Stoppuhr

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&

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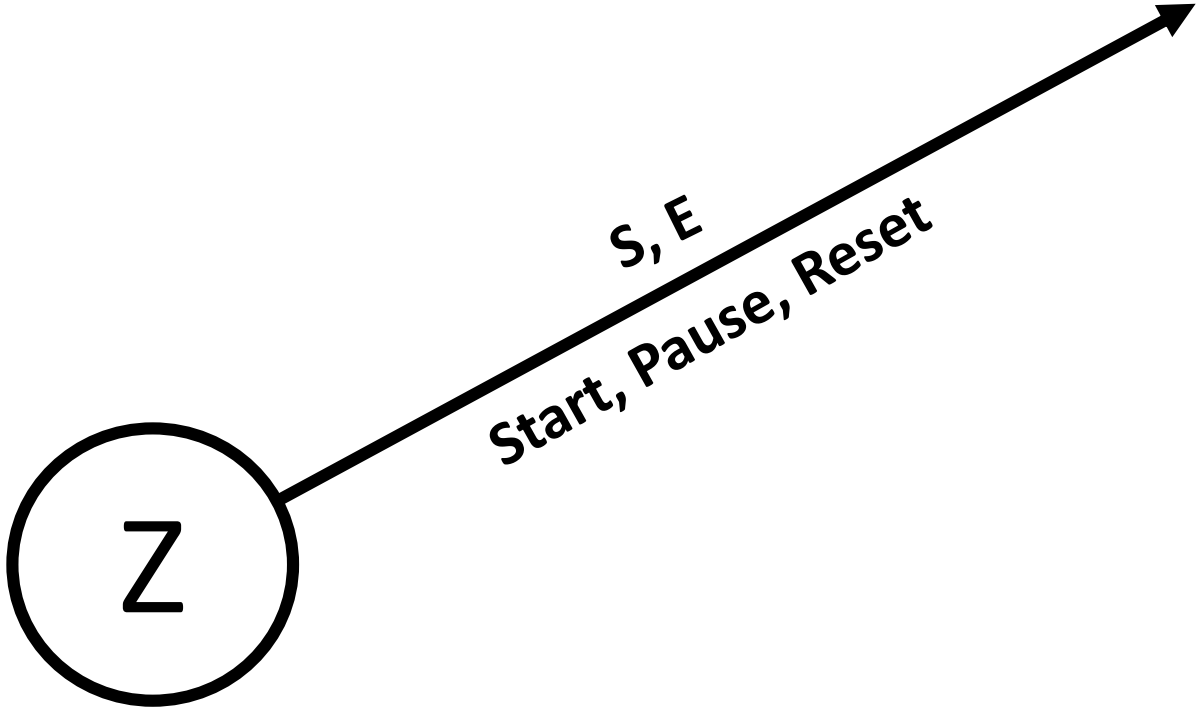
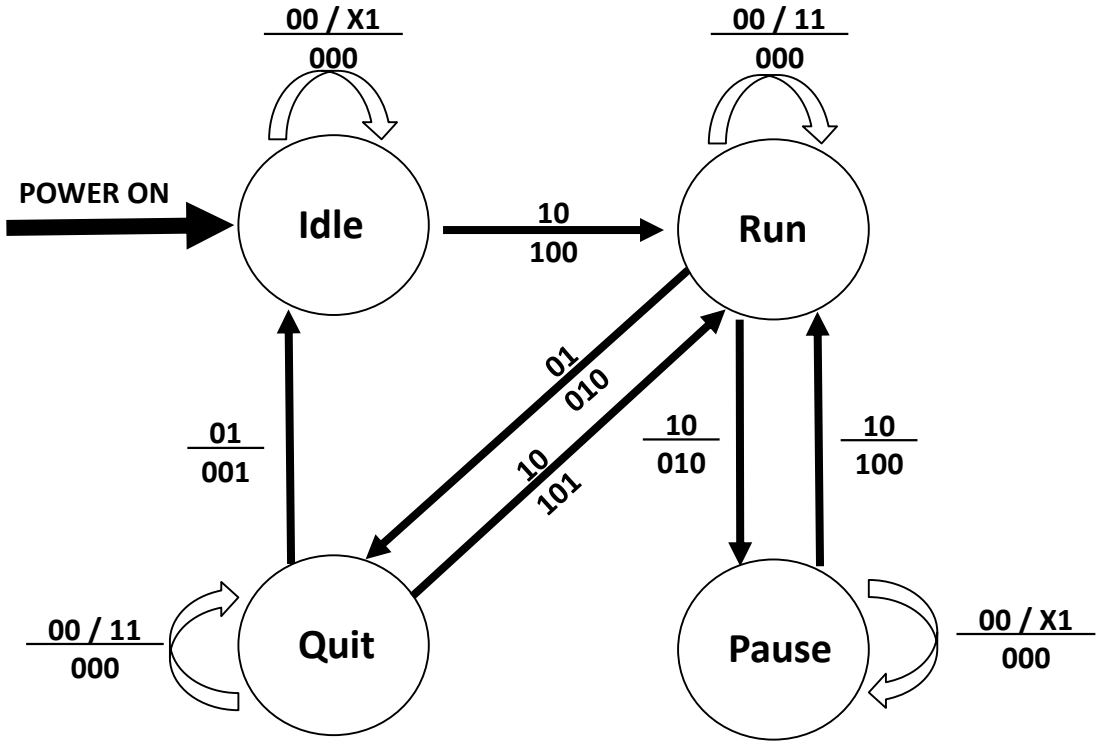
Bestandteile

- Doppelfunktionstasten für Start- und Stopptaste
- Pulserzeuger für beide Tasten
- Zähler
- 7 – Segmentanzeigen: 4 Stück
- Multiplexer für Multiplexdisplay

Doppelfunktionstasten



Zustandsdiagramm



Zustandscodierung

Zustandsname	In Bits ausgedrückt
Idle	0 0
Run	0 1
Pause	1 0
Quit	1 1

Übergangsschaltnetz

Z1	Z0	E	S	Z1+	Z0+
0	0	0	0	0	0
0	0	0	1	0	0
0	0	1	0	0	1
0	0	1	1	0	0
0	1	0	0	0	1
0	1	0	1	1	1
0	1	1	0	1	0
0	1	1	1	0	1
1	0	0	0	1	0
1	0	0	1	1	0
1	0	1	0	0	1
1	0	1	1	1	0
1	1	0	0	1	1
1	1	0	1	0	0
1	1	1	0	0	1
1	1	1	1	1	1

KV - Diagramm

Z1+	¬S		S		
¬E	0	0	1	0	¬Z1
	1	1	0	1	Z1
E	0	0	1	1	
	0	1	0	0	¬Z1
	¬Z0	Z0		¬Z0	

Z0+	¬S		S		
¬E	0	1	1	0	¬Z1
	0	1	0	0	Z1
E	1	1	1	0	
	1	0	1	0	¬Z1
	¬Z0	Z0		¬Z0	

$$Z1+ = (\neg S \wedge \neg E \wedge Z1) \vee (\neg S \wedge \neg E \wedge \neg Z0) \vee (S \wedge E \wedge Z1) \vee (S \wedge \neg E \wedge Z0 \wedge \neg Z1) \vee (\neg S \wedge E \wedge Z0 \wedge \neg Z1)$$

$$Z0+ = (\neg S \wedge E \wedge \neg Z0) \vee (\neg S \wedge E \wedge Z1) \vee (\neg S \wedge \neg E \wedge Z0) \vee (\neg E \wedge Z0 \wedge \neg Z1) \vee (E \wedge Z0 \wedge Z1) \vee (S \wedge E \wedge Z0)$$

Ausgangsschaltnetz

Z1	Z0	E	S	Start	Pause	Reset
0	0	0	0	0	0	0
0	0	0	1	0	0	0
0	0	1	0	1	0	0
0	0	1	1	0	0	0
0	1	0	0	0	0	0
0	1	0	1	0	1	0
0	1	1	0	0	1	0
0	1	1	1	0	0	0
1	0	0	0	0	0	0
1	0	0	1	0	0	0
1	0	1	0	1	0	0
1	0	1	1	0	0	0
1	1	0	0	0	0	0
1	1	0	1	0	0	1
1	1	1	0	1	0	1
1	1	1	1	0	0	0

KV - Diagramm

Start	¬S		S		
¬E	0	0	0	0	¬Z1
	0	0	0	0	Z1
E	1	1	0	0	
	1	0	0	0	¬Z1
	¬Z0	Z0		¬Z0	

Pause	¬S		S		
¬E	0	0	1	0	¬Z1
	0	0	0	0	Z1
E	0	0	0	0	
	0	1	0	0	¬Z1
	¬Z0	Z0		¬Z0	

Reset	¬S		S		
¬E	0	0	0	0	¬Z1
	0	0	1	0	Z1
E	0	1	0	0	
	0	0	0	0	¬Z1
	¬Z0	Z0		¬Z0	

Start = (¬S ∧ E ∧ Z1) ∨
(¬S ∧ E ∧ ¬Z0)

Pause =
(¬S ∧ E ∧ Z0 ∧ ¬Z1) ∨
(S ∧ ¬E ∧ Z0 ∧ ¬Z1)

Reset =
(¬S ∧ E ∧ Z0 ∧ Z1) ∨
(S ∧ ¬E ∧ Z0 ∧ Z1)