Ushikata Area-Curvimeter

X-PLAN F/F.C series

X-PLAN300F/300F.C
X-PLAN380F/380F.C
X-PLAN460F/460F.C
X-PLAN520F/520F.C
X-PLAN620F/620F.C

Interface Manual

Ushikata

PREFACE

This manual explains how to connect the X-PLAN to an external computer. We use N88BASIC for the programming language in the examples.

The basic idea of the X-PLAN interface is that the user's program feeds all commands and the X-PLAN acts accordingly. In other words, the user's program is master and the X-PLAN, working as a digitizer, is slave.

If you have questions on how to operate the X-PLAN, you are requested to refer to the other instruction manual (Operation Manual) included with the X-PLAN unit.

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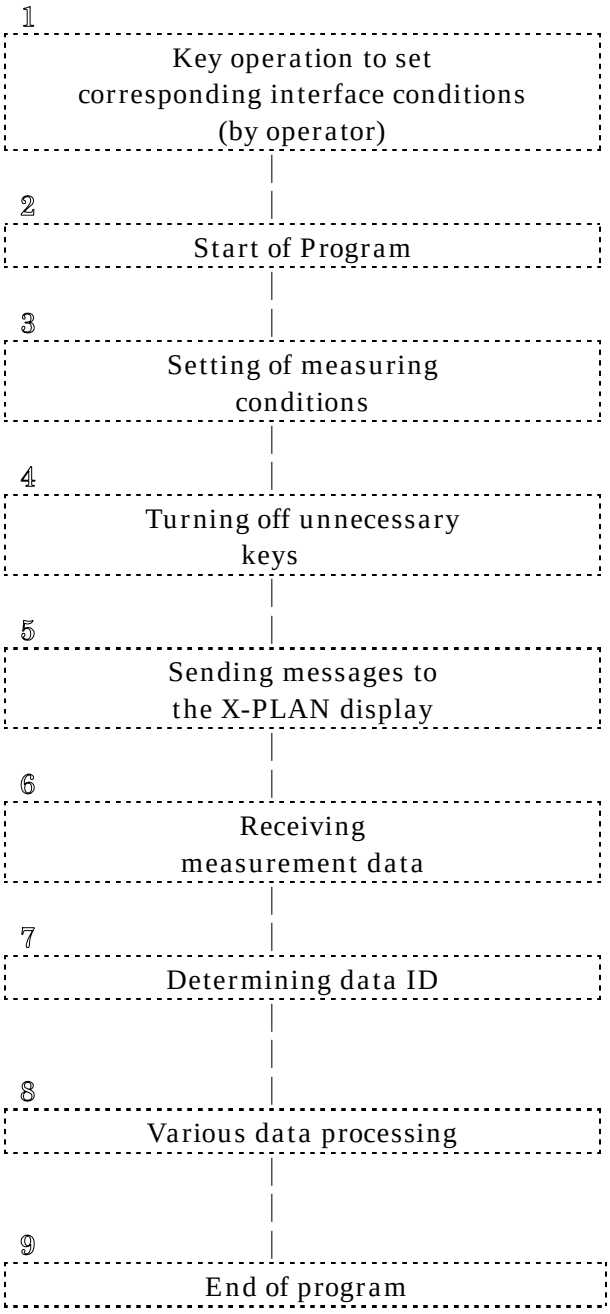
Abbreviations used in this manual:

chr.	---	character(s)
(e.g.)	---	for example
ACK	---	acknowledged
NAK	---	not acknowledged

Contents

1) A typical program procedure

An outline of the typical procedure a program will perform is as shown below. The operator here refers to the person controlling the X-PLAN, which is the user of this program.



First the interface conditions are set by manual operation.(At least the starting baud rates should correspond with each other.)

The X-PLAN is turned on, and user's program is executed.

Commands are used to set various measuring conditions.

Keys and switches on the X-PLAN that are unnecessary are turned off to avoid having the operator use them by mistake.

Where appropriate, instructions are given for the operator to follow.

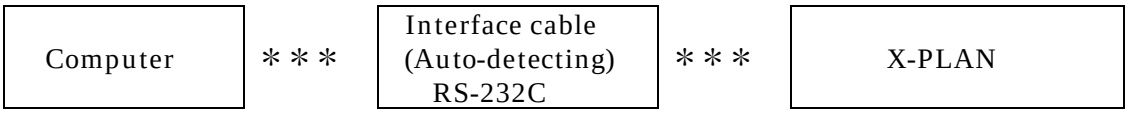
As the operator makes measurements on diagrams, the results are sent from the X-PLAN.

Data sent from the X-PLAN always starts with a two-character ID which is used for distinguishing purposes.

Data processing is performed according to the user's needs.

- Assuming that unexpected data could be sent due to operation error, input logic which always ignores unnecessary data is recommended.
- By making use of various commands to control the X-PLAN, a system can be constructed which prevents operation error or has built-in recovery.
- By displaying messages on the X-PLAN display, instructions can be provided right at the operator's fingertips at all times

2) System Composition



1. Any computer with an RS232C serial interface can be connected to the X-PLAN.

2. The X-PLAN has a built-in RS232C (full duplex).

3. The module numbers of the interface cables specifically designed for the X-PLAN are of the form XPC-aaA-bb, where the number aa identifies the type of computer with which it is to be used. The number bb represents the length: 02 (two meters), 05 (five meters), and 10 (ten meters) are available.

4. Auto-Detecting Function
   The X-PLAN can automatically recognize whether it is connected to the miniprinter 16c or to the interface cable. Thus, it is not necessary for the operator to alter the output destination manually on the X-PLAN.

5. The X-PLAN can be used while it is recharging.

6. The X-PLAN will transmit data to the computer only when it is in "Output" mode. Even when it is in "Non Output" mode, data can be received from the computer.

X-PLAN's display	press [P/NP] key	X-PLAN's display
	<------->	
** OUTPUT **	(toggled)	** NON OUTPUT **

3) Interface Specifications

a	Electrical Spec.	Standard EIA RS-232C compatible
b	Interfacing Method	Start-Stop Synchronous, Full Duplex
c	Data Length	8 bit, 7 bit
d	Baud Rate	300, 600, 1200, 2400, 4800, 9600, 19200
e	Parity	None, Odd, Even
f	Stop Bit	2 bit, 1 bit
g	Delimiter	CRLF, CR, LF
h	Control	OFF (RTS/CTS), R character, XON/OFF
i	Character Code	Standard ASCII Code
j	Unit Data Length	1 to 33 chr. (Excluding Delimiter)
k	Sending Buffer	22 Lines (30 Characters x 22 Lines)
l	Receiving Buffer	100 Bytes

1. Items (c) through (h) are selected by the program (using commands) or by the operator (manually).
2. For items (a) through (i), it is necessary for the conditions on the computer side and on the X-PLAN side to correspond.
3. When sending data from the X-PLAN to the program, the operator must press the [P/NP] key and select "Output" mode.
4. Command data can be sent from the program regardless of the selection of either "Output" mode or "Non Output" mode on the X-PLAN side.
5. When the power is turned on while pressing the [CE/C] key, the interface conditions are initialized (to default values set at factory shipment).

(Default Conditions)

		Interface Condetion	Initial Setting
*	c	Data Length	8 bit
*	d	Baud Rate	1200
*	e	Parity	None
*	f	Stop Bit	2 bit
*	g	Delimiter	CRLF
*	h	Control	OFF

In this manual, Items (c) to (h) are called "interface conditions".

4) Instructions to Operator Before Starting Interface

If the interface conditions of the computer and of the X-PLAN do not correspond before starting data transmission (before starting program), there will be an interface error.

Thus, in the operation manual of the user's program, it is necessary to instruct the operator to set common interface conditions using one of the three methods shown below.

Method 1 Starting Interface Using the Default Conditions

By instructing the operator to press the [CE/C] key while turning on the power, the X-PLAN is initialized. The program then begins interface using the default conditions which can later be changed as necessary using the SI command. (For example, set to a faster baud rate.) This method is probably the least of a burden on the operator.

Method 2 Starting Interface Using the Program's Conditions

When specifying the program's interface conditions, the operator is instructed to use the [SFT] and [SET] keys to make the interface conditions of the X-PLAN correspond to those of the program and/or computer.

Method 3 Starting Interface Using the Computer's Conditions

The interface conditions are specified in the operation manual, and the operator is instructed to make the interface conditions correspond on both sides through the following;

A) On the X-PLAN, press [SFT] and [SET] keys,
B) On the computer, use the dip-switches, SPEED command, SWITCH command, and other operations.

5) Format of Transmitted Data

The data sent to the X-PLAN from the user's program (sending data) and the data sent from the X-PLAN (receiving data) are as shown below.

1. Command Data (Sending and Receiving)

Format

Command Code	Parameter
1 to 2 chr.	1 to 32 chr.

a. Set Commands

The S group commands are used to set values in the X-PLAN. (The X-PLAN always returns ACK or NAK.)

```
(e.g.)
PRINT #1, "SEYNNNNNNN0NNNN"      'Measure coordinates.
INPUT #1, A$                     'A$=CHR$(&H06): ACK.
```

The P group commands are used to control simple operations of the X-PLAN such as sounding the buzzer or blinking the display. (The X-PLAN does not return ACK nor NAK.)

```
(e.g.)
PRINT #1, "BZ2"                  'Sound buzzer twice in succession.
```

b. Reference Commands

The S commands, when sent to the X-PLAN without any parameter, will return internal settings.

```
(e.g.)
PRINT #1, "SE"          'Reference measuring functions.
INPUT #1, A$            'A$="SENNYYNNNN0N": area and line selected.
```

(Note) The P Commands have no reference function.

2. Measurement Data (Receiving)

This is the data sent by the operating of the keys and switches of the X-PLAN by the operator. The data is not always numeric. The type of the data can be identified by the data ID.

Format

Data ID	Measurement Data
2 chr	1 to 16 chr.

(e.g.)

#		1	2	3									
X							1	2	3	.	4	5	m
Y							-	7	8	.	9	0	m

Input number 123.
x-coordinate (unit: m)
y-coordinate (unit: m)

(Note) In certain special cases, the data sent by key operation of the X-PLAN is not necessarily in the format shown above. Details of each type of transferred data are discussed later.

3. ACK and NAK (Receiving)

When the user's program sends a setting S command to the X-PLAN, the X-PLAN will send back ACK in the case of success and NAK in the case of failure. This response must always be input. A NAK is also returned for undefined commands or erroneous commands.

ACK --- "&H06" in ASCII code (&H indicates hexadecimal) meaning that execution is successful (ACKNOWLEDGED).

NAK --- "&H15" in ASCII code meaning that execution is a failure (NOT ACKNOWLEDGED).

Format

&H06 (ACK)
1 chr.

&H15 (NAK)
1 chr.

4. Control Character R (Sending and Receiving)

When the control is set to RON, the data transfer is controlled by receiving the character R.(The character R is "&H52" in ASCII code.)

Format

R
1 chr.

Please see <R-4 Timing of Data Input/Output Using RON> for details.
The following is a diagram of what is explained above.

Data	User's Program	X-PLAN
Set S Command (ACK/NAK)	PRINT command→ INPUT	Reception ↓ ←ACK/NAK
Set P Command	PRINT command→	Completion
Measurement Data	INPUT data	←Key Operation
Control Character R (Control:RON)	PRINT command→ INPUT	Reception ↓ ←Send "R"
	INPUT data ↓ PRINT "R" →	←KEY OPERATION Reception

6) Timing of Data Transmission

Here is an explanation of data input and output procedures. A PRINT statement is used for output (sending) and an INPUT statement is used for input (receiving).

1. How to set measuring conditions

a) Set S Commands

These allow the program to give the X-PLAN measuring conditions which are otherwise set manually using the X-PLAN's [SET], [SET2]([SFT] + [SET]), [MARK], [P/NP] and [CON] keys.

S Command Output
PRINT #1 "S Command"

The X-PLAN will execute the command given.

Check Result of Command Execution
INPUT #1 A$

The X-PLAN will return ACK for success and NAK for error. It will also return NAK in case of syntax error.

(e.g.)

```
1. PRINT #1, "SEYNNNNNNN0NNNN"      'Measure coordinates.
   INPUT #1, A$                     'A$=CHR$(&H06):ACK.

2. PRINT #1, "SEYNNNNNNN0NNNNN"     'Data has one character too many.
   INPUT #1, A$                     'A$=CHR$(&H15):NAK.
```

b) Set P Commands

P Command Output
PRINT #1 "P Command"

The X-PLAN will execute the command given.

Subsequent Statement Not Necessary

Regardless of success or failure, the

X-PLAN will not return ACK nor NAK. errors.
Nor will NAK be returned for syntax

(e.g.)

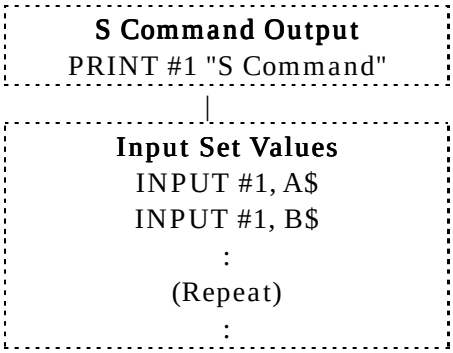
1. PRINT #1, "BZ2" 'Sound buzzer twice in succession.

2. PRINT #1, "BZ5" '"BZ5" command is not supported.
(There is no need to receive NAK.)

2. How to reference internal settings

a) Reference S Commands

These are used in order to read the X-PLAN's internal settings such as interface conditions and measuring conditions set either manually or with commands. Sending an S command without any parameter allows the set values to be input.



The internal settings of the X-PLAN are referenced.

The set value will enter A$. For S commands with multiple-line data, the input statement (INPUT) must be repeated that many times (B$,C$,....). If the command is in error, A$ will be NAK.

(e.g.)

```
1. PRINT #1, "SE"       'Reference measuring functions.
   INPUT #1, A$         'A$="SENNYYNNNN0NNNN" area and line selected.

2. PRINT #1, "SS"       'Reference scale ratio.
   INPUT #1, A$         'A$="SSRX      1000."   :RX=1000
   INPUT #1, B$         'B$="SSRY      1000."   :RY=1000

3. PRINT #1, "SX"       '"SX" command is not supported.
   INPUT #1, A$         'A$=CHR$(&H15):NAK.
```

b) Reference P Commands ----- The P Commands have no reference function.

3. How to input measurement data

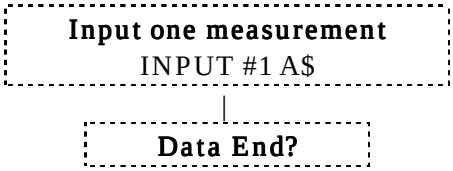
Measurement data is read as a result of manual operation of the X-PLAN. This data can only be received when the X-PLAN is set to "Output" mode.

How to select "Output" mode:

a) Set by the program using an S Command.
(Operation error can be avoided by making the [P/NP] key inactive, so that the

operator may not change the settings.)

b) Set by the operator by pressing the [P/NP] key to get the display "** OUTPUT **".



A waiting state continues until the operator manually operates the X-PLAN.

Repeat as many times as required.

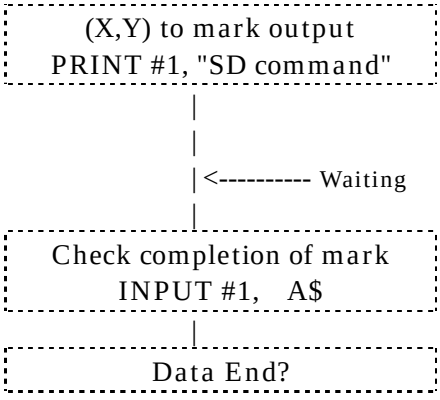
* The function keys (F0 to F9) can be used at the end of measurement data.
* The coordinates data are sent in pairs of two at a time.

(e.g.)

```
1. INPUT #1, A$          'A$="d      26.1 m": line segment
2. INPUT #1, A$          'A$="X    3.8196 m": X-coordinate
   INPUT #1, B$          'B$="Y    4.3766 m": Y-coordinate
```

4. How to transmit marking coordinates

(X,Y) coordinates can be transmitted to the X-PLAN so that the operator may mark those points on the drawing manually.



The X-PLAN will show a "Mark Leading Display" upon receipt of the SD command.

Waiting for the point to be manually marked.

Only the [MARK] and [CE/C] keys are available in the MARK Mode.

(e.g.)

```
PRINT #1, "SDXM12-500"     'SET X=-500m to mark
INPUT #1, A$               'A$=CHR$(&H06):ACK, CHR$(&H15):NAK
PRINT #1, "SDYM12500"      'SET Y=500m to mark
INPUT #1, A$               'A$= ACK or NAK
INPUT #1, A$               'A$="MK", MARK key pressed to show completion.
```

7) Command List

1. Command Functions

a) S commands These have both set and reference functions.

Command	Function
SE	Set of reference “types of measurements” selections
SM	Similar to SE, Reserved for former 360C, No “SPECIAL”s
SU	Set or reference units
SS	Set or reference scale ratios
SA	Set or reference coordinate axes
SB	Set or reference origin bias values
SF	Set or reference position of decimal point
SN	Set or reference whether auto-numbering is active
SI	Set or reference interface conditions
SD	Set (X,Y) coordinates to mark (Reference not available)
SP	Set of reference “Output” / “Non Output” mode status
SC	Set or reference POINT / CONTINUOUS mode status
SL	Set or reference Execution Mode
SK	Set or reference whether keys and switches are active
SW	Set or reference whether Auto-Power-Off is active
ST	Set or reference delay time of data transfer from X-PLAN

Special measurements: Centroid, Triangular area, Angle, Center of arc, Radial distance, Volume, Revolutionary solid

Ordinary measurements: Coordinates, Segment length, Area, Total length, Radius

b) P commands These have set functions only (no reference).

Command	Function
D	Display message on X-PLAN display
C	Clear X-PLAN display
B	Start or stop blinking X-PLAN display
BZ	Sound X-PLAN buzzer : four different sounds

2. Modes in which commands can be executed

For each command, there are conditions (modes) of the X-PLAN in which it can be executed and those in which it cannot be executed.

a) X-PLAN Execution Modes

1.	SET mode	This is the status in which the X-PLAN display shows selection criteria after the [SET] key or [SET2] key (SFT + SET) is pressed.
2.	Measure mode	This is the status during the measuring of a figure, which begins with pressing the [S/P] key and ends with pressing the [END] key or [CE/C] key.
3.	Mark mode	This is the status in which the mark leading display or the marking coordinates input display appears on the X-PLAN. [MARK] or [CE/C] can be used to get out of this mode.
4.	READY mode	This is the status when the X-PLAN is in none of the three execution modes mentioned above.

b) Possible Modes for Each Command

ID	Function	READY Mode		SET Mode		Measure Mode POINT		Measure Mode CONT.		MARK Mode		MOUSE Mode	
		S	R	S	R	S	R	S	R	S	R	S	R
SE	Measure function	O	O	X	O	X	O	X	X	X	O	X	O
SM	Similar to SE	O	O	X	O	X	O	X	X	X	O	X	O
SU	Units	O	O	X	O	X	O	X	X	X	O	X	O
SS	Scale ratio(s)	O	O	O	O	X	O	X	X	X	O	X	O
SA	Coordinate axes	O	O	O	O	X	O	X	X	X	O	X	O
SB	Origin bias	O	O	X	O	X	O	X	X	X	O	X	O
SF	Decimal place	O	O	X	O	X	O	X	X	X	O	X	O
SN	#ing selection	O	O	X	O	X	O	X	X	X	O	X	O
SI	RS232C conditions	O	O	X	O	X	O	X	X	X	O	X	O
SD	(X,Y) to mark	O	X	X	X	X	X	X	X	X	X	X	X
SP	Output / Non Out.	O	O	O	O	O	O	O	O	O	O	O	O
SC	Measure mode	O	O	O	O	O	O	O	O	O	O	O	O
SL	Mode change	O	O	O	O	O	O	O	O	O	O	O	O
SK	Key active / inact.	O	O	O	O	O	O	O	O	O	O	O	O
SW	Auto-power-off	O	O	O	O	O	O	O	O	O	O	O	O
ST	Delay time	O	O	O	O	O	O	O	O	O	O	O	O
D	Display message	O	-	X	-	O	-	X	-	X	-	X	-
C	Clear display	O	-	X	-	O	-	X	-	X	-	X	-
B	Blinking	O	-	X	-	O	-	X	-	X	-	X	-
BZ	Buzzer	O	-	O	-	O	-	X	-	O	-	O	-

"**S**"= SET "**R**"= REFERENCE
"**O**"=Can be executed "**X**"=Cannot be executed "**-**"=No function
"**Ref**"=Referencing "**CONT.**"=Continuous tracing for curved line

1. Where there is an X, any S command (SE to ST) will return NAK.
2. Where there is an X, any P command (D to BZ) will not return anything.
3. NAK will be returned for undefined commands.
4. To set by S command, send the first two characters (command ID) followed by parameter data.
5. To reference by S command, send the first two characters only.

8) How to Use Each Command

1. SE Command (Set Extensive measuring function)

This command sets or references measuring functions.

a) Format for setting

S	E	C x	cd	C a	Cl	C r	p1	p2	p3	p4	p5	p6	p7	p8

b) Format for referencing

S	E

The X-PLAN provides output in the setting format.

c) Parameter setting

Function	Parameter	Yes	No
Coordinates	cX	Y	N
Line Segment	cd	Y	N
Area	Ca	Y	N
Total length	CL	Y	N
Radius	Cr	Y	N
Centroid	p1	Y	N
Triangular	p2	Y	N
Angle	p3	Y	N
Angle unit	p4	“n”	-
Arc center	p5	Y	N
Radial distance	p6	Y	N
Volume	p7	Y	N
Revolutionary solid	p8	Y	N

n = 0 : degree & minute
1 : degree
2 : gon
3 : radian

Y --- Measuring functions that are required, corresponding to pressing the [YES] key in manual operation.
N --- Those that are not required, corresponding to the [NO] key.

(Note)
- When setting, all of the functions cannot be N.
- Even if angle measurement is not selected, the parameter p4 must be set at 0 to 3. Otherwise, NAK will be returned.

(e.g.)

```
1. PRINT #1, "SEYNNNNNNN0NNNN"      'Measure coordinates.
   INPUT #1, A$                     'A$=CHR$(&H06):ACK
                                    'A$=CHR$(&H15):NAK
2. PRINT #1, "SENNYYNNNN0NNNN"      'Measure area and line.
   INPUT #1, A$                     'A$=CHR$(&H06):ACK
                                    'A$=CHR$(&H15):NAK
```

```
3. PRINT #1, "SE"                ‘Reference measuring functions.
   INPUT #1, A$                  'A$="SENNYNNNNN0NNNN" Area selected.
```

2. SM Command (Set Measuring function)

This command, similar to SE, sets or references measuring functions which exclude "SPECIAL" measurements. It is maintained for compatibility with the former X-PLAN360C.

a) Format for setting

S	M	cX	cd	Ca	Cl	cr

b) Format for referencing

S	M

The X-PLAN provides output in the setting format.

c) Parameter setting

Function	Parameter	Yes	No
Coordinates	Cx	Y	N
Line Segment	cd	Y	N
Area	Ca	Y	N
Total length	Cl	Y	N
Radius	cr	Y	N

Y --- Measuring functions that are required, corresponding to pressing the [YES] key in manual operation.

N --- Those that are not required, corresponding to the [NO] key.

(Note)
- When setting, all of the functions cannot be N.
- Receiving an SM command, the 360C(2) automatically sets "NO" to selections for all of the SPECIAL measurements.

(e.g.)

```
1. PRINT #1, "SMYNNNN"           'Measure coordinates.
   INPUT #1, A$                  'A$=CHR$(&H06):ACK
                                 'A$=CHR$(&H15):NAK
2. PRINT #1, "SMNNYYN"           'Measure area and line.
   INPUT #1, A$                  'A$=CHR$(&H06):ACK
                                 'A$=CHR$(&H15):NAK
3. PRINT #1, "SM"                'Reference measuring functions.
   INPUT #1, A$                  'A$="SMNNYNN" Area selected.
```

3. SU Command(Set Unit)

This command sets or references the length and area units. (For angle units, use the SE command.)

a) Format for setting

① Excluding user's unit

S	U	c1	c0

② User's unit

S	U	4	0	d11	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1	d0

b) Format for referencing

S	U

The X-PLAN provides output data in the following format.

S	U	c1	c0	d11	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1	d0

c) Parameter setting

c1c0	Unit	Coefficient
10	Mm	1.
11	Cm	0.1
12	M	0.001
13	M/a	0.001/0.0001
14	Km/ha	0.000001/0.00001
15	Km	0.000001
20	In	0.039370078
21	Ft	0.003280839 897
22	yd	0.001093613 298
23	Yd/ac	0.001093613 298/0.000015719 58592
24	mi	0.000000621 3711922
30*	寸	0.033
31*	尺	0.0033
32*	間/坪	0.00055/0.00055
40	U(user's)	Specified by user.

*(30 through 32) : available only in the oriental model

1. clc0 indicates the unit code.
2. dll through d0 indicate the coefficient. When referencing, it is placed flush right. When setting, either flush right or flush left is allowed.
3. For coefficients that require more than ten digits, only the first ten digits will be output.
4. When the units of line length and area are not the same, the coefficient of line length will be output.

(e.g.)

1. PRINT #1, "SU12" 'Set unit to "m"

```
   INPUT #1, A$                  'A$=CHR$(&H06):ACK
                                 'A$=CHR$(&H15):NAK
 2. PRINT #1, "SU23"             'Set length unit to "yard(yd)" and
                                 'area unit to "acre(ac)"
   INPUT #1, A$                  'A$=CHR$(&H06):ACK
                                 'A$=CHR$(&H15):NAK
 3. PRINT #1,"SU400.00000054"    'Set unit to User's Unit,
                                 'and coefficient to 0.00000054
                                 '(nautical mile).
   INPUT #1, A$                  'A$=CHR$(&H06):ACK
                                 'A$=CHR$(&H15):NAK
 4. PRINT #1, "SU"               'Reference unit.
   INPUT #1, A$                  'A$="SU12          0.001" Unit:m
```

4. SS Command (Set Scale)

This command sets or references the scale ratios.

a) Format for setting

① Scale ratio

S	S	R	X	d11	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1	d0
S	S	R	Y	d11	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1	d0

② Manual scale ratio adjustment

S	S	C	X	c1	c0	d11	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1	d0
S	S	C	Y	c1	c0	d11	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1	d0

b) Format for referencing

① Referencing set value

S	S

The X-PLAN will output in the format that was used to set (when set by scale ratio, scale denominators are returned;
when set by manual scale adjustment, actual reference distance lengths are returned).

② Referencing converted values

S	S	R

Even when the X-PLAN is set with manual scale adjustment, the scale denominators are output in the format of scale ratios.

1. d11 through d0 of the scale ratio format are the scale ratio data.
2. d11 through d0 of the manual scale adjustment format are the actual length data

(reference distance), and clc0 indicates its unit. See the SU command explanation for unit codes.

3. If c1c0 is not the same as the unit set, then d11 through d0 will be converted into the set unit before being used.
4. When referencing, the number in d11 through d0 is placed flush right. When setting, either flush right or flush left is allowed.
5. When the scale ratios of X-axis and Y-axis are the same, the RY or CY may be omitted when setting.
6. When CX and CY are set, the X-PLAN goes into a state of setting the start point and end point of the actual length, and remains in SET mode. In order to continue using S commands, the mode must be changed to READY mode using the SL command, since some S commands cannot be executed in SET mode.

(e.g.)

```
1. PRINT #1, "SSRX1000"          'Set scale ratios RX, RY to 1/1000.
   INPUT #1, A$                  'A$=CHR$(&H06):ACK
                                 'A$=CHR$(&H15):NAK
2. PRINT #1, "SSRX1000"          'Set scale ratio for RX to 1/1000.
   INPUT #1, A$                  'A$=CHR$(&H06):ACK
                                 'A$=CHR$(&H15):NAK
   PRINT #1, "SSRY10000"         'Set scale ratio for RY to 1/10000.
   INPUT #1, A$                  'A$=CHR$(&H06):ACK
                                 'A$=CHR$(&H15):NAK
3. PRINT #1, "SSCX12500"         'Set manual scale adjustment for CX
                                 'and CY to 500 m.
   INPUT #1, A$                  'A$=CHR$(&H06):ACK
                                 'A$=CHR$(&H15):NAK
                                 ("Point" the start point and end
                                  point of the actual length.)
```

(Note) When in "Output" mode, the machine coordinates of the start point and end point will be output upon pressing the [S/P] key. Please see Section 9-1-c-(2) for details.

```
4. PRINT #1, "SS"                'Reference scale ratio.
   INPUT #1, A$                  'A$="SSRX        1000."   RX=1000
   INPUT #1, B$                  'B$="SSRY        1000."   RY=1000
```

5. SA Command (Set Axes)

This command sets or references the coordinate axes.

a) Format for setting

① "Machine axes" or "Origin bias + Direction of X-axis"

S	A	c

After receiving data specifying standard axes or survey axes, the X-PLAN will be in a state of setting points for the axes.

② Plotting points whose coordinates are known

S	A	c	p														
S	A	X	1	c1	c0	d11	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1	d0
S	A	Y	1	c1	c0	d11	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1	d0
S	A	X	2	c1	c0	d11	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1	d0
S	A	Y	2	c1	c0	d11	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1	d0
S	A	X	3	c1	c0	d11	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1	d0
S	A	Y	3	c1	c0	d11	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1	d0

1. Invalid if machine axes have been set.
2. The data must be transmitted in the order of 1 to 7 as shown above.
3. After receiving the data of 1, the X-PLAN will be in a state of setting points immediately after receiving the data of 3, 5, and 7, respectively.
4. When setting only two points, the procedure is completed upon pressing the [NO] key after pointing (X2, Y2).

b) Format for referencing

S	A

The X-PLAN will output in the format used for setting.
1 through 5 will be output if two points have been used.
1 through 7 will be output if three points have been used.

c) Parameter setting

Coordinate axes	C
Machine axes	O
Standard axes	M
Survey axes	S

Defining axes	p	
	SET	REF
two points	2	2
three points	3	3
Affine	4	4
Origin & X-axis	-	Y
each figure	-	A
Not defined	-	B

(Note)
"Y","A" and "B" shown on left will not be output in the Machine Coordinate mode.

1. d11 through d0 are coordinate data. When referencing, it is placed flush right. When setting, either flush right or flush left is allowed.
2. clc0 indicates unit. See the SU command explanation for unit codes aforementioned.
3. If c1c0 is not the same as the unit set, then d11 through d0 will be converted into the set unit before being used.
4. The revolutionary axis cannot be set.
5. The Affine coordinates cannot be set nor referenced.

(Note) When the standard axes or survey axes are set, the X-PLAN goes into SET mode.

In order to continue using S commands, the mode must be changed to READY mode using the SL command, since some S commands cannot be executed in SET mode.

(e.g.)

```
  1. PRINT #1, "SAO"              'Select machine axes.
     INPUT #1, A$                  'A$=CHR$(&H06):ACK
                                   'A$=CHR$(&H15):NAK
  2. PRINT #1, "SAM"              'Select standard axes, and
                                   'go into state of setting origin point.
     INPUT #1, A$                  'A$=CHR$(&H06):ACK
                                   'A$=CHR$(&H15):NAK
                                   (Operator will point origin and X-axis (+) points.)
```

(Note) When in "Output" mode, the coordinates of the origin point and X-axis (+) point will be output upon pressing the [S/P] key. Please see Section 9-1-d-2) for details.

```
3. PRINT #1, "SAS2"               'Select survey axes with two points,
                                  'and go into state of entering X1.
   INPUT #1, A$                   'A$=CHR$(&H06):ACK
                                  'A$=CHR$(&H15):NAK
   PRINT #1, "SAX112100"          'Set X1 to 100 m.
   INPUT #1, A$                   'A$=CHR$(&H06):ACK
                                  'A$=CHR$(&H15):NAK
   PRINT #1, "SAY112-50"          'Set Y1 to -50 m.
   INPUT #1, A$                   'A$=CHR$(&H06):ACK
                                  'A$=CHR$(&H15):NAK
                                  '"Point" (X1, Y1) using [S/P]
   INPUT #1, A$                   'A$="X -54.59362466mm"
                                  'X1-machine-coordinate
   INPUT #1, B$                   'B$="Y  176.5091662mm"
                                  'Y1-machine-coordinate
   PRINT #1, "SAX212-100"         'Set X2 to -100 m.
   INPUT #1, A$                   'A$=CHR$(&H06):ACK
                                  'A$=CHR$(&H15):NAK
   PRINT #1, "SAY212200"          'Set Y2 to 200 m.
   INPUT #1, A$                   'A$=CHR$(&H06):ACK
                                  'A$=CHR$(&H15):NAK
                                  'Point (X2, Y2) using [S/P] key.
   INPUT #1, A$                   'A$="X  191.6232225mm"
                                  'X2-machine-coordinate
   INPUT #1, B$                   'B$="Y -28.56270987mm"
                                  'Y2 machine coordinate
                                  'Finish by pressing [NO] key.
   INPUT #1, A$                   'A$="RX 999.1366796"
                                  'X-axis scale ratio calculated
   INPUT #1, B$                   'B$="RY 999.1366796"
                                  'Y-axis scale ratio calculated
```

(Note) In this example, "Output" mode is in effect. When the same operation is done

in "Non Output" mode, the machine coordinates of the first and second points, and the scale ratios would not be output.

```
4. PRINT #1, "SA"          'Reference coordinate axes.
   INPUT #1, A$            'A$="SAMN" Standard, not defined

5. PRINT #1, "SA"          'Reference coordinate axes.
   INPUT #1, A$            'A$="SAS3" Survey axes of 3 points
   INPUT #1, X1$           'X1$="SAX112        100."   X1=100m
   INPUT #1, Y1$           'Y1$="SAY112         50."   Y1=50m
   INPUT #1, X2$           'X2$="SAX212        200."   X2=200m
   INPUT #1, Y2$           'Y2$="SAY212        150."   Y2=150m
   INPUT #1, X3$           'X3$="SAX312        250."   X3=250m
   INPUT #1, Y3$           'Y3$="SAY312       -50."    Y3=-50m
```

6. SB Command (Set Bias origin)

This command sets or references the bias origin.

a) Format for setting

S	B	B	X	c1	c0	d11	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1	d0
S	B	B	Y	c1	c0	d11	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1	d0

b) Format for referencing

S	B

The X-PLAN will output in the format used for setting.

1. dll through d0 are the origin bias data. When referencing, it is placed flush right. When setting, either flush right or flush left is allowed.
2. clc0 indicates unit. See the SU command explanation for unit codes.
3. If c1c0 is not the same as the unit set, then d11 through d0 will be converted into the set unit before being used.

(e.g.)

```
1. PRINT #1, "SBBX12-5000"     'Set BX to -5000 m.
   INPUT #1, A$                'A$=CHR$(&H06):ACK
                               'A$=CHR$(&H15):NAK
   PRINT #1, "SBBY1210000"     'Set BY to 10000 m.
   INPUT #1, A$                'A$=CHR$(&H06):ACK
                               'A$=CHR$(&H15):NAK
2. PRINT #1, "SB"              'Reference origin bias.
   INPUT #1, A$                'A$="SBBX11         1000." BX=1000cm
   INPUT #1, B$                'B$="SBBY11        -2000." BX=-2000cm
```

7. SF Command (Set Fix)

This command sets or references the number of decimal point digits.

a) Format for setting

S	F	c

b) Format for referencing

S	F

The X-PLAN will output in the format used for setting.

c) Parameter setting

Digits set	c
Not fixed	N
0 digits	0
1 digit	1
2 digits	2
3 digits	3
4 digits	4
5 digits	5
6 digits	6
7 digits	7
8 digits	8
9 digits	9

(e.g.)

```
1. PRINT #1, "SF2"          'Set at two decimal point digits.
   INPUT #1, A$             'A$=CHR$(&H06):ACK
                            'A$=CHR$(&H15):NAK
2. PRINT #1, "SF"           'Reference decimal point digits.
   INPUT #1, A$             'A$="SFN" Number of digits not fixed
```

8. SN Command (Set Numbering)

This command sets or references the selection of Auto-numbering.

a) Format for setting

S	N	c

b) Format for referencing

S	N

The X-PLAN will output in the format used for setting.

c) Parameter setting

Numbering	c
No numbering	N
During measurement	D
After measurement	A

(e.g.)

```
1. PRINT #1, "SND"          'Select auto-numbering during measurement.
   INPUT #1, A$             'A$=CHR$(&H06):ACK
                            'A$=CHR$(&H15):NAK
2. PRINT #1, "SN"           'Reference auto-numbering selected.
   INPUT #1, A$             'A$="SNA" Numbering after measurement.
```

9. SI Command (Set Interface condition)

This command sets or references interface conditions.

a) Format for setting

S	I	Cl	cb	cp	cs	cd	cc

The computer begins transmitting data with the new interface conditions after receiving ACK.

b) Format for referencing

S	I

The X-PLAN will output in the format used for setting.

c) Parameter setting

Data Length	Cl
8 bit	8
7 bit	7

Parity	cp
None	N
Odd	O
Even	e

Delimiter	cd
CRLF	0
CR	1
LF	2

Baud Rate	cb
300	0
600	1
1200	2
2400	3
4800	4
9600	5
19200	6

Stop Bit	cs
2 bit	2
1 bit	1

Control	cc
OFF	N
RON	R
XON	X

(Note) The interface conditions on both sides must correspond before the SI command can be executed. One way to make them correspond is for the operator to reset the interface conditions of the X-PLAN to the default conditions by turning the power on while pressing the [CE/E] key (INITIALIZATION).

(e.g.)

```
1. PRINT #1, "SI85N10N"        'Data Length: 8 bit    Baud Rate: 9600
                               'Parity:None         Stop Bit:1 bit
                               'Delimiter:CRLF    Control:OFF
   INPUT #1, A$                'A$=CHR$(&H06):ACK
                               'A$=CHR$(&H15):NAK
   FOR I=1 TO 1000:NEXT I      'Timer.   From here on, operate with
                               'new interface conditions after changing
                               'the interface conditions of the computer.
                               cf. If enough time is spent after changing
                                   the interface conditions, no timer is needed.
2. PRINT #1, "SI"              'Reference interface conditions.
   INPUT #1, A$                'A$="SI82N20N"
                               'Data Length:8 bit    Baud Rate:1200
                               'Parity:None           Stop Bit:2 bit
                               'Delimiter:CRLF        Control:OFF
```

10. SD Command (Set Draw)

This command sets a pair of (X,Y) coordinates to mark so as to initiate the mark leading display.

Format for setting

S	D	X	M	c1	c0	d11	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1	d0

S	D	Y	M	c1	c0	d11	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1	d0

1. clc0 indicates unit. See the SU command explanation for unit codes.
2. If c1c0 is not the same as the unit set, then d11 through d0 will be converted into the set unit before being used.
3. dll through d0 are the coordinate values to mark. When setting, either flush right or flush left is allowed.
4. SD has no referencing function.

(e.g.)

```
1. PRINT #1, "SDXM12-500"      'Set XM to -500 m.
   INPUT #1, A$                'A$=CHR$(&H06):ACK
                               'A$=CHR$(&H15):NAK
   PRINT #1, "SDYM12500"       'Set YM to 500 m.
   INPUT #1, A$                'A$=CHR$(&H06):ACK, =CHR$(&H15):NAK
                                 ↓
```

As a result, the X-PLAN goes into MARK mode, and a mark leading display will appear. The mark mode can be terminated by pressing [MARK] or [CE/C].

```
2. PRINT #1, "SD"              'Referencing not available
   INPUT #1, A$                'A$=CHR$(&H15):NAK
```

11. SP Command (Set Print)

This command sets or references "Output" or "Non Output" mode.

a) Format for setting

S	P	c

b) Format for referencing

S	P

The X-PLAN will output in the format used for setting.

c) Parameter setting

Output	c
No	N
Yes	Y

(Note) This setting is used only to determine whether data should be output from the X-PLAN upon manual operation. Commands can be sent from the computer at all times.

(e.g.)

```
1. PRINT #1, "SPY"          'Select "Output" mode.
   INPUT #1, A$             'A$=CHR$(&H06):ACK
                            'A$=CHR$(&H15):NAK
2. PRINT #1, "SP"           'Reference which mode.
   INPUT #1, A$             'A$="SPN"   "Non Output" mode.
```

12. SC Command (Set Continuous/Point mode)

This command sets or references Continuous/Point Mode.
(Continuous Mode for curved lines, Point Mode for straight lines)

a) Format for setting

S	C	c

b) Format for referencing

S	C

The X-PLAN will output in the format used for setting.

c) Parameter setting

Mode	c
Continuous	C
Point	P

(e.g.)

```
1. PRINT #1, "SCP"          'Select point mode.
   INPUT #1, A$             'A$=CHR$(&H06):ACK
                            'A$=CHR$(&H15):NAK
2. PRINT #1, "SC"           'Reference Continuous/Point Mode.
   INPUT #1, A$             'A$="SCC"   Continuous Mode
```

13. SL Command (Set mode Level)

This command sets or references execution modes.

a) Format for setting

① READY mode, or SFT+SET mode

S	L	c

② SET mode

S	L	c	l

b) Format for referencing

S	L

The X-PLAN will output in the format used for setting.

c) Parameter setting

Mode	c	Setting	Setting Result
READY	R	Possible	Same as pressing [CE/C]
SET	S	Possible	Same as pressing [SET]
SFT+SET	I	Possible	Same as pressing [SFT]+[SET]
Measure	M	Not Possible	-----
Mark	D	Not Possible	-----
Mouse	N	Not Possible	-----

(Shifting to Mark mode from other modes is impossible.)

(While in SET mode)

Level	1	Result
Measuring functions	1	Same as pressing [1]+[SET]
Unit	2	Same as pressing [2]+[SET]
Scale ratio	3	Same as pressing [3]+[SET]
Coordinate axis	4	Same as pressing [4]+[SET]
Origin bias	5	Same as pressing [5]+[SET]
Decimal point place	6	Same as pressing [6]+[SET]
Auto-numbering	7	Same as pressing [7]+[SET]

1. **"1"** only applies to SET mode.
2. If **"1"** is omitted when selecting SET mode, the default is 1.

(e.g.)

```
1. PRINT #1, "SLR"          'Select READY mode.
   INPUT #1, A$             'A$=CHR$(&H06):ACK
                            'A$=CHR$(&H15):NAK
2. PRINT #1, "SLS3"         'Enter state of setting scale ratio.
   INPUT #1, A$             'A$=CHR$(&H06):ACK
                            'A$=CHR$(&H15):NAK
3. PRINT #1, "SL"           'Reference Execution Mode.
   INPUT #1, A$             'A$="SLM"   Measure Mode.
```

14. SK Command (Set Key)

This command sets or references which keys are active.

a) Format for setting

S	K	k01	k02	k03	k04	k05	k06	k07	k08	k09	k10	k11	k12	k13
	k14	k15	k16	k17	k18	k19	k20	k21	k22	k23	k24	k25	k26	k27

b) Format for referencing

S	K

The X-PLAN will output in the format used for setting.

c) Parameter setting

Data	Key	Data	Key	Data	Key
k01	CE/C	k11	SET	k21	F0 to F4, SFT F5 to F9
k02	RM	k12	YES	k22	CANCEL
k03	SFT CLM	k13	NO	k23	ARC
k04	+M	k14	+/-	k24	CONTINUOUS
k05	SFT CL Σ	k15	SFT P/C	k25	START/POINT
k06	+Σ	k16	P/NP	k26	MARK
k07	END	k17	SFT #	K27	MOUSE
k08	SFT FEED	k18	#P		
k09	COPY	k19	SFT		
k10	SFT SET	k20	0 to 9		

1. For active keys, use Y, and for inactive keys, use N.
2. The system has priority even if Y is specified.
3. All keys are active when the power is turned on.
4. Set values become invalid when the power is turned off.
5. Unexpected manual operations can be avoided by using this command.
6. The X-PLAN can accept an SK without "k26", and unconditionally nullifies the Mark key. (for compatibility with the former 360C.)
7. The X-PLAN can accept an SK without "k27", and unconditionally nullifies the Mouse key. (for compatibility with the former 360C.)

(e.g.)

```
1. PRINT #1, "SKYNNNNNNNNNNNNNNNNNNNNNNNYNN"
                                'Make only [CL] and [S/P] keys active.
   INPUT #1, A$                 'A$=CHR$(&H06):ACK, =CHR$(&H15):NAK
2. PRINT #1, "SKYNNNNNNNNNNNNNYNNNNYYYNNNNNN"
                                'Make only [CL], [+/-], [SFT], numeric and function
                                keys
                                'active.
   INPUT #1, A$                 'A$=CHR$(&H06):ACK, =CHR$(&H15):NAK
3. PRINT #1, "SK"               'Reference which keys are active.
   INPUT #1, A$                 'A$="SKYYYYYYYYYYYYYYYYYYYYYYYYYY"
                                'All keys are active.
```

15. SW Commands (Set power)

This command sets or references the auto-power-off function.

a) Format for setting

S	W	c

b) Format for referencing

S	W

The X-PLAN will output in the format used for setting.

c) Parameter setting

Auto-power-off	C
Active	Y
Inactive	N

The auto-power-off function is active when the power is turned on. Thus, if it is left idle for 20 minutes, the power will automatically shut off, except during measuring (while in Measure mode). The setting becomes invalid when the power is turned off.

(e.g.)

```
1. PRINT #1, "SWN"              'Make auto-power-off function inactive.
   INPUT #1, A$                 'A$=CHR$(&H06):ACK
                                'A$=CHR$(&H15):NAK
2. PRINT #1, "SW"               'Reference auto-power-off function.
   INPUT #1, A$                 'A$="SWY"   Auto-power-off is active.
```

16. ST Command (Set delay Time)

This command sets or references the delay time between receiving data from the computer and transmitting the corresponding data.

a) Format for setting

S	T	d1	d0

b) Format for referencing

S	T

The X-PLAN will output in the format used for setting.

1. The range for d1 and d0 is from 00 to 50 in units of 20msec, so that the range corresponds to that of 0 to 1000msec.
2. When the power is turned on (when delay time is not set), the delay time of 1000msec is in effect for the first time this command is used, but thereafter, the delay time specified goes into effect.
3. The setting becomes invalid when the power is turned off. (The delay time becomes 0.)
4. This applies even to cases of sending more than one line of data. (For example, the interval between sending X- and Y-coordinates.)
5. This command is effective when using a half duplex interface or interfacing with a computer which has a slow data processing speed.

(e.g.)

```
1. PRINT #1, "ST10"          'Set delay time to 200msec.
   INPUT #1, A$              'A$=CHR$(&H06):ACK
                             'A$=CHR$(&H15):NAK
2. PRINT #1, "ST"            'Reference delay time.
   INPUT #1, A$              'A$="ST00" Delay time has not been set.
```

17. D Command (Display)

When the X-PLAN receives the D command, the characters following the D (32 characters maximum) are shown on the display screen from the top left to the bottom right.

a) Format for setting

D	c01	c02	c03	c04	c05	c06	c07	c08	c09	c10	c11
	c12	c13	c14	c15	c16	c17	c18	c19	c20	c21	c22
		c23	c24	c25	c26	c27	c28	c29	c30	c31	c32

1. c01 corresponds to the top left of the display, and c32 corresponds to the bottom right of the display.
2. Using the D alone will clear the screen.

(e.g.)

```
1. PRINT #1, "DINPUT HEIGHT PRESS <NUMBER> + F0"
```

Display on X-PLAN

```
INPUT HEIGHT PRE
SS <NUMBER> + F0
```

18. C Command (Clear)

When the X-PLAN receives the C command, the display screen is cleared.

a) Format for setting

C

(e.g.)
1.PRINT #1, "C"

Display on X-PLAN

(blank)

19. B Command (Blinking)

When the X-PLAN receives the B command, the display screen starts blinking or stops blinking.

a) Format for setting

B	c

b) Parameter setting

c	Blinking
1	On
0	Off

"On" starts blinking, and "Off" stops blinking.

(e.g.)
1. PRINT #1, "B1" 'Turn blinking on.
2. PRINT #1, "B0" 'Turn blinking off.

20. BZ Command (BuZzer)

Upon receiving the BZ command, the X-PLAN sounds its buzzer.

a) Format for setting

B	Z	c

b) Parameter setting

c	Action
1	Sound the buzzer once.
2	Sound the buzzer twice in succession.
3	Sound the buzzer three times in succession.
4	Sound the buzzer for two full seconds.

(e.g.)

```
1. PRINT #1, "BZ2"          'Sound buzzer twice consecutively.
2. PRINT #1, "BZ4"          'Sound buzzer for two full seconds.
```

21. Explanation of d11 through d0 for SU, SS, SA, SB, and SD

a) Range of numeric values

±0.000000001 to ±9999999999
(Ten digits + sign + decimal point)

b) The + sign as well as the 0 before the decimal point for numbers less than 1, are omissible.
c) When using the SU or SS commands, minus will be changed to plus and 0 will be changed to 1 before setting.
d) When setting, either flush right or flush left is allowed, and when referencing, values are placed flush right.

(e.g.)

1. When setting SBBX to "-1.2345 m"

```
PRINT #1, "SBBX12-1.2345"
PRINT #1, "SBBX12    -1.2345"
PRINT #1, "SBBX12       -1.2345"
```

2. When setting SBBX to "0.12345 m"

```
PRINT #1, "SBBX120.12345"
PRINT #1, "SBBX12.12345"
PRINT #1, "SBBX12+0.12345"
```

9) Input of Measurement Data from the X-PLAN

Data is transmitted to the computer every time the operator presses a key on the X-PLAN. (This is true provided the X-PLAN is set for "Output" mode.) The transmitted data must be read by the computer, whether the data is necessary or not. Unnecessary data should be read and ignored, otherwise the following data cannot be transmitted.

1. Reading in various measuring conditions

Normally, programming is made easier by having the computer set the measuring conditions in the X-PLAN using the S commands. However, it is possible to have the operator select the measuring conditions, which are then read into the computer and processed. In Mouse mode, setting data for the measuring conditions will not be output.

a) Reading in the selection of measuring function

The operator's selections using the [SET], [YES], and [NO] keys are read in.

Transmission data format

Measuring function	Operator's selection
1 chr.	1 chr.

① Measuring function codes

X - Coordinates
d - Line Segment
A - Area
L - Line
r - Radius
G - Centroid
T - Triangular area
K - Angle
P - Center of arc
R - Radial distance
D - Volume
V - Revolutionary solid

② Operator's selection codes

Y - Yes
N - No

Note: -1. [SET] key only sends existing values (Y or N), making no changes.
-2. When selecting "SPECIAL" measurements, pressing [NO] causes no output data such as A$="GN". Only YES data such as A$="GY" are transmitted to the computer.
-3. A specific display shown on right makes no output when it is selected by [YES] or [NO].

1 MEAS FUNC	Y/N
SPECIAL	N

(e.g.)

```
INPUT #1, A$        'A$="XY" Coordinates measured.
INPUT #1, B$        'B$="dN" Line segment not measured.
INPUT #1, C$        'C$="GY" Centroid measured.
INPUT #1, D$        'D$="Rn" Radius not measured.
INPUT #1, E$        'E$="PN" is not output to computer
```

b) Unit selecting operation

The units which have been selected with [YES] are transferred and ones rejected with [NO] are not transferred. The input statement needs to be executed only once.

Transmission data format (16 characters)

① Existent units

Unit Data ID	Filler
2 to 5 chr.	

Types of existent units (for length and area)

Unit	ID					Unit	ID				
mm	m	m				尺		F1			
cm	c	m				間/坪		F2	/	F3	F4
m		m				**in**	i	n			
m/a		m	/		a	**ft**	f	t			
Km/ha	k	m	/	h	a	**yd**	y	d			
km	k	m				**yd/ac**	y	d	/	a	c
寸		F0				**mi**	m	i			

Character codes F0 through F4 used above are in hexadecimal form.

Types of existent angle units

Unit	ID						
degree & minute	d	e	g	/	m	i	n
degree	d	e	g				
gon	g	o	n				
radian	r	a	d	i	a	n	

The angle unit selection display appears after the angle measurement is selected with [YES]. Note that they are not displayed at the same time as the length and area units.

② User's unit format (for length and area units only)

U		**<-**	**--**	**-U**	**se**	**r'**	**s**	**fa**	**ct**	**or**	**--**	**--**	**->**		

The user's factor is output in twelve digits from the third character to the fourteenth character, flush right.

(e.g.)

1. INPUT #1, A$	'A$=" m "	Unit m
2. INPUT #1, A$	'A$="U 0.00000054 "	User's unit
3. INPUT #1, A$	'A$="radian "	for angle

c) Reading in scale operation

① "SCALE RATIO" READING

Transmission data format (16 characters)

Data ID	Scale ratio denominator	Blank
2 chr.	12 chr.	2 chr.

(Data ID) CR: Scale ratio
RX: X-axis scale ratio
RY: Y-axis scale ratio

***Examples of manual operations and corresponding data**

------- Display -------	-------Key Operation-------	-------Output Format-------
3 SCALE Y/N SCALE RATIO Y	[YES] or [SET]	CR
SCALE RATIO RX 1000.	[YES] or [SET]	RX 1000.
SCALE RATIO RY 1000.	[YES] or [SET]	RY 2000.

② "MANUAL SCALE RATIO ADJUSTMENT" READING

Data ID	Actual length/Coordinate	Blank
2 chr.	12 chr.	2 chr.

(Data ID) CM: Manual Scale ratio adjustment
CX: X actual length
CY: Y actual length
X : X-machine-coordinate
Y : Y-machine-coordinate

***Examples of manual operations and corresponding data**

------- Display -------	-------Key Operation-------	-------Output Format-------
3 SCALE Y/N MAN. SCALE Y	[YES] or [SET]	CM
MAN.SCALE(X) CX 200. m.	[YES] or [SET]	CX 200. m
MAN.SCALE(X) 1st PRESS S/P	[S/P]	X 17.06687837mm Y –109.1769122mm Indicates machine coordinates of start point in X direction.
MAN.SCALE(X) 2nd PRESS S/P	[S/P]	X 217.1325025mm

Y –112.3683041mm Indicates machine	coordinates of end point in X direction.	
MAN.SCALE(Y) CY 500. m.	[YES] or [SET]	CY 500.m
MAN.SCALE(Y) 1st PRESS S/P	[S/P]	X 217.1325025mm Y –109.2650725mm Indicates machine coordinates of start point in Y direction.
MAN.SCALE(Y) 2nd PRESS S/P	[S/P]	X 22.47311341mm Y 190.9199531mm Indicates machine coordinates of end point in Y direction.

1. Numeric value input is omitted here.
2. Only when numeric input is used for the manual scale ratio adjustment value does the X-PLAN go into a state of setting the start point and end point.
3. The machine coordinates indicate that the [S/P] key has been pressed. The unit is always "mm" with no scale ratio. The user's program should process this data in whatever way necessary.

(e.g.)

1) Scale ratio reading

```
INPUT #1, A$        'A$="CR"   scale ratio
INPUT #1, B$        'B$="RX        1000.  "   RX=1000
INPUT #1, C$        'C$="RY        2000.  "   RY=2000
```

2) Manual scale ratio adjustment reading (machine coordinates)

```
INPUT #1, A$        'A$="CM"   manual scale adjustment
                    '(1) Scale ratio in X direction
INPUT #1, B$        'B$="CX          200. m"   CX=200m
INPUT #1, C$        'C$="X   17.06687837mm": X of 1st pt.
INPUT #1, D$        'D$="Y -109.1769122mm"   Y of 1st pt.
INPUT #1, E$        'E$="X   217.1325025mm"   X of 2nd pt.
INPUT #1, F$        'F$="Y -112.3683041mm"   Y of 2nd pt.
                    '(2) Scale ratio in Y direction
INPUT #1, G$        'G$="CY          500. m"   CY=500m
INPUT #1, H$        'H$="X   217.1325025mm"   X of 1st pt.
INPUT #1, I$        'I$="Y -109.2650725mm"   Y of 1st pt.
INPUT #1, J$        'J$="X   22.47311341mm"   X of 2nd pt.
INPUT #1, K$        'K$="Y   190.9199531mm"   Y of 2nd pt.
```

d) Reading in coordinate axes

① Data format for coordinate axes selection (3 characters)

Data ID (2 chr.)		Selection code
X	Y	1 chr.

(Selection code) O: Machine axes
M: Standard axes
S: Survey axes

***Examples of manual operations and corresponding data**

------- Display -------	-------Key Operation-------	-------Output Format-------
4 AXIS Y/N MACH.AXIS Y	[YES] or [SET]	XYO
4 AXIS Y/N STAND AXIS Y.	[YES] or [SET]	XYM
4 AXIS Y/N SURV AXIS Y	[YES] or [SET]	XYS

② Data format for origin bias & X-axis definition (16 characters)

Data ID 2 chr.	Coordinate data 12 chr.	Unit 2 chr.

(Data ID) XO: Origin bias X-coordinate
YO: Origin bias Y-coordinate
XX: X-axis X-coordinate
YY: X-axis Y-coordinate

***Examples of manual operations and corresponding data**

------- Display -------	-------Key Operation-------	-------Output Format-------
AXIS ORIGIN PRESS S/P	[S/P]	XO 11000.00 m YO 6000.00 m Origin bias coordinates (Origin deviation, decimal point as fixed)
ON X-AXIS(+) PRESS S/P	[S/P]	XX 12349.34 m YX 6000.00 m X-axis(+) coordinates (Origin deviation, decimal point as fixed)

1. Only when standard axes or survey axes are selected does the X-PLAN go into a state of defining axes points.

2. The origin bias coordinates and X-axis (+) coordinates indicate that the [S/P] key has been pressed. Process them as necessary.

③ Data format for plotting known points (16 characters)

Data ID 2 chr.	Coordinate/Scale data 12 chr.	Unit/Blank 2 chr.

(Data ID) X1=Point 1 X-coordinate Y1=Point 1 Y-coordinate
X2=Point 2 X-coordinate Y2=Point 2 Y-coordinate
X3=Point 3 X-coordinate Y3=Point 3 Y-coordinate
X =X-machine-coordinate Y =Y-machine-coordinate
RX=X-axis scale RY=Y-axis scale

***Examples of manual operations and corresponding data**

------- Display -------	-------Key Operation-------	-------Output Format-------
INPUT COORDINATE X1 100. m	[YES] or [SET]	X1 100. m
INPUT COORDINATE Y1 50. M	[YES] or [SET]	Y1 100. m
COORDIN. (X1,Y1) PRESS S/P	[S/P]	X 14.24391285mm Y –80.92677691mm
INPUT COORDINATE X2 200. m	[YES] or [SET]	X2 200. m
INPUT COORDINATE Y2 150. m	[YES] or [SET]	Y2 150. m
COORDIN. (X2,Y2) PRESS S/P	[S/P]	X 117.3210073mm Y 16.02988362mm
INPUT COORDINATE X3 250. m	[YES] or [SET]	X3 250. m
INPUT COORDINATE Y3 -50. M	[YES] or [SET]	Y3 -50. m
COORDIN. (X3,Y3) PRESS S/P	[S/P]	X 160.9397205mm Y -185.3612907mm RX 1000.31988 RY 1000.31988

④ Affine Data format (16 characters)

Data ID 2 chr.	Coordinate/Scale data 12 chr.	Unit/Blank 2 chr.

(Data ID) Xa= X-coordinate Y_b= Y-coordinate
Point number = a*10 + b
AFab= Affine setting end

***Examples of manual operations and corresponding data**

------- Display -------	-------Key Operation-------	-------Output Format-------
AFFINE (1) X 100. m	[YES] or [SET]	X0 100. m
AFFINE (1) Y 50. m	[YES] or [SET]	Y1 50. m
AFFINE (1) PRESS S/P	[S/P]	X 14.24391285mm Y –80.92677691mm
AFFINE (2) X 200. m	[YES] or [SET]	X0 200. m
AFFINE (2) Y 150. m	[YES] or [SET]	Y2 150. m
AFFINE (2) PRESS S/P	[S/P]	X 117.3210073mm Y 16.02988362mm
AFFINE (3) X 250. m	[YES] or [SET]	X0 250. m
AFFINE (3) Y -50. m	[YES] or [SET]	Y3 -50. m
AFFINE (3) PRESS S/P	[S/P]	X 160.9397205mm Y -185.3612907mm AF| |3

1. Only when standard axes or survey axes are selected does the X-PLAN go into a state of defining axes points.
2. Numeric value input is omitted here.
3. When plotting only two points, the operator should press the [NO] key when asked for X3 in the case of plotting known points (d-③). This is the same when less than 25 points get plotted in the Affine case.
4. The machine coordinates indicate that the [S/P] key has been pressed. The unit is always "mm" with no scale ratio. The user's program should process this data in whatever way necessary.
5. RX and RY are output when setting is completed. (These are the results from automatically calculating the scale ratio denominators.) This is not the case

when the Affine transformation is made.

(e.g.)

```
1. PRINT #1, A$              'A$="XYO"   Select machine axes.

2. INPUT #1, A$              'A$="XYS"   Select survey axes.
   INPUT #1, B$              'B$="XO      11000.00 m" Origin bias (x)
   INPUT #1, C$              'C$="YO       6000.00 m" Origin bias (y)
   INPUT #1, D$              'D$="XX      12349.34 m" X-axis(+):(x)
   INPUT #1, E$              'E$="YX       6000.00 m" X-axis(+):(y)

3. INPUT #1, A$              'A$="XYM"   Select standard axes.
   INPUT #1, B$              'B$="X1          100. m" Pt.1(x)
   INPUT #1, C$              'C$="Y1           50. m" Pt.1(y)
   INPUT #1, D$              'D$="X   14.24391285mm" Pt.1
                             'X-machine-coordinate
   INPUT #1, E$              'E$="Y -80.92677691mm" Pt.1
                             'Y-machine-coordinate
   INPUT #1, F$              'F$="X2          200. m" Pt.2(x)
   INPUT #1, G$              'G$="Y2          150. m" Pt.2(y)
   INPUT #1, H$              'H$="X   117.3210073mm" Pt.2
                             'X-machine-coordinate
   INPUT #1, I$              'I$="Y   16.02988362mm" Pt.2
                             'Y-machine-coordinate
   INPUT #1, J$              'J$="X3          250. m" Pt.3(x)
   INPUT #1, K$              'K$="Y3          -50. m" Pt.3(y)
   INPUT #1, L$              'L$="X   160.9397205mm" Pt.3
                             'X-machine-coordinate
   INPUT #1, M$              'M$="Y -185.3612907mm" Pt.3
                             'Y-machine-coordinate
   INPUT #1, N$              'N$="RX   1000.31988   " Scale ratio RX
   INPUT #1, O$              'O$="RY   1000.31988   " Scale ratio RY

4. INPUT #1, A$              'A$="XYM"   Select standard axes.
   INPUT #1, B$              'B$="X0          100. m"   Pt.1(x)
   INPUT #1, C$              'C$="Y1           50. m"   Pt.1(y)
   INPUT #1, D$              'D$="X   14.24391285mm"   Pt.1
                             'X-machine-coordinate
   INPUT #1, E$              'E$="Y -80.92677691mm"   Pt.1
                             'Y-machine-coordinate
   INPUT #1, F$              'F$="X0          200. m"   Pt.2(x)
   INPUT #1, G$              'G$="Y2          150. m"   Pt.2(y)
   INPUT #1, H$              'H$="X   117.3210073mm"   Pt.2
                             'X-machine-coordinate
   INPUT #1, I$              'I$="Y   16.02988362mm" Pt.2
                             'Y-machine-coordinate
   INPUT #1, J$              'J$="X0          250. m"   Pt.3(x)
   INPUT #1, K$              'K$="Y3          -50. m"   Pt.3(y)
   INPUT #1, L$              'L$="X   160.9397205mm"   Pt.3
                             'X-machine-coordinate
   INPUT #1, M$              'M$="Y -185.3612907mm"   Pt.3
```

'Y-machine-coordinate

INPUT #1, N$ 'N$="AF 3" Setting end with 3 Affine points

e) Reading in origin bias

When the coordinate axes are set by "origin and X-axis definition", the known coordinates of the point designated as origin bias can be input.

Data format (16 characters)

Data ID	Origin bias coordinate value	Unit
2 chr.	12 chr.	2 chr.

(Data ID) XB: Origin bias X-coordinate
YB: Origin bias Y-coordinate

***Examples of manual operations and corresponding data**

------- Display -------	-------Key Operation-------	-------Output Format-------
5 BIAS ORIGIN XB 11000. m	[YES] or [SET]	XB 11000. m
5 BIAS ORIGIN YB 6000. m	[YES] or [SET]	YB 6000. m

(Note) Numeric input is omitted.

(e.g.)

1. INPUT #1, A$ 'A$="XB 1000. m" Origin bias (x)
   INPUT #1, B$ 'B$="YB 6000. m" Origin bias (y)

f) Reading in decimal point placement

The number of decimal point digits of measurement values and calculation values transmitted from the X-PLAN can be fixed.

Data format (3 characters)

Data ID		Selection code
F	X	1 chr.

(Selection code) N : Not fixed
0 to 9: Number of decimal point digits

***Examples of manual operations and corresponding data**

------- Display -------		
6 D.P PLACE Y/N D.P FULL	-------Key Operation-------	[YES] or [SET]
	[YES] or [SET]	-------Output Format-------
	6 D.P PLACE Y/N D.P 2	

(e.g.)

FXN	FX2

1. INPUT #1, A$ 'A$="FXN" Number of digits not fixed
2. INPUT #1, A$ 'A$="FX2" Two decimal point digits

g) Reading in automatic numbering selection

Data format (2 characters)

Data ID	Selection code
#	1 chr.

(Selection code) N: None
D: During measurement
A: After measurement

***Examples of manual operations and corresponding data**

------- Display -------	-------Key Operation-------	-------Output Format-------
7 NUMBERING Y/N WITHOUT #ing Y	[YES] or [SET]	#N
7 NUMBERING Y/N #ing IN PLOT Y.	[YES] or [SET]	#D
7 NUMBERING Y/N #ing AFT PLOT Y	[YES] or [SET]	#A

(e.g.)
1. INPUT #1, A$ 'A$="#D" auto-numbering during measurement.

2. Reading in measurements

This section explains how to input the various data transmitted from the X-PLAN after measurement of a diagram begins.

Measurement data format (16 characters) --- excluding angles

Data ID 2 chr.	Number/Measurement data 12 chr.	Blank/Unit 2 chr.

Angle data format (16 characters)

A	n					9	9	9	°	9	9			- deg & min(minute < 60)
A	n					9	9	9	.	9	9			- degree(2nd decimal)
A	n					9	9	9	.	9	9	g	o	n - gon(2nd decimal)
A	n					9	.	9	9	9	9	r	a	d - radian(4th decimal)

All of the unit symbols are fixed to the same positions.

(Data ID)	#	:	Number
	CA	:	Cancel
	X	:	X-coordinate (Point Mode)
	Y	:	Y-coordinate (Point Mode)
	XC	:	X-coordinate (Continuous Mode)
	YC	:	Y-coordinate (Continuous Mode)
	XA	:	X-coordinate (Arc Mode)
	YA	:	Y-coordinate (Arc Mode)
	d	:	Line Segment
	r	:	Radius
	A	:	Area (Double meridian/Triangular)
	L	:	Total Length
	XG	:	Centroid X
	YG	:	Centroid Y
	TB	:	Triangular base
	TH	:	Triangular height
	An	:	Angle
	XP	:	Arc center X
	YP	:	Arc center Y
	RL		Radial distance
	GA		Contour-based volume
	H		Interval between contours
	GV		Volume
	VA		Volume of revolutionary solid
	VF		Surface of revolutionary solid
	XV		Center of gravity X
	YV		Center of gravity Y
	EN	:	End of measurement
	Blank	:	Last measurement

(Note)

1. EN (End of measurement) data is actually "END" in three characters.

2. After all measurement data are sent, the X-PLAN sends a blank line, which is actually one blank character space.

3. If [+/-] is pressed while a measured angle is displayed, the other angle:(360° - the displayed angle) will appear and be output to the computer.

***Examples of manual operations and corresponding data**

------- Display -------	-------Key Operation-------	-------Output Format-------
Any measurement display	[S/P]	# 123. X 123.45 m Y -78.90 m d 12.34 m r 567.89 m
Any measurement display	[CON]	XC 123.4567 m YC -345.6789 m
Any measurement display	[ARC]	XA 9876.543 m YA -876.543 m
Any measurement display	[CAN]	CA
Any measurement display	[END]	END #123.456 A 5678.901 m L 3456.789 m (1 blank space)

1. Data during measurement is output as a result of pressing four keys;[S/P], [CON], [ARC], and [#], and data after measurement is output as a result of pressing the [END] key.
2. In Continuous mode, repeated identical coordinates are not output.
3. The midpoint coordinates of an arc are output when the [ARC] key is pressed. In most cases, this output is just for reference.
4. Both [S/P] and [END] keys output collectively all of the measurement results obtained at that time.

(e.g.)

```
1. INPUT #1, A$          'A$="# 123."    Number during measurement
   INPUT #1, B$          'B$="X      123.45 m"   X-coordinate
   INPUT #1, C$          'C$="Y      -78.90 m"   Y-coordinate
   INPUT #1, D$          'D$="d       12.34 m"   Line Segment
   INPUT #1, E$          'E$="r      567.89 m"   Radius

2. INPUT #1, A$          'A$="END"   End of measurement
   INPUT #1, B$          'B$="# 123.456" Number at end
   INPUT #1, C$          'C$="A    5678.901 m"   Area
   INPUT #1, D$          'D$="L    3456.789 m"   Total length
   LINE INPUT #1, E$     'E$=" "   Indicates end of data output
```

3. Reading in accumulations and averages

The program can read in accumulations and averages of measurements (for one type of measurement at a time from among coordinates, area, line segment, total length, radius, centroid, triangular area, angle, center of arc, radial distance, volume) through manual operation by the operator. Such values with revolutionary solids are explained later in this chapter.

Data format (16 characters) --- For angle data format
see <(9)-2. Reading in measurements>.

Data ID 2 chr.	Average/Occurrence/Accumulation 12 chr.	Blank/Unit 2 chr.

(Data ID) +F6 : +Σ registration
CF6 : Clear Σ
F8_ : Average F6="&HF6"
n : Accumulation occurrence F8="&HF8"
F6_ : Accumulation

"_" : indicates the measuring function code.
A : area(double meridian/triangular/arc center)/angle
X : x-coordinate(point/centroid/arc center)
Y : y-coordinate(point/centroid/arc center)
d : line segment
L : Total Length
R : Radial distance
V : Volume

***Examples of manual operations and corresponding data**

------- Display -------	-------Key Operation-------	-------Output Format-------
Any measurement display	[+Σ]	+ F6
Any desired display	[CL Σ]	C F6
Any desired display	[NO]	F8 X 123.45 m F8 Y -12.34 m n 12. F6 X 1481.40 m F6 Y -148.08 m
Any desired display	[NO]	F8 A 123.456 m n 3. F6 A 370.368 m

(Note) The kind of measurement which can be accumulated using [+Σ] is limited to that

which is displayed and is the same type as the one first chosen for accumulation.
(see Operation Manual)

(e.g.)

```
1. INPUT #1, A$      'A$="+"+CHR$(&HF6) sum registration
2. INPUT #1, A$      'A$=CHR$(&HF8)+"A      123.456m" Area sum
   INPUT #1, B$      'B$="n                3.   "
                     'Accumulation occurrence count
   INPUT #1, C$      'C$=CHR$(&HF8)+"A      370.368m" Area average
```

==========
* Reading in accumulations, averages and composed centers *
* of gravity with revolutionary solid *
==========

Data format (16 characters)

Data ID	Average/Occurrence/Accumulation	Blank/Unit
2 chr.	12 chr.	2 chr.

(Data ID)
+F6 : +Σ registration
CF6 : Clear Σ
F8_ : Average F6="&HF6"
n : Accumulation occurrence F8="&HF8"
F6_ : Accumulation

"_" : indicates the measuring function code.
A : volume
F : Surface area
X : x-coordinate of center of gravity
Y : y-coordinate of center of gravity

***Examples of manual operations and corresponding data**

------- Display -------	-------Key Operation-------	-------Output Format-------
Revolutionary solid	[+Σ]	+ F6
Any desired display	[CL Σ]	C F6
Any desired display	[NO]	F6 A 123.45 m F8 A 12.35 m F6 F 1481.40 m F8 F 148.14 m F8 X 12.34 m F8 Y 0.00 m n 10.

(Note) The kind of measurement which can be accumulated using [+Σ] is limited to that which is displayed and is the same type as the one first chosen for accumulation.

(e.g.)

```
1. INPUT #1, A$      'A$="+"+CHR$(&HF6) sum registration
2. INPUT #1, A$      'A$=CHR$(&HF6)+"A      123.45 m" Volume sum
   INPUT #1, B$      'B$=CHR$(&HF8)+"A       12.35 m" Volume average
   INPUT #1, C$      'C$=CHR$(&HF6)+"F     1481.40 m" Surface sum
   INPUT #1, D$      'D$=CHR$(&HF8)+"F      148.14 m" Surface average
   INPUT #1, E$      'E$=CHR$(&HF8)+"F       12.34 m"   X center of gravity
   INPUT #1, F$      'F$=CHR$(&HF8)+"F        0.00 m"   Y center of gravity
   INPUT #1, G$      'G$=CHR$(&HF8)+"F         10.  "   Occurance
```

4. How to use function keys

[F0] to [F9] can be used as function keys whose function and meaning can be freely determined by the user's program. The X-PLAN will transmit the input value with the key code.

a) Execution modes in which function keys are active

Execution Mode	Key Operation	Input Value Transmission	Mode Change
READY	active	possible	none
Measure (Point)	active	possible	none
Measure (Continuous)	inactive	---	---
SET	active	partially possible	to READY
SFT SET	active	not possible	to READY
MARK (X,Y)input	active	possible	to READY
MARK Lead display	inactive	---	---
Mouse	active	not possible	to READY

1. Input value transmission in SET mode is possible only when numeric input is allowed.
2. Even after using a function key in Point Mode, it is possible to return to the previous screen by pressing the [NO] key.

b) Data format

Key ID	Input value data
2 chr.	0 to 12 chr.

(Key ID) F0 through F9 : correspond to [F0] through [F9] keys

***Examples of manual operations and corresponding data**

------- Display -------	-------Key Operation-------	-------Output Format-------
Any desired display	[F0]	F0
123..	[F1]	F1123.
-123456.7890	[SFT] + [F9]	F9-123456.7890

(Note) Numeric input is omitted here.

(e.g.)

1. INPUT #1, A$ 'A$="F0" F0 key pressed
2. INPUT #1, A$ 'A$="F9-123456.7890" Numeric input + [F9] key

5. Reading in memory operations

The values added by the operator using the [+M] key can be read into the program. ([M] is not applicable to angles and coordinates.)

Data format (2 to 16 characters)

Data ID	Displayed value/Memory data	Blank
2 chr.	12 chr.	2 chr.

(Data ID) +M: Memory add registration
RM: Memory reference
CM: Clear memory

***Examples of manual operations and corresponding data**

------- Display -------	-------Key Operation-------	-------Output Format-------
	[+M]	
123.		
Any desired display	[+M]	+M 123.
Any desired display	[RM]	RM 123.
(When the memory overflows:)	[SFT] + [CLM]	
123.		CM

+M 123.
+M ERROR

(Note) The [+M], [RM], and [CLM] keys can be used even when connected to a computer.

(e.g.)

1 .INPUT #1, A$ 'A$="+M 123." Add to memory
2. INPUT #1, A$ 'A$="CL" Clear memory

6. Reading in measurement sign alterations

The sign of a displayed value is altered, and the result is output.

Data format (2 to 16 characters)

Data ID	Altered data	Unit
2 chr.	12 chr.	2 chr.

(Data ID) +-: Sign alteration

***Examples of manual operations and corresponding data**

------- Display -------	-------Key Operation-------	-------Output Format-------
X 987.65 m -4321.09m	[+/-]	+- X - 987.65 m Y 4321.09 m
AREA A 123.45 m	[+/-]	+- A - 123.45 m

(e.g.)

1. INPUT #1, A$ 'A$="+-" Sign alteration
INPUT #1, B$ 'B$="X -987.65 m" X-coordinate
INPUT #1, C$ 'C$="Y 4321.09 m" Y-coordinate
2. INPUT #1, A$ 'A$="+-" Sign alteration
INPUT #1, B$ 'B$="A -123.45 m" Area

7. Reading in manually input numbers

It is possible to read in numbers input by the operator (using numeric input + [#P] key). As with function keys, the user's program may give various functions in order to enhance the operability.

Data format (2 to 16 characters)

Data ID (2 chr.)		Input value data
#		2 to 12 chr.

(Data ID) #: Number input manually

***Examples of manual operations and corresponding data**

------- Display -------	-------Key Operation-------	-------Output Format-------
123.321	[#P]	# 123.321

(e.g.)

1. INPUT #1, A$ 'A$="# 123.321" Number input manually

8. Reading in a hard copy of the display screen

Regardless of whether it is in "Output" mode or "Non Output" mode, the X-PLAN will transmit whatever is displayed on its screen. (Just push the [COPY] key.)

Data format (2 to 16 characters)

①	Line 1 of the display (1 to 16 chr.)
②	Line 2 of the display (1 to 16 chr.)

***Examples of manual operations and corresponding data**

------- Display -------	-------Key Operation-------	-------Output Format-------
345.	[COPY]	(one space only) 345.
AREA A 643.2 m	[COPY]	AREA A 643.2 m
X –123.456ft Y 789.012ft	[COPY]	X –123.456ft Y 789.012ft

(e.g.)

1. LINE INPUT #1, A$ 'A$=" " Top line data
   LINE INPUT #1, B$ 'B$=" 345. " Bottom line data
2. INPUT #1, A$ 'A$="AREA " Top line data
   INPUT #1, B$ 'B$="A 643.2 m" Bottom line data

9. Reading in a clear key operation

Unless clearing an entry (canceling what has been input), the following data is output to

the computer.

Data format (2 to 16 characters)

Data ID (2 chr.)	
C	L

***Examples of manual operations and corresponding data**

------- Display -------	-------Key Operation-------	-------Output Format-------
Any desired display	[CE/C]	CL

(e.g.)
1. INPUT #1, A$ 'A$="CL"

10. Reading in marking coordinates input

It is possible to read in a series of marking operations (coordinates input and point marking) by the operator.
See the Operation Manual for marking details.

***Examples of manual operations and corresponding data**

------- Display -------	-------Key Operation-------	-------Output Format-------
Non-coordinate display	[MARK]	MK
INPUT X TO MARK XM 123. m	[YES] or [NO]	XM 123. m
INPUT Y TO MARK YM 456. m	[YES] or [NO]	YM 456. m
Mark leading display	[MARK]	MK

1. Only the [MARK] and [CE/C] keys can be used to get out of Mark mode.
2. Even if the input coordinates cause an "out of range" error, there is no message to be output to the computer.

(e.g.)
1. INPUT #1, A$ 'A$="MK" [MARK] pressed
2. INPUT #1, B$ 'B$="XM 123. m" X to MARK

3. INPUT #1, C$ 'C$="YM 456. m" Y to MARK
4. INPUT #1, D$ 'D$="MK" Marking complete

10) Sample Programs

1. Sample program (1)

The conditions of "Example of Usage 1" in the Operation Manual can be programmed as follows using S commands.

Notes:

1. The reason for changing the mode to READY mode in line 1020 is that certain conditions of the X-PLAN can only be set in READY mode.
2. The program will stop when "NAK" is returned after executing an S command.
3. After the conditions have been set, the buzzer sounds twice and a message is displayed to start measurements.
4. The program ends with the pressing of the [CE/C] key.

----------Sample Program (1)----------

```
1000 'SAMPLE1
1010 OPEN "COM1:N83NN" AS #1          'Open RS-232C
1020 PRINT #1, "SLR"                  'Change to READY mode
1030 INPUT #1, A$                     'Check if set
1040 IF A$=CHR$(&H15) THEN STOP
1050 PRINT #1,"SENNYNNNNN0NNNN"       'Area measurement selected
1060 INPUT #1, A$                     'Check if set
1070 IF A$=CHR$(&H15) THEN STOP
1080 PRINT #1, "SU12"                 'Unit m
1090 INPUT #1, A$                     'Check if set
1100 IF A$=CHR$(&H15) THEN STOP
1110 PRINT #1, "SSRX200"              'Scale ratio 1/200
1120 INPUT #1, A$                     'Check if set
1130 IF A$=CHR$(&H15) THEN STOP
1140 PRINT #1, "SF2"                  'Fix two decimal point digits
1150 INPUT #1, A$                     'Check if set
1160 IF A$=CHR$(&H15) THEN STOP
1170 PRINT #1, "SNN"                  'No numbering
1180 INPUT #1, A$                     'Check if set
1190 IF A$=CHR$(&H15) THEN STOP
1200 PRINT #1, "SPY"                  '"Output" mode
1210 INPUT #1, A$                     'Check if set
1220 IF A$=CHR$(&H15) THEN STOP
1230 PRINT #1, "DSTART MEASUREMENT (SAMPLE1)"         'Start message
1240 PRINT #1, "BZ2"                  'Sound buzzer twice consecutively
1250 *IN.D
1260 INPUT #1, D$                     'Input data
1270 PRINT D$                         'Display input data
1280 IF D$<>"CL" THEN *IN.D           'End with CL key
```

```
1290 END
```

2. Sample program (2)

The conditions of "Example of Usage 2" in the Operation Manual can be programmed as follows using S commands.

Notes:

1. In this program, "ACK/NAK" is read in but not checked.
2. Sounding the buzzer in lines 1160 and 1230 is a prompt to point to the first point (point A) and the second point (point B).
3. Input of machine coordinates in lines 1170, 1180, 1240, and 1250 is to check that the [S/P] key has been pressed.
4. Line 1260 sounds the buzzer to prompt the [NO] key, and lines 1270 and 1280 input RX and RY in order to check that it is pressed.
5. The reason for changing to READY mode in line 1290 is that pressing [S/P] at point A to set the axes has switched the X-PLAN to SET mode.
6. The program ends with the pressing of the [CE/C] key.

----------Sample Program (2)----------

```
1000 'SAMPLE2
1010 OPEN "COM1:N83NN" AS #1          'Open RS-232C
1020 PRINT #1, "SLR"                  'Change to READY mode
1030 INPUT #1, A$                     'ACK input with no checking
1040 PRINT #1, "SPY"                  '"Output" mode
1050 INPUT #1, A$
1060 PRINT #1, "SEYNNNNNNN0NNNN"   'Coordinate measurement
1070 INPUT #1, A$
1080 PRINT #1, "SU12"                 'Unit m
1090 INPUT #1, A$
1100 PRINT #1, "SAM2"                  'Standard axes with 2 known points
1110 INPUT #1, A$
1120 PRINT #1, "SAX112100"             'X1=100m
1130 INPUT #1, A$
1140 PRINT #1, "SAY112-300"            'Y1=-300m
1150 INPUT #1, A$
1160 PRINT #1, "BZ2"                  'Sound buzzer twice consecutively
1170 INPUT #1, D$                      'X1 machine coordinate
1180 INPUT #1, D$                      'Y1 machine coordinate
1190 PRINT #1, "SAX212300"             'X2=300m
1200 INPUT #1, A$
1210 PRINT #1, "SAY212500"             'Y2=500m
1220 INPUT #1, A$
1230 PRINT #1, "BZ2"                  'Sound buzzer twice consecutively
1240 INPUT #1, D$                      'X2 machine coordinate
1250 INPUT #1, D$                      'Y2 machine coordinate
1260 PRINT #1, "BZ2"                  'Sound buzzer twice consecutively
1270 INPUT #1, D$                      'RX
```

```
1280 INPUT #1, D$                    'RY
1290 PRINT #1, "SLR"                 'Change to READY mode
1300 INPUT #1, A$
1310 PRINT #1, "SF2"                 'Fix two decimal point digits
1320 INPUT #1, A$
1330 PRINT #1, "SND"                 'Numbering during measurement
1340 INPUT #1, A$
1350 PRINT #1, "BZ2"                 'Sound buzzer twice consecutively
1360 PRINT #1, "DSTART MEASUREMENT (SAMPLE2)"      'Start message
1370 *D.IN
1380 INPUT #1, D$                    'Input data
1390 PRINT D$                        'Display input data
1400 IF D$<>"CL" THEN *D.IN          'End with CE/C key
1410 END
```

3. Sample program (3)

Here is a sample of the X-PLAN acting as a simple digitizer to read coordinates.

Notes:

1. Checking set conditions is done by the "*CHK" subroutine.
2. Line 1160 makes only the [CL/C] and [S/P] keys active in order to avoid unnecessary manual operations.
3. The program ends with the pressing of the [CE/C] key.

----------Sample Program (3)----------

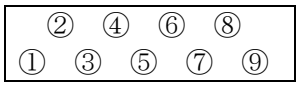
```
1000 'SAMPLE3
1010 OPEN "COM1:N83NN" AS #1          'Open RS-232C
1020 PRINT #1, "SLR"                  'Change to READY mode
1030 GOSUB *CHK                       'Check if set
1040 PRINT #1, "SEYNNNNNNN0NNNN"      'Coordinate measurement
1050 GOSUB *CHK
1060 PRINT #1, "SU10"                 'Unit mm
1070 GOSUB *CHK
1080 PRINT #1, "SSRX1"                'Scale ratio 1/1
1090 GOSUB *CHK
1100 PRINT #1, "SAO"                  'Machine axes
1110 GOSUB *CHK
1120 PRINT #1, "SFN"                  'Do not fix decimal point digits
1130 GOSUB *CHK
1140 PRINT #1, "SNN"                  'No numbering
1150 GOSUB *CHK
1160 PRINT #1, "SKYNNNNNNNNNNNNNNNNNNNNNNNYNN"
                                      'Make only CE/C, S/P keys active
1170 GOSUB *CHK
1180 PRINT #1, "SPY"                  '"Output" mode
1190 GOSUB *CHK
1200 PRINT #1, "DSTART MEASUREMENT (SAMPLE1)"      'Start message
```

```
1210 PRINT #1, "BZ2"                    'Sound buzzer twice consecutively
1220 D$=""                              'Clear D$
1230 WHILE D$<>"CL"                       'End with CE/C key
1240 INPUT #1, D$                       'Input data
1250 PRINT D$                             'Display input data
1260 WEND
1270 END
1280 '
1290 *CHK
1300 INPUT #1, A$                       'Check if set
1310 IF A$=CHR$(&H15) THEN STOP         'Stop if "NAK"
1320 RETURN
```

R-1) Pin Configuration of the X-PLAN Connector

It is necessary to select the interface cable which is compatible with the computer used.

Pin arrangement (viewed from outside of the X-PLAN unit)



The role of each pin

Pin	Signal Name	Description	Input/Output	Cable color
①	PE	Detects printer	Input	
②	CE	Detects computer	Input	
③	+V	Printer power		Brown
④	TXD	Transmit data	Output	Orange
⑤	RXD	Receive data	Input	Yellow
⑥	CTS	Transmit possible	Input	Green
⑦	RTS	Receive possible	Output	Red
⑧	GND	Ground		(Shield)
⑨	VST	Printer power		

1. During connection with a computer, signal lines 4, 5, 6, 7, and 8 are used.
2. CTS 6 is an input signal, and if this is not ON (positive logic), the X-PLAN will not output data through TXD 4. Thus, it should be connected to a control port that is ON whenever the computer is ready to receive data.
3. RTS 7 is an output signal, and if this is not ON (positive logic), the X-PLAN will not receive data properly through RXD 5. Thus, RTS 7 should be connected to a control port that is ON whenever the computer is ready to send data.
4. Cable color refers to colors of each line within the interface cable.

R-2) Itemized Explanation of Interface Conditions

Data Length: Signifies the number of bits in one character of data. When transmitting characters beyond &H80 in ASCII code (&H indicates hexadecimal) such as special characters, this must be set to 8 bits.

Baud Rate: Signifies the bit transmission speed per second. Larger numbers mean faster transmission speeds.

Parity Check: This is for the receiving side to check if the data has been sent correctly. None means that no checking is performed.

Stop Bit: This is the bit(s) appended to each character of data, and can be set to 1 bit or

2 bits.

Delimiter: Signifies the end of data. The delimiter used for output from the X-PLAN to the computer is selected here. As for the delimiter from the computer to the X-PLAN, any of CRLF, CR, or LF are allowed.

Transmitted data	Delimiter (1 chr.)

(Note) Depending on the type of computer, it may be necessary for the user's program to process this delimiter. See your computer's manual.

Control: Signifies the method of transferring data between the X-PLAN and computer, selected from among three control methods. See R-3.

R-3) Three Control Methods (Data Transmission Control Methods)

There are three methods (OFF, RON, XON) of controlling the timing of data transmission.

OFF Control is according to RTS and CTS signals. This is what is generally used.

When the CTS of the X-PLAN is OFF, the X-PLAN stops sending data to the computer, and resumes output of data after it recovers to ON. When its input buffer is more than 3/4 full, the X-PLAN turns the RTS off and stops data coming from the computer.
Thereafter, when the buffer recovers to less than 1/4 full, the RTS is turned back on and data input from the computer is resumed.
Normally this setting is used, and is the setting at factory shipment.

RON Regarding transmission of data or commands, the character R is used for control. This setting is used for computers with a half duplex interface and a slow data processing speed or when data transmission must be done particularly accurately.

XON Control is according to XON/OFF. When dealing with large amounts of data, this is effective for computers which support XON/OFF control.
When the X-PLAN receives the XOFF code ("&H13" in ASCII code: &H indicates hexadecimal), it stops sending. Thereafter when it receives the XON code ("&H11" in ASCII code), it resumes output of data.
When its input buffer is more than 3/4 full, the XOFF code is output by the

X-PLAN and data coming from the computer is stopped.
Thereafter, when the buffer recovers to less than 1/4 full, the XON code is output by the X-PLAN and data from the computer is resumed.

(Note)

1. To use OFF, the user's program need not specify anything.
2. XON is set manually (pressing [SFT] + [SET]) or by command, but the control itself is done automatically by the operating system software, with no burden to the user's program.

3. RON uses the character "R" to control data transmission, and the control must be performed by the user's program itself. This method is not usually implemented. The next section, R-4, describes how to use RON.

R-4) Timing of Data Input/Output Using RON

Transmission is controlled by sending the character R back and forth between the user's program and the X-PLAN.

1. How to set measuring conditions

1) S Commands

S Command Output PRINT #1,"S Command"	The X-PLAN will execute the command.
↓	
Read Execution Result INPUT #1,A$	ACK is returned in case of success. NAK is returned in case of error. (Note) The X-PLAN does not return "R".

(e.g.)

```
1. PRINT #1, "SEYNNNNNNN0NNNN"      'Measure coordinates.
   INPUT #1, A$                     'A$=CHR$(&H06):ACK
2. PRINT #1, "SEYNNNNNNN0NNNNN"     'Data has one character too many.
   INPUT #1, A$                     'A$=CHR$(&H15):NAK
```

2) P Commands

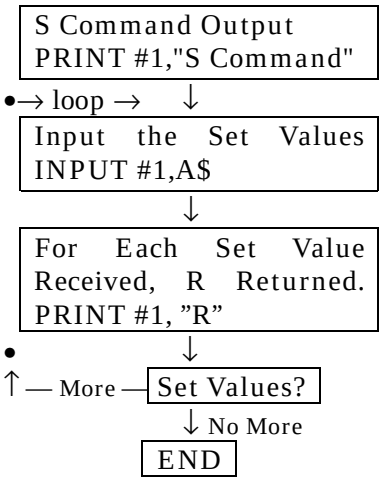
P Command Output PRINT #1,"P Command"	The X-PLAN will execute the command.
↓	
Read Execution Result INPUT #1,A$	Regardless of success or failure, the X-PLAN returns the character "R". (Note) ACK and NAK are not returned.

(e.g.)

```
1. PRINT #1, "BZ2"        'Sound buzzer twice consecutively.
   INPUT #1, A$           'A$="R":  The X-PLAN returns "R."
2. PRINT #1, "BZ5"        '"BZ5" command is not supported.
   INPUT #1, A$           'A$="R":  The X-PLAN returns "R."
```

2. How to reference set values

1) S Commands

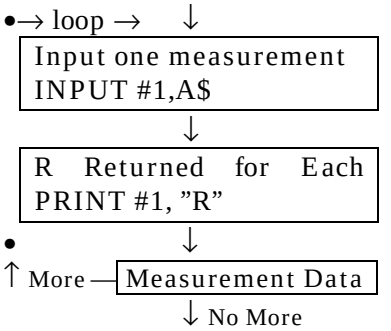


(e.g.)

```
1. PRINT #1, "SE"         'Reference measuring functions.
   INPUT #1, A$           'A$="SMNNYYNNNN0NNNN" Measure area and line.
   PRINT #1, "R"          'Return "R" after receiving data.
2. PRINT #1, "SS"         'Reference scale ratio.
   INPUT #1, A$           'A$="SSRX1000."   :RX=1000
   PRINT #1, "R"          'Return "R" after receiving data.
   INPUT #1, B$           'B$="SSRY1000."   :RY=1000
   PRINT #1, "R"          'Return "R" after receiving data.
3. PRINT #1, "SX"         '"SX" command is not supported.
   INPUT #1, A$           'A$=CHR$(&H15):NAK
```

(Note) The P Commands have no reference function.

3. How to input measurement data



(e.g.)

```
1. INPUT #1, A$          'A$="d          26.1 m":line segment data
   PRINT #1, "R"         'Return "R" after receiving data.
2. INPUT #1, A$          'A$="X          3.8196 m": X-coordinate
   PRINT #1, "R"         'Return "R" after receiving data.
   INPUT #1, B$          'B$="Y          4.3766 m": Y-coordinate
   PRINT #1, "R"         'Return "R" after receiving data.
```

R-5) Initialization of Measuring Conditions of the X-PLAN

As is explained in the section dealing with the initialization of interface conditions, by pressing the [CE/C] key while turning on the power, the X-PLAN is initialized to the state shown below. Once set or changed, most of these conditions are saved even after the power is turned off. However, the axes definition, auto-power-off function, active or inactive keys, and delay time settings are reset.

Initial Set Values of the X-PLAN

Measuring functions	Coordinates, area, line
Unit	m (length), degree & minute (angle)
Scale ratio	1/1
Coordinate axes	Standard axes
Origin bias	X=Y= 0
Decimal point place	Not fixed
Auto-Numbering	Not selected
Data length	8 bit
Baud rate	1200 baud
Parity check	None
Stop bit	2 bits
Delimiter	CRLF
Control	OFF
Connected device	Printer (*see below)
Output/Non Output	"Non Output" mode

*(Note)
The X-PLAN will automatically detect whether it is connected to one of the interface cables specifically designed for it or to the miniprinter 16b.
---> Auto-Sensor Function