XFC[G4]
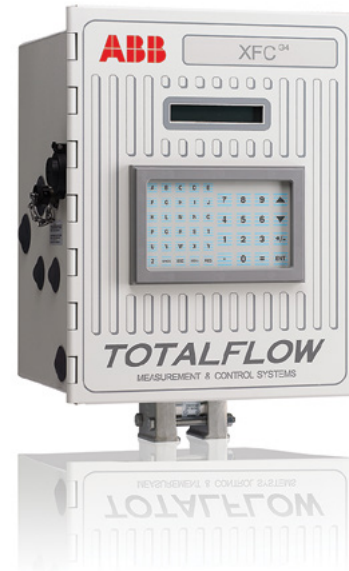# Differential flow computer

Overview

XSeries[G4] devices, from the Totalflow division of ABB provide functionality only possible through the convergence of RTU, PLC and flow computer concepts. Representing a unique milestone in the development of remote, low power, powerful measurement and control devices, ABB Totalflow's XSeries[G4] products are available in one of two product families;

– eXtendable Flow Computers (XFC[G4])
– eXtendable Remote Controllers (XRC[G4])

This datasheet focuses on the XFC[G4] products for differential meters. The XFC[G4] is the "fourth generation" of Totalflow flow computers. Benefits and features of these particular products include:

– Smart Integral Multivariable Transducer (XIMV)
– Comprehensive custody quality data history
– Automation, control, alarming and data logging capability
– Base I/O targeted at low cost automation projects
– Local display and optional keypad
– Quick, easy installation
– Flexible communications
– Onboard Ethernet port
– Backward compatibility
– Extendable hardware and software

With low power, accuracy and system integrity built in, these devices are proven daily on thousands of sites. Totalflow products provide users the best opportunity for successful projects – site by site or system by system.

Power and productivity
for a better world™

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XFC^{G4}
Differential flow computer

Description

The XFC^{G4} includes an Integral Multivariable Transducer (XIMV) to measure differential pressure, static pressure and temperature from a single differential pressure meter run. The XIMV is housed in a shielded environmentally protected enclosure which is mounted inside the flow computer enclosure and is characterized and calibrated at Totalflow's factory. Multi-tube capability is available in each unit and is easily invoked with a few configuration changes and interface connection to external transducers, either digital or analog.

The XFC^{G4} features a powerful 203Mhz, ARM920T, 32-bit microprocessor and Windows® CE operating system. The XFC^{G4} utilizes a unique "engine card" design. The engine card contains the processor, application firmware and memory components. This allows the user to move the engine card with all programming intact from one device to another if necessary. The processing and memory capability of this device, allows the user to run more applications faster than ever before. Up to twenty (20) AGA3 measurement tubes performing full calculations once a second and twenty (20) advanced plunger lift applications may be running in a single XFC^{G4}.

In addition to the basic flow computer inputs (DP, SP and TF), the standard device includes: two (2) analog inputs (0 to 10 volts DC), two (2) digital outputs and two (2) digital inputs which can be configured as either status inputs or pulse accumulator inputs.

I/O modules can be added to extend the hardware I/O capability. The XFC^{G4}6413 accommodates up to three (3) TFIO modules and the XFC^{G4} 6713 accommodates up to six (6). The XFC^{G4} 6410 does not support TFIO modules due to it's smaller enclosure.

Each unit is powered by an internal battery that can be solar charged (or other suitable DC supply) for remote unattended operation. Several charging options are available.

Communications interface cables and equipment can be installed at the factory, ready for quick field installation.

Checking and modifying configuration and calibration is accomplished with ABB Totalflow's PCCU32 laptop software running on a 32-bit Windows operating system.

In addition to the local configuration port, two communications ports are supplied with the standard unit. These ports are modular and user selectable for RS232 and/ or RS485. An additional port may be added using a TFIO Communications Module. Available protocols include Totalflow native low power, Modbus RTU or ASCII, LevelMaster, as well as several others.

One integrated 10Base-T Ethernet port for network connectivity is standard and a USB port for Flash download and local configuration is available as an option.

Hardware modularity

Hardware functionality of XSeries[G4] devices can be extended in a flexible and simple way by adding modular I/O as needed.

Totalflow's TFIO modules are designed to accommodate low power, harsh environments at economical cost. The system recognizes the module types automatically and configures the I/O Scanner subsystem accordingly.

Supported TFIO Modules Include:
– Analog In (8 channel)
– Analog Out (4 channel)
– Binary (DI, DO, PI-8 channels, software selectable)
– RTD (4 channel)
– Thermocouple (4 channel)
– Valve Control (digital or analog)
– Communications (software selectable RS-232, -485, -422- 1 channel)

For more detailed information about TFIO modules, request information on datasheets 2101105 through 2101112.

Software modularity

The software design represents significant modularization through use of object oriented design principles. This allows a flexible and stable real time environment. Totalflow supplied objects (applications) can be enabled in our factory or by the user, one or more times on the same device. It is this framework that allows the support for multi-tube measurement.

Supported software applications continually grow, but a sample of standard applications include:
– AGA-3 orifice meter run
– ISO 5167 orifice meter run
– VCone meter run
– AGA-7 meter run (rotary/turbine/ultrasonic)
– Coriolis gas (serial or pulse input)
– PAD controller for multi-well sites
– Advanced plungerlift control application
– Real-time data logger (trending)
– Valve control (feedback controller)
– RAMS (alarming, exception reporting)
– Operators (simple custom math / logic)
– IEC 61131 (ISaGRAF)
– Selectable units (user selectable engineering units)
– Display / Keypad handler
– I/O subsystem Handler
– Tank level application
– Therms master or slave applications for online chromatograph interface
– Multiple protocols (Totalflow native low power, Modbus slave (binary/ASCII), Modbus master (binary/ASCII), Enron Modbus, LevelMaster, Btu 8000/8001, ABB 267CS/269CS XMV Multivariable, and others)

XFC^{G4}
Differential flow computer

XSeries^{G4} flow computer features

- 203Mhz, ARM920T, 32-bit microprocessor
- Windows CE operating system (allows for a single software development environment for all G4 products)
- Integrated Ethernet 10Base-T port (full networking capabilities)
- USB host and USB device ports (ver 1.1): used for flashing new firmware and may be used as a high speed local configuration and collection port
- SD card capability (future non-volatile memory expansion)
- Significant hardening against over-current transients:
  - Positive Temperature Coefficient, resetting fuses and transient protection on
    - VBATT and SWVBATT outputs
    - Each of the digital outputs
    - Battery charger input
  - Power supply circuit designed to protect XIMV from hot insertion
- Base I/O on XFC^{G4} main electronics board:
  - 2 analog inputs
  - 2 digital inputs (all can be configured as hi speed PI inputs)
  - 2 digital outputs
  - Battery voltage
  - Charger voltage
- Low power design operating as low as 8 mA (<100 mW)
- Aluminum, powder-coated enclosure (3R)
- Flexible accommodation of communications hardware
- Cost-effective communications kits
- Stable time base (accurate integration)
- Rechargeable, lead acid batteries
- Solar, AC or DC charging options
- User-selectable, simple dual-level security code data protection or enhanced user-configurable Role Based Access Control (RBAC)
- Custody transfer applications
  - Monitors user limits for detection, and reporting of abnormal conditions
  - Defaults to 40 days of hourly data and 50 Days of daily data, user configurable.
  - Defaults to 200 Events. User configurable.
  - Complies with API 21.1 standard for custody transfer measurement devices

- Flow and energy calculations per AGA3-85, AGA3-92, AGA-7, AGA-5 and ISO 5167
- Meets flow computer requirements as stated in AGA Report No. 9, 'Measurement of Gas by Multi-path Ultrasonic Meters'
- Super compressibility calculations per NX-19, AGA8-92 Gross or Detail, ISO 12213
- Smart (temperature and pressure compensated) integral, factory calibrated, multivariable transducer (XIMV)
- All calculations performed once per second (user-configurable to longer period)
- Flow retention during user transducer calibration
- Selectable 3 or 5 point user calibration of analog inputs
- User-definable DP, no flow cut-off
- 100 ohm platinum RTD resistance curve fit with user programmable single point offset or 3/5 point user calibration for RTD input
- 100 ohm platinum RTD
- Hazardous Area Certification: CSA C/US, ATEX and IECEx
- Real-time clock that continues running on lithium battery (maintains data backup)
- Advanced embedded data logger (trending)
- Programmable alarm filtering
- Exception reporting capability
- Multiple protocol options including Totalflow packet protocol, various Modbus protocols and others
- User-programmable Modbus register maps (both slave and master)
- User-programmable math and logic sequences
- IEC 61131 capability (ISaGRAF)
- Valve control and nominations capability
- PID controller
- Plunger lift (up to 20 applications per unit)
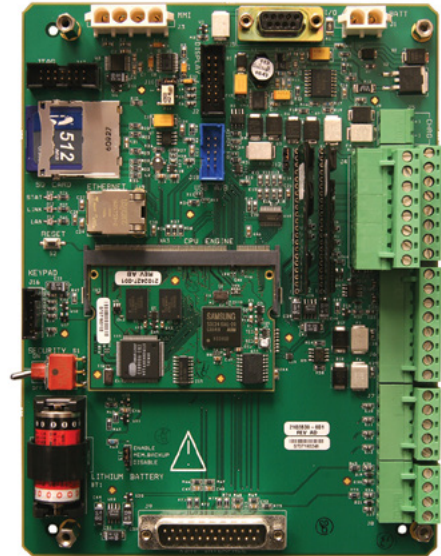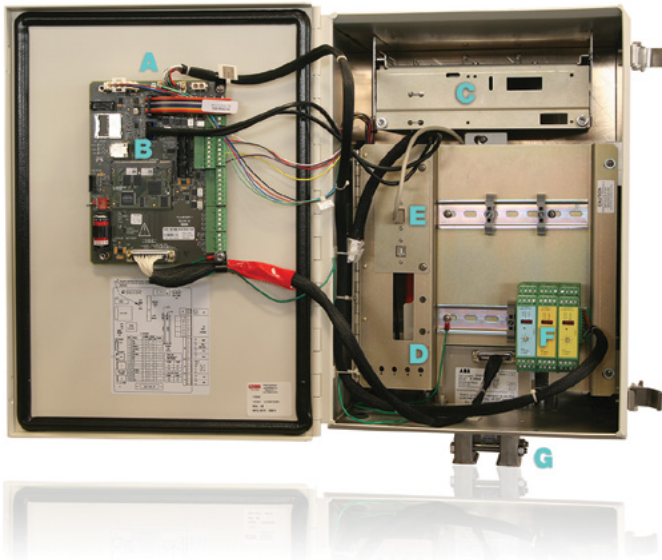
A. XFC^{G4} board
B. Ethernet port
C. Communications equipment compartment
D. Battery compartment
E. USB (host & device)
F. TFIO expansion modules
G. Integrated multivariable transducer

General specifications

		XFC^{G4} 6410	XFC^{G4} 6413	XFC^{G4} 6713
Dimensions	Width	10.000 in. (254.00 mm)	12.756 in. (324.00 mm)	14.920 in. (379.53 mm)
	Height	13.200 in. (335.28 mm)	17.825 in. (452.76 mm)	21.845 in. (554.86 mm)
	Depth	9.370 in. (233.00 mm)	10.269 in. (260.83 mm)	13.710 in. (348.23 mm)
Installed depth	(Pipe Mount)	10.680 in. (271.27 mm)	11.584 in. (294.23 mm)	14.560 in. (369.82 mm)
	(Wall Mount)	10.120 in. (257.05 mm)	11.019 in. (279.88 mm)	14.000 in. (355.60 mm)
Weight (w/o battery)		Approx. 13.5 lbs. (6.13 kg)	Approx. 15 lbs. (6.8 kg)	Approx. 29 lbs. (13.1 kg)
Max I/O modules		0	3	6
Max battery capacity		26AH	26AH	52AH

Enclosure
Powder-coated aluminum; Type 3R

Mounting
Wall, pipe, or direct

Certification (hazardous location classification)
– CSA C/US Class 1, Division 2, Groups C & D T4 –40°F to +140°F
– ATEX Zone 2, Sira 10ATEX4138X, ⟨Ex⟩ II 3G Ex nA IIB T3 Ta = –40°C to +60°C (meets European Union Directive 94/9/EC)
– IECEx CSA09.0013X, Ex nA IIB T3 (–40°C ≤ Tamb ≤ +60°C)

Operating temperature (ambient)
–40°F to 140°F (–40°C to 60°C)

Humidity
0 – 95% non-condensing

XFC^{G4}
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EMC requirements
Emissions
European Regions:
EN55022: 1996 Class B Emissions (Radiated & Conducted)

North America regions
CFR 47, Part 15, Subpart B, Class B, FCC Emissions
ICES-003 Issue 4 CAN/CSA-CEI/IEC CISPR 22:02, Class B
ITE Emissions
AS/NZS CISPR 22-2004 (Australia/New Zealand)

Immunity: European regions
EN61000-6-1: 2001 Immunity
EN61000-4-2 ESD: 1995 ± 8 kV Air, + 4 kV Contact
EN61000-4-3: 2005 RF Immunity, 3/10 V/m
EN61000-4-4 EFT: 2004, 1 kV
EN61000-4-6: 2005, Conducted Susceptibility, 3/10 Vrms
EN61000-4-8: 1994, Power Frequency Magnetic Field 10 A/m

Integral Multivariable (XIMV) Specifications
Temperature limits
Compensated   -20 to 140°F (-29 to 60°C)
Operational   -40 to 140°F (-40 to 60°C)
Storage   -40 to 185°F (-40 to 85°C)

Analog-to-digital resolution (XIMV & onboard AI's)
18 Bit maximum resolution (0.00038% FS)
16 Bit nominal resolution (0.0015%FS)

Vibration performance
1.5 INW per G (2G maximum) at 1 Hz, decreasing to zero at
1 KHz in straight line mode

Mounting specification
Change from perpendicular (front to back / around X-axis)
≤ 0.5% of URL (can be corrected with calibration)

Reference conditions
Temperature at most recent factory or user calibration;
Static pressure and differential pressure ≤ 100% of URL

Single seal rated (ANSI/ISA 12.27.01)
PMax = 3000 psi; wetted materials meet NACE MR0175/
ISO 15156; Process Fluids -62°C to 110°C

Static pressure
Accuracy (including linearity, hysteresis, & repeatability at reference conditions)
± 0.05% of user calibrated spans from 20% to 100% of URL

Ambient temperature effect within the operational temperature limit
± 0.075% of URL ± 0.06% of reading

Stability (for 12 months)
± 0.1% of URL

Differential pressure
Accuracy (including linearity, hysteresis & repeatability at reference conditions)
± 0.05% of user calibrated spans from 20% to 100% of URL

Ambient temperature effect within the operational temperature limit
± 0.075% of URL ± 0.06% of reading

Stability (for 12 months)
± 0.1% of URL

Static pressure effect (DP zero) per 1500 psi
± 0.03% of URL per 1500 psi (3200 psi maximum)

Static pressure effect (DP span) per 1500 psi
± 0.1% of reading per 1500 PSI (3200 PSI maximum)

Temperature
Process range
-80 to +230°F (-62 to 110°C)

Accuracy (as shipped from factory)
± 0.35°F (± 0.2°C) over operating range

Accuracy (after single point field calibration)
± 0.2°F (± 0.12°C) repeatability over operating range

Available ranges

DP	AP (psia)							
(inches H₂O)	100	150	250	500	1000	1500	2000	3200
100	✓		✓	✓	✓	✓		
150	✓	✓	✓	✓	✓	✓	✓	
250	✓	✓	✓	✓	✓	✓	✓	✓
400			✓		✓	✓		✓
800						✓		✓

XFC^{G4} specifications

Power
Nominal 12 VDC battery

Charger
Solar or 15 VDC, 30 W maximum

Memory
– Windows CE operating system, application programs and configuration files stored in 32 megabyte Flash memory
– Program execution and data stored in 16 megabyte pseudo static RAM. (lithium battery backup)

Communications ports
1 – dedicated – PCCU (local configuration port)
2 – RS-232 or RS-485 (via board insertion modules) baud rates up to 115,200
1 – USB 1.1 host port – optional
1 – USB 1.1 device port (may be used as high-speed local configuration port) – optional
1 – 10 Base-T Ethernet port

LCD interface
Dedicated interface for 2 X 24 Liquid Crystal Display (LCD)

Keypad interface
Dedicated interface for optional ABB supplied keypad

I/O expansion
I^{2}C bus Interface for TFIO modules

Security switch
On/Off dual-level on-board security switch; also supports enhanced Role Based Access Control (user configurable, multilevel, multi-user security)

Time base stability
± 7.5 ppm (parts per million)

I/O scan rate
1 time per second (1 Hz)

AGA-3/AGA-7/ISO5167/VCone
Calculations are tested and verified to be within ± 50 parts per million as stated in API 14.3.4

Analog inputs (onboard)
– 18 bit maximum resolution (0.00038% FS); 16 bit nominal resolution (0.0015%FS)
– 2 single-ended channels*
– Open circuit voltage: 0 VDC
– Short circuit leakage current: 0 µA typical
– Input impedance: 21 kΩΩ typical (0 to 7.5V)
– Measurable input voltage range: - 0.5V to 7.5V
– Maximum voltage on input line: 30 VDC
* For 4 to 20 mA inputs, an external power source may be required if device requires more than 12 VDC nominal.

Digital inputs/pulse inputs (onboard)
2 inputs configurable as active or passive with optional software de-bounce.
– Open circuit voltage: 5 VDC (Internally pulled up to 5 VDC nominal)
– Short circuit leakage current: – 395 µA typical
– Input capacitance: 0.1 Ufd typical
– Maximum allowable voltage range on input: - 0.5 VDC to 15 VDC
– Maximum frequency input 100 Hz @ 50% duty cycle with de-bounce enabled
– Maximum frequency input 20 kHz @ 50% duty cycle with de-bounce disabled
– Dry contact (Form A), open collector or active voltage
– Minimum contact resistance to activate input: 1000 Ω
– Voltage threshold to deactivate the input: 3.1 V (referenced to GND terminal)
– Voltage threshold to activate the input: 0.5 V (referenced to GND terminal)
– Conductor pairs must be shielded to prevent spurious signals

Digital outputs (onboard)
2 open channel FET transistor switches:
– Open circuit voltage: 0 VDC
– Short circuit leakage current: 0 µA typical
– Output capacitance: 1000 pF typical
– Maximum allowable voltage range on output: - 0.5 VDC to 26.4 VDC
– Open drain FET type
– 'ON' resistance: 0.1 Ω typical (including PTC fuse resistance)
– Maximum pulse current: 3 A for 5 seconds
– Maximum continuous sink current: 2 A

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