Gammasphere LN Filling System Manual

by

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1. Background

The gammasphere detector has 110 germanium detectors that must be maintained below 105 degrees Kelvin to prevent neutron damage from reducing the resolution of the detectors. Each detector has a Liquid Nitrogen (LN) dewar mounted on the back which must be kept nonempty to maintain the germanium temperature.

1.1. Reliability Requirements

1.1. Reliability Requirements 1

The LN Filling system is responsible for filling the LN dewars on the Gammasphere Detectors. These have a nominal 24 hour supply of LN when full, and the system fills them every 12 hours. There may be approximately 12 hours between a failed fill and massive warmup, depending on many variables. The consequences of a massive warmup are complete re-annealing of all detectors, a process that may take two days per detector, and only two annealing stations are initially planned. The design requirements of this system are to make this happen 0 times in the three year onsite life of the system. Since we are not spending enough to make the system multiply redundant this strategy depends on immediate failure detection and rapid repair in addition to high reliability. This requires onsite spares as well as multiple trained troubleshooters.

1.2. Design Principles

1.2. Design Principles 1

The Gammasphere LN Filling System has been designed for high reliability and maintainability. Components are reliable and readily replaced with available spares. Online spares are used for the workstation components, and passive network components reduce failure modes there. Sensors are monitored continuously for short/open/disconnected conditions. Power, Computer Alive, and other alarms are wired from the system to the accelerator control room alarm panels, and also to an alarm module in the Gammasphere counting room. A Phone dialer is also triggered by the alarms and dials three numbers to notify the responsible standby individual. The components selected are in use elsewhere at LBL, increasing the available pool of emergency spares.

2. Principles of Operation

2.1. LN Flow Overview

2.1. LN Flow Overview 1

A large LN tank on the roof (LN supply) is piped to 200 Liter tanks in the cave. These tanks are piped to manifolds located on the base of the detector support structure. Each manifold has valves which allow LN to flow to individual detector dewars. Vent manifolds collect the nitrogen which is displaced by liquid during filling and exhaust it outside.

2.2. System Overview

2.2. System Overview 1

The LN Filling System consists of a VME based computer, Allen Bradley Input/Output Modules, LED LN Sensors, and Solenoid controlled LN valves. The control computer is a 4megabyte 68040 running at 25 mhz utilizing the VxWorks operating system and EPICS (Experimental Physics and Industrial Control System) operating system. It is connected via ethernet to a pair of Sun Workstations providing boot, file, and user interface service. The Allen Bradley I/O modules are interconnected via a serial bus to a controller in the VME crate. An alarm system monitors the alarm output from the computer, sending it to the control room,

the counting room and (later via timer) to a dialer. A second timer in the alarm system monitors the heartbeat output of the computer and sends 'computer failure' alarms when the heartbeat fails to operate for a time. The alarm outputs go to the alarm state if power is removed from the rack. An led panel on the front of the VME crate displays status information on 32 leds.

2.3. Filling sequence

2.3. Filling sequence 1

Detector filling begins by chilling the fill manifold. This is done by opening the manifold fill and vent valves and waiting until liquid is sensed at the vent valve.

The first four detector fill valves are then opened and each valve is closed when liquid is sensed at the detector dewar overflow. As soon as one valve is closed, another is opened until the end of the cycle when there are less than four detectors waiting to be filled.

2.4. Filling system parameters

2.4. Filling system parameters 1

Parameters such as the maximum number of valves open at once, maximum and minimum open time for each valve, and temperature sensor thresholds are stored in the Informix data base. This data base is accessed from the *gamdb* account. Access to the data base is described in a later chapter.

3. Operation

3.1. Logging In

On the workstation in cave 4c('lncon') use the login name 'gamop' (for gammasphere operations). This login account has restricted privilege. The password may be obtained from the Gammasphere Project Manager.

3.2. Operator Displays

The operator displays are invoked from the menu. Move the cursor to a background area of the display and depress the right mouse button, holding it down. Move the cursor to the LnMain button and release it. This invokes the main display, a small window in the upper left corner of the display.

3.3. Remote Access To Operator Displays

If you are logged into con1.gam, execute the script 'lnmain' to invoke the main display. Otherwise, remotely log into con1.gam or srv1.gam and execute 'lnmain'. If you need an account on srv1.gam or con1.gam for remote access, see the Gammasphere Project Manager.

3.3.1. Main Display

All displays can be reached from the main display.

Display Selectors

There are two display selectors. If the display named in one of the selectors is what you want, move the cursor to that selector and click on it with the left mouse button to activate the display. Otherwise, move the cursor to a selector and hold down the right mouse button to see a menu of choices. Move the cursor to the desired selection in the menu and release the right button to active the display. hold

Alarm status

Alarm status shows most severe control room alarm producing condition. The alarms are ranked from most severe to least severe as follows:

Power OFF
Valve power is out of specs for at least one enabled valve.

AB Errors
Invalid reading from the Allen-Bradley for at least one enabled temperature sensor.

Disc'd Detectors
At least one enabled temperature sensor circuit is open.

Shorted Detectors
At least one enabled temperature sensor circuit is shorted.

Undertimes
At least one fill or purge operation completed undertime.

Overtimes
At least one fill or purge operation went overtime.

No Time
lnfill vme crate could not get time from Unix side when booted. Crate will reboot in 5 minutes.

Sensor PS Fail
Temperature sensor power is out of specs.

Current State

Current state can be

Initializing
From reboot until "Ready".

Ready
While waiting for next automatic fill.

Filling Dets
During a detector fill cycle.

Filling Tanks
During a tank fill cycle.

Aborting
From abort button push until "Ready".

Finishing
From fill done until "Ready".

Fill Mode

Fill Mode is selected in the settings display and can be

MANUAL
No automatic fill cycles allowed.

AUTO DETECTOR
Automatic detector fills only allowed.

AUTO TANK & DETECTOR
Automatic detector and tank fills only allowed.

Time of Next Fill

Time of next fill is time at which next automatic detector fill cycle is to begin. It can be manually set in the settings display. Every fill cycle increments it by Time between fills which is also manually set in the settings display.

HeartBeat

HeartBeat is a strip chart plot of a variable which alternates between 0 and 1 every 10 seconds and serves to indicate that the main lnfill software is functioning.

Reboot

Pushing the Reboot button causes a reboot of the lnfiller VME crate. Changes made to the informix database via the gamdb login do not take effect until the lnfiller VME crate is rebooted. Reboot is provided as a convenience for that purpose. Be careful not to inadvertently hit Reboot during a fill cycle.

3.3.2. System Alarms Display

The alarm display shows the number of enabled temperature sensors which are disconnected and shorted, the number of fills/purges which went undertime and overtime, the number of enabled valves, the number of enabled valves without power and whether or not the dialer is enabled. The ACK buttons allow the operator to override(silence) alarms raised for the corresponding conditions but does NOT reset the alarm condition counts. When ACK is set, the button border is highlighted.

Temperature sensors

Disconnected means sensor voltage is greater than UPPER_MAX(5.2 v). Shorted means sensor voltage is less than LOWER_MIN(2.2 v). Only ENABLED disconnected/shorted sensors are counted.

ACK can be set only when alarm conditions exist. The operator can reset ACK by hitting the ACK button again. ACK is automatically reset by the control system if all alarm conditions go away or if the number of alarm conditions increases over what it was when ACK was set.

Valves

Undertime means that the temperature state associated with a valve changed to ’cold’ in less than minimum time given in informix database. The valve is forced to remain open for the minimum time. Overtime means that the temperature state did not change to ’cold’ in less than maximum time given in informix database.

ACK can be set only when alarm conditions exist. The operator can reset ACK by hitting the ACK button again. ACK is automatically reset by the control system if all alarm conditions go away or if the number of alarm conditions increases over what it was when ACK was set. The under/overtime counts are reset at the beginning of each fill cycle.

Enabled

Enabled is a count of the number of valves set for Auto and not Disabled or Open.

Without power

Without power is a count of the number of enabled valves without power.

3.3.3. Manifold Displays

There is a display for each manifold showing information about the manifold fill and vent stations and the detector fill stations on the manifold. A station is a valve with its associated temperature sensor if it has one. There is no temperature sensor associated with the manifold fill valve.

Detector Stations

The following is shown for each detector station

Station Number

A number between 01 and 15 in orange.

Valve Control

There are 3 choices in light blue. To make a selection, place the cursor over the desired offering and click with the left mouse button. The selected choice is intensified. Select ’Auto’ to include the station in subsequent fill cycles. Select ’Open’ to force the valve open. Select ’Disable’ to force the valve closed and exclude it from subsequent fill cycles.

Open Time

The number of seconds the valve was open during the last fill is shown in green. If the valve went under or over time, open time is shown in red. Open time is reset at the beginning of each fill cycle.

Valve State

The valve states are in green and are

No Data
Data acquisition has not yet begun.

Open
Valve is enabled and open.

Closed
Valve is enabled and closed.

Disabled
Valve is disabled and closed.

No Power
Valve power is off.

Temperature Sensor State

The temperature sensor states are in green and are

No Data
Data acquisition has not yet begun.

Fault
Sensor voltage < LOWER_MIN(2.2 v).

Warm
LOWER_MIN(2.2 v) <= sensor voltage <= UPPER_MAX(5.2 v).

Cold
sensor voltage > UPPER_MAX(5.2 v).

Detector Number

The GE hole number(n of 110) in white.

Temperature Sensor Voltage

The measured temperature sensor voltage in green from which the temperature sensor state is derived.

Manifold Stations
The manifold fill and vent stations contain the same information as for detector fill stations except that manifold fill stations have no temperature sensor data.

3.3.4. Tank Display

The tank display shows the building ln supply fill and purge stations plus the tank vent stations with the information described above for detector and manifold stations.

3.3.5. Settings Display

The settings display provides operator control of several system parameters. Except for fill mode select and pressure thresholds, the current value is shown in the upper box in yellow. New values are made by moving the cursor into the lower box and changing the value by backspacing and typing. The bent bar cursor in the typein box can be moved by pointing and clicking with the left mouse button. The new value is entered when the cursor is moved out of the box or the return key is hit. Check the current value box to make sure the new value was accepted.

Fill Mode Select
Place the cursor in the Fill Mode Select box. Hold down the right mouse button and move down the menu to the desired choice. Let up on the button. The choices are

MANUAL
No automatic fill cycles allowed.

AUTO DETECTOR
Automatic detector fills only allowed.

AUTO TANK & DETECTOR
Automatic detector and tank fills only allowed.

Time Between Fills

The current time between fills is shown as hours:minutes. Hour only or hour:minute may be entered. Time between fills must be between 1 and 12 hours.

Time of Next Fill

The current time of next fill is shown as hour:minute date. New values are entered as hour:minute. If the new time is earlier than the current time of day, it is assumed to be in the following day. Time of next fill must be no more than 15 hours from the current time of day.

Cycles per Tank Fill

Cycles per tank fill is the number of detector fill cycles between tank fills. Enter 1 for tank fill after every detector fill, 2 for every other, etc. Cycles per tank fill must be between 1 and 10.

Cycles Till Tank Fill

Cycles till tank fill counts down the number of detector cycles remaining before the next tank fill.

Pressure Thresholds

These are slider inputs. Place the cursor in the slider box and drag the pointer with the left mouse button until the center number shows the desired value. If the the ln pressure in psi drops below this threshold, the pressure monitors will show "Pressure Low" in yellow rather than "Pressure OK" in green on the tank display. This condition may used to send an alarm to the control room at a later date.

3.3.6. Valve Power Display

The valve power display shows the status of the 110 v. valve power supplies as either ’Power Ok’ or ’No Power’ and whether the system is in RUN or SIMULATE mode. The production system should never be left in simulate mode to avoid the possibility of omitting a fill cycle.

3.3.7. Diagnostic Display

The disgnostic display is for the benefit of the Software Support Group. Operators should NOT use it to change the operating mode to SIMULATE.

4. Operational Cautions and Warnings

The following sections contain operational warnings and cautions that should be understood by all users of the lnfiller system. This is a place to list items that may be software bugs, hardware anomalies, or important system characteristics.

4.1. Changing Valve Enables during Fill

Due to the way in which the filling system determines completion it is inappropriate to change the valve enables during a fill cycle. Doing so may cause the fill to fail to terminate, or hang up. Fixing this would require some careful work in the state machines, and is currently not scheduled.

5. LN Filling System Alarms

The System has been designed to generate two alarms. Each alarm output is generated from the physically de-energized state of a relay so that removal of power generates all possible alarms. The alarms generated are the *LN Alarm,* and the *Computer Fail Alarm.*

5.1. LN Alarm

The LN Alarm is an output of the computer. If the computer is down this alarm may be stuck in either state. It comes out via the Allen Bradley Binary output channel #L0 A3 C1 S14. The VME software generates this alarm by logical 'or-ing' most all the possible alarm conditions detected in software and driving this output (See Sec. 3.2.1). The dialer disable alarm is not or'ed with the alarms - it merely lights a rectangle in the Alarm Display. The other alarms or'd include Sensor Open/Short, Fill Undertime/Overtime, Valve Power, etc.

5.2. Computer Fail Alarm

The relay designated xxx determines the amount of time the computer is allowed to not generate the heartbeat before it is considered a computer failure. The heartbeat is generated by the top level sequencer in the system, and is a pulse every 10 seconds. It comes out via the Allen Bradley BO output channel xxx. Presence of the heartbeat gives a very good indication that the VME system is working. This must be set long enough to allow both the Server workstation and the VME crate to reboot comfortably without generating spurious alarms. The default time for this relay is 10 minutes.

5.3. Alarm Display Panel

The VME System Analysis Board has 32 LEDs visible on the front of the LN Filler Rack. Some of these are used to indicate Alarm Status. These Alarm LEDS are normally ON when there is NO alarm, so OFF = ALARM. See the section on System Analysis Display for specific information.

5.4. Phone Autodialer

The phone dialer alarm is generated by logical 'or-ing' of both the computer and LN alarms, feeding to a time delay relay, and when the time has elapsed generate the dialer output. This output is connected to a BNC on the side of the rack and cabled to an autodialer that dials three numbers.

5.4.1. Programming the AutoDialer Delay

The time delay relay is easily programmable. The relay is located inside the rack and is designated xxx. The mode selector of this relay must always be set at xxx.

5.4.2.

5.4.3. Delay Relay Settings

The two time delay relays are both model xxxxxxx xxxx's. There are (three?) thumbwheels that are adjusted to determine the time delay of the relay. Starting from the left, the first (two?) are multiplied by the units in the (third?). Example: ...

6. Ge Detector Temperature and Detector High Voltage Monitoring and Alarm

Temperature sensors are mounted in the cold finger between the dewar and the germanium crystal in the detector units. These are platinum RTD type sensors. The signals from these are digitized and read in via the Data Acquisition System rather than the LN Filler system. Currently this is a VAX based system, and this information processed by programs in the VAX. This data is not available to the LN Filler system. The VAX system reads the temperature of all detectors twice per hour and generates an alarm signal if any detector is outside of its normal temperature range. This alarm signal is paralleled with the dialer signal from the LN system, so a phone call can result from either source. The temperature alarm also sounds in the control room. The H.V. value of Ge and Bgo ...

6.1. Monitoring temperatures from SUN workstation

Current temperature readings can be reviewed from any unix login by typing "getemp". This script fetches the three most recent report files from the GAMVX1 VAX and generates a summary report showing the current, average, minimum and maximum temperatures.

6.2. GETEMP VAX Temperature monitoring program

GETEMP runs as a batch job on GAMVX1, and reads all Ge modules every 30 minutes. It is automatically started in the batch queue when the system boots up.

All of the files associated with GETEMP are in GAMVX1_USER:[HERA]

Each set of readings is appended to the file GETEMP.REPORT. A new version of GETEMP.REPORT is started at midnight each day.

Any errors found will trigger alarms as follows:

Temperature above alarm limit or shutdown limit will set
both the control room alarm and the auto-dialer.
If temperature is above alarm limit, the alarm is set.
If temperature is above shutdown limit, the alarm is set
and the high voltage is turned off.

High voltage status sets control room alarm only.
Ge high voltage found off when it should be on sets alarm.
BGO high voltage found off when it should be on sets alarm.

The file GETEMP.CONTROL contains temperature thresholds and desired on/off values. To change a threshold or on/off requirement, you must edit this file. (see below for details)

Errors are also reported in the file GETEMP.LOG.

6.3. How to scan for errors

In any window on GAMVX1, type "GESCAN". This will search all versions of GETEMP.REPORT and will print lines containing error messages.

To show all readings for a particular detector, type the following line:

```
search  getemp.report.*  "D 15"
```

Note that when searching for detectors 1-9 you must leave 2 blanks after the "D".

To see error messages in "GETEMP.LOG" type:

```
type  getemp.log.*
```

6.4. ALARMS

Any errors will cause the alarm module to sound. The alarm can be silenced by pressing the red button on the alarm module.

The alarm module is the 71X259 FLIP FLOP in Camac crate 1, slot 3.

The parameters for alarm condition are in the file [HERA]GETEMP.CONTROL. If a detector is added or removed and/or the high voltage is turned on or off, you will have to edit GETEMP.CONTROL to avoid getting a false alarm. Also, if a detector warms up, you may have to edit GETEMP.CONTROL to avoid getting a new alarm every 30 minutes.

The LED display on the alarm module indicates the following conditions:

0
0
0
0 <<< This bit set for any alarm, triggers control room alarm.

0 <<< alarm from LN filling system.
0
0
0

0
0
0
0 <<< Temperature is abnormally low. Sensor may be disconnected.

0 <<<Temperature is over shutoff limit. HV has been shut down
0 <<<Temperature is above alarm limit
0 <<<GE power found off unexpectedly
0 <<<BGO power found off unexpectedly

6.5. GETEMP.CONTROL file format

This file has one line for each detector which is to be monitored.

The line contains:
DETECTOR_NUMBER, GE_HIGH_VOLTAGE_STATE, BGO_HIGH_VOLTAGE_STATE,
MIN_LIMIT, ALARM_LIMIT, SHUTDOWN_LIMIT

If temperature is below MIN_LIMIT, the alarm is set.
If temperature is above ALARM_LIMIT, the alarm is set.
If temperature is above SHUTDOWN_LIMIT, the alarm is set, and
the ge high voltage is turned off.

GE_HIGH_VOLTAGE_STATE= 1 if supply should be on, else =0
BGO_HIGH_VOLTAGE_STATE= 1 if supply should be on, else =0

If either of the high voltage states are found to be =0 when it
should be =1, the alarm is set.

Lines beginning with "*" are ignored, so to turn monitoring off for
a particular detector, just put a "*" at the beginning of the line.

To ignore the MIN_LIMIT, set it to zero. What follows is an
excerpt from the actual GETEMP.CONTROL file.

```
  DETECTOR_NUMBER
  |   GE_HIGH_VOLTAGE_STATE
  |   |     BGO_HIGH_VOLTAGE_STATE
  |   |     |     MIN_LIMIT
  |   |     |     |      ALARM_LIMIT
  |   |     |     |      |      SHUTDOWN_LIMIT
  |   |     |     |      |      |
  1   1     1     75.0   92.    105.
  2   1     1     75.0   92.    105.
  3   1     1     75.0   92.    105.
  4   0     0     75.0   92.    105.
* 5   1     1     75.0   92.    105.  << This one is disabled
  6   1     1     75.0   92.    105.
```

7. Database

The Database controls the values of fairly static parameters. This includes the voltage thresholds for the LN sensors, and the hold time for the LN filling state machines, as well as the lowpass filter coefficients for the LN sensor inputs.

7.1. Accessing the *gamdb* account

The Database is accessible only via the account *gamdb* on srv1.gam. The Informix database is only licensed for operation on srv1.gam. Hence, the *gamdb* account must be on srv1.gam. Informix uses the unix *termcap* database, so it will handle most any cursor addressible terminal via rlogin.

The following users have been entered into the .rhosts file of the *gamdb* account so that they can remotely login from the specified hosts without password. If you are not on the list but need to be, see the Gammasphere Project Manager.

User	Hosts
-----	--------------------
aom	nsa, con1.gam, srv1.gam
bc	nsa, con1.gam, srv1.gam
belshe	nsa, con1.gam, srv1.gam, ws1.gam
biocca	nsa, con1.gam, srv1.gam, swr
fallon	nsa, con1.gam, srv1.gam
fss	nsa, con1.gam, srv1.gam
iylee	nsa, con1.gam, srv1.gam
mads	nsa, con1.gam, srv1.gam
rmd	nsa, con1.gam, srv1.gam
shalz	nsa, con1.gam, srv1.gam, pio

7.2. Using *rsh* to log in

Use the command *rsh srv1.gam -l gamdb* from your regular account and on one the permitted hosts. If it becomes necessary to log in to the database from some other machine than one you have been set up for, simply rlogin first to one that you do have permission from, then rlogin from there to srv1.gam.

7.3. Running the Informix Database

The Database is accessed by the command *change_ln_limits.*

7.3.1. The *help* command

The *help* command displays a file of useful information about the commands in the gamdb account. This includes:

Commands:

change_ln_limits	run Informix Database for limits modification
display_ln_limits	display report of limits in window
print_ln_limits	print report of limits on AP88
show_ln_logs	show ln logs in reverse chronological order
process_ln_logs	process and display ln log data
cmds	display list of available commands
help	display this helpfile

7.3.2. Modifying the Informix Database

The command *change_ln_limits* from the gamdb account prompt runs the ln_limits form of the ln system Database. This brings up the empty data screen and awaits commands.

The first command is usually to query the database for existing data row(s). To query for all the rows in the database, use "Q <ESC>". "Q" is for query, and <ESC> begins the search. Since no criteria was entered, it returns all rows. A message on the bottom of the screen will indicate how many rows were obtained.

If more than one row was available in the query, use "N" and "P" for next and previous to scroll through the results.

To query for a specific item or items, do "Q", then enter search criteria in the appropriate fields, then <ESC>. The easiest way to get to detector 15 on manifold 1, for example, is to query for Station "H1-15". Try "Q" "H1-15" <ESC>.

To query for all manifold stations, do "Q", tab once to the Circuit Type field, enter "Manifold", then <ESC>.

To make changes, use the "U" for update command. Enter the new values in the fields and use <ESC> to make them permanent. To back out of a partially changed row, use Interrupt, which is CONTROL-C.

Hints about valid entries for each field appear on the bottom line when the cursor is in that field. Return advances to the next field, the arrow keys also work. Tab also advances to the next field.

When the screen is exited (with "E"), a report is written and copied to the boot area for the ln system. A reboot is required for these new values to reach the control system.

Ln System Parameter Adjustment Screen Items Described

Station	Detector station ids are H{manifold}-{hose} e.g., H1-03, H2-14. Manifold station ids are M{manifold} e.g., M1, M2 or M3. Tank station ids are T{tank} e.g., T1 or T2. Supply station ids are S[supply} e.g., S1.
Circuit Type	Detector, Manifold, Tank, Supply
Number/Det Hole	is Detector Hole number(1-110) or Manifold number(1-3) or Tank number(1-2) or Supply number(1) depending on Circuit Type.
undertime	declare undertime below XX seconds
overtime	declare overtime above XX seconds
cold voltage	consider cold when above this voltage
hold time	require cold voltage for XX seconds for cold
lowpass filter	new_val = lpf*last_val + (1-lpf)*new_reading

The following information is from the most recent automatic fill, and statistics are computed for the most recent two weeks of automatic fills. Manual fills are not included:

enable	last enable status
state	last state
last open	time last open (sec)
avg	average time open (sec)
std dev	standard deviation of time open
undertimes	count of undertimes
overtimes	count of overtimes
previous cold voltage	threshold last used
min open	minimum open time
max open	maximum open time
N	number of samples
A-3	average plus 3 standard deviations
A+3	average minus 3 standard deviations

8. Safety Procedures

section text ...

8.1. Subsection name

subsection text ...

9. EMail Mailing List

A Unix Listserv email mailing list has been set up to facilitate communications and management of the LN Filling System. The report of the most recent fill is automatically generated and emailed to this list a few minutes after the fill. Users are encouraged to subscribe to this list and submit email to it when changes are made to the system to alert all parties to the situation. To subscribe to this list send email to listserv with the subscribe request in the body (example for unix host):

9.1. Subscribing to the Gamln Email List

```
% mail listserv@gam.lbl.gov
Subject:
subscribe gamln <first_name> <last_name>
<period on line by itself>
```

9.2. Submitting a Message to the Gamln Email List

```
% mail gamln@gam.lbl.gov
Subject: <subject of note>
<body of note>
<period on line by itself>
```

10. Monitoring System Variables

System variables may be captured in a file and manipulated, graphed, etc. This is accomplished using the EPICS Archive tool.

10.1. Capturing Real-Time Filler Data

Scripts are being constructed to facilitate the process of setting up to capture data... The capture of data is normally handled via the ’gamop’ login account.

10.2. Analysis of Captured Data

The data may be inspected, plotted or converted to spreadsheet format. Simplified procedures for doing this...

11. Updates to This Manual

Updates to the manual are made in the software development environment via CVS. Changes are reported to the email listserv residing at gamln@gam.lbl.gov, and the binder at B88 is updated with the new physical pages.

12. Manifold Station Numbering

LN MANIFOLD POSITION TO GAMMASPHERE POSITION TABLE			
LNFILLER DETECTOR NUMBER	**LNFILLER MANIFOLD NUMBER**	**MANIFOLD STATION NUMBER**	**GAMMASPHERE POSITION NUMBER**
-------	-------	-------	-----------
15	1	1	15
9	1	2	9
14	1	3	14
10	1	4	10
5	1	5	5
4	1	6	4
1	1	7	1
11	1	8	11
8	1	9	8
2	1	10	2
3	1	11	3
6	1	12	6
13	1	13	13
12	1	14	12
7	1	15	7
29	2	1	29
25	2	2	25
24	2	3	24
30	2	4	30
19	2	5	19
20	2	6	20
29	2	7	28
21	2	8	21
18	2	9	18
16	2	10	16
17	2	11	17
26	2	12	26
23	2	13	23
27	2	14	27
22	2	15	22
31	3	1	31
32	3	2	32
33	3	3	33
34	3	4	34
35	3	5	35
36	2	6	36

Manifold station numbers are numbered from the fill valve end of the manifold.

13. Maintenance Procedures

13.1. Console Workstation

The Sun workstation designated ’lncon’ is the primary boot and control console for the LN filling system. If this workstation is not functioning properly the LN filling system may be unable to operate correctly. The NonVolatile Boot memory of the current VME CPU is set for booting from ’lncon’. If necessary, the Boot memory may be changed to specify booting from ’srv1.gam’.

Note that it is the intention of Gammasphere Software Support to maintain identical lnfiller software in both lncon and srv1.gam. However, this should be verified before booting from a different machine. In particular, the ’boot’ link needs to be pointing at the right software revision.

The backup(spare) VME CPU has its NonVolatile Boot memory setup for booting from ’srv1.gam’. Therefore, one way to boot from ’srv1.gam’ is to change the VME CPU to the backup unit. However, there is more to it than just changing the VME CPU. See ’Changing Boot Server’ section below.

lncon should be rebooted monthly. This will be done by someone in Gammasphere Software Support.

13.2. Gammasphere Server

13.2.1. Rebooting the Workstation

13.2.1.1. Soft Reboot

Issue the shutdown/reboot command. (this must be avail to user priv). This is the prefered method of rebooting the system. It reboots softly and gives warning to users who are using the filesystems and who are logged in.

```
/etc/shutdown -r +5 quick reboot
```

Wait for the specified five minutes for the system to shut down and reboot.

13.2.1.2. Hard Reboot

The hard reboot is less desirable than the soft reboot, but is in some cases necessary. If the soft reboot doesn’t work... Hold the ’L1’ key down and press ’A’ to halt the machine. If it doesn’t halt try it several times. If it does halt change to the new command set by typing ’new’. (verify this) Then issue a total reset/reboot by typing ’reset’.

If the machine won’t halt then cycle power off and then back on after 20 seconds. The power switch is located ... The system will autoreboot when power is restored. Watch the reboot cycle for erors. FSCK errors (file system check) are the most common ones that might prevent the system from successfully booting.

13.2.1.3. FSCK Problems after reboot

If there are problems after a reboot - the workstation doesn’t respond normally - consider changing the boothost to the alternate machine (if currently booting from lncon, change to srv1.gam, or vice versa).

13.2.1.4. Standalone Reboot Test

lncon is setup to reboot without requiring any other host. This should be verified from time to time. The following procedure is designed to test that lncon can be rebooted while disconnected from the network.

1. logout
2. login as shutdown. Wait for the prompt which
   will be
   Type b (boot) ...
   >
   or
   Type help for more information
   ok
3. disconnect the ethernet cable from lncon.
4. If the prompt was >, type b and hit return.
   If the prompt was ok, type boot and hit return.
5. Wait for the boot to complete. Ignore error
   messages
   leo: No carrier - transciever cable problem?
   lncon lpd[...] unable to get hostname ...
5. When reboot completes, login as gamop in the
   usual way. Activate the LnMain display from
   the menu. If reboot fails, notify Gammasphere
   Software Support.
6. Reconnect the ethernet cable on lncon.
7. Reboot again.

13.2.2. Getting Help from Unix Support

CSE’s Unix Support Group maintains the Gammasphere workstations. They can be reached at:

Unix Support Phone List

Order	Name	Ext	Msg	Pager
1	Mike Bordua	7709		466-9413
2	Jos Polman	6411	7180	
3	Gary Jung	4894		539-1451

13.3. VME Subsystem

13.3.1. Rebooting the VME System

Rebooting the VME system can be accomplished in many different ways. These include pushing the front panel reset, cycling the power, typing Control-X in the tip/telnet/rsh window or pushing the reboot button on the main or diagnostic displays.

Resetting/rebooting should not be done immediately after a fill cycle due to loss of the (very useful) logfile. Wait at least five minutes after the fill completes to give things a chance to fully flush to disk.

13.3.2. Changing VME Cards

VME Cards must be changed with the power off. Static electricity can damage the cards - use grounding strap (this must be installed!!). Insure that the card being inserted is lined up with the card guides. Leaving an empty slot between cards can cause problems with the VME bus since bus grant logic is daisy chained through each card. Install a bus grant jumper card to prevent this problem.

13.3.3. VME CPU

13.3.4. Allen Bradley VME Scanner

13.3.5. VME System Analysis Board

The VME System Analysis Board is not essential for system operation. It may be removed and replaced with a bus grant VME jumper card and the system rebooted (is there a bus grant jumper card in the spares there?).

13.3.6. VME Crate Power Supply

Changing the VME crate power supply requires tools ... and some care. (procedure to be developed)

13.4. Allen Bradley Subsystem

13.4.1. Changing Allen Bradley Modules

Changing Allen Bradley modules is straightforward. Make sure the power to the crate is off, either by the switch on the power supply in the crate (module to the far right), or by cutting power upstream of there (perhaps at the rack main breaker).

There is a locking device at the top of the module that is released by pushing the button and rotating the lock upward. The front connection block is then released by a button on it and swung down. Finally the module is withdrawn straight forward. Insure that the module being installed is the same type and that the jumpering is the same. Consult the Configuration section to verify jumpering if necessary.

13.4.2. Allen Bradley Power Supply

The Allen Bradley power supply is just like other modules. Each crate has one, and they are installed at the right ends of the crates. There are front panel LEDs that indicate the state of the supply.

13.4.3. Allen Bradley Crate Controller

13.4.4. Allen Bradley ADC Module

13.4.5. Allen Bradley 120 VAC Input Module

13.4.6. Allen Bradley 120 VAC Output Module

13.5. Network Components

13.5.1. Transceivers

13.5.2. Multiport Repeaters

The multiport repeaters have been kept out of the critical path. This means that srv1.gam, lncon, and lnfill have direct transceivers. Problems with the multiport repeaters may affect other workstations.

13.5.3. Passive Components

The remainder of the network is passive components - coax cable, connectors, terminators, etc. The most likely problems here are connectors partially unplugged, cables damaged, etc. There is a single ground for the ethernet coax located at ... Multiple grounds can cause problems.

13.6. LN Sensors

The LN sensors utilize 5v Hewlett Packard LED units. They are wired in a nonstandard configuration in series with a 1k resistor fed from a 6v power supply minus one diode drop, making the open circuit voltage about 5.3 volts. The normal operational voltage is about 2.5 volts. The diodes are mounted on a BNC connector and can be easily changed.

13.7. Solenoid Control Valves

The solenoid control valves operate on 120VAC supplied from the Allen Bradley 120VAC output module. Insure that power is removed from the Allen Bradley output modules when working with the valves. The safest way to do this is to power down the entire control system rack (see section on safety procedures).

13.8. Changing Boot Servers

The boot server for the VME crate also contains on a local disk, the lnfiller logfiles(ln_log and ln_log%), state save files(ln.state and ln.state.bak), fill history files and the initialization file(ln.inits).

The cron job which produces the lnfill reports from the fill history files appends the difference between ln_log and ln_log% to the reports and copies ln_log to ln_log%.

When the crate is booted, the detector enables, time between fills, etc. are restored from ln.state and ln.state.bak.

The change_ln_limits procedure keeps identical copies of ln.inits on both srv1.gam and lncon.

When changing form one boot server to another, it is highly desireable to copy the state save files and the fill history files from the current boot server to the new boot server. The procedure 'equalize' exists in the log directory of both srv1.gam and lncon. For example, if switching from lncon to srv1.gam,

```
rlogin lncon
cd /home/lncon/prod/lnfill/log
equalize
```

If lncon is inaccessible, one would have to boot the VME crate and, then, setup all of the enables, etc. via the EPICS display screens. Automatic saves done by the lnfiller software would then preserve the settings in ln.state and ln.state.bak on srv1.gam.

14. VxWorks Boot Parameters

The boot parameters for the VME CPU depend on which of the two unix workstation hosts the crate is to boot from.

14.1. Inspecting and Changing VxWorks Boot Parameters

Get the attention of the monitor ROM program by typing a space while the CPU is rebooting. This must be done quickly - there is a two second window. Control-X initiates a reboot cycle without the need to push the front panel VME reset button. Display the existing boot parameters with the 'p' command. Change the boot parameters with the 'c' command, which prompts each one at a time. Type return to keep the same value. Type the new value to change. Type '.' to erase the value. After making changes type '@' or Control-X to reboot.

14.2. Boot Parameters for lncon and srv1

The following two tables contain the boot parameters for the lnfiller when booting from the respective boot directories.

Booting from lncon.gam	
boot device	ei
processor number	0
host name	lncon
file name	/vxboot/lnfill/boot/vxWorks
inet on ethernet (e)	128.3.44.21
inet on backplane (b)	
host inet (h)	128.3.44.11
gateway inet (g)	
user (u)	vxprod
ftp password (pw) (blank = use rsh)	
flags (f)	0x8
target name (tn)	lnfill
startup script (s)	/vxboot/lnfill/boot/startup.cmd
other (o)	

Booting from srv1.gam	
boot device	ei
processor number	0
host name	srv1.gam.lbl.gov
file name	/vxboot/lnfill/boot/vxWorks
inet on ethernet (e)	128.3.44.21
inet on backplane (b)	
host inet (h)	128.3.44.1
gateway inet (g)	
user (u)	vxprod
ftp password (pw) (blank = use rsh)	
flags (f)	0x8
target name (tn)	lnfill
startup script (s)	/vxboot/lnfill/boot/startup.cmd
other (o)	

15. Hardware Configuration

The following hardware configuration was implemented and documented by Bill Brown.

This file contains a document which describes the hardware configuration of the GAM_LN system. I will attempt to not only describe the hardware configuration as it exists, but also to provide some insight into the configuration choices as well as pointers to the relevant manufacturers documentation.

15.1. System Controller & Processor, MVME167

15.1.1. Hardware Jumper configuration.

There are nine (9) jumpers on the MVME167.

"J1" consists of 8 "General Purpose Readable Jumpers" which, to the best of my knowledge are not used by either EPICS or vxWorks.

"J2 is the "System Controller Header." As the MVME167 is used as the system controller, this jumper should be IN.

15.1.2. System Boot Parameters (stored in on-board NVRAM)

(see VxWorks Boot Parameters in separate section)

15.1.3. Reference:

See "MVME167 Single Board Computer User's Manual (MVME167/D1)", pp 2-2 and 2-3.

15.2. Transition Module MVME712.

The MVME712 Transition Module provides connectors for the ETHERNET connector and up to for RS-232 connections, as well as a SCSI port and an eight-bit parallel CENTRONICS PRINTER port. Currently, This board, which is mounted in the rear of the VME bin, is connected to the "P2" connector on the MVME 167.

At present, only 1 RS-232 port ("SERIAL PORT 1/CONSOLE") is used. It is connected to the "A" serial I/O port on the workstation.

The ETHERNET port is connected to an ETHERNET transceiver. The ETHERNET provides a connection to the "boot host" and various workstations which are used as consoles or developement hosts.

15.2.1. Configuration.

There are four (4) sets of jumpers on the board for configuring the four (4) serial ports as either DCE or DTE. By convention, the Control Systems Group has always configured all four (4) ports as DCE in order to allow their direct use with terminals. This is accomplished by removing all of the jumpers from "J11", "J14", "J17", and "J19", and inserting all jumpers in "J1", "J13", "J16", and "J18". No jumpers are installed in "J15".

15.2.2. Reference:

MVME712M Transition Module and MVME147P2 Adapter Board Reference Manual MVME712M/D1" (Motorola, Inc.) pages 2-1 forward.

15.3. Allen-Bradley 6008-SV "VMEbus I/O Scanner

The Allen-Bradley 6008-SV "VMEbus I/O Scanner "talks" to the two (2) physical Allen-Bradley PLC bins via a single-pair shielded cable. The Physical Connection is made via a connector which plugs into a socket on the front of the 6008-SV.

15.3.1. Configuration.

15.3.1.1. Device Address.

At the time that this is written, EPICS has defined address values for the supported I/O device. This system is configured in conformance to the EPICS default. The A-B 6008-SV is therefore configured to appear at 0xc00000 in the Standard Supervisory Data address space (AM = 3D).

The location within the VME address space is set by jumpers J1, J3, J4, and J5.

15.3.1.1.1. AB Configuration Jumpers for Short I/O or Std Address

a) J1 = OUT

b) J3- 1 & 2 = OUT
- 3 & 4 = OUT
- 5 & 6 = IN
- 7 & 8 = IN
- 9 & 10 = IN
-11 & 12 = IN
-13 & 14 = IN
-15 & 16 = IN

c) J4 = IN (Short I/O or Standard Address Space)

d) J5- 1 & 2 = OUT
- 3 & 4 = OUT
- 5 & 6 = IN
- 7 & 8 = OUT
- 9 & 10 = IN
-11 & 12 = IN
-13 & 14 = IN
-15 & 16 = IN

15.3.1.2. Factory settings, which must not be changed.

a) J2 = IN (Factory setting - do not change!)
b) J6 = OUT (Factory setting - do not change!)
c) J7 = OUT (Factory setting - do not change!)
d) J8 = "B" (Factory setting - do not change!)

15.3.1.3. Reference:

Allen-Bradley VMEbus I/O Scanner User's Manual", page 3-3 forward. NOTE: There are at least two versions of this manual in existence; the correct one (as of this writing) has a copyright date of 1989 and a _BLUE_and_WHITE_ cover.

15.4. IV) Allen-Bradley 1771-A3B Universal I/O chassis

Two (2) Allen-Bradley 1771-A3B Universal I/O chassis are used to support various Allen-Bradley I/O cards. Each bin, or chassis, contains one "1771-ASB B Remote I/O Adapter Module" and several Input or Output Modules, as well as a power supply module.

Each of the physical chassis contains _TWO_(2)_ "logical" chassis. For this reason I will refer to the two _PHYSICAL_ chassis as the _UPPER_ chassis and the _LOWER_ chassis, rather than assigning them numbers.

In each chassis there are two types of card-slots. The slot on the extreme left receives the

1771-ASB Remote I/O Adapter, while the remaining 12 slots receive I/O or power supply modules.

The card-slots are numbered, on the back-plain, "D0" thru "D11." This may seem confusing, since the Allen-Bradley firmware numbers the slots within a chassis, in _OCTAL, zero (0) thru seven (7). The trick is that each _PHYSICAL_ chassis contains two (2) _LOGICAL chassis.

In the case of our 12-slot _PHYSICAL_ chassis, only four (4) slots of the second _LOGICAL_ chassis exist; _LOGICAL_ chassis cannot span _PHYSICAL_ chassis.

To further muddy the already murky waters, the "LOGICAL" chassis are subdivided into eight (8) _GROUPS_. Depending on the I/O cards used, and the setting of a switch on the 1771-ASB Remote I/O Adapter Module, a group can consist of either 1 or 2 _PHYSICAL_SLOTS_.

By convention, the EPICS software does not "believe in" single-slot groups; therefore the DCT configuration for our does not appear to match the physical configuration of the Chassis.

EPICS believes that each _GROUP_ consists of two (2) slots; it "thinks" Input modules are always placed in the lower-numbered or even-numberd slots while Output modules are always placed in the higher-numbered or odd-numbered slots. For example in GROUP 0 the Input module would be placed in slot "D0" while the Output module would be placed in slot "D1." Observe the following tables, based on a 12-slot PHYSICAL CHASSIS.

Double-slot Addressing

Logical Chassis#	Group#	Slot#	Direction
0	0	D0	Input
0	0	D1	Output
0	1	D2	Input
0	1	D3	Output
0	2	D4	Input
0	2	D5	Output
0	3	D6	Input
0	3	D7	Output
0	4	D8	Input
0	4	D9	Output
0	5	D10	Input
0	5	D11	Output

Single-slot Addressing

Logical Chassis#	Group#	Slot#	Direction
0	0	D0	Input or Output
0	1	D1	Input or Output
0	2	D2	Input or Output
0	3	D3	Input or Output
0	4	D4	Input or Output
0	5	D5	Input or Output
0	6	D6	Input or Output
0	7	D7	Input or Output
1	0	D8	Input or Output
1	1	D9	Input or Output
1	2	D10	Input or Output
1	3	D11	Input or Output

Fortunately, EPICS has no way of knowing if we have maintained the assummed structure. If we had chosen to follow the EPICS convention we would have either had to mix Analog Input Modules and Digital Output Modules in the same physical chassis, a practice which Allen-Bradley counsels against, or we would have had to add additional physical chassis. We arranged the hardware configuration to take advantage of "Single-slot Addressing," the bad news being that it makes the transition from the physical hardware to the EPICS-DCT description somewhat obscure.

15.4.1. Configuration:

1) Power-supply Configuration Plug.
   Plug is in LEFT position (specifies plug-in power supply module)

2) Back-plane Switch Settings

1 - OFF	Output go to DISABLE (off) when Fault detected.
2 - ON	Allow processor to restart chassis after fault.
3 - OFF	
4 - OFF	
5 - ON	Single-slot Addressing enabled.
6 - OFF	
7 - OFF	
8 - OFF	

Note: switches which do not have a function specified by the documentation must be OFF to avoid strange behavior!

15.4.2. Upper chassis population

1) Adapter - 1771-ASB B Remote I/O Adapter
2) I/O Slots
   - D0 - 1771-IFE Analog Input Module
   - D1 - 1771-IFE Analog Input Module
   - D2 - 1771-IFE Analog Input Module
   - D3 - 1771-IFE Analog Input Module
   - D4 - 1771-IFE Analog Input Module
   - D5 - 1771-IFE Analog Input Module
   - D6 - 1771-IFE Analog Input Module
   - D7 - 1771-IFE Analog Input Module
   - D8 - 1771-IFE Analog Input Module
   - D9 -
   - D10 -
   - D11 - 1771-P4S Power Supply

15.4.3. Lower chassis population

1) Adapter - 1771-ASB B Remote I/O Adapter
2) I/O Slots
   - D0 - 1771-OAD AC (12-120V) Output Module
   - D1 - 1771-OAD AC (12-120V) Output Module
   - D2 - 1771-OAD AC (12-120V) Output Module
   - D3 - 1771-OAD AC (12-120V) Output Module
   - D4 - 1771-OAD AC (12-120V) Output Module
   - D5 - 1771-OAD AC (12-120V) Output Module
   - D6 - 1771-OAD AC (12-120V) Output Module
   - D7 - 1771-OAD AC (12-120V) Output Module
   - D8 - 1771-OAD AC (12-120V) Output Module
   - D9 - 1771-IAD AC/DC (120V) Input Module
   - D10 -
   - D11 - 1771-P4S Power Supply

15.4.4. Reference:

1) "Allen-Bradley Remote I/O Adapter Module (Cat. No. 1771-ASB) Installation Data." 2) "Allen-Bradley I/O Concepts Manual For Industry Bus Products (6008 Series)," page 5-3.

15.5. Allen-Bradley 1771-ASB B Remote I/O Adapter.

One each Allen-Bradley 1771-ASB B Remote I/O Adapter is installed in each of the Remote I/O chassis described above. These modules communicate with the Allen-Bradley 6008-SV VMEbus I/O Scanner over a shielded single twisted-pair cable. Note that this cable must be terminated by a 120 ohm resistor at each end.

The reader should also note that the two modules are configured differently. This difference in configuration is necessary to provid the proper _LOGICAL_ dhassis address mapping.

15.5.1. Configuration - UPPER CHASSIS

1) S1 - 1-8 ON
2) S2 - 1 ON
2-6 OFF

15.5.2. Configuration - LOWER CHASSIS

1) S1 - 1-4 ON
5 OFF
6-8 ON
2) S2 - 1 ON
2-6 OFF

3) Jumpers
There are 3 jumpers located near the bottom of the board.
All 3 jumpers are placed in the LEFT position.

15.5.3. Power Supply Requirements:

1) 5 V DC - 1.2A

15.5.4. Reference:

1) "Allen_Bradley Remote I/O Adapter Module (Cat. No. 1771-ASB) Installation Data"
2) "Allen_Bradley I/O Concepts Manual For Industry Bus Products
(6008 Series)," Chapter 3. 3) "Allen_Bradley I/O Concepts Manual For Industry Bus Products
(6008 Series)," p 5-1. 4) "Allen_Bradley I/O Concepts Manual For Industry Bus Products
(6008 Series)," p 5-4.

15.6. Allen-Bradley 1771-IFE Analog Input Modules

All channels on all of the "Allen-Bradley 1771-IFE Analog Input Modules" are configured in the same manner, as (single-ended) voltage input devices.

A) Configuration: All 24 jumpers are in the "storage" or RIGHT position.

B) Reference: "Allen-Bradley Analog Input Module Cat. No. 1771-IFE Users Manual," p 3-8.

C) Power Supply Requirements: 1) 5 V DC - .75A

15.7. Allen-Bradley 1771-OAD A.C. (12-120V) Output Modules.

All of the "Allen-Bradley 1771-OAD A.C. (12-120V) Output Modules" are configured in the same manner.

A) Configuration: The jumper is placed in the "RESET" position.

B) Reference: "Allen-Bradley 1771-OAD A.C. (12-120V) Output Modules Installation Data," p 2.

C) Power Supply Requirements: 1) 5 V DC - .7A

15.8. Allen-Bradley 1771-IAD AC/DC (120V) Input Module.

A) Configuration: The jumper is placed in the "RESET" position.
B) Reference: "Allen-Bradley 1771-IAD AC/DC (120V) Input Modules Installation Data," p 2.

C) Power Supply Requirements: 1) 5 V DC - .25A

15.9. Allen Bradley 1771-P4S Power Supply

A) Configuration: Both jumpers are set to the LEFT position

B) Reference: "Allen-Bradley Power Supply Modules (cat. np. 1771-P4S, -P6S, -P4S1, -P6S1) Installation Data."
C) Power Supply Requirements 120 VAC, 47-63 Hz.

E) Output: 5 VDC, 8A.

16. Troubleshooting

16.1. Failure Experience

It has been our experience both in the Gammasphere system, and in the BEVALAC systems that used this technology before that the primary failure modes are human-induced. In several years of BEVALAC 0peration we logged only a couple of VME board failures, a few workstation failures, a few disk failures, more corrupted disks, but mostly people related failures.

The most prevalent hardware problem is Allen_Bradley ADC module lockup following a power failure.

The trouble with people seems primarily to be

1) taking sufficient care - preparation, planning, and follow-through

2) testing adequately after each change

Modifications and maintenance need to be carefully planned, the proper parties notified, and the appropriate testing completed...

16.2. Fault Isolation

17. Log Files

The logfile is appended by the LN system software each time an interesting event occurs.

17.1. Logfile Browsing

There *should* be a browsing tool for the logfiles, currently there is none. Use *tail -30 <filename>* to inspect the most recent 30 lines of the log, or use *view* <filename> to inspect it without changing it. **DO NOT EDIT THE LOGFILES.**

17.2. Adding Comments to the Logfile

Text may be added to the logfile by sending email to the address *gamlnlog@csg.lbl.gov*. Please include a meaningful subject and keep messages fairly short.

17.3. Logfile Location

A logfile is located on each boot server. The VME crate uses the logfile of the machine it boots from. The lnfiller normally boots from the lncon workstation. The logfile on lncon is located in:

’/home/lncon/prod/lnfill/log/ln_log’.

The logfile on srv1.gam is located in:

’/home/gam/prod/lnfill/log/ln_log’.

DO NOT EDIT THE LOGFILES. Automatic *cron* programs manipulate the logfiles.

18. Telephone List

Name	LBL	Pager	Home	Coverage
Bob Belshe	7509		510-376-7677	VAX/VME/Unix Software
Alan Biocca	7700		510-758-7104	VME/Unix/Informix Software
Mike Bordua	7709	466-9413		Unix Hard/Soft-ware, EPICS
Jim Comins	6963			Mechanical
Gary Jung	4894	539-1451		Unix Hard/Soft-ware
Loren Shalz	7729		510-799-7041	VME/Unix Software
Frank Stephens	5724			

19. System Analysis Board LED Definitions

19.1. Static Running Display (Post-Boot)

0	**Init/Pulse**	**Ready/Idle**	**States: ON = current**
2	**Det Fill**	**Tank Fill**	
4	**Aborting**	**Finishing**	
6		**Writing History**	
8			
10	**Simulation**		
12			
14			
16			
18			
20	**ON**	**ON**	
22	**DET PS OK**	**A/B OK**	
24	**Time OK**	**AC Power OK**	**Alarms: ON = OK**
26	**Det Discon**	**Det Shorted**	**OFF = ALARM**
28	**Undertime**	**Overtime**	
30	**Dialer ENA**	**Major Alarm**	**(to control room)**

19.2. Boot Sequence Display (LED Double Bar Graph Display)

Number of LEDs ON:

26	**vxworks running, system analysis board initialized**
24	**iocCore loaded**
22	**drvSup loaded**
20	**recSup loaded**
18	**devSup loaded**
16	**initHooks loaded**
14	**resetEnvParms loaded**
12	**seq loaded**
10	**gamln database loaded**
8	**filler sequencer & subroutines loaded**
6	**environment setup**
4	**iocInit complete**
1	**sequencer initializing (see above)**

20. Programming the Autodialer

The autudialer is a Radio Shack model xxx. It is located on a shelf behind the LN Filler rack in cave 4c. It is capable of dialing three numbers and playing a prerecorded loop cassette message to each.

The normal configuration of the autodialer is to set the three numbers to:

1. The pager
2. The office extension of the person on call
3. The home phone of the person on call

The dialer is programmed by (to be completed)...

21. Spares Inventory

A set of spares is maintained in the cave to facilitate maintenance and troubleshooting. These boards are kept in as nearly as possibe a ready-to-go configuration - that is, jumpers are already set if possible. If there is more than one jumper configuration necessary the instructions for jumpering are included in with the card, a copy of the appropriate section from this manual.

21.1. Spare Modules in B88 Cave 4C

Motorola MVME167 Processor	Gammasphere #10210	
VME Bus Grant card	(where is it?)	
VME Power Supply	LR 44594/ MAX-754-1205	
Allen Bradley Scanner VME Card	6008-SV	
Allen Bradley Power Supply	1771-P4S	
Allen Bradley Crate Controller	1771-ASB C	
Allen Bradley ADC	1771-IFE A	1 gam + 1 R. Dwinell loaner
Allen Bradley AC Input Module	1771-IAD B	
Allen Bradley AC Output Module	1771-OAD	1 R. Dwinnel loaner

21.2. Locations of Other Possible Spares

Motorola MVME167 Processor - some located in B50B elsewhere
Allen Bradley Modules - some located in 50B, B88
VME Power Supply - some in 50B

22. Software Update Procedures

The software is maintained on the workstations using the Concurrent Version System (CVS).

22.1. CVS Procedures

22.1.1. Environment Preparation

Before doing anything involving cvs setup your environment for the correct paths and repository. This must be done for each window that is to use CVS. If this is not done an error '/usr/local/cvs: Permission denied.' occurs. Use one of the following to configure the window for cvs access and set the repository appropriately.

```
gam-cvs                                {std environ alias}

   or

source /usr/local/std/gam-cvs          {setup for cvs}
```

22.1.2. Software Development Cycle

```
cd <work area>
cvs checkout lnfill          { build lnfill tree to work in }
cd lnfill                    { move into work area }
make links                   { construct necessary links in tree }
vi ...                       { make changes }
cvs add <dir/file>           { add new dir/file to source }
make all                     { rebuild }
<test devel version>         { offline testing }
cvs -n update                { find out what has changed }
   cvs update                { update if necessary }
   backup to make all
cvs commit                   { commit changes to repository }
tools/install <destdir>      { install to production directory }
<test prod version>          { online testing }
cvs freeze <version_tag>     { label all sources }

make clean                   { erase nonsources }
cvs release -d               { erase sources }
cd ..
rm -rf lnfill                { delete work area }
   or
cvs update -A                { convert to current version workspac
```

22.1.3. Recovering a Previous Version

```
cd <work area>
cvs export -r <version_tag> lnfill { build lnfill tree to work in }
cd lnfill                    { move into work area }
make links                   { construct necessary links in tree }
make all                     { rebuild }
tools/install <destdir>      { install to production directory }
cd ..
rm -rf lnfill                { delete work area }
```

22.1.4. Performance Notes

```
cvs checkout lnfill     0:43  (complete build)
make clean              0:21  (when dirty)
make (all)              5:23  (mostly dct)
cvs -n update           0:07
cvs -n commit           0:03
cvs commit              0:08  (nothing new)
cvs commit              0:15  (new dir and 2 new files)
tools/install           0:46  (doing all)
tools/install           0:14  (nothing to do)
```

23. LN Filling Archive

The EPICS archive server ARR_cmd is normally kept running on srv1.gam, collecting data only during LN fills.

24. LN Fill Archive Data Retrieval

The EPICS archive retrieval program ARR is described in the EPICS Archive Reference Manual. Script ln_arplot in /home/gam/prod/scripts has been provided to facilite running ARR. If you do not have /home/gam mounted, rlogin to a workstation where it is mounted(e.g., con1.gam).

```
cd /home/gam/prod/lnfill/boot
ln_arplot
```

Script ln_arplot displays some instructions for retrieving LN fill data and brings up the main **ARR** window. The instructions provided by ln_arplot are described below.

24.1. Load Archive Data File.

Click the *Pick data file...* button to get the **ARR: retrieval setup** window.
Click the *Pick file...* button labelled *'by channel' file* to get the **ARR: Pick 'by channel' file** window.
Click in the field to the right of *File:* to select it and type lnfill.bin or copy and paste it in from the list of files in the window.
Click the *File* button to get the file loaded.
Dismiss the **ARR: Pick 'by channel' file** window.
Dismiss the **ARR: retrieval setup** window.

24.2. Load Channel Configuration File

Click the *Chan config File* button on the main **ARR** window to get the **ARR: channel configuration** window. Exmaine the list of standard lnfill channel configuration files displayed by ln_arplot. Use

m1lo.cfg for stations M1 plus H1-01 thru H1-07.
m1hi.cfg for stations M1 plus H1-08 thru H1-15.
m2lo.cfg for stations M2 plus H2-01 thru H2-07.
m2hi.cfg for stations M2 plus H2-08 thru H2-15.
m3lo.cfg for stations M3 plus H3-01 thru H3-06.
t1.cfg for tank 1.
t2.cfg for tank 2.
s1.cfg for supply.

Note that m1lo.cfg - m3lo.cfg contain LN_FILL_ID:XC and t1.cfg , t2.cfg and s1.cfg contain LN_TANK_FILL_ID:XC so that samples can be selected with the *accept sample if* feature described below.

Click in the field to the right of *File:* to select it and type or copy and paste the name of one of the configuration files.
Click on the *File* button to load the file. Click the *Apply configuration* button.
Dismiss the **ARR: channel configuration** window.

24.3. Number of Samples

In the *retrieve:* section of the **ARR** window, click in the *samples* field to select it and type 1000.

24.4. Positioning in the Data File

In the *start retrieving* section, click in the box before and then in the *at_______(mm/dd/yy hh:mm:ss)* field to select it. Type or copy and paste in the date and time of the desired fill from the list of fill start times displayed by ln_arplot.

24.5. Restricting Samples To Desired Fill

Click in the box before and then in the field to select it following *accept samples if* on the main **ARR** window. If the configuration file selected contains LN_FILL_ID:XC, copy and paste in the restriction on LN_FILL_ID:XC corresponding to the fill time selected from the list of fill start times displayed by ln_arplot. For example, LN_FILL_ID:XC == 10120800. If the configuration file selected contains LN_TANK_FILL_ID:XC, copy and paste in the restriction on LN_TANK_FILL_ID:XC corresponding to the fill time selected. For example, LN_TANK_FILL_ID:XC == 10120828.

24.6. Retrieving the Data

Click on the *Retrieve* button.

24.7. Plotting and Printing The Retrieved Data

Click on the *plotting...* button or the *printing...* button.
Plots can be directed to the printer by selecting *to printer* from the drop down menu under the *Plot* button on the **ARR: plotting** window.
Listings can be directed to the printer by selecting *to printer* from the drop down menu under the *Print* button on the **ARR: printing** window.
Dismiss the print or plot window to get back to the main **ARR** window.

24.8. And Then?

Repeat from any of the above steps in order as needed. Click the *quit* button on the main **ARR** window when completely finished.

25. LN Fill Archive Data Acquisition

The command_based version of the EPICS archive server ARR_cmd is described in the EPICS Archive Reference Manual. The archive server and archive data file are maintained by a cron job which runs script ln_maint in /home/gam/prod/scripts. The cron job is defined in the crontab file for account gs in /var/spool/cron/crontabs on srv1.gam.

25.1. Archive Directories and Files

ln_armaint requires directories ./arReq and ../arChan relative to /home/gam/prod/lnfill/boot.

The archive requests are specified in arReq. arReq/open.dat contains the names of archive requests, in this case just lnfill, to be read when the archive server is started. The name of the archive request file is formed by adding the extension .req to the request name. Hence, lnfill.req is also in arReq. Note that lnfill.req is produced by the ddl compiler when it generates the IOC database.

The archive data is saved in ../arChan/lnfill.bin. Note also that arChan contains bin_began, a zero length file which is touched when lnfill.bin is created. bin_began serves to record the time lnfill.bin was created, a help in later determining which fills are included in lnfill.bin. lnfill.bin is currently set for a maximum of 20 megabytes.

When the archiver is started, 2 processes are spawned and three files are created in addition to lnfill.bin, if it does not already exist. The files are

/home/gam/prod/lnfill/boot/AR.lock
/home/gam/prod/lnfill/boot/lnfill.req.open
/home/gam/prod/lnfill/arChan/lnfill.bin.open

25.2. Maintaining the Archive Server

ln_armaint restarts the archive server if it is not running.

When the size of lnfill.bin exceeds 18,000,000 megabytes, ln_armaint

Stops the archive server
Renames arChan to arChan.bak,
Creates a new arChan.
Restarts the archive server

25.3. Interrogating the Archive Server

The get the status report form the archive server run the script ln_arclient.

At the **ARR_cmd:** prompt, enter ’status’.
At the next **ARR_cmd:** prompt, enter ’disconnect’ and
answer ’n’ to ’stop the server (y/n) ?’

26. Missing Manual Items

There are many things needed in this manual that have not been added yet. This is a place to list them. They are in no particular order currently, it would be appropriate to prioritize them here. Perhaps later.

Time/Log server
EPICS section
state files
cron jobs
software update procedures
plumbing

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