CONTROLLERS DATASHEET
DF97
HSE/Profibus Controller

DF97 HSE/Profibus DP Controller with 2 Ethernet 100 Mbps ports, 1 serial port, 4 Profibus PA ports and 1 Profibus DP channel

TECHNICAL INFORMATION

Product Description

DF97 module is the Smar solution for Profibus applications. Its main feature is working as Profibus DP-HSE gateway to provide power to the connectivity and flexibility to the system application. It allows wide communication between the Profibus DP and PA field devices. Through the HSE network and other DFI302 modules, it is possible the communication between field devices and other industrial protocols, providing greater flexibility to the control strategy projects. Through the I/O cards, it is also possible to execute discrete control via relay diagram logic ("Ladder Diagram"), allowing a single and integrated system. The module DF97 also can act as Modbus gateway (slave), allowing the interconnection of modules that are not fieldbus or HSE.

Main Characteristics

Functionalities:

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

Technical Characteristics:

- One Profibus DP channel supporting up to 12 Mbps;
- Four Profibus PA ports supporting up to 32 devices for channel;
- It supports up to 124 Profibus DP and PA field devices;
- It supports up to 3584 bytes of input and 3584 bytes of output during the data interchange process;
- Limit of 64 external links by the HSE network;
- Maximum of 250 function blocks per DF97;
- One (1) Flexible Function Block (counted into the 250 allowed blocks), with 242 linked parameters to interface between the discrete and continuous control.
- It supports up to 16 HART modules (DF116/DF117)

Available Memory

Volatile Memory	8 Mbytes
Non Volatile Memory *	4 Mbytes
EEPROM	1 kbyte
Flash to the program	4 Mbytes
Flash to monitor	2 Mbytes
Flash to EC1 (Profibus)	4 Mbytes

* It is kept by not rechargeable internal battery.

Continuous Control with Profibus

DF97 is a complete Profibus HSE controller with capacity to execute function blocks. Through the available **SYSTEM302**, **Studio302** and **Syscon** configuration tools is possible to configure the DF97 totally.

HSE Communication:
- Maximum of 512 link objects;
- Supervision up to 2000 points per second;

Discrete Control

DF97 module also has the capability of access I/O cards through the IMB (Inter-Module Bus), present in the backplane where the DF97 is mounted. Through the IMB, up to 16 racks DF1A or DF93 can be interconnected, each one having up to 4 cards.

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

Digital inputs and outputs
Analog inputs and outputs
Temperature
Pulse counting

The user program is developed using relay diagrams (IEC-61131-3), through the LogicView for FFB tool, available on System302. The 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 DF97:

I/O Points *	1024 discrete points or 512 analog (maximum)
Ladder Function Blocks	2000 blocks (maximum)
Configuration File	120 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 50 ms (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.

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The extensive library of LogicView for FFB function blocks allow 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.

The size of the configuration file and its time of execution can be estimated through a simple addition of the elements that compose the program. The total execution time will be given by the configuration execution time plus the program execution cycle, that is 10ms.

Redundant Operation

DF97 can operate in stand alone (one DF97) or redundant (two DF97) mode. In redundant mode, the two DF97s are capable to communicate through a proprietary channel and change information about configuration and operation status.

Some DF97 elements are redundant:

- HSE Block Redundancy
- HSE link Redundancy
- Ladder Redundancy
- Supervision Redundancy
- Ethernet Media Redundancy

Topology to interconnection of DF97s in redundancy:

Ethernet 1
Ethernet 2
Synchronism Channel
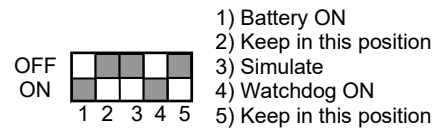
DF97: active and stand by
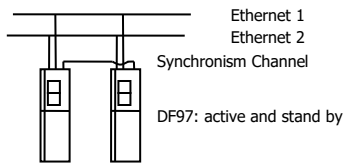
Redundancy General Characteristics:

For redundancy of access in I/O cards, it is necessary the use of a special rack (DF78 or DF92). The two power supplies and the two DF97 must be mounted on this rack, in that order. The remaining modules can be interconnected as usually.
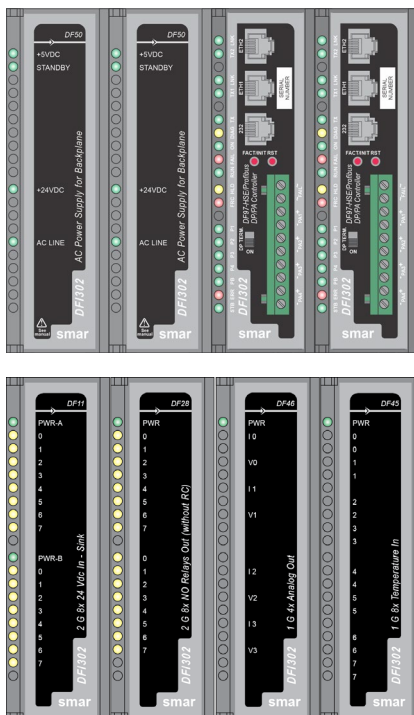
Internal Battery

The DF97 has an internal battery that keeps the Real Time Clock (RTC) and its non volatile RAM (NVRAM) 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 DF97. To enable the battery, set the switch to 1 as shown in the following figure:

OFF
ON
1 2 3 4 5

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).

So, before fixing the DF97 module in the rack, be sure the switch 1, which refers to the battery, is in the enabled position.

The Watchdog is a mechanism to detect if an important or high priority task stops in the controller.
So, be sure the switch 4, which refers to the Watchdog, is in the ON position.

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)

Communication Ports and Channels

Ethernet Port:

Communication rate	10/100 Mbps
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 DF97 is installed.

DP Profibus Channel:

Rate	From 9.6 Kbit/s to 12 Mbits/s
Standard	EN 50170 and EN 50254
Physical Layer	EIA RS-485
Profibus Modem	EC1 (Hilscher)
Connector	M12

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PA Profibus Channels:

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

Modbus Port:

Maximum rate*	115200 bps
Standard	EIA-232
Connector**	RJ12 with shield *
Maximum Current***	0.5A @ 3.3V

*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 DF97 is installed
*** Internally protected by solid state fuse.

Redundant Port

Maximum Rate	115200 bps
Standard	EIA-232
Connector*	RJ12 with shield
Maximum Current**	0.5A @ 3.3V

* Grounded to the rail used for fixing the rack in which the DF97 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	Does not have. 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
Bus	8 bits
Failure indication	Yes
Hot Swap	Yes

Module Features:

Controller - Main Board

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)
Power Supply Voltage	3.3 V for I/O and 2.5V for core (552 mW)

Controller – Secundary Board

FPGA	Changes CycloneIII
Storage Memory	4KB
Processor	NiosII
Running Memory	1MB
Clock	85 MHz
Operating Voltage	3.3 V for I/O, 2.5V for PLL, 1.2V for core and 5V for communication channels.

Card

Power Supply Voltage	5V (± 5% of tolerance)
Typical Current	620 mA
Real Consumption	2,75 W
Environment Air Temperature	0 to 60º C according to the IEC 1131 standard
Storage Temperature	-20 to 80º C according to the IEC 1131 standard
Relative Humidity of the Operation Air	5% to 95% (non-condensing)
Cooling Mode	Air Convection
Weight	0.318 kg
Dimensions (HxWxD, mm)	149x40x138 (without package)

Electrical Certification

The DF97 was developed according to the specifications of the immunity tests applied to equipment in industrial installations, in accordance with the IEC61326:2002 standard. Certification data can be obtained on request.

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

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