



## CONTROLLERS DATASHEET

# DF63

## HSE/Foundation fieldbus Controller



# 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.



### 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 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

|                      |          |
|----------------------|----------|
| Volatile Memory      | 8 Mbytes |
| Non-Volatile Memory  | 4 Mbytes |
| EEPROM               | 1 kbyte  |
| Flash to the program | 4 Mbytes |
| Flash to monitor     | 2 Mbytes |

### 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)**<br>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);<br>10.5 ms/Kbytes of program (typical). |

\* The whole number of points includes inputs and outputs, analog or digital. 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.

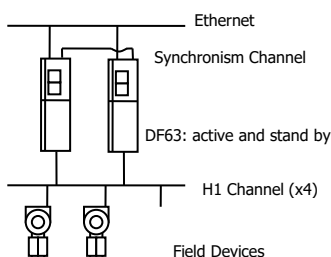
### Redundant Operation

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:

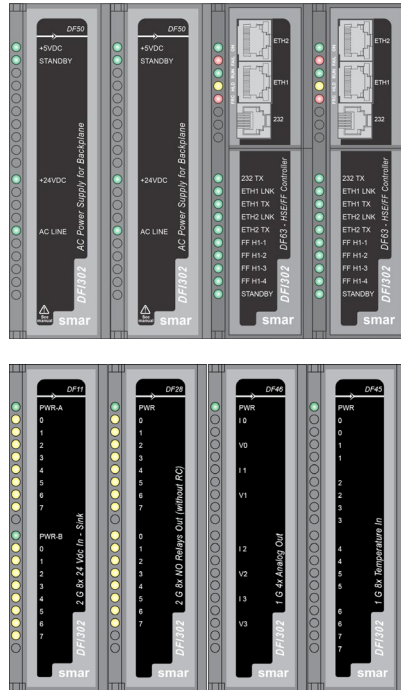
- LAS Redundancy
- H1 and HSE Block Redundancy
- H1 and HSE link Redundancy (to devices that use flat address)
- Ladder Redundancy
- Supervision Redundancy

Topology to interconnection of DF63 in redundancy:



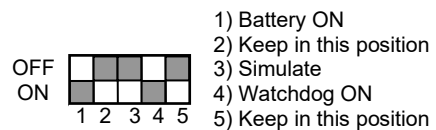
### Redundancy General Characteristics

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:



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 | 10/100Mbps        |
| 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 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 |

## 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 ( $\pm$ 5% of tolerance)  |
| Typical Current                         | 550 mA                       |
| Real Consumption                        | 2.75 W                       |
| Environment Air Temperature (Operation) | 0 to 60° C (IEC 1131)        |
| Storage Temperature                     | -20 to 80° 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<br>(IEC61000-4-4)        | 2 kV      |
| Surge<br>(IEC61000-4-5)        | 1 kV/2 kV |
| Conducted RF<br>(IEC61000-4-6) | 3 V       |

## I/O signal/control

|                                |      |
|--------------------------------|------|
| Burst<br>(IEC61000-4-4)        | 1 kV |
| Surge<br>(IEC61000-4-5)        | 1 kV |
| Conducted RF<br>(IEC61000-4-6) | 3 V  |

## I/O signal/control connected directly to power supply

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

## Emission Rate

## Enclose:

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

## AC mains:

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

Note: For most recent updates, please consult Smar website  
[www.smar.com](http://www.smar.com)

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