# Page Applications in Use

*Diagnostic tools*

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From the early development of the front end system used in IRMs and Linac PowerPC nodes, about three dozen page applications have been developed for use as diagnostic tools. Each runs as an extension of system operation within a node. The page display hardware, or "little console," can be used when available; otherwise, such page applications can be run from a "Page G" little console emulator, which is available on several different platforms. For more details, see note, *Little Console*, Apr 22, 2003.

***Environment***

Only a single page application (PA) can be active at one time in a node. It is organized as a subroutine that, when active, is invoked by the underlying system code for several different reasons. Each of up to 31 pages can be assigned to applications by name. The operator interface allows activating a PA by calling up the desired page number, which is denoted by a single character from 0–9, A–V. Page 0 is permanently assigned the built-in index page application that shows a menu of 14 page titles in two sets. See note, *Page Application Overview*, Mar 11, 1999. Called as a function, a PA has two arguments. The first is a number that indicates the reason for the call; the second is a pointer to a 128-byte area in nonvolatile memory that can be used to keep parameters across page activations. The PA is expected to perform its job for each invocation, then exit promptly, as the underlying system code expects to maintain reliable 15 Hz execution. Reasons for a call to a PA are as follows:

| *Reason#* | *Meaning* |
|---|---|
| 0 | Initialization, made once when page is called up. |
| 1 | Termination, made once when page is to be replaced by another. |
| 2 | Keyboard interrupt, or manual mouse click "Do It" button. |
| 3 | 15 Hz cycle, made every system cycle after alarm scanning is done. |
| 4 | Network, made when PA supports a network protocol. |
| 5 | Serial, made when PA supports RS-232 port input. |
| 6 | Event, made if PA needs prompt notification following a clock event. |

During initialization, which is always the first call, it is common for a PA to allocate static memory for use in maintaining its context while it is active and to initialize the display. During termination, which is always the last call, this allocated memory should be freed, and any other allocated resources should be released. The manually-initiated keyboard interrupt call typically accesses global variables that hold the current cursor position on the 16 line by 32 column display supported by the PA; different cursor locations may cause different actions to be taken in response to this call. The 15 Hz cycle call occurs every operating cycle at a time when fresh data is updated in the data pool, and alarm scanning has been done for the current cycle. Note that a keyboard interrupt call occurs at the same time in the cycle as a 15 Hz call, essentially preempting the 15 Hz call for that cycle.

A library of routines is available to assist PAs in performing their duties. The details are beyond the scope of this note, but one set of library routines supports Classic protocol clients. One or more requests can be made for data of interest to the PA. Such data may be obtainable from the local node or from any set of nodes; the format of a request does not care from whence the data comes, since each "ident" specified in the Classic protocol request includes a node number. To allow that some data may come from other nodes, it is typical to wait until the next 15 Hz call before calling for the reply data. (For data that is sought from faraway nodes, say in Europe, the PA may have to be even more patient.)

***Basic four***

In the early years of this front end operation in the Fermilab Linac and elsewhere, there were just four PAs in use, today known as the "basic four." They are the following:

| *Name* | *Use* |
|---|---|
| PARM | Generic "parameter page" well known to Fermilab console users. |
| EDAD | Edit analog descriptors, including all fields in the ADESC table. |
| EDBD | Edit binary descriptors, including test and alarm flags for each bit. |
| MDMP | Memory dump, displaying 64 bytes from up to 8 nodes at 15 Hz. |

The PARM PA displays up to 14 analog channels updated at about 1 Hz from average readings. It can also show settings, nominal and tolerance values. It supports incremental adjustment of settable channels as well as absolute settings. Each line can be established by channel name or by node and channel number and optionally preserved across activations. See notes, *Parameter Page*, Sep 19, 1989, and *Entering New Parameters*, Mar 16, 1989.

The EDAD PA supports entry of all fields housed in the ADESC table entry for each analog channel. It also supports name lookup. In an Acnet environment, entry of such fields is normally accomplished via DABBEL input or Acnet console page D80. Following successful DABBEL processing, a special Acnet database download application runs to pass the changed information down to the front end. A typical node supports 1024 or 2048 channels. See note, *Analog Descriptor Page*, Jul 21, 2003.

The EDBD PA allows entry of binary information, especially the 16-character descriptive text for each bit. This text is output in Classic alarm messages, which can be set up to ultimately be seen via serial port output. A typical node supports 1024 or 2048 bits. See note, *Binary Descriptor Page*, Jul 25, 2003.

The MDMP PA provides for generic debugging and monitoring of internal system activities. Data of 64 bytes are shown, divided in 8-byte units across as many as 8 nodes, updated at 15 Hz. Memory can be displayed/modified as bytes, words or longwords. If the local node running the PA is connected to one or more SRMs via arcnet, memory inside the SRMs can also be displayed/modified. Besides the display, data can be copied from one block to another, either locally or between nodes. A node reset function is also included. See notes, *Memory Dump Page*, Jul 31, 2003, and *Longword Access*, Mar 31, 2003.

***Page G***

The CRTI (CRT Image) PA is used to operate page applications in another node. It uses the local "little console" to run a PA in a target node. The local console performs a remote keyboard interrupt by typing the keyboard character control-Q, which is turned into an ESC key on the target node. Note that a target node can be monitored by more than one Page G client, in which case typing or cursor movement can be controlled by any client. This has been used as a kind of teaching aid to show another user the steps taken to run a given PA. (Its name comes from its normal assignment to Page number G.) See notes, *CRT Image Page*, Dec 28, 1989, and *Page G Plan*, Mar 10, 1992.

***File transfer***

The DNLD PA is a file transfer client. Each node supports a nonvolatile memory file system. This PA can produce a directory listing of the files in a target node as well as copy a file from one node to another. The newest feature allows use of a multicast target node number for copying a file from the local node to many nodes, taking care to update only those nodes that already house the named file and, in the case of program files, are of the

same CPU type. This scheme simplifies the job of updating many nodes to the latest version of a file. See note, *Memory File System*, Jan 6, 2000.

***File Versions***

Each file has a date assignment, used to identify the version of the file. The VERS PA compares the files housed in a target node with those in a reference node. It lists differences, indicating whether the target file version date is older or newer than that in the reference node. This PA can also list the current contents of the LATBL that includes all the instances of local applications in a given target node. See note, *Program Versions*, Jan 26, 2001.

***Local application client***

Local applications are similar to page applications, but they do not support a console display interface, and multiple local applications can be active at one time. In some cases, it is appropriate to have multiple instances of a given LA, each with its own set of parameters. The LAPP PA provides a common page interface to set up and monitor local application parameters by editing the Local Application Table (LATBL) entries. The ten application parameter values for each application instance in a target node can be displayed/modified. For parameter values that are channel or bit numbers, the present reading of the channel or bit is shown. The LA execution time is updated at 15 Hz. See notes, *Local Application Params*, Jul 28, 2003, and *LAPP Addition*, Oct 7, 1999.

***Nonvolatile memory files***

The NVOL PA compares the contents of the memory file system with the contents of the CODES table, which is the file system directory. It identifies any region of the memory that does not correspond to a CODES table entry. It verifies the health of the file system directory. See note, *Nonvolatile Memory Analysis*, Oct 14, 1994.

***Data stream displays***

A number of diagnostics built into the underlying system write diagnostic records into a data stream queue. The following displays list the contents of some such queues.

| *Name* | *Use* |
|---|---|
| NETF | Network frame/datagram traffic |
| TASK | System task activity listing |
| EVTQ | Clock event queue capture/listing |
| SLOG | Settings activity log |
| TFTP | TFTP file transfer activity log |
| SWFT | Swift digitizer command queue records |

The NETF PA captures the most recent network activity, a kind of "poor man's Sniffer." See notes, *Network Frames Page*, Jul 31, 2003, *Network Frames Addition*, Jun 14, 2003, and *Page F Node Numbers*, Dec 30, 1998.

The TASK PA captures the most recent task activity. Since the TASKLOG data stream "wraps" often, one may have to be quick to catch what is of particular interest. See notes, *Task Activity Analysis*, Feb 17, 1998, and *Task Activity Example*, Jul 28, 1998.

Clock events may be logged into a data stream called EVTLOG. The EVTQ PA can monitor ongoing event activity and list filtered and timed results. See note, *Clock Events Diagnostic*, May 11, 2000.

The SLOG PA lists the most recent setting activity within a target node. See note, *Settings Log*

*Page*, Sep 9, 1994.

The TFTP PA lists the recent TFTP file transfers experienced in a node that is configured to include the TFTPLOG data stream. See note, *TFTP Server Log Page*, Jan 6, 1998.

The SWFT PA lists the contents of the most recent Swift digitizer measurements, especially in Booster HLRF nodes. See note, *Swift Commands Log Page*, Jul 11, 1996. Note that one can use the PMEM PA, described next, to informally list the contents of many other diagnostic tables or data stream queues that are found in the memory of a target node.

***Print memory***

The PMEM PA lists the contents of memory records from a target node or from a set of nodes denoted by a data file containing a list of node numbers. Up to 2048 bytes from each node can be listed in lines of up to 32 bytes each. See note, *Print Memory Utility*, Jul 9, 1998. It can also list portions of the allocated static memory block used by an LA instance.

***Pattern Search***

The PATS PA can scan through one or more nodes and search for matches of patterns of up to 12 hex bytes or up to 24 characters of data. One can search for equality, inequality, or numerical comparison. System tables or arbitrary blocks of memory can be searched. See note, *Pattern Search*, Apr 21, 2003.

***Allocated memory***

The MBLK PA lists the currently-allocated dynamic memory blocks. This PA monitors internal data structures in a 68K node to produce this listing at 15 Hz. It can only do this for the local node; it cannot be used to list memory blocks in another node. Static memory blocks allocated by a PA or LA are identified with the program.

The MEMB PA provides a dynamic display of memory blocks allocated within a given target node, starting from the time the list is initiated, maintaining the list with the oldest block first. The ALLOCLOG data stream is monitored to get the information, especially useful for PowerPC nodes. The base address, size and type of the block is indicated. If the block is related to a local data request, the requesting node is also noted. A snapshot of the listing can also be printed. See the note, *Memory Allocation Page*, Jul 20, 2004.

***Clock events***

The EVTS PA displays the current clock event activity in a target node updated at 15 Hz. The Acnet "Clockscope" console display page is similar. It can also show the number of events seen per event interrupt, illustrating the clumped occurrences of certain events. For a selected event, it can show when the last such event arrived within the target node's 15 Hz cycle of activity as well as the count of the selected events and the time between the last two such events. See note, *Clock Events Page*, Aug 24, 1994.

The CORR PA lists 15 Hz correlated data from specified channels based upon a given clock event. See the note, *Correlated Data Listing*, Feb 1, 2005.

***Station survey***

The SURV PA can scan through a set of nodes, or a single selected node, and show/list some few properties of each, such as the system version date, the CPU type, the operating cycle period, the number of active data requests, and the time since it was last reset. See note, *Station Survey Page*, Dec 28, 1989.

The ALRM PA can display alarm-related statistics for a single node or multicast group of nodes. It lists the number of analog channels and bits in the alarm scan for each node, plus the time of the last build of the internal block of channels and bits to be scanned, as prompted by a change in user needs. See the note, *Alarm Scanning Info*, Jul 15, 2008.

***Network protocol tests***

Several PAs are designed to exercise various network protocols.

| ***Name*** | ***Use*** |
|---|---|
| ECHO | Usual IP tests of ICMP ping, UDP echo, SNTP, and DNS lookup. |
| REQR | Classic protocol request-reply timing |
| CLAS | Classic protocal test client |
| PING | Acnet protocol generic test, PING-PONG demonstration. |
| ACRQ | RETDAT/SETDAT test page |
| SNAP | Acnet snapshot protocol test |

The ECHO PA exercises a few common IP protocols, including the ICMP ping, the UDP echo, the SNTP Simple Network Time Protocol, and the Domain Name Service, both for node name translation and for IP address lookup. See note, *Ping Client Test*, Aug 9, 1989.

The REQR PA performs simple one-shot data requests at 15 Hz using the Classic data request protocol. See note, *Request-reply Page*, Dec 21, 1989.

The CLAS PA allows specifying any listype#, ident, and period or event# to exercise a Classic protocol data request. See note, *Classic Protocol Client*, Aug 13, 2004.

The PING PA is an early demonstration of Acnet protocol support. It can also be used for testing "Acnet Aux" type codes. See note, *Network Layer*, Aug 2, 1989.

The ACRQ PA allows testing Acnet RETDAT and SETDAT protocols via entry of an arbitrary SSDN plus length and offset specifications. It uses a bogus device index value so as not to mislead the recent Acnet alarm block device index capture logic. See note, *RETDAT-SETDAT Test*, Mar 22, 1990.

The SNAP PA is an Acnet snapshot protocol client that is capable of issuing both server and nonserver snapshot requests and showing what is returned by the target node.

***Generic name lookup***

The NAME PA performs generic name lookups using the search logic supported by listype 55. It is most often used via a multicast node number target, so that the search reaches instantly across many, or even all, nodes. One can search for five different types of names: analog channel names, file names, LATBL entry names, data stream names, and page application names. See note, *New Uses of Multicast*, Sep 15, 2003.

***Copy SRM memory***

The SRMC PA allows copying a block of memory from one SRM to another, even across separate arcnet networks. It relies on the appropriate protocol supported by the GATE LA. See note, *Arcnet Gateway*, Feb 22, 1991.

***MIL-1553B test***

The T553 PA allows exercising a local MIL-1553B hardware interface. See note, *1553 Test Page*, Oct 16, 1989.