

New Technical Notes

Macintosh



Developer Support

CD-ROM Notes (Most Excellent) Devices

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This Technical Note discusses issues concerning the use of the AppleCD SC drive, the Apple CD-ROM device driver, and the Foreign File Access software extension.

Multiple CD-ROM Drives

Your application can get access to the driver by calling the Device Manager routine `_OpenDriver`:

```
osErr = OpenDriver("\p.AppleCD", &ioRefNum);
```

`_OpenDriver` returns the driver reference number for the AppleCD SC drive with the lowest SCSI bus number, and this is okay if you are going to control only one AppleCD SC drive. If you want to control or access more than one drive, you must compute the driver reference number yourself. You can use the following formula to compute SCSI driver reference numbers:

$$(32 + \text{SCSI ID}) - 1$$

The following code demonstrates how to open any AppleCD SC drive connected to a Macintosh. `OpenCD` takes a logical CD drive number, not a SCSI ID, as the input parameter `CDDrive`. A logical CD drive number of one refers to the AppleCD SC drive with the lowest SCSI ID connected to the Macintosh.

```
typedef struct WhoIsThereRec {
    ParamBlockHeader
    short      ioRefNum;
    short      csCode;
    struct {
        Byte    fill;
        Byte    SCSIMask;
    } csParam;
} WhoIsThereRec;

OSErr OpenCD(Byte CDDrive, short *ioRefNum) {

    auto      OSErr      osErr;
    auto      short      ioRefNumTemp;
    auto      short      CDDriveCount;
    auto      short      SCSIID;
    auto      WhoIsThereRec *pb;
```

```
pb = (WhoIsThereRec *) NewPtrClear(sizeof (*pb));
osErr = MemError();
if (0 != pb && noErr == osErr) {
    osErr = OpenDriver("\p.AppleCD", &ioRefNumTemp);
    if (noErr == osErr) {
        (*pb).ioRefNum      = ioRefNumTemp;
        (*pb).csCode        = csWhoIsThere;
        osErr = PBStatus((ParmBlkPtr)pb, false);
        if (noErr == osErr) {
            CDDriveCount = 0;
            for (SCSIID = 0; SCSIID < 7; ++SCSIID) {
                if (BitTst(&(*pb).csParam.SCSIMask, 7-SCSIID)) {
                    ++CDDriveCount;
                    if (CDDrive == CDDriveCount) {
                        *ioRefNum = -(32 + SCSIID) - 1;
                        DisposPtr((Ptr) pb);
                        return noErr;
                    }
                }
            }
            osErr = paramErr;
        }
        DisposPtr((Ptr) pb);
    }
    return osErr;
}
```

Device Manager Routines and Parameter Blocks

The Apple CD-ROM driver does not conform to the design criteria of the Device Manager, so do not use high-level Device Manager calls, because they do not work. Mistakenly, status calls are used to change control settings of the device, and control calls are used to get status information of the drive. The high-level `Control` and `Status` calls do not anticipate this implementation and simply do not work; instead, use the low-level `_PBControl` and `_PBStatus` calls for all access to the drive.

Zero parameter blocks before using them. The unused bytes of the parameter blocks must be set to zero before you can use the parameter block in `_PBControl` or `_PBStatus` calls to the driver. Failure to zero the blocks results in the Device Manager calls returning an unexpected `ioResult` of `paramErr` (-50).

Binary Coded Decimal

The AppleCD SC driver communicates track numbers and absolute-minutes-seconds-frame addresses in what is known as Binary Coded Decimal (BCD) format. In BCD, every four bits are used to represent one decimal digit. When working with the AppleCD SC, the BCD values are only up to two digits in length, “99” tops. Table 1 illustrates some possible values and their representation in 2’s complement and Binary Coded Decimal form.

BCD			Value 2's Complement		
Hex Binary			Hex	Binary	
0x01	00000001	1	0x01	00000001	
0x09	00001001	9	0x09	00001001	
0x10	00010000	10	0x0A	00001010	
0x80	10000000	80	0x50	01010000	
0x99	10011001	99	0x63	01100011	

Table 1—BCD and 2' Complement Value Comparison

To convert from a 2's Complement number to a BCD number, take the value of the digit in the ten's place, store it in the leftmost four bits of a byte, then add to it the value of the digit in the one's place.

```
Byte Decimal2BCD(Byte n) {  
    return ((n / 10) << 4) + (n % 10);  
}
```

Converting from BCD to decimal requires multiplying the value in the leftmost four bits by 10 and adding the value of rightmost four bits to the result.

```
Byte BCD2Decimal(Byte n) {  
    return ((n >> 4) * 10) + (n & 0x0f);  
}
```

Block Addresses

Physical blocks on a Compact Disc are defined as being 2K bytes in size. Since the Macintosh operating system likes to work in 512-byte blocks, it sets the logical block size to 512 bytes. If you assume 2K blocks when using block addresses, you get into trouble. If you are going to access the drive using logical block addressing, either change the block size back to 2K or be sure the formula you use in conversion from an absolute-minutes-seconds-frames address to a logical-block address takes this difference into account.

Foreign File Access And The 'sysz' Resource

Large capacity ISO and High Sierra format discs can overload the default memory limits of Apple's current external file system software, Foreign File Access. (This is not a problem for HFS-formatted CD-ROM discs, since the File Manager deals directly with native volumes, bypassing the Foreign File Access software.)

Since unused memory reserved by Foreign File Access at INIT time cannot be reclaimed, Apple limited the amount of memory that is available to Foreign File Access. The Foreign File Access file contains a 'sysz' resource that reserves 71,680 bytes in the system heap. If the 'sysz' is too small discs do not mount, but if it is too big it wastes precious memory. Using the default 'sysz' value, Foreign File Access cannot handle a CD-ROM with an

extremely large number of files and directories. In addition, with multiple AppleCD SC drives connected, Foreign File Access may run out of memory if multiple ISO or High Sierra CD-ROM discs are mounted.



Figure 1—Apple CD-ROM Driver and Foreign File Access Software

Using ResEdit, you can experiment by changing the 'sysz' resource to find the optimal value for your disc's requirements. To avoid wasting valuable space in the System heap, increase this value incrementally until your disc mounts (after you reboot, of course). Asking your users to understand ResEdit or perform this operation is asking a bit much, so following is code upon which you could base a simple application to change the 'sysz' value automatically for them. Remember that this application would need to be shipped separately (i.e., it is not accessible from the CD-ROM if the CD-ROM cannot be mounted).

This code assumes the creator and file type of the Foreign File Access file to be `ufox` and `INIT` respectively. It prompts the user to locate Foreign File Access using the Standard File Package routine `_SFGGetFile`. This example does not allow the 'sysz' value to be made smaller than Apple's default setting.

Note: You should not assume that Foreign File Access can be found in the System Folder; the Foreign File Access software resides in the Extensions folder when running System Software 7.0. Give the user the opportunity to find the file using a standard file dialog box.

```
char    *prompt    = "Find 'Foreign File Access'";
pascal Boolean FilterProc(HParmBlkPtr paramBlk) {
return 'ufox' == (*paramBlk).fileParam.ioFlFndrInfo.fdCreator ? false : true;
}

OSErr Modify_sysz(long size) {
    auto    OSErr      osErr;
    auto    SFReply     reply;
    auto    Point       where;
    auto    OSType       type;
    auto    short        resRefNum;
    auto    long         **sysz;
    osErr = noErr;
    SetPt(&where, 100, 100);
    type = 'INIT';
    SFGGetFile(where, prompt, FilterProc, 1, &type, nil, &reply);
    if (reply.good) {
        resRefNum = OpenRFPPerm(reply.fName, reply.vRefNum, fsRdWrPerm);
        osErr = ResError();
        if (-1 != resRefNum) {
            sysz = (long **) Get1Resource('sysz', 0);
            osErr = ResError();
            if (nil != sysz) {
                if (0x00011800 < size) {
                    **sysz = size;
                }
            }
        }
    }
}
```

```
        ChangedResource((Handle) sysz);
        osErr = ResError();
    }
    CloseResFile(resRefNum);
}
return osErr;
}
```

Mixing Data and Audio

Any time the System, Finder, an application, or another code resource (e.g., XCMDs) accesses a disc, any sound being played from the disc is interrupted.

Further Reference:

- AppleCD SC Developers Guide, Revised Edition