General Specifications

FCN Autonomous Controller Functions (FCN-500)

STARDOM™
FCN

GS 34P02Q03-01E

■ GENERAL

This document describes the system configurations, development/maintenance, software configurations, and network specifications for the FCN autonomous controllers with NFCP501/NFCP502 CPU module in the STARDOM. (FCN is an acronym for field control node.)

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-500

FCN-500 is a controller consisting of CPU, I/O, and other modules as necessary. It supports a variety of I/O modules with excellent scalability. And, highly reliable system can be configured with duplex power supply modules, CPUs, control network system.

For hardware details, refer to FCN Autonomous Controller Hardware (FCN-500), GS 34P02Q14-01E.

■ 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 SCADA Software (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.
- Duolet application is Java language application and enables users to implement the following functions on FCN-500; 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.

● 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 E2 bus/SB bus (FCN local bus) can all be duplexed for an FCN-500.

● 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 PLCs.

● Easy Maintenance

- Online download function allows a control application to be modified during system operation
- All modules are hot-swappable with an FCN-500.

![YOKOGAWA ◆]

■ CONFIGURATIONS

● System Configurations

FCN-500 is 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-500
• A system in which FCN-500s 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 FCN-500s are interlinked with VDS, FCN/FCJ OPC Server or FAST/TOOLS.
  VDS and FCN/FCJ OPC server, FAST/TOOLS can be connected up to 8 units in total. The FCN/FCJ OPC server counts as 2 units because the DA server and AE server operate. The FAST/TOOLS with duplexed network counts as 2 units.

Using a communication portfolio within an Application Portfolio allows an FCN-500 to communicate with other kinds of controllers and devices.
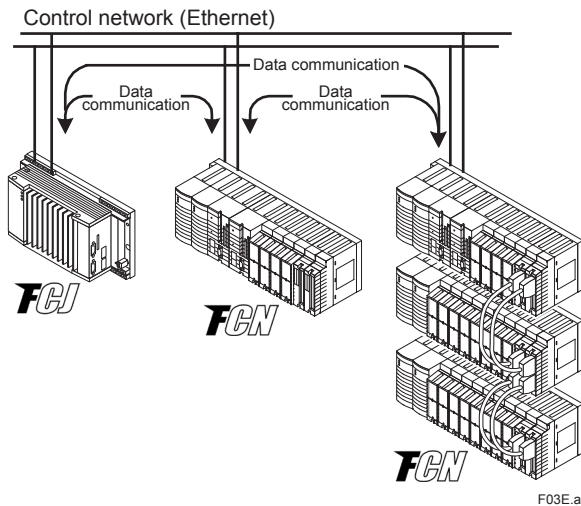

Figure An Example of System Configuration in Which FCNs and an FCJ are Interlinked

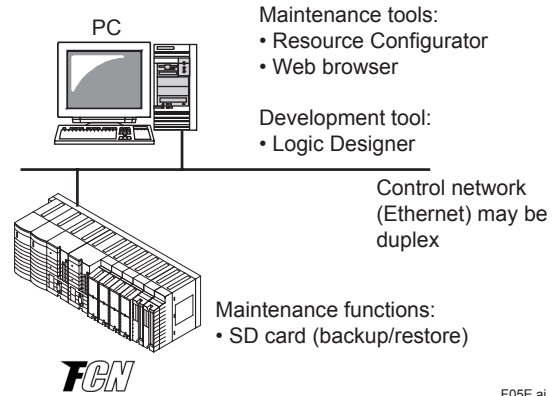## ● Development and Maintenance of FCN-500

Figure Development and Maintenance of FCN-500

A PC/AT-compatible computer is used for development and maintenance of applications for an FCN-500.

Resource Configurator is a tool program to be installed in the computer used for maintenance, and is used to make the FCN-500 hardware settings.

The user can access FCN-500s 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 (IEC 61131-3) for an FCN-500. Logic Designer requires a license to run.

These tool programs are supplied on a DVD-ROM.

Note: For development and maintenance of a control application with FCN/FCJ, use Logic Designer and Resource Configurator same as or later than the release/revision of FCN/FCJ basic software of CPU module.
For example with FCN/FCJ basic software R4.20 on NFCP501/NFCP502, use the following development environment.
Logic Designer: R4.20 or later
Resource Configurator: R4.20 or later

■ SPECIFICATIONS

● CPU Function Specifications

Execution Speed: Approx. 10 μsec per kilosteps in an IL program
Number of Control Applications: Max. 16 tasks
Task Priority: Can be specified (in 16 levels)
Task Execution Cycle: 5 msec or longer (by 5 msec. increments) (*1)

*1: When using the I / O module, task execution cycle is recommended more than 20 msec.

● 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. 700 KB
Duolet 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).

● SD Card Specifications

Usage
Data are stored and restored on SD card. User access is restricted with user authentication.

Specification
Support SDHC (4 to 32 GB) Class 10.

● Network (Ethernet) Specifications

Application
Ethernet is used as the control network, which can be duplexed (*1), connecting FCNs with various PLCs, display units, VDS, and FAST/TOOLS. FCNs are developed and maintained via Ethernet as well.

*1: NFCP502 CPU module is equipped with four Ethernet ports. NFCP502 can configure the duplex network and various PLC network at the same time. The duplex network is available only with the Ethernet port 1 and 2.

Communication Specifications

Connection Destination	Maximum Connections	Remarks
VDS	8	Total of VDSs (*2), FCN/FCJ OPC Servers (*3) and FAST/TOOLS (*4)
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
*2: VDS counts as one unit for both single network or duplex networks.
*3: The FCN/FCJ OPC server counts as 2 units because the DA server and AE server operate.
*4: The FAST/TOOLS with duplexed network counts as 2 units.

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
• 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.

Ex1: Example of a control application:

• Inputs/outputs: 96 AIs, 32 AOs, 256 DIs, and 256 DOs
• Communication Inputs/outputs: 144,000
• PID loops: 32
• Sequence program: 128 sequence tables
• Control cycle: 200 msec

Ex2: Example of a control application:

• Inputs/outputs: 288 AIs, 64 AOs, 768 DIs, and 768 DOs
• Communication Inputs/outputs: 144,000
• PID loops: 64
• Sequence program: 128 sequence tables
• Control cycle: 500 msec

● **Specification of FCN-500 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-500 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.
• 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-500 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.
• Duolet cannot be run.

● **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.

● **FCN/FCJ Duolet Function**

• WWW server functionality:
download HTML files and Java applets to Web browsers and access data in FCN-500s
• 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 NFCP501/NFCP502
support the client mode and the server mode
unsupport NFLR111 RS-232-C communication modules

● **Time Synchronization Function**

FCN-500s enable time synchronization among equipment supporting SNTP (Simple Network Time Protocol). An FCN-500 can operate as an SNTP server or as an SNTP client.

Item	Function	
	Server Function	Client Function
Communication Protocol	SNTP (Simple Network Time Protocol) (*1) UDP port: 123	
Unicast Mode (*2)	X	X
Broadcast Mode (*3)	–	X
Number of Connections	Recommended: 32 connections or less (*4)	4 servers
Accuracy of Time	Depend on the accuracy of the FCN-500's internal timer (*5)	±500 ms (*7)
Time Compensation Method	–	Acquisition of time from a server at intervals of 100 seconds (Unicast Mode) (*6)
Others	• Duplex networks can also be supported. • Duplex CPUs can also be supported.	

X: Conforming
*1:   The server function and the client function can be executed simultaneously.
*2:   An SNTP client periodically interrogates an SNTP server for the time.
*3:   An SNTP server periodically notifies an SNTP client of the time.
*4:   There is no limit to the number of clients to be connected. However, loads on FCN-500 should be taken into account when clients are connected.
*5:   An SNTP client is notified of the time, which may have an error of -17.5 to +12 seconds/day in the FCN-500's internal timer. The time of linked equipment is synchronized. Highly accurate time cannot be provided.
*6:   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.)
*7:   The accuracy of time varies depending on how the time compensation method is configured.

● Connection to Display Unit

FCN-500s 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	Serial port on CPU module (*1)
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	Serial port on CPU module or port on NFLR111 or NFLR121 serial communication module (*1)
Ethernet Connection port	Ethernet port on CPU module
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.

■ SOFTWARE

FCN-500 can simultaneously run IEC 61131-3 compliant control applications and Duolet applications.
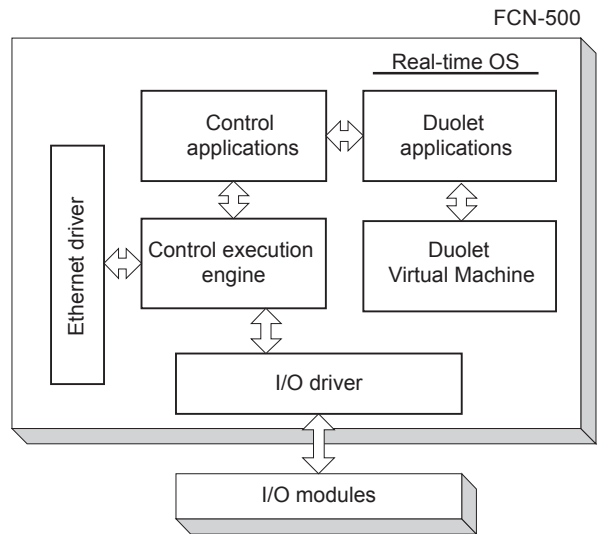

Figure Conceptual Diagram of FCN-500 Software Configuration

● **FCN/FCJ Basic Software**

FCN-500 builds in the FCN/FCJ Basic Software (single and duplexed combination, with Duolet function).

● **Application Portfolios**

An Application Portfolio is a bundle of useful software parts for FCN-500.

The combination of application portfolios can be specified as NFCP501/NFCP502 CPU module suffix code shown in the following table. Application Portfolios can not be added later on.

Software		Controller type (CPU Module)		Specification (GS No. to refer to)	Software Media (Model)
		FCN-500 Standard (NFCP501-S□□ NFCP502-S□□)	FCN-500 Extended (NFCP501-W□□ NFCP502-W□□)		
FCN/FCJ Basic Software (with Duolet function *1)		X	X	GS 34P02Q03-01E	NT203AJ
Duplexed Field Network Module		X	X	GS 34P02Q51-02E	
Application Portfolio	PAS Portfolio		X	GS 34P02P20-02E	
	Time Synchronization Server Portfolio	X	X	GS 34P02Q03-01E	
	FA-M3 Communication Portfolio	X	X	GS 34P02P20-02E	NT205AJ
	MELSEC Communication Portfolio	X	X		
	SYSMAC Communication Portfolio	X	X		
	Modbus Communication Portfolio	X	X		
	DNP3 Communication Portfolio	X	X	GS 34P02P22-02E	
	Gas Flow Calculation Portfolio		X	GS 34P02P32-01E	
	Liquid Flow Calculation Portfolio		X	GS 34P02P33-01E	

*1: Duolet function is not available in duplex CPU configurations.

● **Logic Designer**

Logic Designer is a tool program that runs on a computer and is used for developing control applications (IEC 61131-3) as tasks for an FCN-500.

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

● **FCN/FCJ Simulator**

The simulator is designed to run control applications, which are created using the Logic Designer, on a PC. This simulator enables users to debug control applications without using an FCN-500.

For details, see Logic Designer, GS 34P02Q77-01E.

● **Resource Configurator**

Resource Configurator is a tool program that runs on a computer and is used for making basic settings in an FCN-500, including:

• IP address settings
• I/O module 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.

● **FCN/FCJ Duolet Application Development Kit**

The FCN/FCJ Duolet Application Development Kit is software for developing Duolet application which run on the FCN-500.

For more details, refer to FCN/FCJ Duolet Application Development Kit, GS 34P02Q76-02E."

● **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.
   The IT Security tool can not coexist with Microsoft Office C2R. To coexist, use Microsoft Office MSI.

■ STYLES OF SOFTWARE SUPPLY

● Software Media

Programs and user's manuals, listed below, for an FCN-500 are supplied as a DVD-ROM.

FCN/FCJ Software Media (Model:NT203AJ)
- User's manuals for FCN-500 autonomous controllers (electronic documents)
- Logic Designer (*1)
- Resource Configurator
- PAS Portfolio
- FCN/FCJ Simulator (*1)
- FCN/FCJ OPC Server for Windows (*1)
- Duplexed Network Program for FCN/FCJ OPC Server (*1)
- FCN/FCJ Duolet Application Development Kit (*1)
- FCN/FCJ IT Security Tool

    *1:   Needs a license for use.

Application Portfolio Software Media (Model:NT2035J)
- FA-M3 Communication Portfolio
- MELSEC Communication Portfolio
- SYSMAC Communication Portfolio
- Modbus Communication Portfolio
- DNP3 Communication Portfolio
- Gas Flow Calculation Portfolio
- Liquid Flow Calculation Portfolio

● Engineering Software Licenses

The Logic Designer and FCN/FCJ Simulator Licenses come with an order ID sheet describing 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.

■ MODELS AND SUFFIX CODES

● Software

FCN/FCJ Software Media

		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

Application Portfolio Software Media

		Description
Model	NT205AJ	Application Portfolio software media
Suffix Codes	-P	Programs (including electronic documents)
	C	DVD-ROM
	1	Always 1
	1	Always 1
	E	English version

● Hardware

Refer to FCN Autonomous Controller Hardware (FCN-500), GS 34P02Q14-01E.

■ ORDERING INFORMATION

Specify the model and suffix codes.

■ TRADEMARKS

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