

■ GENERAL

This general specification document describes the Gas Flow Calculation Portfolio on FCN/FCJ autonomous controllers. Using this portfolio, gas flow rate is calculated on robust and hazardous certified STARDOM controllers FCN/FCJ while control logics are running.

■ FEATURES

● High Speed and Volume Calculation

32bit high speed processor achieves a number of flow meter runs for many gas wells and responds to quick change of gas composition.

● Control with Flow Calculation

Control logics, programmed with IEC 61131-3, run with gas flow calculation. Regulatory control function blocks "NPAS" based on Yokogawa DCS expertise are adaptable for gas flow control such as valve control. (*1)

● Parameter Setting Window

Parameter Setting Window is prepared for easier parameters setting. Via OPC server, parameters can be set to SCADA as well.

● Meet the requirement of API21.1

Gas Flow Calculation Portfolio meets the requirement of API21.1.

*1: To use NPAS function blocks, PAS portfolio license is required.

■ PORTFOLIO COMPONENTS

Gas flow calculation portfolio consists of several components.

● Gas Flow Calculation POU

Gas flow calculation POU calculates the gas flow rate and provides the functions meeting to the API21.1 requirement.

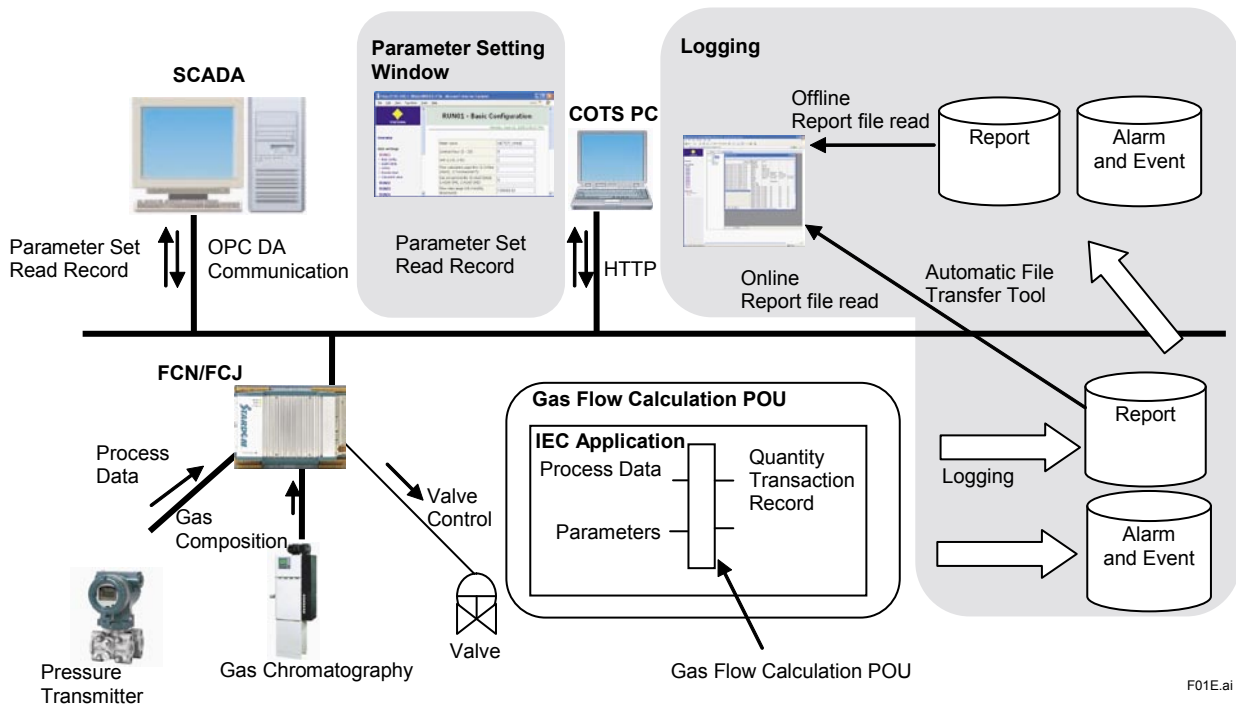
- Gas flow calculation
- Averaging Data
- Hourly and Daily Quantity Record Creation
- Configuration Log
- Alarm Generation

● Parameter Setting Window

Parameters can be set to POU and the calculated gas flows are monitored on Web-based parameter setting windows. Those windows do not require any PC based software apart from a web browser. (*1)

● Logging

Logging Portfolio logs the quantity transaction record created by Gas Flow Calculation POU (*2) and alarms and messages.



*1: Parameter Setting Windows are included in Application Portfolio Software Media. FCN/FCJ Basic Software License for Single CPU with Java function is required to use parameter setting windows. Parameter Setting Windows use InfoWell technologies. If modification of the parameter setting windows is required, Web Application Portfolio License (InfoWell) is required. T134P03A51-01E (Gas Flow Calculation Portfolio) describes the modification methods.

*2: Logging Portfolio is included in Application Portfolio Software Media. Logging Portfolio license is bundled with Gas Flow Calculation Portfolio. FCN/FCJ Basic Software License for Single CPU with Java function is required to use Logging Portfolio.

■ GAS FLOW CALCULATION POU

Gas flow calculation POU calculates the gas flow and creates the quantity transaction record.

● Gas Flow Calculation

Gas flow calculation POU calculates gas flow following AGA publication.

Table Supported Gas Calculation

Report Number	Title	Remark
AGA Report No. 3	Orifice Metering of Natural Gas Part 3: Natural Gas Applications (1992)	
AGA Report No. 7	Measurement of Natural Gas by Turbine Meters (1996)	
AGA Report No. 8	Compressibility Factor of Natural Gas and Related Hydrocarbon Gases (1992)	
AGA Report No. 9	Measurement of Gas by Multipath Ultrasonic Meters (2007)	Pulse input only
AGA Report No. 10	Speed of Sound in Natural Gas and Other Related Hydrocarbon Gases (2003)	
AGA Report No. 11	Measurement of Natural Gas by Coriolis Meter	
GPA 2172	Calculation of Gross Heating Value, Relative Density and Compressibility Factor for Natural Gas Mixtures from Compositional Analysis (1996)	Dry only
V-Cone	V-Cone (2006)	

● Averaging Data

The following two averaging method are supported.

- Flow-dependent time-weighted linear average (*1)
- Flow weighted linear average

*1: Average is calculated using production time.

● Hourly and Daily Quantity Transaction Record Creation

Gas flow calculation POUs calculate the following value

Table Calculated quantity record

Time	Category	Calculated Value
Today, yesterday, current hour, previous hour	Average	Static pressure, differential pressure, temperature, flow rate, mass flow rate, energy
	Total	Total flow, total mass, total uncorrected flow, total energy, total flow time, total shut-in time, total pulse
Current month	Total	Total flow

● Configuration Log

When the configuration parameters are changed, Gas Flow Calculation POUs notify the configuration change by setting the configuration flag ON.

● Alarm Generation

Process Alarm

HH/LL/HI/LO messages are generated when process input (Static Pressure, Differential Pressure and Temperature) exceeds the specified limitations.

● Scan Period of Task and Maximum POU number

Table Scan Period of Task and Maximum POU number

Item	Specification
Scan Period of Task	Limited to 1 second when using Gas Flow Calculation POU
Maximum POU number	12 POU's for FCN and FCJ, 8 POU's for FCN-RTU when using logging portfolio (*1)

*1: The metering numbers are depending on the total CPU performance.

■ PARAMETERS SETTING AND MONITORING WINDOW

The following parameters can be set on Web-based windows.

Table Setting Items (1/2)

Items		Description
Common	Meter name	Meter identifier (Meter Name)
	Contract hour	Report file closing time
	Meter type	Orifice / Turbine / Ultrasonic (Pulse input only) / Coriolis
	Unit	US / SI unit
	Unit Switch	Switch changing unit volume
Flow Conditions	Static pressure	Absolute / Gauge
	Atmospheric pressure	Calculated / Manual Atmospheric pressure is calculated based on "Latitude" and "Altitude" in case of "Calculated".
Base Conditions	Base temperature	Base temperature
	Base pressure	Base pressure
Heating Value	Heating Value calculation method	Manual / GPA 2172 Heating value is calculated on condition that base temperature is equal 60degF in case of "GPA2172."
Compressibility	Compressibility	AGA 8 Detail Characterization Method / Gross Characterization Method 1 / Gross Characterization Method 2
Gas Composition	Gas composition input	Manual / Live Gas composition is set manually in case of "Manual". Gas composition is set to POU inputs in case of "Live".
	Normalize	Yes / No Each gas composition is normalized if total mole fraction is not equal to 1 in case of "Yes".
	Gas composition	Nitrogen, Carbon dioxide, Hydrogen sulfide, Methane, Ethane, Propane, i_Butane, n_Butane, i_Pentane, n_Pentane, n_Hexane, n_Heptane, n-Octane, n_Nonane, n-Decane, Water, Oxygen, Carbon monoxide, Helium, Argon
	Relative density	Calculated / Fixed Relative density calculated based on the gas composition in case of "Calculated". Relative density can be set manually in case of "Fixed".
	Gross heating value	Gross heating value can be set manually.
	Reference temperature for gross heating value	Gross method reference temperature for gross heating value
	Reference temperature for relative density	Gross method reference temperature for relative density
	Reference pressure for relative density	Gross method reference pressure for relative density
	Reference temperature for molar density	Gross method reference temperature for molar density
	Reference pressure for molar density	Gross method reference pressure for molar density
Orifice Parameters	Differential pressure cutoff	Differential pressure cutoff
	Orifice Plate	Bore diameter, material
	Pipe	Internal diameter, material
	Reference temperature	Reference temperature for plate and pipe
	Tap location	Upstream / Downstream
	Isentropic exponent	Isentropic exponent
	Viscosity	Viscosity
	Correction factor	Flow rate correction factor
V-Cone Parameters	Differential pressure cutoff	Differential pressure cutoff
	V-Cone	V-Cone diameter, material
	Pipe	Pipe internal diameter, material
	Isentropic exponent	Isentropic exponent
	Viscosity	Viscosity
	Correction Factor	Flow rate correction factor

Table Setting Items (2/2)

Items		Description
Turbine Parameters	K-Factor	Pulse K-Factor
	Pulse Cutoff	Pulse cutoff
	Meter Factor	Meter Factor
Ultrasonic Parameters	K-Factor	Pulse K-Factor
	Pulse Cutoff	Pulse cutoff
	Meter Factor	Meter Factor
Coriolis Parameters	K-Factor	Pulse K-Factor
	Pulse Cutoff	Pulse cutoff
	Meter Factor	Meter Factor
Calculation condition	Deadband	Gas flow is calculated when process input exceeds the specified deadband. Deadband of static pressure, differential pressure and temperature deadband can be specified.
Alarm	Alarm	HH/HI/LL/LO limits of static pressure, differential pressure and temperature can be specified. Alarms are generated when process inputs exceed limits.
Average	Average method	Flow-dependent time-weighted linear / Flow-weighted linear Average method can be selected for static pressure, differential pressure, temperature and pulse count.
Maintenance	Mode	The specified data is used instead of process data when maintenance mode is set. Maintenance mode of static pressure, differential pressure and temperature can be set.

Table Monitoring Items

Items		Description
Current data	Process input	Static pressure, differential pressure and temperature
	Calculation status	Calculation status
	Calculated data	Flow rate, raw flow rate (uncorrected flow), mass flow rate(Coriolis only) energy, compressibility, compressibility at base condition, super compressibility, ideal relative density, ideal heating value, real heating value, Speed of sound (Ultrasonic only)
Average	Data item	Static pressure, differential pressure, temperature, flow rate, mass flow rate(Coriolis only)
	Time span	Today, yesterday, previous hour
Total	Data item	Flow rate, energy
	Time span	Today, yesterday, previous hour
Time	Data item	Production time, shut-in time
	Time span	Today, yesterday, previous hour

■ LOGGING

● Quantity Transaction Record Logging

Quantity transaction records are logged on the controllers using Logging portfolio (*1)

Table Default Logging Items

Items	Description
File Format	CSV File
File Type	Hourly quantity transaction record file Daily quantity transaction record file
File Closing Timing	Contract hour or configuration change
Default Hourly Quantity Transaction Record	date, time, specified data items

*1: Please refer to GS 34P02P53-01E "STARDOM Logging Portfolio (InfoWell)" for the details of logging portfolio specifications.

● **Alarm and Message Logging**

The alarms and events are logged in the controllers using Logging portfolio (*1)

Table Default Logging Items

Items		Description
File Format		CSV File
File Type	Alarm logging file	Process alarm, system alarm
	Event logging file	Audit trail (configuration change) User event, event message

*1: Please refer to GS 34P02P53-01E "STARDOM Logging Portfolio (InfoWell)" for the details of logging portfolio specifications.

■ **OPERATING ENVIRONMENT**

● **Autonomous Controller FCN/FCJ (Except FCN-RTU)**

Table Hardware

Hardware	Description
Model (CPU)	NFCP100 (FCN) or NFJT100 (FCJ) (*1)
Style (CPU)	S2 or later
System card	More than 128 MB

*1: Only single CPU can be used when using setting windows and logging portfolio.

Table Software

Software	Description
Basic Software	FCN/FCJ basic software (*1)
Revision	R3.10.01 or later

*1: Java function is required as suffix code when using parameter setting windows and logging portfolio

● **Autonomous Controller FCN-RTU**

Table Hardware

Hardware	Description
Model (CPU)	NFCP050
Style (CPU)	S1 or later

Table Software

Software	Description
Basic Software	FCN/FCJ Basic Software
Revision	R3.10.01 or later
License	For FCN-RTU, the licenses are bundled with CPU module (Model: NFCP050). Select CPU modules with the portfolio licenses required.

● **PC for Configuration**

Operating environment of the PC for Parameter Setting Window follows the operating environment described in InfoWell GS (GS 34P02P51-01E).

PC for Logging follows the operating environment described in Logging Portfolio GS (GS 34P02P53-01E).

■ STYLE OF SOFTWARE SUPPLY

● Media

Programs and Help for Gas Flow Calculation Portfolio are supplied with FCN/FCJ Application Portfolio Media .

● Gas Flow Calculation Portfolio License

Autonomous Controller FCN/FCJ (Except FCN-RTU)

A Order ID Sheet with the order ID and password comes with the Gas Flow Calculation Portfolio License. After purchase, access the specified YOKOGAWA Web site page and enter the order ID number and password to obtain the license ID number. To use Gas Flow Calculation Portfolio, register the license ID number with the FCN/FCJ system card.

Low Power Autonomous Controller FCN-RTU

For FCN-RTU, the licenses are bundled with CPU module (Model: NFCP050). Select CPU modules with the Gas Flow Calculation Portfolio License required.

■ MODEL AND SUFFIX CODES (EXCEPT FCN-RTU)

		Description
Model	NT8105J	Gas Flow Calculation Portfolio License
Suffix Codes	-L	License
	W	Issued online via the Internet
	1	Always 1
	1	Always 1
	A	Standard

Note: To use Parameter Setting windows and Logging Portfolio, FCN/FCJ Basic Software License for Single CPU with Java function is required.

Logging Portfolio license is bundled with Gas Flow Calculation Portfolio.

If modification of the parameter setting windows is required, Web Application Portfolio License (InfoWell) is required.

Web Application Portfolio License (InfoWell) can not be added FCN-RTU NFCP050-S0□

■ ORDERING INFORMATIONS

Specify the model and suffix codes when ordering.

For the type of software media supplied, refer to the separate GS, "Application Portfolios" (GS 34P02P20-01E).

■ RELATED DOCUMENTS

- GS 34P02P51-01E InfoWell
- GS 34P02P53-01E Logging Portfolio (InfoWell)
- TI 34P03A51-01E Gas Flow Calculation Portfolio

■ TRADEMARKS

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