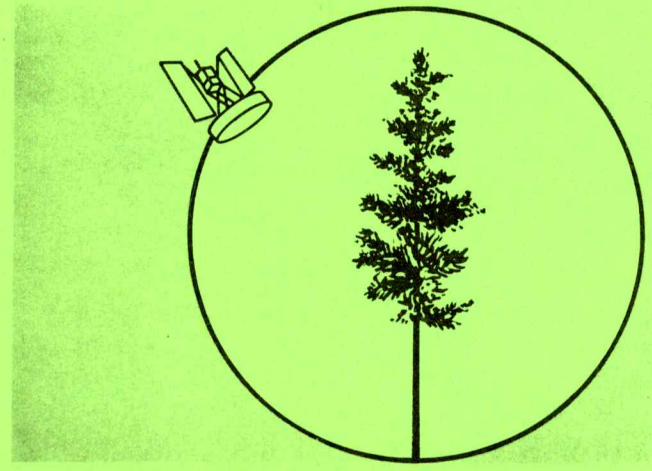

FRIS

FOREST RESOURCE INFORMATION SYSTEM

NASA ST. REGIS LARS

LARSFRIS USER'S MANUAL

Volume 3

Purdue University
Laboratory for Applications
of Remote Sensing

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16. Abstract

This document contains user instructions for the proper use and application of the Software which comprises the LARSFRIS package. LARSFRIS represents a compilation of software developed over a number of years by the staff at Purdue University's Laboratory for Applications of Remote Sensing. The software packages are designed to help the user analyses digital image data such as that collected by the Landsat Multispectral scanner. This is one of five documents that comprise the LARSFRIS package.

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LARS staff who made significant contributions to either creating new or updating existing program modules included; Sue Schwingendorf, Bill Shelley, Carol Jobusch, Joan Buis, Luis Bartolucci, Louis Lang, and John Cain. Kay Hunt deserves special thanks for coordinating and organizing staff efforts.

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PREFACE

The documentation of the LARSFRIS system closely parallels existing LARSYS Version 3.1 documentation. The major differences are in the addition of certain program modules which provide the user greater flexibility in the analysis of multispectral data. The LARSFRIS documentation exists in three parts: LARSFRIS Program Abstracts, LARSFRIS System Manual, and LARSFRIS User's Manual.

The first of these contains the documentation of each Fortran and Assembler routine and each CMS Executive routine in LARSFRIS. These program abstracts are provided for programmers who are required to revise and/or maintain these routines.

The second manual, LARSFRIS System Manual, is directed primarily to programmers and analysts who maintain or revise the system or write new functions that must be interfaced with LARSYS. It contains detailed information of (and references to) the hardware and software framework upon which the system was built, the internal organization of the software, the organization of the data fields, and a discussion of special techniques that were used in the implementation of LARSFRIS.

This manual, LARSFRIS User's Manual, contains a comprehensive description of the functional organization of the system, the processing functions provided, and the manner in which the

functions are invoked and controlled. While it is written primarily for the system's user, a good knowledge of its contents is essential for any individual who intends to work with the system -- be he a user, an analyst, or a programmer.

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APPENDIX I

CONTROL CARD DICTIONARY

The LARSFRIS Control Card Dictionary explains in detail the use of the keywords and the parameters recognized by the LARSFRIS Processing Functions. Also, information pertaining to the data cards in the input deck for the Processing Functions is described.

This dictionary should be used in conjunction with Sections 2, 3, and 6 of this manual. It is important that the user be familiar with subsection 2.3, which describes the input deck and the general formatting rules for control cards. New LARSFRIS users will find it valuable to run several of the examples as described in Section 3. This will give the user a better feel for the system and an improved understanding of the information contained in the LARSFRIS Control Card Dictionary. Each time a user makes initial use of a particular function in LARSFRIS he should carefully study the subsection in Section 6 pertaining to that particular function. This Control Card Dictionary will then become valuable for further detailed explanations of the processing options available for that particular function.

The LARSFRIS Control Card Dictionary is divided into sections, one section per function. The Processing Function is identified in the top right-hand corner of each page. The functions are

included in alphabetical order. Each page in the dictionary contains the keyword for a particular control or data card, the control parameters applicable to the control card, a general description of the overall function of the control card, a general description of the program defaults for the control card, and a description of the control parameters.

A list of each control and data card in the order included in the Control Card Dictionary appears on the following pages. This list along with Figure 2-2 in Section 2 should aid the user in quickly locating information in the Control Card Dictionary.

BIPLOT

```
*BIPLOT
OPTIONS
SYMBOLS
CARDS
SCALE
PLOT
DATA
STATISTICS DECK
END
```

CHANNELTRANSFORMATION

```
*CHANNELTRANSFORMATION
FROM
TO
CHANNELS
NEWCHANNELS
DATA
ALGEBRAIC EXPRESSIONS
END
```

CLASSIFYPOINTS

```
*CLASSIFYPOINTS
RESTART
PROCEDURE
AUTO
RESULTS
PRINT
CLASSES
WEIGHTS
CARDS
CHANNELS
DATA
STATISTICS FILE
FIELD DESCRIPTION CARDS, FORM 1
FIELD DESCRIPTION CARDS, FORM 2
END
```

CLUSTER

```
*CLUSTER
IDNAME
PRINT
PUNCH
CHANNELS
SYMBOLS
DATA
FIELD DESCRIPTION CARDS, FORM 1
FIELD DESCRIPTION CARDS, FORM 2
END
```

COLUMNGRAPH

```
*COLUMNGRAPH
PRINT
CHANNELS
SCALE
END
```

COMPARESULTS

```
*COMPARESULTS
FIRSTRESULTS
SECONDRESULTS
NEWRESULTS
BLOCK
DATA
CLASS CARDS
FIRST
SECOND
END
```

COPYRESULTS

```
*COPYRESULTS
FROM
TO
PRINT
CNAMES
PNAMES
END
```

GRAPHHISTOGRAM

```
*GRAPHHISTOGRAM
CHANNELS
END
```

HISTOGRAM

```
*HISTOGRAM
OPTIONS
PUNCH
BLOCK
CHANNELS
END
```

IDPRINT

```
*IDPRINT
PRINT
END
```

LINEGRAPH

```
*LINEGRAPH
PRINT
CHANNELS
SCALE
END
```

LISTRESULTS

```
*LISTRESULTS
FROM
END
```

MERGESTATISTICS

```
*MERGESTATISTICS
PRINT
PUNCH
CHANNELS
CLASSES
POOL
DISK
SCALE
DATA
STATISTICS DECK(S)
END
```

PICTUREPRINT

```
*PICTUREPRINT
DISPLAY
CHANNELS
SYMBOLS
HISTOGRAM
BLOCK
PRINT
PUNCH
BOUNDARY
DATA
FIELD DESCRIPTION CARDS, FORM 1
FIELD DESCRIPTION CARDS, FORM 2
HISTOGRAM FILE
LEVELS CARDS
END
```

PRINTRESULTS

```
*PRINTRESULTS
RESULTS
PRINT
SYMBOLS
PROBABILITY
PSYMBOLS
```

PRINTRESULTS (cont.)

```
THRESHOLD
GROUP
BLOCK
DATA
FIELD DESCRIPTION CARDS, FORM 1
FIELD DESCRIPTION CARDS, FORM 2
END
```

PUNCHSTATISTICS

```
*PUNCHSTATISTICS
FROM
PRINT
END
```

RATIOMEANS

```
*RATIOMEANS
FROM
OPTIONS
SYMBOLS
PRINT
NORATIOS
DATA
STATISTICS DECK
END
```

SAMPLECLASSIFY

```
*SAMPLECLASSIFY
PRINT
CHANNELS
CARDS
CLASSES
GROUP
DATA
STATISTICS FILE
FIELD DESCRIPTION CARDS, FORM 1
FIELD DESCRIPTION CARDS, FORM 2
END
```

SECHO

```
*SECHO
RESULTS
INTERMEDIATE
ANNEXATION
SYMBOLS
PRINT
CLASSES
OPTIONS
```

SECHO (cont.)

```
CELL
CARDS
CHANNELS
DATA
STATISTICS DECK
FIELD DESCRIPTION CARDS, FORM 1
FIELD DESCRIPTION CARDS, FORM 2
END
```

SEPARABILITY

```
*SEPARABILITY
COMBINATIONS
SYMBOLS
WEIGHTS
CLASSES
CARDS
CHANNELS
PRINT
OPTIONS
STOP
DATA
STATISTICS FILE
END
```

SMOOTHRESULTS

```
*SMOOTHRESULTS
INRESULTS
CELLSIZE
OUTRESULTS
PRIORITY
GROUP
WEIGHTS
BLOCK
MIXCLASS
END
```

STATISTICS

```
*STATISTICS
OPTIONS
PRINT
PUNCH
CHANNELS
SCALE
DATA
FIELD DESCRIPTION CARDS, FORM 1
FIELD DESCRIPTION CARDS, FORM 2
END
```

TRANSFERDATA

```
*TRANSFERDATA
TAPE
PUNCH
PRINT
OPTIONS
CHANNELS
DATA
FIELD DESCRIPTION CARDS, FORM 1
FIELD DESCRIPTION CARDS, FORM 2
END
```

Processing Function: BIPLOT

Key Word: * BIPLOT
Control Parameters: None

Function:

Select the BIPLOT function

Card Default:

None; card is required to select the BIPLOT Function.

Control Parameters:

None

Processing Function: BIPLOT

Key Word: CARDS
Control Parameters: READSTATS

Function:

Indicates that the statistics file is to be read from cards.

Card Default:
The statistics file is expected from the user's D-disk. The statistics must have been calculated in the previous LARSFRIS session or saved from a previous terminal session. In the latter case, the "statdeck use" command must have been typed before executing the present input deck.

Control Parameters:

READSTATS - Read statistics file from cards.

Default - None, the control parameter is required.

Processing Function: BIPLOT

Key Word: OPTIONS
Control Parameters: PROB(.XXX)

Function:

Specifies the probability cut-off for the classification of feature space.

Card Default:

Probability cut-off is set to 0.995.

Control Parameters:

PROB(.XXX) - Allows user to specify a desired probability cut-off equal to (.XXX).

Default: None, control parameter is required if card is used.

Processing Function: BIPLOT

Key Word: SYMBOLS
Control Parameters: S_1, S_2, S_3, ...

Function:

Assigns symbols to represent each class.

Card Default:

Preprogrammed symbols: A, B, C, ...

Control Parameters:

S, S, S, ... - Assigns the symbols S, S, S, etc., to represent classes 1, 2, 3, etc. Alphanumeric symbols may be used.

Default: None, control parameter is required if card is used.

Note: There are 30 preprogrammed symbols for the BIPLOT function.

Class	Symbol	Class	Symbol
1	A	27	$
2	B	28	+
3	C	29	=
.	.	30	/
.	.		
.	.		
24	X		
25	Y		
26	Z		

These symbols are not in order of increasing brightness as the preprogrammed symbols for the PICTUREPRINT and CLUSTER functions.

Processing Function: BIPLOT

Key Word: SCALE
Control Parameters: ORIG(N,X.XX) UNIT(N,X.XX)

Function:

Rescales axes for printing the Mean, Ellipse, and Classification plots.

Card Default:

Control parameter degaults are used.

Control Parameters:

ORIG(N,X.XX)	- Set origin of axis for:	channel N to X.XX
		Default: X.XX = 0.00
UNIT(N,X.XX)	- Set interval unit for:	channel N to X.XX
		Default: X.XX - 1.00

Note: If N=0, then all shannels will be set to X.XX for both the ORIG and UNIT control parameters. The plot size is always 100 by 100 units.

Processing Function: BIPLOT

Key Word: PLOT
Control Parameters: MEAN (C_1, C_2) ELLIPSE (C_1, C_2) CLASS (C_1, C_2)

Function:

Specifies plotting of Means, Ellipses, and/or Classification of feature space.

Card Default:

None, card is always required.

Control Parameters:

MEAN (C_1, C_2) - Specifies plot of class means for channel C_1 versus channel C_2.
Default: No means plotted.

ELLIPSE (C_1, C_2) - Specifies plot of class ellipses for channel C_1 versus channel C_2.
Default: No ellipses plotted.

CLASS (C_1, C_2) - Specifies plot of classification of feature space of each class for channel C_1 versus channel C_2.
Default: No classification of feature space plotted.

Processing Function: BIPLOT

Key Word: DATA
Control Parameters: None

Function:

Indicates beginning of Statistics file and it must precede the first card of the data file.

Card Default:

None; card is required at the beginning of the statistics file.

Control Parameters:

None

Processing Function: BIPLOT

Key Word: None (Statistics File)
Control Parameters: None

Function: The deck of cards that make up the Statistics File is produced by the CLUSTER, the STATISTICS, PUNCHSTATISTICS, or MERGESTATISTICS function. It is not punched by the user.

Card Default: None; One statistics deck is required by the function.

Control Parameters:

Format: The Statistics File contains a header card, several data cards and an end card. The header and end cards are described below. Consult the Statistics File description in the LARSFRIS System Manual for information on the contents of the other data cards. All cards in the deck are sequenced in columns 73 through 80. The first card is number 1, the data cards are numbered 2 to n-1, and the last card is numbered n, where n is the number of cards punched for the Statistics File.

Header Card

Columns	Description
1-33	LARSYS VERSION 3 STATISTICS FILE
34-39	blank
40	Flag = 1 for hexadecimal format = 0 for character format
41-72	blank
73-80	sequence number 1

BIPLOT
None (Statistics File)

End Card

Columns	Description
1-3	EOS
4-15	blank
16-59	***** LAST CARD OF STATISTICS DECK *****
60-72	blank
73-80	sequence number n

Statistics Data Deck:

The Statistics Deck contains:

* Training Field information.
* A record containing the numbers of classes, number of fields, and number of channels.
* Records containing the channel number, wavelength of the spectral band, and calibration code for each channel used.
* A record containing the number of points in each class.
* Records containing the mean for each channel for each class.
* Records containing the covariance matrix of all specified channels for each class.

Processing Function: BIPLOT

Key Word: END
Control Parameters: None

Function:

Indicates end of function control card deck for the BIPLOT function.

Card Default:

None; card is required at the end of the function control card deck.

Control Parameters:

None

Processing Function: CHANNELTRANSFORM

Key Word: * CHANNELTRANSFORM
Control Parameters:

Function: Function Selector Card for CHANNELTRANSFORM.

Card Default: None; card is required to select the Channeltransform function.

Control Parameters: None

Processing Function: CHANNELTRANSFORM

Key Word: FROM
Control Parameters: RUN(xxxxxxxx)

Function: Specifies the run number of the run to be copied.

Card Default: None; card is required.

Control Parameters:

RUN(xxxxxxxx) - data run xxxxxxxx is to be duplicated.

Default: None; parameter is required.

Processing Function: CHANNELTRANSFORM

Key Word: TO
Control Parameters: TAPE(XXX),FILE(XXX) INITIALIZE

Function: Specifies the tape and file number of the tape that will contain duplicated run.

Card Default: None. Card is required.

Control Parameters:

TAPE(XXX) - data run will be copied onto tape XXX. This new tape number is put in the identification record.

Default: None; parameter is required.

FILE(XXX) - data run will be copied onto file XXX. The new file number is placed on the identification record.

Default: None. Parameter is required, unless initialization is requested

INITIALIZE - data run will be copied onto file 1 without regard to any previous information on the tape. The new tape and file numbers are put in the identification record.

Default: None. Either file or initialize must be requested.

Processing Function: CHANNELTRANSFORM

Key Word: CHANNELS
Control Parameters: A(I/P,Q/,J/R,S/,...),B(K/W,X/,L/Y,Z,...),...

Function: Specifies channels to be used and controls the calibration of the data from the Multispectral Image Storage Tape.

Card Default: None; card is required to specify channels to be used.

Control Parameters:

A and B are calibration codes which indicate to the program how the channels in the parentheses are to be calibrated. The table below shows what the codes select.

Calibration Code	Data Calibrated Using
1	C0
2	C1
3	C2
4	C0 and C1
5	C0 and C2
6	C1 and C2
7	Uncalibrated

In the general form of the CHANNELS card, the integers I, J, K, and L are the channels selected. Channels I and J are to be calibrated using calibration code A while channels K and L are to be calibrated using calibration code B. The integers P, Q, R, S, W, X, Y, and Z are fixed calibration levels inserted for the channels they follow

CHANNELTRANSFORM
Channels

Several forms of the CHANNELS card may be used. If the user desires not to enter fixed levels into the system (use fixed levels from the tape), he can enter the card in the form:

```
CHANNELS    A(I,H,...),B(K,L,...)
```

If the user wants to assume a calibration code of 1 and the fixed level of C0 to be from the tape for all desired channels, a card can be used in the form:

```
CHANNELS    I,J,K,L...
```

The example below shows a CHANNELS card that selects channels 1,3,4 and 10. The card also assigns calibration values for C0 (calibration code 1) to channels 1, 3 and 4. The value that is assigned is zero. The second expression on the card assigns both C0 and C1 values (calibration code 4) to channel 10. The C0 value is again zero and the C1 value is 800.

```
CHANNELS    1(1/0.0/,3/0/,4/0/),4(10/0,800/)
```

The following card will assume a calibration code of 1 for selected channels 1, 3, 4 and 10 and use C0 stored on the tape.

```
CHANNELS    1,3,4,10
```

Note that the use of the CHANNELS card does not require the user to determine the processing constants of the system or the constants required to calibrate the data. He is required to know the irradiance values (or percent reflectance) of the calibration sources used in the system and the numerical value he wants to assign to these measurements. At present, the characteristics of the sources are not known. What is significant here is that the user now has the ability to experiment with the data to determine these characteristics, to test hypothesized characteristics, or to use determined characteristics when they are known.

For more information concerning calibration, refer to LARS Information Note 071069, "Calibration of Scanner Data for Operational Processing Programs at LARS," by Terry L. Phillips.

Processing Function: CHANNELTRANSFORM

Key Word: NEWCHANNELS
Control Parameters: N

Function: Specify the number of channels to be included in the new copy.

Card Default: All channels in original run will be included in the new copy.

Control Parameters: N - integer number of channels.

Default: None.

Processing Function: CHANNELTRANSFORM

Key Word: DATA
Control Parameters: None

Function: Indicates that Channel Assignment Cards follow in the deck.

Card Default: Card is required except when an exact copy is to be made of the input run.

Control Parameters: This card precedes cards that give the algebraic formulas for each new channel (one channel per line).

Processing Function: CHANNELTRANSFORM

Key Word: None (Channel Assignment Cards)
Control Parameters: None

Function: Channel Assignment Cards

Card Default: Not applicable.

Format: Each card has the format

CJ = 'algebraic expression'

where CJ is the jth new channel and 'algebraic expression' is a function of the variables C1,...,CN where CI is the current value of channel I for each I=1,...,N. This will be the value of channel I from the input run unless CI has been redefined by a previous equation. Some examples are

C1=C1
C2=C1+C2
C3=C3+C4
C4=C2/C3

Note that C4 is the ratio of the sum of channels 1 and 2 divided by the sum of channels 3 and 4, since C2 and C3 were redefined by equations above the equation for C4.

Processing Function: CHANNELTRANSFORM

Key Word: END
Control Parameters:

Function: Indicates end of function control cards for the Channeltransform function.

Card Default: None. Card is required at the end of the Channeltransform function deck.

Control Parameters: None.

Processing Function: CLASSIFYPOINITS

Key Word: *CLASSIFYPOINTS
Control Parameters: NONE

Function: Select the CLASSIFYPOINTS function

Card Default: None; card is required to select the CLASSIFYPOINTS Function.

Control Parameters: None

Processing Function: CLASSIFYPOINTS

Key Word: RESTART
Control Parameters:

Function: This control card specifies that the function is to be expected in the restart mode, i.e., that a previous execution of the function that was "suspended" is to be completed in this execution.

Card Default: This card overrides the normal execution of the function which is to assume a new Classification Results File.

Control Parameters: None

Processing Function: CLASSIFYPOINTS

Key Word: PROCEDURE
Control Parameters: [L1 L2]

Function: Selects the classification rule to be used in assigning data vectors to classes.

Card Default: Maximum likelihood decision rule used.

Control Parameters:

L1	- Use the minimum L1 distance, or distance of a point to a class along the channel axes, as the criterion for classifying points.
L2	- Use the minimum L2 (Euclidean) distance for assigning points to classes.

Processing Function: CLASSIFYPOINTS

Key Word: AUTO
Control Parameters: CHANNELS

Function: Indicates that the channels to be used are those determined by a previous run of SEPARABILITY.

Card Default: Either an AUTO of a CHANNELS card must be specified.

Control Parameters:

CHANNELS - Use channels selected by SEPARABILITY. SEPARABILITY must have been run in the same input deck as CLASSIFYPOINTS. If several requests were made in SEPARABILITY, the channels passed to CLASSIFYPOINTS are those from the last request.

Default: None.

Processing Function: CLASSIFYPOINTS

Key Word: RESULTS
Control Parameters: [TAPE(ttt), FILE(ff) (, INTIALIZE)] [DISK]

Function: Indicates the destination of the Classification Results File, and when it is tape, whether it is a new tape.

Card Default: None; card is required.

Control Parameters:

TAPE(ttt) - ttt is the tape number of the tape on which the results are to be written. TAPE(0) indicates a scratch tape.

Default: ttt = 0. If DISK is used, TAPE must not be used.

FILE(ff) - ff is the file number on the tape onto which the Classification Results File is to be written.

Default: None. Required unless DISK is specified in which case FILE must not be used.

INITIALIZE - indicates that the tape is a new tape. (No checking will be done for existing files.) This is required for new tapes in order to write a correct label on the tape.

Default: Old tape.

DISK - indicates that the results file is to be written onto the disk.

Default: None. Required unless FILE is specified in which case DISK must not be used.

Processing Function: CLASSIFYPOINTS

Key Word: PRINT
Control Parameters: [STATS] [,MAP]

Function: Specifies printing options that are desired.

Card Default: No statistics or maps printed.

Control Parameters:

STATS - Prints a summary of statistics for each class used in the classification. Statistics include the means, standard deviations, and correlation matrices for the channels used.

Default: No statistics printed.

MAP - Print a map of the classified results.

Default: No map printed.

Both parameters may be included on the same card.

Processing Function: CLASSIFYPOINTS

Key Word: CLASSES
Control Parameters: [name $(k_1/n_1, n_2, n_3, .../), ...$ $n_1, n_2, n_3, ...$]

Function: Groups training classes, pools statistics, and assigns a name and number to the pools; also used to select a subset of those classes defined in the Statistics File.

Card Default: All classes defined in the Statistics File are used in the classification.

Control Parameters: Either of the two forms of this card may be used, but they may not both be used for a single execution of the function.

Form 1:

name $(k_1/n_1, n_2, n_3, .../)$ - groups training classes numbered $n_1, n_2, n_3, ...$; pools the statistics in pool number k_1 which is assigned the name "name". The pool name may be up to 8 characters long; the pool numbers must be specified consecutively, that is 1, 2, 3, ...; class numbers are those previously assigned in the Statistics Function.

Default: No pooling of classes.

Form 2:

n_1, n_2, n_3, ... - training classes numbered n_1, n_2, n_3, ... will be used for classification. This simpler alternative form of the CLASSES card is used when no pooling is required; a subset of the classes defined in the Statistics File is selected and those classes not specified on the card are deleted from further consideration. When this form of the CLASSES card is used, the pool numbers are assigned to the chosen classes in consecutive order beginning with one even though no classes have been statistically pooled.

Default: All classes are used.

Note: If one or more CLASSES cards are used, all classes not explicitly mentioned on the CLASSES cards will be deleted from further consideration and not used in the classification.

Processing Function: CLASSIFYPOINTS

Key Word: WEIGHTS
Control Parameters: w1, w2, w3,...

Function: Assign weights to pools to influence classification algorithm.

Card Default: Equal weights are used for classifying.

Control Parameters:

w1,w2,w3,... - w1 is the weight to be assigned to the first pool, etc. Weights may be entered as integers or decimals, and the number of weights must equal the number of pools (or classes, if no classes are pooled).

Default: None.

Processing Function: CLASSIFYPOINTS

Key Word: CARDS
Control Parameters: READSTATS

Function: Specifies that a Statistics File punched by STATISTICS will be included in this group of function control cards.

Card Default: Statistics are expected from the disk; they must have been calculated previously in this LARSFRIS session or saved from a previous terminal session. In the latter case, the 'statdeck use' command must have been typed before executing the present input deck.

Control Parameters:

READSTATS - Read statistics deck from cards.

Default: None; the parameter is required.

Processing Function: CLASSIFYPOINTS

Key Word: CHANNELS
Control Parameters: A(I/P,Q/,J/R,S/,...),B(K/W,X/,L/Y,Z/,...),...

Function: Specifies channels to be used and controls the calibration of the data from the Multispectral Image Storage Tape.

Card Default: None; the card is required to specify channels unless the AUTO card is used.

Control Parameters:

A and B are calibration codes which indicate to the program how the channels in the parenthesis are to be calibrated. The table below shows what the codes select:

Calibration Code	Data Calibrated Using
1	C0
2	C1
3	C2
4	C0 and C1
5	C0 and C2
6	C1 and C2
7	Uncalibrated

In the general form of the CHANNELS card the intergers I,J,K, and L are the channels selected. Channels I and J are to be calibrated using calibration code A while channels K and L are to be calibrated using calibration code B. The real numbers P,Q,R,S,W,X,Y and Z are fixed calibration levels inserted for the channels they follow.

Several forms of the CHANNELS card may be used. If the user desires not to enter fixed levels into the system (use fixed levels from the tape), he can enter the card in the form:

```
CHANNELS    A(I,H,...),B(K,L,...)
```

If the user wants to assume a calibration code of 1 and the fixed level of C0 to be from the tape for all desired channels, a card can be used in the form:

```
CHANNELS    I,J,K,L,...
```

The example below shows a CHANNELS card that selects channels 1,3,4 and 10. The card also assigns calibration values for C0 (calibration code 1) to channels 1, 3 and 4. The value that is assigned is zero. The second expression on the card assigns both C0 and C1 values (calibration code 4) to channel 10. The C0 value is again zero and the C1 value is 800.

```
CHANNELS    1(1/0.0/,3/0/,4/0/),4(10/0,800/)
```

The following card will assume a calibration code of 1 for selected channels 1, 3, 4, and 10 and use C0 stored on the tape.

```
CHANNELS    1,3,4,10
```

Note that the use of the CHANNELS card does not require the user to determine the processing constants of the system or the constants required to calibrate the data. He is required to know the irradiance values (or percent reflectance) of the calibration sources used in the system and the numerical value he wants to assign to these measurements. At present, the characteristics of the sources are not known. What is significant here is that the user now has the ability to experiment with the data to determine these characteristics, to test hypothesized characteristics, or to use determined characteristics when they are known.

For more information concerning calibration, refer to LARS Information Note 071069, "Calibration of Scanner Data for Operational Processing Programs at LARS", by Terry L. Phillips.

Processing Function: CLASSIFYPOINTS

Key Word: DATA
Control Parameters: None

Function: Indicates that data cards will follow.

Card Default: None. At least one group of data cards (Field Description Cards identifying the source of input data) must always be supplied. In addition, the Statistics File may be supplied on cards (in which case a 'CARDS READSTATS' control card is also required). If both groups of data cards are in the input deck, each group must be preceded by a separate 'DATA' control card, and the Statistics File must precede the Field Description Cards.

Data Decks:

Statistics Deck - Required if CARDS READSTATS was specified. Otherwise, must not be present.

Field Description Cards - Either form of this card may be used to define the area(s) to be classified by CLASSIFYPOINTS. See the following pages for the formats of Field Description Cards.

Processing Function: CLASSIFYPOINTS

Key Word: none (Statistics File)
Control Parameters: None

Function: Statistics File

This deck of cards is produced by the Statistics or Punchstatistics functions and is never punched by the user.

Card Default: Required when 'CARDS READSTATS' is specified.

Format: The Statistics File contains a header card, several data cards and an end card. The header and end cards are described below. Consult the Statistics File description in the LARSFRIS System Manual for information on the contents of the other data cards. All cards in the deck are sequenced in columns 73 through 80. The first card is number 1, the data cards are numbered 2 to n-1, and the last card is numbered n, where n is the number of cards punched for the Statistics File.

Header Card

Columns	Description
1-33	LARSYS VERSION 3 STATISTICS FILE
34-39	blank
40	flag = 1 for hexadecimal format = 0 for character format
41-72	blank
73-80	sequence number 1

End Card

Columns	Description
1-3	E05
4-15	blank
16-59	*****bb LAST CARD OF STATISTICS DECKbb *****
60-72	blank
73-80	sequence number n

Processing Function: CLASSIFYPOINTS

Key Word: None (Field Description Cards, form 1)
Control Parameters: None

Function: Field Description Cards (Form 1)
Defines run number and coordinates of an area.

Card Default: Not applicable.

Format: Each card is formatted:

$$RUN(n_1),LINE(n_2,n_3,n_4),COL(n_5,n_6,n_7)$$

where:

$RUN(n_1)$ - data is located in run number n_1.

Default: None; parameter is required.

$LINE(n_2,n_3,n_4)$ - n_2 is the starting line number; n_3 is the ending line number; and n_4 is the line interval.

Default: None; parameter is required.

$COL(n_5,n_6,n_7)$ - n_5 is the left-most column number; n_6 is the right-most column number; n_7 is the column interval.

Default: None; parameter is required.

Processing Function: CLASSIFYPOINTS

Key Word: None (Field Description Cards, form 2)
Control Parameters: None

Function: Field Description Cards (Form 2)

Defines run number and coordinates of an area.

Card Default: Not applicable.

Format: Each card is formatted as shown below.

	Column	Required Parameter
*Run Number	1-8	YES
Field Designation	11-18	NO
*First Line	21-25	YES
*Last Line	26-30	YES
*Line Interval	31-35	YES
*First Sample	36-40	YES
*Last Sample	41-45	YES
*Sample Interval	46-50	YES
Class Name	51-58	NO
Other Information	59-80	NO

*These parameters can be entered anywhere (without embedded blanks) in the columns listed; i.e., right or left justified. Also these parameters are required on the card as they have no program defaults. The other parameters can be left blank and also have no defaults.

Processing Function: CLASSIFYPOINTS

Key Word: END
Control Parameters:

Function: Indicates end of function control cards for the Classifypoints function.

Card Default: None. Card is required at the end of the Classifypoints function deck.

Control Parameters: None

Processing Function: CLUSTER

Key Word: *CLUSTER
Control Parameters:

Function: Function Selector Card for CLUSTER

Card Default: None; card is required to select the Cluster function.

Control Parameters: None

Processing Function: CLUSTER

Key Word: IDNAME
Control Parameters: AAA.....

Function: Assigns an ID Name to the cluster run for user identification purposes.

Card Default: ID Name is set to NS

Control Parameters:

AAA-up to 16 character to be assigned as the ID Name.

Default: NS

Processing Function: CLUSTER

Key Word: PRINT
Control Parameters: HIST

Function: requests printing of histograms

Card Default: no histograms printed

Control Parameters: HIST - histograms will be printed for each class in every channel.

Processing Function: CLUSTER

Key Word: PUNCH
Control Parameters: [FIELD, [MINPOINTS (N)] STAT, [CHAR]]

Function: Requests punching of cluster results as Field Description Cards or punching of a statistics deck. Only one of these two decks may be requested. If both are specified on the card, only the statistics deck will be punched.

Card Default: No punching.

Control Parameters:

FIELD - punch CLASS card and Field Description Cards for each cluster.

Default: No Field Description Cards are punched.

MINPOINTS (N) - punch Field Description Cards only for those areas containing N or more points.

Default: Only fields with 4 or more points are punched.

STAT - punch a statistics deck in binary format.

Default: No statistics deck will be punched.

CHAR - punch the statistics deck in character (BCD) format.

Default: Binary format.

Processing Function: CLUSTER

Key Word: CHANNELS
Control Parameters: A(I/P,Q/,J/R,S/,...),B(K/W,X/,L/Y,Z),...),...

Function: Specifies channels to be used and controls the calibration of the data from the Multispectral Image Storage Tape.

Card Default: None; card is required to specify channels to be used.

Control Parameters:

A and B are calibration codes which indicate to the program how the channels in the parenthesis are to be calibrated. The table below shows what the codes select.

Calibration Code	Data Calibrated Using
1	C0
2	C1
3	C2
4	C0 and C1
5	C0 and C2
6	C1 and C2
7	Uncalibrated

In the general form of the CHANNELS card the integers I,J, K, and L are the channels selected. Channels I and J are to be calibrated using calibration code A while channels K and L are to be calibrated using calibration code B. The integers P,Q,R,S,W,X,Y, and Z are fixed calibration levels inserted for the channels they follow.

Several forms of the CHANNELS card may be used. If the user desires not to enter fixed levels into the system (use fixed levels from the tape), he can enter the card in the form:

```
CHANNELS    A(I,H,...),B(K,L,...)
```

If the user wants to assume a calibration code of 1 and the fixed level of C0 to be from the tape for all desired channels, a card can be used in the form:

```
CHANNELS    I,J,K,L,...
```

The example below shows a CHANNELS card that selects channels 1,3,4 and 10. The card also assigns calibration values for C0 (calibration code 1) to channels 1, 3 and 4. The value that is assigned is zero. The second expression on the card assigns both C0 and C1 values (calibration code 4) to channel 10. The C0 value is again zero and the C1 value is 800.

```
CHANNELS    1(1/0.0/,3/0/,4/0/),4(10/0,800/)
```

The following card will assume a calibration code of 1 for selected channels 1, 3, 4, and 10 and use C0 stored on the tape.

```
CHANNELS    1,3,4,10
```

Note that the use of the CHANNELS card does not require the user to determine the processing constants of the system or the constants required to calibrate the data. He is required to know the irradiance values (or percent reflectance) of the calibration sources used in the system and the numerical value he wants to assign to these measurements. At present, the characteristics of the sources are not known. What is significant here is that the user now has the ability to experiment with the data to determine these characteristics, to test hypothesized characteristics, or to use determined characteristics when they are known.

For more information concerning calibration, refer to LARS Information Note 071069, "Calibration of Scanner Data for Operational Processing Programs at LARS", by Terry L. Phillips.

Processing Function: CLUSTER

Key Word: SYMBOLS
Control Parameters: $S_1, S_2, S_3, \ldots$

Function: Designates symbols to be used for map of clustered array.

Card Default: Preprogrammed symbols are used. These are listed on the next page.

Control Parameters:

Si - This symbol is used for cluster i in printing the clustered array map. Any typewriter character or blank may be used as a symbol.

Default: Symbols used are, 123456789ABCDEFGHIJKLMNOPQR STUVWXYZ*/-.Ø (blank).

CLUSTER-
Symbols

NUMBER OF CLUSTERS	PROGRAMMED SYMBOLS
	000000000111111111122222222223333333334 123456789012345678901234567890123456789O
2	M
3	*M
4	IEM
5	J*HM
6	)SXNM
7	/I*E$M
8	=CZTGRW
9	+J2*8HOW
10	+1LVYFBOW
11	.)CS*XGNDM
12	.)72VY8KNDW
13	./JIZ*TEH$DM
14	./JLS3Y8GBRQM
15	-=1CIZ*TFGBRQW
16	-=)7IS3&XEKNRQM
17	-+)JL2V*Y8EHNOQW
18	-+/JCIZ3&TFGH$OQW
19	-+/17LSV*YXFKB$OQW
20	-+/17L2Z3&T8EKB$OQW
21	'.=)JCISV*YXFGHNRDAM
22	'.=)JCL2Z3&T8FGHNRDAW
23	'.=)17L2SV*YX8EKBNRDAW
24	'.=/17CISZ3&YXFGKB$RDAW
25	'.+/IJCL2ZV*YT8FGHB$ODAW
26	'.+/)J7L2SV3&YX8EKHN$ODAM
27	'.+/)J7LISZ3*YT8FGKBNRDQAM
28	'-+=)17CL2SV3&YX8FGKBNRDQAW
29	'-+=/1JCLISZ3*&TXFEGHBNRDQAW
30	'-+=/1J7LI2ZV3&YT8FEKHB$RDQAW
31	'-.=/)J7CI2SZ3*&TZ8EGKHN$RDQAM
32	'-.=/)17CLISZV3&YTXFEGKBN$RDQAW
33	'-.+/)1J7LI2SZ3*&YT8FEGHBN$RDQAW
34	'-.+=)1J7CL2SZV3&YTX8FGKHBNRODQAW
35	'-.+=/)J7CLI2SV3*&YTXFEGKHBNRODQAW
36	'-.+=/)1JCLI2SZV3*YTX8FEGKHN$RODQAW
37	'-.+=/)1J7CL2SZV3*&YTX8FGKHBN$RODQAW
38	'-.+=/)1J7CLI2SZV3*YTX8FEGKHBN$RODQAW
39	'-.+=/)1J7CLI2SZV3*&YTX8FEGKHBN$RODQAW
40	'-.+=/)1J7CLI2SZV3*&YTX8FEGKHBN$RODQAWM

The first symbol for each number of clusters above is a blank.

Processing Function: CLUSTER

Key Word: **DATA**
Control Parameters: None

Function: Indicates that the Field Description Cards follow in the deck.

Card Default: None. Card is required.

Control Parameters:

This card precedes Field Description Cards that identify the specific areas to be clustered - one card for each area. The two possible forms of the Field Description Card are shown on the following pages. Either one may be used.

Processing Function: CLUSTER

Key Word: None (Field Description Cards, form 1)
Control Parameters: None

Function: Field Description Cards (Form 1)
Defines run number and coordinates of an area.

Card Default: Not applicable.

Format: Each card is formatted:

$$RUN(n_1),LINE(n_2,n_3,n_4),COL(n_5,n_6,n_7)$$

where:

$RUN(n_1)$ - data is located in run number n_1.

Default: None; parameter is required.

$LINE(n_2,n_3,n_4)$ - n_2 is the starting line number; n_3 is the ending line number; and n_4 is the line interval.

Default: None; parameter is required.

$COL(n_5,n_6,n_7)$ - n_5 is the left-most column number; n_6 is the right-most column number; n_7 is the column interval.

Default: None; parameter is required.

Processing Function: CLUSTER

Key Word: None (Field Description Cards, form 2)
Control Parameters: None

Function: Field Description Cards (Form 2)

Defines run number and coordinates of an area.

Card Default: Not applicable.

Format: Each card is formatted as shown below.

	Column	Required Parameter
*Run Number	1-8	YES
Field Designation	11-18	NO
*First Line	21-25	YES
*Last Line	26-30	YES
*Line Interval	31-35	YES
*First Sample	36-40	YES
*Last Sample	41-45	YES
*Sample Interval	46-50	YES
Class Name	51-58	NO
Other Information	59-80	NO

*These parameters can be entered anywhere (without embedded blanks) in the columns listed; i.e., right or left justified. Also these parameters are require on the card as they have no program defaults. The other parameters can be left blank and also have no defaults.

Processing Function: CLUSTER

Key Word: END
Control Parameters:

Function: Indicates end of function control cards for the Cluster function.

Card Default: None. Card is required at the end of the Cluster function deck.

Control Parameters: None

Processing Function: COLUMNGRAPH

Key Word: *COLUMNGRAPH
Control Parameters:

Function: Function Selector Card for COLUMNGRAPH.

Card Default: None; card is required to select the Columngraph function.

Control Parameters: None

Processing Function: COLUMNGRAPH

Key Word: PRINT
Control Parameters: RUN(n_1), LINE(n_2,n_3,n_4), [COL(n_5,n_6,n_7), ROLL, C0, C1, C2,]

Function: Defines data to be graphed.

Card Default: None; card is required.

Control Parameters:

The control parameters are used to identify the run number and line numbers to be graphed; and to request graphs of columns, the roll parameter, or the calibration values. The following restrictions apply to the use of the five parameters that are available to request graphs:

- At least one of the five parameters must be specified on the control card. (COL,ROLL,C0,C1, or C2).
- If the graphing of columns is requested, (COL.....), the only other graphing that can be done in the same run is the graphing of the ROLL parameter ROLL.
- Any combination of the ROLL parameter, C0, C1, and C2 may be graphed in the same run.

RUN(n_1) - Specifies data from run number n_1 is to be graphed.

Default: Plots data from the current run.

LINE(n_2,n_3,n_4) - plots data from line n_2 through line n_3 with an interval of n_4.

Default: None; parameter is required.

COL(n_5,n_6,n_7) - designates a plot for each column n_5 through column n_6 with an interval of n_7 be printed.

Default: Data not graphed.

ROLL - graphs the roll parameter using a $ as the character on the plot.

Default: Roll not graphed.

C0 - graphs C0 (dark level) calibration values.

Default: C0 values not graphed.

C1 - graphs C1 (light bulb) calibration values.

Default: C1 values not graphed.

C2 - graphs C2 (sun sensor after 1967) calibration values.

Default: C2 values not graphed.

Processing Function: COLUMNGRAPH

Key Word: CHANNELS
Control Parameters: A(I/P,Q/,J/R,S/,...),B(K/W,X/,L/Y,Z),...),...

Function: Specifies channels to be used and controls the calibration of the data from the Multispectral Image Storage Tape.

Card Default: None; card is required to specify channels to be used.

Control Parameters:

A and B are calibration codes which indicate to the program how the channels in the parenthesis are to be calibrated. The table below shows what the codes select.

Calibration Code	Data Calibrated Using
1	C0
2	C1
3	C2
4	C0 and C1
5	C0 and C2
6	C1 and C2
7	Uncalibrated

In the general form of the CHANNELS card the integers I,J,K, and L are the channels selected. Channels I and J are to be calibrated using calibration code A while channels K and L are to be calibrated using calibration code B. The real numbers P,Q,R,S,W,X,Y, and Z are fixed calibration levels inserted for the channels they follow.

Several forms of the CHANNELS card may be used. If the user desires not to enter fixed levels into the system (use fixed levels from the tape), he can enter the card in the form:

```
CHANNELS    A(I,H,...),B(K,L,...)
```

If the user wants to assume a calibration code of 1 and the fixed level of C0 to be from the tape for all desired channels, a card can be used in the form:

```
CHANNELS    I,J,K,L,...
```

The example below shows a CHANNELS card that selects channels 1,3,4 and 10. The card also assigns calibration values for C0 (calibration code 1) to channels 1, 3 and 4. The value that is assigned is zero. The second expression on the card assigns both C0 and C1 values (calibration code 4) to channel 10. The C0 value is again zero and the C1 value is 800.

```
CHANNELS    1(1/0.0/,3/0/,4/0/),4(10/0,800/)
```

The following card will assume a calibration code of 1 for selected channels 1, 3, 4, and 10 and use C0 stored on the tape.

```
CHANNELS    1,3,4,10
```

Note that the use of the CHANNELS card does not require the user to determine the processing constants of the system or the constants required to calibrate the data. He is required to know the irradiance values (or percent reflectance) of the calibration sources used in the system and the numerical value he wants to assign to these measurements. At present, the characteristics of the sources are not known. What is significant here is that the user now has the ability to experiment with the data to determine these characteristics, to test hypothesized characteristics, or to use determined characteristics when they are known.

For more information concerning calibration, refer to LARS Information Note 071069, "Calibration of Scanner Data for Operational Processing Programs at LARS", by Terry L. Phillips.

Processing Function: COLUMNGRAPH

Key Word: SCALE
Control Parameters: [XLOW(a)], [,BINSIZ(b)]

Function: Indicates relative location and increments of axes to be used in the graph of the column.

Card Default: Parameter defaults are used.

Control Parameters:

XLOW(a) - scale the low value of the X-axis to a.

Default: a = 32.0

BINSIZ(b) - scale bin increment of X-axis to b.

Default: b = 2.0

Processing Function: COLUMNGRAPH

Key Word: END
Control Parameters:

Function: Indicates end of function control cards for the Columngraph function.

Card Default: None. Card is required at the end of the Columngraph function deck.

Control Parameters: None

Processing Function: COMPARERESULTS

Key Word: *COMPARERESULTS
Control Parameters:

Function: Function Selector Card for Compareresults.

Card Default: None; card is required to select the Compareresults function.

Control Parameters: None.

Key Word: FIRSTRESULTS
Control Parameters: TAPE(ttt), FILE(ff) DISK

Function: Indicates the location of the first Classification Results File.

Card Default: None; card is required.

Control Parameters:

TAPE(ttt) — ttt is the tape number of the tape on which the first Classification Results File is located. TAPE (0) is not acceptable since up to three tapes could be requested.

Default: None. Either DISK or a tape number greater than 0 is required. If DISK is used, TAPE must not be used.

FILE(ff) — ff is the file number on the tape containing the first Classification Results file.

Default: None. Required unless DISK is specified, in which case FILE must not be used.

DISK — Indicates that the first results file is stored on the disk.

Default: None. Must not be used if TAPE and FILE are used. Remember only one results file may be stored on disk.

Processing Function: COMPARERESULTS

Key Word: SECONDRESULTS
Control Parameters: [TAPE(ttt, FILE(ff)] [DISK]

Function: Indicates the location of the second Classification Results File.

Card Default: None; card is required.

Control Parameters:

TAPE(ttt) — ttt is the tape number of the tape on which the second Classification Results File is located. TAPE(0) is not acceptable since up to three tapes could be requested.

Default: None. Either DISK or a tape number greater than 0 is required. If DISK is used, TAPE must not be used.

FILE(ff) — ff is the file number on the tape containing the second Classification Results File.

Default: None. Required unless DISK is specified, in which case FILE must not be used.

DISK — Indicates that the second results file is stored on the disk.

Default: None. Must not be used if TAPE and FILE are used. Remember only one results file may be stored on disk.

Key Word: NEWRESULTS

Control Parameters:

$$\left[\begin{matrix}\text{TAPE(ttt)} \\ \text{DISK}\end{matrix},\ \text{FILE(ff)},\ \left[\text{(INITIALIZE)}\right]\right]$$

Function: Indicates the destination of the output Classification Results File, and when it is tape, whether it is a new results tape.

Card Default: None; card is required

Control Parameters:

TAPE(ttt) — ttt is the tape number of the tape on which the results are to be written. TAPE(0) indicates a scratch tape.

Default: ttt = 0. If DISK is used, TAPE must not be used.

FILE(ff) — ff is the file number on the tape onto which the Classification Results File is to be written.

Default: None; required unless DISK is specified.

INITIALIZE — indicates that the tape is a new results tape. (No checking will be done for existing files). This is required for new tapes in order to write a correct label on the tape.

Default: Old tape.

DISK — indicates that the results file is to be written onto the disk.

Default: None. Either DISK, or TAPE and FILE must be used, but not both. Remember that only one results file may be present on the disk at one time.

Processing Function: COMPARERESULTS

Key Word: BLOCK
Control Parameters: RUN(n), LINE (r1,r2,r3), COL(c1,c2,c3)

Function: Defines the area to be used for comparing results.

Card Default: None; the card is required.

Control Parameters:

RUN(n)	n is the 8-digit run number of the data from which the Classification Results were obtained.
LINE(r1,r2,r3)	conpare results from line r1 through r2 with an interval of r3.
COL(c1,c2,c3)	compare results from column c1 through column c2 with an interval of c3.

Note: r1, r2, r3, c1, c2, c3 must always have values less than 32,768.

Processing Function: COMPARERESULTS

Key Word: DATA
Control Parameters: None

Function: Indicates beginning of the class definition cards.

Card Default: None; card is required.

Control Parameters:

Processing Function: COMPARERESULTS

Key Word: CLASS CARDS
Control Parameters: Name

Function: Gives the name for the class being defined. There will be a CLASS, FIRST and SECOND card for each desired output class.

Card Default: None

Control Parameters:

name	indicates that this class is to be called "name". The name may be up to eight characters.

Processing Function: COMPARERESULTS

Key Word: FIRST
Control Parameters: n1, n2, n3,...

Function: Defines the classes from the first Classification Results File to which a pixel may belong in order to be assigned to the class on the preceding CLASS card.

Card Default: None.

Control Parameters:

n1,n2,n3...	These are class numbers from the first classification Results File (listed on the FIRSTRESULTS card).

Processing Function: COMPARERESULTS

Key Word: SECOND
Control Parameters: m1,m2,m3,...

Function: Defines the classes from the second Classification Results File to which a pixel may belong in order to be assigned to the class named on the preceding CLASS card.

Card Default: None

Control Parameters:

m1,m2,m3,...	These are class numbers from the second Classification Results File (listed on the SECONDRESULTS card).

Processing Function: COMPARERESULTS

Key Word: END
Control Parameters: None

Function: Indicates end of function control cards for the COMPARE-RESULTS function.

Card Default: None. Card is required at the end of the COMPARE-RESULTS function deck.

Control Parameters:

Processing Function: COPYRESULTS

Key Word: *COPYRESULTS
Control Parameters:

Function: Function Selector Card for COPYRESULTS.

Card Default: None; card is required to select the Copyresults function.

Control Parameters: None

Processing Function: COPYRESULTS

Key Word: FROM
Control Parameters: TAPE(ttt), FILE(ff) ALL DISK

Function: Indicates the tape, file(s), or disk from which to copy the classification results.

Card Default: None; card is required.

Control Parameters:

TAPE(ttt) - Indicates tape ttt will be used for copying from. If ttt = 0 or DISK was not specified and tape not specified then a scratch tape is assumed.

TAPE need not be specified.

FILE(ff) - File ff is the file on tape ttt from which to copy. Only one of FILE, ALL, or DISK may be specified. If both FILE and ALL specified then the FILE will be disregarded.

ALL - Copy all files from tape ttt beginning with file 1. Only one of FILE or ALL or DISK may be specified.

DISK - Classification results to be copied are on disk. Only one of FILE or ALL or DISK may be specified.

Processing Function: COPYRESULTS

Key Word: TO
Control Parameters: TAPE(ttt), [FILE(ff) / INITIALIZE]

Function: Indicates which tape and file to which to copy the requested classification results.

ard Default: None. Card is required.

Control Parameters:

TAPE(ttt) - Indicates the tape number to which the classification results should be copied. Parameter must be specified. A scratch tape (i.e. ttt = 0) is invalid as input.

Default - None.

FILE(ff) - Indicates the file number on tape ttt to which the results should be copied. ff must be greater than 0 if specified. Either FILE or INITIALIZE must be specified.

INITIALIZE - Indicates the tape to be copied onto should be initialized and results will be put into file 1. Either FILE or INITIALIZE must be specified.

Processing Function: COPYRESULTS

Key Word: PRINT
Control Parameters: NOLIST

Function: Suppress printing the Classification Results File ID Listing on the line printer. Only the control cards will be listed along with the tapes and files used.

Card Default: The Classification Results File ID Listing, containing tape number, file number, channels, classes, calibration codes and values, and number of lines classified will be printed.

Control Parameters:

NOLIST - Suppress printing of all results file information on the line printer.

Processing Function: COPYRESULTS

Key Word: CNAMES
Control Parameters: $C_1, C_2, \ldots$

Function: Change class names

Card Default: No name changes

Control Parameters: Change class names to $C_1, C_2 \ldots$ for class one, class two, ...

Processing Function: COPYRESULTS

Key Word: PNAMES
Control Parameters: $P_1, P_2, \ldots$

Function: Change pool names

Card Default: No name changes

Control Parameters: Change pool names to $P_1, P_2, \ldots$ for pool one, pool two,.....

Processing Function: COPYRESULTS

Key Word: END
Control Parameters:

Function: Indicates end of function control cards for the Copyresults function.

Card Default: None. Card is required at the end of the Copyresults function deck.

Control Parameters: None

Processing Function: GRAPHHISTOGRAM

Key Word: *GRAPHHISTOGRAM
Control Parameters:

Function: Function Selector Card for GRAPHHISTOGRAM.

Card Default: None; card is required to select the Graphhistogram function.

Control Parameters: None

Processing Function: GRAPHHISTOGRAM

Key Word: CHANNELS
Control Parameters: I,J,K,.....

Function: Specifies histogramming channels to be graphed.

Card Default: None; card is required.

Control Parameters: The function uses the channels represented by the integers I,J,K, etc., for selecting the histogramed channels to be graphed.

Processing Function: GRAPHHISTOGRAM

Key Word: END
Control Parameters:

Function: Indicates end of function control cards for the Graphhistogram function.

Card Default: None. Card is required at the end of the Graphhistogram function deck.

Control Parameters: None

Processing Function: HISTOGRAM

Key Word: *HISTOGRAM
Control Parameters:

Function: Function Selector Card for HISTOGRAM.

Card Default: None; card is required to select the Histogram function.

Control Parameters: None

Processing Function: HISTOGRAM

Key Word: OPTIONS
Control Parameters: ACCUM

Function: Specifies options desired.

Card Default:

Control parameter defaults used.

Control Parameters:

ACCUM - stored histogram is updated to include data in this run.

Default: Stored histogram is set to zero. New histogram calculated from data run.

Processing Function: HISTOGRAM

Key Word: PUNCH
Control Parameters: HIST

Function: Specifies card punching to be performed.

Card Default: No punching.

Control Parameters:

HIST - the Histogram File is punched. This file indicates the calibration code and the current stored histogram for each channel selected.

Processing Function: HISTOGRAM

Key Word: BLOCK
Control Parameters: RUN(n_1), LINE(n_2,n_3,n_4), COL(n_5,n_6,n_7)

Function: Defines area to be histogrammed or to be used to update previously stored histograms.

Card Default: Control parameter defaults are used.

Control Parameters:

RUN(n_1) - data from run number n_1 is requested.
Default: The most recently specified run is used.

LINE(n_2,n_3,n_4) - data from line n_2 to line n_3 is used, with an interval of n_4.
Default: n_2 = 1, n_3 = maximum number of lines in the run, n_4 = 10.

COL(n_5,n_6,n_7) - data from column n_5 to column n_6 is used with an interval of n_7.
Default: n_5 = 1, n_6 = maximum number of columns in the run, n_7 = 10.

NOTE: n_2 through n_7 must always have values less than 32,768.

Processing Function: HISTOGRAM

Key Word: CHANNELS
Control Parameters: A(I/P,Q/,J/R,S/,...),B(K/W,X/,L/Y,Z),...),...

Function: Specifies channels to be used and controls the calibration of the data from the Multispectral Image Storage Tape.

Card Default: None; card is required to specify channels to be used.

Control Parameters:

A and B are calibration codes which indicate to the program how the channels in the parenthesis are to be calibrated. The table below shows what the codes select.

Calibration Code	Data Calibrated Using
1	C0
2	C1
3	C2
4	C0 and C1
5	C0 and C2
6	C1 and C2
7	Uncalibrated

In the general form of the CHANNELS card the integers I, J, K, and L are the channels selected. Channels I and J are to be calibrated using calibration code A while channels K and L are to be calibrated using calibration code B. The real numbers P, Q, R, S, W, X, Y, and Z are fixed calibration levels inserted for the channels they follow.

Several forms of the CHANNELS card may be used. If the user desires not to enter fixed levels into the system (use fixed levels from the tape), he can enter the card in the form:

```
CHANNELS    A(I,H,...),B(K,L,...)
```

If the user wants to assume a calibration code of 1 and the fixed level of C0 to be from the tape for all desired channels, a card can be used in the form:

```
CHANNELS    I,J,K,L,...
```

The example below shows a CHANNELS card that selects channels 1,3,4 and 10. The card also assigns calibration values for C0 (calibration code 1) to channels 1, 3 and 4. The value that is assigned is zero. The second expression on the card assigns both C0 and C1 values (calibration code 4) to channel 10. The C0 value is again zero and the C1 value is 800.

```
CHANNELS    1(1/0.0/,3/0/,4/0/),4(10/0,800/)
```

The following card will assume a calibration code of 1 for selected channels 1, 3, 4, and 10 and use C0 stored on the tape.

```
CHANNELS    1,3,4,10
```

Note that the use of the CHANNELS card does not require the user to determine the processing constants of the system or the constants required to calibrate the data. He is required to know the irradiance values (or percent reflectance) of the calibration sources used in the system and the numerical value he wants to assign to these measurements. At present, the characteristics of the sources are not known. What is significant here is that the user now has the ability to experiment with the data to determine these characteristics, to test hypothesized characteristics, or to use determined characteristics when they are known.

For more information concerning calibration, refer to LARS Information Note 071069, "Calibration of Scanner Data for Operational Processing Programs at LARS", by Terry L. Phillips.

Processing Function: HISTOGRAM

Key Word: END
Control Parameters:

Function: Indicates end of function control cards for the Histogram function.

Card Default: None. Card is required at the end of the Histogram function deck.

Control Parameters: None

Processing Function: IDPRINT

Key Word: *IDPRINT
Control Parameters:

Function: Function Selector Card for IDPRINT

Card Default: None; card is required to select the IDPRINT function.

Control Parameters: None

Processing Function: IDPRINT

Key Word: PRINT
Control Parameters: [RUN(xxxxxxxx) TAPE(xxx) ALL]

Function: Specifies ID records to be printed.

Card Default: None; card is required.

Control Parameters: (only one parameter may be used)

RUN(xxxxxxxx) - prints identification for run number xxxxxxxx from system runtable.

Default: None; another parameter must be entered.

TAPE(xxx) - prints all identification on Multispectral Image Storage Tape xxx.

Default: None, another parameter must be entered.

ALL - prints all identifications in system runtable.

Default: None; another parameter must be entered.

Processing Function: IDPRINT

Key Word: END
Control Parameters:

Function: Indicates end of function control cards for the Idprint function.

Card Default: None. Card is required at the end of the Idprint function deck.

Control Parameters: None

Processing Function: LINEGRAPH

Key Word: *LINEGRAPH
Control Parameters:

Function: Function Selector Card for LINEGRAPH.

Card Default: None; card is required to select the Linegraph function.

Control Parameters: None

Processing Function: LINEGRAPH

Key Word: PRINT
Control Parameters: RUN(n_1), LINE(n_2, n_3, n_4), COL(n_5, n_6, n_7)

Function: Designates location of data to be plotted.

Card Default: None; card is required.

Control Parameters:

RUN(n_1) - requests data from run number n_1.
Default: Plots data from the current run.

LINE(n_2,n_3,n_4) - designates a plot for each line n_2 through line n_3, with an interval of n_4 be printed.
Default: None; control parameter is required.

COL(n_5,n_6,n_7) - designates data from column n_5 through n_6 at an interval of n_7 from specified lines be plotted.
Default: None, control parameter is required

Processing Function: LINEGRAPH

Key Word: CHANNELS
Control Parameters: A(I/P,Q/,J/R,S/,...) ,B(K/W,X/,L/Y,Z),...),...

Function: Specifies channels to be used and controls the calibration of the data from the Multispectral Image Storage Tape.

Card Default: None; card is required to specify channels to be used.

Control Parameters:

A and B are calibration codes which indicate to the program how the channels in the parenthesis are to be calibrated. The table below shows what the codes select.

Calibration Code	Data Calibrated Using
1	C0
2	C1
3	C2
4	C0 and C1
5	C0 and C2
6	C1 and C2
7	Uncalibrated

In the general form of the CHANNELS card the integers I,J, K, and L are the channels selected. Channels I and J are to be calibrated using calibration code A while channels K and L are to be calibrated using calibration code B. The real numbers P, Q, R, S, W, X, Y, and Z are fixed calibration levels inserted for the channels they follow.

Several forms of the CHANNELS card may be used. If the user desires not to enter fixed levels into the system (use fixed levels from the tape), he can enter the card in the form:

```
CHANNELS  A(I,H,...),B(K,L,...)
```

If the user wants to assume a calibration code of 1 and the fixed level of C0 to be from the tape for all desired channels, a card can be used in the form:

```
CHANNELS  I,J,K,L,...
```

The example below shows a CHANNELS card that selects channels 1,3,4 and 10. The card also assigns calibration values for C0 (calibration code 1) to channels 1, 3 and 4. The value that is assigned is zero. The second expression on the card assigns both C0 and C1 values (calibration code 4) to channel 10. The C0 value is again zero and the C1 value is 800.

```
CHANNELS  1(1/0.0/,3/0/,4/0/) ,4(10/0,800/)
```

The following card will assume a calibration code of 1 for selected channels 1, 3, 4, and 10 and use C0 stored on the tape.

```
CHANNELS  1,3,4,10
```

Note that the use of the CHANNELS card does not require the user to determine the processing constants of the system or the constants required to calibrate the data. He is required to know the irradiance values (or percent reflectance) of the calibration sources used in the system and the numerical value he wants to assign to these measurements. At present, the characteristics of the sources are not known. What is significant here is that the user now has the ability to experiment with the data to determine these characteristics, to test hypothesized characteristics, or to use determined characteristics when they are know.

For more information concerning calibration, refer to LARS Information Note 071069, "Calibration of Scanner Data for Operational Processing Programs at LARS" by Terry L. Phillips.

Processing Function: LINEGRAPH

Key Word: SCALE
Control Parameters: XLOW (a), BINSIZ (b)

Function: Indicates the relative location and increments of the axes to be used in the plot.

Card Default: Parameter defaults are used.

Control Parameters:

XLOW(a) - Scale the low value of the x-axis to a.

Default: a = 32.0

BINSIZ(b) - scale bin increment of x-axis to b.

Default: b = 2.0

Processing Function: LINEGRAPH

Key Word: END
Control Parameters:

Function: Indicates end of function control cards for the Linegraph function.

Card Default: None. Card is required at the end of the Linegraph function deck.

Control Parameters: None

Processing Function: LISTRESULTS

Key Word: *LISTRESULTS
Control Parameters:

Function: Function Selector Card for LISTRESULTS.

Card Default: None; card is required to select the Listresults function.

Control Parameters: None

Processing Function: LISTRESULTS

Key Word: FROM
Control Parameters: TAPE(ttt),FILE(ff)

Function: Indicates to the LISTRESULTS processor which tape and file from which to list results file information.

Card Default: None. Card is required.

Control Parameters:

TAPE(ttt) - Tape number ttt will be used for listing. Scratch tapes (i.e.,ttt=0) are not valid as input.
Default - None. Parameter is required.

FILE(ff) - File number ff on tape ttt will be used for listing.
Default - If FILE(ff) is not specified then all files contained on tape ttt will be listed beginning with file 1.

Processing Function: LISTRESULTS

Key Word: END
Control Parameters:

Function: Indicates end of function control cards for the Listresults function.

Card Default: None. Card is required at the end of the Listresults function deck.

Control Parameters: None

Processing Function: MERGESTATISTICS

Key Word: *MERGESTATISTICS
Control Parameters: none

Function:

Select the MERGESTATISTICS function to modify and/or combine existing statistics files.

Card Default:

None; card is required to select the MERGESTATISTICS function.

Control Parameters:

None

Processing Function: MERGESTATISTICS

Key Word: PRINT
Control Parameters: FIELDS STATS COSPEC MEANS(CI,CJ) MEANS(CI,CJ,CK,CL)

Function: Specifies printed output for MERGESTATISTICS function.

Card Default: Control parameter defaults used.

Control Parameters:

FIELDS - Prints list of training fields.

Default: No training fields printed.

STATS - Prints a summary of statistics for each class included in the output statistics deck. Statistics include the means, standard deviations, and correlation matrices for the channels used.

Default: No statistics printed.

COSPEC - Prints a coincident spectral plot of all classes (including pools) contained in the modified statistics file.

Default: No coincident spectral plot is printed.

MEANS(CI,CJ) - Prints one bi-spectral plot of Channel I vs. Channel J.

Default: No bi-spectral plots printed.

MEANS(CI,CJ,CK,CL) - Prints one bi-spectral plot of the average of Channels I and J vs. the average of Channels K and L.

Default: No bi-spectral plots printed.

Processing Function: MERGESTATISTICS

Key Word: PUNCH
Control Parameters: (NONE) CHARACTERS ONEFIELD

Function: Requests punched Statistics Files.

Card Default: No punching.

Control Parameters:

(NONE) - Punches Statistics file in binary format.

Default: none

CHARACTERS - Punches Statistics file in character format.

Default: Binary format.

ONEFIELD - A single dummy Field Description Card is punched for each class of the modified statistics file.

Default: All Field Description Cards (from input decks) are punched.

NOTE: The new Statistics File will remain on user's temporary disk until user logs off or reinitializes LARSFRIS.

Processing Function: MERGESTATISTICS

Key Word: CHANNELS
Control Parameters: I,J....

Function:

Channels I,J.... are selected to be included in modified statistics file.

Card Default:

Channels common to all statistics deck are used.

Control Parameters:

Processing Function: MERGESTATISTICS

Key Word: CLASSES
Control Parameters: ENTIRE (D1, D2...) DELETE (DN/CI,CJ-CM,CN/,DM/CI,CJ,CK-CP/) INCLUDE (DN/CI,CJ-CM/,DM/CI,CJ,CK-CP,CQ/)

Function:

Specifies which classes from one or more input statistics files are to be used to create the modified statistics file.

Card Default:

This card is required with at least one parameter.

Control Parameters:

ENTIRE (D1,D2...) - All classes in decks D1,D2.-. are included in new Statistics File.

Default: None

DELETE(DN/CI,CJ-CM,CN/,DM/CI,CJ,CK-CP/) - Classes I, J through M and N of deck N and classes I, J, and K through P of deck M are to be deleted from new statistics file.

Default: None

INCLUDE (DN/CI,CJ-CM/,DM/CI,CJ,CK-CP,CQ/) - Classes I, J through M of deck N and classes I, J, K through P and Q of deck M are to be included in new statistics file.

Default: None

NOTE: Function can handle a maximum of 30 input decks with a maximum of 60 classes per deck. The deck numbers used must be within the range of 1 to 30 but need not be listed sequentially.

Processing Function: MERGESTATISTICS

Key Word: POOL
Control Parameters: NAME(DN/CI,CJ-CK,CP/,CM/CI,CK/)

Function:

Pools statistics from specified classes of input decks to create a new class in the modified statistics deck and assigns a name to this new class.

Card Default:

No pooling.

Control Parameters:

NAME(CN/CI,CJ-CK,CP/,CM/CI,CK/) - classes I, J through K and P of deck N and classes I and K of deck M are to be pooled to create a new class with name of 'NAME'. If a pool card is used, all desired pools and classes must be explicitly requested.

Default: None, control parameter is required if card is used.

Processing Function: MERGESTATISTICS

Key Word: DISK
Control Parameters: READSTATS

Function:

Indicates that the first Statistics File is to be read from disk.

Card Default:

All Statistics Files are to be read from cards.

Control Parameters:

READSTATS - Indicates that the first Statistics File will be read from disk.

Default: None; control parameter is required.

Processing Function: MERGESTATISTICS

Key Word: SCALE
Control Parameters: SPCLOW(D) SPCINT(E) ORIGIN(N,X.XX) UNIT(N,Y.YY)

Function: Rescales axis for printed coincident spectral plot or bi-spectral plot.

Card Default: Control parameter defaults are used.

Control Parameters:

SPCLOW(D) - Set low end (origin) of coincident spectral plot abscissa to D.

Default: D=0

SPCINT(E) - Set coincident spectral plot interval to E.

Default: E=1

ORIGIN(N,X.XX) - On the bi-spectral plot, this will set the origin for channel N to X.XX. If the plot is of four channels, i.e., means (CI,CJ,CK,CL), the origin for the left most channel will be used for each axis. E.g., If you are plotting ch. 3 & 4 vs. 8 & 7, the origin for ch. 3 will affect the plot, but, an origin for ch. 4 will not affect the plot. Similarly, an origin for ch. 8 will affect the plot, and an origin for ch. 7 will not affect the plot.

Default: X.XX = 0.00 for any channel plotted.

UNIT(N,Y.YY) - On the bi-spectral plot, this will set the interval for channel N to Y.YY. The left most channel per axis rule as explained above applies here also.

Default: Y.YY - 1.00 for any channel plotted.

Processing Function: MERGESTATISTICS

Key Word: DATA
Control Parameters: NONE

Function:

Indicates beginning of a Statistics Deck. Card follows the last function control card and is repeated in front of each Statistics Deck.

Card Default:

None; card is required at the beginning of each Statistics Deck.

Control Parameters:

None

Processing Function: MERGESTATISTICS

Key Word: None (Statistics File)
Control Parameters: None

Function: The deck of cards that make up the Statistics File has been produced by the CLUSTER, the STATISTICS, PUNCHSTATISTICS, or MERGESTATISTICS function. It is not punched by the user.

Card Default: None; at least one statistics deck is required by the function.

Control Parameters:

Format: The Statistics File contains a header card, several data cards and an end card. The header and end cards are described below. Consult the Statistics File description in the LARSFRIS System Manual for information on the contents of the other data cards. All cards in the deck are sequenced in columns 73 through 80. The first card is number 1, the data cards are numbered 2 to n-1, and the last card is numbered n, where n is the number of cards punched for the Statistics File.

Header Card

Columns	Description
1-33	LARSYS VERSION 3 STATISTICS FILE
34-39	blank
40	Flag = 1 for hexadecimal format = 0 for character format
41-72	blank
73-80	sequence number 1

MERGESTATISTICS
None (Statistics File)

End Card

Columns	Description
1- 3	EOS
4-15	blank
16-59	***** LAST CARD OF STATISTICS DECK *****
60-72	blank
73-80	sequence number n

Statistics Data Deck:

The Statistics Deck contains:

* Training field information.
* A record containing the numbers of classes, number of fields, and number of channels.
* Records containing the channel number, wavelength of the spectral band, and calibration code for each channel used.
* A record containing the number of points in each class.
* Records containing the mean for each channel for each class.
* Records containing the covariance matrix of all specified channels for each class.

Processing Function: MERGESTATISTICS

Key Word: END
Control Parameters: None

Function:

Indicates end of function control card deck for the MERGESTATISTICS function.

Card Default:

None; card is required at the end of the function deck.

Control Parameters:

Processing Function: PICTUREPRINT

Key Word: *PICTUREPRINT
Control Parameters:

Function: Function Selector Card for PICTUREPRINT.

Card Default: None; card is required to select the Pictureprint function.

Control Parameters: None

Processing Function: PICTUREPRINT

Key Word: DISPLAY
Control Parameters: RUN(n_1),LINE(n_2,n_3,n_4),COL(n_5,n_6,n_7) ,WIDTH(n_8)

Function: Defines portion of data to be displayed on the pictorial printout.

Card Default: Control parameter defaults used.

Control Parameters:

RUN(n_1) - requests data from run number n.

Default: The most recently specified run is used.

LINE(n_2,n_3,n_4) - pictorial printout includes data from line n_2 through line n_3 with an interval of n_4. If n_3 is greater than the number of lines in the run, the entire run is displayed.

Default: LINE(1, maximum line of run, n_4) where n_4 is identical with COL(n_7), calculated to produce the desired width display.

COL(n_5,n_6,n_7) - pictorial printout includes data from column n_5 through column n_6 with an interval of n_7.

Default: WIDTH(1) or COL(1, maximum column of run, n_7) is calculated to produce a single width display.

WIDTH (n_8) - an alternate way of selecting LINE(n_4) and COL(n_5,n_6,n_7). Parameter n_4 is calculated so that a printout n_8 sheets wide is generated. Maximum size of n_8 is determined by the size of the data being used.

Default: WIDTH(1)

Note: n_2 through n_8 must always have values less than 32,768.

Processing Function: PICTUREPRINT

Key Word: CHANNELS
Control Parameters: A(I/P,Q/,J/R,S/,...),B(K/W,X/,L/Y,Z/,...),...

Function: Specifies channels to be used and controls the calibration of the data from the Multispectral Image Storage Tape.

Card Default: None; card is required unless HISTOGRAM LEVELSCARDS is used.

Control Parameters:

A and B are calibration codes which indicate to the program how the channels in the parenthesis are to be calibrated. The table below shows what the codes select.

Calibration Code	Data Calibrated Using
1	C0
2	C1
3	C2
4	C0 and C1
5	C0 and C2
6	C1 and C2
7	Uncalibrated

In the general form of the CHANNELS card the integers I, J, K, and L are the channels selected. Channels I and J are to be calibrated using calibration code A while channels K and L are to be calibrated using calibration code B. The real numbers P, Q, R, S, W, X, Y, and Z are fixed calibration levels inserted for the channels they follow.

Several forms of the CHANNELS card may be used. If the user desires not to enter fixed levels into the system (use fixed levels from the tape), he can enter the card in the form:

```
CHANNELS    A(I,H,...),B(K,L,...)
```

If the user wants to assume a calibration code of 1 and the fixed level of C0 to be from the tape for all desired channels, a card can be used in the form:

```
CHANNELS    I,J,K,L,...
```

The example below shows a CHANNELS card that selects channels 1,3,4 and 10. The card also assigns calibration values for C0 (calibration code 1) to channels 1, 3 and 4. The value that is assigned is zero. The second expression on the card assigns both C0 and C1 values (calibration code 4) to channel 10. The C0 value is again zero and the C1 value is 800.

```
CHANNELS    1(1/0.0/,3/0/,4/0/),4(10/0,800/)
```

The following card will assume a calibration code of 1 for selected channels 1, 3, 4, and 10 and use C0 stored on the tape.

```
CHANNELS    1,3,4,10
```

Note that the use of the CHANNELS card does not require the user to determine the processing constants of the system or the constants required to calibrate the data. He is required to know the irradiance values (or percent reflectance) of the calibration sources used in the system and the numerical value he wants to assign to these measurements. At present, the characteristics of the sources are not known. What is significant here is that the user now has the ability to experiment with the data to determine these characteristics, to test hypothesized characteristics, or to use determined characteristics when they are known.

For more information concerning calibration, refer to LARS Information Note 071069, "Calibration of Scanner Data for Operational Processing Programs at LARS", by Terry L. Phillips.

Processing Function: PICTUREPRINT

Key Word: SYMBOLS
Control Parameters: $S_1, S_2, S_3, \ldots$ NLEV(n_1)

Function: Specifies symbols to be used for gray scale print, assigned in order of increasing brightness.

Card Default: Preprogrammed symbols used. These are listed below.

Control Parameters:

$S_1, S_2, S_3, \ldots$ - use symbols $S_1, S_2, S_3, \ldots$ for the gray scale print, assigned in order of increasing brightness.

Default: NLEV(10)

Note: A maximum of 16 symbols may be specified. The number of symbols specified overrides the NLEV(n) option. Do not specify both NLEV and user-supplied symbols.

Number of Symbols	Programmed Symbols
2	M,b
3	M,*,b
4	M,Z,=,b
5	M,H,I,=,b
6	M,H,I,=,-,b
7	M,H,Z,I,=,-,b
8	M,O,H.X,I,=,-,b
9	M,O,H,X,I,/,=,-,b
10	M,$,X,Z,*,I,/,=,-,b
11	M,$,O,H,S,*,I,/,=,-,b
12	M,$,O,H,S,Z,*,I,/,=,-,b
13	M,B,G,V,*,L,/,=,,,',.,-,b
14	M,Q,D,F,V,*,L,/,=,,,',.,-,b
15	M,Q,B,D,G,V,*,L,/,=,,,',.,-,b
16	M,Q,B,D,G,F,V,*,L,/,=,,,',.,-,b

NLEV(n_1) - the number of preprogrammed symbols will be set to n_1, for n_1 between 2 and 16.

Default: NLEV(10)

Processing Function: PICTUREPRINT

Key Word: HISTOGRAM
Control Parameters: [COMPUTE DISK HISTOCARDS LEVELSCARDS]

Function: Specifies the method of histogramming the data to be used to provide equally active symbols.

Card Default: HISTOGRAM COMPUTE

Control Parameters: Only one parameter may be selected:

COMPUTE - calculate the histogram from data specified via BLOCK card.

Default: COMPUTE is the default.

DISK - a previously calculated histogram stored on the temporary disk will be used to set symbol bins. A previous HISTOGRAM, or PICTUREPRINT function run within the current session will store a histogram.

Default: COMPUTE

HISTOCARDS - histogram data cards are read for each channel processed.

Default: COMPUTE

LEVELSCARDS - data cards that define the channels, calibration, and levels are read and used for the pictorial printout.

Default: COMPUTE

Processing Function: PICTUREPRINT

Key Word: BLOCK
Control Parameters: $RUN(n_1),LINE(n_2,n_3,n_4),COL(n_5,n_6,n_7)$

Function: Defines area to be histogrammed prior to generating the pictorial map.

Card Default: Control parameter defaults used.

Control Parameters:

$RUN(n_1)$ - requests data from run number n_1.

Default: The run specified on the DISPLAY card.

$LINE(n_2,n_3,n_4)$ - histogram includes data from line n_2 through line n_3 with an interval of n_4. If n_3 is greater than the number of lines in the run, the entire run is histogrammed.

Default: LINE parameter specified on DISPLAY card with interval of 10.

$COL(n_5,n_6,n_7)$ - histogram includes data from column n_5 through column n_6 with an interval of n_7.

Default: COL parameter specified on DISPLAY card with interval of 10.

Note: n_2 through n_7 must always have values less than 32,768.

Processing Function: PICTUREPRINT

Key Word: PRINT
Control Parameters: HIST

Function: Causes graphs of histograms to be printed.

Card Default: Specified output will not be printed.

Control Parameters:

HIST - Graphs of the histograms of all channels specified on CHANNELS card will be printed.

Default: Histogram graphs will not be printed.

Processing Function: PICTUREPRINT

Key Word: PUNCH
Control Parameters: HIST

Function: Specifies card punching to be performed.

Card Default: No punching.

Control Parameters:

HIST - The Histogram File is punched. This file indicates the calibration code and the current stored histogram for each channel selected.

Processing Function: PICTUREPRINT

Key Word: BOUNDARY
Control Parameters: [DELETE STORE OUTLINE]

Function: Deletes, stores, and/or outlines training and test field boundaries.

Card Default: No changes made in stored boundaries; boundaries are not outlined on pictorial printout.

Control Parameters:

DELETE - deletes all previously stored boundaries for training and test fields.

Default: all stored boundaries are retained.

STORE - reads Field Description Cards in a data deck and stores them or adds them to previously stored boundaries. A maximum of 200 training and 600 test fields can be stored.

Default: No new boundaries are stored.

OUTLINE - outlines on the pictorial printout the training and test fields which have been or were stored.

Default: No boundaries outlined.

Processing Function: PICTUREPRINT

Key Word: DATA
Control Parameters: None

Function: Indicates beginning of a group of data cards.

Card Default: None; card is required at beginning of each data deck. The format of these data decks is described on the following pages.

Data Decks:

(1) If BOUNDARY STORE was specified, Field Description Cards are required. Test fields should follow a card with 'TEST' starting in Column 1 while training fields should follow a card with 'CLASS' starting in column 1.

(2) If HISTOGRAM HISTOCARDS was specified, the histogram deck must be supplied as punched by PICTUREPRINT or HISTOGRAM.

(3) If HISTOGRAM LEVELSCARDS was specified, a Levels card for each channel to be displayed is required.

Note: When multiple data checks are required, the two permissable orders are: Deck 1, Deck 2, or Deck 1, Deck 3.

Processing Function: PICTUREPRINT

Key Word: None (Field Description Cards, form 1)
Control Parameters: None

Function: Field Description Cards (Form 1)

Defines run number and coordinates of an area.

Card Default: Not applicable.

Format: Each card is formatted:

$$RUN(n_1),LINE(n_2,n_3,n_4),COL(n_5,n_6,n_7)$$

where:

$RUN(n_1)$ - data is located in run number n_1.

Default: None; parameter is required.

$LINE(n_2,n_3,n_4)$ - n_2 is the starting line number; n_3 is the ending line number; and n_4 is the line interval.

Default: None; parameter is required.

$COL(n_5,n_6,n_7)$ - n_5 is the left-most column number; n_6 is the right-most column number; n_7 is the column interval.

Default: None; parameter is required.

Processing Function: PICTUREPRINT

Key Word: None (Field Description Cards, form 2)
Control Parameters: None

Function: Field Description Cards (Form 2)

Defines run number and coordinates of an area.

Card Default: Not applicable.

Format: Each card is formatted as shown below.

	Column	Required Parameter
*Run Number	1-8	YES
Field Designation	11-18	NO
*First Line	21-25	YES
*Last Line	26-30	YES
*Line Interval	31-35	YES
*First Sample	36-40	YES
*Last Sample	41-45	YES
*Sample Interval	46-50	YES
Class Name	51-58	NO
Other Information	59-80	NO

*These parameters can be entered anywhere (without embedded blanks) in the columns listed; i.e., right or left justified. Also these parameters are required on the card as they have no program defaults. The other parameters can be left blank and also have no defaults.

Processing Function: PICTUREPRINT

Key Word: None (Histogram File)
Control Parameters: None

Function: Histogram File

This deck of cards is produced by the Pictureprint and Histogram functions, and is never punched by the user.

Card Default: Required when HISTOGRAM HISTOCARDS is specified.

Format: The Histogram File contains a header card identifying the area that was histogrammed, nine different types of data cards, and an END card. The header and end cards are described below. Consult the Histogram File description in the LARSFRIS System Manual for information on the contents of the other cards.

The Header Card

The header card contains the words "LARS HISTO" in the first ten columns and the following in the succeeding columns:

$RUN(n_1)$, $LINE(n_2,n_3,n_4)$, $COL(n_5,n_6,n_7)$, n_8

These indicate the following:

$RUN(n_1)$ - data histogrammed is from run number 1.

$LINE(n_2,n_3,n_4)$ - data histogrammed began with line number n_2 and ended at line number n_3 with an interval of n_4.

$COL(n_5,n_6,n_7)$ - data histogrammed began with column number n_6 and ended at column number n_6 with an interval of n_7.

n_8 - the sequence number of this card is n_8.

The End Card

The last card in the histogram deck contains the following identification.

Columns	
1 to 3	"EOH"
16 to 63	***** LAST DATA CARD OF HISTOGRAM DECK *****
73 to 80	The sequence number of the card.

Processing Function: PICTUREPRINT

Key Word: None (Levels Cards)
Control Parameters: None

Function: LEVELS CARDS

Determines histogram levels arbitrarily without actually histogramming data.

Card Default: None; required when HISTOGRAM LEVELSCARDS is used.

Format:

Each card is formatted:

CHAN(n), CALIB(z), x_1, x_2, x_3, ...

where;

CHAN(n) = channel number n. The n for each levels card must be the next number in sequence on CHANNELS card if there is a CHANNELS card.

Default - None; a parameter is required.

CALIB(z) = calibration code z requested.

Default - None; parameter is required.

x_1, x_2, x_3, ... = x_1 is the upper limit of the first histogram bin, x_2 the upper limit of the second bin, and so on.

Default - None; parameter is required.

NOTE: The group of Levels card are arranged as follows:

Levels card(s) - one per channel

These cards must be input in ascending order by channel number. The number of levels on these cards will override the SYMBOLS card or its defaults for the number of levels.

Processing Function: PICTUREPRINT

Key Word: END
Control Parameters:

Function: Indicates end of function control cards for the Pictureprint function.

Card Default: None. Card is required at the end of the Pictureprint function deck.

Control Parameters: None

Processing Function: PRINTRESULTS

Key Word: *PRINTRESULTS
Control Parameters:

Function: Function Selector Card for PRINTRESULTS.

Card Default: None; card is required to select the Printresults function.

Control Parameters: None

Processing Function: PRINTRESULTS

Key Word: RESULTS
Control Parameters: TAPE(ttt), FILE(ff) DISK

Function: Indicates the location of the Classification Results File that is to be processed.

Card Default: None. Card is required with at least the FILE or DISK parameter.

Control Parameters:

TAPE(ttt) - ttt is the tape number containing the Classification Results File. TAPE(0) indicates a scratch tape.

Default: ttt = 0 (applies only when FILE is used)

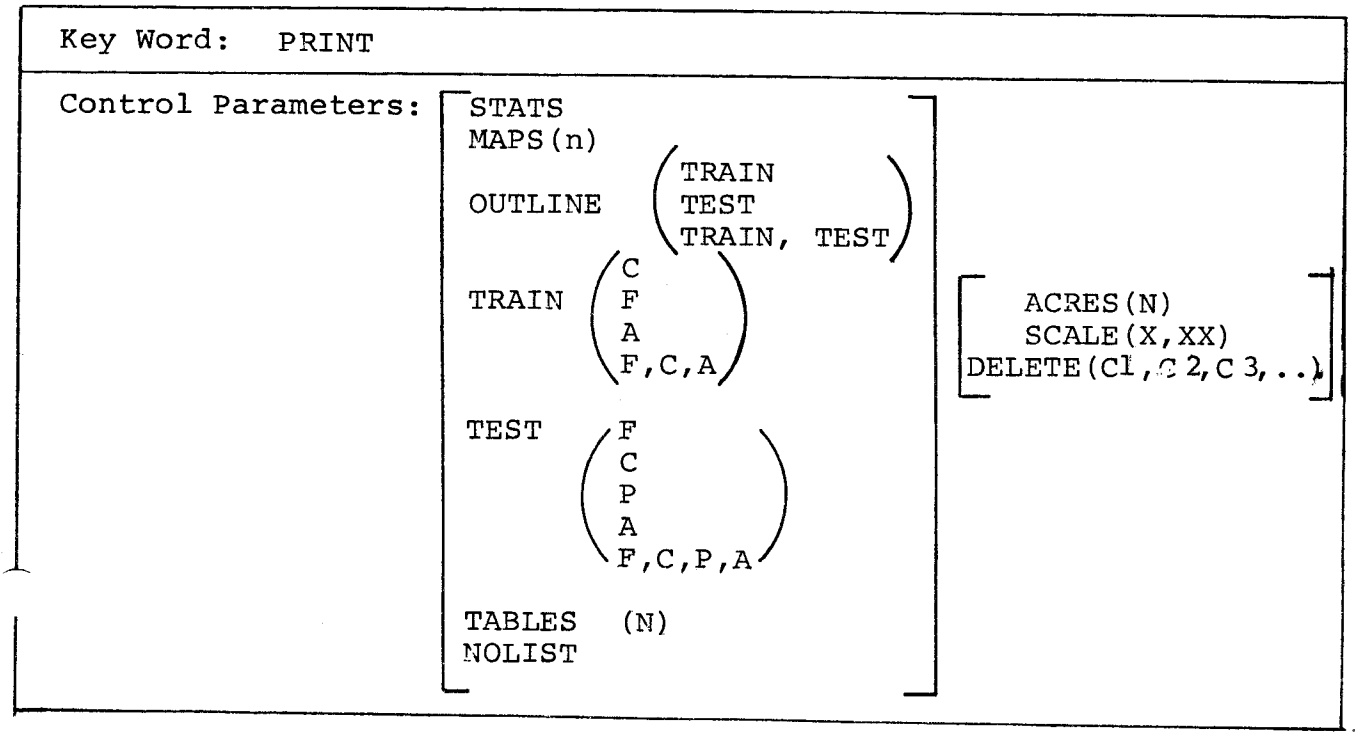
FILE(ff) - ff is the file number on the tape which contains the Classification Results File.

Default: None. Required if Classification Results File is on tape.

DISK - Indicates that the Classification Results File is on disk (created by an earlier CLASSIFYPOINTS execution).

Default: None. Required if the Classification Results File is on disk.

Processing Function: PRINTRESULTS



Function: Specifies printed output desired. Indicates which results tables are to be printed. Output includes channels used, classes, number of samples classified into each class, percentages of samples classified into each class, and an overall performance rating.

Card Default: All control parameter defaults.

Control Parameters:

STATS - prints means standard deviations and correlation matrices for the classes and channels used in the classification.

Default: No statistics printed.

MAPS(n) - print n copies of classification map.

Default: n = 1

OUTLINE(TRAIN)
OUTLINE (TEST)
OUTLINE
(TRAIN,TEST) - outline on the classification map, the training fields, test fields, or both training and test fields.

Default: No fields outlined.

TRAIN(C)
TRAIN(F)
TRAIN(A)
TRAIN(F,C,A) - Print the performance tables (1) for the training classes, (2) for the training fields, (3) for the training fields (tables of acres and hectares), or (4) for both the training fields and classes, plus tables of acres and hectares.

Default: No tables printed for training classes or fields.

TEST(F)
TEST(C)
TEST(A)
TEST(P)
TEST(F,C,P,A)- Print the (1) performance table for the test fields, (2) performance table for the test classes, (3) acres and hectares tables for test fields, (4) percentage table for the test fields, or (5) all of those mentioned.

Default: No tables printed for test results.

TABLES(n) - Print n copies of all requested tables.

Default: TABLES(1) - prints one copy of each requested table.

NOLIST - Suppress training field listings.

Default: Training fields are listed on printed output.

ACRES(n) - Total number of acres in area represented by points tabulated.

Default: Use SCALE factor.

SCALE(XX.X) - Conversion factor from pixels to acres.

Default: Scale is 1 pixel = 1.15 acres.

DELETE(C1,C2,...) - Delete classes C1,C2,... from acreage calculations.

Default: All classes used.

Processing Function: PRINTRESULTS

Key Word: SYMBOLS
Control Parameters: $S_1,S_2,S_3,\ldots$ $n_1*S_1,n_2*S_2,n_3*S_3,\ldots$

Function: Assigns symbols designated to the classification classes in the order that they exist in the classification.

Card Default: None; card is required unless MAPS(0) option is taken.

Control Parameters:

Format 1:

$S_1,S_2,S_3,\ldots$ - symbol S_1 is assigned to the first classification class; symbol S_2 is assigned to the second class, and so on. Symbols are limited to single alphanumerics. A blank is a valid symbol.

Default: None. Either this symbol designation or the one below is required.

Format 2:

$n_1*S_1,n_2*S_2,\ldots$ - optional form for symbol designation when more than one class can be represented by the same symbol. $n_1,n_2,n_3,\ldots$ are integers specifying the number of consecutive classes to be assigned to the same symbol. Thus 3*A is the same as A,A,A.

Default: None. Either this symbol designation or the one above is required.

Processing Function: PRINTRESULTS

Key Word: PROBABILITY
Control Parameters: R1, R2, . . .

Function: Use the values for each pixel which relate to the probability of correct classification instead of the assigned class numbers.

Card Default: Print classification results based on assigned class numbers.

Control Parameters:

R1, R2, . . . - R1, R2, . . . define ranges of "percent probability of correct classification" into which the pixels will be divided. R1, R2, . . . are the lower bounds on these ranges. For example, the first range would include points with a "probability of correct classification" in the range R1% to 100%, the second range would be assigned points with values from R2% up to (but not including) R1%, etc.

Default: 8 preset ranges
80,60,45,30,20,10,3,0

Processing Function: PRINTRESULTS

Key Word: PSYMBOLS
Control Parameters: P1, P2, . . .

Function: Assign symbols to the "probability ranges" specified on the PROBABILITY card.

Card Default: 8 preset symbols
M, X, O, I, /, -, ., ∅

Control Parameters:

P1, P2, . . . - Assign symbol P1 to range R1% to 100%, symbol P2 to range R2% to R1%, etc... where R1, R2, . . . were specified on a PROBABILITY card.

Processing Function: PRINTRESULTS

Key Word: THRESHOLD
Control Parameters: $x_1, x_2, x_3, \ldots$ $n_1 * x_1, n_2 * x_2, n_3 * x_3, \ldots$

Function: Indicates threshold value to be used for each class or pool defined in the classification. Thresholded points are represented by blanks on the display map.

Card Default: No thresholding used.

Control Parameters:

Format 1:

$x_1, x_2, x_3, \ldots$ - decimal numbers here designate the equivalent percentage of points that is expected to be thresholded in each class respectively. Thresholds must be specified for each class or pool.

Format 2:

$n_1 * x_1, n_2 * x_2, n_3 * x_3, \ldots$ - an alternate way of expressing the thresholding when the same percentage of points is expected to be thresholded from more than one consecutive class; $n_1, n_2, n_3, \ldots$ are integers indicating the numbers of consecutive classes to be assigned the same threshold value; $x_1, x_2, x_3, \ldots$ are decimal equivalents of the percentage of points expected to be thresholded.

Thus, 2*7.5,3*2.9,1.5 and
7.5,7.5,2.9,2.9,1.5 have the same effect

Default: None. One of the above forms of the parameter is required.

Processing Function: PRINTRESULTS

Key Word: GROUP
Control Parameters: name(k_1/n_1, n_2, n_3, .../), name(k_2/n_4, n_5, n_6, .../), ...

Function: Groups classes (or pooled classes from the classification for display and calculation purposes; assigns group name and number.

Card Default: No grouping

Control Parameters:

name(k_1/n_1, n_2, n_3, .../) - groups classes numbered n_1, n_2, n_3, ... and assigns the number k_1 and the name "name" to the group. The group name may be up to 8 characters long; group numbers must be assigned consecutively, that is, 1, 2, 3, ...; class numbers are classification pool numbers from CLASSIFYPOINTS. Any classes not included in the GROUP card are assigned group numbers $k_i + 1$, $k_i + 2$, ... where k_i is the highest group number on the GROUP card.

Default: None; parameter is required.

Processing Function: PRINTRESULTS

Key Word: BLOCK
Control Parameters: RUN(n_1),LINE(n_2,n_3,n_4),COL(n_5,n_6,n_7) [,CALC]

Function: Identifies a portion of the classified area to be used for map display and/or for performance calculations.

Card Default: Entire area is displayed and/or used for performance calculations.

Control Parameters:

RUN(n_1) - data from run number n_1 will be displayed.

Default: None; parameter is required.

LINE(n_2,n_3,n_4) - every n_{4th} line beginning with the n_{2nd} line and ending at the n_{3rd} line will be displayed.

Default: None; parameter is required.

COL(n_5,n_6,n_7) - every n_{7th} column beginning with the n_{5th} column and ending at the n_{6th} column will be displayed.

Default: None; parameter is required.

CALC - calculate performance and percentage results for only that part of the classification defined by the control parameters on the BLOCK card.

Default: Performance calculations are based on the entire area classified.

Processing Function: PRINTRESULTS

Key Word: DATA
Control Parameters: None

Function: Indicates that a data deck is to follow.

Card Default: Required to precede the test field data deck. This data deck is required if any of the following PRINT card control parameters are specified:

OUTLINE(TEST), TEST(F), TEST(C), TEST(P), TEST(F,C,P)

Data Deck: PRINTRESULTS has one data deck, the test field deck, which has two kinds of cards, the TEST card and the Field Description Cards. The TEST card precedes a set of Field Description Cards and specifies those areas as the test class defined on the TEST card. There may be as many sets of TEST and Field Description Cards as there are groups (or if no GROUP card was used, classification pools). The TEST card is of the form: 'TEST' in columns 1-4 followed by one or more blanks followed by the group number (or class number if no grouping was used).

The arrangement of the deck follows:

TEST n1
    field description cards (of either form) for test group n1

TEST n2
    field description cards for test group n2

Processing Function: PRINTRESULTS

Key Word: None (Field Description Cards, form 1)
Control Parameters: None

Function: Field Description Cards (Form 1)
Defines run number and coordinates of an area.

Card Default: Not applicable.

Format: Each card is formatted:

$$RUN(n_1),LINE(n_2,n_3,n_4),COL(n_5,n_6,n_7)$$

where:

$RUN(n_1)$ - data is located in run number n_1.

Default: None; parameter is required.

$LINE(n_2,n_3,n_4)$ - n_2 is the starting line number; n_3 is the ending line number; and n_4 is the line interval.

Default: None; parameter is required.

$COL(n_5,n_6,n_7)$ - n_5 is the left-most column number; n_6 is the right-most column number; n_7 is the column interval.

Default: None; parameter is required.

Processing Function: PRINTRESULTS

Key Word: None (Field Description Cards, form 2)
Control Parameters: None

Function: Field Description Cards (Form 2)

Defines run number and coordinates of an area.

Card Default: Not applicable.

Format: Each card is formatted as shown below.

	Column	Required Parameter
*Run Number	1-8	YES
Field Designation	11-18	NO
*First Line	21-25	YES
*Last Line	26-30	YES
*Line Interval	31-35	YES
*First Sample	36-40	YES
*Last Sample	41-45	YES
*Sample Interval	46-50	YES
Class Name	51-58	NO
Other Information	59-80	NO

*These parameters can be entered anywhere (without embedded blanks) in the columns listed; i.e., right or left justified. Also these parameters are required on the card as they have no program defaults. The other parameters can be left blank and also have no defaults.

Processing Function: PRINTRESULTS

Key Word: END
Control Parameters:

Function: Indicates end of function control cards for the Printresults function.

Card Default: None. Card is required at the end of the Printresults function deck.

Control Parameters: None

Processing Function: PUNCHSTATISTICS

Key Word: *PUNCHSTATISTICS
Control Parameters:

Function: Function Selector Card for PUNCHSTATISTICS.

Card Default: None; card is required to select the Punchstatistics function.

Control Parameters: None

Processing Function: PUNCHSTATISTICS

Key Word: FROM
Control Parameters: TAPE(ttt),FILE(ff)

Function: Indicates to the PUNCHSTATISTICS function which tape and file from which to punch the statistics deck.

Card Default: None. Card is required.

Control Parameters:

TAPE(ttt) - Tape number ttt will be used for punching. Scratch tapes (i.e., ttt=0) are not valid as input.
Default - None. Parameter is required.

FILE(ff) - File number ff on tape ttt will be used for punching. Only one file may be processed.
Default - None. Parameter is required.

Processing Function: PUNCHSTATISTICS

Key Word: PRINT
Control Parameters: NOLIST

Function: Suppress printing the Classification Results File ID Listing on the line printer. Only the control cards will be listed along with the tapes and files used.

Card Default: The Classification Results File ID Listing, containing tape number, file number, channels, classes, calibration codes and values, and number of lines classified will be printed.

Control Parameters:

NOLIST - Suppress printing of all results file information on the line printer.

Processing Function: PUNCHSTATISTICS

Key Word: END
Control Parameters:

Function: Indicates end of function control cards for the Punchstatistics function.

Card Default: None. Card is required at the end of the Punchstatistics function deck.

Control Parameters: None

Processing Function: RATIOMEANS

Key Word: *RATIOMEANS
Control Parameters: NONE

Function: Select the RATIOMEANS function.

Card Default: None; card is required to select the RATIOMEANS function.

Control Parameters: None

Processing Function: RATIOMEANS

Key Word: FROM
Control Parameters: DISK CARDS TAPE (TTT), FILE (FF)

Function: Indicates to the RATIOMEANS function the location of the LARSFRIS statistics file to be used.

Card Default: The statistics file is expected from DISK. These statistics must have been calculated during the present LARSFRIS session or saved from a previous terminal session. In the latter case, the 'statdeck use' command should be entered before executing the RATIOMEANS functions.

Control Parameters:

DISK - Indicates that the statistics file is to be read from disk.
Default: Statistics are expected from disk.

CARDS - Indicates that the statistics file is to be read from cards.
Default: Statistics are expected from disk.

TAPE (TTT), FILE (FF) - Indicates that the statistics file is to be read from a classification results tape (TTT) and file (FF)

---

* If the TAPE (TTT) control parameter is specified, the FILE(FF) also has to be included. Otherwise, an error message E590 will be printed both at the terminal and the printer outputs.

Processing Function: RATIOMEANS

Key Word: OPTIONS
Control Parameters: VIS (I, J, L, ...) IR (I, J, L, ...)

Function: Selects the channels to be treated as visible (VIS) and infrared (IR).

Card Default: The first two channels in the statistics file are treated as visible and the second two channels are treated as infrared.

Control Parameters:

VIS (I,J,L, ...) - Specifies the channels to be treated as visible (numerator of the ratio fraction).
Default: The first two channels in the statistics file are treated as visible.*

IR (I,J,L, ...) - Specifies the channels to be treated as infrared (denominator of the ratio fraction).
Default: The second two channels in the statistics file are treated as infrared.*

---

* Both the VIS (I,J,L, ...) and IR (I,J,L, ...) options have to be specified. If only one of these two options is specified, then the following message will be printed at the terminal: "ONLY ONE OPTION SPECIFIED PLEASE TYPE OPTIONS CARD FOR VIS OR IR OPTION", whichever is missing.

Processing Function: RATIOMEANS

Key Word: SYMBOLS
Control Parameters: S1, S2, ...

Function: Assigns symbols to each class in the statistics file.

Card Default: Preprogrammed symbols are used. These symbols are listed below.

Control Parameters: S1, S2, ... - Use symbols S1, S2, ... to designate classes 1,2, ... respectively.

NOTE: These are 30 preprogrammed symbols:

SYMBOL	CLASS #
A	1
B	2
C	3
.	.
.	.
.	.
X	24
Y	25
Z	26
$	27
+	28
=	29
/	30

Processing Function: RATIOMEANS

Key Word: PRINT
Control Parameters: NOLIST

Function: Specifies printing of the classification results file information when the statistics are expected from a classification results tape.

Card Default: The classification results file information is not printed.

Control Parameters: NOLIST - Suppresses printing of the classification results file information.

Default: The classification results file information is printed.

Processing Function: RATIOMEANS

Key Word: NORATIOS
Control Parameters: NONE

Function: Suppresses all calculations and specifies the transfer of the statistics file from either cards or classification results tape to the user's D disk.

Card Default: All calculations are performed.

Control Parameters: None.

Processing Function: RATIOMEANS

Key Word: DATA
Control Parameters: NONE

Function: Indicates beginning of statistics file and it must precede the first card of the statistics data file.

Card Default: None; card is required at the beginning of the statistics file.

Control Parameters: None.

Processing Function: RATIOMEANS

Key Word: NONE (STATISTICS FILE)
Control Parameters:

End Card

Columns	Description
1-3	EOS
4-15	blank
16-59	***** LAST CARD OF STATISTICS DECK *****
60-72	blank
73-80	sequence number n

Statistics Data Deck:

The LARSFRIS Version 3.1 Statistics Deck contains:

* Training field information.
* A record containing the numbers of classes, number of fields, and number of channels.
* Record containing the channel number, wavelength of the spectral band, and calibration code for each channel used.
* A record containing the number of points in each class.
* Records containing the means for each channel for each class.
* Records containing the convariance matrix of all specified channels for each class.

RATIOMEANS
None (Statistics File)

End Card

Columns	Description
1-3	EOS
4-15	blank
16-59	***** LAST CARD OF STATISTICS DECK *****
60-72	blank
73-80	sequence number n

Statistics Data Deck:

The LARSFRIS Version 3.1 Statistics Deck contains:

* Training field information.
* A record containing the numbers of classes, number of fields, and number of channels.
* Records containing the channel number, wavelength of the spectral band, and calibration code for each channel used.
* A record containing the number of points in each class.
* Records containing the mean for each channel for each class.
* Records containing the convariance matrix of all specified channels for each class.

Processing Function: RATIOMEANS

Key Word: END
Control Parameters: NONE

Function: Indicates end of function control card deck.

Card Default: None; card is requred at the end of the function control card deck.

Control Parameters: None.

Processing Function: SAMPLECLASSIFY

Key Word: *SAMPLECLASSIFY
Control Parameters:

Function: Function Selector Card for SAMPLECLASSIFY.

Card Default: None; card is required to select the Sampleclassify function.

Control Parameters: None

Processing Function: SAMPLECLASSIFY

Key Word: PRINT
Control Parameters: STATS

Function: Print saved reduced statistics.

Card Default: Control parameter default used.

Control Parameters:

STATS - prints a summary of the statistics for each class used in the classification. Statistics include the means, standard deviations, and correlation matrices for the channels used.

Default: No statistics printed.

Processing Function: SAMPLECLASSIFY

Key Word: CHANNELS
Control Parameters: A(I/P,Q/,J/R,S/,...),B(K/W,X/,L/Y,Z),...),...

Function: Specifies channels to be used and controls the calibration of the data from the Multispectral Image Storage Tape.

Card Default: None; card is required to specify channels to be used.

Control Parameters:

A and B are calibration codes which indicate to the program how the channels in the parenthesis are to be calibrated. The table below shows what the codes select:

Calibration Code	Data Calibrated Using
1	C0
2	C1
3	C2
4	C0 and C1
5	C0 and C2
6	C1 and C2
7	Uncalibrated

In the general form of the CHANNELS card the integers I, J, K, and L are the channels selected. Channels I and J are to be calibrated using calibration code A while channels K and L are to be calibrated using calibration code B. The real numbers P, Q, R, S, W, X, Y, and Z are fixed calibration levels inserted for the channels they follow

Several forms of the CHANNELS card may be used. If the user desires not to enter fixed levels into the system (use fixed levels from the tape), he can enter the card in the form:

```
CHANNELS    A(I,H,...),B(K,L,...)
```

If the user wants to assume a calibration code of 1 and the fixed level of C0 to be from the tape for all desired channels, a card can be used in the form:

```
CHANNELS    I,J,K,L,...
```

The example below shows a CHANNELS card that selects channels 1,3,4 and 10. The card also assigns calibration values for C0 (calibration code 1) to channels 1, 3 and 4. The value that is assigned is zero. The second expression on the card assigns both C0 and C1 values (calibration code 4) to channel 10. The C0 value is again zero and the C1 value is 800.

```
CHANNELS    1(1/0.0/,3/0/,4/0/),4(10/0,800/)
```

The following card will assume a calibration code of 1 for selected channels 1, 3, 4, and 10 and use C0 stored on the tape.

```
CHANNELS    1,3,4,10
```

Note that the use of the CHANNELS card does not require the user to determine the processing constants of the system or the constants required to calibrate the data. He is required to know the irradiance values (or percent reflectance) of the calibration sources used in the system and the numerical value he wants to assign to these measurements. At present, the characteristics of the sources are not known. What is significant here is that the user now has the ability to experiment with the data to determine these characteristics, to test hypothesized characteristics, or to use determined characteristics when they are known.

For more information concerning calibration, refer to LARS Information Note 071069, "Calibration of Scanner Data for Operational Processing Programs at LARS", by Terry L. Phillips.

Processing Function: SAMPLECLASSIFY

Key Word: CARDS
Control Parameters: READSTATS

Function: Specifies that a Statistics File punched by STATISTICS will be included in this group of function control cards.

Card Default: Statistics are expected from the disk, they must have been calculated previously in this LARSFRIS session o. saved from a previous terminal session. In the latter case, the 'statdeck use' command must have been typed before executing the present input deck.

Control Parameters:

READSTATS - Read statistics deck from cards.

Default: None; the parameter is required.

Processing Function: SAMPLECLASSIFY

Key Word: CLASSES
Control Parameters: name $(k_1/n_1, n_2, n_3, .../)$,..... $n_1, n_2, n_3, ...$

Function: Groups training classes, pools statistics, and assigns a name and number to the pools; also used to select a subset of those classes defined in the Statistics File.

Card Default: All classes defined in the Statistics File are used in the classification.

Control Parameters: Either of the two forms of this card may be used, but they may not both be used for a single execution of the function.

Form 1:

Name $(k_1/n_1, n_2, n_3, .../)$ - groups training classes numbered n_1, n_2, n_3, ...; pools the statistics in pool number k_1 which is assigned the name "name". The pool name may be up to 8 characters long; the pool numbers must be specified consecutively, that is, 1, 2, 3, ...; class numbers are those previously assigned in the Statistics function.

Default: No pooling of classes.

Form 2:

n_1, n_2, n_3, ... - training classes numbered n_1, n_2, n_3, ... will be used for classification. This simpler alternative form of the CLASSES card is used when no pooling is required; a subset of the classes defined in the Statistics File is selected and those classes not specified on the card are deleted from further consideration. When this form of the CLASSES card is used, the pool numbers are assigned to the chosen classes in consecutive order beginning with one even though no classes have been statistically pooled.

Default: All classes are used.

Note: If one or more CLASSES cards are used, all classes not explicitly mentioned on the CLASSES cards will be deleted from further consideration and not used in the classification.

Processing Function: SAMPLECLASSIFY

Key Word: GROUP
Control Parameters: name(k_1/n_1, n_2, n_3,.../), name(k_2/n_4, n_5, n_6,.../),...

Function: Groups classes (or pooled classes) for calculating correct recognition; assigns group name and group number.

Card Default: No grouping.

Control Parameters:

name(k_1/n_1, n_2, n_3,.../) - groups classes numbered n_1, n_2, n_3,... and assigns the number k_1 and the name "name" to the group. The group name may be up to 8 characters long; group numbers must be assigned consecutively, that is 1, 2, 3, ...; class numbers are pool numbers assigned by the CLASSES card if used, otherwise they are the class numbers defined in the Statistics File; any classes not included in the GROUP card are automatically assigned numbers $k_n + 1$, $k_n + 2$... where k_n is the highest number on the GROUP card.

Default: None; parameter is required.

Processing Function: SAMPLECLASSIFY

Key Word: DATA
Control Parameters: None

Function: Indicates the presence of data cards in the input deck.

Card Default: Required in front of each deck of data cards.

Data Decks: SAMPLECLASSIFY will accept two different input data decks, the Statistics File on cards, and Field Description Cards that define the fields to be classified. The Statistics File is optional. If it is present, it must precede the Field Description Cards.

The Field Description Cards are always required and are grouped so that each set of cards belonging to a class, pooled class, or performance group is preceded by a TEST card. The TEST card has the word 'TEST' in the first four columns, followed by a blank and the number of the class, pooled class or group. Either form of the Field Description Card may be used.

Processing Function: SAMPLECLASSIFY

Key Word: none (Statistics File)

Control Parameters:

None

Function: Statistics File

This deck of cards is produced by the Statistics or Punchstatistics functions and is never punched by the user.

Card Default: Required when 'CARDS READSTATS' is specified.

Format: The Statistics File contains a header card, several data cards and an end card. The header and end cards are described below. Consult the Statistics File description in the LARSFRIS System Manual for information on the contents of the other data cards. All cards in the deck are sequenced in columns 73 through 80. The first card is number 1, the data cards are numbered 2 to n-1, and the last card is numbered n, where n is the number of cards punched for the Statistics File.

Header Card

Columns	Description
1-33	LARSYS VERSION 3 STATISTICS FILE
34-39	blank
40	flag = 1 for hexadecimal format = 0 for character format
41-72	blank
73-80	sequence number 1

End Card

Columns	Description
1-3	E05
4-15	blank
16-59	*****bb LAST CARD OF STATISTICS DECKbb *****
60-72	blank
73-80	sequence number n

Processing Function: SAMPLECLASSIFY

Key Word: None (Field Description Cards, form 1)
Control Parameters: None

Function: Field Description Cards (Form 1)

Defines run number and coordinates of an area.

Card Default: Not applicable.

Format: Each card is formatted:

$RUN(n_1),LINE(n_2, n_3,n_4,), COL(n_5,n_6,n_7)$

where:

$RUN(n_1)$ - data is located in run number n_1.

Default: None; parameter is required.

$LINE(n_2,n_3,n_4)$ - n_2 is the starting line number; n_3 is the ending line number; and n_4 is the line interval.

Default: None; parameter is required.

$COL(n_5,n_6,n_7)$ - n_5 is the left-most column number; n_6 is the right-most column number; n_7 is the column interval.

Default: None; parameter is required.

Processing Function: SAMPLECLASSIFY

Key Word: None (Field Description Cards, form 2)
Control Parameters: None

Function: Field Description Cards (Form 2)

Defines run number and coordinates of an area.

Card Default: Not applicable.

Format: Each card is formatted as shown below.

	Column	Required Parameter
*Run Number	1-8	YES
Field Designation	11-18	NO
*First Line	21-25	YES
*Last Line	26-30	YES
*Line Interval	31-35	YES
*First Sample	36-40	YES
*Last Sample	41-45	YES
*Sample Interval	46-50	YES
Class Name	51-58	NO
Other Information	59-80	NO

*These parameters can be entered anywhere (without embedded blanks) in the columns listed; i.e., right or left justified. Also these parameters are required on the card as they have no program defaults. The other parameters can be left blank and also have no defaults.

Processing Function: SAMPLECLASSIFY

Key Word: END
Control Parameters:

Function: Indicates end of function control cards for the Sampleclassify function.

Card Default: None. Card is required at the end of the Sampleclassify function deck.

Control Parameters: None

Processing Function: SECHO

Key Word: *SECHO
Control Parameters: NONE

Function:

Select Supervised Extraction and Classification of Homogeneous Objects

Card Default:

None, card required

Control Parameters:

None

Processing Function: SECHO

Key Word: RESULTS
Control Parameters: TAPE (XXX), FILE (FF) I, INITIALIZE DISK

Function:

Specifies destination of classification results. Can store results on tape or disk.

Card Default:

None: card is required when running both phases of SECHO in single step, and required when running annexation phase (phase 2) of two step process.

Control Parameters:

Tape (TTT): TTT is the tape number of the tape on which the results are to be written.

File (FF): FF is the file number on the tape on to which the results are to be written.

Initialize: Indicates the tape is to be (re)initialize as a results tape.

Disk: Indicates that the results file is to be written on to the temporary disk.

Either tape or disk is required; both cannot be used.

Processing Function: SECHO

Key Word: INTERMEDIATE
Control Parameters: TAPE (XXX), FILE (FF) (, INITIALIZE)

Function:

Specifies location of intermediate classification results.

Card Default:

None, card is required when running either phase of the two step SECHO process. If running the cell processing phase (phase 1) it is the output location of the intermediate results. If running the annexation phase (phase 2) it is the input location of the intermediate results.

Control Parameters:

Tape (TTT): TTT is the tape number of the tape on to which the intermediate results are to be written.

File (FF): FF is the file number on the tape.

Initialize: indicates that the tape is to be (re)initialize as a results tape.

Processing Function: SECHO

Key Word: ANNEXATION
Control Parameters: THRESHOLD (XX.X)

Function:

Specifies annexation threshold criterion, used for annexing cells to fields.

Card Default:

None, card required when running cell annexation phase (phase 2), (single step process or step 2 of two step process).

Control Parameters:

Threshold (XX.X): commonly XX.X ranges from 0 to 4.6. A value of zero will result in no cells being annexed into fields, a value of 4.6 could lead to the entire area being classified as only a few very large fields. For greater explanation, see LARS publication #090177 or #083077.

Processing Function: SECHO

Key Word: SYMBOLS
Control Parameters: S1, S2...

Function:

To allow user to specify symbols for classification map.

	Symbol Default	Class Number
Card Default:	Numbers 1-9	1-9
	Characters A-Z	10-35
	Number 0	36
	+, =, *, /, &, (,)	37-44
Control Parameters:	Numbers 1-9	45-53
	Characters A-G	54-60

S1, S2... user specified alphanumeric characters for classes 1, 2...

Processing Function: SECHO

Key Word: PRINT
Control Parameters: STATISTICS SINGULAR CLASSIFICATION

Function:

To allow user to specify optional printer output.

Card Default:

No optional output printed.

Control Parameters:

Statistics: For each class and channel used in the classification, it prints the mean, standard deviation, and correlation matrix of channels.

Singular*: Produces Singular Cell map of area classified, and is only produced from the cell processing phase (phase 1). The symbol '0' is printed at the coordinate of each cell determined as singular (non-homogeneous). Each '0' represents a cell, so line and column headers are incremented by size of cell specified by user.

Classification*: Produces Classification map of area, and is only produced from the annexation phase (phase 2). Symbols can be specified by user, or default symbols will be used.

*NOTE: Only one of the map options is allowed in any execution, never singular and classification together.

Processing Function: SECHO

Key Word: CLASSES
Control Parameters: NAME (P1/C1, C2.../)

Function: To select a subset of classes or create class pools to be used for classification.

Card Default: All classes in statistics deck will be used as individual classes.

Control Parameters:

Name (P1/C1, C2.../): Name is class or pool name, P1 is Pool sequence number, C1 and C2 represent the class numbers of classes to be included in pool. Pool numbers must be in ascending order.

Processing Function: SECHO

Key Word: OPTIONS
Control Parameters: INTERMEDIATE

Function:

To specify that only the annexation phase (phase 2) is to be performed.

Card Default:

Required when running phase 2 only, otherwise both phases will be performed or only phase 1 if an intermediate results location was specified.

Control Parameters:

Intermediate: Specifies only phase 2 is to be performed.

Processing Function: SECHO

Key Word: CELL
Control Parameters: SIZE (XX) HOMOGENEITY (XX.X)

Function:

To specify cell width and homogeneity criterion for the cell processing phase (phase 1).

Card Default:

None, required when running cell processing phase (phase 1.)

Control Parameters:

Size (XX): Specifies cell width, in number of pixels

Default: XX=2 (4 pixels/cell)

Homogeneity (XX.X): XX.X must be greater than zero. The larger the homogeneity threshold value, the more likely the decision that the cell is homogeneous. For greater explanation see LARS publication #090177 or #083077.

Processing Function: SECHO

Key Word: CARDS
Control Parameters: READSTATS

Function:

Specifies that statistics file will be part of control card file.

Card Default:

Statistics expected from disk.

Control Parameters:

Readstats: Statistics file will follow DATA card and preceed END card in control card file.

Processing Function: SECHO

Key Word: CHANNELS
Control Parameters: I, J...

Function:

To specify which channels will be used for classification.

Card Default:

None, card always required.

Control Parameters:

I, J...: List channel numbers of channels to be used.

Processing Function: SECHO

Key Word: DATA
Control Parameters: NONE

Function:

Indicates that data cards will follow.

Card Default:

None, card required because at least one group of data cards must follow. (Field Description cards must follow.)

Control Parameters:

None

Data Decks:

Statistics Deck: Required if CARDS READSTATS was specified. Otherwise, must not be present.

Field Description Cards: Either form of LARSFRIS field description cards may be used to define area to be classified.

Processing Function: SECHO

Key Word: NONE (STATISTICS FILE)
Control Parameters: None

Function: Statistics File
This deck of cards is produced by the Statistics or Punch-statistics function and is never punched by the user.

Card Default: Required when 'CARD READSTATS' is specified.

Format: The Statistics File contains a header card, several data cards and an end card. The header and end cards are described below. Consult the Statistics File description in the LARSFRIS System Manual for information on the contents of the other data cards. All cards in the deck are sequenced in columns 73 through 80. The first card is number 1, the data cards are numbered 2 to n-1, and the last card is numbered n, where n is the number of cards punched for the Statistics File.

Header Card

Columns	Description
1-33	LARSYS VERSION 3 STATISTICS FILE
34-39	blank
40	flag = 1 for hexadecimal format = 0 for character format
41-72	blank
73-80	sequence number 1

Processing Function: SECHO

Key Word: NONE (FIELD DESCRIPTION CARDS, FORM 1)
Control Parameters: NONE

Function: Field Description Cards (Form 1)
Defines run number and coordinates of an area.

Card Default: Not applicable.

Control Parameters: Each card is formatted:

RUN (n_1), LINE (n_2,n_3,n_4) COL (n_5,n_6,n_7)

where:

RUN (n_1) - data is located in run number n_1.

Default: None; parameter is required.

LINE (n_2,n_3,n_4) - n_2 is the starting line number; n_3 is the ending line number; and n_4 is the line interval.

Default: None; parameter is required.

COL (n_5,n_6,n_7) - n_5 is the left-most column number; n_6 is the right-most column number; n_7 is the column interval.

Default: None; parameter is required.

Processing Function: SECHO

Key Word: NONE (FIELD DESCRIPTION CARDS, FORM 2)
Control Parameters: NONE

Function: Field Description Cards (Form 2)

Defines run number and coordinates of an area.

Card Default: Not applicable

Control Parameters: Each card is formatted as shown below.

	Column	Required Parameter
*Run number	1-8	YES
Field Designation	11-18	NO
*First Line	21-25	YES
*Last Line	26-30	YES
*Line Interval	31-35	YES
*First Sample	36-40	YES
*Last Sample	41-45	YES
*Sample Interval	46-50	YES
Class Name	51-58	NO
Other Information	59-80	NO

*These parameters can be entered anywhere (without embedded blanks) in the columns listed; i.e., right or left justified. Also these parameters are required on the card as they have no program defaults. The other parameters can be left blank and also have no defaults.

Processing Function: SECHO

Key Word: - END
Control Parameters: NONE

Function:

Indicates end of SECHO control cards.

Card Default:

None: Card is requried to be last card in control card file.

Control Parameters:

None.

Processing Function: SEPARABILITY

Key Word: *SEPARABILITY
Control Parameters: NONE

Function: Function Selector Card for SEPARABILITY.

Card Default: None; card is required to select the Separability function.

Control Parameters: None

Processing Function: SEPARABILITY

Key Word: COMBINATIONS
Control Parameters: N1,N2,...

Function: Analyze all combinations of n1 channels out of total channels card, then n2, etc....

Card Default: None; card is required.

Control Parameters:

N1,N2,N3,... - all combinations of N1 channels, N2 channels, N3 channels, etc., will be analyzed.

Default: None; parameter is required.

Processing Function: SEPARABILITY

Key Word: SYMBOLS
Control Parameters: $S_1, S_2, \ldots$

Function: Assigns symbols to classes for printing class pair headings of interclass divergences.

Card Default:

Control Parameters:

$S_1, S_2, \ldots$ - The single character S_1 is assigned to the first class, the character S_2 is assigned to the second class or pool, etc.

Default: - Symbols A,B,C... are used.

Processing Function: SEPARABILITY

Key Word: WEIGHTS
Control Parameters: $S_1S_2...S_n(W),T_1T_2...T_n(X),...$

Function: Assigns weight to class pairs.

Card Default: Weight is 10 for all class pairs.

Control Parameters:

$S_1S_2...S_n(W)$ - all combinations of class pairs represented by Symbols $S_1,S_2,...,S_n$ are assigned the weight W.

Default: None; parameter is required.

Note: A zero weight on the control card causes the class pair (or pairs) to be ignored in all computations, rather than simply assigned a zero weight. This key word may also be entered as typed input if a "OPTIONS TYPE" card was input in the input deck.

Processing Function: SEPARABILITY

Key Word: CLASSES
Control Parameters: $\begin{bmatrix} \text{name } (P_1/C_1, C_2, C_3, .../) \\ C_1, C_2, C_3, \ldots \end{bmatrix}$

Function: Groups training classes, pools statistics, and assigns a name and number to the pools; or selects a subset of those classes defined in the Statistics File.

Card Default: All classes defined in the Statistics File are used in the analysis.

Control Parameters: Either of the two forms of this card may be used, but they may not both be used for a single execution of the function.

Form 1:

name$(P_1/C_1, C_2, C_3, .../)$ - Groups training classes numbered $C_1, C_2, C_3, \ldots$, pools the statistics in pool number P_1 which is assigned the name "name". The pool name may be up to 8 characters long; the pool numbers must be specified consecutively, that is, 1, 2, 3, ...; class numbers are those previously assigned in Statistics function.

Default: No pooling of classes.

Form 2:

C_1, C_2, C_3,... - training classes numbered C_1, C_2, C_3,... will be used for analysis. This simpler alternative form of the CLASSES card is used when no pooling is required; a subset of the classes defined in the Statistics File is selected and those classes not specified on the card are deleted from further consideration. When this form of the classes card is used, the pool numbers are assigned to the chosen classes in consecutive order beginning with one even though no classes have been statistically pooled.

Default: All individual classes are used.

Note: If one or more CLASSES cards are used, all classes not explicitly mentioned on the CLASSES cards will be deleted from further consideration and not used in the analysis.

Processing Function: SEPARABILITY

Key Word: CARDS
Control Parameters: READSTATS

Function: Specifies that a Statistics File punched by STATISTICS will be included in this group of function control cards.

Card Default: Statistics are expected from the disk; they must have been calculated previously in this LARSFRIS session or saved from a previous terminal session. In the latter case, the 'statdeck use' command must have been typed before executing the present input deck.

Control Parameters:

READSTATS - Read statistics deck from cards.

Default: None; the parameter is required.

Processing Function: SEPARABILITY

Key Word: CHANNELS
Control Parameters: I,J,K,.....

Function: Specifies channels to be used from those present in the Statistics File.

Card Default: All channels in the Statistics File are used.

Control Parameters: The function uses the channels represented by the integers I,J,K etc., for selecting a set of channels and calculating a measure of separability between classes.

Default: None; if a CHANNELS card is used, all channels to be considered must be specified.

Processing Function: SEPARABILITY

Key Word: PRINT
Control Parameters: BEST (N) STATS SHOW (F1, F2,...) DIV (Value)

Function: Specify output options desired.

Card Default: Default values of parameters are used.

Control Parameters:

* BEST (N) - Results (minimum divergence, average divergence, and weighted interclass divergences) are printed for the best N channel combinations.

  Default: N = 30

* STATS - Class (or polled class) statistics (means, standard deviations and correlation matrices are printed.

  Default: No statistics printed.

* SHOW (F1,F2,...) - Prints results for channel combination F1,F2,... regardless of ranking.

  Default: No extra combinations printed.

* DIV (Value) - Prints list of all class pairs with a transformed divergence of 'value' or less for the 'best (N)'combinations of channels along with the average of those N divergences, grouping table is printed with threshold equal to 'value'.

  Default: None

SEPARABILITY-
Print

* These parameters may also be entered as typed input on the PRINT card if a 'OPTIONS TYPE' card was input in the input deck. The default values for these parameters will be as listed above or they will be set as previously defined in the input deck.

** This parameter may only be entered in the control card deck. It may not be typed as part of the 'OPTIONS TYPE' input.

Key Word: OPTIONS		
Control Parameters:		
MAX(Value)	,MIN value	,EXCLUDE (F1,F2,...)
,TYPE	,UNTRANS	,SORT

Function: Specify options desired.

Card Default: Default values of parameters are used.

Control Parameters: Parameters may be input from either the card deck or the typewriter, as noted by the asterisks.

MAX(Value) - upper bound on separation measure is set to value. See the functional description for its affect on the Separability Results Listing.

Default: Value = 3000

MIN(Value) - lower bound on separation measure is to Value. See the functional description for its affect on the Separability Results Listing.

Default: Value = 0

EXCLUDE(F1,F2,...) - excludes from consideration any channel set that contains the subset F1,F2,...

Default: All channel combinations considered.

*TYPE - signals that user wants to enter an additional set of options at the typewriter.

Default: Keyboard locked.

SEPARABILITY-
Options

UNTRANS -untransformed divergence results used and printed.

Default: Transformed results used and printed.

SORT -results are sorted and printed by DIJ(MIN).

Default: Results are ordered by D(AVE)

**TRANS -transformed divergence results are used.

Default: Previous specification.

**NOSORT -rank the channel combinations according to D(AVE) results.

Default: Previous specification.

**RESET -all parameters are reset to the card input or default values.

Default: Parameters are not reset.

**HELP -a list of possible typewriter inputs are typed at the terminal to aid the user in inputing cards at the typewriter.

Default: No list printed

**TABLE -a table of class names, numbers, and their corresponding symbol assignment is typed at the terminal for reference.

Default: No table printed

* This parameter may only be used in the input deck.

** These parameters may only be input as a typewriter option in conjunction with the use of an 'OPTIONS TYPE' control card. All defaults for options entered at the typewriter are as listed above.

Processing Function: SEPARABILITY

Key Word: STOP
Control Parameters: None

Function: Terminates the analysis of the number of channels currently being processed. This card may only be entered at the typewriter in conjunction with the use of the 'OPTIONS TYPE' control card. It is not valid in an input deck.

Card Default: Continue analysis of the number of channels currently being processed by entering optional control cards from the typewriter terminal.

Control Parameters: Not applicable.

Processing Function: SEPARABILITY

Key Word: **DATA**
Control Parameters: None

Function: Indicates the beginning of an input data deck.

Card Default: None; must be present if data deck is included.

Data Deck: Separability will accept the Statistics File in card form. The user must also include the 'CARDS READSTATS' control card in his deck.

Processing Function: SEPARABILITY

Key Word: none (Statistics File)
Control Parameters: None

Function: Statistics File

This deck of cards is produced by the Statistics or Punchstatistics functions and is never punched by the user.

Card Default: Required when 'CARDS READSTATS' is specified.

Format: The Statistics File contains a header card, several data cards and an end card. The header and end cards are described below. Consult the Statistics File description in the LARSFRIS System Manual for information on the contents of the other data cards. All cards in the deck are sequenced in columns 73 through 80. The first card is number 1, the data cards are numbered 2 to n-1, and the last card is numbered n, where n is the number of cards punched for the Statistics File.

Header Card

Columns	Description
1-33	LARSYS VERSION 3 STATISTICS FILE
34-39	blank
40	flag = 1 for hexadecimal format = 0 for character format
41-72	blank
73-80	sequence number 1

End Card

Columns	Description
1-3	E05
4-15	blank
16-59	*****bb LAST CARD OF STATISTICS DECKbb *****
60-72	blank
73-80	sequence number n

Processing Function: SEPARABILITY

Key Word: END
Control Parameters:

Function: Indicates end of function control cards for the Separability function.

Card Default: None. Card is required at the end of the Separability function deck.

Control Parameters: None

Processing Function: SMOOTHRESULTS

Key Word: *SMOOTHRESULTS
Control Parameters:

Function: Function Selector card for SMOOTHRESULTS

Card Default: None; card is required to select the SMOOTHRESULTS function.

Control Parameters: None

Processing Function: SMOOTHRESULTS

Key Word: INRESULTS
Control Parameters: [TAPE (ttt), FILE(ff) DISK]

Function: Indicates the location of the input Classification Results File to be processed.

Card Default: None, card is required.

Control Parameters:

TAPE(ttt) - ttt is the tape number containing the Classification Results File.

FILE(ff) - ff is the file number on the tape which contains the input Classification Results File.

Default: None. Required if input Classification Results File is on tape.

DISK - Indicates that the input Classification Results File is on disk.

Default: None. Required if the input Classification Results File is on disk.

Processing Function: SMOOTHRESULTS

Key Word: CELLSIZE
Control Parameters: rr, cc

Function: Indicates the size of the group of points which are considered at one time for the smoothing operation.

Card Default: Assumes a cell size of 2 lines by 2 columns.

Control Parameters:

rr - 'rr' is the number of lines (rows) of classified data in a cell.

cc - 'cc' is the number of columns of classified data in each cell.

Processing Function: SMOOTHRESULTS

Key Word: OUTRESULTS

Control Parameters:

```
[TAPE(ttt),  [FILE(ff)    ]]
             [INITIALIZE  ]
[DISK                     ]
```

Function: Indicates the location of the output Classification Results File that is to be processed.

Card Default: None. Card is required.

Control Parameters:

TAPE(ttt) - ttt is the tape number containing the output Classification Results File. TAPE(0) indicates a scratch tape.

FILE(ff) - ff is the file number on the tape which is to contain the output Classification Results File.

INITIALIZE - indicates that the tape is a new tape, or has not previously been used for Classification Results Files. (No checking will be done for existing files). This is required for new tapes in order to write a correct label on the tape. Results will be written in file 1.

Default: Old tape; Results files have been written on this tape before.

DISK - Indicates that the results file is to be written onto the disk.

Processing Function: SMOOTHRESULTS

Key Word: PRIORITY
Control Parameters: g1, g2, ...

Function: Specifies priority groups or classes whose numbers are not to be changed when a cell is modified.

Card Default: No groups or classes are given priority.

Control Parameters:

g1, g2, ... - g1 is a group or class number which is to be given priority when cells are modified.

Processing Function: SMOOTHRESULTS

Key Word: GROUP
Control Parameters: name1(g_1/c_1,c_2,c_3.../), name2(g_2/n_1,n_2,.../),...

Function: Groups classes (or pooled classes) from the input Classification Results File for calculation and new class assignment purposes; assigns group names and numbers.

Card Default: No grouping

Control Parameters:

name(g_1/c_1,c_2,c_3.../) - groups classes numbered c_1,c_2,c_3,... and assigns the number g_1 and the name "name" to the group. The group name may be up to 8 characters long; group numbers must be assigned consecutively (that is, 1,2,3,...); class numbers are classification pool numbers from a previous classification. Any classes not included in the GROUP card are assigned group numbers g_i+1, g_i+2,... where g_i is the highest group number on the GROUP card.

Processing Function: SMOOTHRESULTS

Key Word: WEIGHTS
Control Parameters: $w_1, w_2, \ldots$

Function: Assigns weights to class groups or class pools to influence the selection of the dominant class in each cell.

Card Default: Equal weights are used.

Control Parameters:

$w_1, w_2, \ldots$ - w_i is the weight to be assigned to the i-th group or pool of classes. Weights may be entered as integers or decimals, and the number of weights must equal the number of groups (or pooled classses if no grouping was requested).

Processing Function: SMOOTHRESULTS

Key Word: BLOCK
Control Parameters: RUN(n_1), LINE(n_2,n_3,n_4), COL(n_5,n_6,n_7)

Function: Identifies the portion of the input classified area to be processed by SMOOTHRESULTS.

Card Default: Entire area is processed.

Control Parameters:

RUN(n_1) - data from run number n_1 will be used.

LINE(n_2,n_3,n_4) - every n_4-th line beginning with the n_2-nd line and ending at the n_3-rd line will be displayed.

COL(n_5,n_6,n_7) - every n_7-th column beginning with the n_5-th column and ending at the n_6-th column will be displayed.

Processing Function: SMOOTHRESULTS

Key Word: MIXCLASS
Control Parameters: name1(p1, p2-p3, ...), name2(p4-p5, p6, ...),

Function: Defines new classes which are mixtures of points belonging to the grouped classification pools or classes.

Card Default: Use existing groups or classes only.

Control Parameters:

name1(p1, p2-p3, ...) - defines a new class called "name1." The points in a cell are assigned to this new class if p1% of the points in a cell are in group 1, between p2% and p3% of the points are in group 2, etc. A percentage or range of percentages must be provided for each classification group (or pooled classes if no grouping specified).

Processing Function: SMOOTHRESULTS

Key Word: END
Control Parameters:

Function: Indicates end of function control cards for the SMOOTHRESULTS function.

Card Default: None. Card is required at the end of the SMOOTHRESULTS function deck.

Control Parameters: None

Processing Function: STATISTICS

Key Word: *STATISTICS
Control Parameters:

Function: Function Selector Card for STATISTICS.

Card Default: None; card is required to select the Statistics function.

Control Parameters: None

Processing Function: STATISTICS

Key Word: OPTIONS
Control Parameters: HIST(n_1,n_2,n_3,...)

Function: When HIST is specified on the PRINT and OPTIONS cards, HIST parameter selects channels to be used for histograms.

Card Default: Histograms all channels specified on CHANNELS card.

Control Parameters:

HIST(n_1,n_2,n_3,...) - specifies that only channels n_1, n_2, n_3,... are to be histogrammed. These must be a subset of the channels specified on the CHANNELS card.

Default: None; parameter is required.

Processing Function: STATISTICS

Key Word: PRINT
Control Parameters: HIST(F / C / F,C) SPECTRL(F / C / F,C) CORRE(F / C / F,C) COSPEC(c_1,c_2,c_3,...)

Function: Specifies printed output for Statistics function.

Card Default: Control parameter defaults used.

Control Parameters:

HIST(F) - print histograms for fields only.
HIST(C) - print histograms for classes only.
HIST(F,C) - print histograms for fields and classes.

Default: No histograms printed.

SPECTRL(F) - print spectral plots for fields only.
SPECTRL(C) - print spectral plots for classes only.
SPECTRL(F,C) - print spectral plots for fields and classes.

Default: No spectral plots for fields and classes.

CORRE(F) - print statistics for fields only.
CORRE(C) - print statistics for classes only.
CORRE(F,C) - print statistics for fields and classes.

Statistics printed include means standard deviations and correlation matrices.

Default: No statistics printed.

COSPEC(c_1,c_2,c_3,...) - print a coincident spectral plot containing classes c_1,c_2,c_3,...

This parameter may be repeated any number of times. One plot will be printed for each occurrence.

Default: A coincident spectral plot containing all classes is printed.

Processing Function: STATISTICS

Key Word: PUNCH
Control Parameters: CHARACTERS

Function: Requests punched Statistics File.

Card Default: No punching.

Control Parameters:

CHARACTER - punch class means and correlation matrices in character format.

Character form means each mean value and covariance value is represented as n.nnnnnnnE + jj ($n.nnnnnnn \times 10^{jj}$).

Default: Punching done in binary form.

Binary form represents each number in four card columns, one byte per column in EBCDIC card code.

Processing Function: STATISTICS

Key Word: CHANNELS
Control Parameters: A(I/P,Q/,J/R,S/,...),B(K/W,X/,L/Y,Z),...),...

Function: Specifies channels to be used and controls the calibration of the data from the Multispectral Image Storage Tape.

Card Default: None; card is required to specify channels to be used.

Control Parameters:

A and B are calibration codes which indicate to the program how the channels in the parenthesis are to be calibrated. The table below shows what the codes select.

Calibration Code	Data Calibrated Using
1	C0
2	C1
3	C2
4	C0 and C1
5	C0 and C2
6	C1 and C2
7	Uncalibrated

In the general form of the CHANNELS card the integers I, J, K, and L are the channels selected. Channels I and J are to be calibrated using calibration code A while channels K and L are to be calibrated using calibration code B. The real numbers P, Q, R, S, W, X, Y, and Z are fixed calibration levels inserted for the channels they follow.

STATISTICS-
Channels

Several forms of the CHANNELS card may be used. If the user desires not to enter fixed levels into the system (use fixed levels from the tape), he can enter the card in the form:

```
CHANNELS    A(I,H,...),B(K,L,...)
```

If the user wants to assume a calibration code of 1 and the fixed level of C0 to be from the tape for all desired channels, a card can be used in the form:

```
CHANNELS    I,J,K,L,...
```

The example below shows a CHANNELS card that selects channels 1,3,4 and 10. The card also assigns calibration values for C0 (calibration code 1) to channels 1, 3 and 4. The value that is assigned is zero. The second expression on the card assigns both C0 and C1 values (calibration code 4) to channel 10. The C0 value is again zero and the C1 value is 800.

```
CHANNELS    1(1/0.0/,3/0/,4/0/),4(10/0,800/)
```

The following card will assume a calibration code of 1 for selected channels 1, 3, 4, and 10 and use C0 stored on the tape.

```
CHANNELS    1,3,4,10
```

Note that the use of the CHANNELS card does not require the user to determine the processing constants of the system or the constants required to calibrate the data. He is required to know the irradiance values (or percent reflectance) of the calibration sources used in the system and the numerical value he wants to assign to these measurements. At present, the characteristics of the sources are not known. What is significant here is that the user now has the ability to experiment with the data to determine these characteristics, to test hypothesized characteristics, or to use determined characteristics when they are known.

For more information concerning calibration, refer to LARS Information Note 071069, "Calibration of Scanner Data for Operational Processing Programs at LARS", by Terry L. Phillips.

Processing Function: STATISTICS

Key Word: SCALE
Control Parameters: SPCLOW(n_1) SPCINT(n_2)

Function: Modifies axes for printing spectral plots.

Card Default: Control parameter defaults used.

Control Parameters:

SPCLOW(n_1) - set low end of spectral plot abscissa to n_1.

Default: $n_1 = 0$

SPCINT(n_2) - set each spectral plot division to a value of n_2.

Default: $n_2 = 3$

Processing Function: STATISTICS

Key Word: DATA
Control Parameters: None

Function: This card must precede the first card of the data deck. It immediately follows the last function control card.

Card Default: None; the training field data cards are required.

Data Deck: The training field data cards consist of a number of groups of cards, each group describing one training class. Each group begins with a card of the form:

CLASS name

where CLASS starts in column 1 and name is the name assigned to the class. The CLASS card is followed by one or more Field Description Cards (either fixed or free form) defining the training fields for the class. The maximum number of classes is 60. A description of the Field Description Cards follows.

Processing Function: STATISTICS

Key Word: None (Field Description Cards, form 1)
Control Parameters: None

Function: Field Description Cards (Form 1)

Defines run number and coordinates of an area.

Card Default: Not applicable.

Format: Each card is formatted:

$$RUN(n_1),LINE(n_2,n_3,n_4),COL(n_5,n_6,n_7)$$

where:

$RUN(n_1)$ - data is located in run number n_1.
Default: None; parameter is required.

$LINE(n_2,n_3,n_4)$ - n_2 is the starting line number; n_3 is the ending line number; and n_4 is the line interval.
Default: None; parameter is required.

$COL(n_5,n_6,n_7)$ - n_5 is the left-most column number; n_6 is the right-most column number; n_7 is the column interval.
Default: None; parameter is required.

Processing Function: STATISTICS

Key Word: None (Field Description Cards, form 2)
Control Parameters: None

Function: Field Description Cards (Form 2)

Defines run number and coordinates of an area.

Card Default: Not applicable.

Format: Each card is formatted as shown below.

	Column	Required Parameter
*Run Number	1-8	YES
Field Designation	11-18	NO
*First Line	21-25	YES
*Last Line	26-30	YES
*Line Interval	31-35	YES
*First Sample	36-40	YES
*Last Sample	41-45	YES
*Sample Interval	46-50	YES
Class Name	51-58	NO
Other Information	59-80	NO

*These parameters can be entered anywhere (without embedded blanks) in the columns listed; i.e., right or left justified. Also these parameters are required on the card as they have no program defaults. The other parameters can be left blank and also have no defaults.

Processing Function: STATISTICS

Key Word: END
Control Parameters:

Function: Indicates end of function control cards for the Statistics function.

Card Default: None. Card is required at the end of the Statistics function deck.

Control Parameters: None

Processing Function: TRANSFERDATA

Key Word: *TRANSFERDATA
Control Parameters:

Function: Function Selector Card for TRANSFERDATA.

Card Default: None; card is required to select the Transferdata function.

Control Parameters: None

Processing Function: TRANSFERDATA

Key Word: TAPE
Control Parameters: TAPE(xxx),FILE(xxx)

Function: Specifies tape output, and identifies the tape and file numbers to be used.

Card Default: No tape output. If no output is specified (tape, print, or punch), the printing of data only (the PRINT DATA control card) is the default.

Control Parameters:

TAPE(xxx) - requests data be output on tape xxx.

Default: None. Tape number must be specified.

FILE(xxx) - output is to be stored in file xxx of requested tape.

Default: FILE(1) of the specified tape.

Note: Module numbers are used on tape and punched output. See the description of the OPTIONS control card.

Processing Function: TRANSFERDATA

Key Word: PUNCH
Control Parameters: None

Function: Specifies punched output.

Card Default: No punched output. If no output specified (punch, tape, or print), the printing of data (the PRINT DATA control card) is the default.

Control Parameters: None

Note: Module numbers are used on tape and punched output. See OPTIONS.

Processing Function: TRANSFERDATA

Key Word: PRINT
Control Parameters: [DATA ROLL]

Function: Specifies printed output.

Card Default: If no output specified (print, tape, or punch), printed output of data only (the PRINT DATA control card) is the default.

Control Parameters: Either DATA or ROLL or both must be specified.

DATA - Requests printing of the data values.

ROLL - Requests printing of the roll parameters.

Processing Function: TRANSFERDATA

Key Word: OPTIONS
Control Parameters: MODNO(xxx)

Function: Specifies the identification number (module number) for each group of data that is to be written on the output if tape or punch output (TAPE or PUNCH control cards) was requested. Each group (or module) of data is defined by a single Field Description Card. There are no module numbers assigned if only printer is requested.

Card Default: The module number starts at 1 and increments by 1 for each succeeding module.

Control Parameters:

MODNO(xxx) - assigns module number xxx to the first unit of tape and/or punched output; following units will be numbered sequentially, one number greater than the previous one.

Default: None; the parameter is required.

Note: The detailed format of the output module is given in the functional description of TRANSFERDATA in Secion 6.

Processing Function: TRANSFERDATA

Key Word: CHANNELS
Control Parameters: A(I/P,Q/,J/R,S/,...),B(K/W,X/,L/Y,Z),...)...

Function: Specifies channels to be used and controls the calibration of the data from the Multispectral Image Storage Tape.

Card Default: None; card is required to specify channels to be used.

Control Parameters:

A and B are calibration codes which indicate to the program how the channels in the parenthesis are to be calibrated. The table below shows what the codes select.

Calibration Code	Data Calibrated Using
1	C0
2	C1
3	C2
4	C0 and C1
5	C0 and C2
6	C1 and C2
7	Uncalibrated

In the general form of the CHANNELS card the integers I, J, K, and L are the channels selected. Channels I and J are to be calibrated using calibration code A while channels K and L are to be calibrated using calibration code B. The integers P, Q, R, S, W, X, Y, and Z are fixed calibration levels inserted for the channels they follow.

Several forms of the CHANNELS card may be used. If the user desires not to enter fixed levels into the system (use fixed levels from the tape), he can enter the card in the form:

```
CHANNELS    A(I,H,...),B(K,L,...)
```

If the user wants to assume a calibration code of 1 and the fixed level of C0 to be from the tape for all desired channels, a card can be used in the form:

```
CHANNELS    I,J,K,L,...
```

The example below shows a CHANNELS card that selects channels 1,3,4 and 10. The card also assigns calibration values for C0 (calibration code 1) to channels 1, 3 and 4. The value that is assigned is zero. The second expression on the card assigns both C0 and C1 values (calibration code 4) to channel 10. The C0 value is again zero and the C1 value is 800.

```
CHANNELS    1(1/0.0/,3/0/,4/0/),4(10/0,800/)
```

The following card will assume a calibration code of 1 for selected channels 1, 3, 4, and 10 and use C0 stored on the tape.

```
CHANNELS    1,3,4,10
```

Note that the use of the CHANNELS card does not require the user to determine the processing constants of the system or the constants required to calibrate the data. He is required to know the irradiance values (or percent reflectance) of the calibration sources used in the system and the numerical value he wants to assign to these measurements. At present, the characteristics of the sources are not known. What is significant here is that the user now has the ability to experiment with the data to determine these characteristics, to test hypothesized characteristics, or to use determined characteristics when they are known.

For more information concerning calibration, refer to LARS Information Note 071069, "Calibration of Scanner Data for Operational Processing Programs at LARS", by Terry L. Phillips.

Processing Function: TRANSFERDATA

Key Word: DATA
Control Parameters: None

Function: Specifies beginning of data cards.

Card Default: None; card is required to mark the beginning of the Field Description Cards.

Data Deck: A deck of Field Description Cards that identify the Multispectral Image Storage Tape data to be transferred is required. The two forms of these cards are described on the following pages.

Processing Function: TRANSFERDATA

Key Word: None (Field Description Cards, form 1)
Control Parameters: None

Function: Field Description Cards (Form 1)
Defines run number and coordinates of an area.

Card Default: Not applicable.

Format: Each card is formatted:

$RUN(n_1),LINE(n_2,n_3,n_4),COL(n_5,n_6,n_7)$

where:

$RUN(n_1)$ - data is located in run number n_1.
Default: None; parameter is required.

$LINE(n_2,n_3,n_4)$ - n_2 is the starting line number; n_3 is the ending line number; and n_4 is the line interval.
Default: None; parameter is required.

$COL(n_5,n_6,n_7)$ - n_5 is the left-most column number; n_6 is the right-most column number; n_7 is the column interval.
Default: None; parameter is required.

Processing Function: TRANSFERDATA

Key Word: None (Field Description Cards, form 2)
Control Parameters: None

Function: Field Description Cards (Form 2)

Defines run number and coordinates of an area.

Card Default: Not applicable.

Format: Each card is formatted as shown below.

	Column	Required Parameter
*Run Number	1-8	YES
Field Designation	11-18	NO
*First Line	21-25	YES
*Last Line	26-30	YES
*Line Interval	31-35	YES
*First Sample	36-40	YES
*Last Sample	41-45	YES
*Sample Interval	46-50	YES
Class Name	51-58	NO
Other Information	59-80	NO

*These parameters can be entered anywhere (without embedded blanks) in the columns listed; i.e., right or left justified. Also these parameters are required on the card as they have no program defaults. The other parameters can be left blank and also have no defaults.

Processing Function: TRANSFERDATA

Key Word: END
Control Parameters:

Function: Indicates end of function control cards for the Transferdata function.

Card Default: None. Card is required at the end of the Transferdata function deck.

Control Parameters: None