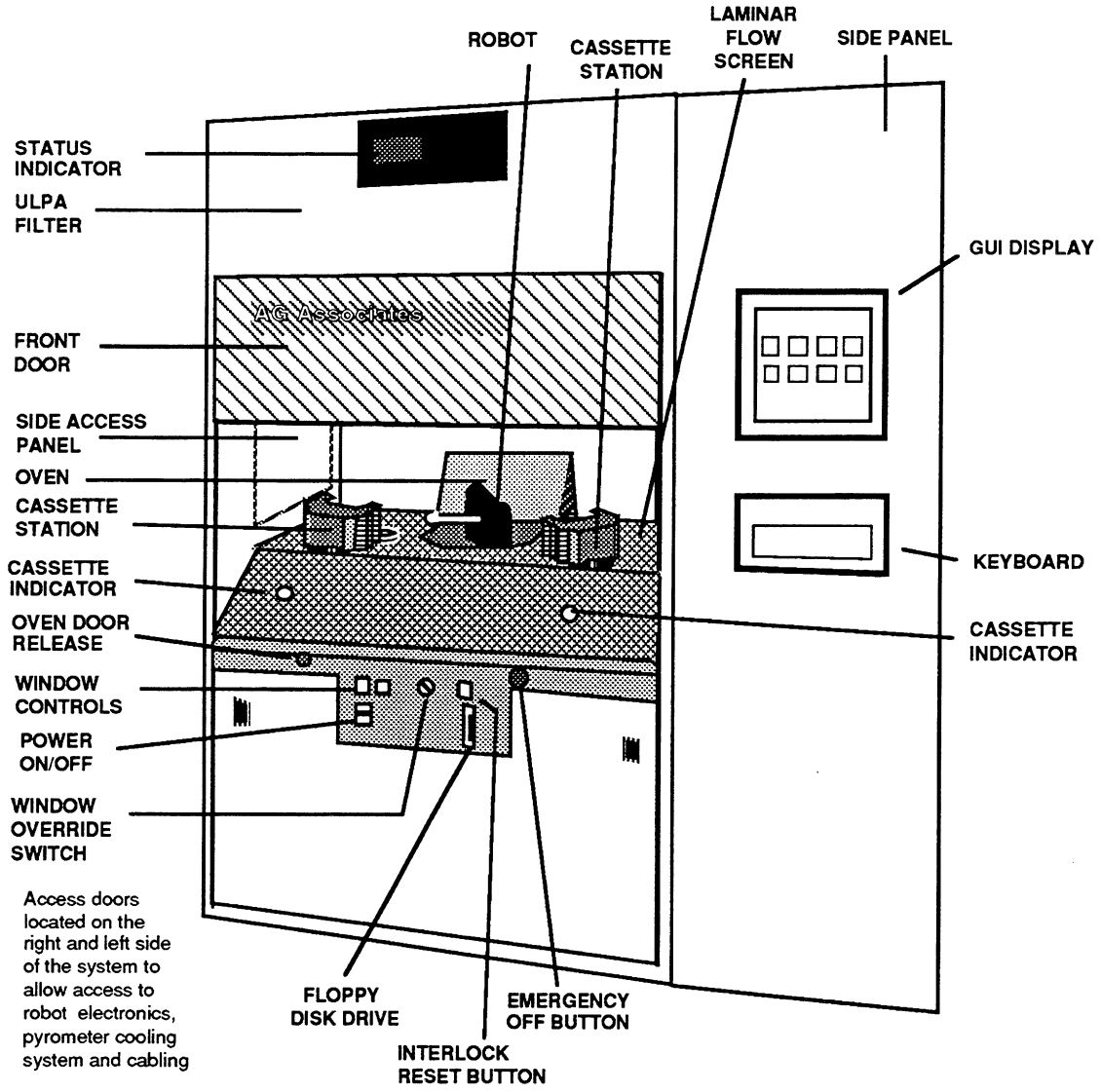

Figure 1:2-1b. *8108 Heatpulse System Features (Monitor-Side-Panel Mount)*

2.2 FEATURES

The Heatpulse 8108 system contains many capabilities which provide significant advantages over conventional batch processing in the production of VLSI circuits. Cleanroom integrity, precise temperature control and measurement, software flexibility, and the physical structure of the system (designed for the production environment) are among these advantages.

2.2.1 Contaminant-Free Processing

The Heatpulse 8108 system is designed with the cleanroom environment in mind. The following are the key features which make this Heatpulse system contaminant-free:

- Stainless-steel laminar flow processing floor and ULPA filter located in the processing area to reduce the number of particles in the environment. The walls of the processing area are also stainless steel.
- Design which prevents particles from circulating around the wafer-handling area, which allows the front panel door to remain open during processing.
- Easy service access available from rear and side panels.
- Through-the-wall installation, which maintains cleanroom integrity.
- No belts and pulleys (a large source of particle contamination) exist in the 8108 wafer-handling area.
- Front touch-screen controller remotely mounted to further reduce particle attraction.

2.2.2 Heating, Cooling, and Temperature Measurement

The following lists the key features of 8108 heating, cooling, and temperature measurement:

- High-intensity radiation which heats wafers for short periods of 1 to 600 seconds at precisely controlled temperatures in the 400-to-1200°C range.
- Tungsten halogen lamps and cold heating-chamber walls which allow fast wafer heating and cooling rates, respectively.
- Lamps arranged in 2 banks of 14 lamps each, 1 bank above and the other below the wafer chamber. Upper lamps which run crosswise and lower lamps which run lengthwise. Thus, the upper and lower lamps are at right angles to each other for optimization of temperature control. In addition, 10-zone lamp control to enable further wafer uniformity.
- The system delivers time and temperature profiles tailored to suit specific process requirements.
- Pyrometer or thermocouple sensing which offers precise closed-loop temperature control.
- Open-loop intensity control (OLIC) option which offers accurate, repeatable temperature control. (This feature requires ±1/2 V at 208 V line voltage regulation to function accurately.)
- Purge gas which flows through the heating chamber and cooling gas (CDA) which flows around the isolation tube and lamps.

2.2.3 Software

The Heatpulse 8108 system features touch-screen operation which is easy to learn. Additional software features are listed below.

- Menu screens which allow a process cycle to be easily defined and executed.
- Status reports continually displayed on the screen as the system operates.
- Self-diagnostic routine active whenever the system is on and terminates the cycle in progress if an abnormal condition is detected.
- Access codes which provide security for the system, recipe programming, and diagnostic functions.
- Highly-flexible recipes and process procedures.
- Simple and easy-to-use menu screens.
- Touch-screen menus which eliminate the need for special commands.
- Manual mode which allows engineers and service personnel to activate individual subassemblies and functions.
- Discrete diagnostic routines, using a separate Diagnostic mode, are available.
- Thermal processing cycles which may be customized for unique processing requirements.
- Custom recipes created by process engineers which may be saved on floppy diskette and executed by production line operators.

2.2.4 Service Access

The 8108 system has been built for fast servicing in the production environment which provides low mean time to repair (MTTR). The features listed below reflect this purpose:

- Optional menu screen available at the rear of the system, enabled through a key control switch.
- Gas box specifically designed for easy access and maintenance.
- Front access window closes to prevent cleanroom contamination during maintenance for through-the-wall installation.
- Top window, which flips out of the way, enables easier wafer-handling area access.

2.2.5 Wafer Handling, Control, and Accuracy

8108 wafer-handling system features include the following:

- Consistent wafer-to-wafer process cycle repeatability
- Optional send and receive cassette bases which swivel to accommodate loading and unloading by a cleanroom robot in a fully robotic environment
- Controlled ambient
- Robotic transport of wafers in excess of 80 wafers per hour (in a null cycle without the flat-finder option)

2.2.6 Safety

The 8108 system was designed with safety in mind. Safety features include:

- Software and hardware interlocks to prevent hazardous gas combinations
- Emergency shut-off buttons in both the front and rear of the system
- Error messages and alarm signals to convey system status
- Domestic 8108 systems are listed by Underwriters Laboratories
- European 8108 systems meet European CE label requirements

2.2.7 Cost Savings

The 8108 offers two features which result in a considerable cost savings when compared to conventional batch processing. Thus, it requires:

- Low energy use
- Few employees for operation and maintenance