MONOTYPE MATHEMATICS

The Monotype System of Mathematics is more easily understood if the printer, already familiar with the terms picas and points, translates these two measurements into thousandths and ten-thousandths of an inch.

Accuracy of Monotype-cast type is maintained by the use of Micrometers to measure the height-to-paper (type high), point size and set size of the type cast.

Height-To-Paper (type high) is a fixed size, although this size varies in different countries throughout the world. In the United States and Canada type-high is .918″ from the foot of the type to the face of the character or printing surface.

Point Size, thickness of the type from its nick side to the opposite side of the type body. This, a fixed size can only be changed by changing the point size of the mold used.

Example: A 12-point mold casts type whose size measures .166″ from the nick to the opposite side of the type body. This .166″ is the decimal size of one pica, and only 12-point type can be cast with this mold.

Set Size, the width of a type body measured "linewise". This size is changed for characters of a font of any point-size so that they will cast on their proper size bodies.

Monotype Matrices used for composition casting are termed "Cellular Matrices". These matrices are of bronze and accurately milled to .200″ square. Holding a cellular matrix as in casting position notice a

tapered hole in the end of the matrix, this hole known as the "cone hole" is accurately drilled and reamed, into which the centering pin of the Casting Machine enters before each cast is made. The characters are driven into the face end of the matrix to a depth of .030″ called (depth of drive), and when used to cast type on a standard Monotype Composition Mold having a casting cavity, from base to top of .888″, forms type of type high of .918″.

.888″ + .030″ = .918″

Note: This measurement (type high) is fixed by the height of the mold plus the depth of drive of the matrix.

All type faces designed for Monotype Machine Composition are given a set-size based upon the widest character in the font, usually the Cap M. While the term set-size is used, it is still a measurement in points.

Example: A 12-point 12-set face has its widest characters cast 12 points or .166″ square. All other characters of the font are made for and cast on proportionate body sizes.

These proportionate body sizes are referred to as "Unit-Sizes" and the average font contains characters ranging in size from 5 to 18 Units of any given set size. Therefore, all characters in a font may be cast on their proper size body without distorting the characteristics of the face.

As two terms are to be discussed (Set-Size and Unit-Size) first consider 1 Unit of 1 Set in its thousandths of an inch reading which is .0007685″. This is obtained in a 12-point 12-set face by—

1. Dividing 12 set or .166″ by 18 units = .009222″ which is 1 unit of 12 set.
2. Divide 1 unit of 12 set or .009222″ by 12 = .0007685″ which is the thousandths of an inch reading for 1 unit of 1 set.

Example:

1 Unit of 12 Set	1 Unit of 1 Set
.009222	.0007685
18).166000	12).0092222
162	84
40	82
36	72
40	102
36	96
40	60
36	60

This same result of .0007685″ or 1 Unit of 1 Set may be obtained by dividing 18 Units of 6 Set.

Example:

1 Unit of 6 Set	1 Unit of 1 Set
.004611	.0007685
18).083000	6).0046111
72	42
110	41
108	36
20	51
18	48
20	30
18	30

The size of any character may be determined by multiplying the set size by the unit size, and the results by 1 Unit of 1 Set or .0007685″.

Example: Find the set size of a character which is 9 Units of 8 Set.

1. Multiply 9 x 8 = 72
2. Multiply 72 x .0007685″ = .0553″

The answer of .0553″ is the set size of this character in thousandths of an inch.

The result of this first multiplication is known as the "Set Factor" which may be used to great advantage by the Monotype Operator.

Example: An operator wishes to use this same 9 unit of 8 set character with a 9 set face. By dividing the set factor 72 by the set of the new face 9 a result of 8 is obtained. This means that the 9 unit character of the 8 set face may be placed in the 8 unit row of the 9 set face and will still cast on its proper size set-wise. By the same means it would be found that this character could also be cast on the 6 unit row of a 12 set face or the 12 unit row of a 6 set face and still be on its proper body size set-wise.

An operator may also determine the variations in thousands of an inch whenever the Set Factor does not exactly agree in Unit or Set Size by multiplying 1 Unit of 1 set .0007685″ by the number of set factors over or under the size desired.

Example: There is a variation of two Set Factors over the size desired. Thus, 2 x .0007685″ = .001537″. This character would then be cast with an additional .0015″ white space to the left of the character, which is a negligible amount.

An alert Keyboard Operator can greatly benefit with such knowledge, by saving keystrokes in certain work classifications, by eliminating thin spaces, and also avoiding letter-spacing characters used for reference marks.

Example: A ruled form job is to be set requiring a superior figure with a space between it and the vertical rule. By placing the superior figure in a unit row large enough to add the necessary space to the set size of the character body the space and the figure can be set and cast with one keystroke and one Caster revolution instead of two strokes and two Caster revolutions otherwise necessary. This will also eliminate the thin spaces in the job.

In another case 9 unit piece-braces are to be used with a 9 unit space. By placing the 9 unit piece braces in the 18 unit row of the Matrix Case, the 9 unit piece-braces and the 9 unit space are set and cast with one keystroke and one Caster revolution. Many additional uses may be found for the practical application of this information and it will serve to test the imagination and resourcefulness of the operator.

Pause now to examine a font of matrices in a Standard C Matrix Case arrangement.

Arrangement C

ROMAN CAPS, SMALL CAPS, and lower case; *ITALIC CAPS and lower case;* Roman and Italic figures and Roman fractions

Row	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Unit Value
1	■	■	*l*	*t*	‘	’	.	,	■	l	i	]	[	′	|	5
2	*j*	*f*	*i*	!	:	;	-	j	f	I	/	:	;	■	■	6
3	*c*	*r*	*s*	*e*	)	(	’	‘	r	s	t	J	*v*	°	*z*	7
4	‡	*q*	*	*b*	*g*	*o*	?	I	z	c	e	Z	S	†	*?*	8
5	*I*	■	*9*	*7*	*5*	*3*	*1*	*0*	.	9	7	5	3	1	0	9[1]
6	C	■	■	*8*	*6*	*4*	*2*	*$*	–	$	8	6	4	2	■	9[2]
7	*x*	*k*	*y*	*d*	*h*	*a*	x	J	g	o	a	P	F	L	T	9[3]
8	A	*fi*	*u*	*n*	.	S	v	y	p	u	n	Q	B	O	E	10[1]
9	D	■	*fl*	*p*	fl	fi	q	k	b	h	d	V	Y	G	R	10[2]
10	H	&	*J*	*S*	*œ*	*æ*	*ff*	■	Z	■	ff	X	U	K	N	11
11	*O*	*L*	*C*	*F*	*w*	£	æ	L	P	F	¶	M	*Z*	*Q*	*G*	12
12	*E*	&	Q	V	C	B	T	O	E	A	w	*P*	*T*	*R*	*B*	13
13	*D*	*A*	*Y*	*ffl*	*ffi*	*m*	œ	Y	U	G	R	Œ	Æ	W	*V*	14
14	*K*	*N*	*H*	ffl	ffi	X	D	N	K	H	m	*&*	℔	*X*	*U*	15
15	Œ	*Æ*	¾	¼	½	*W*	*M*	—	..	M	W	%	*Œ*	*Æ*	■	18
Row	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Unit Value

These Characters are carried in the Matrix Case in this Arrangement

ABCDEFGHIJKLMNO
PQRSTUVWXYZ&ÆŒ
ABCDEFGHIJKLMNOPQRST
UVWXYZ&ÆŒ
abcdefghijklmnopqrstuv
wxyzæœfiffflffiffl.,-:;‘’’!?
ABCDEFGHIJKLMNO
PQRSTUVWXYZ&ÆŒ
abcdefghijklmnopqrstuvwx
yzæœfiffflffiffl:;!?
*†‡¶|%£℔′°[] ()
$1234567890½¼¾
$1234567890

LEFT
Keybank C—Keybars C
3 Keybutton Clips

Stopbars S5

RIGHT
Keybank C—Keybars C
1 Keybutton Clip

Problem 1. Determine the set factors for all Unit Values of a font of 12 point 12-set matrices in a Standard C Arrangement.

2. Determime all the type sizes in thousandths of an inch for a font of 12-point 12 set matrices in a Standard C Arrangement.

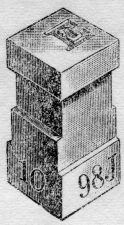
Example: 18 units x 12 set = set factor 216
1 unit of 1 set (.0007685″) x set factor 216 = .166″

Note: All characters in row 15 are designated as 18 unit characters.

Although it is not necessary for an operator to calculate these sizes, the problems presented will help to build a better understanding of the principles involved in Monotype Mathematics.

This information is supplied by the Monotype Company in printed form. One table contains all Set-Sizes from 1 unit of 5 set to 22 units of 12 set. Another table contains all Set Factors of the various combinations of Set Sizes and Unit Sizes. To check your work for accuracy refer to the charts, "Table of Type Sizes and Table of Set Factors."

It should now be possible to calculate the width of the type body, in thousandths of an inch, determine the Set Factor for any given character in any point and set-size, but it poses another problem. Bear in mind that a cellular Matrix is only .200" square and ample room is not provided to mark all the foregoing information on any matrix. Therefore, a Matrix Marking System had to be devised. The operator should thoroughly understand this system for reducing the markings on a Matrix to Set-size and Unit-value. A font of cellular Matrices usually consists of Caps A to Z&, and lower case a to z, fi, ff, fl, ffl, ffi; figures 1 to 0 $. , - ; : ' ? ! . Such a font of matrices would be marked with point size and face identification.



When held so that the character may be read, the lower left side of the Matrix is stamped "10", for the point-size, and the lower edge facing you stamped "98J" for the face number. Matrices not part of any font, but universally used, are marked with the point-size, set-size and unit value. Capital letters following the point-size indicate the set-size as follows:

Z - 5 Set	W - 8 Set	T - 11 Set
Y - 6 Set	V - 9 Set	S - 12 Set
X - 7 Set	U - 10 Set	

Fractions of any set are indicated by three lower-case letters following the Capital Letters

a - ¼ Set	b - ½ Set	c - ¾ Set

Thus: 8 Set would be Wb, and 10¾ Set would be Uc.

Lower-case letters following the Face identification figures indicate the unit-value of the characters.

a - 4 Units	g - 10 Units	m - 16 Units
b - 5 "	h - 11 "	n - 17 "
c - 6 "	i - 12 "	o - 18 "
d - 7 "	j - 13 "	p - 19 "
e - 8 "	k - 14 "	q - 20 "
f - 9 "	l - 15 "	r - 21 "
		s - 22 "

Problem: 3. Use the above three tables to complete the Matrix Markings for the following.

	Set	Unit Value
10 Point	10	15
7 "	7½	13
12 "	11¼	8
6 "	7	10

4. Transpose the following Matrix Markings to point-size, set-size, and unit-value.
Note: Ignore the bold symbols as they will be explained at a future date.

10Ub - **10Rg**	6S - **40Pb**
8Wc - **3698Xf**	12S - **60Rh**