STUDIECENTRUM VOOR ECONOMISCH EN SOCIAAL ONDERZOEK

TSAF Program Library
- no 3 -

PACK 1
User's Manual

Eddy BORGHERS

Rapport 86/190

April 1986

Deze software is tot stand gekomen mede dank zij de steun van de Christelijke Centrale van Houtbewerkers en Bouwvakarbeiders.

We thank Mr. H. Pauwels. Without his help this conversion would never have been a success.

Universitaire Faculteiten St.-Ignatius
Prinsstraat 13 - 2000 Antwerpen

D/1986/1169/08

Abstract

The PACK system is designed to perform BOX-JENKINS type analyses for both univariate stochastic models and univariate transfer function models.

PACK 1 performs the identification stage of the iterative model building process. In its present form PACK 1 is a (passive) interactive program, i.e. the appropriate input is supplied directly to the program by answering the displayed questions.

The input data file for PACK 1 can also be used for the ARSTU, TSERS, PACK 2, PACK 3, MULTISTOCH and MULTITRAN programs.

TABLE OF CONTENTS

INTRODUCTION

This user's manual describes a computer program for the analysis of time series models using the BOX-JENKINS philosophy.

Two basically different types of models may be analyzed. These models are briefly summarized as follows:

1. Univariate Stochastic Model (Single Output Model)
   - model based on a single time series
   - describes the present value of this series as a function of the past values of this same series and a random error.

2. Univariate Transfer Function Model (Single Output-Multiple Input Model)
   - model based on two or more series
   - describes the present value of one series, called the "output" series, as a function of the past values of this same series, the past and present values of the other "input" series, and a "noise". This noise may have a structure described by a univariate stochastic model, called "noise model", reducing the noise to a random error.
   - It is important to note that the transfer function models with more than one input series are analyzed with an implicit assumption that the input series are independent of each other. The interrelationships between the inputs are ignored.

The iterative model building process at the foundation of the BOX-JENKINS approach must be part of the background of anyone attempting to make use of this manual. This document does not explain the process, only the computer program.

PACK 1 is an IDENTIFICATION program. It is an adaption for the HP-1000 computer of SUBROUTINE TRFID, which forms the main part of the "MAIN IDENTIFICATION" program of the PACK SYSTEM [5,7] . The latter was written in early 1977 at the Ohio State University by D. PACK and is distributed on a commercial basis by

Automatic Forecasting Systems, Inc.
P.O. Box 563
HATBORO
Pennsylvania 19040

This PACK program was an extension of a December 1974 program [4] , which was in turn an extension of two previous publicly available programs [6,3].

Since the originally PACK program was a batch processing program, based on a card input, the input part of the program had to be changed.

In its present form PACK 1 is a (passive) interactive program, i.e. the appropriate input is supplied directly to the program by answering the displayed questions.

In a later stage (next release?) this input part could be modified into an independent (passive) interactive input program which generates images of the input cards on an output file. This output file could then be used as an input file for further batch processing.

I - UNIVARIATE STOCHASTIC MODEL

1 - MODEL STRUCTURE

The Univariate Stochastic Model (Single Output Model or Multiplicative ARIMA Model) can be written in its most general form as

$$\prod_{i=1}^{NAR} \phi_i(B) w_t = \theta_0 + \prod_{j=1}^{NMA} \theta_j(B) a_t$$

The model consists of

1. NAR autoregressive factors, the i^{th} factor given by a polynomial of degree p_i in the backward shift operator B, i.e.

   $$\phi_i(B) = (1 - \phi_{i1}B - \phi_{i2}B^2 - \ldots - \phi_{iP_i}B^{P_i})$$

   and containing one or more autoregressive parameters ϕ_{im}.

2. NMA moving average factors, the j^{th} factor given by a polynomial of degree q_j in the backward shift operator B, i.e.

   $$\theta_j(B) = (1 - \theta_{j1}B - \theta_{j2}B^2 - \ldots - \theta_{jq_j}B^{q_j})$$

   and containing one or more moving average parameters θ_{jm}.

3. a variable w_t, defined as the appropriately differenced and transformed series

   $$w_t = \begin{cases} \prod_{k=1}^{ND} (1-b^{S_k})^{d_k} Z_t^{(\lambda)} & (ND \neq 0) \\ Z_t^{(\lambda)} - \bar{Z}^{(\lambda)} & (ND = 0) \end{cases}$$

   where

$$Z_t^{(\lambda)} = \begin{cases} (Z_t + \text{scaling constant})^{\lambda} & (\lambda \neq 0) \\ \ln_e (Z_t + \text{scaling constant}) & (\lambda = 0) \end{cases}$$

$\bar{Z}^{(\lambda)}$ is the mean of $Z_t^{(\lambda)}$

and

ND is the number of differencing factors

S_k is the order of the k^{th} differencing

d_k is the number of differences of order S_k

4. a constant θ_0 which measures
   - the mean value of w_t when ND $\neq$ 0 (representing the possible presence of a deterministic trend)
   - the correction to the sample mean $\bar{Z}^{(\lambda)}$ to estimate the population mean when ND = 0

5. an error term a_t which must be "white noise".

2 - PROGRAM INPUT STRUCTURE

For each input, the original input number is mentioned. Additional inputs can easily be recognized since they all have been given the same number "00".

A "# " sign means that on displaying that particular input question this "# " sign will be replaced by a sequence number (number of time series, factor, parameter, ...).

A vertical accolade means that the indicated inputs form a sequence. If the necessary condition is satisfied this sequence will be repeated as many times as indicated.

2.1. Displayed Questions

GENERAL SPECIFICATION

```
INPUT 00
ENTER IPROG : General Program Parameter
              = 0 STOP
              = 1 Univariate Stochastic Iden.(USID)
              = 2 Mult.Inp.Trans.Func.Iden.(MTID)

INPUT 00
ENTER IOUT : Logical Unit Number Output Device
             = 1 Display
             = 6 Printer

INPUT 00
ENTER LISIN : Listing of Input Parameters
              = 0 No
              = 1 Yes
```

SPECIFICATION OF TIME SERIES

INPUT 02
ENTER NSERIE : Number of Separate Time Series (NSERIE.LE.6)

INPUT 03
ENTER NOB : Number of Observations (NOB.LE.300)

INPUT 06
ENTER RNAM : Title of Time Series # (Max.48 Characters)

ENTER NAME of Datafile

INPUT 00
ENTER FOB : First Obs.of Time Series #

INPUT 07
ENTER ILDID : Listing of Time Series #
= 0 No
= 1 Yes

INPUT 08
ENTER IPDID : Plotting of Time Series #
= 0 No
= 1 Yes

INPUT 09 : Transformation of Time Series #

INPUT 09
ENTER TLAMID : Exponent of Power Transformation (Lambda)
= 0.0 Natural log Transformation
= 1.0 No Data Transformation
= X.X Exponent of Transformation

INPUT 09
ENTER TMID : Mean Correction before Transformation
= 0.0 No Correction of the Mean
= X.X Amount Added to Series before Transform.

INPUT 10
ENTER NDIFID : Number of Differencing Factors (NDIFID.LE.3)
= 0 No Differencing
= X Number of Differencing Types

INPUT 11
ENTER NDID : Number of Differences of Factor #

INPUT 11
ENTER IODID : Order of Differences of Factor #

SPECIFICATION FOR THE AUTOCORRELATION FUNCTION

INPUT 12
ENTER IACF : Auto Corr.Function for Series #
= 0 No
= 1 Yes

INPUT 13
ENTER NAC : Lag for Auto Corr.Function (NAC.LE.100)

INPUT 13
ENTER NPAC : Lag for Part.Auto Corr.Func.(NPAC.LE.NAC)

INPUT 13
ENTER NCHI : Chi-Square Statistic for Auto Corr.Function
= 0 Suppress Statistic
= X Number of Terms to be Used (NCHI.LE.NAC)

INPUT 13
ENTER MCSE : Standard Errors of Individual Auto Correlations
= 0 No
= 1 Yes

INPUT 13
ENTER NAPL : Number of Auto Corr.per Line (NAPL.LE.12)

INPUT 13

ENTER IWTPA : Plotting of Auto Correlations
= 0 No
= 1 Yes

2.2. Conditions, Restrictions and Comments

00 - IOUT : The program output can be displayed (IOUT=1) or printed (IOUT=6)

00 - LISIN : Even when the program output is displayed (IOUT=1) the inputted parameters can be printed (LISIN=1)

02 - NSERIE : Restriction : $1 \leq NSERIE \leq 6$

03 - NOB : The analysis will be based on NOB observations. Restriction: $NOB \leq 300$

06 - RNAM : The heading or running title may consist of any character; numerical, alphanumerical or special. Restriction: Maximum number of characters is 48.

NAME : The only way to input time series data is through a datafile. The name of this datafile must be entered immediately after the message is displayed on the screen. See Appendix I for details about the preparation of this datafile.

00 - FOB : First observation of the datafile to take account of. The total number of observations on the datafile must be at least: FOB + NOB - 1.

06 - RNAM
- NAME
00 - FOB
07 - ILDID
08 - IPDID

As many times as indicated by NSERIE

09 - TLAMID
09 - TMID

As many times as indicated by NSERIE

10 - NDIFID : Number of differencing factors or types.
An autocorrelation and a partial autocorrelation function is calculated for the original series and each requested difference. Differencing factors beyond the first are used to difference the original series to obtain a new "original series".
Restriction: $0 \leq NDIFID \leq 3$

11 - NDID
11 - IODID

Only if NDIFID $\neq 0$
As many times as indicated by NDIFID

12 - IACF : Only if NSERIE > 1
As many times as indicated by NSERIE

13 - NAC : Restriction : $NAC \leq 100$
13 - NPAC : Restriction : $NPAC \leq NAC$
13 - NCHI : Restriction : $NCHI \leq NAC$
13 - NAPL : Restriction : $1 \leq NAPL \leq 12$

3 - EXAMPLE 1 : SINGLE VARIABLE CASE

GENERAL SPECIFICATION

01	CALCULATE AUTO CORRELATIONS	IWACF =	1
01	CALCULATE CROSS CORRELATIONS	IWCCF =	0
01	PREWHITENING MODELS WILL BE SUPPLIED	IWPREW =	0

SPECIFICATION OF TIME SERIES

02	NUMBER OF SEPARATE SERIES	NSERIE =	1
03	NUMBER OF OBSERVATIONS PER SERIES	NOB =	156
06	SERIES 1 &USTRB		
00	FIRST OBS	FOB =	1
07	LISTED	ILDID =	1
08	PLOTTED	IPDID =	0
09	TRANSFORMATION OF TIME SERIES 1	TLAMID =	.100000E+01
		TMID =	.000000E+00
10	NUMBER OF DIFFERENCING FACTORS	NDIFID =	1
11	NUMBER OF DIFFERENCES OF FACTOR 1	NDID =	1
11	ORDER OF DIFFERENCES OF FACTOR 1	IODID =	1

SPECIFICATION FOR THE AUTO CORR. FUNCTION

13	MAX. LAG IN CALC. AUTO CORR.	NAC =	24
13	MAX. LAG IN CALC. PART. AUTO CORR.	NPAC =	24
13	NUMBER OF AUTO CORR. CHI-SQ. STAT.	NCHI =	24
13	STANDARD ERRORS FOR AUTO CORR.	NCSE =	1
13	NUMBER OF AUTO CORR. PER LINE	NAPL =	12
13	PLOTTING OF AUTO CORR.	IWTPA =	1

LISTING OF OBSERVED SERIES

1- 8	.245600E+01	.237200E+01	.231000E+01	.261300E+01	.265000E+01	.252700E+01	.233400E+01	.260600E+01
9- 16	.285000E+01	.296100E+01	.300000E+01	.323000E+01	.321000E+01	.316500E+01	.314000E+01	.311300E+01
17- 24	.304200E+01	.331600E+01	.316500E+01	.340400E+01	.357800E+01	.359100E+01	.333700E+01	.310200E+01
25- 32	.259800E+01	.156200E+01	.135400E+01	.112600E+01	.104600E+01	.881000E+00	.962000E+00	.168600E+01
33- 40	.248400E+01	.279300E+01	.275600E+01	.281400E+01	.283700E+01	.271200E+01	.285200E+01	.296000E+01
41- 48	.285100E+01	.324700E+01	.324300E+01	.335800E+01	.399800E+01	.411700E+01	.420900E+01	.457200E+01
49- 56	.443600E+01	.395400E+01	.343900E+01	.324400E+01	.339200E+01	.264100E+01	.239600E+01	.228600E+01
57- 64	.248900E+01	.242600E+01	.238400E+01	.227200E+01	.230200E+01	.240800E+01	.242000E+01	.232700E+01
65- 72	.228800E+01	.235900E+01	.226800E+01	.240200E+01	.230400E+01	.235000E+01	.245800E+01	.261700E+01
73- 80	.274600E+01	.275200E+01	.271900E+01	.273500E+01	.269400E+01	.271900E+01	.294500E+01	.283700E+01
81- 88	.279200E+01	.275100E+01	.280300E+01	.285600E+01	.291400E+01	.291600E+01	.289700E+01	.290900E+01
89- 96	.292000E+01	.299500E+01	.314300E+01	.332000E+01	.337900E+01	.345300E+01	.352200E+01	.352300E+01
97- 104	.352900E+01	.353200E+01	.355300E+01	.348400E+01	.348200E+01	.347800E+01	.347900E+01	.350600E+01
105- 112	.352700E+01	.357500E+01	.362400E+01	.385600E+01	.382800E+01	.392900E+01	.394200E+01	.393200E+01
113- 120	.389500E+01	.381000E+01	.383100E+01	.383600E+01	.391200E+01	.403200E+01	.408200E+01	.436200E+01
121- 128	.459600E+01	.467000E+01	.462600E+01	.461100E+01	.464200E+01	.453900E+01	.485500E+01	.493200E+01
129- 136	.535600E+01	.538700E+01	.534400E+01	.500700E+01	.475900E+01	.455400E+01	.428800E+01	.385200E+01
137- 144	.364000E+01	.348000E+01	.430800E+01	.427500E+01	.445100E+01	.458800E+01	.476200E+01	.501200E+01
145- 152	.508100E+01	.496900E+01	.514400E+01	.536500E+01	.562100E+01	.554400E+01	.538200E+01	.509500E+01
153- 156	.520200E+01	.533400E+01	.549200E+01	.591600E+01				

AUTOCORRELATION FUNCTION

DATA - &USTRB 156 OBSERVATIONS

DIFFERENCING - ORIGINAL SERIES IS YOUR DATA.

DIFFERENCES BELOW ARE OF ORDER 1

ORIGINAL SERIES
MEAN OF THE SERIES = .34224E+01
ST. DEV. OF SERIES = .10334E+01
NUMBER OF OBSERVATIONS = 156

1- 12	.95	.89	.83	.76	.69	.63	.57	.52	.49	.46	.44	.42
ST.E.	.08	.13	.17	.19	.21	.23	.24	.24	.25	.26	.26	.27
13- 24	.39	.37	.34	.32	.31	.31	.32	.35	.37	.39	.42	.43
ST.E.	.27	.28	.28	.28	.28	.29	.29	.29	.29	.30	.30	.30

MEAN DIVIDED BY ST. ERROR = .41363E+02

TO TEST WHETHER THIS SERIES IS WHITE NOISE, THE VALUE .11419E+04
SHOULD BE COMPARED WITH A CHI-SQUARE VARIABLE WITH 24 DEGREES OF FREEDOM

DIFFERENCE 1
MEAN OF THE SERIES = .22323E-01
ST. DEV. OF SERIES = .22847E+00
NUMBER OF OBSERVATIONS = 155

1- 12	.38	.20	.07	.02	-.10	-.23	-.30	-.17	-.08	.00	-.00	.08
ST.E.	.08	.09	.09	.09	.09	.10	.10	.10	.11	.11	.11	.11
13- 24	.03	-.01	-.01	-.10	-.15	-.21	-.15	-.07	-.09	-.15	.00	.16
ST.E.	.11	.11	.11	.11	.11	.11	.11	.11	.11	.11	.11	.11

MEAN DIVIDED BY ST. ERROR = .12164E+01

TO TEST WHETHER THIS SERIES IS WHITE NOISE, THE VALUE .91349E+02
SHOULD BE COMPARED WITH A CHI-SQUARE VARIABLE WITH 24 DEGREES OF FREEDOM

GRAPH OF OBSERVED SERIES ACF

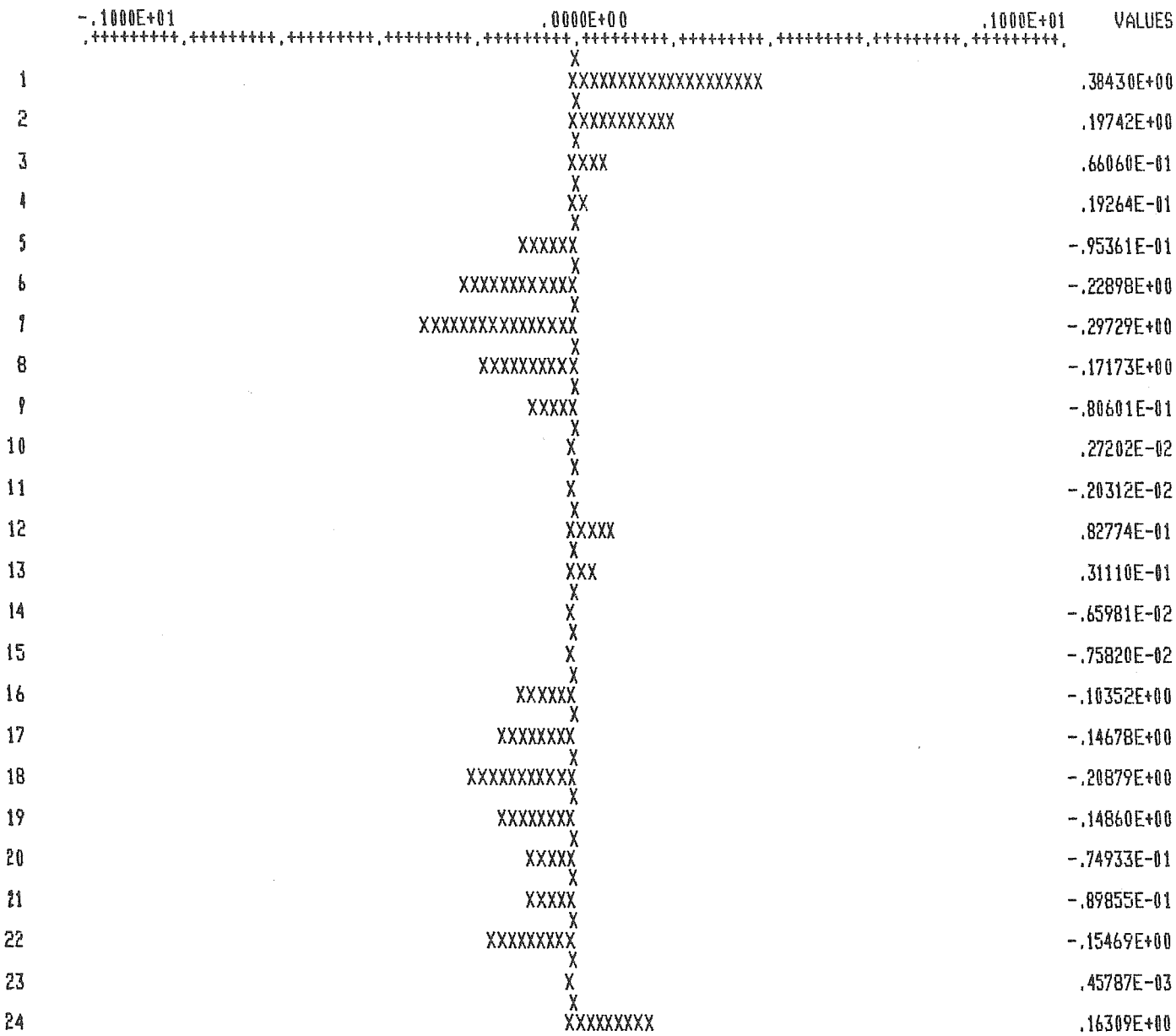
GRAPH INTERVAL IS .2000E-01

	-.1000E+01 .0000E+00 .1000E+01	VALUES
	.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.	
1	X XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	.95402E+00
2	X XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	.89482E+00
3	X XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	.82763E+00
4	X XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	.76060E+00
5	X XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	.69412E+00
6	X XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	.62686E+00
7	X XXXXXXXXXXXXXXXXXXXXXXXXXXXX	.56673E+00
8	X XXXXXXXXXXXXXXXXXXXXXXXXXX	.52103E+00
9	X XXXXXXXXXXXXXXXXXXXXXXXX	.48857E+00
10	X XXXXXXXXXXXXXXXXXXXXXX	.46364E+00
11	X XXXXXXXXXXXXXXXXXXXX	.44114E+00
12	X XXXXXXXXXXXXXXXXXX	.41811E+00
13	X XXXXXXXXXXXXXXXXX	.39170E+00
14	X XXXXXXXXXXXXXXXX	.36701E+00
15	X XXXXXXXXXXXXXXX	.34487E+00
16	X XXXXXXXXXXXXXX	.32476E+00
17	X XXXXXXXXXXXXX	.31169E+00
18	X XXXXXXXXXXXX	.30665E+00
19	X XXXXXXXXXXXXX	.32318E+00
20	X XXXXXXXXXXXXXX	.34583E+00
21	X XXXXXXXXXXXXXXX	.36985E+00
22	X XXXXXXXXXXXXXXXX	.39164E+00
23	X XXXXXXXXXXXXXXXXX	.41525E+00
24	X XXXXXXXXXXXXXXXXXX	.43411E+00

&USTRB

GRAPH OF DIFFERENCE 1 ACF

GRAPH INTERVAL IS .2000E-01



PARTIAL AUTOCORRELATIONS

DATA - &USTRB 156 OBSERVATIONS

DIFFERENCING - ORIGINAL SERIES IS YOUR DATA.

DIFFERENCES BELOW ARE OF ORDER 1

ORIGINAL SERIES
MEAN OF THE SERIES = .34224E+01
ST. DEV. OF SERIES = .10334E+01
NUMBER OF OBSERVATIONS = 156

1- 12	.95	-.17	-.10	-.01	-.03	-.05	.04	.11	.07	.01	-.02	-.04
13- 24	-.06	.02	.04	.03	.08	.07	.21	.01	-.02	-.01	.06	-.02

DIFFERENCE 1
MEAN OF THE SERIES = .22323E-01
ST. DEV. OF SERIES = .22847E+00
NUMBER OF OBSERVATIONS = 155

1- 12	.38	.06	-.03	-.01	-.12	-.19	-.17	.03	.03	.05	-.03	.04
13- 24	-.11	-.09	.00	-.11	-.08	-.13	-.02	-.01	-.10	-.20	.03	.10

GRAPH OF OBSERVED SERIES PACF

GRAPH INTERVAL IS .2000E-01

```
                -.1000E+01                          .0000E+00                          .1000E+01     VALUES
               .+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.
 1                                                  X
                                                    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX   .95402E+00
 2                                                  X
                                          XXXXXXXXXX                                                      -.17074E+00
 3                                                  X
                                             XXXXXX                                                       -.10228E+00
 4                                                  X
                                               XX                                                         -.13858E-01
 5                                                  X
                                               XX                                                         -.29280E-01
 6                                                  X
                                              XXXX                                                        -.52440E-01
 7                                                  X
                                               XXX                                                         .43030E-01
 8                                                  X
                                               XXXXXXX                                                     .11063E+00
 9                                                  X
                                               XXXXX                                                       .71824E-01
10                                                  X
                                               XX                                                          .10610E-01
11                                                  X
                                              XX                                                          -.22211E-01
12                                                  X
                                             XXX                                                          -.38580E-01
13                                                  X
                                              XXXX                                                        -.62090E-01
14                                                  X
                                               XX                                                          .19453E-01
15                                                  X
                                               XXX                                                         .38561E-01
16                                                  X
                                               XX                                                          .28200E-01
17                                                  X
                                               XXXXX                                                       .82850E-01
18                                                  X
                                               XXXXX                                                       .74734E-01
19                                                  X
                                               XXXXXXXXXXXX                                                .21285E+00
20                                                  X
                                               X                                                           .55710E-02
21                                                  X
                                               XX                                                         -.18164E-01
22                                                  X
                                               XX                                                         -.11905E-01
23                                                  X
                                               XXXX                                                        .57901E-01
24                                                  X
                                               XX                                                         -.22904E-01
```

GRAPH OF DIFFERENCE 1 PACF

GRAPH INTERVAL IS .2000E-01

```
                -.1000E+01                          .0000E+00                          .1000E+01     VALUES
                .+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.
 1                                                  X
                                                    XXXXXXXXXXXXXXXXXXX                              .38430E+00
 2                                                  X
                                                    XXXX                                             .58347E-01
 3                                                  X
                                                  XXX                                               -.32732E-01
 4                                                  X
                                                    X                                               -.71258E-02
 5                                                  X
                                                 XXXXXX                                             -.11591E+00
 6                                                  X
                                               XXXXXXXXX                                            -.18709E+00
 7                                                  X
                                                XXXXXXXX                                            -.16517E+00
 8                                                  X
                                                    XXX                                              .31342E-01
 9                                                  X
                                                    XXX                                              .33580E-01
10                                                  X
                                                    XXXX                                             .52218E-01
11                                                  X
                                                  XXX                                               -.31363E-01
12                                                  X
                                                    XXX                                              .37743E-01
13                                                  X
                                                 XXXXX                                              -.10796E+00
14                                                  X
                                                 XXXXX                                              -.94306E-01
15                                                  X
                                                    X                                               .31920E-02
16                                                  X
                                                 XXXXX                                              -.10809E+00
17                                                  X
                                                  XXXX                                              -.77583E-01
18                                                  X
                                                 XXXXXX                                             -.12959E+00
19                                                  X
                                                   XX                                               -.19914E-01
20                                                  X
                                                   XX                                               -.14861E-01
21                                                  X
                                                 XXXXX                                              -.10457E+00
22                                                  X
                                              XXXXXXXXXX                                            -.19612E+00
23                                                  X
                                                    XX                                              .27213E-01
24                                                  X
                                                    XXXXXX                                          .10302E+00
```

4 - EXAMPLE 2 : MULTIPLE VARIABLES CASE

UNIVARIATE STOCHASTIC IDENTIFICATION (USID)

GENERAL SPECIFICATION

01	CALCULATE AUTO CORRELATIONS	IWACF =	1
01	CALCULATE CROSS CORRELATIONS	IWCCF =	0
01	PREWHITENING MODELS WILL BE SUPPLIED	IWPREW =	0

SPECIFICATION OF TIME SERIES

02	NUMBER OF SEPARATE SERIES	NSERIE =	3
03	NUMBER OF OBSERVATIONS PER SERIES	NOB =	150
06	SERIES 1 &TWIN1		
00	FIRST OBS	FOB =	1
07	LISTED	ILDID =	1
08	PLOTTED	IPDID =	0
06	SERIES 2 &TWIN2		
00	FIRST OBS	FOB =	1
07	LISTED	ILDID =	1
08	PLOTTED	IPDID =	0
06	SERIES 3 &TWIN0		
00	FIRST OBS	FOB =	1
07	LISTED	ILDID =	1
08	PLOTTED	IPDID =	0
09	TRANSFORMATION OF TIME SERIES 1	TLAMID =	.100000E+01
		TMID =	.000000E+00
09	TRANSFORMATION OF TIME SERIES 2	TLAMID =	.100000E+01
		TMID =	.000000E+00
09	TRANSFORMATION OF TIME SERIES 3	TLAMID =	.100000E+01
		TMID =	.000000E+00
10	NUMBER OF DIFFERENCING FACTORS	NDIFID =	0

SPECIFICATION FOR THE AUTO CORR. FUNCTION

12	AUTO CORR. FUNCTION FOR SERIES 1	IACF =	1
12	AUTO CORR. FUNCTION FOR SERIES 2	IACF =	1
12	AUTO CORR. FUNCTION FOR SERIES 3	IACF =	1

SPECIFICATION FOR THE AUTO CORR. FUNCTION

13	MAX. LAG IN CALC. AUTO CORR.	NAC =	20
13	MAX. LAG IN CALC. PART. AUTO CORR.	NPAC =	20
13	NUMBER OF AUTO CORR. CHI-SQ. STAT.	NCHI =	20
13	STANDARD ERRORS FOR AUTO CORR.	NCSE =	1
13	NUMBER OF AUTO CORR. PER LINE	NAPL =	10
13	PLOTTING OF AUTO CORR.	IWTPA =	1

&TWIN1

LISTING OF OBSERVED SERIES

1- 8	.723000E+02	.747000E+02	.792000E+02	.810000E+02	.812000E+02	.752000E+02	.752000E+02	.732000E+02
9- 16	.754000E+02	.722000E+02	.759000E+02	.748000E+02	.771000E+02	.746000E+02	.762000E+02	.781000E+02
17- 24	.790000E+02	.754000E+02	.769000E+02	.780000E+02	.757000E+02	.730000E+02	.737000E+02	.755000E+02
25- 32	.753000E+02	.796000E+02	.805000E+02	.826000E+02	.754000E+02	.736000E+02	.754000E+02	.778000E+02
33- 40	.769000E+02	.747000E+02	.743000E+02	.795000E+02	.757000E+02	.735000E+02	.709000E+02	.740000E+02
41- 48	.738000E+02	.756000E+02	.747000E+02	.750000E+02	.779000E+02	.747000E+02	.758000E+02	.799000E+02
49- 56	.764000E+02	.791000E+02	.794000E+02	.817000E+02	.790000E+02	.753000E+02	.742000E+02	.730000E+02
57- 64	.755000E+02	.697000E+02	.693000E+02	.710000E+02	.686000E+02	.756000E+02	.734000E+02	.766000E+02
65- 72	.726000E+02	.729000E+02	.726000E+02	.735000E+02	.759000E+02	.756000E+02	.812000E+02	.809000E+02
73- 80	.812000E+02	.822000E+02	.799000E+02	.787000E+02	.798000E+02	.736000E+02	.720000E+02	.738000E+02
81- 88	.758000E+02	.706000E+02	.728000E+02	.713000E+02	.725000E+02	.725000E+02	.725000E+02	.732000E+02
89- 96	.751000E+02	.727000E+02	.758000E+02	.767000E+02	.781000E+02	.797000E+02	.809000E+02	.810000E+02
97- 104	.791000E+02	.773000E+02	.772000E+02	.766000E+02	.757000E+02	.726000E+02	.720000E+02	.730000E+02
105- 112	.730000E+02	.761000E+02	.775000E+02	.771000E+02	.743000E+02	.762000E+02	.754000E+02	.763000E+02
113- 120	.779000E+02	.794000E+02	.786000E+02	.793000E+02	.761000E+02	.763000E+02	.782000E+02	.765000E+02
121- 128	.790000E+02	.801000E+02	.771000E+02	.746000E+02	.721000E+02	.737000E+02	.766000E+02	.770000E+02
129- 136	.773000E+02	.783000E+02	.775000E+02	.762000E+02	.751000E+02	.772000E+02	.730000E+02	.722000E+02
137- 144	.750000E+02	.709000E+02	.753000E+02	.758000E+02	.778000E+02	.776000E+02	.754000E+02	.764000E+02
145- 150	.741000E+02	.722000E+02	.736000E+02	.750000E+02	.748000E+02	.755000E+02		

&TWIN2

LISTING OF OBSERVED SERIES

1- 8	.100600E+03	.100400E+03	.103700E+03	.101100E+03	.104100E+03	.101200E+03	.104500E+03	.972000E+02
9- 16	.106000E+03	.100700E+03	.103800E+03	.989000E+02	.108300E+03	.102100E+03	.104600E+03	.101200E+03
17- 24	.101900E+03	.995000E+02	.104200E+03	.100400E+03	.106200E+03	.981000E+02	.104200E+03	.102100E+03
25- 32	.100200E+03	.106700E+03	.102200E+03	.102500E+03	.103100E+03	.104600E+03	.102600E+03	.105500E+03
33- 40	.100400E+03	.994000E+02	.103800E+03	.100000E+03	.100200E+03	.100900E+03	.101600E+03	.994000E+02
41- 48	.104800E+03	.100900E+03	.103100E+03	.100800E+03	.991000E+02	.106700E+03	.964000E+02	.103000E+03
49- 56	.987000E+02	.101300E+03	.100100E+03	.986000E+02	.105200E+03	.983000E+02	.107400E+03	.104400E+03
57- 64	.100400E+03	.105000E+03	.981000E+02	.102900E+03	.102600E+03	.986000E+02	.103300E+03	.101600E+03
65- 72	.106400E+03	.101600E+03	.101300E+03	.101500E+03	.986000E+02	.998000E+02	.103700E+03	.990000E+02
73- 80	.104700E+03	.100600E+03	.101900E+03	.101600E+03	.996000E+02	.102300E+03	.101200E+03	.103400E+03
81- 88	.105000E+03	.100800E+03	.104600E+03	.104500E+03	.103100E+03	.100500E+03	.100800E+03	.101500E+03
89- 96	.102200E+03	.103200E+03	.100700E+03	.987000E+02	.105000E+03	.968000E+02	.105100E+03	.101000E+03
97- 104	.998000E+02	.100000E+03	.103100E+03	.984000E+02	.103900E+03	.101000E+03	.104300E+03	.100000E+03
105- 112	.104800E+03	.946000E+02	.102100E+03	.100600E+03	.100300E+03	.103400E+03	.982000E+02	.985000E+02
113- 120	.100900E+03	.975000E+02	.104200E+03	.101100E+03	.103800E+03	.987000E+02	.106700E+03	.988000E+02
121- 128	.100400E+03	.104200E+03	.963000E+02	.101300E+03	.100500E+03	.995000E+02	.983000E+02	.105400E+03
129- 136	.957000E+02	.105700E+03	.101300E+03	.990000E+02	.102100E+03	.105000E+03	.103100E+03	.101700E+03
137- 144	.105000E+03	.973000E+02	.103900E+03	.103000E+03	.998000E+02	.105300E+03	.101600E+03	.106000E+03
145- 150	.104800E+03	.107000E+03	.100400E+03	.110800E+03	.995000E+02	.104700E+03		

&TWIN0

LISTING OF OBSERVED SERIES

1- 8	.440300E+03	.441800E+03	.439400E+03	.446500E+03	.447900E+03	.472900E+03	.471900E+03	.479300E+03
9- 16	.444800E+03	.477700E+03	.436200E+03	.455300E+03	.431200E+03	.475200E+03	.438800E+03	.461700E+03
17- 24	.451500E+03	.456200E+03	.455800E+03	.474900E+03	.455300E+03	.482900E+03	.442000E+03	.464000E+03
25- 32	.443000E+03	.444100E+03	.466300E+03	.445700E+03	.477600E+03	.488300E+03	.479200E+03	.460800E+03
33- 40	.465000E+03	.453400E+03	.457200E+03	.468200E+03	.440800E+03	.464300E+03	.461100E+03	.447900E+03
41- 48	.435100E+03	.451000E+03	.430900E+03	.448000E+03	.436900E+03	.438200E+03	.474400E+03	.424500E+03
49- 56	.470700E+03	.447400E+03	.467600E+03	.467900E+03	.462100E+03	.503100E+03	.463800E+03	.498400E+03
57- 64	.457100E+03	.445100E+03	.462300E+03	.423400E+03	.440300E+03	.417700E+03	.397900E+03	.443100E+03
65- 72	.416800E+03	.455700E+03	.424300E+03	.434000E+03	.431900E+03	.422900E+03	.439100E+03	.454200E+03
73- 80	.446000E+03	.488000E+03	.471500E+03	.491000E+03	.488500E+03	.482200E+03	.491200E+03	.469400E+03
81- 88	.463400E+03	.458400E+03	.442300E+03	.451000E+03	.439400E+03	.427100E+03	.423500E+03	.425900E+03
89- 96	.429300E+03	.430000E+03	.440700E+03	.424900E+03	.428900E+03	.467900E+03	.433600E+03	.487300E+03
97- 104	.466900E+03	.472600E+03	.482100E+03	.487000E+03	.456600E+03	.484800E+03	.456900E+03	.462500E+03
105- 112	.434100E+03	.456000E+03	.405900E+03	.461700E+03	.447200E+03	.450700E+03	.460000E+03	.436300E+03
113- 120	.449500E+03	.459000E+03	.449700E+03	.484800E+03	.463300E+03	.478800E+03	.457300E+03	.484300E+03
121- 128	.452300E+03	.468000E+03	.479400E+03	.455900E+03	.486900E+03	.457200E+03	.447200E+03	.445400E+03
129- 136	.469500E+03	.426500E+03	.484300E+03	.455800E+03	.457000E+03	.474100E+03	.470100E+03	.461000E+03
137- 144	.445500E+03	.454200E+03	.424300E+03	.451200E+03	.435300E+03	.434700E+03	.468400E+03	.447400E+03
145- 150	.469000E+03	.456700E+03	.464500E+03	.427300E+03	.474700E+03	.415200E+03		

AUTOCORRELATION FUNCTION

DATA - &TWIN1 150 OBSERVATIONS

ORIGINAL SERIES
MEAN OF THE SERIES = .75827E+02
ST. DEV. OF SERIES = .28356E+01
NUMBER OF OBSERVATIONS = 150

1- 10	.63	.41	.18	.06	-.06	-.16	-.18	-.19	-.24	-.30
ST.E.	.08	.11	.12	.12	.12	.12	.12	.12	.13	.13
11- 20	-.31	-.24	-.32	-.26	-.18	-.15	-.06	-.02	.16	.31
ST.E.	.13	.14	.14	.15	.15	.15	.15	.15	.15	.15

MEAN DIVIDED BY ST. ERROR = .32752E+03

TO TEST WHETHER THIS SERIES IS WHITE NOISE, THE VALUE .21779E+03
SHOULD BE COMPARED WITH A CHI-SQUARE VARIABLE WITH 20 DEGREES OF FREEDOM

&TWIN1

GRAPH OF OBSERVED SERIES ACF

GRAPH INTERVAL IS .2000E-01

```
      -.1000E+01                                .0000E+00                                .1000E+01     VALUES
      .+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.
                                                X
 1                                              XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX                    .62846E+00
                                                X
 2                                              XXXXXXXXXXXXXXXXXXXXX                               .41328E+00
                                                X
 3                                              XXXXXXXXXX                                          .18448E+00
                                                X
 4                                              XXXX                                                .61255E-01
                                                X
 5                                            XXXX                                                  -.55109E-01
                                                X
 6                                          XXXXXXXXX                                               -.16245E+00
                                                X
 7                                         XXXXXXXXXX                                               -.17817E+00
                                                X
 8                                         XXXXXXXXXX                                               -.18609E+00
                                                X
 9                                       XXXXXXXXXXXXX                                              -.23811E+00
                                                X
10                                      XXXXXXXXXXXXXXXX                                            -.30085E+00
                                                X
11                                     XXXXXXXXXXXXXXXXX                                            -.31453E+00
                                                X
12                                       XXXXXXXXXXXXX                                              -.24392E+00
                                                X
13                                     XXXXXXXXXXXXXXXXX                                            -.32317E+00
                                                X
14                                       XXXXXXXXXXXXX                                              -.26226E+00
                                                X
15                                         XXXXXXXXXX                                               -.18226E+00
                                                X
16                                          XXXXXXXX                                                -.14780E+00
                                                X
17                                            XXXX                                                  -.55761E-01
                                                X
18                                             XX                                                   -.21004E-01
                                                X
19                                             XXXXXXXXX                                            .16070E+00
                                                X
20                                             XXXXXXXXXXXXXXXX                                     .30759E+00
```

PARTIAL AUTOCORRELATIONS

DATA - &TWIN1 150 OBSERVATIONS

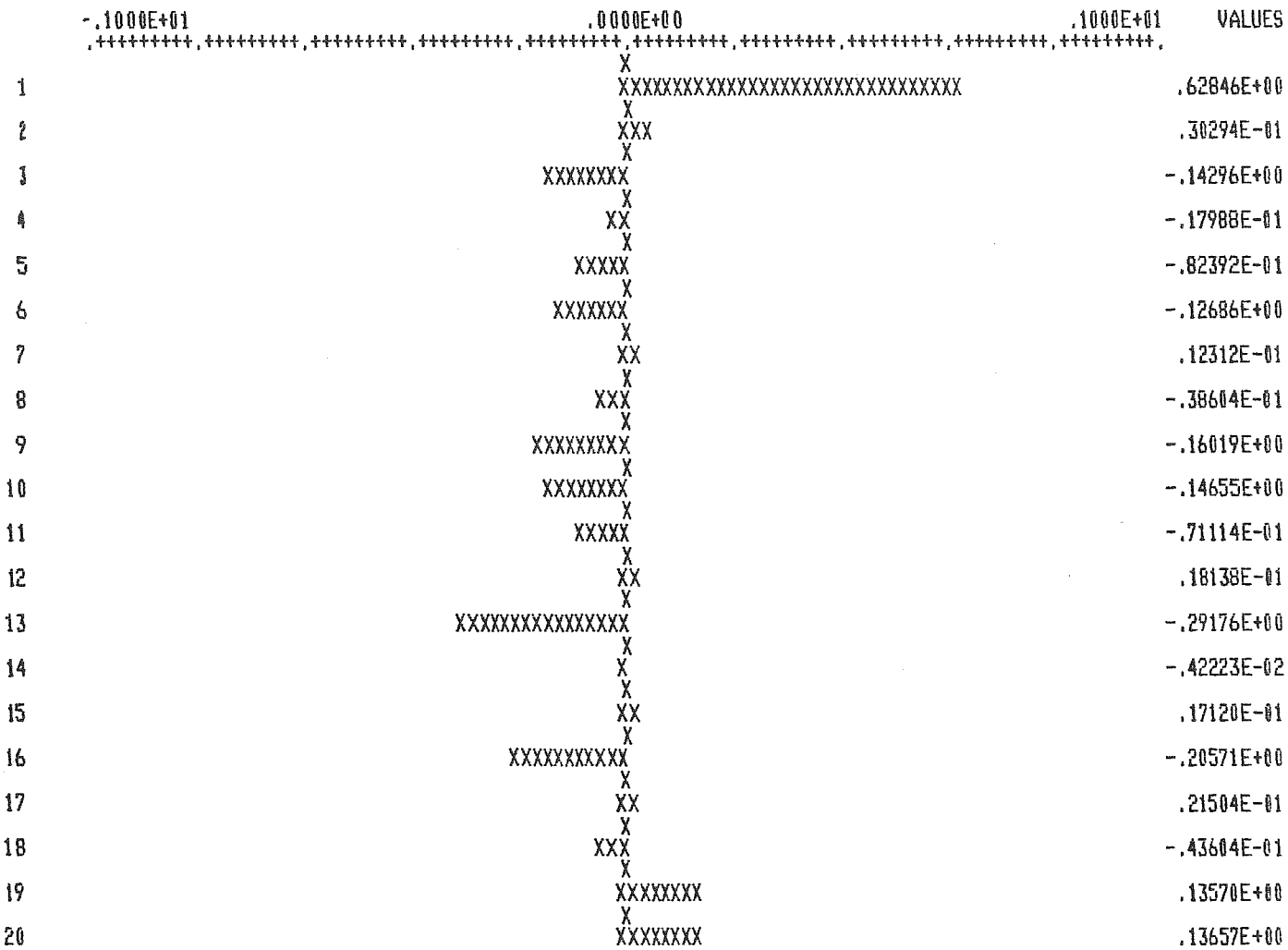
ORIGINAL SERIES
MEAN OF THE SERIES = .75827E+02
ST. DEV. OF SERIES = .28356E+01
NUMBER OF OBSERVATIONS = 150

1- 10	.63	.03	-.14	-.02	-.08	-.13	.01	-.04	-.16	-.15
11- 20	-.07	.02	-.29	-.00	.02	-.21	.02	-.04	.14	.14

&TWIN1

GRAPH OF OBSERVED SERIES PACF

GRAPH INTERVAL IS .2000E-01



AUTOCORRELATION FUNCTION

DATA - &TWIN2 150 OBSERVATIONS

ORIGINAL SERIES
MEAN OF THE SERIES = .10189E+03
ST. DEV. OF SERIES = .27674E+01
NUMBER OF OBSERVATIONS = 150

1- 10	-.40	.37	.01	-.00	.00	.11	-.07	.01	.07	.02
ST.E.	.08	.09	.10	.10	.10	.10	.10	.10	.10	.10
11- 20	-.06	.18	-.16	.08	.10	-.09	.03	.13	-.23	.23
ST.E.	.10	.10	.11	.11	.11	.11	.11	.11	.11	.11

MEAN DIVIDED BY ST. ERROR = .45093E+03

TO TEST WHETHER THIS SERIES IS WHITE NOISE, THE VALUE .84956E+02
SHOULD BE COMPARED WITH A CHI-SQUARE VARIABLE WITH 20 DEGREES OF FREEDOM

&TWIN2

GRAPH OF OBSERVED SERIES ACF

GRAPH INTERVAL IS .2000E-01

```
      -.1000E+01                                  .0000E+00                                     .1000E+01     VALUES
      .+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.
                                                        X
1                                   XXXXXXXXXXXXXXXXXXXXX                                                     -.39979E+00
                                                        X
2                                                       XXXXXXXXXXXXXXXXXXX                                    .36592E+00
                                                        X
3                                                       X                                                      .60011E-02
                                                        X
4                                                       X                                                     -.47627E-02
                                                        X
5                                                       X                                                      .96668E-03
                                                        X
6                                                       XXXXXXX                                                .11322E+00
                                                        X
7                                                    XXXX                                                     -.67364E-01
                                                        X
8                                                       X                                                      .66147E-02
                                                        X
9                                                       XXXXX                                                  .72868E-01
                                                        X
10                                                      XX                                                     .23472E-01
                                                        X
11                                                   XXXX                                                     -.61717E-01
                                                        X
12                                                      XXXXXXXXXX                                             .17513E+00
                                                        X
13                                              XXXXXXXXX                                                     -.16319E+00
                                                        X
14                                                      XXXXX                                                  .82835E-01
                                                        X
15                                                      XXXXXX                                                 .99351E-01
                                                        X
16                                                  XXXXX                                                     -.88107E-01
                                                        X
17                                                      XXX                                                    .30208E-01
                                                        X
18                                                      XXXXXXX                                                .12537E+00
                                                        X
19                                              XXXXXXXXXXXXX                                                 -.23310E+00
                                                        X
20                                                      XXXXXXXXXXXXX                                          .23350E+00
```

PARTIAL AUTOCORRELATIONS

DATA - &TWIN2 150 OBSERVATIONS

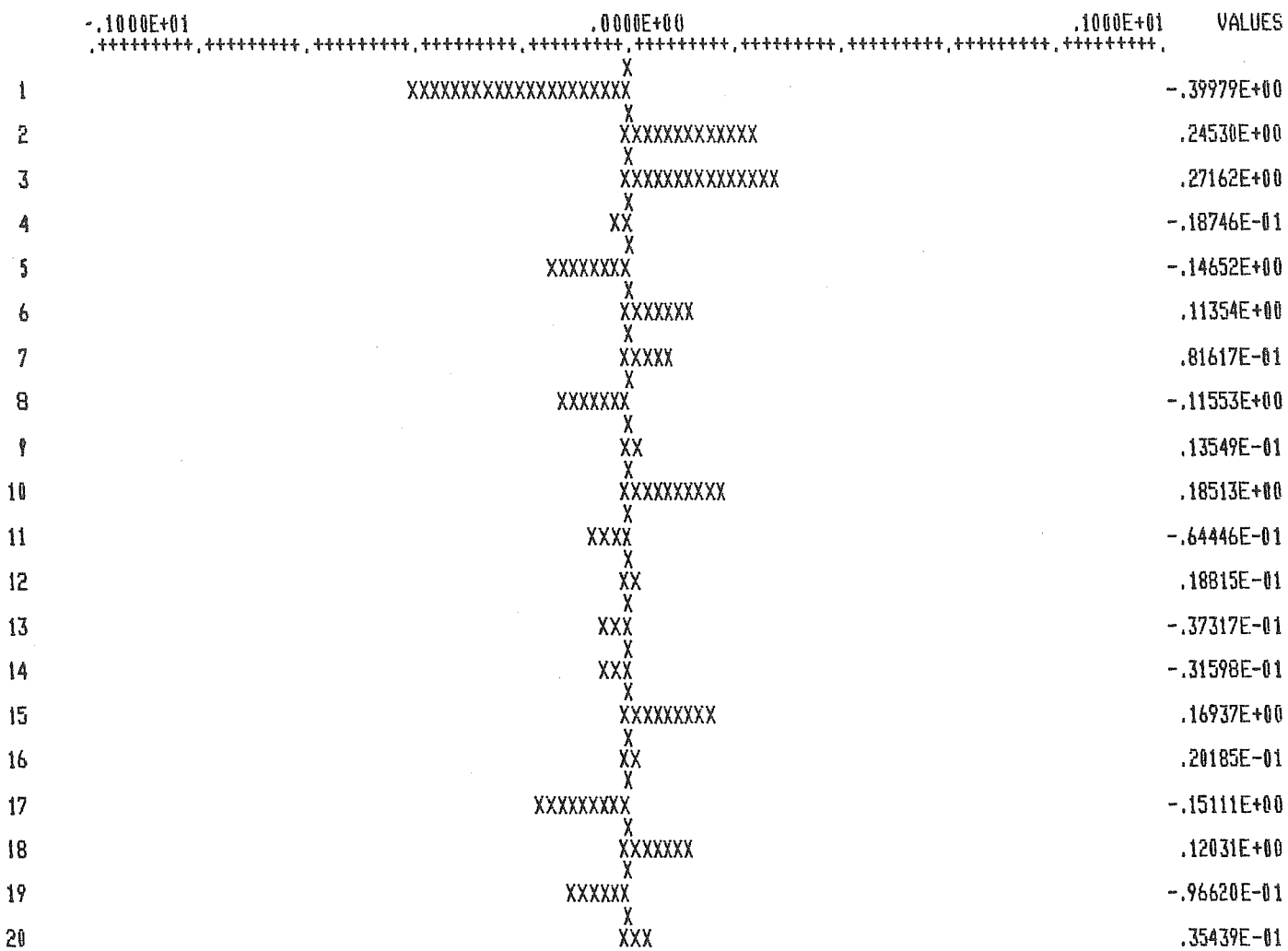
ORIGINAL SERIES
MEAN OF THE SERIES = .10189E+03
ST. DEV. OF SERIES = .27674E+01
NUMBER OF OBSERVATIONS = 150

1- 10	-.40	.25	.27	-.02	-.15	.11	.08	-.12	.01	.19
11- 20	-.06	.02	-.04	-.03	.17	.02	-.15	.12	-.10	.04

&TWIN2

GRAPH OF OBSERVED SERIES PACF

GRAPH INTERVAL IS .2000E-01



AUTOCORRELATION FUNCTION

DATA - &TWINO 150 OBSERVATIONS

ORIGINAL SERIES
MEAN OF THE SERIES = .45467E+03
ST. DEV. OF SERIES = .20045E+02
NUMBER OF OBSERVATIONS = 150

1- 10	.26	.58	.25	.11	.03	-.06	-.17	-.20	-.25	-.27
ST.E.	.08	.09	.11	.11	.11	.11	.11	.12	.12	.12
11- 20	-.38	-.23	-.37	-.23	-.15	-.18	-.01	.11	.05	.37
ST.E.	.13	.13	.14	.14	.14	.15	.15	.15	.15	.15

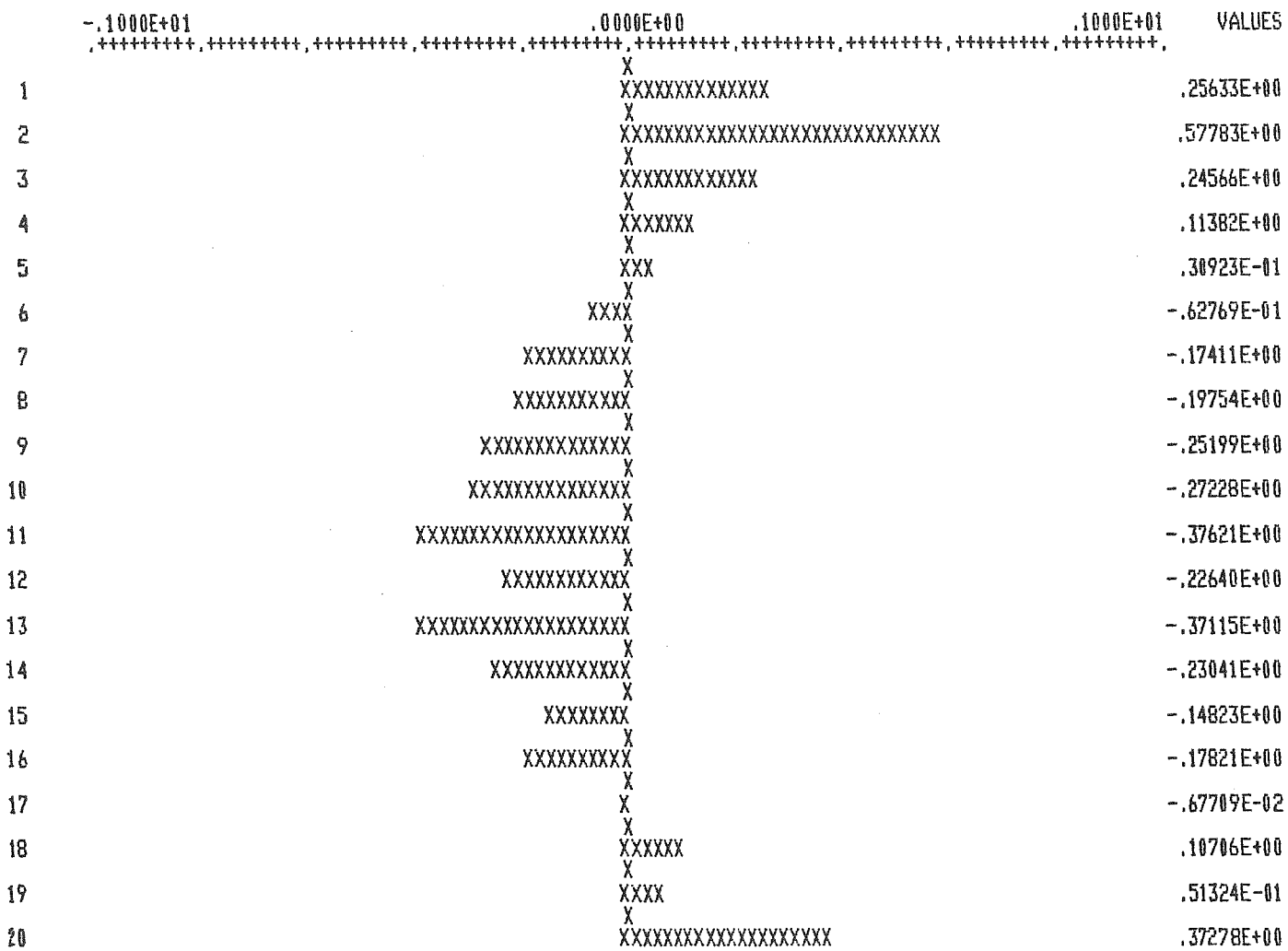
MEAN DIVIDED BY ST. ERROR = .27781E+03

TO TEST WHETHER THIS SERIES IS WHITE NOISE, THE VALUE .20653E+03
SHOULD BE COMPARED WITH A CHI-SQUARE VARIABLE WITH 20 DEGREES OF FREEDOM

&TWINO

GRAPH OF OBSERVED SERIES ACF

GRAPH INTERVAL IS .2000E-01



PARTIAL AUTOCORRELATIONS

DATA - &TWINO 150 OBSERVATIONS

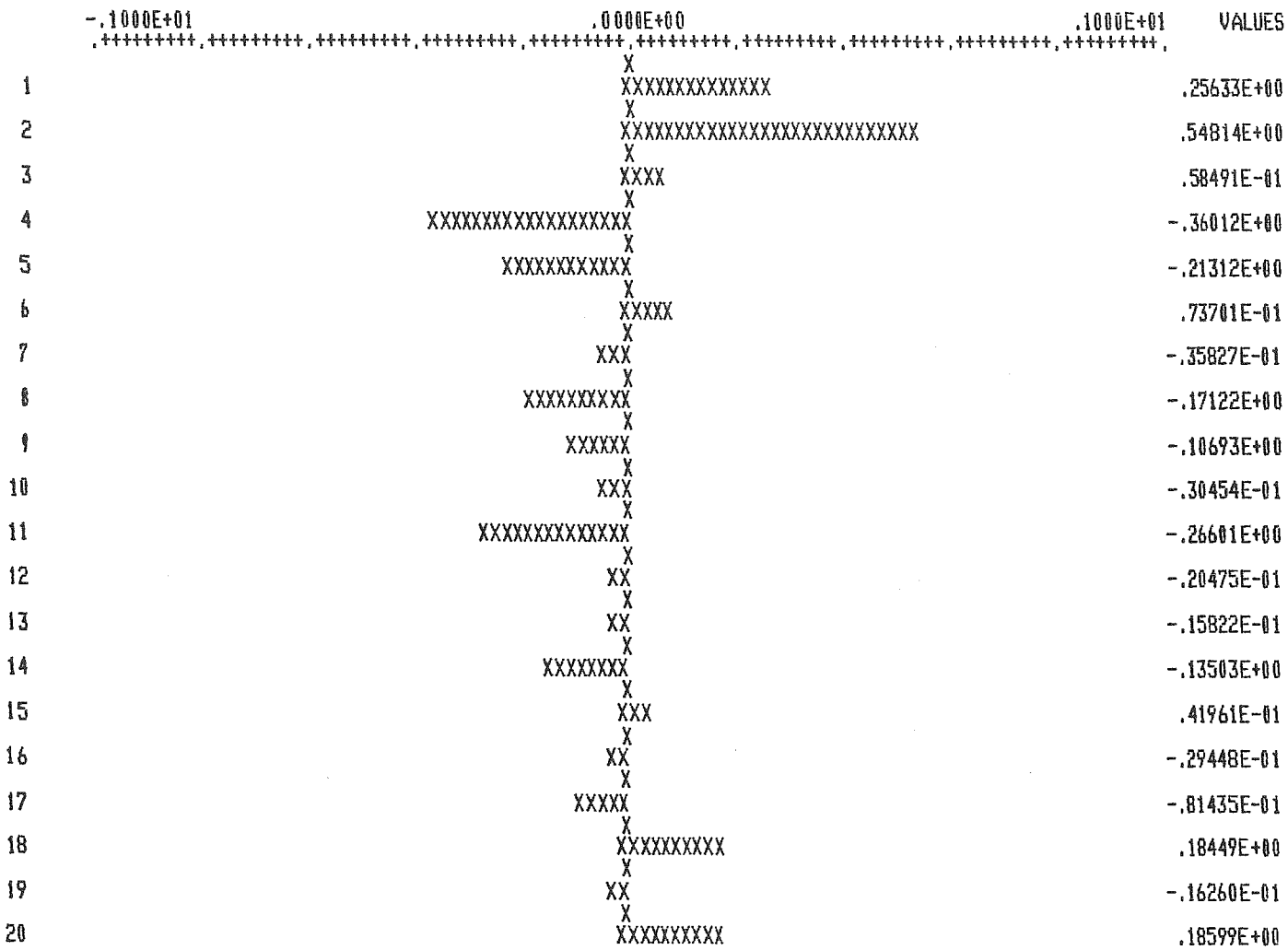
ORIGINAL SERIES
MEAN OF THE SERIES = .45467E+03
ST. DEV. OF SERIES = .20045E+02
NUMBER OF OBSERVATIONS = 150

1- 10	.26	.55	.06	-.36	-.21	.07	-.04	-.17	-.11	-.03
11- 20	-.27	-.02	-.02	-.14	.04	-.03	-.08	.18	-.02	.19

&TWINO

GRAPH OF OBSERVED SERIES PACF

GRAPH INTERVAL IS .2000E-01



II - UNIVARIATE TRANSFER FUNCTION MODEL

1 - MODEL STRUCTURE

The Univariate Transfer Function Model (Single Output - Single Input Model) can be written in its most general form as

$$y_t = \theta_0 + \prod_{i=1}^{NOL} \delta_i^{-1}(B) \prod_{j=1}^{NIL} \omega_j(B) x_{t-b} + N_t$$

The model consists of

1. a stationary output variable y_t, i.e. an appropriately transformed and differenced continuously fluctuating variable defined as

$$y_t = \begin{cases} \prod_{k=1}^{NDY} (1-B^{SY_k})^{dY_k} Y_t^{(\lambda Y)} & (NDY \neq 0) \\ Y_t^{(\lambda Y)} - \bar{Y}^{(\lambda Y)} & (NDY = 0) \end{cases}$$

where

$$Y_t^{(\lambda Y)} = \begin{cases} (Y_t + \text{scaling constant})^{\lambda Y} & (\lambda Y \neq 0) \\ \ln_e (Y_t + \text{scaling constant}) & (\lambda Y = 0) \end{cases}$$

$\bar{Y}^{(\lambda Y)}$ is the mean of $Y_t^{(\lambda Y)}$

and

NDY is the number of differencing factors for Y

SY_k is the order of the k^{th} differencing

dY_k is the number of differences of order SY_k

2. a single parameter θ_0 representing the possible presence of a deterministic trend over time

3. one or more input variables x_t. The Single Input Model can easily be generalized to a Multiple Input Model by adding one or more input variables to the general specification. Each of these inputs may be a continuously fluctuating variable or an intervention variable consisting of a sequence of steps or pulses. If the input is of the continuous type it can be defined as

$$x_t = \begin{cases} \prod_{l=1}^{NDX} (1-B)^{SX_l)^{dX_l}} X_t^{(\lambda X)} & (NDX \neq 0) \\ X_t^{(\lambda X)} - \bar{X}^{(\lambda X)} & (NDX = 0) \end{cases}$$

where

$$X_t^{(\lambda X)} = \begin{cases} (X_t + \text{scaling constant})^{\lambda X} & (\lambda X \neq 0) \\ \ln_e (X_t + \text{scaling constant}) & (\lambda X = 0) \end{cases}$$

$\bar{X}^{(\lambda X)}$ is the mean of $X_t^{(\lambda X)}$

and

NDX is the number of differencing factors for X

SX_l is the order of the l^{th} differencing

dX_l is the number of differences of order SX_l

4. a noise parameter N_t, which is not a random shock in the system but a modelable noise component that may be reduced to a random series or "white noise" by, apart from the transformation, a Univariate Stochastic Model.

The influence of each of the input variables on the output variable y_t is captured by

1. NOL autoregressive transfer function operators or output lag factors, the i^{th} factor given by a polynomial of degree R_i in the backward shift operator B, i.e.

   $$\delta_i(B) = (1-\delta_{i1}B - \delta_{i2}B^2 - \ldots - \delta_{iR_i}B^{R_i})$$

   and containing one or more autoregressive transfer function parameters δ_{im}.
   The output lag factor is so named because it can be seen as multiplying the output y_t.

2. NIL moving average transfer function operators or input lag factors, the j^{th} factor given by a polynomial of degree S_j in the backward shift operator B, i.e.

   $$\omega_j(B) = (\omega_{j0}-\omega_{j1}B-\omega_{j2}B^2 - \ldots - \omega_{jS_j}B^{S_j})$$

   and containing one or more moving average transfer function parameters ω_{jm}.
   The input lag factor is so named because it multiplies the input x_{t-b}.
   It should be noted that for $j > 1$, $\omega_{j0} = 1$ by definition.

3. a delay parameter b measuring the delay before a change in the input x begins to have an effect on the output y_t.

2 - PROGRAM INPUT STRUCTURE

For each input the original input number is mentioned. Additional inputs can easily be recognized since they all have been given the same number "00".

A "# " sign means that on displaying that particular input question this "# " sign will be replaced by a sequence number (number of time series, factor, parameter, ...)

A vertical accolade means that the indicated inputs form a sequence. If the necessary condition is satisfied this sequence will be repeated as many times as indicated.

2.1. Displayed Questions

GENERAL SPECIFICATION

```
INPUT 00
ENTER IPROG : General Program Parameter
              = 0 STOP
              = 1 Univariate Stochastic Iden.(USID)
              = 2 Mult.Inp.Trans.Func.Iden.(MTID)

INPUT 00
ENTER IOUT  : Logical Unit Number Output Device
              = 1 Display
              = 6 Printer

INPUT 00
ENTER LISIN : Listing of Input Parameters
              = 0 No
              = 1 Yes
```

```
INPUT 01
ENTER IWACF : Calculate Auto Correlations
              = 0 No
              = 1 Yes

INPUT 01
ENTER IWCCF : Calculate Cross Correlations
              = 0 No
              = 1 Yes

INPUT 01
ENTER IWPREW : Prewhitening Models will be Supplied
               = 0 No
               = 1 Yes
```

SPECIFICATION OF TIME SERIES

```
INPUT 02
ENTER NSERIE : Number of Separate Time Series (NSERIE.LE.6)

INPUT 03
ENTER NOB    : Number of Observations (NOB.LE.300)

INPUT 06
ENTER RNAM   : Title of Time Series #  (Max.48 Characters)

ENTER NAME     of Datafile

INPUT 00
ENTER FOB    : First Obs. of Time Series  #

INPUT 07
ENTER ILDID  : Listing of Time Series #
               = 0 No
               = 1 Yes
```

```
INPUT 08
ENTER IPDID : Plotting of Time Series #
              = 0 No
              = 1 Yes
```

TRANSFORMATION OF TIME SERIES #

```
INPUT 09    : Transformation of Time Series #

INPUT 09
ENTER TLAMID : Exponent of Power Transformation (Lambda)
               = 0.0 Natural log Transformation
               = 1.0 No Data     Transformation
               = X.X Exponent of Transformation

INPUT 09
ENTER TMID  : Mean  Correction before  Transformation
              = 0.0 No Correction of the Mean
              = X.X Amount Added to  Series before Transform.

INPUT 10
ENTER NDIFID : Number of Differencing Factors (NDIFID.LE.3)
               = 0 No Differencing
               = X Number of Differencing Types

INPUT 11
ENTER NDID  : Number of Differences of Factor #

INPUT 11
ENTER IODID : Order of Differences of Factor #
```

SPECIFICATION FOR THE AUTOCORRELATION FUNCTION

INPUT 13 : Specification for the Autocorrelation Function

INPUT 12
ENTER IACF : Auto Corr.Function for Series #
= 0 No
= 1 Yes

INPUT 13
ENTER NAC : Lag for Auto Corr.Function (NAC.LE.100)

INPUT 13
ENTER NPAC : Lag for Part.Auto Corr.Func.(NPAC.LE.NAC)

INPUT 13
ENTER NCHI : Chi-Square Statistic for Auto Corr.Function
= 0 Suppress Statistic
= X Number of Terms to be Used (NCHI.LE.NAC)

INPUT 13
ENTER MCSE : Standard Errors of Individual Auto Correlations
= 0 No
= 1 Yes

INPUT 13
ENTER NAPL : Number of Auto Corr.per Line (NAPL.LE.12)

INPUT 13
ENTER IWTPA : Plotting of Auto Correlations
= 0 No
= 1 Yes

SPECIFICATION FOR THE CROSS CORRELATION FUNCTION

INPUT 14 : Specification for the Cross Correlation Function

INPUT 14
ENTER ICCF : Cross Corr.between Series # and #
= 0 No
= 1 Yes

INPUT 15
ENTER NCC : Lag for Cross Corr.Function (NCC.LE.109)

INPUT 15
ENTER IWTPCC : Plotting of Cross Correlations
= 0 No
= 1 Yes

PREWHITENING MODEL FOR INPUT SERIES #

INPUT 16 : Prewhitening Model for Input Series #

INPUT 16
ENTER IPWCCF : Cross Corr.between Prewh.Series # and #
= 0 No
= 1 Yes

INPUT 17
ENTER TLAM : Exponent of Power Transformation (Lambda)
= 0.0 Natural log Transformation
= 1.1 No Data Transformation
= X.X Exponent of Transformation

INPUT 17
ENTER TM : Mean Correction before Transformation
= 0.0 No Correction of the Mean
= X.X Amount Added to Series before Transform.

```
INPUT 18
ENTER MFAC2  : Number of Dif.Factors (MFAC2.LE.3)
               = 0 No Differencing
               = X Number of Differencing Types

INPUT 20
ENTER ND     : Number of Differences of Factor #

INPUT 20
ENTER IOD    : Order of Differences of Factor #

INPUT 19
ENTER AVEPA  : Final Estimate of the Mean

INPUT 18
ENTER MFAC1  : Number of AR-Factors (MFAC1.LE.(6-MFAC3))

INPUT 21
ENTER INC    : Number of Parameters in AR-Factor #

INPUT 22
ENTER IOPA   : Order of Parameter #  in AR-Factor #

INPUT 23
ENTER UPA    : Estimate of Param. #  in AR-Factor #

INPUT 18
ENTER MFAC3  : Number of MA-Factors (MFAC3.LE.(6-MFAC1))

INPUT 21
ENTER INC    : Number of Parameters in MA-Factor #

INPUT 22
ENTER IOPA   : Order of Parameter #  in MA-Factor #

INPUT 23
ENTER UPA    : Estimate of Param. #  in MA-Factor #
```

INPUT 24
ENTER ITREND : Trend Parameter
= 0 No
= 1 Yes

INPUT 25
ENTER TREPA : Estimate of Trend Parameter

SPECIFICATION FOR THE OUTPUT SERIES

INPUT 26 : Specification for the Output Series

INPUT 26
ENTER TLAM : Exponent of Power Transformation (Lambda)
= 0.0 Natural log Transformation
= 1.0 No Data Transformation
= X.X Exponent of Transformation

INPUT 26
ENTER TM : Mean Correction before Transformation
= 0.0 No Correction of the Mean
= X.X Amount Added to Series before Transform.

INPUT 27
ENTER MFAC2 : Number of Differencing Factors (MFAC.LE.3)
= 0 No Differencing
= X Number of Differencing Types

INPUT 29
ENTER ND : Number of Differences of Factor #

INPUT 29
ENTER IOD : Order of Differences of Factor #

INPUT 28
ENTER AVEPA : Final Estimate of the Mean

SPECIFICATION FOR THE IMPULSE RESPONSE WEIGHTS

INPUT 31 : Specification for the Impulse Response Weights

INPUT 31
ENTER NIRW : Number of Weights to be Estimated (NIRW.LE.54)

INPUT 31
ENTER NWTGN : Number of Weights to Gen.Noise (NWTGN.LE.NIRW)

INPUT 31
ENTER IPIRW : Plotting of the Impulse Response Weights
= 0 No
= 1 Yes

SPECIFICATION FOR THE NOISE

INPUT 32 : Specification for the Noise

INPUT 32
ENTER NDIFNO : Number of Differencing Factors (NDIFNO.LE.3)
= 0 No Differencing
= X Number of Differencing Types

INPUT 33
ENTER NDNO : Number of Differences of Factor #

INPUT 33
ENTER IODNO : Order of Differences of Factor #

SPECIFICATION FOR THE AUTO CORR.FUNC.OF THE NOISE SERIES

INPUT 34 : Specification for the Auto Corr.Func.of the Noise Series

INPUT 34
ENTER NAC : Lag for Auto Corr.Function (NAC.LE.100)

INPUT 34
ENTER NPAC : Lag for Part.Auto Corr.Func.(NPAC.LE.NAC)

INPUT 34
ENTER NCHI : Chi-Square Statistic for Auto Corr.Function
= 0 Suppress Statistic
= X Number of Terms to be Used (NCHI.LE.NAC)

INPUT 34
ENTER MCSE : Standard Errors of Individual Auto Correlations
= 0 No
= 1 Yes

INPUT 34
ENTER NAPL : Number of Auto Corr.per Line (NAPL.LE.12)

INPUT 34
ENTER IWTPA : Plotting of Auto Correlations
= 0 No
= 1 Yes

SPECIFICATION FOR THE ESTIMATION PROCEDURE

INPUT 30
ENTER IWBF : Backforecasting Procedure
= 0 No
= 1 Yes

2.2. Conditions, Restrictions and Comments

For the identification of Multiple Input Transfer Function Models (IPROG=2) the PACK1 program can be used in three modes:

Mode 1 - Auto Correlations Mode : IWACF = 1
Mode 2 - Cross Correlations Mode : IWCCF = 1
Mode 3 - Prewhitening Mode : IWPREW= 1

Although it is technically possible to run the program in mixed mode, it is highly advisable to use it only in single mode, i.e. in situations for which IWACF=1 OR IWCCF=1 OR IWPREW=1.

In order to facilitate the understanding of the input structure of the PACK1 program, the different inputs can be summarized by the following table

	INPUT				
MODE	00-08	09	10-13	14-15	16-34
IWACF	YES	YES	YES	NO	NO
IWCCF	YES	YES	NO	YES	NO
IWPREW	YES	NO	NO	NO	YES

00-IOUT : The program output can be displayed (IOUT=1) or printed (IOUT=6)

00-LISIN : Even when the program output is displayed (IOUT=1) the inputted parameters can be printed (LISIN=1)

02-NSERIE : Total number of variables, i.e. number of input series plus one. The variable on the last place will be considered as the output variable.
Restriction: $1 < NSERIE \leq 6$

03-NOB : The analysis will be based on NOB observations.
Restriction: $NOB \leq 300$.

06-RNAM : The heading or running title may consist of any character; numerical, alphanumerical or special.
Restriction: Maximum number of characters is 48.

NAME : The only way to input time series data is through a datafile. The name of this datafile must be entered immediately after the message is displayed on the screen.
See Appendix I for details about the preparation of this datafile.

00-FOB : First observation of the datafile to take account of. The total number of observations on the datafile must be at least: FOB+NOB-1

06-RNAM
NAME
00-FOB
07-ILDID
08-IPDID
: As many times as indicated by NSERIE. The input for the output variable comes on the last place.

09-TLAMID
09-TMID
: As many times as indicated by NSERIE

10-NDIFID : Number of differencing factors
Restriction: $0 \leq NDIFID \leq 3$

11-NDID : Only if $NDIFID \neq 0$
11-IODID : As many times as indicated by NDIFID

12-IACF : As many times as indicated by NSERIE

13-NAC : Restriction: $NAC \leq 100$
13-NPAC : Restriction: $NPAC \leq NAC$
13-NCHI : Restriction: $NCHI \leq NAC$
13-NAPL : Restriction: $1 \leq NAPL \leq 12$

14-ICCF : As many times as indicated by NSERIExNSERIE

15-NCC : Restriction: $NCC \leq 109$

16-IPWCCF : As many times as indicated by NSERIE

18-MFAC2 : Number of differencing factors
Restriction: $0 \leq MFAC2 \leq 3$

20-ND] Only if MFAC2 $\neq 0$
20-IOD] As many times as indicated by MFAC2

19-AVEPA : Mean value of the time series
If the time series is a stationary series the mean of the series is one of the parameters estimated by a USES program

18-MFAC1 : Number of AR-factors
Restriction: The total number of AR-and/or MA-factors must be less than or equal to six, i.e. $0 \leq MFAC1+MFAC3 \leq 6$

21-INC] MFAC1 times
22-IOPA] INC times
23-UPA]

23-UPA : Estimated AR-parameter

18-MFAC3 : Number of MA-factors
Restriction: The total number of MA-and/or AR-factors must be less than or equal to six, i.e. $0 \leq MFAC1+MFAC3 \leq 6$

21-INC] MFAC3 times
22-IOPA] INC times
23-UPA]

23-UPA : Estimated MA-parameter

25-TREPA : Only if ITREND = 1
Estimate of trend parameter

27-MFAC2 : Number of differencing factors
Restriction: $0 \leq MFAC2 \leq 3$

29-ND ⎫ Only if $MFAC2 \neq 0$
29-IOD ⎭ As many times as indicated by MFAC2

28-AVEPA : Mean value of the output series

30-IWBF : The use of the backforecasting procedure in the prewhitening process can be suppressed by entering IWBF = 0.
For the backforecasting procedure see [1,pp.215-220]

31-NIRW : Restriction: $NIRW \leq 54$
31-NWTGN : Restriction: $NWTGN \leq NIRW$

32-NDIFNO : Number of differencing factors
Restriction: $0 \leq NDIFNO \leq 3$

33-NDNO ⎫ Only if $NDIFNO \neq 0$
33-IODNO ⎭ As many times as indicated by NDIFNO

34-NAC : Restriction: $NAC \leq 100$
34-NPAC : Restriction: $NPAC \leq NAC$
34-NCHI : Restriction: $NCHI \leq NAC$
34-NAPL : Restriction: $1 \leq NAPL \leq 12$

3 - EXAMPLE 1 : AUTO CORRELATION MODE (IWACF = 1)

GENERAL SPECIFICATION

01	CALCULATE AUTO CORRELATIONS	IWACF =	1
01	CALCULATE CROSS CORRELATIONS	IWCCF =	0
01	PREWHITENING MODELS WILL BE SUPPLIED	IWPREW =	0

SPECIFICATION OF TIME SERIES

02	NUMBER OF SEPARATE SERIES	NSERIE =	3
03	NUMBER OF OBSERVATIONS PER SERIES	NOB =	150

06 SERIES 1 &TWIN1

00	FIRST OBS	FOB =	1
07	LISTED	ILDID =	1
08	PLOTTED	IPDID =	0

06 SERIES 2 &TWIN2

00	FIRST OBS	FOB =	1
07	LISTED	ILDID =	1
08	PLOTTED	IPDID =	0

06 SERIES 3 &TWINO

00	FIRST OBS	FOB =	1
07	LISTED	ILDID =	1
08	PLOTTED	IPDID =	0

09	TRANSFORMATION OF TIME SERIES 1	TLAMID =	.100000E+01
		TMID =	.000000E+00
09	TRANSFORMATION OF TIME SERIES 2	TLAMID =	.100000E+01
		TMID =	.000000E+00
09	TRANSFORMATION OF TIME SERIES 3	TLAMID =	.100000E+01
		TMID =	.000000E+00
10	NUMBER OF DIFFERENCING FACTORS	NDIFID =	0

SPECIFICATION FOR THE AUTO CORR. FUNCTION

12	AUTO CORR. FUNCTION FOR SERIES 1	IACF =	1
12	AUTO CORR. FUNCTION FOR SERIES 2	IACF =	1
12	AUTO CORR. FUNCTION FOR SERIES 3	IACF =	1

SPECIFICATION FOR THE AUTO CORR. FUNCTION

13	MAX. LAG IN CALC. AUTO CORR.	NAC =	20
13	MAX. LAG IN CALC. PART. AUTO CORR.	NPAC =	20
13	NUMBER OF AUTO CORR. CHI-SQ. STAT.	NCHI =	20
13	STANDARD ERRORS FOR AUTO CORR.	NCSE =	1
13	NUMBER OF AUTO CORR. PER LINE	NAPL =	10
13	PLOTTING OF AUTO CORR.	IWTPA =	1

&TWIN1

LISTING OF OBSERVED SERIES

1- 8	.723000E+02	.747000E+02	.792000E+02	.810000E+02	.812000E+02	.752000E+02	.752000E+02	.732000E+02
9- 16	.754000E+02	.722000E+02	.759000E+02	.748000E+02	.771000E+02	.746000E+02	.762000E+02	.781000E+02
17- 24	.790000E+02	.754000E+02	.769000E+02	.780000E+02	.757000E+02	.730000E+02	.737000E+02	.755000E+02
25- 32	.753000E+02	.796000E+02	.805000E+02	.826000E+02	.754000E+02	.736000E+02	.754000E+02	.778000E+02
33- 40	.769000E+02	.747000E+02	.743000E+02	.795000E+02	.757000E+02	.735000E+02	.709000E+02	.740000E+02
41- 48	.738000E+02	.756000E+02	.747000E+02	.750000E+02	.779000E+02	.747000E+02	.758000E+02	.799000E+02
49- 56	.764000E+02	.791000E+02	.794000E+02	.817000E+02	.790000E+02	.753000E+02	.742000E+02	.730000E+02
57- 64	.755000E+02	.697000E+02	.693000E+02	.710000E+02	.686000E+02	.756000E+02	.734000E+02	.766000E+02
65- 72	.726000E+02	.729000E+02	.726000E+02	.735000E+02	.759000E+02	.756000E+02	.812000E+02	.809000E+02
73- 80	.812000E+02	.822000E+02	.799000E+02	.787000E+02	.798000E+02	.736000E+02	.720000E+02	.738000E+02
81- 88	.758000E+02	.706000E+02	.728000E+02	.713000E+02	.725000E+02	.725000E+02	.725000E+02	.732000E+02
89- 96	.751000E+02	.727000E+02	.758000E+02	.767000E+02	.781000E+02	.797000E+02	.809000E+02	.810000E+02
97- 104	.791000E+02	.773000E+02	.772000E+02	.766000E+02	.757000E+02	.726000E+02	.720000E+02	.730000E+02
105- 112	.730000E+02	.761000E+02	.775000E+02	.771000E+02	.743000E+02	.762000E+02	.754000E+02	.763000E+02
113- 120	.779000E+02	.794000E+02	.786000E+02	.793000E+02	.761000E+02	.763000E+02	.782000E+02	.765000E+02
121- 128	.790000E+02	.801000E+02	.771000E+02	.746000E+02	.721000E+02	.737000E+02	.766000E+02	.770000E+02
129- 136	.773000E+02	.783000E+02	.775000E+02	.762000E+02	.751000E+02	.772000E+02	.730000E+02	.722000E+02
137- 144	.750000E+02	.709000E+02	.753000E+02	.758000E+02	.778000E+02	.776000E+02	.754000E+02	.764000E+02
145- 150	.741000E+02	.722000E+02	.736000E+02	.750001E+02	.748000E+02	.755000E+02		

&TWIN2

LISTING OF OBSERVED SERIES

1- 8	.100600E+03	.100400E+03	.103700E+03	.101100E+03	.104100E+03	.101200E+03	.104500E+03	.972000E+02
9- 16	.106000E+03	.100700E+03	.103800E+03	.989000E+02	.108300E+03	.102100E+03	.104600E+03	.101200E+03
17- 24	.101900E+03	.995000E+02	.104200E+03	.100400E+03	.106200E+03	.981000E+02	.104200E+03	.102100E+03
25- 32	.100200E+03	.106700E+03	.102200E+03	.102500E+03	.103100E+03	.104600E+03	.102600E+03	.105500E+03
33- 40	.100400E+03	.994000E+02	.103800E+03	.100000E+03	.100200E+03	.100900E+03	.101600E+03	.994000E+02
41- 48	.104800E+03	.100900E+03	.103100E+03	.100800E+03	.991000E+02	.106700E+03	.964000E+02	.103000E+03
49- 56	.987000E+02	.101300E+03	.100100E+03	.986000E+02	.105200E+03	.983000E+02	.107400E+03	.104400E+03
57- 64	.100400E+03	.105000E+03	.981000E+02	.102900E+03	.102600E+03	.986000E+02	.103300E+03	.101600E+03
65- 72	.106400E+03	.101600E+03	.101300E+03	.101500E+03	.986000E+02	.998000E+02	.103700E+03	.990000E+02
73- 80	.104700E+03	.100600E+03	.101900E+03	.101600E+03	.996000E+02	.102300E+03	.101200E+03	.103400E+03
81- 88	.105000E+03	.100800E+03	.104600E+03	.104500E+03	.103100E+03	.100500E+03	.100800E+03	.101500E+03
89- 96	.102200E+03	.103200E+03	.100700E+03	.987000E+02	.105000E+03	.968000E+02	.105100E+03	.101000E+03
97- 104	.998000E+02	.100000E+03	.103100E+03	.984000E+02	.103900E+03	.101000E+03	.104300E+03	.100000E+03
105- 112	.104800E+03	.946000E+02	.102100E+03	.100600E+03	.100300E+03	.103400E+03	.982000E+02	.985000E+02
113- 120	.100900E+03	.975000E+02	.104200E+03	.101100E+03	.103800E+03	.987000E+02	.106700E+03	.988000E+02
121- 128	.100400E+03	.104200E+03	.963000E+02	.101300E+03	.100500E+03	.995000E+02	.983000E+02	.105400E+03
129- 136	.957000E+02	.105700E+03	.101300E+03	.990000E+02	.102100E+03	.105000E+03	.103100E+03	.101700E+03
137- 144	.105000E+03	.973000E+02	.103900E+03	.103000E+03	.998000E+02	.105300E+03	.101600E+03	.106000E+03
145- 150	.104800E+03	.107000E+03	.100400E+03	.110801E+03	.995000E+02	.104700E+03		

&TWIN0

LISTING OF OBSERVED SERIES

1- 8	.440300E+03	.441800E+03	.439400E+03	.446500E+03	.447900E+03	.472900E+03	.471900E+03	.479300E+03
9- 16	.444800E+03	.477700E+03	.436200E+03	.455300E+03	.431200E+03	.475200E+03	.438800E+03	.461700E+03
17- 24	.451500E+03	.456200E+03	.455800E+03	.474900E+03	.455300E+03	.482900E+03	.442000E+03	.464000E+03
25- 32	.443000E+03	.444100E+03	.466300E+03	.445700E+03	.477600E+03	.488300E+03	.479200E+03	.460800E+03
33- 40	.465000E+03	.453400E+03	.457200E+03	.468200E+03	.440800E+03	.464300E+03	.461100E+03	.447900E+03
41- 48	.435100E+03	.451000E+03	.430900E+03	.448000E+03	.436900E+03	.438200E+03	.474400E+03	.424500E+03
49- 56	.470700E+03	.447400E+03	.467600E+03	.467900E+03	.462100E+03	.503100E+03	.463800E+03	.498400E+03
57- 64	.457100E+03	.445100E+03	.462300E+03	.423400E+03	.440300E+03	.417700E+03	.397900E+03	.443100E+03
65- 72	.416800E+03	.455700E+03	.424300E+03	.434000E+03	.431900E+03	.422900E+03	.439100E+03	.454200E+03
73- 80	.446000E+03	.488000E+03	.471500E+03	.491000E+03	.488500E+03	.482200E+03	.491200E+03	.469400E+03
81- 88	.463400E+03	.458400E+03	.442300E+03	.451000E+03	.439400E+03	.427100E+03	.423500E+03	.425900E+03
89- 96	.429300E+03	.430000E+03	.440700E+03	.424900E+03	.428900E+03	.467900E+03	.433600E+03	.487300E+03
97- 104	.466900E+03	.472600E+03	.482100E+03	.487000E+03	.456600E+03	.484800E+03	.456900E+03	.462500E+03
105- 112	.434100E+03	.456000E+03	.405900E+03	.461700E+03	.447200E+03	.450700E+03	.460000E+03	.436300E+03
113- 120	.449500E+03	.459000E+03	.449700E+03	.484800E+03	.463300E+03	.478800E+03	.457300E+03	.484300E+03
121- 128	.452300E+03	.468000E+03	.479400E+03	.455900E+03	.486900E+03	.457200E+03	.447200E+03	.445400E+03
129- 136	.469500E+03	.426500E+03	.484300E+03	.455800E+03	.457000E+03	.474100E+03	.470100E+03	.461000E+03
137- 144	.445500E+03	.454200E+03	.424300E+03	.451200E+03	.435300E+03	.434700E+03	.468400E+03	.447400E+03
145- 150	.469000E+03	.456700E+03	.464500E+03	.427300E+03	.474700E+03	.415200E+03		

AUTOCORRELATION FUNCTION

DATA - &TWIN1 150 OBSERVATIONS

ORIGINAL SERIES
MEAN OF THE SERIES = .75827E+02
ST. DEV. OF SERIES = .28356E+01
NUMBER OF OBSERVATIONS = 150

1- 10	.63	.41	.18	.06	-.06	-.16	-.18	-.19	-.24	-.30
ST.E.	.08	.11	.12	.12	.12	.12	.12	.12	.13	.13
11- 20	-.31	-.24	-.32	-.26	-.18	-.15	-.06	-.02	.16	.31
ST.E.	.13	.14	.14	.15	.15	.15	.15	.15	.15	.15

MEAN DIVIDED BY ST. ERROR = .32752E+03

TO TEST WHETHER THIS SERIES IS WHITE NOISE, THE VALUE .21779E+03
SHOULD BE COMPARED WITH A CHI-SQUARE VARIABLE WITH 20 DEGREES OF FREEDOM

&TWIN1

GRAPH OF OBSERVED SERIES ACF

GRAPH INTERVAL IS .2000E-01

```
      -.1000E+01                              .0000E+00                              .1000E+01     VALUES
      .+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.
                                              X
 1                                            XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX                    .62846E+00
                                              X
 2                                            XXXXXXXXXXXXXXXXXXXX                                .41328E+00
                                              X
 3                                            XXXXXXXXXX                                          .18448E+00
                                              X
 4                                            XXXX                                                .61255E-01
                                              X
 5                                         XXXX                                                   -.55109E-01
                                           X
 6                                       XXXXXXXX                                                 -.16245E+00
                                           X
 7                                       XXXXXXXXX                                                -.17817E+00
                                           X
 8                                       XXXXXXXXX                                                -.18609E+00
                                           X
 9                                     XXXXXXXXXXX                                                -.23811E+00
                                           X
10                                    XXXXXXXXXXXXX                                               -.30085E+00
                                           X
11                                   XXXXXXXXXXXXXX                                               -.31453E+00
                                           X
12                                     XXXXXXXXXXX                                                -.24392E+00
                                           X
13                                   XXXXXXXXXXXXXX                                               -.32317E+00
                                           X
14                                    XXXXXXXXXXXX                                                -.26226E+00
                                           X
15                                      XXXXXXXXX                                                 -.18226E+00
                                           X
16                                       XXXXXXX                                                 -.14780E+00
                                           X
17                                         XXXX                                                  -.55761E-01
                                           X
18                                          XX                                                   -.21004E-01
                                           X
19                                         XXXXXXXX                                              .16070E+00
                                           X
20                                         XXXXXXXXXXXXXXX                                       .30759E+00
```

PARTIAL AUTOCORRELATIONS

DATA - &TWIN1 150 OBSERVATIONS

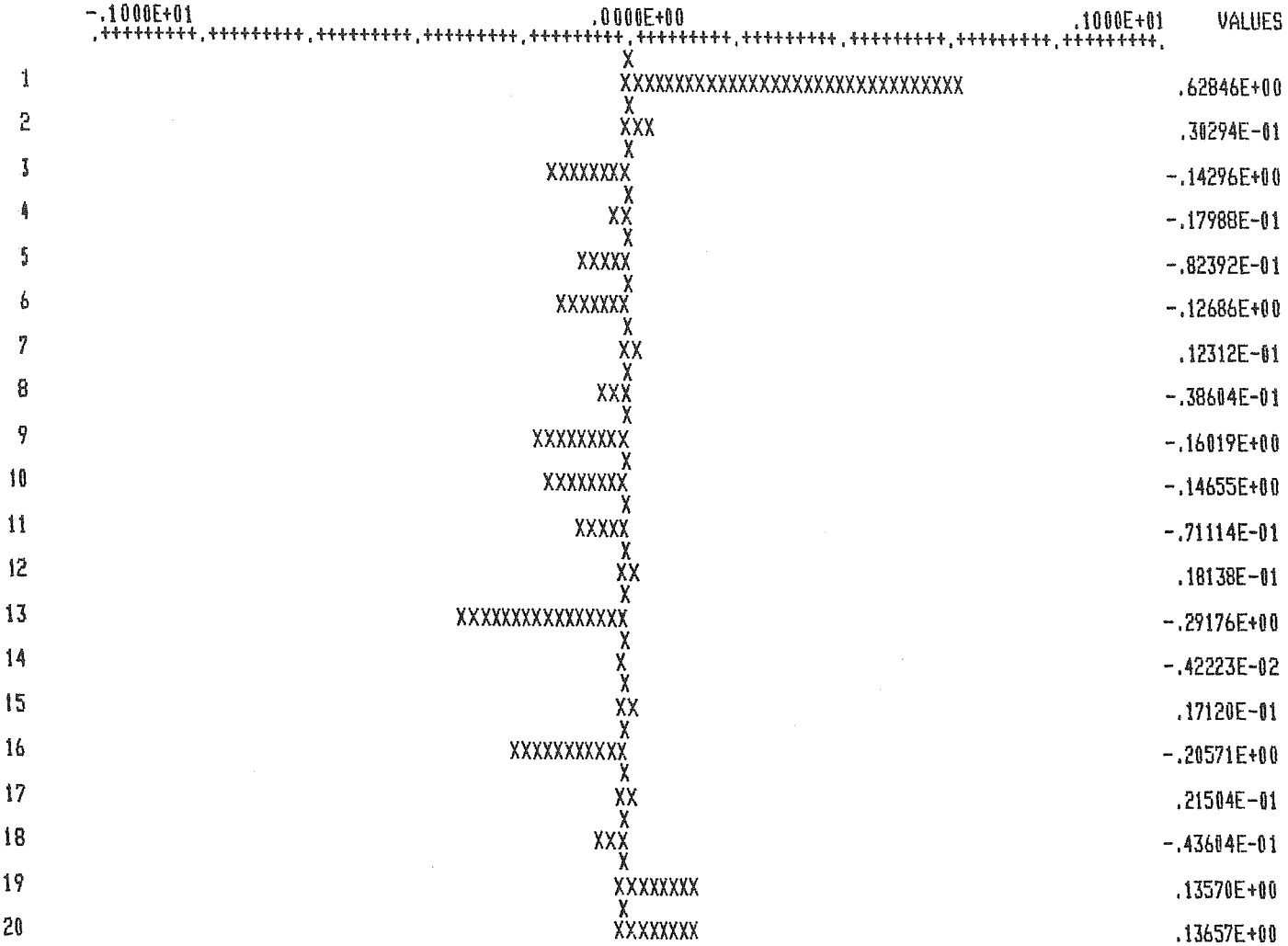
ORIGINAL SERIES
MEAN OF THE SERIES = .75827E+02
ST. DEV. OF SERIES = .28356E+01
NUMBER OF OBSERVATIONS = 150

1- 10	.63	.03	-.14	-.02	-.08	-.13	.01	-.04	-.16	-.15
11- 20	-.07	.02	-.29	-.00	.02	-.21	.02	-.04	.14	.14

&TWIN1

GRAPH OF OBSERVED SERIES PACF

GRAPH INTERVAL IS .2000E-01



DATA - &TWIN2 150 OBSERVATIONS

ORIGINAL SERIES
MEAN OF THE SERIES = .10189E+03
ST. DEV. OF SERIES = .27674E+01
NUMBER OF OBSERVATIONS = 150

1- 10	-.40	.37	.01	-.00	.00	.11	-.07	.01	.07	.02
ST.E.	.08	.09	.10	.10	.10	.10	.10	.10	.10	.10
11- 20	-.06	.18	-.16	.08	.10	-.09	.03	.13	-.23	.23
ST.E.	.10	.10	.11	.11	.11	.11	.11	.11	.11	.11

MEAN DIVIDED BY ST. ERROR = .45093E+03

TO TEST WHETHER THIS SERIES IS WHITE NOISE, THE VALUE .84956E+02
SHOULD BE COMPARED WITH A CHI-SQUARE VARIABLE WITH 20 DEGREES OF FREEDOM

&TWIN2

GRAPH OF OBSERVED SERIES ACF

GRAPH INTERVAL IS .2000E-01

```
      -.1000E+01                                .0000E+00                                .1000E+01     VALUES
      ,+++++++++,+++++++++,+++++++++,+++++++++,+++++++++,+++++++++,+++++++++,+++++++++,+++++++++,+++++++++,
 1                                              X                                                -.39979E+00
                          XXXXXXXXXXXXXXXXXXXX
 2                                              X                                                 .36592E+00
                                                XXXXXXXXXXXXXXXXXX
 3                                              X                                                 .60011E-02
                                                X
 4                                              X                                                -.47627E-02
                                                X
 5                                              X                                                 .96668E-03
                                                X
 6                                              XXXXXXX                                           .11322E+00
                                                X
 7                                            XXXX                                               -.67364E-01
                                                X
 8                                              X                                                 .66147E-02
                                                X
 9                                              XXXXX                                             .72868E-01
                                                X
10                                              XX                                               .23472E-01
                                                X
11                                            XXXX                                               -.61717E-01
                                                X
12                                              XXXXXXXXXX                                       .17513E+00
                                                X
13                                         XXXXXXXXX                                           -.16319E+00
                                                X
14                                              XXXXX                                            .82835E-01
                                                X
15                                              XXXXXX                                           .99351E-01
                                                X
16                                           XXXXX                                              -.88107E-01
                                                X
17                                              XXX                                              .30208E-01
                                                X
18                                              XXXXXXX                                          .12537E+00
                                                X
19                                       XXXXXXXXXXXX                                          -.23310E+00
                                                X
20                                              XXXXXXXXXXXXX                                    .23350E+00
```

DATA - &TWIN2 150 OBSERVATIONS

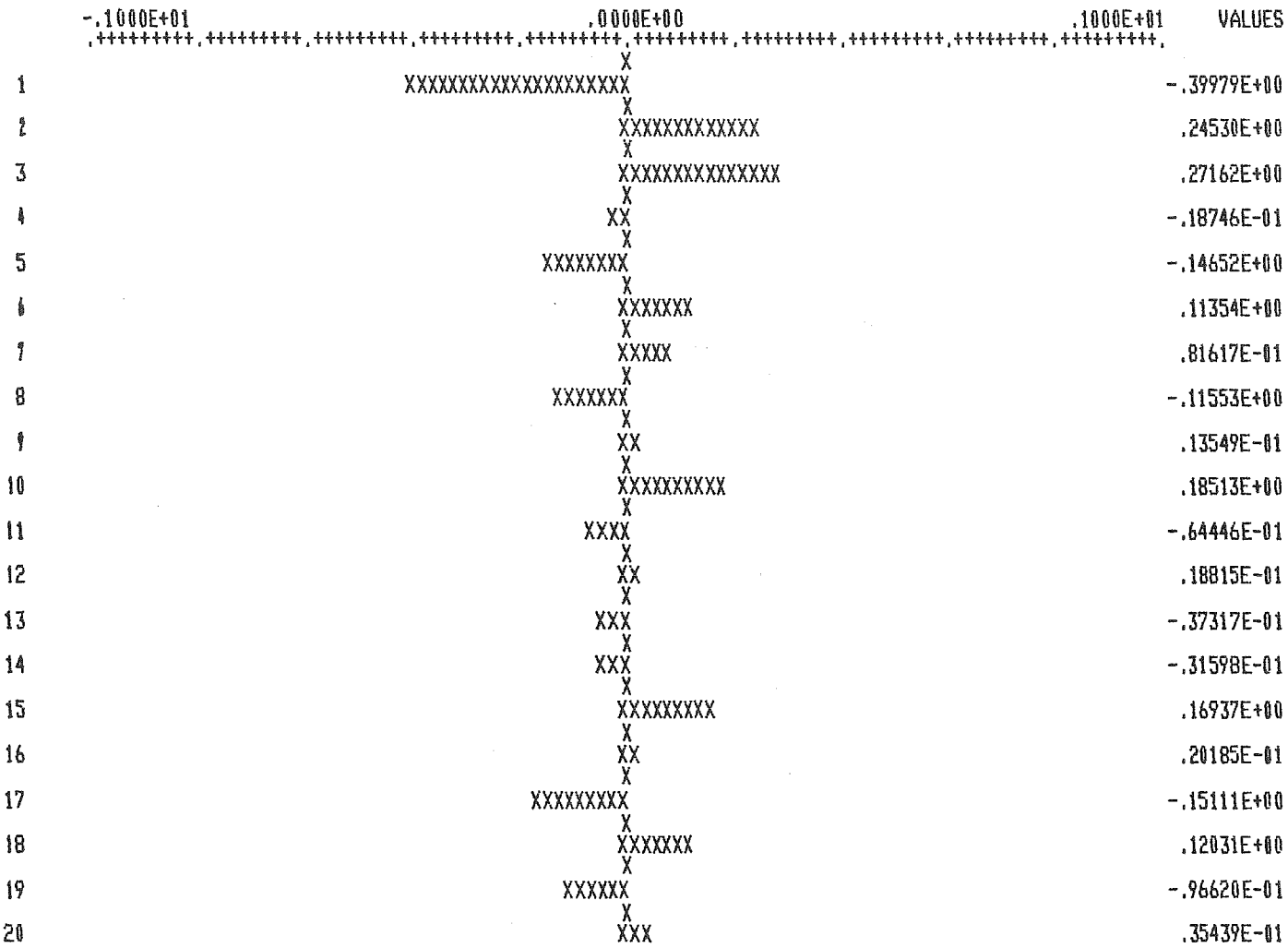
ORIGINAL SERIES
MEAN OF THE SERIES = .10189E+03
ST. DEV. OF SERIES = .27674E+01
NUMBER OF OBSERVATIONS = 150

1- 10	-.40	.25	.27	-.02	-.15	.11	.08	-.12	.01	.19
11- 20	-.06	.02	-.04	-.03	.17	.02	-.15	.12	-.10	.04

&TWIN2

GRAPH OF OBSERVED SERIES PACF

GRAPH INTERVAL IS .2000E-01



DATA - &TWINO 150 OBSERVATIONS

ORIGINAL SERIES
MEAN OF THE SERIES = .45467E+03
ST. DEV. OF SERIES = .20045E+02
NUMBER OF OBSERVATIONS = 150

1- 10	.26	.58	.25	.11	.03	-.06	-.17	-.20	-.25	-.27
ST.E.	.08	.09	.11	.11	.11	.11	.11	.12	.12	.12
11- 20	-.38	-.23	-.37	-.23	-.15	-.18	-.01	.11	.05	.37
ST.E.	.13	.13	.14	.14	.14	.15	.15	.15	.15	.15

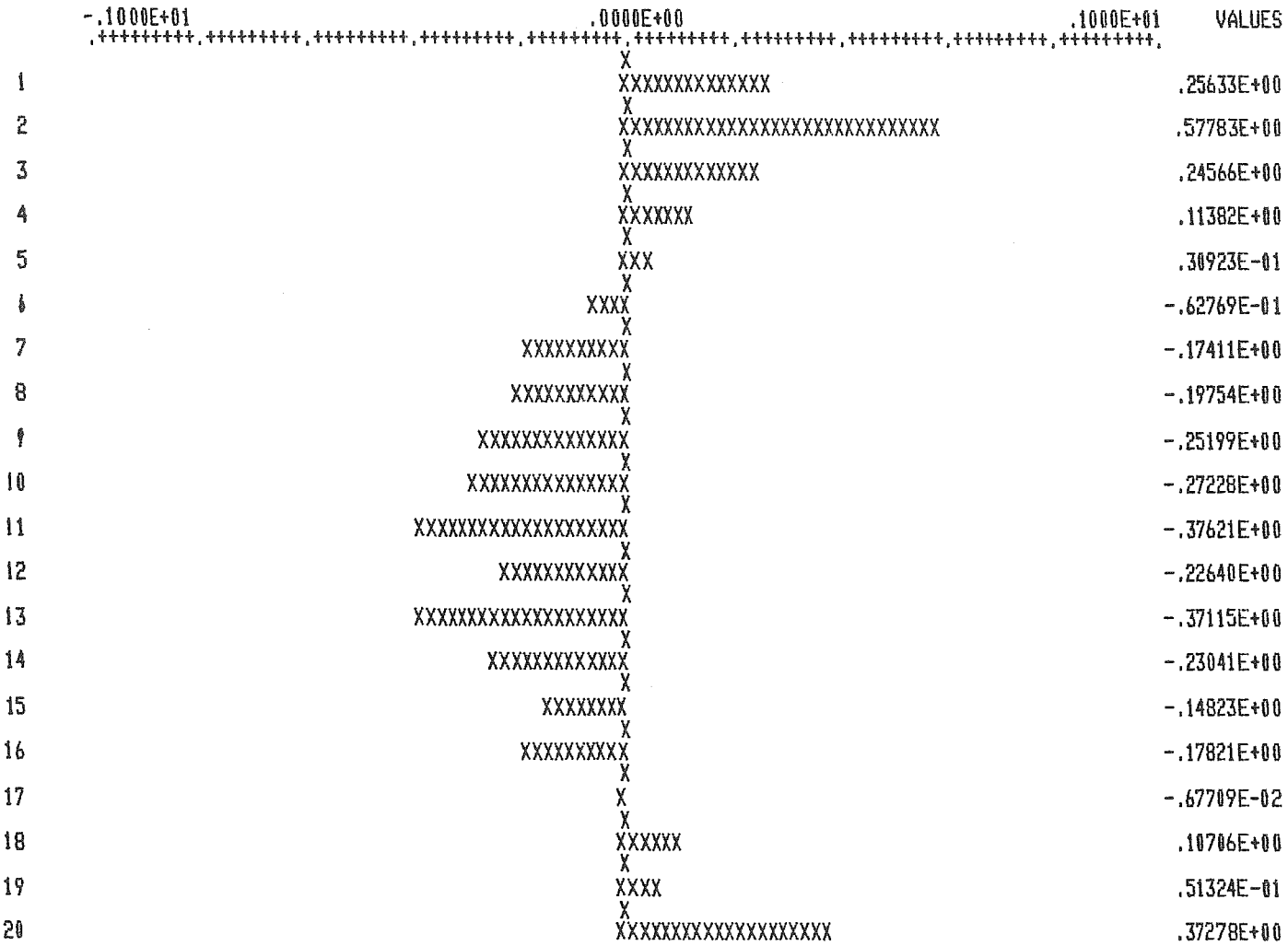
MEAN DIVIDED BY ST. ERROR = .27781E+03

TO TEST WHETHER THIS SERIES IS WHITE NOISE, THE VALUE .20653E+03
SHOULD BE COMPARED WITH A CHI-SQUARE VARIABLE WITH 20 DEGREES OF FREEDOM

&TWINO

GRAPH OF OBSERVED SERIES ACF

GRAPH INTERVAL IS .2000E-01



DATA - &TWIND 150 OBSERVATIONS

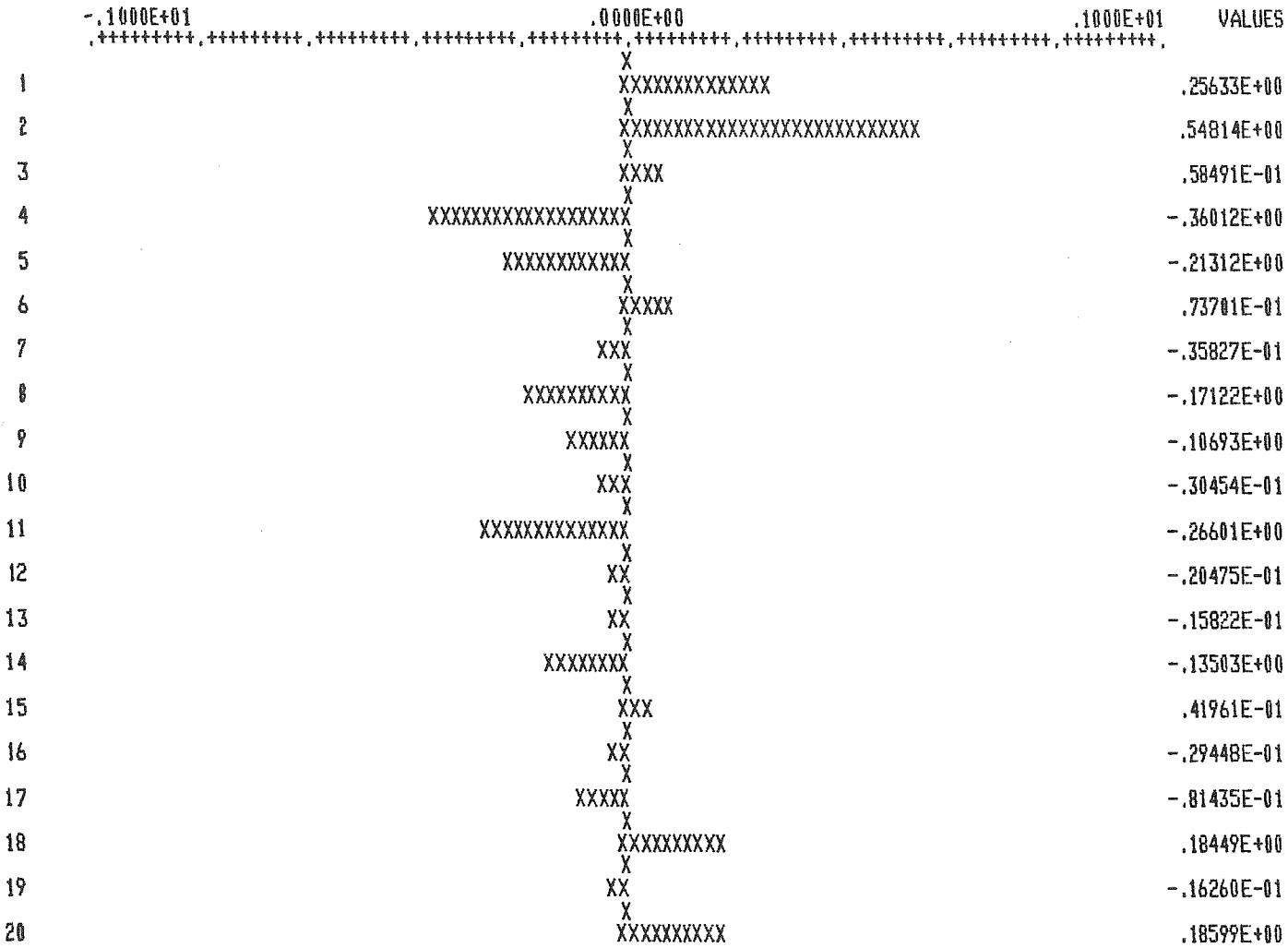
ORIGINAL SERIES
MEAN OF THE SERIES = .45467E+03
ST. DEV. OF SERIES = .20045E+02
NUMBER OF OBSERVATIONS = 150

1- 10	.26	.55	.06	-.36	-.21	.07	-.04	-.17	-.11	-.03
11- 20	-.27	-.02	-.02	-.14	.04	-.03	-.08	.18	-.02	.19

&TWIND

GRAPH OF OBSERVED SERIES PACF

GRAPH INTERVAL IS .2000E-01



4 - EXAMPLE 2 : CROSS CORRELATION MODE (IWCCF = 1)

MULTIPLE INPUT TRANSFER FUNCTION IDENTIFICATION (MTID)

GENERAL SPECIFICATION

01	CALCULATE AUTO CORRELATIONS	IWACF =	0
01	CALCULATE CROSS CORRELATIONS	IWCCF =	1
01	PREWHITENING MODELS WILL BE SUPPLIED	IWPREW =	0

SPECIFICATION OF TIME SERIES

02	NUMBER OF SEPARATE SERIES	NSERIE =	3
03	NUMBER OF OBSERVATIONS PER SERIES	NOB =	150

06 SERIES 1 &TWIN1

00	FIRST OBS	FOB =	1
07	LISTED	ILDID =	1
08	PLOTTED	IPDID =	0

06 SERIES 2 &TWIN2

00	FIRST OBS	FOB =	1
07	LISTED	ILDID =	1
08	PLOTTED	IPDID =	0

06 SERIES 3 &TWINO

00	FIRST OBS	FOB =	1
07	LISTED	ILDID =	1
08	PLOTTED	IPDID =	0

09	TRANSFORMATION OF TIME SERIES 1	TLAMID =	.100000E+01
		TMID =	.000000E+00
09	TRANSFORMATION OF TIME SERIES 2	TLAMID =	.100000E+01
		TMID =	.000000E+00
09	TRANSFORMATION OF TIME SERIES 3	TLAMID =	.100000E+01
		TMID =	.000000E+00

SPECIFICATION FOR THE CROSS CORRELATION FUNCTION

14	CROSS CORR. BETWEEN SERIES 1		
	AND SERIES 1	ICCF =	1
	AND SERIES 2	ICCF =	1
	AND SERIES 3	ICCF =	1
14	CROSS CORR. BETWEEN SERIES 2		
	AND SERIES 1	ICCF =	1
	AND SERIES 2	ICCF =	1
	AND SERIES 3	ICCF =	1
14	CROSS CORR. BETWEEN SERIES 3		
	AND SERIES 1	ICCF =	1
	AND SERIES 2	ICCF =	1
	AND SERIES 3	ICCF =	1

15	MAX. LAG IN CALC. CROSS CORR. FUNC.	NCC =	20
15	PLOTTING OF CROSS. CORR. FUNCTION	IWTPCC =	1

&TWIN1

LISTING OF OBSERVED SERIES

1- 8	.723000E+02	.747000E+02	.792000E+02	.810000E+02	.812000E+02	.752000E+02	.752000E+02	.732000E+02
9- 16	.754000E+02	.722000E+02	.759000E+02	.748000E+02	.771000E+02	.746000E+02	.762000E+02	.781000E+02
17- 24	.790000E+02	.754000E+02	.769000E+02	.780000E+02	.757000E+02	.730000E+02	.737000E+02	.755000E+02
25- 32	.753000E+02	.796000E+02	.805000E+02	.826000E+02	.754000E+02	.736000E+02	.754000E+02	.778000E+02
33- 40	.769000E+02	.747000E+02	.743000E+02	.795000E+02	.757000E+02	.735000E+02	.709000E+02	.740000E+02
41- 48	.738000E+02	.756000E+02	.747000E+02	.750000E+02	.779000E+02	.747000E+02	.758000E+02	.799000E+02
49- 56	.764000E+02	.791000E+02	.794000E+02	.817000E+02	.790000E+02	.753000E+02	.742000E+02	.730000E+02
57- 64	.755000E+02	.697000E+02	.693000E+02	.710000E+02	.686000E+02	.756000E+02	.734000E+02	.766000E+02
65- 72	.726000E+02	.729000E+02	.726000E+02	.735000E+02	.759000E+02	.756000E+02	.812000E+02	.809000E+02
73- 80	.812000E+02	.822000E+02	.799000E+02	.787000E+02	.798000E+02	.736000E+02	.720000E+02	.738000E+02
81- 88	.758000E+02	.706000E+02	.728000E+02	.713000E+02	.725000E+02	.725000E+02	.725000E+02	.732000E+02
89- 96	.751000E+02	.727000E+02	.758000E+02	.767000E+02	.781000E+02	.797000E+02	.809000E+02	.810000E+02
97- 104	.791000E+02	.773000E+02	.772000E+02	.766000E+02	.757000E+02	.726000E+02	.720000E+02	.730000E+02
105- 112	.730000E+02	.761000E+02	.775000E+02	.771000E+02	.743000E+02	.762000E+02	.754000E+02	.763000E+02
113- 120	.779000E+02	.794000E+02	.786000E+02	.793000E+02	.761000E+02	.763000E+02	.782000E+02	.765000E+02
121- 128	.790000E+02	.801000E+02	.771000E+02	.746000E+02	.721000E+02	.737000E+02	.766000E+02	.770000E+02
129- 136	.773000E+02	.783000E+02	.775000E+02	.762000E+02	.751000E+02	.772000E+02	.730000E+02	.722000E+02
137- 144	.750000E+02	.709000E+02	.753000E+02	.758000E+02	.778000E+02	.776000E+02	.754000E+02	.764000E+02
145- 150	.741000E+02	.722000E+02	.736000E+02	.750000E+02	.748000E+02	.755000E+02		

&TWIN2

LISTING OF OBSERVED SERIES

1- 8	.100600E+03	.100400E+03	.103700E+03	.101100E+03	.104100E+03	.101200E+03	.104500E+03	.972000E+02
9- 16	.106000E+03	.100700E+03	.103800E+03	.989000E+02	.108300E+03	.102100E+03	.104600E+03	.101200E+03
17- 24	.101900E+03	.995000E+02	.104200E+03	.100400E+03	.106200E+03	.981000E+02	.104200E+03	.102100E+03
25- 32	.100200E+03	.106700E+03	.102200E+03	.102500E+03	.103100E+03	.104600E+03	.102600E+03	.105500E+03
33- 40	.100400E+03	.994000E+02	.103800E+03	.100000E+03	.100200E+03	.100900E+03	.101600E+03	.994000E+02
41- 48	.104800E+03	.100900E+03	.103100E+03	.100800E+03	.991000E+02	.106700E+03	.964000E+02	.103000E+03
49- 56	.987000E+02	.101300E+03	.100100E+03	.986000E+02	.105200E+03	.983000E+02	.107400E+03	.104400E+03
57- 64	.100400E+03	.105000E+03	.981000E+02	.102900E+03	.102600E+03	.986000E+02	.103300E+03	.101600E+03
65- 72	.106400E+03	.101600E+03	.101300E+03	.101500E+03	.986000E+02	.998000E+02	.103700E+03	.990000E+02
73- 80	.104700E+03	.100600E+03	.101900E+03	.101600E+03	.996000E+02	.102300E+03	.101200E+03	.103400E+03
81- 88	.105000E+03	.100800E+03	.104600E+03	.104500E+03	.103100E+03	.100500E+03	.100800E+03	.101500E+03
89- 96	.102200E+03	.103200E+03	.100700E+03	.987000E+02	.105000E+03	.968000E+02	.105100E+03	.101000E+03
97- 104	.998000E+02	.100000E+03	.103100E+03	.984000E+02	.103900E+03	.101000E+03	.104300E+03	.100000E+03
105- 112	.104800E+03	.946000E+02	.102100E+03	.100600E+03	.100300E+03	.103400E+03	.982000E+02	.985000E+02
113- 120	.100900E+03	.975000E+02	.104200E+03	.101100E+03	.103800E+03	.987000E+02	.106700E+03	.988000E+02
121- 128	.100400E+03	.104200E+03	.963000E+02	.101300E+03	.100500E+03	.995000E+02	.983000E+02	.105400E+03
129- 136	.957000E+02	.105700E+03	.101300E+03	.990000E+02	.102100E+03	.105000E+03	.103100E+03	.101700E+03
137- 144	.105000E+03	.973000E+02	.103900E+03	.103000E+03	.998000E+02	.105300E+03	.101600E+03	.106000E+03
145- 150	.104800E+03	.107000E+03	.100400E+03	.110801E+03	.995000E+02	.104700E+03		

&TWINO

LISTING OF OBSERVED SERIES

1- 8	.440300E+03	.441800E+03	.439400E+03	.446500E+03	.447900E+03	.472900E+03	.471900E+03	.479300E+03
9- 16	.444800E+03	.477700E+03	.436200E+03	.455300E+03	.431200E+03	.475200E+03	.438800E+03	.461700E+03
17- 24	.451500E+03	.456200E+03	.455800E+03	.474900E+03	.455300E+03	.482900E+03	.442000E+03	.464000E+03
25- 32	.443000E+03	.444100E+03	.466300E+03	.445700E+03	.477600E+03	.488300E+03	.479200E+03	.460800E+03
33- 40	.465000E+03	.453400E+03	.457200E+03	.468200E+03	.440800E+03	.464300E+03	.461100E+03	.447900E+03
41- 48	.435100E+03	.451000E+03	.430900E+03	.448000E+03	.436900E+03	.438200E+03	.474400E+03	.424500E+03
49- 56	.470700E+03	.447400E+03	.467600E+03	.467900E+03	.462100E+03	.503100E+03	.463800E+03	.498400E+03
57- 64	.457100E+03	.445100E+03	.462300E+03	.423400E+03	.440300E+03	.417700E+03	.397900E+03	.443100E+03
65- 72	.416800E+03	.455700E+03	.424300E+03	.434000E+03	.431900E+03	.422900E+03	.439100E+03	.454200E+03
73- 80	.446000E+03	.488000E+03	.471500E+03	.491000E+03	.488500E+03	.482200E+03	.491200E+03	.469400E+03
81- 88	.463400E+03	.458400E+03	.442300E+03	.451000E+03	.439400E+03	.427100E+03	.423500E+03	.425900E+03
89- 96	.429300E+03	.430000E+03	.440700E+03	.424900E+03	.428900E+03	.467900E+03	.433600E+03	.487300E+03
97- 104	.466900E+03	.472600E+03	.482100E+03	.487000E+03	.456600E+03	.484800E+03	.456900E+03	.462500E+03
105- 112	.434100E+03	.456000E+03	.405900E+03	.461700E+03	.447200E+03	.450700E+03	.460000E+03	.436300E+03
113- 120	.449500E+03	.459000E+03	.449700E+03	.484800E+03	.463300E+03	.478800E+03	.457300E+03	.484300E+03
121- 128	.452300E+03	.468000E+03	.479400E+03	.455900E+03	.486900E+03	.457200E+03	.447200E+03	.445400E+03
129- 136	.469500E+03	.426500E+03	.484300E+03	.455800E+03	.457000E+03	.474100E+03	.470100E+03	.461000E+03
137- 144	.445500E+03	.454200E+03	.424300E+03	.451200E+03	.435300E+03	.434700E+03	.468400E+03	.447400E+03
145- 150	.469000E+03	.456700E+03	.464500E+03	.427300E+03	.474700E+03	.415200E+03		

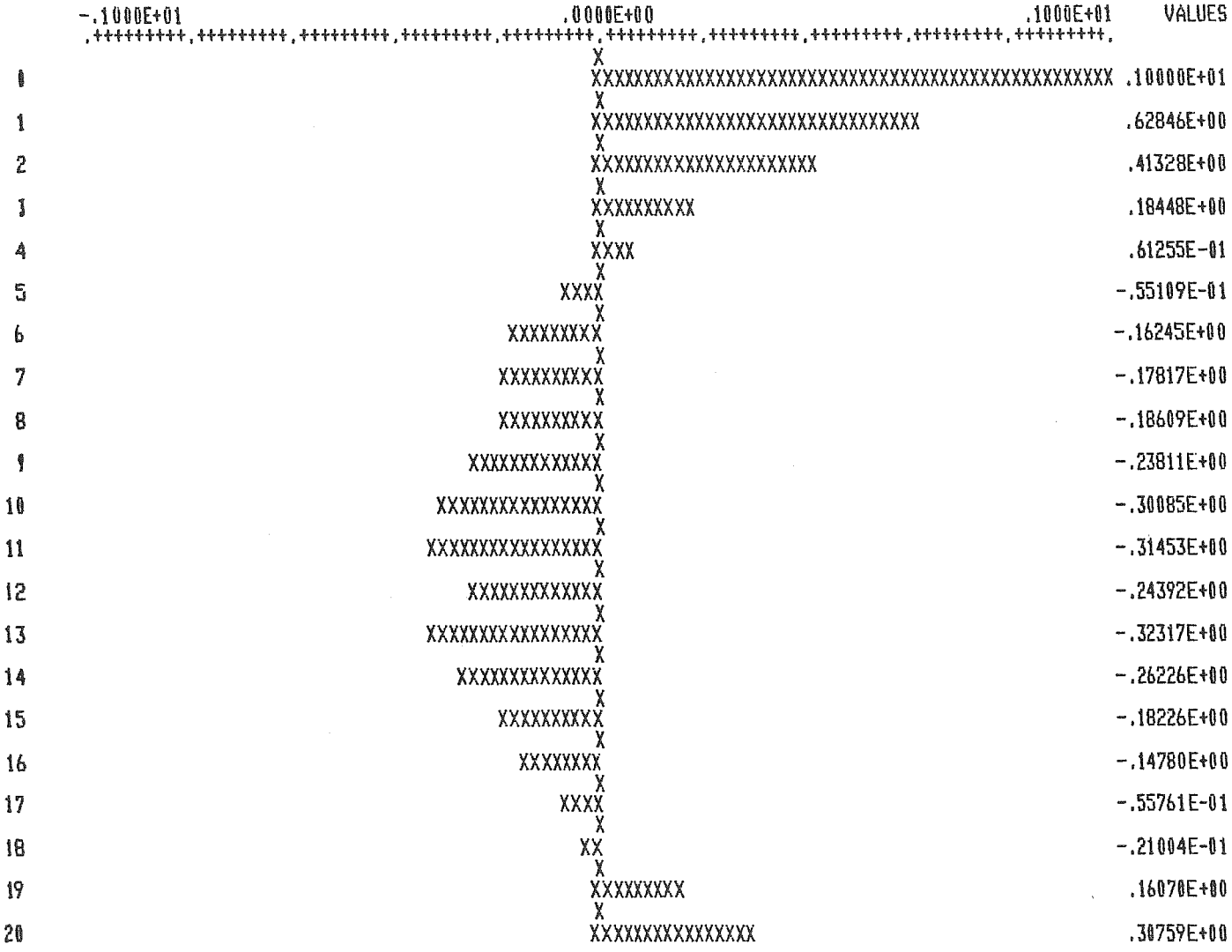
SERIES 1 - &TWIN1
SERIES 2 - &TWIN1

MEAN OF SERIES 1 = .75827E+02
ST. DEV. OF SERIES 1 = .28356E+01
MEAN OF SERIES 2 = .75827E+02
ST. DEV. OF SERIES 2 = .28356E+01

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	1.000	0	1.000
1	.628	1	.628
2	.413	2	.413
3	.184	3	.184
4	.061	4	.061
5	-.055	5	-.055
6	-.162	6	-.162
7	-.178	7	-.178
8	-.186	8	-.186
9	-.238	9	-.238
10	-.301	10	-.301
11	-.315	11	-.315
12	-.244	12	-.244
13	-.323	13	-.323
14	-.262	14	-.262
15	-.182	15	-.182
16	-.148	16	-.148
17	-.056	17	-.056
18	-.021	18	-.021
19	.161	19	.161
20	.308	20	.308

GRAPH OF SERIES CROSS CORRELATION

GRAPH INTERVAL IS .2000E-01



CROSS CORRELATIONS

SERIES 1 - &TWIN1
SERIES 2 - &TWIN2

MEAN OF SERIES 1 = .75827E+02
ST. DEV. OF SERIES 1 = .28356E+01
MEAN OF SERIES 2 = .10189E+03
ST. DEV. OF SERIES 2 = .27674E+01

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	-.029	0	-.029
1	-.063	1	-.176
2	-.042	2	-.073
3	.036	3	-.213
4	.027	4	-.061
5	-.047	5	-.120
6	.025	6	.018
7	-.002	7	.020
8	.070	8	-.065
9	.062	9	.032
10	.048	10	-.029
11	-.004	11	.102
12	.013	12	.042
13	-.013	13	.080
14	.015	14	.050
15	-.020	15	.024
16	-.014	16	.037
17	-.121	17	.024
18	.006	18	.039
19	-.062	19	.028
20	-.030	20	-.005

GRAPH OF SERIES CROSS CORRELATION

GRAPH INTERVAL IS .2000E-01

```
          -.1000E+01                                   .0000E+00                                   .1000E+01     VALUES
          .+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.
 0                                                     X
                                                      XX                                                      -.28933E-01
 1                                                     X
                                                     XXXX                                                     -.63223E-01
 2                                                     X
                                                     XXX                                                      -.41611E-01
 3                                                     X
                                                       XXX                                                    .36149E-01
 4                                                     X
                                                       XX                                                     .27069E-01
 5                                                     X
                                                     XXX                                                      -.47270E-01
 6                                                     X
                                                       XX                                                     .25138E-01
 7                                                     X
                                                       X                                                      -.15596E-02
 8                                                     X
                                                       XXXXX                                                  .70353E-01
 9                                                     X
                                                       XXXX                                                   .61895E-01
10                                                     X
                                                       XXX                                                    .47525E-01
11                                                     X
                                                       X                                                      -.44156E-02
12                                                     X
                                                       XX                                                     .13318E-01
13                                                     X
                                                     XX                                                       -.12732E-01
14                                                     X
                                                       XX                                                     .14831E-01
15                                                     X
                                                     XX                                                       -.20127E-01
16                                                     X
                                                     XX                                                       -.13949E-01
17                                                     X
                                                  XXXXXXX                                                     -.12070E+00
18                                                     X
                                                       X                                                      .57758E-02
19                                                     X
                                                     XXXX                                                     -.62182E-01
20                                                     X
                                                       XXX                                                    -.30000E-01
```

CROSS CORRELATIONS

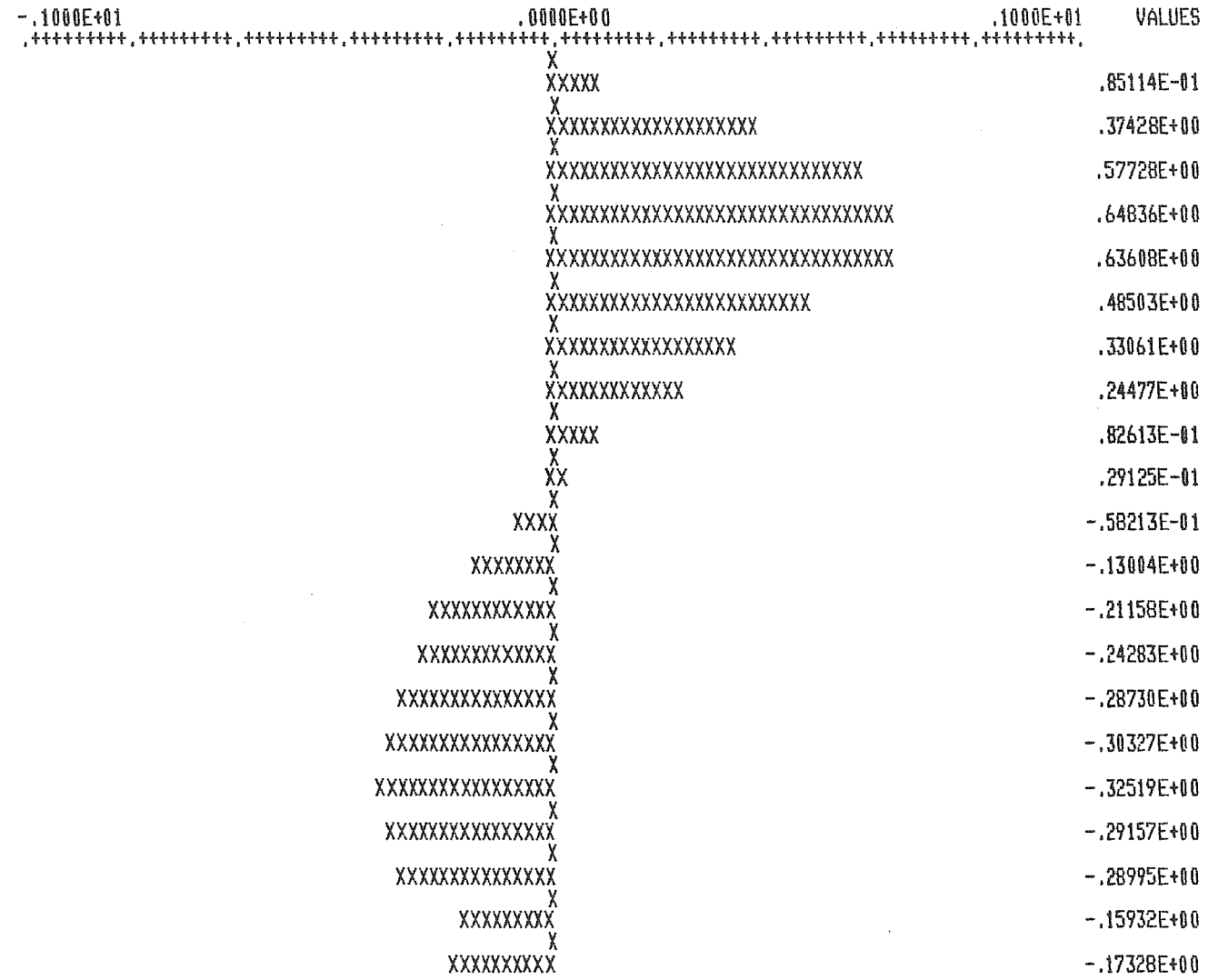
SERIES 1 - &TWIN1
SERIES 2 - &TWIN0

MEAN OF SERIES 1 = .75827E+02
ST. DEV. OF SERIES 1 = .28356E+01
MEAN OF SERIES 2 = .45467E+03
ST. DEV. OF SERIES 2 = .20045E+02

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	.085	0	.085
1	.374	1	.010
2	.577	2	-.190
3	.648	3	-.188
4	.636	4	-.304
5	.485	5	-.248
6	.331	6	-.239
7	.245	7	-.329
8	.083	8	-.284
9	.029	9	-.331
10	-.058	10	-.207
11	-.130	11	-.207
12	-.212	12	-.118
13	-.243	13	-.027
14	-.287	14	.029
15	-.303	15	.126
16	-.325	16	.216
17	-.292	17	.326
18	-.290	18	.369
19	-.159	19	.359
20	-.173	20	.343

GRAPH OF SERIES CROSS CORRELATION

GRAPH INTERVAL IS .2000E-01



CROSS CORRELATIONS

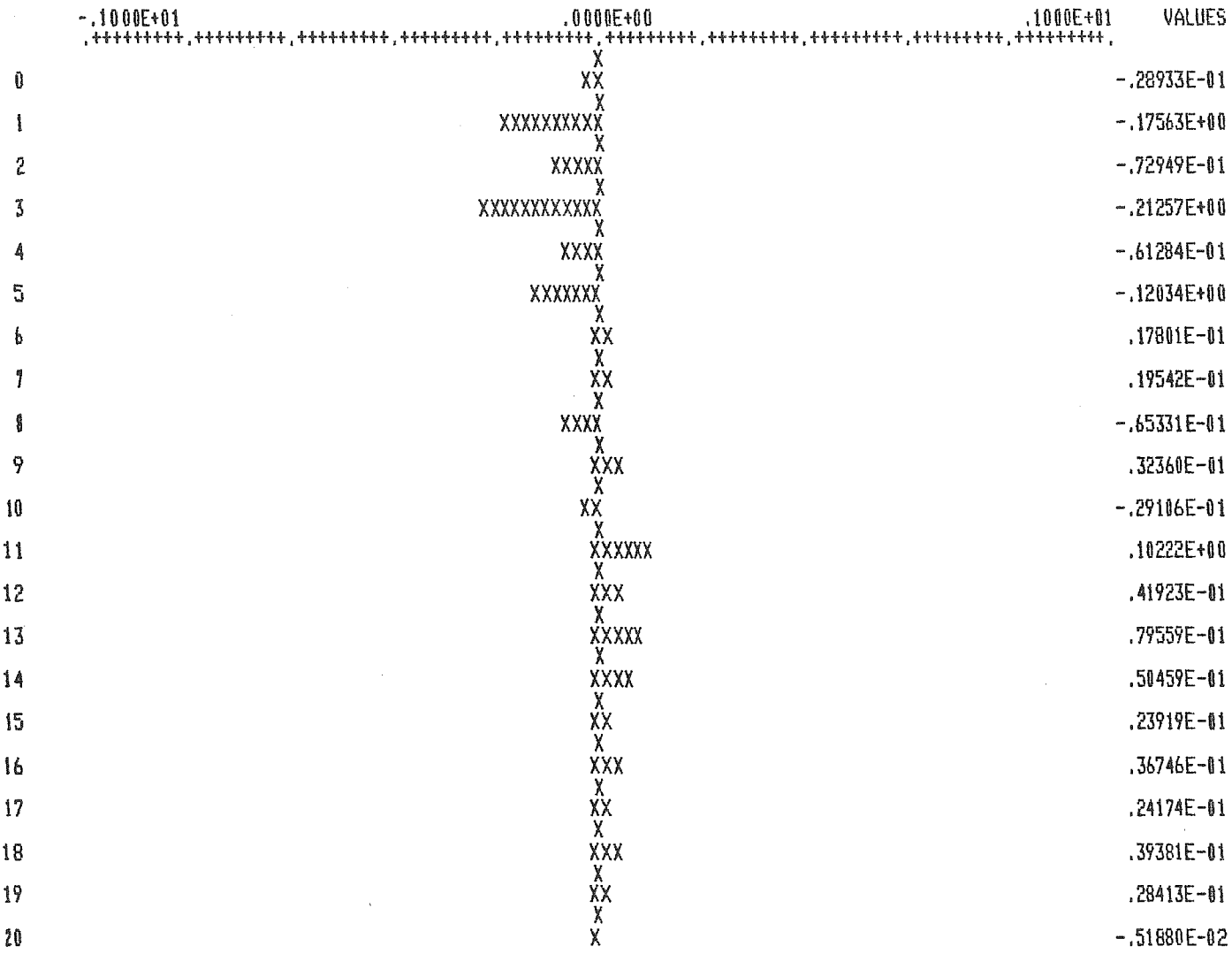
SERIES 1 - &TWIN2
SERIES 2 - &TWIN1

MEAN OF SERIES 1 = .10189E+03
ST. DEV. OF SERIES 1 = .27674E+01
MEAN OF SERIES 2 = .75827E+02
ST. DEV. OF SERIES 2 = .28356E+01

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	-.029	0	-.029
1	-.176	1	-.063
2	-.073	2	-.042
3	-.213	3	.036
4	-.061	4	.027
5	-.120	5	-.047
6	.018	6	.025
7	.020	7	-.002
8	-.065	8	.070
9	.032	9	.062
10	-.029	10	.048
11	.102	11	-.004
12	.042	12	.013
13	.080	13	-.013
14	.050	14	.015
15	.024	15	-.020
16	.037	16	-.014
17	.024	17	-.121
18	.039	18	.006
19	.028	19	-.062
20	-.005	20	-.030

GRAPH OF SERIES CROSS CORRELATION

GRAPH INTERVAL IS .2000E-01



CROSS CORRELATIONS

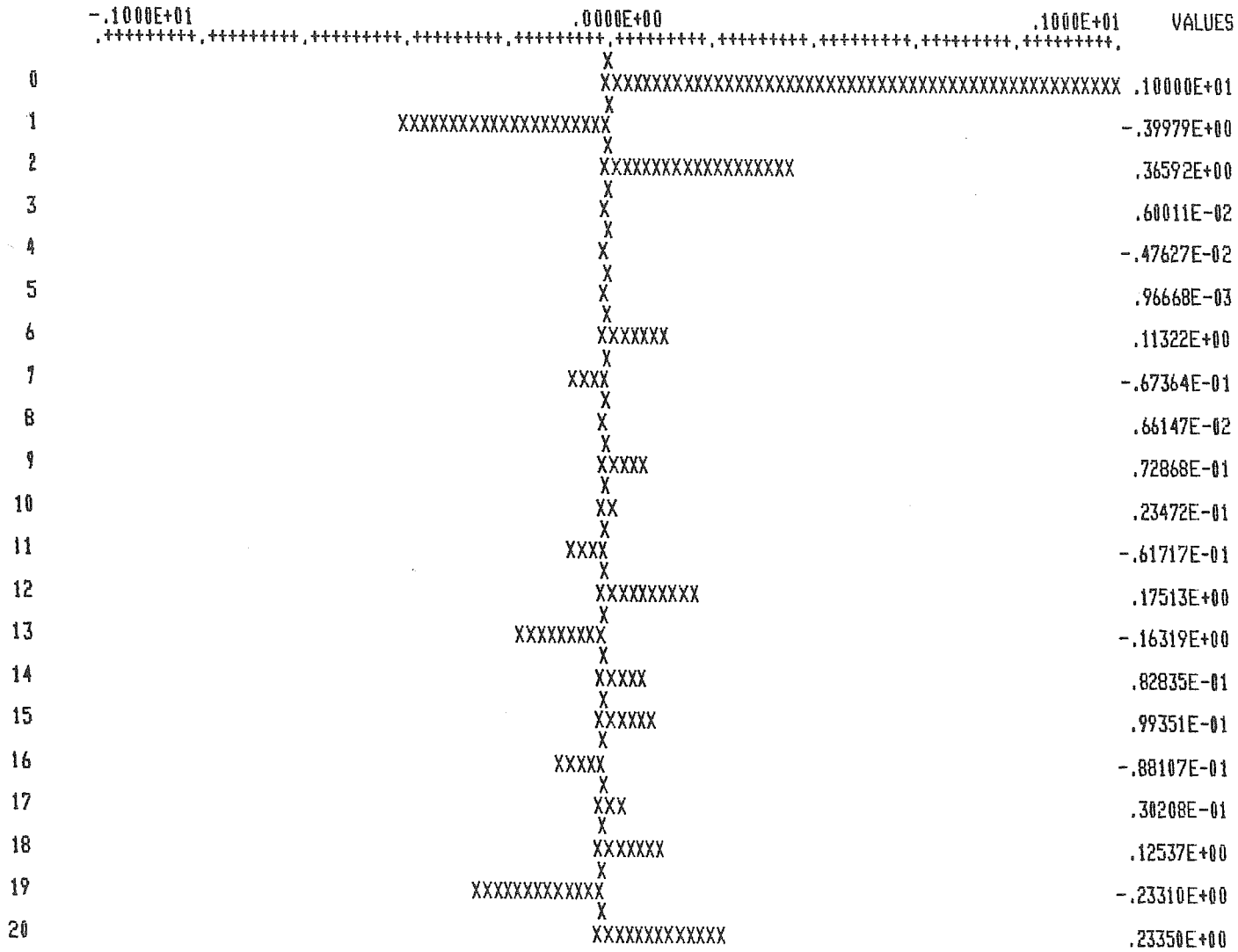
SERIES 1 - &TWIN2
SERIES 2 - &TWIN2

MEAN OF SERIES 1 = .10189E+03
ST. DEV. OF SERIES 1 = .27674E+01
MEAN OF SERIES 2 = .10189E+03
ST. DEV. OF SERIES 2 = .27674E+01

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	1.000	0	1.000
1	-.400	1	-.400
2	.366	2	.366
3	.006	3	.006
4	-.005	4	-.005
5	.001	5	.001
6	.113	6	.113
7	-.067	7	-.067
8	.007	8	.007
9	.073	9	.073
10	.023	10	.023
11	-.062	11	-.062
12	.175	12	.175
13	-.163	13	-.163
14	.083	14	.083
15	.099	15	.099
16	-.088	16	-.088
17	.030	17	.030
18	.125	18	.125
19	-.233	19	-.233
20	.233	20	.233

GRAPH OF SERIES CROSS CORRELATION

GRAPH INTERVAL IS .2000E-01



CROSS CORRELATIONS

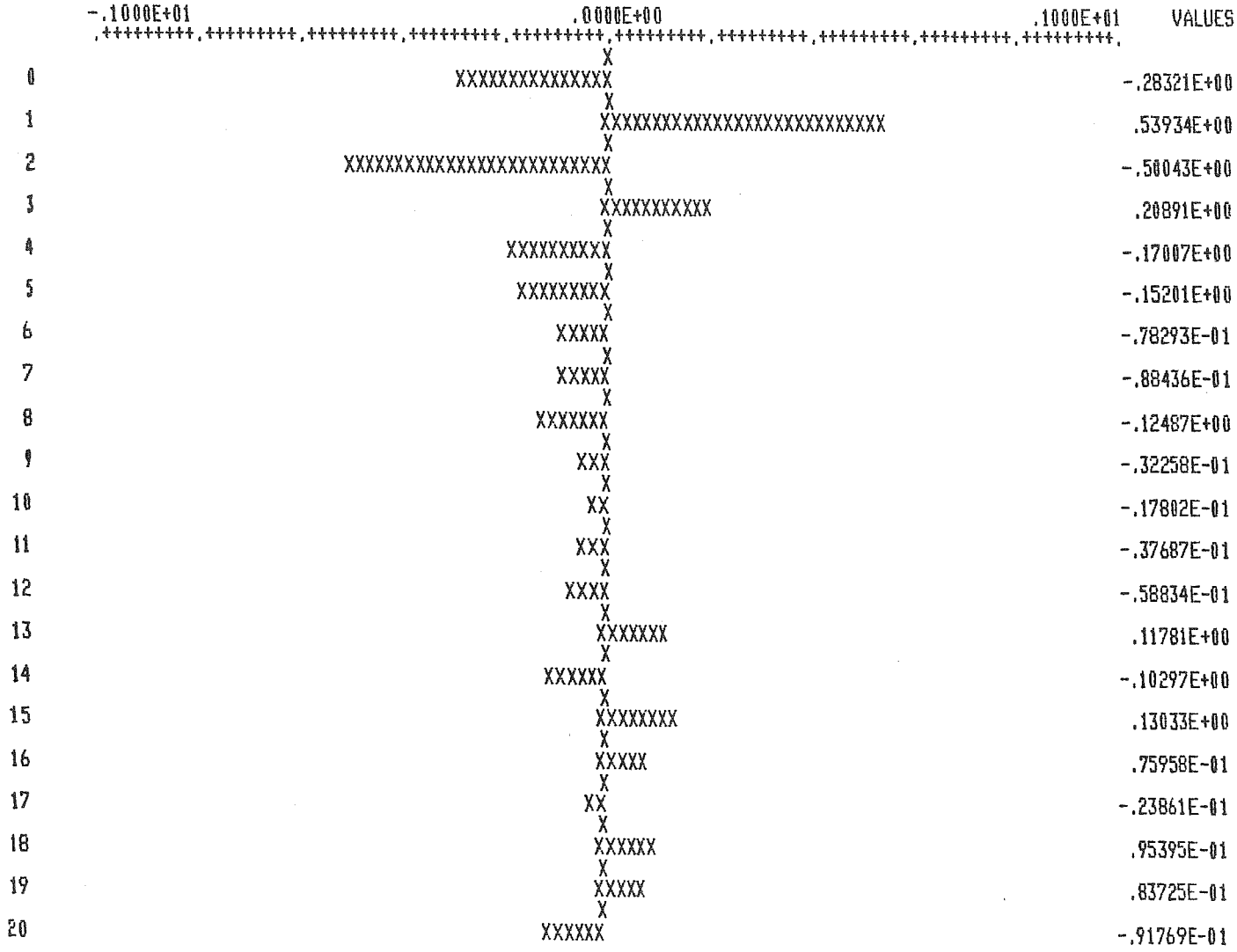
SERIES 1 - &TWIN2
SERIES 2 - &TWIN0

MEAN OF SERIES 1 = .10189E+03
ST. DEV. OF SERIES 1 = .27674E+01
MEAN OF SERIES 2 = .45467E+03
ST. DEV. OF SERIES 2 = .20045E+02

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	-.283	0	-.283
1	.539	1	.187
2	-.500	2	-.001
3	.209	3	.004
4	-.170	4	-.009
5	-.152	5	.102
6	-.078	6	.015
7	-.088	7	.023
8	-.125	8	.013
9	-.032	9	.037
10	-.018	10	-.095
11	-.038	11	.103
12	-.059	12	-.113
13	.118	13	-.042
14	-.103	14	.040
15	.130	15	-.110
16	.076	16	-.033
17	-.024	17	.099
18	.095	18	-.188
19	.084	19	.174
20	-.092	20	-.059

GRAPH OF SERIES CROSS CORRELATION

GRAPH INTERVAL IS .2000E-01



CROSS CORRELATIONS

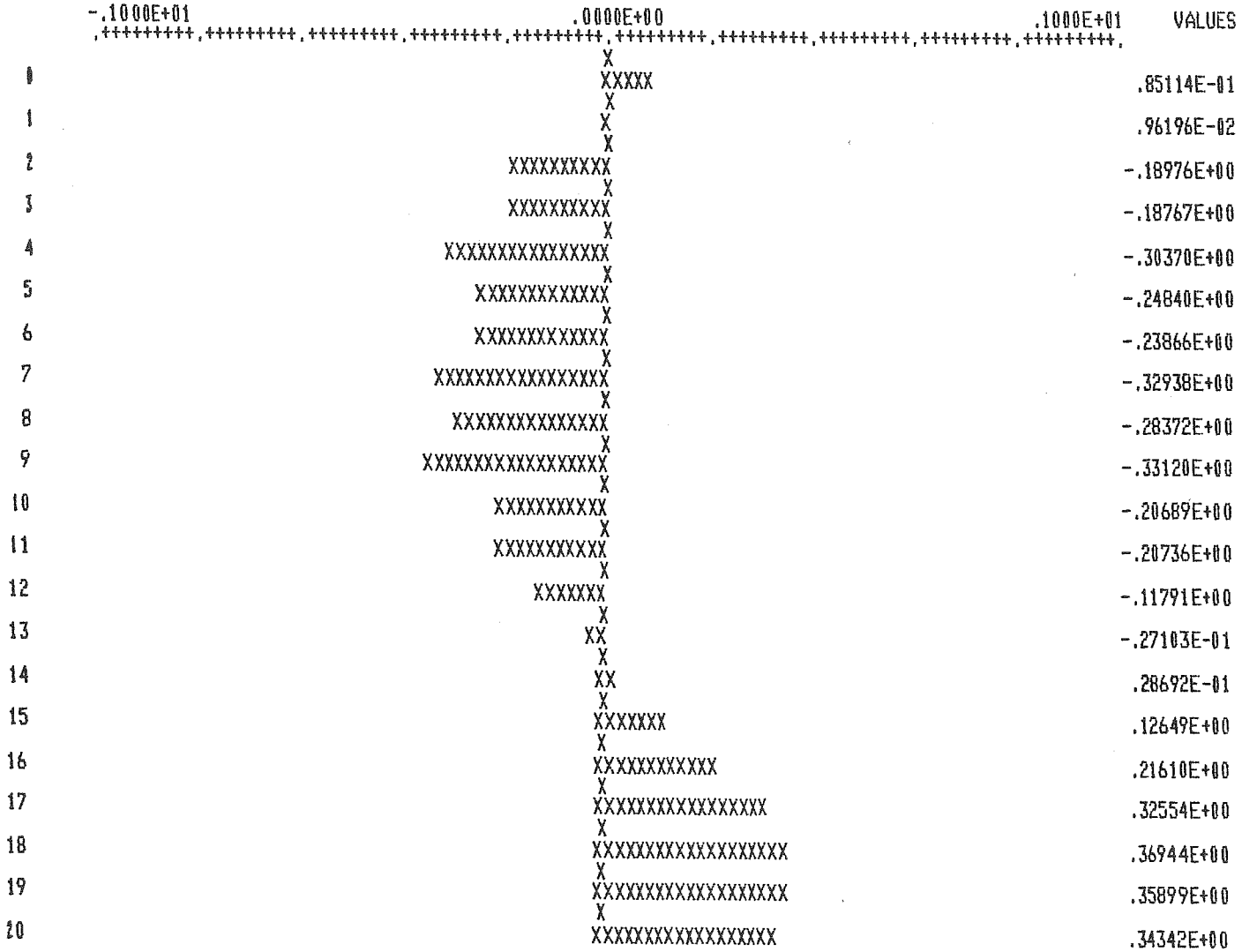
SERIES 1 - &TWIN0
SERIES 2 - &TWIN1

MEAN OF SERIES 1 = .45467E+03
ST. DEV. OF SERIES 1 = .20045E+02
MEAN OF SERIES 2 = .75827E+02
ST. DEV. OF SERIES 2 = .28356E+01

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	.085	0	.085
1	.010	1	.374
2	-.190	2	.577
3	-.188	3	.648
4	-.304	4	.636
5	-.248	5	.485
6	-.239	6	.331
7	-.329	7	.245
8	-.284	8	.083
9	-.331	9	.029
10	-.207	10	-.058
11	-.207	11	-.130
12	-.118	12	-.212
13	-.027	13	-.243
14	.029	14	-.287
15	.126	15	-.303
16	.216	16	-.325
17	.326	17	-.292
18	.369	18	-.290
19	.359	19	-.159
20	.343	20	-.173

GRAPH OF SERIES CROSS CORRELATION

GRAPH INTERVAL IS .2000E-01



CROSS CORRELATIONS

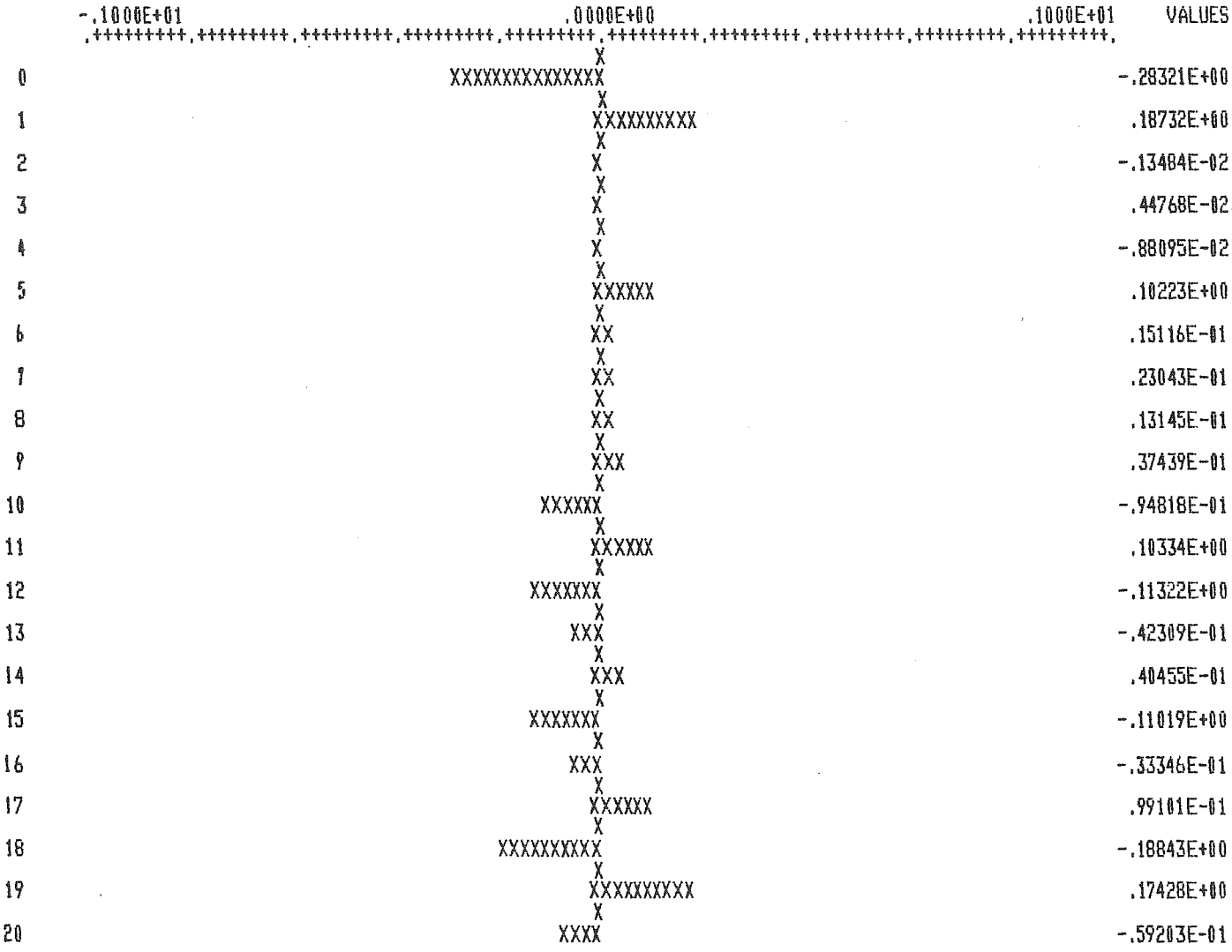
SERIES 1 - &TWIN0
SERIES 2 - &TWIN2

MEAN OF SERIES 1 = .45467E+03
ST. DEV. OF SERIES 1 = .20045E+02
MEAN OF SERIES 2 = .10189E+03
ST. DEV. OF SERIES 2 = .27674E+01

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	-.283	0	-.283
1	.187	1	.539
2	-.001	2	-.500
3	.004	3	.209
4	-.009	4	-.170
5	.102	5	-.152
6	.015	6	-.078
7	.023	7	-.088
8	.013	8	-.125
9	.037	9	-.032
10	-.095	10	-.018
11	.103	11	-.038
12	-.113	12	-.059
13	-.042	13	.118
14	.040	14	-.103
15	-.110	15	.130
16	-.033	16	.076
17	.099	17	-.024
18	-.188	18	.095
19	.174	19	.084
20	-.059	20	-.092

GRAPH OF SERIES CROSS CORRELATION

GRAPH INTERVAL IS .2000E-01



CROSS CORRELATIONS

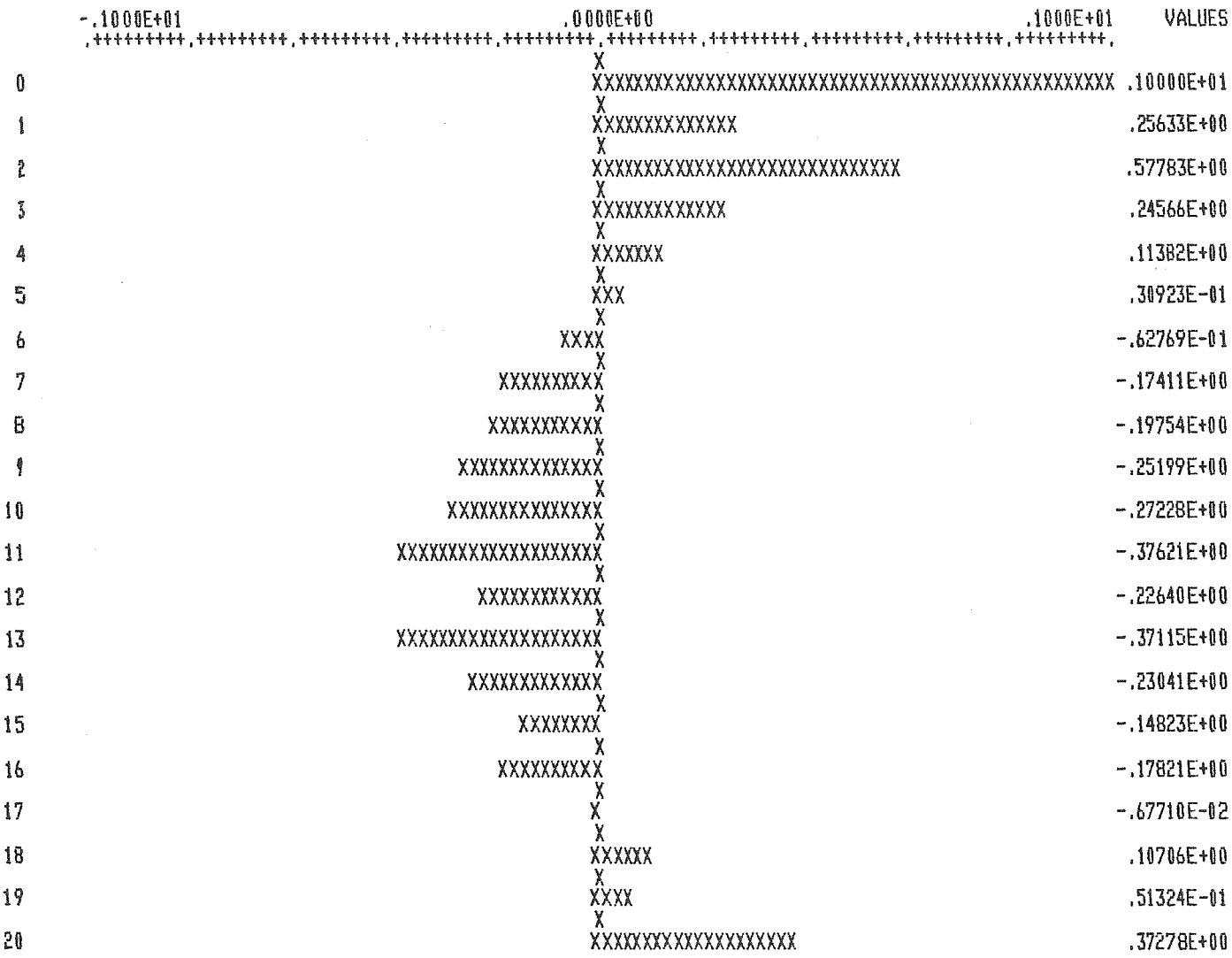
SERIES 1 - &TWINO
SERIES 2 - &TWINO

MEAN OF SERIES 1 = .45467E+03
ST. DEV. OF SERIES 1 = .20045E+02
MEAN OF SERIES 2 = .45467E+03
ST. DEV. OF SERIES 2 = .20045E+02

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	1.000	0	1.000
1	.256	1	.256
2	.578	2	.578
3	.246	3	.246
4	.114	4	.114
5	.031	5	.031
6	-.063	6	-.063
7	-.174	7	-.174
8	-.198	8	-.198
9	-.252	9	-.252
10	-.272	10	-.272
11	-.376	11	-.376
12	-.226	12	-.226
13	-.371	13	-.371
14	-.230	14	-.230
15	-.148	15	-.148
16	-.178	16	-.178
17	-.007	17	-.007
18	.107	18	.107
19	.051	19	.051
20	.373	20	.373

GRAPH OF SERIES CROSS CORRELATION

GRAPH INTERVAL IS .2000E-01



5 - EXAMPLE 3 : PREWHITENING MODE (IWPREW = 1)

MULTIPLE INPUT TRANSFER FUNCTION IDENTIFICATION (MTID)

GENERAL SPECIFICATION

01	CALCULATE AUTO CORRELATIONS	IWACF =	0
01	CALCULATE CROSS CORRELATIONS	IWCCF =	0
01	PREWHITENING MODELS WILL BE SUPPLIED	IWPREW =	1

SPECIFICATION OF TIME SERIES

02	NUMBER OF SEPARATE SERIES	NSERIE =	3
03	NUMBER OF OBSERVATIONS PER SERIES	NOB =	150

06 SERIES 1 &TWIN1

00	FIRST OBS	FOB =	1
07	LISTED	ILDID =	1
08	PLOTTED	IPDID =	1

06 SERIES 2 &TWIN2

00	FIRST OBS	FOB =	1
07	LISTED	ILDID =	1
08	PLOTTED	IPDID =	1

06 SERIES 3 &TWIN0

00	FIRST OBS	FOB =	1
07	LISTED	ILDID =	1
08	PLOTTED	IPDID =	1

PREWH. MODEL FOR INPUT SERIES 1

16	CROSS CORR. BETW. PREWH. SERIES 1 AND PREWH. SERIES 1	IPWCCF =	1
	AND PREWH. SERIES 2	IPWCCF =	1
	AND PREWH. SERIES 3	IPWCCF =	1
17	TRANSFORMATION	TLAM =	.100000E+01
		TM =	.000000E+00
18	NUMBER OF DIFFERENCING FACTORS	MFAC2 =	0
19	ESTIMATION OF THE MEAN	AVEPA =	.758870E+02
18	NUMBER OF AR-FACTORS	MFAC1 =	1
21	NUMBER OF PARAM. IN AR-FACTOR 1	INC =	1
22	ORDER OF PAR. 1 AR-FACT. 1	IOPA =	1
23	ESTI. OF PAR. 1 AR-FACT. 1	UPA =	.628500E+00
18	NUMBER OF MA-FACTORS	MFAC3 =	0
24	TREND PARAMETER	ITREND =	0

PREWH. MODEL FOR INPUT SERIES 2

16	CROSS CORR. BETW. PREWH. SERIES 2 AND PREWH. SERIES 1	IPWCCF =	1
	AND PREWH. SERIES 2	IPWCCF =	1
	AND PREWH. SERIES 3	IPWCCF =	1
17	TRANSFORMATION	TLAM =	.100000E+01
		TM =	.000000E+00
18	NUMBER OF DIFFERENCING FACTORS	MFAC2 =	0
19	ESTIMATION OF THE MEAN	AVEPA =	.101880E+03
18	NUMBER OF AR-FACTORS	MFAC1 =	0
18	NUMBER OF MA-FACTORS	MFAC3 =	1
21	NUMBER OF PARAM. IN MA-FACTOR 1	INC =	2
22	ORDER OF PAR. 1 MA-FACT. 1	IOPA =	1
23	ESTI. OF PAR. 1 MA-FACT. 1	UPA =	.297600E+00
22	ORDER OF PAR. 2 MA-FACT. 1	IOPA =	2
23	ESTI. OF PAR. 2 MA-FACT. 1	UPA =	-.469600E+00
24	TREND PARAMETER	ITREND =	0

SPECIFICATION FOR THE OUTPUT SERIES

26	TRANSFORMATION	TLAM =	.100000E+01
		TM =	.000000E+00
27	NUMBER OF DIFFERENCING FACTORS	MFAC2 =	0
28	ESTIMATION OF THE MEAN	AVEPA =	.450000E+03

SPECIFICATION FOR THE IMPULSE RESPONSE WEIGHTS

31	NUMB. OF WEIGHTS TO BE ESTIMATED	NIRW	=	20
31	NUMB OF WEIGHTS TO GENERATE NOISE	NWTGN	=	20
31	PLOTTING OF THE IMP. RESP. WEIGHTS	IPIRW	=	1

SPECIFICATION FOR THE NOISE SERIES

32	NUMBER OF DIFFERENCING FACTORS	NDIFNO	=	1
33	NUMBER OF DIFFERENCES OF FACTOR 1	NDNO	=	1
33	ORDER OF DIFFERENCES OF FACTOR 1	IODNO	=	1

SPECIFICATION FOR THE AUTO CORR. FUNC. OF THE NOISE

34	MAX. LAG IN CALC. AUTO CORR.	NAC	=	20
34	MAX. LAG IN CALC. PART. AUTO CORR.	NPAC	=	20
34	NUMBER OF AUTO CORR. CHI-SQ. STAT.	NCHI	=	20
34	STANDARD ERRORS FOR AUTO CORR.	MCSE	=	1
34	NUMBER OF AUTO CORR. PER LINE	NAPL	=	10
34	PLOTTING OF AUTO CORR.	IWTPA	=	1
30	BACKFORECASTING PROCEDURE	IWBF	=	0

&TWIN1

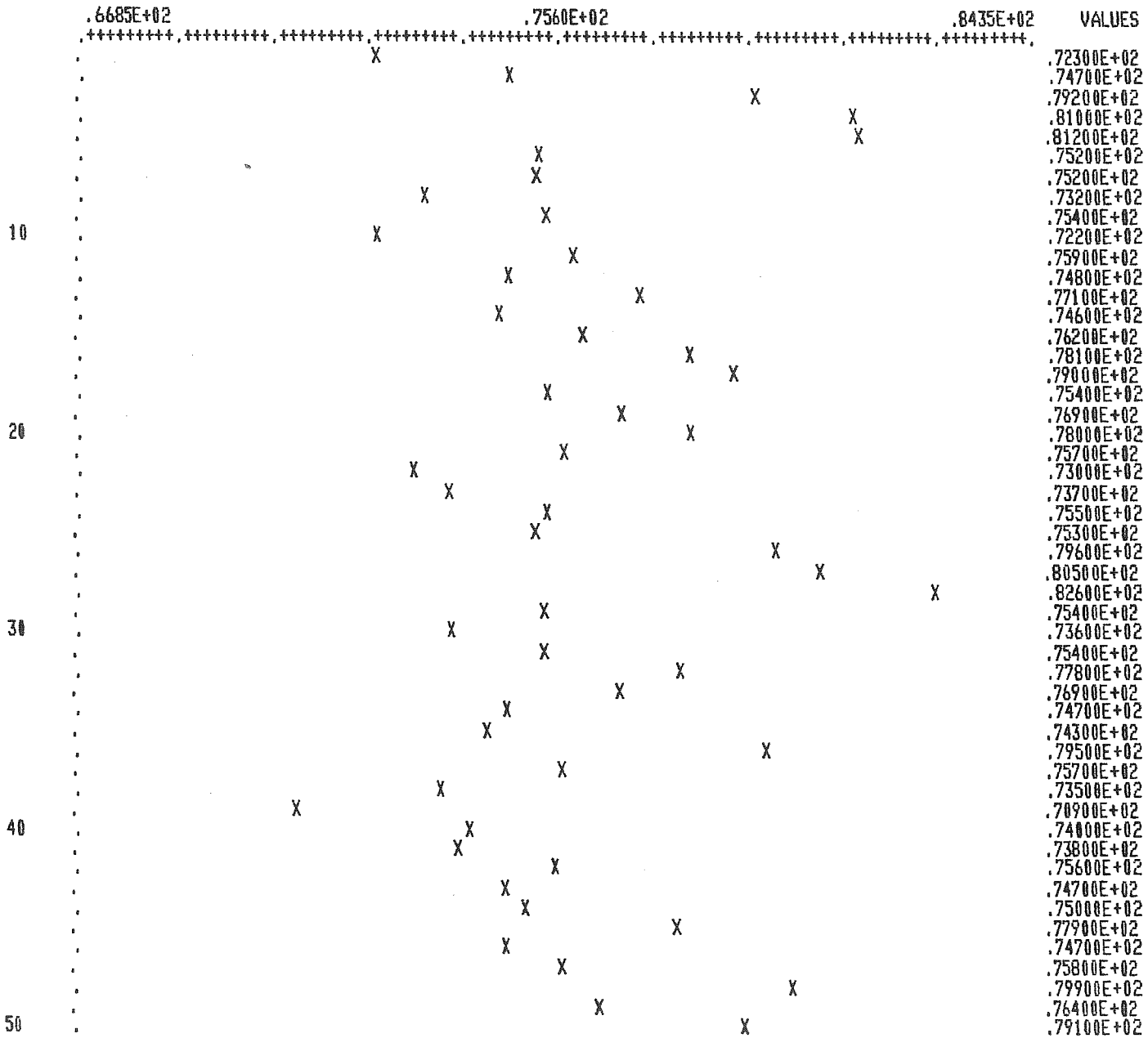
LISTING OF OBSERVED SERIES

1- 8	.723000E+02	.747000E+02	.792000E+02	.810000E+02	.812000E+02	.752000E+02	.752000E+02	.732000E+02
9- 16	.754000E+02	.722000E+02	.759000E+02	.748000E+02	.771000E+02	.746000E+02	.762000E+02	.781000E+02
17- 24	.790000E+02	.754000E+02	.769000E+02	.780000E+02	.757000E+02	.730000E+02	.737000E+02	.755000E+02
25- 32	.753000E+02	.796000E+02	.805000E+02	.826000E+02	.754000E+02	.736000E+02	.754000E+02	.778000E+02
33- 40	.769000E+02	.747000E+02	.743000E+02	.795000E+02	.757000E+02	.735000E+02	.709000E+02	.740000E+02
41- 48	.738000E+02	.756000E+02	.747000E+02	.750000E+02	.779000E+02	.747000E+02	.758000E+02	.799000E+02
49- 56	.764000E+02	.791000E+02	.794000E+02	.817000E+02	.790000E+02	.753000E+02	.742000E+02	.730000E+02
57- 64	.755000E+02	.697000E+02	.693000E+02	.710000E+02	.686000E+02	.756000E+02	.734000E+02	.766000E+02
65- 72	.726000E+02	.729000E+02	.726000E+02	.735000E+02	.759000E+02	.756000E+02	.812000E+02	.809000E+02
73- 80	.812000E+02	.822000E+02	.799000E+02	.787000E+02	.798000E+02	.736000E+02	.720000E+02	.738000E+02
81- 88	.758000E+02	.706000E+02	.728000E+02	.713000E+02	.725000E+02	.725000E+02	.725000E+02	.732000E+02
89- 96	.751000E+02	.727000E+02	.758000E+02	.767000E+02	.781000E+02	.797000E+02	.809000E+02	.810000E+02
97- 104	.791000E+02	.773000E+02	.772000E+02	.766000E+02	.757000E+02	.726000E+02	.720000E+02	.730000E+02
105- 112	.730000E+02	.761000E+02	.775000E+02	.771000E+02	.743000E+02	.762000E+02	.754000E+02	.763000E+02
113- 120	.779000E+02	.794000E+02	.786000E+02	.793000E+02	.761000E+02	.763000E+02	.782000E+02	.765000E+02
121- 128	.790000E+02	.801000E+02	.771000E+02	.746000E+02	.721000E+02	.737000E+02	.766000E+02	.778000E+02
129- 136	.773000E+02	.783000E+02	.775000E+02	.762000E+02	.751000E+02	.772000E+02	.730000E+02	.722000E+02
137- 144	.750000E+02	.709000E+02	.753000E+02	.758000E+02	.778000E+02	.776000E+02	.754000E+02	.764000E+02
145- 150	.741000E+02	.722000E+02	.736000E+02	.750000E+02	.748000E+02	.755000E+02		

&TWIN1

GRAPH OF OBSERVED SERIES

GRAPH INTERVAL IS .1750E+00



&TWIN2

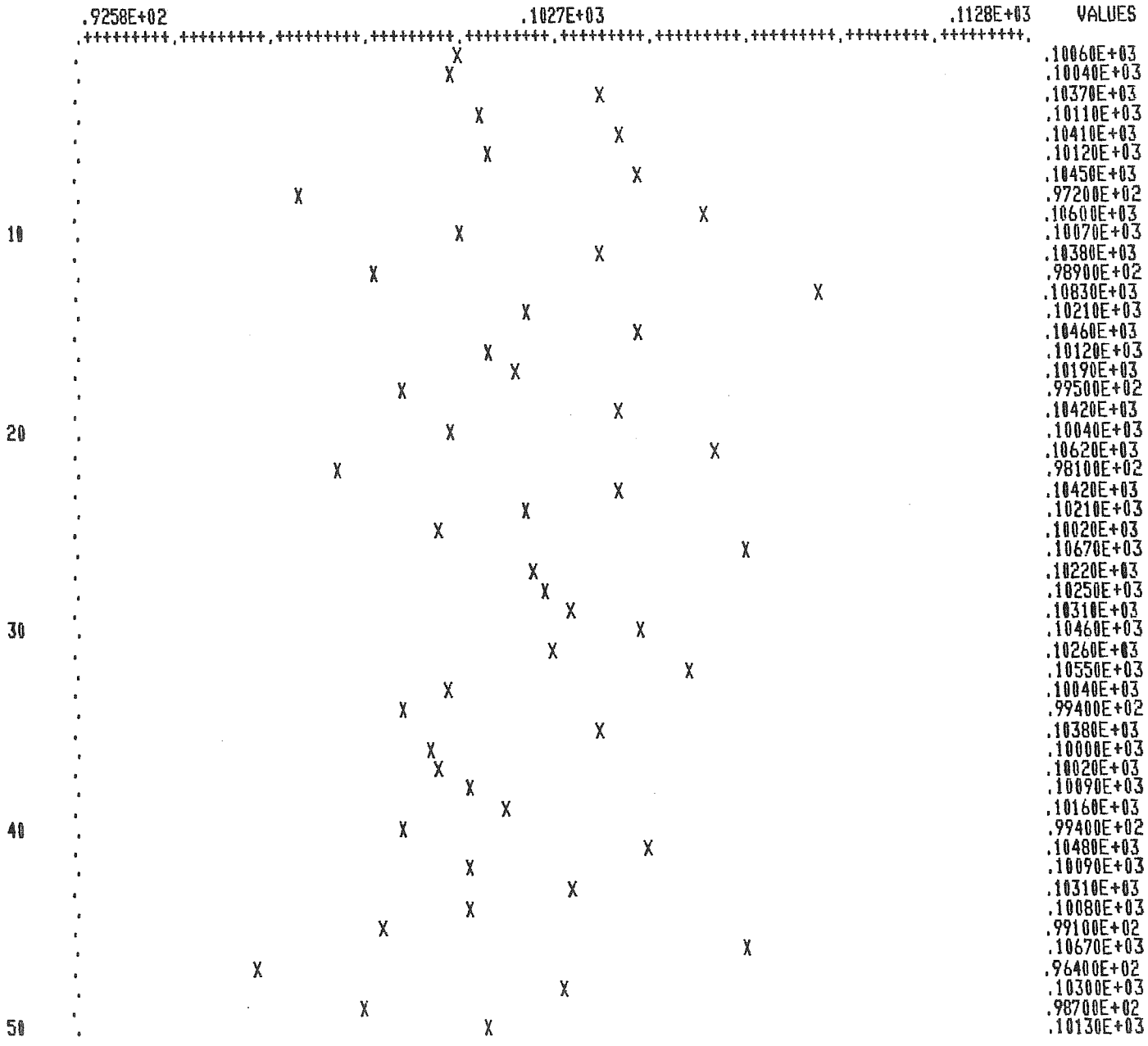
LISTING OF OBSERVED SERIES

1- 8	.100600E+03	.100400E+03	.103700E+03	.101100E+03	.104100E+03	.101200E+03	.104500E+03	.972000E+02
9- 16	.106000E+03	.100700E+03	.103800E+03	.989000E+02	.108300E+03	.102100E+03	.104600E+03	.101200E+03
17- 24	.101900E+03	.995000E+02	.104200E+03	.100400E+03	.106200E+03	.981000E+02	.104200E+03	.102100E+03
25- 32	.100200E+03	.106700E+03	.102200E+03	.102500E+03	.103100E+03	.104600E+03	.102600E+03	.105500E+03
33- 40	.100400E+03	.994000E+02	.103800E+03	.100000E+03	.100200E+03	.100900E+03	.101600E+03	.994000E+02
41- 48	.104800E+03	.100900E+03	.103100E+03	.100800E+03	.991000E+02	.106700E+03	.964000E+02	.103000E+03
49- 56	.987000E+02	.101300E+03	.100100E+03	.986000E+02	.105200E+03	.983000E+02	.107400E+03	.104400E+03
57- 64	.100400E+03	.105000E+03	.981000E+02	.102900E+03	.102600E+03	.986000E+02	.103300E+03	.101600E+03
65- 72	.106400E+03	.101600E+03	.101300E+03	.101500E+03	.986000E+02	.998000E+02	.103700E+03	.990000E+02
73- 80	.104700E+03	.100600E+03	.101900E+03	.101600E+03	.996000E+02	.102300E+03	.101200E+03	.103400E+03
81- 88	.105000E+03	.100800E+03	.104600E+03	.104500E+03	.103100E+03	.100500E+03	.100800E+03	.101500E+03
89- 96	.102200E+03	.103200E+03	.100700E+03	.987000E+02	.105000E+03	.968000E+02	.105100E+03	.101000E+03
97- 104	.998000E+02	.100000E+03	.103100E+03	.984000E+02	.103900E+03	.101000E+03	.104300E+03	.100000E+03
105- 112	.104800E+03	.946000E+02	.102100E+03	.100600E+03	.100300E+03	.103400E+03	.982000E+02	.985000E+02
113- 120	.100900E+03	.975000E+02	.104200E+03	.101100E+03	.103800E+03	.987000E+02	.106700E+03	.988000E+02
121- 128	.100400E+03	.104200E+03	.963000E+02	.101300E+03	.100500E+03	.995000E+02	.983000E+02	.105400E+03
129- 136	.957000E+02	.105700E+03	.101300E+03	.990000E+02	.102100E+03	.105000E+03	.103100E+03	.101700E+03
137- 144	.105000E+03	.973000E+02	.103900E+03	.103000E+03	.998000E+02	.105300E+03	.101600E+03	.106000E+03
145- 150	.104800E+03	.107000E+03	.100400E+03	.110801E+03	.995000E+02	.104700E+03		

&TWIN2

GRAPH OF OBSERVED SERIES

GRAPH INTERVAL IS .2025E+00



&TWINO

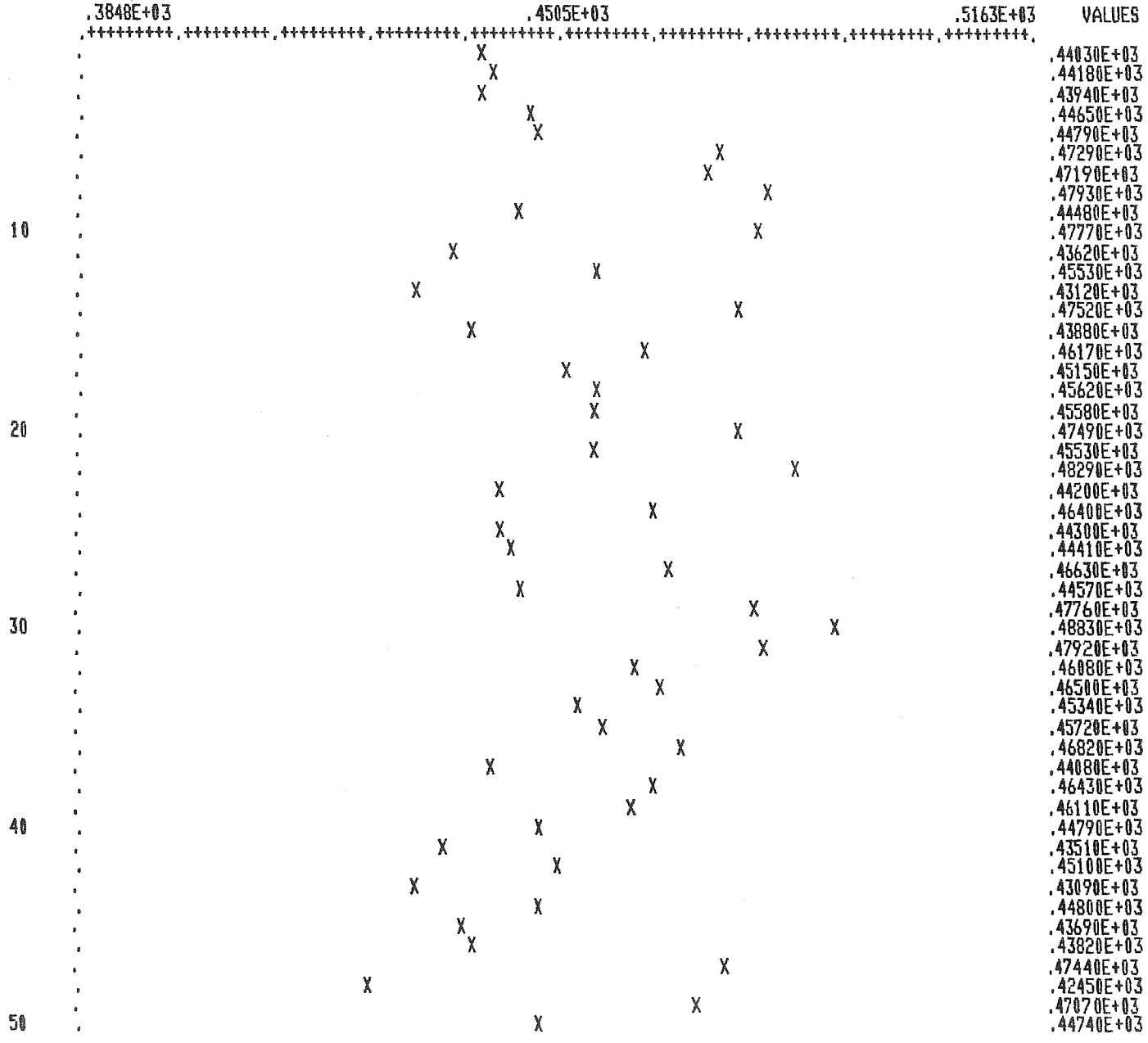
LISTING OF OBSERVED SERIES

1- 8	.440300E+03	.441800E+03	.439400E+03	.446500E+03	.447900E+03	.472900E+03	.471900E+03	.479300E+03
9- 16	.444800E+03	.477700E+03	.436200E+03	.455300E+03	.431200E+03	.475200E+03	.438800E+03	.461700E+03
17- 24	.451500E+03	.456200E+03	.455800E+03	.474900E+03	.455300E+03	.482900E+03	.442000E+03	.464000E+03
25- 32	.443000E+03	.444100E+03	.466300E+03	.445700E+03	.477600E+03	.488300E+03	.479200E+03	.460800E+03
33- 40	.465000E+03	.453400E+03	.457200E+03	.468200E+03	.440800E+03	.464300E+03	.461100E+03	.447900E+03
41- 48	.435100E+03	.451000E+03	.430900E+03	.448000E+03	.436900E+03	.438200E+03	.474400E+03	.424500E+03
49- 56	.470700E+03	.447400E+03	.467600E+03	.467900E+03	.462100E+03	.503100E+03	.463800E+03	.498400E+03
57- 64	.457100E+03	.445100E+03	.462300E+03	.423400E+03	.440300E+03	.417700E+03	.397900E+03	.443100E+03
65- 72	.416800E+03	.455700E+03	.424300E+03	.434000E+03	.431900E+03	.422900E+03	.439100E+03	.454200E+03
73- 80	.446000E+03	.488000E+03	.471500E+03	.491000E+03	.488500E+03	.482200E+03	.491200E+03	.469400E+03
81- 88	.463400E+03	.458400E+03	.442300E+03	.451000E+03	.439400E+03	.427100E+03	.423500E+03	.425900E+03
89- 96	.429300E+03	.430000E+03	.440700E+03	.424900E+03	.428900E+03	.467900E+03	.433600E+03	.487300E+03
97- 104	.466900E+03	.472600E+03	.482100E+03	.487000E+03	.456600E+03	.484800E+03	.456900E+03	.462500E+03
105- 112	.434100E+03	.456000E+03	.405900E+03	.461700E+03	.447200E+03	.450700E+03	.460000E+03	.436300E+03
113- 120	.449500E+03	.459000E+03	.449700E+03	.484800E+03	.463300E+03	.478800E+03	.457300E+03	.484300E+03
121- 128	.452300E+03	.468000E+03	.479400E+03	.455900E+03	.486900E+03	.457200E+03	.447200E+03	.445400E+03
129- 136	.469500E+03	.426500E+03	.484300E+03	.455800E+03	.457000E+03	.474100E+03	.470100E+03	.461000E+03
137- 144	.445500E+03	.454200E+03	.424300E+03	.451200E+03	.435300E+03	.434700E+03	.468400E+03	.447400E+03
145- 150	.469000E+03	.456700E+03	.464500E+03	.427301E+03	.474700E+03	.415200E+03		

&TWINO

GRAPH OF OBSERVED SERIES

GRAPH INTERVAL IS .1315E+01



PREWHITENED INPUT 1 ANALYSIS
****

SPECIFICATION OF PREWHITENING TRANSFORMATION APPLIED TO INPUT SERIES 1

****

DATA - X1 = &TWIN1 150 OBSERVATIONS

DIFFERENCING ON X1 - NONE

TRANSFORMATIONS EXAMINED - NONE

****

UNIVARIATE MODEL PARAMETERS

****

PARAMETER NUMBER	PARAMETER TYPE	PARAMETER ORDER	BEGINNING VALUE
1	MEAN		.75887E+02
2	AUTOREGRESSIVE 1	1	.62850E+00

****

SPECIFICATION OF PREWHITENING TRANSFORMATION APPLIED TO INPUT SERIES 1

****

DATA - X1 = &TWIN1 150 OBSERVATIONS

DIFFERENCING ON X1 - NONE

TRANSFORMATIONS EXAMINED - NONE

****

UNIVARIATE MODEL PARAMETERS

****

PARAMETER NUMBER	PARAMETER TYPE	PARAMETER ORDER	BEGINNING VALUE
1	MEAN		.75887E+02
2	AUTOREGRESSIVE 1	1	.62850E+00

****

OTHER TRANSFER FUNCTION IDENTIFICATION INFORMATION

****

EFFECTIVE NUMBER OF OBSERVATIONS FOR CROSS CORRELATION = 149

CROSS CORRELATIONS

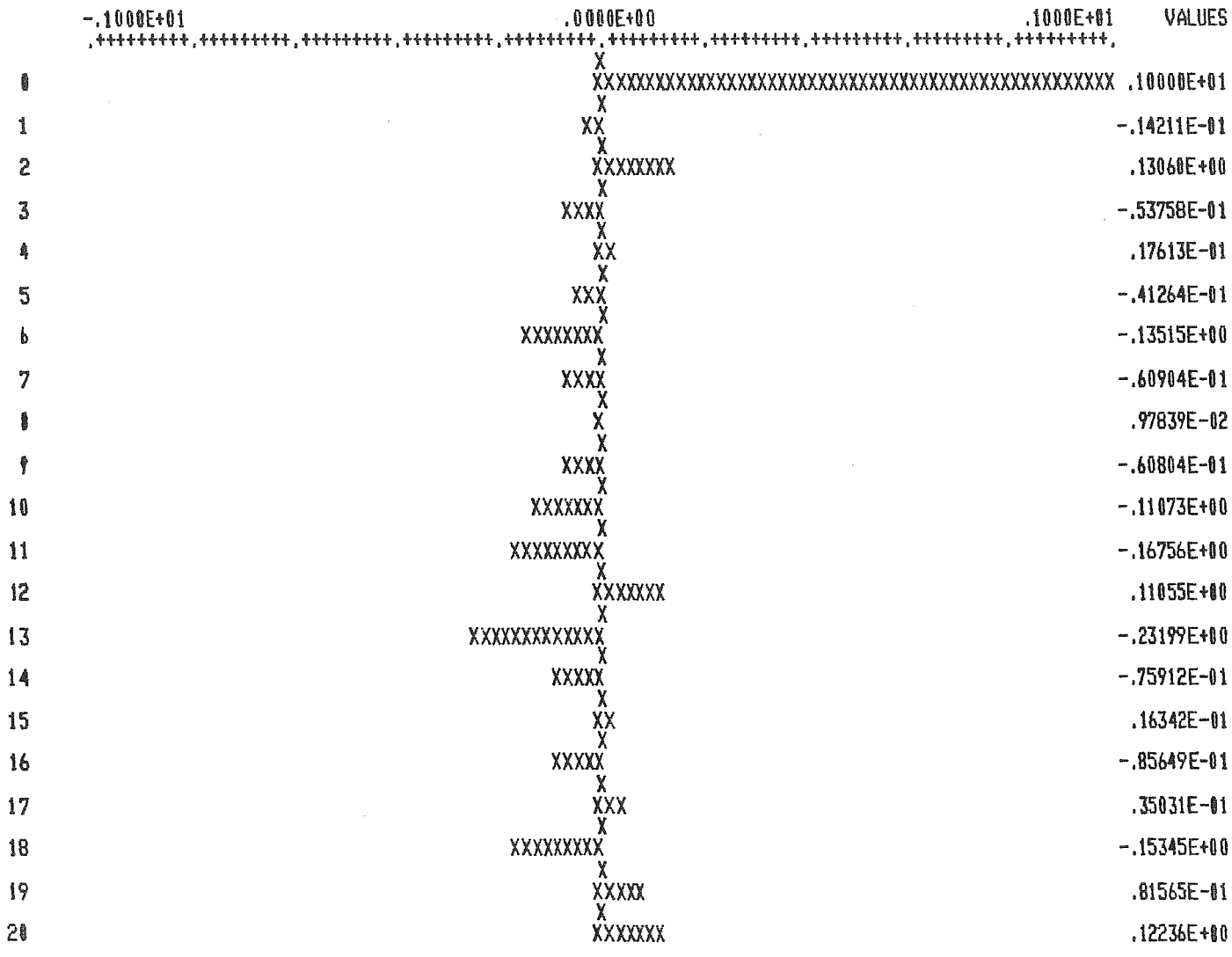
SERIES 1 - PREWHITENED &TWIN1
SERIES 2 - PREWHITENED &TWIN1

MEAN OF SERIES 1 = .12903E-03
ST. DEV. OF SERIES 1 = .21939E+01
MEAN OF SERIES 2 = .12903E-03
ST. DEV. OF SERIES 2 = .21939E+01

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	1.000	0	1.000
1	-.014	1	-.014
2	.131	2	.131
3	-.054	3	-.054
4	.018	4	.018
5	-.041	5	-.041
6	-.135	6	-.135
7	-.061	7	-.061
8	.010	8	.010
9	-.061	9	-.061
10	-.111	10	-.111
11	-.168	11	-.168
12	.111	12	.111
13	-.232	13	-.232
14	-.076	14	-.076
15	.016	15	.016
16	-.086	16	-.086
17	.035	17	.035
18	-.153	18	-.153
19	.082	19	.082
20	.122	20	.122

GRAPH OF PRWH CROSS CORR

GRAPH INTERVAL IS .2000E-01



SPECIFICATION OF PREWHITENING TRANSFORMATION APPLIED TO INPUT SERIES 2

DATA - X2 = &TWIN2 150 OBSERVATIONS

DIFFERENCING ON X2 - NONE

TRANSFORMATIONS EXAMINED - NONE

UNIVARIATE MODEL PARAMETERS

PARAMETER NUMBER	PARAMETER TYPE	PARAMETER ORDER	BEGINNING VALUE
1	MEAN		.10188E+03
2	MOVING AVERAGE 1	1	.29760E+00
3	MOVING AVERAGE 1	2	-.46960E+00

OTHER TRANSFER FUNCTION IDENTIFICATION INFORMATION

EFFECTIVE NUMBER OF OBSERVATIONS FOR CROSS CORRELATION = 149

CROSS CORRELATIONS

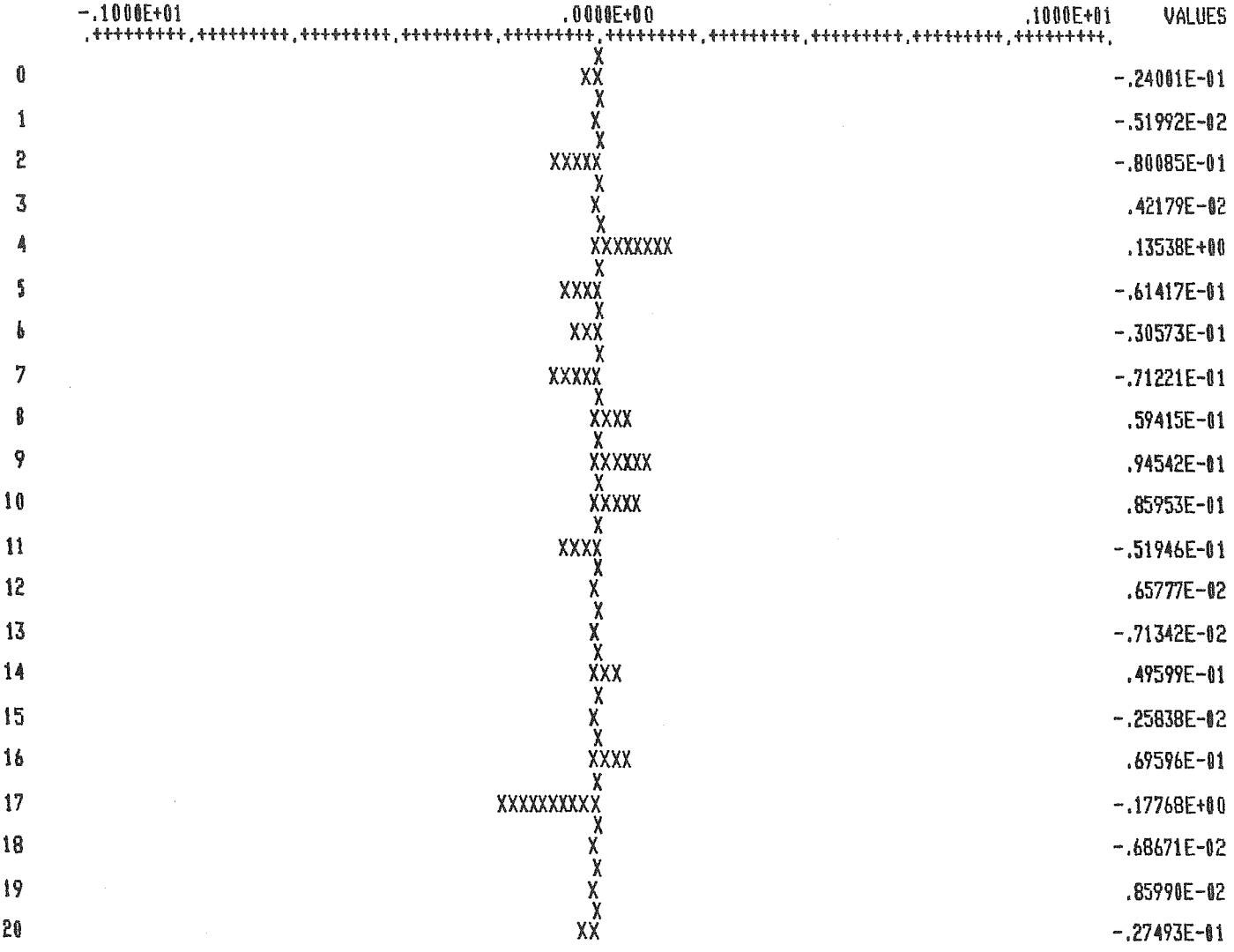
SERIES 1 - PREWHITENED &TWIN1
SERIES 2 - PREWHITENED &TWIN2

MEAN OF SERIES 1 = .12903E-03
ST. DEV. OF SERIES 1 = .21939E+01
MEAN OF SERIES 2 = .17507E-01
ST. DEV. OF SERIES 2 = .23657E+01

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	-.024	0	-.024
1	-.005	1	-.137
2	-.080	2	-.008
3	.004	3	-.220
4	.135	4	.014
5	-.061	5	-.065
6	-.031	6	.176
7	-.071	7	-.035
8	.059	8	-.090
9	.095	9	.029
10	.086	10	-.027
11	-.052	11	.142
12	.007	12	.003
13	-.007	13	.082
14	.050	14	-.016
15	-.003	15	-.013
16	.070	16	.032
17	-.178	17	.025
18	-.007	18	.030
19	.009	19	-.037
20	-.027	20	-.008

GRAPH OF PRWH CROSS CORR

GRAPH INTERVAL IS .2000E-01



SPECIFICATION OF PREWHITENING TRANSFORMATION APPLIED TO OUTPUT SERIES

DATA - Y = &TWIN0 150 OBSERVATIONS

DIFFERENCING ON Y - NONE

TRANSFORMATIONS EXAMINED - NONE

UNIVARIATE MODEL PARAMETERS

PARAMETER NUMBER	PARAMETER TYPE	PARAMETER ORDER	BEGINNING VALUE
1	MEAN		.45000E+03
2	AUTOREGRESSIVE 1	1	.62850E+00

OTHER TRANSFER FUNCTION IDENTIFICATION INFORMATION

EFFECTIVE NUMBER OF OBSERVATIONS FOR CROSS CORRELATION = 149

NUMBER OF IMPULSE RESPONSE WEIGHTS ESTIMATED = 20

NUMBER OF IMPULSE RESPONSE WEIGHTS USED TO GENERATE NOISE SERIES = 20

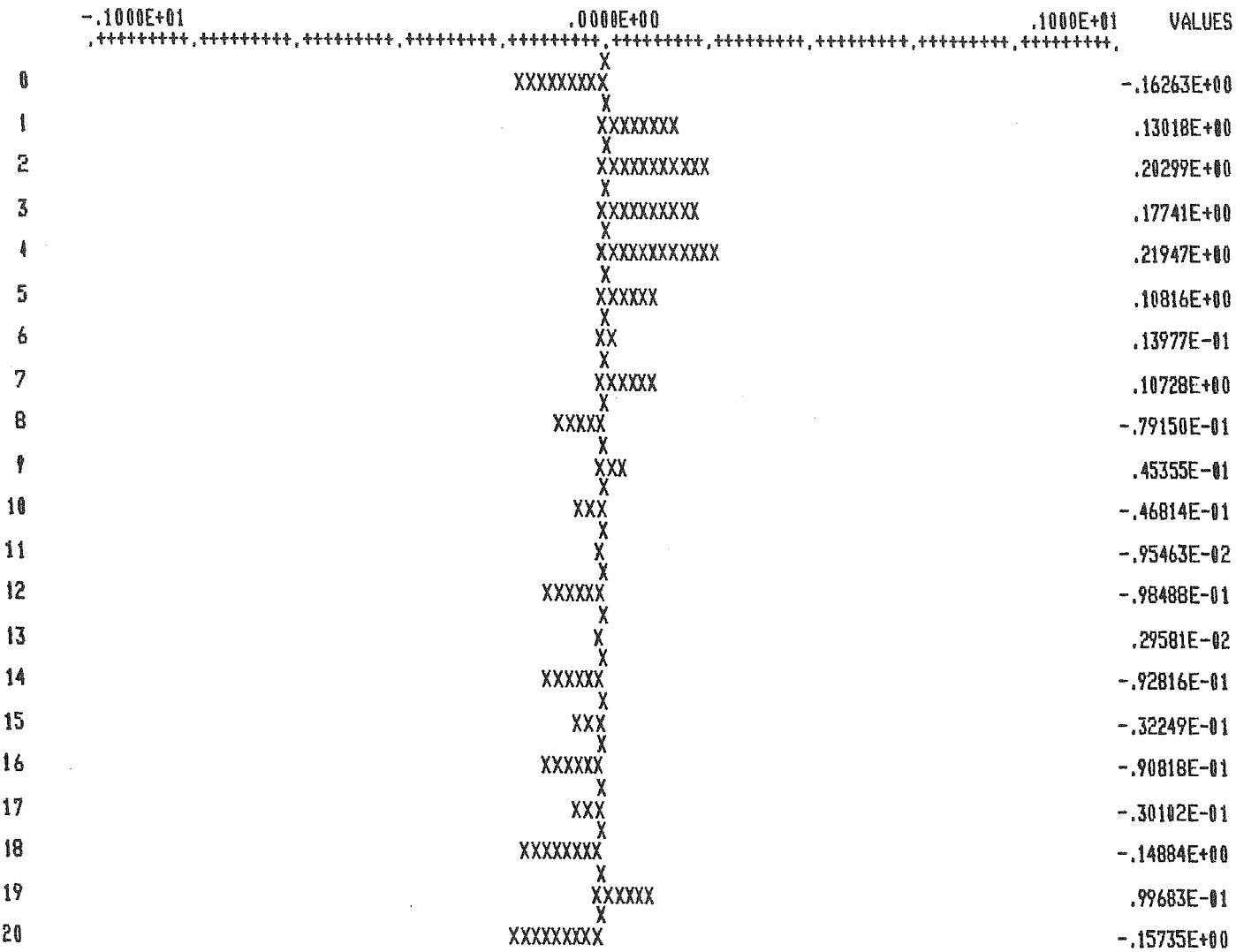
SERIES 1 - PREWHITENED &TWIN1
SERIES 2 - PREWHITENED &TWIN0

MEAN OF SERIES 1 = .12903E-03
ST. DEV. OF SERIES 1 = .21939E+01
MEAN OF SERIES 2 = .16651E+01
ST. DEV. OF SERIES 2 = .20698E+02

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	-.163	0	-.163
1	.130	1	.104
2	.203	2	-.185
3	.177	3	.068
4	.219	4	-.184
5	.108	5	-.016
6	.014	6	.037
7	.107	7	-.170
8	-.079	8	.026
9	.045	9	-.201
10	-.047	10	.068
11	-.010	11	-.110
12	-.098	12	-.017
13	.003	13	.018
14	-.093	14	-.026
15	-.032	15	.033
16	-.091	16	.025
17	-.030	17	.103
18	-.149	18	.110
19	.100	19	.070
20	-.157	20	.110

GRAPH OF PRWH CROSS CORR

GRAPH INTERVAL IS .2000E-01

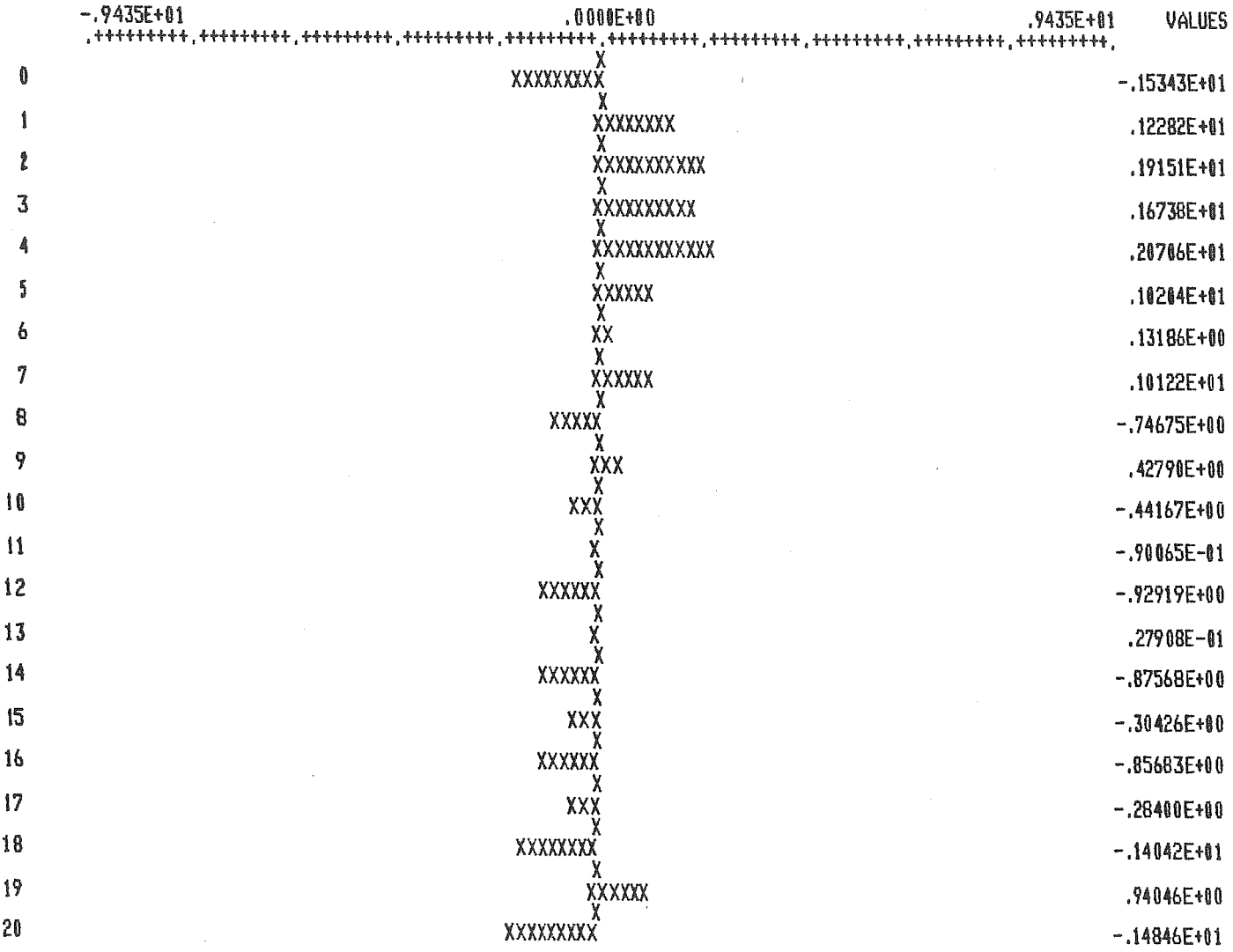


ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

K	V(K)
0	-.153434E+01
1	.122820E+01
2	.191511E+01
3	.167376E+01
4	.207057E+01
5	.102044E+01
6	.131862E+00
7	.101217E+01
8	-.746747E+00
9	.427904E+00
10	-.441667E+00
11	-.900651E-01
12	-.929193E+00
13	.279082E-01
14	-.875680E+00
15	-.304256E+00
16	-.856825E+00
17	-.284000E+00
18	-.140424E+01
19	.940462E+00
20	-.148456E+01

GRAPH OF IMPULSE RESPONSE WEIGHTS

GRAPH INTERVAL IS .1887E+00



SPECIFICATION OF PREWHITENING TRANSFORMATION APPLIED TO INPUT SERIES 2

****

DATA - X2 = &TWIN2 150 OBSERVATIONS

DIFFERENCING ON X2 - NONE

TRANSFORMATIONS EXAMINED - NONE

****

UNIVARIATE MODEL PARAMETERS

****

PARAMETER NUMBER	PARAMETER TYPE	PARAMETER ORDER	BEGINNING VALUE
1	MEAN		.10188E+03
2	MOVING AVERAGE 1	1	.29760E+00
3	MOVING AVERAGE 1	2	-.46960E+00

****

SPECIFICATION OF PREWHITENING TRANSFORMATION APPLIED TO INPUT SERIES 1

DATA - X1 = &TWIN1 150 OBSERVATIONS

DIFFERENCING ON X1 - NONE

TRANSFORMATIONS EXAMINED - NONE

UNIVARIATE MODEL PARAMETERS

PARAMETER NUMBER	PARAMETER TYPE	PARAMETER ORDER	BEGINNING VALUE
1	MEAN		.75887E+02
2	AUTOREGRESSIVE 1	1	.62850E+00

OTHER TRANSFER FUNCTION IDENTIFICATION INFORMATION

EFFECTIVE NUMBER OF OBSERVATIONS FOR CROSS CORRELATION = 149

CROSS CORRELATIONS

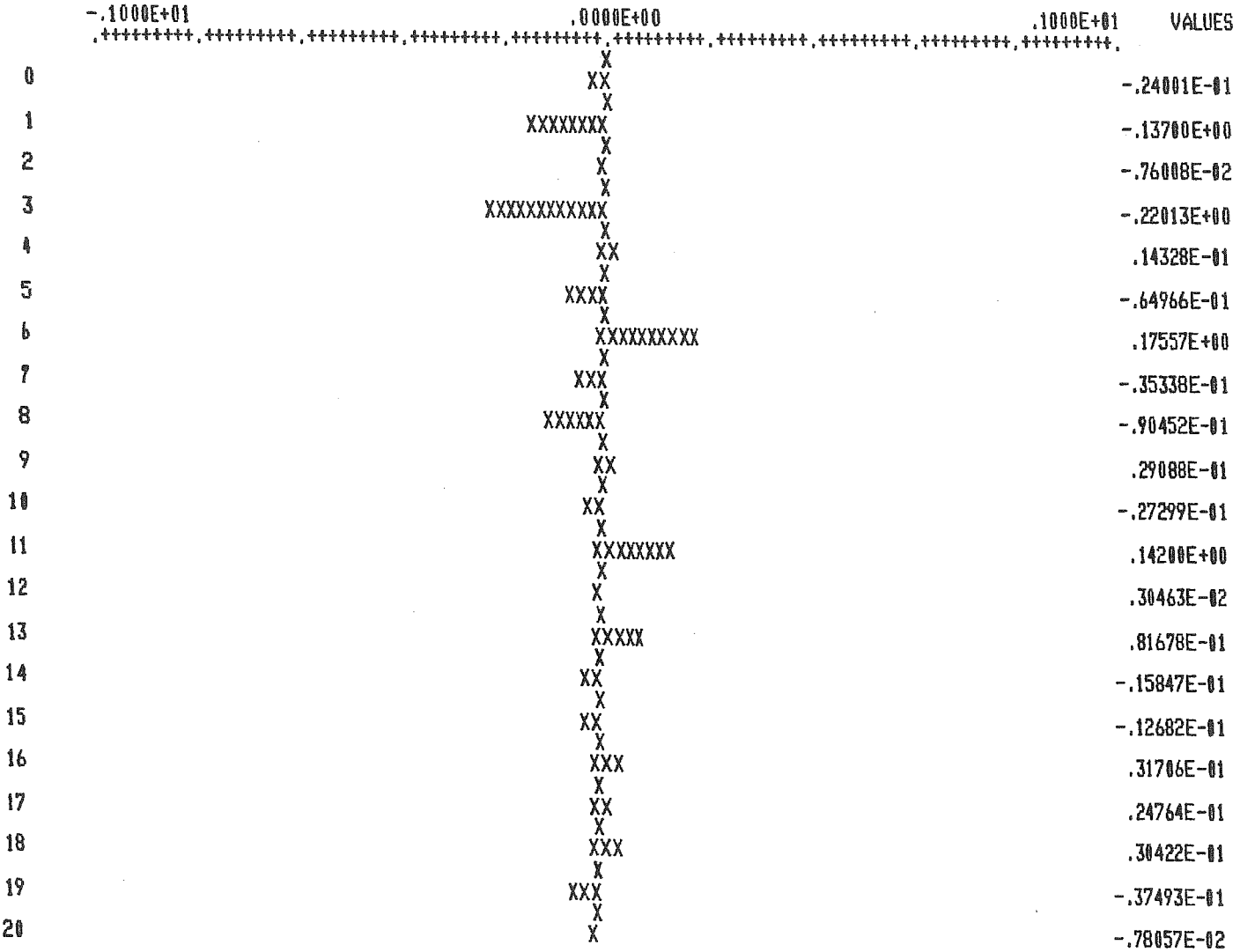
SERIES 1 - PREWHITENED &TWIN2
SERIES 2 - PREWHITENED &TWIN1

MEAN OF SERIES 1 = .17507E-01
ST. DEV. OF SERIES 1 = .23657E+01
MEAN OF SERIES 2 = .12903E-03
ST. DEV. OF SERIES 2 = .21939E+01

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	-.024	0	-.024
1	-.137	1	-.005
2	-.008	2	-.080
3	-.220	3	.004
4	.014	4	.135
5	-.065	5	-.061
6	.176	6	-.031
7	-.035	7	-.071
8	-.090	8	.059
9	.029	9	.095
10	-.027	10	.086
11	.142	11	-.052
12	.003	12	.007
13	.082	13	-.007
14	-.016	14	.050
15	-.013	15	-.003
16	.032	16	.070
17	.025	17	-.178
18	.030	18	-.007
19	-.037	19	.009
20	-.008	20	-.027

GRAPH OF PRWH CROSS CORR

GRAPH INTERVAL IS .2000E-01



SPECIFICATION OF PREWHITENING TRANSFORMATION APPLIED TO INPUT SERIES 2

DATA - X2 = &TWIN2 150 OBSERVATIONS

DIFFERENCING ON X2 - NONE

TRANSFORMATIONS EXAMINED - NONE

UNIVARIATE MODEL PARAMETERS

PARAMETER NUMBER	PARAMETER TYPE	PARAMETER ORDER	BEGINNING VALUE
1	MEAN		.10188E+03
2	MOVING AVERAGE 1	1	.29760E+00
3	MOVING AVERAGE 1	2	-.46960E+00

OTHER TRANSFER FUNCTION IDENTIFICATION INFORMATION

EFFECTIVE NUMBER OF OBSERVATIONS FOR CROSS CORRELATION = 150

CROSS CORRELATIONS

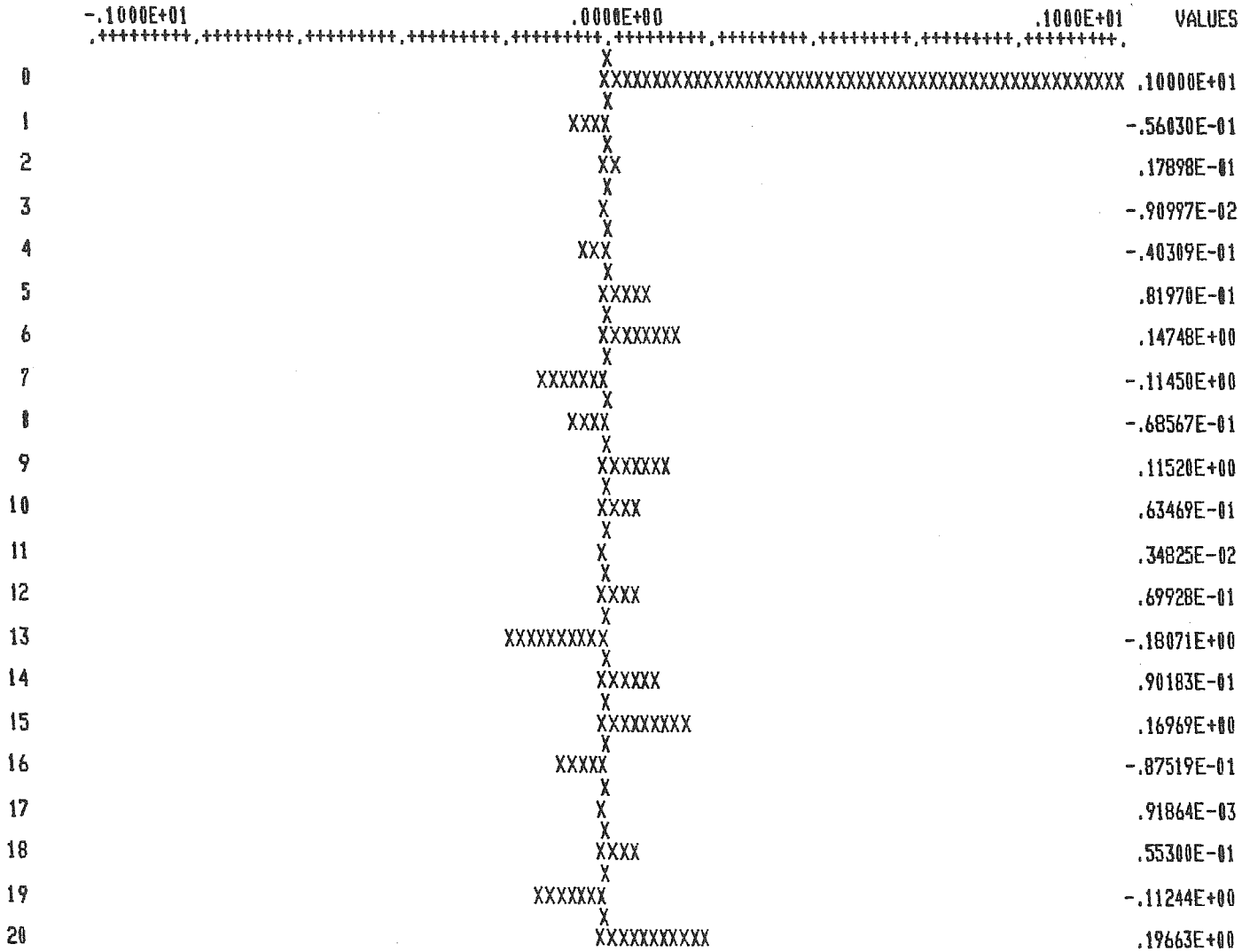
SERIES 1 - PREWHITENED &TWIN2
SERIES 2 - PREWHITENED &TWIN2

MEAN OF SERIES 1 = .88565E-02
ST. DEV. OF SERIES 1 = .23601E+01
MEAN OF SERIES 2 = .88565E-02
ST. DEV. OF SERIES 2 = .23601E+01

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	1.000	0	1.000
1	-.056	1	-.056
2	.018	2	.018
3	-.009	3	-.009
4	-.040	4	-.040
5	.082	5	.082
6	.147	6	.147
7	-.114	7	-.114
8	-.069	8	-.069
9	.115	9	.115
10	.063	10	.063
11	.003	11	.003
12	.070	12	.070
13	-.181	13	-.181
14	.090	14	.090
15	.170	15	.170
16	-.088	16	-.088
17	.001	17	.001
18	.055	18	.055
19	-.112	19	-.112
20	.197	20	.197

GRAPH OF PRWH CROSS CORR

GRAPH INTERVAL IS .2000E-01



DATA - Y = &TWINO 150 OBSERVATIONS

DIFFERENCING ON Y - NONE

TRANSFORMATIONS EXAMINED - NONE

UNIVARIATE MODEL PARAMETERS

PARAMETER NUMBER	PARAMETER TYPE	PARAMETER ORDER	BEGINNING VALUE
1	MEAN		.45000E+03
2	MOVING AVERAGE 1	1	.29760E+00
3	MOVING AVERAGE 1	2	-.46960E+00

OTHER TRANSFER FUNCTION IDENTIFICATION INFORMATION

EFFECTIVE NUMBER OF OBSERVATIONS FOR CROSS CORRELATION = 150

NUMBER OF IMPULSE RESPONSE WEIGHTS ESTIMATED = 20

NUMBER OF IMPULSE RESPONSE WEIGHTS USED TO GENERATE NOISE SERIES = 20

CROSS CORRELATIONS

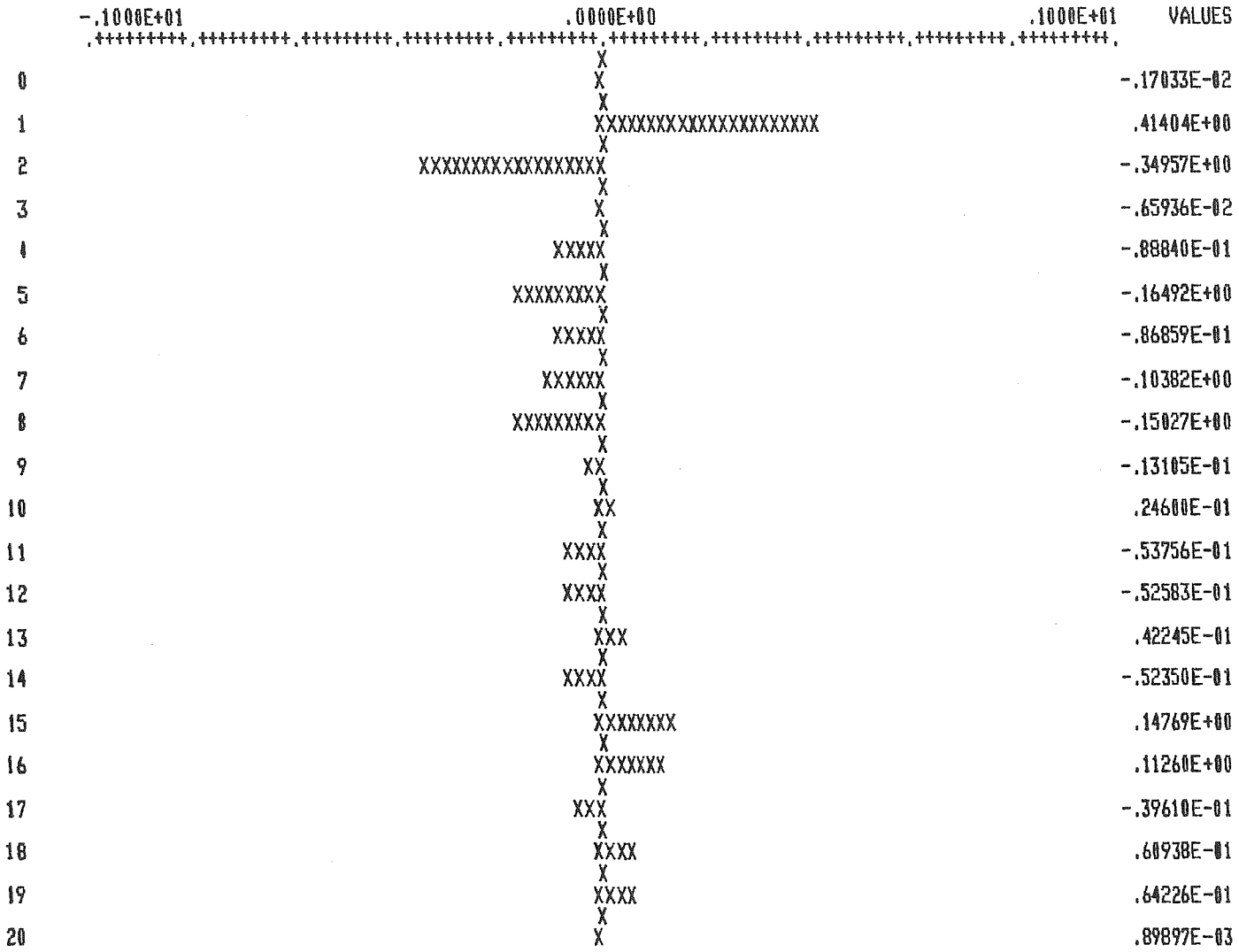
SERIES 1 - PREWHITENED &TWIN2
SERIES 2 - PREWHITENED &TWINO

MEAN OF SERIES 1 = .88565E-02
ST. DEV. OF SERIES 1 = .23601E+01
MEAN OF SERIES 2 = .40011E+01
ST. DEV. OF SERIES 2 = .17587E+02

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	-.002	0	-.002
1	.414	1	.070
2	-.350	2	-.002
3	-.007	3	-.080
4	-.089	4	-.006
5	-.165	5	.159
6	-.087	6	.067
7	-.104	7	-.013
8	-.150	8	-.003
9	-.013	9	.003
10	.025	10	-.028
11	-.054	11	.081
12	-.053	12	-.112
13	.042	13	-.063
14	-.052	14	.035
15	.148	15	-.097
16	.113	16	-.019
17	-.040	17	.034
18	.061	18	-.136
19	.064	19	.141
20	.001	20	.024

GRAPH OF PRWH CROSS CORR

GRAPH INTERVAL IS .2000E-01

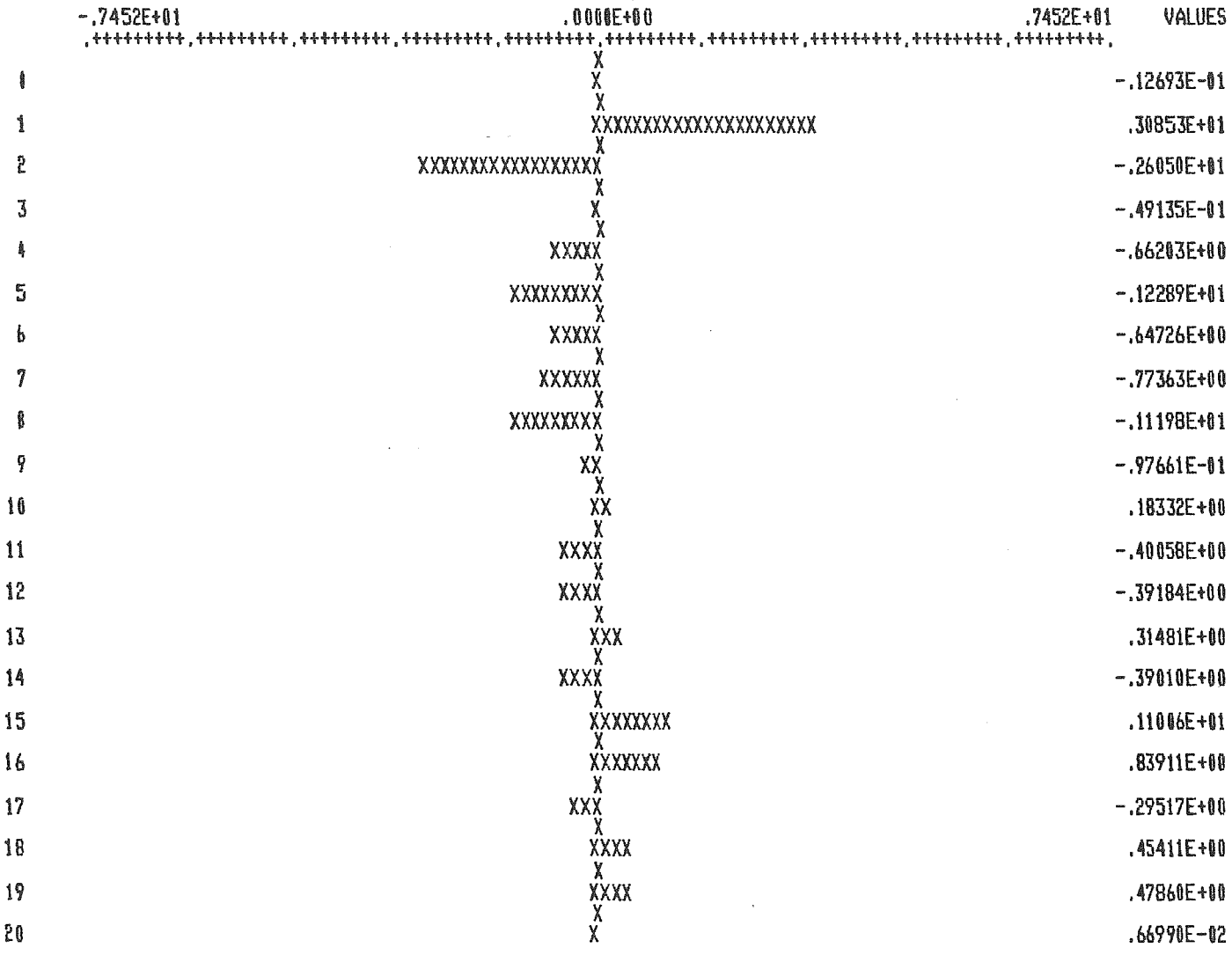


ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

K	V(K)
0	-.126929E-01
1	.308534E+01
2	-.260495E+01
3	-.491351E-01
4	-.662026E+00
5	-.122894E+01
6	-.647264E+00
7	-.773630E+00
8	-.111983E+01
9	-.976607E-01
10	.183319E+00
11	-.400584E+00
12	-.391841E+00
13	.314807E+00
14	-.390104E+00
15	.110057E+01
16	.839112E+00
17	-.295169E+00
18	.454107E+00
19	.478605E+00
20	.669902E-02

GRAPH OF IMPULSE RESPONSE WEIGHTS

GRAPH INTERVAL IS .1490E+00



AUTOCORRELATION FUNCTION

DATA - THE GENERATED NOISE SERIES

130 OBSERVATIONS

DIFFERENCING - ORIGINAL SERIES IS YOUR DATA.

DIFFERENCES BELOW ARE OF ORDER 1

ORIGINAL SERIES
MEAN OF THE SERIES = .48814E+01
ST. DEV. OF SERIES = .14013E+02
NUMBER OF OBSERVATIONS = 130

1- 10	.38	.56	.47	.21	.07	.16	-.29	-.18	-.31	-.42
ST.E.	.09	.10	.12	.13	.14	.14	.14	.14	.15	.15
11- 20	-.48	-.25	-.47	-.24	-.10	-.19	.07	.18	.10	.34
ST.E.	.16	.17	.17	.18	.19	.19	.19	.19	.19	.19

MEAN DIVIDED BY ST. ERROR = .39717E+01

TO TEST WHETHER THIS SERIES IS WHITE NOISE, THE VALUE .27421E+03
SHOULD BE COMPARED WITH A CHI-SQUARE VARIABLE WITH 20 DEGREES OF FREEDOM

DIFFERENCE 1
MEAN OF THE SERIES =-.39625E-01
ST. DEV. OF SERIES = .15526E+02
NUMBER OF OBSERVATIONS = 129

1- 10	-.63	.21	.15	-.10	-.20	.44	-.45	.18	-.00	-.05
ST.E.	.09	.12	.12	.12	.12	.13	.14	.15	.15	.15
11- 20	-.24	.38	-.38	.07	.20	-.29	.12	.16	-.26	.21
ST.E.	.15	.15	.16	.17	.17	.17	.17	.17	.17	.18

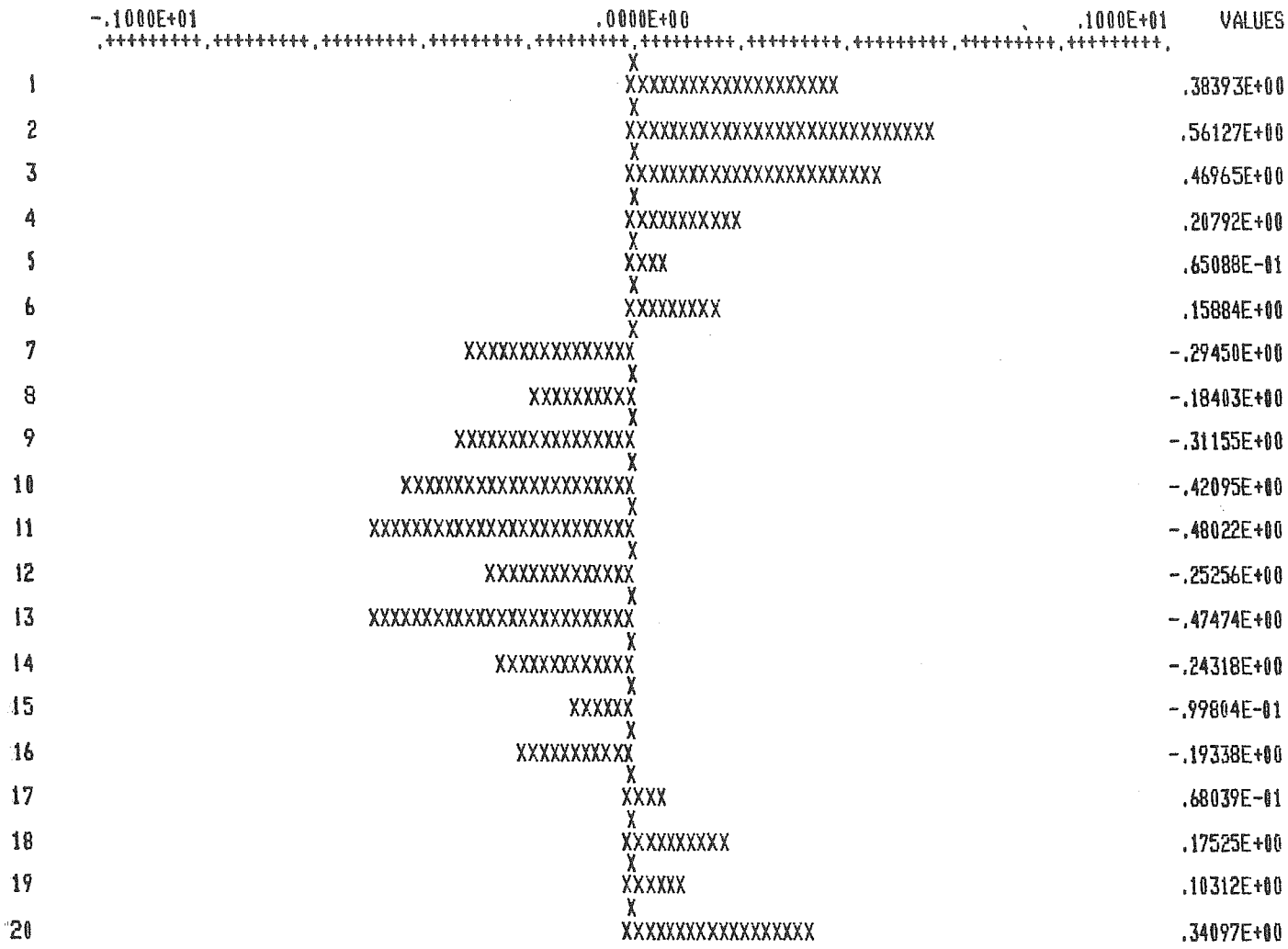
MEAN DIVIDED BY ST. ERROR = .28986E-01

TO TEST WHETHER THIS SERIES IS WHITE NOISE, THE VALUE .22036E+03
SHOULD BE COMPARED WITH A CHI-SQUARE VARIABLE WITH 20 DEGREES OF FREEDOM

THE GENERATED NOISE SERIES

GRAPH OF OBSERVED SERIES ACF

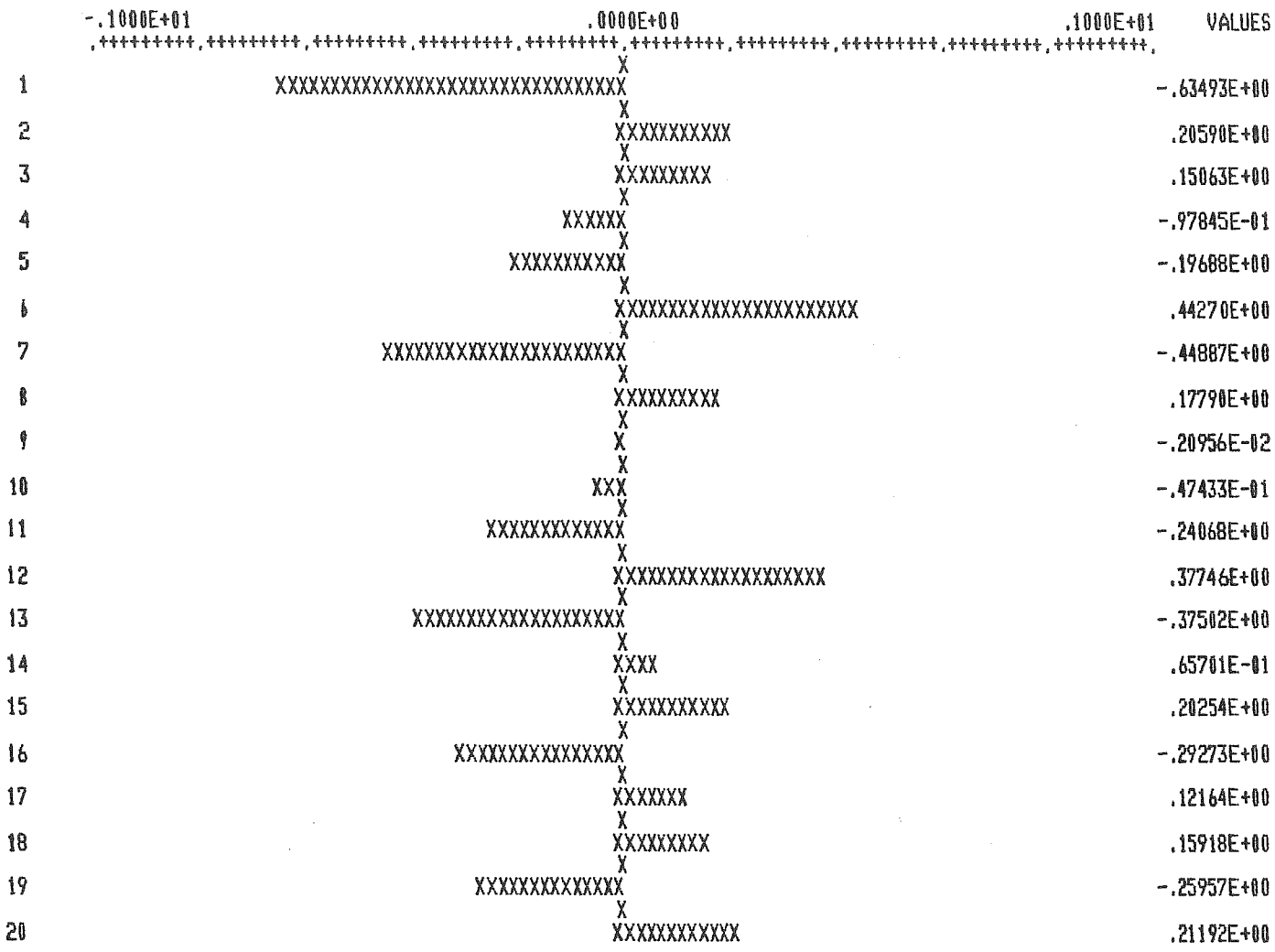
GRAPH INTERVAL IS .2000E-01



THE GENERATED NOISE SERIES

GRAPH OF DIFFERENCE 1 ACF

GRAPH INTERVAL IS .2000E-01



PARTIAL AUTOCORRELATIONS

DATA - THE GENERATED NOISE SERIES 130 OBSERVATIONS

DIFFERENCING - ORIGINAL SERIES IS YOUR DATA.

DIFFERENCES BELOW ARE OF ORDER 1

ORIGINAL SERIES
MEAN OF THE SERIES = .48814E+01
ST. DEV. OF SERIES = .14013E+02
NUMBER OF OBSERVATIONS = 130

1- 10	.38	.49	.26	-.28	-.50	.14	-.21	-.21	-.11	.06
11- 20	-.20	.15	.11	-.10	.14	-.08	.12	-.03	.05	.04

DIFFERENCE 1
MEAN OF THE SERIES =-.39625E-01
ST. DEV. OF SERIES = .15526E+02
NUMBER OF OBSERVATIONS = 129

1- 10	-.63	-.33	.22	.37	-.31	.04	-.01	-.11	-.23	.01
11- 20	-.33	-.20	.01	-.23	.01	-.19	-.02	-.08	-.06	.02

THE GENERATED NOISE SERIES

GRAPH OF OBSERVED SERIES PACF

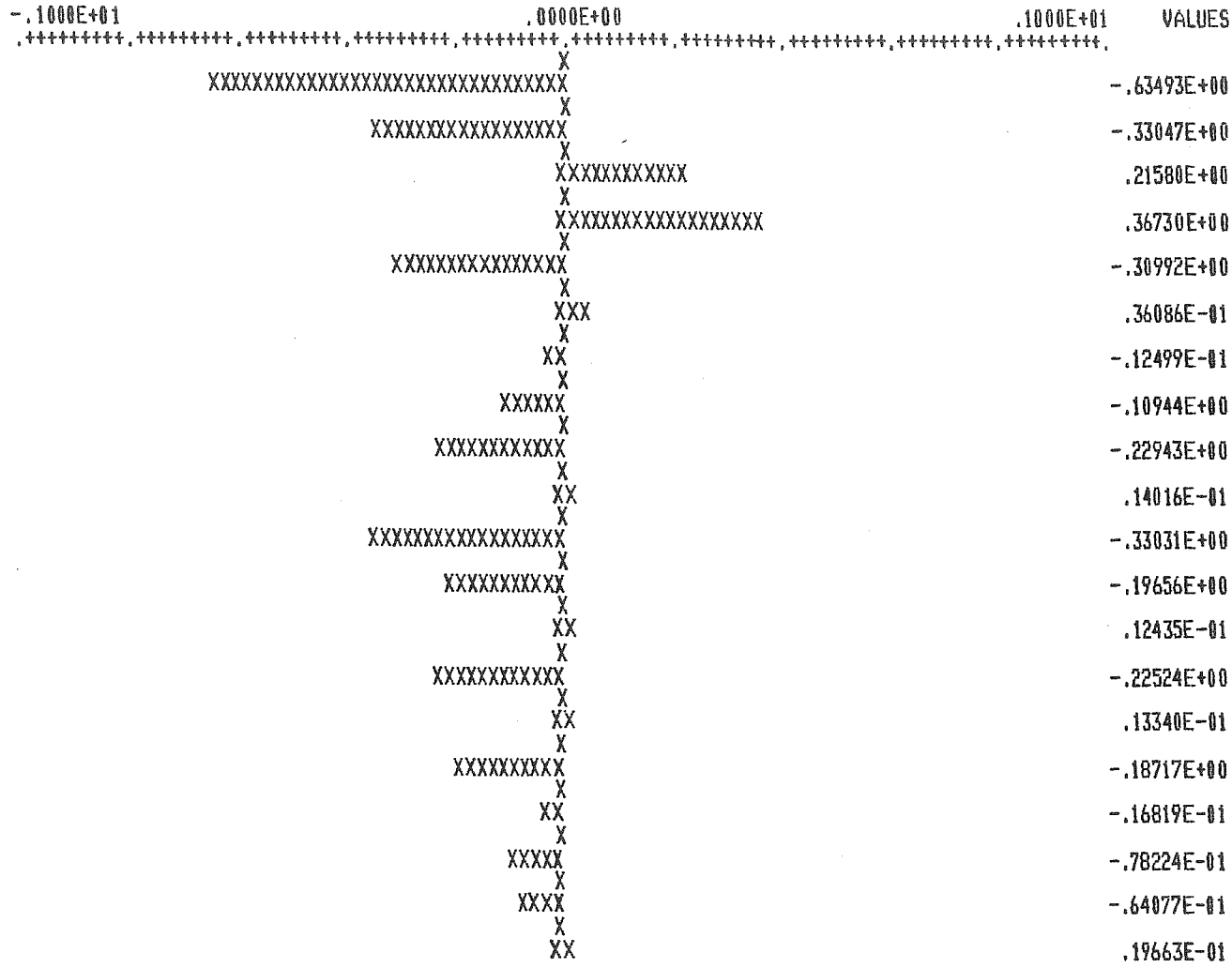
GRAPH INTERVAL IS .2000E-01

```
                -.1000E+01                          .0000E+00                          .1000E+01     VALUES
                .+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.+++++++++.
 1                                                  X
                                                    XXXXXXXXXXXXXXXXXX                              .38393E+00
 2                                                  X
                                                    XXXXXXXXXXXXXXXXXXXXXX                          .48542E+00
 3                                                  X
                                                    XXXXXXXXXXXXX                                   .26453E+00
 4                                                  X
                                        XXXXXXXXXXXXXX                                              -.27921E+00
 5                                                  X
                                XXXXXXXXXXXXXXXXXXXXXXXX                                            -.49565E+00
 6                                                  X
                                                    XXXXXXXX                                        .13999E+00
 7                                                  X
                                     XXXXXXXXXX                                                     -.20546E+00
 8                                                  X
                                     XXXXXXXXXX                                                     -.20643E+00
 9                                                  X
                                       XXXXXX                                                       -.11264E+00
10                                                  X
                                                    XXXX                                            .58034E-01
11                                                  X
                                     XXXXXXXXXX                                                     -.20372E+00
12                                                  X
                                                    XXXXXXXXX                                       .15090E+00
13                                                  X
                                                    XXXXXX                                          .11353E+00
14                                                  X
                                      XXXXX                                                         -.10158E+00
15                                                  X
                                                    XXXXXXX                                         .13997E+00
16                                                  X
                                      XXXX                                                          -.83067E-01
17                                                  X
                                                    XXXXXX                                          .12310E+00
18                                                  X
                                     XXX                                                            -.33427E-01
19                                                  X
                                                    XXX                                             .45781E-01
20                                                  X
                                                    XXX                                             .38930E-01
```

THE GENERATED NOISE SERIES

GRAPH OF DIFFERENCE 1 PACF

GRAPH INTERVAL IS .2000E-01



APPENDIX I - INPUT DATAFILE

1. The datafile is entered, CReated or REplaced by the EDITR. Each line (record), consisting of 70 characters, must contain 7 observations. Each observation, entered in free format, is separated from the other by at least one blank.

   For an example see the input datafile EXF1 on p. 98.

2. If the input datafile is entered such that
   - each line (record) is equally divided into 8 fields, each field consisting of 10 characters,
   - the first 7 of these fields are used for time series observations,
   - each observation is separated from the other by at least one blank,
   - the 8th field, i.e. the last 10 characters of the record, is used for the Identification and Sequencing of the data record

   this same input datafile can also be used for the MULTISTOCH and MULTITRAN programs.

   For an example see the input datafile EXF2 on p. 98.

3. Apart from the Identification and the Sequencing the input datafile, resulting from a TSERS' PUNC command, is MULTISTOCH and MULTITRAN compatible. The FORMAT used is (7 (G 9.5, 1X)).

```
EXF1   T=00004 IS ON CR00007 USING 00003 BLKS R=0000

0001          1         2         3         4         5         6         7         8
0002 12345678901234567890123456789012345678901234567890123456789012345678901234567890
0003
0004  2.456 2.372 2.310 2.613 2.650 2.527 2.334
0005  2.606 2.850 2.961 3.000 3.230 3.210 3.165
0006  3.140 3.113 3.042 3.316 3.165 3.404 3.578
0007  3.591 3.337 3.102 2.598 1.562 1.354 1.126
0008  1.046 0.881 0.962 1.686 2.484 2.793 2.756
```

```
EXF2   T=00004 IS ON CR00007 USING 00004 BLKS R=0000

0001          1         2         3         4         5         6         7         8
0002 12345678901234567890123456789012345678901234567890123456789012345678901234567890
0003
0004  2.456     2.372     2.310     2.613     2.650     2.527     2.334     USTRB   01
0005  2.606     2.850     2.961     3.000     3.230     3.210     3.165     USTRB   02
0006  3.140     3.113     3.042     3.316     3.165     3.404     3.578     USTRB   03
0007  3.591     3.337     3.102     2.598     1.562     1.354     1.126     USTRB   04
0008  1.046     0.881     0.962     1.686     2.484     2.793     2.756     USTRB   05
```

REFERENCES

[1] Box, G.E.P. & JENKINS, G.M.
Time Series Analysis: Forecasting and Control
Holden-Day, San Francisco, 1976

[2] BOX,G.E.P. & TIAO, G.C.
Intervention Analysis with Applications to Economic and Environmental Problems
Journal of the American Statistical Association, 70, no.349, March 1975, pp.70-79

[3] PACK, D.J.
Computer Programs for the Analysis of Single Input Transfer Function Models Using the Methods of Box and Jenkins
The Data Center, College of Administrative Science, Ohio State University, February 1974

[4] PACK, D.J.
Computer Programs for the Analysis of Univariate Time Series Models and Single Input Transfer Function Models Using the Methods of Box and Jenkins
The Data Center, College of Administrative Science, Ohio State University, December 1974

[5] PACK, D.J.
Documentation for "A Computer Program for the Analysis of Time Series Models Using the Box-Jenkins Philosophy"
Automatic Forecasting Systems, Inc., Hatboro, 1979

[6] PACK, D.J., GOODMAN, M.L. & MILLER, R.B.
Computer Programs for the Analysis of Univariate Time Series Using the Methods of Box and Jenkins
Technical Report # 296, Department of Statistics, University of Wisconsin, Madison, April 1972

[7] THE PACK SYSTEM - USER'S GUIDE
Automatic Forecasting Systems, Inc., Hatboro, 1983