Metrology System Operation Manual for Version 7.1 Metrology Software

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Contents

Title | Page

Section 1 - Introduction

Description ---------- 1-1
Metrology Software Installation ---------- 1-1
System Startup ---------- 1-2

Section 2 - Metrology Menu Explanations

Overview of Metrology System ---------- 2-1
Metrology Menus ---------- 2-1
System Program Menu ---------- 2-1
Create SMARTSET File ---------- 2-4
Utility Menu ---------- 2-5
Picture Preview Program ---------- 2-7
Edit Alignment Defaults ---------- 2-8
Edit Mapping Defaults ---------- 2-10
Create/Edit Intrafield Layout ---------- 2-13
User-Selectable Items from the Intrafield Specification Display ---------- 2-15
Evaluate GRID FOCUS ---------- 2-16
Analyze Wafer Flatness File ---------- 2-17
Archive Of Wafer Flatness ---------- 2-18
Analyze Lens Tilt File ---------- 2-19
System Diagnostic Menus ---------- 2-20
DFAS Diagnostic Menu ---------- 2-21
Micro DFAS Diagnostic Menu ---------- 2-22
INSITU Diagnostic Menu ---------- 2-23
View History File ---------- 2-24
Average History File ---------- 2-25
Analyze History File ---------- 2-25
View SETUP History ---------- 2-26
SETUP History Help Menu ---------- 2-34
SETUP History File Edit Screen ---------- 2-35
SETUP Specification ---------- 2-36
Explanations for SETUP Specifications Display ---------- 2-37
ICE Calibration ---------- 2-38
Transmission of the Reticle ---------- 2-38
Edit Intensity Scale Value ---------- 2-38

Section 3 - Engineering Mode Menu Explanations

Engineering Mode ---------- 3-1
Scan Calibration ---------- 3-5

Contents (continued)

Title | Page

Section 4 - SMARTSET Menu Explanations

Overview of SMARTSET ---------- 4-1
SMARTSET Menus ---------- 4-1
SMARTSET Main Menu ---------- 4-1
System Analysis Menu ---------- 4-3
Setup Definition Menu ---------- 4-4
File Housekeeping Menu ---------- 4-6
Deleting Files in Directories ---------- 4-7
Grid Analysis Menu Selections ---------- 4-8
Grid Analysis Menu ---------- 4-8
Manual Data Entry Option ---------- 4-9
Model/Plot Vectors Option ---------- 4-11
Grid Analysis Source of Mode Parameters Display ---------- 4-12
Function Keys from within the Grid Analysis Menu ---------- 4-14
Grid Mode Corrections Menu ---------- 4-15
Grid Mode Corrections Display ---------- 4-16
Intrafield Analysis Menu Selections ---------- 4-17
Intrafield Analysis Menu ---------- 4-17
Manual Data Entry Option ---------- 4-18
Spec Field Size Option ---------- 4-20
Model/Plot Vectors Option ---------- 4-20
Function Keys from within the Intrafield Analysis Menu ---------- 4-22
Platen Adjustments Option ---------- 4-24
Tabulate Results Option ---------- 4-24
Plot Distortion Data Option ---------- 4-26
Displaying Distortion Data ---------- 4-27
Uniformity Analysis Menu Selections ---------- 4-28
Uniformity Analysis Menu ---------- 4-28
Function Keys from within the Uniformity Analysis Menu ---------- 4-29

Section 5 - Metrology System Operation

Executing Intrafield Jobs with DFAS or Micro DFAS ---------- 5-1
User-Selectable Items from the Intrafield Specification Display ---------- 5-2
Reading Intrafield Wafers with DFAS ---------- 5-3
Reading Intrafield Wafers with Micro DFAS ---------- 5-5
Multiple Alignments Within a Die ---------- 5-6
Wafer Summary Screen (DFAS and Micro DFAS) ---------- 5-6
Executing Focus Jobs ---------- 5-7
Systems Equipped with FOCUS Command (6.04.3 or Later MOPs) ---------- 5-7
System Focus ---------- 5-7
FOCUS Command ---------- 5-7
FOCUS Command Operation Overview ---------- 5-9
FOCUS Command Job Specification ---------- 5-10

Contents (continued)

Title | Page

Job/Aperture Verification Test ---------- 5-12
Detailed FOCUS Command Operation Procedure ---------- 5-13
Focus Test without the FOCUS Command ---------- 5-17
Latent Focus Test ---------- 5-17
INSITU Operation ---------- 5-18
SETUP Command ---------- 5-18
The INSITU Utility Options Menu ---------- 5-19
Full Set-Up ---------- 5-19
Determine Focus Using INSITU ---------- 5-19
Intrafield Analysis Using INSITU ---------- 5-20
Determine Micro DFAS Baseline Using INSITU ---------- 5-20
Determine Dose Control Parameters ---------- 5-21
Exit ---------- 5-22

Section 6 - SMARTSET Operation

Overview of Using SMARTSET ---------- 6-1
Intrafield Analysis ---------- 6-1
Mechanically Correctable Errors from Intrafield Analysis ---------- 6-1
Die Rotation and Translation Errors ---------- 6-1
Reduction and Trapezoid Errors ---------- 6-2
Uncorrectable Errors from Intrafield Analysis ---------- 6-2
Distortion Errors ---------- 6-2
Anamorphism Errors ---------- 6-3
Grid Analysis ---------- 6-3
Translation Errors ---------- 6-4
Scale Errors ---------- 6-5
Orthogonality Errors ---------- 6-6
Rotation Errors ---------- 6-7
Setting Up SMARTSET ---------- 6-8
Creating SMARTSET Files from Metrology Data ---------- 6-8
Creating SMARTSET Grid Files ---------- 6-8
Creating SMARTSET Intrafield Files ---------- 6-9
Creating SMARTSET Uniformity Files ---------- 6-9
Performing SMARTSET Analysis ---------- 6-10
Manually Entering Data into SMARTSET ---------- 6-12
Averaging SMARTSET Data Files ---------- 6-13
Performing Grid Analysis ---------- 6-14
Setting Up the Reference System ---------- 6-14
Matching Other Systems to the Reference System ---------- 6-16
Performing Intrafield Analysis ---------- 6-17
Setting Up the Reference System ---------- 6-17
Matching Other Systems to the Reference System ---------- 6-19
Uniformity Analysis ---------- 6-22

Contents (continued)

Title — Page

Appendix A - Restricted Pass Names

DFAS and Micro DFAS Systems ---------- A-1

Illustrations

Figure	Title	Page
2-1	Metrology Software Menu Flowchart	2-2
2-2	System Program Menu	2-3
2-3	Create SMARTSET File	2-4
2-4	Utility Menu	2-5
2-5	Picture Preview Program Menu	2-7
2-6	Edit Defaults Menu	2-8
2-7	Mapping Defaults Main Menu	2-10
2-8	Mapping Thresholds Menu Display	2-11
2-9	DFAS Offsets Menu Display	2-12
2-10	Micro DFAS Offsets Menu Display	2-13
2-11	Create/Edit Reticle Layout Menu	2-13
2-12	Intrafield Specification Display	2-15
2-13	Platen, Lens, and Wand Configuration Option Menus	2-16
2-14	Evaluate Grid Focus Parameters	2-16
2-15	Analyze Wafer Flatness File	2-17
2-16	Archive Of Wafer Flatness Files Menu	2-18
2-17	Analyze Lens Tilt File	2-19
2-18	System Diagnostic Menu	2-20
2-19	DFAS Diagnostic Menu	2-21
2-20	Micro DFAS Diagnostic Menu	2-22
2-21	INSITU Diagnostic Menu	2-23
2-22	View History File Menu	2-24
2-23	Intrafield Numeric Alignment Data History File	2-24
2-24	Analyze Average History File Menu	2-25
2-25	Analyze History File Menu	2-25
2-26	View SETUP History Display	2-27
2-27	SETUP Command History Graphs Flowchart	2-28
2-28	Focus/Temp/Pressure History Display	2-29
2-29	Mag Correction and Weather History[1] Display	2-30
2-30	PPC Motor Position History[2] Display	2-30
2-31	Magnification Error and Weather3 Display	2-31
2-32	Baseline History[1] Display	2-31
2-33	Baseline Error History[2] Display	2-32
2-34	RMS Rotation History[1] Display	2-32
2-35	Rotation Error History[2] Display	2-33

Illustrations (continued)

Figure	Title	Page
2-36	SETUP History Help Menu	2-34
2-37	Example of the SETUP History File Edit Screen	2-35
2-38	SETUP Specification Display	2-36
2-39	ICE Calibration Menu	2-38
3-1	Engineering Mode Options Help Menu	3-1
3-2	DFAS and Non-DUV INSITU Engineering Mode Flowchart	3-2
3-3	Micro DFAS and Non-DUV INSITU Engineering Mode Flowchart	3-3
3-4	Micro DFAS and DUV INSITU Engineering Mode Flowchart	3-4
3-5	Algorithm Parameters Menu	3-5
3-6	Scan Parameters Menu	3-5
3-7	Gain Control Menus for the System Configurations	3-6
3-8	Move Stages Menu	3-7
3-9	Shutter Control Menu	3-8
3-10	Focus Walk Graph	3-8
		3-9
4-1	SMARTSET Software Menu Flowchart	4-2
4-2	SMARTSET Main Menu	4-3
4-3	System Analysis Menu	4-4
4-4	Setup Definition Menu	4-4
4-5	Setup Definition Display	4-5
4-6	File Housekeeping Menu	4-6
4-7	Delete Files Menu	4-7
4-8	Grid Analysis Menu	4-8
4-9	Grid Test Pattern Layout Selection Menu	4-9
4-10	Manual Grid Data Entry Display	4-10
4-11	Manual Grid Data Entry Test Pattern Layout Display	4-10
4-12	Source of Mode Parameters Menu	4-11
4-13	Create or Edit Grid Source of Mode Parameters Display	4-12
4-14	Grid Analysis Menu	4-12
4-15	Typical Grid Analysis Display	4-14
4-16	Typical Bar Chart Display	4-15
4-17	Mode Corrections Menu	4-15
4-18	Grid Analysis Mode Corrections Display	4-16
4-19	Intrafield Analysis Main Menu	4-17
4-20	Intrafield Test Pattern Layout Menu	4-18
4-21	Intrafield Test Pattern Layout Display	4-19
4-22	Manual Intrafield Data Entry Display	4-19
4-23	Type of Field Menu	4-20
4-24	Intrafield Analysis Model/Plot Vectors Menu	4-20
4-25	Typical Intrafield Analysis Model/Plot Vectors Display	4-22
4-26	Typical Bar Chart Display	4-23
4-27	Intrafield Platen Adjustments Display	4-24
4-28	Tabulated Results Field Coordinate Menu	4-24
4-29	Intrafield Tabulated Results Display	4-25
4-30	Radial/Field Coordinate Diagram	4-26

Illustrations (continued)

Figure	Title	Page
4-31	Distortion Plot Menu	4-26
4-32	Distortion Plot Display	4-27
4-33	Uniformity Analysis Main Menu	4-28
4-34	Uniformity Analysis Plot Display	4-29
5-1	Intrafield Specification Display	5-1
5-2	Platen, Lens, and Wand Configuration Option Menus	5-2
5-3	Intrafield Analysis Display	5-4
5-4	Wafer Summary Screen for Grid or Mapping Data	5-6
5-5	Example of FOCUS Command Operation	5-8
5-6	FOCUS Command Operation Flowchart	5-9
5-7	Optimum Evaluate Grid Focus Display	5-14
5-8	Improperly Centered Evaluate Grid Focus Display	5-15
5-9	Unusable Evaluate Grid Focus Displays	5-16
5-10	SETUP Command Operation Flowchart	5-18
5-11	INSITU Utility Options Menu	5-19
5-12	Dose Control System Display Example	5-22
6-1	Typical Platen Corrections Display	6-2
6-2	Examples of Pincushion and Barrel Images	6-3
6-3	Example of Translation (Global Baseline) Error	6-4
6-4	Example of Scale Error	6-5
6-5	Example of Orthogonality Error	6-6
6-6	Example of Microscope Rotation	6-7
6-7	Create SMARTSET File Menu	6-9
6-8	SMARTSET Menus Block Diagram	6-11
6-9	Manual Grid Data Entry Display	6-12
6-10	Manual Intrafield Data Entry Display	6-13
6-11	Wafer Rotation for Orthogonality Setup	6-15
6-12	Grid Mode Corrections Menu (System Setup Option)	6-15
6-13	Grid Mode Corrections (System-to-System Option)	6-17
6-14	Typical Intrafield Analysis Display	6-18
6-15	Typical Platen Corrections Display	6-19
6-16	Measured-Translation-Residual Display	6-20
6-17	Measured-Translation-Residual Bar Chart Display	6-21
6-18	Uniformity Analysis Plot Display	6-23

Tables

Table	Title	Page
5-1	Y DXD Baseline Correction in MODE	5-3
5-2	Y DXD Baseline Correction in MODE	5-10

Section 1 - Introduction

This manual describes the menu options for version 7.1 of the metrology software and version 7.1 of the SMARTSET software. Version 7.1 software and this manual are for DFAS, Micro DFAS, non-DUV INSITU, and DUV INSITU. Multi-Scan is not supported by version 7.1 metrology software.

Description

DFAS, Micro DFAS, and INSITU are hardware and software assemblies used to receive alignment data to determine intrafield, baseline, magnification, and system focus.

NOTE: Throughout this manual DUV INSITU will be called INSITU unless the information is specifically for DUV INSITU.

Typical metrology configurations:

- Micro DFAS with or without INSITU
- DFAS with or without INSITU
- DFAS with Micro DFAS (No INSITU)
- DFAS and Micro DFAS, together, with INSITU is not a standard configuration.

Metrology Software Installation

NOTE: The complete software package needs to be installed only when updating the metrology software. If the metrology hardware is upgraded, the software is also updated. Metrology software is released in a 6-disk format. The installation includes updating of both SMARTSET and metrology software. To install, place disk labeled #1 into the disk drive and reboot computer by performing either of the following:

- Pressing CTRL+ALT+DEL or
- Turning the computer OFF, then ON
- Press reset button (on AST computer)

After SMARTSET is installed (3 disks), the user is prompted for DFAS disks #1, #2 and #3 to install the new metrology software. After installation is complete, reboot the computer again. The metrology software and SMARTSET will be properly installed.

System Startup

The metrology software is a menu-driven set of programs that allow the user to operate the alignment system, store files and alignment pictures, set alignment defaults, perform calibration, and create files for analysis by the SMARTSET software package. This document explains general use of the various features of DFAS, Micro DFAS, and INSITU. As the primary function of the metrology subsystem is alignment, when the computer is powered or rebooted, (CTRL+ALT+DEL), the system is in alignment mode awaiting instructions from the wafer stepper master operating program, (MOP). A self-diagnostic routine is performed and the following is displayed on the screen.

Waiting For MOP Command <ESC> For Main Menu

At this prompt, to enter the main program menu, press the <ESC> key on the keyboard. The system program menu is then displayed.

NOTE: After escaping from the alignment program, no further alignment can take place until the user selects Alignment from the system program menu.

Section 2 - Metrology Menu Explanations

Overview of Metrology System

The metrology system is an integrated alignment system which performs several key functions:

- Aligns wafers in DXD mode (DFAS systems only)
- Aligns wafers in mapping mode
- Stores alignment data for each wafer
- Performs LSF (least-squares-fit) grid analysis after alignment which either updates wafer stepper parameters automatically in mapping mode and/or displays suggested grid corrections
- Displays alignment signals
- Displays wafer alignment/exposure positions
- Provides flexible SMARTSET interface
- Performs automated intrafield analysis and displays platen corrections
- Performs automated best focus analysis on latent images
- Saves/prints certain alignment pictures
- MATCH functions
- Automated Micro DFAS baseline

In automated mode, the user does not use the keyboard for normal operation; however, the keyboard gives direct access to many applications and analysis packages supplied with the metrology system.

NOTE: AUTOSTEP 200 and LASERSTEP 200 Systems have only one keyboard for the entire wafer stepper system. Any wafer stepper systems prior to these models used a separate metrology rack and a separate metrology keyboard for metrology software operation.

Metrology Menus

System Program Menu

Refer to Figure 2-1 for a flowchart of the complete metrology software package.

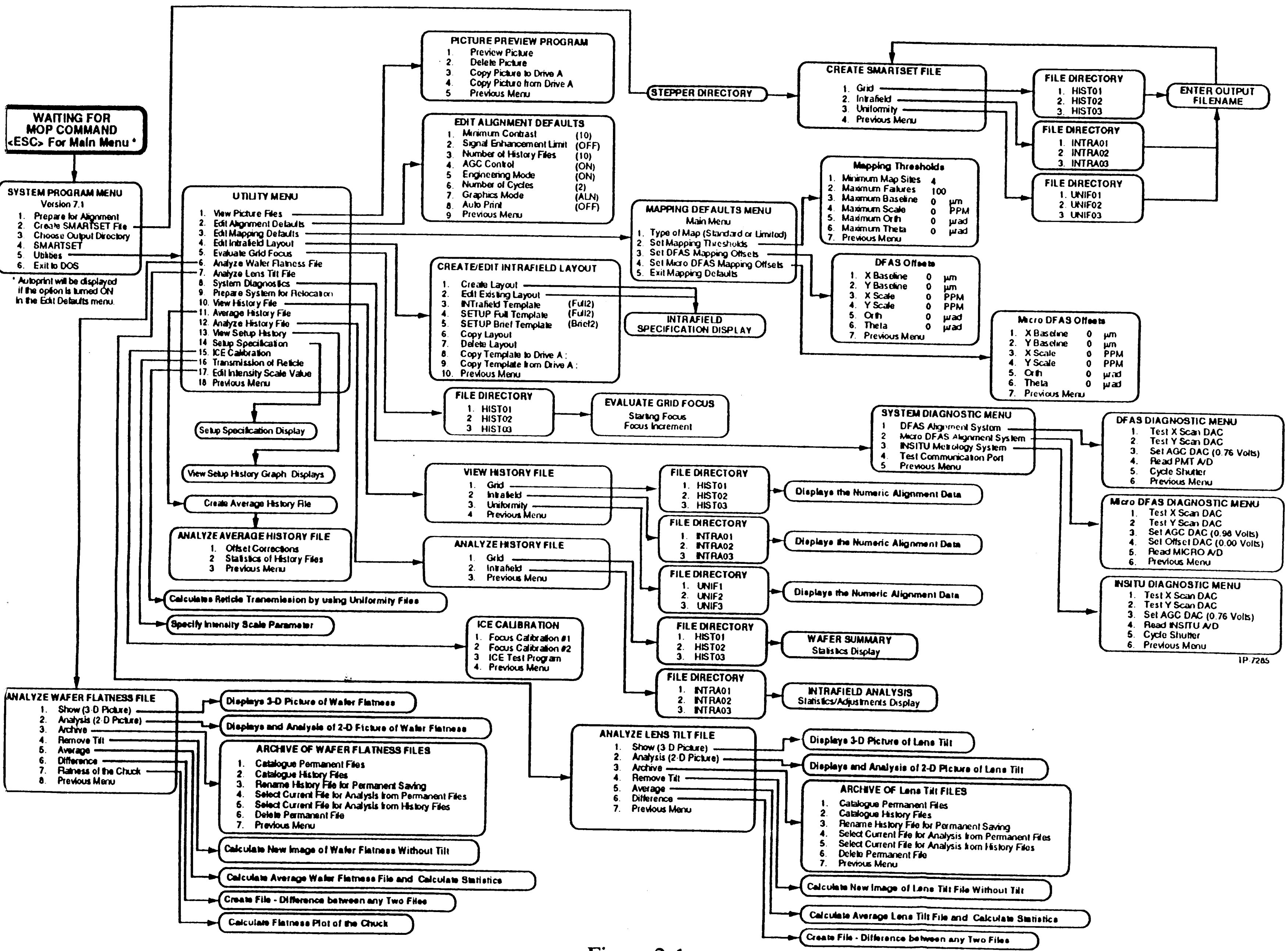

Figure 2-1
Metrology Softw Menu Flowchart

From the System Program menu the user can select six options that range from alignment to SMARTSET analysis. The menu display looks like Figure 2-2:

SYSTEM PROGRAM MENU
Version 7.1

1. **Prepare for Alignment**
2. **Create SMARTSET File**
3. **Choose Output Directory**
4. **SMARTSET**
5. **Utilities**
6. **Exit To DOS**

Figure 2-2
System Program Menu

Option 1: Selecting this option places the computer in alignment mode. In this mode, until the <ESC> key is pressed at the **WAITING FOR MOP COMMAND** prompt, the computer will execute alignment commands initiated from the MOP.

Option 2: This option allows the user to create a SMARTSET-compatible grid or intrafield data file to be used for analysis. The metrology system stores all alignment information from the previous (n) wafers. All alignment information previous to the last (n) wafers is lost unless saved by the user. The number of files stored is user-selectable from the Edit Defaults menu. In order to minimize errors, the DEFAULT.GPD file is updated to contain the proper AWA offsets, AWA row and column, etc. The Default option should be chosen in SMARTSET Source Of Mode Data option to maintain constant analysis.

Option 3: This option allows the user to select the SMARTSET/wafer stepper directory where the data files created in option 2 will be stored. The selected directory appears below the menu title and once selected remains in effect until changed.

Option 4: This option executes the software package. When leaving SMARTSET, the System Program menu is displayed. Always remember to place the computer in alignment mode after SMARTSET analysis is complete.

Option 5: This option allows the user to select various utility programs which are discussed in the Utility menu section.

Option 6: Gives the user access to DOS. This option should only be executed by users with a working knowledge of DOS, as file deletion or corruption will render the software inoperative. To restart the metrology software from DOS, type **DFMA <CR>**.

Create SMARTSET File

From this menu the user can create SMARTSET files from the metrology history files (Figure 2-3).

CREATE SMARTSET FILE
Version 7.1

1. **Grid**
2. **Intrafield**
3. **Uniformity**
4. **Previous Menu**

Figure 2-3
Create SMARTSET File

Option 1: Creates a grid SMARTSET data file for later viewing in the SMARTSET program.

Option 2: Creates an intrafield SMARTSET data file for later viewing in the SMARTSET program.

Option 3: Creates a uniformity SMARTSET data file for later viewing in the SMARTSET program. The file must be created using the UNIF command.

Option 4: Returns the user to the System Program menu.

Utility Menu

From this menu (Figure 2-4) the user can view and change many of the metrology system parameter files (Figure 2-4).

UTILITY MENU
Version 7.1

1. View Picture Files
2. Edit Alignment Defaults
3. Edit Mapping Defaults
4. Edit Intrafield Layout
5. Evaluate GRID FOCUS
6. Analyze Wafer Flatness File
7. Analyze Lens Tilt File
8. System Diagnostics
9. Prepare System For Relocation
10. View History File
11. Average History File
12. Analyze History File
13. View Setup History
14. Setup Specification
15. ICE Calibration
16. Transmission of Reticle
17. Edit Intensity Scale Value
18. Previous Menu

Figure 2-4
Utility Menu

Option 1: Because the metrology system is graphics-oriented, while operating in engineering mode, the user can select to save various alignment screens for future reference. This utility allows the user to transfer, view, print, or delete picture files. See Picture Preview Program for further information.

Option 2: This option allows users to change some of the defaults. See Edit Defaults menu for further information.

Option 3: This gives the user increased flexibility in the use of mapping. The user can add offsets to the mapping parameters.

Option 4: Version 7.1 metrology software offers a new way to easily run intrafield jobs for setting or examining intrafield errors with the standard intrafield reticle 4800-045 Rev. 2. This option allows the operator to define which points (templates) should be aligned while running an intrafield job or the SETUP command. Intrafield jobs are defined as pass names that begin with "INT", for read intrafield. Data setup with this option is used to measure platen errors. After job completion, the platen corrections are displayed on the screen.

Version 7.1 metrology software uses templates created by the user to drop selected sites from the reading pass. The user can easily define the templates and save them for later use. See Executing Intrafield Jobs in Section 5 for more information.

Option 5: The contrast level of the scan is directly proportional to focus. With this option it is possible to enter job and metrology parameters to analyze the focus history files. The history files are created by the FOCUS command and the SETUP command. See Section 5 - Executing Focus Jobs procedure for more information.

Option 6: This option allows the user to view and analyze files containing information about wafer flatness. The user can select files for analysis from special archives. See Analyze Wafer Flatness File for further information.

Option 7: This option allows the user to view and analyze files containing information about the tilt of the reduction lens. The user can select files for analysis from special archives. See Analyze Lens Tilt File for further information.

Option 8: This enters a diagnostic program which allows discrete testing of all DACs and A/Ds used on the various metrology system configurations. The configurations are DFAS, Micro DFAS, and INSITU. The RS-232 communucation channel to the MICROPDP-11/53 computer can also be tested from this menu.

Option 9: This option allows the user to park the fixed disk drive heads automatically when the metrology rack must be moved. The computer system must be turned off and then on to restart. This provides a guard against hard disk damage due to shock while the system is in transit.

Option 10: This option allows the user to view the numeric alignment data stored at the time the history files were created.

Option 11: This option allows the user to create average history files, calculate new offset corrections and statistics from selected history files. See Average History File for further information.

Option 12: This option allows the user to view stored history files as graphic display screens. Grid history files will be displayed on the Wafer Summary statistics plot. Intrafield history files will be displayed on the Intrafield Analysis statistics/adjustments plot.

Option 13: This option displays the SETUP command historical data as 4 graphs (Figure 2-23): focus/temp/pressure, magnification/temp/pressure, local baseline, and RMS rotation.

The user can expand each of these graphs to display the last 120 tests executed by pressing the appropriate key (F, M, B, and R) (Figures 2-25, 2-26, 2-30, 2-31). This option is only for systems equipped with INSITU.

Option 14: This option is used to set up system tolerances (for the SETUP command) for focus, magnification, trapezoid, platen rotation, and local baseline (Figure 2-35).

Option 15: This option enables the user to perform ICE Calibration. This should only be done by GCA service personnel.

Option 16: This option allows the user to calculate transmission of the reticle by using uniformity files.

Option 17: This option allows the user to adjust intensity scale factor.

Option 18: Returns the user to the System Program menu.

Picture Preview Program

This menu (Figure 2-5) allows the operator to manipulate metrology picture files saved while in engineering mode. (See Engineering Mode section.)

PICTURE PREVIEW PROGRAM
Version 7.1

1. **Preview Picture**
2. **Delete Picture**
3. **Copy Picture To Drive A**
4. **Copy Picture From Drive A**
5. **Previous Menu**

Figure 2-5
Picture Preview Program Menu

Option 1: Any picture stored is placed in a special user directory (C:\DFAS\USERPIC). This option allows the user to select and display a file on the screen. A file is selected by entering the number beside the file from the displayed file list. If no files exist, a message will inform the user.

Option 2: Unwanted files can be deleted using this option. Highlight the files to be deleted by entering the appropriate number next to the file, followed by a **CR**. Press **ESC** to exit this routine.

NOTE: Only 90 files can be maintained at any one time. The user should periodically remove unwanted files.

Option 3: This allows the user to copy any picture file to drive A. Make sure a formatted disk is in drive A before selecting this option.

Option 4: This allows the user to copy any picture file from drive A to the hard disk drive of the system. Make sure the disk containing the file is in drive A before selecting this option.

Option 5: Returns the user to the Utility menu.

Edit Alignment Defaults

There are several user-selectable parameters that can be configured using this menu (Figure 2-6). Some control graphic output, others control the actual alignment characteristics of the system. At installation time, the defaults are set at nominal values which should suffice for many applications and are mainly used for system setup and debugging. When an option is selected, the option line changes color. Either a value is requested or ON/OFF is toggled. The new value is displayed in parenthesis on the menu. The menu appears as follows:

EDIT DEFAULTS
Version 7.1

1.	Minimum Contrast	(10)
2.	Signal Enhancement Limit	(OFF)
3.	Number Of History Files	(10)
4.	AGC Control	(ON)
5.	Engineering Mode	(ON)
6.	Number Of Cycles	(2)
7.	Graphics Mode	(ALN)
8.	Auto Print	(OFF)
9.	Password Mode	(OFF)
10.	New Password	
11.	Previous Menu	

Figure 2-6
Edit Defaults Menu

Option 1: Contrast is defined as the ratio of the highest scan value to the lowest scan value as a percent of the total range. This value is used as a determination of adequate signal to perform an alignment. By changing this value, the user can choose to align only on those dies that have a signal-to-noise ratio greater or equal to the input value.

Option 2: If the contrast as defined above drops below this value, software enhances the signal. The signal is effectively squared and scaled to give best signal processing capability. If the user does not want to use this option, a value of OFF will disable it. If the user wants to use this option, it should be set to some value above the minimum contrast limit.

For example, if minimum contrast is 5, the signal enhancement limit could be set to 15. When the contrast drops below 15, the signal will be enhanced if the contrast is above 5. No enhancement will be done if the contrast is above 15. This is helpful when low contrast signals are encountered.

Option 3: The user can now select the number of history files to store. History files contain the data to create SMARTSET files, and focus analysis. The user can select between 1 and 50 files.

Option 4: Automatic gain control is a standard feature. The system automatically increases gain to the detector to ensure adequate nominal signal for alignment. This option can be disabled for setup. In normal operation AGC should be ON.

Option 5: Metrology operation can be placed under user control in engineering mode with this option. In engineering mode, the system waits for the user to press a key after each alignment. Engineering mode is useful for evaluating and optimizing targets and performance on process levels (see Engineering Mode section).

Option 6: Alignment signals can in effect be averaged by taking more than one scan for each axis. This option controls the number of cycles in each axis that will be averaged to obtain the final data. One cycle is the minimum number allowed and six is the maximum. (1 cycle is not recommended.) The more cycles performed the slower the alignment. With fast resist, the alignment mark may be bleached with many cycles, thus affecting alignment results. GCA recommends 2 cycles for the best performance and throughput.

Option 7: The user has four different graphics modes to choose from in normal metrology mode, (engineering mode OFF). They are ALN (align), ITT (iterate), WAF (wafer), and OFF. (With engineering mode ON, the graphics mode must be set to either ALN or ITT.) The first two (ALN and ITT) are similar in that they turn on the alignment screen which displays scan data for the X- and Y-axes, the signal-to-noise ratios, the gain value, the correction data, row, column information, etc. If the calculated alignment error at a site is greater than 0.2μm, the metrology system makes another alignment to ensure optimum accuracy. If the graphics mode is set to ALN the display is updated only after the alignment is complete. If the graphics mode is set to ITT, the display is updated for each alignment at the expense of alignment time. If the graphics mode option WAF is selected, the screen draws a picture of a wafer and places the die on the wafer as it is aligned, (green die, successful alignment; red die, unsuccessful; and blue die, exposed). If the graphics mode OFF is selected, the wafer summary remains on the screen after a mapping/alignment pass. The graphics capability is turned off.

Option 8: With this option ON the system will automatically print the Wafer Summary alignment screen and the SETUP command summary screen (if applicable).

Option 9: With this option ON the user must enter the password to use the following options from the Metrology Utility Menu:

2. Edit Alignment Defaults
3. Edit Mapping Defaults
15. ICE Calibration
17. Edit Intensity Scale Value

The password may be chosen by default or created by the user using option 10 of this menu.

Option 10: Allows the user to create their own password (with option 9 turned ON).

Option 11: This option permanently saves all parameters and returns to the Utilities Menu. The parameters are saved anytime the user leaves the metrology alignment program or the engineering menus.

Edit Mapping Defaults

At some point, the user can select to offset the corrections developed when mapping wafers. This option (Figure 2-7) gives the user some flexibility in wafer alignment.

MAPPING DEFAULTS MENU
Version 7.1

Main Menu

1. **Type of Map**
2. **Set Mapping Thresholds**
3. **Set DFAS Mapping Offsets**
4. **Set Micro DFAS Mapping Offsets**
5. **Exit Mapping Defaults**

Figure 2-7
Mapping Defaults Main Menu

Option 1: The user can select from Standard mapping or Limited mapping. If Standard mapping is selected, all scale factors are used in the mapping calculations. If Limited mapping is selected, X and Y scale factors are assumed to be equal and orthogonality is not corrected by the mapping algorithms.

Option 2: The user can select the minimum and maximum readings before a mapping failure will occur. The Mapping Thresholds menu is displayed when this option is selected (Figure 2-8).

Option 3: Allows the user to offset the measured DFAS mapping errors. The DFAS Offsets menu is displayed when this option is selected (Figure 2-9).

Option 4: Allows the user to offset the measured Micro DFAS mapping errors. The Micro DFAS Offsets menu is displayed when this option is selected (Figure 2-10).

Option 5: Returns the user to the Utility Menu.

```
           Mapping Thresholds
              Version 7.1

1.   Minimum Map Sites    4
2.   Maximum Failures     100
3.   Maximum Baseline     3.000    µm
4.   Maximum Scale        30.000   PPM
5.   Maximum Orth         30.000   µrad
6.   Maximum Theta        30.000   µrad
7.   Previous Menu
```

Figure 2-8
Mapping Thresholds Menu Display

Option 1: The user can select the minimum number of sites necessary before a mapping failure will occur.

Option 2: The user can set the maximum number of failures that can occur while mapping. In this way if adequate sites were mapped to do the analysis, but more than (n) sites failed, the user can force a mapping failure to ensure optimum performance.

Option 3: The user can select the maximum baseline error allowed (as read by the metrology system) before the wafer is exposed. If this threshold is exceeded, an error message appears on the metrology monitor, showing that the baseline threshold was exceeded, and the user must press <CR> on the wafer stepper keyboard to continue. The wafer is NOT exposed and the system continues with the next wafer.

Option 4: The user can select the maximum scale error allowed (as read by the metrology system) before the wafer is exposed. If this threshold is exceeded, an error message appears on the metrology monitor, showing that the scale threshold was exceeded, and the user must press <CR> on the wafer stepper keyboard to continue. The wafer is NOT exposed and the system continues with the next wafer.

Option 5: The user can select the maximum orthogonality error allowed (as read by the metrology system) before the wafer is exposed. If this threshold is exceeded, an error message appears on the metrology monitor, showing that the orthogonality threshold was exceeded, and the user must press <CR> on the wafer stepper keyboard to continue. The wafer is NOT exposed and the system continues with the next wafer.

Option 6: The user can select the maximum theta error allowed (as read by the metrology system) before the wafer is exposed. If this threshold is exceeded, an error message appears on the metrology monitor, showing that the theta threshold was exceeded, and the user must press <CR> on the wafer stepper keyboard to continue. The wafer is NOT exposed and the system continues with the next wafer.

Option 7: Returns the user to the Edit Mapping Defaults main menu.

```
           DFAS Offsets
            Version 7.1

1.    X Baseline      0.000    µm
2.    Y Baseline      0.000    µm
3.    X Scale         0.000    PPM
4.    Y Scale         0.000    PPM
5.    Orth            0.000    µrad
6.    Theta           0.000    µrad
7.    Previous Menu
```

Figure 2-9
DFAS Offsets Menu Display

Options 1-6: Allows the user to input an offset that will be directly added to the calculated corrections of DFAS when mapping.

These corrections will NOT change DFAS alignments when they are used in a DXD mode. These options are useful for tweaking mapping alignment when a process effect induces scaling errors or to correct for wafer stepper stage key errors causing minor theta or orthogonality errors.

Option 7: Returns the user to the Edit Mapping Defaults main menu.

Micro DFAS Offsets
Version 7.1

1.	X Baseline	0.000	µm
2.	Y Baseline	0.000	µm
3.	X Scale	0.000	PPM
4.	Y Scale	0.000	PPM
5.	Orth	0.000	µrad
6.	Theta	0.000	µrad
7.	Previous Menu		

Figure 2-10
Micro DFAS Offsets Menu Display

Options 1-6: Allows the user to input an offset that will be directly added to the calculated corrections of Micro DFAS when mapping.

These options are useful for tweaking mapping alignment when a process effect induces scaling errors or to correct for wafer stepper stage key errors causing minor theta or orthogonality errors.

Option 7: Returns the user to the Edit Mapping Defaults main menu.

Create/Edit Intrafield Layout

The options in this menu (Figure 2-11) allow the user to create predetermined reading passes. The intrafield reading pass must have INT as the first 3 letters of the pass name or the system will not perform intrafield. This reading pass will have all the data points around the wand and microscope assembly dropped out so there will not be any alignment errors from missing data points.

CREATE/EDIT INTRAFIELD LAYOUT
Version 7.1

1. Create Layout
2. Edit Existing Layout
3. INTrafield Template (Full2)
4. SETUP Full Template (Full2)
5. SETUP Brief Template (Brief2)
6. Copy Layout
7. Delete Layout
8. Copy Template to Drive A
9. Copy Template from Drive A
10. Previous Menu

Figure 2-11
Create/Edit Reticle Layout Menu

Option 1: Creates a new intrafield template layout. Displays the Intrafield Specification display (Figure 2-12). If the user selects Platen, Lens, or Wand under the system configuration menu, a sub-menu, in the center of the screen, displays the available options (Figure 2-13).

Option 2: Edits the existing intrafield layout. Displays the Intrafield Specification display (Figure 2-12). If the user selects Platen, Lens, or Wand under the system configuration menu, a sub-menu, in the center of the screen, displays the available options (Figure 2-13).

Option 3: Allows the user to select the INTrafield template. This template is used when performing intrafield data collection on a wafer. A list of the templates previously created is displayed for the user to select from.

Option 4: Allows the user to select which SETUP template to use while reading the setup intrafield data. A list of the templates previously created is displayed for the user to select from.

Option 5: Allows the user to select which SETUP Brief template to use while reading the quick setup data. This template is used in the Micro DFAS baseline command (from the INSITU command option menu or the SETUP command). A default template of 4 points (which is the minimum number of alignment points) at 48mm should normally be used. A list of the templates previously created is displayed for the user to select from.

Option 6: Duplicates the selected template.

Option 7: Deletes the selected template.

Option 8: Allows the user to copy any templates to a floppy disk. The disk can then be taken to another system and option 9 would be used to copy the template from the floppy disk to the hard drive. This way a full set of templates would only need to created once and copied to the other wafer stepper systems.

Option 9: Allows the user to copy any templates saved on a floppy disk to the hard drive.

Option 10: Returns the user to the Utility menu.

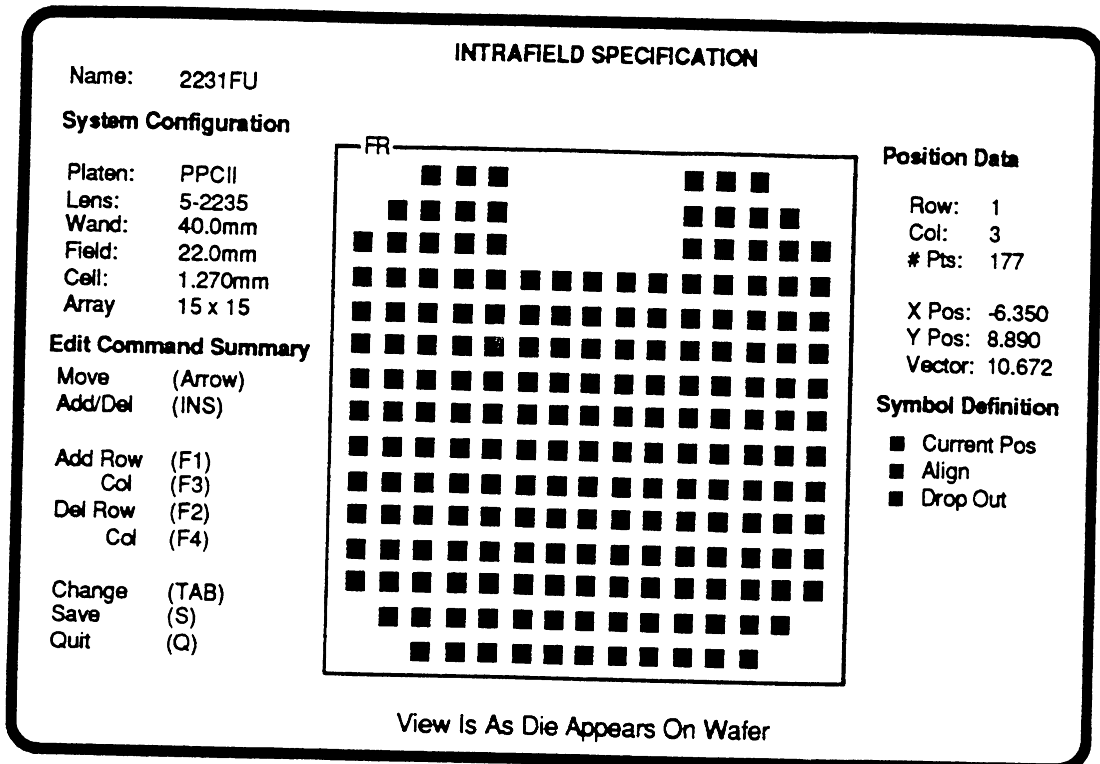

Figure 2-12
Intrafield Specification Display

User-Selectable Items from the Intrafield Specification Display

Platen: Press TAB, to put the cursor at the PLATEN position at the top of the display. Press TAB again to display a submenu of the platen configuration options in the center of the screen. Enter the number of the platen the system is equipped with and press RETURN. Press RETURN again to move to the LENS position.

Lens: Press TAB to view the submenu of the available lens configuration options. Enter the number of the lens the system is equipped with and press RETURN. Press RETURN again to move to the WAND position.

Wand: Press TAB to view the submenu of the available wand configuration options. Enter the number of the wand configuration the system is equipped with and press RETURN. Press RETURN again to move to the FIELD position.

Field: Enter the desired field size to be measured. Press RETURN to move to the CELL position.

Cell: Enter the spacing between the alignment sites. Press RETURN to move to the ARRAY position. The maximum cell size is 10mm.

Array: Enter the size of the array to be read. If the array is going to be a 15x15 array, enter 15 and press RETURN. The array would then be automatically calculated as a 15x15 array. The array must be ≥3 and ≤19 and an odd number.

Platen Configuration	Lens Configuration		Wand Configuration
1. WDG	1. 10-77-58	12. 5-2035	1. 40.0
2. WSH	2. 10-77-61	13. 2142-g	2. 41.2
3. MMP	3. 10-78-06	14. 2145-i	3. 42.0
4. PPCI	4. 10-78-34	15. 5-2232	4. 44.0
5. PPCII	5. 10-78-37	16. 5-2235	5. 48.0
6. RPC	6. 10-78-45	17. 5-2529-g	6. 59.2
7. LLC	7. 10-78-46	18. 5-2923	7. 90.0
	8. 10-78-47	19. 5-2040	
	9. 10-78-48	20. 2035-Krf	
	10. 10-78-52	21. 2135-Krf	
	11. 5-1635	22. ORION	

Figure 2-13
Platen, Lens, and Wand Configuration Option Menus

Evaluate GRID FOCUS

This option (Figure 2-14) prompts the user to specify what the focus alignment parameters were. The data is modeled and the best system focus is displayed graphically. The user must enter the starting focus and the focus increment to be used in this analysis.

EVALUATE GRID FOCUS
Version 7.1

Starting Focus:
Focus Increment:

Figure 2-14
Evaluate Grid Focus Parameters

Starting Focus:

The focus at which the array began.

Focus Increment:

The amount of focus change per exposure (1 increment = 0.1µm for 6.04.3, or later, MOPs). This value should be set at the same increment that was used during an EXPO command. When analyzing SETUP focus history files, the starting focus and focus increment are automatically entered.

Analyze Wafer Flatness File

This menu (Figure 2-15), allows the operator to manipulate files which were created while measuring wafer flatness and stored in the directory: c:\dfas\dfhist.

ANALYZE WAFER FLATNESS FILE

1. Show (3-D Picture)
2. Analysis (2-D Picture)
3. Archive
4. Remove Tilt
5. Average
6. Difference
7. Flatness of the Chuck
8. Previous Menu

Figure 2-15
Analyze Wafer Flatness File

Option 1: This option provides three a dimensional picture of the wafer flatness plot that is contained in the current file. The user can rotate this picture in increments of 90 degrees. The user can also slice a section of this picture and print the screen information.

Option 2: This option allows the user to analyze the result of measurement Z coordinates that are contained in the current file. The user can view the distribution of Z coordinates in any row, column or particular die on the wafer. The user can also print the screen information. The options are selected by entering the proper letter.

Option 3: This option allows the user to select the current file from the archives and manage those archives. See Archive of Wafer Flatness Files Menu.

NOTE: Only 10 files can be maintained at any time for permanent saving and 10 for temporary saving. The user should remove unwanted permanent files.

Option 4: This option allows the user to create a new image of the wafer flatness plot from the current file. This new image is calculated by subracting the tilt from the image of the current file. It is written in the archive of permanent files.

Option 5: This option allows the user to create an average wafer flatness file from up to 10 history files. The files should have the same structure (same measured points). The result file is written in the archive of permanent files.

Option 6: This option allows the user to create a file which represents the difference between any two files. The selected files should have the same structure. The result file becomes the current file for analysis and will not be part of the archive files.

option 7: This option allows the user to create a file which represents the flatness of the wafer chuck. To user must have two flatness files to perform this option. The second file must represent the flatness of the same wafer turned 180°. The result file becomes the current one and will be written in the archive of the permanent files.

Option 8: Returns the user to the Utililty Menu.

Archive Of Wafer Flatness

This submenu (Figure 2-16), allows the user to manage the archives of the wafer flatness files.

ARCHIVE OF WAFER FLATNESS FILES
Version 7.1

1. **Catalogue Permanent Files**
2. **Catalogue History Files**
3. **Rename History File For Permanent Saving**
4. **Select Current File For Analysis from Permanent Files**
5. **Select Current File for Analysis from History Files**
6. **Delete Permanent File**
7. **Previous Menu**

Figure 2-16
Archive Of Wafer Flatness Files Menu

Option 1: This allows the user to view the archive of permanently saved files.

Option 2: This allows the user to view the archive of temporary files. This archive is built like the archive of history files; temporary files have the name FHISTnn.FIL.

Option 3: This allows the user to rename any temporary file (that was created during measurement), in the permanent file for saving.

Option 4: This allows the user to select the current file for analysis from the Temporary or History archive. This selection must be done before performing options 1, 2, or 4 from the Analyze Wafer Flatness File menu.

Option 5: This allows the user to select the current file for analysis from the Temporary or History archive. This selection must be done before performing options 1, 2, or 4 from the Analyze Wafer Flatness File menu.

Option 6: This allows the user to eliminate any file from the permanent archive to prevent the archive from overfilling.

Option 7: Returns the user to the Analyze Wafer Flatness File menu.

Analyze Lens Tilt File

This menu (Figure 2-17) allows the operator to manipulate files which were created while measuring the tilt of the lens (using INSITU options on the MOP side) and stored in the directory: C:\dfas\dfhist.

ANALYZE LENS TILT FILE
Version 7.1

1. **Show (3-D Picture)**
2. **Analysis (2-D Picture)**
3. **Archive**
4. **Remove Tilt**
5. **Average**
6. **Difference**
7. **Previous Menu**

Figure 2-17
Analyze Lens Tilt File

Option 1: This option provides a three dimensional picture of the lens tilt that is contained in the current file. The user can rotate this picture in increments of 90 degrees. The user can also slice a section of this picture and print the screen information.

Option 2: This option allows the user to analyze the lens tilt which is contained in the current file. The user can view the distribution of data in any row, column or particular die on the wafer. The user can also print the screen information. The options are selected by entering the proper letter.

Option 3: This option allows the user to select the current file from archives and manage those archives. See Archive of Wafer Flatness Files Menu.

NOTE: Only 10 files can be maintained at any time for permanent saving and 10 for temporary saving. The user should remove unwanted permanent files.

Option 4: This option allows the user to create a new image of the lens tilt from the current file. This new image is calculated by subtracting the tilt from the image of the current file. It is written in the archive of the permanent files.

Option 5: This option allows the user to create an average lens tilt file from up to 10 history files. The files should have the same structure (same measured points). The result file is written in the archive of the permanent files.

Option 6: This option allows the user to create a file which represents the difference between any two files. The two files should have the same structure. The result file becomes a current file for analysis and will not be part of the archive files.

Option 7: Returns the user to the Utililty Menu.

System Diagnostic Menus

This option (Figure 2-18) allows the user to test the individual metrology components. There are 3 diagnostic menus (Figures 2-18, 2-20, and 2-21). Each pertains to the configuration of the system (DFAS, Micro DFAS, and INSITU).

SYSTEM DIAGNOSTIC MENU
Version 7.1

1. **DFAS Alignment System**
2. **Micro DFAS Alignment System**
3. **INSITU Metrology System**
4. **Test Communications Port**
5. **Previous Menu**

Figure 2-18
System Diagnostic Menu

Option 1: Tests the individual components of the DFAS system.

Option 2: Tests the individual components of the Micro DFAS system.

Option 3: Tests the individual components of the INSITU metrology system.

Option 4: Tests the operation of the communications channel to the MICROPDP-11/53 computer.

Option 5: Returns the user to the Utility menu.

DFAS Diagnostic Menu

This option (Figure 2-19) allows the user to test the individual DFAS components.

```
DFAS Diagnostic Menu
    Version 7.1

1.   Test X Scan DAC
2.   Test Y Scan DAC
3.   Set AGC DAC          (0.98 Volts)
4.   Read PMT A/D
5.   Cycle Shutter
6.   Previous Menu
```

Figure 2-19
DFAS Diagnostic Menu

Option 1: Sends a 0V to 10V square wave from the metrology computer DAC to the X stage servo. One can either monitor proper pin locations for expected output, or while the stages are sitting at the align position observe the stage moving in the X direction on the system monitor.

Option 2: Sends a 0V to 10V square wave from the metrology computer DAC to the Y stage servo. One can either monitor proper pin locations for expected output, or while the stages are sitting at the align position observe the stage moving in the Y direction on the system monitor.

Option 3: Allows the user to send a voltage to the PMT gain amplifier circuit used in DFAS. The voltage is displayed and can range from 0.0V to 1.4V. In DFAS, 0V represents the highest gain constant and 1.4V the lowest.

Option 4: This is similar to option 3 except gain is held constant at the voltage level set in option 3 from 0V-1.4V (min). The PMT output voltage is read and displayed on the screen.

> **NOTICE**
>
> 10V means that the PMT is saturated and can be damaged if held at this range for long periods of time.

Option 5: This option cycles the DFAS shutter output.

Option 6: Returns the user to the System Diagnostic menu.

Micro DFAS Diagnostic Menu

This option (Figure 2-20) allows the user to test the individual Micro DFAS components.

```
        MICRO DFAS DIAGNOSTIC MENU
               Version 7.1

    1.    Test X Scan DAC
    2.    Test Y Scan DAC
    3.    Set AGC DAC          (0.00 Volts)
    4.    Set Offset DAC       (0.00 Volts)
    5.    Read MICRO A/D
    6.    Previous Menu
```

Figure 2-20
Micro DFAS Diagnostic Menu

Option 1: Sends a 0V to 10V square wave from the metrology computer DAC to the X stage servo. One can either monitor proper pin locations for expected output, or while the stages are sitting at the align position observe the stage moving in the X direction on the system monitor.

Option 2: Sends a 0V to 10V square wave from the metrology computer DAC to the Y stage servo. One can either monitor proper pin locations for expected output, or while the stages are sitting at the align position observe the stage moving in the Y direction on the system monitor.

Option 3: Allows the user to send a voltage to the PMT gain amplifier circuit used in Micro DFAS. The voltage is displayed and can range from 0.0V to 1.4V. In Micro DFAS, 0V represents the highest gain constant and 1.4V the lowest.

Option 4: Allows the user to lower the DC level displayed on the alignment screen to 0V.

Option 5: This is similar to option 3 except gain is held constant at the voltage level set in option 3 from 0V-1.4V (min). The PMT output voltage is read and displayed on the screen.

Option 6: Returns the user to the System Diagnostic menu.

INSITU Diagnostic Menu

```
INSITU DIAGNOSTIC MENU
     Version 7.1

1.   Test X Scan DAC
2.   Test Y Scan DAC
3.   Set AGC DAC          (0.76 Volts)
4.   Read INSITU A/D
5.   Cycle Shutter
6.   Previous Menu
```

Figure 2-21
INSITU Diagnostic Menu

Option 1: Sends a 0V to 10V square wave from the metrology computer DAC to the X stage servo. One can either monitor proper pin locations for expected output, or while the stages are sitting at the align position observe the stage moving in the X direction on the system monitor.

Option 2: Sends a 0V to 10V square wave from the metrology computer DAC to the Y stage servo. One can either monitor proper pin locations for expected output, or while the stages are sitting at the align position observe the stage moving in the Y direction on the system monitor.

Option 3: Allows the user to send a voltage to the amplifier circuit used in INSITU. The voltage is displayed and can range from 0.0V to 10V. In INSITU, 10V represents the highest gain constant and 0.0V the lowest.

Option 4: This is similar to option 3 except gain is held constant at the voltage level set in option 3 from 0V-10V. The detector voltage is read and displayed on the screen.

Option 5: This option cycles the *wafer stepper* shutter output.

Option 6: Returns the user to the System Diagnostic menu.

View History File

This option (Figure 2-22) allows the user to display the alignment data in numeric form (Figure 2-23). By displaying the data numerically, the user can identify certain alignment errors that cannot be identified on a graphic display.

VIEW HISTORY FILE MENU
Version 7.1

1. **Grid**
2. **Intrafield**
3. **Uniformity**
4. **Previous Menu**

Figure 2-22
View History File Menu

Option 1: Displays the numeric alignment data from the grid history files.

Option 2: Displays the numeric alignment data from the intrafield history files.

Option 3: Displays the numeric alignment data from the uniformity history files.

Option 4: Returns the user to the Utility menu.

```
5-2235 PPCII 5.000000 352.000000 69.000000 90.000000 22.000000 19 1.000000

-0.0400    0.0500    -5000.00    9000.00    1     5
-0.0700    0.0300    -3000.00    9000.00    1     7
-0.0400    0.0400    -1000.00    9000.00    1     9
-0.0500    0.0200     1000.00    9000.00    1    11
-0.0800    0.0000     3000.00    9000.00    1    13
-0.0800    0.0600     5000.00    9000.00    1    15
-0.0400    0.0600     7000.00    7000.00    3    17
```

Figure 2-23
Intrafield Numeric Alignment Data History File

Average History File

This program allows the user to create the average history file, (this file contains average data from a set of grid history files), and to analyze the set of history files to improve the offsets.

The user selects grid history files for performing. Average History File is written to the same archive, (archive of grid history files.) After that, the Analyze Average History File menu is displayed (Figure 2-24).

ANALYZE AVERAGE HISTORY FILE
Version 7.1

1. **Offset Corrections**
2. **Statistics Of History Files**
3. **Previous Menu**

Figure 2-24
Analyze Average History File Menu

Option 1: This option allows the user to get new offset corrections that are calculated from the average history file. The user has a possibility to update previous offsets.

Option 2: This option allows the user to get statistics of history files set. These statistics are represented in numerical and graphical forms and can be printed.

Option 3: Returns the user to the Utility Menu.

Analyze History File

This option (Figure 2-25) allows the user to display the alignment history files graphically. These are not SMARTSET files; they are the alignment summary screens that are displayed at the end of each job.

ANALYZE HISTORY FILE
Version 7.1

1. **Grid**
2. **Intrafield**
3. **Previous Menu**

Figure 2-25
Analyze History File Menu

Option 1: Displays the metrology wafer summary screen from the job (see Figure 5-4).

Option 2: Displays the metrology intrafield summary screen from the job (see Figure 6-15).

Option 3: Returns the user to the Utilities Menu.

View SETUP History

Each time an INSITU command or SETUP is run, the measurement data is saved. These 4 graphs display this data (Figure 2-26). The graph data range is automatically set.

NOTE: For the purposes of this manual, all of the data displayed in the following graphs is not actual data from a wafer stepper.

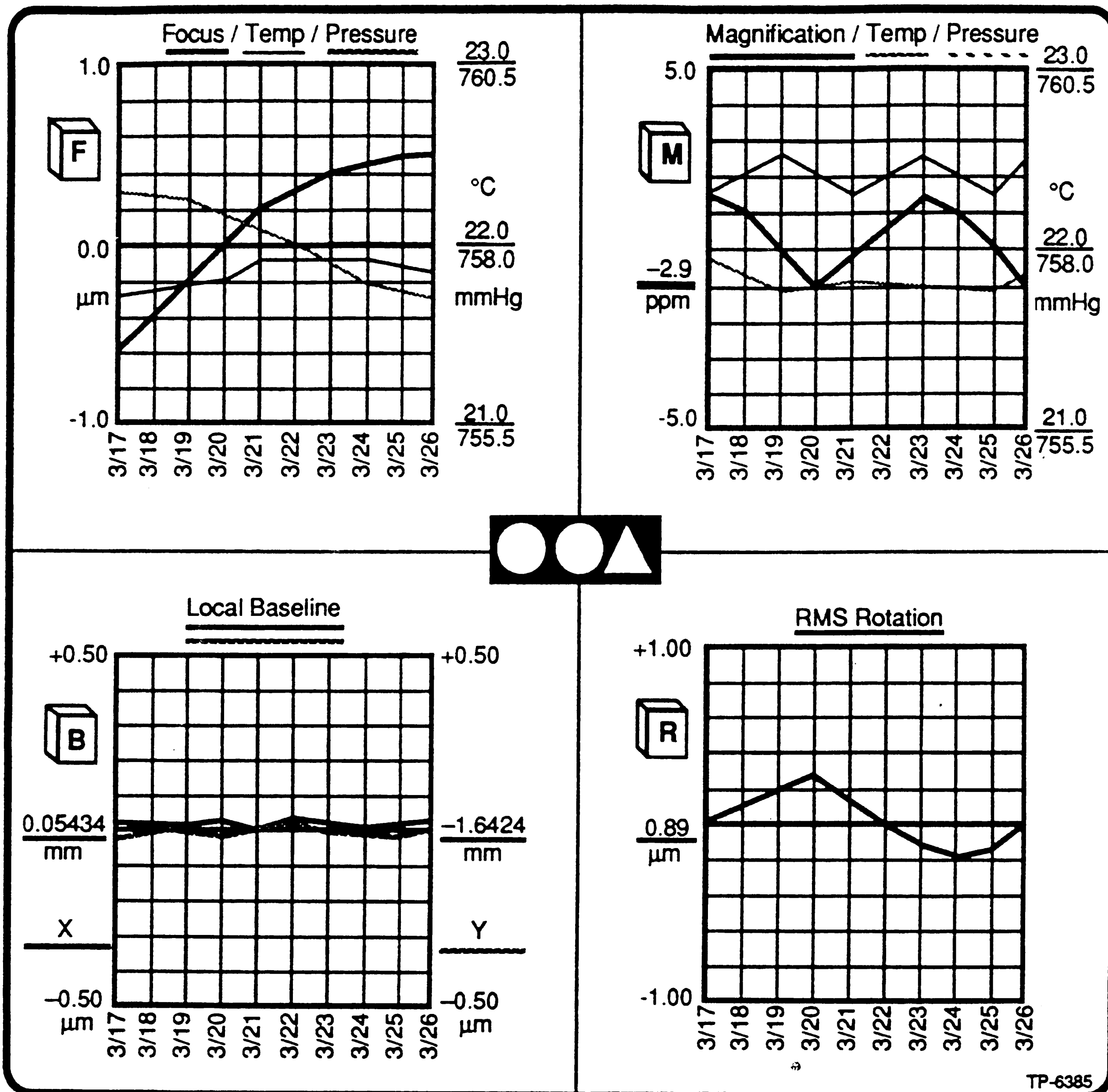

Figure 2-26
View SETUP History Display

The last 120 test results for each graph can be displayed by pressing the **F**, **M**, **B**, or **R** keys. Additional graphs are displayed by pressing the **TAB** key from within the individual graph displays (Figure 2-27). Press **F6** for HELP from any of the individual graph displays (Figure 2-36). Press **E** to edit data points from any of the individual screens (press **S** to save the changes or **Q** to abort the changes) (Figure 2-37):

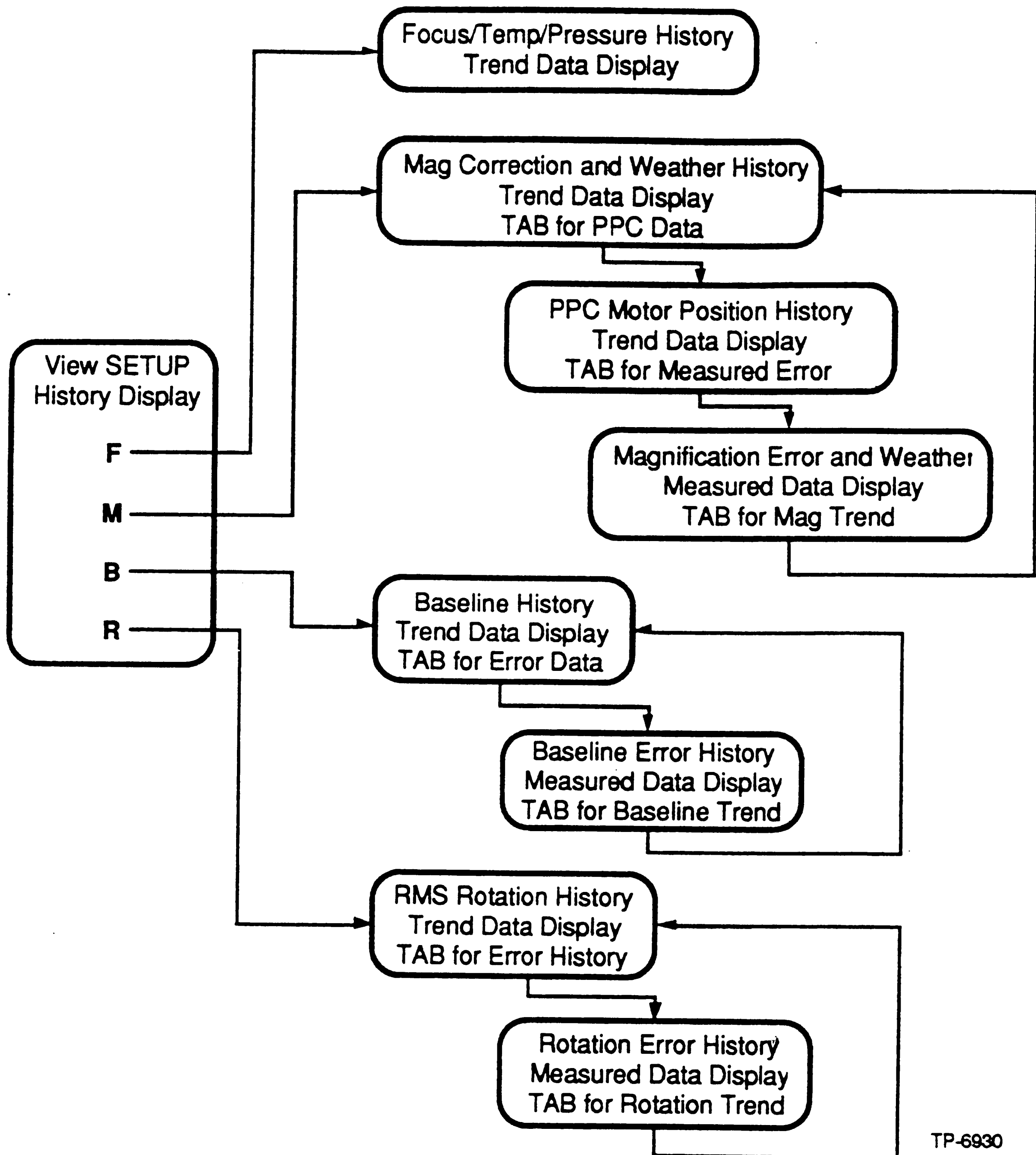

Figure 2-27
SETUP Command History Graphs Flowchart

Option F: Graphically displays the focus trend data from the last 120 tests executed (Figure 2-28). The user can switch to any of the 3 other trend graphs by pressing **M, B, R,** or return to the previous menu by pressing the spacebar.

Option M: Displays the Mag Correction and Weather History[1] trend graph for the last 120 tests executed (Figure 2-29). Press the **TAB** key once to view the PPC Motor Position History[2] data display, and twice to view the Magnification Error and Weather[3] measurement data display. If the **TAB** key is pressed a third time, the Mag Correction and Weather History[1] trend graph will be displayed again. The user can switch to any of the 3 other trend graphs by pressing **F**, **B**, **R**, or return to the previous menu by pressing the spacebar.

Option B: Displays the Baseline History[1] trend data graph for the last 120 tests executed (Figure 2-33). Press the **TAB** key to view the Baseline Error History[2] data display. Press the **TAB** key again to return to the Baseline History[1] trend data display. The user can switch to any of the 3 other trend graphs by pressing **F**, **M**, **R**, or return to the previous menu by pressing the spacebar.

Option R: Displays the RMS Rotation History[1] trend data graph for the last 120 tests executed (Figure 2-34). Press the **TAB** key to view the RMS Rotation Error History[2] data display. Press the **TAB** key again to return to the RMS Rotation History[1] trend data display. The user can switch to any of the 3 other trend graphs by pressing **F**, **M**, **B**, or return to the previous menu by pressing the spacebar.

NOTE:
1. Pressing **F6** from the expanded views displays the History Help screen.
2. Pressing (right arrow) or (left arrow) the user can move the window through the history file (last 120 points) to display the current 30 points.
3. Pressing D ot T the user can see the date or time of measurements accordingly.

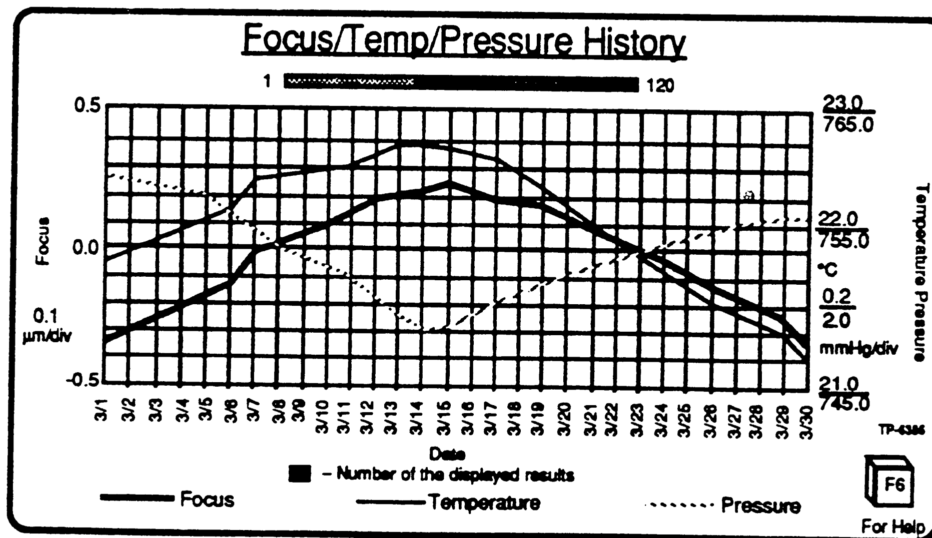

Figure 2-28
Focus/Temp/Pressure History Display

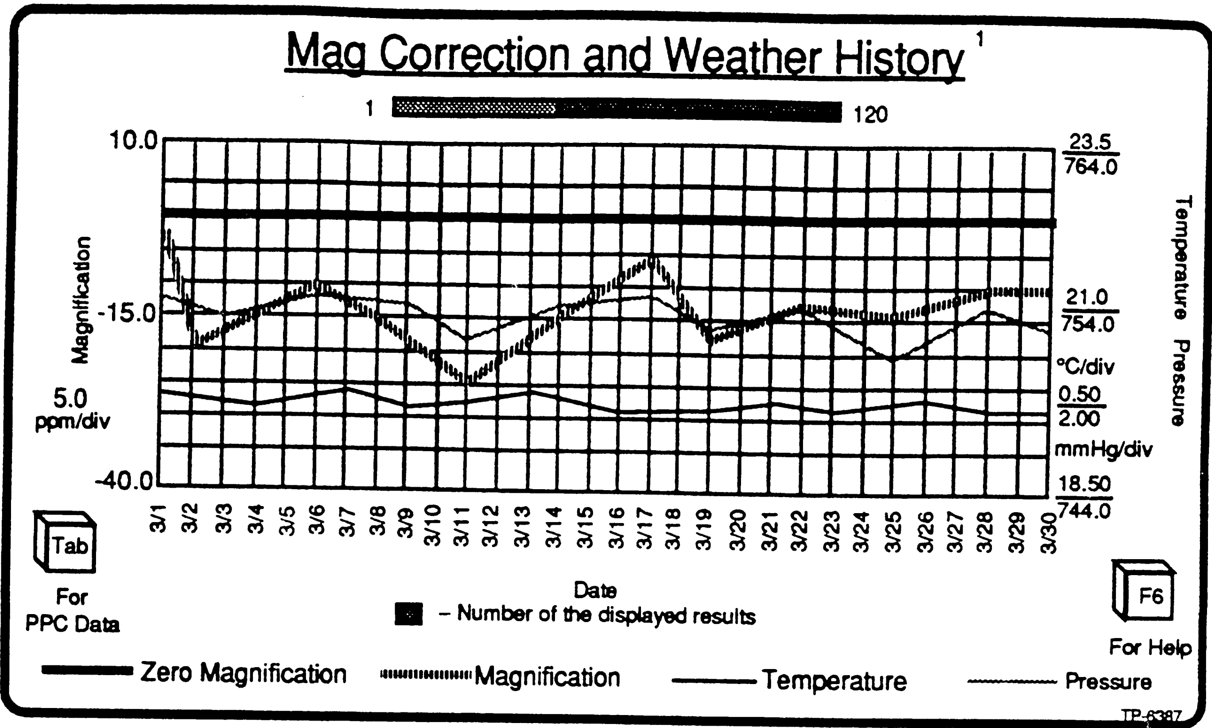

Figure 2-29
Mag Correction and Weather History[1] Display

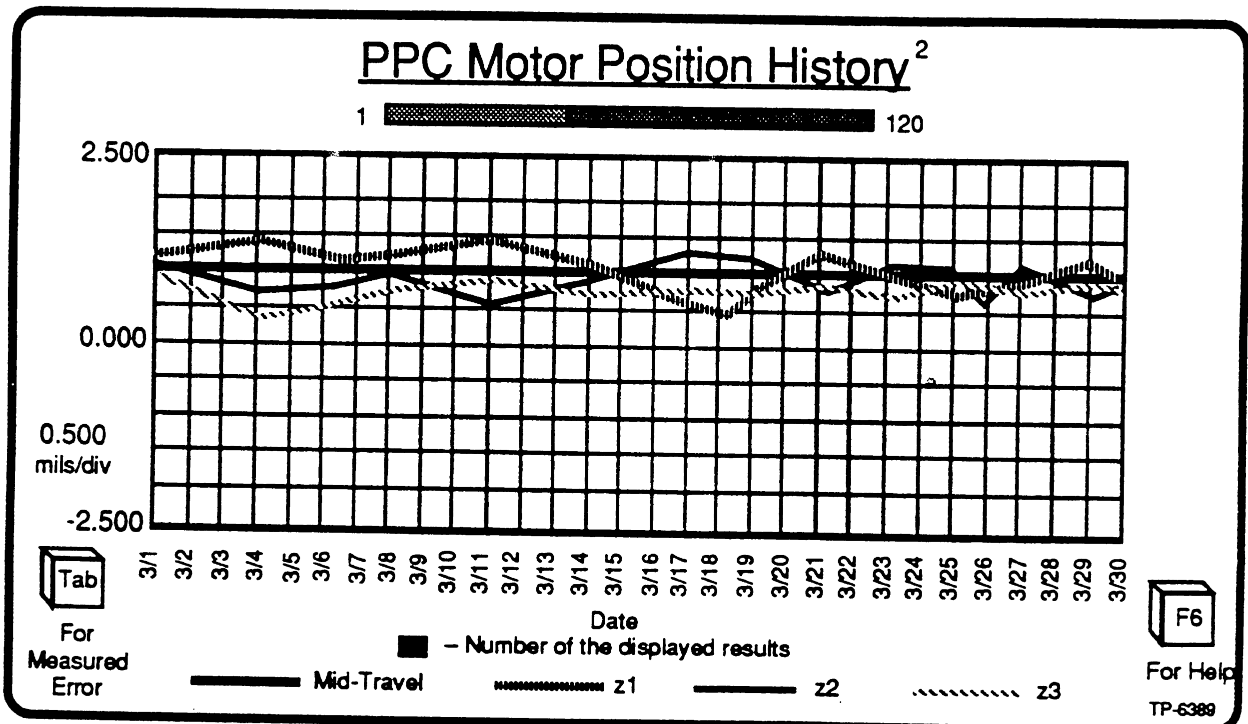

Figure 2-30
PPC Motor Position History[2] Display

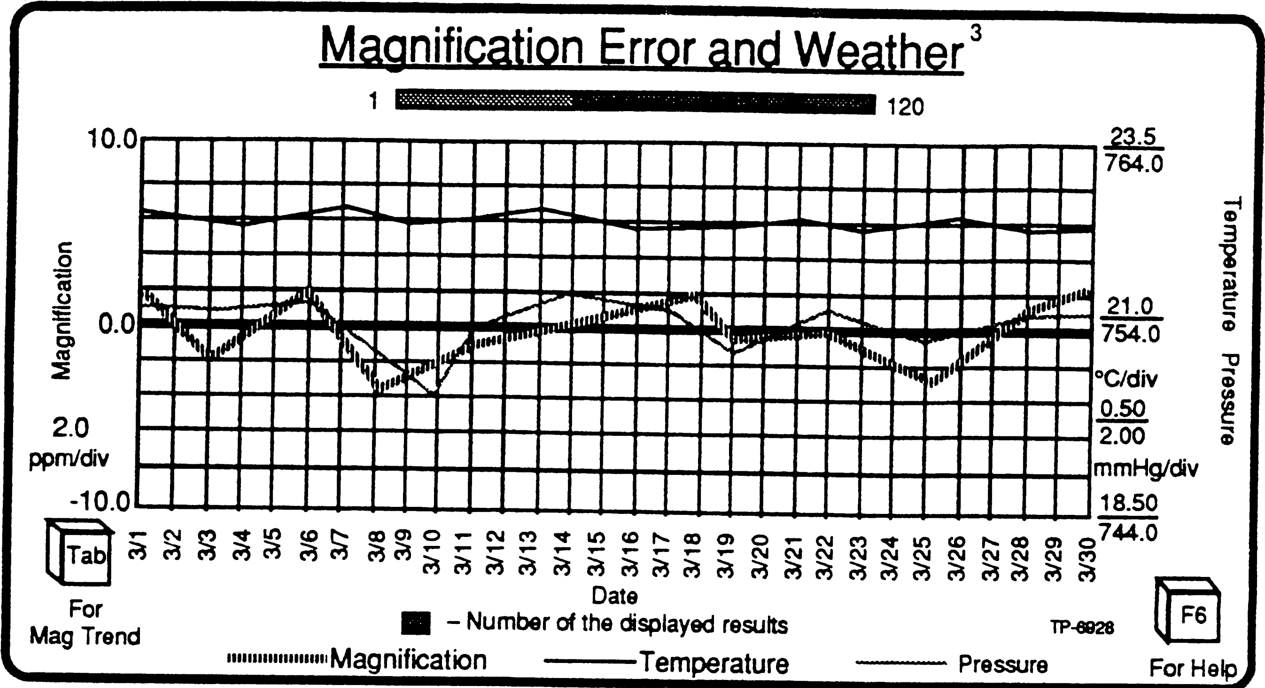

Figure 2-31
Magnification Error and Weather[3] Display

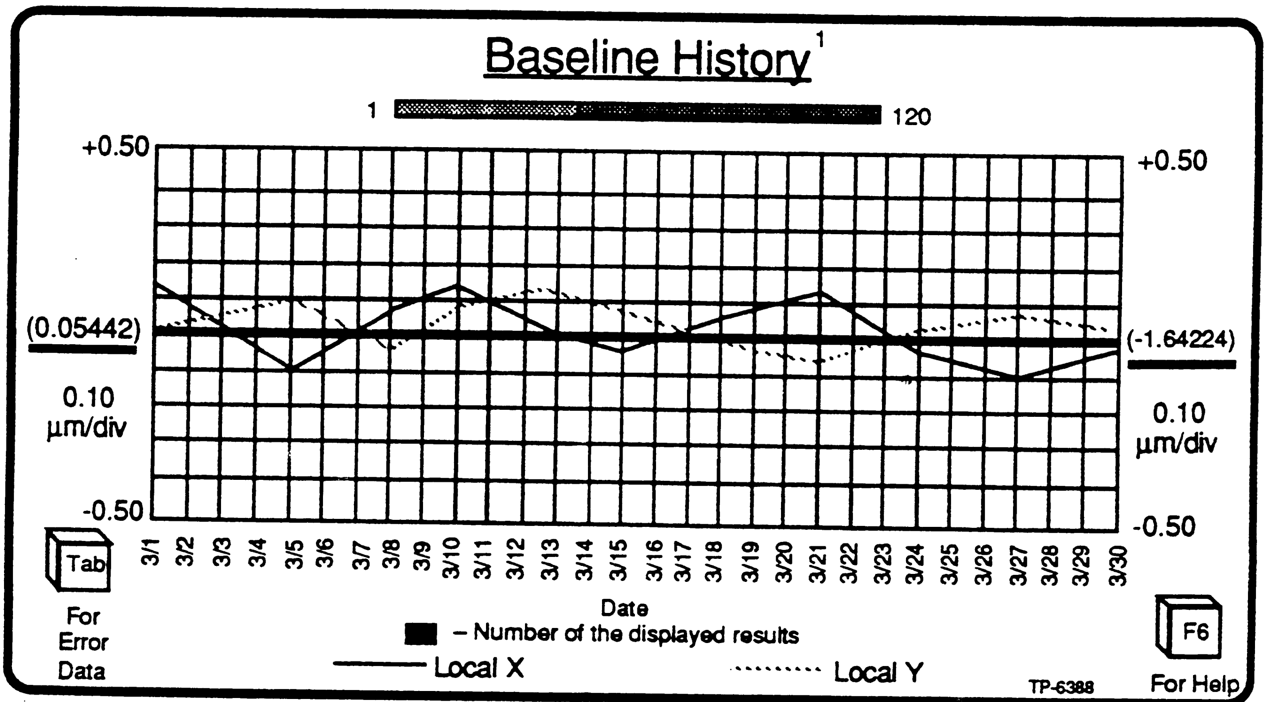

Figure 2-32
Baseline History[1] Display

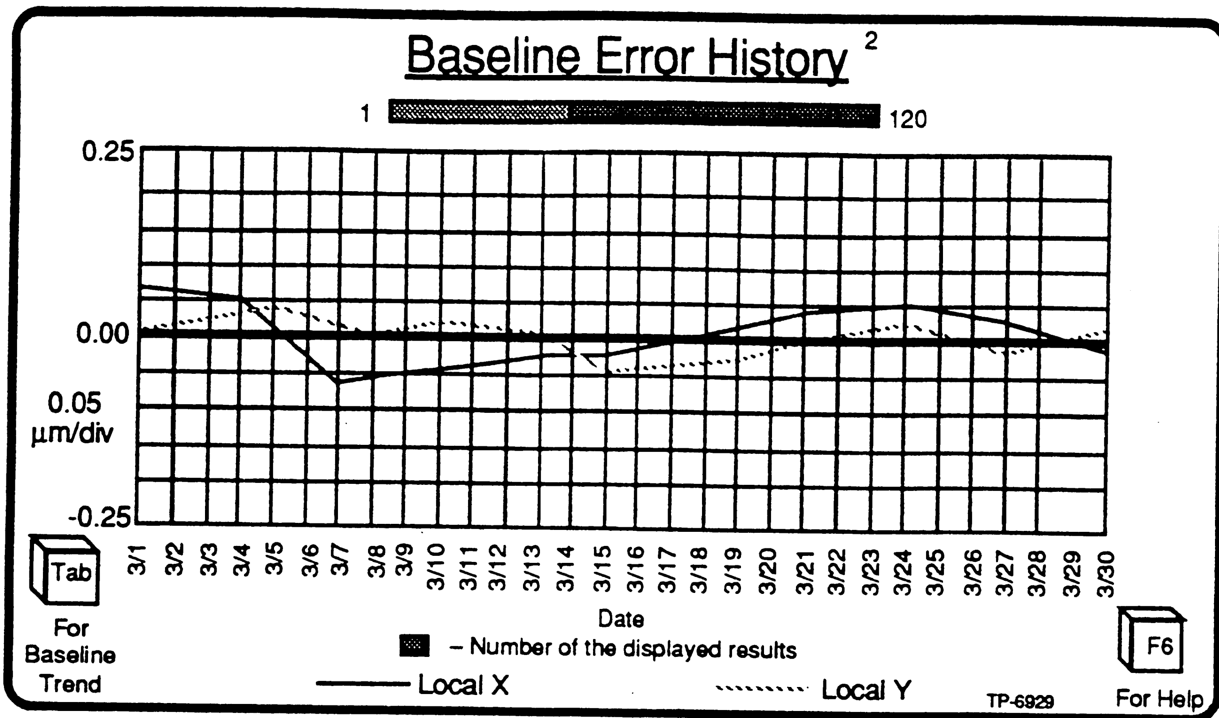

Figure 2-33
Baseline Error History[2] Display

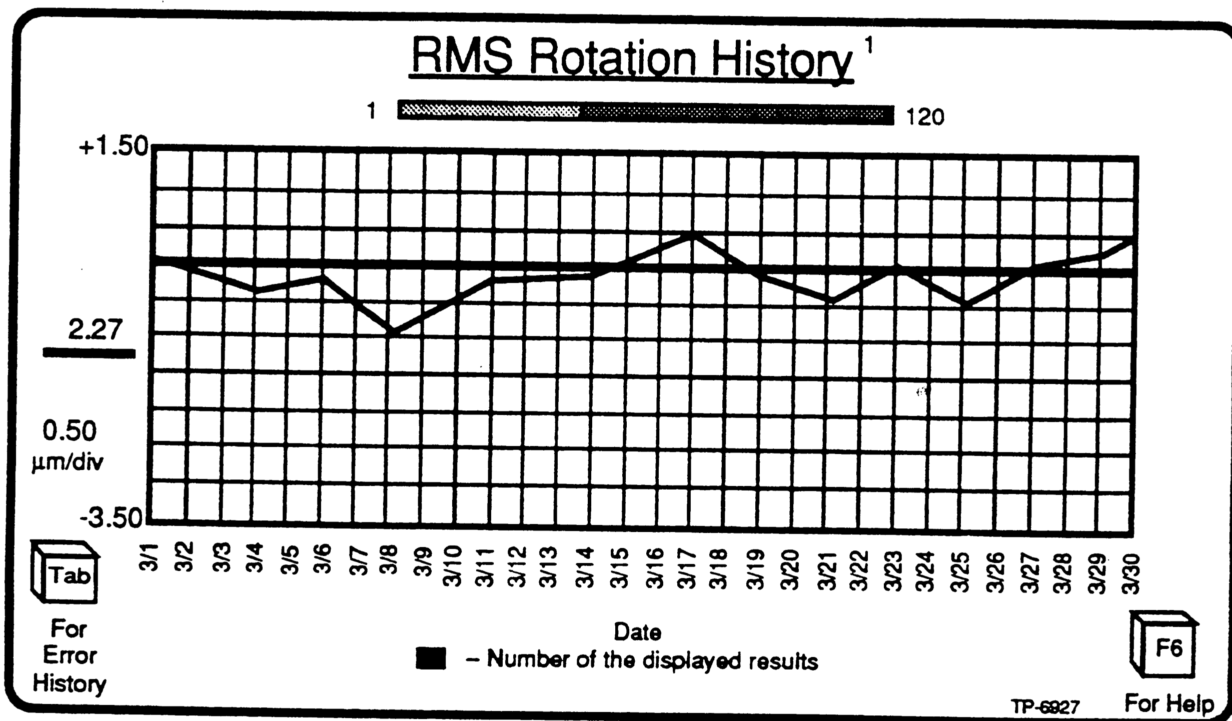

Figure 2-34
RMS Rotation History[1] Display

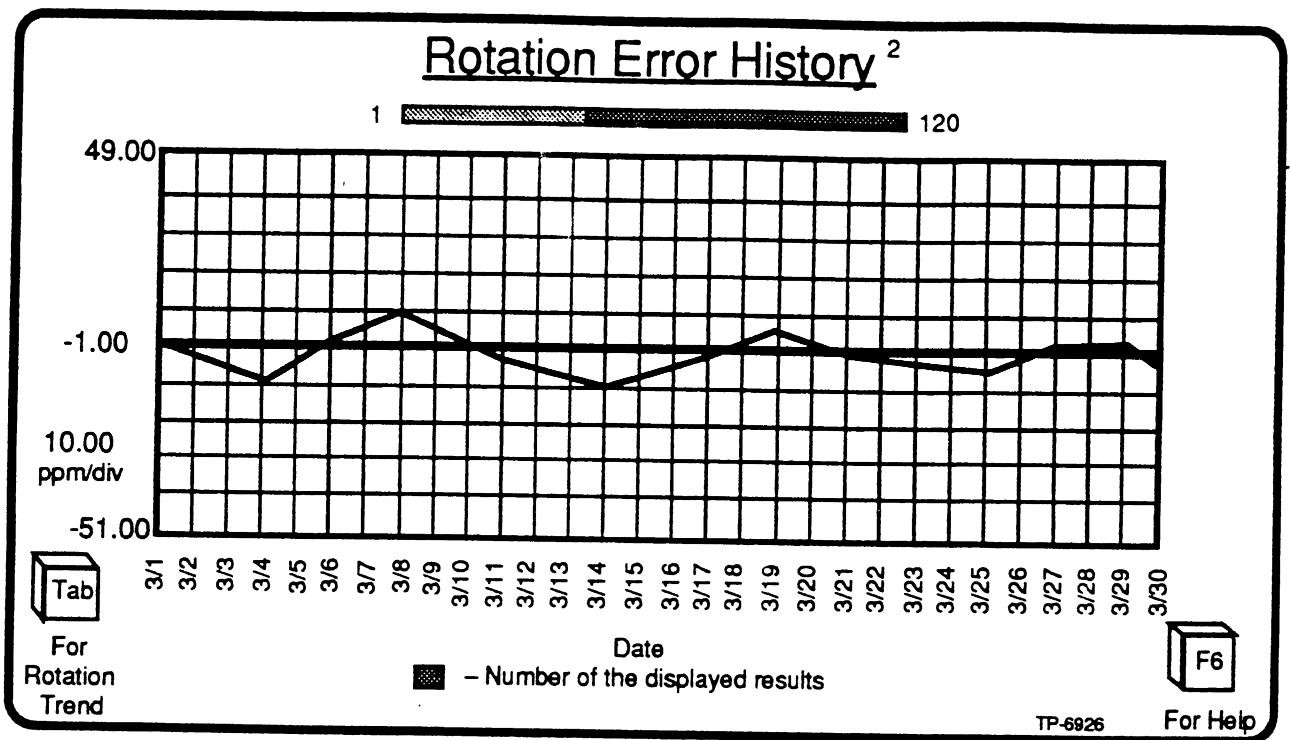

Figure 2-35
Rotation Error History2 Display

SETUP History Help Menu

While the user is in the expanded view, of any of the setup history displays, the user can invoke a help menu by pressing **F6** on the keyboard. Figure 2-36 is displayed regardless of which history file is being viewed.

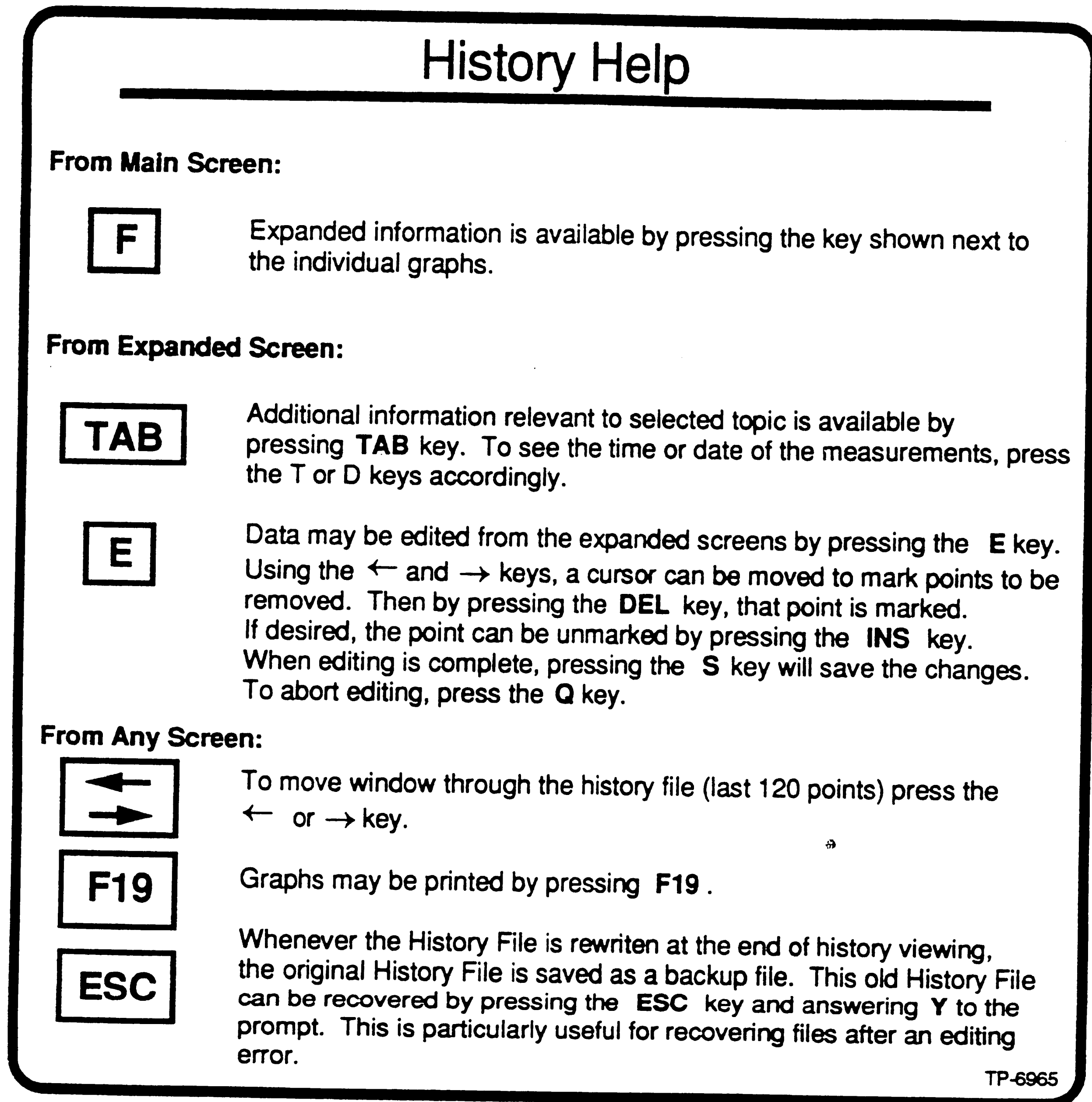

Figure 2-36
SETUP History Help Menu

SETUP History File Edit Screen

Data may be edited from the expanded screens by pressing the **E** key. The history file can then be edited as in Figure 2-37. Using the left and right arrow keys, the cursor can be moved to the points to be removed. Then by pressing the **DEL** key, that point is marked. If desired, the point can be unmarked by pressing the **INS** key. When editing is complete, pressing the **S** key saves the changes. To abort editing, press the **Q** key.

NOTE: When the history file is rewritten at the end of history viewing, the original history file is saved as a backup file. This old history file can be recovered by pressing the **ESC** key, the user is prompted whether or not to recover the previously saved history file, answering **Y** to the prompt replaces the last file saved with the previously saved file.

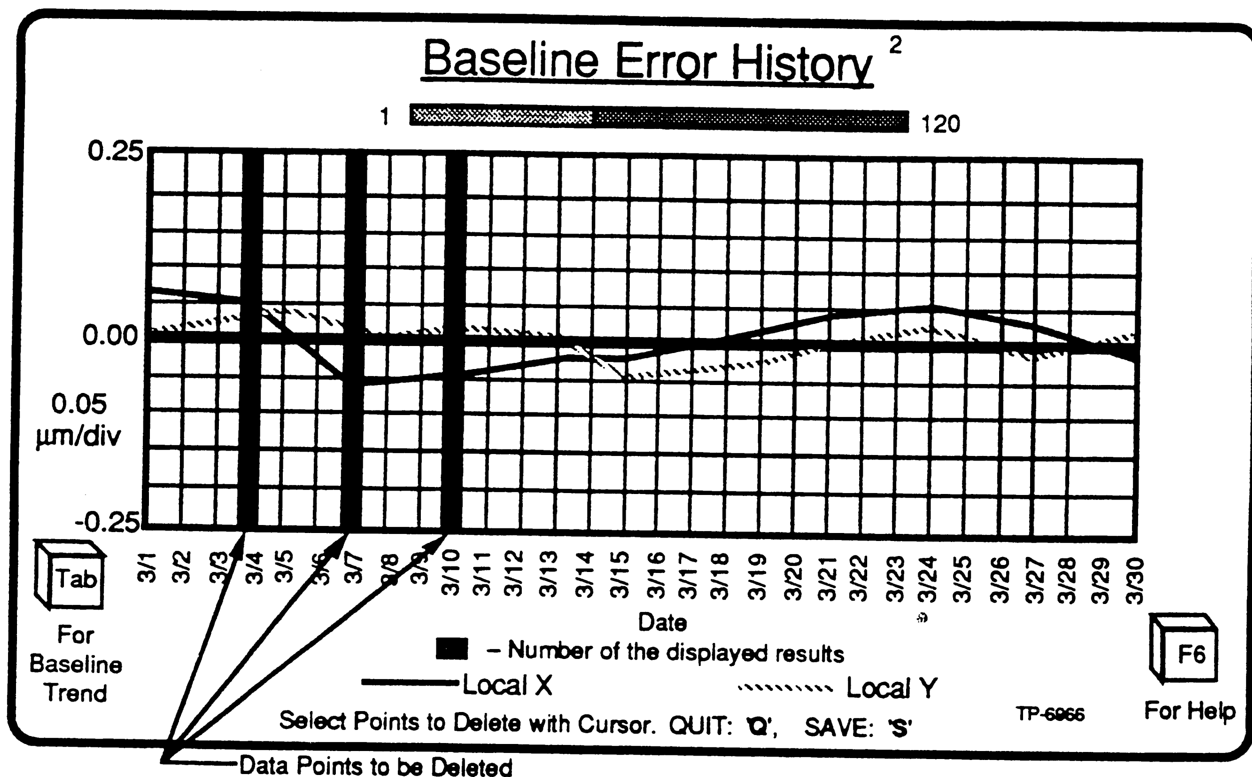

Figure 2-37
Example of the SETUP History File Edit Screen

SETUP Specification

This allows the user to set metrology specifications and tolerances. The display is split into the target and the tolerance. The target can be used as an offset for setting a parameter to a target other than 0.

If the readings meet the target value ± the tolerance value no updating will take place. (Figure 2-38).

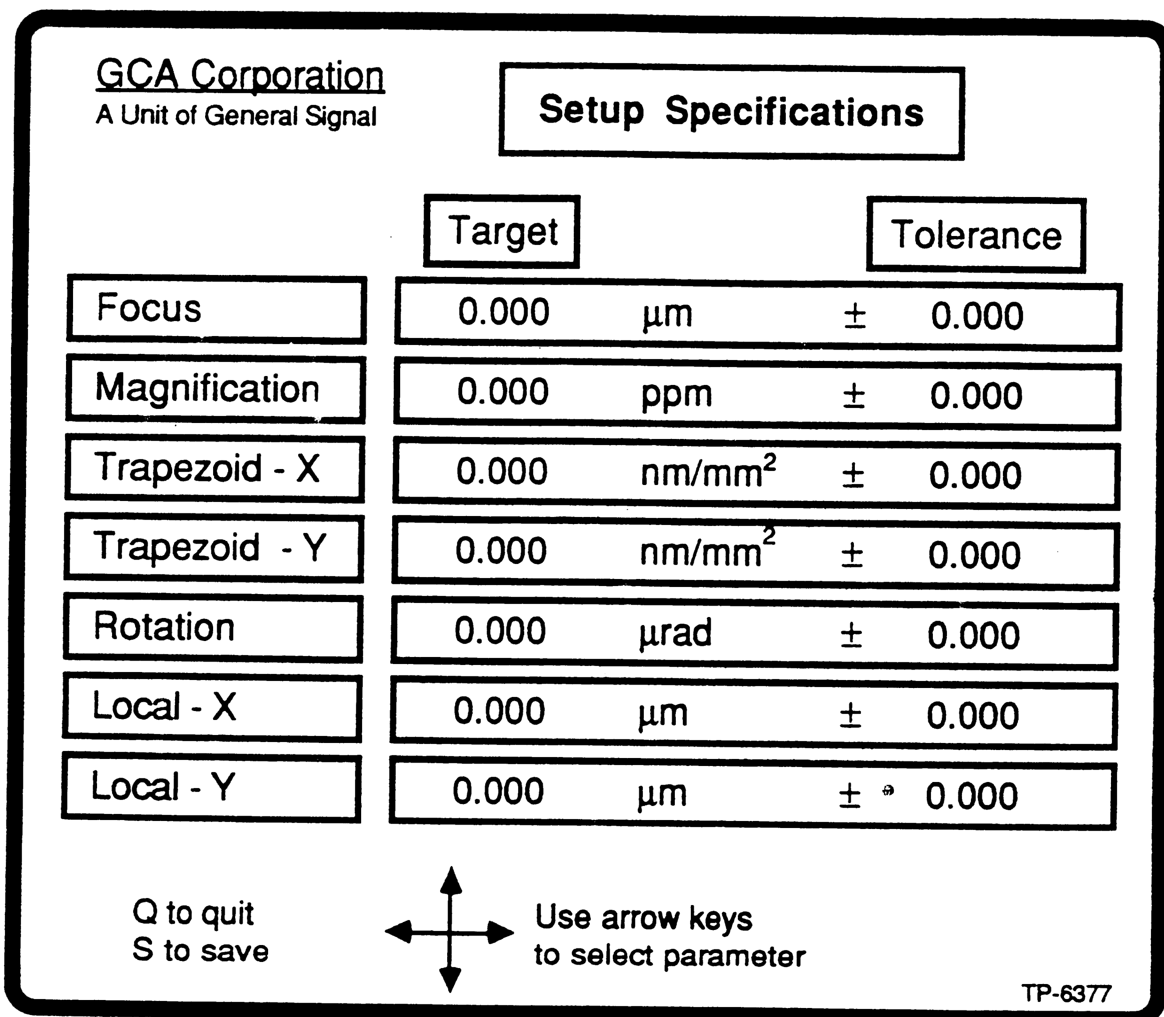

Figure 2-38
SETUP Specification Display

Explanations for SETUP Specifications Display

These define the parameters found in Figure 2-38.

Target - This is used as an offset for the parameter to the left of the target column. Except for Focus, the target value is the offset that is applied after INSITU has determined what errors exist. For example, if Magnification is required to be offset by 10ppm, 10ppm would be entered into the Magnification Target column. When analysis is performed by INSITU, the offset is *added* to the correction value that is applied to the PPC, thereby biasing (offsetting) the magnification by the value specified in the Magnification Target.

Tolerance - If corrections determined by INSITU are less than the Tolerance value, that particular correction is not applied. For example, if Focus Tolerance is set to 1.1µm and the correction determined is 0.7µm, the focus value in MODE is not updated.

Focus - The Focus Target value is the difference between focus found photographically and focus determined by INSITU.

Magnification - This is the magnification (reduction) offset value. The PPC values are not updated if the calculated magnification is equal to the target value, within the tolerance range. Set the target value to a number other than 0 to offset the magnification. If this parameter is exceeded, the PPC corrects the magnification automatically, however; the trapezoid will not be updated.

Trapezoid X and Y - These are the offset values for trapezoid. The PPC values are not updated if the calculated trapezoid is equal to the target value, within the tolerance range. Set the target value to a number other than 0 to offset the trapezoid. If either of these parameters are exceeded, the PPC corrects the trapezoid automatically, however; the magnification will not be updated.

Rotation - This is the offset value for reticle rotation. The RMS reticle rotation values are not updated if the calculated rotation is equal to the target value, within the tolerance range. Set the target value to a number other than 0 to offset the reticle rotation.

Local X and Y - These are the offset values for the local aligner baseline. The local aligner baseline values are not updated if the calculated baseline is equal to the target value, within the tolerance range. Set the target value to a number other than 0 to offset the local aligner baseline. This option is also used to match the local aligner baseline (DFAS or Micro DFAS) to the INSITU baseline.

NOTE: After entering new target and tolerance values the SETUP command must be performed for the new values to be applied.

ICE Calibration

This menu (Figure 2-39) allows the user to correct changes in system focus and lens magnification caused by illumination energy absorbtion in the reduction lens (Refer to Manual P/N 080327 for further information.)

ICE CALIBRATION
Version 7.1

1. **Focus Calibration #1**
2. **Focus Calibration #2**
3. **ICE Test Program**
4. **Previous Menu**

Figure 2-39
ICE Calibration Menu

Option 1: This option allows the user to calculate focus compensation parameters.

Option 2: This option provides the user fine compensation parameters.

Option 3: This option allows the user to run the ICE test by closing and opening the shutter.

Option 4: Returns the user to the Utility Menu.

Transmission of the Reticle

This option allows the user to calculate the transmission of the reticle by using uniformity files. At first, the user should choose the reference uniformity file. This file should be saved for future calculation. It is the users reponsibility to choose the proper reference file (because the intensity of the light is changing by time).

Edit Intensity Scale Value

This option allows the user to change the intensity scale value.

Section 3 - Engineering Mode Menu Explanations

Engineering Mode

Engineering mode is turned on and off using the Edit Defaults menu (which is entered from the Utility menu). Refer to Figure 2-1 for the complete metrology system menu flowchart. When engineering mode is turned ON, the system waits for input from the user after each alignment.

There are 3 possible engineering mode flow patterns, depending on the system configuration: DFAS and INSITU (Figure 3-2), Micro DFAS and non-DUV INSITU (Figure 3-3), and Micro DFAS and DUV INSITU (Figure 3-4). The Micro DFAS engineering modes have 1 additional option on the gain menu for setting an offset (refer to the gain menu, **Option G**, for additional information).

Pressing any key (not assigned to an option listed in Figure 3-1), displays a help menu on the computer screen (Figure 3-1).

AVAILABLE ENGINEERING MODE OPTIONS HELP MENU

A - Change Algorithm Defaults
Bar - Align Next Site
C - Calibrate Scan
D - Save Previous Screen To Disk
E - Toggle Engineering Mode
F - Change Scan Defaults
G - Change Gain Status
L - Laser Diagnostics
M - Move Stage
R - Repeatability Test
S - Open/Close Shutter
W - Perform Focus Walk Test
Z - Perform Repeated Alignments

Hit Any Key For Previous Screen

Figure 3-1
Engineering Mode Options Help Menu

Pressing one of the available option keys, as displayed above, causes either that option to be performed or another menu to be displayed. If one of the defaults is changed, it stays in effect even after exiting to the System Program menu. The user can also change the defaults through the Edit Defaults menu.

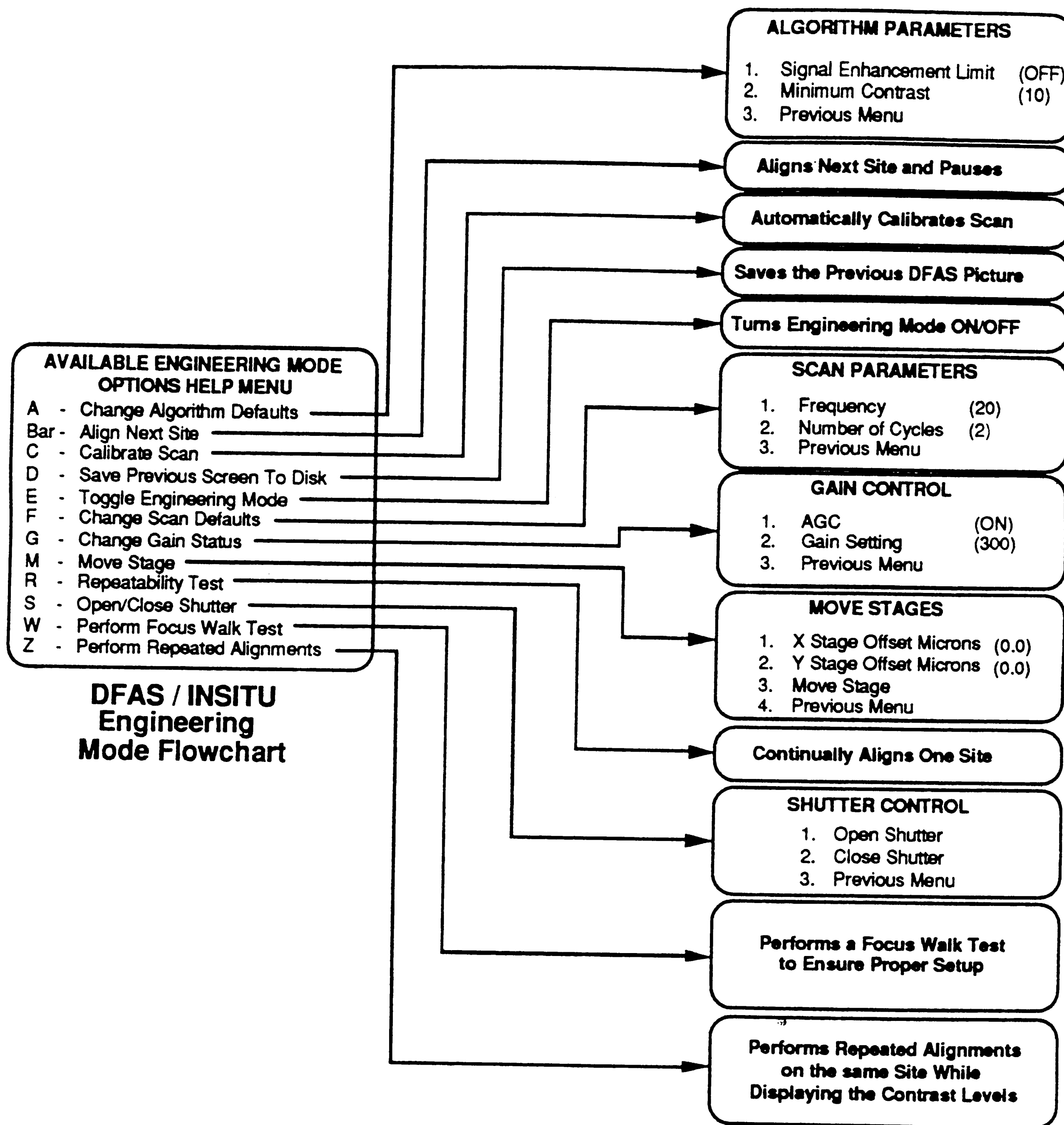

Figure 3-2
DFAS and Non-DUV INSITU Engineering Mode Flowchart

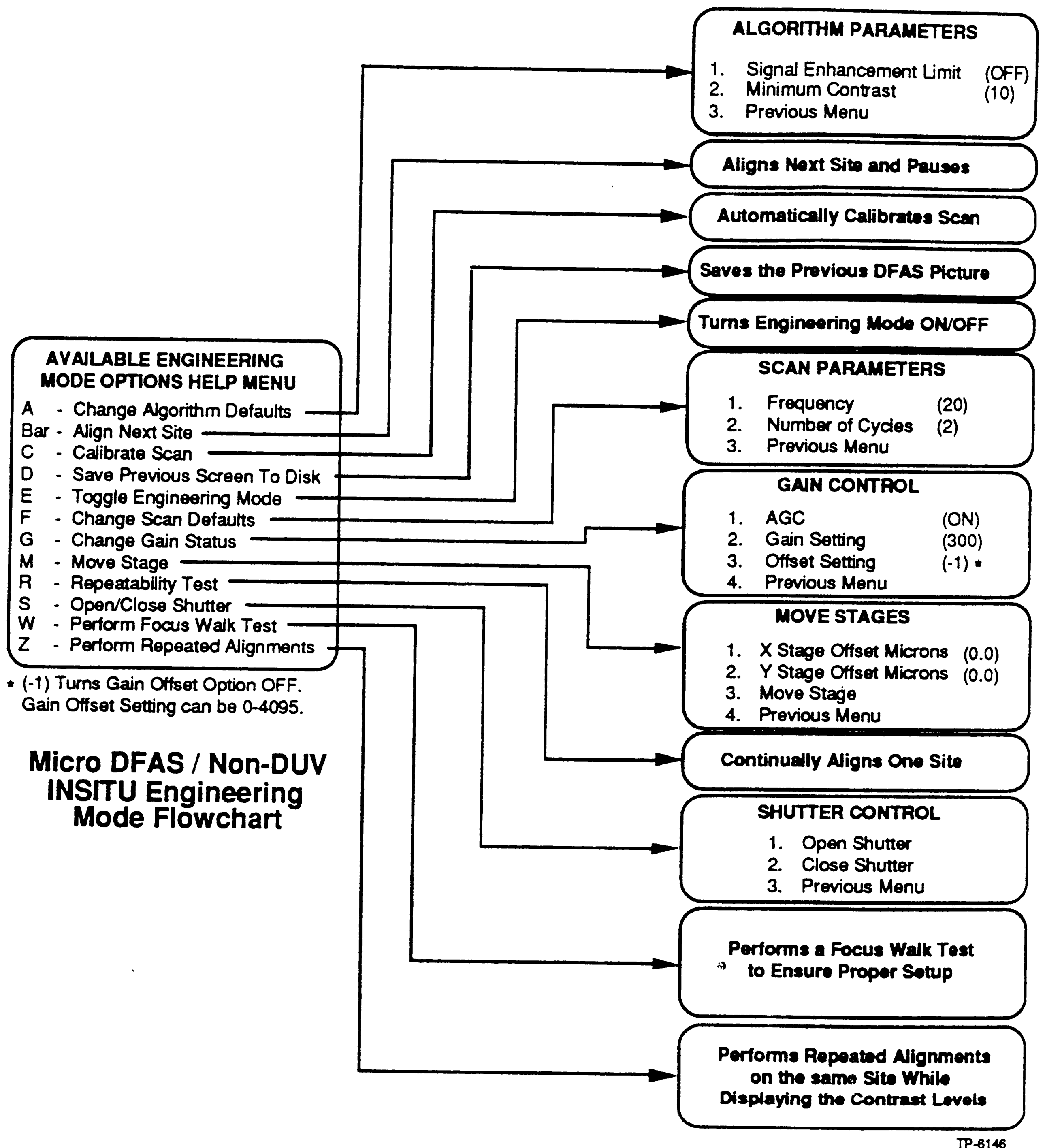

Figure 3-3
Micro DFAS and Non-DUV INSITU Engineering Mode Flowchart

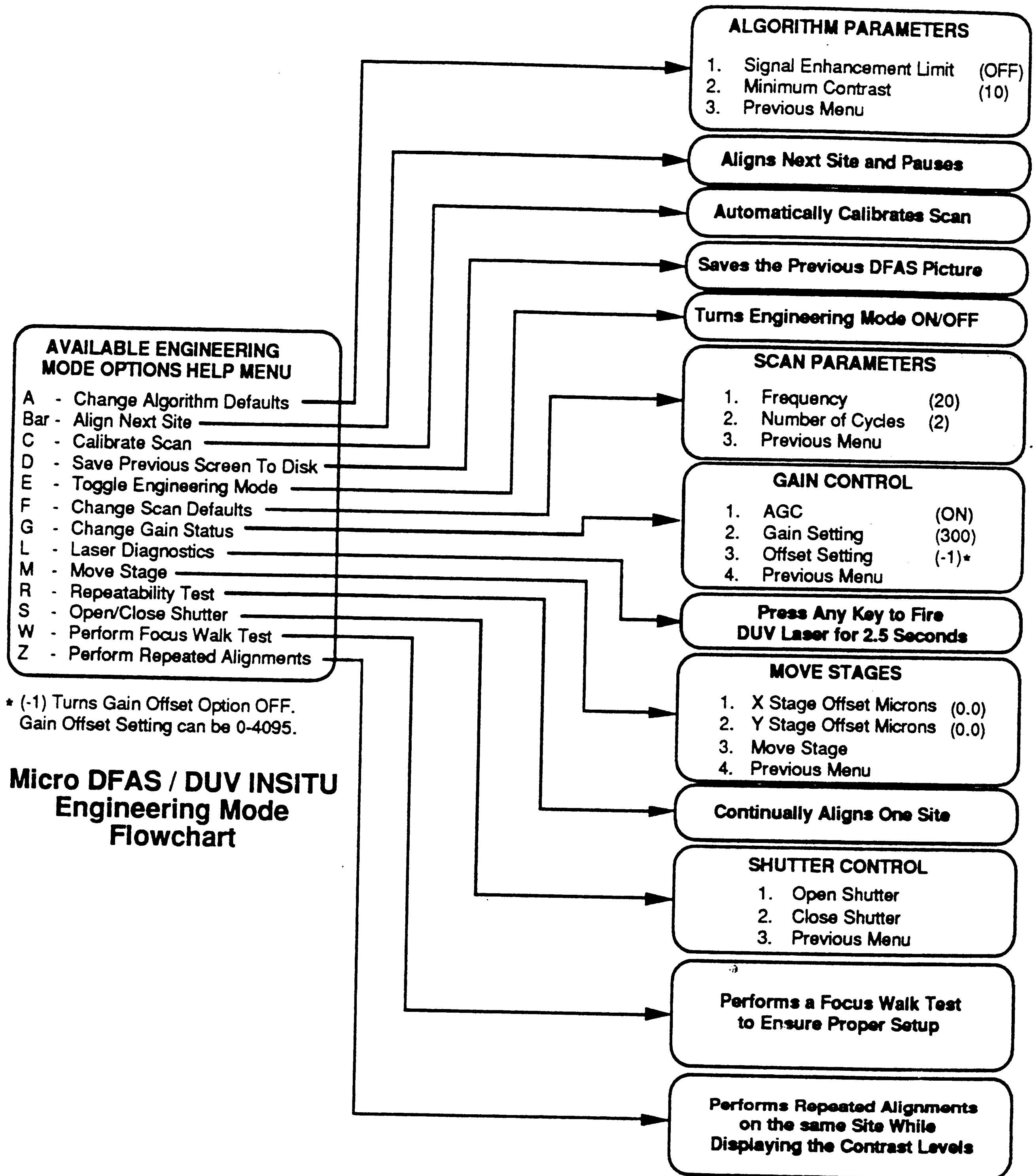

Figure 3-4
Micro DFAS and DUV INSITU Engineering Mode Flowchart

Option A: This option allows the user to change the algorithm defaults. A menu as shown in Figure 3-5 is displayed. When the previous menu is selected, the metrology system realigns the site it is on using the new parameters.

ENGINEERING MODE OPTION
Algorithm Parameters

1. **Signal Enhancement Limit (OFF)**
2. **Minimum Signal-to-Noise (10)**
3. **Previous Menu**

Figure 3-5
Algorithm Parameters Menu

Option 1: Allows the user to set the maximum amount of signal enhancement to the alignment scan.

Option 2: Allows the user to set the minimum signal-to-noise ratio before the alignment fails.

Option Bar: When the <SPACEBAR> is pressed, the alignment system allows the stages to move to the next alignment site.

Option C: This option calibrates the metrology system to the servo stage response. To use this option perform the following scan calibration procedure:

Scan Calibration

1. Use an etched wafer with no photoresist, as 20 alignments will be performed at one site. Bleaching may occur if photoresist is on wafer.
2. Load and align wafer with the metrology system in engineering mode.
3. Stop at any site and press C on the auxiliary rack terminal.
4. The system performs 20 alignments moving the stage from $-1.0\mu m$ to $+1.0\mu m$. Two scale calibration factors are calculated and stored in the file C:\DFAS\DFAS.CA2. All subsequent alignment corrections are scaled by this amount. To abort program while running, press any key on the metrology rack keyboard. This resets the values to 1.0, no calibration.

NOTE: This does not affect the alignment offset.

Option D: This option allows the user to save the alignment screen, repeatability screen, or focus walk screen to disk. The user will be asked for a file name for each picture. These pictures can be viewed, printed, or copied using the Picture Preview program as described earlier.

Option E: This option allows the user to toggle engineering mode on and off. If engineering mode is off, the status light in the lower left corner of the alignment screen, labeled EGM, is red. If engineering mode is toggled on, it is green.

If the engineering mode on/off option is turned off in the Edit Defaults menu, the status light in the lower left of the screen, labeled EGM, is black. If the EGM is black, the user cannot enter the engineering mode options while executing a job. The user must enter the Edit Defaults menu and turn engineering mode ON, to operate the engineering mode while executing jobs.

Option F: The scan defaults can be temporarily changed with this option (Figure 3-6).

ENGINEERING MODE OPTION
Scan Parameters

1.	Frequency	(20)
2.	Number Of Cycles	(2)
3.	Previous Menu	

Figure 3-6
Scan Parameters Menu

Option 1: The speed at which the stages scan is controlled by this value. The value is measured in hertz for a complete forward and backward scan. At 5Hz, the minimum time for scanning would be 2/5 of a second or 400ms for X and Y. Scan frequency does not affect alignment accuracy. GCA recommends using 20Hz for optimum performance and throughput.

Option 2: This option controls the number of cycles in each axis that will be averaged to obtain the final alignment data. At 5Hz and 2 cycles, the total scan time would be 2*(2/5) or 800ms per alignment site. GCA recommends using 2 cycles for optimum performance and throughput.

Option G: Automatic gain control can be changed with this option. To disable AGC, the user selects option 1 on the gain control menu and can then manually set the gain using option 2. Option 2 remains red, not a valid option, until AGC is toggled off. The minimum gain setting is 500, the maximum setting is 0. Figure 3-7 displays the 3 possible engineering mode gain control screens depending on the system configuration (DFAS and INSITU display the same data).

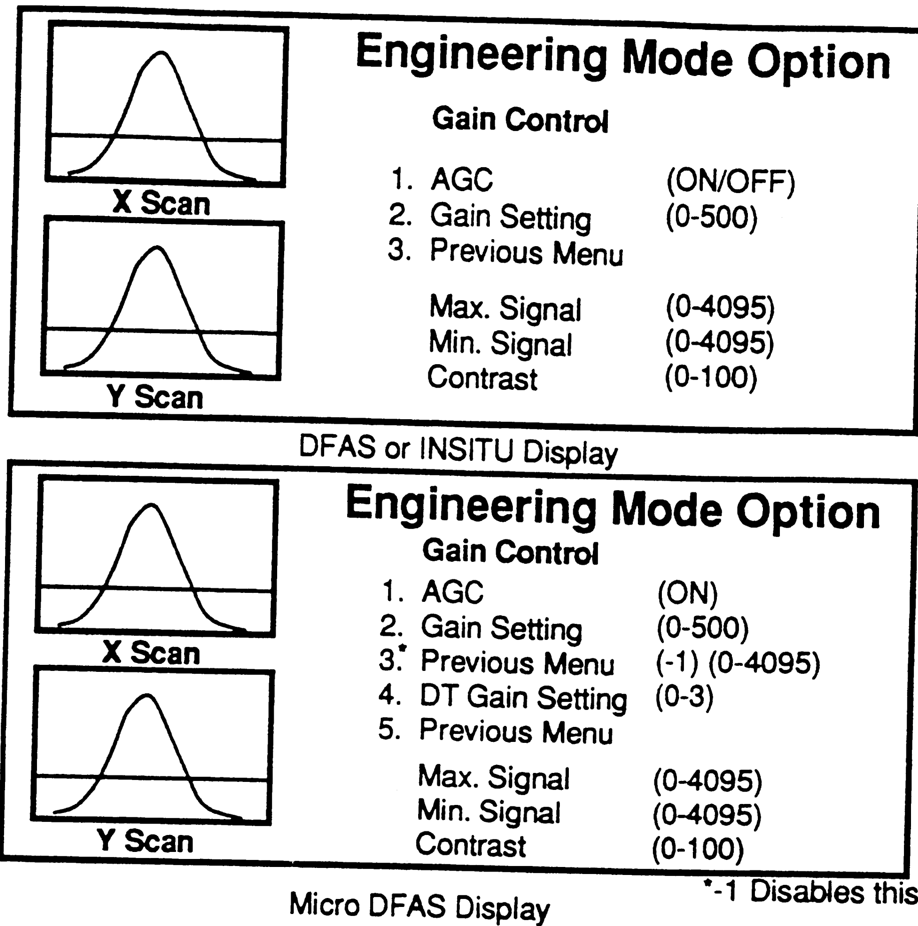

Figure 3-7
Gain Control Menus for the System Configurations

When option 3 is selected, the system aligns the present site at the new gain setting. When AGC is toggled ON, the system automatically sets the gain.

NOTE: On Micro DFAS configurations there is an offset selection line that controls other system aspects. The DT Gain line selects the internal gain setting of the data collection board. Ø represents 1X gain; 1 for 2X; 2 for 4X; and 3 for 8X gain.

Option L: This option is available only on DUV laser systems. When this option is selected the message **HIT ANY KEY TO FIRE LASER FOR 2.5 SECONDS** is displayed. Once the user presses a key, the DUV laser is fired for 2.5 seconds, and the maximum and minimum A/D laser reading is displayed. The message **HIT ANY KEY TO RETURN TO PREVIOUS SCREEN** is displayed after the A/D laser reading.

Option M: This allows the operator to move the stages a fixed offset from their current location. The user can select to move X, Y, or both X and Y. When you select option 3 (Figure 3-8), the stages move to that position and realign.

ENGINEERING MODE OPTION
Move Stages

1. **X Stage Offset Microns (0.0)**
2. **Y Stage Offset Microns (0.0)**
3. **Move Stage**
4. **Previous Menu**

Figure 3-8
Move Stages Menu

Option 1: Allows the user to enter a specified distance in microns for the X stage to be moved when option 3 is selected. After the stage moves, the metrology system tries to realign.

Option 2: Allows the user to enter a specified distance in microns for the Y stage to be moved when option 3 is selected. After the stage moves, the metrology system tries to realign.

Option 3: Moves the stage the distance specified in option 1 or option 2. After the stage moves, the metrology system tries to realign.

Option 4: Returns the user to the alignment screen.

Option R: This option forces the metrology system to repeat the alignment at the same site. A repeatability screen, resembling the alignment screen, is drawn. This screen displays the number of times realignment occurs, the average location, the TIR and 3 sigma values of the repeatability test. The repeatability screen displays a "running average" of the alignment positions. The system continues to align on the same site until the operator presses a key.

Option S: The DFAS shutter can be manually opened or closed with this option (Figure 3-9). The shutter control menu appears as shown. Micro DFAS does not use a shutter and INSITU uses the wafer stepper system shutter.

ENGINEERING MODE OPTION
Shutter Control

1. **Open Shutter**
2. **Close Shutter**
3. **Previous Menu**

Figure 3-9
Shutter Control Menu

Option 1: If the metrology system is equipped with DFAS, the shutter in the shutter box opens until option 2 is selected. If the metrology system is equipped with INSITU, the wafer stepper shutter opens until option 2 is selected. If the metrology system is equipped with Micro DFAS only, no shutter opens because Micro DFAS does not use a shutter.

Option 2: If option 1 was previously selected, this option closes the shutter.

Option 3: Returns the user to the alignment screen.

Option W: In order to ensure that the alignment system is set up telecentrically to the projection lens, this routine walks the user through a test to graphically output the alignment location with respect to focus. The computer prompts the user for the current fine micrometer setting. It then asks the user to set the micrometer to a specific location. When done, the user presses the <SPACEBAR>. The metrology system averages 5 alignments and displays the focus offset, average X correction, and average Y correction. This repeats for five focus locations. When complete, the computer graphically displays the X and Y alignment offset with respect to focus (Figure 3-10).

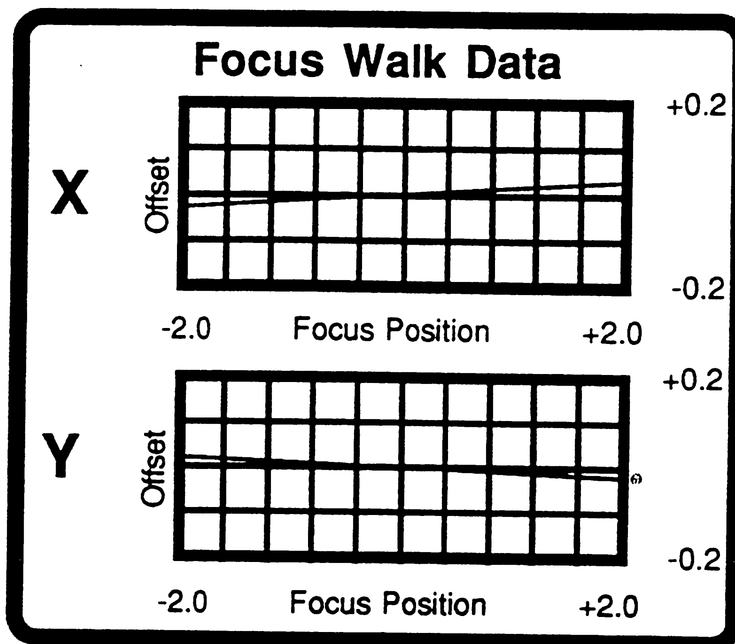

Figure 3-10
Focus Walk Graph

Option Z: This forces repeated alignments on the current die; however, previous alignment data is not displayed or used in the alignment algorithm. Unlike option R, the alignment screen is displayed with the contrast levels. To stop this option, press any key.