EPICS Database Operations

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Definitions

DATABASE

- Collection of ’RECORDS’

RECORD

- A particular instance of a ’RECORD TYPE’ with appropriate values entered into appropriate fields

RECORD TYPE

- A previously defined ’BUILDING BLOCK’ with a unique structure of fields and a unique processing routine to accomplish a specific function.
- ’RECORD SUPPORT’ refers to the processing routine and the definition of the structure of the record type.

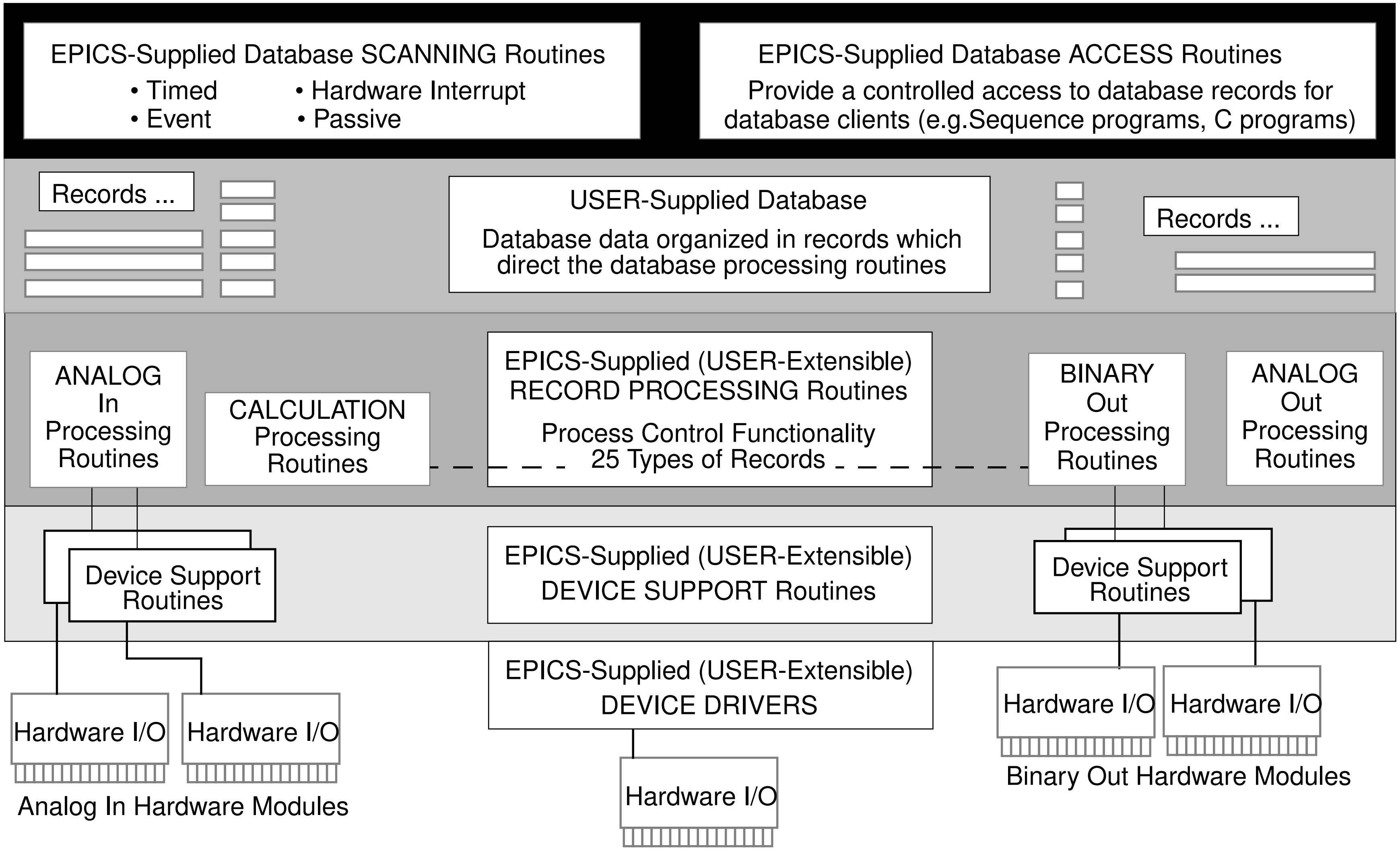
SCANNED (PROCESSED)

- Executing the record processing routine (unique to a record type) for a particular record

Basic Concepts

- The IOC's fundamental responsibility is to input (MONITOR) data from the "PROCESS" (and/or the OPERATOR), manipulate it in an appropriate manner, and (optionally) output data to control the "PROCESS"
- Inputs, data manipulation, and outputs are defined by the "APPLICATION DEVELOPER" by configuring "RECORDS" that become part of the IOC's "DATABASE"
- The IOC's primary task is to "SCAN" the database, deciding when to and knowing how to execute predefined records

IOC Internals



Database Record Types by Category

INPUTS	ALGORITHMS	OUTPUTS
Analog Input	Calculation	Analog Output
Binary Input	PID	Binary Output
Muli-bit Binary Input	Signal Select	Multi-bit Binary Output
Digitized Analog Input	Data Compression	Stepper Motor
State	Subroutine	Timing Signal
String Input	Fanout	Permissive
Long Input	Histogram	String Output
Pulse Counter		Long Output
		Pulse Train
		Pulse Delay

Analog Input Record

```
struct aiRecord{
      /* start of record common fields*/
      char                  name[28];    /* Record Name */
      char                  desc[28];    /* Descriptor */
      unsigned short        scan;        /* Scan Mechanism */
      unsigned short        pini;        /* Process at iocInit */
      short                 phas;        /* Scan Phase */
      short                 evnt;        /* Event Number */
      struct link           sdis;        /* Scanning Disable */
      unsigned short        dtyp;        /* Device Type */
      short                 disv;        /* Disable Value */
      short                 disa;        /* Disable */
      unsigned char         disp;        /* Disable putField */
      unsigned char         proc;        /* Force Processing */
      FAST_LOCK             mlok;        /* Monitor fastlock */
      LIST                  mlis;        /* Monitor List */
      unsigned short        stat;        /* Alarm Status */
      unsigned short        sevr;        /* Alarm Severity */
      unsigned short        nsta;        /* New Alarm Status */
      unsigned short        nsev;        /* New Alarm Severity */
      char                  p001[4];     /* Created Pad  */
      TS_STAMP              time;        /* Time */
```

```
short                   lset;        /* Lock Set */
unsigned char           lcnt;        /* Lock Count */
unsigned char           pact;        /* Record active */
caddr_t                 spvt;        /* Scan Private */
caddr_t                 rset;        /* Address of RSET */
struct dset             *dset;       /* DSET address */
caddr_t                 dpvt;        /* Device Private */
unsigned char           tpro;        /* Trace Processing */
unsigned char           udf;         /* Undefined */
unsigned short          prio;        /* Scheduling Priority */
struct link             flnk;        /* Forward Process Link */

/* start of ai specific fields */
double                  val;         /* Current EGU Value */
struct link             inp;         /* Input Specification */
short                   prec;        /* Display Precision */
unsigned short          linr;        /* Linearization */
float                   eguf;        /* Engineer Units Full */
float                   egul;        /* Engineer Units Low */
char                    egu[16];     /* Engineering Units */
float                   hopr;        /* High Operating Range */
float                   lopr;        /* Low Operating Range */
float                   aoff;        /* Adjustment Offset */
float                   aslo;        /* Adjustment Slope */
float                   smoo;        /* Smoothing */
float                   hihi;        /* Hihi Alarm Limit */
```

```
        float                   lolo;       /* Lolo Alarm Limit */
        float                   high;       /* High Alarm Limit */
        float                   low;        /* Low Alarm Limit */
        unsigned short          hhsv;       /* Hihi Severity */
        unsigned short          llsv;       /* Lolo Severity */
        unsigned short          hsv;        /* High Severity */
        unsigned short          lsv;        /* Low Severity */
        double                  hyst;       /* Alarm Deadband */
        double                  adel;       /* Archive Deadband */
        double                  mdel;       /* Monitor Deadband */
        double                  lalm;       /* Last Value Alarmed */
        double                  alst;       /* Last Value Archived */
        double                  mlst;       /* Last Val Monitored */
        double                  eslo;       /* Rawto EGU Slope */
        long                    roff;       /* Raw Offset */
        caddr_t                 pbrk;       /* Ptrto brkTable */
        short                   init;       /* Initialized? */
        short                   lbrk;       /* LastBreak Point */
        long                    rval;       /* Current Raw Value */
        long                    oraw;       /* Previous Raw Value */
};
```

Record Scanning

SCANNING MECHANISMS :

- PERIODIC (.1, .2, .5, 1, 2, 5, 10 second scan)
- I/O EVENT (typically a hardware interrupt)
- EVENT (a 'soft' interrupt originating from elsewhere)
- PASSIVE (only scans when specifically requested)
- INPUT LINK with CP attribute (R3.13) (scans when a "monitor" is received from the input PV)
- INPUT LINK with CPP attribute (R3.13) (scans when a "monitor" is received and the record is 'Passive'

SCAN DISABLE

- Every record has a 'SCAN DISABLE FIELD' that can override the scan mechanism to inhibit the processing of the record

Links

Records can be 'LINKED' together to create more complex functions or algorithms.

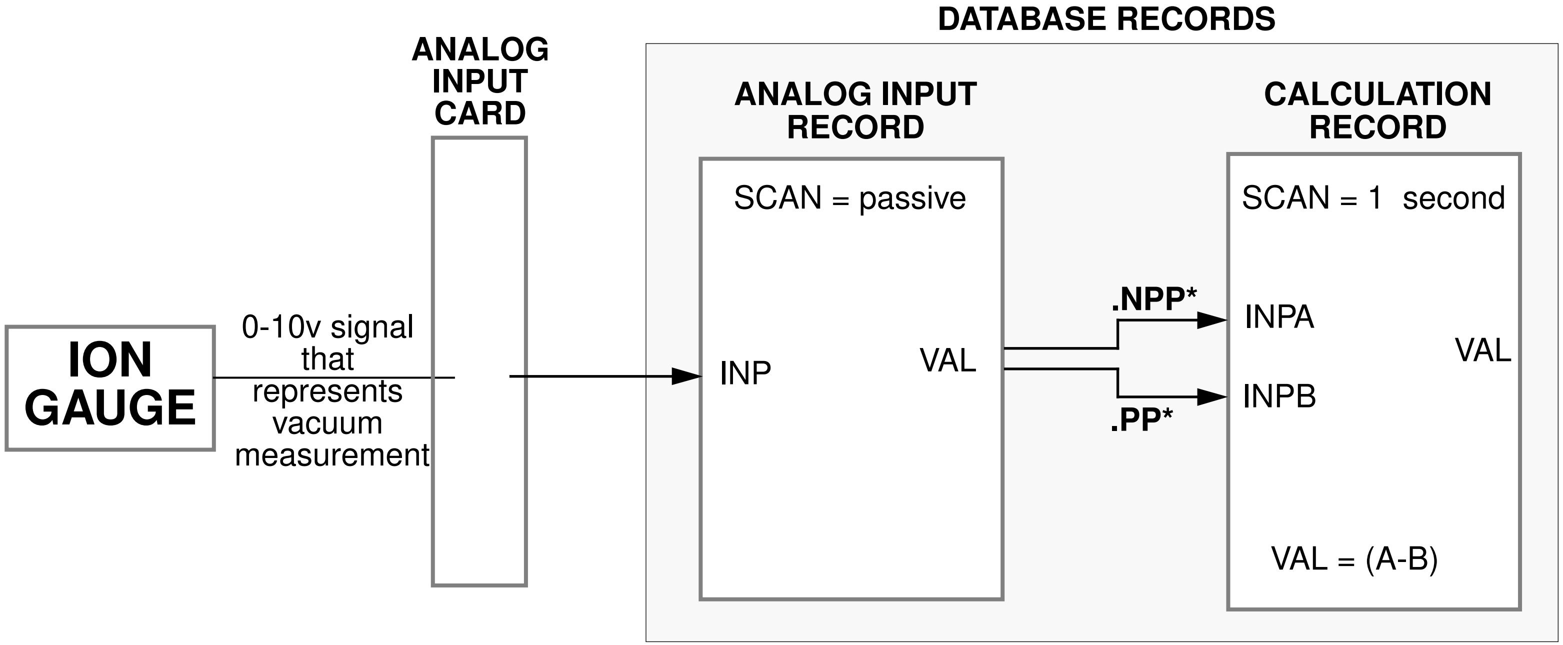
Links between records may represent ...

- Control flow
- Data flow
- Both

Examples of fields in a record where links may be used:

- INP (tells the record processing routine where to get data)
- OUT (tells the record processing routine where to put data)
- SDIS (Scan Disable)
- FLNK (Forward Link) (force processing of a record)
- DOL (Desired Output Location) (the input field to an output record)

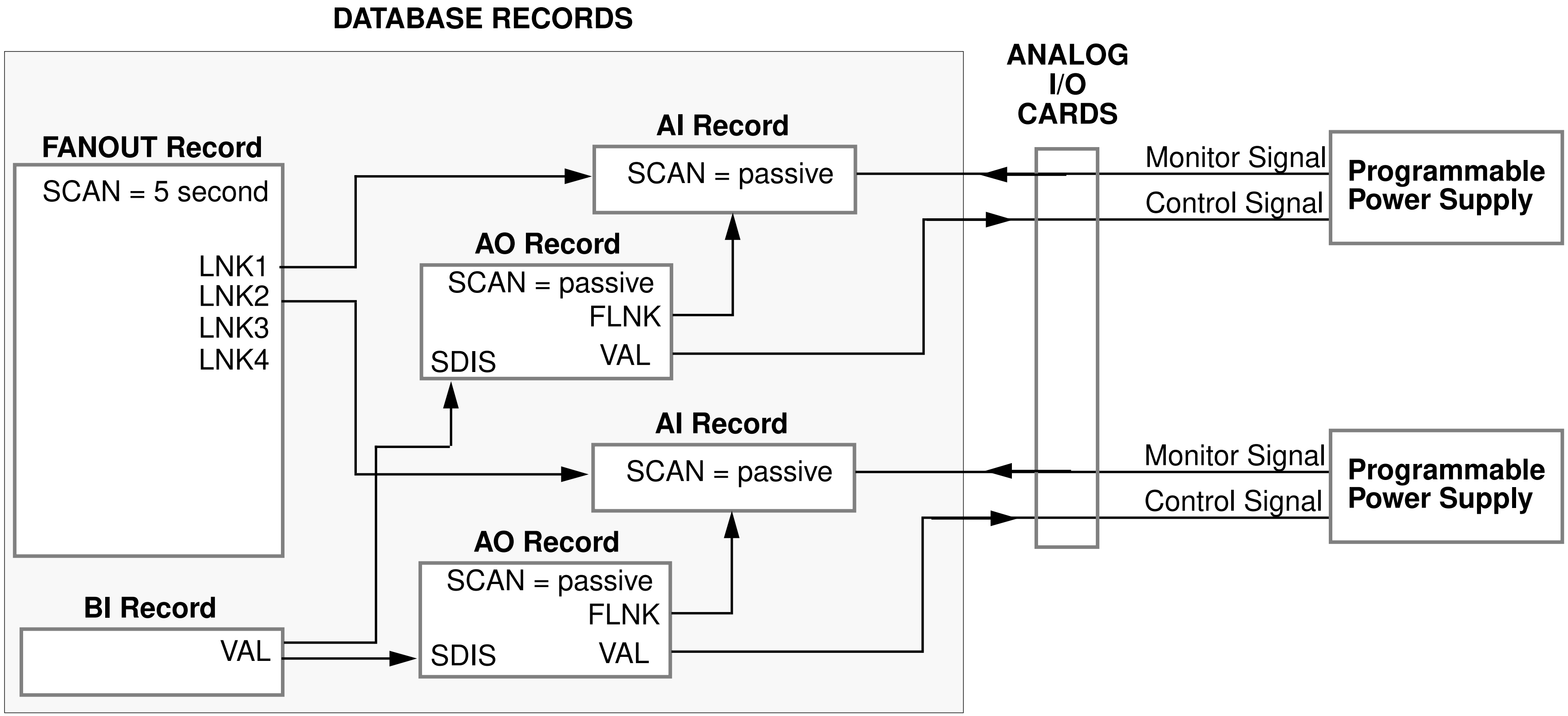
Calculating “Rate of Change” of an Input



* .NPP - No Process Passive
.PP - Process Passive

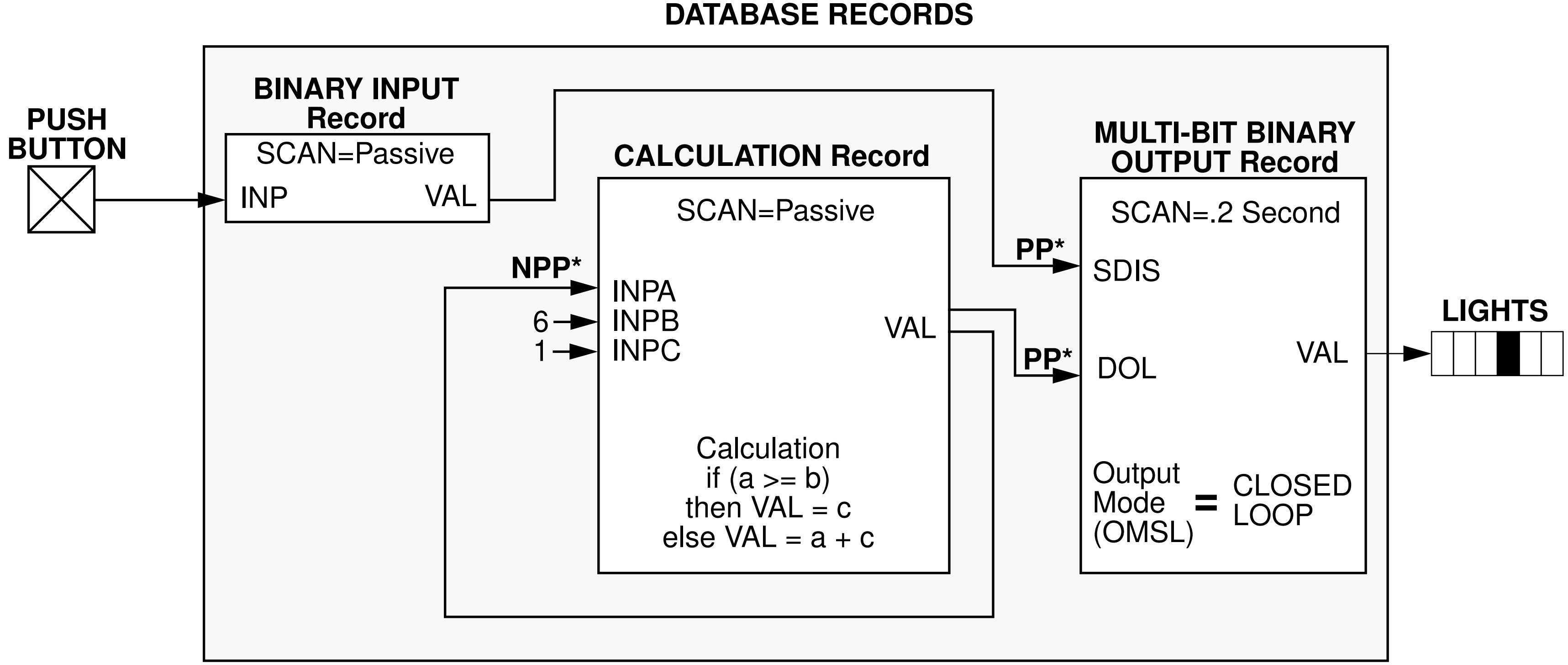
Hint : INPA fetches data that is 1 second old because it does not request processing of the AI record. INPB fetches current data because it requests the AI record to process. The subtraction of these two values reflects the ’rate of change’ (D/sec) of the vacuum signal.

Slow Periodic Scan with Fast Change Response



Hint : AI records get processed every 5 seconds AND when the associated AO record is changed. This provides immediate response to a change even though the desired scan rate is very slow. Changes to the Power Supply settings are inhibited by the BI record, which could represent a Local/Remote switch.

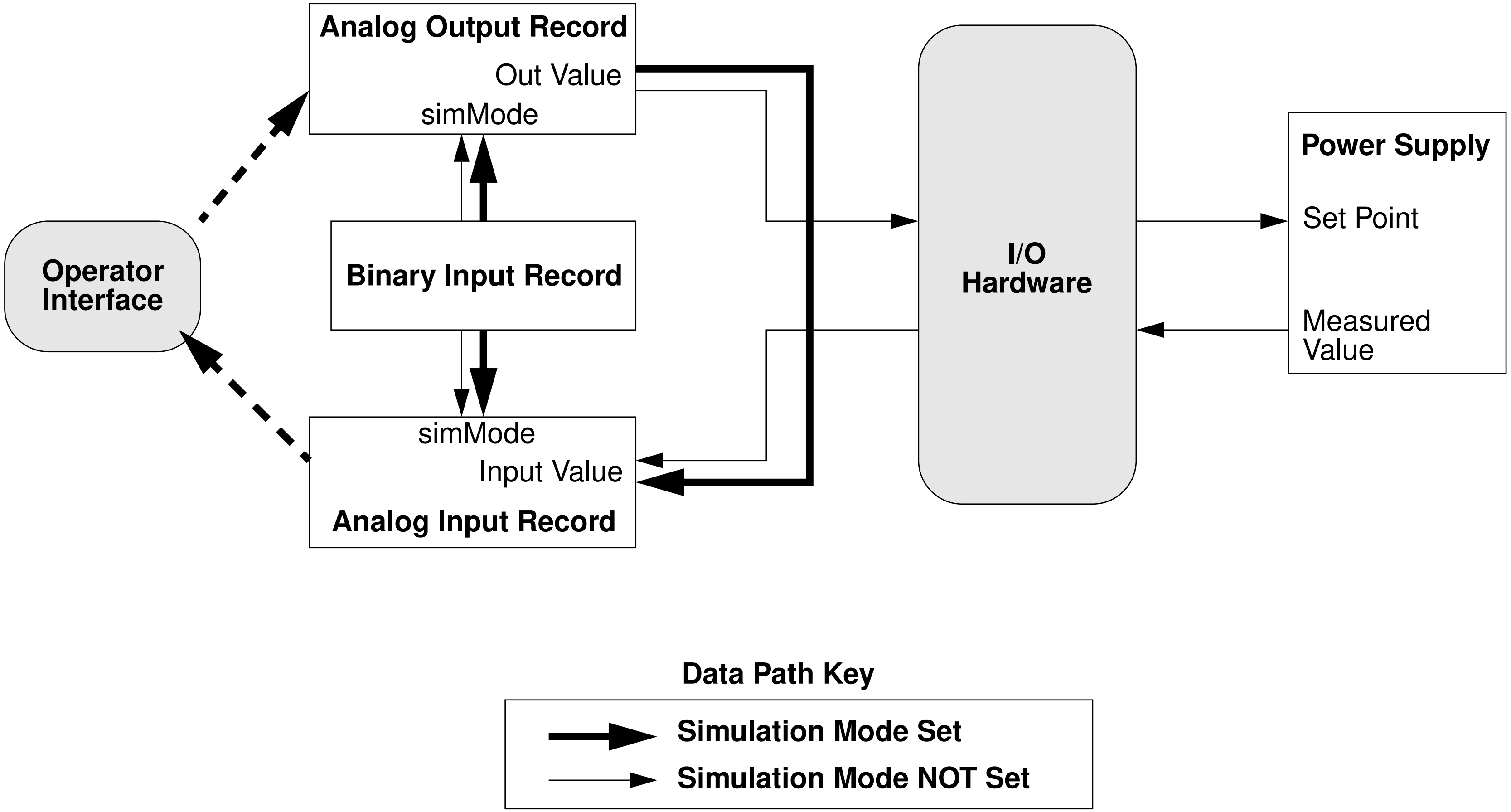
Continuous Calculation with Operator Inhibit



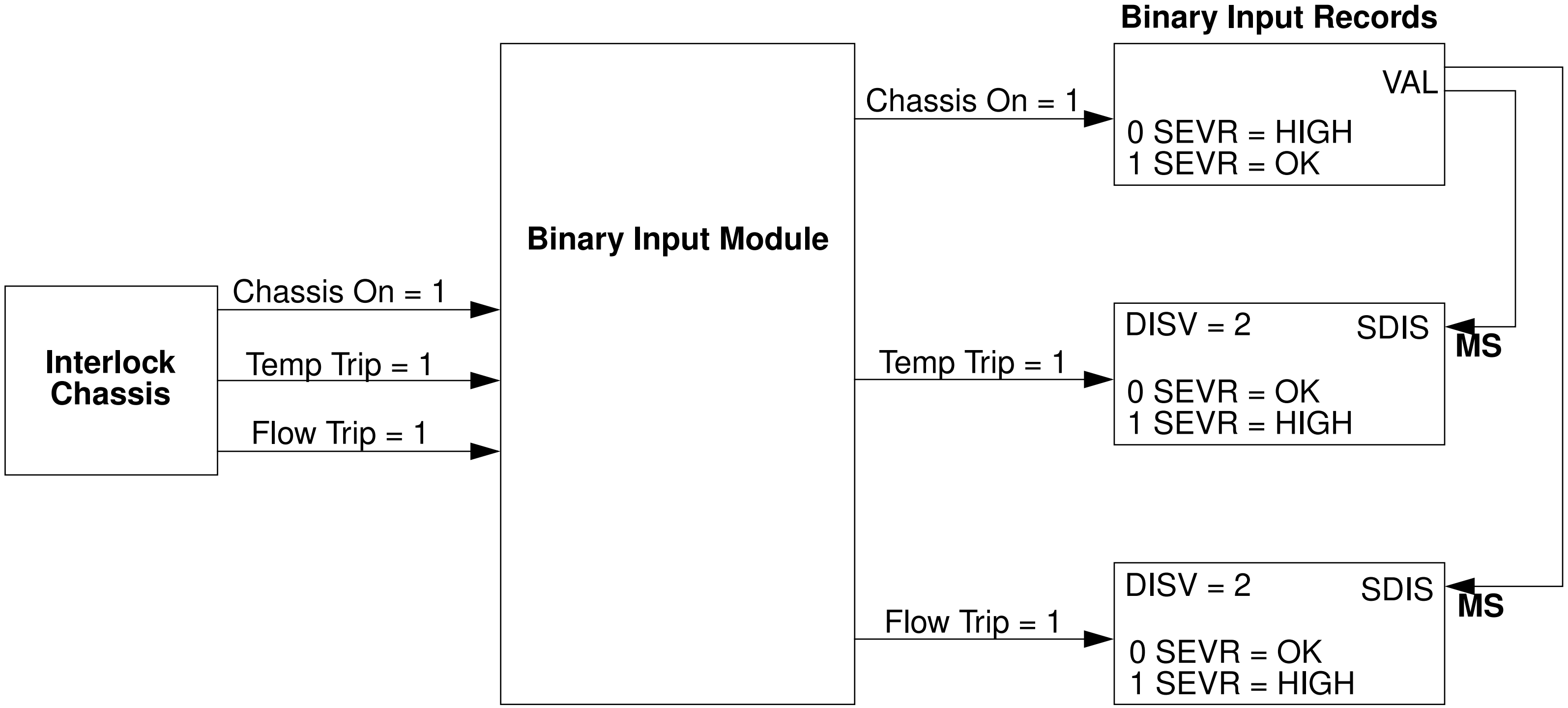
* NPP - No Process Passive
PP - Process Passive

Hint: Each time the MBBO record is processed (and not disabled by the BI record), it forces processing of the CALC record which shifts the VAL field left by 1 bit. Once the VAL field reaches 6, the value is reset to 1.

Simulation Mode

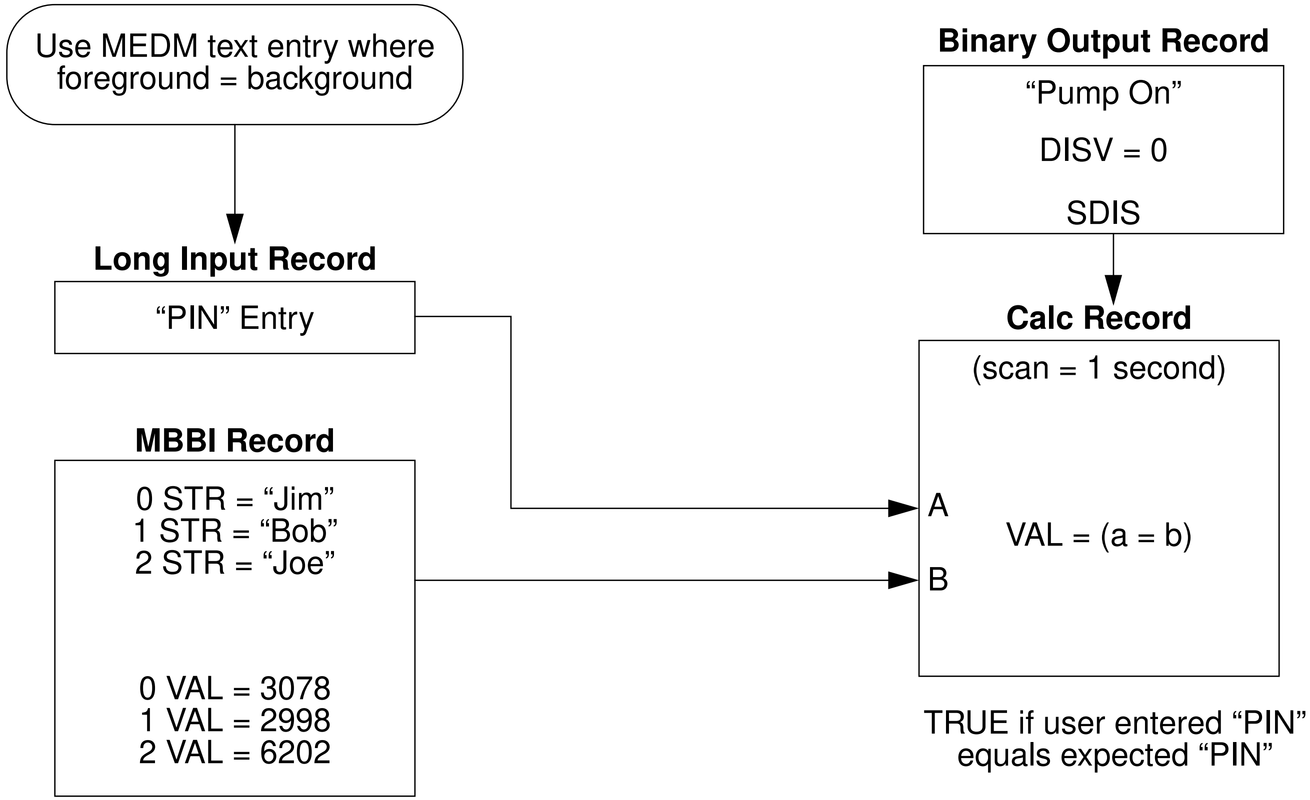


Maximize Severity



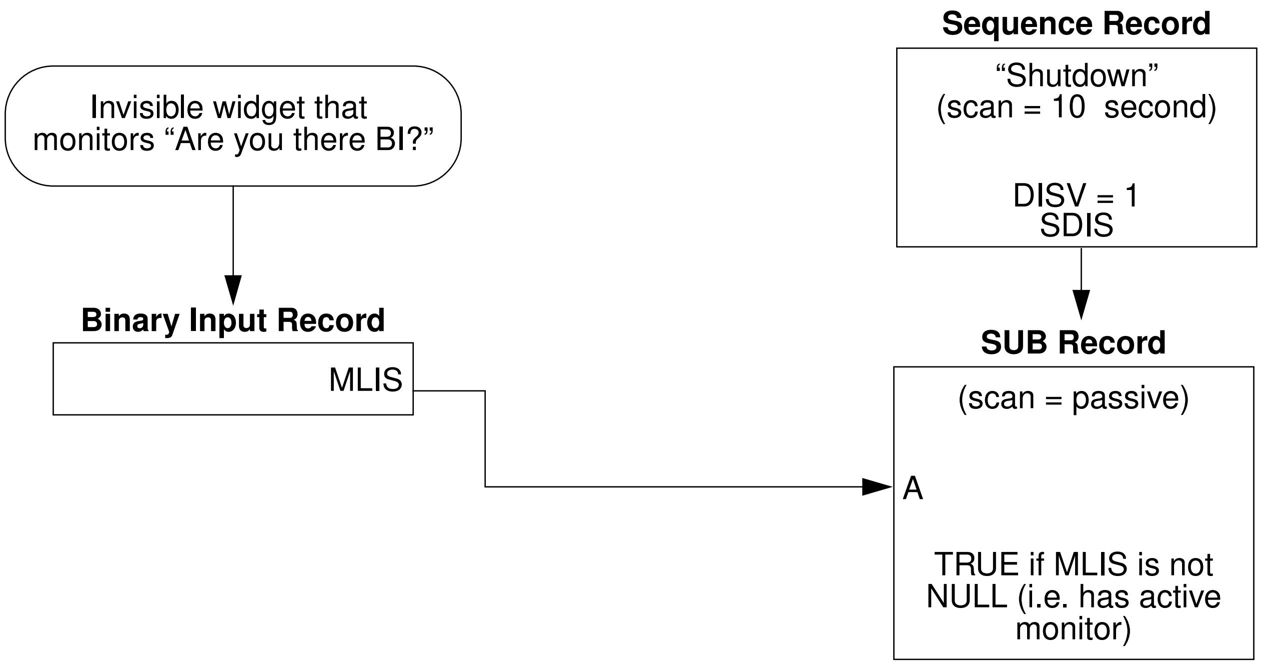
If Chassis is powered off, **TempTrip** and **Flow Trip** indicate **OK**. Disable link to **Chassis On** record with **Maximize Severity** flag will force these records into alarm if chassis is off. Set **DISA** to 2 so processing will never be disabled.

Password Protection



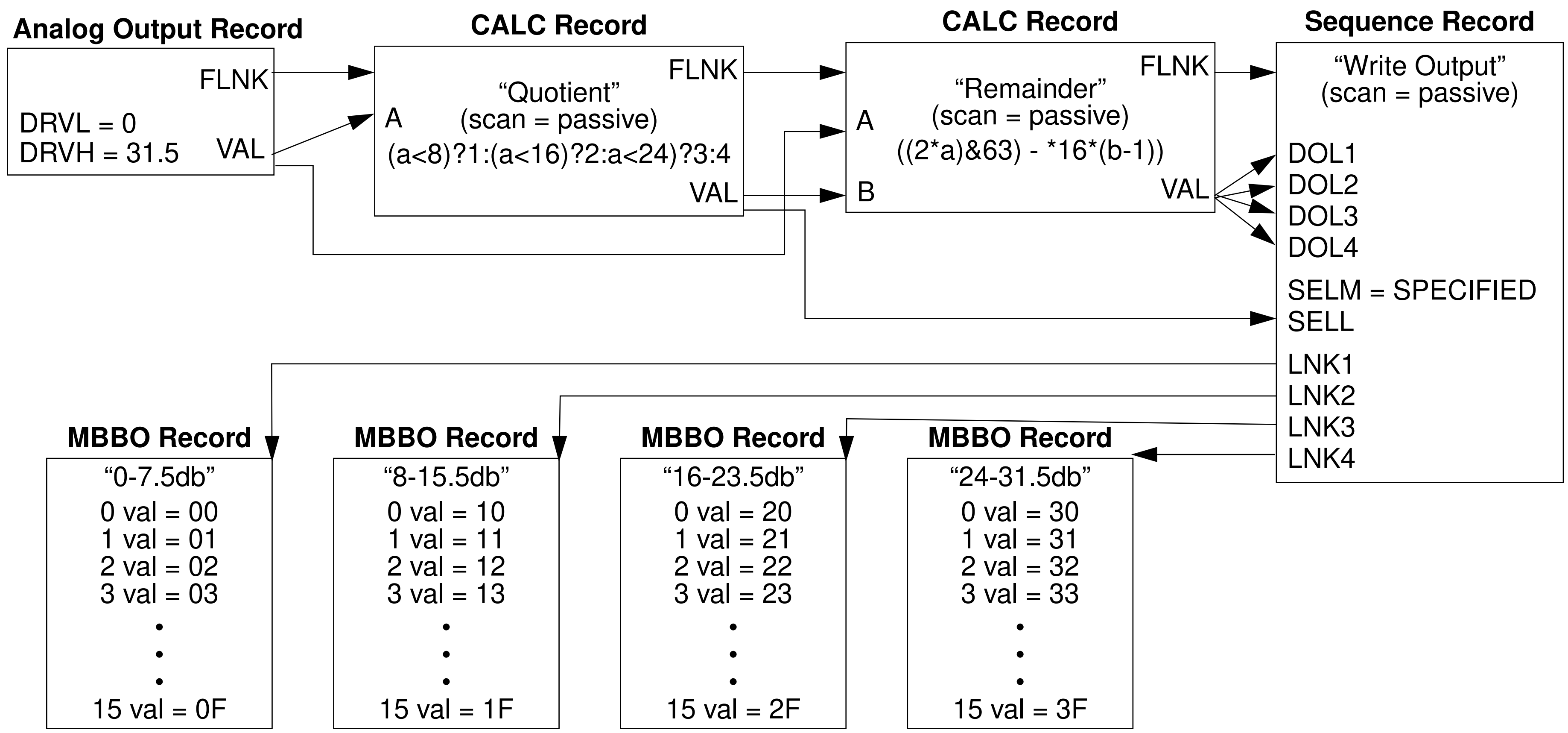
Pump On record is disabled unless **Long Input** record contains the same value as was assigned to the **MBBI** value field for the selected operator.

Automatic Shutdown



If no monitors exist on the **Binary Input** record (i.e. the operator has logged out), **MLIS** will be **NULL,** which will make the **SUB** record = 0, which will allow the **Shutdown** sequence record to process.

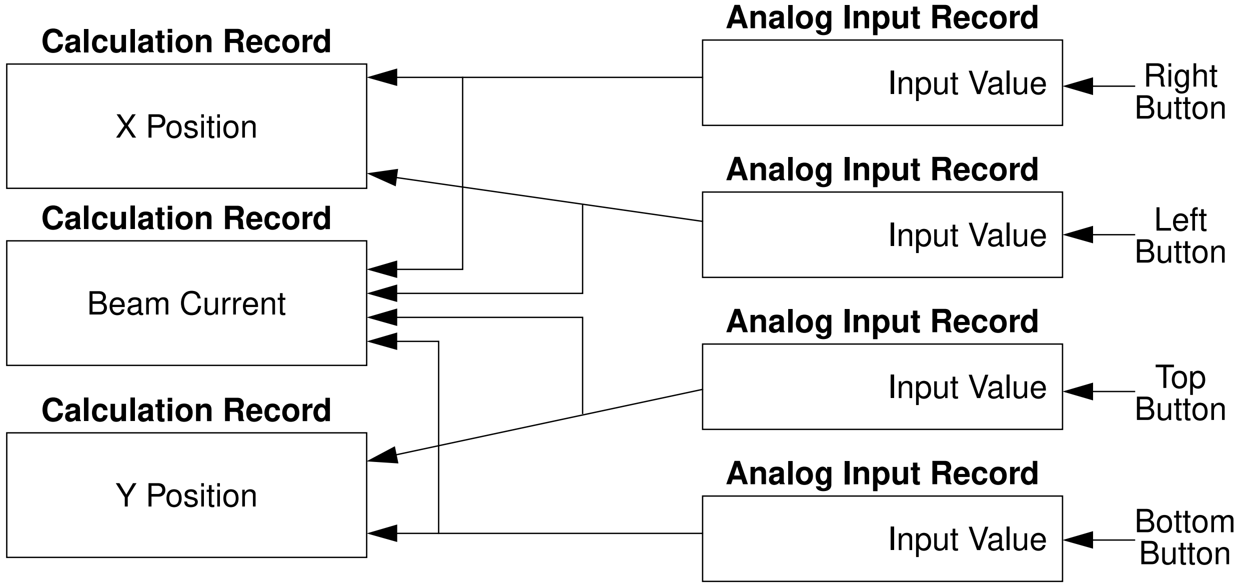
Programmable Attenuator



Support for a 6 bit programmable attenuator from an AO record. No custom device support required.

Quick Prototyping with “Standard EPICS”

Prototype



Custom Record Definition