Powder Booth Controller

Part 107 916A

Nordson.

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POWDER BOOTH CONTROLLER

TABLE OF CONTENTS

Publication P/N 107 916

LIST OF ILLUSTRATIONS

ADDENDUM

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Publication P/N 107 916

Safety
Powder Spray Systems

1. Introduction

This section contains general safety instructions for using your Nordson equipment. Task- and equipment-specific warnings are included in other sections of this manual where appropriate. Note all warnings and follow all instructions carefully. Failure to do so may result in personal injury, death, or property damage.

To use this equipment safely,

- read and become familiar with the general safety instructions provided in this section of the manual before installing, operating, maintaining, or repairing this equipment.
- read and carefully follow the instructions given throughout this manual for performing specific tasks and working with specific equipment.
- store this manual within easy reach of personnel installing, operating, maintaining, or repairing this equipment.
- follow all applicable safety procedures required by your company, industry standards, and government or other regulatory agencies. Refer to the National Fire Protection Association (NFPA) standard 33 and to federal, state, regulatory agency, and local codes for rules and regulations covering installation and operation of powder spray systems.
- obtain and read Material Safety Data Sheets (MSDS) for all materials used.

2. Safety Symbols

Become familiar with the safety symbols presented in this section. These symbols will alert you to safety hazards and conditions that may result in personal injury, death, or property and equipment damage.

WARNING: Failure to observe this warning may result in personal injury, death, or equipment damage.

2. Safety Symbols *(contd.)*

WARNING: Risk of electrical shock. Failure to observe this warning may result in personal injury, death, or equipment damage.

WARNING: Disconnect equipment from line voltage. Failure to observe this warning may result in personal injury, death, or equipment damage.

WARNING: Risk of explosion or fire. Fire, open flames, and smoking prohibited.

WARNING: Wear protective clothing, safety goggles, and approved respiratory protection. Failure to observe may result in serious injury.

WARNING: System or material pressurized. Relieve pressure. Failure to observe this warning may result in serious injury or death.

CAUTION: Failure to observe may result in equipment damage.

3. Qualified Personnel

"Qualified personnel" is defined here as individuals who thoroughly understand the equipment and its safe operation, maintenance, and repair. Qualified personnel are physically capable of performing the required tasks, familiar with all relevant safety rules and regulations, and have been trained to safely install, operate, maintain, and repair the equipment. It is the responsibility of the company operating the equipment to see that its personnel meet these requirements.

4. Intended Use

WARNING: Use of this equipment in ways other than described in this manual may result in personal injury, death, or property and equipment damage. Use this equipment only as described in this manual.

Nordson Corporation cannot be responsible for injuries or damages resulting from nonstandard, unintended applications of its equipment. This equipment is designed and intended only for the purpose described in this manual. Uses not described in this manual are considered unintended uses and may result in serious personal injury, death, or property damage. Unintended uses may result from taking the following actions:

- making changes to equipment that have not been recommended or described in this manual or using parts that are not genuine Nordson replacement parts.
- failing to make sure that auxiliary equipment complies with approval agency requirements, local codes, and all applicable safety standards
- using materials or auxiliary equipment that are inappropriate or incompatible with your Nordson equipment
- allowing unqualified personnel to perform any task

5. Installation

Read the installation section of all system component manuals before installing your equipment. A thorough understanding of system components and their requirements will help you install the system safely and efficiently.

- Allow only qualified personnel to install Nordson and auxiliary equipment.
- Use only approved equipment. Using unapproved equipment in an approved system may void agency approvals.
- Make sure all equipment is rated and approved for the environment in which you are using it.
- Follow all instructions for installing components and accessories.
- Install all electrical, pneumatic, gas, and hydraulic connections to local code.

5. Installation *(contd.)*

- Install locking, manual, shutoff valves in the air supply lines to the system. This allows you to relieve air pressure and lock out the pneumatic system before undertaking maintenance and repairs.
- Install a locking disconnect switch or breaker in the service line ahead of any electrical equipment.
- Use only electrical wire of sufficient gauge and insulation to handle the rated current demand. All wiring must meet local codes.
- Ground all electrically conductive equipment within 10 feet (3 meters) of the spray area. Ungrounded conductive equipment can store a static charge which could ignite a fire or cause an explosion if a hot spark is discharged.
- Route electrical wiring, electrostatic cables, and air hoses and tubing along a protected path. Make sure they will not be damaged by moving equipment. Do not bend electrostatic cables around a radius of less than 6 in. (152 mm).
- Install safety interlocks and approved, fast-acting fire detection systems. These shut down the spray system if the booth exhaust fan fails, a fire is detected, or other emergency situation develops.
- Make sure the spray area floor is conductive to ground and that the operator's platform is grounded.
- Use only designated lifting points or lugs to lift and move heavy equipment. Always balance and block loads when lifting to prevent shifting. Lifting devices must be inspected, certified, and rated for a greater weight than the equipment being lifted.
- Protect components from damage, wear, and harsh environmental conditions.
- Allow ample room for maintenance, material supply container drop-off and loading, panel accessibility, and cover removal.
- If safety devices must be removed for installation, install them immediately after the work is completed and check them for proper functioning.

6. Operation

Only qualified personnel, physically capable of operating the equipment and with no impairments to their judgement or reaction times, should operate this equipment.

Read all component manuals before operating a powder spray system. A thorough understanding of all components and their operation will help you operate the system safely and efficiently.

- Use this equipment only in the environments for which it is rated. Do not operate this equipment in humid, flammable, or explosive environments unless it has been rated for safe operation in these environments.

- Before starting this equipment, check all safety interlocks, fire-detection systems, and protective devices such as panels and covers. Make sure all devices are fully functional. Do not operate the system if these devices are not working properly. Do not deactivate or bypass automatic safety interlocks or locked-out electrical disconnects or pneumatic valves.

- Know where EMERGENCY STOP buttons, shutoff valves, and fire extinguishers are located. Make sure they work. If a component malfunctions, shut down and lock out the equipment immediately.

- Before operating, make sure all conductive equipment in the spray area is connected to a true earth ground.

- Never operate equipment with a known malfunction or leak.

- Do not attempt to operate electrical equipment if standing water is present.

- Never touch exposed electrical connections on equipment while the power is ON.

- Do not operate the equipment at pressures higher than the rated maximum working pressure of any component in the system.

- Know the pinch points, temperatures, and pressures for all equipment that you are working with. Recognize potential hazards associated with these and exercise appropriate caution.

- Wear shoes with conductive soles, such as leather, or use grounding straps to maintain a connection to ground when working with or around electrostatic equipment.

6. Operation (contd.)

- Do not wear or carry metallic objects (jewelry or tools) while working with or around electrostatic equipment. Ungrounded metal can store a static charge and cause harmful shocks.
- Maintain skin-to-metal contact between your hand and the gun handle to prevent shocks while operating manual electrostatic spray guns. If wearing gloves, cut away the palm or fingers.
- Keep parts of the body or loose clothing away from moving equipment or parts. Remove personal jewelry and cover or tie back long hair.
- Wear National Institute of Occupational Safety and Health (NIOSH) approved respirators, safety glasses or goggles, and gloves, and while handling powder containers, filling hoppers, operating spray equipment, and performing maintenance or cleaning tasks. Avoid getting powder coatings on your skin.
- Never point manual guns at yourself or other persons.
- Do not smoke in the spray area. A lit cigarette could ignite a fire or cause an explosion.
- If you notice electrical arcing in a spray area, shut down the system immediately. An arc can cause a fire or explosion.
- Shut off electrostatic power supplies and ground gun electrodes before making adjustments to powder spray guns.
- Shut off moving equipment before taking measurements or inspecting workpieces.
- Wash exposed skin frequently with soap and water, especially before eating or drinking. Do not use solvents to remove coating materials from your skin.
- Do not use high-pressure compressed air to blow powder off your skin or clothes. High-pressure compressed air can be injected under the skin and cause serious injury or death. Treat all high-pressure fittings and hoses as if they could leak and cause injury.

7. Less-obvious Dangers

Operators should also be aware of less-obvious dangers in the workplace that often cannot be completely eliminated:

- exposed surfaces on the equipment which may be hot or have sharp edges and cannot be practically safeguarded
- electrical equipment which may remain energized for a period of time after the equipment has been shut off
- vapors and materials which may cause allergic reactions or other health problems
- automatic hydraulic, pneumatic, or mechanical equipment or parts that may move without warning
- unguarded, moving mechanical assemblies

8. Action in the Event of a System or Component Malfunction

Do not operate a system that contains malfunctioning components. If a component malfunctions, turn the system OFF immediately.

- Disconnect and lock out electrical power. Close and lock out hydraulic and pneumatic shutoff valves and relieve pressures.
- Allow only qualified personnel to make repairs. Repair or replace the malfunctioning component.

9. Maintenance and Repair

Allow only qualified personnel to perform maintenance, troubleshooting, and repair tasks.

- Always wear appropriate protective devices and use safety devices when working on this equipment.
- Follow the recommended maintenance procedures in your equipment manuals.
- Do not service or adjust any equipment unless another person trained in first aid and CPR is present.
- Use only genuine Nordson replacement parts. Using unapproved parts or making unapproved modifications to equipment may void agency approvals and create safety hazards.

9. Maintenance and Repair *(contd.)*

- Disconnect, lock out, and tag electrical power at a disconnect or breaker in the service line ahead of electrical equipment before servicing.
- Do not attempt to service electrical equipment if there is standing water present. Do not service electrical equipment in a high-humidity environment.
- Use tools with insulated handles when working with electrical equipment.
- Do not attempt to service a moving piece of equipment. Shut off the equipment and lock out power. Secure equipment to prevent uncontrolled movement.
- Relieve air pressures before servicing equipment. Follow the specific instructions in this manual.
- Make sure that the room where you are working is sufficiently ventilated.
- If a “power on” test is required, perform the test carefully and then shut off and lock out power as soon as the test is over.
- Connect all disconnected equipment ground cables and wires after servicing the equipment. Ground all conductive equipment.
- Service lines connected to panel disconnect switches may still be energized unless they are disconnected. Make sure the power is off before servicing. Wait 5 minutes for capacitors to discharge after shutting off the electrical power.
- Turn off the electrostatic power supply and ground the gun electrode before adjusting or cleaning.
- Keep high-voltage connection points clean and insulated with dielectric grease or oil.
- Check all ground connections periodically with a megohm meter. Resistance to ground must not exceed one megohm. If arcing occurs, shut down the system immediately.

9. Maintenance and Repair (contd.)

- Check interlock systems periodically to ensure their effectiveness.

WARNING: Operating faulty electrostatic equipment is hazardous and can cause electrocution, fire, or explosion. Make resistance checks part of your periodic maintenance program.

- Do not store flammable materials in the spray area or room. Keep containers of flammable materials far enough away from spray booths to prevent their inclusion in a booth fire. If a fire or explosion occurs, flammable materials in the area will increase the chances and the extent of personal injuries and property damage.

- Practice good housekeeping procedures. Do not allow dust or powder coatings to accumulate in the spray area or booth or on electrical equipment. Read this information carefully and follow instructions.

10. Disposal

Dispose of equipment and materials used in operation and cleaning according to your local regulations.

SECTION 2

EQUIPMENT FAMILIARIZATION

INTRODUCTION

The NORDSON® Powder Booth Controller, is a self contained, microprocessor based module. The module provides complete control of a powder spray booth through menu-driven software. It allows the operator to:

- set up system parameters (Configuration mode)
- program an autostart timer and automatic powder addition systems (Program mode)
- monitor system status on a real-time basis, start and stop oscillators and bulk unloader air, and perform Program mode functions (Run mode)
- manually operate the system (Manual mode)
- obtain diagnostic and run tests (Diagnostic mode)
- obtain error messages (Fault mode)

The Powder Booth Controller Module consists of: a keyboard, display board, CPU (Central Processing Unit) board, logic board, and input-output (I/O) board. They are packaged within and protected by a shield with holes punched in it so that the LED status indicators on the boards can be easily read.

A separate DC power supply board provides 5 VDC and 24VDC to power the circuit boards and a pressure transducer and humidity/temperature sensor.

The Module is usually installed in a system main control panel on the inside of the door, so that the keyboard and display panel will be accessible from the front of the main panel.

Typical System Control Panel

A typical powder coating system main control panel usually includes a latching emergency stop pushbutton, and amber indicator lights for the exhaust fan, sieve, oscillators, recycle air, and bulk unloader air. An alarm reset pushbutton, key operated fire detec-

tion system bypass switch, alarm devices, and green system indicator light will be installed if an optional fire detection system is included in the panel.

The recycle and bulk unloader transfer pump and fluidizing pilot air solenoid valves, supply air pressure switch and final filter differential pressure transducer can be installed in the main panel or in a separate, remote panel. A relative humidity/temperature sensor is used to monitor the air supply dewpoint. The system can be configured so that a shutdown will occur if excessive moisture is detected in the air supply.

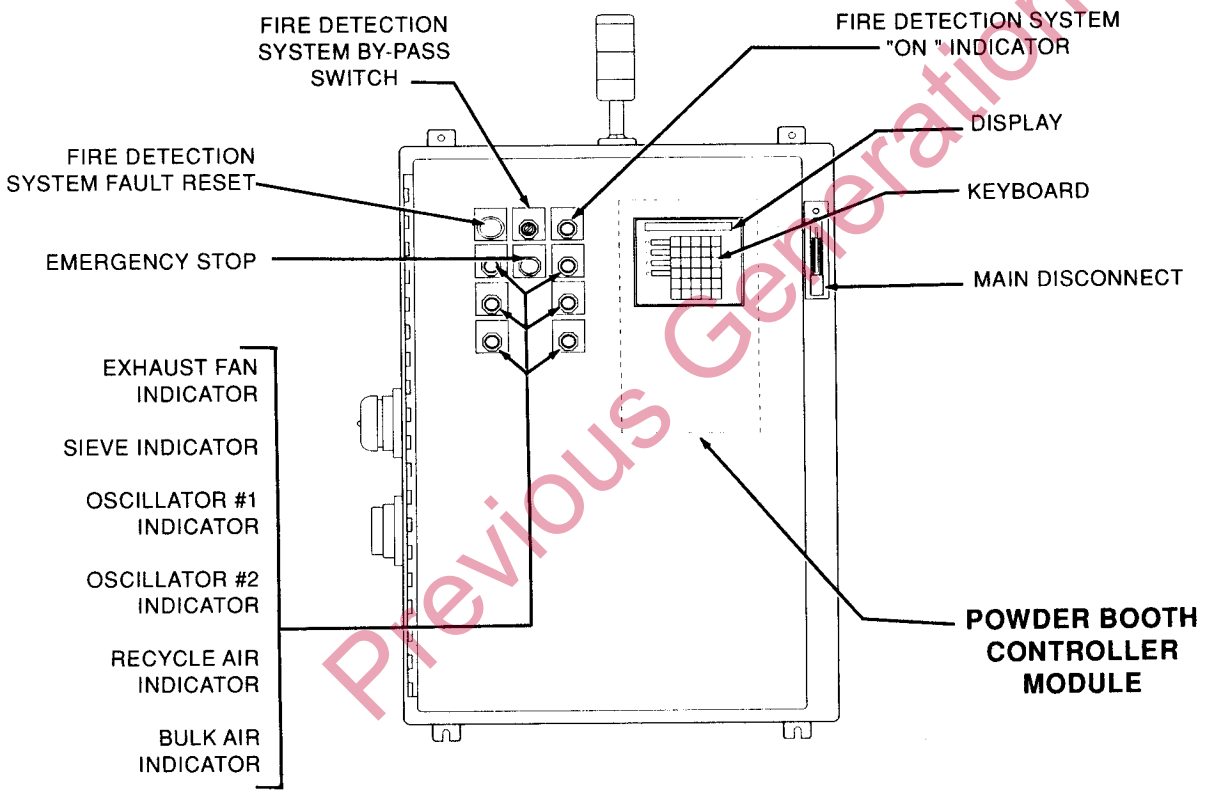

Figure 2-1 — Typical Powder System Main Control Panel

BOOTH CONTROLLER FEATURES

The Booth Controller operating software has 6 modes: Manual, Run, Configuration, Program, Fault, and Diagnostic. Refer to Sections 3 and 5 for instructions on using the software.

Manual Mode

In Manual mode, the operator can start and stop the booth exhaust fan, oscillators, sieve, recycle fluidizing and transfer pump air, and bulk unloader transfer pump air.

Run Mode

When started in Run mode, the controller will automatically start the exhaust fan and feed hopper fluidizing air, start and stop the configured powder addition system in response to signals from the feed hopper level sensor, control cartridge filter pulse solenoids, and monitor supply air pressure and dewpoint and final filter differential pressure. The operator can monitor the operating status of individual devices and systems, obtain supply air temperature and relative humidity values, force on the bulk unloader, start and stop the oscillator(s), and perform program mode functions.

Configuration And Program Modes

In Configuration and Program modes, the operator can set the clock, set up system parameters, program recycle air delay and duration timers, bulk unloader duration timer, filter blowdown timer and autostart timer, and enable or disable the password, autostart timer, and warning and noncritical shutdowns.

Fault Mode

In Fault mode, the operator can obtain diagnostic messages, which are logged into memory whenever an error condition occurs.

Diagnostic Mode

In Diagnostic mode, the operator can obtain values for final filter differential pressure and air supply relative humidity and temperature. The CPU uses air supply relative humidity and temperature to calculate dewpoint. If the supply air dewpoint exceeds 50° F for 15 minutes, the system will shut down (if the Fault shutdown option in Configuration mode is enabled).

Other tests in the Diagnostic mode include a display test, a ROM test, a RAM test, keyboard test and I/O test. Refer to Troubleshooting for more information about the Diagnostic mode.

BOOTH CONTROLLER SAFETY FEATURES

Automatic Full System Shutdowns

Safety features provided with the Booth Controller module include automatic full system shutdowns in the event of a fire, exhaust fan motor overload, loss of system air pressure, open Emergency Stop switch, and open powder module safety switches. If desired, automatic full system shutdowns can be programmed for conveyor stoppage, low or high final filter differential pressure, and a system air supply dewpoint exceeding 50° F for 15 minutes.

Automatic Partial System Shutdowns

The controller will cause partial system shutdowns if the sieve interlocks are opened during operation, or if the sieve motor or an oscillator motor overloads. If recycle and/or bulk powder supplies (depending on the configured powder addition system) run low, the system will shut down until the feed hopper level sensor is satisfied.

Note: NORDSON® 100 PLUS® Master Control Units, NPE-CC2 Master Control Consoles, Tribomatic® Master Control Modules or multiple NPE-CC8 Control Consoles must also be interlocked with the system panel so that the powder spray guns will be shut down along with the booth.

Warnings

The controller can also initiate a visual warning, without shutting any devices down, if the final filter differential pressure reaches a programmed warning level.

System Alarms

Normally open contacts are available to which audible and visible alarm devices can be connected. These devices will then be activated whenever an error condition occurs. The error message will also be logged into memory and can be retrieved through the Fault mode. The alarm devices can be shut off with the MUTE ALARM key on the keyboard.

Note: The fault LED, on the keypad, advises the operator when an error message is present in memory.

If the fire detection system detects a fire within the booth, a warning bell (if installed) will be activated. The fault light and alarm will also be activated and a message logged. If the alarm is activated and the fault LED on the keypad is not illuminated, check the fire detection system. Press the fire detection system reset if required. Consult the fire detection system controller manual if the fault persists.

Note: The fire detection system controller may be installed separate from the main control panel. The fire detection system may contain its own alarm bell (siren), fault light, and fault reset button.

Error messages are logged into the controller's memory depending on the severity of the condition. The system will not be started until the problem is corrected and the error message is cleared from the memory.

DESCRIPTION - BOOTH CONTROLLER MODULE

Keyboard And Display Board

Refer to Figure 2-4 for the Booth Controller connection diagram.

The display panel is a two line, forty character per line, backlit LCD display. On the key board are: 3 numeric keys; up, down, left and right arrow keys; a Mute Alarm key; Exit and Enter keys; and keys for Manual, Program, Run and Fault modes. Pressing the Program and Run keys simultaneously will put the controller in Configuration mode. Pressing the Manual and Program keys simultaneously will put the controller in Diagnostic mode.

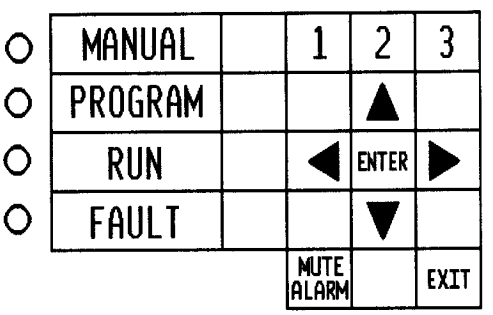

Figure 2-2 — Booth Controller Keyboard

Four LEDs located to the left of the mode keys indicate which mode the controller is currently in. The red LED next to the Fault mode key blinks when an error message has been logged into memory. The Program mode LED will blink when the auto-start feature is enabled.

CPU Board

The CPU board has a clock chip with a lithium battery good for approximately 65,000 hours, an EPROM (Erasable Programmable Read Only Memory) chip, into which is stored the operating software, and a NVRAM (Non-Volatile Random Access Memory) chip into which is stored the parameters and values entered into memory in Configuration and Program modes. The CPU board, keyboard and display are mounted together at the top of the module.

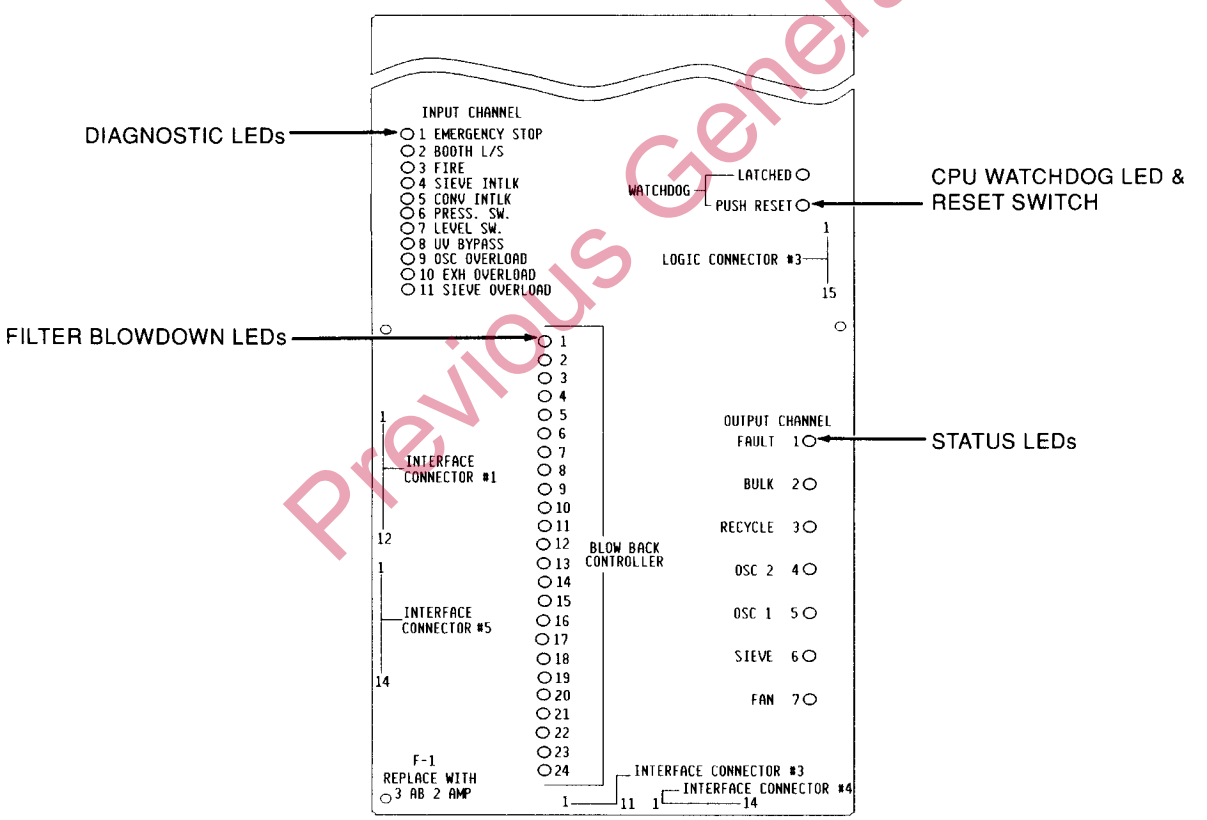

Figure 2-3 — Circuit Board Shield, LEDs, and I/O Connectors

Logic Board

The logic board receives analog input signals from the final filter differential pressure transducer and humidity/temperature sensor, and converts these signals into a digital signal to the CPU board. A watchdog timer on the logic board serves as a check on the functioning of the CPU board. During operations, the watchdog timer is continually reset by the CPU. If the watchdog timer is not reset, it will shut down the system to prevent unusual or unexpected operation. Also mounted on the logic board are 11 LED indicators.

Logic Board LED Indicators

Note: The functions of these indicators correspond to the I/O channels terminating at I/O board connector J3. Refer to Figure 2-6.

LED NO.	FUNCTION	CONDITION DURING NORMAL OPERATION
1	Emergency stop	On
2	Powder module limit switches	On
3	Fire detection system (optional)	On
4	Sieve interlock	On
5	Conveyor interlock	On
6	Air supply pressure switch	On
7	Feed hopper level switch	Off
8	Fire detect. syst. bypass switch (optional)	On
9	Oscillator motor overload	Off
10	Exhaust motor overload	On
11	Sieve motor overload	On

LEDs 1 through 3 should stay lit during normal operations. If they go off, indicating an open circuit, the system will be shut down.

LED 4 will stay lit if a sieve is configured into the system, is running, and the interlocks on the sieve are closed.

LED 5 will remain on as long as the external conveyor interlock contact remains closed.

LED 6 will stay lit as long as the air supply pressure switch remains closed. The switch will open if air pressure falls below 35 psig (2.3 bar).

LED 7 will light whenever the feed hopper level switch is closed, indicating a low powder level.

LED 8 will go off if the fire detection system is bypassed.

LEDs 9 will light whenever one or both of the oscillator motor starter overload protectors detects an excessive current draw and breaks the circuit, shutting off power to the oscillator(s).

LED 10 will remain lit as long as the exhaust fan motor is not overloaded.

LED 11 will light whenever the sieve motor, if configured into the system, is running.

Refer to Figure 2-5. There are 4 connectors on the logic board. CONN 1 has 34 pins and connects the logic board to the CPU board. CONN 2 has 50 pins and connects the logic board to the I/O board. CONN 3 has 15 pins and provides input and output connections for the external pressure transducer and relative humidity/temperature sensor. CONN 4 has 2 pins and provides power to the display board.

I/O Board

The I/O board receives inputs from and controls power to the external devices. In a vertical row on the left side of the board are 24 LEDs which light whenever a filter blowdown solenoid is energized. On the right side of the board are 7 LED indicators which light whenever the CPU actuates one of the following output channels:

I/O Board LED Indicators

Note: The functions of these indicators correspond to the I/O channels terminating at connector J4. Refer to Figure 2-6.

NO.	FUNCTION
1	Fault
2	Bulk
3	Recycle
4	Oscillator #2
5	Oscillator #1
6	Sieve
7	Fan (Exhaust)

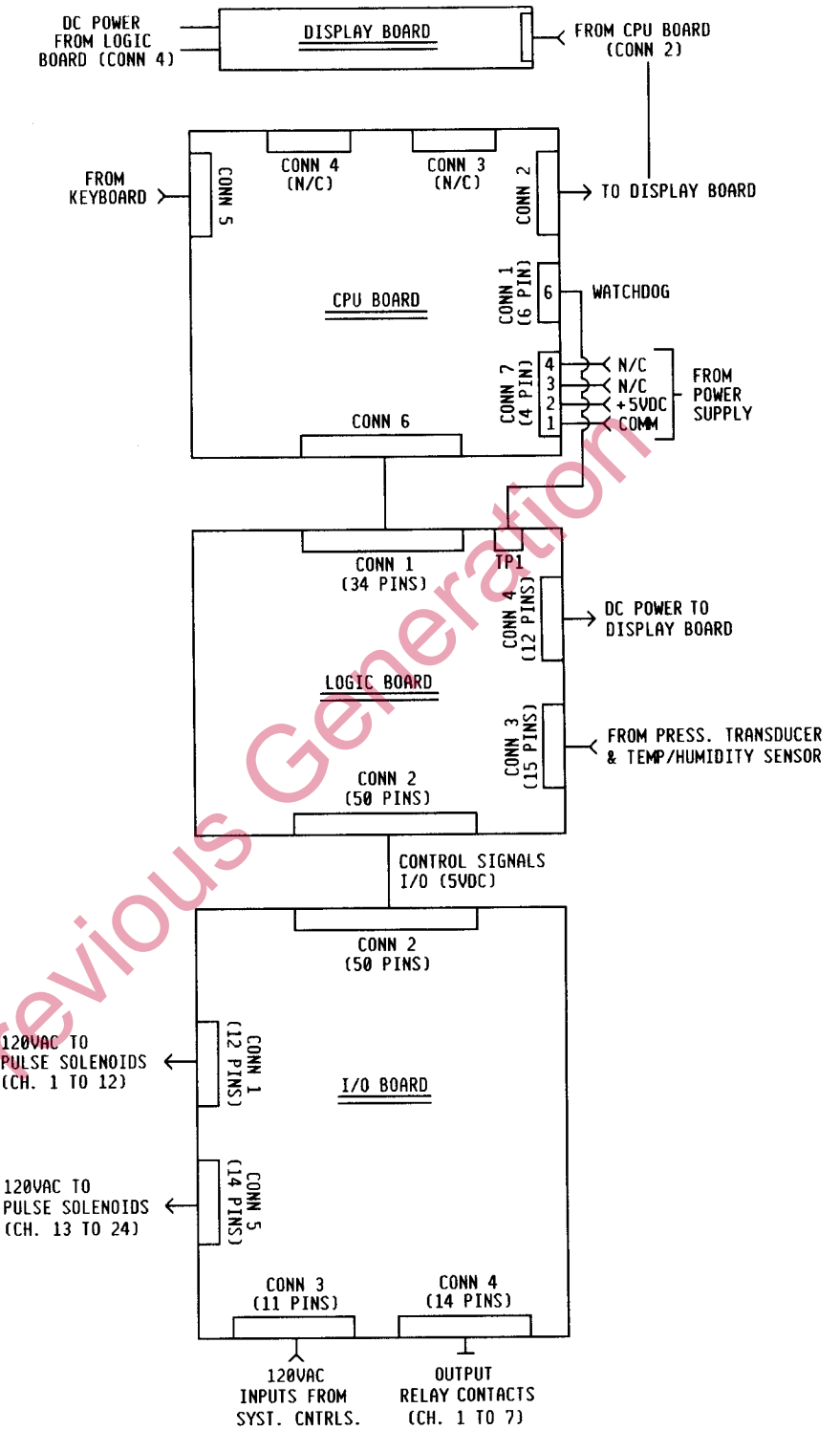

Figure 2-4 — Booth Controller Connector Diagram

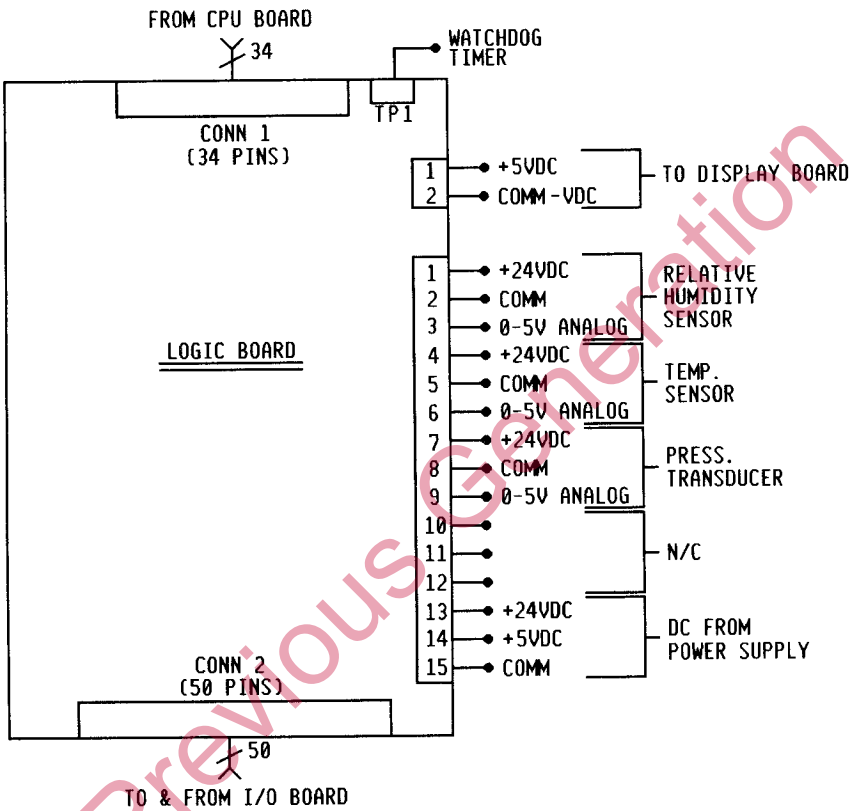

Figure 2-5 — Logic Board Connector Diagram

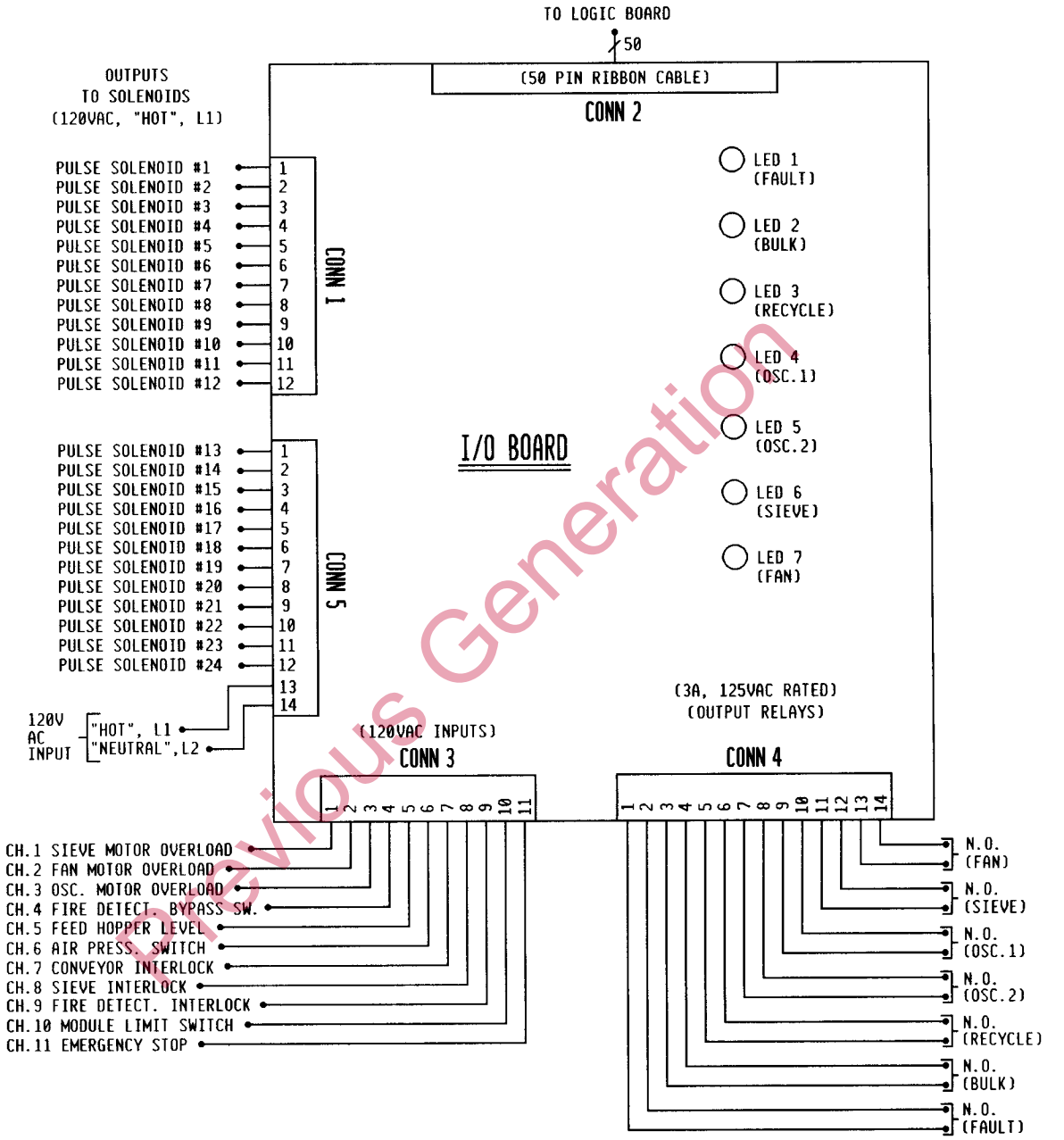

Figure 2-6 — I/O Board Connector Diagram

FIRE DETECTOR

For more information, refer to the system manuals.

POWDER ADDITION SYSTEM

Refer to Figure 2-7.

The Booth Controller can be configured for three possible powder addition schemes to maintain the level of powder in the feed hopper: Add Together, Add Separately, or No Bulk Unloader. The start-up delay is set in Configuration mode and the rest of the delay and duration intervals are set in Program mode or in Run mode.

When the recycle and/or bulk unloader transfer pumps are started, the sieve motor and a timer are also started (if configured). The timer prevents the sieve motor from shutting off for 5 minutes, protecting the motor from constant on/off cycling.

Autostart Operation

If the system is started using the autostart feature the feed hopper powder will be fluidized but the level sensor will not be activated. The powder addition system will not function until the system is in Run mode.

Normal Operation

The powder system is normally started in Run mode. The programmed start-up delay (10 sec. - 5 min.) gives the powder in the feed hopper time to fluidize and open (satisfy) the level switch.

The CPU will disregard a signal from the feed hopper level switch until the expiration of the start-up delay. If the level switch is satisfied the CPU will not activate the powder addition system.

If the level switch is not satisfied at the end of the start-up delay, it will send a signal to the CPU and the CPU will start the recycle delay timer (2 - 180 sec.). This delay allows the powder level to fall further in the feed hopper, preventing constant cycling of the powder addition system. At the end of the delay the CPU will check its memory for the powder addition system configuration.

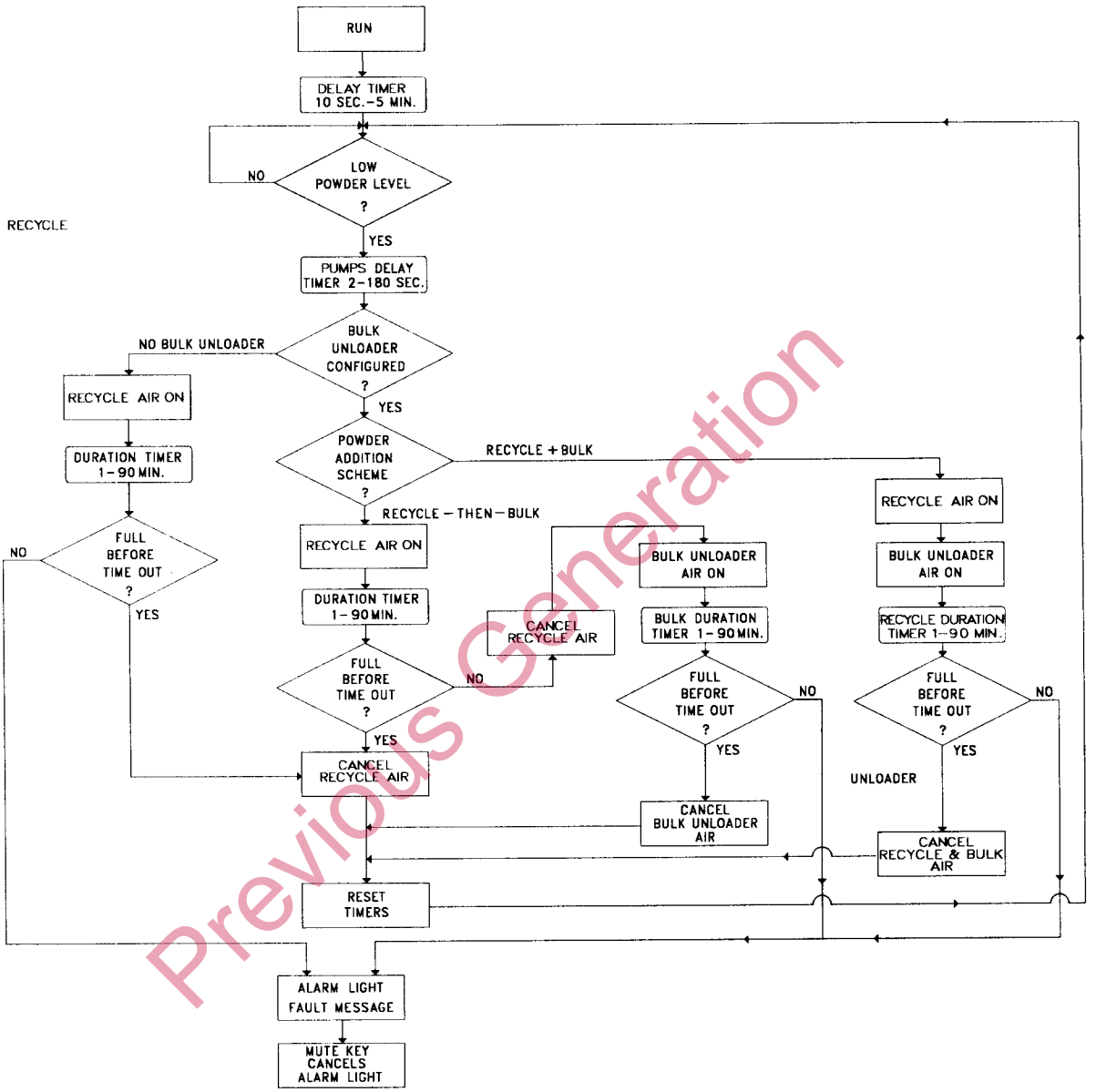

Figure 2-7 — Powder Addition System Flowchart

No Bulk Unloader

If No Bulk Unloader is configured, the CPU activates the sieve motor and timer (if configured), recycle fluidizing air and transfer pumps, and the recycle air duration timer (1 - 90 min.).

At the end of the recycle air duration interval the CPU will, if the level switch is not satisfied, turn on the alarm light and log a Fault message. If the level switch is satisfied before the end of the duration interval, the CPU will shut off the recycle air. The sieve will shut off when the 5 minute timer runs out.

Recycle-Then-Bulk

If the system is configured to Recycle-Then-Bulk, the CPU will turn on the recycle air, sieve and timer (if configured), and start the recycle air duration timer. If the level switch is satisfied before the end of the duration interval, the CPU will shut off the recycle air.

If the level switch is not satisfied, the CPU will shut off the recycle air and turn on the bulk unloader air and the bulk air duration timer (1 - 90 min.). At the end of this duration interval, if the level switch is still not satisfied, the CPU will activate the alarm light and log a Fault message. If the level switch is satisfied before the end of the bulk air duration interval, the bulk unloader air is shut off.

Recycle + Bulk

In this configuration, the CPU turns on recycle air, bulk unloader air, the sieve motor (if configured) and the recycle air duration timer simultaneously. If the level switch is not satisfied at the end of the duration interval, the alarm light is activated and a Fault message is logged.

Duration Interval Time Out

If the feed hopper level switch is not satisfied by powder from the recycle module or the bulk unloader, the alarm light is activated and an error message, "Powder level is low", is logged. Pressing the MUTE ALARM key will shut off the light. The error message will be retained until the level switch is satisfied and the Fault mode is cleared. The system will remain in the Run mode and all devices, including the transfer pumps and sieve will remain in operation. Virgin powder can then be added to the bulk unloader or the recycle module, and spray operations can continue.

SECTION 3

OPERATION

INITIAL START-UP

When the booth controller is "powered up" by pushing the main disconnect switch handle up, several self-tests are run on the controller. The following message is displayed:

```
NORDSON POWDER SYSTEM                VERSION  X.XX
COPYRIGHT NORDSON CORP 1989            SELF TEST
```

If one of the self-tests fail, one of the following messages will be displayed:

```
NORDSON POWDER SYSTEM                VERSION  X.XX
PROM TEST FAILED
```

```
NORDSON POWDER SYSTEM                VERSION  X.XX
* * * BAD NVRAM CHIP * * *
```

```
NORDSON POWDER SYSTEM                VERSION X.XX
* * * BAD CLOCK CHIP * * *
```

If the controller fails one or more of the self-tests, it will not be operational. The indicated memory chip will have to be replaced before operations may begin.

If the following message appears, an error was detected in the clock chip. Press the ENTER key. The clock chip will be reinitialized. It may be necessary to correct the date and time.

```
NORDSON POWDER SYSTEM                VERSION  X.XX
* * * BAD CLOCK CHIP DATA * * * -- PRESS ENTER
```

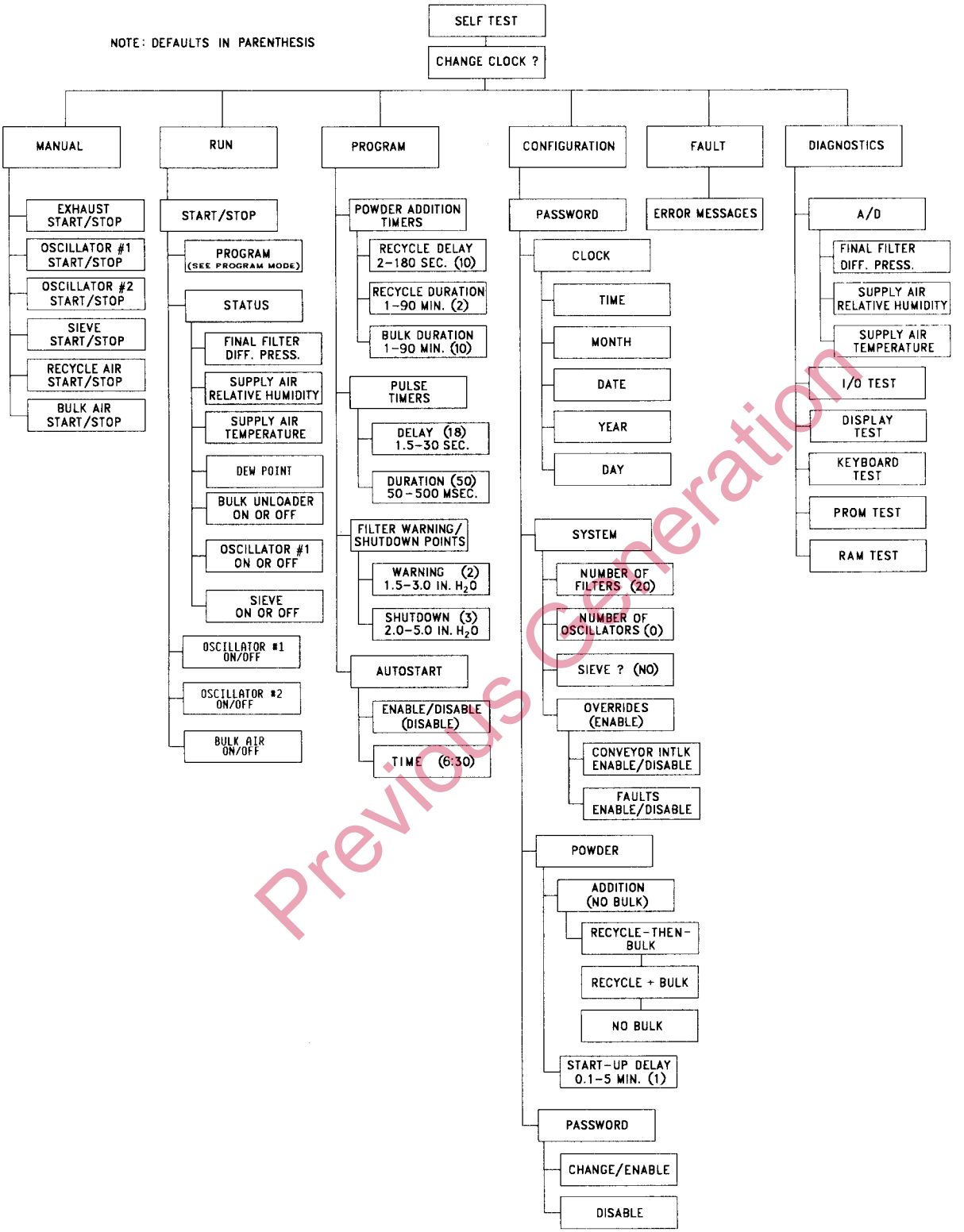

Figure 3-1 — Booth Controller Software Menus

INITIAL START-UP (Cont.)

While the chip is being initialized the following message will be displayed:

NORDSON POWDER SYSTEM	**VERSION X.XX**
INITIALIZING CLOCK CHIP	**PLEASE WAIT**

Assuming that the controller passes the self-tests, the following message will then be displayed:

NORDSON POWDER SYSTEM	**DDD MM/DD/YY**
CHANGE CLOCK ? {NO YES}	**XX:XX AM**

The installer or operator should check the calendar and clock and change them if they are incorrect. The calendar and clock are changed in the Configuration mode. Selecting YES from this display will allow the operator into the clock menu of the Configuration mode only. If NO is chosen, the top level display of the Run mode appears. From this mode, any of the other modes can be entered.

CONFIGURATION MODE

When a new booth controller is installed, it should be configured and programmed before operations begin, unless the default values are to be used. If bad data is somehow written to the NVRAM chip, all configuration and program mode parameters and values will revert to the defaults. The controller will then have to be reconfigured and reprogrammed.

The defaults are:

Number of filter blowdown solenoids	20
Number of oscillators	0
Sieve present	No
Conveyor interlock	Enabled
Noncritical faults	Enabled
Powder addition system	No Bulk
Powder delay	1 min.
Password	123, Enabled

CONFIGURATION MODE (Cont.)

In configuration mode, the operator:

- sets the clock,
- tells the controller what devices the powder system consists of,
- sets up the powder addition scheme,
- enters the start-up delay timer interval,
- enables or disables the password, conveyor interlock, and warning and shutdown overrides.

Once a system is configured, it should not be necessary to re-enter Configuration mode unless modifications are made to the system hardware. Enabling a new password will prevent tampering with the system configuration.

To enter the Configuration mode, the installer or operator presses the Program and Run keys simultaneously. The first display asks for a password, if the password is currently enabled:

```
ENTER PASSWORD _____
```

Controllers are shipped with the default password 123. Enter this password, or the current password, using the numeric keys and press the ENTER key. If a mistake is made while entering the password, pressing the left arrow key will erase the entry and allow the operator to start over.

If the password was Disabled prior to entering Configuration mode, the following display would appear immediately upon entering Configuration mode:

```
CONFIG
SELECT: {CLOCK SYSTEM POWDER PASSWORD}
```

This is the Configuration mode main menu. Any one of the other mode keys can be used to exit this menu.

CONFIGURATION MODE (Cont.)

CLOCK MENU:

CONFIG CLOCK SELECT: {TIME MONTH DATE YEAR DAY}

All clock features except DAY are set by scrolling values up or down using the up and down arrow keys and pressing the ENTER key when the desired value is displayed. The display will then return to the Clock menu (except when setting DAY).

TIME:

CONFIG CLOCK TIME ENTER TIME XX:XXAM

Using a 12 hour clock (AM/PM), enter the current time.

MONTH:

CONFIG CLOCK MONTH ENTER MONTH XX

Enter month (2 digits).

DATE:

CONFIG CLOCK DATE ENTER DAY OF MONTH XX

Enter date (2 digits).

YEAR:

CONFIG CLOCK YEAR ENTER YEAR XX

Enter year (2 digits).

CONFIGURATION MODE (Cont.)

CLOCK MENU (Continued)

DAY:

```
CONFIG CLOCK DAY {SUNDAY}
SELECT: {SUN MON TUE WED THU FRI SAT}
```

The current day of the week is displayed in brackets on the top line. If the displayed day is incorrect, use the left or right arrow keys to move the cursor to the correct day and press the ENTER key. The day selected will be entered into the CPU's memory. Pressing the EXIT key will return the display to the Clock menu.

Press the EXIT key to return to the Configuration mode main menu from the Clock menu.

SYSTEM MENU:

```
CONFIG SYSTEM
SELECT: {FILTER OSC SIEVE OVERRIDE}
```

This menu allows the operator to set the number of filter cartridge blowdown solenoids present in the booth; the number of oscillators to be used; add a sieve to the system; to enable or disable the non-critical system shutdowns. Pressing the EXIT key will return the display to the Configuration mode main menu from this menu.

FILTERS:

```
CONFIG SYSTEM FILTERS
ENTER FILTER SOLENOIDS          XX
```

The Default is 20. The maximum number of filters that can be entered is 20, the minimum is 2. Only an even number of filters will be displayed. The operator uses the up and down arrow keys to scroll the values displayed. Pressing the ENTER key enters the number selected into memory and returns the display to the System menu.

CONFIGURATION MODE (Cont.)

SYSTEM MENU (Continued)

Note: The volume of air supplied to the manifold must be sufficient to allow manifold pressure to recover between pulses, and the manifold must have the capacity to supply a sufficient volume of air to properly clean the cartridge filters.

If there are 16 solenoids on the manifold and only the number 8 is entered, the controller will energize two solenoids (1 & 9, then 2 & 10, etc.) at the same time, which could result in cartridge plugging if the air supply is insufficient or the manifold is undersized. The actual number of filters in the booth should be entered, if possible, for optimum performance.

OSC:

```
CONFIG SYSTEM OSCILLATORS {NONE}
SELECT: {NONE ONE TWO}
```

The current configuration is displayed in brackets on the top line. Use the left or right arrow keys to move the cursor to the desired selection and press the ENTER key. The Default is NONE.

Pressing the EXIT key will return the display to the System menu.

SIEVE:

```
CONFIG SYSTEM SIEVE {NO}
SELECT: {NO YES}
```

The current configuration is displayed in brackets on the top line. Press the ENTER key to add or delete a sieve. The Default is NO sieve. Pressing the EXIT key will return the display to the System menu.

CONFIGURATION MODE (Cont.)

SYSTEM MENU (Continued)

OVERRIDE:

```
CONFIG SYSTEM OVERRIDE
SELECT: {CONVEYOR FAULTS}
```

This menu allows the operator to enable or disable the following automatic system shutdowns, if desired.When an override is "enabled", the interlock it applies to is operational. Pressing the EXIT key will return the display to the System menu.

CONVEYOR:

```
CONFIG SYSTEM OVRD CONV INTLK {DISABLED}
SELECT: {DISABLE ENABLE}
```

The current configuration is displayed in brackets on the top line. Press the ENTER key to enable or disable the conveyor interlock. The Default is ENABLE. Pressing the EXIT key will return the display to the Override menu.

FAULT:

```
CONFIG SYSTEM OVRD FAULTS {DISABLED}
SELECT: {DISABLE ENABLE}
```

Low or high final filter pressure differentials or system air supply high humidity can cause a non-critical shutdown. The above display allows the operator to enable or disable non-critical shutdowns.

The current configuration is displayed in brackets on the top line. Press the ENTER key to enable or disable the shutdowns. The Default is ENABLE. Pressing the EXIT key will return the display to the Override menu.

CONFIGURATION MODE (Cont.)

POWDER MENU:

This menu allows the operator to tell the controller the powder addition (make-up) scheme to be used to satisfy the feed hopper level sensor, and to set the start-up timer. Pressing the EXIT key will return the display to the Configuration mode main menu from this display.

```
CONFIG POWDER
SELECT: {ADDITION DELAY}
```

ADDITION:

```
CONFIG POWDER ADDITION {NO BULK}
SELECT: {NO-BULK RCYL+BULK RCYL-THN-BULK}
```

RCYL-THN-BULK (Recycle - Then - Bulk): The Recycle fluidizing and transfer pump air is turned on first and the recycle duration timer is started. If the feed hopper level sensor is not satisfied at the end of the duration interval (set in Program mode), the recycle air is shut off. The bulk unloader fluidizing and transfer pump air is turned on and the bulk duration timer is started. If the feed hopper level sensor is not satisfied at the end of the bulk duration interval, bulk unloader air is shut off and a buzzer and warning light comes on. If the feed hopper level sensor is satisfied at any point during the make-up process, recycle or bulk air is shut off.

RCYL+BULK (Recycle - Plus - Bulk): This scheme turns on both the recycle air and bulk unloader air simultaneously, and starts a duration timer.

NO-BULK (Default): This scheme allows only the recycle air to be turned on. The bulk unloader is configured out of the system.

The current configuration is displayed in brackets on the top line. Use the left or right arrow keys to move the cursor to the desired configuration and press the ENTER key. Pressing the EXIT key will return the display to the Powder menu.

CONFIGURATION MODE (Cont.)

POWDER MENU (Continued)

DELAY:

CONFIG POWDER DELAY	
ENTER STARTUP DELAY:	X.X (MIN)

The Timer range is 0.1 to 5 minutes in 0.1 minute increments. The Default is 1 minute. Use the up and down arrow keys to scroll the display until the desired value is displayed, then press the ENTER key, which will enter the value chosen and return the display to the Powder menu.

The startup delay timer allows powder in the feed hopper time to become fluidized before the powder addition system is started. If sufficient powder is present in the hopper, it will expand and satisfy the level sensor during the delay interval, preventing feed hopper overfill. This delay timer functions only when the system is started from a complete shutdown.

PASSWORD MENU:

CONFIG PASSWORD
SELECT: {CHANGE/ENABLE DISABLE}

This menu allows the operator to change or enable the password, or to disable the password. Pressing the EXIT key will return the display to the Configuration mode main menu.

CHANGE/ENABLE:

CONFIG PASSWORD CHANGE
ENTER CURRENT PASSWORD _____

If the password is enabled, the operator must first enter the current password (up to 9 numeric characters). If an error is made while entering the password, pressing the left arrow key will erase the incorrect entry and allow the password to be re-entered.

CONFIGURATION MODE (Cont.)

PASSWORD MENU (Continued)

If the password entered is invalid, the following error message will be displayed:

```
CONFIG PASSWORD CHANGE
INVALID PASSWORD
```

Pressing the EXIT key will return the display to the Password menu.

If the password entered is valid, or the password is disabled, the following display will appear next:

```
CONFIG PASSWORD CHANGE
ENTER NEW PASSWORD _____
```

Use the numeric keys to enter the new password and press the ENTER key to set.

The following display will then appear:

```
CONFIG PASSWORD CHANGE
RE-ENTER NEW PASSWORD _____
```

The new password must be entered twice. If the same password is not entered twice and the password was previously disabled, the following message will be displayed:

```
CONFIG PASSWORD CHANGE
INCORRECT ENTRY
```

Pressing the EXIT key will return the display to the Password menu.

CONFIGURATION MODE (Cont.)

PASSWORD MENU (Continued)

If the same password is not entered twice, and the password was previously enabled, the following message will be displayed:

```
CONFIG PASSWORD CHANGE
OLD PASSWORD IN EFFECT
```

Pressing the EXIT key will return the display to the Password menu.

Once the new password has been entered twice, the following display will appear:

```
CONFIG PASSWORD CHANGE
NEW PASSWORD IN EFFECT
```

DISABLE:

```
CONFIG PASSWORD DISABLE
PASSWORD HAS BEEN DISABLED
```

If the operator selects DISABLE and presses the ENTER key, the password, if previously enabled, will be disabled and the message above will be displayed. Pressing the EXIT key will return the display to the Password menu.

If the password was already disabled, the following display will appear:

```
CONFIG PASSWORD DISABLE
PASSWORD ALREADY DISABLED
```

Pressing the EXIT key will return the display to the Password menu.

PROGRAM MODE

Program mode is used to set values for the powder addition timers, the cartridge filter blowdown (Pulse) solenoid delay and duration timers, the final filter differential pressure warning and shutdown points, and the autostart timer. The autostart feature can be enabled or disabled.

On initial start-up, the operator can choose to begin operating the system with the Default values, or go into Program mode and change the values to meet system requirements.

The Defaults are:

Recycle Delay Timer:	10 seconds
Recycle Duration Timer:	2 minutes
Bulk Duration Timer:	10 minutes
Pulse Delay Timer:	18 seconds
Pulse Duration Timer:	50 milliseconds
Final Filter Warning:	2 in. H_2O
Final Filter Shutdown:	3 in. H_2O
Autostart:	Disabled
Autostart Timer:	6:30 AM

Entering Program mode while operating automatically in Run mode or while operating a device in Manual mode will shut down the system or device(s).

Program mode is entered by pressing the Program mode key. The Program mode main menu is:

PROGRAM
SELECT: {TIMERS PULSE FILTER AUTO}

The main menu allows the operator to select between four different menus: Timers, Pulse, Filter, and Auto.

PROGRAM MODE (Cont.)

TIMER MENU:

PROGRAM TIMERS **SELECT [PUMP RECYCLE BULK]**

This menu allows the operator to set the Recycle fluidizing and transfer pump air delay timer, the Recycle fluidizing and transfer pump air duration timer, and the Bulk transfer air duration timer. Pressing the EXIT key while this menu is displayed will return the display to the Program mode main menu.

PUMPS:

PROGRAM TIMER PUMPS	
ENTER PUMPS DELAY ON	**XXX (SEC)**

This display allows the operator to alter the transfer pump delay timer. This timer is started when the feed hopper level sensor sends a low level signal to the CPU. The delay and duration timers allow the operator to control the powder addition system cycle times.

The up/down arrow keys are used to scroll values. Pressing the ENTER key will enter a desired value into memory and will return the display to the program timers menu.

The programmable range is 2 to 180 seconds in 1 second increments. The Default is 10 seconds. The up and down arrow keys are used to alter (scroll) displayed values. Pressing the ENTER key will enter a desired value into memory and will return the display to the previous menu.

RECYCLE:

PROGRAM TIMER RECYCLE	
ENTER RECYCLE DURATION TIME	**XX (MIN)**

This display allows the operator to program the recycle air duration timer. If the feed hopper level sensor is not satisfied by the end of this interval the controller will activate the warning device

PROGRAM MODE (Cont.)

TIMER MENU (Continued)

and record a fault message which is accessible through the Fault mode. If a bulk unloader is configured into the system, the controller will shut off the recycle air and start the bulk unloader air and duration timer.

The programmable range is 1 to 90 minutes in 1 minute increments. The Default is 2 minutes. The up and down arrow keys are used to alter (scroll) displayed values. Pressing the ENTER key will enter a desired value into memory and will return the display to the previous menu.

BULK:

PROGRAM TIMERS BULK **ENTER BULK DURATION TIME XX (MIN)**

This display allows the operator to set the bulk unloader air duration timer. If the feed hopper level sensor is not satisfied by the end of this interval the controller will activate the warning device and record a fault message which is accessible through the Fault mode.

The programmable range is 1 to 90 minutes in 1 minute increments. Default is 10 minutes. The up and down arrow keys are used to alter (scroll) displayed values. Pressing the ENTER key will enter a desired value into memory and will return the display to the previous menu.

PULSE (BLOWDOWN) MENU:

PROGRAM PULSE **SELECT: {DELAY DURATION}**

This menu allows the operator to set the filter cartridge pulse solenoid delay and duration timers. To avoid damaging a solenoid by exceeding the rated duty cycle, the ratio of duration to delay times must be maintained at 1:120. The CPU will not allow this duty cycle to be violated.

PROGRAM MODE (Cont.)

PULSE (BLOWDOWN) MENU (Continued)

Pressing the EXIT key while this menu is displayed will return the display to the Program mode main menu.

If, for example, the delay interval is set first, only those duration times that do not violate the duty cycle will appear on the display. Scrolling will stop at the last value within the duty cycle. The duty cycle is dependent on the number of solenoids configured into the system in Configuration mode.

Note: The operator can enter Configuration mode and change the number of solenoids after the delay and duration timer values have been set in Program mode. The delay and duration timer values can be rendered invalid by this procedure and attempts to start the system in Run mode would then be prevented. An error message will be displayed if this happens.

DELAY:

PROGRAM PULSE DELAY	
ENTER PULSE DELAY TIME	**X.X (SEC)**

The programmable range is 1.5 to 30 seconds. The Default is 18 seconds. The up and down arrow keys are used to alter (scroll) displayed values. Pressing the ENTER key will enter a desired value into memory and will return the display to the previous menu.

DURATION:

PROGRAM PULSE DURATION	
ENTER PULSE DURATION TIME	**XXX (MSEC)**

The programmable range is 50 to 500 milliseconds. The Default is 50 milliseconds. The up and down arrow keys are used to alter (scroll) displayed values. Pressing the ENTER key will enter a desired value into memory and will return the display to the previous menu.

PROGRAM MODE (Cont.)

FILTER MENU:

PROGRAM FILTER SELECT: {WARNING SHUTDOWN}

This menu allows the operator to set final filter differential pressure warning and system shutdown values in inches of water. Pressing the EXIT key while this menu is displayed will return the display to the Program mode main menu.

If the differential pressure exceeds the warning level, the warning device(s) are activated and a fault message is recorded. Pressing the ALARM RESET key will silence the warning device(s) for one hour. The system can still be operated, but the red fault LED next to the Fault mode key will continue to flash and the fault message will remain in the CPU's memory until the problem is fixed and the Fault mode is cleared.

If the differential pressure exceeds the shutdown point, the whole system will be shutdown, the warning device(s) will be activated and a fault message will be recorded. The system cannot be started until the problem has been fixed and the fault message cleared.

WARNING:

PROGRAM FILTER WARNING	
FILTER WARNING POINT	X.X (IN. H_2O)

The programmable range is 1.5 to 3 in. H_2O. The Default is 2 inches. The up and down arrow keys are used to alter (scroll) displayed values. Pressing the ENTER key will enter a desired value into memory and will return the display to the previous menu.

PROGRAM MODE (Cont.)

PULSE (BLOWDOWN) MENU (Continued)

SHUTDOWN:

PROGRAM FILTER SHUTDOWN	
FILTER SHUTDOWN POINT	X.X (IN. H_2O)

The programmable range is 2 to 5 in. H_2O. The value set must be equal to or greater than the warning value. The Default is 3 inches. The up and down arrow keys are used to alter (scroll) displayed values. Pressing the ENTER key will enter a desired value into memory and will return the display to the previous menu.

AUTOSTART MENU:

PROGRAM AUTOSTART
SELECT: {ON/OFF TIME}

This menu allows the operator to enable or disable the autostart feature and set on a 24 hour clock the time at which the CPU will automatically turn on the booth exhaust fan and feed hopper fluidizing air. Pressing the EXIT key while this menu is displayed will return the display to the Program mode main menu menu.

When the autostart feature is enabled, the Program LED will blink until disabled. The warning device(s) will be activated for 5 seconds before the fan and fluidizing air are started. The autostart feature becomes disabled when the system starts and must be re-enabled each time it is to be used.

ON/OFF:

PROGRAM AUTOSTART ON/OFF {DISABLED}
SELECT: {DISABLE ENABLE}

The current status of the autostart feature is displayed in brackets on the top line. Pressing the ENTER key will enable or disable the feature, depending on the choice available on the bottom line. The Default is DISABLED. Press the EXIT key to return to the AutoStart menu.

PROGRAM MODE (Cont.)

AUTOSTART MENU (Continued)

TIME:

PROGRAM AUTOSTART TIME	
ENTER AUTOSTART TIME	XX:XXAM

Use the up and down arrow keys to alter (scroll) the displayed time and press the ENTER key to set the displayed time into memory and return to the AutoStart menu. The Default is 6:30AM.

DAILY OPERATION

Normally, only the Run mode will be used for daily operation. Manual mode may be used if full automatic mode is not desired. The autostart timer described under Program mode may be enabled at the end of the last shift of the previous day so that when operations start the exhaust fans will be running and powder in the feed hopper will be thoroughly fluidized.

RUN MODE

When the system is first activated, the first displays described in this section appear. If the operator chooses NO in response to the question CHANGE CLOCK? the Run Menu appears:

RUN	XX:XXAM
WAITING FOR START COMMAND {START}	

From this display, any of the other modes may be entered. If the operator presses the ENTER key with the cursor on "Start", the startup sequence, as programmed, will begin. The booth controller will sequentially start the exhaust fan (if not started by the autostart feature), cartridge filter pulsing (blowdown), feed hopper fluidization, and the automatic powder addition system. The sieve, if configured into the system, will be started automatically whenever the recycle or bulk air is turned on.

RUN MODE (Cont.)

To prevent constant on/off cycling of the sieve motor, a 5 minute timer is started at the same time as the sieve. If the transfer pumps are shut off after less than 5 minutes, the sieve will continue to run.

If the programmed cartridge filter pulse delay/duration timer values are invalid, the following message will be displayed when an attempt to start the booth controller is made:

```
RUN **ERROR**                                XX:XXAM
INVALID PULSE DELAY/DURATION
```

The controller will not allow the booth to be started until the error is corrected in Program mode.

The controller also checks the validity of the configuration and program data. If the data is found to be invalid, the controller performs a test of the NVRAM chip and if it is found to be defective, the following message will be displayed:

```
RUN                                          XX:XXAM
* * * BAD NVRAM CHIP * * *
```

The defective chip must be replaced before operations can continue.

If the NVRAM chip is not malfunctioning but the configuration or program data is invalid, the controller will revert to the default values for that data found to be invalid. One or both of the following messages will be displayed:

```
RUN                                          XX:XXAM
DEFAULTS SET - PROGRAM YOUR SYSTEM
```

```
RUN                                          XX:XXAM
DEFAULTS SET - CONFIGURE YOUR SYSTEM
```

RUN MODE (Cont.)

The operator can choose to continue operating with the default values by simply pressing the EXIT key, or configuration and program modes can be entered and the parameters and values reset before continuing operations. These messages will also be displayed on initial start-up if the configuration parameters and program values were not set before the controller was started.

The following menu is displayed once the controller is started:

```
RUN                                              XX:XXAM
SELECT: {STOP  PROG  STATUS  OSC1  OSC2  BULK}
```

The cursor will remain on the STOP selection during system operation unless moved by the operator, allowing the system to be shut down immediately by pressing the ENTER key.

Selecting PROG allows the operator to alter values set in PROGRAM mode without shutting down the system. The menus displayed when PROG is selected are the same as those in PROGRAM mode. Refer to PROGRAM mode for an explanation of these menus.

Selecting STATUS displays another menu, allowing the operator to monitor the operating status of system devices and the powder addition system. Values for supply air relative humidity and temperature can also be displayed.

Selecting OSC1 or OSC2 allows the operator to turn the oscillators on or off. For safety reasons, the oscillators will not be started automatically by the booth controller.

Selecting BULK allows the operator to force the bulk unloader on or off. If, during automatic operation, both recycle and bulk unloader powder supply run out, the bulk unloader can be refilled with virgin powder and this powder can then be pumped into the feed hopper to satisfy the level sensor.

RUN MODE (Cont.)

PROGRAM MENU:

This function allows the operator to alter programmable parameters while the system is running.

RUN PROGRAM	**XX:XXAM**
SELECT: {TIMERS PULSE FILTER AUTO}	

"TIMERS", "PULSE", "FILTER", and "AUTO" menus are used exactly as described previously under "PROGRAM MODE" in this section.

STATUS MENU:

RUN STATUS	**XX:XXAM**
SELECT: {FILTER RH TMP DP BLK O1 O2 RCY SVE}	

This menu allows the operator to check, (while the booth is running), final filter differential pressure (FILTER), supply air relative humidity (RH), temperature (TMP), and supply air dew point (DP). The operating status of recycle air (RCY), (if configured) bulk unloader air (BLK), oscillators (O1 or O2), and the sieve (SVE) can be monitored. All status displays are continuously updated. Pressing the EXIT key after checking the status of a device will return the display to the Status menu.

If the operator tries to check the status of a device which is not configured into the system, the following message will be displayed for 5 seconds:

RUN STATUS (device name)	**XX:XXAM**
Device not configured	

RUN MODE (Cont.)

STATUS MENU (Continued)

FILTER:

RUN STATUS FILTER	XX:XXAM
FILTER PRESSURE = X.X	

When selected, this display shows the final filter differential pressure and the present time.

RH:

RUN STATUS RH	XX:XXAM
RELATIVE HUMIDITY = XXX (%)	

When selected, this display shows the supply air relative humidity and the present time.

TMP:

RUN STATUS TEMP
TEMPERATURE = XXX (DEG. F)

When selected, this display shows the supply air temperature and the present time.

DP:

RUN STATUS DEW POINT	XX:XXAM
DEW POINT = XX (DEG. F)	

When selected, this display shows the supply air dew point.

RUN MODE (Cont.)

STATUS MENU (Continued)

BLK:

RUN STATUS BULK	**XX:XXAM**
BULK UNLOADER IS OFF	

When selected, this display shows bulk unloader air status and the present time.

O1:

RUN STATUS OSCILLATOR #1	**XX:XXAM**
OSCILLATOR ONE IS ON	

When selected this display shows oscillator #1 status and the present time.

O2:

RUN STATUS OSCILLATOR #2	**XX:XXAM**
OSCILLATOR TWO IS ON	

When selected this display shows oscillator #2 status and the present time.

RCY:

RUN STATUS RECYCLE	**XX:XXAM**
RECYCLE AIR IS ON	

When selected this display shows recycle fluidizing and transfer pump air status and the present time.

RUN MODE (Cont.)

STATUS MENU (COntinued)

SVE:

RUN STATUS SIEVE	**XX:XXAM**
SIEVE IS ON	

When selected this display shows sieve (if configured) status and the present time. The sieve will start whenever the recycle or bulk unloader air is turned on.

STARTING OSCILLATORS

The oscillators can be started by returning to the RUN mode menu, which appears after the booth controller has been started, and moving the cursor to OSC1 or OSC2. Press the EXIT key to return the display to the Run menu.

OSC1:

RUN OSCILLATOR #1 (OFF)	**XX:XXAM**
SELECT: {ON}	

Pressing the ENTER key will start oscillator #1. The following display will then appear:

RUN OSCILLATOR #1 (ON)	**XX:XXAM**
SELECT: {OFF}	

The cursor will be on OFF, allowing the operator to immediately shut down the oscillator by pressing the ENTER key.

If the operator should try to start an oscillator that has not been configured into the system, the following error message will appear:

RUN OSCILLATOR #X	**XX:XXAM**
Not configured or prerequisite not met	

RUN MODE (Cont.)

This message will be displayed for 5 seconds, after which the Run mode menu will return.

OSC2:

The displays for OSC2 are the same as those for OSC1.

STARTING THE BULK UNLOADER

The bulk unloader transfer pump air can be started by returning to the RUN mode menu, which appears after the booth controller has been started, and moving the cursor to BULK. Press the EXIT key to return the display to the Run menu.

BULK:

```
RUN BULK UNLOADER (AUTO)          XX:XXAM
SELECT: {FORCE-ON}
```

Pressing the ENTER key will start the bulk unloader air. This disables the automatic powder addition feature. The following display will then appear:

```
RUN BULK UNLOADER (FORCED-ON)     XX:XXAM
SELECT: {AUTO}
```

The cursor will be on AUTO, allowing the operator to immediately shut off the bulk unloader air and re-enable the automatic powder addition system.

If the operator should try to start the bulk unloader when it has not been configured into the system, the following error message will appear:

```
RUN BULK UNLOADER                 XX:XXAM
Not configured or prerequisite not met
```

This message will be displayed for 5 seconds, after which the Run mode menu will return.

MANUAL MODE

Manual mode allows the operator to activate system devices or the powder addition system manually. Once activated, they will remain on until the operator either turns them off manually or changes modes.

The exhaust fan is a prerequisite to any other device. It must be turned on before any other devices can be activated. Also, if the sieve is configured into the system, it must be turned on before the recycle and/or bulk transfer pump air can be turned on.

Pressing the Manual mode key will shut down the system, if operating, and the following menu will be displayed:

```
MANUAL
SELECT: {EXH OSC1 OSC2 SVE RCY BLK}
```

An attempt to turn on a device that is not configured into the system or for which the prerequisite has not been met will cause the following error message to be displayed for 5 seconds:

```
MANUAL (device name)
Not configured or prerequisite not met
```

EXH:

```
MANUAL EXHAUST FAN (OFF)
SELECT: {ON}
```

Pressing the ENTER key will turn on the exhaust fan and the following display will then appear:

```
MANUAL EXHAUST FAN (ON)
SELECT: {OFF}
```

Pressing the ENTER key again will turn off the exhaust fan. Pressing the EXIT key will return the display to the Manual mode menu.

MANUAL MODE (Cont.)

OSC1:

```
MANUAL OSCILLATOR #1 (OFF)
SELECT: {ON}
```

Pressing the ENTER key will turn oscillator #1 on, if oscillator #1 has been configured into the system and the exhaust fan has been turned on. The following display will then appear:

```
MANUAL OSCILLATOR #1 (ON)
SELECT: {OFF}
```

Pressing the ENTER key again will turn off oscillator #1. Pressing the EXIT key will return the display to the Manual mode menu.

OSC2:

Oscillator #2 is turned on and off in the same manner as oscillator #1.

SVE:

```
MANUAL SIEVE (ON)
SELECT: {OFF}
```

Pressing the ENTER key will turn the sieve on, provided the sieve has been configured into the system and the exhaust fan has been turned on first. The following display will then appear:

```
MANUAL SIEVE (OFF)
SELECT: {ON}
```

Pressing the ENTER key again will turn the sieve off. Pressing the EXIT key will return the display to the Manual mode menu.

MANUAL MODE (Cont.)

RCY:

MANUAL RECYCLE AIR (ON) **SELECT: {OFF}**

Pressing the ENTER key will turn the recycle transfer pump air on, if the exhaust fan and sieve have been turned on first. The following display will then appear:

MANUAL RECYCLE AIR (OFF) **SELECT: {ON}**

Pressing the ENTER key again will turn off the recycle air. Pressing the EXIT key will return the display to the Manual mode menu.

BLK:

MANUAL BULK UNLOADER (OFF) **SELECT: {ON}**

Pressing the ENTER key will turn on the bulk unloader transfer pump air, if it has been configured into the system and the exhaust fan and sieve have been activated. The following display will then appear:

MANUAL BULK UNLOADER (ON) **SELECT: {OFF}**

Pressing the ENTER key again will shut off the bulk unloader. Pressing the EXIT key will return the display to the Manual mode menu.

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SECTION 4

PREVENTIVE MAINTENANCE

It is important to exercise good housekeeping practices with all components of an electrostatic powder spray system. Allowing dust and powder to accumulate in the spray area, inside the booth, and on equipment increases the probability of personal injury or property damage resulting from electrocution, fire or explosion. The entire system and spray area should be cleaned on a regular basis.

- Check air filtration system daily. Drain oil/water separators daily and replace filters when necessary.

- Check operation of air drier at least once a week. Refer to original manufacturer's service recommendations. Clean, dry air is essential for efficient and safe operation.

- Clean powder spray guns and pumps daily. Use compressed air to blow powder from guns, pumps, and feed hoses. NEVER blow powder backwards from gun to pump or pump to power units. Do not use sharp objects to clean powder contact parts as scratches in machined surfaces will cause powder buildup and impact fusion at those points and affect the operation of the system.

- Maintain dust-tight integrity of electrical enclosures in the spray area. Powder infiltrating enclosures and building up on electrical components can cause shorts and component failure and may result in electrocution hazards, fires, or explosions. Wipe powder and dust off all external surfaces daily.

- Check gun resistor and electrostatic cable resistances with a megohm meter regularly. Refer to the appropriate gun manual for the proper resistance values.

- Check all equipment ground connections on a regular basis. A poor ground could cause sparking, which could trigger a fire.

- Check final filter pressure differentials regularly. Restricted filters could result in poor powder containment within the booth and create a safety hazard if the minimum explosion concentration exceeds safe limits. No powder should be present in final exhaust plenum. Clean or replace cartridge filters as necessary.

- Clean booth daily with a rubber squeegee or other non-conductive, non-sparking device. Extensive cleaning should be done on a weekly or bi-weekly basis. Exhaust fans should always be on while the booth is being cleaned.

- Fire detection systems should be inspected daily. Detector head lenses should be cleaned every four hours, or even more frequently, if necessary.

- System safety interlocks should be checked daily for proper operation.

SECTION 5

TROUBLESHOOTING

WARNING- Disconnect, tag, and lock out external electrical power before opening panel doors or replacing any electrical components.

WARNING- To avoid personal injury or death, never touch exposed connections or components when power is ON. Dangerous voltages exist inside electrical panels.

WARNING- Do not perform internal service or adjustment on any equipment unless another person capable of rendering emergency first aid and CPR is present.

FAULT MODE

DESCRIPTION

The Fault mode is used by the operator to obtain diagnostic messages that are logged by the CPU when an error condition occurs. The Fault mode may be entered at any time from any other mode without interrupting operations. The up and down arrows are used to scroll through the error messages. The EXIT key is used to clear the error message after the problem has been corrected and to return to the mode the controller was in prior to entering the Fault mode.

Whenever a condition occurs which results in the logging of an error message, a warning device is activated, along with the red LED on the keyboard. The MUTE ALARM key will shut off only the device; the LED will remain on and the error message will remain in the CPU's memory until the fault is corrected and the error message is cleared.

Error messages can result from either warning or shutdown conditions. A warning condition has no effect other than to cause a message to be logged. A shutdown condition results in either a partial or full system shutdown as well as causing an error message to be logged.

FAULT MODE (Cont.)

DISPLAYS

When the Fault mode is entered and no errors have been logged, the following message will be displayed:

```
*** FAULT DISPLAY ***
NO ERRORS LOGGED
```

Sieve Interlock

If the sieve hatch is left open or opens during operation, a partial shutdown occurs (if a sieve is configured into the system). Recycle air, bulk air and sieve motor are shut off and the following message will be displayed:

```
*** FAULT DISPLAY ***
Hatch on sieve is open
```

Conveyor Interlock

This interlock may be disabled in Configuration mode. The interlock contacts are normally closed. If the conveyor should stop during operation, a full shutdown will occur and the following message will be displayed:

```
*** FAULT DISPLAY ***
Transfer line stopped
```

Powder Module Limit Switch(es)

Limit switches are installed on the recycle powder module and wired in series. They will prevent system start up if the powder module is incorrectly mated to the booth, and will cause a full system shut down if an attempt is made to remove the module while the system is operating. The following error message will be displayed:

FAULT MODE (Cont.)

*** FAULT DISPLAY ***
Safety switch open

Emergency Stop Contacts

Pressing the emergency stop pushbutton disconnects power to the I/O board, resulting in a full system shutdown. The pushbutton contacts latch open, the button must be rotated for the contacts to close. The following error message will be displayed if the contacts are open:

*** FAULT DISPLAY ***
Emergency system stop engaged

Flame Detection System Contacts (Optional Equipment)

If the fire detection system detects a fire within the booth, a full system shutdown will occur. The following error message will be displayed:

*** FAULT DISPLAY ***
Flame detected in booth

Air Supply Pressure Switch

A pressure switch located in the gauge panel senses system air pressure. If the pressure should drop below 35psi (2.3 bar) the switch contacts will open, causing a full system shutdown. The following error message will be displayed:

*** FAULT DISPLAY ***
Low air supply pressure

Exhaust Fan Motor Starter Overload

If the exhaust fan motor starter senses an excessive current draw, the overload protector normally closed contacts will open and cause a full system shutdown. The following error message will be logged:

FAULT MODE (Cont.)

***** FAULT DISPLAY *****
Motor overload on exhaust fan

Sieve Motor Starter Overload

If the sieve motor starter senses an excessive current draw, the overload protector normally closed contacts will open and cause a partial system shutdown. Power to the sieve motor, recycle air, and bulk air will be shut down. The following error message will be logged:

***** FAULT DISPLAY *****
Motor overload on sieve

Feed Hopper Level Switch

The feed hopper level switch contacts (normally open) will close when the feed hopper powder supply runs low, triggering the automatic powder addition system. If the level switch is not satisfied by the end of the programmed recycle or bulk air duration intervals, the powder addition system will remain on and the following message will be logged:

***** FAULT DISPLAY *****
Powder level is low

Oscillator Motor Starter Overload

One or two oscillators can be configured into the system. The circuit is wired in parallel to the normally open contacts in two main panel motor starters. An excessive current draw will open the contacts and shut down the oscillator(s). The following error message will be logged:

***** FAULT DISPLAY *****
Motor overload on oscillator

FAULT MODE (Cont.)

Low Final Filter Differential Pressure

A pressure transducer located inside the gauge panel senses the final filter differential pressure when the exhaust fan is on. A differential of less than 0.3 inches of water could imply that the exhaust fan is not functioning and will cause a full system shutdown after a 5 second delay. The shutdown can be overridden in Configuration mode. The following error message will be logged if a full system shutdown is initiated:

***** FAULT DISPLAY *****
Low final filter pressure

High Final Filter Differential Pressure Warning

If final filter differential pressure exceeds the programmed warning level (1.5-3.0 inches of water) when the exhaust fan is on, the alarm light will be turned on and the following error message will be logged:

***** FAULT DISPLAY *****
Powder filters are clogging

Pressing the ALARM RESET key will turn off the light for one hour, after which the warning will be re-activated.

High Final Filter Differential Pressure Shutdown

If final filter differential pressure exceeds the programmed shutdown level (2-5 inches of water) when the exhaust fan is on, a full system shutdown will occur. The following error message will be logged:

***** FAULT DISPLAY *****
Powder filters are clogged

The shutdown can also be overridden in Configuration mode.

FAULT MODE (Cont.)

Humidity In Air Supply

A relative humidity/temperature sensor continuously monitors the air supply. If the dewpoint exceeds 50° F (10° C) for more than 15 minutes a full system shutdown will occur.

The shutdown can be overridden in Configuration mode. If a shutdown occurs the following error message will be logged:

```
*** FAULT DISPLAY ***
Water contamination in air supply
```

After all error messages have been displayed, the following message will appear:

```
*** FAULT DISPLAY ***
NO MORE ERRORS LOGGED
```


DIAGNOSTIC MODE

DESCRIPTION

The Diagnostic mode includes:

- Final filter differential pressure readout
- Air supply relative humidity readout
- Air supply temperature readout
- Input/Output Test
- Keyboard Test
- Display Test
- Ram Test
- PROM Test
- Watchdog Test

The Analog-to-Digital menu is used to test the final filter differential pressure, air supply relative humidity, and temperature

DIAGNOSTIC MODE (Cont.)

analog inputs. The Input/Output test is used to determine whether or not errors are being caused by a faulty circuit board. The Display test provides a visual check of the display board. The Keyboard test allows the operator to check the keyboard to ensure that all the keys are functioning properly. The PROM and RAM tests check the memory chips for proper functioning.

Diagnostics mode is entered by pressing the Manual and Program keys simultaneously. The following display appears:

```
DIAGNOSTICS
SELECT {A/D I/O DISP KEY PROM RAM WCHDOG}
```

Press any mode key to exit from this menu.

A/D MENU & I/O TEST:

These two tests require the use of test harnesses. See Optional Equipment, Section 7.

DISPLAY TEST

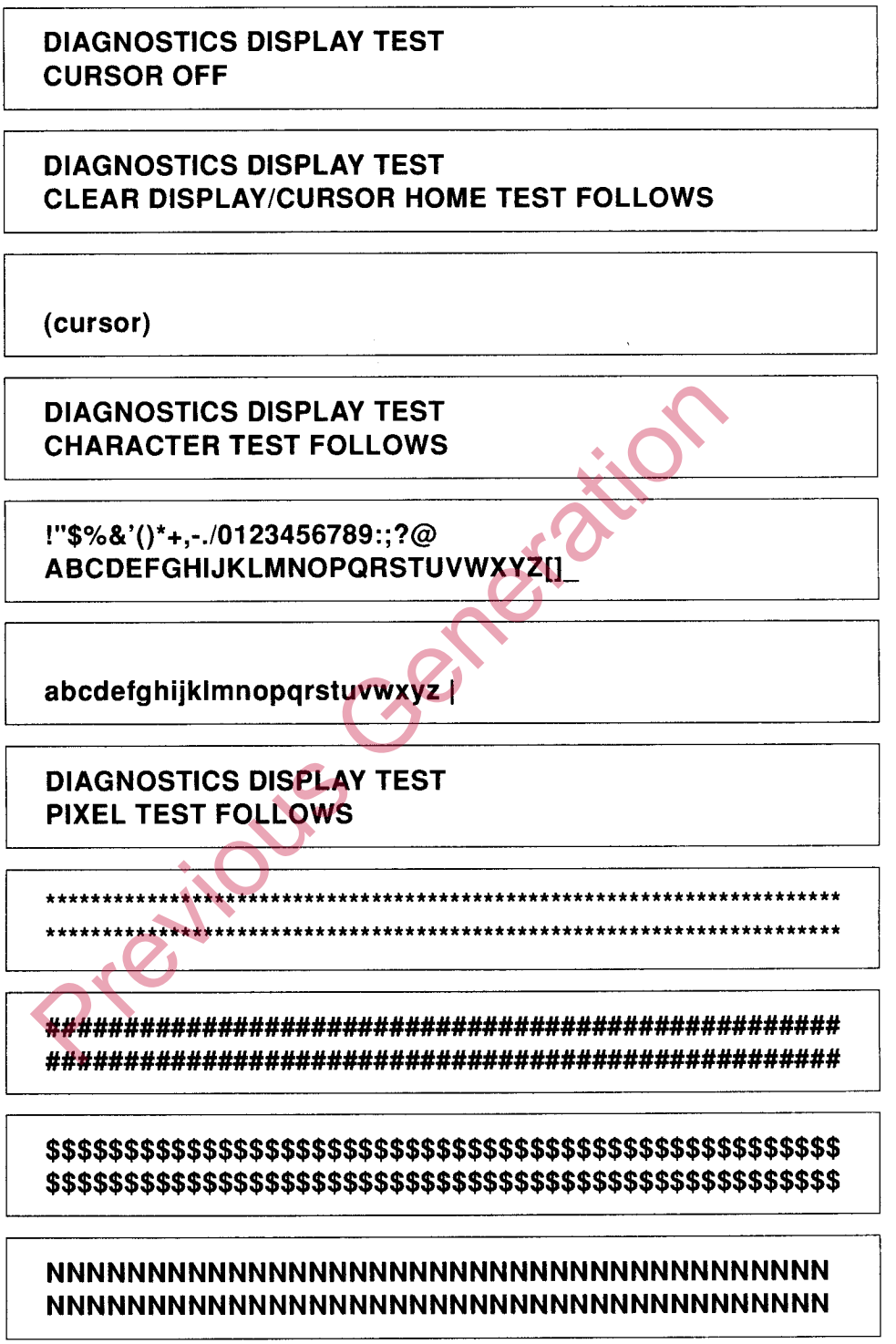
The Display test allows the operator to check the display board for malfunctions. Each display appears for several seconds, allowing the operator to read the display and note any malfunctions. At the end of the test the Diagnostics mode main menu will reappear.If all the displays appear correctly, any problems encountered with the display during operation are caused by a fault in another component.

Test Displays:

```
DIAGNOSTICS DISPLAY TEST
VISUALLY INSPECT DISPLAY FUNCTIONS
```

```
DIAGNOSTICS DISPLAY TEST
CURSOR ON(cursor)
```

DIAGNOSTIC MODE (Cont.)



DIAGNOSTIC MODE (Cont.)

```
OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
```

```
RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR
```

```
DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD
DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD
```

```
SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS
SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS
```

```
OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
```

```
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
```

```
(solid blocks filling display)
(solid blocks filling display)
```

```
DIAGNOSTICS DISPLAY TEST
*** TEST COMPLETE ***
```


KEYBOARD TEST

The Keyboard test requires the operator to press the keys on the keyboard as called for by the prompts in the following displays. The operator cannot exit this test by using the mode keys.

Note: Operator has 4 seconds to respond between keys.

```
DIAGNOSTICS KEYBOARD TEST
PRESS "XXXXXX" KEY...
```

When the operator presses the proper key and the test for that key is successful, the following message is displayed:

DIAGNOSTIC MODE (Cont.)

```
DIAGNOSTICS KEYBOARD TEST
PRESS "XXXXXX" KEY...OK
```

This process will continue until all the keys have been tested. If the operator presses the wrong key, or the key being tested is malfunctioning, the following message will be displayed:

```
DIAGNOSTICS KEYBOARD TEST
PRESS "XXXXXX" KEY...INCORRECT KEY DATA
```

If the operator fails to press a key, or no keys are recognized by the controller, the following error message will be displayed:

```
DIAGNOSTICS KEYBOARD TEST
PRESS "XXXXXX" KEY...NEVER SAW A KEY
```

When the Keyboard test is completed, one of the two messages following will be displayed:

```
DIAGNOSTICS KEYBOARD TEST
*** TEST PASSED ***
```

or:

```
DIAGNOSTICS KEYBOARD TEST
*** TEST FAILED ***
```

The display will then return to the Diagnostics mode main menu.

PROM TEST

When the PROM test is selected, the following message will be displayed. The operator cannot exit from this test until it is completed.

DIAGNOSTIC MODE (Cont.)

```
DIAGNOSTICS PROM TEST
CALCULATING CHECKSUM...
```

A 16 bit checksum will be generated and compared to the value stored in the first two bytes of the PROM chip. If the values are equal, the following message will be displayed for a few seconds before the Diagnostics mode main menu returns:

```
DIAGNOSTICS PROM TEST
*** TEST PASSED ***
```

If the calculated and stored values do not compare the following message will be displayed and the controller will "lock up". No further operation will be possible until the PROM is replaced.

```
DIAGNOSTICS PROM TEST
*** TEST FAILED ***
```

RAM TEST

When the RAM test is selected, the following message will be displayed. The operator cannot exit from this test until it is completed.

```
DIAGNOSTICS NON-DESTRUCTIVE RAM TEST
TEST IN PROGRESS...
```

A RAM test will be run on the entire controller. If the test detects no malfunctions, the following message will be displayed before the Diagnostic mode main menu returns:

```
DIAGNOSTICS NON-DESTRUCTIVE RAM TEST
*** TEST PASSED ***
```

If the test detects a malfunction, the controller will "lock up" and one of the following messages will be displayed:

DIAGNOSTIC MODE (Cont.)

```
DIAGNOSTICS NON-DESTRUCTIVE RAM TEST
*** BAD NVRAM CHIP ***
```

or:

```
DIAGNOSTICS NON-DESTRUCTIVE RAM TEST
*** BAD CLOCK CHIP ***
```

No further operation will be possible if a malfunction is detected.

WATCHDOG TEST

The diagnostics watchdog test causes the software output to the watchdog timer to be terminated. If the watchdog circuitry is operating properly, this test will cause the system to "lock up". If the system does not halt, the watchdog timer is not operating correctly.

Since the test should terminate controller operation, a warning message is given, as shown below, with a prompt to continue or abort the test.

```
DIAGNOSTICS WATCHDOG TEST
SYSTEM MAY HALT - CONTINUE TEST? {NO YES}
```

If the operator continues the test, the message below will be displayed, and output to the timer circuitry will be terminated.

```
DIAGNOSTICS WATCHDOG TEST
WATCHDOG DISABLED - SYSTEM SHOULD HALT
```

After several seconds, the operator should attempt to control the system by pressing keys on the keyboard. A failure of the system to respond indicates that the watchdog timer is working correctly. If, however, the controller is able to detect a key input, then the watchdog timer test has failed and the message below will be displayed.

DIAGNOSTIC MODE (Cont.)

DIAGNOSTICS WATCHDOG TEST
***** WATCHDOG FAILURE *****

If the test is passed the watchdog timer software is restarted and the operator may press EXIT to continue. If the test is failed, the CPU board may have to be replaced.

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Publication P/N 107 916

SECTION 6

PARTS LISTS

INTRODUCTION

The six digit number in the **PART NO.** column is the Nordson Corporation part number assigned to that part. A series of dashes in this column means that the part cannot be ordered separately; it can only be obtained as part of the assembly or subassembly it is a component of.

The **DESCRIPTION** column gives the Nordson Corporation name of the part, together with its dimensions and other physical properties where appropriate, and is the name that should be used when ordering replacement parts. Indented parts are components of assemblies and/or subassemblies.

For example:

PART NO.	DESCRIPTION
000 000	Controller Assy.
000 000	• Circuit Board, P1000
000 000	• • I.C., EPROM

If you order item 1, items 2 & 3 will be included.
If you order item 2, item 3 will be included.
If you order item 3, you will receive item 3 only.

The following parts are only available from Nordson Corporation:

BOOTH CONTROLLER ASSEMBLY

Part No.	Description
119 489	Booth Controller Assembly

BOOTH CONTROLLER SERVICE PARTS

Part No.	Description
118 948	Keyboard Assy. Kit
119 490	• Display Assy. Kit
119 776	Board, P1000, Configured (CPU Board)
114 342	• I.C., T.O.D., Clock
114 343	• I.C., NVRAM

BOOTH CONTROLLER SERVICE PARTS (Cont.)

Part No.	Description
113 103	• I.C., EPROM
100 798	Board, Interface (I/O Board)
100 797	Board, Logic
119 508	Cable Assy., Watchdog
107 420	Power Supply, 5V, ±12V, Fixed
107 422	Transducer, Pressure
939 513	Switch, Pressure, 35 psig

OPTIONAL SERVICE PARTS

Part No.	Description
107 421	Sensor, Hum./Temp.
107 419	• Filter, 12 mm, Membrane

All other components of the booth controller main control panel are available from industrial electrical suppliers. Replacement components must have electrical ratings equal to original equipment.

SECTION 7

OPTIONAL EQUIPMENT

Part No.	Description
130 665	Kit, Circuit Tester, Controller
129 936	• Interface (I/O) Board Test Harness
129 935	• Logic Board Test Harness

The Interface Board Test Harness and The Logic Board Test Harness are used for testing the integrity of A/D and I/O devices on the Interface (I/O) and Logic Boards, within the Booth Controller. These instruments utilize the Diagnostic Mode of the Booth Controller software to perform their tests and will provide an accurate measure of the condition of the Logic and Interface (I/O) boards within the Booth Controller Module.

INTERFACE (I/O) BOARD TEST

Using The Interface Board Test Harness

WARNING! Risk of electrical shock. Disconnect all electrical power before entering electrical enclosure to install test harness. Failure to observe may result in serious injury or death.

This test requires the use of a loopback test harness, Nordson part number 129 936, to replace existing interface board harnesses. The controller will perform the test and determine if any of the inputs and/or outputs are not functioning properly. If the test passes, it can be concluded that the interface board is functioning properly and any I/O related problems are outside the Powder Booth Controller Interface board.

Note: Wire numbers given are those used with Nordson Main Control Panels.

Refer to Figures 2-4 and 2-6.

Disconnect all power from electrical enclosure. Remove existing Interface Board harnesses by removing connectors 1, 3, 4, and 5. Properly secure and insulate removed harnesses from grounded metal surfaces.

Connect the plugs of the test harness to the corresponding connectors of the Interface board. The (Black) wire from the test harness should be connected to the 120VAC "Hot" wire (number 1080), of the electrical cabinet and the (White) wire of the harness connected to the 120VAC "Grounded conductor" wire (number 1060). Secure all test wires and the harness junction box inside the cabinet and close the door.

Energize main control power. Enter Diagnostics mode by simultaneously depressing the MANUAL and PROGRAM mode keys.

DIAGNOSTICS
SELECT: [A/D I/O DISP KEY PROM RAM WCHDOG]

Select I/O.

Immediately after selecting I/O, the following message will be displayed for 5 seconds:

DIAGNOSTICS
IMPORTANT: DISCONNECT ALL I/O CONNECTORS

This message is only a reminder, it does not require any action if the connectors were disconnected earlier.

The controller looks for a logic 1 on input # 1 to detect when the loopback harness is installed. If the loopback harness is improperly installed, or if the 120VAC lead is not properly connected, or if input channel # 1 is defective, the following message is displayed:

DIAGNOSTICS I/O TEST
PLUG IN I/O LOOPBACK TEST HARNESS NOW

At this time, power off the unit and check the harness for proper installation. If the harness and power source appear to function properly, it must be assumed that input channel # 1 is defective.

WARNING! Disconnect all electrical power before entering electrical enclosure to check test harness.

If the unit does not recognize a valid test harness within two minutes, the system will display:

```
DIAGNOSTICS I/O TEST
TEST HARNESS NOT IN PLACE - PRESS EXIT
```

At this point the operator must press the EXIT key, which returns him to the Diagnostics main menu, and begin the test again.

If the test harness is correctly connected the test will begin immediately. The I/O test will take approximately 30 seconds to run if all channels are functioning properly, but could take much longer if malfunctions are detected. During the test, the controller sequentially toggles the outputs from the I/O board and looks for the appropriate input.

While the test is running, the following message will be displayed:

```
DIAGNOSTICS I/O TEST
TEST IN PROGRESS...PLEASE WAIT
```

After performing the test, the controller must clear the hardware. This takes approximately 10 seconds. During this time, the following message is displayed:

```
DIAGNOSTICS I/O TEST
COMPLETING TEST...PLEASE WAIT
```

If no errors are encountered in performing the I/O test, the following message will be displayed until the operator presses EXIT:

```
DIAGNOSTICS I/O TEST
*** I/O TEST PASSED ***
```

After pressing EXIT, the operator will be returned to the top level Diagnostic menu.

If errors are encountered in the I/O test, they will be available for viewing at the conclusion of the test. All outputs that did not successfully excite an input are listed; if all outputs related to an individual input are not read, the input is included in the error list, and if an input is excited when it should not be, this input is noted also.

First, the following message will be displayed for five seconds:

```
DIAGNOSTICS I/O TEST
*** I/O TEST FAILED ***
```

After five seconds, the first set of errors will be displayed. The errors may be scrolled using the up and down arrow keys, as in Fault mode. The errors will be displayed in the following format:

```
DIAGNOSTICS I/O TEST
CHECK XXXXXX,XXXXXX,XXXXXX,XXXXXX
```

Errors are displayed in "sets". A set consists of an input and the 2 or 3 outputs that the test harness connects in parallel to the input. Only the inputs or outputs in a given set which are potentially faulty are displayed; from 1 to 4 errors may be displayed in a set. Listed below are two examples of error displays.

```
DIAGNOSTICS I/O TEST
CHECK EXH OVLD, CHAN1, CHAN11, FAULT
```

```
DIAGNOSTICS I/O TEST
CHECK OSC2
```

In the first example, all 4 I/Os in the set are displayed. This most likely indicates that the input (exhaust overload) is faulty; however, it is possible that all outputs are malfunctioning.

In the second example, only one output, oscillator #2, is faulty.

A list of all possible I/O errors is given below.

SET	INPUTS	PULSE CHANNELS	PULSE CHANNELS	OUTPUTS
1	"EXH OVLD"	"CHAN1"	"CHAN11"	"FAULT"
2	"OSC OVLD"	"CHAN2"	"CHAN12"	"BULK"
3	"UV BYPASS"	"CHAN3"	"CHAN13"	"RECYCLE"
4	"LEVEL SW"	"CHAN4"	"CHAN14"	"OSC2"
5	"PRESS SW"	"CHAN5"	"CHAN15"	"OSC1"
6	"CONV INLK"	"CHAN6"	"CHAN16"	"SIEVE"
7	"SVE INLK"	"CHAN7"	"CHAN17"	"FAN"
8	"FIRE"	"CHAN8"	"CHAN18"	
9	"BOOTH L/S"	"CHAN9"	"CHAN19"	
10	"E-STOP"	"CHAN10"	"CHAN20"	

The operator should scroll through all errors, making notes as necessary, until all messages are displayed, indicating that all errors have been viewed:

DIAGNOSTICS I/O TEST
END OF I/O ERRORS

After viewing the errors, the operator presses EXIT to return to the top level Diagnostic menu.

Disconnect the main power of the controller.

WARNING! Disconnect all electrical power before entering electrical enclosure to service test harness.

Remove the test harness and install the original controller harnesses.

LOGIC BOARD ANALOG INPUT TEST

Using the Logic Board Test Harness

WARNING! Risk of electrical shock. Disconnect all electrical power before entering electrical enclosure to install test harness. Failure to observe may result in serious injury or death.

This test requires the use of a test harness, Nordson part number 129 935, to replace the existing logic board harness. The controller will display the test data. However, the operator must determine that the inputs are functioning properly. If the test passes, it can be concluded that the logic board analog inputs are functioning properly and any transducer related problems are outside the Powder Booth Control Logic board.

Disconnect all power from the electrical enclosure. Refer to Figure 2-5. Connector 3 of the logic board, which has 15 pins, is mated to a 12 pin and a 3 pin plug. Remove the 12 pin plug from the logic board and insert the 12 pin plug from the test harness. Route the test harness away from existing wiring and bring the hand held test box out of the electrical enclosure.

WARNING! The following test requires that the electrical power be energized with the enclosure door open. Exercise extreme caution! Take all necessary precautions to eliminate the risk of contacting any live parts within the cabinet. Disconnect electrical power immediately after conclusion of test!

Energize the main control power. Enter diagnostics mode by simultaneously depressing the MANUAL and PROGRAM mode keys.

DIAGNOSTICS
SELECT: [A/D I/O DISP KEY PROM RAM WCHDOG]

Select A/D

DIAGNOSTICS A/D
SELECT: [FILTER RH TEMP]

Select FILTER

DIAGNOSTICS A/D FILTER
FILTER PRESSURE=X.X(IN H20)

Rotate the potentiometer marked "P" fully counterclockwise. Verify that the controller display reads ≤ 0.1. Rotate the potentiometer fully clockwise. Verify the display reads ≥ 4.5. The display should indicate linear values between the lower and upper limits, with linear movements of the potentiometer.

Press EXIT

DIAGNOSTICS A/D
SELECT: [FILTER RH TEMP]

Select RH

DIAGNOSTICS A/D RH
RELATIVE HUMIDITY=XXX (%)

Rotate the potentiometer marked "H" fully counterclockwise. Verify that the controller display reads ≤ 2. Rotate the potentiometer fully clockwise. Verify that the display reads ≥ 90. The display should indicate linear values between the lower and upper limits, with linear movements of the potentiometer.

Press EXIT

DIAGNOSTICS A/D
SELECT: [FILTER RH TEMP]

Select TEMP

DIAGNOSTICS A/D TEMP
TEMPERATURE=XXX (DEG F)

Rotate the potentiometer marked "T" fully counterclockwise. Verify that the controller display reads ≤ 0. Rotate the potentiometer fully clockwise. Verify that the display reads ≥ 156. The display should indicate linear values between the lower and upper limits, with linear movements of the potentiometer.

Power down the electrical enclosure.

WARNING! Disconnect all electrical power before entering electrical enclosure to remove test harness.

Remove the test harness and replace it with the original 12 pin plug.

POWDER BOOTH CONTROLLER
DATA SHEET

(Defaults in Parenthesis)

Configuration Mode

No. Blowdown Solenoids _____ (20)

No. Oscillators _____ (0)

Sieve Present? _____ (No)

Conveyor Interlock _____ (Enabled)

NonCritical Faults _____ (Enabled)

Powder Addition System _____ (No Bulk)

Powder Delay _____ (1 min.)

Password _____ (Enabled)

Program Mode

Pumps Delay Timer _____ (10 sec.)

Recycle Duration Timer _____ (2 min.)

Bulk Duration Timer _____ (10 Min.)

Pulse Delay Timer _____ (18 sec.)

Pulse Duration Timer _____ (50 msec.)

Final Filter Warning _____ (2" H_2O)

Final Filter Shutdown _____ (3" H_2O)

Autostart _____ (Disabled)

Autostart Timer _____ (6:30 AM)