MELSEC-K SERIES PROGRAMMABLE CONTROLLERS

A-K LINK MODULE

TYPE KJ71P23/R23

MITSUBISHI ELECTRIC

CONTENTS

1. INTRODUCTION

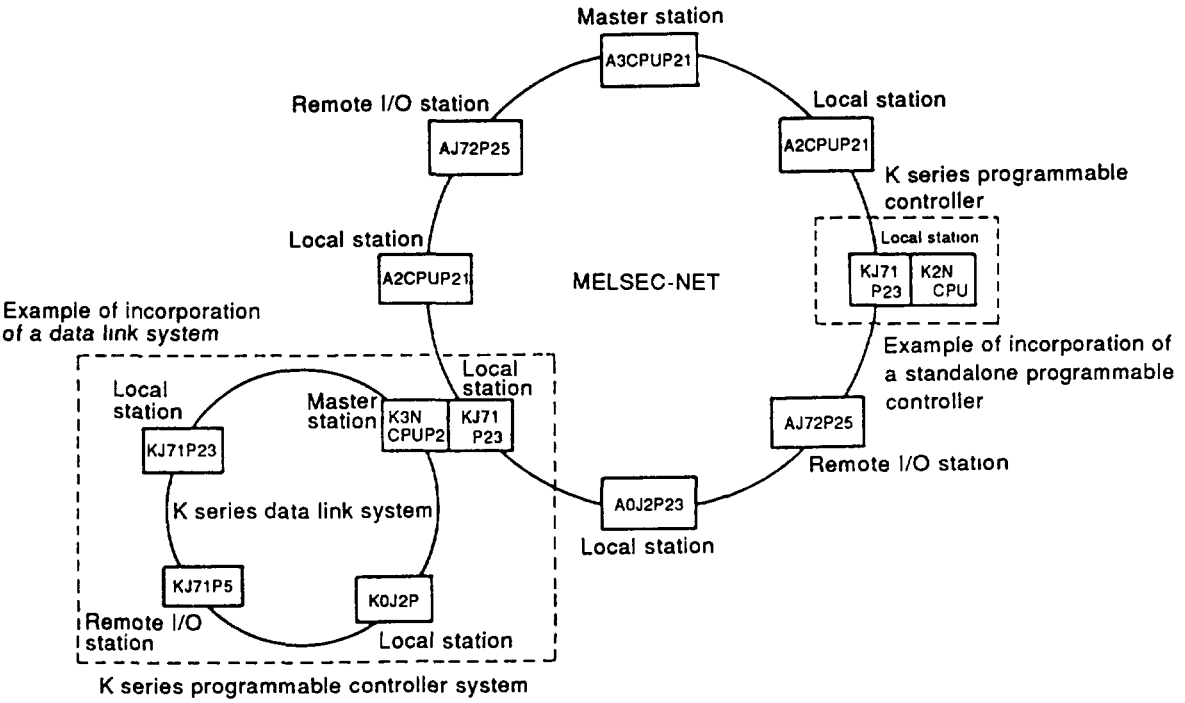
This manual describes the specifications, handling, and programming methods for the type KJ71P23/R23 A-K link module (hereafter called the KJ71P23/R23) used when incorporating a K series programmable controller into a MELSEC-NET data link system.
For details on the MELSEC-NET data link, refer to the following manual:

Data Link Module User's Manual

The KJ71P23/R23 is a module that contains the interface required to incorporate a K series programmable controller (hereafter called a "KCPU") into a MELSEC-NET system as a local station.
The following KCPUs can be used with a KJ71P23/R23:

K2NCPU
K2HCPU
K2CPU-S3
K3NCPU
K3NCPUP2

The examples presented below show how a K series programmable controller that is currently used as a standalone module, and a K series data link system, can be incorporated into a MELSEC-NET data link system.



Use of a KJ71P23/R23 allows the following types of data exchange between the master station of the MELSEC-NET system and the KCPU.
(Direct communication between the KCPU and another local station is not possible.)

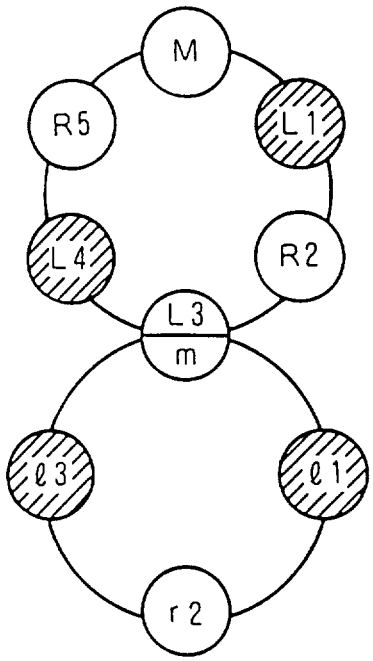
(1) Exchange of ON/OFF information by means of inputs (X) and outputs (Y).
(2) Exchange of 16-bit data between the link registers (W) of the master station and the data registers (D) of the KCPU.

2. SYSTEM CONFIGURATION

This section describes the configuration of data link systems that incorporate a KJ71P23/R23.

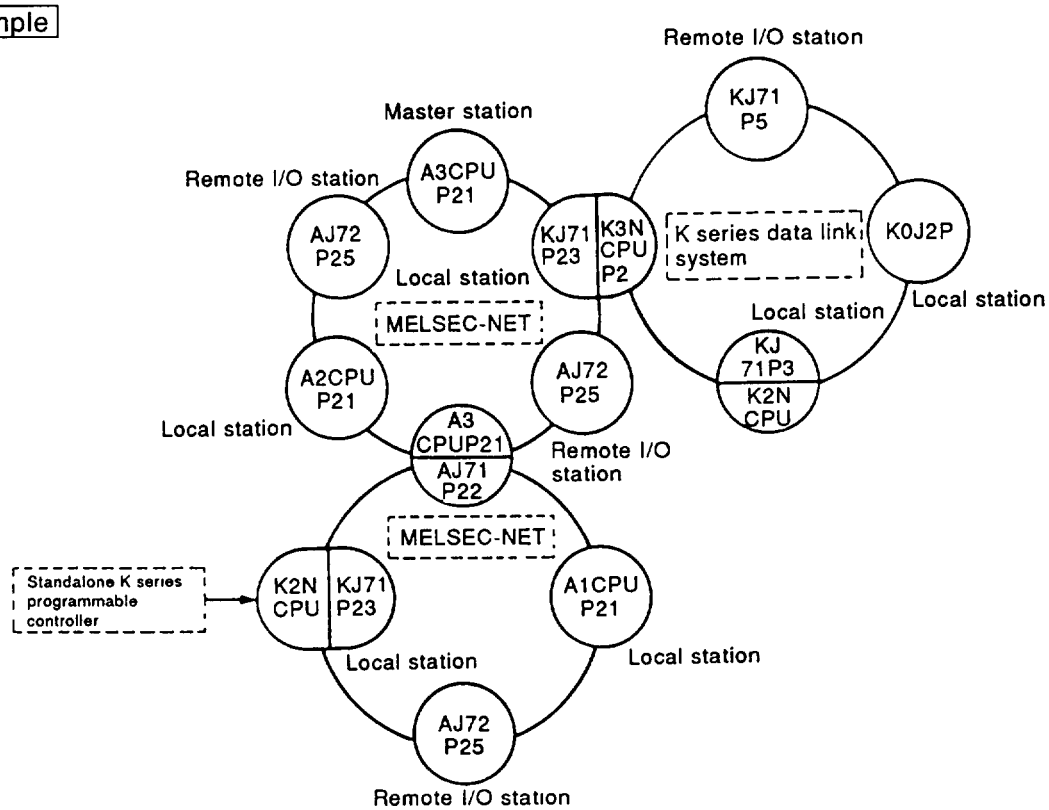
2.1 Overall Configuration

Using a KJ71P23/R23 in combination with a K series programmable controller CPU allows the K series programmable controller to be used as a local station in a MELSEC-NET network, as shown below.



A K series programmable controller system can be used at the local station positions indicated thus: ▨.

System Example



2.2 Applicable Systems

The KJ71P23/R23 can only be used in systems in which the following conditions are met.

(1) A KJ71P23/R23 can be used with the following CPU modules:

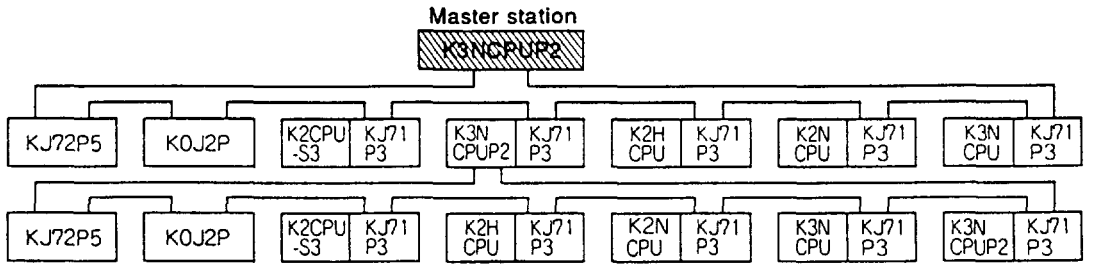
Applicable CPU modules	K2NCPU K2HCPU K2CPU-S3 K3NCPU K3NCPUP2

(2) A KJ71P23/R23 can be installed at any slot other than the 0 slot of a main base unit.
(3) Only one KJ71P23/R23 can be used per programmable controller CPU.
(4) A KJ71P23/R23 can be used in a K system data link system provided that it is installed only at the master station of the system.

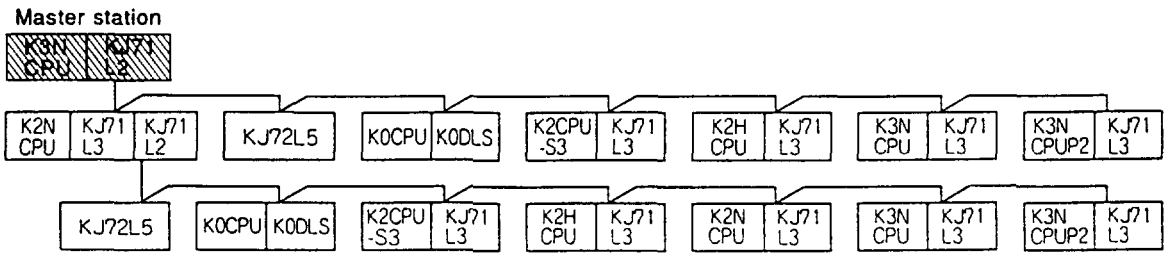
Applicable master station modules	K3NCPUP2 KJ71L2

The KJ71P23/R23 cannot be installed at a local station or remote I/O station. (It cannot be used in combination with a KJ71P3, KJ71L3, KJ72P5 or KJ72L5.)
A KJ71P23/R23 can be installed and used only at the stations indicated thus ▨ in the examples presented below.

Example of KCPU optical data link system



Example of KCPU coaxial data link system

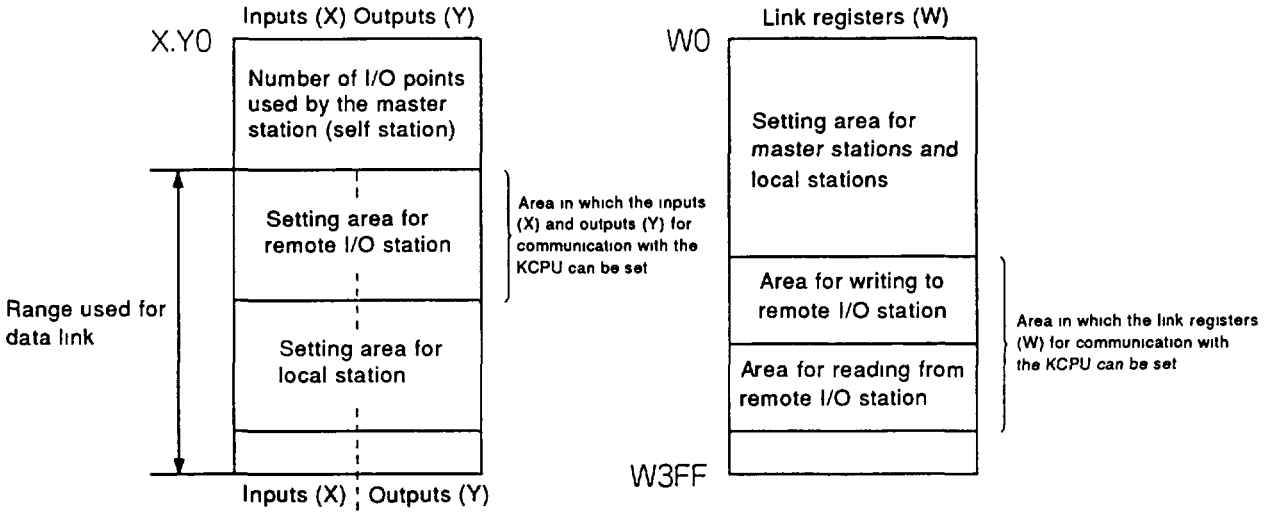


(5) If a KJ71P23/R23 is used with a K2NCPU and installed on a type K55B or K58B extension base unit (with no power supply module), it is important to make sure that the current capacity of the power supply module installed on the main base unit is appropriate.

2.3 Cautions on Connection to MELSEC-NET

This section lists the cautions that should be observed when connecting a K series programmable controller to a MELSEC-NET data link system.

(1) In order to enable communication with the KCPU, devices for communication with the KCPU must be allocated in the master station (ACPU) of the MELSEC-NET data link system.
The allocation should be made for a remote I/O station in the link parameters of the master station (ACPU). (For details, see Sections 6.1 and 6.2).



(2) Only one KJ71P23/R23 can be used per programmable controller CPU. In addition, a KJ71P23/R23 cannot be used in conjunction with the following modules:
Type KJ71P3 data link module (for local station use) connected by fiber-optic cable
Type KJ71L3 data link module (for local station use) connected by coaxial cable

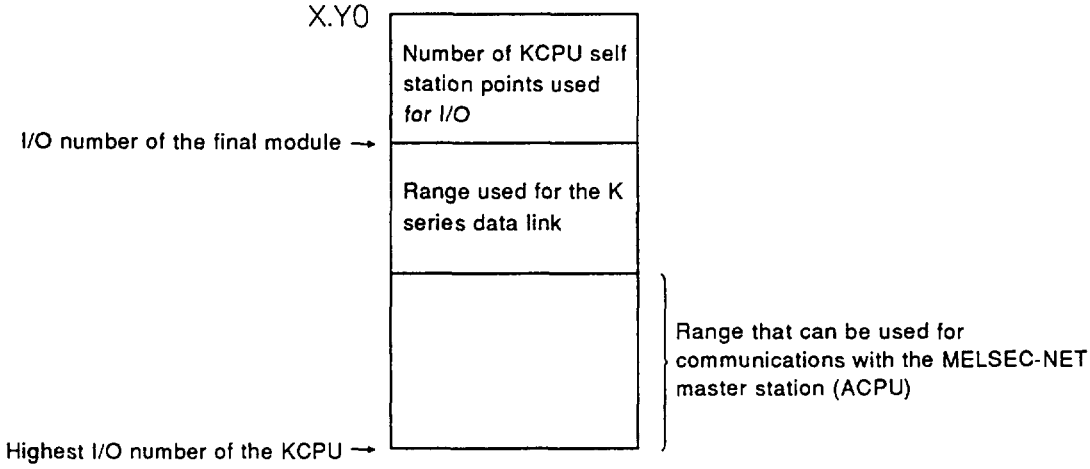
(3) When installing a KJ71P23/R23, ensure that the current capacity of the power supply module is appropriate.
The current consumption of the KJ71P23/R23 modules is indicated below.
KJ71P23.....0.8 A (5 VDC)
KJ71R23.....1.2 A (5 VDC)

(4) The specifications of the data link cable for use in MELSEC-NET data link systems and the data link cable used for K series data links are different. Be sure to use the correct cables for each application.

(5) When installing a KJ71P23/R23, remember that its occupying number of inputs/outputs is 32 points.
If a KJ71P23/R23 is installed in a vacant slot, or as a replacement for a module whose occupying number of inputs/outputs is other than 32 points, the device numbers of the inputs (X) and outputs (Y) used in the sequence program will be shifted.

(6) When a KCPU is used as a local station in a MELSEC-NET data link system, the range of inputs (X) and outputs (Y) that can be used for the data link at the KCPU side is defined by the following conditions: (For more details, see Section 6.1.)

- Points no lower than the I/O number for the final module installed at the self station.
- Points no higher than the highest I/O number in the self stations's CPU.
- Points outside the range used for the K series data link.



Make sure that the link inputs (X) and link outputs (Y) used by MELSEC-NET local stations do not overlap the I/O numbers of module installation points, or the I/O numbers used for the K series data link.

(7) The KCPU data registers that can be used for link register (W) communications are those in the range D0 to D95.
Set these so that there is no overlap with the device numbers used for ordinary data registers (D). (For details, see Section 6.2.)

(8) To execute link register (W) communications, a refresh program must be written into the sequence program of the KCPU. (For details, see Section 7.3.)

3. SPECIFICATIONS

This section describes the performance specifications for the KJ71P23/R23 and the processing time for data communications in a MELSEC-NET data link system.

3.1 Performance Specifications

The performance specifications for the KJ71P23/R23 are tabled below.

		Fiber-Optic Cable Data Link	Coaxial Cable Data Link
		KJ71P23	KJ71R23
Max. number of link points used per station	Input (X)	When using K2NCPU, K2HCPU, K2CPU-S3	When using K3NCPU, K3NCPUP2
		480 points within the range X0 to X1FF	512 points within the range X0 to X7FF
	Output (Y)	When using K2NCPU, K2HCPU, K2CPU-S3	When using K3NCPU, K3NCPUP2
		480 points within the range Y0 to Y1FF	512 points within the range Y0 to Y7FF
	Data registers (D)	96 points (D0 to D95)	
Max. number of link points used in one station		$\frac{X\text{ (points)} + Y\text{ (points)}}{8} + 2 \times D\text{ (points)} \leq 512$ bytes	
Occupying number of inputs/outputs		32 points	
Current consumption (5 VDC)		0.8 A	1.2 A
System's allowable momentary power failure time		Within 20 msec.	
Communication speed		1.25 mbps	
Communication method		Half-duplex bit serial	
Synchronous method		Frame synchronous	
Transmission path method		Duplex loop	
Overall loop distance		Max. 10 km (1 km between stations)	Max. 10 km (500 m between stations)
Modulation method		CMI	
Transmission format		Conforms to HDLC (frame method)	
Error control system		Retry due to CRC (generating polynomial $X^{16} + X^{12} + X^5 + 1$) and time over	
RAS function		The loopback function checks error detection and cable breakage. The diagnostic function checks the self link line.	
Connector		Two-core optical plug (CA9003)	BNC-P-5, BNC-P-3-Ni(DDK) equivalent
		(Same as the connector used for MELSEC-NET)	
Cable used		SI-200/250	3C-2V, 5C-2V equivalent
		(Same as the cable used for MELSEC-NET (for details, refer to the Data Link Module User's Manual))	
Weight kg (lb)		0.8 (1.76)	

3.2 Link Processing Time

The formulae for determining the maximum transmission delay when data is transmitted from the master station of the MELSEC-NET to the KCPU or when data is transmitted from the KCPU to the master station are tabled below.

			M > LS	M < LS
X/Y	Synchronous processing	Master station → KCPU (Y) (X)	$M + LS + L + \alpha_1 + \alpha_2 + \alpha_D + (2 \times \alpha_W)$	$(2 \times LS) + L + \alpha_1 + \alpha_2 + \alpha_D + (2 \times \alpha_W)$
		KCPU → master station (Y) (X)	[When using K2CPU-S3, K2NCPU] $(3 \times M) + L + (2 \times \alpha_1) + \alpha_2 + (2 \times \alpha_D) + \alpha_W$ [When using K2HCPU, K3NCPU] $(3 \times M) + 2 (L + \alpha_1 + \alpha_2 + \alpha_D) + \alpha_W$	[When using K2CPU-S3, K2NCPU] $M + (2 \times LS) + L + (2 \times \alpha_1) + \alpha_2 + (2 \times \alpha_D) + \alpha_W$ [When using K2HCPU, K3NCPU] $M + 2 (LS + L + \alpha_1 + \alpha_2 + \alpha_D) + \alpha_W$
	Non-synchronous processing	Master station → KCPU (Y) (X)	$M + LS + (2 \times L) + \alpha_1 + \alpha_2$	$2 (LS + L) + \alpha_1 + \alpha_2$
		KCPU → master station (Y) (X)	[When using K2CPU-S3, K2NCPU] $(3 \times M) + L + (2 \times \alpha_1) + \alpha_2$ [When using K2HCPU, K3NCPU] $(3 \times M) + 2 (L + \alpha_1 + \alpha_2)$	[When using K2CPU-S3, K2NCPU] $M + (2 \times LS) + L + (2 \times \alpha_1) + \alpha_2$ [When using K2HCPU, K3NCPU] $M + 2 (LS + L + \alpha_1 + \alpha_2)$
W/D	Master station → KCPU (W) (D)		$M + LS + L + \alpha_1 + \alpha_2 + \alpha_D + (2 \times \alpha_W)$	$(2 \times LS) + L + \alpha_1 + \alpha_2 + \alpha_D + (2 \times \alpha_W)$
	KCPU → master station (D) (W)		$(3 \times M) + L + (2 \times \alpha_1) + \alpha_2 + (2 \times \alpha_D) + \alpha_W$	$M + (2 \times LS) + L + (2 \times \alpha_1) + \alpha_2 + (2 \times \alpha_D) + \alpha_W$

M: Scan time for MELSEC-NET master station (ACPU) sequence program
α_1: Link refresh time for MELSEC-NET master station (ACPU)
LS: Link scan time
L: KCPU sequence program scan time

For details, refer to the Data Link Module User's Manual.

α_2: Refresh time for KCPU inputs (X) and outputs (Y)

$$\alpha_2 = 0.2 + 0.2 \times \frac{X + Y}{8} \text{ [msec]}$$

X: Number of input points (X) that the KCPU uses for the data link
Y: Number of output points (Y) that the KCPU uses for the data link

α_D: Refresh time for data registers (D) sent from the KCPU to the master station

1) When a K2CPU is used

$$\alpha_D = (L + \alpha_2) \times \left(\frac{n_{DW}}{\underline{\text{Number of points refreshed at one time}}} \times 2 - 1 \right) + \alpha_3$$
$$\text{Decimal fractions rounded up}$$

n_{DW} : Number of data register points (D) written to the master station

$$\alpha_3 : 7 \times \frac{n_{DW}}{\underline{\text{Number of points refreshed at one time}}} + 0.21 \times n_{DW} \times 2$$
$$\text{Decimal fractions rounded up}$$

2) When a K3NCPU is used

$$\alpha_D = (L + \alpha_2) \times \left(\frac{n_{DW}}{\underline{\text{Number of points refreshed at one time}}} \times 2 \right) + \alpha_3$$
$$\text{Decimal fractions rounded up}$$

αw: Refresh time for data registers (D) whose data is received by the KCPU from the master station

$$\alpha w = (L + \alpha 2) \times \left(\frac{n_{WD}}{\underline{\text{Number of points refreshed at one time}}} \times 2 - 1 \right) + \alpha 4$$
$$\text{Decimal fractions rounded up}$$

n_{WD} : Number of data register (D) points read from the master station

$$\alpha 4 : 7 \times \frac{n_{WD}}{\underline{\text{Number of points refreshed at one time}}} + 0.21 \times n_{WD} \times 2$$
$$\text{Decimal fractions rounded up}$$

3.3 Function List

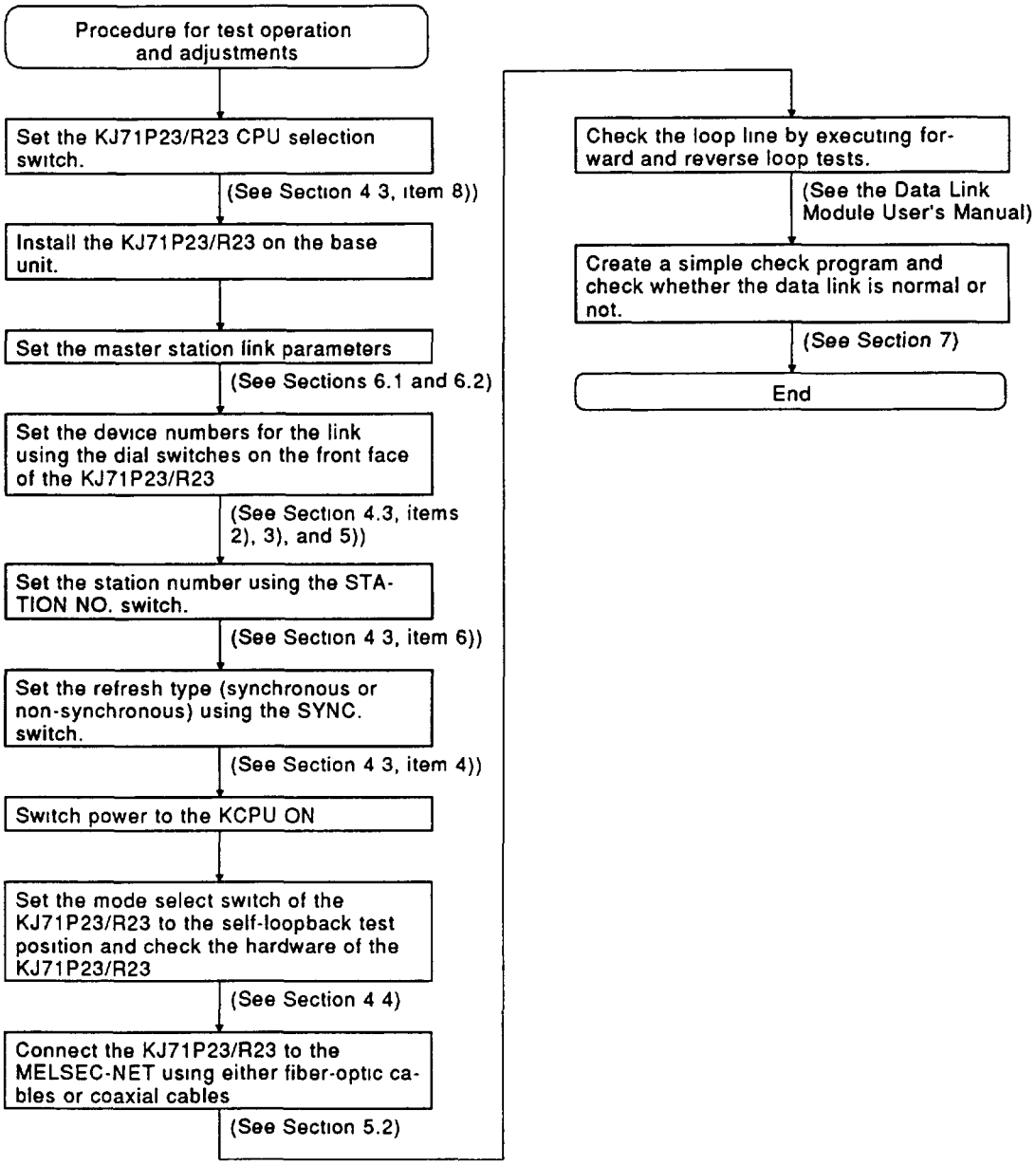
The functions of the KJ71P23/R23 are tabled below.

Function	Description
Data link for inputs (X) and outputs (Y)	• Used for ON/OFF data communications with the master station • The maximum number of link points is 512, both for inputs (X) and for outputs (Y) • The smallest unit of division is 16 points (□□0 to □□F)
Data link for link registers (W)	• 16-bit data communication is executed between the link registers (W) of the master station and the data registers (D) of the KCPU. • The maximum number of link points is 96. • The smallest unit of division is 1 point.
Selection of the number of refresh points for link registers (W)	• The number of link register (W) points that are refreshed in one scan of the KCPU's sequence program can be selected from the following choices: { 12 points 24 points 36 points 48 points (The selection is made using the DIP switches on the front face of the KJ71P23/R23.)
Input (X)/output (Y) refresh selection	• It is possible to select whether link refresh of the link inputs (X) and link outputs (Y) is synchronous or non-synchronous with link refresh of the link registers (W). (This setting is made using the DIP switches on the front face of the KJ71P23/R23.)
Communication with the master station using a peripheral device	• Connecting a peripheral device (A6GPP, A6PHP, A6HGP) to the KJ71P23/R23 allows up/downloading, monitoring, and testing of the master station's sequence program.
Diagnosis function	• Various tests, a hardware check, and a loop line check, can be executed by setting the mode select switch.

4. SETTINGS AND PROCEDURES BEFORE OPERATION

This section describes the settings that must be made and the procedure to be followed in preparation for operating a KJ71P23/R23 incorporated into a system.

4.1 Procedure for Test Operation and Adjustments



4.2 Handling Precautions

This section lists the precautions that should be taken when handling a KJ71P23/R23 (as an independent unit).

(1) Since its case is made of resin, the module should not be dropped or subjected to harsh shocks.

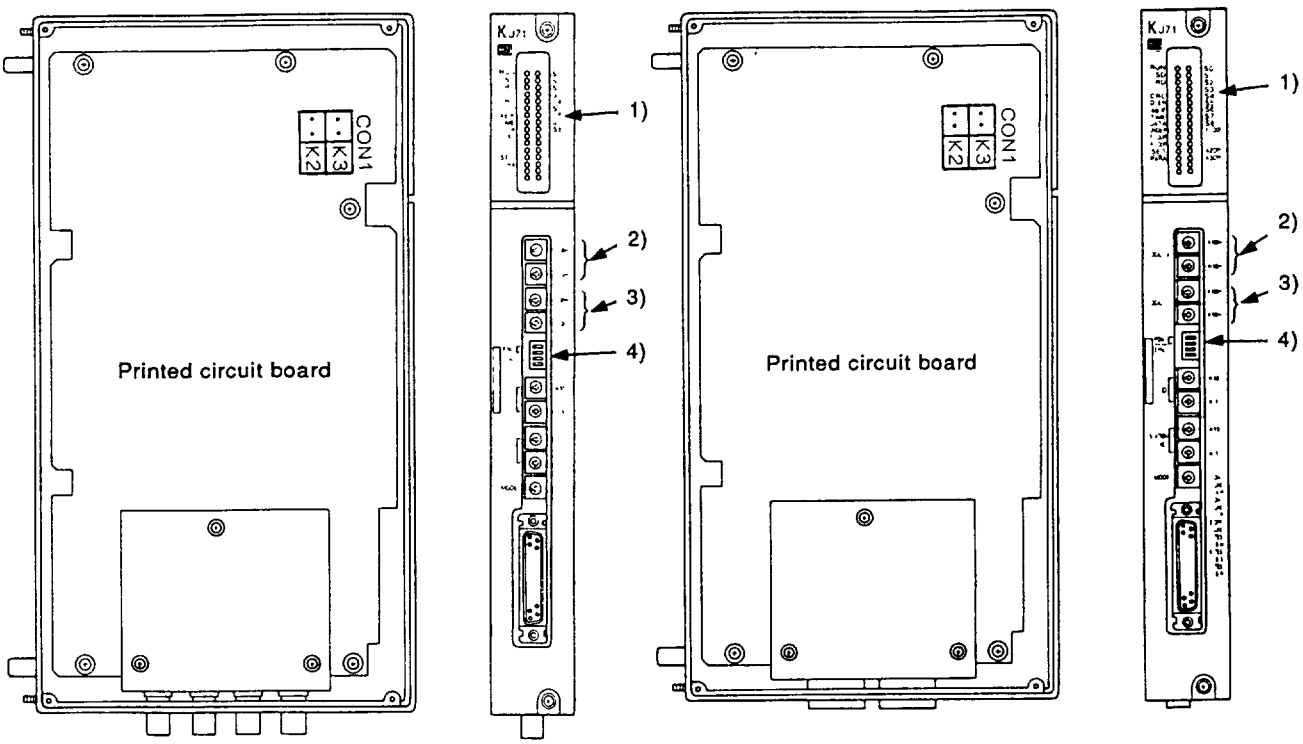
(2) Do not remove the printed circuit board from the case. This can cause faults.

(3) During wiring, ensure that no debris such as wire off-cuts enters the top of the module.
If anything does enter the module, remove it.

(4) Make sure that the tightening torque of the module's fixing screws is within the range indicated below:
Tightening torque: 8 to 12 [kg·cm]

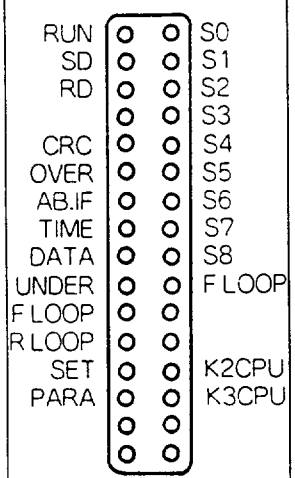
(5) Do not touch the cores of fiber-optic cables or the light-emitting parts of connectors, and ensure that no contaminants become stuck to these parts.
Contamination can cause major loss of transmitted data or make communications impossible.
If these parts have been touched or there are contaminants adhering to them, remove the contamination with a soft cloth.

4.3 Names of Parts



KJ71R23 KJ71P23

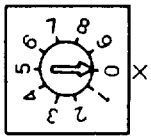
1)

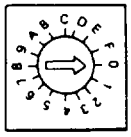


LED	Function	LED	Function
RUN	Lit when KJ71P23/R23 is normal.	S0	Not used (Flashing during data link does not indicate abnormality.)
SD	Lit during data send.	S1	
RD	Lit during data receive.	S2	
	Not used (always unlit)	S3	
CRC	Lit when code check error occurs.	S4	
OVER	Lit when data fetch delay error occurs.	S5	
AB.IF	Lit when all data are "1".	S6	
TIME	Lit when time over occurs.	S7	
DATA	Lit when receive data error occurs.	S8	
UNDER	Lit when send data error occurs.	F.LOOP	Lit when data receive line is forward loop, and unlit when it is reverse loop.
F.LOOP	Lit when forward loop receive error occurs.		Not used (always unlit)
R.LOOP	Lit when reverse loop receive error occurs.		Not used (always unlit)
SET	Lit when device number setting in KJ71P23/R23 exceeds specified range.	K2CPU	Lit according to CPU select switch 8) setting.
PA·RA	Lit when link parameter mismatch occurs.	K3CPU	
	Not used (always unlit)		Not used (always unlit)
	Not used (always unlit)		Not used (always unlit)

For the details of "CRC" to "PARA" LEDs, refer to Section 8.3.

2) LOCAL · X





Link input (X) device number setting switches

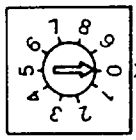
- Used to set the head device number of the link input (X) used with KCPU. (Refer to Section 6.1 for details.)
- Setting can be made within the following ranges.

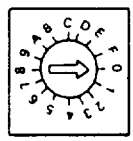
K2NCPU K2CPU-S3 K2HCPU	X000 to X1FF
K3NCPU K3NCPUP2	X000 to X7FF

- Set the 100s digit and the 10s digit of the device number. The 1s digit is automatically set to "0".

X□□0
- 10s digit: Set with the X10H switch.
- 100s digit: Set with the X100H switch.

3) LOCAL Y





Link output (Y) device number setting switches

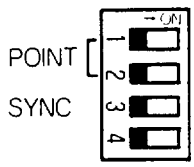
- Used to set the head device number of the link output (Y) used with KCPU. (Refer to Section 6.1 for details.)
- Setting can be made within the following ranges.

K2NCPU K2CPU-S3 K2HCPU	Y000 to Y1FF
K3NCPU K3NCPUP2	Y000 to Y7FF

- Set the 100s digit and the 10s digit of the device number. The 1s digit is automatically set to "0".

Y□□0
- 10s digit: Set with the X10H switch.
- 100s digit: Set with the X100H switch.

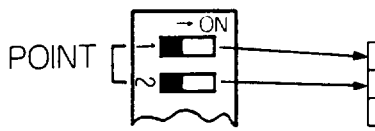
4)



Refresh points / refresh type select switches

(1) Refresh points select switch

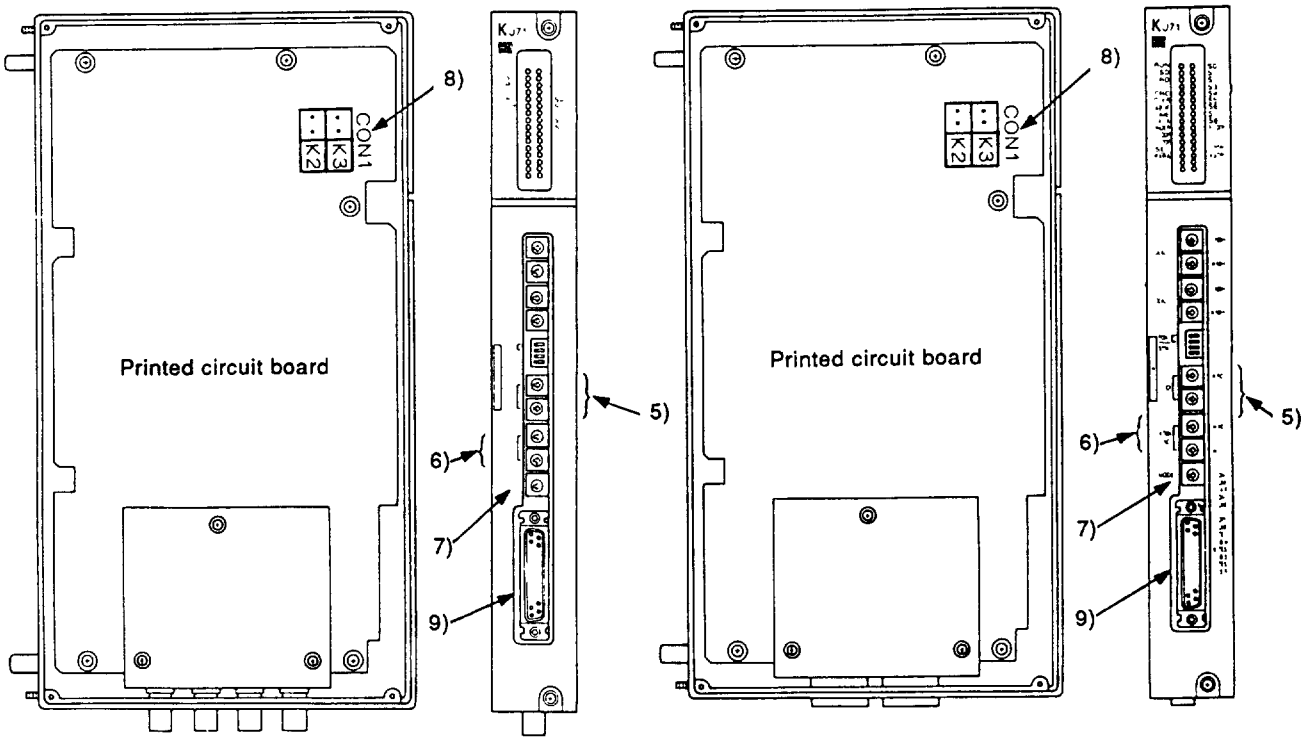
- Used to set the number of points of link register (W) to be refreshed per scan of KCPU. (Refer to Section 6.3.1 for details.)
- Setting can be made by the "POINT" switch ON/OFF positions as follows.



OFF	OFF	ON	ON
OFF	ON	OFF	ON
12 points	24 points	36 points	48 points

(2) Refresh type select switch

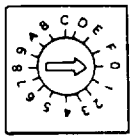
- Used to set whether or not the link refresh of the link input (X) and output (Y) is synchronized with the refresh of link register (W). (Refer to Section 6.3 for details.)
- Setting can be made by the "SYNC" switch ON/OFF positions as follows.



KJ71R23 KJ71P23

5)	D	**Data link data register device number setting switches** • Used to set the head device number of the data register (D) used for communications with the link register (W) in the master station. (Refer to Section 6.2 for details.) • Available setting range: D0 to D95 • Set the 10s digit and the 1s digit of the device number. D□□ 1s digit: Set with the X1 switch. 10s digit: Set with the X10 switch.
6)	STATION NO. ×10 ×1	**Station number setting switches** • Used to set the station number for the host station. • Available setting range: 0 to 64 • Set the 10s digit and the 1s digit of the station number. Station □□ 1s digit: Set with the X1 switch. 10s digit: Set with the X10 switch.

7)

MODE 

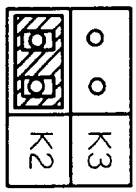
Mode select switch

- Used to select mode as given below.

Setting No.	Name	Content
0	Online	To perform regular operation (automatic online return enabled)
1	Online	To perform regular operation (automatic online return disabled)
2	Offline	To set the host station offline
3	—	Not used
4	—	Not used
5	Test mode 3	Station-to-station test mode (master station)
6	Test mode 4	Station-to-station test mode (slave station)
7	Test mode 5	Self-loopback test
8	—	Not used
9	—	Not used
A	—	Unusable
B	—	Unusable
C to F	—	Not used

Refer to Section 4.4 for the test mode.

8)



CPU type select pin

- Used to set the type of the KCPU to which KJ71P23/R23 is installed.
- Setting is made as follows.

K2NCPU
K2CPU-S3
K2HCPU
} Insert the short pin to the "K2" side.

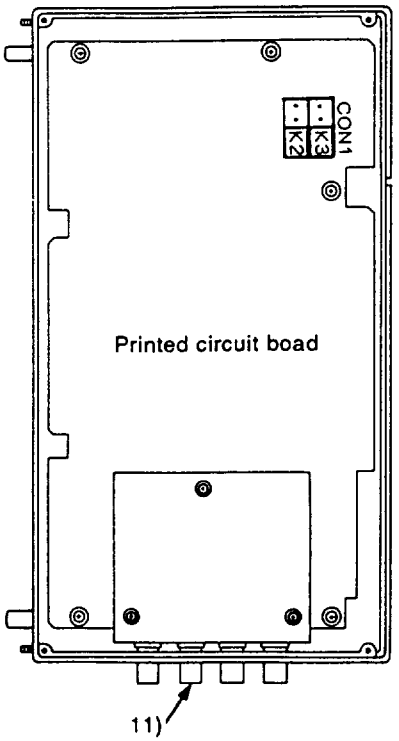
K3NCPU
K3NCPUP2
} Insert the short pin to the "K3" side.

Factory setting is "K2".

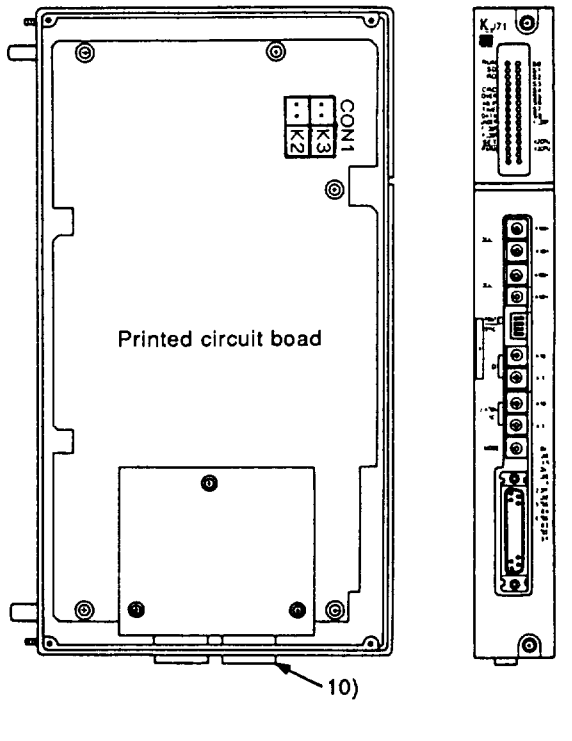
9)

Peripheral device connector

- Used to connect an A6GPP, A6PHP, or A6HGP for performing the link monitor of the host station or up/downloading of the sequence program of the master station.

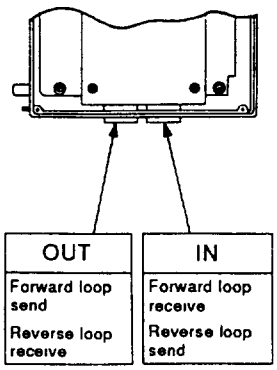


KJ71R23



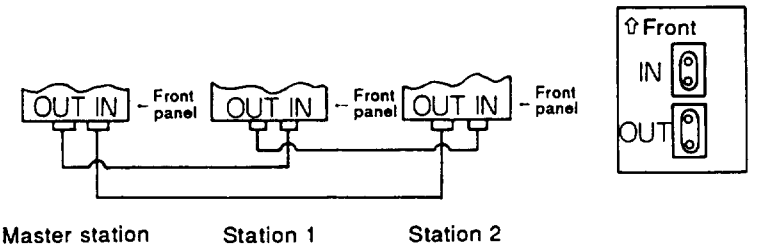
KJ71P23

10)



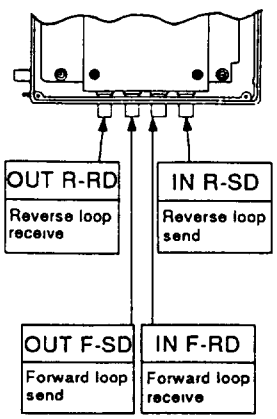
Fiber-optic cable connector (of KJ71P23)

- Connect the cables as shown below.



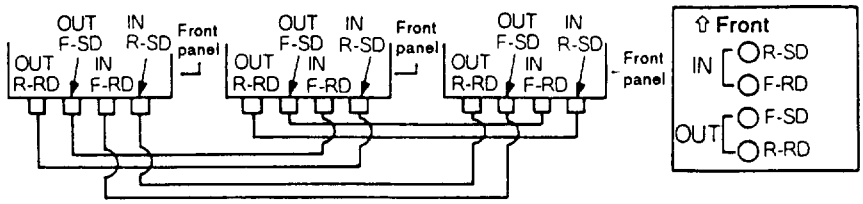
IN Connects to OUT of the previous station.
OUT. Connects to IN of the next station

11)



Coaxial cable connector (KJ71R23)

- Connect the cables as shown below.



IN-R SD Connects to OUT-R RD of the previous station.
IN-F RD · Connects to OUT-F SD of the previous station.
OUT-F.SD : Connects to IN-F.RD of the next station.
OUT-R.RD : Connects to IN-R SD of the next station

4.4 Test Function

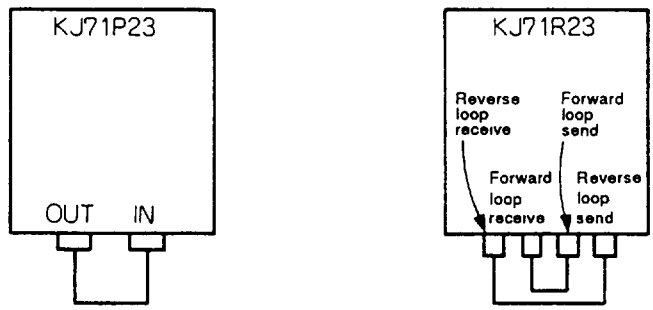
This section describes the test mode operations used for checking hardware of the KJ71P23/R23 and the continuity of the fiber-optic cables or coaxial cables when used with the MELSECNET data link.

4.4.1 Self-loopback test

This test function is used to check hardware of the KJ71P23/R23 including the send and receive circuits of the transmission system by using the KJ71P23/R23 module only.

(1) Description of the test
This test checks whether or not data sent from the forward loop send side is received correctly by the forward loop receive side within specified period of time.
The same checking must be done also in the reverse loop.

(2) Cable connection



(3) Test procedure
1) Set the MODE select switch to "7" (loopback test).
2) Set the RUN/STOP switch of the KCPU to "STOP".
3) Reset the KCPU by using the reset switch.
4) After resetting, the test will start after about 3 seconds.

(4) Test result
The test result is indicated by the LEDs on the front panel of the KJ71P23 /R23.

When normal.....The "CRC", "OVER", "AB.IF", "TIME", "DATA", and "UNDER" LEDs flash in that order.
When abnormal....Corresponding LED lights and the test will be discontinued.
(Refer to Section 8.3 for the details of the LEDs.)
Example) When a forward loop cable is broken, the "F.LOOP", "R.LOOP", and "DATA" LEDs light.

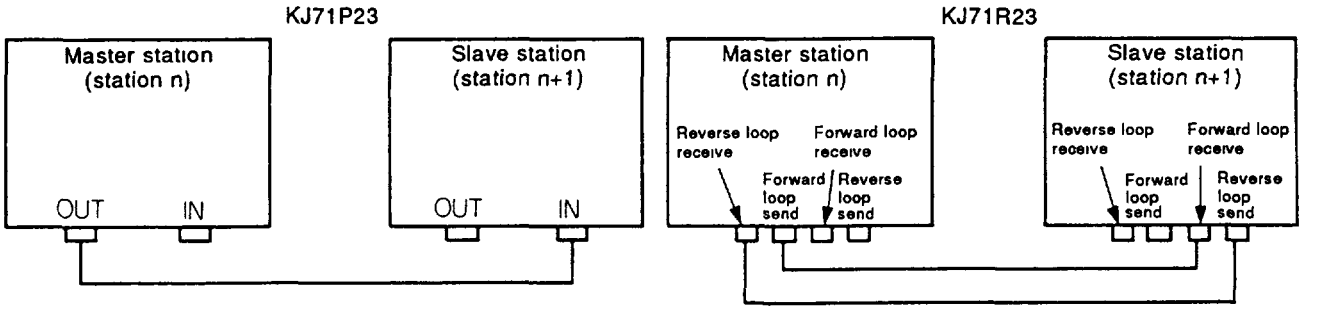
(5) Procedure after the test
1) Set the MODE select switch to "0", "1", or "2".
2) Reset the KCPU with the reset switch.

4.4.2 Station-to-station test

This test function is used to check the line between the KJ71P23/R23 and adjacent station.

(1) Description of the test
In this test, data sent from the forward loop of the master station (station with smaller station number) is received by the slave station (station with larger station number). Then, the data is sent back in the reverse loop to the master station. This test checks whether or not data sent by the master station in the forward loop is sent back in the reverse loop within specified period of time.

(2) Cable connection



(3) Test procedure
1) Set the MODE select switch as follows.
Master station: "5"
Slave station: "6"
2) Set the RUN/STOP switch of the KCPU to "STOP".
3) Reset the KCPU by using the reset switch.
4) After resetting, the test will start after 3 to 5 seconds.

(4) Test result
The test result is indicated by the LEDs on the front panel of the KJ71P23 /R23.

When normal.....The "CRC", "OVER", "AB.IF", "TIME", "DATA", and "UNDER" LEDs flash in that order.
When abnormal....Corresponding LED lights and the test will be discontinued.
(Refer to Section 8.3 for the details of the LEDs.)
Example) When a forward loop cable is broken, the "F.LOOP", "R.LOOP", and "CRC" LEDs light.

(5) Procedure after the test
1) Set the MODE select switch to "0", "1", or "2".
2) Reset the KCPU with the reset switch.

5. LOADING AND INSTALLATION

This section describes the procedures for loading and installing the KJ71P23/R23, and cites relevant precautions, in order to improve the reliability of the system and ensure optimal performance.

5.1 Environment for Installation

The installation environment for the KJ71P23/R23 is the same as that for A series programmable controllers.
When installing a KJ71P23/R23, refer to the User's Manual for A series programmable controllers.

5.2 Connection of Fiber-optic/Coaxial Cables

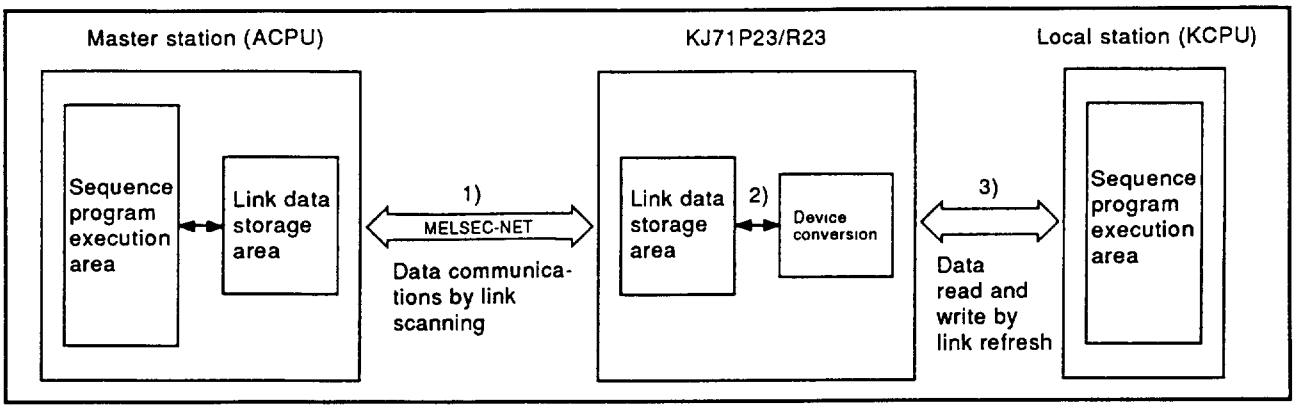
The method for connecting fiber-optic cables and coaxial cables to a KJ71P23/R23 is the same as the method for connection to A series link modules.
Refer to the User's Manual for A series link modules for details of the connection method.

5.2.1 Cautions on handling fiber-optic and coaxial cables

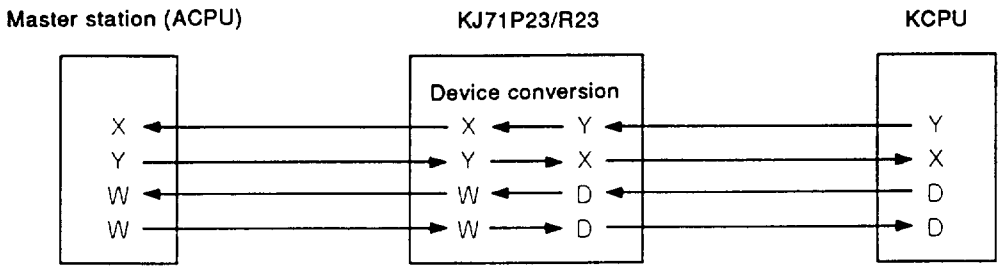
The cautions to be observed when handling fiber-optic cables and coaxial cables are the same as those described for the fiber-optic cables and coaxial cables used with A series link modules.
For details on how to handle fiber-optic and coaxial cables, refer to the User's Manual for A series link modules.

6. LINK DEVICE ALLOCATION AND DATA COMMUNICATION METHOD

This section describes the method for allocating the link device and sending and receiving link data used with the KJ71P23/R23.
Data communications between the MELSEC-NET master station (ACPU), KJ71P23/R23, and KCPU are performed as shown below.



1) Link data is sent and received by MELSEC-NET link scanning between the master station and the KJ71P23/R23.
   In the communications between the master station and the KJ71P23/R23, the KJ71P23/R23 is regarded as a remote I/O station.
2) The KJ71P23/R23 converts the link device used between the master station and the KCPU so that the KCPU is used as a local station.



3) Link data stored in the KJ71P23/R23 is read and written by the link refresh of the KCPU.

Remarks

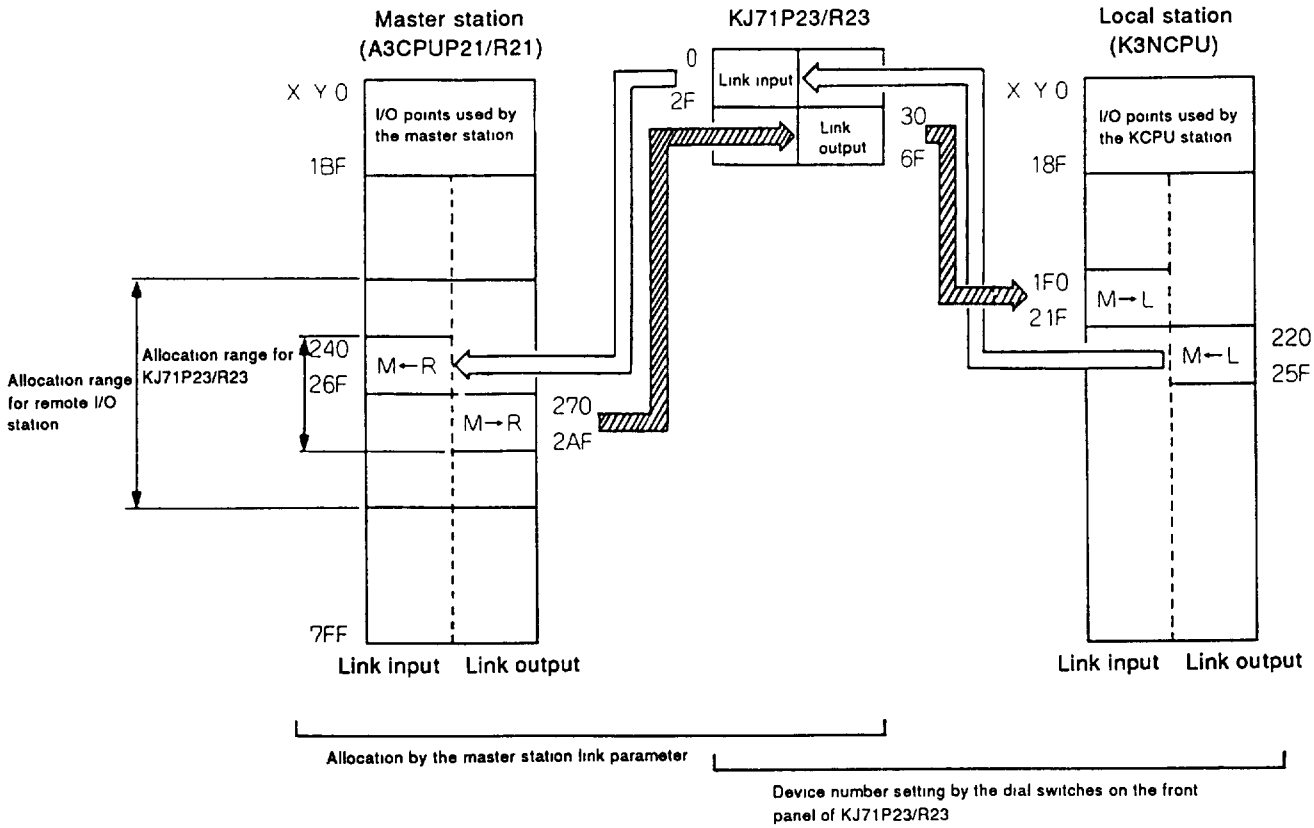
(1) KCPU in MELSEC-NET functions as a local station.
The master station (ACPU) of MELSEC-NET handles the KCPU as a remote I/O station.
The KJ71P23/R23 executes the remote I/O /local conversion for the KCPU.

(2) Devices used for communications between the master station and the KCPU are allocated according to the setting of the rotary switches on the front panel of the KJ71P23/R23 and the link parameters of the master station.

(3) Communications between link register (W) and data register (D) are enabled only to the master station.
The communication data cannot be read at any other local station in MELSEC-NET.

6.1 Input (X) and Output (Y) Allocations

The method for allocating the inputs (X) and outputs (Y) used with the data link is explained by using the memory map examples shown below.
The inputs (X) used for the data link are called link inputs (X) and the outputs (Y) are called link outputs (Y).



6.1.1 Allocation at the master station (ACPU)

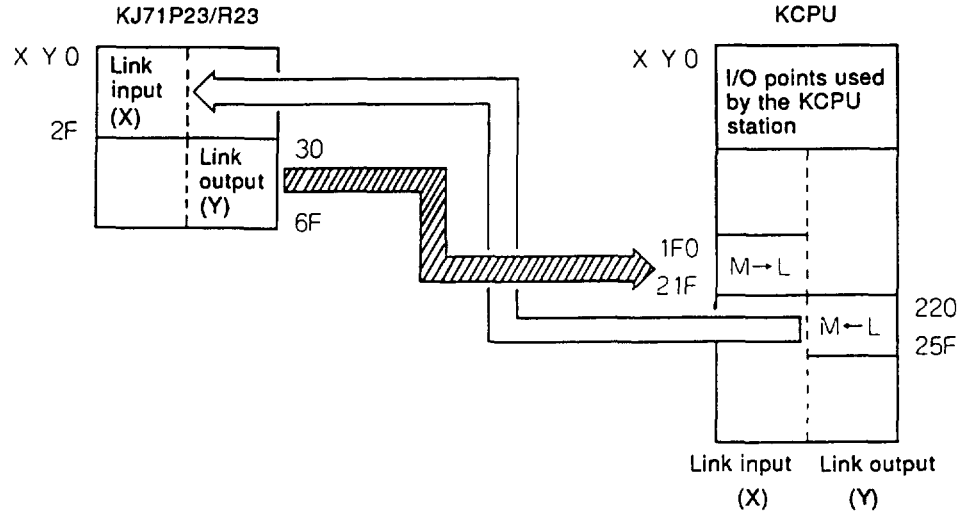
To allocate the KJ71P23/R23 as a remote I/O station by link parameter setting at the master station, set the device numbers on the KJ71P23/R23 for X0 and Y0 and after.
(Refer to the Data Link Module User's Manual for the details of link parameter setting for remote I/O station.)

L/R		M → L/R		M ← L/R	
No.		Y	X/Y	X	Y/X
R 1		270 – 2AF	030 – 06F	240 – 26F	000 – 02F

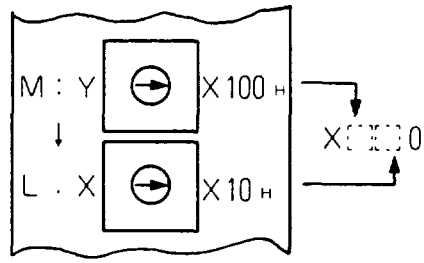
6.1.2 Allocation at the KJ71P23/R23

The device numbers set with the link parameters by using the rotary switches on the front panel of the KJ71P23/R23 are converted to the device numbers to be actually used by the KCPU.

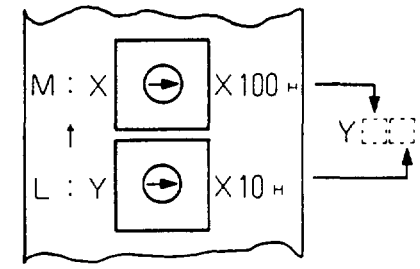
(1) When setting with the rotary switches, set link input (X) of the master station corresponding to the link output (Y) of the KCPU and the link output (Y) of the master station corresponding to the link input (X) of the KCPU.



(2) When setting with the rotary switches, set the higher two digits of the head device number used for the link input (X) and link output (Y) used at the KCPU.
The last device number is automatically set according to the link parameter setting.



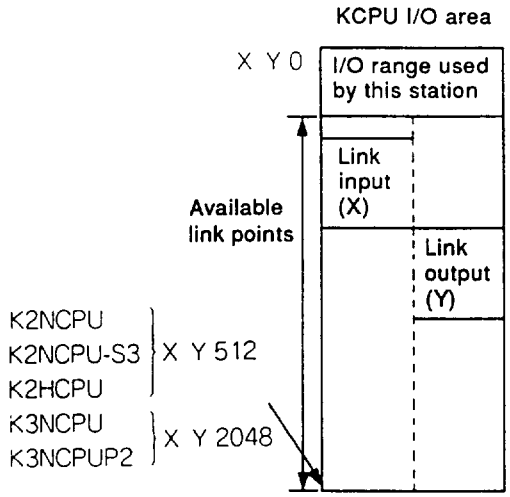
Set the head device number of the link input (X) used at the KCPU.



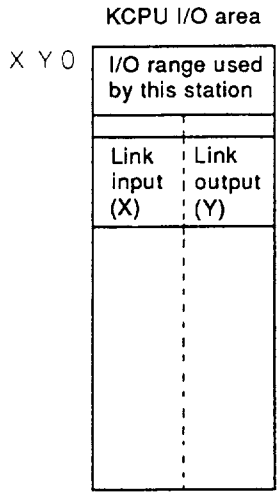
Set the head device number of the link output (Y) used at the KCPU.

(3) The allocation ranges for the link input (X) and link output (Y) are not provided with restrictions within the available link range. The ranges can be allocated at any area within the available link range as shown below.

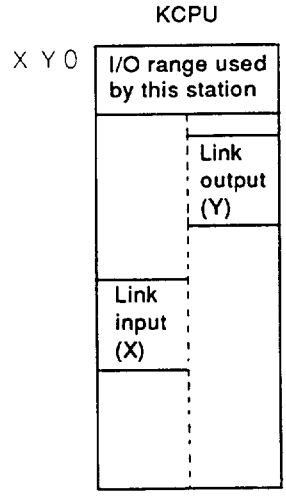
Example 1)
When the link input (X) and link output (Y) are allocated consecutively



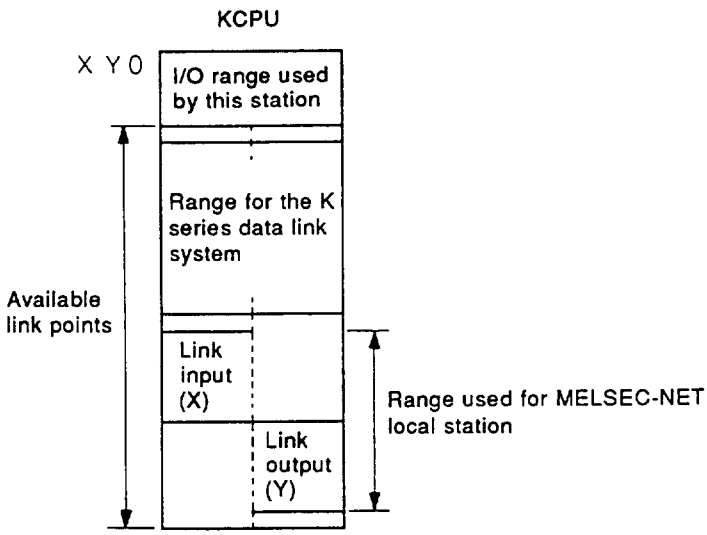
Example 2)
When the link input (X) and link output (Y) are allocated at the same numbers



Example 3)
When the link input (X) and link output (Y) are allocated in different areas

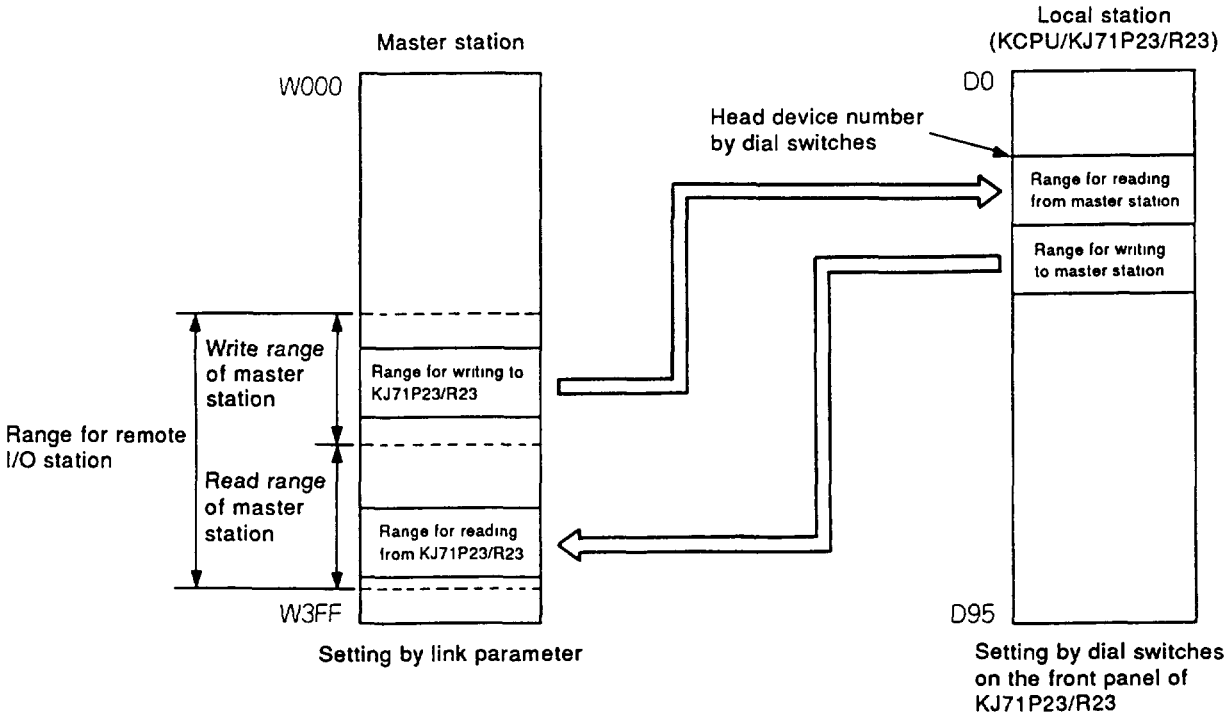


(4) When the KCPU connected to MELSEC-NET is used as a master station for the K series data link system, the device ranges must be set using caution not to overlap with the link input (X) and link output (Y) areas which are used for the K series data link system.



6.2 Allocation of Link Register (W)

The link register (W) used for the data link must be allocated as mentioned below.
The link register (W) range must be set with the link parameter at the master station as shown below, and converted to the data register (D) in the KCPU by using the rotary switches on the front panel of KJ71P23/R23.



POINT

The range for reading from the master station and the range used for writing to the master station in the KCPU are set to consecutive device numbers.

6.2.1 Allocation at the master station (ACPU)

To allocate the KJ71P23/R23 as a remote I/O station by link parameter setting at the master station, set the range for writing to the KJ71P23/R23 separately from the range for reading from the KJ71P23/R23 as shown below.
(Refer to the Data Link Module User's Manual for the details of link parameter setting for remote I/O station.)

L/R	M ← L		M → R	M ← R	
No.	B	W	W	W	
R 1	———	———	230 – 288	33F – 3AF	

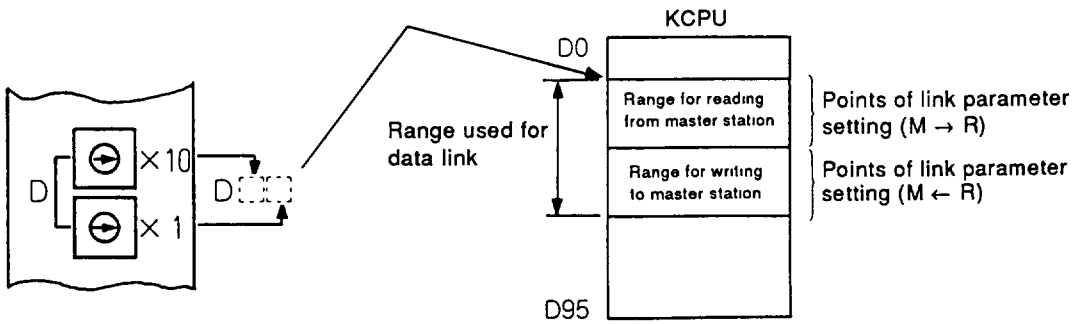
6.2.2 Allocation at the KJ71P23/R23

When setting with the rotary switches, set the device numbers of the data register (D) in the KCPU corresponding to the link register (W) set with the link parameter.

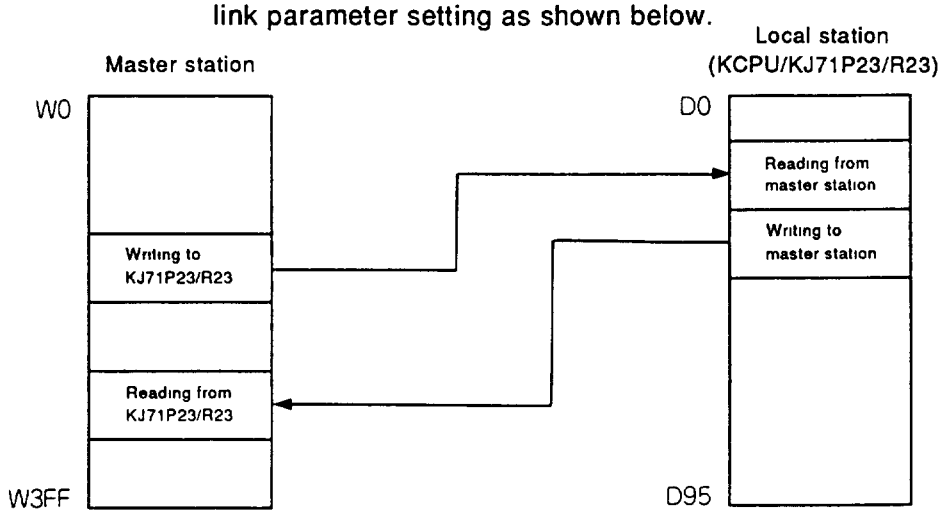
(1) Set the head device number of the data register (D) used for the data link.

(2) The data register (D) range available for the data link is D0 to D95 including that for reading from the master station and that for writing to the master station.

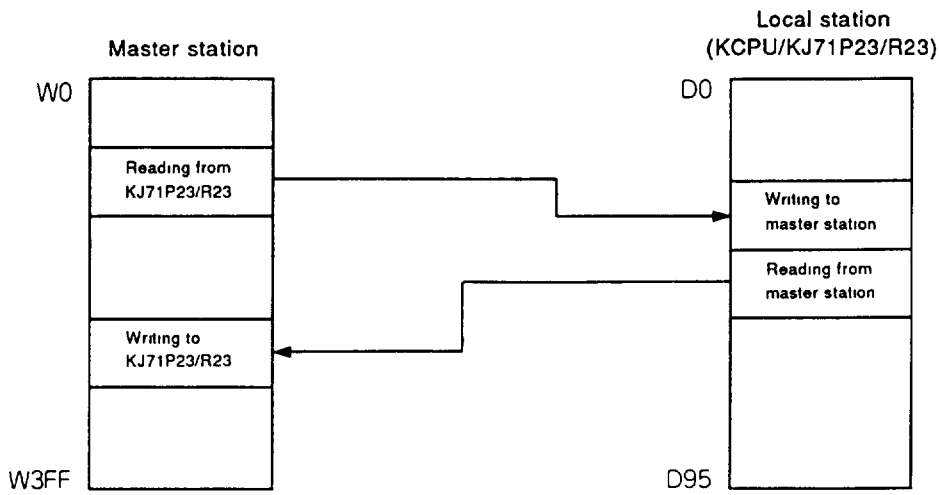
(3) Setting with the rotary switches allocates the data register (D) for the data link.



(4) The allocation areas of the "range for reading from master station" and the "range for writing to master station" will vary corresponding to the link parameter setting as shown below.



When the range for writing to the KJ71P23/R23 is allocated to the device numbers smaller than that for the range for reading from the KJ71P23/R23 by link parameter setting, the "range for reading from master station" in the KCPU will be allocated to smaller device numbers.



When the range for reading from the KJ71P23/R23 is allocated to the device numbers smaller than that for the range for writing to the KJ71P23/R23 by link parameter setting, the "range for writing to master station" in the KCPU will be allocated to smaller device numbers.

6.3 Link Refresh Processing with KCPU

Link refresh processing between the KJ71P23/R23 and the KCPU is executed as explained below.

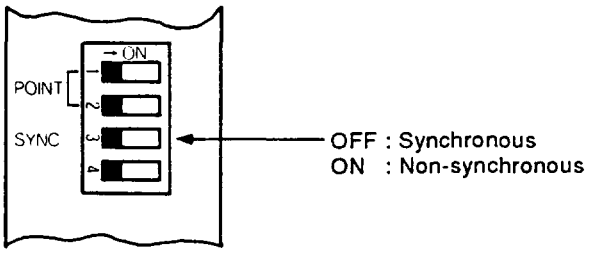
(1) Link refresh processing between the KJ71P23/R23 and the KCPU is executed with the link input (X), link output (Y), and link register (W) individually.

(2) Link refresh processing between the KJ71P23/R23 and the KCPU is executed in two types mentioned below.

Synchronous type..... Link input (X) and link output (Y) are sent and received synchronized with the send and receive of link register (W).
Handshaking for executing send and receive of link register (W) can be done by using the link input (X) and link output (Y).

Non-synchronous type..... Link input (X) and link output (Y) are sent and received independently of the send and receive of link register (W).
Handshaking for executing send and receive of link register (W) cannot be done by using the link input (X) and link output (Y).

(3) The synchronous type and non-synchronous type can be selected by using the dip switch on the front of the KJ71P23/R23.

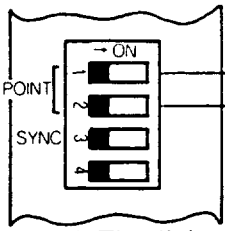


6.3.1 Link refresh for the link register (W)

Link refresh processing for the link register (W) of KCPU is executed as described below.

(1) Link refresh processing for the link register (W) is executed when a link refresh program in a sequence program of the KCPU is executed. (Refer to Section 7.3.1 for detailes of the link refresh program)

(2) The number of points for reading or writing by one time of refresh for the link register (W) is set by using the refresh point select switch on the front of the KJ71P23/R23, as shown below.



Number of refresh points/refresh		12 points	24 points	36 points	48 points
ON/OFF state	1	OFF	OFF	ON	ON
	2	OFF	ON	OFF	ON
Refresh time (msec)		12	17.1	22.1	27.2

1) The link refresh time becomes long in proportion to the number of refresh points per refresh.
2) When the number of refresh points per refresh is large, the sequence program scan time becomes long.
3) When the number of refresh points per refresh is smaller than the number of points for writing to the master station or that for reading from the master station, refresh processing for the link register is executed as divided in several scans. (For the connection with the data link processing time, refer to Section 3.2.)

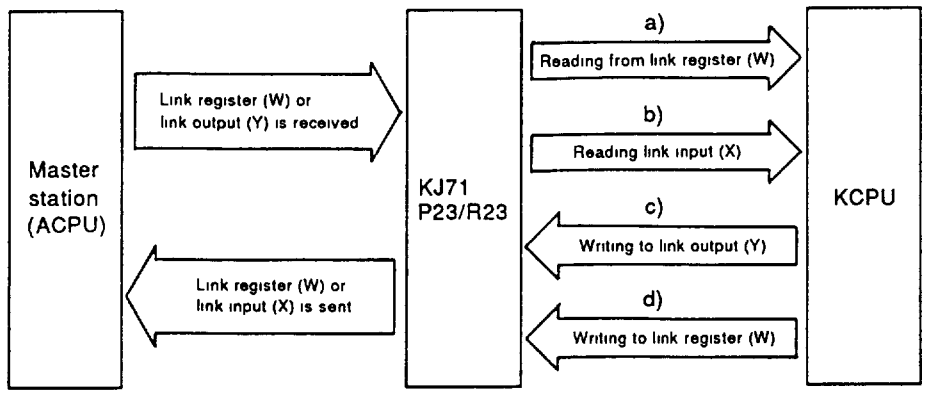
6.3.2 Refresh for the link input (X) and link output (Y)

Link refresh processing for the link input (X) and link output (Y) is executed as described below.

(1) Link refresh processing for the link input (X) and link output (Y) is executed after the execution of the END instruction of the sequence program in KCPU.

(2) When the non-synchronous refresh type has been selected, refresh processing for the link input (X) and link output (Y) is executed at every sequence program scan of the KCPU.

(3) When the synchronous refresh type has been selected, refresh processing is executed as shown below in synchronization with the send and receive of the link register (W).



1) Link refresh processing between KJ71P23/R23 and KCPU is executed in the order of (a), (b), (c), and (d) shown above.
2) Link register (W) and link input (X) are sent to the master station (ACPU) in batch when processing (d) shown above is completed.

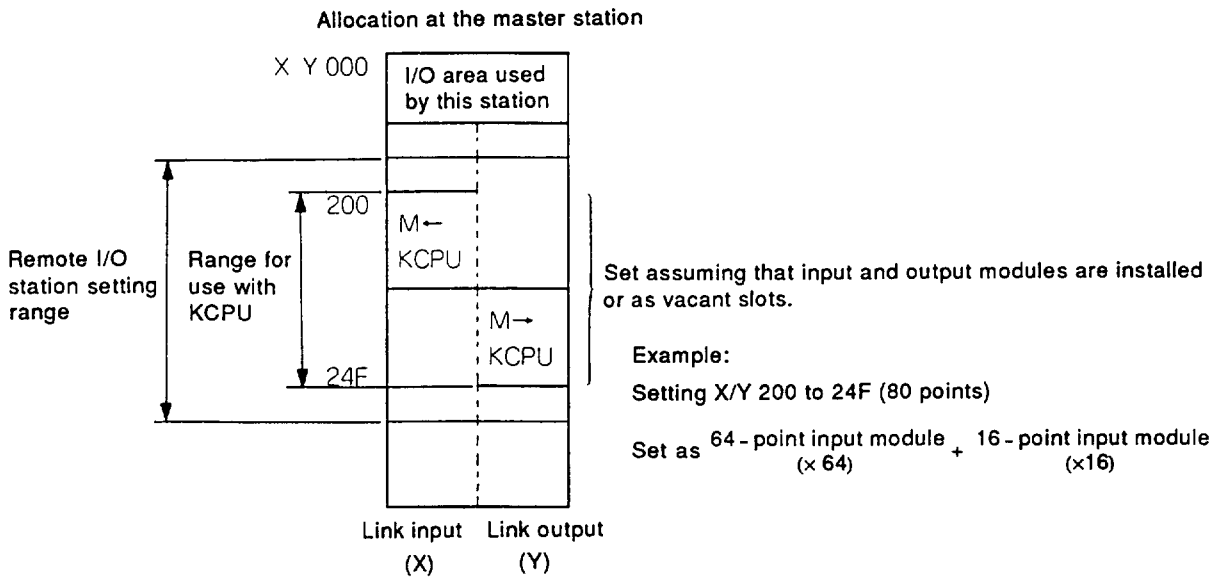
6.4 Special Devices

Special relays used with KCPU are as mentioned below.

Device number		Name	Description	
When K2NCPU, K2HCPU, or K2CPU-S3 is used	When K3NCPU or K3NCPUP2 is used			
M250	MA20	Parameter not received	OFF: Receive completed ON · Not received	This is controlled by whether link parameter or not data from the MELSEC-NET master station has been received. Used for judging whether or not the data communication is possible. (The following factors may cause the data not to be received. • When the master station is abnormal and the data link is impossible. • When the host station (KCPU) is offline.)
M251	MA21	Data communication status	OFF· Normal ON · Abnormal	This is controlled by data communication status. Used for judging whether or not the data communication is normally executed. (The following factors may cause the data communication to become abnormal. • When data from the master station cannot be received due to cable breakage. • When KJ71P23/R23 in the station has hardware failure)

6.5 I/O Allocation to KCPU

The following describes the I/O allocation procedure to KCPU when the I/O allocation is performed to the master station (ACPU) and a remote I/O station by using a peripheral device.
When using the master station (ACPU) link parameter to make the I/O allocation in the area allocated for use with the KCPU, set the number of points assuming that the input and output modules are installed or as vacant slots.



For the I/O allocation to the local station and remote I/O station other than KCPU, refer to the Data Link Module User's Manual.

7. PROGRAMMING

This section describes the programming required to operate a data link between a master station and a KCPU.

7.1 Cautions on Creating Programs

(1) The link devices used in the program for the data link (X, Y, W) use the device numbers set in the link parameters of the master station and with the dial switches on the front face of the KJ71P23/R23.

(2) To ensure a fail-safe system, it is advisable to provide interlocks between the communicating stations by using special relays in the sequence program which are switched ON/OFF when a fault occurs.

(3) When operating a data link using link registers (W), it is advisable to use the synchronous method for the input (X) and output (Y) link and to execute handshaking between the sequence program of the master station and the sequence program of the KCPU by using inputs (X) and outputs (Y).
(For a detailed program, see Section 7.3.2.)

(4) When operating a data link using link registers (W), the following function instructions for link refresh have to be included in the KCPU sequence program.
(For details on link refresh programs, see Section 7.3.1.)

When {K2NCPU / K2HCPU / K2CPU-S3} are used..... F121 / F123

When {K3NCPU / K3NCPUP2} are used..... F141 / F143

(5) Since communications between the master station and KCPU are one to one, it is not possible either to directly read the contents of link registers (W) used by other stations in the MELSEC-NET network, or to directly write the contents of data registers used by the KCPU to other local stations.

(6) A KCPU incorporated into a MELSEC-NET network functions as a local station, but it is treated as a remote I/O station by the master station (ACPU).
Note that the following instructions and special relays cannot be used in relation to the KCPU in the master station's sequence program.

Instruction	Instruction
PLS	FOR
PLF	NEXT
SFT(P)	FROM(P)
(D)ROR(P)	DFRO(P)
(D)RCR(P)	(D)TO(P)
(D)ROL(P)	LRDP
(D)RCL(P)	LWDP
(B)SFR(P)	PR(C)
DSFR(P)	M9030
(B)SFL(P)	M9031
DSFL(P)	M9032
DUTY	M9033
(M9020 to M9024)	M9034

7.2 Programs Using Inputs (X) and Outputs (Y)

This section explains the method for programming with link inputs (X) and link outputs (Y) by using a program example.

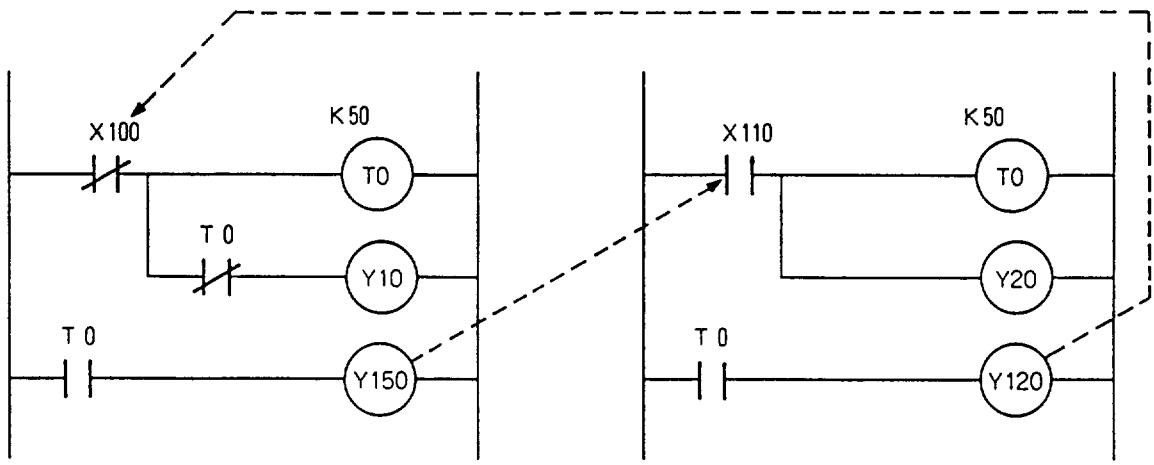
Conditions

(1) We will assume that the allocation of link inputs (X) and link outputs (Y) at the master station and KCPU is as follows:

Master station		KCPU station
X100	←	Y120
Y150	→	X110

(2) The program below switches Y10 of the master station and Y20 of the KCPU alternately ON and OFF (so that they are staggered) at 5 second intervals.

Program Example



Master station program

KCPU program

Explanation

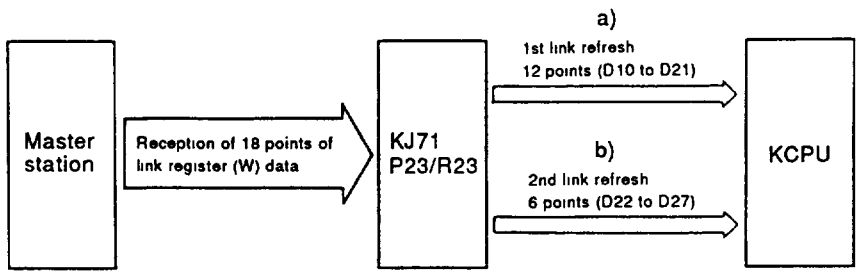
In a data link that uses link inputs (X) and link outputs (Y), when a master station link output (Y) is turned ON, the link input (X) at the KCPU side will be turned ON automatically.
Conversely, when a link output (Y) at the KCPU is turned ON the link input (X) at the master station will also be turned ON automatically.

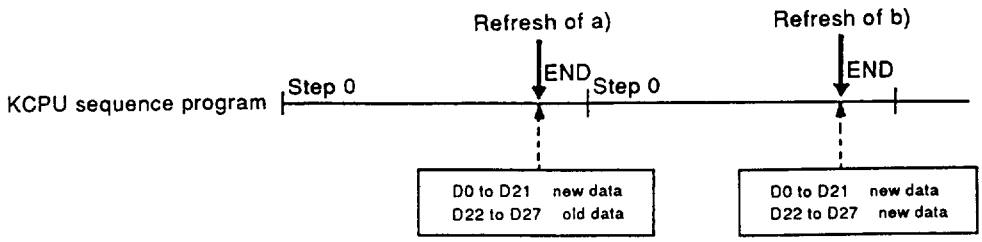
7.3 Programs Using Link Registers

This section describes the programming method used to execute data communications using link registers (W). If link input (X) and link output (Y) communications are executed using the synchronous method, when link register (W) communications are executed, handshaking between the master station and the KCPU can be performed by using link inputs (X) and link outputs (Y).
If link register communications are executed without handshaking, the following malfunctions may occur.

1) The sent data may not be received at the communicating station.
2) If link refresh processing is executed over several scans when link registers (W) are read from the master station, data registers in which newly rewritten data is stored may be mixed with data registers in which old data is stored.

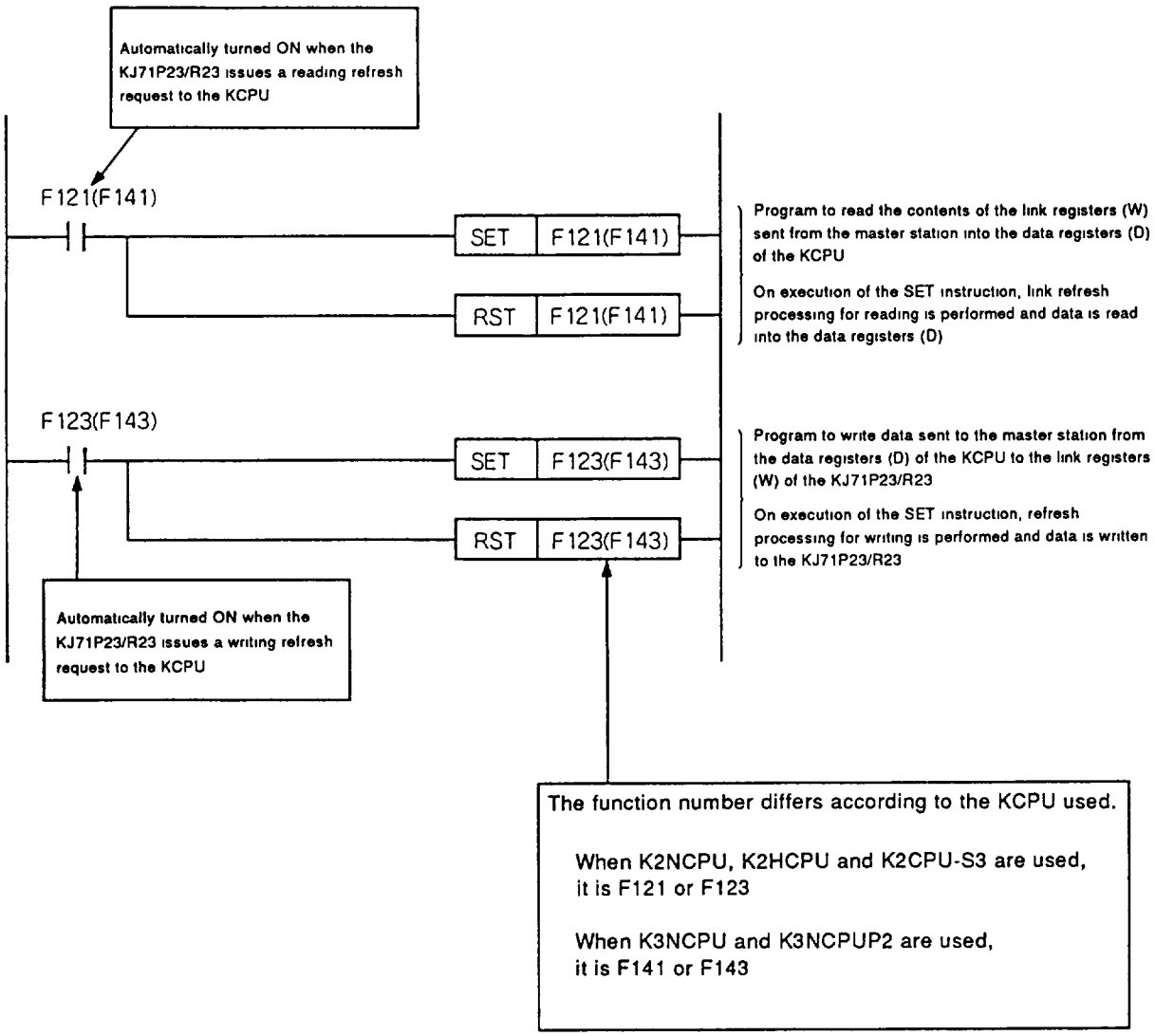
   Example)
   Assuming the following conditions:
   Number of link register (W) points
   read from the master station..... 18 points
   Number of points refreshed per scan ..... 12 points
   Data registers (D) in which data is stored ..... D10 to D27





7.3.1 Programs for link refresh

Since link refresh of link registers is only performed when a refresh program is executed, it is essential to write the refresh program shown below into the KCPU sequence program when performing link register communications.



POINT

The program above must be written if link registers (W) have been set in the link parameters of the master station (ACPU) for the data link with the KCPU.
If the program above is not executed, the data link may be disabled (this includes communication of inputs (X) and outputs (Y)).

7.3.2 Program example

The program example presented here is one in which link register communications are conducted while executing handshaking between the master station and the KCPU.

Conditions

(1) Synchronous processing is set using the DIP switches on the front face of the KJ71P23/R23.

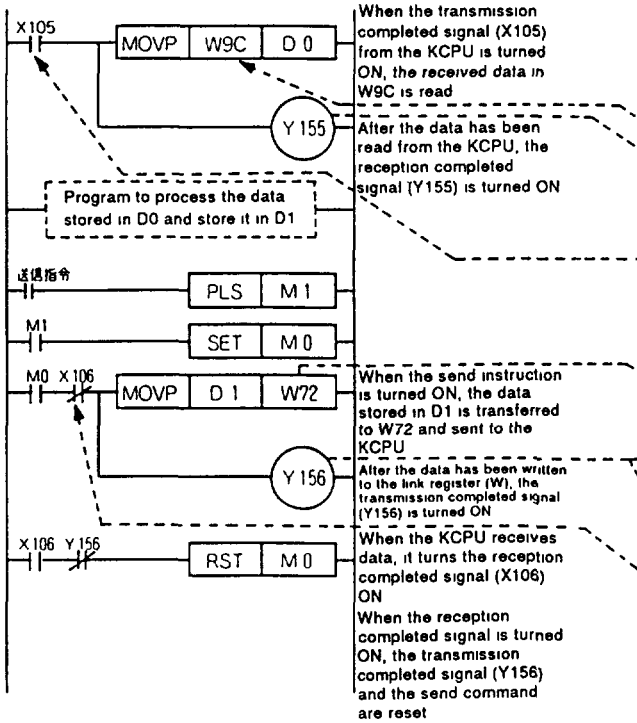
(2) The allocation of link inputs (X), link outputs (Y) and link registers (W) between the master station and the KCPU is as indicated below.

Master station		KCPU	
X105	←	Y125	Used as the transmission completed signal when data is sent from the KCPU to the master station
X106	←	Y126	Used as the reception completed signal when the KCPU receives data from the master station
Y155	→	X115	Used as the reception completed signal when data is sent from the KCPU to the master station
Y156	→	X116	Used as the transmission completed signal when the KCPU receives data from the master station
W72	(M → R) →	D50	
W9C	← (M ← R)	D92	

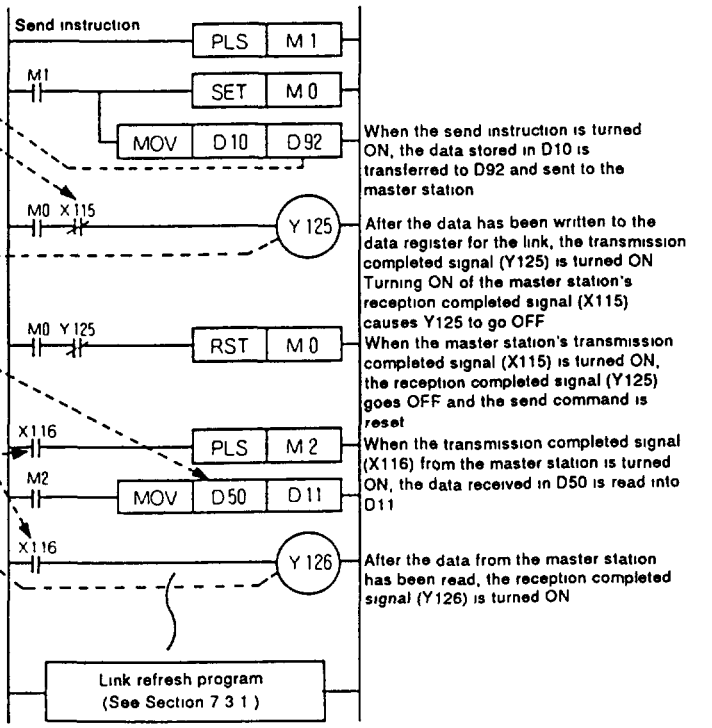
(3) 1) The contents of D10 of the KCPU are sent to the master station.
2) The data from the KCPU is processed by the master station.
3) Processed data is sent from the master station to the KCPU and the KCPU stores it in D11.

Program Example

Master Station Program



KCPU Program



8. TROUBLESHOOTING

8.1 Link Monitoring at Peripheral Devices

The data link status of the KJ71P23/R23 station can be monitored by connecting a peripheral device (A6GPP, A6PHP, A6HGP) to the KJ71P23/R23 and setting "link monitor" (for a remote I/O station) in the [LIST] [MONITOR] mode.

Remarks

(1) Since the KJ71P23/R23 is set as a remote I/O station in the MELSEC-NET network, the only peripheral device link monitor that is possible is that for remote I/O stations.

(2) Any of the following PC model names can be selected in PC model name selection when the peripheral device is started up: A0J2, A1, A2, A3, A3H.

The following two types of link monitor can be used with a KJ71P23/R23:

1) Link monitor (loop monitor when connected to a remote I/O station)
2) Link monitor (batch loop monitor when connected to a remote I/O station)

8.1.1 Loop monitor

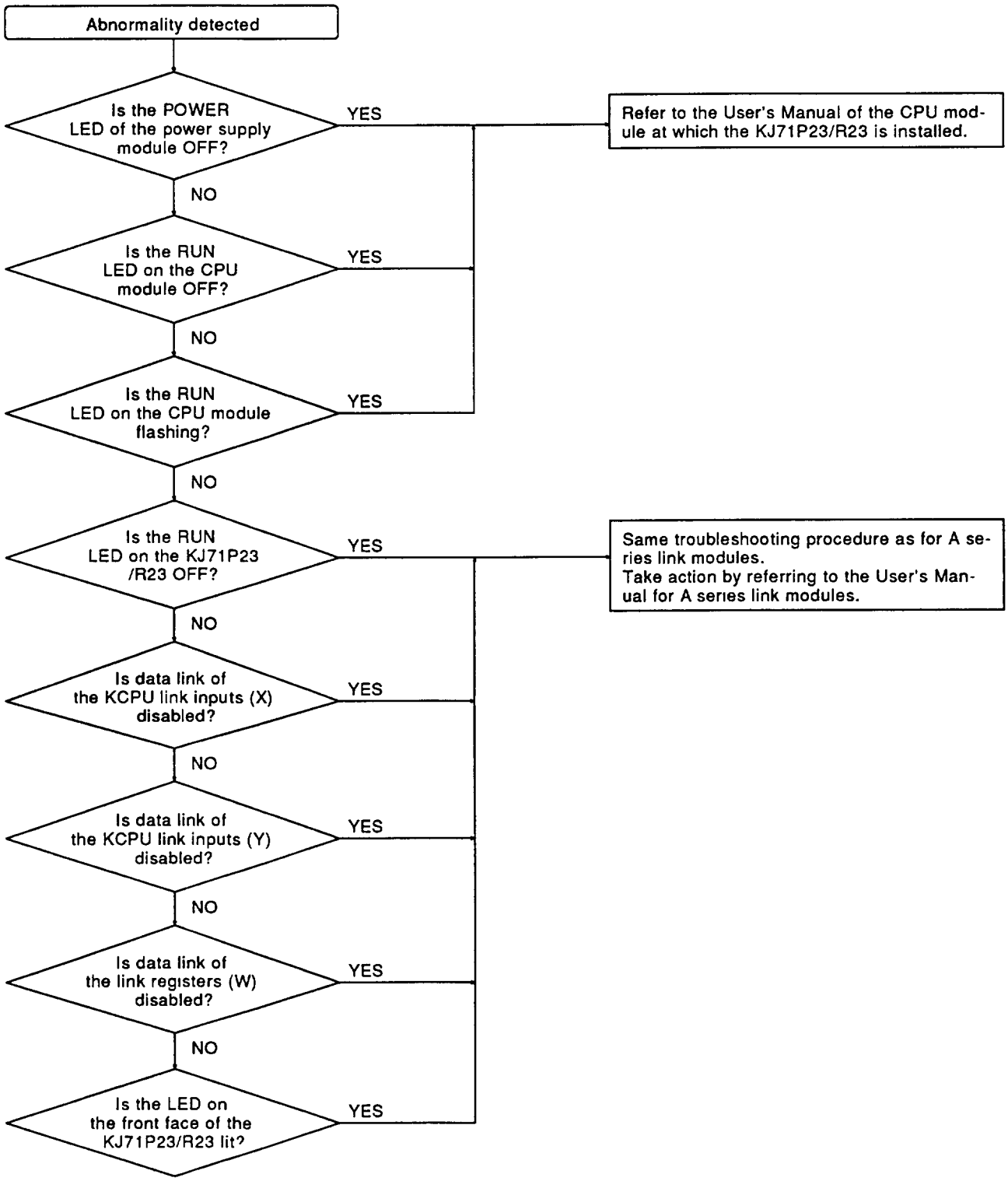
The loop monitor displays the data link status of the KJ71P23/R23 self station. Since it is the same as the loop monitor for A series data link modules, refer to the Data Link Module User's Manual for further details.

8.1.2 Link device batch monitor

The link device batch monitor conducts batch monitoring of the link devices that the KJ71P23/R23 uses for communications. Since it is the same as the link device batch monitor for A series data link modules, refer to the Data Link Module User's Manual for further details.

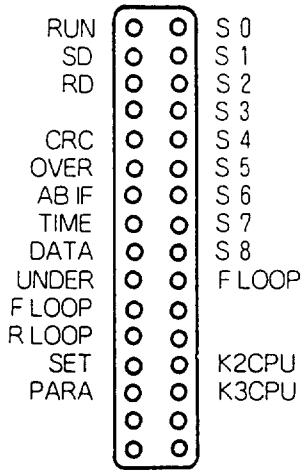
8.2 Troubleshooting Flowchart

This section presents a guide to simple troubleshooting.



8.3 ERROR LEDs

The following describes the LEDs which are located on the front of the KJ71P23/R23 and light when an error occurs in the KJ71P23/R23.



LED	Error	Status	Description
CRC	CRC error (cyclic code check)	Lit	Received data code is checked for errors. This error may occur depending on the timing when a station which sends data to the corresponding station is set offline. Cable abnormality or noise also causes this error.
OVER	Overrun error	Lit	This error occurs when fetching of received data is delayed and the data is cleared by newly received data. This error is caused by hardware failure in the receiving area of the link module. In a system where local stations and remote I/O stations are used together, the OVER LED of the remote I/O station is always dimly lit, which is not abnormal.
AB.IF	Abond invalid frame error	Lit	This error occurs when the number of continuous bits of "1" in received data in the frame is larger than specified or when the received data length is shorter than specified. This error may occur depending on the timing when a station which sends data to the corresponding station is set offline. Cable abnormality or noise also causes this error.
TIME	Time check error	Lit	This error occurs in the local station or remote I/O station when the data link WDT in the master station times out. Cable abnormality or noise also causes this error.
DATE	Data check error	Lit	This error occurs when data with abnormal code is received. (This LED may light in test mode only.) Cable abnormality or noise also causes this error.
UNDER	Underrun error	Lit	This error occurs when the internal processing of send data is not executed at constant intervals. This error is caused by hardware failure in the receiving area of the link module.
F.LOOP	Forward loop error	Lit	This error occurs when the forward loop line has abnormality or when power to the adjacent station is turned OFF. This error occurs when the forward loop cable is broken or not connected.
R.LOOP	Reverse loop error	Lit	This error occurs when the reverse loop line has abnormality or when power to the adjacent station is turned OFF. This error occurs when the reverse loop cable is broken or not connected.
SET	Link device range setting error	Lit	This error occurs when the link device setting range used for data link exceeds available range. Available link device range is determined by the head device number set with the rotary switches on the front of KJ71P23/R23 and by the number of device points set with the master station (ACPU) link parameter.
PARA	Link device point setting error	Lit	This error occurs when the master station (ACPU) link parameter for use with KCPU is not set or when the number of link device setting points by the master station (ACPU) link parameter for use with KCPU exceeds available number of points.