TEXAS INSTRUMENTS
Calculator Products Division

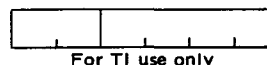
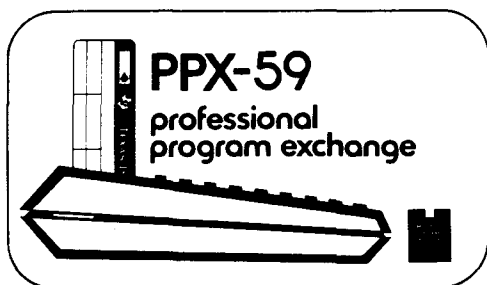
Submission Abstract

Program Title		LIST 13 DIGIT REGISTERS		Rev.
Abstract of Program Lists up to 13 digits and the register number on the same line. A double program, side 1 lists registers 00 thru 86 and side 2 lists registers 33 thru 99. User selects starting and stoping register numbers. Handles negative numbers and numbers in scientific notation also.				
User Benefits: Using both programs allows a continuous listing of registers 00 thru 99.				
Category Number	90	Required Progs.	None	Prog. Steps 231/239
				PC-100A Needed <input checked="" type="checkbox"/> Library Module ID <input type="checkbox"/>
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Signature <u>Lem Matteson</u>		Date <u>Aug 22, 1981</u>		
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IMPORTANT

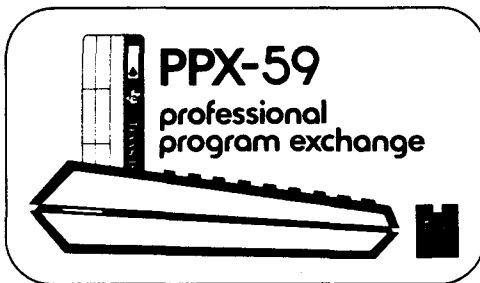
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Program Description

Program Title:	LIST 13 DIGIT REGISTERS	Rev.
Method, Equations, Sketches, Limitations, References, Error Recovery:		
SIDE 1 LIST REGISTERS 00 THRU 86		
<p>The registers to be listed should be forced into their usual banks. Enter the bank number then push +/- and run the card thru the read slot. Registers 00 to 29 are in bank 4, registers 30 to 59 are in bank 3 and registers 60 to 89 are in bank 2. Registers 87, 88 and 89 are used by the program and cannot be listed. Read the program, side 1, in the start-up partition. The program sets the partition to 9 OP 17 to run and resets back to 6 OP 17 when the list is complete. Enter the lowest register number to be listed with key A and enter the highest register number with key B. Each register in use will be listed. Empty registers are skipped completely to save tape. If keys A and B enter the same number, only one register will be listed.</p> <p>Each digit and the sign and/or decimal point, if present, is converted to print codes and the codes are stored in OP 01, OP 02 and OP 03. The register number is converted to code and put in OP 04. Then the entire line is printed. A number with an exponent of 10 or higher is printed as a power of ten with eight digits and the exponent shown. A value less than one is printed as 0. followed by up to twelve digits. A very small number with .000 and up to nine digits will have all nine digits printed. But .0000 with eight or more digits will be listed as a negative power of ten with an integer and up to eight digits rounded off to seven places. Even a number with nine zeros to the right of the decimal point will be listed as a integer and up to seven decimal digits to the minus tenth power of ten. The program automatically selects a display with the maximum information possible.</p> <p>The time for listing a register varies with the number of digits in each. Thirteen digits required about 30 seconds. Skipping empty registers takes very little time and printing in scientific notation is also fast.</p> <p>There is protection against impossible listing. If a register larger than 86 is entered with key B, the entry is rejected and 86 is entered automatically.</p>		
SIDE 2 LIST REGISTERS 33 THRU 99		
<p>When the side 2 program is used, the cards containing the registers to be listed must be forced into the bank one number higher than its actual bank number. A bank 1 card, which can have registers 90 to 99, must be forced into bank 2. Enter 2 +/- and run the card thru the read slot. A bank 2 card, registers 60 to 89, is forced into bank 3 with 3 +/- . A bank 3 card, registers 30 to 29, is forced into bank 4 with 4 +/- . The data to be listed is actually stored in a register 30 numbers lower than expected.</p> <p>If the bank 1 card with registers 90 to 99 is entered into bank 1, it would write over any program in locations 000 thru 239. Entering the program card would also write over the data registers 90 thru 99. Entering the data into a bank one number higher avoids any conflict.</p> <p>The side 2 program is essentially the same as the side 1 program except that 30 is subtracted from the register number of each register to be listed, and 30 is added to the register number actually printed. If register 90 is wanted, the program recalls register 60 which is where the register 90 data is stored.</p>		
See Continuation Sheet		



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Continuation Sheet

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

Program Title:	LIST 13 DIGIT REGISTERS	Rev.
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The data is coded and recorded as usual. Thirty is added to the register number actually recalled.

The program uses registers 00, 01 and 02 internally. When data bank 3 is forced into bank 4, the data originally in registers 30, 31 & 32 ends up in registers 00, 01 & 02 and is lost as the program runs. Therefore only registers 33 and higher can be listed by this program.

If a starting register less than 33 is entered, the program will change it to 33 automatically.

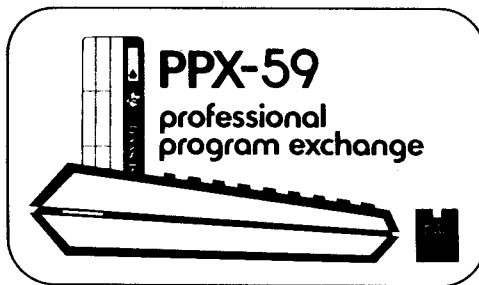
Each program allows entering three banks of data so there is an overlap of registers 33 thru 86 since either program can list them. In most cases only the front side program will be needed, since it can handle up to register 86. Where both programs are needed for greater range, they work together and the change between programs can be any place between 33 and 86. It is easier to enter banks 3 and 4 and run the front side program using 59 as the high limit. Then force banks 1 and 2 into bank 2 and 3, enter the back side program and enter 60 with key A as the new starting number. This way would allow a listing from 00 to 99 in one continuous listing. Both programs skip over empty registers to save tape and cut running time.

Both programs use the HIR (Code 82) instruction. HIR cannot be entered directly from the keyboard. A simple trick will enter the HIR code where needed. Enter STO 82 then backspace twice so that the STO is on display and delete the STO with DEL. Then SST steps forward to the next space to be used. HIR is always followed by a two digit code number. In this program the code can always be entered from the keyboard. HIR appears 13 times in each program and 9 different code are used. The chart below shows how to enter each one:

HIR 04	STO 82	BST	BST	DEL	SST	4
HIR 08	STO 82	BST	BST	DEL	SST	8
HIR 11	STO 82	BST	BST	DEL	SST	A
HIR 14	STO 82	BST	BST	DEL	SST	D
HIR 18	STO 82	BST	BST	DEL	SST	C'
HIR 34	STO 82	BST	BST	DEL	SST	\sqrt{x}
HIR 38	STO 82	BST	BST	DEL	SST	SIN
HIR 48	STO 82	BST	BST	DEL	SST	EXC
HIR 58	STO 82	BST	BST	DEL	SST	FIX

An * in the listing shows where each HIR is located.

The front side program has two other tricky listings, DSZ is usually followed by a single digit register number. In this program registers 88 and 89 are used with DSZ, we must enter the register number with a single keystroke. At 071 DSZ 88 B' is found. D.MS is key code 88 so DSZ D.MS B' instruction. At 034, DSZ 89 052 is found. Pi (π) is key code 89 so DSZ Pi enters DSZ 89 but the three digit transfer address won't enter right. We want 052 in two spaces so enter 0 EE. EE is code 52 so the whole instruction is: DSZ Pi 0 EE. The back side program uses registers 00 and 01 so the keying is normal, DSZ 1 B' and DSZ 0 0 52. A ** marks the DSZ locations.



User Instructions

Program Title LIST 13 DIGIT REGISTERS			
00 or 33	86 or 99		
Low #	High #		
Partition (OP 17) Parentheses Levels			
479.59	1	t Register	<input checked="" type="checkbox"/>
Angular Mode (if applicable)	SBR Levels	Absolute Addresses	<input checked="" type="checkbox"/>
N A	1		
Library Module ID		Disturbs Pending Operations	<input checked="" type="checkbox"/>
None			

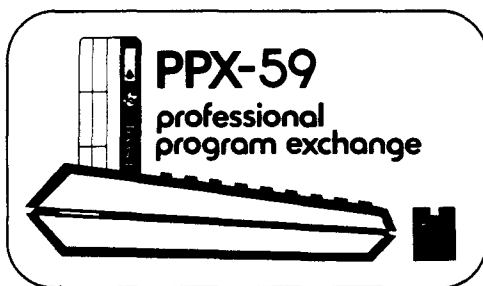
USER DEFINED KEYS	
A	Enter lowest register #
B	Enter highest register #
C	
D	
E	
A'	
B'	
C'	
D'	
E'	

DATA REGISTERS <small>(INV)</small>	
0	Used Pgm 2
1	Used Pgm 2
2	Used Pgm 2
3	
4	
5	
6	
7	
8	
9	
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
0	
1	
2	
3	
4	
5	
6	
7	87 Used Pgm 1
8	88 Used Pgm 1
9	89 Used Pgm 1
0	
1	
2	
3	
4	

FLAGS X	0	1	2	3	4	5	6	7	8	9
---------	---	---	---	---	---	---	---	---	---	---

STEP	PROCEDURE	ENTER	PRESS	OUTPUT/MODE (see legend below)
	LIST REGISTERS 00 THRU 86			
	Read Program card, front side only	0		Read card Display 1.
	Enter data card side 4 Reg 00 to 29	4	+/-	Read card -4.
	Enter data card side 3 Reg 30 to 59	3	+/-	Read card -3.
	Enter data card side 2 Reg 60 to 89	2	+/-	Read card -2.
	Enter lowest register to be listed	Number	A	Display low number
	Enter highest register to be listed	Number	B	Prints list 13 digits with Reg No.
	LIST REGISTERS 33 THRU 99			
	Read Program card, Back side only	0		Read card Display 1
	Enter data card side 1 Reg 90 to 99			
	Force into next higher bank	2	+/-	Read card -2
	Enter data card side 2 Reg 60 to 89	3	+/-	Read card -3
	Enter data card side 3 Reg 30 to 59	4	+/-	Read card -4
	Enter lowest register to be listed	Number	A	Display low number
	Enter highest register to be listed	Number	B	Prints list 13 digits with Reg No.
	NOTE: Data cards are always forced, dont worry about partitions. Programs revert to 479.59 at end of listing.			

Modes: n* — Printed only (n) — Displayed briefly (Pause)
(n)* — Printed and displayed



TEXAS INSTRUMENTS Calculator Products Division

Sample Problem

Statement of Example

A spare card with data recorded in 18 of the 27 registers between 33 and 59, recorded as bank 3 on the front side and data in registers 90 thru 99, recorded as bank 1 on the back side, provided the data listed by the sample problem. Details for a similar card are on the Continuation Sheet.

The sample problem was made by the back side program. Run the program card up side down and force the front side of the data card into bank 4, one number higher than the listed bank number. Force the back side of the data card into bank 2. The tape on the left was made by "33 INV LIST". The tape on the right was produced by the program.

The front side program with the front side of the data card forced into bank 3, will produce a similar listing of the in use registers between 33 and 59. Enter 33 with key A and 59 with key B.

If you enter 0 with key A and 86 with key B you will find out where the data listed by the back side program was actually stored. (In banks 2 and 4)

See Continuation Sheet

ENTER	PRESS		OUTPUT
33	A	33 INV LIST	7.
59	B	0.	1.2345678 25
		0.	-1.2345678 25
		7.	3210.012345678
		1.2345678 25	1234567895678.
		-1.2345678 25	-1234567895678.
		0.	1.2345-10
		0.	0.123456789876
		3210.012346	0.012345678987
		1.2345679 12	0.001234567898
		-1.2345679 12	0.000123456789
		.00000000001	1.2345679-05
		0.	1.2345679-06
		0.	1.2345679-07
		.1234567899	1.2345679-08
		0.012345679	1.2345679-09
		.0012345679	1.2345679-10
		.0001234568	1.2345679-11
90	A	.0000123457	90.
99	B	.0000012346	91.
		.0000001235	92.
		.0000000123	93.
		.0000000012	94.
		.0000000001	95.
		1.2345679-11	96.
		0.	97.
		0.	98.
		0.	99.

Cont.

Sample Problem (cont'd)

ENTER	PRESS	OUTPUT/MODE (see legend below)	COMMENT
DATA FOR SAMPLE PROBLEM			
Set partition to 10 OP 17. Return to 6 OP 17 before recording card.			
Enter (7) in register, STO 35. No trailing zeros are printed.			
Enter (1.2345678 EE 25) STO 36. Enter (+/-) STO 37 (CLR). Makes 37 negative.			
Enter (.012345678 + 3210 =) STO 40. A 13 digit mixed number.			
Enter (123456789 x 10,000 + 5678 =) STO 41. Enter (+/-) STO 42. A 13 digit integer in 41 and the same number only negative in register 42.			
Enter (1.2345 EE +/- 10 INV EE) STO 43 (CLR). Display shows .000,000,000,1 but all five digits are stored.			
<p>The calculator actually stores all memories in scientific notation, with up to 13 digits plus the exponent stored. Normally the display is converted to ten digits, rounded off, when RCL is used. In the EE mode, eight digits and the exponent are displayed. This program prints numbers less than 1 as: Zero integer, Point, followed by up to twelve decimal digits. .000,012,345,678 recalled will be .0000123457 on display with the 6 rounded off to 7 for more accuracy. You would expect the program to print the listing as: 0.000012345678 since the final 9 cannot be printed. However .000012345679 would be more accurate. To realize this accuracy, the program switches to scientific notation display at this point, since eight digits rounded off are displayed. Smaller numbers will show more non zero digits in this mode.</p> <p>Registers 46 to 56 demonstrate this feature. Enter (.3456789876 ÷ 100 + .12 =) STO 46. This puts .123456789876 into register 46 and on display. The rest of the registers used are recorder by dividing the display by 10 and storing the result in the next higher register number. The display shows one more zero added to the right of the decimal point each time. By the time register 55 is loaded, the display shows .0000000001 and the next division would make ten zeros on display so the display changes to scientific notation automatically. Register 56 stores the value in the EE mode, and any further divisions would only change the exponent.</p> <p>For the back side of the card, recorded as bank 1, enter (90) STO 90, (91) STO 91, (92) STO 92, (93) STO 93, (94) STO 94, (95) STO 95, (96) STO 96, (97) STO 97, (98) STO 98 and (99) STO 99.</p>			
Back side of card data Bank 1			
10 OP 17	90 INV LIST	90.	90
		91.	91
		92.	92
		93.	93
		94.	94
		95.	95
		96.	96
		97.	97
		98.	98
		99.	99
6 OP 17			
Modes: n* — Printed only (n) — Displayed Briefly (Pause) (n)* — Printed and displayed			

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For TI use only

LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS
000	43	RCL		054	82	HIR *		108	66	PAU	
001	87	87		055	38	38		109	66	PAU	
002	32	XIT		056	01	1		110	85	+	
003	82	HIR *		057	00	0		111	01	1	
004	14	14		058	85	+		112	95	=	
005	69	DP		059	01	1		113	42	STD	
006	00	00		060	85	+		114	87	87	
007	67	EQ		061	28	LOG		115	81	RST	
008	00	00		062	59	INT		116	29	CP	
009	13	13		063	65	x		117	42	STD	
010	61	GTD		064	02	2		118	89	89	
011	01	01		065	75	-		119	25	CLR	
012	16	16		066	59	INT		120	73	RC*	
013	06	6		067	82	HIR *		121	89	89	
014	69	DP		068	38	38		122	85	+	
015	17	17		069	54)		123	67	EQ	
016	25	CLR		070	65	x		124	02	02	
017	91	R/S		071	97	DSZ **		125	09	09	
018	76	LBL		072	88	88		126	50	IxI	
019	16	A'		073	17	B'		127	28	LOG	
020	05	5		074	82	HIR *		128	59	INT	
021	42	STD		075	18	18		129	32	XIT	
022	88	88		076	82	HIR *		130	01	1	
023	76	LBL		077	58	58		131	02	2	
024	17	B'		078	92	RTN		132	22	INV	
025	01	1		079	76	LBL		133	77	GE	
026	00	0		080	11	A		134	02	02	
027	00	0		081	93	.		135	15	15	
028	82	HIR *		082	01	1		136	04	4	
029	48	48		083	82	HIR *		137	94	+/-	
030	87	IFF		084	04	04		138	77	GE	
031	00	00		085	32	XIT		139	02	02	
032	00	00		086	09	9		140	15	15	
033	47	47		087	69	DP		141	00	0	
034	97	DSZ **		088	17	17		142	95	=	
035	89	89		089	00	0		143	32	XIT	
036	00	00		090	32	XIT		144	00	0	
037	52	52		091	69	DP		145	22	INV	
038	86	STF		092	00	00		146	77	GE	
039	00	00		093	42	STD		147	01	01	
040	04	4		094	89	89		148	55	55	
041	00	0		095	91	R/S		149	02	2	
042	82	HIR *		096	76	LBL		150	00	0	
043	38	38		097	12	B		151	00	0	
044	61	GTD		098	32	XIT		152	00	0	
045	00	00		099	08	8		153	82	HIR *	
046	71	71		100	07	7		154	08	08	
047	82	HIR *		101	32	XIT		155	04	4	
048	11	11		102	22	INV		156	42	STD	
049	67	EQ		103	77	GE		157	88	88	
050	00	00		104	01	01					
051	74	74		105	10	10					
052	08	8		106	08	8					
053	00	0		107	06	6					

MERGED CODES

62	Fem	72	STO	83	GTO
63	Fac	73	RCL	84	Op
64	Ind	74	SUM	92	INV

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LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS
158	01	1		209	01	1					
159	42	STD		210	82	HIR *					
160	89	89		211	34	34					
161	32	XIT		212	82	HIR *					
162	50	I×I		213	14	14					
163	22	INV		214	81	RST					
164	77	GE		215	86	STF					
165	01	01		216	01	01					
166	77	77		217	86	STF					
167	55	÷		218	00	00					
168	28	LDG		219	61	GTO					
169	59	INT		220	01	01					
170	44	SUM		221	91	91					
171	89	89		222	52	EE					
172	22	INV		223	73	RC*					
173	28	LDG		224	89	89					
174	52	EE		225	69	OP					
175	22	INV		226	06	06					
176	52	EE		227	25	CLR					
177	29	CP		228	61	GTO					
178	71	SBR		229	02	02					
179	00	00		230	09	09					
180	58	58									
181	69	OP									
182	01	01									
183	16	A'									
184	58	FIX									
185	08	08									
186	69	OP									
187	02	02									
188	16	A'									
189	69	OP									
190	03	03									
191	22	INV									
192	58	FIX									
193	25	CLR									
194	02	2									
195	42	STD									
196	88	88									
197	82	HIR *									
198	14	14									
199	55	÷									
200	17	B'									
201	69	OP									
202	04	04									
203	87	IFF									
204	01	01									
205	02	02									
206	22	22									
207	69	OP									
208	05	05									

MERGED CODES

62	Pgm	Ind	72	STO	Ind	83	GTO	Ind
63	Esc	Ind	73	RCL	Ind	84	Op	Ind
64	...	Ind	74	SUM	Ind	92	INV	SBR

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LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS
000	43	RCL		054	82	HIR *		108	76	LBL	
001	02	02		055	38	38		109	12	B	
002	32	X:T		056	01	1		110	85	+	
003	82	HIR *		057	00	0		111	01	1	
004	14	14		058	85	+		112	75	-	
005	69	DP		059	01	1		113	03	3	
006	00	00		060	85	+		114	00	0	
007	67	EQ		061	28	LDG		115	95	=	
008	00	00		062	59	INT		116	42	STD	
009	13	13		063	65	X		117	02	02	
010	61	GTO		064	02	2		118	81	RST	
011	01	01		065	75	-		119	29	CP	
012	19	19		066	59	INT		120	42	STD	
013	06	6		067	82	HIR *		121	00	00	
014	69	DP		068	38	38		122	25	CLR	
015	17	17		069	54)		123	73	RC*	
016	25	CLR		070	65	X		124	00	00	
017	91	R/S		071	97	DSZ		125	85	+	
018	76	LBL		072	01	01		126	67	EQ	
019	16	A'		073	17	B'		127	02	02	
020	05	5		074	82	HIR *		128	17	17	
021	42	STD		075	18	18		129	50	IxI	
022	01	01		076	82	HIR *		130	28	LDG	
023	76	LBL		077	58	58		131	59	INT	
024	17	B'		078	92	RTN		132	32	X:T	
025	01	1		079	76	LBL		133	01	1	
026	00	0		080	11	A		134	02	2	
027	00	0		081	32	X:T		135	22	INV	
028	82	HIR *		082	09	9		136	77	GE	
029	48	48		083	69	DP		137	02	02	
030	87	IFF		084	17	17		138	23	23	
031	00	00		085	03	3		139	04	4	
032	00	00		086	03	3		140	94	+/-	
033	47	47		087	32	X:T		141	77	GE	
034	97	DSZ		088	77	GE		142	02	02	
035	00	00		089	00	00		143	23	23	
036	00	00		090	93	93		144	00	0	
037	52	52		091	03	3		145	95	=	
038	86	STF		092	03	3		146	32	X:T	
039	00	00		093	85	+		147	00	0	
040	04	4		094	32	X:T		148	22	INV	
041	00	0	Point	095	93	.		149	77	GE	
042	82	HIR *		096	01	1		150	01	01	
043	38	38		097	75	-		151	58	58	
044	61	GTO		098	03	3		152	02	2	
045	00	00		099	00	0		153	00	0	Minus
046	71	71		100	95	=		154	00	0	
047	82	HIR *		101	82	HIR *		155	00	0	
048	11	11		102	04	04		156	82	HIR *	
049	67	EQ		103	59	INT		157	08	08	
050	00	00		104	42	STD					
051	74	74		105	00	00					
052	08	8		106	32	X:T					
053	00	0		107	91	R/S					

MERGED CODES

62	FOR	72	STO	83	GTO
63	END	73	RCL	84	OP
64	END	74	SUM	92	INV
					SBR

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For TI use only

LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS
158	04	4		211	87	IFF					
159	42	STD		212	01	1					
160	01	01		213	02	2					
161	01	1		214	30	30					
162	42	STD		215	69	DP					
163	00	00		216	05	05					
164	32	XIT		217	01	1					
165	50	IXI		218	82	HIR *					
166	22	INV		219	34	34					
167	77	GE		220	82	HIR *					
168	01	1		221	14	14					
169	80	80		222	81	RST					
170	55	+		223	86	STF					
171	28	LDG		224	01	1					
172	59	INT		225	86	STF					
173	44	SUM		226	00	00					
174	00	00		227	61	GTD					
175	22	INV		228	01	1					
176	28	LDG		229	94	94					
177	52	EE		230	52	EE					
178	22	INV		231	73	RC*					
179	52	EE		232	00	00					
180	29	CP		233	69	DP					
181	71	SBR		234	06	06					
182	00	00		235	25	CLR					
183	58	58		236	61	GTD					
184	69	DP		237	02	2					
185	01	01		238	17	17					
186	16	A'									
187	58	FIX									
188	08	8									
189	69	DP									
190	02	02									
191	16	A'									
192	69	DP									
193	03	03									
194	22	INV									
195	58	FIX									
196	25	CLR									
197	02	2									
198	42	STD									
199	01	01									
200	82	HIR *									
201	14	14									
202	95	=									
203	85	+									
204	03	3									
205	00	0									
206	95	=									
207	55	+									
208	17	B'									
209	69	DP									
210	04	04									

MERGED CODES

62	For	ing	72	STD	ing	83	GTD	ing
63	For	ing	73	RCL	ing	84	DP	ing
64	For	ing	74	SUM	ing	92	INV	SBR