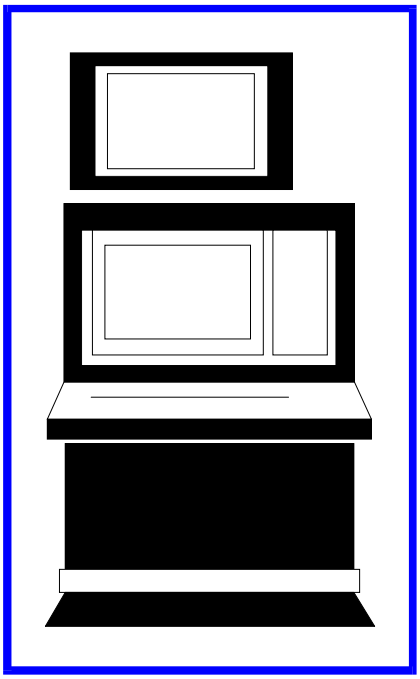
Bailey® infi 90®

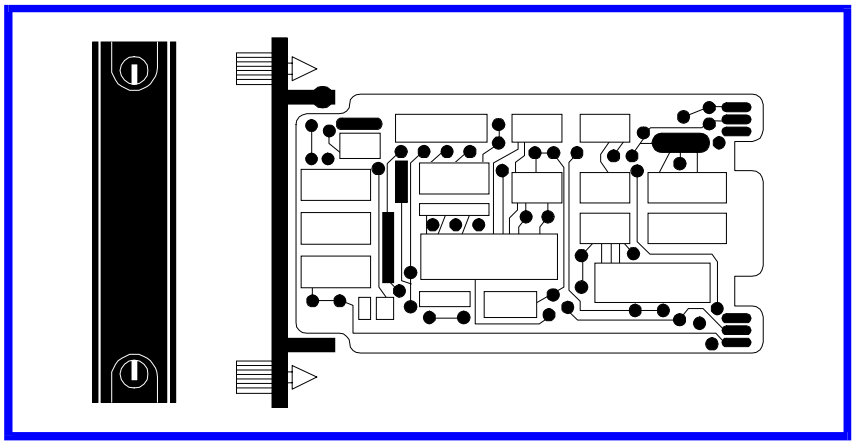
E97-811-6

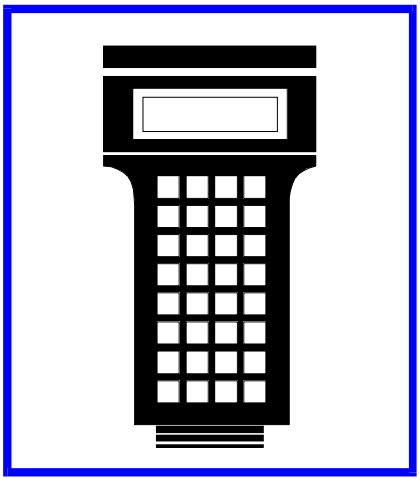
Instruction

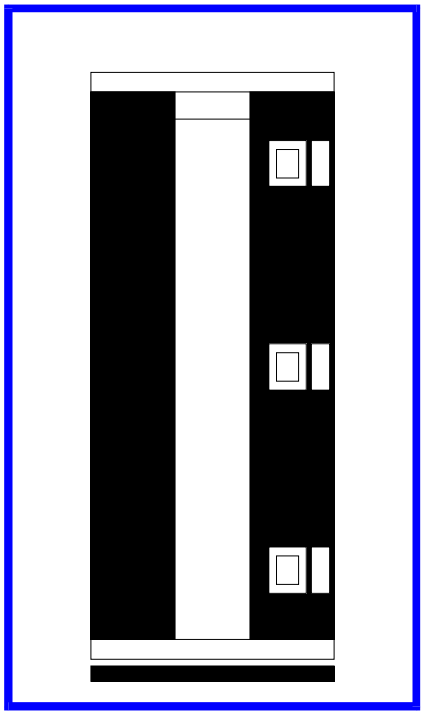
LAN-90® Process Control View (PCV®)

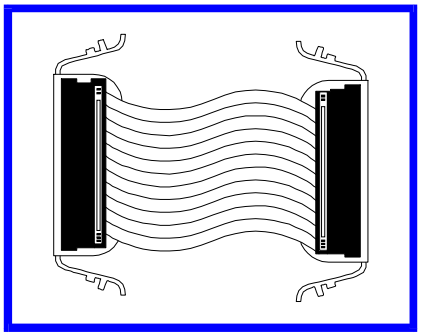
Custom Application Toolkit (Software Release 5.2)

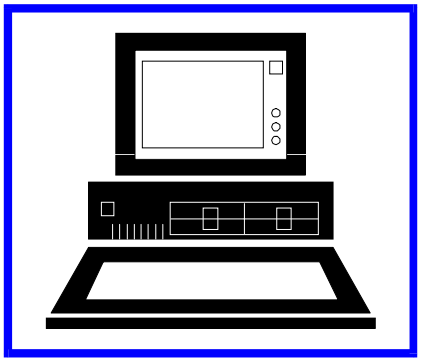












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WARNING notices as used in this instruction apply to hazards or unsafe practices that could result in personal injury or death.

CAUTION notices apply to hazards or unsafe practices that could result in property damage.

NOTES highlight procedures and contain information that assists the operator in understanding the information contained in this instruction.

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Preface

This manual provides general information and specific instructions on configuring and using the LAN-90® PCV® 5.2 Custom Application Toolkit to develop software that uses the library functions provided with LAN-90 PCV data.

This manual can be used as a reference guide for software developers who are developing programs for use with LAN-90 PCV.

This manual assumes the reader has a general knowledge of CRT-based process control systems.

List of Effective Pages

Total number of pages in this instruction is 44, consisting of the following:

Page No.	Change Date
Preface	Original
List of Effective Pages	Original
iii through vi	Original
1-1	Original
2-1 through 2-2	Original
3-1 through 3-6	Original
4-1 through 4-24	Original
5-1 through 5-3	Original
Index-1 through Index-2	Original

When an update is received, insert the latest changed pages and dispose of the superseded pages.

NOTE: On an update page, the changed text or table is indicated by a vertical bar in the outer margin of the page adjacent to the changed area. A changed figure is indicated by a vertical bar in the outer margin next to the figure caption. The date the update was prepared will appear beside the page number.

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Safety Summary

SPECIFIC CAUTIONS

If you are running the example programs while your system is on-line and connected to a live process, you must use extreme care. Executing data sending functions, such as “pcvSendTagValue()”, will actually send values to the process. Only use data sending functions in test scenarios. The configuration and data retrieval functions, such as “pcvGetTagValue()”, will not affect your process. (p. 3-3)

Adding your own application program may adversely affect the performance of the system. Also, if your application writes data to a hard disk or peripheral device, make sure adequate storage is available for both LAN-90 PCV and your own application programs. (p. 3-4)

Applications built with CAT should specify the CFLAGS and LDFLAGS options as is done in the CAT sample application (see “/user/cat/example/makefile”):
i.e.,

CFLAGS = -2 - fp3 - Wc, “ei” - wl - O - W3 - M$ (MODEL) - I$ (I)
LFLAGS = -2 - M$ (MODEL) - l$ (P) - l$ (L) - l$(M) - l$(M) - l$(N) - l$(T) - l$(u) (p. 3-4)

This function should not be used with station type tags. See the pcvOutputToStn() function. Also see USING STATION TAGS WITH CAT in Section 3. (p. 4-24)

Always check the source code for your program after running portfix, to make sure no incorrect translations have taken place. You may still have to make additional changes to your software before it will compile and run properly. (p. 5-3)

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SECTION 1 - INTRODUCTION

INTRODUCTION

The Custom Applications Toolkit (CAT) allows you to write application software programs for use with the LAN-90 PCV system. The Toolkit allows you unlimited access to the database via easy to use library routines. This means you can add application software (reporting, data storage, calculations, alarm management) specifically tailored for your plant's requirements. The Custom Applications Toolkit consists of all the necessary tools for creating your own applications. The tools include a programming language (WATCOM's "C" language compiler) and database access library functions.

This manual is intended for a Software Developer. You must be familiar with a variety of computer programming tools to use CAT. This manual assumes you have a working knowledge of text editors, compilers, and file utilities.

SECTION 2 - INSTALLATION

OVERVIEW

Usually CAT is installed with the base system. Refer to the ***LAN-90 PCV Installation manual*** for information on installing the Custom Application Toolkit.

These instructions are intended for users who purchase the CAT option as a separate package and install it after the base system has been installed.

To install the compiler, follow the instructions which accompany the WATCOM "C" compiler software package.

INSTALLING CAT ON AN EXISTING SYSTEM

To install the CAT package, follow the path depicted in Figure 2-1.

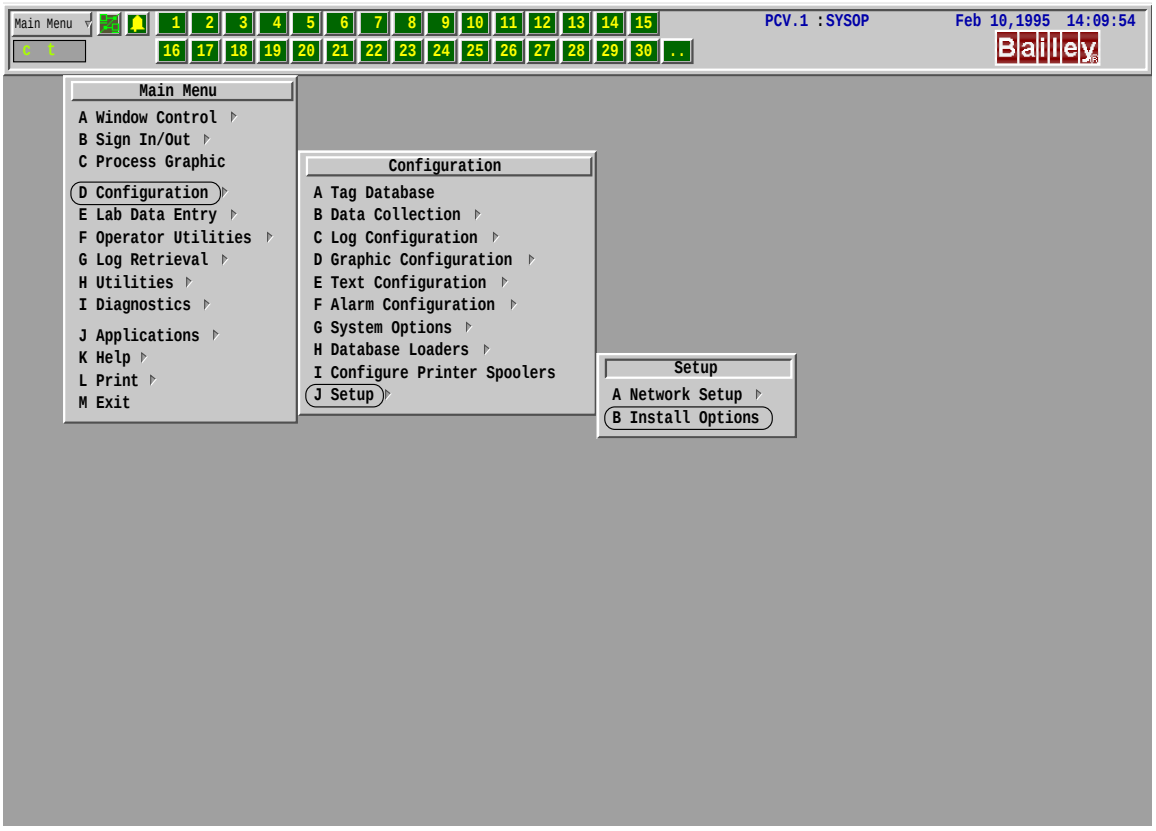

Figure 2-1. Accessing the PCV Install Utility

LOADING CAT

CAT is shipped as an archived volume.

When the installation program asks you to place the first disk in the floppy drive, insert the CAT disk and press <Enter>.

When the program asks if you have other disks to install, press <F10> to continue to the next step.

SECTION 3 - USING THE CUSTOM APPLICATION TOOLKIT

PROGRAMMING WITH THE CAT LIBRARIES

The Custom Applications Toolkit (CAT) allows you to write application software programs for use with the LAN-90 PCV system.

Methods To Create Custom Software Programs

While developing your applications, there are several tools you must use. Some of the tools required are:

- Text Editors.
- Compilers.
- File Utilities.

A text editor is used to create the program source code. A text editor (vedit) is provided with the QNX® operating system.

Compilers translate the program source code into executable files. WATCOM's "C" compiler is included with CAT.

File utilities are used to back up source and executable files to removable media (e.g., floppy disks). Some of the utilities that can be useful during software development are: "cp", "vol", "pax", "ls", and "size". See your ***QNX Operating System Manual*** for details.

You must be familiar with the above tools before you can begin developing software.

Plan and implement your programs using top down design methods. You can include in your program the library calls to receive and send process information. For example, your application could gather process data from many tags (e.g., ten temperature input tags configured in the database), perform a complex calculation, then send the result of the calculation back through another tag. You could implement this program as a background process that executes periodically (e.g., once an hour), or as a foreground process that executes whenever selected by the operator (from the Application menu).

CAT Library Routines.

The Custom Applications Toolkit provides several library routines that application programs can use to access the database. Note that each library call accesses the database administrator programs. The library routine calls are inserted

into the application source code, and are linked into the executable modules during the compile/link phases.

Section 4 contains a complete reference to all the CAT library routines.

On-Line CAT Documentation

The CAT library routine descriptions are available on-line to the developer. To access this on-line "manual", the catman function is provided. To use it, simply type **catman**, followed by the name of the function you wish to see described. For example, typing:

catman pcvGetTagValue

will show a description of the pcvGetTagValue function.

Tutorial - Usage and Compilation

The CAT package comes complete with a tutorial program. The tutorial program illustrates the use of the library routines. The example program is in the "/usr/cat/example" directory and is called "testc.c" (C language tutorial program).

A "makefile" is also included with the example program. The "makefile" is used to compile and link the example program. You can add your application programs to the existing "makefile" or create your own.

Compiling the Tutorial Program

To compile the C tutorial program, enter the following commands at the QNX prompt:

cd /usr/cat/example	The program source directory.
make testc	Compile and link "testc.c".

RUNNING THE TUTORIAL

The tutorial program is designed to show you how each CAT function works, and what parameters are needed by each function. To run the C tutorial program, type:

cd /usr/cat/example
testc

The tutorial program allows you to execute each function and enter the various parameters (Figure 3-1).

Example Program for LAN-90 Custom Applications Toolkit

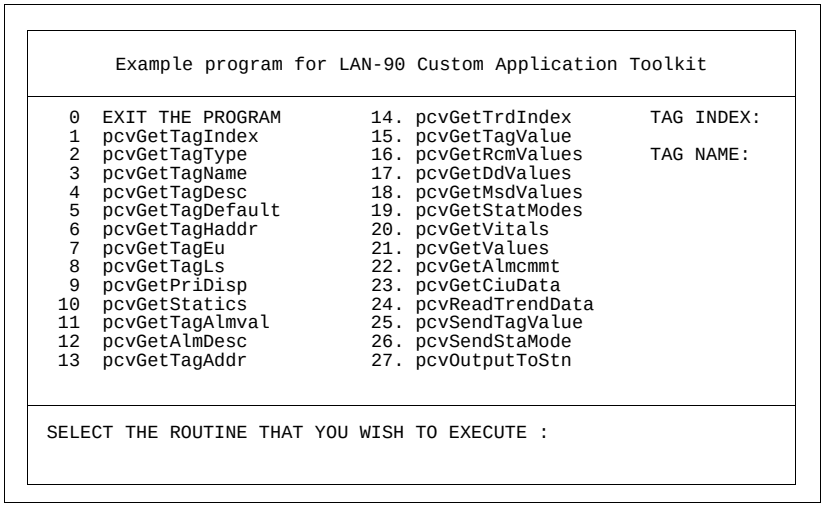

Figure 3-1. Main Display for C Tutorial Program

CAUTION

If you are running the example programs while your system is on-line and connected to a live process, you must use extreme care. Executing data sending functions, such as "pcvSendTagValue()", will actually send values to the process. Only use data sending functions in test scenarios. The configuration and data retrieval functions, such as "pcvGetTagValue()", will not affect your process.

WRITING YOUR OWN APPLICATION PROGRAM

This section describes how you would develop your own application using a simple C program as an example. This simple program retrieves the value for a process tag (TANK LEVEL) and periodically writes the value to the screen.

Create your own directory to store your source programs and executable files by typing:

mkdir /usr/cat/mydir

To begin editing your program source code using the QNX text editor, type:

cd /usr/cat/mydir	Change to your directory.
vedit myprog.c	Edit your program.

You can create an application program that includes the code shown in Figure 3-2, which uses some of the CAT library routines.

```
/* get the internal tag index */
itag =pcvGetTagIndex("TANK LEVEL");
while (1) {
   return_code = pcvGetTagValue(itag, i, &dvalue, &dstatus);
   if (return_code) {
   printf("Error calling function pcvGetTagValue\n");
   }
   else {
       printf("Value for TANK LEVEL - %f\n",dvalue);
   }
   sleep(10);     /* delay for 10 seconds */
}
```

Figure 3-2. Example of a C Program

After creating the complete program (including headers, main function, etc.,) and creating a "makefile", the executable program can be compiled. More details regarding include files and libraries are contained inside the tutorial programs.

Adding Your Own Application Software

The methods you use to add your application software to the system depend on the nature of the application program. If an application program is initiated by a user selection (i.e., a foreground operation), the program should be added using the Application menu (see ***Editing The Application Menu*** in the ***Configuration Manual.***

If an application must run constantly (i.e., a background application), the program should be added to the system start-up file. Note that the system start-up file is in the "/etc/config" directory and is named "sysinit.#" where # is the node number (0 for non-networked systems). The application program start-up should be placed after the LAN-90 PCV system is started.

Adding your own application program may adversely affect the performance of the system. Also, if your application writes data to a hard disk or peripheral device, make sure adequate storage is available for both LAN-90 PCV and your own application programs.

CAUTION

Applications built with CAT should specify the CFLAGS and LDFLAGS options as is done in the CAT sample application (see "/user/cat/example/makefile"):
i.e.,
CFLAGS = -2 - fp3 - Wc, "ei" - wl - O - W3 - M$ (MODEL) - I$ (I)
LFLAGS = -2 - M$ (MODEL) - l$ (P) - l$ (L) - l$(M) - l$(M) - l$(N) - l$(T) - l$(u)

USING STATION TAGS WITH CAT

The Custom Application Toolkit allows you to create a program that adjusts the set point of a station defined in the database. Using an equation based on the current value of related tags, CAT calculates the set point. This set point adjustment feature can be enabled and disabled using a standard graphic station faceplate.

The Custom Application Toolkit interfaces with the system and forwards requests to the INFI 90 OPEN system.

The user-written application program should be designed to adjust the set point periodically and the period calculated is faster than the computer timeout specification configured in the station block. The station outputs should be performed using the “pcvOutputToStn()” function.

Each time the application is run, it first calculates the required set point, then calls the “pcvOutputToStn()” function. If the station is in computer mode, the calculated set point value is sent. If the station is not in computer mode, the function sends a signal to the station indicating that a valid set point has been calculated and can be transmitted once the computer mode option is chosen.

If you want to control a number of stations but do not want to manually put each one into computer mode, the module logic shown in Figure 3-3 could be used to allow a single RCM to control the mode of several station blocks. No change to the application is required to operate in this manner.

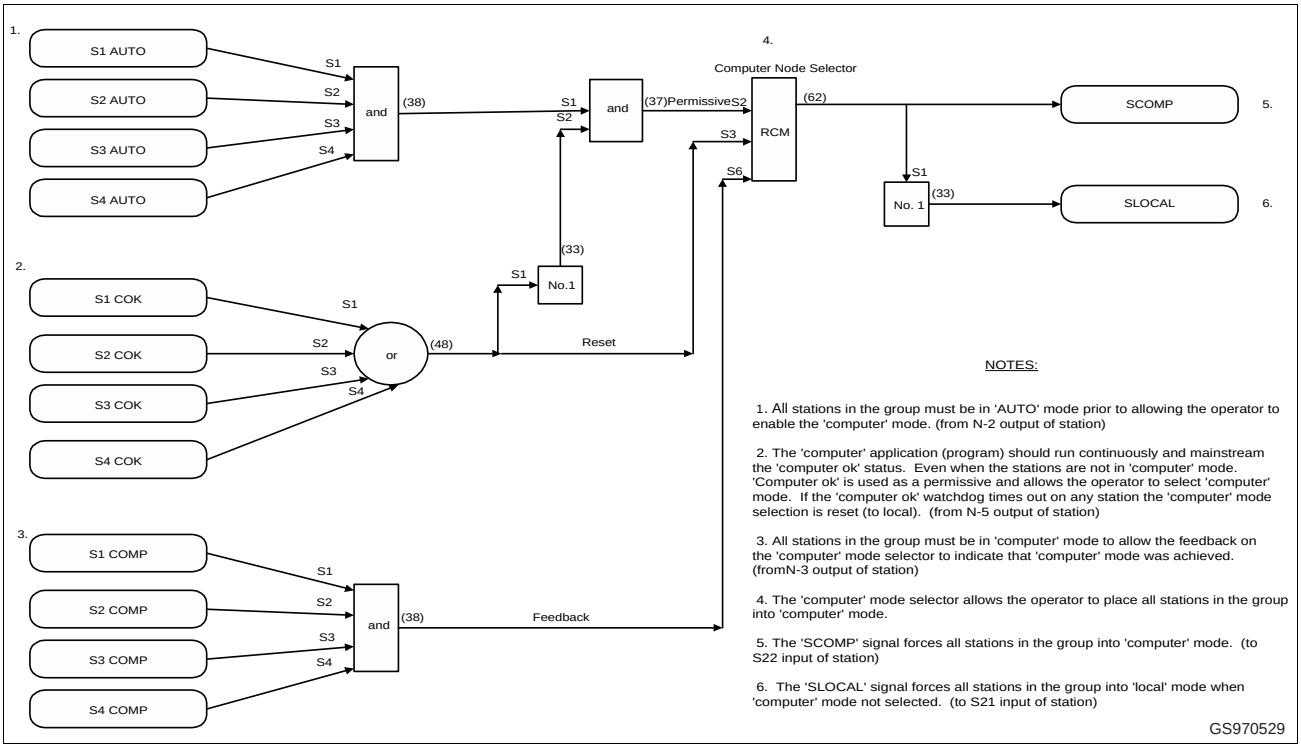

Figure 3-3. Module Logic

SECTION 4 - CAT LIBRARY REFERENCE

CAT LIBRARY REFERENCE

Each function is described in this section.

Table 4-1. Configuration Information Functions

Function	Description
pcvGetTagIndex	Retrieves the tag index from the tag database. Note that the tag index is used to call most other library routines.
pcvGetTagType	Retrieves the tag type.
pcvGetTagName	Retrieves the tag name.
pcvGetTagDesc	Retrieves the tag descriptor.
pcvGetTagDefault	Retrieves the tag default value.
pcvGetTagAddr	Retrieves the tag address (loop, PCU, module, block) as defined in the tag database.
pcvGetTagEu	Retrieves the tag engineering units descriptor.
pcvGetTagLs	Retrieves the tag logic state descriptor (discrete type tags only).
pcvGetPriDisp	Retrieves the primary display name.
pcvGetStatics	Retrieves static information—includes tag name, tag descriptor, digital indicator, decimal precision.
pcvGetTagAlmval	Retrieves the alarm value.
pcvGetAlmDesc	Returns the high and low alarm comments of the specified tag.
pcvGetHaddr	Returns the tag index which matches the given hardware address.
pcvGetTrdIndex	Gets the trend index for the given tag.

Table 4-2. Data Collection Functions

Function	Description
pcvGetTagValue	Retrieves the tag value and status.
pcvGetRcmValues	Retrieves the tag values associated with Remote Control Memory (RCM) tags.
pcvGetDdValues	Retrieves the tag values associated with Device Driver type tags.
pcvGetMsdValues	Retrieves the tag values associated with Multistate Device Driver (MSDD) tags.
pcvGetStatModes	Retrieves the current mode of a station tag.
pcvGetVitals	Retrieves vital tag information—includes tag name,tag descriptor, value, alarm status, alarm value, engineering unit or logic state descriptor, decimal precision.

Table 4-2. Data Collection Functions (continued)

Function	Description
pcvGetValues	Retrieves all tag value information—includes value, alarm status, alarm value, engineering unit or logic state descriptor, discrete tag indicator, decimal precision.
pcvGetAlmcmmt	Returns either the high or the low alarm comment for the specified tag, according to the specified alarm state.
pcvGetCiuData	Returns dynamic database information for the specified tag.
pcvReadTrendData	Retrieves selected amounts of collected trend data for a selected trend tag index.

Table 4-3. Data Sending Functions

Function	Description
pcvSendTagValue	Sets a tag value.
pcvSendStaMode	Sets the mode of a station tag.
pcvOutputToStn	Sets a tag value of a station tag.

pcvGetAlmDesc()

Retrieves the high and low alarm comment for the given tag.

C Synopsis

```
#include  <pcvDServ.h>
int pcvGetAlmDesc(TagIndex index,
     AlarmComment *cmmt)
```

Arguments

index	Tag index.
cmmt	Pointer to storage for AlarmComment structure.

Return Value

BCI_OK	Success.
BCI_WARN	Data has been returned but may be invalid, check errno.
BCI_FATAL	An error has occurred, and errno has been set.

Description

pcvGetAlmDesc() returns both of the alarm comments corresponding to the given tag. If successful, “cmmt.High_alarm” will contain the high alarm comment string. “cmmt.Low_alarm” will contain the low alarm comment string.

Errors

ENODBA	Invalid index.
EINVAL	cmmt pointer is NULL.
ENOSERVER	Database server is not running.
ENODAEMON	Mail manager is not running.

pcvGetAlmcmmt()

Retrieves either the high or low alarm comment for the given tag.

C Synopsis

```
#include <pcvDServ.h>
int pcvGetAlmcmmt(TagIndex index,
     TagStatus state,char *cmmt)
```

Arguments

index	Tag index.
status	Alarm status of comment to return.
cmmt	Pointer to storage for comment string.

Return Value

BCI_OK	Success.
BCI_WARN	Data has been returned but may be invalid, check errno.
BCI_FATAL	An error has occurred, and errno has been set.

Description

pcvGetAlmcmmt() returns the alarm comment appropriate for the alarm status specified for the given tag. “cmmt” must point to a buffer at least 65 characters long.

Errors

ENODBA	Invalid index.
EBADSTATUS	Invalid alarm state.
EINVAL	cmmt pointer is NULL.
ENOSERVER	Database server is not running.
ENODAEMON	Mail manager is not running.

pcvGetCiuData()

Retrieves dynamic database information for the given tag.

C Synopsis

```
#include <pcvDServ.h>
int pcvGetCiuData(TagIndex index, CiuData *ciuData)
```

Arguments

index	Tag index .
ciuData	Pointer to storage for CiuData structure.

Return Value

BCI_OK	Success.
BCI_WARN	Data has been returned but may be invalid, check errno.
BCI_FATAL	An error has occurred, and errno has been set.

Description

pcvGetCiuData() returns a copy of the dynamic database corresponding to the given tag.

Errors	ENODBA	Invalid index.
	EDISEST	Tag has not been established.
	ENOSERVER	Database server is not running.
	ENODAEMO	Mail manager is not running.

pcvGetDdValues()

Retrieves process values of a device driver (DD) tag.

C Synopsis

```
#include <pcvDServ.h>
int pcvGetDdValues(TagIndex index, char *quality,
    char *alarm, char *v, char *f2, char *f1,
    char *fs, char *so, char *mode)
```

Arguments	index	Tag index.
	quality	Quality indicator, 1 if bad quality else 0.
	alarm	1 if in alarm, else 0.
	v	Output value of block, 1 or 0.
	f2	1 if input 2 feedback state is 1, else 0.
	f1	1 if input 1 feedback state is 1, else 0.
	fs	1 if feedback status value bad is 1, else 0.
	so	1 if override value is 1, else 0.
	mode	0=auto, 1=remote, 2=manual, 3=unused.

Return Value	BCI_OK	Success.
	BCI_WARN	Tag not established, invalid data may be returned.
	BCI_FATAL	An error has occurred, and errno has been set.

Description

pcvGetDdValues() returns process values from a device driver (DD) tag. The index passed must be the tag index of a DD and the tag must be established in the CIU in order for the function to succeed. You can use the pcvGetTagType() function to check the tag type of the index. If the function call is successful, the variables quality, alarm, v, f2, f1, fs, so, and mode contain the process values for the DD.

Errors	EDISEST	Tag has not been established.
	ECONFIG	Tag at specified index is not a Device Driver.
	ENODBA	Invalid index.
	ENOSERVER	Database server is not running.
	ENODAEMO	Mail manager is not running.

pcvGetHaddr()

Retrieves tag index matching given hardware address.

C Synopsis

```
#include <pcvDServe.h>
TagIndex pcvGetHaddr(u_int loop, u_int pcu,
u_int mod, u_int block)
```

Arguments

loop	Tag loop address.
pcu	Tag pcu address.
mod	Tag module address.
block	Tag block address.

Return Value

>0	Database index of tag matching hardware address.
BCI_ERROR	Could not find requested tag address in database.
BCI_FATAL	An error has occurred, and errno has been set.

Description

pcvGetHaddr() returns the tag database index of the tag configured at the specified hardware address.

Errors

ENODBA	Unable to locate tag with matching address.
ENOSERVER	Database server is not running.
ENODAEMON	Mail manager is not running.

pcvGetMsdValues()

Retrieves process values from a multistate device driver (MSDD) tag.

C Synopsis

```
#include <pcvDServe.h>
int pcvGetMsdValues(TagIndex index, char *quality,
     char *alarm, char *so, char *co, char *m,
     char *v, char *f1, char *f2, char *f3,
     char *f4, char *gs, char *rs)
```

Arguments

index	Tag index.
quality	Quality indicator, 1 if bad quality, else 0.
alarm	1 if alarm, else 0.
so	1 if status override value is 1, else 0.
co	1 if control override value is 1, else 0.
m	1 if auto mode is 1, else manual 0.
v	1 if in control output state 1, else 0.
f1	1 if input 1 feedback state is 1, else 0.
f2	1 if input 2 feedback state is 1, else 0.
f3	1 if input 3 feedback state is 1, else 0.
gs	Good State table value (Table 4-4).
rs	Requested State table value (Table 4-5).

Table 4-4. Good State Table Value

Good State	State Value
0	0
1	4
2	8
3	12

Table 4-5. Requested State Table Value

Requested State	State Value
0	0
1	1
2	2

Return Value

BCI_OK	Success.
BCI_WARN	Tag not established, invalid data may be returned.
BCI_FATAL	An error has occurred, and errno has been set.

Description

pcvGetMsdValues() returns process values from a multistate device driver (MSDD) tag. The index passed must be the tag index of an MSDD and the tag must be established in the CIU in order for the function to succeed. You can use the pcvGetTagType() function to check the tag type of the index. If the function call is successful, the variables quality, alarm, so, co, v, f1, f2, f3, f4, gs, and rs contain the process values for the MSDD.

Errors

EDISEST	Tag has not been established.
ECONFIG	Tag at specified index is not a Multistate Device Driver.
ENODBA	Invalid index.
ENOSERVER	Database server is not running.
ENODAEMON	Mail manager is not running.

pcvGetPriDisp()

Retrieves the primary display name from the database for a given tag index.

C Synopsis

```
#include <pcvDServ.h>
int pcvGetPriDisp(TagIndex index, char *pdstring)
```

Arguments

index	Tag index.
pdstring	Pointer to character string storage for display name, 9 characters.

Return Value

BCI_OK	Success.

BCI_WARN	Data has been returned but is suspect (check errno).
BCI_FATAL	An error has occurred, and errno has been set.

Description pcvGetPriDisp() returns the primary display name from the database using the passed tag index. If the function call is successful, pdstring will contain the file name of the primary display for the tag.

Errors

ENODBA	Invalid index.
EINVAL	NULL pdsring.
ENOSERVER	Database server is not running.
ENODAEMON	Mail manager is not running.

pcvGetRcmValues()

Retrieves process values from a Remote Control Memory (RCM) tag.

C Synopsis

```
#include <pcvDServ.h>
int pcvGetRcmValues(TagIndex index, char *quality,
     char *alarm, char *ov, char *si, char *sp,
     char *ri, char *fb, char *sc, char *rc)
```

Arguments

index	Tag index.
quality	Quality indicator, 1 if bad quality, else 0.
alarm	1 if alarm, else 0.
ov	Output value of block, 1 or 0.
si	1 if logic set input is 1, else 0.
sp	1 if set permissive input is 1, else 0.
ri	1 if logic reset input value is 1, else 0.
fb	1 if feedback value is 1, else 0.
sc	1 if set command is 1, else 0.
rc	1 if reset command value is 1, else 0.

Return Value

BCI_OK	Success.
BCI_WARN	Tag not established, invalid data may be returned.
BCI_FATAL	An error has occurred, and errno has been set.

Description pcvGetRcmValues() returns process values from a Remote Control Memory (RCM) tag. The index passed must be the tag index of an RCM and the tag must be established in the CIU in order for the function to succeed. You can use the pcvGetTagType() function to check the tag type of the index. If the function call is successful, the variables quality, alarm, ov, si, sp, ri, fb, sc, and rc contain the process values for the RCM.

Errors

EDISEST	Tag has not been established.
ECONFIG	Tag at specified index is not an RCM.
ENODBA	Invalid index.
ENOSERVER	Database server is not running.
ENODAEMON	Mail manager is not running.

pcvGetStatModes()

Retrieves the current station modes from a station tag.

C Synopsis

```
#include <pcvDserv.h>
int pcvGetStatModes(TagIndex index,
     char *auto_man, char *cas_rat,
     char *stn_lev, char *cmpt_stat,
     char *stat_fault, char *op_trk,
     char *man_lock, char *by_pass)
```

Arguments

index	Tag index.

Table 4-6. Station Modes

Mode	Definition	Return Value	
		1	0
auto_man	Auto/Manual Mode Indicator	Auto	Manual
cas_rat	Cascade or Ratio/ Normal Indicator	Cascade or Ratio	Normal Indicator
stn_lev	Station Level	Computer	Local
cmpt_stat	Computer OK Status	Computer OK	Computer Not OK
stat_fault	Station Output Status	Station Fail	Station OK
op_trk	Output Tracking	Track	No Track
man_lock	Manual Interlock	Yes	No
by_pass	Station in Bypass Mode	Yes	No

Return Value

BCI_OK	Success.
BCI_WARN	Tag not established, invalid data may be returned.
BCI_FATAL	An error has occurred, and errno has been set.

Description

pcvGetStatModes() returns the current station modes from the database. The tag must be established in the CIU in order for the function to succeed.

> **NOTE:** This function does NOT check the tag type of the index you send it. Be sure to check the tag type yourself by using the pcvGet-TagType() function.

If the function call is successful, the variables auto_man, cas_rat, stn_lev, cmpt_stat, stat_fault, op_trk, man_lock, and by_pass contain the modes of the station.

Errors

EDISEST	Tag has not been established.
ENOSERVER	Database server is not running.
ENODAEMON	Mail manager is not running.

pcvGetStatics()

Retrieves static tag information from the tag database using the passed tag index.

C Synopsis

```
#include <pcvDServ.h>
int pcvGetStatics(TagIndex index, char *name,
     char *desc, Bool *dig, u_char *dec)
```

Arguments

index	Tag index.
name	Pointer to character string storage for tag name; maximum 15 characters.
desc	Pointer to character string storage for tag descriptor; maximum 33 characters.
dig	Pointer to Boolean storage for digital indicator; 1 if digital.
dec	Pointer to unsigned character storage for number of decimals defined.

Return Value

BCI_OK	Success.
BCI_WARN	Tag not established, invalid data may be returned.
BCI_FATAL	An error has occurred, and errno has been set.

Description

pcvGetStatics() returns the static tag information from the tag database. If the function call is successful, the variables name, desc, dig, and dec contain the static configuration information for the tag.

Errors

ENOSERVER	Database server is not running.
ENODAEMON	Mail manager is not running.

pcvGetTagAddr()

Retrieves the tag location (loop, PCU, module, block) from the tag database using the passed tag index.

C Synopsis

```
#include <pcvDServ.h>
TagType pcvGetTagAddr(TagIndex index, u_int *loop,
            u_int *pcu, u_int *mod, u_int *block)
```

Arguments

index	Tag index.
loop	Pointer to unsigned integer storage for INFI 90 OPEN loop address.
pcu	Pointer to unsigned integer storage for INFI 90 OPEN PCU address.
mod	Pointer to unsigned integer storage for INFI 90 OPEN module address.
block	Pointer to unsigned integer storage for INFI 90 OPEN block address.

Return Value

>0 tag type	
BCI_WARN	Point not established, invalid data might be returned, check errno.
BCI_FATAL	An unexpected error has occurred, check errno.

Description

pcvGetTagAddr() will return the INFI 90 OPEN block location using the passed tag index parameter. The block location consists of a PCU, module, and block address as defined in the tag database.

Errors

ENOSERVER	Database server is not running.
ENODAEMON	Mail manager is not running.

pcvGetTagAlmval()

Retrieves the alarm value for an analog-type tag's given alarm state.

C Synopsis

```
#include <pcvDServ.h>
int pcvGetTagAlmval (TagIndex index,
     TagStatus state, float *value)
```

Arguments

index	Tag index.
state	Alarm state.

Table 4-7. Analog Alarm States

State	Alarm State
4	High
5	Low
6	High Deviation
7	Low Deviation
8	2 High
9	2 Low
10	3 High
11	3 Low

value	Pointer to floating point storage for value.

Return Value

BCI_OK	Success.
BCI_WARN	Data has been returned but may be invalid, check errno.
BCI_FATAL	An error has occurred, and errno has been set.

Description

pcvGetTagAlmval() returns the alarm value for the given the alarm state.

> **NOTE:** This function can only be used for analog, internal analog, analog report, RMSC, and station tags. You can check the tag type of the index by using the pcvGetTagType() function.

If the function call is successful, the variable value contains value for the given alarm state.

Errors

EDISEST	Tag has not been established.
ENODBA	Invalid index.
EBADTYPE	Invalid status value.
EINVAL	Value pointer is NULL.
ENOSERVER	Database server is not running.
ENODAEMON	Mail manager is not running.

pcvGetTagDefault()

Retrieves the tag default value from the tag database using the passed tag index.

C Synopsis

```
#include <pcvDServ.h>
int pcvGetTagDefault(TagIndex index, float *value)
```

Arguments

index	Tag index.
value	Pointer to floating point storage for value.

Return Value

BCI_OK	Success.
BCI_WARN	Data has been returned but may be invalid, check errno.
BCI_ERROR	An expected error has occurred, check errno.
BCI_FATAL	An unexpected error has occurred, check errno.

Description

pcvGetTagDefault() returns the default tag value as defined in the tag database. If the function call is successful, the variable value contains the default value defined for the tag. This default value can be used as a substitute value if a piece of equipment is faulty or out of service.

Errors	ENODBA	Invalid index.
	EINVAL	Value pointer is NULL.
	ENOSERVER	Database server is not running.
	ENODAEMON	Mail server is not running.

pcvGetTagDesc()

Retrieves the tag description using the passed tag index.

C Synopsis

```
#include <pcvDServ.h>
int pcvGetTagDesc(TagIndex index, char *dsstring)
```

Arguments	index	Tag index.
	dsstring	Pointer to character string storage for descriptor, maximum 33 characters.
Return Value	BCI_OK	Success.
	BCI_WARN	Data has been returned but may be invalid, check errno.
	BCI_ERROR	An expected error has occurred, check errno.
	BCI_FATAL	An unexpected error has occurred, check errno.

Description

pcvGetTagDesc() will return the tag descriptor for the passed tag index. If the function call is successful, the variable dsstring contains the tag descriptor. The descriptor is configured in the tag database.

Errors	ENODBA	Invalid index.
	EINVAL	dsstring pointer is NULL.
	ENOSERVER	Database server is not running.
	ENODAEMON	Mail server is not running.

pcvGetTagEu()

Retrieves the tag engineering units descriptor using the passed tag index.

C Synopsis

```
#include <pcvDServ.h>
int pcvGetTagEu(TagIndex index, char *eustring)
```

Arguments	index	Tag index.
	eustring	Pointer to character string storage for engineering units, maximum seven characters.

Return Value

BCI_OK	Success.
BCI_WARN	Data has been returned but may be invalid, check errno.
BCI_ERROR	An expected error has occurred, check errno.
BCI_FATAL	An unexpected error has occurred, check errno.

Description

pcvGetTagEu() will return the tag engineering units (if applicable for the tag type) for the passed tag index. The engineering units are defined inside the INFI 90 OPEN Blockware (via index numbers), and reference the engineering units list defined in LAN-90 PCV. Internal analog and analog report tags have their engineering unit index configured inside the tag database only. If the function call is successful, the variable eustring contains the engineering units descriptor for the tag.

NOTE: This function applies to analog type tags only.

Errors

ENODBA	Invalid index.
EINVAL	eustring pointer is NULL.
ENOSERVER	Database server is not running.
ENODAEMON	Mail manager is not running.

pcvGetTagIndex()

Retrieves the tag index from the tag database.

C Synopsis

```
#include <pcvDServ.h>
TagIndex pcvGetTagIndex(char *name)
```

Arguments

name	Pointer to an ASCII tag name.

Return Value

>0	Index of tag with matching tag name.
BCI_ERROR	Tag name was blank or could not be found, check errno.
BCI_FATAL	An unexpected error has occurred, check errno.

Description

pcvGetTagIndex() will return the tag index using the passed tag name parameter. If the passed tag name matches an entry in the tag configuration, then the corresponding index identifier is returned. The returned tag index can then be used to call several interface subroutines available.

Errors

ENODBA	Tag name could not be found.
EINVAL	Tag name pointer is NULL.
ENOSERVER	Database server is not running.
ENODAEMON	Mail manager is not running.

pcvGetTagLs()

Retrieves the logic state descriptor using the passed tag index and state indicator.

C Synopsis

```
#include <pcvDServ.h>
int pcvGetTagLs(TagIndex index, int state,
     char *lsstring)
```

Arguments

index	Tag index.
state	0 for zero state descriptor, 1 for one state descriptor.
lsstring	Pointer to character string storage for logic state descriptor; maximum 7 characters.

Return Value

BCI_OK	Success.
BCI_WARN	Data has been returned but may be invalid, check errno.
BCI_ERROR	An expected error has occurred, check errno.
BCI_FATAL	An unexpected error has occurred, check errno.

Description

pcvGetTagLs() will return the tag logic state descriptor (if applicable for the tag type) for the passed tag index and state. The logic state descriptors are defined inside the tag database.

Errors

ENODBA	Invalid index.
EBADSTATE	Invalid state.
EINVAL	lsstring pointer is NULL.
ENOSERVER	Database server is not running.
ENODAEMON	Mail manager is not running.

pcvGetTagName()

Retrieves the tag name.

C Synopsis

```
#include <pcvDServ.h>
int pcvGetTagName(TagIndex index, char *nmstring)
```

Arguments

index	Tag index.
nmstring	Pointer to character string storage for name, maximum 15 characters.

Return Value

BCI_OK	Success.
BCI_WARN	Data has been returned but may be invalid, check errno.
BCI_ERROR	An expected error has occurred, check errno.
BCI_FATAL	An unexpected error has occurred, check errno.

Description pcvGetTagName() will return the tag name for the passed tag index. The descriptor is configured in the tag database.

Errors

ENODBA	Invalid index.
EINVAL	nmstring pointer is NULL.
ENOSERVER	Database server is not running.
ENODAEMON	Mail manager is not running.

pcvGetTagType()

Retrieves the tag type

C Synopsis

```
#include <pcvDServ.h>
TagType pcvGetTagType(TagIndex index)
```

Arguments

index	Tag index.

Return Value

>0	Returned tag type.
BCI_WARN	Data has been returned but may be invalid, check errno.
BCI_ERROR	An expected error has occurred, check errno.
BCI_FATAL	An unexpected error has occurred, check errno.

Description pcvGetTagType() will return the tag type using the passed tag parameter. The returned type will match the entry as defined in the tag database. The following tables list the various return codes and matching tag type identifiers.

Table 4-8. Database Tag Types

Code	Type Description
0	Undefined.
5	Analog.
7	Digital.
12	Analog Report.
13	Digital Report.
14	Module Status.
15	Remote Control Memory (RCM).
17	Station.
18	Remote Manual Set Constant (RMSC).
19	Device Driver (DD).
22	Multistate Device Driver (MSDD).
23	Remote Motor Control Block (RMCB).
24	Digital Acquisition Analog (DAANALG).
28	Text.
31	ASCII Text Block.

Table 4-8. Database Tag Types (continued)

Code	Type Description
32	Internal Analog.
33	Internal Digital.

Errors

ENODBA	Invalid index.
ENOSERVER	Database server is not running.
ENODAEMON	Mail manager is not running .

pcvGetTagValue()

Retrieves the current tag value and status from the tag database using the passed tag index.

C Synopsis

```
#include <pcvDServ.h>
int pcvGetTagValue(TagIndex index, u_char parm,
     float *value, TagStatus *status,
     TagQuality *quality)
```

Arguments

index — Tag index.

parm — For station's tag type, specify:

1	PV (Process Variable).
2	SP (Set Point).
3	CO (Control Output).
4	RI (Ratio Index).

value — Pointer to floating point storage for value.

status — Pointer to TagStatus storage for status of Value. The following Table shows all status Codes with descriptions:

Table 4-9. Tag Status Codes Set By pcvGetTagValue()

Code	Type Description
0	No Alarm.
1	Alarm (Boolean).
2	Bad Quality.
3	Out of Service.
4	High.
5	Low.
6	High Deviation.
7	Low Deviation.

quality — Pointer to TagQuality storage for quality of Value. The following list shows all quality Codes with descriptions:

Table 4-10. Tag Quality Codes Set By pcvGetTagValue()

Code	Type Description
0	Good.
1	Bad.
2	Disestablished.
3	Substituted.
4	Suspect.
5	Alarm Inhibited (auto).
6	Alarm Inhibited (group).
7	Alarm Inhibited (manual).

Return Value

BCI_OK	Success.
BCI_WARN	Data has been returned but may be invalid, check errno.
BCI_FATAL	An unexpected error has occurred, check errno.

Description

pcvGetTagValue() will return the current tag value, status and quality from the tag database.

Errors

EDISEST	Tag has not been established.
ENODBA	Invalid index.
ENOSERVER	Database server is not running.
ENODAEMON	Mail manager is not running.

pcvGetTrdIndex()

Gets the index of the trend for the given tag name, trend type and interval.

C Synopsis

```
#include <pcvDServ.h>
int pcvGetTrdIndex(char *tagName, time_t interval,
      char subType, char type, TrendIndex *index)
```

Arguments

tagName	Name of trended tag.
interval	Trend resolution.
subType	Trend subtype: TRDST_PV - Station Process Variable. TRDST_SP - Station Setpoint. TRDST_CO- Station Control Output. TRDST_RA- Station Ratio Index.
type	Trend type: tt_normal- “regular” trend. tt_tuning - tuning trend. tt_opassign - operator assignable trend.
index	Pointer to TrendIndex storage for trend index.

Return Value

BCI_OK	Success.
BCI_WARN	Data returned by may be suspect, check errno.
BCI_ERROR	Error occurred, check errno.
BCI_FATAL	An unexpected error has occurred, check errno.

Description

pcvGetTrdIndex() searches the trend database for a trend which matches the characteristics specified. If an exact match for the trend resolution is not found, it will return the index of the trend with the closest resolution.

Errors

ENODBA	Invalid index.
EINVAL	Data pointer is NULL.
ENOSERVER	Trend server is not running.
ENODAEMON	Mail manager is not running.

pcvGetValues()

Retrieves tag value information.

C Synopsis

```
#include <pcvDServ.h>
int pcvGetValues(TagIndex index, float *value,
      TagStatus *status, float *alarm, char *euls,
      Bool *dig, u_char *dec, TagQuality *quality)
```

Arguments

index	Tag index.
value	Pointer to floating point storage for value.
status	Pointer to TagStatus storage for status of value.

Table 4-11. Tag Status Codes Set By pcvGetValues()

Code	Type Description
0	No Alarm.
1	Alarm (Boolean).
2	Bad Quality.
3	Out of Service.
4	High.
5	Low.
6	High Deviation.
7	Low Deviation.

alarm	Pointer to floating point storage for alarm value.
euls	Pointer to character storage for engineering units (analog type tags), or logic state descriptor (discrete-state tags).
dig	Pointer to Boolean storage for the digital type flag. Set to TRUE if tag is a digital point.
dec	Pointer to unsigned character storage for the decimal precision.
quality	Pointer to TagQuality storage for quality of value. The following Table shows all quality codes with descriptions:

Table 4-12. Tag Quality Codes Set By pcvGetValues()

Code	Type Description
0	Good.
1	Bad.
2	Disestablished.
3	Substituted.
4	Suspect.
5	Alarm Inhibited (auto).
6	Alarm Inhibited (group).
7	Alarm Inhibited (manual).

Return Value

BCI_OK	Success.
BCI_WARN	Point not established, invalid data might be returned.
BCI_FATAL	An unexpected error has occurred, check errno.

Description

pcvGetValues() will return tag values including: value, alarm status, alarm value, engineering unit or logic state descriptor, discrete-state tag indicator, and decimal precision.

Errors

EDISEST	Tag has not been established.
ENODBA	Invalid index.
ENOSERVER	Database server is not running.
ENODAEMON	Mail manager is not running.

pcvGetVitals()

Retrieves the vital statistics for a given tag.

C Synopsis

```
#include <pcvDServ.h>
int pcvGetVitals(TagIndex index, char *tag,
    char *desc, float *value, TagStatus *status,
    float *alarm, char *euls, Bool *dig,
    u_char *dec, TagQuality *quality)
```

Arguments

index — Tag index to get stats for.

tag — Pointer to character string storage for tag name, maximum 15 characters.

desc — Pointer to character string storage for tag descriptor, maximum 33 characters.

value — Pointer to floating point storage for value

status — Pointer to TagStatus storage for status of value. The following Table lists all status codes with descriptions.

Table 4-13. Tag Status Codes Set By pcvGetVitals()

Code	Type Description
0	No Alarm.
1	Alarm (Boolean).
2	Bad Quality.
3	Out of Service.
4	High.
5	Low.
6	High Deviation.
7	Low Deviation.

alarm — Pointer to floating point storage for alarm value (if in alarm).

euls — Pointer to character string storage for tag engineering units or logic state descriptor buffer.

dig — Pointer to Boolean storage for digital indicator; TRUE if digital.

dec — Pointer to unsigned character storage for number of decimals defined.

quality — Pointer to TagQuality storage for quality of value. The Table 4-14 shows all quality codes with descriptions.

Table 4-14. Tag Quality Codes Set By pcvGetVitals()

Code	Type Description
0	Good.
1	Bad.
2	Disestablished.
3	Substituted.
4	Suspect.
5	Alarm Inhibited (auto).
6	Alarm Inhibited (group).
7	Alarm Inhibited (manual).

Return Value

BCI_OK	Success.
BCI_WARN	Point not established, invalid data might be returned.
BCI_FATAL	An unexpected error has occurred, check errno.

Description

pcvGetVitals() will return the vital tag information from the tag database.

Errors

EDISEST	Tag has not been established.
ENODBA	Invalid index.
ENOSERVER	Database server is not running.
ENODAEMON	Mail manager is not running.

pcvOutputToStn()

Function to allow applications to set values for station type tags. This function will check the computer mode of the station before any values are sent. Note that the value will only be sent if the station is in computer mode.

C Synopsis

```
#include <pcvDServ.h>
int pcvOutputToStn(TagIndex index, float value,
u_char parm)
```

Arguments

index	Tag index.
value	Floating point target value.
parm	1 to output set point, 2 to output ratio index, 3 to output control output.

Return Value

BCI_OK	Success.
BCI_WARN	Operation was performed but may be suspect, check errno.
BCI_ERROR	An expected error has occurred, check errno

	BCI_FATAL	An unexpected error has occurred, check errno.

Description pcvOutputToStn() sends the given value to the station tag if the station is in computer mode. The parm argument specifies whether the value is sent to the station's set point, ratio index, or control output.

Errors

ENODBA	Invalid index.
EINVAL	Invalid argument.
EDISEST	Tag has not been established.
ENOSERVER	CIU SCAN server is not running.
ENODAEMON	Mail manager is not running.

pcvReadTrendData()

Retrieves selected amounts of unsigned collected trend data for a given trend index.

C Synopsis

```
#include <pcvDServ.h>
int pcvReadTrendData(TrendIndex tindex,
      time_t time, time_t res, unsigned number,
      float *data)
```

Arguments

tindex	Trend index number (1-n).
time	Starting date/time (linear date format).
res	Sample interval in seconds.
number	Number of samples to return.
data	Storage for floating point trend values.

Return Value

BCI_OK	Success.
BCI_FATAL	An unexpected error has occurred, check errno.

Description pcvReadTrendData() will return selected amounts of trend data for a trend index.

Errors

ENODBA	Invalid index.
EINVAL	Data pointer is NULL.
ENOSERVER	Trend server is not running.
ENODAEMON	Mail manager is not running.

pcvSendStaMode()

Sets the station mode using the passed and mode parameter.

C Synopsis

```
#include <pcvDServ.h>
int pcvSendStaMode(TagIndex index, TagMode mode)
```

Arguments

index	Tag index.
mode	The following parameters apply:

Table 4-15. Station Modes Set By pcvSendStaMode()

Code	Type Description
0	local manual.
1	local auto.
2	local cascade/ratio.
3	computer manual.
4	computer auto.
5	computer cascade/ratio.
6	local level.
7	computer level.
8	computer backup state.
9	computer OK.
10	previous state.

Return Value

BCI_OK	Success.
BCI_FATAL	An unexpected error has occurred, check errno.

Description

pcvSendStaMode() will set the station mode using the passed tag index and mode parameter. (Note: This function should be used normally.) See the ***pcvOutputToStn()*** function and ***USING STATION TAGS WITH CAT*** in Section 3, for details.

Errors

ENODBA	Invalid index.
ENOSERVER	CIU SCAN server is not running.
ENODAEMON	Mail manager is not running.

pcvSendTagValue()

Sets the tag value, state, or mode.

C Synopsis

```
#include <pcvDServ.h>
int pcvSendTagValue(TagIndex index, float value,
       TagState state)
```

Arguments

index	Tag index.
value	The target value.
state	The target state or mode.

Station:
1 setpoint value
2 ratio index value
3 control output value

RCM:
1 sustain reset state
2 sustain set state
5 pulse reset state
6 pulse set state

DD:
8 automatic mode
4 manual mode
2 set state
1 reset state

MSDD:
8 automatic mode
4 manual mode
3 3 state
2 2 state
1 1 state
0 0 state

Return Value

BCI_OK	Success.
BCI_FATAL	An unexpected error has occurred, check errno.

Description

pcvSendTagValue() will set the tag value using the passed tag index, value, and state.

Errors

ENODBA	Invalid index.
ENOSERVER	CIU SCAN server is not running.
ENODAEMON	Mail manager is not running.

CAUTION

This function should not be used with station type tags. See the *pcvOutputToStn()* function. Also see *USING STATION TAGS WITH CAT* in Section 3.

SECTION 5 - PORTING CAT APPLICATIONS

PORTING FROM QNX2 TO QNX4

Porting any user applications, whether they use the Custom Application Toolkit (CAT) or not, require changing from the Computer Innovations C86® compiler to the WATCOM C compiler. Since these are both "C"-language compilers, porting simple applications that don't use CAT could be as straightforward as recompiling using the new compiler. Applications that make use of some of the more advanced language tools, such as terminal I/O, message passing, etc., will require the person doing the port to become familiar with the POSIX syntax supported by the WATCOM compiler.

The ***QNX Migration Guide - Moving from QNX 2.1 to QNX 4.0***, has been included with the Custom Application Toolkit to aid in the port to QNX4. It contains an in depth discussion of language and operating system porting issues.

Translating CAT Header Files and Functions

The CAT package uses different header files and function names from previous releases. Below are tables which allow translation from the old names to the new.

Table 5-1. Header File Translations

Old Header Name	New Header Name
almcmmt.h	pcvAlmCmmt.h
c_serv.h	pcvCiuServ.h
d_serv.h	pcvDServ.h
d_size.h	pcvDSize.h
ibm.h	ibm.h
lazy_types.h	bciTypes.h
t_serv.h	pcvTrdServ.
h t_size.h	pcvTSize.h
tag_type.h	pcvTagType.h
trd_scan.h	pcvTrdScan.h
trend.h	pcvTrend.h

Table 5-2. Function Name Translations

Old Function Name	New Function Name
get_dd_values	pcvGetDdValues
get_msd_values	pcvGetMsdValues
get_pri_disp	pcvGetPriDisp
get_sta_modes	pcvGetStaModes
get_statics	pcvGetStatics
get_rcm_values	pcvGetRcmValues
get_tag_almval	pcvGetTagAlmval
get_tag_default	pcvGetTagDefault
get_tag_desc	pcvGetTagDesc
get_tag_eu	pcvGetTagEu
get_tag_index	pcvGetTagIndex
get_tag_loc	pcvGetTagAddr
get_tag_ls	pcvGetTagLs
get_tag_name	pcvGetTagName
get_tag_type	pcvGetTagType
get_tag_value	pcvGetTagValue
get_values	pcvGetValues
get_vitals	pcvGetVitals
output_to_stn	pcvOutputToStn
read_trd_data	pcvReadTrendData
send_sta_mode	pcvSendStaMode
send_tag_value	pcvSendTagValue

Porting Utility

To assist in porting applications from QNX2 to QNX4, a porting function, *portfix*, is supplied with the CAT package. To run this program, type:

/usr/bin/portfix *<filename>*

where filename is the name of your old "C" application program file. *portfix* will modify your file, where possible, to conform to QNX4 and the new CAT function names. Your old file is renamed, with a "-" character at the end of the filename.

For example, if you have copied your old application programs to "/usr/cat/mydir", and your program name is "myprog.c", type:

cd /usr/cat/mydir
/usr/bin/portfix myprog.c

This will copy “myprog.c” to “myprog.c-”, and create a new version of “myprog.c” which has been updated to conform to QNX4 and CAT.

portfix is provided only as a “first step” in the porting process. It will not change any software logic or make any additions or deletions. *portfix* will only translate old function and file names into new ones.

CAUTION	**Always check the source code for your program after running portfix, to make sure no incorrect translations have taken place. You may still have to make additional changes to your software before it will compile and run properly.**

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