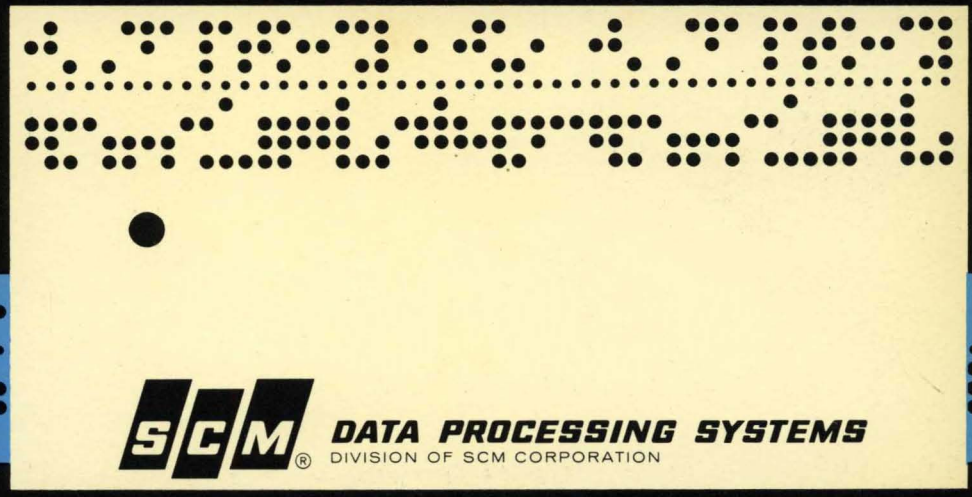
SCM®

TYPETRONIC

7816

POINT TO POINT PROGRAMMING MANUAL



SCM DATA PROCESSING SYSTEMS

SCM® DATA PROCESSING SYSTEMS
DIVISION OF SCM CORPORATION

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Preface

From a programming standpoint, the TYPETRONIC 7816 Automated Data Computing system is an extension of the TYPETRONIC 2816 Automated Data system. The 7816 retains all of the highly versatile functional and programming characteristics of the 2816 and supplements them with computing and digital storage capability.

This manual has been prepared for those who have a working knowledge of TYPETRONIC 2816 programming and now wish to acquire basic 7816 programming technique. This manual is a primer only and should not be treated as a comprehensive textbook.

For those who have not yet become familiar with 2816 programming, it is recommended they acquire a copy of the 2816 POINT TO POINT PROGRAMMING MANUAL (Form No. DPS 2016).

Both the 2816 and 7816 POINT TO POINT PROGRAMMING MANUALS deal with programming and procedural characteristics only. Complete functional and operating descriptions of the 2816 and 7816 systems will be found in their associated PRODUCT DETAIL MANUALS (Form Nos. DPS 2014 and 2015).

Primary 7816 application programming is a service provided at no charge to all SCM TYPETRONIC customers by the SCM Data Processing Systems Division.

Contents

1.
Introduction

How The 7816 Differs From The 2816

The TYPETRONIC 7816, is an extension of the TYPETRONIC 2816 Automated Data System. The most significant difference in the two systems is the inclusion of a "Computing Processor" with the 7816. The Processor consists of an electronic solid-state arithmetic unit connected to an SCM designed magnetic memory disc. The Processor, from a hardware viewpoint, is an independent input/output component of the system. That is, the Processor may be disconnected from the system without disturbing the other functional characteristics (such as automatic tape reading, printing, and punching). The Processor is connected to the system through the Master Control Module (described in the 7816 Product Detail Manual) with simple plug-in connectors.

Differences In Control

Manual Control

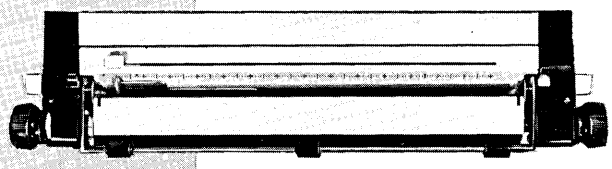
Restore

This key, familiar as the PARITY Reset control of the 2816 system has two additional functions with the 7816.

1. When depressed during a manual entry it will clear the buffer register, if track seven of Field Control is programmed to permit this. It clears all register indications, decimal modifiers, sign reversals, and restores the original order entry.
2. When the RESTORE key is operated simultaneously with the CLEAR STORAGE key it clears all "unlocked" 7816 registers.

Clear Storage

The CLEAR STORAGE key, familiar to 2816 users as the 7-8 PUNCH control also has three functions. As with the 2816 system, this key, when held down while a typing key is operated, will add the 7-8 bit holes to a code configuration. CLEAR STORAGE, when operated with the RESTORE key, will clear all registers not locked by Program Panel wiring. Finally, with Code Control "ON", this key operated with certain printing keys can be used to manually "address" the TYPETRONIC Computing Processor.



MULTIMODE Field Control

Unlike the 2816, MULTIMODE Field Control is a standard feature on all 7816 systems. In addition to dual-mode control ability, as described in the 2816 PRODUCT DETAIL MANUAL, the 7816 Field Control provides two supplementary tracks (7 and 8) of control. These tracks are always "ON" during a PA1 external entry sequence (See Section 2, 7816 control and programming codes).

MULTIMODE Field Control (continued)

Track Seven

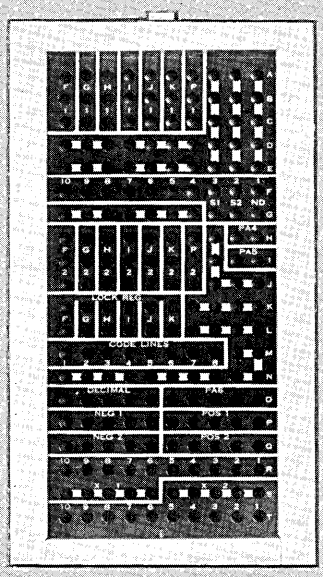
This track is used to enable the clearance of a manual entry with the RESTORE control key. If no signal is programmed in this track, the clear-entry function will not occur (this does not affect the operation of the RESTORE key as a parity reset or Clear Storage function when used with the CLEAR STORAGE key).

When track seven does provide a signal at a given column during a manual entry to the system, depression of the RESTORE key will clear the entry back to the order entry designation. A proper clearance is indicated by the light under the RESTORE key.

Track Eight

Typically track eight is used as a decimal verification track. A signal from this track turns on Reader One to initiate the automatic printing of a decimal representative code. This track is active whenever a PA1 (external entry) command code has been read (with Code Control "ON"). Since this track will always be on during a PA1 sequence, it can be used as a "third" Reader One On mode during these sequences.

The Output Control Panel



The 7816 system is also distinguished from the 2816 by an Output Control Panel. This panel is used for the control of Processor output, and is quite easy to program. Control Panel programming information will be found in section 3.

Automatic Control

The 7816 is controlled automatically by "control codes" just as the 2816 system.

The technique used for controlling the operating and computing functions of the 7816 is called VERSATRONIC programming. This technique permits virtually absolute freedom in format design, systems operation, and control programming.

The following section (2) describes each of the TYPETRONIC Control Codes used to address and instruct the Computing Processor. The characteristics of the Processor arithmetic and memory control are described thereafter.

2.
7816 Control and Programming Codes

(A Complete TYPETRONIC Code Chart is on page 9.)

Because of the unique VERSATRONIC programming technique used with the 7816 system, form and field requirements are virtually "non-restrictive." This means that entries and read-outs can be made in any logical position on a form, with complete freedom of columnar selection. There are two general classes of Processor codes, *Access* and *Instruction.*

The Processor Access Codes (PA codes)

Six codes, not used in the 2816 system, initiate "access" to the Processor and condition it for specific types of entry or output. These codes function as control codes (as described in the 2816 programming manual) and their response is governed by the state of the Code Control mode. That is, if Code Control is on these codes will function but not punch, and if Code Control is off they will punch but not function. (NOTE: When these functions are initiated manually, rather than through an OPTIMATIC Reader, they *will* punch if a Vertipunch is on.)

The Six PA Codes Are:

PA1

Alerts the Processor for an external entry (an entry from keyboard or reader). Whenever the PA1 code is read (with Code Control "ON") Field Control tracks 7 and 8 will be activated.
When the PA1 code is read, a sequence of following Instruction codes will have specific meaning to the Processor (see Entry description on page 14.).

PA2

The PA2 code conditions the Processor for an Internal Transfer (a transfer from the buffer register to one or more of the storage or factor registers).

PA3

This code prepares the Processor for output from any selected Processor storage register to any "ON" system components (printers & punches) and the buffer register. The selected register is always "clear" after a PA3 sequence.

PA4

The PA4 code is also an output command, but it establishes output from a register by use of the extractor function as programmed on the Output Program Panel. The "extractor" enables *selected orders* of a register to be read out to the buffer (and "ON" output components) as zeros. This feature provides an effective means of "discarding" unwanted digit remainders, and obtaining true register splits. The selected output register is clear after a PA4 sequence unless the program panel is wired to prevent this.

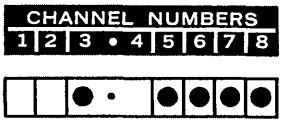
PA5

Also an output code, PA5 sets up selected register output (as with PA3) with an additional automatic transfer to the D (multiplicand) register. PA5 is used most frequently when a series of multiplications (such as chain discounts) are to be performed (i.e. transferring the Product to the Multiplicand register automatically). The selected register clears unless prevented by program panel wiring.

PA6

This is a "zero interrogation" access code. When this code is read (along with a selected register code), the register will be examined for zero content. When the content is zero, a code signal will be emitted from the Processor. Since this signal can be Program Panel wired to be any (five-hole) TYPETRONIC code (other than PA codes), great versatility is possible. The PA6 sequence *does not* clear the selected register.

The PROCESS Code



One additional Processor control code (PROCESS) is used with the 7816 system. The code is in effect the "go" code. After the appropriate PA code has been read along with the Instruction codes, the PROCESS (PRC) code initiates the action. It figuratively tells the Processor to "perform the functions" that have been indicated by the PA code sequence. The PRC code always terminates a PA sequence.

Processor Instruction Codes

The codes that instruct the Processor "how to do it" after the PA code has indicated "what to do" are called *Instruction codes.* They are grouped into six categories:

1. Register Selection Instruction

These codes, when read after a PA code, will instruct the Processor what register or registers to operate on. With input and transfer (PA1 and PA2), TYPETRONIC 7816 registers may be selected individually or in groups. With Output (PA3, PA4, PA5,) and zero-test (PA6), only one register should be selected in the PA sequence.

The following TYPETRONIC I/O Printer codes are used to select registers. When read during any PA sequence (with Code Control "ON") these codes will not print or punch even though AUTO PRINT or VERTIPUNCHes are on:

I/O Printer Code	Instruction
F	Selects Register F for Input, Transfer or Output
G	Selects Register G for Input, Transfer or Output
H	Selects Register H for Input, Transfer or Output
I	Selects Register I for Input, Transfer or Output
J	Selects Register J for Input, Transfer or Output
K	Selects Register K for Input, Transfer or Output
P	Selects Product Register for Input, Transfer or Output
A	Selects Register J for Sign Reversal Input Only
B	Selects Register K for Sign Reversal Input Only
D	Selects Multiplicand Register for Entry Only
R	Selects Multiplier Register for Entry Only

2. Entry "Shift" Codes

These codes "left shift" the decimal point of an entry. They are used when percentages or prices per hundred or thousand are used. When entered manually or automatically (in a PA1 sequence) they *will* print and punch (if AUTO PRINT and/or a VERTIPUNCH is on). They are effective in a PA2 sequence but *will not* print or punch.

%	Shifts the decimal entry two places to the left
C	Shifts the decimal entry two places to the left
M	Shifts the decimal entry three places to the left

3. "Sign" Reversal Codes (Negatives)

Sign reversal codes algebraically affect the sign of selected registers. Since the effect *is* algebraic, two negatives will make a positive and the Non-printing Minus (N) combined with the Printing Minus (—) will be positive.

N Non-printing Minus. Will not print or punch in a PA sequence.

— Printing Minus. Will print and punch. Used most frequently in a **manual** entry to reverse the sign of an entry from its norm. The Printing Minus is also effective in a PA2 sequence, but in this sequence it **will not** print or punch.

4. Order Entry Designations

The Order Entry codes are *always* read immediately following a PA1 code and they *must* be so programmed. The ten decimal digits (0-9) and the letter "Y" are used to designate the start order of the first digit entry into the buffer. Subsequent digits enter sequentially into lesser order positions.

Y	Selects the eleventh order for entry to the D (multiplicand) and R (multiplier) registers only.
Ø (zero)	Selects the tenth order of entry to all registers
9	Selects the ninth order of entry to all registers
8	Selects the eighth order of entry to all registers
7	Selects the seventh order of entry to all registers
6	Selects the sixth order of entry to all registers
5	Selects the fifth order of entry to all registers
4	Selects the fourth order of entry to all registers
3	Selects the third order of entry to all registers
2	Selects the second order of entry to all registers
1	Selects the first order of entry to all registers

5. Register Split Selection (Output Only)

The alternate part of a register may be selected for output by including the digit 2 in the output (PA3, PA4, PA5 or PA6) sequence. When the digit 2 is used in this manner it will not print or punch.

6. The Space Code

During a PA1 sequence the space code will be recognized as a zero in the Processor. On output (PA3, 4 or 5), zeros before the first significant digit will print and punch as spaces.

7. Backspace

In a PA1 sequence Backspace will backstep the entry order one position per depression. It will print and punch.

TYPETRONIC 7816 Systems Code Chart

PRINTING CHARACTER CODES

CHARACTERS LOWER	CHARACTERS UPPER	CHANNEL NUMBERS 1 2 3 • 4 5 6 7 8	FUNCTION WITHIN 7816 PA SEQUENCES (WITH CCN)
1	!	●	•					ORDER ENTRY 1 (PA 1)
2	@		●	•					ORDER ENTRY 2 (PA 1) ALSO SELECTS REGISTER SECOND OUTPUT (PA 3 4 5)
3	#	●	●	•	●				ORDER ENTRY 3 (PA 1)
4	$			●•					ORDER ENTRY 4 (PA 1)
5	=	●		●•	●				ORDER ENTRY 5 (PA 1)
6	¢		●	●•	●				ORDER ENTRY 6 (PA 1)
7	"	●	●	●•					ORDER ENTRY 7 (PA 1)
8	*			•●					ORDER ENTRY 8 (PA 1)
9	(	●		•●	●				ORDER ENTRY 9 (PA 1)
0	)			•		●			ORDER ENTRY 10 (PA 1)
A	A	●		•			●	●	SELECT -J REGISTER (PA 1, 2)
B	B		●	•			●	●	SELECT -K REGISTER (PA 1, 2)
C	C	●	●	•		●	●	●	SHIFT DECIMAL LEFT TWO PLACES (PA 1)
D	D			●•			●	●	SELECT D REGISTER (PA 1, 2)
E	E	●		●•		●	●	●	
F	F		●	●•		●	●	●	SELECT F REGISTER (PA 1, 2, 3, 4, 5, 6)
G	G	●	●	●•			●	●	SELECT G REGISTER (PA 1, 2, 3, 4, 5, 6)
H	H			•●			●	●	SELECT H REGISTER (PA 1, 2, 3, 4, 5, 6)
I	I	●		•●		●	●	●	SELECT I REGISTER (PA 1, 2, 3, 4, 5, 6)
J	J	●		•		●		●	SELECT J REGISTER (PA 1, 2, 3, 4, 5, 6)
K	K		●	•		●		●	SELECT K REGISTER (PA 1, 2, 3, 4, 5, 6)
L	L	●	●	•				●	
M	M			●•		●		●	SHIFT DECIMAL LEFT THREE PLACES (PA 1)
N	N	●		●•				●	REVERSES SIGN OF ENTRY (PA1 - PA2)
O	O		●	●•				●	
P	P	●	●	●•		●		●	SELECT P REGISTER (PA 1, 2, 3, 4, 5, 6)
Q	Q			•●		●		●	
R	R	●		•●				●	SELECT R REGISTER (PA 1, 2)
S	S		●	•		●	●		
T	T	●	●	•			●		
U	U			●•		●	●		
V	V	●		●•			●		
W	W		●	●•			●		
X	X	●	●	●•		●	●		
Y	Y			•●		●	●		ORDER ENTRY 11 (PA 1)
Z	Z	●		•●			●		
%	,	●	●	•●		●		●	SHIFT DECIMAL LEFT TWO PLACES (PA 1)
◊	**		●	•●				●	
–	_			•				●	REVERSES SIGN ON ENTRY (PA 1)
&	+			•		●	●	●	
;	:		●	•●	●				
'	'	●	●	•●	●	●			
.	.	●	●	•●			●	●	
/	?	●		•		●	●		
		1 2 3 • 4 5 6 7 8	

I/O PRINTER FUNCTION CODES

CODE SYMBOL	CHANNEL NUMBERS 1 2 3 • 4 5 6 7 8	FUNCTION
SP			•	●				SPACE
TB		●	●•	●	●			TABULATE
CR			•				●	CARRIAGE RETURN (LINE FEED)
BSP		●	•●		●			BACK SPACE
UC			●•	●	●	●		SHIFT UPPER CASE
LC		●	•●	●	●	●		SHIFT LOWER CASE
SHRD			●•	●			●	RIBBON SHIFT RED
SHBL			●•		●		●	RIBBON SHIFT BLACK
SKTB			•●	●	●	●	●	SKIP TABULATE
ICR		●	•●		●	●	●	INTERMEDIATE CARRIAGE RETURN
	1 2 3 • 4 5 6 7 8	

SYSTEM CONTROL CODES

SYMBOL	CHANNEL NUMBERS 1 2 3 • 4 5 6 7 8	DEFINITION	✱CODE PRODUCED BY
CCN			● • ●	●				CODE CONTROL ON	ON CODE PUNCH CC
CCF		●	● •				●	CODE CONTROL OFF	OFF CODE PUNCH CC
APN			● • ●		●			AUTO PRINT ON	ON CODE PUNCH AP
APF	●		• ●				●	AUTO PRINT OFF	OFF CODE PUNCH AP
P1N			● • ●			●		PUNCH ONE ON	ON CODE PUNCH P1
P1F	●	●	● • ●		●			PUNCH ONE OFF	OFF CODE PUNCH P1
P2N		●	● • ●		●	●		PUNCH TWO ON	ON CODE PUNCH P2
P2F	●		● • ●		●	●		PUNCH TWO OFF	OFF CODE PUNCH P2
SKN	●		● •				●	SKIP ON	ON CODE PUNCH SK
SKF	●		● • ●					SKIP OFF	OFF CODE PUNCH SK
SLSKF			● • ●				●	SELECTIVE SKIP OFF	SLSKF SWITCH OFF OFF CODE PUNCH CR
SSKN	●		● • ●			●	●	SPECIAL SKIP ON	ON CODE PUNCH SSK
SSKF	●	●	• ●	●	●	●	●	SPECIAL SKIP OFF	OFF CODE PUNCH SSK
SW		●	● ●					READER SWITCH	ON CODE PUNCH RIN
STP	●	●	• ●					READER STOP	OFF CODE PUNCH RSTP
MSTP	●	●	● • ●			●		MASTER STOP	OFF LINE PROCESSOR
FC1N		●	● • ●	●		●		FIELD CONTROL ONE ON	ON CODE PUNCH FC1
FC2N	●		•	●	●	●	●	FIELD CONTROL TWO ON	ON CODE PUNCH FC2
FCF	●	●	● • ●	●				FIELD CONTROL OFF	OFF CODE PUNCH FC 1 or 2
	1 2 3 • 4 5 6 7 8	

7816 PROCESSOR ACCESS CODES

SYMBOL	CHANNEL NUMBERS 1 2 3 • 4 5 6 7 8	DEFINITION	✱CODE PRODUCED BY
PA1	●		•				●	●	PROCESSOR ACCESS ONE	CL STORAGE or 7-8 PUNCH/1
PA2		●	•				●	●	PROCESSOR ACCESS TWO	CL STORAGE or 7-8 PUNCH/2
PA3	●	●	•	●			●	●	PROCESSOR ACCESS THREE	CL STORAGE or 7-8 PUNCH/3
PA4			● •				●	●	PROCESSOR ACCESS FOUR	CL STORAGE or 7-8 PUNCH/4
PA5	●		● •	●			●	●	PROCESSOR ACCESS FIVE	CL STORAGE or 7-8 PUNCH/5
PA6		●	● •	●			●	●	PROCESSOR ACCESS SIX	CL STORAGE or 7-8 PUNCH/6
PA7	●	●	● •				●	●	PROCESSOR ACCESS SEVEN	CL STORAGE or 7-8 PUNCH/7
PA8			• ●				●	●	PROCESSOR ACCESS EIGHT	CL STORAGE or 7-8 PUNCH/8
PA9	●		• ●	●			●	●	PROCESSOR ACCESS NINE	CL STORAGE or 7-8 PUNCH/9
PRC			● •		●	●	●	●	PROCESS	CL STORAGE or 7-8 PUNCH/U
PPN	●		● •			●	●	●	OFF LINE PROCESSOR PUNCH ON	CL STORAGE or 7-8 PUNCH/V
PPF		●	● •			●	●	●	OFF LINE PROCESSOR PUNCH OFF	CL STORAGE or 7-8 PUNCH/W
	1 2 3 • 4 5 6 7 8	

SPECIAL AND AUXILIARY SYSTEM CODES

SYMBOL	CHANNEL NUMBERS 1 2 3 • 4 5 6 7 8	DEFINITION	✱CODE PRODUCED BY
DLT	●	●	● • ●	●	●	●		DELETE	DELETE KEY
BLNK				•				BLANK FEED	FEED KEY
ATN		●	•		●	●	●	AUX PRINTER ON	CL STORAGE or 7-8 PUNCH/S
ATF	●	●	•			●	●	AUX PRINTER OFF	CL STORAGE or 7-8 PUNCH/T
FF		●	•●	●		●	●	FORM FEED	CL STORAGE or 7-8 PUNCH/;
	1 2 3 • 4 5 6 7 8	

✱PRODUCED BY HOLDING DOWN INDICATED OVERPUNCH KEY AND DEPRESSING ASSOCIATED CONTROL OR KEY BOARD KEY.

TYPETRONIC 7816 Registers

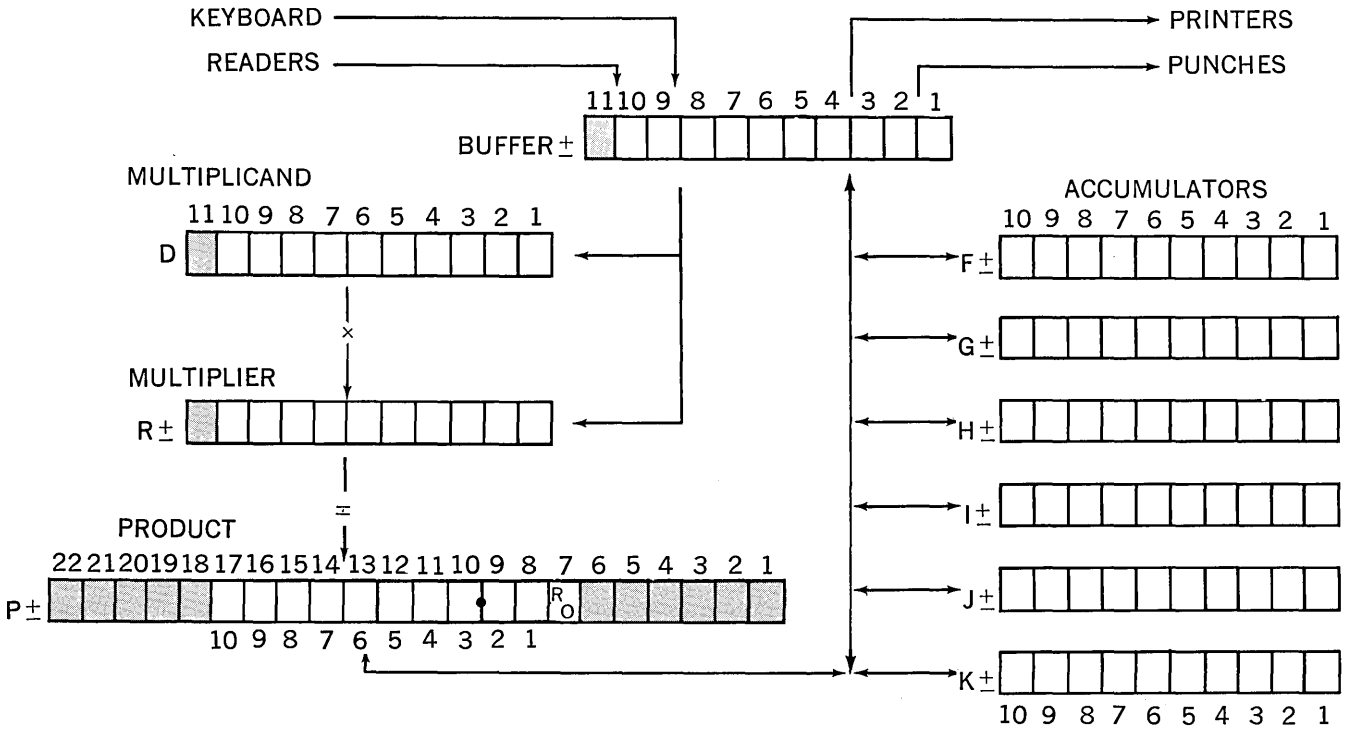
The 7816 Memory consists of nine registers (plus a "Buffer") with the following characteristics:

REGISTER	NO. OF DECIMAL DIGITS	UTILIZATION
D	**11**	Used for storing the first factor of a multiplication. Does not accumulate and cannot be transferred. When Multiplication occurs the D Register retains the original factor. A new factor entered into D will destroy the old factor.
R	**11**	Used for Multiplier entry. Does not accumulate and does not retain the factor after multiplication. When the R register is selected on entry (PA1) and the Process code is read, multiplication will automatically commence.
P	***22** **10**	Receives the result of a multiplication (D times R). The Product Register **does** accumulate and may be entered directly just as the six accumulating registers. Because the D and R registers can contain up to eleven digits each for multiplication, the Product register is equipped with 22 order positions (11 + 11 = 22) to receive the result. The readout of the P register however, is limited to ten digits. These ten digit orders have the same relation to the buffer orders as do the other accumulating registers. Thus a direct entry to P (other than with multiplication) is accomplished in the same manner as with the accumulating registers (See section 2 page 8, Order Entry Designators). **Half-cent Round-off** When automatic round-off is required after a multiplication, it can be achieved by using a "rule of nine" derived from the sum of the decimal order locations in the Multiplier and Multiplicand. When the number of places to the right of the decimal in D and R equals nine, the third order to the right of the decimal in the product will round-off. (NOTE: The diagram on the next page will indicate how the ninth order on multiplication input corresponds with the second order of output. The order marked R/O is the position at which round-off takes place.
F, G, H, I, J, K	**10**	Six accumulators containing 10 digits and "sign". They can be entered, transferred, read out, and individually split.

*Twenty-two positions to accommodate the result of a multiplication. Ten positions for direct entry to the Product or for read out.

Buffer Register

The 7816 Processor is also equipped with a Buffer register which serves as the "clearing house" between the other registers. All input to and output from registers passes through the Buffer. On entry (PA1), as digits are typed or read into the Processor they set up sequentially in the buffer starting at the highest order designated in the programming. Prior to the Process code, these entries may be cleared with the RESTORE key. It is also possible to backspace the I/O Printer carriage during a PA1 sequence and cause an equivalent backstep of the buffer order. Below is a diagram showing the Memory register array.



3. Computing Characteristics

Arithmetic

The computing unit will perform addition, subtraction, and multiplication functions within the capacity of the registers, and will also divide by program control. Except when the application requires unattended operation, it is not recommended that division with variable factors be frequently made, since division can most speedily be accomplished by reciprocal multiplication. This does not mean to say that the 7816 cannot divide a factor by a random divisor—it can. It means only that when the divisor is known in advance, then division will be performed most rapidly by reciprocal multiplication techniques.

Computational Speed

Computational speed is partly governed by the speed of the rotating memory disc, since the factors and results are stored in the memory and must be located prior to operation. The following times are average for the 7816 system:

Add and Subtract

17/1000ths of a second (17ms) (including look-up time)

Multiplication

700/1000ths of a second (700ms) (including look-up)

Application Computing Speed vs. True Computing Speed

The unique PARAPROCESSING feature of the TYPETRONIC 7816 creates a situation in which computation, though electronically requiring a tangible period of time to be performed, may require *no time* in relation to the operation of the application. As an example: It may be required to enter a tax factor after the sub-total on a form, complete a multiplication of the tax times the sub-total, and then print the result in the total column. Since the tax factor can be entered during the carriage return motion immediately after the sub-total, and the multiplication performed during the tabulation to the amount column the systems effect is an instantaneous read-out even though the multiplication required one second or so to accomplish.

PARAPROCESSING ability is extended to all carriage motion time in the system. Thus adding or subtracting a factor can take place while the carriage is tabulating from one column to another, and once more the systems delay will be nil.

It is quite important in programming to take advantage of PARAPROCESSING since application speed can be increased considerably by its use.

Basic Processor Operations

Processor Entry (PA1)

When entry is to be made to the Processor, a certain sequence of coding must be followed.

1. Code Control must be "ON". It is not necessary to precede a PA1 code with a CCN code if Code Control was turned on from a previous operation.
2. The PA1 code sets up the Processor for entry, and the *next code* following the PA1 *must* be one of the eleven order entry codes. This code will not print or punch even though it is a printing code.
3. The order code should be followed by the numeric digits to be entered. (In the case of a manual entry they would be preceded by a Stop [STP] code to permit the keyboard operation.)
4. Following the digits, the register or registers to be selected should be programmed. These codes will not print or punch.
5. The last code is the Process (PRC) code.

A typical entry to the Multiplicand Register and simultaneously to the F accumulator can be programmed as follows:

(Code Control is ON)

APN	Enables printing
PA1	Addresses the Processor for entry
ø	(Indicates entry to start at the tenth order)
STP	Reader stops to permit manual entry
1 **0** **0**	(The digit entry)
D	Selects Multiplicand
F	Selects F Register
PRC	Initiates the prescribed action

It must be noted that when programming an entry sequence the PA1 code will automatically clear the buffer, thus permitting a complete new entry to be made. Once in the PA1 sequence, corrections can be made to the entry by using the RESTORE key.

Transfer (PA2)

The Transfer Code (PA2) conditions the Processor to transfer the buffer to any selected registers. Thus digits stored in the buffer can be transferred (with accumulation and/or multiplication) with only three codes when only one register is involved. To transfer the contents of the buffer to the K Register, for example, the code sequence would be:

(Code Control is ON)

PA2	Sets the transfer address
K	Selects Register K
PRC	Initiates the action

If more than one register must receive data from the buffer, then the sequence will include each appropriate register letter. For example, if the transfer is to be made to K, F, D, and R the coding will be:

PA2
K
F
D
R } alphabetical sequence is not required
PRC

Output with PA3

To read out a given register (to printer or punches), generally only three codes are required (when Auto Print is on). They are the PA3 code, the register code, and the Process code. When the second register format is to be selected, the digit "2" must be included. The 2 may precede or follow the selected register. The following sequences show how the PA3 address can be used for various outputs:

Code Control is ON

OUTPUT 1st FORMAT OF G	OUTPUT 1st FORMAT OF PRODUCT	OUTPUT 2nd FORMAT OF K
PA3	PA3	PA3
G	P	K
PRC	PRC	2
		PRC

Output with PA4

The PA4 (extractor) address operates in the same general manner as the PA3 sequence. The Program Panel permits two extraction patterns to be used. For selection of the first, no special indicator is required; for selection of the second, the digit two (2) is used. If the first five orders of a register were programmed (on the Output Program Panel) to readout as zeros the number 1234567891 in a selected register would read out as follows:

To Buffer 0000067891
To Reader sssss67891
To Punch sssss67891

NOTE:
zeros before significant digits print and punch as spaces.

The program panel can be wired to retain the *complete* factor in the selected register.

Output with PA5

Output for the PA5 sequence is from any selected register to the D Register and any "ON" components (printers and punches). It is also possible to designate only the second format of the selected register to be printed (but the entire register will enter D). Following are some examples of the PA5 sequence.

Product to D	Product to D with Second Half of P to Print	F to D
PA5	PA5	PA5
P	2	F
PRC	P	PRC
	PRC	

Program Panel wiring permits the selected output register to retain the factor in a PA5 (and PA4) transfer.

PA6 Sequence

The PA6 sequence is used to determine if a register is zero (clear) and if it is, to output a specific pre-determined code.

EXAMINE F FOR ZERO

PA6
F
PRC

Output Program Panel Control

In addition to the output control sequences, it is necessary to establish output "field" requirements and sign indicators. Section 5 will describe the use of the Output Program Panel.

4.
Basic Processing Examples

The following examples have been provided to demonstrate the ease of 7816 VERSATRONIC code programming once the basic sequences are mastered.

Example 1

Accumulate the number 100.00 into F, G, and I, starting at the eighth order.

(Code Control is ON, Auto Print is OFF)

PA1	Sets the Processor for external entry
8	Selects the eighth order
1	
0	
0	Digits entered
.	
0	
0	
F	Selects register F
G	Selects register G
I	Selects register I
PRC	Initiates the action

This sequence would require only $^{12}/_{30}$ths of a second to perform since the digits of entry were read in the Auto Print "OFF" mode. If the factor 100.00 *were to print* (Auto-Print must be "ON") then the time required would be $^{29}/_{30}$ths of a second. Note that the digits may print or not print as determined by the state of Auto Print. In the event the digits were all non-printed, the entire sequence could be performed (including the accumulation) in the time required for the I/O Printer to tab only ½ inch or so, and the delay to the system would be nil.

Example 2

Multiply 100 times 55.00 and print the result. This operation requires three sequences.

(Code Control and Auto Print are ON)

a. Entry of 100 to D

PA1
8 (to establish the order)
1
0 } the factor
0
D
PRC

b. Entry of 55.00 to R

PA1
6 (order)
5
5
. } the factor
0
0
R
PRC Multiplication take place automatically

How the Input Orders were Selected

For the Multiplicand and the Multiplier entries, the orders selected were 8 and 6 respectively. This was to establish the half-cent round-off in the product. Note that with the figure 100 the decimal would fall to the left of order 5 since the "1" was entered at order 8), and with 55.00 the decimal would fall to the left of order 4 (since the first "5" was entered at order 6). This would leave 5 and 4 orders remaining to the right of the decimal respectively for each entry. Five and four equals nine (rule of nine), which assures us that the half cent round-off will occur correctly in the Product.

c. Printing the Result

The Program Panel will be wired to initiate product readout at order 7. This order was selected to accommodate the result of the two largest possible factors (999 x 99.99). In the actual example the result would only require 6 positions. The panel will also be wired to place the decimal between orders 2 and 3, and to stop the readout after order one.

The sequence of codes required to print the Product would be:

***APN**	Turns on Auto Print
PA3	
P	Selects Product Register
PRC	
SP	
5	
5	
0	
0	The Printed result
.	
0	
0	

*Auto Print must be on for the result to print. If Auto Print had not been on, the PA3 sequence would only transfer the P Register to the buffer and/or Vertipunch (if "ON").

Output Components Must Be "ON" to Receive Data from the Processor

It is a rule of 7816 Programming that output will be made only to "on" components. Thus the PA3, PA4 and PA5 commands will have no *visual* effect if neither Auto Print nor a VERTIPUNCH is on. These commands *will*, however, perform their assigned internal Processor functions. Thus, the PA5 command would transfer a selected register to D and the Buffer even though all output components were off.

Example 3

A quantity multiplied times a price and then chain discounted three times with printing of the final result. The following mathematical sequence is required:

Quantity times price less discount less discount less discount equals total. OR 100 x 1.00 = 100.00 — 10% x (100.00) = (90.00) — 10% x (90.00) = (81.00) — 1% x (81.00) = 80.19.

If the intermediate products are to be printed then Auto Print can remain on during the entire sequence. If not, then Auto Print must be turned "on" and "off" as required. In this instance it is presumed that the first product and the final product will print but the intermediate products (from the first two discounts) will not print.

Following is the code sequence required. (Start with CCN and APN.)

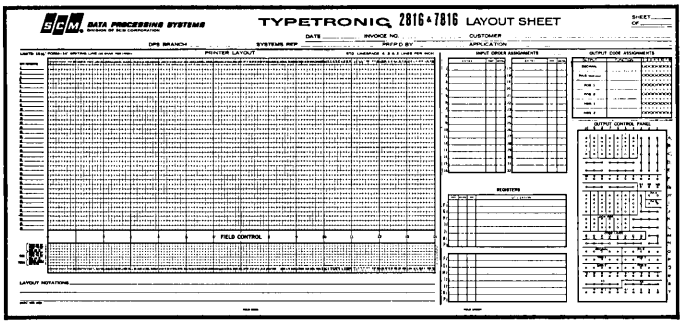
PA1	Sets up Processor for entry
8	Order
1 **0** **0**	Digits
D	Register Selected
PRC	Initiate action
PA1	Sets up Processor for Price entry
5	Order
1 **.** **0** **0**	Price
R	Selects Multiplier
PRC	Initiates multiplication
APF	Turns Auto Print "off"
PA5	Sets up Output with Transfer
P	Selects P for transfer to D
PRC	Initiates action
APN	Turns Auto Print "on"
PA1	Sets up Processor for first discount entry
9	Order
1 **0** **%**	First discount (% shifts decimal two places to the left)
N	*Negative
R	Selects Multiplier for entry
PRC	Initiates multiplication
APF	Turns Auto Print "off"
PA5	Sets up output with transfer
P	Selects P for transfer to D
PRC	Initiates transfer
APN	Turns Auto Print "on"
PA1	Sets up Processor for second discount
9	Order
1 **0** **%**	Second discount factor (% shifts decimal two places to left)
N	*Negative
R	Selects R for discount entry
PRC	Initiates multiplication
APF	Turns Auto Print "off"
PA5	Sets up output and transfer to D
P	Selects P for transfer
PRC	Initiates action
APN	Turns Auto Print "on"
PA1	Sets up Processor for entry
8	Order
1 **%**	Third discount factor
N	*Negative
R	Selects R for discount entry
PRC	Initiates multiplication
PA3	Sets up Processor for readout
P	Selects P for readout
PRC	Initiates action (result prints because Auto Print is "on")

In the above example the Processor Program Panel will be wired to readout the product starting no lower than the 7th order. The PA5 hubs will also be wired to retain the Product each time it is transferred to D.

*In each discount multiplication the N symbol will cause a negative subtraction of the result from the retained Product. The ultimate Product is the remainder after discounting.

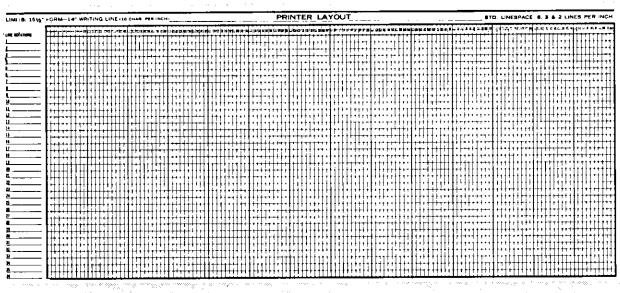
5. Writing the Program

Using the 7816 Layout Sheet



The 7816 layout sheet is provided to "put on paper" the essential requirements for the Program. The sheet is divided into six primary sections: PRINTER LAYOUT, FIELD CONTROL, INPUT ORDER ASSIGNMENTS, REGISTERS, OUTPUT CODE ASSIGNMENTS and OUTPUT CONTROL PANEL.

Printer Layout Grid



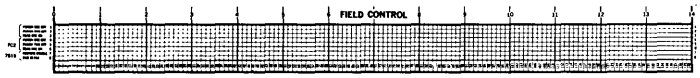
As with TYPETRONIC 2816 programming, the Printer Layout grid is used to outline all fields of printing. It is recommended that entries which affect the Computing Processor operation but do not print, be shown on the layout in parenthesis. Since such entries will not take up printing space they should be written directly above or below printed entries on the form at the point of operation in which they would take effect. As an example: A reciprocal is to be multiplied times the quantity 1000 to compute a price per dozen. The reciprocal for twelve (.08333) could be shown below the quantity entry thus:

1000 ^
(.08333)

Though it is not mandatory, the mathematical symbols (+, −, × or ÷) can be indicated on the form.

Printing of the 7816 is 10 horizontal characters to the inch and all printing should be accurately noted in the appropriate columns.

Field Control



Required Field Control columns should be filled-in or checked. The operation of the PA1 Decimal Verification track (eight) and the Restore Enable track (seven) should be checked as required. Remember that tracks 7 and 8 will always be enabled when a PA1 code is read and that track seven (Restore Enable) must be punched if clearance of manual entries is planned. Section 8 describes the preparation of Field Control media tape.

Input Order Assignments

	ENTRY	START	DECIMAL		ENTRY	START	DECIMAL
1				17			
2				18			
3				19			
4				20			
5				21			

The Input Order Assignments section is used to note the location of the start order and of the decimal for external entries (PA1 sequences). In the ENTRY column write the description of each factor (such as Quantity, Price, Discount, Tax, etc.). In the START column write the start order for each factor. (Remember, the rule of nine is used to determine the start order when round off is required.) In the decimal column write the order of the input decimal. This column will determine where a reader "ON" signal from Field Control will be required to insert the decimal.

Registers

	START	DECIMAL	STOP	UTILIZATION
F1				
G1				
H1				
I1				

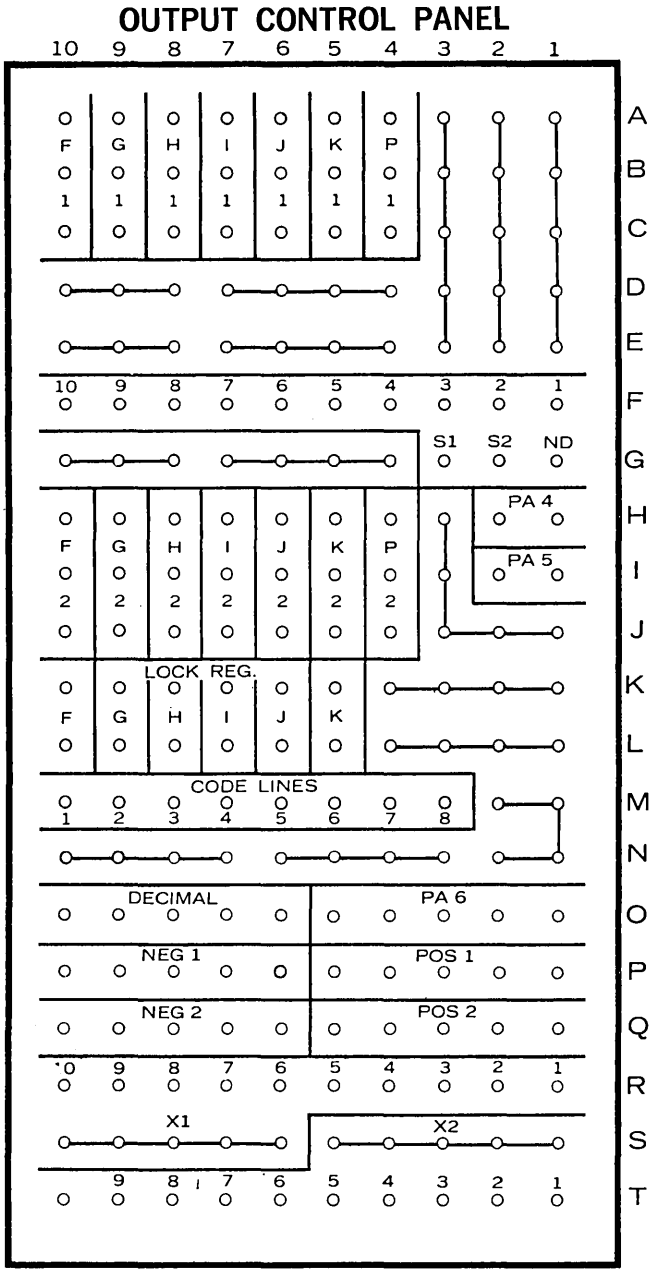
The REGISTERS section is used to indicate the use of each register (and register splits), as well as the start, decimal and stop orders to be wired on the program panel.

Output Code Assignments

OUTPUT	FUNCTION	1	2	3	4	5	6	7	8
DECIMAL		O	O	O	O	O	O	O	O
PA-6 (when zero)		O	O	O	O	O	O	O	O
POS. 1		O	O	O	O	O	O	O	O
POS. 2		O	O	O	O	O	O	O	O

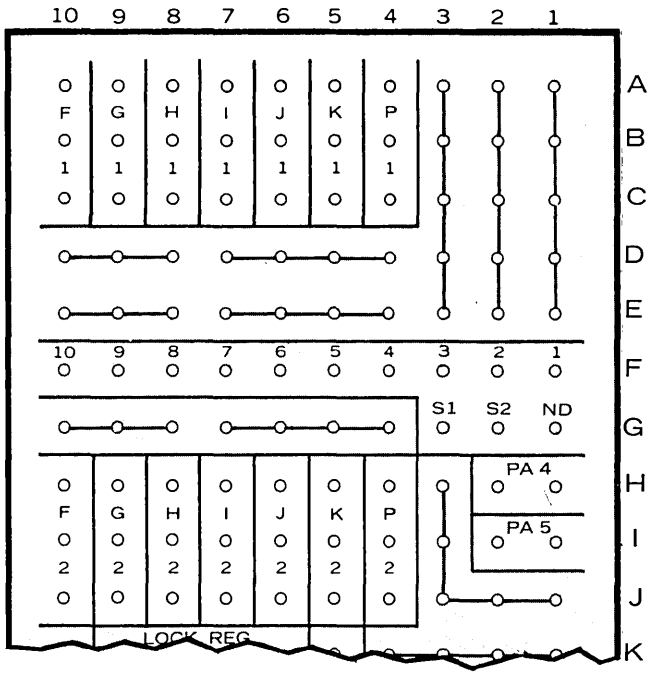
This section is used to "code" the various Processor output signals. Any "five-hole" code may be assigned for each signal, but once assigned that code will be generated each time the particular signal occurs. Thus a "period" code assigned as the decimal will be printed for all registers wired to print a decimal. The PA-6 output is generated each time a register is interrogated with PA6 and found to be clear. The POS 1 & 2 and NEG 1 & 2 codes may be wired to generate appropriate codes during register output. Frequently the POS or the NEG hubs will be wired to initiate a SKIP or SPECIAL SKIP function. Thus branching routines can be effected from registers that are positive, negative or clear (the latter by PA6 interrogation).

The Processor Output Program Panel



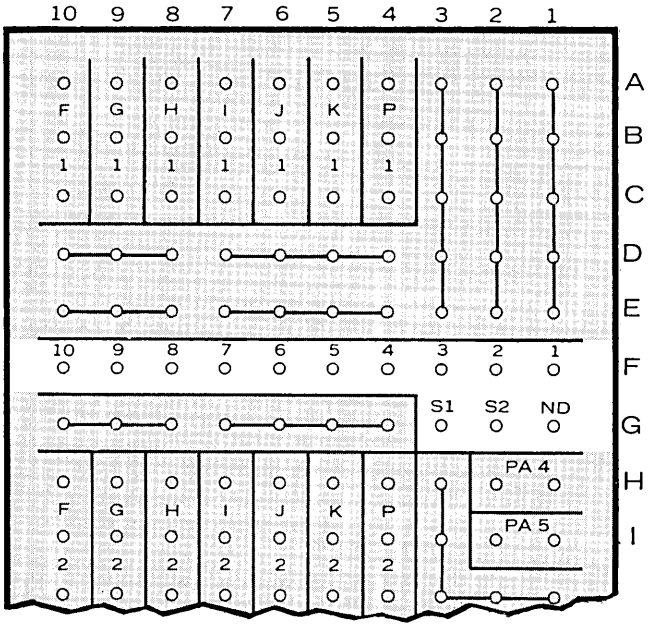
The removable Output Program Panel is recessed behind a door located on the left front side of the Processor. This panel is used for providing output signals and is not related in any manner to Processor input. There are eight primary sections to the output Program Panel. These sections are programmed by interconnecting specific hubs as prescribed by output requirements. The following information describes in detail the programming for each Output Control Panel section.

Register Start, Decimal and Stop Hubs



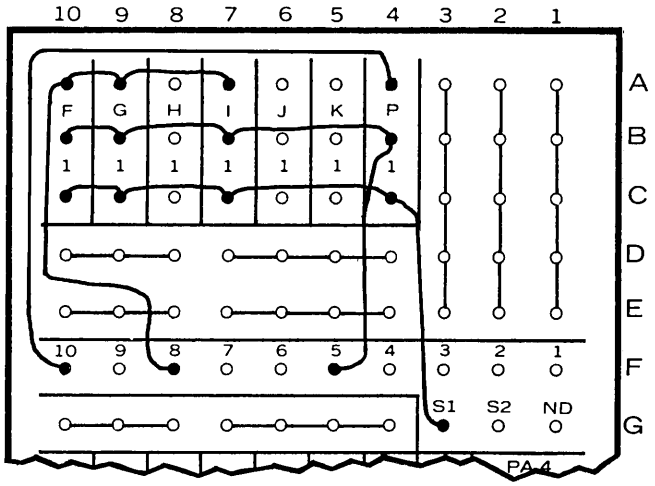
Two sections of the Control Panel (A, B, C 4-10 and H, I, J 4-10) are used to indicate the START ORDER, DECIMAL ORDER, and STOP ORDER of each register and its alternate or "split" section. A series of three hubs is provided for each register and each register split. The hubs are connected to order and symbol hubs on the panel. When two or more registers have common orders of start, decimal or stop, they may be wired in common. It is not necessary that a specific hub of a register be used for start, decimal, or stop, since the electronic "sweep" of the Program Panel will always be from high order to low order, and connected hubs will always be selected in the proper sequence. *It is recommended however*, that the top hubs (A 4-10 and H 4-10) be used for start orders; the middle hubs (B 4-10 and I 4-10) be used for decimal orders; and the bottom hubs (C 4-10 and J 4-10) be used for STOP orders. Doing this will simplify the checking of the program panel.

Order, Symbol and "No Decimal" Hubs



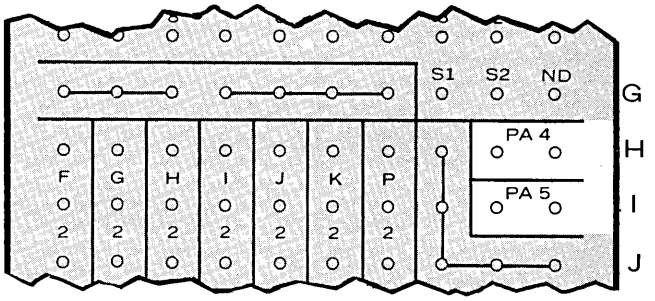
Positions F 1-10 and G 1-3 are used to indicate the order of start, decimal, stop (and when required "no decimal") of each register and register split. Appropriate register hubs are wired to these hubs to indicate the desired field output for each register. The S1 and S2 hubs indicate the first and second symbols available for signs and branching. The ND must be wired when no decimal is used for specified registers. The numbers (10 through 1) correspond with the output orders for the registers.

Example of Register Wiring



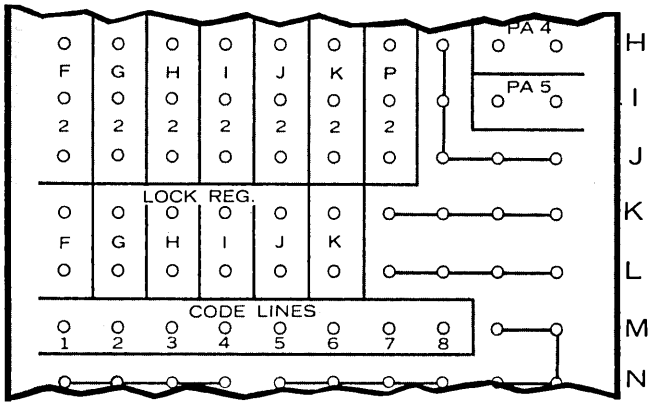
In the example above the F, G, and I Registers are wired to start at order eight, print the decimal at 5 and stop before the first symbol. The Product Register is wired to start at order 10, print the decimal at 5 and stop before the first symbol. Note that "common" hubs are wired together with multiple jumper wires. When desirable, the BUS hubs may be used for connecting hubs in common.

PA4 and PA5 Hubs



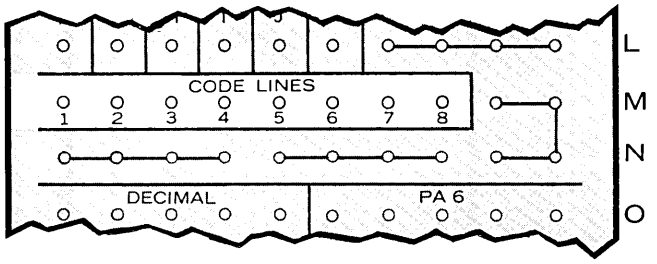
The PA4 and PA5 hubs are wired when either or both functions require *retention* of an output factor in the initiating register. If this connection is not made, the selected register will clear on PA4 or PA5 output.

Lock Register Hubs



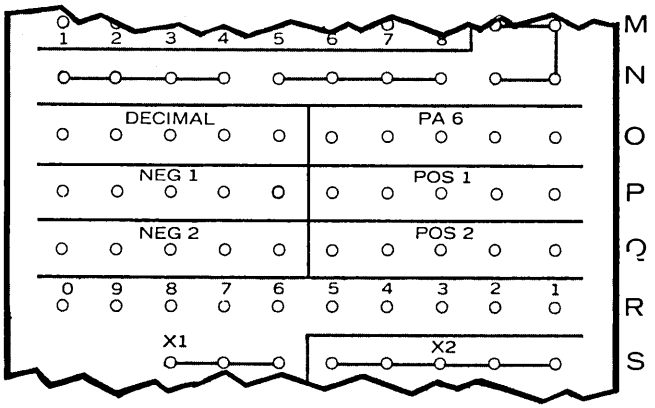
The LOCK REG section is used for *locking* selected registers such that their contents cannot be cleared by the CLEAR STORAGE/ RESTORE key operation. When locked, each selected register (F, G, H, I, J and K) will retain the accumulation unless transferred out by a PA3, 4 or 5 sequence.

Code Line Hubs



Eight hubs (M 3-10) designate the eight channels of the TYPETRONIC systems code. When the Decimal, PA6, NEG 1 and 2 or POS 1 and 2 are used, these Code Line hubs are wired to the specified code for each function.

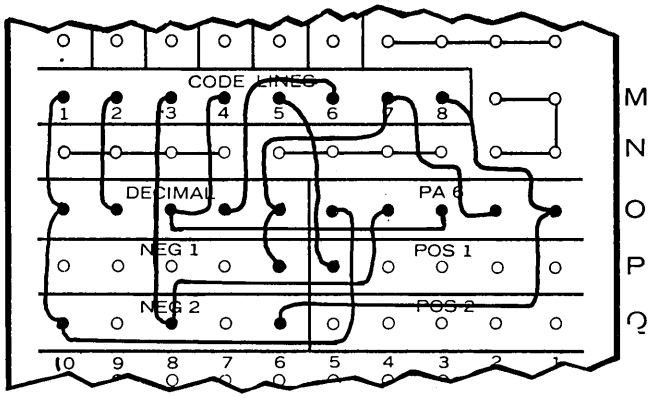
Output Code Assignment Hubs (O, P, Q 1-10)



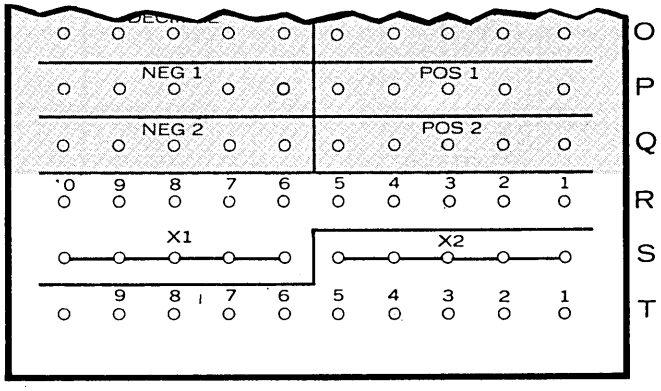
The symbol hubs are wired to the Code Lines to "set up" each code that will be used for a symbol or function. Symbols with common "bits" in their configuration are wired in common.

In the example below the codes are assigned as follows:

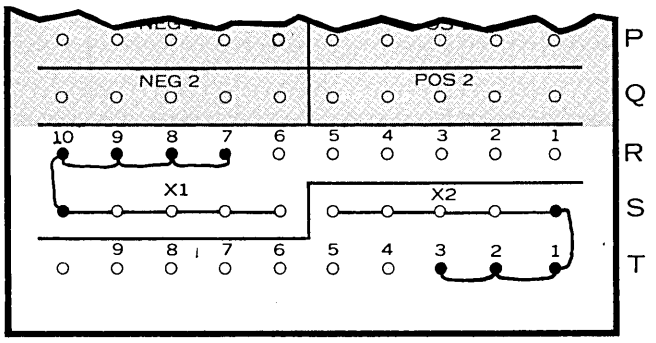
OUTPUT	FUNCTION	1,2,3,4,5,6,7,8
DECIMAL	period(.)	1,2,4,6,7
PA6	SSKN	1,3,4,7,8
NEG 1	hyphen(-)	7
POS 1	space	5
NEG 2	SKN	1,3,8
POS 2	none	



Extractor Hubs

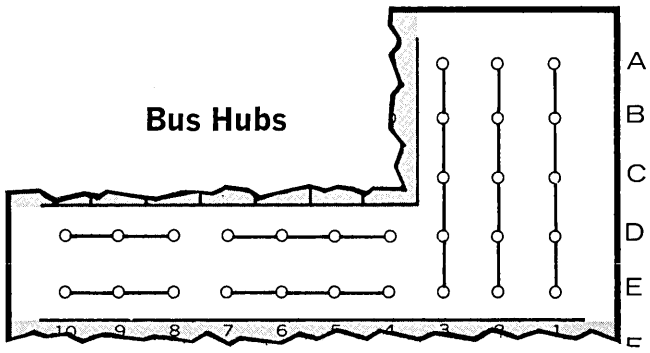


The Extractor Hubs are used to selectively transfer specified orders of a register as zeros. Thus a Register containing the ten digits 5981237468 could be transferred as 5981230000 or 5080207060. Two levels of extraction may be programmed. When the PA4 code is used, the register selected will transfer specified orders as zeros as indicated by Extractor wiring. NOTE: the START, DECIMAL and STOP orders of readout are not affected by Extractor wiring. If the PA4 hubs (I 1-2) are wired, the entire number will remain in the selected Register after transfer.



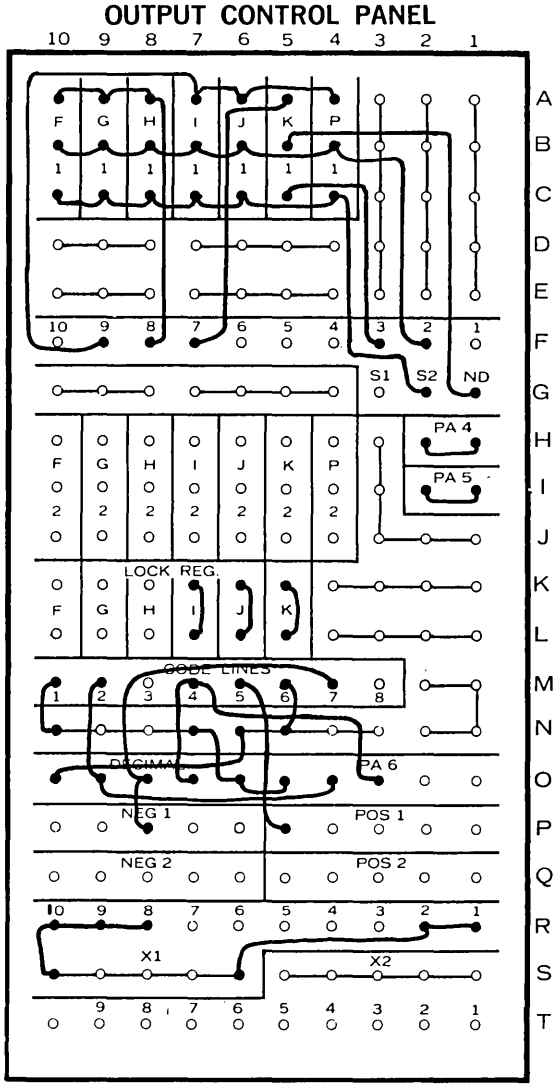
In the example shown, X1 is wired to transfer the first four digits (10-7) of a register as zeros while X2 is wired to transfer the last three (3-1) as zeros. Both X1 and X2 are selected with a PA4 sequence, but the digit 2 must also be included to select the X2 level.

Bus Hubs



The hubs connected by lines are common terminals used to simplify the wiring of the board. All wires plugged to a given BUS hub series will be common.

Complete Program Panel Diagram



The example Program Panel wiring will enable the following Processor output operations:

1. Register Output

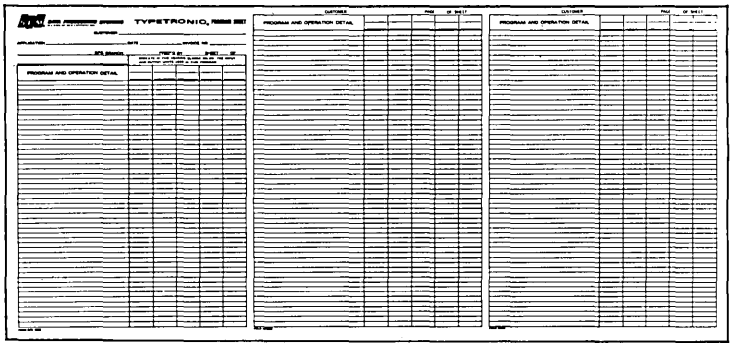
REG	START	DECIMAL	LAST CHARACTER
F,G,H	8	2	S1
I,J,P	9	2	S1
K	7	none	3

2. PA4 and PA5 retain factors in transferred registers.
3. I, J, K Registers are locked
4. Output Code Assignments

SYMBOL	CODE NAME	CODE
DECIMAL	period (.)	1,2,4,6,7
NEG 1	hyphen (-)	7
PA6	STOP	1,2,4
POS 1	space	5

5. Extractor—Will transfer 10, 9, 8, 2 and 1 orders as zeros (selected register will retain the factor).

The TYPETRONIC Program Sheet
(Form No. DPS 2002)



The TYPETRONIC PROGRAM SHEET is used with the 7816 in the same manner as the 2816. The various input/output columns are first labeled (one column can be used for Processor output) and the codes then sequentially written in a point to point manner. Processor Access and Instruction codes are initiated from OPTIMATIC Reader One or Two and must be written in the proper reader columns along with the TYPETRONIC control and printer codes.

In the next section of this manual, two complete programs are described in detail. A careful perusal of these examples should clarify 7816 programming techniques.

6. Programming Examples

Application One

Computing Requirements

1. Horizontally accumulate up to five quantities of no more than two digits each to a total quantity (maximum three digits).
2. Multiply the total quantity times a price to derive an Amount.
3. Accumulate line amounts to a Net Total.
4. Accumulate Net Totals to a "daily" Grand Total of all invoices.

Special Requirements

1. Provide automatic "reverse entry" of a line by using the Selective Skip Off control.
2. Utilize PARAPROCESSING to minimize control and Processing time.
3. Turn Reader One On from Field Control after the manual entry of each quantity.
4. An automatic signal must indicate if Net Total has not been cleared after each invoice is completed.

Format

Application requirements have determined that no more than eight lines will ever be written on one invoice and that the average number of lines is four.

It has also been established that no less than three individual quantities (of A, B, C, and D) will be entered on a single line. (For this reason the program will use spacing rather than tabulating to pass fields where no quantity is to be entered.)

Punched Output

Punched output will be the Quantity Total and the Amount for each line.

The Layout Sheet

The layout sheet on the facing page has been filled in properly for application number one.

Study the layout carefully and note the input order assignments, output code assignments, register use, and Program Panel wiring. Also note that the decimal orders for the Quantity Total and the Price equal nine. This "rule of nine" has been applied for half-cent round-off.

SCM® DATA PROCESSING SYSTEMS
DIVISION OF SCM CORPORATION

TYPETRONIC® 2816 & 7816 LAYOUT SHEET

SHEET 1 OF 2

DATE XX/XX/XX INVOICE NO. ✓ CUSTOMER ✓

DPS BRANCH ✓ SYSTEMS REP. ✓ PREP'D BY ✓ APPLICATION INVOICING (WITH HORIZONTAL ADDITION)

LIMITS: 15½" FORM—14" WRITING LINE (10 CHAR. PER INCH)

PRINTER LAYOUT

STD. LINESPACE: 6, ③ & 2 LINES PER INCH

LINE NOTATIONS

QUANTITIES A	B	C	D	TOTAL QUANTITY	DESCRIPTION	PRICE	AMOUNT	
(Y)XX	XX	XX	XX	XXX	(C)XXXXXXXXXXXXXXXXXXXX	(C)X·XX	XXXX·XX	
10	5	15	70	100		1·00	100·00	
99	99	99	99	396		9·99	3956·04	
10	10	50	30	100		1·00	100·00-	RETURNED MDSE - EXTENSION
10		10	80	100		2·00	200·00	
							4156·04*	NET TOTAL (INVOICE TOTAL)
							4156·04**	GRAND TOTAL (DAILY TOTAL OF INVOICES)

PRINTS IF F IS NOT CLEAR → ////

PRINT OUT FROM TAPE

100	100·00
396	3956·04
100	100·00-
100	200·00

M T T T

FIELD CONTROL

FC2 / 7815

PUNCH ONE OFF	1
PUNCH TWO OFF	2
READ ONE ON	3
PUNCH ONE OFF	4
PUNCH TWO OFF	5
READ ONE ON	6
RESTORE ENABLE	7
RUN IN PA1	8

LAYOUT NOTATIONS Punch Total Quantity, Amount and carriage return code. Maximum items: 8

Margin: 21 Tab stops: 34, 40, 65, 71 Linespace: Double

INPUT ORDER ASSIGNMENTS

	ENTRY	START	DECIMAL
1	Unit Quantities	7	5
2	Price	5	4
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

	ENTRY	START	DECIMAL
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			

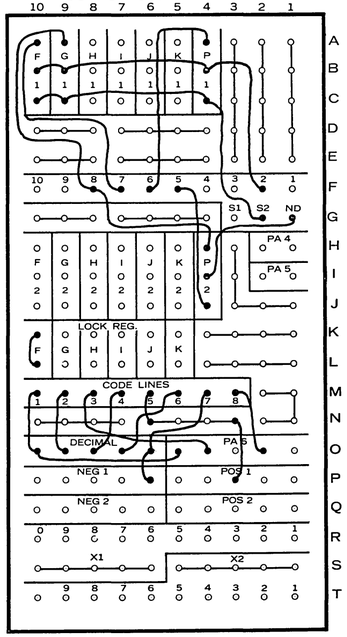
REGISTERS

	START	DECIMAL	STOP	UTILIZATION
F1	7	2	S_2	NET TOTAL
G1	8	2	S_2	GRAND TOTAL - DAILY
H1				
I1				
J1				
K1				
P1	6	2	S_2	EXTENSION AMOUNT
F2				
G2				
H2				
I2				
J2				
K2				
P2	8	-	5	QUANTITY TOTAL

OUTPUT CODE ASSIGNMENTS

OUTPUT	FUNCTION	1 2 3 4 5 6 7 8
DECIMAL	DECIMAL (·)	●●○●○●●○
PA-6 (when zero)	SKN	●○●○○○○●
POS. 1	SPACE	○○○○●○○○
POS. 2		○○○○○○○○
NEG. 1	HYPHEN (-)	○○○○○○●○
NEG. 2		○○○○○○○○

OUTPUT CONTROL PANEL



FORM DPS 2001

SCM® DATA PROCESSING SYSTEMS
DIVISION OF SCM CORPORATION

TYPETRONIC® PROGRAM SHEET

CUSTOMER ✓

APPLICATION INVOICING DATE XX/XX/XX INVOICE NO. ✓

DPS BRANCH ✓ PREP'D BY ✓ SHEET 2 OF 2

INDICATE IN THE HEADING BLOCKS BELOW, THE INPUT AND OUTPUT UNITS USED IN THIS PROGRAM

PROGRAM AND OPERATION DETAIL	READER I PROGRAM	READER II DETAIL	PUNCH I OUTPUT		
To turn off SKIP and stop Reader One	SKF				
after one complete invoice	STP				
Beginning of line program					
Line program: condition Code Control On	CCN				
Auto Print On	APN				
Turn Punch One Off	PIF				
First sequence quantity A	PA1				
Order entry indicator	7				
Enter first quantity A	STP				
Quantity A accum. in reg. P	P				
Initiate action	PRC				
To get to quan. B field	SP				
2nd sequence quantity B	PA1				
Order indicator	7				
Enter quantity B	STP				
Accum. in reg. P	P				
Initiate action	PRC				
To get to quan. C field	SP				
3rd sequence quantity C	PA1				
Order indicator	7				
Enter quantity C	STP				
Accum. in Reg. P	P				
Initiate action	PRC				
To get to quantity D field	SP				
4th sequence quantity D	PA1				
Order indicator	7				
Enter quantity D	STP				
Accum. in Reg. P	P				
Initiate action	PRC				
To get to total quantity field	TB				
Turn on punch one	PIN				
Transfer P2 to D and Print	PA5				
Select 2nd output of selected Register	2				
Select P	P				
Initiate action	PRC		QUAN. TOT.		
Turn off Punch One	PIF				
To get to Price field	TB				
To select Reader Two	SW				
		DESCRIPTION			
To select Reader One		SW			
To get to Price field	TB				
To enter Price	PA1				
Order entry designation	5				
Initiates Skip	SKN				
If SLSK switch On turns off Skip	SLSKF				
Reverses sign of entry	N				
Turns off Skip (for positives)	SKF				
To select Reader Two	SW				

FORM DPS 2002

CUSTOMER ✓ PAGE 2 OF SHEET 1

PROGRAM AND OPERATION DETAIL	READER I	READER II	PUNCH I		
Automatic price entry		PRICE			
To select Reader One		SW			
Enter Price into Multiplier R	R				
Initiate multiplication	PRC				
To get to Amount field	TB				
To turn on Punch One	PIN				
Initiate Product readout (amount)	PA3				
Select Product	P				
Initiate action	PRC		AMOUNT		
To return carriage (punches)	CR		CR		
To transfer buffer to F	PA2				
Select F	F				
Initiate action	PRC				
End of line program	=				
To Spec. Skip to **total program**	SSKF				
Turn off Punch	PIF				
Tab to Amount field	TB4				
For total readout	PA3				
Select F	F				
Initiate action	PRC				
Indicates total	UC * LC				
Return Carriage	CR				
To Transfer buffer to G	PA2				
Select G	G				
Initiate action	PRC				
To "zero interrogate" F	PA6				
Select F	F				
Initiate action—if clear, skip occurs	PRC				
If F not clear print //// on form	////				
and Return carriage	CR				
Grand Total card					
To turn Code Control On	CCN				
To turn Auto Print On	APN				
To condition Punch One Off	PIN				
To Return carriage (conditioning)	CR				
To select output	PA3				
Select G	G				
Initiate action	PRC				
Shift to Upper case	UC				
Type Grand total symbol	* *				
Shift to lower	LC				
Return carriage	CR				
Stop reader	STP				
NOTES: Line program repeated eight times. (area between double lines)					
	Indicates Control and Processor codes that will be masked during carriage motion and will not therefore, have any delay effect on the application. (Note: other control code will cause only a 1/30th of one second delay.)				

FOLD UNDER

PA6 (Zero Interrogation) Control

When a register is addressed with the PA6 code and found to be zero (clear) the SKIP ON code will be generated. On the program sheet it will be seen that if the register is *not* clear that four virgules (////) will print on the form. At the end of a day's operation, if no invoices have the "////" marks on them, then it can be safely determined that the operator *always* correctly totalized each invoice. (NOTE: It could just as easily be determined that the buffer always transferred to G (the Grand Total) after the clearing of Net Total. By programming it is quite simple to develop automatic "checking" routines to determine that final totals are properly accomplished by the operator.

The Program Sheet

The PROGRAM AND OPERATION DETAIL section of the Program Sheet has intentionally been used in this example to describe each program step as it occurs. In actual programming (as will be seen on application two) this would not be necessary. Heavy vertical lines have also been drawn along the program to indicate how PARAPROCESSING conveniently "masks" the various control and processing codes. In this application only two control codes, requiring a total time of only $\frac{2}{30}$ths of a second, have any delay effect on the Printer operation. The effect of the operation will therefore be that of nearly continuous printing.

This program provides the ability to automatically reverse an entry completely by merely turning the SELECTIVE SKIP OFF switch to the "ON" position. When this is done the "N" code is introduced into the computation which automatically provides a negative accumulation.

Application Two

Digital Computing and Storage Requirements

1. Heading

a. Automatic six digit consecutive Invoice Number.
b. Automatic two-digit month.

2. Body

a. Compute Quantity times Price and suppress printing of the Product (Gross Amount).
b. Apply up to three (two-digits each) Discounts to derive a Net Amount.
c. Compute a Commission percent times the Net Amount to derive a Commission Amount.
d. Manually select distribution of each commission to any one of six salesmen.
e. Compute the Unit Cost times the Quantity to derive the Cost Amount.
f. The Net Amount, Commission Amount, and Cost Amount must be stored for Invoice Total.

3. Footing

a. Sub-total the Net Amount and compute a 4% Tax to derive the Tax Amount.
b. Add in a Freight Charge.
c. Derive the Net Invoice Total, Net Commission Total, Net Cost Total.
d. Compute the Invoice Profit (suppress readout).

4. Daily By-Product Computations

a. Provide daily Grand Totals for:
(1) Tax (4) Commission
(2) Freight (5) Cost
(3) Invoices (6) Profit

b. Distribute and total commissions for six salesmen.

Special Requirements

1. *Load Card*—a card must be provided for the daily loading of the consecutive invoice number and month into Processor storage.
2. *Header and Item "Card-Making" Programs*—programs must be prepared for the automatic preparation of Header (customer) and Item (detail) Cards.
3. *Daily By-Product Computations*—two master tapes to be used with the daily by-product "Grand Total" and "Commission" tapes must be programmed.
4. *Tax, Freight and Invoice Total Cards*—cards must be prepared for the Tax, Freight, and Invoice Total programs.
5. Selective ability to manually enter or to bypass entry of "Ship To" information in the heading.
6. By-product tape from VERTIPUNCH Two for tape to card converter operation.

Field Control Requirements

1. *Field Control One*—Operate with the Header and item programs.
   a. Turn Reader One "ON" after two digit "day" is entered.
   b. Turn Punch Two "OFF" and Reader One "ON" after Commission Distribution selection is entered.

2. *Field Control Two*—For making Item Cards.
   a. Turn On Reader One
      (1) To punch decimal between dollars and cents of price.
      (2) After 3 digits of price to the right of the decimal have been punched.
      (3) After six digit code number is punched.
      (4) After 34 characters of description have been punched.
      (5) To punch decimal between dollars and cents of price.
      (6) After three digits of price to the right of the decimal have been punched.
      (7) To punch decimal for commission percent.
      (8) After one digit to the right of the decimal has been punched for commission percent.
      (9) To punch decimal for unit cost.
      (10) After three digits to the right of the decimal have been punched for unit cost.

3. *PA1 (External Entry) Reader One On Control*—to be used during Loading operation and line item operations.
   a. Start Reader One after six digit "invoice number" entry.
   b. Start Reader One after two digit "month" entry.
   c. Start Reader One after quantity entry.
   d. Start Reader One after each discount entry.
   e. Start Reader One after dollar amount of freight is manually entered.
   f. Start Reader One after cent amount of freight is manually entered.

Format

Application requirements have determined that the maximum number of item lines will be three. The program billing loop will provide the facility for three line items. When less than three lines are typed, the Tax card will initiate a Special Skip of the Program loop back to the beginning.

None, One, Two, or Three discounts may be entered. When less than three are entered, a tape Skip must be manually initiated to bypass the remaining discount programs.

Punched Output (application two)

TYPETRONIC VERTIPUNCH One

Tape #1 will be an output tape for a tape-to-card converter. (NOTE: Converter "program" codes have not been included since the type of converter is not established.) The converter tape will include: customer number, invoice number, date, item quantities, product codes, net amounts, commission amounts, and cost amounts. This tape will also provide data for tax, freight and invoice total, and profit total detail cards when operated on the converter.

TYPETRONIC VERTIPUNCH Two

Tape #2 will be used for two operations on the 7816 to derive the following daily totals:

First Operation: Grand totals of: Taxes, Freight charges, Net Invoices, Commission, Cost and Profit.

Second Operation: Grand Commission Totals for six salesmen.

The Form

A complete form has been prepared to show a typical application invoice.

The Layout Sheet

The Layout Sheet graphically describes the automatic printing and computing operations of the application. Note the assignments given to input orders, registers, and output codes.

All entries on the form are automatic (either from OPTIMATIC Reader or Processor output) unless marked with a circled "V" (V).

The Program Sheets

To aid in the understanding of the programming, individual point to point programming sheets have been prepared. They are:

1. Header and Item card-making program (and daily load card)
2. Heading Program and Operation
3. Line Item Program and Operation
4. Tax Card and Freight Card Programs
5. Total Card Program
6. Daily Commission Total Program
7. Daily Grand Total Program

Operation of the Complete Application

The Program Sheets outline the steps for preparing cards and operating the application, since the operator's duties are relatively simple. Following is an abbreviated set of operator instructions (NOTE: The set-up of tab stops, margin, etc. have been omitted since they constitute a "one-time" operation.)

Daily (Before Commencing Billing)

1. Align the first form in the carriage.
2. Check that the tab stops, margin, and linespace are correct.
3. Check the tape supply in each punch and "clear" the punches (by feeding blank tape).
4. Feed enough tape to affix to each VERTIPUNCH rewind reel.
5. Insert the billing program loop in Reader One.
6. Place the daily load card in Reader Two. Operate the card and manually enter the starting invoice number and month.
7. Special Skip the Program loop.

Each Invoice

1. Insert a Customer Card in Reader Two.
2. a. If "Ship To" is the same as "Sold To" start Reader One.
   b. If "Ship To" and "Sold To" are different, turn "on" the SELECTIVE SKIP OFF switch and then start Reader One.
3. a. When the reader stops (from 2.b. above) fill in the first line of the "Ship To." Start Reader One; when the reader stop fills in the "Ship To" street address. Repeat for the "City and State" line.
   b. When Reader One stops (after item 2.a. or 3.a. above) type in the two digit day. (Reader will start automatically.)
4. When the reader stops, type Customer Order Number. Start Reader One.
5. When the reader stops, Customer Card is completed.
6. Insert first Item Card in Reader Two and start Reader One.
7. When Reader stops, type Quantity (Reader will start automatically).
8. When the reader stops, type Discounts (if any). (Reader will start automatically after each Discount.) If less than three Discounts, manually skip Reader One.
9. When the reader stops, enter Salesman distribution selection (Salesman G, H, I, J, K, or P.)
10. Repeat steps 7 through 9 for each Item Card.
11. Insert the Tax Card in Reader Two and start Reader Two.
12. Insert the Freight Card in Reader Two and start Reader Two.
13. When the reader stops, type the freight amount (Reader will start automatically).
14. Insert Total Card in Reader Two and start Reader Two. When the Total Card is finished, remove the form and repeat steps 1 through 14 for the next invoice.

Daily (at the End of Billing)

1. Remove by-product tape number one and forward to the tape-to-card converter location.
2. Manually punch SSKF, SW, SKF, and SW codes in tape number two.
3. Tear off tape number two and place it in Reader One.
4. Place Daily Commissions program in Reader Two.
5. Turn "on" Reader Two.
6. When Reader Two stops, initiate a Skip in Reader One.
7. Tape will operate automatically and distribute commissions to each salesman (printing will not occur). When entire distribution is completed the six totals will automatically print.
8. Replace tape number two in Reader One.
9. Place Daily Grand Total tape in Reader Two.
10. Turn on Reader Two.
11. When tapes are completed the six grand totals will print.

SCM® DATA PROCESSING SYSTEMS
DIVISION OF SCM CORPORATION

TYPETRONIC® 2816 & 7816 LAYOUT SHEET

SHEET 1 OF 8

DATE 10/3/XX INVOICE NO. ✓ CUSTOMER ✓

DPS BRANCH ✓ SYSTEMS REP. ✓ PREP'D BY ✓ APPLICATION INVOICE

LIMITS: 15½" FORM—14" WRITING LINE (10 CHAR. PER INCH)

PRINTER LAYOUT

STD. LINESPACE: 6, 3 & 2 LINES PER INCH

LINE NOTATIONS

SOLD TO
TWIN PEAKS STEEL CO.
21305 MOUNTAIN BLVD.
TWIN PEAKS COLORADO

SHIP TO

ORDER or INVOICE No.	DATE	CUSTOMER ORDER OR REQ. NO.	TERMS
11112	10/03/XX	JD 39003487	NET 30 DAYS

QUANTITY	CODE	DESCRIPTION	UNIT PRICE	DISCOUNT(S)	NET	COMM%	COMM. AMOUNT	COMM DIST.	UNIT COST	COST AMOUNT
1	265890	20 X 32 STEEL HEAD DRUMS	10.000	10	9.00	25.5	2.30	G	8.025	8.03
10	304991	40 X 60 STEEL HEAD DRUMS	15.205	10 5 10	117.00	20.0	23.40	H	9.000	90.00
100	457212	50 X 75 SOLID DRUMS - GREY	106.325	10 10 10	7751.09	15.5	1201.42	J	58.405	5840.50
					7877.090					
		4.0% TAX			315.08					
		FREIGHT			25.00					
					8217.17*		1227.12*			5938.53

M T T T T T T T T T T T

0 1 2 3 4 5 6 FIELD CONTROL 8 9 10 11 12 13 14

FC2 7815
PUNCH ONE OFF 1
PUNCH TWO OFF 2
READ ONE ON 3
PUNCH ONE OFF 4
PUNCH TWO OFF 5
READ ONE ON 6
RESTORE ENABLE 7
R1N IN PA1 8

LAYOUT NOTATIONS

FORM DPS 2001

INPUT ORDER ASSIGNMENTS

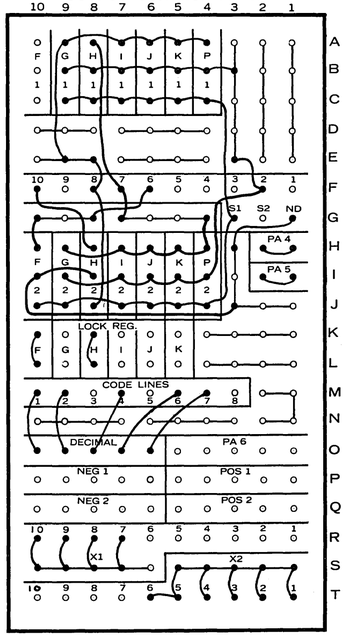
	ENTRY	START	DECIMAL
1	INVOICE NUMBER	6	51
2	MONTH	10	8
3	QUANTITY	9	6
4	PRICE	6	3
5	DISCOUNT (S)	7	7
6	COMMISSION %	7	7
7	UNIT COST	6	3
8	TAX	8	8
9	FREIGHT	8	2
10	UP DATE INVOICE #	1	1
11			
12			
13			
14			
15			
16			

	ENTRY	START	DECIMAL
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			

OUTPUT CODE ASSIGNMENTS

OUTPUT	FUNCTION	1	2	3	4	5	6	7	8
DECIMAL		●	●	○	●	○	●	●	○
PA-6 (when zero)		○	○	○	○	○	○	○	○
POS. 1		○	○	○	○	○	○	○	○
POS. 2		○	○	○	○	○	○	○	○
NEG. 1		○	○	○	○	○	○	○	○
NEG. 2		○	○	○	○	○	○	○	○

OUTPUT CONTROL PANEL



REGISTERS

	START	DECIMAL	STOP	UTILIZATION
F1				QUANTITY (FOR PA 4 EXTRACTIONS)
G1	8	2	S1	NET TOTAL - NET GRAND TOTAL
H1	7	2	S1	COMMISSION TOT - COMMISSION GRAND TOT.
I1	8	2	S1	COST TOTAL - COST GRAND TOTAL
J1	8	2	S1	PROFIT TOTAL - PROFIT GRAND TOTAL
K1	8	2	S1	FREIGHT GRAND TOTAL
P1	8	2	S1	NET AMOUNT - COST AMOUNT - TAX GRAND TOT

F2	6	ND	S1	INVOICE NUMBER
G2	7	2	S1	COMMISSION AMOUNT
H2	10	ND	8	MONTH
I2	7	2	S1	COMMISSION AMOUNT
J2	7	2	S1	COMMISSION AMOUNT
K2	7	2	S1	COMMISSION TOTAL - COMMISSION AMT.
P2	7	2	S1	COMMISSION AMOUNT

SCM® DATA PROCESSING SYSTEMS
DIVISION OF SCM CORPORATION

TYPETRONIC® 2816 SALES ORDER INVOICE
AUTOMATED DATA SYSTEM

SOLD TO:
TWIN PEAKS STEEL CO.
21305 MOUNTAIN BLVD.
TWIN PEAKS, COLORADO

SHIP TO: (same as sold to unless indicated)

ORDER OR INVOICE NO.	DATE	CUSTOMER ORDER OR REQ. NO.	TERMS
111112	8/20/6X	JD 39003487	NET 30 DAYS

QUANTITY	CODE	DESCRIPTION	UNIT PRICE	DISCOUNT(S)	NET	COMM. %	COMM. AMOUNT	COMM. DIST.	UNIT COST	COST AMOUNT
1	265890	20 X 32 STEEL HEAD DRUMS	10.000	10	9.00	25.5	2.30	G	8.025	8.03
10	304991	42 X 60 STEEL HEAD DRUMS	15.205	10 5 10	117.00	20.0	23.40	H	9.000	90.00
100	457212	50 X 75 SOLID DRUMS - GREY	106.325	10 10 10	7751.09	15.5	1201.42	J	58.405	5840.50
					7877.090					
		4.0% TAX			315.08					
		FREIGHT			25.00					
					8217.17*		1227.12*			5938.53*

TYPETRONIC® 7816
AUTOMATED DATA COMPUTING SYSTEM

Featuring Unique PARAPROCESSING®
and VERSATRONIC® Program Control

ON INTERNAL ACCOUNTING COPIES ONLY

SCM® DATA PROCESSING SYSTEMS
DIVISION OF SCM CORPORATION

TYPETRONIC® PROGRAM SHEET

CUSTOMER _____

APPLICATION Invoice DATE 10/3/XX INVOICE NO. _____

HEADING CARDS DPS BRANCH PREP'D BY SHEET 2 OF 8

CARD-MAKING PROGRAM

INDICATE IN THE HEADING BLOCKS BELOW, THE INPUT AND OUTPUT UNITS USED IN THIS PROGRAM

PROGRAM AND OPERATION DETAIL	READER 1 HEADER PROGRAM		PUNCH 1 HEADER CARDS		
INSERT BLANK PAPER IN PLATEN	CCN				
TURN ON READER 1	APN				
	CR				
	PIN				
	UC				
TYPE SOLD TO NAME	STP		NAME		
TURN ON READER 1					
	CCF				
	SW		SW		
	CCN		CCN		
	PIF				
	TB				
	PIN				
	LC				
TYPE CUSTOMER#(5 DIGITS)	STP		CUST #		
TURN ON READER 1					
	CCF				
	SW		SW		
	CCN		CCN		
	PIF				
	CR				
	PIN				
TYPE SOLD TO STREET	STP		STREET		
TURN ON READER 1					
	CCF				
	SW		SW		
	CCN		CCN		
	PIF				
	CR				
	PIN				
	UC				
TYPE SOLD TO CITY & STATE	STP		CITY & STATE		
TURN ON READER 1					
	CCF				
	LC				
	SW		SW		
	CCN		CCN		
	PIF				
	TB				
	PIN				
	UC				
TYPE TERMS	STP		TERMS		
TURN ON READER 1					
	CCF				
	LC				
	SW		SW		
	CCN		CCN		
	PIF				
	SKF				
REPEAT PROGRAM					

FORM DPS 2002

ITEM CARD PROGRAM CUSTOMER

PROGRAM AND OPERATION DETAIL	READER 1 ITEM PROGRAM		PUNCH 1 ITEM CARDS		
INSERT BLANK PAPER IN PLATEN	SKF				
TURN ON READER 1	CCN				
	PIF				
	FC 2N				
	APN				
	CR				
TYPE PRICE (3 DIGITS)	PIN				
RN FC 2	STP		PRICE		
	.		.		
TYPE PRICE (3 DIGITS)	STP		PRICE		
RN FC 2	CCF				
	SW		SW		
	CCN		CCN		
	PIF				
	TB				
	PIN				
TYPE ITEM CODE (6 DIGITS)	STP		CODE		
RN FC 2					
	CCF				
	SW				
	CCN				
	PIF				
	TB				
	PIN				
TYPE DESCRIPTION (IF NOT PAST 46 TAB TO 47)	STP		DESCRIP.		
RN FC2 or TURN ON READER 1					
	CCF				
	SW		SW		
	CCN		CCN		
	PIF				
	TB				
	PIN				
TYPE PRICE (3 DIGITS)	STP		PRICE		
RN FC 2	.		.		
TYPE PRICE (3 DIGITS)	STP		PRICE		
RN FC 2					
	CCF				
	SW		SW		
	CCN		CCN		
	PIF				
	TB				
	PIN				
TYPE WHOLE NUMBER COMM% (2 DIGITS)	STP		COMM%		
RN FC 2	.		.		
TYPE COMM. % (1 DIGIT)	STP		COMM%		
RN FC2					
	CCF				
	SW		SW		
	CCN		CCN		
	PIF				
	TB				
	PIN				
TYPE COST AMOUNT (3 DIGITS)	STP		COST AMT		
RN FC 2	.		.		
TYPE COST AMOUNT (3 DIGITS)	STP		COST AMT		
RN FC 2					
	CCF				
	SW		SW		
	CCN		CCN		
REPEAT PROGRAM	PIF				

FOLD UNDER

PROGRAM AND OPERATION DETAIL	READER 1 LOAD CARD				
TURN ON READER 1					
	CCN				
	FC IN				
	APF				
	PA3				
	F				
	G				
	H				
	I				
	J				
	K				
	P				
	PRC				
	PA1				
	6				
TYPE INVOICE NUMBER (6 DIGITS)	STP				
RN DV					
	F				
	PRC				
	APN				
	TB				
	PA1				
	0				
TYPE MONTH (2 DIGITS)	STP				
RN DV					
	H				
	PRC				
	CR				
	APF				
	FC IF				
	STP				

FOLD OVER

SCM® DATA PROCESSING SYSTEMS
DIVISION OF SCM CORPORATION

TYPETRONIC® PROGRAM SHEET

CUSTOMER _____

APPLICATION Invoice DATE 10/3/XX INVOICE NO. _____

DPS BRANCH PREP'D BY SHEET 3 OF 8

INVOICE HEADING PREPARATION

INDICATE IN THE HEADING BLOCKS BELOW, THE INPUT AND OUTPUT UNITS USED IN THIS PROGRAM

PROGRAM AND OPERATION DETAIL	READER 1 PROGRAM LOOP	READER 2 HEADER CARD	PUNCH 1 SVC. BUR.	PUNCH 2 GRAND TOT. COMM'L TAPE	
TO TURN OFF SPECIAL SKIP AND STOP	SSKF				
READER AFTER ONE COMPLETE INVOICE.	STP				
INSERT FORM AT SOLD TO:					
TURN ON READER 1					
	CCN				
	APN				
	P1F				
	P2F				
	CR				
	SW	NAME			
		SW			
	TB				
	SKN				
	SLSKF				
	TB				
TYPE SHIP TO NAME	STP				
TURN ON READER 1					
	SKF				
	LC				
	CR				
	APF				
	PIN				
	SW	CUST #	CUST #		
		SW			
	P1F				
	APN				
	SW	STREET			
		SW			
	PIN				
	TB		TB		
	P1F				
	SKN				
	SLSKF				
	TB				
TYPE SHIP TO ADDRESS	STP				
TURN ON READER 1					
	SKF				
	CR				
	SW	CITY & STATE			
		SW			
	TB				
	SKN				
	SLSKF				
	TB				
TYPE SHIP TO CITY & STATE	STP				
TURN ON READER 1	SKF				
	CR2				
	FCIN				

FORM DPS 2002

CUSTOMER

PROGRAM AND OPERATION DETAIL	READER 1 PROGRAM LOOP	READER 1 HEADER CARD	PUNCH 1 SVC. BUR.	PUNCH 2 GRAND TOT. + COMM. TOT.	
	PIN				
	PA5				
	F				
	2				
R/O 6 DIGIT INV. #	PRC		INV. #		
	TB		TB		
	PA5				
	H				
	2				
R/O 2 DIGIT MONTH	PRC		MONTH		
	/		/		
TYPE DAY (2 DIGITS)	STP		DAY		
RN FC 1					
	/		/		
	63		63		
	TB		TB		
	PIF				
TYPE CUST ORDER #	STP				
TURN ON READER 1					
	TB				
	SW	TERMS			
		SW			
	CR2				
END OF HEADER	STP				
REMOVE HEADER CARD FROM READER 2					

FOLD UNDER

CUSTOMER

PROGRAM AND OPERATION DETAIL					

FOLD OVER

SCM® DATA PROCESSING SYSTEMS
DIVISION OF SCM CORPORATION

TYPETRONIC® PROGRAM SHEET

CUSTOMER _____

APPLICATION Invoice DATE 10/3/XX INVOICE NO. _____

DPS BRANCH PREP'D BY SHEET 4 OF 8

INVOICE LINE ITEM PREPARATION

INDICATE IN THE HEADING BLOCKS BELOW, THE INPUT AND OUTPUT UNITS USED IN THIS PROGRAM

PROGRAM AND OPERATION DETAIL	READER 1 PROGRAM LOOP	READER 2 ITEM CARD	PUNCH 1 SVC. BUR.	PUNCH 2 GRAND TOT. + COMM. TOT.	
INSERT ITEM CARD IN READER 2					
TURN ON READER 1	SP3				
	PIN				
	PA1				
	9				
TYPE QUANTITY (3 DIGITS)	STP		QTY.		
RN DV					
ENTER QUANTITY IN F	F				
ENTER QUANTITY IN D	D				
	PRC				
	TB		TB		
	PIF				
	APF				
	PA1				
	6				
	SW	PRICE SW			
	R				
ENTER PRICE IN R.	PRC				
	APN				
	PIN				
	SW	CODE SW	CODE		
	TB		TB		
	PIF				
	SW	DESCRIP SW			
	TB				
	APF				
	PA5				
SUPPRESSED R/O OF NET AMOUNT	P				
NET AMOUNT ENTERED IN D.	PRC				
	APN				
	SW	PRICE SW			
	TB				
	PA1				
	7				
TYPE FIRST DISCOUNT (2 DIGITS)	STP				
RN DV					
IF NO DISCOUNT INITIATE SKIP IN READER 1					
ENTER DISCOUNT IN R.	R				
NEGATIVE MULTIPLICATION	N				
MULTIPLY NET AMOUNT X DISCOUNT	PRC				
	SP2				
	APF				
	PA5				
SUPPRESSED R/O OF NET AMOUNT	P				
NET AMOUNT ENTERED IN D.	PRC				
	APN				

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PROGRAM AND OPERATION DETAIL	READER 1 PROGRAM LOOP	READER 2 ITEM CARD	PUNCH 1 SVC. BUR.	PUNCH 2 GRAND TOT. + COMM. TOT.	
	PA1				
	7				
TYPE SECOND DISCOUNT (2 DIGITS) ⟨	STP				
RN DV					
IF NO DISCOUNT, INITIATE SKIP IN READER 1					
ENTER DISCOUNT IN R	R				
NEGATIVE MULTIPLICATION	N				
MULTIPLY NET AMOUNT X DISCOUNT	PRC				
	SP2				
	APF				
	PA5				
	P				
SUPPRESSED R/O OF NET AMOUNT	PRC				
NET AMOUNT ENTERED IN D					
	APN				
	PA1				
	7				
TYPE THIRD DISCOUNT (2 DIGITS) ⟨	STP				
RN DV					
IF NO DISCOUNT, INITIATE SKIP IN READER 1					
ENTER DISCOUNT IN R	R				
NEGATIVE MULTIPLICATION	N				
MULTIPLY NET AMOUNT X DISCOUNT	PRC				
	SKF				
	TB				
	PIN				
	PA3				
	P				
R/O NET AMOUNT	PRC		NET AMT.		
	TB		TB		
	PIF				
	PA2				
TRANSFER NET AMOUNT IN D FOR MULT.	D				
TRANSFER NET AMOUNT IN G FOR TOTAL	G				
TRANSFER NET AMOUNT IN J FOR PROFIT	J				
	PRC				
	PA1				
	7				
	SW	COMM.%			
		SW			
ENTER COMM.% IN R	R				
MULTIPLY NET AMOUNT X COMM.%	PRC				
	TB				
	P2N				
	APF				
	CCF				
	SKF			SKF	
	PA1			PA1	
	7			7	
	CCN			CCN	
	APN				
	PIN				
	PA3				
	P				
	2				
R/O COMMISSION AMOUNT	PRC		COMM. AMT.	COMM. AMT.	
	P2F				
	FCIN				
	TB		TB		
	PIF				

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PROGRAM AND OPERATION DETAIL	READER 1 PROGRAM LOOP	READER 2 ITEM CARD	PUNCH 1 SVC. BUR	PUNCH 2 GRAND TOT. COMM. TOT.	
	PA2				
	H				
TRANSFER COMM. AMT. IN H FOR TOTAL	PRC				
	P2N				
TYPE COMMISSION DIST. (G, H, I, J, K, P)	STP			COMM. DIST.	
RN FC1 P2F FC1					
	TB				
	P2N				
	CCF				
	PRC			PRC	
	SKN			SKN	
	CCN			CCN	
	P2F				
	APF				
	PA4				
	F				
	2				
SUPPRESSED R/O OF F TO EXTRACT QUANTITY	PRC				
	PA2				
	D				
	F				
TRANSFER QUANTITY TO D AND TO F	N				
NEGATIVELY (SUBTRACT QTY-QTY TO CLEAR F)	PRC				
	APN				
	PA1				
	6				
	SW	COST			
		SW			
ENTER COST IN R	R				
MULTIPLY COST X QUANTITY	PRC				
	TB				
	P1N				
	PA3				
	P				
R/O COST AMOUNT	PRC		COST AMT.		
	CR		CR		
	P1F				
	PA2				
	I				
TRANSFER COST AMOUNT TO I FOR TOTAL	PRC				
	≈				
REPEAT ITEM PROGRAM TWO MORE TIMES	≈				
	≈				
REMOVE ITEM CARD	STP				

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DPS BRANCH PREP'D BY SHEET 5 OF 8

TAX CARD AND FREIGHT CARD PROGRAMS

INDICATE IN THE HEADING BLOCKS BELOW, THE INPUT AND OUTPUT UNITS USED IN THIS PROGRAM

PROGRAM AND OPERATION DETAIL	READER 1 PROGRAM LOOP	READER 2 TAX CARD	PUNCH 1 SVC. BUR.	PUNCH 2 GRAND TOT. & COMM. TOT.	
INSERT TAX CARD IN READER 2					
TURN ON READER 2		CCN			
		APN			
		CR			
		TB6			
		PA5			
R/O NET AMOUNT SUB-TOTAL		G			
NET AMOUNT ENTERED IN D		PRC			
		◊			
		CR			
		TB2			
		PA1			
		8			
		4.0%			
ENTER TAX IN R		R			
MULTIPLY TAX X NET AMOUNT		PRC			
		SP			
		TAX			
		TB			
		P2N			
		APF			
		CCF			
		SSKF		SSKF	
		PA1		PA1	
		8		8	
		CCN		CCN	
		P2F			
		APN			
		TB3			
		PIN			
		P2N			
		PA3			
		P			
R/O TAX AMOUNT		PRC	TAX AMT.	TAX AMT.	
		P2F			
		CR	CR		
		PIF			
		P2N			
		CCF			
		P		P	
		PRC		PRC	
		SSKN		SSKN	
		CCN		CCN	
		P2F			
		PA2			
		G			
TRANSFER TAX AMOUNT TO G FOR TOTAL		PRC			
		STP			

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PROGRAM AND OPERATION DETAIL	READER 1 PROGRAM LOOP	READER 2 FREIGHT CARD	PUNCH 1 SVC. BUR	PUNCH 2 GRAND TOT. + COMM. TOT.	
INSERT FREIGHT CARD IN READER 2					
TURN ON READER 2		CCN			
		APN			
		CR			
		TB2			
		FREIGHT			
		TB			
		P2N			
		APF			
		CCF			
		SSKF		SSKF	
		PAI		PAI	
		8		8	
		CCN		CCN	
		P2F			
		APN			
		TB3			
		PIN			
		P2N			
		PAI			
		8			
		SP4	SP4	SP4	
TYPE FREIGHT (2 DIGITS) <		STP	FREIGHT	FREIGHT	
RN DV		•			
TYPE FREIGHT (2 DIGITS) <	SW	STP	FREIGHT	FREIGHT	
RN DV					
	SW	G			
ENTER FREIGHT AMOUNT IN G FOR TOTAL		PRC			
		P2F			
		CR	CR		
		SSKN			
		PIF			
		P2N			
		APF			
		CCF			
		K		K	
		PRC		PRC	
		SSKN		SSKN	
		CCN		CCN	
		P2F			
REMOVE FREIGHT CARD <		STP			

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PROGRAM AND OPERATION DETAIL					

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TOTAL CARD PROGRAM

INDICATE IN THE HEADING BLOCKS BELOW, THE INPUT AND OUTPUT UNITS USED IN THIS PROGRAM

PROGRAM AND OPERATION DETAIL	READER 1 PROGRAM LOOP	READER 2 TOTAL CARD	PUNCH 1 SVC. BUR.	PUNCH 2 GRAND TOT. + COMM. TOT.	
INSERT TOTAL CARD IN READER 2					
TURN ON READER 2		CCN			
		APN			
		CR			
		TB			
		P2N			
		APF			
		CCF			
		SSKF		SSKF	
		PA1		PA1	
		8		8	
		CCN		CCN	
		APN			
		P2F			
		TB5			
		PIN			
		P2N			
		PA3			
		G			
R/O NET TOTAL		PRC	NET TOTAL	NET TOTAL	
		PIF			
		P2F			
		*			
		PIN			
		TB	TB		
		PIF			
		P2N			
		APF			
		CCF			
		G		G	
		PRC		PRC	
		PA1		PA1	
		7		7	
		CCN		CCN	
		APN			
		P2F			
		TB			
		PIN			
		P2N			
		PA4			
CONVERT MONTH TO ZEROS		H			
R/O COMMISSION TOTAL		PRC	COMM. TOT.	COMM. TOT.	
		PA2			
TRANSFER COMMISSION TOT. TO H NEGATIVELY		H			
TRANSFER COMMISSION TOT. TO J NEGATIVELY		J			
		N			
		PRC			
		PIF			
		P2F			
		*			

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PROGRAM AND OPERATION DETAIL	READER 1 PROGRAM LOOP	READER 2 TOTAL CARD	PUNCH 1 SVC. BUR.	PUNCH 2 GRAND TOT. + COMM. TOT.	
		PIN			
		TB	TB		
		PIF			
		P2N			
		APF			
		CCF			
		H		H	
		PRC		PRC	
		CCN		CCN	
		APN			
		P2F			
		TB2			
		P2N			
		APF			
		CCF			
		PA1		PA1	
		8		8	
		CCN		CCN	
		APN			
		PIN			
		PA3			
		I			
R/O COST TOTAL		PRC	COST TOTAL	COST TOTAL	
		P2F			
		APF			
		TB	TB		
		APN			
		PIF			
		*			
		CR			
		PA2			
		A			
TRANSFER COST AMOUNT TO J NEGATIVELY		PRC			
		P2N			
		APF			
		CCF			
		I		I	
		PRC		PRC	
		PA1		PA1	
		8		8	
		CCN		CCN	
		PIN			
		PA3			
		J			
SUPPRESSED R/O OF PROFIT TOTAL		PRC	PROFIT TOT.	PROFIT TOT.	
		P2F			
		CR	CR		
		PIF			
		P2N			
		CCF			
		J		J	
		PRC		PRC	
		SSKN		SSKN	
		CCN		CCN	
		P2F			
		PA1			
		1			
		1			
		F			
UPDATE INVOICE No.		PRC			

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PROGRAM AND OPERATION DETAIL	READER 1 PROGRAM LOOP	READER 2 TOTAL CARD	PUNCH 1 SVC. BUR.	PUNCH 2 GRAND TOT. + COMM. TOT.	
REMOVE TOTAL CARD		STP			
				SSKF	
		PUNCHED		SW	
				SKF	
		MANUALLY		SW	

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DAILY COMMISSION TOTALS

INDICATE IN THE HEADING BLOCKS BELOW, THE INPUT AND OUTPUT UNITS USED IN THIS PROGRAM

PROGRAM AND OPERATION DETAIL	READER 1 GRAND TOT ↓ COMM. TOT	READER 2 PROGRAM LOOP (COMM. TOT.)			
INSERT OUTPUT TAPE FROM PUNCH 2 IN READER 1					
TURN ON READER 2		CCN			
		APF			
		FCF			
		P1F			
		P2F			
INITIATE SKIP IN READER 1		STP			
	SKF				
	PA1				
	7				
	CCN				
	COMM. AMT.				
SAMPLE BY-PRODUCT	DIST.				
	PRC				
	SKN				
	CCN				
	SKF				
	SW				
		APN			
		PA3			
		G			
		2			
R/O COMM. AMT. – G		PRC			
		*			
		SP			
		SLSMN. 1			
		SP2			
		PA4			
EXTRACT COMMISSION AMOUNT		H			
R/O COMMISSION AMT – H		PRC			
		*			
		SP			
		SLSMN. 2			
		SP2			
		PA2			
		H			
TRANSFER COMM. AMT. TO H NEGATIVELY		N			
(SUBTRACT COMM. AMT. – COMM. AMT TO CLEAR H)		PRC			
		PA3			
		I			
		2			
		PRC			
R/O COMM. AMT.-I		*			
		SP			
		SLSMN. 3			
		SP2			
		PA3			
		J			

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PROGRAM AND OPERATION DETAIL	READER 1 GRAND TOT. COMM. TOT.	READER 2 PROGRAM LOOP (COMM. TOT.)			
		2			
R/O COMM. AMT. - J		PRC			
		*			
		SP			
		SLSMN. 4			
		SP2			
		PA3			
		K			
		2			
R/O COMM. AMT. - K		PRC			
		*			
		SP			
		SLSMN. 5			
		SP2			
		PA3			
		P			
		2			
R/O COMM. AMT. - P		PRC			
		*			
		SP			
		SLSMN. 6			
		CR			
		STP			

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PROGRAM AND OPERATION DETAIL					

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DPS BRANCH PREP'D BY SHEET 8 OF 8

DAILY GRAND TOTALS

INDICATE IN THE HEADING BLOCKS BELOW, THE INPUT AND OUTPUT UNITS USED IN THIS PROGRAM

PROGRAM AND OPERATION DETAIL	READER 1 GRAND TOT. COMM. TOT.	READER 2 PROGRAM LOOP (GRAND TOT)			
INSERT OUTPUT TAPE FROM PUNCH 2 IN READER 1					
TURN ON READER 2		CCN			
		APF			
		FCF			
		PIF			
		P2F			
		SSKN			
		SW			
	SSKF				
	PA1				
	8				
	CCN				
	TAX AMT.				
SAMPLE BY-PRODUCT	P				
	PRC				
	SSKN				
	}				
	SSKF				
	SW				
		APN			
		PA3			
		P			
R/O TAX GRAND TOTAL -P		PRC			
		* *			
		SP			
		TAX			
		SP2			
		PA3			
		K			
R/O FREIGHT GRAND TOTAL - K		PRC			
		* *			
		SP			
		FREIGHT			
		SP2			
		PA3			
		G			
R/O INVOICE GRAND TOTAL - G		PRC			
		* *			
		SP			
		INVOICE			
		SP2			
		PA3			
		H			
R/O COMMISSION GRAND TOTAL - H		PRC			
		* *			
		SP			
		COMMISSION			

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PROGRAM AND OPERATION DETAIL	READER 1 GRAND TOT. COMM. TOT.	READER 2 PROGRAM LOOP (GRAND TOT.)			
		SP2			
		PA3			
		I			
R/O COST GRAND TOTAL - I		PRC			
		* *			
		SP			
		COST			
		SP2			
		PA3			
		J			
R/O PROFIT GRAND TOTAL - J		PRC			
		* *			
		SP			
		PROFIT			
		CR			
		STP			

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PROGRAM AND OPERATION DETAIL					

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7. Physical Preparation of Programs

Punching the Program Tape or Card

Once the program has been checked for accuracy and is presumed correct, the program tape can be punched.

Since the initial punching of a program tape is a manual operation, it must be done carefully. It is highly preferable that someone assist in the preparation by sequentially reading the codes aloud as they are punched.

Refer to the Code Chart (page 9) for the use of the ON CODE PUNCH and OFF CODE PUNCH keys for punching Control Codes.

Conditioning the 7816 for Program Preparation

When the 7816 is turned on, all control conditions are off. For preparing the original program tape it is necessary to turn on one of the VERTIPUNCHes manually and feed several inches of tape to provide a lead strip. Once this is done, code punching can commence. Each code is now sequentially punched into the tape. In the case of printing codes, it is only necessary to depress the associated I/O Printer key to punch the code.

Control codes are punched by holding down the ON CODE PUNCH, OFF CODE PUNCH or CLEAR STORAGE key in conjunction with each desired control or printer key. For example, holding down the ON CODE PUNCH and depressing the CODE CONTROL key will automatically punch the Code Control "ON" code (CCN) in the tape. When either CODE PUNCH key is held down, it disables the control action of the control keys, so depressing the CODE CONTROL key (as in the above example) will not turn on Code Control. The PA1 code is made by holding down the CLEAR STORAGE key and depressing the numeral one (1) key. Code Control should be "OFF" when manually punching control codes.

Continue on with the remainder of the program tape. When the program is completed, feed out several inches of tape from the punch and tear off the tape.

If data cards are to be used in the application (as in a two-reader system), one card should be punched representative of each card format (typically one header card and one detail card).

The program tape must now be operationally checked with these cards. To facilitate this checking, it is highly desirable to use the SINGLE STEP key for stepping code by code through the program. As each code is read in the reader, determine that the function corresponds with the written code on the program sheet. If it does not, make a note to that effect. If the error does not affect perputuated results then continue on with the checking. Otherwise it is best to immediately correct the program tape.

Correcting the Program Tape

In many instances the program will be correct the first time prepared. However, when programming or punching mistakes have been made, the program must be corrected and a new tape prepared. This may be done by inserting the first-made program tape in Reader One, turning on SINGLE STEP and VERTIPUNCH One and then sequentially stepping the tape through the reader. CODE CONTROL must be "off" when this is done. To insure Code Control remains off, turn the DUPLICATE switch "ON."

Adding a Code

If a code must be added, step the tape to the correct position, turn off Reader One, punch the code and start the reader again (SINGLE STEP remains "ON").

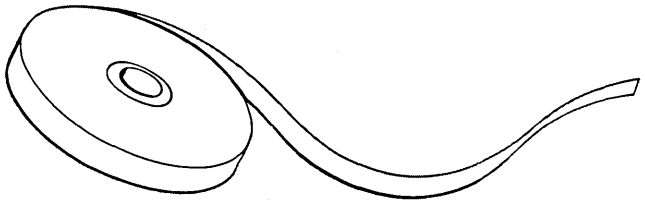
Removing a Code

If a code must be taken out, Single Step the reader up to the code, manually turn the tape past the code to be removed, and continue.

When the new tape is completed, check it operationally with the data cards. If it is correct or "more correct" than the preceding tape, destroy the preceding tape immediately.

Once a perfect program has been prepared, it may now be highspeed duplicated (with the DUPLICATE control "ON") into a permanent media such as laminated plastic/paper tape.

8. Preparing Field Control Tapes



Field Control Media

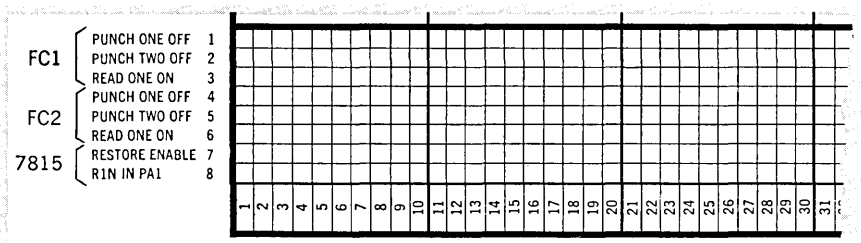
The TYPETRONIC MULTIMODE Field Control uses as its media, special fibrous tape punched on the TYPETRONIC VERTI-PUNCH.

Each channel of tape corresponds with a track of Field Control and each punch position on tape corresponds with a columnar position on the I/O Printer carriage.

Field Control Tracks

Tape channels 1, 2, and 3 are used for Field Control One mode, and channels 4, 5, and 6 for Field Control Two mode. Channels 7 and 8 are effective only in a PA1 sequence as follows:

TRACK	FUNCTION
7	When a signal from track 7 is present, depression of the RESTORE control will clear the digit entry back to (but not including) the order designator.
8	During a PA1 sequence track 8 will turn on Reader One. This track is typically used to insert the decimal automatically (from tape code).



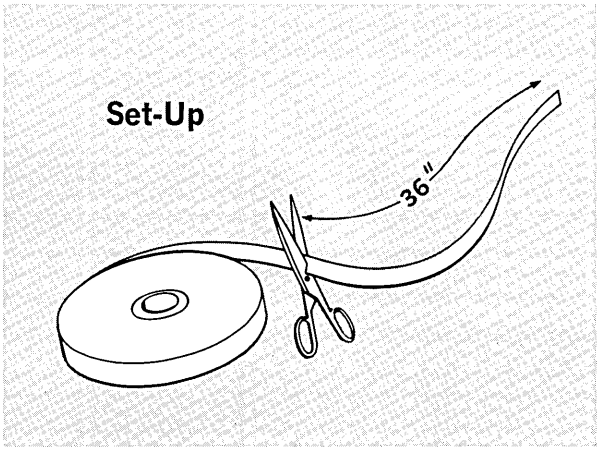
Tracks One through Six function as follows:

	TRACK	FUNCTION
FIELD CONTROL ONE	1	Turns off VERTIPUNCH One
	2	Turns off VERTIPUNCH Two
	3	Turns on Reader One
FIELD CONTROL TWO	4	Turns off VERTIPUNCH One
	5	Turns off VERTIPUNCH Two
	6	Turns on Reader One

When a Field Control tape is to be prepared, it must be provided with punched retainer holes for attaching it to the Field Control Media Carrier. Once attached, it is considered permanent since it is expected that each Field Control tape has its individual carrier plate.

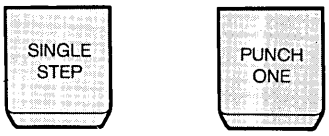
Field Control codes must be punched only in fibrous, black, one inch tape supplied expressly for this purpose.

Set-Up



Cut off a strip of fibrous tape about 36″ in length. This should be done with scissors, since creasing or folding is to be avoided. Place the tape in the punch and blank feed three or four inches until the feed punching is consistent.

Conditioning



Turn on VERTIPUNCH One and SINGLE STEP. Punch the letter "K" code in the tape. Single Step blank FEED four times only. (When SINGLE STEP is "on", FEED will step one position per depression.) Punch the letter "K" again (the two "K" codes will later be overlapped to provide the left retainer holes for the media carrier.) Single Step blank FEED *nine* times only. This will position the Field Control tape at column one.

NOTE: It must be remembered that carriage position on the I/O Printer does not, at this time, necessarily correspond with the Field Control position of the tape. To prepare Field Control media, *only* the Field Control program layout should be followed.

There are 255 possible combinations of Field Control track actuation that can be punched in any one media column, and it is not practical to list each code representative of every combination. It is recommended that individual Field Control columns be prepared by an "over-punching" technique. To accomplish this, it is only necessary to type the Printer code that represents a given track, back the punch and type the next designated track and so forth. As an example, if tracks 1, 2, 3, and 5 were to be punched this sequence would be followed:

Type the digit "one"	(Punches the first track)
Back the punch	
Type the digit "two"	(Punches the second track)
Back the punch	
Type the digit "four"	(Punches the third track)
Back the punch	
Type the "space"	(Punches the fifth track)

The following Printer codes represent each individual track of Field Control:

TRACK REQUIRED	CHANNEL PUNCHED	PRODUCED BY (Printer Key)
1	1	Numeral One (1)
2	2	Numeral Two (2)
3	3	Numeral Four (4)
4	4	Numeral Eight (8)
5	5	Space Bar (SP)
6	6	Numeral Zero (0)
7	7	Minus Sign (—)
8	8	Carriage Return (CR)

As the Field Control media tape is prepared, very carefully maintain count of the columnar layout positions in relation to the tape. Any column that does not require Field Control actuation should be passed over by Single Stepping the FEED key. DO NOT TURN OFF SINGLE STEP while preparing Field Control media.

Each combination of functions should be punched into the Field Control tape precisely at the columnar position shown on the layout.

When all Field Control actuation codes have been punched in the media tape, step the tape to the position just after 140 (140 is the last column of Field Control programming). Then Single Step the FEED *twelve* more times and type the letter "L." Single Step FEED *six* times and again type the letter "L." These two "L" codes will be overlapped to make the right hand retainer holes of the Field Control media.

The tape must now be cut off approximately four feed holes to the left and the right of the extreme retainer holes respectively. (Cut perpendicularly to the length of the tape.)

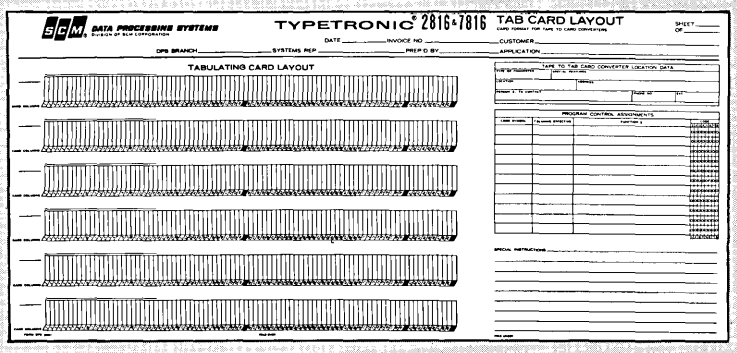
Check the tape by laying it over the Field Control Grid of the Layout Sheet. If the tape is correct, carefully fold over the ends of the tape so each set of retainer holes accurately overlaps. The folds must now be bonded with any acetone base cement (such as "household" or "airplane" type).

Once thoroughly dried, the tape can be affixed to its carrier by placing the retainer holes over the matching carrier pins (NOTE: do not force holes over pins. Properly positioned the holes and pins will correctly match.) The plate is then mounted on the Field Control holder (along the back of the I/O Printer). Field Control tape is long-lasting, and should endure for hundreds of thousands of operations.

9.
Programming Tips and Reminders

TYPETRONIC 2816 & 7816 Tab Card Layout (Form No. DPS 2007)

Purpose of the Tab Card Layout


SCM DATA PROCESSING SYSTEMS
TYPETRONIC® 2816•7816 TAB CARD LAYOUT
TABULATING CARD LAYOUT

This layout has been provided as an additional "tool" for planning TYPETRONIC 7816 programs. When one or more output tapes are to be used for conversion to punched tabulating cards (either 80 or 90 column) it is recommended that the card format be written on the TAB CARD LAYOUT FORM.

How to Use the Layout

Fill in the heading and "converter location" data as indicated by the blocks. As required, indicate in the PROGRAM CONTROL ASSIGNMENTS section the punched tape codes that will be used to represent converter functions.

The CARD LAYOUT section provides room for six individual card formats. Space has been included for numbering and describing each card.

The two card positions, 80 and 90, represent the end-of-card for the 80 and 90 column tabulating cards, respectively. Position 45 indicates the end of the top half of the 90 column card.

Card fields should be headed, and typical punched data written in each field. Automatic card skips or duplications may be indicated by drawing a "criss-cross" over the fields skipped and a horizontal line with the abbreviation "DUP" superimposed to represent duplicated fields. If the SKIP or DUPLICATE is to be initiated by tape code, write the words "FROM CODE" in each appropriate field.

Take Advantage of PARAPROCESSING

While writing the code program, remember that Control codes, and "printer off" codes will respond at thirty characters per second during the delay time caused by I/O Printer carriage motion. A short tabulation will mask as many as 5 such codes without delaying the system. Even individual letters or spaces will mask two Control codes, thus one VERTIPUNCH could be turned off and another on between individual characters without printing delay. Carriage returns are particularly good for masking control functions. When possible, plan automatic skips and Printer Off perpetuation of data during tabulations and carriage returns. By careful programming, PARAPROCESSING will speed the application considerably and provide increased production.

Take Advantage of Skips

Use the SKIP, SPECIAL SKIP, and SELECTIVE SKIP features. Selective Skip, in fact, can serve as a manual "branch" (that is, program change) within the system. For instance, in Application One Selective Skip was used to "reverse" line entries when necessary.

Programs from Programs

In certain applications it may be necessary to write a program for a "master loop" that will then be used to produce other program cards or tapes. This will be necessary whenever a one-reader system is used and both control and constant information will be included in a series of cards or tapes. Such programming is usually more difficult than two-reader programs and extreme care must be exercised in checking them. This is an additional reason for using two-reader 7816 systems.

Simple Program Loops for Making Detail Cards

Detail cards that contain only essential repetitive data will have the TYPETRONIC Switch code (SW) required between each field or section of information. A very simple program loop can be prepared for making these cards. When a given card is complete it will contain a sequence of information like this: data, SW, CCN, data, SW, CCN, data, SW, CCN, and so forth. When MULTIMODE Field Control is used for a card making program, the punching effort is simplified and cards are prepared more rapidly.

Keep Operator Instructions Simple

The program, from the standpoint of the operator, should be simple and straightforward. Avoid the manual starting of Reader Two (instead, start Reader One and switch to Reader Two). Avoid excessive *manual* use of Skip and Special Skip. Except for rare instances, control keys other than READER ONE, SKIP and SPECIAL SKIP should not be operated manually. The objective of the system is to provide automation in source paperwork, and the word "automation" implies minimal operator decision.

Allow for the Unexpected

Very few applications work out exactly as planned. Last minute changes must always be expected. It is advisable to delay preparing tapes (and even written programs) until all concerned have agreed to precisely what is wanted from the system.

The program examples in this manual are only two of an infinite variety of application possibilities. Each new application is unique, and programming therefore, will be unique.

There is no "only way" to program. Specific requirements in one system may warrant programming to be entirely different than another application that on the surface seems nearly the same.

For specific information relating to application planning, please contact the SCM TYPETRONIC Systems representative. Remember—primary programming is a service provided at no charge to SCM customers.

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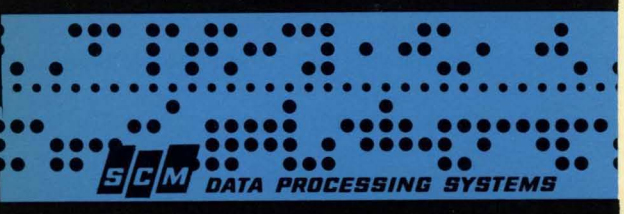

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