Supplement #64

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TURNOVER FOR ISERIES V100 CROSS-REFERENCE SYSTEM

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INTRODUCTION

This document describes how TURNOVER® for iSeries v100's own cross-reference system works. If you have Hawkeye's Pathfinder or ASC's Abstract/Probe+, see the TURNOVER® for iSeries v100 interface guide for one of these products.

To obtain more information, see the training tutorial entitled ***TURNOVER® for iSeries Tutorial***.

TURNOVER®'s cross-referencing system was completely revised in Release 4.0 to include references for ILE program-to-module, program-to-program, file-to-file, file-to-program and user-defined relationships, that you can define yourself. New lookup options have been integrated into the Programmer Worklist and other functions.

To use TURNOVER® for iSeries v100's cross-reference, you must set the application definition parameter *X-Ref Method* to ***TURNOVER** for all application levels that you want included in the cross-reference database. When specifying the name of the *X-Ref Table* that will contain the cross-reference table, consider whether or not your applications intersect (share common resources such as files). You may choose to set up several different cross-reference tables if your applications do not intersect. We recommend that you follow this rule: if an application shares any programs or files with another application, then they should share a cross-reference table; otherwise, they should be separate. Using a single cross-reference table ensures that you are aware of the true impact of a change across application boundaries. For example, a change to a file shared by AP, AR, and Purchasing programs will be evident when you make the file change.

Once you have defined your application(s) to TURNOVER® for iSeries v100, you can run option **20** on the *Work with Application Definition* panel to submit a batch job that updates the cross-reference database. You must do this for each application level you want included in the cross-reference.

Once the cross-reference database is built, you can have TURNOVER® for iSeries v100 update the database each time a form runs, or periodically if you set up a job to run forms on a regular basis. Set the application definition parameter *Update X-Ref on form run* to ***YES** to have TURNOVER® for iSeries v100 update the cross-reference during the Finalization phase of every form run.

You can access cross-reference usage information by selecting option **15=*Check X-Ref*** on the *Programmer Worklist Manager*, by running the command **WRKOBJREF**, or by selecting option **20** (**Work with object references**) on the Checkout/Check-in Menu.

CROSS-REFERENCE FILE LAYOUT

The primary cross-reference database consists of a single physical file located in the TURNOVER® for iSeries v100 data library. This file consists of multiple members that you can use to separate cross-reference information among applications. The cross-reference application definition identifies the member as an *X-Ref Table*. The commands, **ADDXRFTBL** and **RMVXRFTBL**, are used to create or delete the X-Ref table in the cross-reference file, along with all related logical files. All commands that maintain, view and work with cross-reference data have an *X-Ref table* parameter for identifying the X-Ref table. TURNOVER® for iSeries v100 manages the table using the *X-Ref Table* parameter value you supply in the application definition. (We also have a file, called TSETXREF, which stores this information for Hawkeye and Abstract/Probe.)

The cross-reference file consists of the following fields:

File:	TXRFDTAF
Format:	TXRFDTA

Field name	Key	Type	Length	Description
TXOBJ	Y	*CHAR	10	Object
TXLIB	Y	*CHAR	10	Library
TXTYPE	Y	*CHAR	10	Object Type
TXATTR		*CHAR	10	Attribute
TXROBJ		*CHAR	10	Reference object
TXRLIB		*CHAR	10	Reference library
TXRTYP		*CHAR	10	Reference object type
TXRATR		*CHAR	10	Reference attribute
TXRMBR		*CHAR	10	Reference member
TXMTHD		*CHAR	1	X-Ref method
TXUSG		*CHAR	2	Usage
TXADBY		*CHAR	10	Added by user
TXADDT		*DEC	6.0	Date added
TXADTM		*DEC	6.0	Time added

The first four fields in the file describe the object that uses the object identified in the next five fields. Using the typical program-to-file relationship as an example, the program is identified by the information in the first four fields, and the file is identified by the information in the next five fields. There is one record for each file the program uses.

The remaining fields are:

X-Ref method: Defines the type of cross-reference information in the record. This is useful in both deleting and retrieving certain types of records from the file and consists of the following values:

      1 - Object (***PGM**, ***SRVPGM**, ***MODULE**) to file
      2 - Object to object (program calls)
      3 - Program (***PGM**, ***SRVPGM**) to module
      4 - Object to copybook
      5 - PF to LF
      6 - File to another file (Reference file)
      7 - CMD to CPP, or VLDCKR
      U - User added/maintained

Usage: A 1-character code that describes the relationship between the objects. A corresponding table keyed by the 1-character code contains an 8-character short description and 30-character long description to further identify the usage. The table contains several fixed values to be determined when the application is created, but the existence of the table allows you to make use of the user-defined portion of the cross-reference by adding new codes that would then be fully supported on all panels derived from the database. Some examples of codes that you might want in the file are:

      Input, Output, Update, In/Out, PGM-CALL, CMD-CPP, CMD-VLD, COPY, etc.

Another field in the usage description table indicates whether the cross-reference item must be added to a form when adding the related item to a form. For example, when you add a file to a form, you might want all of the usage type 1 objects (such as programs) added to the form automatically. You may not want user-defined usage "U" types to be added automatically.

UNICOM Systems, Inc. Note

When adding lines to a form, TURNOVER® for iSeries v100 checks the cross-reference to see if any related objects must also be added. If a form is large, it's possible to approach or exceed the maximum number of lines allowed on a form. To reserve space for the objects added during the cross-reference check, you can set an overflow threshold in the XREFOVRFLW data area. This threshold controls the number of lines that TURNOVER® for iSeries v100 can add to a form before it begins adding cross-reference items to the form. The default number of lines that TURNOVER® for iSeries v100 can add to a form before cross-referencing is 900.

The individual(s) creating the application can come up with the codes themselves to best suit the design of the application they create. The **DSPPGMREF** command, for example, produces output that has a 1-character usage field in it. If using this command to get X-Ref information, you would probably want to make use of the same codes used by that command, as a start, and then add additional codes as needed.

Added by user, *Date added*, *Time added:* These three fields are for record keeping, especially as they apply to user-added cross-reference entries. They contain the user profile, date and time for when the record is added.

Example of an X-Ref Table

The following table shows how the data might look in the file for the various types of information (not all fields are shown).

TXOBJ	TXLIB	TXTYPE	TXATTR	TXROBJ	TXRLIB	TXRTYP	TXRATR	TXRMBR	TXMTHD
TURRPGMA	SOFTTURN	*MODULE	RPG	TAPPLF	*LIBL	*FILE	PF		1
TURRPGMA	SOFTTURN	*MODULE	RPG	TDFTSRCL	*LIBL	*FILE	LF		1
TURRPGMA	SOFTTURN	*MODULE	RPG	TURCPGMB	*LIBL	*PGM	CLP		2
TURRPGMA	SOFTTURN	*MODULE	RPG	QRPGSRC	SOFTTURN31	*FILE	RPG	TURRCPYA	4
TURRPGMX	SOFTTURN	*PGM	RPG	TURRPGMA	SOFTTURN	*MODULE	RPG		3
TURRPGMX	SOFTTURN	*PGM	RPG	TURCPGMB	SOFTTURN	*MODULE	CLP		3
TURSDSPA	SOFTTURN	*FILE	DSPF	TURHDSPA	SOFTTURNE	*PNLGRP	PNLGRP		U
TUSROPTF	SOFTTURND	*FILE	PF	TUSROPTL	SOFTTURND	*FILE	LF		5
TUSROPTF	SOFTTURND	*FILE	PF	TURNREFF	SOFTTURND	*FILE	PF		6
WRKPRJ	SOFTTURNE	*CMD	CMD	WRKPRJ	*LIBL	*PGM	CLP		7
WRKPRJ	SOFTTURNE	*CMD	CMD	WRKPRJX	*LIBL	*PGM	CLP		7
WRKPRJ	SOFTTURNE	*CMD	CMD	WRKPRJ	SOFTTURNE	*PNLGRP	PNLGRP		U

The information is derived in a variety of ways.

Cross-referencing for *SRVPGM objects

By default, TURNOVER® for iSeries v100 includes ***SRVPGM** objects in the cross-reference check it performs when creating a form. You can exclude these objects from TURNOVER® for iSeries v100's cross-reference check. To exclude the ***SRVPGM** objects, create the SRVPGMXREF data area in the TURNOVER® for iSeries v100 Data library and give it these attributes: a ***CHAR** type, a length of 4, and a value of ***NO**.

Cross-referencing for C header files

In its cross-reference support for C header files, TURNOVER® for iSeries v100 relates the files to their source objects (***MODULE** or ***PGM**). This cross-referencing occurs automatically once you update your cross-reference database.

User-defined relationships

We provide APIs and exits to allow the user to maintain this information automatically. We would also want a work-with style panel where they could maintain this information manually.

CROSS-REFERENCE COMMANDS

TURNOVER® for iSeries v100 uses the following commands to maintain the cross-reference database. The iSeries object authority on the commands controls authority for all commands. We ship them with users QSECOFR and TURNOVER having authority to the commands. ***PUBLIC** is ***EXCLUDE**.

ADDXRFTBL (Add X-Ref Table)

This command adds a member with the same name as specified in the application definition *X-Ref Table* parameter, and then adds members of the same name to all logical files built over the physical file.

RMVXRFTBL (Remove X-Ref Table)

This command removes specified members from the cross-reference files.

LODOBJREF (Load Object References)

This command loads the cross-reference data into the *X-Ref Table* for the object(s) specified. It handles loading data for a single object in a library or for all objects in a library. When you build cross-reference information for an application, TURNOVER® for iSeries v100 runs this command once for each target library in the application level you selected, specifying ***ALL** for object name. When a form runs, TURNOVER® for iSeries v100 runs this command for each line of the form, specifying just the object on that line of the form.

Before loading the cross-reference information for an object, TURNOVER® for iSeries v100 first removes information for that object. It deletes records where the object/library/type key fields match, and the usage field is not equal to 'U'. Maintenance of all user-defined cross-reference information is the responsibility of the user. Immediately after adding the information for an object, a user-exit program is called and passed the same parameters passed to the **LODOBJREF** command (except if ***ALL** was specified for object, in which case the exit will be called once for each object, passing the actual object name.)

The user program that loads the cross-reference information should take care to build all types of the information that could exist for that object, as indicated earlier.

Parameters:

- **OBJ**—Object. The name of the object to be cross-referenced, or ***ALL**.
- **LIB**—Library. The name of the library that contains the object. ***LIBL** and ***CURLIB** are allowed, but not when ***ALL** is specified for object name.
- **TYPE**—Object type. The object type of the object being cross-referenced. **TYPE(*ALL)** is allowed only in when ***ALL** is specified for object name. All other object types are supported, including the TURNOVER® for iSeries v100 types defined in TURNOVER® for iSeries v100's type code file such as ***MSGID**. A user exit program to build information for that type can use these.

- **XRFTBL**—X-Ref table. The name of the cross-reference table into which to load the information. This is a 10-character ***NAME** type field.

RMVOBJREF (Remove Object References)

This command is used to remove all non-user usage types from the cross-reference for a particular object. TURNOVER® for iSeries v100 would use this command to remove cross-reference information from the database whenever an object is deleted by running a form, whether it be in production or in a test library. As with the **LODOBJREF** command, a user-exit program is called for each object for which information is removed.

This command removes object reference records where field TXOBJ matches the object specified. It would not remove records where the object was referenced. For example, if you said to remove information for PGMA, it would remove information for all of the files used by PGMA, programs called by PGMA, copybooks used, and so on. It would NOT remove information for programs that called PGMA, or commands that used PGMA as a processing program or validity checker.

Parameters:
- **OBJ**—Object. The name of the object to be removed, or ***ALL**.
- **LIB**—Library. The name of the library that contains the object. ***LIBL** and ***CURLIB** are not be allowed in conjunction with object parameter of ***ALL**.
- **TYPE**—Object type. The object type of the object to be removed. **TYPE(*ALL)** should be allowed only in conjunction with ***ALL** for object name. Otherwise, all other object types are supported, including the all TURNOVER® for iSeries v100 types that exist only within TURNOVER® for iSeries v100 such as ***MSGID**.
- **XRFTBL**—X-Ref table. The name of the cross-reference table containing the cross-reference information.

ADDUSRREF (Add User Reference)

This command adds, to the X-Ref table, a user-defined cross-reference record for a particular object.

RMVUSRREF (Remove User Reference)

This command removes, from the X-Ref table, all user-defined cross-reference records for a particular object.

WRKOBJREF (Work with Object References)

This command lets you view an object's usage in TURNOVER® for iSeries v100's cross-reference files. For more information, see *Working with Object References* on page 8.

WRKUSRREF (Work with User References)

This command lets you define your own relationships between objects. For more information, see *Working with User-defined References* on page 12.

WORKING WITH OBJECT REFERENCES

You can use the **WRKOBJREF** command to see all of the dependents of an object, or you can select one of the panel options that run this command. This command is also available as an option on the Checkout/Check-in Menu. On a command line, type **WRKOBJREF** and press **Enter**. (To run the command from a *Programmer's Worklist* or Synchronizer's *Work with Change Impact File*, you would select the corresponding option to add related items to your worklist or impact file.)

```
                    Work with Object References (WRKOBJREF)

  Type choices, press Enter.

  Object Name  . . . . . . . . . .                    Name
  Library Name . . . . . . . . . .                    Name
  Type code  . . . . . . . . . . .                    AAUDIT, ABPGM, ADMDL, ADPGM...
  X-Ref Table Name . . . . . . . .                    APDEMO, DEFAULT, J52XREF, L...
  Output . . . . . . . . . . . . .     *              *, *PRINT




                                                                        Bottom
  F3=Exit    F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
  F24=More keys
```

Type an object name, the name of the library where the object resides, the object's type, the cross-reference table name, and specify if you want the output displayed at a display station (*****) or printed (***PRINT**).

```
                    Work with Object References (WRKOBJREF)

 Type choices, press Enter.

 Object Name  . . . . . . . . . .   TLINEF        Name
 Library Name . . . . . . . . . .   SOFTTURND     Name
 Type code  . . . . . . . . . . .   PF            AAUDIT, ABPGM, ADMDL, ADPGM...
 X-Ref Table Name . . . . . . . .   DEFAULT       APDEMO, DEFAULT, J52XREF, L..
 Output . . . . . . . . . . . . .   *             *, *PRINT




                                                                      Bottom
 F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
 F24=More keys
```

Press **Enter**.

```
  4/03/01  11:12:52            Work with Cross-Reference     Your Company, Inc.
                                                            X-Ref Depth= 01
Worklist . . . .  APPR004     Chg credit-term verify program
Data set . . . .  DEFAULT     Apply filters . . . Y  (F17=Filters)

1=Add to Worklist  2=Add to Worklist/Checkout  4=Compile in Development library
5=View checkout  6=Work with relationships  8=Browse member
     ------ Uses/Used-by ------->                              Chk
     Object    Library    Attr    Object     Library    Attr   How Used   Out U/B
  _  TLINEF    SOFTTURND  PF      ADDCHKITMR SOFTTURN   RPG    Input      N   B
  _  TLINEF    SOFTTURND  PF      ADDCMDR    SOFTTURN   RPG    Input      N   B
  _  TLINEF    SOFTTURND  PF      ADDCMDXR   SOFTTURN   RPG    Input      N   B
  _  TLINEF    SOFTTURND  PF      CHGFORMPRR SOFTTURN   RPG    Update     N   B
  _  TLINEF    SOFTTURND  PF      CVTLINCMTR SOFTTURN   RPG    Input      N   B
  _  TLINEF    SOFTTURND  PF      DISTDATAR  SOFTTRUN   RPG    Input      N   B
  _  TLINEF    SOFTTURND  PF      TCRTPGM    SOFTTURN   CLP    Not given  N   B
  _  TLINEF    SOFTTURND  PF      TCRTSRVPGM SOFTTURN   CLP    Not given  N   B
  _  TLINEF    SOFTTURND  PF      TLINEH     SOFTTURND  LF     PF->LF     N   B
  _  TLINEF    SOFTTURND  PF      TLINEL     SOFTTURND  LF     PF->LF     N   B
  _  TLINEF    SOFTTURND  PF      TLINEN     SOFTTRUND  LF     PF->LF     N   B
                                                                   More…
F3=Exit  F4=Prompt  F5=Refresh  F10=Data set information  F12=Cancel
F13=Repeat  F17=Filters  F19=Submit 1/2  F21=Command line  F22=Print
```

You can also access this panel from your worklist (option **15=Check X-Ref**), and look at objects related to one or more items at once. For more information, see the topic *Checking for Cross-reference information* in *Chapter 9* of the *TURNOVER® for iSeries v100 User Guide*.

The *U/B* column indicates whether the object you are researching (listed at the left) uses (**U**) or is used by (**B**) the reference object. The *How Used* column tells you how the object uses or is used by the reference object.

If you press **F17=Filters**, you see the filter panel. Use this panel to subset the list of objects you see on the *Work with Cross-Reference* panel. For example, you may want to see only the reference objects – in this case, programs – that update (UPD) the file you're researching.

```
  4/03/01  12:40:10            Work with Cross-Reference     Your Company, Inc.
 .................................................................................
 : Type filter values, press Enter.                                             :
 :                                                                              :
 :   Attribute . . . . .  _____   F4=List                                 :
 :   Library . . . . . .  _____   Library name                            :
 :   How used  . . . . .  ____         INP, UPD, OUT                           :
 :   Checked out . . . .  _            Y, N, blank                             :
 :   X-Ref type . . . .   _            B=Used by, U=Uses                       :
 :                                                                              :
 :                                                                              :
 :                                                                              :
 :   F3=Exit   F4=List   F12=Cancel                                            :
 :                                                                              :
 :................................................................................
     TLINEF    SOFTTURND  PF      TLINEN     SOFTTURND  LF      PF->LF     N  B
                                                                   More…
F3=Exit  F4=Prompt  F5=Refresh  F10=Data set information  F12=Cancel
F13=Repeat  F17=Filters  F19=Submit 1/2  F21=Command line  F22=Print
```

If you press **F10=Data set information**, you'll see a list of libraries over which the cross-reference is built.

```
1/11/00  9:00:42        Work with X-Ref Data Set Information   Your Company, Inc.

  Data set . . . . .TURN40
                                     Last Appl    Last form
  Library     Appl  Rel  Ver  Lev   X-Ref Update  X-Ref Update
  SOFTTURN    TO    3    2    2      4/17/95        3/15/94
  SOFTTURND   TO    3    2    2      4/17/95        3/15/94
  SOFTTURNE   TO    3    2    2      4/17/95        3/15/94
  SOFTTURN4   TO    4    0    2      4/17/95        4/17/95
  SOFTTURN4D  TO    4    0    2      4/17/95        4/17/95
  SOFTTURN4E  TO    4    0    2      4/17/95        4/17/95






                                                                   Bottom
  F3=Exit    F12=Cancel
```

This panel displays all of the libraries included in the cross-reference table (*X-Ref table*) and the applications associated with each one.

WORKING WITH USER-DEFINED REFERENCES

You can use the **WRKUSRREF** command to add some of your own references to a cross-reference table. On a command line, type **WRKUSRREF** and press **Enter**. The *Work with User References (WRKUSRREF)* panel appears:

```
                     Work with User References (WRKUSRREF)

 Type choices, press Enter.

 X-Ref Table Name . . . . . . . .   _____        APDEMO, DEFAULT, J52XREF, L...

















                                                                        Bottom
 F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
 F24=More keys
 Parameter XRFTBL required.
```

Type the name of a cross-reference table and press **Enter**. On the *Work with User Defined References* panel that appears, press **F6** to add a cross-reference. The *Add User Defined Cross Reference* pop-up panel appears:

```
  1/10/00 15:36:31     Work with User Defined References      Your Company, Inc.
                       Cross Reference Table: APDEMO          YOURSYS

 2=Chan  ┌──────────────────────────────────────────────────────┐   --
         │            Add User Defined Cross Reference            │
   Obje  │  Object. . . . . . . . . .  _____                 │
         │  Library . . . . . . . . .  _____                 │
         │  Object Type . . . . . . .  _____                 │
         │  Attribute . . . . . . . .  _____                 │
         │  Reference Object. . . . .  _____                 │
         │  Reference Library . . . .  _____                 │
         │  Reference Object Type . .  _____                 │
         │  Reference Attribute . . .  _____                 │
         │  Reference Member. . . . .  _____                 │
         │  Usage . . . . . . . . . .  __             F4-List     │
         │                                                        │
         │  F12=Cancel                                            │
         └──────────────────────────────────────────────────────┘



 F3=Exit   F6=Add X-Ref   F12=Cancel   F21=System command
```

On this panel, type an object name, the name of the library where the object resides, the object's type, and the object's TURNOVER® for iSeries v100 type code (attribute). Then type the same information for the existing object to which you're relating the new object. Finally, specify how the new object is using the referenced object. Press **F4** to display a list of values from which you can choose.

When you're finished, the *Add User Defined Cross Reference* pop-up panel looks something like this:

```
 1/10/00 16:03:03    Work with User Defined References    Your Company, Inc.
                     Cross Reference Table: APDEMO        YOURSYS

 2=Chan  ┌─────────────── Add User Defined Cross Reference ───────────────┐
                                                                        --
   Obje  │ Object. . . . . . . . . .  JIMPGM                             │
         │ Library . . . . . . . . .  BROWN                             │
         │ Object Type . . . . . . .  *PGM                              │
         │ Attribute . . . . . . . .  RPG                               │
         │ Reference Object. . . . .  APPF001                           │
         │ Reference Library . . . .  PRODTEST                          │
         │ Reference Object Type . .  *FILE                             │
         │ Reference Attribute . . .  PF                                │
         │ Reference Member. . . . .                                    │
         │ Usage . . . . . . . . . .  A4 PGM->FILE    F4-List           │
         │                                                              │
         │ F12=Cancel                                                   │
         └──────────────────────────────────────────────────────────────┘



 F3=Exit  F6=Add X-Ref  F12=Cancel  F21=System command
```

Press **Enter**. TURNOVER® for iSeries v100 displays the message "***Record added.***" and clears the contents of the pop-up panel. Press **F12**. The *Work with User Defined References* then displays the reference (in alphabetical order by object name) in the list of references that are defined for the cross-reference table:

```
 1/10/00 16:05:34    Work with User Defined References    Your Company, Inc.
                     Cross Reference Table: APDEMO        YOURSYS

 2=Change  4=Delete
                                    Reference -------------------------
   Object    Library   Type   Attr   Object    Library   Type   Attr
 _ ACMPGM    BROWN     *PGM   RPG    APPF001   PRODTEST  *FILE  PF
 _ JPMPGM    BROWN     *PGM   RPG    APPF001   PRODTEST  *FILE  PF
 _ JOPGM     BROWN     *PGM   RPG    APPF001   PRODTEST  *FILE  PF







                                                                 Bottom
 F3=Exit  F6=Add X-Ref  F12=Cancel  F21=System command
```

You can now use option **2** to change any reference listed or option **4** to delete a reference.

If you have any questions about the information in this document, please contact a UNICOM Systems, Inc. Technical Support Representative by phone, fax, or email at the locations shown at the beginning of this document.