# General Specifications

GC8000
Analyzer Bus System

GC8000

**GS 11B06A02-01E**

## ■ GENERAL

*Process analyzers have been typically maintained by maintenance personnel from the front of the analyzer.*

*However, with the implementation of an analyzer bus system, maintenance can now be done entirely by monitoring and operating the analyzers from a remote location. A personal computer can be used as a terminal for controlling the analyzers, enabling the maintenance engineer to operate the gas chromatograph and field analyzers from a comprehensive computer screen interface. The analyzer bus forms an analyzer network which enables this advanced style of maintenance.*

*The analyzer bus system offers the following benefits:*

- *Comprehensive and centrally located remote maintenance of analyzers.*
- *Reduction in the cost of wiring (among field analyzer to control room).*
- *Ease of expansion that is not limited by the physical number of available DCS process inputs.*

## ■ FEATURES

- Easy Maintenance of Analyzers
  Status of multiple analyzers can be monitored on a PC connected to the network. Data are continuously stored in a server, allowing traceability of information necessary for maintenance.
  Stored data include chromatograms of detector signals as well as measured values and alarms. Even after observation of an alarm or a change in measured value, chromatograms can be checked retrospectively.
  Other functions include data storage, parameter uploading/downloading, and network monitoring, with regard to the analyzers connected.
- Reduced Wiring Costs
  The analyzer bus system eliminates the need for wiring between the individual field analyzers and the associated devices, such as a DCS or other host computers, and a PC for analyzer maintenance. Ethernet allows hubs and other general networking equipment to be used.
- Network Scalability
  Ethernet facilitates connection to your network, thereby enabling remote monitoring. (To ensure the safety of your network, firewalls or other network security measures should be taken as appropriate.)
- High-Speed Network
  Fast Ethernet supports data transfer rates of 100 Mbps, providing real-time monitoring of not only measured values and alarm information but also chromatograms.
- Optical Communication
  The analyzer is available with either shielded twisted pair wire or optical fiber. The optical fiber can be advantageously used in long distance networks and electrically noisy environments.
- Redundant System for Increased Reliability
  A redundant system is available for connection of analyzers with host computers such as a server and DCS.

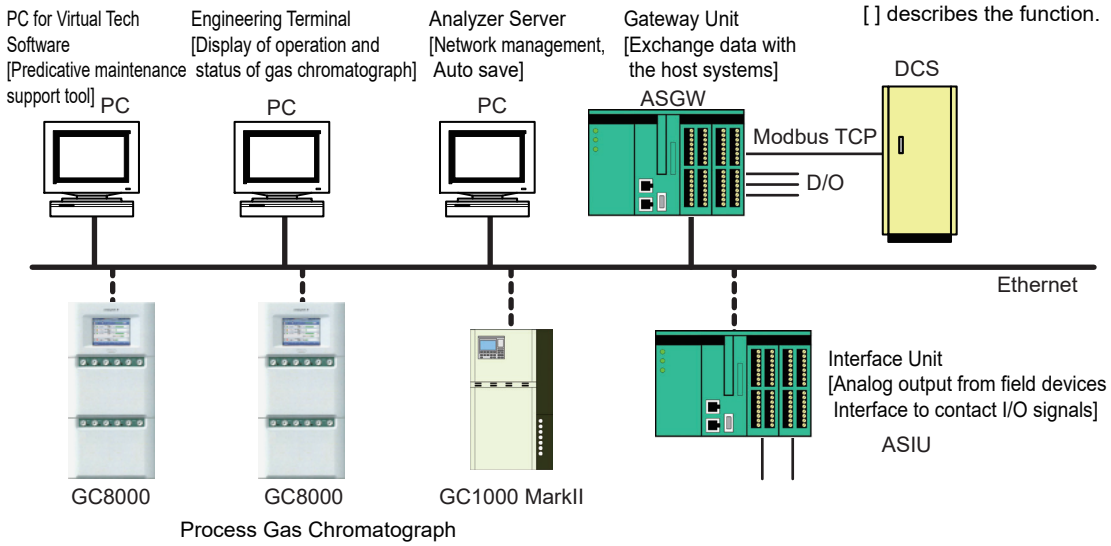


**Figure 1 Typical System Configuration**

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## ■ SYSTEM CONFIGURATION

A typical network configuration of analyzer bus is shown in Figure 1.

The network consists of process gas chromatograph (GC), server, hub, etc.

**(1) Process Gas Chromatograph (GC8000, GC1000 Mark II)**

Analyzers that is installed in the field and connected to Ethernet network.

**(2) Analyzer Server**

Controls network and stores the data. It is composed of PC and Analyzer Server Software (PCAS). PC is connected to analyzers with Ethernet network.

**(3) Engineering Terminal**

A human machine interface for analyzer operation and data view. Its software runs on a PC connected to network.

Consists of a PC that is connected with Ethernet and Analyzer Server Engineering Software (ASET). Enables multiple analyzers to be handled via the analyzer server.

Use Single Analyzer mode to connect one analyzer. Data can also be saved in the ASET Single Analyzer mode.

**(4) Gateway Unit**

Exchanges data with the host systems. Consists of Yokogawa's FCN autonomous controller and Analyzer Server Gateway Unit Software (ASGW).

Using Gateway Units is mandatory for a redundant (Dual) network. This is also necessary for address mapping.

**(5) Interface Unit**

Consists of Yokogawa's FCN autonomous controller and Analyzer Server Interface Unit Software (ASIU).

Interfaces field analyzers other than GC with network.

**(6) PC for Virtual Tech Software**

A support tool for performing predicative maintenance on GC8000 Gas Chromatographs.

The PC is connected to an Ethernet network. Virtual Tech Software (GCVT) is installed in this PC.

## ■ SPECIFICATIONS

### 1. Network (Ethernet)

Connection Type:
IEEE802.3U
100Base-TX (RJ-45 Shielded Twisted Pair cable) or 100Base-FX (SC Optical Fiber cable)
Protocol: TCP/IP
Communication rate: 100 Mbps
Max. number of nodes: 254
Max. distance:
50 m (100Base-TX)
2 km (100Base-FX)
Total distance can be extended using multiple levels of switching hubs* in cascade connection.
*Refer to the switching hub.

Redundant Network:
Two communication paths are provided. Both are on equal level. The path to use is determined by device engaged in the communication.
A PC on which the analyzer server software is installed, and a PC for Virtual Tech Software is installed, both PCs should have dual Ethernet ports.
The GC8000, GC1000 Mark II, analyzer server, gateway unit, interface unit, and PC for Virtual Tech Software can be made redundant.
Engineering terminals, however, cannot be made redundant.
In a redundant network, the maximum number of nodes is 75.
See "2.8 (a) Redundancy."

### 2. Devices

#### 2.1 Process Gas Chromatograph

Connection Type: IEEE802.3U
100Base-TX (RJ-45 Shielded Twisted Pair cable) or 100Base-FX (SC Optical Fiber cable)
Number of channels: 1 or 2
Number of GC8000 connected to a network:
Max. 240 units
Number of analyzer servers one GC8000 can access: 2 servers
Functions: Ethernet connection allows commands, status detection and data acquisition from analyzer server.

For other functions, see the General Specifications: Process Gas Chromatograph GC8000 (GS 11B08A01-01E).

#### 2.2 Analyzer Server

An analyzer server consists of a PC on which the PCAS software is installed.

PC Specifications
OS: Windows 11 Pro, Windows 10 Pro (64-bit version), Windows Server 2022 Standard, Windows Server 2016 Standard
English, Japanese, Chinese, or Russian
Note: Tablet mode is not supported.
CPU: 3 GHz or more
Memory: 4 GB or more
Hard disk: (for data strorage): 100 GB or more
Separately, free up space enough to store other data according to applications.
GC8000: 3.1 GB per detector (for data storage)
2.0 GB per SYS (for data storage)
Example: 5.1 GB for 1 GCM - 1 SYS - 1 detector
30.6 GB for 6 GCM - 6 SYS - 6 detectors
GC1000 Mark II:
3.5 GB per unit (for data storage)
ASIU: 1.9 GB per unit (for data storage)
Display: 1024 × 768 or more
Ethernet port:
1 port (100BaseTX or 100BaseFX)
2 ports (100BaseTX or 100BaseFX) for redundant configuration

Other: CD-ROM drive
DVD-ROM drive for redundant configuration

PCAS software specifications

Analyzer bus connection:

Number of connected analyzers and interface units: Max. 64 sets

Number of PCAS in one network: Max. 14 sets

Automatic data storage:
Data of GC8000, GC1000 Mark II and ASIU software are stored on the server PC.

| Storage Data | Description | Remarks |
|---|---|---|
| Analysis results | Detailed analysis results are stored for one year. Based on this, historical data of concentration and retention time are made. | Storage capacity depends on hardware and settings. |
| Chromatogram history (1) | Chromatograms for every cycle for the past 2 months. | ditto |
| Chromatogram history (2) | Every 10 times of chromatograms for one year. | ditto |
| Alarm history | | 100 kbyte |
| Event history | | 100 kbyte |

Stored data are read with ASET software.

Network monitoring screen:
Analyzer server communication status is monitored for troubleshooting purpose.

Note: PCAS (Primary) and PCAS (Secondary) must be the same version.

## 2.3 Engineering Terminal

Realized by ASET software installed on PC.
ASET and PCAS can be installed on the single PC.

PC Specifications

OS: Windows 11 Pro, Windows 10 Pro (64-bit version), Windows Server 2022 Standard and Windows Server 2016 Standard English, Japanese Chinese, French, or Russian

Note: Tablet mode is not supported.

CPU: 3 GHz or higher

Memory: 4 GB or more

Hard disk: At least 100 GB. Separately, free up space enough to store other data according to applications.

Display: 1024 × 768 or more

Number of Ethernet connection:
1 (100BaseTX or 100BaseFX)

Other: CD-ROM drive

ASET Software specifications

Function:
- Display of the status of GC8000, GC1000 Mark II, and interface unit.
- Display of the results and alarms stored on the PCAS software.
- Operation of GC8000, GC1000 Mark II and interface unit.

Screen display:
a) Overview
b) Analyzer Operation
c) Analysis Result
d) Chromatogram
e) Alarm Status
f) LCD Emulator (EtherLCD)

Max. number of EtherLCD is 4.

Analyzer server connection:
Max. number of ASET connected to one PCAS: 4 sets
ASET is connectable to PCAS on the same network.
One ASET is activated on one PC.

Single Analyzer Mode (ASET-S):
Engineering Terminal Single Analyzer Mode (ASET-S) is the successor software of GCET, it can communicat to GC8000 or GC1000 MarkII by one-to-one, without PCAS.

## 2.4 Gateway Unit

Established by Yokogawa's FCN Autonomous Controller and ASGW software.

It has the following two interfaces for DCS.
Modbus TCP Server (Ethernet communication)
Modbus Slave (Serial communication)

Specifications

Ethernet Communication:
Maximum number of GC8000, GC1000 MarkII, interface unit and analyzer server: 31 devices
Maximum number of clients (DCS): 4 devices

Serial communication:
Serial connection: Modbus Slave
Communication Standard: RS-232C
Number of ports: 3 at max.
Protocol: Modbus RTU mode
Communication speed:
300/1200/2400/4800/9600/14400/19200/28800/38400/57600/115200 bps.
Data length: 8 bits
Stop bit: 1 bit
Parity bit: Odd parity/Even parity/None

Compliant standards

EMC standards: CE Mark, RCM Mark

For the detail, refer to the General specifications of FCN.

Hardware

| Item | Model name | Description |
|---|---|---|
| Base module* | NFBU050 | |
| CPU module *(select 1) | NFCP501-S□□ | LAN 2 port |
| | NFCP502-S□□ | LAN 4 port |
| Power module *(select 1) | NFPW441 | 100-120 V AC |
| | NFPW442 | 200-240 V AC |
| | NFPW444 | 24 V DC |
| RS-232C module | NFLR111 | Required for reduntant network with Modbus RTU, required to install additional port for the Modbus RTU network. |
| Digital output module | NFDV551 | 32 points, 24 V DC |

Items marked * is required. Others are optional.
Select one if necessary.

Software license

The software license is bundled with the hardware.

Software media

| CR-ROM Code | Item | Remarks |
|---|---|---|
| NT203AJ-PC11E | Resource configurator | Loading a license for installation<br>Modification of IP address |

These programs are provided on DVD-ROM.
ASGW software:
Data mapping of GC8000, GC1000 Mark II, analyzer server, interface unit and host system such as DCS for interface with host system.
Capable of commanding, detecting status, and reading data as follows.

**(a) Commands for**

GC8000, GC1000 Mark II and analyzer server:

- Request for individual analyzer clock setting (sets the clock time of all GC8000 and GC1000 Mark II devices that are communicating with an analyzer server when the request is sent to the analyzer server)

GC8000, GC1000 Mark II through mapping:

- Run command
- Stop command
- Stream sequence assign
- Calibration (validation) command
- Stream (continuous) assign

Interface unit through mapping

- DO on command
- DO off command

**(b) Status detection of**

GC8000, GC1000 Mark II and interface unit in common

- In operation
- Communication error
- Write error

GC8000, GC1000 Mark II

- Analyzer normality/failure
- Change of analyzer alarm status
- Measurement, stop, or maintenance status
- Progress of stream sequence
- Rejection of request of stream (continuous)
- Rejection of request of calibration/validation
- Data update
- Calibration coefficient update
- Data validity
- Each alarm condition
  Concentration alarm of each peak, retention time alarm, variation coefficient alarm, tailing coefficient alarm
- Analyzer Server
  Redundant communication status of GC8000, GC1000 Mark II and interface unit that are communicating with an analyzer server

Interface unit

- Unit normality/failure
- Main power supply failure, 24 V DC failure, IO module failure
- DI data
- DO data
- AI IOP
  IOP occurs when value exceeds 106.3% of input range or is below -6.3%. If IOP occurs, the previous value will be held as AI data.

**(c) Data of**

GC8000, GC1000 Mark II

- Stream number
- First peak number
- Number of peak
- Sampling time
- Analysis result
- Retention time
- Calibration coefficient

Interface unit

- AI read data
  (Actual number in 2 words: Range 0.0-1.0)

When multiple requests are received in update period, the last request is executed.

### 2.5 Interface Unit

Realized by Yokogawa's FCN Autonomous Controller and ASIU software.

Function: Read and Write I/O interface data every 200 ms.

Compliant standards

EMC standards: CE Mark

For theadetail, refer to the specifications of FCN.

Hardware specifications

Max. number of contact inputs: 16
Max. number of contact outputs: 16
Max. number of analog inputs: 16

| Item | Model name | Description |
|---|---|---|
| Base module* (select one) | NFBU200 | Long base module |
| | NFBU050 | Short base module |
| CPU module* | NFCP501-S□□ | |
| Power module* | NFPW441 | 100 to 120 V AC |
| | NFPW442 | 220 to 240 V AC |
| | NFPW444- | 24 V DC |
| Digital input module | NFDV151 | 32 points, 24 V DC |
| Digital output module | NFDV551 | 32 points, 24 V DC |
| Relay output module | NFDR541 | 16 points, 24 to 110 V DC / 100 to 240 V AC |
| Analog input module | NFAI135 | 4 to 20 mA, 8 points, channel isolation |
| | NFAI143 | 4 to 20 mA, 16 points, system isolation |
| Dummy cover | NFDCV01 | Cover for empty I/O module |
| | NFDCV02 | Cover for empty power module |

- Items marked * is required. Others are optional. Select one if necessary.
- ASIU software supports redundancy of FCN power modules and CPU modules.

Software license

The software license is bundled with the hardware.

Software media

| Code | Description | Remarks |
|---|---|---|
| NT203AJ-PC11A | Resource configurator | Required for loading software and modifying IP addresses |

These programs are provided on DVD-ROM.

ASIU Software

Capable of commanding, detecting status, and reading data as follows.

**(a) Command**
- DO on/off command

**(b) Status detection**
- Unit normality/failure
- Main power supply failure, 24 V AC failure, IO module failure
- DI data
- DO data
- AI IOP
  IOP occurs when value exceeds 106.3 % of input range or is below -6.3 %. If IOP occurs, the previous value will be held as AI data.

**(c) Data**
- AI read data
  (Actual number in 2 words: Range 0.0-1.0)

### 2.6 PC for Virtual Tech Software

The PC for Virtual Tech Software is connected to an Ethernet network. Virtual Tech Software (GCVT) is installed in this PC.

PC specifications

OS: Windows 11 Pro, Windows 10 Pro (64-bit version), Windows Server 2022 Standard, Windows Server 2016 Standard
English, Japanese, or Chinese
Note: Tablet mode is not supported.

CPU: 3 GHz or higher

Memory: 4 GB or more

Hard disk: 100 GB or more (for data storage)
Additional 3 GB or more per analyzer for saving data (calculated on the condition that the analysis cycle is 10 minute with 60 alerts per day

Display: 1024 × 768 or more

Ethernet ports:
1 to 3 ports (100BaseTX or 100BaseFX)

Other: CD-ROM drive
DVD-ROM drive for redundancy

Virtual Tech Software (GCVT) specifications

GC8000 monitor function:
GCVT monitors the operation status of the GC8000 via PCAS and collects analysis values, chromatograms, and other data when alerts occur.
There is no monitor function for GC1000 MarkII.

- To use GCVT, the component software versions must be updated as follows:

| Software | Revision |
|---|---|
| PCAS | 2.02.01 or later |
| GC8000 | 1.02.15 or later |
| ASET (excluding ASET-S) | 2.02.01 or later (for displaying the trend of peak-related information) |

- GCVT monitors up to 64 GC8000s. Ethernet version GC1000 MarkII and devices connected to ASIU and Arcnet are not monitored.
- A GCVT communicates with a single PCAS.
- A PCAS communicates with a single GCVT.
- GCVT and PCAS can be run on the same PC, but this is not recommended as the security level will be degraded.

E-mail communication route:
To use the e-mail transmission function, design the communication route so that packets sent using the SMTP protocol (TCP) and the specified destination port number (default number: 25) can reach the e-mail server properly and that communication can be established.

- Communication with the mail server is accomplished by inserting a third network card to the PC and communicating via a separate network.
- Communicating with a mail server using the Ch-A side is not recommended in terms of security.
- Direct connection between PCAS and GCVT using an Ethernet crossover cable is also supported.
  (Redundancy cannot be achieved between PCAS and GCVT, but this creates a more secure network configuration.)
- Redundant communication with the mail server is not supported.

### 2.7 Network Components

**(a) Hub**

Switching type 100Base hub is recommended.

example; MOXA made P/N:EDS-308-MM-SC
(multi mode, wave length 1310 nm 100Base-FX (SC connector) 2 ports, TP (RJ45) 6 ports)
(Area classification: class 1 Div 2/Zone 2)

**(b) Cable**

- Optical Fiber Cable
  It is recommended to use optical fiber cable when extending distance, wiring between separate buildings or using the device in electrically noisy environments.
  Optical fiber cable does not require a “Signal interrupter” for explosion proof.
  The type of optical fiber is the multi mode which core diameter is 50/125 mm or 62.5/125 mm.
- Shielded Twisted Pair Cable
  Use Category 5 or higher of ScTP (Screened twisted pair) or STP cable. CE Mark is declared on the condition with ScTP or STP cable.
  Twisted pair cable requires a signal interrupter for explosionproof requirements. Refer to section 2.10, Explosion-proof.

**(c) Media Converter**

Since gateway unit (FCN) and general PC do not have optical interface, a media converter is required to connect an optical fiber network.

Select the appropriate devices according to the conditions of infrastructures.

example; MOXA made P/N:IMC-101-M-SC
(multi mode, wave length 1310 nm 100Base-FX (SC connector) 1 ports, TP (RJ45) 1 ports)
(Area classification: class 1 Div 2/Zone 2)

### 2.8 Analyzer Bus Network

**(a) Redundancy**

In a redundant network, a communication path is switched instantly and automatically to avoid an impact on applications in case of communication failure.

Redundant network requires analyzer bus gateway unit (FCN) and its software (ASGW).

Furthermore, the following licenses and media are required to duplicate the PCs in which PCAS or GCVT is to be installed.

License Code

| Licence Code | Item | Remarks |
|---|---|---|
| NT783AJ-LW11A | Redundant network function license for FCN/FCJ OPC Server (media:NT203AJ) | Required for each PC |

Software media

| CD-ROM Code | Item | Remarks |
|---|---|---|
| NT203AJ-PC11E | Resource Configurator | One media can be used for multiple devices. |

These programs are provided on DVD-ROM.

Analyzer server (PCAS), Virtual Tech Software (GCVT), gateway unit, GC8000, GC1000 Mark II and interface unit can be made redundant.

Engineering terminals (ASET), however, cannot be made redundant.

For details, see “ANABUS Ethernet System Redundancy Setting Manual" (TI 11B03A03-14E).

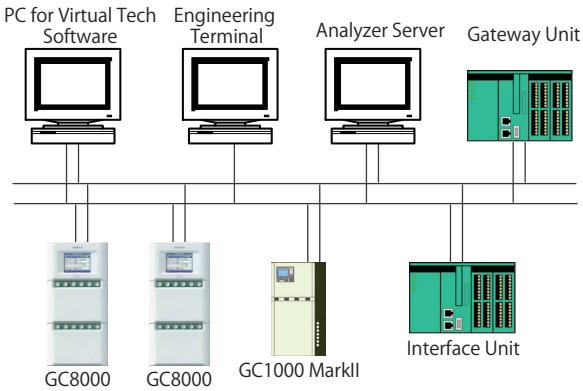


**Figure 2 Conceptual Diagram of redundant network configuration**

**(b) Restrictions on Total Distances of Network**

According to the 100Base-TX standards, cables of up to 100 meters can be used. Use the cable of 50 m or shorter to ensure communication quality. Total distance can be extended using multiple levels of switching hubs* in cascade connections.

* Refer to the switching hub.

### 2.9 OPC

OPC requires gateway unit and OPC server software.

For the detail, refer to “FCN/FCJ OPC Server for Windows” (GS 34P02Q61-01E).

In addition, redundant network function license for FCN/FCJ OPC Server software is required for connecting to the redundant network.

### 2.10 Explosion-proof

The following should be satisfied for explosionproof.

**(a) Process Gas Chromatograph (GC8000)**

See the General specifications of GC8000 (GS 11B08A01-01E).

**(b) Twisted Pair Cable**

When the explosionproof requirements are is not kept at GC8000 with twisted pair cables, signals should be interrupted. The rack-mounted type K9806AA signal interrupter (desktop type: K9806AB) is installed in the non-hazardous area. In the hazardous area, the relevant parts must be mounted in a flameproof enclosure that has been certified by the relevant explosionproof inspection organization.

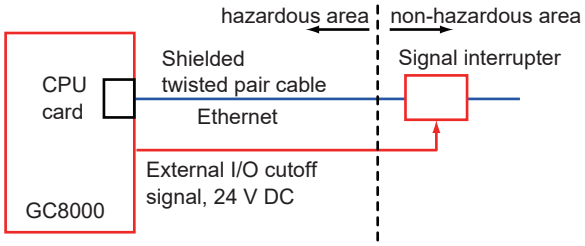


**Figure 3 With twisted pair cable (except for FM-Y explosionproof specification)**

**(c) Optical Fiber**

Optical fiber cable does not require the signal interrupter for explosion proof.

**(d) Hub**

Hubs can be installed in non-hazardous areas. In the hazardous area, the relevant parts must be mounted in an explosionproof enclosure that has been certified by the relevant explosionproof inspection organization.

**(e) Analyzer Bus Interface Unit**

FCN used as analyzer bus interface unit is approved that the product meets the non-incendive requirements of the FM Standards.

For the detail, refer to the General Specifications of FCN/FCJ (GS 34P02Q13-01E) and the Installation Guide of STARDOM FCN/DCJ (TI 34P02Q91-01E).

### 2.11 Security

PC should be protected against computer viruses.

Accesses from external network should be restricted by fire-wall.

## ■ MODEL AND SUFFIX CODES

### 1. Process Gas Chromatograph (GC8000)

Any of the following Suffix Codes should be specified for the Ethernet analyzer bus.

| Model | Suffix Code | Option Code | Description |
|---|---|---|---|
| GC8000 | ••••••••••• | ••••••••••• | Gas chromatograph |
| … | … | ••••••••••• | |
| Ethernet connection | -A | ••••••••••• | 100Base-TX (RJ-45 port) dual |
| | -B | ••••••••••• | 100Base-FX (SC connector) dual |
| | -C | ••••••••••• | 100Base-TX (RJ-45 port) single |
| | -D | ••••••••••• | 100Base-FX (SC connector) single |
| | -E | ••••••••••• | DSL single |

Refer to GS 11B08A01-01E on the specification of other than Ethernet connection on GC8000.

## 2. PC Analyzer Server Software (PCAS)

| Model | Suffix Code | Option Code | Description |
|---|---|---|---|
| **PCAS** | ••••••••••••••••••••••• | •••••••••••• | Software package |
| Function | **-A01** | •••••••••••• | Standard |
| Language | **E** | •••••••••••• | English, Chinese, Russian |
| | **J** | •••••••••••• | Japanese |
| — | **-N** | •••••••••••• | Always -N |
| — | **N** | •••••••••••• | Always N |
| Option | | **/UP** | Version upgraded |

## 3. Analyzer Server Engineering Terminal Software (ASET)

| Model | Suffix Code | Option Code | Description |
|---|---|---|---|
| **ASET** | ••••••••••••••••••••••• | •••••••••••• | Software package |
| Function | **-A01** | •••••••••••• | Standard |
| | **-S01** | •••••••••••• | Single analyzer mode |
| Language | **E** | •••••••••••• | English, Chinese, French, Russian |
| | **J** | •••••••••••• | Japanese |
| — | **-N** | •••••••••••• | Always -N |
| — | **N** | •••••••••••• | Always N |
| Option | | **/UP** | Version upgraded |

## 4. Analyzer Server Gateway software (ASGW)

| Model | Suffix Code | Option Code | Description |
|---|---|---|---|
| **ASGW** | ••••••••••••••••••••••• | •••••••••••• | Software package |
| Function | **-A02** | •••••••••••• | for NFCP501/502 (FCN-500) |
| Language | **E** | •••••••••••• | English |
| | **J** | •••••••••••• | Japanese |
| — | **-N** | •••••••••••• | Always -N |
| — | **N** | •••••••••••• | Always N |

## 5. Analyzer Server Interface Unit Software (ASIU)

| Model | Suffix Code | Option Code | Description |
|---|---|---|---|
| **ASIU** | ••••••••••••••••••••••• | •••••••••••• | Software package |
| Function | **-A02** | •••••••••••• | for NFCP501/502 (FCN-500) |
| Language | **E** | •••••••••••• | English |
| | **J** | •••••••••••• | Japanese |
| — | **-N** | •••••••••••• | Always -N |
| — | **N** | •••••••••••• | Always N |

## 6. Virtual Tech Software (GCVT)

| Model | Suffix Code | Option Code | Description |
|---|---|---|---|
| **GCVT** | ••••••••••••••••••••••• | •••••••••••• | Virtual tech software |
| Function | **-A01** | •••••••••••• | Standard |
| Language | **E** | •••••••••••• | English |
| | **J** | •••••••••••• | Japanese |
| — | **-N** | •••••••••••• | Always -N |
| — | **N** | •••••••••••• | Always N |
| Option | | **/UP** | Version upgraded |