

IMTEC



ACCUBATH®

QUARTZ NITRIDE REFLUX SYSTEM

INSTRUCTION MANUAL

PART NUMBER 10-018-0032

IMTEC Acculine

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All information in this document is subject to change without notice.

The information in this manual has been carefully checked and is believed to be accurate; however, no responsibility is assumed for inaccuracies or omissions.

References in this manual may describe optional equipment. Please contact an IMTEC sales representative for information about standard and optional equipment.

Manual Part Number:	10-018-0032
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Instruction Manual Revision History


Date	Section	Description
9/12/05	Entire Manual	Initial release of reformatted manual. Released new manual part number.
9/30/05	Section 4, Installation	Corrected PinOuts in Table 4-2. Updated rev history page
2/18/15	Three as listed at right	Title / Copyright, Preface and Section 7 updated for LLC instead of Inc.
7/14/16	Three as listed at right	Title / Copyright, Preface and Section 7 updated for no LLC or Inc.
7/31/18	1, 2, and 5	Updated description of Hi Acid Concentration alarm

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PREFACE

This preface includes the following topics:

- intended use and audience
- basic safety considerations
- customer support
- conventions used in this manual
- how this manual is organized
- standard IMTEC Accubath warranty
- table of contents

CAUTION	
	<p>USING IMPROPER CONFIGURATION VALUES CAN CAUSE PRODUCT OR EQUIPMENT DAMAGE</p> <p>Do not enter set-up or configuration values outside the specified range for any given bath or optional device. To do so may seriously damage your product or equipment.</p>

Intended Use of this Equipment

IMTEC's Quartz Nitride Reflux System is not to be used for any purpose other than for which it was designed. What product is to be produced and how the bath and optional equipment are to be configured for the allowed processing chemicals and parameters are stated in this Instructions Manual.

Intended Audience

The level of detail in this manual assumes you have previously been trained to install, operate and maintain this system.

This document supplements that training and addresses the comprehensive needs of Process Engineers and Maintenance personnel. After reading and understanding this information, Process Engineers are responsible for disseminating the appropriate level of information to their Equipment Operators.

Safety Considerations

Your company's policies and procedures for safely operating the Quartz Nitride Reflux System supersede the safety considerations listed below. It is your responsibility to follow your company's safety procedures. If there are none, follow those established by OSHA, DEQ, and/or the DOT, as a minimum.

Environmental Information

The following laws and regulations are applicable to the operation and maintenance of the Quartz Nitride Reflux System.

- Air Emissions are regulated under the US Clean Air Act and local regulations applicable to the emissions of acids, bases and organic compounds.
- Wastewater emissions are regulated under the US Clean Water Act and applicable local pretreatment regulations.
- Solids contaminated with acids and other chemicals are regulated as hazardous wastes.

Additional information pertaining to the laws and regulations stated above and the following information, below, are available from IMTEC's Health and Safety department for the baseline process:

- Overall Chemical Mass Balance
- Exhaust Concentration – Un-reacted Process Chemicals
- Known Environmental Restrictions – Baseline Chemistry
- Volumetric Flow
- Waste Water Contaminants

General Safety

- Do not attempt to work on or with hazardous chemicals or electrical equipment without proper safety training and certification.
- Be sure to lockout and tag the electrical and/or chemical systems before beginning any repair or replacement tasks. Refer to this Instructions Manual for this equipment and your company's safety policies and procedures for specific repair instructions.
- Before attempting any procedures, know how to perform emergency first aid response for electrical shock and spills of hazardous chemicals.
- Review and understand emergency escape routes to safe areas.

Electrical Safety

- During periods of lightning activity, do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration.
- Before attempting any procedures, locate the main electrical source and understand how to safely control it.
- Whenever possible, disengage the bath and optional devices from their electrical sources before attempting repairs.

- Notify nearby personnel that you are attempting to operate or service this equipment. Follow your company's lockout and tagout operating procedures.

Chemical Safety

- Never attempt operations or repairs involving hazardous chemicals by yourself. Always have another person within sight and voice range.
- Protect eyes, face, hands, and body with appropriate personal protective equipment.

Before Powering Up the Quartz Nitride Reflux System

- Understand the system's alarm indications and automatic system interlocks (refer to Section 2, *Safety Requirements*).
- Ensure that all safety devices in the work area are properly installed and functional.

Cleanroom Requirements

Specific cleanroom requirements can vary widely according to the class rating, i.e., Class 10, Class 100, etc. IMTEC's products qualify as Class 1. While performing maintenance or operating the system, follow your company's policies and procedures for this equipment.

Customer Support

For assistance in operating, troubleshooting, or maintaining this system, refer first to this and any other manuals supplied to you by IMTEC. If these manuals do not address your specific question, please contact IMTEC Customer Service:

<p>IMTEC Acculine 49036 Milmont Dr Fremont, CA 94538</p>	<p>Phone: 510-770-1800 Fax: 510-770-1400</p>
<p>Email: imteccaculine.com</p>	<p>From 8:00 a.m. to 5:00 p.m., PST, Monday through Friday</p>

When calling, please be at the system, if possible, and be prepared to give a detailed description of the problem.

NOTE
Review your contract warranty statements regarding specific instructions for receiving help.


Preventive Maintenance

For preventive maintenance schedules and procedures please refer to Section 7, *Maintenance and Troubleshooting Procedures*, of this manual.

Conventions Used In This Manual

1. The following **WARNING** and **CAUTION** boxes are samples of what is used to identify potential hazards that could occur if the equipment is used improperly or if unsafe practices are followed.

WARNING	
	<p style="text-align: center;">IMPROPER USE OF THIS EQUIPMENT CAN CAUSE SEVERE INJURY OR PRODUCT DAMAGE!</p> <p>To ensure operator, equipment, and product safety, follow the instructions and use care when operating this equipment.</p>

CAUTION	
	<p style="text-align: center;">POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!</p> <p>Equipment or product damage can occur if care is not taken.</p>

2. A **NOTE** box highlights special information.

NOTE
<p>Specific information is placed in a NOTE box when clear procedural understanding is essential.</p>

3. The following conventions are used throughout the manual:

Data entries on pictured control screens or menus. Unless stated otherwise, all example values on pictured data entry screens are for display purposes only and were not intended to be considered as recommended values for your equipment.

Boldface text indicates the actual words used in a screen command or on an equipment label.

How To Use This Manual

The level of detail in this manual, and listed below, covers the necessary information to install, operate, maintain, and service the Quartz Nitride Reflux System. The following optional IMTEC equipment information is also included:

- Model 952 Controller
- Automatic Lid Actuation
- Chemistry Leak and Conductive Fault Interrupt Detector

Instruction Manual Revision History Page: details any changes made to the manual, the date the change took place, and what specific information was changed, added or deleted. If changes or updates are added to your individual manual, a new Revision History Page will be sent to you along with those changes.

Preface Section, includes the intended use and audience, basic safety considerations, customer support, conventions used in this manual, how this manual is organized, standard IMTEC Accubath warranty, and a table of contents.

Section 1, *Introduction*, is a description of a typical Quartz Nitride Reflux System, a theory of operations, specifications, and facility requirements.

Section 2, *Safety Requirements*, is a detailed description of all safety features and their functions and interactions.

Section 3, *Unpacking Procedures*, lists the procedures for inspecting and unpacking the Quartz Nitride Reflux System and optional equipment.

Section 4, *Installation Procedures*, are specific to your system. Included is a set of drawings indicating the connections to be made specific to your system and start-up and calibration procedures.

Section 5, *Operating Instructions*, include is how to operate the bath and optional equipment after installation and calibration.

Section 6, *Start Up and Calibration*, covers initial start up and calibration procedures for the system

Section 7, *Maintenance Procedures*, covers preventive maintenance schedules, troubleshooting, and maintenance procedures, and lists the suggested spare parts. This section also states the instructions for returning parts for repair.

Updates. In the event new information is required, such as, corrections or updates after shipment of this documentation, IMTEC

will send this new information to you. Upon initial shipment of this manual this section will be empty.

ACCUBATH Limited Warranty – (Non-Warranty of Merchantability, Fitness and Limitation of Liability)

Terms and Conditions

1. IMTEC warrants the Quartz Nitride Reflux System in materials and workmanship for a period of **one (1) year** from the date of original shipment from our factory with the following exceptions:
 - IMTEC quartzware is guaranteed to remain sound and whole in normal usage for a period of 45 days from the date of initial shipment.
 - Aquaseal tanks have a 30-month limited warranty.
2. The Warranty of IMTEC, with the exceptions noted in #1 above, is limited as follows: In the event of a defect, IMTEC agrees - at its option - to repair or replace the defective equipment OR refund the purchase price and IMTEC's liability is limited thereto. Equipment repaired or replaced under warranty will bear the remainder of the original equipment warranty.
3. All repairs are made at IMTEC's place of business. The Buyer pays the cost of returning the product to IMTEC's factory. Any such return must be pre-authorized by IMTEC through the issuance of an IMTEC Returned Goods Authorization (RGA) number. The RGA number **must** be displayed on the returned merchandise. Refer to Section 6, *Maintenance Procedures*, for the Returned Goods Authorization procedures.
4. The period of warranty commences on the "in-service" date entered by the customer on the Warranty Registration Card provided with the Accubath. The information on the card must be complete and the card returned to IMTEC in a timely manner. If the card has not been returned to IMTEC, the warranty period will commence as of the date of shipment from IMTEC. In no case will the warranty period be delayed more than 120 days from date of the initial shipment from IMTEC.

Exclusions

1. While other Exclusions may apply, IMTEC specifically does not guarantee, and accepts no responsibility for, the following:
 - Penetration of the base material of the outer case wall or flange by any user chemistries.
 - Chemical attack on quartz components.
 - Breakage of quartz or other product by impact, improper facility or wetstation installation, handling or other abusive

treatment, or damage related to such impact-related or physically induced damage, such as internal corrosion.

- Damage to any portion of the bath resulting from operating the equipment with a liquid level so low as to expose the heater strips.
- Unauthorized customer modification to any portion of the system.

NOTE

Unauthorized customer modification(s) may void all warranties.

- Controller enclosure component or hardware failures caused by controller enclosure installation directly within the process-sink hood or other fume areas where it is subjected to corrosive environments. This condition is considered in violation of normal accepted industry practices for appropriate sink control areas.
- External temperature sensors, where the protective outer coating has been torn, cut or abraded.
- Where failure is due to negligence, abuse or vandalism.
- Submersion of the equipment or other non-standard practices.

Damage Related to Shipment

1. It is the buyer's responsibility to carefully inspect each quartz Accubath upon its receipt and determine any breakage, including hairline cracks. Claims for quartz found broken in shipment are not the responsibility of IMTEC and should be submitted to the freight carrier.

Packaging

1. It is the buyer's responsibility to retain the original packing materials or to obtain authorized replacement packing materials from IMTEC should the equipment ever need to be returned to the factory.

In Conclusion:**NOTE**

IMTEC does not warranty merchantability or fitness for any purpose and there are no warranties, expressed or implied other than those expressly stated in this document. IMTEC is not responsible for any consequential, incidental or other damages whatsoever. IMTEC's liability is limited to the repair or replacement of such defective product OR refund of purchase price, at IMTEC's sole option, as stated above. All claims must be made in a timely manner and within the warranty period to be considered valid. Please contact IMTEC at:

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Updates



1 INTRODUCTION – BASIC SYSTEM

This section includes the following topics:

- overview of a typical Quartz Nitride Reflux System
- theory of operations
- specifications
- facility requirements

IMTEC's Quartz Nitride Reflux System (QN), Figure 1-1, supplies the industry's tightest, most predictable process control by providing actual acid concentration and boiling point control in an extremely efficient self-balancing reflux system. Your Quartz Nitride system may be a standard IMTEC static (QZ) or recirculating (QRT/S) bath with a water-cooled collar and manual or automatic lid. A flowmeter regulates the cooling and the IMTEC 952 Controller provides process accuracy.

IMTEC offers side or end-opening automatic lids using reed switches to indicate "closed" and "full open" positions to robotic systems. IMTEC's autolids are water-pressure driven and incorporate a chemically-impervious membrane which aids in the condensation recovery process. IMTEC's manual hinged lids are similarly constructed.

A dual panel flowmeter regulates the cooling water to the collar and sets the rate of the DI water drip into the process bath.

The Model 952 Controller's unique software senses, adjusts and controls the boiling point of process chemistries. It is extremely simple to use and will maintain the set boiling point to within $\pm 0.2^{\circ}\text{C}$.

An optional dispersion plate can be mounted in the bottom of a QRT/S bath process vessel to provide improved flow distribution of the incoming filtered chemistry. The IMTEC liquid dispersion plate may be ordered with a gas manifold for nitrogen agitation.

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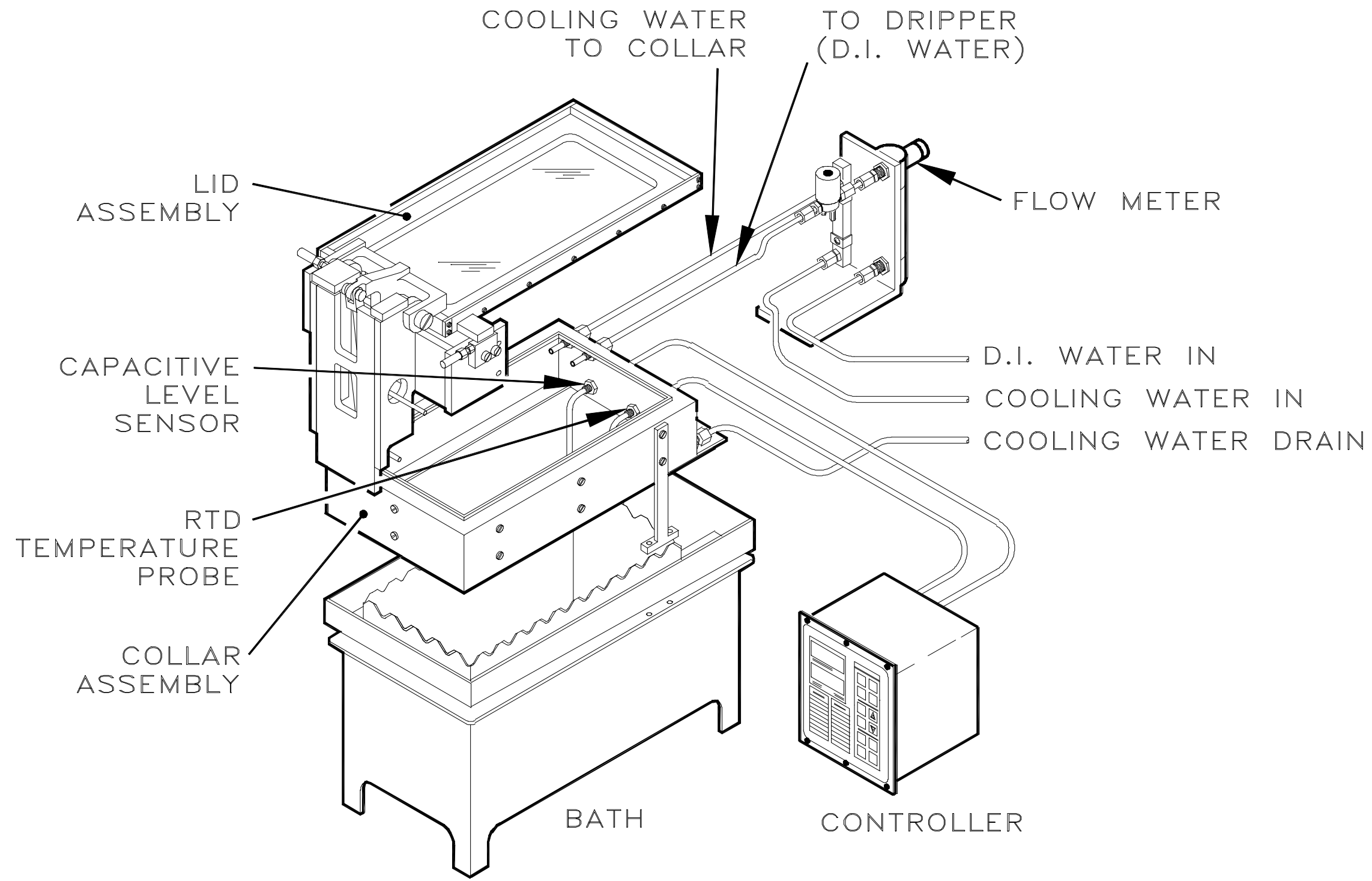


Figure 1-1. Whole-system illustration.

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1.1 System Safety Features

The following information only reflects the safety features of IMTEC's Model 952 Controller.

The **Auto-Shutdown** feature. If the IMTEC QN system either over-temps by 5°C from the preset process temperature without achieving boil or does not correct to within 0.2°C of the process setpoint within five minutes of exceeding that specific setpoint condition, the Model 952 controller will shut down the process and place itself into "HOLD" mode.

The **Over-temperature Shutdown** feature. T/C activated. Two thermocouples, one active and one spare. Supplementary shutdown is provided through a snap switch which shuts down at 210°C, independent of thermocouple signals to the controller.

Alarms. The Model 952 "Hi-Acid Concentration" alarm indicates there is insufficient water content required to maintain boil point control. Refer to section 2-5 for details.

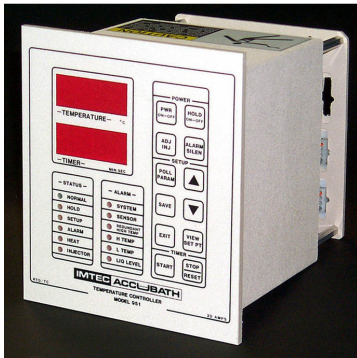
Fire-Resistance. The IMTEC QN system features a flame-retardant (FRPP) polypropylene housing with no air gap between the tank and the housing, eliminating flame space.

RTD Temperature Sensor. A 100-ohm, Teflon-encapsulated, platinum wire Resistance Temperature Detector calibrated to 0.003916 ohm/ohm/°C is supplied as standard. J-type thermocouples are available as options.

Liquid Level Sensors (Customer-supplied option). Two sensors with sensing probes may be mounted as an option in a "high-Low" tank configuration to prevent overflow of solution and provide prompt alarm of low-chemistry conditions.

1.2 System Main Components Overview

- Model 952 Controller
- Model LD-1 Chemistry Leak Interrupt Detector
- Automatic lid and Actuation Panel
- Water-cooled quartz collar
- Dual Flowmeter Panel



1.2.1 Model 952 Controller Overview

The Model 952 Controller is a vital part of the QN system. IMTEC's Model 952 is the designated controller for IMTEC's quartz nitride systems. Its unique software senses, adjusts and controls the boiling point of the Nitride etch process chemistry. The 952 controller is user-friendly as all of the interfaces are pre-wired for nitride etch applications, with all of the required system components and interfaces provided. This process controller uses a special software protocol as part of an IMTEC proprietary control algorithm. It senses and maintains the chemistry boiling point, rather than the process bath temperature. This provides singular control over the most significant nitride etch parameters: phosphoric acid concentration, boil rate, and boiling point temperatures.

Your controller installation may be equipped with IMTEC's optional RS-232 interface. This option allows the user direct access to the controller from a dumb terminal or a computer system through a standard RS232 serial link. All of the standard functions of the controller may be activated, tested and adjusted.

NOTE

The RS232 is a communications module option that must be specified at the time of original controller purchase.

1.2.1.1 Non-IMTEC Controllers

CAUTION



POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!

IMTEC is not responsible for issues related to other control systems. The customer must have knowledge of processes and take appropriate safeguards to prevent stratification.

If the IMTEC Quartz Nitride Reflux System is to be used with a non-IMTEC controller, the manufacturer will provide bath interfacing recommendations and instructions. If the QN system was purchased as part of a wet station from an OEM supplying its own controller, IMTEC will - if contacted - work with the OEM to provide an integrated function and an optimal nitride system.

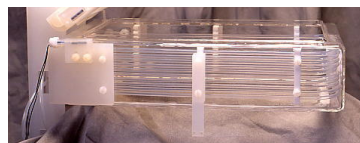
If the QN bath is to be used with a controller other than IMTEC's Model 952, the supplier will provide bath interfacing recommendations and instructions. If the QN bath was purchased installed in a wet station for which the OEM supplies its own controller, IMTEC will gladly work with the OEM to provide integrated function and an optimal performance for the configuration. IMTEC recommends the user carefully review the safety provisions of the non-IMTEC controller and ensure that the wet station OEM integrates and activates all safety features to satisfy the user's safety specifications.



1.2.2 Automatic Lid and Actuation Panel

Part of the "closed" bath, the lid assembly may be manual or automatic. The automatic lid is driven by water pressure with reed switches indicating "closed" and "full open" positions to the wet station's robot system. The autolid incorporates a chemical-resistant membrane and uses an actuation panel.

The actuation panel consists of two air-actuated Teflon 3-way valves, two needle valves, and all associated plumbing and hardware required to operate the water-driven auto-lid cylinder assemblies.



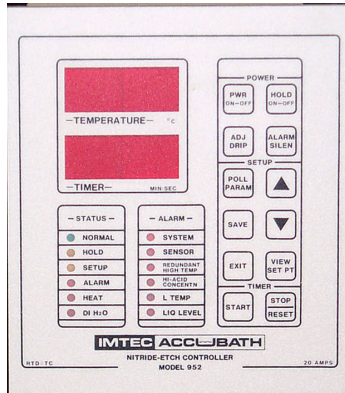
1.2.3 Water-cooled Quartz Condensing Collar

This collar may be separate from the tank with a gasket between the collar and the tank, or this collar may be integral to the tank. Configuring a QN system starts with the bath itself, either static or recirculating. The system must be "closed" to perform its function, so a quartz collar is added to the bath. This collar contains instrumentation ports through which the level sensors and temperature sensors enter the bath from the 952 Controller and other ports through which cooling water flows in and drains out. When ordered, the collar's instrumentation ports may have been configured to conform to a particular specification.

1.2.4 Dual Flowmeter Panel

A dual flowmeter panel performs two functions. One function regulates the flow of cooling water to the collar. The second function controls (on/off) the DI water inject and controls its flow rate. The DI water inject is activated by the 952 controller.





1.3 Theory of Operations – Controller

The IMTEC Model 952 controller is specifically designed for use with the nitride-etch system. While the physical composition of the IMTEC nitride-etch system appears to be similar to most other types of systems, using IMTEC's controller is desirable for ease of use: an operator inputs the desired boiling point temperature and controller does the rest. This controller will:

- adjust the concentration of the phosphoric acid to provide the desired boiling point
- adjust the BTU input to maintain a moderate boil
- warn if the maximum water addition rate is inadequate so that the DI water flowmeter may be reset in a timely manner (100% duty cycle of the control solenoid at the chosen flowmeter setting is inadequate.)

Even if the startup acid concentration is too high, as long as the initial boil point is no more than 7.5°C above the desired process temperature, the controller will bring the bath to a boil. Using the DI water supply, the controller will bring the bath to the correct boiling point within ten minutes and hold it there to within 0.2°C.

As the controller brings the bath to boil status information and alarms are presented so that processing will not start again until acid concentration equilibrium has been restored. If the boiling point cannot be found within 7.5°C of process setpoint, or corrected within ten minutes, the controller puts the bath and dripper subsystems into "**HOLD**" mode.

If, during processing, the DI water supply becomes inadequate, the controller will reduce power to the bath and track the actual boiling point, attempting to bring it back to within operating range. With this mode of operation, a stir motor for avoiding bath stagnation is not necessary.

The controller is microprocessor based allowing it to monitor the temperature using a 100 ohm platinum RTD sensor (J Type T/C is optional). Status and alarm functions are incorporated to monitor system parameters. Additionally, a count-down/count-up programmable timer with cumulative over-timer and pre-warn is integrated into this sub-system.

The controller houses two printed circuit boards: one for display and one for control. The display board contains the twelve individual LEDs, the alphanumeric displays, and the audio transducer. The control board contains the power supplies, the microprocessor, the memory EEPROM, and associated amplifiers.

1.3.1 Theory – RS-232 Option

With the RS232 option, the controller may be connected to either the dumb terminal or computer system using a DB9 connector on the back panel. The pin-out follows the standard IB DB9 configuration, therefore it may be wired directly to an IBM PC or equivalent. The link is fixed at 9600 baud, 8 bit, 1 stop and 1 start bit, no parity and only requires three leads to function.

The internal ACIA uses a full duplex interrupt driven transmission scheme. Thus, the controller may receive and transmit simultaneously as well as continue to perform its normal functions. This means the controller may be interrogated even though it is performing its program. The Protocol for the serial link consists of five basic commands:

- KEY
- READ
- WRITE
- STATUS
- CANCEL (CLEAR)

1.4 System Specifications

System specifications outline the general physical characteristics and capacities of the QN bath and optional equipment, including how to determine some of the bath's specific characteristics from its model number.

1.4.1 Model Number Descriptions

The Accubath model number includes the following information:

- Model type
- Configuration
- Wafer size accommodated
- Cassette capacity
- Liquid capacity

This information is displayed in the model number designators as shown in the following example:

Example: QN-A1501-10							
Designator:	QN	–	A	150	1	–	10
Note:	1		2	3	4		5
NOTE							
1.	Model Type: QN = static bath, with or without drain; QR = Quartz Recirculating; QRT/S = Quartz Recirculating with Trough and Sump, etc.						
2.	A, B, C, etc. Indicates different configurations of the basic design (usually small dimensional variations). A = the first configuration of the bath, B = the second, etc.						
3.	Wafer size: 150 = 150mm (6 inch).						
4.	Accubath wafer cassette capacity: 1 = 1 wafer cassette, 2 = 2 wafer cassette, etc.						
5.	Capacity in liters to the top of the working tank: 10 = 10 liters. This number is not the actual fill amount, which is calculated only to the freeboard line. Note: This is not included in all bath part numbers.						
If, after examining the model number on the Accubath, you cannot determine which bath you have, please contact IMTEC and have the serial number of the bath ready. Using the serial number (found, with the model number, on the faceplate on the bath's exterior surface, and also visible through the quartz tank), we will be able to give you complete information about the bath.							

1.4.2 QN Accubath Physical Characteristics

Bath Function – This application is designed only for use in H_3PO_4 nitride-etch solvent-based resist stripping.

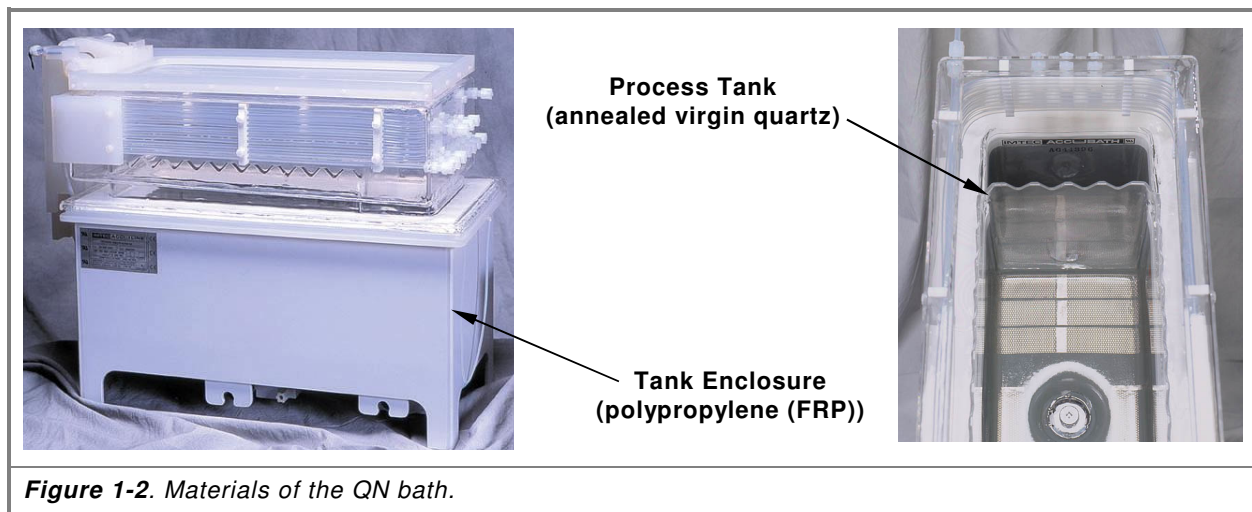
Temperature Range – Ambient to 190°C.

Over-Temperature Sensor #1 – Thermocouple (T/C), J-type. Two (2) thermocouples are included, one active, one spare, and are mounted on the outside of the quartz tank wall, just above the heaters, unless otherwise specified.

Over-Temperature Sensor #2 – One thermostatic snap switch, normally closed, set to open at $210^\circ\text{C} \pm 7^\circ\text{C}$, mounted on outside of quartz tank wall.

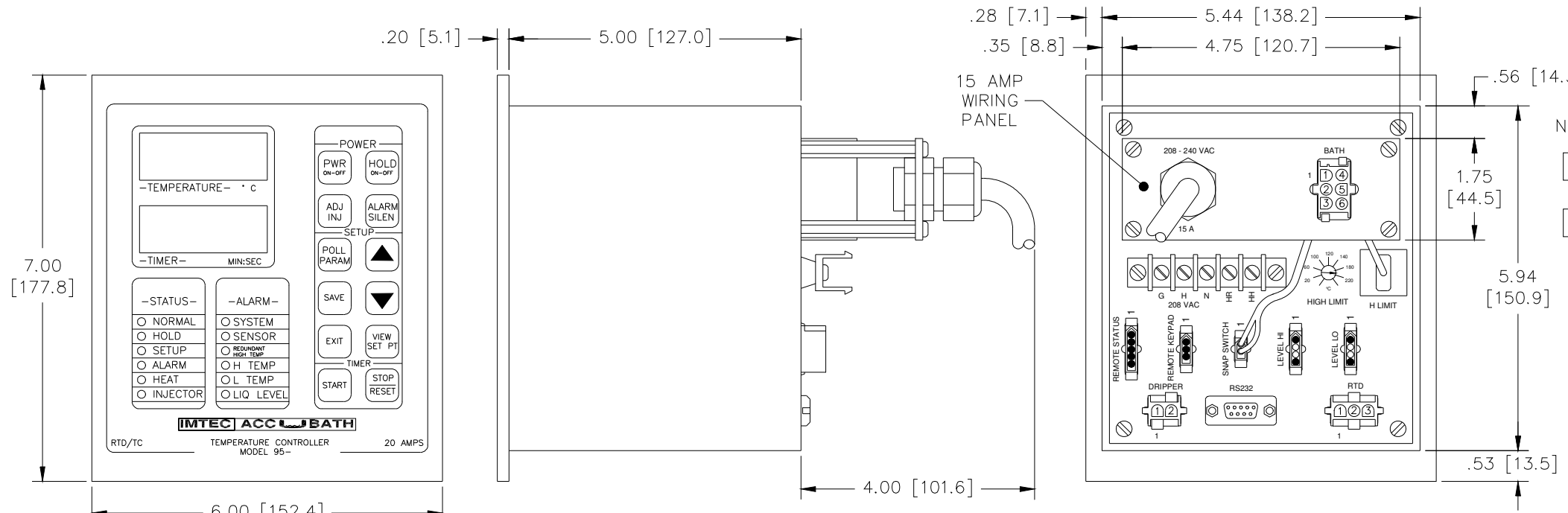
1.4.3 Materials

The process tank (Figure 1-2) is fabricated of annealed virgin quartz with all wetted surfaces fire-polished. Unless specifically ordered otherwise, the tank enclosure is manufactured of flame-retardant polypropylene (FRP) welded to a single-piece white or natural poly flange (for optimal chemical resistance of this highly exposed part). The poly flange is attached to the mating quartz flange. The seal material may vary, depending upon intended bath use. If no chemical usage is stipulated at time of order, IMTEC's standard fluoroelastomer RTV seal is supplied. The patented Inconel heating element is bonded directly to the quartz tank. Insulation is refractory alumina-silica. Drains (optional) are quartz and may terminate with Teflon fittings outside of the FRP housing.



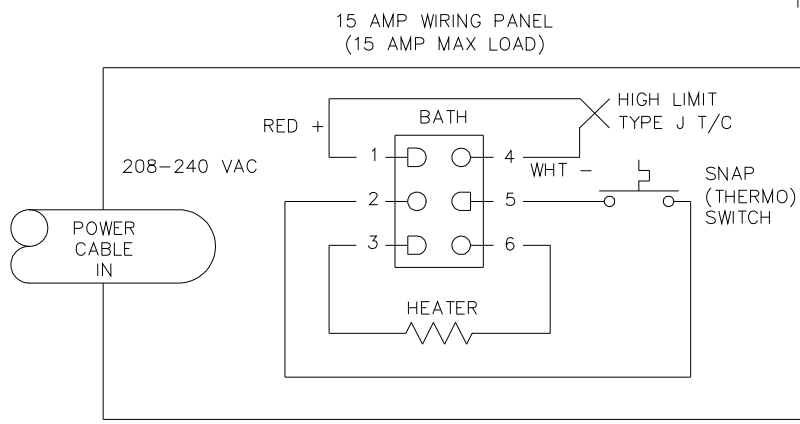
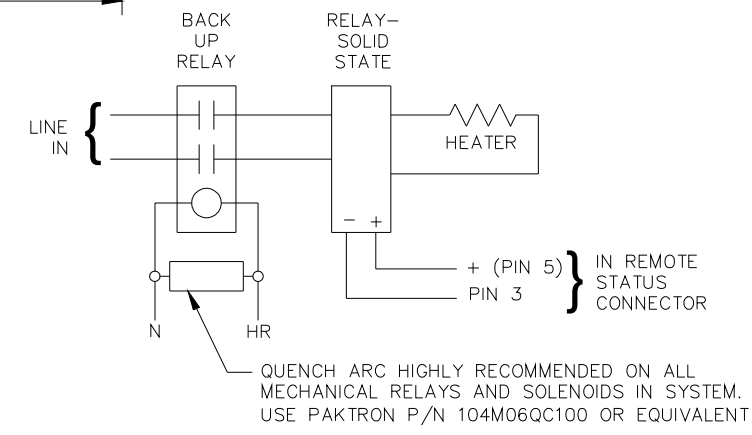
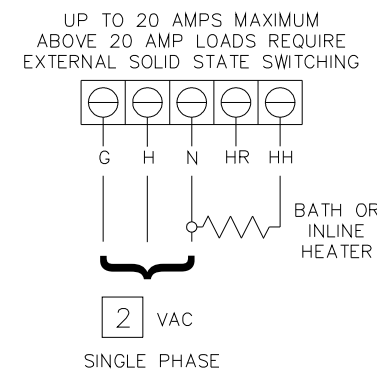
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1.4.4 Model 952 Controller Schematic

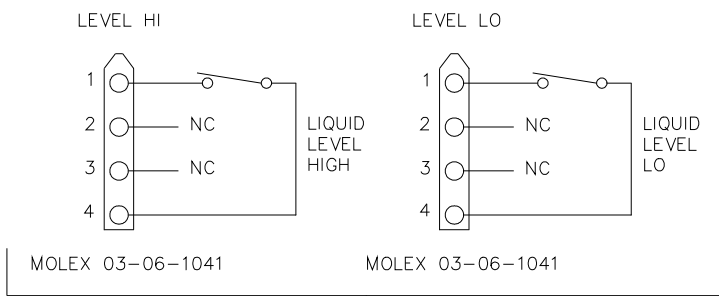
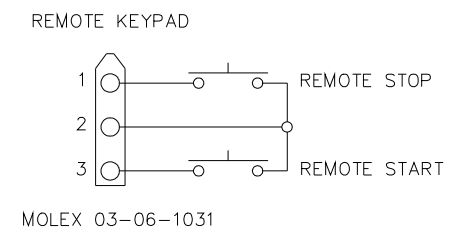
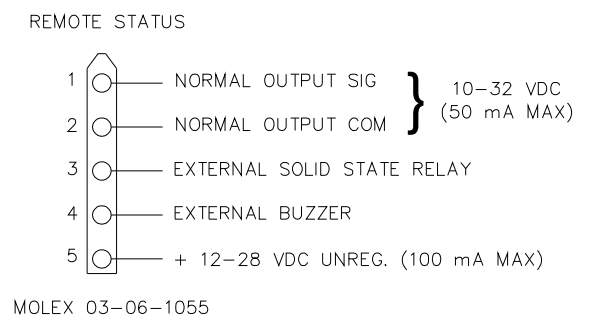
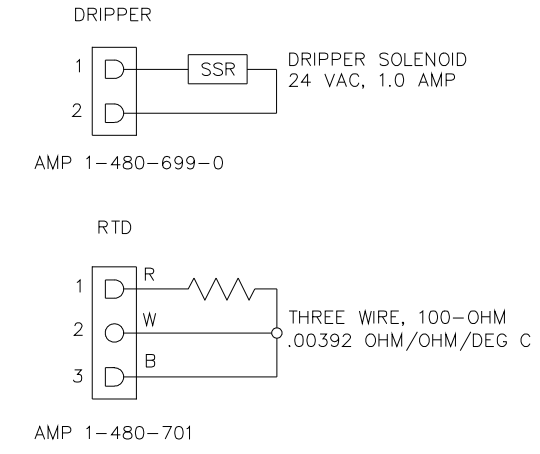


NOTES: UNLESS OTHERWISE SPECIFIED
 1 MATERIALS: CASE - KYDEX
 FACE - LEXAN, BACK PRINTED
 2 VAC IN - 208 TO 240 ± 10%
 = 187 VAC TO 264 VAC

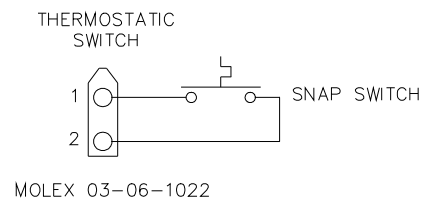
RS232 (OPTIONAL)
 1 - NO CONNECTION
 2 - TxD
 3 - RxD
 4 - NO CONNECTION
 5 - COMMON
 6 - NO CONNECTION
 7 - NO CONNECTION
 8 - NO CONNECTION
 9 - NO CONNECTION



-952 ONLY-



- 10-000-2163 951, 208V W/REMOTE START/STOP
- 10-000-2164 951, 208V W/REMOTE START/STOP AND RS232
- 10-000-2165 952, 208V W/REMOTE START/STOP
- 10-000-2166 952, 208V W/REMOTE START/STOP AND RS232



UPON ACTIVATION OF EITHER, CLOSED OR OPEN, DISPLAY INDICATES "LL". NO DIFFERENTIATION OF HI VS. LO ALARM

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1.4.4.1 Controller Specification Table

For additional information refer to Section 1.4.4, *Model 952 Controller Schematic*.

Feature	Specification
Controller Function	Refer to Section 1.2, <i>Theory of Operations – Controller</i> .
Range (Temperature Control)	0.0 – 249°C
Range (Time)	0 to 99:59 Min:Sec
Range (Ambient Operating)	0-50°C, local controller environment
Resolution (Temperature)	0.1°C
Resolution (Time)	1 Sec.
Normal Mode Rejection (NMR)	60dB at 60Hz
Common Mode Rejection (CMR)	120dB at 60Hz
Memory (Control Parameters)	EEPROM, 10-yr. minimum without power
Sensor (Process Temperature)	100-Ohm, platinum-wire RTD, DIN standard (.00385 ohms/ohm/°C), stainless-steel encased, Teflon encapsulated
Sensor (Over-temp #1)	Thermocouple, J-type, settable 20-220°C
Sensor (Over-temp #2)	Thermostat, normally closed, set at 210°C
Sensor (Liquid level) (Not Supplied)	Capacitive, RF range, open collector (NPN), output simulating switch closure
Case Construction	Enclosure: Kydex. Face: Lexan, back-printed
Size (Faceplate):	7.0 inches high, by 6.0 inches wide, by 0.20 inches thick
Size (Box)	5.94 inches high, by 5.44 inches wide, by 5.0 inches deep. Plus an additional 4 inches deep of service access.
Weight	Approximately 4 lbs (1.8 kg)
Output	SSR. Opto-isolated, zero cross, 20 amp, 208 VAC. Solenoid: 24 VAC
Power	15 VA, 208-240 VAC, working, 50-60 Hz; no circuit breaker provided
Display (Digital)	Two displays, 4 characters each, 0.56" high. Seven segment LED uniplaner numerals
Display (Indicator)	Twelve discrete LEDs (red, green, amber)
Annunciators	Audio tone, approximately 2500 Hz
Connectors (Electrical to Bath)	BASIC: terminal screw strip on 3/8" centers ± T/C jack. J-type adapters on standoff: 2,3 & 6 port AMP-brand universal mate-n-lock receptacles. Level sensor (optional): 4 port MOLEX. Standard 10 ft. Power cable hard-mounted on bath; other lengths by special order only.
Connector (Electrical to Facility)	208-240V models.: NEMA L6-15 male plug. Other models: 15 Amp to be supplied by user.

1.4.5 Chemistry Leak Detector Specifications

Feature	Specification
Size with case:	5.59 x 3.35 x 1.33 inches, including mounting flanges on both sides. Two 0.187 inch diameter mounting holes are provided on 5.075 inch symmetrical centers. A single 0.50 inch diameter grommet is provided on one end for wiring access. A dust-proof lid is included.
Weight:	7 ounces.
Environment:	0-50°C, operating, 95% RH max.
Wiring Connections:	One 10-position and one optional 3-position DIN terminal block. No lugs are required. A jack provides connection to the IMTEC-provided transformer module.

1.5 Facility Requirements

The following information describes the facility requirements needed to install and operate an IMTEC Quartz Nitride Reflux Accubath and standard optional equipment.

1.5.1 Static QN Bath Requirements

Table 1-1. Static QN Bath Facility Requirements.

Supply	Requirement
Bath Power	Refer to the supplied drawings and schematics specific to your system
	Available option: 24-VAC switching remoted relays. For IMTEC QN baths drawing more than 20 amperes and for 24-VAC switching, special circuitry requirement data available from IMTEC.
D.I. Water Dripper	1/4 inch (O.D.) tube make-up water line, supplying 1-liter per hour (min) of stable pressure-regulated ($\pm 5\%$) D.I. water to flowmeter panel.
Cooling Water	1/4 inch (O.D.) tube cooling-water line to flowmeter panel, supplying 10 gph (min) city or chilled water at 40-60 psi.
Wet Station Provisioning	Provide adequate support for bath flange. Refer to the drawings and schematics supplied with your system.
General Electrical Notes	<ul style="list-style-type: none"> The controller requires a separate, adjustable over-temp circuit, which is compatible with a type "J" thermocouple. The snap switch (in all Accubaths) must be wired in series with the back-up relay control circuit. Refer to electrical schematics for bath wiring color codes. Ensure the bath power supply circuit is protected with an adequate circuit overload device such as a fuse or circuit breaker. IMTEC recommends GFI (Ground Fault Interrupt) circuit breakers.

1.5.2 Recirculating QN Bath Requirements

Table 1-2. Recirculating QN Bath Facility Requirements.

Supply	Requirement
Bath Power	Refer to the supplied drawings and schematics specific to your system
	Available option: 24-VAC switching remoted relays. For IMTEC QN baths drawing more than 20 amperes and for 24-VAC switching, special circuitry requirement data available from IMTEC.
D.I. Water Dripper	1/4 inch (O.D.) tube make-up water line, supplying 1-liter per hour (min) of stable pressure-regulated ($\pm 5\%$) D.I. water to flowmeter panel.
Cooling Water	1/4 inch (O.D.) tube cooling-water line to flowmeter panel, supplying 10 gph (min) city or chilled water at 40-60 psi.
Wet Station Provisioning	Provide adequate support for bath flange. Refer to the drawings and schematics supplied with your system.
General Electrical Notes	<ul style="list-style-type: none"> The controller requires a separate, adjustable over-temp circuit, which is compatible with a type “J” thermocouple. The snap switch (in all Accubaths) must be wired in series with the back-up relay control circuit. Always refer to the electrical schematic provided with the bath for wiring color codes. Ensure the bath power supply circuit is protected with an adequate circuit overload device such as a fuse or circuit breaker. IMTEC recommends GFI (Ground Fault Interrupt) circuit breakers.
Chemical Recirculation Components	A typical recirculation system includes a pump, filter, and various components to allow for draining and flushing of the loop. Specifications for these will depend on the type of chemical, capacity, temperature, type of fittings, and other factors related to the application. Always ensure that the recirculation loop is designed properly for the intended use.
Sump Overflow (optional)	The sump overflow prevents overfilling of the bath by draining off liquid in the sump above a specific level. The outlet of the overflow tube should be connected to a drain that is designed to accommodate the chemistry in use at it's operating temperature.

1.5.3 Model 952 Controller Requirements

Table 1-3. Model 952 Controller Facility Requirements.

Supply	Requirement
Heater/Controller Power	
	208V: Dedicated circuit of 200 to 245VAC; single phase, 20-amp; circuit breaker protected; line noise filtering as required. 100V: Dedicated circuit of 100VAC; single phase, 20-amp; circuit breaker protected; line noise filtering as required.
Environment	Protected headcase or equivalent. No exposure to chemical fumes.

1.5.4 Auto-Lid Actuation Panel Guidelines

The following information is intended as general guidelines only. Your system may vary.

Air – Either CDA or Nitrogen. This air is regulated to 30 psi.

Water – Either DI or House water is used. Regulated minimum pressure is specified in Table 1-4.

Table 1-4. Auto-Lid Water Pressure Facility Requirements.

Auto-Lid End-Opening (single piston only)		
Model	Min. Line Pressure (psi)	Max. Regulated Pressure (psi)
A1002	30	35
A1502	32	37
D1502	35	42
A2001	16	25
B2001	30	35
A2002	46	55
Auto-Lid Side-Opening		
Model	Min. Line Pressure (psi)	Max. Regulated Pressure (psi)
A1002	10	19
A1252	10	19
A1502	30	35
A2001	25	30
A2002	25	34

1.5.5 Chemistry Leak Detector LD-1 Requirements

Table 1-5. Terminal Block Connections Facility Requirements.

Terminal Block Number	Requirement
TB1-03	<p>GFI Breaker Ground. This terminal must be connected to the end user-provided heater power GFI breaker “Ground” terminal and from there to the Frame Ground, in accordance with all applicable electrical codes and SEMI 2479 safety standards, Section 7.7.1 and 7.7.2.</p> <p>If the end-user does not provide a GFI breaker, TB1-03 must be connected to the Frame Ground.</p>
TB1-06	<p>End-User Power Connection. The end-user must choose either a customer-supplied power source to power the Model LD-1, or the IMTEC-supplied transformer module. Only one of these two choices can be used. If both are present one must be disconnected.</p> <p>When the end-user supplied power source is used, a positive DC voltage in the range of 7 to 24 volts is applied to this terminal.</p> <p>A 1N4007 1000 volt reverse-protection diode and fuse is provided within the Model LD-1 to protect the user’s power supply.</p> <p>When the IMTEC-supplied transformer is connected to the terminal, disconnect all wires to TB1-06</p>

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2 SAFETY REQUIREMENTS

This section includes the following topics:

- Safety requirements and IMTEC safety recommendations for the QN Quartz Nitride Bath and other optional equipment

The following recommendations and requirements are included for personal and equipment safety. Please read them completely before installing and operating your Accubath QN system.

NOTE

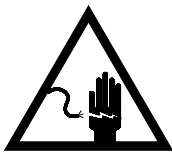
The recommendations included in this section are advisory in scope. **IMTEC assumes no responsibility for the correct installation or use of this equipment in any user's facility.** IMTEC recommends that installation of this equipment be confined to licensed contractors, OEM-provided personnel and/or trained Facility Maintenance personnel.

Ensure you are familiar with your company's Wet Station Safety Regulations and Specifications, the local fire marshal codes and applicable electrical code requirements for compliance.

2.1 Electrical Safeguard Recommendations

If your system uses an IMTEC controller, refer to this section for electrical safety information and recommendations. If you are using a non-IMTEC controller, refer to the controller manufacturer's documentation for electrical safety information and recommendations.

WARNING



DANGEROUS VOLTAGE IS PRESENT!

Hazardous voltages exist. Use caution around exposed circuits.

Check area for exposed contacts prior to contacting the equipment.

To ensure operator, equipment, and product safety, use care when operating this equipment. The following warnings must be adhered to.

- Avoid exposing the power cable or connectors to immersion in water or other liquids.
- When performing a re-installation procedure, unplug or unwire the power cable before moving the bath.

2.2 Handling Requirements

CAUTION



BATH CAN WEIGH OVER 50 lbs. (22.7 kgs)!

IMTEC recommends using two (2) technicians and / or mechanical lifting apparatus when removing and replacing the tank. Follow your company's safe lifting procedures when handling the equipment.

Guard against mechanical impact when handling the bath. Even a small chip can start a crack running.

WARNING

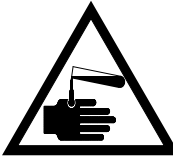


DANGEROUS VOLTAGE IS PRESENT!

DO NOT flex or crimp the electrical cabling any more than absolutely necessary.

To ensure operator, equipment, and product safety, follow the instructions and use care when operating this equipment.

WARNING



HAZARDOUS CHEMICALS CAN CAUSE SEVERE INJURY OR DEATH!

DO NOT move a bath containing any solution. Before attempting removal procedures apply your company's chemical and electrical lockout and tagout procedures. Also, these procedures must be performed while wearing full acid gear.

CAUTION



HOT SURFACES!

Surfaces may be as hot as 200°C. Do not move the tank or touch the hot surfaces of the tank.

2.3 In-Use Requirements

Read, understand, follow and implement the following general warnings and cautions during the use of this system.

GENERAL WARNINGS	GENERAL CAUTIONS
	<ul style="list-style-type: none"> • Ensure that all protective sensors and automatic shutdowns are attached and functional. • Take extra care when using volatile flammables: fumes are more dangerous than liquids. • Always verify that the chemistry to be heated is compatible with the quartz surface. Never use Hydrofluoric Acid, B.O.E., or other HF-bearing solutions in this Accubath QN system. Such solutions will etch the quartz liner tank and void the warranty. In addition, high PH (>11) will have some affect on quartz that will vary with temperature, concentration, and the addition of other chemistries. The user is responsible to ensure that the affect of the chemistry on the bath is acceptable. IMTEC is not responsible for the effects of chemical etching of the quartz or any failure that is a result of this etch. • DO NOT use the Accubath QN system with any process chemistry or solvents unless the bath is properly installed in an operating fume hood. • DO NOT turn on the bath unless it contains liquid filled to the freeboard line (the horizontal interface line formed by the Accubath QN system gray and white backgrounds) or one and one-half inches (1-1/2") from the top of the quartz flange. • DO NOT use the Accubath QN system unless you are wearing protective outer garments including, but not limited to, industry-approved safety glasses or goggles, splash guard sleeves and aprons, and resistant gloves. • DO NOT aspirate (manually drain) hot solution from any process vessel. Allow the liquid to cool first to a maximum temperature of 90°C. • DO NOT leave an operating bath system unattended. If qualified personnel are not available, turn the system power off. • DO NOT operate the Accubath QN system at temperatures exceeding 190°C. Doing so will void the warranty. • DO NOT allow bath liquid levels to fall below the heater mesh and safety over-temperature sensors. The use of a liquid level sensor is highly recommended.

2.4 Model 952 Controller Alarm Indicator LEDs

The Alarm LED indicators on the 952 Controller are located on the lower center of the faceplate (see Figure 2-1). There are two groupings: STATUS and ALARM. In an alarm condition, the ALARM LED in the STATUS grouping will light and one or more of the LEDs in the ALARM grouping may light to indicate the problem detected by the Controller.

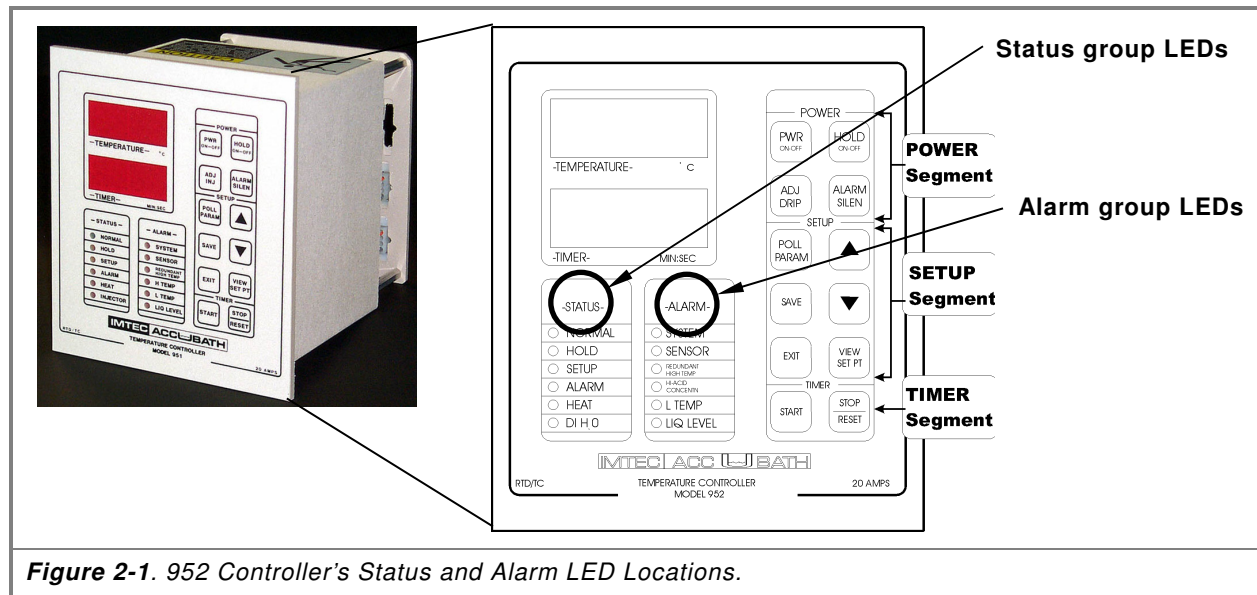


Figure 2-1. 952 Controller's Status and Alarm LED Locations.

In addition, there is one alarm condition *without* an associated LED: AUX. When this LED is lit, it indicates that the Controller has determined that the process is outside of preset values or an equipment malfunction has occurred. Whenever this LED is lit, there will be one or more indicators lit in the ALARM grouping.

The Controller automatically resets this LED when the condition(s) that caused it are corrected.

2.4.1 Alarm LEDs

The six LEDs in the ALARM grouping are:

- SYSTEM
- SENSOR
- REDUNDANT HIGH TEMP
- HI-ACID CONCENTRATION
- LOW TEMPERATURE
- LIQUID LEVEL

SYSTEM LED. Indicates a problem in the Controller software as detected by its built-in diagnostic routines. This alarm condition may require the Controller to be reset by powering OFF and ON. If you are entering commands when this condition occurs, you may have to re-enter them. In addition to the LED, an alarm will sound. The Controller will be put into HOLD.

SENSOR LED. Indicates that the process temperature, or overtemp sensor, is open, shorted or not connected. During processing, the Controller continually monitors the sensor input. If it detects a non-functioning sensor, it shuts off the heater output and activates the SENSOR alarm LED. In addition to the LED, the code “Sn” will alternate in the Temperature display window with the sensed bath temperature, and an alarm will sound. The Controller will be put into HOLD.

REDUNDANT HIGH TEMPERATURE LED. Indicates the high limit circuit has turned off the master relay. Because it is powered directly by the high limit power supply, this LED will remain lit to alert you to the alarm condition even after the master relay has de-energized. The Redundant High Temperature condition does not have an audible alarm. The Controller will be shut down.

HI-ACID CONCENTRATION LED. Indicates there is insufficient water concentration to maintain boil point control. In this alarm condition “HI” will alternate in the Temperature display window with the sensed bath temperature and an alarm will sound. There are two conditions that will initiate the Hi Acid alarm. They are as follows:

1. If the process temperature has exceeded the high temperature setpoint (Parameters SP + HI) a 10 minute internal timer is started. If the temperature has not dropped below this value within 10 minutes the Controller will be put into HOLD mode.
2. If the temperature comes within 2 degrees of the setpoint + the boil rate (Parameters SP + BR -2) the controller will immediately be put into HOLD mode.

LOW TEMPERATURE LED. Indicates that the process temperature has dropped below the (SP – LO) value. This LED may be activated any time after the system has gone through initial warm-up. In addition to the LED, the code “LO” will alternate in the Temperature display window with the process temperature and an alarm will sound. The Controller will be put into HOLD.

LIQUID LEVEL LED. When this LED is lit, it indicates that the process bath liquid level has either dropped below the Low Level Sensor or risen higher than Hi Level Sensor, depending on which sensor has been connected (see Section 3.7). The code “LL” will

alternate in the Temperature display window with the sensed bath temperature, and an alarm will sound. Heater power will be denied, but the Controller will not be put into HOLD and operation will resume when the level condition is corrected.

AUXILIARY. This alarm has no associated LED. When connected, this alarm monitors a customer-defined remote switch and activates when the condition defined by the operator occurs. When activated, the code “**AU**” alternates in the Temperature display window with the sensed bath temperature and heater power will be denied. However, the Controller is not put into HOLD and operation will resume when the alarm condition has been corrected. As delivered from the factory, the value for the auxiliary input parameter (**AS**) is set at 01 (Alarm on closure). To change this setting refer to Section 5.X, *Setting Processing Parameter Values*.

ALARM SILENCE switch turns off the audible alarm and stops the flashing display of alarm codes in the Temperature display window. Once the alarms have been cleared, the controller can then be returned to a functional condition where you can examine the setpoints and reset functions without the interference of the alarm displays and sounds. Even though the sounds and Temperature window displays are discontinued, any STATUS and ALARM LEDs associated with the alarm condition will continue to flash, and – if applicable – power to the heater will be turned off to protect the equipment.

The results of the ALARM SILEN key are not reversible. Once pressed, the sounds and flashing codes will be suppressed for as long as the controller remains in an alarm condition.

2.5 Leak Detect Electrical Safeguards

In the event of significant chemistry leakage, full heater voltage (208VAC) can appear on TB1-01 and / or TB1-02. For this reason, it is *essential* that TB1-03 (Safety Ground) be connected to the heater power GFI circuit breaker (Figure 2-2).

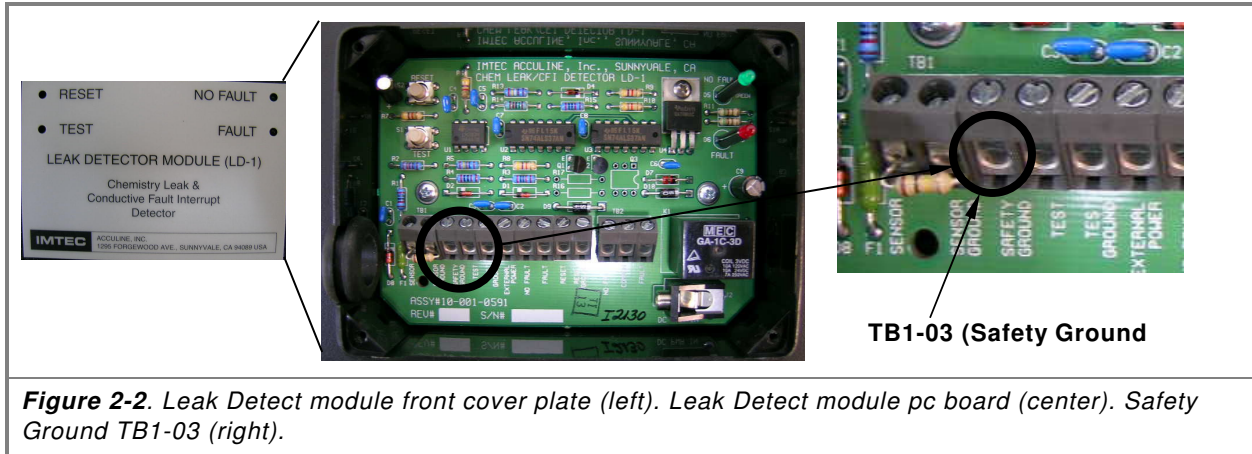



Figure 2-2. Leak Detect module front cover plate (left). Leak Detect module pc board (center). Safety Ground TB1-03 (right).

If the LD-1 is connected to an external device, the use of a relay output provides full electrical isolation in the event of a fault.

CAUTION	
	<p style="text-align: center;">POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!</p> <p>During the installation procedure, DO NOT mount the IMTEC LD-1 Leak Detect device in any area subject to liquids or chemical fumes. Doing so will put the LD-1 components at risk of corrosion.</p>

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3 PRODUCT INSPECTION

This chapter describes guidelines to follow when unpacking and inspection the IMTEC Nitride Reflux System and standard options.

3.1 Inspecting the Packaging

NOTE
<p>These guidelines have also been included with the shipping manifest attached to the outside of the shipping container.</p>

Before opening the shipping container, please look for evidence of transportation damage. It is your responsibility to notify the shipper promptly of any claims of freight damage. Please contact IMTEC also, so that we may be of assistance with an expeditious repair or replacement of the damaged parts.

CAUTION	
	<p style="text-align: center;">POTENTIAL EQUIPMENT DAMAGE!</p> <p>Keep the IMTEC packaging and box in which the system and any options were shipped. If the system should ever need to be returned to IMTEC, it must be returned in an appropriate container to minimize risk of shipping damage. If the original container is not available, purchase a packing kit from IMTEC for a nominal fee.</p>

3.2 Checking the Contents

The Accubath QN system may come in multiple cartons. The following list contains the items that make up a complete system. Optional Items are noted as such:

Quantity	Equipment
1	QZ or QRT/S heated quartz bath
1	QN condensing collar (may be integral to the tank)
1	QN lid (auto or manual)
1	RTD Temperature Sensor (optional)
1	Dual Flowmeter Panel (optional)
1	Autolid Actuation Panel (optional)
1	Warranty registration card (in an envelope)
1	This Instruction Manual
<p>Any optionally ordered items such as a dispersion plate, 952 Controller, etc.</p>	

NOTE

If any of the above items are missing, contact IMTEC immediately.

If the system is consolidated in shipment with other components, check your receiving documents and / or additional manuals for a checklist of the pertinent items.

3.3 Unpacking Considerations**CAUTION****HANDLE WITH CARE!**

Quartz, like glass, is fragile and breaks on impact.

CAUTION**EQUIPEMENT CAN WEIGH OVER ONE HUNDRED POUNDS! (220kgs)**

IMTEC recommends using two (2) technicians and / or mechanical lifting apparatus when lifting this equipment. Follow your company's safe lifting procedures when handling the bath.

This concludes Section 3, *Product Inspection*.

4 INSTALLATION PROCEDURES

NOTE

Please read this section completely before attempting to install this tank and other IMTEC-supplied equipment. For pre-operation setup and calibration procedures go to Section 5, *Setup and Calibration*.

NOTE

Typically, IMTEC ships customized QN systems. Each system is shipped with a set of drawings, specific to that system shipped, indicating the connections to be made. You are referred to these drawings throughout these procedures.

The information presented in this section is:

- Pre-installation Procedures
- Installation Procedures of the System and Optional Components
- Electrical Connections
- Plumbing Connections

4.1 Pre-Installation Procedures

1. Ensure all of the components necessary for safe operation are available and all control and safety features have been considered. This includes but is not limited to:
 - Quartz Heated Tank
 - Condensing Collar and gasket
 - Lid (manual or automatic)
 - 952 Controller
 - Collar mounted RTD probe
 - Liquid Level sensor (not supplied by IMTEC)
 - Electrical components for controlling heater element(s)
2. Remove all chemicals from adjacent work areas in the wetstation. Clean all chemical spills on the sink deck and in the plenum. Observe all electrical safety precautions.
3. Have Facilities provide adequate tank-support and deck cutout.
4. Carefully remove the tank and ancillary items from their shipping cartons.

NOTE

Ensure all items have been inspected for breakage and missing items reported when the system was received, not at installation.

5. Pre-clean the tank and bring all of the items into the production area.
6. Install bulkhead connectors or make accommodations for any electrical and plumbing lines to exit the plenum area.

CAUTION**POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!**

The power cord on the tank is enclosed in a Teflon sheath. This sheath must not be terminated in a wet environment or where chemical vapors are present. Moisture or fumes could migrate back to the sealed housing and damage the heaters.

This ends Pre-Installation Procedures.

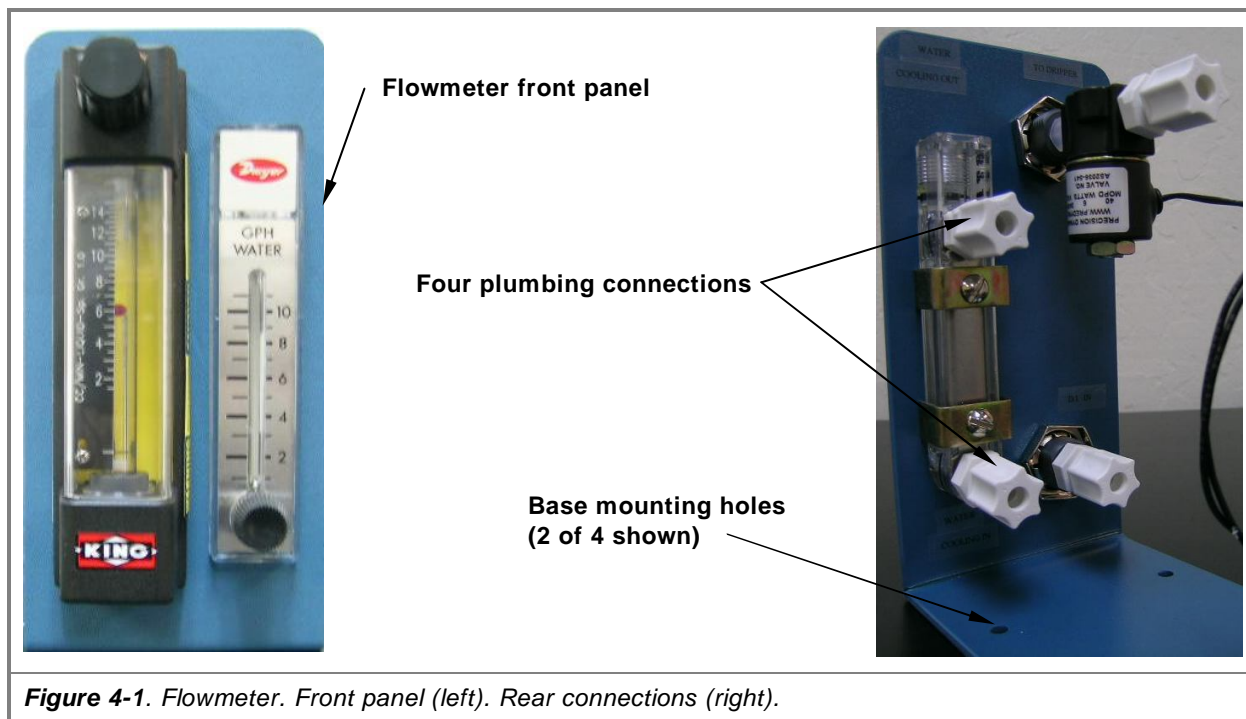
4.2 Installation Procedures

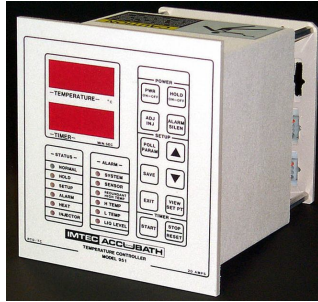
The order of installation and assembly is:

- Tank Flowmeter
- 952 Controller
- Tank into the deck or plenum
- Attach collar and lid
- Connect electrical and plumbing
- any other optional equipment supplied by IMTEC

4.2.1 Installing the Tank Flowmeter

1. Install the dual Flowmeter panel, Figure 4-1, in the appropriate location. The panel should be mounted away from chemical fumes and situated where it is accessible for maintenance.
2. You will need a screwdriver, drill, and four #6 screws.
3. The base of the flowmeter panel has a four-hole mounting pattern. Mount the flowmeter using the #6 screws.
4. Connect the panel to the DI water and city (or chilled) water supplies.






4.2.2 Installing the 952 Controller

Mount the controller in the headcase or maintenance chase according to the following procedures. The information is presented in the following order:

- Regulations Check
- Installing the Controller
- Connecting the Controller to the Tank
- Connecting the RTD Sensor
- Connecting the Dripper Solenoid to the Controller
- Connecting the Level Sensors to the Controller
- Connecting the Auxiliary Monitoring Device
- Connecting the Remote Keypad
- Connecting the Remote Status Display
- Connecting the Power Cord to the Controller
- Connecting the 24 VAC I/O

4.2.2.1 Regulations Check

CAUTION	
	<p>POTENTIAL OF NON-COMPLIANCE!</p> <p>Before attempting these procedures, understand your company's Equipment Safety Regulations and Specifications, the local fire marshal codes and applicable electrical code requirements ensure compliance of these regulations.</p>

4.2.2.2 Controller Installation

1. Refer to Section 1.4.4, *Model 952 Controller Schematic*, for the dimensions of the 952 controller and the suggested cutout. Ensure that the proposed location for the controller is adequate.
2. If the wetstation has a retaining bracket welded to the rear face of the headcase panel, you may slide the controller into it, or solvent-weld an adapter to the "flange" of the controller's faceplate.
3. If the controller is replacing a controller of different, larger dimensions, you may find it more convenient to insert the controller through a bezel plate to cover the existing cut-out, then mount the bezel to the face of the headcase.


4.2.2.3 Connecting the Controller to the Tank

1. If installing the 952 Controller for use with an IMTEC Nitride (QN) tank, route the power cable (permanently fixed to the tank) through the wetstation's plenum and up to the headcase. Take care not to crimp the cable.

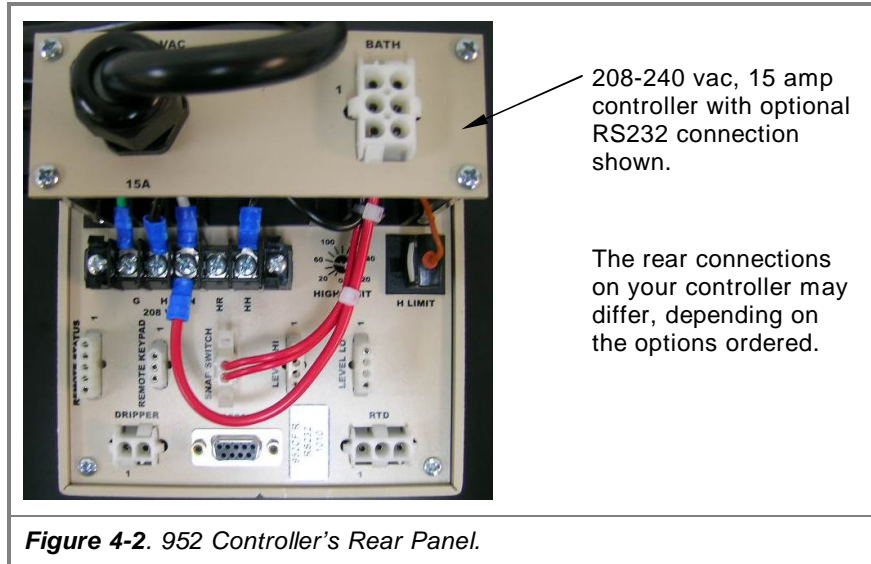
NOTE
If the 952 Controller is to be used with a non-IMTEC tank, please refer to that tank's manufacturer's manual for information about connecting the tank to the 952 Controller.

2. The QN tank's power cable contains the power, overtemperature thermocouple, and thermostatic switch leads, and on tank models that draw less than 15 amperes, terminates in an AMP-brand, six-pin male plug (the 100-120V model uses a 9-pin plug).

Insert this male plug into the matching female receptacle on the controller's rear panel, Figure 4-2.

CAUTION	
	<p style="text-align: center;">POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!</p> <p>There is a Teflon tube protruding from the cable just in front of the plug. This tube permits equalization in the tank housing during heat-up and cool-down cycles and must not be obstructed.</p>

NOTE
<p>For Tanks that draw between 15 and 20 Amperes, the wiring may be connected directly to the terminal strips on the rear of the main enclosure.</p> <p>Tanks drawing in excess of 20 Amperes require external power switching as the internal circuitry is not rated for these high current applications.</p>



3. Seal the entrance of the headcase against fumes.

4.2.2.4 Connecting the RTD Sensor

1. Plug the three-pin cable attached to the RTD into the matching female receptacle on the rear panel, Figure 4-2.

4.2.2.5 Connecting the Dripper Solenoid to the Controller

The IMTEC QN system comes complete with a set of flowmeters mounted on a small panel suitable for mounting in an area that is not exposed to liquids or chemical fumes. On the rear of the flowmeter panel is the dripper solenoid, which has attached power leads terminating in a two-pin AMP male plug, Figure 4-3. The Flowmeter has a 12-inch cable installed. For your convenience a 10-foot extension cable is included in this shipment.

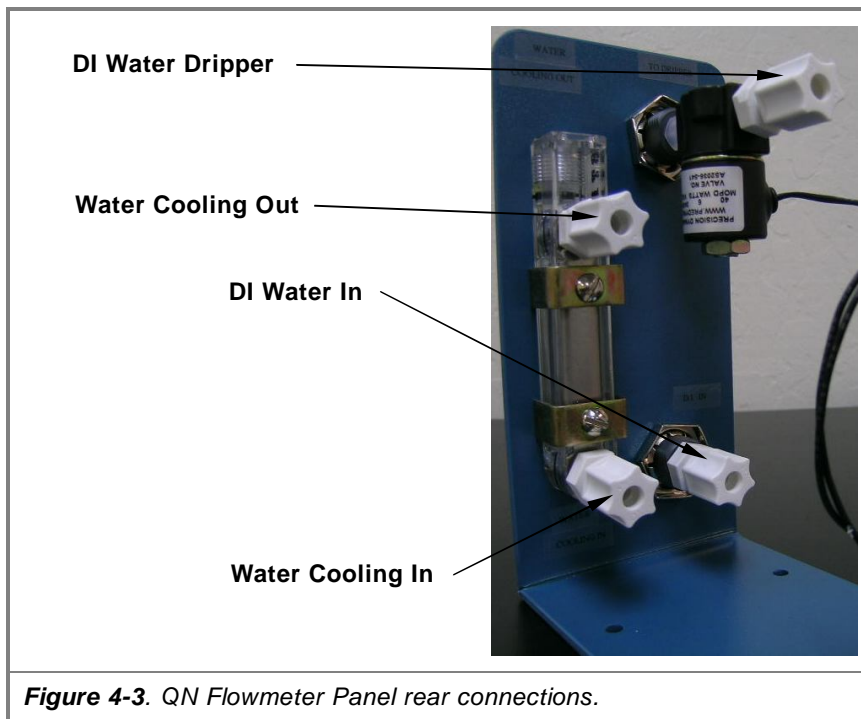


Figure 4-3. QN Flowmeter Panel rear connections.

1. Locate the flowmeter panel in a location so that the flows may be conveniently monitored, then route the electric leads to the rear of the installed 952 Controller.
2. Insert the male plug into the matching female two-pin receptacle on the controller's rear panel, Figure 4-3.
3. Connect the incoming cooling water and incoming DI water drip to their respective $\frac{1}{4}$ -inch compression fittings at the rear of the panel, Figure 4-3.
4. Run the provided Teflon dripper output line through the compression fitting in the quartz condensing collar. Insert this line so that the DI water will drip over the cooling coils when the solenoid is on.
5. Connect the provided cooling water line to the upper cooling water port on the quartz condensing collar. Connect the lower port to the wetstation's drain or reclaim system.

4.2.2.6 Connecting the Level Sensors to the Controller

NOTE

The following procedures do not apply to the 100-volt models.

The Model 952 Controller is configured to accept the signal from one level sensor. The controller can be programmed to accept either a “Normally Open”, or “Normally Closed” switch. IMTEC recommends a “Normally Open – Closed In Safe Mode” configuration. You may connect both a HI level sensor and a LO level sensor, but the 952 Controller will not discriminate between them, and you will have to visually determine the cause of any high or low level alarm.

1. Connect the sensor lead cable(s) as indicated on the rear panel, Figure 4-2.

NOTE

The factory-default setting for the Liquid Level Sensor (LS) is set at 01 (Alarm ON, Switch Closed). To change this setting refer to Section 5.5, *Setting Processing Parameter Values*.

2. Install and tune the sensor(s) according to the sensor instruction manual or the tank manual.

NOTE

Tables 4-1 and 4-2 provide typical details of the 952 Controller’s back panel connections.

Tanks rated between 15-amps and 20-amps must be wired directly to the terminal strip. Tanks rated above 20-amps must use an external relay for tank power switching.

Table 4-1. Typical 100 / 120-volt Standoff Panel Connections.

Connector	Diagram	Pin No.	Wire			Function
			Wire	Wire	Wire	
1 (Plug provided with tanks rated at less than 15-amps.)		1	White	Iron	+	HI-Limit J/TC Sensor
		4	Red	Const	-	
		3	Black	14AWG		Heaters (15-amps maximum)
		6	Red	14AWG		
5		18-22AWG		Open-On-Rise Thermostat		
2		18-22AWG				
		7, 8, 9	Not Connected			
2		1	Red			3-wire RTD. 100-ohm Platinum
		2	White			
		3	White			
3		1	Gray	22AWG	Liquid Level Input	
		2	Not Used			
		3	Not Used			
		4	Orange	22AWG		

Table 4-2. Typical 208 / 240-volt Standoff Panel Connections.

Connector	Diagram	Pin No.	Wire			Function
			Wire	Wire	Wire	
1 (Plug provided with tanks rated at less than 15-amps.)		1	White	Iron	+	HI-Limit J/TC Sensor
		2	Red	Const	-	
		3	Black	14AWG		Heaters (15-amps maximum)
		4	Red	14AWG		
5		18-22AWG		Open-On-Rise Thermostat		
6		18-22AWG				
2		1	Red			3-wire RTD. 100-ohm Platinum
		2	White			
		3	White			
3		1	Gray	22AWG	Liquid Level Input	
		2	Not Used			
		3	Not Used			
		4	Orange	22AWG		

4.2.2.7 Connecting an Auxiliary Monitoring Device

An external monitoring device may be connected to the 952 Controller using the auxiliary switch input. This input operates the same way as the Liquid Level Alarm, except it does not have a LED indicator on the front panel. Upon activation, AU flashes on the temperature display and an audible alarm is triggered. The Aux alarm can be programmed through the A5 parameter to trigger on switch open (00), or switch closed (01).

4.2.2.8 Connecting the Remote Keypad (Optional)

The optional Remote Keypad, Figure 4-4, allows remote control of the Start, Stop or Reset functions of the tank timer.



Figure 4-4. Remote Keypad.

1. Connect the female end of the provided cable to the Remote keypad. Plug the male end of the cable into the rear panel at the labeled connection.

4.2.2.9 Connecting the Remote Status Display

This connection displays to status of the controller and allows the user to monitor the status and functions through an external device. The remote status connector provides an open collector switch rated at 50ma at 10-32VDC and is active any time the controller is in a Normal condition as indicated by the front panel LED. Use the White / Blue wire to attach to the load supply (+) and the White / Brown wire to the load common (-).

4.2.2.10 Connecting the Controller Power Cord

A two-conductor and ground, rubber-encased power cord is attached at the rear panel of the 952 Controller, Figure 4-2. Refer to Table 4-3 for making connections to the power source.

For use on 208VAC models, this power cord terminates in a NEMA L6-15 male plug. As an alternative, the NEMA plug may be removed and the cord wired directly to a circuit breaker power bus.


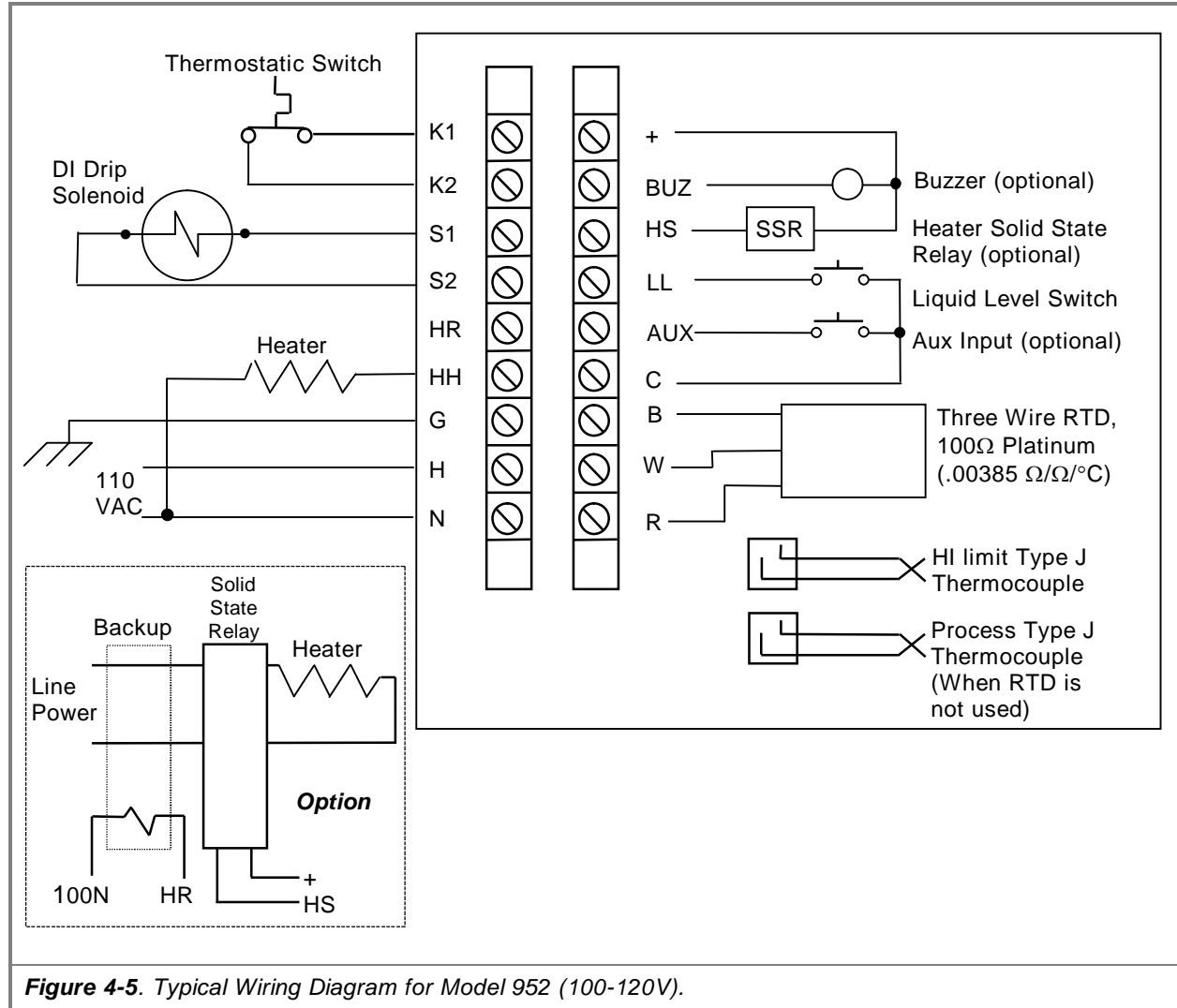
CAUTION	
	<p style="text-align: center;">POTENTIAL EQUIPMENT DAMAGE!</p> <p>Circuit breaker protection is required. At no time must the controller be allowed to switch more than 20 Amps.</p>

Table 4-3. Proper Power Cord Connections.

Model	Connection Description
100V	Connect this plug to a 20-Amp, single phase, 120 VAC circuit.
208V	Connect his plug to a 20-Amp, single phase, 208-240 VAC circuit.
24VAC	No facility power cord is provided and a four pin female connection is installed on the rear panel for connection to a 24VAC supply and a heater control relay. Refer to Section 4.2.2.11, <i>Typical Wiring</i> , Figure 4-8 for proper wire connections.
Other Voltages	You must provide your own connector.

4.2.2.11 Typical Wiring

Figures 4-5, 4-6 and 4-7 show typical wiring diagrams. Figure 4-5 is for the Model 952 100-120V. Figure 4-6 is for the Model 952 208-240V. Figure 4-7 is for the Model 952 24VAC.



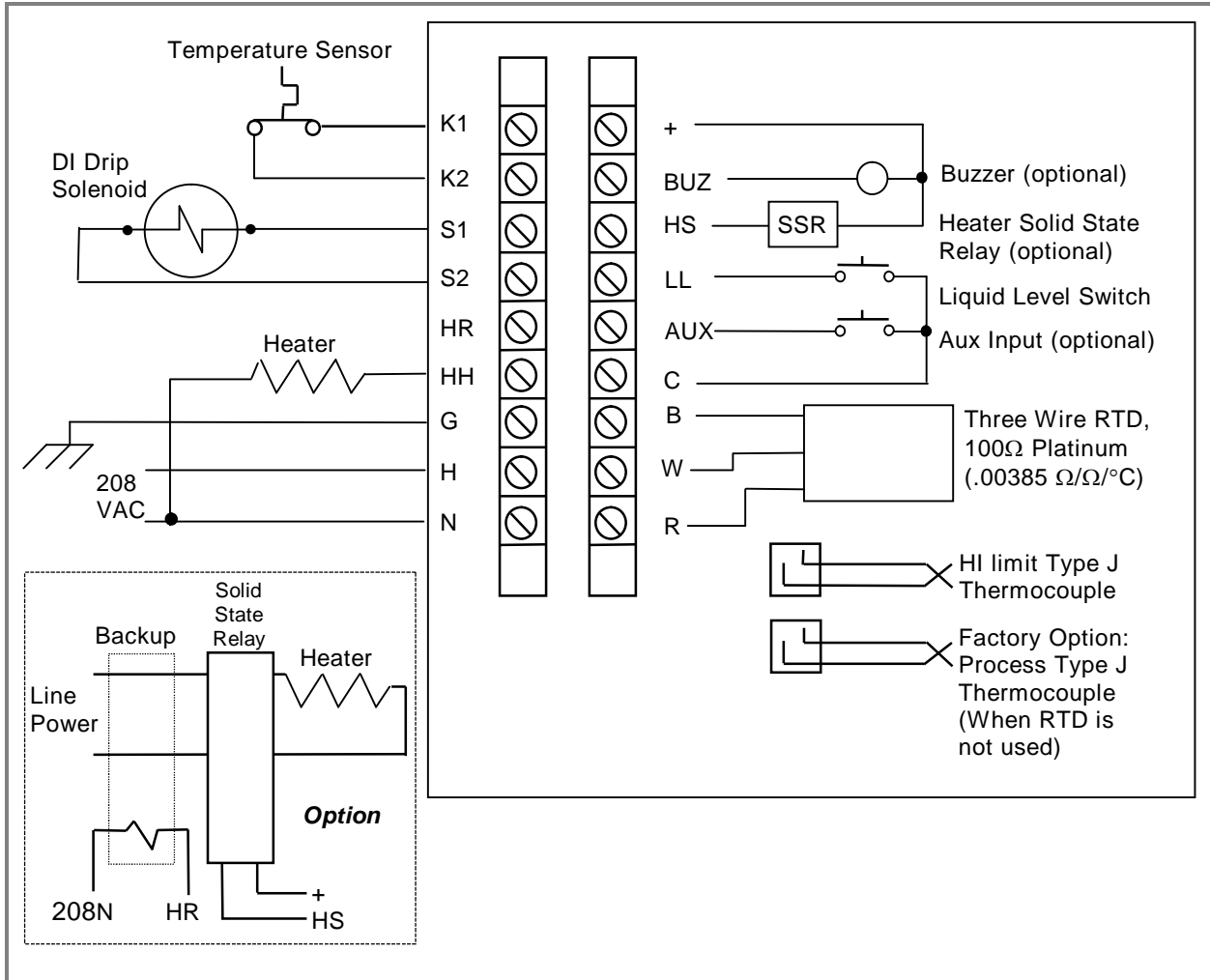


Figure 4-6. Typical Wiring Diagram for Model 952 (208-240V).

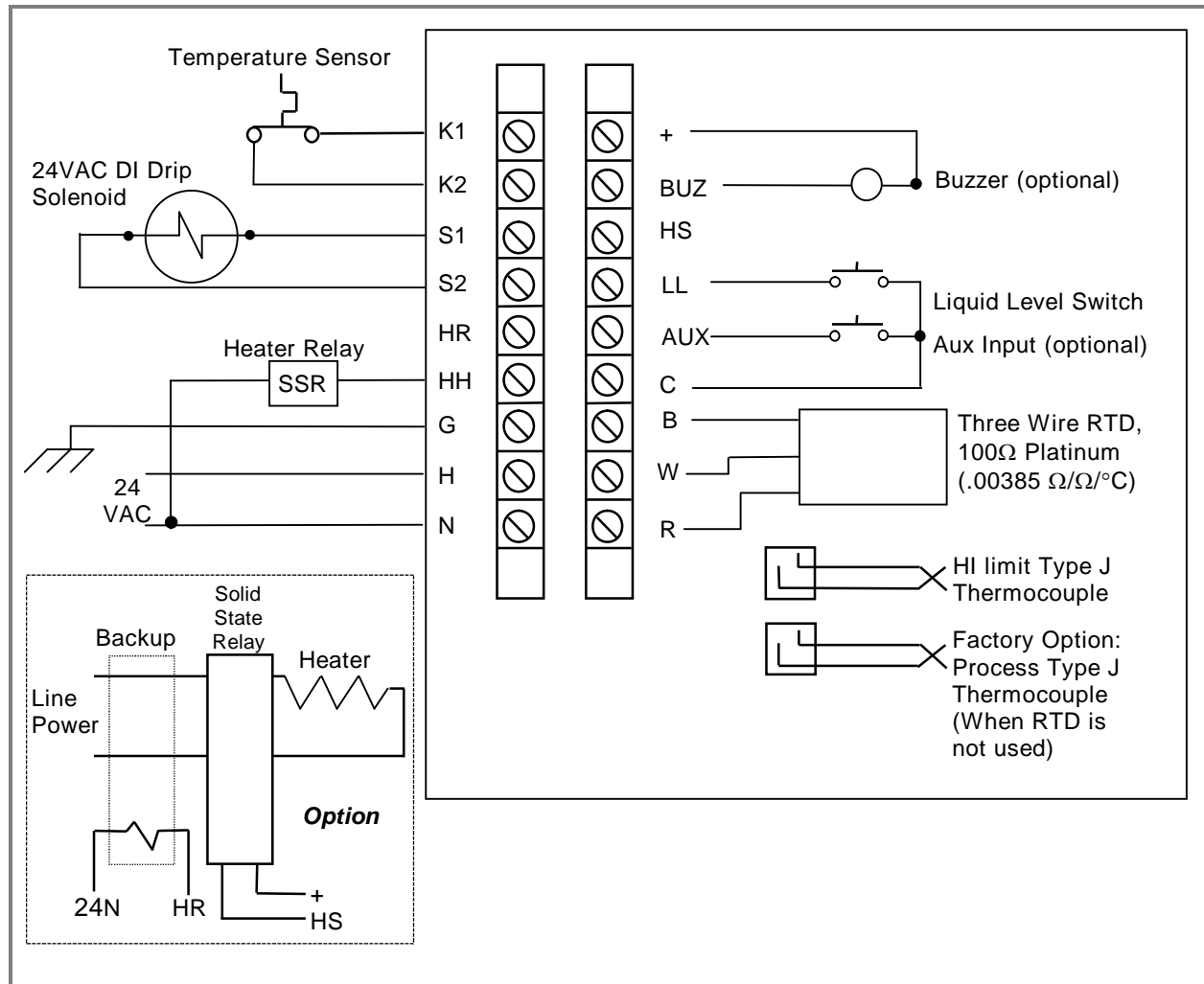


Figure 4-7. Typical Wiring Diagram for Model 952 (24VAC).

4.2.2.12 Controller After-Installation Testing

To test the 952 Controller after all connections are made, press the PWR ON-OFF switch on the keypad to power up the controller, Figure 4-8.

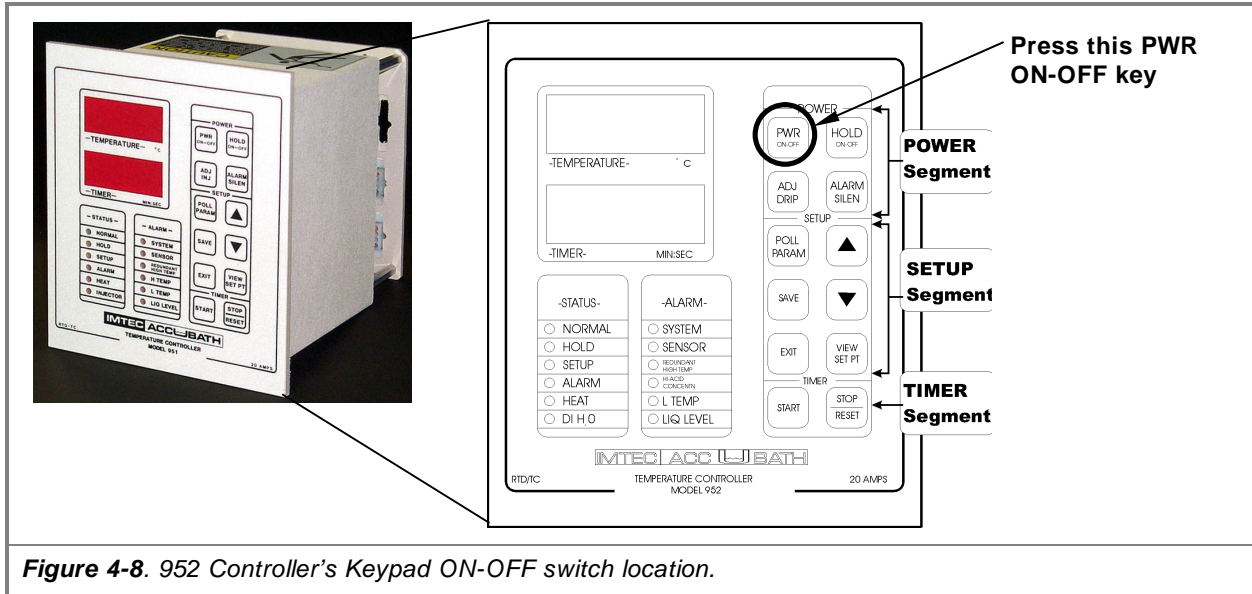



Figure 4-8. 952 Controller's Keypad ON-OFF switch location.

The controller automatically checks for the following conditions and will report errors and alarms if these conditions are not met:

Initial Controller Power On Checks	
An RTD connection	If no RTD connection is sensed, the controller switches to Alarm mode. The code "Sn" (sensor) will flash in the Temperature display window and an alarm will sound.
A Thermocouple connection (through tank cable)	If no Thermocouple connection is sensed, the controller switches to Alarm mode. The code "Sn" (sensor) will flash in the Temperature display window and an alarm will sound.
A Snap Switch connection (through tank cable)	If no Snap Switch connection is sensed, the controller will not power on.
If all connections are sensed, the controller will be powered on and in HOLD mode and the current sensed tank temperature will flash in the Temperature display window.	

If the initial power-on checks are successful, the 952 Controller is ready for operation.

CAUTION	
	<p>POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!</p> <p>If you are unfamiliar with the use of the Model 952 Controller, read the remaining sections of this manual concerning Operation Procedures before attempting processing.</p>

4.2.3 Installing the QN Tank

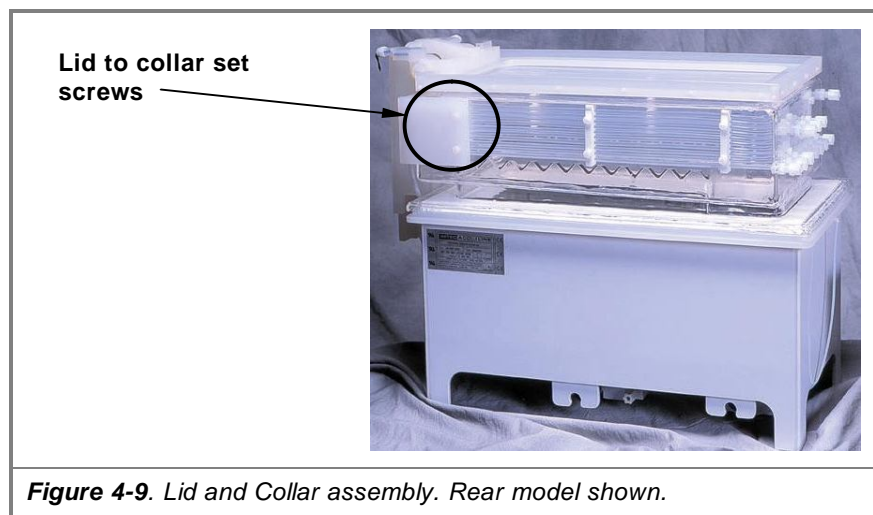
1. Install the tank in the wetstation or deck-mount it. The preferred method of support is from the flange along the entire length of at least two opposing sides. Ensure that the supports are adequate to handle the weight of a fully loaded tank and that the support material will not bend or melt at normal operating temperatures.

4.2.4 Installing the Condensing Collar and Lid

NOTE

Ignore the following procedures if your lid and condensing collar were delivered pre-assembled.

1. Carefully remove the protective wrapping from the lid and collar.
2. Attach the lid to the collar (Figure 4-9) by tightening the one or two set screws (depending on the type of the lid) threaded into the back edge (or sides) of the lid's frame through to the collar. Tighten these set screws very gently against the quartz collar.



3. Make sure the Tank / Collar gasket is properly attached. If it is not, re-attach the gasket before installing the collar.
4. Place the collar / lid assembly on top of the already-installed tank and visually check that the gasket is in place and there is no quartz-to-quartz interference. The weight of the collar and lid is adequate to seat the gasket.


NOTE

Note that the gasket is primarily to provide isolation between quartz members; **do not** try to force a perfect seal.

4.2.5 Electrical Connections

The following instructions assume you are using an IMTEC 952 Controller and a QN tank that has heaters rated at less than 20 amperes.

Larger tanks may exceed the 20-amp rating and require the use of external relays to control the high amperage load. Ensure that all components are rated correctly for the application and all manufacturers recommendations are followed. The product ID tag on your tank should list these electrical requirements.

CAUTION	
	<p>POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!</p> <p>If you are using your own controller, you are assuming responsibility for assuring that the controller will operate the tank correctly and perform the necessary safety functions.</p>

1. Connect the power cord to the 952 Controller. If a different control scheme is used, ensure that it makes use of the internal Overtemperature thermocouple and snap switch.
2. Connect the tank temperature probe to the 952 Controller.
3. Connect the Liquid Level protection device.

NOTE
<p>IMTEC heated tanks require a liquid level sensor for safe operation and these are not included with the system. Numerous types of level sensors are available. The functional requirement of the liquid level sensor is to remove all power from the heaters in the event that the liquid level in the tank drops below the heater height, which is visible through the quartz.</p>

4.2.6 Plumbing Connections

1. Connect the optional drain line to the bottom of the tank. If the tank is recirculating, connect the inlet line.
2. Make all collar connections as shown in the drawings which accompanied the tank. This includes Aquaseal inlet, DI inject, cooling coils, level sensor(s) and any other ports required for the application.
3. If an IMTEC Autolid is used, connect the lid cylinders to the actuation panel as described in the following section.
4. Set the flowmeter for the cooling coils to (mid-scale). Further adjustment may be needed after ramp-up, depending on the temperature of the cooling water and your chosen process



temperature.

4.2.7 Installing the Auto-Lid Actuation Panel

IMTEC suggests the Auto-Lid Actuation Panel be installed in an easily reached location for adjustments and maintenance while maintaining visual contact with the auto-lid assembly.

This panel is easily fastened in place by drilling small pilot holes and using self tapping screws or it can be welded in place using a poly welder.

4.2.7.1 Facilities Installation

1. Install a water pressure regulator on the selected water line, and set the pressure to equal the minimum consistently available water pressure. Do not exceed 50 psi. Review Section 1.5.4, *Auto-Lid Actuation Panel Requirements*.
2. Route a length of polyethylene (or equivalent) tubing from the regulator to the ¼-inch fitting on the Actuation Panel labeled “H₂O” IN”.
3. Route a length of polyethylene tubing from the ¼-inch fitting on the Panel labeled “H₂O” DRAIN” to the facility city water drain.
4. Install a short length of polyethylene tubing on each of the barbed fittings located on the top of each Teflon air-actuated water-control valve located in the Panel.
5. Slip each loose end of the tubing onto a ¼-inch barbed “T” fitting.
6. Install polyethylene tubing from the remaining end of the ¼-inch barbed “T” fitting to a suitable pneumatic three-way, two-position valve switch.


NOTE

The valve switch may be hand operated, foot operated, or a electrically actuated solenoid valve.

7. Connect the three-way valve switch to the regulated CDA or nitrogen supply.
8. Install ¼-inch polyethylene tubing from the Actuation Panel valve fitting labeled “TOP” to the auto-lid cylinder fitting located closest to the shaft end of the cylinder.
9. Install ¼-inch polyethylene tubing from the Actuation Panel valve fitting labeled “BOTTOM” to the auto-lid cylinder fitting located on the end opposite from the cylinder shaft.
10. If used, install the Aquaseal flowmeter assembly in the system's

plumbing bay access area.

4.2.8 Installing the Chemistry Leak Detector (LD-1)

CAUTION	
	<p style="text-align: center;">POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!</p> <p>Do Not mount the IMTEC LD-1 in any area subject to liquids or chemical fumes. Doing so will put the LD-1 components at risk of corrosion.</p>

4.2.8.1 Overview

The IMTEC Model LD-1 Chemistry Leak and CFI (Conductive Fault Interrupt) Detector, Figure 4-10, provides detection for any of the following three fault conditions:

1. Presence of process chemicals inside the housing.
2. An electrical leakage (conductive fault) between the bath/in-line heater element and the leak sensor.
3. The leak sensor circuit opens. This condition requires an end-of-sensor termination resistor, refer to Section 4.2.8.3, *Requirements and Installation*.

Any of the above fault conditions will “set” an alarm latch.

If the LD-1 is connected to an external device, the use of a relay output provides full electrical isolation in the event of a fault.

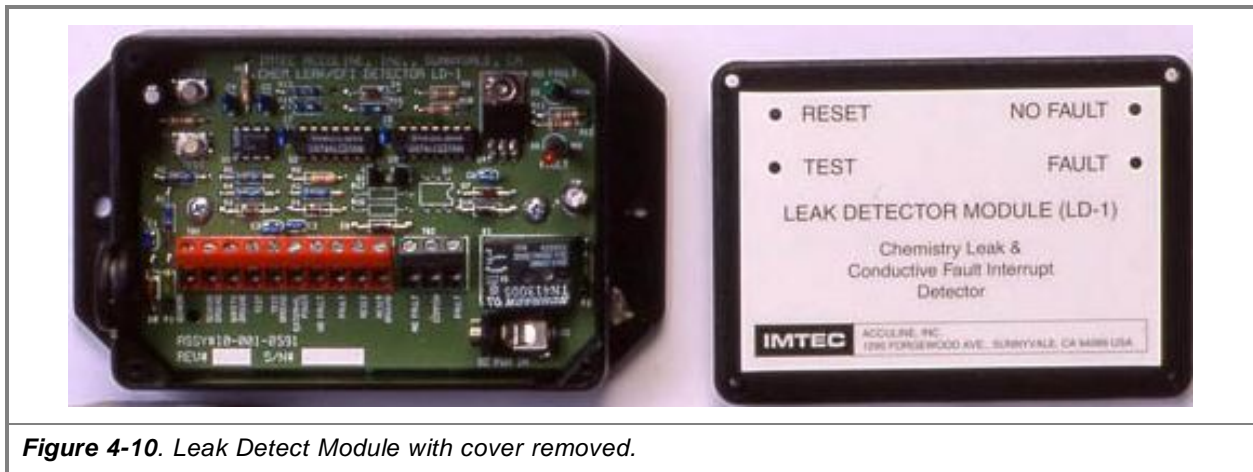


Figure 4-10. Leak Detect Module with cover removed.

4.2.8.2 Terminal Block, Controls and Indicators

The Model LD-1 is provided with one ten-lead terminal block, Figure 4-11 and 4-12, and may have an optional three-lead terminal block, Figure 4-13, for relay output connections. The terminal blocks are connected as described in these figures. Figure 4-14 lists the controls and indicators on the front cover.

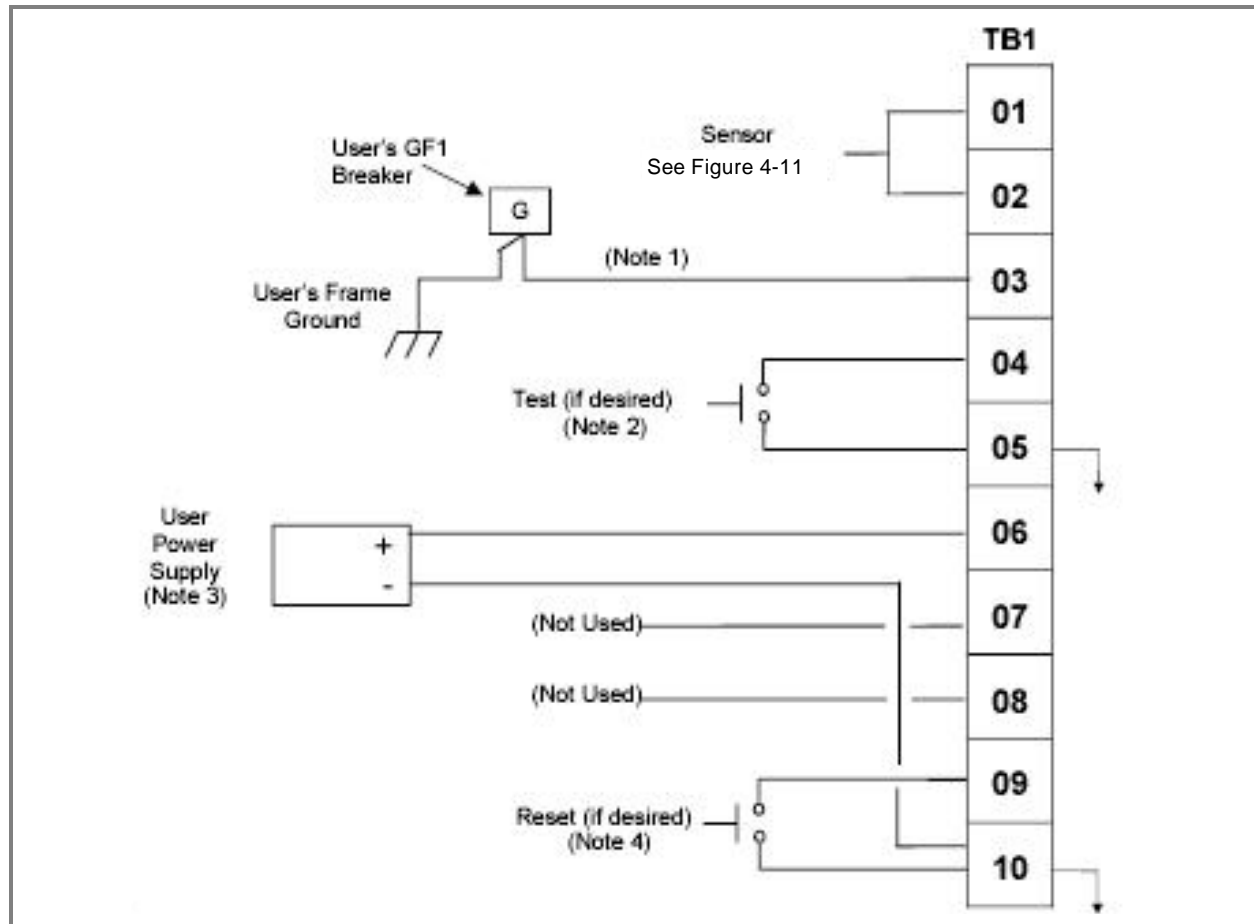



Figure 4-11. 10-Lead Terminal Block Connections and Descriptions.

NOTES

1. GFI ground sense wire should be 16-20 AWG.
2. Any switch, transistor, or digital device which provides a connection between TB1-4 and TB1-5 may be used.
3. If IMTEC transformer is not used, user must supply 7-24VDC (max) at 1/8A.
4. Any switch, transistor, or digital device which provides a connection between TB1-9 and TB1-10 may be used.

Terminal Block	Description
TB1-01	Active Sensor Input. (Also refer to Figure 4-12, <i>Sensor Input Connections</i>). This input must show a nominal impedance of 100K ohms with respect to TB1-02, or an open-sensor fault will be reported. An impedance of <20K ohms with respect to TB1-02 is interpreted as a chemistry leak, and an alarm is set.

TB1-02	Sensor Return (ground). (Also refer to Figure 4-12, <i>Sensor Input Connections</i>).
TB1-03	GFI Breaker Ground. This terminal must be connected to the end user-provided heater power GFI breaker "Ground" terminal and from there to the Frame Ground, in accordance with all applicable electrical codes and SEMI 2479 safety standards, Section 7.7.1 and 7.7.2. If the end-user does not provide a GFI breaker, TB1-03 must be connected to the Frame Ground.
CAUTION	
	POTENTIAL PRODUCT OR EQUIPMENT DAMAGE! In the event of significant chemistry leakage, full heater voltage (208VAC) can appear on TB1-01 and / or TB1-02. For this reason, it is essential that TB1-03 be connected to the heater power GFI circuit breaker as described in this figure.
TB1-04	Leak Detector / CFI Test. When this terminal is grounded (i.e., shorted to TB1-05), a fault condition and alarm is created. A TTL-logic level device (1 gate load) may be used to test this condition.
TB1-05	Leak Detector / CFI Test Return (ground). This terminal may also be used for connecting the negative (ground) source of power.
TB1-06	End-User Power Connection. The end-user must choose either a customer-supplied power source to power the Model LD-1, or the IMTEC-supplied transformer module. Only one of these two choices can be used. If both are present one must be disconnected. When the end-user supplied power source is used, a positive DC voltage in the range of 7 to 24 volts is applied to this terminal. A 1N4007 1000 volt reverse-protection diode and fuse is provided within the Model LD-1 to protect the user's power supply. When the IMTEC-supplied transformer is connected to the terminal, disconnect all wires to TB1-06.
TB1-07	<i>Not Used.</i>
TB1-08	<i>Not Used.</i>
TB1-09	Reset. The fault indication provided by the Model LD-1 is latching. When TB1-09 is grounded (i.e., shorted to TB1-10), the fault latch is reset to normal, no fault, operation. A TTL-logic level device (1 gate load) may be used to perform this reset. If resetting does not occur after grounding, the fault condition has probably not been cleared.
TB1-10	Reset return (ground). This terminal may also be used for connecting the negative (ground) source of power.

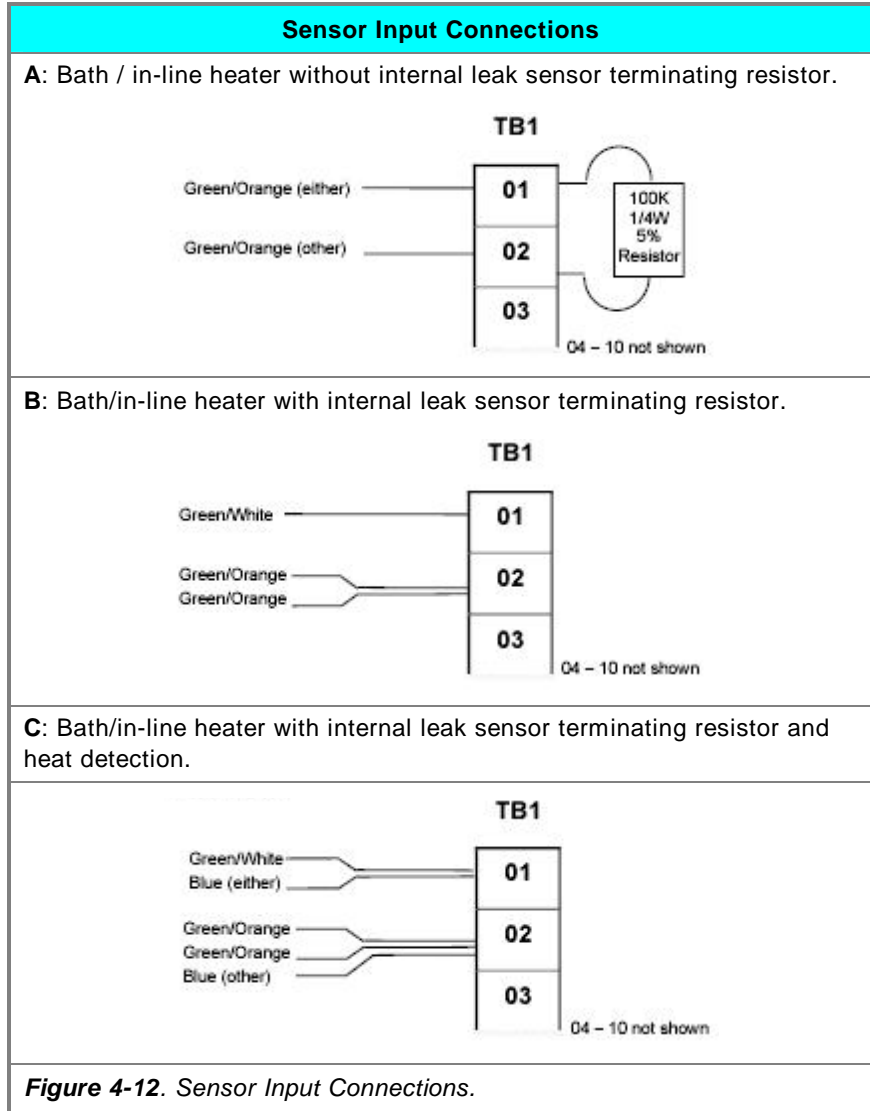


Figure 4-12. Sensor Input Connections.

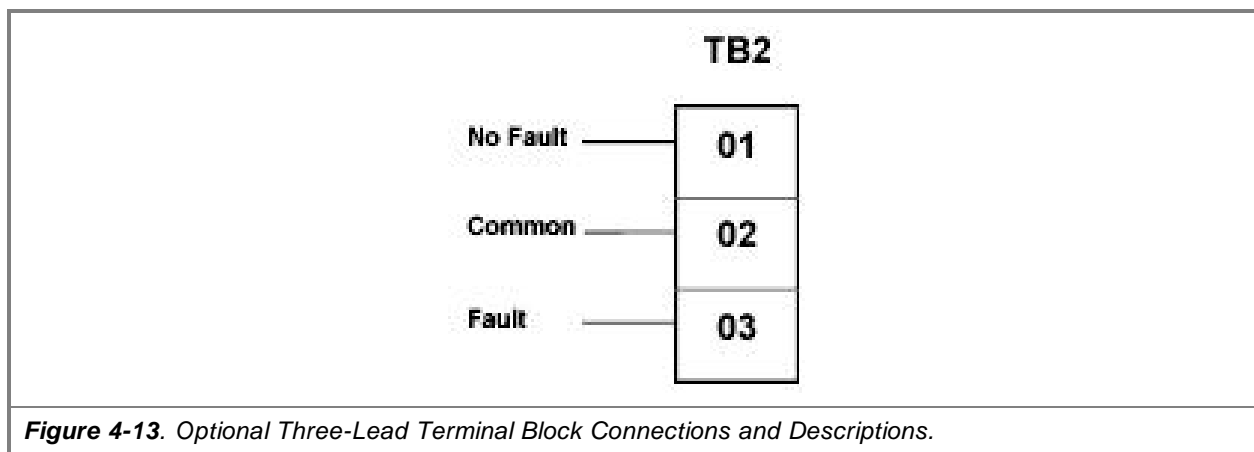


Figure 4-13. Optional Three-Lead Terminal Block Connections and Descriptions.

NOTES	
<ol style="list-style-type: none"> 1. Common-no fault is closed in normal, no-fault operation. 2. Common-fault is closed in all fault modes. 3. The relay, without power, will be normally open at TB2-01 and normally closed at TB2-03, each with respect to common (TB2-02). Under power, these conditions reverse to the alternate state. 	
Terminal Block	Relay (Connected as Failsafe . Open-On-Fault. Rated 7A / 120V. Description
TB2-01	In normal (no-fault) operation, this terminal will show closed to TB2-02 (common). It will open (to TB2-02) in fault condition.
TB2-02	Common.
TB2-03	In normal (no fault) operation, this terminal will show open to TB2-02 (common). It will close (to TB2-02) in fault condition.



Figure 4-14. Controls and Indicators Descriptions.

NOTES	
<p>The Model LD-1 is provided with the following controls and indicators. These need not be operated or observed if the LD-1 is installed internal-to-the-cabinet or is operated remotely.</p>	
Indicator	Description
NO-FAULT LED	A green LED is provided to indicate both no-fault and power-on conditions.
FAULT LED	A red LED is provided to indicate the presence of any of the three fault conditions.
TEST	A momentary TEST push switch is provided to simulate a chemistry leak condition. Pressing this switch should extinguish the green LED and illuminate the red LED. The red LED should remain illuminated when the TEST button is released.
RESET	A momentary RESET push switch is provided to reset the fault latch. Pressing this switch should clear a latched fault (i.e., extinguish the red LED and illuminate the green LED).

4.2.8.3 Requirements and Installation

Requirements:

1. A dry mounting area not subject to chemical fumes.
 - A two or three wire leak sensor installed within the bath / in-line heater housing and terminated at the far end in 100K ohms. An un-terminated sensor will be “seen” as an open sensor by the LD-1, and reported as a fault (simulating a chemistry spill that has opened one of the sensor leads).
 - If the sensor does not have a terminating resistor (check by using multimeter), a 100K ohm 1/4W 5% resistor must be installed between the leak detector sensor input terminals (TB1-01 and TB1-02). This will allow the LD-1 to operate normally with the exception of detecting if the sensor circuit has open.

NOTE

- All LD-1 models are shipped with a 100K resistor installed between TB1-01 and TB1-02 for the convenience of the installer. If a properly-terminated leak sensor (having a 100K end-of-sensor termination) is connected to the LD-1, the resistor between TB1-01 and TB1-02 must be disconnected / discarded.
- If the bath / in-line heater is equipped with Protectowire® fire protection (normally open; shorts in the event of fire fault), the Protectowire may be connected in parallel with the leak sensor between TB1-01 and TB1-02. A 100K ohm terminating resistor is required.

2. A connection to the GFI breaker as described in Section 4.2.8.2, *Interface Terminal Block, Controls and Indicators*.
3. If LD-1 will be powered by the IMTEC-provided transformer, a 110V 50/60Hz duplex outlet is required.
4. If LD-1 will be powered through the TB1-06 User Power Connection, a 7-24VDC max at 1/8-amp max must be supplied to this terminal. A 1N4007 1000V reverse-protection diode and a fuse is provided within the LD-1 to protect the user power supply.

NOTE

Whichever power source is used to power the LD-1, the other source (TB1-06 or jack) must be disconnected.

5. Two #6 screws and screwdriver for mounting LD-1.

Installation:

1. Remove the cover from LD-1 and route all wiring through the grommet provided.
2. The LD-1 may be mounted in any position in an area not subject to chemical fumes. Mount LD-1 using the required two (2) #6 screws.
3. Connect TB1-03 to the heater power GFI circuit breaker as described in Section 4.2.8.2, *Interface Terminal Block, Controls and Indicators*, using 16-20 AWG wire.
4. If using the ten-lead terminal block, make connections as shown in Figures 4-11 and 4-12. If using the optional three-lead terminal block, make connections as shown in Figures 4-12 and 4-13.
5. If using the IMTEC-provided power transformer, plug its output into the LD-1 PCB jack and plug the transformer into a 110V duplex outlet. If the end-user provides a power supply, see Figure 4-11 for the proper connections to power.
6. Ensure grommet rests in the notch in the case. Replace the cover while ensuring that the No Fault and Fault LEDs are aligned, and insert 4 screws.
7. Installation is complete. The lights will illuminate. Remote testing and/or the resetting of switches can take place.

This concludes Section 4, Installation of the LD-1. This concludes the section on Installation.

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5 START UP and CALIBRATION

This section includes the following topics:

- 952 Controller Functions including:
 - Key Switches defined
 - Temperature and Timer Displays defined
 - Status Indicator LEDs defined
 - Alarm Indicator LEDs defined
 - Setting Processing Parameter Values
 - Assigning Access Codes and Security Levels
 - optional RS-232 Communications
- Auto-Lid Pressure Set-Up and Speed Adjustments
- Bath Start Up and Calibration

5.1 952 Controller Key Switches Defined

The twelve key switches are located on the right side of the Model 952 Controller faceplate, Figure 5-1. They are grouped into three segments: POWER, SETUP and TIMER. These key switch functions and how their use affects other Controller functions and keys are detail below. Some of this information touches on process parameters to give you an understanding of how the key switches relate to processing. For instructions for entering or changing process parameter values refer to Section 5.5, *Setting Processing Parameter Values for the Controller*.

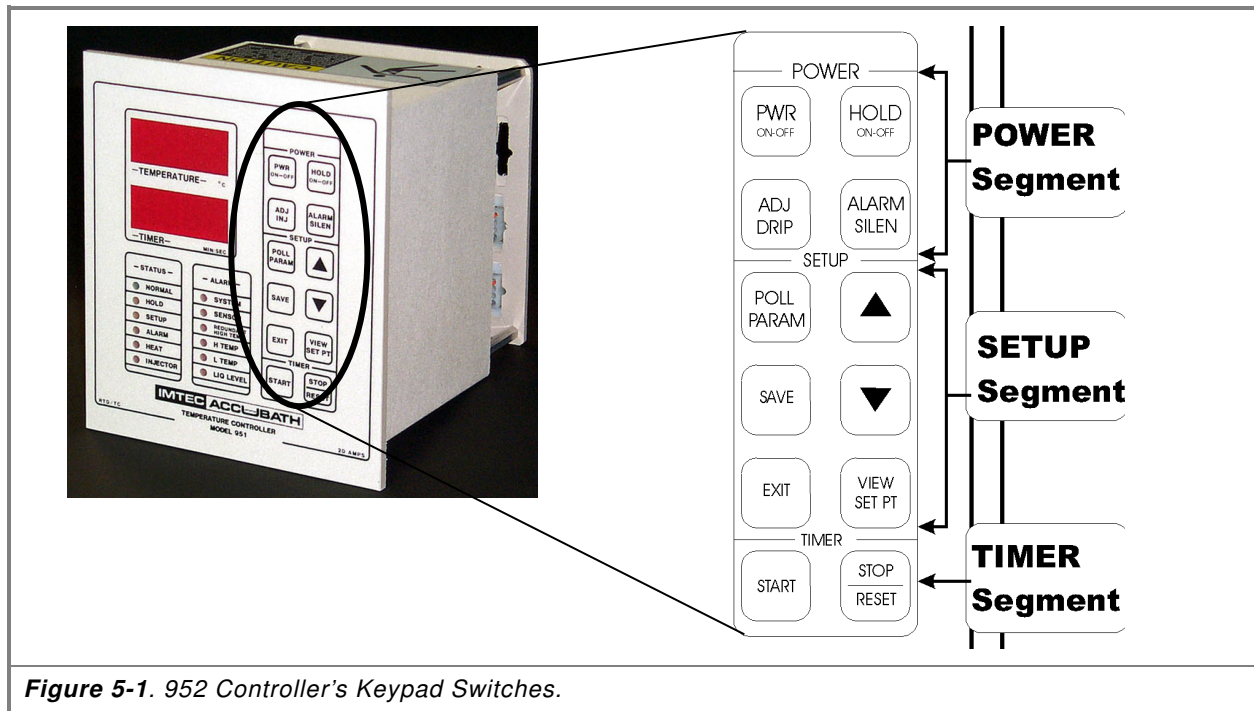

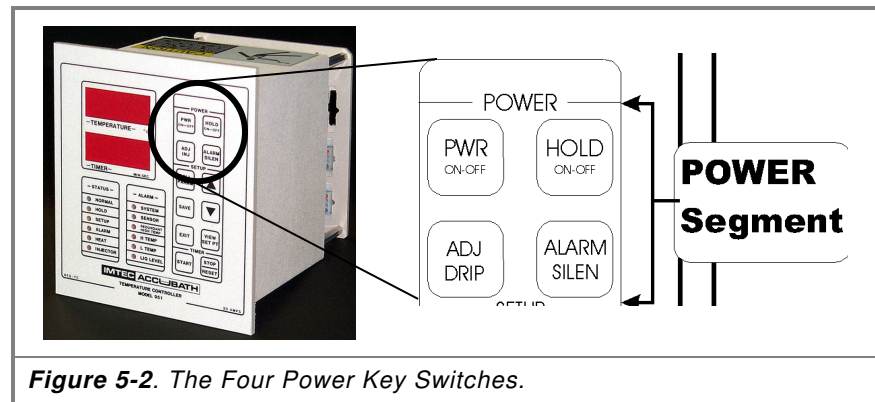


Figure 5-1. 952 Controller's Keypad Switches.

CAUTION	
	<p>POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!</p> <p>Do not attempt any processing procedures until you have read this entire manual and understand it's contents.</p>

5.1.1 Power Switches Defined

There are four (4) Power key switches, Figure 5-2.



PWR ON-OFF. The PWR ON-OFF switch provides or denies power to the Controller.

Until the Controller is turned on, or after a power interrupt, the major control elements (including all displays except Redundant High Temperature) are OFF. Pressing the PWR switch once activates all relevant displays and puts the Controller into HOLD mode. Pressing the PWR switch a second time deactivates the main power relay, returning the Controller to a power off status, except for the Redundant High Temperature protection circuit, which continues to operate.



HOLD ON-OFF. The HOLD ON-OFF switch controls power to the heater.

When the Controller is in HOLD mode, pressing the HOLD switch releases the Controller from HOLD, putting the Controller into normal operating mode.

Pressing the HOLD switch while the Controller is in normal operating mode returns the Controller to HOLD mode, denying power to the heater.

While the Controller is in HOLD, any timing cycle in process will continue; when the Controller is returned to normal status, the timer will display the uninterrupted count. However, a timing cycle cannot be started while the Controller is in HOLD, refer to Section 5.1.3, *Timer Switches Defined*.

If the Controller is put into HOLD mode by an abnormal condition, it can be released to normal status, once the abnormal condition has been corrected, by pressing the HOLD switch.



ADJ DRIP (Adjust Drip). The ADJ DRIP switch bypasses process control of the DI Water Solenoid relay, permitting the operator to manually adjust the flowrate without waiting for a “water-on cycle.” This switch can be used as a test to validate that the entire flow control circuit is working without having to change the process setpoint.

This switch is used for re-starting a bath previously operated at the proper boiling point. The concentration of chemicals in these baths will have risen higher than desired. Increasing the flowrate and holding down the ADJ DRIP switch for a short time while the bath is heating up will introduce enough water to ensure the quick recapture of the desired boiling point. The Controller will attempt to perform this function automatically when the bath comes to full heat, but (for safety reasons) the attempt will be inhibited by built-in time and temperature limitations, making it less effective than a manual adjust using ADJ DRIP.



ALARM SILEN (Alarm Silence). The ALARM SILEN switch turns off the audible alarm and stops the flashing display of alarm codes in the Temperature display window. Once the alarms have been cleared, the Controller can then be returned to a functional condition where you can examine the setpoints and reset functions without the interference of the alarm displays and sounds. Sounds and Temperature window displays are discontinued, but any STATUS and ALARM LEDs associated with the alarm condition will continue to flash, and – if applicable – power to the heater will be turned off to protect the equipment.

The results of the ALARM SILEN key are not reversible. Once pressed, the sounds and flashing codes will be suppressed for as long as the Controller remains in the alarm condition.

5.1.2 Setup Switches Defined

There are six (6) Setup key switches, Figure 5-3.

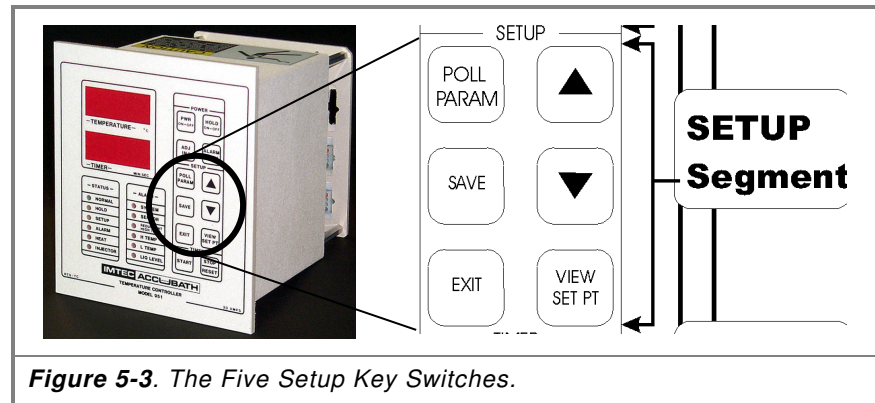


Figure 5-3. The Five Setup Key Switches.

These key switches are dedicated to entering commands into the Controller. There are four security levels to prevent unauthorized changes to processing parameters. IMTEC sets these parameters to the lowest security level as factory defaults. This allows them to be viewed and changed. Once a parameter has been assigned to a security level, however, only operators having access to that level of security will be allowed to change its value, refer to Section 5.6, *Assigning Access codes and Security Levels*.



POLL PARAM (Poll Parameters). “Code” appears in the Timer display window when this key is pressed. An access code must be entered in response. When an acceptable access code has been entered, pressing POLL PARAM again will put the Controller into SETUP mode. Only those parameters assigned to a security level the same as, or lower than, that associated with the input access code will be made available for a change of value. Parameters assigned to higher levels of security will not display. Parameters not specifically assigned a security level will default to the lowest security level and be available to all valid access codes.



SAVE. This key switch is used to confirm any values entered into the Controller’s temporary memory, replacing the old values in the Controller’s permanent memory.

NOTE
<ul style="list-style-type: none"> • If SAVE is pressed while the Controller is in SETUP mode, all values currently in the Controller’s temporary memory will be entered into the EEPROM, replacing the previous set of values. • It is important that you review all new values for correctness before using this key switch. IMTEC also recommends that you write down the old values before pressing SAVE, so that they can be restored, when needed. • It is possible to experiment with different parameter values by placing them in the Controller’s temporary memory and using them for processing. After evaluating the changed values, they can be saved to the Controller’s permanent memory, or discarded refer to Section 5.5, <i>Setting Process Parameter Values</i>.



EXIT. This switch is used to return the Controller to normal operation from the SETUP mode.



VIEW SET PT. Pressing this switch, from normal operating mode, displays the current Timing cycle value and the stored temperature set point in the Timer Display window. Pressing this switch, from SETUP mode, displays the security level assigned to the displayed parameter.



στ (UP and DOWN arrows). These keys are used to enter processing parameters values, security levels or access codes.

5.1.3 Timer Switches Defined

There are two (2) Timer key switches, Figure 5-4.

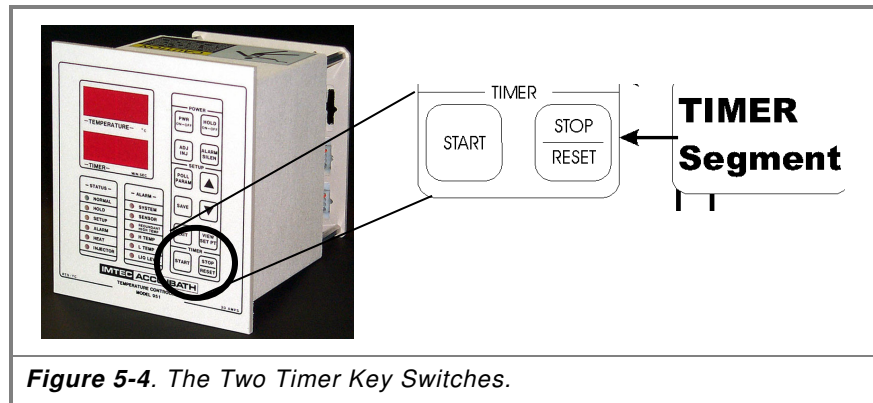
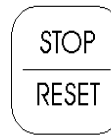


Figure 5-4. The Two Timer Key Switches.



START. Timing cycles are initiated by pressing the START switch. When the count is interrupted, pressing START will cause the count to begin again from the point at which it was stopped. To view the value of the current Timing cycle during processing, press the VIEW SET PT switch.



STOP / RESET. This switch halts the Timing cycles in process. Pressing this switch twice will reset the Timing cycle to the value stored in permanent memory.

When the end of a Timing cycle is reached, the count display in the Timer window will start to flash and an alarm will sound. Pressing ALARM SILEN will stop the sound, but the count will continue to flash until STOP / RESET is pressed.

5.2 Temperature and Timer Displays Defined

There are two alphanumeric display windows located in the upper left of the 952 Controller's faceplate, Figure 5-5. These two display windows are the primary source for information about Controller conditions. The Temperature display window shows the actual sensed bath temperature. The Timer display window shows the current Timer cycle value, or the current position in a Timing cycle, whichever is appropriate.

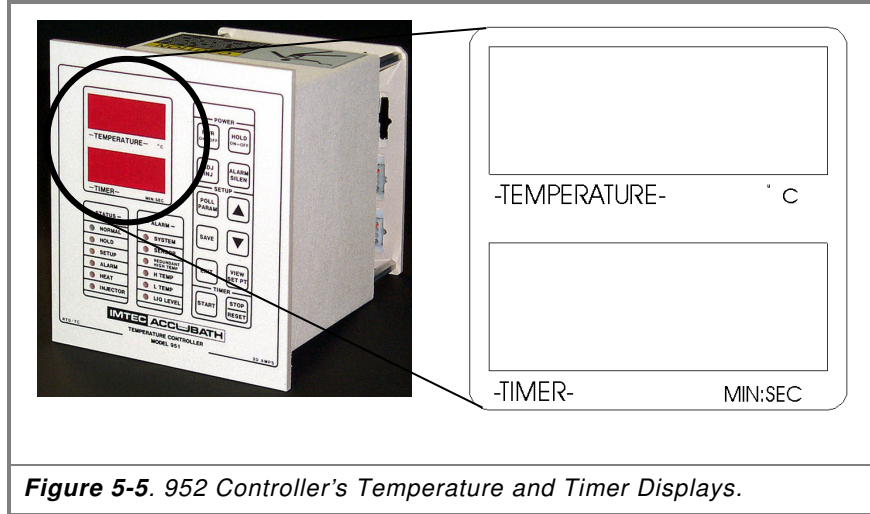


Figure 5-5. 952 Controller's Temperature and Timer Displays.

Both the Temperature and Timer displays have multiple functions related to diagnostics and setup in connection to the Status and Alarm LEDs, refer to Sections 5.3, *Status Indicator LEDs Defined*, and 5.4, *Alarm Indicator LEDs Defined*. Both of the display windows will display information related to key switch entries, refer to Section 5.1, *952 Controller Key Switches Defined*.

5.2.1 Temperature Display Codes Defined

The following information defines the codes that appear in the TEMPERATURE display window. The Temperature display window also shows processing parameter values when the Controller is in SETUP mode, refer to Section 5.5, *Setting Processing Parameter Values*. Table 5-1 list the Temperature Display codes.

Table 5-1. Temperature Display Codes.

Code	Description
NN.N	This is the normal display of actual bath temperature to within 0.1° (e.g., 88.1)
Sn	Sensor. Indicates that one or more of the RTD or thermocouple sensors is open, shorted, or not attached.
HI	High Temperature. Indicates that the bath temperature, as detected by the process temperature sensor, has risen above the process setpoint by at least 0.8°C. This code will alternate with the actual bath temperature.
LO	Low Temperature. Indicates that the bath temperature has fallen below the low temperature alarm setpoint. This code will alternate with the actual bath temp.
LL	Low Level. Indicates a low-liquid level condition. If no low-level sensor is installed, the code indicates the program parameter is set to "00" instead of "01". The code will alternate with the actual bath temperature.

Code	Description
AUX	Auxiliary. Indicates that a user-defined auxiliary monitoring device switch condition has been detected, refer to Section 5.4, <i>Alarm Indicator LEDs Defined</i> . This code will alternate with the actual bath temperature.

5.2.2 Timer Display Codes Defined

The following information defines the codes that appear in the TIMER display window. The Timer display window also show processing parameter values when the Controller is in SETUP mode, refer to Section 5.5, *Setting Processing Parameter Values*. Table 5-2 list the Timer Display codes.

Table 5-2. *Timer Display Codes.*

Code	Description
MM:ss	This is the normal numeric display for the Timer. It displays the timing status in minutes and seconds. The Timing cycle value (length) corresponds to the temporarily or permanently stored value entered in SETUP. During normal operation, pressing the VIEW SET PT key displays the current process timing cycle.
HOLD	Indicates the Controller is in standby condition. Heaters and the dripper solenoid are not powered on while the Controller is in HOLD. If a counting cycle was started before the Controller entered HOLD, the count is displayed in the Timer display window.
Code	Indicates that SETUP has been accessed. An acceptable code must be entered in response to this display in order for changes to processing parameter values to be made, refer to Section 5.5, <i>Setting Processing Parameter Values</i> .

5.3 Status Indicator LEDs Defined

The Status LED indicators on the 952 Controller are located on the lower left of the faceplate, Figure 5-6. These indicators show the momentary operating condition, or mode, of the Controller. These modes are defined below.

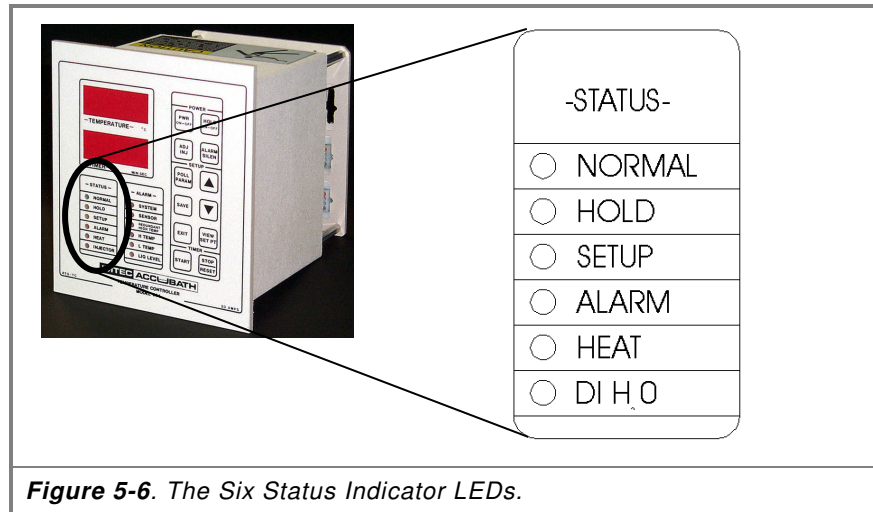


Figure 5-6. The Six Status Indicator LEDs.

NORMAL. Indicates that the Controller is operating in a normal condition, within the defined parameters, refer to Section 5.5, *Setting Processing Parameter Values*.

HOLD. Indicates that the Controller is in a standby condition. When the Controller is in HOLD, the Timer window will alternately display "HOLD" and the current Timer count.

The Controller defaults to HOLD at initial powered up, or after a power failure. In HOLD, the Controller denies power to the bath heaters and the dripper solenoid relay.

If a Timing count was in process before the Controller went into HOLD, the count will continue, but a new Timing cycle cannot be initiated while the Controller is in HOLD.

SETUP. Indicates that the Controller is ready for changes to processing parameter values, refer to Section 5.5, *Setting Processing Parameter Values*.

ALARM. Indicates that the process is outside the preset values or an equipment malfunction has occurred. When this LED is illuminated, there will be one or more indicators illuminated in the ALARM grouping, refer to Section 5.4, *Alarm Indicators Defined*.

The Controller automatically resets this LED when the condition(s) that caused it are corrected.

HEAT. Indicates that the main power relay is active. As the bath temperature approaches process setpoint, this LED will cycle on and off based on the program parameters and the controller logic.

DI H₂O. Indicates that the dripper relay is active. The operator must periodically check the flowmeter to ensure there is actual water flow when this LED is illuminated, refer to **ADJ DRIP** in Section 5.1.1, Power Switches Defined.

5.4 Alarm Indicator LEDs Defined

The Alarm LED indicators on the 952 Controller are located to the right of the Status Indicator LEDs of the faceplate, Figure 5-7. In an alarm condition, the ALARM LED in the STATUS grouping will illuminate and one or more of the LEDs in the ALARM grouping illuminates to indicate the problem detected by the Controller. The AUX alarm condition has no associated LED.

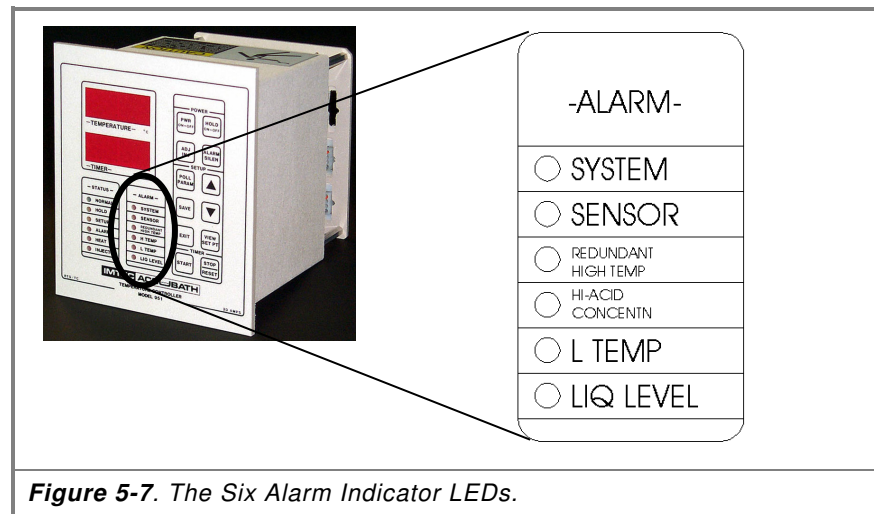


Figure 5-7. The Six Alarm Indicator LEDs.

SYSTEM. Indicates an error in the Controller software as detected by the built-in diagnostic routines. The LED illuminates and an alarm will sound. The Controller is put into HOLD. This alarm condition may require the Controller to be reset by powering OFF and ON. If the operator was entering commands when this condition occurred, the commands may have to be reentered.

SENSOR. Indicates that the process temperature, or overtemp sensor, is open, shorted or not connected. During processing, the Controller continually monitors the sensor input. If it detects a non-functioning sensor the LED illuminates and an alarm will sound. The Controller will be put into HOLD. The heater output shuts off. The code "Sn" will alternate in the Temperature display window with the sensed bath temperature.

REDUNDANT HIGH TEMPERATURE. Indicates the high limit circuit has turned off the master relay. The Controller will be shut down. The LED illuminates. This LED is powered directly by the high limit power supply and will remain illuminated after the master relay has de-energized. This condition does not have an audible alarm.

HI-ACID CONCENTRATION. Indicates there is insufficient water concentration to maintain boil point control. In this alarm condition “HI” will alternate in the Temperature display window with the sensed bath temperature and an alarm will sound. There are two conditions that will initiate the Hi Acid alarm. They are as follows:

1. If the process temperature has exceeded the high temperature setpoint (Parameters SP + HI) a 10 minute internal timer is started. If the temperature has not dropped below this value within 10 minutes the Controller will be put into HOLD mode.
2. If the temperature comes within 2 degrees of the setpoint + the boil rate (Parameters SP + BR -2) the controller will immediately be put into HOLD mode.

LOW TEMPERATURE (L TEMP). Indicates that the process temperature has dropped below the (SP – LO) value. This LED may be activated any time after the system has finished initial warm-up. The LED illuminates, the code “LO” will alternate in the Temperature display window with the process temperature and an alarm will sound. The Controller will be put into HOLD.

LIQUID LEVEL (LIQ LEVEL). Indicates that the process bath liquid level has either dropped below the Low Level Sensor or risen above the Hi Level Sensor, depending on which sensor has been connected. The code “LL” will alternate in the Temperature display window with the sensed bath temperature, and an alarm will sound. Heater power will be denied,. The Controller is **not** put into HOLD. Operation resumes when the level condition is corrected.

AUXILIARY (AUX). This alarm has no associated LED. When connected, this alarm monitors a customer-defined remote switch and activates when the condition defined by the operator occurs. For information about connecting the AUX alarm, refer to Section 4.2.2.7, *Connecting an Auxiliary Monitoring Device*. When activated, the code “AU” alternates in the Temperature display window with the sensed bath temperature. Heater power is denied. The Controller is **not** put into HOLD. Operations will resume when the alarm condition has been corrected. The factory default value for the auxiliary input parameter (AS) is set at 01 (Alarm on closure). To change the value, refer to Section 5.5, *Setting Processing Parameter Values*.

5.5 Setting Processing Parameter Values

The following procedures are for changing processing parameters values in the 952 Controller and storing these changes in memory. The Controller is shipped with factory default processing values set as shown in Table 5-3.

Table 5-3. Factory Default Processing Values.

Parameter	Code	Value	Range / Units	Security Level
Clock Setpoint (Timing Period) (Note 1)	CS	30:00	0 to 99:59 MM:ss	00
Clock Pre-Alarm Warning (Timer)	PA	00:30	0 to 59 Sec	01
Power for Boil Offset	BR	7.5	0 to 250°C	01
Process Temp Setpoint	SP	160.0	0 to 250°C	01
High Alarm Temp Offset	HI	0.8	0 to 50°C	02
Low Alarm Temp Offset	LO	10.0	-0 to -50°C	01
Access Code 1 (Note 2)	AC1	N/A	N/A	Fixed at 01
Access Code 2 (Note 2)	AC2	N/A	N/A	Fixed at 02
Access Code 3 (Note 2)	AC3	N/A	N/A	Fixed at 03
Cycle Rate	CR	10.0	0 to 25 Sec	03
Proportional Band	PB	10.0	0 to 25°C	03
Reset	RE	0.0	0 to 25 Min	03
Rate	RA	0.0	0 to 25 Min	03
Calibration (Note 3)	CA	0.0	±9.9°C	01
Clock Direction (Timer)	CD	DN	DN (down) or UP	01
Liquid Level Sensor	LS	01 (N/O)	N/O or N/C	01
Auxiliary Input Alarm	AS	01 (N/O)	N/O or N/C	01

NOTE

Note 1 – Once a new value has been entered for CS, whether permanently saved or not, the new value is displayed in the TIMER window by pressing the **STOP/RESET** key switch. The new timing cycle may then be initiated by pressing START. As with all Timer counts, to temporarily stop the process, press **STOP/RESET** and to re-start the process press the START key. Pressing **STOP/RESET** twice will completely stop the Timer count and reset the Timer to the value stored in memory.

Note 2 – The security levels for AC1, AC2 and AC3 are fixed and cannot be changed as discussed in Section 5.7, *Assigning Access codes and Security Levels*.

Note 3 – The process temperature sensor may be calibrated against a standard and then error “offset” using the CA parameter. Over-temperature limit (redundant) thermocouple does not need process accuracy and no calibration parameter is provided beyond setting the Redundant High Temperature potentiometer against a standard.

To change the value for any processing parameter requires an access code (password). There are three levels of security available. Operators can only change the values for those parameters they have password access for. Codes for parameters allowed by the password will display. A parameter will not display if the level of security, and it's corresponding password does not allow changes for that parameter: For more information about access codes and security levels, refer to 5.6, *Assigning Access Codes and Security Levels*. Only supervisors can make these changes.

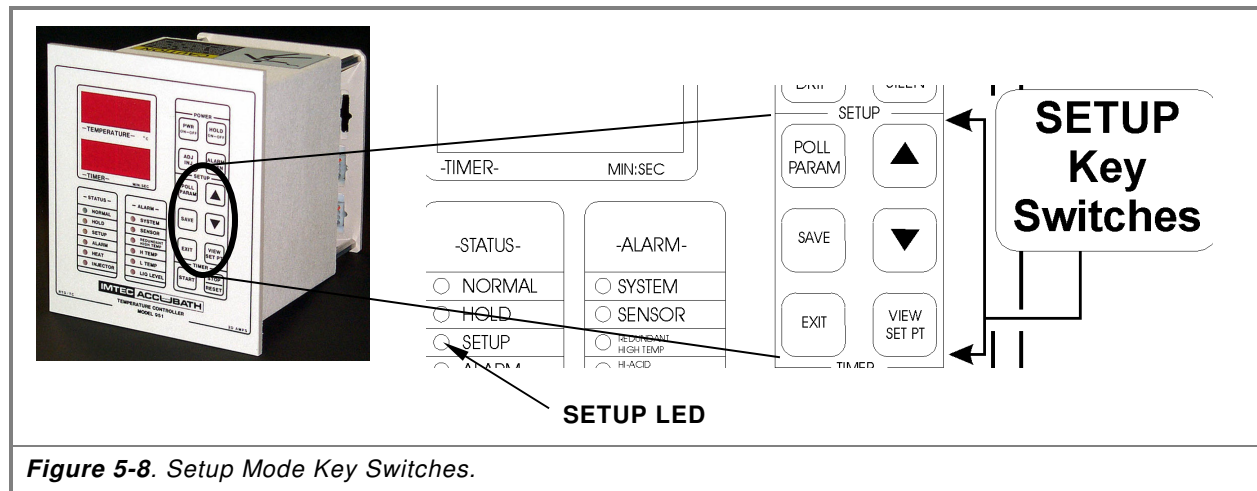


Figure 5-8. Setup Mode Key Switches.

5.5.1 Setting Parameter Values Procedure

To change parameter values:

1. Ensure the Controller is not in operation, power is ON and the Controller has gone through warm-up. If the Controller is in HOLD, press PWR ON-OFF to release it.
2. Press the POLL PARAM key switch to enter SETUP Mode, Figure 5-8. The SETUP LED illuminates and the Temperature / Timer displays: **CODE**.
3. Enter the assigned password (access code). The controller displays, one at a time, the parameters available to this password for change. If the password does not allow access to a particular parameter, the code for that parameter will not be displayed.
4. Using σ and τ , enter your password and press POLL PARAM.
5. The first of the parameter codes available for change displays in the Temperature/Timer window. The codes will display in the order shown in Table 5-3. If changes are not needed for the displayed parameter, press POLL PARAM to advance past it to the next parameter.

6. Use σ and τ to change the value of the parameter, ensure the entries are within acceptable limits listed in Table 5-3.
7. After the needed values are changed, the operator may:
 - Use the new values temporarily — The changed values will be used by the Controller until it is turned off. Once power has been turned off, the changes will be lost.
 - Permanently SAVE the changes — The changed values will be stored in the Controller's memory and the old values lost.
 - Revert to original values — The changed values will be purged and the Controller will revert to the values stored in memory.

CAUTION**POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!**

Whether temporary or permanent, all changes in values *take effect immediately after being entered*. Review all changes for correctness before beginning processing using the new values. EXPERIMENT CAREFULLY.

8. To use the new values temporarily — Press EXIT to leave SETUP mode. The changed values will be in use until the Controller is turned off.

To permanently SAVE the changed values — Press SAVE. The changed values will replace those stored in memory. Press EXIT to leave SETUP mode.

To revert to original values — Press PWR ON-OFF twice.

This ends Setting Parameter Values Procedure.

5.6 Assigning Access Codes and Security Levels

The following information describes the procedures required for changing access codes (passwords) and assigning security levels to the processing parameters of the Controller.

NOTE

For ease of use, IMTEC suggests you read completely through this procedure before attempting to make any changes.

The Model 952 controls processing functions. Each function controlled by the Model 952 has a value. For example, the length of time for a processing cycle (Clock Setpoint/Timing Period) may be set for up to 99 minutes and 59 seconds, refer to Section 5.5, *Setting Processing Parameter Values*. To prevent accidental changes to these processing values, each function has been assigned to a security level. An operator attempting to change a processing parameter value must have an access code (password) for the security level to which that parameter has been assigned.

The Model 952 Controller has four hierarchical levels of security protection: 00, 01, 02, and 03. The lowest level of security protection is 00, the highest is 03. Operators with 03 access may change the values for all parameters. Operators with 02 access can only change the values for those parameters assigned to 02, 01 and 00 security. Operators with 01 access can only change the values for those parameters assigned to 01, and 00 security. Operators with 00 access can only change those parameters assigned to 00, the lowest level of security.

The factory default values for parameters have all been assigned to security levels as listed in Table 5-4. The access codes for levels 01 through 03 have also been set. However, to allow you to set your own codes, the access code values have purposely been set as shown in Table 5-4.


Table 5-4. Factory Preset Security Levels and Access Codes.

Parameter	Code	Security Level	Range/Units	Factory Value
Access Code 1	AC1	Fixed at 01	4 digits, 01-9999	00
Access Code 2	AC2	Fixed at 02	4 digits, 01-9999	408
Access Code 3	AC3	Fixed at 03		
Clock Setpoint (Timing Period)	CS	00		
Pre-Alarm (Timer)	PA	01		
Process Setpoint	PS	01		
Power for Boil	BR	01		
Offset High Temp	HI	02		
Offset Low Temp	LO	01		

Parameter	Code	Security Level	Range/Units	Factory Value
Cycle Rate	CR	03		
Proportional Band	PB	03		
Reset	RE	03		
Rate	RA	03		
Calibration	CA	01		
Clock Direction (Timer)	CD	01		
Liquid Level Sensor	LS	01		
Auxiliary Input	AS	01		

At initial installation, is the time to set “customer-specific” access codes for each security level (except 00, which does not require a code) and assign each processing parameter to a security level. Once levels and codes have been assigned, only operators with the necessary security level access code will be allowed to change a parameter value or security level.

5.6.1 Changing Access Codes Procedure

CAUTION	
	<p>POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!</p> <p>As detailed above, the 952 Controller comes from the factory with preset access codes for the two changeable security levels (01 through 02). The preset code of 00 for security level 01 allows any operator access to most function parameter values. IMTEC strongly advises the end-user to change these codes to make critical parameters accessible to as few as needed operators, since wrong values can significantly change or interfere with the Controller’s operation.</p> <p>Value changes are not allowed if an operator does not have the current access code for the level.</p>

5.6.1.1 Changing Access Codes for AC1 and AC2

1. Enter SETUP mode by pressing the POLL PARAM switch. “Code” appears in the Timer display window.
2. Using σ and τ , enter your access code and press POLL PARAM.

NOTE
<p>Entering codes for the first time: enter the preset access code for level 02 (408), or level 01 (00). The first parameter value available for change appears in the Temperature display window and its code displays in the Timer window below it. If the code is not AC1, press POLL PARAM to scroll through the parameters until AC1 appears in the Timer display window, with four dashes above it, Figure 5-9.</p>

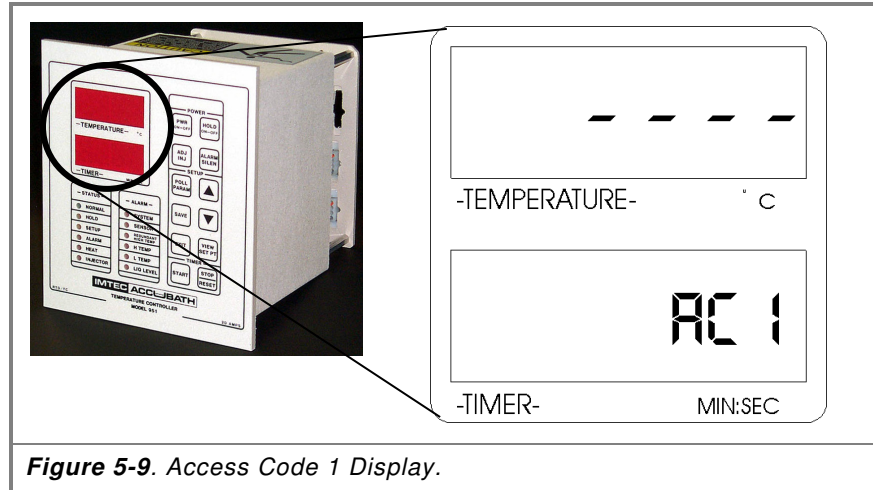


Figure 5-9. Access Code 1 Display.

3. Press σ once. The current access code value replaces the dashes in the Temperature display window.
4. Using σ and τ , enter the new access code number. Any number from 0001 to 9999 that has not already been assigned is valid.
5. Press POLL PARAM to move to AC2. If AC2 does not appear, authorization to change the access code number is not allowed.
6. Use σ and τ to enter a new access code number for AC2, if access has been allowed.
7. Press EXIT to leave SETUP mode. The changes are now temporarily saved.
8. Attempt to re-enter SETUP using all new access codes. If re-entry is successful, press SAVE, then EXIT. All new access codes are now permanently stored in the Controller's memory. If re-entry is not successful, press PWR ON-OFF twice. This will turn off the Controller and bring it back up with the previous access codes valid.

5.6.2 Assigning Security Levels

The Controller is factory-default set with the security level for each processing parameter as outlined in Table 5-4. As with the Access codes, it might be necessary to re-assign some processing parameters to a higher (or lower, if needed) security level. IMTEC suggests using levels 00 and 01 for all process parameters, and reserving level 02 as a “back door” to Controller functions, should operators be accidentally locked out.

5.6.2.1 Assigning Security Levels Procedure

1. Enter SETUP mode by pressing POLL PARAM. “Code” appears in the Timer display window.
2. Using σ and τ , enter the access code and press POLL PARAM.

NOTE
<p>When entering codes for the first time, enter the preset access code for level 02 (408).</p> <p>The first parameter value available for change appears in the Temperature display window and its code displays in the Timer window below it.</p> <p>The operators are only allowed to change the security level for parameters available to their access code and below. If the access code is for level 01, changes to parameters assigned to level 01 or 00 are allowed. Parameters assigned to level 02 will not display.</p>

3. To move past a parameter without changing its security level, press POLL PARAM. When a parameter displays, press VIEW SET PT. The parameter’s current security level will display in the Temperature display window, Figure 5-10).

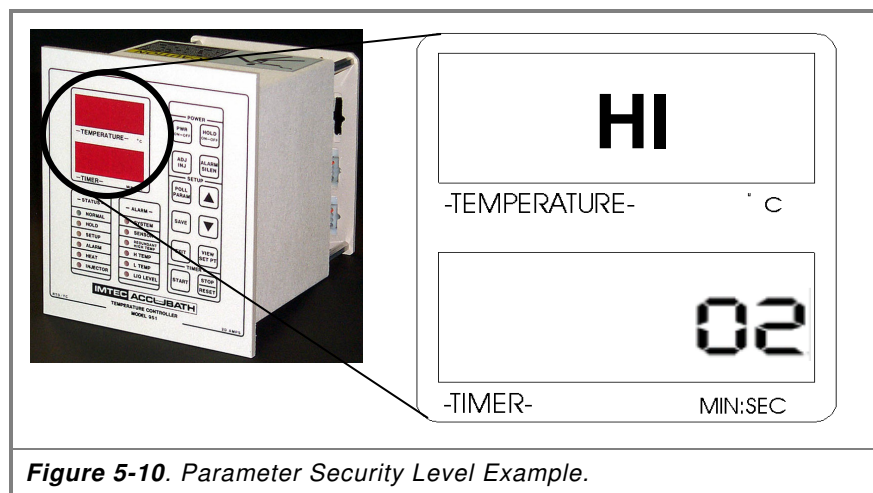


Figure 5-10. Parameter Security Level Example.

4. Using σ and τ , enter a new security level assignment (00, 01 or 02), then press POLL PARAM to move to the next parameter.

5. Repeat Steps 3 and 4 until all of the security level reassignments are made.
6. Press VIEW SET PT. The parameter codes and their values will be displayed, preventing the next operator who enters SETUP mode from seeing a security level number where they expected to see a parameter value.
7. Press SAVE, then EXIT. All changes have now been permanently stored in the Controller's memory.

This ends Assigning Security Levels Procedures.

5.7 RS-232 Communications (Optional)

The following information describes the RS-232 communications option for the IMTEC 952 Controller.

5.7.1 Overview

The RS-232 option allows the user to have direct access to the Controller from a dumb terminal or a computer system using a standard RS-232 link. Through this serial link, all of the standard functions of the controller may be activated, tested and adjusted.

NOTE

The RS-232 is a communications module option that must be specified at the time of original controller purchase: it can not be retrofitted.

The controller may be connected to either the dumb terminal or computer system using the DB9 connector on the back panel, Figure 5-11. The pin-out follows the standard IB DB9 configuration, therefore it may be wired directly to an IBM PC or its equivalent.

The link is fixed at 9600 baud, 8 bit, 1 stop and 1 start bit, no parity and only requires three leads to function. As viewed from the controller, Pin 5 is the *Signal Ground*, Pin 3 is *Receive Data* and Pin 2 is *Transmit Data*.

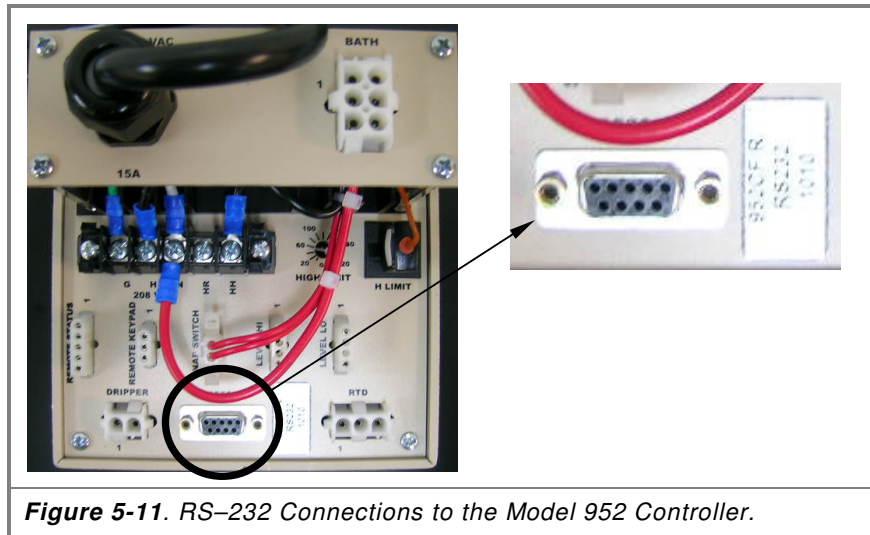


Figure 5-11. RS-232 Connections to the Model 952 Controller.

The internal ACIA uses a full duplex interrupt driven transmission scheme. The controller may receive and transmit simultaneously as well as continue to perform its normal functions. This allows interrogation of the controller during normal system operations.

The Protocol for the serial link consists of five basic commands and are defined below:

- KEY
- READ
- WRITE
- STATUS
- CANCEL (CLEAR)

KEY. The link has been optimized using eleven KEY commands, which are used to instruct the controller to perform its normal operations. Few of the KEY commands are actually needed to operate the controller from a computer terminal because the RS-232 serial link has direct access to the controller's programming stack using the READ and WRITE commands. All KEY commands are entered through the RS-232 link with the prefix "K".

READ and WRITE. Allows the operator to interrogate the controller or overwrite any or all of the items in the program stack. All READ commands are entered through the RS-232 link with the prefix "R" and all WRITE commands with the prefix "W".

STATUS. The basic condition of the controller is accessed through four bytes of information which may be read out at any time using the STATUS command. All STATUS commands are entered through the RS-232 link with the prefix "S".

CANCEL or CLEAR. This command is primarily included as a means to re-establish proper control of the programming stack in the case of an incorrectly entered command. All CANCEL commands are entered through the RS-232 link with the prefix "X".

The data format is standard ASCII and all data (with the exception of the STATUS bytes) are BCD values. STATUS bytes are transmitted in ASCII as hexadecimal as they contain bit information.

5.7.2 KEY Commands

5.7.2.1 Overview

The KEY commands allow the Operator to instruct the controller to perform functions just as if they had been entered on the controller's faceplate.

NOTE

The description of the KEY commands is limited to how the RS-232 link may be used to send those commands. For specific information about each command function, refer to Section 5.1, *952 Controller Key Switches Defined*.

5.7.2.2 KEY Command Syntax

The KEY command is entered as:

Knn <CR>

where “K” indicates a KEY command is being entered, *nn* indicates the KEY number and <CR> transmits the command. The KEY commands are:

KEY	Command
01	DOWN
02	SAVE
03	ALARM SILENCE
04	VIEW SETPOINT
05	TIMER
06	UP
07	POLL PARAMETERS
08	EXIT
09	HOLD ON/OFF
10	STOP/RESET
11	ADJ DRIP

When the <CR> is made, transmitting the KEY command, the controller will echo each of the characters and acknowledge the command with a carriage return and line feed (\$0D, \$0A). If an invalid KEY command is entered, it will be ignored, although the controller will acknowledge receiving it.

5.7.3 READ Command

5.7.3.1 Overview

The READ commands allow the operator to review the program data from the controller using the dumb terminal or IBM PC.

NOTE
The description of the READ commands is limited to how the RS-232 link may be used to send those commands. For specific information about each command function, refer to Section 5.1, <i>952 Controller Key Switches Defined</i> .

5.7.3.2 READ Command Syntax

The READ command is entered as:

Rnn <CR>

where "R" indicates a READ command is being entered, *nn* indicates the READ command number and <CR> transmits the command. The READ commands are:

No.	Description
01	CS: Clock Setpoint
02	BR: Boil Rate*
04	LO: Low temp alarm*
05	AC1: Access Code**
08	SP: Process temperature setpoint
09	CA: RTD calibration (against STD)*
10	PA: Timer Pre-alarm*
16	LS: Liquid Level alarm**
17	AS: Aux alarm**
18	CD: Clock Direction (Timer)*
19	Bath Temperature***
20	Remaining Time***

* User or OEM; ** OEM Only; *** Read Only.

NOTE

READ commands 03, 06, 07 and 11 through 15 are IMTEC use only.

While most of the values will read out directly as they appear on the controller faceplate, Time values will read out on the computer terminal only in seconds. For example, the faceplate may show a clock setpoint as programmed for 5:01 (minutes:seconds), but the terminal will display that setpoint as 0301 (seconds only).

When the <CR> is made, transmitting the READ command, the controller will echo each of the characters and acknowledge the command with a carriage return and line feed (\$0D, \$0A). If an invalid READ command is entered, it will be ignored, although the controller will acknowledge receiving it.

All data will be returned to the computer terminal in ASCII format with 4 BCD characters. When the data to be returned includes information in tenths of degrees of C, the data will be displayed in that fashion. For example, a process temperature setpoint of 10.0°C would be returned as SP0100.

5.7.4 WRITE Command

5.7.4.1 Overview

The WRITE command allows the operator to overwrite the program data from the controller using the dumb terminal or IBM PC. The WRITE command may be used to overwrite all the information in the programming stack with the exception of the calibration value, which may be changed only through the controller faceplate.

The stack data may be overwritten using the WRITE command, but the information will not be permanently saved. To permanently save changed values, two Key commands must be sent to the controller (K07 - Poll Parameter, followed by K02 - Save). For more information refer to Section 5.7.2, *KEY Commands*.

NOTE

The description of the WRITE commands is limited to how the RS-232 link may be used to send those commands. For specific information about each command function, refer to Section 5.1, *952 Controller Key Switches Defined*.

5.7.4.2 Write Command Syntax

The WRITE command is entered as:

Wnn <CR>

where “W” indicates a WRITE command is being entered, *nn* indicates the WRITE command number (see below) and <CR> transmits the command. The WRITE commands are:

No.	Description
01	CS: Clock Setpoint
02	BR: Boil Rate*
04	LO: Low temp alarm*
05	AC1: Access Code**
08	SP: Process temperature setpoint
09	CA: RTD calibration (against STD)*
10	PA: Timer Pre-alarm*
16	LS: Liquid Level alarm**
17	AS: Aux alarm**
18	CD: Clock Direction (Timer)*
19	Bath Temperature***
20	Remaining Time***
* User or OEM; ** OEM Only; *** Read Only.	

NOTE

The WRITE commands 03, 06, 07 and 11 through 15 are for IMTEC use only.

When the <CR> is made, transmitting the WRITE command, the controller will echo each of the characters and acknowledge the command with a carriage return and line feed (\$0D, \$0A). If an invalid WRITE command is entered, it will be ignored, although the controller will acknowledge receiving it.

All data will be returned to the computer terminal in ASCII format with 4 BCD characters. When the data to be returned includes information in tenths of degrees of C, the data will be displayed in that fashion. For example, the command: W021750 would return as BR1750.

5.7.5 STATUS Command

5.7.5.1 Overview

The STATUS command is used to access 5 bytes of information used by the controller to indicate its operating status. The four (4) types of information which can be inquired about are:

- Alarms
- System Modes
- Timer Modes
- Outputs

5.7.5.2 Status Command Syntax

The STATUS command is entered as:

Snn <CR>

where "S" indicates a STATUS command is being entered, *nn* indicates the STATUS command number (see below) and <CR> transmits the command. The Status command numbers are:

No.	Requests Information on Status
01	ALARM (alarm conditions)
02	MODBYT (system conditions)
03	SYSBYT (timer conditions)
04	OUTBYT (output conditions)

When the <CR> is made, transmitting the STATUS command, the controller will echo each of the characters and acknowledge the command with a carriage return and line feed (\$0D, \$0A). If an invalid STATUS command is entered, it will be ignored, although the controller will acknowledge receiving it.

Each of the four bytes contains bits which are set internally by the control algorithms. The information they return is interpreted using the following codes:

ALARM		MODBYT		SYSBYT		OUTBYT	
Code	Alarm	Code	System Mode	Code	Timer Mode	Code	Outputs
0	---	0	---	0	TMR RUNNING	0	---
1	---	1	---	1	---	1	---
2	AUX	2	---	2	PREWARN	2	---
3	LL	3	PROG	3	TMR OVR	3	EXT. AUDIO
4	LO	4	ALARM	4	---	4	HEAT
5	HI	5	WARMUP	5	---	5	DI DRIP or INJ
6	SN	6	HOLD	6	---	6	---
7	SYS	7	NORM	7	---	7	---

NOTE

In the table some bits are undefined. These bits are used for internal functions and may therefore be displayed as either a "1" or "0" at any given reading.

ALARM Code Definitions:

AUX	Used by optional user-defined monitoring and/or signaling devices.
LL	Liquid Level sensor.
LO	Low temperature sensor.
HI	High Acid concentration sensor.
SN	Defective sensor alarm.
SYS	Controller function software error alarm.

MODBYT (System Mode) Code Definitions:

PROG	Controller is ready for programming
ALARM	Controller is in ALARM status
WARMUP	System is in WARMUP status
HOLD	Controller is in standby status
NORM	System is functioning normally

SYSBYT (TIMER Mode) Code Definitions:

TMR RUNNING	Timer is running
PREWARN	Timer is in prewarn mode
TMR OVER	Timer is running overtime

OUTBYT (Output) Code Definitions:	
EXT AUDIO	External audio alarms are on/off
HEAT	Heater is on/off
DI DRIP or INJ	DI Drip or Injector is on/off

The bytes contain both positive and negative logic bits, therefore they require data transmission in a hexadecimal format in order to indicate the “ON” or “OFF” status. The actual data will be returned in ASCII, but is translated to determine the appropriate bit pattern. For example, if a request for ALARM status information was made and a return of \$31, \$30. was made, it would translate into a hex reading of 10 (or “ON”) for ALARM code 3, which would mean that an “LL” or Low Level alarm condition existed.

5.7.6 CANCEL (CLEAR) Command

5.7.6.1 Overview

When CANCEL is entered, the controller will disregard the last command transmitted. In most cases, an incorrect command will be ignored, and the controller will prepare for a new command. However, there may be occasions when a command may be properly accepted by the controller, though the parameters are not what the operator wanted to input. In this case, the operator may enter the CANCEL command to halt the controller from initiating the unwanted operation.

The CANCEL command may also be used to halt a command in the middle of it being entered. The controller will then disregard what had already been entered, and prepare itself for a new command. Additionally, the CANCEL command may be used to confirm the controller is clear and on-line.

5.7.6.2 Cancel Command Syntax

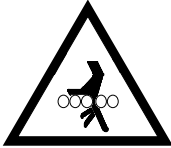
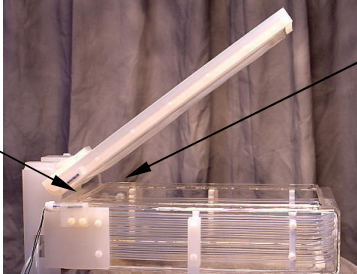
The CANCEL command is entered as:


X

where “X” indicates the CANCEL command.

A <CR> (carriage return) is not required to transmit the CANCEL command. The controller will echo the “X”, but will not return a <CR>, although it *will* return a line feed (\$0D, \$0A) in preparation for a new command.

5.8 Auto-Lid Speed Adjustments

WARNING	
	<p style="text-align: center;">MECHANICAL PINCH POINTS ARE PRESENT!</p> <p>The Auto-Lid has pinch points present at the following locations. Keep clear of these areas when the lid is opening or closing.</p> <div style="display: flex; align-items: center; justify-content: center;"> <div style="margin-right: 20px;">Pinch Points</div>  <div style="margin-left: 20px;">Pinch Points</div> </div>

CAUTION	
	<p style="text-align: center;">POTENTIAL EQUIPMENT DAMAGE!</p> <p>Failure to follow these instructions could result in damage to the actuation panel assembly, the process tank, the quartz collar, and other items within the overall assembly. The following procedure must be followed to insure that the setup of the actuation panel is accomplished in the proper order.</p>

5.8.1 Applying the Water Pressure


1. Before applying water or air pressure to the actuation panel, ensure both needle valve handles (speed controls) are fully closed. Do not over-tighten. Turn the handles completely in the clockwise direction until each is gently seated.
2. Ensure the auto-lid is in the closed (horizontal) position. If not, manually close the auto-lid.
3. Ensure the air valve switch is in the OFF position. Supply air pressure (N₂ or CDA) to the air valve switch by slowly increasing the regulator pressure until a pressure of 30 psi is achieved.
4. Slowly apply water pressure to the actuation panel by increasing the water regulator pressure relative to the model listed below.

NOTE
<p>Values stated in the following two tables are suggested “starting value” only and should be used as general guidelines. Your process values may be different.</p>


Auto-Lid End-Opening (single piston only)		
Model	Min. Line Pressure (psi)	Max. Regulated Pressure (psi)
A1002	30	35
A1502	32	37
D1502	35	42
A2001	16	25
B2001	30	35
A2002	46	55
Auto-Lid Side-Opening		
Model	Min. Line Pressure (psi)	Max. Regulated Pressure (psi)
A1002	10	19
A1252	10	19
A1502	30	35
A2001	25	30
A2002	25	34

5.8.2 Speed Adjustment

1. Turn the air valve switch to the ON position.
2. With the auto-lid in the closed (horizontal) position, slowly open the right-hand speed control needle valve, labeled "Raise", by turning the handle in the counterclockwise direction. This will cause the auto-lid to move towards the open position.

CAUTION	
	<p>POTENTIAL EQUIPMENT DAMAGE!</p> <p>This movement, as stated in the above step, takes approximately two to three (2 to 3) seconds for the lid to reach the fully open position. Speeds higher than this may result in damage to the tank or condensing quartz collar.</p>

3. With the auto-lid in the open position (slightly past vertical), reverse the position of the air valve switch.
4. Slowly open the left speed control needle valve, labeled "Lower", by turning the knob in the counterclockwise direction. This will cause the auto-lid to move towards the closed position.

CAUTION	
	<p>POTENTIAL EQUIPMENT DAMAGE!</p> <p>This movement, as stated in the above step, takes approximately two to three (2 to 3) seconds for the lid to reach the fully closed position. Speeds higher than this may result in damage or condensing quartz collar.</p>

5.8.3 Line Purge

1. To ensure all air is purged from the water lines, repeat the above steps until the proper speed and smooth operation is achieved including no signs of air in the water lines.

5.9 Bath Start Up and Calibration

5.9.1 Initial Set Up Using DI Water

1. Verify that all facilities are connected and all required connections are made to the QN System.
2. Fill the bath to the proper level. The DI water must always be above the heater height. Leave enough room to allow for displacement when there is product in the tank.
3. Ensure the proper parameters have been set in the controller, refer to Section 5.5, *Setting Processing Parameter Values*.

5.9.2 Liquid Level Systems Test

1. Set a process temp to 70°C and allow the bath to start to ramp up to this temperature.
2. Remove the level sensor from liquid and verify that the heater power is interrupted and that the system alarms.
3. Replace the level sensor and reset the controller. Verify that the system returns to normal.

5.9.3 Overtemperature Protection Test

The J-type thermocouple located on the outside wall of the bath should be connected to a device that will shutdown the system in the event of an overtemperature condition. If the IMTEC 952 Controller is used, the overtemp monitor is built in. Regardless of the type of overtemperature device, it should be tested to ensure that it will function in an actual overtemp condition.

CAUTION



POTENTIAL OR EQUIPMENT DAMAGE!

Do not base the overtemperature setpoint entirely on operating temperature. During ramp up, the temperature on the outer quartz wall will be significantly higher than the liquid temperature. Set the temperature to 195°C to prevent false alarms and protect the bath from damage if the temperature control is lost.

1. Connect a J-type thermocouple simulator to the t/c connection point of the 952 controller or other overtemperature monitor. Set the simulator to read less than 100°C.
2. Power up the temperature controller and begin heating the bath. Once the system starts heating, gradually increase the temperature on the simulator. The system will go into an overtemp condition at 190-195°C. If it does not, adjust it so that it an overtemp condition occurs in this range.

5.9.4 RTD Calibration

The model 952 Controller is calibrated at the factory and should be re-calibrated at startup to compensate for minor differences in probes and other application specific variables. These instructions assume that the IMTEC 952 Controller is being used. These instructions should not be used with other controllers. Where other controllers are used, refer to their instructions when calibrating.

1. With DI water in the bath, set the temperature controller to 80°C and initiate the heaters.
2. Turn off the DI Drip Flowmeter (turn knob fully clockwise).

NOTE

The 952 Controller uses the DI Drip function to maintain a boil with Phosphoric Acid at a specific concentration. It will not be possible to get a stable temperature with DI water. Expect erratic behavior as the temperature reaches setpoint. Warning alarms may also occur. The controller will continue to heat when it reaches setpoint and will alarm and the heaters will shut down.

3. Use a hand-held thermometer to calibrate the temperature controller. First stir the bath gently for at least 30 seconds, then read the temperature near the center of the bath. If the display does not match the thermometer, refer to Section 5.5, *Setting Processing Parameter Values*, for offset adjustments.



5.9.5 Final Start-up and Checkout

After the system is checked and calibrated with DI water, it should be checked again using Phosphoric Acid. Most Nitride etch processes run between 150 and 170°C. Following are some general notes regarding the Silicon Nitride Etch Process. Please note that these are general guidelines and your specific results may vary.

Standard Phosphoric Acid from the bottle is approximately 85% and will have a boiling point of 154°C. A boiling bath at this concentration will have a Silicon Nitride (Si_3N_4) etch rate of approximately 50Å/min with less than 2Å/min. etch of Silicon oxide (SiO_2). At a concentration of 91.5%, the boil point temperature is

180 °C, with a Si₃N₄ etch rate of 105/min. with 10Å/min. etch of Silicon oxide. Intermediate results will be somewhere in between, but not linear. The end-user final set point should be based on the need for controlling over etch and throughput.

1. Open the DI Drip Flowmeter knob ¼ turn.
2. Ensure the cooling water Flowmeter is on and set for approximately 6 gallons per hour (gph).
3. Program the controller with the desired setpoint & process time.
4. Set the Low temp alarm to 5 degrees below the setpoint.
5. Set all user-programmable features such as Process timer (count-up or count-down), pre-alert, security codes, etc.

WARNING	
	
<p>HAZARDOUS CHEMICALS CAN CAUSE SEVERE INJURY OR DEATH!</p> <p>Before attempting the following steps apply your company's chemical handling procedures, which are supplemented by these procedures. Also, these procedures must be performed while wearing the appropriate personal protective equipment, such as, but not limited to:</p> <ul style="list-style-type: none"> <li style="width: 33%;">• goggles <li style="width: 33%;">• respirator <li style="width: 33%;">• boots <li style="width: 33%;">• gloves <li style="width: 33%;">• apron 	

6. Fill the bath with fresh Phosphoric Acid following your companies chemical handling procedures and safety protocol.
7. Press the “PWR” and “Hold” keys to put the controller into operating mode and bring the temperature up to set point.

NOTE
<p>Fresh H₃PO₄ will boil at approximately 154 °C. When the temperature reaches the boiling point, the rise will slow as the water starts to boil-off and may appear to stall because the water vapor coming out of solution is being condensed by the cooling coils and sealed lid. Depending on this system and setpoint, the operator may need to open the lid and / or turn off the water to the cooling coils in order to get the bath to the setpoint in a reasonable time. If so, ensure the lid is closed before starting the cooling water flow when the system gets to within 1 degree of setpoint.</p>

5.9.6 Final Calibration

For optimum process performance, the boiling point needs to be controlled as tightly as possible. Depending on the size of the tank and a number of other factors, it may be necessary to fine tune the system. Read carefully and understand the following information before making any adjustments.

When properly set up, the controller will control the heaters and the DI dripper to maintain the acid at the proper boiling point to within 0.2 °C. The controller does this by keeping the heaters at a fixed

duty cycle (at set point) and using the DI drip to maintain temperature and concentration. Two settings are adjusted and since there are a number of factors that impact these settings, it is necessary to follow all of the steps in order to correctly adjust the system.

5.9.6.1 Cooling Coil Flow Rate Adjustment

The purpose of the cooling coils is to help condense the water vapor that rises toward the lid. The cooling water travels through coils of ¼" Teflon tubing in the condensing collar and then exits. When the process is running, the water will be warmed as it travels around the coils. The purpose of this adjustment is to allow for effective condensation with the least amount of cooling water used.

1. With a surface temperature probe measure the cooling coil inlet tube as close to the collar wall (outside) as possible. Then measure the outlet tube. The temp on the outlet tube should be less than 5 degrees warmer than the inlet. If the difference is greater than 5 degrees, increase the flow to the coils. If the difference is less than 5 degrees, the flow can be decreased in order to minimize water consumption.

5.9.6.2 DI Drip Rate Adjustment

This is the most critical adjustment for maintaining an accurate boiling point. If the drip rate is too low, the bath temperature will continue to climb even when the dripper is on 100% of the time. If it is too high, the temperature will fluctuate excessively around the setpoint. A correctly set dripper should maintain the temperature within 0.2°C. Before making any adjustments, ensure that the lid is in the closed position and sealed.

1. With the controller on, press and hold the "ADJ Dripper" button and set the DI Drip Flowmeter for 5cc/min. Take the controller off hold and allow the temperature to come back to the setpoint. When display reads 0.1 degree above setpoint, the DI drip led should come on. Monitor the display. If the temperature rises more than 0.2 degrees above setpoint, the flow rate is likely too low. If the dripper comes on and causes the temperature to drop to 0.1 degree below setpoint, the flow rate is likely too high.

NOTE

Dripper values are based on a "closed" lid. If your system has a feature that creates an "opened" lid (i.e., a "notched" lid) you will have to increase the flowrate. The flowrate increase may be significant compared to the rate used with a "closed" lid.

2. If the system is maintaining temperature within 0.2 degrees of setpoint, monitor the duty cycle of the dripper. With a sealed

system, a duty cycle of 10 to 20% is a good setting. If it exceeds 30%, the flow rate should be increased slightly. If it is under 10%, the flow rate should be decreased. A duty cycle in this range should provide for optimum control of the boiling point temperature and concentration. If a stable temperature is not achieved using the above procedure, contact IMTEC for technical assistance.

5.9.7 Final RTD Adjustment

1. When the temperature is stable, the temperature probe offset adjustment as described in 5.9.4 should be repeated.

This ends Section 5, *Start-up and Calibration*.

6 OPERATING INSTRUCTIONS

This section includes how to operate the:

- IMTEC Model 952 Controller
- Quartz Nitride Reflux System
- Auto-Lid Actuation Panel

6.1 IMTEC Model 952 Controller Operations

This following information describes the procedures necessary for operating the IMTEC Model 952 Controller. This information includes:

- Safety Recommendations
- Operating the Controller

NOTE

Please read completely through these instructions before attempting to operate the Controller.

6.1.1 Safety Recommendations

The following recommendations are included for personnel safety and the protection of the controller.

CAUTION



POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!

The recommendations included in this section are advisory in scope. *IMTEC assumes no responsibility for the correct installation or use of this equipment in any user's facility.*

WARNING



DANGEROUS VOLTAGE IS PRESENT!

Hazardous voltages exist. Use caution.

The rear of the Model 952 Controller may have over 200 volts at high amperage connected to it.

To ensure operator, equipment, and product safety, follow these safety instructions and use care when operating this equipment.

Avoid exposing the power cable or connectors to immersion in water or other liquids.

CAUTION**POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!**

The Model 952 Controller *is not fume tight*. Use it only in chemical-free environments such as a well-ventilated wetstation headcase.

The Model 952 Controller has numerous alarms and over-temperature safety devices. Periodically lower their temperature settings to a practical test level **and test them**. Report any malfunctions to safety engineering or another officially designated group.

Do not leave an operating bath system unattended! If there is no one to attend the bath, turn the Controller power OFF.

WARNING**HAZARDOUS CHEMICALS CAN CAUSE SEVERE INJURY OR DEATH!**

Take extra care when using volatile flammables – fumes are more dangerous than liquids.

Ensure all protective sensors and automatic shutdowns are attached and functional.

6.1.2 Operating the Controller

1. Ensure controller power is ON and is in HOLD mode.
2. If the current parameters stored in memory are acceptable, press the HOLD key to take the Controller out of HOLD mode. Press START to begin processing, or enter SETUP to modify parameters.
3. During normal processing, the timer will count down to zero and the controller will enter HOLD mode. Parameter values may be changed or another timing cycle can be started. To halt processing before the timer has completely counted down, press STOP.
4. Check the flowmeter periodically to ensure that water is flowing when the DI H₂O LED is illuminated.

This concludes Operating the 952 Controller.

6.2 QN Tank Operations Procedures


The following information describes a typical procedure for preparing the bath for processing. Where specific controller buttons or indicators are mentioned, the names are based on the IMTEC Model 952 Controller.

6.2.1 Start Up

1. Fill the bath with the appropriate amount of chemistry. The level in the bath must be at least ½-inch above the wall heaters that can be seen through the quartz. There must also be enough freeboard in the bath to accommodate the displacement of the wafers and carrier(s), as well as handles or robotic end-effectors.
2. Press the Power on/off switch. The controller will perform a short diagnostic test and then enter Hold mode.
3. Verify that there is water flowing to the cooling coils.
4. Verify the controller has the proper setpoint and process times.
5. Press the controllers "Hold" button to initiate the heat-up cycle.
6. Turn the bath power ON.
7. When the specified operating temperature has been reached, begin processing.

6.2.2 Shut Down

1. Turn bath power OFF.
2. Turn controller power OFF.
3. Following your company's operating procedures, allow the process chemistry to cool.

CAUTION	
	POTENTIAL EQUIPMENT DAMAGE! Do not aspirate or drain hot chemicals above 90°C.

4. Aspirate or (if a drain is installed) drain the solution, taking all safety precautions.

This concludes the QN Tank Operations Procedures.

6.3 Auto-Lid Operation Procedures

6.3.1 Manual Wet Stations

1. Manually toggle the switch or valve used to open / close the lid.

6.3.2 Automated Wet Stations

1. The open / close function is performed by the software of the system

This concludes the Auto-Lid Operations Procedures.

7 MAINTENANCE & TROUBLESHOOTING

This section includes how to maintain and troubleshoot the:

- IMTEC Model 952 Controller
- Quartz Nitride Reflux System
- Leak-Detector LD-1
- Instructions for Returning IMTEC ACCUBATHS

7.1 IMTEC Model 952 Controller

The following information describes the procedures necessary for maintaining and troubleshooting the IMTEC Model 952 Controller. This information includes:

- Maintenance
- User Repair
- Electrical Interference
- Problem Diagnosis

NOTE

To minimize maintenance and troubleshooting, place the controller in a well-ventilate area of the headcase. This will minimize chemical contamination of the faceplate and rear panel.
If the controller fails, IMTEC recommends temporarily exchanging the failed controller with a know good one.

7.1.1 Maintenance

1. Check the rear panel inside the headcase periodically to ensure no blockage is preventing the venting of fumes and heat.
2. Check the flowmeter periodically to ensure water flow when the DI H₂O LED is illuminated.

CAUTION



**POTENTIAL EQUIPMENT DAMAGE!
NON-RECOMMENDED CLEANERS OR IMPROPER CLEANING CAN CAUSE
SURFACE DAMAGE OR CONTAMINATION**

- **Thermoplastic** surfaces: ONLY use DI water. DO NOT use isopropyl alcohol (IPA). Using IPA may mix with the out-gases of the various process chemicals and cause the surfaces to cloud or "fog up." (This does not affect processing.)
- DO NOT use any abrasive-based or glass cleaning solutions.
- DO NOT use a wipe from the chemical (inner) side of a system surface on the outer

	side of a system surface.
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3. The controller's face and body are vulnerable to attack by aggressive solvents. When cleaning the controller, use only DI water.
4. The controller has numerous alarms and over-temperature safety devices. Periodically lower the temperature settings to a practical test level and test these alarms and safety devices.

7.1.2 User Repair

7.1.2.1 PC Board Components

When the SYSTEM LED is lit, it indicates a problem in the Controller software. You may try to clear this problem by powering the Controller OFF and ON. If commands were being entered when this alarm condition occurs, the commands may have to be re-entered.

IMTEC does not recommend user repair of the Controller's PC board components and will not be responsible for damage caused by such attempts. If the components require repair, contact IMTEC Customer Service at:

IMTEC Acculine 49036 Milmont Dr Fremont, CA 94538	Phone: 510-770-1800 Fax: 510-770-1400
Email: imteccaculine.com	From 8:00 a.m. to 5:00 p.m., PST, Monday through Friday

7.1.2.2 Spares

Receptacle pins, solenoid step-down transformers and other items may wear and / or fail. Contact IMTEC Customer Service for information about ordering these and other items.

7.1.3 Electrical Interference

A strong electrical interference from other nearby processing equipment (i.e., a plasma unit) may cause the controller to malfunction. If so, ensure power-line filtering has been provided. Once the interference has been eliminated, re-power the controller. If necessary, re-enter values into the controller's memory.

7.1.4 Problem Diagnosis

For assistance with problem diagnosis and correction options, contact IMTEC Customer Service at:

<p>IMTEC Acculine 49036 Milmont Dr Fremont, CA 94538</p>	<p>Phone: 510-770-1800 Fax: 510-770-1400</p>
<p>Email: imtec@imtecacculine.com</p>	<p>From 8:00 a.m. to 5:00 p.m., PST, Monday through Friday</p>

7.2 Quartz Nitride Reflux System

7.2.1 Description

The following information describes the procedures required for troubleshooting the bath. This information includes:

- Heating Element Does Not Heat
- Failed Over-Temperature Thermocouple
- Other Troubleshooting Procedures

7.2.2 Heating Element Does Not Heat

1. Check that power is present at the controller.
2. If power is present at the controller, check that the bath wiring harness is properly connected to the controller.
3. If still no heat, check for proper voltage and power at the bath power cord attachment terminal.
4. If still no heat, use an OHM meter to check the heater condition (contact IMTEC for the proper heater resistances).

NOTE
<p>Baths drawing up to 15 amperes are typically provided with a pre-wired Amp connector. These components are keyed and will only connect when in the proper orientation. <i>Do not force them.</i> Call IMTEC if you experience difficulty testing the bath components.</p> <p>Baths drawing up to 20 amperes may be hard-wired to the IMTEC controller or to an external relay package of adequate capacity which, in turn, is hard-wired to the controller.</p> <p>Baths drawing over 20 amperes <i>must</i> be connected to the IMTEC controller through intermediary external relays.</p>

7.2.3 Sudden Increase in Heat-up Time

Symptom: One heater element may have failed.

1. Refer to the schematic supplied with this system for correct OHM meter reading values.
2. If heater types are wired individually, OHM reading may be half the schematic-listed value. If so, return the system for repair.
3. If heater types are wired in parallel, OHM reading may be two times the schematic-listed value. If so, return the system for repair.

7.2.4 System Overshoots Desired Temperature

Symptom: System is losing DI water or insufficient DI Drip.

1. Verify that the lid works as designed.
2. Verify that the DI Drip is actually dripping.
3. Refer to the Calibration setup to ensure correct desired setup.

7.2.5 Poor Control of the Temperature

1. Verify that the DI Drip is actually dripping.
2. Ensure that the desired controller setup has not changed.

7.2.6 Failed Over-Temperature Thermocouple

1. Over-temperature thermocouples do not have to be highly accurate to perform their safety function. However, if a T/C sensor is open, shorted, or you detect a highly deviant voltage (checking at ambient), disconnect the T/C leads. Find the spare 6-pin connector wire pair (in QN baths, it will be found in the cable harness jacket) and connect them, making sure that the white and red leads are connected in the correct polarity.

7.2.7 Other Troubleshooting Procedures

1. All other troubleshooting procedures for the bath are performed at the controller. If there are any difficulties with either the bath or the IMTEC controller that this manual does not resolve, contact IMTEC for assistance.

7.3 Leak-Detector LD-1

NOTE

It is not necessary to disconnect the LD-1 when troubleshooting unless an alarm condition would interrupt other processes.

If a problem with the LD-1 occurs, press the TEST switch. If a fault displays, press the RESET switch. If the LD-1 does not reset, contact IMTEC Customer Service.

This ends Maintenance and Troubleshooting.

7.4 Instructions for Returning IMTEC ACCUBATHS

The following instructions describe IMTEC's policies regarding returning bath products and the procedures to be followed when returning baths. This information includes:

- Return Policy
- Obtaining a Return Authorization
- Packing the bath for return

NOTE

Read completely through the instructions before packaging any IMTEC equipment for return.

7.4.1 Return Policies

1. All ACCUBATH's must be returned in IMTEC shipping containers and packaging material. If the original containers are no longer available, a shipping kit is available for a nominal fee from IMTEC Customer Service.
2. All ACCUBATH returns must be authorized by an IMTEC representative. If a bath is shipped to IMTEC without a Returned Goods Authorization (RGA) number, the bath will be refused by the IMTEC Receiving Department and returned to the sender.
3. Unless the shipment was an IMTEC error, all freight charges are the responsibility of the customer. IMTEC recommends insuring the shipment for the full or repaired value.

7.4.2 Obtaining a Return Authorization Number

1. Have the following information ready before calling IMTEC:
 - Reason for the repair
 - Type of chemistry used in the bath
 - Process temperature used
 - Purchase Order Number (used for tracking only; there will be no charge amount until the bath has been evaluated by IMTEC).
2. Call IMTEC Customer Service at 408.745.7800 and request an RGA number.
3. If needed, order a shipping container kit.
4. If the bath is contaminated (quartz is cracked or the seal breached), ask for a contamination shipping kit (DOT-approved for transporting acid-present baths).

7.4.3 Packing the Bath for Return

Ensure the following items are available:

1. Tape (OSHA White, 5-mil, 1-inch wide, pressure-sensitive vinyl plastic) meeting Federal Spec.PPP-T-66E, Type 1 and CID A-A-1689A, Type 1.
2. Have the ACCUBATH shipping container ready.
3. Using your company's decontamination procedures, clean the bath chemistry as much as possible, draining the bath and rinsing with DI water. Test with pH paper and ensure a neutral results reading.
4. Create a detailed description of the condition of the quartz before packing the bath for return. This will ensure IMTEC can readily identify any shipment damaged. IMTEC recommends that all baths, with or without quartz damage, be photographed. Photos should show any quartz damage and include the serial number label visible through the quartz. Two pictures of each view should be taken; ship one set with the bath, keep the other set with your shipping documentation.
5. Create a description of the chemistry used and process temperature used with the bath.
6. If the quartz is cracked or broken, carefully tape damaged pieces in position on the quartz bath or assembly, using the approved tape specified above.
7. Disconnect electrical connections and plumbing and tape the power cable to the **outside** of the bath, away from the quartz. It is preferable to tape the cable to the bottom of the bath.

CAUTION



POTENTIAL EQUIPMENT DAMAGE!

For **contaminated** baths (quartz cracked or seal breached), use the contamination shipping kit from IMTEC, making sure that the bath is free of chemistry. Dry the bath, then install the drain plug. Instead of taping the power cable(s) to the bottom of the bath, cut the cable(s) flush with the bottom (1/2" OD) end of fitting and install the power cord plug(s) before continuing.

8. Baths larger than 19.5"Lx11.5"Wx15"D" (QZA1502) must be shipped upright. For these baths, tape the "scored" fiberboard pieces shipped with the bath into place over the bath feet. If these pieces are not available, tape corrugated cardboard to the bath feet; this will prevent the feet from "punching" through the box bottom.
9. Insert the bath into an approved plastic bag (you will need three (3) for each bath to be returned). If the originals are no longer available, bags may be obtained from IMTEC Customer Service.

10. Carefully and **completely** squeeze out all of the trapped air. Seal the bag with a tie-wrap.
11. Repeat steps 9 and 10 twice more, using the remaining two bags.
12. Carefully place the bagged bath into the lower molded foam section in the shipping container, laying the bath on its side (except for those larger baths which are shipped upright).
13. Place upper molded foam section in place over the bath.
14. Pull up the bag liner, twist its top once and squeeze out **all** trapped air. **It is important that ALL trapped air be removed.** Twist the liner excess to seal out the air and use a tie-wrap to secure the liner top.
15. Insert photos, diagrams, and documentation of chemicals and process temperature into a sealed plastic bag and place this bag into the container with the bath.
16. Seal the bath's shipping container.
17. Remove backing and secure a shock watch and companion label to the side of the container.
18. Ensure that the words or labels with the words "GLASS", and "FRAGILE" appear on all sides of the shipping container except bottom.
19. For large baths, position four edge protectors in place and firmly strap the shipping container to a pallet, using strapping and buckles.
20. Apply the RGA number on the sides of the container.
21. Place a packing list on the outside of the container and tape it securely in place.
22. If the bath is palletized, make sure the freight bill is marked, "Do Not Break Down Pallet".
23. Ship the container to IMTEC.

If you have any questions about IMTEC's return policies or procedures, please contact IMTEC at:

IMTEC Acculine 49036 Milmont Dr Fremont, CA 94538	Phone: 510-770-1800 Fax: 510-770-1400
Email: imteccaculine.com	From 8:00 a.m. to 5:00 p.m., PST, Monday through Friday