# EPICS Serial Howto

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## 1 ASYN Support

Based on `http://www.aps.anl.gov/epics/modules/soft/asyn/R4-1/HowToDoSerial/tutorial.html` NOTE: $TOP is `~/project/EPICS/project/Metrolab` in this case
Code can be found in `~/project/EPICS/project/docs/code/Metrolab`
*This may have been replaced by streamdevice support now. See below*

### 1.1 Support module. This is the "driver"

1. Make the skeleton
   - Make a folder and build the skeleton code

     ```
     mkdir Metrolab
     cd Metrolab
     $EPICS_SYNAPPS_BASE/support/asyn-4-26/bin/linux-x86_64/makeSupport.pl
                       -t devGpib Metrolab
     ```

     devGpib type is best for serial communivations
   - Make some changes to configure/RELEASE

     ```
     SNCSEQ=/data/EPICS/synApps/support/seq-2-2-1
     ASYN = /home/longland/project/EPICS/synApps/support/asyn-4-26/
     EPICS_BASE=/data/EPICS/base-3.15.2
     ```

   - Make some changes to configure/CONFIG (uncomment $\text{CROSS}_{\text{COMPILERTARGETARCHS}}$ and set it blank)

     ```
     CROSS_COMPILER_TARGET_ARCHS =
     ```

2. Edit support code

- Edit file `MetrolabSup/devMetrolab.c`
- Comment out unneeded DSET definitions ($DSET_{AI}$ must always be included) Note: "in" is "into EPICS". Out is "write out to device"

```
#define DSET_AI     devAiMetrolab   // analog in   - into EPICS
#define DSET_AO     devAoMetrolab   // analog out  - out to device
#define DSET_BI     devBiMetrolab   // binary in
#define DSET_BO     devBoMetrolab   // binary out
#define DSET_SI     devSiMetrolab   // string in
#define DSET_SO     devSoMetrolab   // string out
#define DSET_LI     devLiMetrolab   // long in
#define DSET_LO     devLoMetrolab   // long out
```

- Define some strings to translate BI and BO numbers

```
static char  *offOnList[] = { "Off","On" };
static struct devGpibNames   offOn = { 2,offOnList,0,1 };

static char  *remoteList[] = { "Remote","Remote" };
static struct devGpibNames remote = { 2,remoteList,0,1 };

static char  *localList[] = { "Local","Local" };
static struct devGpibNames local = { 2,localList,0,1 };
```

- Comment out other unused string things (I uncommented `intExtSsBmStopList` stuff used by MBBI and MBBO)
- Same for EFAST strings (comment out `userOffOn`)
- Now is the important part. The command array. Each element in here is an individual command (see `http://www.aps.anl.gov/epics/modules/soft/asyn/R4-1/devGpib.html#CreateInstrumentSupport`)

```
/* Param 0 -- Read the displayed value */
{&DSET_SI,      // DSET of command (read a string from the device)
 GPIBREAD,      // Type (read)
 IB_Q_HIGH,     // Priority (high)
 "\x05",        // Format string to send to device
                //            (ASCII HEX 05 - <ENQ>)
 "%s",          // String to interpret message
 0, 200,        // Error message length, return message length
 NULL,          // Conversion
 0, 0, NULL,    // P1, P2, and P3 used in conversion
```

```
 NULL,          // Name strings
 NULL           // Input end-of-string
},

/* Param 1 - Remote control */
{&DSET_BO, GPIBCMD, IB_Q_HIGH, "R", NULL, 0, 0,
     NULL, 0, 0, NULL, &remote, NULL},

/* Param 2 - Local control */
{&DSET_BO, GPIBCMD, IB_Q_HIGH, "L", NULL, 0, 0,
     NULL, 0, 0, NULL, &local, NULL},

/* Param 3 -- Read and convert the displayed value */
{&DSET_SI,      // DSET of command (read a string from the device)
 GPIBREAD,      // Type (read)
 IB_Q_HIGH,     // Priority (high)
 "\x05",        // Format string to send to device (ASCII HEX 05 - <ENQ>)
 "%*c%9s",      // String to interpret message (ignore a character then 9 cha
 0, 200,        // Error message length, return message length
 NULL,          // Conversion
 0, 0, NULL,    // P1, P2, and P3 used in conversion
 NULL,          // Name strings
 NULL           // Input end-of-string
},
```

- Modify the `Metrolab/devMetrolab.dbd` to include only the defined DSET definitions (you can comment out things using '#')

```
device(ai,        GPIB_IO, devAiMetrolab,    "Metrolab")
device(ao,        GPIB_IO, devAoMetrolab,    "Metrolab")
device(bi,        GPIB_IO, devBiMetrolab,    "Metrolab")
device(bo,        GPIB_IO, devBoMetrolab,    "Metrolab")
device(stringin,  GPIB_IO, devSiMetrolab,    "Metrolab")
device(stringout, GPIB_IO, devSoMetrolab,    "Metrolab")
device(longin,    GPIB_IO, devLiMetrolab,    "Metrolab")
device(longout,   GPIB_IO, devLoMetrolab,    "Metrolab")

include "asyn.dbd"
```

- Edit the support module database file

  (a) Read the displayed value

(b) Put in remote control

(c) Put in local control

(d) Read the field (in Tesla) - this record auto updates

```
record(stringin, "$(P)$(R)NMR")
{
    field(DESC, "NMR Display Value")
    field(DTYP, "Metrolab")
    field(INP,  "#L$(L) A$(A) @0")
    field(PINI, "YES")
}

record(bo, "$(P)$(R)Remote")
{
    field(DESC, "Remote mode")
    field(DTYP, "Metrolab")
    field(OUT,  "#L$(L) A$(A) @1")
}

record(bo, "$(P)$(R)Local")
{
    field(DESC, "Local mode")
    field(DTYP, "Metrolab")
    field(OUT,  "#L$(L) A$(A) @2")
    field(PINI, "YES")
    field(VAL,  "1")
}

record(stringin, "$(P)$(R)Field")
{
    field(DESC, "Get the field value")
    field(DTYP, "Metrolab")
    field(PINI, "YES")
    field(SCAN, ".2 second")
    field(EGU,  "Tesla")
    field(INP,  "#L$(L) A$(A) @3")
}
```

- Edit the Makefile in (`MetrolabSup/Makefile`) to change the location of db file

```
DB_INSTALLS += ../devMetrolab.db
```

- Compile

```
cd MetrolabSup
make
```

- Check for `libdevMetrolab.so` in `$TOP/lib`
  reminder that here, `$TOP=~/project/EPICS/project/Metrolab`
- Check for `devMetrolab.dbd` in `$TOP/dbd`
- Check for `devMetrolab.db` in `$TOP/db`

## 1.2 Application. This is the code that runs

1. Make the application

   - Go to the $TOP directory

     ```
     cd ~/project/EPICS/project/Metrolab
     ```

   - Make the base application and ioc boot directories

     ```
     makeBaseApp.pl -t ioc Metrolab
     makeBaseApp.pl -i -t ioc Metrolab
     <Enter>
     ```

   - Edit the Makefile in `$TOP/MetrolabApp/src/` to include the dbd created previously and the asyn driver

     ```
     # Include dbd files from all support applications:
     Metrolab_DBD += devMetrolab.dbd
     Metrolab_DBD += drvAsynSerialPort.dbd
     ```

   - Do the same for the libs (before `Metrolab_LIBS += $(EPICS_BASE_IOC_LIBS)`)

     ```
     # Add all the support libraries needed by this IOC
     Metrolab_LIBS += devMetrolab
     Metrolab_LIBS += asyn
     ```

   - Edit the Makefile in `$TOP/iocBoot/iocMetrolab`

     ```
     include $(EPICS_BASE)/configure/RULES.ioc
     ```

   - Compile

     ```
     cd ~/project/EPICS/project/Metrolab
     make
     ```

- Make sure it exists (there should be a `Metrolab` executable)

  ```
  ls bin/linux-x86_64/
  ```

2. Make the startup script work!

   - Find the startup script

     ```
     cd iocBoot/iocMetrolab
     ```

   - Edit `st.cmd`
   - The records need to be loaded

     ```
     ## Load record instances
     dbLoadRecords("db/devMetrolab.db","P=Metrolab:,R=,L=0,A=0")
     ```

   - Get the serial port running

     ```
     ## Serial port
     drvAsynSerialPortConfigure("L0","/dev/ttyUSB0",0,0,0)
     asynSetOption("L0", -1, "baud", "19200")
     asynSetOption("L0", -1, "bits", "8")
     asynSetOption("L0", -1, "parity", "none")
     asynSetOption("L0", -1, "stop", "1")
     asynSetOption("L0", -1, "clocal", "Y")
     asynSetOption("L0", -1, "crtscts", "N")
     ```

   - Turn on debugging

     ```
     ## Debugging
     asynSetTraceMask("L0",-1,0x9)
     asynSetTraceIOMask("L0",-1,0x2)
     ```

   - Make it executable

     ```
     chmod 755 st.cmd
     ```

   - run!

     ```
     ./st.cmd
     ```

## 2 StreamDevice Support

Based on `http://www.aps.anl.gov/epics/modules/soft/asyn/R4-24/HowToDoSerial/HowToDoSerial_StreamDevice.html`

## 2.1 Create the drivers

1. Make the skeleton

   - Make a folder and build the skeleton code

     ```
     mkdir MaxiGauge
     cd MaxiGauge
     $ASYN/bin/$EPICS_HOST_ARCH/makeSupport.pl -t streamSCPI MaxiGauge
     ```

2. Make the App

   - Make the skeleton

     ```
     rm -rf configure
     $EPICS_BASE/bin/$EPICS_HOST_ARCH/makeBaseApp.pl -t ioc MaxiGauge
     EPICS_BASE/bin/$EPICS_HOST_ARCH/makeBaseApp.pl -t ioc -i MaxiGauge
     ```

   - Make some changes to `configure/RELEASE`

     ```
     # Asyn
     ASYN = ${EPICS_SYNAPPS_BASE}/support/asyn-4-26/

     # Streamdevice
     STREAM = ${EPICS_SYNAPPS_BASE}/support/stream-2-6a

     # EPICS_BASE usually appears last so other apps can preempt definitions
     EPICS_BASE=${EPICS_ROOT}/base
     ```

   - Edit the `MaxiGaugeApp/src/Makefile`

     ```
     # Include dbd files from all support applications:
     MaxiGauge_DBD += stream.dbd
     MaxiGauge_DBD += drvAsynSerialPort.dbd

     # Add all the support libraries needed by this IOC
     MaxiGauge_LIBS += stream asyn
     ```

3. Setup the IOC

   - Edit `st.cmd`

   ```
   #!../../bin/linux-x86_64/MaxiGauge

   ## You may have to change MaxiGauge to something else
   ```

```
## everywhere it appears in this file

#############################################################################
# Set up environment
< envPaths

#############################################################################
# Allow PV name prefixes and serial port name to be set from the environment
epicsEnvSet "P" "$(P=MaxiGauge)"
epicsEnvSet "R" "$(R=)"

#############################################################################
## Register all support components
cd "${TOP}"
dbLoadDatabase "dbd/MaxiGauge.dbd"
MaxiGauge_registerRecordDeviceDriver pdbbase

#############################################################################
## Serial port
drvAsynSerialPortConfigure("L0","/dev/ttyUSB0",0,0,0)
asynSetOption("L0", -1, "baud", "19200")
asynSetOption("L0", -1, "bits", "8")
asynSetOption("L0", -1, "parity", "none")
asynSetOption("L0", -1, "stop", "1")
asynSetOption("L0", -1, "clocal", "Y")
asynSetOption("L0", -1, "crtscts", "N")

#############################################################################
## Load record instances
dbLoadRecords("db/devMaxiGauge.db","P=$(P):,R=$(R),L=0,A=0")

#############################################################################
## Start EPICS!
cd "${TOP}/iocBoot/${IOC}"
iocInit
```

- Make it executable

  ```
  cd iocBoot/iocMaxiGauge
  chmod 755 st.cmd
  ```

- Test!

  ```
  ./st.cmd
  ```

- Test some more

  ```
  epics> dbl
  epics> dbpf MaxiGauge:RST
  ```