

```

1  module DisplayControlUnit (
2      input wire clock500Hz, reset,
3
4      input wire[7:0] phrase,
5
6      output reg[4:0] char_index,
7
8      output reg RS,RW,
9      output wire E,
10     output reg[7:0] DB
11 );
12
13     assign E = clock500Hz;
14
15     // Estados
16     parameter
17         FS1 = 4'd0,
18         FS2 = 4'd1,
19         FS3 = 4'd2,
20         FS4 = 4'd3,
21         ClearDisplay = 4'd4,
22         DisplayControl = 4'd5,
23         EntryMode = 4'd6,
24         ReturnHome = 4'd7,
25         SetAddress = 4'd8,
26         WriteChar = 4'd9;
27
28     reg[3:0] PresentState,NextState;
29
30     // Bloco sequencial - Estados
31     always @(posedge reset or posedge clock500Hz) begin
32         if(reset) begin
33             PresentState <= FS1;
34             char_index <= 5'd0;
35         end
36         else begin
37             PresentState <= NextState;
38             if(PresentState == WriteChar) begin
39                 char_index <= char_index + 5'd1;
40             end
41             if(NextState == ReturnHome) begin
42                 char_index <= 5'd0;
43             end
44         end
45     end
46 end
47
48 // Bloco Combinacional - Estados
49 always @(*) begin
50     case(PresentState)
51
52         default: begin
53             RS = 1'b0;
54             RW = 1'b0;
55             DB = 8'b00111000;
56             NextState = FS1;
57         end
58
59         FS1: begin
60             RS = 1'b0;
61             RW = 1'b0;
62             DB = 8'b00111000;
63             NextState = FS2;
64         end
65
66         FS2: begin
67             RS = 1'b0;
68             RW = 1'b0;
69             DB = 8'b00111000;
70             NextState = FS3;
71         end
72
73         FS3: begin
74             RS = 1'b0;
75             RW = 1'b0;
76             DB = 8'b00111000;
77             NextState = FS4;
78         end
79
80         FS4: begin
81             RS = 1'b0;

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```
82         RW = 1'b0;
83         DB = 8'b00111000;
84         NextState = ClearDisplay;
85     end
86
87     ClearDisplay: begin
88         RS = 1'b0;
89         RW = 1'b0;
90         DB = 8'b00000001;
91         NextState = DisplayControl;
92     end
93
94     DisplayControl: begin
95         RS = 1'b0;
96         RW = 1'b0;
97         DB = 8'b00001100;
98         NextState = EntryMode;
99     end
100
101     EntryMode: begin
102         RS = 1'b0;
103         RW = 1'b0;
104         DB = 8'b00000110;
105         NextState = WriteChar;
106     end
107
108     ReturnHome: begin
109         RS = 1'b0;
110         RW = 1'b0;
111         DB = 8'b10000000;
112         NextState = WriteChar;
113     end
114
115     SetAddress: begin
116         RS = 1'b0;
117         RW = 1'b0;
118         DB = 8'b11000000;
119         NextState = WriteChar;
120     end
121
122     WriteChar: begin
123         RS = 1'b1;
124         RW = 1'b0;
125         DB = phrase;
126
127         if (char_index == 5'd15) begin
128             NextState = SetAddress;
129         end
130         else if (char_index == 5'd31) begin
131             NextState = ReturnHome;
132         end
133         else begin
134             NextState = WriteChar;
135         end
136     end
137 end
138 endcase
139 end
140
141 endmodule
```