General Specifications

Models ALR111, ALR121
Serial Communication
Modules (for N-IO/FIO)

CENTUM VP

GS 33J60G10-01EN

[Release 6]

■ GENERAL

This document describes about Models ALR111 and ALR121 Serial Communication Modules (for N-IO/FIO) that a field control station (FCS) uses to perform serial communication with subsystems such as FA-M3. These serial communication modules can be mounted on field control units (AFV30□, AFV40□, A2FV50□, and A2FV70□), ESB bus node unit (ANB10□), optical ESB bus node unit (ANB11□).
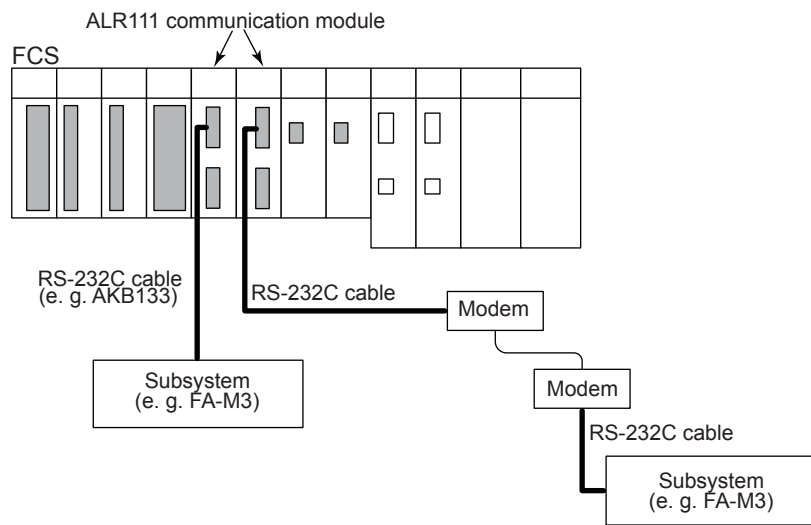
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Figure A Configuration Sample of the Serial Communication Modules

■ STANDARD SPECIFICATIONS

The serial communication modules (ALR111 and ALR121) hardware specifications are as shown below.

Table Serial Communication Module Hardware Specifications

Item	Specifications	
Model	ALR111	ALR121
Interface	RS-232C	RS-422/RS-485
Connection method	Point-to-point	Point-to-point (RS-422) Multipoint (RS-485)
Communication function	Half-duplex	
Synchronization method	Start-stop synchronization	
Transmission speed	1200/2400/4800/9600/19200/38400 bps (*1)	
Transmission code	ASCII/binary	
Character length	7/8 bits	
Stop bit length	1/2 bits	
Parity check	None/even/odd	
Lag time after data transmission	1 ms (The lag time to start receiving data again after data transmission.)	
Transmission distance	Maximum 15 m	Maximum 1200 m (total extended length)
Installation method	Mounted on ANB10□, ANB11□, AFV10□, AFV30□, AFV40□, A2FV50□, or A2FV70□	
I/O wiring	AKB131, AKB132, AKB133, AKB134 cables, etc.	Cable with 3-pair shield, AKB161, or AKB162
Wiring connection	D-sub-9-pin (female x 2)	Clamped with terminal block's M4 screws (5 poles x 2)
Current consumption	0.5 A	
Weight	Approx. 0.30 kg	Approx. 0.30 kg

*1: The applicable transmission speed depends on the communication function, subsystems, and connection method.

An FCS collects data from subsystems or sets data with control calculations to subsystems using the builder functions by way of serial communication modules. A communication module selects only one communication function, thus two ports must have identical communication functions. It is not possible to select different communication function for every port. The communication functions and those transmission speeds for each communication module are as shown in the table below.

Table Communication Functions for Communication Modules

Communication function	ALR111	ALR121
FA-M3 communication	DR	DR
Modbus communication	DR	DR
MELSEC-A communication	DR	DR
YS communication with direct connection	NIL	SG
YS communication	NIL	SG
SLC500 communication	SG	SG
PLC-S communication	SG	SG

DR: Dual-redundant communication is applicable.   SG: Only single communication is applicable.   NIL: Not complied

Table Transmission Speed by the Communication Function

Communication function	Transmission speed (bps)
FA-M3 communication	1200/2400/4800/9600/19200/38400 (*1)
Modbus communication	1200/2400/4800/9600/19200
MELSEC-A communication	1200/2400/4800/9600/19200
YS communication (direct connection)	9600
YS communication	9600
SLC500 communication	1200/2400/4800/9600/19200
PLC-S communication	1200/2400/4800/9600/19200

*1: The transmission speed of 38400 bps is not available for some PC link modules.

■ OPERATING ENVIRONMENT

Hardware Requirements

The serial communication module runs on the following FCS.

AFV30S, AFV30D, AFV40S, AFV40D, A2FV50S, A2FV50D, A2FV70S, A2FV70D

Software Requirements

The serial communication module runs on the control functions of the following FCS.

VP6F1700 Control Function for Field Control Station:	for AFV30□/AFV40□
VP6F1800 Control Function for Field Control Station:	for A2FV50□
VP6F1900 Control Function for Field Control Station:	for A2FV70□

Engineering Requirements

Works on VP6E5100 Standard Builder Function.

■ INSTALLATION ENVIRONMENT

VP6F1700 Control Function for Field Control Station (for AFV30□/AFV40□)

No. of ALR111, ALR121, ALE111, ALP111, ALP121, A2LP131, AGS813, and AGP813 modules	Max. 32 units/FCS (Max. 16 pairs for dual-redundant operation) (*1)
No. of ALF111 modules	Max. 64 units/FCS (Max. 32 pairs for dual-redundant operation)
No. of all the communication modules	Max. 64 modules/FCS (*1) (*2)
I/O data capacity for communication	1000 words/ALR111, 1000 words/ALR121
No. of communication definition	128 definitions/ALR111, 128 definitions/ALR121
No. of communication functions	Max. 8 types/FCS (*1) (*3)
Communication I/O data capacity	Max. 8000 words/FCS (incl. data from other communication function)

*1:   ALP111 and ALP121 cannot be mounted on the same FCS together.
*2:   This is the sum of ALR111, ALR121, ALE111, ALF111, ALP111, ALP121, A2LP131, AGS813, and AGP813 modules.
*3:   This is the sum of communication functions of ALR111, ALR121, ALE111, ALP111, ALP121, and A2LP131.

VP6F1800 Control Function for Field Control Station (for A2FV50□)

No. of ALR111, ALR121, ALE111, ALP121, and A2LP131 modules	Max. 32 units/FCS (Max. 16 pairs for dual-redundant operation)
No. of ALF111 modules	Max. 64 units/FCS (Max. 32 pairs for dual-redundant operation)
No. of all the communication modules	Max. 64 modules/FCS (*1)
I/O data capacity for communication	1000 words/ALR111, 1000 words/ALR121
No. of communication definition	128 definitions/ALR111, 128 definitions/ALR121
No. of communication functions	Max. 8 types/FCS (*2)
Communication I/O data capacity	Max. 8000 words/FCS (incl. data from other communication function)

*1:   This is the sum of ALR111, ALR121, ALE111, ALF111, ALP121, and A2LP131 modules.
*2:   This is the sum of communication functions of ALR111, ALR121, ALE111, ALP121, and A2LP131.

VP6F1900 Control Function for Field Control Station (for A2FV70□)

No. of ALR111, ALR121, ALE111, ALP121, and A2LP131 modules	Max. 32 units/FCS (Max. 16 pairs for dual-redundant operation)
No. of ALF111 modules	Max. 64 units/FCS (Max. 32 pairs for dual-redundant operation)
No. of all the communication modules	Max. 64 modules/FCS (*1)
I/O data capacity for communication	1000 words/ALR111, 1000 words/ALR121
No. of communication definition	128 definitions/ALR111, 128 definitions/ALR121
No. of communication functions	Max. 8 types/FCS (*2)
Communication I/O data capacity	Max. 8000 words/FCS (incl. data from other communication function)

*1:   This is the sum of ALR111, ALR121, ALE111, ALF111, ALP121, and A2LP131 modules.
*2:   This is the sum of communication functions of ALR111, ALR121, ALE111, ALP121, and A2LP131.

■ SUBSYSTEM COMMUNICATIONS

The serial communication module communicates with subsystems at the specified intervals and stores the subsystem data in the communication modules' I/O image area. FCS accesses the communication module asynchronously from them, and refers to or sets the I/O images. This enables FCS to use the subsystem data through the I/O terminals of the function block in the same way as the general analog and digital I/O signals.
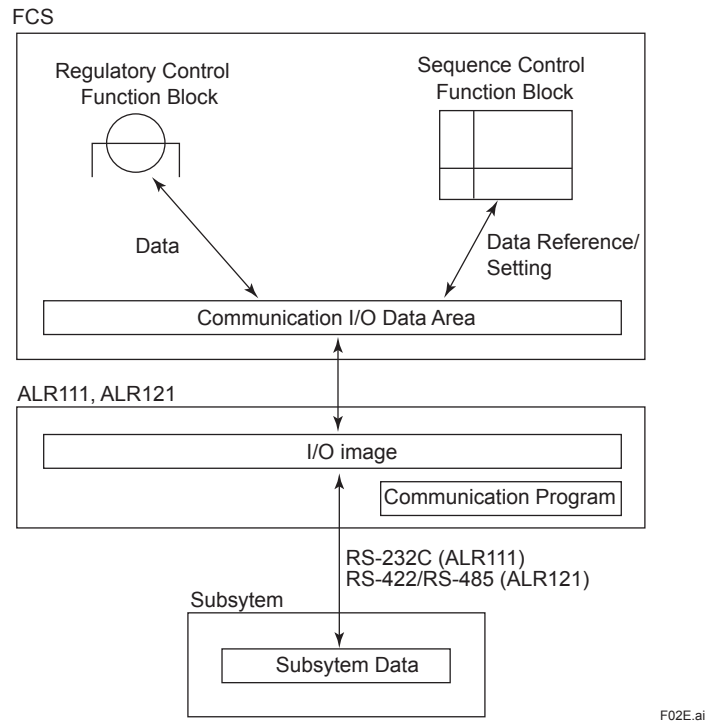

Figure Flow of Data in a Subsystem

■ COMMUNICATION FUNCTIONS

● FA-M3 Communication

Connected device: Personal computer link module
  F3LC11-1N, F3LC11-2N, F3LC11-1F, F3LC11-2F, F3LC12-1F (FA-M3)
  LC01-0N, LC02-0N (FA500)
Connection method: Connect a personal computer link module with ALR111 or ALR121 communication port.
Applicable device: FA-M3, FA500
Transmission protocol: FA-M3 dedicated control protocol
No. of subsystem stations: Max. 30 stations/port

Table List of Applicable Devices

Device type	Device name	Communication capacity (per communication)	Read	Write
Bit device	Input relay	64 words	Y	N
	Output relay		Y	Y
	Internal relay		Y	Y
	Shared relay		Y	Y
	Link relay		Y	N
	Special relay		Y	N
	Time up relay		Y	N
	Count up relay		Y	N
Word device	Decrementing timer current value	64 words	Y	Y
	Incrementing timer current value		Y	Y
	Timer set value		Y	N
	Decrementing counter current value		Y	Y
	Incrementing timer current value		Y	Y
	Counter set value		Y	N
	Data register		Y	Y
	File register (*1)		Y	Y
	Shared register		Y	Y
	Index register (*2)		Y	Y
	Link register		Y	N (*3)
	Special register		Y	N
Special device	Communication time	1 word	Y	N
	Communication status		Y	N

Y: Applicable
N: Not applicable
*1: As for FA500, this is equivalent to the common register.
*2: This device is for FA-M3.
*3: FA-M3 is able to write data to other link devices than the one assigned to the local station; however, the data will be overwritten upon refreshing by other stations.

● **Modbus Communication**

Connected device: Serial transmission interface module
Connection method: Connect an ALR111 or ALR121 module communication port with serial transmission interface module
Applicable devices: By Yokogawa - STARDOM FCN, FCJ, and GC1000 Mark II (*1)
         By Schneider Electric - Modicon484, 584, 584L, 884, 984, 984A, 984B, 984X, and Micro 84
         By Yasukawa Electric - Memocon-SC U84, 584, 684H, 694H, R84H-M, GL60S, and GL20
Transmission protocol: Modbus protocol (RTU mode)
No. of subsystem stations: Max. 30 stations/port

*1:   The communication with GC1000 Mark II is enabled via ASGW, and the number of port available for communication is one.

Table List of Applicable Devices

Device type	Device name	Communication capacity (per communication)	Read	Write
Bit device	Coil	125 words	Y (*2)	Y
	Input relay		Y	N
	Link relay (*1)		Y (*2)	Y
	Step status (*1)		Y	N
Word device	Input register	125 words	Y	N
	Maintenance register		Y (*2)	Y
	Constant register (*1)		Y (*2)	Y
	Step passing time (*1)		Y	N
	Link register (*1)		Y (*2)	Y
	Enhanced register (*1)		Y (*2)	Y
	4-byte register		Y	N
Other device	Specific coil	1 word	Y	N
	Communication status		Y	N

Y: Applicable
N: Not applicable
*1:   These devices are for Memocon-SC GL60S.
*2:   Data may not be readable depending on the functional codes.

● **MELSEC-A Communication**

Connected device: MELSEC-A computer link unit
　　　　　　　AJ71C24-S8/S6/S3, AJ71UC24, A1SJ71UC24-R2/R4/PRF, A1SJ71C24-R2/R4/PRF,
　　　　　　　A1SCPUC24-R2, A2CCPUC24 (PRF)
Connection method: Connect a computer link unit with ALR111 or ALR121 communication ports
Applicable devices: MELSEC-A CPU unit
　　　　　　　(A communication with FCS can be established with if a CPU is connectable with MELSEC-A
　　　　　　　computer link unit.)
Transmission protocol: MELSEC-A dedicated control protocol format 4
No. of subsystem stations: Max. 30 stations/port

Table List of Applicable Devices (*1)

Device type	Device name	Communication capacity (per communication)	Read	Write
Bit device	Input/output relay	32 words (512 points)	Y	Y
	Internal relay		Y	Y
	Latch relay		Y	Y
	Step relay		Y	Y
	Link relay		Y	Y
	Annunciator		Y	Y
	Special relay		Y	Y
	Timer (contact, coil)		Y	Y
	Counter (contact, coil)		Y	Y
Word device	Timer (current value)	64 words	Y	Y
	Counter (current value)		Y	Y
	Data register		Y	Y
	Link register		Y	Y
	File register		Y	Y
	Special register		Y	Y
Other device	Communication status	1 word	Y	N

Y:　Applicable
N:　Not applicable
*1:　For the communication with MELSEC-Q or QnA, it is possible to access the same device range as MELSEC-A via
　　A-compatible communication mode. Access to the MELSEC-Q and QnA devices shown below is not applicable.
　　Edge relay, accumulated timer (contact, coil, current value), special link relay, special link register, direct input, direct output,
　　index register, file register, extended file register, latch relay, and step relay.

● **YS Communication with Direct Connection (for ALR121 only)**

Connected device: YS instruments (YS1000 SERIES and YS100 SERIES)
Connection method: ALR121 communication port is connected with YS instruments via RS-485 cable. (*1)

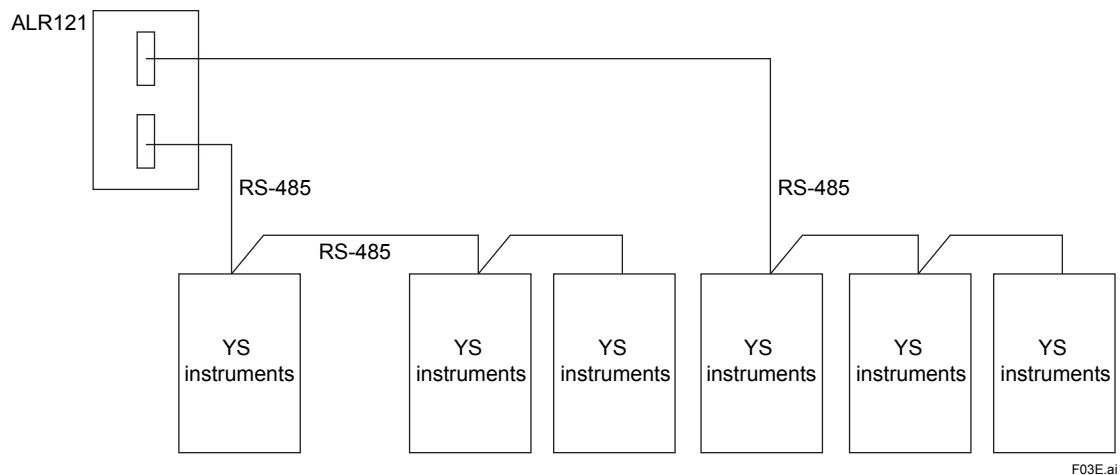*1:   Set the YS instrument control cycle as 100 ms.

Figure Hardware Connection Diagram

Table List of Applicable YS Instruments and Data types

YS instruments	Fast-scan data	Slow-scan data (*1)
YS150/YS1500, YS170/YS1700 Single loop mode or auto-selector mode	LS1, PV1, SV1, MV1	MH1, ML1, PB1, TI1, TD1
YS150/YS1500, YS170/YS1700 cascade mode	LS1, PV1, SV1, MV1	MH1, ML1, PB1, TI1, TD1
YS170/YS1700 user-programmable mode (BSC1 or SSC)	LS1, PV1, SV1, MV1	Y04, Y05, Y06, MH1, ML1, PB1, TI1, TD1, P01, P02
YS170/YS1700 user-programmable mode (CSC)	LS1, PV1, SV1, MV1	Y04, Y05, Y06, MH1, ML1, PB1, TI1, TD1, P01, P02
YS135/YS1350	LS1, PV1, SV1	None
YS136/YS1360	LS1, PV1, MV1	MH1, ML1

*1:   The scan speed of the slow-scan data is described by the fast-scan data speed x n. The figure "n" can be specified within the range of 0-20 by the builder function for each ALR121 port. The default value is set as 0, which is equivalent to x8 of the fast-scan speed.

Table YS Instruments Data and Function Block Data Item

YS instruments data	Function block data item
LS1	LOOP
PV1	PV
SV1	SV
MV1	MV
MH1/MH2	MH
ML1/ML2	ML
PB1	P
TI1	I
TD1	D
Y04	AUX1
Y05	AUX2
P01	BS
P02	CS

No. of connected YS instruments = 20 units (10 units x 2 ports) / ALR121.

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● YS Communication (for ALR121 only)

Connected device: SCIU Communication Interface Unit
Connection method: ALR121 communication port and YS instruments
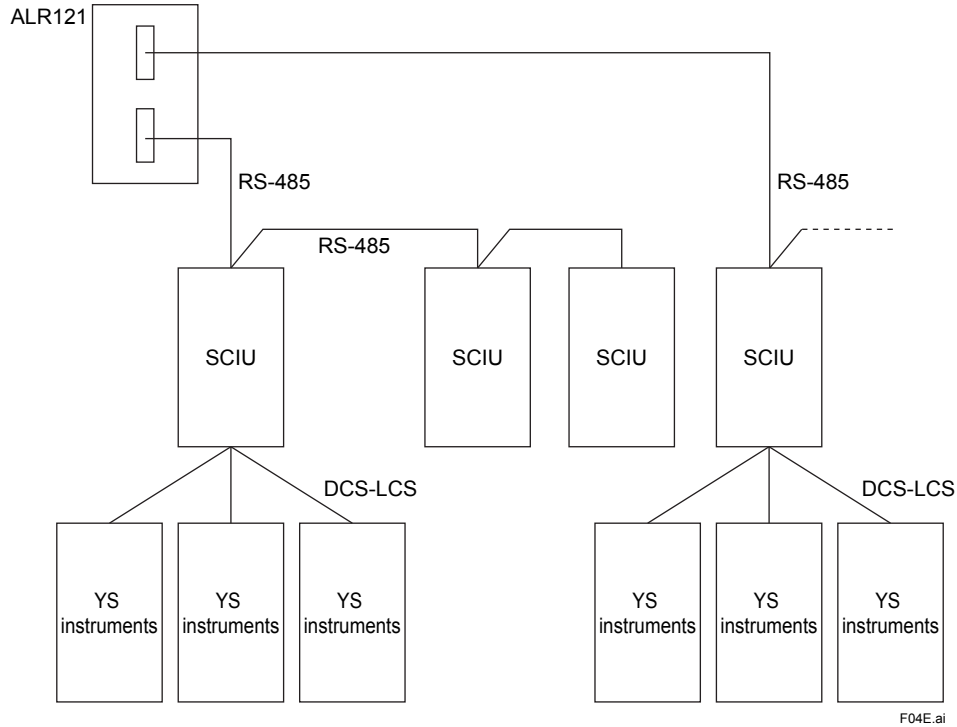(YS1000 SERIES, YS100 SERIES, and YEWSERIES80) are connected via SCIU.

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Figure Hardware Connection Diagram

Table List of Applicable YS Instruments and Data Types

YS instruments	Fast-scan data	Slow-scan data (*1)
SLCD	LS, PV, SV, MV	MH, ML, P, I, D
SLPC, YS170/YS1700, YS150/YS1500	LS, PV, SV, MV	AUX1, AUX2, AUX3, MH, ML, P, I, D, BS, CS
SLMC	LS, PV, SV, MV	AUX1, AUX2, AUX3, MH, ML, P, I, BS, CS
SMST-111, YS135/YS1350	LS, PV, SV	-
SMST-121, YS136/YS1360	LS, PV, MV	MH, ML
SMRT	LS, PV, SV, MV	CALC, DL, MH, ML, P1, P2, P3, P4, EB
SBSD	LS, PV, SV, MV	VL, SUM, PH, PL, CC1, CC2/CC4, CC3, BSET
SLCC	LS, PV, SV, MV	SUM, DV, CC1, CC2/CC4, CC3
SLBC	LS, PV, SV, MV	VL, SUM, PH, PL, CC1, CC2/CC4, CC3, BSET
STLD	LS, PV	SUM, CC1, CC2/CC4, CC3

*1:   The scan speed of the slow-scan data is described by the fast-scan data speed x n. The figure of "n" can be specified within the range of 0-20 by the builder function for each ALR121 port. The default value is set as 0, which is equivalent to x8 of the fast-scan speed.

The maximum number of YS instruments to be connected with ALR121 is as shown below.

No. of SCIU: 20 units (10 units x 2 ports)/ALR121
No. of YS instruments to be connected with SCIU: 4 units/SCIU
No. of YS instruments: 20 units (10 units x 2 ports)/ALR121

● **SLC Communication**

Connected device: 1785-KE, 1770-KF2 (SLC500 link module)
Connection method: Connect ALR111 or ALR121 communication port with SLC500 link module
Applicable device: SLC500 CPU module
           SLC500, SLC5/01, SLC5/02, SLC5/03, SLC5/04
Transmission protocol: DF1 protocol (binary)
No. of subsystem stations: Max. 30 stations/port

Table List of Accessible Files

File type	File name	Communication capacity (per communication)	Read	Write
Word file	Bit file (*1)	115 words	Y	Y
	Timer file		Y	Y
	Counter file		Y	Y
	Control file		Y	Y
	Integer file		Y	Y

Y: Applicable
N: Not applicable
*1:   Access to the bit files in units of words.

● **PLC-5 Communication**

Connected device: 1785-KE, 1770-KF2 (PLC-5 link module)
Connection method: Connect ALR111 or ALR121 communication port with PLC-5 link module (*1)
Applicable device: PLC-5 family
Transmission protocol: PLC-5 family dedicated protocol (half-duplex protocol)
No. of subsystem stations: Max. 30 stations/port

   *1:   It is only 1 to 1 connection for ALR121.

Table List of Accessible Files

File type	File name	Communication capacity(per communication)	Read	Write
Bit file	Output image file	16 words (256 points)	Y	N
	Input image file		Y	N
	Status file		Y	N
	Bit file		Y	Y
Word file	Timer file	114 words	Y	Y
	Counter file		Y	Y
	Control file		Y	Y
	Integer file		Y	Y
	Floating-point numbers file		Y	Y

Y: Applicable
N: Not applicable

■ DUAL-REDUNDANCY OF COMMINUCATION

● Functional Overview

When the communication function complies, the dual-redundant configuration (*1) can be provided by setting the serial communication modules to dual-redundant.

Each of the ALR111 and ALR121 modules has two ports; however, the dual-redundant communication requires two communication modules.

The two sets of dual-redundant communication are enabled by two ports of ALR111/ALR121; however, the communication control is defined by each communication module. When one of the communication ports detects an error, both ports switch over the control/stand-by sides to the redundant module.

Note that the one-shot write specification cannot be used when dual-redundant communication is set.

*1:   Refer to "Table Communication Functions Communication Modules."

● Data Input Flow

Each of the two ALR111/ALR121 modules communicates with the subsystem and reads the subsystem input image data into the module. An FCS accesses the control communication module to read and use these data; however, it does not access the standby communication module. When the FCS detects a control communication module error or subsystem communication failure, the FCS switches its control to the standby module from which to read data.

● Data Output Flow

A control communication module outputs data to a subsystem. The control communication module writes data to the subsystem at the specified intervals when an FCS sets the data in it.

Meanwhile, the standby communication module re-reads and retains the output image data when it accesses the subsystem at the specified interval. This equalizes the data between the control and standby communication modules.

When an error is detected, the FCS switches its control to the stand-by module through which the FCS continues to output data to the subsystem.
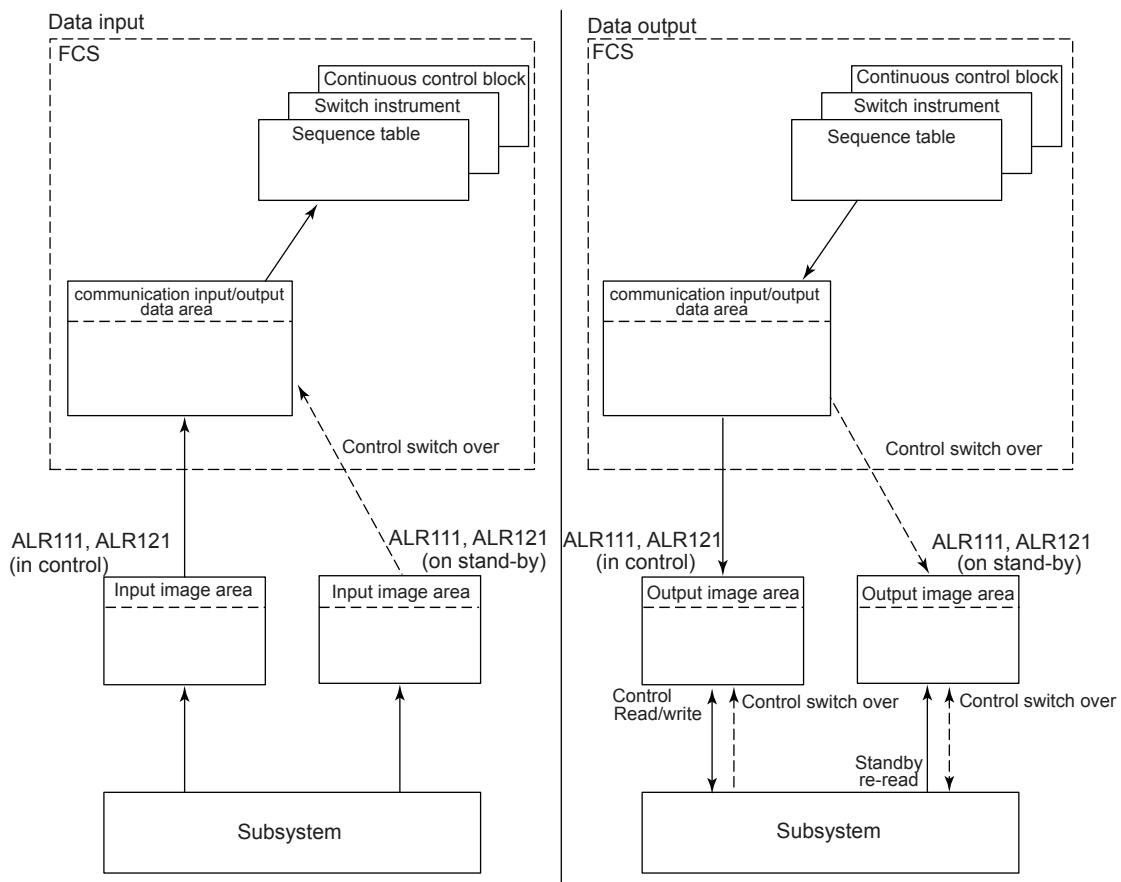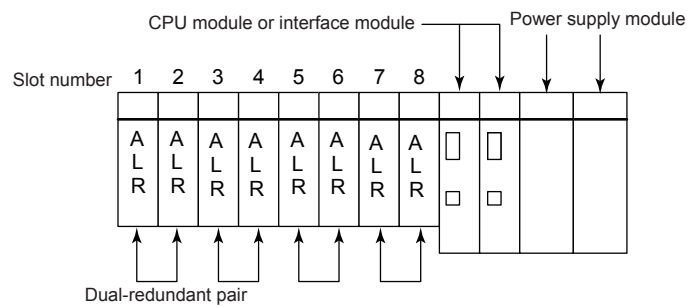

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Figure Data Flow in Dual-redundant Configuration

● **Hardware configuration**

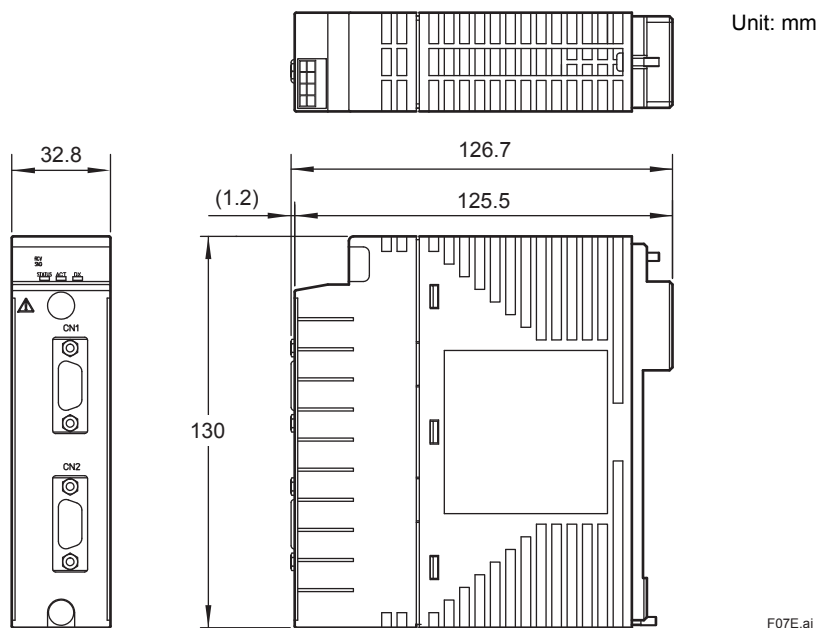Set two of the identical modules in adjacent (even and odd-numbered) slots on the same node unit.

Figure Hardware Configuration for Dual-redundant

■ EXTERNAL DIMENSIONS
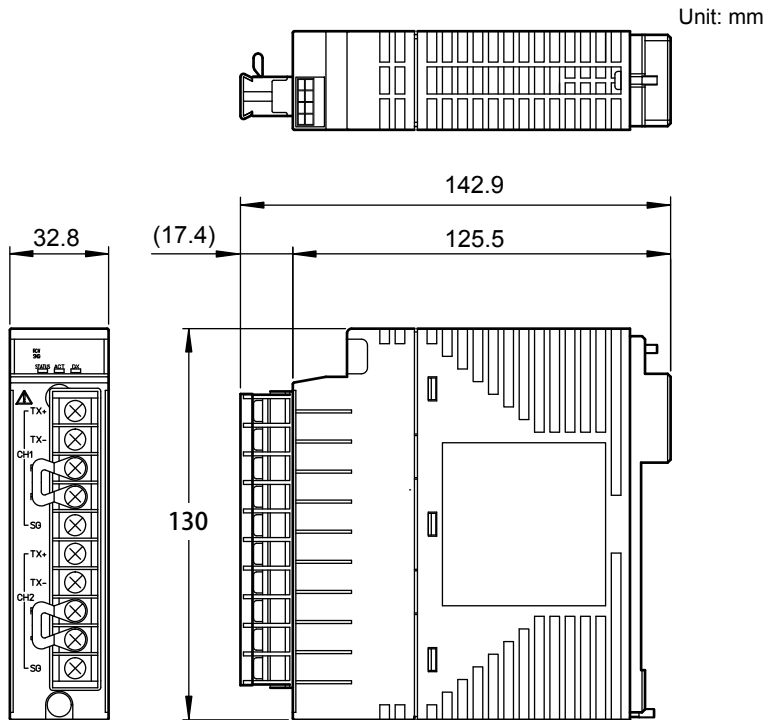
● **ALR111 Serial Communication Module (RS-232C)**

Nominal Tolerances :
When the reference dimension is over 0.5 mm and equal or less than 120 mm, its nominal tolerance is ± 0.8 mm, while its combination of nominal tolerance is ± 1.5 mm.
When the reference dimension is over 120 mm, its nominal tolerance is in accordance with JEM 1459.

● **ALR121 Serial Communication Module (RS-422/RS485)**

Unit: mm

142.9

32.8   (17.4)   125.5

130

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Nominal Tolerances :
   When the reference dimension is over 0.5 mm and equal or less than 120 mm, its nominal tolerance is ± 0.8 mm, while its combination of nominal tolerance is ± 1.5 mm.
   When the reference dimension is over 120 mm, its nominal tolerance is in accordance with JEM 1459.

■ MODEL AND SUFFIX CODES

		Description
Model	ALR111	Serial Communication Module (RS-232C, 2-port for N-IO/FIO)
Suffix Codes	-S	Standard type
	5	With no explosion protection
	E	With explosion protection
	0	Basic type
	1	With ISA Standard G3 option

		Description
Model	ALR121	Serial Communication Module (RS-422/RS-485, 2-port for N-IO/FIO)
Suffix Codes	-S	Standard type
	5	With no explosion protection
	E	With explosion protection
	0	Basic type
	1	With ISA Standard G3 option
	3	With ISA Standard G3 option and temperature (-20 to 70 °C) option

■ APPLICABLE STANDARDS

Refer to the GS "Integrated Production Control System CENTUM VP System Overview" (GS 33J01A10-01EN).

■ ORDERING INFORMATION

Specify models and suffix codes when ordering.
For selecting the right products for explosion protection, please refer to TI 33Q01J30-01E without fail.

■ TRADEMARKS

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