CONTROLLERS DATASHEET

HFC302

HSE/Foundation fieldbus Flow Computer

FOUNDATION

HART COMMUNICATION PROTOCOL

Modbus

smar
Technology Company

HFC302 HSE/ FOUNDATION fieldbus Flow Computer with 2 HSE Ethernet ports and 4 H1 channels

TECHNICAL INFORMATION

Product Description

HFC302 module is the second generation of Smar flow computer. Using four H1 channels (FOUNDATION fieldbus), two ports 10/100 Mbps Ethernet and capacity for execution of blocks and ladder logic, HFC302 can operate as a bridge H1-H1 or as a gateway H1-HSE, allowing a large communication between field devices and high flexibility in the strategies projects in continuous controls. Through I/O modules, it is possible to execute discrete control via ladder logic, allowing an integrated system. The module HFC302 can also work as Modbus gateway, interconnecting modules that are not FOUNDATION fieldbus or HSE, and supports redundancy, supplying to the process high level of safety.

Main Characteristics

Functionalities

- HSE Linking Device
- Modbus Gateway (serial and TCP/IP)
- Ethernet connectivity

Technical Characteristics

- Two 10/100 Mbps Ethernet ports;
- Up to 4 flow measurement loops in any combination of liquid and gas;
- Support for integration with compact prover, sampler/odorizer, chromatograph, IHM and other;
- Liquid product types: crude oil and emulsion, refined products, MTBE, lubricant oil, GLP/condensed and emulsion, water, ethanol;
- Types of gaseous products: natural gas, argon, oxygen, nitrogen, dioxide of carbon, ammonia, steam, and humid steam.

Available Memory

Volatile Memory	16 Mbytes
Non-Volatile Memory	4 Mbytes
EEPROM	1 kbytes
Flash to the program	8 Mbytes
Flash to monitor	2 Mbytes

Continuous Control with Foundation Fieldbus

The HFC302 controller acts like a bridge for the HSE main bus. It performs four functions:

- Message forwarding using Client/Server model;
- Publication of data using Publisher/subscriber model;
- Report forwarding using Report source/sink model;
- Distribution of the time between the applications.

Characteristics and H1 Communication Limits

- Four H1 Channels;
- It supports up to 32 field devices (maximum of 8 devices per channel);
- Limit of 48 linked parameters (16 VCRs publishers and 32 VCRs subscriber in H1 channel);
- Dynamic instantiation of blocks;
- Maximum of 100 function blocks per HFC302;
- One flexible function block (within 100 possible blocks), with 256 linkable parameters for interface between the discrete and continuous control;
- LAS function ("Link Active Scheduler").

Discrete Control

HFC302 module also has the capability of access I/O cards through the IMB (Inter-Module Bus), present in the backplane where the HFC302 is mounted. Through the IMB, up to 16 racks can be interconnected, each one having up to 4 cards. If there is a redundant controller is necessary, the use of rack DF78 or DF92. If DF78 is used plus 16 racks DF1A can be added. If DF92 is used plus 16 racks DF93 can be used. Additional power supplies in other racks can be necessary depending on the load of the cards.

DF Line of I/O cards that can be used:

Digital inputs and outputs
Analog inputs and outputs
Temperature
Pulse counting
HART inputs and outputs

The user program is developed using relay diagrams (IEC-61131-3), through the LogicView for FFB tool, available on System302. LogicView for FFB is a complete development environment, allowing the user to create, edit, simulate and supervise the developed application. The interconnection with fieldbus is made through a flexible function block.

General characteristics of the discrete control in the HFC302:

I/O Points*	64 discrete or analog points (maximum)
Auxiliary Points	1024 points (maximum)
Ladder Function Blocks	300 blocks (maximum)
Analog Points Supervision	2400 analog points (maximum)
Configuration File	5 Kbytes (maximum)
Program Execution Cycle for 1000 boolean operations (without redundancy)	50 ms (minimum)** 90 ms (typical)***
Program Execution Cycle with redundancy	Increment of 10ms (typical)**** up to 50ms (maximum) to execution cycle
Execution Average Time	5.8 ms/Kbytes of program (minimum); 10.5 ms/Kbytes of program (typical).

* The whole number of points includes inputs and outputs, analog or digitals. Maximum may change according I/O type used.
** 1131 Flexible Function Block adjusted to One (High Priority). Each 1000 boolean operations allocate 8,6 Kbytes.
*** Total execution time will change depending on the adjusted priority of 1131 FFB. The adjustment should be compatible with the quantity of function blocks and HSE links.
**** The whole execution time may change depending of the configuration file size.

The extensive library of LogicView for FFB function blocks allows the implementation of discrete and/or continuous control.

The complete list can be seen in the LogicView for FFB manual available on the Smar website.

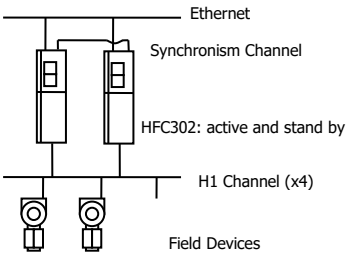
Redundant Operation

HFC302 can operate in standalone (one HFC302) or redundant (two HFC302) mode. In redundant mode, the two HFC302 can communicate through a proprietary channel and exchanging information about configuration and operation status.

Some HFC302 elements are redundant:

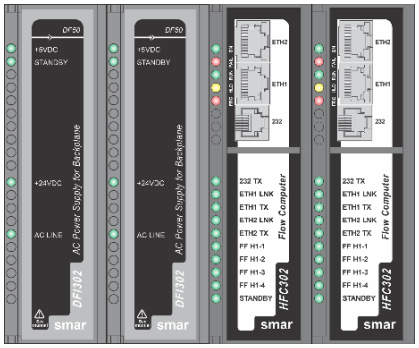
- HSE Block Redundancy
- HSE link Redundancy
- Ladder Redundancy
- Supervision Redundancy
- Network Redundancy

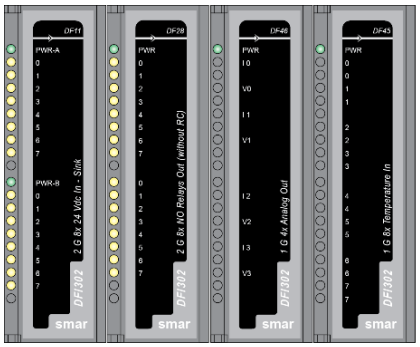
Topology to interconnection of HFC302 in redundancy:



Redundancy General Characteristics

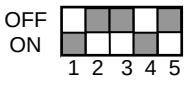
For redundant access of I/O cards, it is necessary to use a special rack (DF78 or DF92). The two power supplies and the two HFC302 must be mounted on this rack, in that order. The remaining modules can be mounted on this rack in the order shown below. The remaining modules can be connected as usual.





Internal Battery

The HFC302 Real Time Clock (RTC) and its nonvolatile RAM (NVRAM) are maintained by a non-chargeable battery when there is lack of external supply. This battery can be either enabled or disabled, depending on the position of the switch 1, in the back part of the HFC302. To enable the battery, set the switch to 1 as shown in the following picture:



1) Battery ON
2) Keep in this position
3) Simulate
4) Watchdog ON
5) Keep in this position

In this configuration, when there is lack of energy, the RTC and the NVRAM will be supplied by the battery, allowing the retention of all configuration data. In case of equipment storage, it is recommended that the battery is turned off (switch 1 in position OFF).

Battery features

Type of battery	Battery Panasonic BR-2/3AE2SP - Lithium
Capacity	1200 mAh
Devices maintained by the battery	RTC and NVRAM
Minimum life span	8 years (typical charge of 17uA)
Maximum life span	49 years (typical charge of 2.8uA)
Voltage	3 V (subject to revision when below 2.5 V)

Ports and Communication Channels

Ethernet Port

Communication rate	10/100Mbits
Standard	IEEE 802.3u
Isolation	150Vrms
Operation Mode	Full-duplex
Connector	RJ45 with shield*

* Grounded to the rail used for fixing the rack in which the HFC302 is installed.

H1 Channels

Number of H1 Channels	4
Communication Rate	31.25 kbps
Standard	EN 61158 EN 50170
Physical Layer	ISA-S50.02-1992
H1 Modem	FB3050P (3.3V)
MAU Type	Passive (not bus powered)
Isolation	500 Vac
Bus Current	40mA

Modbus Port

Communication Rate (Maximum)	19200 bps
Standard	EIA-232
Connector*	RJ12 with shield
Maximum Current **	0.5A @ 3.3V
Cable Length (Maximum)	15 m

* Grounded to the rail used for fixing the rack in which the HFC302 is installed.
** Internally protected by solid state fuse.

Redundancy Port

Maximum Communication Rate*	115200 bps
Standard	EIA-232
Connector	RJ12 with shield**
Maximum Current***	0.5A @ 3.3V
Cable for CPUs connection	Its uses DF82 (length 0.5 m) or DF83 (length 1.8 m) only

*There is an increase in error rate as we increase the communication rate over 19200 bps. In many situations these errors can be acceptable, and they are not noticed by supervision.
** Grounded to the rail used for fixing the rack in which the HFC302 is installed.
*** Internally protected by solid state fuse.

Failure Relay

Output type	Solid state relay, normally closed (NC), isolated
Maximum Voltage	30 VDC
Maximum Current	200 mA
Overload Protection	Not available. It must be provided externally
Normal Operation	Open contacts
Failure Condition	Closed contacts
Maximum cable length connected to the relay	30m

Observation: The power supply for the load must not be from an external network (outside the panel).

IMB Bus

Voltage	5 VDC
Maximum Current	200 mA
Bus	8 bits
Access time to read and write	450 ns
Failure Signal	Yes
Hot Swap	Yes
Redundancy in the bus access	Yes, but only using DF78 or DF92 rack

Module Features

Processor

CPU	Family ARM7TDMI
Bus	32bits
Architecture	RISC
Performance	40 MIPS
CPU Cache	8kbytes
Clock	40 MHz
DMA	10 channels
Ethernet	MAC 10/100 integrated
Watchdog	Yes (200ms of cycle)
Operation Voltage	3.3V to I/O

Module

Operation Voltage	5V (± 5% of tolerance)
Typical Current	550 mA
Real Consumption	2.75 W
Environment Air Temperature (Operation)	0 to 60º C (IEC 1131)
Storage Temperature	-20 to 80º C (IEC 1131)
Relative Air Humidity (Operation)	5% to 95% (non-condensing)
Cooling Mode	Air Convection
Dimensions (HxWxD, mm)	149x40x138 (without package)

Certification Information

Notified Body	INMETRO
Country	Brazil
Type of Instrument	Flow Computer
Brand	AuditFlow
Model	HFC302
Accuracy class	Class 0.3
Mechanical environment class	M2 (places with significant or high levels of vibration and shock transmitted from machines or trucks, conveyors, etc.)
Electromagnetic environment class	E2 (industrial environment)
Climatic environment class	H2 (indoors without humidity control in industrial process plants)
Approval document provides the tested hardware configuration as well the test conditions	N.º 361, of December 28, 2020
Gas measurement - fluid type	Natural gas
Gas measurement - flow meter	Orifice plate, turbine, coriolis, and ultrasonic
Liquid measurement - fluid type	Crude oil and derivatives, ethanol (anhydrous and hydrated) fuel
Liquid measurement - measurement type	Fiscal measurement and allocation measurement

Note: For most recent updates, please consult Smar website www.smar.com

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