

Burner Management System SIMATIC BMS400F



Process Automation Systems

Answers for industry.

SIEMENS

Siemens SIMATIC BMS400F



The SIMATIC BMS400F helps monitor, operate, maintain, and protect all of your plant's combustion assets safely and reliably.

The modular, pre-packaged design achieves compliance with industry standards while offering both modularity and flexibility. This innovative design allows you to custom fit each system to meet specific burner management system (BMS) application requirements. The BMS400F system improves process reliability and reduces life-cycle costs.

System features and user benefits



Increased safety and system availability

- Safety certified equipment for high availability
- Higher system availability achieved without the need for external diagnostic devices
- Integrated safety life-cycle tools available
- Flexible redundancy schemes to meet your safety and availability targets

Improved operations and maintenance

- Advanced local HMI provides a safer environment during all operational states
- Extensive system diagnostics provide efficient maintenance
- Integrated historian complies with OSHA PSM requirements for management of change

Reduced risk and complexity

- Scalable to fit all of your fired equipment processes
- Pre-assembled NEMA cabinet integrated with TÜV-certified PCS 7 hardware and software
- Industry compliant to NFPA 85 and 86, IEC 61511 and 61508, and ANSI/ISA 84 standards
- Pre-configured and TÜV-certified BMS engineering templates

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Conformance to industry standards

Reduce project risk

There are numerous design documents that apply to burner management systems. Historically, these include documents that were rather prescriptive (describing what needs to be done). More recently, performance-oriented (how well it needs to be done) documents are being applied to burner management applications.

The BMS400F has been designed in accordance with all of the technical requirements listed in both NFPA 85 and 86 standards for programmable logic solvers (Sections 4.6.3 of NFPA 85 and section 8.3 of NFPA 86). In addition, all critical BMS functions are managed and handled via IEC 61508-compliant components, thereby ensuring safety metrics are met.

Prescriptive-based standards

NFPA 85 – 2007, Boiler and Combustion Systems Hazards and Code

This edition has a vast history of documents that have been created and combined to form the present day NFPA 85. This code applies to all single burner boilers, multiple burner boilers, stokers, and atmospheric, fluidized-bed boilers with a fuel input rating of 3.7MW (12.5 million BTU/hr or greater).

NFPA 86 – 2007, Standard for Ovens and Furnaces

This standard applies to Class A, Class B, Class C, and Class D ovens; dryers and furnaces; thermal oxidizers; and any other enclosure with a heat input rating greater than 150,000 BTU/hr (44KW) used for the processing of materials and related equipment. This most recent version recognizes the benefits of using certified Safety PLCs for burner management logic.

The purpose of both NFPA standards/codes is to contribute to operating safety and to prevent the uncontrolled fires, explosions, and implosions in equipment.

NFPA defines the burner management system as:

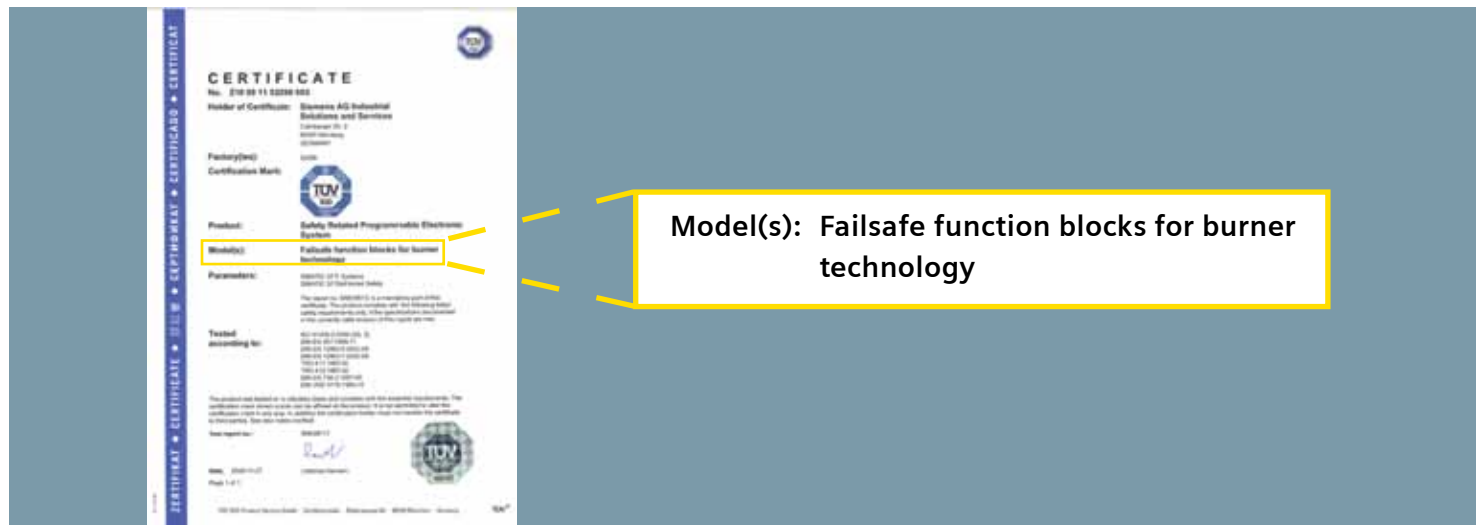
The control system dedicated to boiler furnace safety and operator assistance in the starting and stopping of fuel preparation and burning equipment and for preventing misoperation of and damage to fuel preparation and burning equipment.

Performance-based standards

The International Society of Automation (ISA) formed a special work group under their S84 technical committee focused on developing some guidance and understanding around applying performance-based techniques to Burner Management System (BMS) applications.

This resulted in the recent release of the new ISA S84 Technical Report, TR.84.00.05, *Guidance on the Identification of Safety Instrumented Functions in Burner Management Systems*. The report's purpose is to help end users faced with identifying the hazards associated with operating a BMS, determining the basis of those hazards, and applying risk management concepts and SIL (safety integrity level) selection techniques to specific functions.

It has become a necessity to understand which safety instrumented functions (SIFs) are typically found in fired equipment, particularly in BMS. Historically, the functional safety standards (ANSI/ISA S84/IEC 61511) would present the requirements for an SIS, but did not include guidance for applying them to specific types of equipment. This new technical report shows how to apply the principles and requirements of the performance-based standard to the BMS and other similar systems. It does not recommend the most efficient or mandatory design approach, nor does it replace or take away from any other standard. The intent is to explain how to apply performance-based requirements to BMS applications. Therefore, this report is not considered a mandate, rather a guideline.



Pre-packaged BMS design

Streamline your project schedule

The BMS400F was built to help users by offering a consistent burner management design that provides the maximum amount of safety and system availability. This consistent design principle helps users by reducing costs and minimizing system footprint. The BMS400F is available in three cabinet sizes, offering you the most scalability and flexibility that will best suit your particular BMS requirements.

All BMS packages come with the following:

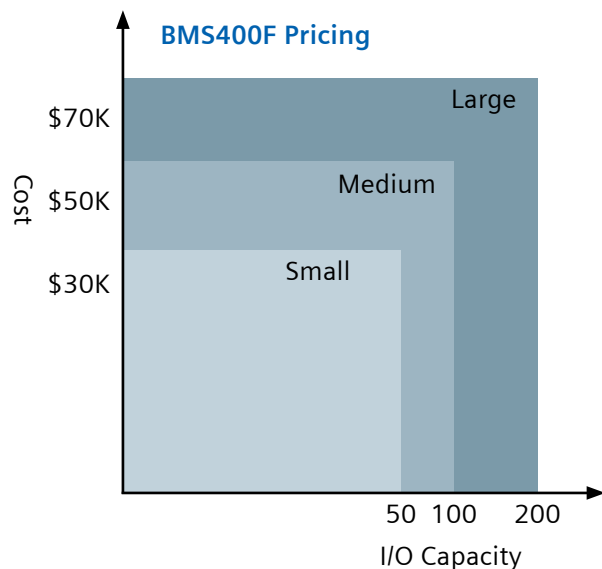
- Separate, isolated, and fused AC and DC power distribution
- Redundant 20A power supplies (with redundancy management circuitry)
- Hardwired e-stop pushbutton, mounted and wired to the front of the cabinet

- High definition HMI touch panel, mounted and wired to the front of the cabinet
- Master fuel trip (MFT) relay panel (expandable in the medium and large-sized systems)
- Professionally mounted and pre-wired internal components
- Painted NEMA 12 cabinet with fan cooling (other cooling options are available upon request)
- Designed and engineered for standalone BMS application
- Easily upgradeable to include combustion control application
- All BMS functions are handled with TÜV-certified, SIL-rated components

System configuration

Below is an example of configurations that can be tailored to suit customer requirements.

SIMATIC BMS400F Configurations	Small (non redundant)		Small		Medium		Large	
	412FH CPU		412FH CPU		414FH CPU		414FH CPU	
	Modules	Channels	Modules	Channels	Modules	Channels	Modules	Channels
FAI	2	12	2	12	4	24	8	48
FDI	1	24	1	24	2	48	3	72
FDO + Relay MTA	1	10	1	10	3	30	5	50
FDO	0	0	0	0	0	0	0	0
Total Modules/Channels	4	46	4	46	9	102	16	170
I/O MTAs	NO		NO		NO		YES	
Redundant I/Os	NO		NO		NO		NO	



Three standard BMS400F system designs offer exceptional value and competitive pricing.

Proven SIMATIC hardware components

Ensure highest level of system reliability

The BMS400F is designed to ensure compliance to industry standards (NFPA, IEC, and ANSI/ISA). This required selection of specific hardware components (CPU, I/O, Communications, HMI, etc.) that support the appropriate architecture (redundancy) and level of integration.

CPU

Each system comes equipped with dual/diverse SIMATIC PCS 7 processors to handle all burner management and combustion control requirements. Each burner management function is treated as a safety critical operation and managed in the independent TÜV-certified S7 400 CPUs. A dedicated SIMATIC PCS 7 RTX processor is used to manage all non-safety critical operations, from interfacing the local PCS 7 OS HMI, to third-party communications via OPC. The PCS 7 RTX CPU also allows for the unique capability of providing complete combustion control functionality with the SIMATIC PCS 7 control library.



I/O

All field interfaces for the BMS400F are handled with SIMATIC ET 200M I/O modules. These modules reduce system complexity and size, while increasing flexibility. This is accomplished by supporting both safety and standard configurations within the same product family. However, separation and independence continue to be maintained. Siemens Flexible Modular Redundancy (FMR) is available to support single, dual, or triple I/O redundancy configurations. All safety critical burner management signals are handled by a special set of TÜV-certified modules, while standard modules provide a simple hardwired interface. The embedded SIL 3-rated, redundant PROFIBUS (via PROFIsafe) communications provide seamless connectivity between the CPU and I/O.



Communications

BMS400F provides various ways to interface and communicate with other systems. The built-in SIMATIC Scalance switch makes connecting multiple BMS400Fs together easy and efficient. For longer distances, fiber optic media can be chosen as an option. Interfacing with third-party systems is also simplified with the BMS400F's built-in OPC server or by adding the optional Modbus interface module.



HMI

The BMS400F's operator interface allows for an industry leading environment for safely operating all of your fired equipment. The built-in features create a simplified system for accessing information. Alarm Management, operator navigation, standard faceplates, and detail displays provide a consistent and intuitive operating environment to reduce both operator and maintenance errors.



Certified safety technology

Simplify your SIL verification

PCS 7F Safety Technology

The process safety instrumented system from Siemens is comprised of safety-rated controllers, communication bus systems, and I/O. This hardware allows for seamless integration within your control system. With more than 25 years of experience with safety product development in the process industry, Siemens has an established reputation of being a reliable safety partner that provides first class solutions for process industry.

Integrated control and safety

Siemens Safety Integrated for Process Automation allows for the integration of the Safety Instrumented System (SIS) into the process control system. The Basic Process Control System (BPCS) and the SIS are based on common hardware in this common integration.

Safety Integrated fieldbus technology

Communication between remote I/O stations, transmitters, drives, valves, and operator terminals is achieved through the use of a powerful, real-time bus system.

Flexible Modular Redundancy

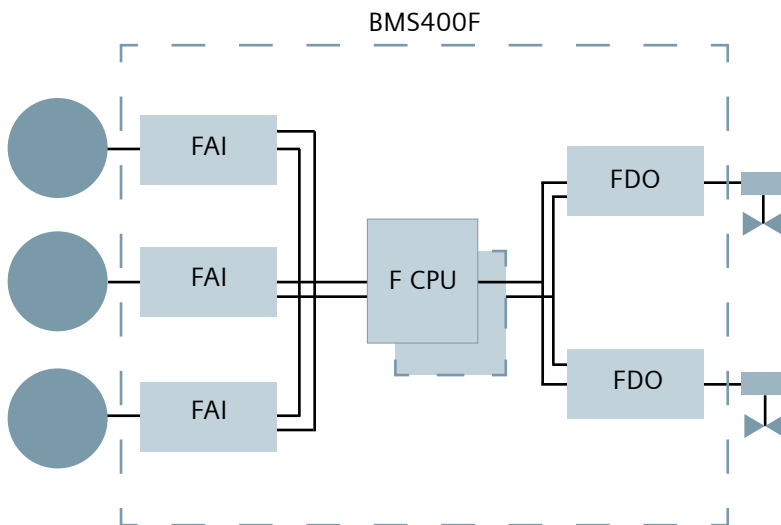
With this feature, a configuring engineer can define the degree of redundancy for the individual architecture levels. The architecture level, comprising of the controller, fieldbus, and I/O, are then matched with the field instrumentation. Each component within a given level can be physically separated and redundant.

Safety life-cycle management

Siemens provides the F-block library in S7 F systems and the SIMATIC Safety Matrix for configuration and programming of the S7-400FH controllers.

Simple SIL Calculations

With the recognition of the new ISA Technical report (TR 84.00.05) customers will be assigning performance requirements (SIL levels) for each BMS function. Based upon the result of the hazard and risk analysis, each BMS function may be identified as a Safety Instrumented Function (SIF). Below is an example of how the SIL calculation could be performed with the BMS400F.



Example SIL calculation for the BMS400F (with redundant field devices)

$$PFD (BMS400F) = PFD(FAI) + PFD(CPU) + PFD(FDO)$$

Where: $PFD (FAI) = 1E-5$
 $PFD (FDO) = 1E-5$
 $PFD (FCPU) = 1.9E-4$

$$PFD (BMS 400F) = 2.1E-4 \text{ (SIL 3) based on a proof test of 10 years}$$

Note: Calculation does not include field devices, and assumes a common cause beta factor of 5%.

Advanced HMI

Safely control your fired equipment

The BMS400F comes equipped with several pre-configured tools for operation, diagnostics, and maintenance. A typical BMS graphical interface has been designed and provided with your BMS. An included CFC chart allows the operator to step through the actions required to satisfy NFPA 85 requirements for lighting a burner system.

Security Levels

Two levels of security are provided with the HMI:

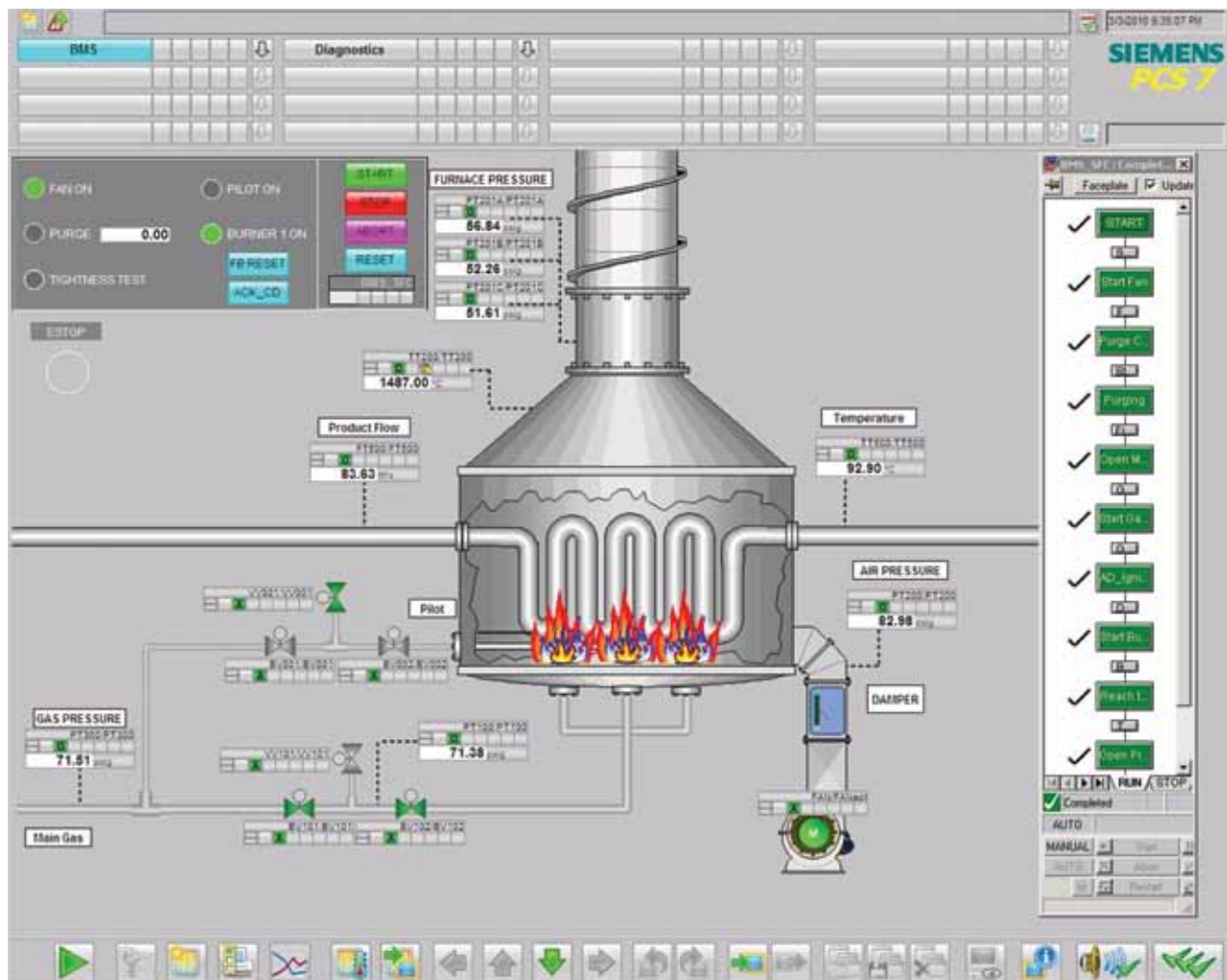
- Operator Screen: A basic screen for the operator which provides complete runtime information with limited control
- Supervisor Screen: Full BMS interface for the supervisory level that provides both operation and maintenance function

Diagnostics

All BMS400Fs include basic system diagnostics to inform your operators of any system-related failures which are displayed in the alarm banner. The PCS 7 Asset Management software package is an optional addition that provides advanced diagnostic features. This will allow for HMI visualization of the entire system and navigation capabilities down to the faulty component.

Maintenance

The optional Safety Matrix supports the ability to perform runtime maintenance operations. This includes bypassing failed channels and forcing specific tag values based on the security level assigned to the user.



Engineering and technical specifications

Improve your design with the TÜV-certified burner block library

All BMS400F systems are designed and configured using Commercially, Off-the-shelf (COTS) SIMATIC components to ensure Siemens commitment for long-term product delivery and support. Each SIMATIC component utilized in the BMS400F has undergone rigorous product research and development, along with strenuous environmental testing, in order to deliver maximum reliability in the field.

SIMATIC BMS Product Specifications			
Component	Description		
Cabinet	Painted Carbon Steel, NEMA 12 rating		
HMI	17" or 19" color TFT display		
CPU	412FH	414FH	417FH
Memory (MB)	2	4	16
Typical DI/DO/AI/AO Mix	50/25/20/10	220/110/80/40	2000/1000/800/400
PCS 7 BOX	Intel Core 2 Duo 2.16GHz Watchdog/Temperature/Fan monitoring		
SCALANCE	Configurable for 10/100/1000 Mbps industrial Ethernet systems using copper or fiber		
Failsafe Signal Modules	10 channel, 24 VDC Digital Output (40mm, 2A max) 24 channel, 24 VDC Digital Input (80mm, 2A max) 6 channel, 24 VDC Analog Input (40mm)		
Marshaled Terminal Assembly	10 channel, 24-120 VDC/120-130 VAC Discrete Output (Relay) MTA 10 channel, 24 VDC Digital Output MTA 12/24 channel, 24 VDC Digital Input MTA 6 channel, 24 VDC Analog Input MTA		

System Environmental Specifications	
Temperature	5 to 50°C
Humidity	80% at 25°C

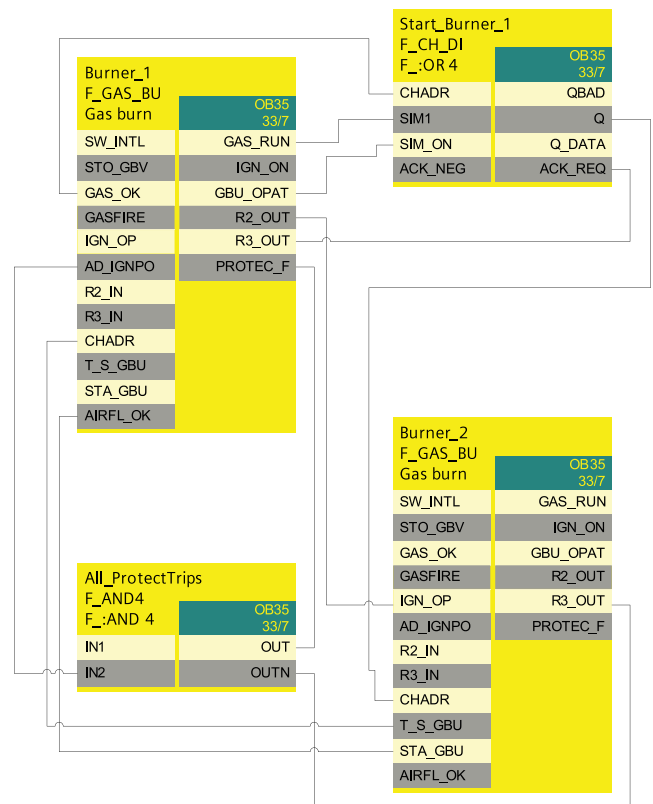
The BMS400F application engineering package allows for the configuration of the system using minimal additional engineering effort. Included in the package is a SIMATIC project containing a single gas burner application. This project utilizes both the general failsafe blocks and the burner management library. It contains trip logic compliant with NFPA 85 and 86 standards. The hardware profile is also matched to the provided BMS400F hardware.

When using the provided project, the additional engineering effort required is as follows:

1. Modify channel names to meet your company's standards. For example, BV100 (Blocking Valve) → XV100 (Blocking Valve) per company standards
2. Modify single gas burner to fit your configuration (multiple burner, oil-fired, etc.)
3. Add additional trip logic beyond the NFPA 85 and 86 requirements
4. Add other supporting logic (i.e. non-safety logic)

Security Levels:

Program downloads have been password protected at the controller level to ensure proper clearance for code changes. Modifying the safety logic also has a separate password, allowing access to be limited only to safety-trained personnel.



Field wiring and engineering drawing package

Lower cost with simplified wiring schemes and complete engineering drawings

Field wiring options

All conventional field wiring for the BMS400F systems utilize simple and cost-effective front panel I/O terminal connections. Customers may elect to upgrade their medium or large BMS systems by adding the Siemens MTAs to further simplify their wiring requirements. Customers also have the option of connecting directly to their own custom wiring schemes where a third-party terminal block is installed and used as the main interface between the SIMATIC I/O modules and both their field instrumentation and final control elements.

Complete engineering drawing package

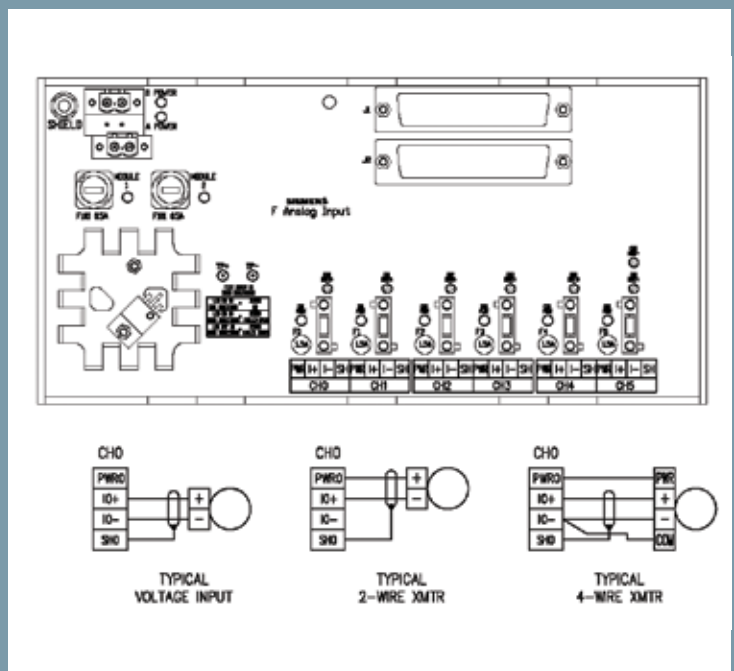
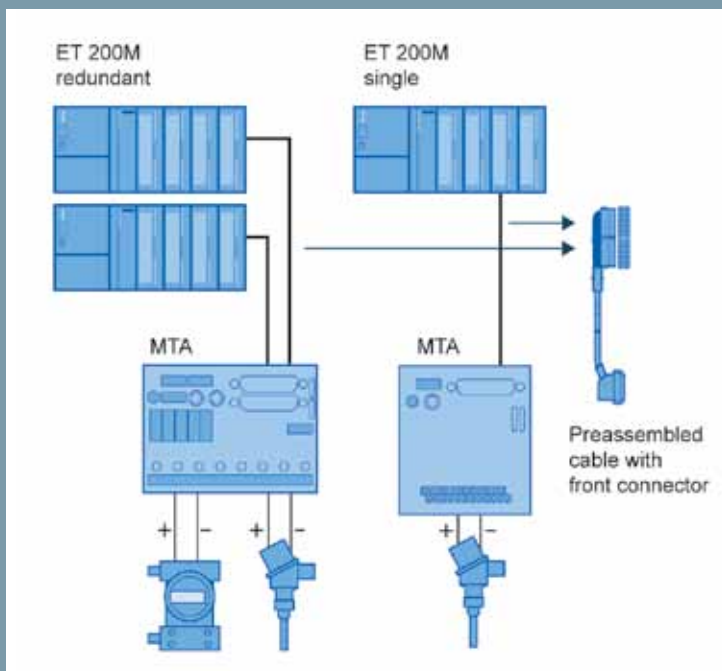
All BMS400F systems are delivered with a complete drawing package which includes:

- Cabinet General Assembly
- Power Distribution
- Cable Connections
- Grounding Scheme

- Typical Wiring Module
 - Front Connector
 - Marshallled Terminal Assembly (MTA)
- Modbus Cabling Options

In this functional example, the following architectures are presented:

- *Single Sensor (1oo1) Voting*
Used when a single sensor provides the necessary safety integrity and higher availability is not required
- *Dual Sensor (1oo2) Voting: Voting in the CPU*
Used when multiple sensors are required to provide the necessary safety integrity and visibility. This is required in both sensors' data. This architecture can also be configured as 2oo2 for higher availability.
- *Triple Sensor (2oo3) Voting*
Used when multiple sensors are required to provide the necessary safety integrity and higher availability is desired.



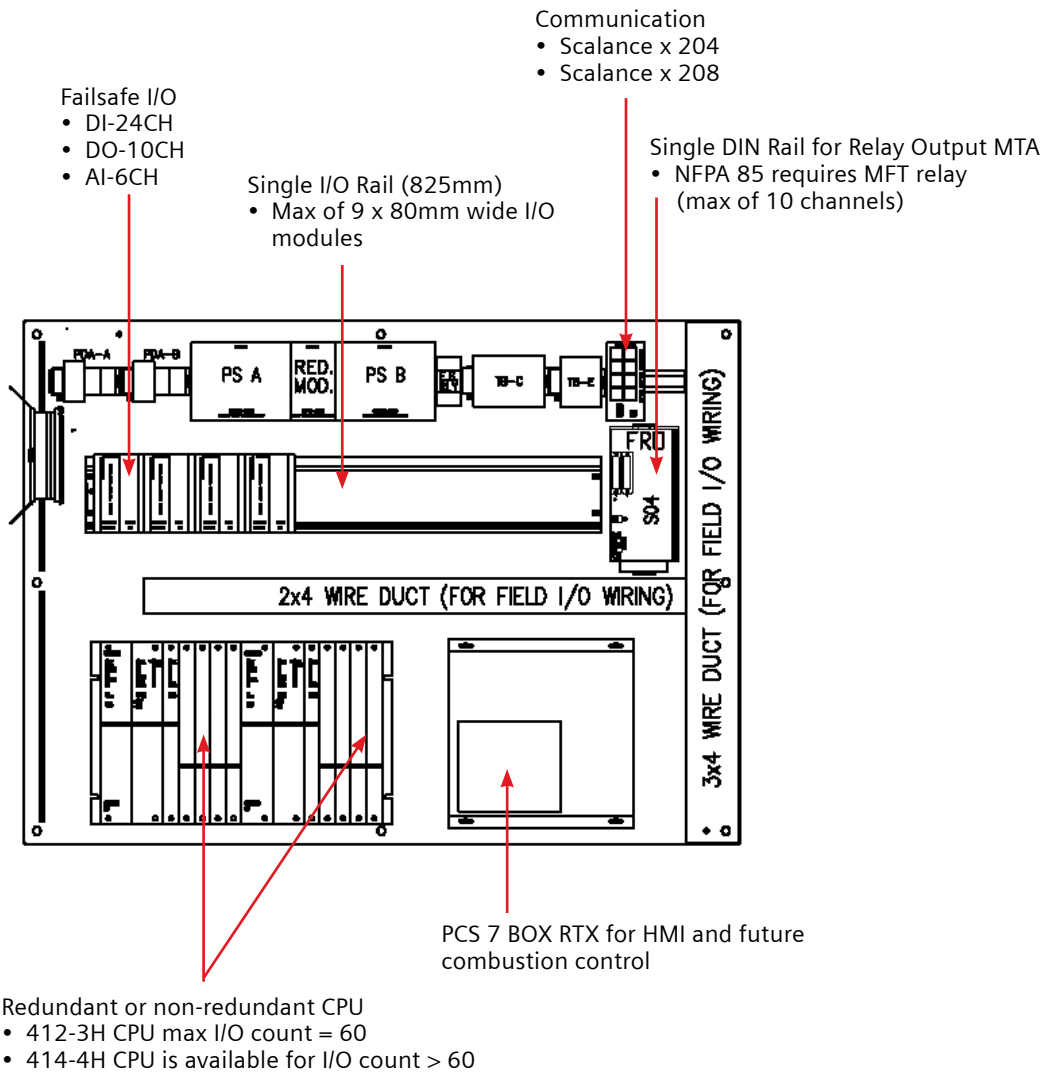
MTA

Three standard size offerings

Increase system scalability and flexibility

Small BMS400F – Lowest cost with minimal footprint

The small BMS400F was designed to cost-effectively handle small burner management applications. It provides low-end scalability, supporting an I/O range from 16 to 75 I/O points. This size was designed for conventional front terminal connections to all I/O modules. It supports a simplex I/O architecture which can vote redundant field devices (single, dual, or triple) in the CPU. This entry level package comes completely wired and assembled in our smallest 36"x48"x12", NEMA-rated, wall-mounted cabinet and includes a 17" touch panel color display.

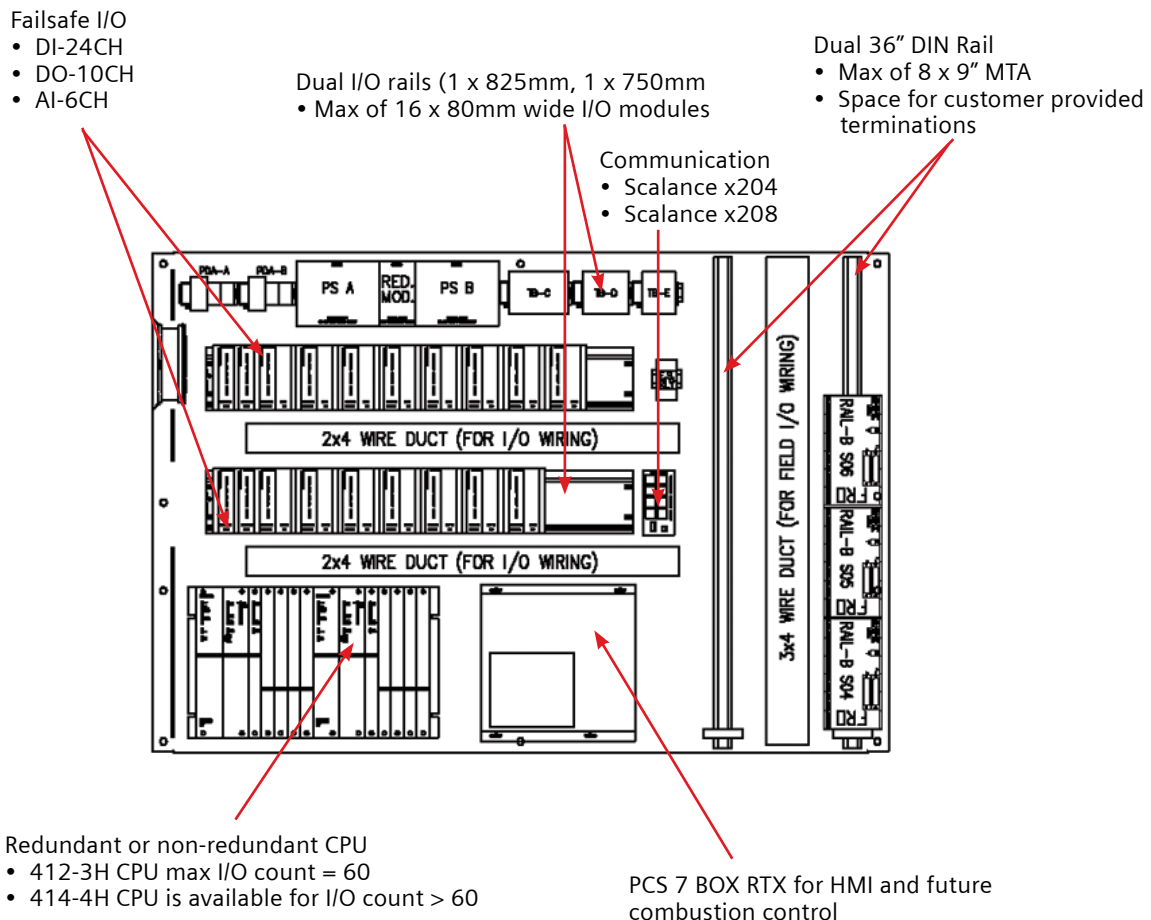


Medium BMS400F – Versatile and flexible design

The medium BMS400F was designed to cost-effectively handle burner management applications ranging from 16 to 150 I/O points. It provides more scalability than the small system, with the addition of a second I/O module rail and dual 36" DIN rail-mounting sections. This size was designed for front terminal connections, Siemens Marshalled Termination Assemblies (MTA), or third-party-supplied terminal block connections, which could be mounted to the supplied DIN rail.

The system also comes equipped with a single, 10-channel master fuel trip (MFT) relay panel, pre-wired to a dedicated TÜV-certified digital output module. This can easily be upgraded to accommodate more output channels per customer requirements. The medium BMS400F supports both simplex and dual-redundant I/O architectures, which can vote redundant field devices (single, dual, or triple) in the CPU.

This mid-level BMS package comes completely wired and assembled in our medium sized, wall-mounted 42"x60"x12" NEMA-rated cabinet and includes a larger 19" touch panel color display.

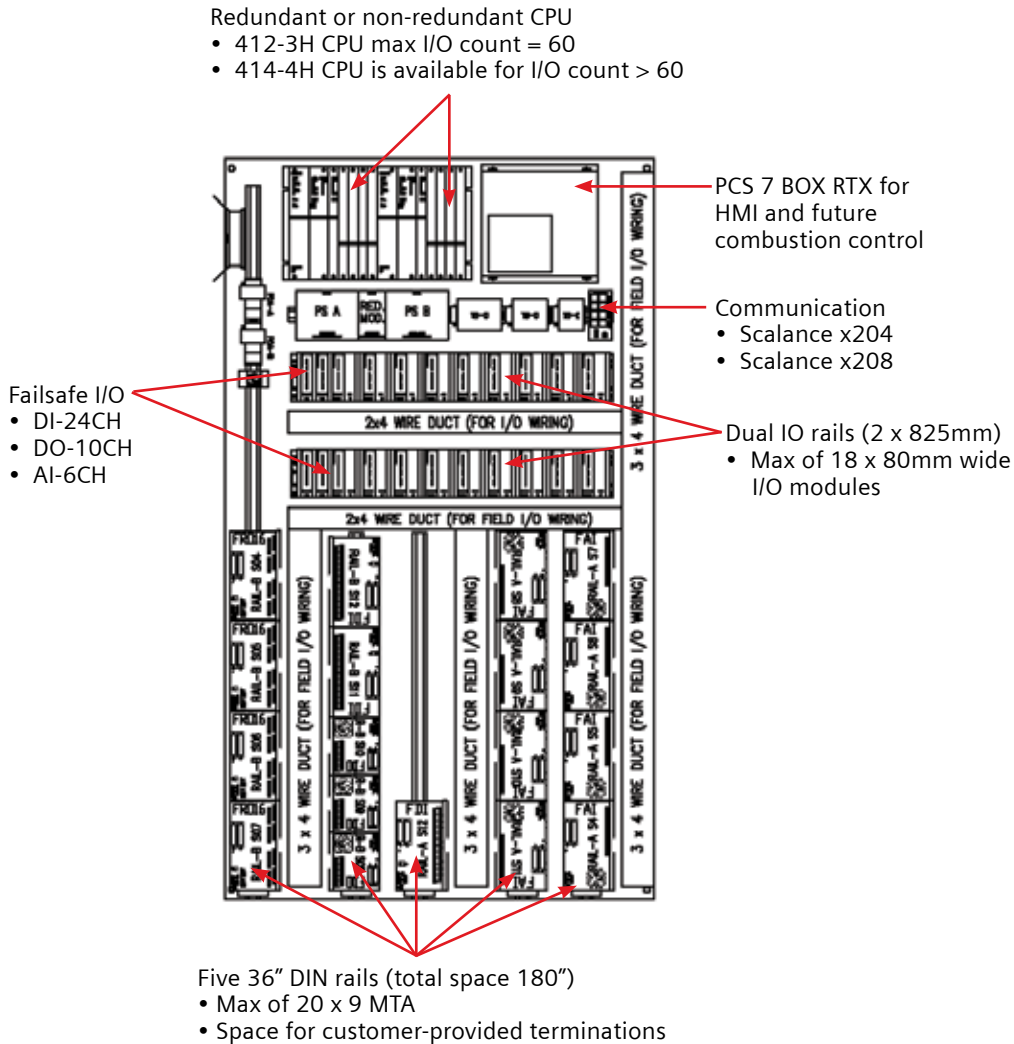


Large BMS400F – Maximum capacity, floor-mounted design

The large BMS400F was designed to handle burner management applications ranging from 50 to 250 I/O points in a cost-effective way. It provides more scalability than both the small and medium systems, having five 36" DIN rail-mounting sections. This size was designed for applications requiring either Siemens Marshalled Termination Assemblies (MTA) or third-party-supplied terminal block connections mounted to the DIN rail-mounting space.

The system also comes equipped with one, 10-channel, Master Fuel Trip (MFT) relay panel, pre-wired to a dedicated TÜV-certified digital output module and can easily be upgraded per customer requirements. The large BMS400F supports both simplex and dual redundant I/O architectures, which can vote redundant field devices (single, dual, or triple) in the CPU.

The large BMS package comes completely wired and assembled in our floor-mounted, 46"x30"x78" NEMA-rated cabinet and includes a large 19" touch panel color display.



Training

Support your engineering and operation with optional hands-on training

Please visit www.usa.siemens.com/bms to view the training course descriptions for the following:

- PCS 7 Process Safety Sustaining (PCSFTS1A)
- PCS 7 System Engineering 1 (PCSYSE1B)
- PCS 7 System Engineering 2 (PCSYSE2B)
- PCS 7 System Operator (PCPCSU1B)



BMS workshops coming Summer 2010

Over the course of each workshop, you will learn:

- How to apply relevant BMS safety standards, including NFPA and ISA
- How to engineer, develop, and modify a BMS safety application
- How to engineer, develop, and modify a BMS HMI
- How to safely operate and maintain a typical BMS
- How to perform safety and reliability verification techniques for typical BMS applications

For more information on our BMS workshops and schedule, please visit:
www.usa.siemens.com/bms

Combustion instrumentation

Seamlessly integrate Siemens line of “best in class” process instrumentation

Pressure Transmitters

SITRANS P DS III

The SITRANS P DS III series includes digital pressure transmitters for measuring gauge pressure, absolute pressure, differential pressure, flow, and level.

- Extensive diagnostics and simulation functions
- Suitable for installation in SIL 2 applications in accordance with IEC 61508 / IEC 61511. In the PROFIsafe version, it guarantees maximum communication safety up to the control system level
- Opens up a host of different bus communication options for you: HART, PROFIBUS PA, PROFIsafe, or Foundation Fieldbus

Temperature Transmitters

SITRANS TH300

The SITRANS TH300 is a Head Transmitter with HART-protocol that is designed to support all common thermocouples, resistance, and millivolt sensors.

- Measures temperature with a linear output signal
- High accuracy across entire ambient temperature range
- Alarm signal for sensor break or short-circuit according to NAMUR 43
- Galvanic insulation for accuracy and safety in thermocouple applications
- Custom characteristic curve for application of non-standard sensors

SITRANS TF

The SITRANS TF field transmitter is designed for applications in the field where excessive heat or vibrations are present at the measuring point. The transmitter is programmable, HART, and offers an optional programmable digital display.

- IP68 degree of protection
- Test terminals for direct read-out of the output signal without breaking the current loop

Positioners

SIPART PS2

SIPART PS2 is currently the most widely used positioner for linear and part-turn actuators in a wide range of process industries. This is not without reason. The proven all-round design has a particularly flexible stroke range, intelligent diagnostics, and communicates either via HART, PROFIBUS PA, or Foundation Fieldbus.

- Standard Macrolon enclosure to IP66/NEMA 4x protection, with optional aluminum or stainless steel enclosure
- Communication via PROFIBUS PA, Foundation Fieldbus, or HART
- Intelligent diagnostics functions



SITRANS P DS III



SITRANS TH300



SITRANS TF



SIPART PS2

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