MITSUBISHI PROGRAMMABLE CONTROLLER

Technical Note

No. 29

TYPE MELSEC-K

TITLE CONTROL OF SEQUENTIAL DRIVE AND SIMULTANEOUS DRIVE FOR COMPRESSORS

SCOPE

In this example of driving 3 sets of compressors sequentially, also those simultaneous driving of multiple compressors are described which increase as 2 sets to 3 sets corresponding with lack of pressure.

The sequential drive is ordered by shift register with temporary memory, (M), and simultaneous drive of multiple units is accomplished by logic combinations.

Especially in this example, it is possible by using sequence instructions only, and may be without data instructions.

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CUSTODY	No.	BCN-35239-B

1. Operation

This example describes pressure control by 3 sets of, compressors.

As shown in Figure 1, pressure switches operate corresponding with lack degree of pressure to control number of driving compressors.

Thongh compressors change the number of running sets corresponding with pressure, respective compressors perform sequential driving as shown in Figure 2.

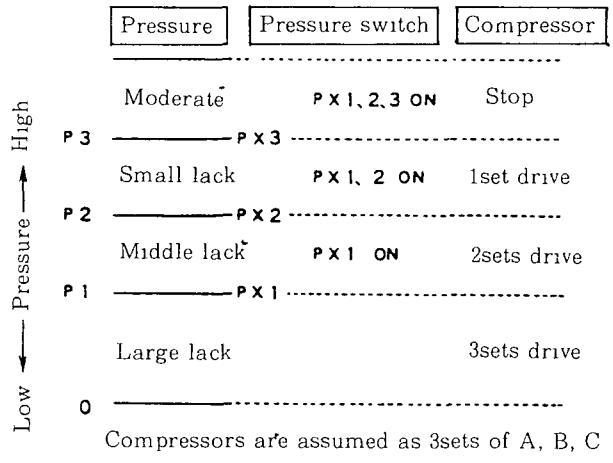


Figure 1 Pressure Control Method

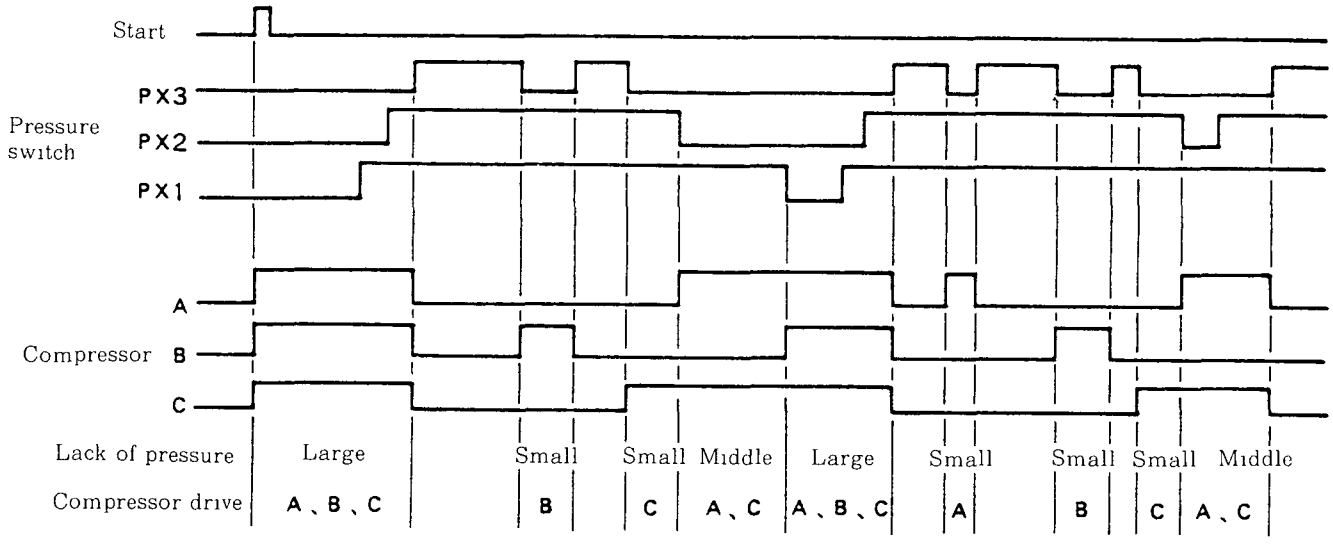


Figure 2 Drive Pattern

Relatin between pressure and the number of compressors are as follows

(1) Moderate . Stop.

(2) Small lack : Basic pattern of 1set running,

(A⟶B⟶C⟶A⟶· ·· ·· ·).

As pressure drops, it shall drive 1set ; and when pressure becomes moderate, it stops. If then pressure drops again, the next compressor shall be driven.

(3) Middle lack : Driving 2sets which are basic pattern + one set.

This added one shall be the last of basic pattern.

For instance, if A is running as basic pattern, C will be added.

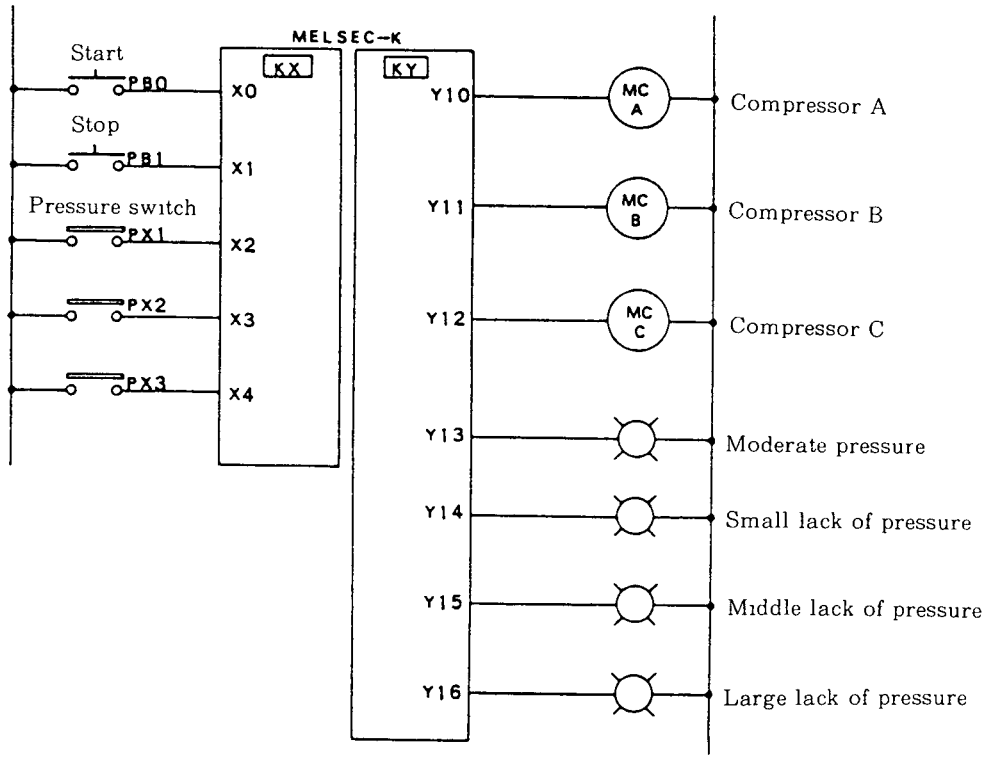
Basic pattern	Added lset
A	C
B	A
C	B

When pressure becomes moderate, the 2sets will stop.

(4) Large lack : Driving 3sets.

The 3sets shall be driven to obtain moderate pressure, then all compressors will stop.

2. System Configuration



Note.

PX1 , will be ON as pressure becomes P1 or more.

Lack of pressure is large

PX2 will be ON as pressure becomes P2 or more

When PX1 is ON and PX2 is OFF, lack of pressure is middle

PX3 will be ON as pressure becomes P3 or more.

When PX1, 2 are ON and PX3 is OFF, lack of pressure is small, then pressure will become moderate when PX3 is ON

3. Intention of Control

3.1 Control for Basic Pattern

Basic patterns are controlled by 3 stages of ring counters (ring shaped shift registers) with M10~M12.

Shift signal is made when OFF of the pressure switch PX3, detecting moderate pressure.

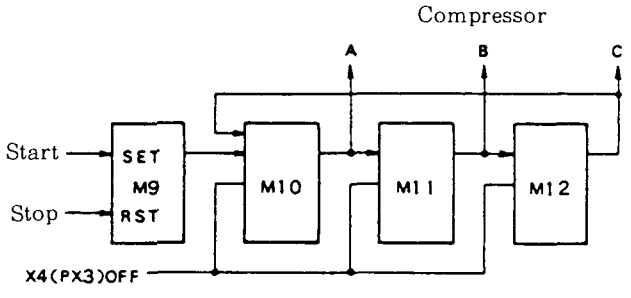
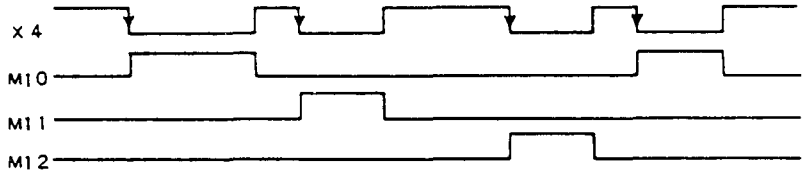


Figure 4 Control of Basic Pattern



Note. Shift is operated at step down of X4.

Figure 5 Shift Operation

3.2 Pressure Determination

	Pressure	Pressure switch	Sufficient condition	Necessary condition	Memory
(1)	Moderate	: PX3 ON	X4 · X3 · X2	X4	Y13
(2)	Small lack	: PX3 OFF, OX2 ON	$\overline{X4}$ · X3 · X2	$\overline{X4}$ · X3	Y14
(3)	Middle lack	: PX2 OFF, PX2 ON	$\overline{X4}$. $\overline{X3}$ · X2	$\overline{X3}$ · X2	Y15
(4)	Large lack	: PX1 OFF	$\overline{X4}$ · $\overline{X3}$ · $\overline{X2}$	$\overline{X2}$	Y16

Since PX1~3 are defined as note of Figure 3, determination employs above necessary conditions.

3.3 Compressor Drive

(1) In case of small lack, it follows basic pattern.

M10 . Drive Compressor A

M11 : Drive Compressor B

M12 : Drive Compressor C

(2) In case of middle lack, it follows paragraph 3. 2.

Compressor A $Y10 = Y15 \cdot M11$

Compressor B $Y12 = Y15 \cdot M10$

(3) In case of large lack, drive A, B, C simultaneously.

(4) Driving period

In any case of small, middle or large lack of pressure, after starting, it shall drive untill to become moderate pressure.

(5) As to sequential start and the like.

Pressure will change from moderate⟶small lack⟶middle lack⟶large lack, and such change as moderate⟶large lack may not occur , consequently, the number of drive sets shall increase so successively that multiple sets do not start simultaneonsly.

But for pressure O, 3sets will start simultanlously. Then A, B and C shall start sequentially as required. Moreover, compressors may take sometimes so long time for starting that it may need cushion-starting. If it is possible to use star-delta start, this sequeucer program may be made.

(6) Summary of Y10~Y12

① $Y10 = (M10 + Y15 \cdot M17 + Y16) \cdot \overline{X4}$

② $Y11 = (M11 + Y15 \cdot M12 + Y16) \cdot \overline{X4}$

③ $Y12 = (M12 + Y15 \cdot M10 + Y16) \cdot \overline{X4}$

In the above formula, insides of ( ) mean as follows.

First item M10, M11 are of small lack of pressure in the basic patterns.

Second item Y15 means middle lack of pressure, and M10~M12 are conditions by the basic pattern.

Third item Y16 means large lack of pressure, then A, B, C may run withont any condition.

And, X4 means to stop at moderate pressure.

4 Circuit Examples

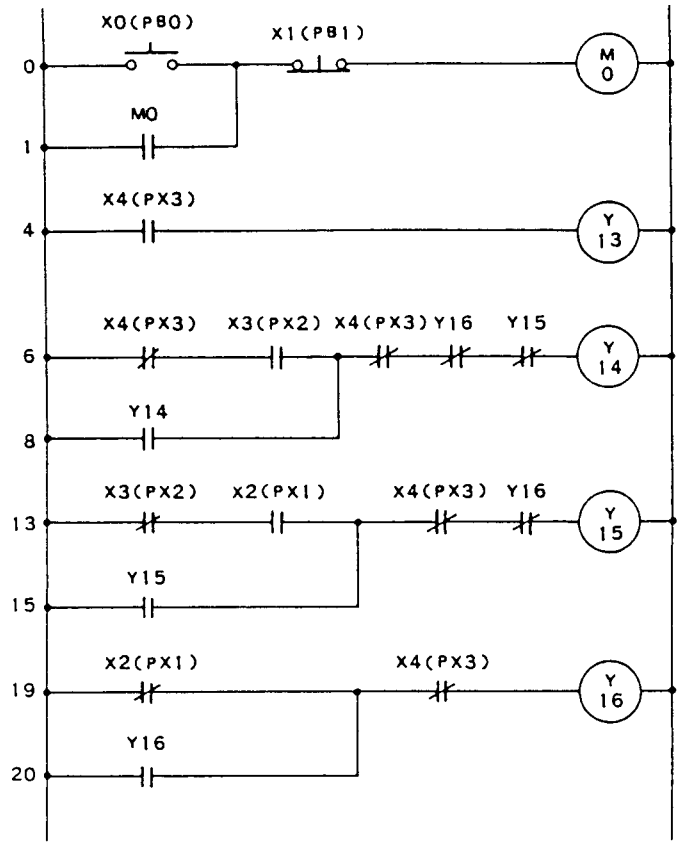


Figure 6 Pressure Determination Circuit

The term during pressure small ~ large means from time of pressure growth to moderate (X4 is ON), for instance, even if in the time of large⟶middle, it is provided not to indicate "middle"

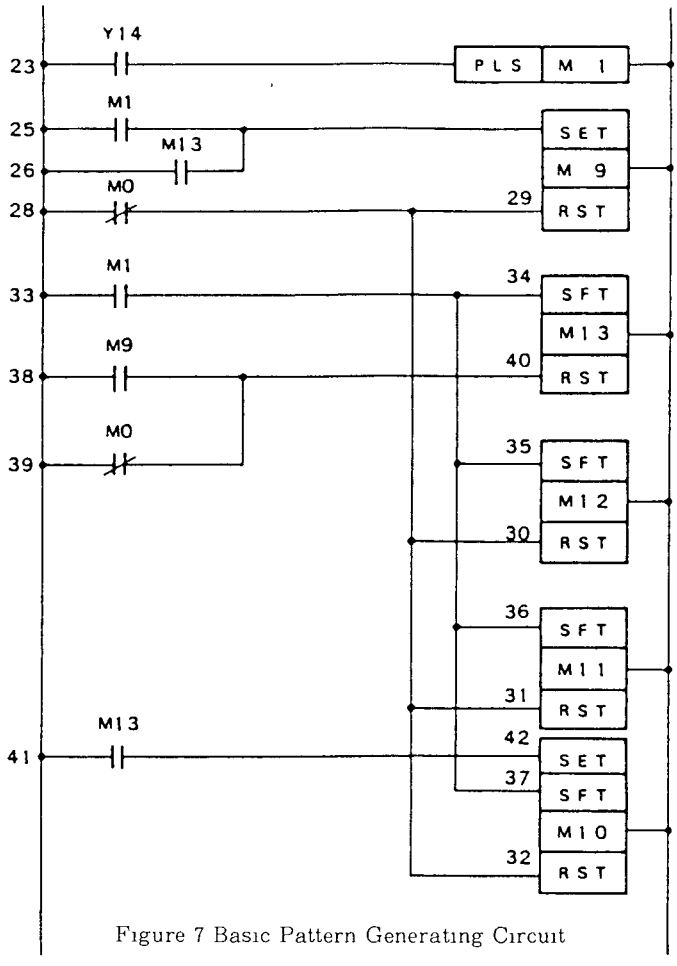


Figure 7 Basic Pattern Generating Circuit

Shift registers are M10~M13, and M13 is dummy to link from M12 to M10.

When starting, M9 is set with pulse M1 by M0 · $\overline{X4}$.At the time of SFT M10, it is shifted from M9 to M10, and M9 is OFF at the same time. Therefore Y10 is ON. Followingly after once moderate pressure, if it becomes small lack of pressure, shift pulse M1 is generated to shift from M10 to M11, therefore making Y11 ON, and Y10 OFF.

Next to M12 (Y12), it shifts to M13, and M10 is set by M13 ON, successively M9 is set and M13 is reset. This operation is executed by M1 ON, and SET M10 is step numbered later than SFT M10, consequently instruction of SFT M10 is equivalently not effective.

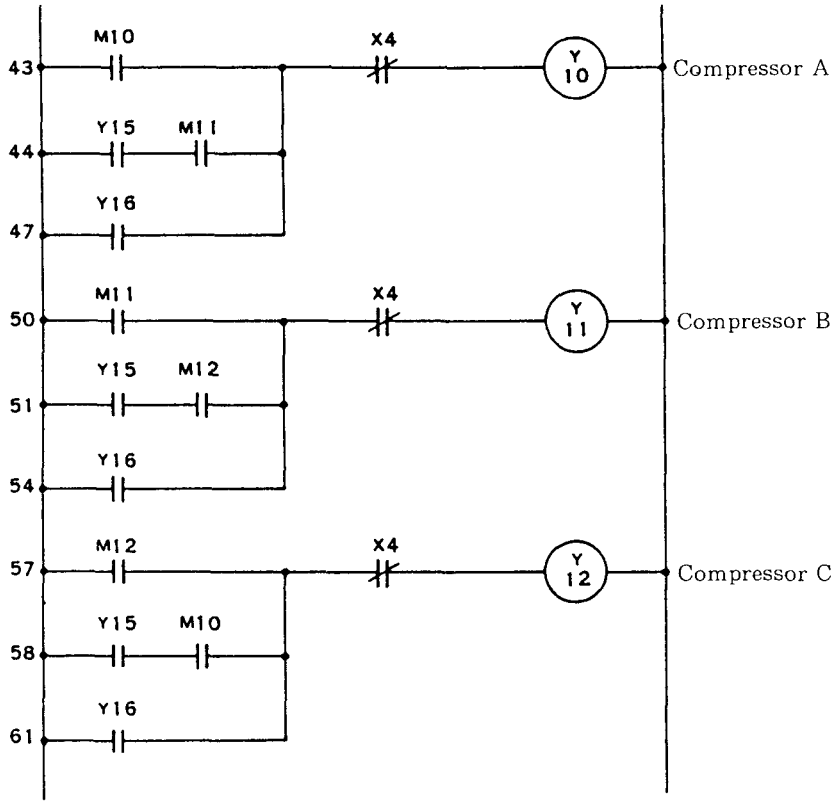


Figure 8 Compressor Output Circuit

M10~M12 : Each of basic pattern to drive one set.

Y15 : 2sets drive for middle lack

Y16 : 3sets drive for large lack

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