

Motorola Semiconductor Engineering Bulletin

EB373

Template for Initializing the Exception Vector Table of CPU32-Based Devices

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Introduction

The assembly language program listed in this engineering bulletin is a template for initializing all of the exception and interrupt vectors in a CPU32-based device.

The Program

The program starts at \$00 0000 because the exception vector table always starts at that address from the release of RESET.

In the CPU-based devices, the exception vector table can be relocated by writing to the vector base address register (VBR). The instructions that write to the VBR are privileged instructions so that they can be used only in supervisor mode.

The first part of the program consists of two `dc .l` directives that specify the initial value for the stack pointer and program counter and 254 `dc .l` declarations that simply define a long word for labels `v2` through `v255`. The applications programmer must input initial stack pointer and initial program counter values.



The first long word value will be at address \$00 0000, the second word at \$00 0004, the third word at \$00 0008, and so on.

When the program is assembled, the assembler will find each label and assign an address to it. For instance, the assembler will find the label `v2`, which is the label for the bus error handler, and put the address of that label in location \$00 0008. This is the purpose of the

`dl v2 ;Bus Error` directive at line 9 of the listing file in this bulletin. Likewise, addresses will be assigned to each of the labels and those addresses will be appropriately substituted for the label names for all of the "dl label" directives at lines 9 through 262 in the listing file that follows.

The second part of the program simply puts an `rte` instruction at each label except for the initial stack pointer and initial program counter values.

The initial stack pointer and initial program counter values must be supplied by modifying the first two `dc.l` statements in the assembly listing. When the program is assembled, an absolute address for all the labels will be calculated. Then, these values are used in the `dc.l` statements. Thus, the address of `v2` will be placed at memory location \$00 0008, the address of `v3` at \$00 000c, the address of `v4` at \$00 0010 and so on. When a particular exception or interrupt occurs, the machine will fetch the associated vector number. The contents of the VBR are concatenated with the vector number which are concatenated with %00 to form a 32-bit address. The contents of this 32-bit address is the location of the exception handler.

In other words, when a BERR exception occurs, the machine will fetch vector 2. If the VBR contains \$0000 0000, the machine will go to memory location \$00 0008. The contents of this memory location is the address of the label `v2` which is where the BERR exception handler is located.

To use this template to initialize the exception vector table, follow these steps:

1. Cut and paste the assembly file into the first part of the user application.

2. Put in the appropriate values for the initial stack pointer and initial reset vector.
3. Put in exception handler code at each label for which an exception handler is needed. This code will replace the RTE instruction that is at the label now. For instance, a BERR exception handler starts at label `v2`. The spurious interrupt handler starts at label `v24`. User-defined vector 0 starts at label `v64`. Be sure to end the exception handler with an `rte` instruction.

Exception Vector Initialization Program Listing File

The following is the listing file for the exception vector initialization program. The assembly source code follows this listing file.

```

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                                           1
                                           2
00000000                                3         org $0000
                                           4
                                           5
                                           6
00000000 00003FFC                        7         dl    $00003ffc    ;initial Stack Pointer
                                           8                                 ;Modify this value
                                           9                                 ;for your application
00000004 00000400                        10        dl    $00000400   ;initial Program Counter
                                           11                                 ;Modify this value
                                           12                                 ;for your application

00000008 00000408                        13        dl    v2         ;Bus Error
0000000C 0000040A                        14        dl    v3         ;Address Error
00000010 0000040C                        15        dl    v4         ;Illegal Instruction
00000014 0000040E                        16        dl    v5         ;Zero Division
00000018 00000410                        17        dl    v6         ;CHK, CHK2 Instructions
0000001C 00000412                        18        dl    v7         ;TRAPcc, TRAPV Instruction
00000020 00000414                        19        dl    v8         ;Privilege Violation
00000024 00000416                        20        dl    v9         ;Trace
00000028 00000418                        21        dl    v10        ;Line 1010 Emulation
0000002C 0000041A                        22        dl    v11        ;Line 1111 Emulation
00000030 0000041C                        23        dl    v12        ;Hardware Breakpoint
00000034 0000041E                        24        dl    v13        ;Reserved, Coprocessor Protocol
                                           ;Violation
00000038 00000420                        25        dl    v14        ;Format Error and Uninitialized
                                           ;Interrupt
0000003C 00000422                        26        dl    v15        ;Format Error and Uninitialized
                                           ;Interrupt

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00000040	00000424	27	dl	v16	;Unassigned
00000044	00000426	28	dl	v17	;Unassigned
00000048	00000428	29	dl	v18	;Unassigned
0000004C	0000042A	30	dl	v19	;Unassigned
00000050	0000042C	31	dl	v20	;Unassigned
00000054	0000042E	32	dl	v21	;Unassigned
00000058	00000430	33	dl	v22	;Unassigned
0000005C	00000432	34	dl	v23	;Unassigned
00000060	00000434	35	dl	v24	;Spurious Interrupt
00000064	00000436	36	dl	v25	;Level 1 Interrupt Autovector
00000068	00000438	37	dl	v26	;Level 2 Interrupt Autovector
0000006C	0000043A	38	dl	v27	;Level 3 Interrupt Autovector
00000070	0000043C	39	dl	v28	;Level 4 Interrupt Autovector
00000074	0000043E	40	dl	v29	;Level 5 Interrupt Autovector
00000078	00000440	41	dl	v30	;Level 6 Interrupt Autovector
0000007C	00000442	42	dl	v31	;Level 7 Interrupt Autovector
00000080	00000444	43	dl	v32	;Trap Instruction Vector 0
00000084	00000446	44	dl	v33	;Trap Instruction Vector 1
00000088	00000448	45	dl	v34	;Trap Instruction Vector 2
0000008C	0000044A	46	dl	v35	;Trap Instruction Vector 3
00000090	0000044C	47	dl	v36	;Trap Instruction Vector 4
00000094	0000044E	48	dl	v37	;Trap Instruction Vector 5
00000098	00000450	49	dl	v38	;Trap Instruction Vector 6
0000009C	00000452	50	dl	v39	;Trap Instruction Vector 7
000000A0	00000454	51	dl	v40	;Trap Instruction Vector 8

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000000A4	00000456	52	dl	v41	;Trap Instruction Vector 9
000000A8	00000458	53	dl	v42	;Trap Instruction Vector 10
000000AC	0000045A	54	dl	v43	;Trap Instruction Vector 11
000000B0	0000045C	55	dl	v44	;Trap Instruction Vector 12
000000B4	0000045E	56	dl	v45	;Trap Instruction Vector 13
000000B8	00000460	57	dl	v46	;Trap Instruction Vector 14
000000BC	00000462	58	dl	v47	;Trap Instruction Vector 15
000000C0	00000464	59	dl	v48	;Reserved, Coprocessor
000000C4	00000466	60	dl	v49	;Reserved, Coprocessor
000000C8	00000468	61	dl	v50	;Reserved, Coprocessor
000000CC	0000046A	62	dl	v51	;Reserved, Coprocessor
000000D0	0000046C	63	dl	v52	;Reserved, Coprocessor
000000D4	0000046E	64	dl	v53	;Reserved, Coprocessor
000000D8	00000470	65	dl	v54	;Reserved, Coprocessor
000000DC	00000472	66	dl	v55	;Reserved, Coprocessor
000000E0	00000474	67	dl	v56	;Reserved, Coprocessor
000000E4	00000476	68	dl	v57	;Reserved, Coprocessor
000000E8	00000478	69	dl	v58	;Reserved, Coprocessor
000000EC	0000047A	70	dl	v59	;Unassigned, Reserved
000000F0	0000047C	71	dl	v60	;Unassigned, Reserved
000000F4	0000047E	72	dl	v61	;Unassigned, Reserved
000000F8	00000480	73	dl	v62	;Unassigned, Reserved
000000FC	00000482	74	dl	v63	;Unassigned, Reserved
00000100	00000484	75	dl	v64	;User Defined Vector 0

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00000104 00000486    76      dl    v65      ;User Defined Vector 1
00000108 00000488    77      dl    v66      ;User Defined Vector 2
0000010C 0000048A    78      dl    v67      ;User Defined Vector 3
00000110 0000048C    79      dl    v68      ;User Defined Vector 4
00000114 0000048E    80      dl    v69      ;User Defined Vector 5
00000118 00000490    81      dl    v70      ;User Defined Vector 6
0000011C 00000492    82      dl    v71      ;User Defined Vector 7
00000120 00000494    83      dl    v72      ;User Defined Vector 8
00000124 00000496    84      dl    v73      ;User Defined Vector 9
00000128 00000498    85      dl    v74      ;User Defined Vector 10
0000012C 0000049A    86      dl    v75      ;User Defined Vector 11
00000130 0000049C    87      dl    v76      ;User Defined Vector 12
00000134 0000049E    88      dl    v77      ;User Defined Vector 13
00000138 000004A0    89      dl    v78      ;User Defined Vector 14
0000013C 000004A2    90      dl    v79      ;User Defined Vector 15
00000140 000004A4    91      dl    v80      ;User Defined Vector 16
00000144 000004A6    92      dl    v81      ;User Defined Vector 17
00000148 000004A8    93      dl    v82      ;User Defined Vector 18
0000014C 000004AA    94      dl    v83      ;User Defined Vector 19
00000150 000004AC    95      dl    v84      ;User Defined Vector 20
00000154 000004AE    96      dl    v85      ;User Defined Vector 21
00000158 000004B0    97      dl    v86      ;User Defined Vector 22
0000015C 000004B2    98      dl    v87      ;User Defined Vector 23
00000160 000004B4    99      dl    v88      ;User Defined Vector 24
00000164 000004B6   100     dl    v89      ;User Defined Vector 25
00000168 000004B8   101     dl    v90      ;User Defined Vector 26
0000016C 000004BA   102     dl    v91      ;User Defined Vector 27
00000170 000004BC   103     dl    v92      ;User Defined Vector 28
00000174 000004BE   104     dl    v93      ;User Defined Vector 29
00000178 000004C0   105     dl    v94      ;User Defined Vector 30
0000017C 000004C2   106     dl    v95      ;User Defined Vector 31
00000180 000004C4   107     dl    v96      ;User Defined Vector 32
00000184 000004C6   108     dl    v97      ;User Defined Vector 33
00000188 000004C8   109     dl    v98      ;User Defined Vector 34

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0000018C 000004CA   110     dl    v99      ;User Defined Vector 35
00000190 000004CC   111     dl    v100     ;User Defined Vector 36
00000194 000004CE   112     dl    v101     ;User Defined Vector 37
00000198 000004D0   113     dl    v102     ;User Defined Vector 38
0000019C 000004D2   114     dl    v103     ;User Defined Vector 39
000001A0 000004D4   115     dl    v104     ;User Defined Vector 40
000001A4 000004D6   116     dl    v105     ;User Defined Vector 41
000001A8 000004D8   117     dl    v106     ;User Defined Vector 42
000001AC 000004DA   118     dl    v107     ;User Defined Vector 43
000001B0 000004DC   119     dl    v108     ;User Defined Vector 44
000001B4 000004DE   120     dl    v109     ;User Defined Vector 45
000001B8 000004E0   121     dl    v110     ;User Defined Vector 46
000001BC 000004E2   122     dl    v111     ;User Defined Vector 47
000001C0 000004E4   123     dl    v112     ;User Defined Vector 48
000001C4 000004E6   124     dl    v113     ;User Defined Vector 49

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000001C8	000004E8	125	dl	v114	;User Defined Vector	50
000001CC	000004EA	126	dl	v115	;User Defined Vector	51
000001D0	000004EC	127	dl	v116	;User Defined Vector	52
000001D4	000004EE	128	dl	v117	;User Defined Vector	53
000001D8	000004F0	129	dl	v118	;User Defined Vector	54
000001DC	000004F2	130	dl	v119	;User Defined Vector	55
000001E0	000004F4	131	dl	v120	;User Defined Vector	56
000001E4	000004F6	132	dl	v121	;User Defined Vector	57
000001E8	000004F8	133	dl	v122	;User Defined Vector	58
000001EC	000004FA	134	dl	v123	;User Defined Vector	59
000001F0	000004FC	135	dl	v124	;User Defined Vector	60
000001F4	000004FE	136	dl	v125	;User Defined Vector	61
000001F8	00000500	137	dl	v126	;User Defined Vector	62
000001FC	00000502	138	dl	v127	;User Defined Vector	63
00000200	00000504	139	dl	v128	;User Defined Vector	64
00000204	00000506	140	dl	v129	;User Defined Vector	65
00000208	00000508	141	dl	v130	;User Defined Vector	66
0000020C	0000050A	142	dl	v131	;User Defined Vector	67
00000210	0000050C	143	dl	v132	;User Defined Vector	68
00000214	0000050E	144	dl	v133	;User Defined Vector	69
00000218	00000510	145	dl	v134	;User Defined Vector	70
0000021C	00000512	146	dl	v135	;User Defined Vector	71
00000220	00000514	147	dl	v136	;User Defined Vector	72
00000224	00000516	148	dl	v137	;User Defined Vector	73
00000228	00000518	149	dl	v138	;User Defined Vector	74
0000022C	0000051A	150	dl	v139	;User Defined Vector	75
00000230	0000051C	151	dl	v140	;User Defined Vector	76
00000234	0000051E	152	dl	v141	;User Defined Vector	77
00000238	00000520	153	dl	v142	;User Defined Vector	78
0000023C	00000522	154	dl	v143	;User Defined Vector	79
00000240	00000524	155	dl	v144	;User Defined Vector	80
00000244	00000526	156	dl	v145	;User Defined Vector	81
00000248	00000528	157	dl	v146	;User Defined Vector	82
0000024C	0000052A	158	dl	v147	;User Defined Vector	83
00000250	0000052C	159	dl	v148	;User Defined Vector	84
00000254	0000052E	160	dl	v149	;User Defined Vector	85
00000258	00000530	161	dl	v150	;User Defined Vector	86
0000025C	00000532	162	dl	v151	;User Defined Vector	87
00000260	00000534	163	dl	v152	;User Defined Vector	88
00000264	00000536	164	dl	v153	;User Defined Vector	89
00000268	00000538	165	dl	v154	;User Defined Vector	90
0000026C	0000053A	166	dl	v155	;User Defined Vector	91
00000270	0000053C	167	dl	v156	;User Defined Vector	92

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00000274	0000053E	168	dl	v157	;User Defined Vector	93
00000278	00000540	169	dl	v158	;User Defined Vector	94
0000027C	00000542	170	dl	v159	;User Defined Vector	95
00000280	00000544	171	dl	v160	;User Defined Vector	96
00000284	00000546	172	dl	v161	;User Defined Vector	97
00000288	00000548	173	dl	v162	;User Defined Vector	98

0000028C	0000054A	174	dl	v163	;User Defined Vector	99
00000290	0000054C	175	dl	v164	;User Defined Vector	100
00000294	0000054E	176	dl	v165	;User Defined Vector	101
00000298	00000550	177	dl	v166	;User Defined Vector	102
0000029C	00000552	178	dl	v167	;User Defined Vector	103
000002A0	00000554	179	dl	v168	;User Defined Vector	104
000002A4	00000556	180	dl	v169	;User Defined Vector	105
000002A8	00000558	181	dl	v170	;User Defined Vector	106
000002AC	0000055A	182	dl	v171	;User Defined Vector	107
000002B0	0000055C	183	dl	v172	;User Defined Vector	108
000002B4	0000055E	184	dl	v173	;User Defined Vector	109
000002B8	00000560	185	dl	v174	;User Defined Vector	110
000002BC	00000562	186	dl	v175	;User Defined Vector	111
000002C0	00000564	187	dl	v176	;User Defined Vector	112
000002C4	00000566	188	dl	v177	;User Defined Vector	113
000002C8	00000568	189	dl	v178	;User Defined Vector	114
000002CC	0000056A	190	dl	v179	;User Defined Vector	115
000002D0	0000056C	191	dl	v180	;User Defined Vector	116
000002D4	0000056E	192	dl	v181	;User Defined Vector	117
000002D8	00000570	193	dl	v182	;User Defined Vector	118
000002DC	00000572	194	dl	v183	;User Defined Vector	119
000002E0	00000574	195	dl	v184	;User Defined Vector	120
000002E4	00000576	196	dl	v185	;User Defined Vector	121
000002E8	00000578	197	dl	v186	;User Defined Vector	122
000002EC	0000057A	198	dl	v187	;User Defined Vector	123
000002F0	0000057C	199	dl	v188	;User Defined Vector	124
000002F4	0000057E	200	dl	v189	;User Defined Vector	125
000002F8	00000580	201	dl	v190	;User Defined Vector	126
000002FC	00000582	202	dl	v191	;User Defined Vector	127
00000300	00000584	203	dl	v192	;User Defined Vector	128
00000304	00000586	204	dl	v193	;User Defined Vector	129
00000308	00000588	205	dl	v194	;User Defined Vector	130
0000030C	0000058A	206	dl	v195	;User Defined Vector	131
00000310	0000058C	207	dl	v196	;User Defined Vector	132
00000314	0000058E	208	dl	v197	;User Defined Vector	133
00000318	00000590	209	dl	v198	;User Defined Vector	134
0000031C	00000592	210	dl	v199	;User Defined Vector	135
00000320	00000594	211	dl	v200	;User Defined Vector	136
00000324	00000596	212	dl	v201	;User Defined Vector	137
00000328	00000598	213	dl	v202	;User Defined Vector	138
0000032C	0000059A	214	dl	v203	;User Defined Vector	139
00000330	0000059C	215	dl	v204	;User Defined Vector	140
00000334	0000059E	216	dl	v205	;User Defined Vector	141
00000338	000005A0	217	dl	v206	;User Defined Vector	142
0000033C	000005A2	218	dl	v207	;User Defined Vector	143
00000340	000005A4	219	dl	v208	;User Defined Vector	144
00000344	000005A6	220	dl	v209	;User Defined Vector	145
00000348	000005A8	221	dl	v210	;User Defined Vector	146
0000034C	000005AA	222	dl	v211	;User Defined Vector	147
00000350	000005AC	223	dl	v212	;User Defined Vector	148
00000354	000005AE	224	dl	v213	;User Defined Vector	149
00000358	000005B0	225	dl	v214	;User Defined Vector	150

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```
0000035C 000005B2 226 dl v215 ;User Defined Vector 151
00000360 000005B4 227 dl v216 ;User Defined Vector 152
00000364 000005B6 228 dl v217 ;User Defined Vector 153
00000368 000005B8 229 dl v218 ;User Defined Vector 154
0000036C 000005BA 230 dl v219 ;User Defined Vector 155
00000370 000005BC 231 dl v220 ;User Defined Vector 156
00000374 000005BE 232 dl v221 ;User Defined Vector 157
00000378 000005C0 233 dl v222 ;User Defined Vector 158
0000037C 000005C2 234 dl v223 ;User Defined Vector 159
00000380 000005C4 235 dl v224 ;User Defined Vector 160
00000384 000005C6 236 dl v225 ;User Defined Vector 161
00000388 000005C8 237 dl v226 ;User Defined Vector 162
0000038C 000005CA 238 dl v227 ;User Defined Vector 163
00000390 000005CC 239 dl v228 ;User Defined Vector 164
00000394 000005CE 240 dl v229 ;User Defined Vector 165
00000398 000005D0 241 dl v230 ;User Defined Vector 166
0000039C 000005D2 242 dl v231 ;User Defined Vector 167
000003A0 000005D4 243 dl v232 ;User Defined Vector 168
000003A4 000005D6 244 dl v233 ;User Defined Vector 169
000003A8 000005D8 245 dl v234 ;User Defined Vector 170
000003AC 000005DA 246 dl v235 ;User Defined Vector 171
000003B0 000005DC 247 dl v236 ;User Defined Vector 172
000003B4 000005DE 248 dl v237 ;User Defined Vector 173
000003B8 000005E0 249 dl v238 ;User Defined Vector 174
000003BC 000005E2 250 dl v239 ;User Defined Vector 175
000003C0 000005E4 251 dl v240 ;User Defined Vector 176
000003C4 000005E6 252 dl v241 ;User Defined Vector 177
000003C8 000005E8 253 dl v242 ;User Defined Vector 178
000003CC 000005EA 254 dl v243 ;User Defined Vector 179
000003D0 000005EC 255 dl v244 ;User Defined Vector 180
000003D4 000005EE 256 dl v245 ;User Defined Vector 181
000003D8 000005F0 257 dl v246 ;User Defined Vector 182
000003DC 000005F2 258 dl v247 ;User Defined Vector 183
000003E0 000005F4 259 dl v248 ;User Defined Vector 184
000003E4 000005F6 260 dl v249 ;User Defined Vector 185
000003E8 000005F8 261 dl v250 ;User Defined Vector 186
000003EC 000005FA 262 dl v251 ;User Defined Vector 187
000003F0 000005FC 263 dl v252 ;User Defined Vector 188
000003F4 000005FE 264 dl v253 ;User Defined Vector 189
000003F8 00000600 265 dl v254 ;User Defined Vector 190
000003FC 00000602 266 dl v255 ;User Defined Vector 191
267
00000400 268 org $00000400 ;The first address after the
;vector
269 ;table is $400. The following
;labels
270 ;can be placed anywhere in
;memory.
271
272
00000400 00003FFC 273 v0 fcb $00,$00,$3f,$fc ;Reset: Initial Stack
```

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```

00000404 00000400 274 v1      fcb $00,$00,$04,$00 ;Pointer
;Reset: Initial Program
;Counter
275 ;These values will never
;be used, they
276 ;are simply serving as
;a place holder

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```

277 ;so that the label v2 will
;start at
278 ;the memory address $xxx8.
00000408 4E73 279 v2      rte ;Bus Error
0000040A 4E73 280 v3      rte ;Address Error
0000040C 4E73 281 v4      rte ;Illegal Instruction
0000040E 4E73 282 v5      rte ;Zero Division
00000410 4E73 283 v6      rte ;CHK, CHK2 Instruction
00000412 4E73 284 v7      rte ;TRAPcc, TRAPV Instructions
00000414 4E73 285 v8      rte ;Privilege Violation
00000416 4E73 286 v9      rte ;Trace
00000418 4E73 287 v10     rte ;Line 1010 Emulation
0000041A 4E73 288 v11     rte ;Line 1111 Emulation
0000041C 4E73 289 v12     rte ;Hardware Breakpoint
0000041E 4E73 290 v13     rte ;Reserved
00000420 4E73 291 v14     rte ;Format Error and Unitialized IRQ
00000422 4E73 292 v15     rte ;Format Error and Unitialized IRQ
00000424 4E73 293 v16     rte ;Unassigned
00000426 4E73 294 v17     rte ;Unassigned
00000428 4E73 295 v18     rte ;Unassigned
0000042A 4E73 296 v19     rte ;Unassigned
0000042C 4E73 297 v20     rte ;Unassigned
0000042E 4E73 298 v21     rte ;Unassigned
00000430 4E73 299 v22     rte ;Unassigned
00000432 4E73 300 v23     rte ;Unassigned
00000434 4E73 301 v24     rte ;Spurious Interrupt
00000436 4E73 302 v25     rte ;Level 1 Interrupt Autovector
00000438 4E73 303 v26     rte ;Level 2 Interrupt Autovector
0000043A 4E73 304 v27     rte ;Level 3 Interrupt Autovector
0000043C 4E73 305 v28     rte ;Level 4 Interrupt Autovector
0000043E 4E73 306 v29     rte ;Level 5 Interrupt Autovector
00000440 4E73 307 v30     rte ;Level 6 Interrupt Autovector
00000442 4E73 308 v31     rte ;Level 7 Interrupt Autovector
00000444 4E73 309 v32     rte ;Trap Instruction Vector 0
00000446 4E73 310 v33     rte ;Trap Instruction Vector 1
00000448 4E73 311 v34     rte ;Trap Instruction Vector 2
0000044A 4E73 312 v35     rte ;Trap Instruction Vector 3
0000044C 4E73 313 v36     rte ;Trap Instruction Vector 4
0000044E 4E73 314 v37     rte ;Trap Instruction Vector 5
00000450 4E73 315 v38     rte ;Trap Instruction Vector 6
00000452 4E73 316 v39     rte ;Trap Instruction Vector 7
00000454 4E73 317 v40     rte ;Trap Instruction Vector 8

```

```

00000456 4E73      318 v41      rte          ;Trap Instruction Vector 9
00000458 4E73      319 v42      rte          ;Trap Instruction Vector 10
0000045A 4E73      320 v43      rte          ;Trap Instruction Vector 11
0000045C 4E73      321 v44      rte          ;Trap Instruction Vector 12
0000045E 4E73      322 v45      rte          ;Trap Instruction Vector 13
00000460 4E73      323 v46      rte          ;Trap Instruction Vector 14
00000462 4E73      324 v47      rte          ;Trap Instruction Vector 15
00000464 4E73      325 v48      rte          ;Reserved Coprocessor
00000466 4E73      326 v49      rte          ;Reserved Coprocessor
00000468 4E73      327 v50      rte          ;Reserved Coprocessor
0000046A 4E73      328 v51      rte          ;Reserved Coprocessor
0000046C 4E73      329 v52      rte          ;Reserved Coprocessor
0000046E 4E73      330 v53      rte          ;Reserved Coprocessor

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```

00000470 4E73      331 v54      rte          ;Reserved Coprocessor
00000472 4E73      332 v55      rte          ;Reserved Coprocessor
00000474 4E73      333 v56      rte          ;Reserved Coprocessor
00000476 4E73      334 v57      rte          ;Reserved Coprocessor
00000478 4E73      335 v58      rte          ;Reserved Coprocessor
0000047A 4E73      336 v59      rte          ;Unassigned, Reserved
0000047C 4E73      337 v60      rte          ;Unassigned, Reserved
0000047E 4E73      338 v61      rte          ;Unassigned, Reserved
00000480 4E73      339 v62      rte          ;Unassigned, Reserved
00000482 4E73      340 v63      rte          ;Unassigned, Reserved
00000484 4E73      341 v64      rte          ;User Vector 0
00000486 4E73      342 v65      rte          ;User Vector 1
00000488 4E73      343 v66      rte          ;User Vector 2
0000048A 4E73      344 v67      rte          ;User Vector 3
0000048C 4E73      345 v68      rte          ;User Vector 4
0000048E 4E73      346 v69      rte          ;User Vector 5
00000490 4E73      347 v70      rte          ;User Vector 6
00000492 4E73      348 v71      rte          ;User Vector 7
00000494 4E73      349 v72      rte          ;User Vector 8
00000496 4E73      350 v73      rte          ;User Vector 9
00000498 4E73      351 v74      rte          ;User Vector 10
0000049A 4E73      352 v75      rte          ;User Vector 11
0000049C 4E73      353 v76      rte          ;User Vector 12
0000049E 4E73      354 v77      rte          ;User Vector 13
000004A0 4E73      355 v78      rte          ;User Vector 14
000004A2 4E73      356 v79      rte          ;User Vector 15
000004A4 4E73      357 v80      rte          ;User Vector 16
000004A6 4E73      358 v81      rte          ;User Vector 17
000004A8 4E73      359 v82      rte          ;User Vector 18
000004AA 4E73      360 v83      rte          ;User Vector 19
000004AC 4E73      361 v84      rte          ;User Vector 20
000004AE 4E73      362 v85      rte          ;User Vector 21
000004B0 4E73      363 v86      rte          ;User Vector 22
000004B2 4E73      364 v87      rte          ;User Vector 23
000004B4 4E73      365 v88      rte          ;User Vector 24
000004B6 4E73      366 v89      rte          ;User Vector 25

```

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000004B8 4E73      367  v90    rte      ;User Vector 26
000004BA 4E73      368  v91    rte      ;User Vector 27
000004BC 4E73      369  v92    rte      ;User Vector 28
000004BE 4E73      370  v93    rte      ;User Vector 29
000004C0 4E73      371  v94    rte      ;User Vector 30
000004C2 4E73      372  v95    rte      ;User Vector 31
000004C4 4E73      373  v96    rte      ;User Vector 32
000004C6 4E73      374  v97    rte      ;User Vector 33
000004C8 4E73      375  v98    rte      ;User Vector 34
000004CA 4E73      376  v99    rte      ;User Vector 35
000004CC 4E73      377  v100   rte      ;User Vector 36
000004CE 4E73      378  v101   rte      ;User Vector 37
000004D0 4E73      379  v102   rte      ;User Vector 38
000004D2 4E73      380  v103   rte      ;User Vector 39
000004D4 4E73      381  v104   rte      ;User Vector 40
000004D6 4E73      382  v105   rte      ;User Vector 41
000004D8 4E73      383  v106   rte      ;User Vector 42
000004DA 4E73      384  v107   rte      ;User Vector 43
000004DC 4E73      385  v108   rte      ;User Vector 44
000004DE 4E73      386  v109   rte      ;User Vector 45
000004E0 4E73      387  v110   rte      ;User Vector 46
000004E2 4E73      388  v111   rte      ;User Vector 47

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```

000004E4 4E73      389  v112   rte      ;User Vector 48
000004E6 4E73      390  v113   rte      ;User Vector 49
000004E8 4E73      391  v114   rte      ;User Vector 50
000004EA 4E73      392  v115   rte      ;User Vector 51
000004EC 4E73      393  v116   rte      ;User Vector 52
000004EE 4E73      394  v117   rte      ;User Vector 53
000004F0 4E73      395  v118   rte      ;User Vector 54
000004F2 4E73      396  v119   rte      ;User Vector 55
000004F4 4E73      397  v120   rte      ;User Vector 56
000004F6 4E73      398  v121   rte      ;User Vector 57
000004F8 4E73      399  v122   rte      ;User Vector 58
000004FA 4E73      400  v123   rte      ;User Vector 59
000004FC 4E73      401  v124   rte      ;User Vector 60
000004FE 4E73      402  v125   rte      ;User Vector 61
00000500 4E73      403  v126   rte      ;User Vector 62
00000502 4E73      404  v127   rte      ;User Vector 63
00000504 4E73      405  v128   rte      ;User Vector 64
00000506 4E73      406  v129   rte      ;User Vector 65
00000508 4E73      407  v130   rte      ;User Vector 66
0000050A 4E73      408  v131   rte      ;User Vector 67
0000050C 4E73      409  v132   rte      ;User Vector 68
0000050E 4E73      410  v133   rte      ;User Vector 69
00000510 4E73      411  v134   rte      ;User Vector 70
00000512 4E73      412  v135   rte      ;User Vector 71
00000514 4E73      413  v136   rte      ;User Vector 72
00000516 4E73      414  v137   rte      ;User Vector 73
00000518 4E73      415  v138   rte      ;User Vector 74

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MOTOROLA

0000051A	4E73	416	v139	rte	;User Vector	75
0000051C	4E73	417	v140	rte	;User Vector	76
0000051E	4E73	418	v141	rte	;User Vector	77
00000520	4E73	419	v142	rte	;User Vector	78
00000522	4E73	420	v143	rte	;User Vector	79
00000524	4E73	421	v144	rte	;User Vector	80
00000526	4E73	422	v145	rte	;User Vector	81
00000528	4E73	423	v146	rte	;User Vector	82
0000052A	4E73	424	v147	rte	;User Vector	83
0000052C	4E73	425	v148	rte	;User Vector	84
0000052E	4E73	426	v149	rte	;User Vector	85
00000530	4E73	427	v150	rte	;User Vector	86
00000532	4E73	428	v151	rte	;User Vector	87
00000534	4E73	429	v152	rte	;User Vector	88
00000536	4E73	430	v153	rte	;User Vector	89
00000538	4E73	431	v154	rte	;User Vector	90
0000053A	4E73	432	v155	rte	;User Vector	91
0000053C	4E73	433	v156	rte	;User Vector	92
0000053E	4E73	434	v157	rte	;User Vector	93
00000540	4E73	435	v158	rte	;User Vector	94
00000542	4E73	436	v159	rte	;User Vector	95
00000544	4E73	437	v160	rte	;User Vector	96
00000546	4E73	438	v161	rte	;User Vector	97
00000548	4E73	439	v162	rte	;User Vector	98
0000054A	4E73	440	v163	rte	;User Vector	99
0000054C	4E73	441	v164	rte	;User Vector	100
0000054E	4E73	442	v165	rte	;User Vector	101
00000550	4E73	443	v166	rte	;User Vector	102
00000552	4E73	444	v167	rte	;User Vector	103
00000554	4E73	445	v168	rte	;User Vector	104
00000556	4E73	446	v169	rte	;User Vector	105

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00000558	4E73	447	v170	rte	;User Vector	106
0000055A	4E73	448	v171	rte	;User Vector	107
0000055C	4E73	449	v172	rte	;User Vector	108
0000055E	4E73	450	v173	rte	;User Vector	109
00000560	4E73	451	v174	rte	;User Vector	110
00000562	4E73	452	v175	rte	;User Vector	111
00000564	4E73	453	v176	rte	;User Vector	112
00000566	4E73	454	v177	rte	;User Vector	113
00000568	4E73	455	v178	rte	;User Vector	114
0000056A	4E73	456	v179	rte	;User Vector	115
0000056C	4E73	457	v180	rte	;User Vector	116
0000056E	4E73	458	v181	rte	;User Vector	117
00000570	4E73	459	v182	rte	;User Vector	118
00000572	4E73	460	v183	rte	;User Vector	119
00000574	4E73	461	v184	rte	;User Vector	120
00000576	4E73	462	v185	rte	;User Vector	121
00000578	4E73	463	v186	rte	;User Vector	122
0000057A	4E73	464	v187	rte	;User Vector	123

0000057C	4E73	465	v188	rte	;User Vector	124
0000057E	4E73	466	v189	rte	;User Vector	125
00000580	4E73	467	v190	rte	;User Vector	126
00000582	4E73	468	v191	rte	;User Vector	127
00000584	4E73	469	v192	rte	;User Vector	128
00000586	4E73	470	v193	rte	;User Vector	129
00000588	4E73	471	v194	rte	;User Vector	130
0000058A	4E73	472	v195	rte	;User Vector	131
0000058C	4E73	473	v196	rte	;User Vector	132
0000058E	4E73	474	v197	rte	;User Vector	133
00000590	4E73	475	v198	rte	;User Vector	134
00000592	4E73	476	v199	rte	;User Vector	135
00000594	4E73	477	v200	rte	;User Vector	136
00000596	4E73	478	v201	rte	;User Vector	137
00000598	4E73	479	v202	rte	;User Vector	138
0000059A	4E73	480	v203	rte	;User Vector	139
0000059C	4E73	481	v204	rte	;User Vector	140
0000059E	4E73	482	v205	rte	;User Vector	141
000005A0	4E73	483	v206	rte	;User Vector	142
000005A2	4E73	484	v207	rte	;User Vector	143
000005A4	4E73	485	v208	rte	;User Vector	144
000005A6	4E73	486	v209	rte	;User Vector	145
000005A8	4E73	487	v210	rte	;User Vector	146
000005AA	4E73	488	v211	rte	;User Vector	147
000005AC	4E73	489	v212	rte	;User Vector	148
000005AE	4E73	490	v213	rte	;User Vector	149
000005B0	4E73	491	v214	rte	;User Vector	150
000005B2	4E73	492	v215	rte	;User Vector	151
000005B4	4E73	493	v216	rte	;User Vector	152
000005B6	4E73	494	v217	rte	;User Vector	153
000005B8	4E73	495	v218	rte	;User Vector	154
000005BA	4E73	496	v219	rte	;User Vector	155
000005BC	4E73	497	v220	rte	;User Vector	156
000005BE	4E73	498	v221	rte	;User Vector	157
000005C0	4E73	499	v222	rte	;User Vector	158
000005C2	4E73	500	v223	rte	;User Vector	159
000005C4	4E73	501	v224	rte	;User Vector	160
000005C6	4E73	502	v225	rte	;User Vector	161
000005C8	4E73	503	v226	rte	;User Vector	162
000005CA	4E73	504	v227	rte	;User Vector	163

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000005CC	4E73	505	v228	rte	;User Vector	164
000005CE	4E73	506	v229	rte	;User Vector	165
000005D0	4E73	507	v230	rte	;User Vector	166
000005D2	4E73	508	v231	rte	;User Vector	167
000005D4	4E73	509	v232	rte	;User Vector	168
000005D6	4E73	510	v233	rte	;User Vector	169
000005D8	4E73	511	v234	rte	;User Vector	170
000005DA	4E73	512	v235	rte	;User Vector	171
000005DC	4E73	513	v236	rte	;User Vector	172

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000005DE 4E73      514 v237      rte          ;User Vector 173
000005E0 4E73      515 v238      rte          ;User Vector 174
000005E2 4E73      516 v239      rte          ;User Vector 175
000005E4 4E73      517 v240      rte          ;User Vector 176
000005E6 4E73      518 v241      rte          ;User Vector 177
000005E8 4E73      519 v242      rte          ;User Vector 178
000005EA 4E73      520 v243      rte          ;User Vector 179
000005EC 4E73      521 v244      rte          ;User Vector 180
000005EE 4E73      522 v245      rte          ;User Vector 181
000005F0 4E73      523 v246      rte          ;User Vector 182
000005F2 4E73      524 v247      rte          ;User Vector 183
000005F4 4E73      525 v248      rte          ;User Vector 184
000005F6 4E73      526 v249      rte          ;User Vector 185
000005F8 4E73      527 v250      rte          ;User Vector 186
000005FA 4E73      528 v251      rte          ;User Vector 187
000005FC 4E73      529 v252      rte          ;User Vector 188
000005FE 4E73      530 v253      rte          ;User Vector 189
00000600 4E73      531 v254      rte          ;User Vector 190
00000602 4E73      532 v255      rte          ;User Vector 191
533
534

```

Assembly Listing

The following is the assembly listing for the previous listing. This listing can be cut and pasted into an assembler for use with a user program.

```

org $0000

d1    $00003ffc    ;initial Stack Pointer
                ;Modify this location with the
                ;correct value for your application
d1    $00000400    ;initial Program Counter
                ;Modify this location with the
                ;correct value for your application

d1    v2          ;Bus Error
d1    v3          ;Address Error
d1    v4          ;Illegal Instruction
d1    v5          ;Zero Division
d1    v6          ;CHK, CHK2 Instructions
d1    v7          ;TRAPcc, TRAPV Instruction
d1    v8          ;Privilege Violation
d1    v9          ;Trace
d1    v10         ;Line 1010 Emulation
d1    v11         ;Line 1111 Emulation
d1    v12         ;Hardware Breakpoint
d1    v13         ;Reserved, Coprocessor Protocol Violation
d1    v14         ;Format Error and Uninitialized Interrupt
d1    v15         ;Format Error and Uninitialized Interrupt
d1    v16         ;Unassigned
d1    v17         ;Unassigned
d1    v18         ;Unassigned
d1    v19         ;Unassigned

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dl    v20    ;Unassigned
dl    v21    ;Unassigned
dl    v22    ;Unassigned
dl    v23    ;Unassigned
dl    v24    ;Spurious Interrupt
dl    v25    ;Level 1 Interrupt Autovector
dl    v26    ;Level 2 Interrupt Autovector
dl    v27    ;Level 3 Interrupt Autovector
dl    v28    ;Level 4 Interrupt Autovector
dl    v29    ;Level 5 Interrupt Autovector
dl    v30    ;Level 6 Interrupt Autovector
dl    v31    ;Level 7 Interrupt Autovector
dl    v32    ;Trap Instruction Vector 0
dl    v33    ;Trap Instruction Vector 1
dl    v34    ;Trap Instruction Vector 2
dl    v35    ;Trap Instruction Vector 3
dl    v36    ;Trap Instruction Vector 4
dl    v37    ;Trap Instruction Vector 5
dl    v38    ;Trap Instruction Vector 6
dl    v39    ;Trap Instruction Vector 7
dl    v40    ;Trap Instruction Vector 8
dl    v41    ;Trap Instruction Vector 9
dl    v42    ;Trap Instruction Vector 10
dl    v43    ;Trap Instruction Vector 11
dl    v44    ;Trap Instruction Vector 12
dl    v45    ;Trap Instruction Vector 13
dl    v46    ;Trap Instruction Vector 14
dl    v47    ;Trap Instruction Vector 15
dl    v48    ;Reserved, Coprocessor
dl    v49    ;Reserved, Coprocessor
dl    v50    ;Reserved, Coprocessor
dl    v51    ;Reserved, Coprocessor
dl    v52    ;Reserved, Coprocessor
dl    v53    ;Reserved, Coprocessor
dl    v54    ;Reserved, Coprocessor
dl    v55    ;Reserved, Coprocessor
dl    v56    ;Reserved, Coprocessor
dl    v57    ;Reserved, Coprocessor
dl    v58    ;Reserved, Coprocessor
dl    v59    ;Unassigned, Reserved
dl    v60    ;Unassigned, Reserved
dl    v61    ;Unassigned, Reserved
dl    v62    ;Unassigned, Reserved
dl    v63    ;Unassigned, Reserved
dl    v64    ;User Defined Vector 0
dl    v65    ;User Defined Vector 1
dl    v66    ;User Defined Vector 2
dl    v67    ;User Defined Vector 3
dl    v68    ;User Defined Vector 4
dl    v69    ;User Defined Vector 5
dl    v70    ;User Defined Vector 6
dl    v71    ;User Defined Vector 7
dl    v72    ;User Defined Vector 8
dl    v73    ;User Defined Vector 9
dl    v74    ;User Defined Vector 10
dl    v75    ;User Defined Vector 11

```

d1	v76	;User Defined Vector	12
d1	v77	;User Defined Vector	13
d1	v78	;User Defined Vector	14
d1	v79	;User Defined Vector	15
d1	v80	;User Defined Vector	16
d1	v81	;User Defined Vector	17
d1	v82	;User Defined Vector	18
d1	v83	;User Defined Vector	19
d1	v84	;User Defined Vector	20
d1	v85	;User Defined Vector	21
d1	v86	;User Defined Vector	22
d1	v87	;User Defined Vector	23
d1	v88	;User Defined Vector	24
d1	v89	;User Defined Vector	25
d1	v90	;User Defined Vector	26
d1	v91	;User Defined Vector	27
d1	v92	;User Defined Vector	28
d1	v93	;User Defined Vector	29
d1	v94	;User Defined Vector	30
d1	v95	;User Defined Vector	31
d1	v96	;User Defined Vector	32
d1	v97	;User Defined Vector	33
d1	v98	;User Defined Vector	34
d1	v99	;User Defined Vector	35
d1	v100	;User Defined Vector	36
d1	v101	;User Defined Vector	37
d1	v102	;User Defined Vector	38
d1	v103	;User Defined Vector	39
d1	v104	;User Defined Vector	40
d1	v105	;User Defined Vector	41
d1	v106	;User Defined Vector	42
d1	v107	;User Defined Vector	43
d1	v108	;User Defined Vector	44
d1	v109	;User Defined Vector	45
d1	v110	;User Defined Vector	46
d1	v111	;User Defined Vector	47
d1	v112	;User Defined Vector	48
d1	v113	;User Defined Vector	49
d1	v114	;User Defined Vector	50
d1	v115	;User Defined Vector	51
d1	v116	;User Defined Vector	52
d1	v117	;User Defined Vector	53
d1	v118	;User Defined Vector	54
d1	v119	;User Defined Vector	55
d1	v120	;User Defined Vector	56
d1	v121	;User Defined Vector	57
d1	v122	;User Defined Vector	58
d1	v123	;User Defined Vector	59
d1	v124	;User Defined Vector	60
d1	v125	;User Defined Vector	61
d1	v126	;User Defined Vector	62
d1	v127	;User Defined Vector	63
d1	v128	;User Defined Vector	64
d1	v129	;User Defined Vector	65
d1	v130	;User Defined Vector	66
d1	v131	;User Defined Vector	67

d1	v132	;User Defined Vector	68
d1	v133	;User Defined Vector	69
d1	v134	;User Defined Vector	70
d1	v135	;User Defined Vector	71
d1	v136	;User Defined Vector	72
d1	v137	;User Defined Vector	73
d1	v138	;User Defined Vector	74
d1	v139	;User Defined Vector	75
d1	v140	;User Defined Vector	76
d1	v141	;User Defined Vector	77
d1	v142	;User Defined Vector	78
d1	v143	;User Defined Vector	79
d1	v144	;User Defined Vector	80
d1	v145	;User Defined Vector	81
d1	v146	;User Defined Vector	82
d1	v147	;User Defined Vector	83
d1	v148	;User Defined Vector	84
d1	v149	;User Defined Vector	85
d1	v150	;User Defined Vector	86
d1	v151	;User Defined Vector	87
d1	v152	;User Defined Vector	88
d1	v153	;User Defined Vector	89
d1	v154	;User Defined Vector	90
d1	v155	;User Defined Vector	91
d1	v156	;User Defined Vector	92
d1	v157	;User Defined Vector	93
d1	v158	;User Defined Vector	94
d1	v159	;User Defined Vector	95
d1	v160	;User Defined Vector	96
d1	v161	;User Defined Vector	97
d1	v162	;User Defined Vector	98
d1	v163	;User Defined Vector	99
d1	v164	;User Defined Vector	100
d1	v165	;User Defined Vector	101
d1	v166	;User Defined Vector	102
d1	v167	;User Defined Vector	103
d1	v168	;User Defined Vector	104
d1	v169	;User Defined Vector	105
d1	v170	;User Defined Vector	106
d1	v171	;User Defined Vector	107
d1	v172	;User Defined Vector	108
d1	v173	;User Defined Vector	109
d1	v174	;User Defined Vector	110
d1	v175	;User Defined Vector	111
d1	v176	;User Defined Vector	112
d1	v177	;User Defined Vector	113
d1	v178	;User Defined Vector	114
d1	v179	;User Defined Vector	115
d1	v180	;User Defined Vector	116
d1	v181	;User Defined Vector	117
d1	v182	;User Defined Vector	118
d1	v183	;User Defined Vector	119
d1	v184	;User Defined Vector	120
d1	v185	;User Defined Vector	121
d1	v186	;User Defined Vector	122
d1	v187	;User Defined Vector	123

d1	v188	;User Defined Vector	124
d1	v189	;User Defined Vector	125
d1	v190	;User Defined Vector	126
d1	v191	;User Defined Vector	127
d1	v192	;User Defined Vector	128
d1	v193	;User Defined Vector	129
d1	v194	;User Defined Vector	130
d1	v195	;User Defined Vector	131
d1	v196	;User Defined Vector	132
d1	v197	;User Defined Vector	133
d1	v198	;User Defined Vector	134
d1	v199	;User Defined Vector	135
d1	v200	;User Defined Vector	136
d1	v201	;User Defined Vector	137
d1	v202	;User Defined Vector	138
d1	v203	;User Defined Vector	139
d1	v204	;User Defined Vector	140
d1	v205	;User Defined Vector	141
d1	v206	;User Defined Vector	142
d1	v207	;User Defined Vector	143
d1	v208	;User Defined Vector	144
d1	v209	;User Defined Vector	145
d1	v210	;User Defined Vector	146
d1	v211	;User Defined Vector	147
d1	v212	;User Defined Vector	148
d1	v213	;User Defined Vector	149
d1	v214	;User Defined Vector	150
d1	v215	;User Defined Vector	151
d1	v216	;User Defined Vector	152
d1	v217	;User Defined Vector	153
d1	v218	;User Defined Vector	154
d1	v219	;User Defined Vector	155
d1	v220	;User Defined Vector	156
d1	v221	;User Defined Vector	157
d1	v222	;User Defined Vector	158
d1	v223	;User Defined Vector	159
d1	v224	;User Defined Vector	160
d1	v225	;User Defined Vector	161
d1	v226	;User Defined Vector	162
d1	v227	;User Defined Vector	163
d1	v228	;User Defined Vector	164
d1	v229	;User Defined Vector	165
d1	v230	;User Defined Vector	166
d1	v231	;User Defined Vector	167
d1	v232	;User Defined Vector	168
d1	v233	;User Defined Vector	169
d1	v234	;User Defined Vector	170
d1	v235	;User Defined Vector	171
d1	v236	;User Defined Vector	172
d1	v237	;User Defined Vector	173
d1	v238	;User Defined Vector	174
d1	v239	;User Defined Vector	175
d1	v240	;User Defined Vector	176
d1	v241	;User Defined Vector	177
d1	v242	;User Defined Vector	178
d1	v243	;User Defined Vector	179

```

dl    v244    ;User Defined Vector 180
dl    v245    ;User Defined Vector 181
dl    v246    ;User Defined Vector 182
dl    v247    ;User Defined Vector 183
dl    v248    ;User Defined Vector 184
dl    v249    ;User Defined Vector 185
dl    v250    ;User Defined Vector 186
dl    v251    ;User Defined Vector 187
dl    v252    ;User Defined Vector 188
dl    v253    ;User Defined Vector 189
dl    v254    ;User Defined Vector 190
dl    v255    ;User Defined Vector 191

org $00000400 ;The first address after the vector
              ;table is $400. The following labels
              ;can be placed anywhere in memory.

v0    fcb $00,$00,$3f,$fc ;Reset: Initial Stack Pointer
v1    fcb $00,$00,$04,$00 ;Reset: Initial Program Counter
              ;The values will never be used, they
              ;are simply serving as a place holders
              ;so that the label v2 will start at
              ;the memory address $xxx8.

v2    rte                ;Bus Error
v3    rte                ;Address Error
v4    rte                ;Illegal Instruction
v5    rte                ;Zero Division
v6    rte                ;CHK, CHK2 Instruction
v7    rte                ;TRAPcc, TRAPV Instructions
v8    rte                ;Privilege Violation
v9    rte                ;Trace
v10   rte                ;Line 1010 Emulation
v11   rte                ;Line 1111 Emulation
v12   rte                ;Hardware Breakpoint
v13   rte                ;Reserved
v14   rte                ;Format Error and Unitialized IRQ
v15   rte                ;Format Error and Unitialized IRQ
v16   rte                ;Unassigned
v17   rte                ;Unassigned
v18   rte                ;Unassigned
v19   rte                ;Unassigned
v20   rte                ;Unassigned
v21   rte                ;Unassigned
v22   rte                ;Unassigned
v23   rte                ;Unassigned
v24   rte                ;Spurious Interrupt
v25   rte                ;Level 1 Interrupt Autovector
v26   rte                ;Level 2 Interrupt Autovector
v27   rte                ;Level 3 Interrupt Autovector
v28   rte                ;Level 4 Interrupt Autovector
v29   rte                ;Level 5 Interrupt Autovector
v30   rte                ;Level 6 Interrupt Autovector
v31   rte                ;Level 7 Interrupt Autovector
v32   rte                ;Trap Instruction Vector 0
v33   rte                ;Trap Instruction Vector 1


```

v34	rte	;Trap Instruction Vector	2
v35	rte	;Trap Instruction Vector	3
v36	rte	;Trap Instruction Vector	4
v37	rte	;Trap Instruction Vector	5
v38	rte	;Trap Instruction Vector	6
v39	rte	;Trap Instruction Vector	7
v40	rte	;Trap Instruction Vector	8
v41	rte	;Trap Instruction Vector	9
v42	rte	;Trap Instruction Vector	10
v43	rte	;Trap Instruction Vector	11
v44	rte	;Trap Instruction Vector	12
v45	rte	;Trap Instruction Vector	13
v46	rte	;Trap Instruction Vector	14
v47	rte	;Trap Instruction Vector	15
v48	rte	;Reserved Coprocessor	
v49	rte	;Reserved Coprocessor	
v50	rte	;Reserved Coprocessor	
v51	rte	;Reserved Coprocessor	
v52	rte	;Reserved Coprocessor	
v53	rte	;Reserved Coprocessor	
v54	rte	;Reserved Coprocessor	
v55	rte	;Reserved Coprocessor	
v56	rte	;Reserved Coprocessor	
v57	rte	;Reserved Coprocessor	
v58	rte	;Reserved Coprocessor	
v59	rte	;Unassigned, Reserved	
v60	rte	;Unassigned, Reserved	
v61	rte	;Unassigned, Reserved	
v62	rte	;Unassigned, Reserved	
v63	rte	;Unassigned, Reserved	
v64	rte	;User Vector	0
v65	rte	;User Vector	1
v66	rte	;User Vector	2
v67	rte	;User Vector	3
v68	rte	;User Vector	4
v69	rte	;User Vector	5
v70	rte	;User Vector	6
v71	rte	;User Vector	7
v72	rte	;User Vector	8
v73	rte	;User Vector	9
v74	rte	;User Vector	10
v75	rte	;User Vector	11
v76	rte	;User Vector	12
v77	rte	;User Vector	13
v78	rte	;User Vector	14
v79	rte	;User Vector	15
v80	rte	;User Vector	16
v81	rte	;User Vector	17
v82	rte	;User Vector	18
v83	rte	;User Vector	19
v84	rte	;User Vector	20
v85	rte	;User Vector	21
v86	rte	;User Vector	22
v87	rte	;User Vector	23
v88	rte	;User Vector	24
v89	rte	;User Vector	25

v90	rte	;User Vector	26
v91	rte	;User Vector	27
v92	rte	;User Vector	28
v93	rte	;User Vector	29
v94	rte	;User Vector	30
v95	rte	;User Vector	31
v96	rte	;User Vector	32
v97	rte	;User Vector	33
v98	rte	;User Vector	34
v99	rte	;User Vector	35
v100	rte	;User Vector	36
v101	rte	;User Vector	37
v102	rte	;User Vector	38
v103	rte	;User Vector	39
v104	rte	;User Vector	40
v105	rte	;User Vector	41
v106	rte	;User Vector	42
v107	rte	;User Vector	43
v108	rte	;User Vector	44
v109	rte	;User Vector	45
v110	rte	;User Vector	46
v111	rte	;User Vector	47
v112	rte	;User Vector	48
v113	rte	;User Vector	49
v114	rte	;User Vector	50
v115	rte	;User Vector	51
v116	rte	;User Vector	52
v117	rte	;User Vector	53
v118	rte	;User Vector	54
v119	rte	;User Vector	55
v120	rte	;User Vector	56
v121	rte	;User Vector	57
v122	rte	;User Vector	58
v123	rte	;User Vector	59
v124	rte	;User Vector	60
v125	rte	;User Vector	61
v126	rte	;User Vector	62
v127	rte	;User Vector	63
v128	rte	;User Vector	64
v129	rte	;User Vector	65
v130	rte	;User Vector	66
v131	rte	;User Vector	67
v132	rte	;User Vector	68
v133	rte	;User Vector	69
v134	rte	;User Vector	70
v135	rte	;User Vector	71
v136	rte	;User Vector	72
v137	rte	;User Vector	73
v138	rte	;User Vector	74
v139	rte	;User Vector	75
v140	rte	;User Vector	76
v141	rte	;User Vector	77
v142	rte	;User Vector	78
v143	rte	;User Vector	79
v144	rte	;User Vector	80
v145	rte	;User Vector	81

v146	rte	;User Vector	82
v147	rte	;User Vector	83
v148	rte	;User Vector	84
v149	rte	;User Vector	85
v150	rte	;User Vector	86
v151	rte	;User Vector	87
v152	rte	;User Vector	88
v153	rte	;User Vector	89
v154	rte	;User Vector	90
v155	rte	;User Vector	91
v156	rte	;User Vector	92
v157	rte	;User Vector	93
v158	rte	;User Vector	94
v159	rte	;User Vector	95
v160	rte	;User Vector	96
v161	rte	;User Vector	97
v162	rte	;User Vector	98
v163	rte	;User Vector	99
v164	rte	;User Vector	100
v165	rte	;User Vector	101
v166	rte	;User Vector	102
v167	rte	;User Vector	103
v168	rte	;User Vector	104
v169	rte	;User Vector	105
v170	rte	;User Vector	106
v171	rte	;User Vector	107
v172	rte	;User Vector	108
v173	rte	;User Vector	109
v174	rte	;User Vector	110
v175	rte	;User Vector	111
v176	rte	;User Vector	112
v177	rte	;User Vector	113
v178	rte	;User Vector	114
v179	rte	;User Vector	115
v180	rte	;User Vector	116
v181	rte	;User Vector	117
v182	rte	;User Vector	118
v183	rte	;User Vector	119
v184	rte	;User Vector	120
v185	rte	;User Vector	121
v186	rte	;User Vector	122
v187	rte	;User Vector	123
v188	rte	;User Vector	124
v189	rte	;User Vector	125
v190	rte	;User Vector	126
v191	rte	;User Vector	127
v192	rte	;User Vector	128
v193	rte	;User Vector	129
v194	rte	;User Vector	130
v195	rte	;User Vector	131
v196	rte	;User Vector	132
v197	rte	;User Vector	133
v198	rte	;User Vector	134
v199	rte	;User Vector	135
v200	rte	;User Vector	136
v201	rte	;User Vector	137

v202	rte	;User Vector	138
v203	rte	;User Vector	139
v204	rte	;User Vector	140
v205	rte	;User Vector	141
v206	rte	;User Vector	142
v207	rte	;User Vector	143
v208	rte	;User Vector	144
v209	rte	;User Vector	145
v210	rte	;User Vector	146
v211	rte	;User Vector	147
v212	rte	;User Vector	148
v213	rte	;User Vector	149
v214	rte	;User Vector	150
v215	rte	;User Vector	151
v216	rte	;User Vector	152
v217	rte	;User Vector	153
v218	rte	;User Vector	154
v219	rte	;User Vector	155
v220	rte	;User Vector	156
v221	rte	;User Vector	157
v222	rte	;User Vector	158
v223	rte	;User Vector	159
v224	rte	;User Vector	160
v225	rte	;User Vector	161
v226	rte	;User Vector	162
v227	rte	;User Vector	163
v228	rte	;User Vector	164
v229	rte	;User Vector	165
v230	rte	;User Vector	166
v231	rte	;User Vector	167
v232	rte	;User Vector	168
v233	rte	;User Vector	169
v234	rte	;User Vector	170
v235	rte	;User Vector	171
v236	rte	;User Vector	172
v237	rte	;User Vector	173
v238	rte	;User Vector	174
v239	rte	;User Vector	175
v240	rte	;User Vector	176
v241	rte	;User Vector	177
v242	rte	;User Vector	178
v243	rte	;User Vector	179
v244	rte	;User Vector	180
v245	rte	;User Vector	181
v246	rte	;User Vector	182
v247	rte	;User Vector	183
v248	rte	;User Vector	184
v249	rte	;User Vector	185
v250	rte	;User Vector	186
v251	rte	;User Vector	187
v252	rte	;User Vector	188
v253	rte	;User Vector	189
v254	rte	;User Vector	190
v255	rte	;User Vector	191

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