

Engineer^{IT}
Control Builder F

Engineering Manual

Process Station - AC 800F



Notice

Information provided in this manual is subject to change without prior notice and represents no obligation on the part of ABB Automation Products.

The industrial standards and regulations (e.g. DIN, VDE, VDI, etc.) applicable in the Federal Republic of Germany are used. Outside the Federal Republic of Germany, the relevant national specifications, standards and regulations must be observed.

ABB Automation Products reserves all rights, especially those arising out of BGB, UWG, UrhG as well as out of industrial property rights (patents, utility models, trademarks, service trademarks and flavor samples).

The designations used and the products shown/mentioned in this manual have not been specifically marked regarding existing industrial property rights.

No part of this manual may be reproduced without prior written permission from ABB Automation Products.

Should you find any mistakes in this manual, please make a copy of the appropriate page(s) and send it/them to us with your comments. Any suggestions which may help to improve comprehension or clarity will also be gratefully accepted.

Please send your suggestions to:

Product Management Dept., DEAPR/LMS-Hannover, Fax: +49 (0)511 6782 701

Engineering Manual

Process Station – ABB FieldController 800

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 AC 800F in project tree	11
3.1 Inserting a D-PS or D-PS/RED resource.....	12
3.2 Inserting a task or redundant 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 process station AC 800F in the hardware structure	17
5.1 Inserting Process Station AC 800F	17
5.2 Process station AC 800FR redundant (new).....	18
5.3 Inserting modules in the AC 800F	19
5.4 Parameterization of AC 800F	20
5.4.1 Module data of AC 800F	21
5.4.2 Location of AC 800F	22
5.4.3 AC 800F Boot Parameters.....	23
5.5 AC 800F Modules	26
5.5.1 Power supply modules SA 801F / SD 802F	26
5.5.2 Ethernet modules EI 801F, EI 802F, and EI 803F	27
5.5.3 Battery module AM 801F	27
5.5.4 Profibus module FI 830F	27
5.5.5 Serial Interface module FI 820F	27
5.5.6 CAN module FI 810F	28
5.6 Diagnostic data for objects	28
5.6.1 STA Error codes	29

6	Commissioning of AC 800F	30
6.1	Operating via resource AC 800F	30
6.2	Task	32
6.2.1	Process image display	33
6.3	Program list (PL).....	34
6.4	State displays in the project tree	34
6.4.1	Resource state displays	35
6.4.2	Resource state diagram	37
6.4.3	Task state displays	38
6.4.4	Task state diagram	39
6.4.5	Program list state displays	39
6.5	State displayed in the hardware structure.....	40
6.5.1	State in the tree view	40
6.5.2	Module state in the system and station views	41
6.5.3	State of the basic unit.....	42
6.5.4	Status of the FieldController modules.....	42
7	Redundancy.....	43
7.1	Network configuration in the hardware structure	43
7.2	Synchronization	44
7.3	Redundancy toggle	45
7.4	Redundancy criteria	45
7.5	Status diagram of the active FieldController (Primary)	46
7.6	States of the active FieldController (Primary)	47
7.7	Status diagram of the passive FieldController (Secondary)	48
7.8	States of the passive FieldController (Secondary)	48
7.9	Technical data on Redundancy	49
7.10	Changing a Non-Redundant Process Station into a Redundant one.....	49

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 ABB FieldController 800 is an Industrial ^{IT} 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 AC 800F.

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 AC 800F.

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 AC 800F. It is used to transmit the input/output values from the AC 800F to the I/O modules. For this purpose, the AC 800F is equipped with fieldbus module FI 810F.

The serial interface **Modbus** connects subsystems – e.g. balances, bar code readers, etc. – to the system, preferably via the RS485 interface. Module FI 820F 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 **AC 800F** 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 ABB FieldController 800 :

- Power supply modules
 - SA 801F : input voltages from 115 ... 230 V AC
 - SD 802F : redundant DC voltage 24 V DC
- Ethernet modules
 - EI 801F : 10Base2 module (Cheapernet) for ThinCoax type coax. cable
 - EI 802F : AUI module for connecting transceivers for 10Base5, 10Base2, 10BaseT, 10BaseFL or star coupler units
- EI 803F : 10/100BaseTP module for Shielded Twisted Pair cables
- Fieldbus modules
 - FI 830F : Profibus DP module for direct operation of Profibus field devices
 - FI 820F : Serial module, 2 channels, protocols available : MODBUS, Sartorius scale protocol, continuously being expanded
 - FI 810F : CAN module, 3 channels, protocols available : DigiNet P
- AM 801F : Battery module for redundant battery back-up

The FieldController fieldbus modules are driven by the CPU board in the AC 800F 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 FI 810F 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 FI 810F 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

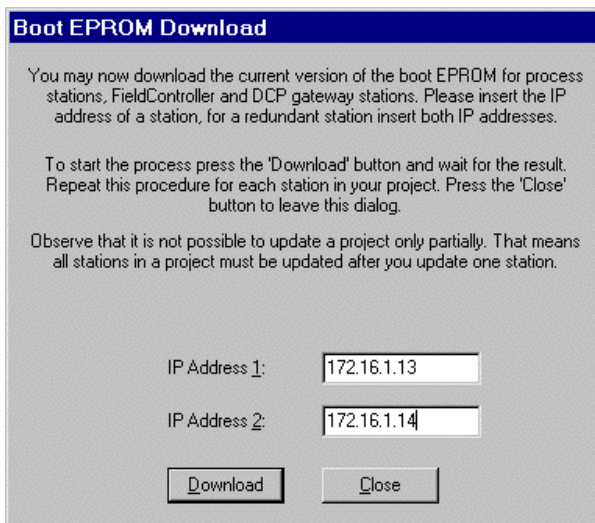
2.1 Bootstrapping the Boot-EPROM's

The Boot-EPROM version on the AC 800F 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 AC 800F.



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



ac004gr.bmp

LOAD The current version of Boot-EPROM's and the operating system is loaded on the AC 800F 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.

If you are using the FieldController redundantly (only AC 800F), enter both addresses (IP address 1 and IP address 2). The Boot-EPROM and the operating system are then loaded in both Field Controllers.

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 FI 830F 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:

ac010us.bmp

Gross Automation, 1725 South Johnson Road, New Berlin, WI 53146, www.ssacsales.com, 800-349-5827

3 Configuration of resource AC 800F in project tree

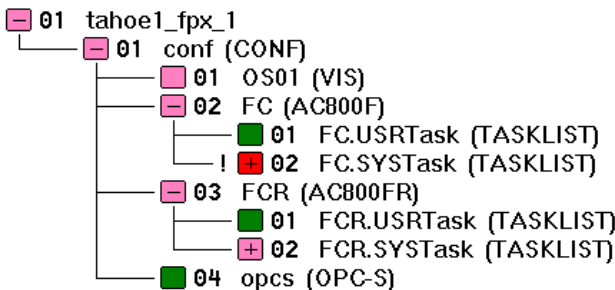
The software components of a project are clearly displayed in the project tree. The individual elements or objects, commonly known as **project elements**, are structured in accordance with IEC 6113 – 3. **D-PS resources (process station)** are used for the actual editing process, **D-LS resources (control 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 ABB FieldController 800 (AC 800F), 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 ABB FieldControllers 800 (AC800F) can be selected for connection of fieldbus modules. A distinction is made between redundant and non-redundant process stations. Thus it is already decided when inserting the resource whether the subordinate tasks and programs can be processed redundantly or non-redundantly.

In the project tree the abbreviation **D-PS** or **D-PS/RED** indicates that allocation to a physical station has not yet taken place in the hardware manager. Following allocation the allocated station type **AC 800F** is displayed or AC 800FR for the redundant FieldController.

A redundant process station type **AC 800FR** consists of two AC 800F. In each case both FieldControllers are connected via a redundancy link and appear to the user in the project tree as a process station resource. When the process station is loaded one of the two FieldControllers becomes Primary and the other Secondary. Only ever the Primary is shown in the project tree however.



ac008us.bmp

3.1 Inserting a D-PS or D-PS/RED 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 or redundant task

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

A redundant task has so-called redundancy data. These are data of the process image and of the function blocks for which a data adjustment is performed after each cycle. This ensures that a redundancy toggle can take place at any point in time.

So that the data of a redundant task are redundancy-capable, all variables of a redundant task must be written in process image mode.

Not only the redundant task (TASK/RED), but also tasks of the previous type (TASK) can be configured under the redundant resources. Thus only those functions of the user program which also actually have to be redundant need to be configured redundantly within a redundant resource.

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 39](#)).

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.

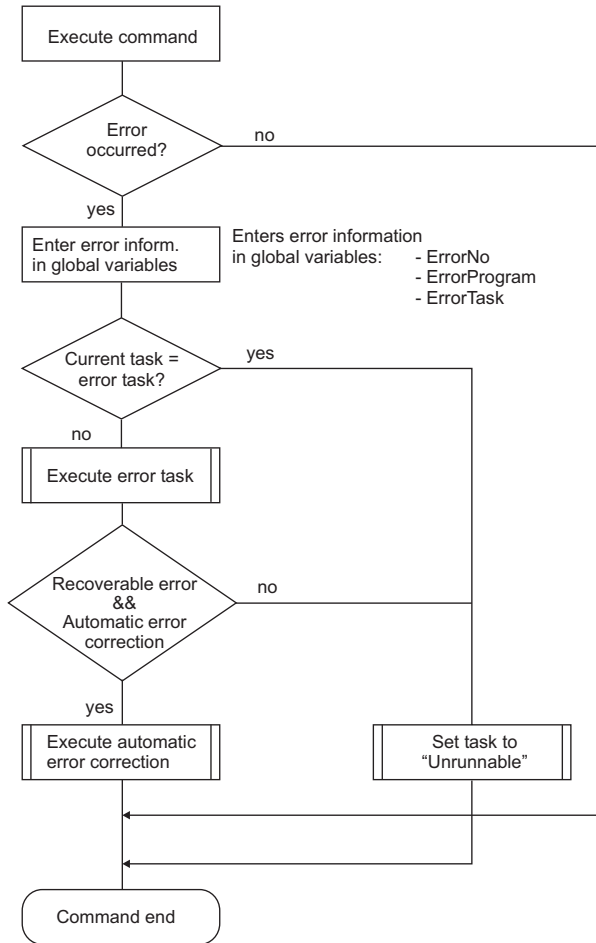
If an error should occur in the error-handling task itself, the error-handling task is signaled as **unrunnable**.

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.

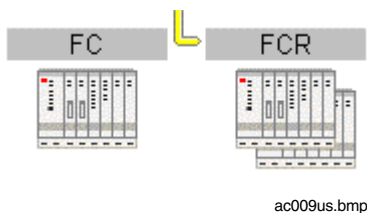
5 Configuration of process station AC 800F in the hardware structure

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 **ABB FieldController 800 (AC 800F)**. 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.



5.1 Inserting Process Station AC 800F

The process station AC 800F 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 Process station AC 800FR redundant (new)

A redundant FieldController always consists of two AC 800F. In each case both modules can be inserted in the station view of the redundant AC 800F (AC 800FR) by a simple double click. The modules can only be inserted in the upper basic unit. The lower basic unit cannot be selected. Otherwise the display is identical to the non-redundant FieldController.

The selection list of the redundant AC 800F only offers modules marked with an R at the end, e.g. FI 830FR. The R stands for redundancy-capable and simply means that the parameter dialog differs slightly from the non-redundancy-capable object. Objects with an R at the end of the type name enable both modules to be configured at the same time. Otherwise the modules for the redundant AC 800F of the HW structure are identically constructed to those of the non-redundant AC 800F and can be used or installed interchangeably.

The redundancy link between the two FieldControllers, via which the redundancy adjustment takes place, is created automatically when a second Ethernet module is inserted in the FieldController, and does not have to be configured.

 The IP address of the second Ethernet module required for redundancy data exchange must be set in the HW of both FieldControllers to IP address 15 (e.g. 172.16..1.15).

In order to differentiate clearly between the two FieldControllers, they are marked IP1 and IP2. A redundant process station or redundant FieldController is always configured with two IP addresses, IP1 indicating that the upper FieldController is operated under IP address 1 and the lower FieldController IP2 is operated with IP address 2.

Specification of IP1 and IP2 does not determine which FieldController becomes Primary or Secondary. Using the online link both the Primary and the Secondary can be located on top. See also **Page 43, Network configuration in the hardware structure.**

5.3 Inserting modules in the AC 800F

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. In each case both modules can be inserted in the station view of the redundant AC 800F (AC 800FR) by a simple double click. Insertion of the modules is only possible in the upper basic unit. The selection list of the redundant AC 800F only offers modules marked with an R at the end, e.g. FI 830FR. The modules for the redundant AC 800F are identically constructed to those of the non-redundant AC 800F. The objects in the hardware structure however are tailored for redundancy and therefore enable both modules to be configured at the same time.

IP1

P	E1	E2	F1	F2	F3	F4
ABB Power State Run/Stop Print/Sec Toggle Reset Run/Stop 115VAC/230VAC	State BoffLow 10Base2	State BoffLow 10Base2	State F-D0 T-D0 F-D1 T-D1 F-D2 T-D2 CAN - 3	State Busy Profibus	State RS-00 T-D0 RS-D1 T-D1	State RS-00 T-D0 RS-D1 T-D1 Serial
SA801	EI801	EI801	FI810	FI830	FI830	FI820

Cabinet name

cabinet 55

Rack bay name

017

IP2

P	E1	E2	F1	F2	F3	F4
ABB Power State Run/Stop Print/Sec Toggle Reset Run/Stop 115VAC/230VAC	State BoffLow 10Base2	State BoffLow 10Base2	State F-D0 T-D0 F-D1 T-D1 F-D2 T-D2 CAN - 3	State Busy Profibus	State RS-00 T-D0 RS-D1 T-D1	State RS-00 T-D0 RS-D1 T-D1 Serial
SA801	EI801	EI801	FI810	FI830	FI830	FI820

Cabinet name

cabinet 55

Rack bay name

018

ac012us.bmp

The station view of the Industrial^{IT} Controller AC 800F shows two basic units, although only the upper one can be equipped. Otherwise the display is identical to the non-redundant ABB FieldController 800 with P slots for the power supply module, E1 and E2 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

Gross Automation, 1725 South Johnson Road, New Berlin, WI 53146, www.ssacsales.com, 800-349-5827

19

The following modules are available :

SA 801F	Power supply 115 V AC / 230 V AC
SD 802F	Power supply 24 V DC
AM 801F	Battery module
AM 802F	Debug module
EI 801F	Ethernet module 10Base2 (Cheapernet)
EI 802F	Ethernet module AUI
EI 803F	Ethernet module Twisted Pair
FI 810F	CAN-3 module
FI 820F	Serial module
FI 830F	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 FI830F (FI830F_4_F1)

S:	Slot
FI830F	Module type, Profibus module here
(FI830F 1_4_F1)	Default name with station position 4, slot F1

5.4 Parameterization of AC 800F

The FieldController takes the fieldbus modules, thus enabling several fieldbuses 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.**

5.4.1 Module data of AC 800F

Industrial IT Controller Redundant (AC 800FR)

General Data

Name: AC800FR5 Short text:

Long text:

Module Data | Rack Location | Boot Parameter

	IP 1	IP 2
Serial number:	<input type="text"/>	<input type="text"/>
Hardware version:	<input type="text"/>	<input type="text"/>
Software version:	<input type="text"/>	<input type="text"/>
Op. hours (total):	<input type="text"/>	<input type="text"/>
Op. hours (exc temp.):	<input type="text"/>	<input type="text"/>
Location:	AC800FR5	

OK Cancel Save Reset Check Help

Firmware Update

ac001us.bmp

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.

5.4.2 Location of AC 800F

Industrial IT Controller Redundant (AC 800FR)

General Data

Name: **AC800FR5** Short text:

Long text:

Module Data **Rack Location** Boot Parameter

IP1 cabinet name:

IP1 rack bay name:

IP2 cabinet name:

IP2 rack bay name:

OK Cancel Save Reset Check Help

Firmware Update

ac002us.bmp

Rack location

IP1 or IP2

Cabinet name

Optional text details of cabinet identifier for FieldController with IP address 1

IP1 or IP2

Rack bay name

Optional text details of rack bay identifier for FieldController with IP address 1

5.4.3 AC 800F Boot Parameters

Industrial IT Controller Redundant (AC 800FR)

General Data
 Name: **AC800FR5** Short text:
 Long text:

Module Data | Rack Location | **Boot Parameter**

Memory
 Max. no. of Objects:
 Configuration data (PRAM): KB
 Configured redundancy memory: KB
 Required redundancy memory: Byte

I/O Bus (CAN)
 Enable
 Transmission rate: 500 Kbit/s 100 Kbit/s
 I/O protocol: Redundant Not redundant

Tasks

	Reserved	Required
Network buffer:	<input type="text" value="20"/>	<input type="text" value="0"/>
Interface objects:	<input type="text" value="20"/>	<input type="text" value="0"/>

System Limits
 Max no. of user tasks:
 Number of V/S:
 Number of G/WY:

OK Cancel Save Reset Check Help

Firmware Update

ac003us.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 AC 800F 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
- redundancy memory
- object data
- communication management

The memory for the objects, memory for PRAM and, if available, memory for redundancy 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.

*Configured
redundancy memory*

Memory size in Kbytes that is reserved for the transfer of redundancy data.

*Max. redundancy
memory required*

Maximum size of memory required by the project for transfer of redundancy data.



The redundancy memory is only shown in redundant and plausible process stations.

Tasks

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

*Network buffer
Interface
objects*

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

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*Redundancy*

Select the I/O protocol

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

Not redundant

As of version 6.1 (AC 800F only) not supported.

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 AC 800F

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

5.5 AC 800F Modules

5.5.1 Power supply modules SA 801F / SD 802F

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 SA 801F power supply module for 115/230 V AC and the SD 802F 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 AC 800F, page 20** and **Diagnostic data for objects, page 28**.

5.5.2 Ethernet modules EI 801F, EI 802F, and EI 803F

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 EI 801F with 10Base2 (Cheapernet or BNC), Ethernet module EI 802F with AUJ connection and Ethernet module EI 803F with Twisted Pair connection.

For further parameter information and object data, see **Parameterization of AC 800F, page 20** and **Diagnostic data for objects, page 28**.

5.5.3 Battery module AM 801F


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 AC 800F, page 20** and **Diagnostic data for objects, page 28**.

5.5.4 Profibus module FI 830F

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 AC 800F, page 20** and **Diagnostic data for objects, page 28**.

 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**.

5.5.5 Serial Interface module FI 820F


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 AC 800F, page 20** and **Diagnostic data for objects, page 28**.

5.5.6 CAN module FI 810F

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 AC 800F, page 20** and **Diagnostic data for objects, page 28**.

 For each FieldController, it is possible to connect only one station bus (CAN) line with maximum 5 racks. The slot of the FI 820F 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.

5.6 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
EI 801F EI 801F EI 803F, AM 801F	Low battery voltage	BTL	BOOL
AM 801F SA 801F SD 802F FI 810F FI 820F FI 830F	For these modules of the FieldController, a message can only be sent if the FieldController operating system is loaded.	PFL1, PFL2	BOOL

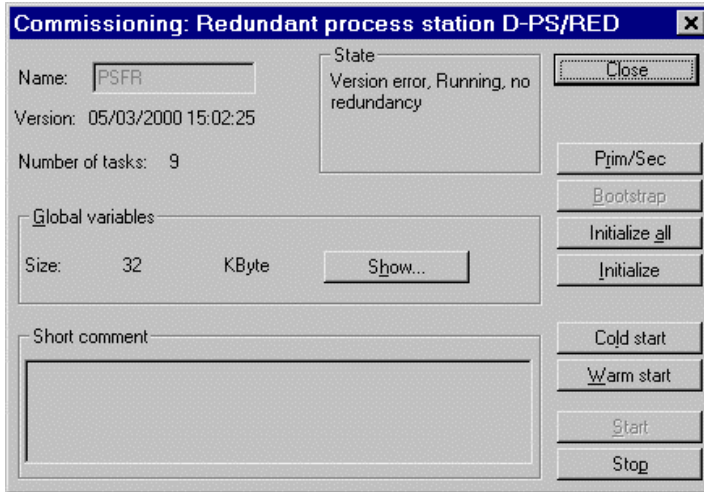
5.6.1 STA Error codes

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 AC 800F

6.1 Operating via resource AC 800F



ac013us.bmp

- PRIM/SEC** For redundant FieldControllers a redundancy toggle is initiated (toggle between Primary and Secondary CPU). A toggle is possible only in SYNC status.
- BOOTSTRAP** The FieldController is loaded with the operating system and is initialized. In the case of redundancy only the Primary is loaded with the operating system.
-  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. In the case of redundancy both FieldControllers are reset. The Primary CPU becomes active first and can then be bootstrapped again. After INITIALIZE ALL the redundancy is no longer active. The operating system in the Secondary is restarted after the user program has been loaded.

INITIALIZE	In the initialization, the FieldController performs a cold start. Any user program already present is also deleted. The redundancy is now no longer active . The Secondary enters the “No BS” state. 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 preset 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	Both FieldControllers perform a cold start.
WARM START	Both FieldControllers perform 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	Both FieldControllers perform the command (Run or Stop). The LED display at the Primary indicates the current status. In a redundancy toggle, the last status is retained, irrespective of the RUN/STOP switch position.

6.2 Task




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

ac014us.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 38**. 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.

Gross Automation, 1725 South Johnson Road, New Berlin, WI 53146, www.ssacsales.com, 800-349-5827

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...	BOOL	CLEAN	WRITE	297

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

ac015us.bmp

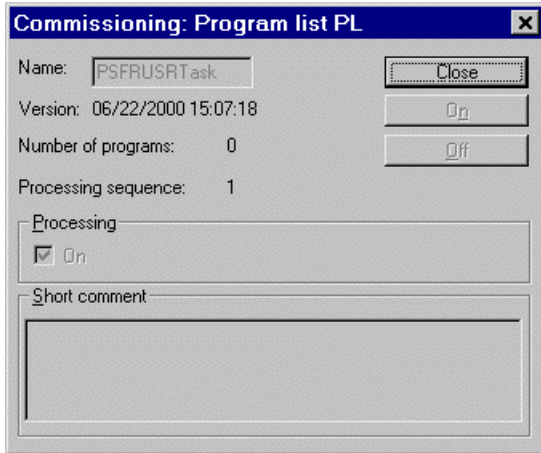
Variable name	Variable name, max. 16 characters
Type	Data type, e.g. REAL, BOOL, UINT etc.
State	CLEAN Object is correct and loaded. DIRTY Object version in engineering station does not match object version in the station. CREATE Object not yet loaded into station. DELETE Object deleted in project database, 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*



ac016us.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. In the case of redundancy however the operating system version must match for both AC 800, otherwise sync status is not possible.

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

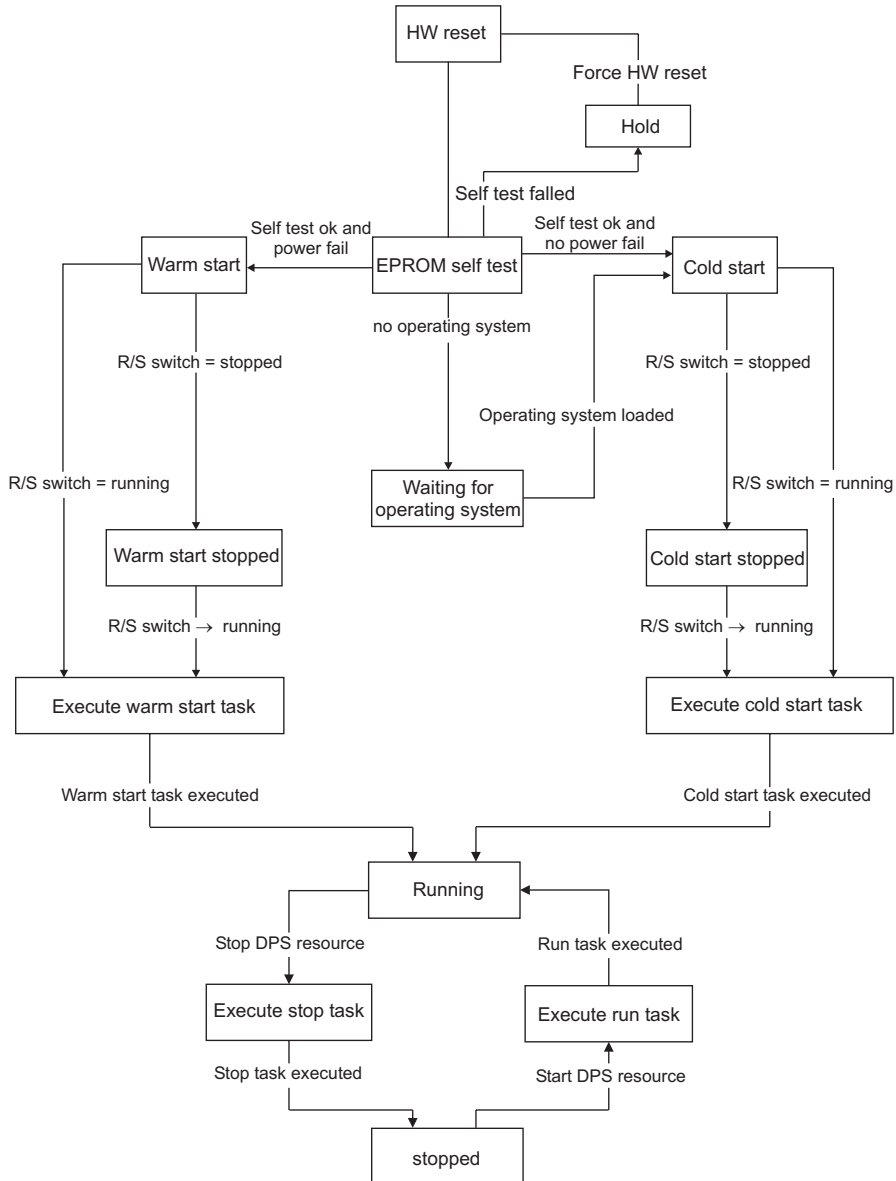
The EPROM version of the CPU module or FieldController does not match the software version of the engineering software.

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

Gross Automation, 1725 South Johnson Road, New Berlin, WI 53146, www.ssacsales.com, 800-349-5827







6.4.2 Resource state diagram

 State diagrams of redundant FieldControllers, see **Page 47, States of the active Field-Controller (Primary)**.




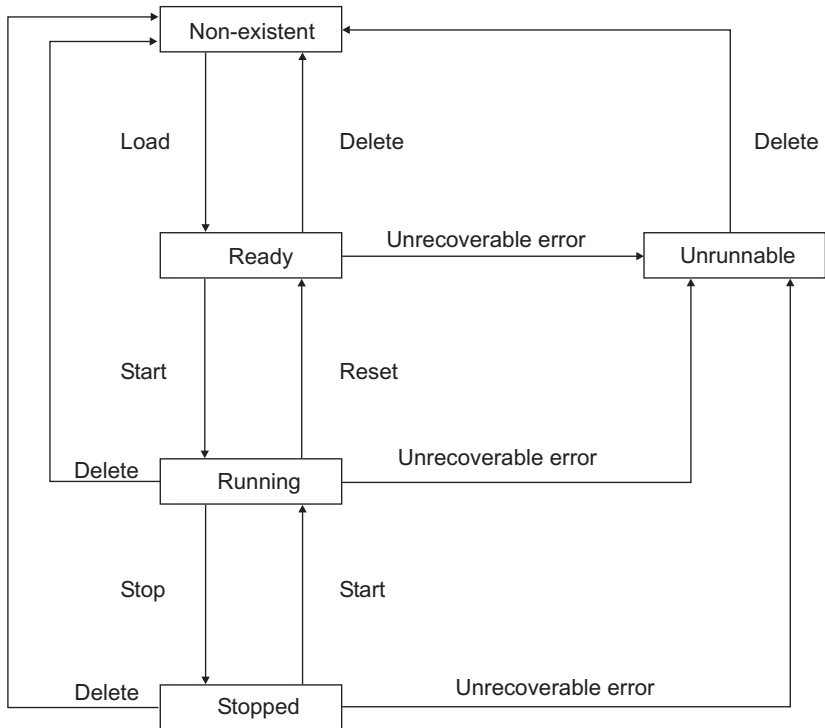
di1501us.eps

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.



di1502us.eps

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

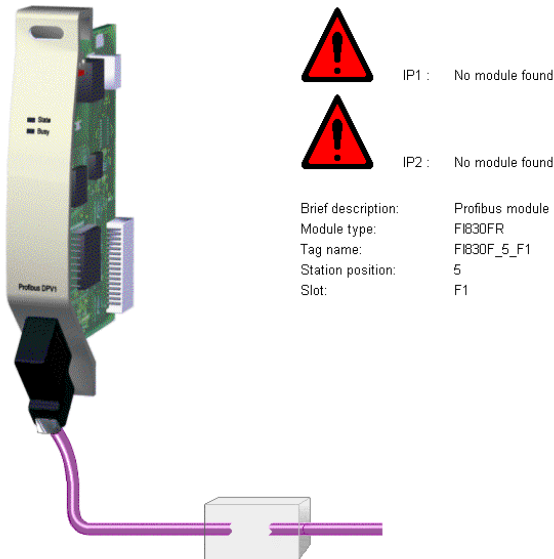
ac017us.bmp

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.



ac018us.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 FI 830F) has been detected as installed in this slot, but no configuration is available.

orange

The module type configured in the hardware structure (e.g. FI 830F) does not match the installed module type (e.g. 810F).

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

ac019us.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**.

7 Redundancy

In the case of redundancy a bumpless toggle is achieved between the active FieldController (Primary) and a passive FieldController (Secondary), so that :

- in the case of CPU failure the outputs of the I/O components are maintained,
- the internal states (component data, variable values) are maintained,
- Configuration and working data are automatically adjusted between the active and passive FieldController.

7.1 Network configuration in the hardware structure

A FieldController possesses a Resource ID and an IP address. In the case of redundant FieldControllers an IP address is specified for each of the two FieldControllers.



Configuration → System → Hardware structure → Network

Type	Name	Res. type	Res. name	Res. ID	IP address 1	IP address 2
		D-ES		33	172.16.1.33	
GWY	GWY4	D-GS	OPCG	92	172.16.1.33	
GWY	GWY3	D-GS	DDE	82	172.16.1.33	
VIS	VIS2	D-OS	OS_2	50	172.16.1.30	
VIS	VIS1	D-OS	OS_1	53	172.16.1.33	
AC800FR	AC800FR7	D-PS/RED	PS_6	6	172.16.1.6	
AC800FR	AC800FR6	D-PS/RED	PS_5	5	172.16.1.5	
AC800FR	AC800FR5	D-PS/RED	PSFR	13	172.16.1.13	172.16.1.14
AC800F	AC800F4	D-PS	PSF	2	172.16.1.2	
PSR	PSR3	D-PS/RED	PSR	44	172.16.1.44	172.16.1.46
PS	PS2	D-PS	PS	10	172.16.1.10	
FC	FC1	D-PS	FC	4	172.16.1.4	

ac020us.bmp



Which of the CPU modules is Primary and which is Secondary is **not** defined by IP address 1 and IP address 2.




The coding switch on the Ethernet module used for the redundancy link must be set to IP address 15 (switch position F). See **Mounting and Installation Instructions**. This module must always be installed in slot E2.

7.2 Synchronization

The active FieldController (Primary) automatically ensures that the passive FieldController (Secondary) can take over in the event of redundancy. The adjustment of operating system, user programs and redundancy data necessary for this is performed via a redundancy connection, the redundancy link. The connection is produced at the front of FieldController and is implemented via an Ethernet cable, optionally 10BASE2 (BNC), AUI, or twisted pair cable (TP) .

When the FieldController is bootstrapped one of the two FieldControllers automatically becomes the Primary. The second FieldController recognizes a Primary on the station bus and reports to the Primary as Secondary.

 A newly plugged-in FieldController recognizes automatically that another FieldController is already active on the station bus and moves automatically into the passive status.

In the adjustment between the active FieldController and a passive FieldController, a connection is established via the redundancy link. The user program is transmitted from the Primary to the CPU.

The Secondary performs a cold start with these data and then logs on at the Primary. The current process data are then transmitted to the Secondary. After successful transmission, both FieldControllers move to "sync" status. From now on, the Secondary is ready for a bumpless redundancy toggle. The relevant process data are adjusted cyclically.

The synchronization runs in parallel with the processing of the applications programs in the FieldController.

Depending on the Boot priority of the Secondary, side-effects can be avoided when synchronizing tasks. The higher the Boot priority of the Secondary compared to the processing priority of the task (51 – 99), the faster the FieldController reaches Sync status.

See also **Engineering Manual, System Configuration, Project Tree, Process Station.**

7.3 Redundancy toggle

If any of the following occur at the Primary, a redundancy toggle is initiated **deliberately** between Primary and Secondary:

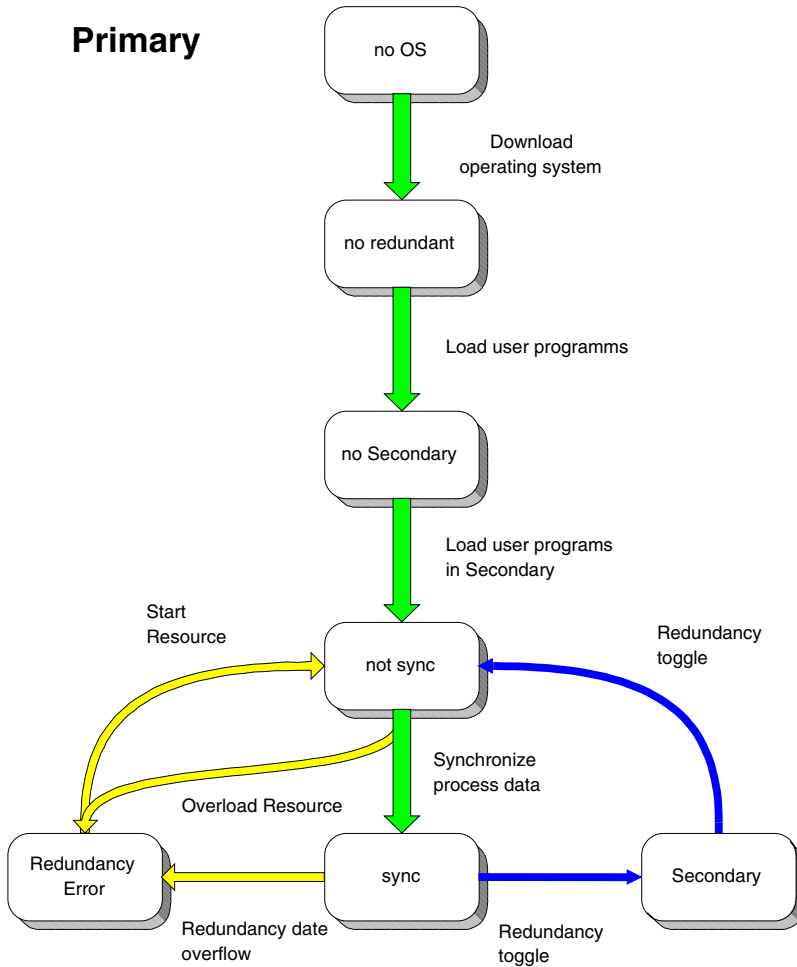
- the Prim/Sec toggle switch of the FieldController is actuated,
- the Prim/Sec button of the resource is actuated in commissioning mode,
- the reset switch is actuated > 5 s, resulting in a cold start of the Primary,
- the system function „Force redundancy toggle“ is executed.

7.4 Redundancy criteria

If the following have been established by the self-test diagnosis, a redundancy toggle between Primary and Secondary **is forced**:

- a different module insertion has been detected in the two FieldControllers,
- a module fault has occurred,
- an equipment fault has been detected on the fieldbus module,
- the watchdog has responded: a hardware fault has occurred on the FieldController,
- a power fail of the power supply is reported,
- a network fault (Ethernet) has occurred,
- a “fatal software error” has occurred.

7.5 Status diagram of the active FieldController (Primary)





di1784us.sg


7.6 States of the active FieldController (Primary)

The following redundancy states are displayed for the redundant resource reported on the resource (project tree).

not redundant	The operating system is loaded but the user program is not yet completely loaded.
no Secondary	Operating system and user programs are completely loaded. The Secondary has not yet logged on at the Primary.
not sync	The Secondary FieldController is present, the operating system and the user programs have been loaded but the process statuses have not yet been adjusted and the synchronization is therefore not yet concluded.
sync	Normal status of the redundant FieldController. The Secondary is synchronized and ready for a redundancy toggle. The cyclic data adjustment between the two FieldControllers runs during the program processing.
redundancy error	Redundancy not possible..

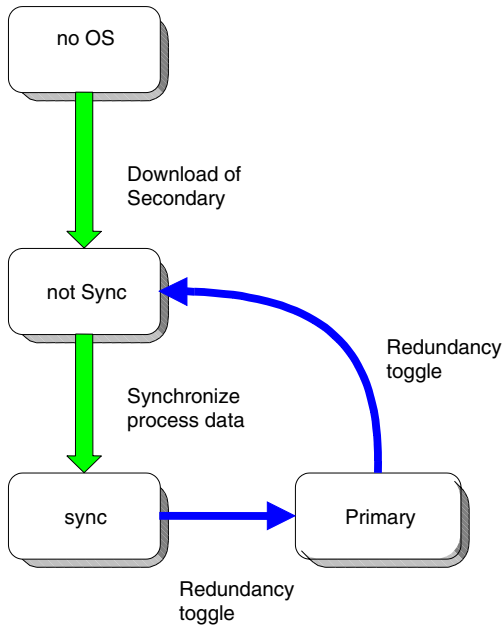
 The FieldController cannot achieve “sync” status. By restopping and then restarting the resource, it was again attempted to reach “sync” status. The reason may be that it was not possible to complete the loading of the user programs successfully.

 The system loading is too high, the redundancy link cannot be maintained. The task cycle times have been configured too short.

 The volume of redundancy data to be transmitted for a task is too large. The system variable xxxx.RedBufLow indicates the remaining memory location for the redundancy data with 0. The user programs have been distributed to too many tasks.

7.7 Status diagram of the passive FieldController (Secondary)

Secondary



di1783us.sg

7.8 States of the passive FieldController (Secondary)

no operating system


Operating system not active. The Secondary CPU is waiting for the transmission of the user programs.

not sync

The Secondary has logged on at the Primary: the user programs are loaded but the process statuses have not yet been adjusted and the synchronization is therefore not yet concluded.

sync

The Secondary is synchronized and ready for a redundancy toggle. The cyclic data adjustment between the two FieldControllers runs during the program processing.

 The redundancy status of a resource can be evaluated using the system variables `xxxx.RedState`.

See also **Engineering Manual, System Configuration, Commissioning, Status displays of the D-PS resource** and **Engineering Manual, IEC 61131-3 Programming, System Variables**.

Gross Automation, 1725 South Johnson Road, New Berlin, WI 53146, www.ssacsales.com, 800-349-5827

7.9 Technical data on Redundancy

- Link monitoring** Link monitoring between the Primary and a Secondary is carried out for FieldControllers linked via the CAN modules at 250 ms / 500 KBit/s (1250 ms / 100 KBit/s). If the FieldControllers are only connected via the Red-Link (Ethernet), link monitoring is ??? (approx. half the speed).
- Failure detection** Both FieldControllers (Primary and Secondary) are processing a monitoring. The Secondary detects a failure of the Primary (redundancy toggle) within 20 ms / 500 KBit/s (40 ms / 100 KBit/s). The Primary detects a failure of the Secondary within 250 ms / 500 KBit/s (1250 ms / 100 KBit/s).
If the redundancy link is used for failure detection the Secondary detects a failure of the Primary (redundancy toggle) within 40 ms / 500 KBit/s (80 ms / 100 KBit/s). The Primary detects a failure of the Secondary within 500 ms / 500 KBit/s (2500 ms / 100 KBit/s)
- Redundancy toggle** An automatic redundancy toggle is performed in less than 5 seconds if the active FieldController (Primary) fails.



7.10 Changing a Non-Redundant Process Station into a Redundant one

- Export of every process station which should be redundant
 - a) block export of the resource process station in the project tree **and**
 - b) block export of all hardware objects of the process station in the hardware structure.



Block import of sub-projects enables a resource to be automatically made redundant via the menu item → *Edit* → *Import block as redundant*. This means that the project elements are filed and all variables are written in process image mode. Export of the individual process stations enables the module insertion and I/O channel assignments to be accepted on re-import, instead of disappearing as would otherwise be the case.

- The variables of the task to be implemented redundantly must be written in process image mode, otherwise they will not be redundancy-capable. Please check your user programs for variables which are not written in the process image (column P in the variables list). If you consider that these variables cannot be written in process image mode because the information within the task must be immediately available and may only be updated at the end of a task cycle, you should directly renew the resource allocation for the variables or relocate the program lists and Sequential Function Chart individually (see also next item)..
- The resources which are now to operate as redundant resources are deleted. Otherwise the redundant resources are automatically renamed on import into the project pool, since the objects with the same name are still located in the project tree or the redundant tasks are inserted under newly inserted redundant resources and the program lists and sequence programs individually relocated. Please do not forget the contents of the system tasks. This method should be chosen if all the variables cannot be written in process image mode or if not all the tasks have to operate redundantly.
- In the project tree and using *Edit* → *Import block as redundant*, insert the resources which were previously exported as redundant resources into the project pool.

- Renew the resources assignment for the variables. This can be done manually or automatically.
 - The global system variables for the previously non-redundant resources, which have been used in programs or pictures, still have the previous resource allocation in the Variables List. The resource allocations must be changed to a possible new resource name.
-  These now undefined Identifiers are reported as errors in the plausibility check.
- In the hardware structure the individually exported blocks of the process stations must now be imported into a redundant process station so that all the information on insertion and I/O components becomes available once more.
-  When a rack-based process station PS is changed into a redundant FieldController AC 800FR, the I/O modules must be imported individually as a block underneath the CAN-Master DNETP.
- Allocate the redundant resource to the redundant process station
 - Plausibility check the project

Index**A**

Adding components 17

B

Battery module AM 801F 27

Boot parameter 25

C

CAN 8

 module FI 810F 28

Commissioning

 Hardware structure 40

Configuration fault 42

D

Default names

 Modules 20

Diagnosis information for modules 28

Diagnostic data 42

 AC 800F 21

DigiTool 7

DigiVis 7

E

Engineering station 7

EPROM-Download 9

Error code 28, 29

 STA 29

Error handling of task 13

Ethernet module 8, 27

 EI 801F, EI 802F, EI 803F 27

F

Fieldbus module 8

FieldController 7

 AC 800F 7

Forced 42

H

Hardware structure 17

I	
I/O unit.....	8
Insert	
Modules.....	19
L	
Load	
Operating system and EPROM's.....	9
Profibus module EPROM.....	10
M	
Modbus	7, 8
Module	
Detail view	42
N	
Network configuration	43
O	
Operating system	
D-PS/FC Resource	10
Load	10
P	
Parameter fault	42
Power fail	16
signal	16
Power supply	8
SA 801F 115/230 V AC	26
SD 802F 24 V DC	26
Prim/Sec-Button.....	30
Primary.....	44
Process image	33
Process station bus	7
Profibus DP	8
Profibus module FI 830F	27
Program list.....	34

R

Redundancy	
Criteria	45
Data	44
Link	44
States	47
States	46
Toggle	43
Toggle	45
Redundant ressource	
Status display	47

S

Secondary	44
Serial interface module FI 820F	27
Service data	
AC 800F	21
Shutdown	16
State display	40, 42
Diagnostic data detected	42
Program list	39
Resource	35
Task	38
Station view	19
Symbols	5
Synchronization	44
System bus	7

T

Task	32
cold start	31
Error	13
Error handling	13
Error messages	14
State displays	38
warm start	31
Types	
of scripts	5
of symbols	5



Gross Automation, 1725 South Johnson Road, New Berlin, WI 53146, www.ssacsales.com, 800-349-5827