National Human Exposure Assessment Survey (NHEXAS)

Arizona Study

Quality Systems and Implementation Plan for Human Exposure Assessment

The University of Arizona
Tucson, Arizona 85721

Cooperative Agreement CR 821560

Standard Operating Procedure **SOP-UA-D-34.0**

Title: Scanning and Verifying Forms and Questionnaires

Source: The University of Arizona

U.S. Environmental Protection Agency
Office of Research and Development
Human Exposure & Atmospheric Sciences Division
Human Exposure Research Branch

Notice: *The U.S. Environmental Protection Agency (EPA), through its Office of Research and Development (ORD), partially funded and collaborated in the research described here. This protocol is part of the Quality Systems Implementation Plan (QSIP) that was reviewed by the EPA and approved for use in this demonstration/scoping study. Mention of trade names or commercial products does not constitute endorsement or recommendation by EPA for use.*

Scanning & Verifying Forms and Questionnaires

1.0 Purpose and Applicability

This procedure defines the implementation steps for scanning and verifying forms and questionnaires that will be used in the NHEXAS Project, the Border Study, and other Health and Environment projects.

2.0 Definitions

2.1 BORDER STUDY = An alias for "Total Human Exposure Arizona: A Comparison of the Border Communities and the State" conducted in Arizona by the University of Arizona/Battelle/Illinois Institute of Technology consortium.

2.2 CODE, GLOBAL: A set of standard codes used to designate the status of a data field in three cases: datum refused, datum non-applicable, and datum missing.

2.3 HEALTH AND ENVIRONMENT PROJECTS (or H&E) = An umbrella title for all projects funded to M.D. Lebowitz and/or M.K. O'Rourke (or their designees) which examine purported or real relationships among environmental factors and any aspect of human health.

2.4 HRP SITE: The **H**ealth **R**elated **P**rofessions building, located at 1435 North Fremont Avenue; Tucson, AZ 85719. This is an annex of the Arizona Prevention Center and the primary site of NHEXAS Arizona, the Border Study, and other Health and Environment projects.

2.5 NHEXAS Arizona: Acronym for **N**ational **H**uman **EX**posure **A**ssessment **S**urvey, a research project conducted in Arizona by the University of Arizona/Battelle/Illinois Institute of Technology Consortium.

3.0 References

3.1 "Pentax Technologies: Installation & User's Guide" Pentax Technologies Corporation. Co. 1995

3.2 "TeleForm Standard: User Guide Version 5" Cardiff Software. Co. 1991-1996

3.3 "Windows 95 User's Guide" Microsoft Corporation Co. 1995

4.0 Discussion

Data scanners are now a cost effective method of entering data. Bubble fields are entered with virtually 100% accuracy. Technology to recognize constrained written numeric fields are available with near 100% accuracy. Use of this technology for the

entry of data is quick and accurate. scannable forms will be used in the field, lab, sample tracking and data entry portions of the project whenever possible.

NHEXAS AZ, the Border Study, and other Health and Environment project forms were developed using the Teleform program package and following procedures outlined in SOP # UA-D-3.X. This package has a dictionary feature and a feature that prints out the characteristics of each created form.

5.0 Responsibilities

The Project Data Coordinator is responsible for creating the forms, defining the database(s) and making sure all data on the forms is accurately scanned into defined data bases. This responsibility may be delegated.

6.0 Materials and Reagents

6.1 Local Area Network.
6.2 Pentax DS10 Document Scanner.
6.3 Purple/red Pen.

7.0 Procedure

7.1 Procedural Steps for Scanner operation and Form Verification

A. Turn on Scanner.

B. Place forms/questionnaires (no more than 30 sheets) which are to be scanned face down with the form ID box on the bottom of the page into the Paper Guide Plate of the Pentax DS10 Document Scanner (See Figure 1).

C. Make sure the Ready Light is on (See Figure 1).

D. Click on the Teleform Reader Icon. The scanner will automatically scan all the pages in the Paper Guide Plate. If necessary, turn the pages over to scan the back side.

E. Once all of the pages have been scanned, exit the Teleform reader and click on the Teleform Verifier Icon.

F. The forms/questionnaires that have been scanned are listed under "Forms". Click on the form you wish to verify.

G. Now click on "Correct" to verify all of the forms that have been scanned. Teleform will verify the forms in the order they were scanned.

H. Make any specific changes. (See Appendix 1)

I. Once all changes are made to the scanned form, Teleform automatically saves the data to an ASCII file.

J. Once done, close the Teleform Verifier.

7.2 Trouble Shooting Scanner Operation

A. If the computer gives the error message "Can't talk to scanner, check cables and power", do the following:

1. Make sure scanner is plugged in.
2. Make sure scanner is on.
3. Check connections between computer and scanner

B. If there is a paper jam the computer will also give the aforementioned error messages Do the following:

1. Press release button
2. Removed jammed paper
3. Press ADF Cover back into place
4. Place paper back into Paper Guide Plate

C. If the automatic scan feature is not working it can be by passed in the following way:

1. In the menu "Scan" choose "Quick Scan"
2. The scanner will scan all of the pages which are in the Paper Guide plate.
3. If necessary, turn the pages over to scan the back side. Then repeat step 1.

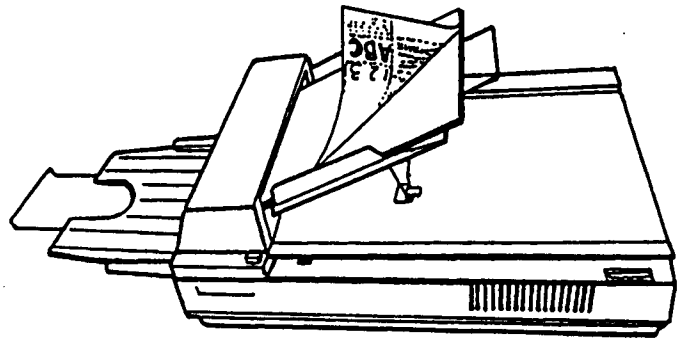
8.0 Records

All changes to the hard copy of the form must be dated and completed in purple or red ink.

Inclusions:

Figure 1. Illustration of the Pentax Document Scanner (1 page)
Appendix 1. Teleform User Guide Chapter 13 (14 pages)

Figure 1. Illustration of the Pentax Document Scanner.



Appendix 1. Teleform User Guide Chapter 13

TELEform

CHAPTER 13

Correcting Forms: Teleform Verifier

About This Chapter

This chapter discusses a major addition to the Teleform lineup: The *High Speed Verifier.* The *High Speed Verifier* provides a fresh approach to correcting information from forms, allowing the user to focus on the data without the distraction of having to search and tab through all the fields on the form.

Overview of High Speed Verification

About High Speed Verification

The *High Speed Verifier* increases the overall throughput of corrected data by employing techniques that are both more rhythmical and in-sync with the way the human mind views and processes data. As a result, significant improvements in the ability to verify data, especially in high volume situations, are attained.

The New Verification Process

High Speed Verification divides the correction process into three separate levels, or modes of correction: *Character Mode Correction, Field Mode Correction, and Form Mode Correction.* Verifying data consists of applying each correction mode in sequence and passing it on to the next. Each correction mode decreases the burden on the next level, so the cycle proceeds very quickly and efficiently. The three correction modes are described below:

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Character Mode Correction

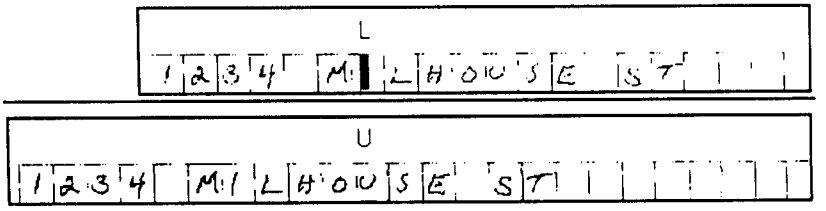
The Character mode is the first and fastest correction mode. In this mode, neither the form nor the field are displayed. Instead, the user sees a row of cells containing the characters requiring review and their best guess value. The user quickly moves through each row of cells, either approving the best guess character, typing the replacement character, or holding the character over for the next mode of correction.

View of Verification in Character Mode

After the final character has been corrected, any characters which were held over become the focus of the Field Mode correction. Teleform *Verifier* automatically switches modes, so no additional keystrokes are required.

Field Mode Correction

Any characters which were held over from Character Mode become the subject of Field Mode correction. In this mode, each field containing an unidentified character is displayed so that the user can deduce that character from the context of the field. Each field is displayed once for each uncertain character it contains. All fields are arranged such that the uncertain characters are aligned vertically, so the eye can drop naturally from one field to the next. The user moves through each field making the necessary corrections.



View of Verification in Field Mode

When field Mode correction is completed, *Verifier* automatically switches to Form Mode, where you can look over all of the fields before saving the corrections.

Form Mode Correction

Form Mode is the correction technique used by prior versions of Teleform. By the time this level is reached, most (if not all) of the errors have been corrected. Form Mode provides an opportunity to look over all of the fields on the form and verify that they contain correct data before saving the results. TrueAddress validation occurs in form mode.

VERIFIER OPERATION NOTES

Customizing Features in Teleform Verifier

The *High Speed Verifier* is highly configurable, allowing you to set form loading characteristics, the order in which errors are corrected, and the keystrokes which control the action. If desired, you can disable either or both of the first two correction levels and use only form Mode, making it just like the earlier versions of Teleform Verifier. You can even customize the fonts, colors, and display characteristics of the correction screens.

High Volume Processing

Teleform *Verifier* can be utilized in different ways to further speed along the task of correcting forms.

Multi-Form Verification

Verifier can load multiple forms at a time, allowing all of the errors to be corrected at once. This saves the time normally needed to save each form and load a new one into *Verifier*.

Workstation-Dependent Operating Levels

In Teleform multi-user environments, you can set particular workstations to perform verification in a particular mode. For instance, you could have one workstation operating in Character Mode verification, another in Field Mode, and a third performing in Form Mode. As each form is processed, it is pushed up to the next level for verification and approval.

Correcting Forms

Each form that Teleform *Reader* holds for review is passed to *Verifier* for manual correction. Forms that were interpreted OK or NonForms cannot be corrected.

This section demonstrates how forms are verified and corrected.

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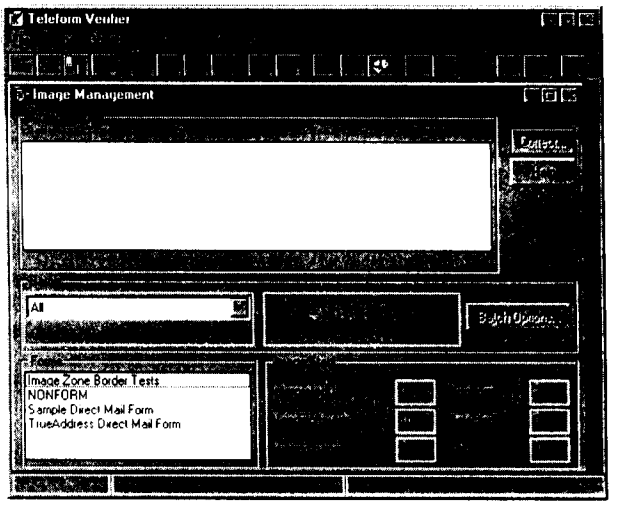
USING TELEFORM VERIFIER

To review and correct data on a form:

After forms have been evaluated by Teleform *Reader*, you must check on their evaluation status to see if they were interpreted okay, and correct those that were not.

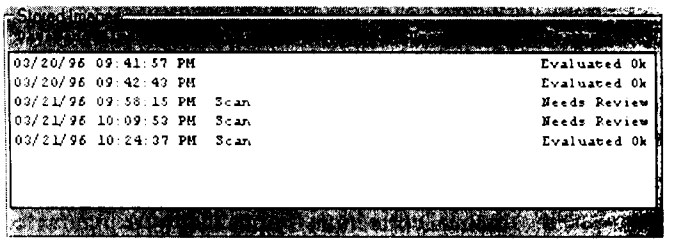
1. Open Teleform *Verifier*. The Image Management window displays:



The Forms box (lower left) lists the names of those forms that have been returned and evaluated.

2. In the Forms box, select the form that you would like to correct.

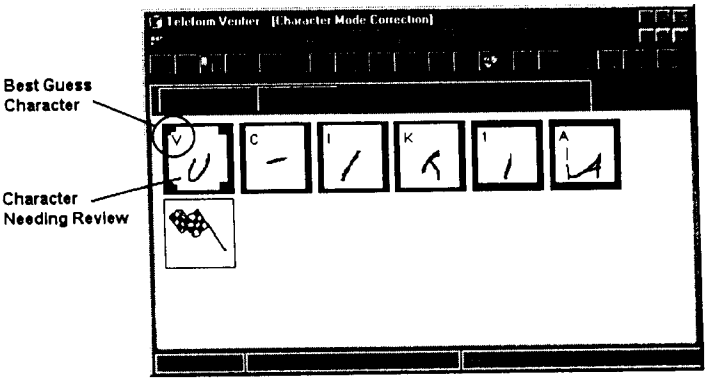
The Stored Images window lists all the returns that have been received for that form. Each record represents one form and shows the date and time the form was evaluated, the status of the evaluation, and other information.



Forms with the status 'Evaluated OK' cannot be corrected and are listed here just to show that they were received. You can restrict the types of forms which are listed in the Stored Images box by editing the Image Management options (Options menu - Image Management). These options are discussed later in this chapter.

3. From the Stored Images list, select a form to correct. You can only correct forms with the status "Needs Review".
   - You can select (and correct) multiple forms at once by holding down the [Ctrl] key while selecting individual records.
   - To select a range of forms, choose the first record and hold down the [Shift] while clicking on the last record in the range. This selects all records in the range.
   - To correct all the forms (needing review) in the Stored Images list, do not select any individual forms and click directly on the Correct button. (i.e., go to step 4)
4. Click on the Correct button. This opens the first level of correction, called "Character Mode Correction".

   In Character Mode, each character requiring review is displayed in a cell, with Teleform's best guess appearing in the upper left corner (default setting).



The Character Mode Correction screen is the first level of verification

5. Starting with the upper left cell, verify each character by comparing it to the best guess character and performing one of the appropriate actions below:

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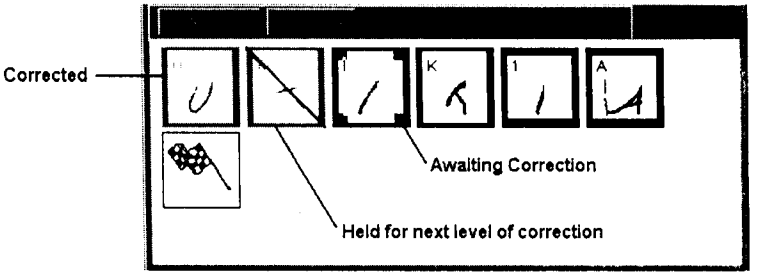
- If you are not absolutely certain about what the character is, click on the 'Hold Error' button or press [Space Bar]. This holds the error until the next level of recognition, where it can be viewed in the context of its field.
- To confirm (agree with) the best guess character, hit [Enter] (or click on the 'Accept Character' button).
- To replace the character with a completely different one, press that character on the keyboard.

As you perform these actions, you are automatically moved to the next cell. The corrected cells take on a different appearance to distinguish them from those awaiting verification:



Distinguishing Alphabetic and Numeric Characters

As you move through these cells, you may notice that the walls on certain cells have a different thickness. This is actually a feature to help you distinguish between alphabetic, numeric, and alphanumeric fields.

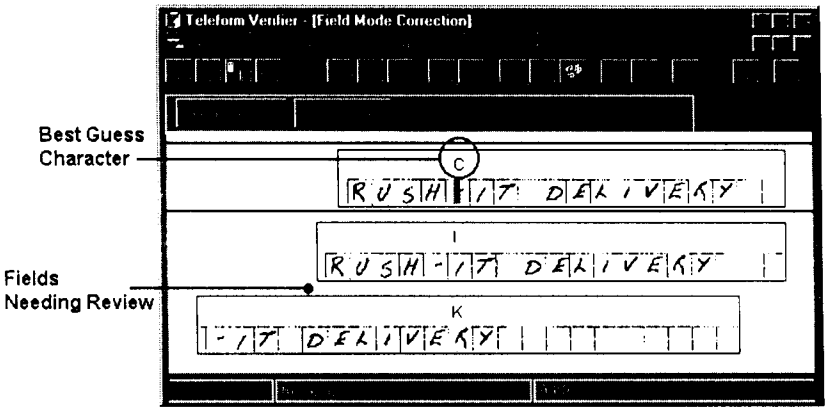
Fields defined as...	have cells that are...	Example
Alphabetic	*thicker on the sides.*	
Numeric	*thicker on the top & bottom.*	
AlphaNumeric	*same thickness on all sides.*	

Note: You can also look at the bottom of the *Verifier* window, where the associated field name and character type are shown for the currently selected character.

Finishing Character Mode Correction

You can revisit (edit) any cell by clicking on it and then typing the desired character. The checkered flag indicates the last cell. Once you accept (i.e. pass) the checked flag, you automatically finish Character Mode and move to the next level or correction.

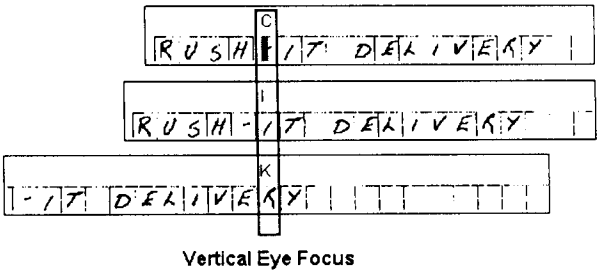
6. After all of the characters have been corrected, *Verifier* automatically switches to Field Mode Correction.



The Field Mode Correction screen is the second level of verification

The Field Mode Correction screen shows the fields associated with those characters that were held over from Character Mode Correction. Each field is displayed once for each error it contains.

Note that the characters requiring review are all centered on a common vertical line. This is done intentionally so you can easily maintain your focus on the characters without being distracted by the surrounding text.



Vertical Eye Focus helps keep your eyes on the action

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7. Starting with the highlighted character in the top field, verify each field by performing the appropriate action:

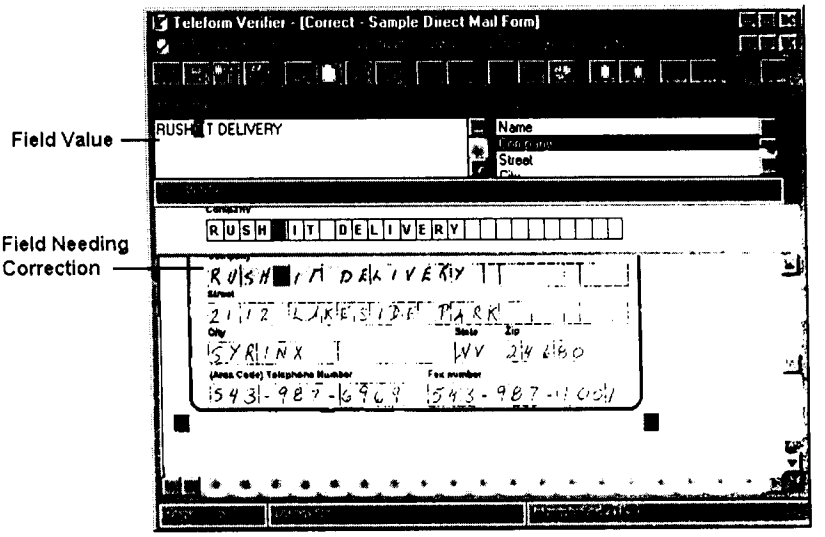
   - To confirm the best guess character, hit [Enter] (or click on the 'Accept Character' button).
   - To specify a different character, press that character on the keyboard.
   - If you see any reason to hold the field for further review, (such as a spelling error elsewhere in the field) click on the 'Hold Error' button or press [Space Bar]. This passes the error onto the next level of correction where you can edit the entire field value.

   As you complete each field you are automatically moved to the next one. You can revisit (edit) any field by clicking on it and then entering the new correction character.

Finishing Field Mode Correction

You can revisit any field by clicking on it and then typing the desired character. The checkered flag indicates the last field. Once you accept (i.e. pass) the checked flag, you automatically finish Field Mode and move to the next level or correction.

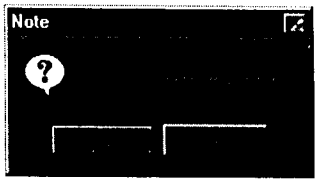
8. After all of the fields have been corrected, *Verifier* automatically switches to Form Mode Correction



The Form Mode Correction screen is the third and final level of verification

Form Mode Correction is the method used in earlier versions of Teleform. In this mode you can review and edit the entire contents of a field, whether it was held for review or not.

9. Verify the data by editing the value of each field in the New Value box:
   - To visit only those fields that were held for verification, use the [Tab] or [Enter] keys.
   - To select any other field, choose it from the Field scroll list.
10. After the last field is verified, you will be prompted to save the corrected form to the results file.



Note: At this point, you also have the option of forwarding this form to a supervisor or another *Verifier* user for final review. This is discussed in the following topic, "Forwarding Images for Review".

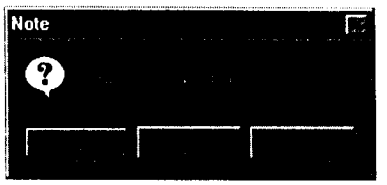
- To save the corrected form, click 'Yes'.
- To forward the form or cancel its verification without saving the corrections, click 'No'.

Continuously Correcting Incoming Forms

To review and correct all images for a given form, simply select the form and click on the Correct button. When you are done correcting all of the forms in the list, you will be prompted to stay in the Correct window and will be notified when any new forms arrive.

Closing a Form During Verification

If you close Teleform *Verifier* while a form is open for correction, you are prompted to save your corrections.

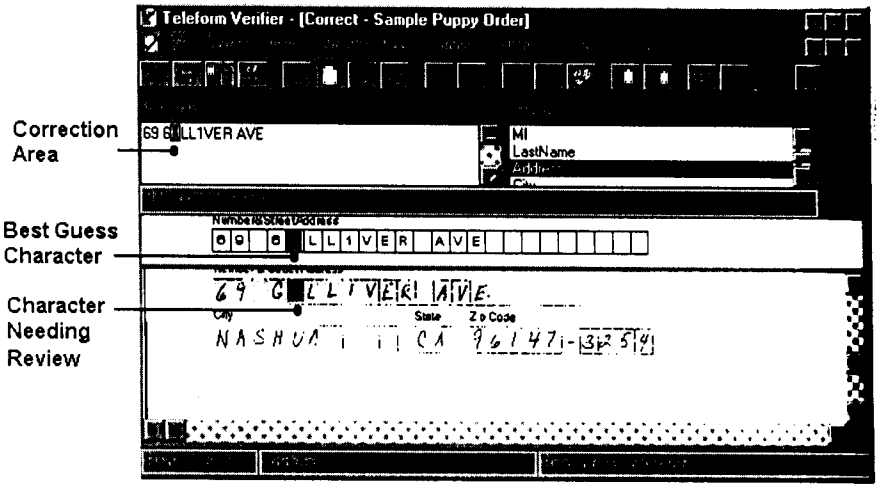


Select the desired save option:

- To save the corrections that have already made, click on 'Yes'. The form will return to the Stored Images list with the status 'Needs Review'. When the form is re-opened for correction, verification will resume from wherever it left off.
- To discard all the corrections made on the form, select 'No'. . The form will return to the Stored Images list with the status 'Needs Review'. When the form is re-opened for correction, verification will start from the beginning.
- If you decide not to close *Verifier*, click 'Cancel' to clear this dialog box and return to the form.

CORRECTING CONSTRAINED PRINT FIELDS

Constrained print fields utilize all three modes of verification. When Form Mode Correction is reached, the New Value box shows the current value for the field, including any corrections made in Character Mode and Field Mode correction. At this level, you are allowed to edit the entire value of each field, so this is a good place to correct spelling errors that could not be corrected in the earlier modes.



Characters that have not yet been corrected are replaced with Teleform's best guess character and highlighted. When Form Mode begins, the focus is on the first questionable character on the form. As you correct each character, the focus automatically moves to the next successive character needing review.

1. Type new values to replace the highlighted questionable characters.

   - **To edit a single character** simply click on the character to highlight it, and then type the correct character over it. The next uncertain character will then be highlighted and the process can be repeated.
   - **To accept the best guess character** shown, press the [Enter] key.
   - **To edit multiple characters** in a field, select the field so that its value appears in the New Value box. Type directly in the New Value box to change any of the characters or assign a completely new value to the field.

2. After all the characters are corrected in a field, press [Enter] or click on the Next button to accept the new values and proceed to the next field that needs review.
   - If you click on another field name before clicking on the Next button, Teleform updates the current field before advancing to the next.
   - If you click on the Skip button, Teleform discards your changes to the field before advancing to the next field.

CORRECTING OMR FIELDS

OMR (Optical Mark Recognition) fields, such as choice fields and entry fields are always corrected using Form Mode Correction. The method of correcting these fields is described below.

Correcting Choice Fields

Choice fields return values associated with fixed options. Although filled bubbles are rarely misinterpreted, occasionally more than one bubble is filled by mistake and editing is necessary.

To edit choice field values:

1. Select the Choice Field to be edited so that it is highlighted.

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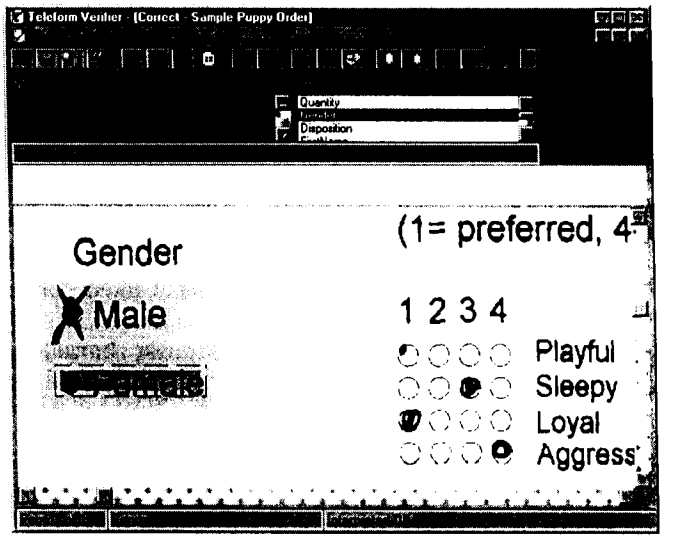

2. Click on the choice value that you wish to assign to this field.
   - When you click on a choice that is not marked, it becomes marked. If the field is a single choice field, then all other choices in the field become unmarked. If the field is a multiple choice field, the other choices are not affected.
   - When you click on a choice that is already marked, the choice becomes unmarked.

   Note that you are not changing the value on the actual form image, just the data that is entered into the database. In the above illustration, both bubbles were accidentally filled, which generated an error because the field is defined as a single-choice only. Since the Male choice is crossed out, the form was corrected to enter "F" into the database, specifying a female puppy.

   You can tab between individual choices by pressing [Alt]+T and mark the choice by selecting [Alt]+M.

   All of the marked choices (storage values) are displayed in the New Value box at the upper left of the dialog box.

3. After the choices are marked properly, press [Enter] or click on the Next button to accept the new values and proceed to the next field that needs review.

   If you click on another field name before clicking on the Next button, Teleform updates the field before advancing to the selected field.

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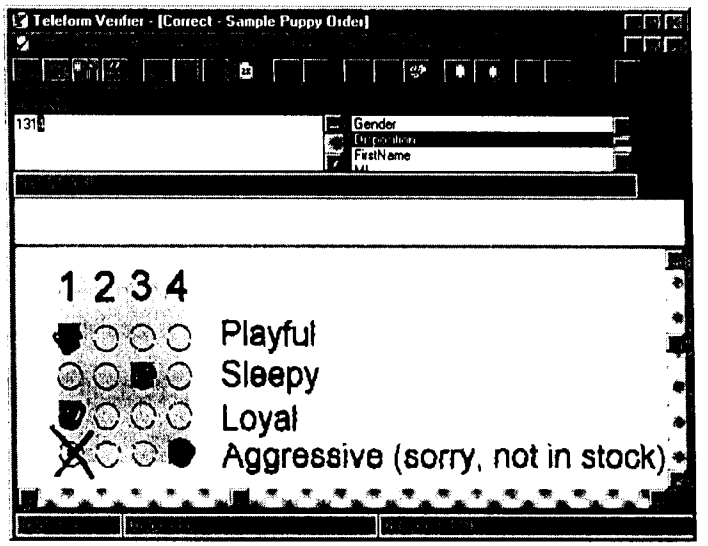
Correcting Entry Fields

Entry fields return a series of characters, as shown in the example below.



To edit entry field values:

1. Select the Entry Field on the form so that it is highlighted. The current value(s) for the field display in the New Value box.
2. You can enter new values for the field either by clicking on the desired bubbles, or entering the values directly in the New Value box. In the illustration, each row in the field is assigned a value from 1-4. Use a [space] character to skip a row without assigning a value.
3. After selecting or entering the desired values for the field, press [Enter] or click on the Next button to accept the new values and proceed to the next field that needs review.

   If you click on another field name before clicking on the Next button, Teleform updates the field before advancing to the selected field.

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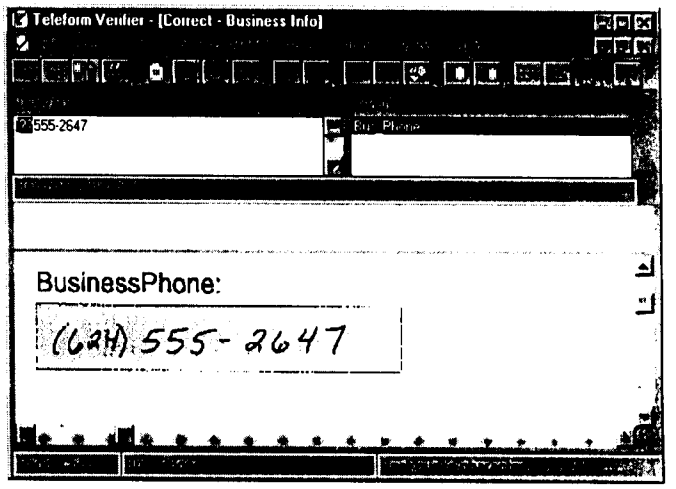
CORRECTING IMAGE ZONES

Image Zones are subjected to all three levels of verification, though Form Mode is often the most effective way to edit the data.

If you defined the image zones on your form as 'Store Value', you can enter additional notes and comments in the field during Form Mode correction. For example, you might type text that corresponds to hand written comments or edit text misinterpreted by the recognition engine.

In the example that follows, the image zone was used to collect a telephone number and was defined as 'store value' and 'store image'. If the field's name is 'Bus_Phone,' the exported field will have two components: 1) the interpreted value of the image zone's text, and 2) the name of the graphics file containing the image (if not stored directly to the database).



To edit the image zone's value:

1. Double-click on the image zone to select it and position the cursor in the New Value box.

   The default text is either the name of an image file (if 'store image' was selected), text from the Tri-CR engine (if 'store value' was selected), or blank (if neither was set), depending on the options you set for the image zone.