

■ HARDWARE SPECIFICATIONS

Hardware specifications of ALR111 and ALR121 serial communication modules are as shown below. These modules are interference-free modules that have no interference with the safety loop.

Table Serial Communication Module Hardware Specifications

Item	Specifications	
Model	ALR111	ALR121
Interface	RS-232C	RS-422/RS-485 (4-wire system)
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	
Transmission code	binary	
Character length	8 bits (Fixed to 8 bit on the Modbus slave communication function and the subsystem communication function)	
Stop bit length	1/2 bits (Fixed to 1 bit on the subsystem communication function)	
Parity check	None/even/odd	
Lag time after data transmission	1 ms	
Transmission distance	Maximum 15 m	Maximum 1200 m (total extended length)
Installation method	Mounted on SSC60□, SSC50□, SSC57□, SSC10□, or SNB10D (*1)	
I/O wiring	AKB131, AKB132, AKB135, AKB136 cables, etc.	Cable with 3-pair shield, AKB161, or AKB162
Wiring connection	D-sub-9-pin (female × 2 ports)	Clamped with terminal block's M4 screws (5 poles × 2 ports)
Communication function (*2)	Modbus slave communication function, subsystem communication function	
Current consumption	0.5 A	0.5 A
Weight	Approx. 0.3 kg	Approx. 0.34 kg

*1: SNB10D connects with SSC60□, SSC50□, SSC57□, or SSC10□ by ESB bus.

*2: A unit of SCS is capable of handling multiple communication functions: however, different types of communication functions cannot be simultaneously performed on a serial communication module. It means that two ports must have identical communication functions.

■ OPERATING ENVIRONMENT

● Hardware Requirements

The serial communication module runs on the following SCS.

SSC60S, SSC60D, SSC50S, SSC50D, SSC57S, SSC57D, SSC10S, SSC10D

● Software Requirements

The serial communication module runs on the control functions on the following SCS.

CFS1300 Safety Control Functions Package (for SSC60□ and Vnet/IP): for SSC60□

CFS1100 Safety Control Functions Package: for SSC50□/SSC10□

CFS1170 Safety Control Functions Package: (for SSC57□ and Vnet/IP-Upstream): for SSC57□

● Engineering Requirements

Engineering work can be performed with CHS5100 Safety System Generation and Maintenance Function Package.

■ INSTALLATION ENVIRONMENT

CFS1300 Safety Control Functions Package (for SSC60□ and Vnet/IP)

No. of communication modules to be mounted (*1)	Max. 2 units/SCS (*2) (for Modbus slave communication function)
	Max. 4 units/SCS (*3) (for subsystem communication function)

- *1: Since Modbus slave communication function and Subsystem communication function modules can be mounted on the same SCS, the maximum number of communication modules is 6 units/SCS.
 *2: This is the sum of ALR111, ALR121, and ALE111.
 *3: This is the sum of ALR111 and ALR121.

CFS1100 Safety Control Functions Package

No. of communication modules to be mounted (*1)	Max. 2 units/SCS (*2) (for Modbus slave communication function)
	Max. 4 units/SCS (*3) (for subsystem communication function)

- *1: Since Modbus slave communication function and Subsystem communication function modules can be mounted on the same SCS, the maximum number of communication modules is 6 units/SCS.
 *2: This is the sum of ALR111, ALR121, and ALE111.
 *3: This is the sum of ALR111 and ALR121.

CFS1170 Safety Control Function Package (for SSC57□ and Vnet/IP-Upstream)

No. of communication modules to be mounted (*1)	Max. 2 units/SCS (*2) (for Modbus slave communication function)
	Max. 4 units/SCS (*3) (for subsystem communication function)

- *1: Modbus slave communication function and Subsystem communication function modules can be mounted on the same SCS, and the maximum number of communication modules is 6 units/SCS.
 *2: This is the sum of ALR111, ALR121, and ALE111.
 *3: This is the sum of ALR111 and ALR121.

■ MODBUS SLAVE COMMUNICATION FUNCTION

Modbus slave communication function enables ProSafe-RS a Modbus communication where an SCS acts as a Modbus slave and communicates with a Modbus master which is a different system from ProSafe-RS.

● Relationship between SCS and Modbus Master

Communication module's definition information, Modbus device addresses, mapping definition of SCS data, and so on are to be downloaded using engineering function of a Safety Engineering Station (SENG).

When a data is sent from an external Modbus master (external device), the SCS's CPU receives it through its serial communication module. The SCS's CPU sends a response message using the Modbus slave communication function to the Modbus master in response to the data request. The SCS Maintenance Support Tool displays error information and notifies the error status using the SCS status display function when an error in the serial communication module and communication content occurs.

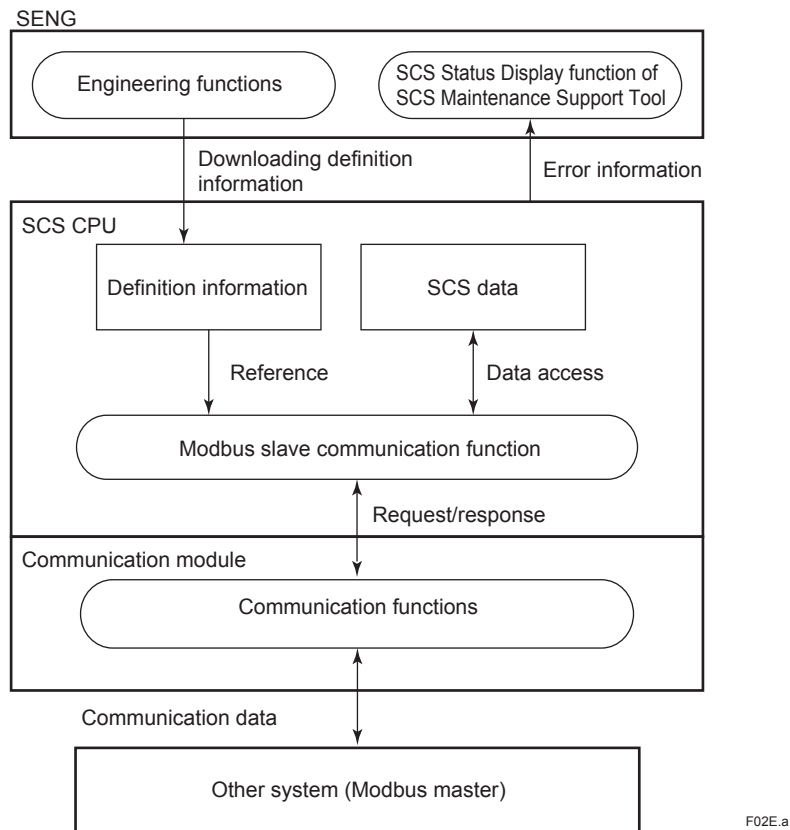


Figure Flow of data in other system

● Specification of Communication Function

Connecting method: Connect a communication port of ALR111 or ALR121 with a serial transmission interface module
 Transmission protocol: Modbus protocol (RTU mode)

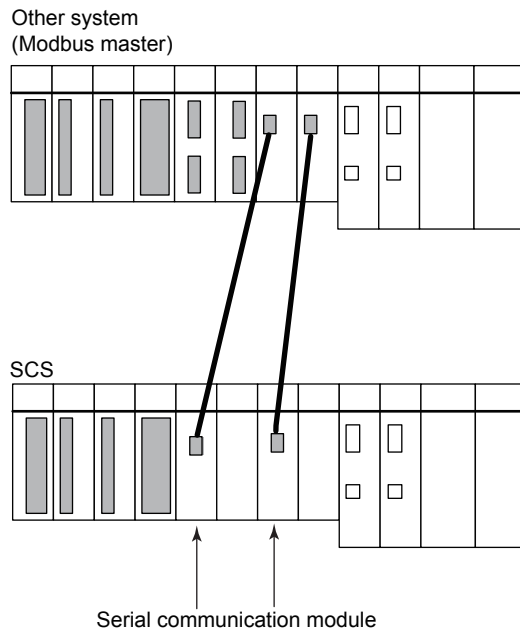
Table List of Applicable Devices

Device type	Device name	Communication capacity (per communication)	Read	Write
Bit device	Coil	32 words	Y	Y
	Input relay		Y	N
Word device	Input register	124 words	Y	N
	Maintenance register		Y	Y

Y: Applicable N: Not applicable

● Dual-redundant Communication

The dual-redundant configuration of the network can be available by establishing an independent transmission path from the Modbus master for every two the serial communication modules mounted in the SCS. However, control/stand-by switching function in between the dual-redundant serial communication modules mounted on adjacent slots is not supported.



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**Figure: Dual-redundant configuration of the serial communication modules
(for dual-redundant network configuration)**

■ SUBSYSTEM COMMUNICATION FUNCTION

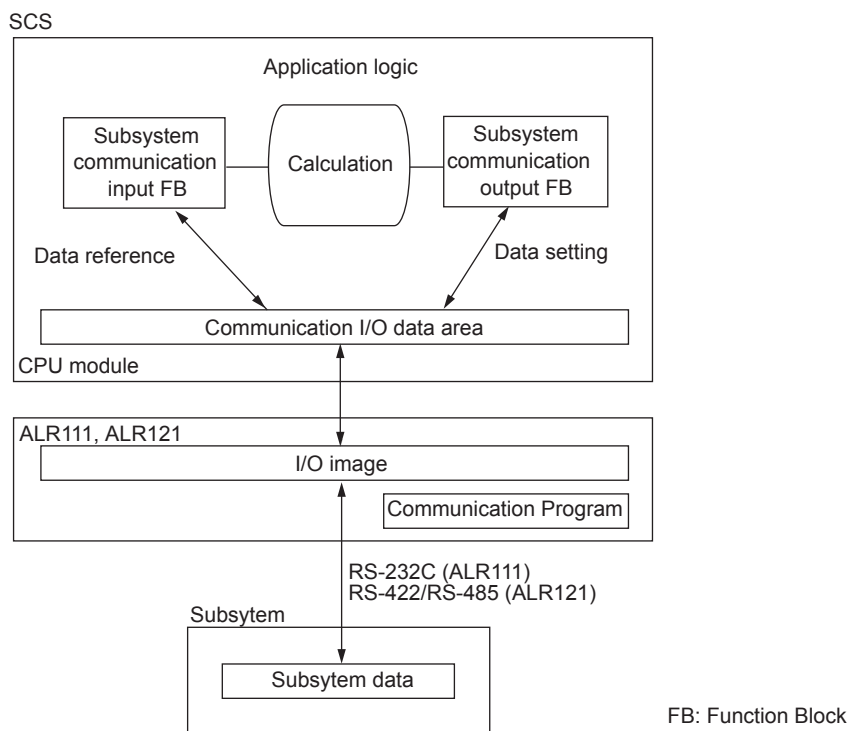
Modbus communication is adopted as the subsystem communication function for ProSafe-RS that allows an SCS to act as a Modbus master to communicate with the subsystem as a Modbus slave.

ALR121 supports ProSafe-SLS communication function which is to extend the Modbus communication function. (*1) (*2)

- *1: ProSafe-SLS communication function is applicable for the single configuration only. It is not applicable for the dual-redundant configuration.
- *2: ProSafe-RS R3.02.20 or later is applicable for SSC60□, SSC50□, and SSC57□.

● Relationship between SCS and a Subsystem

The serial communication module communicates with subsystems at the specified intervals and stores the subsystem data in the communication modules' I/O image. The subsystem communication function of SCS accesses the communication module asynchronously from them, and refers to or sets the I/O image. The application logic of SCS reads data from the communication I/O data area when the communication input FB is executed, and writes the calculation data to the communication I/O data area when the communication output FB is executed.



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Figure: Flow of Data in a subsystem

● Specification of Communication Function

Connected device: Serial transmission interface
 Connection method: Connect a communication port of ALR111 or ALR121 with a serial transmission interface of subsystem
 Transmission protocol: Modbus protocol (RTU mode)
 No. of subsystem stations: Max. 30 stations/port
 No. of communication definition: 128 definitions/ALR111, 128 definitions/ALR121
 No. of communication data item: 500 data/SCS
 Communication I/O data capacity: Max 1000 words/SCS

Table List of Applicable Devices

Device type	Device name	Communication capacity (per communication)	Read	Write
Bit device	Coil	125 words	Y	Y
	Input relay		Y	N
Word device	Input register	125 words	Y	N
	Maintenance register		Y	Y
Other device	SLS event (*1) (*2)	24 words fixed	Y	N

Y: Applicable N: Not applicable

*1: ProSafe-SLS communication function for ALR121 only

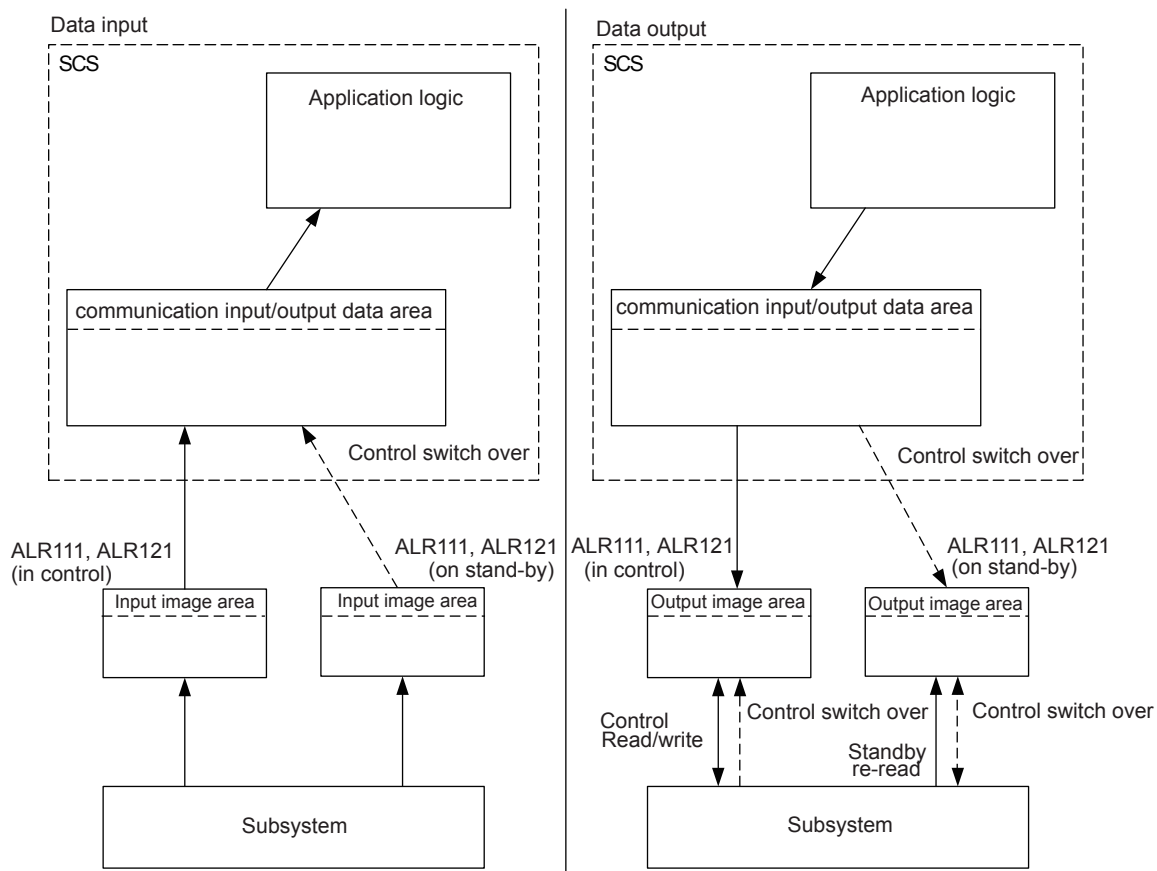
*2: SLS event device uses two communication definitions per allocation.

● Dual-redundant Communication

The dual-redundant configuration can be provided by setting the serial communication modules on an adjacent slot. 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.

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

A control communication module outputs data to a subsystem. The control communication module writes data to the subsystem at the specified intervals when an SCS sets the data in it. Meanwhile, the stand-by 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 stand-by communication modules. When an error is detected, the SCS switches its control to the stand-by module through which the SCS continues to output data to the subsystem.



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Figure Data Flow in Dual-redundant Configuration