908226
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PPX-59
professional
program exchange

TEXAS INSTRUMENTS
Calculator Products Division

Submission Abstract

Program Title	Rev.
LIST 13 DIGIT REGISTERS	

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	Required Progs.	Prog. Steps	PC-100A Needed / Library Module ID
90	None	231/239	☒ / ☐

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Submission Checklist

- ☒ Recorded Magnetic Cards
- ☒ Submission Abstract
- ☒ Program Description
- ☒ User Instructions
- ☒ Sample Problem
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Program Description

Program Title:	Rev.
LIST 13 DIGIT REGISTERS	

Method, Equations, Sketches, Limitations, References, Error Recovery:

SIDE 1 LIST REGISTERS 00 THRU 86

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.

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 posible.

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.

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.

SIDE 2 LIST REGISTERS 33 THRU 99

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 than it's 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.

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.

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.

See Continuation Sheet

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

Program Title: LIST 13 DIGIT REGISTERS	Rev.

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 origionally in registers 30, 31 & 31 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 regisrer 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 continous 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 deleat the STO with DEL. Then SST steps forw rd 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 trickey 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 wont 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.

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User Instructions

Program Title LIST 13 DIGIT REGISTERS

00 or 33	86 or 99			
Low #	High #			

Partition (OP 17): 479.59
Parentheses Levels: 1
t Register: X
Angular Mode (if applicable): N A
SBR Levels: 1
Absolute Addresses: X
Library Module ID: None
Disturbs Pending Operations: X

USER DEFINED KEYS

A Enter lowest register #
B Enter highest register #
C
D
E
A'
B'
C'
D'
E'

DATA REGISTERS (INV)

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

☐ See Co...ation Sheet

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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	33 INV LIST		OUTPUT	
33	A			7.	35
59	B	0.	33	1.2345678 25	36
		0.	34	-1.2345678 25	37
		7.	35	3210.012345678	40
		1.2345678 25	36	1234567895678.	41
		-1.2345678 25	37	-1234567895678.	42
		0.	38	1.2345-10	43
		0.	39	0.123456789876	46
		3210.012346	40	0.012345678987	47
		1.2345679 12	41	0.001234567898	48
		-1.2345679 12	42	0.000123456789	49
		.0000000001	43	1.2345679-05	50
		0.	44	1.2345679-06	51
		0.	45	1.2345679-07	52
		.1234567899	46	1.2345679-08	53
		0.012345679	47	1.2345679-09	54
		.001234567 9	48	1.2345679-10	55
90	A	.0001234568	49	1.2345679-11	56
99	B	.0000123457	50	90.	90
		.0000012346	51	91.	91
		.0000001235	52	92.	92
		.0000000123	53	93.	93
		.0000000012	54	94.	94
		.0000000001	55	95.	95
		1.2345679-11	56	96.	96
		0.	57	97.	97
		0.	58	98.	98
		0.	59	99.	99

Cont.

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.

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.

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 recordey 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.

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) STO94, (95) STO 95, (96) STO 96, (97) STO 97, (98) STO 98 and (99) STO 99.

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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LOC	CODE	KEY	COMMENTS
000	43	RCL	
001	87	87	
002	32	X:T	
003	82	HIR *	
004	14	14	
005	69	OP	
006	00	00	
007	67	EQ	
008	00	0	
009	13	13	
010	61	GTO	
011	01	1	
012	16	16	
013	06	6	
014	69	OP	
015	17	17	
016	25	CLR	
017	91	R/S	
018	76	LBL	
019	16	A'	
020	05	5	
021	42	STO	
022	88	88	
023	76	LBL	
024	17	B'	
025	01	1	
026	00	0	
027	00	0	
028	82	HIR *	
029	48	48	
030	87	IFF	
031	00	0	
032	00	0	
033	47	47	
034	97	DSZ **	
035	89	89	
036	00	0	
037	52	52	
038	86	STF	
039	00	0	
040	04	4 .	
041	00	0 POINT	
042	82	HIR *	
043	38	38	
044	61	GTO	
045	00	0	
046	71	71	
047	82	HIR *	
048	11	11	
049	67	EQ	
050	00	0	
051	74	74	
052	08	8	
053	00	0	
054	82	HIR *	
055	38	38	
056	01	1	
057	00	0	
058	85	+	
059	01	1	
060	85	+	
061	28	LOG	
062	59	INT	
063	65	×	
064	02	2	
065	75	-	
066	59	INT	
067	82	HIR *	
068	38	38	
069	54	)	
070	65	×	
071	97	DSZ **	
072	88	88	
073	17	B'	
074	82	HIR *	
075	18	18	
076	82	HIR *	
077	58	58	
078	92	RTN	
079	76	LBL	
080	11	A	
081	93	.	
082	01	1	
083	82	HIR *	
084	04	04	
085	32	X:T	
086	09	9	
087	69	OP	
088	17	17	
089	00	0	
090	32	X:T	
091	69	OP	
092	00	00	
093	42	STO	
094	89	89	
095	91	R/S	
096	76	LBL	
097	12	B	
098	32	X:T	
099	08	8	
100	07	7	
101	32	X:T	
102	22	INV	
103	77	GE	
104	01	1	
105	10	10	
106	08	8	
107	06	6	
108	66	PAU	
109	66	PAU	
110	85	+	
111	01	1	
112	95	=	
113	42	STO	
114	87	87	
115	81	RST	
116	29	CP	
117	42	STO	
118	89	89	
119	25	CLR	
120	73	RC*	
121	89	89	
122	85	+	
123	67	EQ	
124	02	2	
125	09	09	
126	50	I×I	
127	28	LOG	
128	59	INT	
129	32	X:T	
130	01	1	
131	02	2	
132	22	INV	
133	77	GE	
134	02	2	
135	15	15	
136	04	4	
137	94	+/-	
138	77	GE	
139	02	2	
140	15	15	
141	00	0	
142	95	=	
143	32	X:T	
144	00	0	
145	22	INV	
146	77	GE	
147	01	1	
148	55	55	
149	02	2	
150	00	0 MINUS	
151	00	0	
152	00	0	
153	82	HIR *	
154	08	08	
155	04	4	
156	42	STO	
157	88	88	

MERGED CODES

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

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LOC	CODE	KEY	COMMENTS
158	01	1	
159	42	STO	
160	89	89	
161	32	X:T	
162	50	I×I	
163	22	INV	
164	77	GE	
165	01	1	
166	77	77	
167	55	÷	
168	28	LOG	
169	59	INT	
170	44	SUM	
171	89	89	
172	22	INV	
173	28	LOG	
174	52	EE	
175	22	INV	
176	52	EE	
177•	29	CP	
178	71	SBR	
179	00	0	
180	58	58	
181	69	OP	
182	01	01	
183	16	A'	
184	58	FIX	
185	08	8	
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	STO	
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	1	
205	02	2	
206	22	22	
207	69	OP	
208	05	05	
209•	01	1	
210	82	HIR ✶	
211	34	34	
212	82	HIR ✶	
213	14	14	
214	81	RST	
215•	86	STF	
216	01	1	
217	86	STF	
218	00	0	
219	61	GTO	
220	01	1	
221	91	91	
222•	52	EE	
223	73	RC*	
224	89	89	
225	69	OP	
226	06	06	
227	25	CLR	
228	61	GTO	
229	02	2	
230	09	09	

LOC	CODE	KEY	COMMENTS

MERGED CODES

62 Pgm Ind	72 STO Ind	83 GTO Ind
63 Exc Ind	73 RCL Ind	84 Op Ind
64 x≥t Ind	74 SUM Ind	92 INV SBR

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

MERGED CODES

62 Pgm Ind	72 STO Ind	83 GTO Ind
63 Exc Ind	73 RCL Ind	84 GSB Ind
64 Prd Ind	74 SUM Ind	92 INV SBR

LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS
158	04	4		211	87	IFF	
159	42	STO		212	01	1	
160	01	01		213	02	2	
161	01	1		214	30	30	
162	42	STO		215	69	OP	
163	00	00		216	05	05	
164	32	X⇌T		217	01	1	
165	50	I×I		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	LOG		224	01	1	
172	59	INT		225	86	STF	
173	44	SUM		226	00	0	
174	00	00		227	61	GTO	
175	22	INV		228	01	1	
176	28	LOG		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	OP	
181	71	SBR		234	06	06	
182	00	0		235	25	CLR	
183	58	58		236	61	GTO	
184	69	OP		237	02	2	
185	01	01		238	17	17	
186	16	A'					
187	58	FIX					
188	08	8					
189	69	OP					
190	02	02					
191	16	A'					
192	69	OP					
193	03	03					
194	22	INV					
195	58	FIX					
196	25	CLR					
197	02	2					
198	42	STO					
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	OP					
210	04	04					

MERGED CODES

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