TEXAS INSTRUMENTS
Calculator Products Division

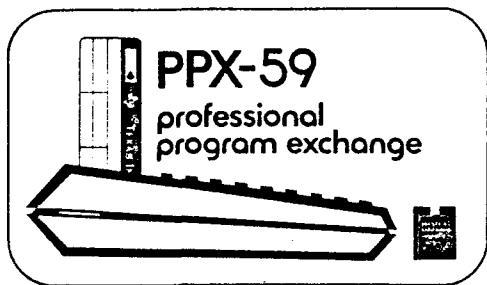
Submission Abstract

Program Title ROMAN NUMERAL MATH		Rev.	
Abstract of Program Enter two roman numeral numbers. Then add them together, multiply them, subtract one from the other or divide one by the other. The answer is given in Roman Numerals. The complete problem, including operation signs, is printed.			
User Benefits: Mostly just for fun, although it will perform two way conversions and work mixed number system problems.			
Category Number 36	Required Progs. _____	Prog. Steps 719	PC-100A Needed <input checked="" type="checkbox"/> Library Module ID <u>None</u> <input type="checkbox"/>
Submittal Agreement <p>All of the information forwarded herewith is contributed to Texas Instruments on a nonconfidential, nonobligatory basis; no relationship, confidential or otherwise, express or implied, is established with Texas Instruments by this contribution. Texas Instruments may use, copyright, distribute, publish, reproduce or sell this information in any way it chooses, without compensation to me. To my knowledge, this data is not copyrighted, and contribution of this information to Texas Instruments by me does not breach any obligation to any other person or organization relating to proprietary or confidential information.</p>			Submission Checklist <input checked="" type="checkbox"/> Recorded Magnetic Cards <input checked="" type="checkbox"/> Submission Abstract <input checked="" type="checkbox"/> Program Description <input checked="" type="checkbox"/> User Instructions <input checked="" type="checkbox"/> Sample Problem <input checked="" type="checkbox"/> Listing <input checked="" type="checkbox"/> Continuation <input type="checkbox"/> _____
Signature <u>Lem Matteson</u> Date <u>May 8, 1979</u> Name <u>Lem Matteson</u> Tel. No. <u>(816)333 0044</u> Address <u>8313 Ward Parkway</u> City <u>Kansas City</u> State <u>Missouri</u> Zip <u>64114</u>			

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TEXAS INSTRUMENTS Calculator Products Division

Program Description

Program Title:	ROMAN NUMERAL MATH	Rev.
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Method, Equations, Sketches, Limitations, References, Error Recovery:

The program performs any of the four basic math operations ($+ - \times \div$) on two Roman Numerals and prints the answer in Roman Numerals. The letters comprising the first numeral are entered in order, from left to right. Then the RECORD key (A) is pressed. The value of the numeral is stored for future use. The second numeral is entered in the same manner using key A to record it. Then the number of the math operation desired is entered by key 2nd A'. The rest is automatic, the printer prints both numbers entered with the math sign and an equals sign, and then prints the answer, all in Roman Numerals.

The display always shows zero and as far as any one can tell, the program is actually manipulating Roman Numerals. Actually the converted value has been calculated and stored. Each time key A stores a value, the value is also put in the t register and x:t will display the value if desired. Also after a problem is printed, the answer is put into t and x:t will display it also. thus any numeral entered can be converted.

The OPERATION key (A') is marked $+ - \times \div$ on the magnetic card and these signs are entered by number. 1 for +, 2 for -, 3 for x and 4 for \div . These numbers set the flags that direct the program to the proper answers.

An Arabic number can be entered by the keyboard instead of entering Roman numeral letters. Key A will store this in place of a Roman numeral. This allows mixed Arabic/Roman problems to be entered.

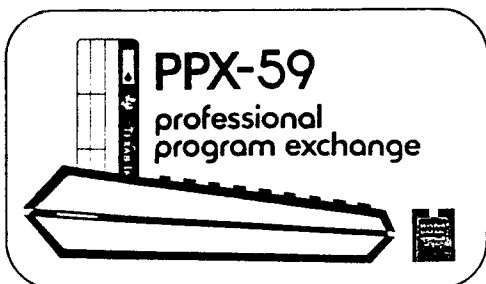
If a number is entered as the first numeral by key A and 0 is entered by key 2nd A', the number will be converted to Roman numerals and printed. A complete problem is not required. Numbers up to 4,999,999 can be converted.

In the Roman Numeral system each letter used has its own value. M is 1000, C is 100, X is 10 and I is 1. D is 500, L is 50 and V is 5. The value of a letter is repeated when the letter is repeated. A special rule allows fours and nines to be written with two letters instead of four or five. The rule states that when a letter of greater value follows one of lesser value, the value of the smaller is subtracted from the larger and the result is added to the total value. IIII and IV have the same value as do VIIII and IX. In all other cases letters are written in order of descending value.

Another rule is that a bar or line above a letter multiplies the letter value by 1000, so M becomes 1000,000. So seven digit Roman numerals can be written. The program does not provide for entering letters with bars over them, so MMMCMXCIX (4,999) is the largest number that can be entered. Answers require much larger numbers.

All the letters representing one digit are printed in a group separated from the other digit groups by spaces. Four groups are printed on each line so a numeral may take two lines to print. The end of the first numeral is marked by the operation sign in use printed to the right side. The second numeral ends with the equals sign. Since letters with bars over them cannot be printed, the symbol X is printed after any letter group requiring bars.

All letters in the group need bars. 47000 is XLVII but would be printed as XLX VIIIX.



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Continuation Sheet

Continued From: ☒ Program Description ☐ User Instructions ☐ Stmt. of Example

Program Title:	Rev.
ROMAN NUMERAL MATH	

Answers larger than 5,000,000 can result from multiplication of large numbers. Since Roman numerals cant express values that large, such answers are printed in figures instead.

In division the answer is the whole number only of the quotient, any remainder is printed seperately and is marked REMAINDER. Of course this is the numerater of a fraction whose denominator is the divisor. Romans are known to have used fractions. In this program the divisor is always the second numeral entered.

In subtraction either numeral can be entered first since the smaller is subtracted from the larger automatically.

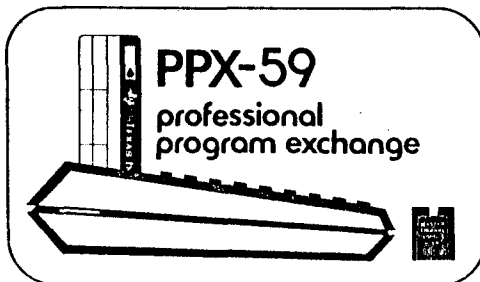
Clearing is not required before entering a new problem. It is only used to clear and reset in case errors are made in entering numerals. Everything is cleared so both numerals must be reentered if an error is made in entering the second number.

PRINT CODES STORED IN REGISTERS 19 TO 29.

After the program has been keyed into the calculator and before recording the magnetic cards, return to keyboard control and enter the following print codes in the registers indicated.

When the program is recorded on the cards, these codes will be stored on side 4 of card #2. They are returned to their registers whenever the cards are read.

ENTER	PRESS	Code for-
67	STO 19	\bar{x}
35 17 30 13	STO 20	REMA
24	STO 21	I
42	STO 22	V
44	STO 23	X
27	STO 24	L
15	STO 25	C
16	STO 26	D
30	STO 27	M
30 30 00 30	STO 28	MM M
23 31 16 17 35	STO 29	INDER



User Instructions

Program Title				
ROMAN NUMERAL MATH				
+X--	CLEAR	D	L	V
RECORD	M	C	X	I

Partition (OP 17)	Parentheses Levels	t Register	<input checked="" type="checkbox"/>
3 OP 17	None		
719.29			
Angular Mode (if applicable)	SBR Levels	Absolute Addresses	<input checked="" type="checkbox"/>
	2		
Library Module ID		Disturbs Pending Operations	<input checked="" type="checkbox"/>
None			

LABELS (Op 08)

INV	Inv	CE	CLR	x:1	x:2
√	V%	STO	RCL	SUM	Y*
EE	()	+	GTO	X
SBR	-	RST	+	R/S	.
+/-	=	CLR	INV	log	CP
tan	Pgm	P-R	sin	cos	CMs
Exc	Prd	Lx1	Exp	Fix	Int
Off	Pause	x:1	MOD	Op	Rad
Lbl	x:1	x:2	x	Grad	St Dig
11/10	DMS	77	List	Write	Dev
Adv	Pit				

USER DEFINED KEYS

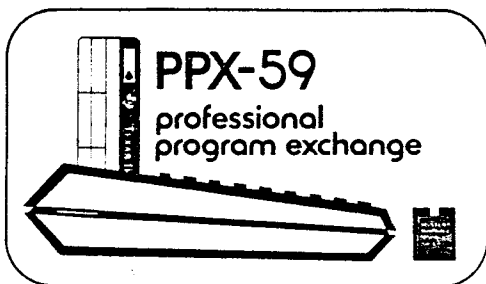
- A Record Numeral
- B Enter M (1000)
- C Enter C (100)
- D Enter X (10)
- E Enter I (1)
- A Operation # (1 to 4)
- B CLEAR
- C Enter D (500)
- D Enter L (50)
- E Enter V (5)

FLAGS Used 0	Used 1	Used 2	Used 3	Used 4	Used 5	Used 6	Used 7	Used 8	Used 9
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STEP	PROCEDURE	ENTER	PRESS	OUTPUT/MODE (see legend below)	DATA REGISTERS (INV) (R/S)
1	Set partition to 719.29	3	OP 17	719.29	0 Not used
2	Read both cards, sides 1, 2, 3, 4.	0		Side number entered.	1 1st digit
3	Enter first Numeral		B	0	2 2nd digit
	For M		2nd C'	0	3 3rd digit
	For D		C	0	4 4th digit
	For C		2nd D'	0	5 5th digit
	For L		D	0	6 6th digit
	For X		2nd E'	0	7 7th digit
	For V		E	0	8 Total value
	For I		A	0	9 Add x̄ symbol
4	Record Numeral entered		x:t	Value	10 Print code
4a	Display Value entered (Optional)		Proper Keys	0	11 Print code
5	Enter second Numeral (Same as 1st)		A	0	12 Print code
6	Record Numeral entered		x:t	Value	13 Indirect STF
6a	Display Value entered (Optional)				14 Letter entered
7	Enter Math Operation by Number				15 Answer
	For Add	1	2nd A'	0	16 2nd numeral
	For Subtract	2	2nd A'	0	17 1st numeral
	For Divide	4	2nd A'	0	19 to 29 Store
	For Multiply	3	2nd A'	0	Print codes.
7a	Display Answer (Optional)		x:t	Answer	
8	Convert Number to Roman Numerals	Number	A 2nd A'	0	
9	Clear error (Reenter all Numerals)		2nd B'	0	

NOTE: The symbol \bar{x} following a group of letters means that all letters in the group should have a BAR over them. \overline{IX} means \overline{IX} .

Modes n* - Printed only (n) - Displayed Briefly (Pause)
(n)* - Printed and displayed



TEXAS INSTRUMENTS Calculator Products Division

Sample Problem

ROMAN NUMERAL MATH

Statement of Example

The Numerals LXIV, which represents 64, and XIX, which represents 19 will be used in the first four examples.

- will add them together, making LXXXIII or 83.
- will subtract one from the other, leaving XLV or 45.
- will multiply them, resulting in MCCXVI or 1216.
- will divide the first by the second, giving III or 3 for the answer with VII or 7 as the remainder. x:t shows the decimal answer as 3.368421053.
- will convert 2,345,678 to Roman Numerals. The answer as printed, MMx CCCx XLx Vx DC LXXX VIII is read as MMCCCLVDCCLXXXVIII, since the first four groups of letters all have the symbol x.

☐ See Continuation Sheet

ENTER	PRESS	OUTPUT/MODE (see legend below)	COMMENT
1. L	2nd D'	0	
X	D	0	
I	E	0	
V	2nd E'	0	
	A	0	Record
	x:t	64	Convert (Optional)
X	D	0	
I	E	0	
X	D	0	
	A	0	Record
	x:t	19	Convert (Optional)
1	2nd A'	0	Add and print.
	x:t	83	Convert answer (Optional)
2. L	2nd D'	0	
X	D	0	
I	E	0	
V	2nd E'	0	
	A	0	Record
X	D	0	
I	E	0	
X	D	0	
	A	0	Record
2	2nd A'	0	Subtract and print
	x:t	45	Convert answer.

Modes: n' — Printed only (n) — Displayed Briefly (Pause)
(n)' — Printed and displayed

☐ Over

PPX-59 Professional Program Exchange Sample Problem (cont'd)

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3	6	8	0	2	7
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ENTER		PRESS	OUTPUT/MODE (see legend below)		COMMENT
3.	L X I V	2nd D' D E A	0 0 0 0		
	X I X	D E D A	0 0 0 0	LX IV X IX	Record ×
	3	A' x:t	0 1216	CC X VI	= M Record Multiply & print. Convert answer.
4.	L X I V	2nd D' D E A	0 0 0 0		
	X I X	D E D A	0 0 0 0	LX IV X IX	Record ÷
	4	A' x:t	0 3.368421053	III REMAINDER VII	= Record Divide and ptint. Convert answer.
5.	2345678	A 2nd A'	0		
		x:t	2345678.	MMX CCCX XLX VZ DC LXX VIII	
					Check entry

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3.6 8.0.2.7

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LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS
000	91	R/S	055 61 GTD	109	42	STD	164 42 STD	214	67	EQ	
001	76	LBL	056 00 00	110	15	15	165 04 04	215	02	02	
002	17	B'	057 64 64	111	42	STD	166 95 =	216	25	25	
003	02	2	058 76 LBL	112	17	17	167 71 SBR	217	71	SBR	
004	69	DP	059 12 B	113	32	X/T	168 04 04	218	05	05	
005	17	17	060 01 1	114	00	0	169 13 13	219	35	35	
006	47	CMS	061 00 0	115	42	STD	170 42 STD	220	71	SBR	
007	03	3	062 00 0	116	08	08	171 03 03	221	04	04	
008	69	DP	063 00 0	117	86	STF	172 95 =	222	19	19	
009	17	17	064 42 STD	118	01	01	173 71 SBR	223	69	DP	
010	06	6	065 14 14	119	91	R/S	174 04 04	224	02	02	
011	07	7	066 87 IFF	120	42	STD	175 13 13	225	71	SBR	
012	42	STD	067 00 00	121	16	16	176 42 STD	226	05	05	
013	19	19	068 00 00	122	32	X/T	177 02 02	227	97	97	
014	00	0	069 77 77	123	00	0	178 95 =	228	43	RCL	
015	81	RST	070 86 STF	124	81	RST	179 71 SBR	229	05	05	
016	76	LBL	071 00 00	125	76	LBL	180 04 04	230	29	CP	
017	15	E	072 44 SUM	126	16	A'	181 13 13	231	67	EQ	
018	01	1	073 08 08	127	42	STD	182 42 STD	232	02	02	
019	61	GTD	074 32 X/T	128	13	13	183 01 01	233	42	42	
020	00	00	075 00 0	129	86	STF	184 95 =	234	71	SBR	
021	64	64	076 91 R/S	130	40	IND	185 71 SBR	235	05	05	
022	76	LBL	077 67 EQ	131	13	13	186 05 05	236	35	35	
023	10	E'	078 00 00	132	43	RCL	187 72 72	237	71	SBR	
024	05	5	079 72 72	133	17	17	188 43 RCL	238	04	04	
025	61	GTD	080 22 INV	134	69	DP	189 07 07	239	19	19	
026	00	00	081 77 GE	135	00	00	190 29 CP	240	69	DP	
027	64	64	082 00 00	136	55	+	191 67 EQ	241	03	03	
028	76	LBL	083 72 72	137	01	1	192 02 02	242	00	0	
029	14	D	084 32 X/T	138	00	0	193 08 08	243	42	STD	
030	01	1	085 22 INV	139	00	0	194 32 X/T	244	09	09	
031	00	0	086 44 SUM	140	00	0	195 05 5	245	43	RCL	
032	61	GTD	087 08 08	141	00	0	196 32 X/T	246	27	27	
033	00	00	088 22 INV	142	00	0	197 77 GE	247	42	STD	
034	64	64	089 44 SUM	143	00	0	198 06 06	248	11	11	
035	76	LBL	090 08 08	144	75	-	199 78 78	249	43	RCL	
036	19	D'	091 43 RCL	145	59	INT	200 71 SBR	250	04	04	
037	05	5	092 14 14	146	42	STD	201 05 05	251	29	CP	
038	00	0	093 61 GTD	147	07	07	202 35 35	252	67	EQ	
039	61	GTD	094 00 00	148	95	=	203 71 SBR	253	02	02	
040	00	00	095 72 72	149	71	SBR	204 04 04	254	82	82	
041	64	64	096 76 LBL	150	04	04	205 19 19	255	32	X/T	
042	76	LBL	097 11 A	151	13	13	206 69 DP	256	04	4	
043	13	C	098 85 +	152	42	STD	207 01 01	257	32	X/T	
044	01	1	099 43 RCL	153	06	06	208 71 SBR	258	22	INV	
045	00	0	100 08 08	154	95	=	209 05 05	259	77	GE	
046	00	0	101 95 =	155	71	SBR	210 84 84	260	02	02	
047	61	GTD	102 22 INV	156	04	04	211 43 RCL	261	71	71	
048	00	00	103 86 STF	157	13	13	212 06 06				
049	64	64	104 00 00	158	42	STD	213 29 CP				
050	76	LBL	105 87 IFF	159	05	05					
051	18	C'	106 01 01	160	95	=					
052	05	5	107 01 01	161	71	SBR					
053	00	0	108 20 20	162	04	04					
054	00	0		163	13	13					

MERGED CODES

62	Pgm	Ind:	72	STD	Ind	83	GTD	Ind
63	Exc.	Ind:	73	RCL	Ind	84	DP	Ind
64	Prg	Ind	74	SUM	Ind	92	INV	SBR

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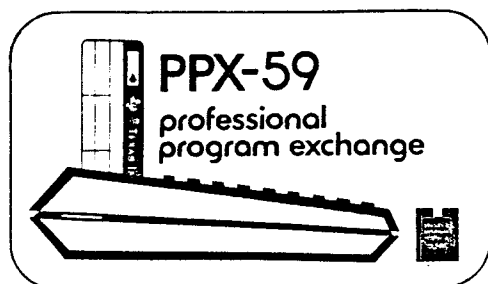
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LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS
262	32	XIT		317	71	SBR		426	43	RCL	
263	71	SBR		318	05	05		427	11	11	
264	06	06		319	35	35		428	71	SBR	
265	10	10		320	69	DP		429	03	03	
266	43	RCL		321	02	02		430	99	99	
267	19	19		322	71	SBR		431	43	RCL	
268	42	STO		323	06	06		432	10	10	
269	09	09		324	10	10		433	71	SBR	
270	32	XIT		325	43	RCL		434	04	04	
271	71	SBR		326	01	01		435	07	07	
272	05	05		327	29	CP		436	92	RTN	
273	35	35		328	67	EQ		437	43	RCL	
274	44	SUM		329	03	03		438	12	12	
275	09	09		330	36	36		439	71	SBR	
276	86	STF		331	71	SBR		440	03	03	
277	08	08		332	05	05		441	77	77	
278	43	RCL		333	35	35		442	43	RCL	
279	09	09		334	69	DP		443	11	11	
280	69	DP		335	03	03		444	71	SBR	
281	04	04		336	87	IFF		445	03	03	
282	22	INV		337	06	06		446	89	89	
283	87	IFF		338	06	06		447	43	RCL	
284	08	08		339	68	68		448	11	11	
285	02	02		340	87	IFF		449	71	SBR	
286	94	94		341	05	05		450	03	03	
287	69	DP		342	06	06		451	99	99	
288	05	05		343	53	53		452	43	RCL	
289	69	DP		344	86	STF		453	11	11	
290	00	00		345	05	05		454	71	SBR	
291	22	INV		346	87	IFF		455	04	04	
292	86	STF		347	00	00		456	07	07	
293	08	08		348	06	06		457	92	RTN	
294	71	SBR		349	68	68		458	43	RCL	
295	05	05		350	43	RCL		459	12	12	
296	84	84		351	16	16		460	71	SBR	
297	43	RCL		352	87	IFF		461	03	03	
298	03	03		353	01	01		462	89	89	
299	29	CP		354	06	06		463	43	RCL	
300	67	EQ		355	23	23		464	11	11	
301	03	03		356	87	IFF		465	71	SBR	
302	08	08		357	02	02		466	03	03	
303	71	SBR		358	06	06		467	99	99	
304	05	05		359	30	30		468	43	RCL	
305	35	35		360	87	IFF		469	11	11	
306	69	DP		361	03	03		470	71	SBR	
307	01	01		362	06	06		471	04	04	
308	71	SBR		363	38	38		472	07	07	
309	05	05		364	87	IFF		473	92	RTN	
310	97	97		365	04	04		474	43	RCL	
311	43	RCL		366	06	06		475	12	12	
312	02	02		367	45	45					
313	29	CP		368	69	DP					
314	67	EQ		369	04	04					
315	03	03		370	69	DP					
316	22	22		371	05	05					

MERGED CODES

62	Per	Ind	72	STO	Ind	83	GTO	Ind
63	Exc	Ind	73	RCL	Ind	84	Op	Ind
64	Pd	Ind	74	SUM	Ind	92	INV	SBR



TEXAS INSTRUMENTS Calculator Products Division

Continuation Sheet

Continued From: ☐ Program Description ☐ User Instructions ☐ Stmt. of Example

ROMAN NUMERAL MATH										Rev.				
525	71	SBR	572	43	RCL	618	43	RCL	663	50	I×I	689	43	RCL
526	04	04	573	27	27	619	23	23	664	59	INT	690	29	29
527	07	07	574	42	STO	620	42	STO	665	61	GTO	691	69	OP
528	92	RTN	575	11	11	621	10	10	666	01	01	692	04	04
529	43	RCL	576	43	RCL	622	92	RTN	667	34	34	693	69	OP
530	11	11	577	28	28	623	44	SUM	668	69	OP	694	05	05
531	71	SBR	578	42	STO	624	15	15	669	05	05	695	43	RCL
532	04	04	579	12	12	625	04	4	670	87	IFF	696	15	15
533	07	07	580	00	0	626	07	7	671	07	07	697	22	INV
534	92	RTN	581	42	STO	627	61	GTO	672	06	06	698	59	INT
535	32	XIT	582	10	10	628	03	03	673	78	78	699	29	CP
536	09	9	583	92	RTN	629	68	68	674	87	IFF	700	67	EQ
537	67	EQ	584	43	RCL	630	22	INV	675	04	04	701	06	06
538	04	04	585	25	25	631	44	SUM	676	06	06	702	78	78
539	26	26	586	42	STO	632	15	15	677	83	83	703	65	x
540	08	8	587	11	11	633	02	2	678	98	ADV	704	43	RCL
541	67	EQ	588	43	RCL	634	00	0	679	43	RCL	705	16	16
542	04	04	589	26	26	635	61	GTO	680	15	15	706	95	=
543	37	37	590	42	STO	636	03	03	681	32	XIT	707	88	DMS
544	07	7	591	12	12	637	68	68	682	17	B'	708	86	STF
545	67	EQ	592	43	RCL	638	49	PRD	683	69	OP	709	07	07
546	04	04	593	27	27	639	15	15	684	00	00	710	61	GTO
547	58	58	594	42	STO	640	05	5	685	43	RCL	711	01	01
548	06	6	595	10	10	641	00	0	686	20	20	712	34	34
549	67	EQ	596	92	RTN	642	61	GTO	687	69	OP	713	00	0
550	04	04	597	43	RCL	643	03	03	688	03	03	714	00	0
551	74	74	598	23	23	644	68	68	Store the following Print Codes in the registers indicated before recording the magnetic cards					
552	05	5	599	42	STO	645	22	INV						
553	67	EQ	600	11	11	646	49	PRD						
554	04	04	601	43	RCL	647	15	15						
555	85	85	602	24	24	648	07	7						
556	04	4	603	42	STO	649	02	2						
557	67	EQ	604	12	12	650	61	GTO						
558	04	04	605	43	RCL	651	03	03						
559	91	91	606	25	25	652	68	68						
560	03	3	607	42	STO	653	06	6						
561	67	EQ	608	10	10	654	04	4	67	STO	19			
562	05	05	609	92	RTN	655	69	OP	35173013	STO	20			
563	02	02	610	43	RCL	656	04	04	24	STO	21			
564	02	2	611	21	21	657	69	OP	42	STO	22			
565	67	EQ	612	42	STO	658	05	05	44	STO	23			
566	05	05	613	11	11	659	86	STF	27	STO	24			
567	18	18	614	43	RCL	660	06	06	15	STO	25			
568	01	1	615	22	22	661	43	RCL	16	STO	26			
569	67	EQ	616	42	STO	662	15	15	30	STO	27			
570	05	05	617	12	12				30300030	STO	28			
571	29	29							2431161735	STO	29			