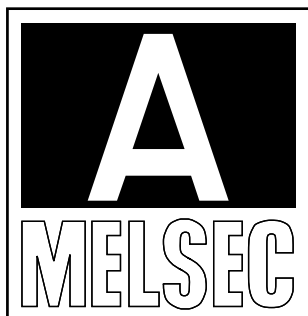
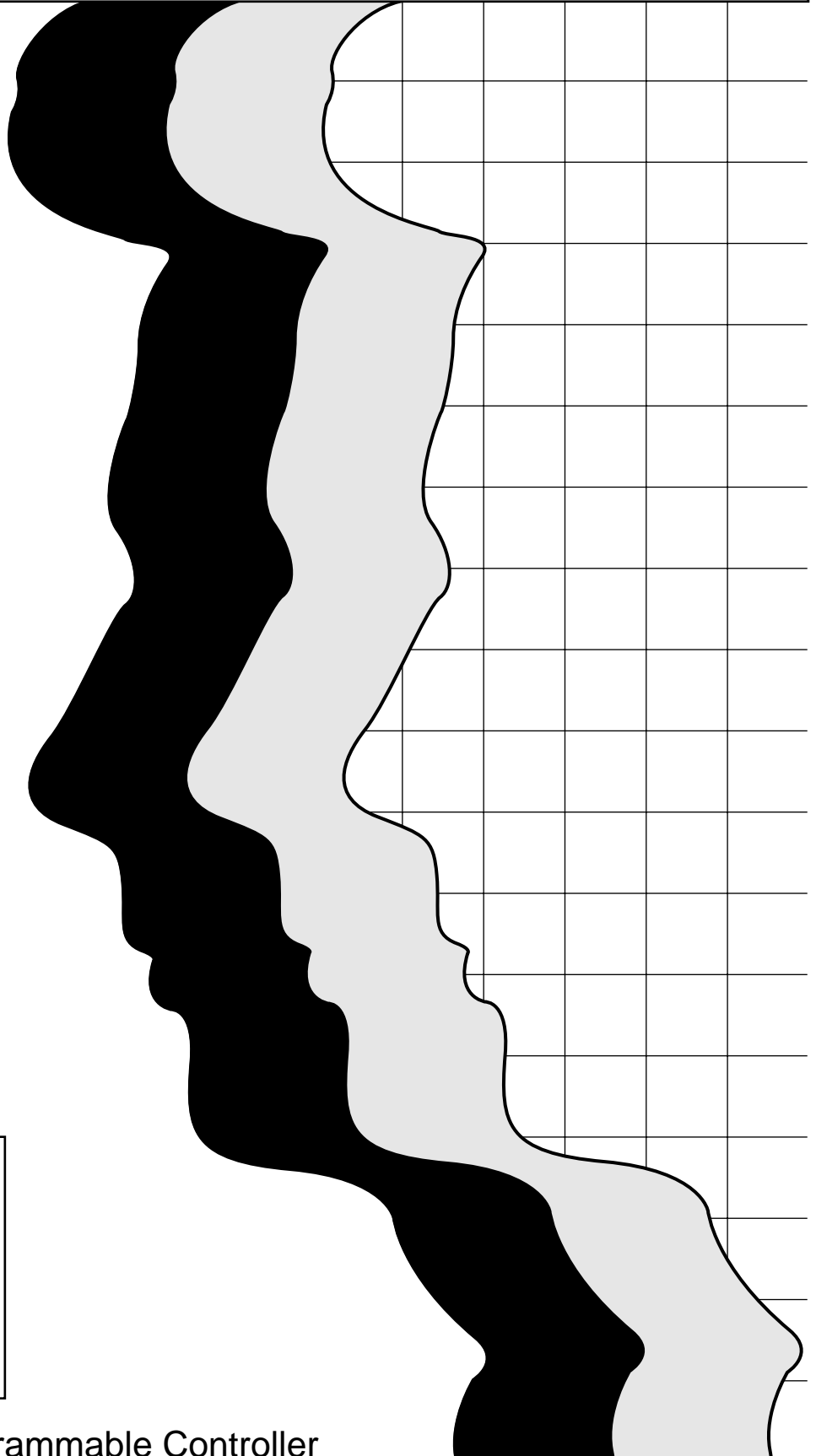


MITSUBISHI

type A3VTS (Data link)

User's Manual



Mitsubishi Programmable Controller

REVISIONS

※The manual number is given on the bottom left of the back cover.

Print Date	*Manual Number	Revision
May, 1989	IB (NA) 66191-A	First edition

INTRODUCTION

Thank you for choosing the Mitsubishi MELSEC-A Series of General Purpose Programmable Controllers. Please read this manual carefully so that the equipment is used to its optimum. A copy of this manual should be forwarded to the end User.

1. GENERAL DESCRIPTION

2. SYSTEM CONFIGURATION

3. SPECIFICATIONS

4. STARTUP PROCEDURES AND SETTINGS

5. LOADING AND INSTALLATION

6. DATA LINK PROCESSING

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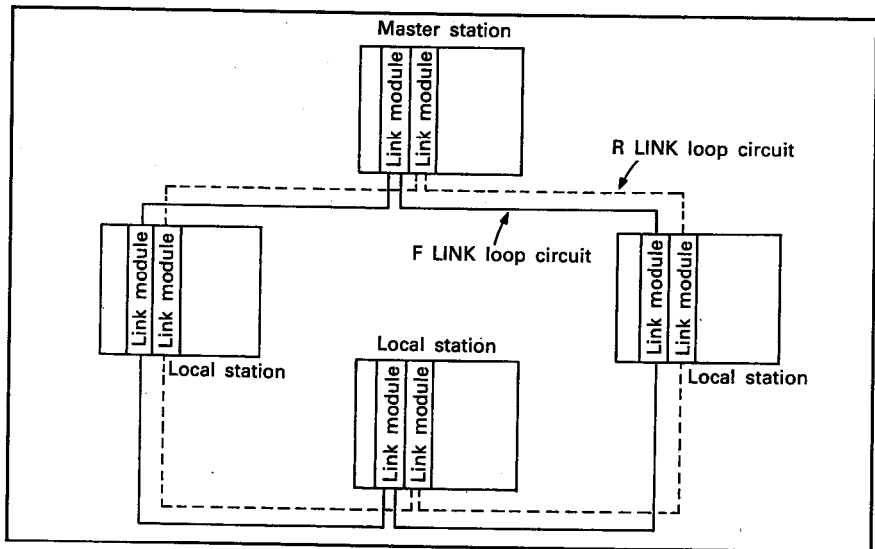
1. GENERAL DESCRIPTION

This manual describes the A3VTS multi-loop data link system (hereinafter referred to as the A3VTS data link system), its specifications, functions, handling, etc.

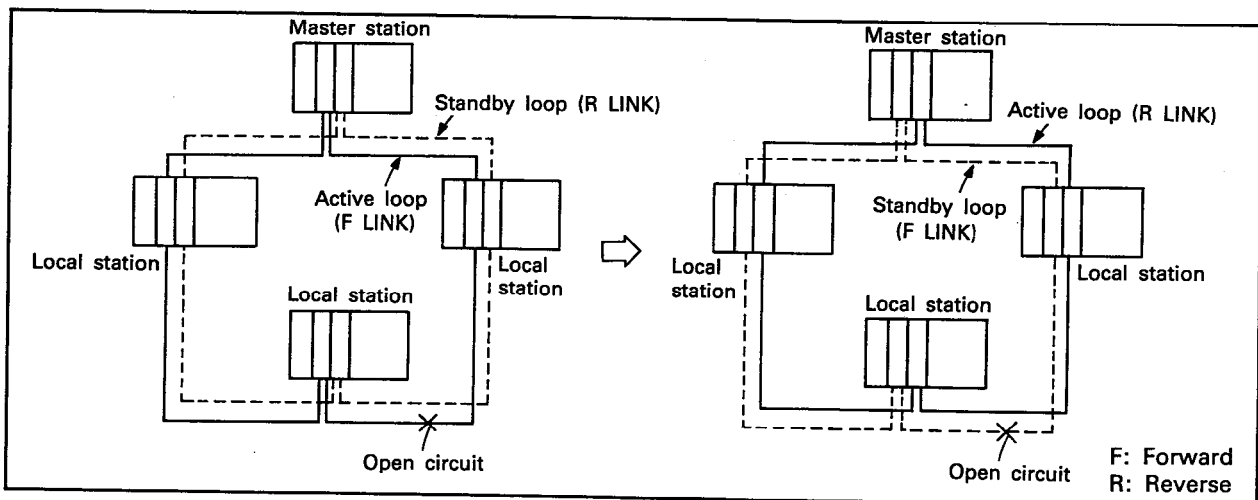
The A3VTS data link system provides data links up to 65 stations (1 master station, 64 local stations) of the A3VTS system via either fiber optic or coaxial cable.

Each station of the A3VTS data link system is configured of two link modules that are matched to the A3VTS system with its dual power supply and triple CPUs.

As shown in the following diagram, datalink processing is conducted between the stations, in which two link modules are mounted, via a data link that connects the modules using a duplex loop circuit.



During data link processing, processing is conducted via one of the two loop circuits while the other one is in standby. When an abnormal condition occurs during data link execution and data link processing can no longer be conducted via that loop circuit, data link processing is automatically switched to the standby loop circuit and data link processing continues.



The duplex loop circuit of the A3VTS data link system enables continued data link operation on one loop circuit while repairing the other circuit.

When the active loop is broken or a piece of equipment in the circuit malfunctions, data link processing is automatically switched to the other loop circuit which is in standby and the malfunctioning loop circuit is placed in standby.

Repairs can be made to the malfunctioning loop circuit by taking appropriate action such as replacing the faulty link cable or module. Since the loop is in standby, there is no need to shut down the data link system.

This manual will designate the peripheral equipment, A6GPP, A6PHP, A6HGP, and A7PU in the following manner.

A6GPP	——	GPP
A6PHP	——	PHP
A6HGP	——	HGP
A7PU	——	PU

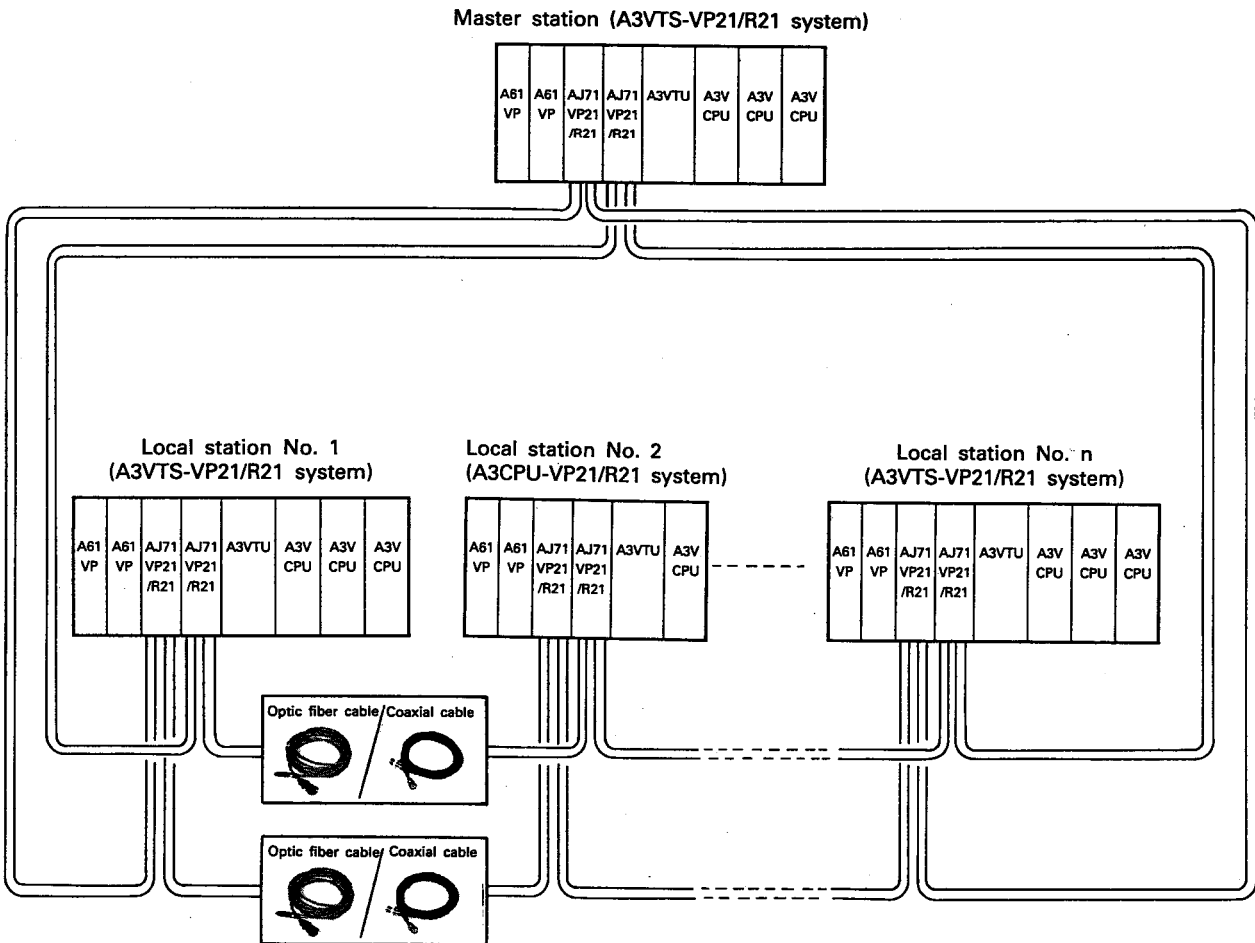
The term "peripheral equipment" shall be meant to include all of the following modules: A6GPP, A6PHP, A6HGP, and A7PU.

2. SYSTEM CONFIGURATION

This chapter describes the configuration and applications of the A3VTS data link system.

2.1 Overall Configuration

The A3VTS data link system is configured of a two-tier system consisting of a master station and local stations. The use of two data link modules within a single station provides the duplex loop capabilities.



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2.2 Configuration of Master Station and Local Station Modules

This section describes the configuration of the master station and local station modules used in the A3VTS data link system.

As shown in the following table, either of two systems can be configured. The system name is dependent on the number of A3VCPU modules used in each of the master stations and local stations.

System Nomenclature	Number of Mounted Base Modules			
	Power supply module (A61VP)	Data link module (AJ71VP21/R21)	Majority module (A3VTU)	CPU module (A3VCPU)
A3VTS-VP21/R21	2	2	1	3
A3CPU-VP21/R21	2	2	1	1

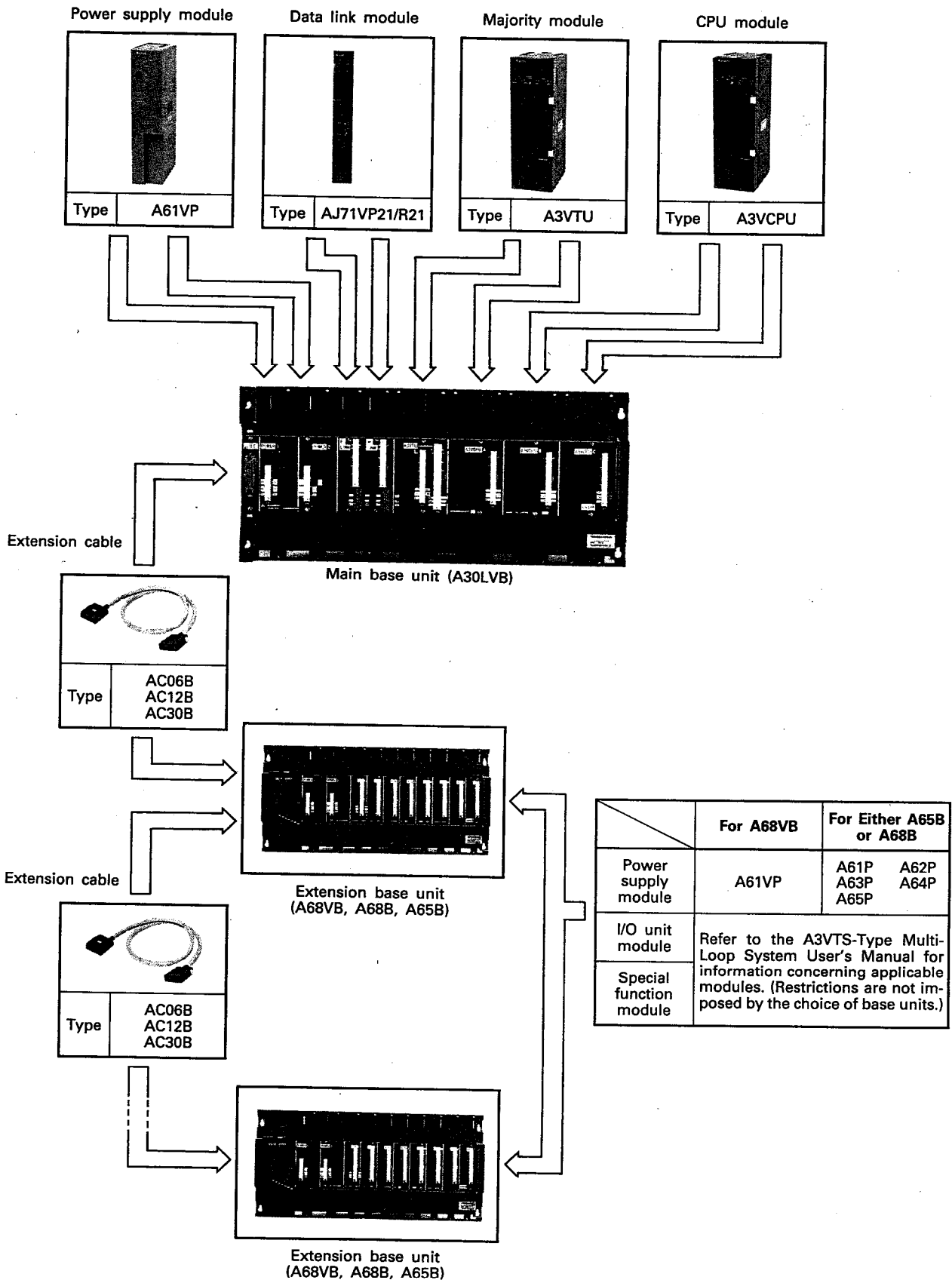
REMARKS

It is recommended that use of the A3VCPU-VP21/R21 be limited to such purposes as monitoring since a malfunction in the A3VCPU of the A3VCPU-VP21/R21 would terminate the sequence program and thus effect control of the overall data link system.

2. SYSTEM CONFIGURATION



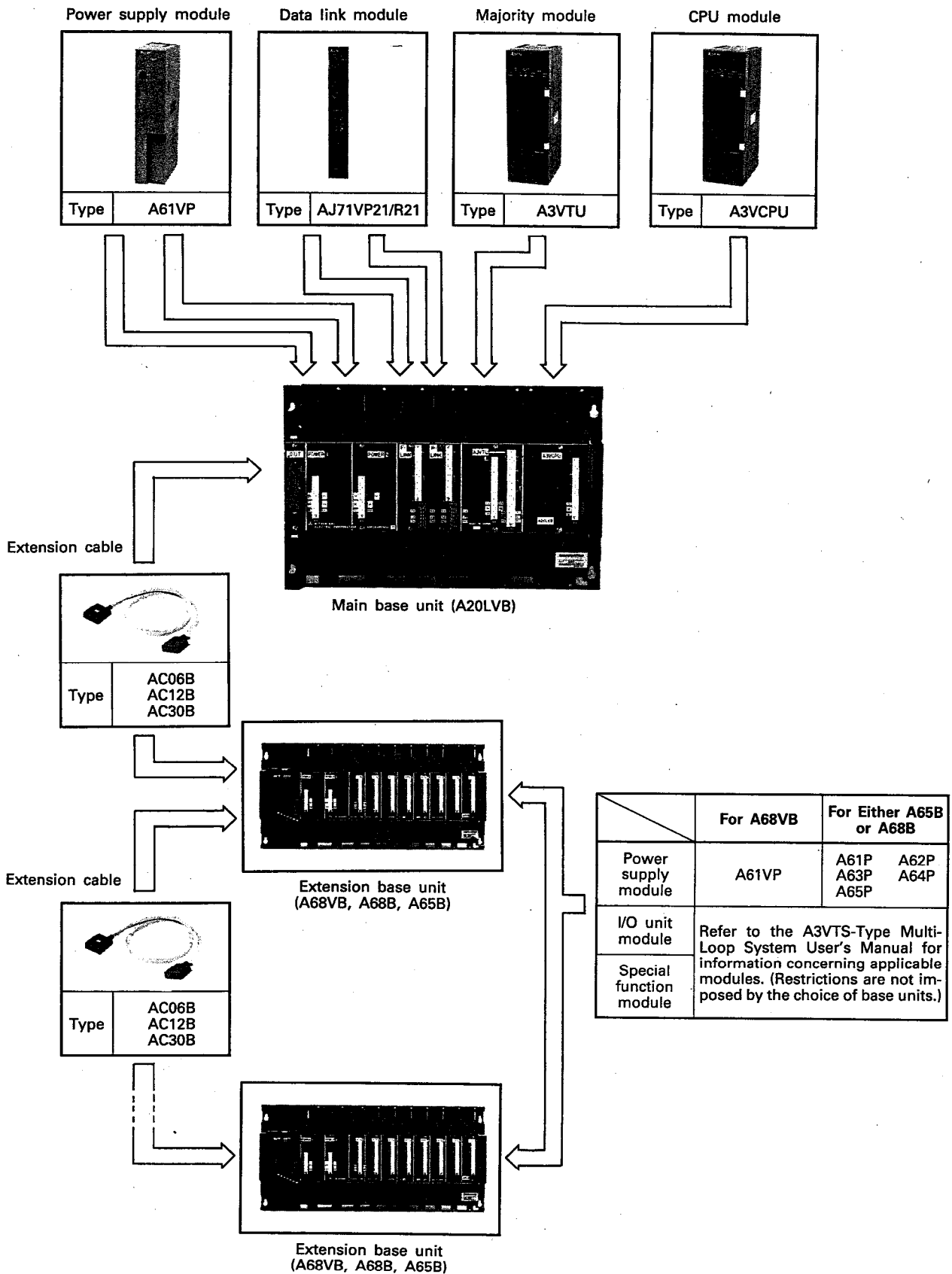
2.2.1 Module configuration of the A3VTS-VP21/R21



2

2. SYSTEM CONFIGURATION

2.2.2 Module configuration of the A3CPU-VP21/R21



2.3 System Configurations - Cautions

This section describes precautions to be followed when configuring the A3VTS data link system and stations.

- (1) Only the CPU systems listed below may be used as master stations or local stations in the A3VTS data link system. Only the CPUs and data link modules included on this list may be connected.

A3VTS-VP21/R21	— CPU module	: A3VCPU	3 modules
	— Majority module	: A3VTU	1 module
	— Data link module	: AJ71VP21/R21	2 modules
A3CPU-VP21/R21	— CPU module	: A3VCPU	1 module
	— Majority module	: A3VTU	1 module
	— Data link module	: AJ71VP21/R21	2 modules

- (2) The master stations and local stations can be configured as two-tier systems in the A3VTS data link system.
- (3) Stations in a MELSECNET cannot be connected to the A3VTS data link system.
- (4) The A3VTS data link system does not provide a backloop function.
Care must be taken since turning off the programmable controller power to even one station will terminate data link processing throughout the entire A3VTS data link system.
- (5) It is recommended that the A68VB extension base unit and a dual power supply be used in the A3VTS data link system. If an expansion unit that does not provide a dual power supply (A68B, A65B, A78B (for the A81CPU)) is used and a malfunction should occur in the power supply module that is mounted in the A68B, A65B, or A78B, processing is terminated in the related A3VTU, AJ71VP21/R21 stopping data link operation of the entire data link system.
- (6) The A3VTS data link system does not provide functions for the monitoring of other stations using peripheral device or the uploading or downloading of programs.
- (7) Refer to the A3VTS-TYPE Multi Loop System User's Manual for restriction concerning applicable modules and usable utility s/w packages.

2. SYSTEM CONFIGURATION



2.4 A3VTS Data Link System Modules - Parts List

This section describes the modules required to configure the A3VTS data link system.

Refer to the A3VTS-Type Multi-Loop System User's Manual for information concerning unlisted modules since the A3VTS data link system is equivalent to the independent A3VTS system.

M: Master station L: Local station
○: May be used

Set Type	Equipment	Type	Qty.	Description	Applicable System						Remarks
					Independent	Coaxial data link		Optical data link		Computer link	
						M station	L station	M station	L station		
A3VTS-VP21	CPU module	A3VCPU	3	Duplex optical data link using multiple CPUs	○						Removable memory cassette for the A3VCPU
	Majority module	A3VTU	1								
	Optical data link module	AJ71VP21	2					○	○		
	Power supply module	A61VP	2								
	Base unit	A30LVB	1								
A3VTS-VR21	CPU module	A3VCPU	3	Duplex coaxial data link using multiple CPUs	○						Removable memory cassette for the A3VCPU
	Majority module	A3VTU	1								
	Coaxial data link module	AJ71VR21	2			○	○				
	Power supply module	A61VP	2								
	Base unit	A30LVB	1								
A3CPU-VP21	CPU module	A3VCPU	1	Duplex optical data link using single CPUs	○						Removable memory cassette for the A3VCPU
	Majority module	A3VTU	1								
	Optical data link module	AJ71VP21	2					○	○		
	Power supply module	A61VP	2								
	Base unit	A20LVB	1								
A3CPU-VR21	CPU module	A3VCPU	1	Duplex coaxial data link using single CPUs	○						Removable memory cassette for the A3VCPU
	Majority module	A3VTU	1								
	Coaxial data link module	AJ71VR21	2			○	○				
	Power supply module	A61VP	2								
	Base unit	A20LVB	1								

Equipment	Type	Description	Occupied Points	Applicable System						Remarks	
				Independent	Coaxial data link		Optical data link		Computer link		
					M station	L station	M station	L station			
CPU module	A3VCPU	Program capacity: 30K steps, I/O points: 2048 points, M,L,S, total points: 2048 points, T: 256 points, C: 256 points, D: 1024 points	—	○	○	○				○	Removable memory cassette
Majority module	A3VTU	For data link system	—	○	○	○					
Optical data link module	AJ71VP21	For optical data link system master station or local station	—					○	○		
Coaxial data link module	AJ71VR21	For coaxial data link system master station or local station	—		○	○					
Optical fiber cable	(See 3.4)	For optical data link system	—					○	○		Consult Mitsubishi representative
Coaxial cable	(See 3.5)	For coaxial data link system	—		○	○					Arrange on user side
Main base unit	A30LVB	Main base unit for A3VTS-VP21/VR21 A3VTU: 1 module, A3VCPU: 1 module, A61VP: 2 modules, AJ71VP21/VR21: 2 modules may be used	—		○	○		○	○		
	A20LVB	Main base unit for A3CPU-VP21/VR21 A3VTU: 1 module, A3VCPU: 1 module, A61VP: 2 modules, AJ71VP21/VR21: 2 modules may be used	—		○	○		○	○		

3. SPECIFICATIONS

This chapter describes the performance specifications and functions of the data link system and the general specifications of the A3VTS data link system.

3.1 General Specifications

The general specifications for the A3VTS data link system are indicated below.

Item	Specifications				
Operating ambient temperature	0 to 55°C				
Storage ambient temperature	-20 to 75°C				
Operating ambient humidity	10 to 90%RH, no condensation				
Storage ambient humidity	10 to 90%RH, no condensation				
Vibration resistance	Conforms to *1 JIS C 0911	Frequency	Acceleration	Amplitude	Sweep Count
		10 to 55Hz	—	0.075mm	10 times *(1 octave/minute)
		55 to 150Hz	1g	—	
Shock resistance	Conforms to JIS C 0912 (10g × 3 times in 3 directions)				
Noise durability	By noise simulator of 1500Vpp noise voltage, 1 μs noise width and 25 to 60Hz noise frequency				
Dielectric withstand voltage	1500V AC for 1 minute across AC external terminals and ground				
Insulation resistance	5MΩ or larger by 500V DC insulation resistance tester across batch of AC external terminals and ground				
Operating ambience	To be free from corrosive gases. Dust should be minimal.				
Cooling method	Self-cooling				

Table 3.1 General Specifications

REMARKS

One octave marked * indicates a change from the initial frequency to double or half frequency. For example, any of the changes from 10Hz to 20Hz, from 20Hz to 40Hz, from 40Hz to 20Hz, and 20Hz to 10Hz are referred to as one octave.

*1 JIS: Japanese Industrial Standard

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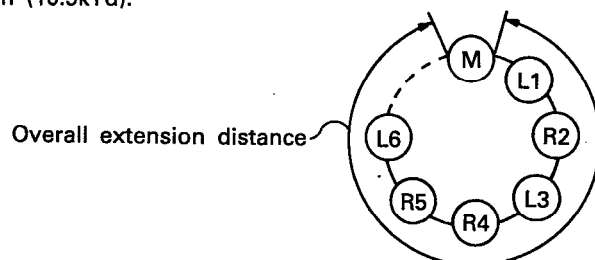
3. SPECIFICATIONS

3.2 Performance Specifications

Item	Specifications	
	Optical data link	Coaxial data link
Maximum I/O points	2048 points	
Maximum points usable for link per station	Input (X)	2048 points
	Output (Y)	2048 points
Maximum link points in one system	Link relay (B)	1024 points
	Link register (W)	1024 points
Maximum points in one master station, local station	Y+B+W ≤ 1024 bytes (Y=8 points/byte, B=8 points/byte, W=1/2 points/byte)	
Current consumption (5V DC)	AJ71VP21: 0.6A	AJ71VR21: 0.8A
Allowable instantaneous power failure time	20msec or less	
Communication speed	0.625MBPS	
Communication method	Half duplex, bit serial method	
Synchronous method	Frame synchronous method	
Transmission path	Single loop, 2 units	
Overall loop distance	Maximum 10km (10.9kYd) (1km (1.09kYd) between stations)	Maximum 10km (10.9kYd) (500m (547kYd) between stations)
Number of connected stations	Maximum of 65 units (1 master station, 64 local stations)	
Modulation method	CMI method	
Transmission format	Conforms to HLDC (Frame format)	
Error control method	CRC (generating polynomial $X^{16}+X^{15}+X^5+1$) and retry after time-out	
RAS function	<ul style="list-style-type: none"> ○ Loopback function on error detection or cable breakage ○ Diagnostic functions such as individual link check 	
Connector	One-core optical connector plug (CA9103)	BNC-P-3-Ni, BNC-P-5-Ni (DDK) or equivalent
Cable	SI-200/250	3C-2V, 5C-2V
Transmission loss	Maximum 12dB/km	—
Sending level	-17 to -11dBm (peak value)	—
Receiving level	-32 to -11dBm (peak value)	—

REMARKS

The overall loop distance refers to the distance from the master station sending port to the master station receiving port via slave stations. For both the optical fiber cables and coaxial cables, the overall loop distance is a maximum of 10km (10.9kYd).



3. SPECIFICATIONS

3.3 Function List

The functions for the A3VTS data link system are described below.

Function	Description	Refer to Section
Data link of input (X) and output (Y)	<ol style="list-style-type: none"> 1) For ON/OFF data communication of input (X) and output (Y) between the master station and the corresponding local station. 2) The maximum number of link points for input (X) and output (Y) is 2048. 3) The minimum setting range of link I/O points is 16 (□□□0 to □□□F). 	6.2.3
Data link of link relay (B)	<ol style="list-style-type: none"> 1) For ON/OFF data communication between the master and local stations or between local stations. 2) Link relay (B) is an internal relay for the data link. 3) The maximum number of link points is 2048. 4) The minimum setting range of link I/O points is 16 (□□□0 to □□□F). 	6.2.1
Data link of link relay (W)	<ol style="list-style-type: none"> 1) For 16 bit data communication between the master and local stations or between local stations. 2) Link relay (W) is data register for the data link. 3) The maximum number of link points is 2048. 4) The minimum setting range of link I/O points is 1. 	6.2.2
Read and write of word devices (T, C, D, W)	<ol style="list-style-type: none"> 1) The application instructions for data link, "LRDP" and "LWTP", enable communication of the present 16 bit data of data registers (D) and link registers (W), and the values of timers (T) and counters (C) between the master station and local stations. 2) The maximum number of link points are 32 points/time. 	6.3
Loop switching function	With the duplex loop system, if a cable break occurs or a link module malfunctions, operation is switched to the operative loop enabling data link operation to continue.	6.1
Automatic return function	If a malfunction prevents data link operation, the automatic return function automatically restores the disconnected station to the system after the malfunction is remedied.	—
Error detection	Special relays and registers for the data link may be monitored to determine errors in the link circuit.	6.4 6.5 8.1
Self-diagnostic functions	Various tests are conducted by setting the mode select switch to check link module hardware and loop lines.	4.6.2 4.6.3

3. SPECIFICATIONS



3.4 Optical Fiber Cable Specifications

This section gives the specifications of the optical fiber cables used for the optical data link.

The optical fiber cables require specialized techniques and special tools for the fitting of the connector plugs. Special connector plugs are used so ensure that the optical fiber cable is compatible with the sockets.

Item	Standard Cable for Indoor Cabling	Reinforced Cable for Indoor Cabling	Standard Cable for Outdoor Cabling	Reinforced Cable for Outdoor Cabling
Construction				
Cable diameter mm (inch)	2.9 (0.11)	6 (0.24)	6 (0.24)	13 (0.51)
Allowable bending radius mm (inch)	60 (2.36)	60 (2.36)	60 (2.36)	130 (5.12)
	2.9 (0.11) dia.	60 (2.36)	60 (2.36)	60 (2.36)
	When cable is extended	120 (4.72)	120 (4.72)	260 (10.2)
Allowable tensile load kg (lb)	Cable	20 (44)	20 (44)	40 (88)
	2.9 (0.11) dia.	20 (44)	20 (44)	20 (44)
	Connector	3 (6.6)		
Ambient temperature	-10 to 70°C		-20 to 60°C	
	Do not subject cables to such action as twisting, bending, or pulling at temperatures below 0°C.			
Transmission loss	Maximum 12dB/km			
Transmission band	Minimum 5MHz · km			
Core diameter	200 μm (SI type multi-component glass fiber)			
Clad diameter	250 μm (SI type multi-component glass fiber)			
Number of cores	1 core			1 core X (1 to 4) cables
Weight kg/km (lb/kYd)	10 (20.1)	30 (60.3)	30 (60.3)	160 (322)
Applicable connector	1-core optical connector plug (CA9103)			
Purchase order type	AS-2P-□M-A	AS-2P-□M-B	AS-2P-□M-C	AS-2P-□M-D

(1) Enter the cable length required in □.

AS-2P-□M-A to AS-2P-□M-C

Specify length. (Unit: m (ft))

Example: 20m (65.6ft) AS-2P-20M-A

AS-2P-□M-□D

Specify the number of 1-core cables (1 to 4) Specify length. (Unit:m (ft))

Example: Two 1-core cords of 30m (98.4ft) length. AS-2P-30M-2D

REMARKS

The allowable bending radius of a cable is defined as the radius allowable for an optical cable to which allowable tensile loads have been applied.

3. SPECIFICATIONS

3.5 Coaxial Cable

This section gives the specifications of coaxial cables used for the coaxial data link.

The coaxial cables used are high-frequency coaxial cables "3C-2V" and "5C-2V" (conforming to JIS C 3501).

Item	3C-2V	5C-2V
Construction		
Cable diameter	5.4mm (0.21inch)	7.4mm (0.29inch)
Allowable bending radius	22mm (0.87inch) or more	30mm (1.18inch) or more
Internal conductive material diameter	0.5mm (0.02inch) (Annealed copper wire)	0.8mm (0.03inch) (Annealed copper wire)
Insulating material diameter	3.1mm (0.12inch) (Polyethylene)	4.9mm (0.19inch) (Polyethylene)
External conductive material diameter	3.8mm (0.15inch) (Single annealed copper wire mesh)	5.6mm (0.22inch) (Single annealed copper wire mesh)
Used jack type	227161-4 (Made by Nippon A.M.P.)	
Applicable connector plug	Connector plug for 3C-2V	Connector plug for 5C-2V

REMARKS

Refer to Section 5.4.4 for a description of the methods used to connect connector plugs and cables.

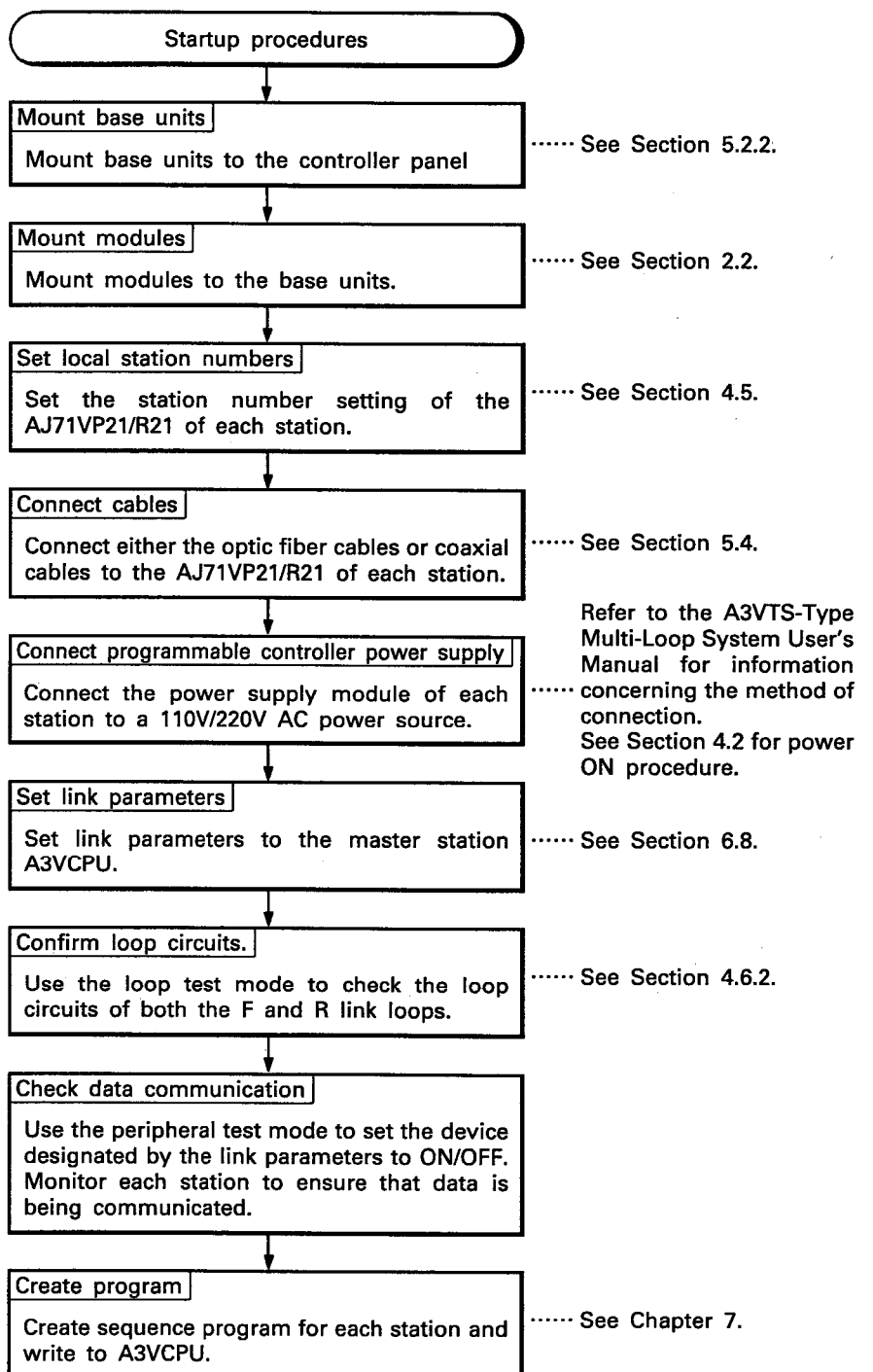
4. STARTUP PROCEDURES AND SETTINGS

This chapter describes the startup procedures and methods of setting the data link modules and other items related to the A3VTS data link system.

Refer to the A3VTS-Type Multi-Loop System User's Manual for information concerning modules and other items not mentioned in this chapter.

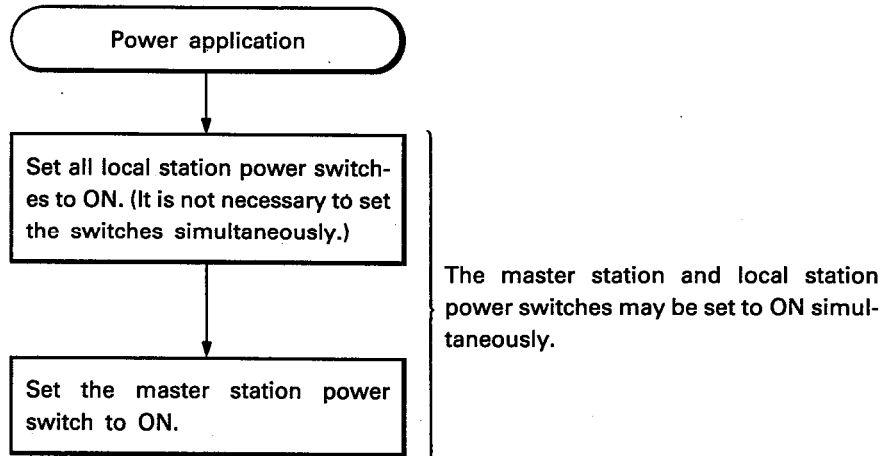
4.1 Startup Procedures and Settings

This section describes the procedures and settings required for the components of each module from unpacking to power application.



4.2 System Power On Procedure

This section describes the procedure to be used when applying power to the system.



If the master station power switch is set to ON prior to the local station and an error in local station or loop circuits is detected by the master station, error data is set in the special relays and registers, and error indications are displayed on the A3VTU front panel monitor.

After power has been applied to all local stations, normal data link processing is possible but the error indications displayed on the A3VTU front panel monitor will not be cleared.

When this occurs, use the A3VTU front panel INDICATOR RESET switch to clear the monitor.

4.3 Module Handling Instructions

This section describes the handling procedures for each of the modules.

- (1) Do not subject the case of the modules to impact.
- (2) Do not touch printed circuit boards.
- (3) Prevent the entry of wire offcuts into the modules.
- (4) Tighten screws as shown below.

Screw	Tightening Torque Range kg-cm (lb-inch)
I/O module terminal block terminal screw (M3 screw)	5 (4.33) to 8 (6.93)
I/O module terminal block terminal screw (M4 screw)	8 (6.93) to 14 (12.1)
Power supply module terminal block screw (M4 screw)	10 (8.66) to 14 (12.1)
Extension cable connector mounting screw	3.7 (3.20) to 4.9 (4.24)

- (5) Do not touch the fiber optic core or the tip of the connector. If these are touched, clean them with a soft cloth. Dirt will cause excessive transmission losses.

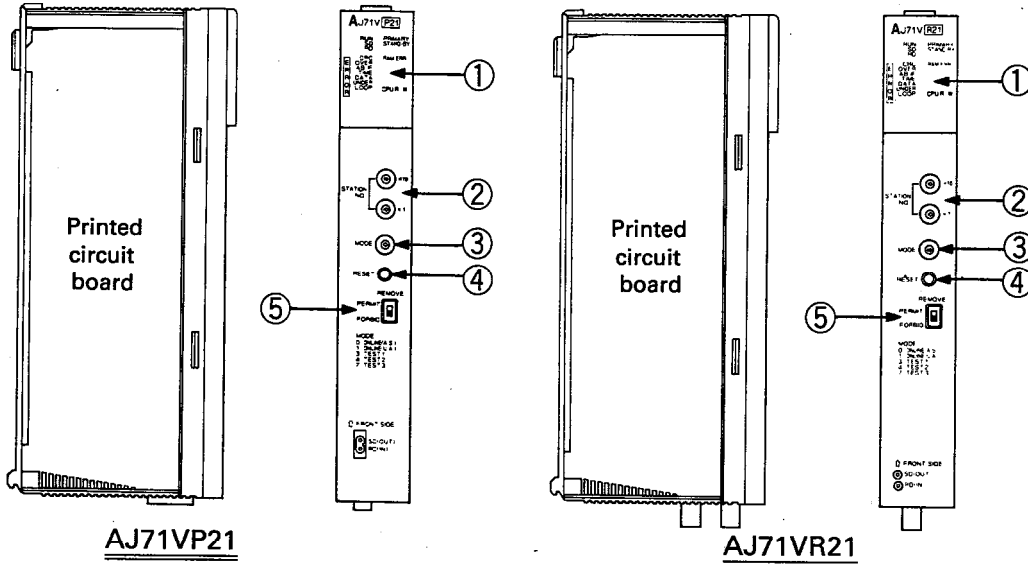
4. STARTUP PROCEDURES AND SETTINGS



4.4 Nomenclature

This section describes the nomenclature of the link modules and base units used in the A3VTS data link system. Refer to the A3VTS-Type Multi-Loop System User's Manual for information concerning unlisted modules since the A3VTS data link system is equivalent to the independent A3VTS system.

4.4.1 AJ71VP21/R21



AJ71VP21

AJ71VR21

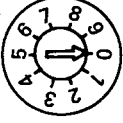
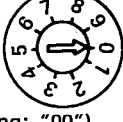
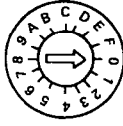


Data link status LED indicators			
LED	Description	LED	Description
RUN	Lit when data link is normal.	PRIMARY	Lit during data link operation
SD	Lit during data sending.	STAND-BY	Lit during data link standby
RD	Lit during data receiving.		Not used (Always off)
	Not used (Always off)		
CRC	Lit at code check error time	RAM ERR.	Lit when error is found in RAM-loaded link data
OVER	Lit at data entry delay error time		
AB.IF	Lit when all data are 1		Not used (Always off)
TIME	Lit at time-out time		
DATA	Lit at receiving data error time		
UNDER	Lit at sending data error time	CPU R/W	Normally lit. Off during link refresh operations
LOOP	Temporarily lit when receive error is generated by loop circuit malfunction.		Not used (Always off)
	Not used (Always off)		

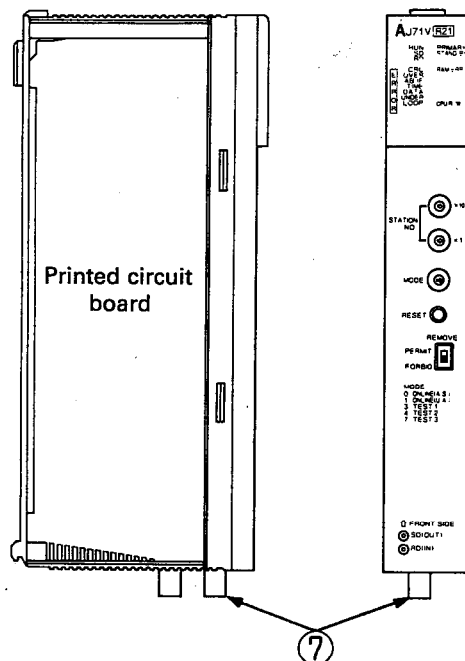
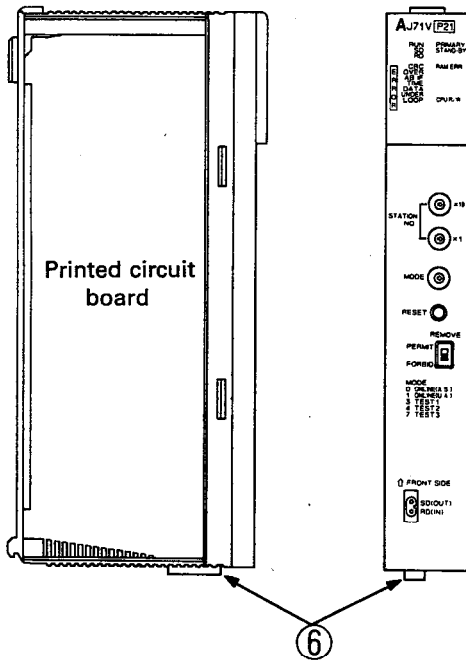
- The ERROR LED of the "CRC" to "RAM ERR." is automatically turned off when status returns to normal.
- For details of "CRC" to "RAM ERR.", refer to Section 8.3.
- When data link operations are conducted, the PRIMARY and STAND-BY LEDs are turned to ON/OFF as follows.

Data Link Status	PRIMARY LED	STAND-BY LED
Online (data link operations active)	ON	OFF
Online (data link operations in standby)	OFF	ON
Online (data link operations stopped)		
Loop test		
Self-loopback test		
Malfunction in AJ71VP21/R21, or improper station number setting	OFF	OFF

4. STARTUP PROCEDURES AND SETTINGS

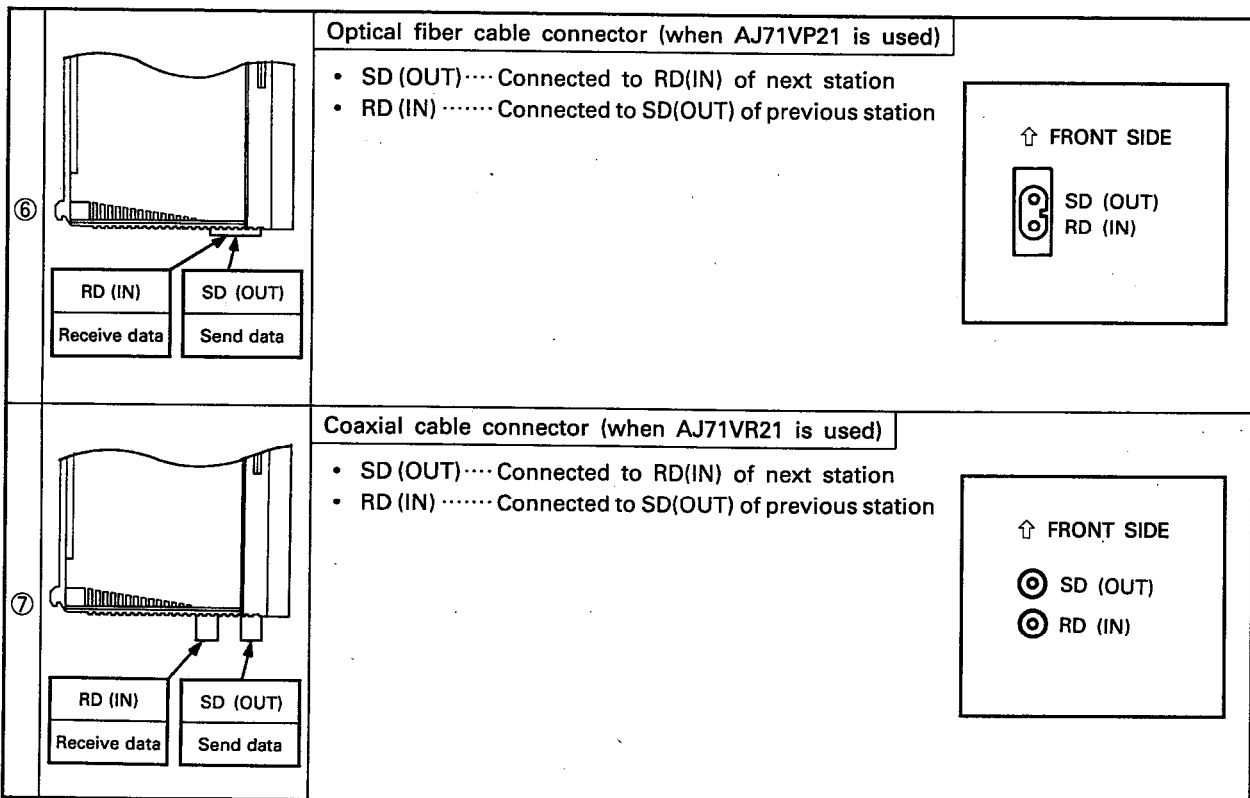


②	<p>STATION No.</p> <p>X10 </p> <p>X1 </p> <p>(Factory setting: "00")</p>	<p>Station number setting switches</p> <ul style="list-style-type: none"> • Set station numbers, 00 to 64. • Set the number of tens of station number to "X10". • Set the number of units of station number to "X1". • When the station is used as a master station, set "00". • When the station is used as a local station, set "01 to 64". • Refer to Section 4.5 for information concerning methods to set each of the station numbers. 																												
③	<p>MODE </p> <p>(Factory setting: "0")</p>	<p>Mode select switch</p> <ul style="list-style-type: none"> • By switching mode, the following functions are available. <table border="1" data-bbox="518 656 1444 1081"> <thead> <tr> <th>Setting Number</th> <th>Name</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Online</td> <td>Set during data link operations (automatic loop switching provided)</td> </tr> <tr> <td>1</td> <td>Online</td> <td>Not used</td> </tr> <tr> <td>2</td> <td>—</td> <td>Not used</td> </tr> <tr> <td>3</td> <td rowspan="2">Loop test</td> <td rowspan="2">Set during loop circuit test</td> </tr> <tr> <td>4</td> </tr> <tr> <td>5</td> <td>—</td> <td rowspan="2">Not used</td> </tr> <tr> <td>6</td> </tr> <tr> <td>7</td> <td>Self-loopback test</td> <td>Set during self-loopback test</td> </tr> <tr> <td>8</td> <td rowspan="3">—</td> <td rowspan="3">Not used</td> </tr> <tr> <td>to</td> </tr> <tr> <td>F</td> </tr> </tbody> </table>	Setting Number	Name	Description	0	Online	Set during data link operations (automatic loop switching provided)	1	Online	Not used	2	—	Not used	3	Loop test	Set during loop circuit test	4	5	—	Not used	6	7	Self-loopback test	Set during self-loopback test	8	—	Not used	to	F
Setting Number	Name	Description																												
0	Online	Set during data link operations (automatic loop switching provided)																												
1	Online	Not used																												
2	—	Not used																												
3	Loop test	Set during loop circuit test																												
4																														
5	—	Not used																												
6																														
7	Self-loopback test	Set during self-loopback test																												
8	—	Not used																												
to																														
F																														
④	<p>RESET </p>	<p>RESET switch</p> <ul style="list-style-type: none"> • Used to reset the hardware of its own station at data link error time. • After moving the station number setting switches and mode select switch, perform reset operation to erase the previous setting. 																												
⑤	<p>PERMIT REMOVE </p> <p>FORBIT</p> <p>(Factory setting: "FORBIT")</p>	<p>REMOVE switch</p> <ul style="list-style-type: none"> • Switch permits mounting and removal of modules while the programmable controller power is ON. <p>Module mounting/removal PERMIT setting</p> <p>Normal data link operations FORBIT setting</p>																												



AJ71VP21

AJ71VR21

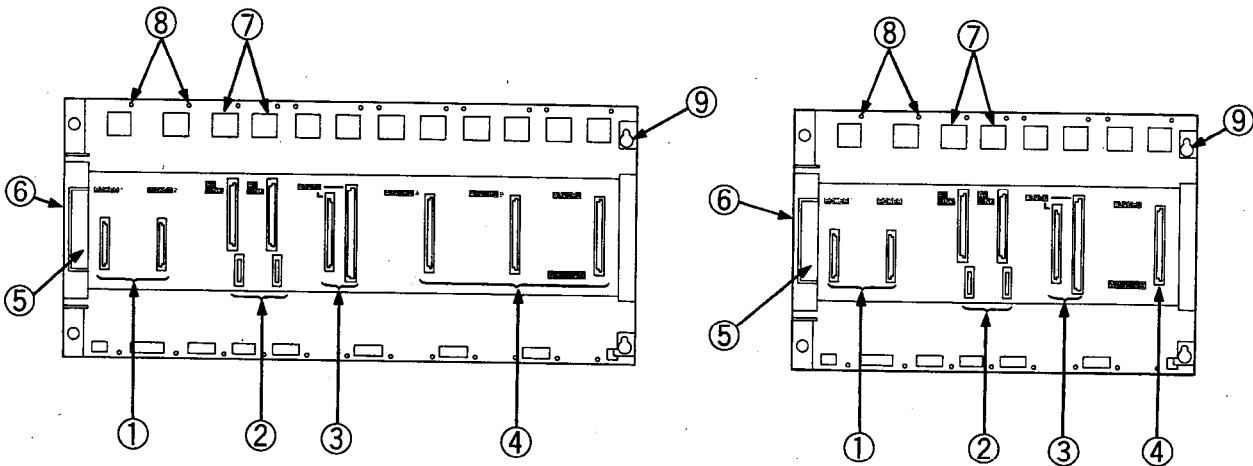


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4. STARTUP PROCEDURES AND SETTINGS

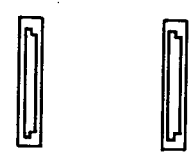
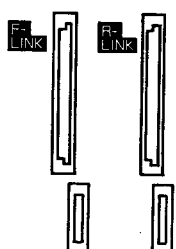
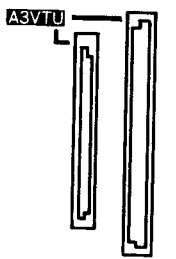


4.4.2 MAIN base unit

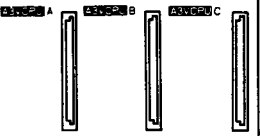
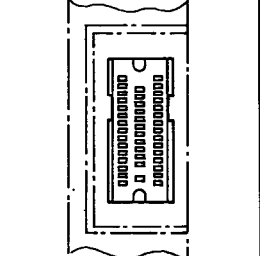
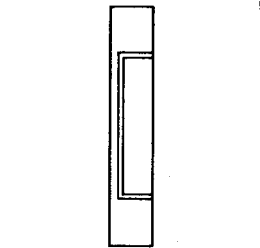
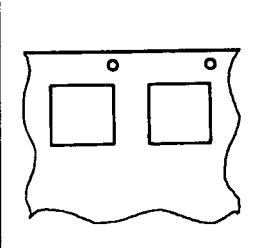
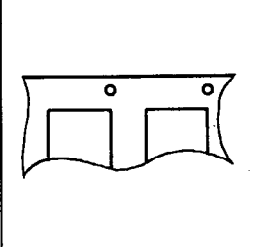
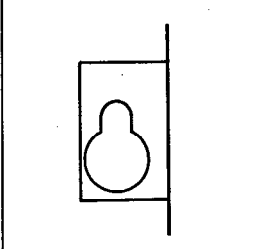


A30LVB

A20LVB

<p>①</p> 	<p>POWER 1,2 connector</p> <ul style="list-style-type: none"> • Connector for the A61VP power supply module <p>REMARKS</p> <ul style="list-style-type: none"> • Power supply modules other than the A61VP may not be mounted.
<p>②</p> 	<p>F-LINK, R-LINK connector</p> <ul style="list-style-type: none"> • Connector for the AJ71VP21 optical data link module or the AJ71VR21 coaxial data link module.
<p>③</p> 	<p>A3VTU connector</p> <ul style="list-style-type: none"> • Connector for the A3VTU Majority module

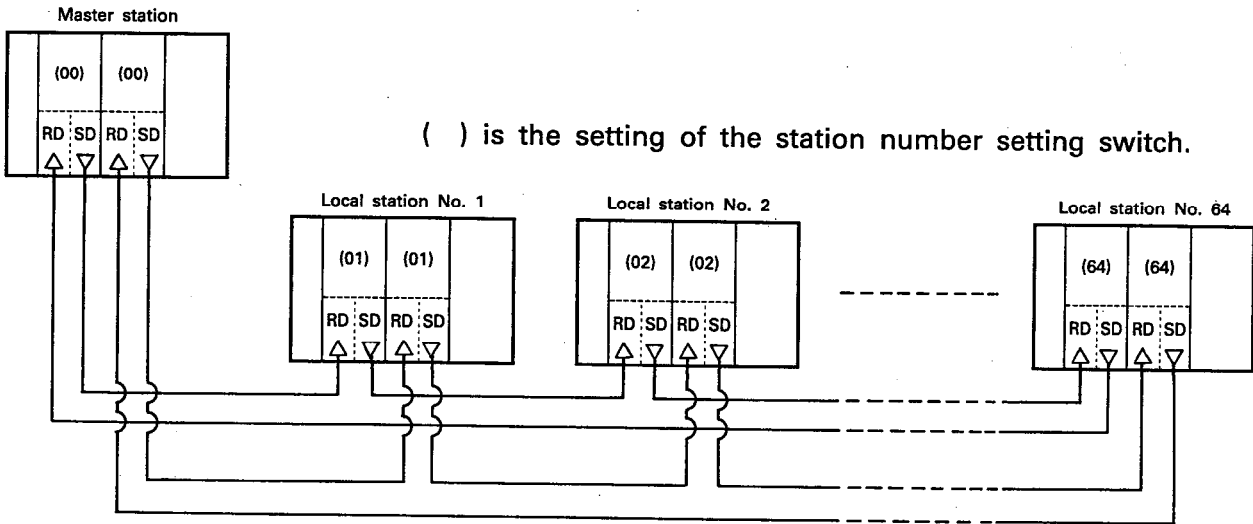
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<p>④</p>		<p>A3VCPU A,B,C connector</p> <p>(The A20LVB main base unit provides only 1 slot.)</p> <ul style="list-style-type: none"> • Connector for the A3VCPU type CPU module
<p>⑤</p>		<p>Expansion cable connector</p> <ul style="list-style-type: none"> • Connector for the communication cable (extension cable (AC[]B)) between main base unit and the extension base unit.
<p>⑥</p>		<p>Base cover</p> <ul style="list-style-type: none"> • Protective cover for the expansion cable connector • When using an extension cable, it is necessary to cut away the upper portion of the connector.
<p>⑦</p>		<p>Module fixing hole</p> <ul style="list-style-type: none"> • Each module is provided with hooks that fit into the module fixing holes in the main base unit.
<p>⑧</p>		<p>Module mounting screws</p> <ul style="list-style-type: none"> • Each module is mounted to the main base unit with screws using these screw holes. • Appropriate screw size: M4x0.7
<p>⑨</p>		<p>Base mounting guide hole</p> <ul style="list-style-type: none"> • Hole used to mount base unit to control panel, etc. • Appropriate screw size: M5

4.5 Station Number Setting Switch

This section describes the procedure used to set station numbers using the station number setting switch located on the front of the AJ71VP21/R21.

- (1) As shown in the following figure, the numbers of the stations connected to the SD (OUT) connector of the AJ71VP21/R21 are set as station number 1, station number 2, station number 3, etc.



- (2) The station numbers in each of the AJ71VP21/R21 must be set to the same number. The following provide two examples of when.

- (a) Two station numbers differ when the programmable controller power supply is turned ON.

The message shown below is displayed on the front monitor of the A3VTU and data link operations cannot be conducted.

"STATION No. 00 * 00"

→ The station number set in the AJ71VP21/R21 installed to the R LINK slot is displayed in hexadecimal.

→ The station number set in the AJ71VP21/R21 installed to the F LINK slot is displayed in hexadecimal.

POINT

When a station number is set to "0" (master station), the error indication is "50".

In this case, set the station number settings of the two AJ71VP21/R21s have been set to the same number and use the A3VTU RUN/STOP key switch to reset operations to normal.

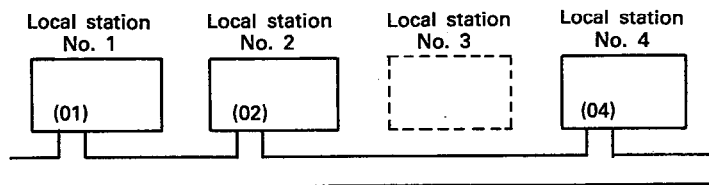
- (b) A data link module is replaced and the set station number is incorrect.

The message "STATION No. ERROR" is displayed on the front monitor of the A3VTU. Data link operations continue. In this case, set the station number of the new AJ71VP21/R21 module has been set to the proper number and use the INDICATOR RESET switch located on the front panel of the A3VTU to reset operations to normal.

The INDICATOR RESET switch can be used to clear messages displayed on the A3VTU front panel monitor.

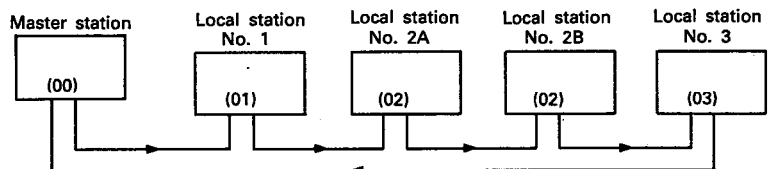
- (3) Situations (a) through (d) explain station number settings that CANNOT be used.

- (a) Settings that omit a station number



When a station number setting is made as shown above, the condition of the F and R loop circuits of local station number is considered abnormal and data link operations cannot be conducted.

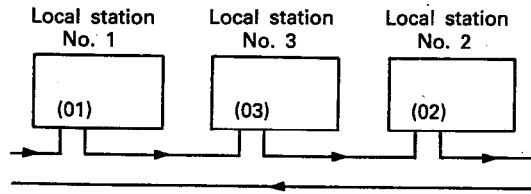
- (b) Same station number used twice



The following describes the situation when station No. 2 is given to two separate stations.

- Either of the No. 2 stations can receive information from the master station.
- Only data sent from the station closest to the master station is received by the master station (local station No. 2B in this example). Data sent from the further station (local station No. 2A in this example) is ignored.

(c) Settings out of sequence



When local station numbers have been set out of sequence, normal data link processing is conducted, but malfunction detection is sometimes precluded if malfunctions occur.

(d) The setting of the number of slave station link parameters differs with the actual number of local stations.

- 1) When the setting of the number of slave station link parameters is larger than the number of the present local station.

Example: Link parameter setting L1 to L5
Actual numbers of local stations L1 to L4

In this case, if the master station detects some malfunction in the F/R loop circuits of the nonexistent station (L5 in this example), data link operation cannot be conducted.

- 2) When the setting of the number of slave station link parameters is smaller than the number of the actual local stations.

Example: Link parameter setting L1 to L5
Actual numbers of local stations L1 to L6

In this case, normal data link processing is conducted between the master station and local stations L1 to L5, but malfunction detection is sometimes precluded if malfunctions occur.

The station (L6, in this example) not set for the link parameter cannot communicate data.

4.6 Mode Select Switch

The following section describes the "Online", "Loop Test", and "Self-loopback Test" modes which are set by the mode select switch located on the front panel of the AJ71VP21/R21.

4.6.1 Online setting (setting: 0)

- (1) Automatic switching enabled (setting: 0) This mode executes data link operations.

If an error is generated in the loop circuits during data link operations, the system automatically switches to the standby loop and data link operation continues.

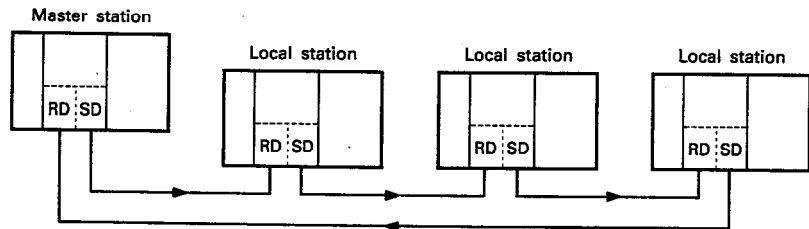
When loop circuits are automatically switched, it is necessary to set the active loop and standby loop of the master station to online (automatic switching enabled), and the active loop and standby loop of the local stations to online (automatic switching may be either enabled or disabled).

4.6.2 Loop test setting (setting: 3 or 4)

This test mode checks a particular loop of an entire loop circuit. Test data is transmitted from the master station checking all the stations for correct data link operations.

Test Procedure

- (1) Connect optic fiber cables and coaxial cables in normal configuration.



- (2) Set the link parameters to the A3VCPU of the master station.
- (3) Set the mode select switch of the AJ71VP21/R21 of the master station to either "3" or "4".
- (4) Set the mode select switch of the AJ71VP21/R21 of the local station to the online mode (0).
- (5) With the reset switch on the front of the AJ71VP21/R21 of the master station, reset operations.
- (6) Either half of the loop circuit can be tested in no matter what the position of A3VTU RUN/STOP. The switch should be in the STOP position when testing both loop circuits.
- (7) The loop test is conducted about two seconds after the AJ71VP21/R21 of the master station is reset.

Test Results

- (1) Determine the test results by link monitoring on the peripheral equipment.
The link monitoring functions of the peripheral equipment permit determination of the status of all loop circuits and the local stations under test. (See Section 8.1 for more detail on link monitoring.)
- (2) Determine the test results using the LEDs located on the front of the AJ71VP21/R21 of the master station.
Loop is normal: The 6 LEDs, "CRC", "OVER", "AB.IF", "TIME", "DATA", and "UNDER" flicker in order.

Loop error:

LED Status	Cause	Corrective Action
"TIME", "DATA", and "UNDER" flicker at the same time	Loopback has occurred due to cable break or a slave station error.	Monitor the station executing loopback with D9204.
No LED flickers.	The total number of slave stations has not been set in the master station link parameters.	Set the link parameter and re-test.

Return Data Link to Normal Status

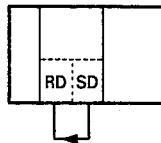
- (1) Set the mode select switch of the AJ71VP21/R21 of the local station to "0" (online mode).
- (2) Reset operation with the reset switch on the front of the AJ71VP21/R21 of the master station.

4.6.3 Self-loopback test setting (setting: 7)

This test mode checks the hardware of both AJ71VP21/R21 of each station to determine if the data transmitted from the same station module can be received correctly within a pre-defined period of time.

Test Method

- (1) Connect optic fiber cable or coaxial cable in the manner shown below.



- (2) When conducting the self-loopback test from the master station, set the link parameters to the A3VCPU of the master station.
- (3) Set the mode select switch of the AJ71VP21/R21 that is undergoing self-loopback testing to "7".
- (4) Using the reset switch on the AJ71VP21/R21 to execute the self-loopback test, reset operations.
- (5) The RUN/STOP position of the A3VTU under test may be in either position when a test is being conducted on only one AJ71VP21/R21.
- (6) When testing both AJ71VP21/R21s, set the RUN/STOP switch to STOP.
- (7) The self-loopback test is conducted about one second after the AJ71VP21/R21 is reset.

Test Results

Determine the test results using the LEDs located on the front of the AJ71VP21/R21.

Loop is normal: The 6 LEDs, "CRC", "OVER", "AB.IF", "TIME", "DATA", and "UNDER" flicker in order.

Loop error: The LED corresponding to the error lights and the test is stopped.

(See Section 8.3 for information concerning the contents of the LEDs.)

Example: When a cable is broken, the "LOOP" LED is lit.

Return Data Link to Normal Status.

- (1) Return the cables to their normal configuration.
- (2) Set the mode select switch of the AJ71VP21/R21 to online mode (master station: 0, local station: 0).
- (3) Reset operation with the reset switch on the front of the AJ71VP21/R21.

5. LOADING AND INSTALLATION

This chapter describes precautions and methods required for the loading and installation of the A3VTS data link system to ensure its reliability and full functionality.

Refer to the A3VTS User's Manual for information concerning each station's power supply module wiring, connection with peripheral device, and methods of grounding.

5.1 Installation Environment

Do not install the A3VTS data link system in the following environments:

- (1) Ambient temperature outside the range 0 and 55°C.
- (2) Ambient humidity outside the range 10 and 90%RH.
- (3) Excessive condensation (e.g. due to sudden temperature changes)
- (4) Corrosive and/or combustible gasses.
- (5) Excessive amounts of conductive powder such as dust, iron filings, oil mist, salt, or organic solvent.
- (6) Direct exposure to sunlight.
- (7) In the vicinity of strong power and magnetic fields.
- (8) Excessive vibration and shock directly transmitted to the main module.

5.2 Installation of Base Units

This section describes the precautions related to the installation procedures of the main base unit and expansion base units used in the A3VTS data link system.

5.2.1 Precautions related to installation

This section describes the precautions related to the installation of programmable controllers to a panel.

- (1) Provide more than 80mm (3.15inch) of space between the top of the units and any structure above them to ensure the free passage of air and to ease unit replacement.
- (2) Unit must not be installed vertically within the cabinet as shown in Fig. 5.4 nor horizontally as shown in Fig. 5.5 to ensure the free passage of air.
- (3) The base unit must be mounted on a flat surface as mounting on warped or uneven surfaces will place unnecessary force on the printed circuit board and cause malfunctions.
- (4) Do not connect the unit to power sources to which power fluctuation generating devices such as large electromagnetic contactors and no-fuse circuit breakers are connected. Either use separate panels or mount the device in a more isolated location.
- (5) Provide wiring ducts where necessary.
When dimensions of the ducts in either the top or lower sections of the programmable controller are less than those given in Fig. 5.1, the precautions below must be followed.
 - (a) When a duct is placed on the top of the programmable controller, the height of the duct must be less than 50mm (1.97inch) to ensure good air passage.
When located separately from the top section of the programmable controller, leave enough space for the fixing hooks on the top of the unit to be used or else units cannot be replaced.
 - (b) When a duct is placed at the bottom of the programmable controller, ensure that the placement of the duct does not interfere with the connection of optic fiber cables and coaxial cables nor force cables to be bent under recommended minimal radius.
 - (c) Do not place coaxial cables near nor bundle with main circuit lines nor high voltage lines.
These could be sources of noise and surge induction causing improper data link operation.
Ensure that coaxial cables are located at least 100mm (3.94inch) away from main circuit lines and high voltage lines.

- (d) Be sure to install the connector cover supplied with the AJ71VR21 on the coaxial cable connector.
Without the connector cover, the connector may become susceptible to static, causing abnormal data link operation.

- (6) To avoid radiated noise and heat, when components are placed in front of the programmable controller or when equipment is mounted to the back of the panel door, ensure that the components are located at least 100mm (3.94inch) away from mounted modules and units and at least 50mm (1.97inch) away from the base units either to the left or right.

5.2.2 Installation

This section describes the installation procedures of the main base and extension base units, and the spacing of structural and other components.

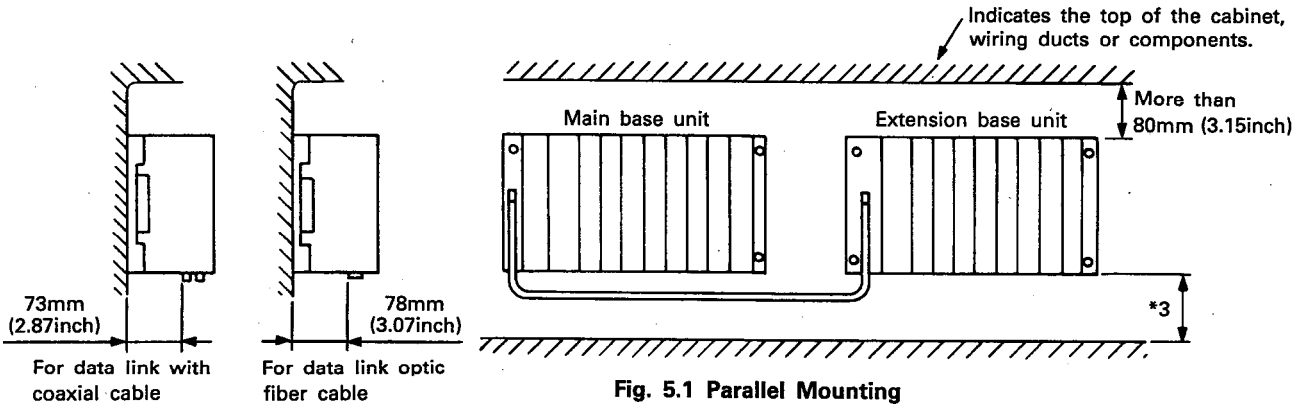


Fig. 5.1 Parallel Mounting

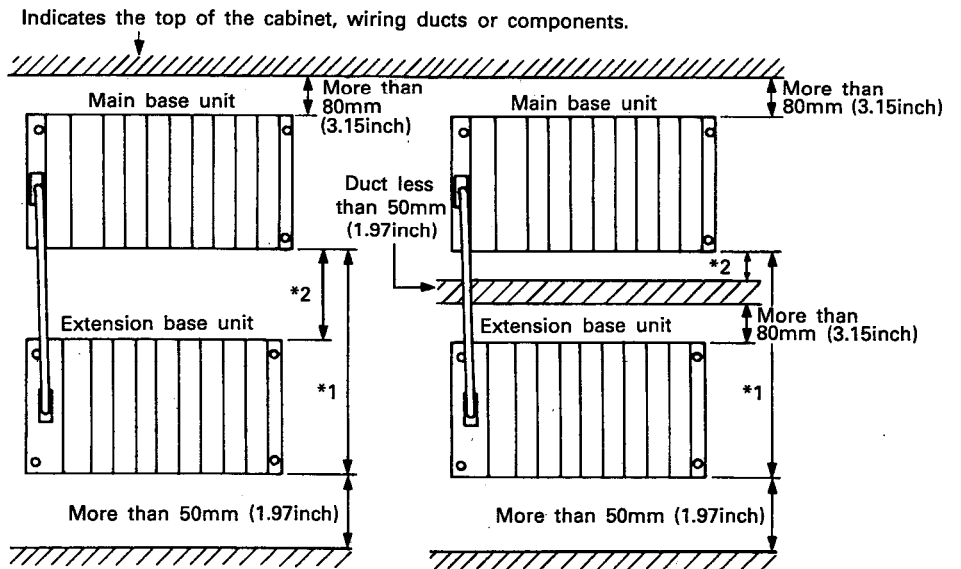


Fig. 5.2 Series Mounting

- *1..... This dimension varies depending on the cable used as shown below.
 - AC06B cable.....less than 450mm (17.72inch)
 - AC12B cable.....less than 1050mm (41.34inch)
 - AC30B cable.....less than 2850mm (112.2inch)

- *2..... Optic fiber cable
 - φ 2.9mm (0.11inch), φ 6mm (0.23inch) ... more than 110mm (4.33inch)
 - φ 13mm (0.51inch) ... more than 180mm (7.09inch)
 - Coaxial cable ... more than 100mm (3.94inch)

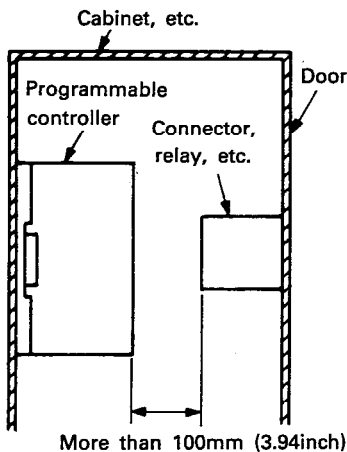


Fig. 5.3 Distance Between Components in Front of Programmable Controller

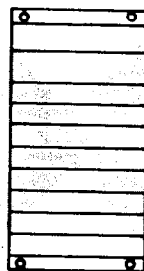


Fig. 5.4 Vertical Mounting (Incorrect mounting)



Fig. 5.5 Horizontal Mounting (Incorrect mounting)

5.3 Replacing Modules During System Operation

This section describes the replacement procedures for AJ71VP21/R21 and A3VTU modules during data link operations in the A3VTS data link system.

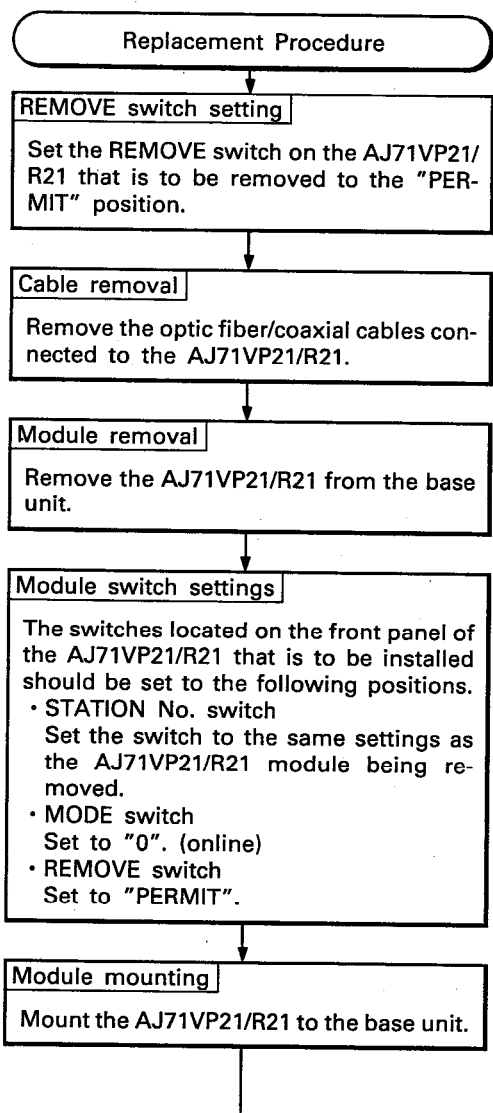
Refer to the A3VTS User's Manual for procedures to replace station power supply modules, CPU modules, I/O modules, while the programmable controller is ON.

POINT

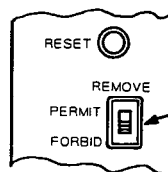
The A3VTU cannot be replaced while the system is operating. Before replacing it, always turn off the power to the power supply module. Keep in mind that turning off each station power supply module disables the system-wide data link operation.

5.3.1 AJ71VP21/R21 replacement procedure

This section describes the replacement procedures for the AJ71VP21/R21.

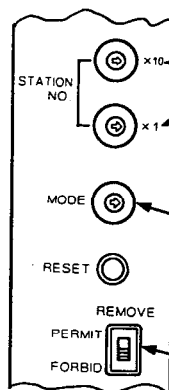


Front panel of the AJ71VP21/R21



Set to "PERMIT".

Front panel of the AJ71VP21/R21

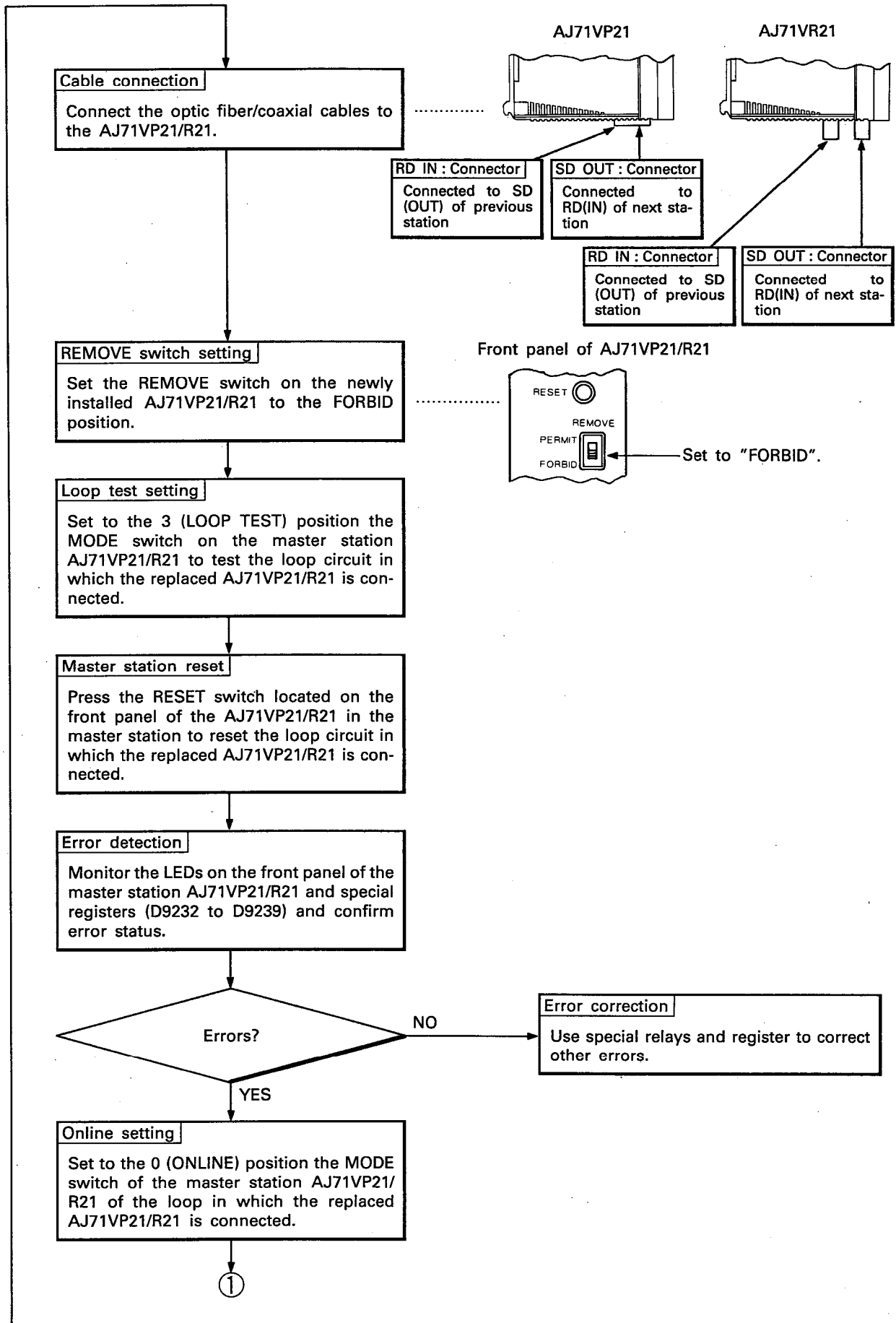


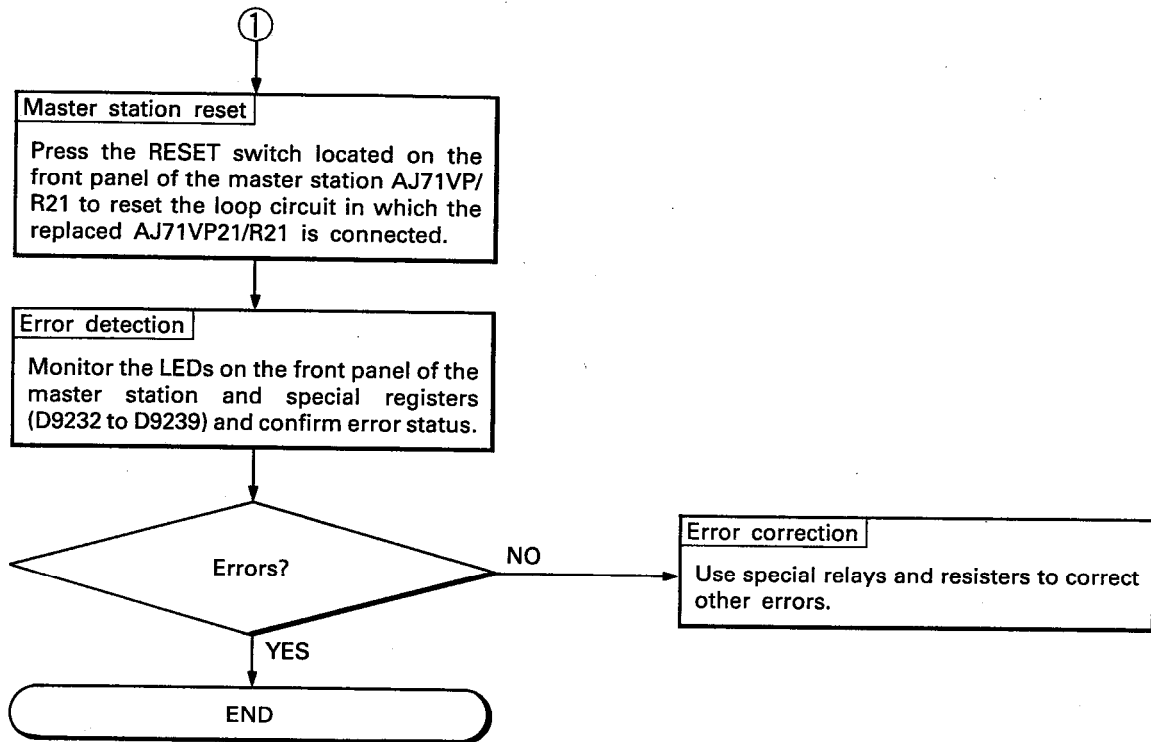
Set the switch to the same settings as the AJ71VP21/R21 module being removed.

Set to "0".

Set to "PERMIT".

5





POINT

- (1) When removing the AJ71VP21/R21 always set the REMOVE switch to the "PERMIT" position. If it is removed with the switch left in the "FORBID" position, the A3VTU of the associated station may malfunction.
- (2) When the station number setting of a newly installed AJ71VP21/R21 is incorrect, the LED labeled "STATION No. ERROR" located on the front panel of the A3VTU will light. (The A3VTU will continue to operate.) Use the following procedure to correct the error.
 AJ71VP21/R21 — Set the station number to the correct number and press the RESET switch on the front panel of the AJ71VP21/R21 to reset operations.
 A3VTU — Use the "INDICATOR RESET" switch to reset the LED display.

5

5.4 Connection of Optical/Coaxial Cables

This section describes the connection of optic fiber cables and coaxial cables to the AJ71VP21/R21.

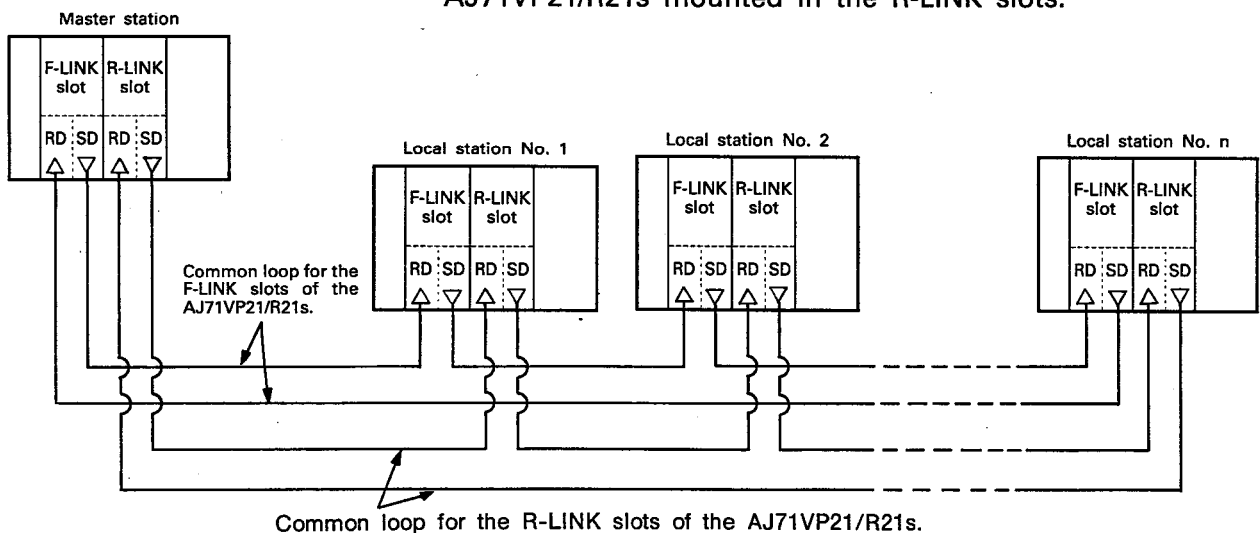
5.4.1 Handling instructions for optical/coaxial cables

If optical fiber cables and coaxial cables are handled roughly, they will be damaged. Therefore:

- (1) Do not bend the cable more than allowable bending radius
- (2) Do not squash the cable.
- (3) Do not twist the cable.
- (4) Do not pull either the connector or the cable above permitted values.
- (5) Do not apply tension exceeding limits to the cables.
- (6) Do not step on cables.
- (7) Do not place objects on cables.
- (8) Do not mar cable covers.

5.4.2 Precautions for connecting cables

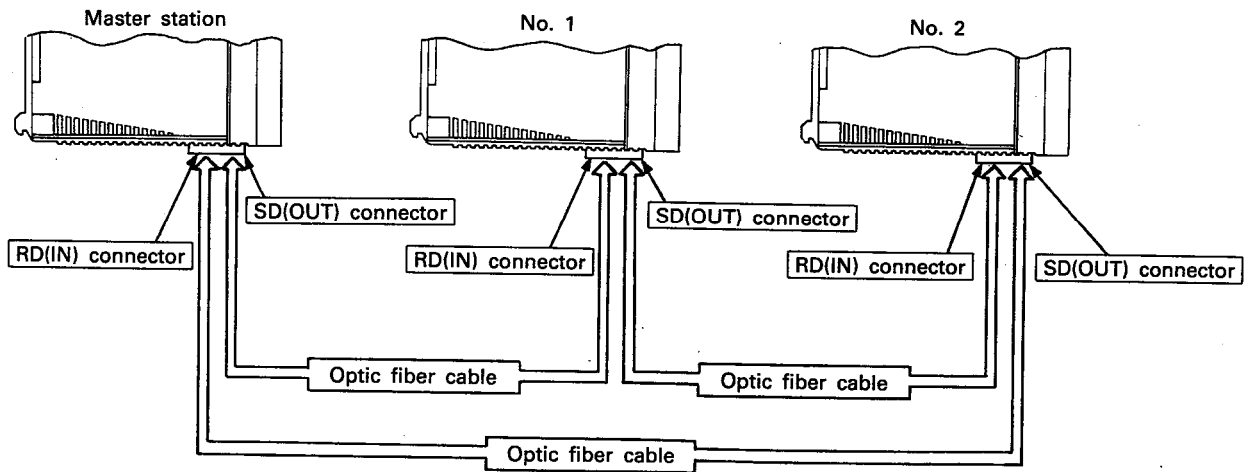
- (1) Do not place coaxial cables near nor bundle with main circuit lines nor high voltage lines. These could be sources of noise and surge induction causing improper data link operation. Ensure that coaxial cables are located at least 100mm (3.94in.) away from main circuit lines and high voltage lines.
- (2) Each of the stations are linked by either optic fiber cable or coaxial cable that are connected to the two AJ71VP21/R21s of each station. The system is linked so that the AJ71VP21/R21s mounted in the F-LINK slots of each station are connected with the F-LINK slots of the stations. The same is true for the AJ71VP21/R21s mounted in the R-LINK slots.



Within the same loop, if the F-LINK slots of the AJ71VP21/R21s and the R-LINK slots of the AJ71VP21/R21s should be interconnected, the data link will operate correctly. However, when an error is generated, correct data will not be registered in the special data register.

5.4.3 Connection of optic fiber cables

As shown in the following diagram, there are two connectors for the optic fiber cables located on the bottom panel of the AJ71VP21 and are connected to neighboring stations.



The SD(OUT) connector is connected to the RD(IN) connector of the next station. The RD(IN) connector is connected to the SD(OUT) connector of the next station.

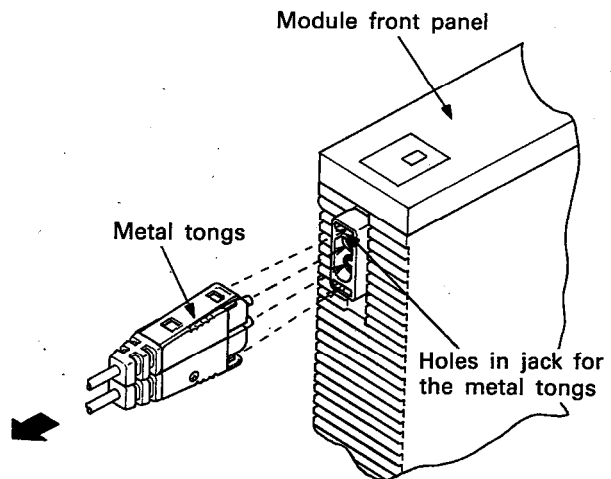
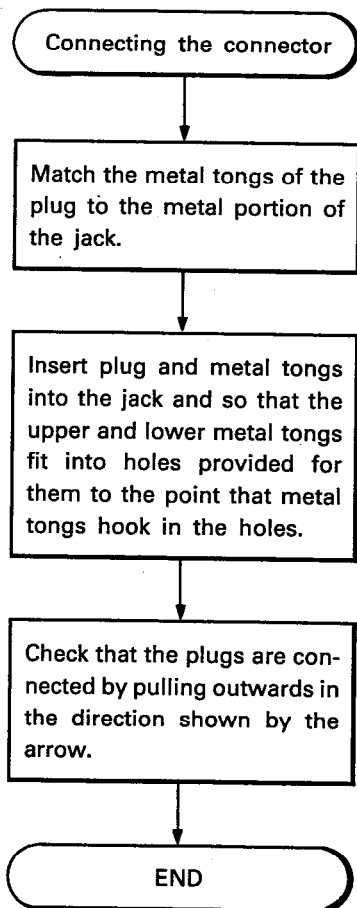


Fig. 5.6

5

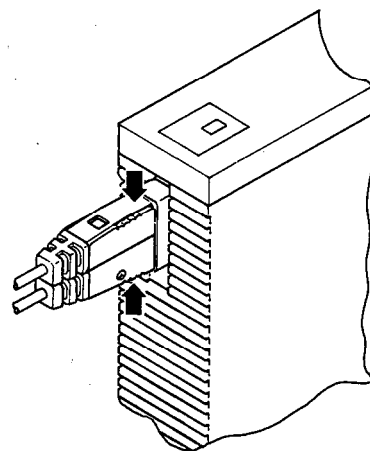
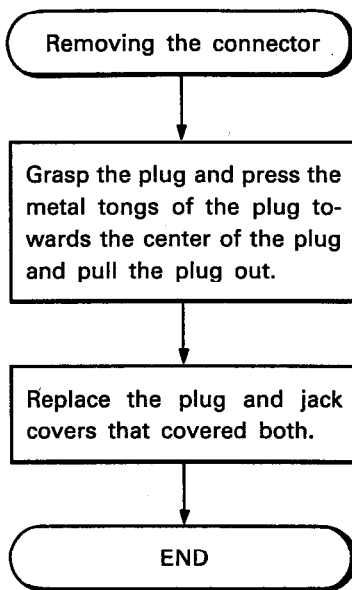
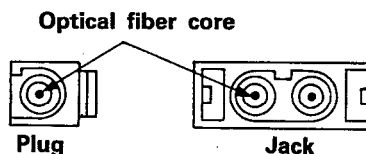


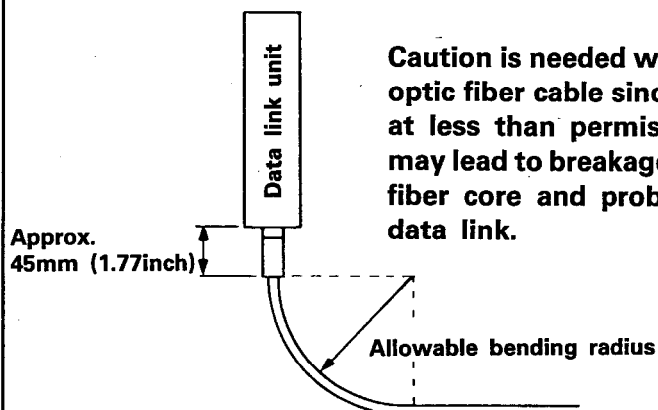
Fig. 5.7

POINT

- (1) Do not touch the optical fiber cores of plug or jack and protect from dirt and dust. Always fit the protective cap to the plugs and sockets for storage.



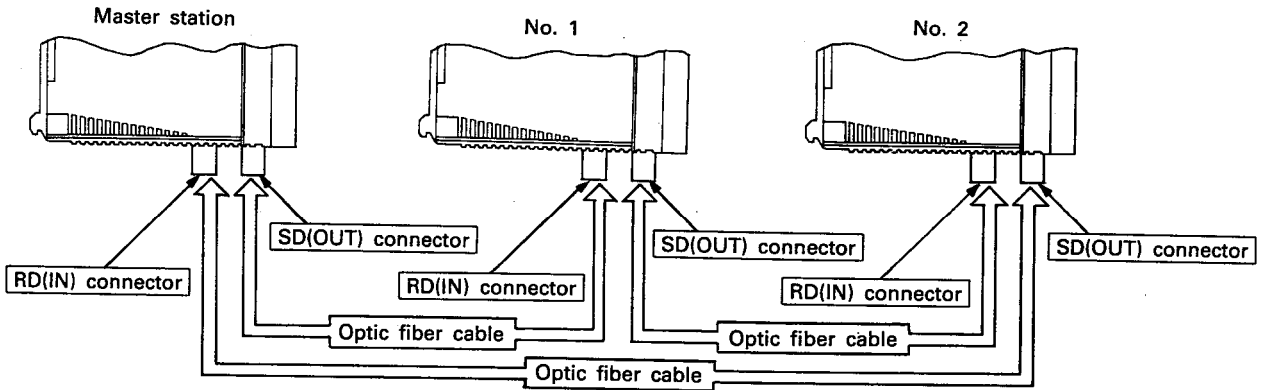
- (2) Allowable bending radii are as indicated below.
 - Standard type for indoor cabling-----60mm (2.36inch) or more
 - Reinforced type for indoor cabling-----
 - Standard type for outdoor cabling-----
 - Reinforced type for outdoor cabling---130mm (5.12inch) or more
- For details, refer to Section 3.4.



Caution is needed when bending optic fiber cable since bending it at less than permissible angles may lead to breakage in the optic fiber core and problems in the data link.

5.4.4 Connection of coaxial cables

As shown in the following diagram, there are two connectors for the coaxial fiber cables located on the bottom panel of the AJ71VR21 and are connected to neighboring stations.



The SD(OUT) connector is connected to the RD(IN) connector of the next station. The RD(IN) connector is connected to the SD(OUT) connector of the next station.

Connect and remove the cable using the following procedure.

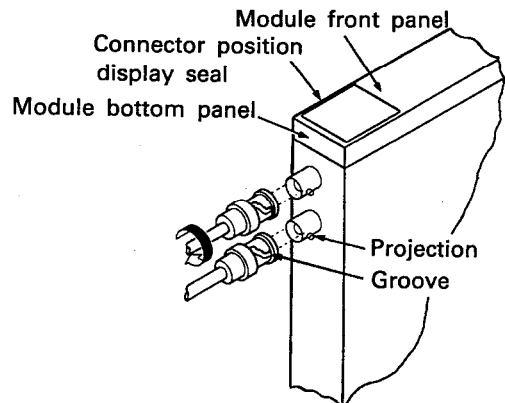
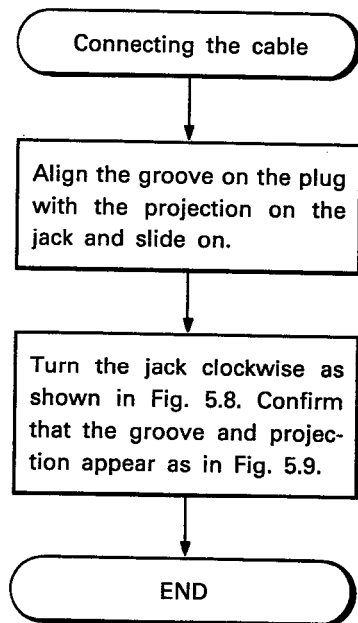


Fig. 5.8

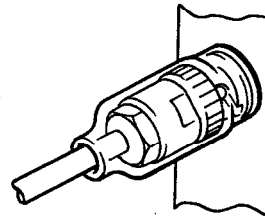


Fig. 5.9

5

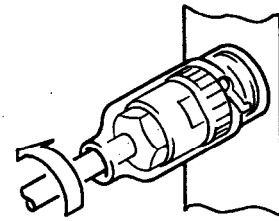
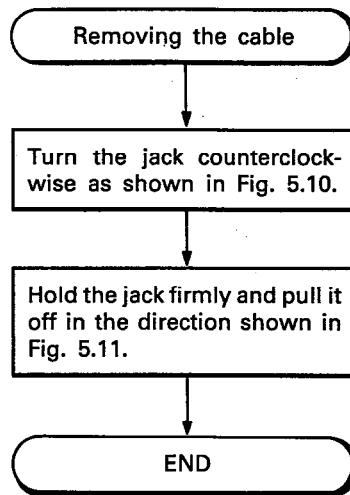


Fig. 5.10

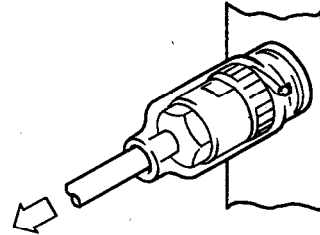
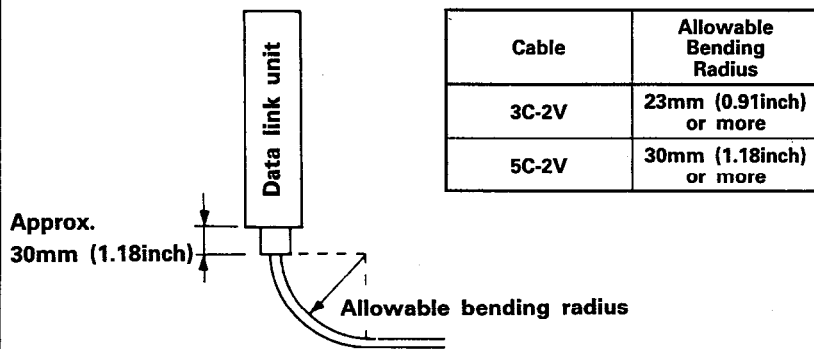


Fig. 5.11

POINT

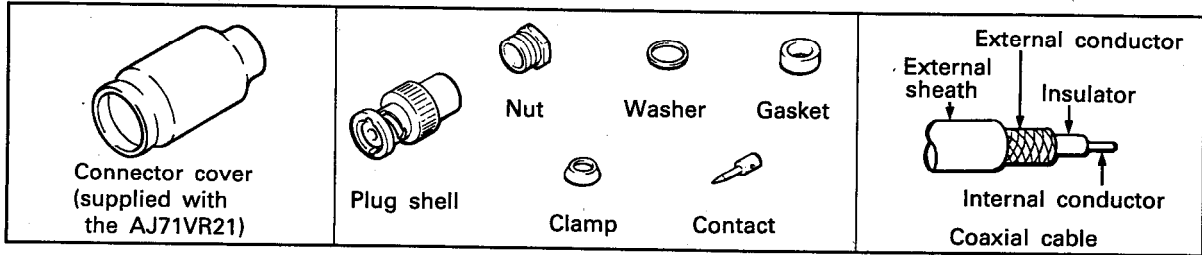
(1) Caution is needed when bending coaxial fiber cable since bending it at less than permissible angles may lead to breakage in the coaxial core. Also take care not to apply too much pressure when connecting jacks to the modules.



The following table shows connector type and their application.

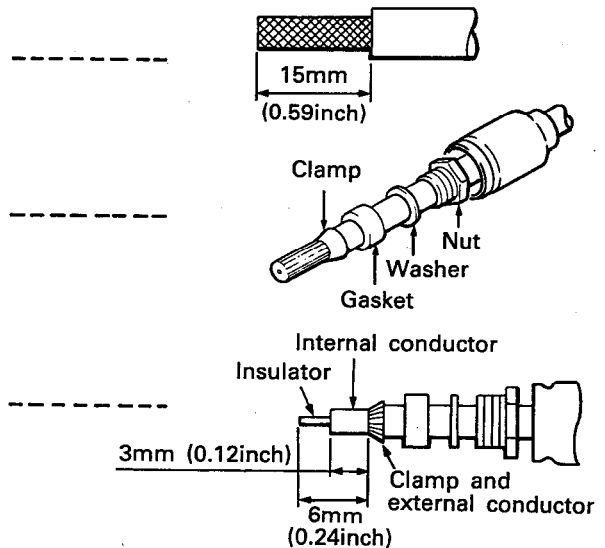
Recommended Connector Type	Cable
BNC-P-3-Ni (for 3C2V)	High-frequency coaxial cable
BNC-P-5-Ni (for 5C2V)	

The following diagram shows the BNC connector and its components



Installing a connector

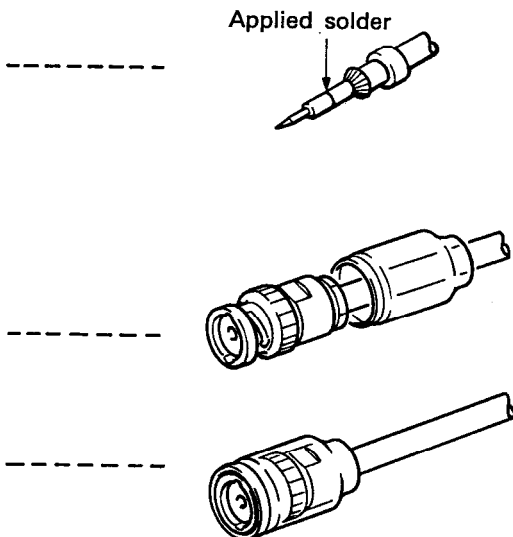
- (1) Remove the external sheath of the coaxial cable as shown in the figure on the right. Ensure that no harm is done to the external conductor.
- (2) Install the connector cover, nut, washer, gasket, and clamp over the coaxial cable as shown in the figure on the right. Next unravel the external conductor.
- (3) Cut the external conductor, insulator, and internal conductor to the measurements given in the figure on the right. Cut the external conductor to the same size as that of the tapered clamp. Bend the external conductor back over the clamp.
- (4) Solder the contact to the internal conductor.



POINT

- (1) Do not apply excess solder.
- (2) The contact should be snug up against the insulator. There should be neither a gap between the contact and the insulator nor should the contact be shoved into the insulator.
- (3) To prevent deformation of the insulator, solder the contact to the internal conductor quickly.

- (5) Insert the contact assembly finished in step (4) into the contact shell and seat the assembly in the plug shell by tightening the nut into the shell.
- (6) Place the connector cover on the connector.



6. DATA LINK PROCESSING

This chapter covers the A3VTS data link system.

6.1 Loop Switching Function

When a malfunction occurs in a loop circuit, processing switches to the alternate circuit and processing continues. This switching between loops is called the loop switching function.

In the A3VTS data link system, each station uses two AJ71VP21/R21 modules and two loop circuits.

Normally, one of the two loop circuits is used for data link processing while the other is in standby.

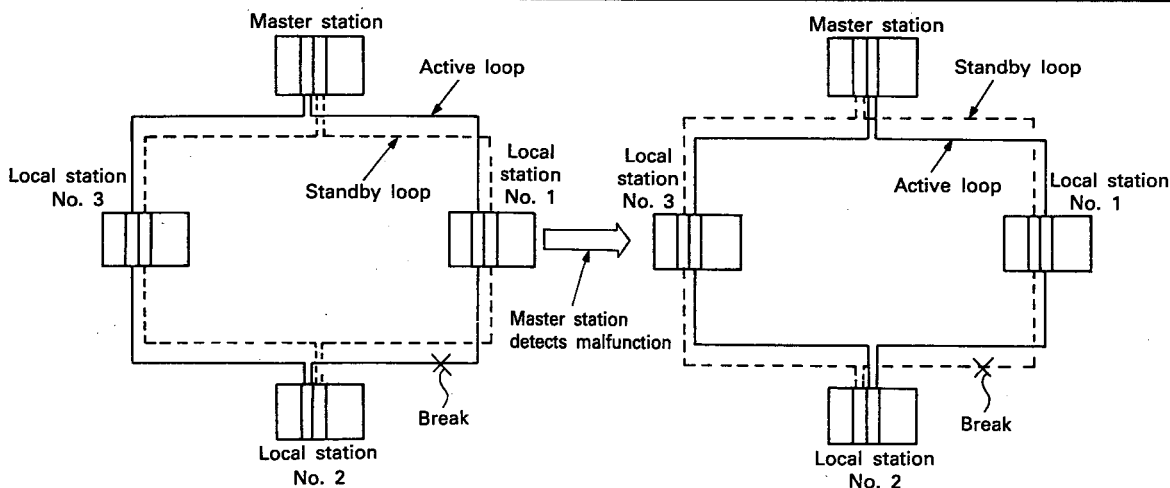
Loop circuit switching occurs either automatically, as explained below, or is forced to occur in one of two methods.

(1) Automatic switching

As shown in the following diagram, when a cable opens or a malfunction occurs in an AJ71VP21/R21 that is in the loop circuit on which data link processing is taking place, the master station automatically switches to the standby loop circuit and data link processing continues.

POINT

Care should be taken with the RESET switch located on the front panel of the AJ71VP21/R21 that is in the active loop, and the latch clear operation of the A3VCPUI, both of which will cause the loop circuit to automatically switch.

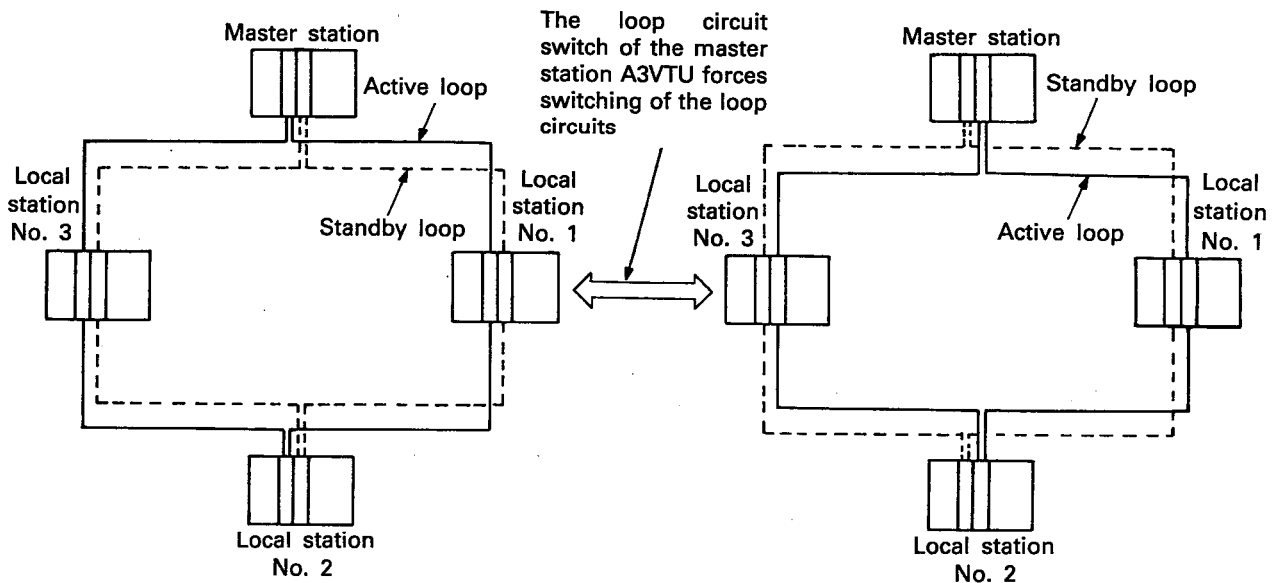


- 1) The master station conducts loop circuit malfunction detection of both the active loop and standby loop. If the active loop circuit should have a malfunction while standby loop also has a malfunction, data link processing terminates.
- 2) Automatic loop circuit switching occurs only if the mode switch of the master station's AJ71VP21/R21 is set to "0" (online).

3) The data link processing (link refresh processing) is interrupted for 900msec (with 64 stations) when loop switching occurs to provide time for switch processing. The communication data of each station that exists directly prior to the interrupt is saved.

(2) Forced switching

When the A3VTU of a local station is being replaced, the loop circuit switch of the master station A3VTU is used to force switching of the loop circuits as shown in the following diagram.



- 1) Forced loop circuit switching occurs when the mode switch of the master station's AJ71VP21/R21 is set to "1" (online).
- 2) When forced loop circuit switching is set and a malfunction occurs in the standby loop, data link processing can be continued in the original loop circuit by again switching the loop circuit.

6.2 Types and Functions of Link Devices

This section describes the data link devices used in the A3VTS data link system.

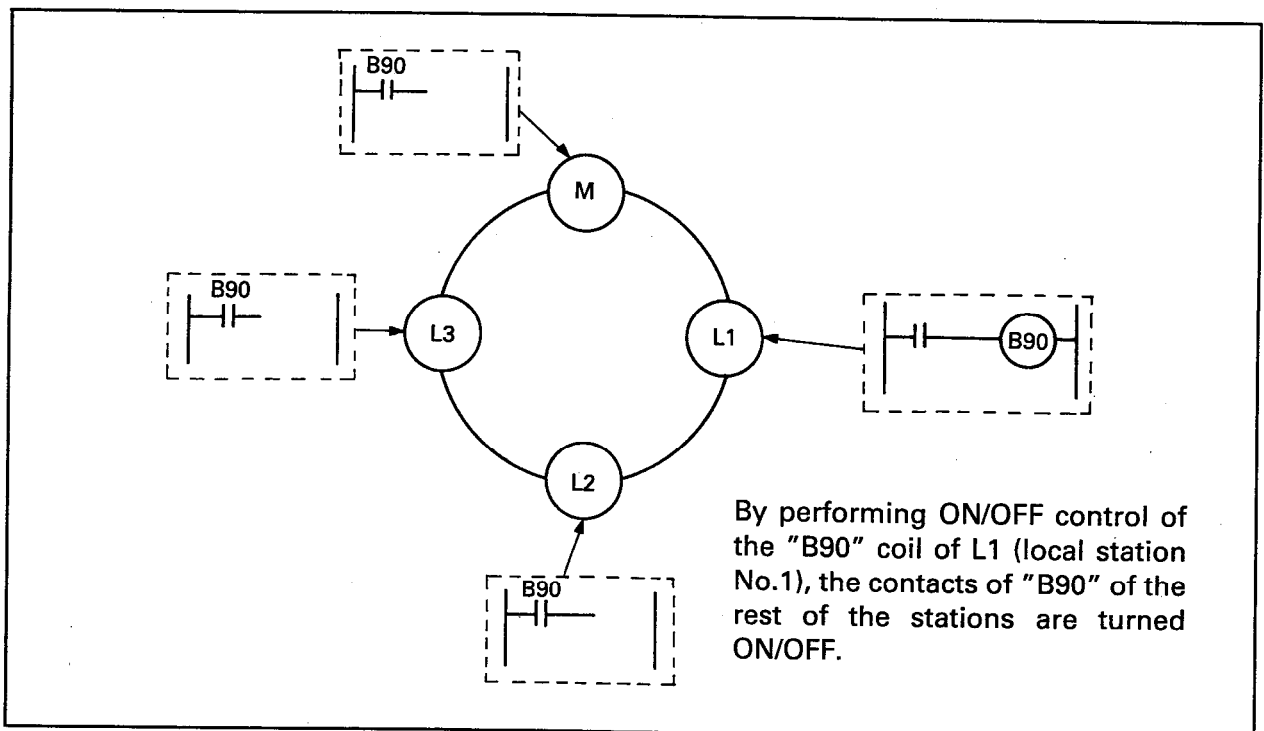
The following is a list of the devices used in the data link for data communication.

- (1) Link relay (B)
- (2) Link register (W)
- (3) Link input (X), Link output (Y)
(The input (X), output (Y) used in the data link are expressed as link input (X) and link output (Y).)

6.2.1 Link relay (B)

The link relay (B) is a device exclusively used for the data link and has no field output.

- (1) Link relay (B) communicates ON/OFF data between master station and local stations, and between the local stations themselves.
- (2) There are a total of 1024 link relays for the master station and all local stations.
- (3) Device numbers are expressed in hexadecimal from 0 to 3FF.
- (4) By performing ON/OFF control of the coil of the link relay (B) assigned to a particular station, the ON/OFF data of the contacts of the link relay (B) of the same device number in other stations can be read.



- (5) The division of link relay (B) to separate stations is set by the peripheral equipment link parameter. The device numbers that conduct ON/OFF control are divided among the master station and local stations.
- (6) The minimum unit of assignment is 16 points, i.e., [] 0 to [] F.

Example of link relay (B) assignments

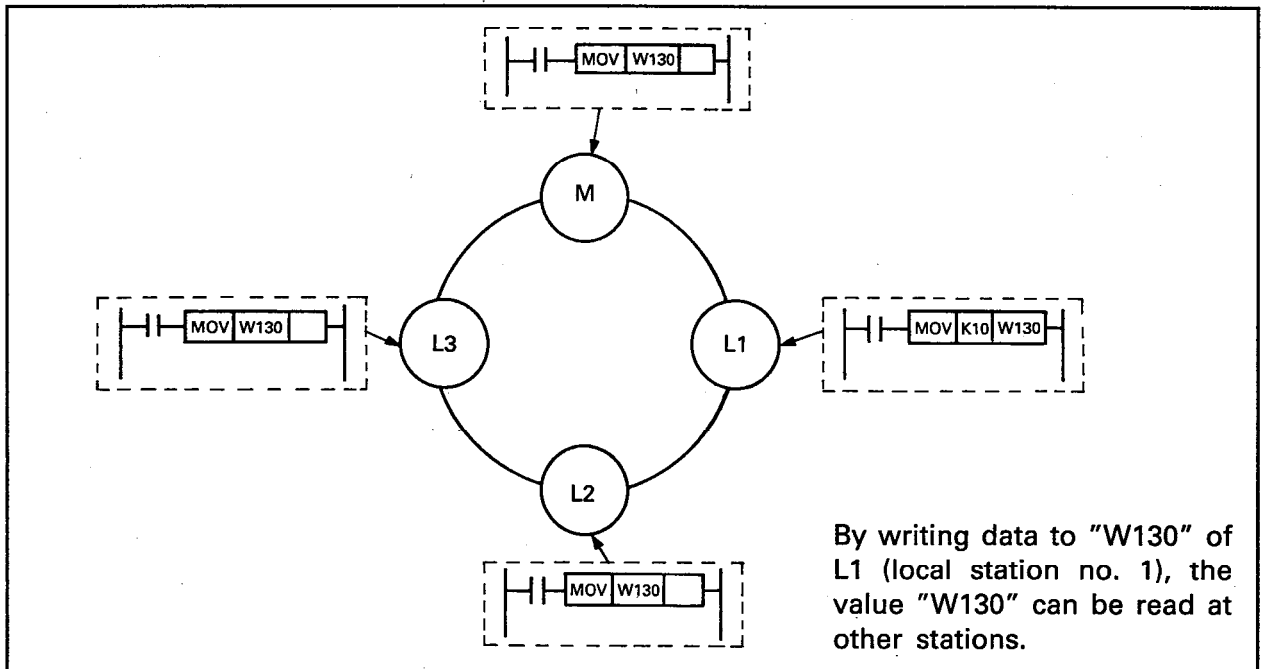
0 to BF	C0 to 17F	180 to 23F	240 to 2DF	2E0 to 37F	380 to 3FF
Range in which master station performs ON/OFF control.	Range in which local station No. 1 performs ON/OFF control.	Range in which local station No. 2 performs ON/OFF control.	Range in which local station No. 3 performs ON/OFF control.	Range in which local station No. 4 performs ON/OFF control.	(Not used for data link)

- When assignment has been made as above, only local station No. 3 is able to perform ON/OFF control of coils B240 to 2DF.
- Reading of the ON/OFF status of contacts B180 to B23F can be performed by the master station and all the local stations.

6.2.2 Link register (W)

The link register (W), a register for 16-bit data communication, is a device exclusively used for data link processing.

- (1) Link register (W) communicates 16-bit data between master station and local stations, and between the local station themselves.
- (2) The maximum number of link points, including the master station and all of the local stations is 1024.
- (3) The device numbers range from 0 to 3FF (hexadecimal, 0-9, A-F)
- (4) Writing data to the link register (W) assigned to a particular station sets the same device number of the link registers (W) of other stations enabling the data of each station to be read.



- (5) For the assignment of the link register (W) to each station, the device numbers, which are used to write the data, are allocated to the master station and local stations. This assignment is set using the link parameters of the peripheral equipment.
- (6) The minimum unit of assignment is 1 point.

Example of link register (W) assignments

0 to D8	D9 to 185	186 to 22E	22F to 306	307 to 3B5	3B6 to 3FF
Range in which master station writes data	Range in which local station No.2 writes data	Range in which local station No.1 writes data	Range in which local station No.3 writes data	Range in which local station No.4 writes data	Not used in data link

- Only local station No. 1 can write data in the W186 to W22E range.
- All stations, the master and locals, can read data from the W186 to W22E range.

6.2.3 Link input (X), link output (Y)

Link input (X) and link output (Y) are devices that provide ON/OFF communication.

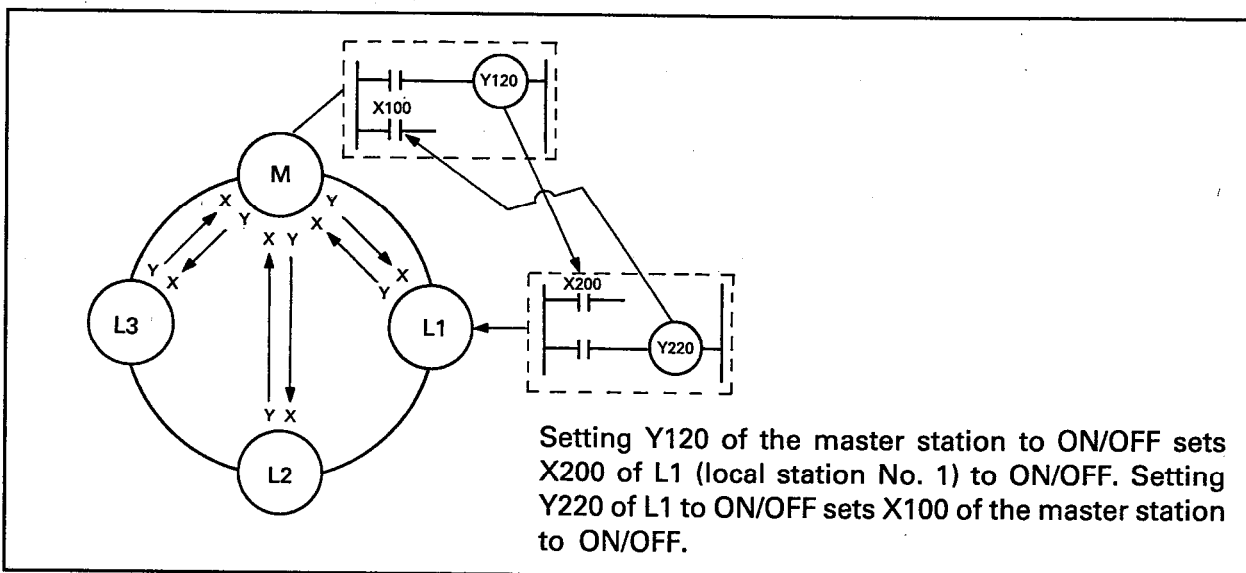
- (1) Link input (X) and link output (Y) provide ON/OFF communication between the master station and local stations. Communication between local stations is not possible.
- (2) The number of link points that can be used between link input (X) and link output (Y) is shown below.

$$\text{Link points} = 2048 - (\text{number of points used for the I/O modules in the master station})$$

- (3) Device numbers are allocated as follows.

Link input (X) = (The number immediately following the number used by the I/O module of any station) to X7FF.
 Link output (Y) = (The number immediately following the number used by the I/O module of any station) to Y7FF.

- (4) Setting link output (Y) of the master station to ON/OFF sets the link input (X) of the local stations to ON/OFF. Setting the link output (Y) of the local stations to ON/OFF also sets the link input (X) of the master station to ON/OFF.



- (5) The assignment of link input (X) and link output (Y) is conducted as follows. The link input (X) and link output (Y) of the master station are divided between and assigned to the slave stations. The link input (X) and link output (Y) of each of the slave stations corresponding to the assignment of the master station are assigned. (Refer to 6.7.2 for more details.)

6.3 Data Link Application Instructions

Use of the link application instructions **LRDP** and **LWTP** enable direct communication of the present values of timer (T) and counter (C), and 16-bit data of data register (D).

(Refer to 7.3.7 and 7.3.8 for more detail of **LRDP**, **LWTP** instructions.)

- (1) Communication using **LRDP** and **LWTP** instructions provides 1:1 communication between the master station and local stations.
- (2) The **LRDP** and **LWTP** instructions can be used only by the sequence program of the master station.
- (3) **LRDP** instructs the master station to read the data of the word device of the local stations.
- (4) **LWTP** instructs the master station to write data to the word device of local stations.
- (5) The maximum number of points that can be communicated to at one time is 32 (1 point is one word or 2 bytes).

6.4 Special Relays and Registers Usable in the Master Station

This section describes the special relays and special registers that can be used by the master station of the A3VTS data link system.

The special relays and special registers for data link processing are used to monitor the data link operating condition, and detect malfunctions in the loop circuits, one's own station, and other local stations.

From the viewpoint of failsafe functions, it is recommended that the interlock features derived from the use of these special relay and special registers, such as in terminating program execution when malfunctions occur in sequence programs or the execution of programs to process the malfunctions, be taken advantaged of.

6.4.1 Cautions concerning the use of special relays and special registers

- (1) When the special relay (M) and special register (D) indicated below are set to ON due to a malfunction, they are set to OFF by the loop circuit if the switched data link returns to normal. This means that there are times when they cannot be used for detection in sequence programs.

- M9233local station malfunction detection status
- M9237local station malfunction status
- M9216 to D9219local station malfunction detection status
- M9228 to D9231local station malfunction status

- (2) The loop circuit being monitored by the following special relay (M) vary depending on the ON/OFF status of the special relay M9018

	M9018 OFF	M9018 ON
M9210 (link module malfunction)	Status of F-LINK loop circuit	Status of R-LINK loop circuit
M9224 (status of auto-matic repeat test)		
M9227 (loop test status)		

M9018 is set ON/OFF with either the sequence program or peripheral device test mode.

Since the ON/OFF status of M9018 is set individually in each A3VCPU of each station, note that if the ON/OFF status of M9018 varies with each A3VCPU, the monitored content of M9210, M9224, M9227 of the designated loop circuit will vary with each A3VCPU.

6

6. DATA LINK PROCESSING

6.4.2 Special relays for use with the master station

Device Number	Name	Description	
M9018	Loop circuit switching during monitoring	OFF: F-LINK loop ON: R-LINK loop	Switches loop circuit while monitoring special relay M9210, M9224, and M9227 ON/OFF status set by user
M9200	LRDP instruction received	OFF: Unreceived ON: Received	<ul style="list-style-type: none"> • Status depends on whether or not [LRDP] (word device read) instruction has been received. • Used in program as an interlock for [LRDP] instruction. • To reset, use [RST] instruction.
M9201	LRDP instruction complete	OFF: Uncompleted ON: Completed	<ul style="list-style-type: none"> • Status depends on whether or not the execution of [LRDP] (word device read) instruction has been completed. • Used as a condition contact for resetting M9200 and M9201 after the completion of [LRDP] instruction. • To reset, use [RST] instruction.
M9202	LWTP instruction received	OFF: Unreceived ON: Received	<ul style="list-style-type: none"> • Status depends on whether or not [LWTP] (word device write) instruction has been received. • Used as an interlock for [LWTP] instruction. • To reset, use [RST] instruction.
M9203	LWTP instruction complete	OFF: Uncompleted ON: Completed	<ul style="list-style-type: none"> • Status depends on whether or not the execution of [LWTP] (word device write) instruction has been completed. • Used as a condition contact to reset M9202 and M9203 after the completion of [LWTP] instruction. • To reset, use [RST] instruction.
M9206	Link parameter error	OFF: Normal ON: Error	<ul style="list-style-type: none"> • Status depends on whether or not the link parameter setting is correct or not. • Set to ON when link parameter setting is in error, or is not set. • Automatically set to OFF when the link parameter is set correctly. • The link parameter is set after the A3VCPU of the master station has been written to and the master station has changed from STOP to RUN or the A3VTU has been reset.
M9210	Link module error	OFF: Normal ON: Error	<p>Contents same as M9212 when M9018 is off.</p> <ul style="list-style-type: none"> • Controlled by whether or not an error indicated below has occurred in the AJ71VP21/R21 hardware installed in the F-LINK slot. <p>Station setting error Mode setting error Base unit not mounted During reset operation (same as when REMOVE switch is set to "PERMIT") Hardware error</p> <ul style="list-style-type: none"> • Automatically set to OFF when normal condition restored.
			<p>Contents same as M9213 when M9018 is off.</p> <ul style="list-style-type: none"> • Controlled by whether or not an error indicated below has occurred in the AJ71VP21/R21 hardware installed in the R-LINK slot. <p>Station setting error Mode setting error Base unit not mounted During reset operation (same as when REMOVE switch is set to "PERMIT") Hardware error</p> <ul style="list-style-type: none"> • Automatically set to OFF when normal condition restored.

6. DATA LINK PROCESSING

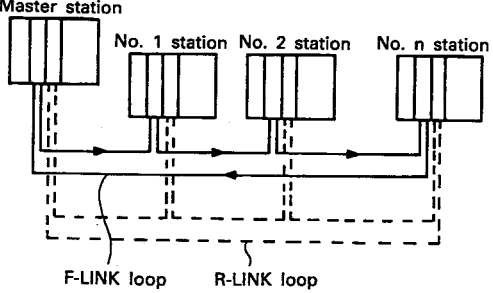
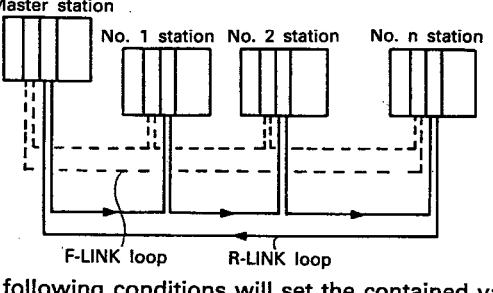


Device Number	Name	Description	
M9212	Link module error (F-LINK)	OFF: Normal ON: Error	<ul style="list-style-type: none"> Controlled by whether or not an error indicated below has occurred in the AJ71VP21/R21 hardware installed in the F-LINK slot. <ul style="list-style-type: none"> Station setting error Mode setting error Base unit not mounted During reset operation (same as when REMOVE switch is set to "PERMIT") Hardware error Automatically set to OFF when normal condition restored.
M9213	Link module error (R-LINK)	OFF: Normal ON: Error	<ul style="list-style-type: none"> Controlled by whether or not an error indicated below has occurred in the AJ71VP21/R21 hardware installed in the R-LINK slot. <ul style="list-style-type: none"> Station setting error Mode setting error Base unit not mounted During reset operation (same as when REMOVE switch is set to "PERMIT") Hardware error Automatically set to OFF when normal condition restored.
M9214	Status of self-loopback test (F-LINK)	OFF: Online, loop test ON: Self-loopback test	<ul style="list-style-type: none"> Set to ON when the mode switch of the AJ71VP21/R21 mounted in the F-LINK slot is set to "7" (self-loopback test).
M9215	Status of self-loopback test (R-LINK)	OFF: Online, loop test ON: Self-loopback test	<ul style="list-style-type: none"> Set to ON when the mode switch of the AJ71VP21/R21 mounted in the R-LINK slot is set to "7" (self-loopback test).
M9216	Loop test status (F-LINK)	OFF: Online, self-loopback test ON: Loop test	<ul style="list-style-type: none"> Set to ON when the mode switch of the AJ71VP21/R21 mounted in the F-LINK slot is set to "3" or "4" (loop test).
M9217	Loop test status (R-LINK)	OFF: Online, automatic repeat test ON: Loop test	<ul style="list-style-type: none"> Set to ON when the mode switch of the AJ71VP21/R21 mounted in the R-LINK slot is set to "3" or "4" (loop test).
M9224	Self-loopback test status	OFF: Online, loop test ON: Self-loopback test	Contents same as M9214 when M9018 is OFF.
			Contents same as M9215 when M9018 is ON.
M9225	Error in F-LINK loop circuit	OFF: Normal ON: Error	<ul style="list-style-type: none"> Set to ON when an error indicated below has occurred in the F-LINK loop between the master station and the last local station. <ul style="list-style-type: none"> Cable break Malfunction in the receiving module of the master station link module Malfunction in the transmitting module of the last local station. Automatically set to OFF when normal condition restored.

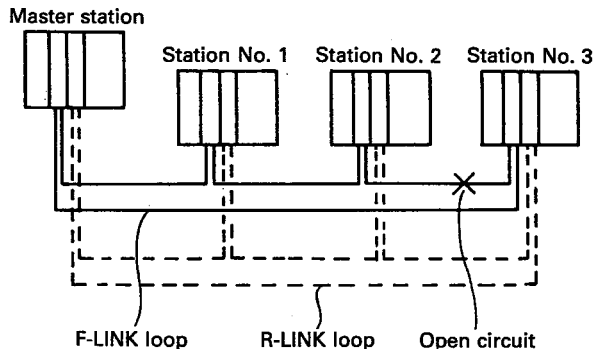
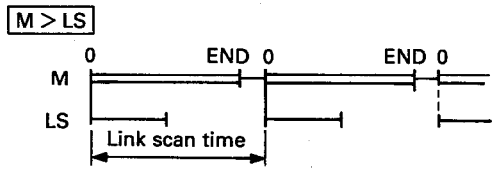
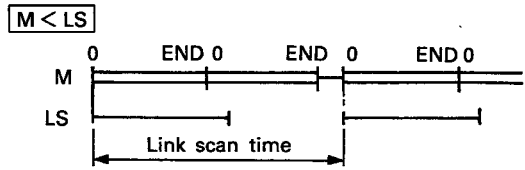
6. DATA LINK PROCESSING

Device Number	Name	Description	
M9226	Error in R-LINK loop circuit	OFF: Normal ON: Error	<ul style="list-style-type: none"> Set to ON when an error indicated below has occurred in the R-LINK loop between the master station and the last local station. <ul style="list-style-type: none"> Cable break Malfunction in the receiving module of the master station link module Malfunction in the transmitting module of the last local station. Automatically set to OFF when normal condition restored.
M9227	Loop test status	OFF: Online, self-loopback test ON: Loop test	Contents same as M9216 when M9018 is OFF
			<ul style="list-style-type: none"> Set to ON when the mode switch of the AJ71VP21/R21 mounted in the F-LINK slot is set to "3" or "4" (loop test).
M9227	Loop test status	OFF: Online, self-loopback test ON: Loop test	Contents same as M9216 when M9018 is ON
			<ul style="list-style-type: none"> Set to ON when the mode switch of the AJ71VP21/R21 mounted in the R-LINK slot is set to "3" or "4" (loop test).
M9232	Local station operational status	OFF: All local stations in RUN status ON: At least one of the local stations is either in STOP or PAUSE status.	<ul style="list-style-type: none"> Controlled by the system operation status of the local station. Set to ON when even one of the local stations is either in STOP or PAUSE status. Automatically set to OFF when all local station are in RUN status. (Refer to the "A3VTS Duplex System Owner's Manual" for information concerning the system operation status of each station.
M9233	Local station error detection status	OFF: No error in local station detected ON: Error in local station detected	<ul style="list-style-type: none"> Set to ON when a local station in the loop detects a error in another station (M9255 ON). The station number of the local station detecting an error in another station is contained in D9216 to D9219. Automatically set to OFF when the station is restored to normal condition, or when the active loop circuit is switched and the data link is returned to normal status.
M9235	Parameter error detection status of local station	OFF: No station detects error ON: A station detecting error	<ul style="list-style-type: none"> For link parameter settings, set to ON by remote I/O setting. The number set in the remote I/O station is contained in D9220 to 9223. Automatically set to OFF after the link parameter of the A3VCPUI has been remedied and the master station has changed from STOP to RUN or the A3VTU has been reset.
M9236	Initial communication status	OFF: Communication ended ON: Communication in progress	<ul style="list-style-type: none"> Set to ON when communication of initial data (link parameters) for data link processing is in progress. Set to OFF otherwise. The station number of the local station communicating the initial data parameters is contained in D9224 to D9227. Automatically set to OFF after initial parameter data communication is ended.
M9237	Local station error status	OFF: No malfunctioning station ON: Malfunctioning station	<ul style="list-style-type: none"> Set to ON when an error occurs in even one local station within the loop. The number of the malfunctioning local station is contained in D9228 to D9231. Automatically set to OFF when the station is restored to normal condition, or when the active loop circuit is switched and the data link is returned to normal status.
M9238	Loop circuit error status	OFF: No error ON: Error	<ul style="list-style-type: none"> Set to ON when an error occurs in either the F-LINK loop circuit or R-LINK loop circuit. The location of where the error occurred is contained in D9232 to D9239. M9238 is automatically set to OFF and D9232 to D9239 are set to "0" when error has been remedied.

6.4.3 Special registers for use with the master station

Device Number	Name	Description	
D9200	LRDP processing result	0: Normal 2: LRDP instruction setting fault 3: Corresponding station error 4: LRDP cannot be executed in the corresponding station	Stores the result of the execution of LRDP (word device read) instruction. <ul style="list-style-type: none"> • LRDP instruction setting fault: Faulty setting of LRDP instruction constant, source, and/or destination. • Corresponding station error: One of the stations is not communicating. • LRDP cannot be executed at the specified station: The station specified by LRDP is set as the remote I/O station by the link parameters.
D9201	LWTP processing result	0: Normal 2: LWTP instruction setting fault 3: Corresponding station error 4: LWTP cannot be executed in the corresponding station	Stores the result of the execution of LWTP (word device write) instruction. <ul style="list-style-type: none"> • LWTP instruction setting fault: Faulty setting of LWTP instruction constant, source, and/or destination. • Corresponding station error: One of the stations is not communicating. • LWTP cannot be executed at the specified station: the station specified by LWTP is set as the remote I/O station by the link parameters.
D9204	Link status	0: No error in R-LINK loop circuit during data link processing using the F-LINK loop 1: No error in F-LINK loop circuit during data link processing using the R-LINK loop 2: No error in either the F-LINK, nor the R-LINK loop circuits. 3: Error in F-LINK loop circuit during data link processing using the R-LINK loop 4: Error in R-LINK loop circuit during data link processing using the F-LINK loop 5: No error in either the F-LINK, nor the R-LINK loop circuits when there is no data link processing.	<ul style="list-style-type: none"> • F-LINK loop data link  • R-LINK loop data link  • The following conditions will set the contained value to "5" <ul style="list-style-type: none"> • Error in link parameter setting • Number of link parameter slave stations set to "0". • Loop test is being executed with both loop circuits. • Self-loopback test is being executed with both loop circuits by the master station link module. • The time set for link parameter monitoring is too short. • Both M9212 and M9213 (link unit error) of the master station are set to ON. • The A3VTU of a local station is set to reset status. • New values in M9204 were written everytime link conditions changed.

6

Device Number	Name	Description	
D9205	Station detecting error in loop circuit	Store station number of F-LINK loop circuit with error	<p>The local station number that detected the loop circuit error is stored.</p> 
D9206		Store station number of R-LINK loop circuit with error	<p>When the link cable opens between two stations, such as between station No. 2 and No.3 as shown above, the local station (No. 3) on the terminal end of receiving detects a fault in the loop circuit.</p> <ul style="list-style-type: none"> • The station number of the "3" (station No. 3) is stored in D9205 of the master station. • The value contained in D9205 and D9206 is automatically set to "0" when the loop circuit is restored to normal condition.
D9207	Link scan time	Maximum value	<p>These devices contain values related to data link scan time of the loop circuit in which data link processing is occurring.</p> 
D9208		Minimum value	
D9209		Present value	<p>(M: Scan time of the sequence program of the master station LS: Link scan (data link processing))</p>
D9210	Transmission error detection count	Total number stored	<p>Since link scan time is a value contained in the active loop circuit, the change in value that occurs when the loop circuit is switched does not result in an error.(When the loop circuit is switched, the maximum and minimum values momentarily become the same as those of the present values.)</p> <ul style="list-style-type: none"> • This device stores the accumulated number of times that retry processing has occurred in the active loop circuit. • Retry processing is the retransmission of data in which an error was generated or data lost during a previous transmission. • The maximum number of retries is "FFFF" (hexadecimal). • The value contained in this device can be restored to "0" using the following procedure. <ul style="list-style-type: none"> • Reset the RESET switch on the AJ71VP21/R21 in the appropriate loop circuit of the master station. • Reset the A3VTU of the master station.

Device Number	Name	Description																																																																																																							
D9211	Loop switching count	Total number stored	<ul style="list-style-type: none"> Contains the accumulated value of the number of times loop circuit switching has occurred. The maximum count value that can be stored is "FFFF" (hexadecimal). When count reaches "FFFF" (hexadecimal), the count returns to "0". To force the count value to return to "0", reset using the A3VTU RUN/STOP key switch. 																																																																																																						
D9212	Local station operating status	Stores the status of equipment No. 1 to 16	Stores the station numbers of local stations, which are in stop or pause status. <table border="1"> <thead> <tr> <th>Device number</th> <th colspan="16">Bit</th> </tr> <tr> <th></th> <th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th> </tr> </thead> <tbody> <tr> <td>D9212</td> <td>L16</td><td>L15</td><td>L14</td><td>L13</td><td>L12</td><td>L11</td><td>L10</td><td>L9</td><td>L8</td><td>L7</td><td>L6</td><td>L5</td><td>L4</td><td>L3</td><td>L2</td><td>L1</td> </tr> <tr> <td>D9213</td> <td>L32</td><td>L31</td><td>L30</td><td>L29</td><td>L28</td><td>L27</td><td>L26</td><td>L25</td><td>L24</td><td>L23</td><td>L22</td><td>L21</td><td>L20</td><td>L19</td><td>L18</td><td>L17</td> </tr> <tr> <td>D9214</td> <td>L48</td><td>L47</td><td>L46</td><td>L45</td><td>L44</td><td>L43</td><td>L42</td><td>L41</td><td>L40</td><td>L39</td><td>L38</td><td>L37</td><td>L36</td><td>L35</td><td>L34</td><td>L33</td> </tr> <tr> <td>D9215</td> <td>L64</td><td>L63</td><td>L62</td><td>L61</td><td>L60</td><td>L59</td><td>L58</td><td>L57</td><td>L56</td><td>L55</td><td>L54</td><td>L53</td><td>L52</td><td>L51</td><td>L50</td><td>L49</td> </tr> </tbody> </table> <p>When a local station is switched to stop or pause status, the bit corresponding to the station number in the register becomes "1". Example: When equipment No. 7 switches to stop status, bit 6 in D9212 becomes "1", and when D9212 is monitored, its value is "64 (40H)".</p>	Device number	Bit																	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	D9212	L16	L15	L14	L13	L12	L11	L10	L9	L8	L7	L6	L5	L4	L3	L2	L1	D9213	L32	L31	L30	L29	L28	L27	L26	L25	L24	L23	L22	L21	L20	L19	L18	L17	D9214	L48	L47	L46	L45	L44	L43	L42	L41	L40	L39	L38	L37	L36	L35	L34	L33	D9215	L64	L63	L62	L61	L60	L59	L58	L57	L56	L55	L54	L53	L52	L51	L50	L49
Device number		Bit																																																																																																							
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D9212		L16		L15	L14	L13	L12	L11	L10	L9	L8	L7	L6	L5	L4	L3	L2	L1																																																																																							
D9213	L32	L31	L30	L29	L28	L27	L26	L25	L24	L23	L22	L21	L20	L19	L18	L17																																																																																									
D9214	L48	L47	L46	L45	L44	L43	L42	L41	L40	L39	L38	L37	L36	L35	L34	L33																																																																																									
D9215	L64	L63	L62	L61	L60	L59	L58	L57	L56	L55	L54	L53	L52	L51	L50	L49																																																																																									
D9213	Stores the status of equipment No. 17 to 32																																																																																																								
D9214	Stores the status of equipment No. 33 to 48																																																																																																								
D9215	Stores the status of equipment No. 49 to 64																																																																																																								
D9216	Local station error detection status	Stores the status of equipment No. 1 to 16	<ul style="list-style-type: none"> Stores the status of each local station's detection of another station's malfunction. The bit, corresponding to the number of the local station that detected a malfunction in another station, is set to "1" when the local station detects (M9255 is ON) a malfunction in another station. <table border="1"> <thead> <tr> <th>Device number</th> <th colspan="16">Bit</th> </tr> <tr> <th></th> <th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th> </tr> </thead> <tbody> <tr> <td>D9216</td> <td>L16</td><td>L15</td><td>L14</td><td>L13</td><td>L12</td><td>L11</td><td>L10</td><td>L9</td><td>L8</td><td>L7</td><td>L6</td><td>L5</td><td>L4</td><td>L3</td><td>L2</td><td>L1</td> </tr> <tr> <td>D9217</td> <td>L32</td><td>L31</td><td>L30</td><td>L29</td><td>L28</td><td>L27</td><td>L26</td><td>L25</td><td>L24</td><td>L23</td><td>L22</td><td>L21</td><td>L20</td><td>L19</td><td>L18</td><td>L17</td> </tr> <tr> <td>D9218</td> <td>L48</td><td>L47</td><td>L46</td><td>L45</td><td>L44</td><td>L43</td><td>L42</td><td>L41</td><td>L40</td><td>L39</td><td>L38</td><td>L37</td><td>L36</td><td>L35</td><td>L34</td><td>L33</td> </tr> <tr> <td>D9219</td> <td>L64</td><td>L63</td><td>L62</td><td>L61</td><td>L60</td><td>L59</td><td>L58</td><td>L57</td><td>L56</td><td>L55</td><td>L54</td><td>L53</td><td>L52</td><td>L51</td><td>L50</td><td>L49</td> </tr> </tbody> </table> <p>Example: A malfunction in station No. 4 is detected by station No. 5 setting bit 4 of D9216 to "1". When D9216 is monitored it becomes "16(10 hexadecimal)".</p> <ul style="list-style-type: none"> D9216 to D9219 contains the status of the loop circuit being used in active data link processing. When a malfunctioning station is restored to normal condition or data link processing is restored to normal by switching the loop circuit, the corresponding bit is automatically restored to "0". 	Device number	Bit																	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	D9216	L16	L15	L14	L13	L12	L11	L10	L9	L8	L7	L6	L5	L4	L3	L2	L1	D9217	L32	L31	L30	L29	L28	L27	L26	L25	L24	L23	L22	L21	L20	L19	L18	L17	D9218	L48	L47	L46	L45	L44	L43	L42	L41	L40	L39	L38	L37	L36	L35	L34	L33	D9219	L64	L63	L62	L61	L60	L59	L58	L57	L56	L55	L54	L53	L52	L51	L50	L49
Device number		Bit																																																																																																							
		b15		b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0																																																																																							
D9216		L16		L15	L14	L13	L12	L11	L10	L9	L8	L7	L6	L5	L4	L3	L2	L1																																																																																							
D9217	L32	L31	L30	L29	L28	L27	L26	L25	L24	L23	L22	L21	L20	L19	L18	L17																																																																																									
D9218	L48	L47	L46	L45	L44	L43	L42	L41	L40	L39	L38	L37	L36	L35	L34	L33																																																																																									
D9219	L64	L63	L62	L61	L60	L59	L58	L57	L56	L55	L54	L53	L52	L51	L50	L49																																																																																									
D9217	Stores the status of equipment No. 17 to 32																																																																																																								
D9218	Stores the status of equipment No. 33 to 48																																																																																																								
D9219	Stores the status of equipment No. 49 to 64																																																																																																								
D9220	Link parameters, error in settings of local stations by type	Stores the status of equipment No. 1 to 16	As shown below, each bit of D9220 through D9223 corresponds to one of the possible 64 local stations. Used by the link parameter settings in the master station, these bits show whether or not a particular local station has been set in the remote I/O station. (A remote I/O station cannot be connected in the A3VTS data link system.) <table border="1"> <thead> <tr> <th>Device number</th> <th colspan="16">Bit</th> </tr> <tr> <th></th> <th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th> </tr> </thead> <tbody> <tr> <td>D9220</td> <td>L16</td><td>L15</td><td>L14</td><td>L13</td><td>L12</td><td>L11</td><td>L10</td><td>L9</td><td>L8</td><td>L7</td><td>L6</td><td>L5</td><td>L4</td><td>L3</td><td>L2</td><td>L1</td> </tr> <tr> <td>D9221</td> <td>L32</td><td>L31</td><td>L30</td><td>L29</td><td>L28</td><td>L27</td><td>L26</td><td>L25</td><td>L24</td><td>L23</td><td>L22</td><td>L21</td><td>L20</td><td>L19</td><td>L18</td><td>L17</td> </tr> <tr> <td>D9222</td> <td>L48</td><td>L47</td><td>L46</td><td>L45</td><td>L44</td><td>L43</td><td>L42</td><td>L41</td><td>L40</td><td>L39</td><td>L38</td><td>L37</td><td>L36</td><td>L35</td><td>L34</td><td>L33</td> </tr> <tr> <td>D9223</td> <td>L64</td><td>L63</td><td>L62</td><td>L61</td><td>L60</td><td>L59</td><td>L58</td><td>L57</td><td>L56</td><td>L55</td><td>L54</td><td>L53</td><td>L52</td><td>L51</td><td>L50</td><td>L49</td> </tr> </tbody> </table> <p>The bit corresponding to the station number set in the remote I/O station is set to "1". Example: When the setting related to local station No. 5 is set in the remote I/O station, the following link parameters are set: Bit 4 of D9220 becomes "1" and when D9220 is monitored it becomes "16(10 hexadecimal)".</p> <p>When the link parameter settings of the master station are changed and the master station is set from STOP to RUN, or the A3VTU is reset, the link parameters are automatically set to OFF ("0").</p>	Device number	Bit																	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	D9220	L16	L15	L14	L13	L12	L11	L10	L9	L8	L7	L6	L5	L4	L3	L2	L1	D9221	L32	L31	L30	L29	L28	L27	L26	L25	L24	L23	L22	L21	L20	L19	L18	L17	D9222	L48	L47	L46	L45	L44	L43	L42	L41	L40	L39	L38	L37	L36	L35	L34	L33	D9223	L64	L63	L62	L61	L60	L59	L58	L57	L56	L55	L54	L53	L52	L51	L50	L49
Device number		Bit																																																																																																							
		b15		b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0																																																																																							
D9220		L16		L15	L14	L13	L12	L11	L10	L9	L8	L7	L6	L5	L4	L3	L2	L1																																																																																							
D9221	L32	L31	L30	L29	L28	L27	L26	L25	L24	L23	L22	L21	L20	L19	L18	L17																																																																																									
D9222	L48	L47	L46	L45	L44	L43	L42	L41	L40	L39	L38	L37	L36	L35	L34	L33																																																																																									
D9223	L64	L63	L62	L61	L60	L59	L58	L57	L56	L55	L54	L53	L52	L51	L50	L49																																																																																									
D9221	Stores the status of equipment No. 17 to 32																																																																																																								
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Device Number	Name	Description																																																																																																						
D9224	Local station initial communication Status	Stores the status of equipment No. 1 to 16																																																																																																						
D9225		Stores the status of equipment No. 17 to 32																																																																																																						
D9226		Stores the status of equipment No. 33 to 48																																																																																																						
D9227		Stores the status of equipment No. 49 to 64																																																																																																						
<p>As shown below, each bit of D9224 through D9227 corresponds to one of the possible 64 local stations. These bits show whether or not a particular local station is conducting communication of the initial setting data (link parameters) for data link processing.</p> <table border="1"> <thead> <tr> <th>Device number</th> <th colspan="16">Bit</th> </tr> <tr> <th></th> <th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th> </tr> </thead> <tbody> <tr> <td>D9224</td> <td>L16</td><td>L15</td><td>L14</td><td>L13</td><td>L12</td><td>L11</td><td>L10</td><td>L9</td><td>L8</td><td>L7</td><td>L6</td><td>L5</td><td>L4</td><td>L3</td><td>L2</td><td>L1</td> </tr> <tr> <td>D9225</td> <td>L32</td><td>L31</td><td>L30</td><td>L29</td><td>L28</td><td>L27</td><td>L26</td><td>L25</td><td>L24</td><td>L23</td><td>L22</td><td>L21</td><td>L20</td><td>L19</td><td>L18</td><td>L17</td> </tr> <tr> <td>D9226</td> <td>L48</td><td>L47</td><td>L46</td><td>L45</td><td>L44</td><td>L43</td><td>L42</td><td>L41</td><td>L40</td><td>L39</td><td>L38</td><td>L37</td><td>L36</td><td>L35</td><td>L34</td><td>L33</td> </tr> <tr> <td>D9227</td> <td>L64</td><td>L63</td><td>L62</td><td>L61</td><td>L60</td><td>L59</td><td>L58</td><td>L57</td><td>L56</td><td>L55</td><td>L54</td><td>L53</td><td>L52</td><td>L51</td><td>L50</td><td>L49</td> </tr> </tbody> </table>			Device number	Bit																	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	D9224	L16	L15	L14	L13	L12	L11	L10	L9	L8	L7	L6	L5	L4	L3	L2	L1	D9225	L32	L31	L30	L29	L28	L27	L26	L25	L24	L23	L22	L21	L20	L19	L18	L17	D9226	L48	L47	L46	L45	L44	L43	L42	L41	L40	L39	L38	L37	L36	L35	L34	L33	D9227	L64	L63	L62	L61	L60	L59	L58	L57	L56	L55	L54	L53	L52	L51	L50	L49
Device number	Bit																																																																																																							
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D9224	L16	L15	L14	L13	L12	L11	L10	L9	L8	L7	L6	L5	L4	L3	L2	L1																																																																																								
D9225	L32	L31	L30	L29	L28	L27	L26	L25	L24	L23	L22	L21	L20	L19	L18	L17																																																																																								
D9226	L48	L47	L46	L45	L44	L43	L42	L41	L40	L39	L38	L37	L36	L35	L34	L33																																																																																								
D9227	L64	L63	L62	L61	L60	L59	L58	L57	L56	L55	L54	L53	L52	L51	L50	L49																																																																																								
D9228	Local station error status	Stores the status of equipment No. 1 to 16																																																																																																						
D9229		Stores the status of equipment No. 17 to 32																																																																																																						
D9230		Stores the status of equipment No. 33 to 48																																																																																																						
D9231		Stores the status of equipment No. 49 to 64																																																																																																						
<p>As shown below, each bit of D9228 through D9231 corresponds to one of the possible 64 local stations. These bits show whether or not the master station has detected an error being generated in a particular local station in the loop circuit conducting data link processing. An error is determined to have occurred if the master station does not receive, within an allocated period of time, from a local station a reply in return to the data sent to local station from the master station.</p> <table border="1"> <thead> <tr> <th>Device number</th> <th colspan="16">Bit</th> </tr> <tr> <th></th> <th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th> </tr> </thead> <tbody> <tr> <td>D9228</td> <td>L16</td><td>L15</td><td>L14</td><td>L13</td><td>L12</td><td>L11</td><td>L10</td><td>L9</td><td>L8</td><td>L7</td><td>L6</td><td>L5</td><td>L4</td><td>L3</td><td>L2</td><td>L1</td> </tr> <tr> <td>D9229</td> <td>L32</td><td>L31</td><td>L30</td><td>L29</td><td>L28</td><td>L27</td><td>L26</td><td>L25</td><td>L24</td><td>L23</td><td>L22</td><td>L21</td><td>L20</td><td>L19</td><td>L18</td><td>L17</td> </tr> <tr> <td>D9230</td> <td>L48</td><td>L47</td><td>L46</td><td>L45</td><td>L44</td><td>L43</td><td>L42</td><td>L41</td><td>L40</td><td>L39</td><td>L38</td><td>L37</td><td>L36</td><td>L35</td><td>L34</td><td>L33</td> </tr> <tr> <td>D9231</td> <td>L64</td><td>L63</td><td>L62</td><td>L61</td><td>L60</td><td>L59</td><td>L58</td><td>L57</td><td>L56</td><td>L55</td><td>L54</td><td>L53</td><td>L52</td><td>L51</td><td>L50</td><td>L49</td> </tr> </tbody> </table> <p>The bit, corresponding to the station number of the local station from which a reply was required but was not received, is set to "1". Example: An error generated in station No. 3 results in no transmission of a reply to the master station and bit 2 of D9228 being set to "1". When monitored, this bit becomes "4".</p> <ul style="list-style-type: none"> • There may be occasions when an error is generated in a loop circuit and all the bits corresponding to stations following the point where the error was generated are set to "1" or all local stations in the loop circuit may be set to "1". • When the error has been remedied or the switching of the loop circuit restores data link processing to normal, the corresponding bit is automatically restored to "0". 			Device number	Bit																	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	D9228	L16	L15	L14	L13	L12	L11	L10	L9	L8	L7	L6	L5	L4	L3	L2	L1	D9229	L32	L31	L30	L29	L28	L27	L26	L25	L24	L23	L22	L21	L20	L19	L18	L17	D9230	L48	L47	L46	L45	L44	L43	L42	L41	L40	L39	L38	L37	L36	L35	L34	L33	D9231	L64	L63	L62	L61	L60	L59	L58	L57	L56	L55	L54	L53	L52	L51	L50	L49
Device number	Bit																																																																																																							
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D9229	L32	L31	L30	L29	L28	L27	L26	L25	L24	L23	L22	L21	L20	L19	L18	L17																																																																																								
D9230	L48	L47	L46	L45	L44	L43	L42	L41	L40	L39	L38	L37	L36	L35	L34	L33																																																																																								
D9231	L64	L63	L62	L61	L60	L59	L58	L57	L56	L55	L54	L53	L52	L51	L50	L49																																																																																								

Device Number	Name	Description	
D9232	Loop circuit error	Stores the status of equipment No. 1 to 8	
D9233		Stores the status of equipment No. 9 to 16	
D9234		Stores the status of equipment No. 17 to 24	
D9235		Stores the status of equipment No. 25 to 32	
D9236		Stores the status of equipment No. 33 to 40	
D9237		Stores the status of equipment No. 41 to 48	
D9238		Stores the status of equipment No. 49 to 56	
D9239		Stores the status of equipment No. 57 to 64	
D9240		Received error detection count	Total number stored

Device number	Bit															
	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
D9232	R	F	R	F	R	F	R	F	R	F	R	F	R	F	R	F
	L8		L7		L6		L5		L4		L3		L2		L1	
D9233	R	F	R	F	R	F	R	F	R	F	R	F	R	F	R	F
	L16		L15		L14		L13		L12		L11		L10		L9	
D9234	R	F	R	F	R	F	R	F	R	F	R	F	R	F	R	F
	L24		L23		L22		L21		L20		L19		L18		L17	
D9235	R	F	R	F	R	F	R	F	R	F	R	F	R	F	R	F
	L32		L31		L30		L29		L28		L27		L26		L25	
D9236	R	F	R	F	R	F	R	F	R	F	R	F	R	F	R	F
	L40		L39		L38		L37		L36		L35		L34		L33	
D9237	R	F	R	F	R	F	R	F	R	F	R	F	R	F	R	F
	L48		L47		L46		L45		L44		L43		L42		L41	
D9238	R	F	R	F	R	F	R	F	R	F	R	F	R	F	R	F
	L56		L55		L54		L53		L52		L51		L50		L49	
D9239	R	F	R	F	R	F	R	F	R	F	R	F	R	F	R	F
	L64		L63		L62		L61		L60		L59		L58		L57	

F: F-LINK loop circuit
R: R-LINK loop circuit

- As shown below in the data registers, each bit of D9232 through D9239 corresponds to either the R-LINK loop circuit or F-LINK loop circuit of one of the possible 64 local stations. These bits identify the station number of a local station that has generated an error as well as a faulty loop circuit.
- The bit, corresponding to the local station generating the error or the faulty loop circuit, is set to "1".
- The station in the loop circuit following the location where the fault existed or the error was generated, detects the fault or error and the bit corresponding to this station is set to "1".
- The station (data receiving station), in the loop circuit following a fault in a loop circuit, detects the fault.
Example: A break in the cable between station No. 2 and No. 3 is detected by station No. 3.
- The following are possible causes of a "1" being set.
 - 1) A malfunction in the AJ71VP21/R21 of the indicated station.
 - 2) An error generated in the A3VTU or A3VCPU of the indicated station.
 - 3) A fault in the cable between the indicated station and the station located in the loop circuit before the indicated station.
 - 4) A malfunction in the AJ71VP21/R21 of the station located in the loop circuit before the indicated station.
 - 5) When the corresponding bit of all the local stations in the loop circuit are set to "1", either there is a malfunction in the master station or the AJ71VP21/R21s of the local stations are in reset status.
- When a loop circuit fault is detected simultaneously in both the active and standby loop circuits, the bits are automatically set to "0" when normal status is restored.
- When data link processing is begun again in the loop circuit in which a fault was detected and if the fault is remedied, the bit is automatically set to "0".
Bits can be forcefully set to "0" with the RESET switch on the AJ71VP21/R21 of the master station.

- D9240 provides accumulated counts of the following error detections in the active loop circuit.
"CRC", "AB.IF", and "OVER"
- The maximum count value that can be stored is "FFFF" (hexadecimal).
- When count reaches "FFFF" (hexadecimal), the count does not return to "0".
- Use the following procedure to set the count value to "0".
Reset AJ71VP21/R21.
Reset using the RUN/STOP key switch of the A3VTU.

6

6.5 Special Relays and Registers Usable by the Local Stations

This section describes the special relays and registers usable by the local station of the A3VTS data link system.

The special relays and registers of the data link are used for detection of the data link operation status, and errors, malfunctions, and faults in the loop circuits, any particular one station, and other local station though use of ON/OFF control and data registration.

From the viewpoint of failsafe functions, it is recommended that the interlock features derived from the use of these special relay and special registers, such as in terminating program execution when malfunctions occur in sequence programs or the execution of programs to process the malfunctions, be taken advantaged of.

6.5.1 Cautions concerning the use of special relays and special registers

- (1) When the special relay (M) and special register (D) indicated below are set to ON due to a malfunction, they are set to OFF by the loop circuit if the switch data link returns to normal. This means that there are times when they cannot be used for detection in sequence programs.

M9251 link interrupt
 M9255 malfunction in another local station
 D9252 to D9255 malfunction in another station

- (2) The loop circuit being monitored by the following special relay (M) vary depending on the ON/OFF status of the special relay M9018

	M9018 ON	M9018 OFF
M9211 (link module malfunction)	Status of F-LINK loop circuit	Status of R-LINK loop circuit
M9240 (status of automatic repeat test)		
M9252 (loop test status)		

M9018 is set ON/OFF with either the sequence program or peripheral device test mode.

Since the ON/OFF status of M9018 is set individually in each A3VCPUs of each station, note that if the ON/OFF status of M9018 varies with each A3VCPUs, the monitored content of M9210, M9224, M9227 of the designated loop circuit will vary with each A3VCPUs.

6.5.2 Special relays for use with the master station

Device Number	Name	Description	
M9018	Loop circuit switching during monitoring	OFF: F-LINK loop ON: R-LINK loop	Switches loop circuit while monitoring special relay M9211, M9240, and M9252 ON/OFF status set by user
M9204	LRDP instruction complete	OFF: Uncompleted ON: Completed	"ON" status indicates that the LRDP instruction has been completed at the local station.
M9205	LWTP instruction complete	OFF: Uncompleted ON: Completed	"ON" status indicates that the LWTP instruction has been completed at the local station.
M9211	Link module malfunction	OFF: Normal ON: Error	<p>Contents same as M9212 when M9018 is off.</p> <ul style="list-style-type: none"> Controlled by whether or not an error indicated below has occurred in the AJ71VP21/R21 hardware installed in the F-LINK slot. <p>Station setting error Mode setting error Base unit not mounted During reset operation (same as when REMOVE switch is set to "PERMIT") Hardware error</p> <ul style="list-style-type: none"> Automatically set to OFF when normal condition restored.
			<p>Contents same as M9213 when M9018 is off.</p> <ul style="list-style-type: none"> Controlled by whether or not an error indicated below has occurred in the in the AJ71VP21/R21 hardware installed in the R-LINK slot. <p>Station setting error Mode setting error Base unit not mounted During reset operation (same as when REMOVE switch is set to "PERMIT") Hardware error</p> <ul style="list-style-type: none"> Automatically set to OFF when normal condition restored.
M9212	Link module malfunction (F-LINK)	OFF: Normal ON: Error	<ul style="list-style-type: none"> Controlled by whether or not an error indicated below has occurred in the AJ71VP21/R21 hardware installed in the F-LINK slot. <p>Station setting error Mode setting error Base unit not mounted During reset operation (same as when REMOVE switch is set to "PERMIT") Hardware error</p> <ul style="list-style-type: none"> Automatically set to OFF when normal condition restored.
M9213	Link module malfunction (R-LINK)	OFF: Normal ON: Error	<ul style="list-style-type: none"> Controlled by whether or not an error indicated below has occurred in the AJ71VP21/R21 hardware installed in the R-LINK slot. <p>Station setting error Mode setting error Base unit not mounted During reset operation (same as when REMOVE switch is set to "PERMIT") Hardware error</p> <ul style="list-style-type: none"> Automatically set to OFF when normal condition restored.

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6. DATA LINK PROCESSING



Device Number	Name	Description	
M9214	Status of self-loopback test (F-LINK)	OFF: Online, loop test ON: Self-loopback test	<ul style="list-style-type: none"> Set to ON when the mode switch of the AJ71VP21/R21 mounted in the F-LINK slot is set to "7" (self-loopback test).
M9215	Status of self-loopback test (R-LINK)	OFF: Online, loop test ON: Self-loopback test	<ul style="list-style-type: none"> Set to ON when the mode switch of the AJ71VP21/R21 mounted in the R-LINK slot is set to "7" (self-loopback test).
M9216	Loop test status (F-LINK)	OFF: Online, self-loopback test ON: Loop test	<ul style="list-style-type: none"> Set to ON when the mode switch of the AJ71VP21/R21 mounted in the F-LINK slot is set to "3" or "4" (loop test).
M9217	Loop test status (R-LINK)	OFF: Online, self-loopback test ON: Loop test	<ul style="list-style-type: none"> Set to ON when the mode switch of the AJ71VP21/R21 mounted in the R-LINK slot is set to "3" or "4" (loop test).
M9240	Self-loopback test status	OFF: Online, loop test ON: Self-loopback test	Contents same as M9214 when M9018 is OFF.
			<ul style="list-style-type: none"> Set to ON when the mode switch of the AJ71VP21/R21 mounted in the F-LINK slot is set to "7" (self-loopback test).
M9241	Error in F-LINK loop circuit	OFF: Normal ON: Error	Contents same as M9215 when M9018 is ON.
			<ul style="list-style-type: none"> Set to ON when the mode switch of the AJ71VP21/R21 mounted in the R-LINK slot is set to "7" (self-loopback test).
M9241	Error in F-LINK loop circuit	OFF: Normal ON: Error	<ul style="list-style-type: none"> Set to ON when an error indicated below has occurred in the F-LINK loop between the master station and the last local station. <ul style="list-style-type: none"> Cable break Malfunction in the receiving module of the master station link module Malfunction in the transmitting module of the last local station. Automatically set to OFF when normal condition restored.
M9242	Error in R-LINK loop circuit	OFF: Normal ON: Error	<ul style="list-style-type: none"> Set to ON when an error indicated below has occurred in the R-LINK loop between the master station and the last local station. <ul style="list-style-type: none"> Cable break Malfunction in the receiving module of the master station link module Malfunction in the transmitting module of the last local station. Automatically set to OFF when normal condition restored.
M9246	Data receive error	OFF: Normal ON: Error	<ul style="list-style-type: none"> Controlled by whether or not error free data can be received from the master station using ???cyclic. Set to ON when data has not been received from the master station within an allotted period. Automatically set to OFF when the data link is restored to normal operation.
M9247			ON (always)
M9250	Parameters not received	OFF: Received ON: Not received	<ul style="list-style-type: none"> Controlled by the link parameter received status sent from the master station. Automatically set to OFF when link parameters are received error free. The master station send link parameters to each of the local stations with each switch of the loop circuit. This is only enabled when the loop circuit on which data link processing is being conducted is online.
M9251	Link interrupt	OFF: Normal ON: Interrupted	<ul style="list-style-type: none"> Controlled by whether data link processing is occurring at the present station or not. Set to ON when data link processing is not occurring in both the F-LINK and R-LINK loop circuits. Automatically set to OFF when data link is restored to normal operation. This is only enabled when the loop circuit on which data link processing is being conducted is online.

6. DATA LINK PROCESSING



Device Number	Name	Description	
M9252	Loop test status	OFF: Online, self-loopback test ON: Loop test	Contents same as M9216 when M9018 is OFF
			<ul style="list-style-type: none"> Set to ON when the mode switch of the AJ71VP21/R21 mounted in the F-LINK slot is set to "3" or "4" (loop test).
M9253	Master station operation status	OFF: RUN status ON: STOP or PAUSE status	Contents same as M9216 when M9018 is ON
			<ul style="list-style-type: none"> Set to ON when the mode switch of the AJ71VP21/R21 mounted in the R-LINK slot is set to "3" or "4" (loop test).
M9253	Master station operation status	OFF: RUN status ON: STOP or PAUSE status	<ul style="list-style-type: none"> Controlled by the operational status of the master station system. Set to ON when the master station is in STOP or PAUSE status. Is automatically set to OFF when the master station is in RUN status. (Refer to the "A3VTS Duplex System Owner's Manual" for information concerning the system operation status of the master station.)
M9254	Operational status of local stations other than present one	OFF: RUN status ON: STOP or PAUSE status	<ul style="list-style-type: none"> Controlled by the operational status of the local stations other than the present station. Set to ON when one or more of the local stations other than the present station is in STOP or PAUSE status. Does not set to ON when the present station is in STOP or PAUSE status. Is automatically set to OFF when local stations other than the present station is RUN status. (Refer to the "A3VTS Duplex System Owner's Manual" for information concerning the system operation status of the local stations.)
M9255	Error status of local stations other than present one	OFF: Normal ON: Error	<ul style="list-style-type: none"> Controlled by the whether an error has been detected in a local station other than the present station. Set to ON when even one of the local stations other than the present station has generated an error. The station number of the local station generating the error is contained in D9252 through D9255. Is automatically set to OFF when the station generating the error is restored to normal status, when the loop circuit is switched, and the data link is restored to normal condition.

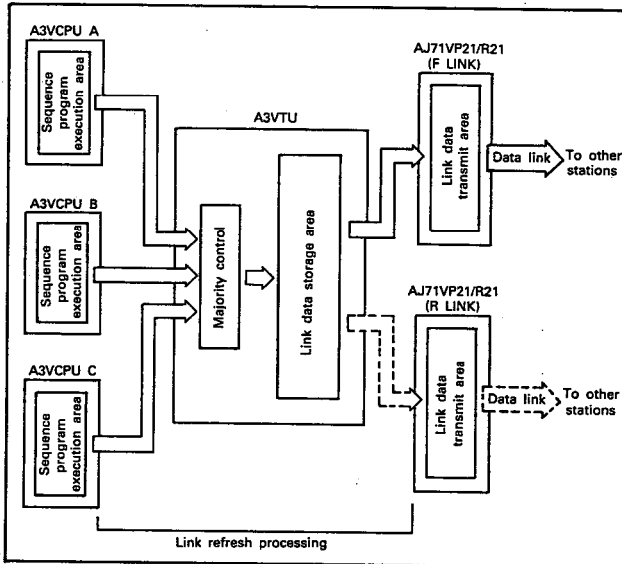
6. DATA LINK PROCESSING

6.5.3 Special registers usable at the local stations

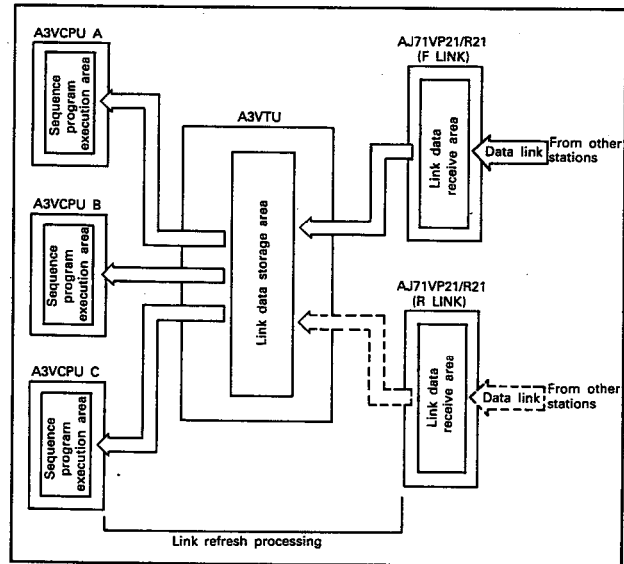
Device Number	Name	Description																																																																																																						
D9243	Own station number check	Stores a station number (0 to 64)	D9243 contains the station number set in the AJ71VP21/R21 of the present station. Used by local station to check their own station numbers.																																																																																																					
D9244	Total number of slave stations	Stores the number of slave stations	Indicates the number of slave stations in one loop.																																																																																																					
D9245	Received error detection count	Total number stored	<ul style="list-style-type: none"> D9240 provides accumulated counts of the following error detections in the active loop circuit. "CRC", "AB.IF", and "OVER" The maximum count value that can be stored is "FFFF" (hexadecimal). When count reaches "FFFF" (hexadecimal), the count does not return to "0". Use the following procedure to set the count value to "0". Reset AJ71VP21/R21. Reset using the RUN/STOP key switch of the A3VTU. 																																																																																																					
D9248	Operational status of other stations	Stores the status of equipment No. 1 to 16	<ul style="list-style-type: none"> Stores the station number of any local station which is in STOP or PAUSE status. <table border="1"> <thead> <tr> <th rowspan="2">Device number</th> <th colspan="16">Bit</th> </tr> <tr> <th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>Bb4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th> </tr> </thead> <tbody> <tr> <td>D9248</td> <td>L16</td><td>L15</td><td>L14</td><td>L13</td><td>L12</td><td>L11</td><td>L10</td><td>L9</td><td>L8</td><td>L7</td><td>L6</td><td>L5</td><td>L4</td><td>L3</td><td>L2</td><td>L1</td> </tr> <tr> <td>D9249</td> <td>L32</td><td>L31</td><td>L30</td><td>L29</td><td>L28</td><td>L27</td><td>L26</td><td>L25</td><td>L24</td><td>L23</td><td>L22</td><td>L21</td><td>L20</td><td>L19</td><td>L18</td><td>L17</td> </tr> <tr> <td>D9250</td> <td>L48</td><td>L47</td><td>L46</td><td>L45</td><td>L44</td><td>L43</td><td>L42</td><td>L41</td><td>L40</td><td>L39</td><td>L38</td><td>L37</td><td>L36</td><td>L35</td><td>L34</td><td>L33</td> </tr> <tr> <td>D9251</td> <td>L64</td><td>L63</td><td>L62</td><td>L61</td><td>L60</td><td>L59</td><td>L58</td><td>L57</td><td>L56</td><td>L55</td><td>L54</td><td>L53</td><td>L52</td><td>L51</td><td>L50</td><td>L49</td> </tr> </tbody> </table> <ul style="list-style-type: none"> The bit corresponding to the station number which is in stop or pause status, becomes "1". Set to "0" when the corresponding station enters RUN status. Example: When local station No. 7 and No. 15 are in a STOP status, bit 6 and bit 14 of D9248 become "1", and when D9248 is monitored, its value is "16448 (4040 hexadecimal)". The bit corresponding to the present station itself will not be set to "1" even if the present station should enter either STOP or PAUSE status. (This bit is normally set to "0".) 	Device number	Bit																b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	Bb4	b3	b2	b1	b0	D9248	L16	L15	L14	L13	L12	L11	L10	L9	L8	L7	L6	L5	L4	L3	L2	L1	D9249	L32	L31	L30	L29	L28	L27	L26	L25	L24	L23	L22	L21	L20	L19	L18	L17	D9250	L48	L47	L46	L45	L44	L43	L42	L41	L40	L39	L38	L37	L36	L35	L34	L33	D9251	L64	L63	L62	L61	L60	L59	L58	L57	L56	L55	L54	L53	L52	L51	L50	L49
Device number		Bit																																																																																																						
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D9248		L16		L15	L14	L13	L12	L11	L10	L9	L8	L7	L6	L5	L4	L3	L2	L1																																																																																						
D9249		L32		L31	L30	L29	L28	L27	L26	L25	L24	L23	L22	L21	L20	L19	L18	L17																																																																																						
D9250	L48	L47	L46	L45	L44	L43	L42	L41	L40	L39	L38	L37	L36	L35	L34	L33																																																																																								
D9251	L64	L63	L62	L61	L60	L59	L58	L57	L56	L55	L54	L53	L52	L51	L50	L49																																																																																								
D9249	Stores the status of equipment No. 17 to 32	Stores the status of equipment No. 33 to 48																																																																																																						
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D9251	Stores the status of equipment No. 49 to 64																																																																																																							
D9252	Error status of other stations	Stores the status of equipment No. 1 to 16	<ul style="list-style-type: none"> As shown below in the data registers, each bit of D9252 through D9255 corresponds to one of the possible 64 local stations. These bits identify the station number of a local station other than the present one that has generated an error. Detection of errors generated in other local stations occurs only in local stations. <table border="1"> <thead> <tr> <th rowspan="2">Device number</th> <th colspan="16">Bit</th> </tr> <tr> <th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>Bb4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th> </tr> </thead> <tbody> <tr> <td>D9252</td> <td>L16</td><td>L15</td><td>L14</td><td>L13</td><td>L12</td><td>L11</td><td>L10</td><td>L9</td><td>L8</td><td>L7</td><td>L6</td><td>L5</td><td>L4</td><td>L3</td><td>L2</td><td>L1</td> </tr> <tr> <td>D9253</td> <td>L32</td><td>L31</td><td>L30</td><td>L29</td><td>L28</td><td>L27</td><td>L26</td><td>L25</td><td>L24</td><td>L23</td><td>L22</td><td>L21</td><td>L20</td><td>L19</td><td>L18</td><td>L17</td> </tr> <tr> <td>D9254</td> <td>L48</td><td>L47</td><td>L46</td><td>L45</td><td>L44</td><td>L43</td><td>L42</td><td>L41</td><td>L40</td><td>L39</td><td>L38</td><td>L37</td><td>L36</td><td>L35</td><td>L34</td><td>L33</td> </tr> <tr> <td>D9255</td> <td>L64</td><td>L63</td><td>L62</td><td>L61</td><td>L60</td><td>L59</td><td>L58</td><td>L57</td><td>L56</td><td>L55</td><td>L54</td><td>L53</td><td>L52</td><td>L51</td><td>L50</td><td>L49</td> </tr> </tbody> </table> <ul style="list-style-type: none"> The bit, corresponding to the station number of the local station detecting the error is set to "1". Example: An error generated in station No. 12 results in bit 11 of D9252 being set to "1". When monitored, this bit becomes "2048 (800 hexadecimal)". When the error generating station has been restored to normal operation or the loop circuit has been switched, and data link processing restored to normal, the bit is automatically restored to "0". 	Device number	Bit																b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	Bb4	b3	b2	b1	b0	D9252	L16	L15	L14	L13	L12	L11	L10	L9	L8	L7	L6	L5	L4	L3	L2	L1	D9253	L32	L31	L30	L29	L28	L27	L26	L25	L24	L23	L22	L21	L20	L19	L18	L17	D9254	L48	L47	L46	L45	L44	L43	L42	L41	L40	L39	L38	L37	L36	L35	L34	L33	D9255	L64	L63	L62	L61	L60	L59	L58	L57	L56	L55	L54	L53	L52	L51	L50	L49
Device number		Bit																																																																																																						
		b15		b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	Bb4	b3	b2	b1	b0																																																																																						
D9252		L16		L15	L14	L13	L12	L11	L10	L9	L8	L7	L6	L5	L4	L3	L2	L1																																																																																						
D9253		L32		L31	L30	L29	L28	L27	L26	L25	L24	L23	L22	L21	L20	L19	L18	L17																																																																																						
D9254	L48	L47	L46	L45	L44	L43	L42	L41	L40	L39	L38	L37	L36	L35	L34	L33																																																																																								
D9255	L64	L63	L62	L61	L60	L59	L58	L57	L56	L55	L54	L53	L52	L51	L50	L49																																																																																								
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6.6 Link Data Communication

This section describes link data transmission in the A3VTS data link system.



Data transmission



Data receiving

Data communication in the A3VTS data link system consists of the transmission and reception of data between the A3VCPUs and the AJ71VP21/R21s, and a link refresh in a single sequence program scan.

During one link refresh, data is received from and transmitted to other stations one time.

(1) Data receiving

Data receive processing occurs in the AJ71VP21/R21 in the active data link loop circuit. Data is received from other stations, stored in the link data receive area of the AJ71VP21/R21, and then fetched to the A3VCPU.

The data received from other stations is first fetched from the link data receive area of the AJ71VP21/R21 to the link data storage area of the A3VTU. From here the data is written to each A3VCPU.

(2) Data transmission

Data transmission consists of the processing of data (ON/OFF and data write) controlled by the A3VCPU for transmission to other stations.

The data controlled by each of the A3VCPU is fetched by the A3VTU, and after undergoing majority processing, is written to the link data transmit area of the AJ71VP21/R21.

6.6.1 Master station data communication

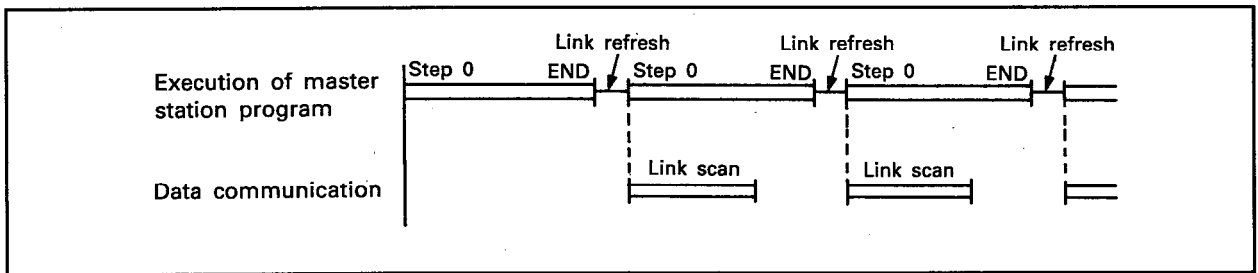
This section describes link refresh in the master station and data communication timing of other stations.

(1) Master station link refresh occurs when the **END** instruction of the sequence program is executed after the data has been communicated with other stations (link scan) as shown in (2).

(2) Link scan takes place after master station link refresh occurred. Link scan timing varies according to the relationship of link scan time and program scan time as shown below.

1) When link scan time is shorter than program scan time

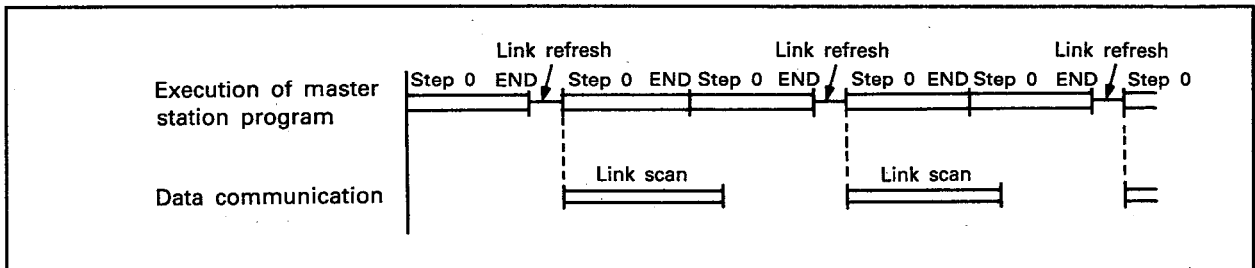
Since master station link refresh takes place with every scan of the sequence program, link scan also takes place with scan of the sequence program.



2) When link scan time is longer than program scan time

Since master station link refresh takes place only 1 time for every n scan of the sequence program, link scan also occurs only one time for every n scan of the sequence program.

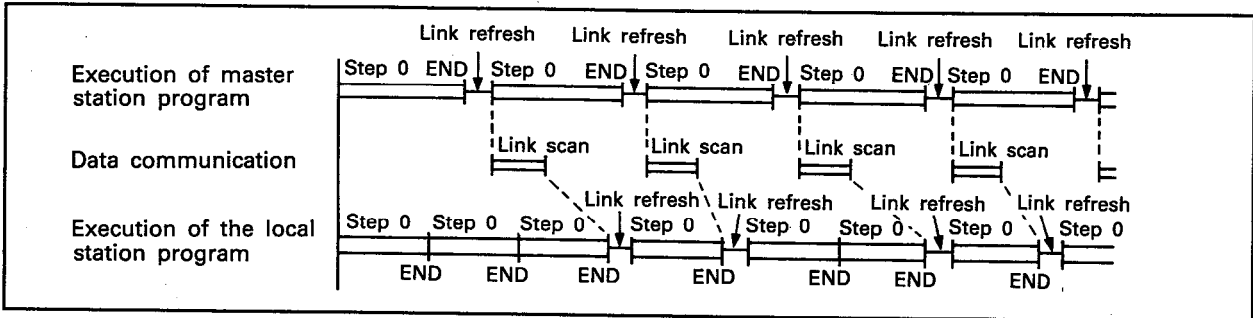
$$(n = \frac{\text{link scan time}}{\text{master station program scan time}} \text{ (rounded up)})$$



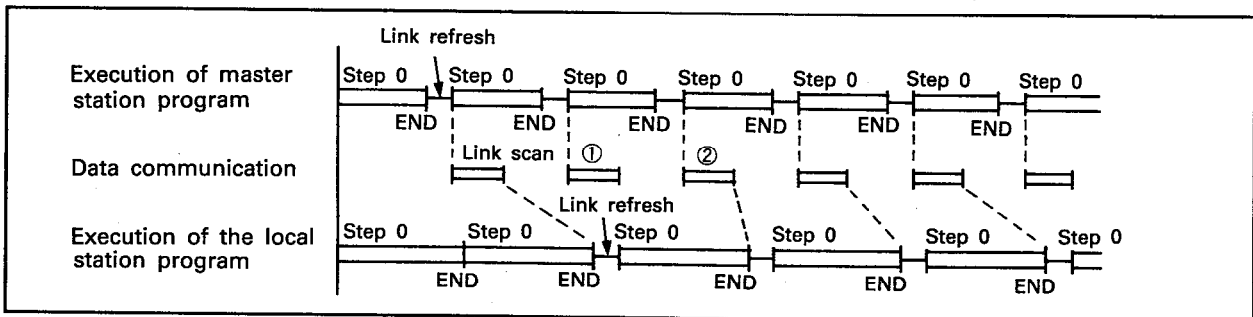
6.6.2 Local station data communication

This section describes link refresh timing of the local stations.

- (1) Link refresh timing of the local stations occurs when the **END** instruction of the sequence program is executed after link scan.



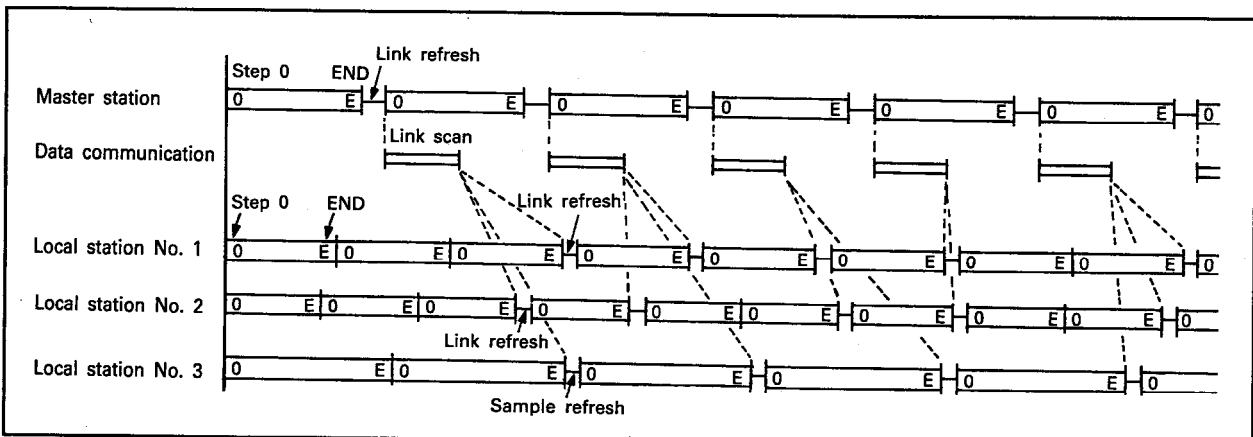
- (2) Care must be taken when the scan time of the local station sequence program is longer than either the scan time or link scan time of the master station sequence program, data may be lost as shown in the following diagram.



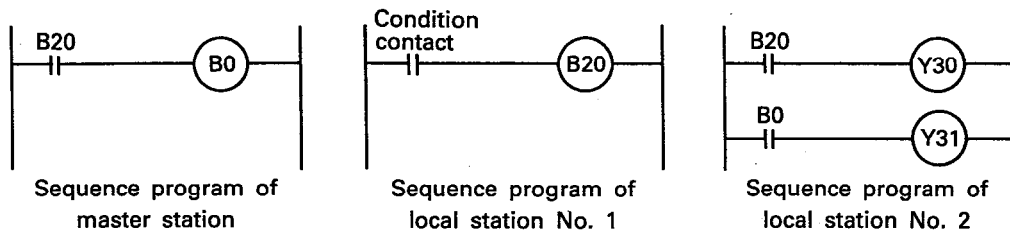
As shown ① and ② in the above figure, when a link scan occurs 2 or more times within 1 scan of the local station sequence program, the local station fetches only data, ②, received directly prior to local station link refresh execution. Since data ① is overwritten with new data at point ②, data ① is lost at the point link refresh occurs and only data ② exists.

- (3) Data linking for multiple-local stations

Link refresh of multiple-local stations occurs when the **END** instruction of the sequence program is executed for each of the stations after link scan.

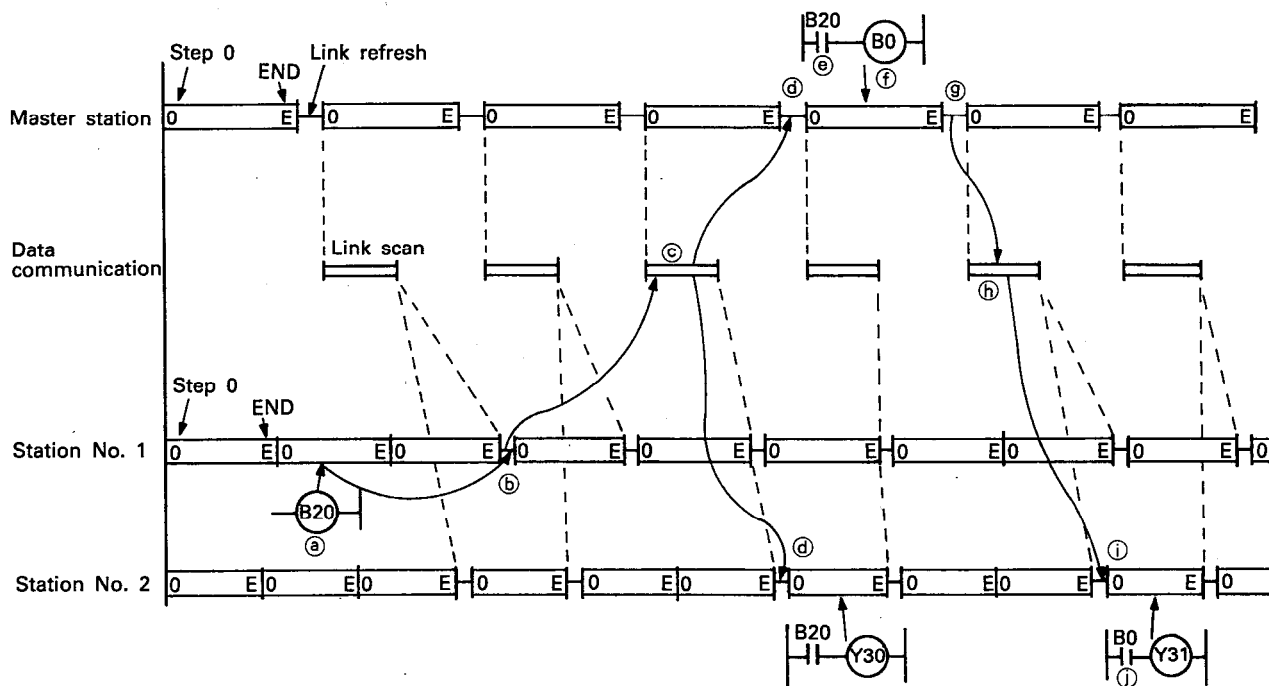


6.6.3 Data sending and receiving for link relay (B), link register (W), link input (X), and link output (Y)



CONDITIONS

When the coil of B20 of local station No. 1 is set to ON, the contacts of B20 of the master and local stations are set to ON. Setting the B20 contacts of the master station to ON sets the coil of B0 to ON and the contacts of B0 of local station No. 2 to ON.

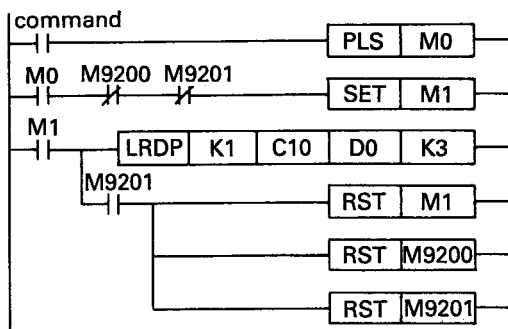


- Ⓐ The coil of B20 is set ON by the program of station No. 1
- Ⓑ Execution of station No. 1 link refresh causes B20 ON/OFF data to be sent to the link data transmit area of the AJ71VP21/R21 of station No. 1.
- Ⓒ The execution of a link scan transmits B20 ON/OFF data from the link data transmit area of the AJ71VP21/R21 of station No. 1 to the link data receive area of the AJ71VP21/R21 of the master station and station No. 2.
- Ⓓ The occurrence of a link refresh, in either the master station or station No. 2 after a link scan, causes B20 ON/OFF data to be transmitted from the link data receive area of the AJ71VP21/R21 to the sequence program area of the A3VCPU.
- Ⓔ Assume that B20 of either the master station or station No. 2 is in use and that its contacts are set to ON.
- Ⓕ Setting B20 contacts to ON sets the coil of B0 in the master station to ON.
- Ⓖ The occurrence of a link refresh in the master station causes B0 ON/OFF data to be transmitted to the link data transmit area of the AJ71VP21/R21 of the master station.
- Ⓗ The execution of a link scan results in the B0 ON/OFF data being transmitted from the link data transmit area of the AJ71VP21/R21 of the master station to the link data receive area of the AJ71VP21/R21 of the station No. 2.
- Ⓙ The occurrence of a link refresh in station No. 2 after a link scan results in B0 ON/OFF data being transmitted from the link data receive area of the AJ71VP21/R21 to the sequence program area of the A3VCPU.
- ⓫ The contacts B0, which are being used during the sequence program of the station No. 2, are set to ON.

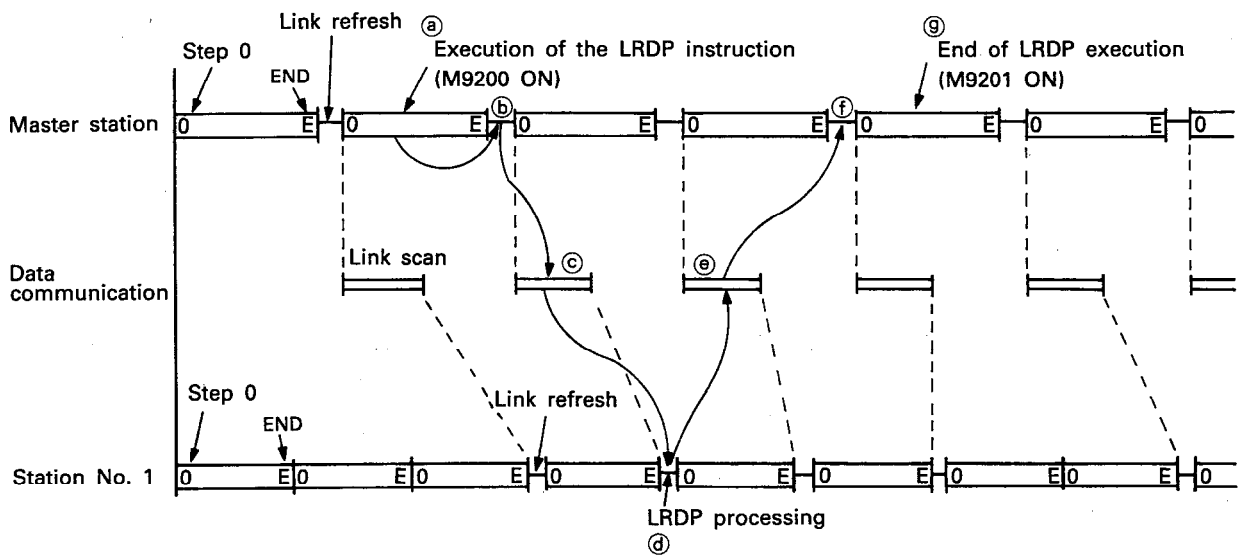
6.6.4 Communication of word devices (T,C,D,W)

This section describes the communication of the present values of timer (T) and counter (C), and of the 16-bit data of link register (W) that is not set by either data register (D) or link parameters. The communication of T, C, D, and W data is executed by the link application instructions **LRDP** and **LWTP** only between the master station and a specific local station. The instructions **LRDP** and **LWTP** can be used only in the master station sequence program.

The diagram below shows the data flow using the **LRDP** instruction.



The program shown in the diagram on the left is written in the master station. The present values of C10 through C12 of local station No. 1 are explained using as an example D0 through D2 of the master station being read and stored.



- Ⓐ The **LRDP** instruction is executed by the master station program. (M9200 is automatically set to ON.)
- Ⓑ Executed by the **LRDP** instruction, a read request for the present values of C10 through C12 of station No. 1 is transmitted to the AJ71VP21/R21 link data transmit area of the master station.
- Ⓒ The link scan transmits the request signal from the link data transmit area of the master station AJ71VP21/R21 to the link data receive area of the AJ71VP21/R21 of station No. 1.
- Ⓓ The link refresh of station No. 1, which occurs after the link scan, executes LRDP processing in which the present values of C10 through C12 are read and then stored in the link data transmit area of station No. 1.
- Ⓔ The link scan executes the transmission of the present values of C10 through C12 from the link data transmit area of the AJ71VP21/R21 of station No. 1 to the link data receive area of the AJ71VP21/R21 in the master station.
- Ⓕ The master station link refresh executes the transmission of the values of C10 through C12 from the link data receive area of the AJ71VP21/R21 to the sequence program area of the A3VCPU where is it written in D0 through D2.
- Ⓖ When the **LRDP** instruction is completed, M9201 is automatically set to ON.
- Ⓗ When M9201 is set to ON, the user's program resets M9200 and M9201.

6.7 Setting Link Devices

The assignment to each station of the devices (B, W, X, Y) used in data link processing is performed using the link setting functions of the parameter setting mode of the peripheral device (A6GPP, A6PHP, A6HGP).

The parameters of the link settings control ON/OFF within each station. In relation to each station, it also sets in the A3VCPU of the master station the device range for datalink processing that conducts data write. (Refer to the appropriate operator's manual for information concerning the operation of peripheral device.)

6.7.1 Assignment of link devices

This section describes how to assign the devices (B, W, X, Y) used in data link processing to each station.

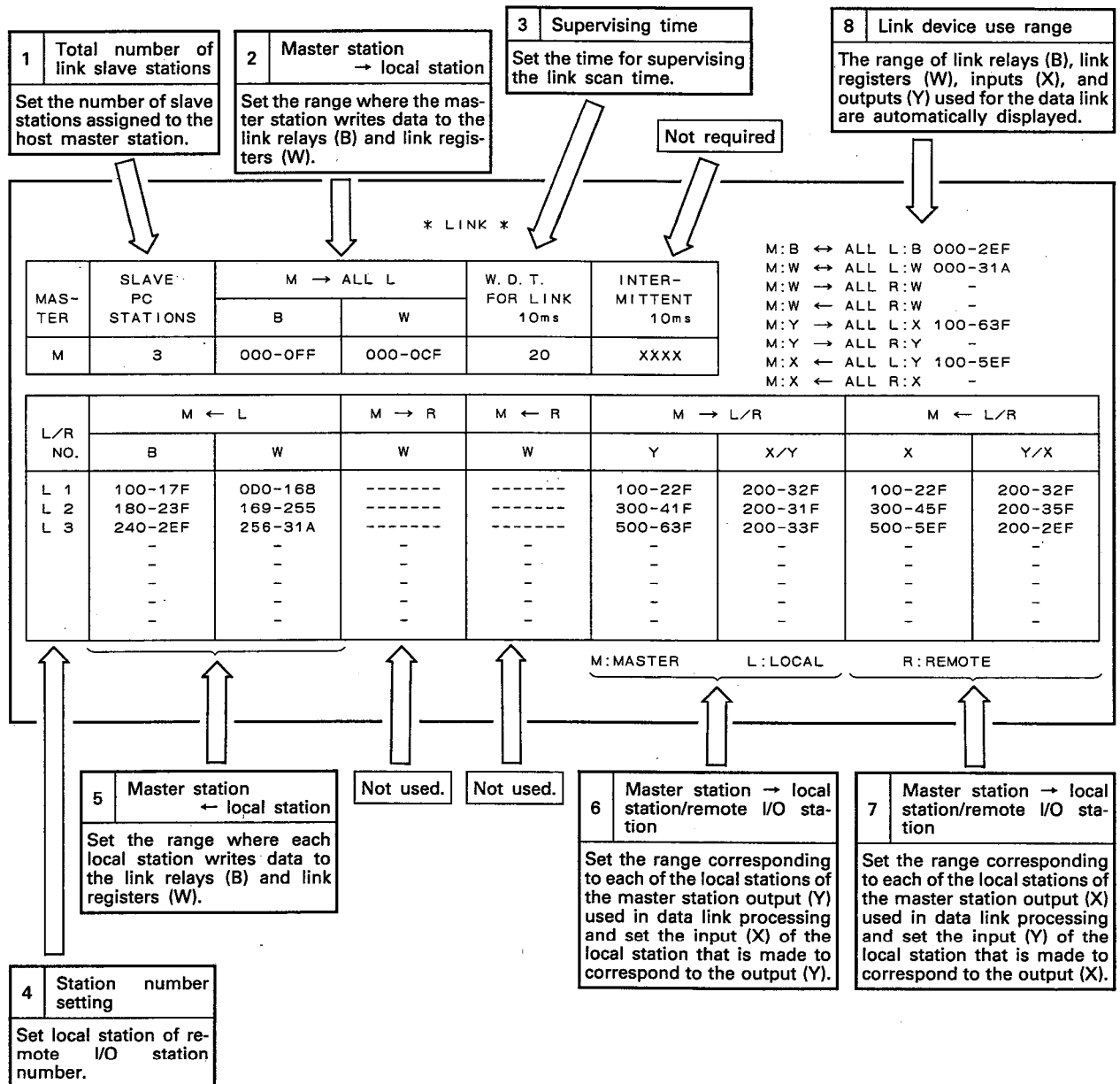
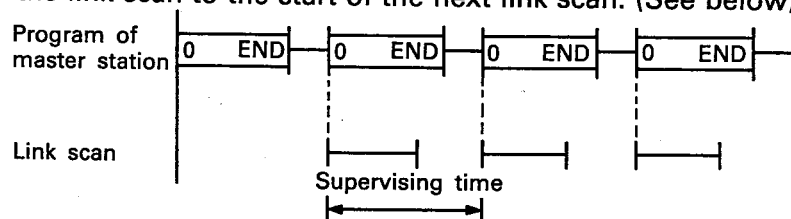


Fig. 6.1 Example of Link Parameter Settings

- (1) Number of link slave stations
- Sets total of local stations within loop circuit
 - Setting range is from 1 to 64.
 - Be careful not to set the number higher than that of the actual number of local stations in the loop circuit, as an error is generated when data link processing is executed preventing data link processing to be completed.
- (2) Master station → local station (B, W link)
- Sets the range for writing ON/OFF data of link relay (B) and the link register (W) using the master station programmable controller program.
 - The data written by the master station sequence program is made available for reading by all of the local stations.
 - Setting range is as follows.
Link relay (B) 0 to 3FF (0000 to 00FF in 16 point units)
Link register (W) 0 to 3FF (1 point units)
The device numbers used in the controlling range at the local station can only be used once.
- (3) Supervising time
- The supervising time is the period of time from the start of the link scan to the start of the next link scan. (See below)



- If the link scan is not performed within the time specified by the supervising time setting, communication with any slave station in that loop is stopped.
- Set the time within the range 10 to 2000ms (10ms to 2s) in 10ms increments.

Example:

When "20" is set, supervising time is 200ms.

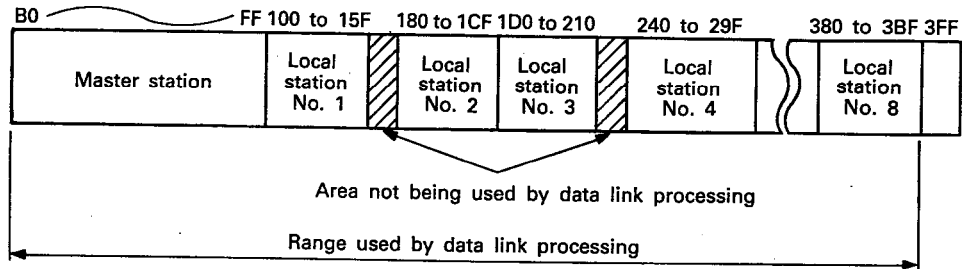
- Determine the time as described below:
 - a) Set supervising time to "200" (2s) and write it to the master station.
 - b) Set the data link system running and monitor the link from the master station. (For link monitor, refer to Section 8.1).
 - c) Read the maximum value of link scan time. (D9207)
 - d) Return to the link parameter screen, reset the supervising time to the value obtained by adding 50msec to the maximum value of the link scan time read in monitor mode, and write it to the master station.

- (4) Setting of station numbers for local stations and remote I/O station
- A specified station is designated as either a local station or a remote I/O station by inputting either an "L" or an "R".
 - Since a remote I/O station cannot be used in the A3VTS data link system, only "L" can be set. Caution is required since data link processing will not be executed for a station in which "R" has been set.
 - Setting must be made for all slave stations.
- (5) Master station ← local station (For B and W)
- Set the range for which the ON/OFF status of link relays (B) and the data of link registers (W) are written to by the sequence program of each local station, classified by station number.
 - The data written by a local station sequence program can be read by the relevant host station, the master station, and the other local stations in that loop.
 - The allowed setting range is as indicated below:
 - Link relay (B) : 0 to 3FF (in units of 16 points from []0 to []F)
 - Link register (W) : 0 to 3FF (in units of 1 point)The device numbers set in the master station or the local stations can only be used once.
- (6) Master station → local stations/remote I/O stations
- The range of the master station output (Y) which corresponds to each of the local stations is set along with the range of the local station input (X) that is made to correspond to output (Y).
 - ON/OFF data of output (Y) of the master station can be read only by input (X) of the local station corresponding to the master station's device number.
 - When the setting shown in Fig. 6.1 has been executed, The correspondence between the output (Y) of the master station and the input (X) of the local station is established as follows.
 - Local station No. 2 ... Each point of Y300 to 41F of the master station is made to correspond respectively to each point of X200 to 31F of local station No. 3.
 - See Section 6.7.2 for details concerning the method of allocation.

- (7) Master station ← local station/remote I/O station
 - The range of the master station input (X) which corresponds to each of the local stations is set along with the range of the local station output (Y) that is made to correspond to input (X).
 - ON/OFF data of input (X) of the master station can be read only by output (Y) of the local station corresponding to the master station's device number.
 - When the setting shown in Fig. 6.1 has been executed, the correspondence between the input (X) of the master station and the output (Y) of the local station is established as follows.
 - Local station No. 2 ... Each point of X300 to 45F of the master station is made to correspond respectively to each point of Y200 to 35F of local station No. 2.
 - See Section 6.7.2 for details concerning the method of allocation.

- (8) Link relay (B) and link register (W) setting ranges
 - Ranges of link devices must be set for the whole system. Any devices which fall between the ranges set for communication cannot be used as extra internal relays, they are allocated to the data link system.

Example



- Ranges are displayed, classified by device, as indicated below.
- M : B <—> ALL L : B Indicates the range of the link relays (B) used in the data link for the master station and all local stations.
- M : W <—> ALL L : W Indicates the range of the link registers (W) used in the data link for the master station and all local stations.
- M : W —> ALL R : W Indicates the range of link registers (W) used for the master station to write data to a special unit in a remote I/O station.
- M : W <— ALL R : W Indicates the range of link registers (W) used for the master station to read data from a special unit in a remote I/O station.
- M : Y —> ALL L : X Indicates the assignment range of master station corresponding to the input (X) of all local stations in one loop.
- M : Y —> ALL R : Y Indicates the assignment range of master station corresponding to the output (Y) of all remote I/O stations in one loop.
- M : X <— ALL L : Y Indicates the assignment range of master station corresponding to the output (Y) of all local stations in one loop.
- M : X <— ALL R : X Indicates the assignment range of master station corresponding to the input (X) of all remote I/O stations in one loop.

6.7.2 Device assignment

This section describes the method of device assignment used in data link processing in the master station and local stations.

The following table shows the number of points of each device usable in the data link system.

Device	Number of Points (Device numbers)
Link relay (B)	1024 points (B0 to B3FF)
Link register (W)	1024 points (W0 to W3FF)
Input (X)	2048 points (Number of I/O points used in the master station itself) ((last I/O number used within a specific station+1) to 7FF)
Output (Y)	2048 points (Number of I/O points used in the master station itself) ((last I/O number used within a specific station+1) to 7FF)

The number of points listed in the above table are portioned and only those used at a specific station are assigned at the master and local stations.

Note that the number of points of a device available to be used at each station is limited as shown in the following formula.

$$\frac{\text{Number of points used for outputs (Y)} + \text{number of points used for link relays (B)}}{8} + (\text{number of points used for link registers (W)} \times 2) \leq 1024 \text{ bytes.}$$

The assignment methods of link relays (B), link registers (W), inputs (X), and outputs (Y) are described below using the example shown in Fig. 6.2.

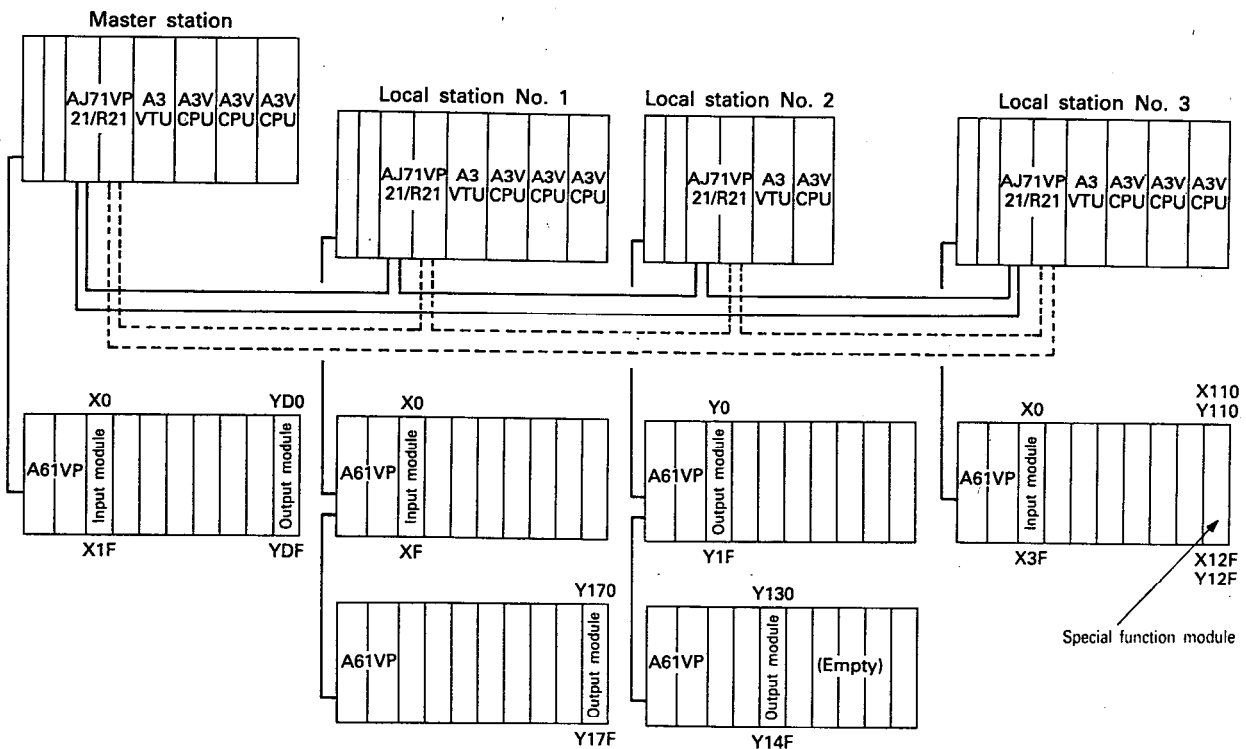


Fig. 6.2 Local System Configuration Example

(1) Link relay (B) assignment

The 1024 points, B0 through B3FF, of the link relays (B) are portioned and assigned to the master and local stations.

An example of the assignment of link relays (B) is shown by the memory map below:

		Master Station	Local Station No. 1		Local Station No. 2		Local Station No. 3		Used as Spare Internal Relay at Each Station (Not in link)
		Coil	Contact	Coil	Contact	Coil	Contact	Coil	Contact
Range available for data link processing	B0 to FF	○	○		○		○		○
	100 to 17F		○	○	○		○		○
	180 to 23F		○		○	○		○	
	240 to 2EF		○		○	○	○	○	
	2F0 to 3FF								

Coil : ON/OFF control of link relay (B)
 Contact : Reads ON/OFF data of link relay (B)
 ○ : Usable range

Fig. 6.3 Assignment Example

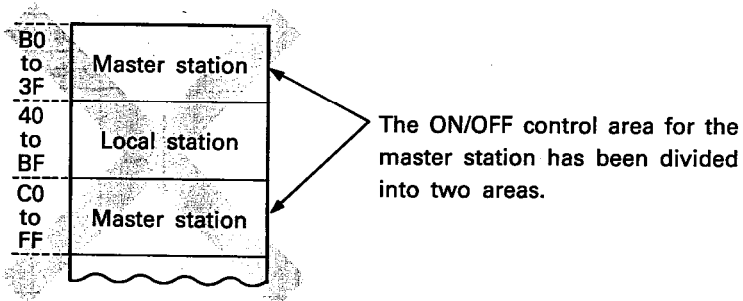
- (a) Link relay (B) assigns the area in which ON/OFF control occurs for each station.
- (b) Reading of ON/OFF data of the link relay (B) contacts is possible from the master station and all local stations.
- (c) Device numbers for the master and local stations can freely be assigned within the area of B0 to B3FF.

- 1) The minimum unit of assignment is 16 points, i.e., [] to []F.
- 2) There are no restrictions on assignment order in regards to station numbers.

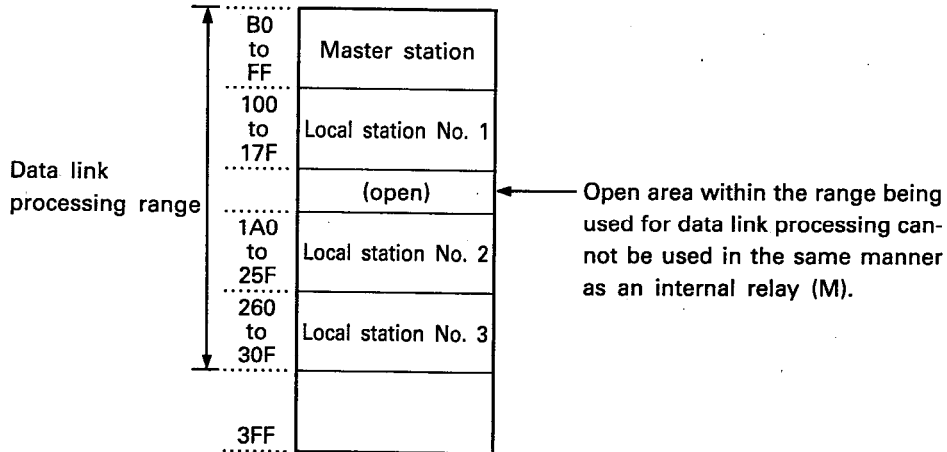
The following is an example of how the assignments may be made freely.

B0 to 7F	Local station No. 1
80 to 12F	Local station No. 3
130 to 22F	Master station
230 to 2EF	Local station No. 2
2F0 to 3FF	(Open)

- 3) Device numbers should not be repeated in the same station as it will result in an error.
- 4) Settings for one station should be located in one area. As shown below, setting cannot be made in two separate locations."



- (d) Areas not used in data link processing (shown as in Fig. 6.3), can be used in the same manner as an internal relay (M) within each station. When there is open area within the range being used for data link processing as shown below, that open area cannot be used in the same manner as an internal relay (M).



POINT

Data cannot be written to any link relay for which ON/OFF control is performed by another station. If data is written to a link relay allocated to another station, that data will be ignored.
Example: If the master station switches link relays, B100 to B17F, (allocated to equipment No. 3), the relays will immediately change to the status as controlled by equipment No. 3 and the ON/OFF switching status from the master station will be ignored.

(2) Link register (W) assignment

For the link registers (W), 1024 points from W0 to W3FF can be portioned to and assigned among the master and local stations.

An example of the assignment of link registers (W) is shown by the memory map below.

		Master Station		Local Station No. 1		Local Station No. 2		Local Station No. 3		Used as Spare Data Register at Each Station (Not in link)
		Write	Read	Write	Read	Write	Read	Write	Read	
W0 to CF	Master station data read range	○	○		○		○		○	
D0 to 168	Local station No. 1 data read range		○	○	○		○		○	
169 to 255	Local station No. 2 data read range		○		○	○	○		○	
256 to 31A	Local station No. 3 data read range		○		○		○	○	○	
31B to 3FF										○

Write : Write of 1-word data
 Read : Read of 1-word data
 ○ : Usable range

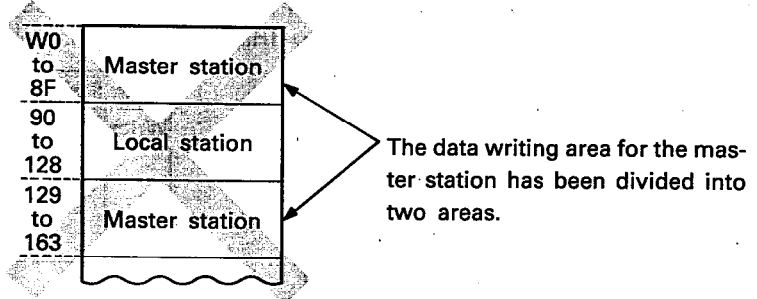
Fig. 6.4 Assignment Example

- (a) Assign the range of link registers (W) to which each station can write.
- (b) The master station and all local stations can read link register data.
- (c) Device numbers for the master and local stations can freely be assigned to a device number within the range of W0 to W3FF.
 - 1) The minimum unit of assignment is one point.
 - 2) There are no restrictions on assignment order in regards to station numbers.

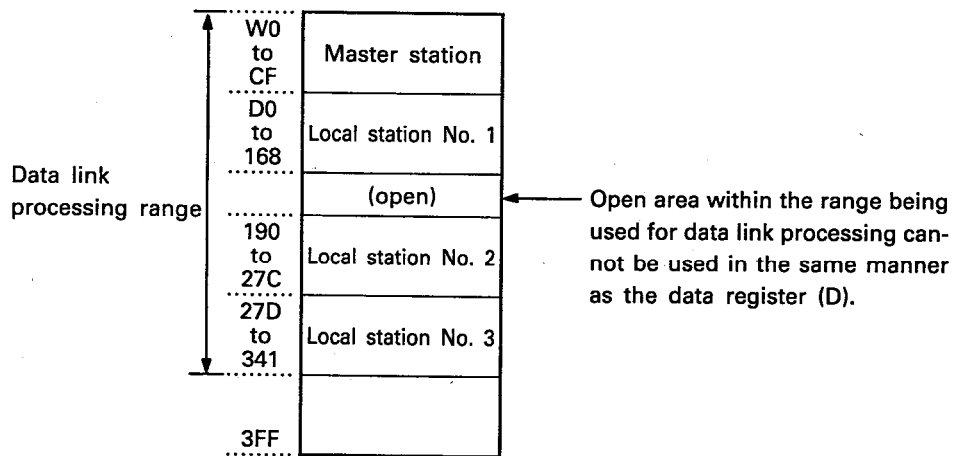
The following is an example of how the assignments may be made freely.

W0 to 98	Local station No. 1
99 to 15D	Local station No. 3
15E to 22D	Master station
22E to 31A	Local station No. 2
31B to 3FF	

- 3) Device numbers should not be repeated in the same station as it will result in an error.
- 4) Settings for one station should be located in one area. As shown below, setting cannot be made in two separate locations.



- (d) Areas not used in data link processing (shown as in Fig. 6.4), can be used in the same manner as a data register (D) within each station. When there is an open area within the range being used for data link processing as shown below, that open area cannot be used in the same manner as data register (D).



POINT

Data cannot be written to a link register by any station other than that set in the link parameters. If data is written to a link register allocated to another station, that data will be immediately rewritten to the set station.
Example: If equipment No. 3 writes data to link registers, WD0 to W168, (allocated to equipment No. 1), the data will be ignored.

(3) Input (X) and Output (Y) assignments

In data link processing, input (X) and output (Y) are referred to as link input (X) and link output (Y) respectively. Master station's link usable range is portioned and assigned for each local station.

An example of link input (X) and link output (Y) assignments is shown in the imagined system configuration of Fig. 6.2.

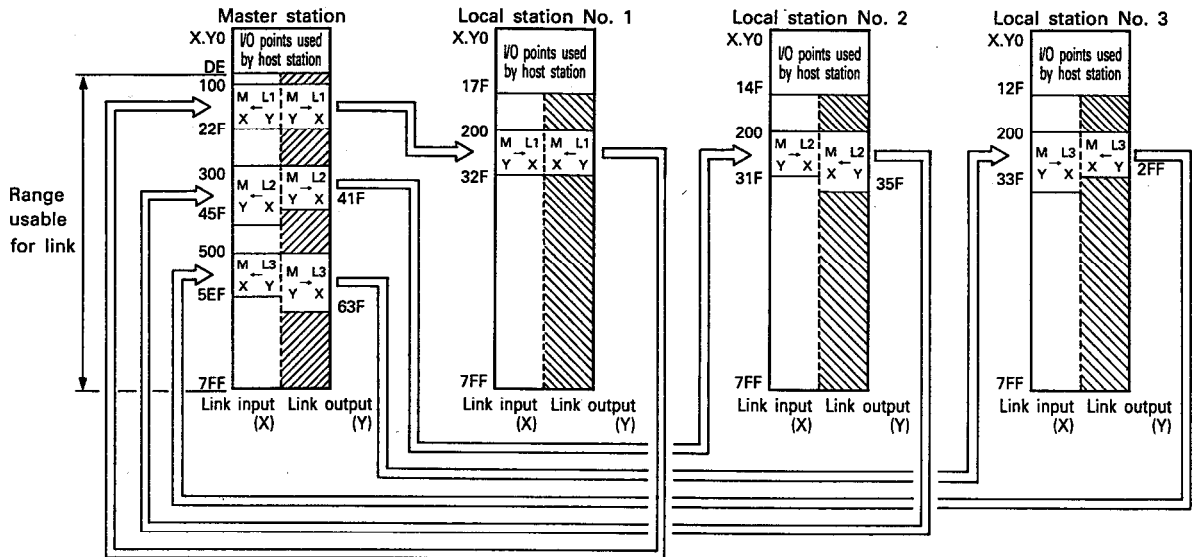


Fig. 6.5 Assignment Example

(a) The points and range usable for link input (X) and link output (Y) in the master and local stations is given below.

1) Usable range

(In the I/O module and special function module of the host station, numbers following the used device numbers) to 7FF.

Example:

In the case of the master station shown in Fig. 6.5, the area from X.YE0 to 7FF can be used for the link input (X) and link output (Y) since the I/O and special function modules use X.Y0 to DF.

2) Usable points

Link input (X) ... 2048—(sum of I/O points of the modules mounted in the master station)
 Link output (Y) ... 2048—(sum of I/O points of the modules mounted in the master station)

Example:

The I/O and special function modules of the master station use a total of 224 from X.Y0 to DF. Therefore,
 Link input (X) = 2048 - 224 = 1824 points
 Link output (Y) = 2048 - 224 = 1824 points
 can be used as data links between the master and other stations.

- (b) Data link processing using link input (X) and link output (Y) can be done between the master station and a local station only as 1 to 1 communication.
- (c) The assignments of link input (X) and link output (Y) of the master station is portioned to each of local station. The link outputs (Y) of the master station are matched with the link outputs (Y) of the local stations, while the link inputs (X) of the master station are matched with the link outputs (Y) of the local stations.

When the link output (Y) of the local station is controlled ON/OFF, the device number of the link input (X) of the master station corresponding to the link output (Y) of the local station is controlled ON/OFF.

Example:

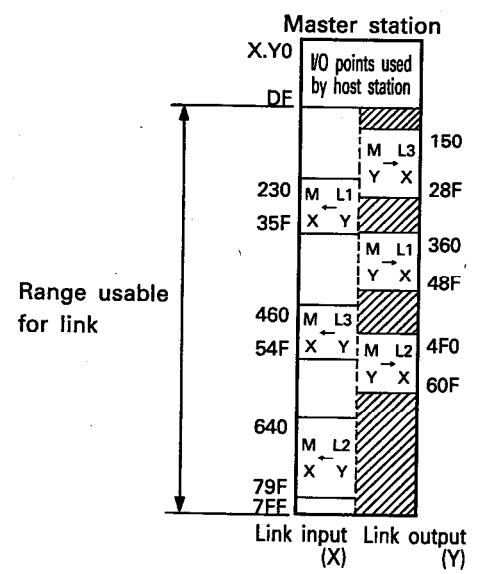
In the example shown in Fig. 6.5

Y100 of the master station is set to ON → X200 of local station No. 1 is set to ON.

Y200 of the local station No. 2 is set to ON → X300 of the master station is set to ON.

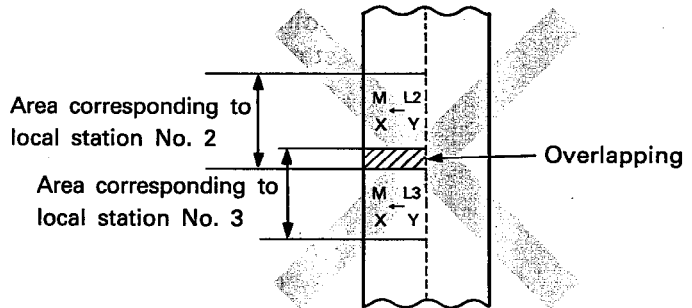
- (d) The method of assignment in the master station and local stations is explained below.
 - 1) The minimum unit of assignment is 16 points, i.e., 0000 to 000F.
 - 2) Since link input (X) and link output (Y) are set independently, it is possible to use the same device number for each of them.
 - 3) In the master station, link input (X) and link output (Y) are assigned within the area usable for link processing and then portioned to each of the local stations.
 - 4) There are no restrictions concerning order in the assignment of local station numbers as far as assignment in the master station is concerned.

The following is an example of how the assignments may be made freely.

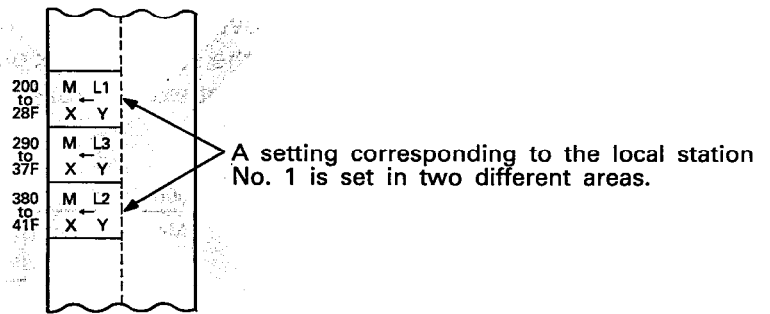


6

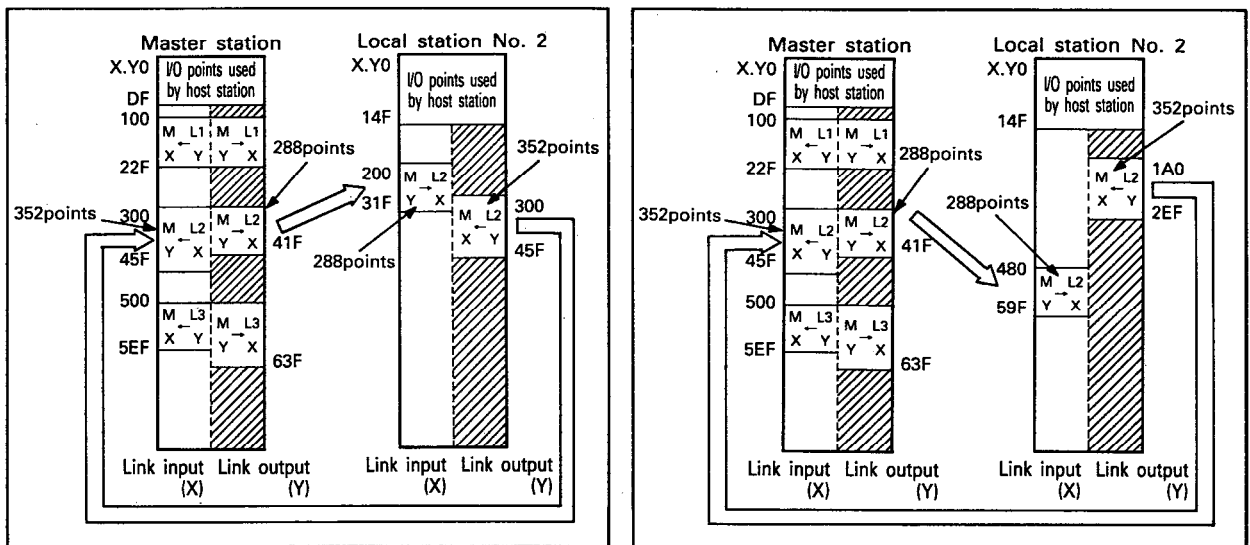
- 5) Device numbers should not be repeated for the same device as it will result in an error as far as assignment in the master station is concerned.




- 6) Within one station, ensure that the settings related to a particular device are all within the same area, as far as assignment in the master station is concerned. Locating settings in different areas as shown in the following example cannot be done.



- 7) The assignment of local stations sets the points that have been assigned for the use of the local station by the master station anywhere in the range that can be used for link processing.



- (e) The link output (Y)  portion of Fig. 6.5 can be used in each host station in the same manner as the internal relay (M).

6.7.3 Maximum number of link points per station

The number of points that are available for data link processing in a link device is limited. These points and the total number of points for link devices used for communication by the master station and each of the local station are determined as shown below.

A decision concerning these points is made based on the assigned points derived from the link parameters of peripheral device.

(1) Maximum number of points per station (master and local)

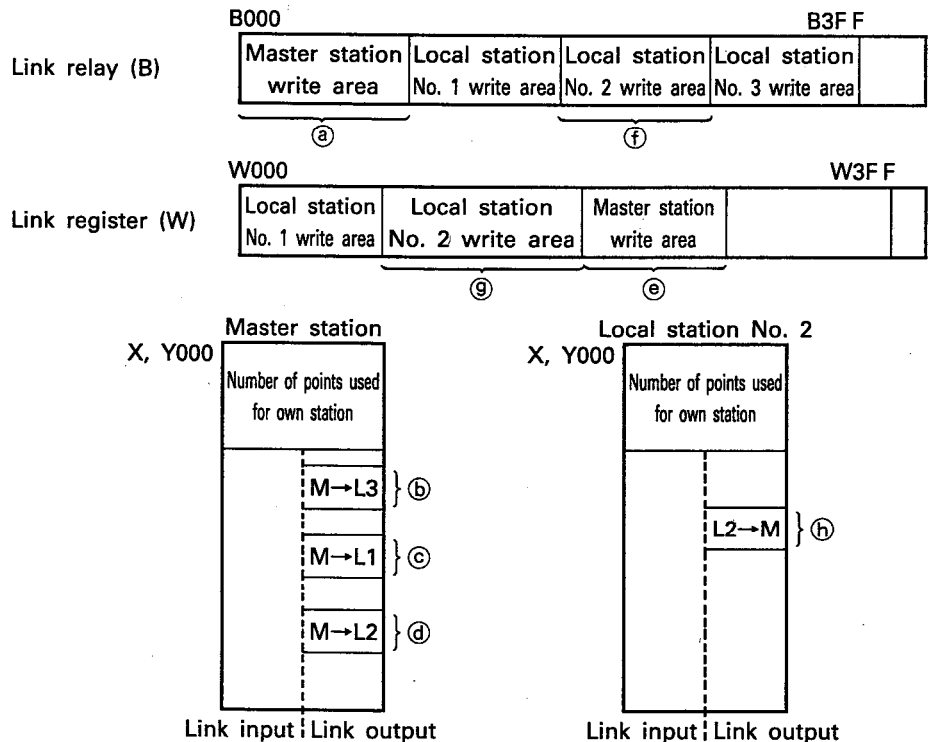
The maximum number of points per station, whether master or local, is calculated in the following manner based on the total number of points used by link output (Y) and link relay (B), which execute ON/OFF control at host stations, and the link register (W), which write data at host stations.

$$\frac{\text{Link output (Y)} + \text{Link relay (B)}}{8} + \text{link register (W)} \times 2 \leq 1024 \text{ bytes.}$$

Link output (Y) and link relay (B) are 1/8 (bytes per point)
Link register (W) is 2 (bytes per point)

From above figures, it can be seen that the total number of bytes between the assigned link output (Y), link relay (B) and link register (W) must not exceed 1024 per host station in either the master or local stations.

Example 1:



The assignment for the above figure calculates as follows.

The total number of bytes in the master station is

$$\frac{(a) + (b) + (c) + (d)}{8} + (e) \times 2 \leq 1024$$

The total number of bytes in local station No. 2 is 90

$$\frac{(f) + (h)}{8} + (g) \times 2 \leq 1024$$

resulting in maximum number of bytes that are available for use.

6

Example 2:

The following is a table using the assignments shown in Fig. 6.3, 6.4, 6.5, of Section 6.7.2 (1) to (3).

	Link Relay (B)	Link Register (W)	Link Output (Y)	Total Number of Bytes
Master station	B0 to FF=256 points $256 \div 8 = 32$ bytes	W0 to CF=208 points $208 \times 2 = 416$ bytes	Y100 to 22F=304 points Y300 to 41F=288 points Y500 to 63F=320 points $\frac{304 + 288 + 320}{8} = 114$ bytes	$B+W+Y = 32 + 416 + 114 = 562$ bytes
Local station No. 1	B100 to 17F=128 points $128 \div 8 = 16$ bytes	WD0 to 168=99 points $99 \times 2 = 198$ bytes	Y200 to 32 F=304 points $304 \div 8 = 38$ bytes	$B+W+Y = 16 + 198 + 38 = 252$ bytes
Local station No. 2	B180 to 23F=192 points $292 \div 8 = 24$ bytes	W169 to 255=237 points $237 \times 2 = 474$ bytes	Y200 to 35 F=352 points $352 \div 8 = 44$ bytes	$B+W+Y = 24 + 474 + 44 = 542$ bytes
Local station No. 3	B240 to 2EF=176 points $176 \div 8 = 22$ bytes	W256 to 31A=197 points $197 \times 2 = 394$ bytes	Y200 to 2EF=240 points $240 \div 8 = 30$ bytes	$B+W+Y = 22 + 394 + 30 = 446$ bytes

7. PROGRAMMING

This chapter describes how to program the master and local stations in order to conduct data link processing between stations.

7.1 Precautions to Observe when Using Stations as Individual Units

When using a station as an independent unit with cables disconnected to other stations for such purposes as debugging, conduct one of the following three procedures and either reapply power to the programmable controller or reset the A3VTU.

- 1) Remove both of the AJ71VP21/R21 modules from the base unit.
- 2) Set the REMOVE switch of both AJ71VP21/R21 modules to the "PERMIT" position.
- 3) Set the number set switch of the AJ71VP21/R21s to within the "1 to 64" range.

If one of the above procedures is not carried out, the following will occur.

- When the station number setting of the two AJ71VP21/R21 modules is 0 (master station):
The program will execute normally, but the LED on the front panel of the A3VTU will indicate "LINK ERROR".
- When the station setting of the AJ71VP21/R21 modules is set to between 65 and 99, or when the station number of the two AJ71VP21/R21 modules is incorrect:
The LED on the front panel of the A3VTU will indicate "STATION NO. []X[]", and the A3VTU will terminate processing. (Program will not execute either.)

7.2 Precautions to Follow While Programming

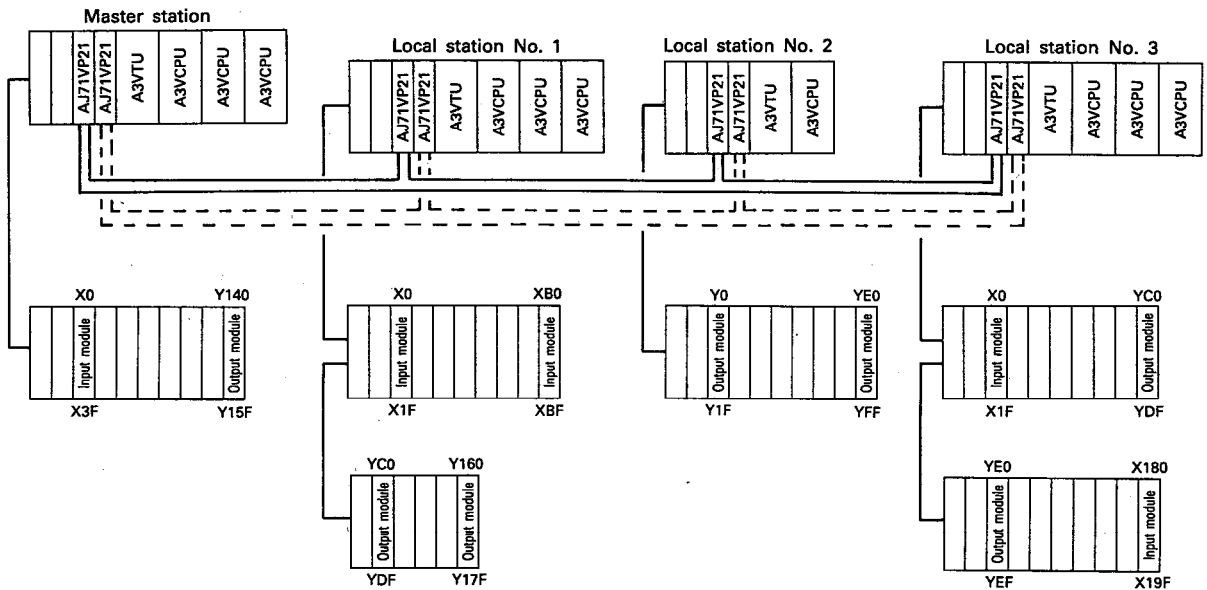
- (1) The link devices (B, W, X, Y) that are used in programs for data link processing, use device numbers assigned in each station by the link parameter settings of the peripheral device.
- (2) From a failsafe point of view, it is recommended that interlocks be set during communication between stations and that special relay (M), which turns on when an error is generated, and other devices, such as special data register (D) which contains information concerning errors, be used during sequence program execution.
- (3) When an error is generated during data link processing and data link processing cannot be conducted, the data immediately prior to processing termination is saved in each station and individual station control is initiated.
If a local station is cut out of the loop circuit, the other stations continue control with the data received from the cut-out station that existed directly prior to the cut out.
The cut-out local station stores the communication data that was received directly before the cut-out and independent control continues.

7.3 Programming Examples

This section describes the special relays, registers, and programming methods required for data link processing between stations.

7.3.1 System configuration used for the programming example

The programming examples given in Section 7.2.2, are based on the system configuration shown below and the assignment used therein.



* LINK *

MAS-TER	SLAVE PC STATIONS	M → ALL L		W. D. T. FOR LINK 10ms	INTER-MITTENT 10ms
		B	W		
M	3	000-07F	000-03F	20	XXXX

L/R NO.	M ← L		M → R	M ← R	M → L/R		M ← L/R	
	B	W	W	W	Y	X/Y	X	Y/X
L 1	080-0FF	080-0FF	-----	-----	200-23F	200-23F	200-23F	200-23F
L 2	100-17F	100-17F	-----	-----	240-27F	100-13F	240-27F	100-13F
L 3	180-1FF	180-1FF	-----	-----	280-28F	200-23F	280-28F	200-23F
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-

M: MASTER L: LOCAL R: REMOTE

TOTAL MEMORY 16K BYTES

7.3.2 How to use special relays (M) and registers (D) in the master station

This section describes programming for the detection of errors using special relays (M) and special registers (D) that were described in section 6.4.

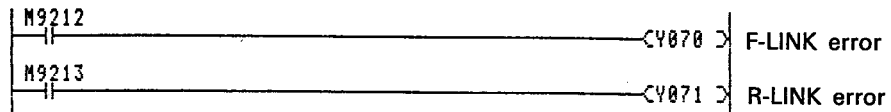
The processing used for ON/OFF control of special relays (M) and writing to the special registers occurs at the point the END instruction is executed.

Note that an error cannot always be detected if an error has been generated and remedied within 1 scan period.

Note that for the special relay (M) and special register (D) indicated below are set to ON due to a malfunction, they are set to OFF by the loop circuit if the switched data link returns to normal. This means that there are times when they cannot be used for detection in sequence programs.

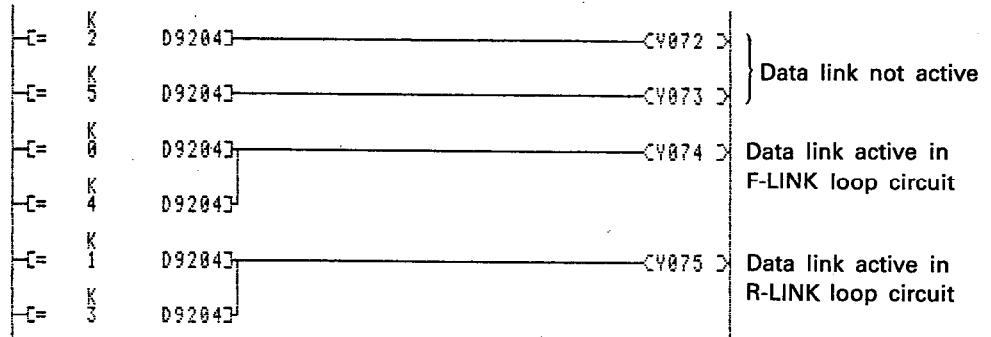
- M9233 local station malfunction detection status
- M9237 local station malfunction status
- D9216 to D9219 local station malfunction detection status
- D9228 to D9231 local station malfunction status

(1) Example program that detects a hardware malfunction in the AJ71VP21/R21 of the master station.



M9212: Set ON when a hardware malfunction occurs in the AJ71VP21/R21 mounted in the F-LINK slot of the host station.
 M9213: Set ON when a hardware malfunction occurs in the AJ71VP21/R21 mounted in the R-LINK slot of the host station.

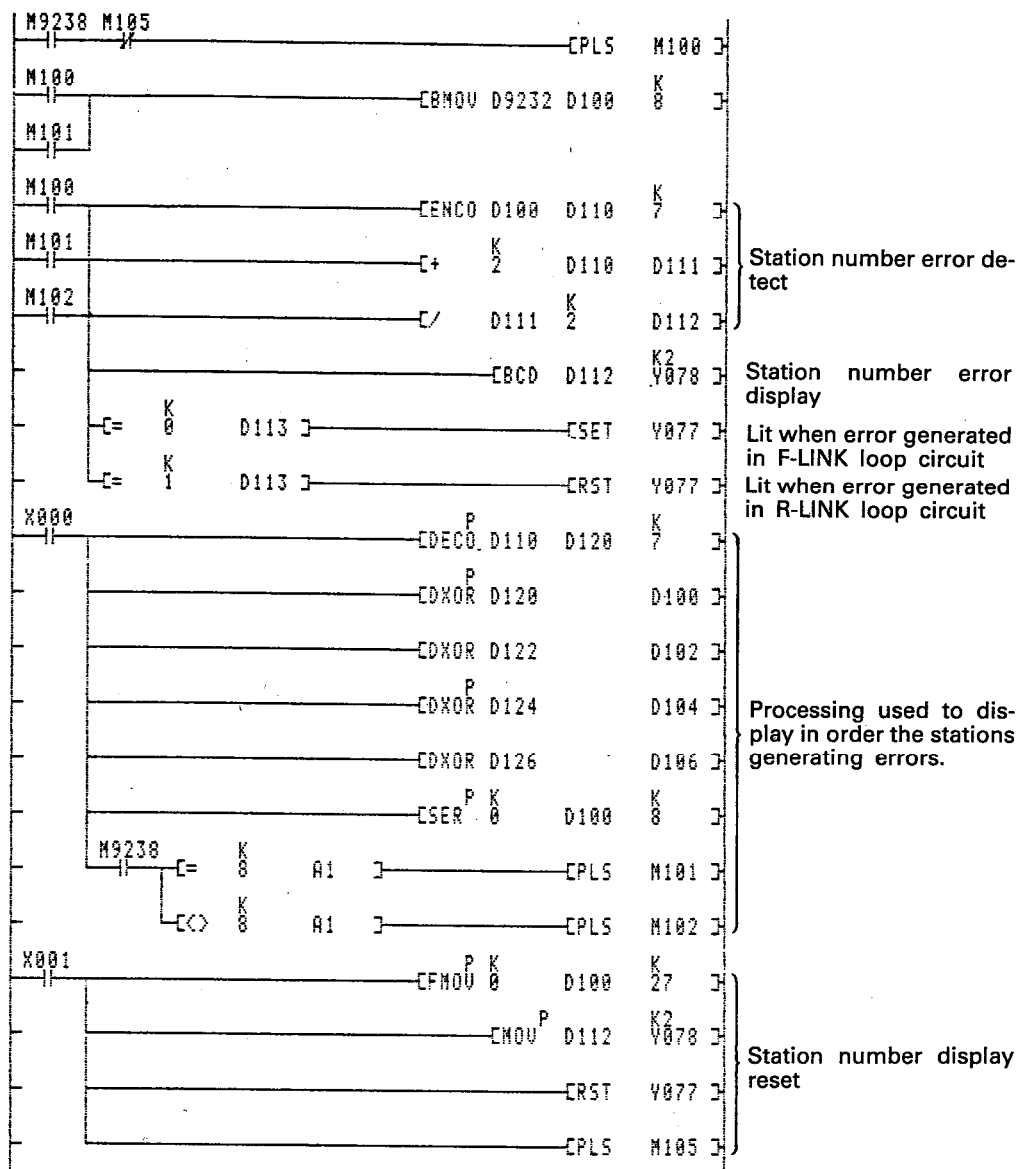
(2) Example program that detects an execute data link status or an active loop circuit.



D9204: Contains the following values depending on the status of data link processing.

- 0.....Data link processing active on F-LINK loop circuit
No errors in R-LINK loop circuit
- 1.....Data link processing active on R-LINK loop circuit
No errors in F-LINK loop circuit
- 2.....Data link not active
Error in both F-LINK and R-LINK loop circuits
- 3.....Data link processing active on R-LINK loop circuit
Error in F-LINK loop circuit
- 4.....Data link processing active on F-LINK loop circuit
Error in R-LINK loop circuit
- 5.....Data link not active
No errors in either R-LINK or F-LINK loop circuits
 - Link parameter error generated
 - Link parameter for the number of slave stations set to "0".
 - The Mode Select switch of both AJ71VP21/R21s of the master station are set to "Loop Test" or "Self-Loop Test" modes.
 - The link parameter set for the monitor period is too short.
 - M9212 and M9213 (link module malfunction) in the master station are ON at the same time.
 - The A3VTU of a local station is in reset status.

(3) Example of program to display number of station with error and its display on an external screen.



M9238: Set ON when error is generated in either the F-LINK or R-LINK loop circuit.

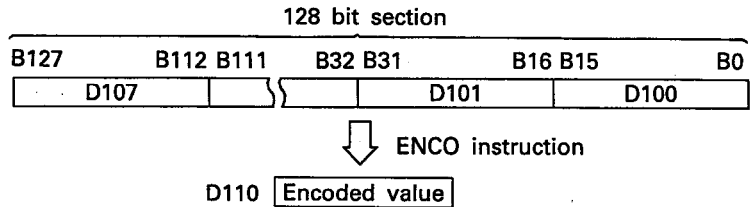
D9232 to D9239: Detects the station number of error generating station, whether it is in the F-LINK loop circuit or R-LINK loop circuit, and sets the bit corresponding to the error generating station to "1".

	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
D9232	L8	L7	L6	L5	L4	L3	L2	L1								
	R	F	R	F	R	F	R	F	R	F	R	F	R	F	R	F
D9233	L16	L15	L14	L13	L12	L11	L10	L9								
	R	F	R	F	R	F	R	F	R	F	R	F	R	F	R	F
D9239	L64	L63	L62	L61	L60	L59	L58	L67								
	R	F	R	F	R	F	R	F	R	F	R	F	R	F	R	F

Explanation

(a) Retrieval of local station generating error

- 1) The ENCO instruction looks at each bit of D100 through D107 (contents of D9232 to D9239), detects if it is set to "1" or not, and stores the data in D110.



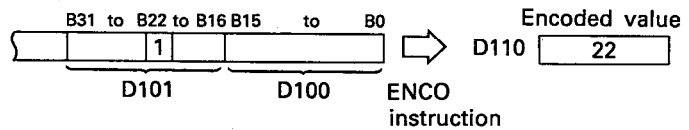
When more than one bit is set to "1", the most significant bits are encoded.

- 2) The station number is calculated from the encoded value.

$$\frac{\text{D110 Encoded value} + 2}{2} = \text{D112 Station number} \dots \text{D113 Remainder}$$

$\left\{ \begin{array}{l} 0 \text{ when error is in F-LINK} \\ 1 \text{ when error is in R-LINK} \end{array} \right.$

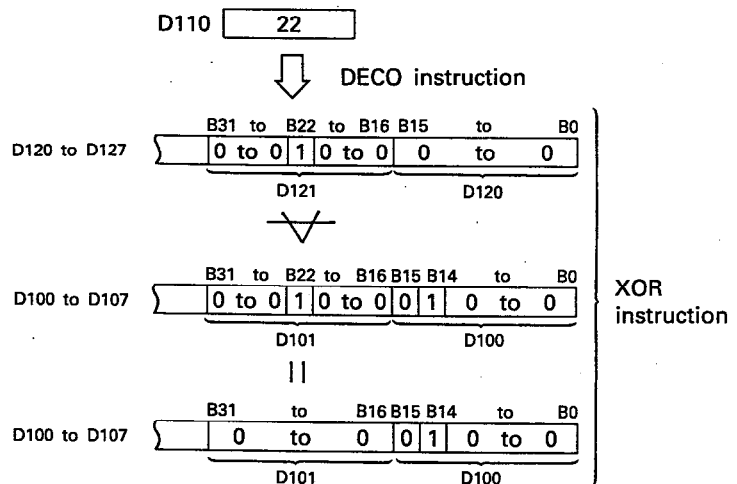
Example: When the 6th bit of D101 (D9233) is "1",



Results in the value $\frac{22+2}{2} = 12$, indicating that the error was generated in the F-LINK of the local station No. 12.

(b) Processing to display the next ERROR station

- 1) The DECO and XOR instructions sets the bit corresponding to a station that has finished display to "0". Example:



2) The SER instruction checks that the content of D100 through D107 is "0".

If the values of D100 through D107 are all "0", the number of the first error-generating station is redisplayed.

If there is a data register among D100 through D107 in which the value is not "0", the ENCO instruction used in (a) displays the number of the next error-generating station.

7.3.3 How to use the special relays (M) and special registers (D) of the local stations

This section describes programming for the detection of errors using special relays (M) and special registers (D) that were described in section 6.5.

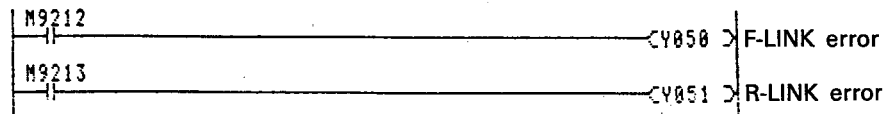
The processing used for ON/OFF control of special relays (M) and writing to the special registers occurs at the point the END instruction is executed.

Note that an error cannot always be detected if an error has been generated and remedied within 1 scan period.

Note that the special relay (M) and special register (D) indicated below are set to ON due to a malfunction, they are set to OFF by the loop circuit if the switched data link returns to normal. This means that there are times when they cannot be used for detection in sequence programs.

- M9251Link stop
- M9255ERROR in local station
- M9252 to D9255ERROR in other station

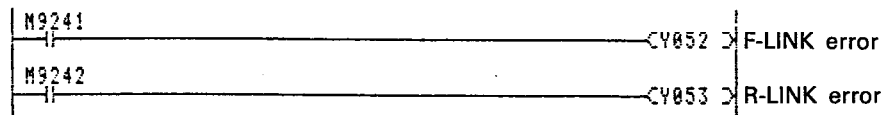
- (1) Example program that detects a hardware malfunction in the AJ71VP21/R21 of the local station.



M9212: Set ON when a hardware malfunction occurs in the AJ71VP21/R21 mounted in the F-LINK slot of the host station.

M9213: Set ON when a hardware malfunction occurs in the AJ71VP21/R21 mounted in the R-LINK slot of the host station.

- (2) Example program that detects the generation of an error in the loop circuit between one station and the station prior to it.



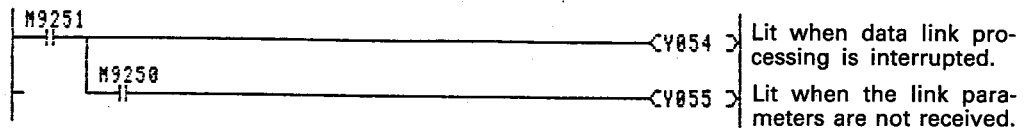
M9241: Set ON when an error has been generated between a station and the station prior to it in the F- LINK loop circuit.

- Cable break
- Hardware malfunction in the receiver section of the AJ71VP21/R21 of the host station.
- Hardware malfunction in the transmitter section of the AJ71VP21/R21 of the local station prior to the host station.

M9242: Set ON when an error has been generated between a station and the station prior to it in the R- LINK loop circuit.

- Cable break
- Hardware malfunction in the receiver section of the AJ71VP21/R21 of the host station.
- Hardware malfunction in the transmitter section of the AJ71VP21/R21 of the local station prior to the host station.

(3) Example program that detects the status of data link processing in the host station.



M9250: Set ON when link parameters are not received from master station.

- Error in master station making data link processing impossible
- Fault in loop circuit

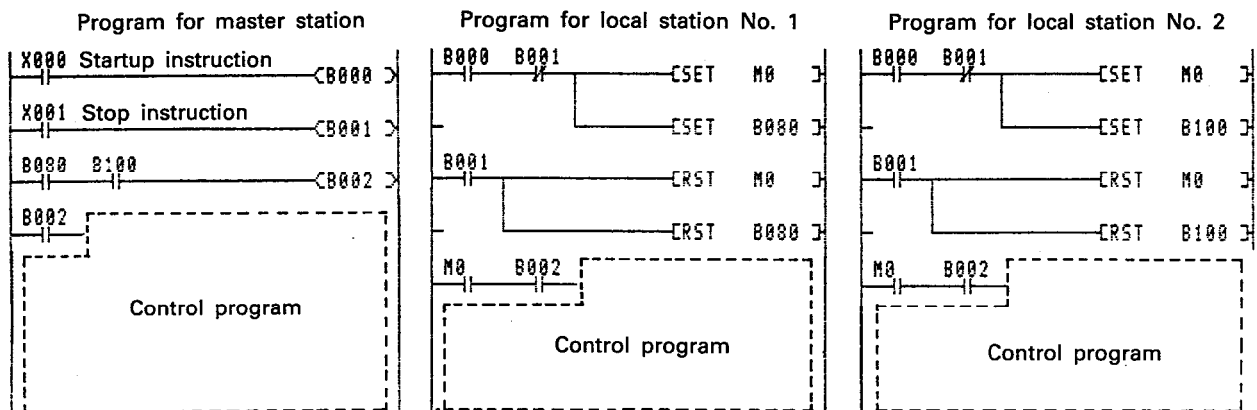
M9251: Set to ON when data link processing is not occurring in host station.

7.3.4 Link relay (B) programming

This section provides an example of programming using link relay (B) for data link processing.

Program

Started in the master station, this program begins control simultaneously of the master station, local station No. 1, and local station No. 2.



Explanation

- (1) Set master station X0 (start instruction) to ON.
Coil of master station B0 is set to ON, and contacts B0 of local station No. 1 and No. 2 are set to ON.
- (2) When the contacts of local stations No. 1 and No. 2 are set to ON, M0 is set to ON at each station, preparing for startup. M0 and the coils of B80 and B100 are simultaneously set to ON and a reply is sent to the master station stating that startup preparations are finished.
- (3) The master station confirms that B80 and B100 have been set to ON in local stations No. 1 and no. 2 respectively, the startup begin signal B2 is set to ON, and control begins.
When startup begin signal B2 is set to ON in the master station, local stations No. 1 and No. 2 begin startup.
- (4) The master station X1 is set to ON when control of each station is stopped.
When B1 contacts are set to ON, M0 of local station No. 1 and No. 2 are reset and control is stopped.
M0, and the coils of B80 and B100 are set to OFF, and master station control is also stopped.

7.3.5 Link register (W) programming

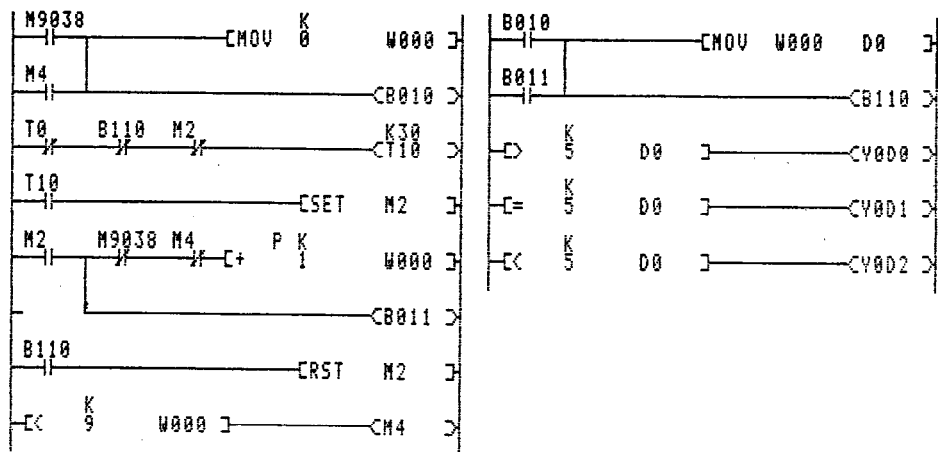
This section provides an example of programming using link relay (B) for 16 bit data communication with other stations.

Program

Run in the master station, this program writes values to link register (W) which is then read by local station No. 2 and compared with maximum/minimum values.

Program for master station

Program for local station No. 2



Explanation

- (1) At the time power is applied to the system, a "0" is written to "W0" of the master station and "B10" is set to ON.
- (2) The contents of "W0" from the master station is read and "B90" set to ON, when the contacts of "B10" of local station No. 2 are set to ON.
- (3) When "B90" is set to ON, "M1" of the master station is set to OFF setting "B10" to OFF as well.
- (4) The master station program increments "W0" by "1".
- (5) The master station does not increment "W0" until local station No. 2 reads the contents of "W0".
- (6) When local station No. 2 reads the contents of "W0", "B90" is set to ON, "M2" of the master station is set to OFF, and "W0" is incremented by "1" again.
- (7) When the contents of "W0" reaches the value of "10", the master station program resets the contents of "W0" to "0" and "W0" is ready to be incremented again.

POINT

In the example shown here, link relay (B) provides handshake functions between the master station and local station thus preventing the master station from incrementing by "1" prior to reading the value of link register (W) in the local station.

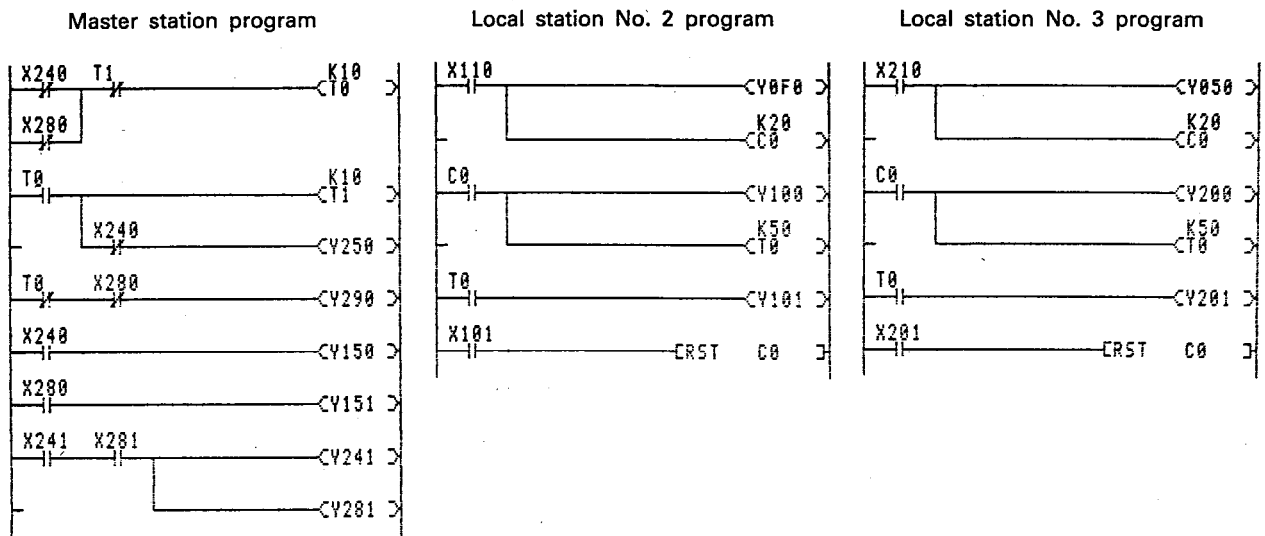
7

7.3.6 Programming input (X) and output (Y)

This section provides an example of programming using input (X) and output (Y) for data link processing between the master station and local stations.

Program Example

The program causes YF0 of local station No. 2 and Y50 of local station No. 3 to flicker. When this happens 20 times for each station, local stations No. 2 and No. 3 light Y150 and Y151 of the master station. After 5 seconds, Y50 is made to begin flickering again.



Explanation

- (1) Setting T0 of the master station ON/OFF, sets Y250 and Y290 ON/OFF.
- (2) When Y250 and Y290 of the master station are set ON/OFF, the corresponding X110 and X210 of local stations No. 2 and No. 3 are set ON/OFF, which in turn, set YF0 and Y50 of each ON/OFF.
- (3) When YF0 and Y50 of local stations No. 2 and No. 3 have been set ON/OFF 20 times each, Y100 and Y200 of local station No. 2 and No. 3 are set ON, and X240 and X280, which correspond to them in the master station, are turned ON.
- (4) When X240 and X280 are set to ON, flickering stops and Y150 and Y151 are set to ON.
- (5) Five seconds after Y150 and Y151 are set to ON, the counter (C) in local stations No. 2 and No. 3 is reset and flickering in Y250 and Y290 of the master station begins again.

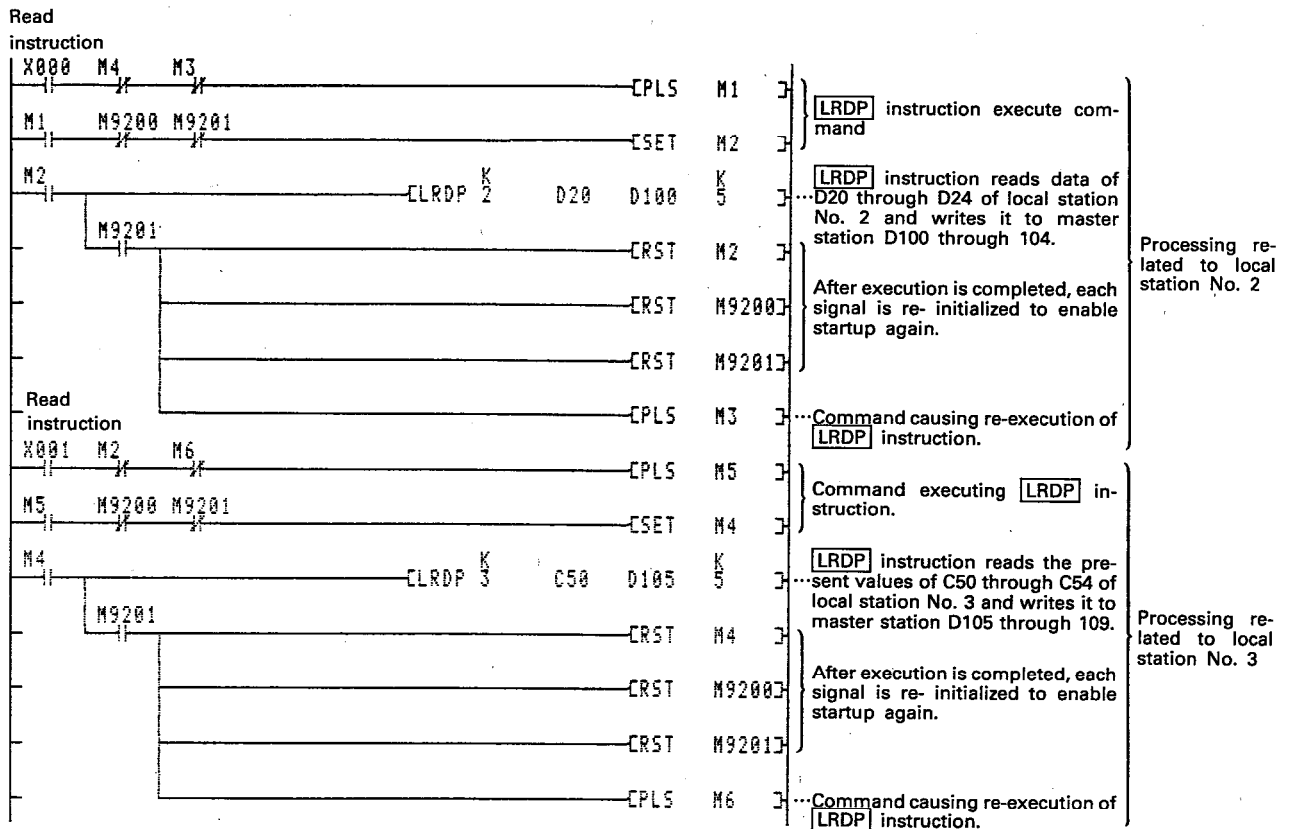
(2) Program example

This section provides an example of a program that reads the present values of D20 through D24 of local station No. 2 and of C50 through C54 of local station No. 3.

Conditions

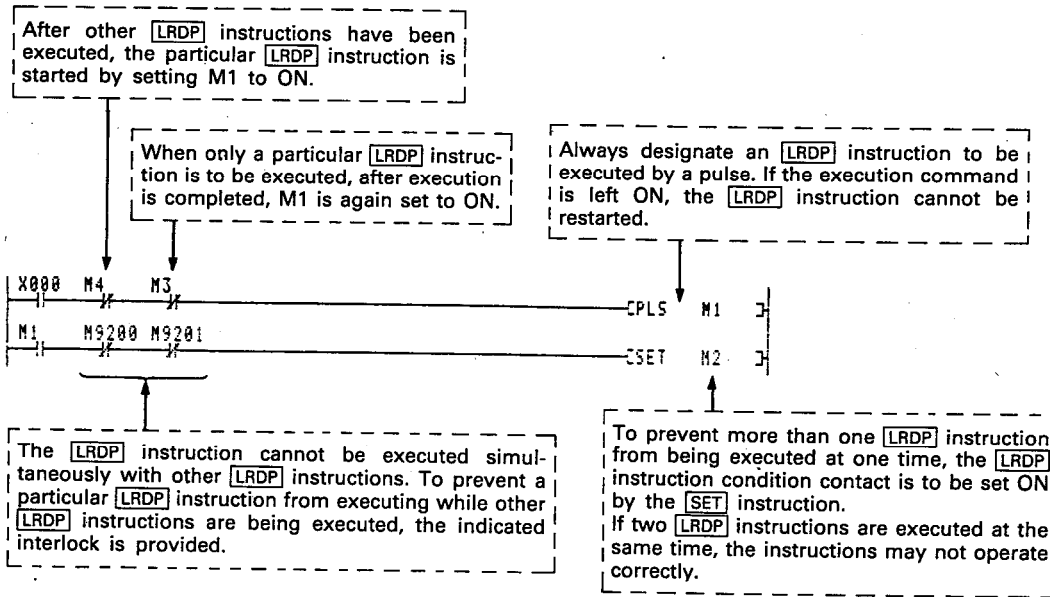
- (1) D20 through D24 of local station No. 2 is contained in D100 through D104 of the master station.
- (2) C50 through C54 of local station No. 3 is contained in D105 through D109 of the master station.
- (3) The data of local station No. 2 is usually read during the period that input "X0" of the master station is ON.
- (4) The data of local station No. 3 is usually read during the period that input "X1" of the master station is ON.

Program Example

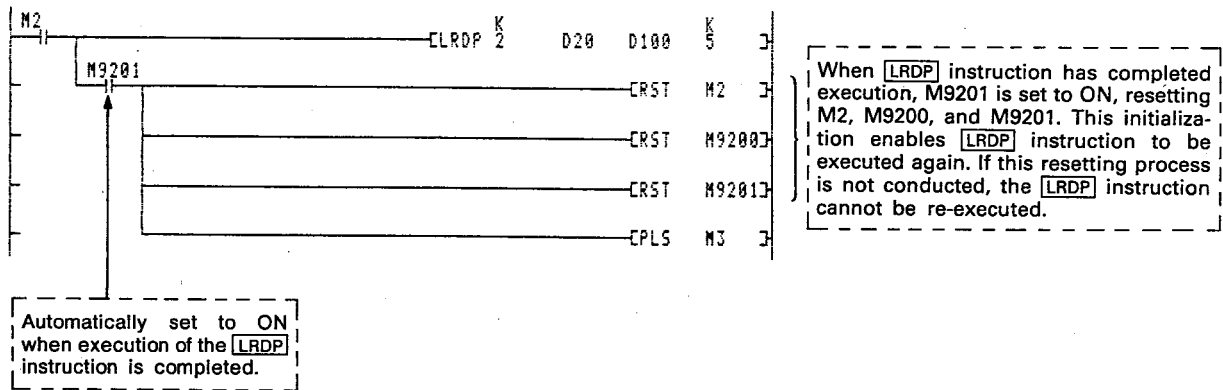


Explanation

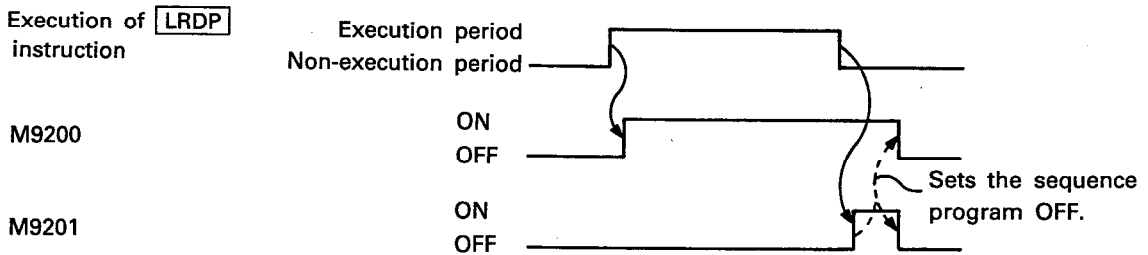
(1) Execution of LRDP instruction and interlock



(2) Initialization of the LRDP instruction after one execution is completed



(3) M9200 and M9201 ON/OFF timing during execution of the LRDP instruction is shown below.



7

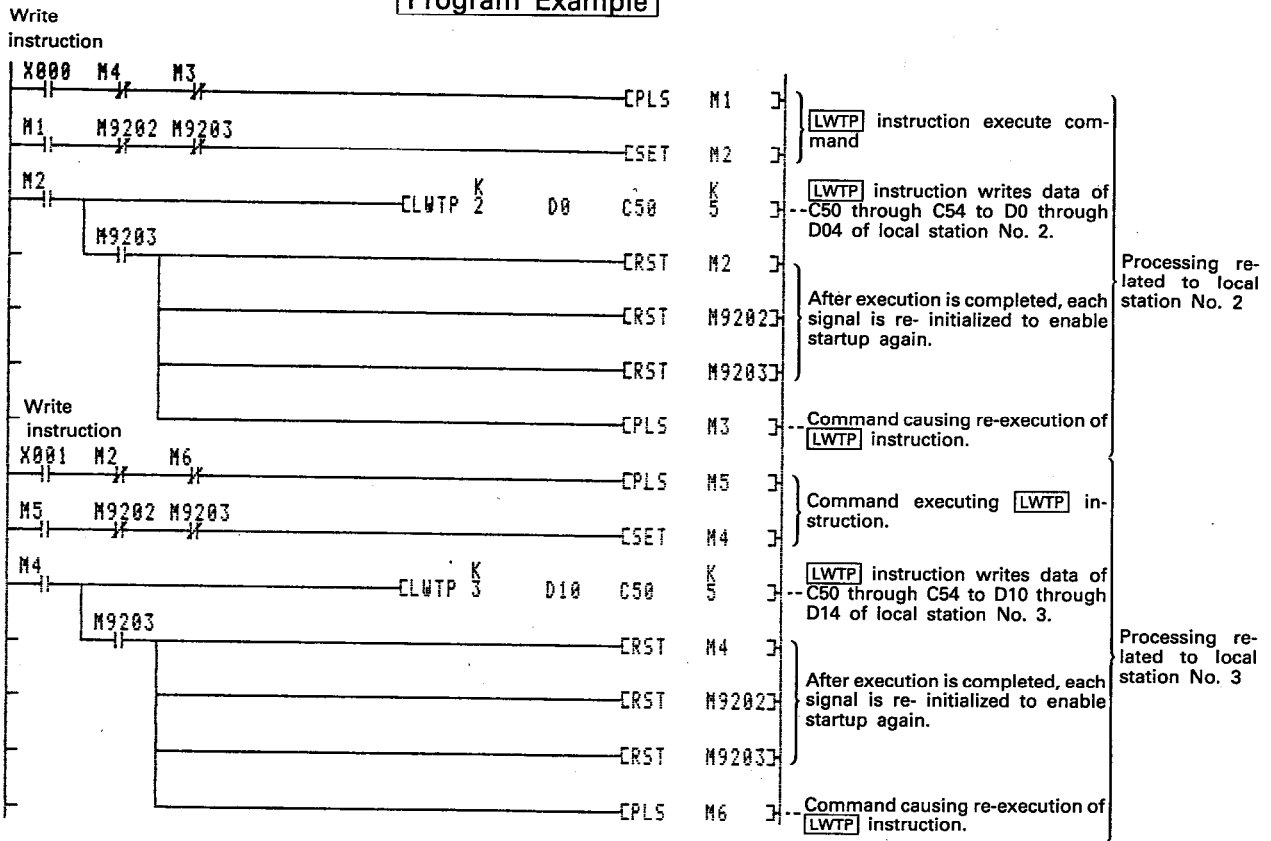
(2) Program example

This section provides an example of a program that writes the present values of C50 through C54 of the master station to local stations No. 2 and No. 3.

Conditions

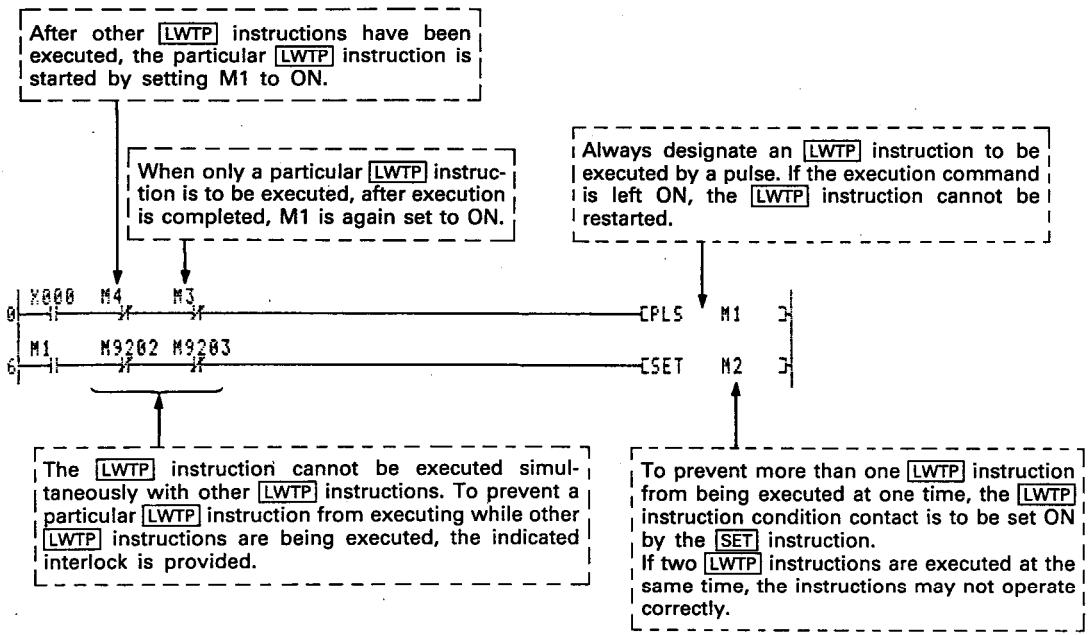
- (1) C50 through C54 of the master station is written to in D0 through D4 of local station No. 2 and D10 through D14 of local station No. 3.
- (2) When input "X0" of the master station is ON, data is usually write to local station No. 2.
- (3) When input "X1" of the master station is ON, data is usually write to local station No. 3.

Program Example

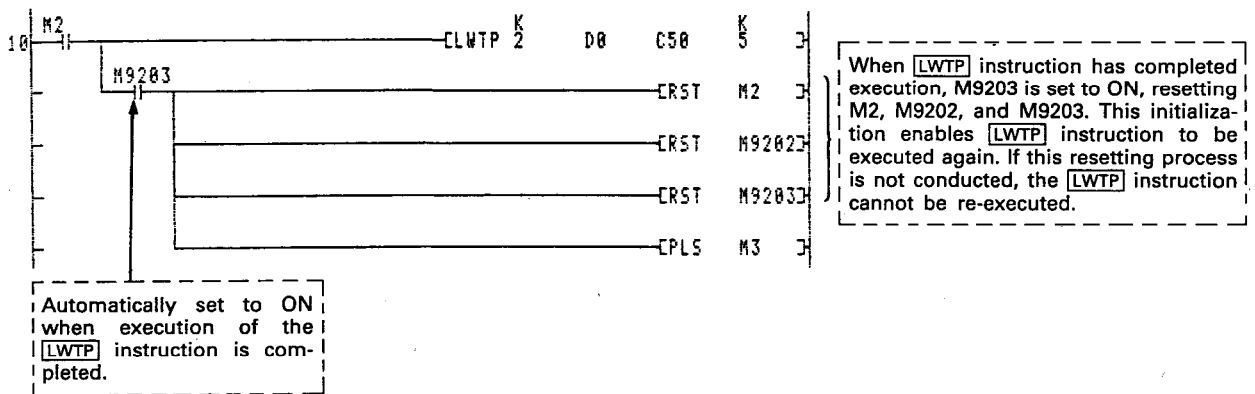


Explanation

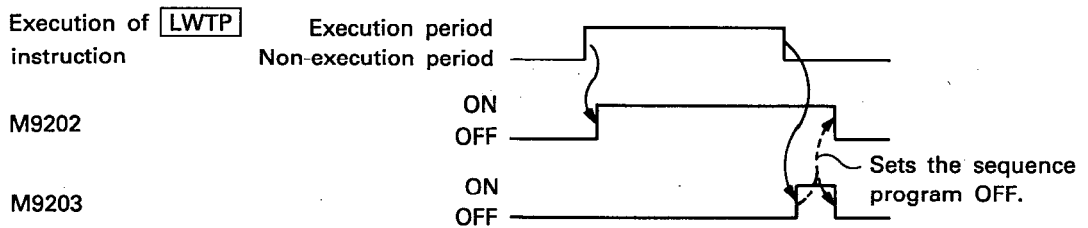
(1) Execution of LWTP instruction and interlock



(2) Initialization of the LWTP instruction after one execution is completed



(3) M9202 and M9203 ON/OFF timing during execution of the LWTP instruction is shown below.



8. TROUBLESHOOTING

This section describes troubleshooting methods used for the A3VTS data link system.

8.1 Link Monitor Using GPP/PHP/HGP

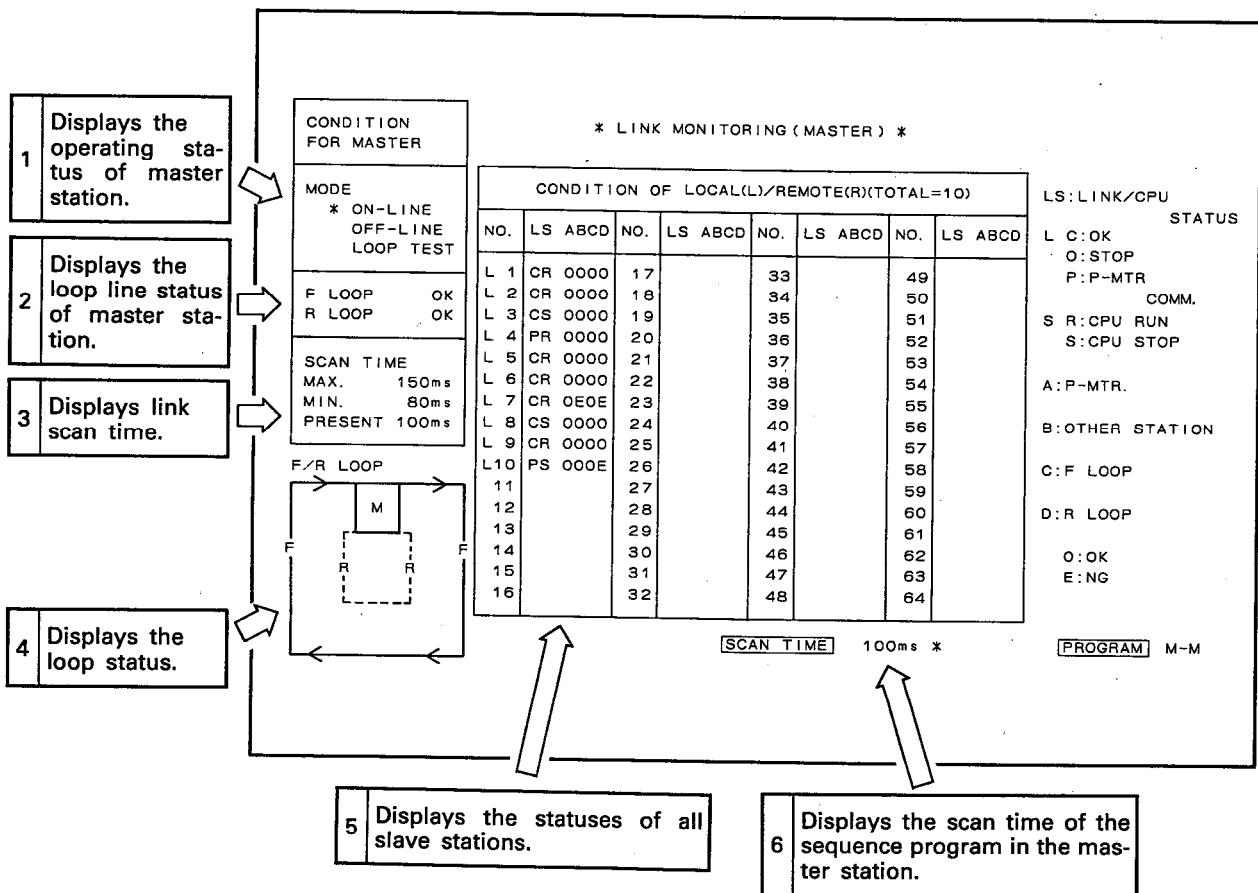
The GPP/PHP/HGP list monitor function enables monitoring of all A3VTS data link system link functions on one screen. The two types of link monitoring provided are "master station monitoring" and "local station monitoring".

Link monitor for master station Used when connected to the master station

Link monitor for local station Used when connected to the local station

8.1.1 Master station monitoring

Screen for master station link monitor:



POINT

When the special relay M9210 (link unit malfunction) of the master station is ON, peripheral equipment cannot be used for link monitoring. Any attempt to do so results in the message "Communication error" being displayed. Restore normal operating condition for M9210 and execute link monitoring again.

(1) Display of operating mode

- Displays the setting of the Mode Select switch of the AJ71VP21/R21 mounted in the master station.

- Online (Automatic loop switching enabled) (setting: 0) } "ONLINE" display
- Online
- Self-loopback test (setting: 7) "OFFLINE" display
- Loop test (setting: 3 or 4) "Loop Test" display

- The section displayed with asterisk (*) shows the present status.
- The loop circuit conducting monitoring is switched according to the ON/OFF status of the special relay M9018.

M9018: OFF...F-LINK loop circuit status displayed
 M9018: ON...R-LINK loop circuit status displayed

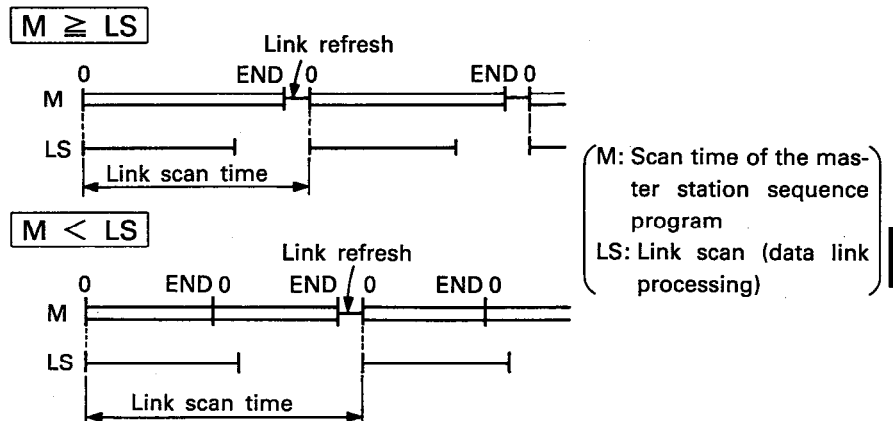
- Monitored contents are the same as those of special relays M9224 and M9227.

(2) Display of loop circuit status

- Displays whether the loop circuits between the master station and the final local station is normal or malfunctioning.
- Status of F-LINK loop circuit is displayed in "F- LOOP". Status of R-LINK loop circuit is displayed in "R- LOOP".
- An "OK" is displayed when the loop circuit is normal, "NG" when a malfunction occurs.
- Monitored contents are the same as those of special relays M9225 and M9226.

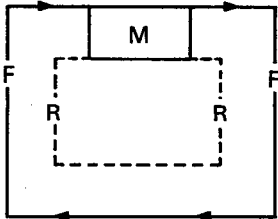
(3) Display of link scan time

- Displays the maximum, minimum, and present value of required times for data link processing between the master station and local stations.
- The following times are displayed.

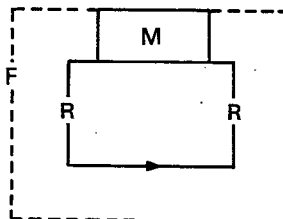


- Monitored contents are the same as those of special relays M9207 to D9209.

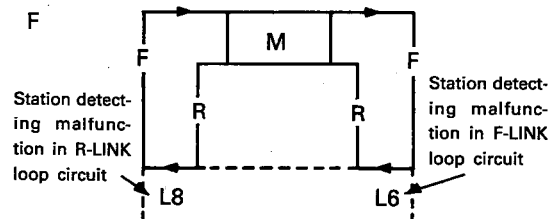
- (4) Display of active loop circuit and station detecting malfunction
 - Displays the number of the station detecting a malfunction in the active loop circuit and the number of the station in which the malfunction occurred.



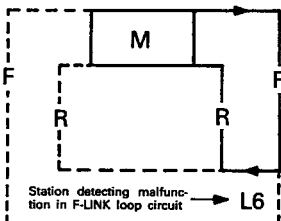
Active F-LINK loop circuit
No malfunction in R-LINK loop circuit
(D9204 0)



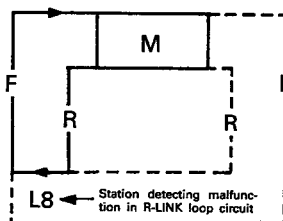
Active R-LINK loop circuit
No malfunction in F-LINK loop circuit
(D9204 0)



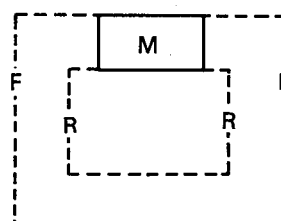
Inactive data link processing
Malfunction in both F-LINK and R-LINK loop circuits
(D92042)



R-LINK loop circuit active
Malfunction in F-LINK loop circuit
(D92043)



F-LINK loop circuit active
Malfunction in R-LINK loop circuit
(D92044)



Inactive data link processing
Normal conditions in both F-LINK and R-LINK loop circuit
(D92045)

- Data link processing is terminated (D9204 ... 5) when the following conditions exist.

- Error is made in link parameters.
- Number of slave station is set to "0" in link parameters.
- Mode Select switch of both AJ71VP21/R21s of the master station are set to either "Loop Test" or self-loopback test.
- Monitor time setting of link parameter is too short.
- When M9212 and M9213 (link module malfunction) are both ON.
- A3VTU of the local station is in reset condition.

- The monitor display for the active loop circuit is the same as that for the special register D9204. The display for the station detecting a malfunction is the same as that for the D9205 and D9206.

(5) Display of local station status

- Displays codes reflecting station of the local station of the whole system.

L column: Displays data link status of each local station.

C: Communication active with other stations

D: Data link processing interrupted

P: Communication of link parameters with master station in progress

The display shows the status of the active loop circuit. Codes C and D display contents of the special data registers D9228 to D9231. Code P displays the contents of D9224 to D9227.

S column: Displays operation status of each local station

R: Indicates the system of related station is in RUN status

S: Indicates the system of related station is in STOP status

The S column displays the contents of special data registers D9212 to D9215.

A column: Displays "0".

B column: Displays whether a local station has detected a malfunction in other local station.

0: No malfunction detected

E: Malfunction detected

The B column displays the status of the active loop circuit and the contents of special data registers D9216 to D9219.

C column: Displays status of the F-LINK loop circuit of the related local station

0: Normal

E: Error

The C column displays the contents of special data registers D9232 to D9239.

D column: Displays status of the R-LINK loop circuit of the related local station

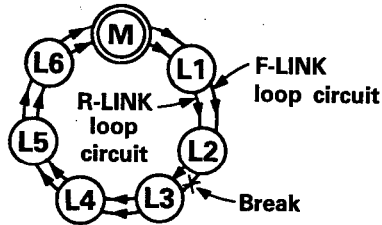
0: Normal

E: Error

The C column displays the contents of special data registers D9232 to D9239.

POINT

1. When a fault is detected in the F-LINK loop circuit or the R-LINK loop circuit due to a broken cable, errors in transmission occur as shown in the following diagram.

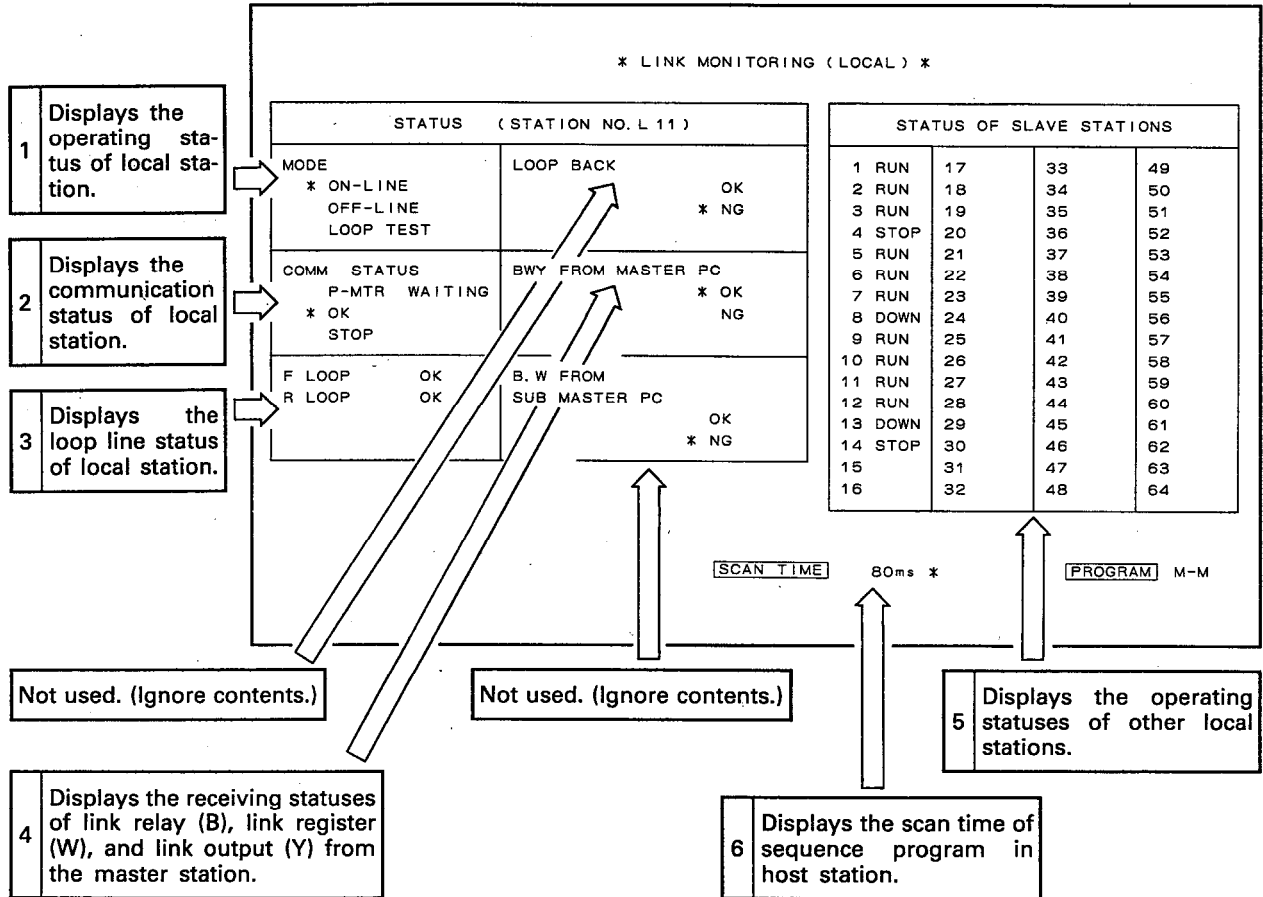


When the cable of the F-LINK loop circuit breaks between local station No. 2 and local station No. 3 as shown in the figure on the left, local station No. 3 is detected as the malfunctioning station in the F-LINK loop circuit.

2. When a "D" is displayed in the L column of the local station status display, the S to D columns display the status of the previous cycle and remain the same.

8.1.2 Local station monitoring

The following is the display shown when GPP/PHP/HGP is connected to a local station.



POINT

When the local station special relay M9211 (link module malfunction) is ON, link monitoring from peripheral equipment cannot be conducted. If attempted the message "Communication Error" is displayed. Restore normal operating condition for M9211 and execute link monitoring again.

- (1) Display of operating status
- Displays the setting of the Mode Select switch of the AJ71VP21/R21 mounted in a local station and whether a "Loop Test" is being conducted.
 - Set to online (setting: 0) "ONLINE" display
 - Set to self-loopback test (setting: 7). "OFFLINE" display
 - Master station loop test active "Loop Test" display
 - The section displayed with asterisk (✱) shows the present status.

- The loop circuit conducting monitoring is switched according to the ON/OFF status of the special relay M9018.
 - M9018: OFF..... F-LINK loop circuit status displayed
 - M9018: ON..... R-LINK loop circuit status displayed
 - Monitored contents are the same as those of special relays M9240 and M9252.
- (2) Display of communication status
- Displays communication status of host station.
 - "Waiting for parameters" Displayed when waiting for parameter data from master station.
 - "Cyclic communication" Displayed when communication is normal.
 - "Communication interrupted" ... Displayed when communication of the host station is interrupted.
 - The section displayed with asterisk (✕) shows the present status.
 - Monitored contents are the same as those of special relays M9250 and M9251.
- (3) Display of loop circuit status
- Displays whether the loop circuits between the host station and the preceding station is normal or malfunctioning.
 - Status of F-LINK loop circuit is displayed in "F- LOOP". Status of R-LINK loop circuit is displayed in "R- LOOP".
 - An "OK" is displayed when the loop circuit is normal, "NG" when a malfunction occurs.
 - Monitored contents are the same as those of special relays M9241 and M9242.
- (4) Display of status B, W, Y data received from master station
- Displays whether B, W, and Y data from the master station can be received correctly or not.
 - "Receiving" Data being received correctly from the master station.
 - "Receiving fault" Data not being received correctly from the master station.
 - The section displayed with asterisk (✕) shows the present status.
 - Monitored contents are the same as special relay M9246.

- (5) Displays operating status of local station
- Displays operating status of all local stations on the active loop circuit.

RUN.....Indicates system of corresponding station is in RUN status.

STOP.....Indicates system of corresponding station is in STOP or PAUSE status.

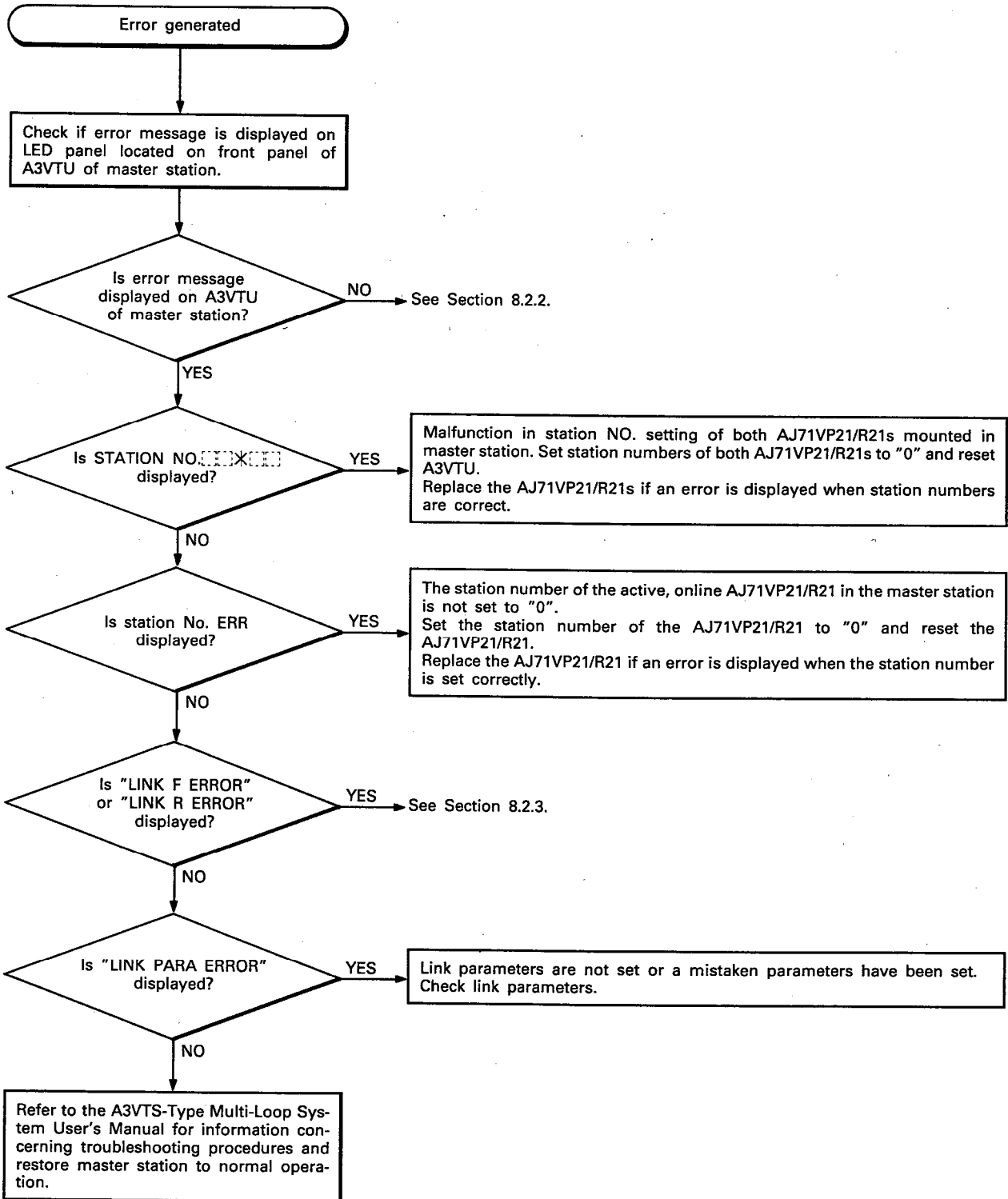
DOWN....Indicates system of corresponding station is in OFF condition or that the loop circuit is malfunctioning.

- Monitored contents are the same as special data registers D9248 to D9255.

8.2 Troubleshooting

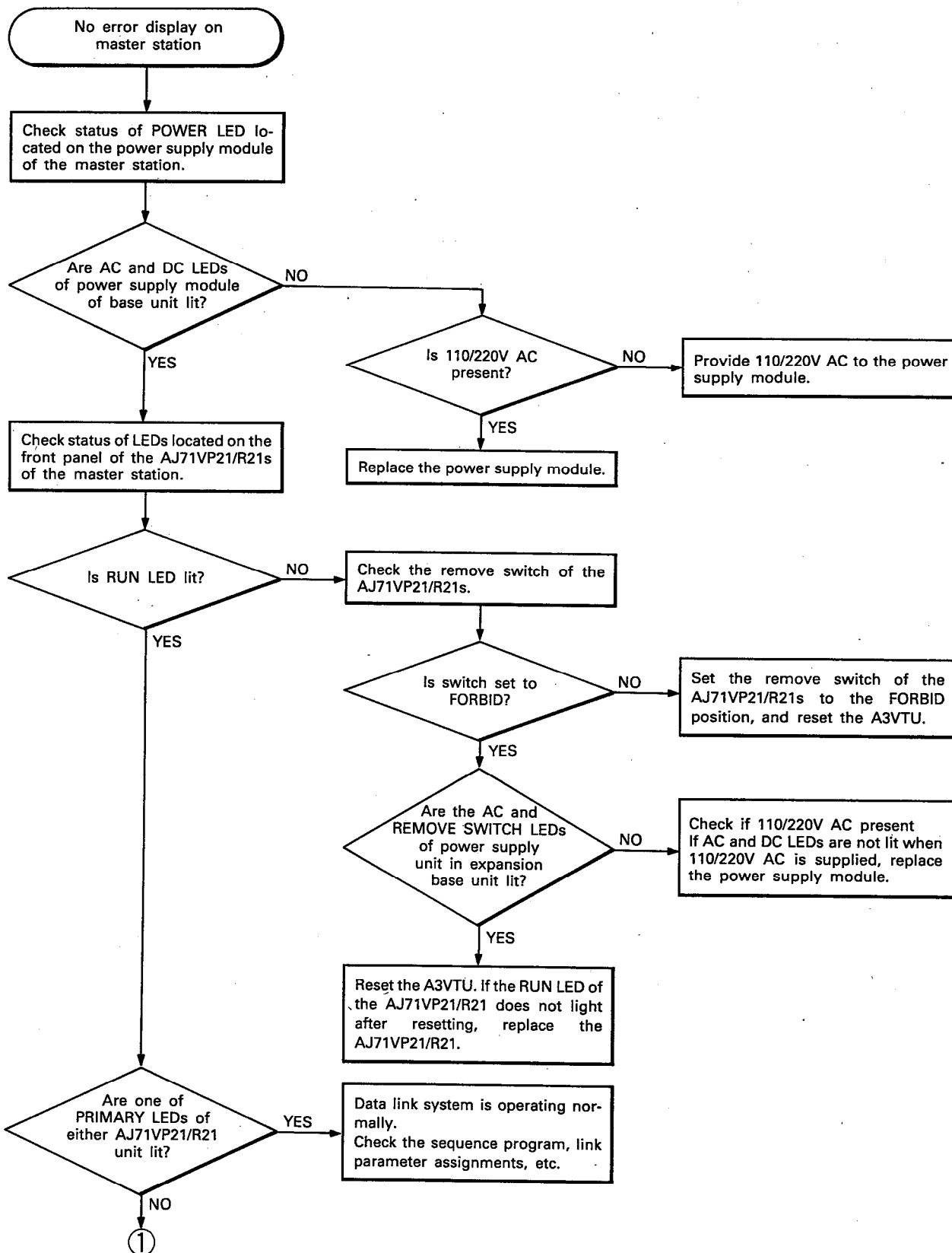
This section describes simple troubleshooting procedures to be used when the data link fails to startup or an error is generated during data link processing.

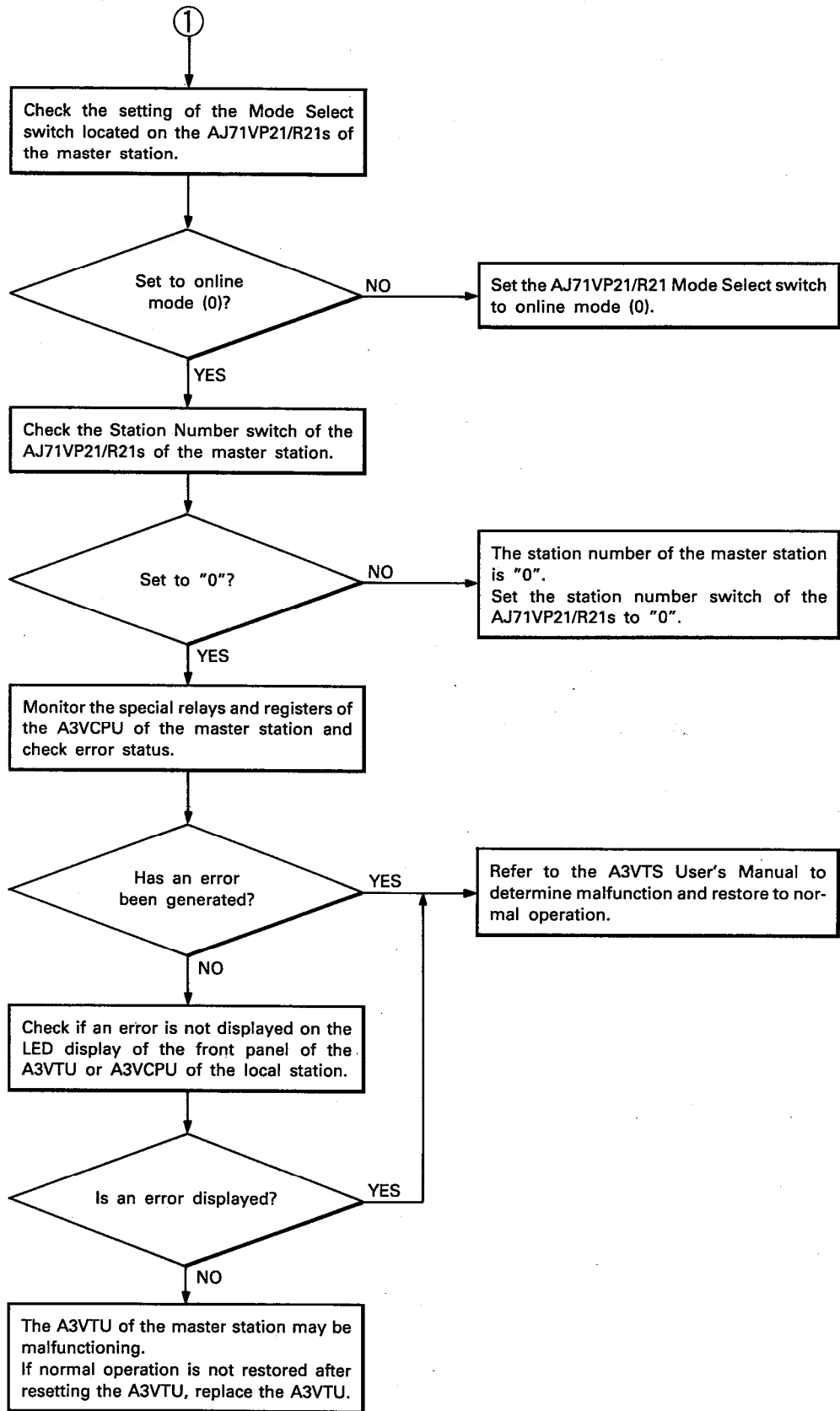
8.2.1 Troubleshooting flowchart



8.2.2 Troubleshooting when an error indication is not given on the master station

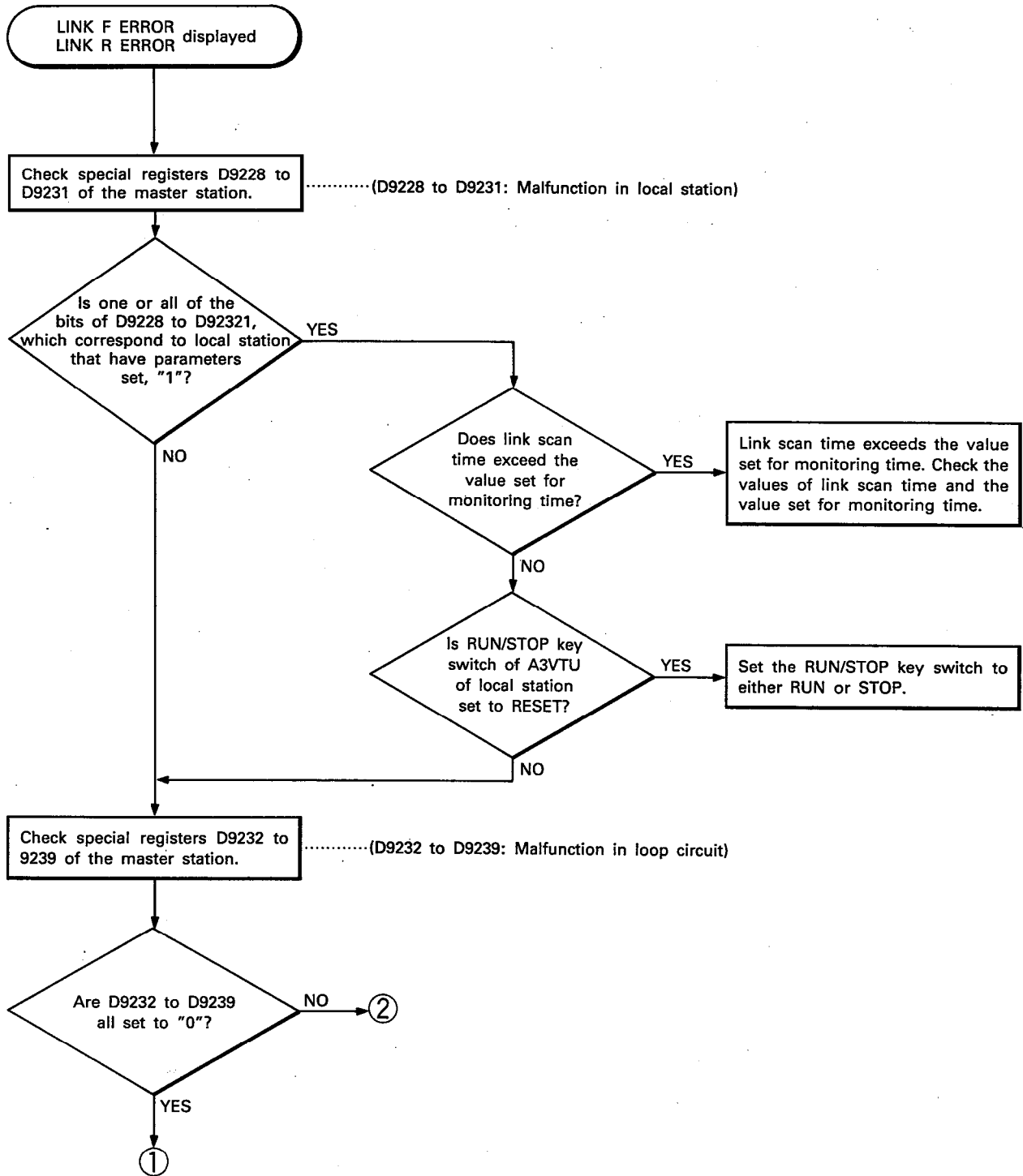
This section describes the troubleshooting methods to be used when an error indication is not given on the display located on the front panel of the A3VTU of the master station.

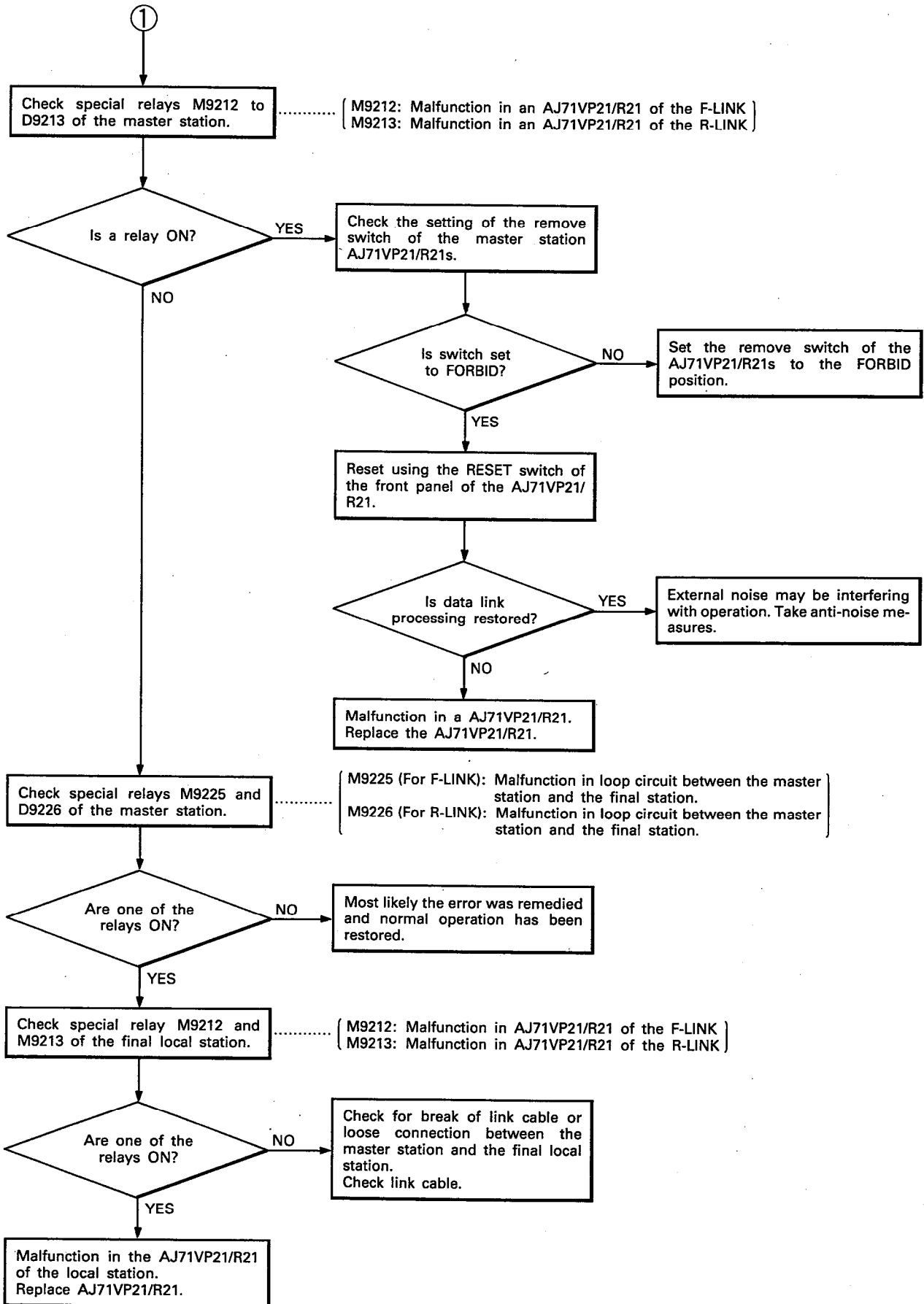


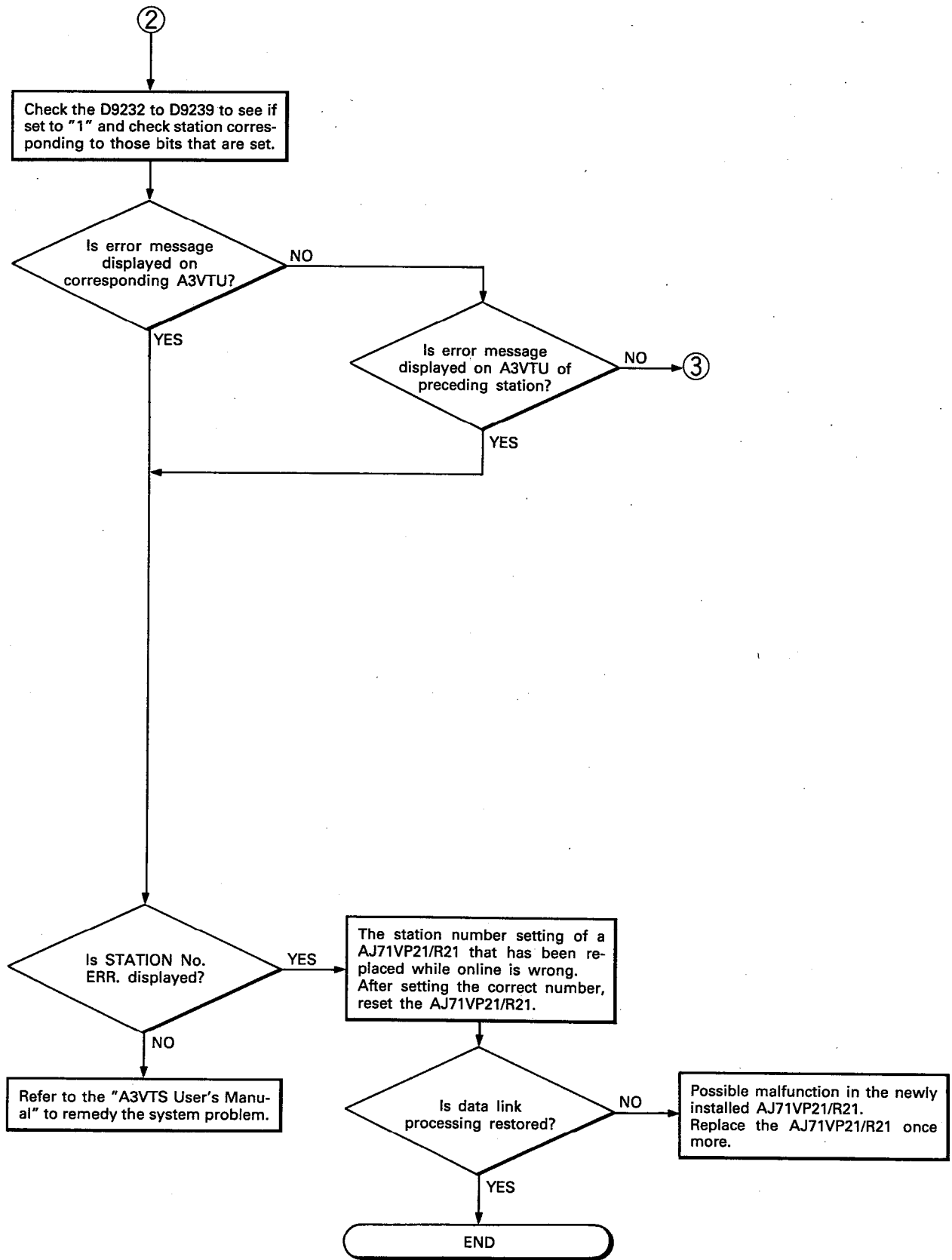


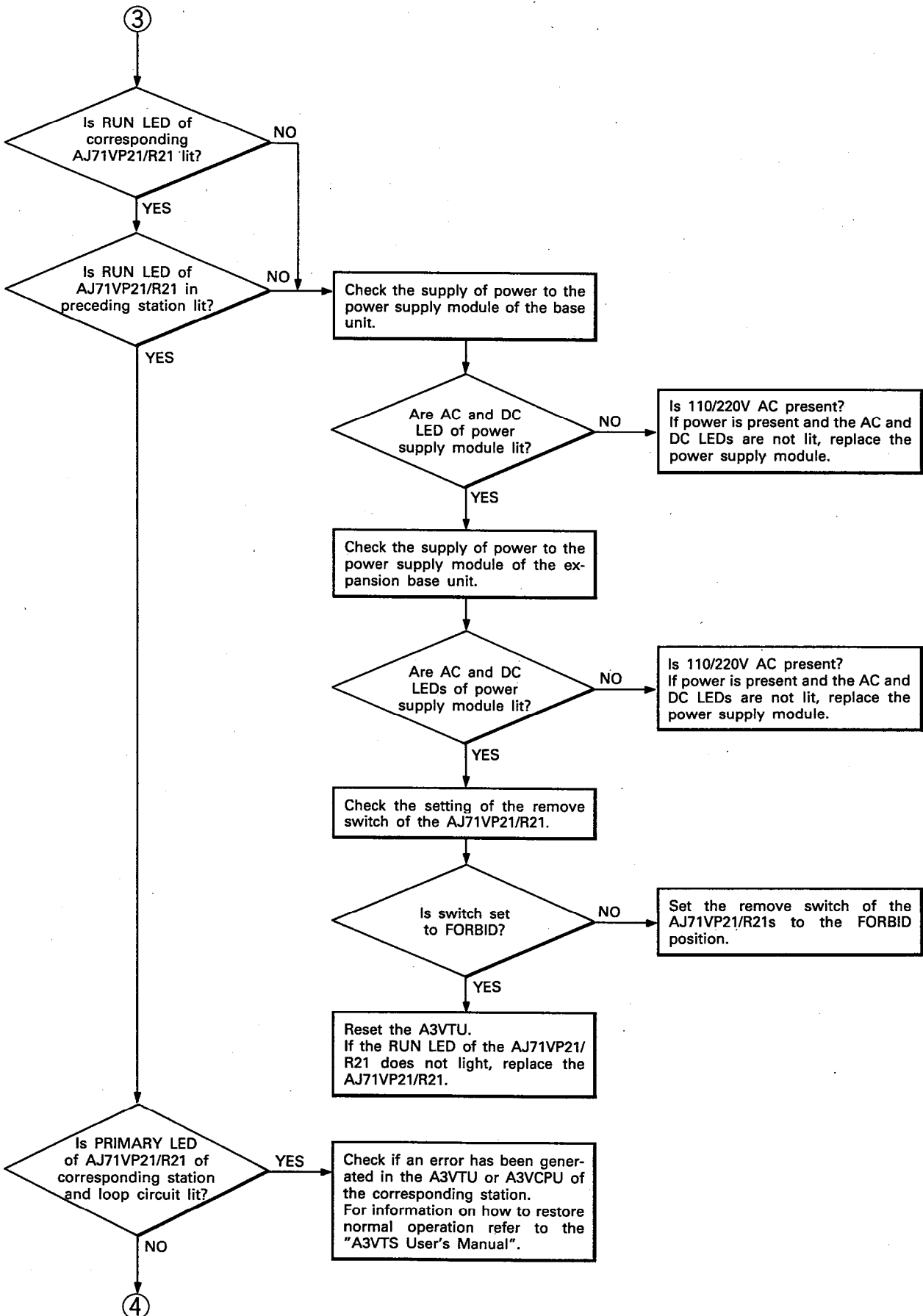
8.2.3 Troubleshooting flowchart for LINK F ERROR and LINK R ERROR

This section describes the troubleshooting methods to be used when either LINK F ERROR or LINK R ERROR indication is shown on the LED display of the A3VTU front panel of the master station.

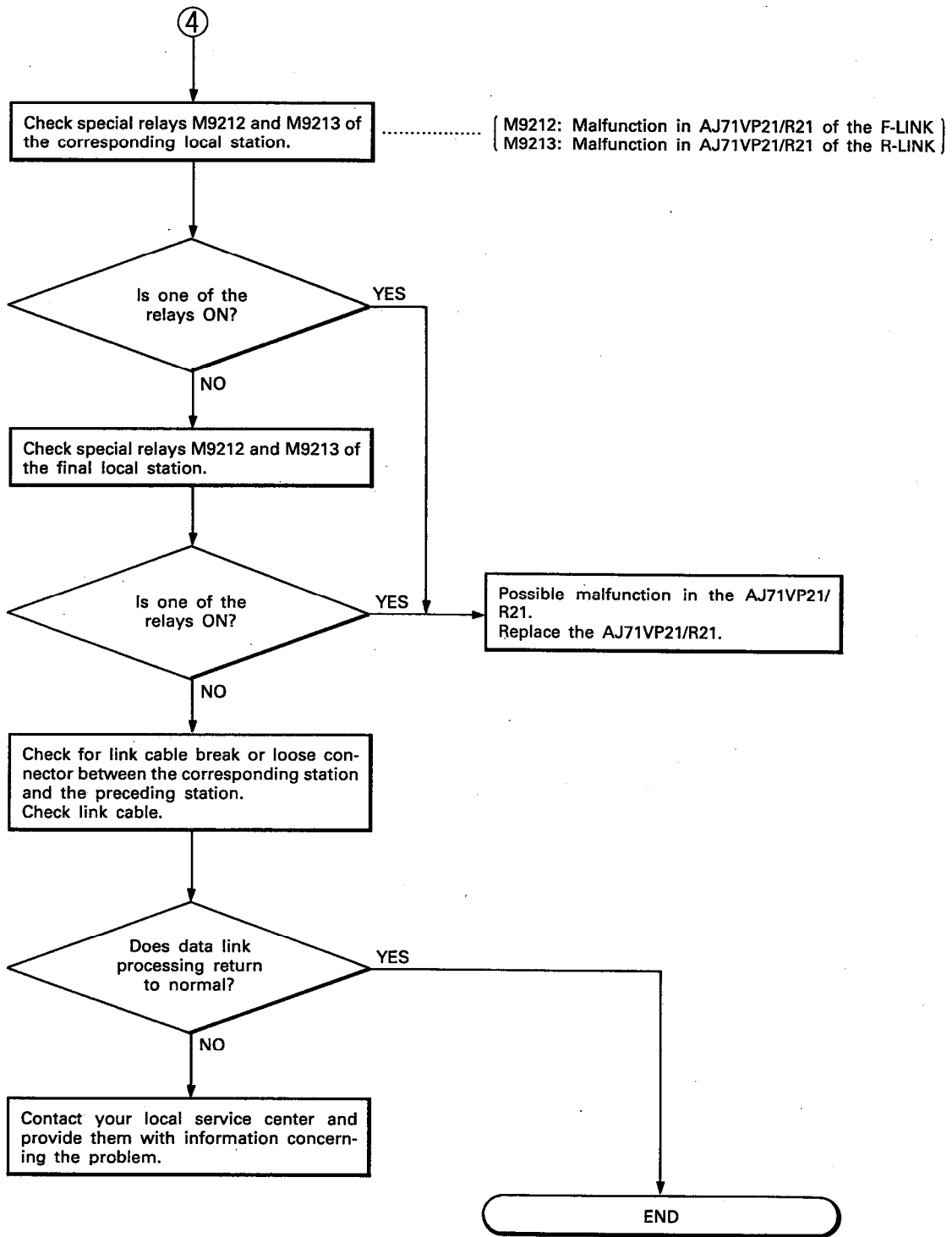








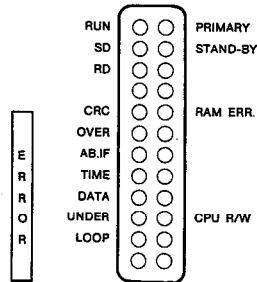
8



8.3 AJ71VP21/R21 LED Indicators

This section describes those LEDs which are set to ON/OFF when an error is generated.

The error LEDs provide information concerning the detection of errors generated during data link processing, and hardware malfunctions in the AJ71VP21/R21s. The ON/OFF status of these LEDs provides valuable troubleshooting information concerning the location of the error and the steps required to restore normal operation.



LED Display	Name	Error Detection Status	Description
CRC	CRC error (cyclic redundancy check)	On	Code check is conducted on transmitted data to determine if data is being transmitted correctly. Error indication is also set when a malfunction in the preceding station results in an error in transmitted data being generated. <div style="border: 1px solid black; padding: 2px; display: inline-block;">Source of malfunction</div> Noise, faulty link cable, loose link cable connector. Malfunctioning receiver in host station, malfunctioning transmitter in previous station.
OVER	Overrun error	On	One set of incoming data has overwritten the previous set before it had been processed. <div style="border: 1px solid black; padding: 2px; display: inline-block;">Source of malfunction</div> Malfunctioning of receiver in host station.
AB.IF	Abort invalid frame error	On	Error indication is also set when a malfunction in the preceding station results in an error in transmitted data being generated. <div style="border: 1px solid black; padding: 2px; display: inline-block;">Source of malfunction</div> Noise, faulty link cable, loose link cable connector. Malfunctioning receiver in host station, malfunctioning transmitter in preceding station.
TIME	Time check error	On	Master station: Error is set when transmitted data cannot be received during the period of time set for reception while a "Loop Test" or "self-loopback test" is being conducted. Local station: Error is set for all local stations when link scan time is longer than the period of time set for monitoring by link parameters during data link processing. <div style="border: 1px solid black; padding: 2px; display: inline-block;">Source of malfunction</div> Noise, faulty link cable, loose link cable connector. Malfunctioning receiver in host station, malfunctioning transmitter in preceding station.

8

LED Display	Name	Error Detection Status	Description
DATA	Data check error	On	<p>Error is set when data containing an error is received during a "Loop Test" or "self-loopback test".</p> <p>Source of malfunction</p> <p>Noise, faulty link cable, loose link cable connector. Malfunctioning receiver in host station, malfunctioning transmitter in preceding station.</p>
UNDER	Underrun error	On	<p>Error occurs when internal processing of sent data is not performed at regular intervals.</p> <p>Source of malfunction</p> <p>Malfunctioning receiver in host station.</p>
LOOP	Loop error	On	<p>Error is set when data cannot be received due to a fault in the data link loop circuit.</p> <p>Source of malfunction</p> <p>Faulty link cable, loose link cable connector. Malfunctioning receiver in host station, malfunctioning transmitter in preceding station.</p>
RAM ERR.	RAM error	On	<p>Error is set when the memory in the AJ71VP21/R21 used for communication with the A3VTU, or for data communication is faulty.</p> <p>Source of malfunction</p> <p>Hardware malfunction in host station.</p>

POINT

The AJ71VP21/R21 is suspect of malfunctioning when the RUN LED is off, or when the UNDER and RAM ERR. LEDs are lit among the LEDs on the front panel of the AJ71VP21/R21. In such a case, the AJ71VP21/R21 should be replaced.

APPENDICES

APPENDIX 1 Transmission Time Delay

The figure below indicates the maximum transmission delays for the A3VTS data link system.

		$L < LS < M$ $LS < L < M$	$LS < M < L$
Master Station ↓ Local Station	Link relay (B) Link register (W) Output (Y)	$M + \alpha_1 + LS + \alpha_2 + 2L$ 	$M + \alpha_1 + LS + 2L + \alpha_2$
	LRDP and LWTP instructions	$4(M + \alpha_1)$ 	$3(M + \alpha_1) + LS + L$
Local Station ↓ Master Station	Link relay (B) Link register (W) Input (X)	$4M + 3\alpha_1 - LS - \alpha_2$ 	$3M + 2\alpha_1 + L$
Local Station ↓ Local Station	Link relay (B) Link register (W)	$2(M + \alpha_1) - \alpha_2 + 2L_2 + \alpha_2'$ 	$M + \alpha_1 + LS + L_1 + 2L_2 + \alpha_2'$

$M + \alpha_1$: Scan time of the master station sequence program (value contained in D9019)

$L + \alpha_2$: Scan time of the local station sequence program (value contained in D9019)

LS: Link scan time (data communication time)

$$LS = 10 + 2.2 \times (\text{Total number of local stations}) + \frac{B + X_0 + Y_0 + (W \times 16)}{500} \text{ [msec]}$$

α_1 : Link refresh period of master station

$$\alpha_1 = 14.1 + \frac{B + X_0 + Y_0}{2048} \times 2.4 + \frac{W}{1024} \times 14.4 \text{ [msec]}$$

α_2 : Link refresh period of local station

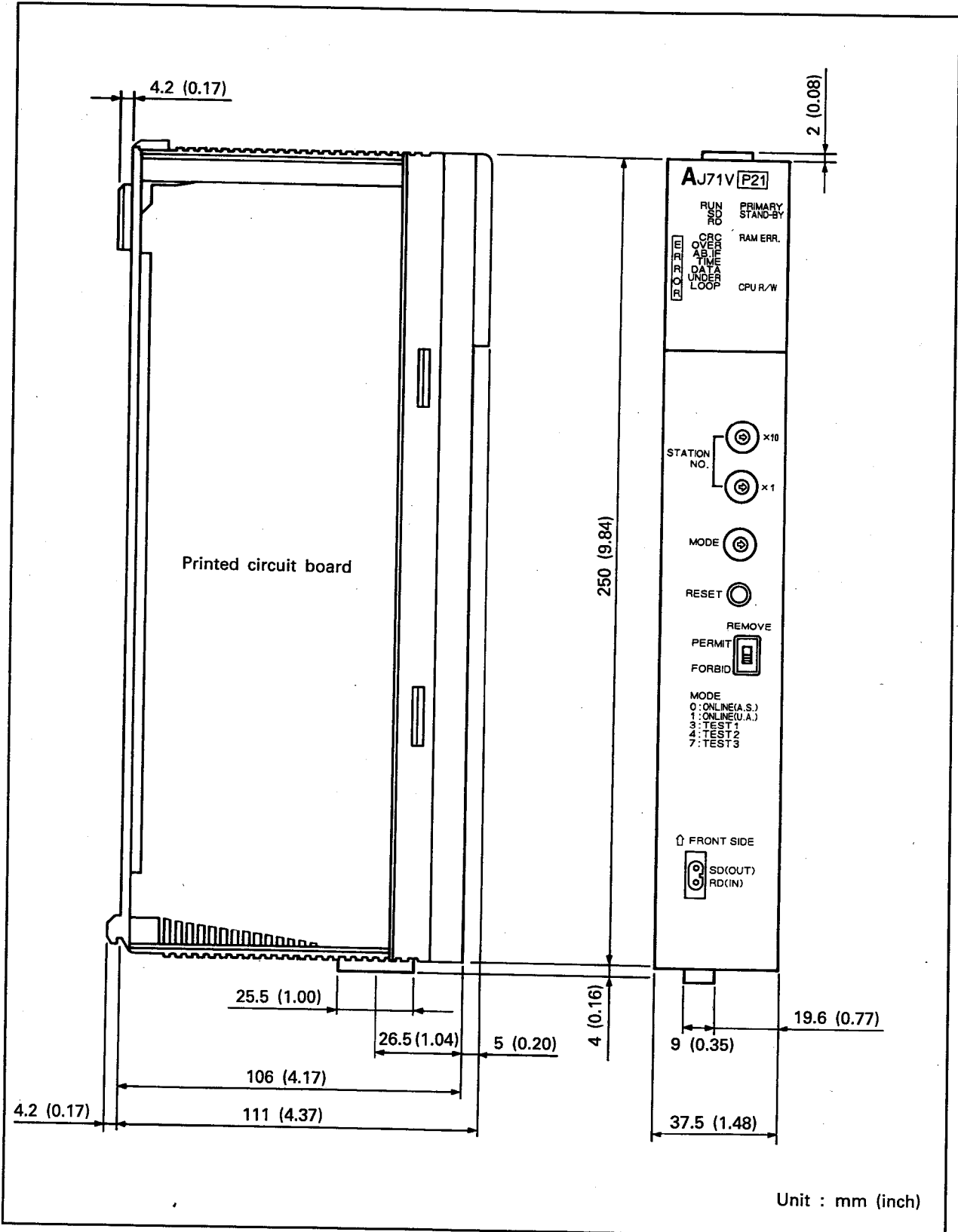
$$\alpha_2 = 13.6 + \frac{B + X_1 + Y_1}{2048} \times 2.4 + \frac{W}{1024} \times 14.4 \text{ [msec]}$$

	$M < L < LS$ $L < M < LS$	$M < LS < L$
	$M + \alpha_1 + 2LS + 2L + \alpha_2$	$M + \alpha_1 + 2LS + 2L + \alpha_2$
	$4(M + \alpha_1 + LS)$	$3(M + \alpha_1) + 4LS + L$
	$5M + 4\alpha_1 + 3LS - \alpha_2$	$3M + 2\alpha_1 + 2LS + L$
	$3(M + \alpha_1 + LS) + 2L_2 + \alpha_2' - \alpha_2$	$M + \alpha_1 + 2LS + L_1 + 2L_2 + \alpha_2'$

- B: Displays number of points, "M: B ↔ ALL L : B", available in link device range for link parameters.
- W: Displays number of points, "M: W ↔ ALL L : W", available in link device range for link parameters.
- X_o: Displays number of points, "M: X ↔ ALL L : Y", available in link device range for link parameters.
- Y_o: Displays number of points, "M: Y ↔ ALL L : X", available in link device range for link parameters.
- X_i: Number of link input (X) points in host station.
- Y_i: Number of link input (Y) points in host station.

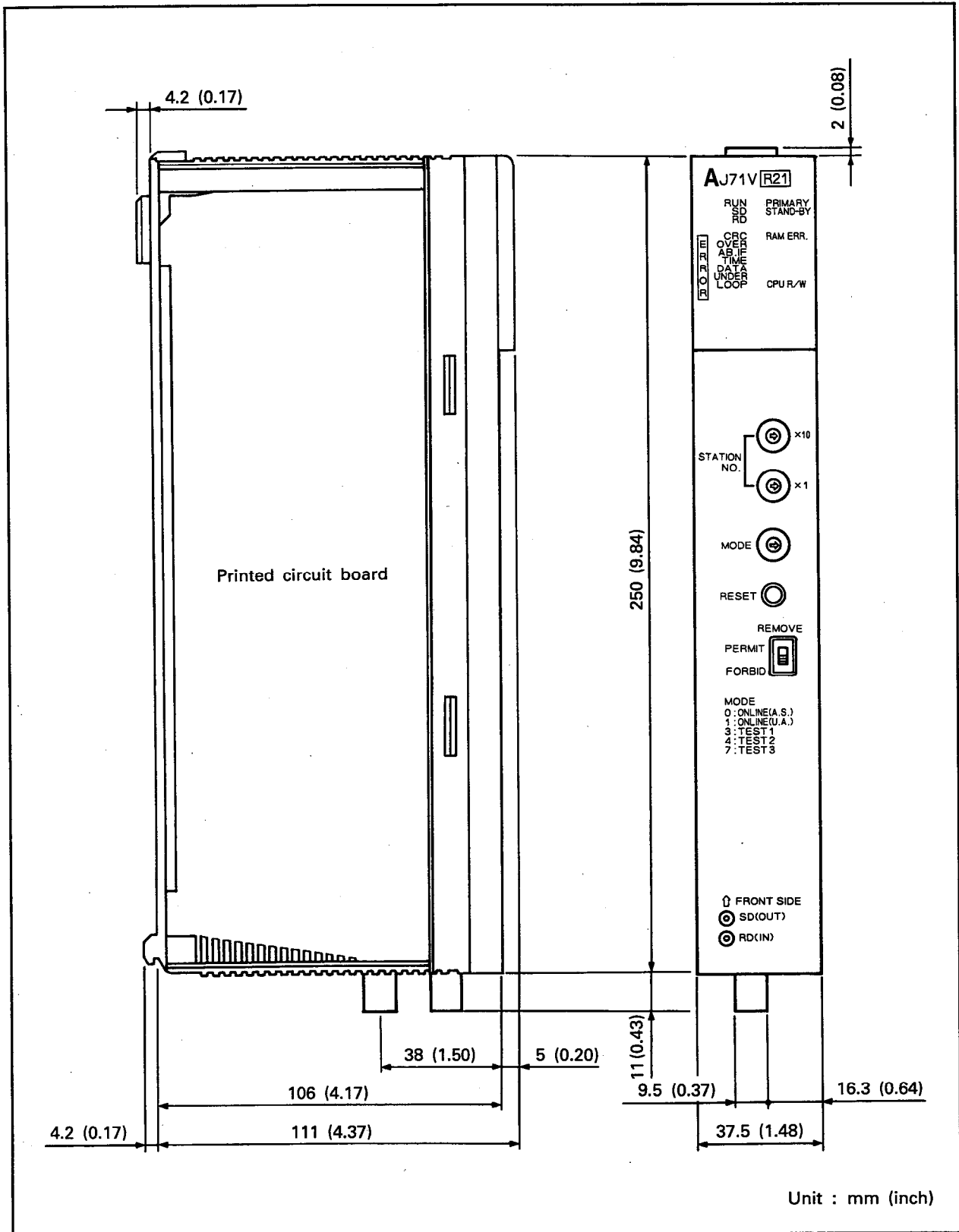
APPENDIX 2 External Diagrams

2.1 AJ71VP21



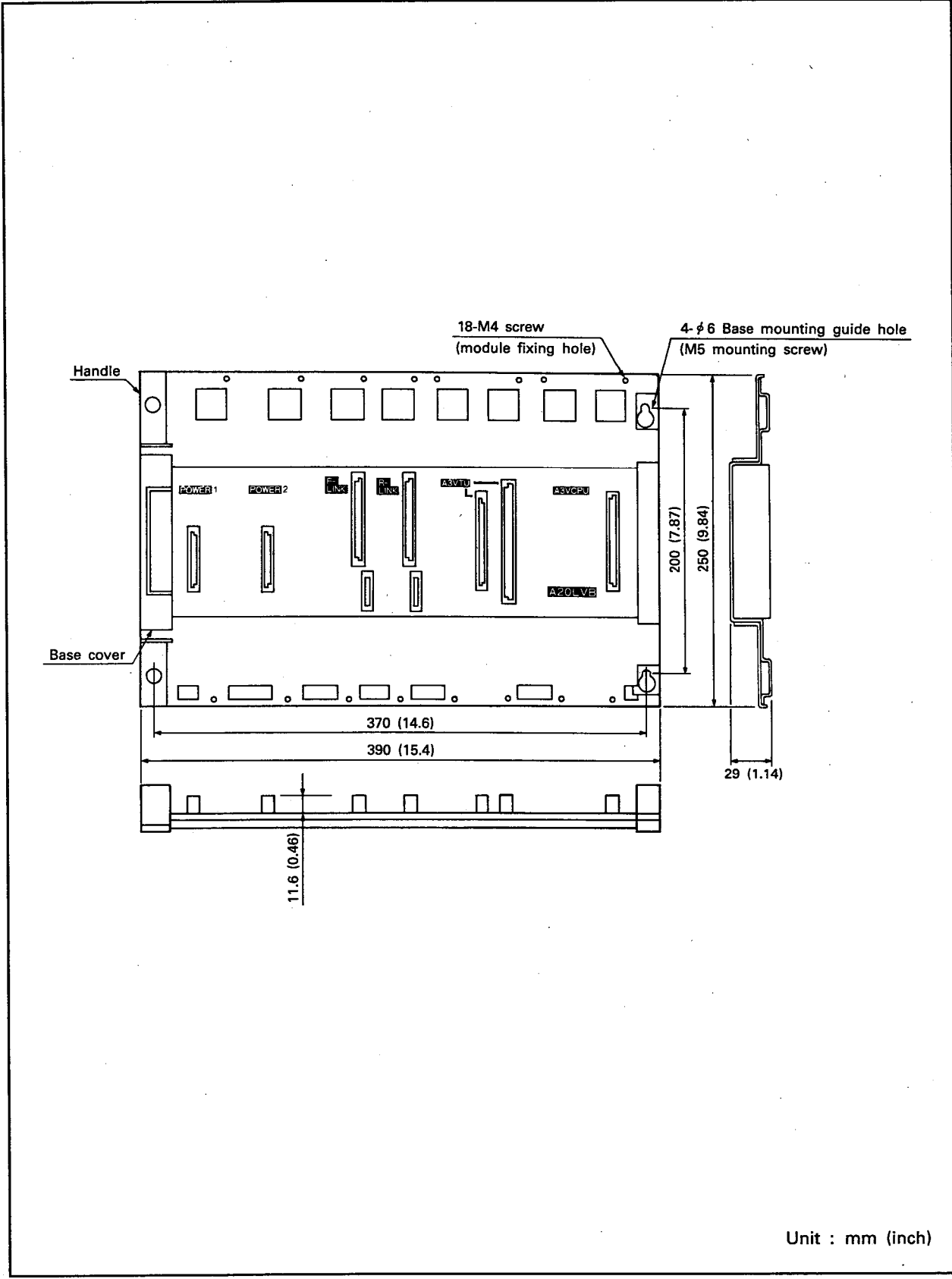
APP

2.2 AJ71VR21



APP

2.4 A20LVB



Unit : mm (inch)

APP

IMPORTANT

The components on the printed circuit boards will be damaged by static electricity, so avoid handling them directly. If it is necessary to handle them take the following precautions.

- (1) Ground human body and work bench.**
- (2) Do not touch the conductive areas of the printed circuit board and its electrical parts with any non-grounded tools etc.**

Under no circumstances will Mitsubishi Electric be liable or responsible for any consequential damage that may arise as a result of the installation or use of this equipment.

All examples and diagrams shown in this manual are intended only as an aid to understanding the text, not to guarantee operation. Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.

Owing to the very great variety in possible applications of this equipment, you must satisfy yourself as to its suitability for your specific application.

type A3VTS (Data link)

User's Manual

MODEL	A3VTS-LINK-U-E
MODEL CODE	13J657
IB(NA)66191-A(8905)MEE	

 **mitsubishi electric corporation**

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Specifications subject to change without notice.