# Stepping ladder command description and basic circuit

Deskripsi perintah tangga langkah
dan rangkaian dasar

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步梯命令說明

# Stepping ladder
# Perintah tangga langkah

- **Step ladder commands are combined into a state transition diagram using state relays, and are structured into a PLC control program in a way similar to a train entering a station.**
- **Perintah tangga langkah digabungkan ke dalam diagram transisi keadaan menggunakan relai keadaan, dan disusun ke dalam program kontrol PLC dengan cara yang mirip dengan kereta yang memasuki stasiun.**

# Stepping ladder
# Perintah tangga langkah

- As shown in Figure 6-1, each station is in an independent state (STATE), and each state is It is numbered and enclosed by a rectangular box.
- Seperti yang ditunjukkan pada Gambar 6-1, setiap stasiun berada dalam keadaan independen (STATE), dan setiap keadaan diberi nomor dan diapit oleh kotak persegi panjang.

# Stepping ladder
# Perintah tangga langkah

- **The double line S0 in the figure can be regarded as the terminal. The condition of the M8002 contact above the state S0 is the initial trigger pulse to enter the terminal,**
- Garis ganda S0 pada gambar dapat dianggap sebagai terminal. Kondisi kontak M8002 diatas state S0 merupakan pulsa pemicu awal untuk masuk ke terminal,

# Stepping ladder
# Perintah tangga langkah

- and the X0 contact below the state S0 is the migration condition, which is executed in the program When entering the S0 state, the X0 contact is triggered and then enters the state S20, and so on
- dan kontak X0 di bawah status S0 adalah kondisi migrasi, yang dijalankan dalam program Saat memasuki status S0, kontak X0 dipicu dan kemudian memasuki status S20, dan seterusnya

# Stepping ladder
# Perintah tangga langkah

- Among them, S0~S9 are reserved for the initial state, which means that multiple groups of state transition programs can be executed at the same time; S10~S19 are reserved for reset control (if there is no reset request at startup, they can not be reserved),
- Diantaranya, S0~S9 dicadangkan untuk keadaan awal, yang berarti bahwa beberapa kelompok program transisi keadaan dapat dieksekusi pada waktu yang sama; S10~S19 dicadangkan untuk kontrol reset (jika tidak ada permintaan reset saat startup, mereka tidak dapat dipesan),

# Stepping ladder
# Perintah tangga langkah

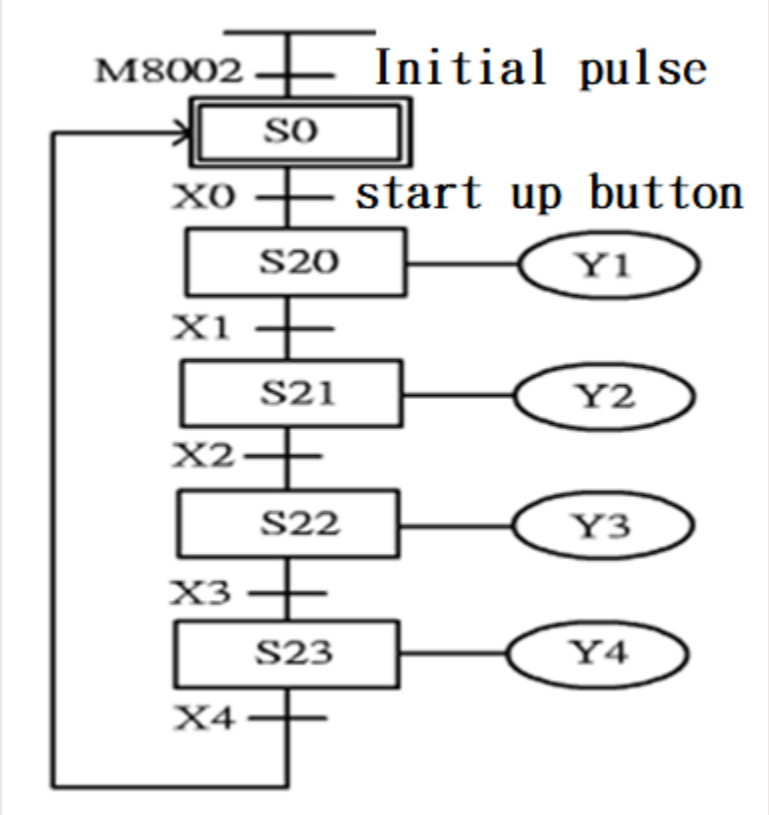
- and the system can be executed before the program is executed. For reset control, each state must be declared by the SET command, and the state must be executed by the STL command. The SET and STL commands in the same state must be used in pairs,
- dan sistem dapat dieksekusi sebelum program dijalankan. Untuk kontrol reset, setiap state harus dideklarasikan dengan perintah SET, dan state harus dieksekusi oleh perintah STL. Perintah SET dan STL dalam keadaan yang sama harus digunakan berpasangan,

# Stepping ladder
# Perintah tangga langkah

- but they are not necessarily limited to one-to-one or continuous execution. One SET can be used with multiple STL instructions, or multiple SETs can be used with one STL instruction; When entering the next state for execution, the previous state is closed, and the previous state will have scan time overlap during the switching process;
- tetapi mereka tidak selalu terbatas pada eksekusi satu-ke-satu atau terus-menerus. Satu SET dapat digunakan dengan beberapa instruksi STL, atau beberapa SET dapat digunakan dengan satu instruksi STL; Saat memasuki keadaan berikutnya untuk dieksekusi, keadaan sebelumnya ditutup, dan keadaan sebelumnya akan memiliki waktu pemindaian yang tumpang tindih selama proses switching;

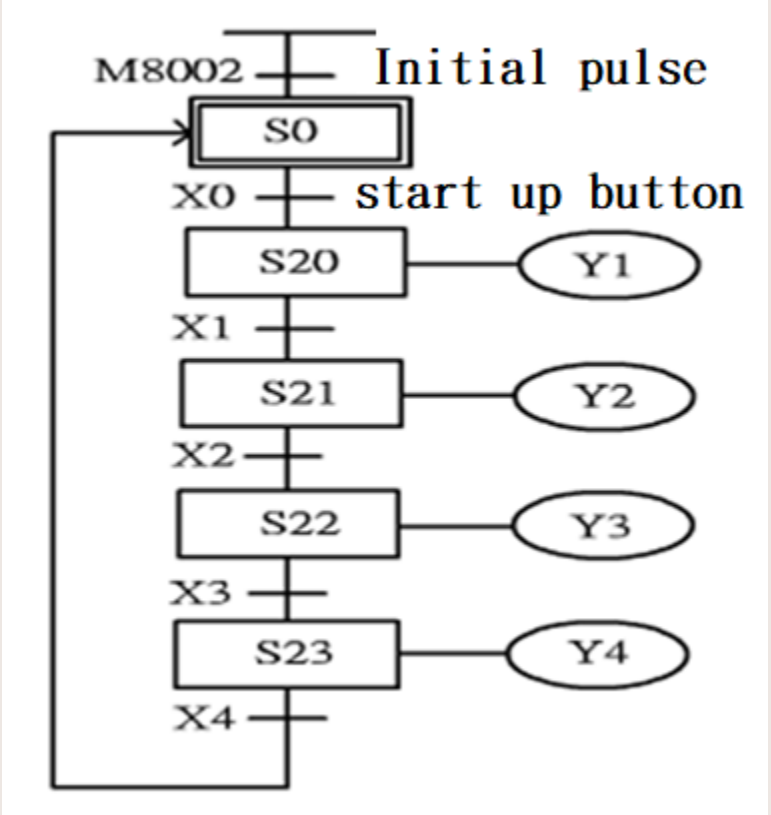
# Stepping ladder
# Perintah tangga langkah

- The right side of each state in the figure is the output condition, and the bottom is the transition condition poin
- Sisi kanan setiap keadaan pada gambar adalah kondisi keluaran, dan bagian bawah adalah titik kondisi transisi.



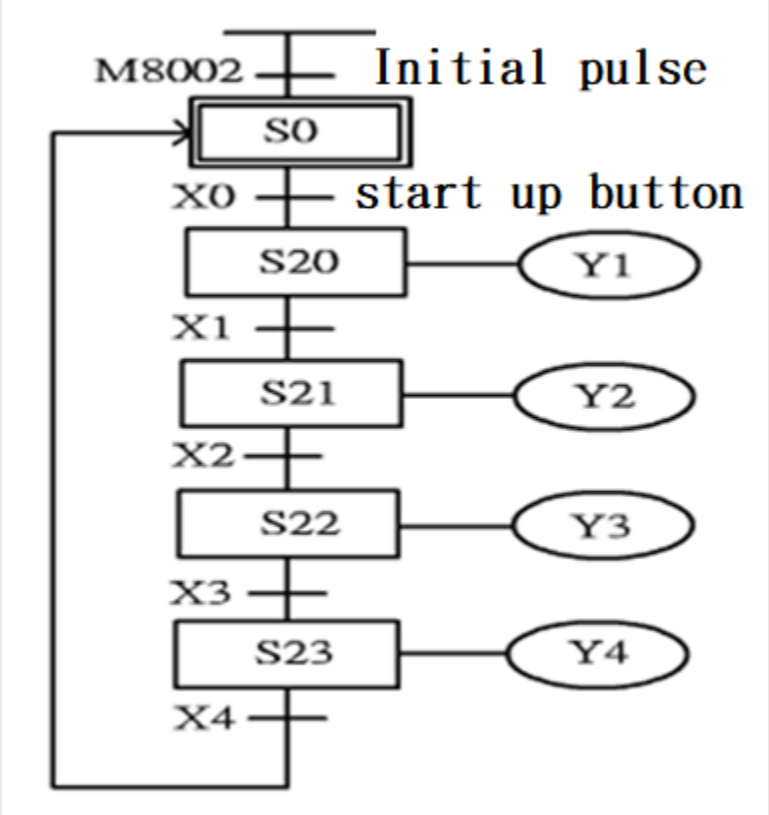
# Stepping ladder
# Perintah tangga langkah

- At the end of the program, RET (Return) must be used to return to the beginning of the program execution.
- Di akhir program, RET (Return) harus digunakan untuk kembali ke awal eksekusi program.

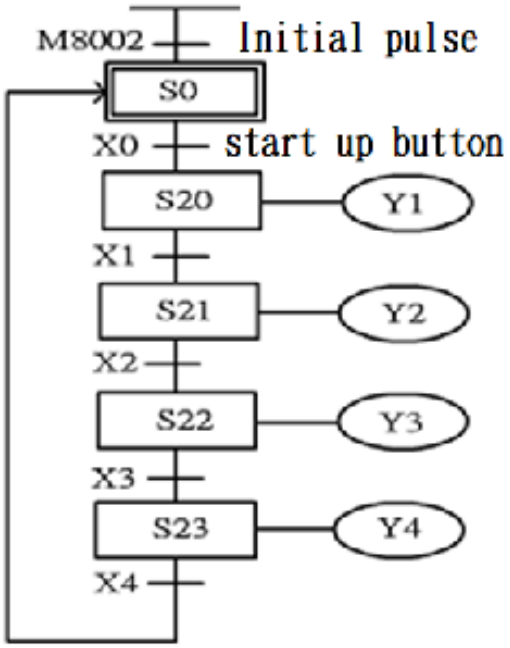


# Stepping ladder
# Perintah tangga langkah

- A total of 900 states from S0 to S899 can be used. This kind of architecture is called Sequence Function Chart, or SFC chart for short.
- Sebanyak 900 status dari S0 hingga S899 dapat digunakan. Arsitektur semacam ini disebut Bagan Fungsi Urutan, atau singkatnya bagan SFC.



# Sequence Function Chart
## Bagan Fungsi Urutan

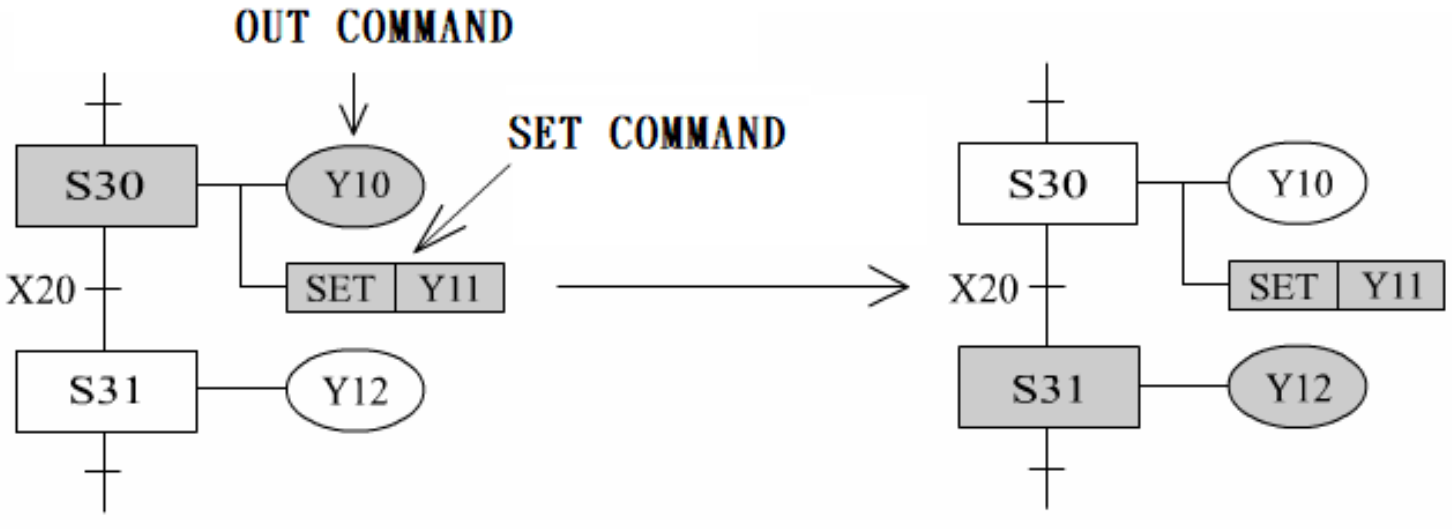



Sequence Function Chart

```
0   LD    M8002   ┐ Initial pulse
1   SET   S 0     ┘
3   STL   S 0     ┐
4   LD    X 0     │ state s0
5   SET   S20     ┘
7   STL   S20     ┐
8   OUT   Y 1     │
9   LD    X 1     │ state s20
10  SET   S21     ┘
12  STL   S21     ┐
13  OUT   Y 2     │ state s21
14  LD    X 2     │
15  SET   S22     ┘
17  STL   S22     ┐
18  OUT   Y 3     │ state s22
19  LD    X 3     │
20  SET   S23     ┘
22  STL   S23     ┐
23  OUT   Y 4     │ state s23
24  LD    X 4     │
25  SET   S 0     ┘
27  RET   <-- last ret command
28  END
```

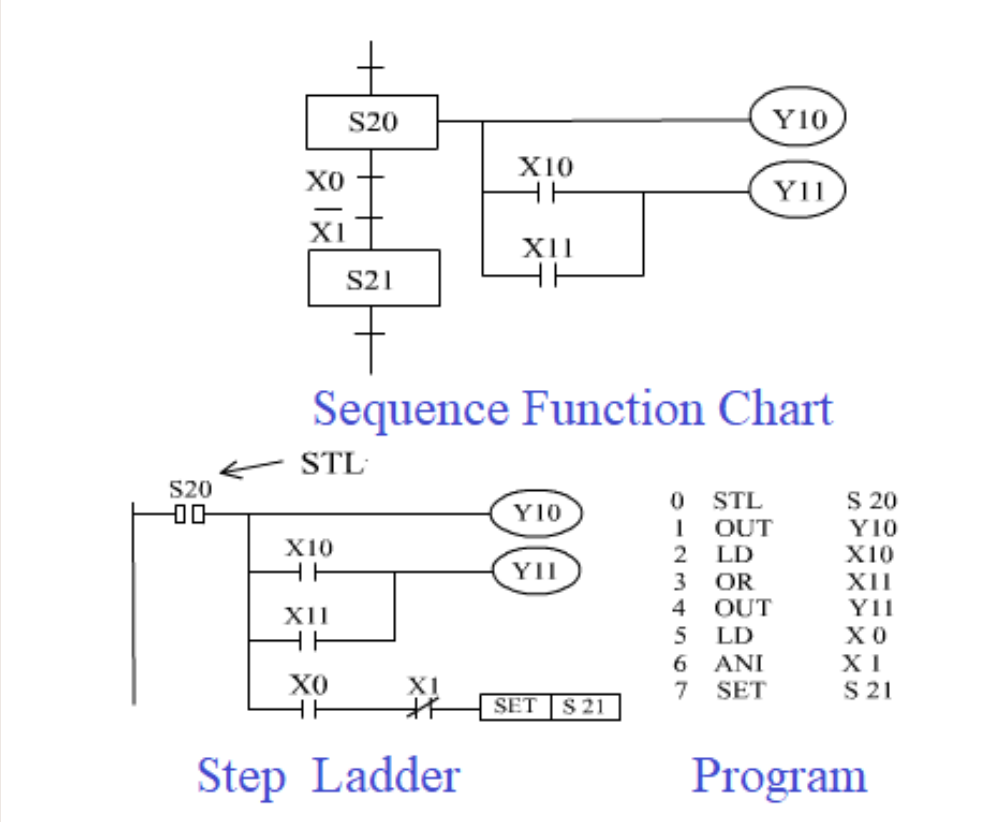
program

# State relay
## estafet negara




State relay
estafet negara

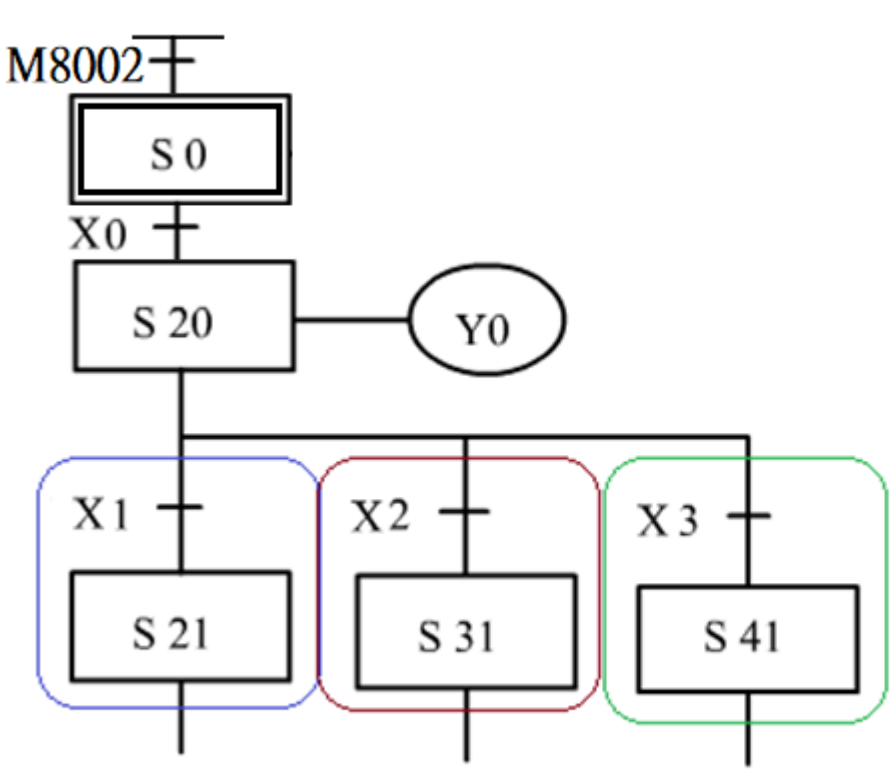
# SFC/ STL圖




SFC.:Sequence Function Chart

STL.:Step Ladder

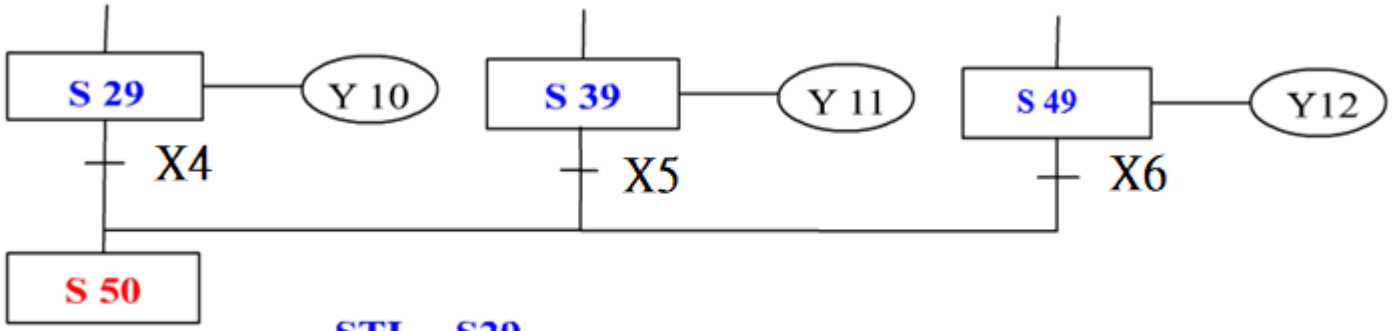
# Divergence and Confluence
# Divergensi dan Pertemuan




```
LD      M8002
SET     S 0
STL     S 0
LD      X0
SET     S21
STL     S20
OUT     Y0
LD      X 1
SET     S21
LD      X 2
SET     S31
LD      X 3
SET     S 41
```

Divergence Program

# Divergence and Confluence
# Divergensi dan Pertemuan




```
STL   S29
OUT   Y10
LD    X4
SET   S50
STL   S39
OUT   Y11
LD    X5
SET   S50
STL   S49
OUT   Y12.
LD    X6
SET   S50
```

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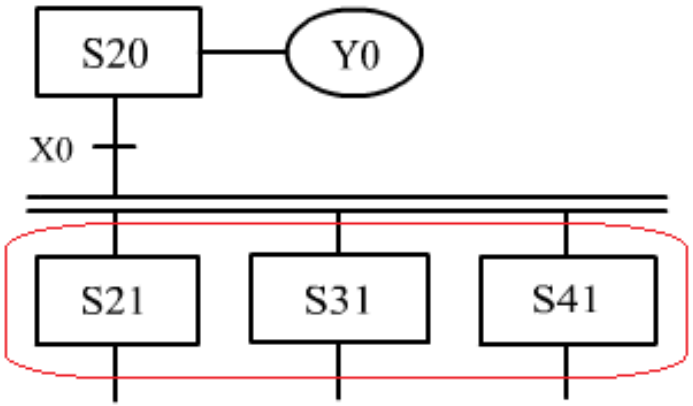
Confluence Program

# Divergence at same time and Confluence

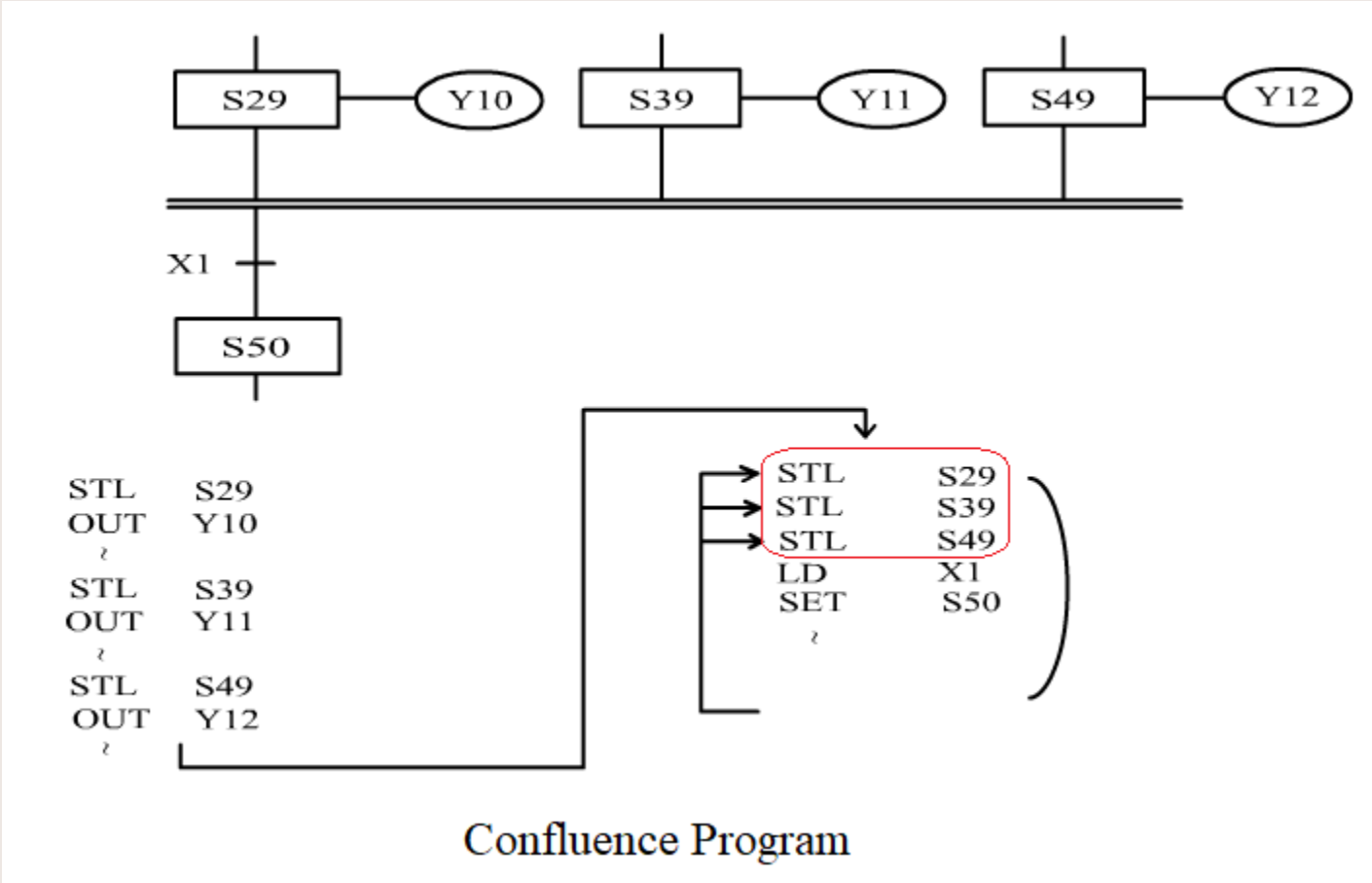
# Divergensi pada saat yang sama dan Confluence




| | |
|---|---|
| STL | S20 |
| OUT | Y0 |
| LD | X0 |
| SET | S21 |
| SET | S31 |
| SET | S41 |

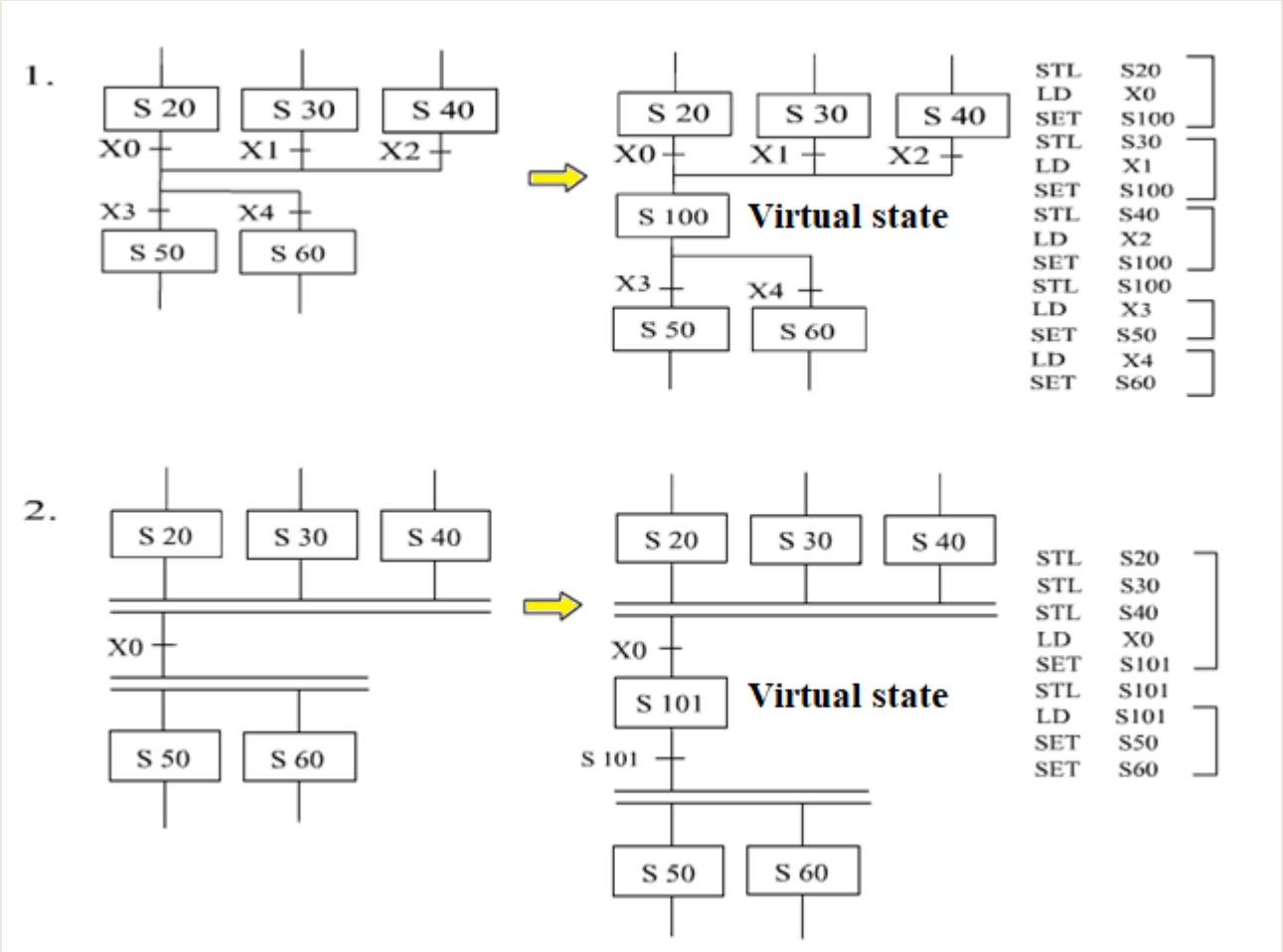
**Divergence at same time Program**

# Divergence at same time and Confluence
# Divergensi pada saat yang sama dan Confluence

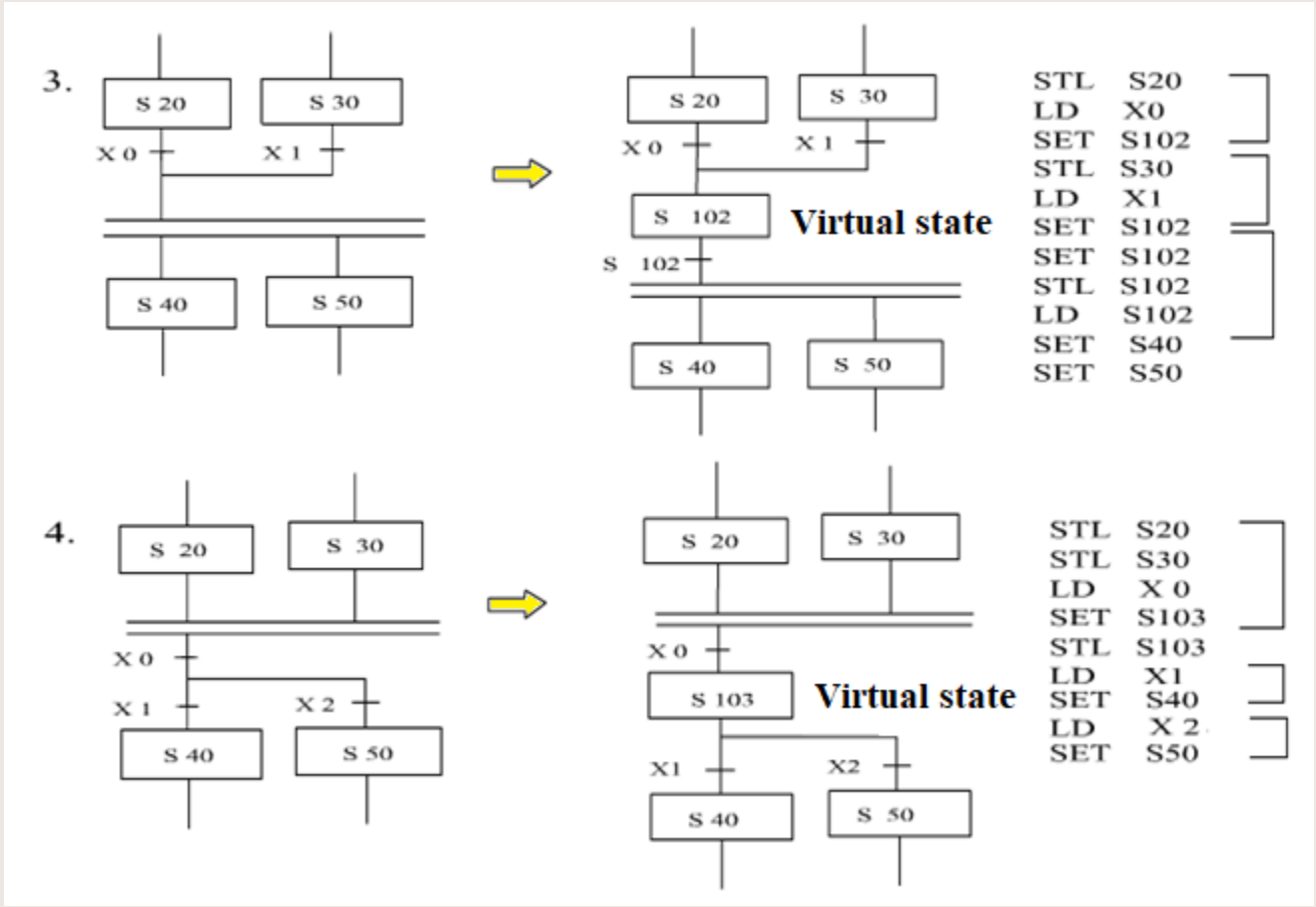



Confluence Program

# Combination of divergence and confluence
## Kombinasi divergensi dan pertemuan

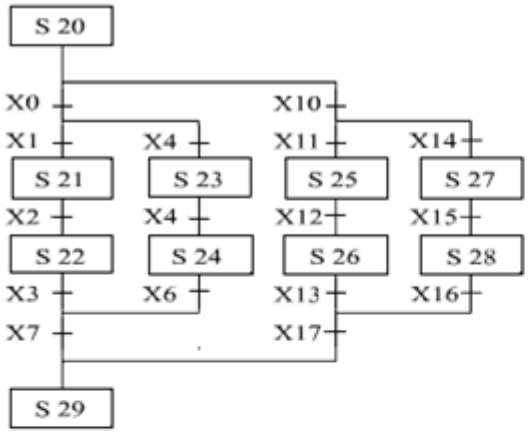


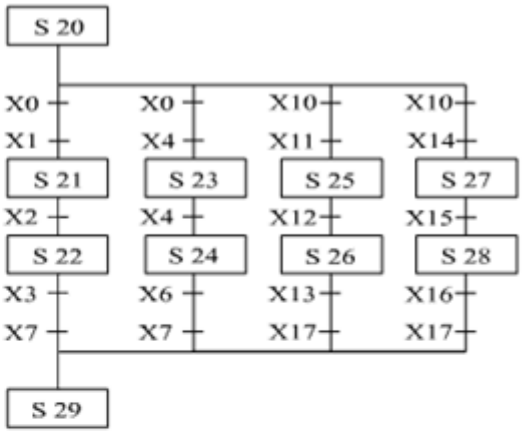
# Combination of divergence and confluence
## Kombinasi divergensi dan pertemuan



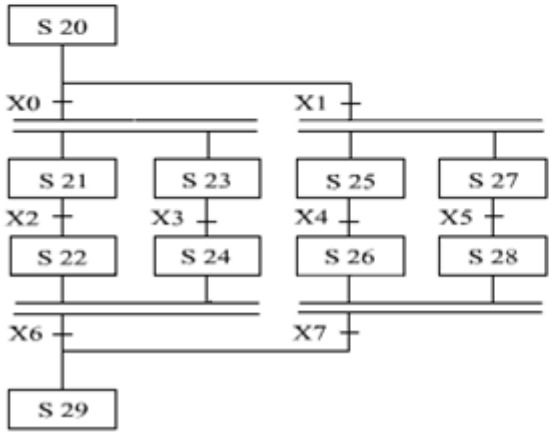
# Combination of divergence and confluence
## Kombinasi divergensi dan pertemuan

5.



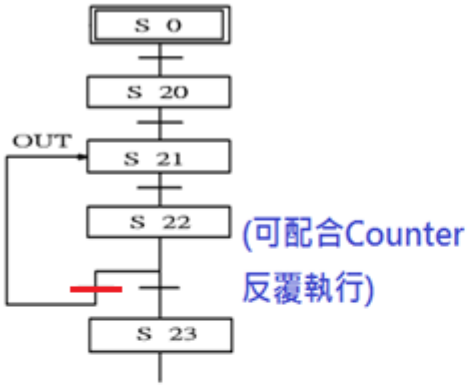

6.



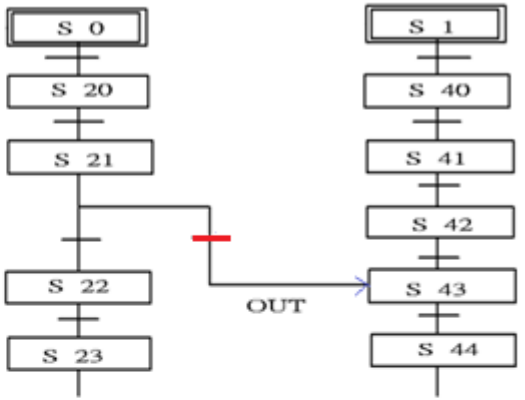

```
STL   S20      STL   S22
LD    X0       STL   S24
SET   S21      LD    X6
SET   S23      SET   S29
LD    X1       STL   S26
SET   S25      STL   S28
SET   S27      LD    X7
               SET   S29
```

# Jump and repeat processing
# Lompat dan ulangi pemrosesan

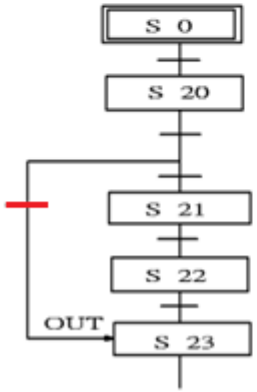
**1. Repeat**



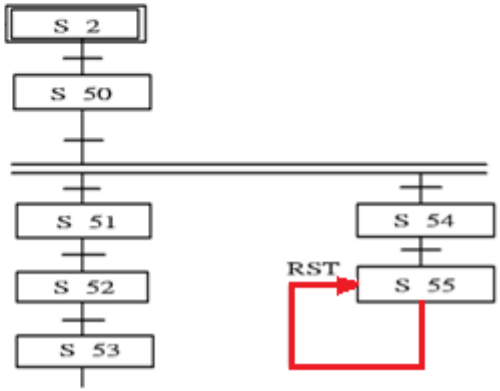

**3. Jump out**




**2. Jump**

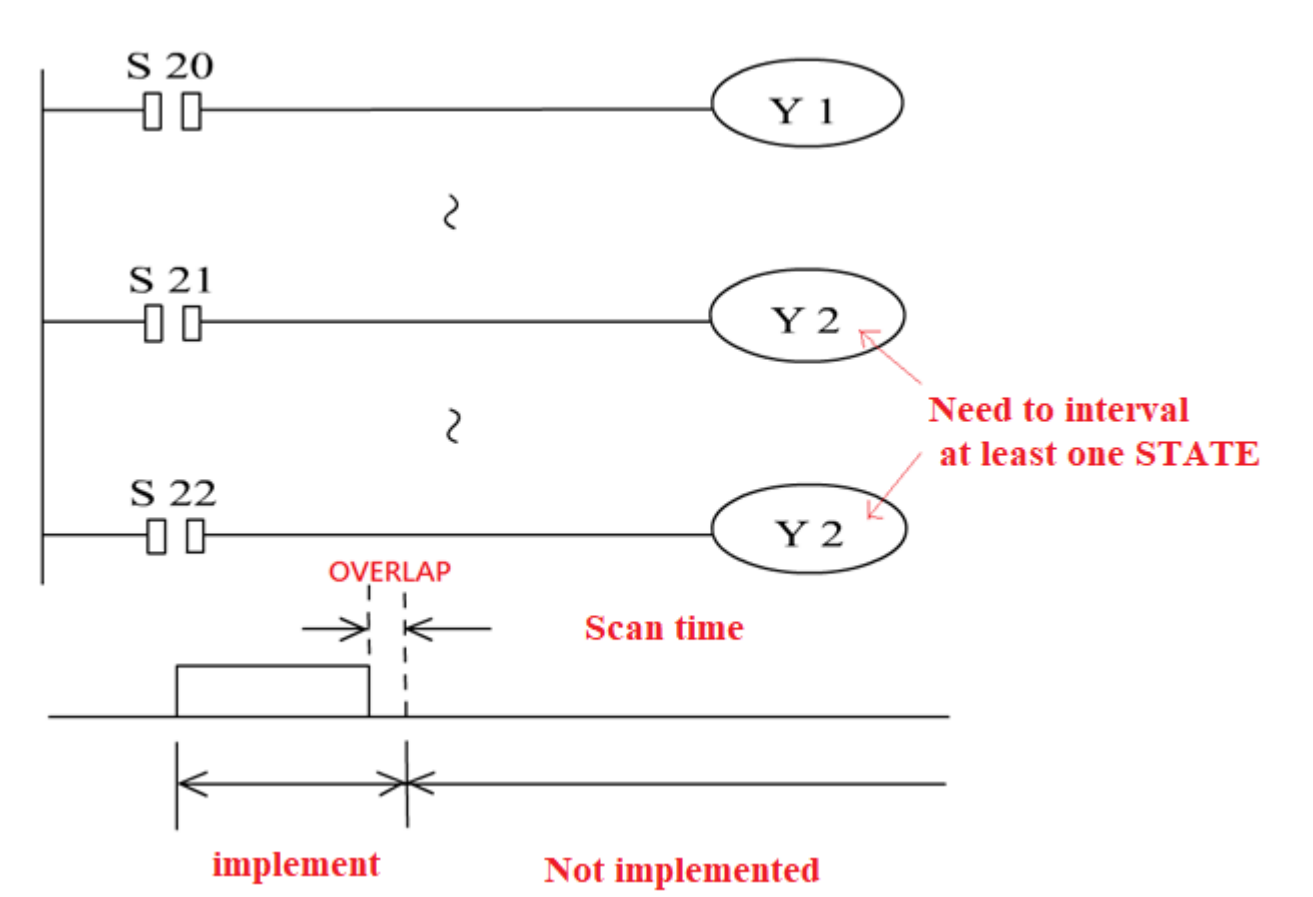



**4. Reset**



# Points to note for step ladder commands

## Poin yang perlu diperhatikan untuk perintah tangga langkah



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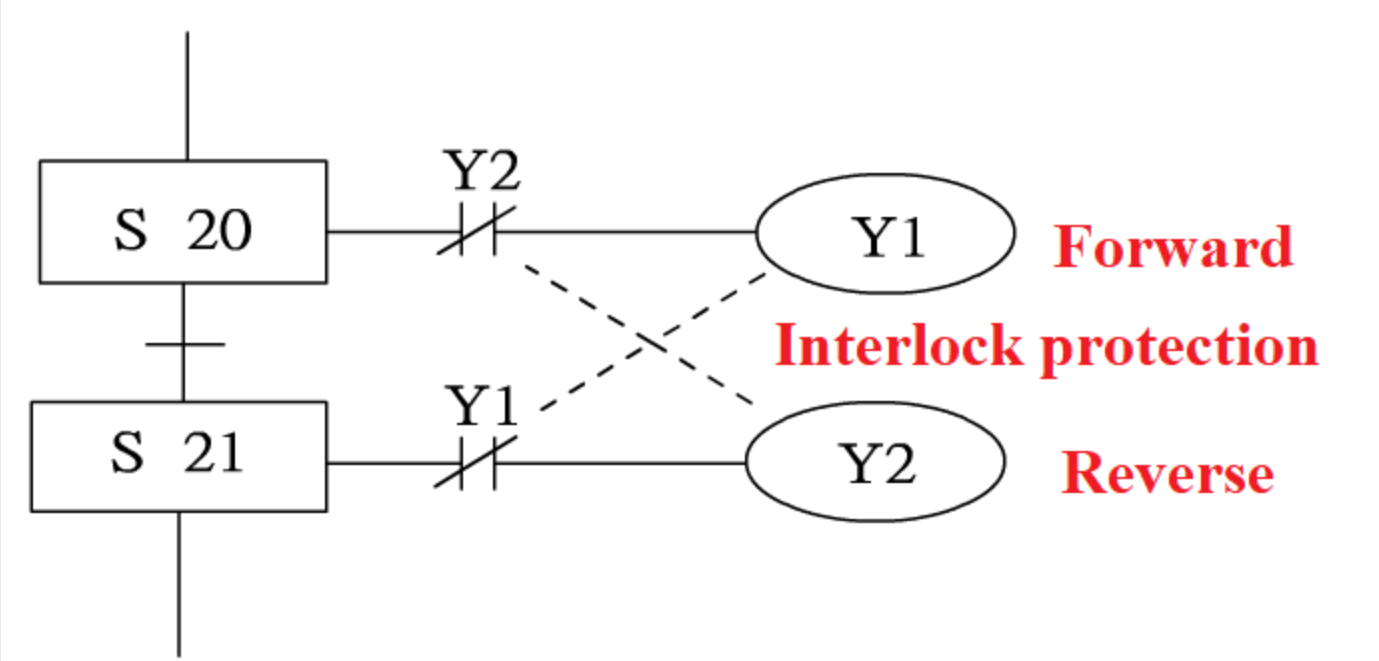

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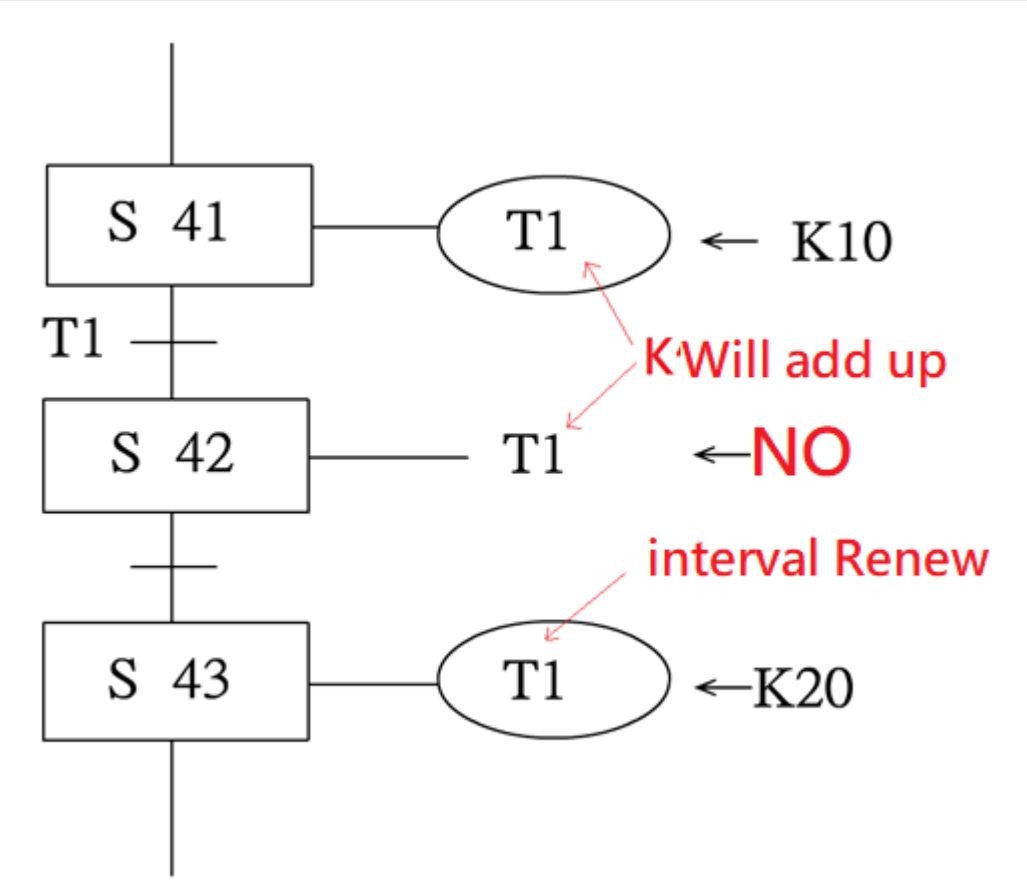
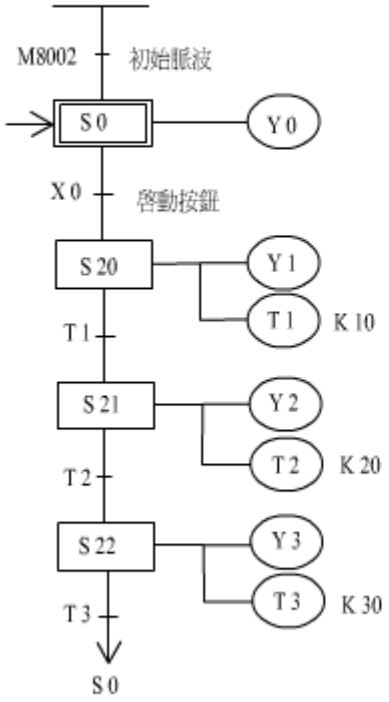
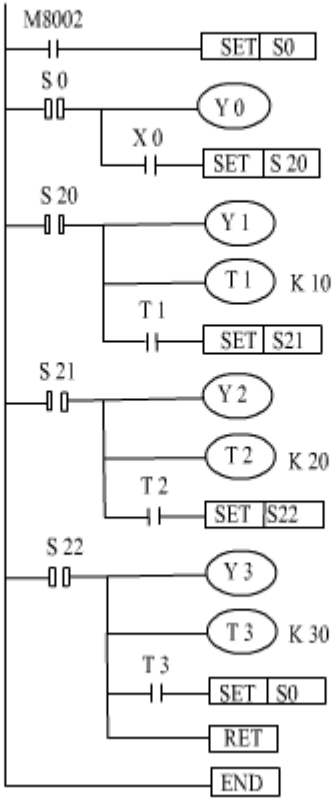


# Example of step ladder command program execution
## Contoh eksekusi program perintah tangga tangga

### SFC Chart

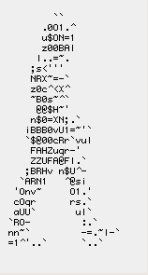



### STL Chart




### PLC Program

```
0  LD   M8002
1  SET  S0
3  STL  S0
4  OUT  Y0
5  LD   X0
6  SET  S20
8  STL  S20
9  OUT  Y1
10 OUT  T1
   (SP) K10
13 LD   T1
14 SET  S21
16 STL  S21
17 OUT  Y2
18 OUT  T2
   (SP) K20
21 LD   T2
22 SET  S22
24 STL  S22
25 OUT  Y3
26 OUT  T3
   (SP) K30
29 LD   T3
30 SET  S0
32 RET
33 END
```



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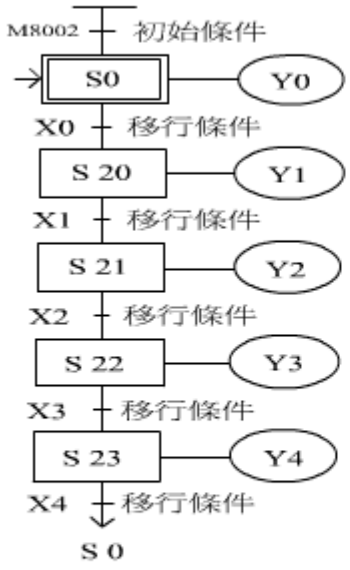


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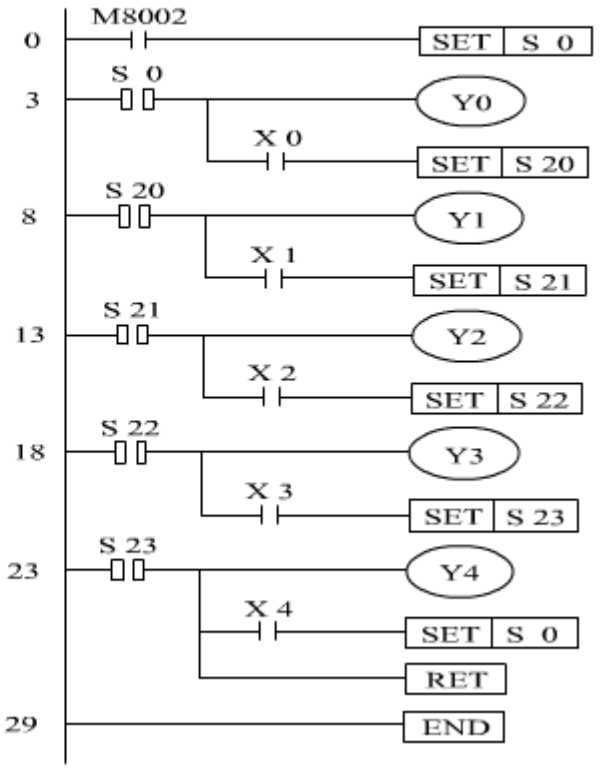


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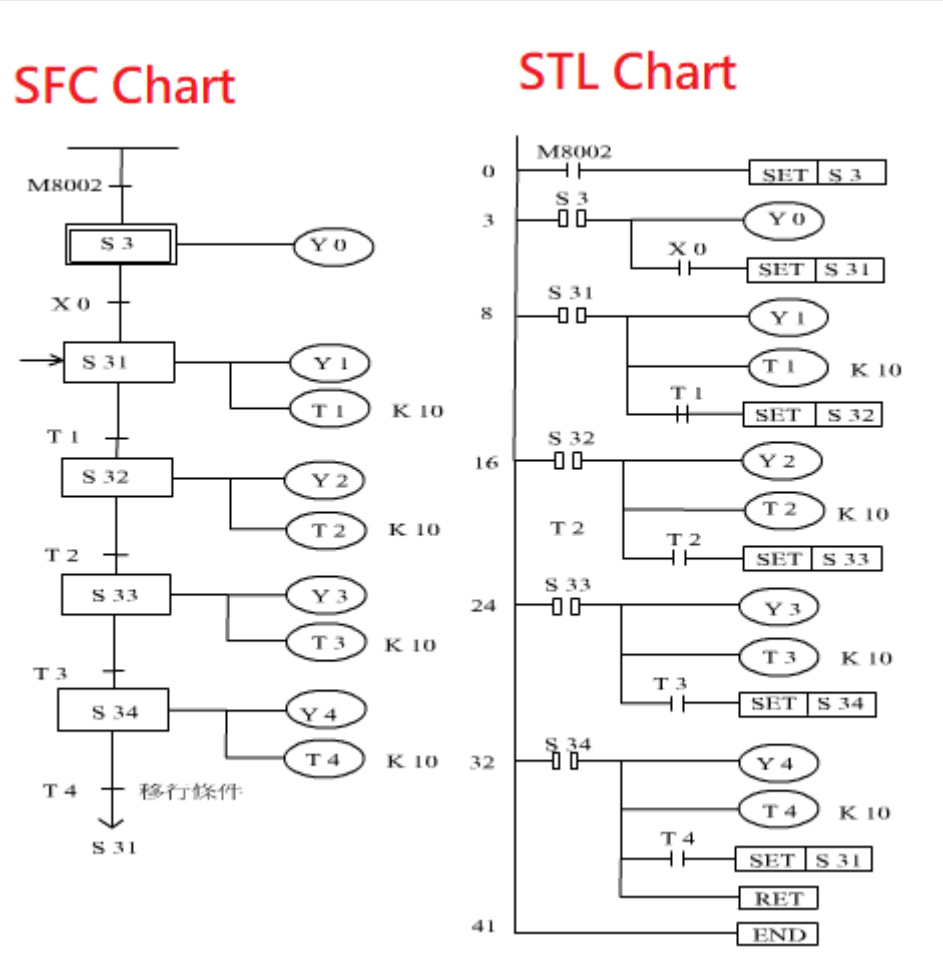


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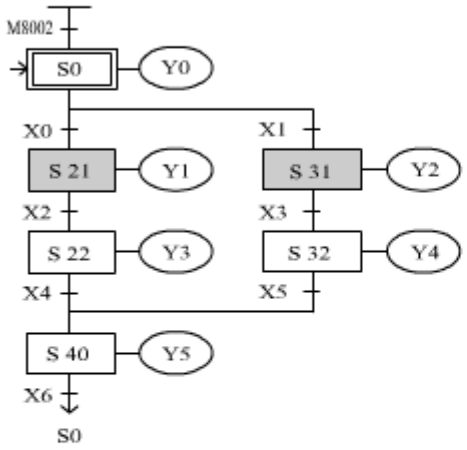
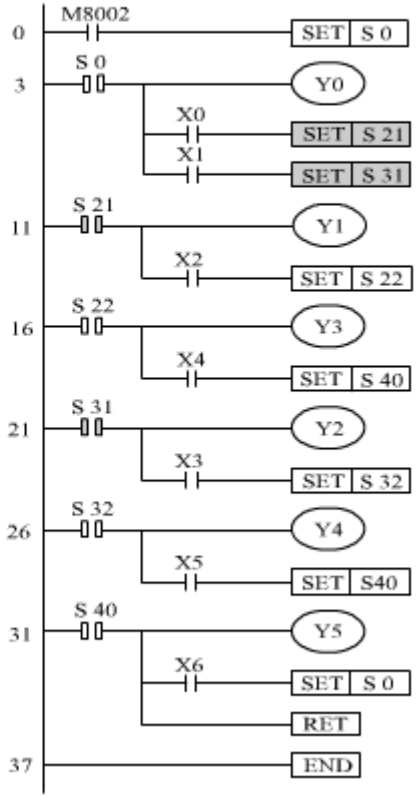
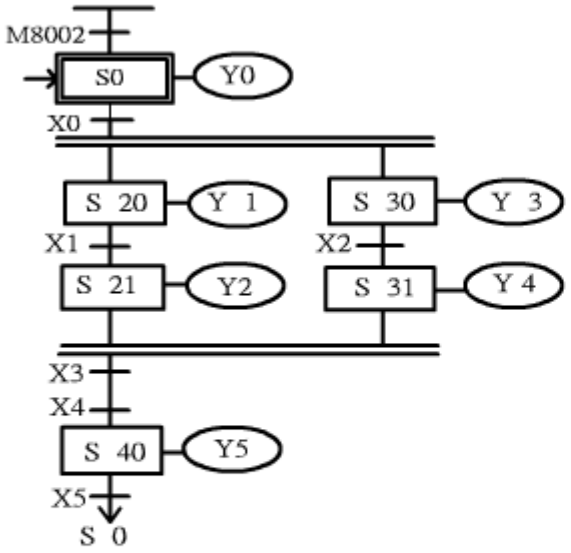



### STL Chart

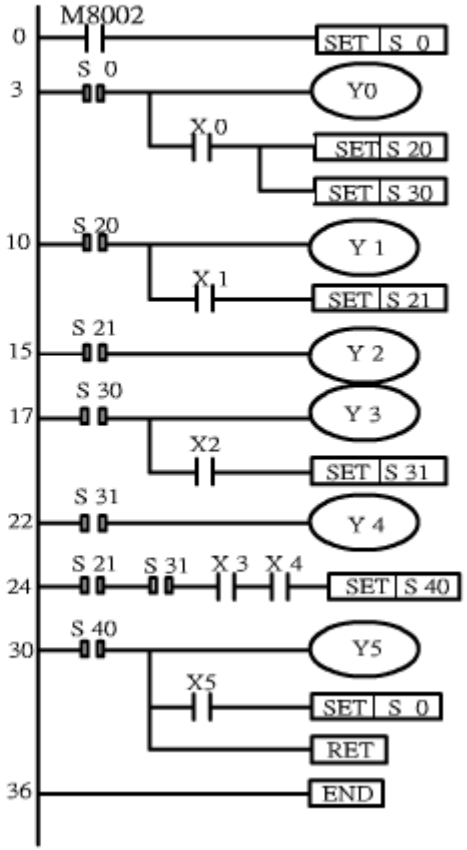



# Example of step ladder command program execution
## Contoh eksekusi program perintah tangga tangga

SFC Chart




STL Chart





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