Significant new features for APLSV!

Special Reference Issue
JOT DOT TIMES...
DON'T LEAVE HOME
WITHOUT IT!
The text for this newsletter was entered on an APL-featured 3277 video terminal, and edited and composed by a set of APL functions called *The APL Text Machine*. The master pages were then typed by the computer on a mag-card terminal ("Cardinal"), using Scribe, Light Italic, and APL typing elements. The headings for the articles were then applied to the masters using commercially-available transfer lettering. The interleaving of dual fonts was handled by the Text Machine without the need for cut-and-paste.

While several people have suggested photo-composer methods for the text, it is important to us to keep the newsletter itself as an example of the type of document that any of our users could produce on their own subjects.

The illustrations scattered throughout the newsletter (including the cover) were created between 1850 and 1925, originally appearing in newspapers, advertisements, and periodicals.

**Some production notes**

The illustrations scattered throughout the newsletter (including the cover) were created between 1850 and 1925, originally appearing in newspapers, advertisements, and periodicals.

**Jon McGrew**

Wordsmith

*Cover Portrait: Could this be APL's own Adin Falkoff, shown here trying desperately to make some sense out of the Jot·Dot·Times' Picture Format article?*
3. **TERMINALS**: Terminal users are responsible for ensuring that:

- Terminals are connected to IBM computers or IBM terminals only for the purpose of conducting internal IBM business and are under IBM control or are in compliance with the control requirements of terminals not under IBM control;
- Registered IBM Confidential and IBM Confidential-Restricted information are not received by or entered into terminals not under IBM control;
- Terminals, while unattended, are protected from unauthorized use;
- Dial terminals, while connected, are attended or otherwise protected;
- Permanently connected terminals, while logged on, are attended or otherwise protected, and
- Telephone numbers for computer dial ports are not posted for general view.

* * *

[This instruction replaces Corporate Information Systems Instruction 2-109A, dated January 1, 1978]
C. USER

1. GENERAL REQUIREMENTS: Users of IBM's data processing assets are responsible for compliance with security requirements and for compliance with control requirements specified by owners and by suppliers of services.

Data processing output is owned by the requesting user, unless other arrangements are made. Users who generate passwords are the owners of the passwords. Information classification and control procedures apply in these cases.

User management must ensure that owners of IBM's classified information or suppliers of services, as appropriate, are notified upon termination of the user's business need for use of the information, services, or facilities.

2. ACCESS CONTROLS: The following access control requirements apply to users.

Verification passwords and user identifiers that serve as verification passwords must not be shared, and they must be:

- Classified at least IBM Confidential and controlled accordingly, with particular attention to terminal entry, terminal display, and recording.

- Deactivated in the event of known or suspected compromise, and the supplier of services notified.

Information access passwords and cipher keys used as information passwords must be:

- Assigned the classification of the associated information and controlled accordingly, with particular attention to terminal entry, terminal display, and recording.

- Controlled so that all persons to whom they have been disclosed are known to the owner or administrator.

- Administered so that the owner or administrator is notified in event of known or suspected compromise of passwords.

Preface

This is the Fall 1980 Edition of The JotoDot Times, published somewhat sporadically by the Kingston SCD APLSV Support Group. A copy is being sent to each of our customers.

This particular issue has been in the works for a long time. We regret the delay in getting it to you, and we hope that you will find the features described here to be worth the wait.

We value your thoughts on this newsletter. If you have any comments or suggestions regarding either the newsletter or our service, please let us know. There is a Feedback form attached to the outside of the newsletter, and we have included some of the quotable quotes from the Feedback forms that we received from the previous newsletter.

Your comments can often help to mould future issues and future offerings on APL. Many of the facilities that we have offered in the past are a direct result of comments that were sent in on newsletter Feedback forms. Please, let's hear from you!

The Kingston APLSV Support Group
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Please return this change form to us if any of your billing or
mailing information (division, location, manager, APL users in
your problem number, etc.) is incorrect. We must have current
information for all APL users.

| **** Do not write inside this block **** |
| New Prob # _____ | TA Info | Old Prob # _____ |
| Action Date | Letter | Directory |

Return to: IBM Corporation, SCD APL Administration,
63C 002, Kingston, NY 12401 (8-373-1234)

** Registered IBM Confidential Data is not supported **

IBM Data Processing services and resources
are to be used for IBM business only

- Issue new sign-on password (don't use this form for
new applications)
- Change
- Delete sign-on (*only these fields are required)

Manager Information:
Manager
Division Dept Bldg

Location (city)
Tie-line/extension

Manager's serial number* Signature of manager* Date*

User Information:
Sign-on number* User name* Tie-line/extension

Division Dept Bldg Location (city) User's serial number

Accounting Information: (Kingston, Poughkeepsie, Charlotte,
Raleigh, and Burlington users only)
DIV Maj Act Project Box Dept. charged

Billing location (city) Coordinator's signature

[To list coordinators, ")LOAD 1 FORMS" and type "COORDINATOR"]
Application for a new account on Kingston APLSV

Manager to be billed________ Manager's serial____
Div/Dept____/____ Bldg____ Loc.____ and ext.

External mailing address (please include ZIP code)

** Registered IBM Confidential data is not supported **

IBM Data Processing services and resources are to be used for IBM business only

Serial Number User name Location (City) Div/Dept Bldg and ext.

Is applicant a regular full-time IBM employee? □ Yes □ No

Bill to this existing I.T.S. problem number _________

Issue a new problem number? ______ Billing location _________

Kingston, Poughkeepsie, Charlotte, and Raleigh personnel please provide the following information for a new problem number:

Div___ Maj___ Act___ Proj___ Box___ Dept charged____

Signature of manager ______ Date ______ Signature of Data Processing Services Coordinator

[To list coordinators, "LOAD 1 FORMS" and type "COORDINATOR"]

The application cannot be processed unless the above signatures have been satisfied.

Note: When we add your new account to the Kingston APLSV system, a verification letter will be SENT TO YOUR MANAGER. The letter will contain your new account number and password, sign-on telephone numbers, and general information. IT IS THEN UP TO YOUR MANAGER TO FORWARD THIS INFORMATION TO YOU. These memos are normally mailed within one week from the time that we receive your application.
Kingston APLSV Assistance Numbers

**APL Hotline** [Administration, Programming, Management, Operations, Line Services] ...... 373-1234

**APL Administration** ....................................... 373-1234  
(Vince Dougherty and Millie Bartsch)

System Status Recording ........................................ 373-7817

Line Status Recording ......................................... 373-4407

**WHO'S WHO in Kingston APL**

Interactive Terminal Systems Manager - Bill Davis .... 373-4652
ITS Secretary - Rhonda Johnson ......................... 373-1299

Planning and User Support Manager - Chuck Norcutt ... 373-2471
**APL User-Support Programmer** - Mike Harellick ...... 373-2405
**APL User-Support Programmer** - Mike Higgs ............ 373-2254
**APL User-Support Programmer** - Joe Traina .......... 373-1365

System Support Manager - John Brink ...................... 373-4294
MVS/JES3 System Programmer - Ken Jonas ................. 373-1198
MVS/JES3 System Programmer - John Opalach ............. 373-6775
**APL System Programmer** - Mike Van Der Meulen .......... 373-1082

Administration & Operations Manager - Tom Dederick ... 373-6413
Console Operators ............................................. 373-5661
Control Centre (ws & file transfers) - Rich Dill ...... 373-6772
**APL Administrator** - Vince Dougherty ................. 373-1234
**APL Administrator** - Millie Bartsch .................. 373-6536 or -1234

2nd shift Operations Manager - Skip Frasier ............. 373-6966
Console Operator - on rotation ......................... 373-6661 or -6837

3rd shift Operations Manager - Don Miller ............... 373-6966
Console Operator - Hank Adams ......................... 373-6661 or -6837

Manager of the Tape Library - Walt Hackett ............. 373-7343
Tape Library - Morgan Moore ............................... 373-6673

Network Services Manager - Ivan Pece .................... 373-7839
Telephone line problems - Wilma Quick .................. 373-7891

Time Accounting Manager - Ed Goodman .................. 373-4049
Billing information - Marguerite Lasher ................. 373-4222
Billing information - John Offermann ................... 373-2691

---

Call for papers: APL81

An international APL conference is being planned for next year by the Association for Computing Machinery (ACM). "APL81" will be held in San Francisco, California, October 21-23, 1981.

Technical papers on all aspects of APL, including the following areas, are solicited:

- APL applications (all areas)
- APL -- the language
- APL implementations (large and small systems)
- APL in education
- APL in business
- APL interfaces with other software systems
- APL system organization and management
- APL compared to other languages

Both abstracts and full papers will be refereed and authors should submit these documents to the program chairman in accordance with the following schedule:

<table>
<thead>
<tr>
<th>Date Due</th>
<th>Author Notification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstracts</td>
<td>October 1, 1980</td>
</tr>
<tr>
<td>Full Papers</td>
<td>February 1, 1981</td>
</tr>
</tbody>
</table>

Final copies of complete papers must be received by the program chairman by June 15, 1981 for inclusion in the conference proceedings and for presentation at the conference.

Further information may be obtained from:

- Ray Polivka (Vice-chairman of STAPL)  
  HM1 706  
  Poughkeepsie, NY (IBM Internal Mail)  
  T/L 253-3216 or 914/463-3216

- Richard J. Orgass (Program Chairman)  
  APL81  
  Xerox Corporation  
  1350 Jefferson Road  
  Rochester, NY 14623

- Eugene R. Mannacio (Program General Chairman)  
  APL81  
  900 North Point Street  
  San Francisco, CA 94109
UG12: Disk Storage Device Capacities

<table>
<thead>
<tr>
<th>Device</th>
<th>2314</th>
<th>3330/3330-II</th>
<th>3340</th>
<th>3344</th>
<th>3350</th>
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</thead>
<tbody>
<tr>
<td>Bytes/track (unit size)</td>
<td>7294</td>
<td>13,030</td>
<td>8368</td>
<td>8368</td>
<td>19,069</td>
</tr>
<tr>
<td>Tracks/Cylinder</td>
<td>20</td>
<td>19</td>
<td>12</td>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td>Bytes/Cylinder</td>
<td>145,880</td>
<td>247,570</td>
<td>100,416</td>
<td>100,416</td>
<td>572,070</td>
</tr>
<tr>
<td>Cylinders/Volume</td>
<td>200</td>
<td>404/808</td>
<td>348/696</td>
<td>2784</td>
<td>555</td>
</tr>
<tr>
<td>Bytes/Volume (millions)</td>
<td>29</td>
<td>100/200</td>
<td>35/70</td>
<td>280</td>
<td>317</td>
</tr>
</tbody>
</table>

Introduction

This issue of the *Jote-Dot Times* is our Special Reference Issue. So what's that? Well, we have discovered that once we have studied the *APL* manuals, we kind of understand what's going on, so we don't really have to carry a stack of manuals with us all of the time. But no way are we ever going to memorize all of the reference tables in those manuals! So, here we are, still carrying all of those manuals around. It would be nice (as us) if we could gather together all of the commonly-needed charts and tables into one convenient handbook, and keep that around. Aha... lucky us; here it is. [applause]

Publishing all of these learned-looking tables also gives us an academic air; perhaps some folks will even be deluded into thinking that we wrote them. Better and better. Besides, you see, what we have here is clearly a most impressive piece of technical research and compilation (as opposed to the shoddy piece of plagiarism that you probably first assumed it to be).

True, the text is ours. There's no escaping that admission. However, if the truth be known (and it probably will be), we swipe the tables. But what the hey, you know? "The Knowledge of The Universe Can Be Yours, Through Plagiarism." [You can quote us on that.] Most of them came from The *APL* Language Manual (GC26-3847) and The *APL* Version 3 User's Guide (SH20-9087). The tables have, in many instances, been modified so that they more properly reflect local conventions on Kingston *APLSV*; they therefore do not necessarily show a true picture of life on other systems. Other manuals are recommended on the "General Information" page; all of them can be ordered internally from Mechanicsburg. If you don't already have each of these manuals, you should order them. They are really quite helpful. While this issue will hopefully mean that you won't have to carry the manuals around all of the time, everyone needs to refer to the text sometimes, and the manuals are still very good reference manuals to have available.

As this issue is being published, quite a few new system enhancements are being installed. It's always quite a pleasure to be able to report the new goodies as they become available. There have been on-going enhancements in the past, both from the *APLSV* Central Support Group and from The *APL* Design Group, but most of what has been released in the past couple of years hasn't been visible to you as a user... these changes have been system speed-ups and measurement tools for those of us that supply the *APL* service. You may not have noticed those changes, although with the increased *APL* workloads you would have noticed the lack of them if they hadn't been installed. But now we have what we expect will be some very popular new system changes, all quite visible.
Operating Schedule for Kingston APLSV

<table>
<thead>
<tr>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Downtimes:

- 12-2am
- 12-2am
- 12-2am
- 12-2am
- 2-7am

Time is shown as:

- Up and attended
- Up, but unattended
- 4:30pm

***On the 2nd Sunday of each month, APLS will be down for maintenance, typically 8am-5pm***

--- Changes to this schedule will be broadcast at least one day in advance ---

Please note that this schedule is the normal weekly schedule for the Kingston APLSV systems... it does not take into account any special scheduling due to holidays, etc. For schedule exceptions, "LOAD 1 NEWS" and type "SCHEDULE".

---
System configuration

Here's a brief rundown of our current system configuration. This list will be periodically updated as things change... "LOAD i 1 SYSTEM" for a current listing. At publication time, the listing looks like this:

IBM Corporation, SCD, Kingston, NY

Host: MVS/JES3, Rel 3.8
APL: APLSV IC4 IR3

[Internal Consolidation Release 4, Incremental Release 3]
(Program No 5799-AQC, modified for internal use)

TSIO: IC4 IR3

<table>
<thead>
<tr>
<th>System N</th>
<th>System H</th>
<th>System L</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU</td>
<td>Sys/370 168</td>
<td>Sys/370 168</td>
</tr>
<tr>
<td>Main storage</td>
<td>8 megabytes</td>
<td>8 megabytes</td>
</tr>
<tr>
<td>Jobs on System</td>
<td>APL (100%)</td>
<td>APL (100%)</td>
</tr>
<tr>
<td>Batch</td>
<td>(15%)</td>
<td>Bath</td>
</tr>
</tbody>
</table>

All workspaces and files are common to all three systems.

Workspace size:

[measured as \[\text{WA after CLEAR}\]]: 169,276 bytes
[maximum overall size]: 173,376 bytes

Permanent storage:
APL: 3330 Mod 11 disks
TSIO: 3330 Mod 11 disks

Terminals supported:

Dial-up
+-Start/Stop-+- BSC/SDLC (as appropriate)
Line speed: 134.5 300 1200 4800-baud
2741, 1651, MCST: x
5100, 5110, 5120: x x
3767: x x
Tektronix 4013/4015: x x x
Most 32xx devices: x
OEM terminals with
Correspondence or > x x
BCD line codes /

APL print train:

APLFULL

APL usage rates for 1980:

Connect time: $ 4.25/hour
CPU time: $ 21.00/CPU minute
Storage: $ .02/track/week [1 track=13,030 bytes]
TSIO surcharge: none (all users are given TSIO capability)
General information

APL typeball (Correspondence) ............... Part Number 1167987
(BCD/EBCD) ....................... Part Number 1167988

APL keyboard stickers ..................... Form Number GX20-1783

The following manuals may be ordered from the Mechanicsburg
Distribution Centre:

- GH20-0689 APL/S360 Primer [old but good beginner's manual]
- GC26-3847 APL Language [reference manual]
- SR20-7183 APL - An Introduction (textbook) [lessons]
- G320-6103 APL Programming Guide [a "how-to" reference]
- S320-5996 The APL Handbook of Techniques [reference]

For information about our system, we recommend the following
workspaces:

- LOAD 1 NEWS .......... General info, system schedule; should be
  checked DAILY for news of system changes
- LOAD 1 ACCOUNT .... Billing and quota information
- LOAD 1 AIDS .......... Contains "ALLOCATE"... the only way to
  create a permanent dataset, and other
general aids.
- LOAD 1 CATALOG .... Locations of Public Library info
- LOAD 1 FILELIB ... Info about your files (if any)
- LOAD 1 FORMS .... Forms for requesting a new APL account,
or for changing the billing/mailing info
  for an existing account
- LOAD 1 PHONES .... A complete and current list of phone
  numbers that you can use for signing on
- LOAD 1 SYSTEM .... Technical data about our system

Typing "DESCRIBE" after loading each workspace will give you
complete information on how to use that workspace.

For APL self-education, we recommend:

- LOAD 45 INDEX .... Library 45 contains a package of 54 APL
  lessons. This workspace gives a course
description.
- LOAD 45 LESSON1 .... The first of 54 APL lessons

UG13: Track Lengths and Block Sizes

<table>
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<th>Blocks per Track</th>
<th>Bytes per Block</th>
<th>% Utilization</th>
<th>Bytes per Block</th>
<th>% Utilization</th>
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<tr>
<td>24</td>
<td>199</td>
<td>65</td>
<td>413</td>
<td>76</td>
<td>188</td>
<td>54</td>
<td>617</td>
<td>78</td>
</tr>
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<td>25</td>
<td>187</td>
<td>64</td>
<td>391</td>
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<td>52</td>
<td>585</td>
<td>77</td>
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<td>26</td>
<td>176</td>
<td>63</td>
<td>371</td>
<td>74</td>
<td>161</td>
<td>50</td>
<td>555</td>
<td>76</td>
</tr>
<tr>
<td>27</td>
<td>166</td>
<td>61</td>
<td>352</td>
<td>73</td>
<td>149</td>
<td>48</td>
<td>528</td>
<td>75</td>
</tr>
<tr>
<td>28</td>
<td>157</td>
<td>60</td>
<td>335</td>
<td>72</td>
<td>137</td>
<td>46</td>
<td>502</td>
<td>74</td>
</tr>
<tr>
<td>29</td>
<td>148</td>
<td>59</td>
<td>318</td>
<td>71</td>
<td>127</td>
<td>44</td>
<td>478</td>
<td>73</td>
</tr>
<tr>
<td>30</td>
<td>139</td>
<td>57</td>
<td>303</td>
<td>70</td>
<td>117</td>
<td>42</td>
<td>456</td>
<td>72</td>
</tr>
</tbody>
</table>

UG13: Track Lengths and Block Sizes
A new facility for tracking file usage

A new Public Library workspace is now available for tracking the usage of your datasets: \texttt{LOAD 1 SMF}. \texttt{APL} has for some time kept track of who accesses each dataset; this is gathered as SMF (System Monitoring Facility) Data. We have had requests in the past to recover information about who was using a particular file, often to help in tracing a suspected security breach. This data is now easily available to all of the users of Kingston \texttt{APLSV}. This workspace retrieves data showing a summary of accesses to each of your files during the past week.

Its usage looks like this:

```
)LOAD 1 SMF
SAVED 16.11.05 08/27/80
SMF
***FILE DATE IS 08/23/80 THRU 08/29/80
SHOW DSN 'MYWORK'
ACCOUNT ACC EXCP BYTES DSN
1234 9 27 351,810 12345 MYWORK
1234 9 28 1,221 7,871,787 12345 MYWORK
1234 9 32 416,960 12345 MYWORK
```

The data is summarized by filename and accessing account number. No attempt is made to show every access to your files, minute by minute, since the resultant listing could be very cumbersome. And since most users need just the summary, we have done that part for you. If you \textit{DO} need the detailed entries to track a suspected security problem, we can get that data for you.

Some warnings and disclaimers

If you suspect a breach in the security of your application, or have any other need to pursue this information, make sure that you follow through on it during the week of the access in question... the data is replaced each Saturday. Due to the volume of the data, historic records are not kept on-line.

Next, the inevitable question of "who are all those people?". This can get sticky. As a general rule, we will NOT match up account numbers and names; that's considered to be quite privileged information, since it could be misused to gain access to another user's workspaces and datasets. However, we recognize the fact that some real security questions may come up on occasion that require such data. Therefore, any such request will be handled by management on an individual basis.
New facility for tracking your billing

A new workspace is now available for retrieving historical billing information for your account. Workspace 1 BILLING contains data for both this year and last year, and is updated weekly as the billing is run.

The functions in the workspace extract the data from our history files and allow you to generate your own reports, or if you wish to use our standard report format, the reports will look like this:

ACCOUNT NUMBER/NAME 12345 A USERNAME, BILLING NUMBER ABCD00K
USAGE BY: A USERNAME, ARC 003, PUNKATAWAY, PA (SUO) 8-555-1234
BILLED TO: M MATAGANNE, ARC 003, PUNKATAWAY, PA (SUO) 8-555-5678

END
DATE
01/04
01/11
01/18
01/25
02/01
02/08
02/15
02/22
02/29
03/07
03/14
03/21
03/28
04/04
04/11
04/18
04/25
05/02
05/09
05/16
05/23
05/30
06/06
06/13
06/20
06/27
07/04
07/11
07/18
07/25
08/01
08/08
08/15
08/22
08/29
09/05
09/12
09/19
09/26
10/03
10/10
10/17
10/24
11/01
11/08
11/15
11/22
11/29
12/06
12/13
12/20
12/27
01/04
01/11
01/18
01/25
02/01
02/08
02/15
02/22
02/29
03/07
03/14
03/21
03/28
04/04
04/11
04/18
04/25
05/02
05/09
05/16
05/23
05/30
06/06
06/13
06/20
06/27
07/04
07/11
07/18
07/25
08/01
08/08
08/15
08/22
08/29
09/05
09/12
09/19
09/26
10/03
10/10
10/17
10/24
11/01
11/08
11/15
11/22
11/29
12/06
12/13
12/20
12/27
1980: 271.01.40 1.53.56 $1.151.85 1.53.56
1980: 4.25/CONNECT HOUR, $ 21.00/CPU MINUTE, $ 0.02/TRACK/WEEK

The information provided from this workspace is from the same files that are used to produce the APL Monthly Utilization Reports, which are mailed to each billing manager every month. Those reports will continue to be sent out, since part of their raison d'etre is to keep the billing managers attuned to any abnormalities in the billing that they might not otherwise have noticed or checked (both for budgeting and security reasons).
As you have undoubtedly already noticed by this time, the workspace size for all Kingston APLSV users has been increased from 125,932 bytes to 169,276 bytes of user area, as measured by [2WA after ]CLEAR [173,376 bytes overall]. You will still have the same number of workspaces in your quota, giving you one-third more space (or, over twice the space that was available four years ago).

If you have an application which checks [2WA to determine how much data may be processed at one time, substantial improvements in performance could result automatically.

There is one concern which should be considered: moving an application to another APL system will require that you do not store more material in a workspace than the receiving system is prepared to accept. Our new workspaces can be transferred to other APLSV systems exactly as before, providing that you have not saved more material than they can fit in their workspaces. And remember, the material not only has to fit in the workspace, it has to run in the workspace. Contact us in APL support if you have any questions on considerations such as this.

Bigger workspaces

1. See Figure UG15.
2. Parameter value may be compound.
3. BLKSIZE is required for data sets that do not have standard labels.
4. (1000,(100,0)) for sequential data set, (1000,(100,0,5)) for partitioned data set.
Kingston APLSV Printer Output Classes

<table>
<thead>
<tr>
<th>Class</th>
<th>Print Train</th>
<th>Page Size</th>
<th>Chars/Inch</th>
<th>Type of Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>APLFULL</td>
<td>11x14</td>
<td>66x130</td>
<td>Normal APL output</td>
</tr>
<tr>
<td>I</td>
<td>APLFULL</td>
<td>11x14</td>
<td>66x130</td>
<td>IBM Confidential</td>
</tr>
<tr>
<td>A</td>
<td>GF12</td>
<td>8.5x14</td>
<td>66x156</td>
<td>Fastest output</td>
</tr>
<tr>
<td>B</td>
<td>BF12</td>
<td>8.5x14</td>
<td>66x156</td>
<td>IBM Confidential</td>
</tr>
<tr>
<td>C</td>
<td>APLFULL</td>
<td>11x8.5</td>
<td>66x80</td>
<td>All-white paper</td>
</tr>
<tr>
<td>K</td>
<td>TN</td>
<td>1.3x4</td>
<td>7x36</td>
<td>Labels</td>
</tr>
<tr>
<td>4</td>
<td>ST12</td>
<td>8.5x14</td>
<td>66x156</td>
<td>Text output</td>
</tr>
</tbody>
</table>

Description of Print Trains or Character Sets

APLFULL: Contains all of the characters that appear on the APL typeball, plus upright (non-italicized) caps and lower-case characters:

```
ABCD EFG abcdef g ABCDEFG abDefG aNle_v 0123456789
```

GF12: "Gothic Folded, 12 pitch" ...3800 laser printer, upper-case only; no lower-case, no APL:

```
ABCD EFGHIJKLMNOPQRSTUVWXYZ
```

ST12: "Serif Text, 12 pitch" ...3800 laser printer, caps and lower-case; no APL:

```
ABCD EFGHIJKLMNOPQRSTUVWXYZ
```

TN: Text train: caps and lower-case; no APL:

```
ABCD EFGHIJKLMNOPQRSTUVWXYZ
```

SYSOUT=P and SYSOUT=I are the two normal output classes for Kingston APLSV. This output will be printed on the all-white side of green-striped paper.

The use of workspace 31 PRINT is recommended for printing data.

The page height is normally indicated as being 66 lines; this includes top and bottom margins. Skipping to a new page (skip to channel 1) will result in the print train being positioned about three-quarters of an inch from the top edge of the paper, leaving about 61 printed lines to the bottom edge of the page, or, comfortably, about 55 printed lines with proper margins. Please do not ask the operators to reposition the paper for special requirements. The 3800 cannot print over page perforations (based on its hardware design).

Punched output will not be interpreted (the data will not be printed on the cards).

Labels (SYSOUT=K) will stay in alignment if a skip to a new page is specified for each new label. Better registration can result if you start the output with about 25 alignment labels.

PARAMETER USAGE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBCPM=</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
</tr>
<tr>
<td>FB</td>
<td></td>
</tr>
<tr>
<td>FRS</td>
<td></td>
</tr>
<tr>
<td>SC=</td>
<td></td>
</tr>
<tr>
<td>UN</td>
<td></td>
</tr>
<tr>
<td>IU</td>
<td></td>
</tr>
<tr>
<td>IC</td>
<td></td>
</tr>
<tr>
<td>IR</td>
<td></td>
</tr>
<tr>
<td>SI=</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td></td>
</tr>
<tr>
<td>SPACE=</td>
<td></td>
</tr>
<tr>
<td>(blocklength, (primary [secondary], [directory]), [RELEASE])</td>
<td></td>
</tr>
<tr>
<td>SYSOUT=(output class[, [program name], [form number]])</td>
<td></td>
</tr>
</tbody>
</table>

PARAMETER COMMENTS

- Only with DISP=NEW or LABEL=BEP or NL
- Security Class for SYSOUT: Unclassified IBM Internal Use IBM Confidential IBM Confidential-Restricted Special Instructions for SYSOUT: Hold for pick-up Special handling: ("LOAD I AIDS" and type "SYSOUT" to send instructions)

**"RELEASE" releases unused space when dataset is closed following initial creation only**

Consult local Programming Support (see page iv)

Seven track tape only Normally not required

Send SYSOUT to another user of this system

Use prevents cataloging a non-TSIO data set

PARAMETER USAGE

UG8 (Part 2 of 2): TSIO Command Parameters

Only with DISP=NEW or LABEL=BEP or NL

Security Class for SYSOUT: Unclassified IBM Internal Use IBM Confidential IBM Confidential-Restricted Special Instructions for SYSOUT: Hold for pick-up Special handling: ("LOAD I AIDS" and type "SYSOUT" to send instructions)

"RELEASE" releases unused space when dataset is closed following initial creation only

Consult local Programming Support (see page iv)

Seven track tape only Normally not required

Send SYSOUT to another user of this system

Use prevents cataloging a non-TSIO data set

**++ KINGSTON LOCAL MODIFICATION**
### New keywords for TSIO

#### COMMENTS

**COPIES**
A new keyword is now available for use in conjunction with the `SYSOUT` keyword: COPIES=n, where "n" is an integer value from 0 through 255.

For example, rather than sending a report to the system printer twice in order to get two copies, simply modify the appropriate TSIO `SYSOUT` command so that it is in the form "SW SYSOUT=P,COPIES=2,BLKSIZE=...".

A value of 0 may be useful for debugging programs without generating any output.

The use of this parameter is, of course, optional. The default is COPIES=1, so it certainly doesn't need to be specified for that.

**SC**
This keyword over-rides the security classification normally associated with any of the output classes:
- **SC=UN** Unclassified
- **SC=IU** IBM Internal Use [default]
- **SC=IC** IBM Confidential
- **SC=IR** IBM Confidential Restricted

**SI**
This keyword indicates that "special instructions" are needed for the output. Valid entries are SI=H (hold for pickup), or SI=S (special). To enter the special instructions for this second case, "LOAD 1 AIDS" and type "SYSOUT". This is the only time that this function needs to be used.

**USER**
Printed output from our machine room now has your name and address printed on it, based upon the address that we have on file for you (need to change it? ...mail the Change Form from Page 92). The "SYSOUT" function in 1 AIDS no longer needs to be used for every report. The USER keyword specifies the numeric sign-on number of another user of the Kingston APL system to which the output should be mailed. If the serial number is that of the requestor, it is ignored. Enter this keyword in the form USER=12345.

Note: The SI and USER keywords are mutually exclusive; if both are entered, the command will be rejected as an IMPARSiBLE COMMAND.

---

### UG8 (Part 1 of 2): TSIO Command Parameters

<table>
<thead>
<tr>
<th>PARAMETER USAGE</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLKSIZE=block size</td>
<td>Required with DISP=NEW or LABEL=NL or BLP</td>
</tr>
<tr>
<td>CODE=</td>
<td>Required when accessing non-APL data sets</td>
</tr>
<tr>
<td>COPIES=n</td>
<td>Number of copies of output from SYSOUT; &quot;n&quot; may be from 0 to 255</td>
</tr>
<tr>
<td>DEN=</td>
<td>Used only with UNIT=tape and DISP=NEW</td>
</tr>
<tr>
<td>DISP=(</td>
<td>See Figure UG7 for defaults</td>
</tr>
<tr>
<td>DSN=</td>
<td>Required except for READTOC</td>
</tr>
<tr>
<td>EXPDT=yyddd</td>
<td>Only with SW DISP=NEW</td>
</tr>
<tr>
<td>KEYLEN=keylength</td>
<td>Only with DISP=OLD or SHR and UNIT=direct access</td>
</tr>
<tr>
<td>LABEL=(data set seq no.[, {BLP</td>
<td>Only with UNIT=tape</td>
</tr>
<tr>
<td>LRECL=record size</td>
<td>With RECMT=FB and DISP=NEW or LABEL=BLP or NL</td>
</tr>
<tr>
<td>NEWNAME=[[-]user number]dsname[(member)]</td>
<td>With RENAME command</td>
</tr>
</tbody>
</table>
Symbolic parameters in indirect commands

First, some background: "What's an indirect command?".

A **reserved** dataset is a dataset that can be accessed **only** by its owner. If you are signed on with any account number other than the account number that the reserved dataset is under, an attempt to access it will result in a return code of 2 - **RESTRICTED COMMAND**. A reserved dataset is distinguished from a standard (non-reserved) dataset by means of the account number: for a non-reserved dataset, it's a positive number that matches the account number; for a reserved dataset, it's the negative version of that same account number. For example, a non-reserved dataset name is "12345 MYDATA". A reserved dataset name looks like this: "-12345 MYDATA". If you don't specify an account number at all, it defaults to a non-reserved dataset (anyone can access it, if they know the name).

Well, a reserved dataset seems to be a nice security feature, but there's one major problem: if it keeps everyone except the owner out, that's somewhat overly restrictive. All of the processing for any sensitive project would have to take place on a single account number. So there's an extension to that.

A **command** dataset is a special instance of a reserved dataset; that is, a command dataset is always reserved, but further, it's a special dataset which contains (you guessed it) commands and lists of user numbers that can use each of the commands. [See the function called "IC" in workspace 1 AIDS for building and maintaining command datasets.] You can put any TSIO command that you wish in your command dataset, and may specify exactly who may use each of the commands. When they use them, they are executing them just as if they were under your account number; that is, they have your access to those commands, and so can access your reserved datasets just as if they were you... if you authorize them.

If you are user 12345, you'd get this response:

```
CTL+'SR DSN=12345 MYDATA'
CTE
0   -- (successful)
```

But if you are any other user, you'd get this:

```
CTL+'SR DSN=12345 MYDATA'
CTE
2 1  -- (restricted command)
```

No problem. If you *want* to let a certain user (or even all users) have a specific type of access to your dataset, you can

<table>
<thead>
<tr>
<th>ABBREV.</th>
<th>OPERATION</th>
<th>MEANING AND USAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW</td>
<td>Sequential Write</td>
<td>Create a new data set, and rewrite or append to an existing data set.</td>
</tr>
<tr>
<td>SR</td>
<td>Sequential Read</td>
<td>Read records sequentially from an existing data set.</td>
</tr>
<tr>
<td>IRW</td>
<td>Indexed Read and Write</td>
<td>Read and write records in arbitrary sequence from or to an existing data set.</td>
</tr>
<tr>
<td>IR</td>
<td>Indexed Read</td>
<td>Read records in arbitrary sequence from an existing data set.</td>
</tr>
<tr>
<td>RENAME</td>
<td>Rename</td>
<td>Change the name of an existing data set.</td>
</tr>
<tr>
<td>DELETE</td>
<td>Delete</td>
<td>Delete an existing data set.</td>
</tr>
<tr>
<td>IC</td>
<td>Indirect Command</td>
<td>Execute a prepared command from a command data set.</td>
</tr>
</tbody>
</table>

UG5: Data Management Operations

<table>
<thead>
<tr>
<th>DISCRIMINANT VALUE</th>
<th>USER QUALIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>SPACE Allowed to create new direct access data sets,</td>
</tr>
<tr>
<td></td>
<td>which implies the allocation of storage space.</td>
</tr>
<tr>
<td>4</td>
<td>DEVICE Allowed to use the UNIT and VOLUME parameters,</td>
</tr>
<tr>
<td></td>
<td>which implies the allocation of specific devices or</td>
</tr>
<tr>
<td></td>
<td>storage units, as well as the CATALOG and</td>
</tr>
<tr>
<td></td>
<td>UNCATALOG parameters, described in the section &quot;System</td>
</tr>
<tr>
<td>2</td>
<td>ACCESS Allowed indexed access or sequential reading of</td>
</tr>
<tr>
<td></td>
<td>other TSIO users' non-reserved data sets, given a</td>
</tr>
<tr>
<td></td>
<td>knowledge of their identification.</td>
</tr>
<tr>
<td>1</td>
<td>SYSTEM Has use of commands beyond the seven available</td>
</tr>
<tr>
<td></td>
<td>to all users, and access to any data set,</td>
</tr>
<tr>
<td></td>
<td>including those vital to system operation,</td>
</tr>
<tr>
<td></td>
<td>within the constraints of the operating system</td>
</tr>
<tr>
<td></td>
<td>security provisions.</td>
</tr>
</tbody>
</table>

On the the Kingston system, Level 10 (SPACE and ACCESS) is given to all users.

UG6: User Levels
Access Control Vector as seen by A and B:

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Comments:
- 0 0 0 0 0 0 0 0: No constraints.
- 0 0 1 1 0 0 1 1: Half-duplex. Ensures that each use is preceded by a set by partner.
- 1 1 0 0 1 1 0 0: Half-duplex. Ensures that each set is preceded by an access by a partner.
- 1 1 1 1 1 1 1 1: Reversing half-duplex. Maximum constraint.
- 0 1 1 0 1 0 0 1: Simplex. Controlled communication from B to A (for card reader, etc.).

Introducing Symbolic Parameters

Now there is a better way: a symbolic parameter can be thought of as being, in many respects, analogous to an APL variable. What's often needed is a way to put most of the command in the dataset, and stipulate what parameters may be added, but then allow the user to supply values for those parameters.

A symbolic parameter is distinguished from other TSIO terms and values in that it begins with "A" (the APL version of what JCL sees as an ampersand: "&"). This term would then be used both in the command within the command dataset and in the command that calls that one. For example, assume the command in the command dataset to be "SR DSN=-12345 ABC,DISP=AD". When this command is invoked, the command would look like this:

```
CTL+IC DSN=-12345 GATE(7),AD=SHR
```

Notice that the "DISP=AD" in the command within the command dataset will be filled in with the value supplied by the user, "AD=SHR", allowing TSIO to read the string as "DISP=SHR".

If you are a user who is entering the IC command, the name of the symbolic parameter that you enter must, of course, match the name that appears in the command dataset. That name can be from 1 to 8 characters, alphanumeric (A-Z, 0-9). The first character may not be numeric. The first three characters may not be SYS... that's a reserved prefix, which gives us some additional features.
Reserved Names for Symbolic Parameters (ASYS...)

Several special names have been established which the system will replace with a value upon their use (a table of these terms follows shortly). For example, one such term is ASYSDATE. This term returns the current date in the form "YYDDD" (Julian date). If you wish to be able to create a new dataset whose name contains the current date, this can be done by placing a command in a command dataset like this:

```
SW DSN=12345 DASYSDATE
```

If this were the 250th day of 1980, the system would then treat the command as though it were

```
SW DSN=12345 D80250
```

Notice that we put an alphabetic character ("D") in the command so that the dataset name won't start with a numeric. The symbolic name may be used to replace any portion of a term (but it can't be used to pass more than one term). For example, consider the following commands:

Command dataset contains: User enters command as: | TSIO sees it as:
---|---|---
IR DSN=12345 DASYSDATE | IC DSN=12345 GATE(7) | IR DSN=12345 D80250
IAX DSN=12345 MINE | IC DSN=12345 GATE(8),A=HW | IAX DSN=12345 MINE
SR DISP=D,DSN=12345 ABC | IC DSN=12345 GATE(12) | SR DISP=DSN=12345 ABC

...Trivia Department: Notice that a specification arrow (+) can always be used in place of an equal-sign in any TSIO command... TSIO will make the substitution.

Notice also that the command dataset won't see any value from a symbolic name if that name isn't specified; that's okay, the system will supply the default value (see the table of default values on page 86). In the example used here, TSIO would treat the command as though it had been "SR DISP=DSN=12345 ABC".

If you would prefer to specify your own defaults, you can do that: Just enter the command in the IC dataset like this: BLENZEI=+IAX,AEX=13050.
<table>
<thead>
<tr>
<th>No.</th>
<th>TROUBLE REPORT</th>
<th>Meaning</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>PRINTER NOT FOUND</td>
<td>Invalid 32xx printer number given</td>
<td>If chronic, redial or have terminal or phone repaired. If you suspect phone-line problems, call Network Line Services (see page iv).</td>
</tr>
<tr>
<td>24</td>
<td>RESEND</td>
<td>Transmission failure; one or more characters were garbled during transmission</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>SI DAMAGE</td>
<td>State indicator damaged while performing an )ERASE or )COPY command</td>
<td>Erase objects not needed, save ws, clear active ws, and perhaps change limit, using )SYMBLS, copy the saved ws and rename active ws</td>
</tr>
<tr>
<td>26</td>
<td>SYMBOL TABLE FULL</td>
<td>Too many names used</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>TERMINAL MUST BE IN DISPLAY MODE</td>
<td>Workspace full, possibly because of 1. Temporary values produced during evaluation of an expression, or 2. Value assigned to shared variable by partner</td>
<td>1. Erase objects not needed, or 2. Clear state indicator, or 3. Revise method of calculation</td>
</tr>
<tr>
<td>28</td>
<td>WS FULL</td>
<td>Workspace full, possibly because of 1. Temporary values produced during evaluation of an expression, or 2. Value assigned to shared variable by partner</td>
<td>1. Erase objects not needed, or 2. Clear state indicator, or 3. Revise method of calculation</td>
</tr>
<tr>
<td>29</td>
<td>WS LOCKED</td>
<td>Password missing, or</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>WS NOT FOUND</td>
<td>No stored ws with given identification</td>
<td></td>
</tr>
</tbody>
</table>

LM20 (Part 3 of 3): Trouble Reports

---

### Reserved Names for Symbolic Parameters

<table>
<thead>
<tr>
<th>Term</th>
<th>Purpose</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASYSACT</td>
<td>Account number</td>
<td>12345</td>
</tr>
<tr>
<td>ASYSACCT</td>
<td>Positive account number (same as above)</td>
<td>12345</td>
</tr>
<tr>
<td>ASYSNACCT</td>
<td>Negative account number</td>
<td>-12345</td>
</tr>
<tr>
<td>ASYSPCODE</td>
<td>&quot;Scramble&quot; of positive account number</td>
<td>AAAADADJ</td>
</tr>
<tr>
<td>ASYSCODE</td>
<td>&quot;Scramble&quot; of negative account number</td>
<td>PPPPMFMH</td>
</tr>
<tr>
<td>ASYSTIME</td>
<td>Time of day (HMMSS)</td>
<td>152148</td>
</tr>
<tr>
<td>ASYSHOUR</td>
<td>Hour (HH)</td>
<td>15</td>
</tr>
<tr>
<td>SYSTEMIN</td>
<td>Minute (MM)</td>
<td>21</td>
</tr>
<tr>
<td>SYSSEC</td>
<td>Second (SS)</td>
<td>48</td>
</tr>
<tr>
<td>SYSDATE</td>
<td>Date (YDDD)</td>
<td>80245</td>
</tr>
<tr>
<td>SYST YEAR</td>
<td>Year (YY)</td>
<td>80</td>
</tr>
<tr>
<td>SYSDAY</td>
<td>Day of year [Julian day] (DDD)</td>
<td>245</td>
</tr>
</tbody>
</table>

**Note:** "ASYS" is a reserved prefix; no user-generated symbolic names may begin with "ASYS". Also, no specification is allowed to these names.

These names (as all symbolic parameters) may only be used by a command within a command dataset (they may not be invoked directly).

The "scramble" of the account number is an encoding that TSIO uses to name datasets. Although you see your dataset as "12345 MYDATA", TSIO sees it as "TSIO.AAAAADADJ.MYDATA". While you (as a standard Level 10 user) can't specify this name directly through TSIO, knowledge of its existence may be helpful for dealing with datasets moving on and off the system.] All TSIO datasets start with "TSIO.", to identify them, and the next eight characters are an encoding (or "scramble") of the account number: 12345+AAAADADJ, and -12345++PPPMMFMH. The functions for performing this translation are as follows:

```
\[
\text{V Z=SCRAMBLE N}
\text{[1]} \quad Z+Q'ABCD\text{EFGHIJKLMNOP'}[[XO+(8p15)\text{IN}]
\text{V SCRAMBLE 12345}
\text{AAAADADJ}
\]
\[
\text{V Z=UNSCRAMBLE N}[[IO}
\text{[1]} \quad [IO=0
\text{[2]} \quad Z=W
\text{[3]} \quad +(-A/Zc' ABCD\text{EFGHIJKLMNOP'})/0
\text{[4]} \quad +(8>pZ)/0
\text{[5]} \quad Z=16\text{I'ABCD\text{EFGHIJKLMNOP'}}12
\text{[6]} \quad Z+Z=4294967296+Z>2147483647
\text{V UNSCRAMBLE 'AAAADADJ'}
\text{12345}
\]
```
New system command: )PASSWORD

As you perhaps already discovered from the news item in NEWS, the old method of changing your password at sign-off time [ ]OFF:newpass ] is no longer supported. Instead, there is now a new system command: )PASSWORD.

Used without an argument, it returns the date by which the current password must be changed:

)PASSWORD
EXPIRES 09/02/80

To change your password, you must supply both the old password and the new password that you wish to start using:

)PASSWORD oldpass: newpass
EXPIRES 10/03/80

The date that is returned following that operation is the expiration date of the new password.

If the "old" password that you enter doesn't match the one that's currently in use on your account, you will get a response of "OLD PASSWORD INCORRECT". You could also get a message of "NEW PASSW0RlD UNACCEPTABLE", usually due to the proposed new password being too short. In order to be in compliance with Corporate Security, a new password on the Kingston system must meet these length requirements:

Mixed alphabetic and numeric password .... 4~8 elements
All alphabetic password ..................... 4~8 elements
All numeric password ........................ 6~8 elements

(Alphabets are A÷Z and 4÷9; numerics are 0÷9)

As before, passwords may be up to eight characters in length... if a longer one is mnemonicly meaningful to you, it's usable, but only the first eight characters will be examined.

When you sign on to APL, the message that used to remind you "PASSWORD LAST CHANGED ..." now reads "PASSWORD EXPIRES ...".

Another change involves the action that comes about if you don't change your password within the prescribed time. Accounts used to be locked out of the system for stale passwords, giving a message of "NUMBER LOCKED OUT" when a sign-on is attempted. Now you will be greeted with a message saying "PASSWORD EXPIRED". So what's the difference? Well, you can't sign on to the account under either case, but if the

* Yes, the eagle-eyed among you may think that these figures appear to be in conflict with Corporate Security Instruction 104; however, they were chosen through agreement with Security, based upon the large size of APL's alphabetic character set.
<table>
<thead>
<tr>
<th>No</th>
<th>TROUBLE REPORT</th>
<th>Meaning</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CLEAR WS</td>
<td>The ws named in the LOAD, VCOPY or PCOPY command is damaged due to system problems</td>
<td>Contact APL System Support (see page iv)</td>
</tr>
<tr>
<td>2</td>
<td>COMMAND DISALLOWED</td>
<td>Attempted rename of a restricted (load-only) workspace</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>DEFN ERROR</td>
<td>Attempted copy or protected copy of function definition as response to an input request</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>IMPROPER LIBRARY REFERENCE</td>
<td>1. Number is not a library number, or 2. Attempted save into alien library, or 3. Attempted reference to alien CONTINUE ws, or 4. Attempted copy from a restricted (load-only) ws</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>INCORRECT COMMAND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>INCORRECT SIGN-ON</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>MESSAGE LOST</td>
<td>Terminal was interrupted before message was received by other end</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>NEW PASSWORD UNACCEPTABLE</td>
<td>Password does not meet requirements</td>
<td>(see page 14)</td>
</tr>
<tr>
<td>9</td>
<td>NO PORTS AVAILABLE</td>
<td>All lines into APL are busy</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>NO PRINTER ATTACHED</td>
<td>32xx printer was attached earlier in this session, and not detached</td>
<td>Issue DETACH first</td>
</tr>
<tr>
<td>11</td>
<td>NOT COPIED: names</td>
<td>Global homonyms in active ws are protected</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>NOT FOUND: purported names</td>
<td>WS does not contain global objects with purported names</td>
<td></td>
</tr>
</tbody>
</table>

LM20 (Part 1 of 3): Trouble Reports

---

Account is locked, you also can't load its workspaces from another account. If the account is being prevented from use because of a stale password, you can use the workspaces from other sign-ons.

If you do let your password lapse, don't worry; assuming that you call within a reasonable time after the password expires, it can still be resolved quickly. A phone call to Kingston APLSV Administration is all that's needed... they're on 7/L 373-1234. They will want to know only your sign-on number, not your password. They can then assign a "grace" period for signing on with the old password, so that you can get on and change it.

If you don't call Administration within another 30 days after your password lapses, the account will be locked (you can't sign on, and no one else can use the workspaces). If you still don't contact Administration within 30 days after that, they will have to assume that you've gone away, and will archive the account to tape, where the workspaces will be held for two years. If your account has been deleted in this manner, reinstatement to the system will require filling out a new application form.

Password change requirements on Kingston APLSV

<table>
<thead>
<tr>
<th>Last Password Change</th>
<th>Required next password change</th>
<th>Eligible for...</th>
<th>Recommended Eligible for...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>63 days maximum</td>
<td>INHIBIT LOCK DELETION</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 month 2 months 3 months 4 months</td>
<td></td>
</tr>
</tbody>
</table>

After these points, a sign-on attempt will result in:

User can sign on normally →

Wss can be loaded from another account →

Account is still on the system, and user can usually be re-instated with one phone call →

* The actual deletion takes place after the next quarterly backup tapes are made, to insure that a suitable two-year retention copy of all of the workspaces will be available.
Improved standard 3270 support

In order to give you additional flexibility and support for more terminal types, the APLSV Central Support Group is in the process of modifying the software that controls the 3270s so that it will run under "VTAM" support (that's Virtual Telecommunications Access Method). So how does this help you, the terminal user? ...glad you asked....

Currently, a 3270 has to be wired directly into the APL system, with each terminal tying up precious resources in the machine even when it's not in use... and the connection can't be used by anyone else, even if you're not using your terminal. Under the VTAM scheme, each 3270 will be consuming resources only when it's active. Also, where you used to be connected to only one APL system, you will be able to select any of the three systems through VTAM... a definite plus should one of the three systems go on the blink. For times when you don't care which system you use, the eventual plan is to let VTAM automatically select the "best" system for you to sign on to, based upon its current performance.

Under the new release, additional types of 3270 terminals will be supported. These are:

<table>
<thead>
<tr>
<th>Device type</th>
<th>Supported models</th>
</tr>
</thead>
<tbody>
<tr>
<td>3276 Control Unit/Display</td>
<td>Models 2, 3 and 4</td>
</tr>
<tr>
<td>3277 Display Station</td>
<td>Model 2</td>
</tr>
<tr>
<td>3278 Display Station</td>
<td>Models 2, 3, 4 and 5</td>
</tr>
<tr>
<td>3279 Display Station</td>
<td>Models 2, 3 and 4</td>
</tr>
<tr>
<td>3284 Printer</td>
<td>Models 1 and 2</td>
</tr>
<tr>
<td>3286 Printer</td>
<td>Models 1 and 2</td>
</tr>
<tr>
<td>3287 Printer</td>
<td>Models 1 and 2</td>
</tr>
<tr>
<td>3288 Printer</td>
<td>As 3286 printer (APL not available)</td>
</tr>
<tr>
<td>3289 Printer</td>
<td>Models 1 and 2 (APL not available)</td>
</tr>
</tbody>
</table>

The following differences may be noted when using a 3270:

1. The user must sign on to APL within two minutes of either the initial display of the logo or signing off APL. If the sign-on is not completed within two minutes, the device will be returned to VTAM.

2. If the user is not signed on to APL, the PA2 attention key will immediately return the device to VTAM.

3. Through VTAM there are many 3270 devices competing for a specific number of APL ports; therefore, the user could receive the message **NO APL PORTS AVAILABLE**. The device will automatically be returned to VTAM after the message is displayed.
4. The CLEAR key in **RUNNING** mode no longer generates an attention signal to APL. The CLEAR key in **SELECT** mode will continue to generate the attention signal. Therefore, the screen may now be cleared in **RUNNING** mode without interrupting the function that is running.

5. The format of the **SELECT** mode status/option area has been modified to accommodate interfacing with the 328x printers through VTAM. The **SELECT** mode options now look like this:

```
---------------------------------------- SELECT	 PAGE nnnn
PRINTER NAME: ? PAGING: ON <<<< FROM nnnn
STATUS: OFF >>>> TO nnnn
```

6. The printer name is the VTAM identification of the 328x printer that printer output will be directed to. If a VTAM printer name is associated with a 327x terminal during APL system generation, that name will appear initially in the **PRINTER NAME** field. If no printer name is provided, "?" will appear in this field. To change the printer associated with the terminal, modify this field and depress ENTER. Up to eight characters will be accepted and the entry will be padded on the right with blanks. If a printer is already attached to the terminal or has been requested and the printer name field is modified, the first printer connection will be terminated. A request to change the printer name is invalid if the terminal is not signed on to APL. The field is reset to the original value (either the associated name or "?" ) when the terminal is signed off from APL.

7. The printer **STATUS** field reflects the disposition of the printer. Initially the printer is **OFF**. The first detection of the field will cause a request to VTAM for the designated printer. The **STATUS** will then change to **ACQUIRING**, which will remain until a response from VTAM is received. Then, on the next status display following the response from VTAM, the status will be changed to **ON** if the request is satisfied, or **INVALID** if there is a problem (note that a status redisplay requires a user input). The problem could be an invalid name or a device that is unknown or unavailable to VTAM. Unless there is a problem, VTAM does not reply until the printer is available; therefore, the **IN USE** message is no longer used. While waiting for the printer, the terminal session can continue normally. Detection of the printer...
STATUS keywords ACQUIRING or ON will terminate the connection or request and return the keyword to OFF. If VTAM terminates the printer connection during a session, the keyword LOST will appear once in the SELECT mode display following the termination. The printer connection is automatically terminated when the terminal is signed off APL. Detection of the printer STATUS field is invalid if the terminal is not signed on to APL or if there is no printer name provided.

8. In the SELECT mode it is now possible to enter some multiple requests. For example, the PRINTER NAME field can be modified and the STATUS field detected in one input. Or, the PAGE number field and the PRINTER NAME field can be modified in one input. Any combinations of requests that are not contradictory will be satisfied. If, however, the PAGE number field is modified and the keyword >>> detected, only the last request will be honoured.

The release date for all of these changes is still a little uncertain; there are hardware changes that we have to implement first. Ports will be converted as soon as possible. Some may be converted within a month; all should be converted by year-end.

<table>
<thead>
<tr>
<th>Form</th>
<th>Purpose</th>
<th>Normal Response</th>
<th>Trouble Reports</th>
</tr>
</thead>
<tbody>
<tr>
<td>WSID wsid [newpass]</td>
<td>Change identification of active ws</td>
<td>SAVED wsid</td>
<td>5</td>
</tr>
<tr>
<td>SAVE wsid [newpass]</td>
<td>Replace named ws by copy of active ws</td>
<td>time date</td>
<td>2,4,5,14,15,16,28</td>
</tr>
<tr>
<td>SAVE</td>
<td>Place copy of active ws in library</td>
<td>time date wsid</td>
<td>4,5,14,16,28</td>
</tr>
<tr>
<td>CONTINUE</td>
<td>Replace ws CONTINUE by copy of active ws and end use of APL</td>
<td>[time date CONTINUE] header; account</td>
<td>2,5,27,28</td>
</tr>
<tr>
<td>CONTINUE HOLD</td>
<td>Replace ws CONTINUE by copy of active ws and end use of APL, but hold telephone connection</td>
<td>[time date CONTINUE] header; account</td>
<td>2,5,27,28</td>
</tr>
<tr>
<td>LOAD wsid [pass]</td>
<td>Activate copy of named ws</td>
<td>SAVED time date</td>
<td>1,4,5,28,29</td>
</tr>
<tr>
<td>DROP accessible-wsid</td>
<td>Drop ws from library</td>
<td>time date</td>
<td>4,5,30</td>
</tr>
</tbody>
</table>

The illustration is from The IBM Systems Journal, Vol 19, No 3. Used with permission.
### Active Workspace - Action Commands

<table>
<thead>
<tr>
<th>Form</th>
<th>Purpose</th>
<th>Normal Response</th>
<th>Trouble Reports</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLEAR</td>
<td>Activate a clear ws</td>
<td>CLEAR WS</td>
<td>5</td>
</tr>
<tr>
<td>SYMBOLS number</td>
<td>Set size of symbol table</td>
<td>WAS number</td>
<td>5</td>
</tr>
<tr>
<td>ERASE [names]</td>
<td>Erase global objects named from active ws</td>
<td></td>
<td>5,12,25</td>
</tr>
<tr>
<td>COPY wsd [pass]names</td>
<td>Copy all objects from named wsd into active ws</td>
<td>SAVED time date</td>
<td>1,3,4,5,17, 25,26,28,29,30</td>
</tr>
<tr>
<td>COPY wsd [pass]names</td>
<td>Copy global objects named from designated wsd into active ws</td>
<td>SAVED time date</td>
<td>1,3,4,5,12, 17,25,26,28, 29,30</td>
</tr>
<tr>
<td>COPY wsd [pass]names</td>
<td>Copy all objects from designated wsd into active ws</td>
<td>SAVED time date</td>
<td>1,3,4,5,11, 17,25,26,28, 29,30</td>
</tr>
<tr>
<td>COPY wsd [pass]names</td>
<td>Copy objects designated that are not named in active ws</td>
<td>SAVED time date</td>
<td>1,3,4,5,11, 12,17,25,26, 28,29,30</td>
</tr>
<tr>
<td>GROUP names</td>
<td>Gather objects into (or disperse) a group (first name designates group)</td>
<td></td>
<td>5,13,26,28</td>
</tr>
</tbody>
</table>

### Active Workspace - Inquiry Commands

<table>
<thead>
<tr>
<th>Form</th>
<th>Purpose</th>
<th>Normal Response</th>
<th>Trouble Reports</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYMBOLS</td>
<td>Give maximum number of names in ws</td>
<td>IS n, n IN USE</td>
<td>5</td>
</tr>
<tr>
<td>VNS [alphabetic]</td>
<td>List defined functions (whose initials follow given character in alphabet)</td>
<td>[names] 5</td>
<td></td>
</tr>
<tr>
<td>VARS [alphabetic]</td>
<td>List global variables (whose initials follow given character in alphabet)</td>
<td>[names] 5</td>
<td></td>
</tr>
<tr>
<td>GRPS [alphabetic]</td>
<td>List groups (whose initials follow given character of alphabet)</td>
<td>[names] 5</td>
<td></td>
</tr>
<tr>
<td>GRP name</td>
<td>List members of named group</td>
<td>[names] 5,26</td>
<td></td>
</tr>
<tr>
<td>SI</td>
<td>List halted functions</td>
<td>state-indicator 5</td>
<td></td>
</tr>
<tr>
<td>SINL</td>
<td>List halted functions and associated local names</td>
<td>state-indicator 5</td>
<td></td>
</tr>
</tbody>
</table>

Based on the many requests from APL users, we will soon be offering 3270 full-screen support, in the form of an auxiliary processor, AP124x. This processor isn't new, but it is new to APLSV.

The release date is still a little uncertain; there are hardware changes that we have to implement first. Ports will be converted as soon as possible. Some may be converted within a month. All should be converted by year-end.

A quick overview

Using AP124x is somewhat similar to using TSIO (AP370): two shared variables are required, a control variable and a data variable, whose names must respectively begin with CTL and DAT. Conceptually, you may think of the DAT variable as a variable that is shared between your APL function and the screen. When you specify a screen-load of data into the DAT variable, and specify "write" codes for CTL, the contents of the DAT variable replace the normal screen. In similar fashion, when the user types in anything, it replaces portions of the DAT variable and can be read by your APL function.

Normal screen operations will look the same as it always did... full screen management is only invoked by calling AP124x (using 124 3900 ---). The normal screen will return upon return to immediate execution, when a normal I/O request is issued, when the FA2 key is depressed, or when an APL error occurs.

In addition to full screen management, AP124x also allows control of the 3277 Graphics Attachment RPQ, with graphic output displayed on a Tektronix 618 display screen.

Please note that what we are offering is strictly a full-screen management auxiliary processor; in particular, it does not include a full-screen function editor. Such an editor is a totally separate issue, and is not being offered now.

To help you get started using AP124x, we have developed a workspace with "building-block" aids: )LOAD 30 FULLSCREEN. This workspace contains various functions for screen management, for offering the shared variables, and for checking return codes.

**CITING OUR SOURCES**: No, alas, we did not write the following description; we copied the AP124 text [from VSAPL for VSPC: Terminal User's Guide, SH20-9066], and then modified it to reflect AP124x [from VSAPL Extended Editor and Full Screen Manager, SH20-2301], and added local changes to reflect our APLSV environment. Since these manuals do not apply exactly to this system, we cannot recommend that you attempt to use them for APLSV.
The Full Screen Management Auxiliary Processor allows you to control the screen format of an IBM 3270 display device through an APL defined function. In addition, it allows your application to:

- Write to the formatted screen
- Read from the formatted screen
- Erase screen fields
- Copy screen images to a printer
  [Not available in the initial release]
- Condition screen fields for light pen usage
- Read Program Function (PF) and Program Attention (PA) keys

Your APL application requests screen management services by assigning to the control variable a numeric scalar or vector that specifies the requested action. In response, the auxiliary processor issues a return code in the control variable indicating whether or not that was successful. If data is to be sent to or from the screen, it's transmitted in the data variable.

When a screen management service request is issued, the IBM 3270 enters full screen mode. When this happens, your function is in full control of the screen and may issue any additional screen management requests. When full screen mode is interrupted, the 3270 is returned to the default screen mode, and the most recent standard formatted screen is displayed.

Full screen mode is interrupted if the application returns to immediate execution mode for any reason; for example, if:

- an interrupt signal is issued (by pressing the PA2 key)
- a normal (non-screen management) input/output request is issued
- an error message is issued

When the 3270 leaves full screen mode and returns to normal mode, the current non-standard screen image is saved. It will be restored when the next full-screen management service request is issued.

Since APL issues a normal input/output request when a defined function completes execution, the duration of the full screen image may be extremely short. Your application must provide an intervening delay (such as a screen management read request) to extend the duration of the full screen image.

LM22: Environment within a Clear Workspace
Screen Management - General Information

To use the Full Screen Management Auxiliary Processor, certain general information about the screen and its attributes is required. This information is provided in the discussions below.

Logical Screens

The Full Screen Management Auxiliary Processor is capable of handling multiple logical screens, each of which is defined to be exactly the size of the physical screen. Each logical screen is accessed through a pair of shared variables. When you share a pair of variables a logical screen is created, and upon retraction of the variables, the logical screen is destroyed. Each pair of variables is kept logically separate from the other variables, and the limit to the number of logical screens that may be open at any time is controlled by your shared variable quota and by system capacity limits.

Screen Fields

The Full Screen Management Auxiliary Processor logically views the screen of an IBM 3270 display device in terms of rectangular areas called screen fields. It is only these areas that data can be entered or displayed. Each screen field has a starting position of each field is the row and column address of the upper left-hand corner of the field. [The upper left-hand position of the screen is row 1 column 1.]

Field Attributes

Each screen field has associated with it certain field attributes that qualify its content. For instance a field attribute may indicate that a field is to contain alphabetic or numeric data or that it is to be light pen sensitive. Your application can set the attributes for a field through various screen management service requests. If attributes are not explicitly set, the auxiliary processor supplies default values.

The 3270 Terminal System notes the attributes of a screen field by preceding the field with a column of attribute characters. These characters display as blanks and are not considered as part of the field. If a screen field begins in column 1, its attribute characters are wrapped around the screen, that is the characters will occupy column 80 in the previous row. A screen field that begins in row 1, column 1, will have an attribute character in column 80 on the bottom row of the screen.
It is generally good practice to leave at least one column for attribute characters between contiguous screen fields. Otherwise, the column of attribute characters preceding the right-hand field will obscure any data written to the last column of the left-hand field.

Light Pen Fields

Unlike other screen fields, light pen fields must contain a column of designator characters. The designator characters must be supplied by your application program... if they are not provided by your function, default values will be supplied by the auxiliary processor. The IBM 3270 Display System requires that the attribute characters and the designator characters must always be on the same row as the light pen field; therefore a light pen field may not be defined starting in column 1 because the display device hardware does not allow attribute characters to be wrapped around to the previous row for light pen fields. Fields adjacent to a light pen field on the same row must be separated by at least three additional blank columns. These blank columns may be either inside or outside of the data areas of the affected screen fields. A maximum of 12 light pen fields may precede the last light pen field on any given row. When mixing light pen and non-light pen fields, a maximum of 14 mixed fields may precede the last light pen field on any given row.

The designator column defines the two types of light pen fields: selection fields and attention fields. Each type of field performs a different light pen operation.

For a selection field, the designator column displays as question marks (?) or greater-than signs (>). When the light pen detects on a selection field, a designator character for the field is automatically changed on the screen from "?" to ">" or from "=" to "?" to provide visible indication to you that the detection is successful. If a mistake was made and you detect on the same field, the ">" reverts to a "=".

At the time an interrupt is generated by the user, the light pen selection fields that contain a "=" as the first character of one of their rows will be flagged as modified. Since the designator column is supplied by your function, certain fields may be "pre-selected" by setting the associated designator characters to a greater-than sign (>).

For an attention field, the designator column displays as blanks. A detection on an attention field completes the current input operation. The detected attention field and any previously detected selection fields are returned to your application.

It is important to remember that your function is responsible for supplying the correct designator character for the field type (? or > for selection, blank for attention). If an

<table>
<thead>
<tr>
<th>Function</th>
<th>Requirements</th>
<th>Effect on Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECR A</td>
<td>12ppA Array of characters</td>
<td>None.</td>
</tr>
<tr>
<td>ECL A</td>
<td>0pp0 Numeric Value</td>
<td>None, but requires seconds to complete delay.</td>
</tr>
<tr>
<td>ECR A</td>
<td>2ppA Array of characters</td>
<td>Expunge (erase) objects named by rows of A, except groups, labels or halted functions.</td>
</tr>
<tr>
<td>EFX M</td>
<td>2ppM Matrix of characters</td>
<td>Fix (establish) definition of the function represented by M, unless its name is already in use for an object other than function which is not halted.</td>
</tr>
<tr>
<td>0 EFX M</td>
<td>2ppM Matrix of characters</td>
<td>Same as monadic EFX</td>
</tr>
<tr>
<td>1 EFX M</td>
<td>2ppM Matrix of characters</td>
<td>Same as monadic EFX, except that the resultant function will be locked.</td>
</tr>
<tr>
<td>EDC A</td>
<td>2ppA Array of characters</td>
<td>None.</td>
</tr>
<tr>
<td>EML N</td>
<td>12ppA A[1..6] 2 3</td>
<td>None.</td>
</tr>
</tbody>
</table>

Canonical Representation??
1. A scalar may be used in place of a one-element vector:

a. as left argument of

<table>
<thead>
<tr>
<th>Function</th>
<th>Scalar</th>
<th>Vector</th>
<th>Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>reshape</td>
<td>3(p_4)</td>
<td>(,3)(p_4)</td>
<td></td>
</tr>
<tr>
<td>take</td>
<td>3(+)15</td>
<td>(,3)(+)15</td>
<td></td>
</tr>
<tr>
<td>drop</td>
<td>3(+)15</td>
<td>(,3)(+)15</td>
<td></td>
</tr>
<tr>
<td>expand</td>
<td>1(\cap)15</td>
<td>(,1)(\cap)15</td>
<td></td>
</tr>
<tr>
<td>transpose</td>
<td>1(\cap)5</td>
<td>(,1)(\cap)5</td>
<td></td>
</tr>
<tr>
<td>execute</td>
<td>P(#)2+</td>
<td>(,P(#)2+)</td>
<td></td>
</tr>
<tr>
<td>format</td>
<td>5(#)3</td>
<td>(,5(#)3)</td>
<td></td>
</tr>
</tbody>
</table>

b. as right argument of

<table>
<thead>
<tr>
<th>Function</th>
<th>Scalar</th>
<th>Vector</th>
<th>Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>execute</td>
<td>P(#)</td>
<td>(,P(#))</td>
<td></td>
</tr>
<tr>
<td>branch</td>
<td>+4</td>
<td>+4</td>
<td></td>
</tr>
</tbody>
</table>

2. A scalar is extended to conform as necessary:

a. as left argument of

<table>
<thead>
<tr>
<th>Function</th>
<th>Scalar</th>
<th>Vector</th>
<th>Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>compress</td>
<td>1 / 13</td>
<td>1 1 1 / 13</td>
<td></td>
</tr>
<tr>
<td>rotate</td>
<td>1(\phi)2 2(\phi)14</td>
<td>1 1 (\phi) 2 2(\phi)14</td>
<td></td>
</tr>
</tbody>
</table>

b. as right argument of

<table>
<thead>
<tr>
<th>Function</th>
<th>Scalar</th>
<th>Vector</th>
<th>Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>compress</td>
<td>1 0 1 / 2</td>
<td>1 0 1 / 2 2 2</td>
<td></td>
</tr>
<tr>
<td>expand</td>
<td>1 0 1 (\cap) 2</td>
<td>1 0 1 (\cap) 2 2</td>
<td></td>
</tr>
<tr>
<td>take</td>
<td>2 3 (+)3</td>
<td>2 3 (+)1 1(\phi)3</td>
<td></td>
</tr>
</tbody>
</table>

3. A one-element vector is permitted in place of a scalar:

a. as left argument of

<table>
<thead>
<tr>
<th>Function</th>
<th>Scalar</th>
<th>Vector</th>
<th>Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>compress</td>
<td>(,1)(\cap)13</td>
<td>1/13</td>
<td></td>
</tr>
<tr>
<td>deal</td>
<td>(,3)(?)5</td>
<td>3?5</td>
<td></td>
</tr>
<tr>
<td>rotate</td>
<td>(,2)(\phi)2 3 5 7</td>
<td>2(\phi) 2 3 5 7</td>
<td></td>
</tr>
</tbody>
</table>

b. as right argument of

<table>
<thead>
<tr>
<th>Function</th>
<th>Scalar</th>
<th>Vector</th>
<th>Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>index generator</td>
<td>1,5</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>deal</td>
<td>3?7,5</td>
<td>3?75</td>
<td></td>
</tr>
</tbody>
</table>

Using the Full Screen Management Auxiliary Processor

The following discussions describe the operations that can be requested through the Full Screen Management Auxiliary Processor.

- CTL represents the name of the control variable.
- DAT represents the name of the data variable.

These items should be replaced with names that are appropriate to your application when you issue your service requests. The names must begin with CTL and DAT, and must be no longer than 12 characters (total). The discussions assume that sharing has been completed for the control and data variables, and that the device is a 3270.

Formatting the Screen

This operation is used to describe the position and size of all screen fields. A request to format the display screen is made through the following assignments:

- \(\text{DAT}+\text{format} \)
- \(\text{CTL}=1\)

where \(\text{format}\) is a 4-, 5-, or 6-column numeric matrix with one row for each screen field to be formatted. If only one field is to be formatted, \(\text{format}\) can be a numeric vector, but is treated as a one-row matrix. The first (or only) row of the matrix defines the first screen field, the second row defines the format of the second screen field, and so on. The first screen field, unless redefined, becomes field number 1 for subsequent screen management operations; the second screen field becomes field number 2, and so on.

**Incorrect Character Handling**

If an incorrect character is supplied for a selection field, it will be changed to a "?". If an incorrect character is supplied for an attention field, it will be changed to a blank.

**Table: Scalar-Vector Substitutions for Mixed Functions**

<table>
<thead>
<tr>
<th>Type of Array</th>
<th>pA</th>
<th>p(pA)</th>
<th>p(p(pA))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scalar</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Vector</td>
<td>N</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Matrix</td>
<td>MN</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3-Dimensional</td>
<td>LMN</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

**Table: Shape and Rank Vectors**

<table>
<thead>
<tr>
<th>Shape and Rank</th>
<th>70</th>
</tr>
</thead>
</table>
The first four elements of each row of the matrix contain:

[1] **FIELD ROW**: the display screen row (origin 1) at which the field begins.

[2] **FIELD COLUMN**: the display screen column (origin 1) at which the field begins.

[3] **FIELD HEIGHT**: the height (number of rows) of the field.

[4] **FIELD WIDTH**: the width (number of columns) of the field.

The 5th and 6th elements of each row of the matrix are optional. If present, they contain:

[5] **FIELD TYPE**: the type of attribute of the field:
   - 0 - character input/output allowed
   - 1 - numeric character input/output allowed
   - *2* - character output only [default]
   - 3 - character output/light pen interruptable
   - 4 - character output/light pen selectable

[6] **FIELD INTENSITY**: the intensity attribute of the field:
   - 0 - off or don't display
   - *1* - normal intensity [default]
   - 2 - highlighted intensity

The starting position (upper left-hand corner) of a field must be a valid screen position. The enclosed area described by the starting position and the field height and width must not extend beyond the screen boundaries. (Except for light pen fields, fields with height 1 may wrap to succeeding rows.)

A zero in any row of the matrix effectively "undefines" a field. This removes the field from the formatted screen area but does not change the field numbers associated with the remaining fields.

When a display screen is formatted, the new screen format overlays the previous screen format. The new screen format is transmitted to the display screen on the next read or write operation.

Initially, the display screen contains only one field which covers the entire screen area.

---

### Table: Functions That Involve Numerical Calculations

<table>
<thead>
<tr>
<th>Name</th>
<th>Sign</th>
<th>Definition or Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Matrix Inverse</strong></td>
<td>HIN</td>
<td>[ \tilde{A} = \frac{1}{\det(A)} \tilde{A} ]</td>
</tr>
</tbody>
</table>

Arguments may be scalars, vectors, or matrices.

| **Matrix Division** | MBN | \[ \tilde{A} = \frac{1}{\det(A)} \tilde{A} \] |

2. Decoding (2x2) matrix:

| **Decode** | AA | \[1011 7 7 6 \rightleftharpoons 1776\] |

| **Encode** | AAT | \[26 60 6013723 \rightleftharpoons 1 2 3\] |

| **Execute, monadic** | \$V | \[\tilde{x} \rightarrow 3\] |

| **Execute, dyadic** | \$SV | \[\tilde{x} \rightarrow 3\] |

| **Format, monadic** | W | \[\tilde{x} \rightarrow 3\] |

| **Format, dyadic** | WV | \[\tilde{x} \rightarrow 3\] |

| **Format, picture** | VW | \[\tilde{x} \rightarrow 3\] |

### Notes:

1. Restrictions on argument ranks are indicated by: *S* for scalar, *V* for vector, *M* for matrix, and *A* for any array. See Figure LM11 for exceptions.

   Conformability requirements are given in The APL Language Manual where each function is defined.

2. Arrays used in examples:

   \[
   P = \begin{bmatrix} 2 & 3 & 5 & 7 \end{bmatrix}, \quad E = \begin{bmatrix} 1 & 2 & 3 & 4 \end{bmatrix}, \quad X = \begin{bmatrix} ABCD \end{bmatrix}, \quad Z = \begin{bmatrix} THE FUTURE \end{bmatrix}
   \]

   \[
   P = \begin{bmatrix} 2 & 3 & 5 & 7 \end{bmatrix}, \quad E = \begin{bmatrix} 1 & 2 & 3 & 4 \end{bmatrix}, \quad X = \begin{bmatrix} ABCD \end{bmatrix}, \quad Z = \begin{bmatrix} THE ANSWER \end{bmatrix}
   \]

3. The function is applied along the last axis; the symbols \(\tilde{}/\), \(\tilde{\backslash}\), and \(\tilde{\phi}\) are equivalent to \(\tilde{/}, \tilde{\backslash}\), and \(\tilde{\phi}\), respectively, except that the function is applied along the first axis. In general, the relevant axis is determined by \([V]\) or \([S]\) after the function symbol.

4. Function depends on index origin.

5. Elision of any index selects all along that axis.
<table>
<thead>
<tr>
<th>Name</th>
<th>Sign</th>
<th>Definition or Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compress</td>
<td>V/A</td>
<td>1 0 1 0/P ← 2 5 1 3 1 0 1 0/E ← 5 7 9 11 1 0 1/(1/E) ← 1 2 3 4 ← 1 0 1/E 9 10 11 12</td>
</tr>
<tr>
<td>Expand</td>
<td>V/A</td>
<td>1 0 1/ii2 ← 1 0 2 A BCD 1 0 1 1/X ← E FGH I JKL</td>
</tr>
</tbody>
</table>

### Functions Concerning Selection from Arrays (continued)

<table>
<thead>
<tr>
<th>Name</th>
<th>Sign</th>
<th>Definition or Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade up</td>
<td>V</td>
<td>3 5 3 2 ← 4 1 3 2 The permutation which would order V (ascending or descending)</td>
</tr>
<tr>
<td>Grade down</td>
<td>V</td>
<td>3 5 3 2 ← 2 1 3 4</td>
</tr>
<tr>
<td>Grade up</td>
<td>A&amp;M</td>
<td>'ABCD' EGHJ IJKLMNOPQRSTUVWXYZ 'Z' ← 5 2 3 1 4 The left argument is an arbitrary alphabet showing the desired collating sequence; the right argument is the character array to be ordered</td>
</tr>
<tr>
<td>Grade down</td>
<td>A&amp;M</td>
<td>'ABCD' EGHJ IJKLMNOPQRSTUVWXYZ 'Z' ← 1 4 3 2 5</td>
</tr>
<tr>
<td>Deal</td>
<td>STS</td>
<td>WTY ← Random deal of W elements from i Y</td>
</tr>
</tbody>
</table>

### Functions That Generate Selector Information

<table>
<thead>
<tr>
<th>Name</th>
<th>Sign</th>
<th>Definition or Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index generator</td>
<td>i/S</td>
<td>First S integers</td>
</tr>
<tr>
<td>Index of</td>
<td>V/A</td>
<td>Least index of A in V, or 1+iV</td>
</tr>
<tr>
<td>Membership</td>
<td>A/A</td>
<td>pW Y ← pW</td>
</tr>
<tr>
<td>Grade up</td>
<td>V</td>
<td>3 5 3 2 ← 4 1 3 2 The permutation which would order V (ascending or descending)</td>
</tr>
<tr>
<td>Grade down</td>
<td>V</td>
<td>3 5 3 2 ← 2 1 3 4</td>
</tr>
<tr>
<td>Grade up</td>
<td>A&amp;M</td>
<td>'ABCD' EGHJ IJKLMNOPQRSTUVWXYZ 'Z' ← 5 2 3 1 4 The left argument is an arbitrary alphabet showing the desired collating sequence; the right argument is the character array to be ordered</td>
</tr>
<tr>
<td>Grade down</td>
<td>A&amp;M</td>
<td>'ABCD' EGHJ IJKLMNOPQRSTUVWXYZ 'Z' ← 1 4 3 2 5</td>
</tr>
</tbody>
</table>

### Writing to the Screen and Erasing Screen Fields

This operation is used to write data to or erase data from one or more screen fields.

**Writing**

A request to write to the screen is made like this:

```
DAT=data ...or... DAT=data
CTL+2,Fieldnum
```

(2 ← Immediate write) (4 ← Write to screen only at next read-screen or immediate write)
... where data is a matrix of characters, each row of which contains the data for the corresponding field number in fieldnum, and fieldnum is a numeric vector of one or more field numbers. Each field number represents a screen field to be written and corresponds to the respective row in the formatting operation matrix that defined that field.

When a write operation is executed, the auxiliary processor maps the data in the first row of data into the screen field represented by the first element of fieldnum, the second row of data into the screen field represented by the second element in fieldnum, and so on. If the height of a screen field format is greater than one, you must supply the data as a vector, not as a matrix. If several fields are being supplied at once, the data should be a matrix where each row is the ravel of the data for a given field (padded with blanks as necessary). The auxiliary processor automatically skips over any unformatted areas of the screen. If a field number in fieldnum is larger than the number of rows specified in the format operation matrix, or if the field number does not currently apply to a defined field, that field number and the corresponding row of data are ignored. Similarly, if data has more rows than field numbers in fieldnum, the extra rows are ignored.

Each line of a screen field is filled with data from left to right, starting at the beginning of the field. Any trailing blanks padding out a field line are replaced with nulls on the screen, subject to the setting of the field attributes. If too much or too little data is specified in a row of data, the data is respectively truncated, or extended with nulls or blanks to fit the full field area. If data written to an attribute character position or to a designator character position will be obscured. Data written will be displayed only momentarily. To maintain the display, a read request must follow the write request.

Erasing
The write operation also doubles as an erase operation, where each erased field is filled with null characters. You can erase data from a screen field in two ways:

1. ...in any write request, by listing the field number in fieldnum without supplying a corresponding row in data. If data is empty, all fields identified in fieldnum are erased. Fields not identified in fieldnum are not affected by this operation.

2. ...in the first write operation after a format operation, by not including the field number in fieldnum. Any fields defined in the previous format operation and not specified in the write operation will be erased. (Subsequent write operations will not affect similarly unspecified fields.)
<table>
<thead>
<tr>
<th>TYPE</th>
<th>Cause; CORRECTIVE ACTION</th>
</tr>
</thead>
</table>
| DEFN ERROR       | Misuse of V or [] symbols:  
1. The function is pendent. DISPLAY STATE INDICATOR AND CLEAR AS REQUIRED.  
2. Use of other than a function name alone in reopening a definition.  
3. Improper request for a line edit or display. |
| DOMAIN ERROR     | Argument is outside the range of valid arguments (domain) of the function.                                                                                                                                                     |
| ENTRY ERROR      | Invalid character has been transmitted or received.                                                                                                                                                                                   |
| []-- IMPLICIT ERROR | The system variable [](for example, [](0)) has been set to an inappropriate value, or has been localized and not been assigned a value.                                                                                                           |
| INDEX ERROR      | Index value out of range.                                                                                                                                                                                                       |
| INTERFACE QUOTA EXHAUSTED | Attempt to share more variables than allotted quota.                                                                                                                     |
| INTERRUPT        | Execution was suspended within an APL statement. TO RESUME EXECUTION, ENTER A BRANCH TO THE STATEMENT INTERRUPTED.                                                                                                               |
| LENGTH ERROR     | Shapes not conformable.                                                                                                                                                                                                       |
| NO SHARES        | Shared variable facility not in operation.                                                                                                                                                                                      |
| NOCE ERROR       | A syntactically correct statement has been entered, but cannot be executed because of an APL implementation restriction: the expression results in an error "for the nonce".                                                               |
| RANK ERROR       | Ranks not conformable.                                                                                                                                                                                                       |
| RESEND           | Transmission failure. RE-ENTER. IF CHRONIC, REPAIR OR HAVE TERMINAL OR PHONE REPAIRED. IF YOU SUSPECT PHONE LINE PROBLEMS, CONTACT THE NETWORK LINE SERVICES GROUP (See page iv).                                                      |
| SI DAMAGE        | The state indicator (an internal list of suspended and pendent functions) has been damaged in editing a function or in performing a COPY or ERASE.                                                                                                  |
| SYMBOL           | Too many names used. SAVE, CLEAR, COPY or SAVE, CLEAR, SYMBOLS, COPY or ERASE, SAVE, CLEAR, COPY                                                                                                                                 |
| TABLE            |                                                                                                                                                                                                                               |
| FULL             |                                                                                                                                                                                                                               |
| SYNTAX ERROR     | Invalid syntax; e.g. two variables juxtaposed; function used without appropriate arguments as dictated by its header; unmatched parentheses.                                                                                                                                                |
| SYSTEM ERROR     | Fault in internal operation of the system. RELOAD. SEND TYPED RECORD, INCLUDING ALL WORK LEADING TO THE ERROR, TO APL PROGRAMMING SUPPORT (See page iv).                                                                                                                               |
| VALUE ERROR      | Use of name that does not have a value. ASSIGN A VALUE TO THE VARIABLE OR DEFINE THE FUNCTION.                                                                                                                                 |
| WS FULL          | Workspace is filled (perhaps by temporary values produced in evaluating a compound expression, or by values of shared variables). CLEAR STATE INDICATOR, ERASE NEEDLESS OBJECTS, OR REVISE CALCULATIONS TO USE LESS SPACE.                                                     |

Example Two

As an example of writing and erasing, the function below formats four fields and then writes to them. WRITE uses two arguments. The left argument tells when the write is to occur (immediate or delayed), and the right argument is the data to be written.

Example Two

As an example of writing and erasing, the function below formats four fields and then writes to them. WRITE uses two arguments. The left argument tells when the write is to occur (immediate or delayed), and the right argument is the data to be written.

<table>
<thead>
<tr>
<th>pMATX</th>
<th>pFIELDDATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 6</td>
<td>4 12</td>
</tr>
</tbody>
</table>

 MATX FIELDDATA
3 5 1 12 2 1  FIRST INPUT
4 5 1 12 2 1  SECOND INPUT
3 18 1 3 1 1
4 18 1 3 1 1

V RET+WHEN WRITE FIELDS
[1] aDATA VARIABLE ASSIGNED FIELDS
[2] DAT+FIELDS
[3] aISSUE WRITE COMMAND, ASSIGN RETURN CODE
[4] CTL+WHEN, \14pFIELDS
[5] RET+CTL
V

V EXAMPLE2;CTL;DAT;RET
[1] aCONTINUATION OF EXAMPLE SHOWN IN 'EXAMPLE1'
[2] +(2×1+RET+124 OFFER 2 3 p.'CTL'DAT')/0
[3] L1:=(0=RET+FORMAT MATX)/L2
[4] a+SCREEN NOT FORMATTED ... RETURN CODE = ',\14RET
[5] \0
[6] aWRITE FIELDS TO SCREEN AND TEST
[7] a 2=IMMEDIATE WRITE ... 4=DELAYED WRITE
[8] L2:=(0=RET+4 WRITE FIELDS)/L3
[9] a+SCREEN NOT WRITTEN ... RETURN CODE = ',\14RET
[10] \0
[11] L3:...'... CONTINUE PROCESSING'
V

Reading from the screen

This operation is a two-step process which is used to read input from the screen. Although both steps are required to read screen fields into your workspace, the first step alone can be used to determine the nature of your input.

Step 1: Read and Wait

This step serves three purposes: first, it directs the auxiliary processor to wait for you to complete the current input operation; second, it tells it to return information about the current screen; third, based on how you completed
input, it may tell it to read all the defined fields on the screen into an internal data area. Data is read only if you completed the input operation using the ENTER key or a PF key. Your function requests this operation by specifying:

\[ \text{CTL+5} \]

In response, the data variable will contain a vector of one or more numbers that indicate:

- the type of action that completed the current input operation. This is returned independently of how input was completed.
- the current cursor position. This information is returned if you completed the input operation using the ENTER key, a PF key or the light pen.
- the field numbers of the modified fields. A field is modified when you enter data into it and stays modified until your application writes to the screen. This information is returned if you completed the input operation using the ENTER key or a PF key.
- the field numbers of any light pen sensitive field selected (via the light pen) in the current input operation.

Step 2: Get the Data

This step completes the read operation. It is used to obtain one or more screen fields (usually the modified fields indicated in the read status vector) after step 1 has been performed. To request this step your function specifies:

\[ \text{CTL+5,fieldnum} \]

...where fieldnum is a numeric vector of one or more field numbers. Each field number represents a screen field to be read and corresponds to the respective row in the formatting operation matrix that defined that field.

When the operation is complete, the data variable contains a matrix of characters, each row of which is the data for the corresponding field in fieldnum. The matrix is padded to the right with blanks so that the number of columns is equal to the length of the longest field.

Note that the data returned in this step might be altered if your application issued any intervening write or format request or changed any field attributes.

<table>
<thead>
<tr>
<th>Monadic form</th>
<th>Dyadic form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Example</td>
</tr>
<tr>
<td>+B is B</td>
<td>Conjugate</td>
</tr>
<tr>
<td>-B is 0-B</td>
<td>Negative</td>
</tr>
<tr>
<td>xB is (Bx0)-B&lt;0</td>
<td>Signum</td>
</tr>
<tr>
<td>+B is 1+B</td>
<td>Reciprocal</td>
</tr>
<tr>
<td>3 1/4 is 1 1/4</td>
<td>Magnitude</td>
</tr>
<tr>
<td>3 1/4 is 1</td>
<td>Floor</td>
</tr>
<tr>
<td>3 1/4 is -1/4 is 3</td>
<td>Ceiling</td>
</tr>
</tbody>
</table>

Table of Dyadic Functions

LM6: Primitive Scalar Functions

<table>
<thead>
<tr>
<th>Dyadic Form</th>
<th>Identity</th>
<th>Left-Element</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plus</td>
<td>+</td>
<td>0</td>
<td>L</td>
</tr>
<tr>
<td>Minus</td>
<td>-</td>
<td>1</td>
<td>R</td>
</tr>
<tr>
<td>Times</td>
<td>x</td>
<td>2</td>
<td>L</td>
</tr>
<tr>
<td>Divide</td>
<td>÷</td>
<td>3</td>
<td>R</td>
</tr>
<tr>
<td>Residue</td>
<td></td>
<td>4</td>
<td>L</td>
</tr>
<tr>
<td>Minimum</td>
<td>(note 1)</td>
<td>5</td>
<td>L</td>
</tr>
<tr>
<td>Maximum</td>
<td>(note 2)</td>
<td>6</td>
<td>R</td>
</tr>
<tr>
<td>Power</td>
<td>+</td>
<td>7</td>
<td>R</td>
</tr>
<tr>
<td>Logarithm</td>
<td>•</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Circle</td>
<td>( )</td>
<td>9</td>
<td>None</td>
</tr>
<tr>
<td>Binomial</td>
<td>!</td>
<td>10</td>
<td>L</td>
</tr>
<tr>
<td>And</td>
<td>^</td>
<td>11</td>
<td>L</td>
</tr>
<tr>
<td>Or</td>
<td>v</td>
<td>12</td>
<td>L</td>
</tr>
<tr>
<td>Nand</td>
<td>÷</td>
<td>13</td>
<td>None</td>
</tr>
<tr>
<td>Nor</td>
<td>#</td>
<td>14</td>
<td>None</td>
</tr>
<tr>
<td>Less</td>
<td>&lt;</td>
<td>15</td>
<td>L</td>
</tr>
<tr>
<td>Not greater</td>
<td>≤</td>
<td>16</td>
<td>L</td>
</tr>
<tr>
<td>Equal</td>
<td>=</td>
<td>17</td>
<td>L</td>
</tr>
<tr>
<td>Not less</td>
<td>≥</td>
<td>18</td>
<td>L</td>
</tr>
<tr>
<td>Greater</td>
<td>&gt;</td>
<td>19</td>
<td>L</td>
</tr>
<tr>
<td>Not equal</td>
<td>≠</td>
<td>20</td>
<td>L</td>
</tr>
</tbody>
</table>

Notes:
1. The largest representable number.
2. The greatest in magnitude of representable negative numbers.

LM7: Identity Elements of Primitive Scalar Dyadic Functions
**Model for the Original APL Circular Functions**

May 16th, 1974; Philadelphia

**Courtesy of Jet Archives**

---

**AC=1**  
**AB=00BC**  
**BC=00AB**  
**AE=24DE**  
**DE=40AE**

**LM8: Pythagorean Functions**

---

**DAT variable returned by read and test requests**

<table>
<thead>
<tr>
<th>User Action</th>
<th>Vector Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter Key</td>
<td>0 0</td>
</tr>
<tr>
<td>PF Keys</td>
<td>1 1-24</td>
</tr>
<tr>
<td>Light Pen</td>
<td>2 0</td>
</tr>
<tr>
<td>PA Keys</td>
<td>4 1-3[6]</td>
</tr>
<tr>
<td>Clear Key</td>
<td>5[7]</td>
</tr>
<tr>
<td>No Input</td>
<td>6</td>
</tr>
</tbody>
</table>

**NOTES:**

[1] Indicates the field number of the field containing the cursor when input was completed. If this element is 0, the cursor was not found in a defined field. Elements 4 and 5 are then physical position indicators (relative to row 1, column 1).

[2] Indicates the position of the cursor when input was completed. The position is indicated by the row and column relative to the first row and column position in the field.

[3] Indicates one field number for each field modified since the last preceding write operation. If no fields were modified, this element is not returned.

[4] Indicates one field number of each selected light pen sensitive field.

[5] Indicates 0 for an accepted badge, 1 for a rejected badge.

[6] Pressing the PA2 key generates a weak attention signal. The function is suspended, and consequently the screen is returned to normal screen mode.

[7] If the Clear Key was used, the current screen format and field attributes are re-established at the next read or write operation.
Example Three

The following function is an example of a complete format, write, and read session. The function READ initiates the read, waits for the user to complete the input. The results are stored in two global variables, INFO and DATA. INFO contains the user's action and the modified fields; DATA is assigned the values contained in the fields which were read. An application can later reference these variables as needed.

(MATX and FIELDATA are found in Example Two)

```
V RET=READ FIELDS
[1] ISSUE READ AND WAIT COMMAND, CHECK RETURN CODE
[2] TTY=CTTY
[3] *((0*RET=CTTY)/0
[4] ASSIGN USER ACTION TO GLOBAL VARIABLE INFO
[5] XXX=DUAT
[6] ISSUE GET DATA COMMAND, CHECK RETURN CODE
[7] TTY=FIELD
[8] *((0*RET=FIELD)/0
[9] ASSIGN DATA TO GLOBAL VARIABLE DATA
[10] DATA=DAT

V EXAMPLE3;CTTY;DAT;RET
[1] CONTINUATION OF EXAMPLE SHOWN IN 'EXAMPLE2'
[2] *((2*4 RET=124 OFFER 23 p'CTLDAT')/0
[3] L1:=(0*RET=FORMAT MATX)/L2
[4] L2:SCREEN NOT FORMATTED ... RETURN CODE = 'x',xRET
[5] =0
[6] L2:=(0*RET=WRITE FIELD)/L3
[7] L3:SCREEN NOT WRITTEN ... RETURN CODE = 'x',xRET
[8] =0
[9] READ FIELDS 2 & TEST
[10] L3:=(0*RET=READ 3 )/L4
[11] L4:SCREEN NOT READ ... RETURN CODE = 'x',xRET
[12] =0
[13] L4: ... [CONTINUE PROCESSING]'

V
```

Modifying Field Attributes

These operations are used to explicitly set the attributes of one or more screen fields. Three kinds of attributes can be set:

- the **type** of data permitted in the field
- the **light pen status** of the field
- the **display intensity** of the field

In the descriptions of each of these cases the term **fieldnum** is a numeric vector of one or more field numbers. Each field number represents a screen field whose attributes are to be set and corresponds to the respective row in the format operation matrix which defined that field.
ACKNOWLEDGEMENTS

Most of the tables were taken from the standard APL manuals, and were reworked to reflect the current state of the internal version of APLSV. Each of these tables is marked with a key showing its source:

LM ↔ The APL Language Manual, GC 26-3847-4
UG ↔ The APLSV Version 3 User’s Guide, SH 20-9087-0

For example, Figure 3 from The APL Language Manual is reprinted here as Figure LM3.

Thanks are in order to the entire Kingston APL Support group for their thoughts and suggestions in the preparation of this newsletter, and in particular to Rhonda L. Johnson and Michael L. Higgs for their many hours of tedious table preparation and proofreading.

Modifying Data Type and Light Pen Status

This operation is used to indicate what type of data is permitted in a field and whether or not the field is light pen sensitive. It takes effect at the next screen management read or write operation and applies until changed explicitly or until the screen is reformatted. Your application can request this operation by specifying:

\[ \text{DAT+type} \]
\[ \text{CTL+6,fieldnum} \]

...where type is a numeric vector of field type indicators. Each value in type indicates the data type and light pen status for the corresponding field in fieldnum. If type is a single value, it is the field type indicator for all the fields specified in fieldnum.

The field type indicators are:

0 - alphabetic or numeric input/output allowed
1 - numeric input/output allowed
2 - alphabetic or numeric output only [default]
3 - alphabetic or numeric output allowed/light pen interruptable
4 - alphabetic or numeric output allowed/light pen selectable

As an example, the following two assignments set the data types and light pen status of two previously formatted screen fields (screen fields 1 and 2). Both fields are set to accept alphabetic or numeric output; the second field in addition, is made light pen interruptable. Sharing for both the control and data variables are assumed to be complete:

\[ \text{DAT+2 3} \]
\[ \text{CTL+6 1 2} \]

Modifying Field Intensity

This operation is used to set the display intensity of one or more fields. It takes effect at the next screen management read or write operation and applies until changed explicitly or until the screen is reformatted. Your application can request this operation by specifying:

\[ \text{DAT+intensity} \]
\[ \text{CTL+7,fieldnum} \]

...where intensity is a numeric vector of intensity indicators. Each value in intensity indicates the display intensity of the corresponding fields in fieldnum. If intensity is a single value, it is the field type indicator for all the fields specified in fieldnum.
The intensity indicators are:

- 0 - off or don't display
- * 1 - normal intensity [default]
- 2 - highlighted intensity

As an example, the following two assignments set the display intensity of a previously formatted screen field (screen field 2) to be highlighted. Sharing for the control and data variables are assumed to be complete:

```
DAT<-2
CTLfr7 2
```

Modifying Input Field Attributes

This operation is used to modify additional attributes for one or more fields. It takes effect at the next screen management read or write operation and applies until changed explicitly or until the screen is reformatted. The additional attributes that may be specified control the handling of (1) trailing nulls, and (2) an "Auto-skip" feature. These attributes are only meaningful for input fields, but may be specified for any field.

Your application can request this operation by specifying:

```
DAT+attribute
CTL+16,fieldnum
```

...where attribute is a numeric vector of attribute indicators. Each value in attribute indicates the attribute of the corresponding field in fieldnum. If attribute is a single value, it is the attribute indicator for all of the fields specified in fieldnum.

The attribute indicators are:

- 0 - Non-Autoskip, no trailing blank processing
- 1 - Autoskip, no trailing blank processing
- 2 - Non-Autoskip, trailing blank processing
- * 3 - Autoskip, trailing blank processing [default]

If "Auto-skip" is specified, at the end of the field the attribute byte is set to automatically skip to the next input field. This attribute is meaningful only for input fields.

If trailing blank processing is specified, all trailing blanks in the user's data are converted to nulls upon presentation to the physical screen. This allows the terminal user to use the INSERT MODE key on the 3270 to insert data into the field. If this option is turned off, the user's data is not modified upon presentation to the 3270 (i.e., trailing blanks will remain true blanks on the screen).

---

"Many thanks for the latest 'Jot+Dot Times', and for providing a few chuckles to brighten the APL day. But please remove the dunce's cap (p. 27). Don Orth has got it wrong-- there are 441 inner products. There is a choice of 21 functions to the left of the dot, and for each of these is a further choice of 21 to the right, making $21 \times 21$ in all. This doesn't double-count A.A or any other."

N. Thomson
Hursley Park
Winchester, Hampshire, England

"My confidence in you guys has dropped considerably in the last month. Do you print anything without checking your facts? I wrote saying that there were 420 different inner products, not 441, and you printed it!! As so many of your readers have so kindly pointed out to me in the last month, there are indeed 441 different inner products.)"

D. Orth
Yorktown Heights, NY

"Your inner-product argument has been under discussion here in The APL Design Group. Proposed extensions to the APL language by Ken Iverson and myself have extended inner product so that it may be used with any dyadic functions. This includes mixed functions, derived functions, and user-defined functions. Now consider the question, "How many inner products are there?".

"Since there are an unlimited number of defined functions, the number of inner products is infinite! (If anyone is uncomfortable with such a large number, we could make every other one invalid.)

"Since the future contains so many inner products, I submit that we should lay to rest the controversy on the number of inner products in current APL.

"Don Orth claimed 420 different inner products; you claim 441. I propose that we settle on the average of these two numbers, 429.5, which can be easily computed as follows:

\[
\text{AVG} = \frac{420 + 441}{2} = 430.5
\]

\[
\text{I don't believe in one-liners)
\]

"...I consider the case closed."

J. Brown
Yorktown Heights, NY
"I recently borrowed a copy of this excellent 'Times' from a friend who brought it from Rio. I think that you have heard many nice comments about this newsletter, therefore I will not take your time just saying how nice you are, but I can't go on without saying at least thank you!.

J. Elias
Sumare, Brazil

"Your 'Jot+Dot Times' (and my son learning more APL in the local IBM Explorer group than I can remember) may just be the incentive that I needed to get back into APL. Thanks for a good issue."

D. Thompson
Kingston, NY

"How good is o.x? ... o.x is so good that I keep a copy on my sailboat in the library created for windless days. Keeping this in mind, you must be careful that the material in the book does not change meaning when read under 12 volt dc lighting.

T. Cook
Raleigh, NC

Reading the Screen Format

The Full Screen Management Auxiliary Processor provides an easy way of determining what format matrix it is currently using. A request to display the current format matrix is made like this:

\texttt{CTL+9 format+DAT}

...where \texttt{format} contains one row for each field, up to the highest valid field defined, and is six columns wide. If a new format is pending, the new format matrix is returned.

Printing a Screen Image

During its interaction with the Full Screen Management Auxiliary Processor, your function may direct a copy of the current screen image to the printer by specifying:

\texttt{CTL+10} \hspace{1cm} [Not available in the initial release]

The printer must have been previously defined. Refer to the previous article.

Sounding the Alarm

In your screen operations, you may find it useful at times to sound an audible alarm. For instance, you might want an alarm sounded when a field of particular importance is filled. Your application can request the auxiliary processor to sound the alarm through the assignment:

\texttt{CTL+11}

This request takes effect at the next screen management read or write operation.

Setting the Cursor

This operation is used to position the cursor at the end of the next read, write, or erase operation. Your application can request this operation by specifying:

\texttt{DAT+fieldnum,row,col}

\texttt{CTL+12}

If the first element is zero, the second and third elements are interpreted as the row and column position of the cursor from the upper left-hand position on the screen.
If either of the last two elements is zero or negative, the position of the cursor will not be changed in the next read, write, or erase operation. [This too, is the default condition until you issue this service request.]

When the auxiliary processor is first invoked, the cursor appears on the screen in position 1, 1. The cursor will default to this position after any new screen format takes effect.

"Thank you for the article on "The One-Liner Syndrome". I've been criticized for years for not writing one-line programs. Now I have the satisfaction of knowing that I was right all along.

"You guys are great! How does the company let you get away with writing a newsletter that's not only useful but entertaining and witty besides?"

Name withheld by request
Kingston, NY

"I note with interest your castigation of the 'one-liner' fraternity. I agree, but I cannot understand why this obfuscacious bunch should have been entrusted with the responsibility and high honor of writing nearly all of our APL manuals.

"I'd like to see some new manuals, written with nearly the informality with which 'Jot•Dot' was written. The emphasis should be on plain English with appropriate penalties for all authors who seem to be on the verge of exhibitionism."

A. Nires
Raleigh, NC

"More of the same! This publication is a model for efforts of this kind. It should be daily required reading for all authors of stuffy and stodgy communications...."

H. Clarke
Charlotte, NC

"Omit the newsletter-- put items in 1 NEWS."

D. Davis
Raleigh, NC

[Sigh .... We tried that, somewhat unsuccessfully. After running two 50-line news items a month apart, we received mail telling us:

"The length of these news items is absurd-- how about remembering that some of us still use 2741's!"

C. Martin
Kingston, NY

...Sorry.]
...Here are some of the comments that we received concerning our service and our previous issue of the Times:

"The entire issue is eminently readable and informative. At the least point where it might have become tedious, there is an illustration or cartoon to brighten it up. The typographic design is outstanding, both on the front cover and in the body of the text. The humour is splendid--all the more so because it is so unusual in an 'official' IBM publication. The size and format are just right. The reference information and articles are in the right order (phone numbers at the front, security guidelines at the back!).

"I have to admit failure. I cannot find ANY fault with it!

"Congratulations, you wordsmiths. The quality of the product reflects the efforts and skill that you put into it."

B. Martin
Endicott, NY

"Your publication is W (think German)."

A. Nunes
Kingston, NY

"Your Summer 1979 Issue was excellent...full of useful info, easy to read...how are you ever going to top it?"

A. Wolf
White Plains, NY

[We're not.]

---

AP124x Return Codes

The return codes from the Full Screen Management Auxiliary Processor (AP124x) are all scalar integers.

<table>
<thead>
<tr>
<th>Return Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Successful</td>
</tr>
<tr>
<td>1</td>
<td>CTL nonce error (command not currently implemented)</td>
</tr>
<tr>
<td>11</td>
<td>CTL rank error</td>
</tr>
<tr>
<td>12</td>
<td>CTL length error</td>
</tr>
<tr>
<td>13</td>
<td>CTL domain error</td>
</tr>
<tr>
<td>14</td>
<td>Invalid command</td>
</tr>
<tr>
<td>15</td>
<td>Request to position cursor in an undefined field</td>
</tr>
<tr>
<td>21</td>
<td>DAT rank error</td>
</tr>
<tr>
<td>22</td>
<td>DAT length error</td>
</tr>
<tr>
<td>23</td>
<td>DAT domain error</td>
</tr>
<tr>
<td>24</td>
<td>DAT variable not shared</td>
</tr>
<tr>
<td>30</td>
<td>Invalid field number</td>
</tr>
<tr>
<td>31</td>
<td>Defined field extends beyond screen</td>
</tr>
<tr>
<td>32</td>
<td>Reference outside field definition</td>
</tr>
<tr>
<td>33</td>
<td>Light pen field starts in column 1</td>
</tr>
<tr>
<td>34</td>
<td>Light pen field (with height 1) not contained in one physical screen line</td>
</tr>
<tr>
<td>35</td>
<td>Invalid field type</td>
</tr>
<tr>
<td>36</td>
<td>Invalid field intensity</td>
</tr>
<tr>
<td>37</td>
<td>&quot;GET&quot; or &quot;PUT&quot; for an undefined field</td>
</tr>
<tr>
<td>38</td>
<td>DAT not specified in correct sequence</td>
</tr>
<tr>
<td>39</td>
<td>DAT not referenced in correct sequence</td>
</tr>
<tr>
<td>40</td>
<td>Printer is not available</td>
</tr>
<tr>
<td>41</td>
<td>Physical field table overflow</td>
</tr>
<tr>
<td>42</td>
<td>Physical field table error, interrupt field not found</td>
</tr>
<tr>
<td>43</td>
<td>1/0 error</td>
</tr>
</tbody>
</table>
Heterogeneous output will be removed (date not yet set)

Also slated for removal in the near future is heterogeneous output, sometimes called mixed output. This was the old practice of printing both numeric and character data on the same line by separating them with semi-colons:

\[ N = 127 \]
\[ 'HEIGHT IS ' ; N ; ' UNITS' \]
\[ HEIGHT IS 127 UNITS \]

A better approach is to format the numeric data into character data, like this:

\[ 'HEIGHT IS ' ; (N) ; ' UNITS' \]
\[ HEIGHT IS 127 UNITS \]

\( \Delta \) and \( \hat{\Delta} \) will be removed as alphabolics (date not yet set)

Currently, the characters "\( \Delta \)" and "\( \hat{\Delta} \)" are allowed to be used as alphabolics; they currently have no other defined purpose. In the future, "\( ^\)" and "\( ^--\)" (respectively) will replace them as alphabolics. However, "\( ^\)" and "\( ^--\)" will not be allowed to start names (much like numerics). The system can do a conversion when necessary to replace embedded \( \Delta \) and \( \hat{\Delta} \), but leading characters will be a problem that you should probably consider approaching now.

* * *

If you do not already have a copy of the APL Language Manual (GC26-3847), you would be well advised to get yourself one. This manual defines what the APL language is supposed to do as opposed to what any particular implementation of the language does. Please realize that changes such as the ones that we have discussed here are not frivolous. Generally, they are made to allow for the future development of APL. To protect yourself from future changes, follow the language manual as closely as possible (with these updates for internal APLSV systems).

There are always a few coding constructions which do not appear in the APL Language Manual, but which will work (for the nonce). Don't get tricked into thinking that they are necessarily part of the language. Be advised that the things discussed in this article are not supported, and that there will come a morning when they won't work anymore.

---

<table>
<thead>
<tr>
<th>Fieldnum</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Delayed clear of screen (see also 20)</td>
</tr>
<tr>
<td>1</td>
<td>Format (see description of DAT on next page)</td>
</tr>
<tr>
<td>1,Fieldnum</td>
<td>Reformat (see description of DAT on next page)</td>
</tr>
<tr>
<td>2,Fieldnum</td>
<td>Immediate write to screen (see also 4)</td>
</tr>
<tr>
<td>3</td>
<td>Read and wait</td>
</tr>
<tr>
<td>4,Fieldnum</td>
<td>Delayed write to screen (see also 2)</td>
</tr>
<tr>
<td>5,Fieldnum</td>
<td>Get data</td>
</tr>
<tr>
<td>6,Fieldnum</td>
<td>Modify field type</td>
</tr>
<tr>
<td>7,Fieldnum</td>
<td>Modify field intensity</td>
</tr>
<tr>
<td>9</td>
<td>Read screen format</td>
</tr>
<tr>
<td>10</td>
<td>Copy screen image to printer</td>
</tr>
<tr>
<td>12</td>
<td>Position the cursor</td>
</tr>
<tr>
<td>16,Fieldnum</td>
<td>Modify field attribute</td>
</tr>
<tr>
<td>20</td>
<td>Immediate clear of screen (see also 0)</td>
</tr>
</tbody>
</table>

*: Default value
Withdrawal of obsolete system facilities

Some system commands have been removed

The )WIDTH, )ORIGIN, and )DIGITS commands have been withdrawn. In their stead, you should use the following system variables:

<table>
<thead>
<tr>
<th>System Command</th>
<th>System Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>)WIDTH</td>
<td>OPW (printing width)</td>
</tr>
<tr>
<td>)ORIGIN</td>
<td>DIO (index origin)</td>
</tr>
<tr>
<td>)DIGITS</td>
<td>OPP (printing precision)</td>
</tr>
</tbody>
</table>

I-beams will be removed at year-end

Also be advised that the ancient I-beam functions will finally be withdrawn around the end of 1980. If you still have any of these old I-beams in your functions, please look into replacing them as soon as possible (don't get caught in a last-minute rush). If you need some assistance in doing this, please contact us.

<table>
<thead>
<tr>
<th>I-beam</th>
<th>Approximate replacement</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>r19</td>
<td>&quot;1+AI&quot;</td>
<td>Keyboard Unlock time</td>
</tr>
<tr>
<td>r20</td>
<td>3+FPS</td>
<td>Time of day</td>
</tr>
<tr>
<td>r21</td>
<td>[AI][2]</td>
<td>CPU time used during this session</td>
</tr>
<tr>
<td>r22</td>
<td>[AW]</td>
<td>Amount of workspace available</td>
</tr>
<tr>
<td>r23</td>
<td>[UL]</td>
<td>User load</td>
</tr>
<tr>
<td>r24</td>
<td>[AI][3]</td>
<td>Session start time</td>
</tr>
<tr>
<td>r25</td>
<td>3+ETS</td>
<td>Current Date</td>
</tr>
<tr>
<td>r26</td>
<td>1+ELC</td>
<td>Current line number being executed</td>
</tr>
<tr>
<td>r27</td>
<td>[ELC]</td>
<td>Vector of line numbers in state indicator</td>
</tr>
<tr>
<td>r28</td>
<td>[TT]</td>
<td>Terminal type</td>
</tr>
<tr>
<td>r29</td>
<td>1+[AI]</td>
<td>User number</td>
</tr>
</tbody>
</table>

*(origin 1 assumed throughout)*

By "approximate replacement", we mean that the recommended expression yields roughly the same information, although it is typically in different units. The newer facilities are in generally much more "user-friendly" units than the I-beams were. For example, [ETS] returns the current time and date as year-month-day-hour-minute-second-millisecond... r20 gave the time in 60-ths of a second since the last midnight previous to your sign-on. It would therefore make sense to re-write the expression that they appear in rather than to convert the quads to old units, and then back to "friendly" units.
left argument. Thus, "AMA", "AMA", and "AMA" are grouped together in the final list.

If a character in the right argument doesn't appear at all in the left argument, it's treated in a fashion analogous to the action of $A \cdot B$: the unknown characters will be pushed to the end of the list, in "first-come-first-served" order:

\[ M^5 3p '000XXXAAATTnnn' \]
\[ M[\{'0on', 'M';] \]

For more information on the use of dyadic grade, refer to ACM's APL79 Conference Proceedings; "Sorting - a New/Old Problem", by Howard J. Smith, Jr. (Part 1, page 123).
An improved sorting capability is now available through the use of dyadic grade. Previously, grade accepted only numeric vectors; sorting a character matrix could occur only by first encoding the character text into a numeric vector, and then grading that vector. Dyadic grade can now do this directly, by specifying the desired collating sequence as the left argument:

```
M+4 4p'NOW IS THE TIME'
ALFM ABOQEDDPHIJKMNOPQRSTUVWXYZ0123456789'
2 1 3 4
```

This case says that our primary interest in sorting the text should be spelling... both fonts have the same weighting since the alphabetesics in each row are aligned. But if several words have identical spelling ("AMA", "AMA", and "AMA"), then they should be sorted according to the row order of the fonts in the

New APL character available: Dollar-sign

A new character has been added to APLSV: the dollar-sign is now available for use as a decorator on reports. It appears in the atomic vector as [AV[210] (in origin 1).

Note that the dollar-sign is neither a function nor an operator; it will always produce an error when used outside of quotes, but it is recognized by the system for use as a decoration symbol. You may find it to be a particularly useful companion to the new Picture Format primitive.

To enter the character from a 3277, you must first go to "APL OFF"-mode. Since the dollar-sign wasn't an APL character back when the APL feature was designed for the 3277, it isn't available in "APL ON"-mode. Please realize that any other characters that you enter in that manner are not APL characters, and may cause problems [e.g., they will be rejected by DF, and they won't display on other terminals].

On typewriter-type terminals (2741, NCST, etc), the dollar-sign may be entered by overstriking "$" and "/".

On a 5100 or 5110 (in communications mode) the dollar-sign key is not supported, and the "S" and "/" overstrike will display as a blot symbol. As with the 3277, this is because the dollar-sign was not supported when those devices were designed. In normal entry mode, however, the character can be entered as a compound character (in "EDIT" mode, it can't be entered).

The translations for TSIO's CODE=E have also been extended to include the dollar-sign as a valid APL character.

Note that any of the sorting methods can take care of the obvious cases... such as putting "AMA" first... but the cases rapidly become more complex when we introduce different fonts (both underscored and non-underscored characters) within the same matrix. In the fourth case, a matrix left argument was used, looking like this:

```
2 77p' ABC...XYZ' 2 77p' ABC...XYZ' 2 77p' ABC...XYZ'
AMA PROPHATE PEM DHILOGENDRON AMA PROPHATE PEM DHILOGENDRON AMA PROPHATE PEM DHILOGENDRON
AMA PROPHATE PEM DHILOGENDRON AMA PROPHATE PEM DHILOGENDRON AMA PROPHATE PEM DHILOGENDRON
AMA PROPHATE PEM DHILOGENDRON AMA PROPHATE PEM DHILOGENDRON AMA PROPHATE PEM DHILOGENDRON
```

The translations for TSIO's CODE=E have also been extended to include the dollar-sign as a valid APL character.
Picture Format (a.k.a. "Format by Example")

One of the most common requirements of business data processing is formatting data for reports. This has sometimes been a difficult task, with the output often lacking the decorators that were desired for a truly readable report. How many of you, for example, have taken the trouble to insert commas into large numbers for readability? "454217329" becomes much more understandable as "454,217,329", but as nice as that might be on the final report, formatting it that way used to be a formidable task. But now, with Picture Format, such tasks become trivial.

The Picture Format primitive shares the same symbol with the other formatting primitives: ",,". But while dyadic format has always used a numeric left argument in the past (5P"M), it may now also use a character left argument ('55,555.00"M). When the left argument is a character string, the function is Picture Format.

There are, of course, very specific rules for the format of the left argument... but we'll come back to that. For now, let's just say that the left argument (or "pattern") shows APL a sample "picture" of what we want the results to look like.

Picture Format provides an easy method for you to:

- Print numeric output with controlled commas: 16,777,215
- Use any "negative" indicator that you wish, in case the APL "-" symbol isn't available with the printer or typeball that you want to print your report on; use "-", "credit", or whatever you want
- Optionally suppress fields that represent values of 0, so that they print as blank fields
- Print values with leading or trailing zeros
- Float a decorator, such as a dollar-sign, in against your data
- Print numeric values in European notation, with a comma separating the integer and decimal portions of a number: 12,34
- Display negative numbers within parentheses, as on accounting reports: (12,50)

...or, well, you name it.

Picture Format often can make short work of what had previously been complex formatting jobs.

Ambi-valence can be used to supply a commonly-used value by default, as we did here, or it can supply an argument which would otherwise require cumbersome entry. For example, assume that you are using a FIND function which will look through selected functions whose names are listed in its left argument for a character string which is specified in its right argument. [An excellent example of such a function is offered in workspace 12 EDITFN.] To tell it that you want to look through all of the functions in the workspace it may be necessary to enter something like (VL 3) FIND 'CHAR STRING'. Most authors have long recognized common cases like this, and have provided a short-hand notation: "FIND 'CHAR STRING'. Now, using ambi-valence, the notation can be made one step easier: FIND 'CHAR STRING'. Ambi-valence, then, is a useful tool for situations where you may frequently want to indicate "all values".

* * *

If you accidentally call a dyadic defined function without its left argument, it used to respond with a SYNTAX ERROR. Now it will invoke the function, and (if you haven't provided for it) will produce a VALUE ERROR the first time that the left argument is referenced. Recognizing this change may save you some time during trouble-shooting.
Ambi-valent defined functions

The "valence" of a function is a count of its explicit arguments: a monadic function has a valence of one, and a dyadic function has a valence of two. An ambi-valent function, then, is one which may be used with both valences.

A dyadic user-defined function may now be invoked either with or without its left argument. This allows you to write functions that more closely resemble the operation of primitive functions. Within the function, you must then check to see if the left argument was supplied before you reference its value; you can do this with \texttt{WC} (name classification).

Here's a simple function for finding the n-th root of a number:

\begin{verbatim}
  \texttt{Z*N \textbf{ROOT} A}
  \texttt{\begin{array}{l}
  \texttt{2 \textbf{ROOT} 64 729 4096} \\
  \texttt{8 27 64} \\
  \texttt{(2 \textbf{ROOT} 64 729 4096)*2} \\
  \texttt{64 729 4096} \\
  \texttt{3 \textbf{ROOT} 64 729 4096} \\
  \texttt{4 9 16} \\
  \texttt{2 3 \textbf{ROOT} 16 125} \\
  \texttt{4 5}
  \end{array}}
\end{verbatim}

Perhaps a form that would be more convenient to use would be one which would use a common default value for the left argument if no value is supplied; let's assume, for instance, that we would usually use this for finding square roots. If the function is called without a left argument, the name used for the left argument ("N") would have no value. This can be checked using \texttt{WC}, like this:

\begin{verbatim}
  \texttt{Z*N \textbf{ROOT} A}
  \texttt{\begin{array}{l}
  \texttt{+\texttt{(0\texttt{WC} \texttt{'N'}))*L2} \quad \texttt{...OR...} \\
  \texttt{\texttt{Z*N \textbf{ROOT} A}} \\
  \texttt{\texttt{(2 \textbf{ROOT} 64 729 4096)*2} \\
  \texttt{64 729 4096} \\
  \texttt{3 \textbf{ROOT} 64 729 4096} \\
  \texttt{4 9 16} \\
  \texttt{2 3 \textbf{ROOT} 16 125} \\
  \texttt{4 5}
  \end{array}}
\end{verbatim}

Notice that \texttt{ROOT} now works with or without a left argument, and uses 2 as a default if the left argument is elided.
One of the problems that you may have experienced in the past is specifying the proper numeric left argument for the format primitive such that the output properly lines up with your column headings. With Picture Format, the length of the left argument is the length of the result, so this becomes a good deal simpler:

```
V FMT V
[1] 'PROBLEM: WHEN USING FORMAT (*), IT'S DIFFICULT TO ALIGN COLUMNS:
[2] 'OLD USERS CONNECT COMPUTE WORKSPACES BLOCKS TRACKS'
[3] 'FMT: 8 0 9 0 9 1 12 0 9 0 9 0 '
[4] 'V
[5] 'SOLUTION: PICTURE FORMAT ALLOWS HEADINGS AND FORMAT CONTROL TO ALIGN:
[6] 'NEW USERS CONNECT COMPUTE WORKSPACES BLOCKS TRACKS'
[7] 'FMT: 55,555 55,555 555.0 555,555 555,555 555,555'
[8] 'V
```

As we mentioned, the length of the result from Picture Format is the same as the length of its left argument (except for the case where Picture Format contains just one field, which will then apply to each column of data). Likewise, the positions of such things as commas and decimal points will match the position of these items in the output.

Fields within the left argument are typically separated by blanks (although we'll see a way to let other characters separate the fields, too). The number of fields in the left argument must match the last dimension of the data being formatted, although if there is only a single field, that's acceptable too... it will be used for every column of data. So then, what's a field? A field is a sequence of characters bounded by blanks (or the end of the pattern) containing at least one digit. If it doesn't have any digits, it's a decoration. That's allowed, too; this example has two fields:

```
\| DATA 55 55 \| \| DATA 10 20 \| \| DATA 30 40 \|
```

The vertical bars and the word "DATA" aren't fields, because they don't contain any digits; they therefore become simple decorators.

```
R+NUM 'ENTER NUMERIC STRING: ' 
ENTER NUMERIC STRING: 1 2 3 4 5 6
INVALID; PLEASE RE-TRY...
ENTER NUMERIC STRING: 3.7
INVALID; PLEASE RE-TRY...
ENTER NUMERIC STRING: 1 2 3 4.5 6
 pR
5
R
1 2 3 4 5 6
R+NUM 'ENTER NUMERIC STRING: ' 
ENTER NUMERIC STRING: [user presses "return"] 
pR
0
```

Note that if the function were "simplified" a bit, it could become difficult for a well-meaning user to exit the function:

```
V \| Z+NUM T 
[1] 03/12/80 + 09/07/80 MCGREW, 63C, KINGSTON
[2] A PROMPTS USER WITH MSG IN RT ARG, EXECUTES INPUT
[3] L1: T 
[5] \| ' 
[6] L9:(fr'INVALID; PLEASE RE-TRY...'
[7] \| 'V
```

...The Moral: while there may be some legitimate times where you want to "trap" a user's input without letting him interrupt the function, be sure that you use this sort of capability with discretion; don't make your functions unresponsive to the user. Be aware that, using dyadic execute, you can now write uninterruptable functions. Be careful that you don't work yourself into a box.

Also take care to avoid name conflicts in functions that use execute (both monadic and dyadic). A user who is entering lots of repetitive data may wish to set up a variable in the workspace, and enter its name in response to the prompt for input. Fine, but with this particular function he would suddenly discover "mysterious" operations occuring if the name that he chose was "T" or "Z". 

...
A particularly useful application of dyadic execute is
'~L9'~'FOO', in which any problem in the character string
'FOO' which would prevent it from being executed will cause a branch
to label L9.

Dyadic execute will switch arguments after any occurrence of an
error in the right argument, regardless of the depth of the
function calls that may have occurred in the right argument. For example, consider '~L9'~'FN',
where FN is a function. If FN calls another function, FNG, which subsequently encounters a
DOMAIN ERROR, the error will not be reported, but rather, the
execute function will immediately abandon execution of the
right argument, and instead will execute the left argument (~L9).

Be aware of a frequent trap: a common approach is to enter an
expression such as Z+~L9~ with the idea that an error would
cause the function to branch. ...'taint so, McGee. If the
input is executable, the expression can be viewed as Z+~L9~. But if it's not executable, the expression becomes Z+~L9~, or
Z+L9 ...an immediate SYNTAX ERROR. Therefore, although it's
longer, a bit slower, and somewhat more cumbersome, what's
really needed is '~L9'~Z+~M'.

Please realize that this primitive is not meant to be an all­
comprising coverage of generalized error side-tracking. There are many situations where recovering from an error during
execution will not be possible. One thing that is admittedly
absent is a manner of determining where the error occurred, and
what type of error would have been reported (LENGTH ERROR,
DOMAIN ERROR, etc.). But for situations in which you can
anticipate a specific problem, and have a remedy for it, dyadic
execute may be just the ticket.

Here is an example of a simple input checking function which
will prompt for numeric data, and will re-prompt if the input
can't be executed:

```
v Z+NUM T
[1] a03/12/80 + 09/06/80 MCGREW, 53C, KINGSTON
[2] *PROMPTS USER WITH MSG IN RT ARG, EXECUTES INPUT
[3] 1:09T
[4] Z+M
[5] ->(Z+=" ')L8
[6] '~L9'~Z+`L2'
[7] ->0
[8] L8:Z+10
[9] ->0
```

Here's an application of the previous example, from workspace
"1 BILLING":

```
v Z+RATESFMT v
[1] Z+RATES FOR 5555: $ 5.50/CONNECT HOUR, $ 55.50/CPU MINUTE, $ 0.50/TRACX/WEEK
v
RATES FOR 1980 4.25 21 .02
RATES FOR 1980: $ 4.25/CONNECT HOUR, $ 21.00/CPU MINUTE, $ 0.02/TRACX/WEEK
```

Consider what its predecessor had to look like:

```
v Z+RATESFMT v
[1] Z+RATES FOR 19804.25 21 .02
RATES FOR 1980: $ 4.25/CONNECT HOUR, $ 21.00/CPU MINUTE, $ 0.02/TRACX/WEEK
```

Digits in the pattern serve a dual purpose: they show where
digits may appear in the result, but further, specific digits
in the left argument have specific meanings regarding the
formatting that is to take place. They are called "distinguished digits", and a table of them follows shortly.

Non-numeric characters in the left argument can be:
- simple decorators (like the example just shown),
- controlled decorators (such as a comma, which appears or
  is suppressed according to established conventions), or
- floating decorators (such as a dollar-sign, which can be
  made to nestle in against the left side of the data). The
  action of these floating decorators is also controlled by
  selecting which of the "distinguished digits" you use.

Further control is provided through the use of a new system
variable, OFC (Format Control). This variable acts as another
(implicit) argument for Picture Format. A table explaining its
operation is also following.
"Distinguished Digits" for Picture Format

[In general, use "5"s for the pattern except where special handling is desired, as noted in the table]

1 Float the decorator in against the number only if the value is negative. [See notes below]

\[ -551.50' -1 10 \sim 100 \\
-1.00 \quad 10.00 \quad -100.00 \]

\[ 551.50' -1 10 \sim 100 \\
1.00- 10.00 \quad 100.00- \]

\[ (55,551)' -10000 \quad -1 \quad 10 \sim 100 \\
(10,000) \quad (1) \quad 10 \quad (100) \]

NOTE that it is up to the applications programmer to provide a "negative" indicator that is appropriate to his own application. Picture Format provides the capability of using any sign that you wish ("-", "—", "CR", etc.). If this is not done, e.g., if the pattern doesn't include "1"s or "2"s, a DOMAIN ERROR will result (see [FC][4] in the "Description of [FC]" to over-ride this).

2 Float the decorator in against the number only if the value is non-negative. [See note below]

\[ +552.50' -1 10 \sim 100 \\
1.00 \quad +10.00 \quad 100.00 \]

3 Float the decorator in against the number for all values (positive or negative). [See note below]

\[ +553.50' \quad 1 \quad 10 \quad 100 \\
1.00 \quad +10.00 \quad +100.00 \]

\[ 553.10' -1 \quad 1 \quad 10 \quad 100 \\
1.00- 10.00 \quad 100.00- \]

\[ 553.10CR' -1 \quad 1 \quad 10 \quad 100 \\
1.00CR \quad 10.00 \quad 100.00CR \]

If only one of distinguished digits 1, 2, or 3 appears within a given pattern, its effect applies to both right and left floating decorations. If more than one appears, each one affects its own respective side.

4 Counteracts the action of a 1, 2, or 3, preventing it from affecting the other side of the field, which is then treated as a simple decorator.

\[ -551.40CR' -1 \quad 10 \sim 100 \\
-1.00CR \quad 10.00CR \quad -100.00CR \]

---

New primitive function: Dyadic Execute

The execute function is now available in a new flavour. Previous discussions of execute have often alluded to the idea that \[R\] can be used as "an alternative to \[I\] input offering more program control". Well, maybe, but any of you who have tried actually doing this have probably discovered that the problems start when the first user of your application types in an entry that's not a "well-formed APL expression":

\[ a\]

\[ 2+ \]

\[ a\] SYNTAX ERROR

\[ 2+ \]

\[ \wedge \]

A function that is trying to prompt for a character string that represents a vector of floating-point numbers, and then execute it to get the string into numeric form, may well spend most of its time simply ensuring that the execution is going to work; every possibility of an erroneous input must first be checked. Perhaps the classic example of this is using \[R\] to invert a matrix: there are rules governing the acceptability of the matrix for inversion, but checking the matrix will probably take longer than the inversion. A nice approach would be to simply try it, and back off if it fails. In the past this wasn't possible, since an error would halt the function. But now, with dyadic execute, this may easily be done.

Consider the case of \[aR\]. If \(R\) can't be executed, an error message will be returned (e.g., \[a\] SYNTAX ERROR, \[a\] LENGTH ERROR, \[a\] WS FULL, etc.). The dyadic form, \(aL\), will return exactly the same result as \[a\] if the execution is successful; the left argument will be ignored. But if \(R\) can't be executed, the expression will be treated just as if it was \(aL\). In particular, if the left and right arguments are both invalid, an error message will be reported that will look just as if the expression had been \[aL\]:

\[ a\]

\[ '3+' \]

\[ a\] SYNTAX ERROR

\[ 3+ \]

\[ \wedge \]

\[ '2+2' a '3+' \]

\[ 4 \]

\[ '2+2' a '3+' \]

\[ a\] SYNTAX ERROR

\[ 2+ \]

\[ \wedge \]
Perform normal formatting, observing normal APL rules of removing leading and trailing zeros, except that a value of zero will display as all-blank. *Careful*, though, it's up to you to include an appropriate sign character if you expect any negative values, and a "1" or "2" to control it; see the "NOTE" on the previous page.

'555.55' • '1.1 10.01 100 0 100.10
1.1 10.01 100 100.1

The decorator to the right also marks the end of this field; treat it as though there's a blank between the fields, but also print the decorator.

'05/55/55' • '32580
03/25/80

'06/06/05' • '3 25 80
03/25/80

The next non-numeric character to the right is the symbol to be used for exponential notation ("E-format").

' -1.70E-01' • '-.001 100 10000 -10000000000
-1.00E-03 1.00E 02 1.00E 04 1.00E 10

"Check-protection": fill empty portions of the field with whatever character is in [F3] (in origin 1). The default character is •.

'8555.50' • '1 10 100
***1.00 • *10.00 • 100.00

'5855.50' • '1 10 100
***1.00 • *10.00 100.00

Pad with leading or trailing zeros out to this point (before or after the decimal point, respectively), unless the value is all zero (then use all blanks). [Compare with 0]

'555.59' • '1.1 10.01 0 100
1.10 10.01 100.00

'555.50' • '1.1 10.01 0 100
1.10 10.01 .00 100.00

Pad with leading or trailing zeros out to this point (before or after the decimal point, respectively). [Compare with 9]

'055.50' • '1 10 100
001.00 010.00 100.00
<table>
<thead>
<tr>
<th><strong>DFC[1]</strong></th>
<th>Decimal point: the character that's to be substituted for the period where a decimal point is required in the result. This also affects numeric-left-argument format.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default setting: <strong>DFC[1]=',.'</strong></td>
<td></td>
</tr>
<tr>
<td>'55.55''12.34'</td>
<td>'55.55''12.34'</td>
</tr>
<tr>
<td>12.34</td>
<td>12.34</td>
</tr>
<tr>
<td>5 2''12.34</td>
<td>5 2''12.34</td>
</tr>
<tr>
<td>12.34</td>
<td>12.34</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>DFC[2]</strong></th>
<th>Comma: the character to be substituted for the comma where a controlled comma is required in the result.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default setting: <strong>DFC[2]=',,'</strong></td>
<td></td>
</tr>
<tr>
<td>'5,555''1234'</td>
<td>'5,555''1234'</td>
</tr>
<tr>
<td>1,234</td>
<td>1 234</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>DFC[3]</strong></th>
<th>Check Protection character: the character to be printed in response to the &quot;8&quot;'s in the pattern.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default setting: <strong>DFC[3]='*'</strong></td>
<td></td>
</tr>
<tr>
<td>' 855''1 10 100'</td>
<td>' 855''1 10 100'</td>
</tr>
<tr>
<td><strong>8</strong> '10 100</td>
<td>//1/10 100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>DFC[4]</strong></th>
<th>Overflow control: If the default character appears here, a value which is too large to fit into a field specified will cause a <strong>Domain Error</strong>. If any other character appears here, the error will not occur and instead the offending field will be filled with the character specified. This also affects numeric-left-argument format.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default setting: <strong>DFC[4]='0'</strong></td>
<td></td>
</tr>
<tr>
<td><strong>DFC[4]=0'</strong></td>
<td><strong>DFC[4]=0'</strong></td>
</tr>
<tr>
<td>' 00''1 10 100'</td>
<td>' 00''1 10 100'</td>
</tr>
<tr>
<td><strong>Domain Error</strong></td>
<td>01 10 ??</td>
</tr>
<tr>
<td>' 00''1 10 100'</td>
<td>' 00'1 10 100'</td>
</tr>
<tr>
<td>A</td>
<td>3 0'10000</td>
</tr>
</tbody>
</table>

While **DFC** currently contains five characters, it is recommended that you don't consider its length to be fixed. Future extensions could add additional elements.

The only valid current configuration for **DFC** is five character elements. Any setting other than this will cause a **DFC IMPLICIT ERROR** to be evoked when any use of dyadic format is attempted.

Note that the first two elements show what characters are to be printed where the decimal point and controlled comma are required in the result. The pattern is always coded using U.S. conventions; **DFC** can be changed to allow display of British or other standards. This requirement for the pattern was done to allow an easy transfer of programs between countries... a change to all the patterns in the workspace isn't needed for such a move, only a simple change to **DFC**.
Description of DFC -- Format Control

Default setting: DFC='..*0_'

| DFC[1] | Decimal point: the character to be substituted for the period where a decimal point is required in the result. This also affects numeric-left-argument format. |
| DFC[2] | Comma: the character to be substituted for the comma where a controlled comma is required in the result. |
| DFC[3] | Check Protection character: the character to be printed in response to the "8"'s in the pattern. |
| DFC[4] | Overflow control: If the default character appears here, a value which is too large to fit into a field specified will cause a DOMAIN ERROR. If any other character appears here, the error will not occur and instead the offending field will be filled with the character specified. This also affects numeric-left-argument format. |

DFC[1]+',',
'55.55'¥12.34
12.34
5 2¥12.34
12.34

DFC[2]+',',
'5,555'¥1234
1,234

DFC[3]+'*/
' 855'¥1 10 100
**1 *10 100
//1 /10 100

DFC[4]+'0'
' 00'¥1 10 100
DOMAIN ERROR
' 00'¥1 10 100
^ 3 0¥10000

While DFC currently contains five characters, it is recommended that you don't consider its length to be fixed. Future extensions could add additional elements.

The only valid current configuration for DFC is five character elements. Any setting other than this will cause a DFC IMPLICIT ERROR to be evoked when any use of dyadic format is attempted.

Note that the first two elements show what characters are to be printed where the decimal point and controlled comma are required in the result. The pattern is always coded using U.S. conventions. DFC can be changed to allow display of British or other standards. This requirement for the pattern was done to allow an easy transfer of programs between countries. A change to all the patterns in the workspace isn't needed for such a move, only a simple change to DFC.
Perform normal formatting, observing normal APL rules of removing leading and trailing zeros, except that a value of zero will display as all-blank. Careful, though, it's up to you to include an appropriate sign character if you expect any negative values, and a "1" or "2" to control it; see the "NOTE" on the previous page.

The decorator to the right also marks the end of this field; treat it as though there's a blank between the fields, but also print the decorator.

The next non-numeric character to the right is the symbol to be used for exponential notation ("E-format").

"Check-protection": fill empty portions of the field with whatever character is in DFC[3] (in origin 1). The default character is *.

Pad with leading or trailing zeros out to this point (before or after the decimal point, respectively), unless the value is all zero (then use all blanks). [Compare with 0]

Pad with leading or trailing zeros out to this point (before or after the decimal point, respectively). [Compare with 9]
"Distinguished Digits" for Picture Format

In general, use "5"'s for the pattern except where special handling is desired, as noted in the table.

1. Float the decorator in against the number only if the value is negative. [See notes below]

```
-551.50 ' 1 10 100
-1.00  10.00 100.00
551.50 ' 1 10 100
1.00- 10.00 100.00-
(55,551)' 1 10000 1 10 100
(10,000)   (1)   10  (100)
```

NOTE that it is up to the applications programmer to provide a "negative" indicator that is appropriate to his own application. Picture Format provides the capability of using any sign that you wish ("-", "-", "CR", etc.). If this is not done, e.g., if the pattern doesn't include "1"s or "2"s, a DOMAIN ERROR will result (see [FC][4] in the "Description of [FC]" to over-ride this).

2. Float the decorator in against the number only if the value is non-negative. [See note below]

```
+552.50 ' 1 10 100
1.00  +10.00 100.00
```

3. Float the decorator in against the number for all values (positive or negative). [See note below]

```
$553.50 ' 1 10 100
$1.00  $10.00 $100.00
$553.10-' 1 10 100
$1.00- $10.00 $100.00-
$553.10CR ' 1 10 100
$1.00CR $10.00 $100.00CR
```

If only one of distinguished digits 1, 2, or 3 appears within a given pattern, its effect applies to both right and left floating decorations. If more than one appears, each one affects its own respective side.

4. Counteracts the action of a 1, 2, or 3, preventing it from affecting the other side of the field, which is then treated as a simple decorator.

```
-551.40CR ' 1 10 100
1.00CR  10.00CR -100.00CR
```

New primitive function: Dyadic Execute

The execute function is now available in a new flavour. Previous discussions of execute have often alluded to the idea that $! can be used as "an alternative to input offering more program control". Well, maybe, but any of you who have tried to actually do this have probably discovered that the problems start when the first user of your application types in an entry that's not a "well-formed APL expression":

```
2+
$ SYNTAX ERROR
2+ ^
```

A function that is trying to prompt for a character string that represents a vector of floating-point numbers, and then execute it to get the string into numeric form, may well spend most of its time simply ensuring that the execution is going to work; every possibility of an erroneous input must first be checked. Perhaps the classic example of this is using $!R to invert a matrix: there are rules governing the acceptability of the matrix for inversion, but checking the matrix will probably take longer than the inversion. A nice approach would be to simply try it, and back off if it fails. In the past this wasn't possible, since an error would halt the function. But now, with dyadic execute, this may easily be done.

Consider the case of $!R. If $R can't be executed, an error message will be returned (e.g., $ SYNTAX ERROR, $ LENGTH ERROR, $ WS FULL, etc.). The dyadic form, $L$R, will return exactly the same result as $!R if the execution is successful; the left argument will be ignored. But if $R can't be executed, the expression will be treated just as if it was $L. In particular, if the left and right arguments are both invalid, an error message will be reported that will look just as if the expression had been $L:

```
'L3+
$ SYNTAX ERROR
3+ ^
2+2 $ 3+
4
2+ $ 3+
$ SYNTAX ERROR
2+ ^
```
A particularly useful application of dyadic execute is `~L9'~FOO, in which any problem in the character string FOO which would prevent it from being executed will cause a branch to label L9.

Dyadic execute will switch arguments after any occurrence of an error in the right argument, regardless of the depth of the function calls that may have occurred in the right argument. For example, consider `~L9'~FN', where FN is a function. If FN calls another function, FN2, which subsequently encounters a DOMAIN ERROR, the error will not be reported, but rather, the execute function will immediately abandon execution of the right argument, and instead will execute the left argument (~L9).

Be aware of a frequent trap: a common approach is to enter an expression such as Z`~L9'~ with the idea that an error would cause the function to branch. ...'taint so, McGee. If the input is executable, the expression can be viewed as Z+~. But if it's not executable, the expression becomes Z+~L9', or Z~L9 ...an immediate SYNTAX ERROR. Therefore, although it's longer, a bit slower, and somewhat more cumbersome, what's really needed is `~L9'~Z+~'.

Please realize that this primitive is not meant to be an all-encompassing coverage of generalized error side-tracking. There are many situations where recovering from an error during execution will not be possible. One thing that is admittedly absent is a manner of determining where the error occurred, and what type of error would have been reported (LENGTH ERROR, DOMAIN ERROR, etc.). But for situations in which you can anticipate a specific problem, and have a remedy for it, dyadic execute may be just the ticket.

Here is an example of a simple input checking function which will prompt for numeric data, and will re-prompt if the input can't be executed:

```
V Z+NUM T
[1] 03/12/80 + 09/06/80 MCGREW, 63C, KINGSTON
[2] PROMPTS USER WITH MSG IN RT ARG, EXECUTES INPUT
[3] L1:0:T
[4] Z+~
[5] →(ZA=' ')L8
[6] `~L9'~Z+~L2'
[7] →0
[8] L8:Z+10
[9] →0
[10] L9:C='INVALID; PLEASE RE-TRY...'  
[11] →L1
```

Here's an application of the previous example, from workspace "1 BILLING":

```
V Z+RATESFMT V
[1] Z+RATES FOR 5555: $ 5.50/CONNECT HOUR, $ 55.50/PU MINUTE, $ 0.50/TRACK/WEEK'W
V RATESFMT 1980 4.25 21 .02
RATES FOR 1980: $ 4.25/CONNECT HOUR, $ 21.00/PU MINUTE, $ 0.02/TRACK/WEEK
```

Consider what its predecessor had to look like:

```
V Z+RATESFMT V
[1] Z+RATES FOR 1980: (5 2 2)'/CONNECT HOUR, 8 '(1 4 1)'/PU MINUTE, $ 0.02/TRACK/WEEK'
V RATESFMT 1980 4.25 21 .02
RATES FOR 1980: $ 4.25/CONNECT HOUR, $ 21.00/PU MINUTE, $ 0.02/TRACK/WEEK
```

Digits in the pattern serve a dual purpose: they show where digits may appear in the result, but further, specific digits in the left argument have specific meanings regarding the formatting that is to take place. They are called "distinguished digits", and a table of them follows shortly.

Non-numeric characters in the left argument can be:
- simple decorators (like the example just shown),
- controlled decorators (such as a comma, which appears or is suppressed according to established conventions), or
- floating decorators (such as a dollar-sign, which can be made to nestle in against the left side of the data). The action of these floating decorators is also controlled by selecting which of the "distinguished digits" you use.

Further control is provided through the use of a new system variable, FPC (Format Control). This variable acts as another (implicit) argument for Picture Format. A table explaining its operation is also following.

...I THINK THIS NEWSLETTER IS GIVING ME A MIGRAINE, KEN! 

[Illustration: A man at a computer]
One of the problems that you may have experienced in the past is specifying the proper numeric left argument for the format primitive such that the output properly lines up with your column headings. With Picture Format, the length of the left argument is the length of the result, so this becomes a good deal simpler:

```
V FMT V
[1] #PROBLEM: WHEN USING FORMAT (*), IT'S DIFFICULT TO ALIGN COLUMNS:
[2] 'OLD USERS CONNECT COMPUTe WORKSPACES BLOCKS TRACKS'
[3] 'FMT:', 8 0 9 0 8 1 1 2 0 9 0 0 0 V
[4] 'V

[5] #SOLUTION: PICTURE FORMAT ALLOWS HEADINGS AND FORMAT CONTROL TO ALIGN:
[6] 'NEW USERS CONNECT COMPUTe WORKSPACES BLOCKS TRACKS'
[7] 'FMT:', 55,555 55,555 555.0 555,555 555,555 555,555 V
```

As we mentioned, the length of the result from Picture Format is the same as the length of its left argument (except for the case where Picture Format contains just one field, which will then apply to each column of data). Likewise, the positions of such things as commas and decimal points will match the position of these items in the output.

Fields within the left argument are typically separated by blanks (although we'll see a way to let other characters separate the fields, too). The number of fields in the left argument must match the last dimension of the data being formatted, although if there is only a single field, that's acceptable too... it will be used for every column of data. So then, what's a field? A field is a sequence of characters bounded by blanks (or the end of the pattern) containing at least one digit. If it doesn't have any digits, it's a decoration. That's allowed, too; this example has two fields:

```
| 'DATA 55 55 | 'v2 2p10 20 30 40 | DATA 10 20 | DATA 30 40 |
```

The vertical bars and the word "DATA" aren't fields, because they don't contain any digits; they therefore become simple decorators.
Ambi-valent defined functions

The "valence" of a function is a count of its explicit arguments: a monadic function has a valence of one, and a dyadic function has a valence of two. An ambi-valent function, then, is one which may be used with both valences.

A dyadic user-defined function may now be invoked either with or without its left argument. This allows you to write functions that more closely resemble the operation of primitive functions. Within the function, you must then check to see if the left argument was supplied before you reference its value; you can do this with `WC` (name classification).

Here's a simple function for finding the n-th root of a number:

```lisp
\[ \sqrt[n]{a} \]
```

Running the "REPORT" function, we get this finished report:

```

<table>
<thead>
<tr>
<th>REPORT DATA</th>
<th>ITEM 1</th>
<th>ITEM 2</th>
<th>ITEM 3</th>
<th>ITEM 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP A</td>
<td>$12,365.67</td>
<td>$1.00</td>
<td>$50.55</td>
<td>$127.23</td>
</tr>
<tr>
<td>GROUP B</td>
<td>$34.15</td>
<td>$34.15</td>
<td>$1,234.56</td>
<td>$222.50</td>
</tr>
<tr>
<td>GROUP C</td>
<td>$227.50</td>
<td>$56,789.00</td>
<td>$52,339.55</td>
<td>$75.71</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$12,607.32</td>
<td>$1,233.56</td>
<td>$52,339.55</td>
<td>$75.71</td>
</tr>
</tbody>
</table>
```

Notice that `ROOT` now works with or without a left argument, and uses 2 as a default if the left argument is elided.

Using Picture Format, we can do a lot of formatting with a minimal amount of programming. Let's say that we want to build a report function that will dress up the output for us. Here's a sample function that could do the formatting for us. Again, don't be concerned right now with just what the rules are for coding up the left argument for Picture Format... we'll get to that in a bit. For right now, simply notice how compact the actual formatting is when we use Picture Format:

```
\[ \sqrt{n}{a} \]
```

```lisp
\[ a\rightarrow \] (\text{format all the data}; add dollar signs and 'CR' notes; add total line:
[1] Z\rightarrow (35.555.19 \text{CR}'n',[1]+'M
[2] Z\rightarrow \text{add column headings}
[3] Z\rightarrow \text{add row headings}
[4] Z\rightarrow \text{put blank lines between heading and body, and between body and total:
[5] Z\rightarrow \text{add column headings}
[6] Z\rightarrow \text{add row headings}
[7] Z\rightarrow \text{put blank lines between heading and body, and between body and totals
```

Here's the data that we're working with:

```
\| DATA | 3 | 4 |
\|-----|---|---|
\| 1234.56 | 1 | 50.55 |
\| 34.15  | 1234.56 | 4500 |
\| 227.5  | 0  | 56,789 |
\| 19.56  | 19.56 |
```

Perhaps a form that would be more convenient to use would be one which would use a common default value for the left argument if no value is supplied; let's assume, for instance, that we would usually use this for finding square roots. If the function is called without a left argument, the name used for the left argument ("n") would have no value. This can be checked using `WC`, like this:

\[ Z+n \text{ root } a \]

\[ \sqrt{n}{a} \]

This allows you to write functions that more closely resemble the operation of primitive functions. Within the function, you must then check to see if the left argument was supplied before you reference its value; you can do this with `WC` (name classification).

Here's a simple function for finding the n-th root of a number:

```
\[ \sqrt{n}{a} \]
```

Perhaps a form that would be more convenient to use would be one which would use a common default value for the left argument if no value is supplied; let's assume, for instance, that we would usually use this for finding square roots. If the function is called without a left argument, the name used for the left argument ("n") would have no value. This can be checked using `WC`, like this:

\[ Z+n \text{ root } a \]

\[ \sqrt{n}{a} \]

Notice that `ROOT` now works with or without a left argument, and uses 2 as adefault if the left argument is elided.
One of the most common requirements of business data processing is formatting data for reports. This has sometimes been a difficult task, with the output often lacking the decorators that were desired for a truly readable report. How many of you, for example, have taken the trouble to insert commas into large numbers for readability? "454217329" becomes much more understandable as "454,217,329", but as nice as that might be on the final report, formatting it that way used to be a formidable task. But now, with Picture Format, such tasks become trivial.

The Picture Format primitive shares the same symbol with the other formatting primitives: "". But while dyadic format has always used a numeric left argument in the past (5 0P""), it may now also use a character left argument ("'55,555.00"'). When the left argument is a character string, the function is Picture Format.

There are, of course, very specific rules for the format of the left argument... but we'll come back to that. For now, let's just say that the left argument (or "pattern") shows APL a sample "picture" of what we want the results to look like.

Picture Format provides an easy method for you to:

- Print numeric output with controlled commas: 16,777,215
- Use any "negative" indicator that you wish, in case the APL """" symbol isn't available with the printer or typeball that you want to print your report on; use ",", "credit", or whatever you want
- Optionally suppress fields that represent values of 0, so that they print as blank fields
- Print values with leading or trailing zeros
- Float a decorator, such as a dollar-sign, in against your data
- Print numeric values in European notation, with a comma separating the integer and decimal portions of a number: 12,34
- Display negative numbers within parentheses, as on accounting reports: (12.50) ...

...or, well, you name it.

Picture Format often can make short work of what had previously been complex formatting jobs.

Ambi-valence can be used to supply a commonly-used value by default, as we did here, or it can supply an argument which would otherwise require cumbersome entry. For example, assume that you are using a FIND function which will look through selected functions whose names are listed in its left argument for a character string which is specified in its right argument. [An excellent example of such a function is offered in workspace 12 EDITFN.] To tell it that you want to look through all of the functions in the workspace it may be necessary to enter something like (WL 3) FIND 'CHAR STRING'. Most authors have long recognized common cases like this, and have provided a short-hand notation: 'FIND 'CHAR STRING'. Now, using ambi-valence, the notation can be made one step easier: FIND 'CHAR STRING'. Ambi-valence, then, is a useful tool for situations where you may frequently want to indicate "all values".

* * *

If you accidentally call a dyadic defined function without its left argument, it used to respond with a SYNTAX ERROR. Now it will invoke the function, and (if you haven't provided for it) will produce a VALUE ERROR the first time that the left argument is referenced. Recognizing this change may save you some time during trouble-shooting.

Previous response: New response:

40 PLUS B PLUS 5
8 PLUS 5 PLUS 5
SYNTAX ERROR VALUE ERROR
PLUS PLUS
PLUS PLUS
PLUS PLUS
SYNTAX ERROR VALUE ERROR
PLUS PLUS
SYNTAX ERROR VALUE ERROR
 PLUS

Notice, in the last example, that ambi-valence does not allow the function to be called niladically.
An improved sorting capability is now available through the use of dyadic grade. Previously, grade accepted only numeric vectors; sorting a character matrix could occur only by first encoding the character text into a numeric vector, and then grading that vector. Dyadic grade can now do this directly, by specifying the desired collating sequence as the left argument:

```
M+4 4p 'NOW IS THE TIME'
ALF+ 1 ABCDEFGHIJKLMNOPQRSTUVWXYZ
ALF+ 2 1 3 4
M[ALF+;]
```

The left argument to grade can be whatever alphabet is best suited to your own application. For example, here is a sample text matrix sorted four different ways:

```
| AHA AMA AMA AHA | PHOSPHATE PHOSPHATE: |
| PHOSPHATE PHOSPHATE: |
| DHA DHA DHA DHA | PHOSPHATE: PPH |
```

New APL character available: Dollar-sign

A new character has been added to APLSV; the dollar-sign is now available for use as a decorator on reports. It appears in the atomic vector as $AV[210]$ (in origin 1).

Note that the dollar-sign is neither a function nor an operator; it will always produce an error when used outside of quotes, but it is recognized by the system for use as a decoration symbol. You may find it to be a particularly useful companion to the new Picture Format primitive.

To enter the character from a 3277, you must first go to "APL OFF"-mode. Since the dollar-sign wasn't an APL character back when the APL feature was designed for the 3277, it isn't available in "APL ON"-mode. Please realize that any other characters that you enter in that manner are not APL characters, and may cause problems (e.g., they will be rejected by $DFX$, and they won't display on other terminals).

On typewriter-type terminals (2741, MCST, etc), the dollar-sign may be entered by overstriking "$s$" and "$t$".

On a 5100 or 5110 (in communications mode) the dollar-sign key is not supported, and the "$s$" and "$t$" overstrike will display as a blot symbol. As with the 3277, this is because the dollar-sign was not supported when those devices were designed. In normal entry mode, however, the character can be entered as a compound character (in "EDIT" mode, it can't be entered).

The translations for TSIO's CODE=E have also been extended to include the dollar-sign as a valid APL character.
left argument. Thus, "AMA", "AMA", and "AMA" are grouped together in the final list.

If a character in the right argument doesn't appear at all in the left argument, it's treated in a fashion analogous to the action of \( A \cdot B \). The unknown characters will be pushed to the end of the list, in "first-come-first-served" order:

```
M+5 3p '000XXXAAA[[[hhh'
M["Don't"]
```

For more information on the use of dyadic grade, refer to ACM's APL79 Conference Proceedings; "Sorting - a New/Old Problem", by Howard J. Smith, Jr. (Part 1, page 123).
Withdrawal of obsolete system facilities

Some system commands have been removed

The )WIDTH, )ORIGIN, and )DIGITS commands have been withdrawn. In their stead, you should use the following system variables:

<table>
<thead>
<tr>
<th>System Command</th>
<th>System Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>)WIDTH</td>
<td>OPW (printing width)</td>
</tr>
<tr>
<td>)ORIGIN</td>
<td>DIO (index origin)</td>
</tr>
<tr>
<td>)DIGITS</td>
<td>OPP (printing precision)</td>
</tr>
</tbody>
</table>

I-beams will be removed at year-end

Also be advised that the ancient I-beam functions will finally be withdrawn around the end of 1980. If you still have any of these old I-beams in your functions, please look into replacing them as soon as possible (don't get caught in a last-minute rush). If you need some assistance in doing this, please contact us.

<table>
<thead>
<tr>
<th>I-beam</th>
<th>Approximate replacement</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>i19</td>
<td>&quot;1+$AI&quot;</td>
<td>Keyboard Unlock time</td>
</tr>
<tr>
<td>i20</td>
<td>3+$F5S</td>
<td>Time of day</td>
</tr>
<tr>
<td>i21</td>
<td>[$AI][2]</td>
<td>CPU time used during this session</td>
</tr>
<tr>
<td>i22</td>
<td>$A4</td>
<td>Amount of workspace available</td>
</tr>
<tr>
<td>i23</td>
<td>$V1</td>
<td>User load</td>
</tr>
<tr>
<td>i24</td>
<td>[$AI][3]</td>
<td>Session start time</td>
</tr>
<tr>
<td>i25</td>
<td>3+$T5S</td>
<td>Current Date</td>
</tr>
<tr>
<td>i26</td>
<td>1+$LC</td>
<td>Current line number being executed</td>
</tr>
<tr>
<td>i27</td>
<td>$LC</td>
<td>Vector of line numbers in state indicator</td>
</tr>
<tr>
<td>i28</td>
<td>$TT</td>
<td>Terminal type</td>
</tr>
<tr>
<td>i29</td>
<td>1+$AI</td>
<td>User number</td>
</tr>
</tbody>
</table>

(origin 1 assumed throughout)

By "approximate replacement", we mean that the recommended expression yields roughly the same information, although it is typically in different units. The newer facilities are in generally much more "user-friendly" units than the I-beams were. For example, \$F5S returns the current time and date as year-month-day-hour-minute-second-millisecond... i20 gave the time in 60-ths of a second since the last midnight previous to your sign-on. It would therefore make sense to re-write the expression that they appear in rather than to convert the quads to old units, and then back to "friendly" units.
Heterogeneous output will be removed (date not yet set)

Also slated for removal in the near future is heterogeneous output, sometimes called mixed output. This was the old practice of printing both numeric and character data on the same line by separating them with semi-colons:

```
N=127
'HEIGHT IS ':N;' UNITS'
HEIGHT IS 127 UNITS
```

A better approach is to format the numeric data into character data, like this:

```
'HEIGHT IS ':N;' UNITS'
HEIGHT IS 127 UNITS
```

Δ and Δ will be removed as alphabatics (date not yet set)

Currently, the characters "Δ" and "Δ" are allowed to be used as alphabatics; they currently have no other defined purpose. In the future, "Δ" and "Δ" (respectively) will replace them as alphabatics. However, "Δ" and "Δ" will not be allowed to start names (much like numerics). The system can do a conversion when necessary to replace embedded Δ and Δ, but leading characters will be a problem that you should probably consider approaching now.

* * *

If you do not already have a copy of the *APL Language Manual* (GC26-3847), you would be well advised to get yourself one. This manual defines what the *APL language* is supposed to do as opposed to what any particular implementation of the language does. Please realize that changes such as the ones that we have discussed here are not frivolous. Generally, they are made to allow for the future development of APL. To protect yourself from future changes, follow the language manual as closely as possible (with these updates for internal APLSV systems).

There are always a few coding constructions which do not appear in the *APL Language Manual*, but which will work (for the nonce). Don't get tricked into thinking that they are necessarily part of the language. Be advised that the things discussed in this article are not supported, and that there will come a morning when they won't work anymore.
Here are some of the comments that we received concerning our service and our previous issue of the Times:

"The entire issue is eminently readable and informative. At the least point where it might have become tedious, there is an illustration or cartoon to brighten it up. The typographic design is outstanding, both on the front cover and in the body of the text. The humour is splendid-- all the more so because it is so unusual in an 'official' IBM publication. The size and format are just right. The reference information and articles are in the right order (phone numbers at the front, security guidelines at the back!)."

"I have to admit failure. I cannot find ANY fault with it!

"Congratulations, you wordsmiths. The quality of the product reflects the efforts and skill that you put into it."

B. Martin
Endicott, NY

"Your publication is $\emptyset$ (think German)."

A. Nunes
Kingston, NY

"Your Summer 1979 Issue was excellent... full of useful info, easy to read... how are you ever going to top it?"

A. Wolf
White Plains, NY

We're not.

<table>
<thead>
<tr>
<th>Return Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Successful</td>
</tr>
<tr>
<td>1</td>
<td>CTL nonce error (command not currently implemented)</td>
</tr>
<tr>
<td>11</td>
<td>CTL rank error</td>
</tr>
<tr>
<td>12</td>
<td>CTL length error</td>
</tr>
<tr>
<td>13</td>
<td>CTL domain error</td>
</tr>
<tr>
<td>14</td>
<td>Invalid command</td>
</tr>
<tr>
<td>15</td>
<td>Request to position cursor in an undefined field</td>
</tr>
<tr>
<td>21</td>
<td>DAT rank error</td>
</tr>
<tr>
<td>22</td>
<td>DAT length error</td>
</tr>
<tr>
<td>23</td>
<td>DAT domain error</td>
</tr>
<tr>
<td>24</td>
<td>DAT variable not shared</td>
</tr>
<tr>
<td>30</td>
<td>Invalid field number</td>
</tr>
<tr>
<td>31</td>
<td>Defined field extends beyond screen</td>
</tr>
<tr>
<td>32</td>
<td>Reference outside field definition</td>
</tr>
<tr>
<td>35</td>
<td>Light pen field starts in column 1</td>
</tr>
<tr>
<td>36</td>
<td>Light pen field (with height 1) not contained in one physical screen line</td>
</tr>
<tr>
<td>37</td>
<td>Invalid field type</td>
</tr>
<tr>
<td>38</td>
<td>Invalid field intensity</td>
</tr>
<tr>
<td>39</td>
<td>&quot;GET&quot; or &quot;PUT&quot; for an undefined field</td>
</tr>
<tr>
<td>41</td>
<td>DAT not specified in correct sequence</td>
</tr>
<tr>
<td>42</td>
<td>DAT not referenced in correct sequence</td>
</tr>
<tr>
<td>43</td>
<td>Printer is not available</td>
</tr>
<tr>
<td>91</td>
<td>Physical field table overflow</td>
</tr>
<tr>
<td>92</td>
<td>Physical field table error, interrupt field not found</td>
</tr>
<tr>
<td>95</td>
<td>I/O error</td>
</tr>
</tbody>
</table>
If either of the last two elements is zero or negative, the position of the cursor will not be changed in the next read, write, or erase operation. [This too, is the default condition until you issue this service request.]

When the auxiliary processor is first invoked, the cursor appears on the screen in position 1, 1. The cursor will default to this position after any new screen format takes effect.

"Thank you for the article on "The One-Liner Syndrome". I've been criticized for years for not writing one-line programs. Now I have the satisfaction of knowing that I was right all along.

"You guys are great! How does the company let you get away with writing a newsletter that's not only useful but entertaining and witty besides?"

Name withheld by request
Kingston, NY

"I note with interest your castigation of the 'one-liner' fraternity. I agree, but I cannot understand why this obfuscacious bunch should have been entrusted with the responsibility and high honor of writing nearly all of our APL manuals.

"I'd like to see some new manuals, written with nearly the informality with which 'JotoDot' was written. The emphasis should be on plain English with appropriate penalties for all authors who seem to be on the verge of exhibitionism."

A. Niros
Raleigh, NC

"More of the same! This publication is a model for efforts of this kind. It should be daily required reading for all authors of stuffy and stodgy communications...."

H. Clarke
Charlotte, NC

"Omit the newsletter-- put items in 1 NEWS."

D. Davis
Raleigh, NC

["S*t*g*h*... We tried that, somewhat unsuccessfully. After running two 50-line new items a month apart, we received mail telling us:

"The length of these news items is absurd-- how about remembering that some of us still use 27c4's!"

C. Martin
Kingston, NY

...Sorry."]
"I recently borrowed a copy of this excellent 'Times' from a friend who brought it from Rio. I think that you have heard many nice comments about this newsletter, therefore I will not take your time just saying how nice you are, but I can't go on without saying at least thank you! ...."  
J. Elias  
Sumare, Brazil

"Your 'Jot+Dot Times' (and my son learning more APL in the local IBM Explorer group than I can remember) may just be the incentive that I needed to get back into APL. Thanks for a good issue."

D. Thompson  
Kingston, NY

"How good is o.x? ... o.x is so good that I keep a copy on my sailboat in the library created for windless days. Keeping this in mind, you must be careful that the material in the book does not change meaning when read under 12 volt dc lighting...."

T. Cook  
Raleigh, NC

---

Reading the Screen Format

The Full Screen Management Auxiliary Processor provides an easy way of determining what format matrix it is currently using. A request to display the current format matrix is made like this:

\[
\text{CTL}+9  
\text{format}+\text{DAT}
\]

...where \text{format} contains one row for each field, up to the highest valid field defined, and is six columns wide. If a new format is pending, the new format matrix is returned.

Printing a Screen Image

During its interaction with the Full Screen Management Auxiliary Processor, your function may direct a copy of the current screen image to the printer by specifying:

\[
\text{CTL}+10  
\text{[Not available in the initial release]}
\]

The printer must have been previously defined. Refer to the previous article.

Sounding the Alarm

In your screen operations, you may find it useful at times to sound an audible alarm. For instance, you might want an alarm sounded when a field of particular importance is filled. Your application can request the auxiliary processor to sound the alarm through the assignment:

\[
\text{CTL}+11
\]

This request takes effect at the next screen management read or write operation.

Setting the Cursor

This operation is used to position the cursor at the end of the next read, write, or erase operation. Your application can request this operation by specifying:

\[
\text{DAT}+\text{fieldnum},\text{row},\text{col}  
\text{CTL}+12
\]

If the first element is zero, the second and third elements are interpreted as the row and column position of the cursor from the upper left-hand position on the screen.
The intensity indicators are:

0 - off or don't display
*1 - normal intensity [default]
2 - highlighted intensity

As an example, the following two assignments set the display intensity of a previously formatted screen field (screen field 2) to be highlighted. Sharing for the control and data variables are assumed to be complete:

```plaintext
DAT<-2
CTLfr7 2
```

Modifying Input Field Attributes

This operation is used to modify additional attributes for one or more fields. It takes effect at the next screen management read or write operation and applies until changed explicitly or until the screen is reformatted. The additional attributes that may be specified control the handling of (1) trailing nulls, and (2) an "Auto-skip" feature. These attributes are only meaningful for input fields, but may be specified for any field.

Your application can request this operation by specifying:

```plaintext
DAT+attribute
CTL+16,fieldnum
```

...where attribute is a numeric vector of attribute indicators. Each value in attribute indicates the attribute of the corresponding field in fieldnum. If attribute is a single value, it is the attribute indicator for all of the fields specified in fieldnum.

The attribute indicators are:

0 - Non-Autoskip, no trailing blank processing
1 - Autoskip, no trailing blank processing
2 - Non-Autoskip, trailing blank processing
*3 - Autoskip, trailing blank processing [default]

If "Auto-skip" is specified, at the end of the field the attribute byte is set to automatically skip to the next input field. This attribute is meaningful only for input fields.

If trailing blank processing is specified, all trailing blanks in the user's data are converted to nulls upon presentation to the physical screen. This allows the terminal user to use the INSERT MODE key on the 3270 to insert data into the field. If this option is turned off, the user's data is not modified upon presentation to the 3270 (i.e., trailing blanks will remain true blanks on the screen).

"Many thanks for the latest 'Jot- Dot Times', and for providing a few chuckles to brighten the APL day. But please remove the dunce's cap (p. 27). Don Orth has got it wrong-- there are 441 inner products. There is a choice of 21 functions to the left of the dot, and for each of these is a further choice of 21 to the right, making 21x21 in all. This doesn't double-count A.A or any other."

N. Thomson
Hursley Park
Winchester, Hampshire, England

"My confidence in you guys has dropped considerably in the last month. Do you print anything without checking your facts? I wrote saying that there were 420 different inner products, not 441, and you printed it!! As so many of your readers have so kindly pointed out to me in the last month, there are indeed 441 different inner products."

D. Orth
Yorktown Heights, NY

"Your inner-product argument has been under discussion here in The APL Design Group. Proposed extensions to the APL language by Ken Iverson and myself have extended inner product so that it may be used with any dyadic functions. This includes mixed functions, derived functions, and user-defined functions. Now consider the question, 'How many inner products are there?'

"Since there are an unlimited number of defined functions, the number of inner products is infinite! (If anyone is uncomfortable with such a large number, we could make every other one invalid.)

"Since the future contains so many inner products, I submit that we should lay to rest the controversy on the number of inner products in current APL.

"Don Orth claimed 420 different inner products; you claim 441. I propose that we settle on the average of these two numbers, 429.5, which can be easily computed as follows:

```
T=420+441
AVG=T/2
```

(I don't believe in one-liners)

"...I consider the case closed."

J. Brown
Yorktown Heights, NY
Modifying Data Type and Light Pen Status

This operation is used to indicate what type of data is permitted in a field and whether or not the field is light pen sensitive. It takes effect at the next screen management read or write operation and applies until changed explicitly or until the screen is reformatted. Your application can request this operation by specifying:

\[ \text{DAT} + \text{type} \]
\[ \text{CTL} + 6, \text{fieldnum} \]

...where \text{type} is a numeric vector of field type indicators. Each value in \text{type} indicates the data type and light pen status for the corresponding field in \text{fieldnum}. If \text{type} is a single value, it is the field type indicator for all the fields specified in \text{fieldnum}.

The field type indicators are:

- 0 - alphabetic or numeric input/output allowed
- 1 - numeric input/output allowed
- 2 - alphabetic or numeric output only [default]
- 3 - alphabetic or numeric output allowed/light pen interruptable
- 4 - alphabetic or numeric output allowed/light pen selectable

As an example, the following two assignments set the data types and light pen status of two previously formatted screen fields (screen fields 1 and 2). Both fields are set to accept alphabetic or numeric output; the second field in addition, is made light pen interruptable. Sharing for both the control and data variables are assumed to be complete:

\[ \text{DAT} + 2 \]
\[ \text{CTL} + 6 \]

Modifying Field Intensity

This operation is used to set the display intensity of one or more fields. It takes effect at the next screen management read or write operation and applies until changed explicitly or until the screen is reformatted. Your application can request this operation by specifying:

\[ \text{DAT} + \text{intensity} \]
\[ \text{CTL} + 7, \text{fieldnum} \]

...where \text{intensity} is a numeric vector of intensity indicators. Each value in \text{intensity} indicates the display intensity of the corresponding fields in \text{fieldnum}. If \text{intensity} is a single value, it is the field type indicator for all the fields specified in \text{fieldnum}.

ACKNOWLEDGEMENTS

Most of the tables were taken from the standard APL manuals, and were reworked to reflect the current state of the internal version of APLSV. Each of these tables is marked with a key showing its source:

\[ \text{LM} \leftrightarrow \text{The APL Language Manual, GC 26-3847-4} \]
\[ \text{UG} \leftrightarrow \text{The APLSV Version 3 User's Guide, SH20-9087-0} \]

For example, Figure 3 from The APL Language Manual is reprinted here as Figure LM3.

Thanks are in order to the entire Kingston APL Support group for their thoughts and suggestions in the preparation of this newsletter, and in particular, I extend many Thank-You's to Rhonda L. Johnson and Michael L. Higgs for their many hours of tedious table preparation and proofreading.
Example Three

The following function is an example of a complete format, write, and read session. The function READ initiates the read, waits for the user to complete the input. The results are stored in two global variables, INFO and DATA. INFO contains the user's action and the modified fields; DATA is assigned the values contained in the fields which were read. An application can later reference these variables as needed.

(MATX and FIELDATA are found in Example Two)

```plaintext
v RET=READ FIELDS
[1] ISSUE READ AND WAIT COMMAND, CHECK RETURN CODE
[2] CTL=0
[3] RET=(0:RETY=CTL)/0
[4] ASSIGN USER ACTION TO GLOBAL VARIABLE INFO
[5] ISSUE GET DATA COMMAND, CHECK RETURN CODE
[6] CTL=3,FIELDS
[7] (0:RETY=CTL)/0
[8] ASSIGN DATA TO GLOBAL VARIABLE DATA
[9] DATA=DAT
v
```

Modifying Field Attributes

These operations are used to explicitly set the attributes of one or more screen fields. Three kinds of attributes can be set:

- the type of data permitted in the field
- the light pen status of the field
- the display intensity of the field

In the descriptions of each of these cases the term fieldnum is a numeric vector of one or more field numbers. Each field number represents a screen field whose attributes are to be set and corresponds to the respective row in the format operation matrix which defined that field.
We did it!!

Here's our first circular function

for the Phillies!

Model for the Original APL Circular Functions
May 16th, 1904, Philadelphia

Courtesy of Jet Archives

LM8: Pythagorean Functions

AC = 1
AB = 00BC
BC = 00AB
AE = 40DE
DE = 40AE

DAT variable returned by read and test requests

<table>
<thead>
<tr>
<th>UserAction</th>
<th>Completion</th>
<th>Cursor Position</th>
<th>Fields</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter Key</td>
<td>0 0</td>
<td>fldnum row column</td>
<td>fieldnums[3]</td>
</tr>
<tr>
<td>PF Keys</td>
<td>1 1-24</td>
<td>fldnum row column</td>
<td>fieldnums[3]</td>
</tr>
<tr>
<td>Light Pen</td>
<td>2 0</td>
<td>fldnum row column</td>
<td>fieldnums[4]</td>
</tr>
<tr>
<td>PA Keys</td>
<td>4 1-3[6]</td>
<td>--- --- --- --- -</td>
<td>---</td>
</tr>
<tr>
<td>Clear Key</td>
<td>5[7]</td>
<td>--- --- --- --- -</td>
<td>---</td>
</tr>
<tr>
<td>No Input</td>
<td>6</td>
<td>--- --- --- --- -</td>
<td>---</td>
</tr>
</tbody>
</table>

NOTES:

[1] Indicates the field number of the field containing the cursor when input was completed. If this element is 0, the cursor was not found in a defined field. Elements 4 and 5 are then physical position indicators (relative to row 1, column 1).

[2] Indicates the position of the cursor when input was completed. The position is indicated by the row and column relative to the first row and column position in the field.

[3] Indicates one field number for each field modified since the last preceding write operation. If no fields were modified, this element is not returned.

[4] Indicates one field number of each selected light pen sensitive field.

[5] Indicates 0 for an accepted badge, 1 for a rejected badge.

[6] Pressing the PA2 key generates a weak attention signal. The function is suspended, and consequently the screen is returned to normal screen mode.

[7] If the Clear Key was used, the current screen format and field attributes are re-established at the next read or write operation.
input, it may tell it to read all the defined fields on the screen into an internal data area. Data is read only if you completed the input operation using the ENTER key or a PF key. Your function requests this operation by specifying:

\[\text{CTL+5, fieldnum}\]

In response, the data variable will contain a vector of one or more numbers that indicate:

- ...the type of action that completed the current input operation. This is returned independently of how input was completed.
- ...the current cursor position. This information is returned if you completed the input operation using the ENTER key, a PF key or the light pen.
- ...the field numbers of the modified fields. A field is modified when you enter data into it and stays modified until your application writes to the screen. This information is returned if you completed the input operation using the ENTER key or a PF key.
- ...the field numbers of any light pen sensitive field selected (via the light pen) in the current input operation.

Step 2: Get the Data

This step completes the read operation. It is used to obtain one or more screen fields (usually the modified fields indicated in the read status vector) after step 1 has been performed. To request this step your function specifies:

\[\text{CTL+5, fieldnum}\]

...where fieldnum is a numeric vector of one or more field numbers. Each field number represents a screen field to be read and corresponds to the respective row in the formatting operation matrix that defined that field.

When the operation is complete, the data variable contains a matrix of characters, each row of which is the data for the corresponding field in fieldnum. The matrix is padded to the right with blanks so that the number of columns is equal to the length of the longest field.

Note that the data returned in this step might be altered if your application issued any intervening write or format request or changed any field attributes.
<table>
<thead>
<tr>
<th>TYPE</th>
<th>Cause; CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFN ERROR</td>
<td>Misuse of V or [] symbols:</td>
</tr>
<tr>
<td>1.</td>
<td>The function is pendent. DISPLAY STATE INDICATOR AND CLEAR AS REQUIRED.</td>
</tr>
<tr>
<td>2.</td>
<td>Use of other than a function name alone in reopening a definition.</td>
</tr>
<tr>
<td>3.</td>
<td>Improper request for a line edit or display.</td>
</tr>
<tr>
<td>DOMAIN ERROR</td>
<td>Argument is outside the range of valid arguments (domain) of the function.</td>
</tr>
<tr>
<td>ENTRY ERROR</td>
<td>Invalid character has been transmitted or received.</td>
</tr>
<tr>
<td>[]-- IMPLICIT ERROR</td>
<td>The system variable []-- (for example, [0]) has been set to an inappropriate value, or has been localized and not been assigned a value.</td>
</tr>
<tr>
<td>INDEX ERROR</td>
<td>Index value out of range.</td>
</tr>
<tr>
<td>INTERFACE ERROR</td>
<td>Attempt to share more variables than allotted quota.</td>
</tr>
<tr>
<td>QUOTA EXHAUSTED</td>
<td>REQUEST LARGER QUOTA FROM APL ADMINISTRATION (See page iv).</td>
</tr>
<tr>
<td>INTERRUPT</td>
<td>Execution was suspended within an APL statement. TO RESUME EXECUTION, ENTER A BRANCH TO THE STATEMENT INTERRUPTED.</td>
</tr>
<tr>
<td>LENGTH ERROR</td>
<td>Shapes not conformable.</td>
</tr>
<tr>
<td>NO SHARES</td>
<td>Shared variable facility not in operation.</td>
</tr>
<tr>
<td>NONCE ERROR</td>
<td>A syntactically correct statement has been entered, but cannot be executed because of an APL implementation restriction: the expression results in an error &quot;for the nonce&quot;.</td>
</tr>
<tr>
<td>RANK ERROR</td>
<td>Ranks not conformable.</td>
</tr>
<tr>
<td>RESEND</td>
<td>Transmission failure. RE-ENTER. IF CHRONIC, REPAIR OR HAVE TERMINAL OR PHONE REPAIRED, IF YOU SUSPECT PHONE LINE PROBLEMS, CONTACT THE NETWORK LINE SERVICES GROUP (See page iv).</td>
</tr>
<tr>
<td>SI DAMAGE</td>
<td>The state indicator (an internal list of suspended and pendent functions) has been damaged in editing a function or in performing a )COPY or )ERASE.</td>
</tr>
<tr>
<td>SYMBOL</td>
<td>Too many names used. )SAVE, )CLEAR, )COPY or )SAVE, )CLEAR, )SYMBOLS, )COPYFULL or )ERASE, )SAVE, )CLEAR, )COPY</td>
</tr>
<tr>
<td>TABLE</td>
<td></td>
</tr>
<tr>
<td>FULL</td>
<td></td>
</tr>
<tr>
<td>SYNTAX ERROR</td>
<td>Invalid syntax; e.g. two variables juxtaposed; function used without appropriate arguments as dictated by its header; unmatched parentheses.</td>
</tr>
<tr>
<td>SYSTEM ERROR</td>
<td>Fault in internal operation of the system. RELOAD. SEND TYPED RECORD, INCLUDING ALL WORK LEADING TO THE ERROR, TO APL PROGRAMMING SUPPORT (See page iv).</td>
</tr>
<tr>
<td>VALUE ERROR</td>
<td>Use of name that does not have a value. ASSIGN A VALUE TO THE VARIABLE OR DEFINE THE FUNCTION.</td>
</tr>
<tr>
<td>WS FULL</td>
<td>Workspace is filled (perhaps by temporary values produced in evaluating a compound expression, or by values of shared variables). CLEAR STATE INDICATOR, ERASE NEEDLESS OBJECTS, OR REVISE CALCULATIONS TO USE LESS SPACE.</td>
</tr>
</tbody>
</table>

Example Two

As an example of writing and erasing, the function below formats four fields and then writes to them. WRITE uses two arguments. The left argument tells when the write is to occur (immediate or delayed), and the right argument is the data to be written.

```
MATX FIELD DATA
4 6

MATX FIELD DATA
3 5 1 2 1 1
4 5 1 2 2 1
3 18 1 3 1 1
4 18 1 3 1 1
```

Example Two

```
  EXAMPLE 2: CTL; DAT; RET
  [1] aDATA VARIABLE ASSIGNED FIELDS
  [2] DAT+FIELDS
  [3] aISSUE WRITE COMMAND, ASSIGN RETURN CODE
  [4] CTL+WHEN, r+FIELDS
  [5] RET+CTL

  V RET+WHEN WRITE FIELDS
  [1] aDATA VARIABLE ASSIGNED FIELDS
  [2] DAT+FIELDS
  [3] aISSUE WRITE COMMAND, ASSIGN RETURN CODE
  [4] CTL+WHEN, r+FIELDS
  [5] RET+CTL

  V EXAMPLE 2; CTL; DAT; RET
  [1] aCONTINUATION OF EXAMPLE SHOWN IN 'EXAMPLE 1'
  [2] aRET+124 OFFER 2 3 p+'CTLDAT')/0
  [3] L1:=(0=RET+FORMAT MATX)/L2
  [4] [+] SCREEN NOT FORMATTED ... RETURN CODE = 'RET
  [5] +
  [6] aWRITE FIELDS TO SCREEN AND TEST
  [7] a 2=IMMEDIATE WRITE ... 4=DELAYED WRITE
  [8] L2:=(0=RET+4 WRITE FIELDS)/L3
  [9] [+] SCREEN NOT WRITTEN ... RETURN CODE = 'RET
  [10] +
```

Reading from the screen

This operation is a two-step process which is used to read input from the screen. Although both steps are required to read screen fields into your workspace, the first step alone can be used to determine the nature of your input.

Step 1: Read and Wait

This step serves three purposes: first, it directs the auxiliary processor to wait for you to complete the current input operation; second, it tells it to return information about the current screen; third, based on how you completed
...where data is a matrix of characters, each row of which contains the data for the corresponding field number in fieldnum, and fieldnum is a numeric vector of one or more field numbers. Each field number represents a screen field to be written and corresponds to the respective row in the formatting operation matrix that defined that field.

When a write operation is executed, the auxiliary processor maps the data in the first row of data into the screen field represented by the first element of fieldnum, the second row of data into the screen field represented by the second element in fieldnum, and so on. If the height of a screen field format is greater than one, you must supply the data as a vector, not as a matrix. If several fields are being supplied at once, the data should be a matrix where each row is the ravel of the data for a given field (padded with blanks as necessary). The auxiliary processor automatically skips over any unformatted areas of the screen. If a field number in fieldnum is larger than the number of rows specified in the format operation matrix, or if the field number does not currently apply to a defined field, that field number and the corresponding row of data are ignored. Similarly, if data has more rows than field numbers in fieldnum, the extra rows are ignored.

Each line of a screen field is filled with data from left to right, starting at the beginning of the field. Any trailing blanks padding out a field line are replaced with nulls on the screen, subject to the setting of the field attributes. If too much or too little data is specified in a row of data, the data is respectively truncated, or extended with nulls or blanks to fit the full field area (we'll show how to choose whether nulls or blanks get used in just a bit).

Any data written to an attribute character position or to a designator character position will be obscured. Data written will be displayed only momentarily. To maintain the display, a read request must follow the write request.

**Erasing**

The write operation also doubles as an erase operation, where each erased field is filled with null characters. You can erase data from a screen field in two ways:

1. **...in any write request, by listing the field number in fieldnum without supplying a corresponding row in data. If data is empty, all fields identified in fieldnum are erased. Fields not identified in fieldnum are not affected by this operation.**

2. **...in the first write operation after a format operation, by not including the field number in fieldnum. Any fields defined in the previous format operation and not specified in the write operation will be erased. (Subsequent write operations will not affect similarly unspecified fields.)**
Example One

The following illustrates a simple example of formatting. Here, a user defines two screen fields. The first field is to begin at row 3 column 5; it is to have a height of 10 rows and a width of 15 columns. The second field begins at row 3 column 30; it is to have a height of 12 rows and a width of 25 columns.

The user starts by defining the following formatting matrix "MATX", to be used as the argument to the function "FORMAT":

```
MATX
3 5 10 15
3 30 12 25
```

Writing to the Screen and Erasing Screen Fields

This operation is used to write data to or erase data from one or more screen fields.

Writing

A request to write to the screen is made like this:

```
DAT=data ...or... DAT=data
CTL+2,fieldnum
```

(2 ↔ Immediate write) (4 ↔ Write to screen only at next read-screen or immediate write)
The first four elements of each row of the matrix contain:

1. **FIELD ROW**: the display screen row (origin 1) at which the field begins.
2. **FIELD COLUMN**: the display screen column (origin 1) at which the field begins.
3. **FIELD HEIGHT**: the height (number of rows) of the field.
4. **FIELD WIDTH**: the width (number of columns) of the field.

The 5th and 6th elements of each row of the matrix are optional. If present, they contain:

5. **FIELD TYPE**: the type of attribute of the field:
   - 0 - character input/output allowed
   - 1 - numeric character input/output allowed
   - 2 - character output only [default]
   - 3 - character output/light pen interruptable
   - 4 - character output/light pen selectable

6. **FIELD INTENSITY**: the intensity attribute of the field:
   - 0 - off or don't display
   - 1 - normal intensity [default]
   - 2 - highlighted intensity

The starting position (upper left-hand corner) of a field must be a valid screen position. The enclosed area described by the starting position and the field height and width must not extend beyond the screen boundaries. (Except for light pen fields, fields with height 1 may wrap to succeeding rows.)

A zero in any row of the matrix effectively "undefines" a field. This removes the field from the formatted screen area but does not change the field numbers associated with the remaining fields.

When a display screen is formatted, the new screen format overlays the previous screen format. The new screen format is transmitted to the display screen on the next read or write operation.

Initially, the display screen contains only one field which covers the entire screen area.

<table>
<thead>
<tr>
<th>Name</th>
<th>Sign</th>
<th>Definition or Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Functions That Involve Numerical Calculations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Matrix Inverse</td>
<td>[ M ]</td>
<td>[ H ] 2p 1 0 1 [ M ] 1 [ M ] 0 1 [ M ] 0 1 [ M ] 0 1 [ M ] 0 1 [ M ] 0 1 [ M ] Arguments may be scalars, vectors, or matrices</td>
</tr>
<tr>
<td>Matrix Division</td>
<td>[ M N ]</td>
<td>[ H ] 2p 1 0 1 [ M ] 1 [ M ] 0 1 [ M ] 0 3 [ M ] 4 [ M ]</td>
</tr>
<tr>
<td>Decode</td>
<td>[ D A ]</td>
<td>10 1 7 7 6 [ D ] 2 4 0 6 0 [ D ] 1 2 3 2 3 [ D ] 3 7 2 3</td>
</tr>
<tr>
<td>Encode</td>
<td>[ E A ]</td>
<td>2 4 0 6 0 [ E ] 1 2 3 2 3 3 7 2 3</td>
</tr>
</tbody>
</table>

| Functions That Involve Data Transformation | | |
| Execute, monadic | \[ x v \] | \[ x \] 1+2 \[ x \] 3 3+5 \[ x \] 7 |
| Execute, dyadic | \[ y x v \] | \[ y \] 1+2 \[ x \] 3 3+5 \[ x \] 7 |
| Format, monadic | \[ a v \] | \[ a \] ~1.5 \[ a \] ~1.5 \[ a \] 1 |
| Format, dyadic | \[ v a \] | \[ v \] 3 12 3 12 10 7 30 50 70 30 50 70 |
| Format, picture | \[ v w a \] | \[ v \] \$3,555.59 \[ v \] 1,234.00 \[ v \] 1,234.00 \[ v \] 100.75 |

Notes:
1. Restrictions on argument ranks are indicated by: \( S \) for scalar, \( V \) for vector, \( M \) for matrix, and \( A \) for any array. See Figure LM11 for exceptions.

2. Conformability requirements are given in The APL Language Manual where each function is defined.

2. Arrays used in examples:

\[
\begin{array}{cccccccc}
P & E & \text{X} & \text{Z} \\
2 & 3 & 5 & 7 & 1 & 2 & 3 & 4 & \text{ABCD} & \text{THE} & \text{FUTURE} \\
5 & 6 & 7 & 8 & \text{EFGH} & \text{IS} & \text{THE} & \text{ANSWER} \\
9 & 10 & 11 & 12 & \text{IJKL} & \end{array}
\]

3. The function is applied along the last axis; the symbols \( / \), \( \backslash \), and \( \theta \) are equivalent to \( / \), \( \backslash \), and \( \theta \), respectively, except that the function is applied along the first axis. In general, the relevant axis is determined by \( [V] \) or \( [S] \) after the function symbol.

4. Function depends on index origin.

5. Elision of any index selects all along that axis.
1. A scalar may be used in place of a one-element vector:
   a. as left argument of
      
      | Operation | Scalar | Vector | Matrix | 3-Dimensional |
      |-----------|--------|--------|--------|---------------|
      | reshape   | \((3)p4\) | \((3)p4\) | \((3)p4\) | \((3)p4\) |
      | take      | \((3)\) | \((3)\) | \((3)\) | \((3)\) |
      | drop      | \((3)\) | \((3)\) | \((3)\) | \((3)\) |
      | expand    | \((1)\) | \((1)\) | \((1)\) | \((1)\) |
      | transpose | \((1)\) | \((1)\) | \((1)\) | \((1)\) |
      | execute   | \((1)\) | \((1)\) | \((1)\) | \((1)\) |
      | format    | \((5)\) | \((5)\) | \((5)\) | \((5)\) |
      | execute   | \((1)\) | \((1)\) | \((1)\) | \((1)\) |
      | branch    | \((1)\) | \((1)\) | \((1)\) | \((1)\) |
   
   b. as right argument of
      
      | Operation | Scalar | Vector | Matrix | 3-Dimensional |
      |-----------|--------|--------|--------|---------------|
      | rotate    | \((2)\) | \((2)\) | \((2)\) | \((2)\) |
      | take      | \((3)\) | \((3)\) | \((3)\) | \((3)\) |

2. A scalar is extended to conform as necessary:
   a. as left argument of
      
      | Operation | Scalar | Vector | Matrix | 3-Dimensional |
      |-----------|--------|--------|--------|---------------|
      | compress  | \((1)\) | \((1)\) | \((1)\) | \((1)\) |
      | rotate    | \((2)\) | \((2)\) | \((2)\) | \((2)\) |
   
   b. as right argument of
      
      | Operation | Scalar | Vector | Matrix | 3-Dimensional |
      |-----------|--------|--------|--------|---------------|
      | expand    | \((1)\) | \((1)\) | \((1)\) | \((1)\) |
      | take      | \((3)\) | \((3)\) | \((3)\) | \((3)\) |

3. A one-element vector is permitted in place of a scalar:
   a. as left argument of
      
      | Operation | Scalar | Vector | Matrix | 3-Dimensional |
      |-----------|--------|--------|--------|---------------|
      | compress  | \((1)\) | \((1)\) | \((1)\) | \((1)\) |
      | deal      | \((3)\) | \((3)\) | \((3)\) | \((3)\) |
      | rotate    | \((2)\) | \((2)\) | \((2)\) | \((2)\) |
   
   b. as right argument of
      
      | Operation | Scalar | Vector | Matrix | 3-Dimensional |
      |-----------|--------|--------|--------|---------------|
      | deal      | \((3)\) | \((3)\) | \((3)\) | \((3)\) |

---

**Using the Full Screen Management Auxiliary Processor**

The following discussions describe the operations that can be requested through the Full Screen Management Auxiliary Processor.

- **CTL** represents the name of the control variable.
- **DAT** represents the name of the data variable.

These items should be replaced with names that are appropriate to your application when you issue your service requests. The names must begin with CTL and DAT, and must be no longer than 12 characters (total). The discussions assume that sharing has been completed for the control and data variables, and that the device is a 3270.

**Formatting the Screen**

This operation is used to describe the position and size of all screen fields. A request to format the display screen is made through the following assignments:

\[ \text{DAT} \cdot \text{format} \]

\[ \text{CTL} = 1 \]

where **format** is a 4-, 5-, or 6-column numeric matrix with one row for each screen field to be formatted. If only one field is to be formatted, **format** can be a numeric vector, but is treated as a one-row matrix. The first (or only) row of the matrix defines the first screen field, the second row defines the format of the second screen field, and so on. The first screen field, unless redefined, becomes field number 1 for subsequent screen management operations; the second screen field becomes field number 2, and so on.

---

**LM11: Scalar-Vector Substitutions for Mixed Functions**

<table>
<thead>
<tr>
<th>Type of Array</th>
<th>( \rho A )</th>
<th>( \rho \rho A )</th>
<th>( \rho \rho \rho A )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scalar</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Vector</td>
<td>( N )</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Matrix</td>
<td>( MN )</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3-Dimensional</td>
<td>( LMN )</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

**LM12: Shape and Rank Vectors**

- 70 -
It is generally good practice to leave at least one column for attribute characters between contiguous screen fields. Otherwise, the column of attribute characters preceding the right-hand field will obscure any data written to the last column of the left-hand field.

Light Pen Fields

Unlike other screen fields, light pen fields must contain a column of **designator** characters. The designator characters must be supplied by your application program... if they are not provided by your function, default values will be supplied by the auxiliary processor. The IBM 3270 Display System requires that the attribute characters and the designator characters must always be on the same row as the light pen field; therefore a light pen field may not be defined starting in column 1 because the display device hardware does not allow attribute characters to be wrapped around to the previous row for light pen fields. Fields adjacent to a light pen field on the same row must be separated by at least three additional blank columns. These blank columns may be either inside or outside of the data areas of the affected screen fields. A maximum of 12 light pen fields may precede the last light pen field on any given row. When mixing light pen and non-light pen fields, a maximum of 14 mixed fields may precede the last light pen field on any given row.

The designator column defines the two types of light pen fields: **selection** fields and **attention** fields. Each type of field performs a different light pen operation.

For a **selection** field, the designator column displays as question marks (?) or greater-than signs (>). When the light pen detects on a selection field, a designator character for the field is automatically changed on the screen from "?" to ">" or from "." to "?" to provide visible indication to you that the detection is successful. If a mistake was made and you detect on the same field, the ">" reverts to a "?".

At the time an interrupt is generated by the user, the light pen selection fields that contain a "?" as the first character of one of their rows will be flagged as modified. Since the designator column is supplied by your function, certain fields may be "pre-selected" by setting the associated designator characters to a greater-than sign (>).

For an **attention** field, the designator column displays as blanks. A detection on an attention field completes the current input operation. The detected attention field and any previously detected selection fields are returned to your application.

It is important to remember that your function is responsible for supplying the correct designator character for the field type (? or > for selection, blank for attention). If an
Screen Management - General Information

To use the Full Screen Management Auxiliary Processor, certain general information about the screen and its attributes is required. This information is provided in the discussions below.

Logical Screens

The Full Screen Management Auxiliary Processor is capable of handling multiple logical screens, each of which is defined to be exactly the size of the physical screen. Each logical screen is accessed through a pair of shared variables. When you share a pair of variables a logical screen is created, and upon retraction of the variables, the logical screen is destroyed. Each pair of variables is kept logically separate from the other variables, and the limit to the number of logical screens that may be open at any time is controlled by your shared variable quota and by system capacity limits.

Screen Fields

The Full Screen Management Auxiliary Processor logically views the screen of an IBM 3270 display device in terms of rectangular areas called screen fields. It is only these areas that data can be entered or displayed. Each screen field has a starting position, a width and height that your application defines when it formats the screen. The starting position of each field is the row and column address of the upper left-hand corner of the field.[The upper left-hand position of the screen is row 1 column 1.]

Field Attributes

Each screen field has associated with it certain field attributes that qualify its content. For instance a field attribute may indicate that a field is to contain alphabetic or numeric data or that it is to be light pen sensitive. Your application can set the attributes for a field through various screen management service requests. If attributes are not explicitly set, the auxiliary processor supplies default values.

The 3270 Terminal System notes the attributes of a screen field by preceding the field with a column of attribute characters. These characters display as blanks and are not considered as part of the field. If a screen field begins in column 1, its attribute characters are wrapped around the screen, that is the characters will occupy column 80 in the previous row. A screen field that begins in row 1, column 1, will have an attribute character in column 80 on the bottom row of the screen.
Full Screen Management Auxiliary Processor

The Full Screen Management Auxiliary Processor allows you to control the screen format of an IBM 3270 display device through an APL defined function. In addition, it allows your application to:

- Write to the formatted screen
- Read from the formatted screen
- Erase screen fields
- Copy screen images to a printer
  [Not available in the initial release]
- Condition screen fields for light pen usage
- Read Program Function (PF) and Program Attention (PA) keys

Your APL application requests screen management services by assigning to the control variable a numeric scalar or vector that specifies the requested action. In response, the auxiliary processor issues a return code in the control variable indicating whether or not that was successful. If data is to be sent to or from the screen, it's transmitted in the data variable.

When a screen management service request is issued, the IBM 3270 enters full screen mode. When this happens, your function is in full control of the screen and may issue any additional screen management requests. When full screen mode is interrupted, the 3270 is returned to the default screen mode, and the most recent standard formatted screen is displayed.

Full screen mode is interrupted if the application returns to immediate execution mode for any reason; for example, if:

- an interrupt signal is issued (by pressing the PA2 key)
- a normal (non-screen management) input/output request is issued
- an error message is issued

When the 3270 leaves full screen mode and returns to normal mode, the current non-standard screen image is saved. It will be restored when the next full-screen management service request is issued.

Since APL issues a normal input/output request when a defined function completes execution, the duration of the full screen image may be extremely short. Your application must provide an intervening delay (such as a screen management read request) to extend the duration of the full screen image.

### Active Workspace - Action Commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
<th>Normal Response</th>
<th>Trouble Reports</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLEAR</td>
<td>Activate a ws</td>
<td>CLEAR WS</td>
<td>5</td>
</tr>
<tr>
<td>SYMBOLS [name]</td>
<td>Set size of symbol table</td>
<td>WAS number</td>
<td>5</td>
</tr>
<tr>
<td>ERASE [names]</td>
<td>Erase global objects named from active ws</td>
<td></td>
<td>5,12,25</td>
</tr>
<tr>
<td>COPY [ws]</td>
<td>Copy all objects from named ws into active ws</td>
<td>SAVED time date</td>
<td>1,3,4,5,12,17,25,28,30</td>
</tr>
<tr>
<td>COPY [pass]</td>
<td>Copy global objects named from designated ws into active ws</td>
<td>SAVED time date</td>
<td>1,3,4,5,12,17,25,28,30</td>
</tr>
<tr>
<td>COPY [pass]</td>
<td>Copy all objects from designated ws not named in active ws</td>
<td>SAVED time date</td>
<td>1,3,4,5,11,17,25,28,30</td>
</tr>
<tr>
<td>GROUP [names]</td>
<td>Gather objects into (or disperse) a group (first name designates group)</td>
<td></td>
<td>5,13,26,28</td>
</tr>
</tbody>
</table>

### Active Workspace - Inquiry Commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
<th>Normal Response</th>
<th>Trouble Reports</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYMBOLS</td>
<td>Give maximum number of names in ws</td>
<td>IS n, n IN USE</td>
<td>5</td>
</tr>
<tr>
<td>VWS [alphabet]</td>
<td>List defined functions functions (whose initials follow given character in alphabet)</td>
<td>[names]</td>
<td>5</td>
</tr>
<tr>
<td>VARS [alphabet]</td>
<td>List global variables (whose initials follow given character in alphabet)</td>
<td>[names]</td>
<td>5</td>
</tr>
<tr>
<td>GRPS [alphabet]</td>
<td>List groups (whose initials follow given character of alphabet)</td>
<td>[names]</td>
<td>5</td>
</tr>
<tr>
<td>GRP name</td>
<td>List members of named group</td>
<td>[names]</td>
<td>5,26</td>
</tr>
<tr>
<td>SI</td>
<td>List halted functions</td>
<td>state-indicator</td>
<td>5</td>
</tr>
<tr>
<td>SINL</td>
<td>List halted functions and associated local names</td>
<td>state-indicator</td>
<td>5</td>
</tr>
</tbody>
</table>

Based on the many requests from APL users, we will soon be offering 3270 full-screen support, in the form of an auxiliary processor, AP124x. This processor isn't new, but it is new to APLSV.

The release date is still a little uncertain; there are hardware changes that we have to implement first. Ports will be converted as soon as possible. Some may be converted within a month. All should be converted by year-end.

A quick overview

Using AP124x is somewhat similar to using TSIO (AP370): two shared variables are required, a control variable and a data variable, whose names must respectively begin with CTL and DAT. Conceptually, you may think of the DAT variable as a variable that is shared between your APL function and the screen. When you specify a screen-load of data into the DAT variable, and specify "write" codes for CTL, the contents of the DAT variable replace the normal screen. In similar fashion, when the user types in anything, it replaces portions of the DAT variable and can be read by your APL function.

Normal screen operations will look the same as it always did...full screen management is only invoked by calling AP124x (using 124 [SYNO --]). The normal screen will return upon return to immediate execution, when a normal I/O request is issued, when the PA2 key is depressed, or when an APL error occurs.

In addition to full screen management, AP124x also allows control of the 3277 Graphics Attachment RPQ, with graphic output displayed on a Tektronix 618 display screen.

Please note that what we are offering is strictly a full-screen management auxiliary processor; in particular, it does not include a full-screen function editor. Such an editor is a totally separate issue, and is not being offered now.

To help you get started using AP124x, we have developed a workspace with "building-block" aids: )LOAD 30 FULLSCREEN. This workspace contains various functions for screen management, for offering the shared variables, and for checking return codes.

CITING OUR SOURCES: No, alas, we did not write the following description; we obtained it with a five-finger discount. Since what we will be offering is AP124x (as opposed to AP124), one would assume that we would have stolen the description from the AP124x manual. Not quite true. We liked the write-up in the AP124 manual (personal preference), so we copied the AP124 text [from VSAPL for VSPC: Terminal User's Guide, SHPO-9667], and then modified it to reflect AP124x [from VSAPL Extended Editor and Full Screen Manager, SHPO-2731], and added local changes to reflect our APLSV environment. Since those manuals do not apply exactly to this system, we cannot recommend that you attempt to use them for APLSV.
 STATUS keywords ACQUIRING or ON will terminate the connection or request and return the keyword to OFF. If VTAM terminates the printer connection during a session, the keyword LOST will appear once in the SELECT mode display following the termination. The printer connection is automatically terminated when the terminal is signed off APL. Detection of the printer STATUS field is invalid if the terminal is not signed on to APL or if there is no printer name provided.

8. In the SELECT mode it is now possible to enter some multiple requests. For example, the PRINTER NAME field can be modified and the STATUS field detected in one input. Or, the PAGE number field and the PRINTER NAME field can be modified in one input. Any combinations of requests that are not contradictory will be satisfied. If, however, the PAGE number field is modified and the keyword >>>>> detected, only the last request will be honoured.

The release date for all of these changes is still a little uncertain; there are hardware changes that we have to implement first. Ports will be converted as soon as possible. Some may be converted within a month; all should be converted by year-end.

---

The 3270 Graphics Attachment.
The illustration is from

Used with permission.
4. The CLEAR key in **RUNNING** mode no longer generates an attention signal to **APL**. The CLEAR key in **SELECT** mode will continue to generate the attention signal. Therefore, the screen may now be cleared in **RUNNING** mode without interrupting the function that is running.

5. The format of the **SELECT** mode status/option area has been modified to accommodate interfacing with the 328x printers through VTAM. The **SELECT** mode options now look like this:

```
---------------------------------------- SELECT PAGE nnnn
PRINTER NAME: ? PAGING:ON <<<< FROM nnnn
STATUS: OFF
<<<< TO nnnn
```

6. The printer name is the VTAM identification of the 328x printer that printer output will be directed to. If a VTAM printer name is associated with a 327x terminal during **APL** system generation, that name will appear initially in the **PRINTER NAME** field. If no printer name is provided, "?" will appear in this field. To change the printer associated with the terminal, modify this field and depress ENTER. Up to eight characters will be accepted and the entry will be padded on the right with blanks. If a printer is already attached to the terminal or has been requested and the printer name field is modified, the first printer connection will be terminated. A request to change the printer name is invalid if the terminal is not signed on to **APL**. The field is reset to the original value (either the associated name or "?") when the terminal is signed off from **APL**.

7. The printer **STATUS** field reflects the disposition of the printer. Initially the printer is **OFF**. The first detection of the field will cause a request to VTAM for the designated printer. The **STATUS** will then change to **ACQUIRING**, which will remain until a response from VTAM is received. Then, on the next status display following the response from VTAM, the status will be changed to **ON** if the request is satisfied, or **INVALID** if there is a problem (note that a status redisplay requires a user input). The problem could be an invalid name or a device that is unknown or unavailable to VTAM. Unless there is a problem, VTAM does not reply until the printer is available; therefore, the **IN USE** message is no longer used. While waiting for the printer, the terminal session can continue normally. Detection of the printer
Improved standard 3270 support

In order to give you additional flexibility and support for more terminal types, the APLSV Central Support Group is in the process of modifying the software that controls the 3270s so that it will run under "VTAM" support (that's Virtual Telecommunications Access Method). So how does this help you, the terminal user? ...glad you asked....

Currently, a 3270 has to be wired directly into the APL system, with each terminal tying up precious resources in the machine even when it's not in use... and the connection can't be used by anyone else, even if you're not using your terminal. Under the VTAM scheme, each 3270 will be consuming resources only when it's active. Also, where you used to be connected to only one APL system, you will be able to select any of the three systems through VTAM... a definite plus should one of the three systems go on the blink. For times when you don't care which system you use, the eventual plan is to let VTAM automatically select the "best" system for you to sign on to, based upon its current performance.

Under the new release, additional types of 3270 terminals will be supported. These are:

<table>
<thead>
<tr>
<th>Device type</th>
<th>Supported models</th>
</tr>
</thead>
<tbody>
<tr>
<td>3276 Control Unit/Display</td>
<td>Models 2, 3 and 4</td>
</tr>
<tr>
<td>3277 Display Station</td>
<td>Model 2</td>
</tr>
<tr>
<td>3278 Display Station</td>
<td>Models 2, 3, 4 and 5</td>
</tr>
<tr>
<td>3279 Display Station</td>
<td>Models 2, 3 and 4</td>
</tr>
<tr>
<td>3284 Printer</td>
<td>Models 1 and 2</td>
</tr>
<tr>
<td>3286 Printer</td>
<td>Models 1 and 2</td>
</tr>
<tr>
<td>3287 Printer</td>
<td>Models 1 and 2</td>
</tr>
<tr>
<td>3288 Printer</td>
<td>As 3286 printer (APL not available)</td>
</tr>
<tr>
<td>3289 Printer</td>
<td>Models 1 and 2 (APL not available)</td>
</tr>
</tbody>
</table>

The following differences may be noted when using a 3270:

1. The user must sign on to APL within two minutes of either the initial display of the logo or signing off APL. If the sign-on is not completed within two minutes, the device will be returned to VTAM.

2. If the user is not signed on to APL, the PA2 attention key will immediately return the device to VTAM.

3. Through VTAM there are many 3270 devices competing for a specific number of APL ports; therefore, the user could receive the message NO APL PORTS AVAILABLE. The device will automatically be returned to VTAM after the message is displayed.

LM19 (Part 4 of 4): System Commands
<table>
<thead>
<tr>
<th>No</th>
<th>TROUBLE REPORT</th>
<th>Meaning</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CLEAR WS</td>
<td>The ws named in the LOAD, COPY or PCOPY command is damaged due to system problems</td>
<td>Contact APL System Support (see page iv)</td>
</tr>
<tr>
<td>2</td>
<td>COMMAND DISALLOWED</td>
<td>Attempted rename of a restricted (load-only) workspace</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>DEFN ERROR</td>
<td>Attempted copy or protected copy of function definition as response to an input request</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>IMPROPER LIBRARY REFERENCE</td>
<td>1. Number is not a library number, or 2. Attempted save into alien library, or 3. Attempted reference to alien CONTINUE ws, or 4. Attempted copy from a restricted (load-only) ws</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>INCORRECT COMMAND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>INCORRECT SIGN-ON</td>
<td>Terminal was interrupted before message was received by other end</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>MESSAGE LOST</td>
<td>Password does not meet requirements</td>
<td>(see page 14)</td>
</tr>
<tr>
<td>8</td>
<td>NEW PASSWORD UNACCEPTABLE</td>
<td>All lines into APL are busy</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>NO PORTS AVAILABLE</td>
<td>32xx printer was attached earlier in this session, and not detached</td>
<td>Issue DETACH first</td>
</tr>
<tr>
<td>10</td>
<td>NO PRINTER ATTACHED</td>
<td>Global homonyms in active ws are protected</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>NOT COPIED: names</td>
<td>WS does not contain global objects with purported names</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>NOT FOUND: purported names</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Account is locked; you also can't load its workspaces from another account. If the account is being prevented from use because of a stale password, you can use the workspaces from other sign-ons.

If you do let your password lapse, don't worry; assuming that you call within a reasonable time after the password expires, it can still be resolved quickly. A phone call to Kingston APLSV Administration is all that's needed... they're on T/L 373-1234. They will want to know only your sign-on number, not your password. They can then assign a "grace" period for signing on with the old password, so that you can get on and change it.

If you don't call Administration within another 30 days after your password lapses, the account will be locked (you can't sign on, and no one else can use the workspaces). If you still don't contact Administration within 30 days after that, they will have to assume that you've gone away, and will archive the account to tape, where the workspaces will be held for two years. If your account has been deleted in this manner, reinstatement to the system will require filling out a new application form.

Password change requirements on Kingston APLSV

<table>
<thead>
<tr>
<th>Last Password Change</th>
<th>Recommended next password</th>
<th>Eligible for change INHIBIT LOCK DELETION</th>
</tr>
</thead>
<tbody>
<tr>
<td>(63 days maximum)</td>
<td></td>
<td>1 month 2 months 3 months 4 months</td>
</tr>
</tbody>
</table>

After these points, a sign-on attempt > EXPIRED LOCKED NOT IN SYSTEM will result in: / OUT SYSTEM

User can sign on normally->

Wss can be loaded from another account->

------Account is still on the system, and ------user can usually be re-instated with one phone call->

* The actual deletion takes place after the next quarterly back-up tapes are made, to insure that a suitable two-year retention copy of all of the workspaces will be available.
New system command: )PASSWORD

As you perhaps already discovered from the news item in 1 NEWS, the old method of changing your password at sign-off time [ )OFF:newpass ] is no longer supported. Instead, there is now a new system command: )PASSWORD.

Used without an argument, it returns the date by which the current password must be changed:

)PASSWORD
EXPIRES 09/02/80

To change your password, you must supply both the old password and the new password that you wish to start using:

)PASSWORD oldpass:newpass
EXPIRES 10/03/80

The date that is returned following that operation is the expiration date of the new password.

If the "old" password that you enter doesn't match the one that's currently in use on your account, you will get a response of "OLD PASSWORD INCORRECT". You could also get a message of "NEW PASSWORD UNACCEPTABLE", usually due to the proposed new password being too short. In order to be in compliance with Corporate Security, a new password on the Kingston system must meet these length requirements:

- Mixed alphabetic and numeric password .... 4~8 elements
- All alphabetic password ..................... 4~8 elements *
- All numeric password .......................... 6~8 elements

(Alphabeticis are A~Z and 4~9; numerics are 0~9)

* * *

As before, passwords may be up to eight characters in length... if a longer one is mnemonicly meaningful to you, it's usable, but only the first eight characters will be examined.

When you sign on to APL, the message that used to remind you "PASSWORD LAST CHANGED ..." now reads "PASSWORD EXPIRES ...".

Another change involves the action that comes about if you don't change your password within the prescribed time. Accounts used to be locked out of the system for stale passwords, giving a message of "NUMBER LOCKED OUT" when a sign-on is attempted. Now you will be greeted with a message saying "PASSWORD EXPIRED". So what's the difference? Well, you can't sign on to the account under either case, but if the

* Yes, the eagle-eyed among you may think that these figures appear to be in conflict with Corporate Security Instruction 104; however, they were chosen through agreement with Security, based upon the large size of APL's alphabetic character set.
<table>
<thead>
<tr>
<th>No</th>
<th>Trouble Report</th>
<th>Meaning</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>Printer Not Found</td>
<td>Invalid 32xx printer number given</td>
<td>If chronic, redial or have terminal or phone repaired. If you suspect phone-line problems, call Network Line Services (see page iv).</td>
</tr>
<tr>
<td>24</td>
<td>Resend</td>
<td>Transmission failure; one or more characters were garbled during transmission</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>SI Damage</td>
<td>State indicator damaged while performing an ERASE or COPY command</td>
<td>Erase objects not needed, save ws, clear active ws, and perhaps change limit, using ( \text{SYMBS} ), copy the saved ws and rename active ws</td>
</tr>
<tr>
<td>26</td>
<td>Symbol Table Full</td>
<td>Too many names used</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Terminal Must Be In Display Mode</td>
<td>Workspace full, possibly because of: 1. Temporary values produced during evaluation of an expression, or 2. Value assigned to shared variable by partner</td>
<td>1. Erase objects not needed, or 2. Clear state indicator, or 3. Revise method of calculation</td>
</tr>
<tr>
<td>28</td>
<td>WS Full</td>
<td>Workspace full, possibly because of: 1. Temporary values produced during evaluation of an expression, or 2. Value assigned to shared variable by partner</td>
<td>1. Erase objects not needed, or 2. Clear state indicator, or 3. Revise method of calculation</td>
</tr>
<tr>
<td>29</td>
<td>WS Locked</td>
<td>Password missing, or Wrong password used, or WS Is not locked, but a password was used in the command</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>WS Not Found</td>
<td>No stored ws with given identification</td>
<td></td>
</tr>
</tbody>
</table>

Reserved Names for Symbolic Parameters

<table>
<thead>
<tr>
<th>Term</th>
<th>Purpose</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASYSCCT</td>
<td>Account number</td>
<td>12345</td>
</tr>
<tr>
<td>ASYSPACCT</td>
<td>Positive account number (same as above)</td>
<td>12345</td>
</tr>
<tr>
<td>ASYSNACCT</td>
<td>Negative account number</td>
<td>-12345</td>
</tr>
<tr>
<td>ASYSPCODE</td>
<td>&quot;Scramble&quot; of positive account number</td>
<td>AAAADAJ</td>
</tr>
<tr>
<td>ASYSCODE</td>
<td>&quot;Scramble&quot; of negative account number</td>
<td>PPPPMFH</td>
</tr>
<tr>
<td>ASYSTIME</td>
<td>Time of day (HHMMSS)</td>
<td>152148</td>
</tr>
<tr>
<td>ASYSHOUR</td>
<td>Hour (HH)</td>
<td>15</td>
</tr>
<tr>
<td>ASYSMIN</td>
<td>Minute (MM)</td>
<td>21</td>
</tr>
<tr>
<td>ASYSSCC</td>
<td>Second (SS)</td>
<td>48</td>
</tr>
<tr>
<td>ASYSDATE</td>
<td>Date (YDDD)</td>
<td>80245</td>
</tr>
<tr>
<td>ASYSYEAR</td>
<td>Year (YY)</td>
<td>80</td>
</tr>
<tr>
<td>ASYSJDAY</td>
<td>Day of year [Julian day] (DDD)</td>
<td>245</td>
</tr>
</tbody>
</table>

Note: "ASYS" is a reserved prefix; no user-generated symbolic names may begin with "ASYS". Also, no specification is allowed to these names.

These names (as all symbolic parameters) may only be used by a command within a command dataset (they may not be invoked directly).

The "scramble" of the account number is an encoding that TSIO uses to name datasets. Although you see your dataset as "12345 MYDATA", TSIO sees it as "TSIO.AAAADAJ.MYDATA". While you (as a standard Level 10 user) can't specify this name directly through TSIO, knowledge of its existence may be helpful for dealing with datasets moving on and off the system. All TSIO datasets start with "TSIO.", to identify them, and the next eight characters are an encoding (or "scramble") of the account number: 12345++AAAADAJ, and 12345++PPPMFH. The functions for performing this translation are as follows:

\[
\text{\texttt{V Z+SCRAMBLE N}}
\]

\[
[
1] Z\leftarrow\text{ABCDEFHIJKLMNOP}\[
2] (\text{IO}+(\text{8p15})\text{IW})
\]

\[
\text{\texttt{V SCRAMBLE 12345}}
\]

\[
\text{\texttt{AAAADAJ}}
\]

\[
\text{\texttt{V Z+UNSCRAMBLE N}}}\text{\texttt{IIO}}
\]

\[
[
1] \text{\texttt{IIO=O}}
\]

\[
[
2] Z\leftarrow\text{N}
\]

\[
[
3] +{-\text{A}/Z\text{e}!\text{ABCDEFHIJKLMNOP}'}/0
\]

\[
[
4] +{-8pZ}/0
\]

\[
[
5] Z\leftarrow16\text{!ABCDEFHIJKLMNOP}'12
\]

\[
[
6] Z\leftarrow4294967296\times2>2147483647
\]

\[
\text{\texttt{V UNSCRAMBLE 'AAAADAJ'}}
\]

\[
12345
\]
Reserved Names for Symbolic Parameters (ASYS...)

Several special names have been established which the system will replace with a value upon their use (a table of these terms follows shortly). For example, one such term is ASYSDATE. This term returns the current date in the form "YYDDD" (Julian date). If you wish to be able to create a new dataset whose name contains the current date, this can be done by placing a command in a command dataset like this:

\[ SW\ DSN=\text{ASYSDATE} \]

If this were the 250th day of 1980, the system would then treat the command as though it were

\[ SW\ DSN=\text{ASYSDATE} \]

Notice that we put an alphabetic character ("D") in the command so that the dataset name won't start with a numeric. The symbolic name may be used to replace any portion of a term (but it can't be used to pass more than one term). For example, consider the following commands:

Command dataset contains: User enters command as: \[ \text{TSIO} \text{ sees it as:} \]

<table>
<thead>
<tr>
<th>Command dataset contains</th>
<th>User enters command as:</th>
<th>TSIO sees it as:</th>
</tr>
</thead>
<tbody>
<tr>
<td>IR DSN=12345 ASYSDATE</td>
<td>IC DSN=12345 GATE(7)</td>
<td>IR DSN=12345 DB0250</td>
</tr>
<tr>
<td>IAX DSN=12345 MINE</td>
<td>IC DSN=12345 GATE(8),A=RW</td>
<td>IRM DSN=12345 MINE</td>
</tr>
<tr>
<td>SR DISP=+DSN=12345 ABC</td>
<td>IC DSN=12345 GATE(12)</td>
<td>SR DISP=DSN=12345 ABC</td>
</tr>
</tbody>
</table>

---

Trivia Department: Notice that a specification arrow (\(\rightarrow\)) can always be used in place of an equal-sign in any TSIO command... TSIO will make the substitution.

Notice also that the command dataset won't see any value from a symbolic name if that name isn't specified; that's okay, the system will supply the default value [see the table of default values on page 86]. In the example used here, TSIO would treat the command as though it had been "SR DISP=DSN,DSN=12345 ABC".

If you would prefer to specify your own defaults, you can do that: Just enter the command in the IC dataset like this: IC DSN=12345 ABC,ABCX=13030.
Legend:
SA SB UA UB: Denote set or use by A or B.
ACM: Access Control Matrix
ASM: Access State Matrix

A one in an element of ACM inhibits the associated access. Allowable accesses are given by the zeros in ACM x ASM. Access control vectors as seen by A and B, respectively, are ACM and @ACM.

The access state matrix represents the last access: ones occur in the last row if it is not a set, and in a column if it is, the first column if set by A and the last if set by B.

LM16: Access Control of a Shared Variable

<table>
<thead>
<tr>
<th>Access Control Vector as seen by</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>A    B</td>
<td></td>
</tr>
<tr>
<td>0 0 0 0 0 0 0 0 0</td>
<td>No constraints.</td>
</tr>
<tr>
<td>0 0 1 1 0 0 1 1</td>
<td>Half-duplex. Ensures that each use is preceded by a set by partner.</td>
</tr>
<tr>
<td>1 1 0 0 1 1 0 0</td>
<td>Half-duplex. Ensures that each set is preceded by an access by partner.</td>
</tr>
<tr>
<td>1 1 1 1 1 1 1 1</td>
<td>Reversing half-duplex. Maximum constraint.</td>
</tr>
<tr>
<td>0 1 1 0 1 0 0 1</td>
<td>Simplex. Controlled communication from B to A (for card reader, etc.).</td>
</tr>
</tbody>
</table>

UG17: Some Useful Settings for the Access Control Vector

In this command, the name of the command dataset is "12345 GATE", and the command that this user is authorized to access has been put into command slot 7 of that dataset. The command that's being used is IC... "Indirect Command".

So far so good. What more could you ask for? Well, just one more problem: the command that appears in the command dataset had to be a complete command, not just a portion of the command. Therefore, if you wanted to let certain people access any of your twenty datasets for indexed-read only, you had to have twenty commands. Hmm, seems like there ought to be a better way.

Introducing Symbolic Parameters

Now there is a better way: a symbolic parameter can be thought of as being, in many respects, analogous to an APL variable. What's often needed is a way to put most of the command in the dataset, and stipulate what parameters may be added, but then allow the user to supply values for those parameters.

A symbolic parameter is distinguished from other TSIO terms and values in that it begins with "A" (the APL version of what JCL sees as an ampersand: "&"). This term would then be used both in the command within the command dataset and in the command that calls that one. For example, assume the command in the command dataset to be "SR DSN="12345 ABC,DISP=AD". When this command is invoked, the command would look like this:

```
CTL+'IC DSN="12345 GATE(7)" AD="SHR"
```

Notice that the "DISP=AD" in the command within the command dataset will be filled in with the value supplied by the user, "AD=SHR", allowing TSIO to read the string as "DISP=SHR".

If you are a user who is entering the IC command, the name of the symbolic parameter that you enter must, of course, match the name that appears in the command dataset. That name can be from 1 to 8 characters, alphanumeric (A-Z, 0-9). The first character may not be numeric. The first three characters may not be SYS... that's a reserved prefix, which gives us some additional features.
Symbolic parameters in indirect commands

First, some background: "What's an indirect command?"

A **reserved** dataset is a dataset that can be accessed *only* by its owner... if you are signed on with any account number other than the account number that the reserved dataset is under, an attempt to access it will result in a return code of 2 - RESTRICTED COMMAND. A reserved dataset is distinguished from a standard (non-reserved) dataset by means of the account number: for a non-reserved dataset, it's a positive number that matches the account number; for a reserved dataset, it's the negative version of that same account number. For example, a non-reserved dataset name is "12345 MYDATA". A reserved dataset name looks like this: "-12345 MYDATA". If you don't specify an account number at all, it defaults to a non-reserved dataset (anyone can access it, if they know the name).

Well, a reserved dataset seems to be a nice security feature, but there's one major problem: if it keeps everyone except the owner out, that's somewhat overly restrictive. All of the processing for any sensitive project would have to take place on a single account number. So there's an extension to that.

A **command** dataset is a special instance of a reserved dataset; that is, a command dataset is always reserved, but further, it's a special dataset which contains (you guessed it) commands and lists of user numbers that can use each of the commands. [See the function called "IC" in workspace 1 AIDS for building and maintaining command datasets.] You can put any TSIO command that you wish in your command dataset, and may specify exactly who may use each of the commands. When they use them, they are executing them just as if they were under your account number; that is, they have your access to those commands, and so can access your reserved datasets just as if they were you... if you authorize them.

If you are user 12345, you'd get this response:

```
CTL+SR DSN=12345 MYDATA
CTL 0          --> (successful)
```

But if you are any other user, you'd get this:

```
CTL+SR DSN=12345 MYDATA
CTL 2 1       --> (restricted command)
```

No problem. If you *want* to let a certain user (or even *all* users) have a specific type of access to your dataset, you can

<table>
<thead>
<tr>
<th>ABBREV.</th>
<th>OPERATION</th>
<th>MEANING AND USAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW</td>
<td>Sequential Write</td>
<td>Create a new data set, and rewrite or append to an existing data set.</td>
</tr>
<tr>
<td>SR</td>
<td>Sequential Read</td>
<td>Read records sequentially from an existing data set.</td>
</tr>
<tr>
<td>IRW</td>
<td>Indexed Read and Write</td>
<td>Read and write records in arbitrary sequence from or to an existing data set.</td>
</tr>
<tr>
<td>IR</td>
<td>Indexed Read</td>
<td>Read records in arbitrary sequence from an existing data set.</td>
</tr>
<tr>
<td>RENAME</td>
<td>Rename</td>
<td>Change the name of an existing data set.</td>
</tr>
<tr>
<td>DELETE</td>
<td>Delete</td>
<td>Delete an existing data set.</td>
</tr>
<tr>
<td>IC</td>
<td>Indirect Command</td>
<td>Execute a prepared command from a command data set.</td>
</tr>
</tbody>
</table>

UG5: Data Management Operations

<table>
<thead>
<tr>
<th>DISCRIMINANT VALUE</th>
<th>NAME</th>
<th>USER QUALIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>SPACE</td>
<td>Allowed to create new direct access data sets, which implies the allocation of storage space.</td>
</tr>
<tr>
<td>4</td>
<td>DEVICE</td>
<td>Allowed to use the UNIT and VOLUME parameters, which implies the allocation of specific devices or storage units, as well as the CATALOG and UNCATALOG parameters, described in the section &quot;System Level Operations&quot; of the AFRSV Version 3 User's Guide.</td>
</tr>
<tr>
<td>2</td>
<td>ACCESS</td>
<td>Allowed indexed access or sequential reading of other TSIO users' non-reserved data sets, given a knowledge of their identification.</td>
</tr>
<tr>
<td>1</td>
<td>SYSTEM</td>
<td>Has use of commands beyond the seven available to all users, and access to any data set, including those vital to system operation, within the constraints of the operating system security provisions.</td>
</tr>
</tbody>
</table>

On the Kingston system, Level 10 (SPACE and ACCESS) is given to all users.

UG6: User Levels
<table>
<thead>
<tr>
<th>PARAMETER USAGE</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLKSIZE=block size</td>
<td>Required with DISP=NEW or LABEL=NL or LBP</td>
</tr>
<tr>
<td>CODE=</td>
<td>Required when accessing non-APL data sets</td>
</tr>
<tr>
<td>COPIES=n</td>
<td>Number of copies of output from SYSOUT; &quot;n&quot; may be from 0 to 255</td>
</tr>
<tr>
<td>DEN=</td>
<td>Used only with UNIT=tape and DISP=NEW</td>
</tr>
<tr>
<td>DISP=(NEW)</td>
<td>See Figure UG8 for defaults</td>
</tr>
<tr>
<td>DSN=r[-user number]dsname[(member)]</td>
<td>Required except for READVTOC</td>
</tr>
<tr>
<td>EXPDT=yyddd</td>
<td>Only with SW DISP=NEW</td>
</tr>
<tr>
<td>KEYLEN=keylength</td>
<td>Only with DISP=OLD or SHR and UNIT=direct access</td>
</tr>
<tr>
<td>LABEL=(data set seq no.[,][BLP][NL]})</td>
<td>Only with UNIT=tape</td>
</tr>
<tr>
<td>LRECL=record size</td>
<td>With RCSTM=FB and DISP=NEW or LABEL=BLP or NL</td>
</tr>
<tr>
<td>NEWNAME=r[-user number]dsname[(member)]</td>
<td>With RENAME command</td>
</tr>
</tbody>
</table>

**PARAMETER USAGE**

**COMMENTS**

<table>
<thead>
<tr>
<th>PARAMETER USAGE</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLKSIZE=block size</td>
<td>Required with DISP=NEW or LABEL=NL or LBP</td>
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<tr>
<td>CODE=</td>
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</tr>
<tr>
<td>COPIES=n</td>
<td>Number of copies of output from SYSOUT; &quot;n&quot; may be from 0 to 255</td>
</tr>
<tr>
<td>DEN=</td>
<td>Used only with UNIT=tape and DISP=NEW</td>
</tr>
<tr>
<td>DISP=(NEW)</td>
<td>See Figure UG8 for defaults</td>
</tr>
<tr>
<td>DSN=r[-user number]dsname[(member)]</td>
<td>Required except for READVTOC</td>
</tr>
<tr>
<td>EXPDT=yyddd</td>
<td>Only with SW DISP=NEW</td>
</tr>
<tr>
<td>KEYLEN=keylength</td>
<td>Only with DISP=OLD or SHR and UNIT=direct access</td>
</tr>
<tr>
<td>LABEL=(data set seq no.[,][BLP][NL]})</td>
<td>Only with UNIT=tape</td>
</tr>
<tr>
<td>LRECL=record size</td>
<td>With RCSTM=FB and DISP=NEW or LABEL=BLP or NL</td>
</tr>
<tr>
<td>NEWNAME=r[-user number]dsname[(member)]</td>
<td>With RENAME command</td>
</tr>
</tbody>
</table>

**PARAMETER USAGE**

**COMMENTS**

**New keywords for TSIO (Kingston only)**

**COPIES**

A new keyword is now available for use in conjunction with the SYSOUT keyword: `COPIES=n`, where "n" is an integer value from 0 through 255.

For example, rather than sending a report to the system printer twice in order to get two copies, simply modify the appropriate TSIO SYSOUT command so that it is in the form "SW SYSOUT=P,COPIES=2,BLKSIZE= ...".

A value of 0 may be useful for debugging programs without generating any output.

The use of this parameter is, of course, optional. The default is `COPIES=1`, so it certainly doesn’t need to be specified for that.

**SC**

This keyword over-rides the security classification normally associated with any of the output classes:

- SC=UN Unclassified
- SC=IU IBM Internal Use [default] header pages only;
- SC=IC IBM Confidential inside pages are IBM Confidential Restricted always up to you.

**SI**

This keyword indicates that "special instructions" are needed for the output. Valid entries are SI=H (hold for pickup), or SI=S (special). To enter the special instructions for this second case, "LOAD 1 AIDS" and type "SYSOUT". This is the only time that this function needs to be used.

**USER**

Printed output from our machine room now has your name and address printed on it, based upon the address that we have on file for you (need to change it? ...mail the Change Form from Page 92). The "SYSOUT" function in 1 AIDS no longer needs to be used for every report. The USER keyword specifies the numeric sign-on number of another user of the Kingston APL system to which the output should be mailed. If the serial number is that of the requestor, it is ignored. Enter this keyword in the form USER=12345.

Note: The SI and USER keywords are mutually exclusive; if both are entered, the command will be rejected as an IMPARSIBLE COMMAND.

Also now supported on TSIO is a RLSE ("release") parameter for use with the SPACE keyword. This allows you to release unused space when the dataset is closed following its initial creation. Refer to Figure UG8 in the back of the newsletter.
Kingston APLSV Printer Output Classes

<table>
<thead>
<tr>
<th>Class</th>
<th>Print Train</th>
<th>Page Size</th>
<th>Char/Inch</th>
<th>Type of Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>APLFULL</td>
<td>11x14</td>
<td>130</td>
<td>Normal APL output</td>
</tr>
<tr>
<td>I</td>
<td>APLFULL</td>
<td>11x14</td>
<td>130</td>
<td>IBM Confidential</td>
</tr>
<tr>
<td>A</td>
<td>GF12</td>
<td>8.5x14</td>
<td>156</td>
<td>Fastest output</td>
</tr>
<tr>
<td>B</td>
<td>GF12</td>
<td>8.5x14</td>
<td>156</td>
<td>IBM Confidential</td>
</tr>
<tr>
<td>N</td>
<td>APLFULL</td>
<td>11x8.5</td>
<td>80</td>
<td>All-white paper</td>
</tr>
<tr>
<td>K</td>
<td>TN</td>
<td>1.3x4</td>
<td>36</td>
<td>Labels</td>
</tr>
<tr>
<td>4</td>
<td>ST12</td>
<td>8.5x14</td>
<td>156</td>
<td>Text output</td>
</tr>
</tbody>
</table>

Description of Print Trains or Character Sets

**APLFULL**
Contains all of the characters that appear on the APL typeball, plus upright (non-italicized) caps and lower-case characters:

```
ABCDEFG abcdef ABCDEFG akl 0123456
```

**GF12**
"Gothic Folded, 12 pitch" ...3800 laser printer, upper-case only; no lower-case, no APL:

```
ABCDEFGHIJKLMNOPQRSTUVWXYZa123456789
```

**ST12**
"Serif Text, 12 pitch" ...3800 laser printer, caps and lower-case; no APL:

```
ABCDEFGHIJKLMNOPQRSTUVWXYZa123456789
```

**TN**
Text train: caps and lower-case; no APL:

```
ABCDEFGHIJKLMNOPQRSTUVWXYZa123456789
```

SYSOUT=P and SYSOUT=I are the two normal output classes for Kingston APLSV. This output will be printed on the all-white side of green-striped paper.

The use of workspace 31 PRINT is recommended for printing data.

The page height is normally indicated as being 66 lines; this includes top and bottom margins. Skipping to a new page (skip to channel 1) will result in the print train being positioned about three-quarters of an inch from the top edge of the paper, leaving about 61 printed lines to the bottom edge of the page, or, comfortably, about 55 printed lines with proper margins. Please do not ask the operators to reposition the paper for special requirements. The 3800 cannot print over page perforations (based on its hardware design).

Punched output will not be interpreted (the data will not be printed on the cards).

Labels (SYSOUT=K) will stay in alignment if a skip to a new page is specified for each new label. Better registration can result if you start the output with about 25 alignment labels.

**PARAMETER USAGE**

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>USAGE</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>RECPS=</td>
<td></td>
<td>Only with DISP=NEW or LABEL=BEP or ML</td>
</tr>
<tr>
<td>SYSOUT=</td>
<td>P, I</td>
<td>Security Class for SYSOUT: Unclassified IBM Internal Use IBM Confidential IBM Confidential-Restricted Special Instructions for SYSOUT: Hold for pick-up Special handling &quot;LOAD 1 AIDS&quot; and type &quot;SYSOUT&quot; to send instructions) &quot;RLSE&quot; releases unused space when dataset is closed following initial creation only Consult local Programming Support (see page IV) Seven track tape only Normally not required Send SYSOUT to another user of this system Use prevents cataloging a non-TSIO data set</td>
</tr>
</tbody>
</table>
As you have undoubtedly already noticed by this time, the workspace size for all Kingston APLSV users has been increased from 125,932 bytes to 169,276 bytes of user area, as measured by OWA after )CLEAR [(173,376 bytes overall). You will still have the same number of workspaces in your quota, giving you one-third more space (or, over twice the space that was available four years ago).

If you have an application which checks OWA to determine how much data may be processed at one time, substantial improvements in performance could result automatically.

There is one concern which should be considered: moving an application to another APL system will require that you do not store more material in a workspace than the receiving system is prepared to accept. Our new workspaces can be transferred to other APLSV systems exactly as before, providing that you have not saved more material than they can fit in their workspaces. And remember, the material not only has to fit in the workspace, it has to run in the workspace. Contact us in APL support if you have any questions on considerations such as this.

![Image of a child with arms raised]

Bigger workspaces

UG7: Data Set Operations, Parameter usage, and Default Values
New facility for tracking your billing

A new workspace is now available for retrieving historical billing information for your account. Workspace BILLING contains data for both this year and last year, and is updated weekly as the billing is run.

The functions in the workspace extract the data from our history files and allow you to generate your own reports, or if you wish to use our standard report format, the reports will look like this:

<table>
<thead>
<tr>
<th>ACCOUNT NUMBER/NAME</th>
<th>USAGE BY:</th>
<th>R重要原因</th>
<th>BILLED TO:</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/04</td>
<td>3.04.00</td>
<td>0.02.01</td>
<td>599</td>
</tr>
<tr>
<td>01/11</td>
<td>8.26.00</td>
<td>0.04.43</td>
<td>599</td>
</tr>
<tr>
<td>01/18</td>
<td></td>
<td></td>
<td>599</td>
</tr>
<tr>
<td>01/25</td>
<td>6.53.00</td>
<td>0.03.29</td>
<td>600</td>
</tr>
<tr>
<td>02/01</td>
<td>3.00.00</td>
<td>0.02.58</td>
<td>600</td>
</tr>
<tr>
<td>02/08</td>
<td>8.30.00</td>
<td>0.04.08</td>
<td>599</td>
</tr>
<tr>
<td>02/15</td>
<td>5.59.00</td>
<td>0.04.26</td>
<td>599</td>
</tr>
<tr>
<td>02/22</td>
<td>6.17.00</td>
<td>0.04.24</td>
<td>599</td>
</tr>
<tr>
<td>02/29</td>
<td>6.30.00</td>
<td>0.03.21</td>
<td></td>
</tr>
<tr>
<td>03/07</td>
<td>1.38.00</td>
<td>0.02.19</td>
<td></td>
</tr>
<tr>
<td>03/14</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The information provided from this workspace is from the same files that are used to produce the APL Monthly Utilization Reports, which are mailed to each billing manager every month. Those reports will continue to be sent out, since part of their raison d'etre is to keep the billing managers attuned to any abnormalities in the billing that they might not otherwise have noticed or checked (both for budgeting and security reasons).
New facility for tracking file usage

A new Public Library workspace is now available for tracking the usage of your datasets: )LOAD 1 SMF. APL has for some time kept track of who accesses each dataset; this is gathered as SMF (System Monitoring Facility) Data. We have had requests in the past to recover information about who was using a particular file, often to help in tracing a suspected security breach. This data is now easily available to all of the users of Kingston APLSV. This workspace retrieves data showing a summary of accesses to each of your files during the past week.

Its usage looks like this:

```
)LOAD 1 SMF
SAVED 16.11.05 08/27/80
```

The data is summarized by filename and accessing account number. No attempt is made to show every access to your files, minute by minute, since the resultant listing could be very cumbersome. And since most users need just the summary, we have done that part for you. If you DO need the detailed entries to track a suspected security problem, we can get that data for you.

Some warnings and disclaimers

If you suspect a breach in the security of your application, or have any other need to pursue this information, make sure that you follow through on it during the week of the access in question... the data is replaced each Saturday. Due to the volume of the data, historic records are not kept on-line.

Next, the inevitable question of "who are all those people?". This can get sticky. As a general rule, we will NOT match up account numbers and names; that's considered to be quite privileged information, since it could be misused to gain access to another user's workspaces and datasets. However, we recognize the fact that some real security questions may come up on occasion that require such data. Therefore, any such request will be handled by management on an individual basis.

---

**Notes:**

1. Action takes place before line is printed for ANSI, and after line is printed for machine encoding.
2. Characters other than these default to space one line, select punch pocket 1, as appropriate.
3. Characters shown for 2520 Punch. See OS/VS references for others.
4. CB: column binary.
General information

APL typeball (Correspondence) .......... Part Number 1167987
(BCD/EBCD) .......................... Part Number 1167988

APL keyboard stickers ................. Form Number GX20-1783

* * *

The following manuals may be ordered from the Mechanicsburg
Distribution Centre:

GH20-0689 APL/360 Primer [old but good beginner's manual]
GC26-3847 APL Language [reference manual]
SR20-7183 APL - An Introduction (textbook) [lessons]
G320-6103 APL Programming Guide [a "how-to" reference]
S320-5996 The APL Handbook of Techniques [reference]

* * *

For information about our system, we recommend the following
workspaces:

)LOAD 1 NEWS ........ General info, system schedule; should be
checked DAILY for news of system changes
)LOAD 1 ACCOUNT .... Billing and quota information
)LOAD 1 AIDS ....... Contains "ALLOCATE"... the only way to
create a permanent dataset, and other
general aids.
)LOAD 1 CATALOG ... Locations of Public Library info
)LOAD 1 FILELIB ... Info about your files (if any)
)LOAD 1 FORMS ...... Forms for requesting a new APL account,
or for changing the billing/mailing info
for an existing account
)LOAD 1 PHONES .... A complete and current list of phone
numbers that you can use for signing on
)LOAD 1 SYSTEM .... Technical data about our system

Typing "DESCRIBE" after loading each workspace will give you
complete information on how to use that workspace.

For APL self-education, we recommend:

)LOAD 45 INDEX .... Library 45 contains a package of 54 APL
lessons. This workspace gives a course
description.
)LOAD 45 LESSON1 ... The first of 54 APL lessons

UG13: Track Lengths and Block Sizes

<table>
<thead>
<tr>
<th>Blocks per Track</th>
<th>Bytes per Block</th>
<th>% Utilization</th>
<th>Bytes per Block</th>
<th>% Utilization</th>
<th>Bytes per Block</th>
<th>% Utilization</th>
<th>Bytes per Block</th>
<th>% Utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>2314</td>
<td>7294</td>
<td>100</td>
<td>13030</td>
<td>100</td>
<td>8368</td>
<td>100</td>
<td>19059</td>
<td>100</td>
</tr>
<tr>
<td>3300/3330-II</td>
<td>3520</td>
<td>97</td>
<td>6447</td>
<td>99</td>
<td>4100</td>
<td>98</td>
<td>9442</td>
<td>99</td>
</tr>
<tr>
<td>3340/3344</td>
<td>2298</td>
<td>95</td>
<td>4253</td>
<td>98</td>
<td>2678</td>
<td>96</td>
<td>6233</td>
<td>98</td>
</tr>
<tr>
<td>3350</td>
<td>1693</td>
<td>93</td>
<td>3156</td>
<td>97</td>
<td>1966</td>
<td>94</td>
<td>4628</td>
<td>97</td>
</tr>
<tr>
<td></td>
<td>1332</td>
<td>91</td>
<td>2498</td>
<td>96</td>
<td>1540</td>
<td>92</td>
<td>3665</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td>1092</td>
<td>90</td>
<td>2059</td>
<td>95</td>
<td>1255</td>
<td>90</td>
<td>3024</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>793</td>
<td>87</td>
<td>1510</td>
<td>93</td>
<td>899</td>
<td>86</td>
<td>2221</td>
<td>93</td>
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<td></td>
<td>694</td>
<td>86</td>
<td>1327</td>
<td>92</td>
<td>781</td>
<td>84</td>
<td>1954</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td>615</td>
<td>84</td>
<td>1181</td>
<td>91</td>
<td>686</td>
<td>82</td>
<td>1740</td>
<td>91</td>
</tr>
<tr>
<td></td>
<td>550</td>
<td>83</td>
<td>1051</td>
<td>90</td>
<td>608</td>
<td>80</td>
<td>1565</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>496</td>
<td>82</td>
<td>962</td>
<td>89</td>
<td>544</td>
<td>78</td>
<td>1419</td>
<td>89</td>
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<td></td>
<td>450</td>
<td>80</td>
<td>877</td>
<td>87</td>
<td>489</td>
<td>76</td>
<td>1296</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td>411</td>
<td>79</td>
<td>805</td>
<td>86</td>
<td>442</td>
<td>74</td>
<td>1190</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>377</td>
<td>78</td>
<td>742</td>
<td>85</td>
<td>402</td>
<td>72</td>
<td>1098</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td>347</td>
<td>76</td>
<td>687</td>
<td>84</td>
<td>366</td>
<td>70</td>
<td>1018</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>321</td>
<td>75</td>
<td>639</td>
<td>83</td>
<td>335</td>
<td>68</td>
<td>947</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>298</td>
<td>74</td>
<td>596</td>
<td>82</td>
<td>307</td>
<td>66</td>
<td>884</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>276</td>
<td>73</td>
<td>557</td>
<td>81</td>
<td>282</td>
<td>64</td>
<td>828</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>258</td>
<td>71</td>
<td>523</td>
<td>80</td>
<td>259</td>
<td>62</td>
<td>777</td>
<td>81</td>
</tr>
<tr>
<td></td>
<td>241</td>
<td>69</td>
<td>491</td>
<td>79</td>
<td>239</td>
<td>60</td>
<td>731</td>
<td>81</td>
</tr>
<tr>
<td></td>
<td>226</td>
<td>68</td>
<td>463</td>
<td>78</td>
<td>220</td>
<td>58</td>
<td>690</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>211</td>
<td>67</td>
<td>437</td>
<td>77</td>
<td>204</td>
<td>56</td>
<td>652</td>
<td>79</td>
</tr>
<tr>
<td></td>
<td>199</td>
<td>65</td>
<td>413</td>
<td>76</td>
<td>188</td>
<td>54</td>
<td>617</td>
<td>78</td>
</tr>
<tr>
<td></td>
<td>187</td>
<td>64</td>
<td>391</td>
<td>75</td>
<td>174</td>
<td>52</td>
<td>585</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td>176</td>
<td>63</td>
<td>371</td>
<td>74</td>
<td>161</td>
<td>50</td>
<td>555</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>166</td>
<td>61</td>
<td>352</td>
<td>73</td>
<td>149</td>
<td>48</td>
<td>528</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>157</td>
<td>60</td>
<td>335</td>
<td>72</td>
<td>137</td>
<td>46</td>
<td>502</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>148</td>
<td>59</td>
<td>318</td>
<td>71</td>
<td>127</td>
<td>44</td>
<td>478</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>139</td>
<td>57</td>
<td>303</td>
<td>70</td>
<td>117</td>
<td>42</td>
<td>456</td>
<td>72</td>
</tr>
</tbody>
</table>

UG13: Track Lengths and Block Sizes
Here's a brief rundown of our current system configuration. This list will be periodically updated as things change...

"LOAD I SYSTEM" for a current listing. At publication time, the listing looks like this:

IBM Corporation, SCD, Kingston, NY

Host: MVS/JES3, Rel 3.8
APL: APLSV IC4 IR3

[Internal Consolidation Release 4, Incremental Release 3]
(Program No 5799-AQC, modified for internal use)

TSIO: IC4 IR3

<table>
<thead>
<tr>
<th>System N</th>
<th>System H</th>
<th>System L</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU ............</td>
<td>Sys/370 168</td>
<td>Sys/370 168</td>
</tr>
<tr>
<td>Main storage ...</td>
<td>8 megabytes</td>
<td>8 megabytes</td>
</tr>
<tr>
<td>Jobs on System ...</td>
<td>APL (100%)</td>
<td>APL (100%)</td>
</tr>
<tr>
<td></td>
<td>TSM (10%)</td>
<td>Batch (15%)</td>
</tr>
</tbody>
</table>

All workspaces and files are common to all three systems.

Workspace size:
[measured as DWA after CLEAR]: 169,276 bytes
[maximum overall size]: 173,376 bytes

Permanent storage:
APL: 3330 Mod 11 disks
TSIO: 3330 Mod 11 disks

Terminals supported:

**Dial-up**
+-Start/Stop-+ BSC/SDLC (as appropriate)

Line speed: 134.5 300 1200 4800-baud

2741, 1651, MCST: x
5100, 5110, 5120: x x
3767: x x
Tektronix 4013/4015: x x x
Most 32xx devices: [see page 16]

OEM terminals with:
Correspondence or > x x x
BCD line codes /

**APL print train:**

**APLFULL**

**APL usage rates for 1980:**
Connect time: $ 4.25/hour
CPU time: $ 21.00/CPU minute
Storage: $ .02/track/week [1 track=13,030 bytes]
TSIO surcharge: none (all users are given TSIO capability)
<table>
<thead>
<tr>
<th>CODE</th>
<th>NAME</th>
<th>DURING</th>
<th>CAUSE</th>
<th>ACTION (None unless stated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Normal</td>
<td>S I</td>
<td>Success.</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Empty vector</td>
<td>SR</td>
<td>Empty vector transmitted was data, not end of file. (This is a warning response).</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Data type</td>
<td>S I</td>
<td>Data type not appropriate to CODE.</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Data length</td>
<td>S I</td>
<td>Data length error</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Data rank</td>
<td>W</td>
<td>CODE=A and data not a vector.</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>File index</td>
<td>I</td>
<td>Improper index (not in 1+M, where N is number of records in data set).</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>CTL domain</td>
<td>I IR</td>
<td>CTL not a 2-element non-negative integer vector with leading 0 1 2 3 4 or 5, for I, or CTL did not have leading 0 for IR.</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>DAT variable</td>
<td>I</td>
<td>DAT variable with suffix = CTL suffix not shared on first data transfer attempt.</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Variable too</td>
<td>R</td>
<td>Shared variable storage area too small.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>large for</td>
<td></td>
<td>SR: Data set closed; to command mode.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>shared mem.</td>
<td></td>
<td>(perhaps CODE=A assumed erroneously).</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>I/O error</td>
<td>S I</td>
<td>Physical error in data transfer.</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Data set full</td>
<td>S W</td>
<td>16 extents have been allocated and filled, or no space on volume for a needed secondary allocation, or primary allocation filled and no secondary allocation specified.</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>System error</td>
<td>S I</td>
<td>System error</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>See legend for *. All relevant terminal output should be given to APL Support System (see page iv).</td>
<td></td>
</tr>
</tbody>
</table>

**CTL Control Variable** has the following significance:

- **DAT Data Variable**
- **RL Record length**
- **SR or SW**
- **IR or IRW**
- **R Reading**

1. VTOC full
2. Allocation failed
3. DD card missing
4. System queue error
5. System queue full
6. Directory error
7. CATALOG Failed
8. OPEN failed, due to RACF or hardware error
9. Error in closing or de-allocation

(Also see APLSV Operations Guide, IBM Publication SH20-9088)

UG15: Return Codes -- Response in Data Transfer Mode
UG12: Disk Storage Device Capacities

<table>
<thead>
<tr>
<th>Device</th>
<th>2314</th>
<th>3330/3330-II</th>
<th>3340</th>
<th>3344</th>
<th>3350</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bytes/track</td>
<td>7294</td>
<td>13,030</td>
<td>8368</td>
<td>8368</td>
<td>19,069</td>
</tr>
<tr>
<td>(unit size)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tracks/Cylinder</td>
<td>20</td>
<td>19</td>
<td>12</td>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td>Bytes/Cylinder</td>
<td>145,880</td>
<td>247,570</td>
<td>100,416</td>
<td>100,416</td>
<td>572,070</td>
</tr>
<tr>
<td>Cylinders/Volume</td>
<td>200</td>
<td>404/808</td>
<td>348/696</td>
<td>2784</td>
<td>555</td>
</tr>
<tr>
<td>Bytes/Volume (millions)</td>
<td>29</td>
<td>100/200</td>
<td>35/70</td>
<td>280</td>
<td>317</td>
</tr>
</tbody>
</table>

Semaphore Operation Codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Key</th>
<th>Use</th>
<th>Effect</th>
<th>Action if in use</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 n</td>
<td>Exclusive use</td>
<td>Immediate</td>
<td>Return code 15</td>
<td></td>
</tr>
<tr>
<td>3 n</td>
<td>Exclusive use</td>
<td>When available</td>
<td>Delay until available</td>
<td></td>
</tr>
<tr>
<td>4 n</td>
<td>Shared use</td>
<td>Immediate</td>
<td>Return code 15</td>
<td></td>
</tr>
<tr>
<td>5 n</td>
<td>Shared use</td>
<td>When available</td>
<td>Delay until available</td>
<td></td>
</tr>
</tbody>
</table>

Any integer from 1 through 2^31-1 may be used. The semaphore is released by assigning a key of 0 with any of the semaphore codes, or by assigning a new semaphore.

Introduction

This issue of the Jot+Dot Times is our Special Reference Issue. So what's that? Well, we have discovered that once we have studied the APL manuals, we kind of understand what's going on, so we don't really have to carry a stack of manuals with us all of the time. But no way are we ever going to memorize all of the reference tables in those manuals! So, here we are, still carrying all of those manuals around. It would be nice (as us) if we could gather together all of the commonly-needed charts and tables into one convenient handbook, and keep that around. Aha... lucky us; here it is. [applause]

Publishing all of these learned-looking tables also gives us an academic air; perhaps some folks will even be deluded into thinking that we wrote them. Better and better. Besides, you see, what we have here is clearly a most impressive piece of technical research and compilation (as opposed to the shoddy piece of plagiarism that you probably first assumed it to be).

True, the text is ours. There's no escaping that admission. However, if the truth be known (and it probably will be), we swiped the tables. But what the hey, you know? "The Knowledge of The Universe Can Be Yours, Through Plagiarism." [You can quote us on that.] Most of them came from The APL Language Manual (GC26-3847) and The APLSV Version 3 User's Guide (SH20-9087). The tables have, in many instances, been modified so that they more properly reflect local conventions on Kingston APLSV; they therefore do not necessarily show a true picture of life on other systems. Other manuals are recommended on the "General Information" page; all of them can be ordered internally from Mechanicsburg. If you don't already have each of these manuals, you should order them. They are really quite helpful. While this issue will hopefully mean that you won't have to carry the manuals around all of the time, everyone needs to refer to the text sometimes, and the manuals are still very good reference manuals to have available.

As this issue is being published, quite a few new system enhancements are being installed. It's always quite a pleasure to be able to report the new goodies as they become available. There have been on-going enhancements in the past, both from the APLSV Central Support Group and from The APL Design Group, but most of what has been released in the past couple of years hasn't been visible to you as a user... these changes have been system speed-ups and measurement tools for those of us that supply the APL service. You may not have noticed those changes, although with the increased APL workloads you would have noticed the lack of them if they hadn't been installed. But now we have what we expect will be some very popular new system changes, all quite visible.
Kingston APLSV Assistance Numbers

**APL Hotline** [Administration, Programming, Management, Operations, Line Services] ........ 373-1234

**APL Administration** ........................................ 373-1234
(Vince Dougherty and Millie Bartsch)

System Status Recording ........................... 373-7817
Line Status Recording .......................... 373-4407

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**WHO'S WHO in Kingston APL**

Interactive Terminal Systems Manager - Bill Davis .... 373-4652
ITS Secretary - Rhonda Johnson .............................. 373-1239

Planning and User Support Manager - Chuck Norcutt .... 373-2471
**APL User-Support Programmer** - Rich Euler ........ 373-6216
**APL User-Support Programmer** - Mike Harelick .... 373-2405
**APL User-Support Programmer** - Mike Higgs ........ 373-2254
**APL User-Support Programmer** - Joe Traina ........ 373-1365

System Support Manager - John Brink ................. 373-4294
**MVS/JESS System Programmer** - Ken Jonas .......... 373-1198
**MVS/JESS System Programmer** - John Opalach ..... 373-6775
**APL System Programmer** - Mike Van Der Meulen ... 373-1082

**Administration & Operations Manager** - Tom Dederick .... 373-6413
Console Operators ........................................ 373-5661
Control Centre (ws & file transfers) - Rich Dill .... 373-6772
**APL Administrator** - Vince Dougherty .......... 373-1234
**APL Administrator** - Millie Bartsch ........ 373-6536 or -1234

2nd shift Operations Manager - Skip Frasier .......... 373-6966
Console Operator - on rotation ......................... 373-6661 or -6837

3rd shift Operations Manager - Don Miller .......... 373-6966
Console Operator - Hank Adams ............................. 373-6661 or -6837

Manager of the Tape Library - Walt Hackett .......... 373-7343
Tape Library - Morgan Moore ............................. 373-6673

Network Services Manager - Ivan Pece .................. 373-7839
Telephone line problems - Wilma Quick ................ 373-7891

Time Accounting Manager - Ed Goodman ................. 373-4049
Billing information - Marguerite Lasher .......... 373-4222
Billing information - John Offermann ................. 373-2691

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**Call for papers: APL81**

An international **APL** conference is being planned for next year by the Association for Computing Machinery (ACM). "**APL81**" will be held in San Francisco, California, October 21-23, 1981.

Technical papers on all aspects of **APL**, including the following areas, are solicited:

- **APL applications** (all areas)
- **APL** - the language
- **APL** implementations (large and small systems)
- **APL** in education
- **APL** in business
- **APL** interfaces with other software systems
- **APL** system organization and management
- **APL** compared to other languages

Both abstracts and full papers will be refereed and authors should submit these documents to the program chairman in accordance with the following schedule:

<table>
<thead>
<tr>
<th>Date Due</th>
<th>Author Notification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstracts</td>
<td>October 1, 1980</td>
</tr>
<tr>
<td>Full Papers</td>
<td>February 1, 1981</td>
</tr>
<tr>
<td></td>
<td>April 15, 1981</td>
</tr>
</tbody>
</table>

Final copies of complete papers must be received by the program chairman by June 15, 1981 for inclusion in the conference proceedings and for presentation at the conference.

Further information may be obtained from:

- Ray Polivka (Vice-chairman of STAPL)
  HM1 706
  Poughkeepsie, NY (IBM Internal Mail)
  T/L 253-3216 or 914/463-3216

- Richard J. Orgass (Program Chairman)
  **APL81**
  Xerox Corporation
  1350 Jefferson Road
  Rochester, NY 14623

- Eugene R. Mannacio (Program General Chairman)
  **APL81**
  900 North Point Street
  San Francisco, CA 94109
Application for a new account on Kingston APLSV

Manager to be billed________________________ Manager's serial________
Div/Dept_____/____Bldg_____/Loc._____/and ext.

External mailing address (please include ZIP code)

** Registered IBM Confidential data is not supported **

IBM Data Processing services and resources are to be used for IBM business only

Serial Number Location ZIP/Tie-line
User name (City) Div/Dept Bldg and ext.

Is applicant a regular full-time IBM employee? □ Yes □ No

Bill to this existing I.T.S. problem number ___________

Issue a new problem number? ____ Billing location ________

Kingston, Poughkeepsie, Charlotte, and Raleigh personnel please provide the following information for a new problem number:

Div____ Maj____ Act____ Proj____ Box____ Dept charged____

Signature of manager __________ Date __________

Signature of Data Processing Services Coordinator __________

[To list coordinators, ")LOAD 1 FORMS" and type "COORDINATOR"]

The application cannot be processed unless the above signatures have been satisfied.

Note: When we add your new account to the Kingston APLSV system, a verification letter will be SENT TO YOUR MANAGER. The letter will contain your new account number and password, sign-on telephone numbers, and general information. IT IS THEN UP TO YOUR MANAGER TO FORWARD THIS INFORMATION TO YOU. These memos are normally mailed within one week from the time that we receive your application.
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Change form

Please return this change form to us if any of your billing or mailing information (division, location, manager, APL users in your problem number, etc.) is incorrect. We must have current information for all APL users.

| **** Do not write inside this block **** |
| New Prob # ____ | TA Info | Old Prob # ____ |
| Action Date | Action Date |
| Letter | File copy |
| Directory | Directory |
| System | |

Return to: IBM Corporation, SCD APL Administration, 63C 002, Kingston, NY 12401 (8-373-1234)

** Registered IBM Confidential Data is not supported **

IBM Data Processing services and resources are to be used for IBM business only

☐ Issue new sign-on password (don't use this form for new applications)
☐ Change
☐ Delete sign-on (*only these fields are required)

Manager Information:

Manager
Division Dept Bldg

Location (city) Tie-line/extension

Manager's serial number Signature of manager Date *

User Information:

Sign-on number* User name* Tie-line/extension

Division Dept Bldg Location (city) User's serial number

Accounting Information: (Kingston, Poughkeepsie, Charlotte, Raleigh, and Burlington users only)

DIV Maj Act Project Box Dept. charged

Billing location (city) Coordinator's signature

[To list coordinators, ")LOAD 1 FORMS" and type "COORDINATOR"]
C. USER

1. GENERAL REQUIREMENTS: Users of IBM's data processing assets are responsible for compliance with security requirements and for compliance with control requirements specified by owners and by suppliers of services.

Data processing output is owned by the requesting user, unless other arrangements are made. Users who generate passwords are the owners of the passwords. Information classification and control procedures apply in these cases.

User management must ensure that owners of IBM's classified information or suppliers of services, as appropriate, are notified upon termination of the user's business need for use of the information, services, or facilities.

2. ACCESS CONTROLS: The following access control requirements apply to users.

Verification passwords and user identifiers that serve as verification passwords must not be shared, and they must be:

- Classified at least IBM Confidential and controlled accordingly, with particular attention to terminal entry, terminal display, and recording.
- Deactivated in the event of known or suspected compromise, and the supplier of services notified.

Information access passwords and cipher keys used as information passwords must be:

- Assigned the classification of the associated information and controlled accordingly, with particular attention to terminal entry, terminal display, and recording.
- Controlled so that all persons to whom they have been disclosed are known to the owner or administrator.
- Administered so that the owner or administrator is notified in event of known or suspected compromise of passwords.

Preface

This is the Fall 1980 Edition of The JotoDotTimes, published somewhat sporadically by the Kingston SCD APLSV Support Group. A copy is being sent to each of our customers.

This particular issue has been in the works for a long time. We regret the delay in getting it to you, and we hope that you will find the features described here to be worth the wait.

We value your thoughts on this newsletter. If you have any comments or suggestions regarding either the newsletter or our service, please let us know. There is a Feedback form attached to the outside of the newsletter, and we have included some of the quotable quotes from the Feedback forms that we received from the previous newsletter.

Your comments can often help to mould future issues and future offerings on APL. Many of the facilities that we have offered in the past are a direct result of comments that were sent in on newsletter Feedback forms. Please, let's hear from you!

The Kingston APLSV Support Group
3. **TERMINALS**: Terminal users are responsible for ensuring that:

- Terminals are connected to IBM computers or IBM terminals only for the purpose of conducting internal IBM business and are under IBM control or are in compliance with the control requirements of terminals not under IBM control;

- Registered IBM Confidential and IBM Confidential-Restricted information are not received by or entered into terminals not under IBM control;

- Terminals, while unattended, are protected from unauthorized use;

- Dial terminals, while connected, are attended or otherwise protected;

- Permanently connected terminals, while logged on, are attended or otherwise protected, and

- Telephone numbers for computer dial ports are not posted for general view.

* * *

[This instruction replaces Corporate Information Systems Instruction 2-109A, dated January 1, 1978]
The text for this newsletter was entered on an APL-featured 3277 video terminal, and edited and composed by a set of APL functions called The APL Text Machine. The master pages were then typed by the computer on a mag-card terminal ("Cardinal"), using Scribe, Light Italic, and APL typing elements. The headings for the articles were then applied to the masters using commercially-available transfer lettering. The interleaving of dual fonts was handled by the Text Machine without the need for cut-and-paste.

While several people have suggested photo-composer methods for the text, it is important to us to keep the newsletter itself as an example of the type of document that any of our users could produce on their own subjects.

The illustrations scattered throughout the newsletter (including the cover) were created between 1850 and 1925, originally appearing in newspapers, advertisements, and periodicals.

Jon McGrew
Wordsmith

The APL Jot•Dot•Times

Some production notes

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JOT DOT TIMES...
DON'T LEAVE HOME
WITHOUT IT!
Significant new features for APLSV!

Special Reference Issue