

**Technical Note****Data Link System****TYPE** **MELSEC-K****TITLE** **INTRODUCTION OF DATA LINK SYSTEM OF**
MELSEC-K Series**SCOPE**

.....
The data link systems used for MELSEC-K series enable the system expanding
the large scale and complicated application.
.....

This booklet shows the outline of the data link systems for MELSEC-K series.
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1. OUTLINES

The data link systems used for the MELSEC-K series are designed to enable the communication of data in series or in parallel between a multiple number of programmable controllers and I/O units, reduce the cost of long-distance input/output wiring work and make it possible to expand the total number of input/output points and also to implement distributed control.

It is also possible to transmit control data to, and receive such data from, personal computers and the like.

The data link systems described below are available.

System 1 : Parallel data link system between K2 CPUs

This is a system which enables data to be passed in parallel between two or three K2 CPUs installed close together. It is suitable when the number of input/output points exceeds 512 or when the number of program steps exceeds 4K.

System 2 : Remote I/O system based on K2 CPU and K0 units

This system employs up to 7 K0 units as the K2 CPU remote I/O and it allows the serial communication of I/O data between the K2 and K0 units. It is suitable for reducing the cost of long-distance input/output wiring work.

System 3 : Remote I/O system based on K2 CPU and K1, K2 input/output units

System 2 uses the K0 units as remote I/O of the K2 CPU but this system uses K1 and K2 input/output units as the remote I/O. Up to seven units can be connected.

This system, too, is suitable for reducing the cost of long-distance input/output wiring work. A wide variety of input/output units can be employed.

- System 2 and system 3 are mixed usable as long as the number of units does not exceed 7.

System 4 : Distributed control system based on K2 and K0

This system employs the K2 as the master sequencer and up to seven K0 units as the local sequencer, and it enables serial data communication between the master sequencer and local sequencers. It is applicable to expansion of the total number of input/output points and to distributed control.

Total input/output points : Max. 1,120

Master sequencer input/output points : Max. 224

Each local sequencer input/output points : Max. 128

System 5 : Distributed control system based on K2 and K2

System 4 employs the K0 units as the local sequencers but this system employs the K2 as the local sequencers (K2 are used for both master and local). System 4 features a maximum total number of input/output points of 1,120 and a maximum number of input/output points of 128 for each local sequencer. This system, therefore, is suitable in cases where these point numbers are exceeded.

Total input/output points : Max. 1,792

Master sequencer input/output points : Max. 224

Each local sequencer input/output points : Max. 224

- System 4 and system 5 are mixed usable as long as the number of units does not exceed 7.

System 6 : Computer link system

This system enables data to be passed between the K2 and a personal computer or other type of computer. It is applicable to cases where the operating status of the K2 sequencer is monitored by the computer or where data are to be gathered.

Note 1) It is possible to configure hierarchical systems through the combination of the above described systems but consultation with MITSUBISHI should be pursued over the details of such systems as sales information.

Note 2) In all cases, the K2 CPU-S3 must be employed for the K2 CPU which is used in these data link systems.

The K2 CPU-S3 is a unit which is more refined than the standard K2 CPU, K2-CPU-S1 and K2 CPU-S2 versions and, as such, it includes all their functions.

Note 3) It is also possible to further expand the number of input/output points mentioned in connection with systems 4 and 5. For details, refer to section 5-7.

2. DATA LINK CONTROL UNITS

Given below are outlines of the various units which are provided for the data link systems.

2-1. K2 CPU-S3

This forms the core of the data link system control, and it is more refined than the standard K2 PCU, K2 CPU-S1 and K2 CPU-S2 units.

As already mentioned, the K2 CPU-S3 should be used for all K2 CPUs in any data link system.

2-2. Parallel Data Link Unit (KJ61)

- This unit is for configuring a parallel data system between K2 units of system 1.
- Same configuration as K1, K2 input/output unit
- 16 input/output points are occupied.

2-3. Serial Data Link Control Unit (KJ71)

- Serial data communication control unit at K2 side of systems 2 ~ 6.
- Self-contained microprocessor (8085) and 2K byte RAM
- Two data link adaptors (KJ81, KJ82) can be installed
Only one KJ81 or KJ82 is installed for use in systems 2 ~ 6.
- Built-in socket to mount ROM (L2ROM, L3ROM, L4ROM) for data communication control (two MB8532's can be mounted)
- 32 input/output points are occupied.

2-4. Serial Data Link Control Unit 2 (KJ72)

- Remote control unit for system 3
- Installed at K1 CPU position of base unit (K12B, K15B, K18B) for K1
- Self-contained microprocessor (8085) and 2K byte RAM
- One data link adaptor (KJ81) can be installed
- ROM (L5ROM) installed for data communication control

2-5. High-speed Link Adaptor (KJ81)

- Adaptor for high-speed (250 Kbps) data communication
- Used as installed inside KJ71 or K0 unit
- Built-in serial I/O and modem functions

2-6. RS-232C Adaptor (KJ82)

- Adaptor for EIA-specified RS-232C interface
- Used as installed on KJ71 in system 6

3. ROM, RAM FOR DATA LINK CONTROL

Following ROMs which contain control programs and RAMs for temporary data storage, are provided for data communication in system 2 ~ 6.

- (1) L1ROM : K0 side control ROM for system 2 and 4
- (2) L1RAM : K0 side RAM for systems 2 and 4
- (3) L2ROM : Master side KJ71 ROM for systems 2, 4 and 5
- (4) L3ROM : Local KJ71 ROM for system 5
- (5) L4ROM : ROM for system 6 (computer link)
- (6) L5ROM : KJ72 side ROM for system 3

At the time of ordering, specify the following part and type names. Shipping will be executed in sets.

System	Part name	Type name	Set contents
2, 4, K0 side	K0 data link set	K0DLS	KJ81, L1RAM, K1ROM
2 to 5, master side	Data link master set	KJ71L2	KJ71, KJ81, L2ROM
5, local side	K2 local set	KJ71L3	KJ71, KJ81, L3ROM
6	Computer link set	KJ71L4	KJ71, KJ82, L4ROM
3, KJ72 side	K1/K2 remote set	KJ72L5	KJ72, KJ81, L5ROM

4. DATA LINK SYSTEM CONFIGURATIONS AND METHODS OF HANDLING AND PROGRAMMING

4-1. Parallel Data Link Systems Between K2 CPUs (System 1)

4-1-1. Configuration

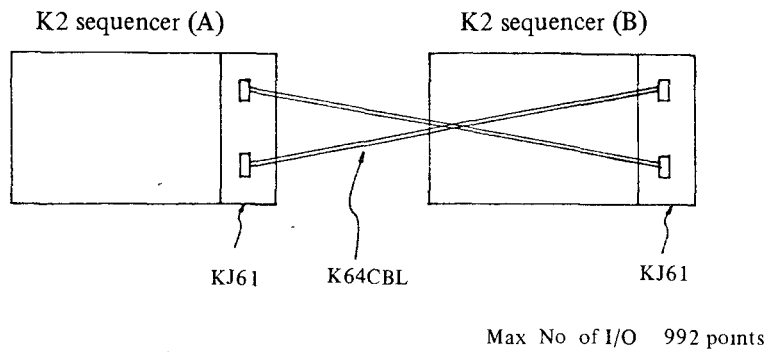


Fig. 4-1 2-unit parallel configuration

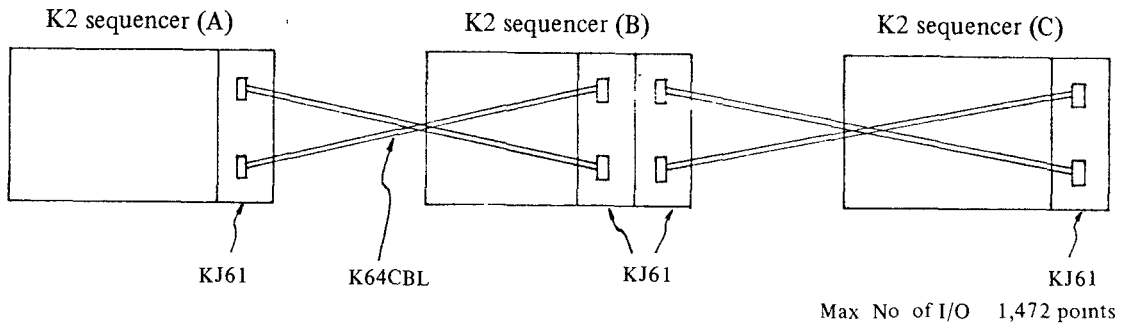


Fig. 4-2 3-unit parallel configuration (A)

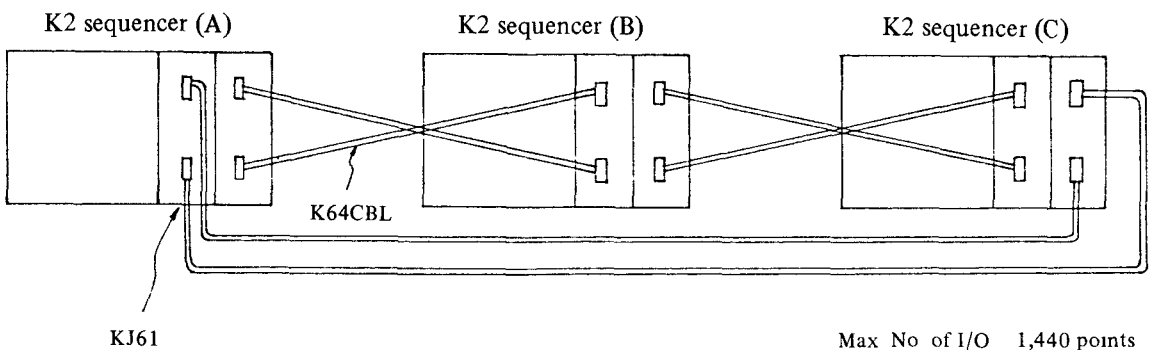


Fig. 4-3 3-unit parallel configuration (B)

4-1-2. Specifications

(1) Number of data link points

- Max. 128 as transmission/reception total (using Y0 – 7F) (Figs. 4-1, 4-2, 4-3)

Note 1) Fig. 4-2 (B) and Fig. 4-3 (A) (B) (C) all use two KJ61 units but in each case the maximum number of points is 128.

(2) Transmission/reception selection

- Selection can be made in 16-point units using the selector switches inside KJ-61.

Note 2) When two KJ61 units are used in the same sequencer: (Figs. 4-2 (B), 4-3 (A) (B) (C))

Two transmission and reception selections must be made identical.

Note 3) When the same output signal from one sequencer is made available to the other two sequencers simultaneously.

For instance, the (A) and (C) output from Fig. 4-2 (B) is the same signal.

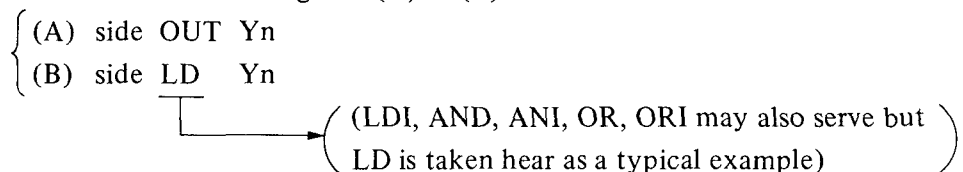
(3) KJ61 insertion position

- The KJ61 can be inserted at any position on the extension base (K68B).

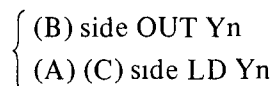
(4) Link data input/output method

- Data are input and output using Y0 – 7F.

Example 1) Transmission from Fig. 4-1 (A) to (B)



Example 2) Transmission from Fig. 4-2 (B) to (A) (C)



Note 4) The link data employ Y0 – 7F as described above. As a rule, therefore only the input unit is inserted in the basic unit of each K2 sequencer. Other units (KN62, KY10, KJ61, etc.) may also be inserted but in this case insertion position Yn cannot be used for data link. The number of possible link points is therefore reduced.

Note 5) With the data link between (A) and (C) in Fig. 4-2, relay must be provided with the (B) program and so the configuration in Fig. 4-3 is recommended for linking three K2 sequencers.

(5) Total number of input/output points (max.)

- Fig. 4-1: $(512 - 16) \times 2 = 992$ points
- Fig. 4-2: $(512 \times 3 - 16 \times 4) = 1,472$ points
- Fig. 4-3: $(512 \times 3 - 16 \times 6) = 1,440$ points

(6) Connecting cable

- Standard 1-meter (D64CBL)
- Special 3-meter (K64CBLH02)

4-2. Remote I/O System Based on K2 CPU and K0 Units (System 2)

4-2-1. Configuration

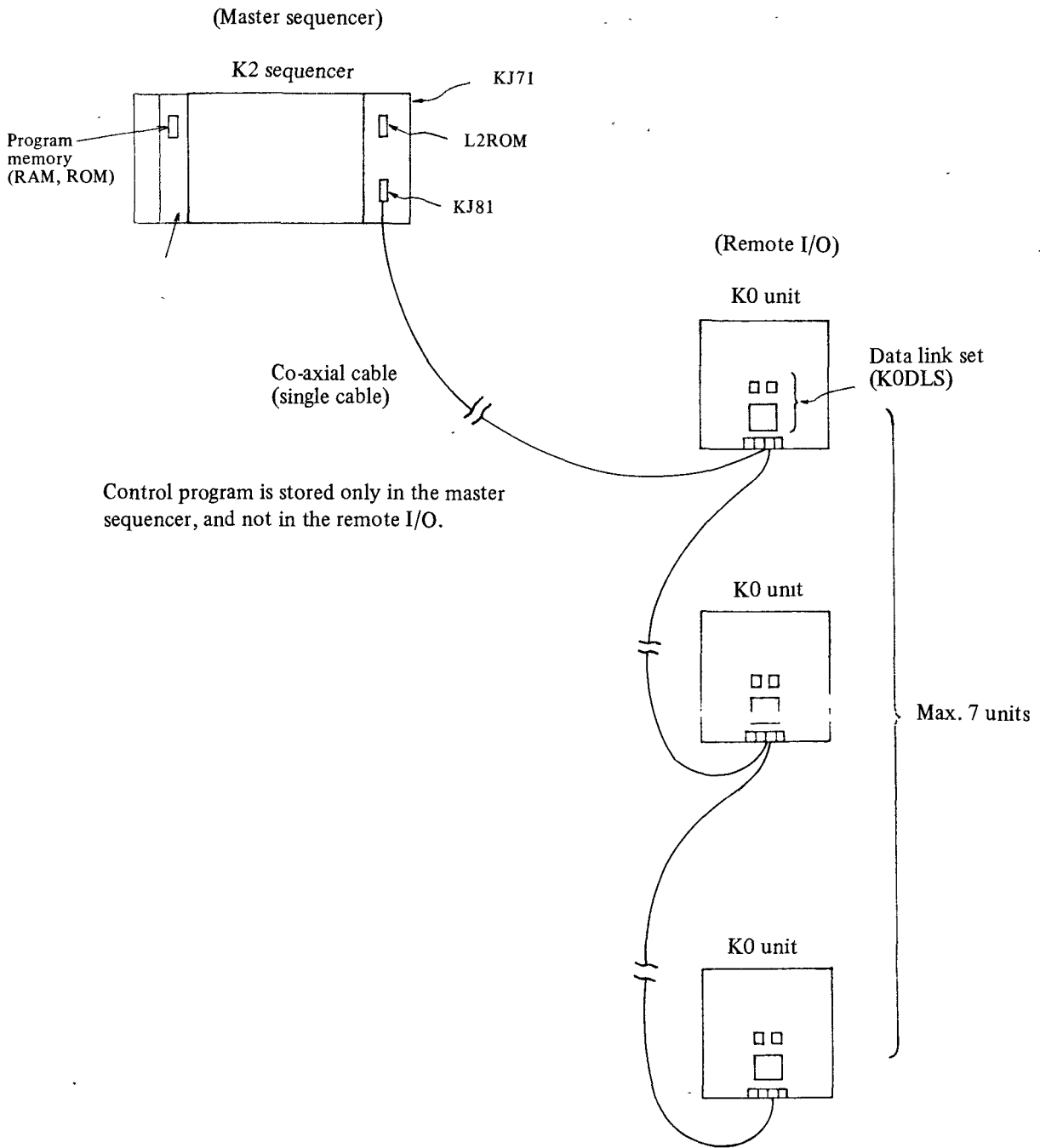


Fig. 4-4 Remote I/O system based on K2-K0

4-2-2. Specifications

(1) Number of remote I/O (K0) units : Max. 7

(2) Number of input/output points

Total of remote I/O, and master I/O points : Max. 480 (512 – 32)

(3) Transmission speed between K2 CPU and remote I/O : 250 KBPS (bits per second)

Note 1) Transmission between the K2 CPU and remote I/O is controlled by the CPU inside KJ71 and so there is hardly any effect on the sequence operation time.

(4) Total length of co-axial cable : Max. 500 meters

* It may be mixed usable with the system of item 4-3.

Note 4) The input/output units inside the remote I/O must be such that the input units are in front and the output units are behind.
The numbers inside the remote I/O must be consecutive. Therefore, use either X or Y for unused areas.

Note 5) The input/output units inside the remote I/O may be only either input units or output units.

(2) When the input/output numbers within the parentheses have been assigned, insert the following program (circuit) at the first of K2 sequencer subprogram.

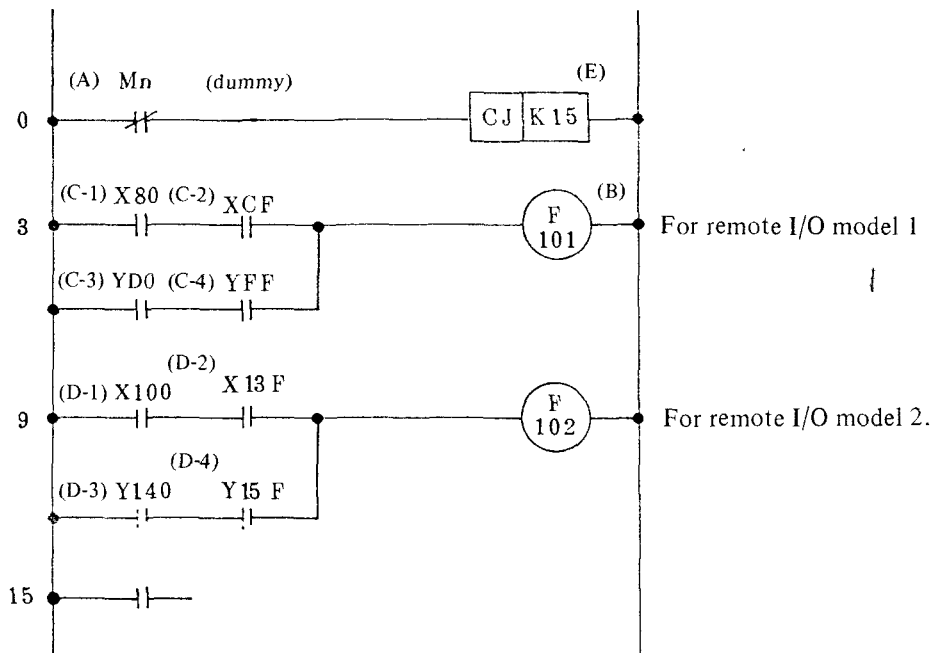


Fig. 4-6 Initial program

Note 1) The above circuit is for designating the number of remote I/O points and it no significance as far as the sequence is concerned. Make it a regular form as in the above figure.

A) Mn : Temporary memory (dummy) which is not used.

B) The "m" of coil F10m designates the number of the remote I/O model. Therefore, "m" is 1 - 7.

And it must be designated consecutively from F101.

4-3. Remote I/O System Based on K2 CPU and K1, K2 Input/Output Units (System 3)

4-3-1. Configuration

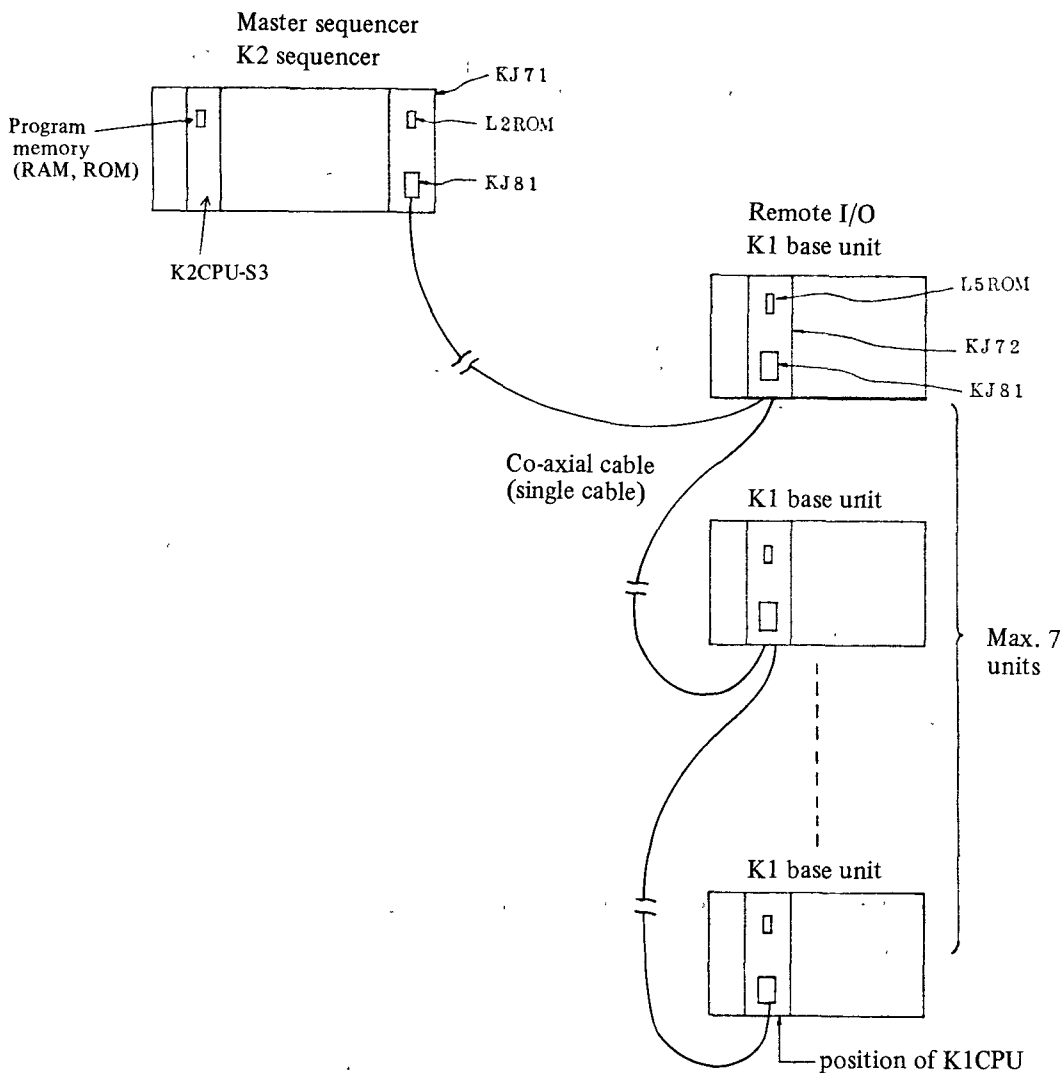


Fig. 4-4' Remote I/O system based on K2-K1, 2 input/output units

4-3-2. Specifications

- (1) The KJ72 is inserted into the K1 CPU position on the K1 base.
- (2) Other specifications are the same as in Section 5-2.

* It may be mixed usable with the system of Section 5-2.

4-3-3. Program method

It is the same as Section 5-2, Remote I/O System Based on K2CPU and K0 Units (System 2).

4-4. Distributed Control System Based on K2 CPU and K0 CPUs (System 4)

4-4-1. Configuration

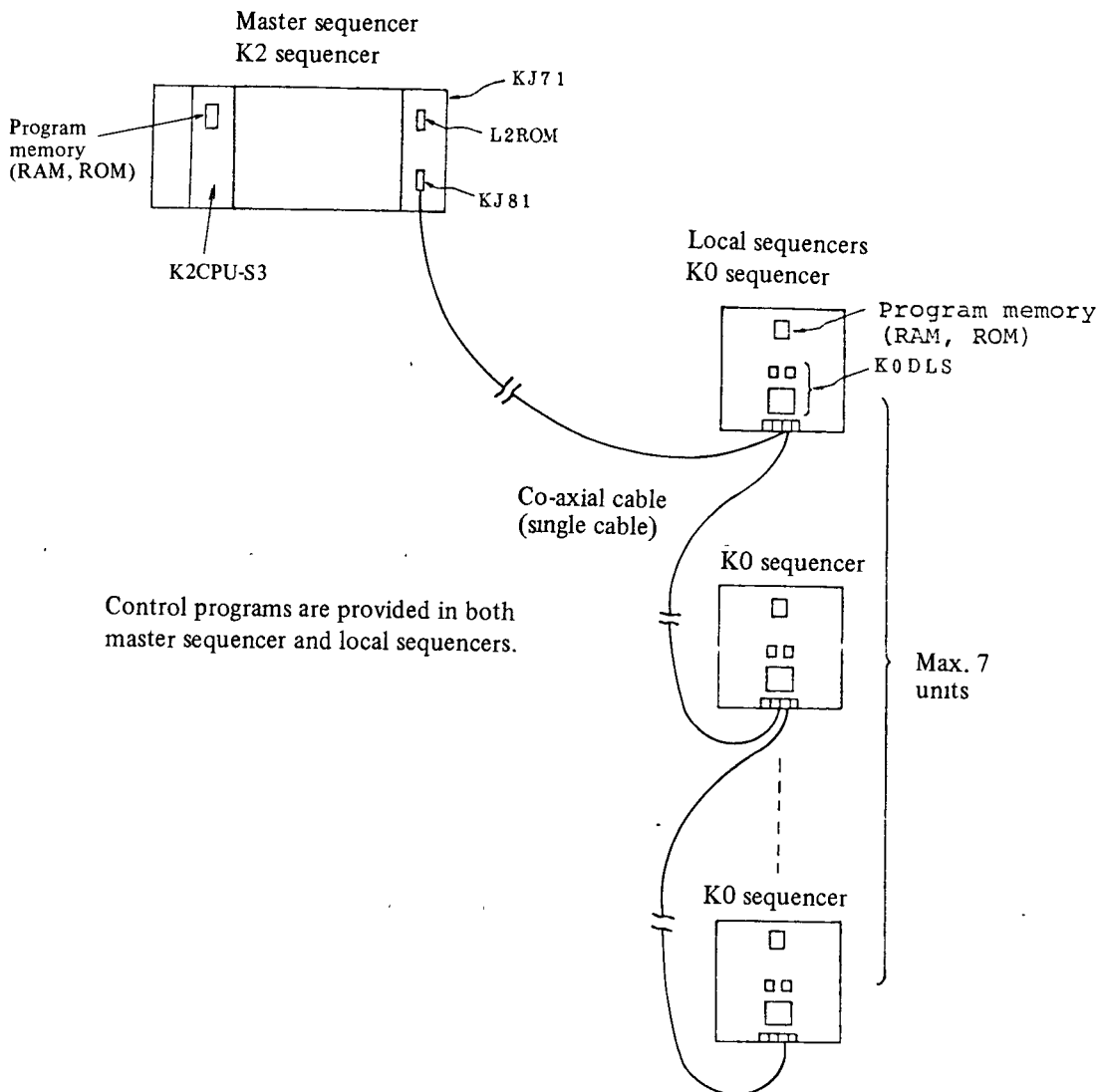


Fig. 4-8 Distributed control system based on K2-K0

4-4-2. Specifications

(1) K2 (master) sequencer specifications

- Number of input/output points : Max. 224 (512 points – 256 points – 32 points)
K2 points – Link points – KJ-71 points
- Other specifications are the same as for the discrete K2.

(2) K0 (local) sequencer specifications

- These are identical to those of the K0 discrete sequencer except that a data link set (K0DLS) is added.

(3) Total number of input/output points : $224 + 128 \times 7 = \text{Max. } 1,120$

(4) Transmission system specifications

- Same as those for remote I/O system based on K2 and K0 units in Section 5-2.

(5) Number of data link points (Total)

- Local \rightarrow master
 - Master \rightarrow local
- Total 256 points

Note 1) The above figures are the total number of possible transmission and reception points between all the local sequencers and the master sequencer.

The K2 program designates how many points are to be used by each local sequencer. (Refer to section 5-4-3)

Note 2) Direct data linking between local sequencers is not possible. When necessary, it is conducted via the master sequencer.

Note 3) Other than the above number of points, it is possible to link even greater volumes of data by using a data register. (See Section 6)

(6) KJ71 insertion position

- The KJ71 can be inserted into any input/output unit position of the K2 sequencer but it is recommended that it is inserted last of all.

4-4-3. Program method

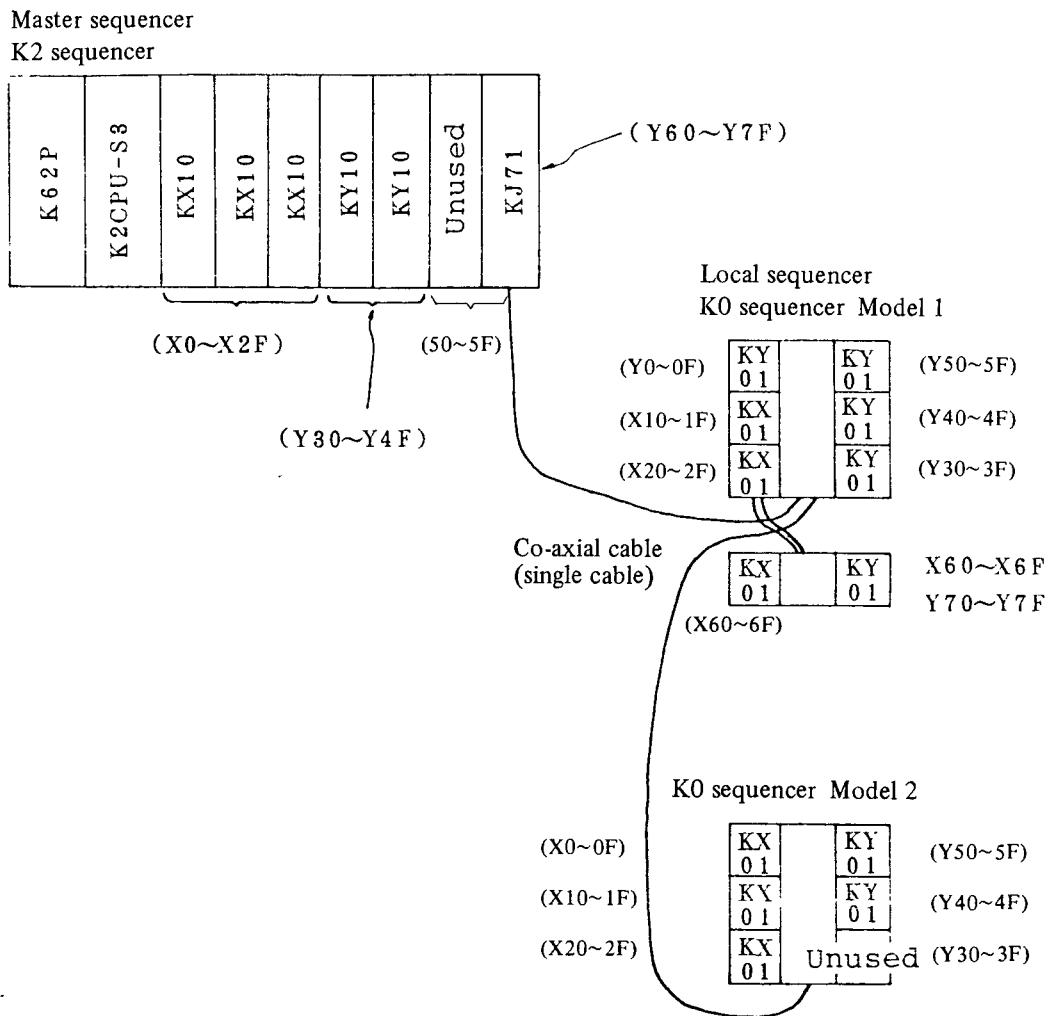


Fig. 4-9 Typical configuration

(1) Input/output numbers of each sequencer

- Numbers are taken as within parentheses in the above figure.
- Exactly the same as in case of the discrete sequencer.

(2) Data link area allotment

- Designation of allotment to local sequencers of data link area in Section 5-4-2 (5). The following figure shows that how many number of points the local sequencers can use respectively is designated by the K2 sequencer program.

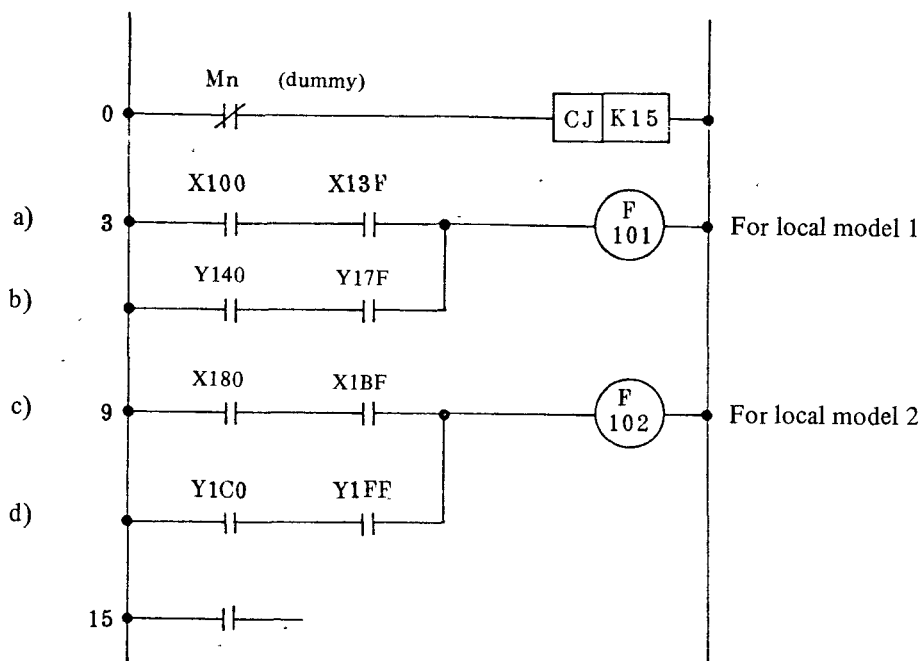


Fig. 4-10 Initial program

Note 1) The above figure shows an instance where 128 points each of the total 256 points are used by model 1 and model 2.

- a) Local model 1 ----> Master
 Y100 ~ Y13F ----> X100 ~ X13F
- b) Local model 1 ----> Master
 Y140 ~ Y17F ----> X140 ~ X17F
- c) Local model 2 Master
 X180 ~ X1BF <---- Y180 ~ Y1BF
- d) Local model 2 <---- Master
 X1C0 ~ X1FF <---- Y1C0 ~ Y1FF

As shown in the above figure, Y is used by the transmission side and X by the reception side. The numbers in the figure are designated by the X and Y numbers of the master side.

The coil commands (OUT, SET, etc.) are used by the transmission side; the contact commands (LD, OR, AND, etc.) are used by the transmission side.

The above figure shows the same format as in Section 5-2-3 (2) but it should be borne in mind that the link head I/O number must be (00 or behind).

4-5. Distributed Control System Based on K2 CPU and K2 CPUs (System 5)

4-5-1. Configuration

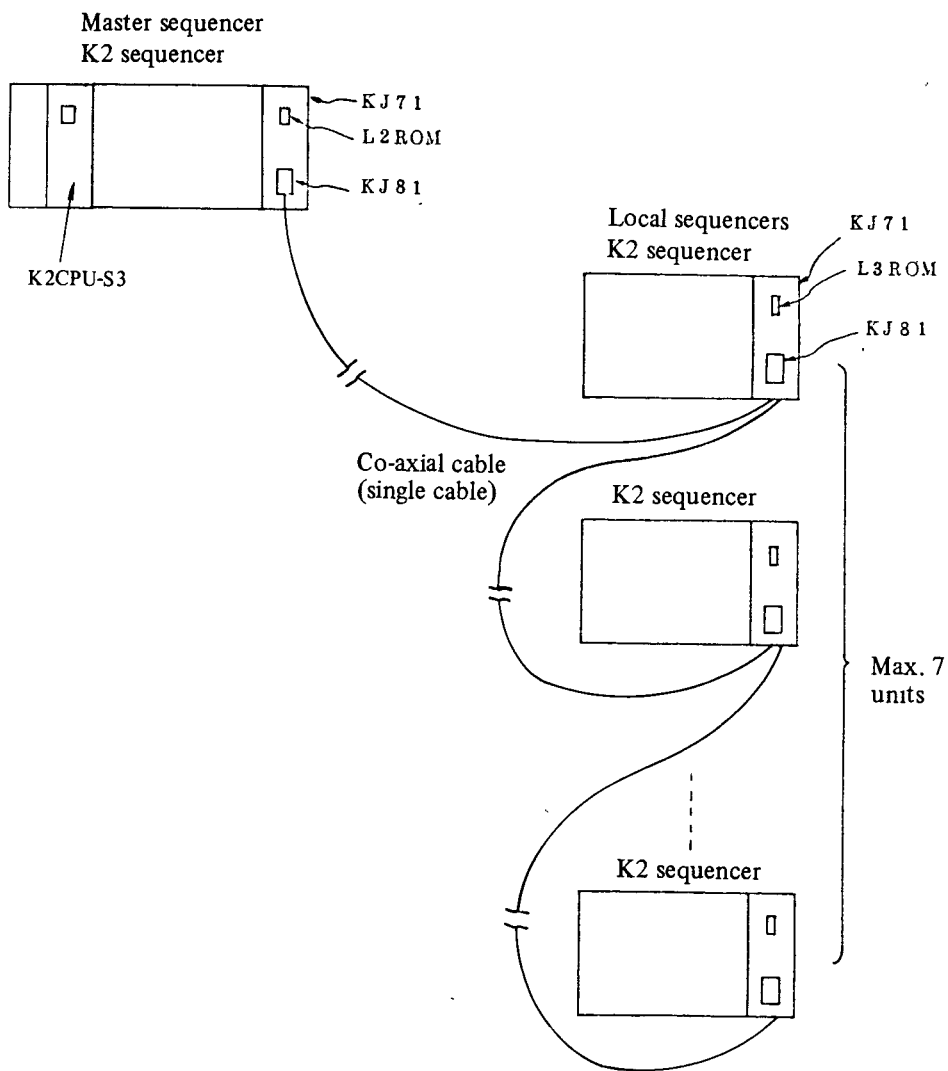


Fig. 4-14 Distributed control system based on K2-K2

4-5-2. Specifications

(1) K2 sequencer (both master and local) specifications

- Number of input/output points : Max. 224
- Other specifications are the same as with the discrete K2

(2) Total number of input/output points : Max. $224 \times 8 = 1,792$

(3) Other specifications are the same as in Section 5-4-2.

Note) Program method is the same as in section 5-4-3.

4-6. Computer Link system

4-6-1. Configuration

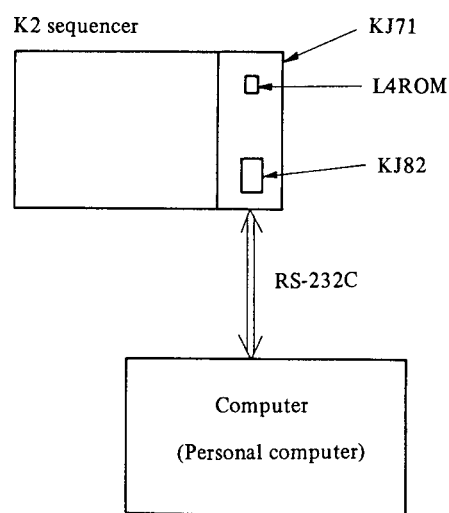


Fig. 4-12. Computer link system

4-6-2. Specifications

(1) Interface H/W specifications

- Conformity with EIA RS-232C
- Transmission speed: 1200, 2400, 4800, 9600 bps (selectable)

(2) Interface S/W specifications

-
- Transmission sequence (protocol): Special protocol
- Transmissino system: Start-stop sync system
- Data format

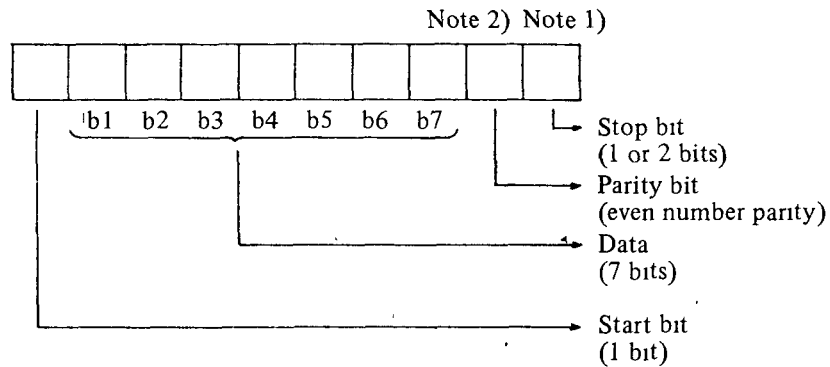


Fig. 4-13. Data format

Note 1) 1 or 2 bits for the stop bit can be selected.

Note 2) The presence or absence of the parity bit can be selected.

(3) Sequencer side data which can be read, written by computer

- The sequencer X, Y, M, T, C, F and D data can all be read and written. However, the program memory data cannot be read and written.

Note) Reading and writing are possible during sequencer runs.

* For details, refer to Computer Link Specifications Sheet BCN-85007.

4-7. Expansion of I/O Points

It has already been mentioned in Sections 4-4 and 4-5 that the maximum number of K2 sequencer input/output points in the distributed control systems is 224. This is a recommendation for making the program easier to understand by using 100 ~ 1FF as the data link I/O numbers.

Therefore, if the number of data link points is reduced, it is possible to increase the number of K2 sequencer input/output points even more.

Example) When using X180 ~ 1BF, Y100 ~ 1FF for linking

Number of K2 sequencer input/output points : Max. 352

5. DATA LINK PROGRAMMING METHODS BASED ON DISTRIBUTED CONTROL SYSTEMS

As mentioned in Section 4-4-2 (5), 128-point data links are possible between the master and local sequencers and vice versa in the K2/K0 and K2/K2 distributed control systems described in Sections 4-4 and 4-5, respectively. This section describes methods which use the data register and function commands F120 ~ F124 for data linking to increase more on a larger scale.

5-1. Special Registers for Data Link

- (1) D120 : For local sequencer model number (local number) designation.
- (2) D121 : For transmission/reception register (D0 ~ D95) head register number designation.
- (3) D122 : For transmission/reception register length designation.

Examples) When using D10 ~ D29 and local sequencer model 2 for data transmission

- D120 ←---- 2 : Model 2
- D121 ←---- 10 : D10 at the head
- D122 ←---- 20 : D10 ~ D29, 20 registers

5-2. Function Commands for Data Link

- (1) F120 : M (master) ----> L (local) Transmission data M side write command
- (2) F121 : M ----> L Transmission data L side read command
- (3) F122 : Data transmission request command from M to L
- (4) F123 : L ----> M Transmission data L side write command
- (5) F124 : L ----> M Transmission data M side read command

Note) The initiative for data transmission/reception between M and L and vice versa lies at the M side. Consequently, the (4) F123 command is executed after the transmission request has been received.

5-3. Data Transmission Program Method from Master to Local

5-3-1. Master (M) side program

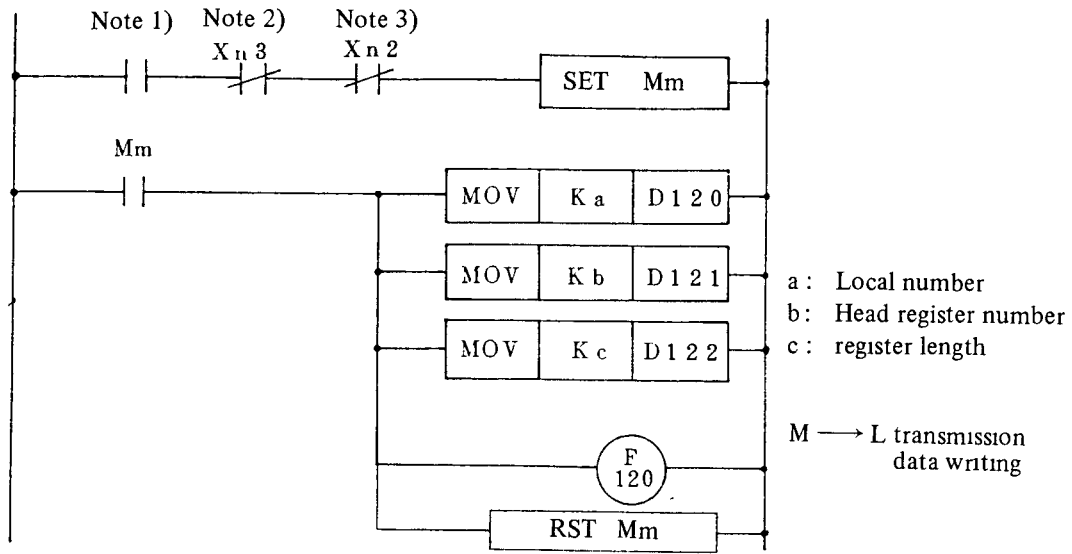


Fig. 5-1 Master side program

5-3-2. Local (L) side program

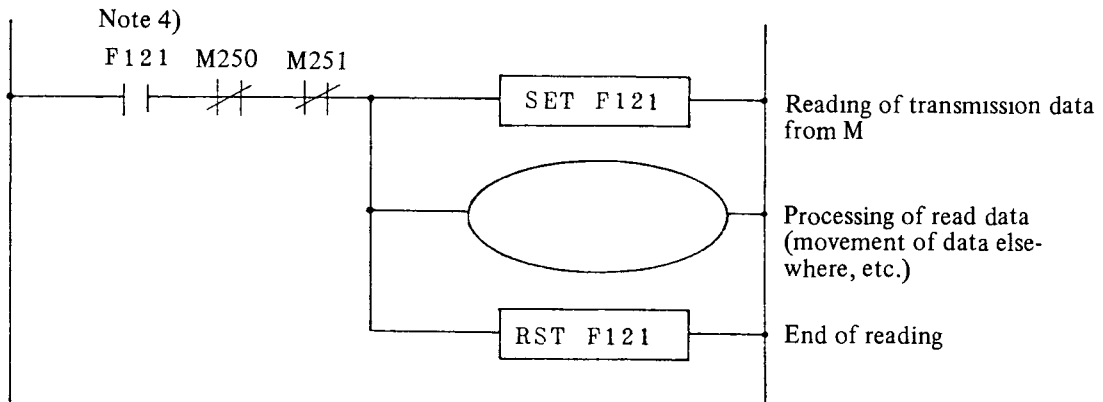


Fig. 5-2 Local side program

Note 1) M → L transmission start signal

Note 2) X_{n3} : L → M data being received

Note 3) X_{n2} : M → L data being transmitted

Data transmission is interlocked here.

Note 4) Contact which indicates that data have been sent from M to L

Note 5) n : KJ71 insertion slot number

Note 6) m : Any number between M0 and M249

Note 7) Obviously, it is necessary to preset the data to be transmitted into Db ~ Db + c - 1.

5-4. Data Transmission Program Method from Local to Master

The transmission of data from local to master takes a form which responds to the data transmission request from the M side.

It is not possible to arbitrarily transmit data from local to master.

5-4-1. Master (M) side program

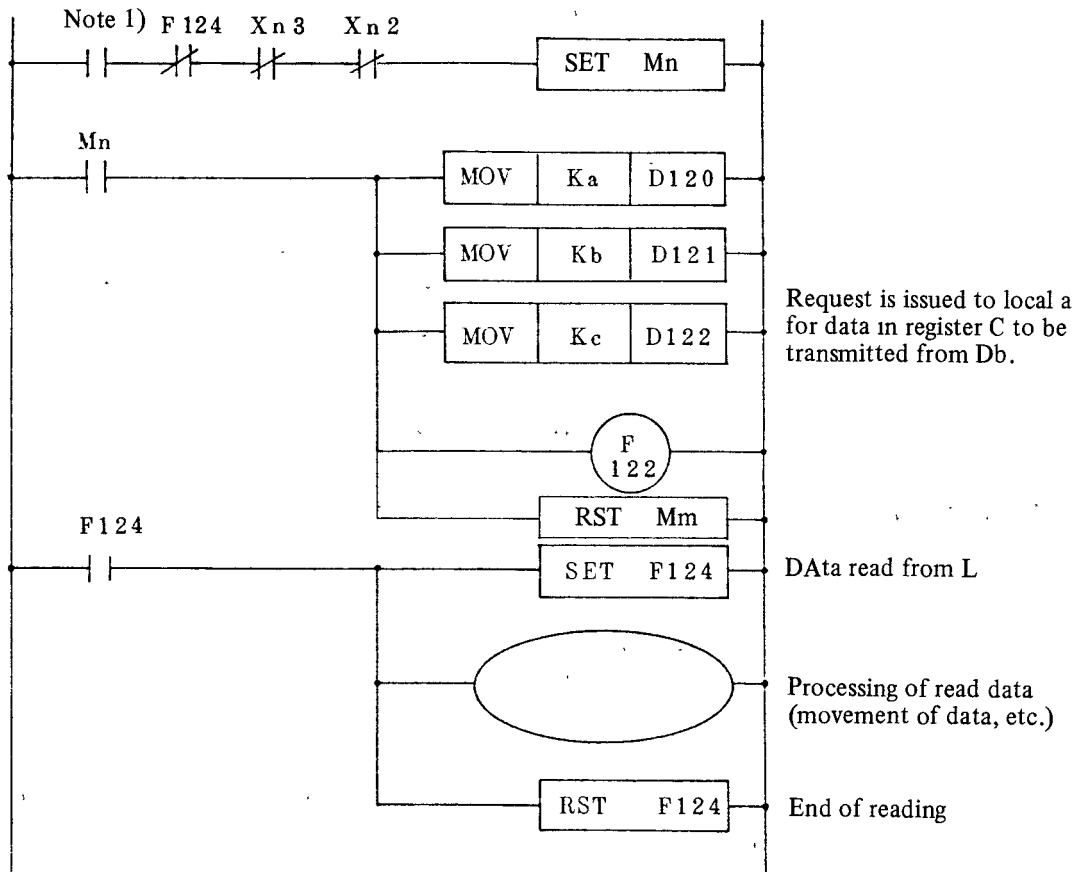


Fig. 5-3 Master side program

5-4-2. Local (L) side program

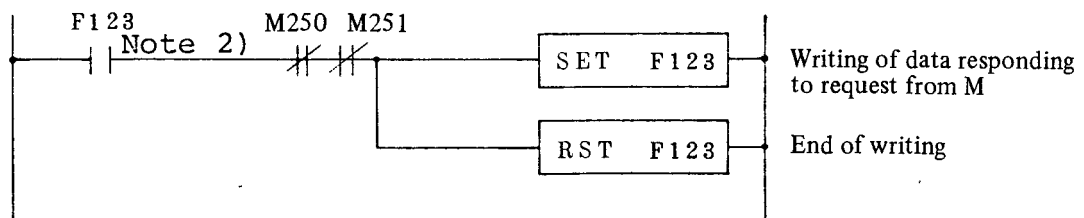


Fig. 5-4 Local side program

Note 1) Start contact for data request to local.

Note 2) Contact which indicates that there had been a request for data transmission from M.

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