

Engineer^{IT}
Control Builder F

Engineering Manual

Process Station - FieldController



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Engineering Manual

Process Station – FieldController

Contents

Notes on this manual	5
1 General	7
1.1 Introduction	7
1.2 System summary	7
2 Loading the operating system and EPROM'S	9
2.1 Bootstrapping the Boot-EPROM's	9
2.2 Loading the operating system.....	10
2.3 Loading the EPROM's of Profibus modules	10
3 Configuration of resource D-PS in project tree	11
3.1 Inserting a D-PS resource	12
3.2 Inserting a task.....	12
4 Processing and failure action	13
4.1 Automatic error handling at task level	13
4.1 Task error messages	14
4.2 Task error characteristics.....	15
4.3 Startup and Shutdown Performance of the Modules	16
4.4 Power fail signal (PF) and no power fail	16
4.5 Power fail signal (PF) and power fail	16
4.6 Safety values for field devices	16
5 Configuration of the FieldController in the hardware structure	17
5.1 Inserting Process Station FieldController	17
5.2 Inserting modules in the FieldController	18
5.3 Parameterization of the FieldController	19
5.3.1 Module data of the FieldController	20
5.3.2 FieldController Boot Parameters	21
5.4 FieldController Modules	24
5.4.1 Power supply modules DFP 01 / DFP 02.....	24
5.4.2 Ethernet modules DFE 01, DFE 02, and DFE 03	25
5.4.3 Battery module DFA 01	25
5.4.4 Profibus module DFM 01	25
5.4.5 Serial Interface module DFM 02.....	25
5.4.6 CAN module DFM 03.....	26
5.5 Diagnostic data for objects	26
5.5.1 STA Error codes	27

6	Commissioning of the FieldController	28
6.1	Operating via resource FieldController	28
6.2	Task	29
6.2.1	Process image display	30
6.3	Program list (PL).....	31
6.4	State displays in the project tree	32
6.4.1	Resource state displays	33
6.4.2	Resource state diagram	35
6.4.3	Task state displays	36
6.4.4	Task state diagram	37
6.4.5	Program list state displays	37
6.5	State displayed in the hardware structure.....	38
6.5.1	State in the tree view	38
6.5.2	Module state in the system and station views	39
6.5.3	State of the basic unit.....	40
6.5.4	Status of the FieldController modules.....	40

Notes on this manual

To grant direct access to information, we have used different types of scripts and symbols.

Script

Meaning

Italics

Representation for (selectable) menu items or parameters.

SMALL CAPITALS

Inputs to be made via the keyboard, also via virtual keys.

boldface

Highlights important information, also as an orientation hint.

Symbols

Meaning



Cross-reference to another Freelance manual.



Selection with mouse. The various instruction steps are separated by arrows.

Example: → *Edit* → *Insert Below* →

In this example, the menu item *Edit* is to be selected, followed by the menu item *Insert Below*.



Operating alternative with the mouse.



Information on operation with the keyboard, inasmuch as it differs from the Windows Standard.

Example: Select module → ALT → E → D →

Having selected the module via the ARROW KEYS, the keys ALT, E and D must be pressed successively.

If two keys are to be pressed simultaneously:

... → SHIFT + INSERT →



Alternative keyboard operation



Hints



Warnings and special hints, must be observed!

1 General

1.1 Introduction

The FieldController is a Controller which, along with its add-ons, offers a straightforward and successful way into Fieldbus systems.

- Reading in and expanding configuration information from new field devices
- Configuring devices via parameter-definition masks and using pre-defined I/O structures
- Showing bus cycle times and diagnostic data from devices
- Searching the bus for subscribers with unknown device addresses
- Removing individual devices from the cyclic communication
- Incorporating new devices without having to initialize the bus line

You can perform the necessary configuration and commissioning tasks from your PC using just a single software tool: Diagnoses are performed in graphic interfaces. In addition the Engineering Software offers extensive diagnosis options right down to the field devices.

Your automation task is configured in graphic editors as per IEC 61131-3 and loaded online into the FieldController.

So that you can easily display and operate your process, high-performance display packages such as DigiVis and Maestro NT are also available for the FieldController.

1.2 System summary

The System bus (**Ethernet**) links the individual stations. It transmits data between the FieldControllers, the operator stations, the engineering station and the process stations via coax. or fiber-optic cables.

The Process station bus (**CAN**) connects a maximum of five I/O units to the FieldController. It is used to transmit the input/output values from the FieldController to the I/O modules. For this purpose, the FieldController is equipped with fieldbus module DFM 03 .

The serial interface **Modbus** connects subsystems – e.g. balances, bar code readers, etc. – to the system, preferably via the RS485 interface. Module DFM 02 provides two channels to the FieldController to enable serial interfacing.

The **engineering station** is a PC or laptop with MS-Windows NT 4.0 and the **DigiTool** software package. It is used by the operator for system configuration, documentation, and commissioning. After these tasks have been completed, the engineering station can be disconnected and used for other purposes.

The **operator station** is a PC with MS-Windows NT 4.0 and the **DigiVis** software package. It is recommended to use an industrial PC. Besides a 17" or 21" color monitor, standard keyboard and mouse, several components to IP 65 are available on request. A maximum of two printers for message and report printing can be connected.

The **FieldController** consists of:

- the housing with CPU board and module slots,
- the power supply module,
- at least one Ethernet module,
- a maximum of four fieldbus modules

There are different variants of the fieldbus modules for:

Profibus DP

Modbus

CAN

The following modules are currently available for the FieldController:

- Power supply modules
 - DFP 01 : input voltages from 115 ... 230 V AC
 - DFP 02 : redundant DC voltage 24 V DC
- Ethernet modules
 - DFE 01 : 10Base2 module (Cheapernet) for ThinCoax type coax. cable
 - DFE 02 : AUI module for connecting transceivers for 10Base5, 10Base2, 10BaseT, 10BaseFL or star coupler units
- DFE 03 : 10/100BaseTP module for Shielded Twisted Pair cables
- Fieldbus modules
 - DFM 01 : Profibus DP module for direct operation of Profibus field devices
 - DFM 02 : Serial module, 2 channels, protocols available : MODBUS, Sartorius scale protocol, continuously being expanded
 - DFM 03 : CAN module, 3 channels, protocols available : DigiNet P
- DFA 01 : Battery module for redundant battery back-up

The FieldController fieldbus modules are driven by the CPU board in the FieldController housing. The data transmitted by the fieldbus modules is processed according to the configured link modules and then transferred to the operator station via the Ethernet modules and the DigiNet S system bus. The processing results are then output via the fieldbus modules and transferred to the fieldbus devices.

By means of CAN module DFM 03 the FieldController can use the Freelance 2000 I/O units. Process station bus (CAN) links the I/O units to the FieldController. A maximum of five I/O units can be connected to the DFM 03 module.

When the FieldController is fully equipped (as described here), 45 slots are available in the I/O units for accommodating Freelance 2000 I/O modules. The three FieldController fieldbus slots remaining can be used for connecting other fieldbusses.

2 Loading the operating system and EPROM'S

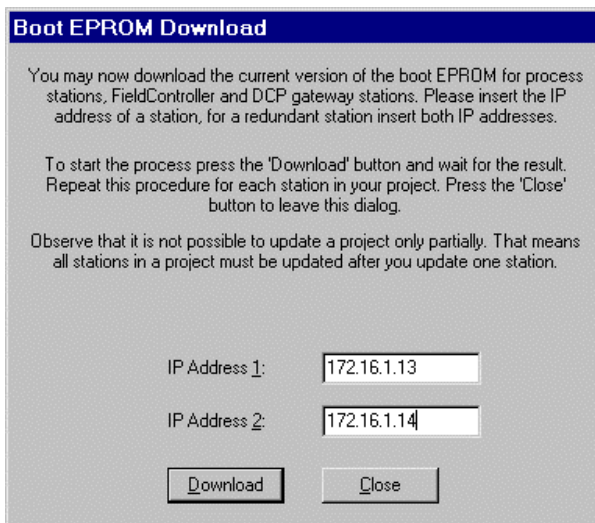
2.1 Bootstrapping the Boot-EPROM's

The Boot-EPROM version on the FieldController must match the software version of the engineering software. The Boot-EPROM can be updated during installation using DigiTool, although an update can also be carried out later using DigiTool Configure.

This requires the TCP/IP protocol to be loaded and the presence of an Ethernet link to the FieldController.



Task Bar → Start → Programs → Freelance 2000 Tools → DigiTool Configure



fc004gr.bmp

LOAD The current version of Boot-EPROM's and the operating system is loaded on the FieldController using the relevant set IP address(es).


END Ends update of EPROM's and finishes installation of DigiTool version.

If you have several FieldControllers, you must perform this procedure for each FieldController.

2.2 Loading the operating system

The operating system can be loaded by **bootstrap** via the system bus into the station.

Requirement It is necessary that no operating system be present in the FieldController (RUN/STOP Led off). If necessary a **general reset** must be performed beforehand.

 The initial loading of the operating system (bootstrapping) takes place automatically when a boot EPROM is first loaded via *load boot EPROM*. It can also, however, be carried out separately from user program loading after **initialize all**. It is not necessary to load the operating system into the Secondary, as loading the Boot-EPROM means that the operating system has already been loaded and it is not deleted in the Secondary when a general reset is carried out.

2.3 Loading the EPROM's of Profibus modules

Profibus module EPROM's can be reprogrammed using software. When this is performed, the complete FieldController is initialized and the outputs of connected I/O modules and field devices are reset.

The EPROM is loaded using DigiTool configure, and all the DFM01 Profibus modules are always loaded.



Loading a more recent EPROM version from Profibus modules can only ever be carried out for the whole FieldController. The whole FieldController is initialized in the process.



DigiTool Configure → *Load Profibus Module EPROM!* → Enter IP address of FieldController → Repeat load operation for each FieldController

Load Profibus Module EPROM

You may now load the current Profibus module EPROM version. Please insert the IP address of the FieldController, for a redundant station insert both IP addresses.

To start the process press the 'Update' button and wait for the result. Repeat this procedure for each FieldController with Profibus modules in your project. Press the 'Close' button to leave this dialog.

Attention: The FieldController will be initialized and the current project on the FieldController will be deleted!

IP Address 1:

IP Address 2:

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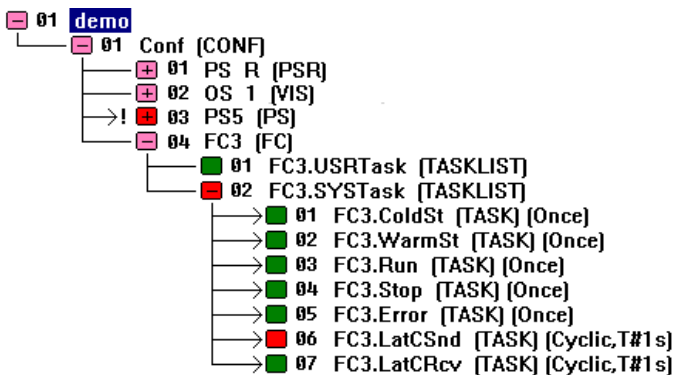
3 Configuration of resource D-PS in project tree

The software components of a project are clearly displayed in the project tree. The individual elements or objects, commonly known as **project elements**, are structured in accordance with IEC 6113 – 3. **D-PS resources (process station)** are used for the actual editing process, **D-LS resources (control station)** or **D-GS resources (gateway station)** are used to operate and observe the process and the **OPC server** resource is used to incorporate data from other systems.

The resources in the project tree must be allocated in the hardware structure (hardware manager) to the hardware objects. This step determines which software programs are processed in which process, control or gateway stations.

The process station resource represents an FieldController, on which the **resource** and the tasks and programs allocated to the resource are processed. Allocation to the physical stations is carried out in the hardware manager. Here process stations (PS) for rack-based systems and Field-Controllers can be selected for connection of fieldbus modules.

In the project tree the abbreviation **D-PS** indicates that allocation to a physical station has not yet taken place in the hardware manager. Following allocation the allocated station type **FieldController** is displayed.



fc008us.bmp

3.1 Inserting a D-PS resource



Select target position of new process station

→ *insert over*

a new process station can be inserted **over** the selected object

→ *Insert under*

a new process station can be inserted **under** the selected object

→ *Insert next level*

a new process station can be inserted one level deeper

The target position can be located at the next level below the configuration element or (only in the case of next level insertion) on the configuration itself.



→ on target position and press left mouse button → OK

3.2 Inserting a task

In the process station the actual programs run into the task. The programs are edited either using Instruction Lists or Sequential Function Chart.

4 Processing and failure action

4.1 Automatic error handling at task level

Error handling at task level is described in the flow chart ([page 37](#)).

When an error is identified in a user program, an error task is executed once. The error- task is the highest priority task (priority 100) of a resource and is used to handle errors in user programs by user programs. In the case of non-recoverable errors, the error-generating task changes to the unrunnable state; in the case of recoverable errors it is possible to continue running the error-generating task, provided the automatic error correction for the D-PS resource is switched on. Owing to its high priority it cannot be interrupted by other tasks. Execution of the error task can be suppressed.

Error handling at task level is switched on by default but can be deactivated in the resource configuration (see **Engineering Manual, System Configuration, Project tree**). When deactivated, an error causes the task to change to the unrunnable state, even if the error is recoverable. The error appears in text form in the task header and the object number of the faulty project object is also displayed.

If automatic error handling is active and a recoverable error is detected, the affected task remains in the running state. In this case, the error condition is ascertainable only by evaluation of the system variables.

Each runtime error detected during execution of a command results in an entry recording the cause and location of the error in system variables specially predefined for error handling. The cause of the error, e.g. 4 for UINT div. by 0, is saved in the variable "ErrorNo". The variable "ErrorProgra" is written with the object number of the program or function block that caused the error. Furthermore, the object number of the affected task is saved in the variable "ErrorTask," but only displayed in the task header if error handling is deactivated. The affected object can then be localized in the object list with its name, state, type and position in the project tree. If the affected task, the one which triggered the error, is not the error-handling task, the error-handling task itself is now triggered. Error handling specific to the cause of the error and/or its location can be undertaken in this task, with the aid of the system variables.

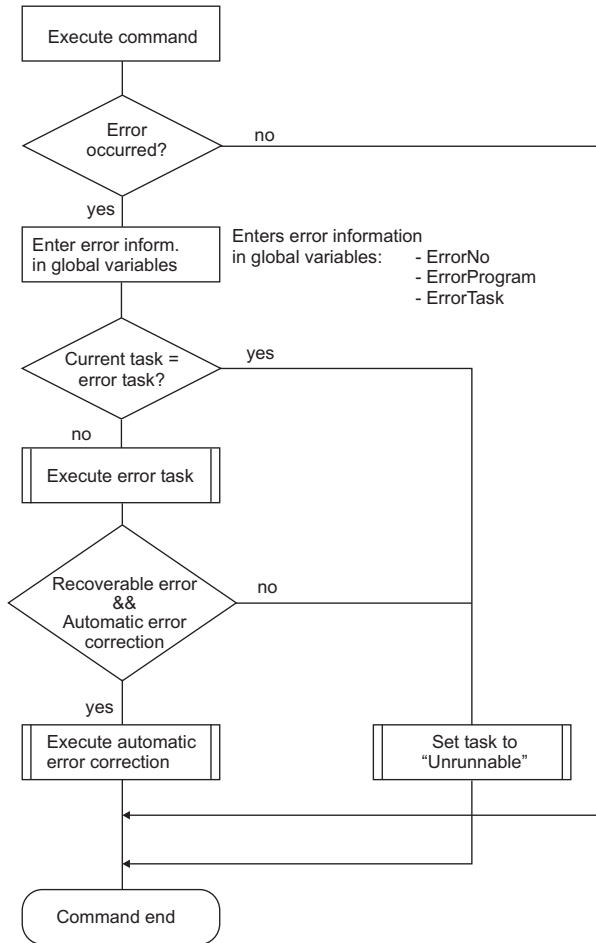
If an error should occur in the error-handling task itself, the error-handing task is signaled as **unrunnable**.

See also **Engineering Manual, IEC 61131-3 Programming, Variables, System Variables**.

4.2 Task error messages

ErrorNo	Error text in status field	Description
1	INT/DINT overflow	Signed integer or time operation caused overflow
2	INT/DINT underflow	Signed integer or time operation caused underflow
3	INT/DINT div. by 0	Signed integer division by zero
4	UINT/DINT div. by 0	Unsigned integer division by 0
5	INT/DINT save overflow	On storage, a signed 16-bit-integer operation caused overflow
6	REAL overflow	Real operation caused overflow
7	REAL underflow	Real operation caused underflow
8	REAL div. by 0	Real division by zero
9	REAL invalid value	Real operation with undefined value
10	DT overflow	Operation with DT and TIME caused overflow
11	DT underflow	Operation with DT and TIME or DT and DT caused underflow
12	UINT/UDINT overflow	Unsigned integer operation caused overflow
13	UINT/UDINT underflow	Unsigned integer operation caused underflow
128	Program exec error	An object not loaded (program, function block etc.) is to be executed
129	FB error integer	A function block from the function block library has triggered an integer overflow or underflow, the error can only be detected following execution of the block and thus no recovery is possible.
130	FB error real	A function block from the function block library has triggered a REAL overflow or underflow, the error can only be detected following execution of the block and thus no recovery is possible.
131	Process image read error	On reading the process image an unrecoverable error has occurred
132	Process image write error	On writing the process image an unrecoverable error has occurred.

4.3 Task error characteristics



Error messages

Recoverable errors		Unrecoverable errors
1 INT_OVERFLOW	8 FLOAT_DIV_BY_ZERO	128 PROGRAM_EXECUTION_ERROR
2 INT_UNDERFLOW	9 FLOAT_NAN_VALUE	129 INT_FB_ERROR
3 INT_DIV_BY_ZERO	10 DT_OVERFLOW	130 FLOAT_FB_ERROR
4 UINT_DIV_BY_ZERO	11 DT_UNDERFLOW	131 PROZABB_READ_ERROR
5 INT_STORE_OVERFLOW	12 UINT_OVERFLOW	132 PROZABB_WRITE_ERROR
6 FLOAT_OVERFLOW	13 UINT_UNDERFLOW	
7 FLOAT_UNDERFLOW		

di1503us.eps

4.4 Startup and Shutdown Performance of the Modules

A signal for connection monitoring is continuously exchanged between I/O modules and the FieldController CPU of the process station or FieldController. If this signal does not appear for more than 250 ms (for 500 kbit/s) and/or 1,25 s (for 100 kbit/s) both sides detect the interruption of the connection. The FieldController sends a system message to the operator station and the output modules adopt the safety values. Dependent on the requests of the process the safety values can be configured as "Hold the last value" or to a particular value/state.

A cold process station or FieldController start always leads to output of the safety values.

For "Load whole station" and at resource Initialization/Overall reset, the output levels of the output modules go to zero current.

4.5 Power fail signal (PF) and no power fail

PF < 15 ms While PF signal is active, the CPU module of the process station or the FieldController does not communicate actual values; I/O modules maintain the last values.

PF > 15 ms I/O modules maintain the last values until they have recognized the interrupted connection with the CPU module or FieldController; they then adopt the configured safety values. Safety values are maintained until the CPU module or FieldController has executed a warm start and sends new values to the I/O modules.


4.6 Power fail signal (PF) and power fail

I/O modules maintain the last values until they have recognized the connection interruption and then adopt safety values until the CPU module or FieldController sends actual values after restart. In the case of power fail of the I/O module, output levels adopt zero voltage and/or zero current.

After voltage return I/O modules only change their output level when the CPU module or FieldController communicates actual values. Analog output modules are an exception. They hold the last values as long as external voltage supply does not fail. Outputs are only deenergized if the CPU module or FieldController is supplied with voltage.

4.7 Safety values for field devices

The cyclic exchange of data between Profibus master and the connected slaves is monitored. When the cyclic exchange of data is interrupted, safety values can be assumed. The definition of safety values for output channels is vendor-specific. For input channels, depending on the requirements of the process, the safety values can be configured to "Hold last value" or a specific value or state.

 A possible power failure can be evaluated using a system variable and utilized in the user program.

5 Configuration of the FieldController in the hardware structure

Within the hardware structure the resources defined in the project tree are allocated to the hardware actually required. The D-PS resource stands for a process station.

The fieldbus-based process station consists of an **FieldController**. The FieldController takes the fieldbus modules and makes it possible to connect various fieldbusses. The FieldController basic unit consists of the case and the main board, which together form a unit which can be equipped with various modules. The module for the power supply and an Ethernet module for connection to the DigiNet S system bus are essential. Both modules are available in various designs. The FieldController can be equipped with a maximum of 4 fieldbus modules selected from CAN, Profibus and serial modules.

The CAN module allows connection of a maximum of 5 I/O units and thus the connection of 45 I/O modules in the same way as they are used in the conventional Freelance 2000 D-PS process station.

Each Profibus module allows the connection of a Profibus line, i.e. the connection of a maximum of 125 slaves. Each of these slaves can also be modular, i.e. contain a maximum of 64 modules.

The serial module has 2 interfaces which can be occupied as preferred either with the Modbus master interface protocol, the Modbus slave interface protocol, the telecontrol interface protocol, the Protronic interface protocol or the Sartorius scale interface protocol.



fc009us.bmp

5.1 Inserting Process Station FieldController

The process station FieldController can be inserted in the system in either the tree view or the system view. After INSERT, the object appears in both the tree view and the system view.



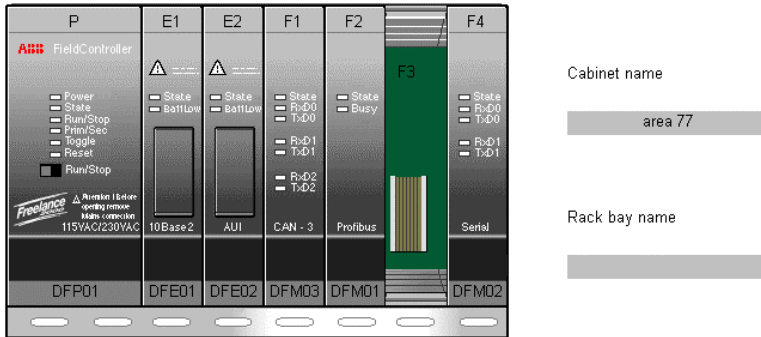
- Select system object (HWSYS) in the tree view → *Edit* → *Insert*.
- Select station type → Select an insertion position



- Select station position (1 -10) in the system view → Double click

5.2 Inserting modules in the FieldController

Modules can be inserted in the FieldController in either the tree view or the station view. After *Insert*, the object appears in the tree view and the station view as well as in the system view I..



fc012us.bmp

The station view of the FieldController shows the basic unit with the P slot for the power supply module, E1 and E2 slots for the Ethernet modules and F1 to F4 for the fieldbus modules.



- Select FieldController (FC) in the tree view → *Edit* → *Insert*.
- Select module type → Select a free slot



- Select slot (P, E1-E2, F1-F4) in the station view → Double click

The following modules are available :

DFP 01	Power supply 115 V AC / 230 V AC
DFP 02	Power supply 24 V DC
DFA 01	Battery module
DFA 02	Debug module
DFE 01	Ethernet module 10Base2 (Cheapernet)
DFE 02	Ethernet module AUI
DFE 03	Ethernet module Twisted Pair
DFM 03	CAN-3 module
DFM 02	Serial module
DFM 01	Profibus module

When inserting a new object it is given a default name which represents the installation point. When copying an object the name will adapt to the new position. When moving the existing name will remain the same.

S:F1 DFM01 (DFM01_4_F1)

S:	Slot
DFM01	Module type, Profibus module here
(DFM01 1_4_F1)	Default name with station position 4, slot F1

5.3 Parameterization of the FieldController

The FieldController takes the fieldbus modules, thus enabling several fieldbusses to be connected to this station, including different ones.

The station must be allocated to a resource (D-PS). This defines which software part of the user program runs on which process station.

See also **Engineering Manual, System Configuration, Hardware Structure.**

5.3.1 Module data of the FieldController

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The module service data is only displayed during commissioning if a communication connection to the process station or FieldController exists at the same time.

See also **Engineering Manual, System Configuration, Commissioning.**

<i>Serial number</i>	Displays the sequential serial number from production.
<i>Hardware version</i>	Displays the hardware version of the FieldController.
<i>Software version</i>	Displays the I/O EPROM version.
<i>Operating hours (total)</i>	Displays the total number of operating hours.
<i>(Excess temp.)</i>	Displays the number of operating hours at excess temperature (excess temperature in FieldController means : over 70 °C).
<i>Location</i>	Allocated resource

These values are only available in commissioning mode.
In the commissioning mode the "Firmware update" button appears for loading the firmware into the Flash EPROM.

Rack location

<i>Cabinet name</i>	Optional text details of cabinet identifier for FieldController
<i>Rack bay name</i>	Optional text details of rack bay identifier for FieldController

5.3.2 FieldController Boot Parameters

The screenshot shows the 'FieldController (DFC02)' configuration window. It has a title bar with a close button. The window is divided into several sections:

- General Data:** Contains 'Name' (FC6), 'Short text', and 'Long text' fields.
- Module Data:** A tabbed section with 'Boot Parameter' selected.
 - I/O Bus (CAN):** Includes an 'Enable' checkbox (checked), 'Transmission rate' (radio buttons for 500 Kbit/s and 100 Kbit/s), and 'I/O protocol' (radio buttons for Redundant and Not redundant).
 - Memory:** Includes 'Max. no. of Objects' (3000) and 'Configuration data (PRAM)' (900 KB).
 - System Limits:** Includes 'Max no. of user tasks' (3), 'Number of VIS' (7), and 'Number of GWY' (3).
 - Tasks:** A table with columns 'Reserved' and 'Required'.

	Reserved	Required
Network buffer:	20	
Interface objects:	20	
- Buttons:** A row of buttons: OK, Cancel, Save, Reset, Check, Help. Below them is a 'Firmware Update' button.

fc003us.bmp

Memory

These parameters affect the allocation of memory within the process station. When there are an extremely large number of objects in the FieldController, errors may occur on loading the objects; these settings may be altered to try to make the project loadable.



Under normal circumstances the boot parameters should not be changed. If they are changed, then the resource is initialized when the modified boot parameters are loaded.

Attention should also be paid to the system variables PRAM_Free and RAM_Free after loading. If the variable PRAM_Free has a value of 0, then the value of PRAM_Size must be increased; if the variable RAM_Free is set to 0, then both PRAM_Size and the maximum number of objects must be reduced.

The FieldController has 4 Mbytes memory. The memory is subdivided into different parts as listed below.

The following are filed in the Flash memory :

- Operating system
- Boot-EPROM

The RAM memory is divided into sections ::

- object directory
- PRAM
- object data
- communication management

The memory for the objects, memory for PRAM can be adjusted in the boot parameters of the resource.

Any surplus memory is made available in RAM. There is no absolute limit on the memory ranges that can be set. Whenever a limit is reached, it can be changed. This results in a reduction of free RAM.

To ascertain a suitable value for PRAM, current values can be read in commissioning mode. These values are shown in the following system variables:

PS.PRAM_SIZE	The PRAM size set in the boot parameters
PS.PRAM_FREE	The proportion of free PRAM
PS.RAM_SIZE	The amount of RAM in use
PS.RAM_FREE	The proportion of free RAM

*Max. no.
of objects*

The maximum number of objects that can be loaded on the resource

*Configuration
date (PRAM)*

Memory size in Kbytes that is reserved for the configuration data. This memory area is cold-start resistant.

Tasks

Communication management parameters. Every communication link requires internal system resources such as additional memory or system objects.

*Network buffer
Interface*

Area of memory in Kbytes that is reserved for the communication links.

objects

Maximum number of objects that can be reserved for interfaces.

Communication link	Required no. of interface objects
Link module DCO01	1
Tele Control Library	4
Profibus Master	2
Profibus Slave	0
Modbus Master	2
Modbus Slave	2
Protronic / Freelance 100	1
Sartorius	1
Send	1
Receive	1
Interbus Send	1
Interbus Receive	1

I/O bus (CAN)

Enable

This configures the usage of slot F1 in the FieldController. If a CAN module is installed in that slot, then the CAN bus must be activated here. If any other module is installed in slot F1, then the CAN bus must be deactivated.

Transmission rate

Select a transmission rate of 100 or 500 Kbit/s of the station bus (default 500 Kbit/s). The transmission rate is closely linked to the distance between two stations of one process station.

Transmission rate	Distance to last I/O unit
500 Kbit/s	80m
100 Kbit/s	400m

I/O Bus

Redundant

Select the I/O protocol

- Default, - I/O EPROM's capable of redundant operation must be plugged on all I/O modules.

System limits	By reducing the total number of user tasks that can be configured, it is possible to gain extra memory (approx. 12.5 Kbytes per task).
<i>Max. no. of user tasks</i>	The number of user tasks that can be configured for this resource.
<i>Number of VIS</i>	Specifies number of communication links to control stations permitted for this resource (Digivis). See also Engineering Manual, System Configuration, Project Tree, Links
<i>Number of GWY</i>	Specifies number of communication links to gateways permitted for this resource (e.g. DDE, OPC). See also Engineering Manual, System Configuration, Project Tree, Links

Object data: FieldController

Name	Data type	Comment
Diagnostic data		
TMP	BOOL	Excess module temperature
BTL	BOOL	Low battery voltage
ERR	BOOL	Module is defective
STA	UDINT	Bit-coded error

5.4 FieldController Modules

5.4.1 Power supply modules DFP 01 / DFP 02

Power supply for the FieldController. The module must be mounted in every basic unit and installed in slot P (first slot on the left side of the basic unit).

There are two different versions, the DFP 01 power supply module for 115/230 V AC and the DFP 02 power supply module for 24 V DC and redundant power supply, which meets stricter requirements for the availability of the power supply.

For further parameter information and object data, see **Parameterization of the FieldController, page 19** and **Diagnostic data for objects, page 26**.

5.4.2 Ethernet modules DFE 01, DFE 02, and DFE 03

Ethernet connection module of the FieldController. The module must be mounted in every basic unit and installed in slot E1 or E2 (second and third slots on the left side of the basic unit). There are three different variants : Ethernet module DFE 01 with 10Base2 (Cheapernet or BNC), Ethernet module DFE 02 with AU1 connection and Ethernet module DFE 03 with Twisted Pair connection.

For further parameter information and object data, see **Parameterization of the FieldController, page 19** and **Diagnostic data for objects, page 26**.

5.4.3 Battery module DFA 01


Battery module of the FieldController. The module can be mounted as an add-on in every basic unit and is used for redundant battery back-up of the internal memory (RAM). The module must be installed in slot E1 or E2 (second and third slots on the left side of the basic unit).

For further parameter information and object data, see **Parameterization of the FieldController, page 19** and **Diagnostic data for objects, page 26**.

5.4.4 Profibus module DFM 01

Profibus module of the FieldController. Each Profibus module allows the connection of a Profibus line, i.e. the connection of a maximum of 125 slaves. Each of these slaves may also be modular, i.e. may contain a maximum of 64 modules. The module may be installed in slots F1 to F4.

For further parameter information and object data, see **Parameterization of the FieldController, page 19** and **Diagnostic data for objects, page 26**.

 The software version of the EPROM on the Profibus module can be updated via the DigiTool Configure Dialog. See **Engineering Manual, System Configuration, Installation DigiTool, Installation Adjustment**.

5.4.5 Serial Interface module DFM 02


Serial interface module of the FieldController. The serial module has 2 interfaces which can be equipped as preferred by the Modbus master interface protocol, Modbus slave interface protocol, telecontrol interface protocol, Protronic interface protocol or Sartorius scale interface protocol. Below the serial module, the interface objects can be configured. The module itself can be installed in slots F1 to F4..

For further parameter information and object data, see **Parameterization of the FieldController, page 19** and **Diagnostic data for objects, page 26**.

5.4.6 CAN module DFM 03

CAN module of the FieldController. The CAN module allows the connection of a maximum of 5 I/O units and thus the connection of 45 I/O modules in the way in which they are also used in the conventional Freelance 2000 D-PS process station. Below the CAN module, a CAN master must be configured.

For further parameter information and object data, see **Parameterization of the FieldController, page 19** and **Diagnostic data for objects, page 26**.

 For each FieldController, it is possible to connect only one station bus (CAN) line with maximum 5 racks. The slot of the DFM 03 module is preset to F1 and cannot be changed. If a CAN module is installed in slot F1 of the FieldController, then the CAN bus must be activated in the boot parameters of the resource. If a different module is installed in slot F1, the CAN bus must be deactivated.

5.5 Diagnostic data for objects

In addition to the I/O components of an object, certain diagnostic data can be evaluated; variables are assigned to the diagnostic components and are then evaluated in programs.

Objects	Description	Name	Data type
All	High temperature	TMP	BOOL
All	Module fault	ERR	BOOL
All	Error code	STA	UDINT
DFE 01 DFE 01 DFE 03, DFA 01	Low battery voltage	BTL	BOOL
DFA 01 DFP 01 DFP 02 DFM 03 DFM 02 DFM 01	For these modules of the FieldController, a message can only be sent if the D-FC operating system is loaded.	PFL1, PFL2	BOOL

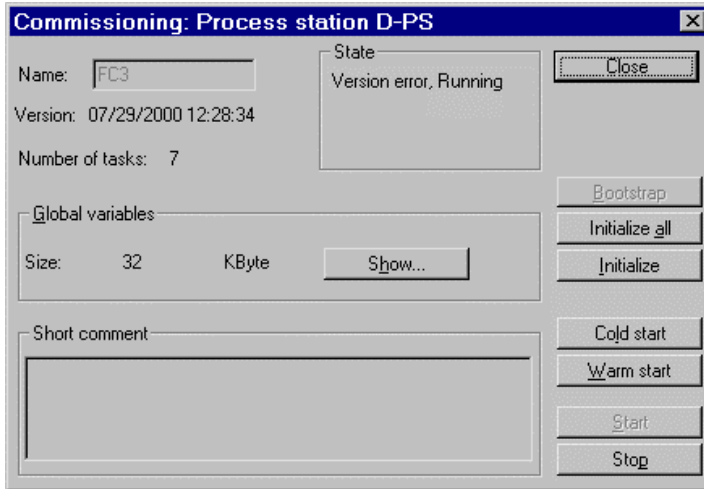
5.5.1 STA Error codes

If "Module fault" is reported for the module, correct operation of the I/O module is not guaranteed and no data are transmitted. The errors are saved bit-coded in the error code. The following are possible error causes:


Error code bit	Error code decimal	Fault	Cause
0	0	Self-test error	The I/O module has detected a non-tolerable error in its cyclic self-test
1	2	Configuration doesn't match	The configured module type doesn't match the connected I/O module.
2	4	Boot test error	Boot test of the I/O module was unsuccessful
3	8	Slot not used	The module configuration has been loaded but the module is not mounted.
4	16	Communication error	I/O module has not correctly signaled in the given period (no keep alive signal)

6 Commissioning of the FieldController

6.1 Operating via resource FieldController



fc013us.bmp

BOOTSTRAP	The FieldController is loaded with the operating system and is initialized.
	 In a FieldController there is no automatic adjustment of the operating system after the process station has been loaded! When using the FieldController a corresponding operating system version must already be loaded on this FieldController.
INITIALIZE ALL	The FieldController is deleted. General reset means that the user program is deleted. The operating system is not executed.
INITIALIZE	In the initialization, the FieldController performs a cold start. Any user program already present is also deleted. A cold start task -is performed once. The task is performed during transition from cold start or cold start stopped to running state. In a cold start all the variables and working data of the function blocks are initialized. The initial values of the variables can be pre-set individually in the Variables List for each variable. Outputs from I/O modules are set to the safety values. After the cold start task has been computed the outputs are rewritten in accordance with the programs.
COLD START	The FieldController performs a cold start.

WARM START

The FieldController performs a warm start. The formerly active FieldController reverts to Primary. A warm start task is performed once. The warm start task is performed while the resource is in transition from the warm start state or warm start stopped to the running state. It is computed before the cyclic user tasks are started. After a power failure the process station always performs a warm start when the power returns.



The number of warm starts is counted in a system variable (xxxx.NoPowerFail), which is reset to zero in the event of a cold start. The time of the last power fail signal can be read in a further system variable (xxxx.PowerOffTim).

RUN/STOP

The FieldController performs the command (Run or Stop). The LED display at the Primary indicates the current status.

6.2 Task



Select project object task → *Project* → *Header*

Commissioning: Redundant Task TASK/RED

Name: PSFRUSRTask Version: 06/22/2000 15:06:13

Number of program lists: 1

Processing

Interval mode Equidistant
 PLC mode Load optimal

Interval time: #500ms

Automatic start up Priority: 51

Overload message

Priority: - Msg. text:

Process image

Size: 8 KByte Show...

Short comment

State

Error

Not loaded

Error object

Info

Close

Start

Execute once

Stop


Reset

fc014us.bmp



If configured for autostart, the task starts automatically when the resource is started. All lower-level program lists and programs start along with the task as long as the program list parameter has been set **ON**.

Task states are explained on **page 36**. For further information on tasks **see Engineering Manual, System Configuration, Project Tree**.

START	The selected task is started. It is processed either in the cycle or as soon as possible (SPS mode), depending on configuration.
EXECUTE ONCE	The selected task is executed precisely once. Task subsequently reverts to the stopped state.
STOP	The selected task is stopped.
	Task can also be stopped by using the RUN/STOP switch on the FieldController.
RESET	Current task reverts to the configured state.
CLOSE	Exits the dialog box and returns to project tree.
SHOW...	Selected task's process image is displayed. Process image size can be configured. Process image is displayed automatically when the operating system is loaded.

6.2.1 Process image display



Select project object task → *Project* → *Header* → SHOW...

Variable n...	Type	State	Access	Offset
Value	REAL	CLEAN	WRITE	312
FPX_2_Co...	BOOL	CLEAN	READ/WRI...	310
FPX_2_Idle...	BOOL	CLEAN	WRITE	309
FPX_2_Run	BOOL	CLEAN	WRITE	308
FPX_2_Spd...	BOOL	CLEAN	READ/WRI...	307
FPX_2_Abg...	BOOL	CLEAN	READ/WRI...	306
FPX_2_Par...	BOOL	CLEAN	READ/WRI...	305
FPX_2_Run...	BOOL	CLEAN	READ/WRI...	304
FPX_2_Alt_...	BOOL	CLEAN	READ/WRI...	303
FPX_2_Run...	BOOL	CLEAN	READ/WRI...	302
FPX_2_Reset	BOOL	CLEAN	READ/WRI...	301
FPX_2_Fail...	BOOL	CLEAN	WRITE	300
FPX_2_Error	INT	CLEAN	WRITE	298
FPX_2_...

Max. memory size: 8192 Byte
 Available memory: 7868 Byte
 Largest memory block available: 7867 Byte

fc015us.bmp

Variable name		Variable name, max. 16 characters
Type		Data type, e.g. REAL, BOOL, UINT etc.
State	CLEAN	Object is correct and loaded.
	DIRTY	Object version in engineering station does not match object version in the station.
	CREATE	Object not yet loaded into station.
	DELETE	Object deleted in project database, but still present in station.
Access	READ	read-only,
	WRITE	write-only,
	READ/WRITE	read and write.
Offset		Memory address offset

See also **Engineering Manual, System Configuration, Process Image.**

6.3 Program list (PL)



Select project object program list → *Project* → *Header*

Commissioning: Program list PL [X]

Name: PSFRUSRTask [Close]

Version: 06/22/2000 15:07:18 [On]

Number of programs: 0 [Off]

Processing sequence: 1

Processing
 On

Short comment
 [Empty text area]

fc016us.bmp

Processing

- ON Selected program list is switched on, and with it all lower-level programs. All function blocks with configured processing state set to **ON** are evaluated with each task cycle.
- ON Selected program list is switched off, and with it all lower-level programs. Processing of all function blocks is terminated immediately.
- OK OK exits the dialog box and returns to the project tree.
- ON Processing of program list is switched on.
- OFF Processing of program list is switched off.

6.4 State displays in the project tree

In contrast to configuration, state information is maintained on project objects during commissioning. This state information appears after each project object in brackets (like the object types) and reflects the state of the process station. If arrows should appear before the nodes, these project objects must first be loaded or reloaded into the station because of a configuration change. An exclamation mark indicates that other objects at levels below the one so marked need to be updated because of changes in their configuration.

The color of the node in the display provides information about the effects of its configuration change on other objects. Higher-level information may also need to be updated in the station.

In commissioning, **nodes** are displayed in the same formats as in configuration.

See **Engineering Manual, System Configuration, Project Tree, Display of project object states**. The following details may appear after the object name and type. All states except **Running** are displayed in red.

6.4.1 Resource state displays

No

connection

The system bus connection has been interrupted, or **initialize all** is currently being executed, or no connection is possible, e.g. because of an invalid network address or an incorrect station number.



Any interruption in the system bus connection will be signaled after approx. 15 seconds.

No operating system

Seen when system is first switched on, or after **initialize all** of resource. No operating system means that the operating system is loaded but is not yet being executed. In the FieldController the operating system is loaded when the Boot-EEPROM is bootstrapped.



The FieldController holds the operating system in the Flash memory and in contrast to a rack-based redundant process station does not require automatic operating system adjustment, as the operating system cannot be deleted.

Stopping

Resource in transition from **Running** to **stopped**.



This state is only displayed if task processing takes a relatively long time.

Stopped [HW]

Resource has been **Stopped** by utilizing the RUN/STOP switch on the FieldController

Stopped [SW]

Resource → **Stop** was selected in commissioning

Cold start stopped


The command to cold start the resource had been initiated by the person responsible for commissioning, or from the system function „Force cold start“. Indicates self-test of the FieldController was OK, however, the RUN/STOP switch on the FieldController was in the STOP position or the resource was stopped by the person responsible for commissioning before achieving **running** state.



The cold start task, *Name.ColdSt* (where *Name* = resource name) is executed only when the resource is started (STOP to RUN). When cold starting, all the resource data is initialized. The operating system is not affected and the output module channels assume their safety values.


**Warm start
stopped**

The command to warm start the resource was initiated by the person responsible for commissioning or a power failure (power-fail signal from the power supply unit), the RUN/STOP switch on the FieldController was set to STOP or the resource was stopped before achieving **running** state by the person responsible for commissioning.

 The warm start task, *Name.WarmSt* (where *Name* = resource name) is executed only when the resource is started (STOP to RUN). When warm starting, all data and variable values of the resource are unaffected and the output module channels assume their safety values.

Starting

Resource in transition from **stopped** to **running**

 This state is only displayed if task processing takes a relatively long time.

Running

Resource started and RUN/STOP switch in RUN position

Running partially

Not all resource program objects are processing, e.g. task in stop or program list OFF

**Version error,
running**

There are user program version disparities between the active station and the assigned resource. Such disparities are displayed independently of the run state of the resource, and are therefore also displayed when stopped.

[del2]

Resource objects have been deleted, in this case, two objects

**Wrong
station number**

The station number in the FieldController does not match the station number in the hardware structure (network).

**Incompatible
EPROM version**

The EPROM version of the CPU module or FieldController does not match the software version of the engineering software.







 The boot EPROM must be updated. See **Engineering Manual, System Configuration, Installation DigiTool**.

6.4.2 Resource state diagram




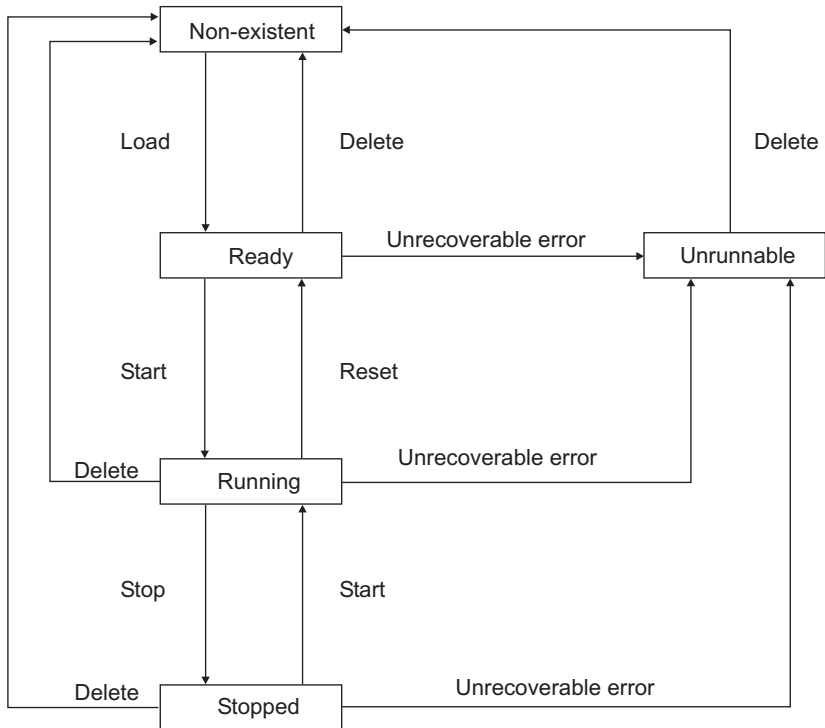
di1501us.eps

6.4.3 Task state displays

Ready	<p>Task already loaded and manual start possible.</p> <p> If no autostart has been configured for a task, it reverts to the ready state after each cold start and has to be restarted.</p>
Non-existent	<p>Task is loaded but cannot be started. A software version error exists.</p>
Not loaded	<p>A change to a task, or to a program within the task, which has a side effect on the task, has not yet been loaded.</p>
Unrunnable	<p>During execution of the task either an unrecoverable error occurred or a recoverable error occurred while automatic error correction was switched off.</p> <p> Automatic error correction for a task is switched on in the default setting. If automatic error correction is switched off, the task changes to the unrunnable state on any error, even if the error is recoverable. The error appears in text form in the task header and the object number of the faulty project object is also displayed.</p> <p> Exceptions are tasks which, although loadable, have no lower-level user program. Such a task is thus unable to initiate execution of a program, and if started nevertheless, it goes into the unrunnable state.</p>
Running	<p>After manual start of the task or when the task has been set up with Autostart.</p> <p> When a higher-level resource is stopped and re-started, the lower-level task reverts to its old state. A task with Autostart changes automatically to running. A task's state may also be changed when the resource is stopped, and the changed state will be reassumed when the resource is restarted.</p>
Stopped	<p>After execution of Stop task, Stop station (HW) or Stop higher-level resource (SW).</p> <p> If a stopped task is reset to the ready state (not visible) with Reset, no change to its state of stopped is displayed to the user. When Stop is changed to Start, the RUN task is executed.</p>
	<p>A task starts automatically if the switch on CPU module or FieldController is switched to RUN and previous state of the task was Running.</p>

6.4.4 Task state diagram

 Unrecoverable errors are errors in configuration, for example division by zero. In this case the task, and in particular the program, should be checked.



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6.4.5 Program list state displays

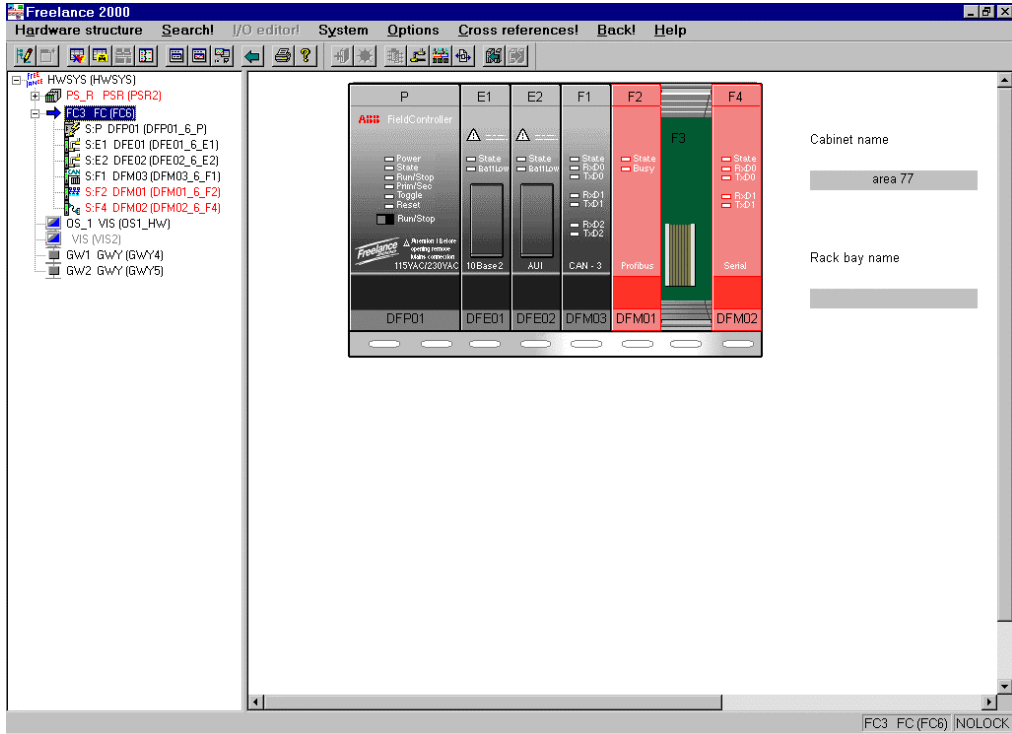
versions error	Program list was loaded but the versions do not match
not loaded	Program list is not yet loaded
On	Program list is switched on
Off	Program list is switched off

6.5 State displayed in the hardware structure

After loading the resource in the FieldController, the system or FieldController knows which modules and field devices are configured. The components (modules, devices) themselves may not have been installed yet, or the position of the installed component may not match the positions (slots) or bus addresses configured. Such errors are signaled by colored state information.



System → Hardware structure



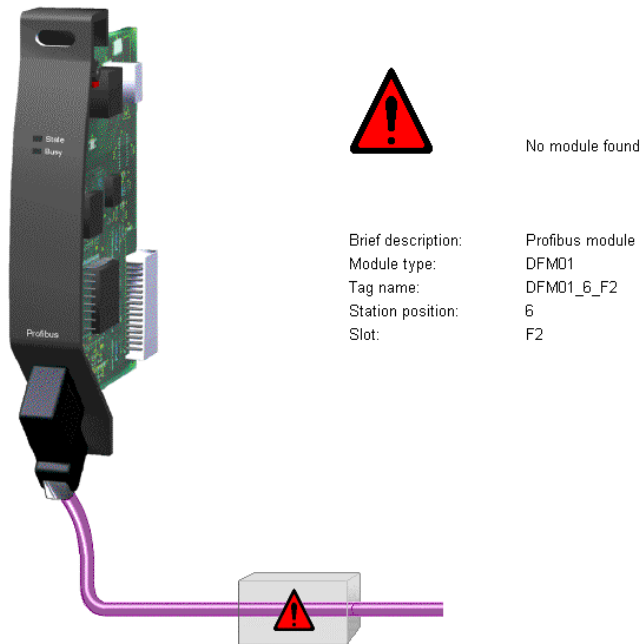
fc017us.bmp

6.5.1 State in the tree view

In the tree view, state information is shown thus: active (black), faulty (red) and inactive (gray). The color coding is applied to the object information (text) rather than the icon.

6.5.2 Module state in the system and station views

The modules in the FieldController modules are displayed in various different colors according to their current state.



fc018us.bmp

Color and state

transparent
(rear view)

There is no module configured in this slot, nor is any module installed in the station.

gray

The module is configured and the correct module type installed.

red

A module is configured in this slot, but not present in the FieldController.

yellow

A module (e.g. type DFM 01) has been detected as installed in this slot, but no configuration is available.

orange

The module type configured in the hardware structure (e.g. DFM 01) does not match the installed module type (e.g. DFM 02).

6.5.3 State of the basic unit

On insertion into the hardware structure the FieldController is displayed with its basic unit. The FieldController basic unit indicates whether the unit is active, inactive or faulty. Where a fault is indicated, this is generally due to the unit not being detected at all, i.e. not being installed or being impossible to address via the system bus.

dark gray	The basic unit is activated.
light gray	The basic unit is not activated
red	The basic unit cannot be addressed

6.5.4 Status of the FieldController modules

The **detailed picture** of the module shows more detailed information on the modules of the FieldController, so that these can be identified more easily.

The status of modules in the FieldController is marked by a colored triangle.



IP1 : No module found

fc019us.bmp

No module found (red exclamation mark)

A module is configured in this slot, but not present in the FieldController.

Wrong module type (orange exclamation mark)

The module type configured in the hardware structure does not match the installed module type

Forced channels (green exclamation mark)

At least one of the module's channels has been forced. See **Engineering Manual, System Configuration, Commissioning, Forcing inputs and outputs**.

Config fault (red exclamation mark)

The Profibus-Master has detected a configuration fault. See **Engineering Reference Manual, Communications and Fieldbuses, Profibus, Profibus-DP States**

Parameter fault (red exclamation mark)

The Profibus-Master has a detected a parameter fault. See **Engineering Reference Manual, Communications and Fieldbuses, Profibus, Profibus-DP States**

Diagnostic value detected (blue exclamation mark)

A diagnostic value has been recorded for the slave or for a module of the slave. The diagnostic value is shown in the list in the slave detail view, below the graphical representation. See **Engineering Reference Manual, Communications and Fieldbuses, Profibus, Diagnostic Data**.

Index**A**

Adding components 17

B

Battery module DFA 01 25

Boot parameter 23

C

CAN 8

 module DFM 03 26

Commissioning

 Hardware structure 38

Configuration fault 40

D

Default names

 Modules 19

Diagnosis information for modules 26

Diagnostic data 40

 FieldController 20

DigiTool 7

DigiVis 7

E

Engineering station 7

EPROM-Download 9

Error code 26, 27

 STA 27

Error handling of task 13

Ethernet module 8, 25

 DFE 01, DFE 02, DFE 03 25

F

Fieldbus module 8

FieldController 7

Forced 40

H

Hardware structure 17

I	
I/O unit.....	8
Insert	
Modules.....	18
L	
Load	
Operating system and EPROM's.....	9
Profibus module EPROM.....	10
M	
Modbus	7, 8
Module	
Detail view	40
O	
Operating system	
D-PS/FC Resource	10
Load	10
P	
Parameter fault	40
Power fail	16
signal	16
Power supply	8
DFP 01 115/230 V AC	24
DFP 02 24 V DC	24
Process image	30
Process station bus	7
Profibus DP.....	8
Profibus module DFM 01	25
Program list.....	31
S	
Serial interface module DFM 02.....	25
Service data	
FeldController.....	20
Shutdown	16
State display	38, 40
Diagnostic data detected	40
Program list.....	37
Resource.....	32
Task.....	36
Symbols	5
System bus	7

T

- Task..... 29
 - Cold start..... 28
 - Error 13
 - Error handling 13
 - Error messages 14
 - State displays 36
 - Warm start 29
- Types
 - of scripts..... 5
 - of symbols..... 5



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