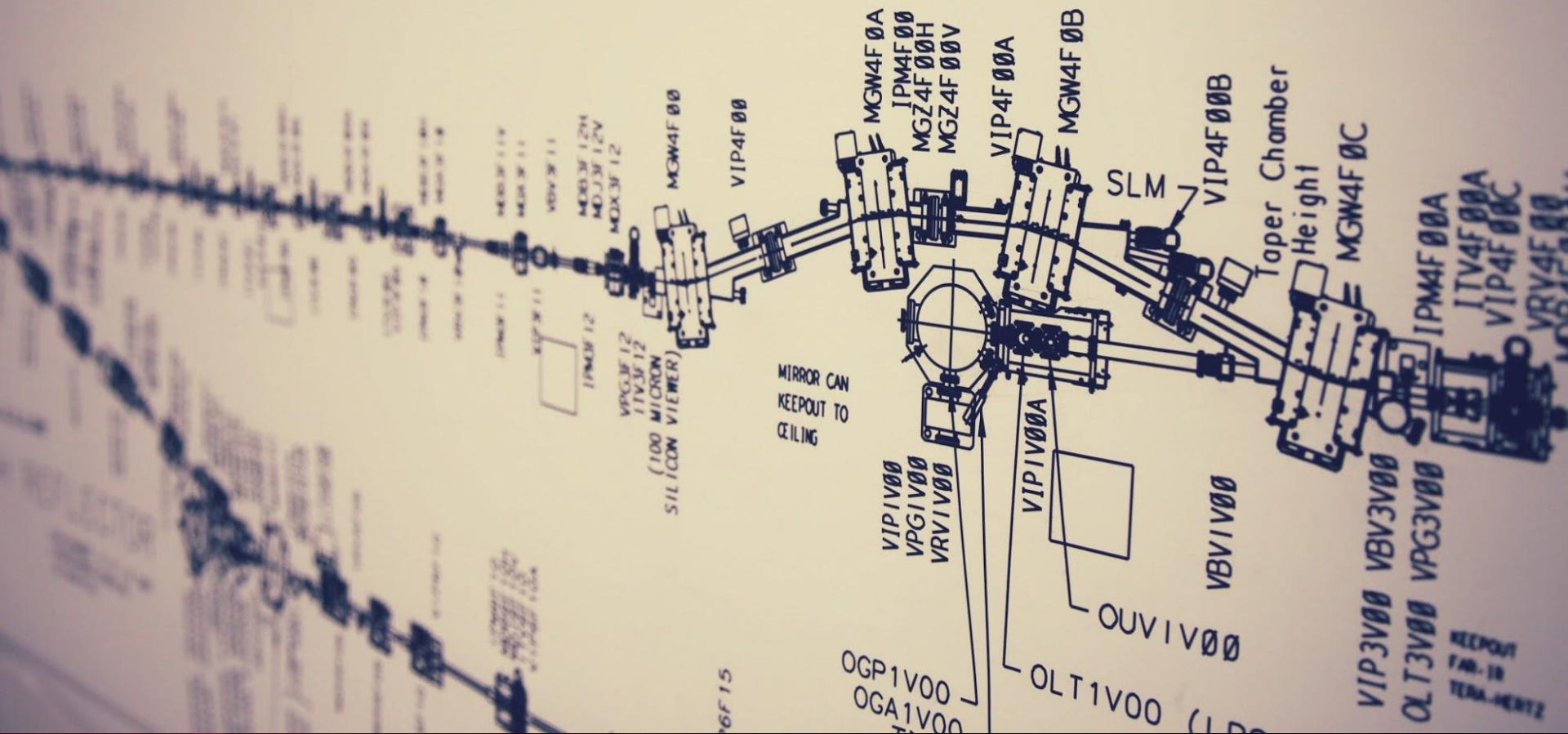


## Hall B Software Support - **Chillers**



# Overview

- **Hardware**

- **Anova A-25 Circulator**
- **Configuration**

- **Software**

- **Database**
- **streamDevice protocol**

- **Operator Interfaces**

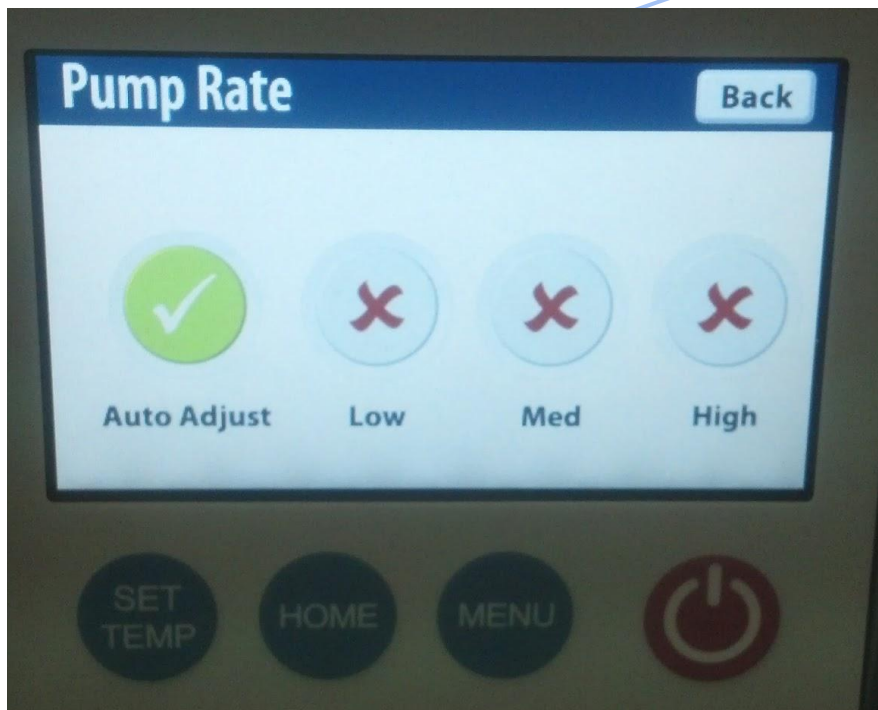
# Hardware

## Anova A25 Circulator

- -25°C to 200°C, +/-0.01°C
- Tank Volume, 7 liters

## Communication

- RS232 interface
- Digi EtherLite (TCP/IP -> RS232)



Touchscreen for local control

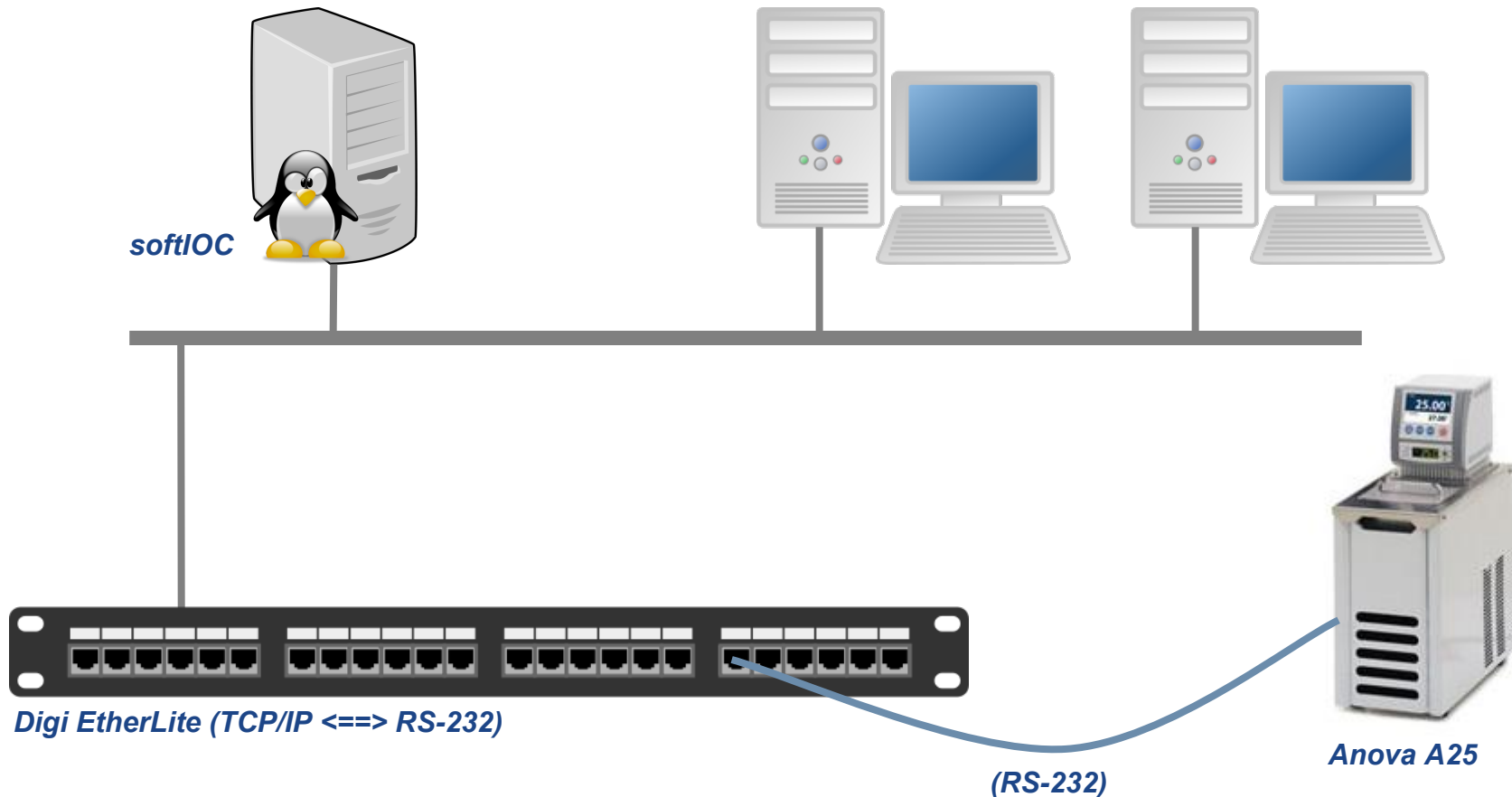


Located in HPS Test Area

# Hardware - Configuration

## Communication

- RS-232 interface
- Digi EtherLite (TCP/IP <==> RS232)



# Software

- **EPICS 3.14.12.3**
- **asyn** - low level communication driver
- **streamDevice** - “byte stream” interface
- **autosave** - save/restore setpoints, bumpless reboots
- **devlocStats** - ioc health and status, basic control features

# Software - EPICS db

```
#
# Anova Refrigerated and Heating Circulators - A Series
#
#
# Notes:
# [Macros]
# P - standard record prefix
# R - standard record prefix
# PROTO - streams protocol file name
# PORT - asyn port name
#
# Author: Wesley Moore
# Date: June 2014
#

record(asyn, "$(P)$ (R) ASYN") {
  field(PORT, "$(PORT)")
  field(OEOS, "\r")
  field(IEOS, "\r")
}

#####
# Status Commands
#####

record(stringin, "$(P)$ (R) VERSION") {
  field(DTYP, "stream")
  field(INP, "@anova.proto getVersion $(PORT)")
  field(VAL, "")
  field(PINI, "1")
}

record(stringin, "$(P)$ (R) STATUS") {
  field(DTYP, "stream")
  field(INP, "@anova.proto getStatus $(PORT)")
  field(VAL, "")
  field(SCAN, "1 second")
}

record(bo, "$(P)$ (R) DEFAULT") {
  field(DTYP, "stream")
  field(OUT, "@anova.proto setDefault $(PORT)")
}
```

```
record(ai, "$(P)$ (R) TEMP") {
  field(DTYP, "stream")
  field(INP, "@anova.proto getBathTemp $(PORT)")
  field(PREC, "2")
  field(SCAN, "1 second")
}

#####
# Control Commands
#####

record(bo, "$(P)$ (R) START") {
  field(DTYP, "stream")
  field(OUT, "@anova.proto start $(PORT)")
}

record(bo, "$(P)$ (R) STOP") {
  field(DTYP, "stream")
  field(OUT, "@anova.proto stop $(PORT)")
}

record(bo, "$(P)$ (R) CLEAR") {
  field(DTYP, "stream")
  field(OUT, "@anova.proto clear $(PORT)")
}

#####
# Settings Commands
#####

record(ai, "$(P)$ (R) TEMP_REQD") {
  field(DTYP, "stream")
  field(INP, "@anova.proto getTemp $(PORT)")
  field(PREC, "2")
  field(SCAN, "1 second")
}

record(ao, "$(P)$ (R) TEMP_SETPT") {
  field(DTYP, "stream")
  field(OUT, "@anova.proto setTemp $(PORT)")
  field(PREC, "2")
}

...
(additional records not shown)
...
```



# Software - streamDevice

## Db/anova.db

```
#
# Anova Refrigerated and Heating Circulators - A Series
#
# Notes:
# [Macros]
# P      - standard record prefix
# R      - standard record prefix
# PROTO - streams protocol file name
# PORT  - asyn port name
#
# Author: Wesley Moore
# Date:  June 2014
#

record(asyn, "$(P)$ (R)ASYN") {
  field(PORT, "$(PORT)")
  field(OEOS, "\r")
  field(IEOS, "\r")
}

#####
# Status Commands
#####

record(stringin, "$(P)$ (R)VERSION") {
  field(DTYP, "stream")
  field(INP, "@anova.proto getVersion $(PORT)")
  field(VAL, "")
  field(PINI, "1")
}

record(stringin, "$(P)$ (R)STATUS") {
  field(DTYP, "stream")
  field(INP, "@anova.proto getStatus $(PORT)")
  field(VAL, "")
  field(SCAN, "1 second")
}

...
(additional records not shown)
...
```

## Db/anova.proto

```
...

InTerminator = ""; # differs for several readbacks...
OutTerminator = CR;
ReadTimeout = 1000;
ReplyTimeout = 1000;

#####
# Status Commands
#####
getVersion {
  out "version";
  in "version\rFirmware Version: %s\r\n\r";
}

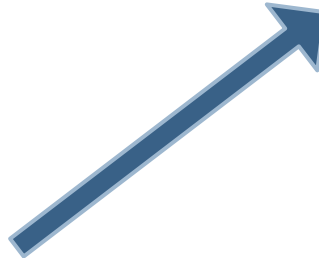
getStatus {
  out "status";
  in "status\r%s\r\n\r";
}

setDefault {
  out "default";
  in "%*s";
}

getBathTemp {
  out "temp";
  in "temp\r %f\r";
}

#####
# Control Commands
#####
start {
  out "start";
  in "%*50c";
}

...
(additional protocols not shown)
...
```



# Operator Interfaces

## st.cmd

```
#!../bin/linux-x86/chiller

< envPaths

cd ${TOP}

## Register all support components
dbLoadDatabase("dbd/chiller.dbd")
chiller_registerRecordDeviceDriver(pdbbase)

epicsEnvSet("STREAM_PROTOCOL_PATH","${TOP}/proto")

drvAsynSerialPortConfigure("SER8","/dev/tty_dgrp_D_7",0,0,0)

# debugging...
#asynSetTraceMask("SER8",-1,0x09)
#asynSetTraceIOMask("SER8",-1,0x2)

## Load record instances
dbLoadRecords("db/save_restoreStatus.db", "P=iocchillerTest:")
dbLoadRecords("db/anova.db", "P=CHILL:,R=,PROTO=anova.
proto,PORT=SER8")

cd ${TOP}/iocBoot/${IOC}

# autosave setup
< save_restore.cmd

dbI > pv.list
ioclnit

# autosave startup
create_monitor_set("anova_settings.req", 30, "P=CHILL:,R=")

# Handle autosave 'commands' contained in loaded databases.
makeAutosaveFiles()
create_monitor_set("info_positions.req", 5, "P=xxx:")
create_monitor_set("info_settings.req", 30, "P=xxx:")
```

\*Need to fix fonts

\*autosaved

The screenshot shows a web-based operator interface for a chiller system. The title bar indicates it is running on a clonios2.jlab.org machine. The main window is titled "ANOVA A Series Chiller - HPS Test Area".

Key elements of the interface include:

- Current Temp (C):** 17.50
- Status:** running
- Controls:** Start, Stop, Clear Errors, Load Defaults buttons.
- Settings:** Pump Speed (Auto), Requested Temp (C) (17.50), High Limit (C) (200.00), Low Limit (C) (-20.00).
- Firmware:** 1.7.1

Four arrows point from the text "\*autosaved" to the "Start", "Clear Errors", "Load Defaults", and "Pump Speed" controls.





# Operator Interfaces (cont'd)

## Asyn Screens

### Stats

- Port Name
- Port config (baud rate, etc)
- Connection status
- Present error, if any

### Controls

- Port debug levels
- General testing

The screenshot shows the 'asynRecord.adl' window with the following details:

- Window title: asynRecord.adl (on clonioc2.jlab.org)
- Device: CHILL:ASYN
- Port: SER8, Address: 0
- Status: Connected
- Buttons: Connect, Cancel queueRequest, More...
- Fields: drvInfo, Reason: 0, Interface: asynOctet
- Error: (empty)
- Buttons: Connect, Enable, autoConnect
- Labels: Connected, Enabled, autoConnect
- traceMask: 0x1
- traceIOMask: 0x0
- Trace file: Unknown
- Trace options (all Off): traceError, traceIODevice, traceIOFilter, traceIODriver, traceFlow
- Trace options (all On): traceIOASCII, traceIOEscape, traceIOHex, Truncate size: 80

The screenshot shows the 'asynSerialPortSetup' window with the following details:

- Window title: asynSerialPortSetup
- Device: CHILL:ASYN
- asynOption: Supported
- Baud rate: 9600
- Data bits: 8
- Stop bits: 1
- Parity: None
- Modem control: CLOCAL
- Flow control: None

# Operator Interfaces (cont'd)

## Autosave Screens

- Status of save and restore for IOC and each save set. Including:
  - Timestamp of last save
  - Saves pending
  - Restore failure due to IOC being started in production area

/cs/opshome/edm/autosave/save\_restoreStatus\_more.edl (on fell00)

### IOC Save Sets

#### Autosave

IOC

Prefix	Status	Message	HB	Recently	Reboot	Message	Last Reboot
iocchillerTest	Failure	Can't open save file.	■	Wrote 'info_positions.sav0'	Failure	Can't open save file.	Mon Jul 14 09:07:16

Save Sets

Name	Status	Message	Time	State*
anova_settings	OK	Ok	Mon Jul 14 10:24:26	M C T R P
info_positions	Warning	.savB file was bad	Mon Jul 14 09:08:16	M C T R P
info_settings	Warning	.savB file was bad	Mon Jul 14 09:08:16	M C T R P
Not In Use	No Status	Status unknown	Not yet saved	M C T R P
Not In Use	No Status	Status unknown	Not yet saved	M C T R P
Not In Use	No Status	Status unknown	Not yet saved	M C T R P
Not In Use	No Status	Status unknown	Not yet saved	M C T R P
Not In Use	No Status	Status unknown	Not yet saved	M C T R P
Not In Use	No Status	Status unknown	Not yet saved	M C T R P

What the progress/status bits mean...

- M - manual save is pending
- C - a monitored value has changed
- T - the save timer has elapsed
- R - trigger-PV value has changed
- P - periodic timer has elapsed

# Operator Interfaces (cont'd)

The screenshot shows the 'iocsfelCryoHtr (on fell00)' diagnostic window. It features a title bar with standard window controls and an 'Exit' button. The main content is organized into several sections:

- System Information:** Startup Time (04/10/2014 14:35:05), Current Time (07/15/2014 11:38:07), Up Time (95 days, 21:03:03), Heartbeat (8282662), # Records (356), Host Name (fell00), User Name (wmoore), and Location (FEL).
- Operational Metrics:** # CA Clients (7), # CA PV Conns (52), and # Susp Tasks (0).
- Configuration and Actions:** Buttons for 'Alarm Limits...', 'EPICS Env Vars...', 'Release Versions...', and 'Scan Monitor...'. A 'Mode' section shows 'Running' with a checkbox and buttons for 'Reload Access Security Conf File...' and 'Reboot...'. Below this are fields for 'EPICS Version' (EPICS R3.14.11 \$R3-14-11\$ \$2009/06/28 1) and 'OS Version' (Linux 2.6.32-431.11.2.el6.i686 i686).
- System Resources:** A table showing Memory (#bytes) with Free (2461638656), Used (6991672), and Machine Maximum (3199918080) values. Another table shows # File Descriptors with Free (995) and Max (1024) values. A third table shows CPU Load with IOC (one CPU) at 0.1%, System (all CPUs) at 0.3%, and # System CPUs at 24.

## devlocStats Screens (future addon)

### Stats

- CPU load
- Num. clients
- Num. PV connections

### Controls

- Reboot
- Reload access security config

The screenshot shows the 'iocsfelCryoHtr Limits (on fell00)' diagnostic window. It features a title bar with standard window controls and an 'Exit' button. The main content is organized into several sections:

- System Information:** # CA Clients (7), # CA PV Conns (61), and # Susp Tasks (0).
- Operational Metrics:** CPU Load (0.1%).
- Configuration and Actions:** Buttons for 'Alarm Limits...', 'EPICS Env Vars...', 'Release Versions...', and 'Scan Monitor...'. A 'Mode' section shows 'Running' with a checkbox and buttons for 'Reload Access Security Conf File...' and 'Reboot...'. Below this are fields for 'EPICS Version' (EPICS R3.14.11 \$R3-14-11\$ \$2009/06/28 1) and 'OS Version' (Linux 2.6.32-431.11.2.el6.i686 i686).
- System Resources:** A table showing Memory (#bytes) with Free (2461638656), Used (6991672), and Machine Maximum (3199918080) values. Another table shows # File Descriptors with Free (995) and Max (1024) values. A third table shows CPU Load with IOC (one CPU) at 0.1%, System (all CPUs) at 0.3%, and # System CPUs at 24.

# Questions?

(This slide intentionally left blank.)