

HERO-GRAM

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NEWSLETTER OF THE HERO RESOURCE EXCHANGE

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The HERO 2000 Has Arrived!

Recently Heath Co. introduced their new robot, the HERO 2000. This machine is not an updated version of the HERO 1 but an entirely different robot, redesigned from the ground up. It's sophistication is unprecedented in the world of personal robotics. I took a trip to Heath Co. last October for a sneak preview of this marvelous machine. The following presents a brief overview of it.

HERO 2000 is a 8088 based machine with 11 sub-processors (12 if you count the remote terminal). On-Board Memory is 64K ROM (expandable to 96K) and 24K RAM (expandable to 576K). The sub-processors are used to control the motor functions independent of the main 8088 microprocessor. This allows the robot to execute several movements simultaneously. This means that (unlike HERO 1 where each motor of the arm must wait it's turn) HERO 2000 can move all the motor joints at the same time. The 8042 subprocessors give the robot incredible speed to execute a maneuver. It also results in an uncanny sense of anthropomorphism. The arm on the machine is structurally much sounder than that on HERO 1 as well as more accurate. It also uses a unique force sensing system developed by HEATH. Instead of the head rotating to get the arm into position, the entire upper torso rotates. Some of it's other features include an excellent new SSI 263A voice system with 4096 levels of inflection, a full ASCII keyboard 75 MHz remote terminal with a 2 line 40 character LCD display, Sound- temperature- light- and voltage sensors, a cassette port, Auto-Docking and disk drive capability, and two DCE RS-232C Serial Ports. Navigation is achieved through the use of two Polaroid-Type Sonar transducers. One is mounted at the base of the robot for low profile object avoidance. The other is at the top of the head. The most impressive feature of this one is that it mechanically scans 360 degrees. This way the robot can take in the entire room as it travels. The light sensor uses the same scanning mechanism. The main drive system has two motor driven wheels and two idler wheels. Steering is achieved by the robot changing the speed of one wheel independent of the other. Because the robot uses a servo feedback on the drive motors it can correct for wheel slippage on a soft surface (such as carpet). During the demonstration, we pushed the robot off its straight line travel and it corrected for this by steering back on course.

Overall I found the robot an excellent machine. It is far more accurate in it's movement than HERO 1. By adding a disk drive in the future it seems that this machine has some real possibilities as a personal robot. We were shown a demonstration of the Auto-Docking feature where the robot will seek out it's charger, when the battery gets low, and plug itself in! That alone should tell you how well the robot can maneuver and navigate to a given destination.

We intend to support the HERO 2000 with this newsletter pending members have material to submit on the subject. Be Advised... we have no intention of altering our plans of continuing to support the HERO 1. There are thousands of of this original robot out there and, for the price, they still have more to offer than any other robot today.

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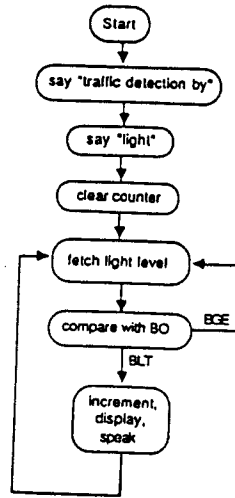
This program will allow you to use Hero as an "electric eye". It will detect traffic (cars, people or any moving object) using its sensors. It has three modes: detecting traffic by light, by sound or by sonar. It will not only display the number of passersby, but will also speak the cumulative total. It could be used to count the number of customers entering a store, or to count the number of cars that pass by your house in a certain time interval, or any number of other ideas.

Here's how to use it:

1. Load the program by hand.
2. Save the program on tape (from 0030 to 04FF).
3. Re-check each byte against my listing and make corrections if necessary (re-save program if corrections were made).
4. Press user 1 key to detect traffic by light. If an object blocks the light from Hero's light detector, it will be counted. The byte at 0060 may be changed to vary the light intensity threshold above which the object will be detected.
5. Press user 2 key to detect traffic by sound. If an object makes a loud sound, it will be counted. The byte at 007B may be changed to vary the sound amplitude threshold above which the sound will be detected.
6. Press user 3 key to detect traffic by sonar. If an object comes within 30 centimeters of Hero's sonar transducers, it will be counted. The byte at 0094 may be changed to vary the distance at which the object will be detected.

The algorithms and program listing follow. On page zero are the actual sensor detection routines. Addresses 0100 thru 04EA contain my SPEAK-NUMBER subroutine, which will speak any number in the index register between 1 and 999 (decimal). Documentation and source code of SPEAK-NUMBER are limited to save space. Questions, comments or suggestions are welcome.

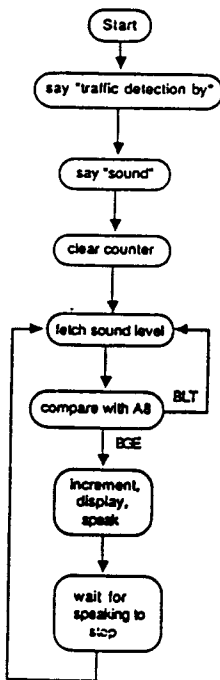
by light



```

    ERL
    SPW@TRAF DET BY
    SPW@LITE
    ELD
    DFL
    CLR@M15
    LDAA@C240
    CMPA#B0
    BGE
    JSR INC-DIS-SP
    BRA
    
```

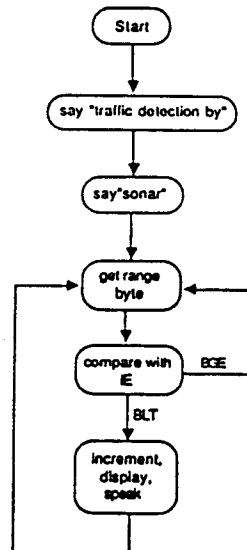
by sound



```

    ERL
    SPW@TRAF DET BY
    SPW@SOUND
    ESD
    DFL
    CLR@M15
    LDAA@C240
    CMPA#A8
    BLT
    BSR INC-DIS-SP
    BSR PULSE
    BRA
    
```

by sonar



```

    ERL
    SPW@TRAF DET BY
    SPW@SONAR
    ESR
    DFL
    CLR@M15
    LDAA#11
    CMPA#IE
    BGE
    BSR INC-DIS-SP
    BRA
    
```

zero page memory locations:

M14 - 0046
M15 - 0047

symbols I use for 6808 addressing modes:

- is direct (zero page)
@ is extended
% is indexed
is immediate

mnemonics I use for robot language

ELD enable light detection
ESD enable sound detection
ESR enable sonar ranging
ERL enable robot language
DRL disable robot language
SPW @ speak wait extended

0000		006B 3F	SOUND	ERL	*****	00C1 00	T
0001		006C 72		SPW @	TRAFFIC	00C2 19	I
.		006D 00			DETECT	00C3 2A	O
.		006E B3			BY	00C4 11	N
.		006F 72		SPW @	SOUND	00C5 32	
002E		0070 00				00C6 0D	
002F		0071 D5				00C7 03	
0030 7E	JMP LITE (user 1)	0072 42		ESD		00C8 0E	B
0031 00		0073 83		DRL		00C9 15	Y
0032 50		0074 7F		CLR @	M15	00CA 00	
0033 7E	JMP SOUND (user 2)	0075 00				00CB 29	
0034 00		0076 47				00CC 03	
0035 6B		0077 B6	SOUND2	LDAA @	C240	00CD FF	
0036 7E	JMP SONAR (user 3)	0078 C2				00CE 18	L
0037 00		0079 40				00CF 23	I
0038 85		007A 81		CMPA #	A8	00D0 08	G
0039 01		007B A8				00D1 29	H
003A 01		007C 2D		BLT	SOUND2	00D2 2A	T
003B 01		007D F9				00D3 03	
003C 01		007E 8D		BSR	INC-DIS-SP	00D4 FF	
003D 01		007F 1E				00D5 IF	S
003E 01		0080 8D		BSR	DELAY	00D6 15	O
003F 01		0081 63				00D7 23	U
0040 01		0082 20		BRA	SOUND2	00D8 2D	N
0041 01		0083 F3				00D9 0D	D
0042 01		0084 01				00DA 1E	
0043 01		0085 3F	SONAR	ERL	*****	00DB 03	
0044 01		0086 72		SPW @	TRAFFIC	00DC FF	
0045 01		0087 00			DETECT	00DD IF	S
0046 01		0088 B3			BY	00DE 35	O
0047 01		0089 72		SPW @	SONAR	00DF 37	N
0048 01		008A 00				00E0 0D	A
0049 01		008B DD				00E1 15	R
004A 01		008C 45		ESR		00E2 2B	
004B 01		008D 83		DRL		00E3 03	
004C 01		008E 7F		CLR @	M15	00E4 FF	
004D 01		008F 00				00E5 CE	DELAY LDX#3000
004E 01		0090 47				00E6 30	
004F 01		0091 96	SONAR2	LDAA -	11	00E7 00	
0050 3F	LITE ERL *****	0092 11				00E8 09	DELAY2 DEX
0051 72	SPW @ TRAFFIC	0093 81		CMPA #	1E	00E9 26	BNE DELAY2
0052 00	DETECT	0094 1E				00EA FD	
0053 B3	BY	0095 2C		BGE	SONAR2	00EB 39	RTS
0054 72	SPW @ LITE	0096 FA				00EC 01	
0055 00		0097 8D		BSR	INC-DIS-SP	00ED 01	
0056 CE		0098 05				00EE 01	
0057 41	ELD	0099 20		BRA	SONAR2	00EF 01	
0058 83	DRL	009A F6				00F0 01	
0059 7F	CLR @M15	009B 01				00F1 01	
005A 00		009C 01				00F2 01	
005B 47		009D 01		INC-DIS-SP	INC @ M15 *****	00F3 01	
005C B6	LITE2 LDAA @C240	009E 7C			; increment, display	00F4 01	
005D C2		009F 00			; and speak	00F5 01	
005E 40		00A0 47		JSR	CLRDIS	00F6 01	
005F 81	CMPA #B0	00A1 BD				00F7 01	
0060 B0		00A2 F6				00F8 01	
0061 2C	BGE LITE2	00A3 5B				00F9 01	
0062 F9		00A4 96		LDAA -	M15	00FA 01	
0063 BD	JSR INC-DIS-SP	00A5 47				00FB 01	
0064 00		00A6 BD		JSR	OUTBYTE	00FC 01	
0065 9E		00A7 F7				00FD 01	
0066 20	BRA LITE2	00A8 AD				00FE 01	
0067 F4		00A9 7F		CLR @	M14	00FF 01	
0068 01		00AA 00				0100 7E	JMP CHECK>999
0069 01		00AB 46		LDX -	M14	0101 04	
006A 01		00AC DE				0102 C9	
		00AD 46				0103 CE	
		00AE BD		JSR	SPEAK NUM	0104 00	
		00AF 01				0105 64	
		00B0 00				0106 DF	
		00B1 39		RTS		0107 39	
		00B2 01			*****	0108 DE	
		00B3 2A		T		0109 42	
		00B4 2B		R		010A BD	
		00B5 2F		A		010B 04	
		00B6 00		F		010C E1	
		00B7 1D		F		010D 2B	
		00B8 0B		I		010E 62	
		00B9 09		C		010F CE	
		00BA 19				0110 00	
		00BB 03				0111 CB	
		00BC 1E		D		0112 DF	
		00BD 3C		E		0113 39	
		00BE 29		T		0114 DE	
		00BF 2A		E		0115 42	
		00C0 02		C			

0116	BD				0262	7E	02B7	7E	030C	73			
0117	04	016A	BD	020F	BD	0263	03	02B8	03	030D	00	0361	15
0118	E1	016B	04	0210	02	0264	39	02B9	82	030E	39	0362	83
0119	2B	016C	E1	0211	E1	0265	81	02BA	81	030F	73	0363	39
011A	59	016D	2B	0212	BD	0266	06	02BB	12	0310	00	0364	3F
011B	CE	016E	3D	0213	02	0267	2C	02BC	2C	0311	3A	0365	72
011C	01	016F	20	0214	E1	0268	03	02BD	03	0312	7C	0366	04
011D	2C	0170	43	0215	E1	0269	7E	02BE	7E	0313	00	0367	1B
011E	DF	0171	7E	0216	02	026A	03	02BF	03	0314	3A	0368	83
011F	39	0172	01	0217	40	026B	40	02C0	88	0315	26	0369	39
0120	DE	0173	D5	0218	BD	026C	81	02C1	01	0316	03	036A	3F
0121	42	0174	BD	0219	03	026D	07	02C2	81	0317	7C	036B	72
0122	BD	0175	03	021A	9A	026E	2C	02C3	13	0318	00	036C	04
0123	04	0176	27	021B	20	026F	03	02C4	2C	0319	39	036D	24
0124	E1	0177	BD	021C	F2	0270	7E	02C5	03	031A	BD	036E	83
0125	2B	0178	03	021D	BD	0271	03	02C6	7E	031B	02	036F	39
0126	55	0179	CA	021E	03	0272	46	02C7	03	031C	F3	0370	3F
0127	CE	017A	20	021F	A0	0273	81	02C8	8E	031D	39	0371	72
0128	01	017B	56	0220	20	0274	08	02C9	7E	0313	01	0372	04
0129	90	017C	BD	0221	EA	0275	2C	02CA	03	031F	01	0373	2C
012A	DF	017D	03	0222	BD	0276	03	02CB	94	0320	01	0374	83
012B	39	017E	2D	0223	03	0277	7E	02CC	01	0321	3F	0375	39
012C	DE	017F	BD	0224	A6	0278	03	02CD	01	0322	72	0376	3F
012D	42	0180	03	0225	20	0279	4C	02CE	01	0323	03	0377	72
012E	BD	0181	CA	0226	E2	027A	81	02CF	86	0324	D3	0378	04
012F	04	0182	20	0227	BD	027B	09	02D0	64	0325	83	0379	35
0130	E1	0183	4B	0228	03	027C	2C	02D1	97	0326	39	037A	83
0131	2B	0184	BD	0229	AC	027D	03	02D2	3A	0327	3F	037B	39
0132	51	0185	03	022A	20	027E	7E	02D3	7F	0328	72	037C	3F
0133	CE	0186	33	022B	DA	027F	03	02D4	00	0329	03	037D	72
0134	01	0187	BD	022C	BD	0280	52	02D5	39	032A	D9	037E	04
0135	F4	0188	03	022D	03	0281	01	02D6	DE	032B	83	037F	40
0136	DF	0189	CA	022E	B2	0282	81	02D7	42	032C	39	0380	83
0137	39	018A	20	022F	20	0283	0A	02D8	BD	032D	3F	0381	39
0138	DE	018B	40	0230	D2	0284	2C	02D9	03	032E	72	0382	3F
0139	42	018C	BD	0231	BD	0285	03	02DA	OC	032F	03	0383	72
013A	BD	018D	03	0232	03	0286	7E	02DB	OF	0330	DF	0384	04
013B	04	018E	39	0233	B8	0287	03	02DC	42	0331	83	0385	4A
013C	E1	018F	BD	0234	20	0288	58	02DD	39	0332	39	0386	83
013D	2B	0190	03	0235	CA	0289	81	02DE	01	0333	3F	0387	39
013E	4D	0191	CA	0236	BD	028A	0B	02DF	01	0334	72	0388	3F
013F	CE	0192	20	0237	03	028B	2C	02E0	01	0335	03	0389	72
0140	02	0193	35	0238	BE	028C	03	02E1	86	0336	E5	038A	04
0141	58	0194	BD	0239	20	028D	7E	02E2	0A	0337	83	038B	56
0142	DF	0195	03	023A	C2	028E	03	02E3	97	0338	39	038C	83
0143	39	0196	40	023B	01	028F	5E	02E4	3A	0339	3F	038D	39
0144	DE	0197	BD	023C	01	0290	81	02E5	7F	033A	72	038E	3F
0145	42	0198	03	023D	01	0291	OC	02E6	00	033B	03	038F	72
0146	BD	0199	CA	023E	01	0292	2C	02E7	39	033C	EB	0390	04
0147	04	019A	20	023F	01	0293	03	02E8	DE	033D	83	0391	63
0148	E1	019B	2A	0240	96	0294	7E	02E9	42	033E	39	0392	83
0149	2B	019C	BD	0241	43	0295	03	02EA	BD	033F	01	0393	39
014A	49	019D	03	0242	81	0296	64	02EB	03	0340	3F	0394	3F
014B	CE	019E	46	0243	01	0297	81	02EC	0C	0341	72	0395	72
014C	02	019F	BD	0244	2C	0298	0D	02ED	DF	0342	03	0396	04
014D	BC	01A0	03	0245	03	0299	2C	02EE	42	0343	F1	0397	6C
014E	DF	01A1	CA	0246	7E	029A	03	02EF	39	0344	83	0398	83
014F	39	01A2	20	0247	03	029B	7E	02FO	01	0345	39	0399	39
0150	DE	01A3	IF	0248	21	029C	03	02F1	01	0346	3F	039A	3F
0151	42	01A4	BD	0249	81	029D	6A	02F2	01	0347	72	039B	72
0152	BD	01A5	03	024A	02	029E	81	02F3	36	0348	03	039C	04
0153	04	01A6	4C	024B	2C	029F	OE	02F4	37	0349	F8	039D	77
0154	E1	01A7	BD	024C	03	02A0	2C	02F5	DF	034A	83	039E	83
0155	2B	01A8	03	024D	7E	02A1	03	02F6	3B	034B	39	039F	39
0156	45	01A9	CA	024E	03	02A2	7E	02F7	D6	034C	3F	03A0	3F
0157	CE	01AA	20	024F	27	02A3	03	02F8	3B	034D	72	03A1	72
0158	03	01AB	14	0250	81	02A4	70	02F9	96	034E	04	03A2	04
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015A	DF	01AD	03	0252	2C	02A6	0F	02FB	DB	0350	83	03A4	83
015B	39	01AE	52	0253	03	02A7	2C	02FC	39	0351	39	03A5	39
015C	DE	01AF	BD	0254	7E	02A8	03	02FD	9B	0352	3F	03A6	3F
015D	42	01B0	03	0255	03	02A9	73	02FE	3A	0353	72	03A7	72
015E	BD	01B1	CA	0256	2D	02AA	03	02FF	01	0354	04	03A8	04
015F	04	01B2	20	0257	81	02AB	76	0300	24	0355	08	03A9	87
0160	E1	01B3	09	0258	04	02AC	81	0301	01	0356	83	03AA	83
0161	2B	01B4	BD	0259	2C	02AD	10	0302	5C	0357	39	03AB	39
0162	41	01B5	03	025A	03	02AE	2C	0303	D7	0358	3F	03AC	3F
0163	CE	01B6	58	025B	7E	02AF	03	0304	3B	0359	72	03AD	72
0164	03	01B7	BD	025C	03	02B0	7E	0305	97	035A	04	03AE	04
0165	84	01B8	03	025D	33	02B1	03	0306	3C	035B	0E	03AF	8F
0166	DF	01B9	CA	025E	81	02B2	7C	0307	DE	035C	83	03B0	83
0167	39	01BA	BD	025F	05	02B3	81	0308	3B	035D	39	03B1	39
0168	DE	01BB	02	0260	2C	02B4	11	0309	33	035E	3F	03B2	3F
0169	42	01BC	CF	0261	03	02B5	2C	030A	32	035F	72	03B3	72
						02B6	03	030B	39	0360	04	03B4	04

03B5 97	0408 05 E	0456 1F S	04AC 05 E
03B6 83	0409 05 I	0457 02 E	04AD 05 I
03B7 39	040A 29 G	0458 00 V	04AE 29 G
03B8 3F	040B 2A H	0459 0F E	04AF 2A H
03B9 72	040C 03 T	045A 02 N	04B0 29 T
03BA 04	040D FF	045B 00 T	04B1 03 Y
03BB A1	040E 0D N	045C 0D E	04B2 FF
03BC 83	040F 15 I	045D 2A E	04B3 0D N
03BD 39	0410 00 N	045E 3C N	04B4 15 I
03BE 3F	0411 29 E	045F 29	04B5 00 N
03BF 72	0412 0D	0460 0D	04B6 29 T
03C0 04	0413 03	0461 03	04B7 0D Y
03C1 AC	0414 FF	0462 FF	04B8 2A
03C2 83	0415 2A T	0463 05 E	04B9 29
03C3 39	0416 02 E	0464 05 I	04BA 03
03C4 3F	0417 00 N	0465 29 G	04BB FF
03C5 72	0418 0D	0466 2A H	04BC 1B H
03C6 04	0419 03	0467 3C T	04BD 32 U
03C7 B3	041A FF	0468 29 E	04BE 31 N
03CB 83	041B 02 E	0469 0D E	04BF 0D D
03C9 39	041C 18 L	046A 03 N	04C0 1E R
03CA 3F	041D 02 E	046B FF	04C1 2B E
03CB 72	041E 00 V	046C 0D N	04C2 09 D
03CC 04	041F 0F E	046D 15 I	04C3 1E
03CD BC	0420 0A N	046E 00 N	04C4 03
03CE 83	0421 0D	046F 29 E	04C5 FF
03CF 39	0422 03	0470 0D T	04C6 01
03D0 01	0423 FF	0471 2A E	04C7 01
03D1 01	0424 2A T	0472 3C E	04C8 01
03D2 01	0425 2D W	0473 29 N	04C9 DF
03D3 19 Z	0426 02 E	0474 0D	04CA 42
03D4 03 E	0427 00 L	0475 03	04CB CE
03D5 03 R	0428 18 V	0476 FF	04CC 03
03D6 03 O	0429 0F E	0477 2A T	04CD E7
03D7 03	042A 03	0478 2D W	04CE DF
03D8 FF	042B FF	0479 02 E	00CF 39
03D9 2D	042C 39 T	047A 00 N	04D0 DE
03DA 32 O	042D 3A H	047B 0D T	04D1 42
03DB 31 N	042E 2B I	047C 2A Y	04D2 BD
03DC 0D E	042F 2A R	047D 29	04D3 04
03DD 03	0430 3C T	047E 03	04D4 E1
03DE FF	0431 29 E	047F FF	04D5 2A
03DF 2A T	0432 0D E	0480 39 T	04D6 03
03E0 36 W	0433 03 N	0481 3A H	04D7 7E
03E1 37 O	0434 FF	0482 2B I	04D8 01
03E2 37	0435 1D F	0483 2A R	04D9 03
03E3 03	0436 35 O	0484 29 T	04DA 3F
03E4 FF	0437 34 U	0485 03 Y	04DB 72
03E5 39 T	0438 2B R	0486 FF	04DC 03
03E6 2B H	0439 2A T	0487 1D F	04DD D3
03E7 3C R	043A 3C E	0488 34 O	04DE 83
03E8 29 E	043B 29 E	0489 34 R	04DF 39
03E9 03 E	043C 0D N	048A 2B T	04E0 01
03EA FF	043D 03	048B 2A Y	04E1 BD
03EB ID F	043E FF	048C 29	04E2 03
03EC 35 O	043F 01	048D 03	04E3 0C
03ED 34 U	0440 1D F	048E FF	04E4 DF
03EE 2B R	0441 0B I	048F 1D F	04E5 44
03EF 03	0442 09 F	0490 0B I	04E6 7D
03F0 FF	0443 1D T	0491 09 F	04E7 00
03F1 1D F	0444 2A E	0492 1D T	04E8 44
03F2 15 I	0445 3C E	0493 2A Y	00E9 39
03F3 00 V	0446 29 N	0494 29	04EA 01
03F4 29 E	0447 0D	0495 03	04EB 01
0375 OF	0448 03	0496 FF	04EC 01
03F6 03	0449 FF	0497 1F S	04ED 01
03F7 FF	044A 1F S	0498 0B I	04EE 01
03F8 1F S	044B 0B I	0499 09 X	04EF 01
03F9 0B I	044C 09 X	049A 19 T	04F0 01
03FA 09 X	044D 19 T	049B 03 Y	04F1 01
03FB 19	044E 03 E	049C 1F	04F2 01
03FC 03	044F 1F E	049D 2A	04F3 01
03FD 1F	0450 2A N	049E 29	04F4 01
03FE 03	0451 3C	049F 03	04F5 01
03FF FF	0452 29	04A0 FF	04F6 01
0400 1F S	0453 0D	04A1 1F S	04F7 01
0401 02 E	0454 03	04A2 02 E	04F8 01
0402 00 V	0455 FF	04A3 00 V	04F9 01
0403 0F E		04A4 0F E	04FA 01
0404 0A N		04A5 02 N	04FB 01
0405 0D		04A6 00 T	04FC 01
0406 03		04A7 0D Y	04FD 01
0407 FF		04A8 2A	04FE 01
		04A9 29	04FF 01
		04AA 03	
		04AB FF	