General Specifications

FCN/FCJ Autonomous Controller Functions (FCN-100/FCJ)

GS 34P02Q01-01E

STARDOM™
FCN
FCJ

■ GENERAL

This document describes the system configurations, development/maintenance, software configurations, network and specifications, for two types of autonomous controllers in the STARDOM: FCN with NFCP100 CPU module and FCJ. (FCN is an acronym for field control node, and FCJ for field control junction.)

Notation in this document:
- The term "FCN" refers to the module consisting type autonomous controllers.
- The term "FCN-500" refers to the autonomous controllers with NFCP501/NFCP502 CPU module.
- The term "FCN-100" refers to the autonomous controllers with NFCP100 CPU module.
- The term "FCN-RTU" refers to the low power autonomous controllers with NFCP050 CPU module.
- The term "FCJ" refers to the all-in-one type autonomous controllers.

● FCN-100

FCN-100 is a controller module consisting of CPU, I/O, and other modules as necessary. It supports a variety of I/O modules, provides a highly reliable system with duplexed power supply, CPU and control network options as well as superb scalability.

For hardware details, refer to FCN Autonomous Controller Hardware (FCN-100), GS 34P02Q12-01E.

● FCJ

FCJ is an all-in-one controller with a built-in I/O interface — ideal for installing inside machine equipment as well as configuring a distributed system. Its control network can be duplexed.

For hardware details, refer to FCJ Autonomous Controller Hardware, GS 34P02Q11-01E.

■ FEATURES

● High Performance

- Applicable to a variety of processes, from sequence control processes to analog control processes.
- Intercommunication with other autonomous controllers or other equipment for inter-linked control actions, in addition to stand-alone operation.
- Using Versatile Data Server Software (VDS) or Supervisory Systems (FAST/TOOLS) together allows a system with enriched operation and monitoring functions to be built up.
- An FCN/FCJ OPC server for Windows can be used for accessing the data of an FCN/FCJ from an OPC (OLE for Process Control) client on a PC.
- Java-enabled — enables users to implement various applications, including displaying images on a Web browser, saving data files, transferring files using the FTP protocol, sending/receiving e-mails and public network connection using the PPP protocol.
  With InfoWell, applications such as web browsers and e-mail communications can be utilized without programming.

● High Reliability

- RAS features (CPU self-diagnostics, temperature monitoring, I/O diagnostics, and more)
- Memory with error-correcting code (ECC)
- Low heat dissipation, eliminating the need for a cooling fan
- The Ethernet control network, CPU, power supply module, and SB bus (FCN local bus) can all be duplexed for an FCN-100.
- The control network can be duplexed for an FCJ.

● Engineering Efficiency

- Five IEC 61131-3 compliant programming languages are supported, enabling the user to selectively use these languages according to their purposes of use and applications.
- Control logic can be encapsulated into software parts for reuse, allowing efficient and quality system configuration.
- Application Portfolios packed with Yokogawa's application expertise, enable easy implementation of advanced functions, including control-loop instrument blocks and communication with non-Yokogawa PLCs.

● Easy Maintenance

- Online download function allows a control application to be modified during system operation
- All modules are hot-swappable with an FCN-100.

■ CONFIGURATIONS

● System Configurations

Both FCN and FCJ are locally mounted controllers to allow diverse systems to be configured according to the individual users' work sites; however, the possible system configurations can be broadly divided into three types:

• A system consisting of a standalone FCN or FCJ
• A system in which FCNs and/or FCJs are connected to each other through the control network and perform interlinked actions (up to a total of 15 FCNs and FCJs can intercommunicate with one FCN/FCJ).
• A system in which one or more FCNs and/or FCJs are interlinked with VDS, FCN/FCJ OPC Server or FAST/TOOLS (up to a total of 4 VDSs, FCN/FCJ OPC Servers and FAST/TOOLS can be connected).

Using a communication portfolio within an Application Portfolio allows an FCN/FCJ to communicate with other kinds of controllers and devices.
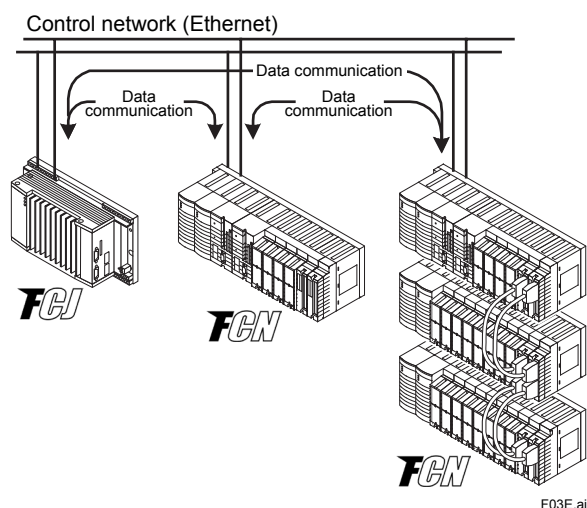

Figure An Example of System Configuration in Which FCNs and an FCJ are Interlinked

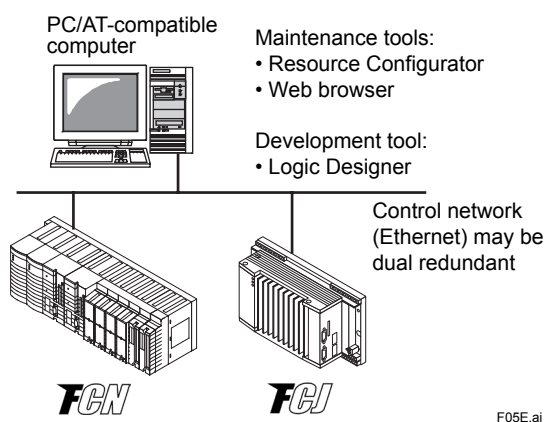## ● Development and Maintenance of FCN/FCJ

Figure Development and Maintenance of FCN/FCJ

A PC/AT-compatible computer is used for development and maintenance of applications for an FCN and FCJ.

Resource Configurator is a tool program to be installed in the computer used for maintenance, and is used to make the FCN/FCJ hardware settings.

The user can access FCN and FCJs via a Web browser from a PC to make detailed settings for the network and so on, and to perform maintenance operations such as database backup and restoration.

Logic Designer is a tool program for the development of control applications for an FCN/FCJ. Logic Designer requires a license to run.

These tool programs are supplied on a DVD-ROM.

■ SPECIFICATIONS

● CPU Function Specifications

Execution Speed:
　　Approx. 50 μs per kilosteps in an IL program
Number of Control Applications: Max. 16 tasks
Task Priority: Can be specified (in 16 levels)
Task Execution Cycle:
　　10 ms or longer (by 10 msec. increments)

● CPU Memory Capacity

Control Application Capacity:
　　Max. 3 MB (approx. 400 kilosteps in an IL program)
Data Area (*1): Max. 8 MB
Retained Data Area (*2): Max. 410 KB (*3)
Java Application Capacity: Max. 32 MB

*1:　The data is not retained when the power is off.
*2:　The data is retained even if the power is off. The data is retained during a power failure (can be used to store tuning parameter settings for the control application).
*3:　Retained Data Area for control application is Max 350 KByte.

● System Card Specifications for FCN/FCJ

System Card for FCN/FCJ	128 MByte type	512 MByte type (*1)
System program size	32 Mbyte	
User application size (*2)	96 MByte	480 MByte

*1:　Use of a 512-MB system card is recommended in order to implement a Java application such as InfoWell for saving data in the FCN/FCJ system card.
*2:　User application size is the total file size of control application, Java application, and data. The file size of control applications is up to 10 Mbyte.

● **Network (Ethernet) Specifications**

Application

Ethernet is used as the control network, which can be dual redundant, connecting FCNs/FCJs with various PLCs, display units and VDS. FCNs/FCJs are developed and maintained via Ethernet as well.

Communication Specifications

Connection Destination	Maximum Connections	Remarks
VDS	4	Total of VDSs, FCN/FCJ OPC Servers and FAST/TOOLS
FCN/FCJ OPC Server		
FAST/TOOLS		
FCN/FCJ	15	Number of FCNs/FCJs as connection destinations (*1)
PLC	32	Number of various PLCs such as FA-M3s or MELSECs (*1)

*1: Number when assigning the destinations one channel each
Note: Compliant with IEEE802.3
Note: For system network configuration and network load, refer to TI 34P02K25-01E "STARDOM Network Configuration Guide."

● **Network (Serial) Specifications**

Serial ports can be used to link diverse devices and controllers. Communication portfolios facilitating interconnection with display units, various programmable logic controllers, temperature controllers, and power monitors are available via a serial port.

Specifications
• FCJ: two ports (RS-232-C)
• FCN-100:CPU module: one port (RS-232-C) (*1)
          serial communication module:
                two ports per module
                (RS-232-C or RS-422/RS-485) (*2)
*1: The port cannot be used when CPU modules are configured in redundancy.
*2: Up to eight serial communication modules can be installed.

● **Guideline of Control Application Capacity**

As a guideline, the capacity of the control application is a total of the following.

(1) Function blocks (POUs)
     Up to 512
     • Regulator control blocks (e.g., indicator blocks, controller blocks, and manual loaders):
          Up to 128
     • Others (e.g., calculation blocks, switch instrument blocks, and communication POUs):
          Up to 384
(2) Sequence program
     Up to 180 kilosteps in Ladder or up to 128 sequence tables each of which has 32 condition and 32 action rows.

Example of a control application with the maximum size:
• Inputs/outputs: 96 AIs, 32 AOs, 256 DIs, and 256 DOs
• PID loops: 32
• Sequence program: 128 sequence tables
• Control cycle: 1 second

● **Specification of FCN-100 with Duplexed CPU Modules**

• After a failure of the CPU in service, the stand-by CPU obtains the control right instantaneously and resumes control without any influence of the CPU switchover.
• When additionally installing a CPU module to an FCN with a single CPU module to configure duplexed CPU modules, such as when replacing a failed CPU module, carry out the All-program-copy (APC) command for equalization between the CPU modules. It is also possible to run the APC command automatically after CPU replacement. When the APC command is running, the control period lengthens by a second or two only during its first cycle. (*1)
• Synchronization is periodically performed between the in-service CPU and stand-by CPU. The total processing time is hence longer than that of an FCN-100 with single CPU.
• If the control application comprises multiple tasks, those tasks cannot access the same global variable.
• The CPU module's serial port cannot be used.
• Java applications cannot be run.
     *1: If one of the two CPUs in dual-redundant configuration is not style-3 NFCP100 CPUs, the APC command cannot be started automatically. In this case, control stops when the APC command is running and the I/O modules operate in the same way as they do when the Fallback option (can be set to 'hold the output' or 'output specified values,' for example) is selected.

● **Online Download Function**

• Online download function is a feature with which control applications can be modified while a control function continues in operation.
• With this feature, I/Os, variables, data types, program codes, and libraries can be added, deleted or modified.
• Modifying the control loop during system operation does not affect other control loops. Changing a range of control loop or loop connection causes the control loop to become the MAN mode.

● **Implementation of Java Virtual Machine**

• WWW server functionality:
  download HTML files and Java applets to Web browsers and access data in FCN-100s and FCJs
• E-mail transmission/reception:
  send and receive e-mail using SMTP and POP3 protocols, respectively
  support the authentication function of SMTP servers (SMTP Authentication/Pop Before SMTP)
• FTP client/server functionality:
  transfer files to/from other networking systems
• PPP (Point to Point Protocol) functionality:
  exchange data with a PC or a cellular phone via the public network such as GPRS by connecting a modem to a serial port of FCN/FCJ
  support the client mode and the server mode
  unsupport FCN-100's serial port on one of duplexed CPU modules

● **Time Synchronization Function**

FCNs/FCJs enable time synchronization among equipment supporting SNTP (Simple Network Time Protocol). An FCN/FCJ can operate as an SNTP server or as an SNTP client.

Item	Function	
	Server Function	Client Function
Communica tion Protocol	SNTP (Simple Network Time Protocol) (*1) UDP port: 123	
License	Required (*2)	Not required
Unicast Mode (*3)	X	X
Broadcast Mode (*4)	–	X
Number of Connections	Recommended: 32 connections or less (*5)	4 servers
Accuracy of Time	Depend on the accuracy of the FCN/FCJ's internal timer (*6)	±500 ms (*8)
Time Compensation Method	–	Acquisition of time from a server at intervals of 100 seconds (Unicast Mode) (*7)
Others	• Redundant networks can also be supported. • Redundant CPUs can also be supported.	

*1:   The server function and the client function can be executed simultaneously.
*2:   A Time Synchronization Server Portfolio License is required. Refer to Application Portfolios for FCN/ FCJ (GS 34P02P20-01E) for details.
*3:   An SNTP client periodically interrogates an SNTP server for the time.
*4:   An SNTP server periodically notifies an SNTP client of the time.
*5:   There is no limit to the number of clients to be connected. However, loads on FCNs/FCJs should be taken into account when clients are connected.
*6:   An SNTP client is notified of the time, which may have an error of -17.5 to +12 seconds/day in the FCN/FCJ's internal timer. The time of linked equipment is synchronized. Highly accurate time cannot be provided.
*7:   The following adjustments are to be performed depending on time differences. (The time differences below are default values. Time differences are configurable.)
500 ms or less: No adjustment
Less than 5 seconds:
        Smooth adjustments (The time is adjusted smoothly so that it does not skip.)
5 seconds or more: Immediate setting (The specified time is set immediately.)
*8:   The accuracy of time varies depending on how the time compensation method is configured.

● **Connection to Display Unit**

FCNs and FCJs can connect a display unit using FA-M3 Emulation Function or Modbus Communication Portfolio.

Display Unit Connection Using FA-M3 Emulation Function

Item	Description
Connectable units	Any display units that can be connected to FA-M3 controllers
Connection port	FCN-100: Serial port on CPU module (*1) FCJ: Serial port
Available devices	Internal relays (I00001 - I32767) Data registers (D00001 - D32767) File registers (B00001 - B32767)

*1:   No serial communication module (NFLR111 or NFLR121) can be used for this purpose. A serial port on one of duplexed CPU modules cannot be used, either.

Display Unit Connection Using Modbus Communication Portfolio

Item	Description
Connectable units	Any display units that support Modbus communication
Serial Connection port	FCN-100: Serial port on CPU module or port on NFLR111 or NFLR121 serial communication module (*1) FCJ: Serial port
Ethernet Connection port	FCN-100: Ethernet port on CPU module FCJ: Ethernet port
Available devices (*2)	Coils (00001 - 09999) Input relays (10001 - 19999) Input registers (30001 - 39999) Storage registers (40001 - 49999)

*1:   When using an NFLR111 or NFLR121 serial communication module for connection, the CPU module can be duplexed.
*2:   The ranges of available devices depend on the display unit model used.
Note: Modbus Communication Portfolio is required to perform Modbus communication in addition to the port.

■ SOFTWARE

FCN-100 and FCJ can simultaneously run IEC 61131-3-compliant control applications and Java applications.
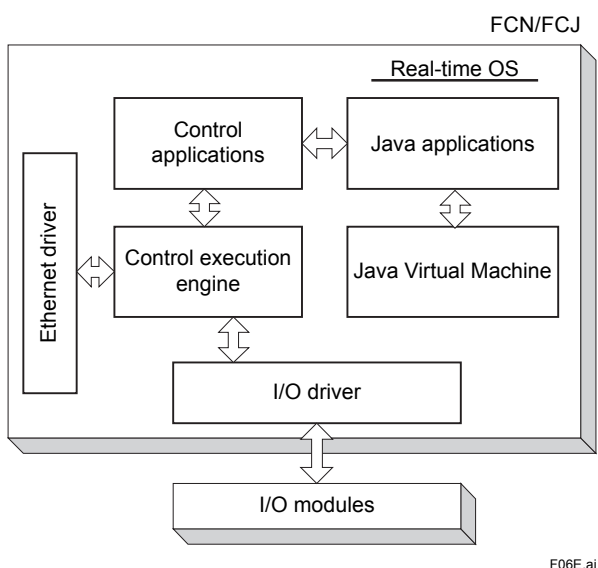
FCN/FCJ

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Figure Conceptual Diagram of FCN/FCJ Software Configuration

● Licenses

The following licenses are required to run an FCN-100 and FCJ.

FCN/FCJ Basic Software License

Available in two editions: License for single-CPU FCN-100 and FCJ, and license for duplexed-CPU FCN-100.

To use the FCN/FCJ Java functions, enable Java in the FCN/FCJ application software. (See *1 below)

*1:   For dual-redundant CPUs, FCN/FCJ Java functions cannot be used.

FCN/FCJ Application Portfolio License

To use application portfolios for FCNs/FCJs, respective portfolio licenses are required.

For details, see Application Portfolios for FCN/FCJ, GS 34P02P20-01E.

● Logic Designer

Logic Designer is a tool program that runs on a computer and is used for developing control applications as tasks for an FCN/FCJ.

For details, see Logic Designer, GS 34P02Q01-01E.

● FCN/FCJ Simulator

The simulator is designed to run control applications, which are created using the Logic Designer, on a general-purpose PC. This simulator enables users to debug control applications without using an FCN/FCJ.

For details, see Logic Designer, GS 34P02Q75-01E.

● Resource Configurator

Resource Configurator is a tool program that runs on a computer and is used for making basic settings in an FCN/FCJ, including:

• IP address settings
• I/O module settings
• License settings
• Initial communication settings

Note: Resource Configurator is included in the supplied media (DVD-ROM) containing the FCN/FCJ software, and does not require a license to run.

● Application Portfolios

An Application Portfolio is a bundle of useful software parts for FCN/FCJ, such as those for advanced control. Application Portfolios are offered as:

For control logic:
PAS Portfolio
SAMA Portfolio
For communication:
FA-M3 Communication Portfolio
MELSEC Communication Portfolio
SYSMAC Communication Portfolio
Modbus Communication Portfolio
DNP3 Communication Portfolio
Temperature Controller Communication Portfolio
and many more multifunctional portfolios. For details, see Application Portfolios, GS 34P02P20-01E.

● FCN/FCJ Java Application Development Kit

The FCN/FCJ Java Application Development Kit is software for developing Java software applications which run on the FCN-100 or FCJ. For more details, refer to FCN/FCJ Java Application Development Kit, GS 34P02Q76-01E.

● InfoWell

InfoWell is designed to transfer control application data from FCN/FCJ via web screens or e-mail. This package does not require programming and enables data transfer via web screens or e-mail by simple settings.

For details, see InfoWell, GS 34P02P51-01E.

● FCN/FCJ IT Security Tool

This IT Security Tool sets IT security compliant with other Yokogawa system products security policy.

FCN/FCJ engineering tools support IT security.

Note: The IT Security is not available either for Domain Management or for Combination Management in CENTUM VP.

● Counter Measure against Wide Area Network connection

It is necessary to install VPN and/or firewall as a counter measure against network risk from Wide Area Network connection. For details, refer to STARDOM Network Configuration Guide, TI 34P02K25-01E.

■ STYLES OF SOFTWARE SUPPLY

● FCN/FCJ Basic Software License

- The Logic Designer License comes with an order ID sheet with the order ID number and password. Access the specified Web site of Yokogawa and enter the order ID number and password shown. Then, a file containing the respective license IDs for the supplied software titles will be given.
- FCN/FCJ system card(s): Each basic software license comes with a system card for a single-CPU FCN-100 and FCJ, or two for a duplexed-CPU FCN-100. Install this card in an FCJ or in each CPU card for an FCN-100 for use.

● Software Media

Programs and user's manuals, listed below, for an FCN/FCJ are supplied as a DVD-ROM.

- User's manuals for FCN/FCJ autonomous controllers (electronic documents)
- Logic Designer (*1)
- Resource Configurator
- PAS Portfolio (*1)
- FCN/FCJ Simulator (*1)
- FCN/FCJ OPC Server for Windows (*1)
- Duplexed Network Program for FCN/FCJ OPC Server (*1)
- FCN/FCJ Java Application Development Kit (*1)
- FCN/FCJ IT Security Tool

    *1:   Needs a license for use.

■ MODELS AND SUFFIX CODES

● Software Medium

		Description
Model	NT203AJ	FCN/FCJ software media
Suffix Codes	-P	Programs (including electronic documents)
	C	DVD-ROM
	1	Always 1
	1	Always 1
	E	English version

● FCN/FCJ Basic Software License (for single CPU)

		Description
Model	NT711AJ	FCN/FCJ basic software license for single CPU
Suffix Codes	-L	License
	S05	Without Java function (System card for FCN/FCJ: 128 MB)
	M05	With Java function (System card for FCN/FCJ: 128 MB)
	M04	With Java function (System card for FCN/FCJ: 512 MB)
	E	English version

● FCN Basic Software License (for duplexed CPU)

		Description
Model	NT712AJ	FCN basic software license for duplexed CPU
Suffix Codes	-L	License
	M05	2 system cards for FCN: 128 MB
	E	English version

● Additional FCN/FCJ Java Function License

		Description
Model	NT719AJ	Additional FCN/FCJ Java Function License
Suffix Codes	-L	License
	W	Issued at Web
	1	Always 1
	1	Always 1
	A	Standard

Note: They are applicable only to NT711AJ-LS□□E (Without Java function) .
However, in NT712AJ (for duplex configuration) Java Function is unavailable.

● **System Card for FCN/FCJ Spare Parts**

		Description
Model	NT225AA	System Card for FCN/FCJ Spare Parts
Suffix Codes (*1)	-04	Memory of the System Card: 512 MB
	-05	Memory of the System Card: 128 MB

*1: Please use a couple of FCN/FCJ system cards of the same suffix code to make the CPU module dual-redundant.

■ ORDERING INFORMATION
Specify the model and suffix codes.

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