CONTROLLERS DATASHEET

DF63

HSE/Foundation fieldbus Controller

FOUNDATION

FOUNDATION HART COMMUNICATION PROTOCOL Modbus

smar
Technology Company

DF63 HSE/ FOUNDATION fieldbus Controller with 2 HSE Ethernet ports and 4 H1 channels

TECHNICAL INFORMATION

Product Description

DF63 module is the second generation of Smar HSE Linking Devices. With four H1 channels (FOUNDATION fieldbus), two 10/100 Mbps Ethernet ports and capability of block execution. DF63 can work as a bridge H1-H1 or as linking device H1-HSE, allowing a wide communication between field devices and greater flexibility in the project of strategies of continuous control. It has two Ethernet ports for HSE network redundancy. 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 DF63 also can act as Modbus gateway, allowing the interconnection of modules that are not fieldbus or HSE. DF63 also has redundant operation, giving higher security level for industrial process.

Important
From serial number 7000 onwards there was a CPU upgrade.
DF63 modules (NETARM CPU) have serial numbers below 7000. Their specific characteristics will be indicated by (SN<7000).
DF63 modules (iMX6 CPU) have serial numbers above 7000. Their specific characteristics will be indicated by (SN>=7000).

Main Characteristics

Functionalities

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

Technical Characteristics

- Two 10/100 Mbps Ethernet ports;
- Four H1 channels (FOUNDATION fieldbus);
- It is recommended the use of up to 32 field devices (8 devices per H1 channel). However, more devices can be used (up to 16 per H1 channel) under evaluation of performance according to each application;
- Links characteristics:
  - 128 parameters can be linked externally via HSE and H1 (any proportion among HSE and H1 links totaling 128 links);
  - For external links among controller – H1 devices there is the limit of 16 Publisher links and 16 Subscribers links per each H1 port;
  - Regardless of the above limits there is the limit of 16 H1 bridge links (links among H1 ports of the same controller). This limit is shared by all ports, with no limit per port;
- Dynamic block instantiation;
- Maximum 100 function blocks;
- It supports Flexible Function Block with 242 parameters that can be linked by using interface between the discrete and analog control;
- LAS Function ("Link Active Scheduler");
- It supports up to 16 HART modules (DF116/DF117).

Available Memory

Serial Number	SN<7000	SN>=7000
Volatile Memory	8 Mbytes	256 Mbytes
Non-Volatile Memory*	4 Mbytes	4 Gbytes Flash
EEPROM	1 kbytes	256 Bytes EEPROM 32 Mbytes Serial Flash
Flash to the program	4 Mbytes	-
Flash to monitor	2 Mbytes	-

* It is kept by not rechargeable internal battery.

Continuous Control with Foundation Fieldbus

The DF63 controller acts like a bridge for the HSE main bus. It performs four functions:

- Message forwarding using Client/Server relationships
- Data republishing using Publisher/subscriber relationships
- Report forwarding using Report source/sink relationships
- Application clock time distribution

Characteristics and H1 Communication Limits

- Four H1 Channels
- It supports up to 32 field devices (maximum of 8 devices per channel)
- Limit of 128 linked parameters (16 VCRs publishers and 16 VCRs subscriber in H1 channel)
- Dynamic instantiation of blocks
- Maximum of 100 function blocks per DF63
- One flexible function block (entered inside of the 100 possible blocks), with 256 linkable parameters for interface between the discrete and continuous control.
- LAS function ("Link Active Scheduler")

Discrete Control

DF63 module also has the capability of access I/O cards through the IMB (Inter-Module Bus), present in the backplane where the DF63 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

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 DF63:

I/O Points*	I/O Points* 256 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	20 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 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.

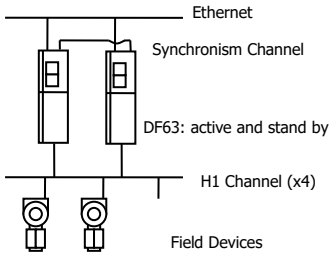
Redundant Operation

DF63 can operate in standalone (one DF63) or redundant (two DF63) mode. In redundant mode, the two DF63 are capable of communicating through a proprietary channel and exchanging information about configuration and operation status.

Some DF63 elements are redundant:

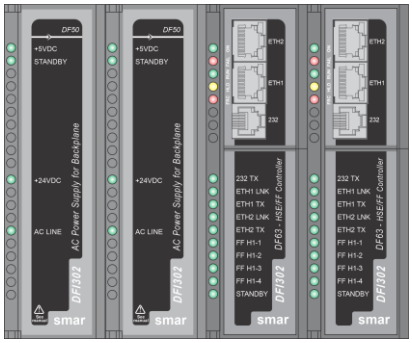
- LAS Redundancy
- H1 and HSE Block Redundancy
- H1 and HSE link Redundancy (to devices that use flat address)
- Ladder Redundancy
- Supervision Redundancy

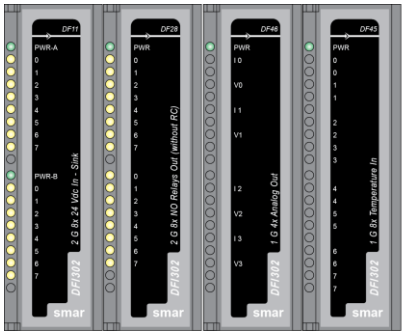
Topology to interconnection of DF63 in redundancy:



Redundancy General Characteristics

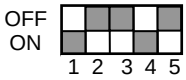
For redundant access of I/O cards, it is necessary to use a special rack (DF78 or DF92). The two power supplies and the two DF63 must be mounted on this rack, in that order. The remaining modules can be mounted on this rack in the order shown below. The remaining modules can be connected as usual.





Internal Battery

The DF63 Real Time Clock (RTC) and its non-volatile 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 DF63. 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 (SN<7000) RTC (SN>=7000)
Minimum life span (estimated) (1)(2)(3)	10 years (typical) Variable with operating temperature. Important to disconnect the battery when the module is not installed.
Voltage	3 V (subject to revision when below 2.5 V)

(1) The battery only comes into operation when the DF63 is de-energized. In this condition, the lifespan of the battery in relation to its charge is estimated to be at least 10 years, for ambient temperatures up to 25°C,
(2) For this reason, it is important to keep the battery switch off when the module is not installed for operation (key 1 of the rear dip switch).
(3) The status of the battery lifespan can be monitored through the module's webserver in the "Information" page, "Power off data retention" field.

Capacitor (only SN>= 7000)

Type of capacitor (1)	GLL1493 (super capacitor)
Capacity	6 s hold (minimum)
Devices maintained	Processor, during shutdown.
Minimum life span (estimated)(2)(3)	10 years (typical) Variable with operating temperature.
Voltage	5.4 V (maximum)

(1) Consult technical assistance if replacement is necessary.
(2) The lifespan of the capacitor is a theoretical data, considering operation at fixed temperatures: 18 years, operating at 50°C, 11 years, operating at 55°C and 7 years, operating at 60°C.
(3) The status of the capacitor lifespan can be monitored through the module's webserver in the "Information" page, "Power off data retention" field.

Ports and Communication Channels

Ethernet Port

Communication rate	10/100Mbits
Standard	IEEE 802.3u
Isolation	SN < 7000: 150 Vrms SN >= 7000: 1500 Vrms
Operation Mode	Full-duplex
Connector	RJ45 with shield*

* Grounded to the rail used for fixing the rack in which the DF63 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)*	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 DF63 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

* Grounded to the rail used for fixing the rack in which the DF63 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. 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 Signal	Yes
Hot Swap	Yes
Redundancy in the bus access	Yes, but only using DF78 or DF92 rack

Typical start-up time, from power-up to H1 start-up

SN < 7000	30 s
SN >= 7000	90 s

Module Features:

Processor

Serial Number	SN<7000	SN>=7000
CPU	Family ARM7TDMI	ARM Cortex™-A9, 800 MHz
Bus	32bits	32 bits
Architecture	RISC	RISC
Performance	40 MIPS	2000 DMIPS
CPU Cache	8kbytes	L1 Instruction Cache: 32K L1 Data Cache; 32K L2 Cache: 512K
Clock	40 MHz	800 MHz
DMA	10 channels	-
Ethernet	MAC 10/100 integrated	MAC 10/100 Automated polarity detection and correction
Watchdog	Yes (200ms of cycle)	Yes (30s of cycle)
Operation Voltage	3.3V for I/O	3.3V

Module

Operation Voltage	5V (± 5% of tolerance)
Typical Current	550 mA (SN<7000) 566 mA (SN>=7000)
Real Consumption	2.75 W (SN<7000) 2.83 W (SN>=7000)
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)

Electrical Certification*

DF63 follows the immunity test specification to equipment to industrial installation, as IEC61326:2002 standard.
Enclose

Electrostatic discharge (IEC61000-4-2)	4 kV/8 kV contact/air
EM field (IEC61000-4-3)	10 V/m
Rated power frequency magnet field (IEC61000-4-8)	30 A/m

AC power

Voltage dip/short interruptions (IEC61000-4-11)	0,5 cycle, each polarity/100%
Burst (IEC61000-4-4)	2 kV
Surge (IEC61000-4-5)	1 kV/2 kV
Conducted RF (IEC61000-4-6)	3 V

DC power

Burst (IEC61000-4-4)	2 kV
Surge (IEC61000-4-5)	1 kV/2 kV
Conducted RF (IEC61000-4-6)	3 V

I/O signal/control

Burst (IEC61000-4-4)	1 kV
Surge (IEC61000-4-5)	1 kV
Conducted RF (IEC61000-4-6)	3 V

I/O signal/control connected directly to power supply

Burst (IEC61000-4-4)	2 kV
Surge (IEC61000-4-5)	1 kV/2 kV
Conducted RF (IEC61000-4-6)	3 V

Emission Rate

Enclose:

30 to 230 MHz (CISPR 16-1, CISPR 16-2)	40 dB (uV/m) quasi peak, measured at 10m distance
239 to 1000 MHz (CISPR 16-1, CISPR 16-2)	40 dB (uV/m) quasi peak, measured at 10m distance

AC mains:

0.15 to 0.5 MHz (CISPR 16-1, CISPR 16-2)	79 dB (uV) quasi peak 66 dB (uV) average
0.5 to 5 MHz (CISPR 16-1, CISPR 16-2)	73 dB (uV) quasi peak 60 dB (uV) average
5 to 30 MHz (CISPR 16-1, CISPR 16-2)	73 dB (uV) quasi peak 60 dB (uV) average

*SN >= 7000 - Tests pending

Note: For most recent updates, please consult Smar website https://www.smar.com.br/en

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